FINAL STANDARDIZED RISK ASSESSMENT METHODOLOGY REVISION 2 ADDENDUM
SANTA SUSANA FIELD LABORATORY
VENTURA COUNTY, CALIFORNIA

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ACRONYMS AND ABBREVIATIONS

µg/dL	microgram(s) per deciliter
µg/m^3	microgram(s) per cubic meter
%	percent
ABS	dermal absorption factor
AET	apparent effects threshold
AF	soil adherence factor
ARAR	applicable, relevant, and appropriate requirements
AT	averaging time
ATSDR	Agency for Toxic Substances and Disease Registry
AUF	area use factor
BAF	bioaccumulation factor
BCF	bioconcentration factor
BCR	Biological Conditions Report
BSAF	biota sediment accumulation factor
BTAG	Biological Technical Assistance Group
BTEX	benzene, toluene, ethylbenzene and xylenes
BW	body weight
Cal-EPA	California Environmental Protection Agency
CCME	Canadian Council of Ministers of the Environment
CDD	chlorinated dibenzo-p-dioxin
CDF	chlorinated dibenzofuran
CHHSL	California Human Health Screening Level
cm^2	square centimeters
CMS	corrective measures study
COPC	constituent of potential concern
CPEC	constituent of potential ecological concern
CSF	cancer slope factor
CSM	conceptual site model
CWQCB	California Water Quality Control Board
DF	dermal contact factor
DOE	United States Department of Defense
DTSC	Department of Toxic Substances Control
EC_{10}	effective concentration where 10% of test population shows effect

EC_{20}	effective concentration where 20% of test population shows effect
EC_{50}	effective concentration where 50% of test population shows effect
EcoRBSL	ecological risk-based screening level
ED	exposure duration
EF	exposure frequency
EFA	Engineering Field Activity
EPI	Estimation Programs Interface
EPC	exposure point concentration
ERA	ecological risk assessment
ERL/T_{20}	concentration corresponding to a 20% probability of observing sediment toxicity
ERM/T_{50}	concentration corresponding to a 50% probability of observing sediment toxicity
ESB	equilibrium partitioning sediment benchmark
ESL	ecological screening level
FDA	Food and Drug Administration
FS	feasibility study
g/mole	gram(s) per mole
GIS	graphic information system
GRAS	generally recognized as safe
HEAST	Health Effects Assessment Summary Table
HERD	Human and Ecological Risk Division
HHERA	human health and ecological risk assessment
HHRA	human health risk assessment
HI	hazard index
HMW PAH	high molecular weight polyaromatic hydrocarbon
HQ	hazard quotient
IDW	inverse distance weight
IR	ingestion rate
IF	ingestion factor
IRIS	Integrated Risk Information System
IUR	inhalation unit risk
kg	kilogram(s)
kg/d	kilogram(s) per day
kg/kg	kilogram(s) per kilogram(s)

L	liter
LC_{50}	lethal concentration to 50% of test population
L/d	liters per day
LHR	large home range
LMW PAH	low molecular weight polyaromatic hydrocarbon
LOAEL	lowest-observed-adverse-effect-level
LOEC	lowest-observed-effect-concentration
log Kow	octanol-water partition coefficient
m^2	square meters
m^3/kg	cubic meter(s) per kilogram
mg/m^3	milligram(s) per cubic meter(s)
MATC	maximum acceptable toxicant concentration
MET	minimal effects threshold
mg	milligram(s)
mg/cm^2	milligram(s) per square centimeter
mg/kg	milligram(s) per kilogram
mg/kg-d	milligram(s) per kilogram per day
mg/L	milligram(s) per liter
MLF	plant mass loading factor
MRL	minimum risk level
MWH	Montgomery Watson Harza
NASA	National Aeronautics and Space Administration
NCEA	National Center for Environmental Assessment
NCP	National Contingency Plan
NEC	no effect concentration
NFA	no further action
NFEC	Naval Facilities Engineering Command
NJDEP	New Jersey Department of Environmental Protection
NOAA	National Oceanic and Atmospheric Administration
NOAEL	no-observed-adverse-effect-level
NOEC	no-observed-effect-concentration
NRWQC	National Recommended Water Quality Criteria
OEHHA	Office of Environmental Health Hazard Assessment
ORNL	Oak Ridge National Laboratory
PAH	polyaromatic hydrocarbon

PCB	polychlorinated biphenyl
PEC	probable effect concentration
PEF	particulate emission factor
PEL	probable effects level
ppm	parts per million
PPRTV	Provisional Peer Reviewed Toxicity Values
PRG	Preliminary Remediation Goal
RAGS	Risk Assessment Guidance for Superfund
RAIS	Risk Assessment Information System
RBSL	risk-based screening level
RCRA	Resource Conservation and Recovery Act
REL	recommended exposure limit
RfC	reference concentration
RfD	reference dose
RFI	RCRA Facility Investigation
RME	reasonable maximum exposure
RAO	remedial action objectives
RPs	responsible parties
RR RBSLs	rural residential risk-based screening levels
RSL	Regional Screening Level
SA	skin surface area
SB990	California Senate Bill 990
SRAM	Standardized Risk Assessment Methodology
SQB	sediment quality benchmark
SQL	sample quantitation limit
SQuiRTs	Screening Quick Reference Tables
SRC	serious risk concentration
SSFL	Santa Susana Field Laboratory
2,3,7,8-TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
TCE	trichloroethene
TEC	threshold effect concentration
TEF	toxicity equivalence factor
TEL	threshold effect level
TEQ	toxicity equivalent
THQ	target hazard quotient

TM	technical memorandum/memoranda
TNRCC	Texas Natural Resources Conservation Commission
TPH	total petroleum hydrocarbon
TR	target risk
TRV	toxicity reference value
UCL	upper confidence limit
UET	upper effects threshold
UF	uncertainty factor
USACHPPM	US Army Center for Health Promotion and Preventive Medicine
USEPA	United States Environmental Protection Agency
VF	volatilization factor
VOC	volatile organic compound
WHO	World Health Organization

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1.0 INTRODUCTION

This Standardized Risk Assessment Methodology Revision 2 Addendum (SRAM Rev. 2 Addendum) provides updates to the human health and ecological risk assessment (HHERA) approach, methods, assumptions and toxicity criteria presented in the *Standardized Risk Assessment Methodology Work Plan, Santa Susana Field Laboratory, Ventura, California. Revision 2 – Final* (SRAM Rev. 2) (MWH, 2005). This SRAM Rev. 2 Addendum, in conjunction with portions of SRAM Rev. 2 (MWH, 2005) that remain applicable, will serve as the technical basis for conducting future HHERAs for Boeing-owned parcels referred to as Administrative Areas I, III, and the Southern Undeveloped Land (SUL), and in select northern areas where contaminants have migrated from Boeing-owned parcels, at the Santa Susana Field Laboratory (SSFL), Ventura County, California (Boeing areas). This document was prepared for the California Environmental Protection Agency (Cal-EPA) Department of Toxic Substances Control (DTSC) on behalf of the Boeing Company (Boeing), as agreed to during a meeting between the DTSC and Boeing held on February 17, 2010 in response to DTSC comments on previous risk assessments included in Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Group Reports.

2.0 BACKGROUND

As presented in the *Human Health Risk Assessment Sum-of-Fractions Methodology for Chemicals, Santa Susana Field Laboratory* (MWH, 2011) and the *Proposed Approaches for Streamlining Future Ecological Risk Assessments at the Santa Susana Field Laboratory – Technical Memorandum* (MWH, 2009), future HHERAs for Boeing areas at the SSFL will be conducted using a sum-of-fractions approach. In the sum-of-fractions approach, human health cancer risk and noncancer hazard estimates are quantified as the ratio of a chemical-specific exposure concentration (EPC) to corresponding medium- and receptor-specific risk-based screening levels (RBSLs), and then summed to a cumulative cancer risk or noncancer hazard, as appropriate. Similarly, ecological hazard estimates are quanitified as the ratio of a chemical—specific EPC to corresponding medium- and receptor-specific ecological risk-based screening levels (EcoRBSLs), and then summed to a cumulative hazard, as appropriate. Between April 2010 and December 2013, Boeing prepared a series of human health and ecological risk assessment (HHERA) procedures technical memoranda (TMs) describing the methods and assumptions to be used in the preparation of future HHERAs for Boeing areas at the SSFL. The HHERA methods and assumptions included in these TMs represent updates and refinements to the HHERA methods and assumptions that were published in the SRAM Rev. 2 (MWH, 2005), as well as new risk assessment procedures utilizing the sum-of-fractions approach. These HHERA procedures technical memoranda were individually submitted to the DTSC for review and approval, and DTSC provided tentative approval of them after their comments and requested changes were addressed.

In addition, Boeing submitted a draft *Human Health Risk-Based Screening Levels Technical Memorandum* (MWH, 2011) and a draft *Ecological Risk-Based Screening Levels Technical Memorandum* (MWH, 2012) to the DTSC in November 2011 and February 2012, respectively. DTSC provided comments on the draft Human Health (HH) RBSLs and EcoRBSLs TMs in May 2012 and January 2012, respectively. DTSC comments on the HH RBSLs and EcoRBSLs TMs were partially addressed by Boeing, as described in a letter from Boeing to DTSC, dated 27 September 2012, in order to allow the HH and EcoRBSLs to be used during data gap characterization activities for Boeing areas. The remainder of DTSC's comments on the HH RBSLs and EcoRBSLs TMs are addressed herein.

Finally, the medium- and receptor-specific HH RBSLs and EcoRBSLs have been updated to reflect the most current toxicity criteria, exposure assumptions, and physical/chemical information, as of December 2013.

3.0 SCOPE

Portions of SRAM Rev. 2 remain applicable, while others have been updated with the technical memoranda listed in Section 4.0 of this SRAM Rev. 2 Addendum. Attachment 1 of this SRAM Rev. 2 Addendum presents the annotated SRAM Rev. 2 document indicating, through redline and inserted notes, exactly what portions of the SRAM that are no longer applicable and where to find updated information on these specific risk assessment methodologies that are being updated or replaced. The following are the portions of SRAM Rev. 2, as noted in Attachment 1, that have been replaced, updated, or are no longer applicable based on more recent guidance documents and this SRAM Rev. 2 Addendum:

- Section 1, specifically Subsection 1.5 - Guidance and Authorities.
- Section 2, specifically:
    - Subsection 2.7 – PCB Extrapolation Methodology, and
    - Subsection 2.8 – Total Petroleum Hydrocarbon Extrapolation Methodology.
- Section 3 – Hazard Identification, specifically:
    - Subsection 3.1.2.1 – Soil Background and Groundwater Comparison Concentrations,
    - Subsection 3.1.2.4 – Special Mixtures,
    - Subsection 3.2 – Additional Criteria for Selection of Chemicals of Potential Ecological Concern,
    - Subsection 3.3 – Comparison of Site Data to Soil Background and Groundwater Comparison Concentration Data, and
    - Subsection 3.3.3 – Comparison Methods for Dioxins.
- Section 4 – Conceptual Site Model for Human Receptors, specifically:
    - Subsection 4.1.1 – Receptors, and
    - Subsection 4.1.2 – Potential Exposure Pathways.

- Section 5 – Human Exposure Models, specifically:
  - Subsection 5.1 – Receptors,
  - Subsection 5.2 – Exposure to COPCs in Soil or Sediment,
  - Subsection 5.3 – Exposure to COPCs in Groundwater,
  - Subsection 5.4 – Dermal Contact with Surface Water, and
  - Subsection 5.5 – Exposure to COPCs in Food.
- Section 6 – Exposure Point Concentrations for Human Health Risk, specifically:
  - Subsection 6.1 – Exposure Point Concentrations in Groundwater,
  - Subsection 6.2.1 – Deterministic Estimation of Exposure Point Concentrations,
  - Subsection 6.4 – Exposure Point Concentrations in Air,
  - Subsection 6.4.1 – Fugitive Dust Emissions,
  - Subsection 6.4.2 – Volatilization from Soil and Groundwater to Ambient Air,
  - Subsection 6.4.3 – Indoor Air Concentrations from Volatile Emissions from Soil and Groundwater,
  - Subsection 6.5 – Exposure Point Concentrations in Produce, and
  - Subsection 6.6 – Exposure Point Concentrations at Seeps and Springs.
- Section 7 – Human Health Toxicity Assessment, specifically:
  - Subsection 7.1 – Non-carcinogenic Health Effects,
  - Subsection 7.2 – Carcinogenic Health Effects,
  - Subsection 7.3 – Chemical-Specific Toxicity Criteria, and
  - Subsection 7.4 – Toxicity Equivalent Factors for Dioxin and PCB Congeners.
- Section 8 – Human Risk Characterization, specifically:
  - Subsection 8.1 – Characterization of Potential Carcinogenic Health Risks,
  - Subsection 8.2 – Characterization of Potential Non-carcinogenic Health Effects,
  - Subsection 8.5.1 – Risk Characterization for Lead,
  - Subsection 8.5.2 – Risk Characterization for Dioxin and PCB Congeners,
  - Subsection 8.5.3 – Risk Characterization for Total Petroleum Hydrocarbons, and
  - Subsection 8.5.4 – Risk Characterization for Special Exposure Pathways.
- Section 9 – Ecological Problem Formulation.
- Section 10 – Ecological Exposure Assessment.
- Section 11 – Ecological Effects Assessment.
- Section 12 – Ecological Risk Characterization.
- Appendix B – Derivation of Total Petroleum Hydrocarbon Extrapolation Factors.
- Appendix C – Ecological Screening Level Calculations.
- Appendix D – Soil Background Report.
- Appendix G – Vapor Migration Modeling Methodology.
- Appendix I – Biological Conditions Report.
- Appendix J – Large Home Range Species Exposure.
- Appendix K – Bioaccumulation Factors Calculations.

4.0 TECHNICAL MEMORANDA AND APPROVALS

The HHERA procedures technical memoranda and DTSC approvals of each technical memorandum included in this SRAM Rev. 2 Addendum are presented as follows:

Appendix A - *Process for Selecting the Comprehensive List of Chemicals for Development of Human Health Risk-Based Screening Levels for Soil at the Santa Susana Field Laboratory, Ventura County, California - Technical Memorandum* (Comprehensive List of Chemicals TM): This TM describes the process that was used during selection of a Comprehensive List of Chemicals for development of HH and EcoRBSLs for soil at the SSFL. This technical memorandum was originally prepared and submitted to DTSC in July 2011 with the final version submitted to DTSC in September 2011.

Appendix B - *Human Health Risk-Based Screening Levels Technical Memorandum* (HH RBSL TM): This TM documents all methods used in the actual calculation of HH RBSLs as well as how the HH RBSLs will be used in future risk assessments conducted at the SSFL. This technical memorandum was originally prepared and submitted to DTSC in May 2010. The finalized workbooks used to calculate the HH RBSLs, including rural residential (RR) RBSLs, for the full list of chemicals are provided to DTSC in electronic format.

Appendix C - *Ecological Exposure Assessment Updates for Use in Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura County, California - Technical Memorandum* (Exposure Assessment TM): This TM documents revisions and clarifications to ERA methodologies regarding ecological exposure modeling, including receptor-specific exposure media and exposure pathways, and medium-specific and chemical-specific biota transfer factors. In particular, this TM describes updated exposure parameters, bioaccumulation factors (BAFs), and detailed conceptual site models (CSMs) for ecological indicator receptors identified for the SSFL including aquatic receptors and amphibians. This TM was originally prepared and submitted to DTSC on June 4, 2010.

Appendix D - *Ecological Effects Characterization Updates for Chemicals for Use in Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura County, California - Technical Memorandum* (Effects Characterization TM): This TM presents the effects characterization information to be used in future ERAs conducted for the SSFL, including medium-specific screening levels to be proposed as EcoRBSLs for lower trophic level receptors, and low (NOAEL-based) and high (LOAEL-based) toxicity reference values (TRVs) for evaluating exposure pathways, other than the inhalation pathway, for higher trophic level receptors. Medium-specific screening benchmarks and oral TRVs are required to develop RBSLs for an expanded list for chemicals and to include toxicological information that has been updated since the development of the SRAM Rev. 2. This TM also includes the detailed hierarchies of sources from which medium-specific benchmarks and TRVs are derived. This TM was originally prepared and submitted to DTSC on March 2, 2011.

Appendix E - *Inhalation Toxicity Reference Value Updates for Use in Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura County, California - Technical Memorandum* (Inhalation TRV TM): This TM describes the inhalation toxicity reference values (TRVs) that will be used for evaluation of impacts to burrowing mammals in future ERAs conducted at the SSFL. The final version of this TM was submitted to DTSC on January 7, 2011. In addition, a formal, standalone version of this TM, with attribution, was produced and submitted to DTSC on June 21, 2011.

Appendix F - *Ecological Risk-Based Screening Levels for Use in Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura County, California - Technical Memorandum* (EcoRBSL TM): This TM documents all methods used in the actual calculation of EcoRBSLs as well as how the EcoRBSLs will be used in future risk assessments conducted at the SSFL. This TM was originally prepared and submitted to DTSC on November 23, 2011. The finalized workbook used to calculate the EcoRBSLs, including Eco RBSLs for soil, surface water, sediment, near-surface groundwater, and burrow air (inhalation pathway) for the full list of chemicals was submitted to DTSC in electronic format on November 23, 2011.

Appendix G - *Large Home Range Receptor Ecological Risk Assessment Methodology, Santa Susana Field Laboratory, Ventura County, California - Technical Memorandum* (Large Home Range TM): This TM presents the methodologies to be used in future ERAs conducted for the SSFL for the following representative large home range receptors: the mule deer, the red-tailed hawk, and the bobcat. This TM was originally prepared and submitted to DTSC on October 14, 2013.

Appendix H –*Method for Documenting the Use of Extrapolated Data in Risk Assessments Prepared for the Santa Susana Field Laboratory, Ventura County, California - Technical Memorandum* (Extrapolated Data TM): This technical memorandum describes the originally proposed approach for documenting the use of extrapolated data in future HHERAs at the SSFL during RCRA Facility Investigation and/or Remedial Investigation (RFI/RI) activities. This TM was originally prepared and submitted to DTSC on April 27, 2010.

Appendix I - *Incremental Risk Calculation Methodology for Human Health and Ecological Risk Assessments Prepared for the Santa Susana Field Laboratory, Ventura County, California - Technical Memorandum* (Incremental Risk TM): This TM presents methods for calculating incremental risk for chemicals and radionuclides, and includes examples of how these data are presented. This TM was originally prepared and submitted to DTSC on April 27, 2010. This TM does not include updated background data collected and published by DTSC (URS, 2012) and the USEPA (HydroGeoLogic, 2012).

Appendix J - *Hot Spot Evaluation Technical Memorandum Prepared for the Santa Susana Field Laboratory, Ventura County, California - Technical Memorandum* (Hot Spot TM): This TM presents methods for identifying hot spots and describes the procedures to be used to evaluate individual sample results to determine if a hot spot is present. This TM also describes how hot spot analysis will be performed during the selection of chemicals of potential concern (COPCs),

chemicals of potential ecological concern (CPECs), radionuclides of potential concern (ROPCs), and radionuclides of potential ecological concern (RPECs); and after exposure point concentrations (EPCs) are calculated. This TM was originally prepared and submitted to DTSC on July 1, 2010.

Some technical changes, as well as formatting and editorial changes, were made to the above technical memoranda since they were last submitted to DTSC in response to DTSC comments on the HH and EcoRBSLs TMs, or to provide consistency between the TMs.

5.0 REFERENCES

Applicable references to this SRAM Rev.2 Addendum are presented in each individual technical memorandum.

ATTACHMENT 1

Annotated Standardized Risk Assessment Methodology (SRAM) Work Plan, Santa Susana Field Laboratory, Ventura County, California Revision 2 - Final

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LIST OF ACRONYMS AND ABBREVIATIONS

ABSP	Alfa/Bravo Skim Pond
ACR	acute to chronic ratio
ADD	average daily dosage
AOC	Areas of Concern
APTF	Advanced Propulsion Test Facility
AST	aboveground storage tank
ATSDR	Agency for Toxic Substances and Disease Registry
AWQC	Ambient Water Quality Criteria
BAF	biota sediment/soil accumulation factor
BCR	Biological Conditions Report
bgs	below ground surface
Boeing	The Boeing Company
BTAG	Biological Technical Advisory Group
BTEX	benzene, toluene, ethylbenzene, xylenes
Cal-EPA	California Environmental Protection Agency
CDC	Center for Disease Control
CDD	chlorinated dibenzo-p-dioxin
CDF	chlorinated dibenzofuran
CFOU	Chatsworth Formation Operable Unit
CLP	Contract Laboratory Program
CMI	corrective measures implementation
CMS	corrective measures study
COPC	Chemical of Potential Concern
CPEC	Chemical of Potential Ecological Concern
CSF	cancer slope factor
CSM	conceptual site model
CTE	central tendency exposure
CTL-III	Component Test Laboratory III
DHS	Department of Health Services
DHS-RHB	Department of Health Services - Radiologic Health Branch
DOE	U.S. Department of Energy
DTSC	Department of Toxic Substance Control
EC50	median effective concentration
ECAO	Environmental Criteria and Assessment Office
ECL	Engineering Chemistry Lab
ED50	median effective dose
EPC	exposure point concentration
EPV	exposure point values
ESL	ecological screening level
ETEC	Energy Technology Engineering Center
FSDF	Former Sodium Disposal Facility
GC/MS	Gas Chromatograph/Mass Spectrometer
GIS	geographic information system
GWTS	groundwater treatment systems

LIST OF ACRONYMS AND ABBREVIATIONS

ha	alternative hypothesis
HCPC	high-carbon petroleum constituents
HEAST	Health Effects Assessment Summary Table
HERD	Health and Ecological Risk Division
HI	hazard index
h_o	null hypothesis
HQ	hazard quotient
HWSA	Hazardous Waste Storage Area
ICF	ICF Kaiser Engineers
ICP	inductively coupled plasma
IEL	Instrument and Equipment Laboratories
IRIS	Integrated Risk Information System
LADD	lifetime average daily dosage
LC50	median lethal concentration
LCPC	low-carbon petroleum constituents
LCV	lowest chronic value
LD50	median lethal dose
LOAEL	lowest observable adverse effect level
LOEC	lowest observable effect concentration
LOEL	lowest observable effect level
LOX	liquid oxygen
mg/kg	milligrams per kilogram
mg/kg-day	milligrams per kilogram per day
mm Hg	millimeters of mercury
MMH	monomethyl hydrazine
NASA	National Aeronautics and space Administration
NOAEL	no observable adverse effect level
NOEC	no observable effect concentration
NOEL	no observable effect level
NPDES	National Pollutant Discharge Elimination System
OEHHA	Office of Environmental Health Hazard Assessment
Ogden	Ogden Environmental and Energy Services Co., Inc.
ORNL	Oak Ridge National Laboratory
OU	operable unit
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PEF	particulate emission factor
PLF	Propellant Load Facility
QA	quality assurance
QC	quality control
RCRA	Resource Conservation and Recovery Act
RDL	reportable detection limit
RFA	RCRA facility assessment
RfC	reference concentration

LIST OF ACRONYMS AND ABBREVIATIONS

RfD	reference dose
RFI	RCRA facility investigation
RME	reasonable maximum exposure
RMHF	Radioactive Materials Handling Facility
RWQCB	Regional Water Quality Control Board
SAIC	Science Applications International Corporation
SF	scaling factor
SMMC	Santa Monica Mountains Conservancy
SPA	Storable Propellant Area
SQG	sediment quality guideline
SQL	sample quantitation limit
SRAM	Standardized Risk Assessment Methodology
SSFL	Santa Susana Field Laboratory
STL-IV	Systems Test Laboratory IV
Surficial OU	Surficial Media Operable Unit
SVOC	semivolatile organic compound
SWMU	Solid Waste Management Unit
SWRCB	State Water Resources Control Board
TCA	1,1,1-trichloroethane
TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
TCE	trichloroethylene
TEF	toxicity equivalency factor
TEQ	toxicity equivalent
TIC	Tentatively Identified Compound
TOC	total organic carbon
TPH	Total Petroleum Hydrocarbons
TRV	toxicity reference value
TTF	Thermal Treatment Facility
UCL	upper confidence limit
UDMH	unsymmetrical dimethyl hydrazine
UF	uncertainty factor
USEPA	United States Environmental Protection Agency
UST	underground storage tank
VCAPCD	Ventura County Air Pollution Control District
VCEHD	Ventura County Environmental Health Division
VF	volatilization factor
VOC	volatile organic compound
WDR	Waste Discharge Requirement
WHO	World Health Organization
WRS Test	Wilcoxon Rank Sum Test
µg/dL	micrograms per deciliter

SECTION 1

The following have been updated or replaced in this section and subsections:

- **Additional guidance documents applicable to the human health risk assessment are presented in Appendix B of the SRAM Rev. 2 Addendum.**
- **Additional guidance documents applicable to the ecological risk assessment are presented in Appendix C through Appendix F of the SRAM Rev. 2 Addendum.**
- **The RCRA Corrective Action Program at the SSFL is currently being conducted by Boeing as required by the 2007 Consent Order for Corrective Action (DTSC, 2007), which also includes reference to the Hazardous Waste Facility Post-Closure Permits for Areas I and III cited in Sections 1 and 1.3.1 below.**

1 INTRODUCTION

The Standardized Risk Assessment Methodology (SRAM) Revision 2 describes the methods to be used to conduct human health and ecological risk assessments for chemical contamination of the Surficial Media Operable Unit (Surficial OU) and Chatsworth Formation OU (CFOU) at the Santa Susana Field Laboratory (SSFL). This document supercedes the original SRAM (Ogden 2000a) approved by the Human and Ecological Risk Division (HERD) of the California Environmental Protection Agency (Cal-EPA) Department of Toxic Substances Control (DTSC) during June 2000. This revision to the SRAM was requested by DTSC because it includes, expands on, and provides additional information to supplement the original SRAM.

This document has been prepared on behalf of The Boeing Company (Boeing); the National Aeronautics and Space Administration (NASA); and the U.S. Department of Energy (DOE) as part of the Resource Conservation and Recovery Act (RCRA) Corrective Action Program at the SSFL. The RCRA Corrective Action Program at the SSFL is being conducted as required by three Hazardous Waste Facility Permits issued to Boeing, NASA, and DOE by DTSC. The three permits governing the RCRA Corrective Action Program at the SSFL include (1) the Areas I and III Post-Closure Permit issued in 1995, (2) the Area II Post-Closure Permit issued in 1995, and (3) the Area IV Hazardous Waste Management Facility Operating Permit issued in 1993.

The SRAM Revision 2, hereafter referred to as the SRAM, expands upon the methods presented in the original SRAM and SRAM Revision 1 and incorporates several additional methods at the request of the DTSC. This revision of the SRAM (Revision 2) also incorporates comments made

by DTSC on the draft version of this document published in June 2005. The purpose of the SRAM is to establish a standardized, regulatory-approved approach to assess the human health and ecological risk of chemicals that are present in the various environmental media (*e.g.*, air, soil, water) at the SSFL. Because risk assessment science and regulatory policy change with time, provisions are presented in this work plan that allow the proposed approach to be "evergreen" through time (see definitions provided in Section 1.7).

After the risk assessments are completed, the risk assessments will be used to help identify areas at any investigational unit that are determined to need remediation. Both wide-area and SSFL-site wide risks may need to be addressed in addition to investigation unit risks for some receptors. Area wide risks may be addressed in bundled reports which are inclusive of a large reporting area. SSFL risks may be addressed in a limited and specific site-wide risk assessment.

1.1 OBJECTIVE AND SCOPE OF THE SRAM

The objective of the SRAM is to provide a consistent approach for risk assessment at the investigational units at the SSFL. Although each investigational unit is unique, many have similar potential contaminants, exposure pathways, and receptors. As such, a consistent technical approach for all investigational units at the SSFL is proposed as the first step in the risk assessment process. The methodology will be applied to each investigational unit to determine the potential human and ecological risks due to exposures to chemicals present in various media at the SSFL.

The scope of the SRAM includes both human and ecological risk assessments and describes the following:

- establish the requirements for data to be used for the risk assessment
- identify the criteria for selection of chemicals of potential concern for the human health and ecological risk assessments
- establish a conceptual model to identify human health and ecological receptors, exposure pathways, exposure points, and exposure mechanisms
- establish the procedure for human health and ecological toxicity assessments
- develop the procedure to characterize human and ecological risk

These general tasks are common to the assessment of both human health and ecological risk. However, the specific steps recommended by the regulatory risk assessment guidance for the SSFL (see Section 1.5) sometimes overlap and sometimes diverge for the two assessments. The

relationship of human health and ecological risk assessment steps, as driven by the prevailing regulatory guidance, is shown on Figure 1-1. Where the specific steps are similar, this work plan describes an approach common to both human health and ecological assessment. Where there are divergent techniques, human health and ecological assessment methods are described separately. This is reflected in the subject of subsequent sections of this work plan, which are summarized in Section 1.6.

1.2 FACILITY BACKGROUND

The SSFL is approximately 29 miles northwest of downtown Los Angeles, California, in the southeast corner of Ventura County. The SSFL occupies approximately 2,850 acres of hilly terrain, with approximately 1,100 feet of topographic relief near the crest of the Simi Hills. The Simi Hills are bordered to the east by the San Fernando Valley and to the north by the Simi Valley. Figure 1-2 shows the general geographic location, property lines, and topography of the site.

1.2.1 History and Land Use

Table 1-1 outlines the history of property ownership at the SSFL, and Figure 1-3 identifies the location of the acquired properties. Prior to use as a rocket engine testing facility, the land at the SSFL was used for ranching and grazing. North American Aviation (a predecessor to Boeing) began using (by lease) what is now known as the northeastern portion of Area I during 1947/1948. The majority of the SSFL was acquired as part of the Silvernale property in 1954, and development of the western portion of the SSFL began soon after. Undeveloped land parcels to the south of the SSFL were acquired during 1968 and 1976, and to the north during 1998. These undeveloped portions of the SSFL were primarily used for historical ranching and grazing, and motion picture film-making. No site-related operations were conducted in these undeveloped areas.

The SSFL is jointly owned by The Boeing Company and NASA. A portion of the SSFL includes facilities owned by DOE.

The site is divided into four administrative areas (Areas I, II, III, and IV) and undeveloped land to both the north and south (Figure 1-2). The areas are owned and operated as follows (Science Applications International Corporation [SAIC] 1994):

- Area I (U.S. Environmental Protection Agency [USEPA] ID Number CAD 093365435) consists of 713 acres located in the northeast portion of the site. Boeing owns 671 acres, and the remaining 42 acres are owned by NASA. Boeing operates the entire Area I, including the NASA portion. The 42-acre NASA property in Area I was formerly owned by the U.S. Air Force.

- Area II (USEPA ID Number CA 1800090010) consists of 410 acres located in the north-central portion of the site. Area II is owned by NASA and operated by Boeing.

- Area III (USEPA ID Number CAD 093365435) consists of 114 acres in the northwest portion of the SSFL and is owned and operated by Boeing.

- Area IV (USEPA ID Number CAD 000629972 and CA 3890090001) consists of 290 acres located in the extreme northwest section of the site, which are owned and operated by Boeing. A portion of Area IV (consisting of 90 acres that house the Energy Technology Engineering Center [ETEC]) was leased to DOE, and operated by Boeing.

- Southern Undeveloped Area in the southern portion of the SSFL is an undeveloped, open-space area that consists of approximately 1,200 acres along the southern boundary of the site. This naturally vegetated area is owned by Boeing. Industrial activities have never been conducted in this area.

- Northern Undeveloped Area in the northern portion of the SSFL, adjacent to Areas II, III, and IV, is an undeveloped open space area consisting of about 180 acres. This area is naturally vegetated and has not been used for industrial activity. It is owned by Boeing.

The SSFL has been active since 1948. Site activities have included research, development, and testing of rocket engines, water jet pumps, lasers, liquid metal heat exchanger components, nuclear energy, and related technologies. The principal activity has been large rocket engine testing by Boeing and NASA in Areas I, II, and III, and energy technology research for DOE in Area IV. Laboratory research, rocket engine assembly, and rocket engine testing are ongoing activities at the site, along with site use supporting these activities (maintenance, site engineering, environment, health and safety, and security).

1.2.2 Surrounding Land Use

Most of the land adjacent to the site property is undeveloped and mountainous. About 75 percent of the area within a five-mile radius of the site is undeveloped. Surrounding land use and the

boundaries of adjacent properties in Ventura County are shown on Figure 1-4. A brief description of the land use of each of the adjacent properties is presented below.

Northern Adjacent Properties - Two properties are situated adjacent to the north of the SSFL. The adjacent property located to the northwest is occupied by the Brandeis-Bardin Institute and the adjacent property located to the northeast is occupied by the Santa Monica Mountains Conservancy (SMMC). The Brandeis-Bardin Institute is zoned as rural agricultural on Ventura County zoning maps. This designation permits a wide range of agricultural uses. The specific land use permit conditions for the Brandeis-Bardin Institute indicate that this property contains religious, teaching, and camping facilities, and a cemetery. The SMMC is zoned as open space.

Eastern Adjacent Properties - The properties situated immediately adjacent to the east of the SSFL are zoned light agricultural, with variances that permit higher density use (*e.g.*, mobile home parks). An existing residential community occurs approximately ¼ mile east of the SSFL boundary in Woolsey Canyon.

Southern Adjacent Properties - The properties situated adjacent to the south of the SSFL are used for residential purposes. While residential properties abut the southern border of the SSFL, the southern portion of the site consists of an undeveloped area lying between the active portions of the SSFL and residential areas. Dense residential development begins in the San Fernando Valley about five miles to the south of the SSFL.

Western Adjacent Properties - The properties situated adjacent to the west of the SSFL are designated by the Ventura County Planning Department as Open Space, with the exception of a 2,800 acre section of Ahmanson Ranch which is zoned Specific Plan (Rincon Consultants 2002; D. Hawkins 2003). This Open Space zoning category indicates that the purpose of the open space zoning designation is to provide for the conservation of renewable and nonrenewable natural resources, to preserve and enhance environmental quality and to provide for the retention of the maximum number of future land use options while allowing reasonable and compatible uses on open lands in the County which have not been altered to any great extent by human activities.

1.2.3 Facility Operations and Chemical Use

Operational activities at the SSFL began in 1948 and have primarily included research, development, and testing of liquid-propellant rocket engines and associated components (pumps, valves, etc.) (SAIC 1994). Liquid-propellant rocket engine testing activities have been conducted

at six major rocket engine test areas: Bowl, Canyon, Alfa, Bravo, Coca, and Delta. These areas were in operation simultaneously in the late 1950s and early 1960s. The Bowl, Canyon, and Delta test areas were phased out of operation in the late 1960s and 1970s. The Coca test area was shut down in May 1988. The Alfa and Bravo test areas are currently in operation. Engine testing at these areas primarily used petroleum-based compounds as the "fuel" and liquid oxygen (LOX) as the "oxidizer." Solvents, primarily trichloroethene (TCE), were used for cleaning of engine components. In 1961, a TCE recycling system was installed in active testing areas to capture and reuse this solvent. After 1977, TCE was only used (and reclaimed) at one test stand location (Alfa) (ICF Kaiser Engineers [ICF] 1993a,b, c). TCE use at the SSFL was discontinued in the early 1990s. In addition to the primary facility operation for testing liquid-propelled rocket engines, the SSFL was used for research, development, and testing of water jet pumps, and lasers.

From the mid 1950s until the mid 1990s, DOE and its predecessor agencies sponsored nuclear energy research and energy development projects within Area IV of the SSFL. Today, the research center is referred to as the ETEC. The research and energy development activities included nuclear energy operations (development, fabrication, disassembly, and examination of nuclear reactors, reactor fuel, and other radioactive materials) and large-scale liquid sodium metal experiments for testing liquid metal fast breeder reactor components. All nuclear energy operations ended in 1988 and included 10 nuclear research reactors, seven critical facilities, the Hot Laboratory, the Nuclear Materials Development Facility (SWMU 7.2), the Radioactive Materials Handling Facility (RMHF) (SWMU 7.6), and various test and nuclear material storage areas at ETEC. Area IV nuclear energy research and other energy development operations and facility status are summarized in a recent Environmental Assessment Report prepared in anticipation of ETEC closure activities (DOE 2003).

Laboratories, chemical storage areas, equipment assembly, and maintenance facilities have supported operations at the SSFL. Laboratories were used to supply chemicals for testing operations, or to conduct small-scale testing of materials (*e.g.*, metals). Liquid chemicals were historically stored in various types of containers and vessels including drums, aboveground storage tanks (ASTs), and underground storage tanks (USTs). Solid or powdered chemicals used at the SSFL were stored in drums or small containers and often kept in buildings or above-grade storage pads. Equipment assembly was typically performed inside buildings and only involved minimal chemical use.

A summary of the types of chemicals used for SSFL operations is provided in Table 1-2. Petroleum fuel hydrocarbons and chlorinated solvents have been used at the SSFL in the largest volumes. Petroleum hydrocarbons were used as fuel for many of the liquid-propellant rocket engine tests performed there. Chlorinated solvents, primarily TCE, were used following engine tests to clean elements of the rocket engines (*e.g.*, thrust chambers) and for other equipment degreasing operations at the SSFL. Another solvent used in lesser quantities, 1,1,1-trichloroethane (TCA), contained 1,4-dioxane as a stabilizer to increase the longevity and usefulness of the solvent. Based on facility records, 1,4-dioxane was not added to TCE as a stabilizer for rocket engine testing operations at the SSFL because it also caused an undesirable residue on engine components that did not meet specifications. Solid propellants, including perchlorate compounds, were used at the SSFL for research and testing operations. Perchlorate was used in relatively small quantities as an oxidizer for the production of turbine spinners and igniters; for research, development, and production of flares; and for small-scale solid-propellant rocket motors research, development, and testing (MWH 2003a). Polychlorinated biphenyls (PCBs) were present in some waste oils, and oils within pre-1980 electrical transformers at various sites within the SSFL.

Other chemicals may have entered the environment as by-products of operations at the SSFL. The periodic burning of off-spec fuels in ponds may have produced polychlorinated dibenzodioxins and dibenzofurans (collectively referred to in this document as “dioxins”). N-nitrosodimethylamine may have been produced by the environmental breakdown of unsymmetrical dimethyl hydrazine (UDMH). UDMH and monomethyl hydrazine (MMH) were used as a fuel in testing certain rocket engines for research and development at a few limited locations within the SSFL. Various metals may have used in machining operations, or stored or disposed as construction debris.

Chemical and solid wastes created from facility operations have been managed through various methods. Three landfills were used at the SSFL primarily for disposal of nonhazardous, inert construction debris (*e.g.*, concrete, asphalt, rock, soil, etc.). Liquid wastes from engine testing were managed until the 1980s in a series of both flow-through and retention ponds. Ten of these ponds (impoundments) have undergone closure; one was clean-closed, and nine were closed as RCRA-regulated investigational units, managed under the Post-Closure Permit (described further in Section 1.2, below). After closure of these impoundments, wastes were managed for offsite recycling, treatment, or disposal. Extensive efforts at waste reduction and minimization over the last 20 years have greatly reduced the volume and types of wastes produced at the SSFL. Waste management at the SSFL has been performed consistent with standard practices of the time

throughout the SSFL's history and is performed in compliance with applicable laws and regulations.

1.3 REGULATORY PROGRAMS AND OVERSIGHT

A comprehensive environmental program is conducted at the SSFL under the jurisdiction of several federal, state, and county regulatory agencies. Because it is an active facility, five environmental programs at the SSFL are being conducted under the authority of RCRA. However, other federal, state, and county environmental programs are also being performed at the SSFL. These programs are designed so that facility operations are conducted in an environmentally protective manner, and that investigation and cleanup are performed to meet regulatory standards. Both RCRA- and non-RCRA-related programs are described in the following sections.

1.3.1 RCRA Programs

The following have been updated or replaced in this section:

- **The RCRA Corrective Action Program at the SSFL is currently being conducted by Boeing as required by the 2007 Consent Order for Corrective Action (DTSC, 2007), which also includes reference to the Hazardous Waste Facility Post-Closure Permits for Areas I and III.**

The RCRA-related activities at the SSFL include five major environmental programs, all under the oversight and jurisdiction of the DTSC. These programs include (1) RCRA Corrective Action, (2) Closure of inactive RCRA units, (3) Compliance/permitting of RCRA units, (4) Groundwater Characterization and Remediation, and (5) Interim Measures. In some instances these programs overlap (*e.g.*, closed RCRA investigational units within RCRA Facility Investigation (RFI) sites are investigated as part of Corrective Action). Although related under RCRA, each program has separate process requirements and guidelines. Collectively, these programs represent a comprehensive program for the handling and cleanup of hazardous chemicals. Investigation and cleanup of radioactive constituents are under oversight of DOE and the Department of Health Services (DHS) as described in Section 1.3.2 below.

<u>RCRA Corrective Action</u>

This program includes the RCRA facility assessment (RFA), RFI, corrective measures study (CMS), and corrective measures implementation (CMI) phases. Corrective Action at the SSFL is

being conducted as required by the Stipulated Enforcement Order issued by DTSC in 1992. Specifications regarding the ongoing Corrective Action Program were subsequently provided in three Hazardous Waste Facility Permits issued to Boeing, NASA, and DOE by DTSC. The three permits governing the RCRA Corrective Action Program at the SSFL include (1) the Areas I and III Post-Closure Permit issued in 1995, (2) the Area II Post-Closure Permit issued in 1995, and (3) the Area IV Hazardous Waste Management Facility Operating Permit issued in 1993.

The first phase of the RCRA Corrective Action, the RFA, was conducted for USEPA in 1989 identified 122 Solid Waste Managements (SWMUs) and Areas of Concern (AOCs) at the SSFL (SAIC 1991). These include any units at the SSFL that have used, stored, or handled various hazardous materials. When finalized in 1994, the RFA included three additional sites for a total of 125 SWMUs and AOCs at the SSFL (SAIC 1994). During the subsequent RFI phase of Corrective Action, 10 additional AOCs have been identified at the SSFL. All 135 SWMUs and AOCs currently identified at the SSFL are listed in Table 1-3 and shown on Figure 1-5 and, either individually or as combined groups, represent investigational units that will be among the subjects of the risk assessment process. Because of the association of most leach fields with RFI Sites, these are not shown individually on Figure 1-5 except where they are independent units (Area IV).

The SSFL RCRA Corrective Action program is currently in the RFI phase. Identified SWMUs and AOCs undergoing closure as part of the RFI program have been grouped by location for investigation and are called “RFI sites.” Fifty-one RFI sites have been identified for investigation and are shown on Figure 1-6 and listed in Table 1-4. Both surficial media and groundwater characterization are ongoing as part of the RFI. The scope and approach for the overall RFI program are further described in Sections 1.3 and 2 of this document. Site investigation is being conducted under DTSC-approved work plans (Ogden 1996, 2000b, 2000c; Montgomery Watson 2000; MWH 2001). Since 1984, over 17,500 laboratory analyses have been performed on more than 10,000 samples collected from surficial media during this program. As part of the groundwater characterization effort since 1990, over 5,000 feet of bedrock core have been drilled and more than 4,000 samples have been collected and analyzed.

Closure of Inactive RCRA Regulated Units

This program includes the closure of 12 units used to store RCRA-regulated wastes. These units include 10 former surface impoundments, a PCB storage area and a Hazardous Waste Storage Area (HWSA). These closed RCRA units are:

- Advanced Propulsion Test Facility (APTF) Impoundments 1 and 2 (SWMUs 4.9, 4.10)
- Alfa/Bravo Skim Pond (ABSP) (SWMU 5.12)
- Storable Propellant Area (SPA) Impoundments 1 and 2 (SWMUs 5.16, 5.17)
- Propellant Load Facility (PLF) Impoundment (SWMU 5.22)
- Delta Skim Pond (SWMU 5.24)
- Engineering Chemistry Lab (ECL) Pond (SWMU 6.2)
- Systems Test Laboratory IV (STL-IV) Impoundments 1 and 2 (SWMUs 6.6, 6.7)
- Building 231 PCB Storage Facility (SWMU 5.2)
- HWSA Container Storage Area (SWMU 5.8)

Nine of the closed surface impoundments are being managed and monitored according to the Post-Closure Permits administered by DTSC. The first permit applies to five Boeing impoundments in Areas I and III, and the second applies to four NASA impoundments in Area II. These Post-Closure Permits were finalized and issued to Boeing and NASA in May 1995. The PLF impoundment was clean-closed by the DHS because it was never used. The two remaining units (PCB Storage Facility and HWSA Container Storage) were sampled and closed by DTSC in 1998, since no contamination was identified.

Compliance/Permitting of RCRA Units

This program includes the permitting and compliance of active and inactive RCRA-regulated units at the SSFL, including storage areas and waste disposal practices. The three current permits issued by DTSC for active RCRA facilities at the SSFL include the Areas I and III Post-Closure Permit, the Area II Post-Closure Permits for groundwater treatment system operations, and the Operating Permit for the Area IV Hazardous Waste Management Facility (SWMU 7.2). Closure of the Area IV Hazardous Waste Management Facility began in 1998 and is ongoing at the time this report was prepared. Interim status authorization has also been issued to Boeing by DTSC to operate the DOE-owned Area IV RMHF.

In addition, this program also includes ongoing or future closure activities for other sites under RCRA Permits issued by DTSC: the Thermal Treatment Facility (TTF) (SWMU 4.8), the Hazardous Waste Management Facility (SWMU 7.2), the RMHF (SWMU 7.6), and the Building 029 Reactive Metal Storage Yard (SWMU 7.11).

Groundwater Monitoring and Remediation

SSFL groundwater characterization began in the early 1980s and continues as part of a monitoring program under DTSC oversight. This ongoing program consists of continuing groundwater monitoring and groundwater remediation. To date, over 14,000 chemical analyses have been performed on more than 8,000 samples collected from groundwater wells during this program. Groundwater monitoring and remediation are also performed in support of the surface impoundment Post-Closure Permits described above. In addition to regular monitoring and characterization activities, the groundwater RFI being conducted includes several additional, comprehensive tasks. Further information regarding the groundwater RFI characterization program is provided in Sections 2 and 3 of the *RCRA Facility Investigation Program Report* (MWH 2004a).

Thirty-two extraction wells supply water to the eight RCRA-permitted groundwater treatment systems (GWTS) at the SSFL. Currently, three of the GWTS are not being operated but remain on stand-by. Sampling of effluent at the GWTS locations has been conducted since 1986. To date, over 6,900 samples have been collected during this program. These samples are all regularly analyzed for volatile organic compounds (VOCs). Perchlorate is also monitored at four of the treatment systems.

Interim Measures

Interim measures have been conducted under DTSC oversight as part of the RCRA Corrective Action Program. Interim measures are cleanup activities that address a specific contamination issue that requires immediate cleanup. Sites where interim measures have been completed are still subject to the RCRA Corrective Action Program and will be evaluated as part of the RFI and, as appropriate, during the CMS and CMI. To date, interim measures for soil cleanup have been completed at the Happy Valley site in Area I (MWH 2004b) and the Former Sodium Disposal Facility (FSDF) site in Area IV (IT 2002). Building 203). Interim measures for groundwater contamination were initiated in the late 1980s under Los Angeles Regional Water Quality Control Board (RWQCB) oversight. The ongoing groundwater pump and treatment systems described above, now under DTSC permit, is a continuation of this interim measure.

1.3.2 Non-RCRA Environmental Programs

Environmental programs not related to RCRA include environmental permitting (including air and surface water discharges), other types of site investigation, and closure activities. These programs, under the jurisdiction of various agencies, include the activities described below.

Fuel Storage Tanks

Two types of storage tank programs are being conducted at the SSFL. The UST program includes soil investigation and cleanup associated with fuel USTs historically used at the site. This program was under the jurisdiction of the Ventura County Environmental Health Division (VCEHD). However, based on review of previous data and discussions with the RWQCB and VCEHD, DTSC assumed oversight of ongoing UST investigations at the Instrument and Equipment Laboratories (IEL) and B-1 Area investigational units. Soil investigation and cleanup associated with fuel and solvent ASTs historically used at the site is included in the RFI program under the oversight of DTSC.

Environmental Permitting

The SSFL is an active industrial facility with several types of environmental permits. Current environmental permits include those for surface water and air discharges.

Historically, waste discharges from the SSFL have been regulated since 1959. Waste Discharge Requirements (WDR) were issued by the RWQCB to regulate sewage and industrial waste discharge onsite (*i.e.*, nonhazardous leach fields). There are no longer any active leach fields at the SSFL, and the WDR permit was rescinded by the RWQCB in 1994. Sewage treatment plants are inactive (standby status), and all sanitary waste is disposed to the municipal sewer system.

Surface water discharge from the SSFL is regulated under an National Pollutant Discharge Elimination System (NPDES) permit issued by the RWQCB, beginning in 1984. Surface water discharges from the site are regularly monitored at 18 NPDES locations, shown on Figure 1-6, as per the NPDES permit (effective August 2004). Since 1998, over 2,400 laboratory analyses have been performed on more than 200 samples collected from the eight sampling locations routinely monitored in this program.

Air emissions at the SSFL are regulated and permitted by Ventura County Air Pollution Control District (VCAPCD). Emissions of carbon monoxide, nitrogen and sulfur oxides, reactive organic compounds, and particulate matter are managed in accordance with all applicable rules,

regulations, and permit conditions. In addition, lead and asbestos abatement work performed at the facility is managed as required by applicable local, state, and federal regulations. When required, notifications are prepared and submitted to the appropriate regulatory agencies.

Landfills

Nonhazardous solid waste landfills are regulated by the RWQCB and VCEHD. Currently, the SSFL has two inactive nonhazardous landfills, which are inspected quarterly by VCEHD (Area I and Area II Landfills, SWMUs 4.2 and 5.1, respectively). These landfills are being investigated as part of the RCRA Corrective Action Program under oversight of the DTSC, RWQCB, and VCEHD. A third landfill, the Building 56 Landfill (SWMU 7.1), is located in Area IV and is also being investigated under DTSC oversight as part of the RFI. Locations of these three sites are shown on Figure 1-6. There are no designated hazardous waste landfills at the SSFL.

Mixed and Radioactive Waste Monitoring and Closure Activities

Radioactive materials have been used in Area IV of the SSFL. The only remaining nuclear-related activity at the SSFL is decontamination and decommissioning of former nuclear facilities. DOE owns some buildings and equipment in Area IV and has primary jurisdiction of monitoring radioactive materials in this area. The DHS Radiologic Health Branch (DHS-RHB) oversees the Boeing-owned Radioactive Materials License, conducts facility verification surveys, concurs with the radioactive facility cleanup, and conducts environmental monitoring. SWMUs or AOCs identified in the RFA with potential radioactive contamination (SAIC 1994) are being addressed by the DOE site closure programs. Potential chemicals at these sites are being addressed by the RFI under DTSC oversight, after DOE has approved each site for unrestricted use. The process followed when former radioactive facilities are also RCRA RFI sites is that radiological characterization, cleanup (if necessary), and closure are completed first. This is then followed by RCRA Correction Action to address any chemical contamination.

1.4 RCRA Corrective Action and Operable Units

Since the early 1980s, SSFL site characterization has proceeded along two parallel paths, one for groundwater and the other for soil and related surficial media. In 1999, DTSC formalized this approach by identifying two OUs (DTSC 1999a). As defined by USEPA, an OU is a discrete entity that may comprise various attributes including the characteristics of the impacted media, geographical location, vertical and aerial considerations, specific site problems, potential exposure pathways. An OU may also consider various phases of an action, any set of actions

performed over time, or any actions that are concurrent but located in different parts of a site. The cleanup of a site can be divided into a number of OUs, depending on the complexity of the problems associated with the site.

The OUs identified at the SSFL are consistent with this definition and incorporate different geographical portions of the site, project phases, and exposure pathways. Two OUs have been identified at the SSFL through discussion with DTSC based on an understanding of where chemicals are present today, where they may migrate in the future, and how either human or ecological receptors may be exposed to those chemicals (DTSC 1999a). The OUs at the SSFL are:

- the CFOU, comprised of the Chatsworth formation aquifer, and both saturated and unsaturated unweathered (competent) bedrock; and,
- the Surficial OU, comprised of saturated and unsaturated soil, sediment, surface water, near-surface groundwater, air, biota, and weathered bedrock. Near-surface groundwater is groundwater that occurs within the alluvium or weathered bedrock.

The boundary between these two OUs is the boundary between weathered and unweathered bedrock. A brief description of each OU is provided below and depicted graphically on Figure 1-7.

It should be noted that one of the goals of the RFI program is to characterize contamination in all environmental media at the SSFL – this goal will be achieved by combining and integrating site data from the characterization programs for both OUs. Similarly, the goal of the RFI risk assessment program is to evaluate risks from all environmental media at the SSFL. This will be accomplished by combining the estimated risk associated with exposure pathways for both OUs. Reporting and evaluation aspects of the OU delineation are further described below. This revision of the SRAM (Revision 2) incorporates the CFOU. Further discussion of the exposure pathways for the SSFL is provided in Section 4 of this work plan.

1.4.1 Chatsworth Formation OU

The CFOU consists of the groundwater and associated unweathered, competent bedrock of the Chatsworth formation. Approximately 170 groundwater wells associated with the Chatsworth formation are sampled and analyzed on a regular basis. As described above, Chatsworth formation groundwater is currently being extracted and treated onsite at the GWTS.

Chatsworth formation bedrock is comprised of thickly bedded sandstone with interbeds of siltstone and shale and is unweathered and competent within the CFOU. This investigational unit has been impacted by downward flow of chlorinated solvents (primarily TCE) from surficial spills and/or by dissolved contaminants transported by Chatsworth formation groundwater. However, due to its nature and depth, it is unlikely human or ecological receptors would be exposed to chemicals in the unweathered, deeper bedrock (surficial impacts to weathered bedrock are addressed in the Surficial OU). Direct exposures to Chatsworth formation groundwater could only occur through the installation of a drinking water well, or at a surface seep or spring supplied by Chatsworth formation groundwater.

1.4.2 Surficial Media OU

The Surficial OU consists primarily of soil, sediment, and surface water, which are potentially impacted by spills or waste management practices at the SSFL. Also included in this OU are near-surface groundwater, air, biota, and the upper, weathered portion of the bedrock. These additional media have been included in the Surficial OU because chemicals released into soil, sediment, or surface water could directly contact and potentially be transferred to near-surface groundwater, air, biota, and weathered bedrock.

Soil and surface sediment are typically comprised of fine-grained silty sands, with occasional silts and clays. Surface water is present in ponds, intermittent streams, and surface seeps across the site. Near-surface groundwater is present only in selected locations at the SSFL; its occurrence generally follows topographic constraints and coincides with alluvial deposits. Biota has been included in the Surficial OU because organisms may take up chemicals from surficial media.

<u>Migration between OUs</u>

Several possible pathways of migration of chemicals across or between OUs have been identified. These are:

<u>Migration from the CFOU to the Surficial OU</u>

- Migration of volatile chemicals (via vapor transport) from Chatsworth formation groundwater or deep, unweathered bedrock to surficial media (soils, weathered bedrock, near-surface groundwater, and air). When available, direct measurement data will be used to evaluate this migration. However, when direct measurement of surficial soil vapor cannot be

collected, field validated vapor flux model calculations will be used to evaluate this migration.

- Migration of nonvolatile chemicals (via mass transport) from Chatsworth formation groundwater to surficial media (soils, weathered bedrock, seeps, springs, surface water, near-surface groundwater). This occurs when the level of Chatsworth formation groundwater either rises within surficial media (*i.e.*, then defined as near-surface groundwater), or discharges at the surface as a spring or seep. Direct measurement of Chatsworth formation groundwater at existing wells and spring/seep monitoring data will be used to evaluate this migration pathway.

Migration from the Surficial OU to the CFOU

- Migration of chemicals (via mass transport or leaching) from surficial media (soil, weathered bedrock, surface water, near-surface groundwater) to Chatsworth formation groundwater or deeper bedrock. This pathway will be evaluated on a case by case basis with respect to potential sources in the Surficial OU and relative chemical concentrations measured in Surficial OU media and Chatsworth formation groundwater or deep bedrock.

This SRAM describes procedures for assessing the risks associated with the possible migration of chemicals from the CFOU to the Surficial OU. These pathways are further described in Section 4. Characterization of the CFOU and evaluation of its associated pathways are in progress. Where Chatsworth formation groundwater exists at near-surface depths in direct communication with the near-surface groundwater zone, or where near-surface and Chatsworth formation groundwater cannot be differentiated, groundwater data from wells at or near the investigational unit will be evaluated as part of the Surficial OU risk assessment (see Section 2.6).

Based on this approach, risks from all media at the SSFL will be considered for corrective action decisions although the timing of those decisions will vary for the media assessed. Corrective actions based on risk management decisions for the Surficial OU will therefore be sufficient to protect all media within the Surficial OU. Possible impacts of residual chemicals within the Surficial OU on CFOU media will be evaluated in the risk assessment(s) for the CFOU.

1.5 GUIDANCE AND AUTHORITIES

The following have been updated or replaced in this subsection:

- **Additional guidance documents applicable to the human health risk assessment are presented in Appendix B of the SRAM Rev. 2 Addendum.**
- **Additional guidance documents applicable to the ecological risk assessment are presented in Appendix C through Appendix F of the SRAM Rev. 2 Addendum.**

While there are several regulatory authorities with jurisdiction for environmental compliance at the SSFL, the organization with primary authority for applying risk-based decisions is the DTSC of Cal-EPA. Thus, the primary source of guidance for this work plan comes from DTSC.

In the case of human health risk assessment, this guidance is the *Supplemental Guidance for Human Health Multimedia Risk Assessment of Hazardous Waste Sites and Permitted Facilities* (DTSC 1992). For ecological risk assessment, DTSC guidance is contained in *Guidance for Ecological Risk Assessment of Hazardous Waste Sites and Permitted Facilities* (DTSC 1996). In each of these documents, DTSC references specific guidance documents from USEPA. These guidance documents served as secondary sources for development of the present work plan and include the following:

- Risk Assessment Guidance for Superfund. Volume I. Human Health Evaluation Manual (Part A) (USEPA 1989a)
- Exposure Factors Handbook, Volume I. General Factors (USEPA 1997a)
- Guidelines for Ecological Risk Assessment (USEPA 1998)

In addition, risk assessment guidance from the California Office of Environmental Health Hazard Assessment (OEHHA) was also used where appropriate. Other appropriate guidance and relevant published literature was used in the development of the work plan and is cited throughout the document.

1.6 WORK PLAN ORGANIZATION

This SRAM work plan is organized into the following sections:

- Section 1 describes the SSFL and the scope, objectives, and approach of the SRAM and other ongoing environmental programs at SSFL
- Section 2 presents the data requirements for use in the human health and ecological risk assessments.

- Section 3 describes the hazard identification process and identification of chemicals of potential concern (COPCs) for human health and chemicals of potential environmental concern (CPECs) for ecological risk assessments, including a discussion of background.
- Section 4 describes the conceptual site model approach for human receptors.
- Section 5 presents human exposure models.
- Section 6 presents methods for estimating exposure point concentrations for the human health assessment.
- Section 7 presents the human toxicity assessment procedure.
- Section 8 describes the human risk characterization procedure.
- Section 9 presents the ecological problem formulation with selection of ecological receptors, identification of exposure pathways, and the ecological conceptual site model.
- Section 10 describes the ecological exposure assessment procedure.
- Section 11 presents the ecological toxicity criteria.
- Section 12 describes the ecological risk characterization procedure.
- Section 13 lists references cited in this document.

The following are included as appendices to this document:

- Appendix A Derivation of Polychlorinated Biphenyl Extrapolation Factors
- Appendix B Derivation of Total Petroleum Hydrocarbon Extrapolation Factors
- Appendix C Ecological Screening Level Calculations
- Appendix D Soil Background Report
- Appendix E Groundwater Comparison Data Set Report
- Appendix F SSFL Physical Parameters Tables
- Appendix G Vapor Migration Modeling Methodology
- Appendix H Example Human Health Risk Summary Tables
- Appendix I Biological Conditions Report (March 2005 Update)
- Appendix J Large Home Range Species Exposure
- Appendix K Bioaccumulation Factor Calculations

1.7 DEFINITIONS

Terms are used in this methodology that have specific meaning with respect to the SSFL or the processes described. The following are definitions of special or important terms:

1. The entirety of the SSFL, including Areas I through IV as described in earlier work plans and work plan addenda for environmental investigations (ICF Kaiser 1993a,b,c; Ogden

1996) and the undeveloped land along the southern boundary, will hereinafter be referred to as the "site."

2. Individual portions of the site subject to environmental investigations, such as SWMUs and AOCs under the Corrective Action requirements of RCRA, will be referred to as "investigational units" or simply "units."

3. "Reporting Areas" are either an investigational unit or a group of investigational units.

4. An "operable unit" (OU) is a discrete action that comprises an incremental step toward comprehensively addressing site issues. An OU may be a portion of a remedial response, a geographical portion of a site, or any actions that are concurrent but located in different parts of a site. At the SSFL, OUs are specific media or groups of media that will be characterized together and include (1) Chatsworth Formation OU (CFOU): Chatsworth formation groundwater and inaccessible, unweathered (competent) bedrock and (2) Surficial OU: near-surface groundwater, soil, sediment, surface water, air, biota, and accessible weathered bedrock.

5. A "Chemical of Potential Concern" (COPC) is a potentially site-related chemical with data of sufficient quality for use in quantitative human health risk assessment.

6. A "Chemical of Potential Ecological Concern" (CPEC) is a potentially site-related chemical with data of sufficient quality for use in quantitative ecological risk assessment.

7. "Pristine conditions" are concentrations of metals in soils naturally occurring in locations unaffected by human activity (DTSC 1997).

8. "Ambient conditions" are concentrations of compounds in soils in the vicinity of a site that are unaffected by site-related activities. Ambient conditions are sometimes referred to as "local background" (DTSC 1997).

9. "Type I error" is rejecting the null hypothesis when it is true. Type I error is often called a "false positive." An example of Type I error would be identifying a metal as a COPC when its concentrations are within the range of ambient conditions.

10. "Type II error" is accepting the null hypothesis when it is false. Type II error is often called a "false negative." An example of Type II error would be identifying concentrations of a

metal as within the range of ambient conditions, and thus not a COPC, when contamination is actually present.

11. "Dioxins" refers to the family of polychlorinated dibenzo-p-dioxin and dibenzofuran compounds.

12. "Toxicity equivalency factor" (TEF) is a normalizing factor used to relate the relative contribution to total exposure and risk of the various dioxin and furan congeners.

13. "Coplaner PCBs" refer to the 12 PCB congeners for which the World Health Organization (WHO), as published in Van den Berg *et al*. (1998), has developed TEFs.

14. "Toxicity equivalent" (TEQ) is the total dioxin and furan concentration of a sample expressed as the sum of the product of the individual congener concentrations and their TEF.

15. An "exposure area" is the minimum area that will sustain an assumed exposure in humans or ecological receptors. An exposure area may be larger or smaller than an investigational unit or may encompass several investigational units. Boeing recognizes that specification of exposure areas larger or smaller than investigational units is subject to DTSC approval and may provide proposals on a study-by-study basis.

16. A "human receptor" is a hypothetical individual who may be exposed to compounds in the environment. Receptors are often identified by the behaviors that determine how or with what intensity they may be exposed, such as "workers" or "residential receptors."

17. An "ecological receptor" is an organism that occurs onsite that may be exposed to compounds in the environment.

18. An "exposure route" is a mechanism of uptake. Environmentally relevant exposure routes for both human and ecological receptors typically include inhalation, ingestion, and absorption through the skin.

19. USEPA (1989a) defines an "exposure pathway" as consisting of four elements: (a) source and mechanism of chemical release; (b) retention or transport mechanism through an environmental medium; (c) point of potential contact with the impacted medium (*i.e.*, an exposure point); and (d) exposure route at the exposure point. If any of these elements is missing, the exposure pathway is considered "incomplete," and compound uptake via the pathway would not occur.

20. An "exposure point concentration" (EPC) is the concentration of a COPC in a medium at the location where a receptor is assumed to make contact with that medium. Depending on the nature of the exposure, an EPC may be estimated at a specific point (*e.g.*, a wellhead), or may need to be averaged about an "exposure area" (*e.g.*, the soil surface). It may also be necessary to take account of the potential for the EPC to change in time.

21. DTSC (1996) defines an "assessment endpoint" as the environmental attributes that are considered critical to the function of the biological community or population. The assessment endpoint is the ultimate focus of the ecological risk assessment.

22. DTSC (1996) defines a "measurement endpoint" as the measurable observable change that is used to evaluate the effects of chemicals of concern on the selected assessment endpoints. Measurement endpoints are specific qualities of an ecosystem that can be measured and that relate to the general ecosystem to be protected.

23. The term "evergreen" refers to the concept that the methods and assumptions described in the SRAM may be modified in the future based on scientific advancements or changes in regulatory guidance or policies.

SECTION 2

The following have been updated or replaced in this section and subsections:

- **Additional information regarding the methodology for evaluating PCBs in the human health risk assessment (Section 2.7), including which PCBs will be evaluated, is presented in Appendix A and B of the SRAM Rev. 2 Addendum.**
- **Additional information regarding the methodology for evaluating PCBs in the ecological risk assessment (Section 2.7), including which PCBs will be evaluated, is presented in Appendix C, D and F of the SRAM Rev. 2 Addendum.**
- **Additional information regarding how extrapolated PCB data will be presented (Section 2.7) is described in Appendix H of the SRAM Rev. 2 Addendum.**
- **The TPH extrapolation methodology (Section 2.8) is no longer applicable because adequate data have been collected for petroleum chemical constituents, and as a result TPH extrapolation is no longer necessary.**
- **When primary and duplicate samples are available, the higher of the primary and duplicate detected results or the lower of the primary and duplicate non-detected reporting limit results will be included in the dataset for use in the risk assessment.**

2 DATA REQUIREMENTS AND SELECTION CRITERIA

All sample analytical results will be evaluated to determine their suitability for use in the risk assessment. The data quality assessment performed on the sampling results will follow the criteria provided by USEPA in the *Guidance for Data Usability in Risk Assessment (Part A), Final* (USEPA 1992a). The criteria specified by USEPA will be met for sampling data results used in any risk assessment of investigational units at the SSFL. The data assessment will be based on the five criteria described in Sections 2.1 through 2.5. Findings of the data quality assessment will be presented in the RFI reports.

Although USEPA provides a comprehensive framework for risk assessment data requirements, specific data requirements for any particular data point will be established based on how that data point will be used during the risk assessment (*e.g.*, what decision is to be made based on that data) (USEPA 1992a). The establishment of any alternative data requirements will be approved by DTSC prior to use in any risk assessment.

In addition to the data requirements described above, methods for selecting representative data sets for groundwater, PCBs, and total petroleum hydrocarbon (TPH) constituent concentrations are presented in this section. The data selection criteria and methodologies described herein are common to all risk assessments for the SSFL, and have been developed in conjunction with DTSC.

2.1 DATA SOURCE REVIEW

The data source review evaluates the analytical methods performed on the sample with respect to site use information. The objective of the review is to ensure that appropriate analytical methods are used to identify all potential COPCs for each environmental medium of interest.

2.2 DOCUMENTATION

The documentation review evaluates the manner in which samples were managed by the field sampling teams and receiving laboratories. The objective of this review is to ensure that each analytical result can be associated with a sampling location and that appropriate procedures were used to collect the environmental sample. The three types of documentation that will be used to trace samples and analytical methods are chain-of-custody forms, standard operating procedures, and field sampling and analytical records.

Data obtained from previous reports will be appropriately reviewed. The criteria used to evaluate information contained in the previous reports include:

- map(s) of sampling locations
- rationales for sampling design and procedures
- identification of sample collection and preparation methods
- identification of analytical methods
- analytical results
- sample-specific detection limits
- sample-specific qualification of the analytical results
- a description of the data review
- a description of the field conditions and physical parameters

2.3 ANALYTICAL METHODS AND DETECTION LIMITS

For an analytical result to be usable for assessing risk, the sample collection, preparation, and analytical methods should appropriately identify the chemical form or species, and the specified

sample detection limit should be at or below a concentration that is associated with toxicologically relevant levels (*e.g.*, benchmark). The significance of detection limits greater than benchmark levels will be evaluated on a case-by-case basis in the discussion of uncertainty. Typical sample analytical suites and the chemical compounds detected are summarized in Table 2-1. The analytical methods listed in Table 2-1 include both historical and current laboratory procedures used for sample analysis at investigational units at the SSFL. This table summarizes the analytical methods for any sample collected at an investigational unit that may be used in the risk assessment; sampling at any investigational unit will be performed according to an agency-approved sampling plan specifying the appropriate analytical methods to be used.

Where a chemical species (*e.g.*, trivalent versus hexavalent chromium) is not specified, a conservative assumption—considering the following information; site use, media of concern, and environmental chemistry—relative to the potential for the most toxic form to be present will be applied as appropriate.

2.4 DATA REVIEW AND VALIDATION

All sample data utilized in the risk assessment will be reviewed and validated. The data will be validated following the guidance set forth in USEPA's *Contract Laboratory Program National Functional Guidelines for Organic Data Review* (1994a), and USEPA's *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (1994b).

Soil matrix, soil vapor, and water sample data will be validated based on the following criteria: sample management (appropriate containers, preservatives, documented chain-of-custody, and holding times), method blank sample results, blank spikes and laboratory control sample results, surrogate recoveries, matrix spike/matrix spike duplicate recoveries and precision, reporting limits, and field quality control (QC) sample results (equipment rinsate blanks, field blanks, and field duplicates).

A more detailed validation may be performed on selected data according to requirements specified in the relevant work plan for field studies for the investigational unit in question. The additional review may include, but is not limited to, evaluation of calibration data; gas chromatography/mass spectrometry (GC/MS) tuning; internal standards; confirmation analyses; inductively coupled plasma (ICP) interference checks; post digestion spikes; all raw data (quantitation sheets, extraction benchsheets, chromatograms, and analysts log sheets); and all information pertinent to the collection, extraction, and analysis of the samples.

The data validation procedures are designed to meet overall project data quality objectives. Data qualifiers will be assigned to data with associated qualification codes, which denote the specific reason for the qualification. The data qualifiers that may be assigned to a sample with a qualification code are shown in Table 2-2. A list of qualification codes that explain the reason for the data qualifier is provided in Table 2-3. Section 6 presents specifications for the use of qualified data.

2.5 DATA QUALITY INDICATORS - REPRESENTATIVENESS AND COMPLETENESS

Data will be evaluated to determine how well the chemicals are characterized. Data representativeness is an evaluation of site characterization, *i.e.*, how well the samples describe investigational unit conditions (*e.g.*, are samples appropriately placed to reveal potential releases and have all compounds potentially related to activities at the investigational unit been analyzed). Completeness relates to whether enough sample results are retained after validation to adequately characterize the investigational unit. Additionally, the data will be reviewed to determine if the variability of chemical concentrations in time and space are adequately characterized.

2.6 GROUNDWATER DATA SELECTION CRITERIA

Groundwater that occurs within the alluvium or weathered bedrock is defined as near-surface groundwater, while groundwater in unweathered, competent bedrock of the Chatsworth formation is defined as Chatsworth formation groundwater. As such, these groundwaters may represent potentially complete exposure pathways for human and ecological receptors (see Section 4.1.2). At the SSFL, near-surface groundwater is primarily monitored by wells and piezometers constructed with open intervals within the alluvium and/or weathered bedrock. However, some near-surface groundwater at the site is also monitored by deeper wells constructed with open intervals within both the overlying weathered bedrock and deeper unweathered (competent) bedrock. Depending on groundwater levels, water quality data from these deeper wells could represent near-surface groundwater conditions and should be considered near surface groundwater. During 2000, discrete depth interval monitoring systems were installed in some deep wells to provide additional understanding of the chemical distribution within the Chatsworth formation groundwater system. Recent monitoring data (water levels and water quality information) have been collected from the weathered bedrock portion of these wells and should also be considered near surface groundwater.

Because of the complexity of the data available for the SSFL risk assessments, selection criteria have been established to maintain consistency of groundwater data used. These criteria include

the definition of and identification of CFOU and near-surface groundwater monitoring wells and the selection of the water quality data set, as described below:

1. Definition of Near-Surface Groundwater Monitoring Wells

   a) Monitoring wells completed within the alluvium and/or weathered bedrock, or

   b) Monitoring wells completed within the deeper, competent bedrock that have an open interval exposed to the alluvium/weathered bedrock, and historical water levels that have risen to within that alluvium/weathered bedrock interval.

2. Definition of CFOU Groundwater Monitoring Wells

   a) Monitoring wells completed within the deeper unweathered, competent bedrock of the Chatsworth formation.

3. Selection of Water Quality Data Set

   a) Groundwater monitoring data from the most recent three year period will be evaluated to determine whether the adequately reflects water concentrations to which potential receptors will be exposed. All historical groundwater monitoring data will be evaluated to assure representativeness for the three-year period used. In addition, groundwater data from upgradient monitoring wells will be evaluated to determine what chemicals may migrate resulting in future exposures.

   b) If a compound was previously detected in groundwater and not represented in the analytical suite for the most recent consecutive three-year period, then use the most recent data over a consecutive three-year period when that compound was analyzed.

   c) Compare the analytes represented in the CFOU or near-surface groundwater data set with those mobile chemicals (*e.g.*, VOCs, perchlorate) selected as COPCs in soil and soil vapor and determine the need for inclusion of certain mobile soil or soil vapor COPCs as CFOU or near-surface groundwater COPCs.

If discrete depth water quality monitoring data within the alluvium or weathered bedrock are available for a well, those data will be used instead of standard water quality data collected from deep, open boreholes.

2.7 PCB EXTRAPOLATION METHODOLOGY

The following have been updated or replaced in this subsection:

- **Additional information regarding the methodology for evaluating PCBs in the human health risk assessment, including which PCBs will be evaluated, is presented in Appendix A and B of the SRAM Rev. 2 Addendum.**
- **Additional information regarding the methodology for evaluating PCBs in the ecological risk assessment, including which PCBs will be evaluated, is presented in Appendix C, D and F of the SRAM Rev. 2 Addendum.**
- **Additional information regarding how extrapolated PCB data will be presented is described in Appendix H of the SRAM Rev. 2 Addendum.**

Historically, PCB samples collected at SSFL investigational units have been analyzed using USEPA Method 8082, with PCBs reported as Aroclor mixtures (*e.g.*, Aroclors 1016, 1221, 1232, 1242, 1248, 1254, and 1260). To date, only Aroclors 1254 and 1260 have been detected at the SSFL using this analytical method. Aroclor 1254 is the predominant Aroclor mixture detected at the SSFL; Aroclor 1260 has only been detected in a few soil samples (Ogden 1999).

Recent developments in risk science have prompted DTSC to request an evaluation of potential risks based on both Aroclor mixture analytical results and PCB congener analytical results. The impetus for DTSC's request is the fact that certain coplanar PCB congeners act through similar mechanisms and exhibit similar toxic responses to that of dioxins (Van den Berg *et al*. 1998). Therefore, risks should be assessed using the dioxin toxicity equivalency approach described in Section 7.4. Furthermore, PCB congeners may be measured at much lower concentrations using USEPA Method 1668 than Aroclor mixtures using USEPA Method 8082. The availability of USEPA- and DTSC-approved analytical methods for PCB congeners, as well as the development of methods for assessing risks associated with PCB congeners, are relatively recent developments with respect to the RFI program. Therefore, because PCB congener data are not available for many of the sites for which Aroclor data are available, data were collected specifically for the purpose of evaluating the relationship between Aroclor concentrations and PCB concentrations in order to develop a method for estimating PCB concentrations from Aroclor results specific for the site.

This section describes the evaluation of the relationship between detected concentrations of Aroclors and detected concentrations of PCB congeners in soil. The purpose of this evaluation was to develop a method for estimating PCB congener concentrations, using Aroclor sampling results, for use in site-specific risk assessments at the SSFL. This approach allows use of all the PCB data collected at an investigational unit and provides a more complete evaluation of potential site risks.

As requested by DTSC, potential risks associated with PCBs will be assessed using two different methods: (1) risks associated with the 12 "dioxin-like" PCB congeners using the toxicity equivalency approach (Van den Berg *et al*. 1998), and (2) risks associated with a total Aroclor mixture (USEPA 1996a). Potential risks associated with the 12 PCB congeners and potential risks associated with Aroclor mixtures will be presented separately in the risk assessments. The PCB extrapolation methods described in this section will be used to estimate the concentrations of each of the 12 PCB congeners in samples for which only Aroclors have historically been detected.

The sampling and analytical program for this PCB extrapolation methodology was developed in conjunction with DTSC based on previous Aroclor results at the SSFL investigational units. Seven samples for both Aroclor and congener analysis were colocated with previous samples with elevated Aroclor results. Table 2-4 presents the site locations, samples, and analyses for samples collected during this program. Field, laboratory, and validation procedures used for this sampling event followed DTSC-approved RFI protocols (Ogden 2000b). Analytical results and data validation reports for these samples are presented in Appendix A. Data review indicated all data were useable for risk assessment. Field, laboratory, and validation procedures for this sampling event are further described in the RFI Program Report (MWH 2004a). All site-specific PCB data will be used in the RFI site reports.

Only the 12 PCB congeners applicable to risk assessment, as described by Van den Berg *et al*. (1998), were evaluated to develop a method for extrapolating Aroclor concentrations to PCB congener concentrations. Each of these 12 congeners was detected in each of the seven soil samples, with the exception of PCB 169, which was only detected in two duplicate samples. Aroclor 1254 was detected in all seven soil samples; Aroclor 1260 was only detected in two samples.

To develop Aroclor-specific extrapolation factors, Aroclor 1254 and 1260 were evaluated separately. Only pairs of detected data (Aroclor and congener) were included in the evaluation. Due to small sample size, regression analysis was not considered appropriate for relating Aroclor

concentrations to congener concentrations. Rather, the ratio of congener concentration to Aroclor concentration was determined for each set of paired results. For non detect PCB 169 results, the concentrations were estimated at one-half the sample quantitation limit (SQL). The maximum ratio of PCB congener to Aroclor concentration was conservatively selected as the extrapolation factor to be used for predicting congener concentrations in risk assessments at the SSFL. Use of the maximum ratio gives the maximum degree of confidence (based on this data set), that the predicted PCB congener concentrations will be greater than actual congener concentrations. Its use, therefore, tends to over-predict, rather than under-predict, actual congener concentrations. This uncertainty will be discussed in each of the investigational unit risk assessments for which the method is employed. The calculations used to derive Aroclor to PCB extrapolation factors are also presented in Appendix A. The extrapolation factors that will be used in risk assessments at the SSFL are summarized in Table 2-5.

Aroclor to congener extrapolation factors will be used to predict PCB congener concentrations as described in Equation 2-1.

$$C_{congener} = EF \times C_{Aroclor} \tag{2-1}$$

Where,

$C_{congener}$ = Predicted PCB congener concentration in soil (nanograms per kilogram [ng/kg])

$C_{Aroclor}$ = Measured Aroclor concentration in soil (micrograms per kilogram [µg/kg])

EF = Aroclor to PCB congener extrapolation factor ([ng/kg]/[µg/kg])

Note that all data used to derive Aroclor to PCB congener extrapolation factors were reported on a dry weight basis, and therefore, extrapolation factors can only be applied to soil samples in which Aroclor concentrations were reported on a dry weight basis. If data are not reported on a dry weight basis, then the sample-specific percent moisture content report by the laboratory will be used to convert Aroclor concentrations to a dry weight basis.

The application of PCB extrapolation factors requires that during COPC and CPEC selection, assumptions are made regarding the presence of PCB congeners based on the presence of Aroclors. This requirement is described in detail in Section 3.1. The specific methods for applying PCB extrapolation factors during the process of calculating EPCs are described in Section 6.2.

2.8 TOTAL PETROLEUM HYDROCARBON EXTRAPOLATION METHODOLOGY

- **The TPH extrapolation methodology is no longer applicable because adequate data have been collected for petroleum chemical constituents and, as a result, TPH extrapolation is no longer necessary.**

~~Risks associated with TPH impacts are commonly included in risk assessments based on the petroleum constituent concentrations rather than the TPH results because toxicity criteria for TPH are not well established or approved within the regulatory community. For the purpose of evaluation in this SRAM, petroleum chemical constituents include: benzene, toluene, ethylbenzene, and xylenes (BTEX), polycyclic aromatic hydrocarbons (PAHs), 2-methyl-naphthalene, and naphthalene (collectively, "petroleum constituents"). The petroleum constituents and their molecular formulas are presented in Table 2-6.~~

~~As required by the RFI work plans and site reviews by DTSC, TPH data are used to determine the nature and extent of a petroleum release at an investigational unit, and typically greatly outnumber the petroleum constituent data. To adequately assess the potential risks associated with TPH in environmental media, a site-specific extrapolation methodology has been developed to allow correlation between the TPH fraction concentration and the petroleum constituent concentration.~~

~~This section describes the evaluation of the relationship TPH fraction and petroleum constituent concentrations. The purpose of this evaluation was to develop a method for estimating petroleum constituent using TPH fraction sampling results for use in site-specific risk assessments at the SSFL. This approach allows use of all the TPH data collected at an investigational unit and provides a more complete evaluation of potential site risks. The TPH extrapolation methods described in this section are applicable only to soil media, and cannot be used for other media or for extrapolation between different media.~~

~~The sampling and analytical program for this TPH extrapolation methodology was based on previous TPH results at the SSFL investigational units. Sixteen soil samples were colocated near previous soil samples with elevated TPH fraction results. Each colocated sample was analyzed for TPH, VOCs (including BTEX), and/or PAHs. Because different types of petroleum constituents are associated with different carbon ranges of TPH fractions, the sampling program differed depending on previous TPH fraction results. BTEX, naphthalene, and 2-methyl-naphthalene are associated with the lighter, "low-carbon" (C08-C11) petroleum constituents~~

~~(hereafter designated LCPC) whereas PAHs are associated with the heavier, "high-carbon" (C11-C14, C14-C20, C20-C30) petroleum constituents (hereafter designated HCPC).~~

~~The initial premise for this sampling and analysis approach was that any individual petroleum constituent would only occur within one of the four TPH fractions based on the number of carbons comprising the compound. For example, acenaphthene has 12 carbons, and therefore, would only occur within the C11-C14 TPH fraction. In the case of benzene and toluene, which have six and seven carbons, respectively, it was assumed that the C08-C11 fraction may be an indicator of their presence. Although benzene and toluene contain less carbons than the low-carbon TPH fraction (C08-C11), they were included in this evaluation because they are commonly associated with petroleum mixtures that contain the C08-C11 TPH fraction.~~

~~Table 2-7 presents the site locations, samples, and analyses for samples collected during this program. Sixteen samples were collected and analyzed for this evaluation at previous locations with elevated high-carbon TPH fraction results, and eight samples at previous locations with elevated low-carbon TPH fraction results. Field, laboratory, and validation procedures used for this sampling event followed DTSC-approved RFI protocols (Ogden 1996, 2000b), or augmented them to allow for low-level detection limit methodologies. Analytical results and data validation reports for these samples are presented in Appendix B. Data review indicated all data were useable for risk assessment. Field, laboratory, and validation procedures for this sampling event are further described in the RFI Program Report (MWH 2004a). All site-specific TPH and petroleum constituent data will be used in the RFI site reports.~~

~~In most cases, linear regression analysis of individual petroleum constituents against the applicable TPH fractions did not produce correlations between petroleum constituents and TPH fractions that were adequate for extrapolation purposes. An attempt to correlate PAHs to the sum of the high-end fractions (*i.e.*, C11-C30) also failed to produce good correlations (Appendix B, Attachment 1). In most cases correlations were either negative or had low regression coefficients (*i.e.*, $r^2 < 0.5$). Further, comparison of some historical TPH data with more recent TPH data found a systematic error in the reporting of historical TPH data from one laboratory during a specific time frame (Columbia Analytical Services [CAS], between 1997 and 2000). The concentrations of C11-C14 fraction reported by CAS during this period were consistently biased low and the concentrations of C14-C20 were consistently biased high (Appendix B, Attachment 2). The historical TPH fraction C08-C11 data and C08-C11 data collected for this evaluation were found to be comparable.~~

~~Because of the discrepancy between recent and historical high-carbon fraction TPH data, and the lack of good correlation between petroleum constituents and individual TPH fractions, the following approach was developed for estimating petroleum constituent concentrations in soil from historical TPH data.~~

~~1. The C08-C11 TPH fraction will be used for estimating BTEX, 2-methylnaphthalene, and naphthalene concentrations by application of TPH C08-C11 to LCPC extrapolation factors to RFI site TPH C08-C11 soil sample data.~~

~~2. The sum of the concentrations of the C11-C14, C14-C20, and C20-C30 TPH fractions, equivalent to C11-C30, will be used for estimating PAH concentrations by application of TPH C11-C30 to HCPC extrapolation factors to RFI site TPH C11-C30 soil sample data.~~

~~3. The maximum ratio of individual petroleum constituent concentrations to TPH concentrations from the data sets of paired TPH and petroleum constituent samples will serve as chemical-specific extrapolation factors in the SSFL risk assessments.~~

~~4. The data used to calculate extrapolation factors include only detected TPH data, but include both detect and non-detect petroleum constituent data. Non-detect petroleum constituent data were not included in the calculations because these data would result in ratios that are neither conservative nor meaningful.~~

~~The maximum ratios of individual petroleum constituent concentrations to TPH concentrations were determined by first calculating the individual chemical- and sample-specific ratios for each set of paired petroleum constituent and TPH data. For each petroleum constituent, the maximum ratio was then selected as an extrapolation factor for use in SSFL risk assessments. Both detect and non-detect TPH data were used in the above calculations because petroleum constituents were generally detected in all samples (with the exception of benzene) regardless of whether TPH fractions were detected. Use of non-detect TPH data and detect petroleum constituent data result in maximum possible ratios.~~

~~The spreadsheet presenting all data and calculations of maximum ratios is presented in Appendix B, Attachment 3. Use of the maximum ratio gives the maximum degree of confidence that the predicted petroleum constituent concentrations will be greater than actual petroleum constituent concentrations. Its use, therefore, tends to over-predict, rather than under-predict, actual concentrations. The TPH extrapolation factors that will be used in risk assessments at the SSFL are summarized in Table 2-8.~~

~~TPH extrapolation factors will be used to predict LCPC and HCPC concentrations as described in Equations 2-2 and 2-3, respectively.~~

$$\cancel{C_{LCPC} = EF \times C_{C08\text{-}C11} \quad (2\text{-}2)}$$

~~Where,~~

~~C_{LCPC} = Predicted BTEX, naphthalene, or 2-methylnaphthalene concentration in soil (milligrams per kilogram [mg/kg])~~
~~$C_{C08\text{-}C11}$ = Measured C08-C11 TPH fraction concentration in soil (mg/kg)~~
~~EF = TPH to LCPC extrapolation factor ([mg/kg]/[mg/kg])~~

$$\cancel{C_{HCPC} = EF \times C_{C11\text{-}C30} \quad (2\text{-}3)}$$

~~Where,~~

~~C_{HCPC} = Predicted PAH concentration in soil (mg/kg)~~
~~$C_{C11\text{-}C30}$ = Sum of measured C11-C14, C14-C20, and C20-C30 TPH fraction concentrations in soil (mg/kg)~~
~~EF = TPH to HCPC extrapolation factor ([mg/kg]/[mg/kg])~~

~~All data used to derive extrapolation factors were reported on a dry weight basis, and therefore, extrapolation factors can only be applied to soil samples in which TPH concentrations were reported on a dry weight basis. In cases where TPH data are reported on a wet weight basis, then sample-specific moisture content data reported by the laboratory will be used to adjust the data to a dry weight basis. As noted previously, the TPH extrapolation methods described in this section are applicable only to soil media, and cannot be used for other media or for extrapolation between different media.~~

~~The application of TPH extrapolation factors requires that during COPC and CPEC selection, assumptions are made regarding the presence of individual petroleum constituents based on the presence of specific TPH fractions. This requirement is described in detail in Section 3.1. TPH extrapolations will only be applied at investigational units where no combustion is known or suspected to have taken place. at sites where combustion is known or is evident, direct measurements of PAHs in soils will be made. The specific methods for applying TPH extrapolation factors during the process of calculating EPCs are described in Section 6.2.~~

~~This extrapolation methodology for evaluating TPH in risk assessment is similar to the 'fractionation' method developed by the TPH Criteria Working Group (TPHCWG, 1997a,b; 1998a,b;~~

~~1999). In both procedures, TPH data are represented by fraction-specific toxicity criteria. Both methods are similar in that the toxicity of the specific hydrocarbon fraction is represented by a specific compound. For example, both methods use benzene and carcinogenic PAHs as indicator compounds to evaluate cancer risk. Differences between the two methods include:~~

~~1. The TPHCWG uses toxicity criteria representative of both aliphatic and aromatic fractions of LCPCs. The SRAM TPH extrapolation methodology uses only toxicity criteria for the aromatic constituents of LCPCs. However, as mentioned by the TPHCWG (1997b), aromatic fractions are considered to be at least an order of magnitude more toxic than the aliphatic fractions. Therefore, the use of the toxicity criteria for aromatics is conservative.~~

~~2. The TPHCWG uses toxicity criteria representative of both aliphatic and aromatic fractions of HCPCs. The SRAM TPH extrapolation methodology uses only toxicity criteria for the aromatic constituents of HPCPs. However, this is conservative because the aromatic fractions are considered to be at least an order of magnitude more toxic than the aliphatic fractions.~~

~~3. The TPHCWG divides both aromatic and aliphatic constituents into three groups. The SRAM TPH extrapolation methodology uses two groups for aromatic constituents.~~

~~4. The TPHCWG considers all the toxicity of a given hydrocarbon fraction to be equal to a specific chemical. In the SRAM, specific hydrocarbon fractions are assumed to contain numerous chemicals and each of those are assumed to be present for purposes of the risk assessment. In many cases, the same chemicals assumed to be present by the SRAM methodology are those used in the TPHCWG methodology to be representative of the entire fraction.~~

~~The SRAM TPH extrapolation methodology is considered appropriate for estimating exposures and risks at SSFL. The methodology is similar to other published methods (*e.g.*, TPHCWG) and uses petroleum constituents generally considered the more toxic components of TPH (*i.e.*, BTEX, PAHs). The SRAM TPH extrapolation methodology conservatively estimates the risks associated with exposures to TPH.~~

SECTION 3

The following have been updated or replaced in this section and subsections:

- **Information related to TPH extrapolation methodology and the selection of petroleum constituents as COPCs and CPECs when TPH fractions are detected (Sections 3 and 3.1.2.4) are no longer applicable because adequate data have been collected for petroleum chemical constituents, and as a result TPH extrapolation is no longer necessary.**
- **Information related to the soil background dataset (Sections 3.1.2.1. and 3.3) is no longer applicable because a newer soil background dataset is available in the Final Chemical Soil Background Study Report for the SSFL (DTSC, 2012).**
- **The frequency of detection will no longer be used as a selection criterion during the identification of COPCs and CPECs, as described in Appendix J of the SRAM Rev. 2 Addendum.**
- **Section 3.2 and all subsections have been replaced by Appendix C of the SRAM Rev. 2 Addendum.**
- **Information related to dioxin background comparison methods (Section 3.3.3) is no longer applicable because dioxins/furans are evaluated using a 2,3,7,8-TCDD TEQ, as described in Appendix A and B of the SRAM Rev. 2 Addendum.**

3 HAZARD IDENTIFICATION

The following have been updated or replaced in this section:

- **Information related to TPH extrapolation methodology and the selection of petroleum constituents as COPCs and CPECs when TPH fractions are detected are no longer applicable because adequate data have been collected for petroleum chemical constituents, and as a result, TPH extrapolation is no longer necessary.**

A large number of individual analytes will be considered for inclusion in the risk assessment. It is neither appropriate nor necessary to carry every chemical compound through the risk assessment process in order to quantify site-related risks. DTSC (1992) and USEPA (1989a) provide guidance on methods for selecting COPCs for purposes of risk assessment.

Section 3.1 describes the process for selecting COPCs for evaluation within risk assessments conducted at the SSFL. The selection of COPCs relies on a multi-step process of screening data from each unit subject to environmental investigation. This method will be applied to select COPCs for human health risk assessment.

The steps included in the selection of human health COPCs are generally applicable to selecting CPECs. However, further review of data may be required to determine if additional compounds need to be addressed based on special effects in nonhuman species. Additional steps in the CPEC selection process that are specific to the ecological risk assessment are discussed in Section 3.2.

Among the criteria discussed below is an evaluation of whether unit-related compounds are consistent with soil background or groundwater comparison concentrations. Section 3.3 provides a detailed description of the methodology for making this comparison.

Methods for extrapolating soil Aroclor concentrations to soil PCB congener concentrations, and soil TPH concentrations to soil petroleum constituent concentrations, were described in Section 2.7 and 2.8, respectively. These methods require certain assumptions about the presence of TPH constituents when a TPH fraction is selected as a COPC or CPEC, and about the presence of PCB congeners when an Aroclor is selected as a COPC or CPEC. Following the methods described in Section 3.1, when TPH fraction C8-C11 is selected as a COPC or CPEC, then benzene, toluene, ethylbenzene, xylenes, naphthalene, and 2-methylnaphthalene will be selected as COPCs and/or CPECs. When either TPH fraction C11-C14, C14-C20, or C20-C30 is selected as a COPC or CPEC, then PAHs will be selected as COPCs and/or CPECs. When any Aroclor is selected as a COPC or CPEC, then all 12 PCB congeners described in Section 2.7 will also be selected as COPCs and/or CPECs.

3.1 COPC SELECTION CRITERIA

The following have been updated or replaced in this section:

- **The frequency of detection will no longer be used as a selection criterion during the identification of COPCs and CPECs, as described in Appendix J of the SRAM Rev. 2 Addendum.**

The goal of the risk assessment is to estimate the potential risks to human and ecological receptors from site-related chemicals under reasonable exposure scenarios (USEPA 1989a,b). To ensure that the focus of the risk assessment is on site-related chemicals, COPCs are selected

using several criteria. The criteria used to select COPCs ensure that site-related chemicals that may pose a human health or ecological risk are included in the evaluation and, if risks are above acceptable levels, subsequently in remedial response actions. The following sequential criteria will be applied to select COPCs in the human health evaluation:

1. A chemical is detected at an investigational unit using validated laboratory analyses;
2. Chemicals occur above a five percent detection frequency and/or historical use at the investigational unit;
3. Chemicals are present in excess of concentrations observed in laboratory or field blanks; and
4. For metals and for chlorinated dibenzo-p-dioxins and dibenzofurans (collectively referred to as dioxins), the measured concentrations are in excess of soil background or groundwater comparison concentrations.

A decision flow diagram for selecting human health COPCs is shown on Figure 3-1. All excluded data will be documented in the investigational unit risk assessments, including the rationale for the removal.

3.1.1 Candidate Compounds

The first step in the COPC selection process is the evaluation of candidate COPCs. Candidate COPCs are selected from chemicals that have been detected at an investigational unit and meet acceptable data quality requirements (USEPA 1989a, 1992a). Any compound detected in a useable data set will be a candidate COPC.

3.1.1.1 Data Validation

For those analytes that meet the quality assurance/quality control (QA/QC) requirements, the data will be sorted by environmental media (*i.e.*, soil, sediment and groundwater) and the SQL will be evaluated. Those compounds detected in the validated samples will be included as candidate COPCs. It may also be necessary to retain undetected compounds as candidate COPCs if the chemical may be site-related, and if SQLs in one or more samples are too high to adequately evaluate the presence or absence of the compound. For purposes of the SRAM, a high SQL is defined as being inconsistent with reportable detection limits (RDLs). RDLs are the laboratory's estimate of what the SQL will be, based on optimal analytical conditions and theoretical sample weight. Table 3-1 presents RDLs for analytical procedures specified by USEPA in the Contract Laboratory Program (CLP).

High SQLs will be evaluated on a case-by-case basis using best professional judgment and knowledge of the investigational unit. Possible outcomes include:

- requesting additional sampling
- retaining the compound on the COPC list
- determining that the higher SQL does not alter the decision to remove the compound from the COPC list

When a high SQL is used to remove a compound from the COPC list, justification will be provided to DTSC in the Hazard Identification section of the risk assessment report.

3.1.1.2 Tentatively Identified Compounds

A Tentatively Identified Compound (TIC) is reported based on an analytical pattern that approximately fits the mass and retention time pattern of a particular chemical. However, "approximate" is the operative word. By definition, the pattern diverges sufficiently from the pattern in the analytical library that neither the identity nor reported concentration can be confirmed. TICs will not generally be considered as COPCs for the following reasons:

- The identity of a TIC is not as certain as compounds identified in the analyte list. Thus, it is not clear whether the compound is actually present.
- TICs are frequently general compound classes (*e.g.*, "C-8 compounds") for which specific toxicity data are not available.
- TICs are frequently compounds for which no toxicity data are available.

When TICs are encountered, the risk assessor may include the compound as a COPC for purposes of "screening" the compound in the risk assessment. However, the assessor may also offer a justification based on (1) probability of the compound identity (*i.e.*, demonstrate that an attempt to identify the unknown, based on judgment by an analyst, was not possible) or (2) infeasibility of doing a risk assessment to eliminate the TIC from the COPC list. If a TIC is eliminated from the list of COPCs, it will be discussed in the uncertainty assessment of the risk assessment report.

3.1.2 Screening Candidate Compounds

Candidate compounds may be screened to determine whether they will be included as COPCs in the quantitative risk assessment. A serial multi-step screening process will be used to evaluate candidate compounds[i], including comparison of detected site concentrations to comparison concentrations, evaluation of frequency of detection, and consideration of blank contamination. Each of these steps is described in the following subsections.

3.1.2.1 Soil Background and Groundwater Comparison Concentrations

The following have been updated or replaced in this subsection:

- **Information related to the soil background dataset is no longer applicable because a newer soil background dataset is available in the Final Chemical Soil Background Study Report for the SSFL (DTSC, 2012).**

Soil and groundwater samples collected from individual units or from appropriately scaled exposure areas will be evaluated using the two-tiered approach described in DTSC (1997) guidance *Selecting Inorganic Constituents as Chemicals of Potential Concern for Risk Assessments at Hazardous Waste Sites and Permitted Facilities.* This approach is described in Section 3.3. Inorganic analytes and dioxins, whose concentrations at units are determined to not be representative of concentrations in the soil background and groundwater comparison concentration data sets, will be identified as candidate COPCs.

Since the goal of a risk assessment is to evaluate site-related risks, the elimination of chemicals as COPCs can appropriately be applied to either inorganic chemicals or dioxins determined to be present in the local ambient environment and not related to the site (USEPA 1989a,b, 1994c). If a chemical is present in soil or groundwater as part of ambient conditions, defined as concentrations in the vicinity of a site or local background, that chemical should be fully considered in the background evaluation (USEPA 1989a). Although DTSC policy specifically addresses the issue of background levels of inorganic chemicals, DTSC has agreed that this policy may be extended to dioxins since they are widespread throughout the environment, and

[i] It is noted that the selection of COPCs is a serial process. That is, each criterion is applied to the candidate compounds that remain after application of the previous selection criterion. For instance, the frequency of detection criterion will only be applied to compounds that have been selected from the candidate COPC list because they are in excess of site-specific soil background or groundwater comparison concentrations.

because background levels of dioxins have been well characterized by USEPA (1994c) and others in the scientific literature.

Both naturally occurring chemicals and anthropogenic chemicals meet the criteria for background chemicals, as specified by USEPA (1989a, 1994c). USEPA defines the two sources of background chemicals that are considered in the risk assessment process as follows (USEPA 1989a, p. 4-5):

> naturally occurring levels, which are ambient concentrations of chemicals present in the environment that have not been influenced by humans … [and] anthropogenic levels, which are concentrations of chemicals that are present in the environment due to human-made, nonsite sources.

Therefore, the USEPA definition of background is fully aligned with their definition of a COPC to the extent that only site-related chemicals are evaluated in the risk assessment, and those chemicals detected in site media that are not site related are present due to natural sources or offsite anthropogenic sources.

DTSC (1997) further differentiates between pristine and ambient conditions as described in the following definitions:

> "Pristine conditions" are concentrations of metals in soils naturally occurring in locations unaffected by human activity. "Ambient conditions" are concentrations of metals in soils in the vicinity of a site but which are unaffected by site-related activities (also referred to as local background).

Background levels of metals and dioxins are the result of both natural and anthropogenic sources. Both can be characterized in the context of "pristine conditions" and "ambient conditions." Metals occur naturally within the geologic matrix and as a result of atmospheric deposition and other nonpoint sources (USGS 1984). Dioxins are also present in the environment due to natural sources (*i.e.*, forest fires, volcanoes) and atmospheric deposition, primarily related to various combustion processes (USEPA 1994c). Therefore, background levels of metals and dioxins will be evaluated in the risk assessments conducted at the SSFL.

The proposed protocols, described in Sections 3.3 are consistent with both state and federal regulatory guidance (DTSC 1992; USEPA 1989a,b,c, 1992a,b, 1994c).

3.1.2.2 Frequency of Detection

The following have been updated or replaced in this section:

- **The frequency of detection will no longer be used as a selection criterion during the identification of COPCs and CPECs, as described in Appendix J of the SRAM Rev. 2 Addendum.**

Analytes that are infrequently detected may be artifacts in the data due to sampling, analytical, or other errors. Analytes will be identified as COPCs if they are detected in greater than five percent of the samples at a site (USEPA 1989a; DTSC 1992) or when use of a chemical at the site is historically documented. Application of the selection criterion necessarily requires that 20 or more samples be in the candidate data set. Therefore, the frequency of detection step in the screening process will not be applied at sites with fewer than 20 samples.

Professional judgment must be applied to findings with a frequency of detection between zero percent and five percent. Thus, this step in the selection process will review data on a case-by-case basis and retain infrequently detected compounds as COPCs if:

- The compound was historically present in processes associated with the investigational unit.
- The compound is potentially a breakdown product of other compounds detected at the investigational unit.
- The compound is present in other media within the investigational unit.
- The compound is present in the same or other media in areas that may impact the investigational unit (*e.g.*, upgradient or adjacent areas).
- The compound is detected in a concentration high enough relative to its toxicity to be cause for concern, even if its presence is limited[ii].
- Samples with detections are grouped spatially.
- Other judgments make it difficult to rule out the possibility that a compound is present at an environmentally relevant concentration.

This evaluation will be discussed in an appropriate section of the risk assessment report.

[ii] The potential presence of a compound in a "hot spot" such as described here may potentially impact health based on chronic and/or acute exposure assessment. Such evaluations require separate exposure assumptions and will be developed as needed.

3.1.2.3 Blank Contamination

In the event of blank contamination of samples, if a compound is not associated with past activities at the investigational unit and the analyte is a common laboratory contaminant, it will only be identified as a COPC if the concentration in any sample from the candidate data set is greater than ten times the concentration observed in the corresponding blank. If an analyte detected in the blank is not a common laboratory contaminant, it will be included as a COPC unless the observed concentrations are less than five times the corresponding blank. "Common" laboratory contaminants are:

- acetone
- 2-butanone (also know as methyl ethyl ketone, MEK)
- methylene chloride
- toluene
- any common phthalate ester

As a practical matter, the validation procedures for many data sets (as described in Section 2) call for ranking a compound as "non detect" if observed concentrations are less than tenfold or fivefold higher than observations of common laboratory contaminants or other compounds, respectively. Thus, the evaluation of compounds based on blank contamination may actually be applied within the data validation step.

If a compound encountered in the blank does not meet the specifications for proportionally greater concentrations than the blank, but was associated with former unit activities, Boeing will either resample and/or reanalyze for the compound or include the compound as a COPC regardless of the blank contamination. Additionally, the compound found in the blank will be included as a COPC if any of the following conditions is true:

- The compound is present in other media within the investigational unit.
- The compound is present in media upslope, upgradient, or in areas adjacent to the investigational unit onsite.
- The compound is a breakdown product of other compounds detected at or adjacent to the investigational unit.

Where a portion of the samples of the compound in question have concentrations greater than the corresponding blank criterion, but other samples have detectable levels above the criterion, the

compound will be identified as a COPC. However, if all samples without blank contamination are non detect, the compound will not be identified as a COPC.

3.1.2.4 Special Mixtures

The following have been updated or replaced in this subsection:

- **Information related to TPH extrapolation methodology and the selection of petroleum constituents as COPCs and CPECs when TPH fractions are detected are no longer applicable because adequate data have been collected for petroleum chemical constituents, and as a result TPH extrapolation is longer necessary.**

Certain compounds that typically exist as mixtures, specifically PCB and TPH, have or will be evaluated at many of the investigational sites using analytical methods that account for the whole mixture, as opposed to individual chemical compounds. Thus, an additional "rule" for including all or a portion of the individual compounds making up a mixture in the list of COPCs and/or CPECs is required. The general approach applied to hazard identification for the mixtures will be to apply the selection criteria described above to the analytical results for the mixture (*i.e.*, Aroclor for PCBs or TPH fractions as a representation of the various compounds that may exist in a petroleum based product). Where criteria indicate inclusion is appropriate, individual compounds present in the mixture will be included in the COPC/CPEC list. Methods for extrapolating soil Aroclor concentrations to soil PCB congener concentrations, and soil TPH concentrations to soil petroleum constituent concentrations, were described in Section 2.7 and 2.8, respectively, and indicate that the following assumptions are appropriate:

- When TPH fraction C8-C11 is selected as a COPC or CPEC, then benzene, toluene, ethylbenzene, xylenes, naphthalene, and 2-methylnaphthalene will be selected as COPCs and/or CPECs.

- When either TPH fraction C11-C14, C14-C20, or C20-C30 is selected as a COPC or CPEC, then PAHs will be selected as COPCs and/or CPECs.

- When any Aroclor is selected as a COPC or CPEC, then all 12 PCB congeners described in Section 2.7 will also be selected as COPCs and/or CPECs.

3.2 Additional Criteria for Selection of Chemicals of Potential Ecological Concern

All of Section 3.2 and subsections within have been replaced by Appendix C of the SRAM Rev. 2 Addendum.

~~Selection of CPECs can vary from the selection of COPCs for human health risk assessments. Exposure pathways, chemical detection limits, and mode of toxic action for ecological receptors may differ significantly from human receptors. Therefore, additional criteria for selection of CPECs have been added to the COPC screening methods described above to further identify data that are adequate for conducting an ecological risk assessment. The decision process for the selection of CPECs is summarized on Figure 3-2 and is discussed in more detail below.~~

~~Analytical detection limits for soil, sediment, and water samples may not be sufficiently sensitive to detect concentrations reported to cause adverse effects in ecological receptors, particularly in aquatic systems. RDLs for USEPA CLP methods are presented in Table 3-1. To assure that chemicals are not eliminated as CPECs if their analytical detection limits are not sufficiently low to detect chemical concentrations that could cause adverse effects, a toxicity screening step has been included in the CPEC selection process. As described in Section 3.2.1, ecological screening levels (ESLs) were developed for the purpose of evaluating analytical detection limits in the CPEC selection process. The application of ESLs in the CPEC selection process is described in Section 3.2.2.~~

~~3.2.1 Ecological Screening Levels~~

~~As discussed in Section 3.2, an additional step is included in the CPEC selection process to assure that chemicals with analytical detection limits (*e.g.*, SQLs) exceeding a level of ecological concern are not eliminated as CPECs. In general, if SQLs exceed ESLs, then those chemicals with SQLs exceeding ESLs will be carried forward as CPECs in the ecological risk assessment. Since ESLs were developed for screening purposes only, they are not intended and may not be used as toxicological benchmarks for establishing cleanup levels.~~

~~ESLs were developed for both aquatic and terrestrial habitats. For aquatic habitats, ESLs were developed for surface waters, and are based on available water quality criteria such as the USEPA's Ambient Water Quality Criteria (AWQC) for the protection of aquatic organisms. For terrestrial habitats, ESLs were derived for small mammals and avian species using exposure values and models described in Section 10.7 and chronic toxicity data. Because avian and mammalian ESLs developed for SSFL are derived using site-specific data, these ESLs are only~~

~~applicable for environmental conditions and ecological receptors found at the Facility. For terrestrial invertebrates, ESLs are based on toxicity-concentration data reported in the scientific literature. The methods used to derive ESLs are summarized in Appendix C, Attachment 1, and the ESL calculation spreadsheets are presented in Appendix C, Attachment 2. No ESLs for terrestrial plants were derived and applied because of the limited appropriate and applicable phytotoxicity data. Screening of potential effects on plants was based on findings of observational studies (see Sections 11.3 and 12.1.4 for future details).~~

~~Aquatic habitat ESLs are summarized in Table 3-2. Terrestrial habitat ESLs for small mammals, avian species, and invertebrates are summarized in Tables 3-3, 3-4, and 3-5, respectively.~~

~~3.2.2 Application of ESLs in the CPEC Selection Process~~

~~This section describes the application of aquatic habitat (water) and terrestrial habitat (soil) ESLs in the CPEC selection process for ecological risk assessments to be conducted at the SSFL. ESLs will be used in the CPEC selection process to ensure that SQLs for chemicals in soil and water samples are sufficiently low to detect a chemical concentration that could pose a risk to ecological receptors.~~

~~For aquatic habitats, the ESLs presented in Table 3-2 will be compared to investigational unit SQLs for chemicals measured in water. For terrestrial habitats, the lowest chemical-specific ESL presented in Tables 3-3, 3-4, and 3-5 will be used for comparison to investigational unit SQLs for chemicals measured in soil. Because SQLs are sample-specific detection limits, each chemical data set will comprise a range of SQLs. Therefore, only a portion of the SQLs in a data set may actually exceed the ESL, while the remaining SQLs will be lower than the ESL. Depending on the sample size, there may be a sufficient number of samples in a data set with SQLs less than ESLs to ensure that chemicals are not present at levels that could pose an ecological risk. For the purpose of CPEC selection, if there are a sufficient number of the SQLs in a data set below the ESL to conclude that the chemical is not present at concentrations that could pose an ecological risk, and all other criteria are met, then the chemical will be excluded as a CPEC. Justification (*i.e.*, sample size, frequency of detection, number of SQLs below the ESL) will be presented in the risk assessment in cases where a chemical with one or more SQLs exceeding the ESL is excluded as a CPEC.~~

3.3 Comparison of Site Data to Soil Background and Groundwater Comparison Concentration Data

The following have been updated or replaced in this subsection:

- **Information related to the soil background dataset is no longer applicable because a newer soil background dataset is available in the Final Chemical Soil Background Study Report for the SSFL (DTSC, 2012).**

DTSC risk assessment policy indicates metals should be included as COPCs or CPECs, if the site-specific analytical data indicate conditions are in excess of "background" (DTSC 1997). As discussed in Section 3.3.1.3, this policy is also applicable to dioxins.

The following subsections outline a method to determine whether onsite investigational unit soil and groundwater data are consistent with soil background conditions and groundwater comparison concentrations at the SSFL for purposes of selecting COPCs and CPECs. Section 3.3.1 provides the mathematical approaches for comparing investigational unit data to soil background or groundwater comparison concentration data. Appendix D provides details of the soil background data set, including the analytical data and process used to establishing site-specific soil metal and dioxin background concentrations, and tabular and graphic presentations. As discussed in Appendix D, soil metal and dioxin background concentrations are based on data collected from DTSC approved locations at and in the vicinity of SSFL.

Appendix E describes the derivation of the groundwater comparison data set and comparison concentrations. As discussed in Appendix E, a groundwater comparison data set was established to conservatively represent unimpacted, naturally occurring conditions at or below background in the vicinity of SSFL. Because of data variability related to improving analytical methods through time, sample variability, hydrogeologic complexity, and the focus of the SSFL monitoring well network on VOC impacts, there was uncertainty that the full range of background concentrations could be identified. The groundwater comparison data set provides a conservative threshold that serves as one tool to evaluate COPCs and completeness of characterization. Constituents will be selected as COPCs using these comparison concentrations, other site data, and best professional judgment. The COPC selection will be described in each investigational unit risk assessment. A more specific background determination may be made for selected constituents if necessary based on risk assessment findings during the CMS.

DTSC policy discusses the use of a simple comparison of investigational unit and metals comparison data distributions, and, if necessary, the use of a statistic called the Wilcoxon Rank Sum (WRS) Test for comparison with investigational unit data (DTSC 1997). Both approaches make use of complete available data sets for both comparison concentrations and the investigational unit. The use of all data is a more robust test, which minimizes both Type I and Type II errors (see Section 2). While the DTSC (1997) procedures for comparison of site data are focused on metals, the methods of comparison are also applicable to dioxins as discussed in Appendix D. Furthermore, it should be noted that the comparison procedures are applicable to both soil and groundwater data. As described in Appendix E, the applicability of the WRS Test for groundwater will be discussed in each investigational unit risk assessment.

Following DTSC guidance, a two-tiered approach will be used to evaluate investigational unit and comparison data sets. The first tier is a simple comparison of the investigational unit data against the comparison data. This method is referred to as the Comparison Method. For groundwater, the maximum concentration in the groundwater comparison data set will be the groundwater comparison concentration. If the maximum unit concentration does not exceed the groundwater comparison concentration, then the chemical is excluded as a COPC. If the maximum unit concentration exceeds the groundwater comparison concentration, then the data sets are further evaluated by application of the WRS Test. The groundwater comparison concentrations developed for use in risk assessments at the SSFL are presented in Table 3-6. The data and methods used to calculate groundwater comparison concentrations are presented in Appendix E.

According to DTSC, the maximum unit concentration is compared against a value representing the upper range of soil background conditions or the groundwater comparison concentrations. However, as discussed in Appendix D, the Comparison Method will not be used for selecting COPCs and CPECs in soil.

The WRS Test tests the null hypothesis (h_o) that soil background or groundwater comparison concentration data sets and investigational unit data are within the same distribution (*i.e.*, the presence of a chemical at the investigational unit or area is due to background and is not site related). The hypothesis is tested by analyzing the "location" of investigational unit data within the overall distribution. The data are placed in rank order and, if the investigational unit data tends to be located toward the upper extreme of the overall distribution, there is a decreasing probability that the observations are from the same population as background data. At some specified probability level, the investigational unit observations are declared inconsistent with

background and an alternative hypothesis (h_a) is accepted that the observations suggest site-related contamination. In instances where more than 40 percent of the site or background data sets are non detect values, then the Gehan Test will be used instead of the WRS Test (Department of the Navy 2002).

3.3.1 Mathematical Procedures

The simplest WRS Test uses the equation:

$$W_{rs} = \sum R_{ns} \tag{3-1}$$

where,

W_{rs} = Wilcoxon Rank Sum statistic

R_{ns} = rank value of each member of the n_s (unit-specific) population in a rank-ordered population comprised of n_s and n_b values (where n_b is the population of background or comparison samples)

W_{rs} may be used to estimate the probability, p, that n_s and n_b are from the same population by consulting statistical tables[iii]. An example of this procedure is shown in the example box.

For larger samples (n_b and n_s both greater than 10 samples), a further evaluation is possible using the equation:

$$Z_{rs} = \frac{W_{rs} - n_1(m+1)/2}{\sqrt{n_1 n_2 (m+1)/12}} \tag{3-2}$$

where,

n_1 = number of items in the smaller data set (this may be either the number of samples in n_s or n_b)

n_2 = number of items in the larger population data set (this may be either the number of samples in n_s or n_b)

m = $n_1 + n_2$

[iii] An abbreviated W_{rs} table is available in DTSC (1997) and more comprehensive tables are available in statistical texts.

This statistic is designated Z_{rs} because it is an approximation to the normal distribution, such that Z_{rs} may be compared to values of Z (or values of the t-distribution) to determine the probability of test populations coming from the same distribution.

Example Application of the WRS Test:

- Let unit-specific data be population n_s.
- Where ns = {1, 2.5, 5, and 6 mg/kg}.
- Let background information be population n_b, where n_b = {0.5, 1.5, 3 mg/kg}.
- Test the null hypothesis (h_o) that the data in n_s and n_b are all from the same population by placing all values (n_s and n_b combined) in a single group, sorted in ascending rank order.
- The test population in rank order is as follows (where values from n_s are shown in bold italic):

1	2	3	4	5	6	7
0.5	***1***	1.5	***2.5***	3	***5***	***6***

- The rank values of the smaller of the data sets, n_b population are 1, 3, and 5 and W_{rs} therefore equals 9.
- Select a probability (p) criterion for declaring the populations distinct. In this example, let the criterion be $p < 0.05$ (*i.e.*, less than five chances in 100 that the two sets of values would be selected at random from a single population).
- Where $W_{rs} = 9$ for sample sizes $n_b = 3$ and $n_s = 4$, the *p* value is greater than 0.05. Therefore, do not reject h_o, and declare the n_s population is not different from n_b.

It should be noted that, in the case of ties (two or more samples having an equal value) the rank assigned to each is the average of the rank values occupied by the group. Therefore, three equal values taking up the second, third, and fourth positions in the rank order would each be assigned a rank value of (2+3+4)/3 = 3. Where ties exist, equation 3-2 must be adjusted by subtracting a quantity from the (m+1) term, as follows:

$$Z_{rs} = \frac{W_{rs} - n_1(m+1)/2}{\sqrt{\frac{n_1 n_2}{12}\left[(m+1) - \frac{\sum_j^g t_j(t_j^2 - 1)}{m(m-1)}\right]}} \qquad (3\text{-}3)$$

where,

t_j = number of items in tied group j
g = total number of groups with ties

For any permutations of the test, a critical probability, usually termed α, must be specified, below which one rejects h_o (the assumption that soil background or groundwater comparison concentration data sets and investigational unit data are the same), and accepts h_a, that the investigational unit observations are site related. An α of 0.05 will be used for evaluations of individual inorganic compounds at the SSFL. This level is suggested in the DTSC (1997) guidance and is a frequently used decision level. Selecting α=0.05 is equivalent to stating that the investigational unit data should be assumed to be site related until there is less than one chance in 20 that the observed ranks of investigational unit and soil background or groundwater comparison concentration data were selected from the same population.

3.3.2 Application of the Wilcoxon Rank Sum Test

The WRS Test and Gehan Test are nonparametric, *i.e.*, they can be applied independently of the distribution of the data sets. Therefore, they can be applied to data whether or not it fits "typical" (*e.g.*, normal, log-normal) distributions and in cases where the underlying distribution is unresolvable due to small sample size or nonrandom sampling. This makes the WRS Test and Gehan Test applicable to any of the possible data sets that may be gathered at investigation units at the SSFL.

The WRS Test (or as applicable, the Gehan Test) may be employed with small data sets (indeed, DTSC guidance notes a method for sample sets of n = five to 10). As described below, Boeing anticipates that the SSFL metals soil background or groundwater comparison data sets will rarely have less than 20 samples[iv]. At this sample size, the test would be able to delineate differences between soil background or groundwater comparison concentration data sets and data from an investigational unit at the $p < 0.05$ level for as few as two unit-specific samples. Given this ability to delineate from the soil background or groundwater comparison concentration data sets, it is expected that the WRS Test (or as applicable, the Gehan Test) could be used for evaluation of almost all investigation units at the SSFL, because two or more samples would be collected. For this reason, no alternatives to the WRS Test (or as applicable, the Gehan Test) are proposed at this time.

[iv] Many background metal data sets are in excess of 30 samples.

Finally, it has previously been noted that the WRS Test (or as applicable, the Gehan Test) utilizes a data distribution rather than a sample parameter. Therefore, it is necessary to specify the total soil background or groundwater comparison concentration data set, rather than a single specific value (*e.g.*, central tendency, confidence bound) for comparison to investigational unit values.

3.3.3 Comparison Methods for Dioxins

The following have been updated or replaced in this section and subsections:

- **Information related to dioxin background comparison methods is no longer applicable because dioxins/furans are evaluated using a 2,3,7,8-TCDD TEQ, as described in Appendix A and B of the SRAM Rev. 2 Addendum.**

The family of dioxin compounds consists of 75 chlorinated dibenzo-p-dioxin (CDD) and 135 chlorinated dibenzofuran (CDF) congeners. Of these compounds, it has been determined that only the 2,3,7,8-substituted congeners are toxicologically active in biological systems (USEPA 1989c). Accordingly, only the seventeen 2,3,7,8-dioxin congeners are evaluated in risk assessments (USEPA 1989c).

Dioxins are found in all media and in all parts of the world and are therefore considered to be ubiquitous in the environment (USEPA 1994c). Sources of dioxins include forest and brush fires and various combustion and chemical processes, including automobile exhaust and charcoal-fired barbecues. An extensive database of background concentrations in various environmental media has been compiled by USEPA for use in risk assessment and other scientific applications (USEPA 1994c, Appendix B). Therefore, the SRAM will apply a soil background delineation similar to the procedures described for metals to dioxin data, except that a modification is required to account for the fact that dioxins often occur as mixtures.

Consistent with a HERD memorandum (DTSC 1998a) on establishing dioxin background, a graphical representation of relative CDD and CDF concentrations in samples (a “radar” plot) will be compared to similar presentations for background to determine qualitatively if the site samples are similar to background. This would be done for five congener groups: tetra-CDD/CDFs, penta-CDD/CDFs, hexa-CDD/CDFs, hepta-CDD/CDFs, and octa-CDD/CDFs. As only the 2,3,7,8-substituted CDDs and CDFs are of toxicological interest, the five group concentrations are calculated as the sum of the concentrations of each 2,3,7,8-substituted congener within the chlorination group, on a per-sample basis. In cases where a congener is

detected a least once in a given media at an investigational unit, it will be assumed to be present in other samples of the same media at that unit. When a congener is thus assumed to be present at an investigational unit, but is not detected in a sample, then the concentration in that sample will be estimated as one-half the SQL. In cases where a specific congener is never detected in a given media at an investigational unit, then that congener is assumed to not be present in that media at that unit and will not be included in the summation of congeners within its respective congener group at that unit.

Following the graphical evaluation, the same approach used to evaluate metals is used to evaluate investigational unit and soil background CDD/CDF data sets. The data sets are evaluated by application of the WRS Test (or as applicable, the Gehan Test) to determine consistency with soil background concentrations. In the case of CDD/CDFs, the WRS Test (or as applicable, the Gehan Test) evaluation will be performed on the five congener groups as described above. If the WRS Test (or as applicable, the Gehan Test) is implemented, a Bonferroni correction to the statistical significance threshold, α, will be applied. As the critical significance level applied to single inorganic compounds is 0.05, the corrected term for comparison of the five CDD/CDF groups will be 0.01 (*i.e.*, 0.05/5).

Because CDD and CDF compounds frequently appear as mixtures, an additional requirement for evaluation of investigational unit data is that <u>all</u> "groups" of CDD and CDF classes must be shown to be consistent with soil background concentrations. If such a demonstration cannot be made, all CDD and CDF compounds must be considered in the risk assessment. Because a groundwater comparison concentration data set was not developed for the potential presence of dioxins in groundwater, the approach described above for soil will also be applied for groundwater.

SECTION 4

The following have been updated or replaced in this section and subsections:

- **Updated information related to residential and recreational exposure to soil, ephemeral sediment and food (Sections 4.1.1 and 4.1.2) is presented in Appendix B of the SRAM Rev. 2 Addendum; some text for those receptors and pathways presented in this section is no longer applicable.**
- **Additional information on the indoor air evaluation (Section 4.1.2) is provided in the Technical Memorandum *An Updated Approach for Assessing the Vapor Intrusion Pathway* (CH2M Hill, 2012).**
- **Exposure to volatile compounds in ambient air via migration from groundwater (Section 4.1.2) will not be evaluated quantitatively because no reliable and approved groundwater-to-ambient air model is available for use, the ambient air pathway is likely a minor pathway when compared to direct contact groundwater pathways, and there are more robust datasets for volatile compounds in soil.**

4 CONCEPTUAL SITE MODEL FOR HUMAN RECEPTORS

A generalized conceptual site model (CSM) for the SSFL has been developed based on field observations, current and future site use scenarios, and data collected to date during environmental programs at the SSFL. Potential exposure pathways were considered to determine if they might be "complete" (receptors can come into contact with compounds from the site), "incomplete" (no exposure is possible), or "potentially complete" (exposure may occur if site conditions change). The generalized CSM includes complete or potentially complete exposure pathways for receptors that may occur, either at certain locations or throughout the SSFL.

Figure 4-1 depicts a diagrammatic representation of an illustrated CSM for the SSFL, including the contaminant sources, direct and indirect exposure pathways, and receptors. A generalized CSM for human receptors is shown on Figure 4-2. Potential human receptors are populations potentially exposed to chemicals, either onsite or as a result of chemical migration to offsite areas. The current potential human receptors are current site workers and trespassers. Onsite residents and visitors who might occupy the site in the future in the event of a change in property use are future potential human receptors. Complete or potentially complete exposure pathways include direct contact with soil, sediment, weathered bedrock, surface water, air, and

groundwater (including seeps and springs), as well as indirect exposure to chemicals in soil via uptake into plants. Justification for these selections is provided below.

4.1 SELECTION OF RECEPTORS AND PATHWAYS

The following sections present the candidate receptors and exposure pathways for the SSFL.

4.1.1 Receptors

The following have been updated or replaced in this section and subsections:

- **Identification of the residential receptor to be evaluated is presented in Appendix B of the SRAM Rev. 2 Addendum.**

Receptors were identified considering both current and future site use scenarios. In each case, there may be more than one receptor whose exposures are qualitatively similar in terms of the mechanisms by which they might be exposed. However, the magnitude of exposure may differ between these receptors, based on specific receptor characteristics and behaviors. Exposure parameters that may differ among receptors include body weight, skin surface area, intake rates, frequency of exposure, and duration of exposure. Specific exposure parameter values for the receptors identified here are provided in Section 5.

Where more than one receptor is plausible in terms of selecting a receptor for a human health risk assessment of a selected investigational unit, the most exposed relevant receptor will be evaluated. Other less exposed receptors might or might not be included in the risk assessment of that unit, depending on the need to provide perspective on the variability of risk with different site use. When the most exposed receptor is found not to have significant risk, the less exposed receptors also have no significant risk and the less exposed receptor need not be evaluated. Similarly, if the most exposed receptor is found to have significant risk and a risk management decision is made to protect that receptor, less exposed receptors will also be protected and may not require evaluation. However, if the most exposed receptor is found to have significant risk and a risk management decision not fully protective of this receptor is made, less exposed receptors might be evaluated to determine their risk within the context of the risk management decision.

While several receptors are described below and pertain to either current or future site use, it is anticipated that, in general, one of two receptors will be evaluated and used to support risk-based decisions. For investigational units that are physically appropriate for future residential

development, the receptor to be evaluated will be a resident. This future site-use receptor is usually the most exposed and therefore will reveal high-end risk. Other plausible receptors (*e.g.*, recreational user, worker) will be presented and discussed in the specific risk assessments, but may or may not be the subject of quantitative risk assessment, depending on the needs of the risk manager.

Groundwater is being addressed in the risk assessments since direct use of groundwater is being evaluated as an exposure pathway. In addition, future impacts to groundwater due to contaminant transport from surficial media (soil, weathered bedrock, surface water, near-surface groundwater) to Chatsworth formation groundwater, or transport of contaminants within the CFOU, will be evaluated during the risk assessment and RFI. Based on characterization and modeling results, the risk assessment will use current concentrations and predicted future concentrations of contaminants in groundwater to calculate the risks associated with those concentrations. The groundwater characterization report and risk assessments will identify locations where groundwater risks may change in the future due to contaminant migration. This includes addressing predicted downgradient groundwater conditions for both potential on- and offsite receptors. Current and future potential degradation of groundwater quality in beneficial use aquifers (as designated by the RWQCB Los Angeles Basin Plan), is evaluated during the RFI when establishing well placement and sampling requirements, and addressed in the risk assessment and the CMS phase when establishing media cleanup standards and points of compliance. Therefore, groundwater as a receptor is being directly addressed in these other project phases.

Current Site Use

Currently, the site is an operating industrial facility of approximately 2,850 acres, including the undeveloped land along its northern and southern boundaries that effectively separates adjacent property from active or formerly active portions of the SSFL. The site is completely fenced and subject to 24-hour manned security at the gates. The nearest residences to active or formerly active areas of the site are more than 3,000 feet to the south in Bell Canyon and more than 2,000 feet to the east in Woolsey Canyon.

Receptors consistent with current site conditions are limited to workers at the facility and trespassers. Given existing site security measures and steep terrain in many adjacent areas, it is not likely that trespassers could gain access to active or formerly active portions of the SSFL for frequent or prolonged periods of time. A trespasser's potential exposure is likely to be less

frequent, shorter in duration, and possibly less intense than potential exposure of a site worker. Accordingly, the worker is the current site use receptor with the greatest potential exposure.

Future Site Use

Boeing currently has no plans to cease operations at the SSFL. Therefore, the most likely future site use scenario is identical to the current site use scenario. However, there is only a small portion of the property with deed restrictions (the nine former surface impoundments under Post-Closure Permit care as described in Section 1), so the possibility of future development of certain portions of the site for other purposes cannot be dismissed. It is possible that portions of the site may be developed for residential use. Other portions of the site may be used for recreational purposes, such as hiking and camping. These uses are consistent with current uses of property contiguous to the SSFL.

Potential receptors consistent with this future scenario include residents, visitors (recreational users), and workers. In areas subject to possible residential development, residential receptors would be anticipated to be the most exposed, because residential receptors are generally assumed to (1) include children, who would have higher intensity exposures for certain exposure pathways (*e.g.*, soil ingestion), particularly when considered on a body-weight basis, (2) have longer durations of exposure, and (3) have unique exposures (*e.g.*, exposure while showering) in addition to other pathways. Although certain portions of the site are not suitable for residential development because of unfavorable physical characteristics (*i.e.*, steep terrain), the future resident was conservatively selected as the most highly exposed receptor for all units. Other plausible receptors (*e.g.*, recreational user) will be presented and discussed in the specific risk assessments, but may or may not be the subject of quantitative risk assessment, depending on the needs of the risk manager.

4.1.2 Potential Exposure Pathways

The following have been updated or replaced in this section and subsections:

- **Complete exposure pathways for residential receptors exposed to soil and ephemeral sediment is presented in Appendix B of the SRAM Rev. 2 Addendum, and as a result text for these pathways below is no longer applicable.**
- **Exposure to volatile compounds in ambient air via migration from groundwater will not be evaluated quantitatively because no reliable and approved groundwater-to-**

ambient air model is available for use, the ambient air pathway is likely a minor pathway when compared to direct contact groundwater pathways, and there are more robust datasets for volatile compounds in soil.

- **Additional information on the indoor air evaluation is provided in the Technical Memorandum *An Updated Approach for Assessing the Vapor Intrusion Pathway* (CH2M Hill, 2012).**

Selection of complete or potentially complete exposure pathways includes consideration of (1) the physical/chemical nature of COPCs selected for the investigational unit, (2) receptors assumed to be present at the site or investigational unit, and (3) the physical features of the site or investigational unit promoting or preventing particular pathways. Criteria for selecting complete pathways are generically discussed in the following sections. Individual risk assessments conducted at the SSFL will include site-specific exposure pathways analyses.

Current Site Use

As described above, current site use receptors with the greatest potential exposure are site workers. Trespassers are also potential receptors; however, their exposure potential is substantially less than site workers. During outdoor work activities, workers may contact compounds in soil, accessible weathered bedrock, near-shore sediment in ponds and channels, groundwater associated with seeps and springs, and surface water at the facility. Direct contact exposure to soil may occur via ingestion and dermal absorption. Current receptors may also be exposed via inhalation of nonvolatile compounds in fugitive dust. These potential exposure pathways are currently considered to be complete for the site worker in areas where work is authorized. These exposure pathways are also considered complete for trespassers.

Certain compounds detected in soil, soil vapor, weathered bedrock, and groundwater at the SSFL are volatile and may migrate to the atmosphere or into an overlying structure where workers may be exposed via inhalation of vapors in indoor air. Analysis of this potential exposure pathway includes assessment of the physical and chemical properties of detected COPCs to determine whether a compound is considered to be volatile. According to DTSC Office of Scientific Affairs, a compound with a Henry's Law Constant of 1×10^{-5} (unitless) or higher and a vapor pressure of 0.001 millimeters of mercury (mm Hg) or higher is considered volatile (DTSC 1994). Therefore, inhalation of volatile compounds in ambient and/or indoor air is considered to be a complete exposure pathway for COPCs that meet DTSC's definition of a volatile compound. Although exposure associated with this pathway is likely negligible for the trespasser due to the

low frequency of exposure, it is considered complete for the purposes of conducting risk assessments at the SSFL.

It is also possible that workers may be exposed to fugitive dust. Generally, fugitive dust generation is thought to occur as the result of vehicular traffic over unpaved, unvegetated areas, but may also occur in other areas during construction activities. A small amount of soil particulates also may be entrained by wind. Almost all road surfaces at the SSFL are paved. However, this exposure pathway will be considered complete for both the site worker and trespasser. Consistent with DTSC (1994) policy, the inhalation of fugitive dust pathway will only be evaluated for nonvolatile compounds, which are those chemicals not evaluated for the inhalation of volatile compounds pathways.

Surface soils also might be subject to runoff, which would transfer compounds in soil to sediments and/or surface water. Sediment near the edge of a water body could be contacted by a receptor in a manner similar to that by which surface soil is contacted. Therefore, the direct exposure pathways previously described for soil were also considered to be complete for sediment near the edge of a surface water body in the current exposure scenarios. During dry periods, compounds in sediment could volatize to ambient air or be present in fugitive dust. Additionally, volatile compounds in surface water might be transferred from this media to air. For both workers and trespassers, the inhalation of volatiles pathway was also considered complete for COPCs in surface water and near-shore sediment that meet DTSC's definition of a volatile compound. The inhalation of fugitive dust pathway was also considered complete for COPCs in near-shore sediment that do not meet DTSC's definition of a volatile compound.

In the current exposure scenarios, sediments in deeper water do not represent significant complete pathways for human exposure because no regular worker activity causing contact exists. Exposure to surface water is a complete pathway at the SSFL because of maintenance activities at the surface water holding ponds. Similarly, exposure to surface water and sediments in deeper water is considered insignificant for trespassers, since trespassers are unlikely to have direct contact with surface water in the holding ponds, and their frequency of visits to the site is expected to be low. However, for conducting risk assessments at the SSFL, it is conservatively assumed that these pathways are complete for the trespasser.

During outdoor activities, workers and trespassers may be exposed to groundwater flowing from seeps or springs within some units at the SSFL. Possible pathways of exposure include incidental ingestion, dermal contact, and inhalation of volatile compounds. For the trespasser, these

pathways are potentially complete. For the worker, only the inhalation pathway is potentially complete since workers would not directly contact seeps and springs. The completeness of these pathways will be further evaluated on a unit-by-unit basis, since each is dependent upon the physical characteristics of the respective seeps or springs (*e.g.*, flow rate, spatial extent, frequency of occurrence, depth of water). As described in a recent report on spring and seep sampling during June/October 2002, saturated seeps and springs almost entirely occur in undeveloped portions of the SSFL, with one noted near the boundaries of an investigational unit (MWH 2003b).

While indoors, it is possible that workers could be exposed to volatile compounds that migrate from soil, soil vapor, or groundwater through building foundations to indoor air. Therefore, for the site worker, these pathways were considered complete for the COPCs that meet DTSC's definition of a volatile compound. For the trespasser, indoor air exposures are incomplete since trespassers are not likely to have access to building facilities at the SSFL. For exposure and risk associated with volatile compounds in indoor and outdoor air, soil vapor concentrations are the preferred input into the vapor migration models and will be used at investigational units near VOC source areas where collection of soil vapor samples is technically feasible, *e.g.,* where access and soil thickness are adequate. When soil vapor samples cannot be collected at an investigational unit near VOC source areas, bulk soil media concentrations will be used as inputs to the vapor migration models. Any indoor or outdoor air concentrations and risks estimated based on bulk soil media concentrations will be noted in the risk assessment text. When soil vapor samples cannot be collected and multiple sources of volatile compounds are present (*e.g.*, both soil and groundwater contain volatile compounds), then risks from all sources will be calculated.

The completeness of the indoor air pathway is dependent upon the models used to estimate COPC concentrations in indoor air. Methods for calculating EPCs in various media, including indoor air, are presented in Section 6. The models for EPC calculations in indoor air are associated with significant uncertainty. As such, DTSC has recommended that this pathway be calculated separately from other exposures in an appendix to a risk assessment and presented as a supplement to the total risk calculation. In this way, the uncertainty associated with this pathway may be addressed easily when making risk management decisions.

Future Site Use

As described in Section 4.2.1, potential future receptors include future residents, recreational property users, and workers. All potential future receptors may be exposed to compounds in soil and weathered bedrock via direct contact pathways (ingestion and dermal exposures). These pathways are therefore considered complete for all future receptors. Potential exposure to compounds migrating from soil, soil vapor, weathered bedrock, groundwater, or surface water to ambient and/or indoor air is also considered a complete pathway for all future receptors, but only for compounds that meet DTSC's definition of a volatile compound. Future receptors may also be exposed via inhalation of nonvolatile compounds in fugitive dust. This is a complete exposure pathway for all future receptors. Residential receptors and workers may also be exposed via volatilization of compounds in soil, soil vapor, weathered bedrock, or groundwater to indoor air for compounds that meet DTSC's definition of a volatile compound. This exposure pathway is complete for future residents, incomplete for recreators since they would not have access to residences, and insignificant for workers since the amount of time spent inside a completed home would be negligible. For any unit risk assessment, exposure and risk associated with transfer of volatile compounds in soil or soil vapor will be assessed using either soil concentration data or soil vapor data as discussed above.

Future residents, workers, and recreators may be exposed to groundwater flowing from seeps or springs within some units at the SSFL. Possible pathways of exposure include incidental ingestion, dermal contact, and inhalation of volatile compounds. These pathways are potentially complete for future residents and recreators. For the worker, only the inhalation pathway is potentially complete since workers would not directly contact seeps and springs. The completeness of these pathways will be further evaluated on a unit-by-unit basis, since each is dependent upon the physical characteristics of the respective seeps or springs (*e.g.*, flow rate, spatial extent, frequency of occurrence, depth of water).

Compounds in soil may be transferred to sediments and/or surface water via runoff. Future residents and recreational receptors could contact compounds in surface water via dermal absorption while swimming or wading, depending upon the size of the water body (swimming would apply to water bodies greater than one meter in depth; wading would apply to shallower systems). Future residents and recreational receptors may also be exposed to compounds in surface water via incidental ingestion while swimming in surface waters of sufficient depth. Future residents and recreational receptors may contact compounds in exposed near-shore sediments via ingestion, dermal absorption, or inhalation of volatile compounds meeting DTSC's

definition of a volatile compound. These pathways, therefore, are considered potentially complete for these receptors. Future workers are likely to be present at the site only during construction of a residence or other building and are not assumed to be exposed to surface water or sediment by direct contact. However, exposure to volatile COPCs by future workers is a potentially complete pathway.

If residences are constructed at the SSFL in the future, it is possible that produce may be grown in impacted soil in backyard gardens. Compounds in soil may then be incorporated into edible plant tissues via root uptake. Residents could be exposed to compounds in soil via consumption of produce grown in backyard gardens. This pathway is complete for future residents, but incomplete for future workers and recreators. Although it is unlikely that weathered bedrock could support the types of vegetation grown in home gardens and consumed by residents, the physical characteristics of weathered bedrock and the ability to support vegetation will be evaluated on a unit-by-unit basis and will be subject to DTSC review.

The completeness of the food chain and indoor air pathways is dependent upon the models used to estimate COPC concentrations in these media. The compounds of significance may be limited by physicochemical properties of the COPCs. Methods for calculating EPCs in various media, including produce and indoor air, are presented in Section 6. The models for making EPC calculations in plants and indoor air are associated with significant uncertainty. As such, DTSC has recommended that these pathways be calculated separately from other exposures in an appendix to a risk assessment and presented as a supplement to the total risk calculation. In this way, the uncertainty of these pathways may be addressed easily when making risk management decisions.

Future residents could also be exposed to compounds in groundwater if homes are constructed at the SSFL in the future and water supply wells are installed to supply household water to these homes. Ingestion, dermal absorption, and inhalation (during showering) of COPCs in groundwater are considered potentially complete exposure pathways for the future resident. The completeness of pathways of exposure via domestic use of groundwater must be conducted on a unit-by-unit basis, depending on the yield and quality of groundwater.

The domestic water use pathways for the future resident will be considered complete only if groundwater quality parameters are within published drinking water standards and meet municipal or domestic supply standards as defined by the State Water Resources Control Board (SWRCB) Resolution 88-63 (*i.e.*, total dissolved solids <3,000 mg/L, deliverability >200 gal/day

[0.14 gal/min], or existing contamination that cannot be reasonably treated). TDS and yield are appropriate criteria for determining future groundwater uses. However, there may be other uses of this water, including irrigation of backyard gardens. These other potential uses of groundwater will be addressed in the uncertainty section of the risk assessment and their potential contribution to overall residential exposure and risk will be considered when making recommendations. Direct exposure to groundwater is an incomplete pathway for future workers and recreators, since neither would have access to water supply wells.

4.1.3 Physical Features Affecting the CSM

On a unit-specific basis, consideration of relevant potential exposures for each receptor requires evaluation of physical site features. The most obvious examples of these situations are for those units with surface water, seeps and springs, and weathered bedrock. At these units, the frequency and magnitude of exposure is largely a function of the characteristics of the feature.

At units that do have surface water features, evaluation of exposures in drainage areas of these water bodies may be necessary, even if the drainage goes beyond the administrative border of an investigational unit. Similarly, some units may have near-surface groundwater and others not. These near-surface groundwater units at the SSFL may or may not be connected, and they should be evaluated on a unit-by-unit basis.

The nature of exposure in a surface water body would depend on physical characteristics of the water body (*e.g.*, swimming versus wading). The risk assessments will assume that all permanent water bodies greater than one meter deep are considered "swimmable," while other water is considered "wadable." Exposure parameter values distinguishing these two activities are discussed in Section 5. However, it is worth noting that the distinction between swimmable and wadable relates to the skin surface area available for dermal uptake of compounds. A swimmable water body would be associated with dermal absorption over the entire surface area of the body, whereas wadable connotes the surface area of the body that would be covered in a person standing upright in the water body. Finally, it will be necessary to consider whether the surface water in question would continue to exist in the absence of present industrial activities before determining the relevance of the exposure pathway.

Similarly, the potential for exposure to COPCs in groundwater flowing from seeps or springs depends on the presence of seeps or springs within an investigational unit. The presence of seeps or springs at the SSFL is dependent upon a number factors, including variation in the height of the water table, slope of the land, and season. For each unit risk assessment, the potential for

active seeps and springs to occur in an investigational unit will be evaluated using land surveys and historical information. Whether to include exposure to seeps and springs in an investigational unit risk assessment will be determined on a unit-by-unit basis and will be subject to DTSC review.

Investigational units may consist of weathered bedrock or some fraction of weathered bedrock and soil. In these units, the characteristics of the weathered bedrock will be evaluated as they pertain to the completeness of possible exposure pathways. Weathered bedrock characteristics will also be considered with respect to the applicability of exposure parameters developed for use with the soil matrix. In units where both soils and weathered bedrock exist, the relative fraction of area consisting of weathered bedrock and soil will be considered in the risk assessments. Any actions taken to address issues related to the presence of both weathered bedrock and soil will be subject to DTSC review.

SECTION 5

The following have been updated or replaced in this section and subsections:

- **Updated information regarding the methods, parameters and complete exposure pathways that will be included in the calculation of risks associated with residential and recreational exposure to soil, ephemeral sediment, and/or food (Sections 5.1 through 5.5) is described in Appendix B of the SRAM Rev. 2 Addendum; therefore information for those pathways described in this section is no longer applicable.**

- **Consistent with Risk Assessment Guidance for Superfund Volume I Part F (USEPA, 2009), the concentration of volatile compounds will be used as the exposure metric to evaluate the inhalation pathway instead of an inhalation dose based on inhalation rate and body weight (Section 5.2.3).**

- **Central tendency exposure (CTE) estimates will not be estimated for residential and recreational exposure to soil, ephemeral sediment and/or food. CTE estimates will only be estimated as necessary for other exposure media and receptors.**

- **Consistent with the methodology in Appendix B of the SRAM Rev. 2 Addendum, residential and recreational exposures will be evaluated with an age-adjusted composite adult for the carcinogenic effects and a child for non-carcinogenic effects for all media (Sections 5.3 and 5.4).**

- **An updated exposure frequency for recreators is presented in Appendix B of the SRAM Rev. 2 Addendum; this exposure frequency will be used for all recreational exposure pathways (Section 5.4).**

- **Exposure to volatile compounds in ambient air via migration from groundwater (Section 5.2.3) will not be evaluated quantitatively because no reliable and approved groundwater-to-ambient air model is available for use, the ambient air pathway is likely a minor pathway when compared to direct contact groundwater pathways, and there are more robust datasets for volatile compounds in soil.**

5 HUMAN EXPOSURE MODELS

The following have been updated or replaced in this section:

- **Text regarding the methods, parameters and complete exposure pathways that will be included in the calculation of risks associated with residential and recreational exposure to soil, ephemeral sediment and/or food described below is no longer applicable because updated information for those pathways and receptors is described in Appendix B of the SRAM Rev. 2 Addendum.**
- **Consistent with Risk Assessment Guidance for Superfund Volume I Part F, the concentration of volatile compounds will be used as the exposure metric to evaluate the inhalation pathway instead of an inhalation dose based on inhalation rate and body weight.**
- **Central tendency exposure (CTE) estimates will not be estimated for residential and recreational exposure to soil, ephemeral sediment and/or food. CTE estimates will only be estimated as necessary for other exposure media and receptors.**

Human exposure models provide the basis for quantifying potential exposure to COPCs. The exposure models are based on the calculation of an internal dosage for each COPC. Dose is defined as the amount of chemical absorbed into the body over a given period of time (USEPA 1989a). Dosage is defined as the amount of chemical per unit of body weight. For non-carcinogenic effects, the dosage is averaged over the period of exposure and is referred to as the average daily dosage (ADD). For carcinogenic effects, the dosage is averaged over a lifetime and is referred to as the lifetime average daily dosage (LADD).

Consistent with current DTSC (1992) and USEPA guidance (1989a), the following general equation will be applied to assess chemical dosage for each complete or potentially complete exposure pathway considered in the risk assessment:

$$Dosage = \frac{C \times IR \times EF \times ED \times B}{BW \times AT} \tag{5-1}$$

where:

Dosage = ADD (mg/kg-day) for non-carcinogens;
LADD (mg/kg-day) for carcinogens

C	=	chemical concentration in environmental medium (mg/kg soil; mg/L water; or, mg/m^3 air)
IR	=	intake rate (mg soil/day; L water/day; or, m^3 air/day)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
B	=	bioavailability (fraction)
BW	=	body weight (kg)
AT	=	averaging time (days)

With the exception of EPCs (discussed in Section 6), explanation of the specific parameters applied to this general equation and recommended parameter values are presented in this section. For bioavailability, a default value of 1 will be used for oral and inhalation exposures, unless a different value is approved by DTSC.

Estimation of exposure may proceed in a deterministic or probabilistic fashion. A deterministic analysis will be presented along with any probabilistic analyses. The former provides a "point estimate" of exposure by specifying constant values for each equation parameter. Probabilistic estimation considers a range of values that might be applied to each exposure factor. Variables for each parameter are selected at random from a probability distribution (*i.e.*, each factor is a random variable) and the risk estimate is calculated many times, resulting in a probability distribution of risk (a cumulative frequency distribution) that is a continuum of possible risk estimates accounting for the variability of each exposure parameter.

The cumulative frequency is a measure of the confidence of the estimate. That is, it shows the probability of any given risk estimate. To the extent that the random exposure values represent variation in a population, the cumulative frequency plot indicates the proportion of a specified population that might be associated with the estimated exposure (and corresponding health risk)[v].

The probabilistic approach is a comprehensive treatment of the risk estimate, which may be helpful to risk managers who are charged with balancing risk reduction against cost and/or technical feasibility of a response, and the potential to create a competing risk. However, the probabilistic method is complicated to implement. A certain amount of information about the

[v] It is important to note that for most distributions used to specify the random variables, it is not possible to separate that variation produced by measurement error from actual variability in human behavior or physiological traits producing the exposure. As such, the cumulative frequency distribution is only a crude indication of the potential distribution of risk within a population.

variability in an exposure estimate may be obtained simply by using the deterministic system to calculate exposure for different point estimates (*e.g.*, reasonable maximum exposure [RME]). The point estimates may represent the typical or central tendency exposure [CTE] among the plausible range of exposures or an estimate of the RME.

Either deterministic alone or deterministic and probabilistic approaches may be used for SSFL units, depending on a unit-by-unit assessment of the practicality and need for probabilistic risk assessment. At a minimum, all units will be evaluated to provide CTE and RME dosage estimates. Based on the results of the deterministic dosage estimates, probabilistic-based dosage estimates may be calculated for specific pathways.

5.1 RECEPTORS

The following have been updated or replaced in this subsection:

- **Updated information regarding the methods, parameters and complete exposure pathways that will be included in the calculation of risks associated with residential and recreational exposure to soil, ephemeral sediment, and/or food is described in Appendix B of the SRAM Rev. 2 Addendum; therefore information for those pathways described in this subsection is no longer applicable.**
- **Consistent with Risk Assessment Guidance for Superfund Volume I Part F, the concentration of volatile compounds will be used as the exposure metric to evaluate the inhalation pathway instead of an inhalation dose based on inhalation rate and body weight.**
- **Consistent with the methodology in Appendix B of the SRAM Rev. 2 Addendum, residential and recreational exposures will be evaluated with an age-adjusted composite adult for the carcinogenic effects and a child for non-carcinogenic effects for all media.**
- **Exposure to volatile compounds in ambient air via migration from groundwater will not be evaluated quantitatively because no reliable and approved groundwater-to-ambient air model is available for use, the ambient air pathway is likely a minor pathway when compared to direct contact groundwater pathways, and there are more robust datasets for volatile compounds in soil.**

The concept of a receptor was introduced in Section 4 (Conceptual Site Model). As was discussed, four general receptor groups (workers, residents, trespassers, and recreational users), with associated exposure pathways, will be used to evaluate current and estimate future human health risks and hazards at SSFL units. A general description of each group of receptors follows.

It is the general intent to initially use the particular receptor for each unit that is likely to have the greatest exposure in the risk assessment because, if an acceptable level of risk for this receptor is revealed, further evaluation is unnecessary (*i.e.*, less exposed receptors would have less exposure and consequently less risk). Thus, the risk assessment process is more efficient. Based on comparison of the exposure parameter values for each receptor (shown in Tables 5-1 through 5-5 of this section), it is concluded that the "residential" receptor is the most exposed and should be the primary receptor for evaluation. Specifically, residential receptors (both adult and child) have substantially greater RME exposure frequency and duration (24 hours/day, 350 days/year, for 30 years) than other receptors. The receptor with the next greatest RME exposure is the worker with exposure frequency and duration of eight hrs/day, 250 days/year, for 25 years. Potential exposure to trespassers or recreators would be substantially less than for either the worker or residents. Evaluation of other receptors would be useful for making risk management decisions concerning the necessity or extent of remediation required for various intended unit or partial-unit uses.

Under current land-use conditions, a current worker at the SSFL has the greatest potential for exposure to COPCs and generally represents the highest potential exposures relative to other possible current land-use scenarios, such as trespassers. Pathways for which a dosage estimate may be quantitatively assessed as a component of the current worker scenario include:

- inhalation of volatile COPCs in indoor air and ambient air
- direct contact exposure to COPCs in soil or sediment (ingestion, dermal contact, and inhalation of soil particulates)

Potential exposure to trespassers may also be evaluated in addition to the worker scenario, for appropriate areas, as a component of the current land use scenario. The approach for evaluating exposure to trespassers will be similar to the recreational land use scenario, which evaluates individuals who spend a limited time engaging in outdoor activities at the site (USEPA 1991). Pathways for which dosage will be quantitatively assessed as a component of the trespasser scenario include:

- exposure to COPCs in soil or sediment (ingestion, dermal contact, and inhalation of dust and vapors)

- exposure to COPCs in surface water (dermal contact)

Under future land use conditions, hypothetical residents and recreators are possible receptors. As a most conservative measure, residential land use, as described in the conceptual site model (Section 4) will be evaluated as the future land use scenario. The exposure assumptions for this land use scenario account for long-term daily exposure and generally represent the highest potential exposures relative to those associated with other land use scenarios (USEPA 1991). Pathways for which a dosage estimate will be quantitatively assessed as a component of the suburban residential scenario include:

- exposure to COPCs in soil or sediment (ingestion, dermal contact, and inhalation of particulates)
- exposure to COPCs in groundwater (ingestion, dermal contact, and inhalation)
- indirect exposure to volatile COPCs migrating from soil or groundwater to indoor air
- exposure to COPCs in food (ingestion)

Recreational land use may also be evaluated in addition to the residential scenario, for appropriate areas, as a component of the future land use scenario. The recreational land use scenario evaluates individuals who spend a limited time engaging in outdoor activities at the site (USEPA 1991). Pathways for which dosage will be quantitatively assessed as a component of the recreational scenario include:

- exposure to COPCs in soil or sediment (ingestion, dermal contact, and inhalation of dust and vapors)
- exposure to COPCs in surface water (dermal contact)

The pathway-specific dosage equations for each land use scenario are presented below, along with recommended deterministic parameter values and parameter value distributions for probabilistic assessment for several parameters (see Tables 5-1 through 5-5). In some cases, it was determined that a distribution would not be applied to a parameter either because varying the parameter would not produce significantly different estimates of exposure, or because no information of the distribution was available. Sources for exposure parameter values are specified, but came primarily from default exposure parameters noted in Cal-EPA's risk assessment modeling tool, CalTOX (DTSC 1993), the DTSC *Supplemental Guidance for Human Health Multimedia Risk Assessments of Hazardous Waste Facilities and Permitted Facilities* (DTSC 1992), or the USEPA *Exposure Factors Handbook* (USEPA 1997a). Exposure factors will be approved by the DTSC's HERD if unavailable from the sources listed above.

CalTOX is compatible with probabilistic exposure estimations and provides default distributions for many exposure parameters (DTSC 1993). This was used as the priority source for the distributions recommended here. Alternative distributions from other sources were used only where newer or more specific distributions were available, or where no distribution was offered in DTSC (1993).

5.2 EXPOSURE TO COPCS IN SOIL OR SEDIMENT

The following have been updated or replaced in this subsection:

- **Information regarding the methods, parameters and complete exposure pathways that will be included in the calculation of risks associated with residential and recreational exposure to soil, ephemeral sediment and/or food described below is no longer applicable because updated information for those pathways and receptors is described in Appendix B of the SRAM Rev. 2 Addendum.**

Residential, recreational, or worker receptors may be exposed to COPCs in soil or sediment through direct contact of the medium (*e.g.*, incidental ingestion, dermal contact, inhalation of particulates) or as a result of vapor migration from subsurface depths. Dosage equations for these pathways are presented below.

5.2.1 Incidental Ingestion of Soil

The following have been updated or replaced in this subsection:

- **Information regarding the methods, parameters and complete exposure pathways that will be included in the calculation of risks associated with residential and recreational exposure to soil, ephemeral sediment, and/or food described below is no longer applicable because updated information for those pathways and receptors are described in Appendix B of the SRAM Rev. 2 Addendum.**

Chemical uptake via ingestion of soil will be calculated for residential, recreational, or worker receptors according to the following equation (USEPA 1989a):

$$Dosage = \frac{C_{soil} \times IR \times CF \times EF \times ED \times B}{BW \times AT} \tag{5-2}$$

where:

Dosage	=	dosage for each chemical of concern (mg/kg-day)
C_{soil}	=	soil concentration (mg/kg)
IR	=	soil ingestion rate (mg/day)
CF	=	conversion factor (10^{-6} kg/mg)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
B	=	bioavailability (fraction)
BW	=	body weight (kg)
AT	=	averaging time (period over which exposure is averaged - days) (= *ED* for non-carcinogens; 70 years for carcinogens)

Chemical-specific oral bioavailability factors will be applied when the oral toxicity criteria are based on administered dosage, or when oral studies are available in the peer-reviewed literature that reported gastrointestinal absorption fractions for chemicals administered in a soil matrix. The use of bioavailability factors derived from the literature will be subject to DTSC approval.

Exposure parameter values for soil ingestion are provided in Tables 5-1 through 5-5 for workers, adults, and children, respectively. It will be noted from these tables that the only exposure parameters not taken from the priority sources specified in the introduction are body weight distribution for children and exposure frequency (deterministic values and distribution) for adults and children in the recreational exposure scenario.

Body weights for children were adjusted because CalTOX evaluates a “child” between the ages of zero to 15 years, whereas this document specifies the more typical child age step of one to six years. As such, the CalTOX-specified body weight would be too high for the younger receptor, causing an underestimate of exposure. No published distributions of body weight were available for this age range, but Anderson *et al*. (1985, same data cited in USEPA 1997a) provide percentiles of body weights on a year-by-year basis for children. A three- to four-year-old child was used, as this is the mid-point age for the receptor in question and notes that the reported percentiles fit a normal distribution where the mean (50th percentile) equals 15.6 kilograms (kg), and the standard deviation equals approximately two kg.

The duration of exposure in a recreational setting has not been specified by DTSC or USEPA and was therefore based on professional judgment, using the conservative assumption that in the future the SSFL might be open to visitors. As noted in Tables 5-4 and 5-5, it is assumed that, in the future, one day every other week might be spent by adults in territory at the SSFL that is too

steep or wet to be considered residential. Double this rate, one day per week, was used for children. It was assumed any value between four and eight hours per week is equally likely. It was further assumed that the period of the visit would be from four to eight hours. Thus, for probabilistic assessment, uniform distribution between these rates will be used.

5.2.2 Dermal Contact with Soil

The following have been updated or replaced in this subsection:

- **Information regarding the methods, parameters and complete exposure pathways that will be included in the calculation of risks associated with residential and recreational exposure to soil, ephemeral sediment, and/or food described below is no longer applicable because updated information for those pathways and receptors is described in Appendix B of the SRAM Rev. 2 Addendum.**

Chemical dosage via dermal contact with surficial soil will be calculated for residential and recreational receptors according to the following equation (USEPA 2004):

$$Dosage = \frac{C_{soil} \times AF \times B \times CF \times EF \times ED}{BW \times AT} \tag{5-3}$$

where:

$Dosage$	=	dosage for each chemical of concern, mg/kg-day
C_{soil}	=	soil concentration, mg chemical/kg soil
AF	=	soil loading to skin, mg soil/day
B	=	bioavailability, fraction
CF	=	conversion factor, 10^{-6} kg/mg
EF	=	exposure frequency, days/year
ED	=	exposure duration, years
BW	=	body weight, kg
AT	=	averaging time (period over which exposure is averaged - days) (= *ED* for non-carcinogens; 70 years for carcinogens)

Chemical-specific dermal bioavailability factors will be taken from Cal-EPA guidance (DTSC 1994).

Exposure parameter values for dermal contact are provided in Tables 5-1 through 5-5 for workers, adults, and children, respectively. Distributions of these parameters for use in probabilistic risk assessment were obtained from DTSC (1999b) and the anticipated USEPA dermal guidance or developed from pooled data (geometric means and standard deviations) for relevant experimental groups provided in the pending dermal guidance or USEPA (1997a) using the software Crystal Ball (Decisioneering, Inc., Denver, Colorado).

5.2.3 Inhalation of Vapors

The following have been updated or replaced in this subsection:

- **Information regarding the methods, parameters and complete exposure pathways that will be included in the calculation of risks associated with residential and recreational exposure to soil, ephemeral sediment and/or food described below is no longer applicable because updated information for those pathways and receptors is described in Appendix B of the SRAM Rev. 2 Addendum.**
- **Consistent with Risk Assessment Guidance for Superfund Volume I Part F, the concentration of volatile compounds will be used as the exposure metric to evaluate the inhalation pathway instead of an inhalation dose based on inhalation rate and body weight.**
- **Exposure to volatile compounds in ambient air via migration from groundwater will not be evaluated quantitatively because no reliable and approved groundwater-to-ambient air model is available for use, the ambient air pathway is likely a minor pathway when compared to direct contact groundwater pathways, and there are more robust datasets for volatile compounds in soil.**

Chemical uptake via inhalation of vapors released to air at the soil surface will be calculated for residential, recreational, and worker receptors according to the following equation (USEPA 1989a):

$$Dosage = \frac{C_{air} \times IR \times EF \times ED}{BW \times AT} \tag{5-4}$$

where:

Dosage = dosage for each chemical of concern (mg/kg-day)

C_{air} = vapor concentration in air (mg/m^3)
IR = inhalation rate (m^3/day)
EF = exposure frequency (days/year)
ED = exposure duration (years)
BW = body weight (kg)
AT = averaging time (period over which exposure is averaged - days) (= ED for non-carcinogens; 70 years for carcinogens)

The air concentration for this algorithm may be computed from a vapor transport model described in Section 6, or from direct measurements of vapors in air. Exposure parameter values for vapor inhalation are provided in Tables 5-1 through 5-5 for workers, adults, and children. Deterministic adult inhalation rates were obtained from USEPA (1997a) and were set at recommended resting rates for the residential exposure and a rate midway between the values listed in USEPA (1997a) for light and moderate activity for the recreational scenario. Distributions were obtained from CalTOX and relate to the recommended distribution for a "resting" inhalation rate in the case of residential exposure and an "active" inhalation rate for the recreational exposure. Children's rates for deterministic evaluation were obtained from USEPA (1997a) and relate to the mean inhalation rate recommended for a child from age three to five years. The distribution provided by CalTOX for children relates to ages zero to 15 years and would not be appropriate for the one- to six-year-old receptor considered here. Therefore, the distribution assigned is the adult distribution multiplied by 0.75, which is the approximate ratio of child to adult breathing rates selected for the deterministic evaluation.

This equation may also be used to quantify exposure to vapors migrating from groundwater into a structure (see Section 5.3). Because the migration pathway from groundwater would be through soil overburden, it is possible that use of modeling of vapor transport from groundwater and soil could amount to "double counting" the resulting ambient indoor air concentration. As such, indoor air concentrations should be computed separately for soil and groundwater sources, and only the higher estimated concentration used for quantifying exposure.

5.2.4 Inhalation of Particulates

The following have been updated or replaced in this subsection:

- **Information regarding the methods, parameters, and complete exposure pathways that will be included in the calculation of risks associated with residential and recreational exposure to soil, ephemeral sediment, and/or food described below is no**

longer applicable because updated information for those pathways and receptors is described in Appendix B of the SRAM Rev. 2 Addendum.

- **Consistent with Risk Assessment Guidance for Superfund Volume I Part F, the concentration of volatile compounds will be used as the exposure metric to evaluate the inhalation pathway instead of an inhalation dose based on inhalation rate and body weight.**

Chemical uptake via inhalation of particulates (for nonvolatile compounds) will be calculated for residential, recreational, or worker receptors according to the following equation (USEPA 1989a):

$$Dosage = \frac{C_{soil} \times CF \times IR \times EF \times ED}{PEF \times BW \times AT} \tag{5-5}$$

where:

Dosage	=	dosage for each chemical of concern (mg/kg-day)
C_{soil}	=	concentration in soil (mg/kg)
PEF	=	particulate emission factor ($m^3/\mu g$)
CF	=	conversion factor (10^{-9} kg/µg)
IR	=	inhalation rate (m^3/workday)
EF	=	exposure frequency (workdays/year)
ED	=	exposure duration (years)
BW	=	body weight (kg)
AT	=	averaging time (period over which exposure is averaged - days) (= *ED* for non-carcinogens; 70 years for carcinogens)

Exposure parameter values for particulate inhalation are provided in Tables 5-1 through 5-5 for workers, adults, and children, respectively.

5.3 EXPOSURE TO COPCS IN GROUNDWATER

The following have been updated or replaced in this subsection:

- **Consistent with the methodology in Appendix B of the SRAM Rev. 2 Addendum, residential exposure will be evaluated with an age-adjusted composite adult for the carcinogenic effects and a child for non-carcinogenic effects for all media.**

- **Exposure to volatile compounds in ambient air via migration from groundwater will not be evaluated quantitatively because no reliable and approved groundwater-to-ambient air model is available for use, the ambient air pathway is likely a minor pathway when compared to direct contact groundwater pathways, and there are more robust datasets for volatile compounds in soil.**

Residential receptors may be exposed to COPCs in groundwater through ingestion of groundwater or as a result of showering (*e.g.*, dermal contact, inhalation). Residential, trespasser, and recreational receptors may also be exposed (*e.g.*, ingestion, dermal contact, inhalation of VOCs released to ambient air) to groundwater in seeps or springs at units where seeps and springs exist. The potential for exposure to groundwater in seeps and springs will be evaluated on a unit-by-unit basis at those units where seeps and springs exist, since possible exposure by these pathways is a function of the physical characteristics of unit-specific seeps and springs. Depending on the spatial area and yield of seeps and springs, exposure parameter values may vary substantially across units. Unit-specific parameter values (*e.g.*, intake rates, exposure frequencies) related to seeps and springs will be presented to DTSC during the conduct of unit risk assessments and will be subject to DTSC approval.

Calculation methods for estimating domestic groundwater exposures to residential receptors are discussed below.

5.3.1 Ingestion of Groundwater

The following have been updated or replaced in this subsection:

- **Consistent with the methodology in Appendix B of the SRAM Rev. 2 Addendum, residential exposure will be evaluated with an age-adjusted composite adult for the carcinogenic effects and a child for non-carcinogenic effects for all media.**

Chemical uptake via ingestion of groundwater will be calculated according to the following equation (USEPA 1989a):

$$Dosage = \frac{C_{gw} \times IR \times EF \times ED}{BW \times AT} \tag{5-6}$$

where:

Dosage = dosage for each chemical of concern (mg/kg-day)

C_{gw}	=	concentration in groundwater (mg/L)
IR	=	groundwater ingestion rate (L/day)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
BW	=	body weight (kg)
AT	=	averaging time (period over which exposure is averaged - days) (= *ED* for non-carcinogens; 70 years for carcinogens)

Exposure parameter values for groundwater ingestion are provided in Tables 5-2 and 5-3 for residential adult and child receptors, respectively. While the deterministic parameter values are from USEPA (1997a) or DTSC guidance, these reports actually parameterize total fluid intake rather than only groundwater intake. Accordingly, a distribution for tapwater consumption more realistically reflects the contemplated groundwater exposure. These distributions were published by Roseberry and Burmaster (1992) and refer to adults and one- to 11-year-old children for the adult and child exposures, respectively.

5.3.2 Dermal Contact with Groundwater and Inhalation of Groundwater Vapor COPCs

The following have been updated or replaced in this section:

- **Consistent with the methodology in Appendix B of the SRAM Rev. 2 Addendum, residential exposure will be evaluated with an age-adjusted composite adult for the carcinogenic effects and a child for non-carcinogenic effects for all media.**

Chemical uptake via dermal contact with groundwater and inhalation of vapors during showering (note that this inhalation pathway is different from exposure due to vapors migrating from the subsurface, which was covered in Section 5.2.3) will be estimated for residential receptors by assuming that the dosage associated with these pathways is equal to the dosage received via groundwater ingestion (USEPA 1997a). This methodology results in very conservative estimates of total groundwater dosage and will therefore be used as a screening methodology. If necessary, USEPA dosage equations for dermal and inhalation exposures associated with showering will be applied to refine the dosage estimates for these pathways (USEPA 1997a).

5.4 Dermal Contact with Surface Water

The following have been updated or replaced in this section and subsections:

- **Consistent with the methodology in Appendix B of the SRAM Rev. 2 Addendum, recreational exposure will be evaluated with an age-adjusted composite adult for the carcinogenic effects and a child for non-carcinogenic effects for all media.**

- **An updated exposure frequency for recreators is presented in Appendix B of the SRAM Rev. 2 Addendum; this exposure frequency will be used for all recreational exposure pathways.**

Dermal contact with surface water is a potentially complete exposure pathway for workers and recreators. For SSFL workers, the potential for direct contact with surface water is site specific and negligible due to the small amount of time that workers work in pond areas. Worker exposure is further limited by standard safety precautions taken when working in all areas of the SSFL. Therefore, worker contact with surface water is a potentially complete pathway. Chemical uptake via dermal contact with surface water will be calculated for recreational receptors according to the following equation (USEPA 2004):

$$Dosage = \frac{DA_{event} \times EV \times EF \times ED \times SA}{BW \times AT} \tag{5-7}$$

where:

$Dosage$	=	dosage for each chemical of concern (mg/kg-day)
DA_{event}	=	absorbed dosage per surface area-event (mg/cm^2-event)
EV	=	event frequency (events/day)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
SA	=	skin surface area available for contact (cm^2)
BW	=	body weight (kg)
AT	=	averaging time (period over which exposure is averaged - days) (= ED for non-carcinogens; 70 years for carcinogens)

where

$$DA_{event} = K_p^{\,w} \times C_w \times t_{event} \tag{5-8}$$

and,

$K_p^{\,w}$	=	chemical permeability coefficient in water (cm/hr)

C_w = chemical concentration in water (mg/cm^3)
t_{event} = duration of event (hr)

Site-specific information for each exposure unit will be used to identify whether a swimming or wading scenario is most suitable and appropriate skin surface areas will be used accordingly. Skin surface area values for swimming are provided in Tables 5-4 and 5-5 for adults and children, respectively. However, as mentioned in the discussion of conceptual site models of exposure (Section 4), surface area exposed during wading is a function of water depth and will have to be determined on a unit-by-unit basis. As described in Section 5.2.1, it is estimated that one day every other week might be spent by adults in territory at the SSFL that is too steep or wet to be considered residential. Double this rate, one day per week, was used for children. During this time, recreators may be engaged in various activities such as hiking, wading, and swimming.

5.5 EXPOSURE TO COPCS IN FOOD

The following have been updated or replaced in this subsection:

- **Information regarding the methods, parameters and complete exposure pathways that will be included in the calculation of risks associated with residential exposure to food described below is no longer applicable because updated information for those pathways and receptors is described in Appendix B of the SRAM Rev. 2 Addendum.**

Future residential receptors may be exposed to COPCs by ingestion of produce in which the chemicals have accumulated; however, as acknowledged by USEPA (1991, 1996b), this pathway is only relevant for a limited number of compounds. USEPA identifies three separate food groups for characterizing food intake dosages:

- fruits and vegetables
- fish and shellfish
- meat, eggs, and dairy products

For the SSFL, it cannot be ruled out that fruits and vegetables may be grown onsite in the future. Accordingly, these food sources will be quantitatively assessed for future residential receptors.

USEPA's food intake equation, given below, will be applied to assess potential site-related chemical intake from food ingestion.

$$Dosage = \frac{C_p \times IR \times F \times EF \times ED}{BW \times AT} \tag{5-9}$$

where:

Dosage	=	dosage for each chemical of concern (mg/kg-day)
C_p	=	concentration in food item (mg/g)
F	=	fraction of produce locally grown (unitless)
IR	=	intake rate (g/kg-day)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
AT	=	averaging time (period over which exposure is averaged - days) (= *ED* for non-carcinogens; 70 years for carcinogens)

Exposure parameter values for residential ingestion of homegrown fruits and vegetables are provided in Tables 5-2 and 5-3 for adults and children, respectively. Deterministic values for adult and three- to five-year-old child consumption rates were obtained from USEPA (1997a) and relate specifically to homegrown produce in the western United States. Accordingly, the F term in the above equation was set at 1.0.

Biotransfer of chemicals from soil to plants (produce) will be calculated using the soil to plant biotransfer model described in the DTSC CalTOX model (DTSC 1993). The DTSC model provides equations for estimating both above-ground (leaf and fruit) produce concentrations as well as below-ground (root) produce concentrations. Consumption rate data as described in the preceding paragraph are not specific to above- and below-ground produce. Therefore, it will be conservatively assumed that one-half an individual's total produce consumption is associated with above-ground produce, and one-half is associated with below-ground plants. This assumption is conservative because it his highly unlikely that most individual's consume a higher amount of below-ground produce than above-ground produce, yet the biotransfer factors for below-ground produce are 35 times greater than those for above-ground produce.

Distributions of produce consumption were obtained from DTSC (1993). This value representing total combined consumption of fruit and vegetables must be adjusted to account for locally grown produce. The distribution of the F term was also taken from CalTOX.

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SECTION 6

The following have been updated or replaced in this section and subsections:

- **Information regarding the methods, parameters and complete exposure pathways that will be included in the calculation of risks associated with residential and recreational exposure to soil, ephemeral sediment and/or food described below is no longer applicable because updated information for those pathways and receptors are described in Appendix B of the SRAM Rev. 2 Addendum.**
- **Exposure to volatile compounds in ambient air via migration from groundwater (Sections 6.1 and 6.4) will not be evaluated quantitatively because no reliable and approved groundwater-to-ambient air model is available for use, the ambient air pathway is likely a minor pathway when compared to direct contact groundwater pathways, and there are more robust datasets for volatile compounds in soil.**
- **Additional information on the indoor air evaluation (Sections 6.1 and 6.4) is provided in the Technical Memorandum *An Updated Approach for Assessing the Vapor Intrusion Pathway* (CH2M Hill, 2012).**
- **CTE estimates (Sections 6.2 and 6.6) will not be estimated for residential and recreational exposure to soil, ephemeral sediment and/or food. CTE estimates will only be estimated as necessary for other exposure media and receptors.**

6 EXPOSURE POINT CONCENTRATIONS FOR HUMAN HEALTH RISK ASSESSMENT

This section presents the methodology for estimating EPCs for complete and potentially complete exposure pathways at the site for the human health risk assessment. Exposure pathways were identified in Section 4, which presented criteria for selecting potential exposure pathways and receptors at individual investigational units at the site. Complete or potentially complete exposure pathways include direct contact with soil, sediment, surface water, and regional near-surface and/or Chatsworth formation groundwater associated with seeps and springs; inhalation of chemicals transported from soil, groundwater, or surface water to air; and indirect exposure to compounds in soil via uptake into produce.

To estimate potential exposures via complete or potentially complete exposure pathways, compound concentrations in media in areas where receptors may be exposed (*e.g.*, exposure

points) are necessary. EPCs can be estimated through direct measurement (*e.g.,* sampling and analysis of a medium) or through prediction (*e.g.,* modeling). Direct measurement involves the sampling and analysis of soil, water, air, and produce, including QA/QC validation of the sample results, for the target chemical(s). In risk assessments of investigational units at the site, measured concentrations will be used whenever available and appropriate. As recommended by USEPA (1989a), "J" qualified data (*i.e.*, the value is estimated) will be used in the calculation of EPCs.

In some cases, direct measurement may not be possible or practical because it is difficult to obtain a sample (*e.g.,* beneath a building). In these cases, predictive models may be used. Predictive models require knowledge of environmental fate and transport modeling to estimate chemical concentrations in a given medium. All predictive models will be submitted to DTSC for review and approval. In some cases, the report containing the risk assessment may also be the same report describing the model. In this case, it is recognized that acceptance of the risk assessment conclusions is contingent on approval of the model.

The source of data used to define exposures for complete or potentially complete pathways identified at each OU at the SSFL is presented in Table 6-1 and discussed in this section. EPCs will be estimated for the following media: soil, air, sediment, surface water, groundwater, and produce. EPCs for several chemical classes (*e.g.*, inorganics, volatiles, and high and low molecular weight semi-volatile organic compounds (SVOCs), as defined in DTSC 1994) will be estimated in these media.

For direct contact pathways, EPCs in soil will be based on measured concentrations. EPCs in other media will be based on measured concentrations when data are available. When measured concentrations are not available or are uncertain, EPCs will be modeled. Various models to estimate EPCs are presented in regulatory guidance documents (*e.g.*, USEPA 1993a, 1996b, 2002a), ranging in complexity from simple analytical expressions through fully integrated numerical models. It is recognized that acceptance of the risk assessment conclusions is contingent on approval of each model. Site specific physical parameters for the SSFL are presented in Appendix F.

This section describes methodologies for calculating EPCs, consisting of groundwater, surface soil and accessible weathered bedrock, surface sediment, surface water, and seeps and springs. Secondary pathways, such as potential food sources, may also be addressed.

6.1 EXPOSURE POINT CONCENTRATIONS IN GROUNDWATER

The following have been updated or replaced in this subsection:

- **Exposure to volatile compounds in ambient air via migration from groundwater will not be evaluated quantitatively because no reliable and approved groundwater-to-ambient air model is available for use, the ambient air pathway is likely a minor pathway when compared to direct contact groundwater pathways, and there are more robust datasets for volatile compounds in soil.**
- **Additional information on the indoor air evaluation is provided in the Technical Memorandum *An Updated Approach for Assessing the Vapor Intrusion Pathway* (CH2M Hill, 2012).**

In all cases, groundwater contaminated with volatile chemicals will be assumed to provide a source for volatilization of these compounds into ambient and indoor air. As described in Section 2, in cases where groundwater meets the SWRCB definition of a drinking water source standard for domestic water (Resolution 88-63), the resource will be assumed to have the potential for exposure through ingestion and dermal absorption, as well as inhalation of compounds volatilized during showering or washing.

EPCs for the Surficial OU will be developed on an investigational unit basis. EPCs will be the maximum concentrations measured from near-surface groundwater wells from within a particular investigational unit and from areas which are up gradient from the investigational unit. For the CFOU, EPCs will be the maximum concentrations measured from Chatsworth formation groundwater at an investigational unit, in a Reporting Area, or upgradient from these areas. The most recent three year groundwater monitoring data will be evaluated to determine whether this adequately reflects water concentrations to which potential receptors will be exposed. All historical groundwater monitoring data will be evaluated to assure representativeness for the three-year period used. Data, including soil vapor measurements, collected during field investigations of areas overlying groundwater will be the basis for modeling the volatilization of COPCs from groundwater to indoor and ambient air. At investigational units where soil vapor data is not available, groundwater and bulk soil concentrations will be used.

Since the groundwater metals data set consists of both total and dissolved analytical results, both filtered and unfiltered samples will be considered for use in risk assessment at an investigational unit. When adequate monitoring data for groundwater units are not available, an initial approach

to estimating potential groundwater concentration will be a leachate model approved by DTSC and USEPA. All models used to estimate EPCs for water will be submitted to DTSC. It is recognized that acceptance of the risk assessment conclusions is contingent on approval of the model.

6.2 Exposure Point Concentrations in Surface Soil and Sediment

Ingestion of and dermal absorption from soil and surface sediment are potentially complete exposure pathways at the site. Data collected during field investigations at the site will form the basis for soil/surface sediment (hereafter collectively referred to as soil) EPCs used to estimate chemical-specific dosages for these pathways.

As described in Section 6.2.1, deterministic estimates of EPCs will be calculated for all investigational units. In cases where the sampling density is not consistent across units, area-weighting may also be used at those units to estimate EPCs as described in Section 6.2.2.

6.2.1 Deterministic Estimation of Exposure Point Concentrations

The following have been updated or replaced in this section:

- **Central tendency exposure (CTE) estimates will not be estimated for residential and recreational exposure to soil, ephemeral sediment, and/or food. CTE estimates will only be estimated as necessary for other exposure media and receptors.**

For all adequately characterized investigational units, and consistent with DTSC guidance (1992), the chemical-specific soil EPC for the RME will be characterized as the lower of (1) the maximum detected concentration or (2) the 95 percent UCL of the arithmetic mean concentration.

The UCL is calculated differently depending on the nature of the distribution of the data and on spatial considerations in the case of soil ingestion exposure scenarios and where measured concentrations are used as source terms for indirect exposures (*e.g.*, volatilization from the subsurface). Spatial distributions are discussed in Section 6.2.2. In the case of normally distributed data with no spatial component, the UCL is:

$$UCL = \bar{x} + (t_{\alpha} * s/\sqrt{n-1}) \qquad (6\text{-}1)$$

where,

UCL = a specified limit (*i.e.*, 95 percent) on the estimate of the arithmetic mean

$\bar{x}$ = mean concentration
t_α = the value of t for a specified confidence level, α
s = the standard deviation of the distribution
n = number of independent analytical samples

If the data are log-normally distributed and no spatial considerations are required, the UCL is:

$$UCL = e^{\bar{x}+0.5s^2+\sigma H\sqrt{n-1}} \tag{6-2}$$

where,

UCL = a specified limit (*i.e.*, 95 percent) on the estimate of the arithmetic mean
$\bar{x}$ = mean of the sample distribution
s = the standard deviation of the sample distribution
H = a statistic accounting for interaction of the distribution developed by Land (1975)
n = number of independent analytical samples

Where neither normal nor log-normal distributions are encountered, the 95 percent UCL will be estimated using nonparametric statistical methods (*e.g.*, bootstrapping) as described in recent USEPA risk assessment guidance (USEPA 1997b, 2002a). Nonparametric statistical calculations will be performed using the most current version of USEPA's ProUCL software.

The chemical-specific exposure concentration for the most likely (average) exposure, also referred to as the CTE concentration, will be characterized as the arithmetic mean soil concentration. As recommended in DTSC guidance (1992), one-half of the analytical reporting limit concentration will be used as a representative concentration for non detect results for COPCs.

The methods described above are applicable only to adequately characterized investigational units with data sets comprising at least three samples. In cases where only one sample is available, the single measured sample result will be used for both the CTE and RME concentrations. In cases where only two samples are available, the CTE concentration will be estimated as the arithmetic mean of the two measured values, and the RME exposure concentration will be estimated as the maximum measured value.

6.2.2 Spatial Distribution Considerations

For area-specific soil EPCs, DTSC (1992) and USEPA (1989a) guidance will be followed. For areas where spatial sampling has adequately characterized contamination, the spatial distribution of COPCs will be evaluated to determine the appropriate method for estimating soil EPCs. In cases where sampling density is not consistent across an exposure area, area-weighted averaging will be applied, as recommended by DTSC (1992).

Area-weighted averaging may be conducted in a number of ways, ranging in complexity from constructing polygons from lines drawn equidistant between sampling locations (Thiessen polygons) (Clifford *et al*. 1995) to establishing unbiased estimates of concentration and variance change with distance and using the results to construct a spatial grid of estimated concentrations (ordinary kriging) (Isaaks and Srivastava 1989). The latter is data intensive and unlikely to be feasible for many of the investigation units at the SSFL. Thus, it is proposed that area-weighting be conducted using Thiessen polygons.

To construct Thiessen polygons, a perpendicular line is drawn equidistant between sampling points. For samples surrounded by other sampling points, where the set of lines meet, it creates a polygon. The outermost samples are truncated at a defined boundary, such as the border of the investigational unit or a defined exposure area. It is assumed that the concentration observed at the sampling point within each polygon is the best representation of concentrations within the entire area of that polygon.

Figures 6-1 and 6-2 illustrate this procedure. On Figure 6-1, polygons have been created by using a geographic information system (GIS), which also calculates the area included in each space. Hypothetical data are shown on Figure 6-2. The hypothetical COPC concentration and area associated with each polygon is shown in Table 6-2.

The area-weighted concentration is calculated using the following formula (Isaaks and Srivastava 1989):

$$\overline{x}_{sc} = \sum_{i=1}^{n} p_i c_i \tag{6-3}$$

where,

$\overline{x}_{sc}$ = area-weighted mean concentration (mg/kg)

c_i = the concentration representing the condition within polygon, *i*, where there are *i* = 1 through n polygons

p_i = the proportion of the total area that is incorporated in polygon *i* (unitless)

It is also possible to calculate the variance of area-weighted samples using the formula (Isaaks and Srivastava 1989):

$$s_{sc}^{2} = \sum_{i=1}^{n} p_i c_i^{2} - \left(\sum_{i=1}^{n} p_i c_i\right)^2 \tag{6-4}$$

where,

s_{sc}^2 = variance of the distribution (mg^2/kg^2) of area-weighted sample

and all other parameters are as described above

Under the assumption that the concentration data may be modeled as a t-distribution, a confidence limit on the estimated area-weighted mean may be calculated as:

$$UCL = \overline{x}_{sc} + (t_{\alpha} * s_{sc} / \sqrt{n-1}) \tag{6-5}$$

where,

UCL = a specified confidence limit on the estimate of the mean

t_{α} = the value of t for a specified confidence level, α

$\overline{x}_{sc}$ = area-weighted estimator of the mean (μ)

s_{sc} = the sample standard deviation, which is the square root of the sample variance (s^2)

n = the number of polygons used to estimate the distribution

It is typical to calculate the 95 percent UCL, for which the appropriate value of t would be calculated at $\alpha = 0.1$ for a two-tailed distribution.

Table 6-2 illustrates this procedure and also presents the estimated mean and 95 percent UCL of the unweighted data for comparison. It can be seen that the size of the polygons strongly influences the outcome. In the example case, the weighted mean and 95 percent UCL are greater than the unweighted statistics, because the higher observed concentrations are associated with polygons of large area. If the reverse were true (*i.e.*, high concentrations associated with small

polygons — a condition that frequently exists when "hot spots" (areas of known contamination) are intensively sampled relative to other areas of an investigation unit), area-weighted means and UCLs would be lower than statistics calculated ignoring spatial dependence. This is illustrated with a hypothetical data set shown in Table 6-3. The only difference in these data is that the hypothetical concentrations for SS-2 and SS-17 have been transposed, such that the highest concentration is now associated with a small polygon, and a low concentration is applied to a larger polygon.

Where area-weighted data appear to be log-normally distributed, means and standard deviations of log-transformed data and the statistical parameters will be applied to the so-called Land evaluation or "H" for calculating the UCL on the mean of log-normally distributed data (Land 1975; USEPA 1992c) discussed previously or may be bootstrapped as described in USEPA (1997b).

6.2.3 Land Use-Specific Exposure Areas

For recreational land use scenarios and for trespassers, soil EPCs will be determined using summary statistics on the data set for a reasonable exposure area. For direct contact soil pathways, all sample data within the zero to two feet below ground surface (bgs) profile will be employed.

For a residential land use scenario, exposure activities and data distributions (*e.g.*, potential hot spot areas) will be considered in the selection of an appropriate data set for soil EPCs. Surface samples, as well as a depth-weighted average of data for zero to 10 feet bgs (or to the maximum depth above bedrock of shallower than 10 feet) will be evaluated for direct contact soil EPCs.

For a worker land use scenario, exposure activities and data distributions (*e.g.*, potential hot spot areas) will be considered in the selection of an appropriate data set for soil EPCs. Surface samples (zero to two feet bgs), as well as a depth-weighted average of data for zero to 10 feet bgs (or to the maximum depth above bedrock of shallower than 10 feet) will be evaluated for direct contact soil EPCs. The depth interval representing the higher concentrations will be used to assess exposure to workers.

Physical or topographic conditions at an investigational unit may indicate that one or more potential human receptors would not have access to a specific area within an investigational unit, while other receptors may have access. Similarly, for the same reasons, it may not be feasible to construct future residential or commercial buildings within a specific area of an investigational

unit. Examples of such areas include rock outcrops, steep terrain, and drainages. Therefore, it may be appropriate, in certain cases, to exclude chemical data collected within inaccessible areas, for specific receptors, in the calculation of EPCs. In such cases, this decision will be clearly stated in the risk assessment, approved by DTSC, and discussed in the uncertainty section of the risk assessment.

6.3 EXPOSURE POINT CONCENTRATIONS IN SURFACE WATER

Ingestion of chemical contaminants and dermal absorption of chemicals from surface water are potentially complete exposure pathways at the site. Accordingly, EPCs will be evaluated for surface water COPCs. Surface water sampling and analysis will be used for EPCs for surface water pathways. EPCs for surface water will be calculated as described for soils in Section 6.2.1.

6.4 EXPOSURE POINT CONCENTRATIONS IN AIR

The following have been updated or replaced in this subsection:

- **Information regarding the methods to model ambient air concentrations for residential and recreational exposure to soil and ephemeral sediment described below is no longer applicable because updated information for those pathways and receptors is described in Appendix B of the SRAM Rev. 2 Addendum.**
- **Exposure to volatile compounds in ambient air via migration from groundwater will not be evaluated quantitatively because no reliable and approved groundwater-to-ambient air model is available for use, the ambient air pathway is likely a minor pathway when compared to direct contact groundwater pathways, and there are more robust datasets for volatile compounds in soil.**
- **Additional information on the indoor air evaluation is provided in the Technical Memorandum *An Updated Approach for Assessing the Vapor Intrusion Pathway* (CH2M Hill, 2012).**

Inhalation of compounds in air represents a potentially complete exposure pathway at the site. Measured concentrations of compounds in air at the site are not available. Furthermore, when direct air sampling is used in a risk assessment, significant background air sampling data are necessary to characterize site-related chemical concentrations in air. As such, EPCs in air will be modeled, assuming that volatile compounds in the subsurface may volatilize to ambient air, and particulate-bound compounds in soil may be present in air as a result of fugitive dust emissions.

Based on the results of the modeling, either DTSC or Boeing may recommend additional field work (*e.g.*, direct measurement of surface soil flux from soil and groundwater sources) to further refine modeling predictions. Methods for estimating EPCs in air as a result of volatilization are described in detail in Appendix G. Methods for estimating EPCs in air as a result of volatilization and fugitive dust emissions are summarized in the following sections.

6.4.1 Fugitive Dust Emissions

The following have been updated or replaced in this subsection:

- **Information regarding the methods to model particulate concentration in air for residential and recreational exposure to soil and ephemeral sediment described below is no longer applicable because updated information for those pathways and receptors is described in Appendix B of the SRAM Rev. 2 Addendum.**

Fugitive dust may be resuspended to air from surface soils in unpaved areas of the site. As an initial conservative evaluation of EPCs for particulates in air, the particulate emission factor (PEF), recommended by USEPA (1996b) as the basis of a default value for particulate EPCs will initially be applied. The PEF relates the concentration of a chemical in soil with the concentration as suspended particulates in air. USEPA has updated the PEF equation since 1993, which was the basis of the DTSC *Preliminary Endangerment Assessment (PEA) Manual*'s default equation (DTSC 1994). A detailed discussion of USEPA's rationale for correcting the PEF equation is provided in USEPA (1996b, Section 2.4.5, p. 31-32).

The current USEPA default PEF equation is as follows:

$$PEF = \frac{LS \times V \times DH \times 3{,}600\,\text{sec/}hour}{A} \times \frac{1{,}000\ \text{g/kg}}{0.036 \times (1\text{-}G) \times \left(\frac{U_m}{U_t}\right)^3 \times F(x)} \qquad (6\text{-}6)$$

where,

PEF	=	particulate emission factor (m^3/kg)
LS	=	width of contaminated area (m, unit-specific)
V	=	wind speed in the mixing zone (1.78 m/s, site-specific)[1]
G	=	fraction of vegetative cover (0.5, unitless)

0.036	=	respirable fraction (g/m^2-hr, USEPA default)
U_m	=	annual windspeed (1.78 m/s, site-specific)[vi]
U_t	=	equivalent threshold of windspeed at 7 m (11.32 m/s, USEPA default)[vii]
$F(x)$	=	function dependent on U_m/U_t (0.194 unitless, USEPA default)

Using soil concentrations and the estimated PEF, air COPC concentrations are calculated as follows:

$$Ca = \frac{Cs}{PEF} \tag{6-7}$$

where,

Ca	=	concentration of COPC in air (mg/m^3)
Cs	=	concentration of COPC in soil (mg/kg)
PEF	=	particulate emission factor (m^3/kg)

6.4.2 Volatilization from Soil and Groundwater to Ambient Air

The following have been updated or replaced in this subsection:

- **Information regarding the methods to model ambient air concentrations for residential and recreational exposure to soil and ephemeral sediment described below is no longer applicable because updated information for those pathways and receptors is described in Appendix B of the SRAM Rev. 2 Addendum.**
- **Exposure to volatile compounds in ambient air via migration from groundwater will not be evaluated quantitatively because no reliable and approved groundwater-to-ambient air model is available for use, the ambient air pathway is likely a minor pathway when compared to direct contact groundwater pathways, and there are more robust datasets for volatile compounds in soil.**

[vi] Based on mean annual wind speed measurement data for SSFL for the year 1997.

[vii] The equivalent threshold value of wind speed (U_t) at 7 m of 11.32 m/s is the USEPA (1996b) default value based on a soil aggregate size distribution of approximately 0.9 mm. A site-specific U_t may be calculated for individual units in cases where surficial soil characteristics indicate that use of the USEPA default value would overestimate exposure. Unit-specific soil grain size data collected with all soil samples at SSFL would be used to calculate U_t and F(x) following USEPA (1996b) guidance.

Ambient air concentrations of volatile compounds from the subsurface will be estimated using a steady-state vapor flux model combined with an ambient air dispersion model. The results of the flux model serves as an input to the dispersion model to estimate ambient air concentrations. Appendix G provides more detail on the equations, input parameters and use of the models. These two models are discussed separately below.

Vapor Flux Model

The vapor flux model is a steady-state model that simulates vapor flux through the gaseous and aqueous phases of the subsurface to the ground surface. The model accounts for upward diffusive flux as well as downward advective flux due to recharge. The model is a steady-state model and does not account for changes in concentration over time. The model equations are presented in Appendix G and represent a refined approach to estimate flux which accounts for the potential transport of vapors through fractures and matrix in the bedrock in addition to the vadose zone soils. The potential for migration through bedrock fractures is not specifically addressed in the Jury model (Jury *et al*. 1983, 1990), or similarly based models used by USEPA (1996 and 2002b) and American Society for Testing and Materials (ASTM 2000).

Air Dispersion Model

Two air dispersion models are presented for use in Appendix G. The first model is the USEPA Q/C simplified air dispersion model. USEPA Soil Screening Guidance (1996 and 2002b) presents the Q/C dispersion factor that relates an estimated flux-rate to an ambient air concentrations. The second model is the Industrial Source Complex 3 (ISC3) model (USEPA 1995) which allows for more site-specific considerations in the modeling but also requires an additional level of resources to run. The ISC3 model will be used when results of the Q/C dispersion model estimates risks to either onsite or offsite receptors that exceed acceptable criteria. The Q/C dispersion model terms assume that the receptor is located directly over the source area. The use of this model may not be adequate to evaluate potential downwind receptors. To evaluate potential downwind receptors further air dispersion modeling maybe necessary. The ISC3 is a steady-state Gaussian plume model which can be used to assess pollutant concentrations from a wide variety of sources associated with an industrial complex. This model can account for the following: settling and dry deposition of particles; downwash; area sources; plume rise as a function of downwind distance; separation of point sources; and limited investigational unit-specific terrain adjustment.

6.4.3 Indoor Air Concentrations from Volatile Emissions from Soil and Groundwater

The following have been updated or replaced in this subsection:

- **Additional information on the indoor air evaluation is provided in the Technical Memorandum *An Updated Approach for Assessing the Vapor Intrusion Pathway* (CH2M Hill, 2012).**

The potential human exposures via indoor vapor inhalation of VOCs originating in subsurface soil or groundwater are calculated using the model of Johnson and Ettinger (1991). Appendix G provides more detail on the equations, input parameters and use of this model that accounts for vapor migration through fractured bedrock. The Johnson and Ettinger model calculates an attenuation factor that relates a soil vapor concentrations from a subsurface source to indoor air. Three transport mechanisms are considered:

- Diffusion through vadose zone soils, porous bedrock, and fractured bedrock;
- Convection into the building due to the negative pressure differential between the subsurface and building; and
- Mixing of vapors within a building resulting from building ventilation.

The CTE and RME EPCs for soil vapor used as inputs to the Johnson and Ettinger (1991) model will be calculated as described for soil in Section 6.2. If it is necessary to use groundwater or soil data to model indoor air concentrations, then the CTE and RME concentrations calculated for these media, as described in Sections 6.1 and 6.2, respectively, will be used as concentration inputs to the model.

6.5 EXPOSURE POINT CONCENTRATIONS IN PRODUCE

The following have been updated or replaced in this subsection:

- **Information regarding the methods and parameters used to estimate exposure point concentrations in produce described below is no longer applicable because updated information is described in Appendix B of the SRAM Rev. 2 Addendum.**

Consumption of produce-containing compounds from soil via root uptake was identified as a potentially complete exposure pathway under a future hypothetical scenario. Because there is substantial uncertainty associated with the modeling of plant uptake, the resulting exposure and risk estimates will be summarized separately. As discussed by USEPA (1996b), a comparison of

risk-based plant concentrations with risk-based soil ingestion and leachate-based soil concentrations, indicates that the soil-plant-human exposure pathway may be of concern for two of the six metals evaluated by USEPA: arsenic and cadmium. USEPA (1996b) states that direct pathway risk assessment (*i.e.*, soil ingestion) is likely to be protective of the soil-plant-human pathway for the other four metals (mercury, nickel, selenium, and zinc). In addition, USEPA reports that data presented regarding phytotoxicity of these metals suggest that toxic effects to plants will generally occur below levels that would be harmful to humans (USEPA 1996b). Since organic contaminants may also be present in soil, this potential exposure pathway will be examined. As an initial evaluation, EPCs in plants will be evaluated using a recommended screening approach from USEPA (1996b, Section 2.7 and Appendix G). The equation for calculating plant uptake using this approach is:

$$C_p = S_c \times BTF_p \tag{6-8}$$

where:

C_p = compound concentration in plant (mg/kg)
S_c = concentration in soil (mg/kg)
BTF_p = biotransfer factor [(mg/kg plant)/(mg/kg soil)]

Biotransfer factors will be obtained from chemical-specific literature where possible. Alternative sources are compendia of uptake factors for inorganic compounds (*e.g.*, Baes and Sharp 1983; DTSC 1994), or model uptake factors based on regression of empirical information on physical properties, primarily the octanol-water partition coefficient (K_{ow}) (*e.g.*, Travis and Arms 1988; Briggs *et al*. 1982, as modified by Ryan *et al*. 1988; and USEPA 1993a).

Soil concentrations used in this model will be the arithmetic mean concentration for the typical exposure and the 95 percent UCL for the RME of concentrations measured within an area encompassing the typical backyard garden. Only shallow soil (zero to two feet bgs) concentrations will be used, as the biotransfer factors refer to the root zone.

If the results of the conservative screening evaluation for the soil-plant-human pathway indicate the need for direct sampling, it will be implemented to support a more refined evaluation of EPCs for this pathway. Additionally, ongoing collaborative research efforts currently are underway with USEPA and the State of California (USEPA 1996b). Applicable results of this research will be considered in the evaluation of EPCs in produce.

6.6 EXPOSURE POINT CONCENTRATIONS AT SEEPS AND SPRINGS

The following have been updated or replaced in this subsection:

- **CTE estimates will not be estimated for residential and recreational exposure to soil, ephemeral sediment and/or food. CTE estimates will only be estimated as necessary for other exposure media and receptors.**

Seeps and springs identified at an investigational unit will be evaluated in the risk assessment. In cases where it is determined that existing groundwater data, either near-surface or Chatsworth formation groundwater (depending on the groundwater source), are representative of specific seeps or springs, then existing groundwater data will be used as EPCs. If the groundwater source is not representative of specific seeps, then those seeps and springs will be sampled and that data used as EPCs. The CTE and RME concentrations will be calculated using the methods described for soil in Section 6.2.

SECTION 7

The following have been updated or replaced in this section and subsections:

- **The hierarchy of toxicity values described below (Section 7.3) is no longer applicable because an updated hierarchy of toxicity values is presented in Appendix B of the SRAM Rev. 2 Addendum.**
- **Consistent with Risk Assessment Guidance for Superfund Volume I Part F (USEPA, 2009), the concentration of volatile compounds will be compared to reference concentration and inhalation unit risk instead of reference dose and cancer slope factor for the inhalation pathway (Sections 7.1 and 7.2).**
- **Specific toxicity values and surrogates presented in this section are no longer applicable (Section 7.3).**

7 HUMAN HEALTH TOXICITY ASSESSMENT

The relationship between the dosage of a chemical and the probability of an adverse health effect in the exposed population is characterized in the toxicity assessment portion of the human health risk assessment. This section will present the dosage-response assessment for the COPCs identified for each investigational unit. Chemicals will be identified as having carcinogenic and/or non-carcinogenic toxicity criteria and will be evaluated in accordance with OEHHA and DTSC guidelines (DTSC 1992, 1994; OEHHA 2003). The chemical-specific toxicological criteria for each COPC will be presented in tabular format. Specific reference sources for the toxicity criteria will be cited.

Toxicity criteria for chemicals that have been detected onsite and may be selected as COPCs during the human health risk assessment are presented in Tables 7-1 and 7-2. It should be noted that hazard identification for each of the investigational units has not been completed. This list is provided based on the data collected to date and may not be complete or may include compounds that will not be selected as COPCs.

7.1 NON-CARCINOGENIC HEALTH EFFECTS

The following have been updated or replaced in this section and subsections:

- **Consistent with Risk Assessment Guidance for Superfund Volume I Part F (USEPA, 2009), the concentration of volatile compounds will be compared to reference concentration and inhalation unit risk instead of reference dose and cancer slope factor for the inhalation pathway.**

It is widely accepted that non-carcinogenic health effects from chemical substances occur only after a threshold dosage is reached. For the purposes of establishing health criteria, this threshold dosage is usually estimated from the no observed adverse effect level (NOAEL) or the lowest observed adverse effect level (LOAEL) determined from chronic animal studies. The NOAEL is defined as the highest dosage at which no adverse effects are observed, while the LOAEL is defined as the lowest dosage at which adverse effects are observed.

Safety factors are applied to the NOAEL or LOAEL observed in animal studies or human epidemiological studies to establish "reference doses" (RfDs). An RfD is an estimate of a dosage level that is not expected to result in adverse health effects in persons exposed for a lifetime, even among the most sensitive members of the population. The RfD is utilized in the risk characterization to estimate the potential for non-carcinogenic health hazards.

7.2 CARCINOGENIC HEALTH EFFECTS

The following have been updated or replaced in this subsection:

- **Consistent with Risk Assessment Guidance for Superfund Volume I Part F (USEPA, 2009), the concentration of volatile compounds will be compared to reference concentration and inhalation unit risk instead of reference dose and cancer slope factor for the inhalation pathway.**

Regulatory agencies have generally assumed that carcinogenic agents should be treated as if they do not have toxicological thresholds. In short, the dosage-response curve utilized for regulation of carcinogens only predicts zero risk when there is zero dosage (*i.e.*, for all dosages greater than zero, some risk is assumed to be present). Cancer risks from potential human exposures to carcinogenic chemicals are modeled mathematically using either animal or human data. USEPA generally uses the linearized multistage model for low-dosage extrapolation. The model is

considered to be one of the most conservative of any models that may be applied and has been recognized by USEPA to overpredict incremental cancer risks.

Cancer risks for exposure to carcinogens are defined in terms of upper bounds on probabilities. The probabilities identify the likelihood of a carcinogenic response in an individual that receives a given dosage of a particular chemical (based on mathematical modeling of the animal or human data). These probabilities are expressed in terms of the cancer slope factor (CSF). The CSF represents the upper bound on the probability of a carcinogenic response (per unit dosage) and is usually expressed as milligrams per kilogram per day $(mg/kg\text{-}day)^{-1}$. The CSF multiplied by the predicted chemical dosage provides an estimate of the incremental upper-bound cancer risk.

7.3 CHEMICAL-SPECIFIC TOXICITY CRITERIA

The following have been updated or replaced in this subsection:

- **The hierarchy of toxicity values described below is no longer applicable because an updated hierarchy of toxicity values is presented in Appendix B of the SRAM Rev. 2 Addendum.**
- **Consistent with Risk Assessment Guidance for Superfund Volume I Part F (USEPA, 2009), the concentration of volatile compounds will be compared to reference concentration and inhalation unit risk instead of reference dose and cancer slope factor for the inhalation pathway.**
- **Specific toxicity values and surrogates presented in this section are no longer applicable.**

The appropriate chemical-specific toxicity criteria will be identified for each COPC. The hierarchy of sources for toxicological criteria is as follows:

1. OEHHA (http://www.oehha.ca.gov/risk/chemicalDB/index.asp)
2. Integrated Risk Information System (IRIS; USEPA 2005a)
3. Health Effects Assessment Summary Table (HEAST; USEPA 1997c)
4. USEPA criteria documents
5. Agency for Toxic Substances and Disease Registry (ATSDR) toxicological profiles
6. Environmental Criteria and Assessment Office (ECAO)
7. Other sources

Although the use of OEHHA CSFs is recommended by DTSC, USEPA CSFs will also be presented and discussed in this section. USEPA CSFs have been subjected to peer-review by USEPA expert panels and are recognized by USEPA, all states other than California, and members of the scientific community as valid dose-response criteria. Table 7-1 provides non-cancer toxicological data for certain compounds, as an example of the data available from the preferred sources (Cal-EPA and USEPA sources including IRIS and HEAST). Toxicological data for carcinogens are provided in Table 7-2. Toxicity data for many chemicals are unavailable; therefore, it may be necessary to supplement data from the preferred sources with alternative sources and professional judgments.

Professional judgments on toxicity factors may include (1) deriving new RfDs from literature information and standard uncertainty factors when acceptable standards are not available, (2) applying route-to-route extrapolations where data indicate similar toxic endpoints would exist for different exposure routes, and (3) application of structure-activity assumptions to justify use of a HERD-approved surrogate toxicity factor for a compound of similar structure. An example of this last approach is presented in Table 7-1, where the RfD of xylene (an alkyl-substituted benzene) is provided for other substituted benzene compounds (1,2,4- and 1,3,5-trimethylbenzene), and the RfD for pyrene (a low-molecular weight PAH) is provided for acenaphthylene and phenanthrene, which are also low molecular weight PAHs. A conference with DTSC (HERD) will be employed to attain approval whenever professional judgment is required to supplement the toxicity database.

7.4 TOXICITY EQUIVALENT FACTORS FOR DIOXIN AND PCB CONGENERS

- **This entire subsection has been replaced by methods described in Appendix B of the SRAM Rev. 2 Addendum.**

~~The toxicity criteria used to assess dioxin and coplanar PCB congeners will be the TEFs developed by the World Health Organization and published by Van den Berg *et al*. (1998). TEFs are measures of the relative toxicity of a dioxin or coplanar PCB congener to the toxicity of 2,3,7,8-TCDD. TEFs may be applied to exposure concentrations, dosages, or toxicity values. For risk assessment conducted at the SSFL, dioxin and PCB congener-specific TEFs will be applied to toxicity criteria (*i.e.*, the CSF for 2,3,7,8-TCDD) to generate congener-specific toxicity values that will then applied to congener-specific exposure levels to estimate risk. This is the preferred method as it allows for further evaluation of potential risk posed by individual congeners.~~

~~The specific coplanar PCB and dioxin congeners that will be evaluated in risk assessments at the SSFL are the 12 non-ortho- and mono-ortho-substituted coplanar PCB congeners and 17 2,3,7,8-substituted dioxin congeners for which TEFs have been presented by Van den Berg *et al*. (1998). The specific coplanar PCB and dioxin congeners and their respective human health TEFs are presented in Table 7-3.~~

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SECTION 8

The following have been updated or replaced in this section and subsections:

- **Risks for residential and recreational receptors exposed to soil and ephemeral sediment will be estimated using the sum of fractions method, as described in Appendix B of the SRAM Rev. 2 Addendum, and as a result the risk summary tables for these receptors and pathways will differ from the example tables presented in Appendix H.**
- **Consistent with Risk Assessment Guidance for Superfund Volume I Part F (USEPA, 2009), concentrations of volatile compounds will be compared to reference concentrations and inhalation unit risk factors instead of reference doses and cancer slope factors for the inhalation pathway (Sections 8.1 and 8.2).**
- **Consistent with the methodology in Appendix B of the SRAM Rev. 2 Addendum, residential and recreational exposures will be evaluated with an age-adjusted composite adult for the carcinogenic effects and a child for non-carcinogenic effects for all media (Sections 8.1 and 8.2).**
- **CTE estimates will not be estimated for residential and recreational exposure to soil, ephemeral sediment and/or food. CTE estimates will only be estimated as necessary for other exposure media and receptors (Sections 8.1 and 8.2).**
- **Information regarding the methods used to calculate risks associated with residential and recreational exposure to soil, ephemeral sediment and/or food described below is no longer applicable because updated information for those pathways and receptors are described in Appendix B of the SRAM Rev. 2 Addendum.**
- **Updated methodology for the evaluation of residential and recreational exposure to lead in soil and ephemeral sediment and/or food in Appendix B of the SRAM Rev. 2 Addendum, and as a result the method described below (Section 8.5.1) is no longer applicable.**
- **The methodology for the evaluation of residential and recreational exposure to dioxin and PCB congeners in soil, ephemeral sediment and/or food, including the**

dioxin and PCB congeners to be evaluated (Section 8.5.2), is summarized in Appendix A of the SRAM Rev. 2 Addendum.

- **The TPH extrapolation methodology is no longer applicable because adequate data have been collected for petroleum chemical constituents, and as a result TPH extrapolation (Section 8.5.3) is no longer necessary.**
- **Additional information on the indoor air evaluation (Section 8.5.4) is provided in the Technical Memorandum *An Updated Approach for Assessing the Vapor Intrusion Pathway* (CH2M Hill, 2012).**

8 HUMAN RISK CHARACTERIZATION

The following have been updated or replaced in this section:

- **Risks for residential and recreational receptors exposed to soil and ephemeral sediment will be estimated using the sum of fractions method, as described in Appendix B of the SRAM Rev. 2 Addendum, and as a result the risk summary tables for these receptors and pathways will differ from the example tables presented in Appendix H.**

Risk characterization "…serves as the bridge between risk assessment and risk management and is therefore a key step in the ultimate site decision-making process" (USEPA 1989a). Because the risk assessment plays such a critical role in ultimate site decisions, it is imperative that the results (*i.e.*, the risk characterization) are clearly and accurately portrayed, and that a framework is provided for the interpretation of the results by reviewers and managers. Accordingly, the risk assessment will follow USEPA's recommended outline for presentation of the risk characterization (USEPA 1989a, Chapters 8 and 9). The primary components of the risk characterization are discussed in detail in the remainder of this section of the work plan. In an effort to standardize the presentation of human health risk assessment data inputs and results, USEPA (2001) has developed standardized reporting tables. Examples of these tables are presented in Appendix H, and may be used to summarize human health risk assessments at the SSFL.

8.1 CHARACTERIZATION OF POTENTIAL CARCINOGENIC HEALTH RISKS

The following have been updated or replaced in this subsection:

- **Consistent with Risk Assessment Guidance for Superfund Volume I Part F (USEPA, 2009), concentrations of volatile compounds will be compared to reference concentrations and inhalation unit risk factors instead of reference doses and cancer slope factors for the inhalation pathway.**

- **Consistent with the methodology in Appendix B of the SRAM Rev. 2 Addendum, residential and recreational exposures will be evaluated with an age-adjusted composite adult for the carcinogenic effects and a child for non-carcinogenic effects for all media.**

- **CTE estimates will not be estimated for residential and recreational exposure to soil, ephemeral sediment and/or food. CTE estimates will only be estimated as necessary for other exposure media and receptors.**

- **Risks for residential and recreational receptors exposed to soil and ephemeral sediment will be estimated using the sum of fractions method, as described in Appendix B of the SRAM Rev. 2 Addendum, and as a result the risk summary tables for these receptors and pathways will differ from the example tables presented in Appendix H.**

Potential carcinogenic health risks will be characterized as the upper-bound probability of an individual developing cancer over a lifetime as a result of exposure to a site-related chemical under specific exposure scenarios. The incremental probability of developing cancer (*i.e.*, the theoretical excess [above background] carcinogenic risk) is the risk attributed to exposure to the COPCs at the site (USEPA 1989a) and is independent of chemical exposures in our daily lives that are not related to the SSFL. For example, National Cancer Statistics indicate that each person has a three in 10 chance, or 300,000 chances in one million, of developing cancer during his or her lifetime. Consequently, a cancer risk of 10^{-4} corresponds to a theoretical[viii] probability of one-in-ten thousand, which is in addition to (*e.g.*, in excess of) the three in 10 background cancer risk. Expressed mathematically, the receptor allowed an incremental upper-bound cancer risk of 10^{-4} has a risk of 300,010 chances in one million. The actual risk is less than the upper bound and may be as low as zero (USEPA 1986, 1989a). This fact is based on the regulatory goal to not underestimate risk and on the uncertainty associated with characterization of chemical-specific dosage-response relationships at low dosages.

[viii] The risk is a theoretical value (based on the assumptions used in the toxicity and exposure assessments), and not an actual (*e.g.*, based on statistical trends reported for the population) risk.

For each COPC identified as a potential human carcinogen, the theoretical upper-bound excess cancer risk is based on the LADD and a factor relating dosage to cancer risk (the CSF). CSFs presented in Section 7 will be used to characterize carcinogenic risk. These values are, in general, upper-bound estimates on the slope of the cancer-response/exposure relationship. The following equation (USEPA 1989a; DTSC 1992) will be applied to estimate cancer risk for each relevant exposure pathway:

$$Excess\ Cancer\ Risk = LADD \times CSF \tag{8-1}$$

The calculations will be performed separately for children and adults. A total lifetime excess cancer risk will be calculated by first (1) summing chemical-specific risks calculated for all complete pathways, for both age groups, and then (2) summing risks for all COPCs evaluated as potential carcinogens. This approach is conservative as different chemical classes (and often individual chemicals within a chemical class) often act by different mechanisms of action and at different target organs. In addition, the current regulatory approach assumes that exposure to a carcinogen at any dosage will present some risk (USEPA 1986, 2005b). Cancer risk estimates will be expressed using one significant figure (USEPA 1989a). If the deterministic exposure approach is used, risk estimates for both the CTE and RME will be presented as recommended by USEPA (1989a,b, 1992b). A frequency distribution of risk estimates will be presented, if a probabilistic approach is used.

8.2 Characterization of Potential Non-Carcinogenic Health Effects

The following have been updated or replaced in this subsection:

- **Consistent with Risk Assessment Guidance for Superfund Volume I Part F (USEPA, 2009), the concentration of volatile compounds will be compared to reference concentrations and inhalation unit risk factors instead of reference doses and cancer slope factors for the inhalation pathway.**
- **CTE estimates will not be estimated for residential and recreational exposure to soil, ephemeral sediment and/or food. CTE estimates will only be estimated as necessary for other exposure media and receptors.**
- **Risks for residential and recreational receptors exposed to soil and ephemeral sediment will be estimated using the sum of fractions method, as described in Appendix B of the SRAM Rev. 2 Addendum, and as a result the risk summary**

tables for these receptors and pathways will differ from the example tables presented in Appendix H.

Potential non-carcinogenic adverse health effects will be characterized by comparing predicted dosages for the site to RfDs (see hierarchy of information presented in Section 7). To calculate a hazard quotient (HQ), the ADD for each relevant COPC, received as a result of the exposure assumed (*e.g.*, upper-bound dosage averaged over the exposure period), will be divided by the chemical-specific RfD as shown in the following equation:

$$\textit{Hazard Quotient} = ADD/RfD \qquad (8\text{-}2)$$

When available, pathway-specific RfDs will be applied. For each chemical, the HQs will be summed for all complete pathways to estimate the chemical-specific HQ. As a first tier analysis, all HQs (*e.g.*, for all chemicals, regardless of target organ) will be summed as the basis for conservatively estimating a screening hazard index (HI) for each exposure scenario. If the result exceeds a value of 1.0, then target organ-specific HIs will be calculated based on target organs as recommended by USEPA (1989a).

Hazard quotients and indices will be calculated separately for chronic (greater than seven years), subchronic (two weeks to seven years) and "shorter term" (if relevant) exposure periods as specified by USEPA (1989a). HIs will expressed using appropriate significant figures for both CTE and RME scenarios (USEPA 1989a,b; 1992b) in the case of deterministic assessment, or as a frequency distribution, if probabilistic assessment is used.

8.3 SENSITIVITY ANALYSIS

A sensitivity analysis may be performed to evaluate the magnitude of impact of exposure parameter values, exposure modeling assumptions, and toxicity values on the final exposure and risk estimates. This analysis differs from the uncertainty analysis described in Section 8.4 to the extent that the sensitivity analysis focuses on the mathematical relationships between variables used in the exposure and risk calculations and does not address the issues of uncertainty and variability of individual parameter values. A sensitivity analysis is warranted in cases where there is some evidence that risks are driven by one or more parameter values which may overestimate or underestimate risk; determination of its need will be done on a unit-by-unit basis. If performed, the results of the sensitivity analysis will be used to focus the uncertainty analysis described in Section 8.4 on those variables that have the greatest impact on the final risk estimates.

8.4 ASSESSMENT AND PRESENTATION OF UNCERTAINTY

As recommended by USEPA (1989a, 1992b), an assessment of uncertainties in the risk characterization estimates will be presented. The risk estimates are based on conservative risk assessment methodologies and assumptions (applied to both the toxicity assessment and exposure assessment). Accordingly, it is critical that uncertainties associated with the conservative practices employed, as well as those associated with known or potential data gaps, be thoroughly addressed such that the numerical estimates are placed in the proper perspective by risk managers.

The risk assessment will identify and evaluate those COPCs with the greatest contribution to the cumulative risk (*e.g.*, "risk drivers"). USEPA has defined risk drivers "as those chemicals which contribute at least 90 percent of the total estimated risk." Specifically, a percent contribution to risk (or hazard), by chemical and by pathway, will be assessed and may be presented in graphic and/or tabular format. The subsequent uncertainty analysis will focus on the identified "risk drivers."

In the case of deterministic risk assessment, discussion of uncertainties will be largely qualitative. The probabilistic approach to exposure assessment provides a quantitative depiction of uncertainty assessment, as an enhancement to qualitative discussion of uncertainty.

8.5 SPECIAL CASES

8.5.1 Risk Characterization for Lead

The following have been updated or replaced in this section:

- **Updated methodology for the evaluation of residential and recreational exposure to lead in soil and ephemeral sediment and/or food is presented in Appendix B of the SRAM Rev. 2 Addendum, and as a result the method described below is no longer applicable.**

If lead is selected as a COPC, the current Lead Spread model will be used to predict blood lead levels for both children and adults. Site-specific chemical concentration data will be used as the basis for soil ingestion, inhalation, and dermal contact pathways. Initially, default values (as provided in the model) will be used for dietary intake and drinking water intake pathways; however, site-specific data may be used.

The blood lead concentration identified as acceptable, for both children and adults, is 10 micrograms per deciliter (µg/dL) (DTSC 1992). The Center for Disease Control (CDC 1991) has identified the LOAEL for lead to be 10 µg/dL for children and 30 µg/dL for adults. As recommended by DTSC (1992), the 90th, 95th, 98th, and 99th percentile blood lead concentrations predicted by the model will be evaluated for both children and adults. While DTSC identifies the 99th percentile blood lead level as a "point of departure" (*e.g.*, remedial actions would not be implemented when predicted blood lead levels are less than 10 µg/dL), risk management considerations may also require assessment of the 90th, 95th, and 98th percentile blood lead levels predicted by the model.

8.5.2 Risk Characterization for Dioxin and PCB Congeners

The following have been updated or replaced in this subsection:

- **The methodology for the evaluation of residential and recreational exposure to dioxin and PCB congeners in soil, ephemeral sediment and/or food, including which dioxin and PCB congeners will be evaluated, is summarized in Appendix A of the SRAM Rev. 2 Addendum.**

The specific dioxin and coplanar PCB congeners that will be considered in risk assessments at the SSFL are the 17 2,3,7,8-substituted dioxin congeners and 12 non-ortho- and mono-ortho-substituted coplanar congeners for which TEFs were developed by WHO and published by Van den Berg *et al*. (1998). The congeners and TEFs were discussed in Section 7.4 and are summarized in Table 7-3.

Risk estimates for dioxins and coplanar PCBs conducted under this SRAM will be based on the assumption that all 17 of the 2,3,7,8-substituted dioxin congeners and 12 coplanar PCB congeners are present in all samples at some level when at least one congener is detected in a single sample in a given media at an investigational unit. The concentrations for those congeners not detected in sample media will be estimated at one-half the SQL. In cases where a congener is never detected in a given media at an investigational unit, that congener will be assumed not present.

For each of the 12 PCB congeners and 17 dioxin congeners, one of two approaches may be taken for estimating risks. PCB congener and dioxin TEFs will be applied either to the CSF for 2,3,7,8-TCDD, and risks estimated by multiplying the estimated congener-specific CSFs (based on 2,3,7,8-TCDD) by the respective congener-specific LADDs.

It not appropriate to include both estimated Aroclor risks and PCB congener risks in the cumulative risk estimate, as this would essentially be "double-counting". Therefore, DTSC has requested that only Aroclor risks included in the cumulative risk estimates, and that PCB congeners risks presented with the risk estimates for other chemicals, but not included in the cumulative risk estimate.

8.5.3 Risk Characterization for Total Petroleum Hydrocarbons

The following have been updated or replaced in this subsection:

- **The TPH extrapolation methodology is no longer applicable because adequate data have been collected for petroleum chemical constituents, and as a result TPH extrapolation will no longer be necessary.**

For the purpose of evaluation in the SSFL RFI risk assessment program, petroleum chemical constituents include BTEX, and PAHs. To adequately assess the potential risks associated with TPH in environmental media, a site-specific extrapolation methodology has been developed to allow correlation between the TPH fraction concentration and petroleum constituent concentrations (see Section 2.8). When TPH is detected in the gasoline range, then BTEX compounds are added as COPCs. When TPH is detected in the diesel range, then PAHs are added as COPCs. Concentrations of BTEX or PAHs are determined by using the site-specific extrapolation factors.

8.5.4 Risk Characterization for Special Exposure Pathways

The following have been updated or replaced in this subsection:

- **Additional information regarding the evaluation of indoor air is provided in the Technical Memorandum *An Updated Approach for Assessing the Vapor Intrusion Pathway* (CH2M Hill, 2012).**

<u>Indoor Air Exposure Associated with Soil Vapor</u>

The presence of volatile compounds in soil vapor is the result of partitioning of COPCs from either groundwater or soils into the soil pore air space. Volatile COPCs in soil pore air space may migrate upward through the soil column, through building foundation cracks, and into building air space. Given the complexity of the migration pathways for soil vapor to indoor air, the models available for predicting indoor air concentrations inherently contain substantial

uncertainty. Therefore, DTSC has requested that risk estimates related to the soil vapor pathway be presented separately in the risk assessment and discussed in the uncertainty analysis.

Exposure through Plant Uptake

Evaluation of direct exposure through plant uptake and subsequent ingestion utilizes models that may or may not accurately predict actual conditions. This pathway was included specifically as a requirement of DTSC, who, in recognition of the state of the science of this particular exposure assessment, recommended that the evaluation be carried out separately from other exposures. As such, the estimates for this pathway will be uncoupled from other estimated risks and presented separately to facilitate evaluation by risk managers. Uptake data from the ecological validation study may be useful in determination of parameters utilized in the plant ingestion portion of the human health risk assessment.

8.5.5 Evaluation of Potential Inter-Site Sediment Migration

An evaluation of inter-site sediment migration (to a downgradient investigational unit, or from an upgradient investigational unit) will be performed on all investigational unit reports and risk assessments. However, a preliminary evaluation of the potential for significant migration of COPCs from the investigational unit under evaluation to a downgradient investigational unit through transport of sediment will be evaluated in each risk assessment if a mechanism for sediment transport is suggested by the direction and slope of the land, or by the presence of creeks or ditches connecting the two units. This determination will be described in each risk assessment. Further evaluation of the potential impacts of sediment migration to a downgradient unit will be determined by comparison of the human health receptors and exposure pathways that are relevant to the investigational unit under evaluation and the downgradient unit as follows:

1. Investigation unit and the downgradient unit, then it will be assumed that human health risks at the adjacent unit could be as high as those at the site under evaluation. In these cases, it is conservatively assumed that no attenuation or dilution occurs during sediment transport, and that the concentrations of COPCs at an adjacent downgradient site could be as high as those at the site under evaluation. Therefore, if the risk assessment for the investigational unit under evaluation shows a potential for further action, then it will be assumed that risks at the adjacent site may also be unacceptable. Likewise, if the risk assessment for the investigational unit under evaluation concludes that no further action is necessary, then it will be assumed that risks at the downgradient site are also acceptable.

2. If the human health receptors and exposure pathways are more sensitive at the downgradient unit as compared to the investigational unit under evaluation, then additional quantitative assessment will be performed using the soil concentration data from the investigational unit under evaluation and applying that data to the more sensitive human health conditions at the downgradient unit. For human risk assessment, child receptors will be considered more sensitive than adult receptors, and residential scenarios more sensitive than worker scenarios, and worker scenarios more sensitive than recreational scenarios.

The initial comparison of receptors, exposure pathways, and habitats will be described in the investigational unit risk assessments. Should quantitative evaluation of potential impacts to a downgradient unit be necessary, such evaluations will follow the methods as described in this SRAM, and will be presented in the investigation unit risk assessment as an attachment.

8.6 PRESENTATION OF RISK CHARACTERIZATION RESULTS FOR RISK MANAGERS

Because many factors must be weighed by the DTSC risk manager, it is imperative that the results of the risk assessment be presented in a format that allows the DTSC risk manager to integrate and weigh decision factors appropriately and optimally.

USEPA emphasizes the importance of providing information to risk managers regarding key assumptions, rationale, and the extent of scientific consensus; the uncertainties associated with risk characterization estimates; and the effect of reasonable alternative assumptions on conclusions and estimates (USEPA 1992b). In particular, the risk manager should be able to understand which components of the risk assessment (*e.g.*, chemicals, pathways, and assumptions) contribute most significantly to the results of the assessment. Pie charts or tables that show percent contribution to total risk (for chemicals as well as for pathways) are particularly useful to a risk manager who must integrate uncertainty into risk management decisions; accordingly, tables and charts may be used to present risk characterization results.

Since deterministic risk estimates do not provide any information regarding the distribution of risk, results of probabilistic risk assessments will be used in the interpretation of deterministic risk estimates. Probabilistic risk estimates will be presented with respect to appropriate percentile benchmarks (*i.e.*, 50th and 90th percentile of the distribution), and benchmark risk levels (*i.e.*, 10^{-4}, 10^{-5}, 10^{-6}) will be presented with respect to the correlating percentile on the distribution. Similarly, probabilistic HI estimates will be presented with respect to appropriate percentile benchmarks (*i.e.*, 50th and 90th percentile of the distribution), and benchmark HIs (*i.e.*, 0.1, 1.0, 10) will be presented with respect to the correlating percentile on the distribution.

A final risk management consideration is that of new data that may become available subsequent to completion of the baseline risk assessment. When remedial action activities occur over a significant period of time (*e.g.*, months to years), it is important for the risk manager to consider newly published information (site-specific and chemical-specific) as it becomes available to ensure that final site decisions are protective of human and environmental health and are based on all available information. Following completion of the baseline risk assessment, Boeing will submit relevant site-specific or chemical-specific information, as it becomes available, to DTSC for consideration in risk management decisions on specific units.

SECTION 9

9 ECOLOGICAL RISK ASSESSMENT PROBLEM FORMULATION

- **This entire section has been replaced by Appendix C of the SRAM Rev. 2 Addendum.**

~~The steps of an ecological risk assessment are outlined in DTSC guidance (1996) and are shown in the risk assessment flowchart on Figure 1-1. Problem formulation is the first step in the ecological risk assessment process and is intended to establish the scope of the ecological risk assessment and identify major factors to be considered. Key components of the problem formulation are the identification of representative ecological receptors, selection of CPECs[ix], analysis of complete or potentially complete exposure pathways, and exposure routes, identification of assessment endpoints, and the development of a conceptual site model. Accordingly, the problem formulation contains the information needed to complete a Scoping Assessment as described in DTSC (1996) guidance.~~

~~To facilitate the identification of ecological receptors and potentially complete exposure pathways for the purpose of evaluating potential biological effects, a biological characterization of the SSFL was conducted. The results of the biological surveys are reported in the *Biological Conditions Report, Santa Susana Field Laboratory, Ventura County, California* (provided in Appendix I with addendum). The Biological Conditions Report (BCR) describes vegetation communities and plant and wildlife species that were observed or could potentially occur at the SSFL. The BCR provides information on an SSFL-wide basis; however, detailed vegetation mapping, wildlife, and sensitive species occurrences have been prepared for certain units currently being investigated as part of the corrective action provisions of the RFI. While the BCR provides an overview of existing biological conditions for the SSFL, the identification of representative species and exposure pathways must be conducted on an investigational unit basis and reported in unit-specific ecological risk assessments.~~

~~The BCR will be used as a basis to prepare the biological characterization of a given investigational unit evaluated in an ecological risk assessment. Additional site visits, vegetation mapping, and biological surveys may also be performed. The types of information obtained for the investigational unit from the BCR or site visits will include:~~

~~[ix] Selection of CPECs was discussed in Section 3.~~

- ~~identification of vegetation communities and other habitat types found at the specific unit and associated exposure area that may be potentially affected by unit-related chemicals or remediation,~~
- ~~identification of species and biological communities present or potentially present at the investigational unit or associated exposure area,~~
- ~~identification of species that are considered to be essential to, or indicative of, normal ecosystem or biological community functions, and~~
- ~~identification of special status species and their habitats at the investigational unit or associated exposure area.~~

~~The BCR contains extensive information concerning habitats and species observed throughout the SSFL. Evaluations of each unit and adjacent areas will be performed to gain additional understanding of the area and species interactions at that particular unit.~~

~~9.1 Identification of Ecological Receptors~~

~~An ecological receptor is an organism, population, or community that is potentially exposed to chemicals, either onsite or as a result of chemical migration to offsite areas. The purpose of identifying unit-specific ecological receptors is to focus the analysis on the potential for chemicals to adversely affect the specific biological resources present at the investigational unit. Sensitive species onsite or potentially occurring onsite can also be identified. All wildlife and plant species occurring in the vicinity of the investigational unit are potential ecological receptors. The general trophic relationships between ecological receptors at the SSFL are shown on Figure 9-1. Because it is neither practical nor necessary to evaluate the potential risk to every organism occurring at an investigational unit, representative species are chosen to represent groups of ecological receptors with similar life histories or sensitivities. Representative species are ecological receptors that are (1) potentially exposed to chemicals that originated at the investigational unit and (2) related to the unit-specific assessment endpoints as described in Section 9.6. In some instances, however, representative species are surrogate species that are similar to unit-specific ecological receptors with respect to their life history requirements, but are better supported (*e.g.*, have regulatory approved exposure factors) and/or are better studied (*e.g.*, more complete toxicity information).~~

~~9.1.1 Method for Selecting Representative Species~~

~~DTSC recommends that representative species selected for a given investigational unit include a primary producer, a primary consumer, and higher level consumers (DTSC 1996). Furthermore,~~

~~DTSC guidance suggests that California species of special concern, federally and state-listed threatened or endangered species, and species that are proposed for federal or state listing be included as representative species (DTSC 1996). Representative species will be identified using the following criteria:~~

- ~~Species considered essential to, or indicative of, healthy functioning ecosystems~~
- ~~Species vital to the structure and function of the food web (*e.g.*, principal prey species or top predators, based on trophic relationships)~~
- ~~Species that represent ecological niches or guilds~~
- ~~Species for which toxicological data are readily available in the literature~~
- ~~Species that link viable exposure pathways and CPECs~~
- ~~Species that provide protective estimates of exposure and risk to other members of the guild~~
- ~~Species considered sensitive by federal or state regulatory agencies~~

~~The biological, toxicological, and societal criteria listed above are summarized for potential representative species found at the SSFL in Table 9-1. The assessment endpoints in this table will be discussed further in Section 10.~~

~~9.1.2 Representative Species~~

~~Based on the information provided in Table 9-1, representative species that meet most of the requirements were identified. Due to the variety of plant species observed throughout the SSFL and the lack of information concerning invertebrate receptors (*e.g.*, species occurring at the SSFL), generic lower trophic level aquatic and terrestrial species were identified as representative species. Lower trophic level receptors generally uptake chemicals through direct contact with abiotic media, therefore the more complex exposure models, that incorporate life history information, used for higher trophic level species are not appropriate. Proposed general representative species for the SSFL ecological risk assessments include:~~

- ~~Generic aquatic plant (aquatic primary producer)~~
- ~~Generic aquatic invertebrate (aquatic primary consumer)~~
- ~~Generic aquatic species (aquatic primary/secondary consumer)~~
- ~~Great blue heron (aquatic tertiary consumer)~~
- ~~Generic terrestrial plant (terrestrial primary producer)~~
- ~~Generic soil invertebrate (terrestrial detritivore/primary consumer)~~
- ~~Deer mouse (terrestrial primary/secondary consumer)~~
- ~~Thrush (terrestrial primary/secondary consumer)~~

- ~~Mule deer (terrestrial primary consumer)~~
- ~~Red-tailed hawk (terrestrial secondary/tertiary consumer)~~
- ~~Bobcat (terrestrial secondary/tertiary consumer)~~

~~Ecological receptors from each of the trophic levels in aquatic and terrestrial habitats were chosen as representative species. The food web interactions for these species are shown on Figure 9-1. Not all of the representative species listed above will be evaluated for each investigational unit; only those associated with the habitats occurring at that unit will be evaluated. For example, aquatic receptors would not be evaluated at units with only terrestrial habitat types. Therefore, it is likely that a subset of the representative species listed above will be evaluated in each of the unit-specific ecological risk assessments.~~

~~Aquatic plants, invertebrates, and fish represent receptors with potential exposures to chemicals in sediment and surface water, and are prey species for fish-eating birds, such as the great blue heron. In addition to being a food source, aquatic plants provide refuge and nesting habitats for various species. Invertebrates and fish were selected because they may bioconcentrate or bioaccumulate chemicals through the food chain. The great blue heron was included as a receptor species because it is at the top of the aquatic food chain. The aquatic representative species were chosen to increase the specificity of the risk assessments, and expand the representation of feeding guilds and prey species.~~

~~Terrestrial plants were chosen because they provide forage for herbivores, (*i.e.*, may bioaccumulate and expose higher trophic levels to unit-related chemicals) are directly exposed to chemicals in the soil, and are indicative of the status of wildlife habitat. The California state-protected Santa Susana tarplant (*Hemizonia minthornii*) was not specifically chosen as a representative species because it may have low potential for exposure to CPECs at most investigational units since it grows out of small pockets of soil covering bedrock. In general, only limited toxicological information exists for plant species. For each unit, a qualitative assessment of effects of site-related chemicals on vegetation will be made by comparing factors such as abundance and diversity between areas with detected chemical concentrations and site-specific reference locations (see Section 11.3, Section 12.1.4, and Appendix I).~~

~~Soil invertebrates were selected because they provide forage for insectivores (*i.e.*, may bioaccumulate and expose higher trophic levels to investigational unit-related chemicals) and are directly exposed to chemicals in the soil.~~

~~The deer mouse was chosen because it is prevalent throughout the SSFL, it is a prey species for carnivores (*e.g.*, raptors and bobcats), it is a burrowing mammal, and it represents several exposure pathways. The deer mouse is directly exposed to soil and has complete ingestion exposure pathways for both insects and plants. The mule deer was selected as a representative species because its diet consists almost entirely of vegetation, it has a relatively large home range, and its rate of food consumption is relatively high as compared to other species.~~

~~The thrush was selected because it is representative of a primary and secondary consumer, is observed frequently at the SSFL, and has a high ingestion rate relative to body weight.~~

~~The red-tailed hawk and bobcat were chosen as representative species because of their prevalence on the SSFL, and because as high trophic level carnivores, they are exposed to chemicals though ingestion of a number of different prey items.~~

~~Due to the lack of relevant toxicity data in the peer-reviewed literature, adult amphibians and reptiles were not quantitatively evaluated in the ecological risk assessments for SSFL (Sparling *et al*. 2000). As no special-status amphibian species are found in the ponds at SSFL, ambient water quality criteria (AWQC) are anticipated to be protective of early-life stage exposures of amphibian embryos and tadpoles (DTSC 2005a).~~

~~9.2 IDENTIFICATION OF COMPLETE OR POTENTIALLY COMPLETE EXPOSURE PATHWAYS~~

~~An exposure pathway is the means by which a representative species is exposed to a CPEC. A complete exposure pathway must include four components: (1) a source and mechanism of chemical release, (2) a retention or transport mechanism through an environmental medium, (3) a point of potential contact with the impacted medium (*i.e.*, an exposure point), and (4) an exposure route (a mechanism of uptake) at the exposure point USEPA (1989c). The exposure pathway is considered incomplete if any of the four components are determined to be absent, with the exception that the transport mechanism is not required if the ecological receptor is in direct contact with the release point of the CPEC. Exposure to ecological receptors may occur directly through primary exposure pathways or indirectly through secondary exposure pathways (*e.g.*, exposures through food webs). Potential exposure pathways evaluated for the ecological risk assessments are discussed below.~~

~~9.2.1 Surface Water~~

~~Potential surface water pathways include direct contact, root contact, and ingestion. Terrestrial organisms may be dermally exposed to waterborne CPECs as a result of wading or swimming in contaminated waters and aquatic receptors may be exposed through osmotic exchange or respiration of surface waters. However, dermal exposures have been identified as not typically contributing to risks (USEPA 2000a, 2000b) and will not be evaluated. Terrestrial and aquatic receptors may ingest waterborne CPECs if surface waters are used as a drinking source. CPECs may be taken up by terrestrial or aquatic plants whose roots are in contact with surface water and/or pore water; aquatic plants (*e.g.*, algae and emergent plants) may also uptake CPECs through direct contact. Inhalation of vapors from contaminated surface water may also occur, but this is a less than significant pathway when compared to direct contact and ingestion; therefore, this pathway will not be evaluated.~~

~~9.2.2 Sediment~~

~~Potential exposure pathways to sediments are evaluated for those units containing surface water bodies (*e.g.*, ponds, streams). Receptors such as the great blue heron that forage in surface water bodies may incidentally ingest sediments associated with prey species such as benthic invertebrates. Terrestrial receptors may have direct contact with sediments while wading or drinking from a water source but this pathway is considered less than significant due to the expected minimal duration of this exposure; therefore, this pathway will not be evaluated. Aquatic receptors may be directly exposed to sediment-associated contaminants by physical contact and by osmotic exchange, respiration, or ventilation of sediments in the water column or in pore water. Bottom feeding aquatic organisms may also ingest sediments associated with feeding on benthic organisms. Emergent aquatic plants may be exposed to CPECs through root contact with contaminated sediments or pore water exchange.~~

~~9.2.3 Soil~~

~~For purposes of ecological risk assessments at the SSFL, only soil to a depth of six feet bgs will be evaluated (DTSC 1998b). Burrowing animals may be exposed to CPECs at substantially deeper soil depths than other species. It was with this consideration that the soil depth interval of up to six feet bgs forms the basis for ecological risk assessments. While the zero to six foot depth interval is appropriate for the burrowing animals (*e.g.*, deer mouse), this depth interval is not appropriate for most other terrestrial receptors that would only be exposed to CPECs in "surface" soils (*i.e.*, no more than two feet deep) (See Section 10.2).~~

~~Dermal contact, foliar deposition (deposition of soil or dust on plant leaves), and ingestion are the potential exposure routes for CPECs in soil. The dermal contact pathway is considered less than significant than other exposure pathways such as soil and food ingestion (USEPA 2000a, 2000b). Therefore, this pathway will not be evaluated. Terrestrial plants may be exposed to CPECs in the soil by foliar deposition or pore water uptake through the roots. Incidental ingestion by terrestrial target receptors may occur while foraging, grazing on vegetation, or grooming.~~

~~9.2.4 Air~~

~~Exposure routes of airborne CPECs include inhalation of vapors and/or dust. Airborne CPECs are usually limited to burrowing animals that may be exposed to CPECs while in their burrow or while digging or foraging. While air pathways may be potentially complete for surface-dwelling terrestrial wildlife species, they are considered less significant relative to other routes of exposure (USEPA 2005c); therefore, this pathway will not be evaluated for these receptors.~~

~~9.2.5 Groundwater~~

~~At many sites, groundwater is considered to be inaccessible to representative species (*i.e.*, groundwater occurs at depths greater than six feet bgs) (see Section 10.2, *Soil Depth Intervals For Terrestrial Representative Species*). However, representative species may be exposed to CPECs in groundwater, for example where groundwater comes to the surface in seeps or springs and plant roots can come into contact with groundwater that is near the ground surface (See Section 10.2).~~

~~The significance of groundwater pathways for other receptors will be addressed on an investigational unit basis; dependent on the depth to groundwater, presence of seeps, and presence of representative species. If there are no obvious exposure pathways between groundwater and receptors, groundwater will not be evaluated in the ecological risk assessment. Rationale will be provided for each investigational unit that does not address groundwater as a significant pathway.~~

~~9.2.6 Food Webs~~

~~CPECs may also pass up the food web through ingestion of prey species by higher trophic level predators. Aquatic and terrestrial receptors, with the exception of primary producers, may be exposed to CPECs through the consumption of contaminated food items. A food web showing~~

~~the relationship between receptors at the SSFL is provided on Figure 9-1. Higher trophic level fauna (*e.g.*, hawk and bobcat) may be exposed to chemicals accumulated by prey species (*e.g.*, mouse). Representative species exposure through ingestion of prey will be evaluated using food web models as described in Section 10. Potentially complete exposure pathways that will be evaluated on an investigational unit specific basis are presented on Figure 9-2.~~

~~9.3 INTEGRATION OF REPRESENTATIVE SPECIES AND EXPOSURE PATHWAYS~~

~~Not all representative species occur at each investigational unit, just as not all potential exposure pathways are applicable to each investigational unit and/or representative species. To determine which pathways and representative species are appropriate for ecological risk assessment at each of the investigational units on the SSFL, the following questions will be addressed:~~

- ~~What habitats and representative species are present?~~

  ~~The presence or absence of certain habitats at an investigational unit will determine the representative species evaluated for that investigational unit. For example, if no water is present, there is no need to evaluate aquatic receptors.~~

- ~~Which CPECs are present?~~

  ~~Selection of CPECs for ecological risk assessment purposes will follow the procedure described in Sections 3.1 and 3.2. If no CPECs are present at the site or investigational unit, then there is no exposure.~~

- ~~Of the relevant pathways, which ones apply to the representative species present?~~

  ~~Once the representative species, CPECs, and potential exposure pathways have been derived for the investigational unit, pathways that link the representative species and CPECs will be evaluated.~~

~~Once a chemical is selected as a CPEC, its physicochemical properties will be used to determine if it may be transported to representative species via identified exposure pathways. Potential pathways for each representative species are identified in Table 9-2. CPECs specific to a particular pathway and representative species will be selected by physicochemical properties (*e.g.*, molecular weight, Henry's law constant). The effects of physicochemical properties on routes of exposure and representative species uptake are discussed further in Section 10.~~

~~9.4 Ecological Conceptual Site Model~~

~~The ecological CSM is a diagrammatic representation of potential sources of CPECs, primary and secondary exposure pathways, and ecological receptors that may be exposed to CPECs via a particular pathway. The generalized CSM on Figure 9-2 evaluates potentially complete and significant exposure pathways for the SSFL and integrates biotic and abiotic exposure routes; it is an example of the individual CSMs that will be created for each investigational unit.~~

~~9.5 Selection of Exposure Areas~~

~~As defined in Section 1.7, an "exposure area" is the minimum area that will sustain an assumed exposure for ecological receptors. Accordingly, an exposure area for a particular representative species is the area where the species occurs and may come into contact with unit-specific chemicals. For the purposes of an ecological risk assessment, with few exceptions, an exposure area is defined as an individual area, called an investigational unit, of the SSFL that has been delineated based on the presence of chemicals and past operations. Either individually or combined into groups, the SWMUs and AOCs, defined under the Corrective Action requirements of RCRA, are considered units. For the SSFL ecological risk assessments, an exposure area will be the investigational unit.~~

~~In addition, an exposure area may be the home range of the representative species and may potentially encompass several units and areas outside the investigational units. Aquatic plants, aquatic invertebrates, and fish are limited to areas of open water; therefore, their exposure area is defined by the limits of the water body. As terrestrial plants are sessile, the exposure area for plants will be the area of the individual unit. Similarly, as soil invertebrates are considered not to move great distances, the exposure area for soil invertebrates will be the area of the investigational unit. Determining the exposure area for the other representative species depends on life history requirements and home range of the receptor as well as and the type and amount of habitat present at an investigational unit, the area of the investigational unit and the distribution of suitable habitat throughout the SSFL.~~

~~There are four representative species at the SSFL with home ranges that are larger than the size of any of the investigational units: bobcat, red-tailed hawk, mule deer, and great blue heron. The typical home range sizes and diet for these receptors are listed below.~~

~~Representative Species~~	~~Home Range Size~~	~~Diet~~
~~Bobcat~~	~~1.8 to 20.7 sq. mi. (Zezulak and Schwab 1980)~~	~~Mostly rabbits and rodents (75%) with some deer, birds, reptiles, amphibians, invertebrates, and vegetation (Zeiner *et al.* 1990a)~~
~~Red-tailed Hawk~~	~~0.3 to 3.8 sq. mi. (Zeiner *et al.* 1990b)~~	~~Small mammals (68%), small birds (17.5%), reptiles and amphibians (7%), and invertebrates (3.2%) (Sherrod 1978)~~
~~Mule Deer~~	~~0.20 to 1.19 sq. mi. for does (Taber and Dasmann 1958)~~ ~~0.15 to 3.2 sq. mi. for bucks (Chapman and Feldhammer 1992)~~	~~Vegetation (100%)~~
~~Great Blue Heron~~	~~1.8 to 10 miles from nest (Zeiner *et al.* 1990b; USEPA 1993b)~~	~~Fish (75%); aquatic invertebrates (USEPA 1993b; Zeiner *et al.* 1990b)~~

~~There are a variety of developed land and wildlife habitats across the SSFL. The amount of foraging habitat available at each investigational unit will determine the relative proportion of exposure that particular unit contributes to the total exposure of the large home-range representative species. Based on the types of prey species or food items of the bobcat, great blue heron, mule deer, and red-tailed hawk and the types of habitats that occur at the SSFL, the habitats that these three species would be expected to most frequently use on the facility are listed below.~~

~~Representative Species~~	~~Foraging Habitats~~	~~Reference~~
~~Bobcat~~	~~Native and nonnative grasslands, Venturan coastal sage scrub, chaparral, coast live oak woodlands, rock outcrops, coast live oak riparian forest, and southern cottonwood willow riparian forest~~	~~Zeiner *et al.* 1990a~~

~~Representative Species~~	~~Foraging Habitats~~	~~Reference~~
~~Red-tailed Hawk~~	~~Native and nonnative grasslands, Venturan coastal sage scrub, rock outcrops, ruderal habitat~~	~~Zeiner *et al*. 1990b~~
~~Great Blue Heron~~	~~Open water, freshwater marsh, undifferentiated wetlands, surface waters, native and nonnative grasslands~~	~~Zeiner *et al*. 1990b~~
~~Mule Deer~~	~~Native and nonnative grasslands, coast live oak woodlands, coast live oak riparian forest, and southern cottonwood willow riparian forest, Venturan coastal sage scrub, chaparral,~~	~~Wallmo 1978, 1981~~

~~Native and nonnative grasslands are the primary habitats of rodents and all four of the large home range species include rodents in their diets; therefore, they would be expected to forage in these habitats. Bobcats generally use the cover of scrub, rock outcrops, and trees to stalk and capture prey in the open (Zeiner *et al*. 1990a). Bobcats are not considered to use dense habitat types like Baccharis scrub or some of the wetland habitats that do not afford adequate cover. Red-tailed hawks forage over open grasslands and fields, over rock outcrops, and in the more open Venturan coastal sage scrub as opposed to dense chaparral (Zeiner *et al*. 1990b). Although hawks use woodlands and riparian habitats for perching or nesting, they generally do not forage in these habitats. Great blue heron are expected to spend the majority of its foraging time in and around the edges of the ponds and marsh, but not in the woodlands (Zeiner *et al*. 1990b). Mule deer are expected to forage primarily on small branches and leaves of trees, and occasionally on new scrub growth and grasses (Wallmo 1978, 1981).~~

~~The calculation of a representative species' exposure and risk at each investigational unit and for the SSFL facility as a whole will be a step-wise process, progressing from smaller spatial scales to large spatial scales (see Section 12.1.3). The first step assumes the large home range representative species forages in appropriate habitats within a single investigational unit, *i.e.*, the exposure area is the area of appropriate habitats within an investigational unit. The second step assumes the large home range representative species forages in appropriate habitats among investigational units within a single Reporting Area, *i.e.*, the exposure area is the area of appropriate habitats within a Reporting Area. The last step assumes the large home range~~

~~representative species forages in appropriate habitats among Reporting Areas across the entire SSFL facility, *i.e.*, the exposure area is the area of appropriate habitats within the SSFL property line.~~

~~Specific steps to calculate risks to large home range representative species are described in more detail in Section 12 and Appendix J.~~

~~9.6 ENDPOINTS~~

~~An assessment endpoint is an explicit expression of the environmental value that is to be protected (USEPA 1992d). Selection of assessment endpoints is designed to focus the ecological risk assessment on those ecological features or resources that have substantial aesthetic, social, or economic value or are important in the biological functions or biodiversity of the system. Definition of appropriate assessment endpoints avoids making decisions on the basis of trivial or insignificant effects.~~

~~A measurement endpoint is a measurable ecological characteristic that is related to the valued characteristic chosen as the assessment endpoint. Measurement endpoints often are expressed as the statistical or arithmetic summaries of the observations that make up the measurement. (USEPA 1992d)~~

~~Successful ecological assessments are based on adequate definition of assessment endpoints and their associated measurement endpoints (Beanlands and Duinker 1983; Suter 1993). Establishing appropriate assessment and measurement endpoints requires that ecological species and functions purportedly at risk be identified and that some measurable aspect of these values be defined (Barnthouse *et al*. 1986; USEPA 1989c,d, 1992d; Norton *et al*. 1992; Suter 1993). This element is crucial because both assessment and measurement endpoints must be specific and relevant and should be limited to organisms that spend a significant portion of their lives or derive a significant portion of their diet or physiological needs from the investigational unit. The relationship between the assessment goals, assessment endpoints, and measurement endpoints is shown in Table 9-3.~~

~~9.6.1 Assessment Endpoints~~

~~Assessment endpoints are formal expressions of the actual environmental values to be protected from risk (Suter 1993). They need to be specific and should be tied directly to specific ecological values requiring protection. Well-crafted assessment endpoints provide a clear, logical~~

~~connection between regulatory policy goals and anticipated ecotoxicological investigations. The assessment goal for the SSFL is to protect wildlife and plant species from certain chronic or acute effects resulting from site-related chemicals. This goal is used as a basis for defining assessment endpoints applicable to all sites, as follows:~~

1. ~~Protect raptor species from acute (mortality) and chronic (*e.g.*, reproductive, growth, disease, and behavioral impairment) adverse effects from direct and/or secondary exposure to site-related CPECs.~~
2. ~~Protect the abundance of raptor and bobcat prey items (*e.g.*, rodents) by limiting acute and chronic adverse effects from direct and/or secondary exposure to site-related CPECs.~~
3. ~~Protect bobcat from acute (mortality) and chronic (*e.g.*, reproductive impairment) adverse effects from direct and/or secondary exposure to site-related CPECs.~~
4. ~~Protect mule deer from acute (mortality) and chronic (*e.g.*, reproductive impairment) adverse effects from secondary exposure to site-related CPECs.~~
5. ~~Protect the abundance of native terrestrial vegetation by limiting acute and chronic adverse effects from exposure to site-related CPECs.~~
6. ~~Protect the abundance of great blue heron prey items (*e.g.*, fish, and aquatic invertebrates) by limiting acute and chronic adverse effects from direct and/or secondary exposure to site-related CPECs.~~
7. ~~Protect great blue heron from acute (mortality) and chronic (*e.g.*, reproductive, growth, and behavioral impairment, disease) adverse effects from direct and/or secondary exposure to site-related CPECs.~~
8. ~~Protect the abundance of benthic invertebrate community by limiting acute and chronic adverse effects from exposure to site-related CPECs.~~
9. ~~Protect the abundance of terrestrial invertebrate community by limiting acute and chronic adverse effects from exposure to site-related CPECs.~~
10. ~~Protect the abundance of wetland and aquatic vegetation by limiting acute and chronic adverse effects from exposure to site-related CPECs.~~

~~Assessment endpoints for each investigational unit will vary depending on the types of contamination, habitat, and receptors that occur on each site.~~

~~9.6.2 Measurement Endpoints~~

~~For the purposes of SSFL ecological risk assessments, measurement endpoints include mortality, reproductive impairment, reduction of growth, and other less serious effects to individuals that~~

~~are most relevant to assessment endpoints (*e.g.*, protection of populations and communities of concern and their food sources). Not all of these measurement endpoints will be assessed by direct measure of the ecological population, rather they are evaluated during exposure and effect analysis and risk characterization through modeling (Section 10.4, Section 11) and estimation of HQs (Section 12).~~

~~Indicators of aquatic and terrestrial habitat quality as well as field observations will provide a "weight of evidence approach" to qualitatively assess measurement endpoints during this risk assessment. Information collected during development of the BCR or site investigation (*e.g.*, soil or rock staining) will then be used to further support or refute the results of the conservative assumptions made during the risk assessment.~~

SECTION 10

10 ECOLOGICAL EXPOSURE ASSESSMENT

- **This entire section has been replaced by Appendix C of the SRAM Rev. 2 Addendum.**

~~Assessing the potential for adverse effects to ecological receptors due to contact with environmental chemicals requires the estimation of exposure to these chemicals. Such exposure estimation is a critical step in the ecological risk assessment process. Exposure estimates are also needed to quantitatively evaluate the relative importance of various chemical sources or pathways when considering remediation strategies. Exposure analysis attempts to quantify the magnitude or type of actual and/or potential exposures of ecological receptors to site-specific chemicals, termed chemical stressors. This section identifies methods for characterizing representative species exposure to chemicals identified at the investigational units.~~

~~Various terms are used to describe chemical intake rates and concentrations in environmental media. Specific estimates of average or upper-bound chemical concentrations in abiotic media, such as soil, sediment, air, and water at locations where an ecological receptor may contact them, are referred to as EPCs (see Section 10.1). In contrast to the EPC, an exposure point value (EPV) is an estimate of the concentration of a chemical in the tissues of a representative prey species in a particular exposure area (see Section 10.5). Specifically, the EPV is a whole body tissue concentration in prey species consumed by the receptor, also sometimes referred to as the body burden tissue concentration.~~

~~10.1 Calculation of Exposure Point Concentrations~~

~~As described in Section 6 for human health risk assessment, EPCs will be computed both as the arithmetic mean and the 95 percent UCL of the arithmetic mean, to represent CTE and RME concentrations, respectively. The method selected for calculating of the 95 percent UCL will be based on the results of statistical tests to determine the type of data distribution. The statistical tests and equations that will be used are identical to those described for the human health risk assessment (shown in Section 6.1).~~

~~For any chemical selected as a CPEC, as described in Section 3.1 and 3.2, if the investigational unit-specific data set contains any value classified as a positive detect, then all non detect samples are included in the EPC calculation as values equal to one-half the SQL. If the data set contains only non detect values then the chemical will not be carried forward in the risk~~

~~assessment, unless a substantial number of the SQLs for a given chemical are greater than the site-specific ESL. Justification (*e.g.*, total number of samples, number of samples with SQLs below ESLs) for exclusion of a chemical on this basis will be provided in the risk assessment. In cases where there are an insufficient number of SQLs below the ESL to conclude that a chemical is not present at concentrations that may pose and ecological risk, then the chemical will be carried forward in the risk assessment, with individual samples concentrations estimated at one-half the SQL. Site-specific ESLs for the SSFL are presented in Section 3.2.~~

~~Terrestrial species at the SSFL have been identified and described in the BCR (Appendix I). Based on the listing of known terrestrial mammalian, avian, and plant species at the SSFL, representative species' were selected as ecological receptors to be evaluated in site-specific ecological risk assessments at the SSFL (Section 9). These include representative prey species (*e.g.*, plants, soil invertebrates), primary/secondary consumers (*e.g.*, thrush, deer mouse), avian carnivore (*e.g.*, red-tailed hawk), mammalian carnivores (*e.g.*, bobcat), and large mammalian herbivores (*e.g.*, mule deer). Potential risks to these representative species will be used to infer potential risks to other taxonomically and trophically related ecological receptors that may occur at an investigational unit. As previously described, potential hazards to plants will be qualitatively assessed as described in Section 12.1.4. Of the representative classes of species selected as potential receptors for ecological risk assessment at the SSFL, prey species and the primary/secondary consumers would have the greatest and most significant direct contact with soils. Higher trophic species such as the avian and mammalian carnivores are primarily exposed to CPECs through the consumption of prey species. Therefore, direct contact with soil will be evaluated for primary and secondary consumers only. Burrowing animals may be exposed to CPECs at substantially deeper soil depths than other species (see Section 9.2.3 and 10.2 for further details regarding soil depth intervals).~~

~~For aquatic receptors, current EPCs will be calculated from the available surface water (unfiltered samples) and sediment concentration data using the same approach as was described above for soil. Data from unfiltered surface water samples provide a protective measure of exposure to aquatic biota and are appropriate for estimating current surface water (drinking water) exposures to terrestrial biota. At some sites, future discharge of the groundwater to the surface may result in hypothetical future exposures to contaminants in groundwater. Future exposures predicted using fate and transport models are derived using groundwater data (mostly filtered samples). Consequences to risk estimates associated with future surface water exposures due to the use of filtered versus unfiltered samples will be discussed in the uncertainty analysis of the risk assessments.~~

~~These water and sediment EPCs will be used as the measures of exposure for aquatic receptors for ecological risk characterization.~~

~~The upper stratum or biotic zone for sediment is considered the top two centimeters. This upper stratum is thought to be most important from an ecological perspective because most of the biota associated with sediments are found in this stratum. However, to account for the possible resuspension of sediments, all sediment concentration data up to a depth of two feet bgs will be used for developing sediment EPCs.~~

~~10.2 Soil Depth Intervals for Terrestrial Representative Species~~

~~The purpose of this section is to clarify the approach, and to identify and establish species-specific soil depth intervals for evaluation in ecological risk assessments at the SSFL. An important factor to consider when evaluating a species' exposure to soil is the species' habitat use.~~

~~**Plants.** It should be noted that in ecological risk assessments for SSFL, calculation of exposures to plants are considered only in regard to calculating exposures to higher trophic level biota that consume plants—potential risks to plants themselves are evaluated using field observations (see Section 11.3 and 12.1.4). Accordingly, only the root zones of plants that are likely to be food sources for representative plant consumers are considered in ecological risk assessments for SSFL. In general, herbaceous grasses and forbs are considered the preferred food for small mammals (as represented by the deer mouse). Mule deer browse and graze, preferring forbs, grasses, and tender new growth of various shrubs (*e.g.*, ceanothus, bitterbrush) (Zeiner *et al.* 1990a).~~

~~Clearly, the root zone depth will vary depending on environmental variables such as soil type and moisture content, and on the plant species. Most herbaceous grasses and forbs occurring on the SSFL are considered to have relatively shallow root systems (*i.e.*, less than two feet bgs). Raven *et al.* (1986) reports that much of the root hairs, and thus much of the root absorption, is found in surface soils. Moreover, in an article published in SETAC News 1998 that discusses the soil depths accessed by plants, the author recommends a soil depth of 39 inches bgs for plants (B. Davis 2000). Accordingly, for the most part, the soil depth interval used to calculate the uptake of CPECs into plants consumed by representative herbivores will be zero to two feet bgs.~~

~~It should be noted that the root zone of some plants observed at SSFL are known to extend to depths well below two feet bgs. Chamise, which has been observed at the SSFL, was reported to~~

~~have a maximum root penetration depth of 25 feet bgs (Hellmers *et al*. 1955). Coast live oaks have tap roots that penetrate to depths of 36 feet bgs (USDA 2003). Accordingly, where appropriate, deeper soil depth intervals that are relevant for vegetation observed at a site and likely to be consumed by representative herbivorous consumers will be considered on a unit-by-unit basis.~~

~~**Soil Invertebrates.** Although some soil invertebrates (*e.g.*, earthworms) may burrow up to three feet in depth, they generally consume vegetation and detritus in surface soils (Nuutinen and Butt 2002). As with plants, the calculation of exposures to soil invertebrates is important in estimating exposures to insectivorous consumers (*e.g.*, thrush, deer mouse). As both the thrush and deer mouse primarily glean insects from the ground or in vegetation—*i.e.*, glean soil invertebrates that are primarily exposed to surface soils. Accordingly, the soil depth interval used to evaluate risks and the uptake of CPECs into soil invertebrates consumed by insectivores will be zero to two feet bgs.~~

~~**Deer Mouse.** A number of small mammal species live on the surface or in shallow burrows. However, some small mammal species will construct burrows in deeper soils. Accordingly, to address potential exposures to CPECs in deeper soils, a soil depth interval of up to six feet bgs was considered for the deer mouse.~~

~~Consistent with DTSC's (1998b) EcoNOTE No. 1, the soil depth interval with greatest potential exposure and risk will be selected as the soil depth interval for assessing exposure and risk to burrowing animals in the risk assessment. Accordingly, the zero to two feet bgs, zero to four feet bgs, and zero to six feet bgs depth intervals will be evaluated to determine which soil depth interval is likely to pose the greatest exposure and risk. The soil depth interval representing the greatest potential exposure and risk will be selected using a concentration-toxicity screen. For each chemical detected within a depth interval the toxicity-adjusted concentration will be calculated as the measured concentration divided by the appropriate ESL. Next, the sum of chemical-specific toxicity-screen results within each depth interval will be calculated. The soil depth interval with highest summed concentration-toxicity value will be selected to evaluate potential risks to the deer mouse.~~

~~**Mule Deer.** The primary exposure route for larger herbivorous mammals is through the consumption of aboveground vegetation. In particular, the mule deer grazes or browses, preferring tender new growth of various forbs, grasses, and shrubs (Zeiner *et al*. 1990a).~~

~~Accordingly, direct contact with surface soil (zero to two feet bgs) will be evaluated for the mule deer.~~

~~**Red-Tailed Hawk and Bobcat.** The primary exposure route to higher trophic species such as the red-tailed hawk and the bobcat is through the consumption of prey species. Therefore, direct contact with soil will not be evaluated for the red-tailed hawk and bobcat.~~

~~10.3 Estimation of VOC Concentrations in Burrow Air~~

~~Burrow air concentrations may either be measured directly or estimated, for example using a steady-state soil to burrow air partitioning model (Hope 1995). To evaluate these options, burrow air VOC concentrations estimated using the Hope (1995) model were compared against soil vapor measurements taken within the same area of the SSFL as the soil samples. Measured soil vapor concentrations were found to be greater than the modeled burrow air concentrations. Because soil vapor measurements account for VOC vapor migration from all potential sources and represent measured rather than modeled data, soil vapor data will be used to estimate EPCs for airborne VOCs in burrows—modeled concentrations will only be used when VOCs are detected in the soil horizon of interest and measured soil vapor data are not available. The estimated burrow air EPCs will be used to calculate the applied daily dose for the deer mouse. In the event that this approach suggests risks to burrowing animals, additional evaluations may be performed in order to estimate an EPC for VOCs in burrow air.~~

~~10.4 Biota Sediment/Soil Accumulation Factors~~

~~Biota sediment/soil accumulation factors (BAFs) will be used to estimate aquatic and terrestrial receptor tissue concentrations from sediment and soil concentration data, respectively. The estimated concentrations will subsequently be used for calculation of exposures in food chain models described in Section 10.5 through 10.7.~~

~~The relationship between chemical concentration in soil or sediment and tissue is described by Equation 10-1:~~

$$BAF = C_{tissue} / C_{soil/sed} \quad (10\text{-}1)$$

~~where:~~

~~BAF = bioaccumulation factor (unitless)~~
~~C_{tissue} = concentration in tissue (mg/kg dry weight)~~

~~$C_{soil/sed}$ = concentration in soil or sediment (mg/kg dry weight)~~

~~Chemical-specific BAFs will be obtained from one of three sources: (1) site-specific BAFs, (2) applicable BAF value obtained from the scientific literature, or (3) a surrogate BAF based on a chemical with similar structure and activity relationship. Site-specific BAFs will preferentially be used when available. The methods used to obtain data for deriving site-specific BAFs are described below.~~

~~To validate exposure models for higher trophic levels species presented later in this section, paired biotic and abiotic chemistry samples have been collected for use in calculating site-specific BAFs. The data used to derive BAFs for the SSFL include (1) colocated soil and terrestrial organism samples, and (2) colocated sediment and aquatic organism samples. Throughout this section, colocated tissue and soil or sediment samples are referred to as "paired data" or "paired samples." Four sites were selected and approved by the DTSC for the BAF study (Ogden 2000d). Two sites, the Bravo Area (SWMUs 5.13, 5.14, and 5.15) and the Component Test Laboratory III (CTL-III) (SWMU 4.7), were sampled for soil and colocated terrestrial organisms consisting of various plants, invertebrates, and vertebrates. The other two locations, the R2A/R2B Ponds (SWMU 5.26) and the Silvernale Reservoir (SWMU 6.8), were sampled for sediments and colocated aquatic organisms consisting of plants, invertebrates, and fish.~~

~~Soil and tissue samples collected at the Bravo Area were analyzed for metals and PCB congeners. Soil and tissue samples collected at CTL-III were analyzed for PAHs and dioxins. Sediment and tissue samples collected at the R2A/R2B Ponds were analyzed for metals, PAHs, and dioxins. Sediment and tissue samples collected at Silvernale Reservoir were analyzed for PCB congeners. Metals, PAHs, PCBs, and dioxins were analyzed by USEPA Methods 6010B/7000, 8270, 1668, and 1613B, respectively. All analytical data were validated. The sample locations, sample media, numbers of samples collected from each media, and the analytes of interest are summarized in Table 10-1. Sampling and analysis for this study were performed as outlined in the DTSC-approved work plan (Ogden 2000d). Description of the field and analytical procedures used for this sampling event and individual sample results will be presented in the RFI report.~~

~~Only paired (soil-tissue or sediment-tissue) data in which a given analyte was detected in *both* soil and sediment and tissue were used to derive BAFs. Normalization by the fraction of organic carbon measured in soil and sediment was not done in the present calculations because total~~

~~organic carbon (TOC) data were not available for all soil and sediment samples. Furthermore, normalization of tissue data by lipid content is not necessary for this particular set of BAFs because the BAFs are intended for use in calculating food chain exposures. The same measures of tissue-specific lipid concentrations would then be used in the exposure models, thus canceling out the initial lipid normalization.~~

~~The following method was used to calculate BAFs at the SSFL. First, the ratio of tissue chemical concentration to soil or sediment chemical concentration was calculated for each set of paired (colocated) data. Next, the 75th percentile of the distribution of individual BAFs was estimated for each tissue type, as follows, for data sets with one to four paired samples:~~

- ~~1 paired sample – the single ratio was selected as the BAF.~~
- ~~2 paired samples – the average of the two ratios was selected as the BAF.~~
- ~~3 paired samples – If the approximate 75th percentile ratio (calculated as the average plus one standard deviation) was less than the maximum value, then it was selected as the BAF. If the average plus one standard deviation was greater than the maximum sample, then the approximate 75th percentile was estimated as the midpoint between the arithmetic mean ratio and the maximum ratio.~~
- ~~4 paired samples – If the approximate 75th percentile ratio (calculated as the average plus one standard deviation) was less than the maximum value, then it was selected as the BAF. If the average plus one standard deviation was greater than the maximum sample, then the second highest value was selected as the BAF.~~

~~Tables 10-2 and 10-3 present the site-specific BAFs for aquatic and terrestrial receptors, respectively.~~

~~All analytical data for tissues except for the terrestrial vertebrate (*i.e.*, deer mouse) data were reported on a dry weight basis, consistent with analytical data for soil and sediment. The mouse tissue data were converted to a dry weight basis using percent moisture content for mouse tissue as reported in the Wildlife Exposure Factors Handbook (USEPA 1993b). Therefore, all reported BAFs were derived on dry weight basis. In cases where a default BAF value of 1 is used in ecological risk assessments, it is assumed that it is based on a dry weight relationship. BAF values obtained from the scientific literature will be converted to a dry weight basis, if necessary. The spreadsheets used to calculate the BAFs are presented in Appendix K.~~

~~Perchlorate has been detected in soils at a sites. To support effective decision-making for these few sites, both human health and ecological risk assessments will evaluate potential risks due to~~

~~exposures to perchlorate in soil. Information obtained from the scientific literature and from discussions with Dr. Andrew Jackson of Texas Tech University, a recognized expert who has conducted numerous studies on the uptake of perchlorate into plants, were used to develop a (soil-to-plant) BAF for perchlorate (see Appendix K-9). Based on the available scientific information and recommendations from Dr. Jackson, a (soil-to-plant) BAF of 282 was derived for perchlorate. This BAF has been approved by DTSC for the use in screening for risk assessments (DTSC 2005b). It should be noted that groundwater at SSFL wherein perchlorate has been detected is typically located well below root zones. However, unit-specific conditions will be considered when estimating potential perchlorate exposures to biota at SSFL. If new information suggests the need, a (water-to-plant) BAF for perchlorate will be developed.~~

~~10.5 Estimation of Exposure Point Values for Representative Aquatic Prey Species~~

~~EPV calculations are based on the predicted exposure pathways previously discussed in Section 9.2. Information on the habitats and prey of the representative species used in determining appropriate exposure scenarios is provided in Section 9.~~

~~10.5.1 Generic Aquatic Invertebrate~~

~~Aquatic invertebrates are potentially exposed to chemicals in sediment, food, and the water column. To estimate exposure to higher tropic level organisms that consume aquatic invertebrates, chemical concentrations in aquatic invertebrate tissues (EPVs) will either be measured directly or estimated by multiplying the sediment concentration by the site-specific BAF for aquatic invertebrates.~~

$$EPV_{ai} = EPC_{sed} \times BAF_{ai} \text{ or = direct measurement} \qquad (10\text{-}2)$$

~~where:~~

~~EPV_{ai} = chemical body burden in aquatic invertebrates, mg/kg (dry weight)~~
~~EPC_{sed} = sediment exposure point concentration, mg/kg (dry weight)~~
~~BAF_{ai} = chemical-specific bioaccumulation factor for aquatic invertebrates, unitless~~

~~Equation 10-2 is from Hope (1995).~~

~~To calculate a range of potential EPVs, the EPC in the above equation will be calculated as a 95 percent UCL and a mean sediment concentration. For species with large home ranges, aquatic invertebrate EPVs will be estimated using the protocol presented in Section 12.1.3.~~

~~10.5.2 Generic Fish~~

~~Fish are potentially exposed to chemicals in sediment, food, and the water column. To estimate exposure to higher trophic level organisms that consume fish, the chemical body burden in fish is either measured directly or estimated by multiplying the sediment concentration by the site-specific BAF for fish.~~

$$EPV_f = EPC_{sed} \times BAF_f \text{ or } = \text{direct measurement} \quad (10\text{-}3)$$

~~where:~~

~~EPV_f = chemical body burden in fish, mg/kg (dry weight)~~
~~EPC_{sed} = sediment exposure point concentration, mg/kg (dry weight)~~
~~BAF_f = site-specific biota to sediment bioaccumulation factor for fish, unitless~~

~~Equation 10-3 is adapted from Hope (1995).~~

~~To calculate a range of potential EPVs, the EPC in the above equation will be calculated as a 95 percent UCL and a mean sediment concentration. For species with large home ranges, generic fish EPVs will be estimated using the protocol presented in Section 12.1.3.~~

~~10.6 Estimation of Exposure Point Values for Representative Terrestrial Prey Species~~

~~As discussed above, an EPV is an estimate of the concentration of a chemical in the tissues of a representative prey species in a particular exposure area. Specifically, the EPV is a whole body tissue concentration in prey species consumed by the receptor, also sometimes referred to as the body burden tissue concentration.~~

~~EPV calculations are based on the predicted exposure pathways previously discussed in Section 9.2. Information on the habitats and prey of the representative species used in determining appropriate exposure scenarios is provided in Section 9.~~

~~10.6.1 Terrestrial Plant~~

~~Terrestrial plants may be exposed to chemicals by foliar deposition (*e.g.*, rainsplash), root contact, or foliar uptake (vapor or dust). Chemical uptake by plants may be affected by chemical concentrations, physiochemical properties of the chemical, and the physical processes of the plant itself. For example, some plants are able to regulate the uptake of chemicals that are also important nutrients, or may sequester potentially toxic compounds so they do not adversely affect the plant. To estimate exposure to higher trophic level organisms that consume plants, concentrations in plant tissues will be either measured directly or will be estimated by multiplying soil concentrations by the site-specific bioaccumulation factor for plants. The following model will be used to estimate the concentrations of chemicals in plants via uptake by plant roots.~~

$$EPV_p = BAF_{tp} \times EPC_s \text{ or = direct measurement} \quad (10\text{-}4)$$

~~where:~~

~~EPV_{tp} = chemical concentration in terrestrial plant, mg/kg (dry weight)~~
~~EPC_s = soil exposure point concentration, mg/kg (dry weight)~~
~~BAF_{tp} = chemical-specific bioaccumulation factor for the terrestrial plants, unitless~~

~~Equation 10-4 is from Hope (1995).~~

~~To calculate a range of potential EPVs, the EPC in the above equation will be calculated as a 95 percent UCL and a mean soil concentration. For species with large home ranges, terrestrial plant EPVs will be estimated using the protocol presented in Section 12.1.3.~~

~~10.6.2 Soil Invertebrate~~

~~Terrestrial invertebrates are exposed to chemicals in the soil through direct contact and ingestion. Chemical concentrations terrestrial soil invertebrate tissues will either be measured directly or estimated by multiplying the soil concentration by the site-specific BAF for terrestrial invertebrates.~~

$$EPV_{ti} = EPC_s \times BAF_{ti} \text{ or = direct measurement} \quad (10\text{-}5)$$

~~where:~~

~~EPV_{ti} = chemical body burden in terrestrial invertebrate, mg/kg (dry weight)~~

~~EPC_s = soil exposure point concentration, mg/kg (dry weight)~~
~~BAF_{ti} = chemical-specific bioaccumulation factor for terrestrial invertebrates, unitless~~

~~Equation 10-5 is adapted from Hope (1995).~~

~~To calculate a range of potential EPVs, the EPC in the above equation will be calculated as a 95 percent UCL and a mean soil concentration. For species with large home ranges, soil invertebrate EPVs will be estimated using the protocol presented in Section 12.1.3.~~

~~10.6.3 Deer Mouse~~

~~To estimate exposures of higher trophic level organisms that consume deer mice, concentrations of chemicals in the deer mouse (body burden or EPV) will be either measured directly or calculated using the site-specific soil to deer mouse bioaccumulation factor.~~

$$EPV_d = EPC_s \times BAF_d \text{ or } = \text{direct measurement} \quad (10\text{-}6)$$

~~where:~~

~~EPV_d = chemical body burden in deer mouse tissue, mg/kg (dry weight)~~
~~EPC_s = soil exposure point concentration, mg/kg (dry weight)~~
~~BAF_d = chemical-specific bioaccumulation factor for deer mice, unitless~~

~~Equation 10-6 is adapted from Hope (1995).~~

~~To calculate a range of potential EPVs, the EPC in the above equation will be calculated as a 95 percent UCL and a mean soil concentration. For species with large home ranges, deer mouse EPVs will be estimated using the protocol presented in Section 12.1.3.~~

~~10.7 Estimation of Applied Daily Doses for Receptors of Interest~~

~~The previous sections have presented the estimation of EPCs for the abiotic media and EPVs for the representative prey species. This section presents the approach for estimating the ADDs for the receptors of interest foraging in the aquatic and terrestrial habitats at SSFL. The ADD is defined as the average daily dose received by a receptor over the duration of exposure. The ADD is the measure of exposure that is required for calculating receptor- and chemical-specific HQs using toxicity values that are reported for derived as daily doses in investigational units of mg/kg-day. Applicable toxicity values are described in Section 11.~~

~~Terrestrial receptors may be exposed to chemicals present in soil, sediments, air, and surface water through ingestion, inhalation, or direct contact with abiotic media. They may also be exposed through ingestion of prey items that have been exposed to chemicals present at the exposure unit. Terrestrial receptors are also mobile and may be exposed to chemicals and concentrations in varying media as they move between habitat types and sites. Dermal contact, inhalation, and ingestion are the three possible exposure routes through which a terrestrial receptor may come in contact with a chemical.~~

~~Dermal and inhalation routes were not included in the development of potential exposures because the contribution from these routes of exposure to overall risks has been shown to be generally less than one percent (USEPA 2000a,b). Inhalation pathways will be considered for the deer mouse since this is a representative burrowing organism. However, inhalation of chemicals will be considered negligible for surface dwelling large mammals and birds (USEPA 2000a). Exposures to volatile compounds are minimal for surface-dwelling terrestrial receptors because of the nature of the chemical (volatile compounds volatilize from soil and surface water to the air where they are rapidly diluted and dispersed). Conversely, burrowing animals may be exposed to volatile compounds during use of burrows, where dispersion and dilution of vapors is likely to be reduced compared to the surface. Therefore, inhalation exposure of volatile compounds in burrow air will be estimated for the deer mouse as described in Section 10.7.2.~~

~~The ingestion exposure route is the primary exposure route that will be evaluated for terrestrial receptors at the SSFL. Higher trophic level animals tend to consume a variety of prey species; estimates of ingestion exposure must also account for diversity, seasonality, and proportionality of the prey items in the diet. Additionally, animals may favor one habitat over another or vary their use of habitats depending on seasonality and reproductive needs. Oral ingestion exposure calculations should also account for spatial factors. Food, habitat, and life history parameters used in the exposure models for representative species are listed in Table 10-4. Calculations of exposure will be based on the mean and 95 percent UCL EPC chemical concentrations and the mean and 95 percent UCL EPV concentrations in prey species.~~

~~If the representative species' home range is smaller than the exposure area (*i.e.*, for plants, invertebrates, thrush, and deer mouse), area-use factors will be set to one—the representative species is considered to spend 100 percent of its time within the exposure area.. However, if the representative species' home range is greater than the exposure area (*i.e.*, red-tailed hawk, great blue heron, and bobcat) the representative species is considered to spend a portion of its time within the exposure area. In this case, the exposure calculations will be modified by the ratio of~~

~~the exposure area to the representative species home range area (area use factor = exposure area / home range area). For representative species with large home ranges, an evaluation of potential cumulative exposures across investigational units, and, if needed, across Reporting Areas will be conducted to address potential risks at spatial scales that may occur at scales greater than an investigational unit (see Sections 10.8 and 12.1.3).~~

~~10.7.1 Great Blue Heron~~

~~Great blue heron and other aquatic foraging birds are potentially exposed to chemicals by direct contact with soil, sediment, and surface water; inhalation of air; and ingestion of soil, sediment, water, and prey items. To estimate exposure of great blue heron to CPECs, ingestion will be considered as the primary and most significant exposure route. The following model considers ingestion of aquatic invertebrates, fish, and surface water; incidental ingestion of sediment, based on prey information in Section 9.5. This exposure medium was selected based on relevance to existing toxicological criteria (see Section 11) for piscivorous birds.~~

$$ADD_h = \{[(EPV_{ai} \times R_h \times F_{ai}) + (EPV_f \times R_h \times F_{hf}) + (EPC_{sed} \times R_h \times F_{sed}) + (EPC_{sw} \times Q_h)]/W_h\} \times \Psi_h \times \Theta_h \quad (10\text{-}7)$$

$$Q_h = 0.0059 \times W_h^{0.67} \quad (10\text{-}8)$$

~~where:~~

~~ADD_h = applied daily dosage to great blue heron from consumption, mg/kg-d~~
~~EPV_{ai} = chemical concentration in aquatic invertebrate, mg/kg (dry weight) (Equation 10-2)~~
~~R_h = food intake rate for great blue heron, kg/d (dry weight) (Table 10-4)~~
~~F_{ai} = fraction of aquatic invertebrate in great blue heron diet, unitless (Table 10-4)~~
~~EPV_f = chemical concentration in fish, mg/kg (Equation 10-3) (dry weight)~~
~~F_f = fraction of fish in great blue heron diet, unitless (Table 10-4)~~
~~EPC_{sed} = chemical concentration in sediment, mg/kg (dry weight)~~
~~F_{sed} = fraction of incidentally ingested sediment, unitless (Table 10-4)~~
~~EPC_{sw} = chemical concentration in surface water, mg/L~~
~~Q_h = calculated water intake of great blue heron, L/d~~
~~W_h = mean weight of adult great blue heron, kg (Table 10-4)~~
~~Ψ_h = fraction of year spent at SSFL, unitless (Table 10-4)~~

~~Θ_h = fraction of time on SSFL spent in exposure unit, unitless (Table 10-4)~~

~~The food intake rate (R_h) for the great blue heron is calculated from predictive equations presented in Nagy (2001) for carnivorous birds. Equation 10-7 is from Hope (1995) and Equation 10-8 is from USEPA (1993b). These equations are based on metabolic energy requirements. Therefore, as presented in Table 10-4, the sum of the dietary fractions is 1.0. Beyer *et al.* (1994) as well as others (*e.g.*, USEPA 1993b) have presented estimates of soil ingestion as percentages of the diet. Because soil ingestion does not contribute to metabolic energy requirements, these fractional amounts have been added to the total ingestion rate.~~

~~To calculate a range of potential ADDs, both the EPCs and the EPVs in the above equation will be calculated as 95 percent UCL and mean soil concentrations. For species with large home ranges, terrestrial plant EPVs will be estimated using the protocol presented in Section 12.1.3.~~

~~10.7.2 Deer Mouse~~

~~Deer mice are potentially exposed to chemicals through direct contact with soil, inhalation of air, ingestion of water and prey, and incidental ingestion of soil. Deer mice are known to inhabit a variety of habitats, including all terrestrial habitats on the SSFL. They are primarily granivores, but are also known to regularly eat small invertebrates. Therefore, exposure models for consumption of both plants and invertebrates were selected. Chemical concentrations in the terrestrial invertebrates will be measured directly or estimated by multiplying the soil concentration by the site-specific bioaccumulation factor for terrestrial invertebrates (Equation 10-5). The following equations will be used to estimate deer mice exposure via ingestion of chemicals present at a site.~~

$$ADD_d = \{[(EPV_{ti} \times R_d \times F_{ti}) + (EPV_{tp} \times R_d \times F_{tp}) + (EPC_{sw} \times Q_d) + (EPC_s \times R_d \times F_s)]/W_d\} \times \Psi_d \times \Theta_d \quad (10\text{-}9)$$

$$Q_d = 0.099 \times W_d^{0.9} \quad (10\text{-}10)$$

~~where:~~

~~ADD_d = applied daily dosage to deer mouse, mg/kg-d~~
~~EPV_{ti} = chemical concentration in terrestrial invertebrate, mg/kg (dry weight) (Equation 10-5)~~
~~F_{ti} = fraction of invertebrate in deer mouse diet, unitless (Table 10-4)~~
~~R_d = food intake rate of deer mouse, kg/d (dry weight)~~

~~EPV_{tp} = chemical concentration in terrestrial plant, mg/kg (dry weight) (Equation 10-4)~~

~~F_{tp} = fraction of terrestrial plant in deer mouse diet, unitless (Table 10-4)~~

~~EPC_{sw} = exposure point concentration of chemicals in surface water, mg/L~~

~~EPC_s = exposure point concentration of chemicals in soil, mg/kg (dry weight)~~

~~F_s = fraction of soil in deer mouse diet, unitless (Table 10-4)~~

~~Q_d = water intake rate of deer mouse diet, L/d~~

~~W_d = mean weight of adult deer mouse, kg (Table 10-4)~~

~~Ψ_d = fraction of year spent at SSFL, unitless (Table 10-4)~~

~~Θ_d = fraction of time on SSFL spent in exposure unit, unitless (Table 10-4)~~

~~The food intake rate (R_d) for the deer mouse is taken from Nagy (2001). Equation 10-9 is from Hope (1995) and Equation 10-10 is from USEPA (1993b). These equations are based on metabolic energy requirements. Therefore, as presented in Table 10-4, the sum of the dietary fractions is 1.0. Beyer *et al.* (1994) as well as others (*e.g.*, USEPA 1993b) have presented estimates of soil ingestion as percentages of the diet. Because soil ingestion does not contribute to metabolic energy requirements, these fractional amounts have been added to the total ingestion rate.~~

~~To calculate a range of potential ADDs, both the EPCs and the EPVs in the above equation will be calculated as 95 percent UCL and mean soil concentrations. For species with large home ranges, terrestrial plant EPVs will be estimated using the protocol presented in Section 12.1.3.~~

~~Generally, it is not necessary to calculate an ADD for the inhalation pathway (*e.g.*, deer mouse exposed to burrow air), because burrow air VOC concentrations will usually be used directly to calculate an HQ using a toxicity reference concentration (RfC) derived or reported in the same investigational units as burrow air concentrations (mg/m^3). RfCs for inhalation exposures are described in Section 11. In the unusual case where a toxicity RfC is not available for a VOC and there exists an acceptable inhalation toxicity value reported in the units of dose (mg/kg-day), then the daily dosage resulting from the inhalation of the volatile chemical in burrow air may be estimated using the following equations.~~

$$ADDv_d = [(IR_d \times EPC_{ba}) / W_d] \times \Psi_d \times \Theta_d \times B_d \quad (10\text{-}11)$$

$$IR_d = 0.54576 \times W_d^{0.8} \quad (10\text{-}12)$$

~~where:~~

~~$ADDv_d$ = applied daily dosage to the deer mouse from vapor inhalation, mg/kg-d~~
~~IR_d = deer mouse resting inhalation rate, m^3/d~~
~~EPC_{ba} = concentration of volatile chemical in burrow air, mg/m^3~~
~~B_d = fraction of day spent in burrow, unitless (Table 10-4)~~
~~W_d = mean weight of adult deer mouse, kg (Table 10-4)~~
~~Ψ_d = fraction of year spent at SSFL, unitless (Table 10-4)~~
~~Θ_d = fraction of time on SSFL spent in exposure unit, unitless (Table 10-4)~~

~~Equation 10-11 is from Hope (1995) and Equation 10-12 is from USEPA (1993b). This dose-based calculation of an inhalation exposure to a volatile chemical in burrow air assumes that the detected chemical concentration in burrow air is equivalent to the concentration that passes across the lungs.~~

~~10.7.3 Thrush~~

~~Thrush are primarily exposed to CPECs through intake of food, water, and soil. Thrush may inhabit a variety of habitats, including many of the terrestrial habitats on the SSFL. Thrush primarily forage on insects, spiders, worms, and other invertebrates (Zeiner *et al*. 1990b), but are also known to regularly eat berries, fruits, and seeds. Therefore, exposure models for consumption of both plants and invertebrates were selected. Chemical concentrations in the terrestrial invertebrates will be measured directly or estimated by multiplying the soil concentration by the site-specific bioaccumulation factor for invertebrates (Equation 10-2). The following equations will be used to estimate thrush exposure to chemicals present at a site. Only the ingestion exposure route will be evaluated as previously discussed in Section 10.6.~~

$$ADD_{th} = \{[(EPV_{ti} \times R_{th} \times F_{ti}) + EPV_{tp} \times R_{th} \times F_{tp}) + (EPC_{sw} \times Q_{th}) + (EPC_s \times R_{th} \times F_s)]/W_{th}\} \times \Psi_{th} \times \Theta_{th} \quad (10\text{-}13)$$

$$Q_{th} = 0.059 \times W_{th}^{0.67} \quad (10\text{-}14)$$

~~where:~~

~~ADD_{th} = applied daily dosage to thrush, mg/kg-d~~
~~EPV_{ti} = chemical concentration in terrestrial invertebrate, mg/kg (dry weight) (Equation 10-5)~~
~~F_{ti} = fraction of terrestrial invertebrates in thrush diet, unitless (Table 10-4)~~
~~R_{th} = food intake rate of thrush diet, kg/d (dry weight)~~

~~EPV_{tp} = chemical concentration in terrestrial plant, mg/kg (dry weight) (Equation 10-4)~~

~~F_{tp} = fraction of terrestrial plants in thrush diet, unitless (Table 10-4)~~

~~EPC_{sw} = exposure point concentration of chemicals in surface water, mg/L~~

~~EPC_s = exposure point concentration of chemicals in soil, mg/kg (dry weight)~~

~~F_s = fraction of soil in thrush diet, unitless (Table 10-4)~~

~~Q_{th} = water intake rate of thrush diet, L/d~~

~~W_{th} = mean weight of adult thrush, kg (Table 10-4)~~

~~Ψ_{th} = fraction of year spent at SSFL, unitless (Table 10-4)~~

~~Θ_{th} = fraction of time on SSFL spent in exposure unit, unitless (Table 10-4)~~

~~The food intake rate (R_{th}) for the thrush is calculated from predictive equations presented in Nagy (2001) for passerines. Equation 10-13 is from Hope (1995) and Equation 10-14 is from USEPA (1993b). These equations are based on metabolic energy requirements. Therefore, as presented in Table 10-4, the sum of the dietary fractions is 1.0. Beyer *et al*. (1994) as well as others (*e.g.*, USEPA 1993b) have presented estimates of soil ingestion as percentages of the diet. Because soil ingestion does not contribute to metabolic energy requirements, these fractional amounts have been added to the total ingestion rate.~~

~~To calculate a range of potential ADDs, both the EPCs and the EPVs in the above equation will be calculated as 95 percent UCL and mean soil concentrations. For species with large home ranges, terrestrial plant EPVs will be estimated using the protocol presented in Section 12.1.3.~~

~~10.7.4 Mule Deer~~

~~For the purpose of this evaluation, it is assumed that the primary exposure routes for mule deer are food ingestion, water ingestion, and soil ingestion. Mule deer are known to inhabit a variety of habitats, including all terrestrial habitats on the SSFL. They are primarily herbivores, and an exposure model based primarily on consumption of plants was selected. Chemical concentrations in the plants will be measured directly or estimated by multiplying the soil concentration by the site-specific bioaccumulation factor for plants (Equation 10-4). The following equations will be used to estimate mule deer exposure via ingestion of plants and incidental ingestion of chemicals present at a site.~~

$$\cancel{ADD_d = \{[(EPV_{tp} \times R_d \times F_{tp}) + (EPC_{sw} \times Q_d) + (EPC_s \times R_d \times F_s)]/W_d\} \times \Psi_d \times \Theta_d} \qquad \cancel{(10\text{-}15)}$$

$$Q_d = 0.099 \times W_d^{0.9} \text{ (in kg)} \quad (10\text{-}16)$$

where:

ADD_d = applied daily dosage to mule deer, mg/kg-d (dry weight)
R_d = food intake rate of mule deer, kg/d (dry weight)
EPV_{tp} = chemical concentration in terrestrial plant, mg/kg (dry weight) (Equation 10-4)
F_{tp} = fraction of terrestrial plant in mule deer diet, unitless (Table 10-4)
EPC_{sw} = exposure point concentration of chemicals in surface water, mg/L
EPC_s = exposure point concentration of chemicals in soil, mg/kg (dry weight)
F_s = fraction of soil in mule deer diet, unitless (Table 10-4)
Q_d = water intake rate of mule deer diet, L/d
W_d = mean weight of adult mule deer, kg (Table 10-4)
Ψ_d = fraction of year spent at SSFL, unitless (Table 10-4)
Θ_d = fraction of time on SSFL spent in exposure unit, unitless (Table 10-4)

The food intake rate (R_d) for the mule deer is taken from Nagy (2001). Equation 10-15 is from Hope (1995) and Equation 10-16 is from USEPA (1993b). These equations are based on metabolic energy requirements. Therefore, as presented in Table 10-4, the sum of the dietary fractions is 1.0. Beyer *et al.* (1994) as well as others (*e.g.*, USEPA 1993b) have presented estimates of soil ingestion as percentages of the diet. Because soil ingestion does not contribute to metabolic energy requirements, these fractional amounts have been added to the total ingestion rate.

To calculate a range of potential ADDs, both the EPCs and the EPVs in the above equation will be calculated as 95 percent UCL and mean soil concentrations. For species with large home ranges, terrestrial plant EPVs will be estimated using the protocol presented in Section 12.1.3.

10.7.5 Red-Tailed Hawk

The red-tailed hawk is primarily exposed to chemicals through ingestion of prey items. For purposes of this work plan, deer mice were chosen as representative prey for the hawk and will comprise 100 percent of the red-tailed hawk's diet. While red-tailed hawk are also potentially exposed to chemicals via direct contact with soils (dermal contact) and inhalation of air, these exposure routes will not be evaluated as discussed previously. Red-tailed hawk water requirements are met in most instances from food intake (Zeiner *et al.* 1990b); therefore, uptake

~~of surface water was not factored into the model. Incidental soil ingestion is considered a negligible pathway compared to the ingestion of prey; therefore, that pathway is not evaluated. The following model will be used to estimate the ADD:~~

$$ADD_{rt} = \{(EPV_d \times R_{rt} \times F_d)/W_{rt}\} \times \Psi_{rt} \times \Theta_{rt} \quad (10\text{-}17)$$

~~where:~~

~~ADD_{rt} = daily dosage to red-tailed hawk from prey, mg/kg-d~~
~~EPV_d = chemical concentration in deer mouse, mg/kg (dry weight) (Equation 10-6)~~
~~R_{rt} = food intake rate for red-tailed hawk, kg/d (dry weight)~~
~~F_d = fraction of deer mouse in red-tailed hawk diet, unitless (Table 10-4)~~
~~W_{rt} = mean weight of adult red-tailed hawk, kg (Table 10-4)~~
~~Ψ_{rt} = fraction of year spent at SSFL, unitless (Table 10-4)~~
~~Θ_{rt} = fraction of time on SSFL spent in exposure unit, unitless (Table 10-4)~~

~~The food intake rate (R_{rt}) for the red-tailed hawk is calculated from predictive equations presented in Nagy (2001) for carnivorous birds. Equation 10-17 is from Hope (1995). This equation is based on metabolic energy requirements. Therefore, as presented in Table 10-4, the sum of the dietary fractions is 1.0.~~

~~To calculate a range of potential ADDs, both the EPCs and the EPVs in the above equation will be calculated as 95 percent UCL and mean soil concentrations. For species with large home ranges, terrestrial plant EPVs will be estimated using the protocol presented in Section 12.1.3.~~

~~10.7.6 Bobcat~~

~~The bobcat is potentially exposed to chemicals through direct contact with soil, inhalation of air, ingestion of water and prey, and incidental ingestion of soil. For purposes of this work plan, the bobcat is primarily exposed to chemicals through the ingestion of contaminated prey and/or ingestion of surface water. In the exposure model, deer mice were chosen as representative of bobcat prey and will comprise 100 percent of the bobcat's diet. While bobcat are also potentially exposed to chemicals via direct contact with soils (dermal contact) and inhalation of air, these exposure routes will not be evaluated as discussed previously in Section 10.6. Incidental soil ingestion is considered a negligible pathway compared to the ingestion of prey; therefore, that~~

~~pathway is not evaluated. The following equations will be used to estimate the daily dosage for the bobcat.~~

$$ADD_{bc} = \{[(EPV_d \times R_{bc} \times F_d) + (EPC_{sw} \times Q_{bc})]/W_{bc}\} \times \Psi_{bc} \times \Theta_{bc} \quad (10\text{-}18)$$

$$Q_{bc} = 0.099 \times W_{bc}^{0.9} \quad (10\text{-}19)$$

~~where:~~

ADD_{bc} = ~~applied daily dosage for the bobcat, mg/kg-d~~
EPV_d = ~~chemical concentration in deer mouse, mg/kg (dry weight) (Equation 10-6)~~
R_{bc} = ~~food intake rate for bobcat, kg/d (dry weight)~~
F_d = ~~fraction of deer mice in diet, unitless (Table 10-4)~~
EPC_{sw} = ~~environmental concentration of chemical in surface water, mg/kg~~
Q_{bc} = ~~water intake rate for bobcat, L/d~~
W_{bc} = ~~mean weight of adult bobcat, kg (Table 10-4)~~
Ψ_{bc} = ~~fraction of year spent at SSFL, unitless (Table 10-4)~~
Θ_{bc} = ~~fraction of time on SSFL spent in exposure unit, unitless (Table 10-4)~~

~~The food intake rate (R_{rt}) for the red-tailed hawk is calculated from predictive equations presented in Nagy (2001) for carnivorous mammals. Equation 10-18 is from Hope (1995) and Equation 10-19 is from USEPA (1993b). These equations are based on metabolic energy requirements. Therefore, as presented in Table 10-4, the sum of the dietary fractions is 1.0.~~

~~To calculate a range of potential ADDs, both the EPCs and the EPVs in the above equation will be calculated as 95 percent UCL and mean soil concentrations. For species with large home ranges, terrestrial plant EPVs will be estimated using the protocol presented in Section 12.1.3.~~

~~10.8 LARGE HOME RANGE SPECIES EXPOSURE~~

~~As previously discussed in Section 9.5, the calculation of a large home range representative species exposure and risk at each investigational unit and for the SSFL as a whole will be a step-wise process, progressing from smaller spatial scales to larger spatial scales (see Section 12.1.3 and Appendix J). The first step assumes the large home range representative species forages in appropriate habitats within a single investigational unit. The second step assumes large home range representative species forages in appropriate habitats among investigational units within a single Reporting Area. The last step assumes the large home range representative species forages~~

~~in appropriate habitats among Reporting Areas across the entire SSFL facility. Specific steps to calculate risks to large home range species following this step-wise process are described in Section 12. Further details and an example of how the exposure and risk will be calculated is included in Appendix J.~~

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SECTION 11

11 ECOLOGICAL EFFECTS ASSESSMENT

- **This entire section has been replaced by Appendix D of the SRAM Rev. 2 Addendum.**

~~Toxicity benchmarks are necessary for evaluating potential effects to ecological receptors in lieu of empirically measuring effects in ecological receptors. There are no standard toxicity benchmarks for every medium or every species, and occasionally the absence of toxicity benchmarks can limit the ability to quantify risks to certain species for specific pathways. Availability of toxicity benchmarks was one of the parameters used to select representative species for the SSFL (Section 9).~~

~~DTSC generally recommends that toxicity benchmarks be expressed as either RfCs, concentrations in abiotic media that are not expected to have adverse effects on lower trophic level organisms, or Toxicity Reference Values (TRVs), dosages of chemicals that are not expected to adversely effect higher trophic level receptors. For aquatic receptors, there is very little exposure parameter information available, and toxicity data are almost always reported as exposure concentrations. Therefore, the RfC is the preferred toxicity value for use in site-specific aquatic risk assessments at the SSFL. TRVs are the preferred toxicity benchmarks for use in site-specific terrestrial risk assessments at the SSFL. TRVs are the primary toxicity values available for mammalian and avian species, and the use of TRVs implies an estimate of site-specific exposure in terms of average daily dose. In contrast to RfCs, the use of TRVs also allows for the assessment of risks to higher trophic level receptors though body size extrapolation and receptor-specific exposure assumptions.~~

~~RfCs and TRVs are generally derived from the results of laboratory or field toxicity tests reported in peer-reviewed literature or other technical publications. Toxicity benchmarks, which refer to both the type and magnitude (concentration or dosage) of observed toxicity include, but are not limited to, the following:~~

~~Reference Concentrations~~

- ~~lowest federal or state acute or chronic AWQC~~
- ~~sediment quality guidelines (SQGs)~~
- ~~no observed effect concentration (NOEC)~~
- ~~lowest observed effect concentration (LOEC)~~

- ~~lowest chronic value (LCV)~~
- ~~median lethal concentration (LC_{50})~~
- ~~median effective concentration (EC_{50})~~

~~Toxicity Reference Values~~

- ~~no observed effect level (NOEL)~~
- ~~NOAEL~~
- ~~lowest observed effect level (LOEL)~~
- ~~LOAEL~~
- ~~median lethal dose (LD_{50})~~
- ~~median effective dose (ED_{50})~~

~~Of the above toxicity benchmarks, "no effect" concentrations or exposure levels (*i.e.*, NOECs, NOAELs) will be the preferred toxicity endpoints for selection and/or derivation of TRVs and RfCs. When appropriate AWQC, NOECs, or NOAELs are not available, other toxicity benchmarks, such as LOECs and LOAELs, will be converted to aquatic and terrestrial NOECs or terrestrial NOAEL values following methodology described in Section 11.1 and 11.2, respectively.~~

~~The principal sources of toxicity benchmarks that were reviewed for the derivation of risk assessment TRVs and RfCs at the SSFL include:~~

~~Terrestrial Birds and Mammals~~

- ~~EFA West (1998), as cited in DTSC (2000)~~
- ~~ORNL Toxicological Benchmarks (Sample *et al*. 1996)~~
- ~~ATSDR chemical-specific Toxicological Profiles~~
- ~~USEPA's IRIS database (USEPA 2005a)~~
- ~~Region 6 Combustor Guidance (USEPA 1999)~~

~~Soil Invertebrates~~

- ~~ORNL Toxicological Benchmarks (Efroymson *et al*. 1997; Will and Suter 1995)~~
- ~~Ecological Soil Screening Levels (USEPA 2003a-b, 2005d-n)~~
- ~~Region 6 Combustor Guidance (USEPA 1999)~~
- ~~Sverdrup *et al*. (2002)~~

~~Aquatic Biota~~

- ~~National Recommended AWQC (USEPA 2002b)~~
- ~~USEPA's ECOTOX database, as presented in USEPA (2002c)~~

~~Sediment Invertebrates~~

- ~~MacDonald *et al*. (2000) – metals~~
- ~~Johnson *et al*. (2002) – PAHs~~
- ~~Meader *et al*. (2002) – PCBs~~

~~To develop TRV values needed to derive ESLs, EFA West (1998) values were used where available (ESL derivation is presented in Appendix C). For compounds without TRV values from EFA West (1998), the lowest available TRV for a particular chemical was selected from the other sources cited above.~~

~~For development of TRVs to derive ESLs, the most conservative (lowest) and appropriate toxicity value applicable to the assessment endpoints described in Section 9.6, will be used. Generally, these assessment endpoints are established to protect species populations and abundance of food and prey species. While mortality, reproductive effects, and developmental effects are considered to be toxic endpoints that directly impact populations, its is also possible that toxic effects considered less serious could impact a population at lower exposure levels than would produce mortality, reproductive effects, and developmental effects. Therefore, the selection of appropriate toxicity studies and toxic endpoints for derivation of TRVs to calculate ESLs will consider the established assessment endpoints presented in Section 9.6 as well as the nature of other "less serious" toxic effects and the relative magnitude of their no effects levels. Baseline risk assessment TRVs are not presented in this SRAM, but will be derived on a case-by-case basis as required for investigational unit risk assessments.~~

~~The following sections describe the specific selection or derivation of toxicity benchmarks for use in SSFL ecological screening evaluations.~~

~~11.1 Reference Concentrations~~

~~11.1.1 Aquatic Receptors~~

~~Benchmark RfCs for surface waters were obtained from the National Recommended Water Quality Criteria for Priority Pollutants, AWQC table (USEPA 2002b). AWQC are intended to~~

~~prevent significant toxic effects associated with either acute or chronic exposures to species occurring in a water body. AWQC are designed to protect for acute exposures at the lower 5th percentile of the distribution of species with a safety factor of two and to protect for chronic exposures at a similar level. AWQC are calculated with higher emphasis on the most sensitive species for which reliable toxicity data are available. Thus, their use as RfCs implies that they will be protective of all organisms found in aquatic habitats at the SSFL.~~

~~For compounds without freshwater AWQC values, the principal source for aquatic toxicity data for chemical-specific RfC development was the USEPA ECOTOX database (USEPA 2002c). For aquatic species, a common toxicological endpoint is the LC_{50}, the chemical concentration that was lethal to 50 percent of the test animals in a specified time period. Because the 96-hour LC_{50}s represent acute exposures and the RfCs are designed to protect against chronic exposures, the 96-hour LC_{50} data are divided by an uncertainty factor of 100 to approximate chronic NOEC values (see Section 11.1.3 for further discussion of uncertainty factors). If no 96-hour LC50 was reported, an alternate duration was selected if available. If no chemical-specific toxicity information was available in ECOTOX, a chemical with structural similarity was selected as a surrogate. RfCs for dioxin and PCB congeners were generated using the World Health Organization congener-specific TEFs for fish (Van den Berg *et al*. 1998) and the LC_{50} for 2,3,7,8-TCDD. As pointed out by DTSC (2005a), a caveat summarized by Van den Berg *et al*. (1998) noted that tissue-based TEFs applied to dioxin, furan, or PCB congener soil, sediment, food, or water exposure concentrations generates highly uncertain risk estimates.~~

~~The available AWQCs, 96-hour LC_{50} values and the chronic RfCs for the chemicals identified in surface water at the SSFL to date are presented in Table 11-1. RfCs may also be derived from primary toxicity studies in cases where there is more recent toxicity information that has become available since the publication of the above-cited sources.~~

~~Benchmark RfCs for sediments are based on recommended sediment quality criteria as published by MacDonald *et al*. (2000), Johnson *et al*. (2002), and Meader *et al*. (2002) for metals, PAHs, and PCBs, respectively. Sediment RfCs are presented in Table 11-2.~~

~~11.1.2 Terrestrial Invertebrates~~

~~Studies on soil concentrations that pose a risk to invertebrate receptors are limited. Soil benchmarks were obtained primarily from Efroymson *et al*. (1997), USEPA EcoSSLs (2003a-b, 2005d-n), USEPA Combustor Guidance (1999), and Sverdrup *et al*. (2002). Benchmarks for~~

~~chemicals not listed will be derived from the literature. The RfCs for terrestrial invertebrates are presented in Table 11-3.~~

~~11.2 Toxicity Reference Values~~

~~In agreement with DTSC, TRVs for terrestrial mammalian and avian species for use in baseline risk assessment are not presented in this SRAM, but will be derived as needed on a site-specific basis during the preparation of investigational unit risk assessments. However, terrestrial mammal and bird TRVs were derived for the purpose of deriving ESLs, and are presented in Appendix C. The methods described below generally apply to the selection or derivation of TRVs for both ESLs and for use in baseline risk assessments.~~

~~As recommended by DTSC, the following secondary sources were evaluated for the identification and selection of applicable TRVs for terrestrial wildlife at the SSFL:~~

- ~~Navy/Biological Technical Advisory Group (BTAG) TRVs summarized in EFA West (1998);~~
- ~~Toxicity benchmark values developed and/or summarized for wildlife by ORNL (Sample *et al.* 1996);~~
- ~~Toxicity values summarized in the ATSDR chemical-specific Toxicological Profiles; and,~~
- ~~The USEPA's IRIS.~~

~~These secondary sources were reviewed to select the lowest screening values for ESLs. It should be noted that without thorough review of all the primary studies and other relevant literature, the values obtained from these sources are only as defensible as the secondary literature sources cited. To develop TRVs for site-specific ecological risk assessments, the primary literature will be reviewed.~~

~~For the purpose of selecting applicable TRVs to derive ESLs from the above-cited sources, the effects considered ecologically relevant include growth, reproduction, mortality, and other less serious effects that are relevant to assessment endpoints described in Section 9.6 (*i.e.*, protection of receptor populations and communities and their food sources). The relevancy of the route of administration was considered secondary to the effect. The highest NOAEL lower than the lowest LOAEL is used when available. If a NOAEL is derived by application of an uncertainty factor to a LOAEL (to adjust for endpoint) and the derived NOAEL TRV value is lower than an actual measured NOAEL, the measured NOAEL is used. Uncertainty factor (UF) application~~

~~was performed using the same methods as were used for deriving ESL TRVs, as described in Section 3.2.1.2, and below.~~

~~For chemicals without chronic dose-response-based NOAELs, but for which other toxicity values were available, uncertainty factors were applied to extrapolate these other toxicity values to chronic NOAELs. These other toxicity values include less than chronic NOAELs (*e.g.*, subchronic NOAELs), LOAELs, and LD_{50}s. Specifically, a UF of 5 was used to adjust LOAEL TRVs to NOAEL TRVs; a UF of 2 was used to extrapolate TRVs derived from subchronic studies to chronic TRVs. An uncertainty factor of 100 was used to adjust LD_{50} values to chronic NOAEL equivalent values. Uncertainty factors were combined as necessary.~~

~~If no toxicity values were available for a particular compound, appropriate surrogate chemical chronic NOAELs were used as the mammalian TRVs. Surrogate chemicals were selected based on structural chemistry, specifically, the active moiety/functional group of the chemical, and are expected to exhibit toxicity equal to, or greater than, the particular compound without toxicity values. Therefore, uncertainty factors were not included to account for surrogate use. This process was only performed for chemicals for which a NOAEL, LOAEL, or LD_{50} toxicity value was available. In those cases where appropriate chemical surrogates were not identified, the most conservative TRV within the chemical class (*e.g.*, VOCs, metals, etc.) was used as the TRV.~~

~~To develop TRVs for dioxin PCB congeners, congener specific TEFs compiled by Van den Berg *et al.* (1998) were applied to the mammalian and avian 2,3,7,8-TCDD TRVs. The TEFs serve as weighting factors to generate 2,3,7,8-TCDD equivalent toxic potency for the other 16 2,3,7,8-substituted dioxin congeners and 12 coplanar PCB congeners. The mammalian and avian specific 2,3,7,8-TCDD TRVs were multiplied by the congener-specific TEFs to derive the congener specific TRVs.~~

~~Finally, laboratory studies may have been conducted on species other than the receptor species selected for ecological risk assessment at the SSFL. If toxicity values used were not based on data for that specific species, an allometric conversion based on body size (*i.e.*, weight and surface area) was used to extrapolate between species, but only in cases where there was a 100-fold difference between test species' and representative species' body weights as recommended by DTSC (1999c). The body size adjusted TRVs, referred to here as "adjusted NOAEL-equivalent toxicity values," were calculated using the allometric conversion described in Equation 11-1 (Sample and Arenal 1999):~~

$$TRV_{adj} = TRV_t \, (BW_t/BW_r)^{SF} \qquad (11\text{-}1)$$

~~Where:~~

~~TRV_{adj} = Adjusted NOAEL-equivalent TRV (mg/kg of body weight per day)~~
~~TRV_t = NOAEL-equivalent toxicity reference value for test organism (mg of chemical/kg of body weight per day)~~
~~BW_t = Body weight for test organism (kg)~~
~~BW_r = Body weight for receptor species (kg)~~
~~SF = Body size scaling factor (unitless)~~

~~Sample and Arenal (1999) developed chemical-specific mammalian scaling factors (SFs) for 167 chemicals and avian SFs for 194 chemicals. A body size SF of (1 – 0.94), or 0.06, was used to extrapolate TRVs between mammalian species for which chemical-specific SFs were not available (Sample and Arenal 1999). An SF of zero was used in Equation 11-1 to extrapolate TRVs between avian species. Mineau *et al*. (1996) identified a mean SF of (1 – 1.15) for birds; Sample and Arenal (1999) recently reported a mean SF of (1 – 1.2) for birds. However, in an earlier study, Sample *et al*. (1996) reported that scaling factors for a majority of the chemicals evaluated (29 of 37) were not significantly different from 1. Therefore, a SF of zero for TRV extrapolation between avian species was determined to be more appropriate for scaling between avian species.~~

~~From an ecological standpoint, basing a TRV on a NOAEL may be unduly conservative because exceedance of a NOAEL does not necessarily imply an adverse effect at the receptor population level. The U.S. Navy and the BTAG along with other consultants and federal agencies produced a consensus publication (Engineering Field Activity, West; EFA West) in 1998. EFA West proposed both conservative TRV-low values for use in screening and TRV-high values that represent a mid-range adverse effect level. The EFA West TRVs were intended to be used to quickly screen sites that were clean and those sites where impacts were likely to occur. It should be noted that as initially agreed among the EFA West participants, these draft TRVs were only to be used at Navy sites in the San Francisco Bay area. Nevertheless, the DTSC has sanctioned the use of TRV-high values to estimate the upper limit of an estimated hazard quotient with the caveat that if the value is exceeded, the adverse effect upon which the TRV was derived can be assumed to occur (DTSC 2000). A small mammal health protective goal based on effects to an individual is not consistently demonstrated through the EFA West selection of TRV-high values. TRV-high endpoints range from, for example, a TRV-high LOAEL for effect of a 50 percent reduction in fetuses (PCBs) to a TRV-high LOAEL for hair loss (thallium). Therefore, EFA West TRV-high values are not always appropriate for protection against population-level ecological~~

~~effects. The population level ecological significance of the critical effect was taken into consideration, and professional judgment was applied in the use of EFA West TRV high values as TRVs.~~

~~11.3 Toxicity Criteria for Plants~~

~~Plants are an assessment endpoint, specifically to protect the abundance of native terrestrial vegetation by limiting acute and chronic adverse effects from exposure to site-related chemicals. Efforts to obtain appropriate and applicable toxicity data for plants have proven that plant toxicity data are limited. The majority of phytotoxicity studies readily available in the scientific literature used exposure media such as vermiculite and hydroponics that are not representative of natural soil conditions. The effect of using such media is illustrated in the comparison of soil TRVs for metals, which are purportedly protective of plants, to the ambient background metal concentrations at the SSFL. The comparison suggests that significant adverse impacts to plants should result from ambient background metal concentrations in soils at the SSFL. However, both native and nonnative plant species appear to thrive throughout the SSFL property, despite exposure to ambient soil metal concentrations well above the literature-derived TRVs. Moreover, the toxicity data available from plant toxicity studies have only been conducted on very few organic chemicals.~~

~~For the vast majority of chemicals requiring evaluation at the SSFL, there are no phytotoxicity data. This endpoint is more readily assessed and characterized through observational studies (*i.e.*, transect studies) at each site during the ecological risk assessment. Since the abundance of native terrestrial vegetation is a function of numerous factors, including anthropogenic impediments (*i.e.*, buildings, roadways, other structures), a qualitative observational assessment of plant abundance will be performed (see Section 12.1.4). In cases where there is evidence suggesting that chemical contamination may have adversely impacted the abundance of native terrestrial vegetation, additional quantitative assessments may be conducted.~~

~~11.4 Critical Tissue Concentrations~~

~~Critical tissue concentrations are chemical concentrations in organism tissue that correlate to the absence of adverse effects. As an additional line of evidence, terrestrial and/or aquatic receptor tissue concentrations may be estimated using site-specific BAFs or literature-based BAFs. Estimated receptor tissue concentrations will be compared to relevant critical tissue concentrations reported in the scientific literature (*e.g.*, Kabata-Pendias and Pendias 1992; Beyer~~

~~*et al*. (1996), Jarvinen and Ankley (1999); Meader *et al*. 2002) to support the risk assessment. Additional lines of evidence will be discussed in the uncertainty section of the risk assessment.~~

SECTION 12

12 ECOLOGICAL RISK CHARACTERIZATION

- **This entire section has been replaced by Appendix F of the SRAM Rev. 2 Addendum.**

~~Risk characterization combines information concerning exposure to chemicals with information about the potential effects of those chemicals to estimate potential ecological risks to representative species. Risk characterization addresses the following questions:~~

- ~~Are ecological receptors currently exposed to site-related CPECs at levels capable of causing harm, or is future exposure of receptors likely?~~
- ~~If adverse ecological effects are observed or predicted, what are the types, extent, and severity of effects?~~
- ~~What are the principal uncertainties associated with the risk characterization?~~

~~Generally, a weight-of-evidence approach is used. In other words, the physicochemical properties, bioavailability, historical site use, and areal distribution of CPECs, in addition to the quantitative risk estimates, are used to determine the potential for ecological risk. Moreover, the suitability of available habitat at a given investigational unit for ecological receptor species of concern is determined. The following sections describe the proposed methodology for each individual line of evidence, as well as ways to combine and evaluate all the evidence. The uncertainty analysis will be discussed in Section 12.3.~~

~~12.1 RISK ESTIMATION METHODOLOGY~~

~~Risk estimation is the calculation of potential risk by comparing either the exposure concentration or exposure dosage (*i.e.*, the EPCs or ADDs) to the RfC or TRV, respectively. Risks will be estimated by calculating HQs and HIs as described below.~~

~~12.1.1 Hazard Quotients~~

~~DTSC (1996) defines an HQ as "the chemical-specific ratio of the dosage by an exposure route to the TRV for that route, or the chemical-specific ratio of a concentration in a medium to the RfC for that medium." As described in Section 10, ADDs and EPCs are estimates of the dosage or concentration (respectively) of a chemical experienced by a representative species in a particular exposure area.~~

~~HQs will be calculated using the following equation:~~

$$HQ_{ij} = ADD_{ij} / TRV_{ij} \quad (12\text{-}1)$$

$$HQ_{ij} = EPC_{ij} / RfC_{ij} \quad (12\text{-}2)$$

~~where:~~

~~HQ_{ij} = hazard quotient for the ith CPEC for the jth target receptor~~
~~ADD_{ij} = average daily dosage for the ith CPEC for the jth target receptor~~
~~TRV_{ij} = toxicity reference value for the ith CPEC for the jth target receptor~~
~~EPC_{ij} = exposure point concentration for the ith CPEC in abiotic media~~
~~$RfCij$ = reference concentration value for the ith CPEC for the jth target receptor~~

~~Both the CTE and RME will be evaluated in the estimation of HQs. Each of these exposure values will be considered qualitatively in the uncertainty analysis of the risk assessment. RfCs and TRVs are discussed further in Section 11. Estimation of HQs from ADDs and TRVs will include HQ estimates using the screening TRVs used to derive ESLs. If a chemical-specific HQ exceeds a value of 1 when using the ESL TRV, then the relevance and applicability of the ESL TRV will be evaluated, and if necessary, a more relevant and applicable TRV will be derived for calculation of the HQ. Both HQs, based on the ESL TRV and on a more relevant and applicable TRV, will be presented in the risk assessment.~~

~~If the exposure concentration is less than an acceptable effect or dosage concentration (HQ less than 1), then it is inferred that there exists a negligible potential for adverse effects. If a chemical-specific HQ exceeds a value of 1 when using the ESL TRV, then the relevance and applicability of the ESL TRV to the stated assessment endpoints will be evaluated, and if necessary, a more relevant and applicable TRV will be presented in the risk assessment. The likelihood of an adverse effect to the representative species will be evaluated with respect to other lines of evidence and uncertainty discussed in Sections 12.2 and 12.3, respectively.~~

~~12.1.2 Hazard Index~~

~~HQs are chemical and exposure pathway specific. However, representative species present at an investigational unit are usually exposed to more than one chemical and pathway. HIs are calculated to determine the potential cumulative effects of chemicals and pathways on a representative species. For each representative receptor, HIs will initially be calculated by summing all HQs for a given representative species across all exposure pathways. Since HQs are~~

~~considered to be additive only for those chemicals that act through similar mechanisms or on the same target organ, then in cases where the initially estimated HI exceeds 1, HIs will be calculated separately for each class of structurally similar chemicals that have a similar mechanism of action and the same target organ. HQs for individual chemicals will be used for chemicals that do not act similarly on the same organs.~~

~~As inferred by the preceding discussion, some chemicals have been shown to act through similar mechanisms or on the same target organ, and thus can be considered to have additive effects on organisms. For instance, coplanar PCBs and dioxins are believed to exhibit similar toxic action to that of 2,3,7,8-TCDD, but with differing relative degrees of toxicity among the individual PCB and dioxin congeners. These compounds are all highly lipophilic and persistent and readily bioaccumulate in food chains. As with 2,3,7,8-TCDD, at certain doses they all may cause body weight loss, thymic atrophy, dermal lesions, impairment of immune responses, hepatotoxicity, carcinogenesis, teratogenicity, and reproductive toxicity (Safe 1990). TEFs for these chemicals relative to 2,3,7,8-TCDD will be used to evaluate the toxicity of specific dioxins and coplanar PCB congeners (Van den Berg *et al*. 1998). In addition to estimating HQs for coplanar PCB congeners, HQs will also be estimated for Aroclor mixtures using appropriate TRVs for Aroclors. HQs for Aroclors will be included, as applicable, in the calculation of cumulative HIs; however, estimated HQs for coplanar PCBs will be presented separately due the high degree of uncertainty associated with their TEFs and to avoid potential "double counting" of exposure and risk. Other individual chemicals with similar toxicological characteristics may have an additive effect and will be added together, as necessary, for separate HI calculations.~~

~~Therefore, it is likely that there will be several HIs and HQs for each representative species, depending on the classes of CPECs that are evaluated. An HI value greater than or equal to 1 suggests the potential for adverse cumulative effects. Each HQ and HI calculated for each representative species will be evaluated for its contribution to ecological risk at each investigational unit.~~

~~12.1.3 Large Home Range Species Risk Calculations~~

~~Species with large home ranges (*e.g.*, red-tailed hawk, bobcat, mule deer, and great blue heron) may be exposed to chemicals at more than one investigational unit, as described in Sections 9 and 10. Therefore, the risk calculation will take into account potential exposure at one investigational unit, all investigational units with appropriate habitats within a Reporting Area, and across the entire facility. The steps for calculating the risk for each of these three exposure~~

~~scenarios are given below. A detailed example of how the risks will be calculated is provided in Appendix J.~~

~~**Step 1. Calculation of Individual Investigational Unit Risk**~~

~~**Step 1a – Select investigational units for evaluation.** Using information provided in the BCR (Appendix I) and methodology described in this SRAM (Sections 9 through 12), select investigational units for evaluation based on (1) appropriate foraging habitat for the large home range species of concern and (2) the presence of a complete exposure pathway in air, soil, sediment, or surface water, for the habitat. Each investigational unit will be evaluated, provided each contains appropriate habitat for the large home range species of concern.~~

~~**Step 1b – Calculate large home range species exposure at each investigational unit assuming that the species forages 100 percent of the time (assume area use factor = 1) in the investigational unit.** This will provide a conservative method for assessing risk presented in an investigational unit.~~

~~**Step 1c – Calculate the HQ based on the methodology described in Step 1b above and in Section 12.1.1.** The relative exposure at each investigational unit will be divided by the TRV to calculate the HQ. For CPECs with similar toxic effects (*e.g.*, PAHs), HQs will be added to calculate an HI. If the HQ or HI for the individual investigational unit is less than 1, then a decision identifying acceptably low risk to large home range species at 100 percent usage can be made for a site; however, the site will still be evaluated as part of the incremental risk to large home range species. The resulting HQ and HI values will be used to rank each investigational unit for potential ecological risk. Proceed to Step 2.~~

~~**Step 2. Calculation of Combined Investigational Unit Risk**~~

~~**Step 2a – Calculate exposure of large home range species at all investigational units with appropriate foraging habitat.** Relative exposure at each investigational unit will be calculated with a species-specific adjusted area use factor for each investigational unit that is based on the percent of foraging habitat provided in the investigational unit divided by the total foraging habitat provided by all investigational units.~~

~~**Step 2b – Calculate HQs and/or HIs based on methodology previously discussed.**~~

~~**Step 2c – Add chemical-specific HQs or HIs for each investigational unit to calculate a "total HQ or HI" for the large home range species.** If the combined investigational unit HQ~~

~~and/or HI is less than 1, then no additional iterations would be necessary because risk would be identified as acceptably low. If the "total HQ" and/or HI is greater than 1, further investigation is necessary. Total HQ or HI values will be used to rank each investigational unit for potential ecological risk and to identify potential contamination hot spots. Proceed to Step 3.~~

~~Step 3. Calculation of Facility-wide Risk~~

~~Step 3a – Identify and quantify acreage of appropriate habitat for large home range species that is not associated with investigational units but is contained within the entire facility.~~

~~Step 3b – Calculate facility-wide exposure assuming the large home range species evaluated in Step 2 also forage in habitats that are not part of investigational units (*i.e.*, exposed across the entire facility and not just in contaminated sites).~~ ~~Relative exposure at an investigational unit will be calculated with an adjusted area use factor based on the summed percent of foraging habitat on each investigational unit and the foraging habitat outside the investigational units divided by the total foraging habitat on all investigational units. Because this step incorporates all appropriate habitats available at the SSFL, and not just habitats occurring at a given investigational unit, background concentrations of metals and dioxins will be included in the exposure calculations.~~

~~Step 3c – Calculate the HQ and/or HI based on previously described methodology.~~

~~The resulting HQs will be added for each investigational unit and the areas outside of the investigational units at the SSFL to calculate a facility-wide total HQ or HI for the large home range species. This HQ and/or HI can be used to support risk management decisions.~~

~~The results of this iterative, large home range species risk assessment will be used to facilitate the risk decision and management processes as described in Section 12.4.~~

~~12.1.4 Evaluation of Plants in Ecological Risk Assessments~~

~~Plants are identified as assessment endpoints, specifically to protect the abundance of native terrestrial vegetation by limiting acute and chronic adverse effects from exposure to site-related CPECs. However, appropriate and applicable toxicity data for plants are limited (see Section 11). The abundance of native terrestrial vegetation is more readily assessed and characterized through observational studies (*i.e.*, transect studies) at each site during the ecological risk assessment. In cases where there is evidence suggesting that chemical contamination may have adversely impacted the abundance of native terrestrial vegetation, additional quantitative assessments may~~

~~be conducted. Following is a summary of the general approach to be used for risk assessments of investigational units at the SSFL.~~

~~The investigation units at the SSFL have terrestrial vegetation distributions ranging from highly disturbed and patchy to relatively continuous undisturbed stands of native vegetation. Because of the wide variability of potential habitat occurrence at each of the individual investigational units to be evaluated, the following three general approaches will be used to evaluate potential effects to vegetation at the SSFL potentially attributable to chemical concentrations in surface soil.~~

1. ~~For those investigational units with relatively highly disturbed and patchy distributions of vegetation types, specific vegetation communities associated with soil sampling efforts will be identified and an attempt will be made to find similar vegetation communities at locations within the investigational unit that have not been impacted by soil chemical concentrations. A semi-quantitative comparison will be made between these two areas to document changes, if any, that may be attributable to the presence of chemical concentrations in soil.~~

2. ~~For those investigational units with relatively large or continuous stands of vegetation, a semi-quantitative, visual comparison will be made between vegetation communities occurring in known areas of CPEC concentrations (based on soil sampling results) and similar vegetation communities in areas where soil sampling has not occurred. This approach is based on the assumption that soil sampling efforts at an investigational unit targeted areas where chemical impacts were possible based on historical practices and operations.~~

3. ~~For those investigational units with relatively highly disturbed areas (*e.g.*, pavement) and no complete exposure pathways, areas with similar chemical concentrations and relatively undisturbed vegetation will be located. As above, these areas will be compared to areas of lower chemical concentrations or areas with no history of chemical use or presence. A semi-quantitative comparison (*e.g.*, dominant species, number of species, abundance, percent cover, etc.) will be made between these two areas to document changes, if any, that may be attributable to the presence of chemical concentrations in soil.~~

~~Any areas of damaged, unhealthy, or otherwise anomalous vegetation associations within investigational units will be documented, and an attempt will be made to determine potential causes for the changes. The information will be summarized in the investigational unit risk assessments.~~

~~12.1.5 Evaluation of Potential Inter-Site Sediment Migration~~

~~The potential for significant migration of CPECs from the investigational unit under evaluation to a downgradient investigation unit through transport of sediment will be evaluated in each risk assessment for a Reporting Area. If a mechanism for sediment transport is suggested by the direction and slope of the land or by the presence of creeks or ditches connecting the two investigational units, this determination will be initially identified in each appropriate described in each site-specific risk assessment and fully discussed in the risk assessment for the appropriate Reporting Area. Evaluation of the potential impacts of sediment migration to a downgradient unit will be identified by a comparison of the ecological habitats, receptors, and exposure pathways that are relevant to the investigational unit under evaluation and the downgradient unit as follows:~~

~~1. If the ecological receptors and exposure pathways are identical at the investigational unit under evaluation and the downgradient unit, then it will be assumed that ecological risks at the adjacent unit could be has high as those at that site under evaluation. In these cases, it is conservatively assumed that no attenuation or dilution occurs during sediment transport, and that the concentrations of CPECs at an adjacent downgradient site could be as high as those at the site under evaluation. Therefore, if the risk assessment for the investigational unit under evaluation shows a potential unacceptable risk, then it will be assumed that risks at the adjacent site may also be unacceptable. Likewise, if the risk assessment for the investigational unit under evaluation concludes that risks are acceptable, then it will be assumed that risks at the downgradient site are also acceptable.~~

~~2. If the ecological receptors and exposure pathways are more sensitive at the downgradient unit as compared to the investigational unit under evaluation, then additional quantitative assessment will be performed using the soil concentration data from the investigational unit under evaluation and applying that data to the more sensitive ecological conditions at the downgradient unit. In general, for ecological risk assessment an aquatic habitat will be considered more sensitive than a terrestrial habitat.~~

~~The initial comparison of receptors, exposure pathways, and habitats will be described in the investigational unit risk assessments. Should quantitative evaluation of potential impacts to a downgradient unit be necessary, such evaluations will follow the methods as described in this SRAM, and will be presented in the investigation unit risk assessment as an attachment or the risk assessment for the Reporting Area.~~

~~12.2 WEIGHT OF EVIDENCE ANALYSIS AND RISK DESCRIPTION~~

~~A weight-of-evidence approach will be used to evaluate the risk to each representative species from different chemicals and the likelihood of adverse effects, taking into account factors such as the following: resulting HQ or HI values; past chemical use history at the site (*i.e.*, chemical of concern was used primarily in one portion of the site); habitat suitability for ecological receptors of concern (small amount of appropriate habitat onsite with extensive habitat offsite); physicochemical properties of chemicals (*i.e.*, chemical form in the environment, persistence, and mobility); bioavailability of chemicals (is a chemical bound to soil or in a form that is not readily absorbed; exposure assumptions (assuming a thrush spends 100 percent of its time in the most contaminated portion of the site); uncertainty factors used in derivation of toxicity criteria; and the uncertainty analysis discussed in Section 12.3. Using all lines of evidence, an estimate of the risk to each representative species will be determined.~~

~~Evaluating potential risk to ecological receptors will be an iterative process. The calculated HQs or HIs and the weight-of-evidence analysis will be used to support recommendations for the next phase of work, if necessary. It is possible that there will be HQs and HIs for chemicals and groups, respectively, that are greater than 1. An HQ or HI value of 1 will not be an absolute point of departure for ecological risk; rather, it will be used as a guideline. To simplify the risk description process, the value of one will be used as the point of reference for evaluating the environmental significance of HQs or HIs. HQs and HIs will be calculated based on the mean (CTE) and 95 percent UCL (RME) exposures for each representative species at each investigational unit. If the RME HQ or HI is less than 1, then risks to ecological receptors will be considered *de minimis* and no further action with respect to ecological risk assessment will be proposed (Figure 12-1). If the maximum HQ or HI is greater than 1, then the mean HQ or HI values will be examined. The likelihood of an adverse effect to representative species will depend on the magnitude of the risk quotient or index, the general toxicity of the chemical and its endpoint being evaluated, the bioavailability of the chemical, and other factors that will be taken into account in the weight-of-evidence analysis. For instance, an HQ of 10 based on the 95 percent UCL exposure concentration may be calculated for a terrestrial mammal exposed to lead using a TRV based on a soluble form of lead. However, only total lead was measured onsite and risk would be expected to be less than 10 due to expected lower bioavailability of total versus soluble lead. Existing habitats onsite will be considered; however, the entire site is considered for exposure to account for any changes onsite for land use in the future.~~

~~The need for refinement of exposure and toxicity assumptions will be made using professional judgment according to the flowchart on Figure 12-1. Uncertainty associated with each component of the ecological risk assessment will be identified as described below. Risk decision criteria will be based on the risk characterization, and recommendations to risk managers will be made as discussed in Section 12.4.~~

~~12.3 UNCERTAINTY ANALYSIS~~

~~Estimates of the potential for adverse effects from exposure to CPECs must often be made with imperfect information (data gaps) and may include several sources of uncertainty. To ensure that risk management decisions protective of ecological receptors are made despite these uncertainties, conservative assumptions are made that may overestimate rather than underestimate potential risks to these receptors. The principal common sources of uncertainty in the ecological risk assessment are described below and should be considered when evaluating risk estimates and when formulating risk management decisions for any investigational unit.~~

~~The uncertainty analysis section of the ecological risk assessment will summarize assumptions made for each element of the assessment and will evaluate the validity, strengths, and weaknesses of the analyses, as well as qualify the uncertainties associated with each risk estimate. This analysis addresses uncertainty associated with each component of the assessment: hazard identification, representative species, exposure estimation, toxicity criteria, and risk characterization. An important step in the ecological risk assessment will be to identify data gaps that may hinder or prevent the determination of potential risk and that need to be filled to facilitate such a determination.~~

~~Hazard Identification and Quantification~~

~~Uncertainty may be introduced in the selection and quantification (*i.e.*, statistical estimation of environmental concentrations) of the CPECs due to incomplete site chemical characterization. A comprehensive site characterization has been completed at each investigational unit with input from DTSC; therefore it is unlikely that chemicals are under-represented. Uncertainty is also introduced by the possibility that some detection limits were not adequate to register CPEC concentrations capable of inducing long-term chronic adverse effects in ecological receptors. There is uncertainty surrounding the substitution of the SQL for non detected chemical concentrations that are greater than toxicity criteria. Uncertainty in these components will be qualitatively evaluated for each investigational unit.~~

~~Receptor Selection~~

~~Knowledge of the potential suite of ecological receptors at the SSFL is based on previous field observations over several dates during different seasons. The range of representative species in this assessment encompasses range of potential receptors at the site. Therefore, it is unlikely that ecological receptors are under-represented in the species inventory. Uncertainties associated with representative species selection, diet, habitat use, ranges, and biology will be discussed qualitatively. Uncertainty concerning representation of feeding guilds and trophic levels at the facility is likely to be low, based on biological surveys of the facility and life history information available for most of the species.~~

~~Exposure Estimation~~

~~Uncertainty arises from the selection of exposure pathways and the quantitative estimation of contaminant uptakes. Factors that might reduce exposure rates, such as bioavailability from soil or surface water; degradation rates in soil or surface water; metabolic transformation in vegetation or invertebrates; receptor avoidance of contaminated soils, sediments, or surface water; dilution over distance; or frequency of receptor exposure to contaminated media, could add uncertainty to results. The collection of paired abiotic and biotic samples for exposure model validation will reduce some of these uncertainties. Uncertainties associated with exposure model assumptions and calculations will be discussed qualitatively.~~

~~Toxicity Criteria~~

~~Applicability of literature-derived toxicity data depends upon types of results available and methods used to arrive at these results. Test endpoints produced by laboratory and field tests may be reported as formally defined toxicological endpoints or as less stringently defined measures of mortality or sublethal effect; variations in format introduce a source of error when combined into a single TRV or RfC. Thus, seemingly equivalent toxicity values may be significantly different owing to differences in test protocols, test conditions, or responses of individual organisms (Lewis *et al*. 1990). Uncertainty surrounding toxicity criteria will be evaluated qualitatively.~~

~~Risk Characterization~~

~~The quotient method compares two point estimates, one for exposure and one for effect, to determine their position relative to each other. Each of these single point estimates actually represents a data set with a unique set of statistical characteristics, characteristics that strongly~~

~~influence the assessment of actual risk and the quantification of uncertainty. Focusing the risk characterization on a quotient of two numbers that have uncertainty associated with each creates additional uncertainty. Uncertainty associated with the risk characterization step will be qualitatively assessed.~~

~~12.4 ECOLOGICAL RISK DECISION CRITERIA~~

~~Ecological decisions made with the information provided in an ecological risk assessment will be based on a weight-of-evidence analysis. Information that will be synthesized and evaluated in the weight-of-evidence analysis includes:~~

- ~~Identified CPECs and potential exposure pathways~~
- ~~Estimated and field-verified EPCs~~
- ~~Estimated and potentially field-verified toxicity evaluations~~
- ~~Persistence and bioaccumulation potential~~
- ~~Life history, home range and foraging habits of representative species of concern~~

~~In addition, the weight-of-evidence analysis will consider the toxicological endpoint of the toxicity value used to calculate the HI, the magnitude of any uncertainty factors used to develop the final toxicity value, the uncertainty contained in exposure models, the quality of the onsite habitat relative to offsite habitat, and the range of representative species evaluated. Risk, relative to selected assessment endpoints (Section 9), will be characterized after this weight-of-evidence analysis is completed.~~

~~Based on the weight-of-evidence analysis, one of three following recommendations will be made to risk managers:~~

1. ~~No further action with respect ecological risk will be recommended for investigational unit(s) where *de minimus* risk (HI<1) to ecological receptors is identified for small home range species (*i.e.*, representative species that spend the majority of their life span within an investigational unit) and large home range species (*i.e.*, representative species that spend the majority of their life span outside of investigational units or forage across multiple investigational units). Single investigational units will not be recommended for no further action until cumulative risks to large home range representative species are evaluated across multiple investigational units.~~

~~2. Further evaluation by risk managers will be recommended for individual sites or site combinations where potential risk exceeds an HI of 1. This evaluation will include the selection of an appropriate remedial alternative (including no action). As appropriate, natural resource trustees, including the California Department of Fish and Game and the United States Fish and Wildlife Service, must be consulted in the selection of a remedial alternative.~~

~~3. A Phase III Impact Assessment may be recommended for sites where potential risk to ecological receptors is identified, and where it is determined that remediation may cause adverse effects to ecological receptors or their habitats.~~

SECTION 13

- **Some of the references listed below are no longer applicable due to revision or replacement of SRAM methodology, as described in this document and presented in appendices of the SRAM Rev. 2 Addendum. Additional references are provided in the SRAM Rev. 2 Addendum.**

- **References cited in inserted notes include:**

  - **CH2M Hill, 2012. An Updated Approach for Assessing the Vapor Intrusion Pathway, Boeing RCRA Facility Investigation Project, Santa Susana Field Laboratory, California. March.**

  - **DTSC, 2007. Consent Order for Corrective Action, Docket No. P3-07/08-003.**

  - **DTSC, 2012. Chemical Soil Background Study Report, Santa Susana Field Laboratory, Ventura County, California. Final. December.**

  - **USEPA, 2009. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment). Final. January.**

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TABLES

Table 1-1 (1 of 1)
Land Acquisition History at SSFL

LOCATION*	SSFL AREA	OWNERSHIP HISTORY	DATE DEED TRANSFERRED TO SSFL	GRANT DEED NUMBER	ACRES	LAND USE
A/B/C/D	I	3/1/47 portions of parcels A,B,C &D leased by North American Aviation, with option to purchase parcels A & B	NA	Recorded 4-29-47 as Document 8260, Book 786, Page 164	617.56 (leased)	Undeveloped
A	I	Ida M. Dundas ** (prior owner Lewis Mortimer & Gene Mortimer)	4/27/1954 to North American Aviation	No. 11872 Book 1198 Pg. 278 CA-0-1661-03	430.28	Undeveloped
B	I, III and IV	Henry William Silvernale, Beulah A. Silvernale, Wiliam W. Hall, Elizabeth Hall	4/2/1954 to North American Aviation	No. 9323 Book 1193 Pg 278	1095.55 (451.18) / 644.37	Undeveloped
C	I and II	Portion of Silvernale Property (see above) transferred to USAF	12/31/1958 to USAF	No. 57603 Book 1688 Pgs 212-245 CA-0-164-005	451.18	Undeveloped
D	Undeveloped Property (South)	Spruce Land Corp. (Developer of Bell Canyon)	9/30/1968 to North American Rockwell Corporation	No. 50795 Book 3373 Pg. 508 CA-0-1661-010	1032.3	Undeveloped
E	Undeveloped Property (South)	Geopac Property	4/16/1976 to Rockwell International Corporation	No. 30727 Book 4574 Pg. 788 CA-0-1664-002	110.25	Undeveloped
F	Undeveloped Property (North)	Brandeis Bardin Institute Property	2/15/1998 to Boeing North American, Inc.		181.7	Undeveloped

Total Deeded Acreage 2850.08

* For property location, see Figure 1-2.
** Two additional deeds were later recorded for very small parts (< 1 acre each) of the Dundas parcel.
1) Estate of Marian F. Lewis, 6/1/59, Grant Deed No. 20988, Book 1740, pg. 238.
2) John Jacob Groebli & Norma C. Groebli, 6/1/59, Grant Deed No. 28989, Book 1740, pg. 241.

Table 1-2 (Page 1 of 1)

Chemical Use and Wastes Generated at the SSFL

Chemical or Waste Category	Use	Types of Chemicals Used / Stored / Produced
Petroleum Test Fuels	Large engine and component systems testing	RP-1 (kerosene-based), JP-4 (jet fuel),
Storable Test Fuels	Small engine and component testing	monomethyl hydrazine (MMH), unsymmetrical dimethyl hydrazine (UDMH), hydrazine derivatives, N-nitrosodimethylamine
Oxidizers	Engine and component system testing	Nitrogen tetraoxide (NTO), inhibited red fuming nitric acid (IRFNA), liquid oxygen (LOX), and fluorine compounds
Solvents	Cleaning	Trichloroethene (TCE), tetrachloroethene (PCE), 1,1,1-trichloroethane (TCA), 1,1-dichloroethane (DCA), chlorofluorocarbons (Freon compounds), 1,4-dioxane
Caustic and Acidic Solutions	Laboratory testing	Potassium hydroxide, sodium hydroxide, hydrochloric and other acids
Scrap Metals	Construction	Copper, lead, zinc, etc.
Polychlorinated Biphenyls	Pre-1980 transformers, waste oils	Primarily Aroclor 1254 / 1260 mixtures
Petroleum Fuel and Solvent Burn Products	Generated through burning practices	Polyaromatic hydrocarbons (PAHs) and dioxins/furans
Solid Propellants and Energetic Compounds	Igniters and energetic testing	Perchlorate, beryllium, gycildyl azide polymer (GAP), RDX, HMX, and C-4
Vehicle Fuels	Transportation	Petroleum hydrocarbons (gasoline-range)
Waste Oil	Maintenance operations, lubricating oils	Petroleum hydrocarbons (oil-range)
Construction Debris	Construction	Concrete, asphalt, wood, scrap metal, and asbestos
"Green Liquor" Wastewater	Coal gasification processes	Water containing organic and sulfur compounds, and ash (generated from coal gasification operations)
Incinerator Ash	Refuse burning (paper, wood, etc.)	PAHs and dioxins
Photographic Waste	Photo and X-Ray development	Silver
Nuclear Energy Research Wastes	Area IV nuclear energy, research and testing	Sodium potassium (NaK)
Pyrophoric material	Ignition source	Triethyl aluminum/triethyl boron (TEA/TEB)
Biocides	Control algal growth in ponds [(a)]	Sodium hypochlorite [(a)]

(a) Biocides are not currently used in cooling waters or water treatment systems at the SSFL; sodium hypochlorite, an oxidizer, was used at sewage treatment plants as a disinfectant.

Sources: SAIC 1994; ICF 1993; Ogden 1996.

See Acronym List for definitions of acronyms.

Table 1-3 (Page 1 of 18)

SWMUs and AOCs at SSFL

SWMU or AOC	Description	Responsible Party	Regulatory Jurisdiction	Current Regulatory Program	Current Status	Comments
AREA I						
4.1	B-1 Area	Boeing	DTSC	RCRA Corrective Action	RFI	Originally a UST site under VCEHD. DTSC assumed oversight of field sampling after 1999 site review.
4.2	Area I Landfill	Boeing	VCEHD/ RWQCB DTSC	RCRA Corrective Action	RFI	DTSC lead for characterization; site action and lead agency determination based on results.
4.3	Building 324 Instrument Lab, Hazardous Waste Tank	Boeing	DTSC	RCRA Corrective Action	RFI	
4.4	Building 301 Equipment Lab, TCA Unit and Used Product Tank	Boeing	DTSC	RCRA Corrective Action	RFI	
4.5	LOX Plant Waste Oil Sump and Clarifier	NASA	DTSC	RCRA Corrective Action	RFI	Accelerated cleanup performed during 1993 (removal of clarifier).
4.6	LOX Plant Asbestos and Drum Disposal Area	NASA	VCEHD/ VCAPCD DTSC	RCRA Corrective Action	RFI	Asbestos cleanup conducted in 1990 under oversight of VCEHD and VCAPCD; NFA required by VCEHD.
4.7	Component Test Laboratory III (CTL-III)	Boeing	DTSC	RCRA Corrective Action	RFI	
4.8	Area I Thermal Treatment Facility (TTF)	Boeing	DTSC	RCRA Part A Permit Interim Status	RFI Undergoing closure	Awaiting approval of risk assessment methodology.

Table 1-3 (Page 2 of 18)

SWMUs and AOCs at SSFL

SWMU or AOC	Description	Responsible Party	Regulatory Jurisdiction	Current Regulatory Program	Current Status	Comments
4.9	Advanced Propulsion Test Facility (APTF)	Boeing	DTSC	RCRA Corrective Action	RFI	
4.10	APTF Surface Impoundment-1 (APTF - 1)	Boeing	DTSC	PC Permit RCRA Corrective Action	Closed	Soil vapor sampling near impoundment performed during RFI (included in APTF site). Groundwater monitoring ongoing as specified in PC Permit (1995).
4.11	APTF Surface Impoundment-2 (APTF - 2)	Boeing	DTSC	PC Permit RCRA Corrective Action	Closed	Soil vapor sampling near impoundment performed during RFI (included in APTF site). Groundwater monitoring ongoing as specified in PC Permit (1995).
4.12	Laser Engineering Test Facility (LETF)/ Component Test Lab I (CTL-I)	Boeing	DTSC	RCRA Corrective Action	RFI	Site expanded to include CTL-I during RFI field program; accelerated cleanup performed in 1993 (fluoride).
4.13	LETF Pond	Boeing	DTSC	RCRA Corrective Action	Closed	Clean–closed by DHS 1984.
4.14	Canyon Test Area and Ponds	Boeing	DTSC	RCRA Corrective Action	RFI	
4.15	Bowl Test Area and Ponds	Boeing	DTSC	RCRA Corrective Action	RFI	
4.16	Area I Reservoir (R-1 Pond)	Boeing	DTSC	RCRA Corrective Action	RFI	Surface water discharge from ponds monitored under RWQCB jurisdiction at NPDES outfall locations.

Table 1-3 (Page 3 of 18)

SWMUs and AOCs at SSFL

SWMU or AOC	Description	Responsible Party	Regulatory Jurisdiction	Current Regulatory Program	Current Status	Comments
4.17	Perimeter Pond	Boeing	DTSC	RCRA Corrective Action	RFI	Surface water discharge from ponds monitored under RWQCB jurisdiction at NPDES outfall locations.
4.18	Area I Air Stripping Towers (Canyon, Area I Road)	Boeing	DTSC VCAPCD	RCRA Part B Permit	Standby	Part of groundwater treatment system under jurisdiction of DTSC; currently inactive on standby. When operational, air discharges permitted by VCAPCD.
4.20	Former Rocketdyne Employee Shooting Range (Gun Club) [(a)]		NA	NA	NA	Included in RFA but property belongs to SMMC
4.19	Area I AOCs (combined and listed as a SWMU in RFA)	Boeing				
Area I – AOC	Happy Valley	Boeing	DTSC	RCRA Corrective Action	RFI	Interim measures (IM) performed in 1999 and 2003 (UXB 2002 and MWH 2004).
Area I – AOC	Component Test Laboratory V (CTL-V)	Boeing	DTSC	RCRA Corrective Action	RFI	New AOC added to RFI after DTSC site review.
Area I – AOC	APTF Aboveground Tanks	Boeing	DTSC	RCRA Corrective Action	RFI	Includes fuel, hydrazine, and ozonator ASTs at APTF site (SWMU 4.9). Ozonator tank exempt from RCRA.
Area I Leach Fields[(b)] (16):					Inactive	There are no active leach fields onsite; formerly under WDR issued by RWQCB.
Area I – AOC	Engine Test Facility, Building 312 Leach Field	Boeing	DTSC	RCRA Corrective Action	RFI	At B-1 Area site (SWMU 4.1).

Table 1-3 (Page 4 of 18)

SWMUs and AOCs at SSFL

SWMU or AOC	Description	Responsible Party	Regulatory Jurisdiction	Current Regulatory Program	Current Status	Comments
Area I – AOC	Instrument Lab, Building 324 Leach Field	Boeing	DTSC	RCRA Corrective Action	RFI	At IEL site (SWMUs 4.3, 4.4, AOC).
Area I – AOC	Chemistry Lab, Building 300 Leach Field	Boeing	DTSC	RCRA Corrective Action	RFI	At IEL site (SWMUs 4.3, 4.4, AOC). Leach field not found during RFI.
Area I – AOC	Solid Propellants Building 359 Leach Field and Sump	Boeing	DTSC	RCRA Corrective Action	RFI	RFA listed leach field incorrectly as Building 259; co-located sump added to RFI in 1996. Both at Building 359 Area site (Area I AOC). IM in progress.
Area I – AOC	Service Building 741 Leach Field	Boeing	DTSC	RCRA Corrective Action	RFI	At Building 359 Area site (Area I AOC).
Area I – AOC	Loading Building 376 Leach Field	Boeing	DTSC	RCRA Corrective Action	RFI	Building 376 is at Building 359 Area site (Area I AOC), but facility records indicate leach field did not exist.
Area I – AOC	Research Storage Yard, Building 423 Leach Field	Boeing	DTSC	RCRA Corrective Action	RFI	Combined with Building 317 leach field at LETF site (SWMU 4.12).
Area I – AOC	Canyon Control Center, Building 375 Leach Field	Boeing	DTSC	RCRA Corrective Action	RFI	Not listed in RFA, but included in CCR. Exact location and existence uncertain. Facility records show leach field did not exist.
Area I – AOC	Canyon Pretest, Building 382 Leach Field	Boeing	DTSC	RCRA Corrective Action	RFI	At Canyon site (SWMU 4.14).

Table 1-3 (Page 5 of 18)

SWMUs and AOCs at SSFL

SWMU or AOC	Description	Responsible Party	Regulatory Jurisdiction	Current Regulatory Program	Current Status	Comments
Area I – AOC	LETF, Building 317 Leach Field	Boeing	DTSC	RCRA Corrective Action	RFI	At LETF site (SWMU 4.12); combined with Building 423 leach field.
Area I – AOC	CTL-I, Building 309 Leach Field	Boeing	DTSC	RCRA Corrective Action	RFI	At LETF/CTL-I site (SWMU 4.12).
Area I – AOC	Bowl Control Center, Building 900 Leach Field	Boeing	DTSC	RCRA Corrective Action	RFI	At Bowl site (SWMU 4.15).
Area I – AOC	Bowl Pretest, Building 901 Leach Field	Boeing	DTSC	RCRA Corrective Action	RFI	Incorrectly listed in RFA as Building 905 (office trailer), and in CCR as Building 906 (change room). Leach field at Bowl site (SWMU 4.15).
Area I – AOC	CTL-III Test, Buildings 411/ 413 Leach Field	Boeing	DTSC	RCRA Corrective Action	RFI	At CTL-III site (SWMU 4.7).
Area I – AOC	CTL-III Welding, Building 412 Leach Field	Boeing	DTSC	RCRA Corrective Action	RFI	At CTL-III site (SWMU 4.7).
Area I – AOC	CTL-V Workshop, Building 439/420 Leach Field	Boeing	DTSC	RCRA Corrective Action	RFI	At CTL-V site (Area I AOC).
Area I USTs[(b)] (2):						

Table 1-3 (Page 6 of 18)

SWMUs and AOCs at SSFL

SWMU or AOC	Description	Responsible Party	Regulatory Jurisdiction	Current Regulatory Program	Current Status	Comments
Area I – AOC	Buildings 301/324 Gasoline USTs (UT-37/UT-38)	Boeing	DTSC	RCRA Corrective Action	RFI	Former gasoline USTs in parking lot west of B324 (at IEL, SWMUs 4.3/4.4). VCEHD jurisdiction of LUFT program; UT-37/UT-38 soil investigation oversight transferred to DTSC in 2000 (Beach 2000).
Area I – AOC	Building 301 Diesel UST (UT-44)	Boeing	VCEHD	LUFT	RFI (Closed)	Closed 1994. Former diesel UST located north of Building 301. Additional sampling requested by DTSC in area of tank for RFI at IEL site.
AREA II						
5.1	Area II Landfill	NASA	VCEHD/ RWQCB DTSC	RCRA Corrective Action	RFI	DTSC lead for characterization; site action and lead agency determination based on results.
5.2	ELV Final Assembly, Building 206	NASA	DTSC	RCRA Corrective Action	RFI	Site expanded during RFI field program to include area near Building 203.
5.3	Building 231 PCB Storage Facility	NASA	DTSC	Former RCRA Part A Permit	Closed	Closed 1998 by DTSC.
5.4	RD-9 Area Ultraviolet Light/ Hydrogen Peroxide (UV/H_2O_2) Treatment System	NASA	DTSC	RCRA Part B Permit	Standby	Part of groundwater treatment system under jurisdiction of DTSC. Currently inactive on standby.
5.5	Building 204 Former Waste Oil UST (UT-50)	NASA	DTSC	RCRA Corrective Action	RFI	Former waste oil UST closed by VCEHD in 1991. DTSC requested additional assessment for RFI.

Table 1-3 (Page 7 of 18)

SWMUs and AOCs at SSFL

SWMU or AOC	Description	Responsible Party	Regulatory Jurisdiction	Current Regulatory Program	Current Status	Comments
5.6	Former Area II Incinerator Ash Pile	NASA	DTSC	RCRA Corrective Action	RFI	Accelerated cleanup performed during 1993 (removal of ash pile).
5.7	Hazardous Waste Storage Area (HWSA) Waste Coolant Tank (WCT)	Boeing	DTSC	RCRA Corrective Action	RFI	Former tank used to store cutting oil.
5.8	HWSA Container Storage Area	Boeing NASA	DTSC	Former RCRA Part A Permit	Closed	Closed 1998 by DTSC.
5.9	Alfa Test Area	NASA	DTSC	RCRA Corrective Action	RFI	
5.10	Alfa Test Area Tanks	NASA	DTSC	RCRA Corrective Action	RFI	
5.11	Alfa Skim and Retention Ponds and Drainage	NASA	DTSC	RCRA Corrective Action	RFI	Previous sampling performed in channels for PC Permit.
5.12	Alfa/Bravo Skim Pond (ABSP)	NASA	DTSC	PC Permit	Closed	Soil vapor sampling near impoundment performed during RFI (included in Bravo site). Groundwater monitoring ongoing as specified in PC Permit (1995).
5.13	Bravo Test Area	NASA	DTSC	RCRA Corrective Action	RFI	
5.14	Bravo Test Stand Waste Tank	NASA	DTSC	RCRA Corrective Action	RFI	

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SWMUs and AOCs at SSFL

SWMU or AOC	Description	Responsible Party	Regulatory Jurisdiction	Current Regulatory Program	Current Status	Comments
5.15	Bravo Skim Pond and Drainage	NASA	DTSC	RCRA Corrective Action	RFI	Previous sampling performed in channels for PC Permit.
5.16	Storable Propellant Area Surface Impoundment-1 (SPA-1) and Drainage	NASA	DTSC	PC Permit	Closed	Soil vapor sampling near impoundment performed during RFI (included in SPA site); groundwater monitoring ongoing as specified in PC Permit (1995).
5.17	SPA Surface Impoundment-2 (SPA-2) and Drainage	NASA	DTSC	PC Permit	Closed	Soil vapor sampling near impoundment performed during RFI (included in SPA site); groundwater monitoring ongoing as specified in PC Permit (1995).
5.18	Coca Test Area	NASA	DTSC	RCRA Corrective Action	RFI	
5.19	Coca Skim Pond and Drainage	NASA	DTSC	RCRA Corrective Action	RFI	
5.20	Propellant Load Facility (PLF) Waste Tank	NASA	DTSC	RCRA Corrective Action	RFI	Tank never used.
5.21	PLF Ozonator Tank	NASA	DTSC	RCRA Corrective Action	RFI	Ozonator tank received RCRA variance from DTSC.
5.22	PLF Surface Impoundment	NASA	DTSC	RCRA Corrective Action	Closed	Closed by DHS in 1989.
5.23	Delta Test Area	NASA	DTSC	RCRA Corrective Action	RFI	

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SWMUs and AOCs at SSFL

SWMU or AOC	Description	Responsible Party	Regulatory Jurisdiction	Current Regulatory Program	Current Status	Comments
5.24	Delta Skim Pond and Drainage	NASA	DTSC	PC Permit	Closed	Soil vapor sampling near impoundment performed during RFI (included with Delta site); groundwater monitoring ongoing as specified in PC Permit (1995).
5.25	Purge Water Tank near Delta Treatment System	NASA	DTSC	RCRA Corrective Action	NFA	Polypropylene AST intermittently used since 1992 as temporary holding tank for groundwater to transfer to treatment system; DTSC did not request further investigation during 1999/2000 site review.
5.26	R-2A and R-2B Ponds and Drainage	NASA	DTSC	RCRA Corrective Action	RFI	Surface water discharge from ponds monitored under RWQCB jurisdiction at NPDES outfall locations.
5.27	Area II Air Stripping Towers (Delta and Bravo)	NASA	DTSC VCAPCD	RCRA Part B Permit	Operational	Part of groundwater treatment system under jurisdiction of DTSC; air discharges permitted by VCAPCD.
5.29	RD-51 Watershed [(c)]	(c)	(c)	(c)	(c)	
5.28	Area II AOCs (combined and listed as a SWMU in RFA)					
Area II – AOC	Building 515 Sewage Treatment Plant (STP) Area	NASA	RWQCB DTSC	NPDES Permit RCRA Corrective Action	Inactive RFI	When operational, discharges from sewage treatment plant under RWQCB jurisdiction (NPDES permit). Site includes Building 211 leach field (Area II AOC) and downslope area near RD-9 groundwater treatment system (SWMU 5.4).

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SWMUs and AOCs at SSFL

SWMU or AOC	Description	Responsible Party	Regulatory Jurisdiction	Current Regulatory Program	Current Status	Comments
Area II – AOC	Storable Propellant Area (SPA)	NASA	DTSC	RCRA Corrective Action	RFI	
Area II – AOC	Alfa/Bravo Fuel Farm (ABFF) and Stormwater Basin	NASA	RWQCB DTSC	SPCC RCRA Corrective Action	Operational RFI	Site added to RFI field program when soil impacts observed at fuel farm during underground pipeline removal.
Area II – AOC	Coca/Delta Fuel Farm (CDFF)	NASA	DTSC	RCRA Corrective Action	RFI	New AOC added to RFI after DTSC site review (Boeing 1997a).
Area II – AOC	Drainage Pipes Under ABSP	NASA	DTSC	PC Permit	Closed	Soil vapor sampling near impoundment drainage performed during RFI (included in Bravo site); groundwater monitoring ongoing as specified in PC Permit (1995).
Area II Leach Fields[(b)] (10):					Inactive	There are no active leach fields onsite; formerly under WDR Permit issued by RWQCB.
Area II – AOC	Area II Service Area, Building 211	NASA	DTSC	RCRA Corrective Action	RFI	Included with Building 515 STP site (Area II AOC).
Area II – AOC	Alfa Control Ctr, Building 208	NASA	DTSC	RCRA Corrective Action	RFI	At Alfa site (SWMUs 5.9/10/11).
Area II – AOC	Alfa Pretest, Building 212	NASA	DTSC	RCRA Corrective Action	RFI	North of Alfa site (SWMUs 5.9/10/11).
Area II – AOC	Bravo Pretest, Building 217	NASA	DTSC	RCRA Corrective Action	RFI	At Bravo site (SWMUs 5.13/14/15).

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SWMUs and AOCs at SSFL

SWMU or AOC	Description	Responsible Party	Regulatory Jurisdiction	Current Regulatory Program	Current Status	Comments
Area II – AOC	Bravo Recording Ctr, Building 213	NASA	DTSC	RCRA Corrective Action	RFI	At Bravo site (SWMUs 5.13/14/15).
Area II – AOC	Coca Pretest, Building 222	NASA	DTSC	RCRA Corrective Action	RFI	At Coca site (SWMUs 5.18/19).
Area II – AOC	Coca Upper Pretest, Building 234	NASA	DTSC	RCRA Corrective Action	RFI	At Coca site (SWMUs 5.18/19). Not listed in RFA but included in CCR.
Area II – AOC	Coca Control Center, Building 218	NASA	DTSC	RCRA Corrective Action	RFI	At Coca site (SWMUs 5.18/19). Listed incorrectly as Building 216 in RFA.
Area II – AOC	Delta Control Ctr, Building 224	NASA	DTSC	RCRA Corrective Action	RFI	At PLF site (SWMU 5.20/21/22).
Area II – AOC	Delta Pretest, Building 223	NASA	DTSC	RCRA Corrective Action	RFI	At Delta site (SWMU 5.23).
Area II USTs[(b)] (4 Sites)						
Area II – AOC	Building 207 Diesel UST (UT-53)	NASA	VCEHD	LUFT	Closed	Closed 1996. Former diesel UST on north side of Building 207.
Area II – AOC	UST across from Alfa/Bravo Fuel Farm (ABFF) (UT-52)	NASA	VCEHD	LUFT	Closed	Closed 1994. Former gasoline UST north of ABFF site (Area II AOC) along road.
Area II – AOC	Building 206 Diesel UST (UT-51)	NASA	VCEHD	LUFT	Closed	Closed 1996. Former diesel UST east of Building 206 (ELV site, SWMU 5.2).

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SWMUs and AOCs at SSFL

SWMU or AOC	Description	Responsible Party	Regulatory Jurisdiction	Current Regulatory Program	Current Status	Comments
Area II – AOC	Two Underground Tanks at Plant Services (UT-48 and UT-49)	NASA	VCEHD	LUFT	RFI (Tanks closed)	UT-48 closed 1996; former fuel oil UST located on east side of Building 204. UT-49 closed by VCEHD 1991; former gasoline UST located on south side of Building 204. Additional soil sampling requested by DTSC in area for Building 204 site.
AREA III						
6.1	Engineering Chemistry Laboratory (ECL) Building 270, Waste Tank, and Container Storage Area	Boeing	DTSC	RCRA Corrective Action	RFI	
6.2	ECL Pond and Suspect Water Pond	Boeing	DTSC	PC Permit RCRA Corrective Action	ECL Pond – Closed Suspect Pond -RFI	Soil vapor sampling near ECL Pond during RFI (included in ECL site); groundwater monitoring and remediation ongoing as specified in PC Permit (1995).
6.3	ECL Collection Tank	Boeing	DTSC	RCRA Corrective Action	RFI	Formerly used as groundwater transfer tanks under DTSC jurisdiction; secondary containment installed; no documented releases.
6.4	Building 418 Compound A Facility	Boeing	DTSC	RCRA Corrective Action	RFI	
6.5	Systems Test Laboratory IV (STL-IV) Test Area and Ozonator Tank	Boeing	DTSC	RCRA Corrective Action	RFI	Ozonator tank exempt from RCRA.

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SWMUs and AOCs at SSFL

SWMU or AOC	Description	Responsible Party	Regulatory Jurisdiction	Current Regulatory Program	Current Status	Comments
6.6	STL-IV-1 Impoundment and Drainage	Boeing	DTSC	PC Permit	Closed	Soil vapor sampling near impoundment during RFI (included in STL-IV site); groundwater monitoring ongoing as specified in PC Permit (1995).
6.7	STL-IV-2 Impoundment and Drainage	Boeing	DTSC	PC Permit	Closed	Soil vapor sampling near impoundment during RFI (included in STL-IV site); groundwater monitoring ongoing as specified in PC Permit (1995).
6.8	Silvernale Reservoir and Drainage	Boeing	DTSC	RCRA Corrective Action	RFI	Surface water discharge from ponds monitored under RWQCB jurisdiction at NPDES outfall locations.
6.9	Environmental Effects Laboratory (EEL)	Boeing	DTSC	RCRA Corrective Action	RFI	Accelerated cleanup performed in 1993 (limited TPH excavation).
6.10	STL-IV Groundwater Treatment System	Boeing	DTSC VCAPCD	RCRA Part B Permit	Operational	Part of groundwater treatment system under jurisdiction of DTSC; air discharges permitted by VCAPCD.
6.11	Area III AOCs (combined and listed as a SWMU in RFA)					
Area III – AOC	Building 260 ECL Runoff Tanks	Boeing	DTSC	RCRA Corrective Action	RFI	Aboveground tanks removed, area near tanks included in ECL site (SWMU 6.1).
Area III – AOC	Area III Sewage Treatment Plant (STP) Pond	Boeing	RWQCB DTSC	NPDES Permit RCRA Corrective Action	Inactive RFI	When operational, discharges from STP under RWQCB jurisdiction (NPDES permit). Catchment pond added to RFI field program during 1999/2000 DTSC site review.

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SWMUs and AOCs at SSFL

SWMU or AOC	Description	Responsible Party	Regulatory Jurisdiction	Current Regulatory Program	Current Status	Comments
Area III Leach Fields [(b)] (2):					Inactive	There are no active leach fields onsite; formerly under WDR Permit issued by RWQCB.
Area III – AOC	ECL, Building 270	Boeing	DTSC	RCRA Corrective Action	RFI	At ECL site (SWMUs 6.1/6.3).
Area III – AOC	SSET F Area, Buildings 253/254	Boeing	DTSC	RCRA Corrective Action	RFI	At STL-IV site (SWMU 6.5); listed incorrectly in RFA as located in Area IV.
AREA IV						
7.1	Building 056 Landfill	DOE	DTSC	RCRA Corrective Action	RFI	
7.2	Building 133 Hazardous Waste Management Facility	DOE	DTSC	RCRA Part B Permit	Inactive	Closure plan submitted to DTSC.
7.3	Building 886 Former Sodium Disposal Facility (FSDF)	DOE	DTSC	RCRA Corrective Action	RFI	Interim measures completed in 2000 (IT 2002).
7.4	Old Conservation Yard (OCY) Container Storage Area and Fuel Tanks	DOE	DTSC	RCRA Corrective Action	RFI	
7.5	Building 100 Trench	DOE	DTSC	RCRA Corrective Action	RFI	

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SWMUs and AOCs at SSFL

SWMU or AOC	Description	Responsible Party	Regulatory Jurisdiction	Current Regulatory Program	Current Status	Comments
7.6	Radioactive Materials Handling Facility (RMHF)	DOE	DOE/DHS DTSC	Part A Permit Interim Status	Operational	Site under DTSC/DOE jurisdiction; Part A permit administered by DTSC. Closure plan in preparation.
7.7	Rockwell International Hot Laboratory (RIHL), Building 020	DOE	DTSC	RCRA Corrective Action	RFI	Site investigation pending.
7.8	New Conservation Yard	Boeing	DTSC	RCRA Corrective Action	RFI	
7.9	ESADA Chemical Storage Yard	Boeing	DTSC	RCRA Corrective Action	RFI	
7.10	Building 005 Coal Gasification Process Development Unit (PDU)	Boeing	DTSC	RCRA Corrective Action	RFI	
7.11	Building 029 Reactive Metal Storage Yard	DOE	DTSC	RCRA Part B Permit	Operational	Closure plan submitted to DTSC.
7.12	Area IV AOCs (combined and listed as a SWMU in RFA)					
Area IV - AOC	Building 059 Former SNAP Reactor Facility	DOE	DOE/DHS DTSC	DOE Closure RCRA Corrective Action	RFI	Site undergoing demolition and decontamination under DHS/DOE jurisdiction; unrestricted release anticipated in 2005. Groundwater monitoring ongoing; RFI sampling scheduled after unrestricted release.

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SWMUs and AOCs at SSFL

SWMU or AOC	Description	Responsible Party	Regulatory Jurisdiction	Current Regulatory Program	Current Status	Comments
Area IV-AOC	Southeast Drum Storage Yard	Boeing	DTSC	RCRA Corrective Action	RFI	
Area IV-AOC	Sodium Reactor Experiment (SRE) Complex Area	Boeing	DTSC	RCRA Corrective Action	RFI	New AOC added to RFI after DTSC site review (DTSC 1998).
Area IV-AOC	Building 065 Metals Laboratory Clarifier	DOE	DTSC	RCRA Corrective Action	RFI	New AOC added after DTSC site review in 1999/2000.
Area IV-AOC	Building 457 Hazardous Materials Storage Area (HMSA)	DOE	DTSC	RCRA Corrective Action	RFI	New AOC added after DTSC site review in 1999/2000.
Area IV-AOC	Area IV Pond Dredge Area	Boeing	DTSC	RCRA Corrective Action	RFI	New AOC added after DTSC site review in 1999/2000.
Area IV Leach Fields (15):					Inactive	There are no active leach fields onsite; formerly under WDR issued by RWQCB.
Area IV – AOC	AI-Z1, Building 003	Boeing	DTSC	RCRA Corrective Action	RFI (removed)	At SRE site (Area IV AOC).
Area IV – AOC	AI-Z2, Building 064	DOE	DTSC	RCRA Corrective Action	RFI (removed)	Included in DOE leach fields RFI site (Area IV COC). Incorrectly listed as Building 014 in RFA.
Area IV – AOC	AI-Z3, Building 030	DOE	DTSC	RCRA Corrective Action	RFI (removed)	Included in DOE leach fields RFI site (Area IV AOC). Not located during RFI.

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SWMUs and AOCs at SSFL

SWMU or AOC	Description	Responsible Party	Regulatory Jurisdiction	Current Regulatory Program	Current Status	Comments
Area IV – AOC	AI-Z4, Building 093	DOE	DTSC	RCRA Corrective Action	RFI (removed)	Incorrectly listed as Building 003 in RFA. Part of DOE leach fields RFI site.
Area IV – AOC	AI-Z5, Building 021	DOE	DTSC	RCRA Corrective Action	RFI (removed)	Regulatory assignment subject to review pending approval of RMHF (SWMU 7.6) closure plan (Part A Permit).
Area IV – AOC	AI-Z6, Building 028	DOE	DTSC	RCRA Corrective Action	NFA (not present)	Not located during CCR investigation- facility records confirm the building never had a leach field. DTSC did not require further investigation during 1999/2000 site review.
Area IV – AOC	AI-Z7, Building 010/ 012	DOE	DTSC	RCRA Corrective Action	RFI (removed)	Not located during CCR or RFI. Included in DOE leach fields RFI site (Area IV AOC). Incorrectly listed as Building 012 in RFA and CCR.
Area IV – AOC	AI-Z8, Building 005/006	Boeing	DTSC	RCRA Corrective Action	RFI (removed)	At PDU RFI site (SWMU 7.10).
Area IV – AOC	AI-Z10, Building 383	DOE	DTSC	RCRA Corrective Action	RFI (removed)	Incorrectly listed as Building 483 in RFA. Included in DOE leach fields RFI site (Area IV AOC).
Area IV – AOC	AI-Z11, Building 009	DOE	DTSC	RCRA Corrective Action	RFI (removed)	Included in DOE leach fields RFI site (Area IV AOC).
Area IV – AOC	AI-Z12, Building 020	DOE	DTSC	RCRA Corrective Action	RFI (removed)	At RIHL RFI site (SWMU 7.7).
Area IV – AOC	AI-Z13, Building 373	DOE	DTSC	RCRA Corrective Action	RFI (removed)	Included in DOE leach fields RFI site (Area IV AOC).

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SWMUs and AOCs at SSFL

SWMU or AOC	Description	Responsible Party	Regulatory Jurisdiction	Current Regulatory Program	Current Status	Comments
Area IV – AOC	AI-Z14, Building 363	DOE	DTSC	RCRA Corrective Action	RFI (removed)	Included in DOE leach fields RFI site (Area IV AOC).
Area IV – AOC	AI-Z15, Building 353	DOE	DTSC	RCRA Corrective Action	RFI (removed)	Included in DOE leach fields RFI site (Area IV AOC).
Area IV-AOC	Building 008 Warehouse	Boeing	DTSC	RCRA Corrective Action	RFI (not present)	Building 008 incorrectly listed in RFA as Area I leach field. Included as Boeing Area IV Leach Field RFI site.
Area IV-AOC	Building 011 Leach Field	Boeing	DTSC	RCRA Corrective Action	RFI (removed)	Leach field (AI-Z9) identified during investigation. Included as Boeing Area IV Leach Field RFI site.
7.13	SRE Watershed[(c)]	(c)	(c)	(c)	(c)	

Notes: All SWMUs and AOCs (except those added by DTSC during the field program) are described in the RFA Report (SAIC 1994) and CCR (ICF 1993). Site descriptions for all SWMUs/AOCs added during RFI are further described in the RFI WPAA (Ogden 2000b) and this document.

See Acronym List for acronym definitions

(a) The former Rocketdyne Employee Shooting Range is an offsite location and is owned by SMMC. It is included in this table because it was listed in the RFA.

(b) Individual leach fields and USTs located in Areas I, II, and III are all associated with existing SWMUs and/or AOCs, and are being evaluated as part of those sites. Individual Area IV leach fields located outside of other RFI sites have been grouped as RFI sites by owner. Nine of these are being evaluated as a single AOC (DOE Leach Fields RFI site), and two are being evaluated as a separate AOC (Boeing Leach Field RFI site). Of the remaining five leach field sites in Area IV, four are being evaluated with associated RFI sites, and one is pending approval of a RCRA closure plan. Please note that this table reflects corrections to site identification errors in the RFA (e.g., Building 008 listed as an Area I leach field in the RFA, but it is an Area IV warehouse).

(c) The RD-51 and SRE watersheds were identified as SWMUs in the RFA (SAIC 1994) based on radiologic sample data collected during initial sampling in 1993 (McLaren Hart 1993). Subsequent resampling of these areas did not detect or confirm initial data (McLaren Hart 1995).

Table 1-4 (Page 1 of 3)
RFI SITES AT SSFL

RFI Site SWMU Number or AOC and Name	**Sampling Plan Reference**
AREA I	
B-1 Area 4.1 B-1 Area AOC Building 312 Leach Field	DTSC site review 1999/2000
Area I Landfill 4.2 Area I Landfill	Area I & II Landfills Work Plan (MWH 2003e)
Instrument and Equipment Laboratories (IEL) 4.3 Building 324 Instrument Lab, Hazardous Waste Tank 4.4 Building 301 Equipment Lab, TCA Unit and Used Product Tank AOC Buildings 301/324 Gasoline USTs (UT-37/UT-38) AOC Building 301 Diesel UST (UT-44) AOC Building 300 Leach Field AOC Building 324 Leach Field	WPA (Ogden 1996) DTSC site review 1999/2000
Liquid Oxygen (LOX) Plant 4.5 LOX Plant Waste Oil Sump and Clarifier 4.6 LOX Plant Asbestos and Drum Disposal Area	WPA (Ogden 1996) DTSC site review 1999/2000
Component Test Laboratory III (CTL-III) 4.7 CTL-III AOC Building 413 Leach Field AOC Building 412 Leach Field	WPA (Ogden 1996) DTSC site review 1999/2000
Advanced Propulsion Test Facility (APTF) 4.9 Advanced Propulsion Test Facility AOC APTF Aboveground Tanks	WPA (Ogden 1996)
LETF/CTL-I 4.12 Laser Engineering Test Facility (LETF)/ Component Test Laboratory I (CTL-I) AOC Building 309 Leach Field AOC Building 317 Leach Field AOC Building 423 Leach Field	WPA (Ogden 1996) DTSC site review 1999/2000
Canyon Area 4.14 Canyon Area AOC Building 375 Leach Field AOC Building 382 Leach Field	WPA (Ogden 1996) DTSC site review 1999/2000
Bowl Area 4.15 Bowl Area AOC Building 900 Leach Field AOC Building 901 Leach Field	WPA (Ogden 1996) DTSC site review 1999/2000
R-1 Pond 4.16 Area I Reservoir (R-1 Pond)	WPA (Ogden 1996)
Perimeter Pond 4.17 Perimeter Pond	Identified in WPA DTSC site review 1999/2000
Building 359 Area AOC Building 359 Leach Field/Sump AOC Building 376 Leach Field AOC Building 741 Leach Field	WPA (Ogden 1996) DTSC site review 1999/2000
Happy Valley AOC Happy Valley	WPA (Ogden 1996)
Component Test Laboratory V (CTL-V) AOC CTL-V AOC Building 439 Leach Field	Letter Work Plan (Boeing 1997); Building 439 Leach Field identified in RFA
AREA II	
Area II Landfill 5.1 Area II Landfill	Area I & II Landfills Work Plan (MWH 2003e)
Expendable Launch Vehicle (ELV) 5.2 ELV Final Assembly, Building 206	WPA (Ogden 1996)
Building 204 USTs 5.5 Building 204 Former Waste Oil UST (UT-50) AOC Underground Tanks at Plant Services (UT-48 and UT-49)	WPA (Ogden 1996)
Former Area II Incinerator Ash Pile 5.6 Former Area II Incinerator Ash Pile	WPA (Ogden 1996)
Hazardous Waste Storage Area (HWSA) Waste Coolant Tank (WCT) 5.7 Hazardous Waste Storage Area Waste Coolant Tank	WPAA (Ogden 2000b)

Table 1-4 (Page 2 of 3)
RFI SITES AT SSFL

RFI Site SWMU Number or AOC and Name	**Sampling Plan Reference**
AREA II (Cont'd)	
Alfa Area 5.9 Alfa Test Area 5.10 Alfa Test Area Tanks 5.11 Alfa Skim and Retention Ponds and Drainage AOC Building 208 Leach Field AOC Building 212 Leach Field	WPA (Ogden 1996) DTSC site review 1999/2000
Bravo Area 5.13 Bravo Test Area 5.14 Bravo Test Stand Waste Tank 5.15 Bravo Skim Pond and Drainage AOC Building 213 Leach Field AOC Building 217 Leach Field	WPA (Ogden 1996) DTSC site review 1999/2000
Coca Area 5.18 Coca Test Area 5.19 Coca Skim Pond and Drainage AOC Building 222 Leach Field AOC Building 234 Leach Field AOC Building 218 Leach Field	WPA (Ogden 1996) DTSC site review 1999/2000
Propellant Load Facility (PLF) 5.20 PLF Waste Tank 5.21 PLF Ozonator Tank 5.22 PLF Surface Impoundment (Closed) AOC Building 224 Leach Field	Identified in WPA DTSC site review 1999/2000
Delta Area 5.23 Delta Test Area AOC Building 223 Leach Field	WPA (Ogden 1996) DTSC site review 1999/2000
R-2 Ponds 5.26 R-2A and R-2B Ponds and Drainage	Identified in WPA DTSC site review 1999/2000
Building 515 Sewage Treatment Plant (STP) AOC Building 515 STP Area AOC Building 211 Leach Field	WPA (Ogden 1996) DTSC site review 1999/2000
Alfa/Bravo Fuel Farm (ABFF) AOC ABFF and Stormwater Basin	DTSC site review 1997
Coca/Delta Fuel Farm (CDFF) AOC CDFF	Letter Work Plan (Boeing 1997)
Storable Propellant Area (SPA) AOC SPA	WPA (Ogden 1996)
AREA III	
Engineering Chemistry Laboratory (ECL) Area 6.1 ECL Building 270, Waste Tank, and Container Storage Area 6.2 ECL Suspect Water Pond 6.3 ECL Collection Tank AOC Building 260 ECL Runoff Tanks AOC Building 270 Leach Field	WPA (Ogden 1996) DTSC site review 1999/2000
Compound A Facility 6.4 Building 418 Compound A Facility	WPA (Ogden 1996)
Systems Test Laboratory IV (STL-IV) 6.5 STL-IV Test Area and Ozonator Tank AOC Buildings 253/254 Leach Field	WPA (Ogden 1996) DTSC site review 1999/2000
Silvernale Reservoir 6.8 Silvernale Reservoir and Drainage	WPA (Ogden 1996)
Environmental Effects Laboratory (EEL) 6.9 EEL	WPA (Ogden 1996)
Sewage Treatment Plant (STP) Pond AOC Sewage Treatment Plant (STP) Pond	DTSC site review 1999/2000
AREA IV	
Building 56 Landfill 7.1 Building 56 Landfill	WPA (Ogden 1996) B56 Landfill WP
Former Sodium Disposal Facility (FSDF) 7.3 Building 886 FSDF	Identified in WPA DTSC site review 1999/2000
Old Conservation Yard (OCY) 7.4 OCY Container Storage Area and Fuel Tanks	WPA (Ogden 1996)

Table 1-4 (Page 3 of 3)
RFI SITES AT SSFL

RFI Site SWMU Number or AOC and Name	**Sampling Plan Reference**
AREA IV (Cont'd)	
Building 100 Trench 7.5 Building 100 Trench	DTSC site review 1999/2000
Rockwell International Hot Laboratory (RIHL) 7.7 RIHL, Building 20 AOC Building 20 Leach Field	WPA (Ogden 1996) (revised in WPAA)
New Conservation Yard (NCY) 7.8 NCY	WPA (Ogden 1996)
Empire State Atomic Development Authority (ESADA) 7.9 ESADA Chemical Storage Yard	Identified in WPA DTSC site review 1999/2000
Coal Gasification Process Development Unit (PDU) 7.10 Building 005 Coal Gasification PDU AOC Buildings 005/006 Leach Field	Identified in WPA DTSC site review 1999/2000
Sodium Reactor Experiment (SRE) Area AOC SRE AOC Building 003 Leach Field	Letter Work Plan (Boeing 1997)
Southeast Drum (SE Drum) Storage Yard AOC SE Drum Storage Yard	DTSC site review 1999/2000
Pond Dredge Area AOC Pond Dredge Area	WPAA (Ogden 2000b)
Boeing Area IV Leach Fields AOC Building 011 Leach Field AOC Building 008 Warehouse	DTSC site review 1999/2000
Systems for Nuclear Auxiliary Power (SNAP) Facility AOC Building 59, SNAP Facility	WPAA (Ogden 2000b)
Building 65 Metals Laboratory Clarifier AOC Building 65, Metals Laboratory Clarifier	WPAA (Ogden 2000b)
Hazardous Materials Storage Area (HMSA) AOC Building 457, Former HMSA	WPAA (Ogden 2000b)
DOE Leach Fields AOC Building 009 Leach Field AOC Building 010 Leach Field AOC Building 030 Leach Field AOC Building 064 Leach Field AOC Building 093 Leach Field AOC Building 353 Leach Field AOC Building 363 Leach Field AOC Building 373 Leach Field AOC Building 383 Leach Field	DTSC site review 1999/2000
RMHF Leach Field AOC Building 021 Leach Field	Pending

Notes:

1. Sampling plans included in referenced document or as directed during field investigation by DTSC.

2. Because of proximity, the Building 011 and Building 008 sites will be reported together as one RFI site.

3. Only SWMUs and AOCs considered part of each RFI site are listed. No RCRA permitted units or closed USTs shown, with the exception of tanks for which DTSC has requested additional characterization. All SWMUs and AOCs included in the RFI are listed here and designated in Table 1-3 by "RFI" under "Current Status."

4. Leach Field AOCs originally introduced in the RFA (SAIC 1994)

See Acronym List for acronym definitions

Table 2-1 (1 of 2)

Sample Analytical Suites

Laboratory Analytical Method [a, b]	Types of Chemicals
Organics	
Methods 8290, 1613	Dioxin and Furan Compounds
Method 8330	Energetic Compounds
Methods 8010/8020, 8021, 8240, 8260, TO-14A	Volatile Organic Compounds[c]
Methods 418.1, 8015, 8015M	Petroleum Hydrocarbons
8321, CARB-429[d]	Polycyclic Aromatic Hydrocarbons
Methods 1668, 8080, 8082	Polychlorinated Biphenyls
Method 8270 SIM	Semivolatile Organic Compounds (selected list, low detection limits)
Method 8270	Semivolatile Organic Compounds (standard list and detection limits)
Method 1625	n-Nitrosodimethylamine
Inorganics	
Methods 6010/6020/7000[e]	Metals
None Established [f]	Tributyltin
Method SM2320	Alkalinity (total, bicarbonate, carbonate)
Method 300.0	Bromide, ortho-Phosphate
Methods 300, SM429, SM4500	Chloride, Nitrate
Method 335.0	Cyanide
Methods 300.0, 340.2, SM413	Fluoride
Methods 8315, ASTM D19, NIOSH 3500	Formaldehyde
Methods 7196, 7199	Hexavalent Chromium
None Established [g]	Hydrazine compounds

Table 2-1 (2 of 2)

Sample Analytical Suites

Laboratory Analytical Method [a, b]	Types of Chemicals
Method 300.0, 354.1	Nitrite
Method 300(M) [h], 314.0, 8321M[i], 331.0	Perchlorate
Methods 150.1, 9040, 9045	pH
Methods 300.0, 375.4	Sulfate
Method 376.1	Sulfide
Method 160.2	Total Dissolved Solids
Method 160.1	Total Suspended Solids

Notes:

(a) Analytical methods listed include historical and current laboratory procedures used for sample analysis at investigational units. This table provides a comprehensive list of analytical methods for any sample collected at an investigational unit that may be used in the risk assessment and is not meant to replace an agency-approved sampling and analysis plan for future investigations.

(b) As several revisions of the method may have been used, the letters designating the revisions have been omitted.

(c) Samples are currently collected and prepared according to Method 5035.

(d) California Air Resources Board isotope dilution method.

(e) Other methods may include 7470, 7471, 7740, 7841

(f) No formal regulatory-approved method exists; the method of Krone et al. (1989) has been approved by the Department of Toxic Substance Control (DTSC).

(g) No formal regulatory-approved method exists; the laboratory may use an ion chromatography procedure as approved by DTSC.

(h) Prior to the promulgation of USEPA 314.0, Method, the Department of Health Services (DHS) and DTSC reviewed and found acceptable an analytical procedure similar to Method 300.

(i) Prior to the promulgation of USEPA 331.0, DTSC reviewed and found acceptable a modified method 8321 (liquid chromatography/mass spectrometry/mass spectrometry) for confirmation purposes.

Table 2-2 (1 of 1)

Data Qualifier Reference Table

Qualifier	Organics	Inorganics
U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.	The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.
J	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.	The associated value is an estimated quantity.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification."	Not applicable.
NJ	The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.	Not applicable.
UJ	The analyte was not deemed above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.	The material was analyzed for, but was not detected. The associated value is an estimate and may be inaccurate or imprecise.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and to meet quality control criteria. The presence or absence of the analyte cannot be verified.	The data are unusable. (Note: Analyte may or may not be present.)

Table 2-3 (1 of 1)

Qualification Code Reference Table

Qualifier	Organics	Inorganics
H	Holding times were exceeded.	Holding times were exceeded.
S	Surrogate recovery was outside QC limits.	The sequence or number of standards used for the calibration was incorrect
C	Calibration %RSD or %D was noncompliant.	Correlation coefficient is <0.995.
R	Calibration RRF was <0.05.	%R for calibration is not within control limits.
B	Presumed contamination from preparation (method) blank.	Presumed contamination from preparation (method) or calibration blank.
L	Laboratory Blank Spike/Blank Spike Duplicate %R was not within control limits.	Laboratory Control Sample %R was not within control limits.
Q	MS/MSD recovery was poor.	MS recovery was poor.
E	Not applicable.	Duplicates showed poor agreement.
I	Internal standard performance was unsatisfactory.	ICP ICS results were unsatisfactory.
A	Not applicable.	ICP Serial Dilution %D was not within control limits.
M	Tuning (BFB or DFTPP) was noncompliant.	Not applicable.
T	Presumed contamination from trip blank.	Not applicable.
+	False positive – reported compound was not present.	Not applicable.
-	False negative – compound was present but not reported.	Not applicable.
F	Presumed contamination from FB or ER.	Presumed contamination from FB or ER.
$	Reported result or other information was incorrect.	Reported result or other information was incorrect.
?	TIC identity or reported retention time has been changed.	Not applicable.
D	The analysis with this flag should not be used because another more technically sound analysis is available.	The analysis with this flag should not be used because another more technically sound analysis is available.
P	Instrument performance for pesticides was poor.	Post Digestion Spike recovery was not within control limits.
*#	Unusual problems found with the data. The number following the asterisk (*) is the reference to a description of where the problem can be found.	Unusual problems found with the data. The number following the asterisk (*) is the reference to a description of where the problem can be found.

Notes:
BFB = bromofluorobenzene
D = difference
DFTPP = decafluorotriphenylphosphine
ER = equipment rinsate
FB = field blank
ICP = inductively coupled plasma
ICS = internal check standard
MS/MSD = matrix spike/matrix spike duplicate
QC = quality control
R = recovery
RPD = relative percent difference
RRF = relative response factor
RSD = relative standard deviation
TIC = tentatively identified compound

Table 2-4 (1 of 1)
PCB Sampling Locations and Analyses [a]

RFI Site	Number of Samples
Bravo Area	3
Silvernale Reservoir	2
Old Conservation Yard	1
Component Test Laboratory	1

Notes:

a. Aroclor mixtures and PCB congeners were analyzed using USEPA methods 8082 and 1668, respectively.
PCB- polychlorinated biphenyl

The extrapolation factors are unitless.

Table 2-5 (1 of 1)

Summary of Aroclor to PCB Congener Extrapolation Factors [a]

PCB Congener	Aroclor 1254[b] Extrapolation Factor (EF) ~~(ng congener/kg soil)/(µg Aroclor/kg soil)~~	Aroclor 1260[c] Extrapolation Factor (EF) ~~(ng congener/kg soil)/(µg Aroclor/kg soil)~~
77	1.5E-02	1.3E-02
81	3.0E-03	2.3E-03
105	1.2E-01	8.2E-02
114	4.5E-03	1.5E-03
118	2.7E-01	1.6E-01
123	3.0E-03	2.3E-03
126	7.5E-03	6.4E-03
156	6.3E-02	5.5E-02
157	1.2E-02	2.5E-02
167	2.1E-02	4.3E-02
169	3.7E-04	6.4E-04
189	3.0E-03	6.4E-03

Notes:

(a) Extrapolation factors are the maximum ratios of PCB congener ~~(ng/kg)~~ to Aroclor ~~(µg/kg)~~ concentration.

(b) Evaluation is based on seven paired Aroclor 1254 and congener samples.

(c) Evaluation is based on two paired Aroclor 1260 and congener samples.

EF - Aroclor to PCB congener extrapolation factor

PCB - polychlorinated biphenyl

~~kg - kilogram~~

~~ng - nanogram~~

~~µg - microgram~~

The TPH extrapolation methodology is no longer applicable because adequate data have been collected for petroleum chemical constituents.

Table 2-6 (1 of 1)

Molecular Formulas for Petroleum Constituents

Chemical	Molecular Formula
2-Methylnaphthalene	$C_{11}H_{10}$
Acenaphthene	$C_{12}H_{10}$
Acenaphthylene	$C_{12}H_{8}$
Anthracene	$C_{14}H_{10}$
Benzene	$C_{6}H_{6}$
Benzo(a)anthracene	$C_{18}H_{12}$
Benzo(a)pyrene	$C_{20}H_{12}$
Benzo(b)fluoranthene	$C_{20}H_{12}$
benzo(e)pyrene	$C_{20}H_{12}$
Benzo(g,h,i)perylene	$C_{22}H_{12}$
Benzo(k)fluoranthene	$C_{20}H_{12}$
Chrysene	$C_{18}H_{12}$
Dibenz(a,h)anthracene	$C_{22}H_{14}$
Ethylbenzene	$C_{8}H_{10}$
Fluoranthene	$C_{16}H_{10}$
Fluorene	$C_{13}H_{10}$
Indeno(1,2,3-cd)pyrene	$C_{22}H_{12}$
m,p-Xylene	$C_{8}H_{10}$
Naphthalene	$C_{10}H_{8}$
o-Xylene	$C_{8}H_{10}$
Perylene	$C_{20}H_{12}$
Phenanthrene	$C_{14}H_{10}$
Pyrene	$C_{16}H_{10}$
Toluene	$C_{7}H_{8}$
Xylenes (total)	$C_{8}H_{10}$

The TPH extrapolation methodology is no longer applicable because adequate data have been collected for petroleum chemical constituents.

Table 2-7 (1 of 1)

TPH and Petroleum Constituent Sampling Locations and Analyses [a]

Sample Locations	Number of Samples	Analyses Performed [b]
Bowl Area (SWMU 4.15 and AOC)	4	TPH, PAHs, 2-methylnapthalene, napthalene
Building 204 (SWMU 5.5 and AOC)	1	
Alfa Area (SWMU 5.9, 5.10,5.11)	2	
Bravo Area (SWMU 5.13, 5.14, 5.15)	2	
Alfa Bravo Fuel Farm (AOC)	2	
Coca/Delta Fuel Farm (AOC)	2	
B-1 Area (SWMU 4.1)	1	
Old Conservation Yard (SWMU 7.4)	1	
ELV (SWMU 5.2)	1	
Bowl Area (SWMU 4.15 and AOC)	3	TPH, BTEX
Bravo Area (SWMU 5.13,5.14 and 5.15)	1	
Alfa Bravo Fuel Farm (AOC)	2	
Coca/Delta Fuel Farm (AOC)	1	
B-1 Area (SWMU 4.1)	1	
Old Conservation Yard (SWMU 7.4)	1	

Notes:

a. Soil samples were analyzed using methods USEPA 8015B, CARB-429, and USEPA 8260B for TPHs. PAHs and BTEX, respectively.

b. After chemical analyses, all data were validated following Level IV protocol.

TPH-total petroleum hydrocarbons.

PAH- polycyclic aromatic hydrocarbons.

BTEX- benzene, toluene, ethylbenzene, and xylene.

The TPH extrapolation methodology is no longer applicable because adequate data have been collected for petroleum chemical constituents.

Table 2-8 (1 of 1)

Summary of TPH to Petroleum Constituent Extrapolation Factors

Chemical	Extrapolation Factor (mg PC/kg soil)/(mg TPH/kg/soil)
Benzene	1.2E-04 [a]
Ethylbenzene	1.2E-04 [a]
Toluene	1.2E-04 [a]
m,p-Xylene	3.6E-04 [a]
o-Xylene	8.0E-05 [a]
Xylene (total)	4.4E-04 [a]
2-Methylnaphthalene	2.8E-02 [a]
Naphthalene	6.9E-03 [a]
Acenaphthene	5.7E-04 [b]
Acenaphthylene	7.0E-05 [b]
Anthracene	3.7E-04 [b]
Benzo(a)anthracene	2.7E-05 [b]
Benzo(a)pyrene	2.7E-05 [b]
Benzo(b)fluoranthene	4.3E-05 [b]
Benzo(e)pyrene	2.1E-04 [b]
Benzo(g,h,i)perylene	2.2E-04 [b]
Benzo(k)fluoranthene	2.1E-05 [b]
Chrysene	5.9E-05 [b]
Dibenz(a,h)anthracene	1.1E-05 [b]
Fluoranthene	7.5E-05 [b]
Fluorene	5.7E-04 [b]
Indeno(1,2,3-cd)pyrene	2.4E-05 [b]
Perylene	1.2E-04 [b]
Phenanthrene	1.5E-03 [b]
Pyrene	1.4E-04 [b]

Notes:

(a) Applicable to the TPH C08-C11 fraction.

(b) Applicable to the TPH C11-C30 fraction

TPH - total petroleum hydrocarbons

PC - petroleum constituent

Table 3-1 (1 of 7)

Reportable Detection Limits [a]

Analyte	Water µg/L	Water µg/L	Soil µg/kg	Soil µg/kg	Soil Vapor ug/L	Soil Vapor ppbv	Air ug/L	Air ppbv	Air ug/L	Air ppbv
Inorganics	ICP-MS	ICP	ICP-MS	ICP						
Aluminum	N/A	50	N/A	0.01	N/A	N/A	N/A	N/A	N/A	N/A
Antimony	2	10	0.001	0.01	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic	1	5	0.0005	0.002	N/A	N/A	N/A	N/A	N/A	N/A
Barium	1	10	0.0005	0.001	N/A	N/A	N/A	N/A	N/A	N/A
Beryllium	0.5	4	0.0003	0.0005	N/A	N/A	N/A	N/A	N/A	N/A
Boron	N/A	50	N/A	0.005	N/A	N/A	N/A	N/A	N/A	N/A
Cadmium	1	5	0.0005	0.0005	N/A	N/A	N/A	N/A	N/A	N/A
Calcium	N/A	100	N/A	0.015	N/A	N/A	N/A	N/A	N/A	N/A
Chromium	2	5	0.001	0.001	N/A	N/A	N/A	N/A	N/A	N/A
Cobalt	1	10	0.0005	0.001	N/A	N/A	N/A	N/A	N/A	N/A
Copper	2	10	0.001	0.002	N/A	N/A	N/A	N/A	N/A	N/A
Iron	20	40	N/A	0.005	N/A	N/A	N/A	N/A	N/A	N/A
Lead	1	5	0.0005	0.002	N/A	N/A	N/A	N/A	N/A	N/A
Lithium	N/A	50	N/A	0.0063	N/A	N/A	N/A	N/A	N/A	N/A
Magnesium	N/A	20	N/A	0.01	N/A	N/A	N/A	N/A	N/A	N/A
Manganese	2	20	0.0005	0.001	N/A	N/A	N/A	N/A	N/A	N/A
Mercury	N/A	0.2	0.00002	0.00002	N/A	N/A	N/A	N/A	N/A	N/A
Molybdenum	2	20	0.001	0.002	N/A	N/A	N/A	N/A	N/A	N/A
Nickel	2	10	0.001	0.002	N/A	N/A	N/A	N/A	N/A	N/A
Potassium	N/A	500	N/A	0.05	N/A	N/A	N/A	N/A	N/A	N/A
Selenium	2	10	0.001	0.002	N/A	N/A	N/A	N/A	N/A	N/A
Silver	1	10	0.0005	0.001	N/A	N/A	N/A	N/A	N/A	N/A
Sodium	N/A	500	N/A	0.05	N/A	N/A	N/A	N/A	N/A	N/A
Thallium	1	10	0.0005	0.01	N/A	N/A	N/A	N/A	N/A	N/A
Vanadium	2	10	0.001	0.001	N/A	N/A	N/A	N/A	N/A	N/A
Zinc	20	20	0.01	0.005	N/A	N/A	N/A	N/A	N/A	N/A
Zirconium	N/A	200	N/A	25	N/A	N/A	N/A	N/A	N/A	N/A
Polychlorinated Biphenyls										
Aroclor 1016	0.5	1	50	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Aroclor 1221	0.5	1	50	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Aroclor 1232	0.5	1	50	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 3-1 (2 of 7)

Reportable Detection Limits [a]

Analyte	Water µg/L	Water µg/L	Soil µg/kg	Soil µg/kg	Soil Vapor ug/L	Soil Vapor ppbv	Air ug/L	Air ppbv	Air ug/L	Air ppbv
Polychlorinated Biphenyls										
Aroclor 1242	0.5	1	50	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Aroclor 1248	0.5	1	50	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Aroclor 1254	0.5	1	50	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Aroclor 1260	0.5	1	50	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PCB-28 (2,4,4')	0.001	N/A	0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PCB-44 (2,2',3,5')	0.001	N/A	0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PCB-52 (2,2',5,5')	0.001	N/A	0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PCB-66 (2,3',4,4')	0.001	N/A	0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PCB-77 (3,3',4,4')	0.001	N/A	0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PCB-81 (3,4,4',5)	0.001	N/A	0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PCB-101 (2,2',3,5,5')	0.001	N/A	0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PCB-105 (2,3,3',4,4')	0.001	N/A	0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PCB-114 (2,3,4,4',5)	0.001	N/A	0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PCB-118 (2,3',4,4',5)	0.001	N/A	0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PCB-123 (2',3,4,4',5')	0.001	N/A	0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PCB-126 (3,3',4,4',5)	0.001	N/A	0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PCB-128 (2,2',3,3',4,4')	0.001	N/A	0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PCB-138 (2,2',3,4,4',5')	0.001	N/A	0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PCB-153 (2,2',4,4',5,5')	0.001	N/A	0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PCB-156 (2,3,3',4,4',5)	0.001	N/A	0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PCB-157 (2,3,3',4,4',5')	0.001	N/A	0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PCB-167 (2,3',4,4',5,5')	0.001	N/A	0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PCB-169 (3,3',4,4',5,5')	0.001	N/A	0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PCB-170 (2,2',3,3',4,4',5)	0.001	N/A	0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PCB-180 (2,2',3,4,4',5,5')	0.001	N/A	0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PCB-187 (2,2',3,4',5,5',6)	0.001	N/A	0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PCB-189 (2,3,3',4,4',5,5')	0.001	N/A	0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PCB-195 (2,2',3,3',4,4',5,6)	0.001	N/A	0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PCB-206 (2,2',3,3',4,4',5,5',6)	0.001	N/A	0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
PCB-209 (2,2',3,3',4,4',5,5',6,6')	0.001	N/A	0.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 3-1 (3 of 7)

Reportable Detection Limits [a]

Analyte	Water µg/L	Water µg/L	Soil µg/kg	Soil µg/kg	Soil Vapor ug/L	Soil Vapor ppbv	Air ug/L	Air ppbv	Air ug/L	Air ppbv
Polychlorinated Dioxins/Furans										
2,3,7,8-TCDD	0.00001	N/A	0.001	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1,2,3,7,8-PeCDD	0.00005	N/A	0.005	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1,2,3,4,7,8-HxCDD	0.00005	N/A	0.005	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1,2,3,6,7,8-HxCDD	0.00005	N/A	0.005	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1,2,3,7,8,9-HxCDD	0.00005	N/A	0.005	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1,2,3,4,6,7,8-HpCDD	0.00005	N/A	0.005	N/A	N/A	N/A	N/A	N/A	N/A	N/A
OCDD	0.0001	N/A	0.01	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2,3,7,8-TCDF	0.00001	N/A	0.001	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1,2,3,7,8-PeCDF	0.00005	N/A	0.005	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2,3,4,7,8-PeCDF	0.00005	N/A	0.005	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1,2,3,4,7,8-HxCDF	0.00005	N/A	0.005	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1,2,3,6,7,8-HxCDF	0.00005	N/A	0.005	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2,3,4,6,7,8-HxCDF	0.00005	N/A	0.005	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1,2,3,7,8,9-HxCDF	0.00005	N/A	0.005	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1,2,3,4,6,7,8-HpCDF	0.00005	N/A	0.005	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1,2,3,4,7,8,9-HpCDF	0.00005	N/A	0.005	N/A	N/A	N/A	N/A	N/A	N/A	N/A
OCDF	0.0001	N/A	0.01	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Semivolatile Organic Compounds										
1,2,4-Trichlorobenzene	10	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1,2-Dichlorobenzene	10	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1,3-Dichlorobenzene	10	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1,4-Dichlorobenzene	10	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2,4,5-Trichlorophenol	20	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2,4,6-Trichlorophenol	20	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2,4-Dichlorophenol	10	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2,4-Dimethylphenol	20	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2,4-Dinitrophenol	20	N/A	660	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2,4-Dinitrotoluene	10	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2,6-Dinitrotoluene	10	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2-Chloronaphthalene	10	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2-Chlorophenol	10	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 3-1 (4 of 7)

Reportable Detection Limits [a]

Analyte	Water µg/L	Water µg/L	Soil µg/kg	Soil µg/kg	Soil Vapor ug/L	Soil Vapor ppbv	Air ug/L	Air ppbv	Air ug/L	Air ppbv
Semivolatile Organic Compounds										
2-Methylnaphthalene	10	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2-Methylphenol	10	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2-Nitroaniline	20	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2-Nitrophenol	10	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3,3'-Dichlorobenzidine	20	N/A	830	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3-Nitroaniline	20	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4,6-Dinitro-2-methylphenol	20	N/A	420	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4-Bromophenyl-phenylether	10	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4-Chloro-3-methylphenol	20	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4-Chloroaniline	10	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4-Chlorophenyl-phenylether	10	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3,4-Methylphenol	10	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4-Nitroaniline	20	N/A	830	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4-Nitrophenol	20	N/A	830	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzoic Acid	20	N/A	830	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzyl Alcohol	20	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
bis(2-Chloroethoxy)methane	10	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
bis(2-Chloroethyl)ether	10	N/A	170	N/A	N/A	N/A	N/A	N/A	N/A	N/A
bis(2-Chloroisopropyl)ether	10	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
bis(2-Ethylhexyl)phthalate	50	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Butylbenzylphthalate	20	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Carbazole	20	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dibenzo(a,h)Anthracene	20	N/A	420	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dibenzofuran	10	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Di-n-octylphthalate	20	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Di-n-butylphthalate	20	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Diethylphthalate	10	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Dimethylphthalate	10	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Hexachlorobenzene	10	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Hexachlorobutadiene	10	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Hexachlorocyclopentadiene	20	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 3-1 (5 of 7)

Reportable Detection Limits [a]

Analyte	Water µg/L	Water µg/L	Soil µg/kg	Soil µg/kg	Soil Vapor ug/L	Soil Vapor ppbv	Air ug/L	Air ppbv	Air ug/L	Air ppbv
Semivolatile Organic Compounds										
Hexachloroethane	10	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Isophorone	10	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
N-Nitroso-di-n-propylamine	10	N/A	250	N/A	N/A	N/A	N/A	N/A	N/A	N/A
N-Nitrosodiphenylamine (1)	20	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Nitrobenzene	20	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pentachlorophenol	20	N/A	830	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Phenol	10	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Acenaphthene	10	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Acenaphthylene	10	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Anthracene	10	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzo(a)anthracene	10	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzo(a)pyrene	10	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzo(b)fluoranthene	10	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzo(g,h,i)perylene	10	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzo(k)fluoranthene	10	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chrysene	10	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Fluoranthene	10	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Fluorene	10	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Indeno(1,2,3-cd)pyrene	10	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Naphthalene	10	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Phenanthrene	10	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Pyrene	10	N/A	330	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Volatile Organic Compounds	low[b]	medium[c]	low[b]	medium[c]	TO-15 SIM	TO-15 SIM	TO-15	TO-15	TO-15 SIM	TO-15 SIM
1,1,1-Trichloroethane	1	2	1	2	1	180	0.0011	0.198	0.00011	0.0198
1,1,1,2-Tetrachloroethane	1	5	2	5	1	143	0.014	2.00	N/A	N/A
1,1,2,2-Tetrachloroethane	1	2	2	2	1	143	0.0014	0.200	N/A	N/A
1,1,2-Trichloroethane	1	2	1	2	1	180	0.0011	0.198	0.000099	0.0178
1,1-Dichloroethane	1	2	1	2	1	243	0.00081	0.197	0.000081	0.0197
1,1-Dichloroethene	1	5	2	5	1	248	0.00079	0.196	0.0000395	0.0098
1,2,4-Trimethylbenzene	1	2	1	2	N/A	N/A	N/A	N/A	N/A	N/A
1,3,5-Trimethylbenzene	1	2	1	2	N/A	N/A	N/A	N/A	N/A	N/A

Table 3-1 (6 of 7)

Reportable Detection Limits [a]

Analyte	Water µg/L	Water µg/L	Soil µg/kg	Soil µg/kg	Soil Vapor ug/L	Soil Vapor ppbv	Air ug/L	Air ppbv	Air ug/L	Air ppbv
Volatile Organic Compounds	low[b]	medium[c]	low[b]	medium[c]	TO-15 SIM	TO-15 SIM	TO-15	TO-15	TO-15 SIM	TO-15 SIM
1,2-Dibromo-3-chloropropane	5	5	10	5	N/A	N/A	N/A	N/A	N/A	N/A
1,2-Dichlorobenzene	1	2	1	2	N/A	N/A	N/A	N/A	N/A	N/A
1,2-Dichloroethane	0.5	2	1	2	1	243	0.00081	0.197	0.000081	0.0197
1,3-Dichlorobenzene	1	2	1	2	N/A	N/A	N/A	N/A	N/A	N/A
1,4-Dichlorobenzene	1	2	1	2	N/A	N/A	0.0012	0.000196	N/A	N/A
2-Butanone	10	10	10	10	N/A	N/A	N/A	N/A	N/A	N/A
2-Chloro-1,1,1-Trifluoroethane	50	50	50	50	N/A	N/A	N/A	N/A	N/A	N/A
2-Chloroethyl Vinyl Ether	5	5	5	5	N/A	N/A	N/A	N/A	N/A	N/A
Acetone	10	10	10	10	N/A	N/A	N/A	N/A	N/A	N/A
Benzene	0.5	0.5	1	2	1	308	0.00064	0.197	0.0001504	0.0463
Bromodichloromethane	1	2	1	2	N/A	N/A	N/A	N/A	N/A	N/A
Bromoform	1	5	2	5	N/A	N/A	N/A	N/A	N/A	N/A
Bromomethane	1	5	2	5	N/A	N/A	N/A	N/A	N/A	N/A
Carbon Tetrachloride	0.5	5	2	5	1	156	0.0013	0.203	N/A	N/A
Chlorobenzene	1	2	1	2	N/A	N/A	N/A	N/A	N/A	N/A
Chloroethane	1	5	2	5	1	367	0.0011	0.404	N/A	N/A
Chloroform	1	2	1	2	1	201	0.00097	0.195	0.0000679	0.0136
Chloromethane	1	5	2	5	N/A	N/A	0.00082	0.000391	N/A	N/A
Chlorotrifluoroethene	50	50	50	50	N/A	N/A	N/A	N/A	N/A	N/A
cis-1,2-Dichloroethene	1	2	1	2	1	248	0.00079	0.196	0.0000553	0.0137
cis-1,3-Dichloropropene	0.5	2	1	2	N/A	N/A	0.00091	0.000197	N/A	N/A
Dichlorodifluoromethane	2	5	5	5	1	199	0.00099	0.197	N/A	N/A
Ethylbenzene	0.5	2	1	2	1	227	0.00087	0.197	N/A	N/A
Methylene Chloride	5	5	10	20	1	283	0.00069	0.195	0.000414	0.1172
Tetrachloroethene	1	2	1	2	1	145	0.0014	0.203	0.00014	0.0203
Toluene	0.5	2	1	2	1	261	0.0011	0.287	N/A	N/A
trans-1,2-Dichloroethene	1	2	1	2	1	248	0.00079	0.196	0.0000553	0.0137
trans-1,3-Dichloropropene	1	2	1	2	N/A	N/A	N/A	N/A	N/A	N/A
Trichloroethene	1	2	1	2	1	183	0.0011	0.201	0.00004125	0.0075
Trichlorofluoromethane	1	5	2	5	1	175	0.0022	0.385	N/A	N/A
Trichlorotrifluoroethane	10	10	10	10	1	128	0.0031	0.397	N/A	N/A

Table 3-1 (7 of 7)

Reportable Detection Limits [a]

Analyte	Water µg/L	Water µg/L	Soil µg/kg	Soil µg/kg	Soil Vapor ug/L	Soil Vapor ppbv	Air ug/L	Air ppbv	Air ug/L	Air ppbv
Volatile Organic Compounds	low[b]	medium[c]	low[b]	medium[c]	TO-15 SIM	TO-15 SIM	TO-15	TO-15	TO-15 SIM	TO-15 SIM
Vinyl Chloride	0.5	5	2	5	1	384	0.00051	0.196	1.9125E-05	0.0073
Xylene (total)	1.5	4	3	4	N/A	N/A	N/A	N/A	N/A	N/A
Xylenes, m-, p-	N/A	N/A	N/A	N/A	2	150	0.0022	0.330	N/A	N/A
Xylene, o-	N/A	N/A	N/A	N/A	1	75	0.00087	0.065	N/A	N/A

Notes:

µg/L = micrograms compound per liter of water

µg/kg = micrograms compound per kilogram soil or sediment

[a] Reportable detection limits (RDLs) are the reporting limits currently achievable by Del Mar Analytical, or other subcontract laboratories. Typical reporting limits will generally be equal to or lower than the values listed here. The actual detection limits achieved for a chemical in a specific sample are referred to as Sample Quantiation Limits (SQLs). SQLs, not RDLs, are used to evaluate data and estimate exposure in the risk assessments. Method detection limits (MDLs) should be sufficiently low enough to allow evaluation of risk for all pathways.

[b] Detection limit for typical soil/water extraction volume

[c] Detection limit for soil/water extracted in larger volume

This table has been replaced by sediment and water EcoRBSLs in Table 12-2 and Table 12-3 in Appendix F of the SRAM Rev. 2 Addendum.

Table 3-2 (1 of 2)

Criteria for Evaluating Levels of Detection for Sediment and Water Samples

	Sediment (mg/kg)		Water (µg/L)	
Analyte	Sediment Criteria[1]	Reference	Water Criteria[2]	Reference
Inorganics				
Antimony				
Arsenic	5.9	TEL	150.0	NRWQC-ch
Beryllium			0.5	NAWQC-ch*
Cadmium	0.6	TEL	1.1	NAWQC-ch
Chromium III	37.3	TEL	74.0	NRWQC-ch**
Chromium VI			11.0	NRWQC-ch
Copper	34.0	ER-L	9.0	NRWQC-ch**
Iron			1,000.0	NAWQC-ch
Lead	35.0	TEL	2.5	NRWQC-ch**
Mercury	0.15	ER-L	0.012	NAWQC-ch
Nickel	18.0	TEL	52.0	NRWQC-ch**
Selenium			5.0	NRWQC-ch
Silver	1.0	ER-L	0.1	NAWQC-ch
Thallium			4.0	NAWQC-ch*
Zinc	123.1	TEL	110.0	NAWQC-ch
Pesticides				
4,4'-DDD	0.002	ER-L		
4,4'-DDE	0.002	ER-L		
4,4'-DDT	0.001	ER-L	0.001	NAWQC-ch
Dieldrin	0.00002	ER-L	0.002	NAWQC-ch
Endosulfan (alpha and beta)			0.056	NAWQC-ch
Endrin	0.002	TEL	0.002	NAWQC-ch
gamma-BHC (Lindane)	0.0009	TEL	0.060	NAWQC-ch
Heptachlor			0.004	NAWQC-ch
Polychlorinated Biphenyls				
Aroclor 1016	0.023	ER-L PCBs	0.014	NAWQC-ch PCBs
Aroclor 1221	0.023	ER-L PCBs	0.014	NAWQC-ch PCBs
Aroclor 1232	0.023	ER-L PCBs	0.014	NAWQC-ch PCBs
Aroclor 1242	0.023	ER-L PCBs	0.014	NAWQC-ch PCBs
Aroclor 1248	0.023	ER-L PCBs	0.014	NAWQC-ch PCBs
Aroclor 1254	0.023	ER-L PCBs	0.014	NAWQC-ch PCBs
Aroclor 1260	0.023	ER-L PCBs	0.014	NAWQC-ch PCBs
Polycyclic Aromatic Hydrocarbons				
Acenaphthene	0.016	ER-L	52.00	NAWQC-ch*
Acenaphthylene	0.044	ER-L		
Anthracene	0.085	ER-L		
Benzo(a)anthracene	0.032	TEL		
Benzo(a)pyrene	0.032	TEL		
Chrysene	0.057	TEL		
Fluoranthene	0.111	TEL		
Fluorene	0.019	ER-L		
Naphthalene	0.160	ER-L	62.00	NAWQC-ch*
Phenanthrene	0.042	TEL		
Pyrene	0.053	TEL		

Table 3-2 (2 of 2)
Criteria for Evaluating Levels of Detection for Sediment and Water Samples

Analyte	Sediment (mg/kg)		Water (µg/L)	
	Sediment Criteria[1]	Reference	Water Criteria[2]	Reference
Semivolatile Organic Compounds				
1,2-Dichlorobenzene			76.30	NAWQC-ch*
1,3-Dichlorobenzene			76.30	NAWQC-ch*
1,4-Dichlorobenzene			76.30	NAWQC-ch*
2,4-Dichlorophenol			36.50	NAWQC-ch*
2,4-Dinitrotoluene			23.00	NAWQC-ch*
2-Chlorophenol			200.00	NAWQC-ch*
2-Methylnaphthalene	0.070	ER-L		
Aniline			15.00	NAWQC-ch*
bis(2-Ethylhexyl)phthalate			0.30	NAWQC-ch*
Butylbenzylphthalate			0.30	NAWQC-ch*
Di-n-Butylphthalate			0.30	NAWQC-ch*
Di-n-Octyl Phthalate			0.30	NAWQC-ch*
Dibutylphthalate			0.30	NAWQC-ch*
Diethylphthalate			0.30	NAWQC-ch*
Hexachlorobutadiene			0.93	NAWQC-ch*
Hexachlorocyclopentadiene			0.52	NAWQC-ch*
Hexachloroethane			54.00	NAWQC-ch*
Pentachlorophenol			13.00	NAWQC-ch***
Phenol			256.00	NAWQC-ch*
Volatile Organic Compounds				
1,1,2,2-Tetrachloroethane			240.00	NAWQC-ch*
1,1,2-Trichloroethane			940.00	NAWQC-ch*
1,2-Dibromoethane			2,000.00	NAWQC-ch*
1,3-Dichloropropene			24.40	NAWQC-ch*
2,2-Dichloropropane			570.00	NAWQC-ch*
Acrolein			2.10	NAWQC-ch*
Acrylonitrile			260.00	NAWQC-ch*
Chlorobenzene			5.00	NAWQC-ch*
Chloroform			124.00	NAWQC-ch*
Tetrachloroethylene			84.00	NAWQC-ch*
Trichloroethylene			2,190.00	NAWQC-ch*

Notes:

[1] National Oceanic and Atmospheric Administration (NOAA) Status and Trends Effects Range-Low (ER-L) and Threshold Effects Level (TEL) criteria for evaluating sediment detection limits

[2] National Ambient Water Quality Criteria (NAWQC) and National Recommended Water Quality Criteria (NRWQC) chronic (ch) freshwater criteria for evaluating surface water and shallow groundwater detection limits

*NAWQC chronic freshwater criteria that were lowest observable adverse effects level (LOAEL) values that have been divided by 10 to convert the LOAEL values to no observable adverse effects level (NOAEL) criteria

**NRWQC is hardness dependent

***NAWQC criteria is pH dependent on 7.8 pH.

This table has been replaced by mammalian soil EcoRBSLs in Table 12-4 in Appendix F of the SRAM Rev. 2 Addendum.

Table 3-3 (1 of 9)

Terrestrial Mammalian Ecological Screening Levels[a]

Soil	
Chemical	Terrestrial Mammal ESL (mg/kg)
1,2,3,4,6,7,8-HpCDD	9.6E-04
1,2,3,4,6,7,8-HpCDF	4.9E-04
1,2,3,4,7,8,9-HpCDF	4.3E-04
1,2,3,4,7,8-HxCDD	4.5E-05
1,2,3,4,7,8-HxCDF	4.7E-05
1,2,3,6,7,8-HxCDD	4.6E-05
1,2,3,6,7,8-HxCDF	5.4E-05
1,2,3,7,8,9-HxCDD	4.3E-05
1,2,3,7,8,9-HxCDF	4.3E-05
1,2,3,7,8-PeCDD	4.4E-06
1,2,3,7,8-PeCDF	1.0E-04
2,3,4,6,7,8-HxCDF	4.9E-05
2,3,4,7,8-PeCDF	9.8E-06
2,3,7,8-TCDD	4.3E-06
2,3,7,8-TCDF	4.3E-05
OCDD	1.2E-01
OCDF	9.7E-02
Aluminum	1.2E+01
Antimony	9.5E-02
Arsenic	1.9E+00
Barium	1.5E+01
Beryllium	5.0E+00
Boron	9.2E+00
Cadmium	2.1E-02
Chromium	9.3E+02
Cobalt	8.9E+00
Copper	2.1E+00
Hexavalent Chromium	1.4E+01
Lead	2.8E+00
Manganese	2.9E+01
Mercury	2.9E+00
Methyl mercury	1.1E+00
Molybdenum	1.1E-01
Nickel	1.0E-01
Selenium	1.7E-01
Silver	5.4E-01

Table 3-3 (2 of 9)

Terrestrial Mammalian Ecological Screening Levels[a]

Soil	
Chemical	Terrestrial Mammal ESL (mg/kg)
Thallium	1.4E+00
Vanadium	1.5E+00
Zinc	2.1E+01
Aroclor 1016	1.6E+00
Aroclor 1221	1.6E+00
Aroclor 1232	7.7E-02
Aroclor 1242	7.9E-02
Aroclor 1248	1.6E-02
Aroclor 1254	7.7E-02
Aroclor 1260	7.7E-02
Aroclor 1262	7.7E-02
PCB-105	8.5E-03
PCB-114	8.8E-04
PCB-118	8.2E-03
PCB-123	7.5E-03
PCB-126	1.4E-05
PCB-156	2.6E-03
PCB-157	2.5E-03
PCB-167	1.2E-01
PCB-169	4.3E-04
PCB-189	2.0E-02
PCB-77	1.3E-02
PCB-81	1.2E-02
Perchlorate	4.2E-06
1,1,1,2-Tetrachloroethane	7.6E+01
1,1,1-Trichloroethane	4.3E+03
1,1,2,2-Tetrachloroethane	6.0E+00
1,1,2-Trichloro-1,2,2-trifluoroethane	2.1E+02
1,1,2-Trichloroethane	8.3E+00
1,1-Dichloroethane	2.1E+02
1,1-Dichloroethene	2.9E-01
1,1-Dichloropropene	2.2E+01
1,2,3-Trichlorobenzene	6.3E+01
1,2,3-Trichloropropane	1.2E+01
1,2,4-Trichlorobenzene	6.3E+01
1,2,4-Trimethylbenzene	6.4E+02

Table 3-3 (3 of 9)

Terrestrial Mammalian Ecological Screening Levels[a]

Soil	
Chemical	Terrestrial Mammal ESL (mg/kg)
1,2-Dibromo-3-chloropropane	2.2E+01
1,2-Dibromoethane	2.5E+01
1,2-Dichloro-1,1,2-Trifluoroethane	1.9E+03
1,2-Dichlorobenzene	3.7E+02
1,2-Dichloroethane	2.1E+02
1,2-Dichloropropane	2.5E+01
1,2-Diphenylhydrazine	8.5E+00
1,3,5-Trimethylbenzene	6.4E+02
1,3,5-Trinitrobenzene	1.1E+01
1,3-Dichlorobenzene	3.2E+02
1,3-Dichlorobenzene	3.2E+02
1,3-Dichloropropane	2.2E+01
1,3-Dichloropropene	4.4E+00
1,3-Dinitrobenzene	7.5E-01
1,4-Dichlorobenzene	1.6E+02
2,2-Dichloropropane	2.2E+01
2,4,5-Trichlorophenol	2.1E+02
2,4,6-Trichlorophenol	4.3E+02
2,4,6-Trinitrotoluene	3.2E-01
2,4-Dichlorophenol	1.3E+00
2,4-Dimethylphenol	1.1E+02
2,4-Dinitrophenol	1.2E+01
2,4-Dinitrotoluene	1.3E+00
2,6-Dinitrotoluene	2.5E+00
2-AMINO-4,6-DNT	1.3E+00
2-Butanone	7.6E+03
2-Chloroethylvinylether	7.3E-01
2-Chloronaphthalene	5.3E+02
2-Chlorophenol	2.1E+01
2-Chlorotoluene	3.2E+02
2-Hexanone	2.4E+03
2-Methylnaphthalene	2.1E+02
2-Methylphenol	1.1E+02
2-Nitroaniline	2.3E+01
2-Nitrophenol	2.3E+01
2-Nitrotoluene	1.3E+00

Table 3-3 (4 of 9)

Terrestrial Mammalian Ecological Screening Levels[a]

Soil	
Chemical	Terrestrial Mammal ESL (mg/kg)
3,3'-Dichlorobenzidine	1.3E+00
3,5-Dimethylphenol	2.1E+02
3-Methylphenol	2.1E+02
3-Nitroaniline	2.3E+01
3-Nitrotoluene	1.3E+00
4,4'-DDD	3.4E+00
4,4'-DDE	3.4E+00
4,4'-DDT	3.4E+00
4,6-Dinitro-2-methylphenol	2.3E+01
4-AMINO-2,6-DNT	1.3E+00
4-bromofluorobenzene	6.3E+01
4-Bromophenyl phenyl ether	4.3E+00
4-Chloro-3-methylphenol	2.1E+01
4-Chloroaniline	1.1E+01
4-Chlorophenyl phenyl ether	1.3E+00
4-Chlorotoluene	3.2E+02
4-Methyl-2-Pentanone	2.4E+03
4-Methylphenol	2.1E+02
4-Nitroaniline	2.3E+01
4-Nitrophenol	2.3E+01
4-Nitrotoluene	1.3E+00
Acenaphthene	2.7E+02
Acenaphthylene	7.5E+02
Acetone	4.3E+01
Acrolein	2.3E+02
Acrylonitrile	4.3E-01
Aldrin	4.3E-01
alpha-BHC	2.1E-01
Aniline	5.3E+01
Anthracene	1.4E+03
Azobenzene	4.3E+00
Benzene	4.3E+00
Benzidine	2.3E+00
Benzo(a)anthracene	5.6E+00
Benzo(a)pyrene	5.6E+00
Benzo(b)fluoranthene	5.6E+00

Table 3-3 (5 of 9)

Terrestrial Mammalian Ecological Screening Levels[a]

Soil	
Chemical	Terrestrial Mammal ESL (mg/kg)
Benzo(g,h,i)perylene	6.4E+00
Benzo(k)fluoranthene	5.8E+00
Benzoic Acid	3.1E+01
Benzyl Alcohol	3.1E+01
beta-BHC	2.1E-01
bis(2-Chloroethoxy)methane	1.5E+02
bis(2-Chloroethyl)ether	1.5E+02
bis(2-Chloroisopropyl) ether	1.5E+02
Bis(2-ethylhexyl)phthalate	7.8E+01
Bromobenzene	4.3E+00
Bromochloromethane	2.5E+01
Bromodichloromethane	1.5E+01
Bromoform	3.8E+01
Bromomethane	2.5E+01
Butyl benzyl phthalate	3.4E+02
Carbazole	4.3E+03
Carbon disulfide	4.7E+01
Carbon tetrachloride	1.5E+00
Chlordane	3.4E-01
Chlorobenzene	8.7E+01
Chlorodibromomethane	7.6E+01
Chloroethane	7.3E+01
Chloroform	2.4E-01
Chloromethane	2.5E+01
Chlorotrifluoroethene	1.6E+01
Chlorotrifluoromethane	6.4E+01
Chrysene	2.4E+00
cis-1,2-Dichloroethene	6.8E+01
cis-1,3-Dichloropropene	2.2E+01
Decahydronaphthalene	2.1E+02
delta-BHC	2.1E-01
Dibenz(a,h)anthracene	5.6E+00
Dibenzofuran	4.3E+03
Dibromochloromethane	4.6E+01
Dibromomethane	2.5E+01
Dichlorobenzenes	3.2E+02

Table 3-3 (6 of 9)

Terrestrial Mammalian Ecological Screening Levels[a]

Soil	
Chemical	Terrestrial Mammal ESL (mg/kg)
Dichlorodifluoromethane	6.4E+01
Dieldrin	8.5E-02
Diethylphthalate	6.9E+03
Dimethyl phthalate	6.9E+03
Dimethylphenol isomer	2.1E+02
Di-n-butylphthalate	5.1E+02
Di-n-octyl phthalate	1.5E+03
Endosulfan Sulfate	6.4E-01
Endrin	1.3E-01
Ethylbenzene	2.1E+02
Fluoranthene	1.2E+02
Fluorene	1.5E+02
Formaldehyde	5.9E+01
Freon 113	1.9E+03
Heptachlor	5.6E-01
Heptachlor Epoxide	1.6E-02
Hexachlorobenzene	3.4E-01
Hexachlorobutadiene	8.5E-01
Hexachlorocyclopentadiene	1.3E+01
Hexachloroethane	2.1E+00
Hexanal	2.4E+03
HMX	6.4E+01
Hydrazine	5.0E-02
Indeno(1,2,3-cd)pyrene	5.8E+00
Isophorone	4.8E+02
Isopropylbenzene	4.1E+02
Lindane	2.1E-01
m,p-Xylene	6.4E+02
Methyl Isobutyl Ketone	7.6E+03
Methyl tert-butyl ether	6.1E+01
Methylene chloride	2.5E+01
Methylphenol	2.1E+02
Monochlorobenzene	3.2E+02
Monomethylhydrazine	5.0E-02
Naphthalene	2.1E+02
n-Butylbenzene	4.1E+02

Table 3-3 (7 of 9)

Terrestrial Mammalian Ecological Screening Levels[a]

Soil	
Chemical	Terrestrial Mammal ESL (mg/kg)
Nitrobenzene	2.0E+00
Nitrobenzene	2.0E+00
Nitrosodimethylamine	5.6E+01
N-Nitrosodimethylamine	5.6E+01
N-Nitrosodi-n-propylamine	5.6E+01
N-Nitrosodiphenylamine	5.6E+01
Nonane	2.4E+03
n-Propylbenzene	4.1E+02
o-Xylene	6.4E+02
Pentachlorophenol	1.3E+01
Pentanal	2.4E+03
Phenanthrene	6.2E+01
Phenol	2.6E+02
p-Isopropyltoluene	6.4E+02
Pyrene	7.6E+01
Pyridine	2.1E+00
RDX	4.3E+01
sec-Butylbenzene	4.1E+02
Styrene	6.4E+02
tert-Butylbenzene	4.1E+02
Tetrachloroethene	2.1E+00
Tetramethylcyclohexane Isomer	6.4E+02
Tetryl	2.8E+01
Thiobismethane	4.7E+01
Toluene	2.5E+00
Total xylenes	6.4E+01
trans-1,2-Dichloroethene	9.7E+02
trans-1,3-Dichloropropene	4.4E+00
Trichloroethene	3.0E+00
Trichlorofluoromethane	3.0E+02
Trimethyl benzene	6.4E+02
Unsymetricaldimethylhydrazin	5.0E-02
Vinyl acetate	5.0E+02
Vinyl chloride	7.3E-01

Table 3-3 (8 of 9)

Terrestrial Mammalian Ecological Screening Levels [a]

Inhalation -- for Burrowing Mammals Only	
Chemical	Terrestrial Mammal ESL (mg/m^3)
1,1,1-Trichloroethane	38
1,1,2-Trichloroethane	0.057
1,1-Dichloroethane	36
1,1-Dichloroethene	0.60
1,1-Dichloropropene	4.1
1,2,3-Trichlorobenzene	50
1,2,4-Trichlorobenzene	50
1,2,4-Trimethylbenzene	16
1,2-Dichlorobenzene	50
1,2-Dichloroethane	42
1,2-Dichloroethene	1.9
1,2-Dichloropropane	1.2
1,2-Dichlorotetrafluoroethane (Freon 114)	91
1,3,5-Trimethylbenzene	16
1,3-Dichlorobenzene	50
1,4-Dichlorobenzene	50
2-Butanone (MEK)	869
2-Hexanone	2.4
2-Methylnaphthalene	0.38
Acetone	1305
Benzene	0.57
Carbon disulfide	0.24
Carbon tetrachloride	0.63
Chlorobenzene	58
Chloroethane	992
Chloroform	0.24
Chloromethane	0.74
cis-1,2-Dichloroethene	1.9
Dichlorodifluoromethane (Freon 12)	91
Ethylbenzene	23
Ethylene dibromide	0.58
Fluorene	0.17
Freon 113	91
Isopropylbenzene (cumene)	23
m,p-Xylenes	16
Methyl tert-butyl ether (MTBE)	258

Table 3-3 (9 of 9)

Terrestrial Mammalian Ecological Screening Levels [a]

Inhalation -- for Burrowing Mammals Only	
Chemical	Terrestrial Mammal ESL (mg/m^3)
1,1,1-Trichloroethane	38
Methylene Chloride	0.87
Naphthalene	0.38
n-butylbenzene	23
n-Propylbenzene	23
o-Xylene	16
p-cymene (p-isopropyltoluene)	16
Phenanthrene	0
sec-butylbenzene	23
Styrene	38
t-butylbenzene	23
Tetrachloroethene	24
Toluene	0.084
trans-1,2-Dichloroethene	1.9
Trichloroethene	6.4
Trichlorofluoromethane (Freon 11)	90.9
Vinyl chloride	0.56
Xylenes (total)	16

Notes:

(a) Spreadsheets used to derive terrestrial mammal ESLs are presented in Appendix C, Attachment C-4.

ESL - ecological screening level

ug/m^3 air - micrograms per cubic meter

This table has been replaced by avian soil EcoRBSLs in Table 12-4 in Appendix F of the SRAM Rev. 2 Addendum.

Table 3-4 (1 of 3)

Terrestrial Avian Ecological Screening Levels[a]

Chemical	Terrestrial Avian ESL (mg/kg)
1,2,3,4,6,7,8-HpCDD	1.3E-01
1,2,3,4,6,7,8-HpCDF	8.7E-03
1,2,3,4,7,8,9-HpCDF	6.3E-03
1,2,3,4,7,8-HxCDD	1.5E-03
1,2,3,4,7,8-HxCDF	8.0E-04
1,2,3,6,7,8-HxCDD	7.4E-03
1,2,3,6,7,8-HxCDF	1.1E-03
1,2,3,7,8,9-HxCDD	6.6E-04
1,2,3,7,8,9-HxCDF	6.3E-04
1,2,3,7,8-PeCDD	6.8E-05
1,2,3,7,8-PeCDF	9.6E-04
2,3,4,6,7,8-HxCDF	8.6E-04
2,3,4,7,8-PeCDF	8.9E-05
2,3,7,8-TCDD	6.3E-05
2,3,7,8-TCDF	4.4E-06
OCDD	1.6E+00
OCDF	1.4E+00
Aroclor-1254	3.7E-01
Aroclor-1260	8.1E-02
PCB-105	8.6E-02
PCB-114	3.7E-02
PCB-118	8.0E-01
PCB-123	7.3E-01
PCB-126	1.6E-04
PCB-156	1.5E-01
PCB-157	1.4E-01
PCB-167	1.4E+00
PCB-169	6.3E-02
PCB-189	2.8E+00
PCB-77	2.8E-04
PCB-81	1.4E-04
Aluminum	9.1E+02
Arsenic	3.7E+01
Barium	4.5E+01
Boron	2.3E+01
Cadmium	4.5E-03
Copper	1.1E+00

Table 3-4 (2 of 3)

Terrestrial Avian Ecological Screening Levels[a]

Chemical	Terrestrial Avian ESL (mg/kg)
Lead	1.3E-02
Manganese	3.4E+02
Mercury	8.8E-01
Methyl Mercury	1.7E-01
Molybdenum	1.8E+00
Nickel	1.5E+00
Selenium	6.8E-01
Vanadium	1.0E+02
Zinc	2.6E+01
1,2-Dichloroethane	7.6E+01
1,3-Dinitrobenzene	1.9E+00
2,4-Dinitrophenol	5.9E-01
2-Nitroaniline	3.3E+01
3-Nitroaniline	5.9E+00
4,4'-DDE	1.2E-02
4,4'-DDT	1.2E-02
4-Chloroaniline	4.4E+00
4-Methylphenol	4.3E+00
4-Nitroaniline	3.3E+00
Acenaphthene	2.5E+00
Acetone	2.4E+04
alpha-BHC	2.5E+00
Aniline Surrogate	2.5E+01
Anthracene	2.4E+00
Benzoic Acid	4.4E+00
Benzyl Alcohol	4.4E+00
beta-BHC	2.5E+00
Bis(2-ethylhexyl)phthalate	4.9E+00
Chlordane	1.4E+00
delta-BHC	2.5E+00
Dieldrin	3.4E-01
Dimethylphthalate	4.4E+00
Di-n-butylphthalate	4.9E-01
Di-n-octylphthalate	3.9E+01
Endosulfan Sulfate	4.4E+01
Endrin	4.4E-02
Fluorene	1.6E+00
Heptachlor	5.9E+00

Table 3-4 (3 of 3)

Terrestrial Avian Ecological Screening Levels [a]

Chemical	Terrestrial Avian ESL (mg/kg)
Hexachlorobenzene	1.2E+02
Hexachlorobutadiene	1.4E+01
Lindane	8.9E+00
Pentachlorophenol	3.9E+01
Phenanthrene	1.3E+00
Phenol	5.0E+00

Notes:

(a) Spreadsheets used to derive terrestrial avian ESLs are presented in Appendix C, Attachment C-2.

ESL - ecological screening level

mg/kg - milligrams per kilogram

This table has been replaced by soil invertebrate EcoRBSLs in Table 12-4 in Appendix F of the SRAM Rev. 2 Addendum.

Table 3-5 (1 of 2)

Terrestrial Invertebrate Ecological Screening Levels [a]

Chemical	Terrestrial Invertebrate ESL (mg/kg soil)
2,3,7,8-TCDD	5.0E+02
Antimony	7.8E+01
Arsenic	NA
Barium	3.3E+02
Beryllium	4.0E+01
Cadmium	1.4E+02
Chromium	NA
Copper	3.2E+01
Hexavalent Chromium	2.0E-01
Lead	1.7E+03
Mercury	1.0E-01
Methyl mercury	2.5E+00
Nickel	1.0E+02
Selenium	7.7E+00
Vanadium	NA
Zinc	2.0E+02
Aroclor 1016	5.0E+01
Aroclor 1254	5.0E+01
1,2,3-Trichlorobenzene	2.0E+01
1,2,4-Trichlorobenzene	2.0E+01
1,2-Dichloropropane	7.0E+02
1,4-Dichlorobenzene	2.0E+01
2,4,5-Trichlorophenol	9.0E+00
2,4,6-Trichlorophenol	1.0E+01
4-Nitrophenol	7.0E+00
Benzo(a)pyrene	2.5E+04
Carbazole	3.4E+01
Chlorobenzene	4.0E+01
Dibenzofuran	6.2E+01
Dieldrin	NA
Dimethyl phthalate	2.0E+02
Fluoranthene	3.8E+01
Fluorene	2.7E+01
Nitrobenzene	4.0E+01

Table 3-5 (2 of 2)

Terrestrial Invertebrate Ecological Screening Levels [a]

Chemical	Terrestrial Invertebrate ESL (mg/kg soil)
N-Nitrosodiphenylamine	2.0E+01
Pentachlorophenol	6.0E+00
Phenanthrene	3.4E+01
Phenol	3.0E+01
Pyrene	1.8E+01

Notes:

(a) Spreadsheet used to derive terrestrial invertebrate ESLs is presented in Appendix C, Attachment C-3.

ESL - ecological screening level

NA - Not available. Data were insufficient. USEPA EcoSSL (2003a-b, 2005d-n)

mg/kg - milligrams per kilogram

Table 3-6 (1 of 1)

Groundwater Comparison Concentrations for Metals and Selected Inorganic Compounds

	All Concentrations in µg/L				
Constituent	**SSFL Groundwater Comparison Concentration[a]**	**CA DHS MCLs**	**Ca DHS NLs**	**OEHHA PHGs**	**USEPA PRGs**
Antimony	2.5	6		20	15
Arsenic	7.7	50		0.004	0.05
Barium	150	1,000		2000	2,600
Beryllium	ND < 0.14	4		1	73
Boron	340		1,000		7,300
Cadmium	0.2	5		0.07	18
Chromium	14	50			55,000
Cobalt	1.9				730
Copper	4.7	1,000[b]	1,300	170	1,500
Fluoride	800	2,000		1,000	2,200
Iron	4,100	300[b]			11,000
Lead	11		15	2	
Magnesium	77,000				
Manganese	150	50[b]	500		880
Mercury	ND <0.063	2		1.2	11
Molybdenum	2.2				180
Nickel	17	100		12	730
Selenium	1.6	50			180
Silver	ND <0.17	100[b]			180
Strontium	800				22,000
Thallium	ND< 0.13	2		0.1	2.40
Tin	ND <2.4				22,000
Vanadium	2.6		50		36
Zinc	6,300	5,000[b]			11,000
Potassium	9,600				
Sodium	190,000				
Sulfate	376,000	250,000[b]			

(a) Groundwater Comparison Concentrations represent the maximum value retained in the Final Groundwater Comparison Data Set (Appendix E)

(b) Secondary MCL - Non-health based criterion (i.e. based on aesthetic, discoloration issues).

Note: A Groundwater Comparison Concentration was not established for aluminum because of insufficient data. Dissolved analysis was only conducted on one sample.

ND = Non Detect. Groundwater mercury, silver and tin results greater than values shown will undergo further evaluation.
µg/L = Micrograms per liter
Ca DHS - California Department of Health Services
MCL - Maximum Contaminant Level
NL = Notification Level
OEHHA PHG - Office of Environmental Health Hazard Assessment Public Health Goals
USEPA PRG - United States Environmental Protection Agency Preliminary Remediation Goal for tap water

Sources:
Ca DHS MCLs from http://www.dhs.ca.gov/ps/ddwem/chemicals/MCL/EPAandDHS.pdf
Ca DHS Notification Levels (NL) from DHS website - http://www.dhs.ca.gov/ps/ddwem/
OEHHA PHGs from http://www.oehha.ca.gov/water/phg/allphgs.html

Table 5-1 (1 of 3)

Exposure Assessment Parameters for Workers

Parameter	Central Tendency Exposure (CTE)	Exposure Distribution	Reasonable Maximum Exposure (RME)
General Parameters:			
Body Weight (BW)	Value: 70 kg Rationale: Average body weight, USEPA 1997	Lognormal mean: 71 kg standard deviation: 14.2 Source: CalTOX 1994[1]	Value: 70 kg Rationale: Average body weight, USEPA 1997
Exposure Frequency (EF)	Value: 8 hrs/d, 219 d/yr Rationale: DTSC 1999	Constant	Value: 8 hrs/d, 250 d/yr Rationale: USEPA 1997
Exposure Duration (ED)	Value: 9 years Rationale: DTSC 1999	Continuous variable across age-specific occupational tenure reported by Carey (1988) as presented by USEPA (1997)	Value: 25 years Rationale: DTSC 1999
Averaging Time (AT)	Value: Carcinogenic Effects: 75 years (27,375 days) Noncarcinogenic Effects: AT = Exposure duration Rationale: USEPA 1997	Carcinogenic Effects: Constant at 75 years Noncarcinogenic Effects: Co-vary with exposure duration	Value: Carcinogenic Effects: 75 years (27,375 days) Noncarcinogenic Effects: AT = Exposure duration Rationale: USEPA 1997
Inhalation of Particulates and/or Vapors:			
Breathing Rate (BR)	Value: 1.3 m^3/hr Rationale: Hourly average for outdoor workers, USEPA 1997	Lognormal mean: 1.44 m^3/hr standard deviation: 0.66 m^3/hr Rationale: General construction workers and laborers reported by Linn et al. (1993) as presented by USEPA (1997)	Value: 2.0 m^3/hour Rationale: Midpoint between moderate and heavy activity values, USEPA 1997

Table 5-1 (2 of 3)

Exposure Assessment Parameters for Workers

Parameter	Central Tendency Exposure (CTE)	Exposure Distribution	Reasonable Maximum Exposure (RME)
Dermal Contact with Soil:			
Soil Adherence Factor (AF)	Value: Value from anticipated USEPA Guidance on Dermal Assessment or 0.02 mg/cm^2 Rationale: Weighted soil adherence for face, forearms, and hands for pooled groundskeepers data (USEPA 1997, Table 6-13); typical activity combined with 50th percentile body part-specific soil adherence factors	Empirical Distribution Rationale: Distribution from anticipated USEPA Dermal Guidance or fitted distribution of pooled data from sources cited in that Guidance	Value: Value from anticipated USEPA Guidance on Dermal Assessment or 0.2 mg/cm^2 Rationale: Weighted soil adherence for face, forearms, and hands for pooled utility workers data (USEPA 1997, Table 6-13); high-end activity combined with 50th percentile body part-specific soil adherence factors
Surface Area (SA)	Value: 2,500 cm^2 Rationale: DTSC 1999	Empirical Distribution Co-vary with body weight Rationale: Distribution developed from percentile values (USEPA 1997, Tables 6-2, 6-3), summed across relevent body parts, and fitted to Crystal Ball	Value: 2,500 cm^2 Rationale: DTSC 1999
Bioavailability (B)	Chemical-specific: 0.1 for VOCs; 0.001 for Cd; 0.03 for As; 0.01 for other metals DTSC 1994	Constant	Chemical-specific: 0.1 for VOCs; 0.001 for Cd; 0.03 for As; 0.01 for other metals DTSC 1994
Incidental Soil Ingestion:			
Ingestion Rate (IR_{soil})	Value: 50 mg/day Rationale: Based on range of plausible soil ingestion rates for adults, USEPA 1997	Lognormal mean: 9.94 mg/day standard deviation: 19.9 mg/day Source: CalTOX 1994[1]	Value: 200 mg/day Rationale: RME ingestion rate, DTSC, personal communication, T.R. Hathaway, 3/30/00

Table 5-1 (3 of 3)

Exposure Assessment Parameters for Workers

Parameter	Central Tendency Exposure (CTE)	Exposure Distribution	Reasonable Maximum Exposure (RME)
Bioavailability (B)	Value: Chemical-specific Rationale: Current peer-reviewed literature values for chemical in soil matrix; subject to DTSC approval	Constant	Value: Chemical-specific Rationale: Current peer-reviewed literature values for chemical in soil matrix; subject to DTSC approval

[1] CalTOX computer model version 1994.
Crystal Ball (Decisioneering, Inc., Denver, CO)

Updated exposure parameters for soil, ephemeral sediment and food pathways are presented in Appendix B of the SRAM Rev. 2 Addendum

Table 5-2 (1 of 4)

Exposure Assessment Parameters for a Residential Adult

Parameter	Central Tendency Exposure (CTE)	Exposure Distribution	Reasonable Maximum Exposure (RME)
General Parameters:			
Body Weight (BW)	Value: 70 kg Rationale: Average body weight, USEPA 1997	Lognormal mean: 71 kg standard deviation: 14.2 Source: CalTOX 1994[1]	Value: 70 kg Rationale: Average body weight, USEPA 1997
Exposure Frequency (EF)	Value: Pathway-specific Rationale: USEPA 1997	Continuous variable between selected pathway specific average exposure duration and 350 days/year Rationale: professional judgment	Value: 350 days/year (unless otherwise specified in guidance) Rationale: USEPA 1997; DTSC 1992
Exposure Duration (ED)	Value: 9 years Rationale: Average residence time, USEPA 1997	Selected exposure duration from distribution given below, less 6 years for child exposure (truncated at 0 years) Lognormal mean: 9.37 years standard deviation: 2.52 years Source: CalTOX 1994[1]	Value: 24 years (30-year lifetime minus 6 years as child) Rationale: 95th percentile value for residence time, USEPA 1997
Averaging Time (AT)	Value: Carcinogenic Effects: 75 years (27,375 days) Noncarcinogenic Effects: AT = Exposure duration or 9 years (3,285 days) Rationale: USEPA 1997	Carcinogenic Effects: Constant at 75 years Noncarcinogenic Effects: Co-vary with exposure duration	Value: Carcinogenic Effects: 75 years (27,375 days) Noncarcinogenic Effects: AT = Exposure duration or 24 years (8,760 days) Rationale: USEPA 1997

Table 5-2 (2 of 4)

Exposure Assessment Parameters for a Residential Adult

Parameter	Central Tendency Exposure (CTE)	Exposure Distribution	Reasonable Maximum Exposure (RME)
Inhalation of Particulates and/or Vapors:			
Breathing Rate (BR)	Value: 0.43 m^3/hr Rationale: Mean value for resting inhalation rate; CalTOX 1994	Lognormal mean: 0.43 m^3/hr standard deviation: 0.09 m^3/hr Source: Resting inhalation rate; CalTOX 1994[1]	Value: 0.55 m^3/hour Rationale: Recommended value for RME (midpoint between male and female values), USEPA 1997
Hours of day spent in or near home	16.3 hours/day Rationale: CalTOX average	Lognormal mean: 16.3 hours/day standard deviation: 2.24 hours/day Source: CalTOX 1994[1]	24 hours./day Rationale: Maximum hours in a day
Dermal Contact with Soil:			
Soil Adherence Factor (AF)	Value: Value from anticipated USEPA Guidance on Dermal Assessment or 0.01 mg/cm^2 Rationale: Weighted soil adherence for face, forearms, hands, and lower legs for "groundskeepers" (USEPA 1997, Table 6-13); typical activity combined with 50th percentile body part-specific soil adherence factors	Empirical Distribution Rationale: Distribution from anticipated USEPA Dermal Guidance or fitted distribution of pooled data from sources cited in that Guidance	Value: Value from anticipated USEPA Guidance on Dermal Assessment or 0.07 mg/cm^2 Rationale: Weighted soil adherence for face, forearms, hands, and lower legs for "gardeners" (USEPA 1997, Table 6-13); typical activity combined with 50th percentile body part-specific soil adherence factors
Skin Surface Area (SA)	Value: 5,700 cm^2 Rationale: Exposed surface area for head, hands, lower legs, and forearms; USEPA 1997	Empirical Distribution Co-vary with body weight Rationale: Distribution developed from percentile values (USEPA 1997, Tables 6-2, 6-3), summed across relevant body parts, and fitted with Crystal Ball	Value: 5,700 cm^2 Rationale: Exposed surface area for head, hands, lower legs, and forearms; USEPA 1997

Table 5-2 (3 of 4)

Exposure Assessment Parameters for a Residential Adult

Parameter	Central Tendency Exposure (CTE)	Exposure Distribution	Reasonable Maximum Exposure (RME)
Bioavailability (B)	Chemical-specific: 0.1 for VOCs; 0.001 for Cd; 0.03 for As; 0.01 for other metals DTSC 1994	Constant	Chemical-specific: 0.1 for VOCs; 0.001 for Cd; 0.03 for As; 0.01 for other metals DTSC 1994
Incidental Soil Ingestion:			
Ingestion Rate (IR_{soil})	Value: 50 mg/day Rationale: Based on range of plausible soil ingestion rates for adults, USEPA 1997	Lognormal mean: 9.94 mg/day standard deviation: 19.9 mg/day Source: CalTOX 1994[1]	Value: 100 mg/day Rationale: Based on range of plausible soil ingestion rates for adults, USEPA 1997
Bioavailability (B)	Value: Chemical-specific Rationale: Current peer-reviewed literature values for chemical in soil matrix; subject to DTSC approval	Constant	Value: Chemical-specific Rationale: Current peer-reviewed literature values for chemical in soil matrix; subject to DTSC approval
Ingestion of Groundwater During Domestic Use			
Ingestion Rate (IR_{gw})	Value: 1.0 L/day (non-VOCs) Value: 2.0 L/day (VOCs) Rationale: Value for non-VOCs from DTSC (1994) accounts for ingestion pathway only. Value for VOCs accounts for chemical uptake via dermal contact with groundwater and inhalation of vapors during showering by assuming that the dosage associated with these pathways is equal to the dosage received via groundwater ingestion as described in Section 5.3.2.	Empirical Distribution Source: Distribution of water consumption rates as reported by Roseberry and Burmaster (1992)	Value: 1.5 L/day (non-VOCs) Value: 3.1 L/day (VOCs) Rationale: Value for non-VOCs from DTSC (1994) accounts for ingestion pathway only. Value for VOCs accounts for chemical uptake via dermal contact with groundwater and inhalation of vapors during showering by assuming that the dosage associated with these pathways is equal to the dosage received via groundwater ingestion as described in Section 5.3.2.
Bioavailability (B)	Value: Chemical-specific Rationale: Current peer-reviewed literature values for chemical in water matrix; subject to DTSC approval	Constant	Value: Chemical-specific Rationale: Current peer-reviewed literature values for chemical in water matrix; subject to DTSC approval

Table 5-2 (4 of 4)

Exposure Assessment Parameters for a Residential Adult

Parameter	Central Tendency Exposure (CTE)	Exposure Distribution	Reasonable Maximum Exposure (RME)
Ingestion of Homegrown Food/Fish:			
Ingestion Rate, Fruit	Value: 1.20 g/kg-day Rationale: 50th percentile value of homegrown fruit consumption in the western U.S., USEPA 1997	Lognormal mean: 4.2 g/kg-day standard deviation: 0.84 g/kg-day Source: Distribution for consumption of fruits and vegetables combined, CalTOX 1994[1]	Value: 5.39 g/kg-day Rationale: 90th percentile value of homegrown fruit consumption in the western U.S., USEPA 1997
Ingestion Rate, Vegetables	Value: 0.9 g/kg-day Rationale: 50th percentile value of homegrown vegetable consumption in the western U.S., USEPA 1997		Value: 4.64 g/kg/day Rationale: 90th percentile value of homegrown vegetable consumption in the western U.S., USEPA 1997
Fractions of fruit and vegetable local	Value: 1 Rationale: Deterministic value is for homegrown produce	Lognormal mean: 0.24 standard deviation: 0.17 Source: CalTOX 1994[1]	Value: 1 Rationale: Deterministic value is for homegrown produce

[1] CalTOX computer model version 1994.
Crystal Ball (Decisioneering, Inc., Denver, CO)

Updated exposure parameters for soil, ephemeral sediment and food pathways are presented in Appendix B of the SRAM Rev. 2 Addendum

Table 5-3 (1 of 4)

Exposure Assessment Parameters for a Residential Child

Parameter	Central Tendency Exposure (CTE)	Exposure Distribution	Reasonable Maximum Exposure (RME)
General Parameters:			
Body Weight (BW)	Value: 15 kg Rationale: Average body weight, USEPA 1997; DTSC 1992	Normal mean: 15.6 kg standard deviation: 2 kg Rationale: Fit of reported percentiles of body weight for 3- to 4-year-olds (midpoint of 1- to 6-year-old receptor) as reported in Anderson et al. 1985	Value: 15 kg Rationale: Average body weight, USEPA 1997; DTSC 1992
Exposure Frequency (EF)	Value: Pathway-specific Rationale: USEPA 1997	Continuous variable between selected pathway specific average exposure duration and 350 days/year Rationale: Professional judgment	Value: 350 days/year Rationale: RME, USEPA 1997; DTSC 1992
Exposure Duration (ED)	Value: 6 years Rationale: RME, USEPA 1997; DTSC 1992	Constant	Value: 6 years Rationale: RME, USEPA 1997; DTSC 1992
Averaging Time (AT)	Value: Carcinogenic Effects: 75 years (27,375 days) Noncarcinogenic Effects: AT = Exposure duration or 6 years (2,190 days) Rationale: Average lifetime, USEPA 1997 Exposure duration, DTSC 1992	Carcinogenic Effects: Constant at 75 years Noncarcinogenic Effects: Co-vary with exposure duration	Value: Carcinogenic Effects: 75 years (27,375 days) Noncarcinogenic Effects: AT = Exposure duration or 6 years (2,190 days) Rationale: Average lifetime, USEPA 1997 Exposure duration; DTSC 1992

Table 5-3 (2 of 4)

Exposure Assessment Parameters for a Residential Child

Parameter	Central Tendency Exposure (CTE)	Exposure Distribution	Reasonable Maximum Exposure (RME)
Inhalation of Particulates and/or Vapors:			
Breathing Rate (BR)	Value: 0.35 m^3/hour Rationale: Mean rate for 3- to 5-year-old, USEPA 1997	Lognormal mean: 0.35 m^3/hour standard deviation: 0.07 m^3/hour Source: Adult resting inhalation rate times 0.75 (ratio of recommended mean rates in adults vs children per USEPA 1997); CalTOX 1994[1]	Value: 0.35 m^3/hour Rationale: Mean rate for 3- to 5-year-old, USEPA 1997
Hours of day spent in or near home	Value: 24 h/d Rationale: Small preschool child not anticipated to spend large amounts of time away from home	Constant	24 h/d Rationale: Small preschool child not anticipated to spend large amounts of time away from home
Dermal Contact with Soil:			
Soil Adherence Factor (AF)	Value: Value from anticipated USEPA Guidance on Dermal Assessment or 0.06 mg/cm^2 Rationale: Weighted soil adherence for hands, face, forearms, lower legs, and feet for "day care kids" (USEPA 1997, Table 6-13); typical activity combined with 50th percentile body part-specific soil adherence factors	Empirical Distribution Rationale: Distribution from anticipated USEPA Dermal Guidance or fitted distribution of pooled data from sources cited in that Guidance	Value: Value from anticipated USEPA Guidance on Dermal Assessment or 0.2 mg/cm^2 Rationale: Weighted soil adherence for hands, face, forearms, lower legs, and feet for "children playing in wet soil" (USEPA 1997, Table 6-13); high-end activity combined with 50th percentile body part-specific soil adherence factors
Skin Surface Area (SA)	Value: 2,800 cm^2 Rationale: Exposed skin surface area for hands, head, forearms, lower legs, and feet; USEPA 1997	Empirical Distribution Co-vary with body weight Rationale: Distribution developed from percentile values (USEPA 1997, Tables 6-6, 6-7), adjusted for fraction of skin exposed, and fitted with Crystal Ball	Value: 2,800 cm^2 Rationale: Exposed skin surface area for hands, head, forearms, lower legs, and feet; USEPA 1997

Table 5-3 (3 of 4)

Exposure Assessment Parameters for a Residential Child

Parameter	Central Tendency Exposure (CTE)	Exposure Distribution	Reasonable Maximum Exposure (RME)
Bioavailability (ABS)	Chemical-specific: 0.1 for VOCs; 0.001 for Cd; 0.03 for As; 0.01 for other metals DTSC 1994	Constant	Chemical-specific: 0.1 for VOCs; 0.001 for Cd; 0.03 for As; 0.01 for other metals DTSC 1994
Incidental Soil Ingestion:			
Ingestion Rate (IR_{soil})	Value: 100 mg/day Rationale: Average value, USEPA 1997	Lognormal arithmetic mean 86 mg/day standard deviation 191 mg/day Source: CalTOX 1994[1]	Value: 200 mg/day Rationale: RME, DTSC 1992
Bioavailability (B)	Value: Chemical-specific Rationale: Current peer-reviewed literature values for chemical in soil matrix; subject to DTSC approval	Constant	Value: Chemical-specific Rationale: Current peer-reviewed literature values for chemical in soil matrix; subject to DTSC approval
Ingestion of Groundwater During Domestic Use			
Ingestion Rate (IR_{gw})	Value: 0.75 L/day (non-VOCs) Value: 1.5 L/day (VOCs) Rationale: Value for non-VOCs from DTSC (1994) accounts for ingestion pathway only. Value for VOCs accounts for chemical uptake via dermal contact with groundwater and inhalation of vapors during showering by assuming that the dosage associated with these pathways is equal to the dosage received via groundwater ingestion as described in Section 5.3.2.	Empirical Distribution Source: Distribution of water consumption rates as reported by Roseberry and Burmaster (1992)	Value: 1.3 L/day (non-VOCs) Value: 2.5 L/day (VOCs) Rationale: Value for non-VOCs from DTSC (1994) accounts for ingestion pathway only. Value for VOCs accounts for chemical uptake via dermal contact with groundwater and inhalation of vapors during showering by assuming that the dosage associated with these pathways is equal to the dosage received via groundwater ingestion as described in Section 5.3.2.
Bioavailability (B)	Value: Chemical-specific Rationale: Current peer-reviewed literature values for chemical in water matrix; subject to DTSC approval	Constant	Value: Chemical-specific Rationale: Current peer-reviewed literature values for chemical in water matrix; subject to DTSC approval

Table 5-3 (4 of 4)

Exposure Assessment Parameters for a Residential Child

Parameter	Central Tendency Exposure (CTE)	Exposure Distribution	Reasonable Maximum Exposure (RME)
Ingestion of Homegrown Food/Fish:			
Ingestion Rate, Fruit	Value: 2.15g/kg-day Rationale: 50th percentile value for adult times 1.79 (ratio of adult to 3- to 5-year-old consumption for all U.S. regions combined), USEPA 1997	Lognormal mean: 7.5 g/kg-day standard deviation: 1.5 g/kg-day Source: Distribution for consumption of fruits and vegetables combined, by children, CalTOX 1994[1]	Value: 5.43 g/kg-day Rationale: 90th percentile value for adult, times 1.008 (ratio of adult to 3- to 5-year-old consumption for all U.S. regions combined), USEPA 1997
Ingestion Rate, Vegetables	Value: 1.01 g/kg-day Rationale: 50th percentile value for adult times 1.13 (ratio of adult to 3- to 5-year-old consumption for all U.S. regions combined), USEPA 1997		Value: 5.66 g/kg-day Rationale: 90th percentile value for adult times 1.22 (ratio of adult to 3- to 5-year-old consumption for all U.S. regions combined), USEPA 1997
Fractions of fruit and vegetable local	Value: 1 Rationale: Deterministic value is for homegrown produce	Lognormal mean: 0.24 standard deviation: 0.17 Source: CalTOX 1994[1]	Value: 1 Rationale: Deterministic value is for homegrown produce

[1] CalTOX computer model version 1994.
Crystal Ball (Decisioneering, Inc., Denver, CO)

Updated exposure parameters for soil and ephemeral sediment pathways are presented in Appendix B of the SRAM Rev. 2 Addendum

Table 5-4 (1 of 3)

Exposure Assessment Parameters for a Recreational Adult

Parameter	Central Tendency Exposure (CTE)	Exposure Distribution	Reasonable Maximum Exposure (RME)
General Parameters:			
Body Weight (BW)	Value: 70 kg Rationale: Average body weight, USEPA 1997	Lognormal mean: 71 kg standard deviation: 14.2 Source: CalTOX 1994	Value: 70 kg Rationale: Average body weight, USEPA 1997
Exposure Frequency (EF)	Value: 4 hours/day, 1 day every other week, 50 weeks/year Rationale: Site-specific assumption	Constant weekly frequency, with uniform: minimum 4 hours/day maximum 8 hours/day Rationale: Site-specific assumption	Value: 8 hours/day, 1 days/week, 50 weeks/year Rationale: Site-specific assumption
Exposure Duration (ED)	Value: 9 years Rationale: Average residence time, USEPA 1997	Selected exposure duration from distribution given below, less 6 years for child exposure (truncated at 0 years) Lognormal mean: 9.37 years standard deviation: 2.52 years Source: CalTOX 1994[1]	Value: 24 years (30-year lifetime minus 6 years as child) Rationale: 95th percentile value for residence time, USEPA 1997
Averaging Time (AT)	Value: Carcinogenic Effects: 75 years (27,375 days) Noncarcinogenic Effects: AT = Exposure duration or 9 years (3,285 days) Rationale: USEPA 1997	Carcinogenic Effects: Constant at 75 years Noncarcinogenic Effects: Co-vary with exposure duration	Value: Carcinogenic Effects: 75 years (27,375 days) Noncarcinogenic Effects: AT = Exposure duration or 24 years (8,760 days) Rationale: USEPA 1997

Table 5-4 (2 of 3)

Exposure Assessment Parameters for a Recreational Adult

Parameter	Central Tendency Exposure (CTE)	Exposure Distribution	Reasonable Maximum Exposure (RME)
Inhalation of Particulates and/or Vapors:			
Breathing Rate (BR)	Value: 1.3 m^3/hour Rationale: Midpoint between recommended values for RME for light and moderate activity, USEPA 1997	Lognormal mean: 1.28 m^3/hour standard deviation: 0.38 m^3/hour Source: active inhalation rate; CalTOX 1994[1]	Value: 1.3 m^3/hour Rationale: Midpoint between recommended values for RME for light and moderate activity, USEPA 1997
Dermal Contact with Soil:			
Soil Adherence Factor (AF)	Value: Value from anticipated USEPA Guidance on Dermal Assessment or 0.01 mg/cm^2 Rationale: Weighted soil adherence for hands, face, and forearms for "Soccer Nos. 2&3" (USEPA 1997, Table 6-13); typical activity combined with 50th percentile body part-specific soil adherence factors	Empirical Distribution Rationale: Distribution from anticipated USEPA Dermal Guidance or fitted distribution of pooled data from sources cited in that Guidance	Value: Value from anticipated USEPA Guidance on Dermal Assessment or 0.9 mg/cm^2 Rationale: Weighted soil adherence for hands, face, and forearms for "archeologists" (USEPA 1997, Table 6-13); high-end activity combined with 50th percentile body part-specific soil adherence factors
Skin Surface Area (SA)	Value: 5,700 cm^2 Rationale: Exposed skin surface area for hands, head, lower legs, and forearms; USEPA 1997	Empirical Distribution Co-vary with body weight Rationale: Distribution developed from percentile values (USEPA 1997, Tables 6-2, 6-3), summed across relevent body parts, and fitted with Crystal Ball	Value: 5,700 cm^2 Rationale: Exposed skin surface area for hands, head, lower legs, and forearms; USEPA 1997
Bioavailability (B)	Value: 0.1 for VOCs; 0.001 for Cd; 0.03 for As; 0.01 for other metals Rationale: DTSC 1994	Constant	Value: 0.1 for VOCs; 0.001 for Cd; 0.03 for As; 0.01 for other metals Rationale: DTSC 1994
Dermal Contact with Surface Water:			
Event Frequency (EV)	Value: 0.5 Rationale: Site-specific assumption	Constant Rationale: Site-specific assumption	Value: 0.5 Rationale: Site-specific assumption

Table 5-4 (3 of 3)

Exposure Assessment Parameters for a Recreational Adult

Parameter	Central Tendency Exposure (CTE)	Exposure Distribution	Reasonable Maximum Exposure (RME)
Time of Event (t_{event})	Value: 1 hr Rationale: Site-specific assumption	Uniform Distribution: Minimum 1 hr Maximum 2 hrs Rationale: Site-specific assumption	Value: 2 hrs Rationale: Site-specific assumption
Skin Surface Area (SA)	Value: 18,150 cm^2 Rationale: Total skin surface area for adult (male and female averaged), based on the 50th percentile of the distribution from USEPA 1997, Tables 6-2 and 6-3	Empirical Distribution Co-vary with body weight Rationale: Distribution developed from percentile values (USEPA 1997, Tables 6-2 and 6-3), and fitted with Crystal Ball	Value: 18,150 cm^2 Rationale: Total skin surface area for adult (male and female averaged), based on the 50th percentile of the distribution from USEPA 1997, Tables 6-2 and 6-3
Bioavailability (ABS)	Value: Chemical-specific: 0.1 for VOCs; 0.001 for Cd; 0.03 for As; 0.01 for other metals Rationale: DTSC 1994[1]	Constant	Value: Chemical-specific: 0.1 for VOCs; 0.001 for Cd; 0.03 for As; 0.01 for other metals Rationale: DTSC 1994[1]
Incidental Soil Ingestion:			
Ingestion Rate (IR_{soil})	Value: 50 mg/day Rationale: Based on range of plausible soil ingestion rates for adults, USEPA 1997	Lognormal mean: 9.94 mg/day standard deviation: 19.9 mg/day Source: CalTOX 1994[1]	Value: 100 mg/day Rationale: Based on range of plausible soil ingestion rates for adults, USEPA 1997
Bioavailability (B)	Value: Chemical-specific Rationale: Current peer-reviewed literature values for chemical in soil matrix; subject to DTSC approval	Constant	Value: Chemical-specific Rationale: Current peer-reviewed literature values for chemical in soil matrix; subject to DTSC approval

[1] CalTOX computer model version 1994.
Crystal Ball (Decisioneering, Inc., Denver, CO)

Updated exposure parameters for soil and ephemeral sediment pathways are presented in Appendix B of the SRAM Rev. 2 Addendum

Table 5-5 (1 of 4)

Exposure Assessment Parameters for a Recreational Child

Parameter	Central Tendency Exposure (CTE)	Exposure Distribution	Reasonable Maximum Exposure (RME)
General Parameters:			
Body Weight (BW)	Value: 15 kg Rationale: Average body weight (at midpoint of 1- to 6-year-olds), USEPA 1997; DTSC 1992	Normal mean: 15.6 kg standard deviation: 2 kg Rationale: Fit of reported percentiles of body weight for 3- to 4-year-olds (mid-point of 1- to 6-year-old receptor) as reported in Anderson et al. 1985	Value: 15 kg Rationale: Average body weight (at midpoint of 1- to 6-year-olds); USEPA 1997; DTSC 1992
Exposure Frequency (EF)	Value: 4 hours/day, 1 day/week, 50 weeks/year Rationale: Site-specific assumption	Uniform: minimum 4 hours/week maximum 8 hours/week Rationale: Site-specific assumption	Value: 8 hours/day, 2 days/week, 50 weeks/year Rationale: Site-specific assumption
Exposure Duration (ED)	Value: 6 years Rationale: RME, USEPA 1997; DTSC 1992	Constant	Value: 6 years Rationale: RME, USEPA 1997; DTSC 1992
Averaging Time (AT)	Value: Carcinogenic Effects: 75 years (27,375 days) Noncarcinogenic Effects: AT = Exposure duration or 6 years (2,190 days) Rationale: Average lifetime, USEPA 1997; Exposure duration, DTSC 1992	Carcinogenic Effects: Constant at 75 years Noncarcinogenic Effects: Co-vary with exposure duration	Value: Carcinogenic Effects: 75 years (27,375 days) Noncarcinogenic Effects: AT = Exposure duration or 6 years (2,190 days) Rationale: Average lifetime, USEPA 1997; Exposure duration, DTSC 1992

Table 5-5 (2 of 4)

Exposure Assessment Parameters for a Recreational Child

Parameter	Central Tendency Exposure (CTE)	Exposure Distribution	Reasonable Maximum Exposure (RME)
Inhalation of Particulates and/or Vapors:			
Breathing Rate (BR)	Value: 1.1 m^3/hour Rationale: Midpoint between recommended values for RME for light and moderate activity in children; USEPA 1997	Lognormal mean: 1.08 m^3/hour standard deviation: 0.32 m^3/hour Source: Active inhalation rate in adults times 0.86 (ratio of child to adult recommended rates in USEPA 1997); CalTOX 1994[1]	Value: 1.1 m^3/hour Rationale: Midpoint between recommended values for RME for light and moderate activity in children, USEPA 1997
Dermal Contact with Soil:			
Soil Adherence Factor (AF)	Value: Value from anticipated USEPA Guidance on Dermal Assessment or 0.06 mg/cm^2 Rationale: Weighted soil adherence for hands, face, forearms, lower legs, and feet for "day care kids" (USEPA 1997, Table 6-13); typical activity combined with 50th percentile body part-specific soil adherence factors	Empirical Distribution Rationale: Distribution from anticipated USEPA Dermal Guidance or fitted distribution of pooled data from sources cited in that Guidance	Value: Value from anticipated USEPA Guidance on Dermal Assessment or 0.2 mg/cm^2 Rationale: Weighted soil adherence for hands, face, forearms, lower legs, and feet for "children playing in wet soil" (USEPA 1997, Table 6-13); high-end activity combined with 50th percentile body part-specific soil adherence factors
Skin Surface Area (SA)	Value: 2,800 cm^2 Rationale: Exposed skin surface area for hands, head, forearms, lower legs, and feet; USEPA 1997	Empirical Distribution Co-vary with body weight Rationale: Distribution developed from percentile values (USEPA 1997, Tables 6-6, 6-7), adjusted for fraction of skin exposed, and fitted with Crystal Ball	Value: 2,800 cm^2 Rationale: Exposed skin surface area for hands, head, forearms, lower legs, and feet; USEPA 1997

Table 5-5 (3 of 4)

Exposure Assessment Parameters for a Recreational Child

Parameter	Central Tendency Exposure (CTE)	Exposure Distribution	Reasonable Maximum Exposure (RME)
Bioavailability (ABS)	Value: Chemical-specific: 0.1 for VOCs; 0.001 for Cd; 0.03 for As; 0.01 for other metals Rationale: DTSC 1994[1]	Constant	Value: Chemical-specific: 0.1 for VOCs; 0.001 for Cd; 0.03 for As; 0.01 for other metals Rationale: DTSC 1994[1]
Dermal Contact with Surface Water:			
Event Frequency (EV)	Value: 0.5 Rationale: Site-specific assumption	Constant Rationale: Site-specific assumption	Value: 0.5 Rationale: Site-specific assumption
Time of Event (t_{event})	Value: 1 hr Rationale: Site-specific assumption	Uniform Distribution: Minimum 1 hr Maximum 2 hrs Rationale: Site-specific assumption	Value: 2 hrs Rationale: Site-specific assumption
Skin Surface Area (SA)	Value: 6,560 cm^2 Rationale: Total skin surface area based on the 50th percentile of the distribution for 1- to 6-year-olds from USEPA 1997, Tables 6-6 and 6-7	Empirical Distribution Co-vary with body weight Rationale: Distribution developed from percentile values (USEPA 1997, Tables 6-6, 6-7), and fitted with Crystal Ball	Value: 6,560 cm^2 Rationale: Total skin surface area based on the 50th percentile of the distribution for 1- to 6-year-olds from USEPA 1997, Tables 6-6 and 6-7
Bioavailability (ABS)	Value: Chemical-specific: 0.1 for VOCs; 0.001 for Cd; 0.03 for As; 0.01 for other metals Rationale: DTSC 1994[1]	Constant	Value: Chemical-specific: 0.1 for VOCs; 0.001 for Cd; 0.03 for As; 0.01 for other metals Rationale: DTSC 1994[1]

Table 5-5 (4 of 4)

Exposure Assessment Parameters for a Recreational Child

Parameter	Central Tendency Exposure (CTE)	Exposure Distribution	Reasonable Maximum Exposure (RME)
Incidental Soil Ingestion:			
Ingestion Rate (IR_{soil})	Value: 100 mg/day Rationale: Average value, USEPA 1997	Lognormal arithmetic mean: 86 mg/day standard deviation: 191 mg/day Source: CalTOX 1993	Value: 200 mg/day Rationale: RME, DTSC 1992
Bioavailability (B)	Value: Chemical-specific Rationale: Current peer-reviewed literature values for chemical in soil matrix; subject to DTSC approval	Constant	Value: Chemical-specific Rationale: Current peer-reviewed literature values for chemical in soil matrix; subject to DTSC approval

[1] CalTOX computer model version 1994.
Crystal Ball (Decisioneering, Inc., Denver, CO)

Table 6-1 (1 of 1)

Data Sources for Estimating Exposure Point Concentrations

Media	Source of Exposure Point Concentration	Exposure Type
Seeps and Springs	Direct sampling and analysis of either shallow or deep groundwater, depending upon the relevant source of water	Current and future human contact, biota use
Shallow Groundwater	Direct sampling and analysis	Current and future contact, biota use
Chatsworth Formation Groundwater	Direct sampling and analysis	Current and future human contact
Soil	Direct sampling and analysis Possible predictive measure of transport to contiguous area	Current and future human contact, biota use
Sediment	Direct sampling and analysis	Current and future human contact, biota use
Surface Water	Direct sampling and analysis Possible predictive measure of transport to contiguous area	Current and future human contact, biota use
Air (indoor/outdoor)	Predictive measures	Current and future human inhalation, biota use
Biota Used as Food	Predictive measures	Future human consumption, biota use

Table 6-2 (1 of 1)

Example of Area-Weighted Statistics

Site ID (sample identification relevant to those shown in Figure 6-1)	COPC Concentration (c_i; mg/kg)	Area (square feet)	Proportion of Total Area (p_i)	p_i * c_i^2	Weighted Concentration (mg/kg)
SS-1	11.00	4,829	0.03	3.12	0.28
SS-2	3.00	969	0.01	0.05	0.02
SS-3	20.00	7,968	0.04	17.04	0.85
SS-4	2.00	5,643	0.03	0.12	0.06
SS-5	5.00	9,116	0.05	1.22	0.24
SS-6	8.00	7,985	0.04	2.73	0.34
SS-7	15.00	5,120	0.03	6.16	0.41
SS-8	5.00	18,870	0.10	2.52	0.50
SS-9	2.00	6,357	0.03	0.14	0.07
SS-10	2.00	12,544	0.07	0.27	0.13
SS-11	58.00	8,543	0.05	153.70	2.65
SS-12	330.00	15,709	0.08	9,148.62	27.72
SS-13	120.00	16,645	0.09	1,281.82	10.68
SS-14	11.00	19,918	0.11	12.89	1.17
SS-15	130.00	15,124	0.08	1,366.91	10.51
SS-16	2.00	16,984	0.09	0.36	0.18
SS-17	1,600.00	14,668	0.08	200,812.50	125.51
sum		186,993		212,810	181
sample number	17				17
mean	137				
area-weighted mean					181
standard deviation (SD)	375				
area-weighted SD					424
standard error of the mean (SEM)	94				
area-weighted SEM					103
t 0.95 (two tailed, 16 degrees of freedom)	1.76				1.76
95% upper concentration limit	302				362

Table 6-3 (1 of 1)

Example of Area-Weighted Statistics

Site ID	COPC Concentation (c_i; mg/kg)	Area (square feet)	Proportion of Total Area (p_i)	p_i * c_i^2	Weighted Concentration (mg/kg)
BSPC-6	11.00	4,829	0.03	3.12	0.28
BSPC-7	1,600.00	969	0.01	13,263.08	8.29
BRAVO3	20.00	7,968	0.04	17.04	0.85
BRAVO2	2.00	5,643	0.03	0.12	0.06
SV-5.15-2	5.00	9,116	0.05	1.22	0.24
BTSC-1-5	8.00	7,985	0.04	2.73	0.34
B-2	15.00	5,120	0.03	6.16	0.41
BTSC-1-2	5.00	18,870	0.10	2.52	0.50
BRAVO1	2.00	6,357	0.03	0.14	0.07
B-1	2.00	12,544	0.07	0.27	0.13
SV-LF-217-1	58.00	8,543	0.05	153.70	2.65
SV-5.13-2	330.00	15,709	0.08	9,148.62	27.72
BTSC-2/3-15	120.00	16,645	0.09	1,281.82	10.68
BTSC-2/3-5	11.00	19,918	0.11	12.89	1.17
SV5.13-1	130.00	15,124	0.08	1,366.91	10.51
SV5.13-4	2.00	16,984	0.09	0.36	0.18
SV5.13-3	3.00	14,668	0.08	0.71	0.24
sum		186,993		25,261	64
sample number	17				17
mean	137				
area-weighted mean					64
standard deviation (SD)	375				
area-weighted SD					145
standard error of the mean (SEM)	94				
area-weighted SEM					35
t 0.95 (two tailed, 16 degrees of freedom)	1.76				1.76
95% upper concentration limit	302				126

Some toxicity values presented in this Table are no longer applicable because an updated hierarchy of toxicity values are presented in Appendix B of the SRAM Rev. 2 Addendum

Summary of Non-Cancer Toxicity Values for Human Health Risk Assessment COPCs

	Oral Reference Dose (mg/kg-day)						Inhalation Reference Dose (mg/kg-day)					
Compound	Value	UF	Source	Species	Exp. Route	Effect	Value	UF	Source	Species	Exp. Route	Effect
1,1,1-Trichloroethane	0.28		USEPA 2004				0.63		USEPA 2004			
1,1-Dichloroethene	0.05	100	USEPA 2005	Rat	Water	Liver	0.057	30	USEPA 2005	Rat	Inhalation	Liver
1,1,2-Trichloroethane	0.004	1000	USEPA 2005	Mouse	Water	Blood chemistry	0.004[a]	1000	USEPA 2005	Mouse	Water	Blood chemistry
1,2,4-Trimethylbenzene	0.05		USEPA 2004				0.0017		USEPA 2004			
1,2-Dichloroethane	0.02		USEPA 2004				1.40E-03		USEPA 2004			
1,3,5-Trimethylbenzene	0.05		USEPA 2004				0.0017		USEPA 2004			
1,4-Dioxane												
2-Butanone	0.6	1000	USEPA 2005	Rat	Water	Reduced fetal BW	1.4	300	USEPA 2005	Mouse	Inhalation	Skeletal Variations
2,4,6-Trinitrotoluene	0.0005	1000	USEPA 2005	Dog	Gavage	Liver	0.0005[a]	1000	USEPA 2005	Dog	Gavage	Liver
2,4-Dimethylphenol	0.02	3000	USEPA 2005	Mouse	Gavage	Clinical signs	0.02[a]	3000	USEPA 2005	Mouse	Gavage	Clinical signs
2,4-Dinitrophenol	0.002	1000	USEPA 2005	Human	Oral	Cataract formation	0.002[a]	1000	USEPA 2005	Human	Oral	Cataract formation
2,6-Dinitrotoluene	0.001		USEPA 1997				0.001[a]		USEPA 1997			
3,3'-Dichlorobenzidine												
Aluminum	1		USEPA 2004				0.0014		USEPA 2004			
4-Amino-2,6-dinitrotoluene												
Acenaphthene	0.06	3000	USEPA 2005	Mouse	Oral	Liver	0.06[a]	3000	USEPA 2005	Mouse	Oral	Liver
Acenaphthylene	0.03		Value for pyrene				0.03[a]		Value for pyrene			
Acetone	0.9	1000	USEPA 2005	Rat	Water	Nephropathy	0.9[a]	1000	USEPA 2005	Rat	Water	Nephropathy
Anthracene	0.3	3000	USEPA 2005	Mouse	Gavage	None observed	0.3[a]	3000	USEPA 2005	Mouse	Gavage	None observed
Antimony	0.0004	1000	USEPA 2005	Rat	Oral	Blood parameters						
Aroclor 1254	2.00E-05	300	USEPA 2005	Monkey	Oral	Immunotoxicity	0.00002[a]	300	USEPA 2005	Monkey	Oral	Immunotoxicity
Arsenic	0.0003	3	USEPA 2005	Human	Oral	Skin effects	0.000143		CAPCOA 1992			
Barium	0.07	3	USEPA 2005	Human	Water	Blood pressure	0.00014	1000	USEPA 1997 Table II	Rat	Inhalation	Fetotoxicity
Benzene	0.004	300	USEPA 2005	Human	Inhalation	Dec. Lymphocyte Ct.	0.0086	300	USEPA 2005	Human	Inhalation	Dec. Lymphocyte Ct.
Benzo(a)anthracene												
Benzo(a)pyrene												
Benzo(b)fluoranthene												
Benzo(ghi)perylene												
Benzo(k)fluoranthene												
Beryllium	0.002	300	USEPA 2005	Dog	Diet	Intestinal Lesions	5.7E-06	10	USEPA 2005	Human	Occupational	Chronic Beryllium Diseas
Bis(2-ethylhexyl)phthalate	0.02	1000	USEPA 2005	Guinea Pig	Diet	Inc. rel. liver wt.	0.02[a]	1000	USEPA 2005	Guinea Pig	Diet	Inc. rel. liver wt.
Boron	0.2	66	USEPA 2005	Rat	Diet	Dec. Fetal weight	5.70E-03		USEPA 1997			
Cadmium	0.0005	10	USEPA 2005	Human	Water	Proteinurea	0.001		CAPCOA 1992			
Carbazole												
Chloride												
Chloroform	0.01	1000	USEPA 2005	Dog	Oral	Liver effects	0.014		USEPA 2004			

Table 7-1 (2 of 3)

Summary of Non-Cancer Toxicity Values for Human Health Risk Assessment COPCs

	Oral Reference Dose (mg/kg-day)						Inhalation Reference Dose (mg/kg-day)					
Compound	Value	UF	Source	Species	Exp. Route	Effect	Value	UF	Source	Species	Exp. Route	Effect
Chromium	1.5	1000	USEPA 2005	Rat	Oral	None	5.71E-07		CAPCOA 1992			
Chromium VI	0.003	900	USEPA 2005	Rat	Water	None	2.20E-06		USEPA 2005	Human	Occupational	nasal septum atrophy
Chrysene												
cis-1,2-Dichloroethene	0.01		USEPA 2004				0.01[a]		USEPA 2004			
Cobalt	0.02		USEPA 2004				5.70E-06		USEPA 2004			
Copper	0.04		USEPA 1997	Calculated from a Treatment Technology Action L			0.000686		CAPCOA 1992			
Dibenz(ah)anthracene												
Dibutylphthalate	0.1	1000	USEPA 2005	Rat	Diet	Inc. mortality	0.1[a]	1000	USEPA 2005	Rat	Diet	Inc. mortality
Dichlorodifluoromethane	0.2	100	USEPA 2005	Rat	Diet	Reduced BW	0.057		USEPA 1997			
Dichlorofluoromethane	0.2		Surrogate - Dichlorodifluoromethane				0.057		Surrogate - Dichlorodifluoromethane			
Diesel												
Diethylphthalate	0.8	1000	USEPA 2005	Rat	Diet	Dec. weight	0.8[a]	1000	USEPA 2005	Rat	Diet	Dec. weight
2,3,7,8-TCDD												
Ethylbenzene	0.1	1000	USEPA 2005	Rat	Gavage	Liver & kidney effects	0.29	300	USEPA 2005	Rat/rabbit	Inhalation	Devel. toxicity
Fluoranthene	0.04	3000	USEPA 2005	Mouse	Gavage	Liver & kidney effects	0.04[a]	3000	USEPA 2005	Mouse	Gavage	Liver & kidney effects
Fluorene	0.04	3000	USEPA 2005	Mouse	Gavage	Blood effects	0.04[a]	3000	USEPA 2005	Mouse	Gavage	Blood effects
Fluoride	0.06	1	USEPA 2005	Human	Water	Fluorosis						
Formaldehyde	0.2	100	USEPA 2005	Rat	Water	c. wt. Gain & Liver effects						
Gasoline												
HMX	0.05	1000	USEPA 2005	Rat	Diet	Liver	0.05[a]	1000	USEPA 2005	Rat	Diet	Liver
Hydrazine							6.86E-05		CAPCOA 1992			
Indeno(123cd)pyrene												
Kerosene												
Lead												
Lube Oil												
Manganese	0.14	1	USEPA 2005	Human	Diet	CNS	1.4E-05	1000	USEPA 2005	Human	Occupational	CNS
Mercury	0.0003		CAPCOA 1992				8.57E-05	30	USEPA 2005	Human	Occupational	CNS
Methylene chloride	0.06	100	USEPA 2005	Rat	Water	Liver	0.86		USEPA 1997			
Molybdenum	0.005	30	USEPA 2005	Human	Diet	Inc. uric acid levels						
Monomethylhydrazine												
Naphthalene	0.02	3000	USEPA 2005	Rat	Gavage	Decreased BW	0.00086	3000	USEPA 2005	Mouse	Inhalation	Nasal effects
N-Nitrosodimethylamine												
N-Nitrosodiphenylamine												
Nickel	0.02	300	USEPA 2005	Rat	Diet	Dec. body wt.	6.86E-05		CAPCOA 1992			
Nitrate	1.6	1	USEPA 2005	Human	Water	Methemoglobinemia						
Nitrite	0.1	10	USEPA 2005	Human	Water	Methemoglobinemia						
Nitrobenzene	0.0005	10000	USEPA 2005	Rat/Mouse	Inhalation	Blood/Kidney/Liver	0.00057		USEPA 1997			
Perchlorate	0.00012	30	OEHHA 2005	Human		Thyroid	0.00012	30	OEHHA 2005	Human		Thyroid

Summary of Non-Cancer Toxicity Values for Human Health Risk Assessment COPCs

	Oral Reference Dose (mg/kg-day)						Inhalation Reference Dose (mg/kg-day)					
Compound	Value	UF	Source	Species	Exp. Route	Effect	Value	UF	Source	Species	Exp. Route	Effect
Phenanthrene	0.03		Value for pyrene				0.03		Value for pyrene			
Phenol	0.3	300	USEPA 2005	Rat	Gavage	Dec. body weight	0.3[a]	300	USEPA 2005	Rat	Gavage	Dec. body weight
Pyrene	0.03	3000	USEPA 2005	Mouse	Gavage	Kidney	0.03[a]	3000	USEPA 2005	Mouse	Gavage	Kidney
RDX	0.003	100	USEPA 2005	Rat	Diet	Prostate	0.003[a]	100	USEPA 2005	Rat	Diet	Prostate
Selenium	0.005	3	USEPA 2005	Human	Diet	Selenosis						
Silver	0.005	3	USEPA 2005	Human	Intravenous	Argyria						
Styrene	0.2	1000	USEPA 2005	Dog	Gavage	Blood & liver effects	0.29	30	USEPA 2005	Human	Occupational	CNS
Tetrachloroethene	0.01	1000	USEPA 2005	Mouse	Gavage	Liver	0.01		OEHHA 2005			
Thallium	0.00008	3000	USEPA 2005	Rat	Gavage	Blood parameters						
Toluene	0.2	1000	USEPA 2005	Rat	Gavage	Liver/Kidney	0.11	300	USEPA 2005	Human	Inhalation	CNS
trans-1,2-Dichloroethene	0.02	1000	USEPA 2005	Mouse	Water	Blood chemistry	0.02[a]	1000	USEPA 2005	Mouse	Water	Blood chemistry
Trichloroethene	3.00E-04		USEPA 2004				0.17		OEHHA 2005			
Trichlorofluoromethane (CFC 11)	0.3	1000	USEPA 2005	Rat	Gavage	Mortality	0.2	10000	USEPA 1997 Table II	Dog	Inhalation	Kidney & lung
Trichloropropene	0.01		USEPA 2004				3.00E-04		USEPA 2004			
Unsymmetrical dimethylhydrazine												
Vanadium	0.001		USEPA 2004									
Vinyl chloride	0.003	30	USEPA 2005	Rat	Diet	Liver	0.0290	30	USEPA 2005	Rat	Diet	Liver
Xylenes	0.2	1000	USEPA 2005	Rat	Gavage	Dec. BW; hyperactivity	0.029	300	USEPA 2005	Rat	Inhalation	Motor Activity
Zinc	0.3	3	USEPA 2005	Human	Diet	Blood parameters	0.01		CAPCOA 1992			

Note: Compounds on this table have been previously detected in environmental media at the SSFL. Because unit investigations are ongoing, this is not necessarily complete and may be revised.

[a] Value shown is based on oral route of exposure. Use of this value for inhalation exposure will require route-to-route extrapolation.

Some toxicity values presented in this Table are no longer applicable because an updated hierarchy of toxicity values are presented in Appendix B of the SRAM Rev. 2 Addendum

Summary of Cancer Toxicity Values for Human Health Risk Assessment COPCs

Compound	USEPA Carc. Class	Oral CSF [1/(mg/kg-day)]					Inhalation CSF [1/(mg/kg-day)]				
		Value	Source	Species	Exp. Route	Tumor Site	Value	Source	Species	Exp. Route	Tumor Site
1,1,1-Trichloroethane	D										
1,1-Dichloroethene	C										
1,1,2-Trichloroethane	C	0.072	OEHHA 2005				0.057	OEHHA 2005	Mouse	Gavage	Liver
1,2,4-Trimethylbenzene	NA										
1,2-Dichloroethane	B2	0.047	OEHHA 2005	Rat	Gavage	Circ. system	0.072	OEHHA 2005	Rat	Gavage	Circ. system
1,3,5-Trimethylbenzene	NA										
1,4-Dioxane	B2	0.027	OEHHA 2005	Mouse	Water	Liver	0.027	OEHHA 2005	Mouse	Water	Liver
2-Butanone	NA										
2,4,6-Trinitrotoluene	C	0.03	USEPA 2005	Rat	Diet	Urinary bladder	0.03[a]	USEPA 2005	Rat	Diet	Urinary bladder
2,4-Dimethylphenol	NA										
2,4-Dinitrophenol	NA										
2,6-Dinitrotoluene	B2	0.68	USEPA 2005	Rat	Diet	Liver/Mammary	0.68[a]	USEPA 2005	Rat	Diet	Liver/Mammary
3,3'-Dichlorobenzidine	B2	1.2	OEHHA 2005				1.2	OEHHA 2005	Rat	Diet	Mammary
4-Amino-2,6-dinitrotoluene	NA										
Acenaphthene	NA										
Acenaphthylene	D										
Acetone	D										
Aluminum	NA										
Anthracene	D										
Antimony	NA										
Aroclor 1254	B2	2	USEPA 1998	Rat	Diet	Liver	2	USEPA 1998	Rat	Diet	Liver
Arsenic	A	9.45	OEHHA 2005				12	OEHHA 2005	Human	Occup. Inh.	Lung
Benzene	A	0.1	OEHHA 2005	Human	Inhalation	Leukemia	0.1	OEHHA 2005	Human	Inhalation	Leukemia
Barium	D										
Benzo(a)anthracene	B2	1.2	OEHHA 2005 TEF				0.39	OEHHA 2005 TEF			
Benzo(a)pyrene	B2	12	OEHHA 2005	Hamster	Inhalation	Resp. tract	3.9	OEHHA 2005	Hamster	Inhalation	Resp. tract
Benzo(b)fluoranthene	B2	1.2	OEHHA 2005 TEF				0.39	OEHHA 2005 TEF			
Benzo(ghi)perylene	D										
Benzo(k)fluoranthene	B2	1.2	OEHHA 2005 TEF				0.39	OEHHA 2005 TEF			
Beryllium	B2						8.4	OEHHA 2005	Human	Occup. Inh.	Lung
Bis(2-ethylhexyl)phthalate	B2	0.003	OEHHA 2005				0.0084	OEHHA 2005	Rat	Diet	Liver
Boron	NA										
Cadmium	B1	0.38	OEHHA 2005				15	OEHHA 2005	Human	Occup. Inh.	Lung
Carbazole	NA	0.02	USEPA 1997	Mouse	Diet	Liver	0.02[a]	USEPA 1997	Mouse	Diet	Liver
Chloride	NA										
Chloroform	B2	0.031	OEHHA 2005	Mouse	Water	Liver	0.019	OEHHA 2005	Rat/Mice	Gavage	Kidney
Chromium	NA										

Table 7-2 (2 of 3)

Summary of Cancer Toxicity Values for Human Health Risk Assessment COPCs

Compound	USEPA Carc. Class	Oral CSF [1/(mg/kg-day)]					Inhalation CSF [1/(mg/kg-day)]				
		Value	Source	Species	Exp. Route	Tumor Site	Value	Source	Species	Exp. Route	Tumor Site
Chromium VI	A						510	OEHHA 2005	Human	Occup. Inh.	Lung
Chrysene	B2	0.12	OEHHA 2005 TEF				0.039	OEHHA 2005 TEF			
cis-1,2-Dichloroethene	D										
Cobalt	NA						9.8	USEPA 2004			
Copper	D										
Dibenz(ah)anthracene	B2	4.1	OEHHA 2005	Mouse	Water	Lung	4.1	OEHHA 2005	Mouse	Water	Lung
Dibutylphthalate	D										
Diesel	NA										
Diethylphthalate	D										
2,3,7,8-TCDD	B2	130000	OEHHA 2005	Mouse	Gavage	Liver	130000	OEHHA 2005	Mouse	Gavage	Liver
Ethylbenzene	D										
Fluoranthene	D										
Fluorene	D										
Fluoride	NA										
Formaldehyde	B1						0.021	OEHHA 2005	Rat	Inhalation	Nasal cavity
Gasoline											
HMX	D										
Hydrazine	B2	3	OEHHA 2005	Mouse	Gavage	Liver	17	OEHHA 2005	Rat	Inhalation	Nasal cavity
Indeno(123cd)pyrene	B2	1.2	OEHHA 2005 TEF				0.39	OEHHA 2005 TEF			
Kerosene											
Lead	B2										
Lube Oil											
Mercury	D										
Methylene chloride	B2	0.014	OEHHA 2005				0.0035	OEHHA 2005	Mouse	Inhalation	Lung
Molybdenum	NA										
Monomethylhydrazine	NA										
Naphthalene							0.12	OEHHA 2005	Rat	Inhalation	Nasal cavity
N-Nitrosodimethylamine	B2	16	OEHHA 2005	Rat	Water	Liver	16	OEHHA 2005	Rat	Water	Liver
N-Nitrosodiphenylamine	B2	0.009	OEHHA 2005	Rat/Mice	Oral/Gavage	Bladder/Liver	0.009	OEHHA 2005	Rat/Mice	Oral/Gavage	Bladder/Liver
Nickel	A/NA						0.91	OEHHA 2005	Human	Occup. Inhal	Lung
Nitrate	NA										
Nitrite	NA										
Perchlorate	NA										
Phenanthrene	D										
Phenol	D										
Pyrene	D										
RDX	C	0.11	USEPA 2005	Mouse	Diet	Liver	0.11[a]	USEPA 2005	Mouse	Diet	Liver
Selenium	D										
Silver	D										

Table 7-2 (3 of 3)

Summary of Cancer Toxicity Values for Human Health Risk Assessment COPCs

Compound	USEPA Carc. Class	Oral CSF [1/(mg/kg-day)]					Inhalation CSF [1/(mg/kg-day)]				
		Value	Source	Species	Exp. Route	Tumor Site	Value	Source	Species	Exp. Route	Tumor Site
Styrene	NA										
Tetrachloroethene	NA	0.54	OEHHA 2005				0.021	OEHHA 2005	Mouse	Gavage	Liver
Thallium	D										
Trichloroethene	NA	0.013	OEHHA 2005				0.007	OEHHA 2005	Mouse	Inhalation	Lung, liver
Trichlorofluoromethane (CFC 11)	NA										
Unsymmetrical dimethylhydrazine											
Vanadium	NA										
Vinyl chloride	A	0.27	OEHHA 2005	Mouse	Inhalation	Lung	0.27	OEHHA 2005	Mouse	Inhalation	Lung
Xylenes	D										
Zinc	D										

Note: Compounds on this table have been previously detected in environmental media at the SSFL. Because unit investigations are ongoing, this is not necessarily complete and may be revised.

[a] Value shown is based on oral route of exposure. Use of this value for inhalation exposure will require route-to-route extrapolation.

This table has been replaced by information in Appendix B of the SRAM Rev. 2 Addendum.

Table 7-3 (1 of 1)

Coplanar PCB and Dioxin Toxicity Equivalent Factors (TEFs) for Humans *

PCB Congener	WHO TEF (unitless)
PCB-77 (3,3',4,4')	0.0001
PCB-81 (3,4,4',5)	0.0001
PCB-105 (2,3,3',4,4')	0.0001
PCB-114 (2,3,4,4',5)	0.0005
PCB-118 (2,3',4,4',5)	0.0001
PCB-123 (2',3,4,4',5')	0.0001
PCB-126 (3,3',4,4',5)	0.1
PCB-156 (2,3,3',4,4',5)	0.0005
PCB-157 (2,3,3',4,4',5')	0.0005
PCB-167 (2,3',4,4',5,5')	0.00001
PCB-169 (3,3',4,4',5,5')	0.01
PCB-189 (2,3,3',4,4',5,5')	0.0001

Dioxin Congener	WHO TEF (unitless)
2,3,7,8-TCDD	1
1,2,3,7,8-PeCDD	1
1,2,3,4,7,8-HxCDD	0.1
1,2,3,6,7,8-HxCDD	0.1
1,2,3,7,8,9-HxCDD	0.1
1,2,3,4,6,7,8-HpCDD	0.01
OCDD	0.0001
2,3,7,8-TCDF	0.1
1,2,3,7,8-PeCDF	0.05
2,3,4,7,8-PeCDF	0.5
1,2,3,4,7,8-HxCDF	0.1
1,2,3,6,7,8-HxCDF	0.1
2,3,4,6,7,8-HxCDF	0.1
1,2,3,7,8,9-HxCDF	0.1
1,2,3,4,6,7,8-HpCDF	0.01
1,2,3,4,7,8,9-HpCDF	0.01
OCDF	0.0001

* Van den Berg *et al*. (1998)
WHO = World Health Organization

Table 9-1 (1 of 1)

Biological, Toxicological, and Societal Criteria for Selection of Reference Species [1]

		Ecological Factors				Toxicological Factors			Societal Factors		
Assessment Endpoints	Observed at Site	High Trophic Level Predator	Important Prey Species	Important to Structure or Function of	High Potential for Exposure Based on Amount and Type of Site Use	Susceptible to Bioaccumulation or Biomagnification	Toxicological Information	Directly Measurable Toxic	Species of Special Concern	Economically Important	High Social or Recreational Value
Protect raptor species from acute (mortality) and chronic (reproductive, growth, and behavioral impairment, disease) adverse effects from direct and/or secondary exposure to site-related CPECs.											
American kestrel	x	x		x	x	x	x		x		x
Cooper's hawk	x	x		x	x	x			x		x
Red-shouldered hawk	x	x		x	x	x			x		x
Red-tailed hawk	x	x		x	x	x	x		x		x
Sharp-shinned hawk	x	x		x	x	x			x		x
Protect the abundance and quality of raptor and bobcat prey items (frogs, snakes, rodents, and rabbits) by limiting acute and chronic adverse effects from direct and/or secondary exposure to site-related CPECs.											
California toad	x		x	x	x	x		x			
Pacific tree frog	x		x	x	x	x		x			
California kingsnake	x		x	x	x	x			x		
Gopher snake	x		x	x	x	x		x			
Two-striped garter snake	x		x	x	x	x			x		
Botta's pocket gopher	x		x	x	x	x		x			
Deer mouse	x		x	x	x	x	x	x			
Little pocket mouse	x		x	x	x	x	x	x			
Brush rabbit	x		x	x	x	x		x			
Desert cottontail	x		x	x	x	x		x			
San Diego black-tailed jackrabbit	x		x	x	x	x			x		
Protect bobcat from acute (mortality) and chronic (reproductive impairment) adverse effects from direct and/or secondary exposure to site-related CPECs.	x	x		x	x	x			x		x
Protect the abundance of native terrestrial vegetation by limiting acute and chronic adverse effects from direct and/or secondary exposure to site-related CPECs.	x		x	x				x			x
Protect the abundance of great blue heron prey items (fish, frogs, snakes, rodents) by limiting acute and chronic adverse effects from direct and/or secondary exposure to site-related CPECs.	x		x	x	x	x	x	x			
Protect great blue heron from acute (mortality) and chronic (reproductive, growth, and behavioral impairment, disease) adverse effects from direct and/or secondary exposure to site-related CPECs.	x	x		x	x	x	x		x		x
Protect the abundance of benthic invertebrate community by limiting acute and chronic adverse effects from exposure to	x		x	x	x	x	x	x			
Protect the abundance of terrestrial invertebrate community by limiting acute and chronic adverse effects from exposure						x		x			
Protect the abundance of wetland and aquatic vegetation by limiting acute and chronic adverse effects from exposure to site-related CPECs.	x			x				x			x

Notes:

[1] Developed from information contained within the Biological Conditions Report (Appendix C).

[2] Indicates tissue analysis is possible (e.g., species can be readily trapped at the SSFL).

This table has been replaced by information in the updated Figure 9-2 in Appendix C of the SRAM Rev. 2 Addendum.

Table 9-2 (1 of 1)

Summary of Generalized Ecological Conceptual Site Model

Media	Potential Exposure Route	Terrestrial Reference Species	Aquatic Reference Species	Terrestrial Habitats	Aquatic Habitats	CPEC
Surface Water & Groundwater Seeps	Direct Contact	Yes	Yes	No	Yes	All
	Root Contact	Yes	Yes	No	Yes	All
	Ingestion	Yes	Yes	No	Yes	All
Sediment	Direct Contact	Yes	Yes	No	Yes	All
	Root Contact	Yes	Yes	No	Yes	All
	Ingestion	Yes	Yes	No	Yes	All
Groundwater	Root Contact	Yes	No	Yes	No	All
Soil	Dermal Contact	Yes	No	Yes	No	All
	Foliar Deposition	Yes	No	Yes	No	All
	Ingestion	Yes	No	Yes	No	All
Air	Inhalation (vapors)	Yes	No	Yes	No	All
	Inhalation (dust)	Yes	No	Yes	No	All
Food Web	Ingestion	Yes	Yes	Yes	Yes	All

CPEC = contaminant of potential ecological concern

This table has been replaced by Table 9-3 in Appendix C of the SRAM Rev. 2 Addendum.

Table 9-3 (1 of 4)

Summary of Assessment Goals and Endpoints

Assessment Goal	Assessment Endpoint	Measures of Exposure	Measures of Effect
Protect wildlife, fish, invertebrate, and plant species from acute or chronic effects resulting from site-related chemicals	Protect raptor species from acute (mortality) and chronic (e.g., reproductive impairment) adverse effects from direct and/or secondary exposure to site-related CPECs.	Calculate daily dosage to red-tailed hawk using exposure models, measured chemical concentrations in abiotic and biotic media, and food web interactions.	• Compare to NOAEL dosages for the red-tailed hawk or similar raptor species.
	Protect bobcat from acute (mortality) and chronic (e.g., reproductive impairment) adverse effects from direct and/or secondary exposure to site-related CPECs.	Calculate daily dosage to bobcat using exposure models, measured chemical concentrations in abiotic and biotic media, and food web interactions.	• Compare to NOAEL dosages for the bobcat or similar mammal species.
	Protect the abundance of raptor and bobcat prey items (e.g., rodents) by limiting acute and adverse effects from direct and/or secondary exposure to site-related CPECs.	Measure contaminant concentrations in surface soil, plants, rodents, and invertebrates at selected investigational units. Extrapolate results to other investigational units as appropriate.	• Compare to NOAEL concentrations or NOAEL dosages for prey species.
	Protect mule deer from acute (mortality) and chronic (e.g., reproductive impairment) adverse effects from direct and/or secondary exposure to site-related CPECs.	Calculate daily dosage to mule deer using exposure models, measured chemical concentrations in abiotic and biotic media, and food web interactions.	• Compare to NOAEL dosages for the mule deer or similar mammal species.

Table 9-3 (2 of 4)

Summary of Assessment Goals and Endpoints

Assessment Goal	Assessment Endpoint	Measures of Exposure	Measures of Effect
	Protect the abundance of native terrestrial vegetation by limiting acute and chronic adverse effects from exposure to site-related CPECs.	Note any stressed vegetation or reduced density of vegetation. SSFL-specific BCFs have been calculated for use at other investigational units using concentrations measured in co-located soil and terrestrial plant samples..	• Indicators of habitat quality (e.g., vegetation survey results).
	Protect the abundance of great blue heron prey items (e.g., fish,) by limiting acute and chronic adverse effects from direct and/or secondary exposure to site-related CPECs.	Measure contaminant concentrations in surface water and sediment.	• Compare to NOAEL concentrations or NOAEL dosages for prey species.
Protect wildlife, fish, invertebrate, and plant species from acute or chronic effects resulting from site-related chemicals	Protect great blue heron from acute (mortality) and chronic (e.g., reproductive impairment) adverse effects from direct and/or secondary exposure to site-related CPECs.	Calculate daily dosage to great blue heron using exposure models, measured chemical concentrations in abiotic and bitoic media, and food web interactions.	• Compare to NOAEL dosages for the great blue heron or similar bird species.

Table 9-3 (3 of 4)

Summary of Assessment Goals and Endpoints

Assessment Goal	Assessment Endpoint	Measures of Exposure	Measures of Effect
	Protect the abundance of benthic invertebrate community by limiting acute and chronic adverse effects from exposure to site-related CPECs.	Measure contaminant concentrations in sediments. SSFL-specific BCFs have been calculated for use at other investigational units using concentrations measured in co-located surface water, sediment, and aquatic invertebrate samples.	• Compare to LOAEL concentrations for benthic invertebrate communities.
	Protect the abundance of terrestrial invertebrate community by limiting acute and chronic adverse effects from exposure to site-related CPECs.	Measure contaminant concentrations in soils. SSFL-specific BCFs have been calculated for use at other investigational units using concentrations measured in co-located soil and terrestrial soil invertebrate samples.	• Compare to LOAEL concentrations for terrestrial invertebrate communities.

Table 9-3 (4 of 4)

Summary of Assessment Goals and Endpoints

Assessment Goal	Assessment Endpoint	Measures of Exposure	Measures of Effect
	Protect the abundance of wetland and aquatic vegetation by limiting acute and chronic adverse effects from exposure to site-related CPECs.	Note any stressed vegetation or reduced density of vegetation. SSFL-specific BCFs have been calculated for use at other investigational units using concentrations measured in co-located surface water, sediment, and aquatic plant samples.	• Indicators of wetland habitat quality (e.g., vegetation survey results).

Notes:
BCF = bioconcentration factor
CPEC = contaminant of potential ecological concern
NOAEL = no observable adverse effects level

This table has been replaced by Table 10-2 in Appendix C of the SRAM Rev. 2 Addendum.

Table 10-1 (1 of 1)

BAF Study Sampling Locations and Analyses [a]

Ecological receptor	Locations	Media Sampled	Number of samples	Analyses
Fish	R2A/R2B Ponds (SWMU 5.26) Silvernale Reservoir (SWMU 6.8)	Tissue, sediment	4 4	Metals, PAHs, dioxins PCB congeners
Aquatic Invertebrate	R2A/R2B Ponds (SWMU 5.26) Silvernale Reservoir (SWMU 6.8)	Tissue, sediment	4 4	Metals, PAHs, dioxins PCB congeners
Terrestrial Vertebrate	Bravo Area (SWMU 5.13, 5.14, 5.15) Component Test Laboratory III (SWMU 4.7)	Tissue, soil	4 4	Metals, PCB congeners PAHs, dioxins
Terrestrial Invertebrate	Bravo Area (SWMU 5.13, 5.14, 5.15) Component Test Laboratory III (SWMU 4.7)	Tissue, soil	4 4	Metals, PCB congeners PAHs, dioxins
Aquatic Plant	R2A/R2B Ponds (SWMU 5.26) Silvernale Reservoir (SWMU 6.8)	Tissue, sediment	4 4	Metals, PAHs, dioxins PCB congeners
Terrestrial Plant	Bravo Area (SWMU 5.13, 5.14, 5.15) Component Test Laboratory III (SWMU 4.7)	Tissue, soil	4 4	Metals, PCB congeners PAHs, dioxins

Notes:

a. The data used to derive BAFs for the SSFL include (1) colocated soil and terrestrial organism samples, and (2) colocated sediment and aquatic organism samples.

b. Sites chosen for BAF study as approved by the DTSC.

c. Metals, PAHs, PCBs, and dioxins analyzed by USEPA Methods 6010B/7000, 8270, 1668, and 1613B, respectively

BAF - biota soil/sediment accumulation factor

PAH - polycyclic aromatic hydrocartbons

PCB - polychlorinated biphenyl

SWMU - Solid waste mangement unit

This table has been replaced by Table 10-3 in Appendix C of the SRAM Rev. 2 Addendum.

Table 10-2 (1 of 2)

Site-Specific Aquatic Bioaccumulation Factors - Santa Susana Field Laboratory

Chemical	Fish		Aquatic Invertebrates		Aquatic Plants	
	BAF [a] (unitless)	Sample Size[b]	BAF [a] (unitless)	Sample Size[b]	BAF [a] (unitless)	Sample Size[b]
1,2,3,4,6,7,8-HpCDD	3.9E-02	4	1.4E-01	4	2.8E-02	4
1,2,3,4,6,7,8-HpCDF	4.3E-02	1	1.2E-01	4	3.7E-02	4
1,2,3,4,7,8,9-HpCDF	-	-	7.3E-02	1	-	-
1,2,3,4,7,8-HxCDD	3.2E-01	4	3.6E-01	3	-	-
1,2,3,4,7,8-HxCDF	1.3E-01	2	4.2E-01	4	-	-
1,2,3,6,7,8-HxCDD	5.1E-01	4	3.6E-01	4	-	-
1,2,3,6,7,8-HxCDF	4.8E-01	3	3.6E-01	4	-	-
1,2,3,7,8,9-HxCDD	1.8E-01	4	2.8E-01	3	-	-
1,2,3,7,8-PeCDD	1.4E+00	4	5.7E-01	4	-	-
1,2,3,7,8-PeCDF	9.2E-01	4	1.0E+00	4	-	-
2,3,4,6,7,8-HxCDF	1.1E-01	2	2.2E-01	4	-	-
2,3,4,7,8-PeCDF	1.6E+00	4	6.9E-01	4	-	-
2,3,7,8-TCDD	2.5E+00	4	8.2E-01	4	-	-
2,3,7,8-TCDF	1.1E+00	4	2.5E+00	4	7.1E-02	1
Aluminum	1.8E-02	4	2.5E-02	4	1.6E-01	4
Antimony	1.8E+00	2	2.6E-01	1	5.4E-01	1
Anthracene	-	-	-	-	-	-
Arsenic	-	-	3.1E-01	4	3.5E-01	2
Barium	1.0E-01	4	1.4E+00	4	3.6E-01	4
Benzo(a)anthracene	-	-	1.1E+00	1	-	-
Benzo(a)pyrene	-	-	5.6E-01	1	-	-
Benzo(b)fluoranthene	-	-	1.4E+00	1	-	-
Benzo(g,h,i)perylene	-	-	6.4E-01	1	-	-
Benzo(k)fluoranthene	-	-	7.9E-01	2	-	-
Beryllium	-	-	1.9E-01	3	3.3E-01	1
Boron	-	-	4.3E-01	2	1.8E+00	2
Cadmium	-	-	-	-	-	-
Chromium	2.7E-01	4	4.0E-01	4	7.7E-01	4
Chrysene	-	-	1.1E+00	2	-	-
Cobalt	3.0E-02	1	9.0E-02	4	2.3E-01	4
Copper	1.2E-01	4	3.1E+00	4	3.0E-01	3
Dibenz(a,h)anthracene	-	-	3.2E+00	1	-	-
Fluoranthene	8.9E-02	1	8.3E-01	2	-	-
Fluorene	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	-	-	6.3E-01	1	-	-
Iron	2.0E-02	4	2.6E-02	4	2.1E-01	4
Lead	-	-	-	-	-	-
Magnesium	2.5E-01	4	5.3E-01	4	5.3E-01	4
Manganese	8.4E-02	4	8.6E-01	4	9.7E-01	4
Mercury	1.2E+00	4	3.0E-01	4	3.7E-01	1
Molybdenum	7.6E-01	2	-	-	-	-
Naphthalene	5.8E+00	1	-	-	-	-
Nickel	1.6E-01	4	3.4E-01	4	5.8E-01	4
OCDD	1.7E-02	4	1.7E-01	4	2.7E-02	4
OCDF	1.8E-02	4	4.0E-02	4	3.2E-02	4
PCB-105	2.7E+02	4	2.3E+01	4	1.4E+00	3
PCB-114	2.8E+02	4	3.3E+01	4	-	-
PCB-118	3.2E+02	4	2.7E+01	4	1.5E+00	4
PCB-123	3.6E+02	4	4.0E+01	4	-	-
PCB-126	1.2E+02	4	1.5E+01	4	-	-
PCB-128	2.6E+02	4	3.0E+00	4	1.4E+00	2
PCB-138	3.5E+02	4	2.1E+01	4	1.4E+00	4
PCB-153	4.3E+02	4	2.8E+01	4	1.2E+00	4
PCB-156	3.7E+02	4	2.9E+01	4	1.6E+00	1
PCB-157	2.8E+02	4	2.5E+01	4	-	-
PCB-167	3.8E+02	4	3.4E+01	4	-	-
PCB-170	5.1E+02	4	1.7E+01	4	-	-
PCB-18	5.8E+00	2	7.7E-01	2	6.5E-01	2
PCB-180	4.4E+02	4	2.3E+01	4	1.3E+00	2
PCB-187	5.3E+02	4	3.0E+01	4	-	-

Table 10-2 (2 of 2)

Site-Specific Aquatic Bioaccumulation Factors - Santa Susana Field Laboratory

Chemical	Fish		Aquatic Invertebrates		Aquatic Plants	
	BAF [a] (unitless)	Sample Size[b]	BAF [a] (unitless)	Sample Size[b]	BAF [a] (unitless)	Sample Size[b]
PCB-189	1.5E+01	2	3.2E+00	2	-	-
PCB-195	4.1E+02	4	1.2E+01	4	-	-
PCB-206	2.4E+02	4	3.8E+00	4	-	-
PCB-209	1.0E+02	4	-	-	-	-
PCB-28	8.1E+00	2	1.9E+00	2	8.8E-02	1
PCB-44	1.2E+02	4	6.9E+00	4	2.2E+00	4
PCB-52	1.7E+02	4	1.8E+01	4	1.9E+00	4
PCB-66	1.8E+02	3	1.8E+01	4	1.8E+00	4
PCB-77	1.9E+01	4	1.1E+01	4	-	-
PCB-8	5.9E+00	2	-	-	-	-
PCB-81	1.3E+02	4	1.8E+00	2	-	-
PCB-90/101	2.1E+02	4	1.7E+01	4	1.1E+00	4
Total PCB/Aroclor[c]	2.4E+02	-	1.8E+01	-	1.4E+00	-
Phenanthrene	2.6E-01	2	1.5E+00	3	-	-
Pyrene	-	-	5.9E-01	2	-	-
Selenium	4.6E+00	4	3.6E+00	4	2.2E+00	2
Silver	-	-	1.0E+00	4	-	-
Thallium	-	-	2.9E-01	3	3.5E-01	2
Vanadium	2.1E-02	4	3.5E-02	4	2.8E-01	4
Zinc	4.1E-01	4	6.6E-01	4	2.8E-01	4

Notes:

a. The bioaccumulation factor (BAF) is calculated as the ratio of tissue chemical concentration to soil chemical concentration, when the sample size = 1 the value is the ratio, when the sample size = 2 the BAF value is the mean of the two measured ratios, when the sample size = 3 or 4, the BAF is an approximation of the 75th percentile distribution of the concentration ratio values.

b Number of tissue chemical concentration to soil chemical concentration ratios used to calculate the BAF.

c. BAF for total PCB or Aroclors is based on the arithmetic mean of the PCB congener-specific BAFs.

"-" chemical either not analysed for or analytical data not sufficient for calculating a BAF

BAF - bioaccumulation factor

This table has been replaced by Table 10-4 in Appendix C of the SRAM Rev. 2 Addendum.

Table 10-3 (1 of 2)

Site-Specific Terrestrial Bioaccumulation Factors - Santa Susana Field Laboratory

Chemical	Soil to Terrestrial Vertebrates		Soil to Terrestrial Invertebrates		Soil to Terrestrial Plants	
	BAF [a] (unitless)	Sample Size[b]	BAF [a] (unitless)	Sample Size[b]	BAF [a] (unitless)	Sample Size[b]
1,2,3,4,6,7,8-HpCDD	2.9E-01	4	5.4E-01	4	3.2E-01	4
1,2,3,4,6,7,8-HpCDF	4.3E-01	3	5.4E-01	3	2.3E-01	3
1,2,3,4,7,8-HxCDD	2.4E-01	1	7.8E-01	2	-	-
1,2,3,4,7,8-HxCDF	8.1E-02	1	6.5E-01	1	-	-
1,2,3,6,7,8-HxCDD	2.2E-01	1	7.7E-01	3	1.6E-01	1
1,2,3,6,7,8-HxCDF	6.5E-01	1	2.6E-01	1	-	-
1,2,3,7,8,9-HxCDD	1.8E-01	1	9.3E-01	3	-	-
1,2,3,7,8-PeCDD	-	-	8.8E-01	2	-	-
1,2,3,7,8-PeCDF	-	-	4.3E-01	2	-	-
2,3,4,6,7,8-HxCDF	5.4E-01	1	5.6E-01	1	-	-
2,3,4,7,8-PeCDF	4.4E-01	1	5.1E-01	2	-	-
2,3,7,8-TCDF	1.9E-01	1	1.0E+00	4	-	-
Acenaphthene	-	-	2.4E+00	1	-	-
Aluminum	1.2E-01	4	3.7E-01	4	7.4E-01	4
Anthracene	-	-	2.8E+00	1	-	-
Antimony	5.8E-01	2	7.8E+00	4	5.4E+00	4
Arsenic	-	-	4.7E-01	3	7.7E-01	3
Barium	3.6E-01	4	2.8E+00	4	1.0E+00	4
Benzo(a)anthracene	1.6E+01	1	1.9E+00	1	5.2E+00	1
Benzo(a)pyrene	5.9E+00	1	1.0E+00	1	-	-
Benzo(b)fluoranthene	5.3E+00	1	2.0E+00	1	-	-
Benzo(e)pyrene	-	-	1.1E+00	1	-	-
Benzo(g,h,i)perylene	4.5E+00	1	5.3E-01	1	-	-
Benzo(k)fluoranthene	7.8E+00	1	8.9E-01	1	-	-
Beryllium	-	-	2.8E-01	3	6.1E-01	4
Boron	1.2E+01	1	4.6E+00	1	7.4E+00	1
Cadmium	-	-	2.0E+01	3	1.1E+01	3
Chromium	1.5E-01	4	2.4E+00	4	9.4E+00	4
Chrysene	6.4E+00	1	1.9E+00	1	2.8E+00	3
Cobalt	2.5E-01	4	2.1E-01	3	6.6E-01	4
Copper	7.6E-01	4	1.5E+01	4	1.9E+00	4
Dibenz(a,h)anthracene	1.6E+01	1	-	-	-	-
Fluoranthene	2.3E+00	1	9.1E-01	2	2.8E+00	3
Fluorene	-	-	3.9E+00	1	-	-
Indeno(1,2,3-cd)pyrene	7.2E+00	1	8.6E-01	1	-	-
Iron	1.0E-01	4	4.5E-01	4	6.3E-01	4
Lead	-	-	2.4E-01	2	2.1E+00	4
Magnesium	7.5E-01	4	1.2E+00	4	1.2E+00	4
Manganese	1.5E-01	4	6.6E-01	4	8.5E-01	4
Mercury	-	-	3.3E+00	3	8.2E-01	2
Molybdenum	2.9E+00	4	5.9E+00	4	1.4E+01	4
Naphthalene	-	-	-	-	-	-
Nickel	1.2E-01	4	2.1E+00	4	7.7E+00	4
OCDD	2.1E-01	4	4.7E-01	4	2.3E-01	4
OCDF	9.4E-01	3	5.0E-01	3	3.3E-01	4
PCB-105	2.7E+00	4	1.0E+01	4	3.3E+00	4
PCB-114	6.6E+00	3	2.7E+01	4	3.7E+00	2
PCB-118	2.8E+00	4	1.1E+01	4	3.2E+00	4
PCB-123	3.4E+00	2	1.3E+01	4	3.4E+00	2
PCB-126	1.8E+00	2	5.3E+00	4	2.2E+00	2
PCB-128	3.0E+00	4	5.2E+00	4	2.6E+00	4
PCB-138	2.5E+00	4	6.1E+00	4	2.9E+00	4
PCB-153	4.2E+00	4	7.1E+00	4	3.1E+00	4
PCB-156	3.9E+00	4	5.8E+00	4	2.5E+00	4
PCB-157	2.7E+01	4	5.9E+00	4	2.6E+00	4
PCB-167	4.9E+00	4	5.9E+00	4	2.8E+00	4
PCB-170	4.2E+00	4	4.2E+00	4	1.9E+00	4
PCB-18	6.5E-02	1	1.4E-01	1	-	-
PCB-180	4.2E+00	4	3.6E+00	4	2.1E+00	4
PCB-187	1.2E+00	4	7.9E+00	4	2.8E+00	4

Table 10-3 (2 of 2)

Site-Specific Terrestrial Bioaccumulation Factors - Santa Susana Field Laboratory

Chemical	Soil to Terrestrial Vertebrates		Soil to Terrestrial Invertebrates		Soil to Terrestrial Plants	
	BAF [a] (unitless)	Sample Size[b]	BAF [a] (unitless)	Sample Size[b]	BAF [a] (unitless)	Sample Size[b]
PCB-189	7.0E+00	3	2.4E+00	4	2.2E+00	2
PCB-195	3.4E+00	3	1.9E+00	4	1.0E+00	1
PCB-206	1.8E+00	3	9.8E-01	3	7.9E-01	1
PCB-209	2.4E+00	3	1.4E+00	3	2.4E+00	1
PCB-28	-	-	1.7E+00	1	8.0E+00	1
PCB-44	-	-	7.3E+00	4	4.0E+00	4
PCB-52	-	-	1.1E+01	4	4.4E+00	4
PCB-66	1.3E+00	4	1.1E+01	4	3.5E+00	4
PCB-77	7.7E-01	1	6.2E+00	4	2.4E+00	3
PCB-8	3.7E-01	1	2.2E-01	1	-	-
PCB-81	-	-	6.0E+00	4	3.0E+00	2
PCB-90/101	2.2E-01	4	6.2E+00	4	3.6E+00	4
Total PCB/Aroclor	3.9E+00	-	6.5E+00	-	3.0E+00	-
Phenanthrene	3.4E+00	1	1.8E+00	2	7.2E+00	4
Pyrene	3.6E+00	1	2.9E+00	2	1.9E+00	3
Selenium	5.8E+00	2	1.8E+00	1	-	-
Silver	-	-	6.6E+00	3	1.7E+00	2
Thallium	-	-	1.1E+00	3	5.1E-01	4
Vanadium	1.7E-01	4	3.2E-01	4	6.9E-01	4
Zinc	3.5E+00	4	3.1E+00	4	1.6E+00	4

Notes:

a. The bioaccumulation factor (BAF) is calculated as the ratio of tissue chemical concentration to soil chemical concentration, when the sample size = 1 the value is the ratio, when the sample size = 2 the BAF value is the mean of the two measured ratios, when the sample size = 3 or 4, the BAF is an approximation of the 75th percentile distribution of the concentration ratio values.

b. Number of tissue chemical concentration to soil chemical concentration ratios used to calculate the BAF.

c. BAF for total PCB or Aroclors is based on the arithmetic mean of the PCB congener-specific BAFs.

"-" chemical either not analysed for or analytical data not sufficient for calculating a BAF

BAF - bioaccumulation factor

This table has been replaced by Table 10-8 Appendix C of the SRAM Rev. 2 Addendum.

Table 10-4 (1 of 2)

Life History Parameters Used in Calculating Applied Daily Doses

Reference Species	Great Blue Heron	Deer Mouse	Hermit Thrush
Body Weight (kg)	2.204 (USEPA 1993)	0.0179 (Nagy 2001)	0.029 (Dunning 1993)
Food Intake Rate[a] (kg/d)	0.141	0.0038	0.0063
Prey Items (F) (fraction of diet)[b]	Fish (0.70) Deer mouse (0.15) Invertebrates (0.10) Sediment (0.05) (Zeiner et al 1990)	Invertebrates (0.30) Vegetation (0.70) Soil (0.02) (Beyer et al 1994)	Invertebrates (0.61) Vegetation (0.39) Soil (0.04)
Area Use[c] (0)	Dependent on habitat and size of the site	1	1
Seasonability[d] (Ψ)	1	1	1
Lifespan		1.6 years (Brown and Zeng 1989) Assume 0.75 amount of time per day in burrow	
Soil Depth Interval	NA (sediment)	0-2, 0-4, or 0-6 feet bgs (determined on a site-by-site basis)	0-2 feet bgs

Table 10-4 (2 of 2)

Life History Parameters Used in Calculating Applied Daily Doses

Reference Species	Red-Tailed Hawk	Bobcat	Mule Deer
Body Weight (kg)	1.224 (USEPA 1993)	10.0 (Jameson and Peeters 1988)	39.1 (Nagy 2001)
Food Intake Rate[a] (kg/d)	0.094	0.332	1.565
Prey Items (F) (fraction of diet)[b]	Deer mice (1.0) (surrogate for rodents)	Deer mice (1.0) (surrogate for rodents)	Vegetation (1.0)
Area Use[c] (0)	Dependent on habitat and size of the site	Dependent on habitat and size of the site	At least 40 ha. Dependent on habitat and size of the site
Seasonability[d] (Ψ)	1	1	1
Lifespan	18 years (USEPA 1993)	10-14 years (Zeiner et al 1990)	Approximately 8 years (Chapman & Feldhamer 1992)
Soil Depth Interval	NA	NA	0-2 feet bgs

Notes:
(a) Based on Nagy (2001).
(b) The percentage of prey items in the diet is based on the appropriate references, where indicated and assumptions used for exposure models.
(c) Area use is the fraction of time the species at the SSFL spends at an investigational unit (see Appendix D).
(d) Seasonability is the fraction of the year the species spends at the SSFL.

kg = kilograms' bgs = below ground surface
NA = Not applicable – either (i) not exposed to soil (great blue heron is exposed to sediments) or (ii) dermal contact and incidental ingestion of soil are considered to be negligible exposure pathways compared to the ingestion of prey (see Section 10.2 for further discussion of soil depth intervals).
USEPA = United States Environmental Protection Agency

This table has been replaced by Table 11-3 and additional information in Appendix D of the SRAM Rev. 2 Addendum.

Table 11-1 (1 of 7)

Reference Concentrations for Aquatic Biota Exposed to Surface Water

Chemical Name	Scientific Name	Common Name	Endpoint	Media Type	Test Duration	Duration Units	Exposure Type[1]	ECOTOX Ref #[2]	Concentration ug/L	TEF, Surrogate, or source of alternative value[3]	Chronic RfC[4] ug/L	FW AWQC CMC ug/L[5]	FW AWQC CCC ug/L[5]
1,1,1,2-Tetrachloroethane	Lepomis macrochirus	Bluegill	LC50	FW	96	H	S	5590	2.0E+04		2.00E+02		
1,1,1-Trichloroethane	Pimephales promelas	Fathead minnow	LC50	FW	96	H	F	12858	4.2E+04		4.23E+02		
1,1,2,2-Tetrachloroethane	Pimephales promelas	Fathead minnow	LC50	FW	96	H	F	12447	2.0E+04		2.03E+02		
1,1,2-Trichloro-1,2,2-trifluoroethane										Hexachloroethane	8.40E+00		
1,1,2-Trichloroethane	Jordanella floridae	Flagfish	LC50	FW	96	H	F	140	4.5E+04		4.51E+02		
1,1-Dichloroethane										1,2-Dichloroethane	1.00E+03		
1,1-Dichloroethene	Lepomis macrochirus	Bluegill	LC50	FW	96	H	S	5590	7.4E+04		7.40E+02		
1,1'-Oxybis[2-chloroethane][8]	Lepomis macrochirus	Bluegill	LC50	FW	96	H	S	5590	6.0E+05		6.00E+03		
1,2,3,4,6,7,8-HpCDD									1.1E-02	0.001	1.10E+01		
1,2,3,4,6,7,8-HpCDF									1.1E-02	0.01	1.10E+00		
1,2,3,4,7,8,9-HpCDF									1.1E-02	0.01	1.10E+00		
1,2,3,4,7,8-HxCDD									1.1E-02	0.5	2.20E-02		
1,2,3,4,7,8-HxCDF									1.1E-02	0.1	1.10E-01		
1,2,3,6,7,8-HxCDD									1.1E-02	0.01	1.10E+00		
1,2,3,6,7,8-HxCDF									1.1E-02	0.1	1.10E-01		
1,2,3,7,8,9-HxCDD									1.1E-02	0.01	1.10E+00		
1,2,3,7,8,9-HxCDF									1.1E-02	0.1	1.10E-01		
1,2,3,7,8-PeCDD									1.1E-02	1	1.10E-02		
1,2,3,7,8-PeCDF									1.1E-02	0.05	2.20E-01		
1,2,4-Trichlorobenzene	Jordanella floridae	Flagfish	LC50	FW	96	H	F	140	1.2E+03		1.22E+01		
1,2,4-Trimethylbenzene	Pimephales promelas	Fathead minnow	LC50	FW	96	H	F	12858	7.7E+03		7.72E+01		
1,2-Dibromo-3-chloropropane	Micropterus salmoides	Largemouth bass	LC50	FW	48	H	S	2786	2.0E+04		2.00E+02		
1,2-Dichlorobenzene	Oncorhynchus mykiss	Rainbow trout,donaldson tr	LC50	FW	96	H	F	10579	1.6E+03		1.58E+01		
1,2-Dichloroethane	Pteronarcys californicus	Stonefly	LC50	FW	96	H	S	666	1.0E+05		1.00E+03		
1,2-Dichloroethene (total)	Lepomis macrochirus	Bluegill	LC50	FW	96	H	S	5590	1.4E+05		1.40E+03		
1,2-Dichloropropane	Pimephales promelas	Fathead minnow	LC50	FW	96	H	F	12447	1.3E+05		1.27E+03		
1,3,5-Trimethylbenzene	Carassius auratus	Goldfish	LC50	FW	96	H	F	416	1.3E+04		1.25E+02		
1,3,5-Trinitrobenzene	Ictalurus punctatus	Channel catfish	LC50	FW	96	H	S	11830	3.8E+02		3.80E+00		
1,3-Dichlorobenzene	Lepomis macrochirus	Bluegill	LC50	FW	96	H	S	5590	5.0E+03		5.00E+01		
1,3-Dinitrobenzene	Lepomis macrochirus	Bluegill	LC50	FW	96	H	S	11830	1.4E+03		1.44E+01		
1,4-Dichlorobenzene	Oncorhynchus mykiss	Rainbow trout,donaldson tr	LC50	FW	96	H	S	6797	8.8E+02		8.80E+00		
1-Methylnapthalene	Pimephales promelas	Fathead minnow	LC50	FW	96	H	S	719	9.0E+03		9.00E+01		
2,3,4,6,7,8-HxCDF									1.1E-02	0.1	1.10E-01		
2,3,4,7,8-PeCDF									1.1E-02	0.5	2.20E-02		
2,3,7,8-TCDD	Salvelinus namaycush	Lake trout, siscowet	NOAEL	FW	48	H	R	3597	1.1E-02		1.10E-02		

Reference Concentrations for Aquatic Biota Exposed to Surface Water

Chemical Name	Scientific Name	Common Name	Endpoint	Media Type	Test Duration	Duration Units	Exposure Type[1]	ECOTOX Ref #[2]	Concentration ug/L	TEF, Surrogate, or source of alternative value[3]	Chronic RfC[4] ug/L	FW AWQC CMC ug/L[5]	FW AWQC CCC ug/L[5]
2,3,7,8-Tetrachlorodibenzofuran							S	3117	1.1E-02	0.05	2.20E-01		
2,4,5-Trichlorophenol	Oncorhynchus mykiss	Rainbow trout,donaldson tr	LC50	FW	96	H	F	56474	2.5E+02		2.49E+00		
2,4,6-Trichlorophenol	Lepomis macrochirus	Bluegill	LC50	FW	96	H	S	5590	3.2E+02		3.20E+00		
2,4,6-Trinitrotoluene	Daphnia magna	Water flea	LC50	FW	96	H	R	4006	9.8E+02		9.80E+00		
2,4-Dichlorophenol	Carassius auratus	Goldfish	LC50	FW	96	H	F	563	1.2E+03		1.24E+01		
2,4-Dimethylphenol	Lepomis macrochirus	Bluegill	LC50	FW	96	H	F	56473	6.3E+03		6.30E+01		
2,4-Dinitrophenol	Notopterus notopterus	Asiatic knifefish	LC50	FW	96	H	R	6432	6.0E+01		6.00E-01		
2,4-Dinitrotoluene	Gasterosteus aculeatus	Threespine stickleback	LC50	FW	96	H	R	823	6.3E+03		6.30E+01		
2,6-Dinitrotoluene	Pimephales promelas	Fathead minnow	LC50	FW	96	H	S	10141	1.9E+04		1.85E+02		
2-Amino-4,6-Dinitrotoluene	Daphnia magna	Water flea	LC50	FW	96	H	R	4006	2.0E+02		2.00E+00		
2-Butanone	Pimephales promelas	Fathead minnow	LC50	FW	96	H	F	12448	3.2E+06		3.22E+04		
2-Chloroethylvinylether	Lepomis macrochirus	Bluegill	LC50	FW	96	H	S	5590	3.5E+05		3.50E+03		
2-Chloronaphthalene										Naphthalene	1.00E+01		
2-Chlorophenol	Lepomis macrochirus	Bluegill	LC50	FW	96	H	S	5590	6.6E+03		6.60E+01		
2-Hexanone	Pimephales promelas	Fathead minnow	LC50	FW	96	H	F	12858	4.3E+05		4.28E+03		
2-Methylnaphthalene	Oncorhynchus mykiss	Rainbow trout,donaldson tr	LC50	FW	96	H	R	3386	1.5E+03		1.46E+01		
2-Methylphenol	Oncorhynchus mykiss	Rainbow trout,donaldson tr	LC50	FW	96	H	F	569	8.4E+03		8.40E+01		
2-Nitroaniline	Danio rerio	Zebra danio	LC50	FW	96	H	R	5436	1.9E+04		1.95E+02		
2-Nitrophenol	Pimephales promelas	Fathead minnow	LC50	FW	96	H	F	12859	1.6E+05		1.60E+03		
2-Nitrotoluene	Poecilia reticulata	Guppy	LC50	FW	96	H	R	19263	3.0E+04		3.01E+02		
3,3'-Dichlorobenzidine	Pimephales promelas	Fathead minnow	LC50	FW	96	H	S	17138	1.1E+03		1.05E+01		
3-Nitroaniline	Poecilia reticulata	Guppy	LC50	FW	96	H	R	19263	8.1E+04		8.12E+02		
3-Nitrotoluene	Pimephales promelas	Fathead minnow	LC50	FW	96	H	S	719	3.0E+04		3.00E+02		
4,6-Dinitro-2-methylphenol	Oncorhynchus mykiss	Rainbow trout,donaldson tr	LC50	FW	96	H	S	666	6.6E+01		6.60E-01		
4-Amino-2,6-Dinitrotoluene	Dugesia dorotocephala	Turbellarian, flatworm	LC50	FW	96	H	R	4006	3.0E+02		3.00E+00		
4-Bromophenyl-phenylether	Lepomis macrochirus	Bluegill	LC50	FW	96	H	S	5590	5.9E+03		5.90E+01		
4-Chloro-3-methylphenol	Oncorhynchus mykiss	Rainbow trout,donaldson tr	LC50	FW	96	H	R	344	9.2E+02		9.17E+00		
4-Chloroaniline	Lepomis macrochirus	Bluegill	LC50	FW	96	H	S	939	2.4E+03		2.40E+01		
4-Chlorophenyl-phenylether	Salvelinus fontinalis	Brook trout	LC50	FW	96	H	R	6896	7.3E+02		7.30E+00		
4-Methyl-2-pentanone	Pimephales promelas	Fathead minnow	LC50	FW	96	H	F	12448	5.1E+05		5.05E+03		
4-Methylphenol	Lepidocephalichthyes gunte	Fish	LC50	FW	96	H	R	19254	7.0E+03		7.00E+01		
4-Nitroaniline	Pimephales promelas	Fathead minnow	LC50	FW	96	H	S	2966	1.0E+05		1.02E+03		
4-Nitrophenol	Gammarus pseudolimnaeus	Scud	LC50	FW	96	H	S	13274	2.8E+03		2.80E+01		
4-Nitrotoluene	Pimephales promelas	Fathead minnow	LC50	FW	96	H	S	10141	5.0E+04		4.97E+02		
Acenaphthene	Tallaperla maria	Stonefly	LC50	FW	96	H	S	14563	2.4E+02		2.40E+00		

Reference Concentrations for Aquatic Biota Exposed to Surface Water

Chemical Name	Scientific Name	Common Name	Endpoint	Media Type	Test Duration	Duration Units	Exposure Type[1]	ECOTOX Ref #[2]	Concentration ug/L	TEF, Surrogate, or source of alternative value[3]	Chronic RfC[4] ug/L	FW AWQC CMC ug/L[5]	FW AWQC CCC ug/L[5]
Acenaphthylene										Acenaphthene	2.40E+00		
Acetone										2-Butanone	3.22E+04		
Aluminum												750	87
Aniline	Oncorhynchus mykiss	Rainbow trout,donaldson tr	LC50	FW	96	H	F	58703	3.0E+01		3.00E-01		
Anthracene	Lepomis macrochirus	Bluegill	LC50	FW	96	H	F	3862	1.3E+00		1.27E-02		
Antimony [7a]	Daphnia magna	Water flea	LC50	FW	96	H	S	3783	5.4E+00		5.39E-02		
Aroclor-1248	Gammarus pseudolimnaeus	Scud	LC50	FW	96	H	F	530	2.9E+01		2.90E-01		
Aroclor-1254	Oncorhynchus mykiss	Rainbow trout,donaldson tr	LC50	FW	96	H	R	6772	3.2E-01		3.20E-03		
Aroclor-1260	Perca flavescens	Yellow perch	LC50	FW	96	H	F	6797	2.0E+02		2.00E+00		
Arsenic												340	150
Azobenzene	Oryzias latipes	Medaka, high-eyes	LC50	FW	48	H	S	10132	5.0E+02		5.00E+00		
Barium [7b]	Austropotamobius pallipes p	Crayfish	LC50	FW	96	H	S	5421	3.0E+04		3.03E+02		
Benzene	Oncorhynchus mykiss	Rainbow trout,donaldson tr	LC50	FW	96	H	F	17889	5.3E+03		5.30E+01		
Benzidine	Oryzias latipes	Medaka, high-eyes	LC50	FW	48	H	S	10132	1.1E+04		1.05E+02		
Benzo(a)anthracene	Daphnia pulex	Water flea	LC50	FW	96	H	S	15337	1.0E+01		1.00E-01		
Benzo(a)pyrene	Daphnia pulex	Water flea	LC50	FW	96	H	S	15337	5.0E+00		5.00E-02		
Benzo(b)fluoranthene										Benzo(a)pyrene	5.00E-02		
Benzo(e)pyrene										Benzo(a)pyrene	5.00E-02		
Benzo(g,h,i)perylene										Benzo(a)pyrene	5.00E-02		
Benzo(k)fluoranthene										Benzo(a)pyrene	5.00E-02		
Benzoic acid	Gambusia affinis	Western mosquitofish	LC50*	FW	96	H	S	508	1.8E+05		1.80E+03		
Benzyl alcohol	Lepomis macrochirus	Bluegill	LC50	FW	96	H	S	863	1.0E+04		1.00E+02		
Beryllium [7c]	Daphnia magna	Water flea	LC50	FW	96	H	S	11951	5.6E+00		5.64E-02		
Boron		minnow	LOEC		6	H			1.8E+07	1986 AWQC	1.80E+06		
Bromodichloromethane										Trichloromethane [8]	1.33E+02		
Bromoform	Lepomis macrochirus	Bluegill	LC50	FW	96	H	S	5590	2.9E+04		2.90E+02		
Bromomethane	Poecilia reticulata	Guppy	LC50	FW	96	H	R	5331	8.0E-01		8.00E-03		
Butyl benzyl phthalate	Cyprinodon variegatus	Sheepshead minnow	LC50	FW	96	H	S	15040	6.8E+02		6.80E+00		
Cadmium												4	2
Carbazole	Pimephales promelas	Fathead minnow	LC50	FW	96	H	F	17138	9.3E+02		9.30E+00		
Carbon Disulfide	Poecilia reticulata	Guppy	LC50	FW	96	H	R	11455	4.0E+03		4.00E+01		
Carbon tetrachloride	Lepomis macrochirus	Bluegill	LC50	FW	96	H	S	5590	2.7E+04		2.70E+02		

Reference Concentrations for Aquatic Biota Exposed to Surface Water

Chemical Name	Scientific Name	Common Name	Endpoint	Media Type	Test Duration	Duration Units	Exposure Type[1]	ECOTOX Ref #[2]	Concentration ug/L	TEF, Surrogate, or source of alternative value[3]	Chronic RfC[4] ug/L	FW AWQC CMC ug/L[5]	FW AWQC CCC ug/L[5]
Chlorobenzene	Carassius auratus	Goldfish	LC50	FW	96	H	F	563	2.4E+03		2.37E+01		
Chloroethane										Chloromethane	5.50E+03		
Chloroform	Lepomis macrochirus	Bluegill	LC50	FW	96	H	F	5267	1.3E+04		1.33E+02		
Chloromethane	Lepomis macrochirus	Bluegill	LC50	FW	96	H	S	863	5.5E+05		5.50E+03		
Chlorotrifluoroethane										1,1,1,2-Tetrachloroethane	2.00E+02		
Chlorotrifluoroethene										Tetrachloroethene	3.60E+01		
Chromium (III)												570	74
Chrysene										Benzo(a)anthracene	1.00E-01		
Cobalt [7d]	Oncorhynchus mykiss	Rainbow trout,donaldson tro	LC50	FW	96	H	F	20081	6.4E+02		6.38E+00		
Copper												13.0	9.0
Di-n-butylphthalate	Perca flavescens	Yellow perch	LC50	FW	96	H	F	6797	3.5E+02		3.50E+00		
Di-n-octylphthalate										Dibutyl phthalate [8]	3.50E+00		
Dibenz(a,h)anthracene										Benzo(a)pyrene	5.00E-02		
Dibenzofuran	Pimephales promelas	Fathead minnow	LC50	FW	96	H	F	17138	1.1E+03		1.05E+01		
Dibutyl phthalate [8]	Perca flavescens	Yellow perch	LC50	FW	96	H	F	6797	3.5E+02		3.50E+00		
Dibromochloromethane[6]	Cyprinus carpio	Common, mirror, colored, c	LC50	FW	4	D	R	6360	3.4E+04		3.40E+02		
Dichlorodifluoromethane										Tetrachloromethane [8]	2.43E+02		
Diethylphthalate									3.0E+00	Chronic toxicity value, 1986 AWQC	3		
Dimethylphthalate									3.0E+00	Chronic toxicity value, 1986 AWQC	3		
Ethylbenzene	Oncorhynchus mykiss	Rainbow trout,donaldson tro	LC50	FW	96	H	R	13142	4.2E+03		4.20E+01		
Fluoranthene	Pimephales promelas	Fathead minnow	LC50	FW	96	H	F	19043	6.8E+00		6.83E-02		
Fluorene	Gammarus pseudolimnaeus	Scud	LC50	FW	96	H	S	9512	6.0E+02		6.00E+00		
Fluoride	Salmo trutta	Brown trout	LC50	FW	48	H	NR	448	1.3E+05		1.25E+03		
HMX	Pimephales promelas	Fathead minnow	LC50	FW	96	H	S	5966	1.5E+04		1.50E+02		
Hexachlorobenzene	Salmo trutta	Brown trout	LC50	FW	96	H	S	6797	3.0E+02		3.00E+00		
Hexachlorobutadiene	Carassius auratus	Goldfish	LC50	FW	96	H	R	540	9.0E+01		9.00E-01		
Hexachlorocyclopentadiene	Pimephales promelas	Fathead minnow	LC50	FW	96	H	F	2097	7.0E+00		7.00E-02		
Hexachloroethane	Oncorhynchus mykiss	Rainbow trout,donaldson tro	LC50	FW	96	H	F	4433	8.4E+02		8.40E+00		
Hexavalent Chromium												16	11
Indeno(1,2,3-cd)pyrene										Benzo(a)anthracene	1.00E-01		
Isophorone	Pimephales promelas	Fathead minnow	LC50	FW	96	H	F	15152	1.5E+05		1.45E+03		
Manganese [7e]	Daphnia magna	Water flea	LC50	FW	96	H	S	3783	4.6E+03		4.58E+01		

Table 11-1 (5 of 7)

Reference Concentrations for Aquatic Biota Exposed to Surface Water

Chemical Name	Scientific Name	Common Name	Endpoint	Media Type	Test Duration	Duration Units	Exposure Type[1]	ECOTOX Ref #[2]	Concentration ug/L	TEF, Surrogate, or source of alternative value[3]	Chronic RfC[4] ug/L	FW AWQC CMC ug/L[5]	FW AWQC CCC ug/L[5]
Mercury												1	1
Methylene chloride	Pimephales promelas	Fathead minnow	LC50	FW	96	H	F	973	1.9E+05		1.93E+03		
Molybdenum [7f]	Daphnia magna	Water flea	LC50	FW	96	H	S	3783	2.1E+04		2.13E+02		
N-ethyl-n-nitrosoethanamine	Gammarus limnaeus	Scud	LC50	FW	96	H			5.0E+05		5.00E+03		
N-Nitrosodi-n-propylamine										N-ethyl-n-nitrosoethanamine	5.00E+03		
N-Nitrosodimethylamine	Gammarus limnaeus	Scud	LC50	FW	96	H	F	5744	2.8E+05		2.80E+03		
N-Nitrosodiphenylamine	Lepomis macrochirus	Bluegill	LC50	FW	96	H	S	5590	5.8E+03		5.80E+01		
Naphthalene	Daphnia pulex	Water flea	LC50	FW	96	H	S	15337	1.0E+03		1.00E+01		
Nickel												470	52
Nitrobenzene	Oncorhynchus mykiss	Rainbow trout,donaldson tro	LC50	FW	96	H	S	16888	2.4E+04		2.43E+02		
PCB-105									1.1E-02	5.0E-06	2.20E+03		
PCB-114									1.1E-02	5.0E-06	2.20E+03		
PCB-118									1.1E-02	5.0E-06	2.20E+03		
PCB-123									1.1E-02	5.0E-06	2.20E+03		
PCB-126									1.1E-02	5.0E-03	2.20E+00		
PCB-156									1.1E-02	5.0E-06	2.20E+03		
PCB-157									1.1E-02	5.0E-06	2.20E+03		
PCB-167									1.1E-02	5.0E-06	2.20E+03		
PCB-169									1.1E-02	5.0E-05	2.20E+02		
PCB-189									1.1E-02	5.0E-06	2.20E+03		
PCB-77									1.1E-02	1.0E-04	1.10E+02		
PCB-81									1.1E-02	5.0E-04	2.20E+01		
Pentachlorophenol												19	15
Perchlorate										Toxicity Value Not Available			
Phenanthrene	Daphnia pulex	Water flea	LC50	FW	96	H	S	15337	1.0E+02		1.00E+00		
Phenol	Cyprinus carpio	Common, mirror, colored, c	LC50	FW	96	H	R	10385	1.8E+00		1.75E-02		
Pyrene	Oncorhynchus mykiss	Rainbow trout,donaldson tro	LC50	FW	96	H	R	3386	2.0E+03		2.00E+01		
Pyridine	Oncorhynchus gorbuscha	Pink salmon	LC50	FW	96	H	S	12605	1.1E+03		1.10E+01		
RDX	Lepomis macrochirus	Bluegill	LC50	FW	96	H	S	5962	3.6E+03		3.60E+01		
Selenium													5
Silver												3	2
Styrene	Pimephales promelas	Fathead minnow	LC50	FW	96	H	F	3217	4.0E+03		4.02E+01		
Tetrachloroethene	Tallaperla maria	Stonefly	LC50	FW	96	H	S	14563	3.6E+03		3.60E+01		
Tetrachloromethane [8]	Danio rerio	Zebra danio	LC50	FW	96	H	F	56372	2.4E+04		2.43E+02		

Table 11-1 (6 of 7)

Reference Concentrations for Aquatic Biota Exposed to Surface Water

Chemical Name	Scientific Name	Common Name	Endpoint	Media Type	Test Duration	Duration Units	Exposure Type[1]	ECOTOX Ref #[2]	Concentration ug/L	TEF, Surrogate, or source of alternative value[3]	Chronic RfC[4] ug/L	FW AWQC CMC ug/L[5]	FW AWQC CCC ug/L[5]
Tetryl										trinitrotoluene [8]	9.80E+00		
Thallium [7g]	Gammarus minus	Scud	LC50	FW	96	H	S	14563	8.1E+01		8.10E-01		
Toluene	Oncorhynchus kisutch	Coho salmon,silver salmon	LC50	FW	96	H	F	15191	5.5E+03		5.50E+01		
Trichloroethene	Jordanella floridae	Flagfish	LC50	FW	96	H	R	140	3.1E+03		3.10E+01		
Trichloromethane [8]	Lepomis macrochirus	Bluegill	LC50	FW	96	H	F	5267	1.3E+04		1.33E+02		
Trichlorofluoromethane										Tetrachloromethane [8]	2.43E+02		
Trinitrotoluene [8]	Daphnia magna	Water flea	LC50	FW	96	H	R	4006	9.8E+02		9.80E+00		
Vanadium [7h]	Pimephales promelas	Fathead minnow	LC50	FW	96	H	F	3783	1.0E+00		1.01E-02		
Vinyl Acetate	Pimephales promelas	Fathead minnow	LC50	FW	96	H	S	728	1.4E+04		1.40E+02		
Vinyl chloride										1,1-Dichloroethene	7.40E+02		
Xylene (total)	Oncorhynchus mykiss	Rainbow trout,donaldson tr	LC50	FW	96	H	S	6797	3.3E+03		3.30E+01		
Zinc												120	120
bis(2-Chloroethoxy)methane	Pimephales promelas	Fathead minnow	LC50	FW	96	H	S	11961	1.8E+05		1.84E+03		
bis(2-Chloroethyl)ether	Lepomis macrochirus	Bluegill	LC50	FW	96	H	S	5590	6.0E+05		6.00E+03		
bis(2-Ethylhexyl)phthalate	Pimephales promelas	Fathead minnow	LC50	FW	96	H	S	15040	1.6E+02		1.60E+00		
bis-chloroisopropyl ether										1,1'-Oxybis[2-chloroethane] [8]	6.00E+03		
cis-1,2-Dichloroethene										trans-1,2-Dichloroethene	2.20E+03		
cis-1,3-Dichloropropene										1,2-Dichloropropane	1.27E+03		
Total OCDD									1.1E-02	1.00E-04	1.10E+02		
meta-xylene	Oncorhynchus mykiss	Rainbow trout,donaldson tr	LC50	FW	96	H	R	13142	8.4E+03	Xylene (total)	8.40E+01		
o-Xylene	Oncorhynchus mykiss	Rainbow trout,donaldson tr	LC50	FW	96	H	R	13142	7.6E+03		7.60E+01		
trans-1,2-Dichloroethene	Daphnia magna	Water flea	LC50	FW	48	H	S	5184	2.2E+05		2.20E+03		
trans-1,3-Dichloropropene										1,2-Dichloropropane	1.27E+03		
Calcium									3.6E+06	1986 AWQC, see text for	3.60E+06		
Chloride												860000	230000
Iron	Morone saxatilis	Striped bass	LC50	FW	96	H	S	2012	1.8E+03		1.76E+01		
Lead												65	3
Magnesium [7i]	Daphnia magna	Water flea	LC50	FW	96	H	S	915	3.2E+04				1000
Nitrate		Chinook salmon	LC50	FW	96	H			9.0E+02	1986 AWQC	9.00E+02		
Potassium	Gammarus lacustris	Scud	LC50	FW	96	H	F	13058	5.3E+04		5.32E+02		
Sodium									3.9E+06	1986 AWQC, see text for derivation	3.93E+06		

Reference Concentrations for Aquatic Biota Exposed to Surface Water

Chemical Name	Scientific Name	Common Name	Endpoint	Media Type	Test Duration	Duration Units	Exposure Type[1]	ECOTOX Ref #[2]	Concentration ug/L	TEF, Surrogate, or source of alternative value[3]	Chronic RfC[4] ug/L	FW AWQC CMC ug/L[5]	FW AWQC CCC ug/L[5]

Notes:

* The asterisk (*) on the concentration value means it was recalculated by ECOTOX staff to meet database conformity in terms of units or chemical form.

1. Abbreviations for exposure type; F=flow-through, NR=not reported, S=static, R=renewal
2. See ECOTOX Reference Table (Table 1-a) for full citation.
3. If toxicity values were not available in ECOTOX a chemical with structural similarity was selected as a surrogate. For halogenated hydrocarbons, surrogates were chosen by the number of halogen substitutions and alkyl chain characteristics, for polycyclic aromatic hydrocarbons number and size of aromatic rings were considered for surrogate selection, for all other compounds the closest structurally similar surrogate was selected. If no structurally similar surrogate was available in ECOTOX, USEPA 1986 AWQC guidance was consulted. Listed toxicity equivalency factors (TEFs) were developed for fishes (Van den Berg et al. 1998). Because there is limited evidence for ligand activation of Ah receptor or for TCDD-like toxicity in invertebrates (Wiesner et al. 2004; Van den Berg et al. 1998), it is assumed that surface water RfCs for TCDD and other dioxin/furan congeners that are applicable for fishes will also be protective of aquatic invertebrates exposed to surface water. For compounds with TEFs for fishes, the TCDD toxicity value (based on effects observed in the lake trout) was divided by the TEF.
4. Acute toxicity values were divided by 100 for adjustment to a chronic RfC. Values for beryllium, phthalates and vanadium were chronic and therefore not adjusted.
5. Freshwater Ambient Water Quality Criteria (AWQC) values take from USEPA, 1999.
6. For Dibromochloromethane, the 3-5 day test duration retrieved from ECOTOX was averaged to a 4-day (96-hr) duration for the acute to chronic exposure calculation.
7. Concentrations reported in ECOTOX were adjusted to free metal ion concentration, specific salt forms listed below.
   a. antimony trichloride, MW=228.12, CAS No. 10025919
   b. barium dichloride, MW=208.23, CAS No. 10361372
   c. beryllium dichloride, MW=79.92, CAS No. 7787475
   d. cobalt chloride, MW=129.84, CAS No. 7646799
   e. manganese sulfate, MW=151, CAS No. 7785877
   f. molybdenum trioxide, MW=143.94, CAS No. 1313275
   g. sulfuric acid, thallium salt, MW= 504.83, CAS No. 10031591
   h. vanadium pentoxide, MW=181.88, CAS No. 1314621
   i. magnesium sulfate, MW=120.37, CAS No. 7487889
   j. Iron (II) chloride, MW 126.75, CAS No. 7758943
8. Not a COPC at SSFL, data added to support use of chemical surrogate.

FW - Fresh Water
H - time in hours
D - time in days
LC_{50} - lethal concentration for 50% of study population

This table has been replaced by Table 11-3 in Appendix D of the SRAM Rev. 2 Addendum.

Table 11-1a (1 of 4)

References for Aquatic Toxicity Data Retrieved From ECOTOX.

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This table has been replaced by Table 11-3 and additional information in Appendix D of the SRAM Rev. 2 Addendum.

Table 11-1b (1 of 1)

Summary of Freshwater Aquatic Toxicity Data Retrieval

		Source of TRV value	Number of chemicals	Chemicals in category
Chemicals in Rocketdyne analyte list [1]	194			
LC50 retrieved from ECOTOX	120			
		96-hr LC50	112	
		48-hr LC50	7	1,2-dibromo-3-chloropropane, 2,3,7,8-tetrachlorodibenzodioxin, azobenzene, barium, benzidine, fluoride ion, trans-1,2-dichloroethylene
		3-5 d (96-hr) LC50	1	dibromochloromethane
LC50 not retrived from ECOTOX	74			
		AWQC criteria	13	aluminum, arsenic, cadmium, chromium (III), copper, hexavalent chromium, mercury, nickel, pentachlorophenol, silver, zinc, chloride, lead
		used surrogate chemical	28	
		calculated with TEF	26	dioxins, dibenzofurans, polychlorinated biphenyls
		AWQC 1986 LC50	6	boron, diethylphthalate, dimethylphthalate, calcium, nitrate. sodium
		No relevant toxicity information obtained	1	perchlorate

Notes:

(1) Not Including compounds used as chemcial surrogates which are not SSFL COPCs .

Table 11-2 (1 of 6)

This table has been replaced by Table 11-4 in Appendix D of the SRAM Rev. 2 Addendum.

Reference Concentrations for Aquatic Biota Exposed to Sediment

	Freshwater Threshold Effects Concentration (mg/kg sediment)	Freshwater Upper Effects Threshold Concentration (mg/kg sediment)	Marine Apparent Effects Threshold (mg/kg sediment)	Selected Reference Concentration (mg/kg sediment)
Inorganic Compounds				
Aluminum	-	-	18,000	18,000
Antimony	2	3.0		2.0
Arsenic	9.79	-	-	9.79
Barium	-	-	48	48
Beryllium	-	-	-	-
Boron	-	-	-	-
Cadmium	0.99	-	-	0.99
Chromium	43.4	-	-	43.4
Hexavalent chromium	-	-	-	-
Cobalt	-	-	10	10
Copper	31.6	-	-	31.6
Lead	35.8	-	-	35.8
Manganese	-	1,100	-	1,100
Mercury	0.18	-	-	0.2
Molybdenum	-	-	-	-
Nickel	22.7	-	-	22.7
Perchlorate	-	-	-	-
Selenium	-	-	1.0	1.0
Silver	-	4.5	-	4.5
Strontium	-	-	-	-
Thallium	-	-	-	-
Tin	-	-	-	-
Vanadium	-	-	57	57
Zinc	121	-	-	121
VOCs				
1,1,1,2-Tetrachloroethane	-	-	-	-
1,1,1-Trichloroethane	-	-	-	-
1,1,2,2-Tetrachloroethane	-	-	-	-
1,1,2-Trichloro-1,2,2-trifluoroet	-	-	-	-
1,1,2-Trichloroethane	-	-	-	-
1,1-Dichloroethane	-	-	-	-
1,1-Dichloroethene	-	-	-	-
1,1-Dichloropropene	-	-	-	-
1,2,3-Trichlorobenzene	-	-	-	-
1,2,3-Trichloropropane	-	-	-	-
1,2,4-Trichlorobenzene	-	-	-	-
1,2,4-Trimethylbenzene	-	-	-	-

Table 11-2 (2 of 6)

Reference Concentrations for Aquatic Biota Exposed to Sediment

	Freshwater Threshold Effects Concentration (mg/kg sediment)	Freshwater Upper Effects Threshold Concentration (mg/kg sediment)	Marine Apparent Effects Threshold (mg/kg sediment)	Selected Reference Concentration (mg/kg sediment)
1,2-Dibromo-3-chloropropane	-	-	-	-
1,2-Dibromoethane	-	-	-	-
1,2-Dichlorobenzene	-	-	-	-
1,2-Dichloroethane	-	-	-	-
1,2-Dichloropropane	-	-	-	-
1,3,5-Trimethylbenzene	-	-	-	-
1,3-Dichlorobenzene	-	-	-	-
1,4-Dichlorobenzene	-	-	-	-
2-Butanone	-	-	-	-
2-Chloroethylvinylether	-	-	-	-
2-Chlorotoluene	-	-	-	-
2-Chloro-1,1,1-trifluoroethane	-	-	-	-
2-Hexanone	-	-	-	-
4-Bromofluorobenzene	-	-	-	-
4-Chlorotoluene	-	-	-	-
4-Methyl-2-pentanone	-	-	-	-
Acetone	-	-	-	-
Acrolein	-	-	-	-
Acrylonitrile	-	-	-	-
Benzene	-	-	-	-
Benzidine	-	-	-	-
Bromobenzene	-	-	-	-
Bromodichloromethane	-	-	-	-
Bromoform	-	-	-	-
Bromomethane	-	-	-	-
Carbon disulfide	-	-	-	-
Carbon tetrachloride	-	-	-	-
Chlorobenzene	-	-	-	-
Chloroethane	-	-	-	-
Chloroform	-	-	-	-
Chloromethane	-	-	-	-
Chlorotrifluoroethene	-	-	-	-
cis-1,2-Dichloroethene	-	-	-	-
cis-1,3-Dichloropropene	-	-	-	-
Dibromochloromethane	-	-	-	-
Dibromomethane	-	-	-	-
Dichlorodifluoromethane	-	-	-	-
Ethylbenzene	-	-	-	-
Formaldehyde	-	-	-	-

Table 11-2 (3 of 6)

Reference Concentrations for Aquatic Biota Exposed to Sediment

	Freshwater Threshold Effects Concentration (mg/kg sediment)	Freshwater Upper Effects Threshold Concentration (mg/kg sediment)	Marine Apparent Effects Threshold (mg/kg sediment)	Selected Reference Concentration (mg/kg sediment)
Isopropylbenzene	-	-	-	-
m,p-Xylene	-	-	-	-
Methyl tert-butyl ether	-	-	-	-
Methylene chloride	-	-	-	-
n-Butylbenzene	-	-	-	-
n-Propylbenzene	-	-	-	-
o-Xylene	-	-	-	-
p-Isopropyltoluene	-	-	-	-
sec-Butylbenzene	-	-	-	-
Styrene	-	-	-	-
tert-Butylbenzene	-	-	-	-
Tetrachloroethene	-	-	-	-
Toluene	-	-	-	-
trans-1,2-Dichloroethene	-	-	-	-
trans-1,3-Dichloropropene	-	-	-	-
Trichloroethene	-	-	-	-
Trichlorofluoromethane	-	-	-	-
Vinyl acetate	-	-	-	-
Vinyl chloride	-	-	-	-
SVOCs				
1,2-Diphenylhydrazine	-	-	-	-
1,4-Dioxane	-	-	-	-
2,4,5-Trichlorophenol	-	-	-	-
2,4,6-Trichlorophenol	-	-	-	-
2,4-Dichlorophenol	-	-	-	-
2,4-Dimethylphenol	-	-	-	-
2,4-Dinitrophenol	-	-	-	-
2,4-Dinitrotoluene	-	-	-	-
2,6-Dinitrotoluene	-	-	-	-
2-Chloronaphthalene	-	-	-	-
2-Chlorophenol	-	-	-	-
2-Methylnaphthalene	-	-	-	-
2-Methylphenol	-	-	-	-
2-Nitroaniline	-	-	-	-
2-Nitrophenol	-	-	-	-
3- and 4-Methylphenol Coelutio	-	-	-	-
3-Methylphenol	-	-	-	-
4-Methylphenol	-	-	-	-

Table 11-2 (4 of 6)

Reference Concentrations for Aquatic Biota Exposed to Sediment

	Freshwater Threshold Effects Concentration (mg/kg sediment)	Freshwater Upper Effects Threshold Concentration (mg/kg sediment)	Marine Apparent Effects Threshold (mg/kg sediment)	Selected Reference Concentration (mg/kg sediment)
3,3'-Dichlorobenzidine	-	-	-	-
3-Nitroaniline	-	-	-	-
4,6-Dinitro-2-methylphenol	-	-	-	-
4-Bromophenyl phenyl ether	-	-	-	-
4-Chloro-3-methylphenol	-	-	-	-
4-Chloroaniline	-	-	-	-
4-Chlorophenyl phenyl ether	-	-	-	-
4-Nitroaniline	-	-	-	-
4-Nitrophenol	-	-	-	-
Acenaphthene		0.29		0.29
Acenaphthylene		0.16		0.16
Aniline	-	-	-	-
Anthracene	0.0572			0.0572
Benzo(a)anthracene	0.108			0.108
Benzo(a)pyrene	0.15			0.15
Benzo(b)fluoranthene			1.8	1.8
Benzo(g,h,i)perylene		0.30		0.30
Benzo(k)fluoranthene		13.4		13.4
Benzoic acid	-	-	-	-
Benzyl alcohol	-	-	-	-
bis(2-Chloroethoxy)methane	-	-	-	-
bis(2-Chloroethyl)ether	-	-	-	-
bis(2-Chloroisopropyl) ether	-	-	-	-
bis(2-Ethylhexyl)phthalate	-	-	-	-
Butyl benzyl phthalate	-	-	-	-
Carbazole	-	-	-	-
Chrysene	0.166			0.166
Dibenz(a,h)anthracene	0.423			0.423
Dibenzofuran	-	-	-	-
Diethylphthalate	-	-	-	-
Dimethyl phthalate	-	-	-	-
Di-n-butylphthalate	-	-	-	-
Di-n-octyl phthalate	-	-	-	-
Fluoranthene	0.195			0.195
Fluorene	0.0774			0.0774
Hexachlorobenzene	-	-	-	-
Hexachlorobutadiene	-	-	-	-
Hexachlorocyclopentadiene	-	-	-	-
Hexachloroethane	-	-	-	-

Table 11-2 (5 of 6)

Reference Concentrations for Aquatic Biota Exposed to Sediment

	Freshwater Threshold Effects Concentration (mg/kg sediment)	Freshwater Upper Effects Threshold Concentration (mg/kg sediment)	Marine Apparent Effects Threshold (mg/kg sediment)	Selected Reference Concentration (mg/kg sediment)
Indeno(1,2,3-cd)pyrene		0.33		0.33
Isophorone	-	-	-	-
Naphthalene	0.176			0.176
Nitrobenzene	-	-	-	-
N-Nitrosodimethylamine	-	-	-	-
N-Nitrosodi-n-propylamine	-	-	-	-
N-Nitrosodiphenylamine	-	-	-	-
Pentachlorophenol	-	-	-	-
Phenanthrene	0.204			0.204
Phenol	-	-	-	-
Pyrene	0.195			0.195
Pyridine	-	-	-	-
Total Petroleum Hydrocarbons				
C08-C11(Gasoline Range)	-	-	-	-
C11-C14(Kerosene Range)	-	-	-	-
C14-C20(Diesel Range)	-	-	-	-
C20-C30(Lubricant Oil Range)	-	-	-	-
PCDD/PCDFs				
2,3,7,8-TCDD	-	0.0088	-	0.0088
1,2,3,7,8-PeCDD	-	0.0088	-	0.0088
1,2,3,4,7,8-HxCDD	-	0.018	-	0.018
1,2,3,6,7,8-HxCDD	-	0.88	-	0.88
1,2,3,7,8,9-HxCDD	-	0.88	-	0.88
1,2,3,4,6,7,8-HpCDD	-	8.8	-	8.8
OCDD	-	88	-	88
2,3,7,8-TCDF	-	0.18	-	0.18
1,2,3,7,8-PeCDF	-	0.18	-	0.18
2,3,4,7,8-PeCDF	-	0.018	-	0.018
1,2,3,4,7,8-HxCDF	-	0.088	-	0.088
1,2,3,6,7,8-HxCDF	-	0.088	-	0.088
2,3,4,6,7,8-HxCDF	-	0.088	-	0.088
1,2,3,7,8,9-HxCDF	-	0.088	-	0.088
1,2,3,4,6,7,8-HpCDF	-	0.88	-	0.88
1,2,3,4,7,8,9-HpCDF	-	0.88	-	0.88
OCDF	-	88	-	88
Total Tetra	-	-	-	-
Total Penta	-	-	-	-

Table 11-2 (6 of 6)

Reference Concentrations for Aquatic Biota Exposed to Sediment

	Freshwater Threshold Effects Concentration (mg/kg sediment)	Freshwater Upper Effects Threshold Concentration (mg/kg sediment)	Marine Apparent Effects Threshold (mg/kg sediment)	Selected Reference Concentration (mg/kg sediment)
Total Hexa	-	-	-	-
Total Hepta	-	-	-	-
Total Octa	-	-	-	-
PCDD/PCDF	-	-	-	-
PCBs				
Aroclor-1016	0.0598			0.0598
Aroclor-1221	0.0598			0.0598
Aroclor-1232	0.0598			0.0598
Aroclor-1242	0.0598			0.0598
Aroclor-1248	0.0598			0.0598
Aroclor-1254	0.0598			0.0598
Aroclor-1260	0.0598			0.0598
PCB-105	-	-	-	-
PCB-114	-	-	-	-
PCB-118	-	-	-	-
PCB-123	-	-	-	-
PCB-126	-	-	-	-
PCB-156	-	-	-	-
PCB-157	-	-	-	-
PCB-167	-	-	-	-
PCB-169	-	-	-	-
PCB-189	-	-	-	-
PCB-77	-	-	-	-
PCB-81	-	-	-	-

This table has been replaced by Table 11-5 in Appendix D of the SRAM Rev. 2 Addendum.

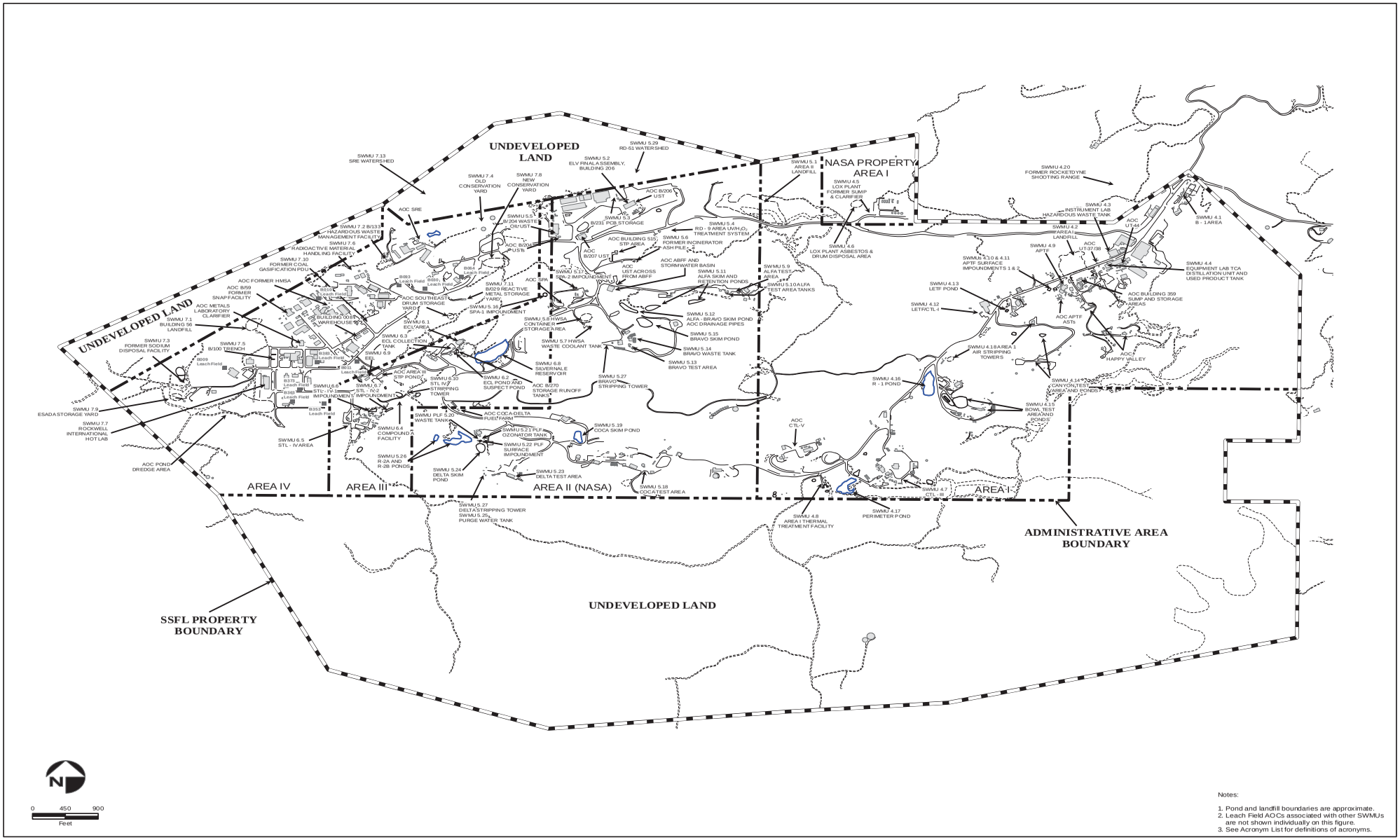
Table 11-3 (1 of 1)

Reference Concentrations for Terrestrial Invertebrates

Analyte	Earthworms (mg/kg)
Inorganics	
Antimony	78
Arsenic	NA
Barium	330
Beryllium	40
Cadmium	140
Chromium	NA
Copper	32
Hexavalent Chromium	0.2
Lead	1700
Mercury	0.1
Methyl mercury	2.5
Nickel	100
Selenium	7.7
Vanadium	NA
Zinc	199
Organics	
2,3,7,8-TCDD	500
Aroclor 1016	50
Aroclor 1254	50
1,4-Dichlorobenzene	20
2,4,5-Trichlorophenol	9
2,4,6-Trichlorophenol	10
4-Nitrophenol	7
Benzo(a)pyrene	25000
Dimethyl phthalate	200
Fluorene	27
Nitrobenzene	40
N-Nitrosodiphenylamine	20
Pentachlorophenol	6
Phenol	30
1,2,3-Trichlorobenzene	20
1,2,4-Trichlorobenzene	20
1,2-Dichloropropane	700
Pyrene	18
Fluoranthene	38
Phenanthrene	34
Carbazole	34
Dibenzofuran	62
Chlorobenzene	40
Dieldrin	NA

Source: USEPA (2005a-m), Efroymson et al.(1997), USEPA (1999), Sverdrup et al. (2002), Will and Suter (1995), Parmelee et al. (1997).

FIGURES



Notes:

1. Pond and landfill boundaries are approximate.
2. Leach Field AOCs associated with other SWMUs are not shown individually on this figure.
3. See Acronym List for definitions of acronyms.

MWH

Santa Susana Field Laboratory (SSFL)
SWMUs and AOCs

FIGURE 1-5

Project/Boeing SSFL RAMWH_SRAM2005-Rev2/Figure 1-5.mxd

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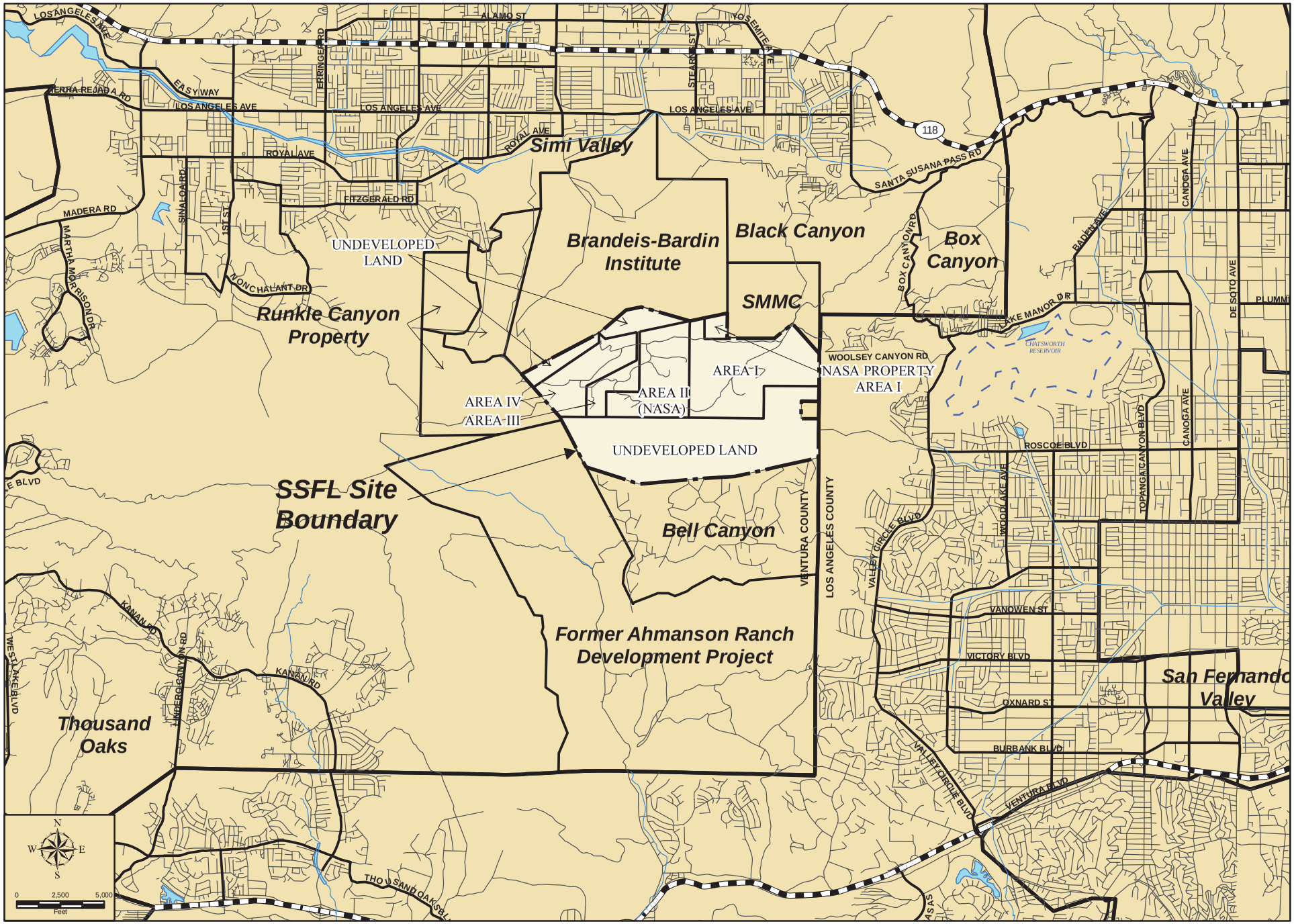

MWH

Santa Susana Field Laboratory (SSFL)
Regional Map

FIGURE
1-4

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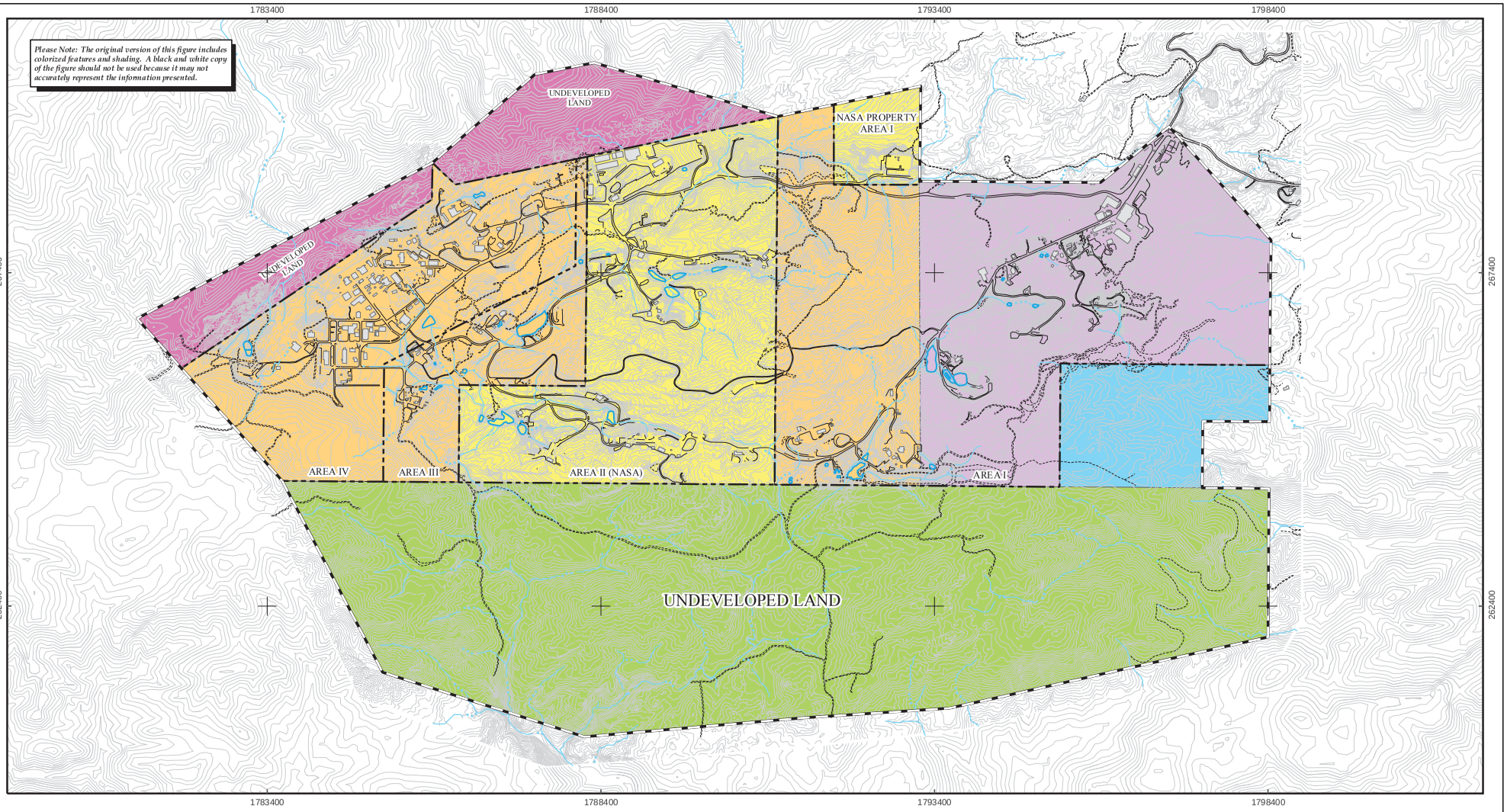

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FEET

MAP COORDINATES IN STATEPLANE, NAD 27, ZONE V

Legend

- A Dundas Parcel A
- B Silvernale Property to North American Aviation
- C Silvernale Propery to USAF
- D Spruce Property
- E Geopac Property
- F Brandeis Bardin Institute Property

Note: See Table 1-1 for Details

Base Map Legend

- Buildings
- SSFL Property Boundary
- Administrative Area Boundary
- Drainages
- Ponds
- Contours
- Dirt Roads
- Roads

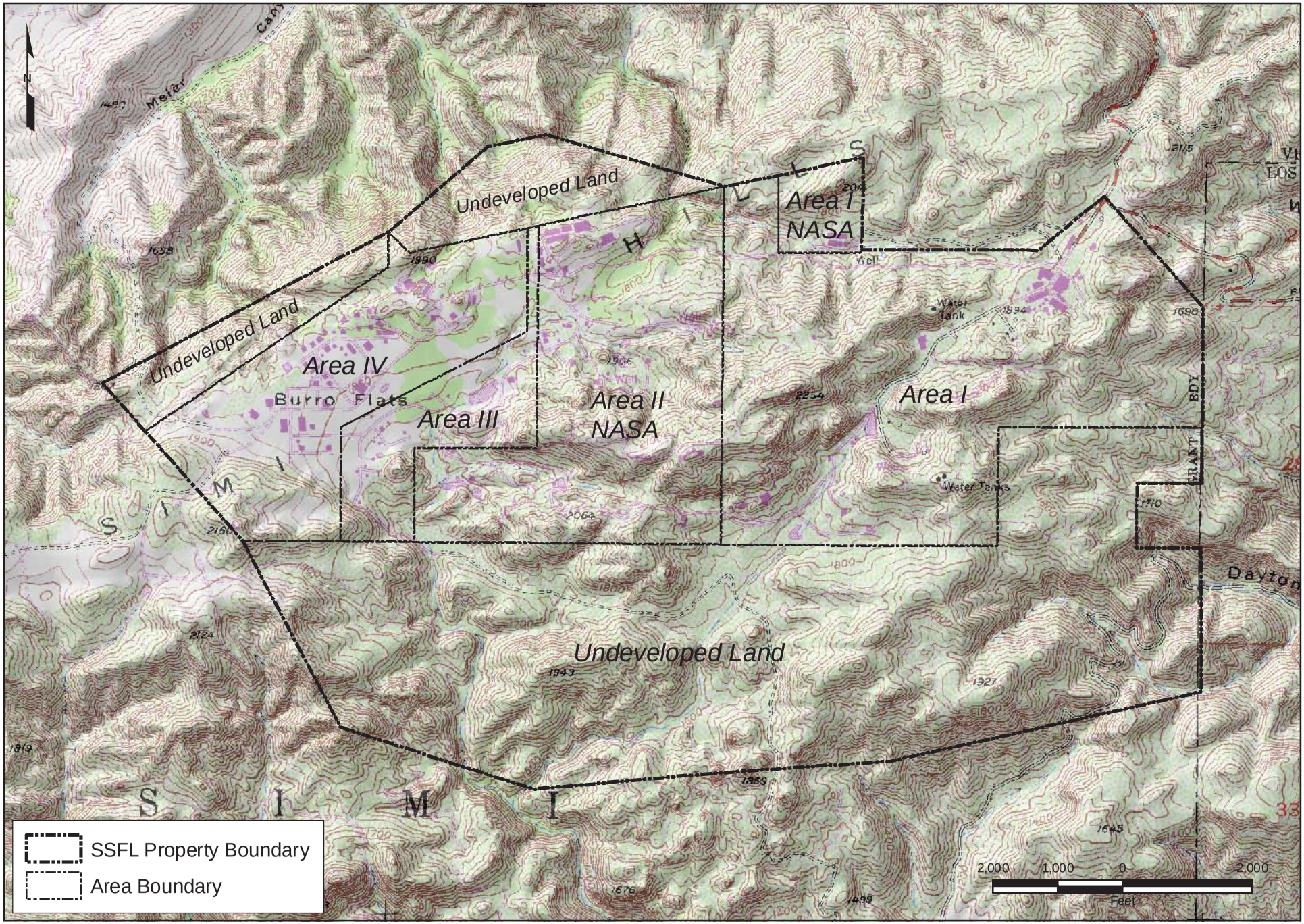
MWH

Santa Susana Field Laboratory (SSFL)
Land Acquisition History Map

FIGURE
1-3

Project/Boeing/SSFL RA/MWH_SRAM2005-Rev2/Figure 1-3.mxd

09/07/05



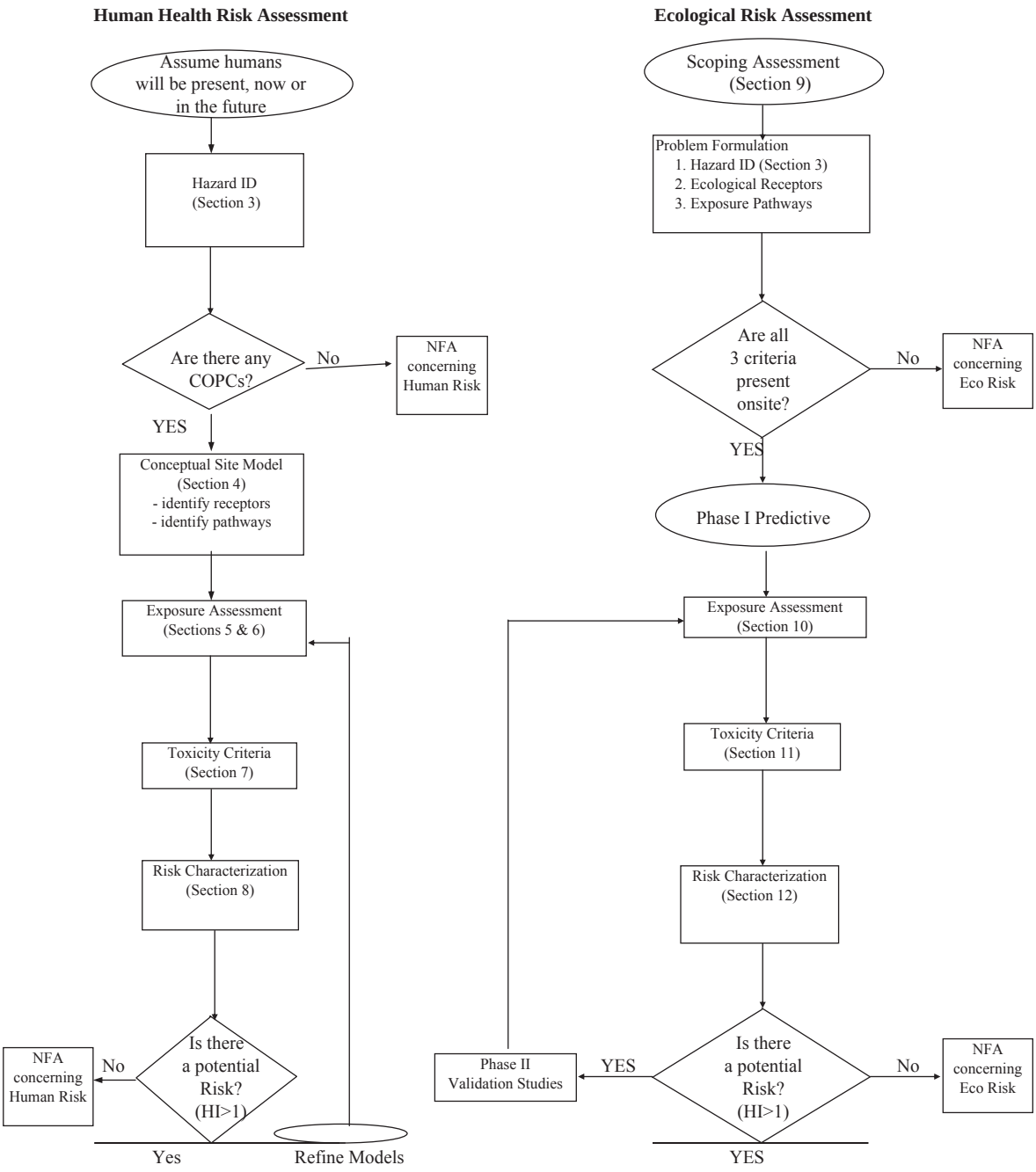
MWH

Santa Susana Field Laboratory (SSFL)
Site Plan

FIGURE
1-2

Project/Boeing SSFL RA/MWH_SRAM2005-Rev2/Figure 1-2.mxd

06/07/05



MWH

Santa Susana Field Laboratory (SSFL)
Risk Assessment Flow Chart

FIGURE 1-1

Project/Boeing SSFL RA/MWH_SRAM2005-Rev2/Figure 1-1.ai

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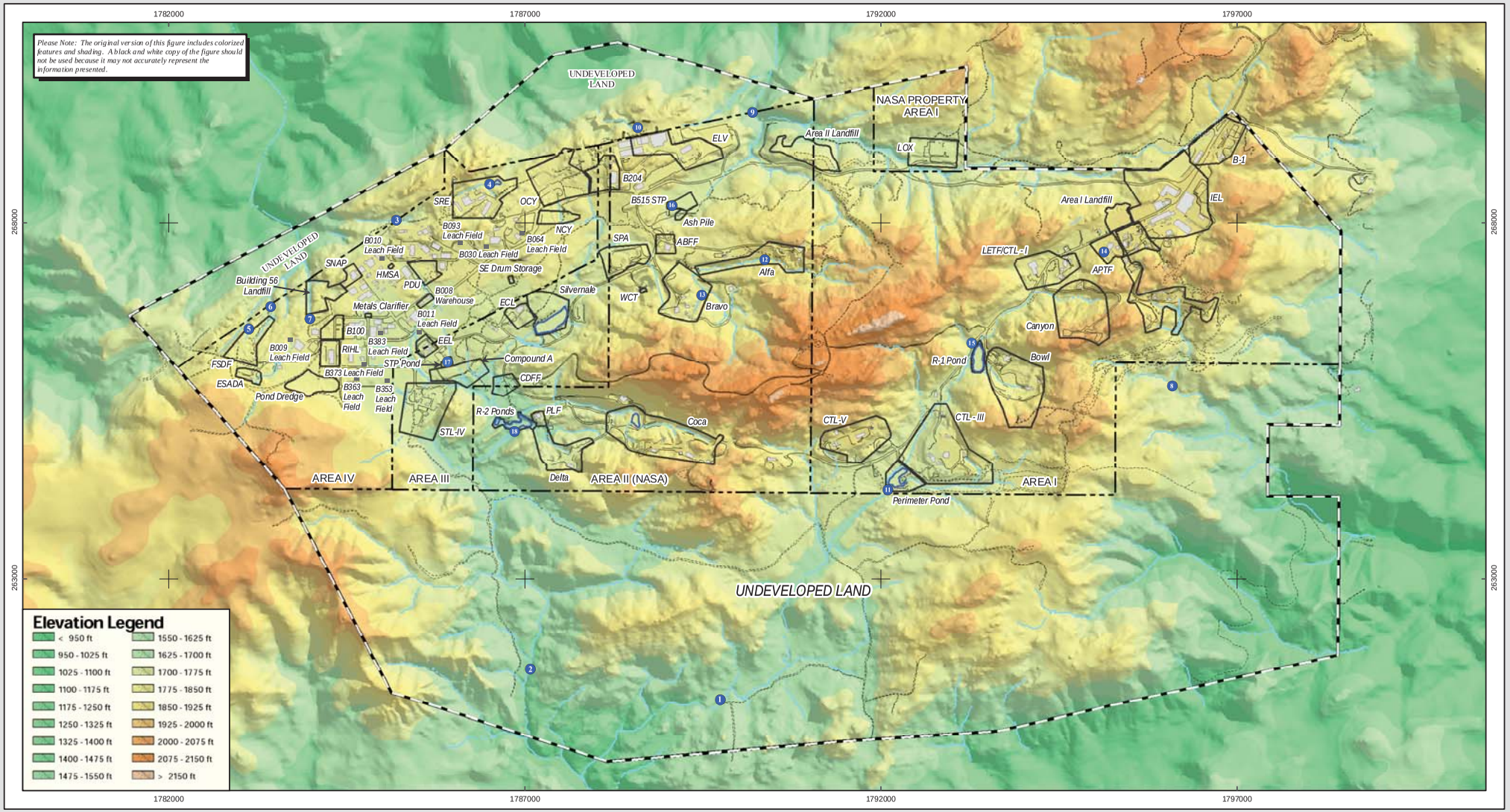

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MAP COORDINATES IN STATEPLANE, NAD 27, ZONE V

AREA I
SWMU 4.1, AOC - B-1 Area
SWMU 4.2 - Area I Landfill
SWMUs 4.3, 4.4, AOCs - Instrument and Equipment Laboratories (IEL)
SWMUs 4.5, 4.6 - Liquid Oxygen (LOX) Plant Area
SWMU 4.7, AOCs - Component Test Laboratory III (CTL-III)
SWMU 4.9, AOC - Advanced Propulsion Test Facility (APTF)
SWMU 4.12, AOCs - Laser Engineering Test Facility (LETF)/ Component Test Lab I (CTL-I)
SWMU 4.14, AOCs - Canyon Area
SWMU 4.15, AOCs - Bowl Area
SWMU 4.16 - Area I Reservoir (R-1 Pond)
SWMU 4.17 - Perimeter Pond
AOCs - Building 359 Area
AOC - Happy Valley Area

AREA I (cont)
AOCs - Component Test Laboratory V (CTL-V)

AREA II
SWMU 5.1 - Area II Landfill
SWMU 5.2 - ELV Final Assembly, Building 206
SWMU 5.5 and AOC - Building 204 Area
SWMU 5.6 - Former Area II Incinerator Ash Pile
SWMU 5.7 - Hazardous Waste Storage Area Waste Coolant Tank (WCT)
SWMU 5.9, 5.10, 5.11, AOCs - Alfa Area
SWMU 5.13, 5.14, 5.15, AOCs - Bravo Area
SWMU 5.18, 5.19, AOCs - Coca Area
SWMU 5.20, 5.21, 5.22, AOCs - Propellant Load Facility (PLF)
SWMU 5.23, AOC - Delta Area
SWMU 5.26 - R-2 Ponds
AOCs - Building 515 Sewage Treatment Plant (STP) Area

AREA II (cont)
AOC - Storable Propellant Area (SPA)
AOC - Alfa/Bravo Fuel Farm (ABFF)
AOC - Coca/Delta Fuel Farm (CDFF)

AREA III
SWMUs 6.1, 6.2, 6.3, AOCs - ECL Area
SWMU 6.4 - Compound A Facility
SWMU 6.5, AOC - Systems Test Laboratory IV (STL-IV)
SWMU 6.8 - Silvernale Reservoir
SWMU 6.9 - Environmental Effects Laboratory (EEL)
AOC - Sewage Treatment Plant (STP) Pond

AREA IV
SWMU 7.1 - Building 56 Landfill
SWMU 7.3 - Former Sodium Disposal Facility (FSDF)
SWMU 7.4 - Old Conservation Yard (OCY)

AREA IV (cont)
SWMU 7.5 - Building 100 Trench
SWMU 7.7, AOC - Rockwell International Hot Laboratory (RIHL)
SWMU 7.8 - New Conservation Yard (NCY)
SWMU 7.9 - ESADA Chemical Storage Yard
SWMU 7.10, AOC - Former Coal Gasification Process Development Unit (PDU)
AOCs - Building 008 Warehouse/Building 011 Leach Field
AOC - Building 457 Former Hazardous Materials Storage Area (HMSA)
AOC - Building 65 Metals Laboratory Clarifier
AOC - Pond Dredge Area
AOC - Sodium Reactor Experiment (SRE) Area
AOC - Southeast Drum Storage Yard (SE Drum)
AOC - SNAP Facility
AOCs - DOE Leach Fields

Base Map Legend
Buildings
SSFL Property Boundary
Administrative Area Boundary
RFI Site Boundary
Drainages
Dirt Roads
Roads
Ponds
Leach Field
NPDES Location

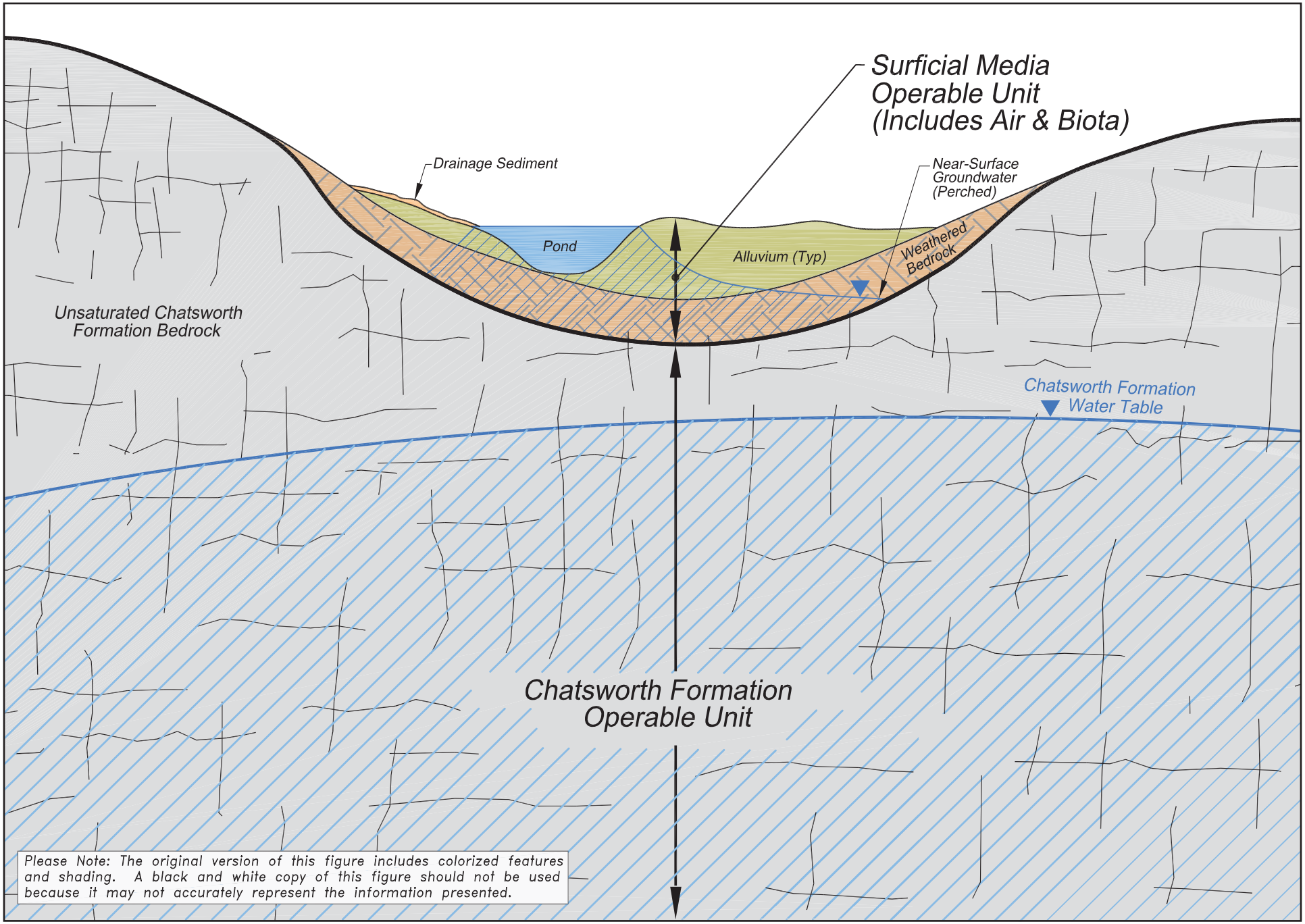
RFI Site Locations Santa Susana Field Laboratory

SANTA SUSANA FIELD LABORATORY

Date: Jun 30, 2005
File: r:\rocky\plots\arcmap\rfi_location.mxd

MWH

FIGURE 1-6



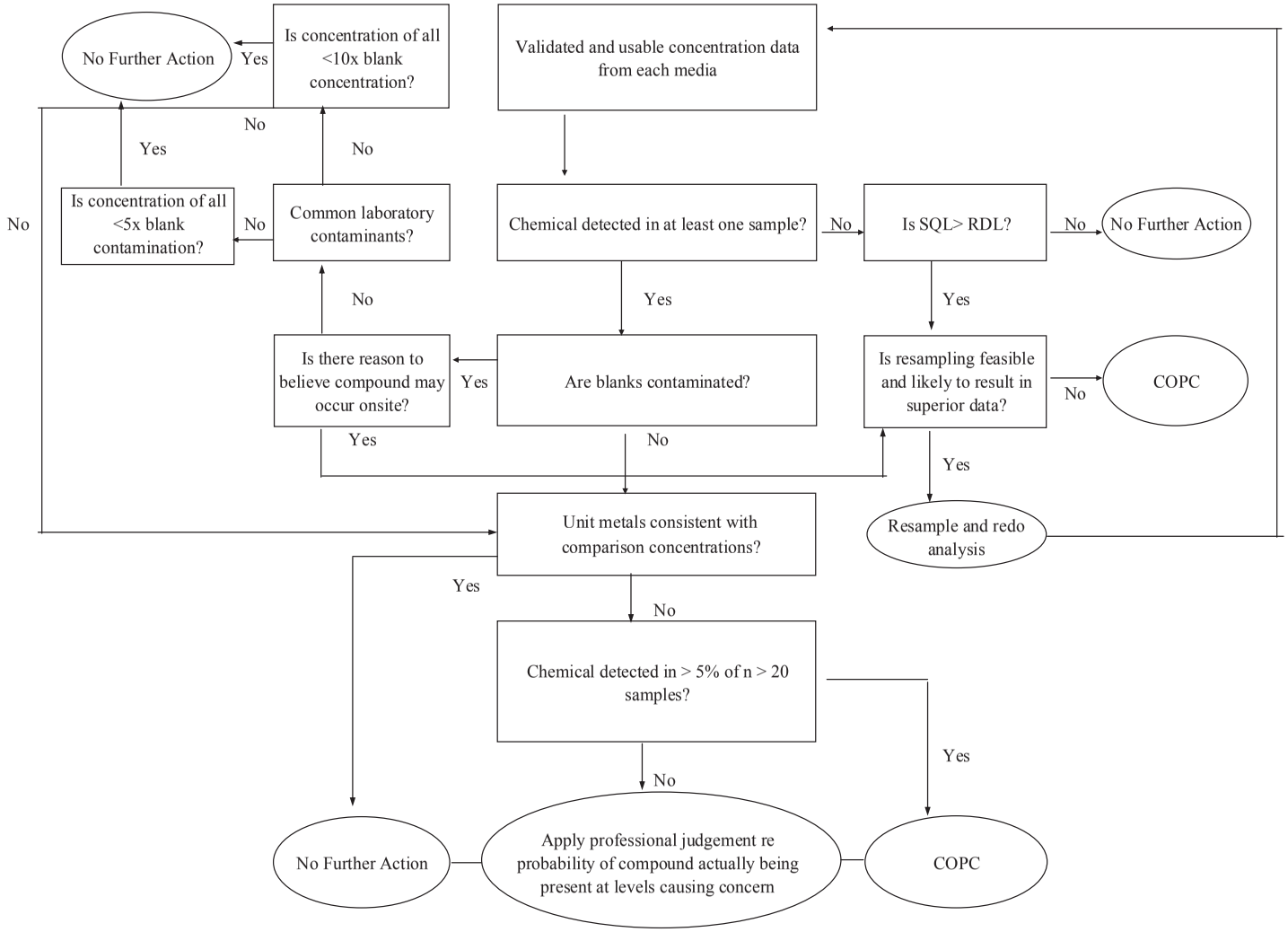
MWH

Santa Susana Field Laboratory (SSFL)
Cross Section Depiction of Operable Units

FIGURE
1-7

Project/Boeing SSFL RA/MWH_SRAM2005-Rev2/Figure 1-7.dwg

06/07/05



MWH

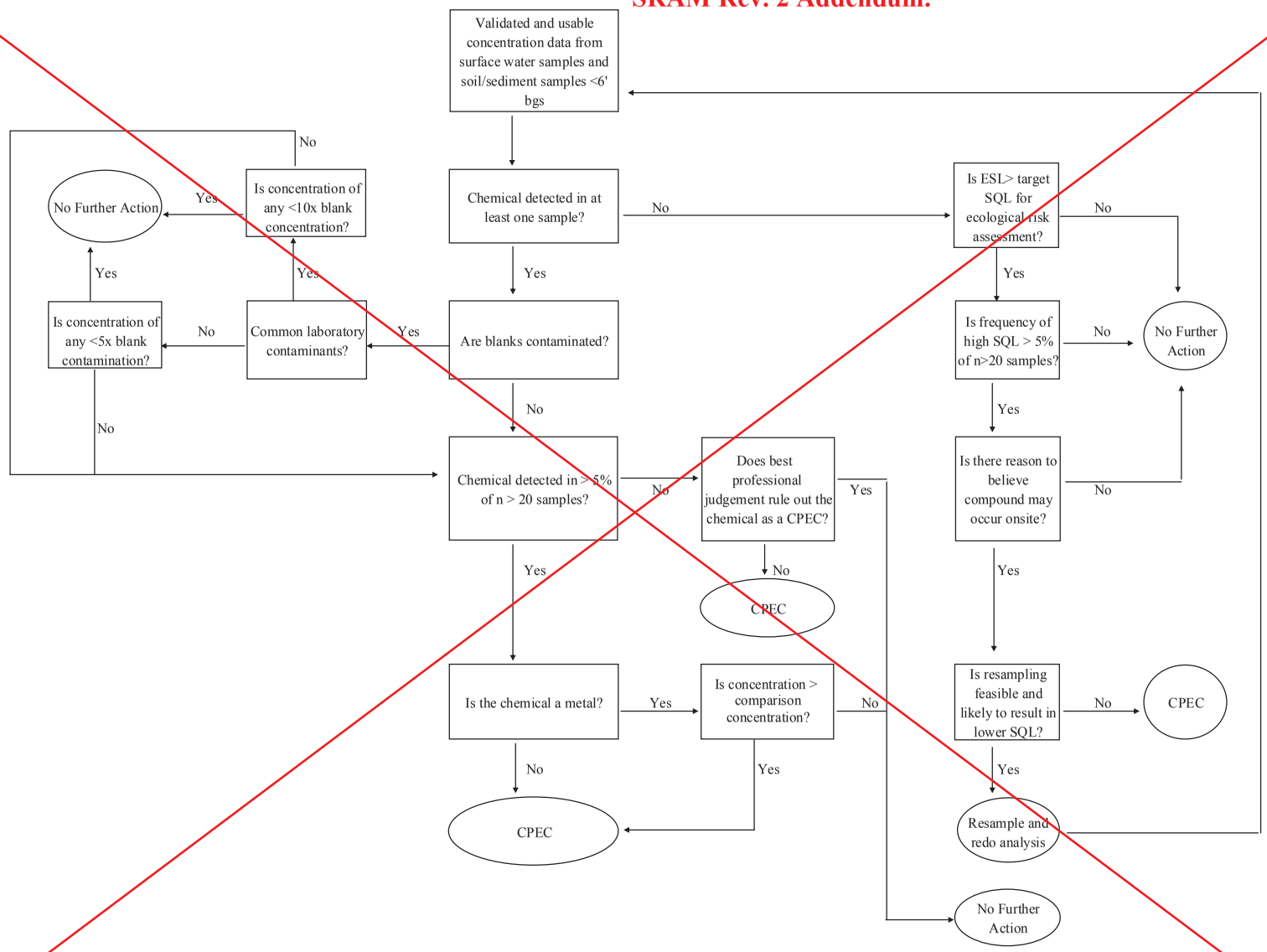
Santa Susana Field Laboratory (SSFL)
Human Health Risk Assessment Selection of Chemicals of Potential Concern

FIGURE
3-1

Project/Boeing SSFL RA/MWH_SRAM2005-Rev2/Figure 3-1.ai

06/07/05

This figure has been replaced by a revised Figure 3-2 in Appendix C of the SRAM Rev. 2 Addendum.



MWH

Santa Susana Field Laboratory (SSFL)
Ecological Risk Assessment Selection of Chemicals of Potential Ecological Concern

FIGURE
3-2

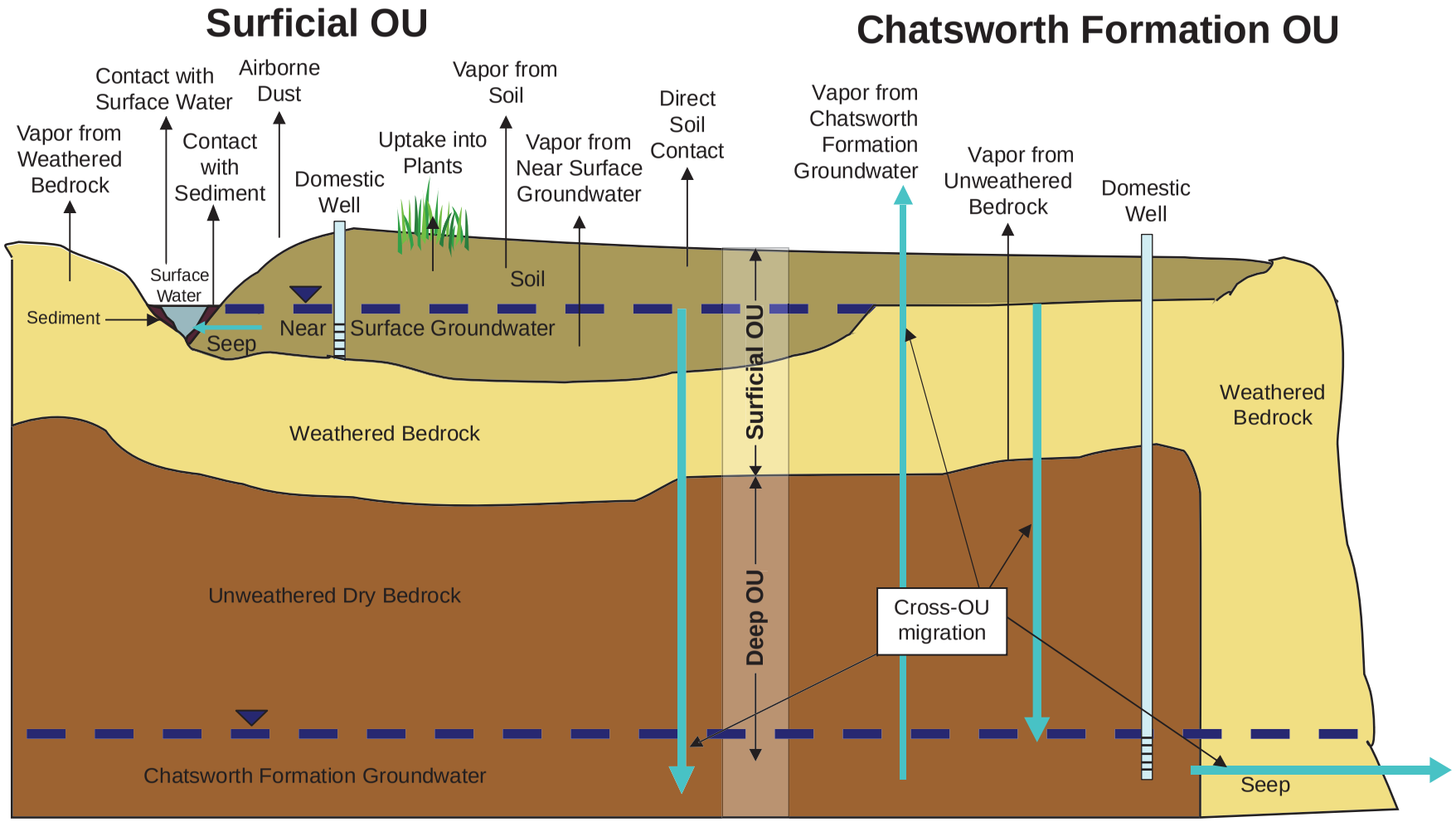
Project/Boeing SSFL RA/MWH_SRAM2005-Rev2/Figure 3-2.ai

06/07/05

Representative Ecological Receptors:
- Generic aquatic species (aquatic primary/secondary consumer)
- Great blue heron (aquatic tertiary consumer)
- Deer mouse (terrestrial primary/secondary consumer)
- Thrush (terrestrial primary/secondary consumer)
- Mule deer (terrestrial primary consumer)
- Red-tailed hawk (terrestrial secondary/tertiary consumer)
- Bobcat (terrestrial secondary/tertiary consumer)

Worker Receptor:
- Inhalation of dust (Surficial OU)
- Inhalation of vapors from soil and groundwater (Surficial OU and CFOU)
- Dermal contact with soil (Surficial OU)
- Ingestion of soil (Surficial OU)
- Dermal contact with surface water and sediment (Surficial OU)
- Ingestion of surface water and sediment (Surficial OU)
- Inhalation of vapors from bedrock

Future Residential Receptor:
- Inhalation of dust (Surficial OU)
- Inhalation of vapors from soil and groundwater (Surficial OU and CFOU)
- Ingestion of plants (Surficial OU)
- Dermal contact with soil (Surficial OU)
- Ingestion of soil (Surficial OU)
- Dermal contact with surface water and sediment (Surficial OU)
- Ingestion of surface water and sediment (Surficial OU)
- Ingestion of groundwater (Surficial OU and CFOU)
- Inhalation of vapors during domestic use (Surficial OU and CFOU)
- Dermal contact with groundwater (Surficial OU and CFOU)
- Inhalation of vapors from bedrock



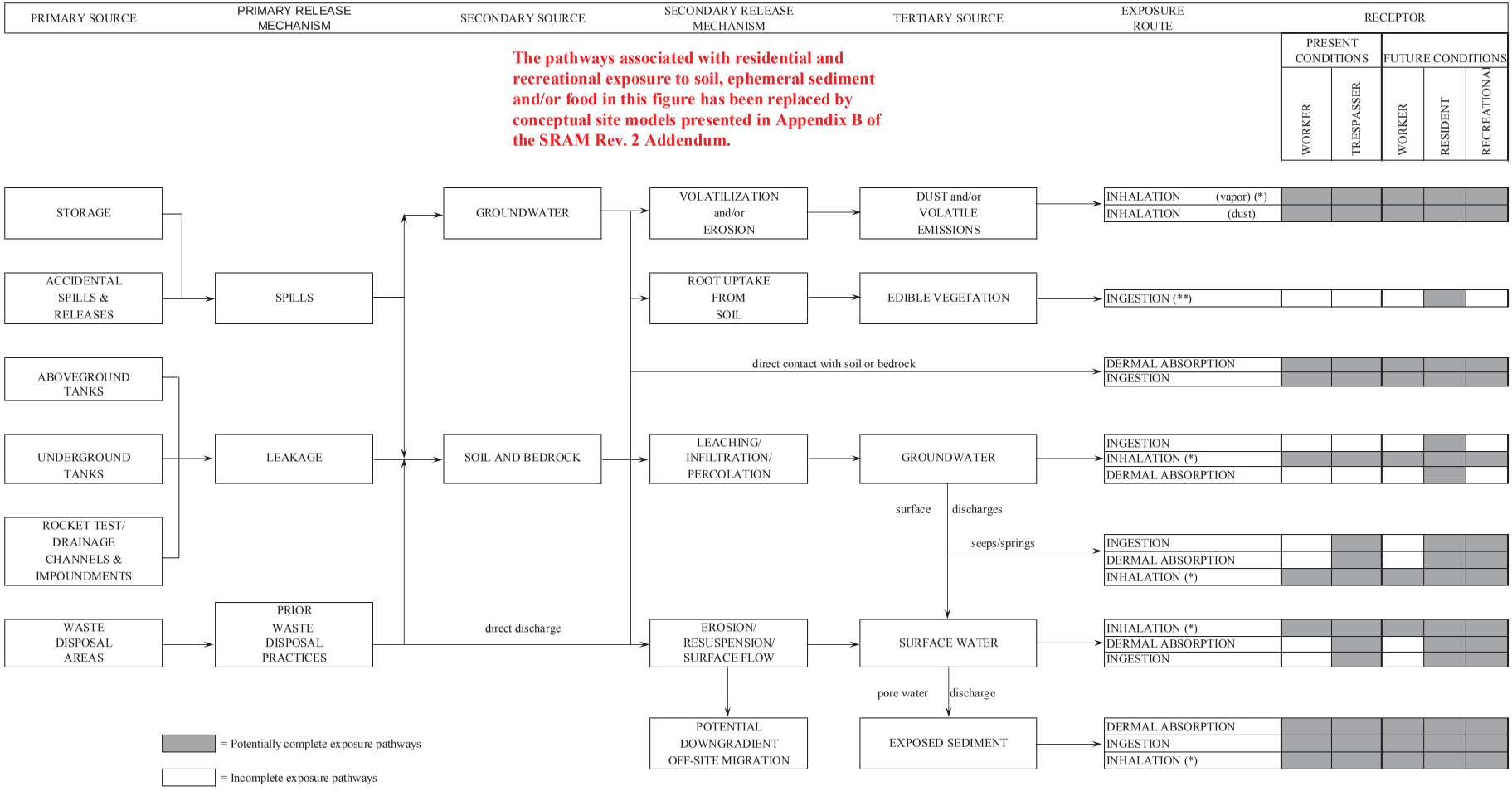
MWH

Santa Susana Field Laboratory (SSFL)
Illustrated Conceptual Site Model of Human Health and Ecological Exposures

FIGURE
4-1

Project/Boeing SSFL RA/MWH_SRAM2005-Rev2/Figure 4-1.ai

06/07/05



Notes:

See Figure 9-2 for a generalized Conceptual Site Model of ecological exposures.

(*) Exposure limited to volatile compounds as defined in the text; residential and worker receptors include both indoor and outdoor air exposure to volatiles; nonresidental and nonworker receptors include only outdoor air exposure. For residents, inhalation of volatiles from shallow groundwater includes pathways associated with both domestic use and migration to indoor air, whereas, nonresidential exposure includes only migration to indoor and outdoor air for workers and only outdoor air for recreators. Exposure to fugitive dust is limited to non-volatile organic compounds.

(**) Exposure limited to bioaccumulatable compounds as described in the text.

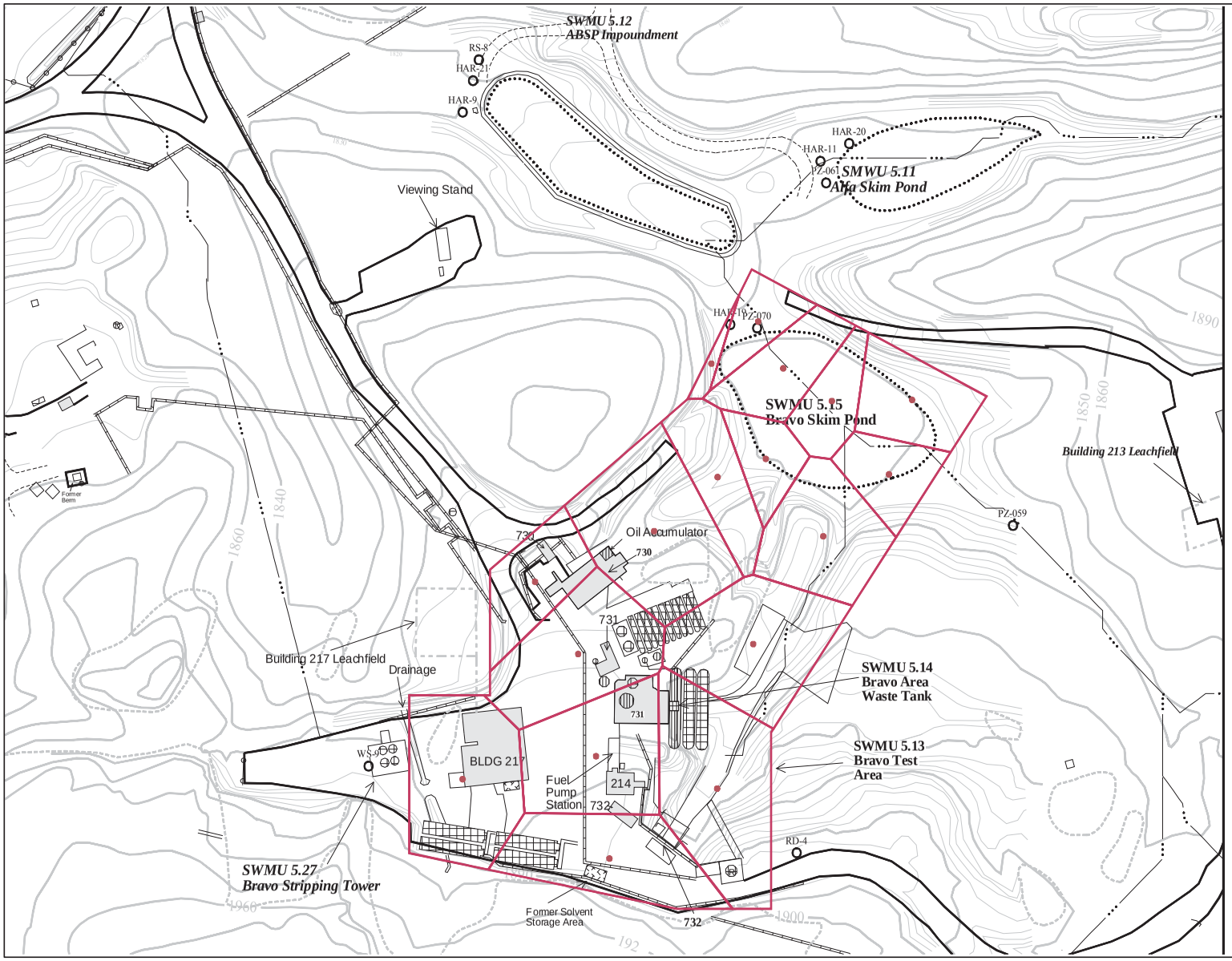
MWH

Santa Susana Field Laboratory (SSFL)
Generalized Conceptual Site Model of Human Health Exposures

FIGURE
4-2

Project/Boeing SSFL RA/MWH_SRAM2005-Rev2/Figure 4-2.ai

09/27/05



SWMUs 5.13, 5.14, 5.15

BRAVO AREA

Legend

THEISSEN POLYGON

Base Map Legend

- Existing Building or Structure
- Removed Building or Structure
- Solvent Tanks, R Indicates Removed
- Petroleum Fuel/Oil Tanks, R Indicates Removed
- Hydrazine (MMH,UDMH,HZ) Tanks, R Indicates Removed
- Other Tanks, R Indicates Removed
- Awnings
- Excavation
- Ground Elevation Contours
- A/C Curbing
- Dirt Road
- Possible Ponds (approx. location)
- Ponds
- Fences
- Pipes
- Creeks
- Rock Outcrops
- Leachfields
- SH-1 Monitoring Well

N

0 100
FEET

SANTA SUSANA FIELD LABORATORY

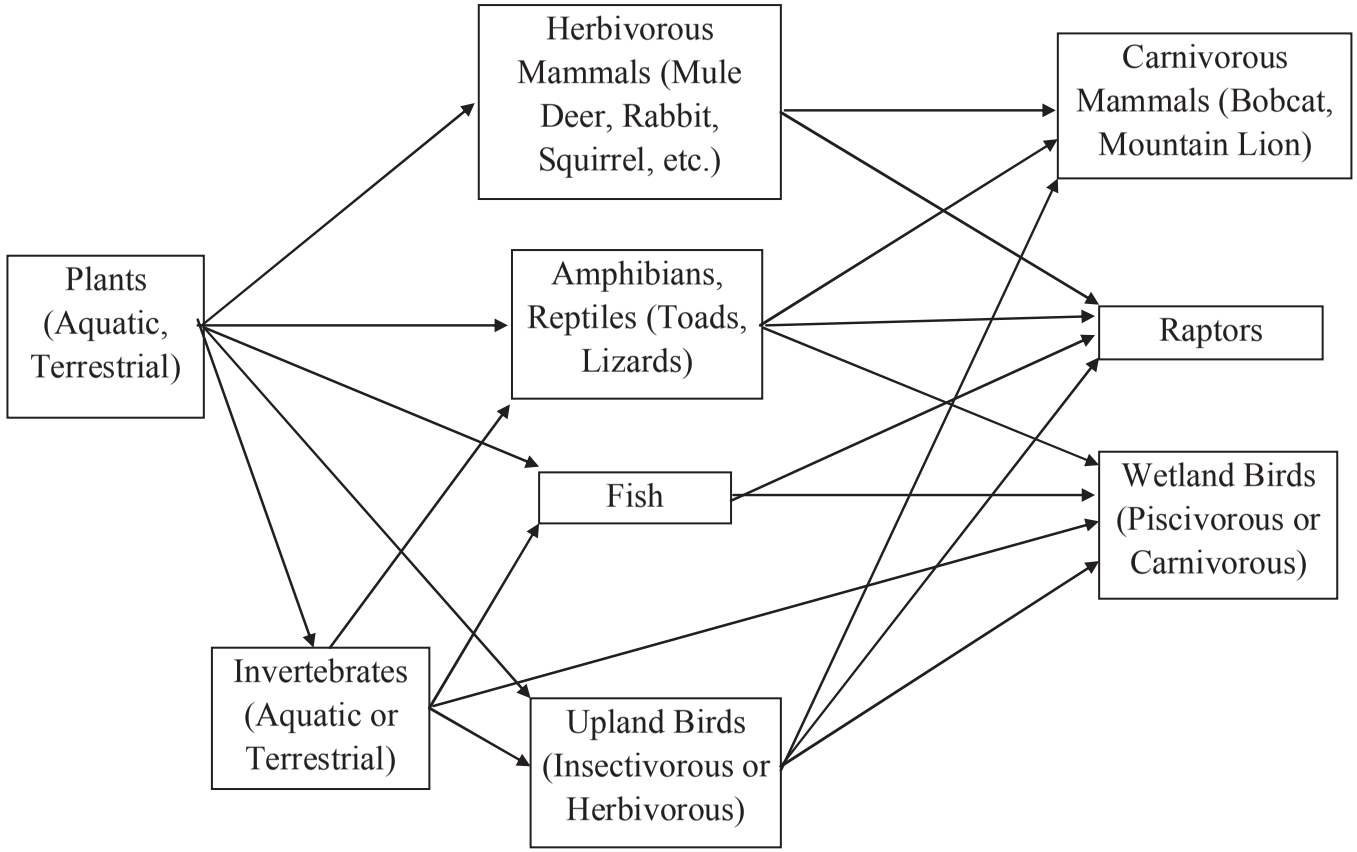
MWH

Santa Susana Field Laboratory (SSFL)
Thiessen Polygons for Surface Soil Sampling Locations - BRAVO

FIGURE
6-1

Project/Boeing SSFL RAI/MWH_SRAW2005-Rev2/Figure 6-1.ai

06/07/05



MWH

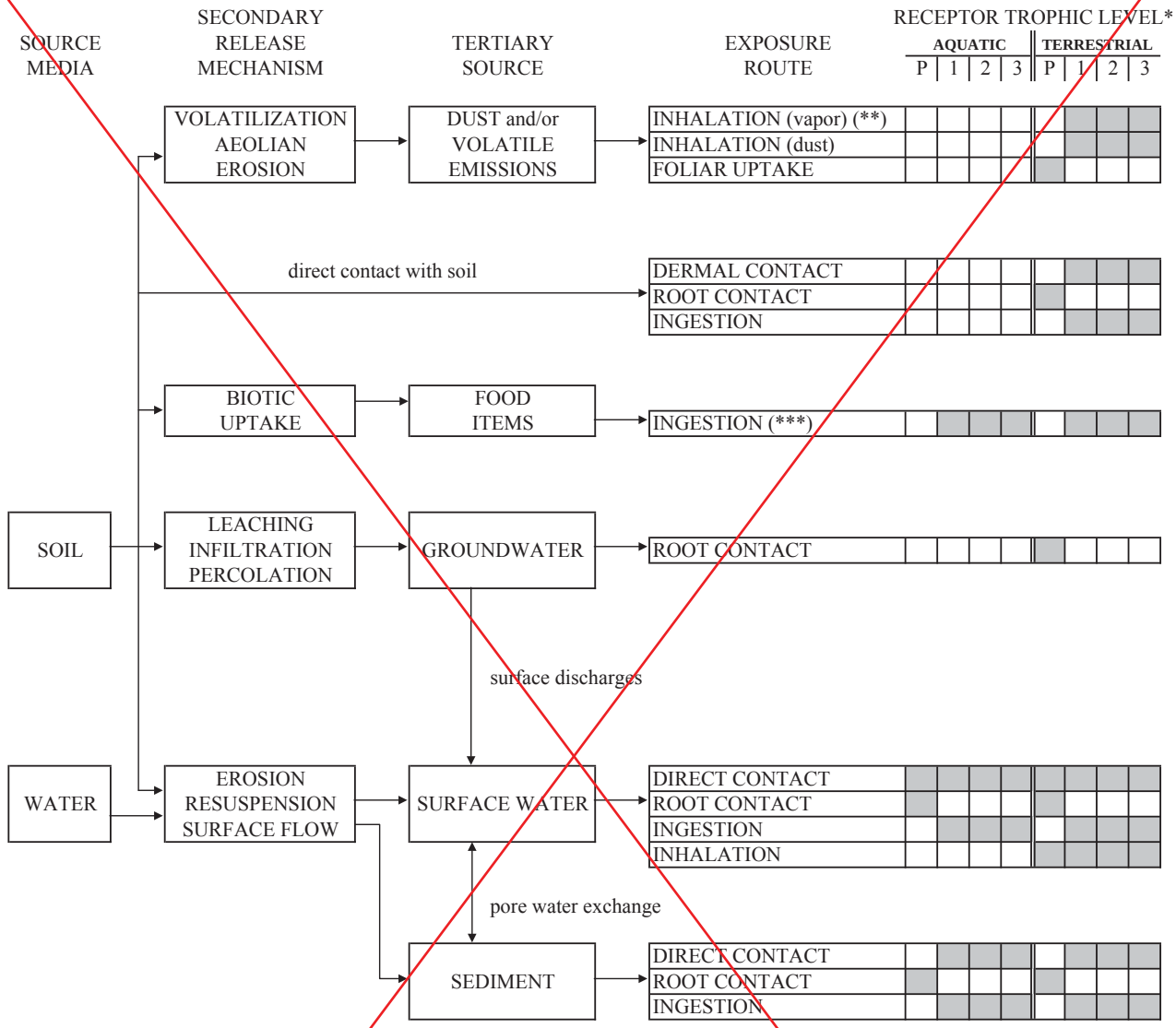
Santa Susana Field Laboratory (SSFL)
Trophic Model for the Boeing SSFL Facility

FIGURE
9-1

Project/Boeing SSFL RA/MWH_SRAM2005-Rev2/Figure 9-1.ai

06/07/05

This figure has been replaced by a revised Figure 9-2 in Appendix C of the SRAM Rev. 2 Addendum.



Notes:

See Figure 4-2 for a generalized Conceptual Site Model of human health exposures.

(*) Trophic Level: P= Primary producers (e.g., plants); 1=1st consumer (e.g., invertebrates); 2=2nd consumer (e.g., wading birds); 3=3rd consumer (e.g., fish-eating birds)

(**) Exposures limited to volatile compounds as defined in the text.

(***) Exposures limited to bioaccumulatable compounds as described in the text.

MWH

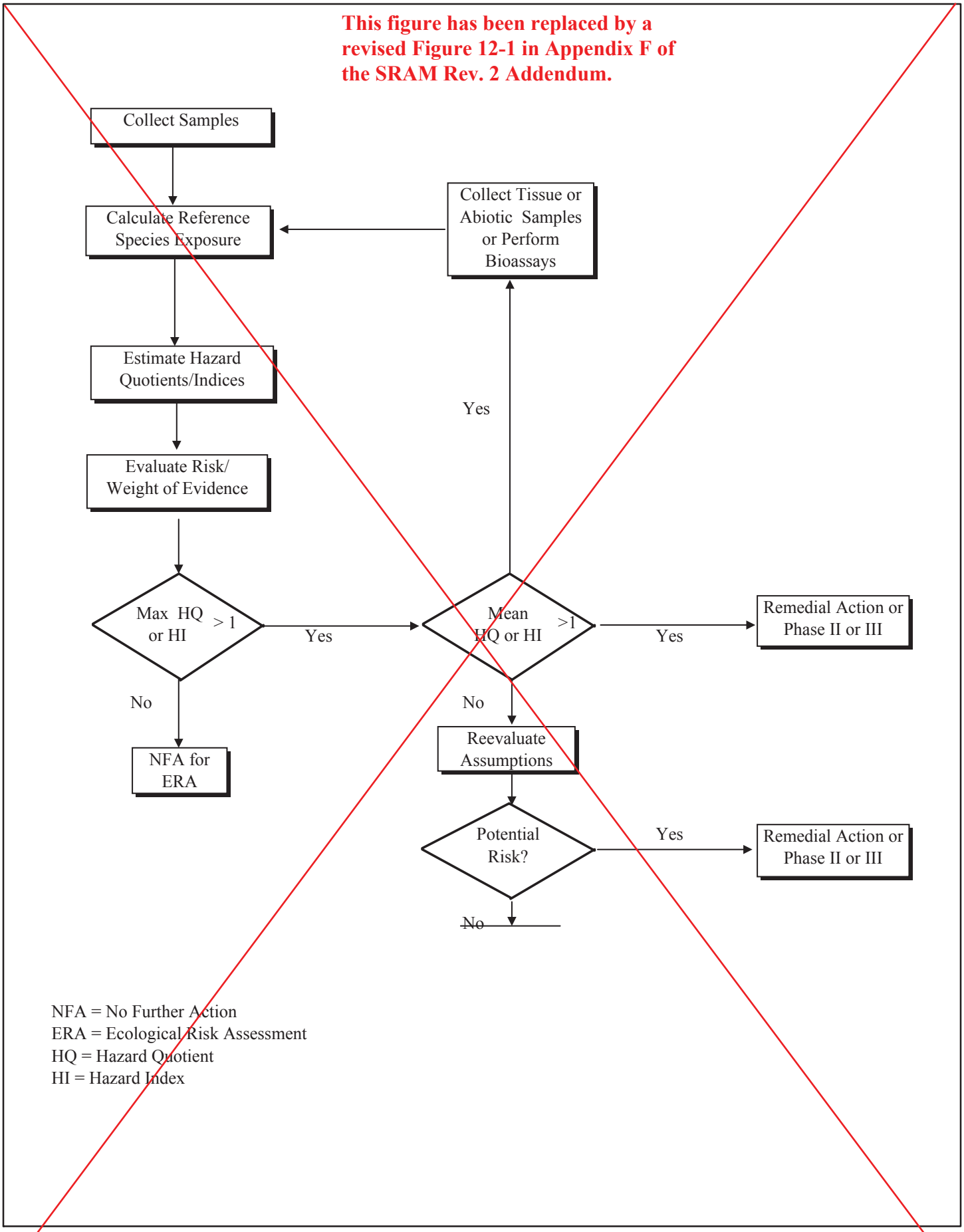
Santa Susana Field Laboratory (SSFL)
Generalized Conceptual Site Model of Ecological Exposures

FIGURE 9-2

Project/Boeing SSFL RA/MWH_SRAM2005-Rev2/Figure 9-2.ai

09/27/05

This figure has been replaced by a revised Figure 12-1 in Appendix F of the SRAM Rev. 2 Addendum.



MWH

Santa Susana Field Laboratory (SSFL)
Ecological Risk Characterization Flowchart

FIGURE 12-1

Project/Boeing SSFL RA/MWH_SRAM2005-Rev2/Figure 12-1.ai

06/07/05

APPENDIX A

DERIVATION OF POLYCHLORINATED BIPHENYL EXTRAPOLATION FACTORS

APPENDIX A (1 of 3)

Aroclor and PCB Congener Data and Calculation of Maximum Ratio Extrapolation Factors

CHEMICAL	EPA ID	OGDEN ID	DETECTED CONCENTRATION	ADJUSTED CONCENTRATION	UNIT	QUALIFIER	DETECTION LIMIT	CENSORED	PCB CONGENER : AROCLOR RATIO	
									PCB : AROCLOR-1254	PCB : AROCLOR-1260
Aroclor-1254	RB043	BVSS05S01	65	65	ug/kg					
Aroclor-1260	RB043	BVSS05S01	18	9	ug/kg	U	18	Yes		
PCB-105	RB043	BVSS05S01	3.3	3.3	ng/g				5.1E-02	
PCB-114	RB043	BVSS05S01	0.081	0.081	ng/g				1.2E-03	
PCB-118	RB043	BVSS05S01	6.6	6.6	ng/g				1.0E-01	
PCB-123	RB043	BVSS05S01	0.095	0.095	ng/g				1.5E-03	
PCB-126	RB043	BVSS05S01	0.069	0.069	ng/g				1.1E-03	
PCB-156	RB043	BVSS05S01	1.5	1.5	ng/g				2.3E-02	
PCB-157	RB043	BVSS05S01	0.43	0.43	ng/g				6.6E-03	
PCB-167	RB043	BVSS05S01	0.71	0.71	ng/g				1.1E-02	
PCB-169	RB043	BVSS05S01	0.0055	0.00275	ng/g	U	0.0055		4.2E-05	
PCB-189	RB043	BVSS05S01	0.088	0.088	ng/g				1.4E-03	
PCB-77	RB043	BVSS05S01	0.18	0.18	ng/g				2.8E-03	
PCB-81	RB043	BVSS05S01	0.059	0.059	ng/g				9.1E-04	
Aroclor-1254	RB047	BVSS07D01	62	62	ug/kg					
Aroclor-1260	RB047	BVSS07D01	24	24	ug/kg	J	41			
PCB-105	RB047	BVSS07D01	1.8	1.8	ng/g				2.9E-02	7.5E-02
PCB-114	RB047	BVSS07D01	0.03	0.03	ng/g	J			4.8E-04	1.3E-03
PCB-118	RB047	BVSS07D01	3.6	3.6	ng/g				5.8E-02	1.5E-01
PCB-123	RB047	BVSS07D01	0.053	0.053	ng/g				8.5E-04	2.2E-03
PCB-126	RB047	BVSS07D01	0.14	0.14	ng/g				2.3E-03	5.8E-03
PCB-156	RB047	BVSS07D01	1.1	1.1	ng/g				1.8E-02	4.6E-02
PCB-157	RB047	BVSS07D01	0.58	0.58	ng/g				9.4E-03	2.4E-02
PCB-167	RB047	BVSS07D01	0.99	0.99	ng/g				1.6E-02	4.1E-02
PCB-169	RB047	BVSS07D01	0.014	0.014	ng/g	J			2.3E-04	5.8E-04
PCB-189	RB047	BVSS07D01	0.15	0.15	ng/g				2.4E-03	6.3E-03
PCB-77	RB047	BVSS07D01	0.3	0.3	ng/g				4.8E-03	1.3E-02
PCB-81	RB047	BVSS07D01	0.054	0.054	ng/g				8.7E-04	2.3E-03
Aroclor-1254	RB045	BVSS07S01	48	48	ug/kg					
Aroclor-1260	RB045	BVSS07S01	22	22	ug/kg	J	37			
PCB-105	RB045	BVSS07S01	1.8	1.8	ng/g				3.8E-02	8.2E-02
PCB-114	RB045	BVSS07S01	0.032	0.032	ng/g	J			6.7E-04	1.5E-03
PCB-118	RB045	BVSS07S01	3.6	3.6	ng/g				7.5E-02	1.6E-01
PCB-123	RB045	BVSS07S01	0.51	0.51	ng/g				1.1E-02	2.3E-02
PCB-126	RB045	BVSS07S01	0.014	0.014	ng/g				2.9E-04	6.4E-04
PCB-156	RB045	BVSS07S01	1.2	1.2	ng/g				2.5E-02	5.5E-02

APPENDIX A (2 of 3)

Aroclor and PCB Congener Data and Calculation of Maximum Ratio Extrapolation Factors

CHEMICAL	EPA ID	OGDEN ID	DETECTED CONCENTRATION	ADJUSTED CONCENTRATION	UNIT	QUALIFIER	DETECTION LIMIT	CENSORED	PCB CONGENER : AROCLOR RATIO	
									PCB : AROCLOR-1254	PCB : AROCLOR-1260
PCB-157	RB045	BVSS07S01	0.54	0.54	ng/g				1.1E-02	2.5E-02
PCB-167	RB045	BVSS07S01	0.94	0.94	ng/g				2.0E-02	4.3E-02
PCB-169	RB045	BVSS07S01	0.014	0.014	ng/g	J			2.9E-04	6.4E-04
PCB-189	RB045	BVSS07S01	0.14	0.14	ng/g				2.9E-03	6.4E-03
PCB-77	RB045	BVSS07S01	0.28	0.28	ng/g				5.8E-03	1.3E-02
PCB-81	RB045	BVSS07S01	0.049	0.049	ng/g				1.0E-03	2.2E-03
Aroclor-1254	RB078	CTSS02S01	3300	3300	ug/kg					
Aroclor-1260	RB078	CTSS02S01	860	430	ug/kg	U	860	Yes		
PCB-105	RB078	CTSS02S01	170	170	ng/g				5.2E-02	
PCB-114	RB078	CTSS02S01	4.6	4.6	ng/g				1.4E-03	
PCB-118	RB078	CTSS02S01	380	380	ng/g				1.2E-01	
PCB-123	RB078	CTSS02S01	5.4	5.4	ng/g				1.6E-03	
PCB-126	RB078	CTSS02S01	3.9	3.9	ng/g				1.2E-03	
PCB-156	RB078	CTSS02S01	84	84	ng/g				2.5E-02	
PCB-157	RB078	CTSS02S01	18	18	ng/g				5.5E-03	
PCB-167	RB078	CTSS02S01	32	32	ng/g				9.7E-03	
PCB-169	RB078	CTSS02S01	0.12	0.12	ng/g				3.6E-05	
PCB-189	RB078	CTSS02S01	3.7	3.7	ng/g				1.1E-03	
PCB-77	RB078	CTSS02S01	10	10	ng/g				3.0E-03	
PCB-81	RB078	CTSS02S01	3.4	3.4	ng/g				1.0E-03	
Aroclor-1254	RB077	OCSS03S01	97	97	ug/kg	J				
PCB-105	RB077	OCSS03S01	12	12	ng/g				1.2E-01	
PCB-114	RB077	OCSS03S01	0.44	0.44	ng/g				4.5E-03	
PCB-118	RB077	OCSS03S01	26	26	ng/g				2.7E-01	
PCB-123	RB077	OCSS03S01	0.29	0.29	ng/g				3.0E-03	
PCB-126	RB077	OCSS03S01	0.73	0.73	ng/g				7.5E-03	
PCB-156	RB077	OCSS03S01	6.1	6.1	ng/g				6.3E-02	
PCB-157	RB077	OCSS03S01	1.2	1.2	ng/g				1.2E-02	
PCB-167	RB077	OCSS03S01	2	2	ng/g				2.1E-02	
PCB-169	RB077	OCSS03S01	0.071	0.0355	ng/g	U	0.071		3.7E-04	
PCB-189	RB077	OCSS03S01	0.29	0.29	ng/g				3.0E-03	
PCB-77	RB077	OCSS03S01	1.5	1.5	ng/g				1.5E-02	
PCB-81	RB077	OCSS03S01	0.29	0.29	ng/g				3.0E-03	

APPENDIX A (3 of 3)

Aroclor and PCB Congener Data and Calculation of Maximum Ratio Extrapolation Factors

CHEMICAL	EPA ID	OGDEN ID	DETECTED CONCENTRATION	ADJUSTED CONCENTRATION	UNIT	QUALIFIER	DETECTION LIMIT	CENSORED	PCB CONGENER : AROCLOR RATIO	
									PCB : AROCLOR-1254	PCB : AROCLOR-1260

MAXIMUM RATIO EXTRAPOLATION FACTORS

CHEMICAL	PCB : AROCLOR-1254	PCB : AROCLOR-1260
PCB-105	1.2E-01	8.2E-02
PCB-114	4.5E-03	1.5E-03
PCB-118	2.7E-01	1.6E-01
PCB-123	1.1E-02	2.3E-02
PCB-126	7.5E-03	5.8E-03
PCB-156	6.3E-02	5.5E-02
PCB-157	1.2E-02	2.5E-02
PCB-167	2.1E-02	4.3E-02
PCB-169	3.7E-04	6.4E-04
PCB-189	3.0E-03	6.4E-03
PCB-77	1.5E-02	1.3E-02
PCB-81	3.0E-03	2.3E-03

APPENDIX B

DERIVATION OF TOTAL PETROLEUM HYDROCARBON EXTRAPOLATION FACTORS

Information related to TPH extrapolation methodology and the selection of petroleum constituents as COPCs and CPECs when TPH fractions are detected are no longer applicable, because adequate data have been collected for petroleum chemical constituents, and as a result, TPH extrapolation will no longer be necessary. Therefore, Appendix B, in its entirety, has been deleted.

APPENDIX B
TABLE OF CONTENTS

DERIVATION OF TOTAL PETROLEUM HYDROCARBON EXTRAPOLATION FACTORS

SECTION	TITLE
Attachment B-1	B-1-1 HCPC Graphs B-1-2 LCPC Graphs
Attachment B-2	Comparison of 1997 TPH with 2002 Data
Attachment B-3	TPH and Petroleum Constituent Data and Calculation of Maximum Ratio Extrapolation Factors

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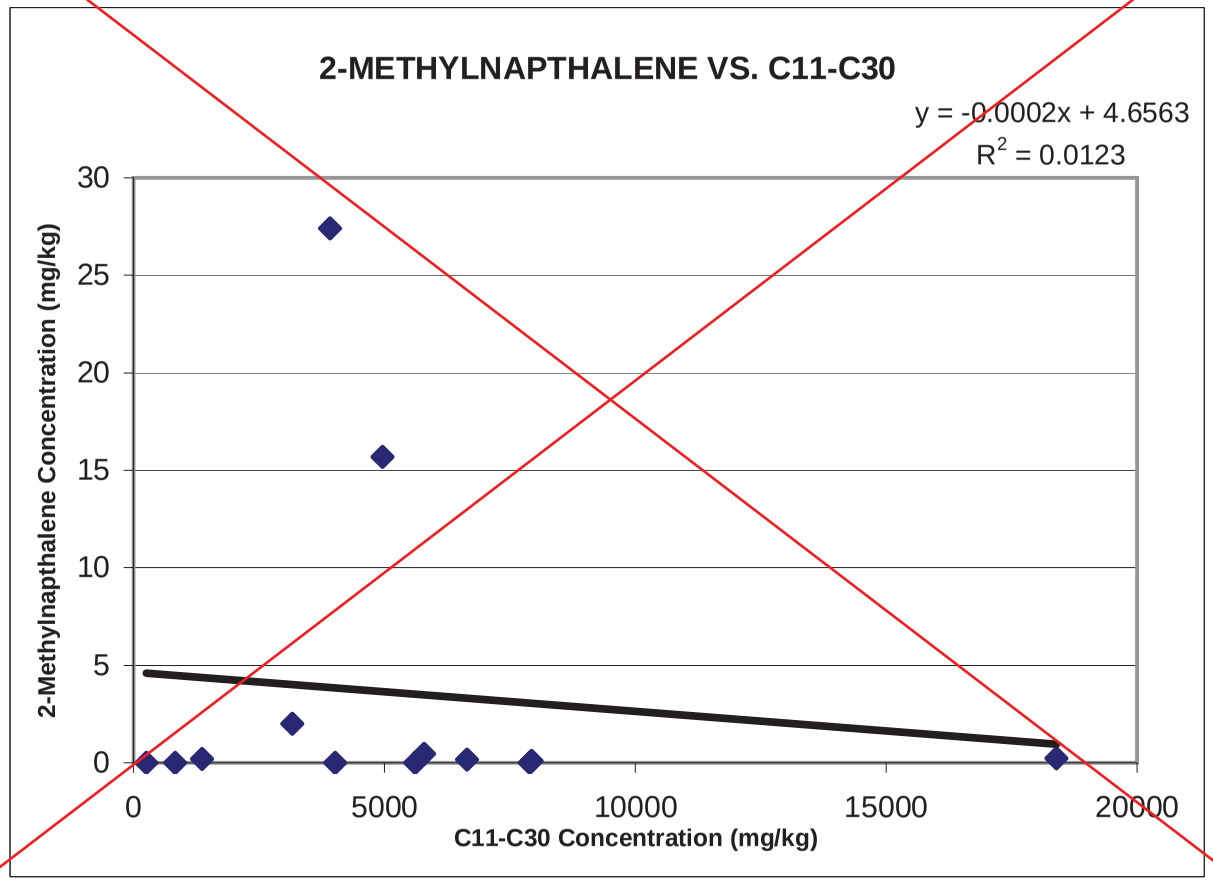
APPENDIX B

ATTACHMENT B-1-1

HCPC GRAPHS

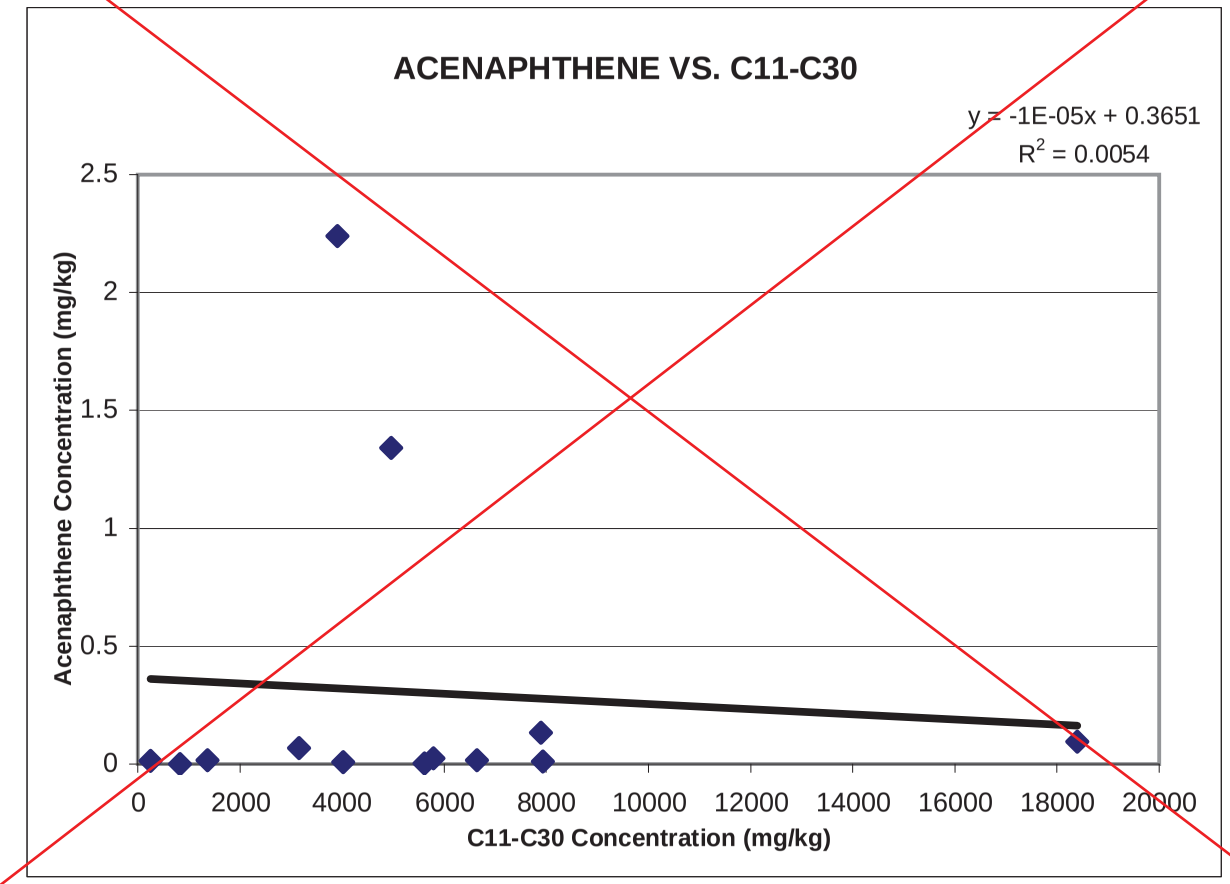
Appendix B, Attachment 1 (1 of 18)

HCPC Graphs



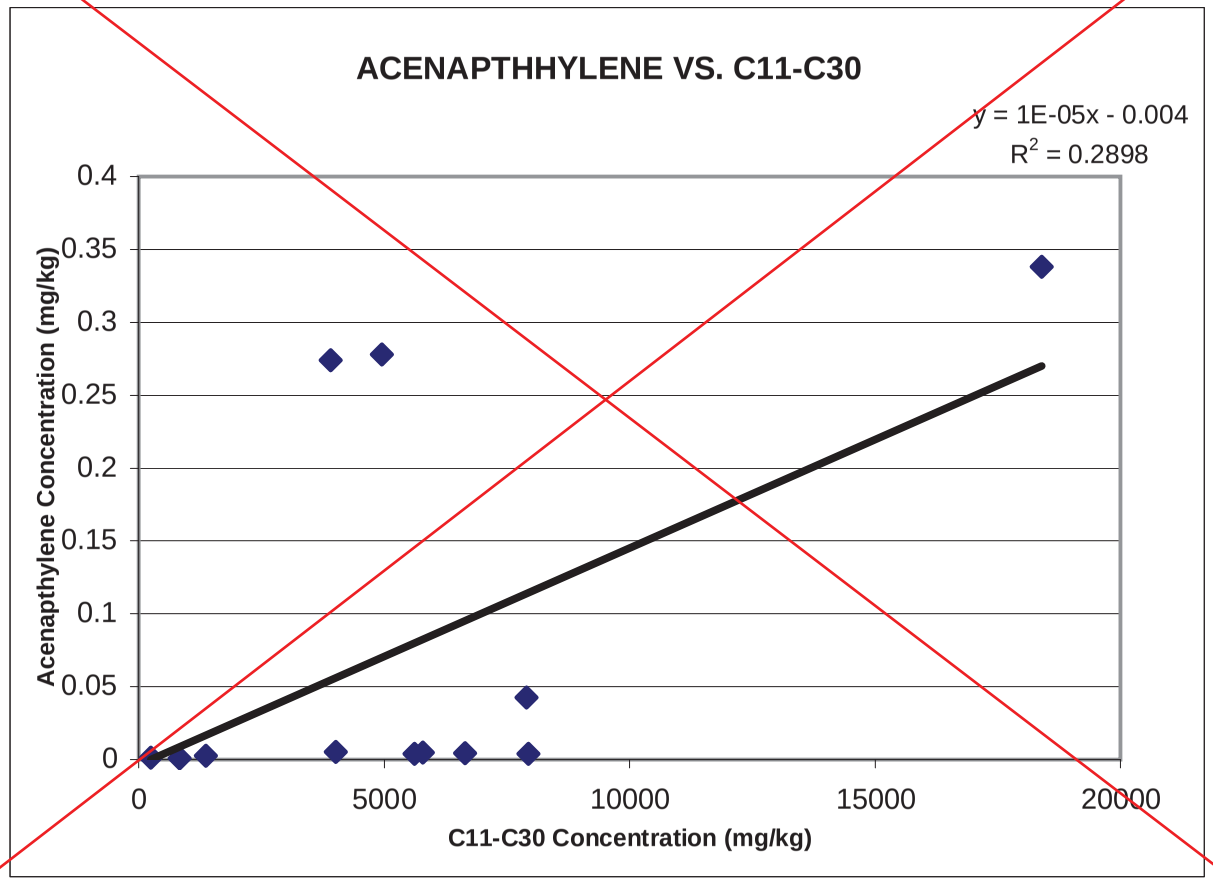
Appendix B, Attachment 1 (2 of 18)

HCPC Graphs

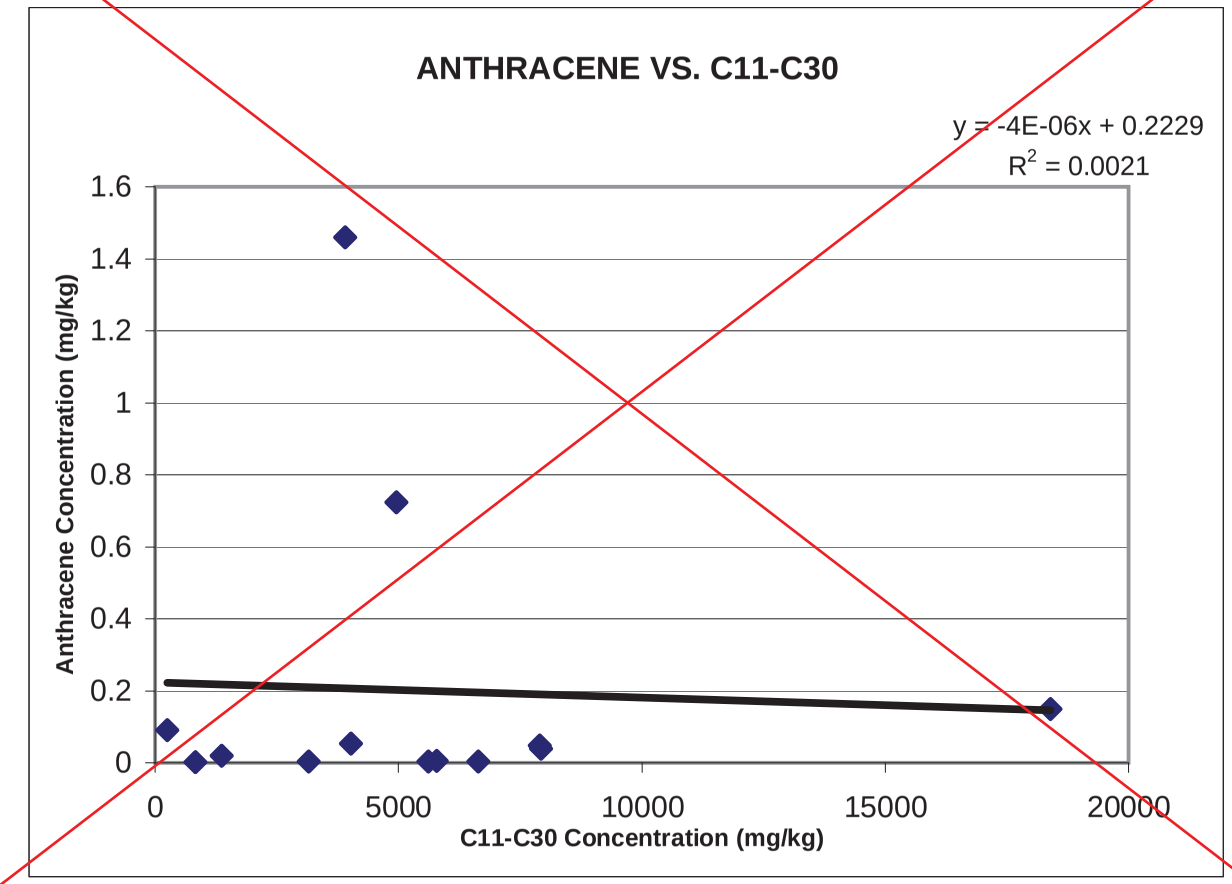


Appendix B, Attachment 1 (3 of 18)

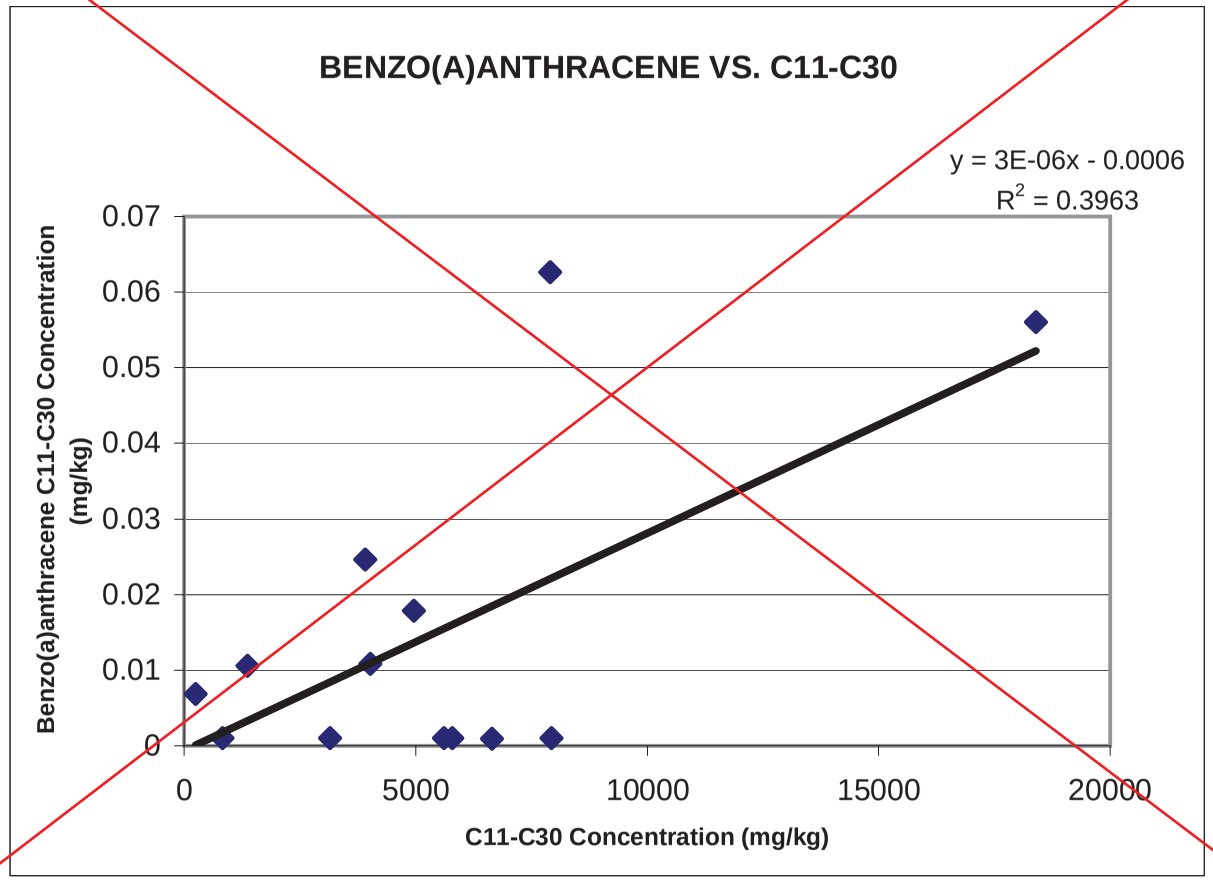
HCPC Graphs



HCPC Graphs

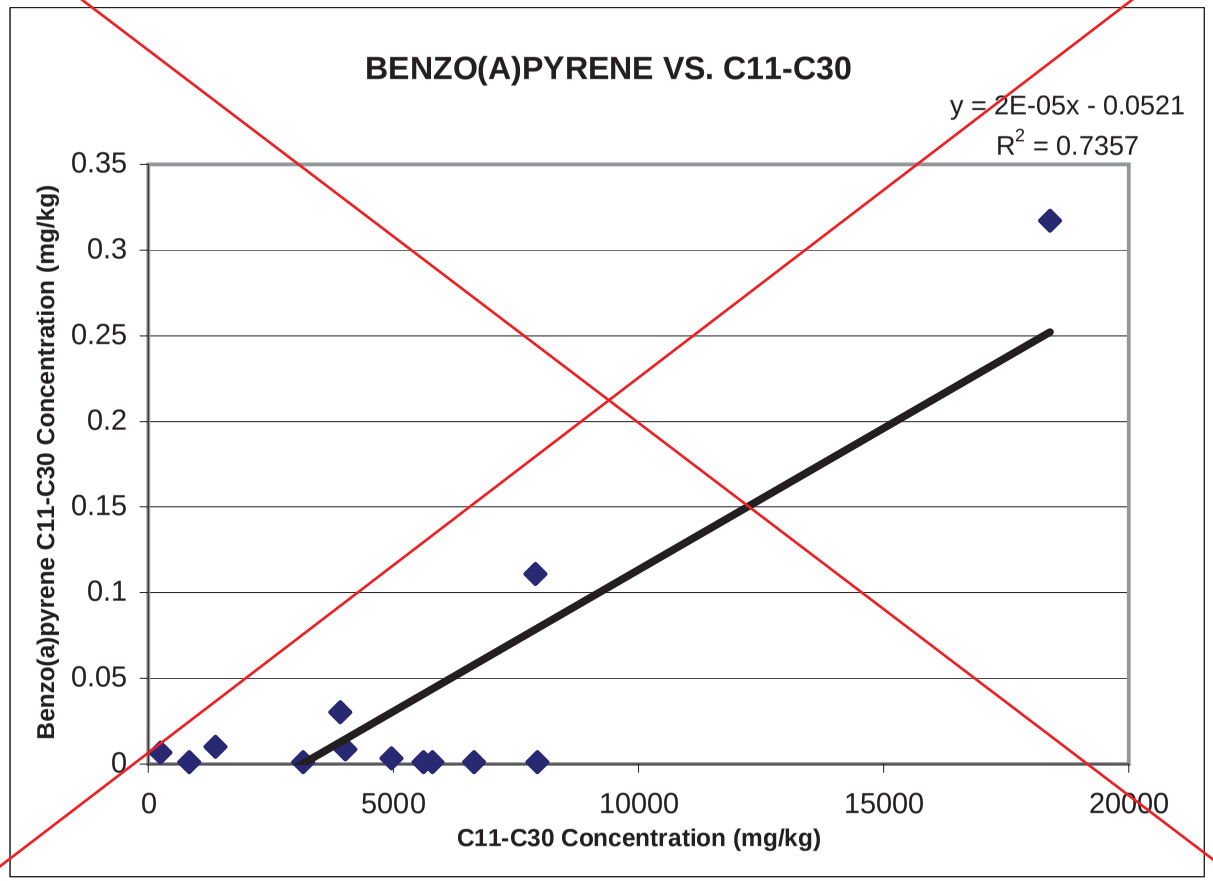

ANTHRACENE VS. C11-C30
y = -4E-06x + 0.2229
R2 = 0.0021
Anthracene Concentration (mg/kg)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
5000
10000
15000
20000
C11-C30 Concentration (mg/kg)

HCPC Graphs

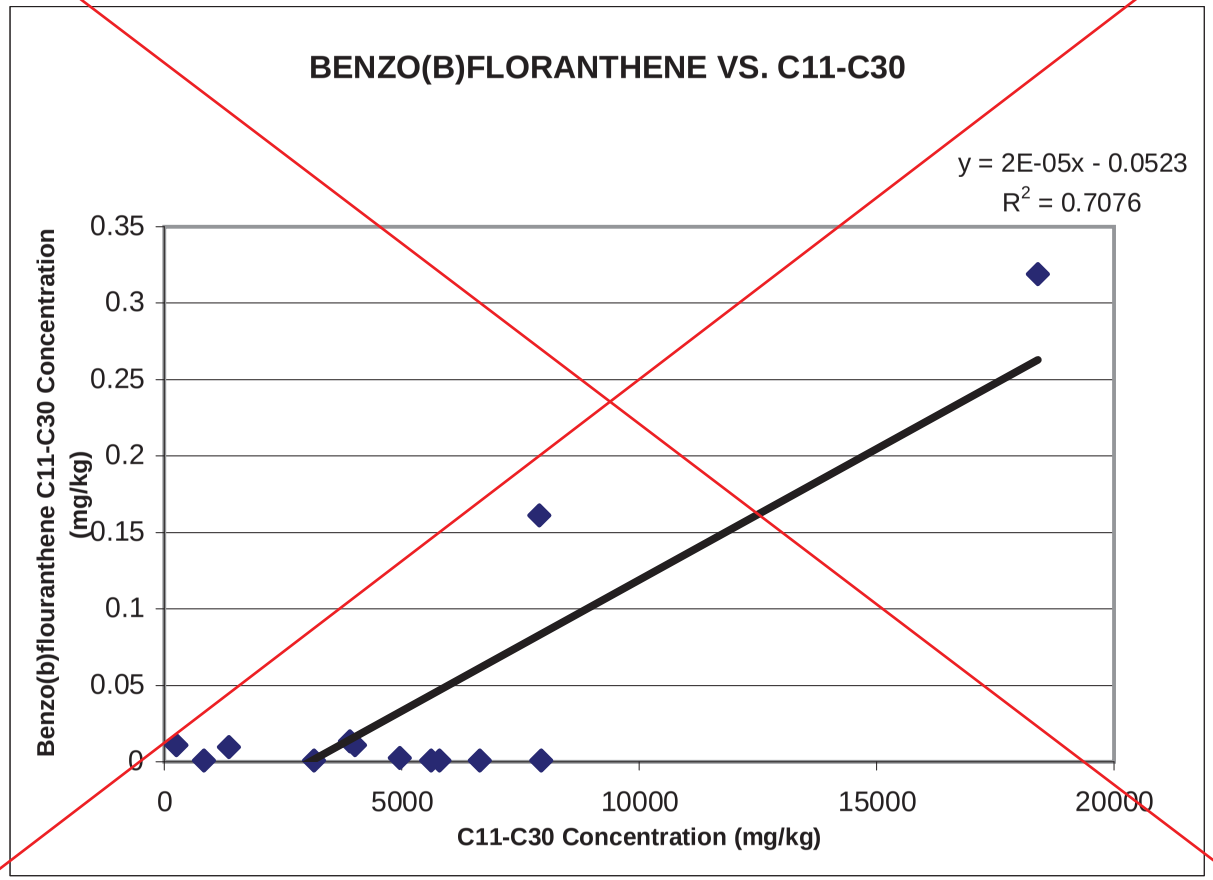

BENZO(A)ANTHRACENE VS. C11-C30
y = 3E-06x - 0.0006
R2 = 0.3963
Benzo(a)anthracene C11-C30 Concentration (mg/kg)
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
0
5000
10000
15000
20000
C11-C30 Concentration (mg/kg)

Appendix B, Attachment 1 (6 of 18)

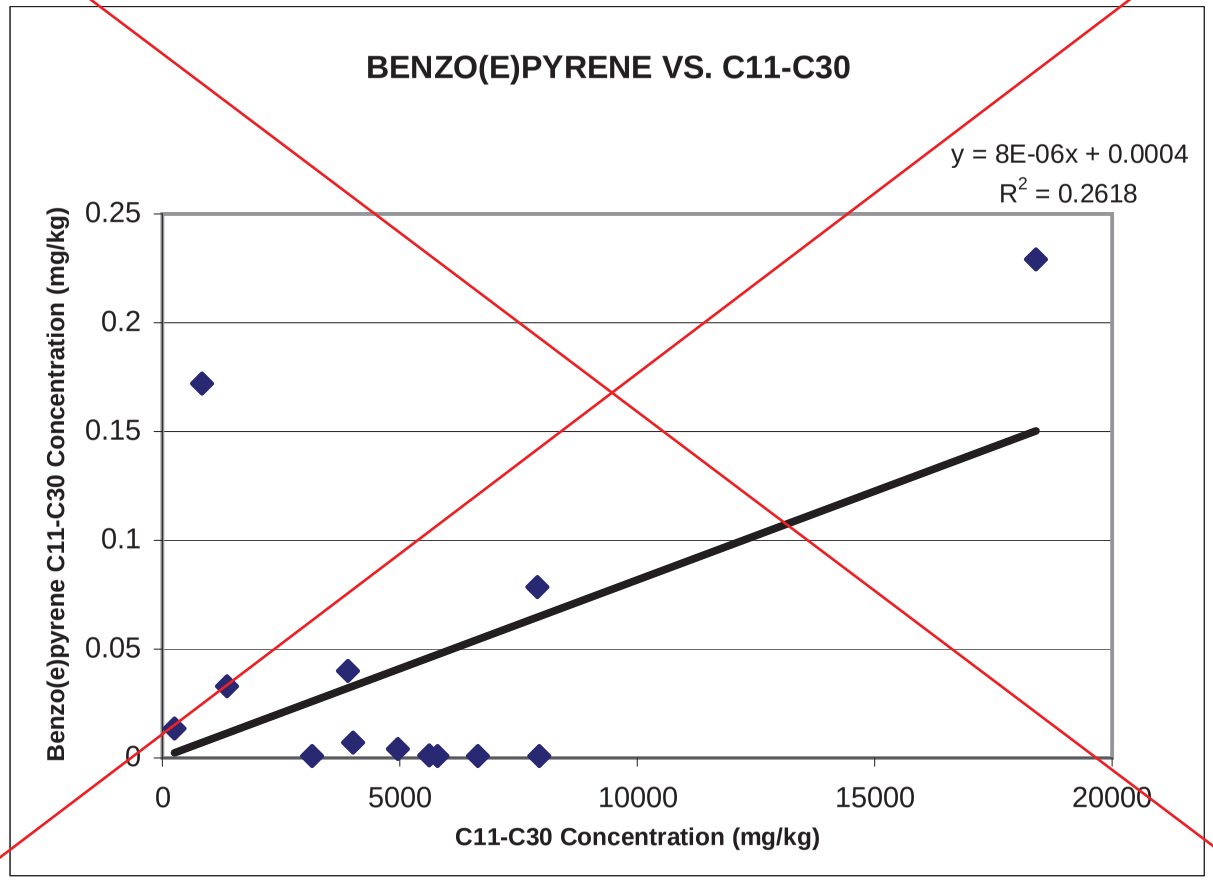
HCPC Graphs



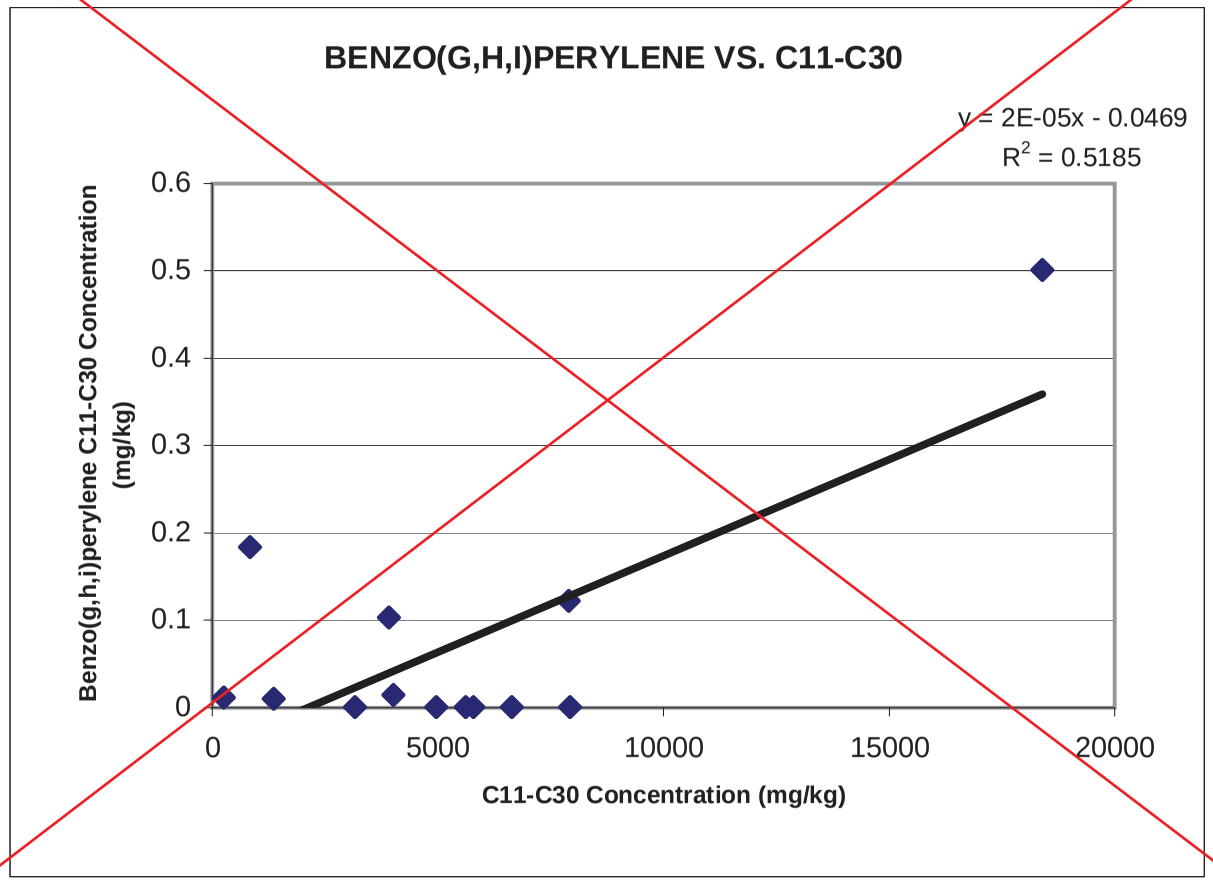
HCPC Graphs


BENZO(B)FLORANTHENE VS. C11-C30
y = 2E-05x - 0.0523
R2 = 0.7076
Benzo(b)flouranthene C11-C30 Concentration (mg/kg)
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0
5000
10000
15000
20000
C11-C30 Concentration (mg/kg)

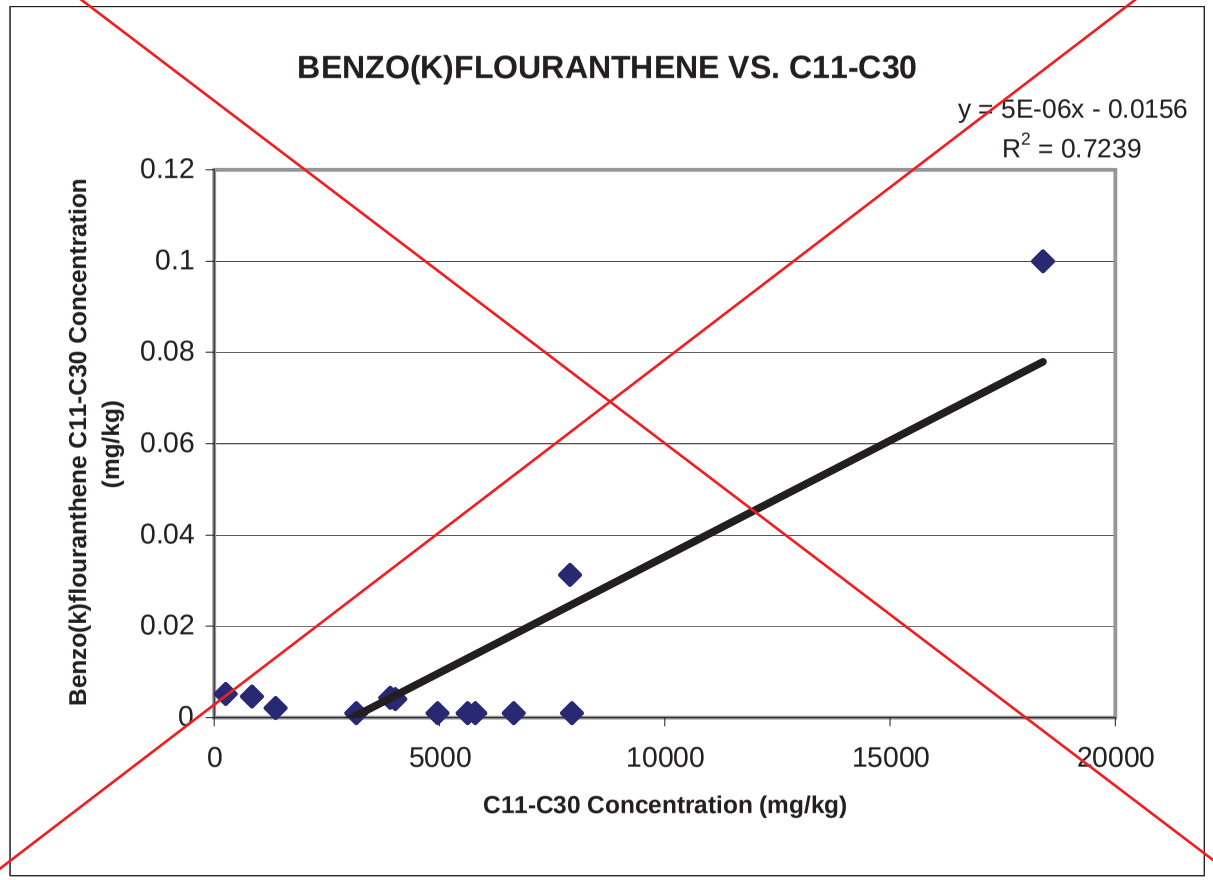
HCPC Graphs


BENZO(E)PYRENE VS. C11-C30
y = 8E-06x + 0.0004
R2 = 0.2618
Benzo(e)pyrene C11-C30 Concentration (mg/kg)
0.25
0.2
0.15
0.1
0.05
0
0
5000
10000
15000
20000
C11-C30 Concentration (mg/kg)

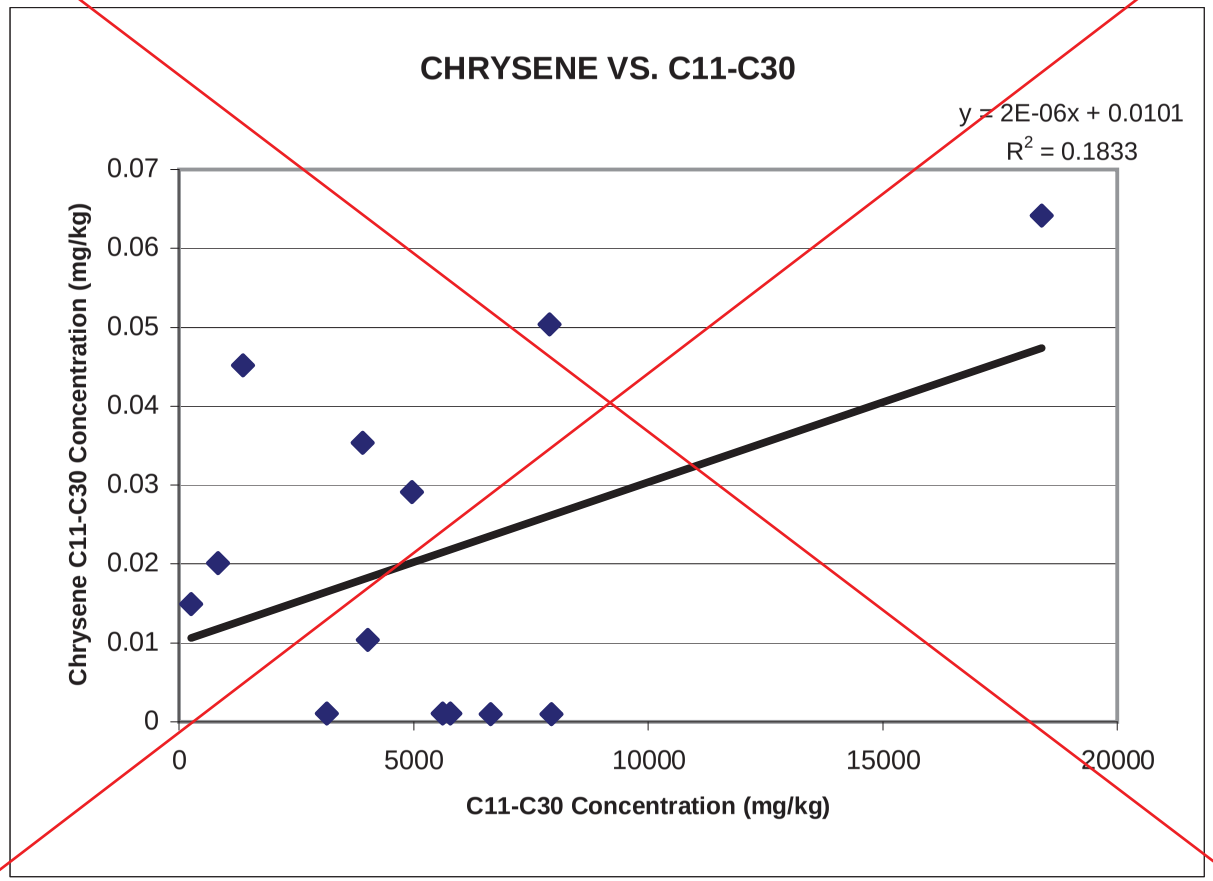
HCPC Graphs


BENZO(G,H,I)PERYLENE VS. C11-C30
y = 2E-05x - 0.0469
R2 = 0.5185
Benzo(g,h,i)perylene C11-C30 Concentration (mg/kg)
0.6
0.5
0.4
0.3
0.2
0.1
0
0
5000
10000
15000
20000
C11-C30 Concentration (mg/kg)

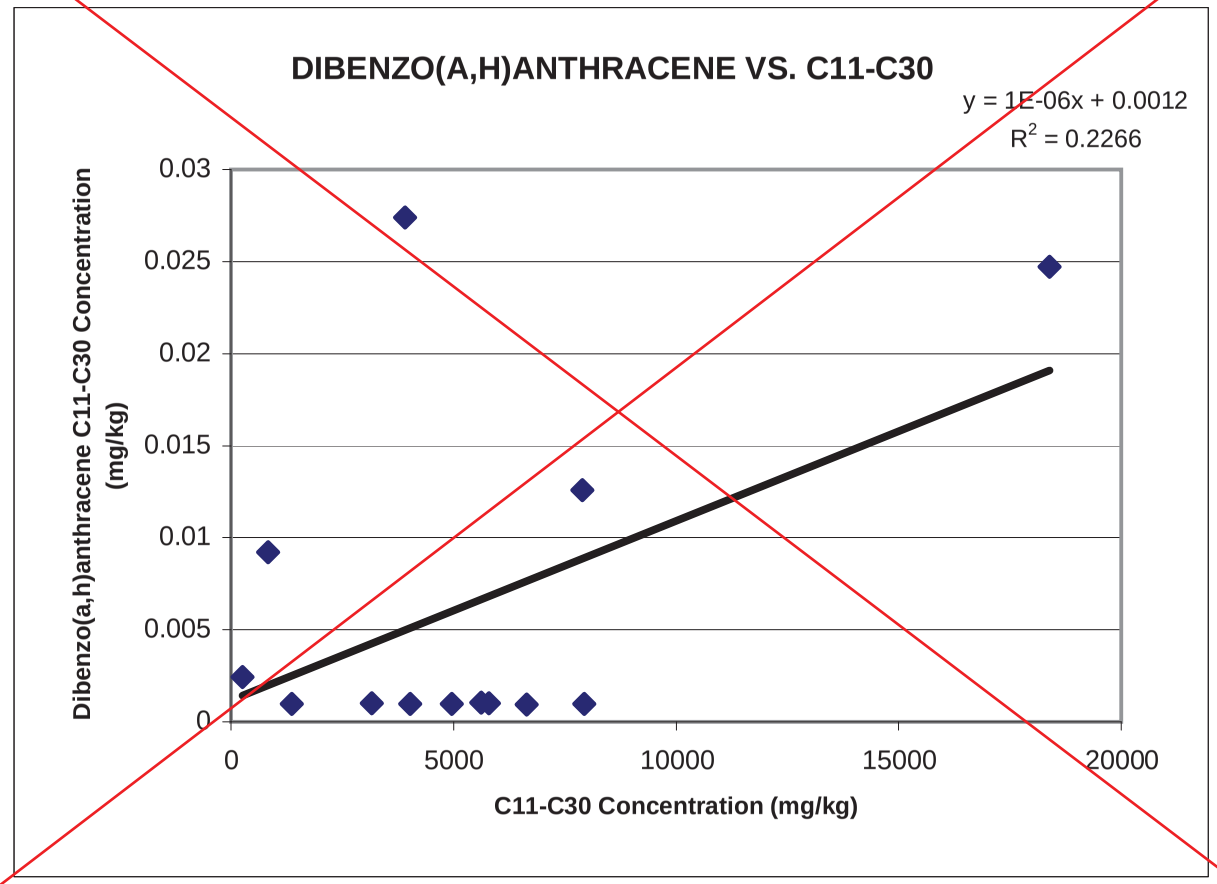
HCPC Graphs


BENZO(K)FLOURANTHENE VS. C11-C30
y = 5E-06x - 0.0156
R2 = 0.7239
Benzo(k)flouranthene C11-C30 Concentration (mg/kg)
0.12
0.1
0.08
0.06
0.04
0.02
0
0
5000
10000
15000
20000
C11-C30 Concentration (mg/kg)

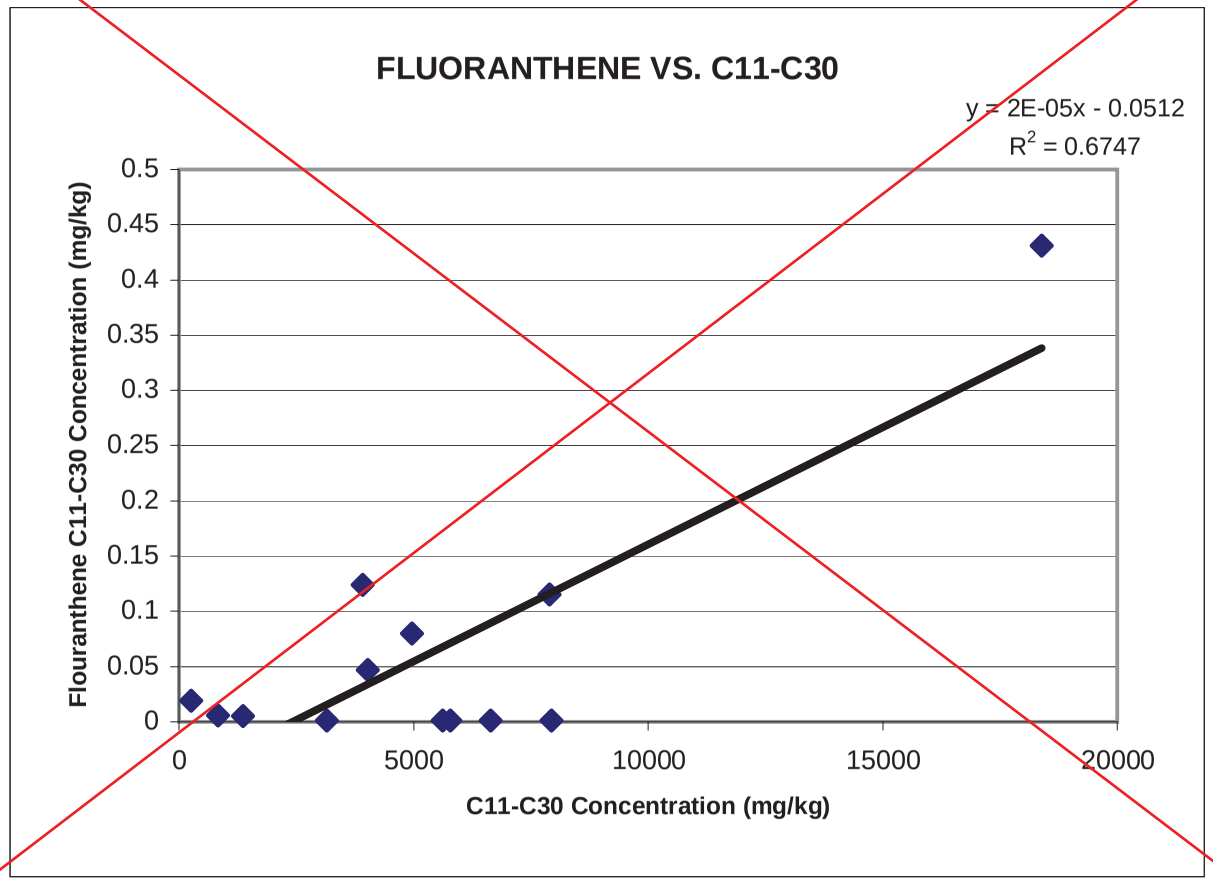
HCPC Graphs


CHRYSENE VS. C11-C30
y = 2E-06x + 0.0101
R2 = 0.1833
Chrysene C11-C30 Concentration (mg/kg)
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
0
5000
10000
15000
20000
C11-C30 Concentration (mg/kg)

HCPC Graphs

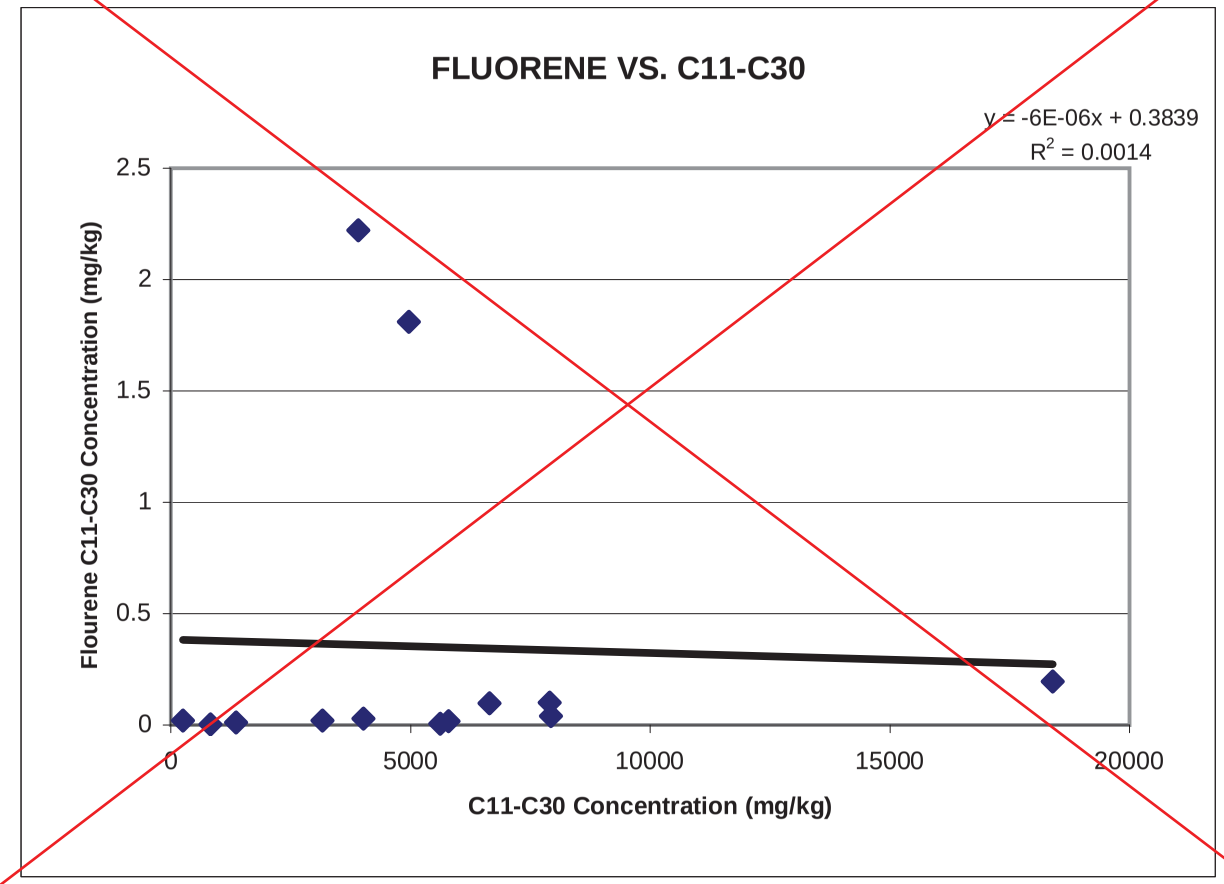

DIBENZO(A,H)ANTHRACENE VS. C11-C30
y = 1E-06x + 0.0012
R2 = 0.2266
Dibenzo(a,h)anthracene C11-C30 Concentration (mg/kg)
0.03
0.025
0.02
0.015
0.01
0.005
0
0
5000
10000
15000
20000
C11-C30 Concentration (mg/kg)

HCPC Graphs

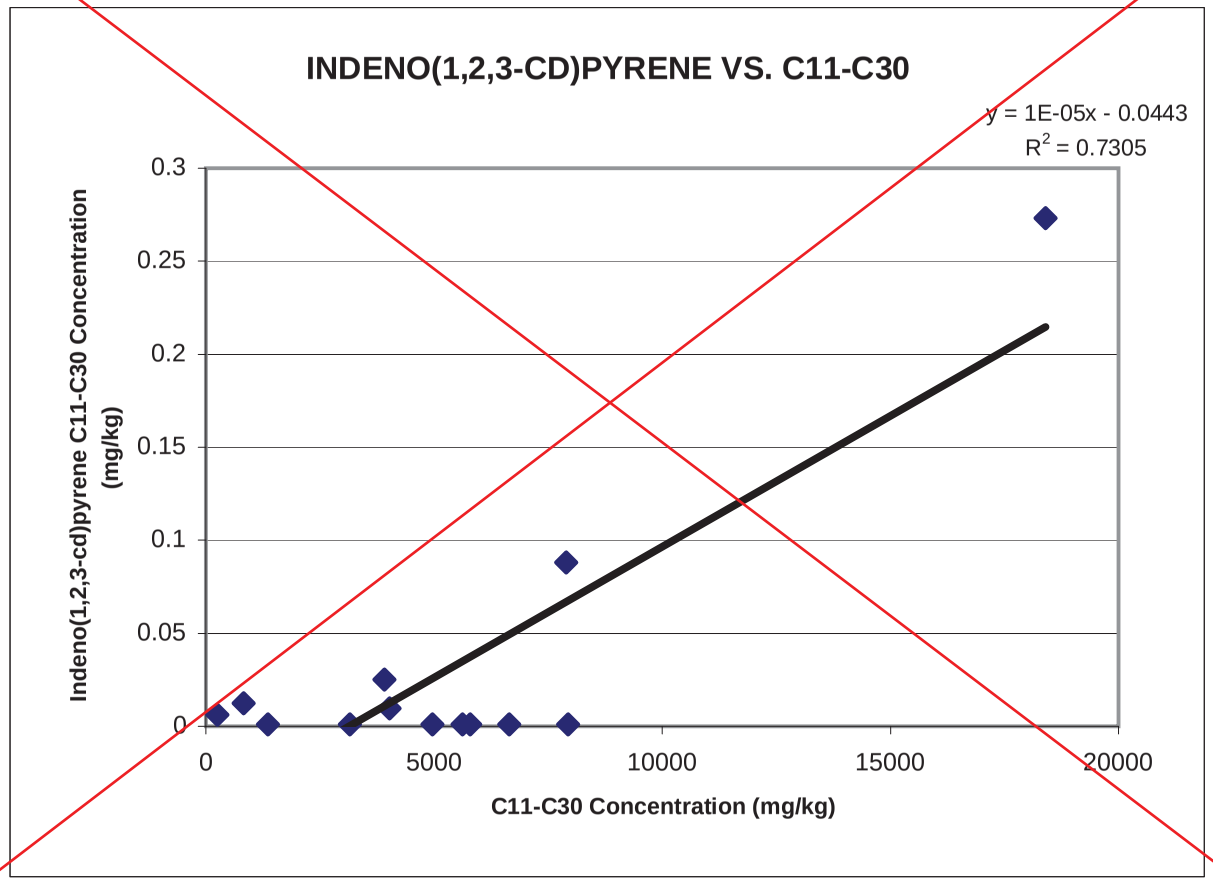

FLUORANTHENE VS. C11-C30
y = 2E-05x - 0.0512
R2 = 0.6747
Flouranthene C11-C30 Concentration (mg/kg)
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0
5000
10000
15000
20000
C11-C30 Concentration (mg/kg)

Appendix B, Attachment 1 (14 of 18)

HCPC Graphs

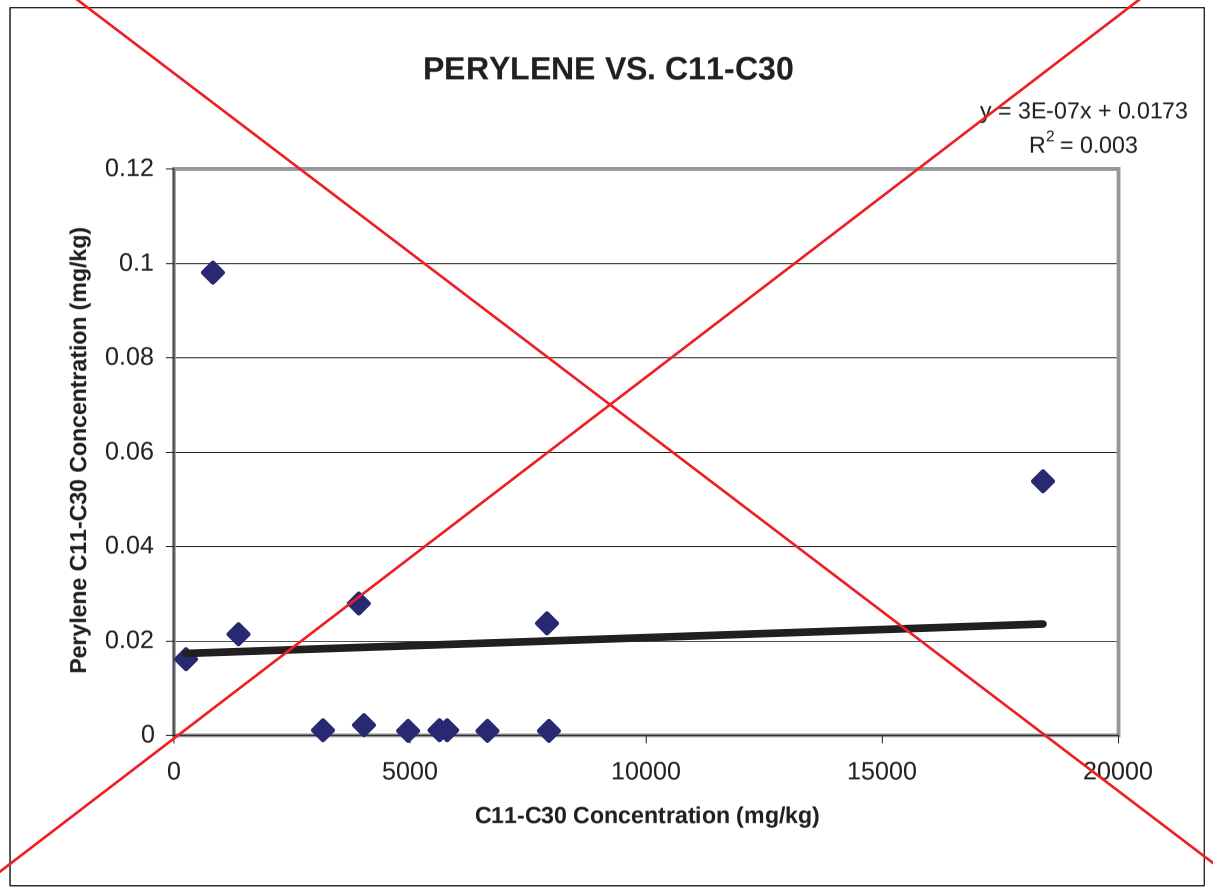


HCPC Graphs


INDENO(1,2,3-CD)PYRENE VS. C11-C30
y = 1E-05x - 0.0443
R2 = 0.7305
Indeno(1,2,3-cd)pyrene C11-C30 Concentration (mg/kg)
0.3
0.25
0.2
0.15
0.1
0.05
0
0
5000
10000
15000
20000
C11-C30 Concentration (mg/kg)

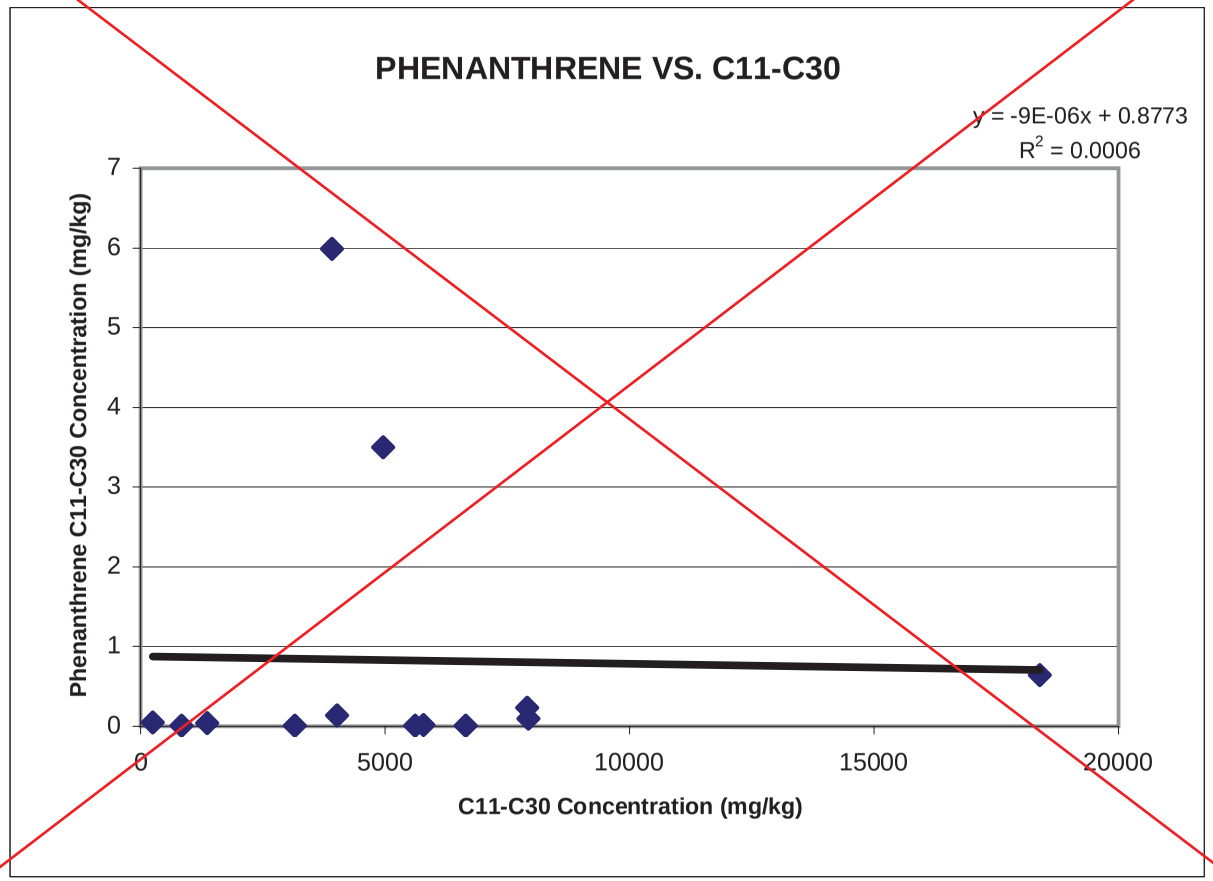
Appendix B, Attachment 1 (16 of 18)

HCPC Graphs



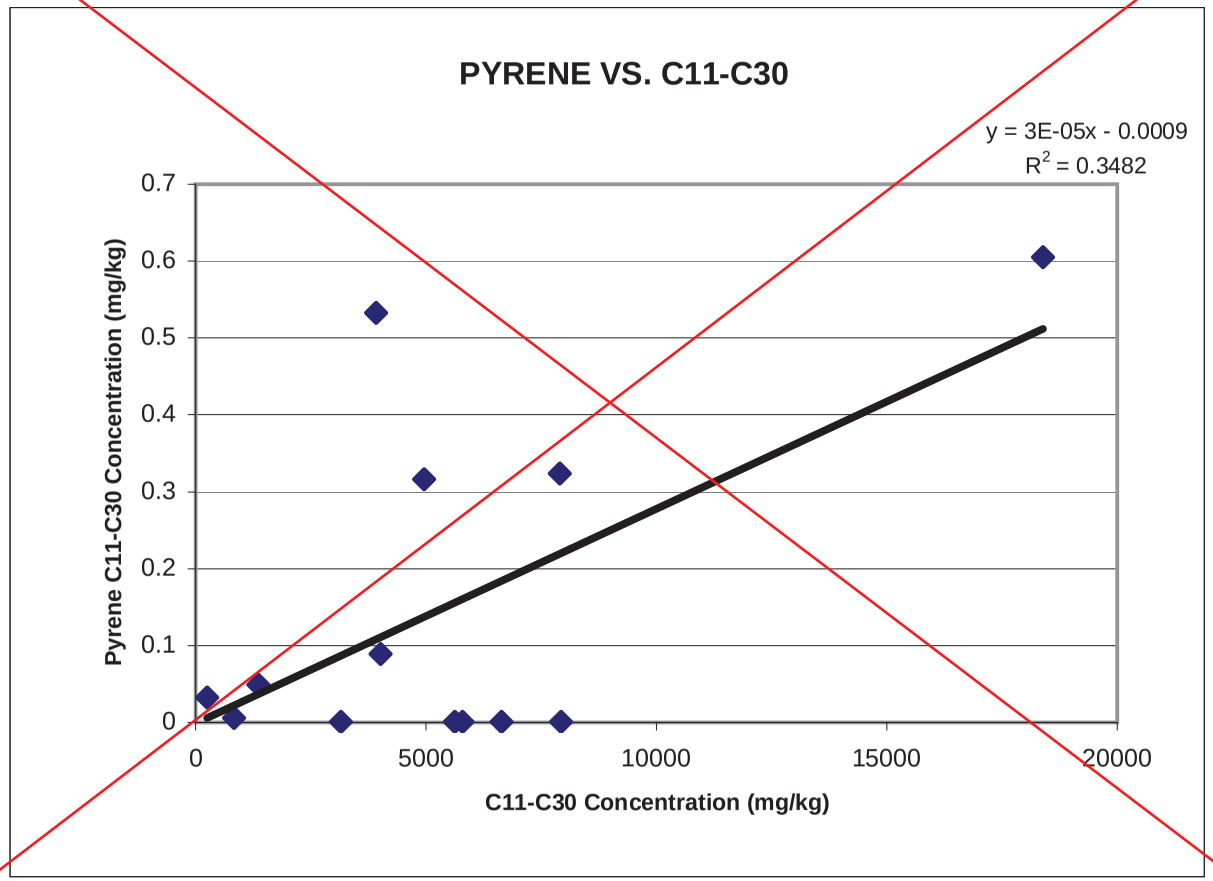
Appendix B, Attachment 1 (17 of 18)

HCPC Graphs



Appendix B, Attachment 1 (18 of 18)

HCPC Graphs



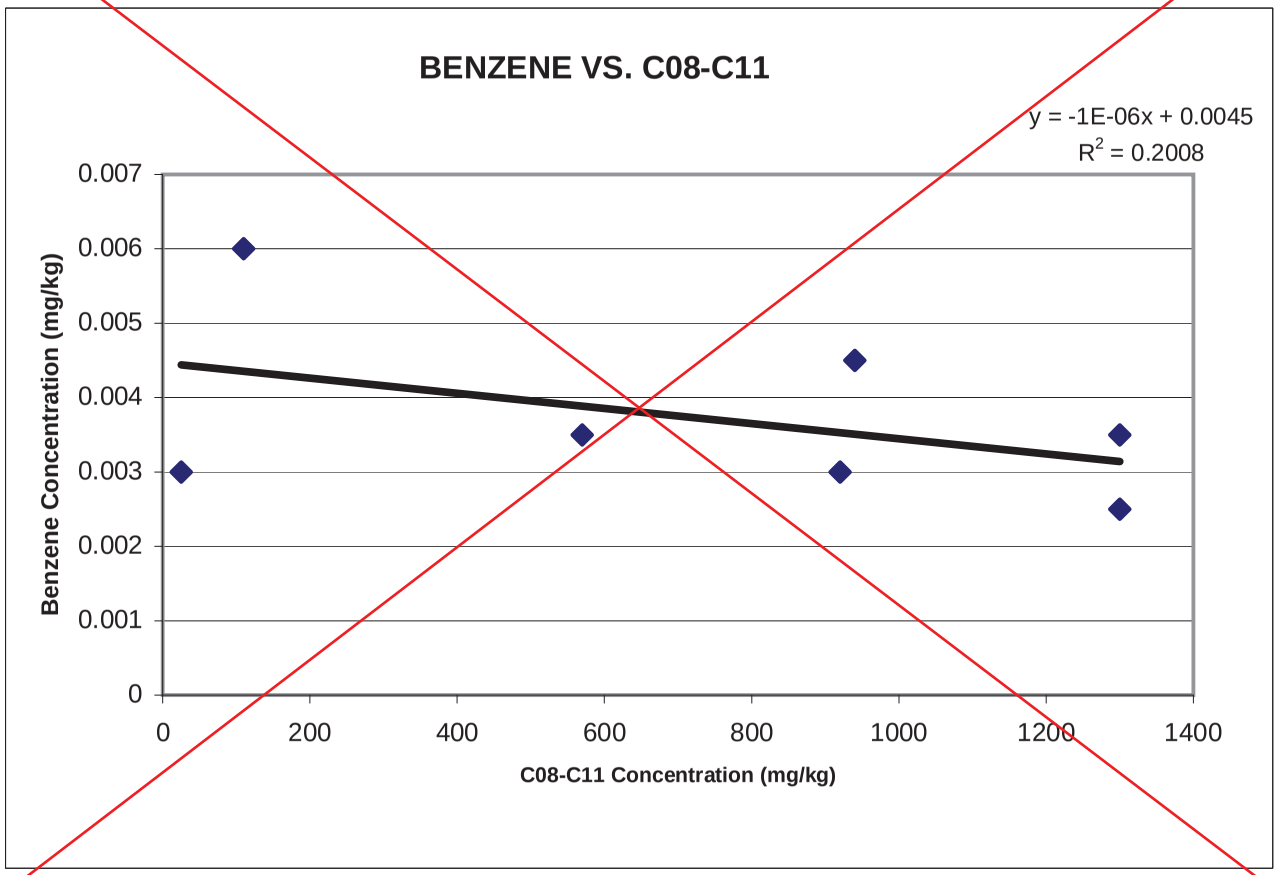
APPENDIX B

ATTACHMENT B-1-2

LCPC GRAPHS

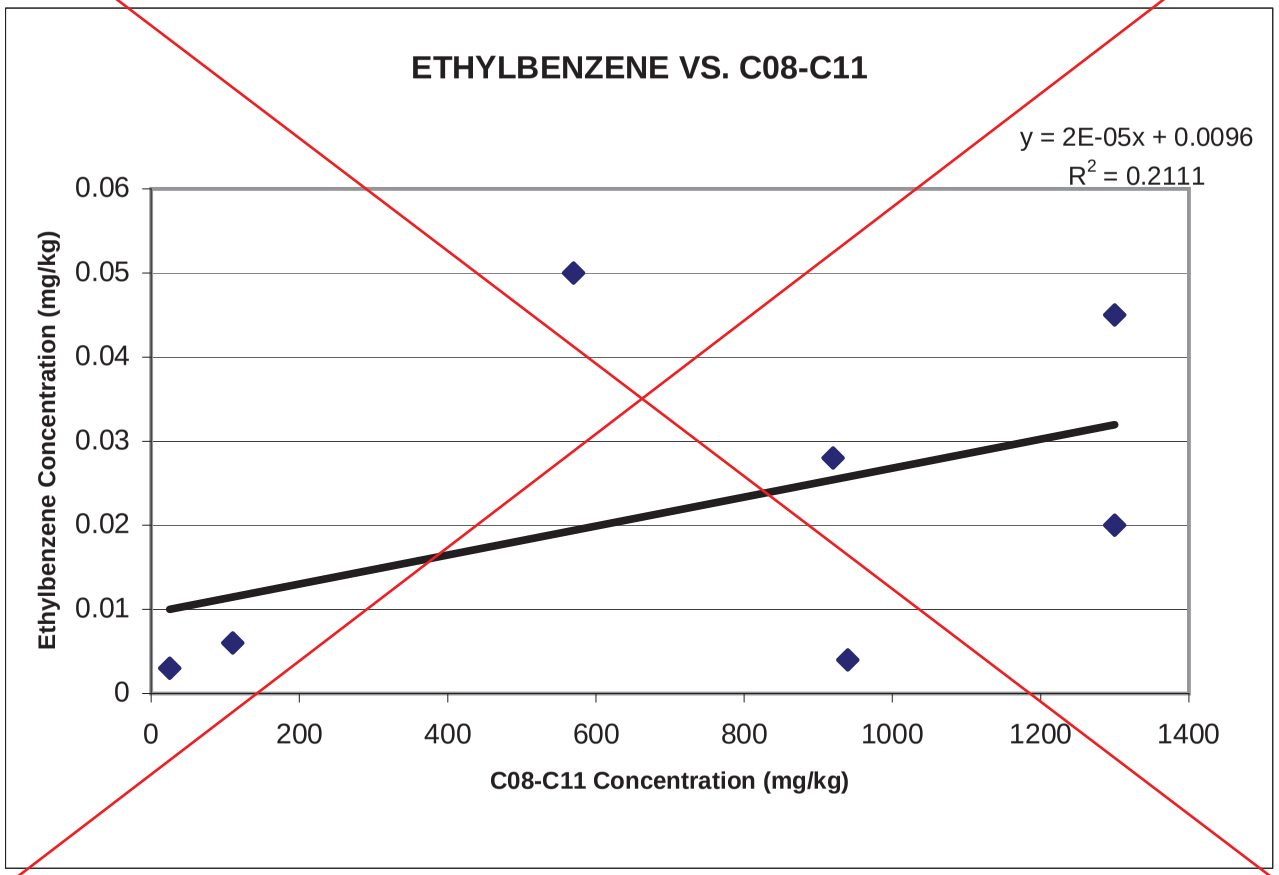
Appendix B, Attachment 1 (1 of 8)

LCPC Graphs



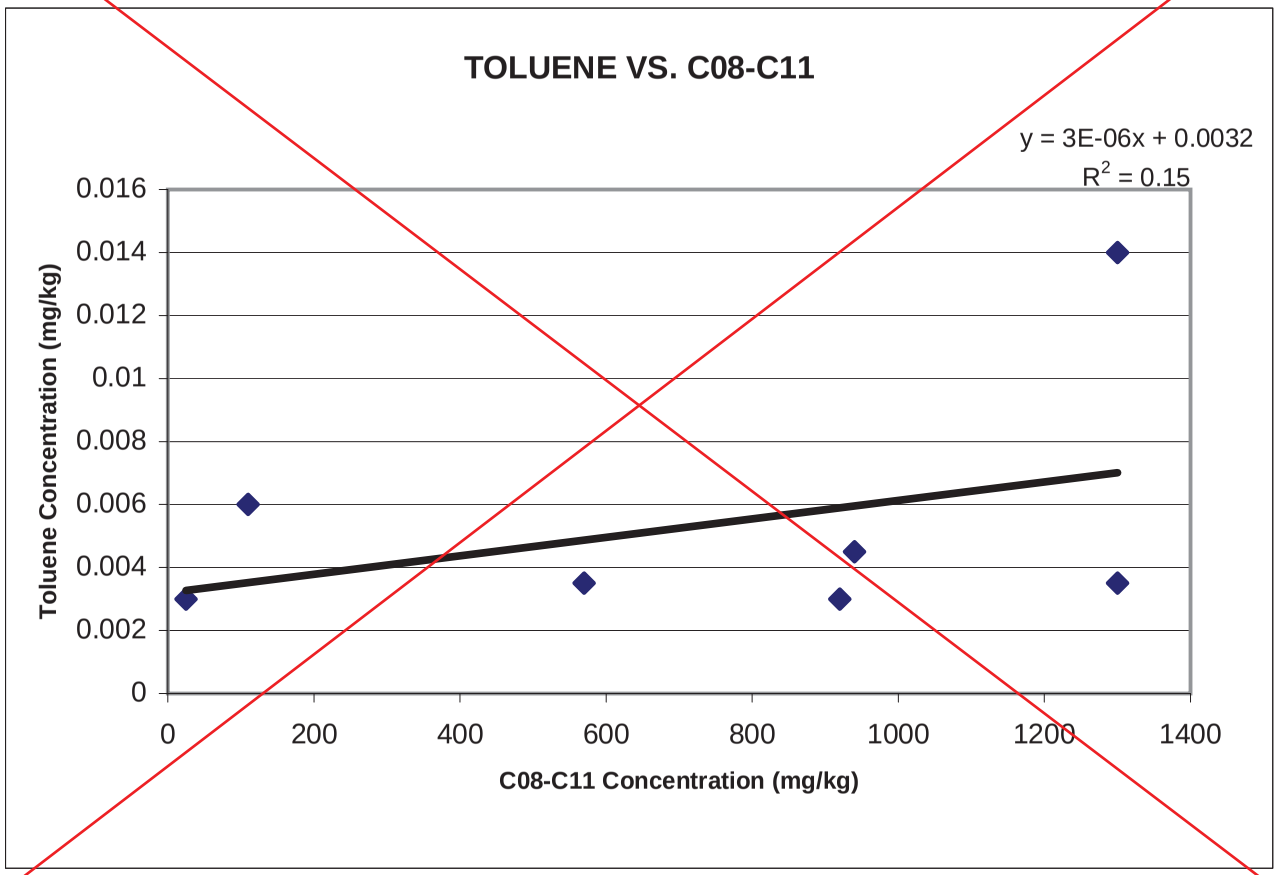
Appendix B, Attachment 1 (2 of 8)

LCPC Graphs



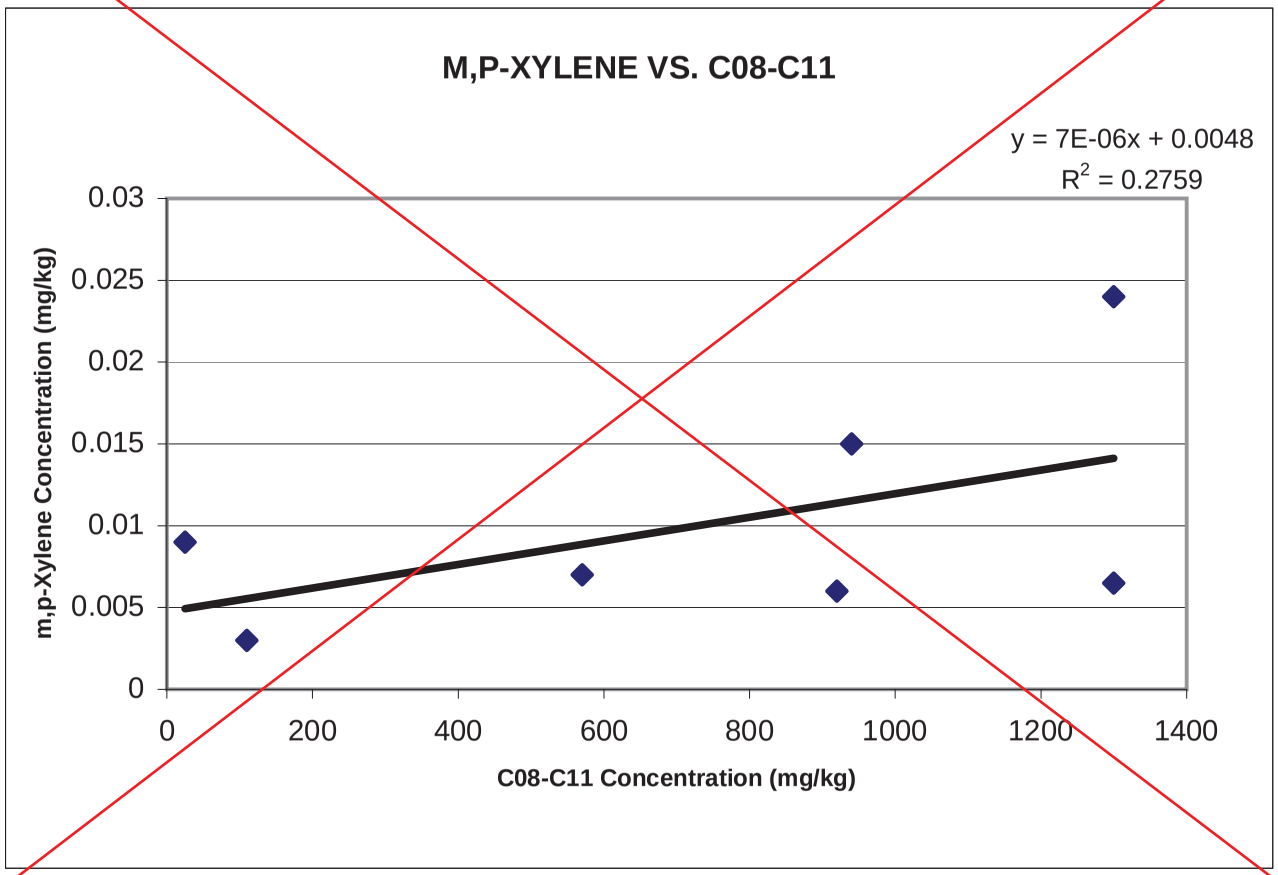
Appendix B, Attachment 1 (3 of 8)

LCPC Graphs



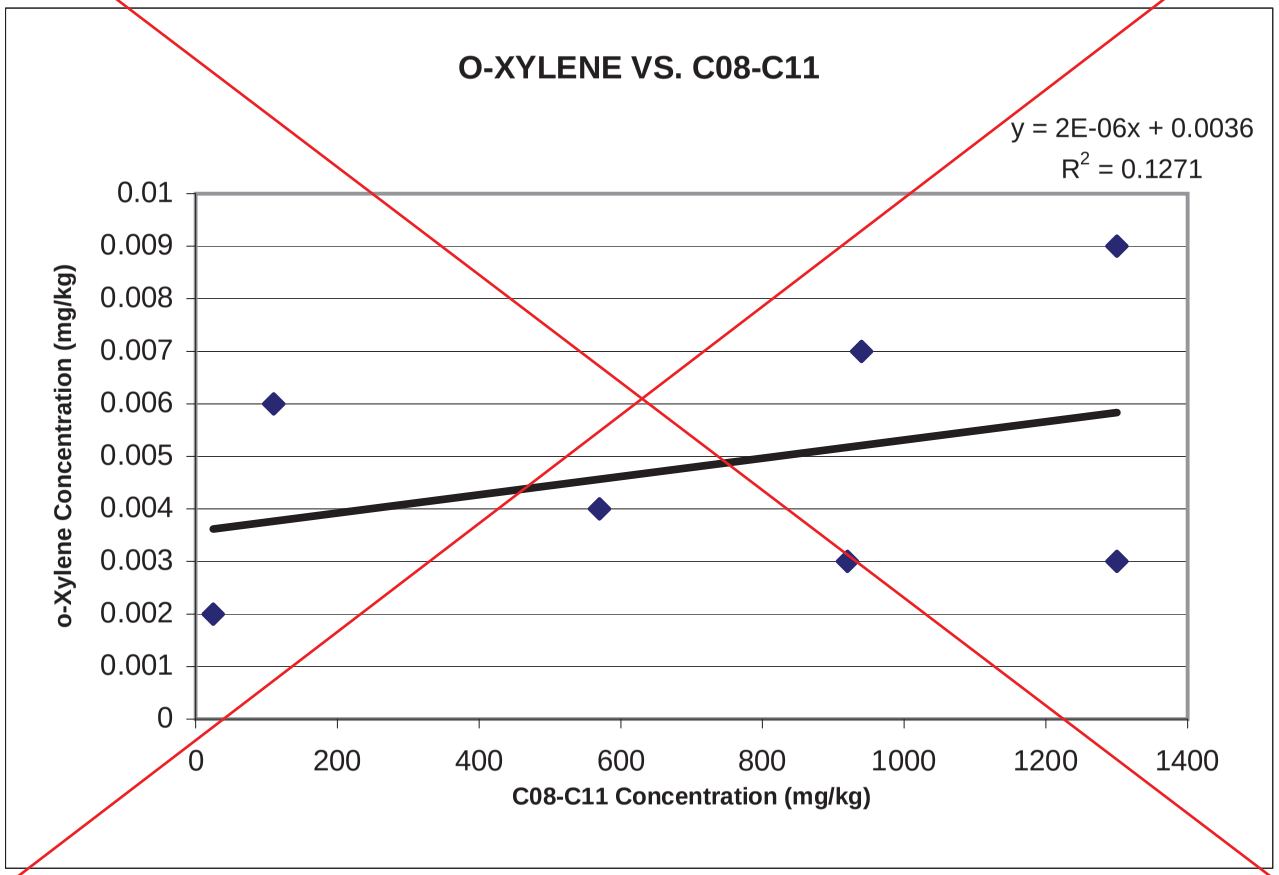
Appendix B, Attachment 1 (4 of 8)

LCPC Graphs



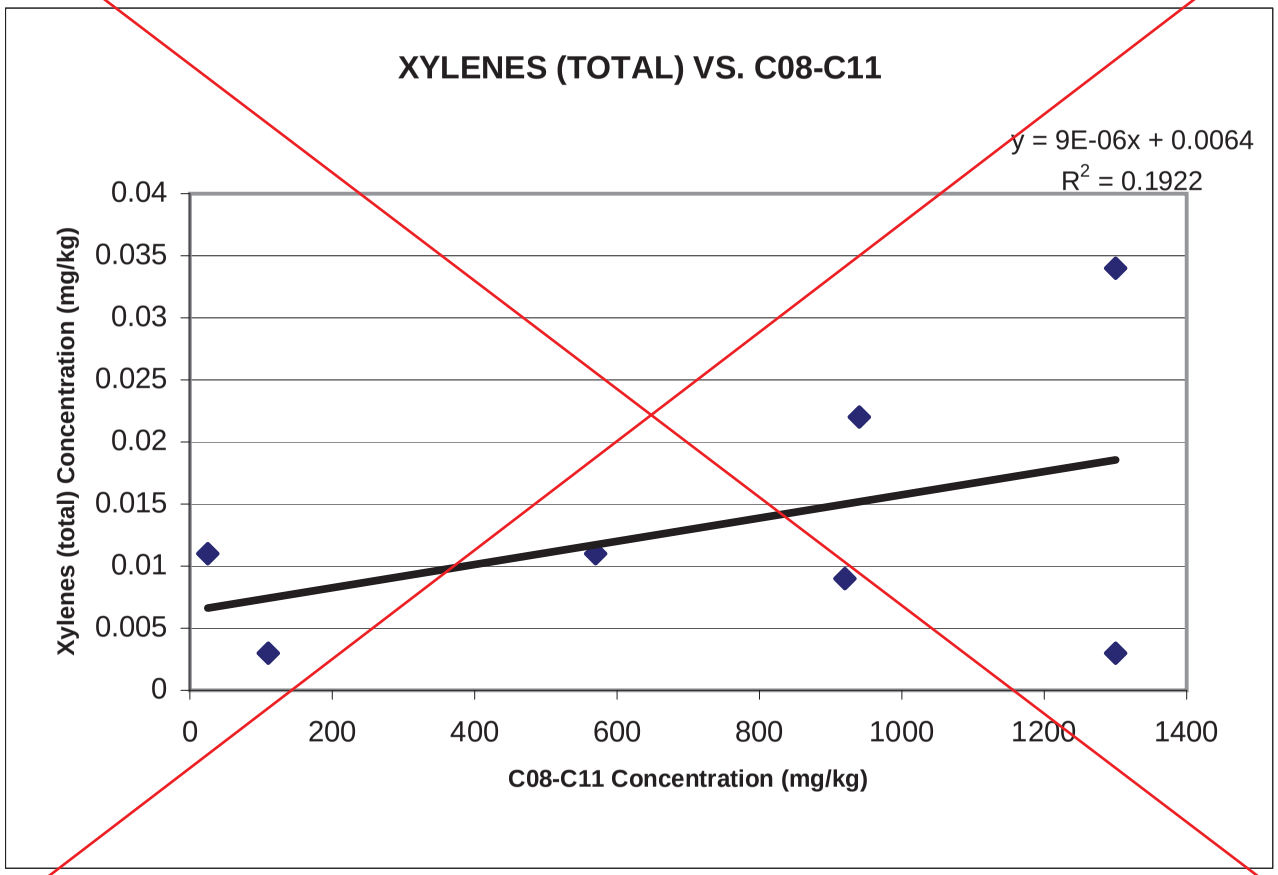
Appendix B, Attachment 1 (5 of 8)

LCPC Graphs



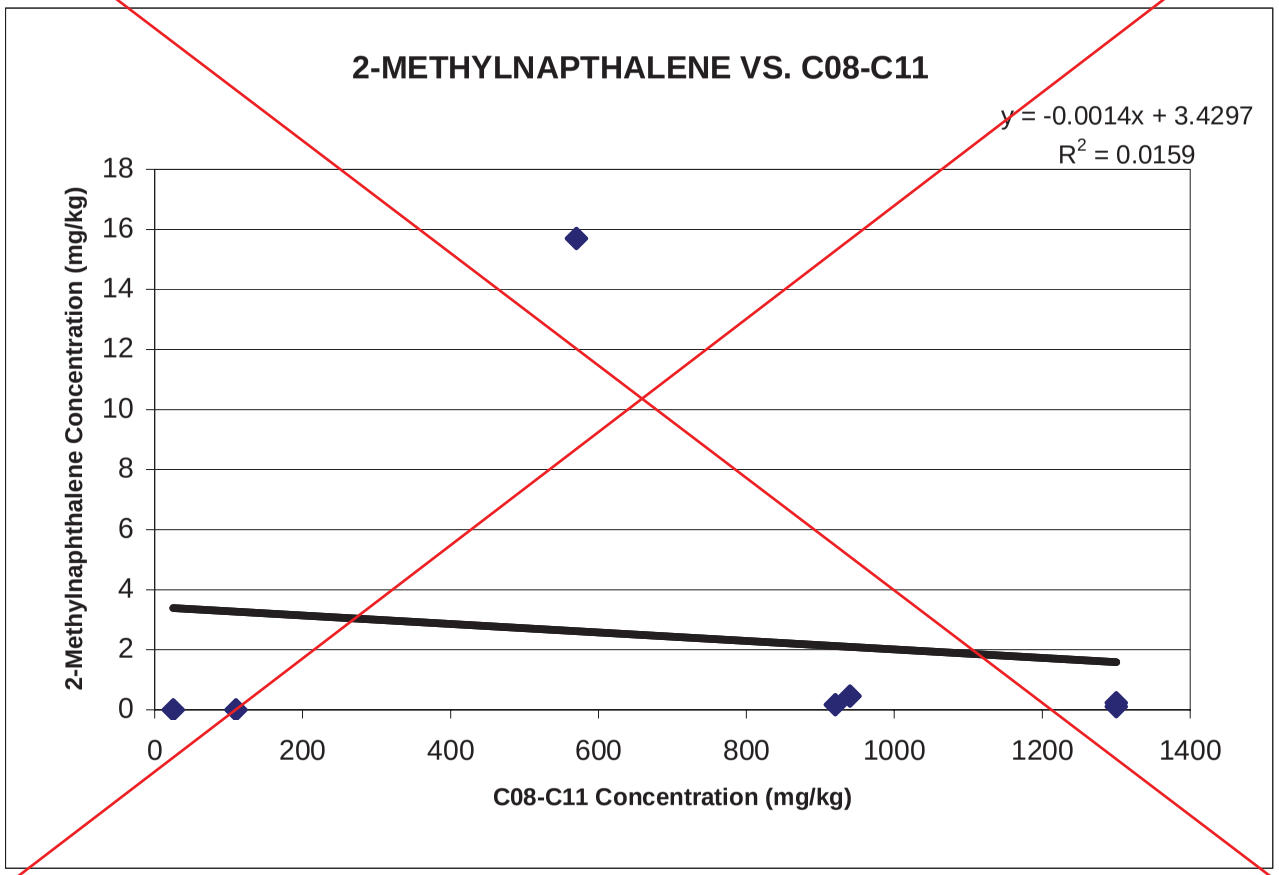
Appendix B, Attachment 1 (6 of 8)

LCPC Graphs



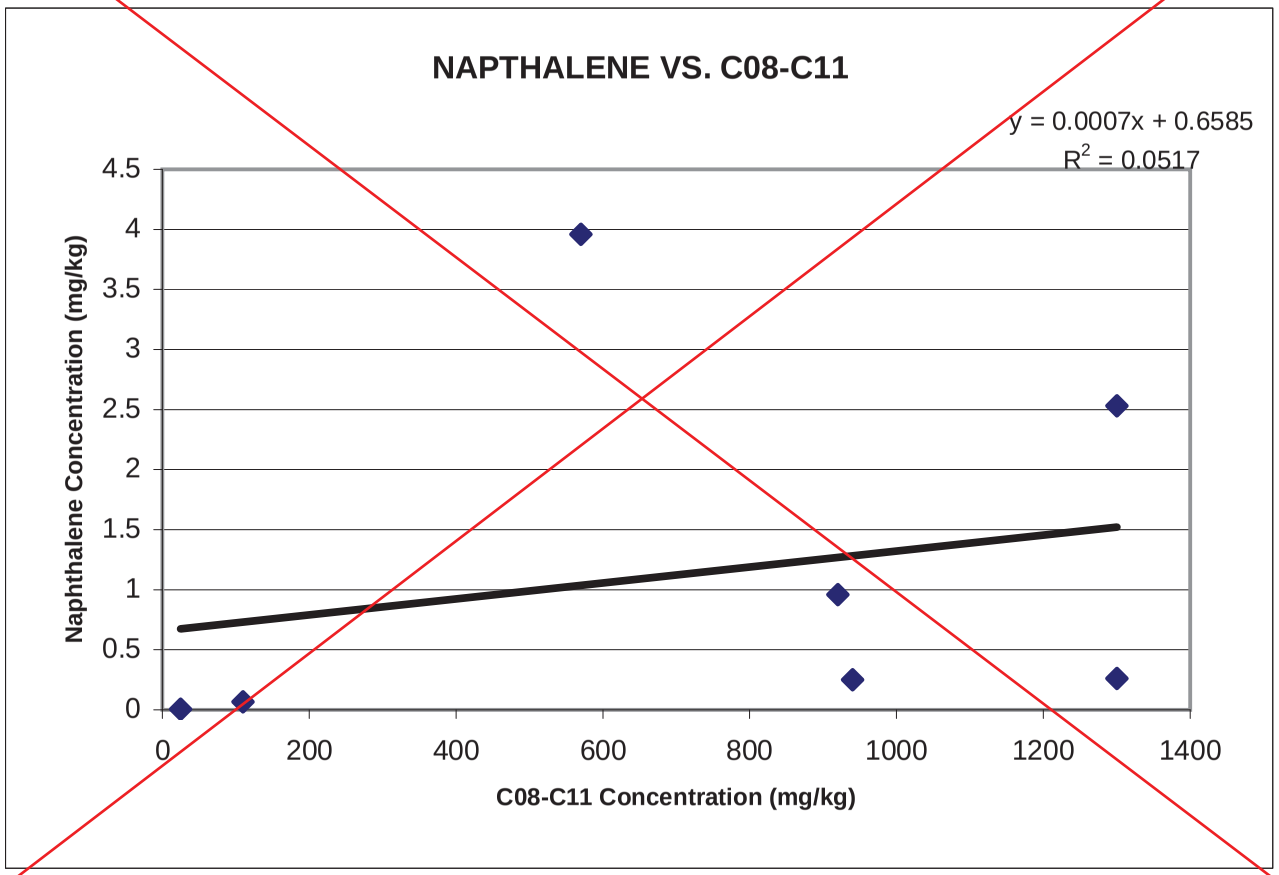
Appendix B, Attachment 1 (7 of 8)

LCPC Graphs



Appendix B, Attachment 1 (8 of 8)

LCPC Graphs



APPENDIX B

ATTACHMENT B-2

COMPARISON OF 1997 TPH WITH 2002 DATA

Appendix B Attachment 2 (1 of 1)

Comparison of 1997 TPH Data with 2002 TPH Data

RFI Site	EPA ID	Sample ID	Date Collected	Depth bgs (feet)	Sample Type	C08-C11 (mg/kg)	C11-C14 (mg/kg)	C14-C20 (mg/kg)	C20-C30 (mg/kg)
Bowl Area	RD133	BABS12S02	10/28/1997	11	primary	250	2500	9700	< 12
	MJ094	BABS12S02	12/9/2002	11	primary	110	2300	3300	< 37
	MN006	BASV21S01	12/12/2002	11	primary	NA	NA	NA	NA
	RD135	BABS12S04	10/28/1997	20	primary	660	4400	17000	< 13
	MJ095	BABS12S04	12/9/2002	20	primary	920	5800	750	< 190
	RD197	BABS14S04	11/5/1997	21.5	primary	940	6400	28000	< 12
	MJ106	BABS14S04	12/11/2002	21	primary	1300	6900	940	< 190
	MN004	BASV20S01	12/12/2002	21	primary	NA	NA	NA	NA
	RJ555	BATS03S01	7/20/2000	3.5	primary	< 36	< 36	200	5400
	MJ112	BATS03S01	12/9/2002	3.5	primary	< 4	< 4	< 4	< 4
Bravo Area	RD352	BVBS23S01	11/24/1997	6	primary	1200	7300	23000	< 107
	MJ099	BVBS23S02	12/10/2002	6	primary	1300	15000	3200	< 390
	MN001	BVSV20S01	12/11/2002	6	primary	NA	NA	NA	NA
	RD206	BVBS15S01	11/6/1997	5	primary	330	1700	8600	< 12
	MJ098	BVBS15S02	12/10/2002	5.5	primary	960	6100	1700	< 200
Alfa-Bravo Fuel Farm	RD844	ABBS10S02	11/12/1997	5	primary	780	4900	15000	< 105
	MJ101	ABBS10S02	12/10/2002	5	primary	940	4500	1200	< 180
	MJ102	ABBS10D02	12/10/2002	5.5	duplicate	710	3700	1100	< 180
	MN002	ABSV01S01	12/11/2002	5	primary	NA	NA	NA	NA
	RD997	ABBS15S02	12/4/1997	5	primary	39	760	3700	< 11
	MJ103	ABBS15S03	12/10/2002	6.5	primary	280	2300	840	< 36
Alfa Test Stand	RD011	AABS06S03	10/13/1997	13	primary	540	4700	14000	1300
	MJ100	AABS06S03	12/10/2002	13	primary	< 4	< 4	< 4	< 4
	RD649	AABS14S02	10/16/1997	5	primary	15	380	2200	300
	MJ097	AABS14S02	12/10/2002	5.5	primary	260	2200	1500	320
Coca-Delta Fuel Farm	RD235	CDBS04S02	11/10/1997	3	primary	390	2500	10000	1100
	MJ105	CDBS04S02	12/10/2002	3	primary	570	3000	1800	160
	MN005	CDSV04S01	12/12/2002	3	primary	NA	NA	NA	NA
	RS155	CDBS17S01	1/26/1998	6	primary	260	1200	3200	190
	MJ104	CDBS17S01	12/10/2002	5	primary	< 170	970	2600	340
	MN003	CDSV03S01	12/12/2002	5	primary	NA	NA	NA	NA
B-1 Area	B-12-(7-7.5)	Boring 12		7	primary	NR	NR	3400	NR
	MJ107	B1BS06S01	12/11/2002	7.5	primary	25	36	120	98
	MN007	B1SV50S01	12/12/2002	7	primary	NA	NA	NA	NA
Old Conservation Yard	RD068	OCBS06S01	10/20/1997	0.5	primary	< 109	< 109	1200	3500
	MJ110	OCBS06S01	12/12/2002	0.5	primary	< 140	< 140	92	670
ELV	RD020	EVBS01S01	10/14/1997	1	primary	< 114	< 114	200	1900
	MJ111	EVBS01S01	12/12/2002	1	primary	< 3.7	< 3.7	< 3.7	< 3.7
Building 204	RF621	BUTS01S04	9/12/1997	13	primary	35	230	2700	18000
	MJ096	BUTS01S04	12/9/2002	13	primary	18	17	250	1100

Notes:

TPH - total petroleum hydrocarbons

bgs - below ground surface

APPENDIX B

ATTACHMENT B-3

TPH AND PETROLEUM CONSTITUENT DATA AND CALCULATION OF MAXIMUM RATIO EXTRAPOLATION FACTORS

Appendix B Attachment 3 (1 of 13)

TPH and Petroleum Constituent Data and Calculation of Maximum Ratio Extrapolation Factors

EPA ID	RFI SITE ID	CHEMICAL	CONCENTRATION	ADJ CONC	REV QUAL	PERCENT OF TOTAL TPH	LCPC:C08-C11	HCPC:C11-C30	CENSORED
MJ094	BABS12S02	2-Methylnaphthalene	0.0076	0.0038	U		3.5E-05		
MJ094	BABS12S02	Acenaphthene	0.0076	0.0038	U			6.8E-07	
MJ094	BABS12S02	Acenaphthylene	0.0076	0.0038	UJ			6.8E-07	
MJ094	BABS12S02	Anthracene	0.0076	0.0038	U			6.8E-07	
MJ094	BABS12S02	Benzo(a)anthracene	0.00208	0.00104	U			1.9E-07	
MJ094	BABS12S02	Benzo(a)pyrene	0.00208	0.00104	U			1.9E-07	
MJ094	BABS12S02	Benzo(b)fluoranthene	0.00208	0.00104	U			1.9E-07	
MJ094	BABS12S02	Benzo(e)pyrene	0.00208	0.00104	U			1.9E-07	
MJ094	BABS12S02	Benzo(g,h,i)perylene	0.00208	0.00104	U			1.9E-07	
MJ094	BABS12S02	Benzo(k)fluoranthene	0.00208	0.00104	U			1.9E-07	
MJ094	BABS12S02	Chrysene	0.00208	0.00104	U			1.9E-07	
MJ094	BABS12S02	Dibenzo(a,h)anthracene	0.00208	0.00104	U			1.9E-07	
MJ094	BABS12S02	Fluoranthene	0.00208	0.00104	U			1.9E-07	
MJ094	BABS12S02	Fluorene	0.00912	0.00456	UJ			8.1E-07	
MJ094	BABS12S02	Indeno(1,2,3-cd)pyrene	0.00208	0.00104	U			1.9E-07	
MJ094	BABS12S02	Naphthalene	0.0673	0.0673	J		6.1E-04		
MJ094	BABS12S02	Perylene	0.00208	0.00104	U			1.9E-07	
MJ094	BABS12S02	Phenanthrene	0.019	0.0095	U			1.7E-06	
MJ094	BABS12S02	Pyrene	0.00208	0.00104	U			1.9E-07	
MJ094	BABS12S02	C08-C11 (Gasoline Range)	110	110		1.9%			
MJ094	BABS12S02	C11-C14 (Kerosene Range)	2300	2300		40.2%			
MJ094	BABS12S02	C14-C20 (Diesel Range)	3300	3300		57.6%			
MJ094	BABS12S02	C20-C30 (Lubricant Oil Rang	37	18.5	U	0.3%			
MJ094	BABS12S02	C11-C30		5618.5					
MJ094	BABS12S02	Benzene	0.012	0.006	U		5.5E-05		
MJ094	BABS12S02	Ethylbenzene	0.012	0.006	U		5.5E-05		
MJ094	BABS12S02	Toluene	0.012	0.006	U		5.5E-05		
MJ094	BABS12S02	Xylene (total)	0.003	0.003	J		2.7E-05		
MJ094	BABS12S02	m,p-Xylene	0.003	0.003	J		2.7E-05		
MJ094	BABS12S02	o-Xylene	0.012	0.006	U		5.5E-05		
MJ095	BABS12S04	2-Methylnaphthalene	0.172	0.172			1.1E-05		
MJ095	BABS12S04	Acenaphthene	0.0153	0.0153				2.3E-06	
MJ095	BABS12S04	Acenaphthylene	0.00842	0.00421	U			6.3E-07	
MJ095	BABS12S04	Anthracene	0.00842	0.00421	U			6.3E-07	
MJ095	BABS12S04	Benzo(a)anthracene	0.00189	0.000945	U			1.4E-07	
MJ095	BABS12S04	Benzo(a)pyrene	0.00189	0.000945	U			1.4E-07	
MJ095	BABS12S04	Benzo(b)fluoranthene	0.00189	0.000945	U			1.4E-07	
MJ095	BABS12S04	Benzo(e)pyrene	0.00189	0.000945	U			1.4E-07	

Appendix B Attachment 3 (2 of 13)

TPH and Petroleum Constituent Data and Calculation of Maximum Ratio Extrapolation Factors

EPA ID	RFI SITE ID	CHEMICAL	CONCENTRATION	ADJ CONC	REV QUAL	PERCENT OF TOTAL TPH	LCPC:C08-C11	HCPC:C11-C30	CENSORED
MJ095	BABS12S04	Benzo(g,h,i)perylene	0.00189	0.000945	U			1.4E-07	
MJ095	BABS12S04	Benzo(k)fluoranthene	0.00189	0.000945	U			1.4E-07	
MJ095	BABS12S04	Chrysene	0.00189	0.000945	U			1.4E-07	
MJ095	BABS12S04	Dibenzo(a,h)anthracene	0.00189	0.000945	U			1.4E-07	
MJ095	BABS12S04	Fluoranthene	0.00189	0.000945	UJ			1.4E-07	
MJ095	BABS12S04	Fluorene	0.0988	0.0988				1.5E-05	
MJ095	BABS12S04	Indeno(1,2,3-cd)pyrene	0.00189	0.000945	U			1.4E-07	
MJ095	BABS12S04	Naphthalene	0.96	0.96	J		4.6E-05		
MJ095	BABS12S04	Perylene	0.00189	0.000945	U			1.4E-07	
MJ095	BABS12S04	Phenanthrene	0.0211	0.01055	U			1.6E-06	
MJ095	BABS12S04	Pyrene	0.00189	0.000945	U			1.4E-07	
MJ095	BABS12S04	C08-C11 (Gasoline Range)	920	920		12.2%			
MJ095	BABS12S04	C11-C14 (Kerosene Range)	5800	5800		76.7%			
MJ095	BABS12S04	C14-C20 (Diesel Range)	750	750		9.9%			
MJ095	BABS12S04	C20-C30 (Lubricant Oil Rang	190	95	U	1.3%			
MJ095	BABS12S04	C11-C30		6645					
MJ095	BABS12S04	Benzene	0.006	0.003	U		3.3E-06		
MJ095	BABS12S04	Ethylbenzene	0.028	0.028	J		3.0E-05		
MJ095	BABS12S04	Toluene	0.006	0.003	U		3.3E-06		
MJ095	BABS12S04	Xylene (total)	0.018	0.009	U		9.8E-06		
MJ095	BABS12S04	m,p-Xylene	0.012	0.006	U		6.5E-06		
MJ095	BABS12S04	o-Xylene	0.006	0.003	U		3.3E-06		
MJ096	BUTS01S04	2-Methylnaphthalene	0.209	0.209	J		1.2E-02		
MJ096	BUTS01S04	Acenaphthene	0.0175	0.0175	J			1.3E-05	
MJ096	BUTS01S04	Acenaphthylene	0.00277	0.00277				2.0E-06	
MJ096	BUTS01S04	Anthracene	0.02	0.02	J			1.5E-05	
MJ096	BUTS01S04	Benzo(a)anthracene	0.0106	0.0106				7.8E-06	
MJ096	BUTS01S04	Benzo(a)pyrene	0.0101	0.0101				7.4E-06	
MJ096	BUTS01S04	Benzo(b)fluoranthene	0.00942	0.00942				6.9E-06	
MJ096	BUTS01S04	Benzo(e)pyrene	0.0329	0.0329				2.4E-05	
MJ096	BUTS01S04	Benzo(g,h,i)perylene	0.0105	0.0105				7.7E-06	
MJ096	BUTS01S04	Benzo(k)fluoranthene	0.00211	0.00211				1.5E-06	
MJ096	BUTS01S04	Chrysene	0.0452	0.0452	J			3.3E-05	
MJ096	BUTS01S04	Dibenzo(a,h)anthracene	0.00197	0.000985	U			7.2E-07	
MJ096	BUTS01S04	Fluoranthene	0.011	0.0055	U			4.0E-06	
MJ096	BUTS01S04	Fluorene	0.0208	0.0104	UJ			7.6E-06	
MJ096	BUTS01S04	Indeno(1,2,3-cd)pyrene	0.00197	0.000985	U			7.2E-07	
MJ096	BUTS01S04	Naphthalene	0.0349	0.01745	UJ		9.7E-04		

Appendix B Attachment 3 (3 of 13)

TPH and Petroleum Constituent Data and Calculation of Maximum Ratio Extrapolation Factors

EPA ID	RFI SITE ID	CHEMICAL	CONCENTRATION	ADJ CONC	REV QUAL	PERCENT OF TOTAL TPH	LCPC:C08-C11	HCPC:C11-C30	CENSORED
MJ096	BUTS01S04	Perylene	0.0214	0.0214				1.6E-05	
MJ096	BUTS01S04	Phenanthrene	0.0407	0.0407	J			3.0E-05	
MJ096	BUTS01S04	Pyrene	0.0489	0.0489				3.6E-05	
MJ096	BUTS01S04	C08-C11 (Gasoline Range)	18	18		1.3%			
MJ096	BUTS01S04	C11-C14 (Kerosene Range)	17	17	J	1.2%			
MJ096	BUTS01S04	C14-C20 (Diesel Range)	250	250		18.1%			
MJ096	BUTS01S04	C20-C30 (Lubricant Oil Rang	1100	1100	J	79.4%			
MJ096	BUTS01S04	C11-C30		1367					
MJ097	AABS14S02	2-Methylnaphthalene	0.012	0.012	J		4.6E-05		
MJ097	AABS14S02	Acenaphthene	0.0088	0.0088	J			2.2E-06	
MJ097	AABS14S02	Acenaphthylene	0.00518	0.00518	J			1.3E-06	
MJ097	AABS14S02	Anthracene	0.0525	0.0525				1.3E-05	
MJ097	AABS14S02	Benzo(a)anthracene	0.0108	0.0108				2.7E-06	
MJ097	AABS14S02	Benzo(a)pyrene	0.00875	0.00875				2.2E-06	
MJ097	AABS14S02	Benzo(b)fluoranthene	0.0108	0.0108				2.7E-06	
MJ097	AABS14S02	Benzo(e)pyrene	0.00712	0.00712				1.8E-06	
MJ097	AABS14S02	Benzo(g,h,i)perylene	0.015	0.015				3.7E-06	
MJ097	AABS14S02	Benzo(k)fluoranthene	0.0041	0.0041				1.0E-06	
MJ097	AABS14S02	Chrysene	0.0104	0.0104				2.6E-06	
MJ097	AABS14S02	Dibenzo(a,h)anthracene	0.00198	0.00099	U			2.5E-07	
MJ097	AABS14S02	Fluoranthene	0.0468	0.0468				1.2E-05	
MJ097	AABS14S02	Fluorene	0.0563	0.02815	UJ			7.0E-06	
MJ097	AABS14S02	Indeno(1,2,3-cd)pyrene	0.00979	0.00979				2.4E-06	
MJ097	AABS14S02	Naphthalene	0.0278	0.0139	UJ		5.3E-05		
MJ097	AABS14S02	Perylene	0.00221	0.00221				5.5E-07	
MJ097	AABS14S02	Phenanthrene	0.14	0.14				3.5E-05	
MJ097	AABS14S02	Pyrene	0.0894	0.0894				2.2E-05	
MJ097	AABS14S02	C08-C11 (Gasoline Range)	260	260		6.1%			
MJ097	AABS14S02	C11-C14 (Kerosene Range)	2200	2200		51.4%			
MJ097	AABS14S02	C14-C20 (Diesel Range)	1500	1500		35.0%			
MJ097	AABS14S02	C20-C30 (Lubricant Oil Rang	320	320	J	7.5%			
MJ097	AABS14S02	C11-C30		4020					
MJ098	BVBS15S02	2-Methylnaphthalene	0.0136	0.0136			1.4E-05		
MJ098	BVBS15S02	Acenaphthene	0.132	0.132				1.7E-05	
MJ098	BVBS15S02	Acenaphthylene	0.0427	0.0427				5.4E-06	
MJ098	BVBS15S02	Anthracene	0.0943	0.04715	U			6.0E-06	
MJ098	BVBS15S02	Benzo(a)anthracene	0.0626	0.0626				7.9E-06	
MJ098	BVBS15S02	Benzo(a)pyrene	0.111	0.111				1.4E-05	

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TPH and Petroleum Constituent Data and Calculation of Maximum Ratio Extrapolation Factors

EPA ID	RFI SITE ID	CHEMICAL	CONCENTRATION	ADJ CONC	REV QUAL	PERCENT OF TOTAL TPH	LCPC:C08-C11	HCPC:C11-C30	CENSORED
MJ098	BVBS15S02	Benzo(b)fluoranthene	0.161	0.161				2.0E-05	
MJ098	BVBS15S02	Benzo(e)pyrene	0.0785	0.0785				9.9E-06	
MJ098	BVBS15S02	Benzo(g,h,i)perylene	0.122	0.122				1.5E-05	
MJ098	BVBS15S02	Benzo(k)fluoranthene	0.0312	0.0312				3.9E-06	
MJ098	BVBS15S02	Chrysene	0.0504	0.0504				6.4E-06	
MJ098	BVBS15S02	Dibenzo(a,h)anthracene	0.0126	0.0126				1.6E-06	
MJ098	BVBS15S02	Fluoranthene	0.231	0.1155	U			1.5E-05	
MJ098	BVBS15S02	Fluorene	0.0996	0.0996				1.3E-05	
MJ098	BVBS15S02	Indeno(1,2,3-cd)pyrene	0.0881	0.0881				1.1E-05	
MJ098	BVBS15S02	Naphthalene	0.163	0.163	J		1.7E-04		
MJ098	BVBS15S02	Perylene	0.0237	0.0237				3.0E-06	
MJ098	BVBS15S02	Phenanthrene	0.236	0.236				3.0E-05	
MJ098	BVBS15S02	Pyrene	0.324	0.324				4.1E-05	
MJ098	BVBS15S02	C08-C11 (Gasoline Range)	960	960		10.8%			
MJ098	BVBS15S02	C11-C14 (Kerosene Range)	6100	6100		68.8%			
MJ098	BVBS15S02	C14-C20 (Diesel Range)	1700	1700		19.2%			
MJ098	BVBS15S02	C20-C30 (Lubricant Oil Rang	200	100	U	1.1%			
MJ098	BVBS15S02	C11-C30		7900					
MJ099	BVBS23S02	2-Methylnaphthalene	0.239	0.239			1.8E-04		
MJ099	BVBS23S02	Acenaphthene	0.0947	0.0947				5.1E-06	
MJ099	BVBS23S02	Acenaphthylene	0.338	0.338				1.8E-05	
MJ099	BVBS23S02	Anthracene	0.15	0.15				8.2E-06	
MJ099	BVBS23S02	Benzo(a)anthracene	0.056	0.056				3.0E-06	
MJ099	BVBS23S02	Benzo(a)pyrene	0.317	0.317				1.7E-05	
MJ099	BVBS23S02	Benzo(b)fluoranthene	0.319	0.319				1.7E-05	
MJ099	BVBS23S02	Benzo(e)pyrene	0.229	0.229				1.2E-05	
MJ099	BVBS23S02	Benzo(g,h,i)perylene	0.501	0.501				2.7E-05	
MJ099	BVBS23S02	Benzo(k)fluoranthene	0.1	0.1				5.4E-06	
MJ099	BVBS23S02	Chrysene	0.0642	0.0642				3.5E-06	
MJ099	BVBS23S02	Dibenzo(a,h)anthracene	0.0247	0.0247				1.3E-06	
MJ099	BVBS23S02	Fluoranthene	0.431	0.431				2.3E-05	
MJ099	BVBS23S02	Fluorene	0.195	0.195				1.1E-05	
MJ099	BVBS23S02	Indeno(1,2,3-cd)pyrene	0.273	0.273				1.5E-05	
MJ099	BVBS23S02	Naphthalene	2.53	2.53	J		1.9E-03		
MJ099	BVBS23S02	Perylene	0.0538	0.0538				2.9E-06	
MJ099	BVBS23S02	Phenanthrene	0.644	0.644				3.5E-05	
MJ099	BVBS23S02	Pyrene	0.605	0.605				3.3E-05	
MJ099	BVBS23S02	C08-C11 (Gasoline Range)	1300	1300		6.6%			

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TPH and Petroleum Constituent Data and Calculation of Maximum Ratio Extrapolation Factors

EPA ID	RFI SITE ID	CHEMICAL	CONCENTRATION	ADJ CONC	REV QUAL	PERCENT OF TOTAL TPH	LCPC:C08-C11	HCPC:C11-C30	CENSORED
MJ099	BVBS23S02	C11-C14 (Kerosene Range)	15000	15000		76.2%			
MJ099	BVBS23S02	C14-C20 (Diesel Range)	3200	3200		16.2%			
MJ099	BVBS23S02	C20-C30 (Lubricant Oil Rang	390	195	U	1.0%			
MJ099	BVBS23S02	C11-C30		18395					
MJ099	BVBS23S02	Benzene	0.005	0.0025	U		1.9E-06		
MJ099	BVBS23S02	Ethylbenzene	0.02	0.02	J		1.5E-05		
MJ099	BVBS23S02	Toluene	0.014	0.014	J		1.1E-05		
MJ099	BVBS23S02	Xylene (total)	0.034	0.034	J		2.6E-05		
MJ099	BVBS23S02	m,p-Xylene	0.024	0.024	J		1.8E-05		
MJ099	BVBS23S02	o-Xylene	0.009	0.009	J		6.9E-06		
MJ100	AABS06S03	2-Methylnaphthalene	0.00199	0.00199	R				Yes
MJ100	AABS06S03	Acenaphthene	0.00297	0.00297	J			5.0E-04	Yes
MJ100	AABS06S03	Acenaphthylene	0.00199	0.00199	R				Yes
MJ100	AABS06S03	Anthracene	0.00199	0.000995	U			1.7E-04	Yes
MJ100	AABS06S03	Benzo(a)anthracene	0.00199	0.000995	U			1.7E-04	Yes
MJ100	AABS06S03	Benzo(a)pyrene	0.00199	0.000995	U			1.7E-04	Yes
MJ100	AABS06S03	Benzo(b)fluoranthene	0.00199	0.000995	U			1.7E-04	Yes
MJ100	AABS06S03	Benzo(e)pyrene	0.00199	0.000995	U			1.7E-04	Yes
MJ100	AABS06S03	Benzo(g,h,i)perylene	0.00199	0.000995	U			1.7E-04	Yes
MJ100	AABS06S03	Benzo(k)fluoranthene	0.00199	0.000995	U			1.7E-04	Yes
MJ100	AABS06S03	Chrysene	0.00199	0.000995	U			1.7E-04	Yes
MJ100	AABS06S03	Dibenzo(a,h)anthracene	0.00199	0.000995	U			1.7E-04	Yes
MJ100	AABS06S03	Fluoranthene	0.00199	0.000995	U			1.7E-04	Yes
MJ100	AABS06S03	Fluorene	0.0155	0.00775	UJ			1.3E-03	Yes
MJ100	AABS06S03	Indeno(1,2,3-cd)pyrene	0.00199	0.000995	U			1.7E-04	Yes
MJ100	AABS06S03	Naphthalene	0.0442	0.0442	R				Yes
MJ100	AABS06S03	Perylene	0.00199	0.000995	U			1.7E-04	Yes
MJ100	AABS06S03	Phenanthrene	0.00498	0.00249	U			4.2E-04	Yes
MJ100	AABS06S03	Pyrene	0.00199	0.000995	U			1.7E-04	Yes
MJ100	AABS06S03	C08-C11 (Gasoline Range)	4	2	U	25.0%			Yes
MJ100	AABS06S03	C11-C14 (Kerosene Range)	4	2	U	25.0%			Yes
MJ100	AABS06S03	C14-C20 (Diesel Range)	4	2	U	25.0%			Yes
MJ100	AABS06S03	C20-C30 (Lubricant Oil Rang	4	2	U	25.0%			Yes
MJ100	AABS06S03	C11-C30		6					Yes
MJ101	ABBS10S02	2-Methylnaphthalene	0.458	0.458			4.9E-04		
MJ101	ABBS10S02	Acenaphthene	0.0244	0.0244				4.2E-06	
MJ101	ABBS10S02	Acenaphthylene	0.00996	0.00498	U			8.6E-07	
MJ101	ABBS10S02	Anthracene	0.00996	0.00498	U			8.6E-07	

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TPH and Petroleum Constituent Data and Calculation of Maximum Ratio Extrapolation Factors

EPA ID	RFI SITE ID	CHEMICAL	CONCENTRATION	ADJ CONC	REV QUAL	PERCENT OF TOTAL TPH	LCPC:C08-C11	HCPC:C11-C30	CENSORED
MJ101	ABBS10S02	Benzo(a)anthracene	0.00204	0.00102	U			1.8E-07	
MJ101	ABBS10S02	Benzo(a)pyrene	0.00204	0.00102	U			1.8E-07	
MJ101	ABBS10S02	Benzo(b)fluoranthene	0.00204	0.00102	U			1.8E-07	
MJ101	ABBS10S02	Benzo(e)pyrene	0.00204	0.00102	U			1.8E-07	
MJ101	ABBS10S02	Benzo(g,h,i)perylene	0.00204	0.00102	U			1.8E-07	
MJ101	ABBS10S02	Benzo(k)fluoranthene	0.00204	0.00102	U			1.8E-07	
MJ101	ABBS10S02	Chrysene	0.00204	0.00102	U			1.8E-07	
MJ101	ABBS10S02	Dibenzo(a,h)anthracene	0.00204	0.00102	U			1.8E-07	
MJ101	ABBS10S02	Fluoranthene	0.00204	0.00102	U			1.8E-07	
MJ101	ABBS10S02	Fluorene	0.0352	0.0176	UJ			3.0E-06	
MJ101	ABBS10S02	Indeno(1,2,3-cd)pyrene	0.00204	0.00102	U			1.8E-07	
MJ101	ABBS10S02	Naphthalene	0.25	0.25	J		2.7E-04		
MJ101	ABBS10S02	Perylene	0.00204	0.00102	U			1.8E-07	
MJ101	ABBS10S02	Phenanthrene	0.0249	0.01245	U			2.2E-06	
MJ101	ABBS10S02	Pyrene	0.00204	0.00102	U			1.8E-07	
MJ101	ABBS10S02	C08-C11 (Gasoline Range)	940	940		14.0%			
MJ101	ABBS10S02	C11-C14 (Kerosene Range)	4500	4500		66.9%			
MJ101	ABBS10S02	C14-C20 (Diesel Range)	1200	1200		17.8%			
MJ101	ABBS10S02	C20-C30 (Lubricant Oil Rang	180	90	U	1.3%			
MJ101	ABBS10S02	C11-C30		5790					
MJ101	ABBS10S02	Benzene	0.009	0.0045	U		4.8E-06		
MJ101	ABBS10S02	Ethylbenzene	0.004	0.004	J		4.3E-06		
MJ101	ABBS10S02	Toluene	0.009	0.0045	U		4.8E-06		
MJ101	ABBS10S02	Xylene (total)	0.022	0.022	J		2.3E-05		
MJ101	ABBS10S02	m,p-Xylene	0.015	0.015	J		1.6E-05		
MJ101	ABBS10S02	o-Xylene	0.007	0.007	J		7.4E-06		
MJ103	ABBS15S03	2-Methylnaphthalene	2.01	2.01	J		7.2E-03		
MJ103	ABBS15S03	Acenaphthene	0.0685	0.0685	J			2.2E-05	
MJ103	ABBS15S03	Acenaphthylene	0.012	0.012	R				Yes
MJ103	ABBS15S03	Anthracene	0.00839	0.004195	U			1.3E-06	
MJ103	ABBS15S03	Benzo(a)anthracene	0.00204	0.00102	U			3.2E-07	
MJ103	ABBS15S03	Benzo(a)pyrene	0.00204	0.00102	U			3.2E-07	
MJ103	ABBS15S03	Benzo(b)fluoranthene	0.00204	0.00102	U			3.2E-07	
MJ103	ABBS15S03	Benzo(e)pyrene	0.00204	0.00102	U			3.2E-07	
MJ103	ABBS15S03	Benzo(g,h,i)perylene	0.00204	0.00102	U			3.2E-07	
MJ103	ABBS15S03	Benzo(k)fluoranthene	0.00204	0.00102	U			3.2E-07	
MJ103	ABBS15S03	Chrysene	0.00204	0.00102	U			3.2E-07	
MJ103	ABBS15S03	Dibenzo(a,h)anthracene	0.00204	0.00102	U			3.2E-07	

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TPH and Petroleum Constituent Data and Calculation of Maximum Ratio Extrapolation Factors

EPA ID	RFI SITE ID	CHEMICAL	CONCENTRATION	ADJ CONC	REV QUAL	PERCENT OF TOTAL TPH	LCPC:C08-C11	HCPC:C11-C30	CENSORED
MJ103	ABBS15S03	Fluoranthene	0.00204	0.00102	U			3.2E-07	
MJ103	ABBS15S03	Fluorene	0.0416	0.0208	UJ			6.6E-06	
MJ103	ABBS15S03	Indeno(1,2,3-cd)pyrene	0.00204	0.00102	U			3.2E-07	
MJ103	ABBS15S03	Naphthalene	1.05	1.05	J		3.8E-03		
MJ103	ABBS15S03	Perylene	0.00204	0.00102	U			3.2E-07	
MJ103	ABBS15S03	Phenanthrene	0.021	0.0105	U			3.3E-06	
MJ103	ABBS15S03	Pyrene	0.00204	0.00102	U			3.2E-07	
MJ103	ABBS15S03	C08-C11 (Gasoline Range)	280	280		8.1%			
MJ103	ABBS15S03	C11-C14 (Kerosene Range)	2300	2300		66.9%			
MJ103	ABBS15S03	C14-C20 (Diesel Range)	840	840		24.4%			
MJ103	ABBS15S03	C20-C30 (Lubricant Oil Rang	36	18	U	0.5%			
MJ103	ABBS15S03	C11-C30		3158					
MJ104	CDBS17S01	2-Methylnaphthalene	27.4	27.4	J		3.2E-01		Yes
MJ104	CDBS17S01	Acenaphthene	2.24	2.24	J			5.7E-04	
MJ104	CDBS17S01	Acenaphthylene	0.274	0.274	J			7.0E-05	
MJ104	CDBS17S01	Anthracene	1.46	1.46	J			3.7E-04	
MJ104	CDBS17S01	Benzo(a)anthracene	0.0246	0.0246	J			6.3E-06	
MJ104	CDBS17S01	Benzo(a)pyrene	0.0303	0.0303				7.7E-06	
MJ104	CDBS17S01	Benzo(b)fluoranthene	0.0134	0.0134				3.4E-06	
MJ104	CDBS17S01	Benzo(e)pyrene	0.04	0.04				1.0E-05	
MJ104	CDBS17S01	Benzo(g,h,i)perylene	0.103	0.103				2.6E-05	
MJ104	CDBS17S01	Benzo(k)fluoranthene	0.00432	0.00432				1.1E-06	
MJ104	CDBS17S01	Chrysene	0.0354	0.0354	J			9.1E-06	
MJ104	CDBS17S01	Dibenzo(a,h)anthracene	0.0274	0.0274				7.0E-06	
MJ104	CDBS17S01	Fluoranthene	0.124	0.124				3.2E-05	
MJ104	CDBS17S01	Fluorene	2.22	2.22	J			5.7E-04	
MJ104	CDBS17S01	Indeno(1,2,3-cd)pyrene	0.025	0.025				6.4E-06	
MJ104	CDBS17S01	Naphthalene	1.84	1.84	J		2.2E-02		Yes
MJ104	CDBS17S01	Perylene	0.028	0.028				7.2E-06	
MJ104	CDBS17S01	Phenanthrene	5.99	5.99	J			1.5E-03	
MJ104	CDBS17S01	Pyrene	0.533	0.533				1.4E-04	
MJ104	CDBS17S01	C08-C11 (Gasoline Range)	170	85	U	2.1%			Yes
MJ104	CDBS17S01	C11-C14 (Kerosene Range)	970	970		24.3%			
MJ104	CDBS17S01	C14-C20 (Diesel Range)	2600	2600		65.1%			
MJ104	CDBS17S01	C20-C30 (Lubricant Oil Rang	340	340	J	8.5%			
MJ104	CDBS17S01	C11-C30		3910					
MJ105	CDBS04S02	2-Methylnaphthalene	15.7	15.7			2.8E-02		
MJ105	CDBS04S02	Acenaphthene	1.34	1.34				2.7E-04	

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TPH and Petroleum Constituent Data and Calculation of Maximum Ratio Extrapolation Factors

EPA ID	RFI SITE ID	CHEMICAL	CONCENTRATION	ADJ CONC	REV QUAL	PERCENT OF TOTAL TPH	LCPC:C08-C11	HCPC:C11-C30	CENSORED
MJ105	CDBS04S02	Acenaphthylene	0.278	0.278				5.6E-05	
MJ105	CDBS04S02	Anthracene	0.723	0.723				1.5E-04	
MJ105	CDBS04S02	Benzo(a)anthracene	0.0179	0.0179				3.6E-06	
MJ105	CDBS04S02	Benzo(a)pyrene	0.00328	0.00328				6.6E-07	
MJ105	CDBS04S02	Benzo(b)fluoranthene	0.00257	0.00257				5.2E-07	
MJ105	CDBS04S02	Benzo(e)pyrene	0.00401	0.00401				8.1E-07	
MJ105	CDBS04S02	Benzo(g,h,i)perylene	0.00194	0.00097	U			2.0E-07	
MJ105	CDBS04S02	Benzo(k)fluoranthene	0.00194	0.00097	U			2.0E-07	
MJ105	CDBS04S02	Chrysene	0.0291	0.0291				5.9E-06	
MJ105	CDBS04S02	Dibenzo(a,h)anthracene	0.00194	0.00097	U			2.0E-07	
MJ105	CDBS04S02	Fluoranthene	0.0799	0.0799				1.6E-05	
MJ105	CDBS04S02	Fluorene	1.81	1.81				3.6E-04	
MJ105	CDBS04S02	Indeno(1,2,3-cd)pyrene	0.00194	0.00097	U			2.0E-07	
MJ105	CDBS04S02	Naphthalene	3.96	3.96	J		6.9E-03		
MJ105	CDBS04S02	Perylene	0.00194	0.00097	U			2.0E-07	
MJ105	CDBS04S02	Phenanthrene	3.5	3.5				7.1E-04	
MJ105	CDBS04S02	Pyrene	0.316	0.316				6.4E-05	
MJ105	CDBS04S02	C08-C11 (Gasoline Range)	570	570		10.3%			
MJ105	CDBS04S02	C11-C14 (Kerosene Range)	3000	3000		54.2%			
MJ105	CDBS04S02	C14-C20 (Diesel Range)	1800	1800		32.5%			
MJ105	CDBS04S02	C20-C30 (Lubricant Oil Rang	160	160	J	2.9%			
MJ105	CDBS04S02	C11-C30		4960					
MJ105	CDBS04S02	Benzene	0.007	0.0035	UJ		6.1E-06		
MJ105	CDBS04S02	Ethylbenzene	0.05	0.05	J		8.8E-05		
MJ105	CDBS04S02	Toluene	0.007	0.0035	UJ		6.1E-06		
MJ105	CDBS04S02	Xylene (total)	0.011	0.011	J		1.9E-05		
MJ105	CDBS04S02	m,p-Xylene	0.007	0.007	J		1.2E-05		
MJ105	CDBS04S02	o-Xylene	0.004	0.004	J		7.0E-06		
MJ106	BABS14S04	2-Methylnaphthalene	0.107	0.107			8.2E-05		
MJ106	BABS14S04	Acenaphthene	0.0113	0.0113				1.4E-06	
MJ106	BABS14S04	Acenaphthylene	0.00777	0.003885	U			4.9E-07	
MJ106	BABS14S04	Anthracene	0.0777	0.03885	UJ			4.9E-06	
MJ106	BABS14S04	Benzo(a)anthracene	0.00195	0.000975	U			1.2E-07	
MJ106	BABS14S04	Benzo(a)pyrene	0.00195	0.000975	U			1.2E-07	
MJ106	BABS14S04	Benzo(b)fluoranthene	0.00195	0.000975	U			1.2E-07	
MJ106	BABS14S04	Benzo(e)pyrene	0.00195	0.000975	U			1.2E-07	
MJ106	BABS14S04	Benzo(g,h,i)perylene	0.00195	0.000975	U			1.2E-07	
MJ106	BABS14S04	Benzo(k)fluoranthene	0.00195	0.000975	U			1.2E-07	

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TPH and Petroleum Constituent Data and Calculation of Maximum Ratio Extrapolation Factors

EPA ID	RFI SITE ID	CHEMICAL	CONCENTRATION	ADJ CONC	REV QUAL	PERCENT OF TOTAL TPH	LCPC:C08-C11	HCPC:C11-C30	CENSORED
MJ106	BABS14S04	Chrysene	0.00195	0.000975	U			1.2E-07	
MJ106	BABS14S04	Dibenzo(a,h)anthracene	0.00195	0.000975	U			1.2E-07	
MJ106	BABS14S04	Fluoranthene	0.00195	0.000975	U			1.2E-07	
MJ106	BABS14S04	Fluorene	0.0777	0.03885	U			4.9E-06	
MJ106	BABS14S04	Indeno(1,2,3-cd)pyrene	0.00195	0.000975	U			1.2E-07	
MJ106	BABS14S04	Naphthalene	0.262	0.262	J		2.0E-04		
MJ106	BABS14S04	Perylene	0.00195	0.000975	U			1.2E-07	
MJ106	BABS14S04	Phenanthrene	0.194	0.097	UJ			1.2E-05	
MJ106	BABS14S04	Pyrene	0.00195	0.000975	U			1.2E-07	
MJ106	BABS14S04	C08-C11 (Gasoline Range)	1300	1300		14.1%			
MJ106	BABS14S04	C11-C14 (Kerosene Range)	6900	6900		74.7%			
MJ106	BABS14S04	C14-C20 (Diesel Range)	940	940		10.2%			
MJ106	BABS14S04	C20-C30 (Lubricant Oil Rang	190	95	U	1.0%			
MJ106	BABS14S04	C11-C30		7935					
MJ106	BABS14S04	Benzene	0.007	0.0035	UJ		2.7E-06		
MJ106	BABS14S04	Ethylbenzene	0.045	0.045	J		3.5E-05		
MJ106	BABS14S04	Toluene	0.007	0.0035	UJ		2.7E-06		
MJ106	BABS14S04	Xylene (total)	0.003	0.003	J		2.3E-06		
MJ106	BABS14S04	m,p-Xylene	0.013	0.0065	UJ		5.0E-06		
MJ106	BABS14S04	o-Xylene	0.003	0.003	J		2.3E-06		
MJ107	B1BS06S01	2-Methylnaphthalene	0.00509	0.002545	UJ		1.0E-04		
MJ107	B1BS06S01	Acenaphthene	0.0148	0.0148				5.8E-05	
MJ107	B1BS06S01	Acenaphthylene	0.00233	0.001165	U			4.6E-06	
MJ107	B1BS06S01	Anthracene	0.0912	0.0912				3.6E-04	
MJ107	B1BS06S01	Benzo(a)anthracene	0.00685	0.00685				2.7E-05	
MJ107	B1BS06S01	Benzo(a)pyrene	0.00691	0.00691				2.7E-05	
MJ107	B1BS06S01	Benzo(b)fluoranthene	0.011	0.011				4.3E-05	
MJ107	B1BS06S01	Benzo(e)pyrene	0.0134	0.0134				5.3E-05	
MJ107	B1BS06S01	Benzo(g,h,i)perylene	0.0115	0.0115				4.5E-05	
MJ107	B1BS06S01	Benzo(k)fluoranthene	0.00521	0.00521				2.1E-05	
MJ107	B1BS06S01	Chrysene	0.0149	0.0149				5.9E-05	
MJ107	B1BS06S01	Dibenzo(a,h)anthracene	0.00244	0.00244				9.6E-06	
MJ107	B1BS06S01	Fluoranthene	0.019	0.019				7.5E-05	
MJ107	B1BS06S01	Fluorene	0.0399	0.01995	UJ			7.9E-05	
MJ107	B1BS06S01	Indeno(1,2,3-cd)pyrene	0.00611	0.00611				2.4E-05	
MJ107	B1BS06S01	Naphthalene	0.00853	0.004265	UJ		1.7E-04		
MJ107	B1BS06S01	Perylene	0.0161	0.0161				6.3E-05	
MJ107	B1BS06S01	Phenanthrene	0.0462	0.0462				1.8E-04	

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TPH and Petroleum Constituent Data and Calculation of Maximum Ratio Extrapolation Factors

EPA ID	RFI SITE ID	CHEMICAL	CONCENTRATION	ADJ CONC	REV QUAL	PERCENT OF TOTAL TPH	LCPC:C08-C11	HCPC:C11-C30	CENSORED
MJ107	B1BS06S01	Pyrene	0.0326	0.0326				1.3E-04	
MJ107	B1BS06S01	C08-C11 (Gasoline Range)	25	25		9.0%			
MJ107	B1BS06S01	C11-C14 (Kerosene Range)	36	36		12.9%			
MJ107	B1BS06S01	C14-C20 (Diesel Range)	120	120		43.0%			
MJ107	B1BS06S01	C20-C30 (Lubricant Oil Rang	98	98	J	35.1%			
MJ107	B1BS06S01	C11-C30		254					
MJ107	B1BS06S01	Benzene	0.006	0.003	UJ		1.2E-04		
MJ107	B1BS06S01	Ethylbenzene	0.003	0.003	J		1.2E-04		
MJ107	B1BS06S01	Toluene	0.006	0.003	UJ		1.2E-04		
MJ107	B1BS06S01	Xylene (total)	0.011	0.011	J		4.4E-04		
MJ107	B1BS06S01	m,p-Xylene	0.009	0.009	J		3.6E-04		
MJ107	B1BS06S01	o-Xylene	0.002	0.002	J		8.0E-05		
MJ110	OCBS06S01	2-Methylnaphthalene	0.00648	0.00324	UJ		4.6E-05		Yes
MJ110	OCBS06S01	Acenaphthene	0.00196	0.00098	U			1.2E-06	
MJ110	OCBS06S01	Acenaphthylene	0.00196	0.00098	U			1.2E-06	
MJ110	OCBS06S01	Anthracene	0.00196	0.00098	UJ			1.2E-06	
MJ110	OCBS06S01	Benzo(a)anthracene	0.00196	0.00098	U			1.2E-06	
MJ110	OCBS06S01	Benzo(a)pyrene	0.00196	0.00098	U			1.2E-06	
MJ110	OCBS06S01	Benzo(b)fluoranthene	0.00196	0.00098	U			1.2E-06	
MJ110	OCBS06S01	Benzo(e)pyrene	0.172	0.172				2.1E-04	
MJ110	OCBS06S01	Benzo(g,h,i)perylene	0.184	0.184				2.2E-04	
MJ110	OCBS06S01	Benzo(k)fluoranthene	0.00463	0.00463				5.6E-06	
MJ110	OCBS06S01	Chrysene	0.0201	0.0201				2.4E-05	
MJ110	OCBS06S01	Dibenzo(a,h)anthracene	0.00921	0.00921				1.1E-05	
MJ110	OCBS06S01	Fluoranthene	0.0056	0.0056				6.7E-06	
MJ110	OCBS06S01	Fluorene	0.00428	0.00214	UJ			2.6E-06	
MJ110	OCBS06S01	Indeno(1,2,3-cd)pyrene	0.0123	0.0123				1.5E-05	
MJ110	OCBS06S01	Naphthalene	0.0108	0.0054	UJ		7.7E-05		Yes
MJ110	OCBS06S01	Perylene	0.0981	0.0981				1.2E-04	
MJ110	OCBS06S01	Phenanthrene	0.00911	0.00911	J			1.1E-05	
MJ110	OCBS06S01	Pyrene	0.00587	0.00587				7.1E-06	
MJ110	OCBS06S01	C08-C11 (Gasoline Range)	140	70	U	7.8%			
MJ110	OCBS06S01	C11-C14 (Kerosene Range)	140	70	U	7.8%			
MJ110	OCBS06S01	C14-C20 (Diesel Range)	92	92	J	10.2%			
MJ110	OCBS06S01	C20-C30 (Lubricant Oil Rang	670	670		74.3%			
MJ110	OCBS06S01	C11-C30		832					
MJ111	EVBS01S01	2-Methylnaphthalene	0.00315	0.001575	UJ		8.5E-04		Yes
MJ111	EVBS01S01	Acenaphthene	0.00205	0.001025	UJ			1.8E-04	Yes

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TPH and Petroleum Constituent Data and Calculation of Maximum Ratio Extrapolation Factors

EPA ID	RFI SITE ID	CHEMICAL	CONCENTRATION	ADJ CONC	REV QUAL	PERCENT OF TOTAL TPH	LCPC:C08-C11	HCPC:C11-C30	CENSORED
MJ111	EVBS01S01	Acenaphthylene	0.00205	0.001025	UJ			1.8E-04	Yes
MJ111	EVBS01S01	Anthracene	0.00221	0.00221				4.0E-04	Yes
MJ111	EVBS01S01	Benzo(a)anthracene	0.00205	0.001025	U			1.8E-04	Yes
MJ111	EVBS01S01	Benzo(a)pyrene	0.00205	0.001025	U			1.8E-04	Yes
MJ111	EVBS01S01	Benzo(b)fluoranthene	0.00205	0.001025	U			1.8E-04	Yes
MJ111	EVBS01S01	Benzo(e)pyrene	0.00205	0.001025	U			1.8E-04	Yes
MJ111	EVBS01S01	Benzo(g,h,i)perylene	0.00205	0.001025	U			1.8E-04	Yes
MJ111	EVBS01S01	Benzo(k)fluoranthene	0.00205	0.001025	U			1.8E-04	Yes
MJ111	EVBS01S01	Chrysene	0.00205	0.001025	U			1.8E-04	Yes
MJ111	EVBS01S01	Dibenzo(a,h)anthracene	0.00205	0.001025	U			1.8E-04	Yes
MJ111	EVBS01S01	Fluoranthene	0.00205	0.001025	U			1.8E-04	Yes
MJ111	EVBS01S01	Fluorene	0.0455	0.02275	UJ			4.1E-03	Yes
MJ111	EVBS01S01	Indeno(1,2,3-cd)pyrene	0.00205	0.001025	U			1.8E-04	Yes
MJ111	EVBS01S01	Naphthalene	0.0162	0.0162	R				Yes
MJ111	EVBS01S01	Perylene	0.00205	0.001025	U			1.8E-04	Yes
MJ111	EVBS01S01	Phenanthrene	0.00513	0.002565	U			4.6E-04	Yes
MJ111	EVBS01S01	Pyrene	0.00205	0.001025	U			1.8E-04	Yes
MJ111	EVBS01S01	C08-C11 (Gasoline Range)	3.7	1.85	U	25.0%			Yes
MJ111	EVBS01S01	C11-C14 (Kerosene Range)	3.7	1.85	U	25.0%			Yes
MJ111	EVBS01S01	C14-C20 (Diesel Range)	3.7	1.85	U	25.0%			Yes
MJ111	EVBS01S01	C20-C30 (Lubricant Oil Rang	3.7	1.85	U	25.0%			Yes
MJ111	EVBS01S01	C11-C30		5.55					Yes
MJ112	BATS03S01	2-Methylnaphthalene	0.00205	0.001025	UJ		5.1E-04		Yes
MJ112	BATS03S01	Acenaphthene	0.00198	0.00099	UJ			1.2E-04	Yes
MJ112	BATS03S01	Acenaphthylene	0.00198	0.00099	UJ			1.2E-04	Yes
MJ112	BATS03S01	Anthracene	0.00198	0.00099	U			1.2E-04	Yes
MJ112	BATS03S01	Benzo(a)anthracene	0.00198	0.00099	U			1.2E-04	Yes
MJ112	BATS03S01	Benzo(a)pyrene	0.00198	0.00099	U			1.2E-04	Yes
MJ112	BATS03S01	Benzo(b)fluoranthene	0.00198	0.00099	U			1.2E-04	Yes
MJ112	BATS03S01	Benzo(e)pyrene	0.00246	0.00246				3.1E-04	Yes
MJ112	BATS03S01	Benzo(g,h,i)perylene	0.002	0.002				2.5E-04	Yes
MJ112	BATS03S01	Benzo(k)fluoranthene	0.00198	0.00099	U			1.2E-04	Yes
MJ112	BATS03S01	Chrysene	0.00198	0.00099	U			1.2E-04	Yes
MJ112	BATS03S01	Dibenzo(a,h)anthracene	0.00198	0.00099	U			1.2E-04	Yes
MJ112	BATS03S01	Fluoranthene	0.00198	0.00099	U			1.2E-04	Yes
MJ112	BATS03S01	Fluorene	0.00503	0.002515	UJ			3.1E-04	Yes
MJ112	BATS03S01	Indeno(1,2,3-cd)pyrene	0.00198	0.00099	U			1.2E-04	Yes
MJ112	BATS03S01	Naphthalene	0.00935	0.00935	R				Yes

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TPH and Petroleum Constituent Data and Calculation of Maximum Ratio Extrapolation Factors

EPA ID	RFI SITE ID	CHEMICAL	CONCENTRATION	ADJ CONC	REV QUAL	PERCENT OF TOTAL TPH	LCPC:C08-C11	HCPC:C11-C30	CENSORED
MJ112	BATS03S01	Perylene	0.00515	0.00515				6.4E-04	Yes
MJ112	BATS03S01	Phenanthrene	0.00495	0.002475	U			3.1E-04	Yes
MJ112	BATS03S01	Pyrene	0.00198	0.00099	U			1.2E-04	Yes
MJ112	BATS03S01	C08-C11 (Gasoline Range)	4	2	U	25.0%			Yes
MJ112	BATS03S01	C11-C14 (Kerosene Range)	4	2	U	25.0%			Yes
MJ112	BATS03S01	C14-C20 (Diesel Range)	4	2	U	25.0%			Yes
MJ112	BATS03S01	C20-C30 (Lubricant Oil Rang	4	2	U	25.0%			Yes
MJ112	BATS03S01	C11-C30		8					Yes

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TPH and Petroleum Constituent Data and Calculation of Maximum Ratio Extrapolation Factors

EPA ID	RFI SITE ID	CHEMICAL	CONCENTRATION	ADJ CONC	REV QUAL	PERCENT OF TOTAL TPH	LCPC:C08-C11	HCPC:C11-C30	CENSORED
MAXIMUM RATIOS OF PETROLEUM CONSTITUENTS TO TPH ([MG/KG]/[MG/KG])									
		2-Methylnaphthalene					2.8E-02		
		Acenaphthene						5.7E-04	
		Acenaphthylene						7.0E-05	
		Anthracene						3.7E-04	
		Benzo(a)anthracene						2.7E-05	
		Benzo(a)pyrene						2.7E-05	
		Benzo(b)fluoranthene						4.3E-05	
		Benzo(e)pyrene						2.1E-04	
		Benzo(g,h,i)perylene						2.2E-04	
		Benzo(k)fluoranthene						2.1E-05	
		Chrysene						5.9E-05	
		Dibenzo(a,h)anthracene						1.1E-05	
		Fluoranthene						7.5E-05	
		Fluorene						5.7E-04	
		Indeno(1,2,3-cd)pyrene						2.4E-05	
		Naphthalene					6.9E-03		
		Perylene						1.2E-04	
		Phenanthrene						1.5E-03	
		Pyrene						1.4E-04	
		Benzene					1.2E-04		
		Ethylbenzene					1.2E-04		
		Toluene					1.2E-04		
		Xylene (total)					4.4E-04		
		m,p-Xylene					3.6E-04		
		o-Xylene					8.0E-05		

Notes:
TPH - total petroleum hydrocarbon
LCPC - low carbon petroleum constituent; includes benzene, toluene, ethylbenzene, xylenes, 2-methynaphthalene, and naphthalene.
HCPC - high carbon petroleum constituent; includes polycyclic aromatic hyrdrocarbons.
Concentration - either the detected concentration or sample quantitation limit (SQL) as reported by the analytical laboratory.
Adj Conc - either the detected concentration or, if not detected, the estimated concentration calculated as one-half the SQL.
Rev Qual - data qualifier deterimined during data validation.
Censored - data not included in the calculation of maximum ratios either because data were rejected or because the relevant TPH data were not detected.

APPENDIX C

ECOLOGICAL SCREENING LEVEL CALCULATIONS

APPENDIX C
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ECOLOGICAL SCREENING LEVEL CALCULATIONS

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Attachment C-1 Calculation of Ecological Screening Levels for Terrestrial Mammals

Attachment C-2 Calculation of Ecological Screening Levels for Terrestrial Avian Species

Attachment C-3 Calculation of Ecological Screening Levels for Terrestrial Invertebrates

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APPENDIX C

DERIVATION OF ECOLOGICAL SCREENING LEVELS

1.0 INTRODUCTION

The following sections describe the methods used to derive ecological screening levels (ESLs) for use in the selection of chemicals of potential ecological concern (CPECs) in ecological risk assessments at the Santa Susana Field Laboratory (SSFL). The application of ESLs in the CPEC selection process was previously described and summarized in Section 3.2 of the SRAM.

2.0 AQUATIC HABITAT ECOLOGICAL SCREENING LEVELS

Chronic freshwater National Ambient Water Quality Criteria (NAWQC), developed by USEPA (1986), and National Recommended Water Quality Criteria (NRWQC), developed by USEPA (1998), were established to protect aquatic life from adverse effects. These criteria will be used in the development of ESLs for the evaluation of surface water and near-surface groundwater SQLs, as applicable. Of the various criteria or screening benchmarks proposed for consideration (e.g., NAWQC, NRWQC), the lowest criterion or screening benchmark established for each candidate CPEC will be adopted as the ESL for screening purposes. It should be noted that ESLs based on these criteria should not be considered site-specific since NAWQC and NRWQC for many chemicals are based on toxic effect in aquatic species that do not occur at the SSFL. Further these criteria are often based on toxic end-points that are not relevant to population effects, which is the focus of ecological risk assessments at the SSFL. Therefore, ESLs based on these criteria should not be used for making risk management decisions including remedial decisions and cleanup goals.

Surface water and near-surface groundwater ESLs that are based on NAWQC or NRWQC are summarized in Table 3-2. For CPECs that do not have established NAWQC or NRWQC, SQLs will be compared to literature derived reference concentrations RfCs that represent no-observable-effect-concentrations (NOECs) and lowest-observable-effect-concentrations (LOECs) for that chemical (see Section 11.2). If no toxicity data are available, the SQL will be compared to a water quality criterion or RfCs that exists for the most closely related chemical (i.e., by chemical structure).

An exceedance of an Aquatic ESL will not necessarily trigger a remedial action. However, an exceedance of an Aquatic ESL may trigger a review of the basis for the Aquatic ESL or water quality criterion, the applicability of that criterion to SSFL habitats and receptors, a refinement of

the surface or groundwater exposure point concentration, toxicity bioassays, and/or further chemical and biological monitoring.

3.0 TERRESTRIAL HABITAT ECOLOGICAL SCREENING LEVELS

In contrast to water quality criteria (i.e., NAWQC) that are readily available for the protection of aquatic receptors in surface water, similar criteria for soil are not available for the protection of ecological receptors in the terrestrial environment. Therefore, site-specific soil ESLs were developed using the standard ecological risk assessment equations specified in Section 10.4 and screening-level toxicity reference values (TRVs) for terrestrial mammals and avian species. ESLs were also derived for soil invertebrates as described in Section 3.2.1.2.3.

3.1 Selection of Toxicity Reference Values

Toxicological data were compiled for chemicals and representative species with available information. Ecotoxicological databases were searched for chronic mammalian and avian no-observable-adverse-effect-level (NOAEL) TRVs for chemicals that were analyzed in soil at the SSFL. The chronic NOAEL is the toxicity value used in the derivation of ESLs.

Sources of ecotoxicological data included the U.S. Navy (EFA West 1998, as cited in HERD 2000), USEPA's IRIS database, ATSDR chemical-specific Toxicological Profiles, USEPA Region 6 Combustor Guidance (USEPA 1999), and Oak Ridge National Laboratory (Sample et al. 1996). The selection of appropriate TRVs focused on identifying NOAELs for growth, reproduction, mortality, and other less serious effects that are relevant to assessment endpoints described in Section 9.6 (i.e., protection of receptor populations and communities and their food sources). In cases where toxicity data for these toxic endpoints were not available, toxicity data for other toxic endpoints were used even if those endpoints were less relevant to receptors and attributes identified in assessment endpoints. EFA West (1998) values were used where available. For compounds without TRV values from EFA West (1998), the lowest available TRV for a particular chemical was selected from the other sources cited above.

For chemicals without chronic dose-response-based NOAELs, but for which other toxicity values were available, uncertainty factors were applied to extrapolate these other toxicity values to chronic NOAELs. These other toxicity values include less than chronic NOAELs (e.g., subchronic NOAELs), lowest-observable-adverse-effect-levels (LOAELS), and the lethal dose for 50 percent of a study population (LD_{50}). Consistent with DTSC guidance (1996), a UF of 5 was used to adjust LOAEL TRVs to NOAEL a UF of 2 was used to extrapolate TRVs derived

from subchronic studies to chronic TRVs. An uncertainty factor of 100 was used to adjust LD_{50} values to chronic NOAEL equivalent values. Finally, laboratory studies may have been conducted on species other than the receptor species selected for ecological risk assessment at the SSFL. If toxicity values used were not based on data for that specific species, an allometric conversion based on body size (*i.e.*, weight and surface area) was used to extrapolate between species, but only in cases where there was a 100-fold difference between test species' and representative species' body weights as recommended by DTSC (1999c). The body size adjusted TRVs, referred to here as "adjusted NOAEL-equivalent toxicity values," were calculated using the following allometric conversion equation (Sample and Arenal 1999):

$$TRV_{adj} = TRV_t \, (BW_t/BW_r)^{SF} \qquad \text{(C3-1)}$$

Where:

TRV_{adj}	=	Adjusted NOAEL-equivalent TRV (mg/kg of body weight per day)
TRV_t	=	NOAEL-equivalent toxicity reference value for test organism (mg of chemical/kg of body weight per day)
BW_t	=	Body weight for test organism (kg)
BW_r	=	Body weight for deer mouse (kg)
SF	=	Body size scaling factor (unitless)

Sample and Arenal (1999) developed chemical-specific mammalian scaling factors (SFs) for 167 chemicals and avian SFs for 194 chemicals. A body size SF of (1 – 0.94), or 0.06, was used to extrapolate TRVs between mammalian species for which chemical-specific SFs were not available (Sample and Arenal 1999). A SF of zero was used in Equation C3-1 to extrapolate TRVs between avian species. Mineau *et al*. (1996) identified a mean SF of (1 - 1.15) for birds; Sample and Arenal (1999) recently reported a mean SF of (1 - 1.2) for birds. However, in an earlier study, Sample *et al*. (1996) reported that scaling factors for a majority of the chemicals evaluated (29 of 37) were not significantly different from 1. Therefore, a SF of zero for TRV extrapolation between avian species was determined to be more appropriate for scaling between avian species.

If no toxicity values were available for a particular compound, appropriate surrogate chemical chronic NOAELs were used as the mammalian TRVs. Surrogate chemicals were selected based on structural chemistry, specifically, the active moiety/functional group of the chemical. These surrogate chemicals have been selected to have expected toxicity equal to, or greater than, the particular compound without toxicity values. Therefore, uncertainty factors were not included to

account for surrogate use. This process was only performed for chemicals for which a NOAEL, LOAEL, or LD_{50} toxicity value was available. In those cases where appropriate chemical surrogates were not identified, the most conservative TRV within the chemical class (e.g., VOCs, metals, etc.) was used as the TRV for ESL derivation.

Because avian toxicology is less well understood than mammalian toxicology, no attempt was made to apply structure-activity relationships to select surrogate compounds, unless already selected by one of the above references. Consequently, TRVs for fewer compounds were derived for avian species than were derived for mammalian species.

3.2. Calculation of Terrestrial Mammalian and Avian ESLs

The risk model presented in the SRAM uses the ratio of the chemical-specific dose to the TRV to estimate a hazard quotient (Equation 3-2). Soil ESLs for the deer mouse or thrush were calculated by setting the hazard quotient in Equation 3-2 equal to 1, rearranging that equation, and solving for soil concentration (mg/kg) as shown in Equation 3-3:

$$HQ_i=1=EPV_i/TRV_i = (ESL_i*\{(BAF_{ti*}F_{ti}\ FIR)+(BAF_{tp*}F_{tp}\ FIR)+ F_t\})/TRV_i \qquad (3\text{-}2)$$

or

$$ESL_i = TRV_i/\{(BAF_{ti*}F_{ti}\ FIR)+(BAF_{tp*}F_{tp}\ FIR)+ F_t\} \qquad (3\text{-}3)$$

Where:

HQ_i = Hazard quotient for chemical *i* (unitless)

EPV_i = Exposure point value for chemical *i* (mg of chemical/kg of body weight per day)

TRV_i = NOAEL-equivalent TRV for chemical *i* (mg of chemical/kg of body weight per day)

ESL_i = Ecological screening level in soil for chemical *i* (mg of chemical/kg of soil)

FIR = Food/incidental soil ingestion rate (mg of food/soil per kg of body weight per day)

BAF_{ti} = Soil-to-biota bioaccumulation factor for terrestrial invertebrates for chemical *i* (unitless)

BAF_{tp} = Soil-to-biota bioaccumulation factor for terrestrial plants for chemical *i* (unitless)

F_{ti} = Fraction of terrestrial invertebrates in diet (unitless)
F_{tp} = Fraction of terrestrial plants in diet (unitless)
F_t = Fraction of soil in diet (unitless)

All concentration data, BAFs, and food intake rates used to derive ESLs are on a dry weight basis. Standardized exposure parameters presented in the SRAM were incorporated in the derivation of soil ESLs. Exposure parameters used in Equation 3-3 that were not defined in the SRAM or required modification are discussed below.

Derived BAFs for the SSFL are presented in Section 10.4 of the SRAM. Biota to soil BAFs for invertebrates (i.e., BAF_{ti}), presented in Section 10.4 of the SRAM, were used in Equation 3-3. For chemicals not addressed in Section 10.4, a default BAF of 1 was assumed.

The BAFs presented in Section 10.0 are expressed on a dry weight basis. All applicable exposure parameters used to calculate ESLs are expressed on a dry weight basis. It should be noted that the deer mouse and thrush food intake rate equations presented in the SRAM indicate that these rates, taken from USEPA (1993), are on a wet weight basis. Therefore, deer mouse and thrush food intake rates were derived on a dry weight basis using allometric equations presented by Nagy (2001). These allometric equations relate food intake rate to body weight using estimated field metabolic rates and general dietary composition.

Dermal and inhalation routes were not included in the development of the soil ESLs because the contribution from these routes of exposure to overall risks has been shown to be generally less than 1 percent (USEPA 2000b,c). However, as described in Section 10.3, inhalation exposure will be assessed for burrowing animals using soil vapor data.

3.3 Summary of Terrestrial Mammalian and Avian ESLs

Terrestrial mammal ESLs for soil derived according to the protocol described in Section 3.2.1.2 are presented in Table 3-3. Mammalian ESLs were developed for 256 compounds. Of these 256 compounds, 115 compounds had sufficient data to derive chemical-specific ESLs. Surrogate compounds were used where available for 130 compounds, and the most conservative NOAEL toxicity value within a chemical class (e.g., VOCs, metals, etc.) was used as the TRV for 11 compounds. The spreadsheets used to derive mammalian ESLs for soil are presented in Appendix C, Attachment C-1.

Avian ESLs derived according to the protocol described in Section 3.2.1.2 are presented in Table 3-4. Avian ESLs were developed for 68 compounds. As discussed above, chemical surrogates

were not used in the development of avian ESLs. The spreadsheets used to derive avian ESLs are presented in Appendix C, Attachment C-2.

In several cases, the avian TRVs reported in USEPA (1999) were found to not be applicable for deriving avian ESLs due to misinterpretation of toxicity test results or the inappropriate calculation of estimated doses. Each of these cases is discussed below.

The USEPA (1999) derived TRVs for acetone, hexachlorobenzene, and pentachlorophenol from LD_{50} determinations for 5-day exposures of 14-day-old Japanese quail (Hill and Camardese 1986). However, Hill and Camardese (1986) reported no mortality at the lowest concentration tested and no overt signs of toxicity at that concentration. USEPA (1999) selected an uncertainty factor of 100 for deriving TRVs for acetone, hexachlorobenzene, and pentachlorophenol, perhaps because these were meant to be LD_{50} determinations. For the purpose of deriving ESLs, an uncertainty factor of 10 was used to account for the shorter duration of exposure. Because these were NOAELs, no other uncertainty factors were necessary.

Also with respect to acetone, hexachlorobenzene, and pentachlorophenol, USEPA (1999) converted the chemical concentration in food to a dose in mg/kg-day using the method of Sample et al. (1996). Body weight was not reported in Hill and Camardese (1986) so USEPA's calculation was based on an assumed body weight of 100 grams (0.1 kg) and the average daily food intake rate reported in the study. A multi-generational study of body weight in Japanese quail found that at 14 days, the male and female combined average body weight was 0.0413 kg (Sefton and Siegel 1974). This body weight value was used with the food consumption rate from Hill and Camardese (1986) to calculate the dose for use in the TRV derivation.

The chemical concentration in food was converted by USEPA (1999) to an estimated dose (mg/kg-day) based on body weight and intake rate using the method of Sample et al. (1996). However, the heptachlor study reported the actual rate of food consumption in the control group (Sefton and Siegel 1974); the control group food consumption rate was used with the body weight data from Sefton and Siegel (1974) to calculate a dose for use in the TRV derivation.

3.4 Summary of Terrestrial Invertebrate ESLs

Toxicity data for terrestrial invertebrates are generally limited to RfCs reported as NOECs and LOECs. Similar to the methods used to derive mammalian and avian ESLs, preference was given to population effects endpoints such as reproduction, growth/development, and mortality. Sources of toxicity data that were reviewed for terrestrial invertebrates include Efroymson et al.

(1997), Will and Suter (1995), USEPA Region 6 Combustor Guidance (USEPA 1999), USEPA EcoSSLs (USEPA 2003), Sample et al. (1996), and Sverdrup et al. (2002). Extrapolation of LOECs to NOECs and from non-chronic values to chronic values followed the same methods as described for mammals and avian species described in Section 3.2.1.2. Terrestrial invertebrate ESLs are summarized in Table 3-5. The spreadsheets used to calculate terrestrial invertebrate ESLs for soil are presented in Appendix C, Attachment C-3.

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APPENDIX C

ATTACHMENT C-1

CALCULATION OF ECOLOGICAL SCREENING LEVELS FOR TERRESTRIAL MAMMALS

Calculation of Soil Ecological Screening Levels for Terrestrial Mammals
Santa Susana Field Laboratory

Chemical	TEF	Test Species Common Name	Test Species Body Weight (kg)	Endpoint	Study Type	Effect to Test Organism	Toxicity Value (mg/kg-day)	Subchronic to Chronic UF	LOAEL to NOAEL UF	Rodent NOAEL-Equiv TRV (mg/kg-day)	Toxicity Value Surrogate[a]	Mammalian ESL[b] (mg/kg soil)	Plant BAFc (unitless)	Invertebrate BAFc (unitless)	Default Plant BAF (unitless)	Default Invertebrate BAF (unitless)	Initial Compilation Source
1,2,3,4,6,7,8-HpCDD	0.01	rat	0.35				0.000001			1.00E-04	2,3,7,8-TCDD	9.58E-04	0.32	0.54			TEF from Van den Berg et al. 1998
1,2,3,4,6,7,8-HpCDF	0.01	rat	0.35				0.000001			1.00E-04	2,3,7,8-TCDD	4.88E-04	1.00	0.54	Yes		TEF from Van den Berg et al. 1998
1,2,3,4,7,8,9-HpCDF	0.01	rat	0.35				0.000001			1.00E-04	2,3,7,8-TCDD	4.27E-04	1.00	1.00	Yes	Yes	TEF from Van den Berg et al. 1998
1,2,3,4,7,8-HxCDD	0.1	rat	0.35				0.000001			1.00E-05	2,3,7,8-TCDD	4.54E-05	1.00	0.78	Yes		TEF from Van den Berg et al. 1998
1,2,3,4,7,8-HxCDF	0.1	rat	0.35				0.000001			1.00E-05	2,3,7,8-TCDD	4.72E-05	1.00	0.65	Yes		TEF from Van den Berg et al. 1998
1,2,3,6,7,8-HxCDD	0.1	rat	0.35				0.000001			1.00E-05	2,3,7,8-TCDD	4.57E-05	1.00	0.76	Yes		TEF from Van den Berg et al. 1998
1,2,3,6,7,8-HxCDF	0.1	rat	0.35				0.000001			1.00E-05	2,3,7,8-TCDD	5.35E-05	1.00	0.26	Yes		TEF from Van den Berg et al. 1998
1,2,3,7,8,9-HxCDD	0.1	rat	0.35				0.000001			1.00E-05	2,3,7,8-TCDD	4.35E-05	1.00	0.93	Yes		TEF from Van den Berg et al. 1998
1,2,3,7,8,9-HxCDF	0.1	rat	0.35				0.000001			1.00E-05	2,3,7,8-TCDD	4.27E-05	1.00	1.00	Yes	Yes	TEF from Van den Berg et al. 1998
1,2,3,7,8-PeCDD	1	rat	0.35				0.000001			1.00E-06	2,3,7,8-TCDD	4.42E-06	1.00	0.88	Yes		TEF from Van den Berg et al. 1998
1,2,3,7,8-PeCDF	0.05	rat	0.35				0.000001			2.00E-05	2,3,7,8-TCDD	1.01E-04	1.00	0.43	Yes		TEF from Van den Berg et al. 1998
2,3,4,6,7,8-HxCDF	0.1	rat	0.35				0.000001			1.00E-05	2,3,7,8-TCDD	4.85E-05	1.00	0.56	Yes		TEF from Van den Berg et al. 1998
2,3,4,7,8-PeCDF	0.5	rat	0.35				0.000001			2.00E-06	2,3,7,8-TCDD	9.85E-06	1.00	0.51	Yes		TEF from Van den Berg et al. 1998
2,3,7,8-TCDD	1	rat	0.35	NOAEL	chronic	growth, organ toxicity, blood chemistry	0.000001			1.00E-06		4.27E-06	1.00	1.00	Yes	Yes	Sample et al. 1996
2,3,7,8-TCDF	0.1	rat	0.35				0.000001			1.00E-05	2,3,7,8-TCDD	4.25E-05	1.00	1.02	Yes		TEF from Van den Berg et al. 1998
OCDD	0.0001	rat	0.35				0.000001			1.00E-02	2,3,7,8-TCDD	1.16E-01	0.23	0.47			TEF from Van den Berg et al. 1998
OCDF	0.0001	rat	0.35				0.000001			1.00E-02	2,3,7,8-TCDD	9.70E-02	0.33	0.50			TEF from Van den Berg et al. 1998
Aluminum	1	mouse	0.03	NOAEL	chronic	reproduction	1.93			1.93E+00		1.24E+01	0.74	0.37			Sample et al. 1996
Antimony	1	mouse	0.03	NOAEL	chronic	longevity	0.125		Y	1.25E-01		9.48E-02	5.36	7.79			Sample et al. 1996
Arsenic	1	mouse	0.03	NOAEL	chronic	reproduction	0.32			3.20E-01		1.93E+00	0.75	0.52			EFA West 1998
Barium	1	rat	0.435	NOAEL	chronic	growth, development	5.1			5.10E+00		1.46E+01	1.00	2.80			Sample et al. 1996
Beryllium	1	rat	0.35	NOAEL	chronic	longevity	0.66			6.60E-01		5.00E+00	0.61	0.32			Sample et al. 1996
Boron	1	dog	12.7	NOAEL	chronic	reproduction	8.8			1.30E+01		9.19E+00	7.40	4.64			IRIS
Cadmium	1	mouse	0.0322	NOAEL	chronic	reproduction	0.06			6.00E-02		2.08E-02	10.80	19.69			EFA West 1998
Chromium	1	rat	0.35	NOAEL	chronic	growth, organ weight, blood chemistry	1468			1.47E+03		9.27E+02	9.45	2.43			IRIS
Cobalt	1	rat	0.35	LOAEL	chronic	reproduction (decreased pup growth)	1.2		Y	1.20E+00		8.90E+00	0.66	0.23			EFA West 1998
Copper	1	mouse	0.03	NOAEL	subchronic	growth, thymic cell count, mortality	2.667	Y		2.67E+00		2.15E+00	1.88	14.72			EFA West 1998
Hexavalent Chromium	1	rat	0.35	NOAEL	chronic	growth	3.28			3.28E+00		1.40E+01	1.00	1.00	Yes	Yes	Sample et al. 1996
Lead	1	rat	0.35	NOAEL	chronic	kidney function	1			1.00E+00		2.81E+00	2.14	0.24			Region 9 BTAG 2002
Manganese	1	mouse	0.0346	LOAEL	subchronic	reproductive organ toxicity	13.7	Y	Y	1.37E+01		5.85E+01	1.00	1.00	Yes	Yes	EFA West 1998
Mercury	1	mink	1	NOAEL	chronic	reproduction	1.01			1.01E+00		2.86E+00	0.82	3.28			Sample et al. 1996
Methyl mercury	1	rat	0.1875	NOAEL	chronic	reproductive, developmental	0.25			2.50E-01		1.07E+00	1.00	1.00	Yes	Yes	EFA West 1998
Molybdenum	1	mouse	0.03	NOAEL	chronic	reproduction	0.26		Y	2.60E-01		1.07E-01	13.58	5.91			Sample et al. 1996
Nickel	1	rat	0.35	LOAEL	chronic	reproduction (decreased pup viability)	0.133		Y	1.33E-01		1.02E-01	7.70	2.10			EFA West 1998
Selenium	1	rats	0.35	NOAEL	chronic	hepatic lesions	0.05			5.00E-02		1.74E-01	1.00	1.84	Yes		EFA West 1998
Silver	1	mouse	0.03	LOAEL	chronic	*	0.375		Y	3.75E-01		5.39E-01	1.69	6.63			EPA Region 6
Thallium	1	rat	0.35	NOAEL	subchronic	hair loss	0.48	Y		4.80E-01		2.88E+00	0.51	1.09			EFA West 1998
Vanadium	1	rat	0.26	NOAEL	chronic	reproduction	0.21			2.10E-01		1.45E+00	0.69	0.32			Sample et al. 1996
Zinc	1	mouse	0.0255	LOAEL	chronic	pancreatic,adrenal	9.6		Y	9.60E+00		2.07E+01	1.62	3.13			EFA West 1998
Aroclor 1016	1	mink	1	NOAEL	chronic	reproduction	1.37			1.37E+00		1.56E+00	2.97	6.47			Sample et al. 1996
Aroclor 1221	1	mink	1				1.37			1.37E+00	Aroclor 1016	1.56E+00	2.97	6.47			Sample et al. 1996
Aroclor 1232	1	mouse	0.014				0.068			6.80E-02	Aroclor 1254	7.75E-02	2.97	6.47			Sample et al. 1996
Aroclor 1242	1	mink	1	LOAEL	chronic	reproduction	0.069		Y	6.90E-02		7.86E-02	2.97	6.47			Sample et al. 1996
Aroclor 1248	1	Rhesus monkey	5	LOAEL	chronic	reproduction	0.01		Y	1.40E-02		1.60E-02	2.97	6.47			Sample et al. 1996
Aroclor-1254	1	mouse	0.014	NOAEL	chronic	reproduction	0.068			6.80E-02		7.75E-02	2.97	6.47			Sample et al. 1996
Aroclor-1260	1	mouse	0.014				0.068			6.80E-02	Aroclor 1254	7.75E-02	2.97	6.47			Sample et al. 1996
Aroclor 1262	1	mouse	0.014				0.068			6.80E-02	Aroclor 1254	7.75E-02	2.97	6.47			Sample et al. 1996
PCB-105	0.0001	rat	0.35				0.000001			1.00E-02	2,3,7,8-TCDD	8.51E-03	3.30	10.36			TEF from Van den Berg et al. 1998
PCB-114	0.0005	rat	0.35				0.000001			2.00E-03	2,3,7,8-TCDD	8.81E-04	3.68	26.61			TEF from Van den Berg et al. 1998
PCB-118	0.0001	rat	0.35				0.000001			1.00E-02	2,3,7,8-TCDD	8.18E-03	3.15	11.47			TEF from Van den Berg et al. 1998
PCB-123	0.0001	rat	0.35				0.000001			1.00E-02	2,3,7,8-TCDD	7.49E-03	3.42	12.59			TEF from Van den Berg et al. 1998
PCB-126	0.1	rat	0.35				0.000001			1.00E-05	2,3,7,8-TCDD	1.44E-05	2.23	5.32			TEF from Van den Berg et al. 1998
PCB-156	0.0005	rat	0.35				0.000001			2.00E-03	2,3,7,8-TCDD	2.62E-03	2.49	5.80			TEF from Van den Berg et al. 1998
PCB-157	0.0005	rat	0.35				0.000001			2.00E-03	2,3,7,8-TCDD	2.54E-03	2.63	5.87			TEF from Van den Berg et al. 1998
PCB-167	0.00001	rat	0.35				0.000001			1.00E-01	2,3,7,8-TCDD	1.24E-01	2.77	5.88			TEF from Van den Berg et al. 1998
PCB-169	0.01	rat	0.35				0.000001			1.00E-04	2,3,7,8-TCDD	4.27E-04	1.00	1.00	Yes	Yes	TEF from Van den Berg et al. 1998
PCB-189	0.0001	rat	0.35				0.000001			1.00E-02	2,3,7,8-TCDD	2.02E-02	2.16	2.39			TEF from Van den Berg et al. 1998
PCB-77	0.0001	rat	0.35				0.000001			1.00E-02	2,3,7,8-TCDD	1.29E-02	2.38	6.24			TEF from Van den Berg et al. 1998
PCB-81	0.0001	rat	0.35				0.000001			1.00E-02	2,3,7,8-TCDD	1.18E-02	3.00	5.98			TEF from Van den Berg et al. 1998
Perchlorate	1	rat	0.35	NOAEL	chronic	thyroid effects	0.001			1.00E-03		2.38E-05	282.00	1.00	Yes	Yes	US EPA 1995
1,1,1,2-Tetrachloroethane	1	rat	0.35	LOAEL	chronic	kidney/liver toxicity	89.3		5	1.79E+01		7.63E+01	1.00	1.00	Yes	Yes	IRIS
1,1,1-Trichloroethane	1	mouse	0.035	NOAEL	chronic	reproductive	1000			1.00E+03		4.27E+03	1.00	1.00	Yes	Yes	Sample et al. 1996
1,1,2,2-Tetrachloroethane	1	mouse	0.03				1.4	Y		1.40E+00	1,1,2,2-Tetrachloroethylene	5.98E+00	1.00	1.00	Yes	Yes	Sample et al. 1996
1,1,2-Trichloro-1,2,2-trifluoroethane	1	human	70	NOAEL	subchronic	no adverse medical symptoms observed	30	Y		4.93E+01		2.10E+02	1.00	1.00	Yes	Yes	IRIS
1,1,2-Trichloroethane	1	mouse	0.03	NOAEL	subchronic	hematology	3.9	2		1.95E+00		8.33E+00	1.00	1.00	Yes	Yes	IRIS
1,1-Dichloroethane	1	mouse	0.035				50			5.00E+01	1,2 Dichloroethane	2.14E+02	1.00	1.00	Yes	Yes	Sample et al. 1996
1,1-Dichloroethene	1	dog	14	NOAEL	subchronic	organ toxicity, mortality	2.5	Y		6.89E-02		2.94E-01	1.00	1.00	Yes	Yes	Sample et al. 1996
1,1-Dichloropropene	1	rat	0.35				5.1			5.10E+00	1,3-Dichloropropene	2.18E+01	1.00	1.00	Yes	Yes	IRIS
1,2,3-Trichlorobenzene	1	rat	0.35				14.8			1.48E+01	1,2,4-Trichlorobenzene	6.32E+01	1.00	1.00	Yes	Yes	IRIS
1,2,3-Trichloropropane	1	rat	0.35	NOAEL	subchronic	clinical chemistry, hematology	5.71	2		2.86E+00		1.22E+01	1.00	1.00	Yes	Yes	IRIS
1,2,4-Trichlorobenzene	1	rat	0.35	NOAEL	chronic	reproduction	14.8			1.48E+01		6.32E+01	1.00	1.00	Yes	Yes	IRIS
1,2,4-Trimethylbenzene	1	rat	0.35				150			1.50E+02	Xylenes	6.41E+02	1.00	1.00	Yes	Yes	Condie et al.1988
1,2-Dibromo-3-chloropropane	1	rat	0.35				5.1			5.10E+00	1,3-Dichloropropene	2.18E+01	1.00	1.00	Yes	Yes	IRIS
1,2-Dibromoethane	1	rat	0.35				5.85			5.85E+00	Methylene chloride	2.50E+01	1.00	1.00	Yes	Yes	Sample et al. 1996
1,2-Dichloro-1,1,2-Trifluoroethane	1	human	70				273			4.48E+02	1,1,2-Trichloro-1,2,2-trifluoroethane	1.92E+03	1.00	1.00	Yes	Yes	IRIS
1,2-Dichlorobenzene	1	rat	0.35	NOAEL	chronic	organ toxicity	85.7			8.57E+01		3.66E+02	1.00	1.00	Yes	Yes	IRIS
1,2-Dichloroethane	1	mouse	0.035	NOAEL	chronic	reproduction	50			5.00E+01		2.14E+02	1.00	1.00	Yes	Yes	Sample et al. 1996
1,2-Dichloropropane	1	rat	0.35				5.85			5.85E+00	Methylene chloride	2.50E+01	1.00	1.00	Yes	Yes	Sample et al. 1996
1,2-Diphenylhydrazine	1	rat	0.35	NOAEL	chronic	survival	2			2.00E+00		8.54E+00	1.00	1.00	Yes	Yes	ATSDR
1,3,5-Trimethylbenzene	1	rat	0.35				150			1.50E+02	Xylenes	6.41E+02	1.00	1.00	Yes	Yes	Condie et al.1988
1,3,5-Trinitrobenzene	1	rat	0.35	NOAEL	chronic	growth, organ toxicity	2.68			2.68E+00		1.14E+01	1.00	1.00	Yes	Yes	IRIS
1,3-Dichlorobenzene	1	rat	0.35				75			7.50E+01	1,4-Dichlorobenzene	3.20E+02	1.00	1.00	Yes	Yes	ATSDR
1,3-Dichlorobenzene	1	rat	0.35				75			7.50E+01	1,4-Dichlorobenzene	3.20E+02	1.00	1.00	Yes	Yes	ATSDR

Calculation of Soil Ecological Screening Levels for Terrestrial Mammals
Santa Susana Field Laboratory

Chemical	TEF	Test Species Common Name	Test Species Body Weight (kg)	Endpoint	Study Type	Effect to Test Organism	Toxicity Value (mg/kg-day)	Subchronic to Chronic UF	LOAEL to NOAEL UF	Rodent NOAEL-Equiv TRV (mg/kg-day)	Toxicity Value Surrogate[a]	Mammalian ESL[b] (mg/kg soil)	Plant BAFc (unitless)	Invertebrate BAFc (unitless)	Default Plant BAF (unitless)	Default Invertebrate BAF (unitless)	Initial Compilation Source
1,3-Dichloropropane	1	rat	0.35				5.1			5.10E+00	1,3-Dichloropropene	2.18E+01	1.00	1.00	Yes	Yes	IRIS
1,3-Dichloropropene	1	rat	0.35	LOAEL	chronic	growth, histology	5.1		5	1.02E+00		4.36E+00	1.00	1.00	Yes	Yes	IRIS
1,3-Dinitrobenzene	1	rat	0.35	NOAEL	subchronic	testicular degeneration	0.35	2		1.75E-01		7.47E-01	1.00	1.00	Yes	Yes	Talmage et al. 1999
1,4-Dichlorobenzene	1	rat	0.35	NOAEL	subchronic	body weight gain	75	2		3.75E+01		1.60E+02	1.00	1.00	Yes	Yes	ATSDR
2,2-Dichloropropane	1	rat	0.35				5.1			5.10E+00	1,3-Dichloropropene	2.18E+01	1.00	1.00	Yes	Yes	IRIS
2,4,5-Trichlorophenol	1	rat	0.35	NOAEL	subchronic	liver and kidney toxicity	100	2		5.00E+01		2.14E+02	1.00	1.00	Yes	Yes	IRIS
2,4,6-Trichlorophenol	1	rat	0.35				100			1.00E+02	2,4,5-Trichlorophenol	4.27E+02	1.00	1.00	Yes	Yes	IRIS
2,4,6-Trinitrotoluene	1	dog	14	LOAEL	subchronic	liver toxicity	0.5	2	5	7.46E-02		3.18E-01	1.00	1.00	Yes	Yes	IRIS
2,4-Dichlorophenol	1	rat	0.35	NOAEL	chronic	reproduction	0.3			3.00E-01		1.28E+00	1.00	1.00	Yes	Yes	IRIS
2,4-Dimethylphenol	1	rat	0.35	NOAEL	subchronic	growth, hematology	50	2		2.50E+01		1.07E+02	1.00	1.00	Yes	Yes	IRIS
2,4-Dinitrophenol	1	rat	0.35	NOAEL	subchronic	growth	5.4	2		2.70E+00		1.15E+01	1.00	1.00	Yes	Yes	IRIS[c]
2,4-Dinitrotoluene	1	dog	14	NOAEL	chronic	behavioral, neurotoxicity	0.2			2.98E-01		1.27E+00	1.00	1.00	Yes	Yes	ATSDR
2,6-Dinitrotoluene	1	dog	14	LOAEL	acute	*	0.4	Y	Y	5.97E-01		2.55E+00	1.00	1.00	Yes	Yes	EPA Region 6
2-AMINO-4,6-DNT	1	dog	14				0.2			2.98E-01	2,4-Dinitrotoluene	1.27E+00	1.00	1.00	Yes	Yes	ATSDR
2-Butanone	1	rat	0.35	NOAEL	chronic	reproduction	1771			1.77E+03		7.56E+03	1.00	1.00	Yes	Yes	IRIS
2-Chloroethylvinylether	1	rat	0.35				0.17			1.70E-01	Vinyl chloride	7.26E-01	1.00	1.00	Yes	Yes	Sample et al. 1996
2-Chloronaphthalene	1	mouse	0.03	NOAEL	subchronic	growth, mortality, organ toxicity	250	2		1.25E+02		5.34E+02	1.00	1.00	Yes	Yes	IRIS
2-Chlorophenol	1	rat	0.35	NOAEL	chronic	reproduction	5			5.00E+00		2.14E+01	1.00	1.00	Yes	Yes	IRIS
2-Chlorotoluene	1	rat	0.35				75			7.50E+01	1,4-Dichlorobenzene	3.20E+02	1.00	1.00	Yes	Yes	ATSDR
2-Hexanone	1	rat	0.35				570			5.70E+02	Hexane	2.43E+03	1.00	1.00	Yes	Yes	HEAST FY 1997
2-Methylnaphthalene	1	mouse	0.03				50			5.00E+01	Naphthalene	2.14E+02	1.00	1.00	Yes	Yes	EFA West 1998
2-Methylphenol	1	rat	0.35	NOAEL	subchronic	growth, neurotoxicity	50	2		2.50E+01		1.07E+02	1.00	1.00	Yes	Yes	IRIS
2-Nitroaniline	1	rat	0.35				5.4			5.40E+00	2,4-Dinitrophenol	2.31E+01	1.00	1.00	Yes	Yes	IRIS
2-Nitrophenol	1	rat	0.35				5.4			5.40E+00	2,4-Dinitrophenol	2.31E+01	1.00	1.00	Yes	Yes	IRIS
2-Nitrotoluene	1	dog	14				0.2			2.98E-01	2,4-Dinitrotoluene	1.27E+00	1.00	1.00	Yes	Yes	ATSDR
3,3'-Dichlorobenzidine	1	rat	0.35				0.3			3.00E-01	2,4-Dichlorophenol	1.28E+00	1.00	1.00	Yes	Yes	IRIS
3,5-Dimethylphenol	1	rat	0.35				50			5.00E+01	2,4-Dimethylphenol	2.14E+02	1.00	1.00	Yes	Yes	IRIS
3-Methylphenol	1	rat	0.35				50			5.00E+01	2-Methylphenol	2.14E+02	1.00	1.00	Yes	Yes	IRIS
3-Nitroaniline	1	rat	0.35				5.4			5.40E+00	2,4 Dinitrophenol	2.31E+01	1.00	1.00	Yes	Yes	IRIS
3-Nitrotoluene	1	dog	14				0.2			2.98E-01	2,4-Dinitrotoluene	1.27E+00	1.00	1.00	Yes	Yes	ATSDR
4,4'-DDD	1	rat	0.32				0.8			8.00E-01	4,4'-DDT	3.42E+00	1.00	1.00	Yes	Yes	EFA West 1998
4,4'-DDE	1	rat	0.32				0.8			8.00E-01	4,4'-DDT	3.42E+00	1.00	1.00	Yes	Yes	EFA West 1998
4,4'-DDT	1	rat	0.32	NOAEL	chronic	reproductive	0.8			8.00E-01		3.42E+00	1.00	1.00	Yes	Yes	EFA West 1998
4,6-Dinitro-2-methylphenol	1	rat	0.35				5.4			5.40E+00	2,4 Dinitrophenol	2.31E+01	1.00	1.00	Yes	Yes	IRIS
4-AMINO-2,6-DNT	1	dog	14				0.2			2.98E-01	2,4-Dinitrotoluene	1.27E+00	1.00	1.00	Yes	Yes	ATSDR
4-bromofluorobenzene	1	rat	0.35				14.8			1.48E+01	1,2,4-Trichlorobenzene	6.32E+01	1.00	1.00	Yes	Yes	IRIS
4-Bromophenyl phenyl ether	1	rat	0.35				1			1.00E+00	Decabromodiphenyl ether	4.27E+00	1.00	1.00	Yes	Yes	IRIS
4-Chloro-3-methylphenol	1	rat	0.35				5			5.00E+00	2-Chlorophenol	2.14E+01	1.00	1.00	Yes	Yes	IRIS
4-Chloroaniline	1	rat	0.35	LOAEL	chronic	growth, histology	12.5		5	2.50E+00		1.07E+01	1.00	1.00	Yes	Yes	IRIS
4-Chlorophenyl phenyl ether	1	rat	0.35				0.3			3.00E-01	2,4-Dichlorophenol	1.28E+00	1.00	1.00	Yes	Yes	IRIS
4-Chlorotoluene	1	rat	0.35				75			7.50E+01	1,4-Dichlorobenzene	3.20E+02	1.00	1.00	Yes	Yes	ATSDR
4-Methyl-2-Pentanone	1	rat	0.35				570			5.70E+02	Hexane	2.43E+03	1.00	1.00	Yes	Yes	HEAST FY 1997
4-Methylphenol	1	rat	0.35				50			5.00E+01	2-Methylphenol	2.14E+02	1.00	1.00	Yes	Yes	IRIS
4-Nitroaniline	1	rat	0.35				5.4			5.40E+00	2,4-Dinitrophenol	2.31E+01	1.00	1.00	Yes	Yes	IRIS
4-Nitrophenol	1	rat	0.35				5.4			5.40E+00	2,4-Dinitrophenol	2.31E+01	1.00	1.00	Yes	Yes	IRIS
4-Nitrotoluene	1	dog	14				0.2			2.98E-01	2,4-Dinitrotoluene	1.27E+00	1.00	1.00	Yes	Yes	ATSDR
Acenaphthene	1	mouse	0.03	NOAEL	subchronic	growth, organ toxicity	175	2		8.75E+01		2.70E+02	1.00	2.41	Yes		IRIS
Acenaphthylene	1	mouse	0.03				175			1.75E+02	Acenaphthene	7.47E+02	1.00	1.00	Yes	Yes	IRIS
Acetone	1	rat	0.35	NOAEL	subchronic	kidney and liver toxicity	10	Y		1.00E+01		4.27E+01	1.00	1.00	Yes	Yes	Sample et al. 1996
Acrolein	1	rat	0.35				53			5.30E+01	Acrylic acid	2.26E+02	1.00	1.00	Yes	Yes	IRIS
Acrylonitrile	1	rat	0.35	NOAEL	chronic	early mortality	0.1			1.00E-01		4.27E-01	1.00	1.00	Yes	Yes	ATSDR
Aldrin	1	rat	0.065	LOAEL	subchronic	Decrease in conditioned avoidance response	1	Y	Y	1.00E+00		4.27E+00	1.00	1.00	Yes	Yes	EFA West 1998
alpha-BHC	1	rat	0.176				0.05			5.00E-02	Lindane	2.14E-01	1.00	1.00	Yes	Yes	EFA West 1998
Aniline	1	rat	0.35				12.5			1.25E+01	4-Chloroaniline	5.34E+01	1.00	1.00	Yes	Yes	IRIS
Anthracene	1	mouse	0.03	NOAEL	subchronic	growth, histology	1000	2		5.00E+02		1.43E+03	1.00	2.82	Yes		IRIS
Azobenzene	1	rat	0.35				1.0			1.00E+00	Benzene	4.27E+00	1.00	1.00	Yes	Yes	Sample et al. 1996
Benzene	1	rat	0.35	NOAEL	chronic	hematopoetic	1.0			1.00E+00		4.27E+00	1.00	1.00	Yes	Yes	ATSDR
Benzidine	1	mouse	0.03	LOAEL	chronic	growth, organ toxicity	2.7		5	5.40E-01		2.31E+00	1.00	1.00	Yes	Yes	IRIS
Benzo(a)anthracene	1	mouse	0.03				1.31			1.31E+00	Benzo(a)pyrene	5.60E+00	1.00	1.00	Yes	Yes	EFA West 1998
Benzo(a)pyrene	1	mouse	0.03	NOAEL	chronic	longevity, pulmonary edema	1.31			1.31E+00		5.60E+00	1.00	1.00	Yes	Yes	EFA West 1998
Benzo(b)fluoranthene	1	mouse	0.03				1.31			1.31E+00	Benzo(a)pyrene	5.60E+00	1.00	1.00	Yes	Yes	EFA West 1998
Benzo(g,h,i)perylene	1	mouse	0.03				1.31			1.31E+00	Benzo(a)pyrene	6.42E+00	1.00	0.53	Yes		EFA West 1998
Benzo(k)fluoranthene	1	mouse	0.03				1.31			1.31E+00	Benzo(a)pyrene	5.76E+00	1.00	0.89	Yes		EFA West 1998
Benzoic Acid	1	human	70	NOAEL	chronic	no adverse medical symptoms observed	4.4			7.23E+00		3.09E+01	1.00	1.00	Yes	Yes	IRIS
Benzyl Alcohol	1	human	70				4.4			7.23E+00	Benzoic Acid	3.09E+01	1.00	1.00	Yes	Yes	IRIS
beta-BHC	1	rat	0.176				0.05			5.00E-02	Lindane	2.14E-01	1.00	1.00	Yes	Yes	EFA West 1998
bis(2-Chloroethoxy)methane	1	mouse	0.03				35.8			3.58E+01	bis(2-Chloroisopropyl) ether	1.53E+02	1.00	1.00	Yes	Yes	IRIS
bis(2-Chloroethyl)ether	1	mouse	0.03				35.8			3.58E+01	bis(2-Chloroisopropyl) ether	1.53E+02	1.00	1.00	Yes	Yes	IRIS
bis(2-Chloroisopropyl) ether	1	mouse	0.03	NOAEL	chronic	hematopoetic	35.8			3.58E+01		1.53E+02	1.00	1.00	Yes	Yes	IRIS
Bis(2-ethylhexyl)phthalate	1	mouse	0.03	NOAEL	chronic	reproduction	18.33			1.83E+01		7.83E+01	1.00	1.00	Yes	Yes	Sample et al. 1996
Bromobenzene	1	mouse	0.03				1			1.00E+00	Benzene	4.27E+00	1.00	1.00	Yes	Yes	Sample et al. 1996
Bromochloromethane	1	rat	0.35				5.85			5.85E+00	Methylene chloride	2.50E+01	1.00	1.00	Yes	Yes	Sample et al. 1996
Bromodichloromethane	1	mouse	0.03	LOAEL	chronic	kidney toxicity	17.9		5	3.58E+00		1.53E+01	1.00	1.00	Yes	Yes	IRIS
Bromoform	1	rat	0.35	NOAEL	subchronic	organ toxicity	17.9	2		8.95E+00		3.82E+01	1.00	1.00	Yes	Yes	IRIS
Bromomethane	1	rat	0.35				5.85			5.85E+00	Methylene chloride	2.50E+01	1.00	1.00	Yes	Yes	Sample et al. 1996
Butyl benzyl phthalate	1	rat	0.35	NOAEL	subchronic	growth, organ toxicity	159	2		7.95E+01		3.40E+02	1.00	1.00	Yes	Yes	IRIS
Carbazole	1	mouse	0.03				1000			1.00E+03	Anthracene	4.27E+03	1.00	1.00	Yes	Yes	IRIS
Carbon disulfide	1	rabbit	1.13	NOAEL	chronic	fetal toxicity/malformations	11			1.10E+01		4.70E+01	1.00	1.00	Yes	Yes	IRIS
Carbon tetrachloride	1	rat	0.35	NOAEL	subchronic	liver toxicity	0.71	2		3.55E-01		1.52E+00	1.00	1.00	Yes	Yes	IRIS
Chlordane	1	rat	0.35	NOAEL	chronic	liver toxicity	0.08			8.00E-02		3.42E-01	1.00	1.00	Yes	Yes	Khasawinah and Grutsch 1989
Chlorobenzene	1	dog	14	NOAEL	subchronic	organ toxicity	27.25	2		2.03E+01		8.68E+01	1.00	1.00	Yes	Yes	IRIS
Chlorodibromomethane	1	mouse	0.03				17.9			1.79E+01	Bromodichloromethane	7.65E+01	1.00	1.00	Yes	Yes	IRIS
Chloroethane	1	mouse	0.03				17			1.70E+01	trans-1,2-dichloroethene	7.26E+01	1.00	1.00	Yes	Yes	Sample et al. 1996
Chloroform	1	dog	14	LOAEL	chronic	liver toxicity	1		5	5.57E-02		2.38E-01	1.00	1.00	Yes	Yes	IRIS[c]

Calculation of Soil Ecological Screening Levels for Terrestrial Mammals
Santa Susana Field Laboratory

Chemical	TEF	Test Species Common Name	Test Species Body Weight (kg)	Endpoint	Study Type	Effect to Test Organism	Toxicity Value (mg/kg-day)	Subchronic to Chronic UF	LOAEL to NOAEL UF	Rodent NOAEL-Equiv TRV (mg/kg-day)	Toxicity Value Surrogate[a]	Mammalian ESL[b] (mg/kg soil)	Plant BAFc (unitless)	Invertebrate BAFc (unitless)	Default Plant BAF (unitless)	Default Invertebrate BAF (unitless)	Initial Compilation Source
Chloromethane	1	rat	0.35				5.85			5.85E+00	Methylene chloride	2.50E+01	1.00	1.00	Yes	Yes	Sample et al. 1996
Chlorotrifluoroethene	1	dog	14				2.5	Y		3.73E+00	1,1-Dichloroethene	1.59E+01	1.00	1.00	Yes	Yes	Sample et al. 1996
Chlorotrifluoromethane	1	rat	0.35				15			1.50E+01	Dichlorodifluoromethane	6.41E+01	1.00	1.00	Yes	Yes	IRIS
Chrysene	1	mouse	0.03				1.31			1.31E+00	Benzo(a)pyrene	2.36E+00	2.78	1.86			EFA West 1998
cis-1,2-Dichloroethene	1	rat	0.35	NOAEL	subchronic	body weight gain	32	2		1.60E+01		6.83E+01	1.00	1.00	Yes	Yes	ATSDR
cis-1,3-Dichloropropene	1	rat	0.35				5.1			5.10E+00	1,3-Dichloropropene	2.18E+01	1.00	1.00	Yes	Yes	IRIS
Decahydronaphthalene	1	rat	0.28				50			5.00E+01	Naphthalene	2.14E+02	1.00	1.00	Yes	Yes	EFA West 1998
delta-BHC	1	mouse	0.03				0.05			5.00E-02	Lindane	2.14E-01	1.00	1.00	Yes	Yes	EFA West 1998
Dibenz(a,h)anthracene	1	mouse	0.03				1.31			1.31E+00	Benzo(a)pyrene	5.60E+00	1.00	1.00	Yes	Yes	EFA West 1998
Dibenzofuran	1	mouse	0.03				1000			1.00E+03	Anthracene	4.27E+03	1.00	1.00	Yes	Yes	IRIS
Dibromochloromethane	1	rat	0.35	NOAEL	subchronic	hepatic lesions	21.4	2		1.07E+01		4.57E+01	1.00	1.00	Yes	Yes	IRIS
Dibromomethane	1	rat	0.35				5.85			5.85E+00	Methylene chloride	2.50E+01	1.00	1.00	Yes	Yes	Sample et al. 1996
Dichlorobenzenes	1	rat	0.35				75			7.50E+01	1,4-Dichlorobenzene	3.20E+02	1.00	1.00	Yes	Yes	ATSDR
Dichlorodifluoromethane	1	rat	0.35	NOAEL	chronic	growth	15			1.50E+01		6.41E+01	1.00	1.00	Yes	Yes	IRIS
Dieldrin	1	rat	0.35	NOAEL	chronic	reproduction	0.02			2.00E-02		8.54E-02	1.00	1.00	Yes	Yes	Sample et al. 1996
Diethylphthalate	1	mouse	0.03	NOAEL	*	body weight gain	1625			1.63E+03		6.94E+03	1.00	1.00	Yes	Yes	ATSDR
Dimethyl phthalate	1	mouse	0.03				1625			1.63E+03	Diethylphthalate	6.94E+03	1.00	1.00	Yes	Yes	ATSDR
Dimethylphenol isomer	1	rat	0.35				50			5.00E+01	2,4-Dimethylphenol	2.14E+02	1.00	1.00	Yes	Yes	IRIS
Di-n-butylphthalate	1	rat	0.35	NOAEL	chronic	reproduction (decreased pup weight)	120			1.20E+02		5.13E+02	1.00	1.00	Yes	Yes	ATSDR
Di-n-octyl phthalate	1	rat	0.35	NOAEL	chronic	reproduction	350			3.50E+02		1.49E+03	1.00	1.00	Yes	Yes	ATSDR
Endosulfan Sulfate	1	rat	0.35	NOAEL	subchronic	reproduction	0.15	Y		1.50E-01		6.41E-01	1.00	1.00	Yes	Yes	Sample et al. 1996
Endrin	1	dog	14	NOAEL	chronic	neurologic/systemic	0.025			3.11E-02		1.33E-01	1.00	1.00	Yes	Yes	ATSDR
Ethylbenzene	1	rat	0.35	NOAEL	subchronic	liver and kidney toxicity	97.1	2		4.86E+01		2.07E+02	1.00	1.00	Yes	Yes	IRIS
Fluoranthene	1	mouse	0.03	NOAEL	subchronic	liver and kidney toxicity, hematology	125	2		6.25E+01		1.24E+02	2.84	0.91			IRIS
Fluorene	1	mouse	0.03	NOAEL	subchronic	hematology	125	2		6.25E+01		1.48E+02	1.00	3.94	Yes		IRIS
Formaldehyde	1	dog	12	NOAEL	chronic	reproduction	9.4			1.39E+01		5.93E+01	1.00	1.00	Yes	Yes	Sample et al. 1996
Freon 113	1	human	70				273			4.48E+02	1,1,2-Trichloro-1,2,2-trifluoroethane	1.92E+03	1.00	1.00	Yes	Yes	IRIS
Heptachlor	1	rat	0.1	LOAEL	chronic	weight gain, prostate androgenic receptor effects	0.13		Y	1.30E-01		5.55E-01	1.00	1.00	Yes	Yes	EFA WEST 1998
Heptachlor Epoxide	1	dog	14	LOAEL	chronic	liver toxicity	0.0125		5	3.73E-03		1.59E-02	1.00	1.00	Yes	Yes	IRIS
Hexachlorobenzene	1	rat	0.35	NOAEL	chronic	liver toxicity	0.08			8.00E-02		3.42E-01	1.00	1.00	Yes	Yes	IRIS
Hexachlorobutadiene	1	rat	0.35	NOAEL	chronic	kidney toxicity	0.2			2.00E-01		8.54E-01	1.00	1.00	Yes	Yes	ATSDR
Hexachlorocyclopentadiene	1	rat	0.35	NOAEL	subchronic	stomach lesions	6	2		3.00E+00		1.28E+01	1.00	1.00	Yes	Yes	IRIS
Hexachloroethane	1	rat	0.35	NOAEL	subchronic	kidney toxicity	1	2		5.00E-01		2.14E+00	1.00	1.00	Yes	Yes	IRIS
Hexanal	1	rat	0.35				570			5.70E+02	Hexane	2.43E+03	1.00	1.00	Yes	Yes	HEAST FY 1997
HMX	1	mouse	0.03	NOAEL	subchronic	mortality	30	2		1.50E+01		6.41E+01	1.00	1.00	Yes	Yes	Talmage et al. 1999
Hydrazine	1	mouse	0.03	LOAEL	chronic	survival and histopathology	0.059		5	1.18E-02	1,2 dimethylhydrazine	5.04E-02	1.00	1.00	Yes	Yes	ATSDR
Indeno(1,2,3-cd)pyrene	1	mouse	0.03				1.31			1.31E+00	Benzo(a)pyrene	5.82E+00	1.00	0.86	Yes		EFA West 1998
Isophorone	1	dog	14	NOAEL	subchronic	kidney toxicity	150	2		1.12E+02		4.78E+02	1.00	1.00	Yes	Yes	IRIS
Isopropylbenzene	1	rat	0.35				97.1			9.71E+01	Ethylbenzene	4.15E+02	1.00	1.00	Yes	Yes	IRIS
Lindane	1	rat	0.176	NOAEL	chronic	reproduction, development	0.05			5.00E-02		2.14E-01	1.00	1.00	Yes	Yes	EFA West 1998
m,p-Xylene	1	rat	0.35				150			1.50E+02	Xylenes	6.41E+02	1.00	1.00	Yes	Yes	Condie et al.1988
Methyl Isobutyl Ketone	1	rat	0.35				1771			1.77E+03	2-Butanone	7.56E+03	1.00	1.00	Yes	Yes	IRIS
Methyl tert-butyl ether	1	rat	0.35	LOAEL	subchronic	mortality	143	2	5	1.43E+01		6.10E+01	1.00	1.00	Yes	Yes	ATSDR
Methylene chloride	1	rat	0.35	NOAEL	chronic	organ toxicity	5.85			5.85E+00		2.50E+01	1.00	1.00	Yes	Yes	Sample et al. 1996
Methylphenol	1	rat	0.35				50			5.00E+01	2-Methylphenol	2.14E+02	1.00	1.00	Yes	Yes	IRIS
Monochlorobenzene	1	rat	0.35				75			7.50E+01	1,4-Dichlorobenzene	3.20E+02	1.00	1.00	Yes	Yes	ATSDR
Monomethylhydrazine	1	mouse	0.03	LOAEL	chronic	survival and histopathology	0.059		5	1.18E-02	1,2 dimethylhydrazine	5.04E-02	1.00	1.00	Yes	Yes	ATSDR
Naphthalene	1	rat	0.28	NOAEL	chronic	reproductive, systemic effects	50			5.00E+01		2.14E+02	1.00	1.00	Yes	Yes	EFA West 1998
Naphthalene	1	rat	0.28	NOAEL	chronic	reproductive, systemic effects	50			5.00E+01		2.14E+02	1.00	1.00	Yes	Yes	EFA West 1998
n-Butylbenzene	1	rat	0.35				97.1			9.71E+01	Ethylbenzene	4.15E+02	1.00	1.00	Yes	Yes	IRIS
Nitrobenzene	1	mouse/rat	0.03	LOAEL	subchronic	organ toxicity	4.6	2	5	4.60E-01		1.96E+00	1.00	1.00	Yes	Yes	IRIS
Nitrobenzene	1	mouse	0.03	LOAEL	subchronic	organ toxicity	4.6	2	5	4.60E-01		1.96E+00	1.00	1.00	Yes	Yes	IRIS
Nitrosodimethylamine	1	rat	0.35				13			1.30E+01	Tetryl	5.55E+01	1.00	1.00	Yes	Yes	Talmage et al. 1999
N-Nitrosodimethylamine	1	rat	0.35				13			1.30E+01	Tetryl	5.55E+01	1.00	1.00	Yes	Yes	Talmage et al. 1999
N-Nitrosodi-n-propylamine	1	rat	0.35				13			1.30E+01	Tetryl	5.55E+01	1.00	1.00	Yes	Yes	Talmage et al. 1999
N-Nitrosodiphenylamine	1	rat	0.35				13			1.30E+01	Tetryl	5.55E+01	1.00	1.00	Yes	Yes	Talmage et al. 1999
Nonane	1	rat	0.35				570			5.70E+02	Hexane	2.43E+03	1.00	1.00	Yes	Yes	HEAST FY 1997
n-Propylbenzene	1	rat	0.35				97.1			9.71E+01	Ethylbenzene	4.15E+02	1.00	1.00	Yes	Yes	IRIS
o-Xylene	1	rat	0.35				150			1.50E+02	Xylenes	6.41E+02	1.00	1.00	Yes	Yes	Condie et al.1988
Pentachlorophenol	1	rat	0.35	NOAEL	chronic	liver and kidney toxicity	3			3.00E+00		1.28E+01	1.00	1.00	Yes	Yes	Schwetz et al. 1978 (IRIS)
Pentanal	1	rat	0.35				570			5.70E+02	Hexane	2.43E+03	1.00	1.00	Yes	Yes	HEAST FY 1997
Phenanthrene	1	mouse	0.03				75			7.50E+01	Pyrene	6.20E+01	7.19	1.85			IRIS
Phenol	1	rat	0.35	NOAEL	chronic	reproduction	60			6.00E+01		2.56E+02	1.00	1.00	Yes	Yes	IRIS
p-Isopropyltoluene	1	rat	0.35				150			1.50E+02	Xylenes	6.41E+02	1.00	1.00	Yes	Yes	Condie et al.1988
Pyrene	1	mouse	0.03	NOAEL	subchronic	kidney toxicity	75	2		3.75E+01		7.63E+01	1.91	2.92			IRIS
Pyridine	1	rat	0.35	NOAEL	subchronic	liver toxicity	1	2		5.00E-01		2.14E+00	1.00	1.00	Yes	Yes	IRIS
RDX	1	rat	0.35	NOAEL	chronic	organ toxicity	10			1.00E+01		4.27E+01	1.00	1.00	Yes	Yes	Talmage et al. 1999
sec-Butylbenzene	1	rat	0.35				97.1			9.71E+01	Ethylbenzene	4.15E+02	1.00	1.00	Yes	Yes	IRIS
Styrene	1	dog	14	NOAEL	subchronic	growth, hematotogy	200	2		1.49E+02		6.37E+02	1.00	1.00	Yes	Yes	IRIS
tert-Butylbenzene	1	rat	0.35				97.1			9.71E+01	Ethylbenzene	4.15E+02	1.00	1.00	Yes	Yes	IRIS
Tetrachloroethene	1	mouse	0.011	LOAEL	subchronic	behavior	5	2	5	5.00E-01		2.14E+00	1.00	1.00	Yes	Yes	Fredriksson et al. 1993
Tetramethylcyclohexane Isomer	1	rat	0.35				150			1.50E+02	Xylenes	6.41E+02	1.00	1.00	Yes	Yes	Condie et al.1988
Tetryl	1	rat	0.35	NOAEL	subchronic	organ weight, kidney, blood cell counts	13	2		6.50E+00		2.78E+01	1.00	1.00	Yes	Yes	Talmage et al. 1999
Thiobismethane	1	rabbit	1.13				11			1.10E+01	Carbon disulfide	4.70E+01	1.00	1.00	Yes	Yes	IRIS
Toluene	1	mouse	0.03	LOAEL	chronic	behavior	2.88		5	5.76E-01		2.46E+00	1.00	1.00	Yes	Yes	Kostas and Hotchin 1981
Total xylenes	1	rat	0.35	LOAEL	subchronic	liver and kidney toxicity	150	2	5	1.50E+01		6.41E+01	1.00	1.00	Yes	Yes	Condie et al.1988
trans-1,2-Dichloroethene	1	mouse	0.03	NOAEL	subchronic	organ toxicity	452	2		2.26E+02		9.65E+02	1.00	1.00	Yes	Yes	ATSDR
trans-1,3-Dichloropropene	1	rat	0.35	LOAEL	chronic	organ toxicity	5.1		5	1.02E+00		4.36E+00	1.00	1.00	Yes	Yes	IRIS
Trichloroethene	1	mouse	0.03	LOAEL	subchronic	liver toxicity	0.7	Y	Y	7.00E-01		2.99E+00	1.00	1.00	Yes	Yes	Sample et al. 1996
Trichlorofluoromethane	1	rat/mice	0.35	LOAEL	chronic	survival and histopathology	349		5	6.98E+01		2.98E+02	1.00	1.00	Yes	Yes	IRIS
Trimethyl benzene	1	rat	0.35				150			1.50E+02	Xylenes	6.41E+02	1.00	1.00	Yes	Yes	Condie et al.1988
Unsymmetrical dimethylhydrazine	1	mouse	0.03	LOAEL	chronic	survival and histopathology	0.059		5	1.18E-02	1,2 dimethylhydrazine	5.04E-02	1.00	1.00	Yes	Yes	ATSDR
Vinyl acetate	1	rat	0.35	NOAEL	chronic	pup body weight gain	117			1.17E+02		5.00E+02	1.00	1.00	Yes	Yes	ATSDR

Calculation of Soil Ecological Screening Levels for Terrestrial Mammals
Santa Susana Field Laboratory

Chemical	TEF	Test Species Common Name	Test Species Body Weight (kg)	Endpoint	Study Type	Effect to Test Organism	Toxicity Value (mg/kg-day)	Subchronic to Chronic UF	LOAEL to NOAEL UF	Rodent NOAEL-Equiv TRV (mg/kg-day)	Toxicity Value Surrogate[a]	Mammalian ESL[b] (mg/kg soil)	Plant BAFc (unitless)	Invertebrate BAFc (unitless)	Default Plant BAF (unitless)	Default Invertebrate BAF (unitless)	Initial Compilation Source
Vinyl chloride	1	rat	0.35	NOAEL	chronic	longevity	0.17			1.70E-01		7.26E-01	1.00	1.00	Yes	Yes	Sample et al. 1996

Notes:
(a) # Indicates no appropriate structurally related surrogate available. Surrogate chosen is the lowest within the chemical group.
(b) Food and incidental soil intake values calculated as described in the text.

Deer Mouse Exposure Factors:	
Default deer mouse bodyweight (kg)	0.0179
Ingestion rate(kg/day-kg body weight) =	0.213
Fraction plant consumed (dry weight) (unitless) =	0.7
Fraction invertebrate consumed (dry weight) (unitless) =	0.3
Soil consumed (dry weight) at 10% of intake (kg/day-kg bodyweight) =	0.0213

(c) BAFs are actual data or a default of 1.
(d) Secondary study selected because primary study was an anecdotal account of human cataract formation, not necessarily relevant to ecological endpoints.
(e) BMDL10
* Indicates that experimental detail not available in cited source document.
BAF - bioaccumulation factor
ESL - ecological screening level
kg - kilogram
LOAEL - lowest-observable-adverse-effect-level
mg - milligram
NOAEL - no-observable-adverse-effect-level
PCB - polychlorinated biphenyl
SVOC - semivolatile organic compound
TEF - toxicity equivalence factor
TRV - toxicity reference value
UF - uncertainty factor
VOC - volatile organic compound
Y - uncertainty factor used to derive TRV was included by original source

APPENDIX C

ATTACHMENT C-2

CALCULATION OF ECOLOGICAL SCREENING LEVELS FOR TERRESTRIAL AVIAN SPECIES

Appendix C Attachment C-2 (1 of 2)

Calculation of Soil Ecological Screening Levels for Terrestrial Avian Species
Santa Susana Field Laboratory

Chemical	TEF	Test Species Common Name	Endpoint	Study Type	Effect to Test Organism	Toxicity Value (mg/kg-day)	LD_{50} to NOAEL UF	Subchronic to Chronic UF	LOAEL to NOAEL UF	Avian NOAEL-Equiv TRV (mg/kg-day)	Toxicity Value Surrogate[a]	Avian ESL[b] (mg/kg soil)	Plant BAF[b] (unitless)	Invertebrate BAF[b] (unitless)	Default Plant BAF (unitless)	Default Invertebrate BAF (unitless)	Initial Compilation Source	
1,2,3,4,6,7,8-HpCDD	0.001	Ring-Necked Pheasant				1.43E-02				1.43E-02	2,3,7,8-TCDD	1.33E-01	0.32	0.54			TEF from Van den Berg et al. 1998	
1,2,3,4,6,7,8-HpCDF	0.01	Ring-Necked Pheasant				1.43E-03				1.43E-03	2,3,7,8-TCDD	8.69E-03	1.00	0.54	Yes		TEF from Van den Berg et al. 1998	
1,2,3,4,7,8,9-HpCDF	0.01	Ring-Necked Pheasant				1.43E-03				1.43E-03	2,3,7,8-TCDD	6.35E-03	1.00	1.00	Yes	Yes	TEF from Van den Berg et al. 1998	
1,2,3,4,7,8-HxCDD	0.05	Ring-Necked Pheasant				2.86E-04				2.86E-04	2,3,7,8-TCDD	1.46E-03	1.00	0.78	Yes		TEF from Van den Berg et al. 1998	
1,2,3,4,7,8-HxCDF	0.1	Ring-Necked Pheasant				1.43E-04				1.43E-04	2,3,7,8-TCDD	7.97E-04	1.00	0.65	Yes		TEF from Van den Berg et al. 1998	
1,2,3,6,7,8-HxCDD	0.01	Ring-Necked Pheasant				1.43E-03				1.43E-03	2,3,7,8-TCDD	7.40E-03	1.00	0.76	Yes		TEF from Van den Berg et al. 1998	
1,2,3,6,7,8-HxCDF	0.1	Ring-Necked Pheasant				1.43E-04				1.43E-04	2,3,7,8-TCDD	1.12E-03	1.00	0.26	Yes		TEF from Van den Berg et al. 1998	
1,2,3,7,8,9-HxCDD	0.1	Ring-Necked Pheasant				1.43E-04				1.43E-04	2,3,7,8-TCDD	6.60E-04	1.00	0.93	Yes		TEF from Van den Berg et al. 1998	
1,2,3,7,8,9-HxCDF	0.1	Ring-Necked Pheasant				1.43E-04				1.43E-04	2,3,7,8-TCDD	6.35E-04	1.00	1.00	Yes	Yes	TEF from Van den Berg et al. 1998	
1,2,3,7,8-PeCDD	1	Ring-Necked Pheasant				1.43E-05				1.43E-05	2,3,7,8-TCDD	6.84E-05	1.00	0.88	Yes		TEF from Van den Berg et al. 1998	
1,2,3,7,8-PeCDF	0.1	Ring-Necked Pheasant				1.43E-04				1.43E-04	2,3,7,8-TCDD	9.57E-04	1.00	0.43	Yes		TEF from Van den Berg et al. 1998	
2,3,4,6,7,8-HxCDF	0.1	Ring-Necked Pheasant				1.43E-04				1.43E-04	2,3,7,8-TCDD	8.56E-04	1.00	0.56	Yes		TEF from Van den Berg et al. 1998	
2,3,4,7,8-PeCDF	1	Ring-Necked Pheasant				1.43E-05				1.43E-05	2,3,7,8-TCDD	8.88E-05	1.00	0.51	Yes		TEF from Van den Berg et al. 1998	
2,3,7,8-TCDD	1	Ring-Necked Pheasant	NOAEL	chronic	reproduction	1.43E-05				1.43E-05		6.35E-05	1.00	1.00	Yes	Yes	Sample et al. 1996	
2,3,7,8-TCDF	1	Chicken	LOAEL	sub-chronic	mortality	0.000001		Y	Y	1.00E-06		4.39E-06	1.00	1.02	Yes		TEF from Van den Berg et al. 1998	
OCDD	0.0001	Ring-Necked Pheasant				1.43E-01				1.43E-01	2,3,7,8-TCDD	1.58E+00	0.23	0.47			TEF from Van den Berg et al. 1998	
OCDF	0.0001	Ring-Necked Pheasant				1.43E-01				1.43E-01	2,3,7,8-TCDD	1.38E+00	0.33	0.50			TEF from Van den Berg et al. 1998	
Aroclor-1254	1	Screech Owl	NOAEL	chronic	reproduction	0.41				4.10E-01		3.68E-01	2.97	6.47			Sample et al. 1996	
Aroclor-1260	1	Chicken	LOAEL	chronic	reproduction	0.09			Y	9.00E-02		8.07E-02	2.97	6.47			EFA West 1998	
PCB-105	0.0001	Ring-Necked Pheasant				1.43E-01				1.43E-01	2,3,7,8-TCDD	8.63E-02	3.30	10.36			TEF from Van den Berg et al. 1998	
PCB-114	0.0001	Ring-Necked Pheasant				1.43E-01				1.43E-01	2,3,7,8-TCDD	3.73E-02	3.68	26.61			TEF from Van den Berg et al. 1998	
PCB-118	0.00001	Ring-Necked Pheasant				1.43E+00				1.43E+00	2,3,7,8-TCDD	7.99E-01	3.15	11.47			TEF from Van den Berg et al. 1998	
PCB-123	0.00001	Ring-Necked Pheasant				1.43E+00				1.43E+00	2,3,7,8-TCDD	7.29E-01	3.42	12.59			TEF from Van den Berg et al. 1998	
PCB-126	0.1	Ring-Necked Pheasant				1.43E-04				1.43E-04	2,3,7,8-TCDD	1.59E-04	2.23	5.32			TEF from Van den Berg et al. 1998	
PCB-156	0.0001	Ring-Necked Pheasant				1.43E-01				1.43E-01	2,3,7,8-TCDD	1.45E-01	2.49	5.80			TEF from Van den Berg et al. 1998	
PCB-157	0.0001	Ring-Necked Pheasant				1.43E-01				1.43E-01	2,3,7,8-TCDD	1.42E-01	2.63	5.87			TEF from Van den Berg et al. 1998	
PCB-167	0.00001	Ring-Necked Pheasant				1.43E+00				1.43E+00	2,3,7,8-TCDD	1.40E+00	2.77	5.88			TEF from Van den Berg et al. 1998	
PCB-169	0.001	Ring-Necked Pheasant				1.43E-02				1.43E-02	2,3,7,8-TCDD	6.35E-02	1.00	1.00	Yes	Yes	TEF from Van den Berg et al. 1998	
PCB-189	0.00001	Ring-Necked Pheasant				1.43E+00				1.43E+00	2,3,7,8-TCDD	2.82E+00	2.16	2.39			TEF from Van den Berg et al. 1998	
PCB-77	0.05	Ring-Necked Pheasant				2.86E-04				2.86E-04	2,3,7,8-TCDD	2.76E-04	2.38	6.24			TEF from Van den Berg et al. 1998	
PCB-81	0.1	Ring-Necked Pheasant				1.43E-04				1.43E-04	2,3,7,8-TCDD	1.36E-04	3.00	5.98			TEF from Van den Berg et al. 1998	
Aluminum	1	Mallard Duck	NOAEL	chronic	reproduction	109.7				1.10E+02		9.12E+02	0.74	0.37			Sample et al. 1996	
Arsenic	1	Mallard Duck	NOAEL	chronic	growth/development	5.14				5.14E+00		3.66E+01	0.75	0.52			Sample et al. 1996	
Barium	1	Chicken	NOAEL	sub-chronic	mortality	20.8		Y		2.08E+01		4.49E+01	1.00	2.80			Sample et al. 1996	
Boron	1	Mallard Duck	NOAEL	chronic	reproduction	28.8				2.88E+01		2.31E+01	7.40	4.64			Sample et al. 1996	
Cadmium	1	Mallard Duck	LOAEL	chronic	growth/development	0.08			Y	8.00E-02		2.27E-02	10.80	19.69			EFA West 1998	
Copper	1	Broiler chicks	NOAEL	sub-chronic	weight gain	2.3		Y		2.30E+00		1.09E+00	1.88	14.72			EFA West 1998	
Lead	1	Japanese Quail	LOAEL	chronic	reproduction	0.014			Y	1.40E-02		6.32E-02	2.14	0.24			EFA West 1998	
Manganese	1	Japanese Quail	NOAEL	chronic	development, behavior	77.6			Y	7.76E+01		3.44E+02	1.00	1.00	Yes	Yes	EFA West 1998	
Mercury	1	Japanese Quail	NOAEL	chronic	reproduction	0.45				4.50E-01		8.79E-01	0.82	3.28			Sample et al. 1996	
Methyl Mercury	1	Mallard Duck	LOAEL	chronic	reproduction	0.039			Y	3.90E-02		1.73E-01	1.00	1.00	Yes	Yes	EFA West 1998	
Molybdenum	1	Chicken	LOAEL	chronic	reproduction	3.5			Y	3.50E+00		1.81E+00	13.58	5.91			Sample et al. 1996	
Nickel	1	Mallard Duck	NOAEL	sub-chronic	growth/development	1.38		Y		1.38E+00		1.47E+00	7.70	2.10			EFA West 1998	
Selenium	1	Mallard Duck	NOAEL	chronic	reproduction	0.23				2.30E-01		6.83E-01	1.00	1.84	Yes		EFA West 1998	
Vanadium	1	Mallard Duck	NOAEL	chronic	mortality	11.4				1.14E+01		1.04E+02	0.69	0.32			Sample et al. 1996	
Zinc	1	Chicken	NOAEL	chronic	reproduction	14.5				1.45E+01		2.59E+01	1.62	3.13			Sample et al. 1996	
1,2-Dichloroethane	1	Chicken	NOAEL	chronic	reproduction	17.2				1.72E+01		7.63E+01	1.00	1.00	Yes	Yes	Sample et al. 1996	
1,3-Dinitrobenzene	1	Red-Winged Blackbird	LD_{50}	acute	mortality	42.2	100			4.22E-01		1.87E+00	1.00	1.00	Yes	Yes	Schafer, 1972[c]	*
2,4-Dinitrophenol	1	Red-Winged Blackbird	LD_{50}	acute	mortality	13.3	100			1.33E-01		5.90E-01	1.00	1.00	Yes	Yes	Schafer et al. 1983[c]	
2-Nitroaniline	1	Red-Winged Blackbird	LD_{50}	acute	mortality	750	100			7.50E+00		3.33E+01	1.00	1.00	Yes	Yes	Schafer et al. 1983[c]	
3-Nitroaniline	1	Red-Winged Blackbird	LD_{50}	acute	mortality	133	100			1.33E+00		5.90E+00	1.00	1.00	Yes	Yes	Schafer et al. 1983[c]	
4,4'-DDE	1	Brown Pelican	LOAEL	chronic	reproduction	0.0028			Y	2.80E-03	4,4'-DDT	1.24E-02	1.00	1.00	Yes	Yes	Sample et al. 1996	
4,4'-DDT	1	Brown Pelican	LOAEL	chronic	reproduction	0.0028			Y	2.80E-03		1.24E-02	1.00	1.00	Yes	Yes	Sample et al. 1996	
4-Chloroaniline	1	House Sparrow	LD_{50}	acute	mortality	100	100			1.00E+00		4.44E+00	1.00	1.00	Yes	Yes	Schafer et al. 1983[c]	
4-Methylphenol	1	Red-Winged Blackbird	LD_{50}	acute	mortality	96	100			9.60E-01		4.26E+00	1.00	1.00	Yes	Yes	Schafer et al. 1983[c]	
4-Nitroaniline	1	Red-Winged Blackbird	LD_{50}	acute	mortality	75	100			7.50E-01		3.33E+00	1.00	1.00	Yes	Yes	Schafer et al. 1983[c]	
Acenaphthene	1	Red-Winged Blackbird	LD_{50}	acute	mortality	101	100			1.01E+00		2.46E+00	1.00	2.41	Yes		Schafer et al. 1983[c]	
Acetone	1	Japanese Quail	NOAEL	acute	*	10928		2		5.46E+03		2.43E+04	1.00	1.00	Yes	Yes	Hill and Camardese, 1986[d]	*
alpha-BHC	1	Japanese Quail	NOAEL	chronic	reproduction	0.563				5.63E-01		2.50E+00	1.00	1.00	Yes	Yes	Sample et al. 1996	
Aniline Surrogate	1	Red-Winged Blackbird	LD_{50}	acute	mortality	562	100			5.62E+00		2.49E+01	1.00	1.00	Yes	Yes	Schafer et al. 1983[c]	
Anthracene	1	Red-Winged Blackbird	LD_{50}	acute	mortality	111	100			1.11E+00		2.38E+00	1.00	2.82	Yes		Schafer et al. 1983[c]	
Benzoic Acid	1	Red-Winged Blackbird	LD_{50}	acute	mortality	100	100			1.00E+00		4.44E+00	1.00	1.00	Yes	Yes	Schafer et al. 1983[c]	

Calculation of Soil Ecological Screening Levels for Terrestrial Avian Species
Santa Susana Field Laboratory

Chemical	TEF	Test Species Common Name	Endpoint	Study Type	Effect to Test Organism	Toxicity Value (mg/kg-day)	LD_{50} to NOAEL UF	Subchronic to Chronic UF	LOAEL to NOAEL UF	Avian NOAEL-Equiv TRV (mg/kg-day)	Toxicity Value Surrogate[a]	Avian ESL[b] (mg/kg soil)	Plant BAF[b] (unitless)	Invertebrate BAF[b] (unitless)	Default Plant BAF (unitless)	Default Invertebrate BAF (unitless)	Initial Compilation Source	
Benzyl Alcohol	1	Red-Winged Blackbird	LD_{50}	acute	mortality	100	100			1.00E+00		4.44E+00	1.00	1.00	Yes	Yes	Schafer et al. 1983[c]	
beta-BHC	1	Japanese Quail	NOAEL	chronic	reproduction	0.563				5.63E-01		2.50E+00	1.00	1.00	Yes	Yes	Sample et al. 1996	
Bis(2-ethylhexyl)phthalate	1	Ringed Dove	NOAEL	sub-chronic	reproduction	1.11		Y		1.11E+00		4.93E+00	1.00	1.00	Yes	Yes	Sample et al. 1996	
Chlordane	1	European Starling	LD50	acute	mortality	23.4	100			2.34E-01		1.04E+00	1.00	1.00	Yes	Yes	Stickel et al. 1979[e]	*
delta-BHC	1	Japanese Quail	NOAEL	chronic	reproduction	0.563				5.63E-01		2.50E+00	1.00	1.00	Yes	Yes	Sample et al. 1996	
Dieldrin	1	Barn Owl	NOAEL	chronic	reproduction	0.077				7.70E-02		3.42E-01	1.00	1.00	Yes	Yes	Sample et al. 1996	
Dimethylphthalate	1	Red-Winged Blackbird	LD_{50}	acute	mortality	100	100			1.00E+00		4.44E+00	1.00	1.00	Yes	Yes	Schafer et al. 1983[c]	
Di-n-butylphthalate	1	Ringed Dove	LOAEL	chronic	reproduction	0.11			Y	1.10E-01		4.88E-01	1.00	1.00	Yes	Yes	Sample et al. 1996	
Di-n-octylphthalate	1	Ring-Necked Pheasant	LD_{50}	acute	mortality	293.3	100			2.93E+00		1.30E+01	1.00	1.00	Yes	Yes	Hill et al., 1975[f]	*
Endosulfan Sulfate	1	Gray Partridge	NOAEL	chronic	reproduction	10				1.00E+01		4.44E+01	1.00	1.00	Yes	Yes	Sample et al. 1996	
Endrin	1	Screech Owl	LOAEL	chronic	reproduction	0.01			Y	1.00E-02		4.44E-02	1.00	1.00	Yes	Yes	Sample et al. 1996	
Fluorene	1	Red-Winged Blackbird	LD_{50}	acute	mortality	101	100			1.01E+00		1.65E+00	1.00	3.94	Yes		Schafer et al. 1983[c]	
Heptachlor	1	Japanese Quail	LOAEL	acute	mortality	13.358		2	5	1.34E+00		5.93E+00	1.00	1.00	Yes	Yes	Hill and Camardese, 1986[d]	*
Hexachlorobenzene	1	Japanese Quail	NOAEL	acute	mortality	54.5		2		2.73E+01		1.21E+02	1.00	1.00	Yes	Yes	Hill and Camardese, 1986[d]	*
Hexachlorobutadiene	1	Japanese Quail	NOAEL	chronic	*	3.185				3.19E+00		1.41E+01	1.00	1.00	Yes	Yes	Schwetz et al. 1974	
Lindane	1	Mallard Duck	LOAEL	chronic	reproduction	2			Y	2.00E+00		8.88E+00	1.00	1.00	Yes	Yes	Sample et al. 1996	
Pentachlorophenol	1	Japanese Quail	LD_{50}	acute	mortality	871	100			8.71E+00		3.87E+01	1.00	1.00	Yes	Yes	Hill and Camardese, 1986[d]	*
Phenanthrene	1	Red-Winged Blackbird	LD_{50}	acute	mortality	113	100			1.13E+00		1.31E+00	7.19	1.85			Schafer et al. 1983[c]	
Phenol	1	Red-Winged Blackbird	LD_{50}	acute	mortality	113	100			1.13E+00		5.02E+00	1.00	1.00	Yes	Yes	Schafer et al. 1983[c]	

Notes:
(a) Food and incidental soil intake values calculated as described in the text.
(b) BAFs are actual data or a default of 1
(c) In the Schafer et al. 1972 and 1983 studies birds were dosed by oral gavage on a mg/kg bodyweight basis.
(d) In the Hill and Camardese, 1986 study, 14 day old quail were administered test compound in feed.
Feed concentration was converted to daily dose by dividing intake by bodyweight.
Bodyweight for a 14 day old quail was estimated to be 0.04125kg from Sefton and Siegel, 1974.
Intake was calculated from reported food consumption of control and low dose groups over the 5 day exposure period;
pentachlorophenol 0.0116 kg/day calculated using the overall average control group values reported in the study.
acetone 0.01127 kg/day calculated using the average of control and treatment group food consumption in the acetone exposure.
heptachlor 0.01082 kg/day calculated using the average of control group food consumption in the heptachlor exposure.
hexachlorobenzene 0.01087 kg/day calculated using the average of control and treatment group food consumption in the hexachlorobenzene exposure.
(e) Stickel et al. 1979, exposed birds to 150 ppm in diet for 6 days. Using an approximate body weight for an adult starling (obtained from Stickel et al., 1983)
Intake was calculated using the equation of Nagy (2001), the daily intake is 0.630 x (82.1g)^0.683 = 12.79 g/day. The concentration in food may be converted to a daily dose as follows:
150 mg/kg food x 12.79 g/day x 1 kg/1000 g / 0.0821 kg = 23.4 mg/kg/day.
(f) The study by Hill et al. (1975), as cited in USEPA ECOTOX, exposed 10 day old pheasants n-dioctylphthalate at 5000 ppm in feed for 5-6 days.
The LC50 was reported as greater than the maximum concentration fed. Intake was calculated using the equation of Nagy (2001),
assuming a body weight for a juvenile Galliformes of approximately 0.04125 (Sefton and Siegel, 1974) as follows; 0.088(41.25)^0.891= 2.42 g/day,
for the calculation of dose 5000 mg/kg in feed x 2.42 g/day x 1kg/1000g * 1/0.04125 kg BW = 293.3 mg/kg BW - day

Thrush Exposure Factors:

Body weight (kg)	0.029
Ingestion rate (Nagy 2001 for passerines),(kg/day-kg body weight) =	0.22
Fraction plant consumed (dry weight) (unitless)=	0.39
Fraction invertebrate consumed (dry weight) (unitless) =	0.61
Fraction soil consumed (dry weight) (unitless) =	0.04

* Indicates experimental detail not available in cited source document.
BAF - bioaccumulation factor
ESL - ecological screening level
kg - kilogram
LD_{50} - lethal dose for 50% of study population
LOAEL - lowest-observable-adverse-effect-level
mg - milligram
NOAEL - no-observable-adverse-effect-level
PCB - polychlorinated biphenyl
SVOC - semivolatile organic compound
TEF - toxicity equivalency factor
TRV - toxicity reference value
UF - uncertainty factor
VOC - volatile organic compound
Y - uncertainty factor used to derive TRV was included by original source

APPENDIX C

ATTACHMENT C-3

CALCULATION OF ECOLOGICAL SCREENING LEVELS FOR TERRESTRIAL INVERTEBRATES

Appendix C Attachment C-3 (1 of 1)

Calculation of Soil Ecological Screening Levels for Terrestrial Invertebrates
Santa Susana Field Laboratory

Chemical	Chemical Group	Test Species Common Name	Growth Medium	Exposure (days)	Endpoint	Response Parameter	Subchronic to Chronic UF	LOEC to NOEC UF	Invertebrate ESL (mg/kg soil)	Initial Compilation Source
2,3,7,8-TCDD	Dioxin	Earthworm	*	85	LOEC	*		Y	500	EPA Combustor Guidance
Antimony	Metal	Soil Invertebrate							78	EPA Eco-SSL
Arsenic	Metal	Soil Invertebrate							NA	EPA Eco-SSL
Barium	Metal	Soil Invertebrate							330	EPA Eco-SSL
Beryllium	Metal	Soil Invertebrate							40	EPA Eco-SSL
Cadmium	Metal	Soil Invertebrate							140	EPA Eco-SSL
Chromium	Metal	Soil Invertebrate							NA	EPA Eco-SSL
Copper	Metal	Earthworm	*	56	NOEC	cocoon production			32	EPA Combustor Guidance
Hexavalent Chromium	Metal	Earthworm	*	60	LOEC	reduced survival			0.2	EPA Combustor Guidance
Lead	Metal	Soil Invertebrate							1700	EPA Eco-SSL
Mercury	Metal	Earthworm	soil & dung	60	LOEC	survival, cocoon production		Y	0.10	ORNL (BMD)
Methyl mercury	Metal	Earthworm	*	84	NOEC	segment regeneration			2.50	ORNL
Nickel	Metal	Earthworm	*	100	NOEC	cocoon production			100	EPA Combustor Guidance
Selenium	Metal	Earthworm	*	chronic	LOEC	cocoon production		Y	8	EPA Combustor Guidance
Vanadium	Metal	Soil Invertebrate							NA	EPA Eco-SSL
Zinc	Metal	Earthworm	*	56	NOEC	cocoon production			199	EPA Combustor Guidance
Aroclor 1016	PCB	Earthworm	*	7	NOEC	*	Y		50	Parmelee et al. 1997
Aroclor 1254	PCB	Earthworm	*	7	NOEC	*	Y		50	Parmelee et al. 1997
1,4-Dichlorobenzene	SVOC	Earthworm	sandy soil	14	LOEC	survival LC_{50}		Y	20	ORNL (BMD)
2,4,5-Trichlorophenol	VOC	Earthworm	sandy soil	14	LOEC	survival LC_{50}		Y	9	ORNL (BMD)
2,4,6-Trichlorophenol	SVOC	Earthworm	horse manure	56	LOEC	cocoon production		Y	10	ORNL (BMD)
4-Nitrophenol	SVOC	Earthworm	sandy soil	56	LOEC	cocoon production		Y	7	ORNL (BMD)
Benzo(a)pyrene	SVOC	Woodlouse		28	NOEC	growth			25000	EPA Combustor Guidance
Dimethyl phthalate	SVOC	Earthworm	horse manure	56	NOEC	cocoon production			200	ORNL (BMD)
Fluorene	SVOC	Enchytraeid	sandy soil	21	NOEC	NOEC reproduction			27	Sverdrup et al. 2002
Nitrobenzene	SVOC	Earthworm	*	14 (subchronic)	LOEC	*	Y	Y	40	EPA Combustor Guidance
N-Nitrosodiphenylamine	SVOC	Earthworm	horse manure	56	LOEC	cocoon production		Y	20	ORNL (BMD)
Pentachlorophenol	SVOC	Earthworm	*	21 (chronic)	NOEC	hatching success			6	EPA Combustor Guidance
Phenol	SVOC	Earthworm	horse manure	56	NOEC	cocoon production			30	ORNL (BMD)
1,2,3-Trichlorobenzene	VOC	Earthworm	sandy soil	14	LOEC	survival LC_{50}		Y	20	ORNL (BMD)
1,2,4-Trichlorobenzene	VOC	Earthworm	OECD soil	14	LOEC	survival LC_{50}		Y	20	ORNL (BMD)
1,2-Dichloropropane	VOC	Earthworm	horse manure	56	NOEC	growth			700	ORNL (BMD)
Pyrene	SVOC	Enchytraeid	sandy soil	21	NOEC	NOEC reproduction			18	Sverdrup et al. 2002
Fluoranthene	SVOC	Enchytraeid	sandy soil	21	NOEC	NOEC reproduction			38	Sverdrup et al. 2002
Phenanthrene	SVOC	Enchytraeid	sandy soil	21	NOEC	NOEC reproduction			34	Sverdrup et al. 2002
Carbazole	SVOC	Enchytraeid	sandy soil	21	NOEC	NOEC reproduction			34	Sverdrup et al. 2002
Dibenzofuran	SVOC	Enchytraeid	sandy soil	21	NOEC	NOEC reproduction			62	Sverdrup et al. 2002
Chlorobenzene	VOC	Earthworm	sandy soil	14	LOEC	survival LC_{50}		Y	40	ORNL (BMD)
Dieldrin	Pesticide	Soil Invertebrate							NA	EPA Eco-SSL

Notes:
These data are concentration and not dose based.
* Indicates experimental detail not available in cited source document.
(BMD) indicated a Bench Mark Dose calculated by primary source, incorporating appropriate uncertainty factors.
SVOC - semi-volatile organic compound
LD_{50} - lethal concentration for 50% of study population
LOEC - lowest-observable-effect-concentration
NOEC - no-observable-effect-concentration
NA - Not available. Data were insufficient. USEPA EcoSSL (2005)
UF - uncertainty factor
Y - uncertainty factor used to derive RfC was included by original source

APPENDIX C

ATTACHMENT C-4

CALCULATION OF INHALATION ECOLOGICAL SCREENING LEVELS FOR TERRESTRIAL MAMMALS

Appendix C Attachment C-4 (1 of 4)

Calculation of Inhalation Ecological Screening Levels for Terrestrial Mammals
Santa Susana Field Laboratory[1]

	Primary Study Information:												Uncertainty Factors				
Chemical:	**Test Species**	**Endpoint**	**Chronic/ Subchronic**	**Effect level**	**Exposure Duration**	**Body Weight (kg)**	**Formula Weight**	**Dose Reported in the Study (ppm)**	**Non-adjusted TRV (mg/m^3)**	**Non-adjusted TRV (mg/m^3)**	**Dose-time Adjustment (to 24-hrs/day, 7-days/week)**	**Dose - Time Adjustment (to 24 hrs/day, 7 days/week)**	**Toxicologically non-sensitive to sensitive endpoint**	**Subchronic to Chronic UF**	**LOAEL to NOAEL UF**	**Adjusted NOAEL-Equivalent TRV (mg/m^3)**	**Adjusted NOAEL-Equivalent TRV (mg/m^3)**
1,1,1-Trichloroethane	Gerbil	neurological	Subchronic	NOAEL	24 hr day	0.1	133.42	70	382.0	76.4	-	-	-	2	-	191.0	38.2
1,1,2-Trichloroethane	Mouse	survival, LC50	Subchronic	LC50	6 hour	0.03	133.42	416	2270.0	22.7	2270*6hrs/24hrs = 567.5	22.7*6hrs/24hrs = 5.675	-	100 *(LD_{50} to NOAEL)*		5.7	0.05675
1,1-Dichloroethane	Cat	hepatic, renal, hematopoetic	Subchronic	NOAEL	6 hrs/day, 5 days/wk	2	98.97	500	2023.9	404.8	2023.9*6hrs/24hrs*5days/7days = 361	404.8*6hrs/24hrs*5days/7days = 72.29	-	2		180.5	36.15
1,1-Dichloroethene	Guinea Pig	survival	Subchronic	LOAEL	24 hrs/day	0.5	96.94	15	59.5	6	-	-	***	2	5	6.0	0.6
1,1-Dichloropropene	Mouse	respiratory	Chronic	NOAEL	6 hrs/day, 5 days/wk	0.03	110.97	5	22.7	22.7	22.7*5days/7days*6hrs/24hrs = 4.05	22.7*5 days/7 days*6 hrs/24 hrs = 4.05	-	-	-	4.1	4.05
1,2,3-Trichlorobenzene	Rat	hepatic	Subchronic	NOAEL	6 hrs/day; 7 days/wk	0.35	181.44	66	489.8	397	489.9*6hrs/24hrs = 122.5	397*6 hrs/24 hours = 99.25	-	2	-	61.3	49.625
1,2,4-Trichlorobenzene	Rat	hepatic	Subchronic	NOAEL	6 hrs/day; 7 days/wk	0.35	181.44	66	489.8	397	489.9*6hrs/24hrs = 122.5	397*6 hrs/24 hours = 99.25	-	2	-	61.3	49.625
1,2,4-Trimethylbenzene	Rat	behavior (rotorod performance, spontaneity)	Chronic	LOAEL	6 hrs/day, 5 days/wk	0.35	120.19	100	434.0	434	434*6hrs/24hrs*5days/7days = 77.5	434*6 hrs/24 hrs*5 days/7 days = 77.5	-	-	5	15.5	15.5
1,2-Dichlorobenzene	Rat	hepatic	Subchronic	NOAEL	6 hrs/day; 7 days/wk	0.35	151.02	66	407.7	397	407.7*6hrs/24hrs = 102	397*6 hrs/24 hours = 99.25	-	2	-	51.0	49.625
1,2-Dichloroethane	Rat	systemic	Chronic	NOAEL	7 hrs/day, 5 days/wk	0.35	98.97	50	202.4	202.4	202.4*7hrs/24hrs*5days/7days = 42.167	202.4*7 hrs/24 hrs*5 days/7 days = 42.167	-	-	-	42.2	42.167
1,2-Dichloroethene	Rat	systemic	Subchronic	LOAEL	8 hrs/day; 5 days/wk	0.35	96.94	200	793.0	79.3	793*8hrs/24hrs*5days/7days = 188.8	79.3*8 hrs/24 hrs*5 days/7 days = 18.88	-	2	5	18.9	1.89
1,2-Dichloropropane	Rat	respiratory	Subchronic	LOAEL	6 hrs/day; 5 d/wk	0.35	112.98	15	69.3	69	69.6hrs/24hrs*5days/7days = 12.3	69*6 hrs/24 hrs*5days/7days = 12.3	-	2	5	1.2	1.23
1,2-Dichlorotetrafluoroethane (Freon 114)	Rat	maternal wt. gain	Chronic	NOAEL	24hrs/day, 7days/week	0.35	170.92	1000	884.2	909	000 ppm * 86.47/24.45 * 6 hrs/24 hrs = 884.2 mg/m	-	10	-	-	90.9	90.9
1,3,5-Trimethylbenzene	Rat	behavior (rotorod performance, spontaneity)	Chronic	LOAEL	6 hrs/day, 5 days/wk	0.35	120.19	100	434.0	434	434*6hrs/24hrs*5days/7days = 77.5	434*6 hrs/24 hrs*5 days/7 days = 77.5	-	-	5	15.5	15.5
1,3-Dichlorobenzene	Rat	hepatic	Subchronic	NOAEL	6 hrs/day; 7 days/wk	0.35	147	66	396.8	397	397*6hrs/24hours = 99.25	397*6 hrs/24 hours = 99.25	-	2	-	49.6	49.625
1,4-Dichlorobenzene	Rat	hepatic	Subchronic	NOAEL	6 hrs/day; 7 days/wk	0.35	147	66	396.8	397	397*6hrs/24hours = 99.25	397*6 hrs/24 hours = 99.25	-	2	-	49.6	49.625
2-Butanone (MEK)	Mouse	development	Chronic	NOAEL	7 hrs/day	0.03	72.1	1000	2948.9	2978	2948.9*7hrs/24hrs = 860	2978*7 hrs/24 hrs = 868.58	-	-	-	860.0	868.58
2-Hexanone	Rat	neurological	Subchronic	LOAEL	8 hrs/day; 5 days/wk	0.35	100.16	50	204.8	20.5	204.8*8hrs/24hrs*5days/7days = 48.8	20.5*8 hrs/24 hrs*5 days/7 days =4.88	-	2	5	4.9	2.44
2-Methylnaphthalene	Mouse	olfactory	Chronic	LOAEL	6 hrs/day; 5 days/wk	0.03	142.2	10	58.2	10.5	58.2*6hrs/24hrs*5days/7days = 10.4	10.5*6 hrs/24 hrs*5 days/7 days = 1.875	-	-	5	2.1	0.375
Acetone	Rat	developmental	Chronic	NOAEL	6 hr/day; 7 days/wk	0.35	58.08	2200	5220.0	5220	5220*6hrs/24hrs = 1305	5220*6 hrs/24 hrs = 1305	-	-	-	1305.0	1305
Benzene	Mouse	systemic (decreased CFU-E lympocytes and RBCs)	Subchronic	LOAEL	6 hrs/day, 5 days/wk	0.03	78.11	10	32.0	32	32*6hrs/24hrs*5days/7days = 5.714	32*6 hrs/24 hrs*5 days/7 days = 5.714	-	2	5	0.6	0.5714
Carbon disulfide	Rat	cardio	Subchronic	NOAEL	8 hrs/day; 5 days/wk	0.35	76.13	3.2	10.0	2	10*8hrs/24hrs*5days/7days = 2.38	2*8 hrs/24 hrs*5 days/7 days = 0.476	-	2	-	1.2	0.238
Carbon tetrachloride	Guinea Pig	survival	Subchronic	LOAEL	24 hrs/day	0.5	153.8	10	62.9	6.3		-	***	2	5	0.6	0.63
Chlorobenzene	Rat	hepatic, renal	Chronic	NOAEL	6 hr/day; 7 days/wk	0.35	112.55	50	230.2	230.2	230.2*6hrs/24hrs = 57.75	230.2*6 hrs/24 hrs = 57.55	-	-	-	57.6	57.55
Chloroethane	Mouse	development	Chronic	NOAEL	6 hrs/day	0.03	64.52	1504	3968.8	3968.2	3968.2*6hrs/24hrs = 992.05	3968.2*6 hrs/24 hrs = 992.05	-	-	-	992.1	992.05
Chloroform	Mouse	renal	Subchronic	NOAEL	6 hrs/day; 7 days/wk	0.03	119.38	1.99	9.7	1.94	9.7*6hrs/24hrs = 2.4	1.94*6 hrs/24 hrs = 0.485	-	2	-	1.2	0.243
Chloromethane	Mouse	neurological, hepatic	Chronic	LOAEL	6 hrs/day; 5 days/wk	0.03	64.52	51	134.6	20.7	134.6*6hrs/24hrs*5days/7days = 24	20.7*6 hrs/24 hrs*5 days/7 days = 3.696	-	-	5	4.8	0.7392
cis-1,2-Dichloroethene	Rat	systemic	Subchronic	LOAEL	8 hrs/day; 5 days/wk	0.35	96.94	200	793.0	79.3	809.5*8hrs/24hrs*5days/7days = 192.6	79.3*8 hrs/24 hrs*5 days/7 days = 18.88	-	2	5	19.3	1.888
Dichlorodifluoromethane (Freon 12)	Rat	maternal wt. gain	Chronic	NOAEL	24hrs/day, 7days/week	0.35	120.9	1000	909.0	909	-	-	10	-	-	90.9	90.9
Ethylbenzene	Rat	systemic (blood and renal effects)	Subchronic	LOAEL	6 hrs/day, 5 days/wk	0.35	106.16	300	1301.0	1301	1301*6 hours/24 hrs*5 days/7 days = 232.32	1301*6 hours/24 hrs*5 days/7 days = 232.32	-	2	5	23.2	23.232
Ethylene dibromide	Rat	respiratory	Subchronic	NOAEL	6 hrs/day	0.35	187.88	3	23.1	4.62	23.1*6hrs/24hrs = 5.8	4.62*6 hrs/24 hrs = 1.155	-	2	-	2.9	0.5775
Fluorene	Hamster	tumors	Chronic	NOAEL	4.5 hrs/day; 7 days/wk	0.125	166.22	9.5	0.9	0.9	0.9*4.5 hrs/24 hrs = 0.169	0.9*4.5 hrs/24 hrs = 0.169	-	-	-	0.2	0.169
Freon 113	Rat	maternal wt. gain	Chronic	NOAEL	24hrs/day, 7days/week	0.35	187.38	1000	909.0	909	-	-	10	-	-	90.9	90.9

Appendix C Attachment C-4 (2 of 4)

Calculation of Inhalation Ecological Screening Levels for Terrestrial Mammals
Santa Susana Field Laboratory[1]

	Primary Study Information:												Uncertainty Factors				
Chemical:	**Test Species**	**Endpoint**	**Chronic/ Subchronic**	**Effect level**	**Exposure Duration**	**Body Weight (kg)**	**Formula Weight**	**Dose Reported in the Study (ppm)**	**Non-adjusted TRV (mg/m^3)**	**Non-adjusted TRV (mg/m^3)**	**Dose-time Adjustment (to 24-hrs/day, 7-days/week)**	**Dose - Time Adjustment (to 24 hrs/day, 7 days/week)**	**Toxicologically non-sensitive to sensitive endpoint**	**Subchronic to Chronic UF**	**LOAEL to NOAEL UF**	**Adjusted NOAEL-Equivalent TRV (mg/m^3)**	**Adjusted NOAEL-Equivalent TRV (mg/m^3)**
Isopropylbenzene (cumene)	Rat	systemic (blood and renal effects)	Subchronic	LOAEL	6 hrs/day, 5 days/wk	0.35	120.19	300	1301.0	1301	1301*6 hours/24 hrs*5 days/7 days = 232.32	1301*6 hours/24 hrs*5 days/7 days = 232.32	-	2	5	23.2	23.232
m,p-Xylenes	Rat	behavior (rotorod performance, spontaneity)	Chronic	LOAEL	6 hrs/day, 5 days/wk	0.35	106.16	100	434.0	434	434*6 hrs/24 hrs*5 days/7 days = 77.5	434*6 hrs/24 hrs*5 days/7 days = 77.5	-	-	5	15.5	15.5
Methyl tert-butyl ether (MTBE)	Rat	hepatic, renal, development, endocrin	Chronic	NOAEL	6 hrs/day, 5 days/wk	0.35	88.14	400	1442.0	1442.1	1442.1*6 hrs/24 hrs*5 days/7 days = 257.5	1442.1*6 hrs/24 hrs*5 days/7 days = 257.5	-	-	-	257.5	257.5
Methylene Chloride	Rat	hepatic, renal	Subchronic	LOAEL	24 hrs/day	0.35	84.9	25	86.8	1.74	-	-	-	2	5	8.7	0.87
Naphthalene	Mouse	olfactory	Chronic	LOAEL	6 hrs/day, 5 days/wk	0.03	128.18	10	52.4	10.5	52*6hrs/24hrs*5days/7days = 9.3	10.5*6 hrs/24 hrs*5 days/7 days =1.875	-	-	5	1.9	0.375
n-butylbenzene	Rat	systemic (blood and renal effects)	Subchronic	LOAEL	6 hrs/day, 5 days/wk	0.35	134.22	300	1301.0	1301	1301*6 hours/24 hrs*5 days/7 days = 232.32	1301*6 hours/24 hrs*5 days/7 days = 232.32	-	2	5	23.3	23.232
n-Propylbenzene	Rat	systemic (blood and renal effects)	Subchronic	LOAEL	6 hrs/day, 5 days/wk	0.35	120.19	300	1301.0	1301	1301*6 hours/24 hrs*5 days/7 days = 232.32	1301*6 hours/24 hrs*5 days/7 days = 232.32	-	2	5	23.3	23.232
o-Xylene	Rat	behavior (rotorod performance, spontaneity)	Chronic	LOAEL	6 hrs/day, 5 days/wk	0.35	106.16	100	434.0	434	434*6 hrs/24 hrs*5 days/7 days = 77.5	434*6 hrs/24 hrs*5 days/7 days = 77.5	-	-	5	15.5	15.5
p-cymene (p-isopropyltoluene)	Rat	behavior (rotorod performance, spontaneity)	Chronic	LOAEL	6 hrs/day, 5 days/wk	0.35	134.22	100	434.0	434	434*6 hrs/24 hrs*5 days/7 days = 77.5	434*6 hrs/24 hrs*5 days/7 days = 77.5	-	-	5	15.5	15.5
Phenanthrene	Hamster	tumors	Chronic	LOAEL	4.5 hrs/day; 7 days/wk	0.125	178.23	9.5	69.3	0.9	69.3*4.5hrs/24hrs = 12.9	0.9*4.5 hrs/24 hrs = 0.169	-	-	5	2.6	0.169
sec-butylbenzene	Rat	systemic (blood and renal effects)	Subchronic	LOAEL	6 hrs/day, 5 days/wk	0.35	134.22	300	1301.0	1301	1301*6 hours/24 hrs*5 days/7 days = 232.32	1301*6 hours/24 hrs*5 days/7 days = 232.32	-	2	5	23.2	23.232
Styrene	Rat	neurological	Subchronic	NOAEL	24 hrs/day	0.35	104.14	90	383.3	76.7	-	-	-	2	-	191.7	38.35
t-butylbenzene	Rat	systemic (blood and renal effects)	Subchronic	LOAEL	6 hrs/day, 5 days/wk	0.35	134.21	300	1301.0	1301	1301*6 hours/24 hrs*5 days/7 days = 232.32	1301*6 hours/24 hrs*5 days/7 days = 232.32	-	2	5	23.2	23.232
Tetrachloroethene	Mouse	systemic (lung congestion, heptatocellular degeneration, necrosis)	Chronic	LOAEL	6 hrs/day, 5 days/wk	0.03	165.83	100	679.0	679	679*6 hrs/24 hrs*5 days/7 days = 121.25	679*6 hrs/24 hrs*5 days/7 days = 121.25	-	-	5	24.3	24.25
Toluene	Rat	immune (increased susceptibility to infection)	Subchronic	LOAEL	3 hrs/day, 5 days/wk	0.35	92.13	2.5	9.4	9.4	9.4*3 hrs/24 hrs*5 days/7 days = 0.839	9.4*3 hrs/24 hrs*5 days/7 days = 0.839	-	2	5	0.1	0.0839
trans-1,2-Dichloroethene	Rat	systemic	Subchronic	LOAEL	8 hrs/day; 5 days/wk	0.35	96.94	200	795.0	79.3	793*8hrs/24hrs*5days/7days = 188.8	79.3*8 hrs/24 hrs*5 days/7 days = 18.88	-	2	5	18.9	1.888
Trichloroethene	Rat	behavior (decrased wakefulness, heart rate)	Subchronic	LOAEL	24 hrs/day; 5 days/wk	0.35	131.4	50	270.0	270	270*8 hrs/24 hrs*5 days/7 days =64.29	270*8 hrs/24 hrs*5 days/7 days =64.29	-	2	5	6.4	6.429
Trichlorofluoromethane (Freon 11)	Rat	maternal wt. gain	Chronic	NOAEL	24hrs/day, 7days/week	0.35	137.36	1000	909.0	909	-	-	10	-	-	90.9	90.9
Vinyl chloride	Rat	hepatic, testes	Subchronic	LOAEL	6 hrs/day; 6 days/wk	0.35	62.5	10	25.6	26	26*6 hrs/24 hrs*6 days/7 days = 5.57	26*6 hrs/24 hrs*6 days/7 days = 5.57	-	2	5	0.6	0.557
Xylenes (total)	Rat	behavior (rotorod performance, spontaneity)	Chronic	LOAEL	6 hrs/day, 5 days/wk	0.35	106.16	100	434.0	434	434*6 hrs/24 hrs*5 days/7 days = 77.5	434*6 hrs/24 hrs*5 days/7 days = 77.5	-	-	5	15.5	15.5

Appendix C Attachment C-4 (3 of 4)

Calculation of Inhalation Ecological Screening Levels for Terrestrial Mammals
Santa Susana Field Laboratory[1]

Chemical:	Primary Source	Source/TRV Provided by:	Source Cited in:	Source Article(s)
1,1,1-Trichloroethane	Rosengren et al. 1985	Recommended by HERD	ATSDR	Rosengren LE, Aurell A, Kjellstrand P, et al. 1985. Astrogliosis in the cerebral cortex of gerbils after long-term exposure to 1,1,1-trichloroethane. Scand J Work Environ Health 11:447-456.
1,1,2-Trichloroethane	Gradiski et al. 1978	Recommended by HERD	ATSDR	Gradiski D, Bonnet P, Raoult G, et al. 1978. [Comparative acute inhalation toxicity of the principal chlorinated aliphatic solvents.] Arch Mal Prof Med Trav Secur Soc 39:249-257. (French)
1,1-Dichloroethane	Hofmann et al. 1971	Recommended by HERD	ATSDR	Hofmann HT, Birnstiel H, Jobst P. 1971. [Inhalation toxicity of 1,1- and 1,2-dichloroethane]. Arch Toxikol 27:248- 265. (German).
1,1-Dichloroethene	Prendergast et al. 1967	Recommended by HERD	ATSDR	Prendergast JA, Jones RA, Jenkins LJ, et al. 1967. Effects on experimental animals of long-term inhalation of trichloroethylene, carbon tetrachloride,1,1,1-trichloroethene, dichlorodifluoromethane, and 1,1-dichloroethylene.Toxicol Appl Pharmacol 10:270-289.
1,1-Dichloropropene	Lomax et al. 1989 (1,3-DCP)	Recommended by HERD	ATSDR (1,3-DCP)	Lomax L, Stott W, Johnson K, et al. 1989. The chronic toxicity and oncogenicity of inhaled technical grade 1,3-dichloropropene in rats and mice. Fundam Appl Toxicol 12:418-431.
1,2,3-Trichlorobenzene	1,4-Dichlorobenzene as surrogate	Recommended by HERD	ATSDR	Tyl RW, Neeper-Bradley TL. 1989. Paradichlorobenzene: Two generation reproductive study of inhaled paradichlorobenzene in Sprague-Dawley (CD) rats. Laboratory Project 86-81-90605. Washington, DC: Chemical Manufacturers Association, Chlorobenzene Producers Association.
1,2,4-Trichlorobenzene	1,4-Dichlorobenzene as surrogate	Recommended by HERD	ATSDR	Tyl RW, Neeper-Bradley TL. 1989. Paradichlorobenzene: Two generation reproductive study of inhaled paradichlorobenzene in Sprague-Dawley (CD) rats. Laboratory Project 86-81-90605. Washington, DC: Chemical Manufacturers Association, Chlorobenzene Producers Association.
1,2,4-Trimethylbenzene	Tech Memo (Xylenes)	Tetra Tech, 2002	Tech Memo (Xylenes)	Korsak, Z., J.A. Sokal, and R. Gorny. 1992 Toxic effects of combined exposure to toluene and m-xylene in animals. III. Subchronic inhalation study. Polish Journal of Occupational Medicine and Environmental Health 5(1):27-33.
1,2-Dichlorobenzene	1,4-Dichlorobenzene as surrogate	Recommended by HERD	ATSDR	Tyl RW, Neeper-Bradley TL. 1989. Paradichlorobenzene: Two generation reproductive study of inhaled paradichlorobenzene in Sprague-Dawley (CD) rats. Laboratory Project 86-81-90605. Washington, DC: Chemical Manufacturers Association, Chlorobenzene Producers Association.
1,2-Dichloroethane	Cheever et al. 1990	Recommended by HERD	ATSDR	Cheever KL, Cholakis JM, el-Hawari AM, et al. 1990. Ethylene dichloride: The influence of disulfiram or ethanol on oncogenicity, metabolism, and DNA covalent binding in rats. Fundam Appl Toxicol 14:243-261.
1,2-Dichloroethene	Freundt et al. 1977	Recommended by HERD	ATSDR	Freundt KJ, Liebaldt GP, Lieberwirth E. 1977. Toxicity studies on trans-1,2-dichloroethylene. Toxicology 7:141-153.
1,2-Dichloropropane	Nitschke et al. 1988	Recommended by HERD	IRIS	Nitschke K.D., K.A. Johnson, D.L. Wackerle, J.E. Phillips and D.A. Dittenber. 1988. Propylene dichloride: A 13-week inhalation toxicity study with rats, mice, and rabbits. Dow Chemical Company, Mammalian and Environmental Toxicology Research Laboratory, Midland, MI. OTS Doc. #86-870001397
1,2-Dichlorotetrafluoroethane (Freon 11	Palmer et al. 1978 (Freon 22)	Recommended by HERD	IRIS (Freon 22)	Palmer, A.K., D.D. Cozens, R. Clark, and G.C. Clark. 1978a. Effect of Arcton 22 on pregnant rats: Relationship to anophthalmia and microphthalmia. Report No. ICI 174/78208. Huntingdon Research Centre, Huntingdon, UK.
1,3,5-Trimethylbenzene	Tech Memo (Xylenes)	Tetra Tech, 2002	Tech Memo (Xylenes)	Korsak, Z., J.A. Sokal, and R. Gorny. 1992 Toxic effects of combined exposure to toluene and m-xylene in animals. III. Subchronic inhalation study. Polish Journal of Occupational Medicine and Environmental Health 5(1):27-33.
1,3-Dichlorobenzene	1,4-Dichlorobenzene as surrogate	Recommended by HERD	ATSDR	Tyl RW, Neeper-Bradley TL. 1989. Paradichlorobenzene: Two generation reproductive study of inhaled paradichlorobenzene in Sprague-Dawley (CD) rats. Laboratory Project 86-81-90605. Washington, DC: Chemical Manufacturers Association, Chlorobenzene Producers Association.
1,4-Dichlorobenzene	Tyl and Neeper-Bradley, 1989	Recommended by HERD	ATSDR	Tyl RW, Neeper-Bradley TL. 1989. Paradichlorobenzene: Two generation reproductive study of inhaled paradichlorobenzene in Sprague-Dawley (CD) rats. Laboratory Project 86-81-90605. Washington, DC: Chemical Manufacturers Association, Chlorobenzene Producers Association.
2-Butanone (MEK)	Mast et al. 1989	Recommended by HERD	ATSDR	Mast T, Dill J, Evanoff J, et al. 1989. Inhalation developmental toxicology studies: teratology study of methyl ethyl ketone in mice. Report by Pacific Northwest Laboratory, Richland, WA to National Institute of Environmental Health Science, National Toxicology Program. PNL-6833 DE89 009563.
2-Hexanone	Duckett et al. 1979	Recommended by HERD	ATSDR	Duckett S, Streletz LJ, Chambers RA, et al. 1979. 50 ppm MnBK subclinical neuropathy in rats. Experientia 35:1365-1367.
2-Methylnaphthalene	NTP 1992 (Naphthalene)	Recommended by HERD	ATSDR (Naphthalene)	NTP. 1992. National Toxicology Program. Technical report series No. 410. Toxicology and carcinogenesis studies of naphthalene (CAS No. 91-20-3) in B6C3F1 mice (inhalation studies). Research Triangle Park, NC: U.S. Department of Health and Human Services, Public Health Service, National Institutes of Health. NIH Publication No. 92-3141.
Acetone	NTP 1998	U.S. Air Force, 2004	Vandenberg Tox Profiles	NTP. 1988. National Toxicology Program--report no. PNL-6768. Inhalation developmental toxicology studies: Teratology study of acetone in mice and rats. Research Triangle Park, NC: U.S. Department of Health and Human Services, Public Health Service, National Institute of Health. NTIS DE89- 005671.
Benzene	Tech Memo	Tetra Tech, 2002	Tech Memo	Baarson, K.A., C.A. Snyder, and R.E. Albert. 1984 Repeated exposures of C57BL mice to inhaled benzene at 10 ppm markedly depressed erythropoietic colony formation. Toxicol. Lett. 20:337-342.
Carbon disulfide	Antov et al. 1985	Recommended by HERD	ATSDR	Antov G, Kazakova B, Spasovski M, et al. 1985. Effect of carbon disulphide on the cardiovascular system. J Hyg Epidemiol Microbiol Immunol 29:329-335.
Carbon tetrachloride	Prendergast et al. 1967	Recommended by HERD	ATSDR	Prendergast JA, Jones RA, Jenkins LJ, et al. 1967. Effects on experimental animals of long-term inhalation of trichloroethylene, carbon tetrachloride, 1,1,1,-trichloroethane, dichlorofluoromethane, and 1,1-dichloroethylene. Toxicol Appl Pharmacol 10:270-289.
Chlorobenzene	Nair et al. 1987	Recommended by HERD	ATSDR	Nair RS, Barter JA, Schroeder RE, et al. 1987. A two generation reproduction study with monochlorobenzene vapor in rats. Fundam Appl Toxicol 9:678-686.
Chloroethane	Scortichini et al. 1986	Recommended by HERD	ATSDR	Scortichini BH, Johnson KA, Momany-Pfruenderd JJ, et al. 1986. Ethyl chloride: Inhalation teratology study in CF-1 mice. Dow Chemical Company, Mammalian and Environmental Toxicology Research Laboratory, Health and Environmental Sciences, Midland, MI. NTIS no. OTS0001135.
Chloroform	Larson et al. 1996	Recommended by HERD	ATSDR	Larson JL, Templin MV, Wolf DC. 1996. A 90-day chloroform inhalation study in female and male B6C3F mice: Implications for cancer risk assessment. Fundamental and Applied Toxicology 1 30:118-137.
Chloromethane	CIIT 1981, McKenna et al. 1981	Recommended by HERD	ATSDR	CIIT. 1981. Final report on a chronic inhalation toxicology study in rats and mice exposed to methyl chloride. Unpublished study prepared by Battelle-Columbus Laboratories, Columbus, OH. OTS Submission Document ID 40-8120717. Microfiche 511310. McKenna MJ, Burek JD, Henck JW, et al. 1981b. Methyl chloride: A 90-day inhalation toxicity study in rats, mice and beagle dogs. Toxicology Research Laboratory, Dow Chemical USA, Midland MI. OTS submission document 40-8120723. Microfiche 511317.
cis-1,2-Dichloroethene	Freundt et al. 1977 (1,2-DCE)	Recommended by HERD	ATSDR (1,2-DCE)	Freundt KJ, Liebaldt GP, Lieberwirth E. 1977. Toxicity studies on trans-1,2-dichloroethylene. Toxicology 7:141-153.
Dichlorodifluoromethane (Freon 12)	Palmer et al. 1978 (Freon 22)	Recommended by HERD	IRIS (Freon 22)	Palmer, A.K., D.D. Cozens, R. Clark, and G.C. Clark. 1978a. Effect of Arcton 22 on pregnant rats: Relationship to anophthalmia and microphthalmia. Report No. ICI 174/78208. Huntingdon Research Centre, Huntingdon, UK.
Ethylbenzene	Tech Memo	Tetra Tech, 2002	Tech Memo	Elovaara, E., K. Engstrom, J. Nickels, et al. 1985 Biochemical and morphological effects of long-term inhalation exposure of rats to ethylbenzene. Xenobiotica 15:299-308.
Ethylene dibromide	Nitschke et al. 1981; Reznik et al. 1980	Recommended by HERD	ATSDR	Nitschke KD, Kociba RJ, Keyes DG, et al. 1981. A thirteen week repeated inhalation study of ethylene dibromide in rats. Fundam Appl Toxicol 1:437-442. Reznik G, Stinson SF, Ward JM. 1980. Respiratory pathology in rats and mice after inhalation of 1,2-dibromo-3-chloropropane or 1,2-dibromoethane for 13 weeks. Arch Toxicol 46:233-240.
Fluorene	Thyssen et al. 1981 (BaP)	Recommended by HERD	ATSDR	Thyssen J, Althoff JKG, Mohr U. 1981. Inhalation studies with benzo[a]pyrene in Syrian golden hamsters. J Natl Cancer Inst 66:575-577.
Freon 113	Palmer et al. 1978 (Freon 22)	Recommended by HERD	IRIS (Freon 22)	Palmer, A.K., D.D. Cozens, R. Clark, and G.C. Clark. 1978a. Effect of Arcton 22 on pregnant rats: Relationship to anophthalmia and microphthalmia. Report No. ICI 174/78208. Huntingdon Research Centre, Huntingdon, UK.

Appendix C Attachment C-4 (4 of 4)

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Santa Susana Field Laboratory[1]

Chemical:	Primary Source	Source/TRV Provided by:	Source Cited in:	Source Article(s)
Isopropylbenzene (cumene)	Tech Memo (Ethylbenzene)	Tetra Tech, 2002	Tech Memo (Ethylbenzene)	Elovaara, E., K. Engstrom, J. Nickels, et al. 1985 Biochemical and morphological effects of long-term inhalation exposure of rats to ethylbenzene. Xenobiotica 15:299-308.
m,p-Xylenes	Tech Memo (Xylenes)	Tetra Tech, 2002	Tech Memo (Xylenes)	Korsak, Z., J.A. Sokal, and R. Gorny. 1992 Toxic effects of combined exposure to toluene and m-xylene in animals. III. Subchronic inhalation study. Polish Journal of Occupational Medicine and Environmental Health 5(1):27-33.
Methyl tert-butyl ether (MTBE)	Chun et al. 1992	Recommended by HERD	ATSDR	Chun, J.S., H.D. Burleigh-Flayer, and W.J. Kintigh. 1992. Methyl tertiary butyl ether: vapor inhalation oncogenicity study in Fischer 344 rats (unpublished material). Prepared for the MTBE Committee by Bushy Run Research Center, Union Carbide Chemicals and Plastics Company Inc. Docket No. OPTS- 42098.
Methylene Chloride	Haun et al. 1972	Recommended by HERD	ATSDR	Haun CC, Vernot EH, Darmer KI, et al. 1972. Continuous animal exposure to low levels of dichloromethane. In: Proceedings of the 3rd annual conference on environmental toxicology. Wright Patterson Air Force Base, OH: Aerospace Medical Research Laboratory, 199-208. AMRL-TR-72-130. AD 773766.
Naphthalene	NTP 1992	Recommended by HERD	ATSDR	NTP. 1992. National Toxicology Program. Technical report series No. 410. Toxicology and carcinogenesis studies of naphthalene (CAS No. 91-20-3) in B6C3F1 mice (inhalation studies). Research Triangle Park, NC: U.S. Department of Health and Human Services, Public Health Service, National Institutes of Health. NIH Publication No. 92-3141.
n-butylbenzene	Tech Memo (Ethylbenzene)	Tetra Tech, 2002	Tech Memo (Ethylbenzene)	Elovaara, E., K. Engstrom, J. Nickels, et al. 1985 Biochemical and morphological effects of long-term inhalation exposure of rats to ethylbenzene. Xenobiotica 15:299-308.
n-Propylbenzene	Tech Memo (Ethylbenzene)	Tetra Tech, 2002	Tech Memo (Ethylbenzene)	Elovaara, E., K. Engstrom, J. Nickels, et al. 1985 Biochemical and morphological effects of long-term inhalation exposure of rats to ethylbenzene. Xenobiotica 15:299-308.
o-Xylene	Tech Memo (Xylenes)	Tetra Tech, 2002	Tech Memo (Xylenes)	Korsak, Z., J.A. Sokal, and R. Gorny. 1992 Toxic effects of combined exposure to toluene and m-xylene in animals. III. Subchronic inhalation study. Polish Journal of Occupational Medicine and Environmental Health 5(1):27-33.
p-cymene (p-isopropyltoluene)	Tech Memo (Xylenes)	Tetra Tech, 2002	Tech Memo (Xylenes)	Korsak, Z., J.A. Sokal, and R. Gorny. 1992 Toxic effects of combined exposure to toluene and m-xylene in animals. III. Subchronic inhalation study. Polish Journal of Occupational Medicine and Environmental Health 5(1):27-33.
Phenanthrene	Thyssen et al. 1981 (BaP)	Recommended by HERD	ATSDR	Thyssen J, Althoff JKG, Mohr U. 1981. Inhalation studies with benzo[a]pyrene in Syrian golden hamsters. J Natl Cancer Inst 66:575-577.
sec-butylbenzene	Tech Memo (Ethylbenzene)	Tetra Tech, 2002	Tech Memo (Ethylbenzene)	Elovaara, E., K. Engstrom, J. Nickels, et al. 1985 Biochemical and morphological effects of long-term inhalation exposure of rats to ethylbenzene. Xenobiotica 15:299-308.
Styrene	Rosengren and Haglid 1989	Recommended by HERD	ATSDR	Rosengren LE, Haglid KG. 1989. Long term neurotoxicity of styrene. A quantitative study of glial fibrillary acidic protein (GFA) and S-100. Br J Ind Med 46:316-320.
t-butylbenzene	Tech Memo (Ethylbenzene)	Tetra Tech, 2002	Tech Memo (Ethylbenzene)	Elovaara, E., K. Engstrom, J. Nickels, et al. 1985 Biochemical and morphological effects of long-term inhalation exposure of rats to ethylbenzene. Xenobiotica 15:299-308.
Tetrachloroethene	Tech Memo	Tetra Tech, 2002	Tech Memo	NTP 1986. National Toxicology Program--technical report series no. 311. Toxicology and carcinogenesis studies of tetrachloroethylene (perchloroethylene) (CAS No. 127-18-4) in F344/N rats and B6C3F1 mice (inhalation studies). Research Triangle Park, NC: U.S. Department of Health and Human Services, Public Health Service, National Institutes of Health, NIH publication no. 86-2567.
Toluene	Tech Memo	Tetra Tech, 2002	Tech Memo	Aranyi, C., W.J. O'Shea, R.L. Sherwood, J.A. Grahm, and F.J. Miller. 1985 Effects of Toluene Inhalation on Pulmonary Host Defenses of Mice. Toxicol. Letters 25: 103-110.
trans-1,2-Dichloroethene	Freundt et al. 1977 (1,2-DCE)	Recommended by HERD	ATSDR (1,2-DCE)	Freundt KJ, Liebhardt GP, Lieberwirth E. 1977. Toxicity studies on trans-1,2-dichloroethylene. Toxicology 7:141-153.
Trichloroethene	Tech Memo	Tetra Tech, 2002	Tech Memo	Arito H, Takahashi M, Ishibashi T. 1994 Effect of subchronic inhalation exposure to low-level trichloroethylene on heart rate and wakefulness-sleep in freely moving rats. Sangyo Igaku 36:1-8.
Trichlorofluoromethane (Freon 11)	Palmer et al. 1978 (Freon 22)	Recommended by HERD	IRIS (Freon 22)	Palmer, A.K., D.D. Coombs, R. Clark, and G.C. Clark. 1978a. Effect of Arcton 22 on pregnant rats: Relationship to anophthalmia and microphthalmia. Report No. ICI 174/78208. Huntingdon Research Centre, Huntingdon, UK.
Vinyl chloride	Bi et al. 1985	Recommended by HERD	ATSDR	Bi, WF; Wang, YS; Huang, MY; et al. (1985) Effect of vinyl chloride on testis in rats. Ecotoxicol Environ Saf 10(3):281-289.
Xylenes (total)	Tech memo	Tetra Tech, 2002	Tech Memo	Korsak, Z., J.A. Sokal, and R. Gorny. 1992 Toxic effects of combined exposure to toluene and m-xylene in animals. III. Subchronic inhalation study. Polish Journal of Occupational Medicine and Environmental Health 5(1):27-33.

Notes:
*** - Determined by DTSC to be the lowest dose at which an adverse effect occurred, therefore no non-sensitive to sensitive endpoint needs to be applied.
[1] Inhalation ESLs and calculation were provided by HERD/DTSC (August 2005)

SOIL BACKGROUND REPORT
SANTA SUSANA FIELD LABORATORY
VENTURA COUNTY, CALIFORNIA

FINAL

Prepared for:

THE BOEING COMPANY

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

U.S. DEPARTMENT OF ENERGY

With the exception of Section 5.2 of Appendix D, this appendix has been replaced by information in the *Final Chemical Soil Background Study Report for the SSFL* (URS, 2012) and the *Final Radiological Characterization of Soils for Area IV and the Northern Buffer Zone* (HydroGeoLogic, Inc., 2012).

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LIST OF ACRONYMS

AMEC	AMEC Earth and Environmental
AOC	area of concern
Boeing	The Boeing Company
BBI	Brandeis-Bardin Institute
Cal-EPA	California Environmental Protection Agency
Calscience	Calscience Environmental Laboratories, Inc.
CAS	Columbia Analytical Services
COPC	chemical of potential concern
CPEC	chemical of potential ecological concern
CV	coefficient of variation
DHS	California Department of Health Services
dioxins/furans	(a) - *see table below*
DOE	U.S. Department of Energy
DTSC	Department of Toxic Substances Control
FAL	field action level
FSDF	Former Sodium Disposal Facility
GC/MS	gas chromatography/ mass spectrometry
GPS	global positioning satellite
GRC	Groundwater Resources Consultants, Inc.
GSU	Geological Services Unit
HERD	Human and Ecological Risk Division
HML	Hazardous Materials Laboratory
ICF	ICF Kaiser Engineers
IT	IT Corporation
MDL	method detection limit
MWH	MWH Americas, Inc.
McLaren/Hart	McLaren/Hart Environmental Engineering Corporation
NASA	National Aeronautics and Space Administration
Ogden	Ogden Environmental and Energy Services Co., Inc.
ppt	parts per trillion
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/ quality control
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RL	reporting limit
SMMC	Santa Monica Mountains Conservancy
SOP	standard operating procedure
SRAM	Standardized Risk Assessment Methodology
SSFL	Santa Susana Field Laboratory
SWMU	Solid Waste Management Unit
TEQ	Total Equivalency Quotient

LIST OF ACRONYMS (continued)

TIC	tentatively identified compound
UCL	upper confidence limit
USEPA	United States Environmental Protection Agency
WPA	Work Plan Addendum
WPAA	Work Plan Addendum Amendment

(a) Definition of dioxin/furan congeners

PCDD/PCDFs	**Polychlorinated dibenzo-p-dioxins/dibenzofurans**
2,3,7,8-TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
1,2,3,7,8-PeCDD	1,2,3,7,8-pentachlorodibenzo-p-dioxin
1,2,3,4,7,8-HxCDD	1,2,3,4,7,8-hexachlorodibenzo-p-dioxin
1,2,3,6,7,8-HxCDD	1,2,3,6,7,8-hexachlorodibenzo-p-dioxin
1,2,3,7,8,9-HxCDD	1,2,3,7,8,9-hexachlorodibenzo-p-dioxin
1,2,3,4,6,7,8-HpCDD	1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin
OCDD	1,2,3,4,6,7,8,9-octachlorodibenzo-p-dioxin
2,3,7,8-TCDF	2,3,7,8-tetrachlorodibenzofuran
1,2,3,7,8-PeCDF	1,2,3,7,8-pentachlorodibenzofuran
2,3,4,7,8-PeCDF	2,3,4,7,8-pentachlorodibenzofuran
1,2,3,4,7,8-HxCDF	1,2,3,4,7,8-hexachlorodibenzofuran
1,2,3,6,7,8-HxCDF	1,2,3,6,7,8-hexachlorodibenzofuran
2,3,4,6,7,8-HxCDF	2,3,4,6,7,8-hexachlorodibenzofuran
1,2,3,7,8,9-HxCDF	1,2,3,7,8,9-hexachlorodibenzofuran
1,2,3,4,6,7,8-HpCDF	1,2,3,4,6,7,8-heptachlorodibenzofuran
1,2,3,4,7,8,9-HpCDF	1,2,3,4,7,8,9-heptachlorodibenzofuran
OCDF	1,2,3,4,6,7,8,9-octachlorodibenzofuran

SECTION 1
SCOPE AND PURPOSE OF THE SOIL BACKGROUND DATA SET

This report presents the comprehensive data set that defines ambient background concentrations of metals, polychlorinated dioxin and furan compounds, fluoride, and pH in soil at the Santa Susana Field Laboratory (SSFL) in Ventura County, California. This report has been prepared by MWH Americas, Inc. (MWH) for The Boeing Company (Boeing), National Aeronautics and Space Administration (NASA), and the United States Department of Energy (DOE) to support the Resource Conservation and Recovery Act (RCRA) Program at the SSFL. This final document replaces an earlier version published in June 2005, and incorporates requested revisions by the California Environmental Protection Agency (Cal-EPA) Department of Toxic Substances Control (DTSC).

Background sampling locations for the SSFL were established to provide data representative of ambient or local soil conditions, unaffected by site-related activities. To accomplish this, sampling locations were selected within and surrounding the SSFL in areas not impacted by site activities. Figure 1-1 shows the locations of the SSFL and surrounding areas. The background sampling locations were chosen based on extensive review and input by the DTSC, Geological Services Unit (GSU) Branch. An overview of the sampling events from which the data set was assembled, and details of recent soil sampling to supplement the existing metals background data set, are also provided herein.

The comprehensive soil background data set will be used to assist site characterization and risk assessments for the ongoing RCRA Corrective Action Program at the SSFL. To guide onsite RCRA Facility Investigation (RFI) site characterization decisions, comparison values derived from the data set will be used to determine if soil at a given investigational unit (solid waste management unit [SWMU] or area of concern [AOC]) has metals, fluoride, or dioxins concentrations above ambient background. In both the human and ecological risk assessment, the comprehensive soil background data set will

also be used in the selection of chemicals of potential concern (COPCs) or chemicals of potential ecological concern (CPECs).

This report is organized as follows:

- Section 1 presents the scope and purpose of the soil background data set;
- Section 2 describes the sampling events from which the final data set are comprised;
- Section 3 summarizes agency oversight throughout development of the data set;
- Section 4 presents compilation of the final comprehensive soil background data set;
- Section 5 describes how the comprehensive soil background data set will be used for characterization and risk assessment;
- Section 6 provides references cited in this document; and
- Appendices contain field boring logs, location photographs, laboratory and validation information, and data set distribution and rank order plots.

For the purposes of this report, the term 'dioxins' refers to the group of chlorinated dibenzo-p-dioxin and chlorinated dibenzofuran congeners being evaluated during the RCRA Program at the SSFL. These congeners are listed in the List of Acronyms.

SECTION 2
OVERVIEW OF SOIL BACKGROUND DATA SET DEVELOPMENT

The soil background data set for metals, dioxins, fluoride, and pH is comprised of a subset of soil data collected over six discrete sampling events between 1992 and 2005. Each of these investigations was conducted in accordance with DTSC-approved work plans, and included analytical suites designed for the specific purposes of that sampling program. Background sample locations for each investigation were selected based on DTSC input, and were visited by DTSC personnel. In some cases, described further below, other agency and public review also occurred. Samples at each location were collected within the upper 1 foot of soil; a depth of zero feet was assigned to surface samples (i.e., the top 3 inches of soil), and the bottom depth of the sample interval was assigned to samples collected from 0.5 feet or 1 foot bgs. Samples from three background locations were collected at both 0.5 feet and 1 foot bgs. Improvement in laboratory analytical techniques over the course of these investigations resulted in different analytical methods, metals suites, and/or laboratory reporting limits (RL) for each metal analyzed. Sample locations are shown on Figure 2-1; detailed descriptions and photographs of each sampling location are provided in Appendix A.

This section presents a summary of the soil sampling events from which the comprehensive background metals and dioxins data sets were compiled. Table 2-1 presents this information in tabular form. As the soil background data set was developed for the SSFL RCRA Program, DTSC reviewed the data collected in the sampling programs described in this section. Decisions regarding inclusion or exclusion of data for the RCRA Program were made by DTSC as the investigation proceeded at the site. At the end of each of these following sections is the DTSC determination of sampling locations approved for use in the SSFL RCRA Program based on a comprehensive review during the Spring of 2005.

2.1 MULTI-MEDIA SAMPLING AT THE BRANDEIS-BARDIN INSTITUTE AND SANTA MONICA MOUNTAINS CONSERVANCY (1992 - 1994)

Initial assessments of the potential for offsite contamination at properties adjacent to and north of SSFL were conducted according to the DTSC-approved *Work Plan for Multi-Media Sampling at the Brandeis-Bardin Institute (BBI) and Santa Monica Mountains Conservancy (SMMC)* (McLaren/Hart 1992) and the *Work Plan for Additional Soil and Water Sampling at the Brandeis-Bardin Institute and Santa Monica Mountains Conservancy* (McLaren/Hart 1993a). The investigations were conducted between 1992 and 1994, and included sampling of soil, surface water, groundwater, and produce at both properties (Figure 2-1). In consultation with the USEPA, personnel from Brandeis-Bardin and Rocketdyne, and the general public, six local background sample locations were selected to provide data on background concentrations of metals and radionuclides (McLaren/Hart 1992). These data were also used for interpretation of sampling results at the two properties.

- Rocky Peak (Sample Location BG01, approximately 5.1 miles north-northeast of the SSFL);
- Santa Susana Park (Sample Location BG02, approximately 2 miles northeast of the SSFL);
- Bell Canyon (Sample Location BG03, approximately 1 mile south-southeast of the SSFL);
- Western Sampling Site (Sample Location BG04; approximately 0.4 miles west of the SSFL);
- Happy Camp (Sample Location BG05, approximately 12.5 miles northwest of the SSFL); and
- Santa Monica Mountains National Recreation Area (Sample Location BG06, approximately 4.3 miles south-southwest of the SSFL).

At each of these areas, soil samples were collected from three locations within the upper 1 foot of soil and assigned a depth of 0 to 1 foot bgs. The three locations were laterally

spaced using a random sampling methodology (Gilbert 1987) in which a hypothetical 100 square-foot grid is utilized. Samples were named according to the area (e.g. BG02) and the 3-digit code designating the block (numbered 001-099) within the grid where the sample was collected (e.g. BG02074). Samples were analyzed for 13 priority pollutant metals by USEPA Method 6010/7000 at McLaren/Hart. Sampling results for these events are presented in the *Multi-Media Sampling Report for the Brandeis-Bardin Institute and the Santa Monica Mountains Conservancy* and *Additional Soil and Water Sampling at the Brandeis-Bardin Institute and the Santa Monica Mountains Conservancy* (McLaren/Hart 1993b and 1995).

Based on the 2005 DTSC determination and criteria described in Section 3, the sampling locations from this event approved for use in the SSFL RCRA Program background data set include Sample Locations BG01, BG02, and BG04 (Figure 2-1).

2.2 FSDF CLOSURE FIELD INVESTIGATION (JULY 1995)

During 1995 investigation activities for the Former Sodium Disposal Facility (FSDF) (SWMU 7.3) in the SSFL Area IV, 12 background soil sampling locations were selected for comparison with site sampling metals and dioxins data. This sampling event was conducted according to the DTSC-approved *Sampling and Analysis Workplan, Former Sodium Disposal Facility (ICF 1995).* Soil samples collected at each location were collected from the surficial soils and analyzed for 17 Title 22 metals by SW846 Method 6010/7000 and dioxins/furans by USEPA Method 8290 (ICF 1997). Soil metals and dioxins data from 7 of the 12 sampling locations (BKND-1 through BKND-7) were approved by DTSC for use in the background data set for the FSDF Interim Measures (IT Corporation [IT] 2002, DTSC 2004) and 5 of the 12 were not selected for the background data set. Five of the seven selected locations are within undeveloped land in the southern portion of the SSFL; the other two selected are along the SSFL property boundary adjacent to Area IV, away from any known site activities (Figure 2-1).

Based on the 2005 DTSC determination and criteria described in Section 3, the sampling locations from this event approved for use in the RCRA Program background data set for SSFL include sampling locations BKND-1 through BKND-7 (Figure 2-1).

2.3 METALS SAMPLING FOR THE RFI WORK PLAN ADDENDUM (MAY 1996)

Soil sampling was conducted by Ogden Environmental and Energy Services Co., Inc. (Ogden) within and adjacent to the SSFL in May 1996 in accordance with the *Metals Sampling and Analysis Plan* (Ogden 1996a). This sampling event was performed at onsite and offsite locations to provide total and soluble metals data for development of groundwater-protective field action levels (FALs) for the RFI. This event included sampling at 11 background locations selected in conjunction with DTSC in undisturbed areas away from and upslope of developed areas (buildings, roads, etc.) to minimize the potential for anthropogenic influences (Ogden 1996b). Soil data collected from these background locations were used to augment and expand the existing background metals data set, and used with other preliminary metals sampling data to propose preliminary background comparison concentrations for the RFI. Fifteen soil samples were collected from the 11 background locations during this event. Sample location identifiers are BGSS01 through BGSS07 (seven locations, nine samples) and BZSS01 through BZSS04 (four locations, six samples) (Figure 2-1).

Samples were collected from the upper 1 foot of soil (generally 0.5 feet or 1 foot below ground surface [bgs]); samples from two locations were collected at both 0.5 feet and 1 foot bgs. Each sample was analyzed for metals by USEPA Method 6010/7000 at Ceimic Corporation in San Diego, California. Sampling protocol followed standard operating procedures outlined in the RFI Work Plan Addendum (Ogden 1996b) in progress at the time; this document was approved by DTSC in September 1996.

Metals data collected from these 11 background locations during this event were combined with previous background sample data collected during the Brandeis-Bardin and FSDF investigations described above, and used to develop FALs for the RFI.

Based on the 2005 DTSC determination and criteria described in Section 3, data collected from all 11 of the sampling locations from this event were approved for use in the background data set for the RCRA Program at the SSFL.

2.4 BELL CANYON AREA SAMPLING (JUNE 1998)

Background soil and/or surface sediment samples were collected from six locations within undeveloped portions of Bell Canyon and the southern portion of the SSFL for comparison with data collected during the investigation, and to reflect non-impacted areas. Soil sampling in accordance with the DTSC-approved *Bell Canyon Residence Soil Sampling Work Plan* (Ogden 1998a) was conducted in June 1998, following RFI sampling protocol outlined in the *RFI Work Plan Addendum* (Ogden 1996b). The background locations were selected in conjunction with DTSC based on geological rock type and accessibility (Ogden 1998b). Samples were collected from the upper 1 foot of soil overlying the primary rock types within Bell Canyon (Chatsworth and Lindero Canyon formations) (Figure 2-2). Samples were analyzed at Columbia Analytical Services (CAS) in Canoga Park, California. Samples were analyzed for 19 metals by USEPA Method 6010/7000 and dioxins by USEPA Method 8290.

Sampling results were presented in the *Bell Canyon Area Soil Sampling Report* (Ogden 1998b). Sample identifiers for this event are indicated with "BC" as the first two characters. BCSSxx indicates a surface soil or sediment sample, while BCBSxx indicates a boring sample collected below the surface (generally 0.5 feet bgs).

Based on the 2005 DTSC determination and criteria described in Section 3, data collected from all six sampling locations during this event were approved for use in the background data set for the RCRA Program at the SSFL.

2.5 ADDITIONAL SAMPLING FOR THE RFI STANDARDIZED RISK ASSESSMENT METHODOLOGY WORK PLAN (MARCH 2000)

In 2000, after review of the soil background metals and dioxins data collected in the events described above, DTSC requested additional sampling to improve sample distribution at and surrounding the SSFL and increase the number of samples in the dioxins data set. Three additional sampling locations were selected in conjunction with DTSC within undeveloped land in the northern and southern portions of the SSFL. Sampling was conducted on March 22, 2000 following RFI sampling protocol outlined in the RFI WPA (Ogden 1996) and RFI WPAA (Ogden 2000b). Samples collected at two of these locations (BGSS07 and SGSS01) were analyzed for metals and dioxins using USEPA Methods 6010/7000 and 8290, respectively. The sample collected at location BZSS05 was analyzed only for dioxins by Method 8290. All samples were analyzed at Calscience in Garden Grove, California. The resulting metals and dioxins background data sets were approved by DTSC (2000c) as part of the *Standardized Risk Assessment Methodology (SRAM) Work Plan* in June 2000.

Based on the 2005 DTSC determination and criteria described in Section 3, data collected from all three sampling locations from this event were approved for use in the background data set for the RCRA Program at the SSFL.

2.6 METALS BACKGROUND SAMPLING (APRIL 2005)

After discussions with DTSC during late 2004 and early 2005, it was agreed that additional sampling at DTSC-approved background locations was necessary to supplement the existing soil metals background data set. This was accomplished by collecting samples and either completing the analyses not previously performed on all samples, or by adding new analytes not previously included (MWH 2004b). This sampling event was conducted in April 2005. During this event, analysis of the following sampling suites was performed at the locations described:

1. **Aluminum, antimony, barium, cobalt, mercury, molybdenum, selenium, and vanadium:** The background data set for these eight metals was augmented by collecting samples at locations either not previously analyzed for these metals, or where previously collected data were deemed unusable during validation (Appendix B).
2. **Zirconium, fluoride, lithium, sodium, potassium and pH:** these target compounds were added to the soil background analytical suite to support closure of RCRA-permitted units in the SSFL Area IV.
3. **Thallium:** A background range for thallium was established by recollecting samples from all background locations and analyzing them at the lower laboratory detection limits currently attainable for RFI samples.
4. **Boron and manganese**: These metals were added to the soil background analytical suite to support RFI risk assessment for metals.
5. **Iron** was added to the soil background analytical suite and sampled at all locations to aid in evaluation of the chemistry of other metals, and to support groundwater data evaluation.
6. **All metals** were analyzed in samples collected from location BZSS05, where a sample was previously analyzed only for dioxins.

2.6.1 Sampling Procedures

Sampling to supplement the soil metals background data set, as described in Section 2.6, was conducted by MWH between April 12th and 19th, 2005. This sampling event was conducted following RFI standard operating procedures (SOPs) (Ogden 1996b and 2000b). Field documentation of each sampling location included recording soil properties on field boring logs, recording global positioning satellite (GPS) survey coordinates, and taking photographs (Appendix A). Laboratory analytical data and validation information are provided in Appendix B.

To ensure consistency in the sample data, samples from background locations were collected from the same locations and depths as previous samples. At all locations, vegetation was carefully removed by scraping it aside with a pre-cleaned trowel. Surface soil samples assigned a depth of "0" feet were collected from the upper 2 to 3 inches of soil beneath vegetation by a grab sampling technique (using a capped sample sleeve). Samples from 0.5 feet bgs (or deeper) were collected by advancing the sample sleeves by hand to the desired depth. The depth assigned to these samples was the bottom of the sample interval.

2.6.2 Sample Analytical Results

Analytical results of April 2005 soil metals sampling are summarized in Section 4. All metals sample data from this event were validated according to USEPA Level IV requirements as specified in the Quality Assurance Project Plan (QAPP) in Appendix A of the RFI WPAA (Ogden 2000b). Laboratory method detection limits (MDLs) for all new analyses met RFI requirements specified in the QAPP (Ogden 2000b); the MDLs for all new analyses were at least as low as, or lower than, previous soil background sample limits. Data validation of the final soil background data set is discussed further in Section 4.

SECTION 3
REGULATORY REQUIREMENTS, OVERSIGHT AND APPROVAL

This section describes regulatory agency requirements for background soil sampling and agency involvement throughout compilation of the soil background data set for the RCRA Program at the SSFL.

3.1 REGULATORY REQUIREMENTS

The criteria for selecting background sampling locations representative of ambient conditions are listed in several regulatory agency guidance documents. DTSC (1997) guidance defines 'ambient conditions' as concentrations of metals in the vicinity of a site but which are unaffected by site-related activities (also known as 'local background'). USEPA (2002) guidance defines 'ambient' as having characteristics that include levels of both naturally occurring (not influenced by humans) and anthropogenic (human made, non-site) chemicals. USEPA (2002) guidance also states that the background reference area should have the same physical, chemical, geological and biological characteristics as the site being investigated, but has not been affected by activities at the site.

The DTSC 1997 policy for selection of inorganic chemicals of potential concern (COPCs) consists of eight steps. These steps are:

1. Expand the data set
2. Test the distribution
3. Display summary statistics for the expanded data set
4. Plot concentration vs. cumulative probability
5. Identify the population nearest the origin
6. Select a value to represent the upper range of ambient conditions
7. Include or exclude metals as a COPC
8. Perform Wilcoxon Rank Sum Test (optional)

Steps 1 though 6 of the DTSC policy are used to define the background data set and establish comparison values, and Steps 7 and 8 are used when conducting the site risk assessment to determine COPCs. Specific application of these steps to the SSFL background data set are described in Section 4 (definition of the data set), and in Section 5 (use of the data set). The overall approach used to develop the SSFL background soil data set is consistent with the intent and generally follows the procedures of the DTSC policy. The approach for the SSFL background data set is described in this section.

The purpose of the 1997 DTSC policy is to establish the ambient or background concentrations of metals in soil. This policy allows inclusion of site data collected during the investigation to supplement the background samples when developing the background data set for a facility (DTSC 1997). The purpose of adding the site data is to increase the number of background samples. However, this approach of using site data was not used in defining the SSFL background data set. Rather, a modified approach was used to achieve the goal of the policy and to reflect the size and complexity of the SSFL site conditions.

The approach used for the SSFL background data set was to collect a sufficient number of samples that represent ambient conditions. Only samples from agency-approved locations representing ambient soil conditions were included for evaluation. These locations were selected in undeveloped portions of the SSFL and surrounding areas to be representative of ambient conditions including the wide range of geomorphic and geologic settings present at the SSFL investigational units. Only locations situated on geologic units found within the SSFL were chosen for background sampling to ensure the data set is representative of ambient conditions. The background soil sampling locations were visited by DTSC and determined to represent ambient conditions, unaffected by site activities (DTSC 2000c). All data were reviewed and validated by qualified chemists. As described in Section 2, the data set was expanded (Step 1 of the DTSC policy) by the addition of sampling locations in 2000 to meet the policy criteria of both a sufficient number of samples and representative of ambient conditions.

By limiting the background sampling for the SSFL to only agency-approved locations not affected by site operations, the background data set derived from sampling those locations represents ambient background conditions and meets the regulatory criteria for background data and satisfies the intent of the DTSC policy. Samples were collected from 29 widespread locations in areas outside of site operations (up to 3 miles away), and results are representative of the range of ambient geologic units and soil types at the SSFL. Background concentrations are expected to vary in onsite soils, since the SSFL:

- comprises a large area (over 2,800 acres);
- includes a variety of soil types (clays, sands, silts), and geologic units (Chatsworth formation, Santa Susana formation, Quaternary alluvium); and,
- is characterized by variable geomorphic conditions, vegetation, and hydrology.

In contrast to smaller investigation sites, more naturally occurring variability in sampling results is expected in the SSFL background data set because of the factors listed above. This data variability is reflected in the distribution of some metals which show a range of concentrations related to the type of source rock forming the soils. As explained in Section 4, this factor was considered in application of the 1997 DTSC policy Steps 2 though 6.

An additional modification to the DTSC policy was that a background data set was developed for dioxins. A subset of the metals sampling locations were sampled for dioxins (17 locations). This was done with DTSC concurrence since dioxins are widespread throughout the environment and their background levels have been well characterized by USEPA (2000). Known ambient sources of dioxins in soil include brush fires at and near the site, and contributions from bedrock (i.e. shale and clay) (Cleverly, et al. 1997, Ferrario 2000). These sources have not only contributed to dioxin concentrations in soil on and in the vicinity of the SSFL, but also to a regional dioxin background value. Measurements of background dioxins in the western United States result in a Total Equivalency Quotient (TEQ) less than 2 parts per trillion (ppt) (USEPA

2001). A dioxin TEQ is the sum of the 17 dioxin and furan congener concentrations after those concentration have been multiplied by a toxicity equivalency factor. A TEQ value represents a total dioxin concentration.

3.2 AGENCY OVERSIGHT

DTSC was involved in the selection of background soil sample locations for each of the field events described in this report. All background sample locations in the final data set have been visited by the DTSC. Additionally, the DTSC has observed field sampling procedures and collected split soil samples to confirm laboratory findings. The background locations sampled by McLaren/Hart in 1992 were also reviewed by public representatives and other regulatory agencies (USEPA and DHS), and the background locations sampled by Ogden in 1996, 1998, and 2000 were selected and sampled in the presence of DTSC staff (Ogden 2000a).

3.3 DTSC REVIEW AND APPROVAL OF THE SOIL BACKGROUND DATA SET

An overall evaluation of the background data set by the DTSC's Geological Services Unit (GSU) and Human and Ecological Risk Division (HERD) in 2000 confirmed that the soil sampling locations have not been impacted by site activities, and reflect ambient or local background conditions (DTSC 2000b). DTSC approved the soil background data set as part of the SRAM Work Plan (DTSC 2000e). However, additional DTSC review of the background data in 2004/2005 resulted in modification of the data set. As a result, soil data from sample location BG03 were removed from the data set due to differing geologic conditions for onsite evaluations (DTSC 2005). This DTSC review also resulted in the recommendation of the supplemental metals data discussed in Section 2.6.

The DTSC GSU and HERD have reviewed all metals and dioxins sampling results, and provided input on the selection of comparison values for both metals and dioxins

(Section 4). In addition, both GSU and HERD reviewed and provided comments on the June 2005 version of this report. This August 2005 final soil background report reflects requested DTSC revisions to that document. DTSC Hazardous Materials Laboratory (HML) chemists have reviewed previously published soil background sample data and determined that they are satisfactory for project use (DTSC 2000a and 2000d). HML has also reviewed the most recent sampling data and concurred with the data validation findings (see Section 4.1 and Appendix B).

DTSC review and approval of this document serves as approval of the soil background data set for metals, dioxins, fluoride, and pH for use in the SSFL RCRA Corrective Action Program as described below in Section 5. The following section presents and summarizes the final soil background data set for the onsite RCRA Program.

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SECTION 4
DESCRIPTION OF THE FINAL SOIL BACKGROUND DATA SET

The inorganic soil background data set consists of metals, fluoride and pH data from 41 soil samples collected at 29 agency-approved locations. A total of 27 samples were collected at 21 locations within the SSFL property boundary, and 14 samples were collected from offsite locations (Figure 2-2). The dioxins soil background data set consists of 17 samples from 16 of the metals sampling locations. Twelve of the locations were onsite and four of the dioxins sampling locations were offsite (Figure 2-2).

Background metals, fluoride and pH data are presented in Table 4-1, and dioxins data are presented in Table 4-2. Sampling information (e.g. dates collected, sample depths, and validation qualifiers) is also presented in these tables.

The SSFL soil background data set meets regulatory criteria established for background data. This includes both the California (DTSC 1997) and Federal (USEPA 2002) criteria described in Section 3. DTSC has reviewed and approved each of the sampling locations. Each location was reviewed to ensure similar geology to the SSFL and evaluated for potential site impacts. The following sections describe data quality review findings, steps followed, and samples included in each of the background data sets for the SSFL.

4.1 DATA QUALITY

After laboratory analysis and review, all sampling results were validated by qualified chemists at AMEC Earth and Environmental, Inc. (AMEC). In addition DTSC reviewed and validated several of the soil background samples (DTSC 2000a and 2000d), and a April 2005 data package as described below. Overall, data quality was determined to meet project requirements and data were deemed acceptable by validation and included in the final soil background data set. This section summarizes the laboratory and data validation procedures used, and the data review findings for the background samples.

The ICF Kaiser and McLaren/Hart laboratory programs are described in the appropriate work plans (ICF Kaiser 1995; McLaren/Hart 1993b). For samples collected by Ogden and MWH, laboratory procedures, methods, and requirements followed the quality assurance criteria specified in the Quality Assurance Project Plans (QAPPs) prepared for the RFI and characterization programs at the SSFL (Ogden 1996 and 2000b).

Laboratory information and data validation results for the final soil background data are provided in Appendix B.

4.1.1 Data Review and Validation Procedures

All background sample data were validated at either Level IV or Level V, in accordance with the requirements in the USEPA *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (USEPA 1994a), the USEPA *Contract Laboratory Program National Functional Guidelines for Organic Data Review* (USEPA 1994b), the analytical methods referenced by the laboratory, laboratory SOPs, and the appropriate AMEC data validation procedures. Level IV validation includes review of the following items (when applicable): sample management, gas chromatography/mass spectrometry (GC/MS) instrument performance, initial and continuing calibration, method blank results, calibration blank results, matrix spike sample results, surrogate results, laboratory and field quality control (QC) sample results, internal standard performance, target compound identification, compound quantification and reported detection limits, tentatively identified compounds (TICs), and a definitive review of the raw data. Level V validation includes review of sample management, method blanks, matrix spike samples, surrogates, laboratory control samples, and field QC samples.

Data used to characterize the background samples include acceptable validated data without qualifiers, and estimated data ("J" or "UJ" qualifiers). Unusable data are denoted with an "R," qualifier, indicating that the data were rejected (Appendix B). Rejected data were not included in the soil background data set.

4.1.2 Data Validation Findings

Based on validation, all data were usable, except for a few metals data collected by McLaren/Hart (1992). Six antimony, six mercury, and nine selenium results were rejected due to matrix spike recovery outliers (Appendix B). These samples were recollected during the April 2005 sampling event; therefore all sample data included in the final background data set were deemed usable for purposes described in this document.

A more detailed summary of the data validation findings is included in Appendix B. These data validation findings include:

- Some metals and dioxins data were qualified as non detect or as estimated non detects due to detects in the associated method blanks and field QC samples. No metals or dioxins qualifications appeared related to significant laboratory contamination.
- Fluoride was detected below the reporting limit in several laboratory method blanks and calibration blanks, as well as in most background soil samples. The blank detects resulted in the qualification of most fluoride detects as estimated non detects, at the level of laboratory contamination in the samples. Therefore, the final fluoride results for these samples are all estimated values below the reporting limit.
- Most pH results were qualified as estimated because analysis exceeded holding times. The holding time for pH is "immediate." Therefore, exceeded holding times are not uncommon and are not indicative of poor laboratory or field quality assurance/ quality control (QA/QC) procedures.
- Some data (all methods) were qualified as estimated detects and non detects due to laboratory QC results that were outside of the laboratory or method control limits. For the most part, these qualifications were related to interference caused by the soil matrix and were not indicative of laboratory quality control issues.

- Some analytical results for antimony were determined to be suspect due to poor instrument sensitivity near the instrument detection limit as indicated by positive results for antimony in the calibration blanks. All antimony results were reviewed by data validators and, when necessary, the antimony method detection limits (MDLs) were raised to the value of the interference.

Some dioxin results were qualified for interferences related to sample preparation, instrument calibration, and identification criteria. For the most part, these qualifications were related to interference inherent in the method or caused by the soil matrix and were not indicative of laboratory QC issues.

Comparison of field duplicate data generally indicated good agreement between the field duplicate pairs.

In addition to previous data reviews, HML reviewed metals and mercury data from one April 2005 background data deliverable group and concurred with the qualification of the data described above (Appendix B). Furthermore, HML noted that "sample results associated with satisfactory QA/QC results should be acceptable. Sample results associated with unsatisfactory QA/QC results should be qualified as estimations." In this comment, DTSC re-states the definition of the use data qualifiers in the data validation process; data qualification was performed as indicated during the data review.

A more detailed summary of the validation findings is presented in Appendix B. Also in Appendix B are data summary tables, data validation reports, and annotated laboratory result forms for each validated soil sample included in the final soil background data set. Recent April 2005 sampling event laboratory reports and chain-of-custody information are also included in Appendix B.

4.2 FINAL SOIL BACKGROUND METALS DATA SET

The metals background data set consists of data from the 41 soil samples collected at 29 agency-approved locations over the course of 6 sampling events. The metals sampling analytical suites for each event are summarized as follows:

- Nine samples collected by McLaren/Hart in 1992 (3 samples each from BG01, BG02, and BG04) for analysis of 13 metals (antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc);
- Seven samples collected by ICF Kaiser in 1995 (locations BKND-1 through BKND-7) for analysis of 17 metals (barium, cobalt, molybdenum, and vanadium in addition to the target list utilized by McLaren/Hart);
- Fifteen samples collected by Ogden in 1996 (locations BGSS01 through BGSS04; BGSS06, BGSS07, BZSS01 through BZSS04) for analysis of 18 metals (aluminum added to the analytical suite);
- Seven samples collected by Ogden in 1998 (locations BCBS09, BCSS09, and BCSS11-14) for analysis of 19 metals (boron added to the analytical suite);
- Three samples collected by Ogden in 2000 (locations SGSS01 and BZSS05-06 and analyzed for the same 19 metals; and
- Forty supplemental samples collected by MWH in 2005, which added fluoride and six metals (iron, lithium, manganese, potassium, sodium, and zirconium) to the target list, resulting in a total of 25 metals in the validated analyses.

Metals sampling locations are shown on Figure 2-1 and data presented in Table 4-1. As described in Steps 2 and 3 of the 1997 DTSC background policy, the data distributions were tested for all constituents and data set statistics summarized (Table 4-3). Cumulative probability plots (Step 4 of the DTSC policy) were prepared and are provided in Appendix C. As noted in Table 4-3, several constituents had a low frequency of detection (e.g., antimony, molybdenum, silver). Because of this, additional cumulative probability plots were prepared in which non detects were eliminated so that the data distribution of detected values could be considered (Appendix C). In addition, per DTSC

request, probability plots are also provided showing non detects substituted with one half the detection limit and with the minimum detected value.

4.2.1 Evaluation of the Background Metals Data Distributions

As described in this section, the background metals data are acceptable for use in characterization and risk assessment based on a review of results, distributions, summary statistics, and probability plots. The data meet the DTSC policy criteria since all data are within two orders of magnitude (most detected data are within or near one order of magnitude), and almost all probability plots yielded a coefficient of variation (CV) less than 1 (Table 4-3). Two metals have a CV greater than 1 (antimony at 1.1, and molybdenum at 1.3). Review of the probability plots in Appendix C and soil boring logs in Appendix A indicates that this is mostly caused by either (1) the influence of non detects in the distribution, and/or (2) the influence of soil type and source rock composition. Distributions influenced by non detect data include antimony, boron, cadmium, fluoride, mercury, selenium, silver, and thallium. As noted above, probability plots for these metals were prepared with non detects eliminated to evaluate the data distributions (Appendix C). This additional evaluation of data distribution augments the procedure described in the DTSC policy and was performed because some data have a high proportion of non detects.

Influence of soil type on background metal concentrations is related to the amount of silt or clay in the soil sample and source rock composition. Silt and clay content varies in soils and this grain size fraction has a different mineralogy and chemistry than sands, which are primarily silica. As a result, soils with high clay content can contain higher concentrations of some metals. Some metals (e.g., magnesium, iron, and aluminum) are constituents of the clay mineral structure, and various other metals can 'substitute' for these (Hurlbut and Klein, 1977). Also, because of the open crystal structure metals can be trapped in the clay minerals. Fine grain size and higher organic content typically found in silts and clays also increases the capacity of clay rich soils to adsorb metals. This enrichment of metals can occur over a wide range, sometimes even resulting in

economically valuable metal ore deposits in clay and shale (a fine-grained rock containing many clay minerals) (Sethi and Schieber, 1998). SSFL background sample soil types are predominately silts and silty sands (Appendix A), but also include clays, clayey sands, and well sorted sands. Soil types for the background sampling locations are summarized in Table 4-4. Soil types vary across the SSFL and can vary within investigational units.

"Source rock" is the parent bedrock that degrades to form soils. In terrain like the SSFL, where there is much exposed bedrock and generally thin soil cover, soil is formed by the weathering and breakdown of parent bedrock materials. Because of this, soil types and composition are dependent in part on the type of source rock present. At the SSFL, bedrock composition varies and includes shale, siltstone, fine- to coarse-grained sandstone, and conglomerate. Similar to the soil types described above, these bedrock types represent a range in clay content, with shale containing a high proportion of clay minerals. As such, source rock influences soil type, and ultimately the mineralogy and chemistry of the soil. Furthermore, faults are present within areas where some background samples were collected, and the mineralogy associated with these geological structures also adds to sample heterogeneity. In addition, it is worth noting that drainages at the SSFL tend to contain finer-grained soils since they typically form where softer shale bedrock is located.

Based on a comparison of data presented in Table 4-1, population and rank order plots (Appendix C), soil types, percentage of fine-grained material, and location above differing rock types (Table 4-4; Figure 2-1), most background metals data distributions appear to be influenced by soil type and/or source rock composition. In general, the higher concentrations of almost all metals in background samples are associated with higher percentages of clay and silt in the sample (with copper, silver and vanadium as possible exceptions) (Table 4-4, Appendix C).

Background sampling metals results were also compared to published background values for California soils (Kearney 1996; Hunter et al. 2005). Information regarding the range

of metals in California soils is provided for each metal in Table 4-1. As shown in this table, all background sampling results are within the published range of metals in California soils.

Finally, in addition to the statistical and regional comparisons described above, an evaluation of the geographic and vertical distribution of metals data within the data set was conducted to evaluate the potential of airborne impacts from SSFL operations. These evaluations and findings are described below.

The prevailing wind pattern at the SSFL is bimodal, from both the northwest and southeast (MWH 2004a). Engine testing locations and thermal treatment areas are shown on the figures used for the following evaluations.

The geographic distribution of metals concentrations was evaluated by plotting the location of upper populations or maximum concentrations in the data set, and comparing the resulting distribution to prevailing wind directions, onsite testing locations, and the soil and rock types at the sampling location (Figure 4-1). For each metal, upper populations or maximum concentrations were identified on rank order or probability plots. Upper populations were generally small and somewhat distinct from the overall data distribution pattern. Figure 4-1 displays the sampling locations where the upper population or maximum metals concentrations were detected. If an upper, distinct population was not noted because of an overall linear data distribution, then the maximum detected concentration was shown on the figure. Based on the results of this analysis depicted on Figure 4-1, there is a wide geographic distribution of higher metals concentrations around the SSFL (i.e., higher concentrations for different metals are located at a variety of locations). This suggests airborne releases from SSFL operations have not affected background soil metals concentrations because higher concentrations do not occur only in northwest-southeast directions.

Four sampling locations (BG04, BCBS09, BCSS14, BZSS03), represent locations with some of the higher concentrations of several metals, including antimony, aluminum,

arsenic, boron, beryllium, iron, lithium, and zinc, among others. These four sampling locations are in the southwest and southeast, both onsite and outside of the facility (Figure 4-1). Each of these soil samples is characterized by a high percentage of fines (65 to 100 percent) as indicated in Table 4-4. It is worth noting that at least two of these samples, BCBS09S01 and BCSS14S01, were collected from thin soils developed above a shale bedrock unit (the geology at the western sampling location has not been mapped in detail).

Based on data shown on Figure 4-1, the only pattern observed in the geographic distribution of higher metals concentrations in the soil background data set is associated with source rock composition. The widespread distribution of many higher metals concentrations, the lack of higher concentrations in samples nearest the testing or thermal treatment areas, and association of higher results with fine-grained soils shown on Figure 4-1, indicates that airborne dispersion of contaminants from SSFL has had no significant affect on background data set soils.

To further test this conclusion, an evaluation of the vertical distribution of metals in soil was also performed. Results from shallow and deeper samples ("depth pairs") at the same location were compared. Both shallow (0.5 foot bgs) and deeper (1 foot bgs) soil samples were collected at three locations, BGSS02, BZSS03, and BGSS03 (Figure 4-2; Table 4-5). Metal concentrations in these depth pair samples were compared to determine if any metals were consistently higher in the shallower sample, since this is the expected distribution if airborne impacts were present. As noted in Appendix A, "0.5 feet bgs" samples are collected from soil extending from the ground surface to 0.5 feet deep, and "1 foot bgs" samples were collected from soil extending from 0.5 to 1 foot deep. Without removing surficial soils, all samples were collected after the vegetation was cleared by hand from the designated sampling location.

Evaluation of metals results in the three depth pair samples indicates both increasing and decreasing metals concentrations with depth. The results shown in Table 4-5 indicate no consistent vertical distribution pattern or metals in the depth pairs (i.e., no pattern of

higher metals concentrations in the shallower samples), with the exception of lead (as described below). As shown at the bottom of Table 4-5, the ratio for background metal depth pair concentrations (shallow concentration divided by deeper concentration) is close to 1 (ranging from 1 to 1.3), for individual sample pairs with higher surface concentrations, indicating similar concentrations in both samples (i.e., no significant vertical gradient).

As noted above, the only metal consistently detected at higher concentrations in shallow depth pair soil background samples was lead. Lead impacts in ambient air of urban environments are well documented (USEPA 1998). Although the SSFL is mostly rural land, it is surrounded by major metropolitan areas with a long history of air quality impacts. The higher concentrations of lead in the shallow depth pair background soil samples is attributed to ambient air quality associated with the Los Angeles metropolitan area. It is worth noting that two of these depth pairs are located southeast of the rocket testing locations. If airborne impacts due to rocket engine testing were present in these two sample pairs, higher concentrations of other metals in addition to lead would be expected in the shallow samples at these locations. As shown in the table, this is not the case.

In summary, based on the available data, there is no pattern in the geographic or vertical distribution of soil background metals sampling results to indicate airborne dispersion and deposition of metal contaminants from SSFL operations. Based on this finding, the overall consistency in the data set indicated by the range of detected results and CVs near or below 1, and because the detected concentrations are within the range of California soils, the entire metals background data set has been determined acceptable for use and representative of ambient conditions (i.e., background).

4.2.2 Selection of Comparison Values for the Metals Background Data Set

Comparison values for background metals were selected using the entire data set based on the finding presented above. Application of Step 5 of the DTSC policy (selection of

the population nearest the origin) was modified for some metals because their distributions reflected multiple populations. This was due to either non detected values, or because the range of detected values was considered related to natural variability caused by thin soil conditions and proximity of variable source rock materials (i.e., shale or sandstone), and the presence of geologic structures (i.e., faults). As described in Section 3, this variability is expected because of the range of geomorphic and geologic conditions at and surrounding the SSFL. Therefore, multiple populations were retained in the background data set since all sampling locations were agency-approved and the data determined as described above to be representative of unimpacted ambient conditions.

A single concentration value was selected for each inorganic constituent to represent the upper range of ambient conditions in the metals data set (Step 6 of the DTSC policy). This upper range concentration value is called in this document the soil background "comparison value." The comparison value selected for each constituent was the maximum detected concentration. Use of these values for characterization is described in Section 5. Table 4-6 provides a summary of the metals background data set comparison values. Also included in Table 4-6 are regional California values for background. These are based on published information (Kearney 1997; Hunter et al. 2005). As shown in Table 4-6, the SSFL soil background comparison values for metals are within the range of published California values, and for most results are considerably below the maximum value.

4.3 FINAL SOIL BACKGROUND DIOXINS DATA SET

The dioxins background sampling locations are shown on Figure 2-1, and the data set is provided in Table 4-2. The final dioxins data set consists of validated data from 17 soil samples collected at 16 DTSC-approved locations (one duplicate). All dioxins samples were collected at locations where background metals samples were collected, as follows:

- Seven samples collected from seven locations during July 1995 FSDF closure activities (BKND-1 through BKND-7);
- Seven samples collected from six locations in June 1998 within and near Bell Canyon (BCBS09, BCSS09, and BCSS11through BCSS14); and
- Three samples collected from three background locations during March 2000 (BZSS05, BZSS06, and SGSS01).

Evaluation of the validated soil background dioxins data set in 2004/2005 did not indicate that any additional data were needed and the dioxins data set is reproduced here as reported and approved (Ogden 2000a, DTSC 2000e).

Similar to the metals background data set, the dioxins data distributions were tested for all congeners and data set statistics summarized as outlined in Steps 2 and 3 of the DTSC policy (Table 4-3). Cumulative probability plots (Step 4) were prepared and are provided in Appendix C. As noted on Table 4-3, many dioxins had a low frequency of detection (e.g., 2,3,7,8-TCDD, 1,2,3,7,8-PeCDD). Because of this, additional cumulative probability plots were prepared where non detects were eliminated so that the data distribution of detected values could be considered (Appendix C).

It should be noted that laboratory reported data for dioxins include "Total" results. These Total dioxins results reflect a combination of the 2,3,7,8-substituted and non-2,3,7,8-substituted congeners. These results are included on Table 4-2 for completeness only and are not used in either characterization or risk assessment decisions (Section 5).

4.3.1 Evaluation of the Background Dioxins Data Distributions

As described in this section, the background dioxins data are acceptable for use in characterization and risk assessment based on review of the results, distributions, summary statistics, and probability plots. The data meet the DTSC policy criteria since all data are within two orders of magnitude (most detected data are within or near one order of magnitude), and almost all probability plots have a coefficient of variation (CV)

less than 1 (Table 4-3). Eight dioxin congeners (including groups called 'Total') have a CV greater than 1, ranging up to 1.3 (Table 4-3). Overall, there are fewer detected concentrations in the dioxins data set than in the metals data set. The most frequently detected congeners in the background data set are those most commonly detected throughout the United States (e.g., OCDD) (USEPA 2000). Review of the probability plots in Appendix C indicates that the variability in dioxins results is primarily caused by the influence of non detects in the distribution. As with metals, probability plots for dioxin results with a low frequency of detection were prepared with non detects eliminated to evaluate the data distributions (Appendix C). In addition, per DTSC request, probability plots are also provided showing non detects substituted with one half the detection limit and with the minimum detected value.

Although the influence of soil types and parent source rock on the dioxins data distribution is less pronounced than in the metals data set, several of the samples with the greatest number of detects were associated with fine-grained soils (Appendix A and Table 4-2). As described in Section 3, another source of dioxins are related to natural brush fires (USEPA 2000).

The detected dioxin results are within the ambient range of measurements of dioxins measured in the western United States where regional TEQ values are typically less than 2 ppt (USEPA 2001). TEQs calculated for the SSFL background dioxin samples are shown in Table 4-2. The background dioxin TEQs range up to 0.98 ppt, slightly less than half of the western regional value.

An evaluation of the geographic distribution of the dioxins data was also conducted to evaluate the potential or airborne impacts within the data set. (A vertical distribution evaluation could not be performed since all were surficial samples, collected at 0 feet bgs). To evaluate the geographic distribution, the background dioxins TEQ values were plotted adjacent to each sampling location (Figure 4-3). Higher TEQs in the data set are widely distributed around the site, with a suggestion that the values may be lower in the southeastern area. Based on the results shown on Figure 4-3, there is no pattern in the

geographic distribution of the dioxins data set indicating higher concentrations relative to SSFL engine testing locations or thermal treatment areas onsite, prevailing wind patterns, or source rock contributions. The highest concentrations of dioxin TEQs are found distributed around the site instead of in upwind or downwind areas. In addition, the lack of a pattern in either the geographic or vertical distribution of the metals data set also supports the conclusion that background soil has not been affected by SSFL combustion activities since both metals and dioxins are present in airborne emissions from combustion sources.

In summary, based on the available data, there is no pattern in the geographic distribution of soil background dioxins sampling results to indicate airborne dispersion and deposition of dioxin contaminants from SSFL operations. Based on this finding, the overall consistency in the data set indicated by the range of detected results and CVs near or below 1, and by the lower values compared to regional studies, the entire dioxins background data set has been determined acceptable for use and representative of ambient conditions unimpacted by site operations (i.e., background).

4.3.2 Selection of the Comparison Values for the Dioxins Background Data Set

Comparison values for background dioxins were selected based on the entire data set based on the finding described above. Application of Step 5 of the DTSC policy (selection of the population nearest the origin) was modified for dioxins since most distributions reflected multiple populations. These resulted from either a large number of non detected values or because the range of detected values was considered related to natural variability caused by thin soil conditions, and proximity of variable source rock materials (i.e., shale or sandstone). As described in Section 3.1, this variability is expected because of the range of geomorphic and geologic conditions at and surrounding the SSFL. Therefore, multiple populations were retained in the background data set since all sampling locations were agency-approved and the data were determined (as described above) to be representative of ambient conditions.

A single concentration was selected for each congener to represent the upper range of ambient conditions in the dioxins data set (Step 6 of the DTSC policy). Similar to the metals data set, this upper range concentration value is called the soil background "comparison value." The comparison value selected for each congener was the maximum detected concentration, or a recent laboratory detection limit for congeners with all non detect data. Use of these values for characterization is described in Section 5. Table 4-7 provides a summary of the dioxins background data set comparison values. As noted in Table 4-7, a comparison value was not selected for the 'Total' dioxin congener groups, since these results represent the concentrations of multiple congeners, including those listed in the table. As described in Section 5, 'Total' dioxin concentrations are also not used for characterization or risk assessment decisions.

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SECTION 5
USES OF THE SOIL BACKGROUND DATA SET

This section summarizes uses of the soil background data set for SSFL RCRA Program onsite investigational unit characterization and risk assessment. Uses of the soil background data set presented here are also described in the SRAM Work Plan, Revision 2 (MWH 2005).

5.1 COMPARISON FOR INVESTIGATIONAL UNIT CHARACTERIZATION

The comprehensive background metals, dioxins, fluoride, and pH data sets will be used to guide investigational unit characterization decisions (e.g., additional step-out sampling). Metals, fluoride and pH data collected from investigational units will be directly compared to background data set concentrations to determine whether soil at a given location contains concentrations above ambient background. The concentration of each metal in the investigational unit data will be evaluated against the soil background comparison value developed from the final background data set (see Table 4-6).

If a metal concentration in the investigational unit data is below this soil background comparison value, no further characterization would be required unless multiple lines of evidence suggest the site data set is incomplete and additional sampling warranted. Lines of evidence to be considered include: site operations/history, soil and groundwater sampling data trends, and risk-based standards. If the metal concentration in the investigational unit data exceed the soil background comparison value, further evaluation will be necessary to determine whether site characterization is complete. As discussed with DTSC, this includes evaluating other site information (historical operations, sampling data trends, and risk assessment findings) in a best professional judgement approach to making decisions regarding additional sampling needs (DTSC 2005).

For dioxins, the soil concentrations at investigational units are evaluated using an approach that considers each of the seventeen 2,3,7,8-substituted congeners separately (these are the individual congeners listed in Tables 4-2 and 4-3). The comparison value approach is used to determine if any of the individual congeners are present above the background comparison value (Table 4-7). If any are present above the background comparison value, additional sampling may be performed after all dioxins sampling results are reviewed in the context of other site data. If additional samples are collected, all 17 dioxin/furan congeners will be included in the analysis.

5.2 COMPARISON FOR INVESTIGATIONAL UNIT RISK ASSESSMENTS

The comprehensive background data set will also be used to guide selection of chemicals of potential concern (COPCs) and/or chemicals of potential ecological concern (CPECs) during investigational unit risk assessments (MWH 2005) following a procedure outlined in the DTSC policy. This policy states that metals should be included as COPCs or CPECs if the site-specific analytical data indicate conditions are in excess of an upper limit of ambient concentrations (Step 7), or if a statistical test indicates that the investigational unit data are higher than the background data (Step 8) (DTSC 1997). While the procedure for comparison of site investigational unit data to background data is focused on metals in the DTSC guidance, the methods of comparison are also applicable to dioxins. Because the statistical test method reduces the potential for errors in selection of COPC/CPECs, and because it allows quantification of those error rates, it will be used for the SSFL risk assessments as described below. The comparison of site data to an upper limit of background will not be done in the risk assessments.

5.2.1 Comparison with Investigational Unit Metals Data

Data from soil samples collected at investigational units will be statistically compared to the background data set by application of the Wilcoxon Rank Sum (WRS) Test (MWH 2005) as specified in Step 8 of the DTSC policy. The WRS Test is a non-parametric statistical evaluation that compares the entirety of investigational unit metals data set to

the entirety of the metals background data set to determine if the unit data are higher than the background data. In instances where more than 40 percent of the site or background data sets are non detect values, then the Gehan Test will be used instead of the WRS Test (Department of the Navy 2002). The Gehan Test is a modification of the WRS Test for data sets with a low frequency of detection. For metals with less than five detected concentrations statistical evaluation is not appropriate, and best professional judgement using a 'weight of evidence' approach will be used to select COPC/CPECs for the risk assessment. Rationales for COPC/CPEC selection will be documented in the risk assessment report.

If the investigational unit data are determined to be higher than the background data, then that constituent is selected as a COPC/CPEC for the investigational unit. If applicable, portions of the investigational data set may be compared to the background data set (e.g., if the investigational unit data have distinct areas of higher concentrations). As described in the DTSC policy, the WRS Test reduces the error in selection of COPC/CPECs. It is also worth noting that there is a final data comparison step for risk assessment, described in the SRAM, that includes inspection of the site data for any apparent anomalous conditions (MWH 2005)

5.2.2 Comparison Method for Dioxins

The same approach used to evaluate metals is used to evaluate investigational unit and background dioxins data sets. Similar to the process described above for metals, the entirety of the investigational unit dioxins data set will be compared to the entirety of the background dioxins data set using the WRS Test, the Gehan Test (if 40 percent or more non detect data), or best professional judgement (if less than five detected concentrations). Using these methods, if the investigational unit data are determined to be higher than background, then dioxins will be selected as a COPC/CPEC. As for metals, there is a review of the entire data set for any apparent anomalous conditions (MWH 2005). Rationales for COPC/CPEC selection will be documented in the risk assessment report.

For background comparison purposes, the pertinent dioxins data include the 2,3,7,8-substituted tetra-, penta-, hexa-, hepta-, and octa-chlorinated dioxin and furan congeners. The individual congener background data are presented in Table 4-2 and Table 4-3. Consistent with a DTSC memorandum on establishing dioxin background (DTSC 1998), a graphical representation of relative dioxins concentrations in samples (a "radar" plot) will be compared to similar presentations for background to determine qualitatively if the site samples are similar to background. This would be done for the five 2,3,7,8-substituted congener groups listed above. The five group concentrations are calculated as the sum of the concentrations of each 2,3,7,8-substituted congener within the chlorination group, on a per-sample basis. In cases where a congener is detected a least once in a given media at an investigational unit, it will be assumed to be present in other samples of the same media at that unit. When a congener is thus assumed to be present at an investigational unit, but is not detected in a sample, then the concentration in that sample will be estimated as one-half the sample RL. In cases where a specific congener is never detected in a given media at an investigational unit, then that congener is assumed to not be present in that media at that unit, and will not be included in the summation of congeners within its respective congener group at that unit.

Following the qualitative graphical evaluation, the dioxin data sets are further evaluated by application of the WRS Test (or as applicable, the Gehan Test or best professional judgement using criterion described above) to determine consistency with soil background concentrations. For dioxins, these evaluation methods will be performed on the five 2,3,7,8-substituted congener groups listed above. Because dioxins frequently appear as mixtures, an additional requirement for evaluation of investigational unit data is that all "groups" of congeners must be shown to be consistent with soil background concentrations. If such a demonstration cannot be made, all the seventeen 2,3,7,8-substituted dioxin congeners will be selected as COPC/CPECs in the risk assessment.

SECTION 6
LIST OF REFERENCES

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Table 2-1

Chronology of the SSFL Soil Background Data Set
(Page 1 of 2)

Sample Collection Date	Reference	Investigator	Agency or Public Review	Original Purpose and Use of Data
March 1992	McLaren/ Hart 1993 (Multi-Media Report)	McLaren/Hart	USEPA, DHS, DTSC, SSFL Work Group	Interpretation of northern offsite soil sampling results for Brandeis-Bardin and Santa Monica Mountains Conservancy properties. SSFL Work Group requested sampling outside of SSFL boundaries.
July 1995	ICF 1997 (FSDF Characterization Report)	ICF Kaiser	DTSC	Interpretation of FSDF sampling results and definition of soil impacts.
May 1996	Ogden 1996 (RFI Work Plan Addendum)	Ogden	DTSC	Augment and expand previous soils background data set (three datasets now combined). Collected following DTSC-approved work plan (Ogden 1996). Work included sampling at metals-impacted sites also. Both data sets used to develop FALs for RFI. Soil background metals data included in RFI work plan as histograms (sample IDs labeled), and in distribution plots.
June 1998	Ogden 1998 (Bell Canyon Report)	Ogden	DTSC, DHS, USEPA	Interpretation of southern offsite soil sampling results on Bell Canyon property. Determination made regarding offsite impacts using this data in Bell Canyon Report and subsequent DTSC Memo (Ogden 1998; DTSC 1999).
April 2000	Ogden 2000 (SRAM)	Ogden	DTSC	DTSC visited and reviewed each of the above locations for appropriateness. Based on their review findings, 2 locations (6 samples) not approved for inclusion in the data set because of distance from the SSFL. Also based on DTSC review findings, 3 additional locations added and sampled to achieve an adequate distribution at and surrounding the facility. Prior to submittal in SRAM, rank order plots prepared and reviewed by GSU and HERD staff (sample IDs labeled).

Table 2-1

Chronology of the SSFL Soil Background Data Set
(Page 2 of 2)

Acronyms

DHS = California Department of Health Services
DTSC = Department of Toxic Substances Control
FAL = field action level
FSDF = Former Sodium Disposal Facility
GSU = DTSC Geological Services Unit
HERD = DTSC Human and Ecological Risk Division
RFI = RCRA Facility Investigation
SRAM = Standardized Risk Assessment Methodology
SSFL = Santa Susana Field Laboratory
USEPA = U.S. Environmental Protection Agency

Table 4-1
SSFL Soil Background Metals Data Set
(Page 1 of 2)

SAMPLE ID	Depth (ft. bgs)	Aluminum			Antimony			Arsenic			Barium			Beryllium			Boron			Cadmium			Chromium			Cobalt			Copper			Fluoride			Iron			Lead			Lithium			Manganese			Mercury			Molybdenum			Nickel		
BGSS01S01	0.5	12,800		2	5.3	J	2	9.2		2	101		2	0.64		2	**3**		6	0.06	U	2	22.1		2	8.5		2	12.6		2	**3.1**	UJ	6	**18,000**		6	13.8		2	**20**	J	6	**190**		6	0.05	U	2	0.8	U	2	13.8		2
BGSS02S01	0.5	7,380		2	3.1	J	2	3.3		2	50.7		2	0.41		2	**1.2**	UJ	6	0.06	U	2	8.8		2	2.9		2	4.5		2	**2.6**	UJ	6	**12,000**		6	5.3		2	**17**		6	**190**		6	0.05	U	2	0.78	U	2	5.9		2
BGSS02S02	1	6,470		2	3.9	J	2	3.5		2	38.6		2	0.36		2	**1.2**	UJ	6	0.06	U	2	11.6		2	3		2	5.8		2	**2.2**	UJ	6	**14,000**		6	4.2		2	**20**	J	6	**230**		6	0.04	U	2	0.79	U	2	5.2		2
BGSS03D01	0.5	12,200		2	7.4	J	2	2.4		2	91.8		2	0.59		2	**5**	UJ	6	0.06	U	2	17.3		2	5.8		2	8.7		2	**2.5**	J	6	**23,000**		6	7.5		2	**32**	J	6	**500**		6	0.05	U	2	0.95	UJ	2	12.1		2
BGSS03S01	0.5	11,800		2	7	J	2	2.1		2	96.6		2	0.45		2	**5**	UJ	6	0.06	U	2	15.5		2	6.4		2	8.1		2	**2.3**	J	6	**23,000**		6	7.3		2	**31**	J	6	**490**		6	0.05	U	2	0.82	UJ	2	11		2
BGSS03S02	1	12,400		2	6.5	J	2	2.5		2	93.2		2	0.62		2	**5.1**	UJ	6	0.06	U	2	17.4		2	5.5		2	9.2		2	**3.1**	J	6	**24,000**		6	5.6		2	**31**	J	6	**420**		6	0.05		2	0.78	U	2	11.8		2
BGSS04S01	0.5	12,200		2	6.7	J	2	3.2		2	44.2		2	0.47		2	**7**	UJ	6	0.06	U	2	36.8		2	5.3		2	3.8		2	**1.8**	UJ	6	**25,000**		6	15.4		2	**29**	J	6	**290**		6	0.05	U	2	0.81	U	2	9.8		2
BGSS06S01	0.5	9,960		2	6.7	J	2	4		2	62.7		2	0.54		2	**2.9**	UJ	6	0.06	U	2	16		2	4.4		2	6.2		2	**2.1**	J	6	**17,000**		6	7.9		2	**21**	J	6	**320**		6	0.04	U	2	0.76	U	2	10.4		2
BGSS07S01	0.5	14,300		2	5.3	J	2	2.6		2	77		2	0.65		2	**4.5**	UJ	6	0.06	UJ	2	25		2	6.8		2	6.7		2	**2.4**	UJ	6	**19,000**		6	14		2	**29**	J	6	**310**		6	0.09		2	0.81	U	2	15.6		2
BKND-1	0	**14,000**		6	1	U	3	3.9		3	54		3	0.28		3	**8**	J	6	0.25		3	28.3		3	6.1		3	7.3		3	**1.8**	UJ	6	**20,000**		6	18.6		3	**27**	J	6	**370**		6	0.1	U	3	0.4		3	9.7		3
BKND-2	0	**10,000**		6	1.1	U	3	5.1		3	65.7		3	0.11	U	3	**5.5**	UJ	6	0.46		3	19.8		3	8		3	17		3	**1.4**	UJ	6	**18,000**		6	20.3		3	**19**	J	6	**230**		6	0.11	U	3	0.37		3	15.4		3
BKND-3	0	**9,300**		6	1	U	3	4.3		3	69.8		3	0.43		3	**2.5**		6	0.21	U	3	14.3		3	5.6		3	8.2		3	**1.9**	UJ	6	**15,000**		6	11.2		3	**18**	J	6	**260**		6	0.1	U	3	0.36		3	9.9		3
BKND-4	0	**10,000**		6	1	U	3	3.9		3	77.5		3	0.37		3	**3.9**	UJ	6	0.22		3	14		3	5.3		3	8.5		3	**1.7**	UJ	6	**17,000**		6	15.1		3	**19**	J	6	**300**		6	0.1	U	3	0.53		3	9.8		3
BKND-5	0	**10,000**		6	1	U	3	3.2		3	77.2		3	0.34		3	**2.7**	UJ	6	0.25		3	13.9		3	5		3	8		3	**1.7**	UJ	6	**15,000**		6	21.5		3	**21**	J	6	**280**		6	0.1	U	3	0.38		3	9.9		3
BKND-6	0	**8,500**		6	1.1	U	3	6.3		3	110		3	0.37		3	**2.7**		6	0.23		3	15.8		3	5.8		3	9.9		3	**1.8**	UJ	6	**15,000**		6	33.1		3	**20**	J	6	**370**		6	0.11	U	3	0.64		3	10.9		3
BKND-7	0	**11,000**		6	1.1	U	3	3.9		3	109		3	0.48		3	**4.5**		6	0.4		3	21.9		3	10		3	17		3	**1.9**	UJ	6	**15,000**		6	8.9		3	**22**	J	6	**390**		6	0.11	U	3	0.35		3	15.4		3
BZSS01D01	0.5	10,300		2	8.7	J	2	5.9		2	58.6		2	0.63		2	**2.7**		6	0.06	UJ	2	16.3		2	7.2		2	9.6		2	**1.9**	UJ	6	**17,000**		6	7.2		2	**21**	J	6	**320**		6	0.07		2	5.4		2	13.4		2
BZSS01S01	0.5	10,700		2	6.4	J	2	5.8		2	62.8		2	0.59		2	**2.3**		6	0.06	UJ	2	16.7		2	7.5		2	8.7		2	**1.9**	UJ	6	**17,000**		6	8		2	**19**	J	6	**320**		6	0.07		2	5.2		2	13.8		2
BZSS02S01	0.5	11,900		2	4.4	J	2	4.2		2	69.2		2	0.47		2	**1.2**	UJ	6	0.06	UJ	2	16.6		2	5.4		2	8.2		2	**2.3**	UJ	6	**17,000**		6	18		2	**16**	J	6	**210**		6	0.07		2	2.6		2	12		2
BZSS03S01	0.5	15,800		2	7.4	J	2	8.4		2	103		2	0.85		2	**5.3**	UJ	6	0.06	UJ	2	23.2		2	7.5		2	14.5		2	**2.9**	UJ	6	**24,000**		6	14.4		2	**28**	J	6	**320**		6	0.07		2	1.1		2	16.6		2
BZSS03S02	1	18,100		2	8.7	J	2	8.5		2	106		2	0.99		2	**6.2**	UJ	6	0.06	UJ	2	26.2		2	8.4		2	15.1		2	**4**	UJ	6	**28,000**		6	10.8		2	**34**	J	6	**330**		6	0.08		2	0.83	U	2	17.4		2
BZSS04S01	0.5	14,500		2	6.3	J	2	3.2		2	91.8		2	0.63		2	**2.6**		6	0.06	UJ	2	18.8		2	6.2		2	6.9		2	**2**	UJ	6	**20,000**		6	14.3		2	**16**	J	6	**290**		6	0.09		2	0.77	U	2	11.9		2
SGSS01S01	0	12,000		5	0.982	U	5	0.982	U	5	106		5	0.463		5	1.31	U	5	0.655	U	5	18.3		5	7.59		5	7.77		5	**1.7**	UJ	6	**18,000**		6	10.9		5	**23**	J	6	**320**		6	0.11	U	5	0.328	U	5	13.9		5
BZSS06S01	0	12,400		5	1.03	U	5	1.03	U	5	90.4		5	0.468		5	1.37	U	5	0.685		5	18.4		5	8.1		5	7.99		5	**1.9**	UJ	6	**17,000**		6	12.8		5	**21**	J	6	**310**		6	0.115	U	5	0.343	U	5	12.2		5
BZSS05S01	0	**10,000**		6	**0.66**	UJ	6	**4.1**		6	**66**		6	**0.48**		6	**3.6**	UJ	6	**0.39**		6	**15**		6	**4.9**		6	**11**		6	**2.6**	UJ	6	**14,000**		6	**14**		6	**15**	J	6	**310**		6	**0.02**		6	**0.62**		6	**11**		6
BG01005	0 - 1	**12,000**		6	**0.47**	UJ	6	2.1	J	1	**75**		6	0.66		1	**0.97**	U	6	0.5	U	1	21		1	**5.4**		6	11		1	**3.2**	J	6	**20,000**		6	18		1	**16**	J	6	**260**		6	**0.027**		6	**0.62**		6	16		1
BG01008	0 - 1	**13,000**		6	**0.48**	UJ	6	2.2	J	1	**72**		6	0.61		1	**0.98**	U	6	0.5	U	1	21		1	**6.9**		6	11		1	**2.6**	J	6	**13,000**		6	9.5		1	**15**	J	6	**310**		6	**0.029**		6	**0.69**		6	16		1
BG01100	0 - 1	**12,000**		6	**0.49**	UJ	6	1.7	J	1	**69**		6	0.71		1	**1**	U	6	0.5	U	1	22		1	**5.4**		6	12		1	**3.1**	UJ	6	**20,000**		6	26		1	**18**	J	6	**300**		6	**0.026**		6	**0.7**		6	16		1
BG02007	0 - 1	**9,600**		6	**0.5**	UJ	6	3.6	J	1	**71**		6	0.53		1	**8**	UJ	6	0.5	U	1	14		1	**4.7**		6	10		1	**2.4**	UJ	6	**19,000**		6	34		1	**19**	J	6	**300**		6	**0.031**		6	**0.94**		6	9.1		1
BG02074	0 - 1	**9,500**		6	**0.5**	UJ	6	1.7	J	1	**76**		6	0.46		1	**5.2**	UJ	6	0.5	U	1	16		1	**21**		6	15		1	**3.3**	UJ	6	**15,000**		6	6.5		1	**18**	J	6	**350**		6	**0.039**		6	**0.82**		6	14		1
BG02076	0 - 1	**9,200**		6	**0.55**	UJ	6	2.9	J	1	**68**		6	0.54		1	**4.6**	UJ	6	0.5	U	1	14		1	**4.5**		6	11		1	**3.2**	UJ	6	**14,000**		6	12		1	**16**	J	6	**270**		6	**0.029**		6	**0.8**		6	10		1
BG04025	0 - 1	**20,000**		6	2.5	UJ	1	3.3	J	1	**92**		6	0.65		1	**9.7**	J	6	0.5	U	1	23		1	**9.3**		6	20		1	**3**	J	6	**28,000**		6	18		1	**37**	J	6	**380**		6	**0.034**		6	**0.41**		6	16		1
BG04029	0 - 1	**14,000**		6	2.5	UJ	1	3	J	1	**84**		6	0.73		1	**8.5**	J	6	0.5	U	1	23		1	**8.3**		6	14		1	**2.6**	J	6	**26,000**		6	15		1	**33**	J	6	**350**		6	**0.031**		6	**0.47**		6	15		1
BG04090	0 - 1	**13,000**		6	2.5	UJ	1	3	J	1	**80**		6	0.65		1	**8.6**	J	6	0.5	U	1	24		1	**8.1**		6	14		1	**2.4**	J	6	**26,000**		6	20		1	**35**	J	6	**340**		6	**0.04**		6	**0.47**		6	14		1
BCSS09S01	0	5,600		4	**0.18**	UJ	6	9		4	36		4	0.5	U	4	**3**	UJ	6	1	U	4	9		4	4		4	6		4	2.2		4	**25,000**		6	7		4	**27**	J	6	**300**		6	**0.032**		6	**0.76**		6	7		4
BCSS11S01	0	13,000		4	**0.46**	UJ	6	5	U	4	97		4	0.7		4	**5.9**	UJ	6	1		4	17		4	5		4	8		4	1.7		4	**20,000**		6	10		4	**12**	J	6	**410**		6	**0.048**		6	**4.4**		6	14		4
BCSS12S01	0	11,000		4	**0.6**	UJ	6	6	U	4	82		4	0.7		4	**4**		6	1	U	4	16		4	6		4	9		4	4.3		4	**28,000**		6	14		4	**29**	J	6	**420**		6	**0.019**		6	**2**		6	12		4
BCSS13S01	0	13,000	J	4	**0.38**	UJ	6	5	U	4	84	J	4	1.1		4	**6.6**	UJ	6	1	U	4	22		4	8		4	17		4	2.7		4	**23,000**		6	25		4	**29**	J	6	**370**		6	**0.054**		6	**0.93**		6	17		4
BCBS09S01	0	18,000	J	4	--			14		4	140	J	4	1.1		4	--			1	U	4	29		4	12		4	28		4	6.7		4	--			29		4	--			--			--			29		4
BCSS14S01	0	16,000	J	4	**0.56**	UJ	6	16		4	87	J	4	1		4	**5.6**		6	1	U	4	25		4	10		4	30		4	3.5		4	**27,000**		6	23		4	**31**	J	6	**390**		6	**0.023**		6	**0.73**	UJ	6	20		4
BCSS14D01	0	16,000	J	4	**0.58**	UJ	6	14		4	91	J	4	1.1		4	**9**		6	1	U	4	26		4	11		4	28		4	4.2		4	**24,000**		6	26		4	**37**	J	6	**370**		6	**0.022**		6	**0.68**	UJ	6	23		4
California Benchmark Soils (Kearney Study, March 1996)	Mean	73,000			0.6			3.5			509			1.28			19			0.36			122			14.9			28.7			n.a.			37,000			23.9			23			646			0.26			1.3			57		
	min	30,000			0.15			0.6			133			0.25			1			0.05			23			2.7			9.1			n.a.			10,000			12.4			4			253			0.05			0.1			9		
	max	106,000			1.95			11			1,400			2.7			74			1.7			1,579			46.9			96.4			n.a.			87,000			97.1			90			1,687			0.9			9.6			509		
California Air Force Bases (Hunter et al 2005)	95th	23,000			12.5			12.7			320			1.1			140			2.3			49.4			22			53.3			8.9			36,100			25			n.a.			823			0.3			20			41.5		
	99th	31,300			25			23.2			584			5.6			201			7.7			100			35.9			157			23			49,400			148			n.a.			1,600			0.6			44			85.4		

Notes
(a) Data set is for characterization and risk assessment evaluation of onsite investigational units for the SSFL RCRA Program.

All values in milligrams per kilogram (mg/kg) except pH units
"--" indicates sample was not collected (location inaccessible)
Bold indicates recent data collected in April 2005.
J = estimated value
U = non detect
UJ = estimated non detect
ft. bgs = feet below ground surface

Data Source Reference Documents
1 = Multi-Media Sampling Report for the BBI and the SMMC (McLaren/Hart 1993b)
2 = RFI Work Plan Addendum (Ogden 1996)
3 = FSDF Characterization Report (ICF 1997)
4 = Bell Canyon Area Soil Sampling Report (Ogden 1998b)
5 = SRAM Work Plan (Ogden 2000a)
6 = This report

Example:

Antimony		
5.3	J	2

Sample Result
Data Qualifier
Data Source Document

Table 4-1
SSFL Soil Background Metals Data Set
(Page 2 of 2)

SAMPLE ID	Depth (ft. bgs)	Potassium			Selenium			Silver			Sodium			Thallium			Vanadium			Zinc			Zirconium			pH		
BGSS01S01	0.5	**3,100**		6	0.47	U	2	0.76	U	2	**100**	J	6	**0.21**	UJ	6	38.2		2	70.4		2	**1.9**	U	6	**6.82**	J	6
BGSS02S01	0.5	**1,800**		6	0.46	U	2	0.74	U	2	**50**		6	**0.19**	UJ	6	16.7		2	41.8		2	**1.7**	U	6	**7.27**	J	6
BGSS02S02	1	**2,000**		6	0.47	U	2	0.75	U	2	**45**		6	**0.16**	UJ	6	14.7		2	40.7		2	**1.6**	U	6	**7.07**	J	6
BGSS03D01	0.5	**4,300**		6	0.72		2	0.75	U	2	**63**	J	6	**0.31**		6	27.3		2	63.6		2	**3.1**	J	6	**8.25**	J	6
BGSS03S01	0.5	**3,900**		6	0.59		2	0.74	U	2	**57**	J	6	**0.31**		6	25.5		2	61.3		2	**3.3**	J	6	**8.08**	J	6
BGSS03S02	1	**3,900**		6	0.53		2	0.74	U	2	**66**	J	6	**0.29**	J	6	28.1		2	62.8		2	**3.2**	J	6	**7.8**	J	6
BGSS04S01	0.5	**4,000**		6	0.48	U	2	0.77	U	2	**88**	J	6	**0.3**		6	57.1		2	47.3		2	**6.6**	J	6	**7.4**	J	6
BGSS06S01	0.5	**3,200**		6	0.45	U	2	0.72	U	2	**61**	J	6	**0.25**	J	6	26.6		2	56.9		2	**5.7**	J	6	**7.35**	J	6
BGSS07S01	0.5	**3,800**		6	0.48	UJ	2	0.77	U	2	**65**	J	6	**0.28**	UJ	6	35.7		2	53.2		2	**2.8**	J	6	**6.98**	J	6
BKND-1	0	**3,500**		6	2.1	U	3	0.21	U	3	**66**	J	6	**0.33**		6	44.5		3	47.4		3	**3.7**	J	6	**8.86**	J	6
BKND-2	0	**2,100**		6	2.1	U	3	0.21	U	3	**74**	J	6	**0.13**	J	6	31.9		3	62.5		3	**5.8**	J	6	**7.68**	J	6
BKND-3	0	**3,600**		6	2.1	U	3	0.21	U	3	**54**	J	6	**0.17**	UJ	6	21.4		3	50.3		3	**1.6**	U	6	**7.21**	J	6
BKND-4	0	**3,600**		6	2	U	3	0.2	U	3	**48**	J	6	**0.46**		6	22.5		3	52.5		3	**1.8**	J	6	**6.78**	J	6
BKND-5	0	**3,200**		6	2.1	U	3	0.21	U	3	**51**	J	6	**0.36**		6	21.7		3	62.4		3	**5.9**	J	6	**6.95**	J	6
BKND-6	0	**3,100**		6	2.1	U	3	0.21	U	3	**51**	J	6	**0.19**	UJ	6	26.5		3	59.3		3	**1.7**	U	6	**7.08**	J	6
BKND-7	0	**3,000**		6	2.1	U	3	0.21	U	3	**51**	J	6	**0.24**	UJ	6	37.8		3	51.7		3	**1.9**	U	6	**7.08**	J	6
BZSS01D01	0.5	**4,000**		6	0.48	UJ	2	1.1		2	**78**	J	6	**0.23**	J	6	26.6		2	48.3		2	**1.6**		6	**7.2**	J	6
BZSS01S01	0.5	**3,600**		6	0.7	J	2	0.76	U	2	**72**	J	6	**0.23**	J	6	27.8		2	50.6		2	**1.9**		6	**6.98**	J	6
BZSS02S01	0.5	**2,500**		6	0.46	UJ	2	0.74	U	2	**47**		6	**0.23**	UJ	6	28.1		2	50.3		2	**1.9**	U	6	**6.88**	J	6
BZSS03S01	0.5	**4,000**		6	0.48	U	2	0.74	U	2	**83**		6	**0.045**	UJ	6	32.4		2	63.1		2	**3.3**		6	**7.75**	J	6
BZSS03S02	1	**3,700**		6	0.49	UJ	2	0.79		2	**110**		6	**0.44**	UJ	6	35.8		2	64.1		2	**4.2**		6	**7.5**	J	6
BZSS04S01	0.5	**3,800**		6	0.45	UJ	2	0.73	U	2	**100**	J	6	**0.25**	UJ	6	30.6		2	52.7		2	**1.9**		6	**7.21**	J	6
SGSS01S01	0	**3,800**		6	0.982	U	5	0.328	U	5	**53**	J	6	**0.2**	UJ	6	34.6		5	54.2		5	**3.2**	J	6	**6.15**	J	6
BZSS06S01	0	**2,700**		6	1.03	U	5	0.343	U	5	**65**	UJ	6	**0.29**	UJ	6	38.4		5	60.6		5	**2.3**	J	6	**6.17**		6
BZSS05S01	0	**2,600**		6	**0.45**	UJ	6	**0.19**	U	6	**70**	UJ	6	**0.3**	UJ	6	**26**		6	**44**		6	**2.3**	J	6	**6.22**		6
BG01005	0 - 1	**2,100**		6	**0.28**		6	1	U	1	**65**		6	**0.22**	UJ	6	**42**		6	48		1	**2**	J	6	**6.85**		6
BG01008	0 - 1	**3,000**		6	**0.28**		6	1	U	1	**78**	J	6	**0.53**	UJ	6	**40**		6	45		1	**2.2**	J	6	**6.58**		6
BG01100	0 - 1	**2,600**		6	**0.2**	U	6	1	U	1	**65**	J	6	**0.29**	UJ	6	**36**		6	51		1	**1.7**	J	6	**7.11**		6
BG02007	0 - 1	**3,000**		6	**0.21**	U	6	1	U	1	**68**	J	6	**0.24**	UJ	6	**27**		6	48		1	**1.9**	J	6	**7.04**		6
BG02074	0 - 1	**3,600**		6	**0.27**		6	1	U	1	**62**	J	6	**0.22**	UJ	6	**26**		6	55		1	**1.7**	J	6	**6.85**		6
BG02076	0 - 1	**3,200**		6	**0.27**		6	1	U	1	**73**	J	6	**0.2**	UJ	6	**26**		6	49		1	**7.1**	J	6	**6.95**		6
BG04025	0 - 1	**6,100**		6	**0.31**		6	1	U	1	**93**	J	6	**0.35**		6	**62**		6	69		1	**6**	J	6	**8.42**	J	6
BG04029	0 - 1	**6,400**		6	**0.25**		6	1	U	1	**81**	J	6	**0.33**		6	**56**		6	67		1	**5.5**	J	6	**7.89**	J	6
BG04090	0 - 1	**5,400**		6	**0.31**		6	1	U	1	**81**	J	6	**0.31**		6	**57**		6	70		1	**5.1**	J	6	**7.58**	J	6
BCSS09S01	0	**4,700**		6	**0.45**		6	1	U	4	**68**		6	**0.34**	UJ	6	19		4	35		4	**2.6**		6	**5.85**	J	6
BCSS11S01	0	**2,400**		6	**0.23**		6	1	U	4	**98**	J	6	**0.27**	UJ	6	28		4	32	J	4	**8.6**	J	6	**6.9**	J	6
BCSS12S01	0	**4,800**		6	**0.23**		6	1	U	4	**88**	J	6	**0.39**	J	6	30		4	56	J	4	**2.6**		6	**7.48**	J	6
BCSS13S01	0	**3,700**		6	**0.32**		6	1	U	4	**76**	J	6	**0.31**	UJ	6	43		4	78	J	4	**2.8**		6	**6.93**	J	6
BCBS09S01	0	--			--			1	U	4	--			--			54		4	110	J	4	--			--		
BCSS14S01	0	**3,600**		6	**0.22**		6	1	U	4	**96**	J	6	**0.27**	UJ	6	45		4	97	J	4	**7.2**		6	**7.48**	J	6
BCSS14D01	0	**3,300**		6	**0.19**		6	1	U	4	**78**	J	6	**0.27**	UJ	6	46		4	110	J	4	**4.3**		6	**8.2**	J	6
California Benchmark Soils (Kearney Study, March 1996)	Mean	17,300			0.058			0.8			15,838			0.56			112			149			93			n.a.		
	min	2,100			0.015			0.1			5,580			0.17			39			88			19			n.a.		
	max	30,000			0.43			8.3			73,400			1.1			288			236			610			n.a.		
California Air Force Bases (Hunter et al 2005)	95th	n.a.			11			2.1			1,660			25			88.3			104			n.a.			n.a.		
	99th	n.a.			25			6.1			3,980			173.5			126			307			n.a.			n.a.		

Notes
(a) Data set is for characterization and risk assessment evaluation of onsite investigational units for the SSFL RCRA Program.

All values in milligrams per kilogram (mg/kg) except pH units
"--" indicates sample was not collected (location inaccessible)
Bold indicates recent data collected in April 2005.
J = estimated value
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UJ = estimated non detect
ft. bgs = feet below ground surface

Data Source Reference Documents
1 = Multi-Media Sampling Report for the BBI and the SMMC (McLaren/Hart 1993b
2 = RFI Work Plan Addendum (Ogden 1996)
3 = FSDF Characterization Report (ICF 1997)
4 = Bell Canyon Area Soil Sampling Report (Ogden 1998b)
5 = SRAM Work Plan (Ogden 2000a)
6 = This report

Table 4-2
SSFL Soil Background Dioxins Data Set
(Page 1 of 2)

SAMPLE ID	Depth (feet bgs)	2,3,7,8-TCDD			2,3,7,8-TCDF			1,2,3,7,8-PeCDD			1,2,3,7,8-PeCDF			2,3,4,7,8-PeCDF			1,2,3,4,7,8-HxCDD			1,2,3,6,7,8-HxCDD			1,2,3,7,8,9-HxCDD			1,2,3,4,7,8-HxCDF			1,2,3,6,7,8-HxCDF			1,2,3,7,8,9-HxCDF			2,3,4,6,7,8-HxCDF			1,2,3,4,6,7,8-HpCDD			1,2,3,4,6,7,8-HpCDF		
BCBS09S01	0	2	U	2	2	U	2	10	U	2	10	U	2	10	U	2	10	U	2	10	U	2	10	U	2	10	U	2	10	U	2	10	U	2	10	U	2	10	U	2	10	U	2
BCSS09S01	0	0.99	U	2	0.99	U	2	5	U	2	5	U	2	5	U	2	5	U	2	5	U	2	5	U	2	5	U	2	5	U	2	5	U	2	5	U	2	5	U	2	5	U	2
BCSS11S01	0	1	U	2	1	U	2	5	U	2	5	U	2	5	U	2	5	U	2	5	U	2	5	U	2	5	U	2	5	U	2	5	U	2	5	U	2	5	U	2	5	U	2
BCSS12S01	0	0.99	U	2	0.99	U	2	5	U	2	5	U	2	5	U	2	5	U	2	5	U	2	5	U	2	5	U	2	5	U	2	5	U	2	5	U	2	5	U	2	5	U	2
BCSS13S01	0	1	U	2	1	U	2	5.2	U	2	5.2	U	2	5.2	U	2	5.2	U	2	5.2	U	2	5.2	U	2	5.2	U	2	5.2	U	2	5.2	U	2	5.2	U	2	5	U	2	5.2	U	2
BCSS14D01	0	1.3	U	2	1.3	U	2	6.4	U	2	6.4	U	2	6.4	U	2	6.4	U	2	6.4	U	2	6.4	U	2	6.4	U	2	6.4	U	2	6.4	U	2	6.4	U	2	6	U	2	6.4	U	2
BCSS14S01	0	1.4	U	2	1.4	U	2	6.8	U	2	6.8	U	2	6.8	U	2	6.8	U	2	6.8	U	2	6.8	U	2	6.8	U	2	6.8	U	2	6.8	U	2	6.8	U	2	7	U	2	6.8	U	2
BKND-1	0	0.57	U	1	0.72	J	1	0.12	J	1	0.21	J	1	0.33	UJ	1	0.41	U	1	0.43	J	1	0.48	J	1	0.35	J	1	0.44	U	1	0.23	U	1	5.1	U	1	7		1	1.7	UJ	1
BKND-2	0	0.66	U	1	1.1	J	1	0.26	UJ	1	0.4	J	1	0.38	J	1	0.27	J	1	0.63	J	1	0.77	J	1	0.48	J	1	0.58	U	1	0.21	U	1	5.4	U	1	8		1	1.6	UJ	1
BKND-3	0	0.78	U	1	0.45	UJ	1	0.44	U	1	0.48	U	1	0.17	J	1	0.2	UJ	1	0.49	UJ	1	0.69	J	1	0.23	UJ	1	0.62	U	1	0.33	UJ	1	5	U	1	9		1	1.6	J	1
BKND-4	0	0.44	U	1	0.29	J	1	0.24	U	1	0.32	U	1	0.12	U	1	0.13	UJ	1	0.57	J	1	0.63	J	1	0.28	J	1	0.43	U	1	0.27	UJ	1	5.1	U	1	8	J	1	1.7	J	1
BKND-5	0	0.52	U	1	1.4		1	0.46	U	1	0.45	J	1	0.44	J	1	0.18	J	1	0.74	J	1	0.7	J	1	0.57	UJ	1	0.71	U	1	0.1	J	1	5.2	U	1	9	J	1	2.4	UJ	1
BKND-6	0	0.84	U	1	1.8	J	1	0.76	U	1	0.59	J	1	0.64	J	1	0.75	U	1	0.95	J	1	1.1	J	1	0.73	J	1	1	U	1	0.43	J	1	5.3	U	1	11	J	1	3.6	UJ	1
BKND-7	0	0.6	U	1	1.3	UJ	1	0.18	J	1	0.34	U	1	0.5	J	1	0.2	J	1	0.76	UJ	1	0.81	J	1	0.56	J	1	0.69	U	1	0.21	U	1	5.3	U	1	9		1	2	UJ	1
BZSS05S01	0	0.16	U	3	0.15	U	3	0.4	U	3	0.18	U	3	0.16	U	3	0.13	U	3	0.84	J	3	1	J	3	0.16	U	3	0.16	U	3	0.1	U	3	0.14	U	3	4	UJ	3	0.8	J	3
BZSS06S01	0	0.15	U	3	0.18	U	3	0.31	U	3	0.31	U	3	0.28	U	3	0.21	U	3	0.22	U	3	0.2	U	3	0.11	U	3	0.11	U	3	0.088	U	3	0.09	U	3	2	UJ	3	0.49		3
SGSS01S01	0	0.24	U	3	0.34	J	3	0.43	U	3	0.22	U	3	0.54		3	0.34	J	3	0.77	J	3	0.64	J	3	0.47		3	0.3		3	0.14	U	3	0.45		3	13		3	2.5		3

Notes
(a) TEQ values were calculated using detected congener concentrations
and WHO toxicity equivalency factors. For comparison, western United States dioxin TEQs typically range up to 2 pg/g or parts per trillion.
(b) TEQ values do not include total dioxin or total furan concentrations.
(c) Data set is for characterization and risk assessment evaluation
of onsite investigational units for the SSFL RCRA Program.

All sample results in picograms per gram (pg/g)
bgs = below ground surface

Example:

TOTAL TCDF		
0.99	U	2

Sample Result
Data Qualifier
Data Source Document

Table 4-2
SSFL Soil Background Dioxins Data Set
(Page 2 of 2)

SAMPLE ID	Depth (feet bgs)	1,2,3,4,7,8,9-HpCDF			OCDD			OCDF			TOTAL TCDD			TOTAL TCDF			TOTAL PeCDD			TOTAL PeCDF			TOTAL HxCDD			TOTAL HxCDF			TOTAL HpCDD			TOTAL HpCDF			TEQ[a]
BCBS09S01	0	10	U	2	20	U	2	20	U	2	2	U	2	2	U	2	10	U	2	10	U	2	10	U	2	10	U	2	10	U	2	10	U	2	0
BCSS09S01	0	5	U	2	9.9	U	2	9.9	U	2	0.99	U	2	0.99	U	2	5	U	2	5	U	2	5	U	2	5	U	2	5	U	2	5	U	2	0
BCSS11S01	0	5	U	2	46	J	2	10	U	2	1	U	2	3.1	J	2	5	U	2	5	U	2	5	U	2	5	U	2	5	U	2	5	U	2	0.0046
BCSS12S01	0	5	U	2	17	J	2	9.9	U	2	0.99	U	2	0.99	U	2	5	U	2	5	U	2	5	U	2	5	U	2	5	U	2	5	U	2	0.0017
BCSS13S01	0	5.2	U	2	10	U	2	10	U	2	1	U	2	1	U	2	5.2	U	2	5.2	U	2	5.2	U	2	5.2	U	2	5.2	U	2	5.2	U	2	0
BCSS14D01	0	6.4	U	2	13	J	2	13	U	2	1.3	U	2	1.3	U	2	6.4	U	2	6.4	U	2	6.4	U	2	6.4	U	2	6.4	U	2	6.4	U	2	0.0013
BCSS14S01	0	6.8	U	2	14	U	2	14	U	2	1.4	U	2	1.4	U	2	6.8	U	2	6.8	U	2	6.8	U	2	6.8	U	2	6.8	U	2	6.8	U	2	0
BKND-1	0	0.19	UJ	1	74.6		1	3.2	J	1	1	U	1	22.3	U	1	5.1	U	1	15.5	U	1	5.2	J	1	6.6	U	1	16.4		1	3.4	J	1	0.41
BKND-2	0	0.21	UJ	1	44.7		1	1.7	J	1	1.1	U	1	44.1	U	1	5.4	U	1	24.3	U	1	6.8	J	1	8.9	U	1	15.5		1	2.9	J	1	0.62
BKND-3	0	2.2	U	1	76.2		1	3.9	J	1	1	U	1	7.7	U	1	5	U	1	8.5	U	1	5.4	J	1	8.7	U	1	17.7		1	3.8	J	1	0.27
BKND-4	0	0.19	J	1	83.1		1	3.7	J	1	1	U	1	6.6	U	1	5.1	U	1	6.6	U	1	5.3	J	1	5.8	U	1	18.2		1	3.9	J	1	0.28
BKND-5	0	1.3	U	1	110		1	3.9	J	1	1	U	1	28.3	U	1	5.2	U	1	18.3	U	1	7.3	J	1	10.2	U	1	26.3		1	4.5	J	1	0.65
BKND-6	0	1.3	U	1	138		1	7.9	J	1	1.6	UJ	1	54.9	U	1	5.3	U	1	32.3	U	1	10	J	1	14.8	U	1	31.5		1	6.8	J	1	0.98
BKND-7	0	1.3	U	1	108		1	3.4	J	1	1.1	U	1	41.9	U	1	5.3	U	1	24.4	U	1	7.9	J	1	10.8	U	1	25.1		1	3.9	J	1	0.69
BZSS05S01	0	0.086	U	3	25		3	1.4	J	3	0.16	U	3	0.5		3	0.4	U	3	1.7	J	3	4.2		3	1.1	J	3	8.4		3	1.5	J	3	0.19
BZSS06S01	0	0.062	U	3	15		3	0.96		3	0.15	U	3	0.95		3	0.31	U	3	2.5	J	3	0.91	J	3	0.97	J	3	4.2		3	0.49	J	3	0.0065
SGSS01S01	0	0.25	U	3	140		3	8.1		3	0.24	U	3	4		3	0.43	U	3	4.6		3	6.4		3	4.2		3	26		3	6.9		3	0.77

Notes
(a) TEQ values were calculated using detected congener concentrations
and WHO toxicity equivalency factors. For comparison, western United States dioxin TEQs typically range up to 2 pg/g or parts per trillion.
(b) TEQ values do not include total dioxin or total furan concentrations.
(c) Data set is for characterization and risk assessment evaluation
of onsite investigational units for the SSFL RCRA Program.

All sample results in picograms per gram (pg/g)
bgs = below ground surface

Example:

TOTAL TCDF		
0.99	U	2

Sample Result — Data Qualifier — Data Source Document

Qualifiers
U = non detect
J = estimated value
UJ = estimated non detect

Data Source Documents
1 = FSDF Characterization Report (ICF 1997)
2 = Bell Canyon Area Soil Sampling Report (Ogden 1998b)
3 = SRAM Work Plan (Ogden 2000a)

TCDD = tetrachlorodibenzo-p-dioxin
TCDF = tetrachlorodibenzofuran
PeCDD = pentachlorodibenzo-p-dioxin
PeCDF = pentachlorodibenzofuran
HxCDD = hexachlorodibenzo-p-dioxin
HxCDF = hexachlorodibenzofuran

HpCDD = heptachlorodibenzo-p-dioxin
HpCDF = heptachlorodibenzofuran
OCDD = octachlorodibenzo-p-dioxin
OCDF = octachlorodibenzofuran

TEQ = Toxicity Equivalent

Table 4-3 (1 of 2)
Summary of Soil Background Data
Santa Susana Field Laboratory

Chemical	Number of Detects	Number of Samples	Range of Detection Limits [a]	Percent Frequency of Detection	Range of Detected Concentrations	Arithmetic Mean [b]	Standard Deviation [b]	Coefficient of Variation [b]	Type of Distribution [c]
Inorganics									
Aluminum	38	38	6.1 - 68	100	5600 - 20000	11958	3070	0.26	Normal
Antimony	13	37	0.18 - 2.5	35	3.1 - 8.7	2.4	2.9	1.2	Indeterminate
Arsenic	33	38	0.56 - 6	87	1.7 - 15	4.4	3.2	0.73	Indeterminate
Barium	38	38	0.37 - 1	100	36 - 140	80	21	0.27	Normal
Beryllium	36	38	0.091 - 0.6	95	0.28 - 1.1	0.58	0.23	0.39	Normal
Boron	12	37	0.97 - 8	32	2.5 - 9.7	3.0	2.4	0.81	Indeterminate
Cadmium	9	38	0.05 - 1	24	0.22 - 1	0.25	0.22	0.89	Indeterminate
Chromium	38	38	0.099 - 2	100	8.8 - 36.8	19	5.7	0.30	Normal
Cobalt	38	38	0.12 - 2	100	2.9 - 21	6.9	3.1	0.45	Lognormal
Copper	38	38	0.26 - 2	100	3.8 - 29	11	5.6	0.49	Lognormal
Fluoride	14	38	1.1 - 5.8	37	1.7 - 6.7	1.9	1.2	0.65	Indeterminate
Iron	37	37	1.1 - 2.5	100	12000 - 28000	19581	4693	0.24	Lognormal
Lead	38	38	0.32 - 6	100	4.2 - 34	15	7.5	0.50	Lognormal
Lithium	37	37	5.8 - 7	100	12 - 37	23	6.8	0.29	Lognormal
Manganese	37	37	0.41 - 0.5	100	190 - 495	319	66	0.21	Normal
Mercury	22	37	0.0065 - 0.115	59	0.019 - 0.09	0.044	0.020	0.46	Indeterminate
Molybdenum	24	37	0.13 - 0.95	65	0.35 - 5.3	0.85	1.1	1.3	Indeterminate
Nickel	38	38	0.29 - 13.9	100	5.2 - 29	13	4.3	0.33	Lognormal
pH	37	37	-	100	5.85 - 8.86	7.2	0.62	0.086	Normal
Potassium	37	37	8.6 - 10	100	1800 - 6400	3496	1031	0.29	Lognormal
Selenium	16	37	0.19 - 2.1	43	0.205 - 0.655	0.44	0.32	0.71	Indeterminate
Silver	2	38	0.19 - 1	5	0.74 - 0.79	0.38	0.18	0.48	Indeterminate
Sodium	35	37	12 - 76	95	45 - 110	69	19	0.27	Normal
Thallium	13	37	0.04 - 0.53	35	0.13 - 0.46	0.19	0.11	0.56	Indeterminate
Vanadium	38	38	0.18 - 2	100	14.7 - 62	34	12	0.35	Lognormal
Zinc	38	38	0.54 - 1.3	100	32 - 110	57	15	0.27	Lognormal
Zirconium	30	37	1.5 - 1.9	81	1.7 - 8.6	3.2	2.1	0.64	Indeterminate

Table 4-3 (2 of 2)
Summary of Soil Background Data
Santa Susana Field Laboratory

Chemical	Number of Detects	Number of Samples	Range of Detection Limits [a]	Percent Frequency of Detection	Range of Detected Concentrations	Arithmetic Mean [b]	Standard Deviation [b]	Coefficient of Variation [b]	Type of Distribution [c]
Dioxins									
1,2,3,4,6,7,8-HPCDD	8	16	1.7 - 10	50	7.4 - 13	5.9	3.7	0.63	Normal
1,2,3,4,6,7,8-HPCDF	5	16	1.6 - 10	31	0.49 - 2.5	1.9	1.2	0.60	Normal
1,2,3,4,7,8,9-HPCDF	1	16	0.062 - 10	6	0.19 - 0.19	1.4	1.5	1.1	Lognormal
1,2,3,4,7,8-HxCDD	4	16	0.13 - 10	25	0.18 - 0.34	1.3	1.6	1.2	Indeterminate
1,2,3,4,7,8-HXCDF	6	16	0.11 - 10	38	0.28 - 0.73	1.4	1.5	1.1	Lognormal
1,2,3,6,7,8-HxCDD	7	16	0.22 - 10	44	0.43 - 0.95	1.5	1.4	0.93	Lognormal
1,2,3,6,7,8-HXCDF	1	16	0.11 - 10	6	0.3 - 0.3	1.3	1.5	1.2	Lognormal
1,2,3,7,8,9-HXCDD	9	16	0.2 - 10	56	0.48 - 1.1	1.6	1.3	0.84	Lognormal
1,2,3,7,8,9-HXCDF	2	16	0.088 - 10	13	0.1 - 0.43	1.2	1.6	1.3	Indeterminate
1,2,3,7,8-PECDD	2	16	0.24 - 10	13	0.12 - 0.18	1.3	1.5	1.2	Indeterminate
1,2,3,7,8-PECDF	4	16	0.18 - 10	25	0.21 - 0.59	1.3	1.5	1.2	Indeterminate
2,3,4,6,7,8-HXCDF	1	16	0.09 - 10	6	0.45 - 0.45	2.3	1.2	0.53	Indeterminate
2,3,4,7,8-PeCDF	6	16	0.12 - 10	38	0.17 - 0.64	1.3	1.5	1.1	Lognormal
2,3,7,8-TCDD	0	16	0.15 - 2	0	-- - --	0.38	0.24	0.61	Normal
2,3,7,8-TCDF	6	16	0.15 - 2	38	0.29 - 1.8	0.65	0.47	0.73	Normal
OCDD	13	16	9.9 - 20	81	13 - 140	57	48	0.85	Lognormal
OCDF	10	16	9.9 - 20	63	0.96 - 8.1	4.7	2.5	0.54	Normal

Notes:

(a) - The detection limits reported here may vary from the original laboratory reports based on results from data validation.

(b) - The calculations were performed using 1/2 the detection limit for non-detect

(c) - Distribution of data based on the Shapiro-Wilk W-test as tested using ProUCL version 3.0 (USEPA 2004). The Type I alpha = 0.05.

"--" indicates no applicable value since all results were not detectec

Metals are reported in units of mg/kg; dioxins in ng/kg; and pH is unitless.

Table 4-4
Soil and Geologic Information for SSFL Background Samples
(Page 1 of 1)

Sample ID	USCS	Percentage			Presence of Shale or Siltstone[a]
		Gravel	Sand	Fines	
BCBS09	CL		5	95	Yes
BCSS09	ML	20	5	75	Yes
BCSS11	SC		15	85	
BCSS12	SM		10	90	
BCSS13	SM	20	60	20	
BCSS14	SM	5	35	65	Yes
BG01	SM		70	30	
BG01	SM		70	30	
BG02	ML		40	60	
BG02	ML		40	60	
BG04	ML		20	80	
BGSS01	ML	5	65	30	Yes
BGSS02	SM		70	30	
BGSS03	SM	20	15	65	Yes
BGSS04	ML		65	35	
BGSS06	ML		15	85	
BGSS07	SM			100	Yes
BKND-1	SM		65	35	
BKND-2	SM	10	55	35	
BKND-3	SM		70	30	
BKND-4	ML		40	60	
BKND-5	ML		45	55	
BKND-6	SM		55	45	
BKND-7	ML		10	90	
BZSS01	ML		5	95	
BZSS02	SM	20	30	50	(b)
BZSS03	ML			100	(b)
BZSS04	SM		55	45	
BZSS05	ML		5	95	(b)
BZSS06	SM		25	75	
SGSS01	SM		30	70	

Notes:

USCS = Unified Soil Classification System

CL = Clay

ML = Silt

SC = Clayey Sand

SM = Silty Sand

Fines = silt plus clay

(a) Presence of shale or siltstone based on geologic mapping of shales (Figure 4-1) and information in soil boring logs (Appendix A).

(b) This portion of the Lower Chatsworth formation contains a high proportion of shale and siltstone (geologic mapping ongoing).

Table 4-5
Summary of Soil Background Metals Results for Colocated Depth Pairs
(Page 1 of 1)

SAMPLE ID	Depth (ft. bgs)	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium	Cobalt	Copper	Fluoride	Iron	Lead	Lithium	Manganese	Mercury	Molybdenum	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Vanadium	Zinc	Zirconium
BGSS02S01	0.5	7,380	3.1 J	3.3	50.7	0.41	1.2 UJ	0.06 UJ	8.8	2.9	4.5	2.6 UJ	12,000	5.3	17	190	0.05 UJ	0.78 UJ	5.9	1,800	0.46 UJ	0.74 UJ	50	0.19 UJ	16.7	41.8	1.7 UJ
BGSS02S02	1	6,470	3.9 J	3.5	38.6	0.36	1.2 UJ	0.06 UJ	11.6	3	5.8	2.2 UJ	14,000	4.2	20 J	230	0.04 UJ	0.79 UJ	5.2	2,000	0.47 UJ	0.75 UJ	45	0.16 UJ	14.7	40.7	1.6 UJ
BGSS03S01	0.5	11,800	7 J	2.1	96.6	0.45	5 UJ	0.06 UJ	15.5	6.4	8.1	2.3 J	23,000	7.3	31 J	490	0.05 UJ	0.82 UJ	11	3,900	0.59	0.74 UJ	57 J	0.31	25.5	61.3	3.3 J
BGSS03S02	1	12,400	16.5 J	2.5	93.2	0.62	5.1 UJ	0.06 UJ	17.4	5.5	9.2	3.1 J	24,000	5.6	31 J	420	0.05	0.78 UJ	11.8	3,900	0.53	0.74 UJ	66 J	0.29 J	28.1	62.8	3.2 J
BZSS03S01	0.5	15,800	7.4 J	8.4	103	0.85	5.3 UJ	0.06 UJ	23.2	7.5	14.5	2.9 UJ	24,000	14.4	28 J	320	0.07	1.1	16.6	4,000	0.48 J	0.74 UJ	83	0.045 UJ	32.4	63.1	3.3
BZSS03S02	1	18,100	8.7 J	8.5	106	0.99	6.2 UJ	0.06 UJ	26.2	8.4	15.1	4 UJ	28,000	10.8	34 J	330	0.08	0.83 UJ	17.4	3,700	0.49 UJ	0.79	110	0.44 UJ	35.8	64.1	4.2

For which pairs are surface concentrations higher for each metal?

BGSS02S01	0.5	H			H	H								H					H				H		H	H	
BGSS02S02	1																										
BGSS03S01	0.5		H		H					H				H	H	H				H	H						H
BGSS03S02	1																										
BZSS03S01	0.5													H						H							
BZSS03S02	1																										

For those pairs, what is the ratio (I.e. by how much are surface > subsurface concentrations for each metal?

BGSS02S01	0.5	1.1			1.3	1.1								1.3					1.1				1.1		1.1	1.0	
BGSS02S02	1																										
BGSS03S01	0.5		1.1		1.0					1.2				1.3	1.0	1.2				1.0	1.1						1.0
BGSS03S02	1																										
BZSS03S01	0.5													1.3						1.1							
BZSS03S02	1																										

H = Metals Concentration **Higher** in Surface Sample

Non detected or non analyzed data

Conclusions:

1. **For most metals, with exception of lead, there is no trend for surficial elevation (atmospheric deposition) in the 3 depth pairs.**
2. **For those pairs/metals where the surface is higher, ratios are generally below 1.3.**

Table 4-6 (1 of 2)
Soil Background Comparison Levels for Metals
Santa Susana Field Laboratory

Chemical	Type of Distribution	Distribution Excluding Non-Detects	Percent Frequency of Detection	Number of Detects	Soil Background Comparison Level Value	California Benchmark Soils (Kearney study, March 1996)			California Air Force Bases (Hunter et al, 2005)	
						Mean	min	max	95th	99th
Aluminum	Normal	Normal	100	38	20,000	73,000	30,000	106,000	23,000	31,300
Antimony	Indeterminate	Normal	35	13	8.7	0.6	0.15	1.95	12.5	25
Arsenic	Indeterminate	Indeterminate	87	33	15	3.5	0.6	11	12.7	23.2
Barium	Normal	Normal	100	38	140	509	133	1,400	320	584
Beryllium	Normal	Lognormal	95	36	1.1	1.28	0.25	2.7	1.1	5.6
Boron	Indeterminate	Indeterminate	32	12	9.7	19	1	74	140	201
Cadmium	Indeterminate	Lognormal	24	9	1	0.36	0.05	1.7	2.3	7.7
Chromium	Normal	Normal	100	38	37	122	23	1,579	49.4	100
Cobalt	Lognormal	Lognormal	100	38	21	14.9	2.7	46.9	22	35.9
Copper	Lognormal	Lognormal	100	38	29	28.7	9.1	96.4	53.3	157
Fluoride	Indeterminate	Lognormal	37	14	6.7	**n.a.**	**n.a.**	**n.a.**	8.9	23
Iron	Lognormal	Lognormal	100	37	28,000	37,000	10,000	87,000	36,100	49,400
Lead	Lognormal	Lognormal	100	38	34	23.9	12.4	97.1	25	148
Lithium	Lognormal	Lognormal	100	37	37	23	4	90	**n.a.**	**n.a.**
Manganese	Normal	Normal	100	37	495	646	253	1,687	823	1,600
Mercury	Indeterminate	Lognormal	59	22	0.09	0.26	0.05	0.9	0.3	0.6
Molybdenum	Indeterminate	Indeterminate	65	24	5.3	1.3	0.1	9.6	20	44
Nickel	Lognormal	Lognormal	100	38	29	57	9	509	41.5	85.4

Table 4-6 (2 of 2)
Soil Background Comparison Levels for Metals
Santa Susana Field Laboratory

Chemical	Type of Distribution	Distribution Excluding Non-Detects	Percent Frequency of Detection	Number of Detects	Soil Background Comparison Level Value	California Benchmark Soils (Kearney study, March 1996)			California Air Force Bases (Hunter et al, 2005)	
						Mean	min	max	95th	99th
pH	Normal	Normal	100	37	8.86	**n.a.**	**n.a.**	**n.a.**	**n.a.**	**n.a.**
Potassium	Lognormal	Lognormal	100	37	6,400	17,300	2,100	30,000	**n.a.**	**n.a.**
Selenium	Indeterminate	Lognormal	43	16	0.655	0.058	0.015	0.43	11	25
Silver	Indeterminate	--	5	2	0.79	0.8	0.1	8.3	2.1	6.1
Sodium	Normal	Normal	95	35	110	15,838	5,580	73,400	1,660	3,980
Thallium	Indeterminate	Normal	35	13	0.46	0.56	0.17	1.1	25	173.5
Vanadium	Lognormal	Lognormal	100	38	62	112	39	288	88.3	126
Zinc	Lognormal	Lognormal	100	38	110	149	88	236	104	307
Zirconium	Indeterminate	Indeterminate	81	30	8.6	93	19	610	**n.a.**	**n.a.**

Notes:
1. Metals are reported in units of milligrams per kilogram (mg/kg); and pH is unitless.
2. Data set summary information provided in Table 4-3 and detailed in Appendix B. Distribution of data based on the Shapiro-Wilk W-test as tested using ProUCL version 3.0 (USEPA 2004). The Type I alpha = 0.05.
3. The comparison level value for the inorganic data set was selected as the maximum detected value of the entire data set, where duplicate results have been averaged.

-- = insufficient data to perform distribution test
n.a. = data not available

Table 4-7 (1 of 2)
Soil Background Comparison Levels for Dioxins
Santa Susana Field Laboratory

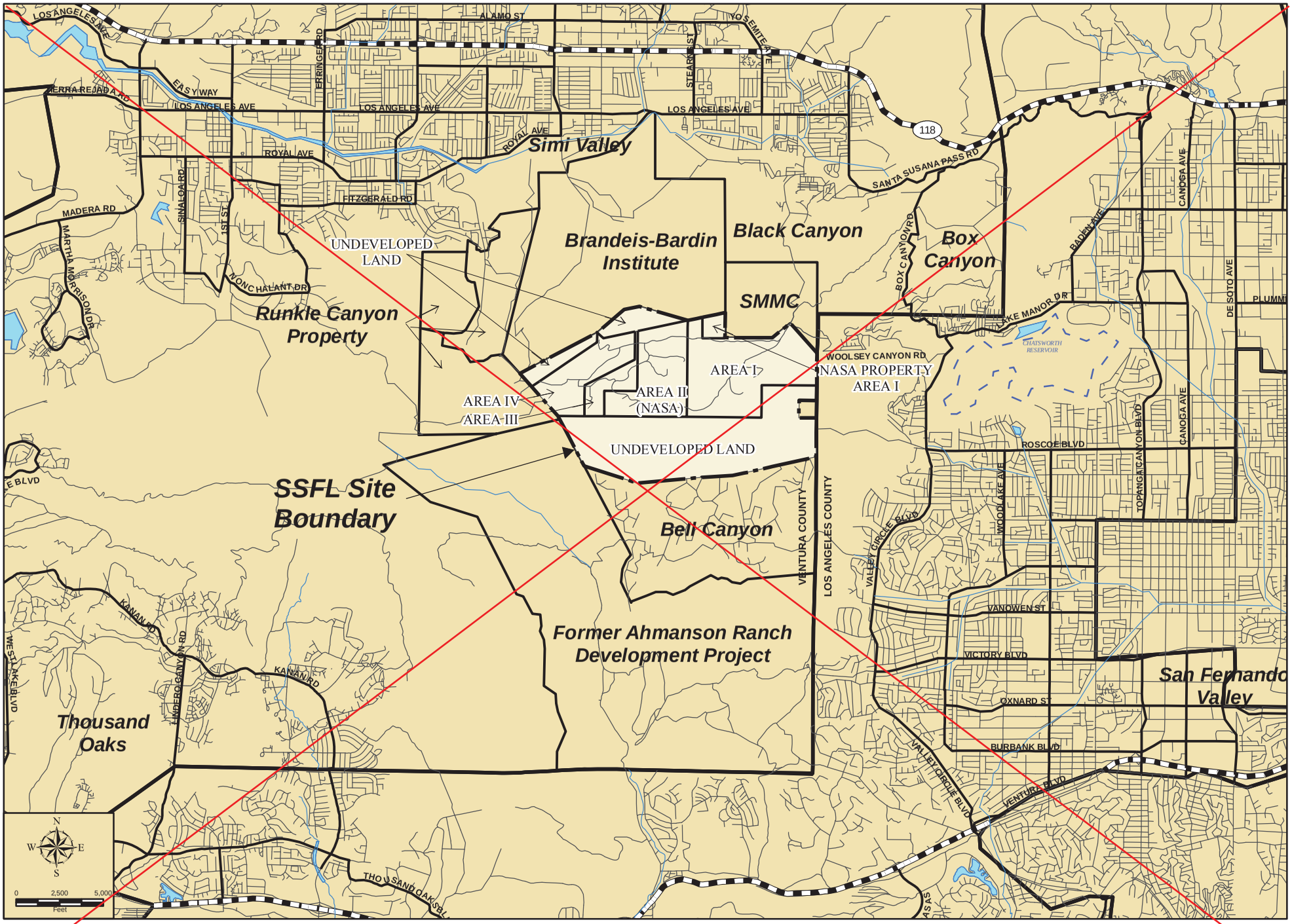
Chemical	Type of Distribution	Distribution Excluding Non-Detects	Percent Frequency of Detection	Number of Detects	Soil Background Comparison Level Value
1,2,3,4,6,7,8-HpCDD	Normal	Normal	50	8	13
1,2,3,4,6,7,8-HpCDF	Normal	Normal	31	5	2.5
1,2,3,4,7,8,9-HpCDF	Lognormal	--	6	1	0.19
1,2,3,4,7,8-HxCDD	Indeterminate	Normal	25	4	0.34
1,2,3,4,7,8-HxCDF	Lognormal	Normal	38	6	0.73
1,2,3,6,7,8-HxCDD	Lognormal	Normal	44	7	0.95
1,2,3,6,7,8-HxCDF	Lognormal	--	6	1	0.3
1,2,3,7,8,9-HxCDD	Lognormal	Normal	56	9	1.1
1,2,3,7,8,9-HxCDF	Indeterminate	--	13	2	0.43
1,2,3,7,8-PeCDD	Indeterminate	--	13	2	0.18
1,2,3,7,8-PeCDF	Indeterminate	Normal	25	4	0.59
2,3,4,6,7,8-HxCDF	Indeterminate	--	6	1	0.45
2,3,4,7,8-PeCDF	Lognormal	Normal	38	6	0.64
2,3,7,8-TCDD	Normal	--	0	0	0.5 [(a)]
2,3,7,8-TCDF	Normal	Normal	38	6	1.80
OCDD	Lognormal	Normal	81	13	140
OCDF	Normal	Normal	63	10	8.1

Table 4-7 (2 of 2)
Soil Background Comparison Levels for Dioxins
Santa Susana Field Laboratory

Notes:

1. Dioxins are reported in units of nanograms per kilogram (ng/kg).
2. Data set summary information provided in Table 4-3 and detailed in Appendix B. Distribution of data based on the Shapiro-Wilk W-test as tested using ProUCL version 3.0 (USEPA 2004). The Type I alpha = 0.05.
3. The comparison level value for the dioxins data set was selected as the maximum detect of the entire data set (with duplicate values averaged), or a recent laboratory detection limit if the data for constituents with no detects.
4. Total dioxins data not included in this table since these represent a combination of congener data including those individually listed here.

(a) = values correspond to the representative soil reporting limit (as analyzed by Alta Analytical Laboratory).
-- = insufficient data to perform distribution test



MWH

Santa Susana Field Laboratory (SSFL)
Regional Map

FIGURE
1-1

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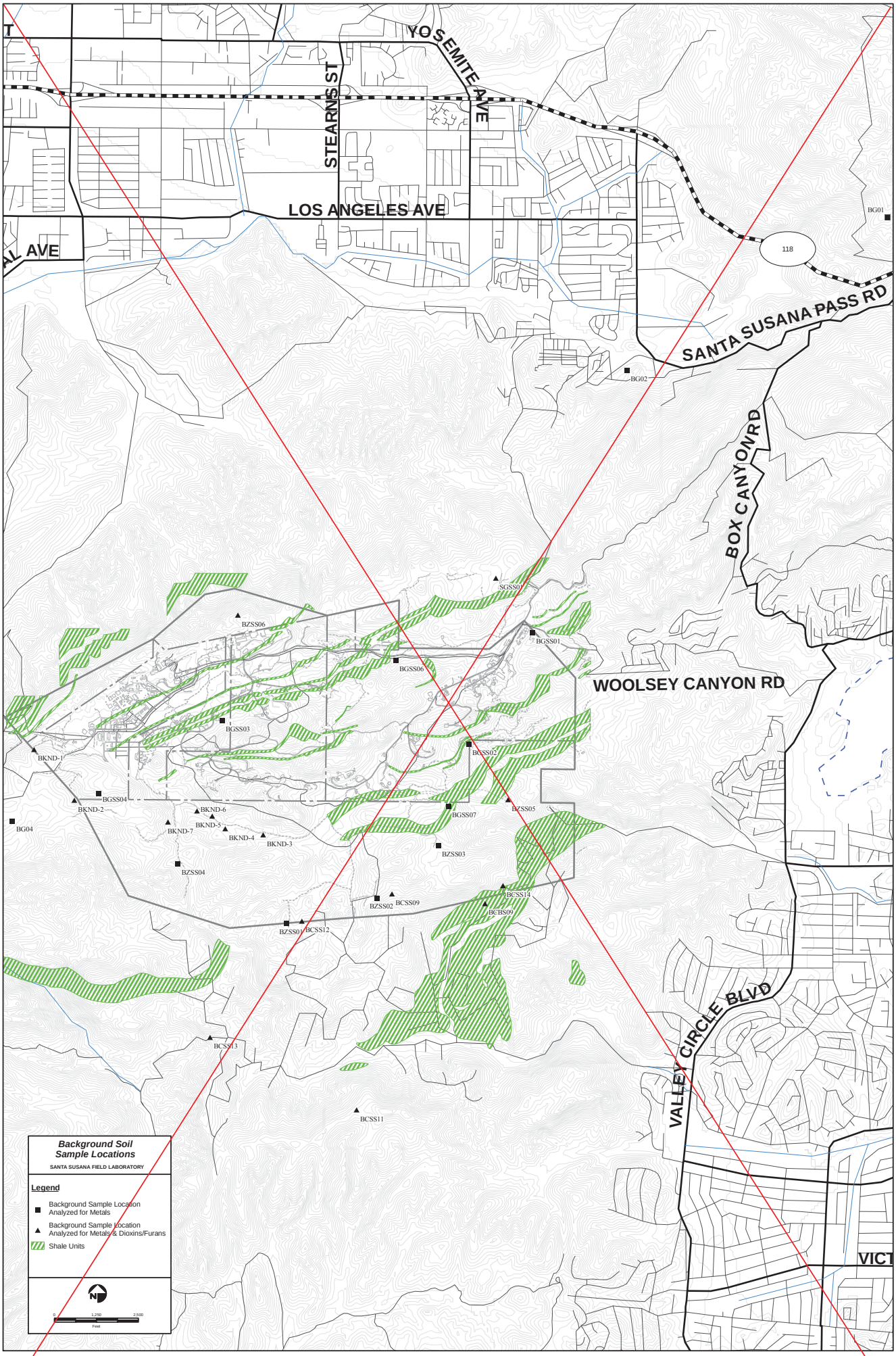
06/24/04



MWH

SSFL Background Soil Sample Locations

FIGURE 2-1

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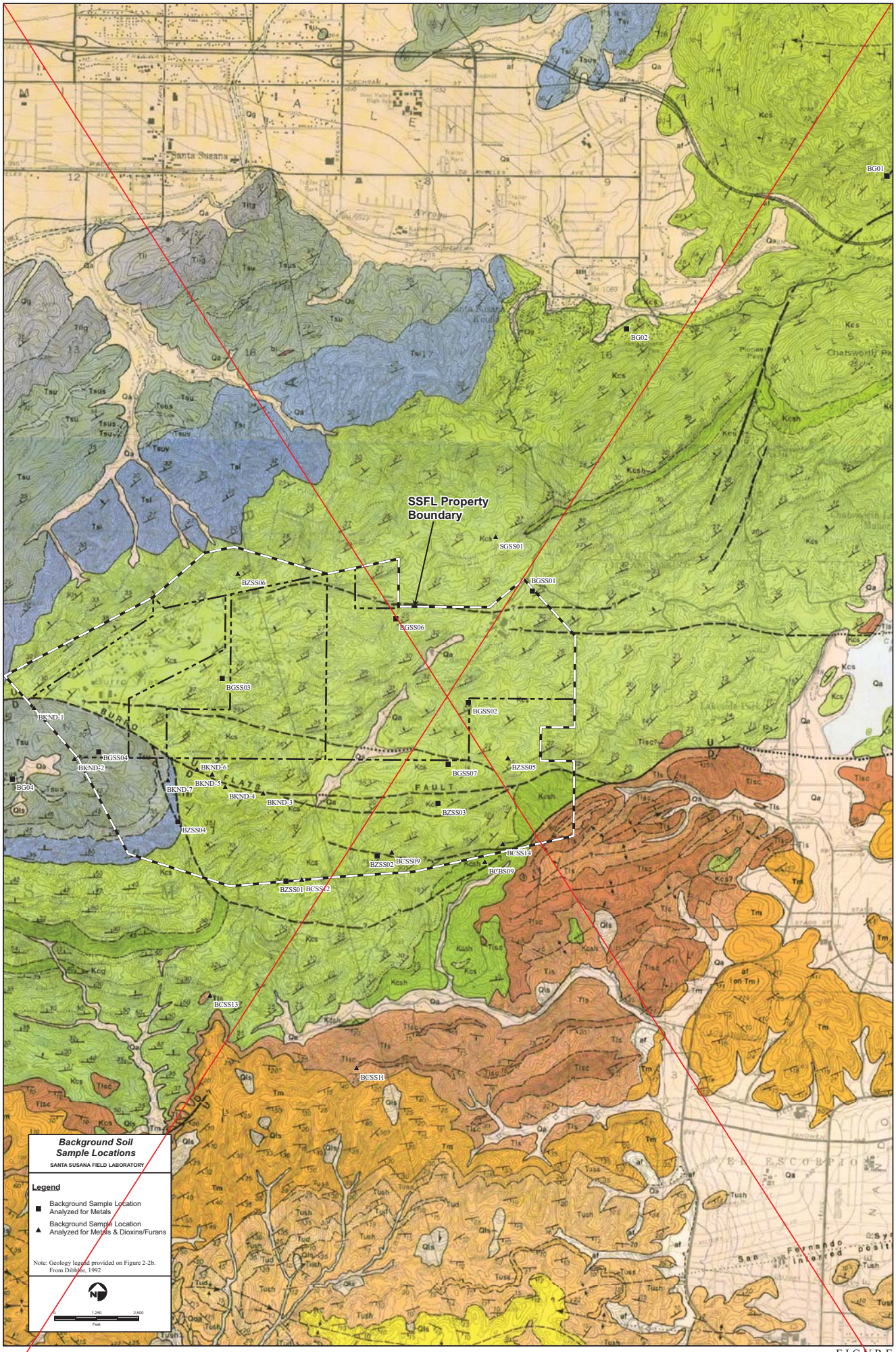
Date: Jun 30, 2005



MWH

Regional Geology
Santa Susana Field Laboratory

FIGURE
2-2a

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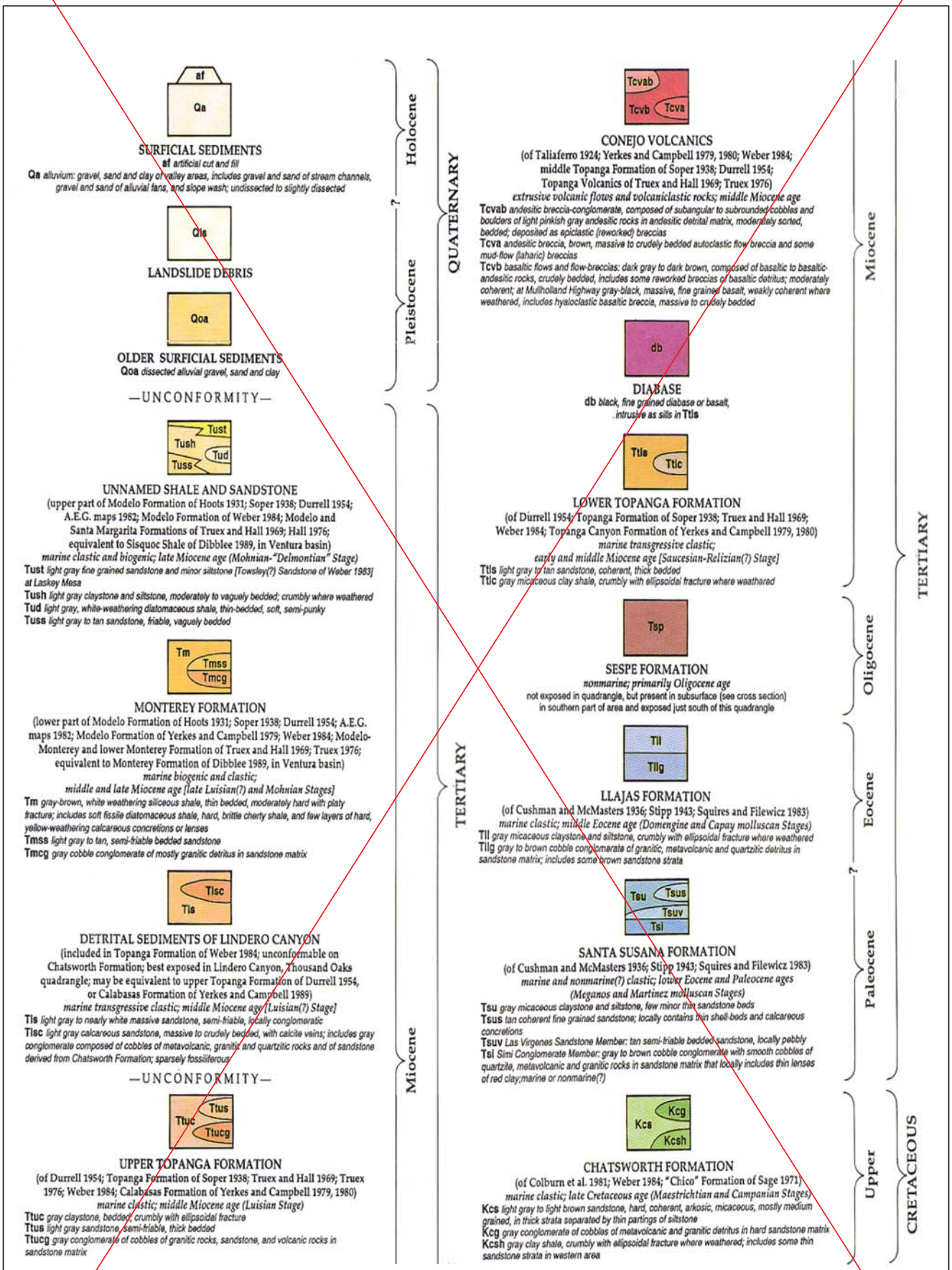
Date: Jun 30, 2005



From Dibblee, 1992

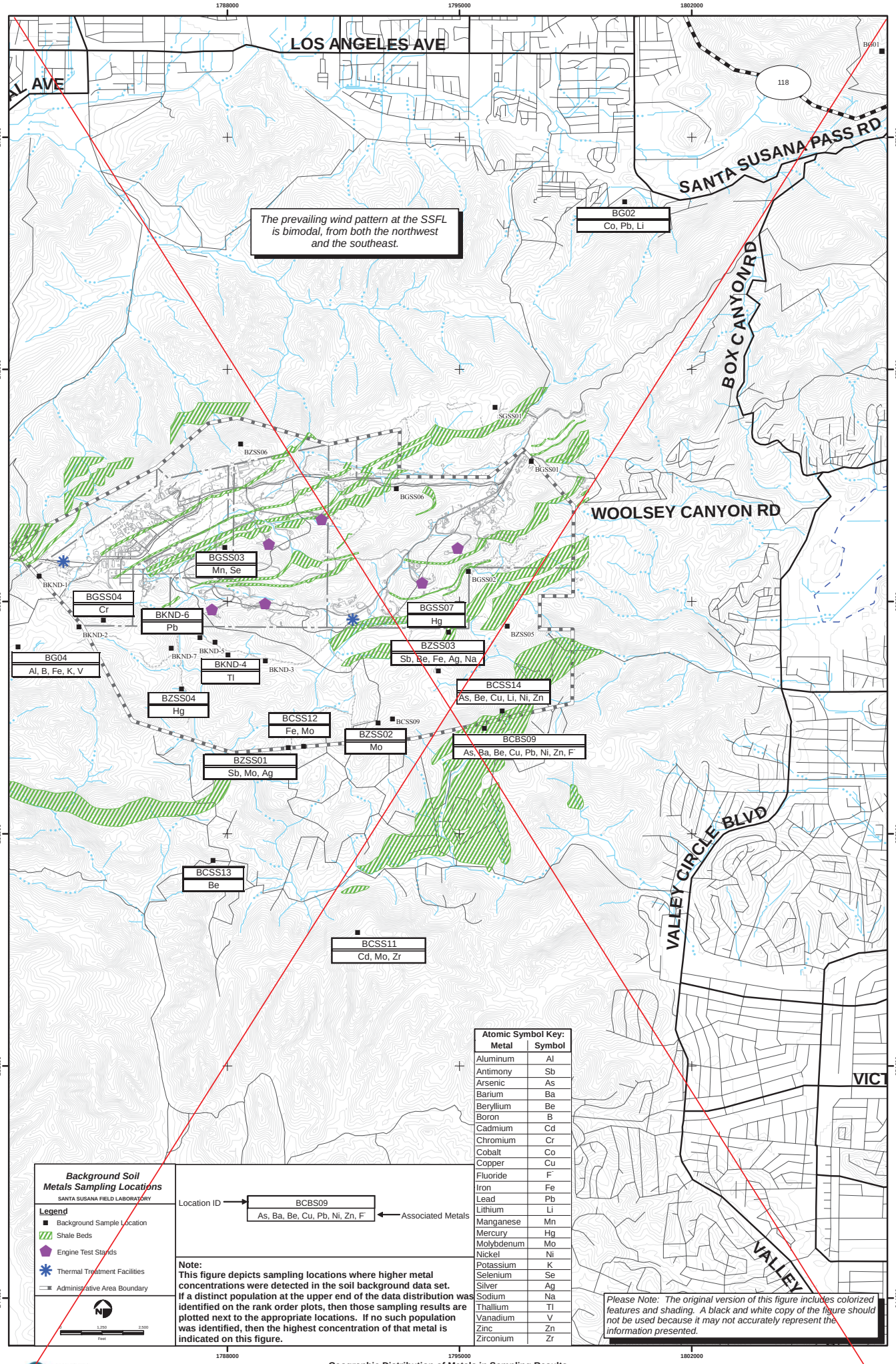
MWH

Regional Geology Legend
Santa Susana Field Laboratory

FIGURE
2-2b

File r:/rock/plots/arcmap/sram_background_geo_leg.mxd

Date: Jun 30, 2005



Background Soil Metals Sampling Locations

SANTA SUSANA FIELD LABORATORY

Legend

- Background Sample Location
- Shale Beds
- Engine Test Stands
- Thermal Treatment Facilities
- Administrative Area Boundary

Location ID → BCBS09 (As, Ba, Be, Cu, Pb, Ni, Zn, F-) ← Associated Metals

Note:
This figure depicts sampling locations where higher metal concentrations were detected in the soil background data set. If a distinct population at the upper end of the data distribution was identified on the rank order plots, then those sampling results are plotted next to the appropriate locations. If no such population was identified, then the highest concentration of that metal is indicated on this figure.

Atomic Symbol Key: Metal	Symbol
Aluminum	Al
Antimony	Sb
Arsenic	As
Barium	Ba
Beryllium	Be
Boron	B
Cadmium	Cd
Chromium	Cr
Cobalt	Co
Copper	Cu
Fluoride	F-
Iron	Fe
Lead	Pb
Lithium	Li
Manganese	Mn
Mercury	Hg
Molybdenum	Mo
Nickel	Ni
Potassium	K
Selenium	Se
Silver	Ag
Sodium	Na
Thallium	Tl
Vanadium	V
Zinc	Zn
Zirconium	Zr

Please Note: The original version of this figure includes colorized features and shading. A black and white copy of the figure should not be used because it may not accurately represent the information presented.

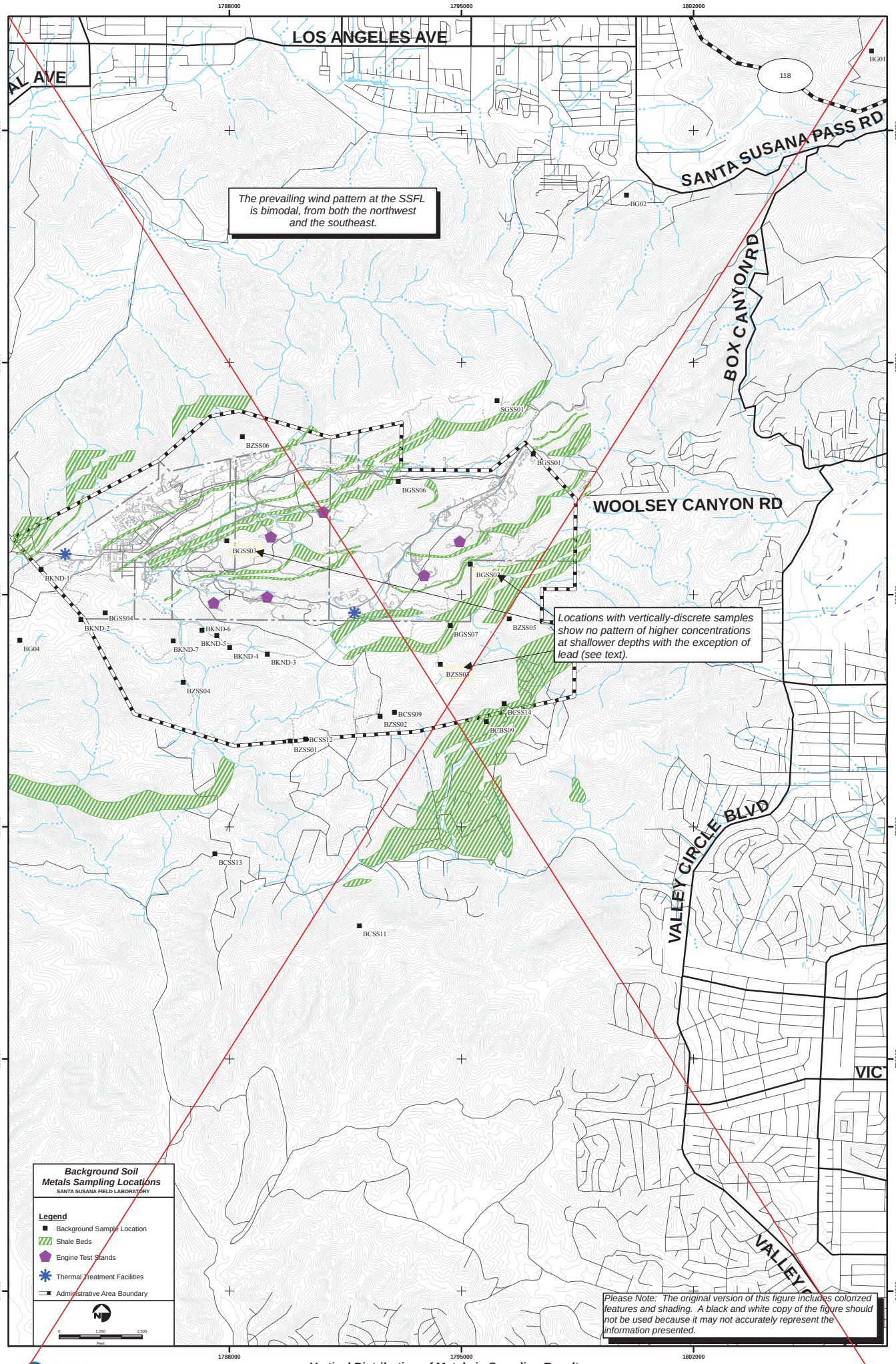
MWH

Geographic Distribution of Metals in Sampling Results
SSFL Soil Background

FIGURE **4-1**

File: 510.10.1.2\gis\projects\rocky\kml\barcmap\arsen_soil_background_rpt.mxd

Date: Sep 07, 2005



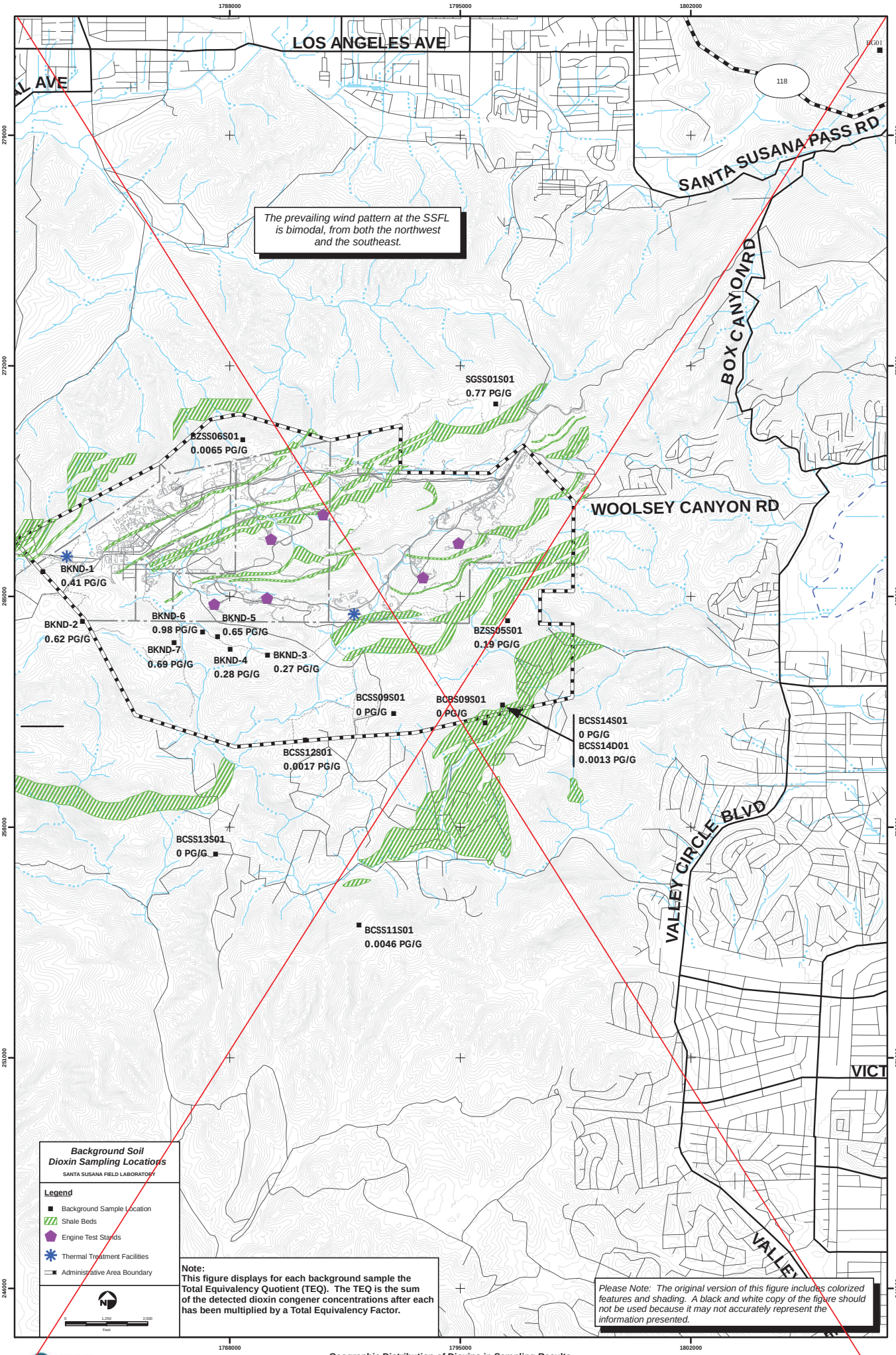
MWH

Vertical Distribution of Metals in Sampling Results
SSFL Soil Background

FIGURE
4-2

File: \\10.10.1.2\gis\projects\rocklpkt\arcmap\arsen_soil_background_rpt_figure_4-2.mxd

Date: Sep 07, 2005



MWH

Geographic Distribution of Dioxins in Sampling Results
SSFL Soil Background

FIGURE
4-3

APPENDIX A

SAMPLE LOCATION DESCRIPTIONS

APPENDIX A

TABLE OF CONTENTS

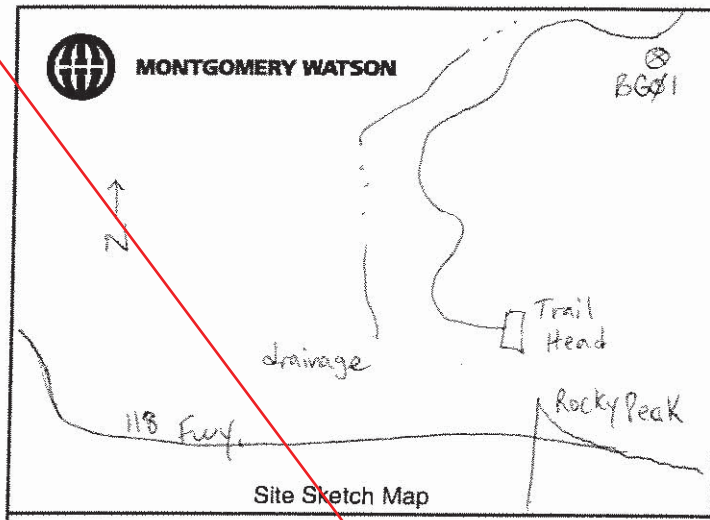
ATTACHMENTS

A-1	Soil Boring Logs
A-2	Sample Location Photographs

ATTACHMENT A-1

SOIL BORING LOGS

MONTGOMERY WATSON



Site Sketch Map

Boring #: BG01 MW#:	Sheet 1 of 1
Project: SSFL Background Soil Sampling	
Job #:	Site: SSFL/Rocky Peak
Logged By: E. Vander Velde	Reviewed By: T. Burton
Drilling Contractor: N/A	
Drill Rig Type/Method: N/A	
Drillers Name: N/A	
Borehole Diam./Drill Bit Type: trowel/shovel	Total Depth 1.0' / Ref. Elev. —
Sampler Type: trowel/shovel	
Drill Start Time/Date: 4/14/05	Drill Finish Time/Date: 4/14/05
Well Completion Time/Date: —	
Soil Boring Backfill Time/Date: —	

Depth to 1st Water (▽): —	Time/Date:
Depth to Water After Drilling (▼): —	Time/Date:
Depth to other Water Bearing Zones: —	

PID/OVA	Sample Interval	Recovered (in.)	Blow Counts / 6 in.	Retained for Analysis	Casing Type & Size	Annulus Filler	Depth (Feet)	USCS Soil Type	Soil Description	Estimated % Of: Gravel	Sand: Coarse	Sand: Medium	Sand: Fine	Silt/clay
	X							SM	Silty sand, light yellowish brown (10YR 6/4), loose, dry, fine sand w/some med-coarse grains, no odor		10	10	50	30
									Total Depth 1' bgs					

QA/QC

MONTGOMERY WATSON

Boring #: BG02 MW#:	Sheet 1 of 1
Project: SSFL Background Soil Sampling	
Job #:	Site: SSFL / Santa Susana Park
Logged By: E. Van der Velde	Reviewed By: T. Burton
Drilling Contractor: N/A	
Drill Rig Type/Method: N/A	
Drillers Name: N/A	
Borehole Diam./Drill Bit Type:	Total Depth 1.0'
	Ref. Elev. —
Site Sketch Map	Sampler Type: shovel/trowel
Depth to 1st Water (▽): — Time/Date:	Drill Start Time/Date: 4/4/05 Drill Finish Time/Date: 4/4/05
Depth to Water After Drilling (▼): — Time/Date:	Well Completion Time/Date: —
Depth to other Water Bearing Zones: —	Soil Boring Backfill Time/Date: —

PID/OVA	Sample Interval	Recovered (in.)	Blow Counts / 6 in.	Retained for Analysis	Casing Type & Size	Annulus Filler	Depth (Feet)	USCS Soil Type	Soil Description	Estimated % Of: Gravel	Sand: Coarse	Sand: Medium	Sand: Fine	Silt/clay
	X							ML	Sandy silt, dark brown (10YR 3/3), moist, soft, fine sands, mod. plasticity, no odor				40	60
									Total Depth 1' bgs					

QA/QC

MONTGOMERY WATSON

Boring #: BG04 MW#: Sheet 1 of 1

Project: SSFL Background Soil Sampling

Job #: Site: SSFL

Logged By: E. Vander Velde Reviewed By: T. Burton

Drilling Contractor: N/A

Drill Rig Type/Method: N/A

Drillers Name: N/A

Borehole Diam./Drill Bit Type: Total Depth 1.0' Ref. Elev. —

Site Sketch Map

Sampler Type: Grab

Depth to 1st Water (▽): — Time/Date:

Drill Start Time/Date: 4/13/05 Drill Finish Time/Date: 4/13/05

Depth to Water After Drilling (▼): — Time/Date:

Well Completion Time/Date: —

Depth to other Water Bearing Zones: —

Soil Boring Backfill Time/Date: —

PID/OVA	Sample Interval	Recovered (in.)	Blow Counts / 6 in.	Retained for Analysis	Casing Type & Size	Annulus Filler	Depth (Feet)	USCS Soil Type	Soil Description	Estimated % Of: Gravel	Sand: Coarse	Sand: Medium	Sand: Fine	Silt/clay
	X							ML	Silt, brown (7.5YR 4/4), moist, soft, mod. plasticity, fine sand, no odor				20	80
									Total Depth 1' bgs					

QA/QC

MONTGOMERY WATSON

Boring #: BKND-1 MW#: Sheet 1 of 1

Project: SSFL Background Soil Sampling

Job #: Site: SSFL

Logged By: E. Vander Velde Reviewed By: T. Burton

Drilling Contractor: N/A

Drill Rig Type/Method: N/A

Drillers Name: N/A

Borehole Diam./Drill Bit Type: Total Depth Ø' Ref. Elev. —

Site Sketch Map

Sampler Type: Grab w/sample container

Depth to 1st Water (▽): — Time/Date:

Drill Start Time/Date: 4/13/05 Drill Finish Time/Date: 4/13/05

Depth to Water After Drilling (▼): — Time/Date:

Well Completion Time/Date: —

Depth to other Water Bearing Zones: —

Soil Boring Backfill Time/Date: —

PID/OVA	Sample Interval	Recovered (in.)	Blow Counts / 6 in.	Retained for Analysis	Casing Type & Size	Annulus Filler	Depth (Feet)	USCS Soil Type	Soil Description	Estimated % Of: Gravel	Sand: Coarse	Sand: Medium	Sand: Fine	Silt/clay
	X							SM	Silty sand, light (brown yellowish) (10YR 4/6), dry, very loose, fine sand, some very fine grains, no odor				65	35

QA/QC

MONTGOMERY WATSON

Boring #: BKND-2 MW#: | Sheet 1 of 1

Project: SSFL Background Soil Sampling

Job #: | Site: SSFL

Logged By: E. Vander Velde | Reviewed By: T. Burton

Drilling Contractor: N/A

Drill Rig Type/Method: N/A

Drillers Name: N/A

Borehole Diam./Drill Bit Type: N/A | Total Depth: Ø' | Ref. Elev.: —

Site Sketch Map

Sampler Type: Grab w/ sample container

Depth to 1st Water (▽): — Time/Date:

Drill Start Time/Date: 4/13/05 | Drill Finish Time/Date: 4/13/05

Depth to Water After Drilling (▼): — Time/Date:

Well Completion Time/Date: —

Depth to other Water Bearing Zones: —

Soil Boring Backfill Time/Date: —

PID/OVA	Sample Interval	Recovered (in.)	Blow Counts / 6 in.	Retained for Analysis	Casing Type & Size	Annulus Filler	Depth (Feet)	USCS Soil Type	Soil Description	Estimated % Of: Gravel	Sand: Coarse	Sand: Medium	Sand: Fine	Silt/clay
	X							SM	Silty sand, yellowish brown (10YR 4/6), dry, loose-v. loose, very fine to fine sand, some fine gravel	10			55	35

QA/QC

MONTGOMERY WATSON

Boring #: BKND-3 MW#: Sheet 1 of 1

Project: SSFL Background Soil Sampling

Job #: Site: SSFL

Logged By: E. Vander Velde Reviewed By: T. Burton

Drilling Contractor: N/A

Drill Rig Type/Method: N/A

Drillers Name: N/A

Borehole Diam./Drill Bit Type: N/A

Total Depth: Ø

Ref. Elev.: —

Site Sketch Map

Sampler Type: Grab w/sample container

Depth to 1st Water (▽): — Time/Date:

Drill Start Time/Date: 4/12/05 Drill Finish Time/Date: 4/12/05

Depth to Water After Drilling (▼): — Time/Date:

Well Completion Time/Date: —

Depth to other Water Bearing Zones: —

Soil Boring Backfill Time/Date: —

PID/OVA	Sample Interval	Recovered (in.)	Blow Counts / 6 in.	Retained for Analysis	Casing Type & Size	Annulus Filler	Depth (Feet)	USCS Soil Type	Soil Description	Estimated % Of: Gravel	Sand: Coarse	Sand: Medium	Sand: Fine	Silt/clay
	X							SM	Silty sand, yellowish brown (10 YR 4/6), dry, very loose, fine & very fine sand, no odor				70	30

QA/QC

MONTGOMERY WATSON

Boring #: BKND-4 MW#: Sheet 1 of 1

Project: SSFL Background Soil Sampling

Job #: Site: SSFL

Logged By: E. Vander Velde Reviewed By: T. Burton

Drilling Contractor: N/A

Drill Rig Type/Method: N/A

Drillers Name: N/A

Borehole Diam./Drill Bit Type: N/A

Total Depth: Ø'

Ref. Elev.: —

Site Sketch Map

Sampler Type: Grab w/sample container

Depth to 1st Water (▽): — Time/Date:

Drill Start Time/Date: 4/13/05 Drill Finish Time/Date: 4/13/05

Depth to Water After Drilling (▼): — Time/Date:

Well Completion Time/Date: —

Depth to other Water Bearing Zones: —

Soil Boring Backfill Time/Date: —

PID/OVA	Sample Interval	Recovered (in.)	Blow Counts / 6 in.	Retained for Analysis	Casing Type & Size	Annulus Filler	Depth (Feet)	USCS Soil Type	Soil Description	Estimated % Of: Gravel	Sand: Coarse	Sand: Medium	Sand: Fine	Silt/clay
	X							ML	Sandy silt, dark brown (7.5 YR 3/3), moist, very soft, low to mod. plasticity, very fine to fine sands, no odor				40	60

QA/QC

MONTGOMERY WATSON

Boring #: BKND-5 MW#:	Sheet 1 of 1
Project: SSFL Background Soil Sampling	
Job #:	Site: SSFL
Logged By: E. Van der Velde	Reviewed By: T. Burton
Drilling Contractor: N/A	
Drill Rig Type/Method: N/A	
Drillers Name: N/A	
Borehole Diam./Drill Bit Type: N/A	Total Depth: Ø'
	Ref. Elev.: —
Site Sketch Map	Sampler Type: Grab w/sample container
Depth to 1st Water (▽): — Time/Date:	Drill Start Time/Date: 4/13/05 Drill Finish Time/Date: 4/13/05
Depth to Water After Drilling (▼): — Time/Date:	Well Completion Time/Date: —
Depth to other Water Bearing Zones: —	Soil Boring Backfill Time/Date: —

PID/OVA	Sample Interval	Recovered (in.)	Blow Counts / 6 in.	Retained for Analysis	Casing Type & Size	Annulus Filler	Depth (Feet)	USCS Soil Type	Soil Description	Estimated % Of: Gravel	Sand: Coarse	Sand: Medium	Sand: Fine	Silt/clay
	X							ML	Sandy silt, brown (10YR 4/3), moist, very soft, nonplastic fines, very fine to fine sands				45	55

QA/QC

MONTGOMERY WATSON

Boring #: BKND-6 MW#: Sheet 1 of 1

Project: SSFL Background Soil Sampling

Job #: Site: SSFL

Logged By: E. Van der Velde Reviewed By: T. Burton

Drilling Contractor: N/A

Drill Rig Type/Method: N/A

Drillers Name: N/A

Borehole Diam./Drill Bit Type: N/A

Total Depth: Ø'

Ref. Elev.: —

Site Sketch Map

Sampler Type: Grab w/sample container

Depth to 1st Water (▽): — Time/Date:

Drill Start Time/Date: 4/12/05 Drill Finish Time/Date: 4/12/05

Depth to Water After Drilling (▼): — Time/Date:

Well Completion Time/Date: —

Depth to other Water Bearing Zones: —

Soil Boring Backfill Time/Date: —

PID/OVA	Sample Interval	Recovered (in.)	Blow Counts / 6 in.	Retained for Analysis	Casing Type & Size	Annulus Filler	Depth (Feet)	USCS Soil Type	Soil Description	Estimated % Of: Gravel	Sand: Coarse	Sand: Medium	Sand: Fine	Silt/clay
	X							SM	Silty sand, dark brown (7.5 YR 3/3), moist, very loose, vf-fine sand, no odor				55	45

QA/QC

MONTGOMERY WATSON

Boring #: BKND-7 MW#: Sheet 1 of 1

Project: SSFL Background Soil Sampling

Job #: Site: SSFL

Logged By: E. Vander Velde Reviewed By: T. Burton

Drilling Contractor: N/A

Drill Rig Type/Method: N/A

Drillers Name: N/A

Borehole Diam./Drill Bit Type: N/A

Total Depth: Ø'

Ref. Elev.: —

Site Sketch Map

Sampler Type: Grab w/sample container

Depth to 1st Water (▽): — Time/Date:

Drill Start Time/Date: 4/12/05 Drill Finish Time/Date: 4/12/05

Depth to Water After Drilling (▼): — Time/Date:

Well Completion Time/Date: —

Depth to other Water Bearing Zones: —

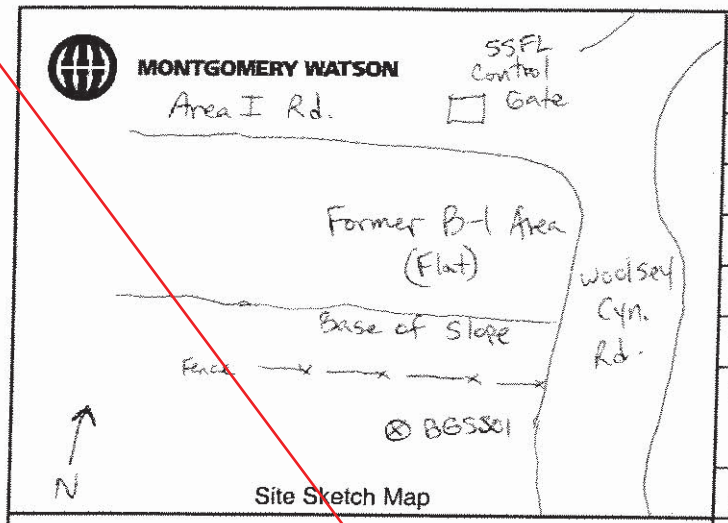
Soil Boring Backfill Time/Date: —

PID/OVA	Sample Interval	Recovered (in.)	Blow Counts / 6 in.	Retained for Analysis	Casing Type & Size	Annulus Filler	Depth (Feet)	USCS Soil Type	Soil Description	Estimated % Of: Gravel	Sand: Coarse	Sand: Medium	Sand: Fine	Silt/clay
	X							ML	Silt, dark brown (7.5 YR 3/4), moist, soft, moderate plasticity (20-30% clay), very fine & fine sands, no odor				10	90

QA/QC

BGSS01

MONTGOMERY WATSON



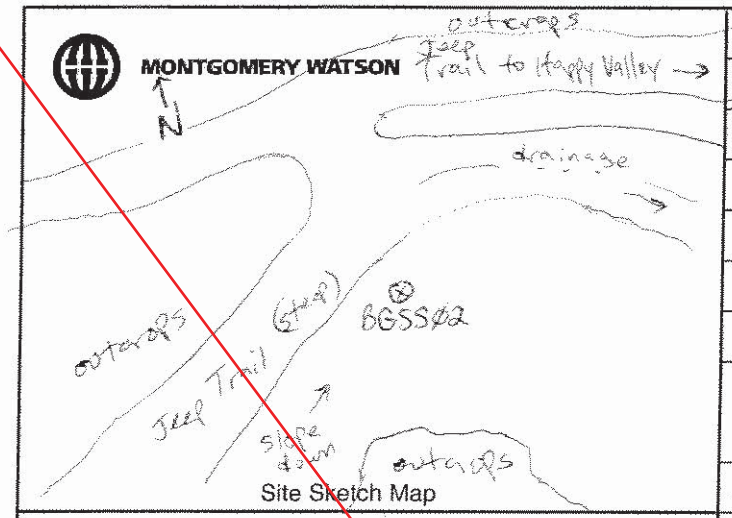
Site Sketch Map

Boring #:	MW#:
Sheet 1 of 1	
Project: SSFL Background Soil Sampling	
Job #:	Site: SSFL
Logged By: E. Vander Velde	Reviewed By: T. Burton
Drilling Contractor: N/A	
Drill Rig Type/Method: N/A	
Drillers Name: N/A	
Borehole Diam./Drill Bit Type: N/A	Total Depth: 0.5'
	Ref. Elev.: —
Sampler Type: shovel/trowel	
Depth to 1st Water (▽): —	Time/Date:
Drill Start Time/Date:	Drill Finish Time/Date:
Depth to Water After Drilling (▼): —	Time/Date:
Well Completion Time/Date: —	
Depth to other Water Bearing Zones: —	
Soil Boring Backfill Time/Date: —	

PID/OVA	Sample Interval	Recovered (in.)	Blow Counts / 6 in.	Retained for Analysis	Casing Type & Size	Annulus Filler	Depth (Feet)	USCS Soil Type	Soil Description	Estimated % Of: Gravel	Sand: Coarse	Sand: Medium	Sand: Fine	Silt/clay
	X							SM	Silty sand, dark yellowish brown (10YR 4/6), moist, very loose, very fine to fine sands, some shale fragments up to 1", trace medium sand	5		tr	65	30

QA/QC

MONTGOMERY WATSON



Site Sketch Map

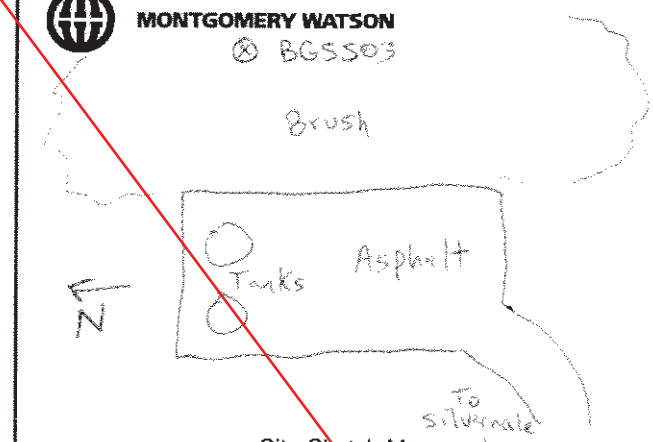
Boring #:	MW#:	Sheet 1 of 1	
Project: BGSS02		Soil Background	
Job #:		Site: SSFL	
Logged By: T. Burton		Reviewed By:	
Drilling Contractor: N/A			
Drill Rig Type/Method: N/A			
Drillers Name: N/A			
Borehole Diam./Drill Bit Type: N/A		Total Depth 1'	Ref. Elev. —
Sampler Type: Grab w/ sample containers			
Drill Start Time/Date: 4/19/05 1230		Drill Finish Time/Date: 1315	
Well Completion Time/Date: —			
Soil Boring Backfill Time/Date: —			

Depth to 1st Water (▽): —	Time/Date: —	
Depth to Water After Drilling (▼): —	Time/Date: —	
Depth to other Water Bearing Zones: —		

PID/OVA	Sample Interval	Recovered (in.)	Blow Counts / 6 in.	Retained for Analysis	Casing Type & Size	Annulus Filler	Depth (Feet)	USCS Soil Type	Soil Description	Estimated % Of: Gravel	Sand: Coarse	Sand: Medium	Sand: Fine	Silt/clay
	X							SM	Surface: grassy slope adjacent to sandstone outcrops + dirt road (overgrown)	tr	tr	15	55	30
							1		Silty sand (SM), dark yellowish brown (10YR 4/6), dry, very loose, vf ~~fine~~ med sand, trace ~~medium~~ coarse sand + pebble-sized weathered sandstone fragments; refusal @ 1' on sandstone					
							2							
							3							
									BGSS02 S01 @ 0.5' 1295					
									BGSS02 S02 @ 1.0' 1255					

QA/QC

MONTGOMERY WATSON



Site Sketch Map

Boring #:	MW#:	Sheet 1 of 1	
Project: BGSS03			
Job #:	Site: SSFL		
Logged By: T. Burton	Reviewed By:		
Drilling Contractor: N/A			
Drill Rig Type/Method: N/A			
Drillers Name: N/A			
Borehole Diam./Drill Bit Type: N/A	Total Depth 10.0'	Ref. Elev.	
Sampler Type: Continuous - stainless steel sleeve			
Depth to 1st Water (▽): —	Time/Date: —	Drill Start Time/Date: 4/13/05 0740	Drill Finish Time/Date: 1030
Depth to Water After Drilling (▼): —	Time/Date: —	Well Completion Time/Date: —	
Depth to other Water Bearing Zones: —		Soil Boring Backfill Time/Date: —	

PID/OVA	Sample Interval	Recovered (in.)	Blow Counts / 6 in.	Retained for Analysis	Casing Type & Size	Annulus Filler	Depth (Feet)	USCS Soil Type	Soil Description	Estimated % Of: Gravel	Sand: Coarse	Sand: Medium	Sand: Fine	Silt/clay
	X							ML	Surface: flat soil w/ minor veg.	—	+	—	20	80
	X								@ 0.5': silt w/ sand (ML), dark	20	—	—	15	65
							1		brown (7.5YR3/3), moist, soft,					
							2		vf sand, non-plastic; trace					
									yellowish brown fine sandstone frags					
							3		@ 1.0': As above, w/ fine gravel (fine ss and					
									interbedded siltstone fragments)					
							4		BGSS03 S01 0.5' @ 1000					
									BGSS03 D01 0.5' @ 1000					
							5		BGSS03 S02 1.0' @ 1013					
							6							
							7							
							8							
							9							
							10							
							11							
							12							

QA/QC

BGSS04

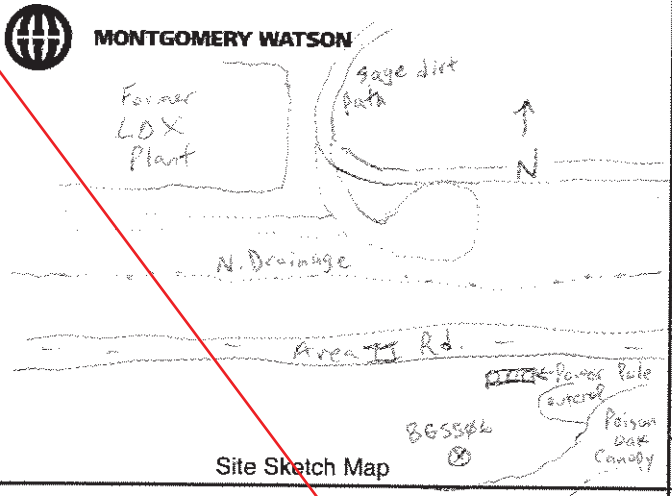
MONTGOMERY WATSON

Boring #:	MW#:
Sheet 1 of 1	
Project: SSFL Background Soil Sampling	
Job #:	Site: SSFL
Logged By: E. Vander Velde	Reviewed By: T. Burton
Drilling Contractor: N/A	
Drill Rig Type/Method: N/A	
Drillers Name: N/A	
Borehole Diam./Drill Bit Type:	Total Depth 0.5'
	Ref. Elev. —
Site Sketch Map	Sampler Type: Grab w/ sample container
Depth to 1st Water (▽): — Time/Date:	Drill Start Time/Date: 4/12/05 Drill Finish Time/Date: 4/12/05
Depth to Water After Drilling (▼): — Time/Date:	Well Completion Time/Date: —
Depth to other Water Bearing Zones: —	Soil Boring Backfill Time/Date: —

PID/OVA	Sample Interval	Recovered (in.)	Blow Counts / 6 in.	Retained for Analysis	Casing Type & Size	Annulus Filler	Depth (Feet)	USCS Soil Type	Soil Description	Estimated % Of: Gravel	Sand: Coarse	Sand: Medium	Sand: Fine	Silt/clay
	X							SM	Silty sand, reddish brown (2.5YR4/3), moist, very loose, vf-fine sands, no odor				65	35

QA/QC

MONTGOMERY WATSON



Site Sketch Map

Boring #:	MW#:	Sheet 1 of 1	
Project: BGSS06 Soil Background			
Job #:	Site: SSFL		
Logged By: T. Burton	Reviewed By:		
Drilling Contractor: N/A			
Drill Rig Type/Method: Grab sample			
Drillers Name: N/A			
Borehole Diam./Drill Bit Type: N/A	Total Depth	0.5'	
	Ref. Elev.	—	
Sampler Type: Sample Container - s/s sleeve			
Drill Start Time/Date: 4/13/05 1105	Drill Finish Time/Date: 1115		
Well Completion Time/Date:			
Soil Boring Backfill Time/Date:			
Depth to 1st Water (▽): —	Time/Date: —		
Depth to Water After Drilling (▼): —	Time/Date: —		
Depth to other Water Bearing Zones: —			

PID/OVA	Sample Interval	Recovered (in.)	Blow Counts / 6 in.	Retained for Analysis	Casing Type & Size	Annulus Filler	Depth (Feet)	USCS Soil Type	Soil Description	Estimated % Of: Gravel	Sand: Coarse	Sand: Medium	Sand: Fine	Silt/clay
	X							ML	Surface: flat, grassy area @ 0.5' silt w/ sand (ML), brown (7.5YR 4/3), dry, soft, w/ trace medium sand & 3/4" med. sandstone fragments; non-plastic; rootlets	tr	—	tr	15	85
							1							
							2							
							3							
							4		BGSS06SA1 0.5' @ 1110					
							5							
							6							
							7							
							8							
							9							
							10							
							11							
							12							

QA/QC

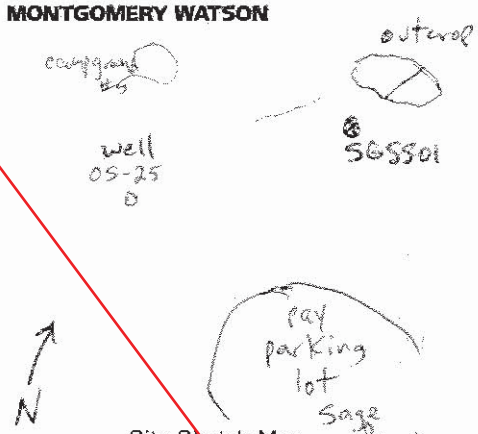
MONTGOMERY WATSON

Boring #:	MW#:
Sheet 1 of 1	
Project: BGSS07	Soil Background
Job #:	Site: SSFL
Logged By: T. Burton	Reviewed By:
Drilling Contractor: N/A	
Drill Rig Type/Method: N/A	
Drillers Name: N/A	
Borehole Diam./Drill Bit Type: N/A	Total Depth: 0.5'
	Ref. Elev.: —
Site Sketch Map	Sampler Type: Grab w/ sample container
Depth to 1st Water (▽): —	Time/Date: —
Depth to Water After Drilling (▼): —	Time/Date: —
Depth to other Water Bearing Zones: —	
Drill Start Time/Date: 4/19/05 1440	Drill Finish Time/Date: 1520
Well Completion Time/Date: —	
Soil Boring Backfill Time/Date: —	

PID/OVA	Sample Interval	Recovered (in.)	Blow Counts / 6 in.	Retained for Analysis	Casing Type & Size	Annulus Filler	Depth (Feet)	USCS Soil Type	Soil Description	Estimated % Of: Gravel	Sand: Coarse	Sand: Medium	Sand: Fine	Silt/clay
	X							ML	Surface: soil slope beneath scrub oak	—	—	—	tr	100
							1		Silt (ML), dark brown (7.5YR 4/4)					
									dry, v. soft, w/ trace vf sand					
							2		BGSS07 SB1 @ 175 0.5'					

QA/QC

MONTGOMERY WATSON



Site Sketch Map

Boring #:	MW#:	Sheet 1 of 1	
Project: SGSSØ1 SØ1 Soil Background			
Job #:	Site: Sage Ranch/SSFL		
Logged By: T. Burton	Reviewed By:		
Drilling Contractor: N/A			
Drill Rig Type/Method: N/A			
Drillers Name: N/A			
Borehole Diam./Drill Bit Type: N/A	Total Depth Ø'	Ref. Elev. —	
Sampler Type: Grab w/ Sample Containers			
Drill Start Time/Date: 4/14/05 1345	Drill Finish Time/Date: 1515		
Well Completion Time/Date: —			
Soil Boring Backfill Time/Date: —			

Depth to 1st Water (▽): —	Time/Date: —		
Depth to Water After Drilling (▼): —	Time/Date: —		
Depth to other Water Bearing Zones: —			

PID/OVA	Sample Interval	Recovered (in.)	Blow Counts / 6 in.	Retained for Analysis	Casing Type & Size	Annulus Filler	Depth (Feet)	USCS Soil Type	Soil Description	Estimated % Of: Gravel	Sand: Coarse	Sand: Medium	Sand: Fine	Silt/clay
	X							ML	Surface: gentle slope, grassy Sandy silt (ML), brown (7.5YR4/4) soft, dry, vf-fine sand, non-plastic; with rootlets	—	—	tr	30	70
									SGSSØ1 SØ1 0' @ 1400					

QA/QC

MONTGOMERY WATSON

Boring #:	MW#:
Sheet 1 of 1	
Project: BZSS01	Soil Background
Job #:	Site: SSFL / Bell Canyon
Logged By: T. Burton	Reviewed By:
Drilling Contractor: N/A	
Drill Rig Type/Method: Grab	
Drillers Name: N/A	
Borehole Diam./Drill Bit Type: N/A	Total Depth: 0'
	Ref. Elev.: —
Sampler Type: S/S sleeve (grab)	
Drill Start Time/Date: 4/12/05 1445	Drill Finish Time/Date: 1455
Well Completion Time/Date: —	
Soil Boring Backfill Time/Date: —	

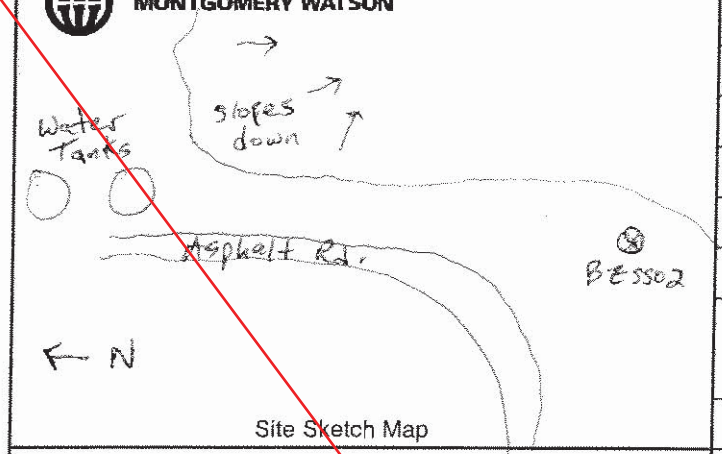
Site Sketch Map

Depth to 1st Water (▽): —	Time/Date: —
Depth to Water After Drilling (▼): —	Time/Date: —
Depth to other Water Bearing Zones: —	

PID/OVA	Sample Interval	Recovered (in.)	Blow Counts / 6 in.	Retained for Analysis	Casing Type & Size	Annulus Filler	Depth (Feet)	USCS Soil Type	Soil Description	Estimated % Of: Gravel	Sand: Coarse	Sand: Medium	Sand: Fine	Silt/clay
	X							ML	Surface: Thick grass; flat Silt (ML), dark grayish brown (10YR 4/2), moist, soft, some vf sand	~~X~~ rb			5	95
							1							
							2							
							3							
							4		BZSS01SØ1, DØ1 @ 1450 Ø' bgs					
							5		Sample collected below root zone, approx 1.5-2" bgs					
							6							
							7							
							8							
							9							
							10							
							11							
							12							

QA/QC

MONTGOMERY WATSON



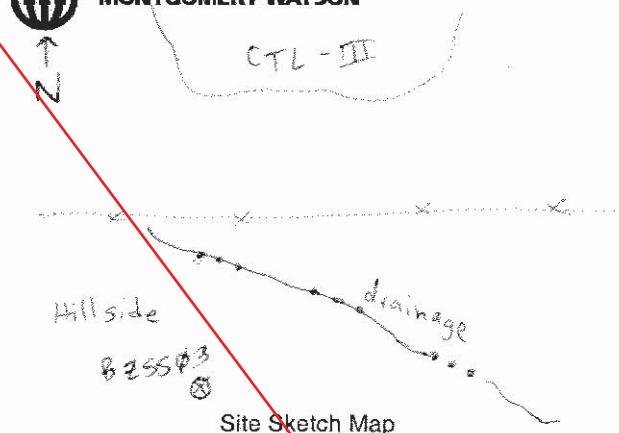
Site Sketch Map

Boring #:	MW#:
Sheet 1 of 1	
Project: BES502	Soil Background
Job #:	Site: SSFL/Bell Canyon
Logged By: T. Burton	Reviewed By:
Drilling Contractor: N/A	
Drill Rig Type/Method: N/A	
Drillers Name: N/A	
Borehole Diam./Drill Bit Type: N/A	Total Depth 0.5' / Ref. Elev. —
Sampler Type: Grab w/ sample sleeve	
Depth to 1st Water (▽): —	Time/Date: —
Drill Start Time/Date: 4/19/05 1520	Drill Finish Time/Date: 1550
Depth to Water After Drilling (▼): —	Time/Date: —
Well Completion Time/Date: —	
Depth to other Water Bearing Zones: —	Soil Boring Backfill Time/Date: —

PID/OVA	Sample Interval	Recovered (in.)	Blow Counts / 6 in.	Retained for Analysis	Casing Type & Size	Annulus Filler	Depth (Feet)	USCS Soil Type	Soil Description	Estimated % Of: Gravel	Sand: Coarse	Sand: Medium	Sand: Fine	Silt/clay
	X							ML	Surface: flat, grassy area above dip slope	20		tr	30	50
									Sandy silt w/ gravel (ML), brown (10YR 4/3), dry, soft, very fine sand; angular fragments as vf sandstone up to 1/4"; trace rootlets; non-plastic					
									BES502 SP1 0.5' 1540					

QA/QC

MONTGOMERY WATSON



Site Sketch Map

Boring #:	MW#:
Sheet 1 of 1	
Project: BZSSØ3	Soil Background
Job #:	Site: SSFL
Logged By: T. Burton	Reviewed By:
Drilling Contractor: N/A	
Drill Rig Type/Method: N/A	
Drillers Name: N/A	
Borehole Diam./Drill Bit Type: N/A	Total Depth: 1.0'
	Ref. Elev.: —
Sampler Type: Trowel / grab w/sample container	
Depth to 1st Water (▽): —	Time/Date: —
Drill Start Time/Date: 4/18/05 1510	Drill Finish Time/Date: 1550
Depth to Water After Drilling (▼): —	Time/Date: —
Well Completion Time/Date: —	
Depth to other Water Bearing Zones: —	Soil Boring Backfill Time/Date: —

PID/OVA	Sample Interval	Recovered (in.)	Blow Counts / 6 in.	Retained for Analysis	Casing Type & Size	Annulus Filler	Depth (Feet)	USCS Soil Type	Soil Description	Estimated % Of: Gravel	Sand: Coarse	Sand: Medium	Sand: Fine	Silt/clay
	X							ML	Surface: grassy slope	—	—	—	—	100
	X						1		Silt (ML), dark yellowish brown (10YR 3/6), dry, medium stiffness, non-plastic but increasing plasticity in 1' sample (clay content ≈ 10-15%)	—	—	—	—	100
							2							
									BZSSØ3SØ1 0.5' @ 1530					
									BZSSØ3SØ2 1.0' @ 1535					

QA/QC

BZSS04

MONTGOMERY WATSON

Boring #:	MW#:
Sheet 1 of 1	
Project: SSFL Background Soil Sampling	
Job #:	Site: SSFL
Logged By: E. Vander Velde	Reviewed By: T. Burton
Drilling Contractor: N/A	
Drill Rig Type/Method: N/A	
Drillers Name: N/A	
Borehole Diam./Drill Bit Type: N/A	Total Depth 0.5'
	Ref. Elev. —
Sampler Type: Grab w/ sample container	
Drill Start Time/Date: 4/13/05	Drill Finish Time/Date: 4/13/05
Well Completion Time/Date: —	
Soil Boring Backfill Time/Date: —	

Site Sketch Map

Depth to 1st Water (▽): —	Time/Date:
Depth to Water After Drilling (▼): —	Time/Date:
Depth to other Water Bearing Zones: —	

PID/OVA	Sample Interval	Recovered (in.)	Blow Counts / 6 in.	Retained for Analysis	Casing Type & Size	Annulus Filler	Depth (Feet)	USCS Soil Type	Soil Description	Estimated % Of: Gravel	Sand: Coarse	Sand: Medium	Sand: Fine	Silt/clay
	X							SM	Silty sand, yellowish brown (10YR4/6), dry, very loose, vf-fine sand, no odor				55	45

QA/QC

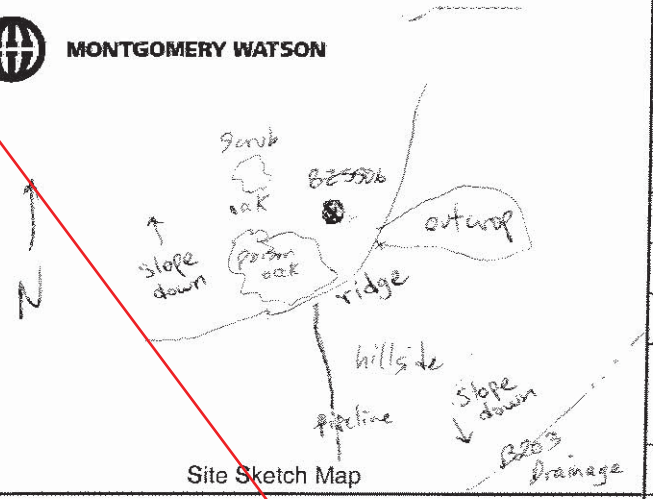
MONTGOMERY WATSON

Boring #: MW#:	Sheet 1 of 1
Project: BZSS05 Soil Background	
Job #:	Site: SSFL
Logged By: T. Burton	Reviewed By:
Drilling Contractor: N/A	
Drill Rig Type/Method: N/A	
Drillers Name: N/A	
Borehole Diam./Drill Bit Type: N/A	Total Depth: 0' / Ref. Elev.: —
Site Sketch Map	Sampler Type: Sample Container (Grab)
Depth to 1st Water (▽): — Time/Date: —	Drill Start Time/Date: 4/15/05 Drill Finish Time/Date: 4/15/05
Depth to Water After Drilling (▼): — Time/Date: —	Well Completion Time/Date: —
Depth to other Water Bearing Zones: —	Soil Boring Backfill Time/Date: —

PID/OVA	Sample Interval	Recovered (in.)	Blow Counts / 6 in.	Retained for Analysis	Casing Type & Size	Annulus Filler	Depth (Feet)	USCS Soil Type	Soil Description	Estimated % Of: Gravel	Sand: Coarse	Sand: Medium	Sand: Fine	Silt/clay
	X						1	ML	Surface: flat grassy area Silt (ML), dark brown (7.5YR 3/3), moist, soft, non-plastic, with some very fine sand + rootlets	—	—	—	5	95
									BZSS05 S01 0' @ 1325					

QA/QC

MONTGOMERY WATSON



Site Sketch Map

Boring #:	MW#:
Sheet 1 of 1	
Project: BZSS06	Soil Background
Job #:	Site: SSFL
Logged By: T. Burton	Reviewed By:
Drilling Contractor: N/A	
Drill Rig Type/Method: N/A	
Drillers Name: N/A	
Borehole Diam./Drill Bit Type: N/A	Total Depth: Ø' / Ref. Elev.: —
Sampler Type: Grab w/ sample container	
Drill Start Time/Date: 4/15/05 1000	Drill Finish Time/Date: 1040
Well Completion Time/Date: —	
Soil Boring Backfill Time/Date: —	
Depth to 1st Water (▽): —	Time/Date: —
Depth to Water After Drilling (▼): —	Time/Date: —
Depth to other Water Bearing Zones: —	

PID/OVA	Sample Interval	Recovered (in.)	Blow Counts / 6 in.	Retained for Analysis	Casing Type & Size	Annulus Filler	Depth (Feet)	USCS Soil Type	Soil Description	Estimated % Of: Gravel	Sand: Coarse	Sand: Medium	Sand: Fine	Silt/clay
	X							ML	Surface: grassy slope downslope from Chatsworth Fm ss outcrop	tr	tr	tr	25	75
							1		Silt w/sand (ML), dk. brown (7.5YR 4/3), dry, v. soft, non-plastic, vf to fine sand w/ trace coarse sand + fine gravel-sized sandstone fragments; rootlets visible in upper 3"					
									BZSS06 S01 0' @ 1020					

QA/QC

MONTGOMERY WATSON

Site Sketch Map

Boring #:	MW#:
Sheet 1 of 1	
Project: BCSS09 Soil Background	
Job #:	Site: SSFL / Bell Canyon
Logged By: Tom Burton	Reviewed By:
Drilling Contractor: N/A	
Drill Rig Type/Method: N/A	
Drillers Name: N/A	
Borehole Diam./Drill Bit Type: N/A	Total Depth: Ø'
	Ref. Elev.: —
Sampler Type: Grab w/ Sample Container	
Depth to 1st Water (▽): —	Time/Date: —
Drill Start Time/Date: 4/19/05 1445	Drill Finish Time/Date: 1530
Depth to Water After Drilling (▼): —	Time/Date: —
Well Completion Time/Date: —	
Depth to other Water Bearing Zones: —	Soil Boring Backfill Time/Date: —

PID/OVA	Sample Interval	Recovered (in.)	Blow Counts / 6 in.	Retained for Analysis	Casing Type & Size	Annulus Filler	Depth (Feet)	USCS Soil Type	Soil Description	Estimated % Of: Gravel	Sand: Coarse	Sand: Medium	Sand: Fine	Silt/clay
	X							ML	Surface: bare soil - thin cover over shale outcrop, slope Silt w/ gravel (ML), dark grayish brown (10YR4/2), dry, soft, non-plastic, w/ angular shale fragments up to 1/4"	20	—	—	5	75
									BCSS09 S01 Ø' @ 1515					

QA/QC

MONTGOMERY WATSON

Boring #:	MW#:
Sheet 1 of 1	
Project: BCSS11 S01 Soil Background	
Job #:	Site: SSFL/Bell Cyn.
Logged By: T. Burton	Reviewed By:
Drilling Contractor: N/A	
Drill Rig Type/Method: N/A	
Drillers Name: N/A	
Borehole Diam./Drill Bit Type: N/A	Total Depth: 0'
	Ref. Elev.: —
Sampler Type: Grab w/ sample container	
Drill Start Time/Date: 4/13/05 1420	Drill Finish Time/Date: 1440
Well Completion Time/Date: —	
Soil Boring Backfill Time/Date: —	

Site Sketch Map

Depth to 1st Water (▽): —	Time/Date: —
Depth to Water After Drilling (▼): —	Time/Date: —
Depth to other Water Bearing Zones: —	

PID/OVA	Sample Interval	Recovered (in.)	Blow Counts / 6 in.	Retained for Analysis	Casing Type & Size	Annulus Filler	Depth (Feet)	USCS Soil Type	Soil Description	Estimated % Of: Gravel	Sand: Coarse	Sand: Medium	Sand: Fine	Silt/clay
	X							CL	Surface: dry grass on gentle slope	—	5	5	5	85
							1		Lean Clay w/ sand (CL), dark grayish brown (10YR 4/2), ~~dry~~, moist, stiff, ~~sub~~ fine to coarse sand, blocky texture, scattered rootlets + secondary porosity visible					
							2		BCSS11 S01 0' @ 1435					

QA/QC

MONTGOMERY WATSON

Boring #:	MW#:
Sheet 1 of 1	
Project: BCSS12 Soil Background	
Job #:	Site: SSFL/Bell Cyn.
Logged By: T. Burton	Reviewed By:
Drilling Contractor: N/A	
Drill Rig Type/Method: N/A	
Drillers Name: N/A	
Borehole Diam./Drill Bit Type: N/A	Total Depth: 0'
	Ref. Elev.: —
Sampler Type: Grab w/ sample container	
Drill Start Time/Date: 4/13/05 1320	Drill Finish Time/Date: 1430
Well Completion Time/Date: —	
Soil Boring Backfill Time/Date: —	

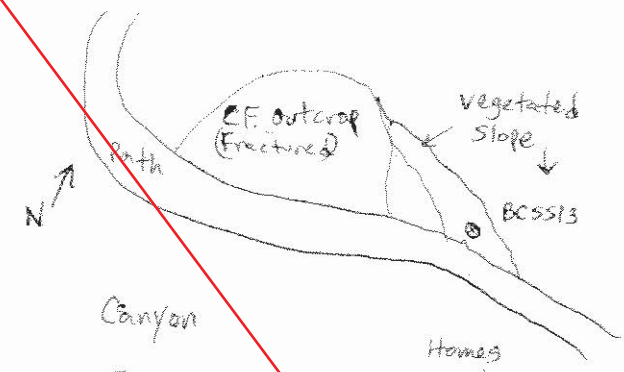
Site Sketch Map

Depth to 1st Water (▽): —	Time/Date: —
Depth to Water After Drilling (▼): —	Time/Date: —
Depth to other Water Bearing Zones: —	

PID/OVA	Sample Interval	Recovered (in.)	Blow Counts / 6 in.	Retained for Analysis	Casing Type & Size	Annulus Filler	Depth (Feet)	USCS Soil Type	Soil Description	Estimated % Of: Gravel	Sand: Coarse	Sand: Medium	Sand: Fine	Silt/clay
	X							ML	Silt (ML), dk. reddish brown to dark brown (7.5YR3/3), moist, soft, non-plastic, vf sand, some 1/4" - 1/2" shalestone & sandstone fragments	tr			10	90
							1							
							2							
							3							
							4		BCSS12 S01 0' @1425					
							5							
							6							
							7							
							8							
							9							
							10							
							11							
							12							

QA/QC

MONTGOMERY WATSON



[No Scale] Site Sketch Map

Boring #:	MW#:	Sheet 1 of 1	
Project: BCSS13		Boeing SSFL RFI	
Job #:		Site: Bell Canyon / SSFL	
Logged By: T. Burton		Reviewed By:	
Drilling Contractor: N/A			
Drill Rig Type/Method: N/A			
Drillers Name: N/A			
Borehole Diam./Drill Bit Type: N/A		Total Depth	Ø'
		Ref. Elev.	—
Sampler Type: grab w/ sample container			
Drill Start Time/Date: 4/14/05 1045		Drill Finish Time/Date: 1115	
Well Completion Time/Date: —			
Soil Boring Backfill Time/Date: —			

Depth to 1st Water (▽): —	Time/Date: —
Depth to Water After Drilling (▼): —	Time/Date: —
Depth to other Water Bearing Zones: —	

PID/OVA	Sample Interval	Recovered (in.)	Blow Counts / 6 in.	Retained for Analysis	Casing Type & Size	Annulus Filler	Depth (Feet)	USCS Soil Type	Soil Description	Estimated % Of: Gravel	Sand: Coarse	Sand: Medium	Sand: Fine	Silt/clay
	X							SM	Surface: outcrop slope; wildflowers adjacent to horse trail	20	10	30	20	20
									@ Ø' Silty sand w/gravel (SM), dark yellowish brown (10YR 4/6), dry, very loose, fine to coarse grains, with up to 1/2" subangular sandstone fragments					
									BCSS13 S01 @ 0' @ 1100					
									Notes:					
									Chatsworth Fm. Sandstone outcrop, weathered in place					

QA/QC

MONTGOMERY WATSON

Boring #:	MW#:
Sheet	1 of 1
Project:	BCSS14 SSFL Soil Background
Job #:	Site: Bell Canyon
Logged By:	T. Burton Reviewed By:
Drilling Contractor:	N/A
Drill Rig Type/Method:	N/A
Drillers Name:	N/A
Borehole Diam./Drill Bit Type:	N/A
Total Depth	Ø'
Ref. Elev.	—
Sampler Type:	Grab w/ sample container
Drill Start Time/Date:	4/12/05 1315
Drill Finish Time/Date:	1325
Well Completion Time/Date:	—
Soil Boring Backfill Time/Date:	—

Site Sketch Map

Depth to 1st Water (▽):	—	Time/Date:	—
Depth to Water After Drilling (▼):	—	Time/Date:	—
Depth to other Water Bearing Zones:	—		

PID/OVA	Sample Interval	Recovered (in.)	Blow Counts / 6 in.	Retained for Analysis	Casing Type & Size	Annulus Filler	Depth (Feet)	USCS Soil Type	Soil Description	Estimated % Of: Gravel	Sand: Coarse	Sand: Medium	Sand: Fine	Silt/clay
	X							ML	Sandy silt (ML), grayish brown (10YR 5/2), dry, stiff (loose in sample), non-plastic, vf-fine sand, some fine sandstone gravels (1/2" diam)	~~10~~ 5	—	—	~~30~~ 30	65
							1							
							2							
							3							
							4							
							5		SØ1 Ø' Collected @ 1320 East side of drainage; flat spot					
							6							
							7							
							8							
							9							
							10							
							11							
							12							

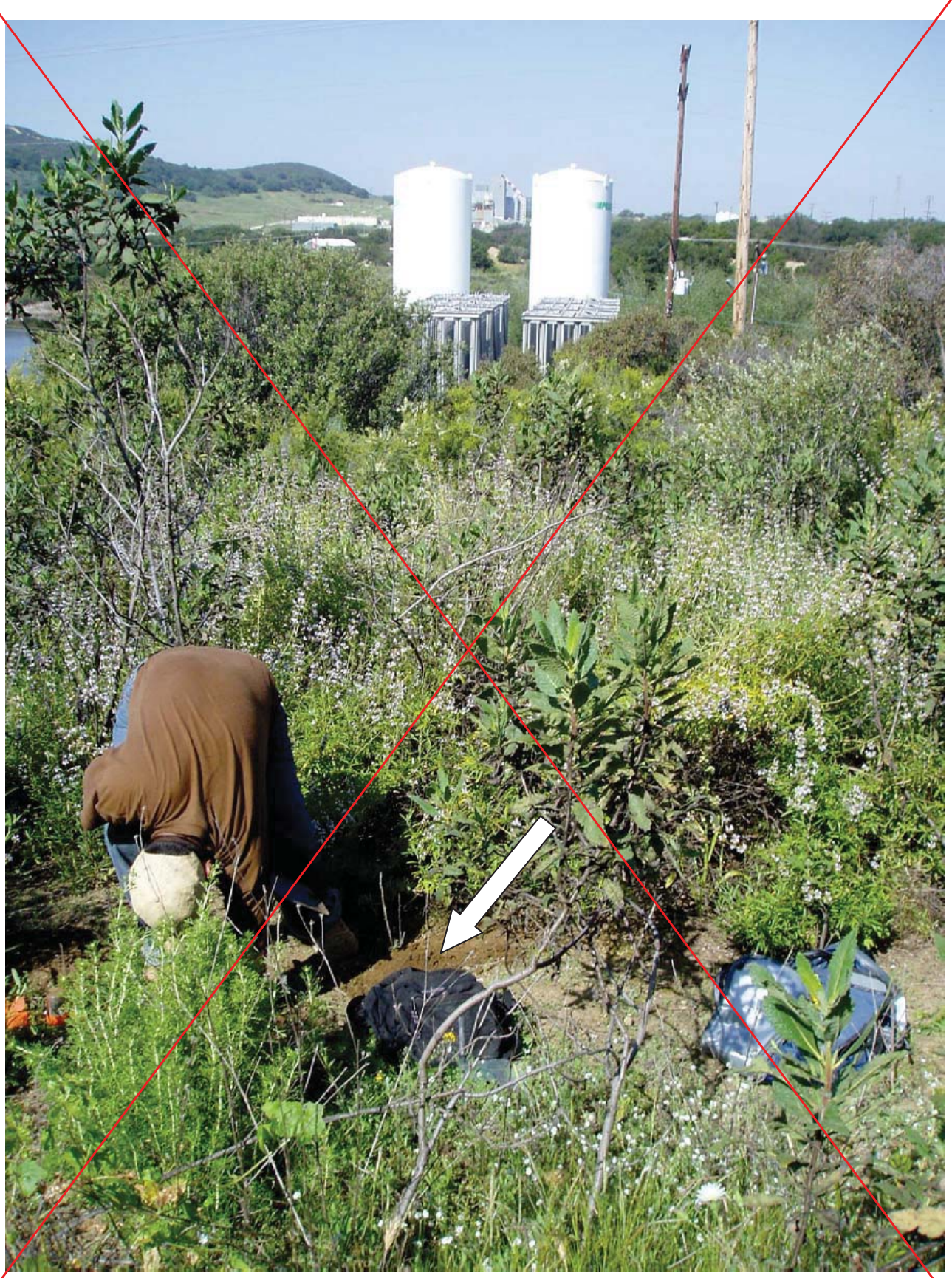
QA/QC

ATTACHMENT A-2

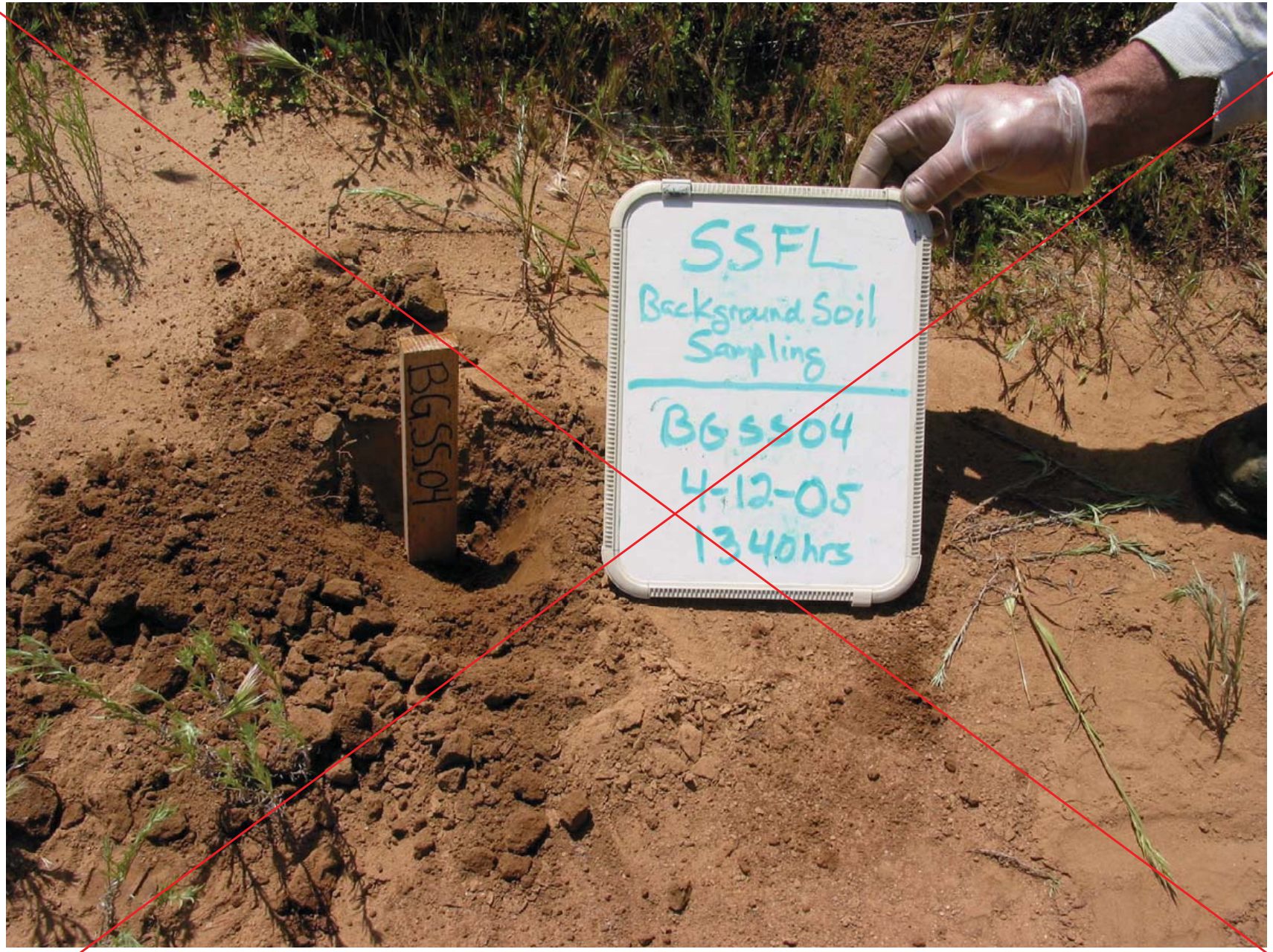
SAMPLE LOCATION PHOTOGRAPHS

Sample Location BGSS01

Sample Location BGSS02



Sample Location BGSS03



Sample Location BGSS04

Sample Location BGSS06

Sample Location BGSS07

Sample Location BKND-1

Sample Location BKND-2

Sample Location BKND-3

Sample Location BKND-4

Sample Location BKND-5

Sample Location BKND-6

Sample Location BKND-7

Sample Location BZSS01

Sample Location BZSS02

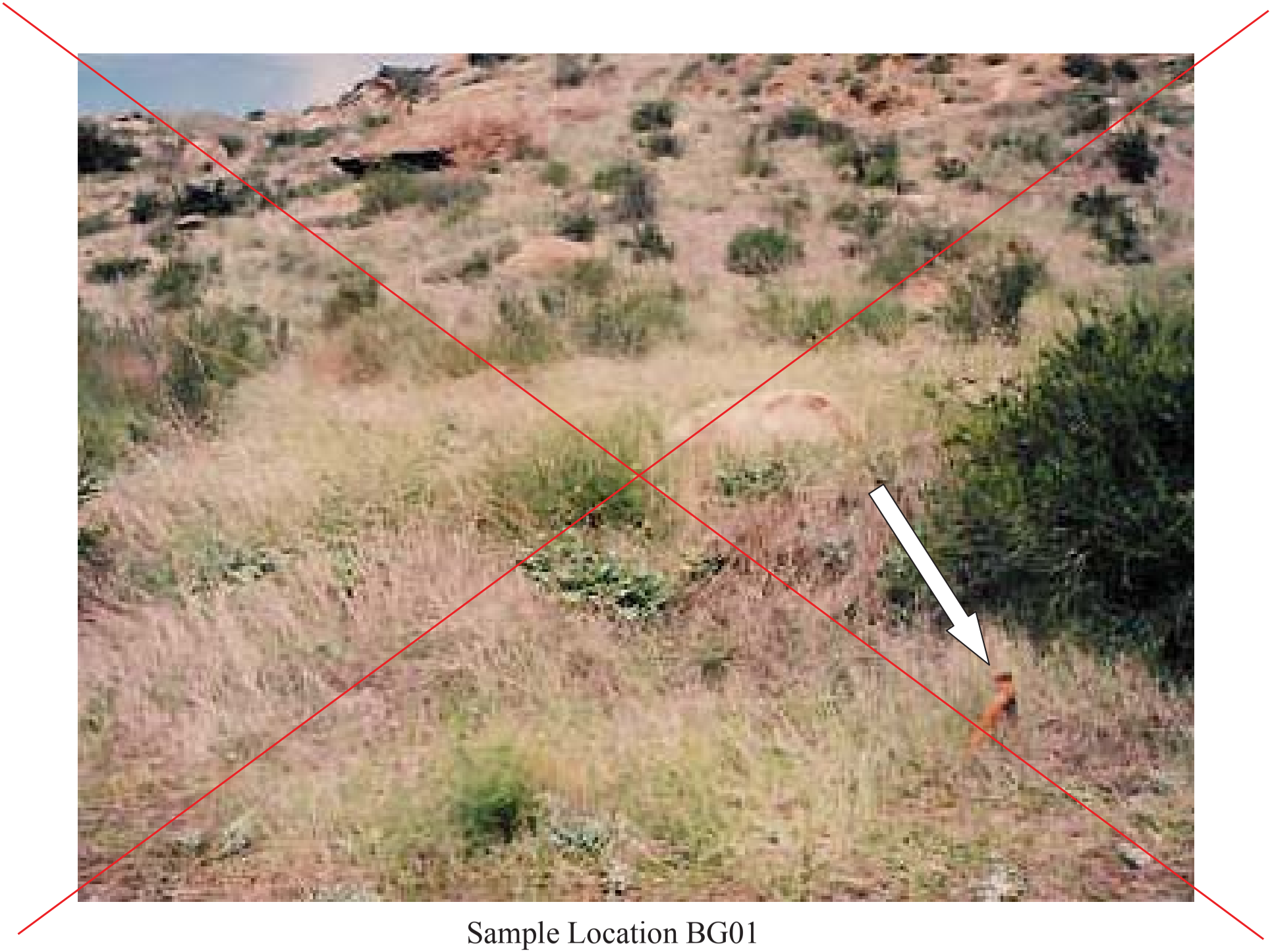
Sample Location BZSS03

Sample Location BZSS04

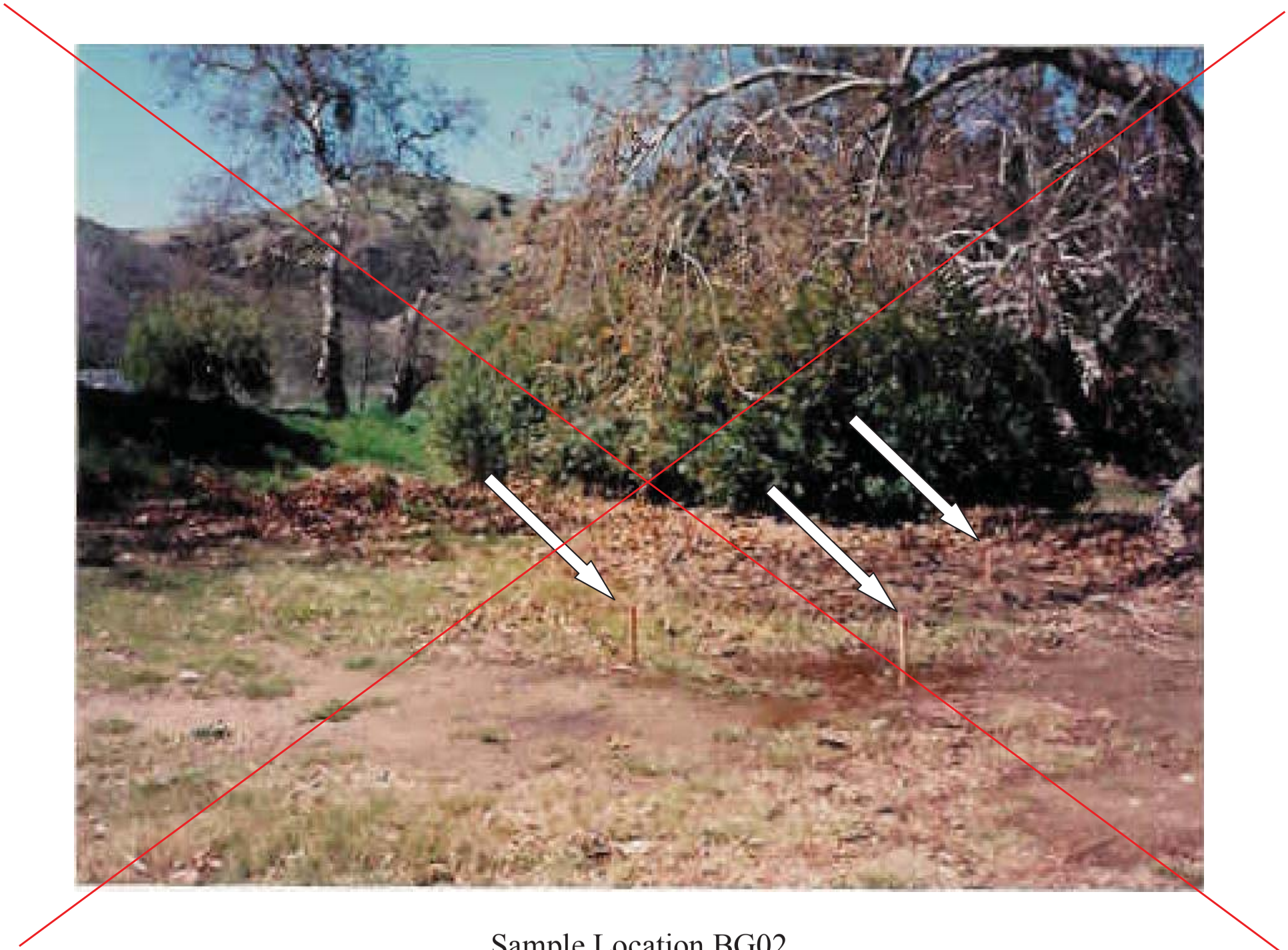
Sample Location BZSS05

Sample Location BZSS06

Sample Location SGSS01

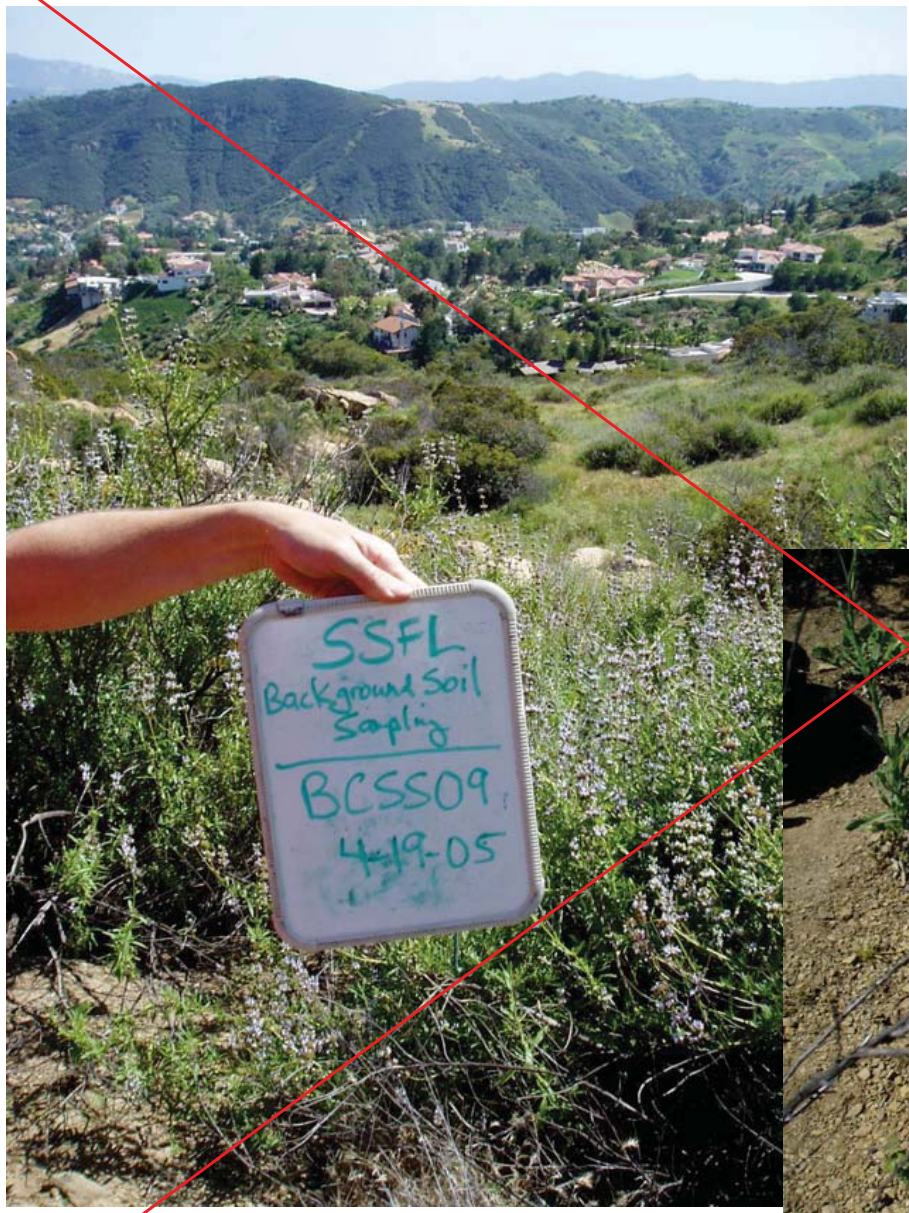


Sample Location BG01



Sample Location BG02

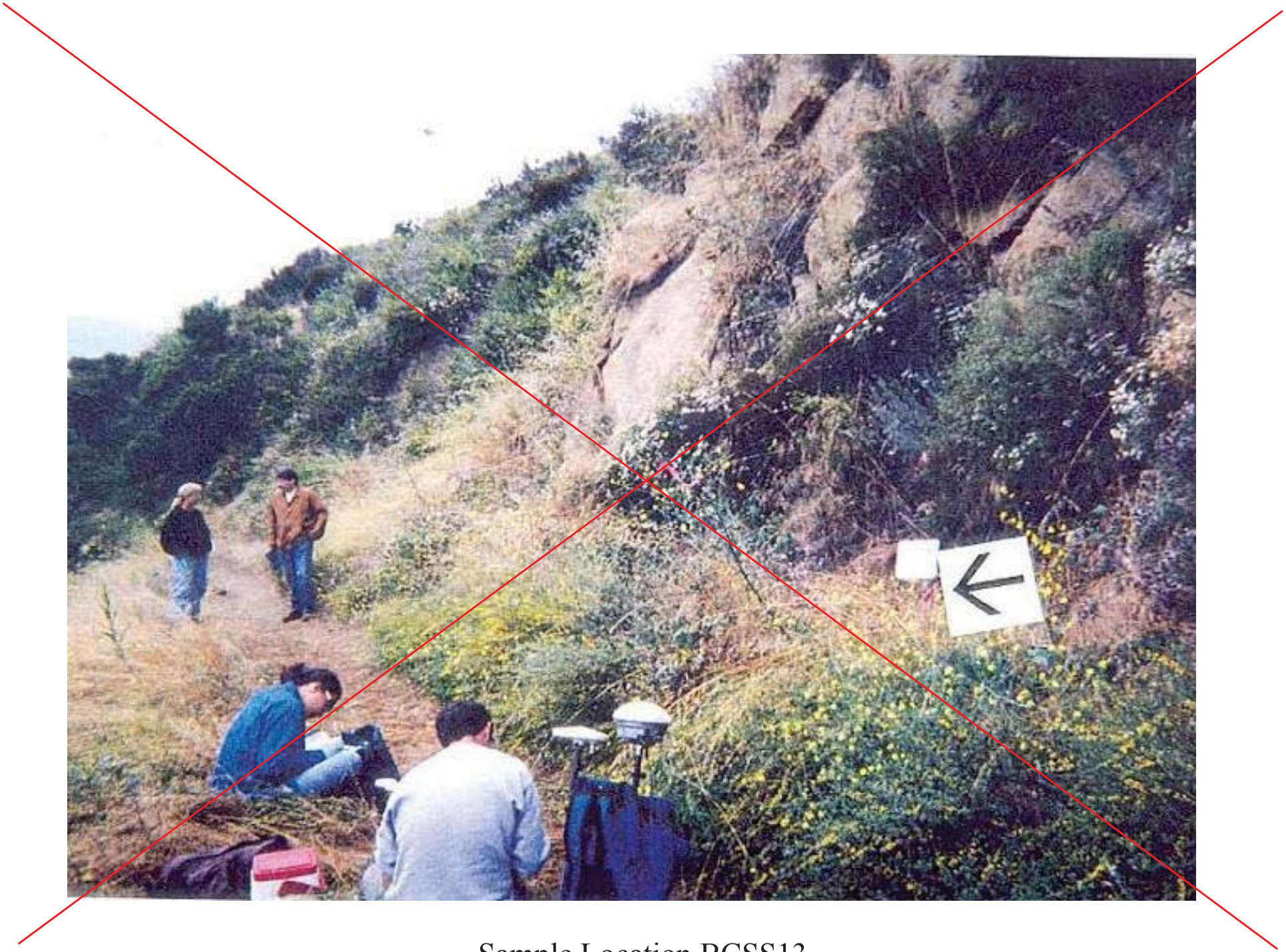
Sample Location BG04



Sample Location BCSS09

Sample Location BCSS11

Sample Location BCSS12



Sample Location BCSS13

Sample Location BCBS09

Sample Location BCSS14

APPENDIX B
DATA VALIDATION FINDINGS AND LABORATORY INFORMATION

SOIL BACKGROUND REPORT
SANTA SUSANA FIELD LABORATORY
VENTURA COUNTY, CALIFORNIA
FINAL

Prepared for:

The Boeing Company

National Aeronautics and Space Administration

U.S. Department of Energy

Prepared by:

AMEC Earth & Environmental, Inc.
355 South Teller Street, Suite 300
Lakewood, Colorado 80226

September 2005

Elizabeth A. Wessling
PROGRAM QA / QC MANAGER

Patti Meeks, Ph.D.
PROGRAM CHEMIST

APPENDIX B
DATA VALIDATION FINDINGS AND LABORATORY INFORMATION

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ATTACHMENTS

B-1 ELECTRONIC COPY OF SOIL BACKGROUND LABORATORY INFORMATION AND VALIDATION REPORTS

B-2 HML SOIL BACKGROUND MEMORANDUM

ACRONYMS

Boeing	The Boeing Company
Cal-EPA	California Environmental Protection Agency
CCB	continuing calibration blank
DHS	California Department of Health Services
DOE	U.S. Department of Energy
DTSC	Department of Toxic Substances Control
ELAP	Environmental Lab Accreditation Program
FSDF	Former Sodium Disposal Facility
GC/MS	gas chromatography/ mass spectrometry
ICF	ICF Kaiser Engineers
ICP	inductively coupled plasma spectrometry
ICSA	interference check sample A
MDL	method detection limit
MWH	Montgomery Watson Harza
NASA	National Aeronautics and Space Administration
OCDD	octachlorodibenzo-p-dioxin
PARCC	precision, accuracy, representativeness, completeness, comparability
%D	percent difference
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
SOP	standard operating procedure
SSFL	Santa Susana Field Laboratory
TIC	tentatively identified compound
USEPA	U.S. Environmental Protection Agency

B.1 INTRODUCTION

This document has been prepared by AMEC Earth and Environmental, Inc. (AMEC) for presentation in the Soil Background Report prepared by MWH Americas, Inc. on behalf of The Boeing Company (Boeing), the National Aeronautics and Space Administration (NASA) and the U.S. Department of Energy (DOE).

The Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) at the Santa Susana Field Laboratory (SSFL) includes soil, groundwater, surface water, and biota sampling and analysis, as well as passive and active soil gas sampling and analysis following California Environmental Protection Agency (Cal-EPA) Department of Toxic Substances Control (DTSC) approved work plans (ICF Kaiser Engineers [ICF] 1993a, 1993b, and 1993c; McLaren/Hart 1992, 1993a and 1993b; Ogden 1996, 2000a, and 2000b). Samples are analyzed for a variety of compounds including those analyzed for the soil background data set: metals, dioxins, and general minerals (pH and fluoride). The resulting data is validated by qualified chemists following United States Environmental Protection Agency (USEPA) guidelines as described in the RFI Quality Assurance Plans (QAPPs) and data validation standard operating procedures (SOPs). These data validation procedures are based on USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (1994a) and USEPA National Functional Guidelines for Organic Data Review (1994b).

Soil samples collected to define the background soil data set for the SSFL were collected in accordance with DTSC-approved work plans (ICF 1993b and 1993c; McLaren/Hart 1993b; Ogden 1996, 2000a, and 2000b). As discussed in Section 2 of the Background Soils Report, these samples were collected in six distinct events:

- **Multi-Media Sampling at the Brandeis-Bardin Institute and Santa Monica Mountains Conservancy** - soil sampling conducted by McLaren Hart in 1992-1994 under the Work Plan for Multi-Media Sampling at the Brandeis-Bardin Institute and Santa Monica Mountains Conservancy (McLaren/Hart 1992)

Metals analyses were performed by McLaren/Hart Analytical Laboratory, a California Department of Health Services (DHS)-certified laboratory located in Rancho Cordova, California.

- **FSDF Closure Field Investigation** - soil sampling conducted by ICF in 1995 in support of the Former Sodium Disposal Facility (FSDF) closure activities. Metals and dioxin analyses were performed by Quanterra Environmental Services, a California DHS-certified laboratory located in Knoxville, Tennessee.

- **Metals Sampling for the RFI Work Plan Addendum** - samples collected by Ogden in 1996 under the Metals Sampling and Analysis Plan for the RFI Work Plan Addendum (Ogden 1996). Metals analyses were performed by Ceimic Corporation, a California DHS-certified laboratory located in San Diego, California.

- **Bell Canyon Area Sampling** - samples collected by Ogden in 1998 under the Bell Canyon Residence Soil Sampling Work Plan (Ogden 1998a). Metals and general mineral analyses were performed by Columbia Analytical Services, Inc, a California DHS-certified laboratory located in Canoga Park, California. Dioxin analyses were performed by Alta Analytical, a California DHS-certified laboratory located in El Dorado Hills, California.

- **Additional Sampling for the RFI Standardized Risk Assessment Methodology Work Plan** – DTSC-requested, additional background soil samples collected by Ogden in 2000 under the RFI Work Plan Addendum (Ogden 1996) and RFI Work Plan Addendum Amendment (Ogden 2000b). Metals and general mineral analyses were performed by Calscience Environmental Laboratories, Inc., a California DHS-certified laboratory located in Garden Grove, California. Dioxin analyses were performed by Alta Analytical.

- **April 2005 Metals Supplemental Sampling** - additional samples collected by MWH in 2005 at DTSC-approved locations to supplement the soil metals background data set. All samples were analyzed by Del Mar Analytical, a California DHS-certified laboratory located in Irvine, California.

Field quality control (QC) samples provide a means of evaluating the quality of field sampling procedures, the effectiveness of equipment decontamination procedures, and the potential for introduction of contaminants unrelated to the project. Field QC samples collected during the six background soil sampling events included equipment rinsate samples, field blank samples, and field duplicate samples.

As determination of the background soil data set was not a complete field project, a precision, accuracy, representativeness, completeness, and comparability (PARCC) parameter assessment was not performed.

Data validation results in the following qualifications of analytical results: "U" (non detect), "J" (estimated), "UJ" (estimated non detect), "N" (tentative identification), "NJ" (estimated and tentatively identified), and "R" (rejected). Data with "U," "J," "UJ," "NJ," or "N" qualifiers and data without qualifiers are usable; data with "R" qualifiers are unusable. Level IV validation includes review of the following items (when applicable): sample management (collection techniques, sample containers, preservation, handling, transport, chain-of-custody, holding times), gas chromatography/mass spectrometry (GC/MS) instrument performance, initial and continuing calibration, method blank results, calibration blank results, laboratory duplicate precision, matrix spike accuracy, matrix spike/matrix spike duplicate precision and accuracy, surrogate results, serial dilution precision, laboratory and field QC sample results, internal standard performance, target compound identification, compound quantification and reported detection limits, tentatively identified compounds (TICs), and a definitive review of the raw data. Level V validation includes review of sample management, blanks, matrix spike samples, surrogates, and laboratory and field QC samples.

Overall, data reviewed for the background soil data set met project quality objectives and were determined usable for decision making as no data were rejected, except for a few metals data collected by McLaren/Hart in 1992. Six antimony, six mercury, and nine selenium results were rejected due to matrix spike recovery outliers. These samples were recollected during the April 2005 sampling event and these results were usable. Some results were qualified as estimated concentrations. These data are usable; therefore all sample data included in the final background data set were deemed usable for risk analysis.

The following sections contain brief summaries of the data validation results for the six background soil sampling events. A more detailed summary of the validation findings is presented in the individual data validation reports attached.

B.2 MULTI-MEDIA SAMPLING AT THE BRANDEIS-BARDIN INSTITUTE AND THE SANTA MONICA MOUNTAINS CONSERVANCY (1992-1994)

All data were validated at a Level V.

B.2.1 METALS

All metals results are considered useable as no data were rejected, except for six antimony, six mercury, and nine selenium results rejected due to matrix spike recovery outliers. Samples were recollected at the locations corresponding to the rejected data. These results are discussed in Section 7.0.

Nine soil samples were analyzed for antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc by EPA SW-846 Methods 6010 and 7471. Some thallium and all arsenic data were qualified as estimated detects and non detects for matrix spike recovery outliers. There were no method blank qualifications.

No field blank or equipment rinsate samples were collected in association with this sampling event; therefore, no assessment could be made with respect to possible contamination due to field decontamination procedures.

B.3 FSDF CLOSURE FIELD INVESTIGATION (1995)

All data were validated at a Level V.

B.3.1 DIOXINS

All dioxin results are considered useable as no data were rejected. Seven soil samples were analyzed for 21 individual dioxin congeners by EPA SW-846 Method 8290. No field duplicate samples were collected during this sampling event.

In one case a sample had multiple analytical results for an individual congener. Based on professional evaluation of the data quality, the data validator accepted the most technically sound result.

A few compounds were qualified as estimated due to surrogate recovery outliers. Several compounds were qualified as non detects due to interference from a coextracted ether compound in the sample matrix. Several compounds were qualified as estimated non detects due to outliers for an identification criterion, the ion abundance ratio. A few results were qualified as estimated detects due to interference from a calibration-related compound. For the most part, these qualifications were related to interference inherent in the method or caused by the soil matrix and were not indicative of laboratory quality control issues. Several dioxin totals and one individual congener were qualified as non detected due to detects in the associated method blank.

No field blank samples were collected in association with this sampling event; therefore, no assessment could be made with respect to possible contamination due to field decontamination procedures.

B.3.2 METALS

All metals results are considered usable as no data were rejected. Seven soil samples were analyzed for antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, silver, thallium, vanadium, and zinc by EPA SW-846 Methods 6010 and 7471. No qualifications were applied to the data.

No field blank or equipment rinsate samples were collected in association with this sampling event; therefore, no assessment could be made with respect to possible contamination due to field decontamination procedures.

B.4 METALS SAMPLING FOR THE RFI WORK PLAN ADDENDUM (1996)

All data were validated at a Level V.

B.4.1 METALS

All metals results are considered usable as no data were rejected. Fifteen soil samples were analyzed for analyzed for aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, silver, thallium, vanadium, and zinc by EPA SW-846 Methods 6010 and 7471. Two field duplicate pairs were collected and the results were in good agreement.

All antimony and some cadmium and selenium data were qualified as estimated detects and non detects due to matrix spike recovery outliers. For the most part, these qualifications were related to interference caused by the soil matrix and were not indicative of laboratory quality control issues. Some thallium data were qualified as estimated non detects due to laboratory control sample recovery outliers. A few molybdenum detects were qualified as estimated non detects due to molybdenum detected in the associated laboratory method blanks.

No field blank or equipment rinsate samples were collected in association with this sampling event; therefore, no assessment could be made with respect to possible contamination due to field decontamination procedures.

B.5 BELL CANYON AREA SAMPLING (1998)

All data were validated at a Level V.

B.5.1 DIOXINS

All dioxin results are considered useable as no data were rejected. Seven soil samples were analyzed for 21 individual dioxin congeners by EPA SW-846 Method 1613B. One field duplicate pair was collected during this sampling event and the results were in good agreement.

Two compounds not reported by the laboratory were determined to be present, and were reported as such by the data validator. The compounds were originally reported as detected in the initial analysis by EPA SW-846 Method 1613A.

One equipment rinsate sample and one field blank sample were collected in association with this sampling event. One sample result for OCDD was qualified as an estimated detect for OCDD detected in the field blank.

B.5.2 METALS

All metals results are considered usable as no data were rejected. Seven soil samples were analyzed for analyzed for aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, silver, thallium, vanadium, and zinc by EPA SW-846 Methods 6010 and 7471. One field duplicate pair was collected and the results were in good agreement.

All antimony results were qualified as estimated non detects due to matrix spike recovery outliers. All zinc and some aluminum and barium results were qualified as estimated detects and non detects due to serial dilution percent difference (%D) outliers. For the

most part, these qualifications were related to interference caused by the soil matrix and were not indicative of laboratory quality control issues.

Two equipment rinsate and two field blank samples were collected in association with this sampling event. No data were qualified due to these results.

B.5.3 GENERAL MINERALS

All general minerals results are considered usable as no data were rejected. Seven samples were analyzed for pH by EPA SW-846 Method 9045 and for fluoride by EPA Method 340.2. One field duplicate pair was collected during this sampling event and the results were in good agreement.

Most pH results were qualified as estimated due to analysis exceeding holding times. The holding time for pH is "immediate." Therefore, exceeded holding times are not uncommon and are not indicative of poor laboratory or field QA/QC procedures.

Two equipment rinsate and two field blank samples were collected in association with this sampling event. No data were qualified due to these results.

B.6 ADDITIONAL SAMPLING FOR THE RFI STANDARDIZED RISK ASSESSMENT METHODOLOGY WORK PLAN (2000)

All dioxins and metals data were validated at a Level V.

B.6.1 DIOXINS

All dioxin results are considered useable as no data were rejected. Three soil samples were analyzed for 21 individual dioxin congeners by EPA SW-846 Method 8290. No field duplicate samples were collected during this sampling event.

A few detected compounds were qualified as estimated non detects due to detects in the associated method blank. A few results were qualified as estimated because the laboratory did not use "J" qualifiers for results reported below the method calibration limit. These required data validation qualifiers, but these qualifications are not indicative of data quality problems.

No field blank or equipment rinsate samples were collected in association with this sampling event; therefore, no assessment could be made with respect to possible contamination due to field decontamination procedures.

B.6.2 METALS

All metals results are considered usable as no data were rejected. Three soil samples were analyzed for analyzed for aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, lead, mercury, molybdenum, nickel, selenium, silver, thallium, vanadium, and zinc by EPA SW-846 Methods 6010B and 7471A. No data were qualified.

One equipment rinsate was collected in association with this sampling event. No data were qualified due to these results.

B.7 SUPPLEMENTAL METALS SAMPLING (APRIL 2005)

All metals data and a representative portion (10%) of the general minerals (fluoride and pH) data were validated at a Level IV. The remaining general minerals data were validated at a Level V.

B.7.1 METALS

All metals results are considered usable as no data were rejected. Forty soil samples were analyzed for analyzed for aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, iron, lead, lithium, manganese, mercury, molybdenum, nickel, potassium, selenium, silver, sodium, thallium, vanadium, zinc, and zirconium by EPA SW-846 Methods 6020, 6010B, and 7471A. Three field duplicate pairs were collected and the results were in good agreement.

In one case, a sample had multiple analytical results for mercury. Based on professional evaluation of the data quality, the data validator accepted the most technically sound result.

Most lithium results were qualified as estimated due to lithium detected in the inductively coupled plasma (ICP) check solution A (ICSA). Some antimony results were qualified as estimated non detects due to matrix spike recovery outliers. For the most part, these qualifications were related to interference caused by the soil matrix and were not indicative of laboratory quality control issues.

Most zirconium results were qualified as estimated due to laboratory control sample recovery outliers and some thallium results were qualified as estimated detects and non detects due to reporting limit check standard recovery outliers. Most antimony results were qualified as estimated detects and non detects due to reporting limit check standard recovery outliers. These antimony qualifications, coupled with antimony detects in most

continuing calibration blanks (CCBs), potentially indicated poor instrument sensitivity near the instrument detection limit. All antimony results were reviewed by data validators and, when necessary, the antimony method detection limits (MDLs) were raised to the value of the interference in the CCBs. The MDL for one potassium result was also raised due to consistently negative potassium results in the CCBs.

Some antimony, boron, molybdenum, selenium, sodium, and thallium results were qualified as estimated detects and non detects due to detects and negative results in the associated laboratory method blanks and CCBs. No qualifications appeared related to severe laboratory contamination.

One field blank and two equipment rinsate samples were collected in association with this sampling event. Sodium and thallium were detected in one of the equipment rinsate samples, resulting in the estimation of most sodium and some thallium detects.

B.7.2 GENERAL MINERALS

All general minerals results are considered usable as no data were rejected. Forty samples were analyzed for pH by EPA SW-846 Method 9045C and for fluoride by EPA Method 300.0. Two field duplicate pairs were collected during this sampling event and the results were in good agreement.

Most pH results were qualified as estimated due to exceeded holding time; however, as noted in Section 4.2, the pH holding time is "immediate" and exceeded holding times are not indicative of poor laboratory or field QA/QC procedures. Fluoride was detected below the reporting limit in several laboratory method blanks and CCBs, as well as in most site samples. The blank detects resulted in the qualification of most fluoride detects as estimated non detects, at the level of contamination in the samples. As fluoride was detected below the reporting limit in these samples, the final fluoride results are all estimated values below the reporting limit.

One field blank and two equipment rinsate samples were collected in association with this sampling event. No qualifications were required due to these results.

B.8 HAZARDOUS MATERIALS LABORATORY DATA VALIDATION AND DATA REVIEW

As described in the RFI Program Report (MWH 2004), the DTSC Hazardous Materials Laboratory (HML) was requested to conduct reviews of 5% of the RFI data and of some data collected for specific tasks. As task-specific requests, HML reviewed and/or validated the metals and dioxin background soil data for Bell Canyon, metals and dioxin background soil data for the RFI Standardized Risk Assessment Methodology Work Plan (2000), and the metals data for the samples from one April 2005 data package.

For Bell Canyon and RFI Standardized Risk Assessment Methodology Work Plan, the AMEC data validation program included a full EPA Level IV validation of the first laboratory package submitted from each analytical laboratory for each method, as specified in the DTSC-approved RFI work plans and quality assurance project plans. Level V validation is performed on the remainder of the data. In some instances, insufficient raw data was available for a full validation by HML or AMEC. However, the HML findings were consistent with the data validation findings of AMEC in Level IV data validation packages. The HML validation did not identify causes for rejection of the data not previously identified by AMEC. The data are considered acceptable by HML and the data validation findings are consistent with the findings reported by the AMEC data validators. Additionally, HML performed a cursory review of metals and mercury data from one April 2005 soil background data deliverable group and generally concurred with the qualification of the data.

Attachment B-1 provides individual validation reports prepared by AMEC, chain-of-custody information, and laboratory information. For each data set, AMEC provided HML with the most complete hard copy laboratory data available. Attachment B-1 presents the data validation reports and associated laboratory QC information for the comprehensive data set that defines ambient background concentrations of metals, polychlorinated dioxin and furan compounds, fluoride, and pH in soil at the Santa Susana

Field Laboratory (SSFL) in Ventura County, California. Data validation was performed by AMEC Earth and Environmental (AMEC) following standard United States Environmental Protection Agency (USEPA) procedures. The data validation findings are described above.

Attachment B-2 presents the published DTSC/HML memorandum regarding the April 2005 metals background soils data. Other HML memoranda may be found in the RFI Program Report (MWH 2004).

B.9 REFERENCES

ICF Kaiser Engineers (ICF) 1993a. Current Conditions Report and Draft RCRA Facility Investigation Work Plan, Areas I and III, Santa Susana Field Laboratory, Ventura County, California. October.

ICF 1993b. Current Conditions Report and Draft RCRA Facility Investigation Work Plan, Area II and Area I LOX Plant, Santa Susana Field Laboratory, Ventura County, California. October.

ICF 1993c. Current Conditions Report and Draft RCRA Facility Investigation Work Plan, Area IV, Santa Susana Field Laboratory, Ventura County, California. October.

McLaren/Hart Environmental Engineering Corporation (McLaren/Hart) 1992. Workplan for Multi-Media Sampling at the Brandeis-Bardin Institute and the Santa Monica Mountains Conservancy. February.

McLaren/Hart 1993a. Multi-Media Sampling Report for the Brandeis-Bardin Institute and the Santa Monica Mountains Conservancy. March.

McLaren/Hart 1993b. Workplan for Additional Soil and Water Sampling at the Brandeis-Bardin Institute and the Santa Monica Mountains Conservancy. October.

McLaren/Hart 1995. Additional Soil and Water Sampling at the Brandeis-Bardin Institute and the Santa Monica Mountains Conservancy. January.

MWH 2004. RCRA Facility Investigation Program Report Surficial Media Operable Unit. July.

Ogden Environmental and Energy Services Co., Inc. (Ogden) 1996. RCRA Facility Investigation Work Plan Addendum, Santa Susana Field Laboratory, Ventura County, California. September.

Ogden 1998. Bell Canyon Residence Soil Sampling Work Plan, Santa Susana Field Laboratory, Ventura County, California. June.

Ogden 2000a. Standardized Risk Assessment Methodology Work Plan, Surficial Operable Unit, Santa Susana Field Laboratory, Ventura County, California. June.

Ogden 2000b. RCRA Facility Investigation Work Plan Addendum Amendments, Santa Susana Field Laboratory, Ventura County, California. June.

U.S. Environmental Protection Agency (USEPA) 1994a. USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. February.

USEPA 1994b. USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review. February.

ATTACHMENT B-1

SOIL BACKGROUND LABORATORY INFORMATION AND VALIDATION REPORTS

(ELECTRONIC COPY)

Electronic copy not included due to file sice

ATTACHMENT B-1
Electronic Copy of Soil Background Laboratory Information and Validation Reports Readme File

This Readme file contains information and instructions regarding use of Appendix B of the *Soil Background Report, Santa Susana Field Laboratory, Ventura County California* (MWH September 2005) and is also provided electronically on the CD provided in this appendix.

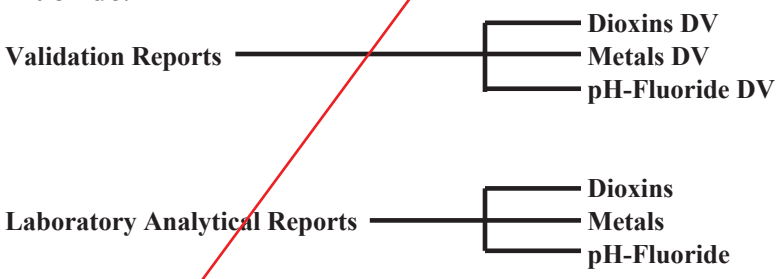
This appendix provides a read-only compact disc (CD-ROM) that contains electronic copies of validation reports, chain-of-custody (COC) forms, chain-of-custody analytical request change forms (Change Forms) and laboratory analytical reports which include case narratives, analytical results and laboratory quality control (QC) data (method blanks, matrix spike/matrix spike duplicates [MS/MSD] and laboratory control samples [LCS]). Data is presented in support of the soil matrix background data set contained in Table 4-1 of the Soil Background Report.

Electronic files are scanned images of hard copy documents presented in Portable Document Format (PDF) files, which can be viewed using Adobe Acrobat software.

Hard copy printouts of all documents on this CD will be included in copies of the *Soil Background Report* sent to Repositories, all other copies will include electronic files only.

Also included in this Appendix are two analytical results tables**, Table B-1-1 SSFL Soil Background Metals and Inorganics Data Set** and **Table B-1-2 SSFL Soil Background Dioxins Data Set**. These tables can be used as reference tables for locating associated laboratory and validation documentation as described below in Section 3C.

Files are organized into two main folders: **Validation Reports** and **Laboratory Analytical Reports**.
Each of these folders is subdivided into three analytical types, **Dioxins**, **Metals** and **pH-Fluoride**.



1. Validation Reports:

Validation reports include laboratory results and a data assessment form completed by AMEC Earth and Environmental, Inc. (AMEC) data validators. The validation report summaries identify the laboratory method and target compounds for each sample, in addition, the report indicates whether each compound was detected, the concentration (or detection limit if not detected), and applicable laboratory and data validation qualifiers. With the exception of field QC samples

(field blanks, equipment rinsates), all analytical data generated from background field samples were validated by AMEC. Data validation report PDFs are organized by chemical group (analytical method), with each folder containing validation reports specific to respective analytical method as shown above.

These files are organized by validation report number, which are listed in Tables B-1-1 and B-1-2 (Section 3).

2. Laboratory Analytical Reports:

Analytical data reports include analytical results for every soil background sample, and associated laboratory QC, COCs, laboratory report case narratives, and Change Forms (where applicable).
Analytical data reports are generated by the laboratory in Sample Delivery Groups (SDGs) of up to 20 samples (assigned upon receipt at the laboratory).

The case narrative is text typically found at the beginning of the laboratory report. Laboratories use the case narrative to describe any deviations from standard handling or analytical procedures for a sample or SDG.

Results and summaries of QC procedures implemented by the laboratory demonstrate that the laboratory is "in control" during sample analysis. Examples of such QC procedures include laboratory control samples, method blanks, matrix duplicates, matrix spike and matrix spike duplicates, and LCS samples. Analytical results are considered "in control" if QC procedure results meet prescribed precision, recovery, and accuracy criteria

Change Forms are generated for samples subsequent to shipment to the laboratory. Generally, change forms were generated when a changes/corrections to a COC were needed (e.g., when additional analyses were requested for a sample).

These files are organized by SDG number and are referenced in Tables B-1-1 and B-1-2 (Section 3).

3. Tables B-1-1 and B-1-2

Tables B-1-1 and B-1-2 are analytical summary analytical result tables for the soil background data set listed in Table 4-1 of the Soil Background Report. Both tables are structured identically and are sorted by analyte, then by Sample ID.
Results included in the soil background data set are flagged with an “X” in the last column of the table titled “Background Data Set”.
These tables can be used as correlation look-up tables provided to make documents in this appendix easier to access.

A. Table B-1-1 SSFL Soil Background Metals and Inorganics Data Set

Table B-1-1 summarizes metals, pH and fluoride analytical results for the metals data set described in Table 4-1 of the Soil Background Report. These tables can be used as a reference for association of analytical results with their respective sampling, analytical, and validation documentation (laboratory and data validation reports) as described below in section 3C

B. Table B-1-2 SSFL Soil Background Dioxins Data Set

Table B-1-2 summarizes dioxin analytical results for the metals data set described in Table 4-2 of the Soil Background Report.

C. Instructions for use as look-up tables

These tables are configured to facilitate the search for a document in any of the folders described above. The table is arranged by sample identification. To locate documents for samples associated with a particular result:

1. Locate the sample of interest in the 'Sample Identification' column.
2. Scroll right to the Sample Delivery Group and Data Validation Number columns.
3. Note the appropriate SDG and Data Validation Number.
4. Locate the document of interest under the appropriate folder as described above. Laboratory Analytical Reports are organized by SDG Number and Validation Reports are organized by Data Validation Number.

ATTACHMENT B-2

HML SOIL BACKGROUND MEMORANDUM

Department of Toxic Substances Control

C. Lloyd, Ph.D.
ency Secretary
Cal/EPA

Hazardous Materials Laboratory
700 Heinz Avenue, Suite 100
Berkeley, California 94710

Arnold Schwarzenegger
Governor

MEMORANDUM

TO: Gerard Abrams
Department of Toxic Substances Control
Geology, Permitting and Corrective Action Branch
5796 Corporate Ave
Cypress, CA 90630

FROM Fred Seto, Ph.D. FS
Hazardous Materials Laboratory
Department of Toxic Substances Control
700 Heinz Avenue, Suite 100
Berkeley, CA 94710

DATE September 15, 2005

SUBJECT: Review of Data Packages and Data Validation Reports
Metals by EPA Methods 6010B, 6020 (Sb, Se, Tl) and 7471A (Hg)
Boeing Rocketdyne, Santa Susana Field Laboratory RFI Background Soils

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We have received data packages, chain-of-custody reports and data validation reports by AMEC for the background soil samples. The samples are described below.

SDG.	Analysis	No. of Samples	Date Collected
IOD0902	Metals, Fluoride, pH	10	April 12, 2005
IOD1092	Metals, Fluoride, pH	9	April 13, 2005
IOD1093	Metals, Fluoride, pH	4	April 13, 2005
IOD1094	Metals, Fluoride, pH	6	April 14, 2005
IOD1095	Metals, Fluoride, pH	2	April 13, 2005
IOD1178	Metals, Fluoride, pH	4	April 15, 2005
IOD1505	Metals, Fluoride, pH	6	April18/19, 2005
ROCK01	Metals	3	May 22, 1996
ROCK02	Metals	5	May 22/23, 1996
ROCK05	Metals	7	May 24, 1996
4275	Metals	7	May 25, 1995
29403	Metals	9	March 10, 1992
16187	Metals	2	March 22, 2000

We selected a data package designated as SDG IOD1094 to review at this time. We can review more data packages if necessary. We reviewed the quality assurance/quality control (QA/QC) results and other materials such as the chain-of-custody reports and data validation reports associated with SDG IOD1094 for metals. The data package contains 6 soil samples collected on April 14, 2005. Del Mar Analytical analyzed the soil samples for metals by methods 6010B, 6020 (Sb, Se, Tl) and 7471A (Hg). AMEC performed the data validation. The samples are as follows:

SDG	Sample ID	MWH Sample ID	Del Mar Analytical Sample ID
IOD1094	BG039*	BG01005	IOD1094-01
	BG029	BG01008	IOD1094-02
	BG031	BG01100	IOD1094-03
	BG033	BG02007	IOD1094-04
	BG035	BG02074	IOD1094-05
	BG037	BG02076	IOD1094-06
	BG033REI	BG02007	IOD1094-04 REI (Hg reanalysis)

*Note: BG027 was changed to BG039 in the chain of custody report.

We have the following comments:

Sample Traceability

The samples are appropriately identified in the chain-of-custody reports to the final analytical reports. As described above, for SDG IOD1094, each sample was linked from sample collection through sample analysis by using Sample ID, MWH Sample ID and Del Mar Analytical Sample ID. It was noted in the chain-of-custody reports that sample BG027 was changed to BG039. The data package contained a table cross referencing the samples with the various ID numbers.

Data Validation Report

The data validation report was prepared by AMEC on May 12, 2005. As data validation guidelines, AMEC included the document, USEPA CLP National Functional Guidelines for Inorganic Data Review (2/94). We wish to point out that a newer version known as USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, Final, October 2004 is available.

In the validation report, for antimony (Sb) by method 6020, the MDLs were raised five fold due to contamination found in the continuing calibration blanks.

Antimony results were reported by Del Mar which analyzed the samples as follows:

	MDL mg/kg	Reporting Limit mg/Kg	Sb Result mg/Kg
IOD1094-01	0.094	1.0	ND
IOD1094-02	0.095	1.1	ND
IOD1094-03	0.098	1.1	ND
IOD1094-04	0.10	1.2	ND
IOD1094-05	0.10	1.2	0.18
IOD1094-06	0.11	1.2	ND

Antimony results were reported as follows after MDLs were raised five fold:

	MDL mg/kg (Raised 5X)	Reporting Limit mg/kg	Sb Result mg/kg
IOD1094-01	0.47	1.1	ND (UJ)
IOD1094-02	0.48	1.1	ND (UJ)
IOD1094-03	0.49	1.1	ND (UJ)
IOD1094-04	0.5	1.2	ND (UJ)
IOD1094-05	0.5	1.2	0.5 (UJ)
IOD1094-06	0.55	1.2	ND (UJ)

The raw data for the continuing calibration blanks indicated antimony contamination ranging from 0.32 ug/L to 0.88 ug/L. To account for the contamination, the MDL was raised five fold to 0.5 mg/kg after considering the sample analysis "dilution factor." With a MDL of 0.5 mg/kg, the 0.18 mg/kg for sample IOD1094-05 was qualified as not detected above an estimate quantity of 0.5 mg/kg. We believe that the qualification is reasonable. If the reporting limits are considered as "action levels', then, the sample antimony results are below the action levels.

Data Quality

We have evaluated the holding times, initial calibration (IC), initial calibration verification (ICV), continuing calibration verification (CCV), method blank, laboratory control sample

(LCS), matrix spike /matrix spike duplicate (MS/MSD) and quantitation. The results are summarized in Table 1.

As shown in Table 1, the holding times were met. The tuning, IC, ICV, CCV, ICS results were within the control limits. Method blanks were non-detect except for boron and thallium. LCS results were within the control limits, except for zirconium. MS/MSD results were within the control limits except for aluminum, iron, manganese and antimony. Some quantitations for methods 6010A, 6020 and 7471A were verified to be correct.

Thus, sample results associated with satisfactory QA/QC results should be acceptable. Sample results associated with unsatisfactory QA/QC results should be qualified as estimates.

If you have any questions, please contact me or Lorna Garcia at (510) 540-3003.

CC: Bruce La Belle, Ph.D.
Cindy Dingman
Lorna Garcia
James Cheng
Laura Rainey

TABLE1: SDG IOD1094 Data Review Summary: EPA Methods 6010A, 6020 and 7471A

	ACCEPTABILITY		
	Method 6010A	Method 6020 Se, Sb and Tl only	Method 7471A Hg
1. Holding Times	Yes	Yes	Yes
2. Tuning	Not applicable	Yes	Not applicable
3. Initial Calibration	Yes	Yes	Yes
4. Initial Calibration Verification	Yes	Yes	Yes
5. Continuing Calibration Verification	Yes	Yes	Yes
6. Interference Check Standard	Yes	Yes	Not applicable
7. Method Blank	Yes, Except B = 1.82 mg/kg	Yes, Except Tl = 0.147 mg/kg	Yes
8. Laboratory Control Sample 80% - 120% Recovery	Yes, Except Zr = 135%	Yes	Yes
9. Matrix Spike/Matrix Spike Duplicate 75% -125% Recovery	Yes, Except Al = 5530 %, 5530% Fe = -382%, 382% Mn = 52%, 67%	Yes, Except Sb = 33%, 34%	Yes

SOIL BACKGROUND REPORT
SANTA SUSANA FIELD LABORATORY
VENTURA COUNTY, CALIFORNIA
APPENDIX C – PLOTS
README FILE

Contents

I. Rank Order Plots
II. Probability Plots

Descriptions

I Rank Order Plots

Rank order plots are provided for each metal and fluoride. Where constituents were not detected, non detects (NDs) are designated with different symbols. All results are shown as reported by the analytical laboratory (i.e. NDs are shown at sample detection limit).

II Probability Plots

Data are presented in probability plots for the following datasets:

A. Metals and fluoride

Metals and fluoride data represented in probability plots are derived from the Background Soil Metals Data Set (Table 4-1). Relevant statistics are also included with metals and fluoride plots. These statistics are generated with Minitab (Version 14) statistical software. Statistics discussed in Section 4 were generated using ProUCL (USEPA 2004).

B. Dioxins

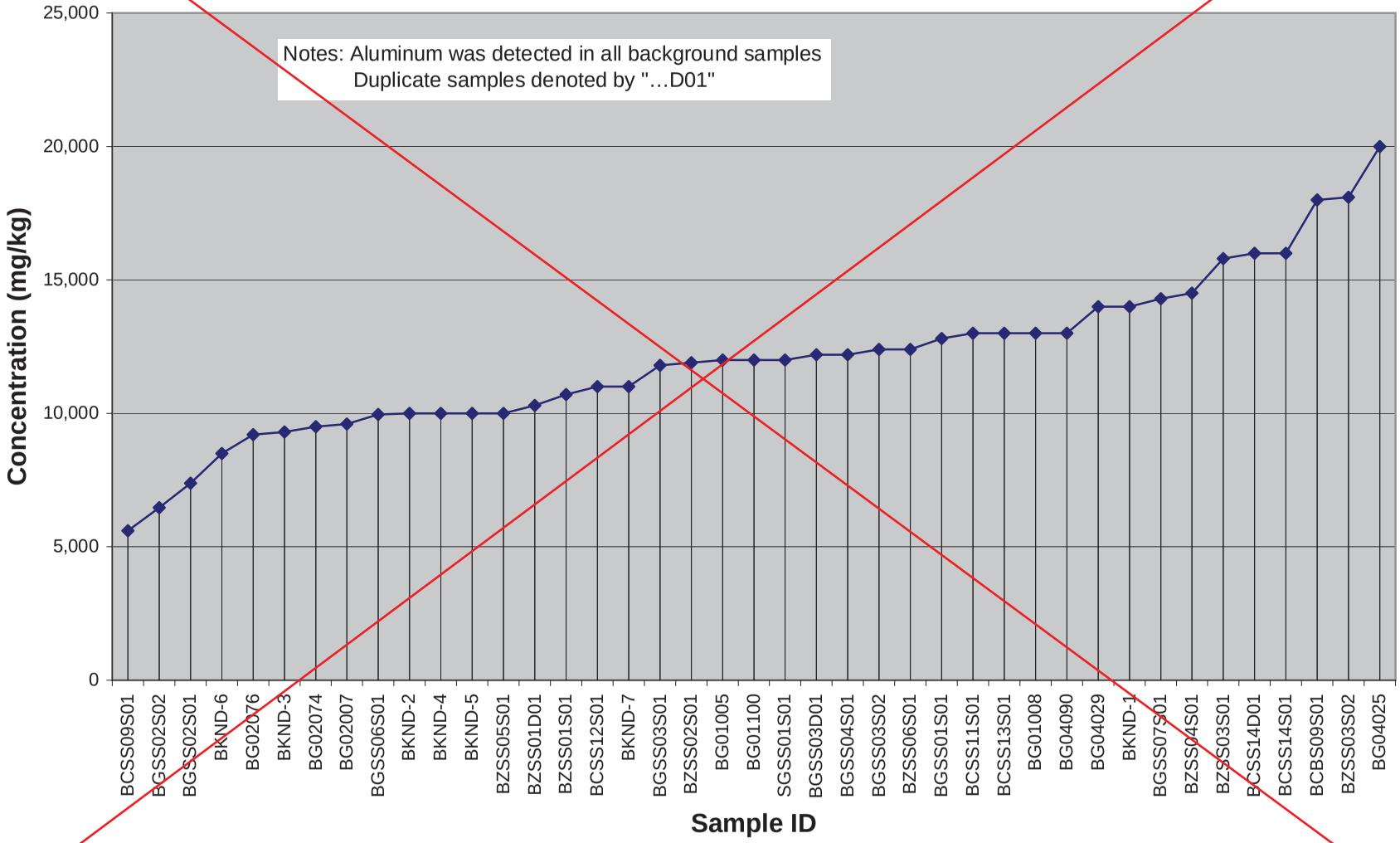
Dioxins data represented in probability plots are derived from the Background Dioxins Data Set (Table 4-2). Relevant statistics are also included with dioxin plots. These statistics are generated with Minitab (Version 14) statistical software. Statistics discussed in Section 4 were generated using ProUCL (USEPA 2004).

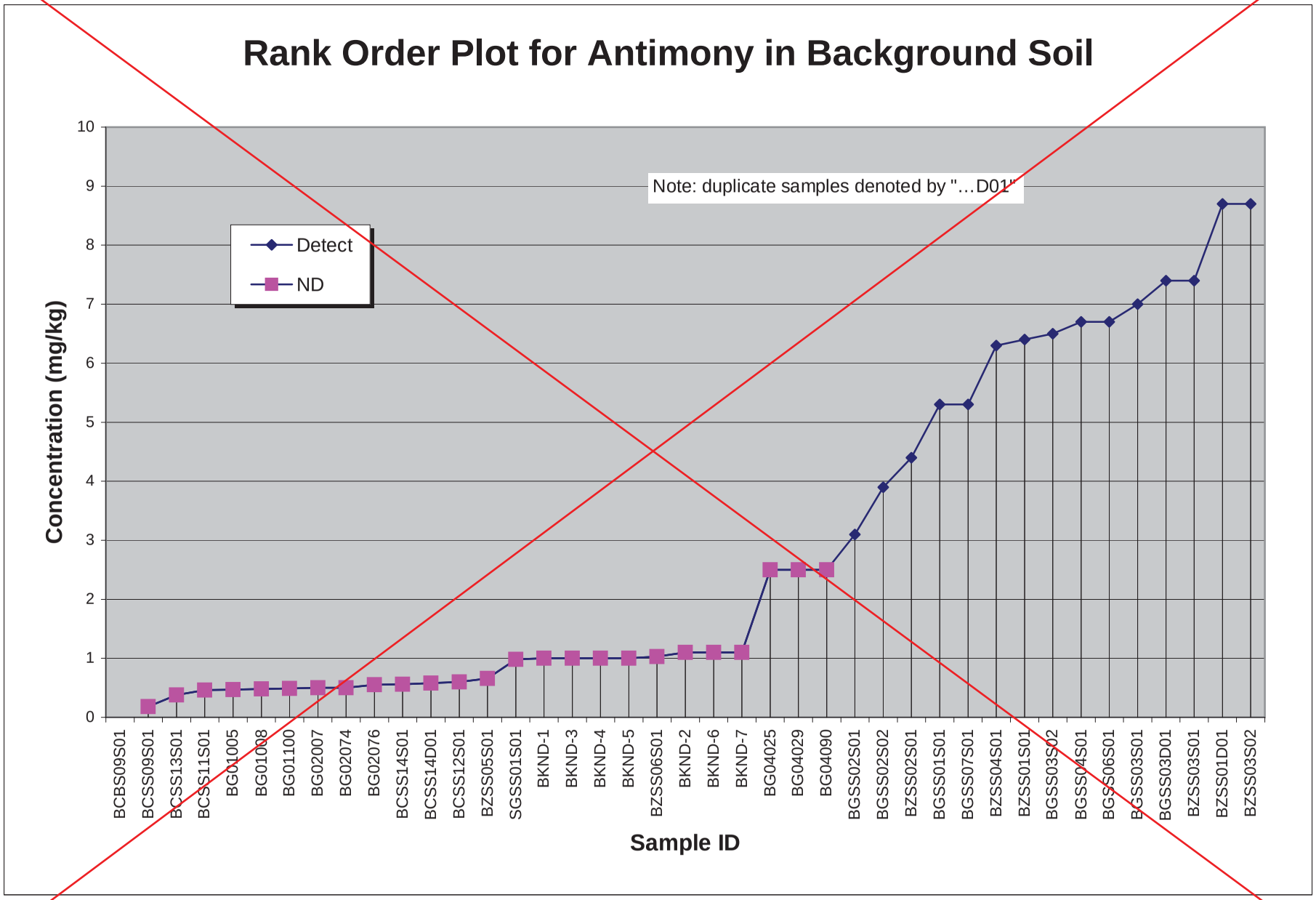
Metals and dioxins data is plotted with the following conditions applied:

- Duplicate analytical data are averaged when the two candidate values are not markedly different. In cases where duplicate data included one detect and one non-detect, the average is conservatively calculated using the value of detect and half the Detection Limit (DL) of the non-detect. In each case, primary and duplicate data are plotted as a single data point.

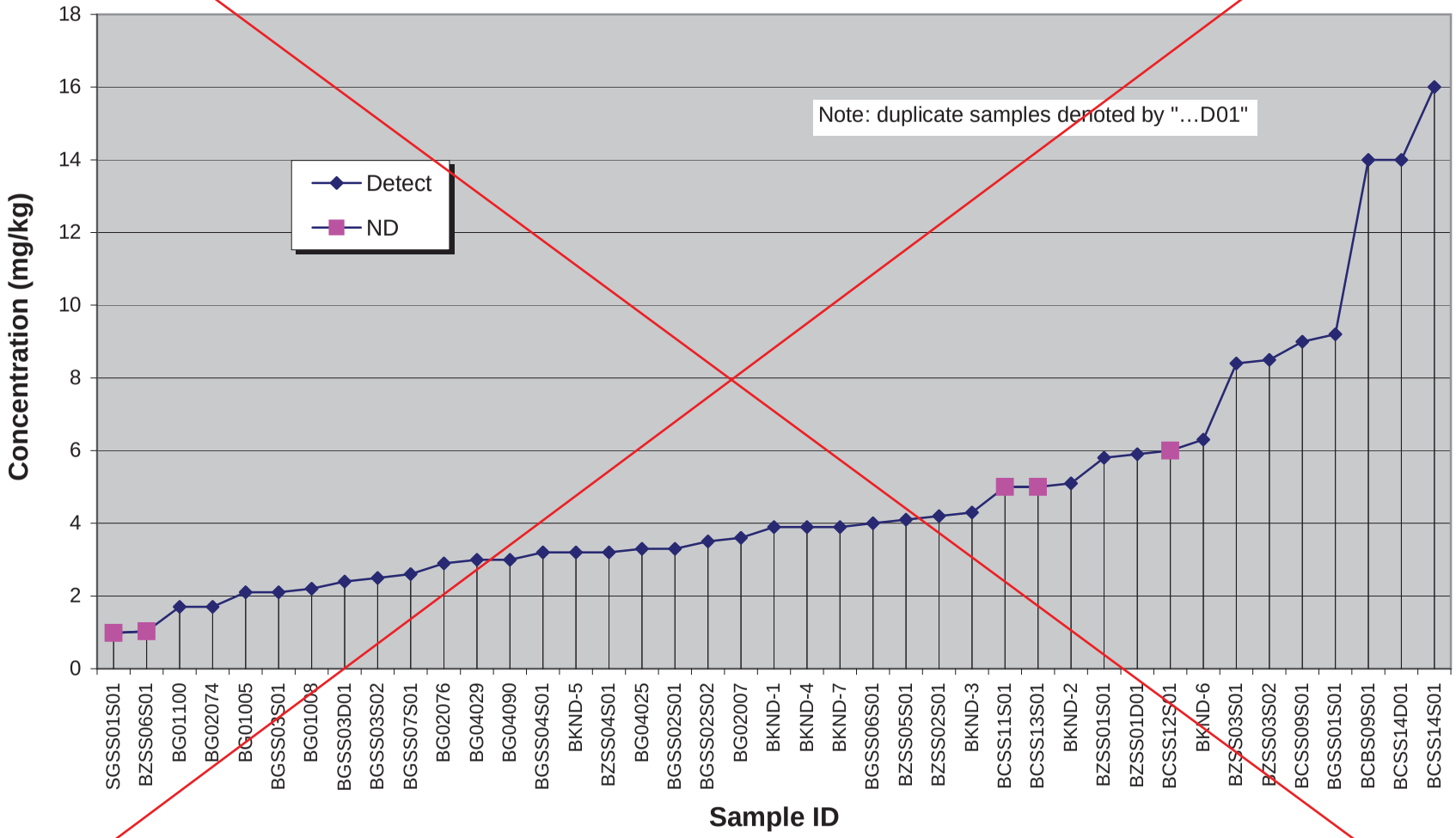
- Due to data validation, some DLs vary from the original laboratory report and the revised estimated non detect values (UJ-flag) are used for data plotting.
- For each metal (and fluoride), each dioxin congener, and total dioxins congener group plots are generated for three cases: (I) NDs deleted, (II) NDs set equal to the minimum detected concentration, and (III) NDs set equal to one half the DL.

Rank Order Plot for Aluminum in Background Soil

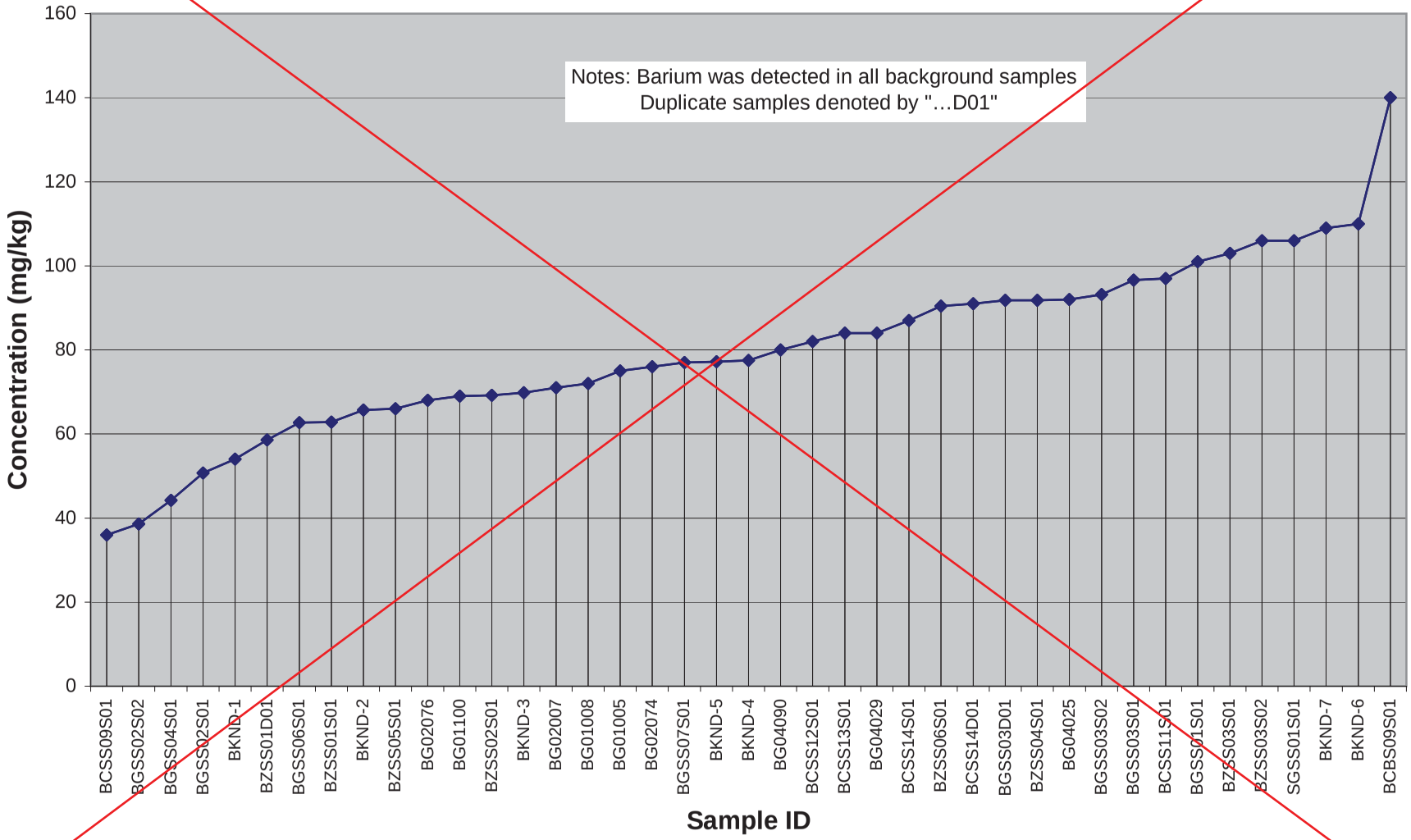


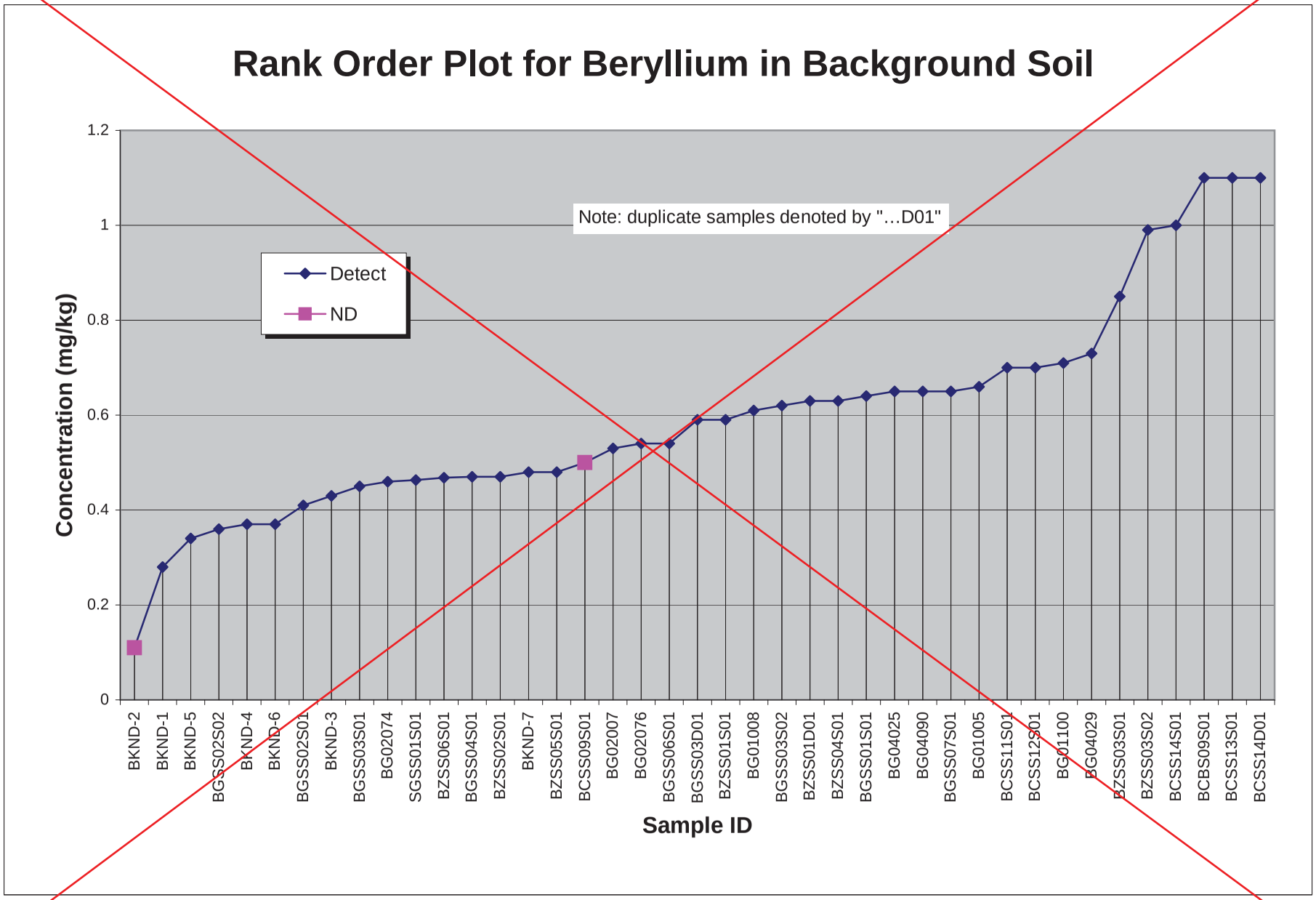

Rank Order Plot for Antimony in Background Soil
Note: duplicate samples denoted by "…D01"
Detect
ND
Concentration (mg/kg)
0
1
2
3
4
5
6
7
8
9
10
BCBS09S01
BCSS09S01
BCSS13S01
BCSS11S01
BG01005
BG01008
BG01100
BG02007
BG02074
BG02076
BCSS14S01
BCSS14D01
BCSS12S01
BZSS05S01
SGSS01S01
BKND-1
BKND-3
BKND-4
BKND-5
BZSS06S01
BKND-2
BKND-6
BKND-7
BG04025
BG04029
BG04090
BGSS02S01
BGSS02S02
BZSS02S01
BGSS01S01
BGSS07S01
BZSS04S01
BZSS01S01
BGSS03S02
BGSS04S01
BGSS06S01
BGSS03S01
BGSS03D01
BZSS03S01
BZSS01D01
BZSS03S02
Sample ID

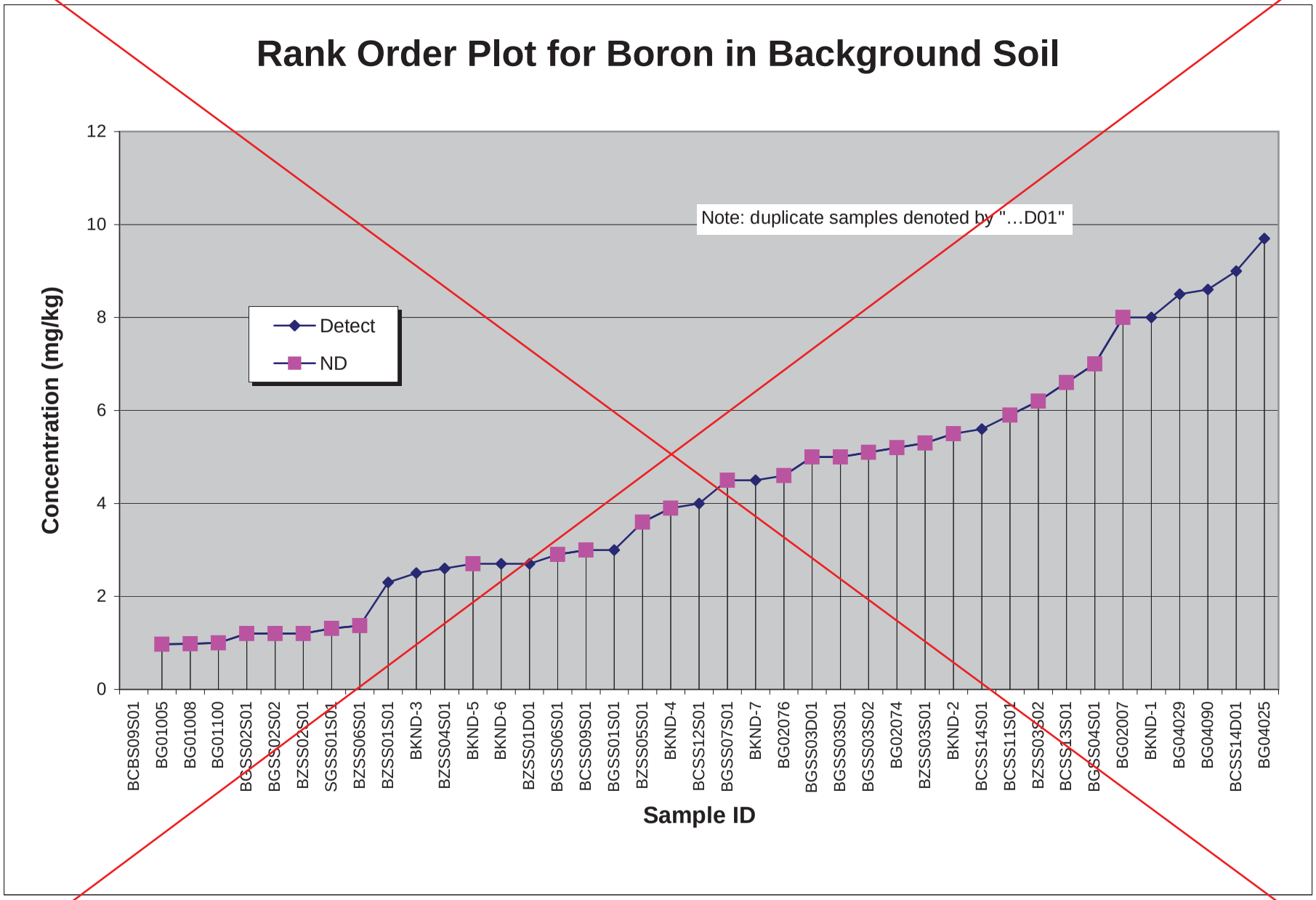
Rank Order Plot for Arsenic in Soil Background



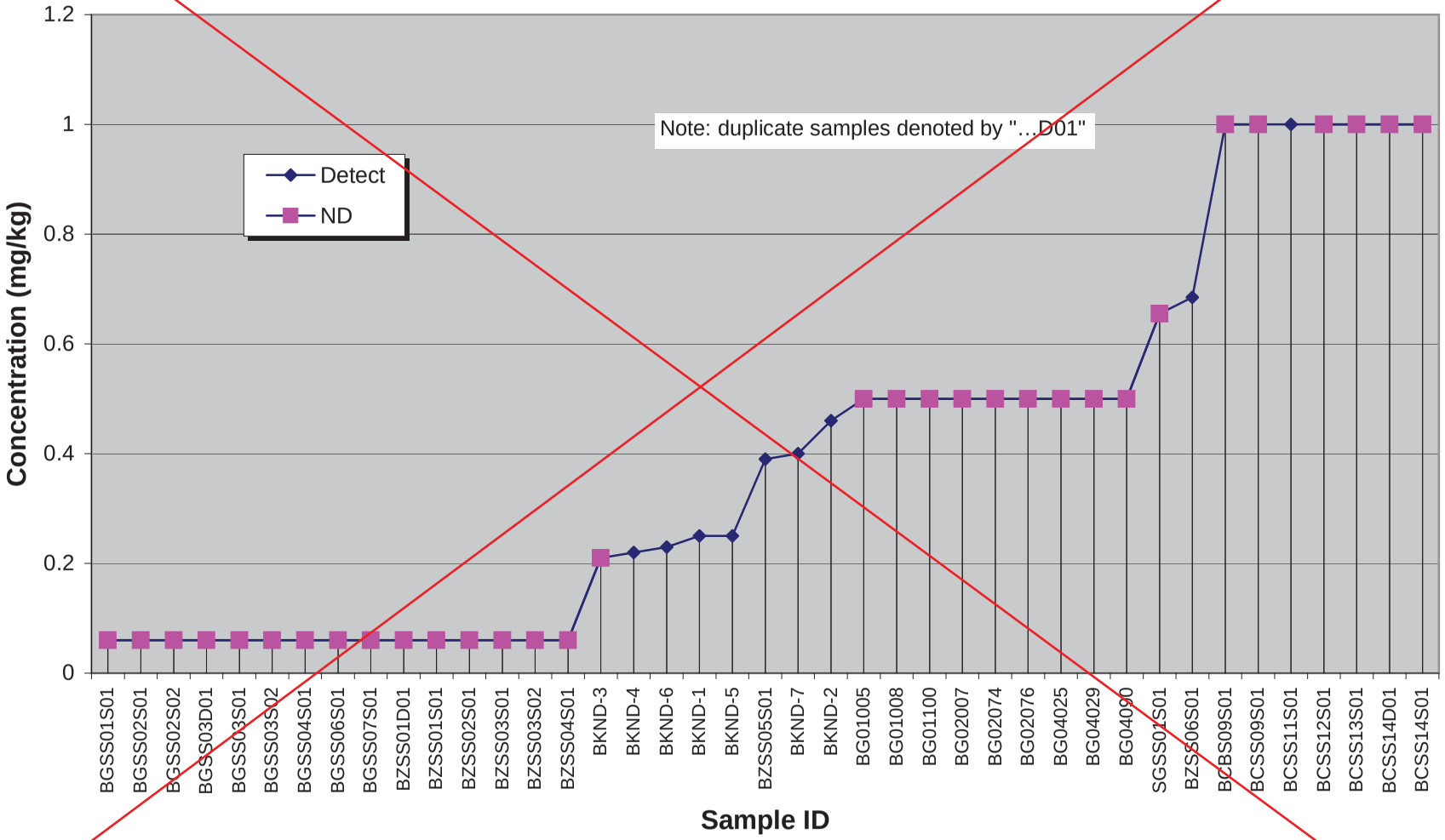
Rank Order Plot for Barium in Background Soil



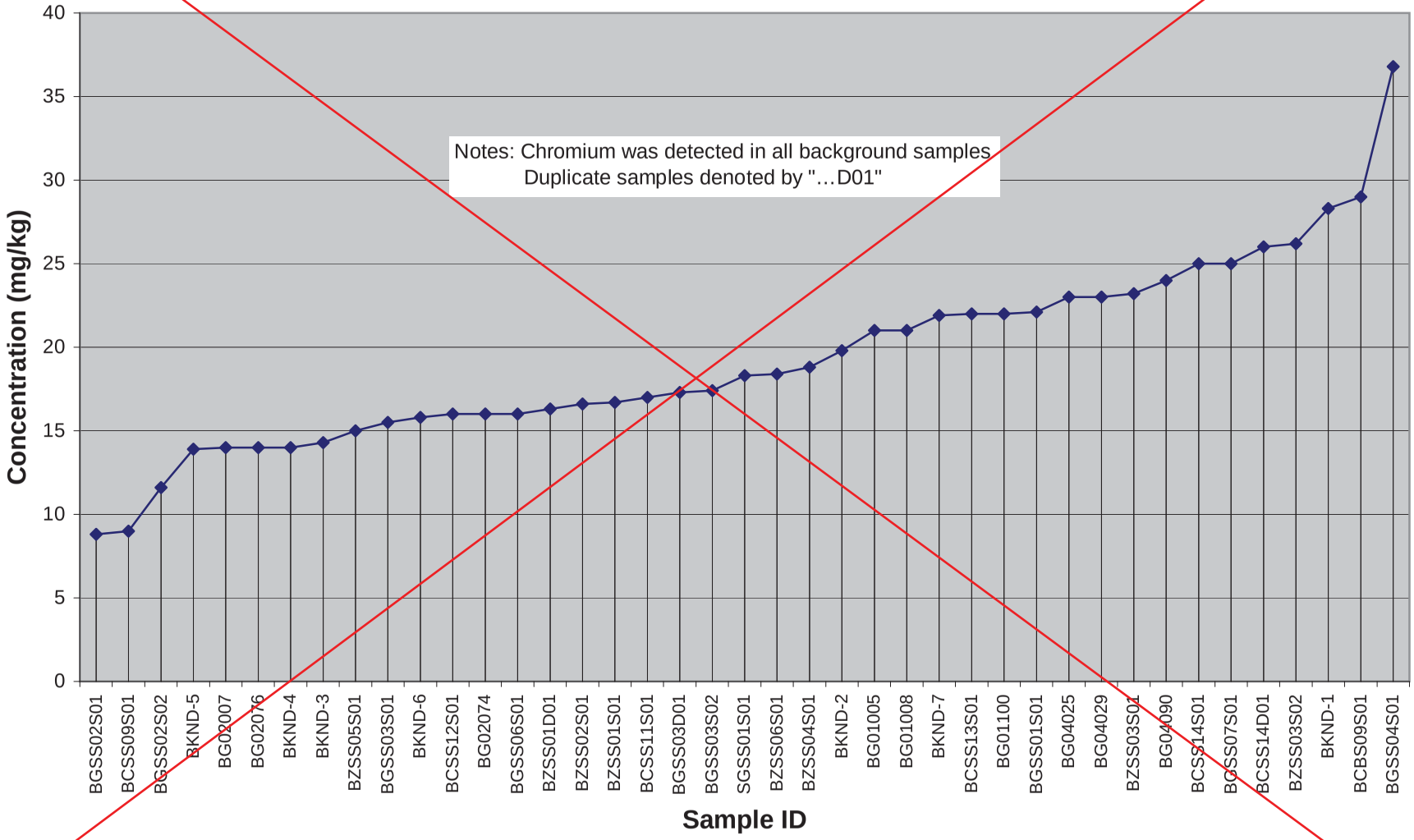

Rank Order Plot for Beryllium in Background Soil
Note: duplicate samples denoted by "…D01"
Detect
ND
Concentration (mg/kg)
1.2
1
0.8
0.6
0.4
0.2
0
BKND-2
BKND-1
BKND-5
BGSS02S02
BKND-4
BKND-6
BGSS02S01
BKND-3
BGSS03S01
BG02074
SGSS01S01
BZSS06S01
BGSS04S01
BZSS02S01
BKND-7
BZSS05S01
BCSS09S01
BG02007
BG02076
BGSS06S01
BGSS03D01
BZSS01S01
BG01008
BGSS03S02
BZSS01D01
BZSS04S01
BGSS01S01
BG04025
BG04090
BGSS07S01
BG01005
BCSS11S01
BCSS12S01
BG01100
BG04029
BZSS03S01
BZSS03S02
BCSS14S01
BCBS09S01
BCSS13S01
BCSS14D01
Sample ID


Rank Order Plot for Boron in Background Soil
Note: duplicate samples denoted by "…D01"
Detect
ND
Concentration (mg/kg)
0
2
4
6
8
10
12
BCBS09S01
BG01005
BG01008
BG01100
BGSS02S01
BGSS02S02
BZSS02S01
SGSS01S01
BZSS06S01
BZSS01S01
BKND-3
BZSS04S01
BKND-5
BKND-6
BZSS01D01
BGSS06S01
BCSS09S01
BGSS01S01
BZSS05S01
BKND-4
BCSS12S01
BGSS07S01
BKND-7
BG02076
BGSS03D01
BGSS03S01
BGSS03S02
BG02074
BZSS03S01
BKND-2
BCSS14S01
BCSS11S01
BZSS03S02
BCSS13S01
BGSS04S01
BG02007
BKND-1
BG04029
BG04090
BCSS14D01
BG04025
Sample ID

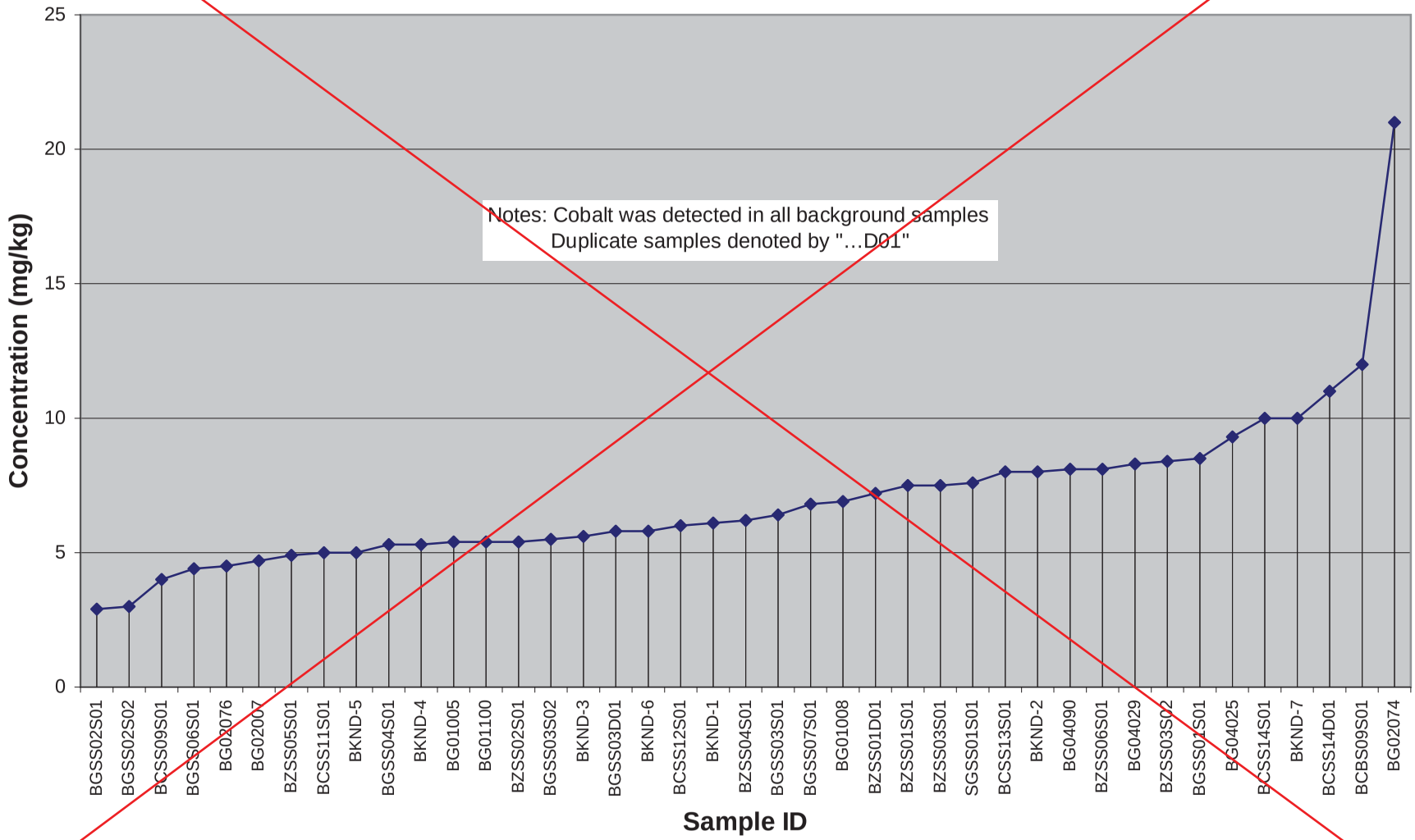
Rank Order Plot for Cadmium in Background Soil



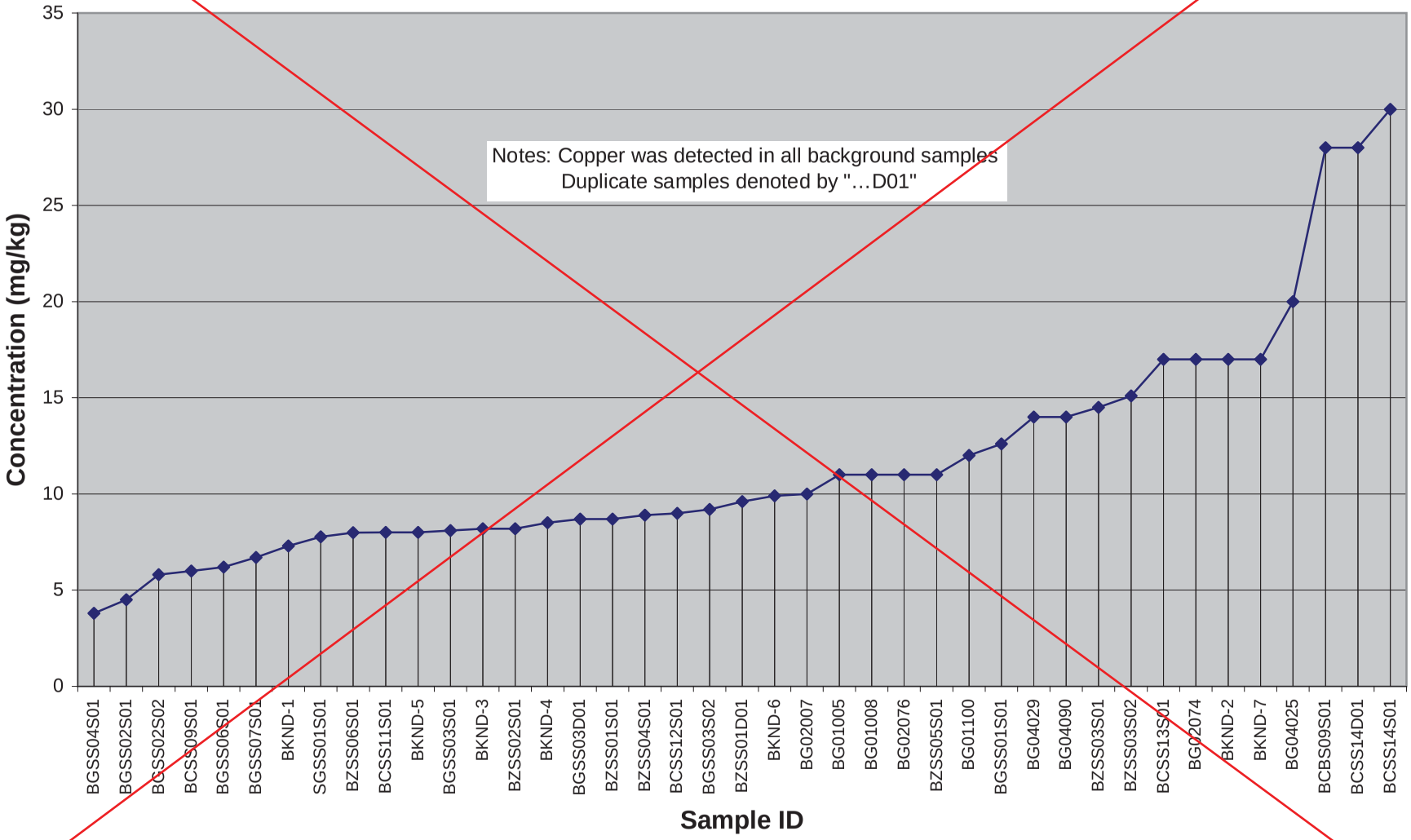
Rank Order Plot for Chromium in Background Soil



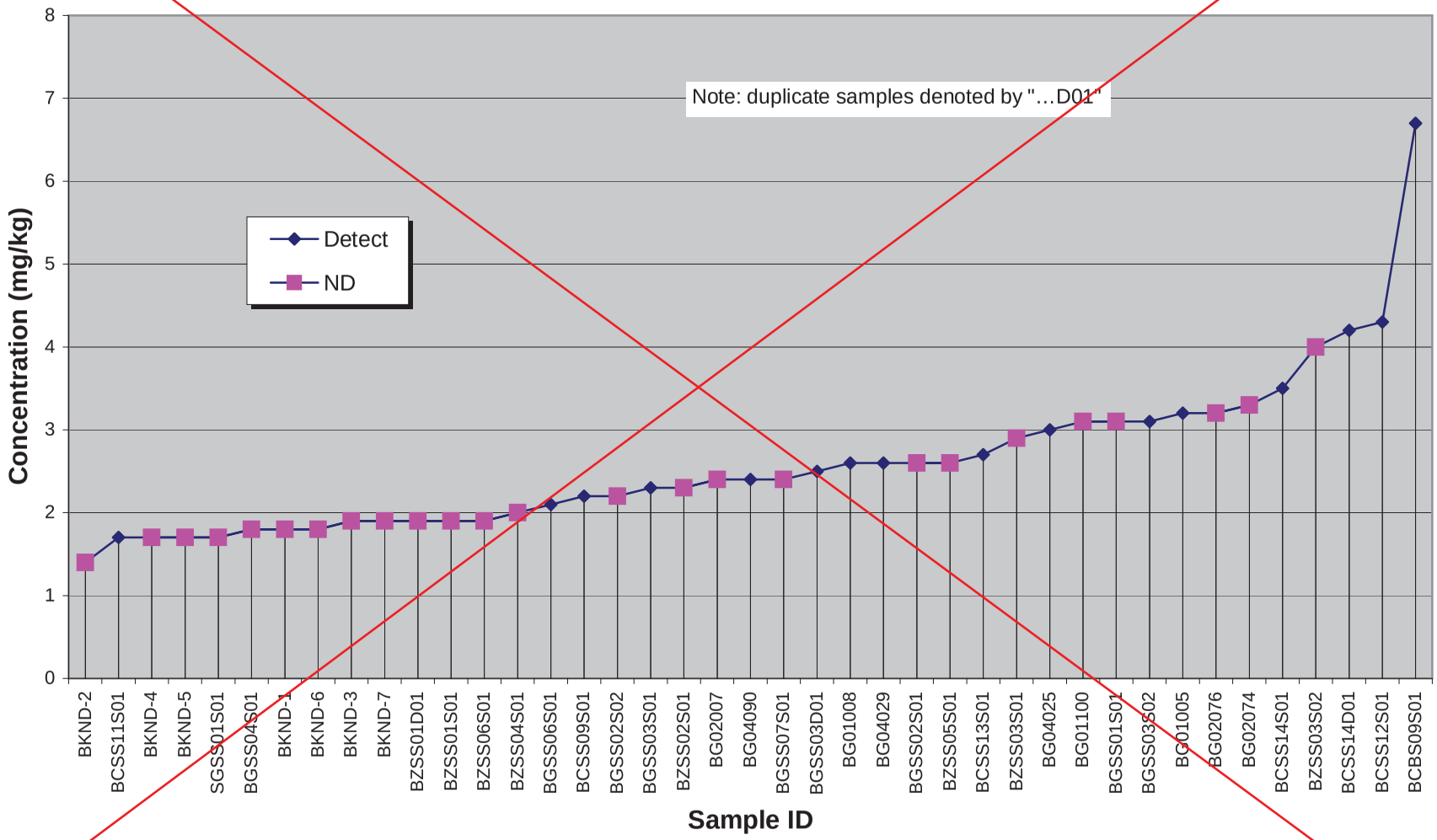
Rank Order Plot for Cobalt in Background Soil



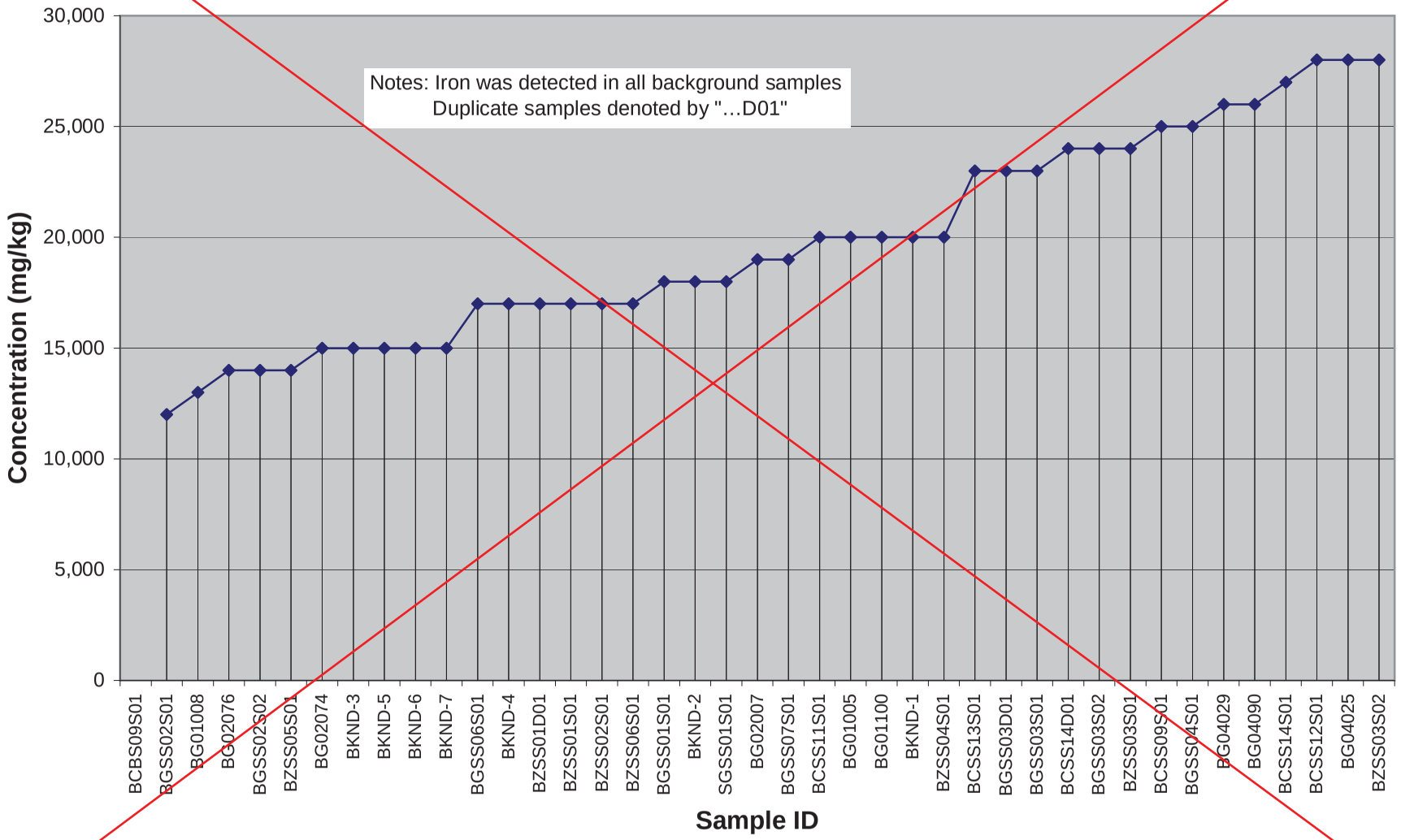
Rank Order Plot for Copper in Background Soil



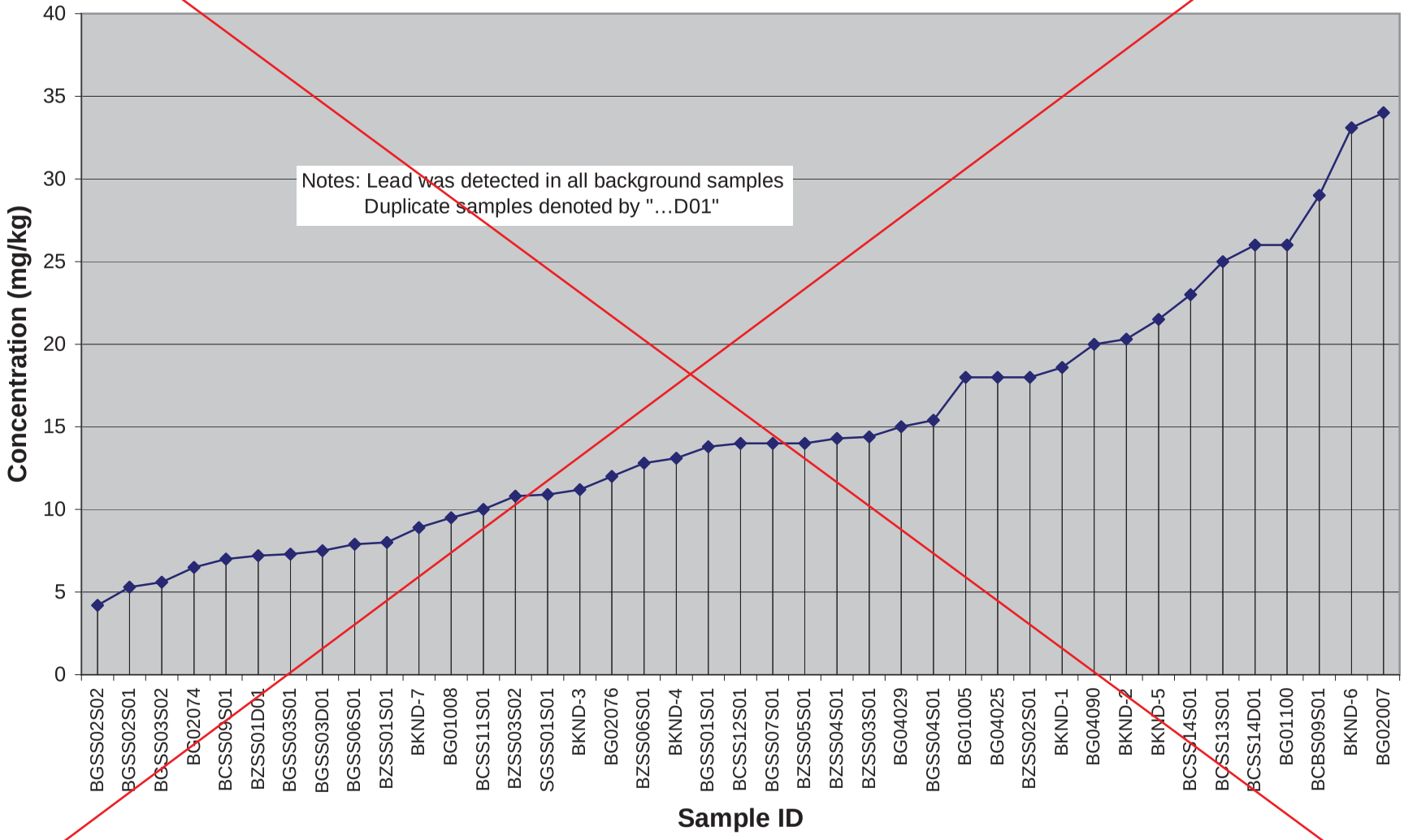
Rank Order Plot for Fluoride in Background Soil



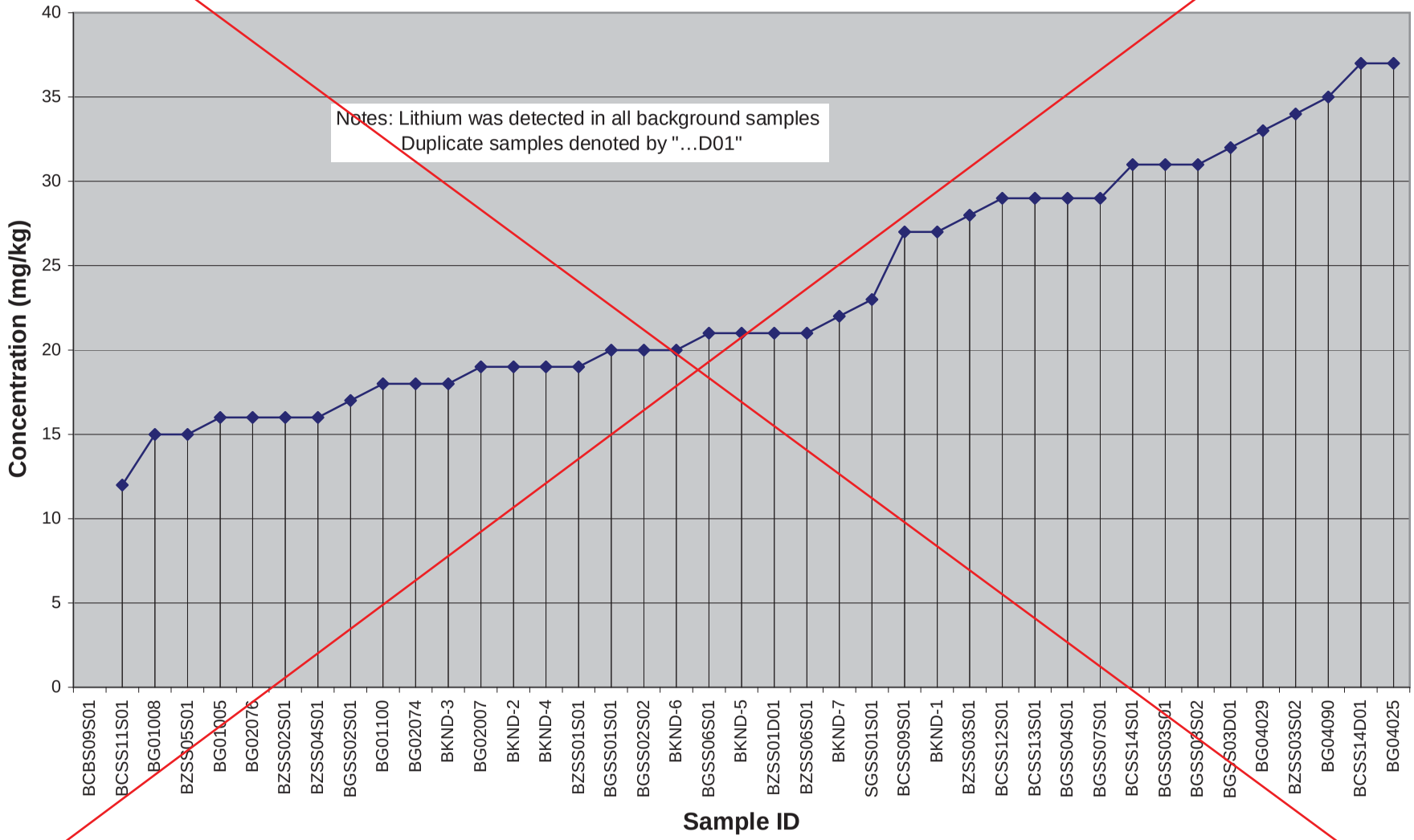
Rank Order Plot for Iron in Background Soil



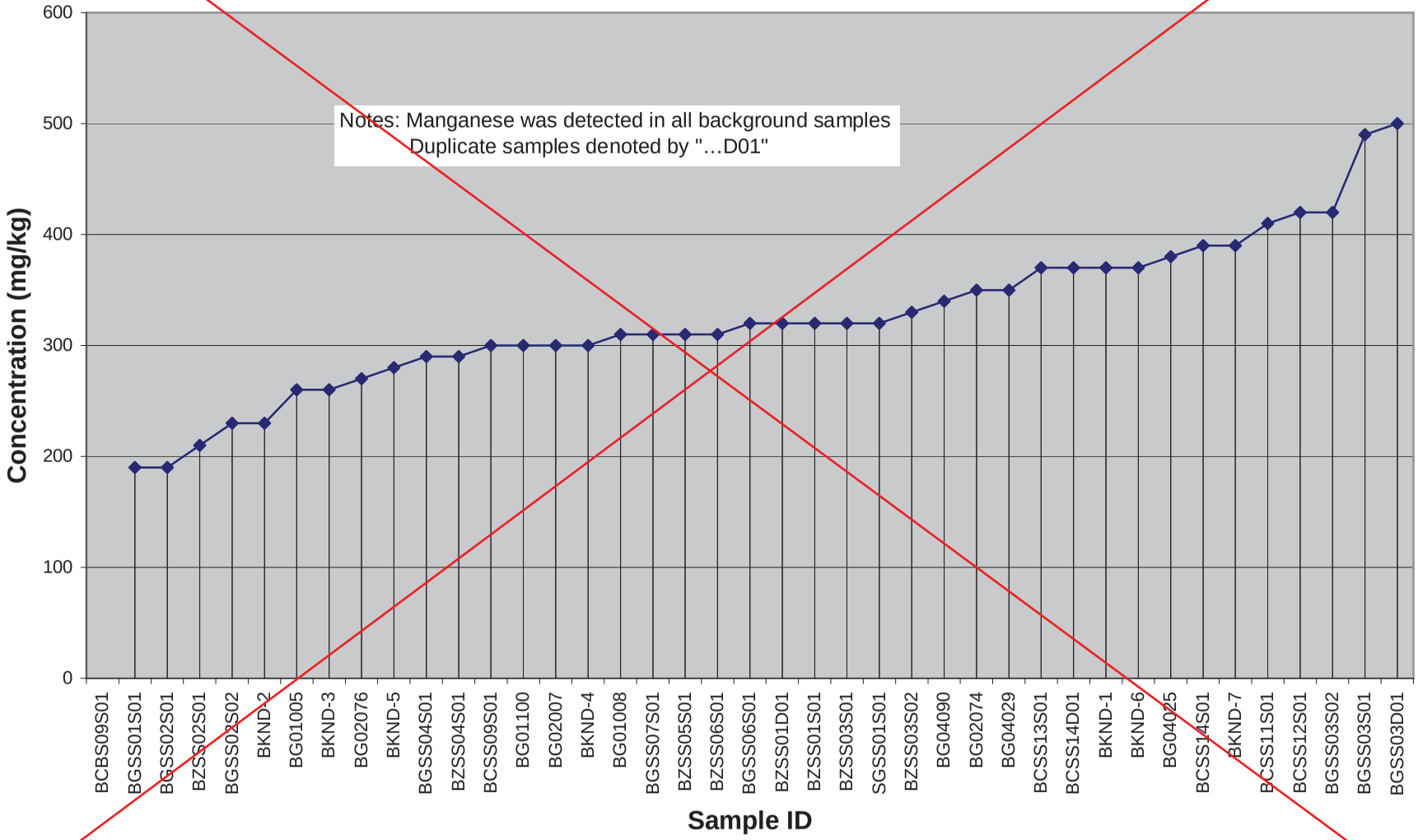
Rank Order Plot for Lead in Background Soil



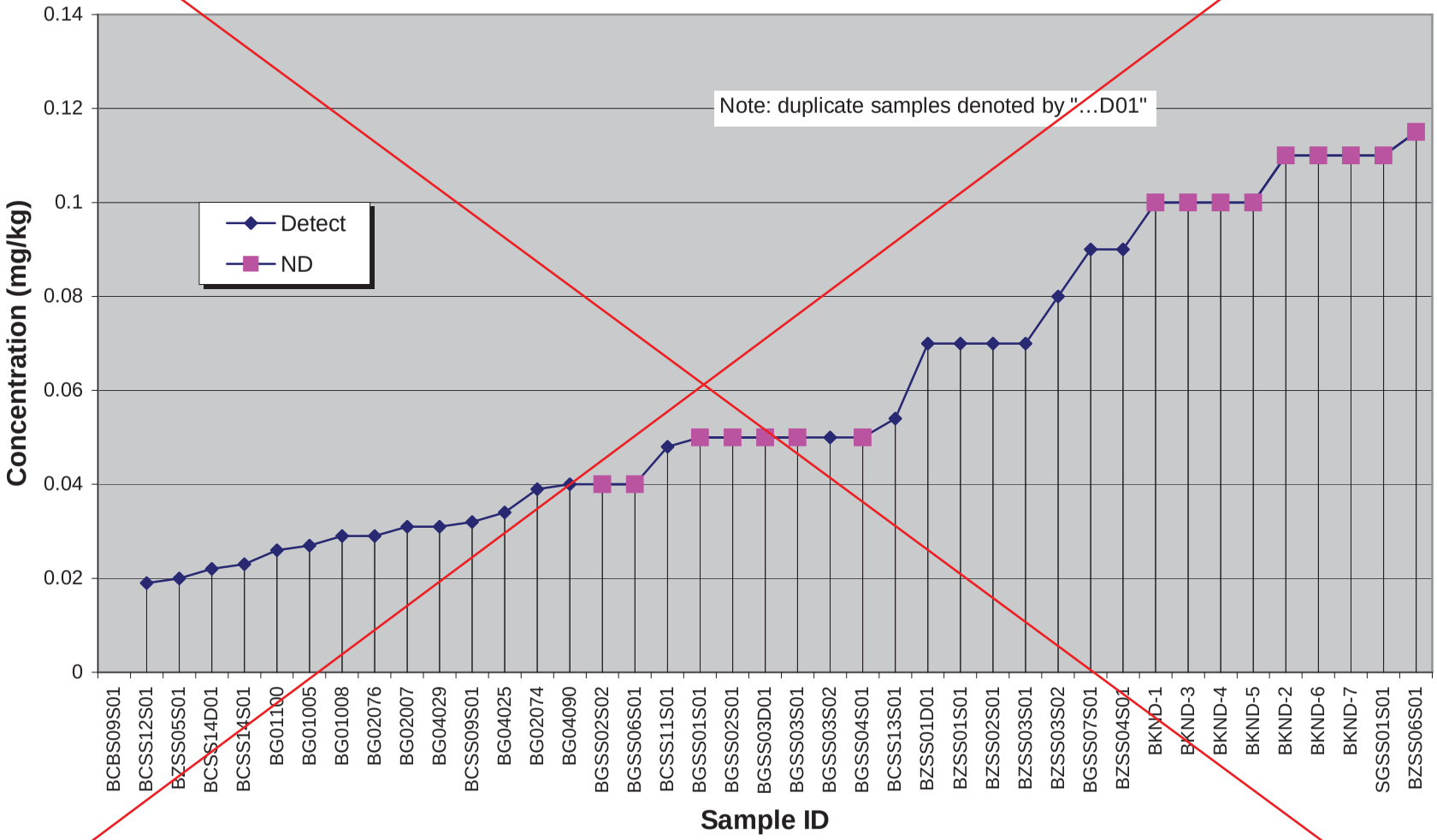
Rank Order Plot for Lithium in Background Soil



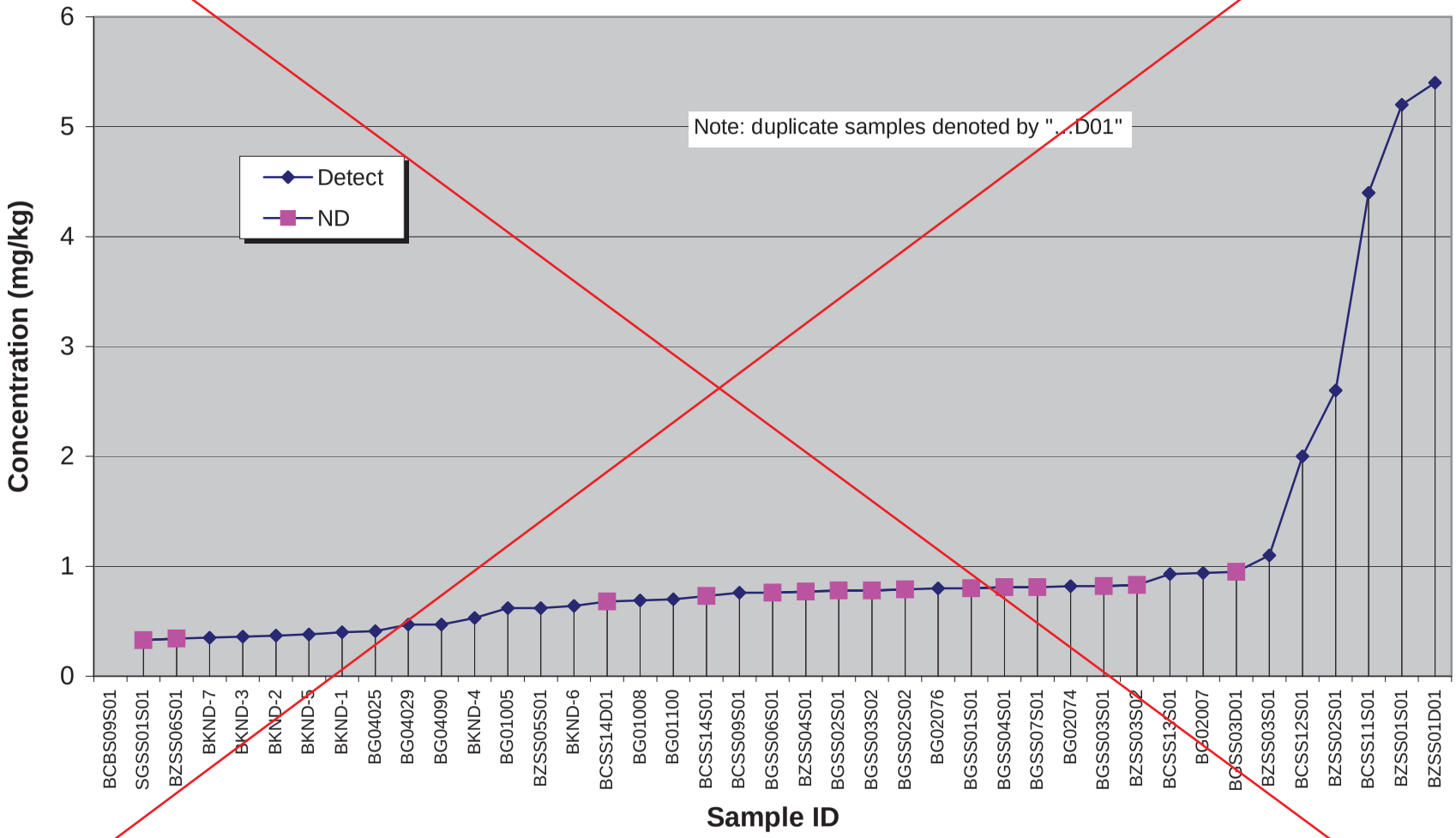
Rank Order Plot for Manganese in Background Soil



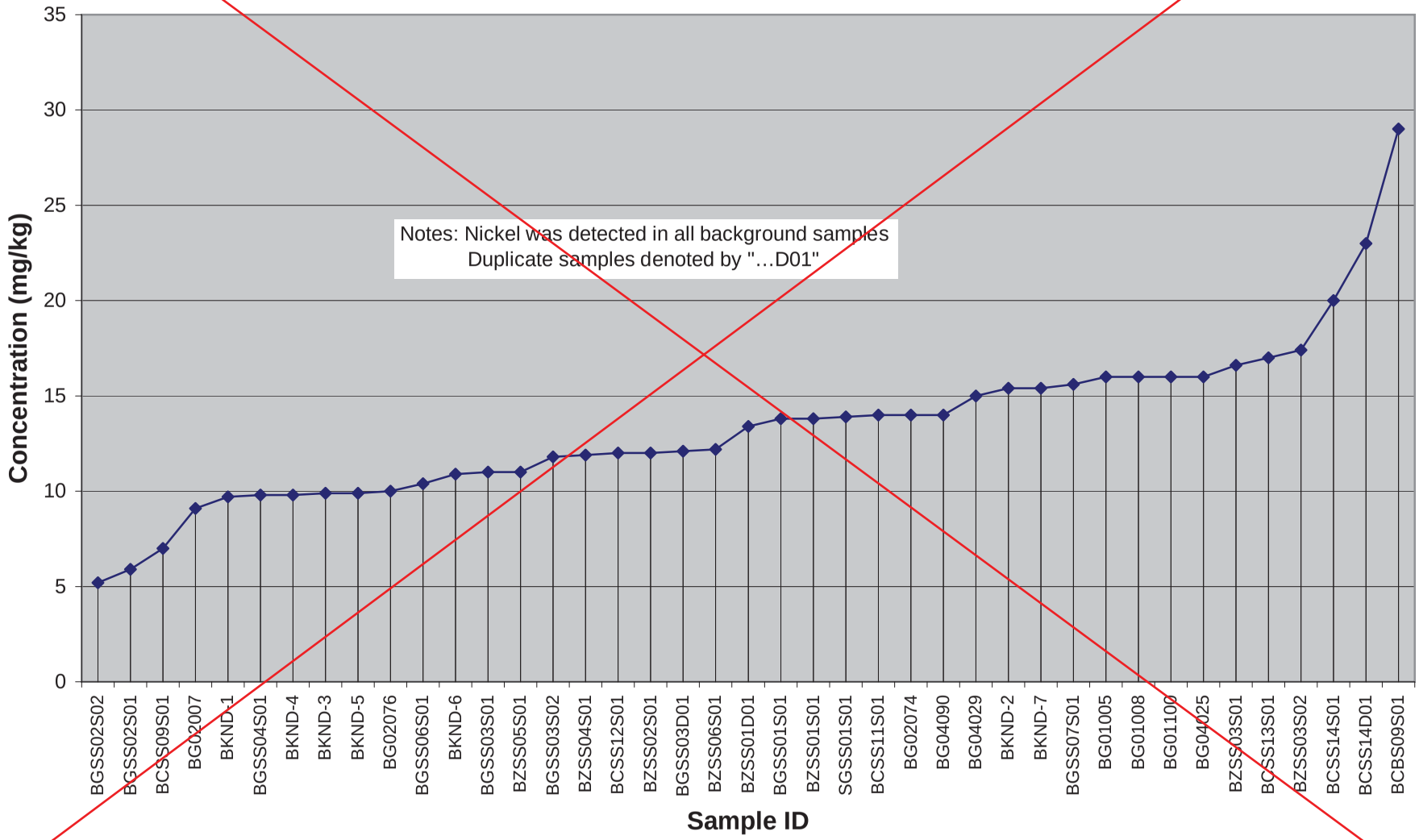
Rank Order Plot for Mercury in Background Soil



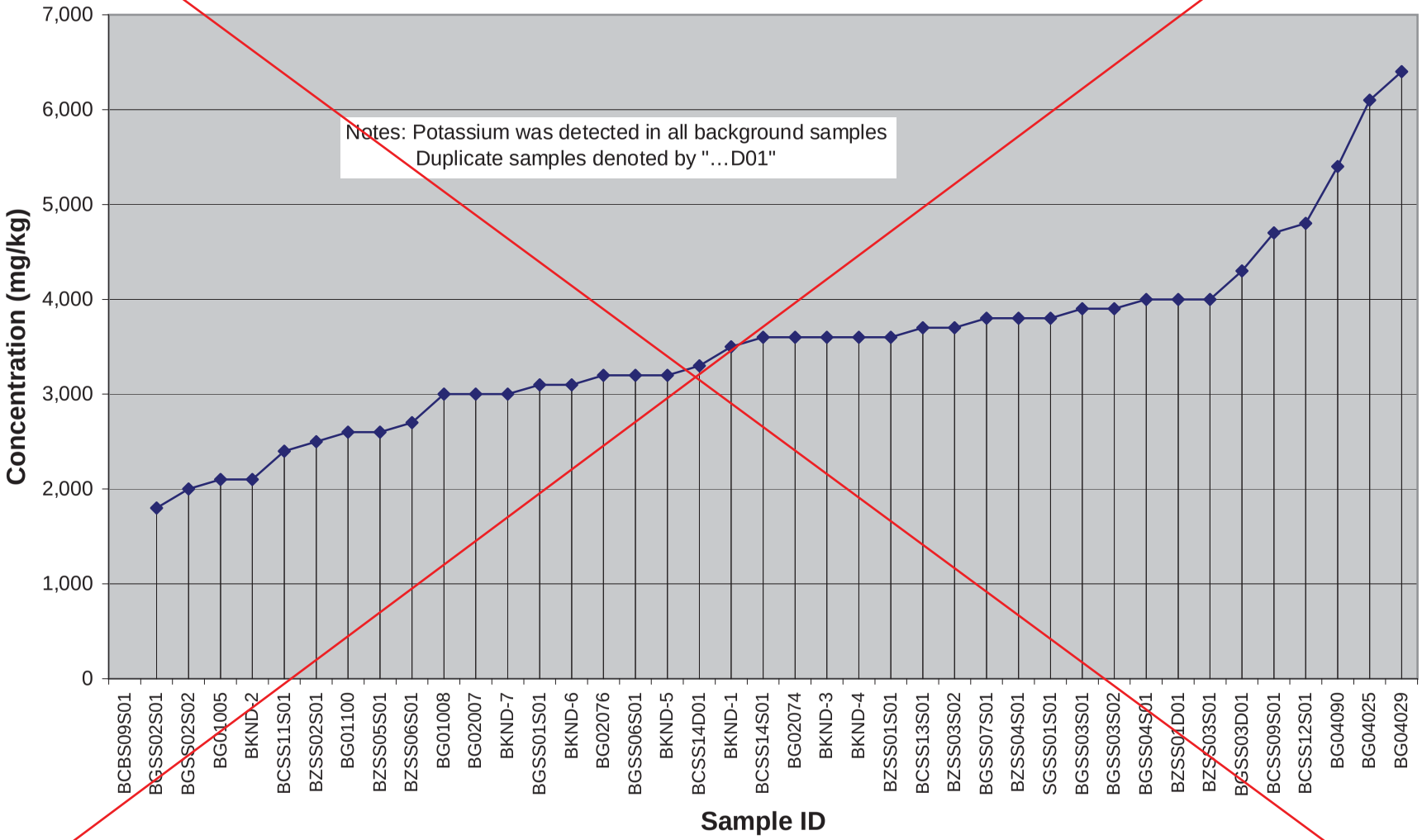
Rank Order Plot for Molybdenum in Background Soil

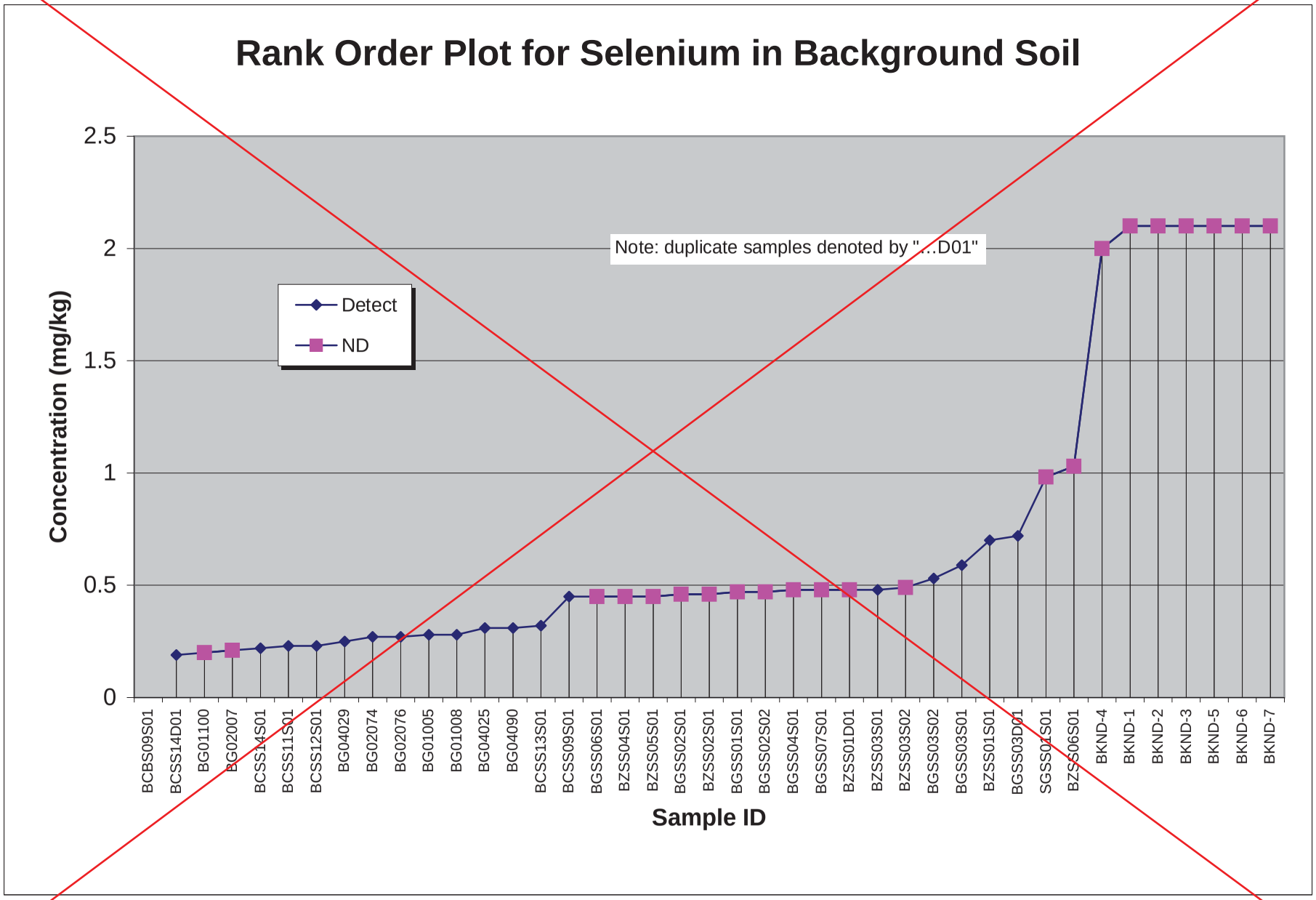


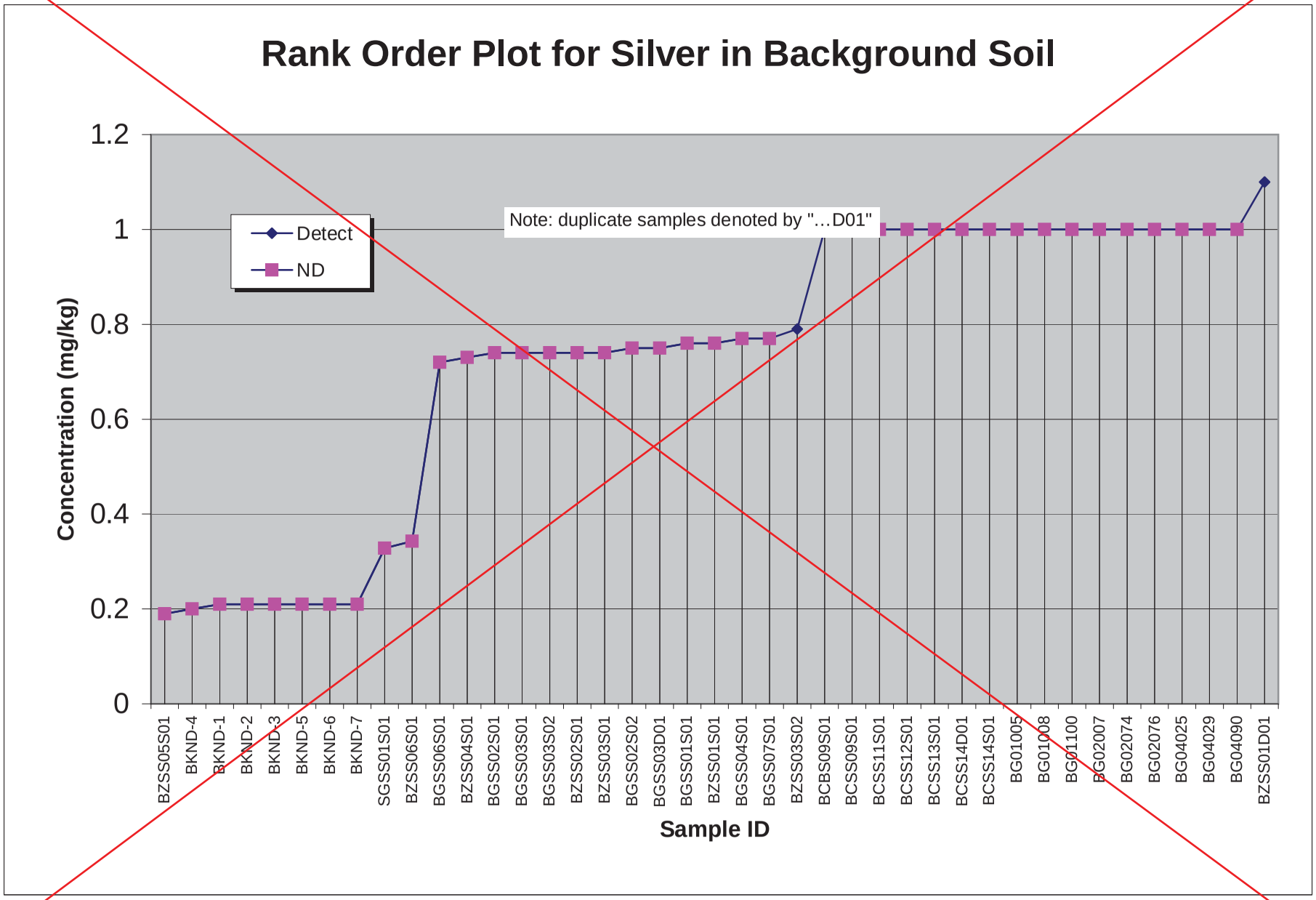
Rank Order Plot for Nickel in Background Soil

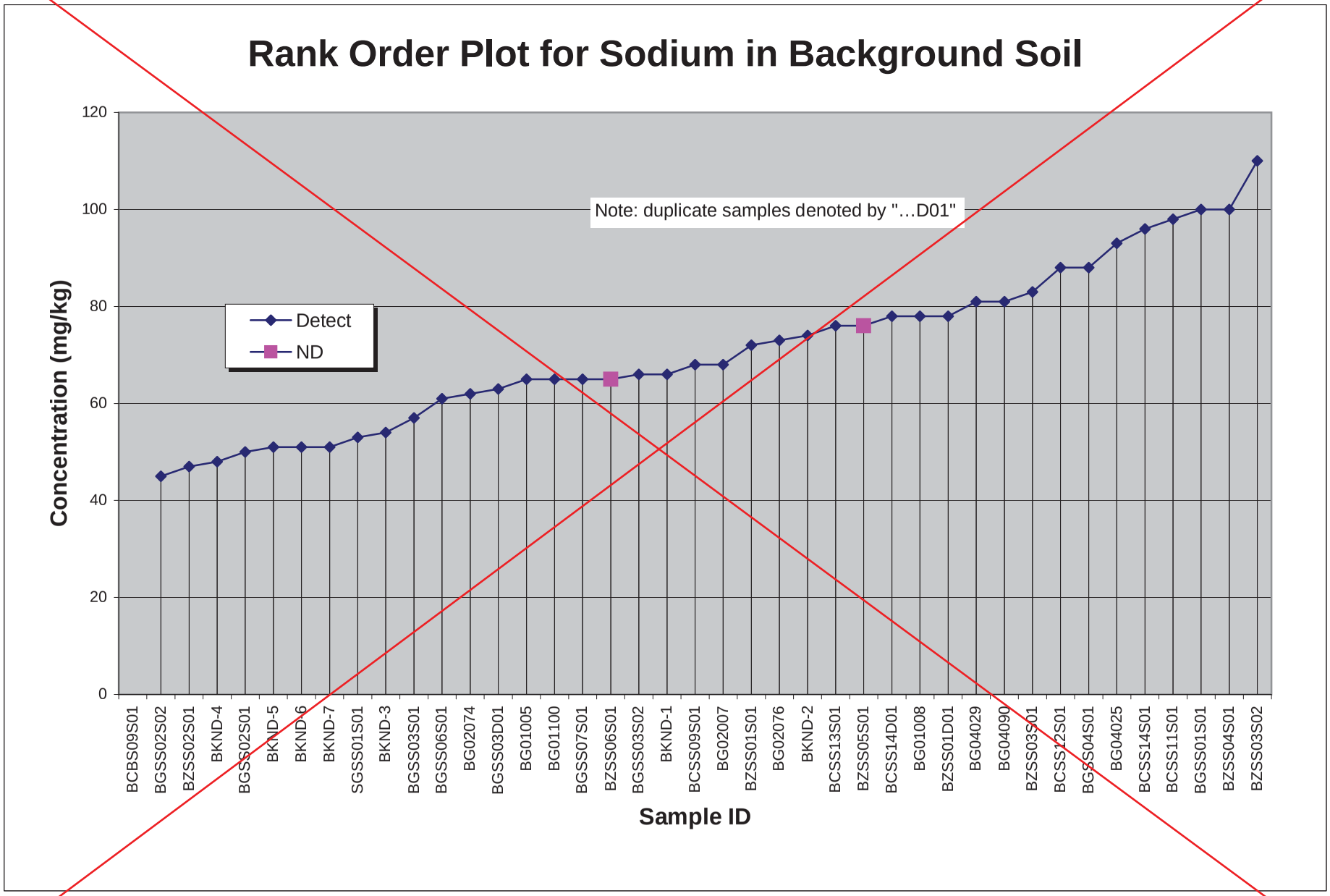


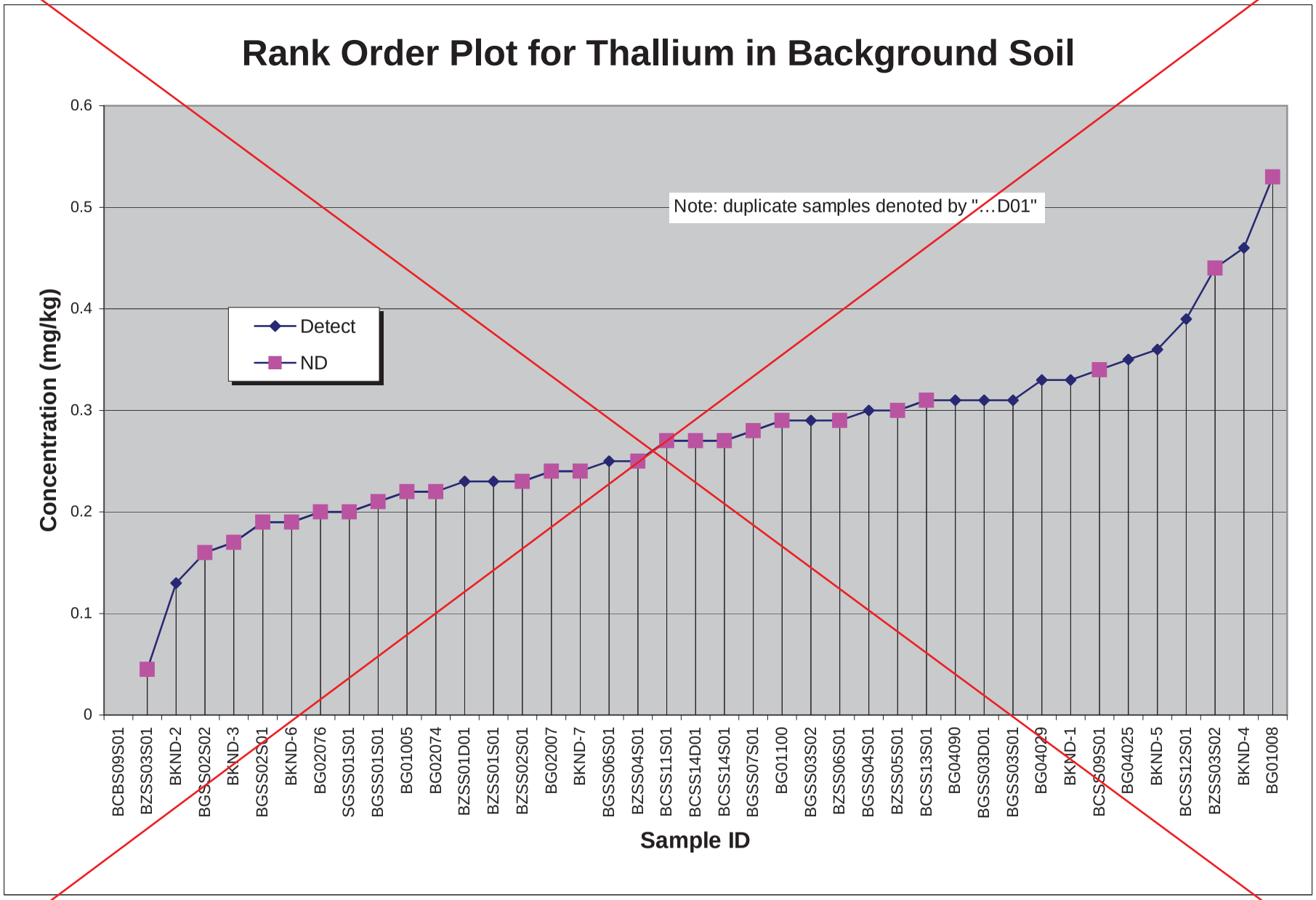
Rank Order Plot for Potassium in Background Soil



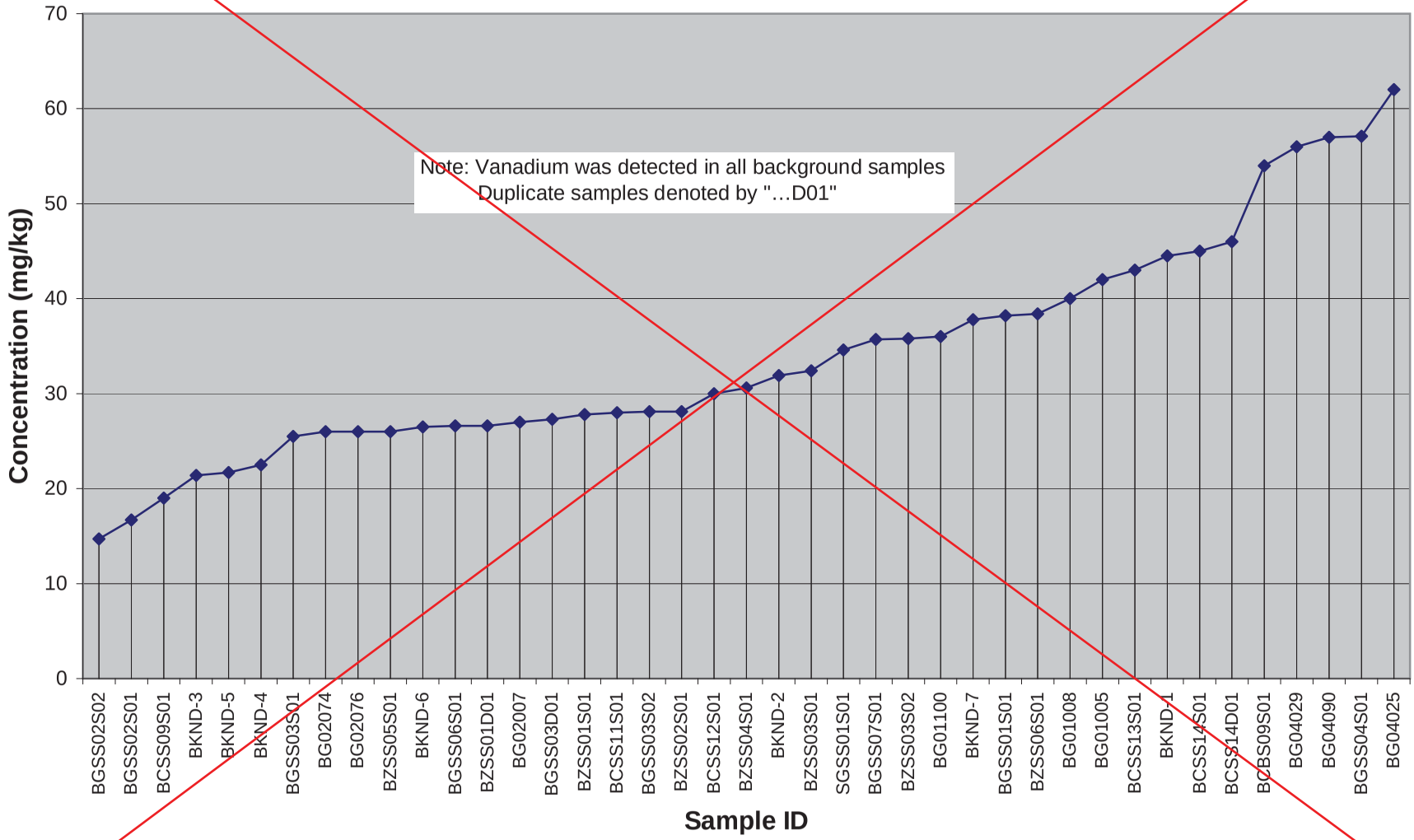

Rank Order Plot for Selenium in Background Soil
Concentration (mg/kg)
2.5
2
1.5
1
0.5
0
Note: duplicate samples denoted by "...D01"
Detect
ND
BCBS09S01
BCSS14D01
BG01100
BG02007
BCSS14S01
BCSS11S01
BCSS12S01
BG04029
BG02074
BG02076
BG01005
BG01008
BG04025
BG04090
BCSS13S01
BCSS09S01
BGSS06S01
BZSS04S01
BZSS05S01
BGSS02S01
BZSS02S01
BGSS01S01
BGSS02S02
BGSS04S01
BGSS07S01
BZSS01D01
BZSS03S01
BZSS03S02
BGSS03S02
BGSS03S01
BZSS01S01
BGSS03D01
SGSS01S01
BZSS06S01
BKND-4
BKND-1
BKND-2
BKND-3
BKND-5
BKND-6
BKND-7
Sample ID


Rank Order Plot for Silver in Background Soil
Note: duplicate samples denoted by "…D01"
Detect
ND
Concentration (mg/kg)
1.2
1
0.8
0.6
0.4
0.2
0
BZSS05S01
BKND-4
BKND-1
BKND-2
BKND-3
BKND-5
BKND-6
BKND-7
SGSS01S01
BZSS06S01
BGSS06S01
BZSS04S01
BGSS02S01
BGSS03S01
BGSS03S02
BZSS02S01
BZSS03S01
BGSS02S02
BGSS03D01
BGSS01S01
BZSS01S01
BGSS04S01
BGSS07S01
BZSS03S02
BCBS09S01
BCSS09S01
BCSS11S01
BCSS12S01
BCSS13S01
BCSS14D01
BCSS14S01
BG01005
BG01008
BG01100
BG02007
BG02074
BG02076
BG04025
BG04029
BG04090
BZSS01D01
Sample ID

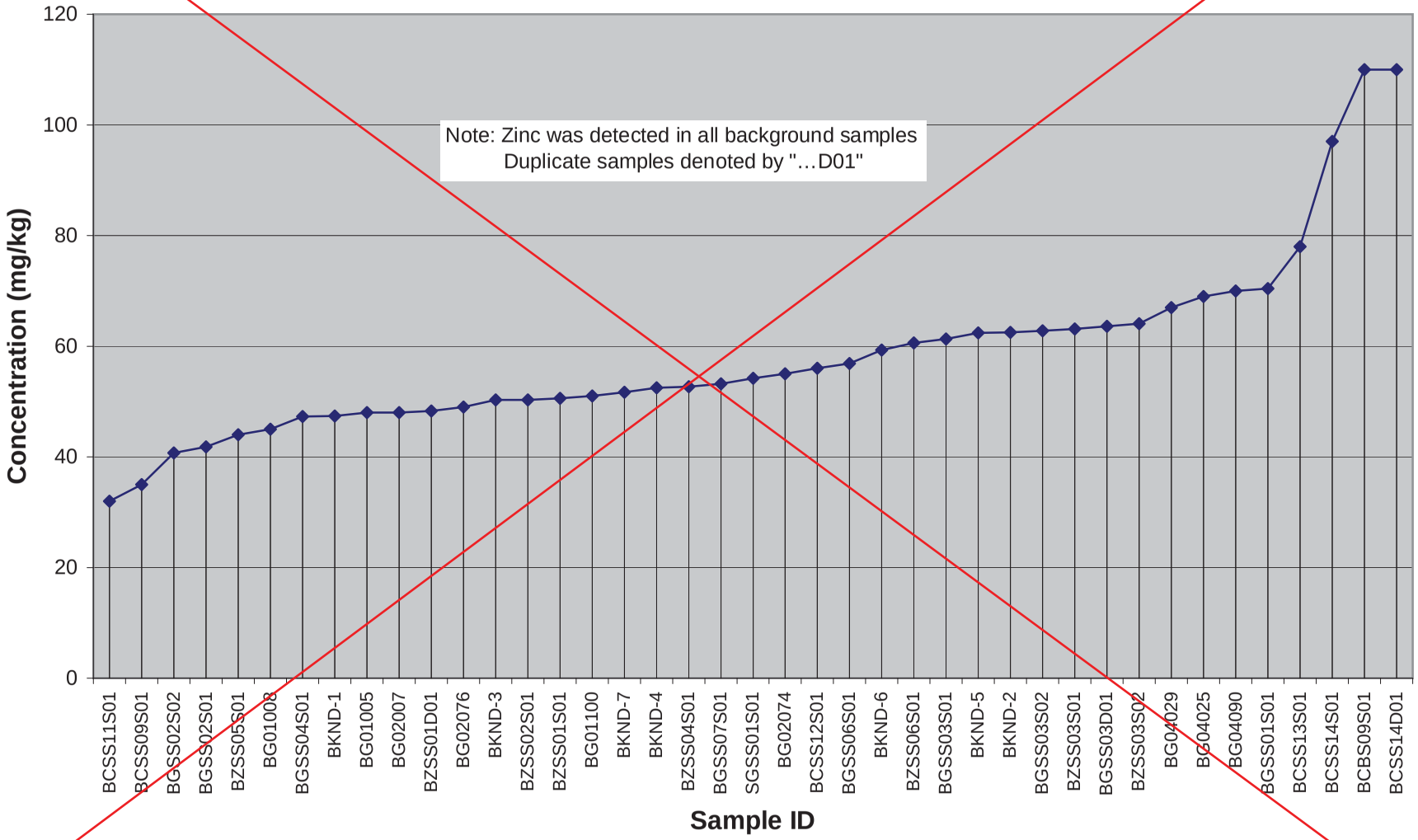

Rank Order Plot for Sodium in Background Soil
Note: duplicate samples denoted by "…D01"
Detect
ND
Concentration (mg/kg)
0
20
40
60
80
100
120
BCBS09S01
BGSS02S02
BZSS02S01
BKND-4
BGSS02S01
BKND-5
BKND-6
BKND-7
SGSS01S01
BKND-3
BGSS03S01
BGSS06S01
BG02074
BGSS03D01
BG01005
BG01100
BGSS07S01
BZSS06S01
BGSS03S02
BKND-1
BCSS09S01
BG02007
BZSS01S01
BG02076
BKND-2
BCSS13S01
BZSS05S01
BCSS14D01
BG01008
BZSS01D01
BG04029
BG04090
BZSS03S01
BCSS12S01
BGSS04S01
BG04025
BCSS14S01
BCSS11S01
BGSS01S01
BZSS04S01
BZSS03S02
Sample ID


Rank Order Plot for Thallium in Background Soil
Note: duplicate samples denoted by "…D01"
Detect
ND
Concentration (mg/kg)
0.6
0.5
0.4
0.3
0.2
0.1
0
BCBS09S01
BZSS03S01
BKND-2
BGSS02S02
BKND-3
BGSS02S01
BKND-6
BG02076
SGSS01S01
BGSS01S01
BG01005
BG02074
BZSS01D01
BZSS01S01
BZSS02S01
BG02007
BKND-7
BGSS06S01
BZSS04S01
BCSS11S01
BCSS14D01
BCSS14S01
BGSS07S01
BG01100
BGSS03S02
BZSS06S01
BGSS04S01
BZSS05S01
BCSS13S01
BG04090
BGSS03D01
BGSS03S01
BG04029
BKND-1
BCSS09S01
BG04025
BKND-5
BCSS12S01
BZSS03S02
BKND-4
BG01008
Sample ID

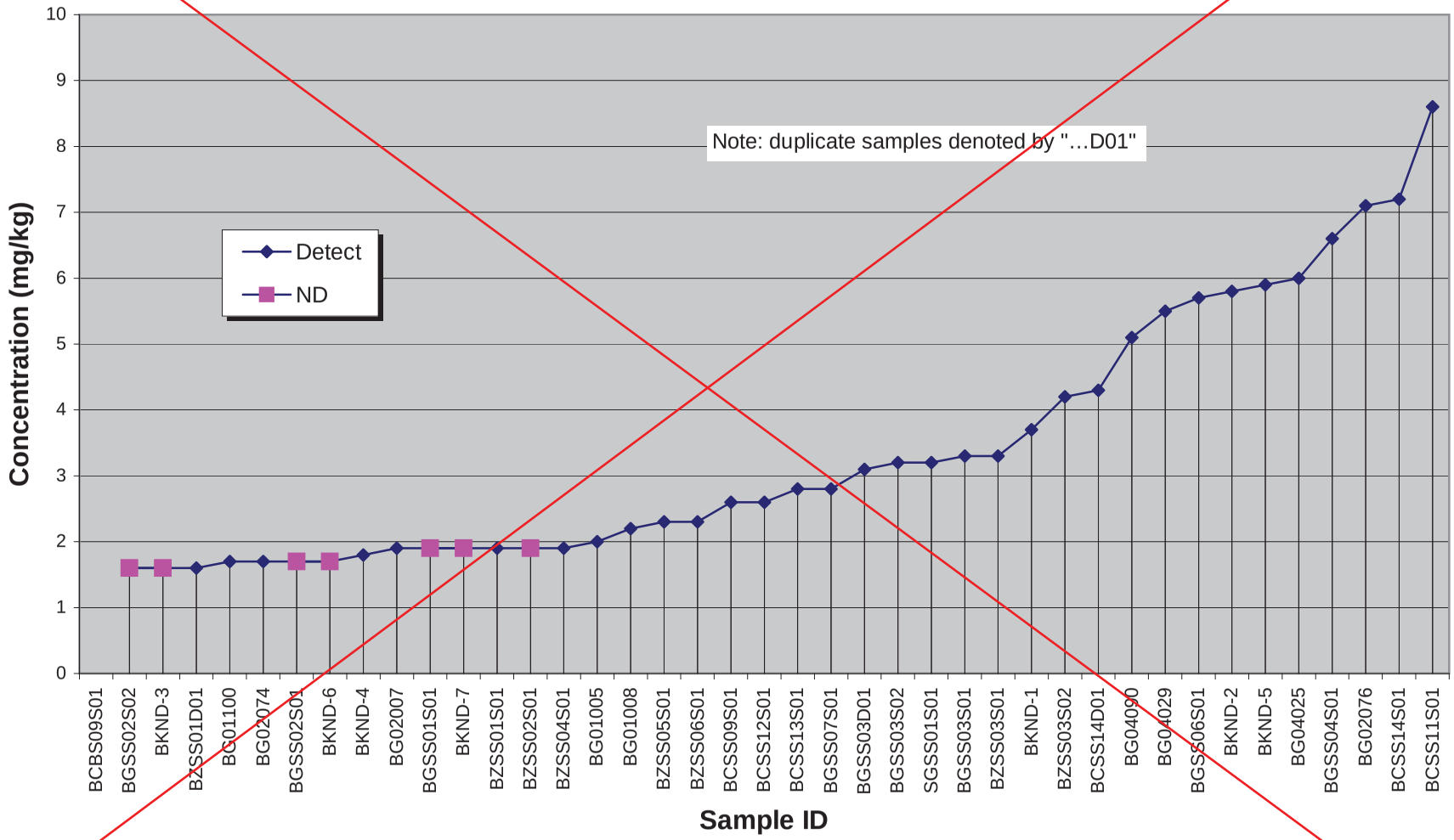
Rank Order Plot for Vanadium in Background Soil

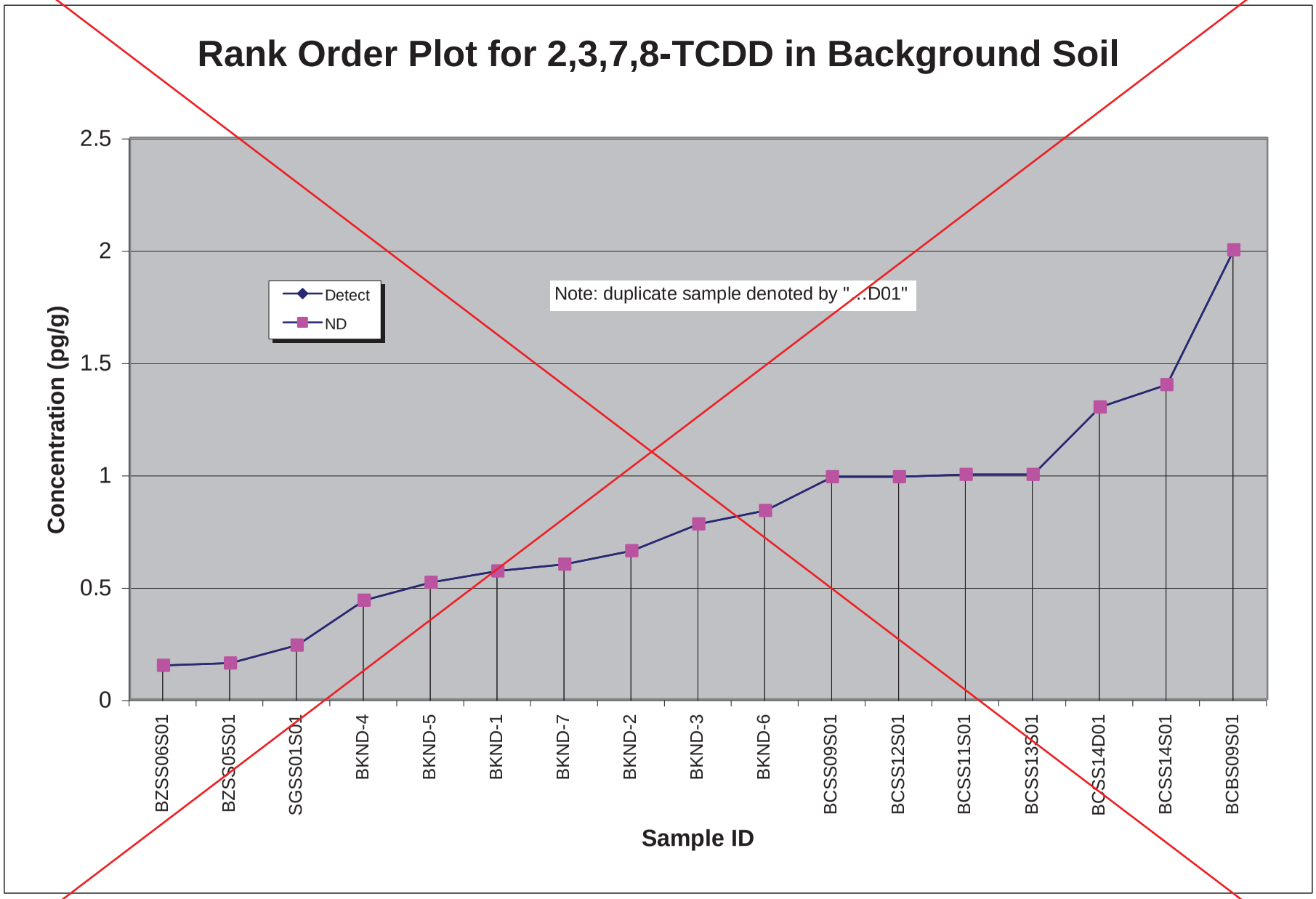


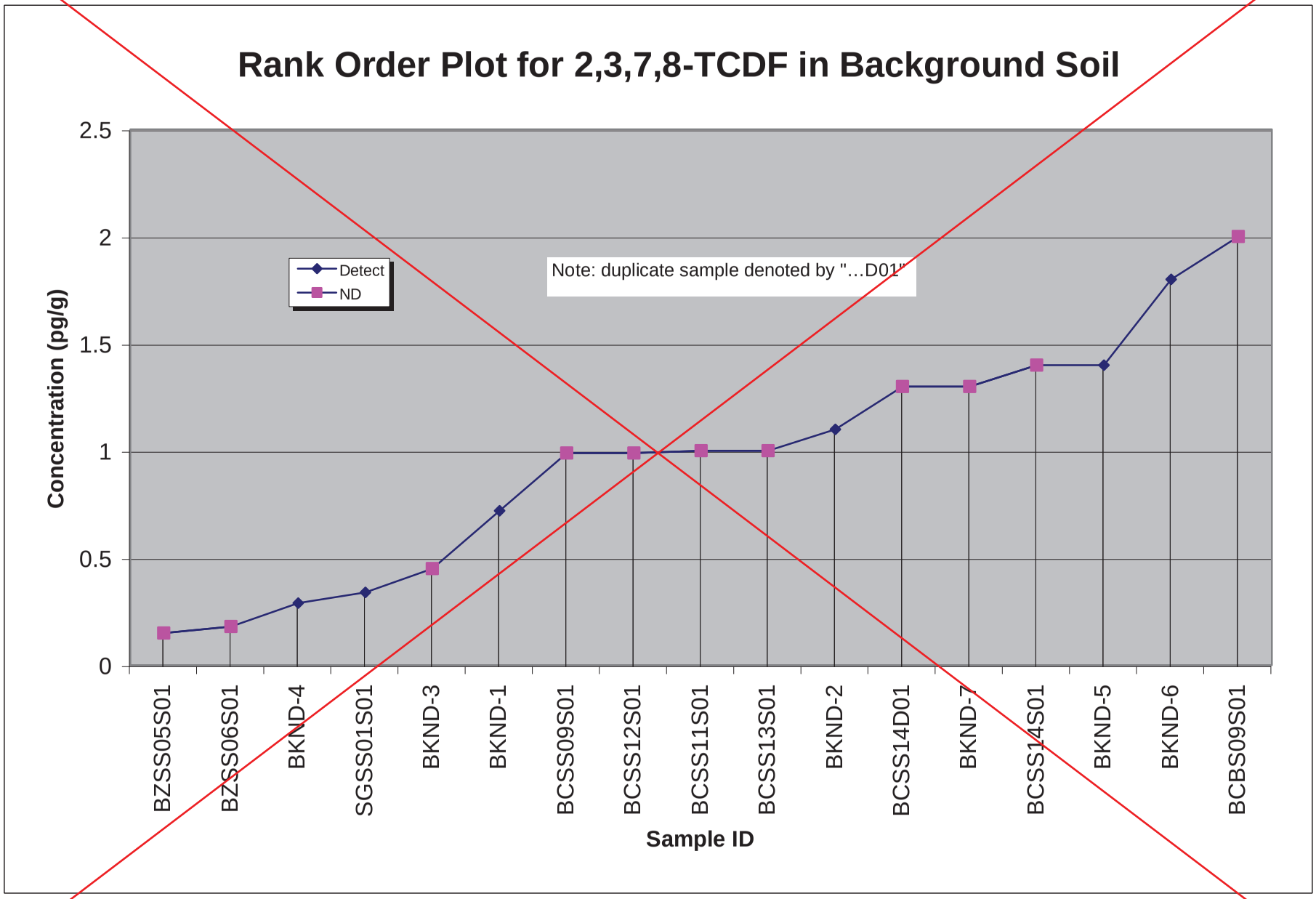
Rank Order Plot for Zinc in Background Soil

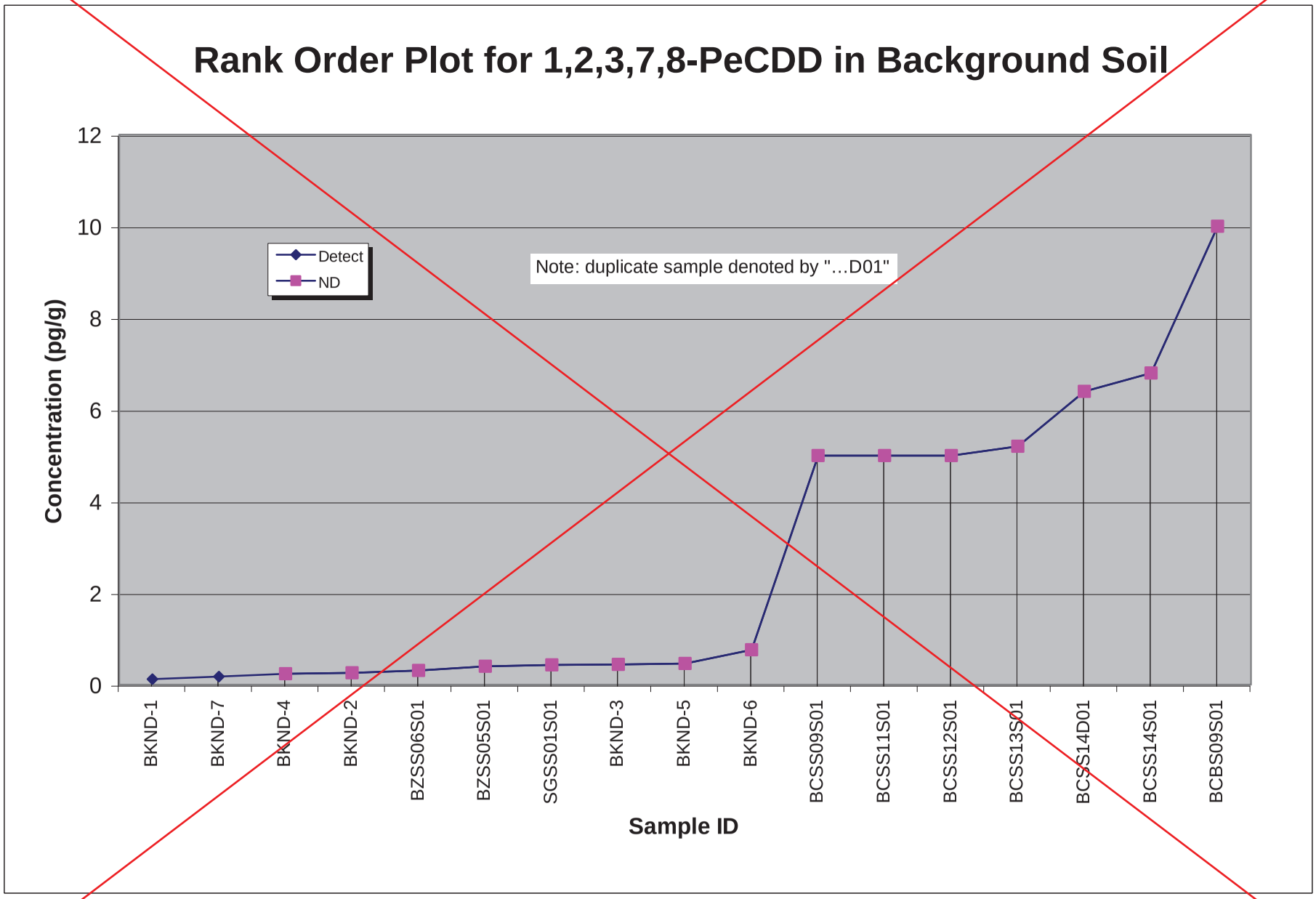


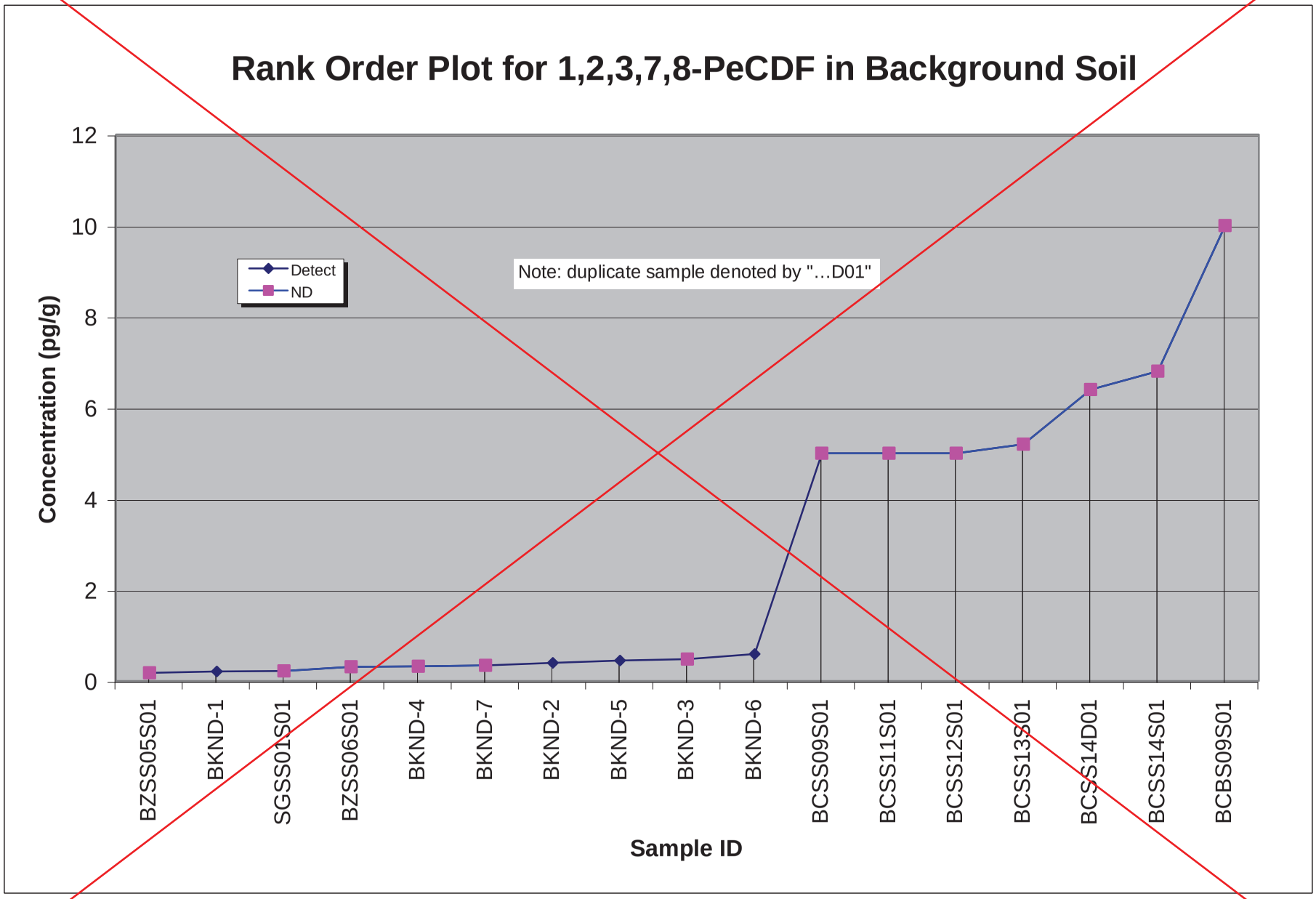
Rank Order Plot for Zirconium in Background Soil

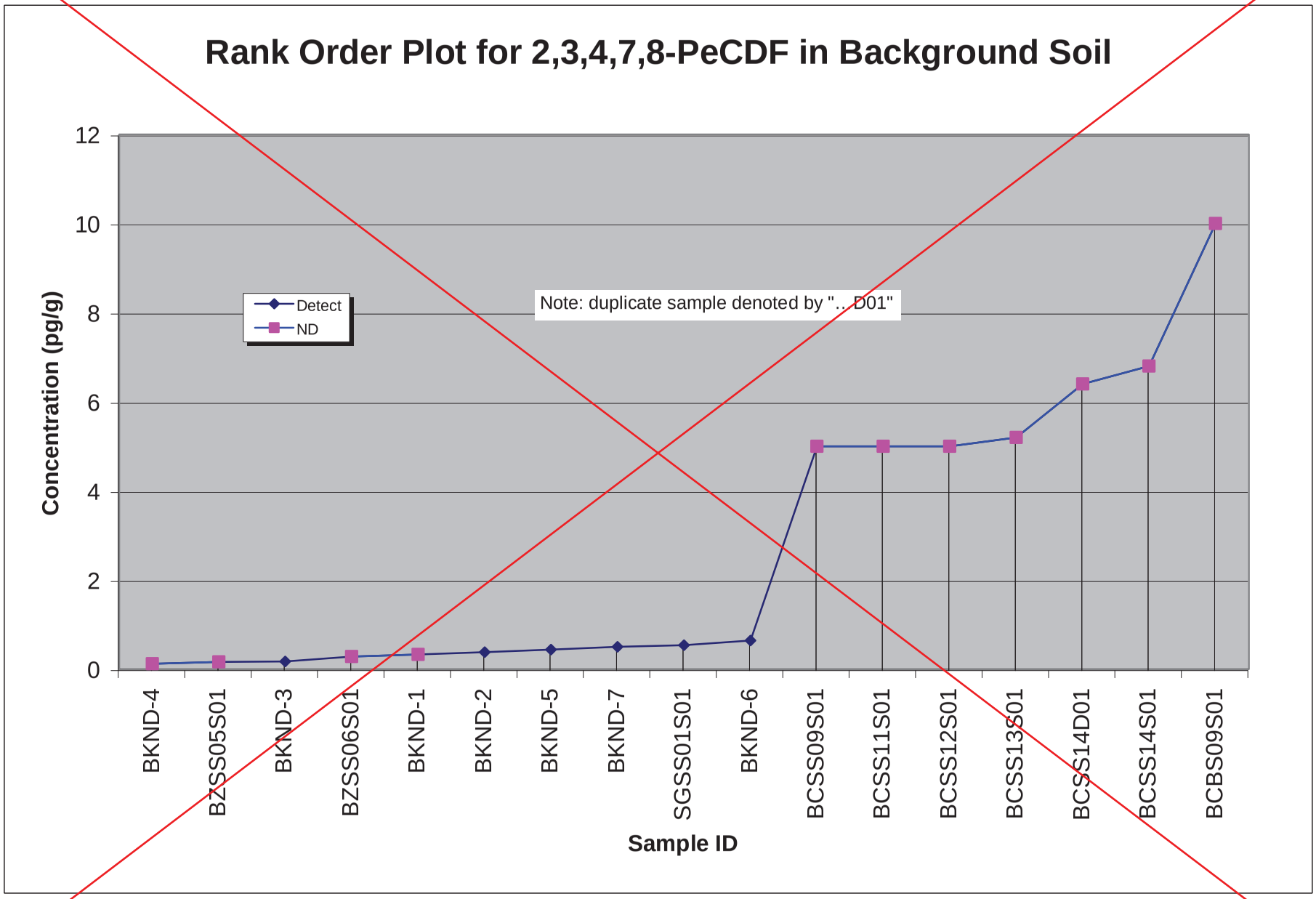


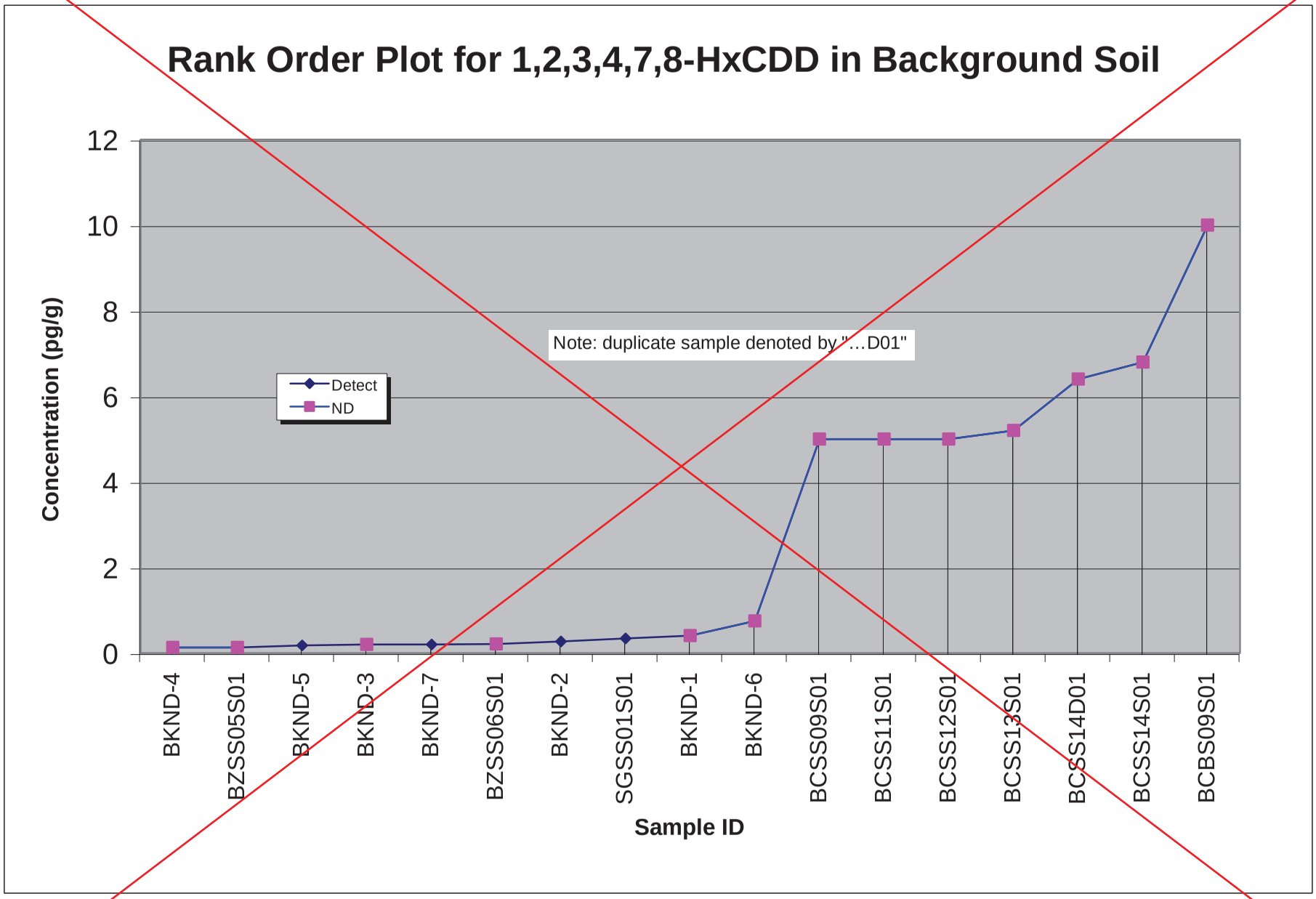

Rank Order Plot for 2,3,7,8-TCDD in Background Soil
Concentration (pg/g)
2.5
2
1.5
1
0.5
0
Detect
ND
Note: duplicate sample denoted by "..D01"
BZSS06S01
BZSS05S01
SGSS01S01
BKND-4
BKND-5
BKND-1
BKND-7
BKND-2
BKND-3
BKND-6
BCSS09S01
BCSS12S01
BCSS11S01
BCSS13S01
BCSS14D01
BCSS14S01
BCBS09S01
Sample ID

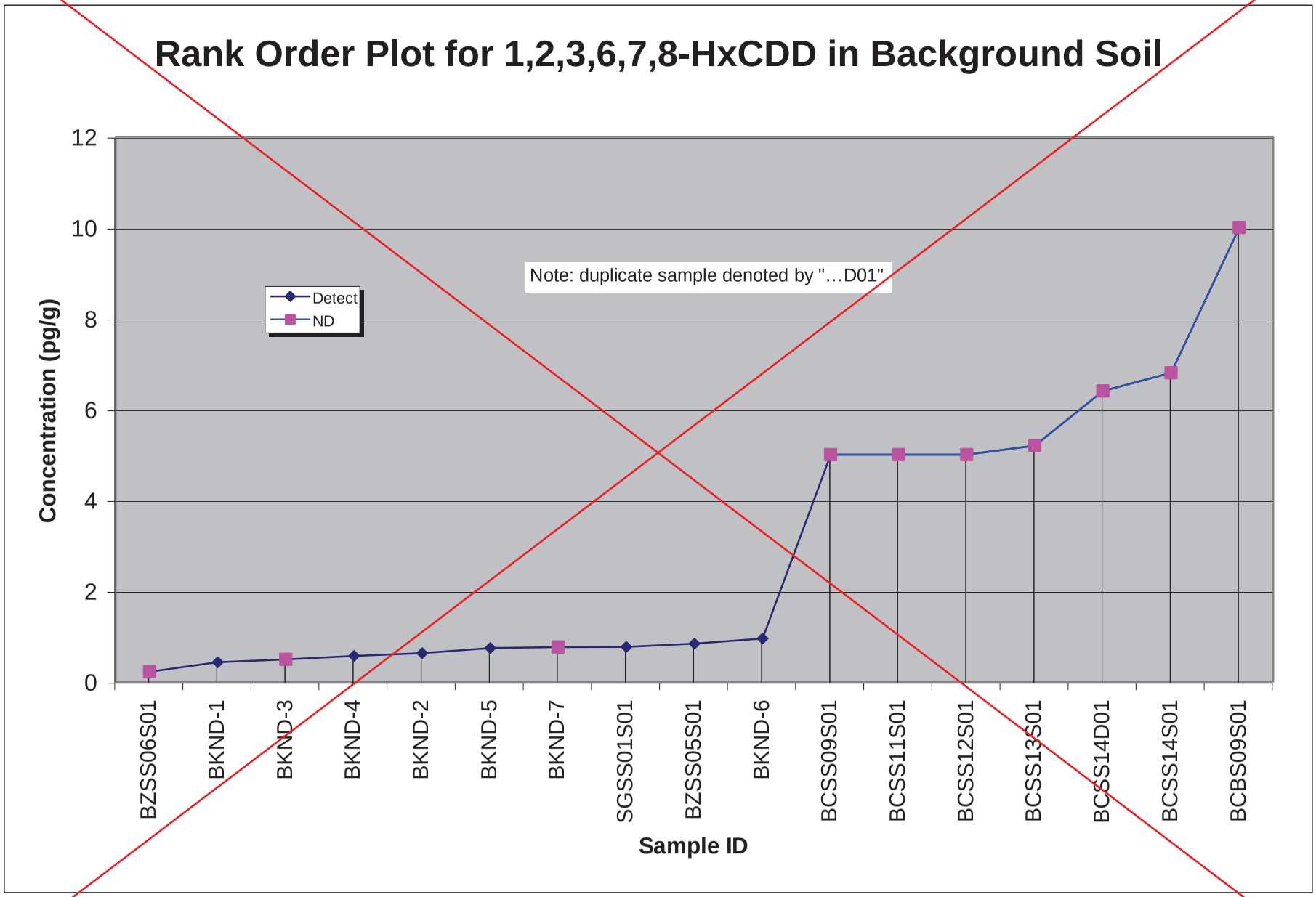

Rank Order Plot for 2,3,7,8-TCDF in Background Soil
Concentration (pg/g)
2.5
2
1.5
1
0.5
0
Detect
ND
Note: duplicate sample denoted by "…D01"
BZSS05S01
BZSS06S01
BKND-4
SGSS01S01
BKND-3
BKND-1
BCSS09S01
BCSS12S01
BCSS11S01
BCSS13S01
BKND-2
BCSS14D01
BKND-7
BCSS14S01
BKND-5
BKND-6
BCBS09S01
Sample ID

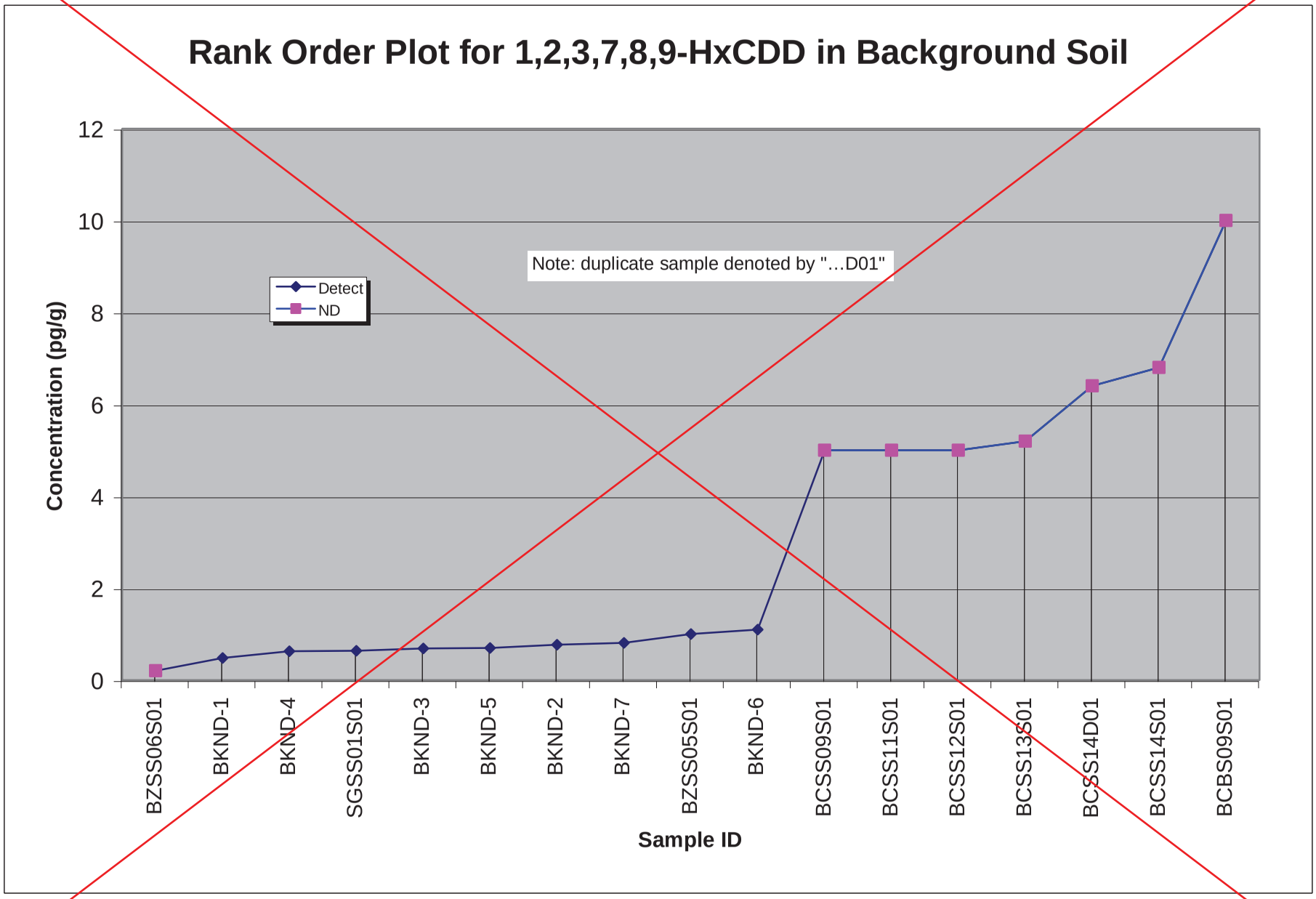

Rank Order Plot for 1,2,3,7,8-PeCDD in Background Soil
Concentration (pg/g)
0
2
4
6
8
10
12
Detect
ND
Note: duplicate sample denoted by "…D01"
BKND-1
BKND-7
BKND-4
BKND-2
BZSS06S01
BZSS05S01
SGSS01S01
BKND-3
BKND-5
BKND-6
BCSS09S01
BCSS11S01
BCSS12S01
BCSS13S01
BCSS14D01
BCSS14S01
BCBS09S01
Sample ID

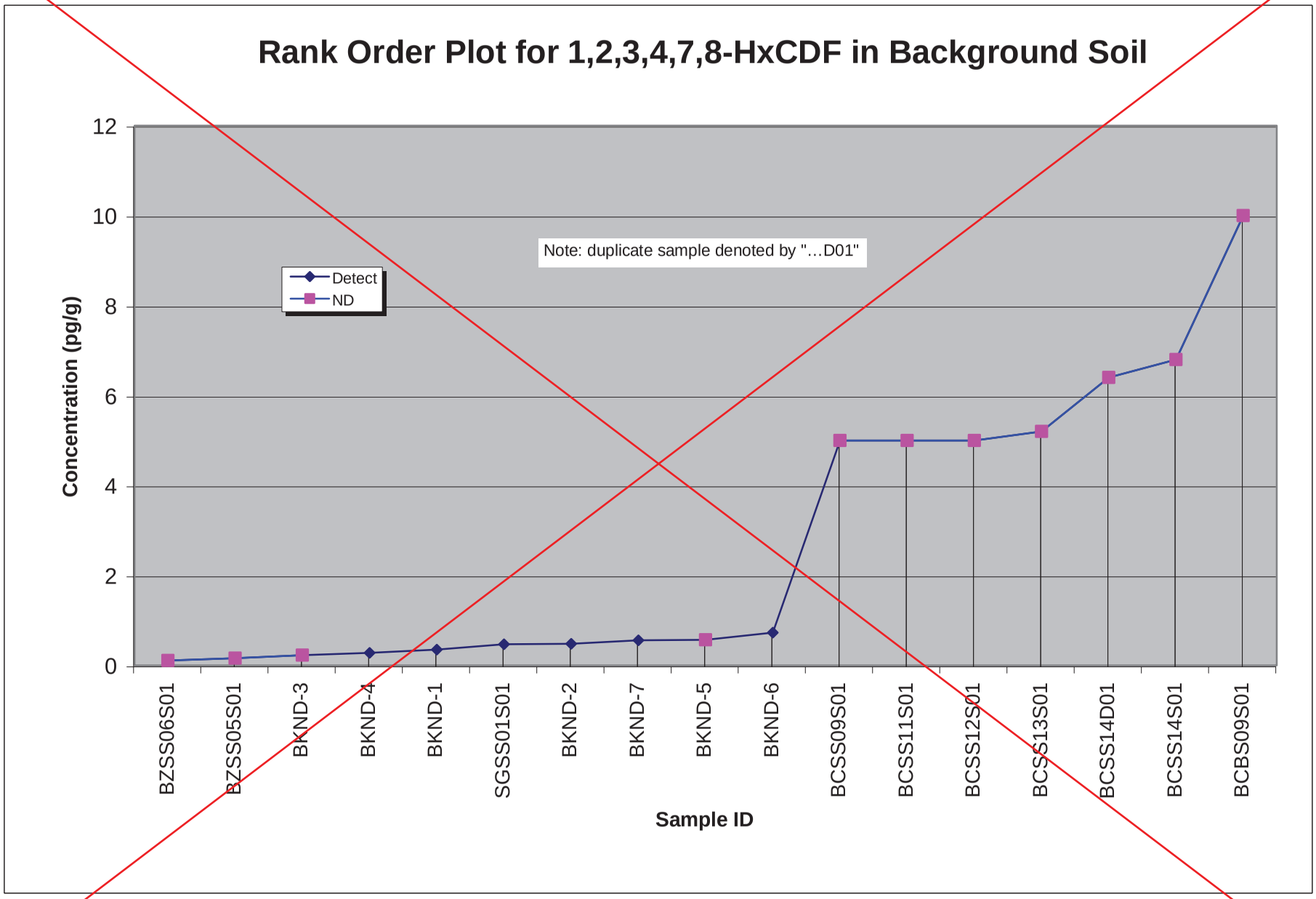

Rank Order Plot for 1,2,3,7,8-PeCDF in Background Soil
Concentration (pg/g)
0
2
4
6
8
10
12
Detect
ND
Note: duplicate sample denoted by "…D01"
BZSS05S01
BKND-1
SGSS01S01
BZSS06S01
BKND-4
BKND-7
BKND-2
BKND-5
BKND-3
BKND-6
BCSS09S01
BCSS11S01
BCSS12S01
BCSS13S01
BCSS14D01
BCSS14S01
BCBS09S01
Sample ID

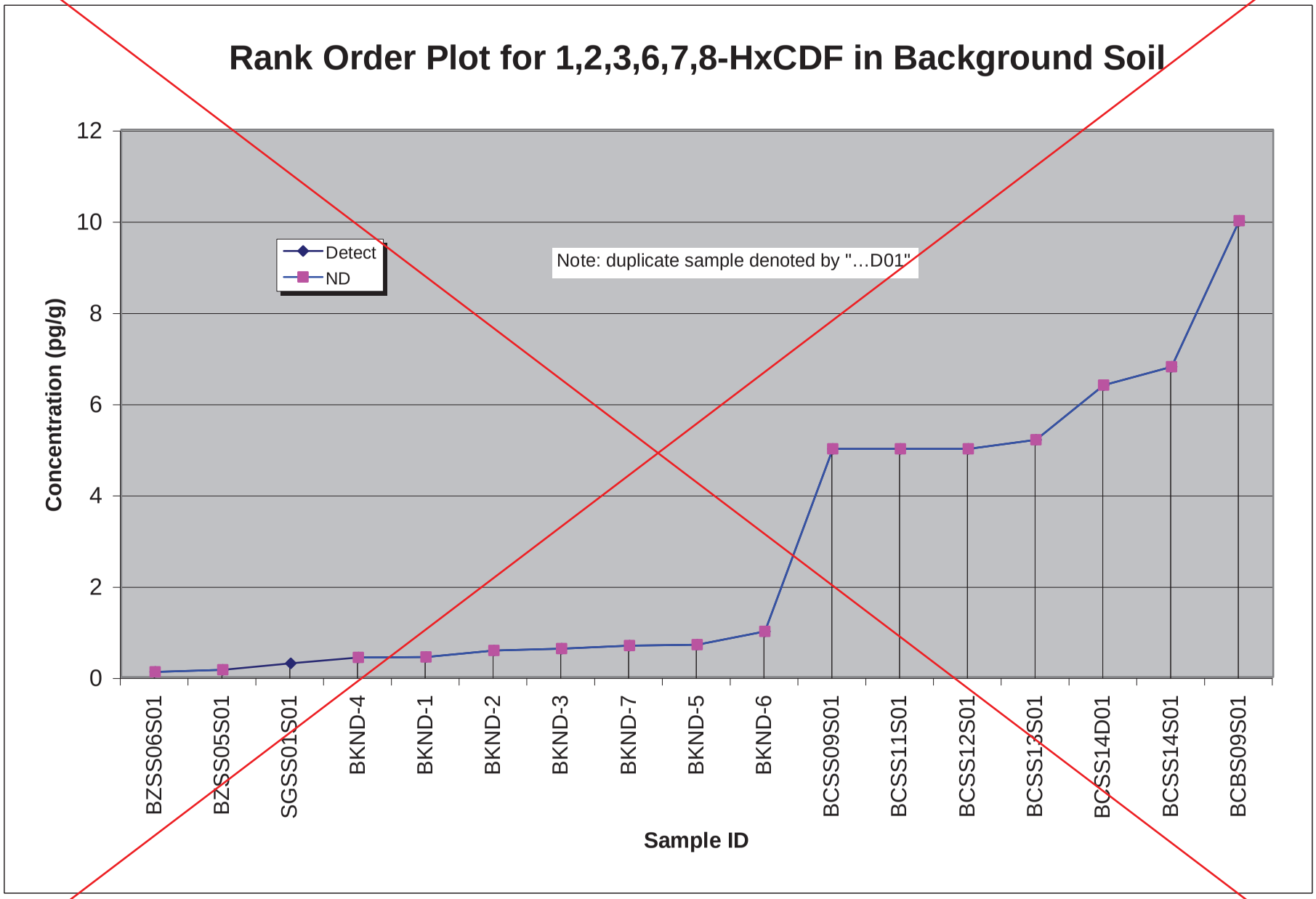

Rank Order Plot for 2,3,4,7,8-PeCDF in Background Soil
Concentration (pg/g)
12
10
8
6
4
2
0
Detect
ND
Note: duplicate sample denoted by "...D01"
BKND-4
BZSS05S01
BKND-3
BZSS06S01
BKND-1
BKND-2
BKND-5
BKND-7
SGSS01S01
BKND-6
BCSS09S01
BCSS11S01
BCSS12S01
BCSS13S01
BCSS14D01
BCSS14S01
BCBS09S01
Sample ID

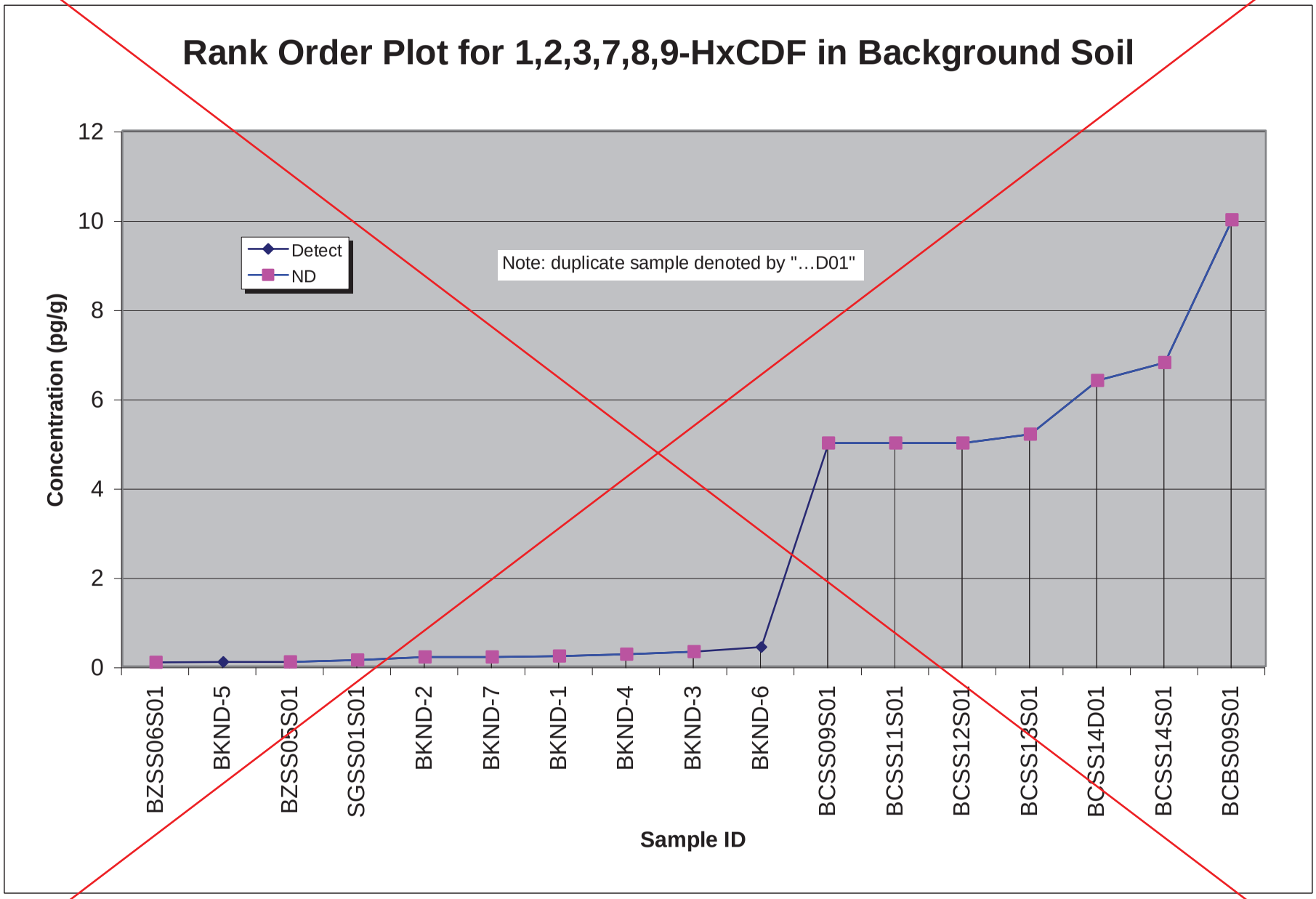

Rank Order Plot for 1,2,3,4,7,8-HxCDD in Background Soil
Concentration (pg/g)
12
10
8
6
4
2
0
Note: duplicate sample denoted by "…D01"
Detect
ND
BKND-4
BZSS05S01
BKND-5
BKND-3
BKND-7
BZSS06S01
BKND-2
SGSS01S01
BKND-1
BKND-6
BCSS09S01
BCSS11S01
BCSS12S01
BCSS13S01
BCSS14D01
BCSS14S01
BCBS09S01
Sample ID

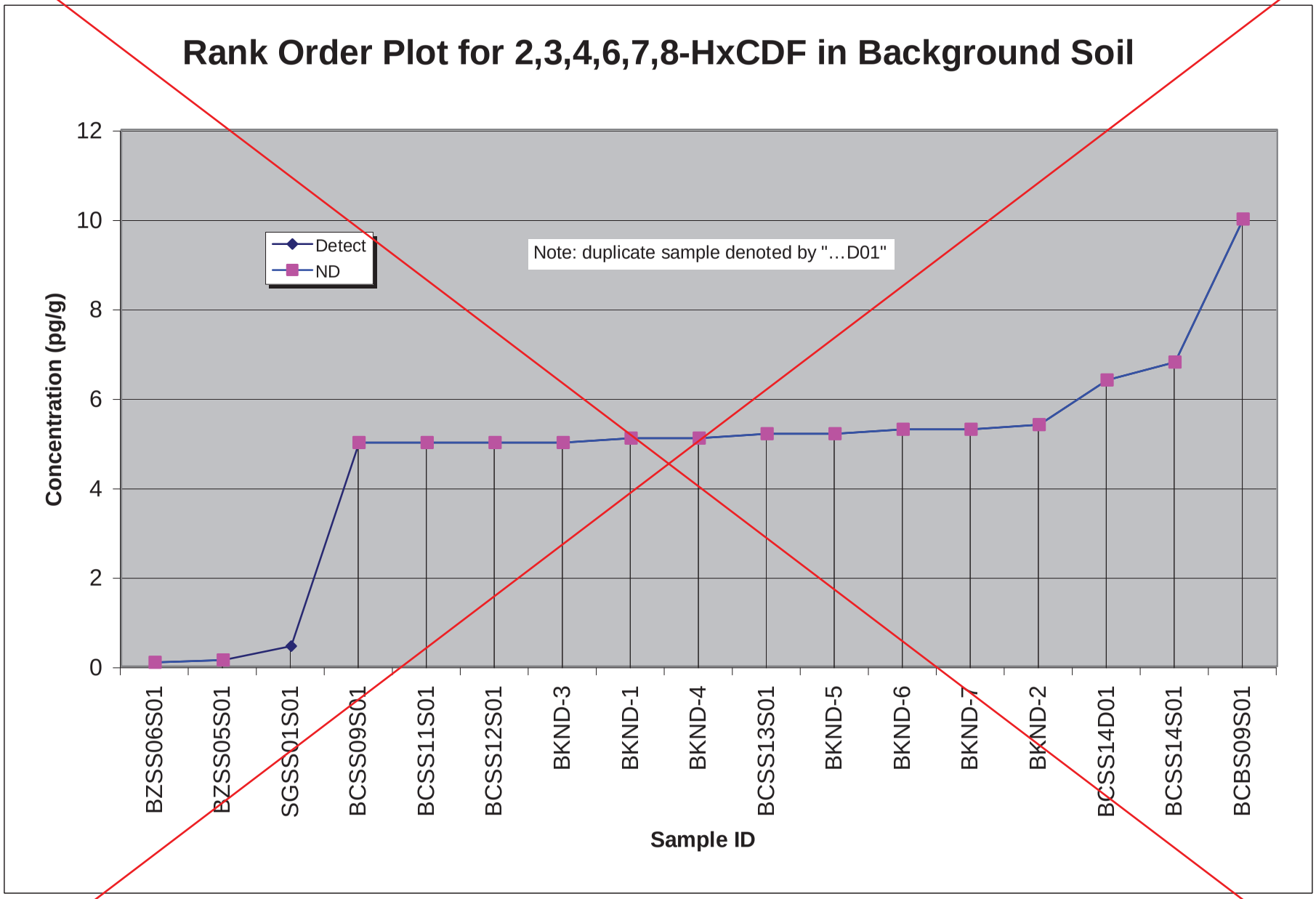

Rank Order Plot for 1,2,3,6,7,8-HxCDD in Background Soil
Note: duplicate sample denoted by "…D01"
Detect
ND
Concentration (pg/g)
0
2
4
6
8
10
12
BZSS06S01
BKND-1
BKND-3
BKND-4
BKND-2
BKND-5
BKND-7
SGSS01S01
BZSS05S01
BKND-6
BCSS09S01
BCSS11S01
BCSS12S01
BCSS13S01
BCSS14D01
BCSS14S01
BCBS09S01
Sample ID

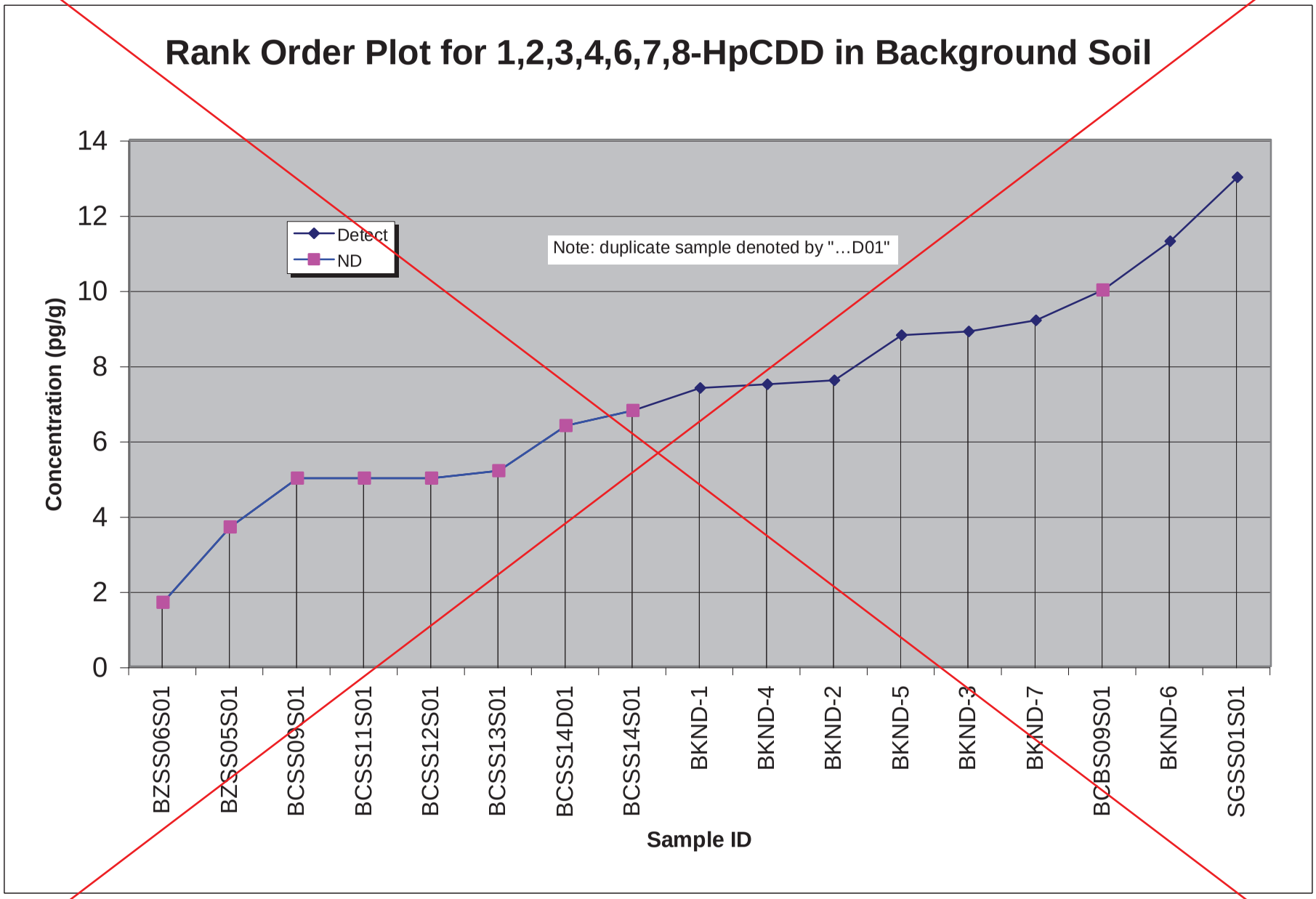

Rank Order Plot for 1,2,3,7,8,9-HxCDD in Background Soil
Note: duplicate sample denoted by "…D01"
Detect
ND
Concentration (pg/g)
0
2
4
6
8
10
12
BZSS06S01
BKND-1
BKND-4
SGSS01S01
BKND-3
BKND-5
BKND-2
BKND-7
BZSS05S01
BKND-6
BCSS09S01
BCSS11S01
BCSS12S01
BCSS13S01
BCSS14D01
BCSS14S01
BCBS09S01
Sample ID

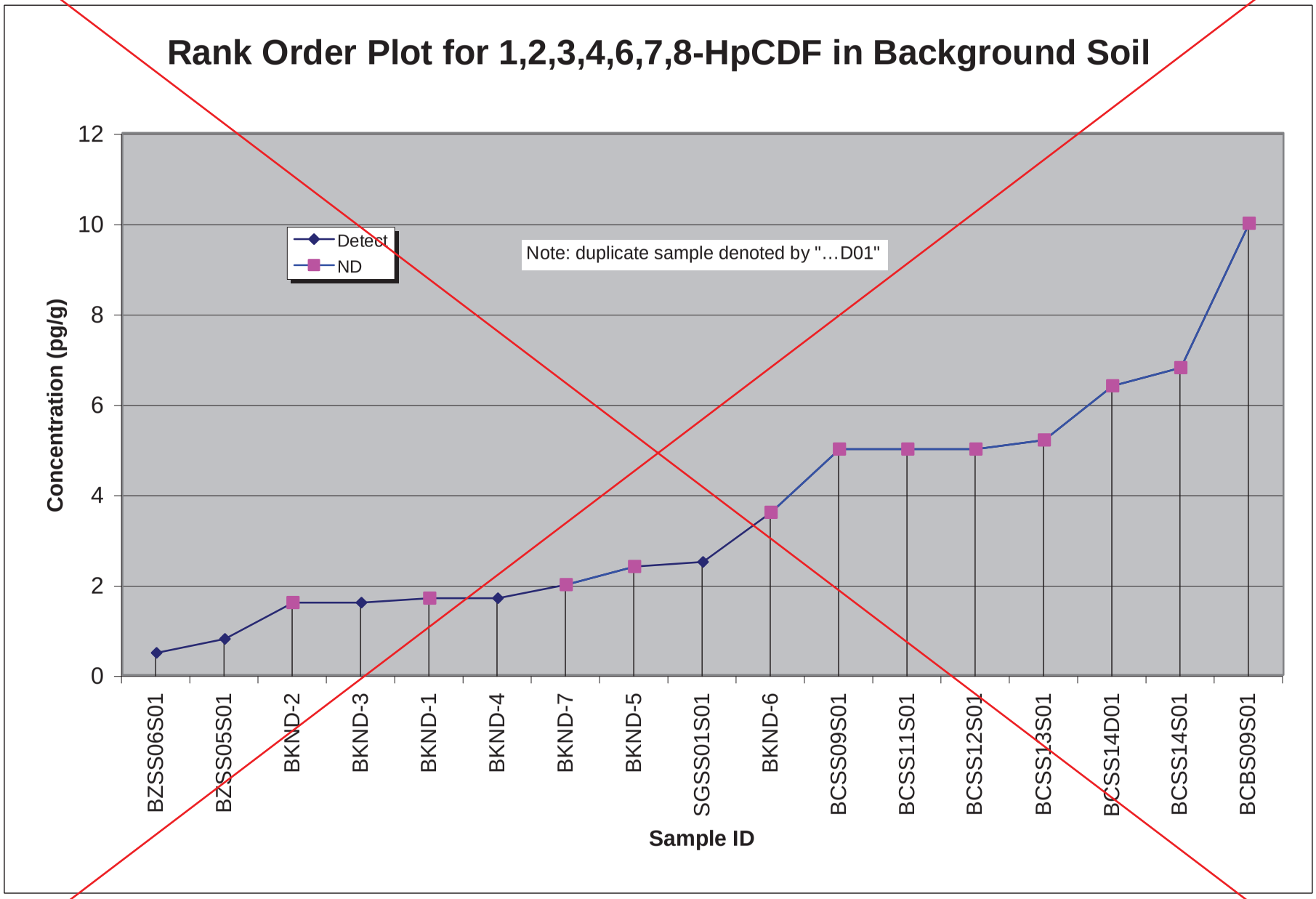

Rank Order Plot for 1,2,3,4,7,8-HxCDF in Background Soil
Concentration (pg/g)
0
2
4
6
8
10
12
Note: duplicate sample denoted by "…D01"
Detect
ND
BZSS06S01
BZSS05S01
BKND-3
BKND-4
BKND-1
SGSS01S01
BKND-2
BKND-7
BKND-5
BKND-6
BCSS09S01
BCSS11S01
BCSS12S01
BCSS13S01
BCSS14D01
BCSS14S01
BCBS09S01
Sample ID

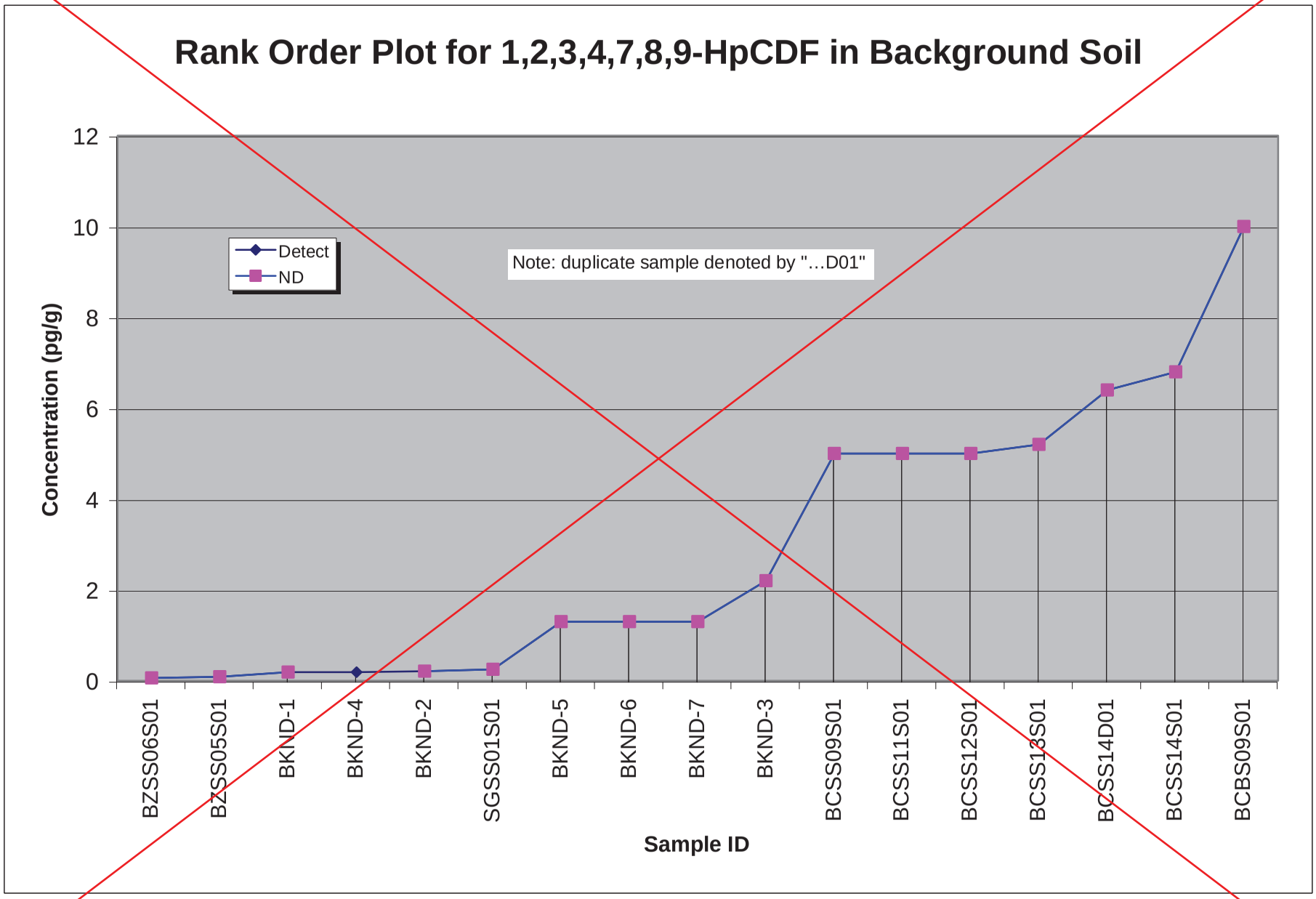

Rank Order Plot for 1,2,3,6,7,8-HxCDF in Background Soil
Concentration (pg/g)
12
10
8
6
4
2
0
Detect
ND
Note: duplicate sample denoted by "…D01"
BZSS06S01
BZSS05S01
SGSS01S01
BKND-4
BKND-1
BKND-2
BKND-3
BKND-7
BKND-5
BKND-6
BCSS09S01
BCSS11S01
BCSS12S01
BCSS13S01
BCSS14D01
BCSS14S01
BCBS09S01
Sample ID

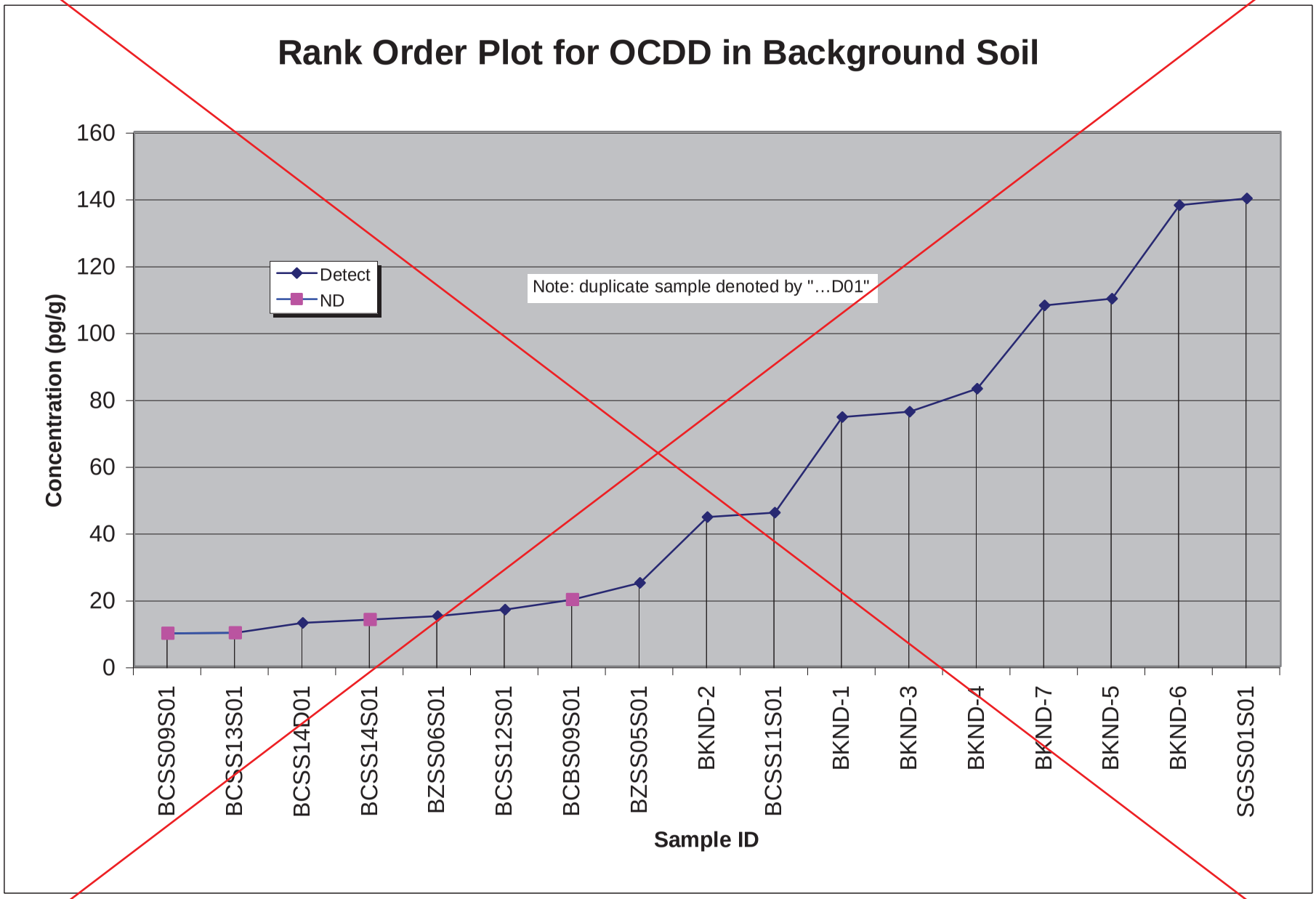

Rank Order Plot for 1,2,3,7,8,9-HxCDF in Background Soil
Concentration (pg/g)
12
10
8
6
4
2
0
Detect
ND
Note: duplicate sample denoted by "…D01"
BZSS06S01
BKND-5
BZSS05S01
SGSS01S01
BKND-2
BKND-7
BKND-1
BKND-4
BKND-3
BKND-6
BCSS09S01
BCSS11S01
BCSS12S01
BCSS13S01
BCSS14D01
BCSS14S01
BCBS09S01
Sample ID

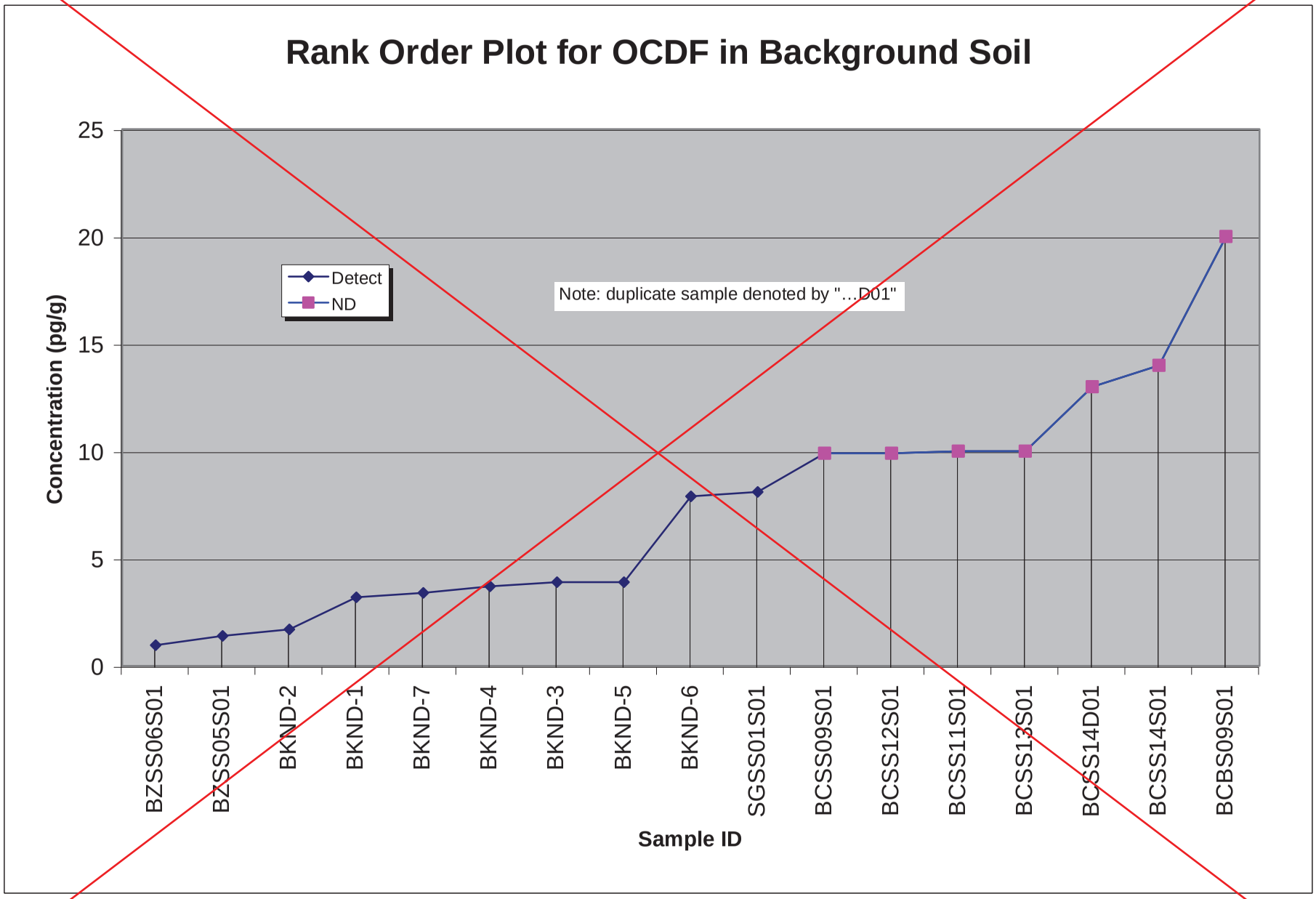

Rank Order Plot for 2,3,4,6,7,8-HxCDF in Background Soil
Concentration (pg/g)
0
2
4
6
8
10
12
Detect
ND
Note: duplicate sample denoted by "…D01"
BZSS06S01
BZSS05S01
SGSS01S01
BCSS09S01
BCSS11S01
BCSS12S01
BKND-3
BKND-1
BKND-4
BCSS13S01
BKND-5
BKND-6
BKND-7
BKND-2
BCSS14D01
BCSS14S01
BCBS09S01
Sample ID

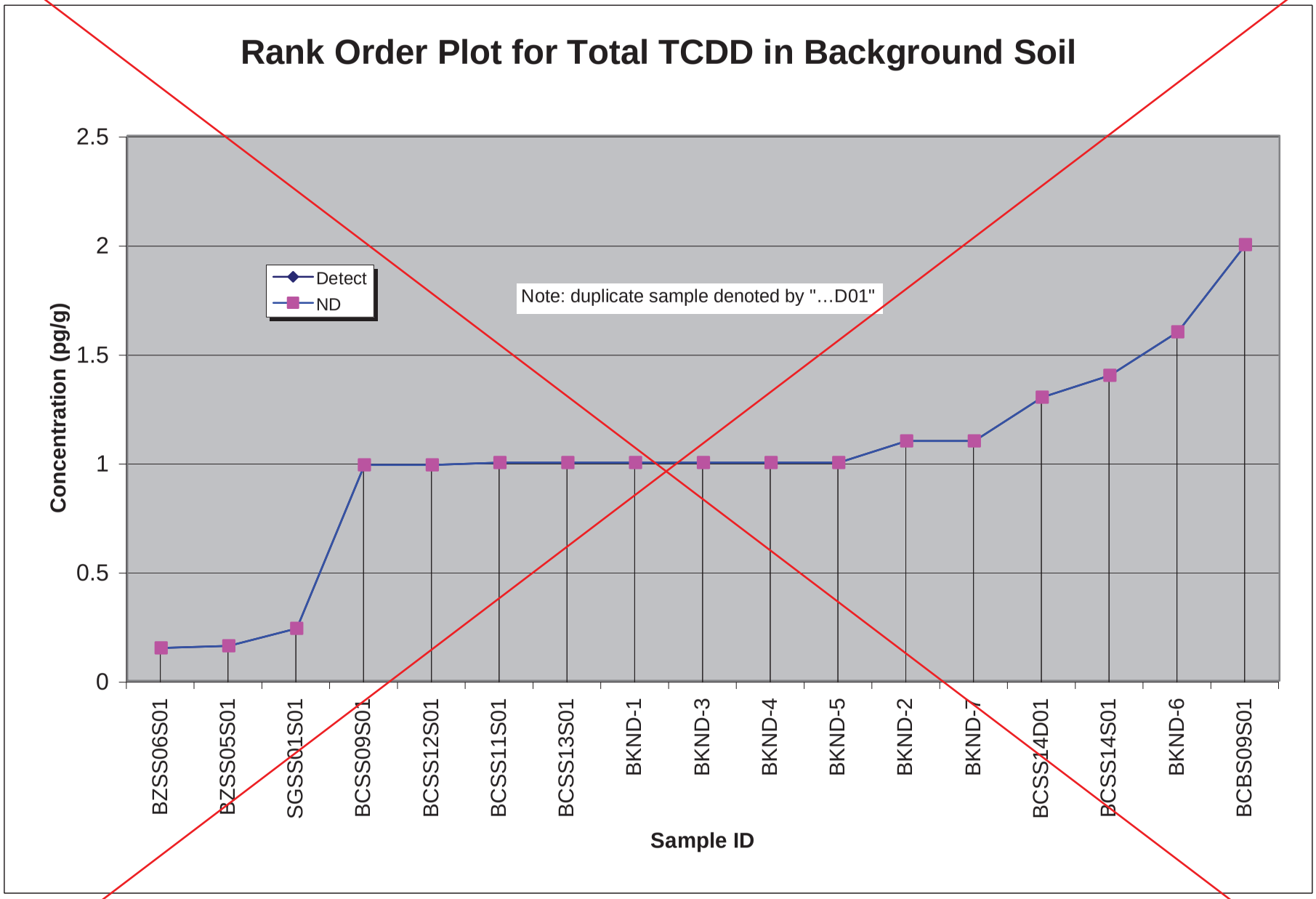

Rank Order Plot for 1,2,3,4,6,7,8-HpCDD in Background Soil
Concentration (pg/g)
0
2
4
6
8
10
12
14
Detect
ND
Note: duplicate sample denoted by "…D01"
BZSS06S01
BZSS05S01
BCSS09S01
BCSS11S01
BCSS12S01
BCSS13S01
BCSS14D01
BCSS14S01
BKND-1
BKND-4
BKND-2
BKND-5
BKND-3
BKND-7
BCBS09S01
BKND-6
SGSS01S01
Sample ID

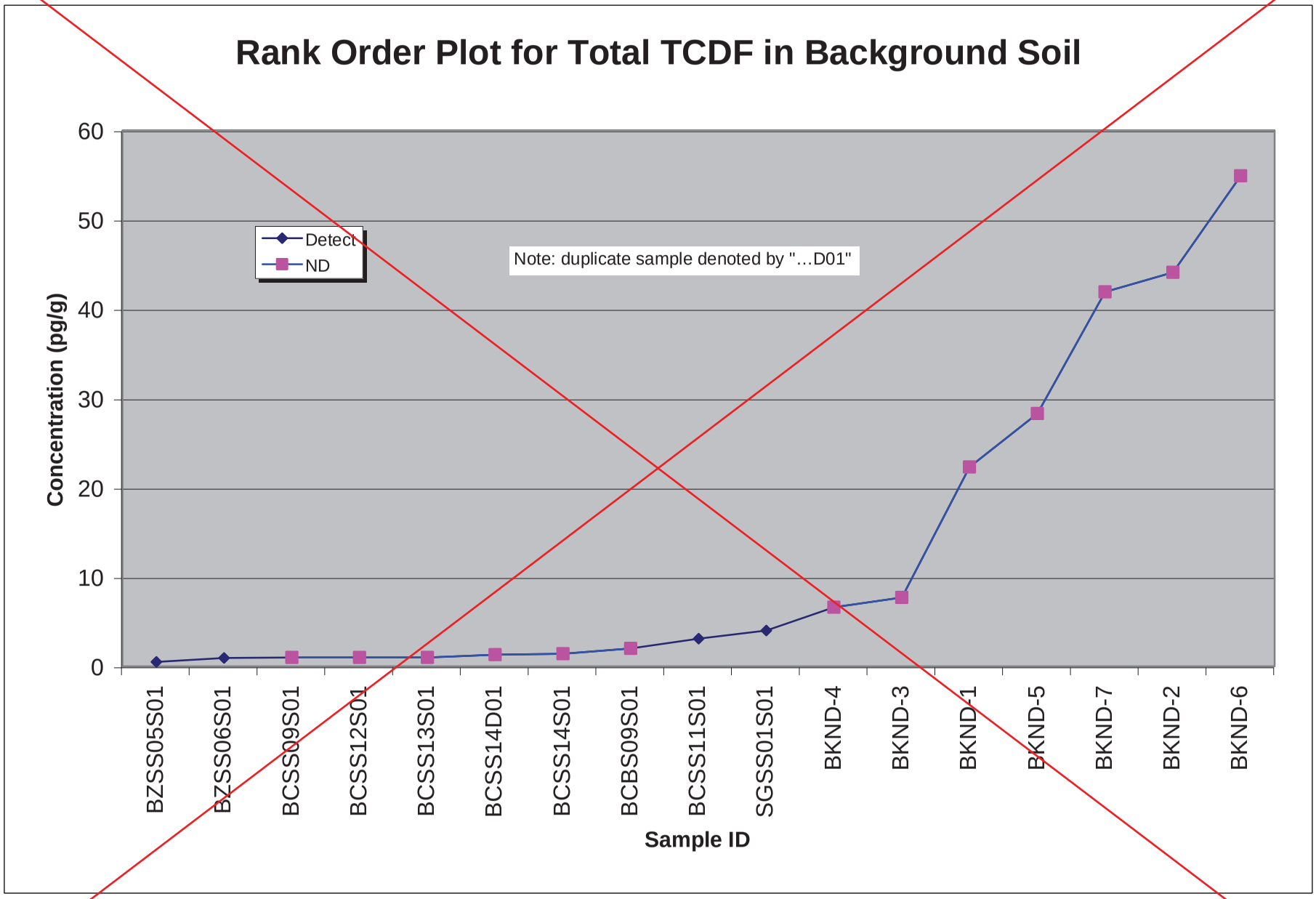

Rank Order Plot for 1,2,3,4,6,7,8-HpCDF in Background Soil
Concentration (pg/g)
0
2
4
6
8
10
12
Detect
ND
Note: duplicate sample denoted by "…D01"
BZSS06S01
BZSS05S01
BKND-2
BKND-3
BKND-1
BKND-4
BKND-7
BKND-5
SGSS01S01
BKND-6
BCSS09S01
BCSS11S01
BCSS12S01
BCSS13S01
BCSS14D01
BCSS14S01
BCBS09S01
Sample ID

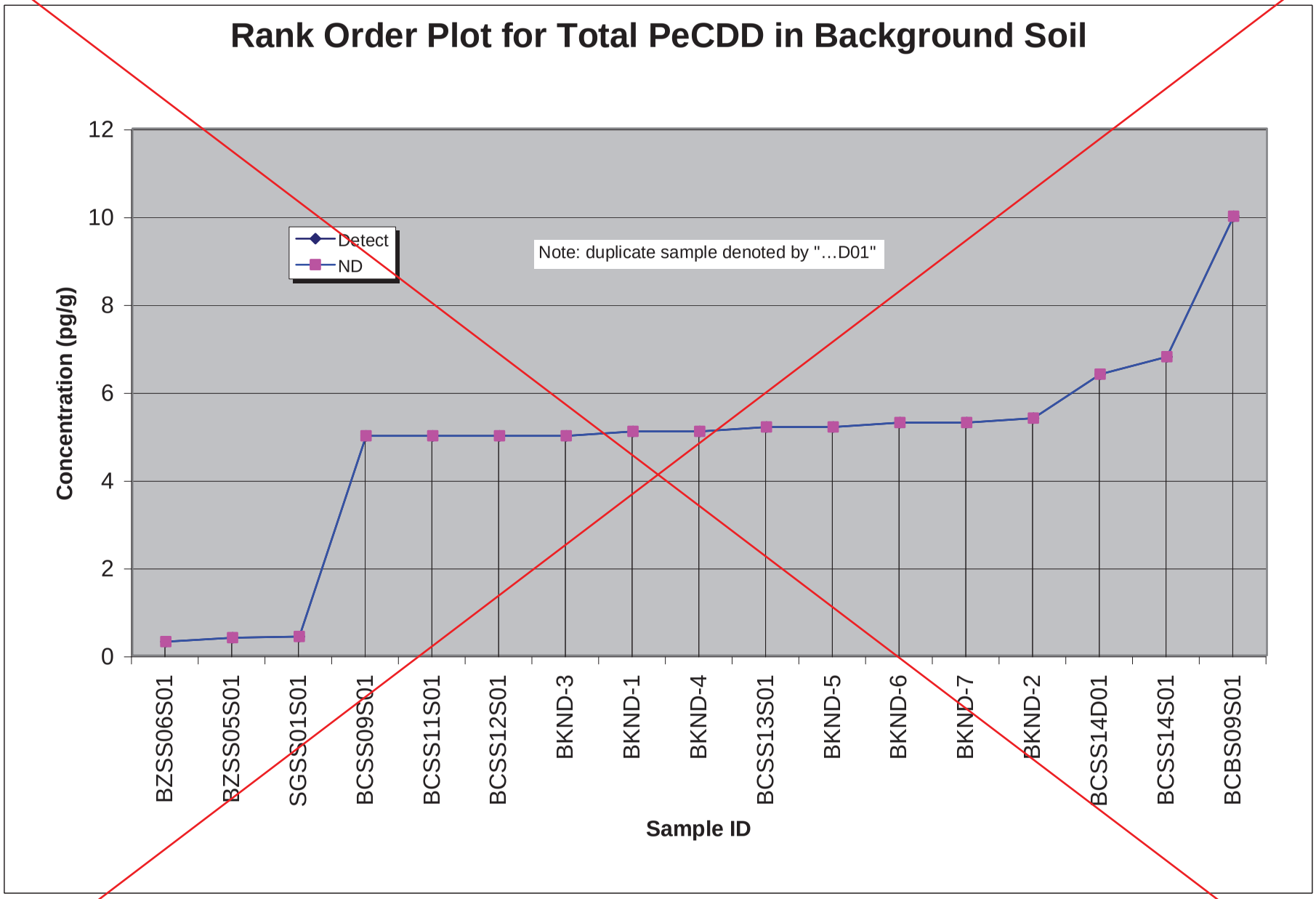

Rank Order Plot for 1,2,3,4,7,8,9-HpCDF in Background Soil
Concentration (pg/g)
0
2
4
6
8
10
12
Detect
ND
Note: duplicate sample denoted by "…D01"
BZSS06S01
BZSS05S01
BKND-1
BKND-4
BKND-2
SGSS01S01
BKND-5
BKND-6
BKND-7
BKND-3
BCSS09S01
BCSS11S01
BCSS12S01
BCSS13S01
BCSS14D01
BCSS14S01
BCBS09S01
Sample ID

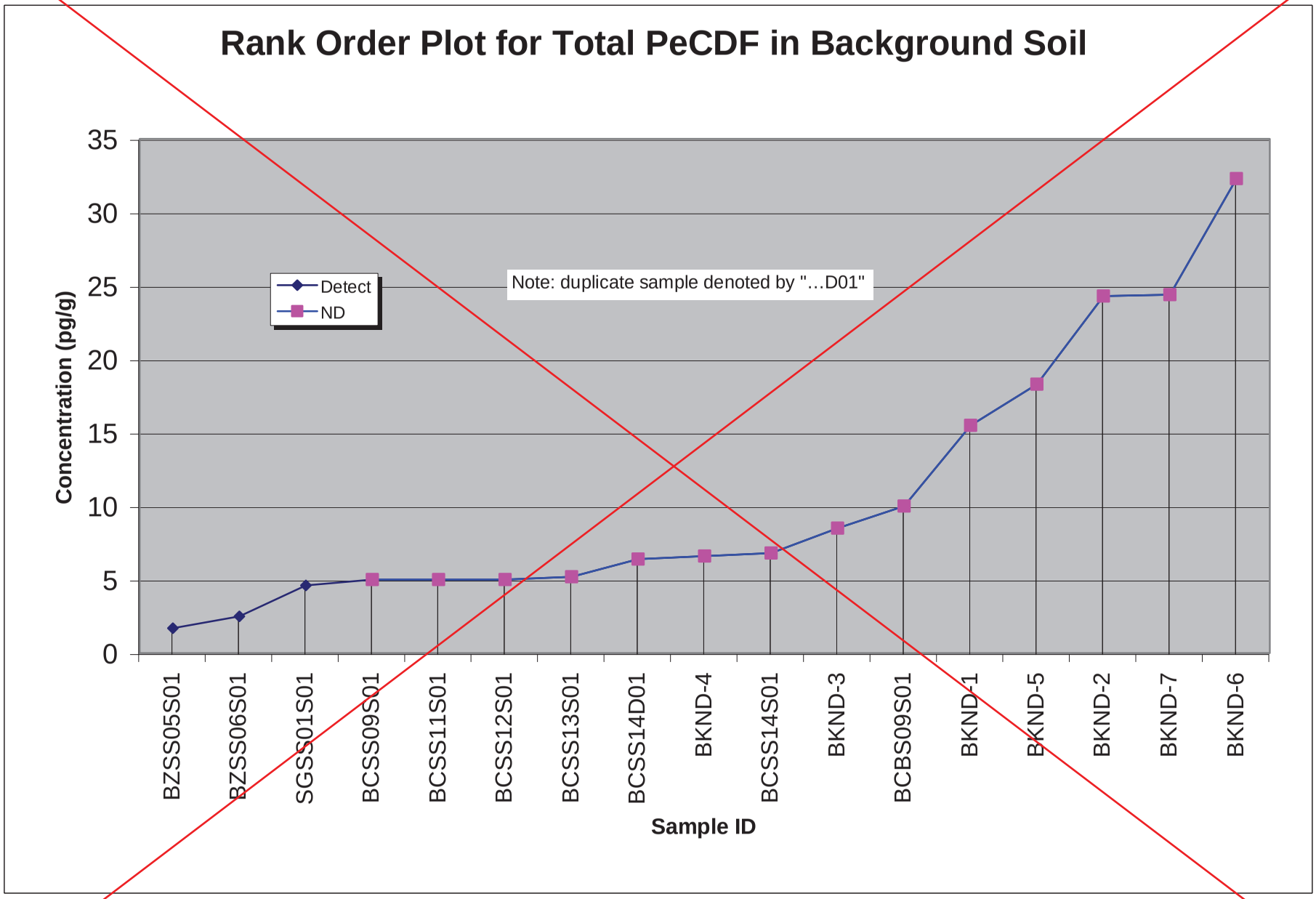

Rank Order Plot for OCDD in Background Soil
Concentration (pg/g)
160
140
120
100
80
60
40
20
0
Detect
ND
Note: duplicate sample denoted by "…D01"
BCSS09S01
BCSS13S01
BCSS14D01
BCSS14S01
BZSS06S01
BCSS12S01
BCBS09S01
BZSS05S01
BKND-2
BCSS11S01
BKND-1
BKND-3
BKND-4
BKND-7
BKND-5
BKND-6
SGSS01S01
Sample ID

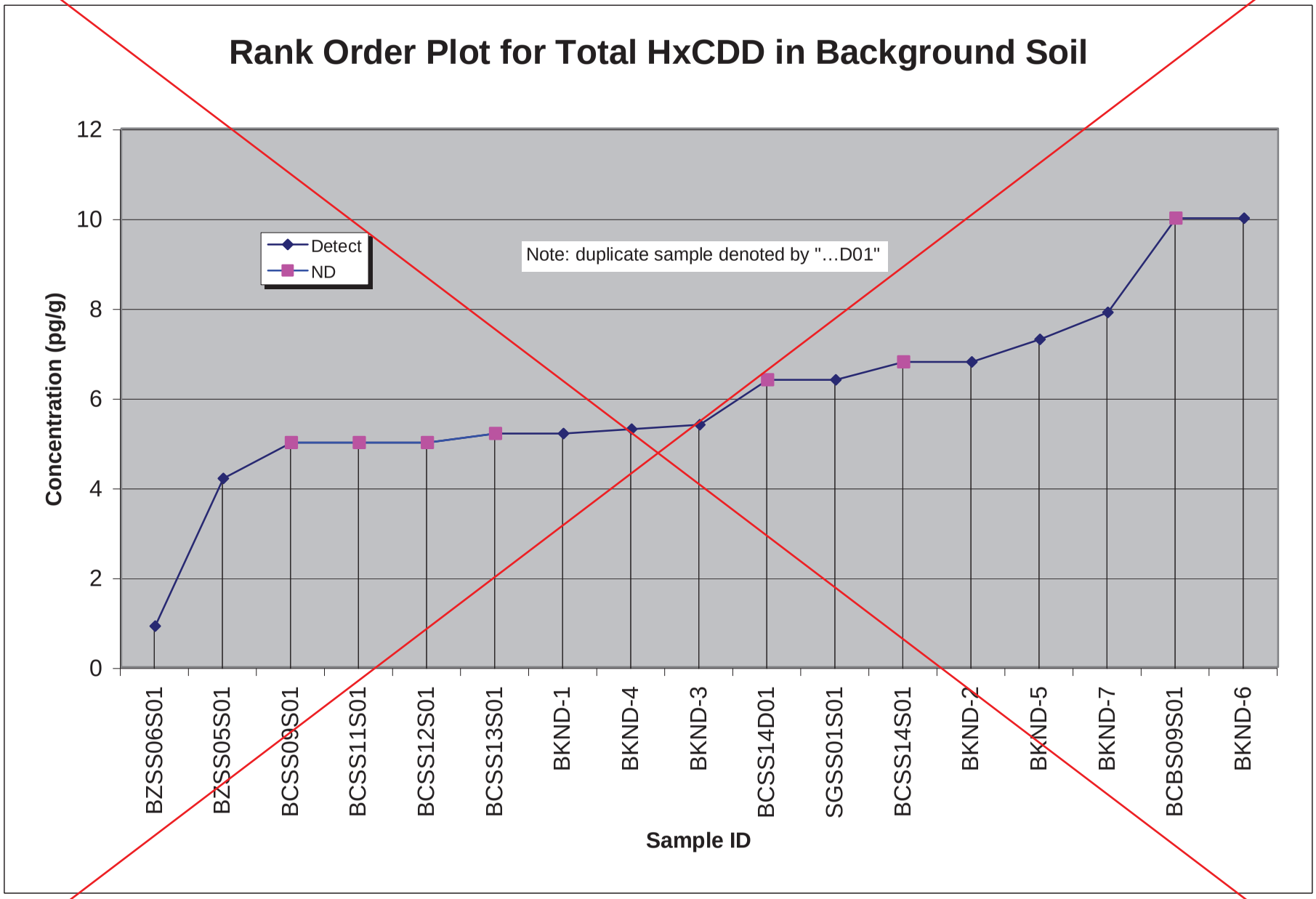

Rank Order Plot for OCDF in Background Soil
Concentration (pg/g)
25
20
15
10
5
0
Detect
ND
Note: duplicate sample denoted by "…D01"
BZSS06S01
BZSS05S01
BKND-2
BKND-1
BKND-7
BKND-4
BKND-3
BKND-5
BKND-6
SGSS01S01
BCSS09S01
BCSS12S01
BCSS11S01
BCSS13S01
BCSS14D01
BCSS14S01
BCBS09S01
Sample ID

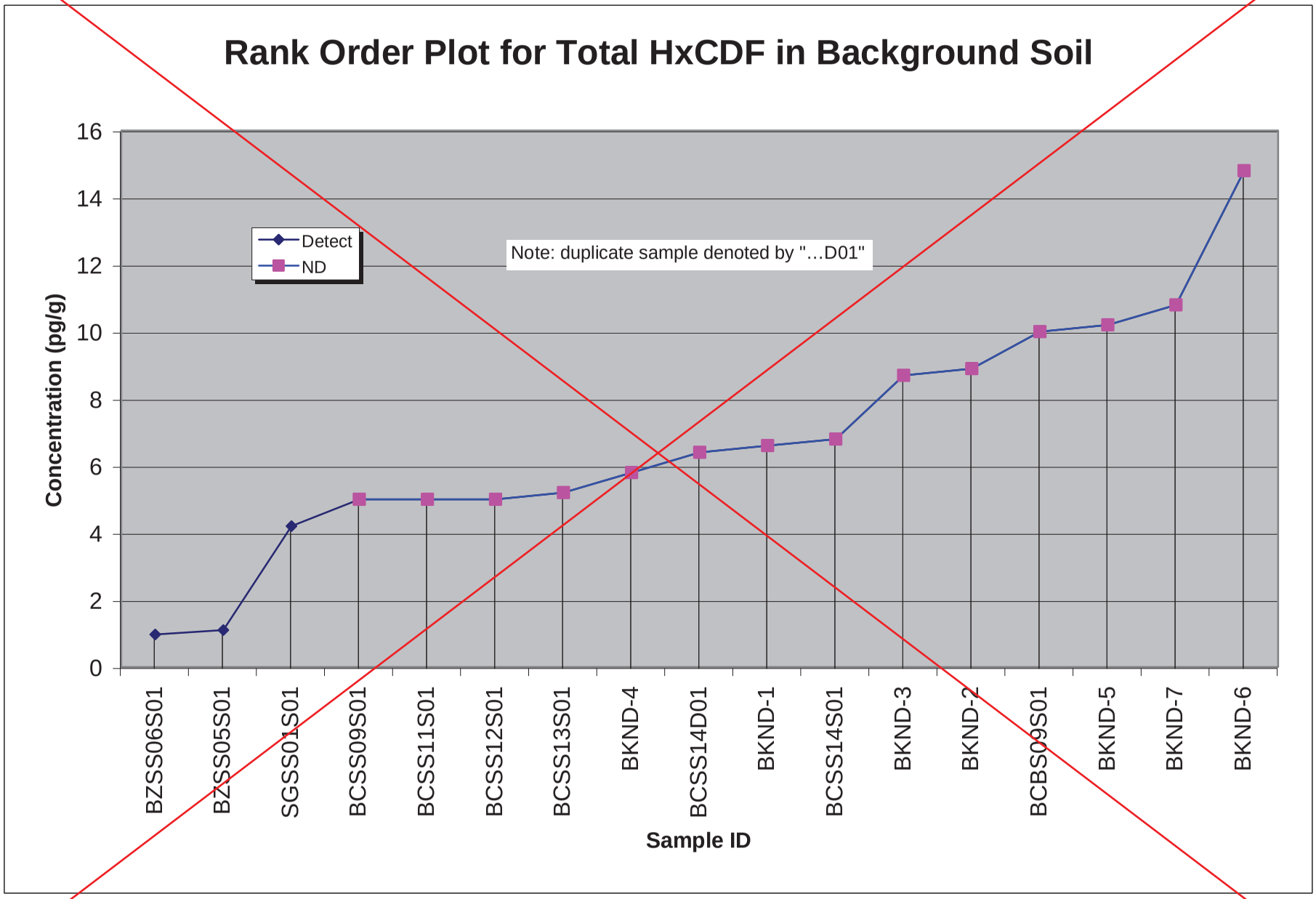

Rank Order Plot for Total TCDD in Background Soil
Concentration (pg/g)
2.5
2
1.5
1
0.5
0
Detect
ND
Note: duplicate sample denoted by "…D01"
BZSS06S01
BZSS05S01
SGSS01S01
BCSS09S01
BCSS12S01
BCSS11S01
BCSS13S01
BKND-1
BKND-3
BKND-4
BKND-5
BKND-2
BKND-7
BCSS14D01
BCSS14S01
BKND-6
BCBS09S01
Sample ID

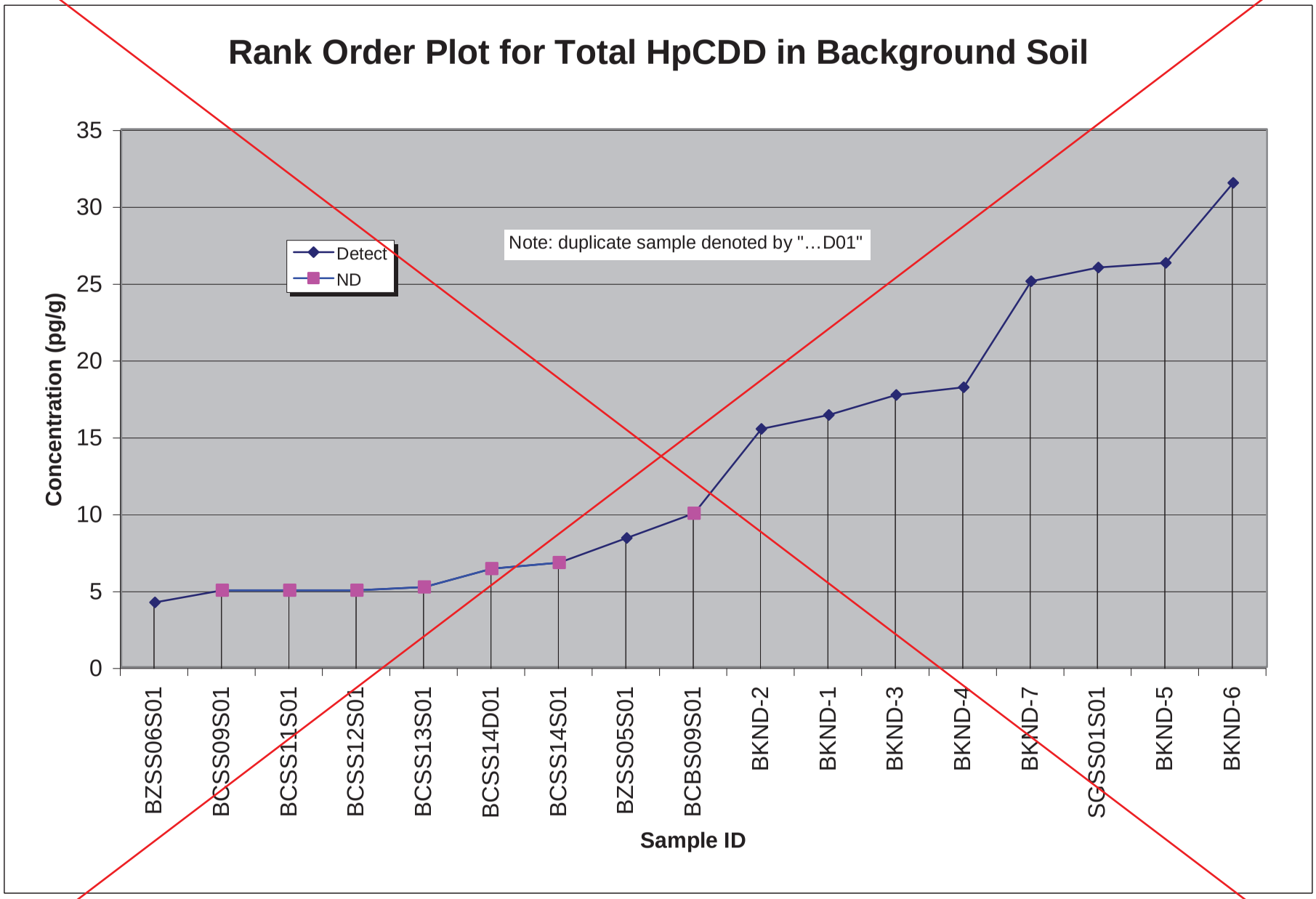

Rank Order Plot for Total TCDF in Background Soil
Concentration (pg/g)
60
50
40
30
20
10
0
Detect
ND
Note: duplicate sample denoted by "…D01"
BZSS05S01
BZSS06S01
BCSS09S01
BCSS12S01
BCSS13S01
BCSS14D01
BCSS14S01
BCBS09S01
BCSS11S01
SGSS01S01
BKND-4
BKND-3
BKND-1
BKND-5
BKND-7
BKND-2
BKND-6
Sample ID

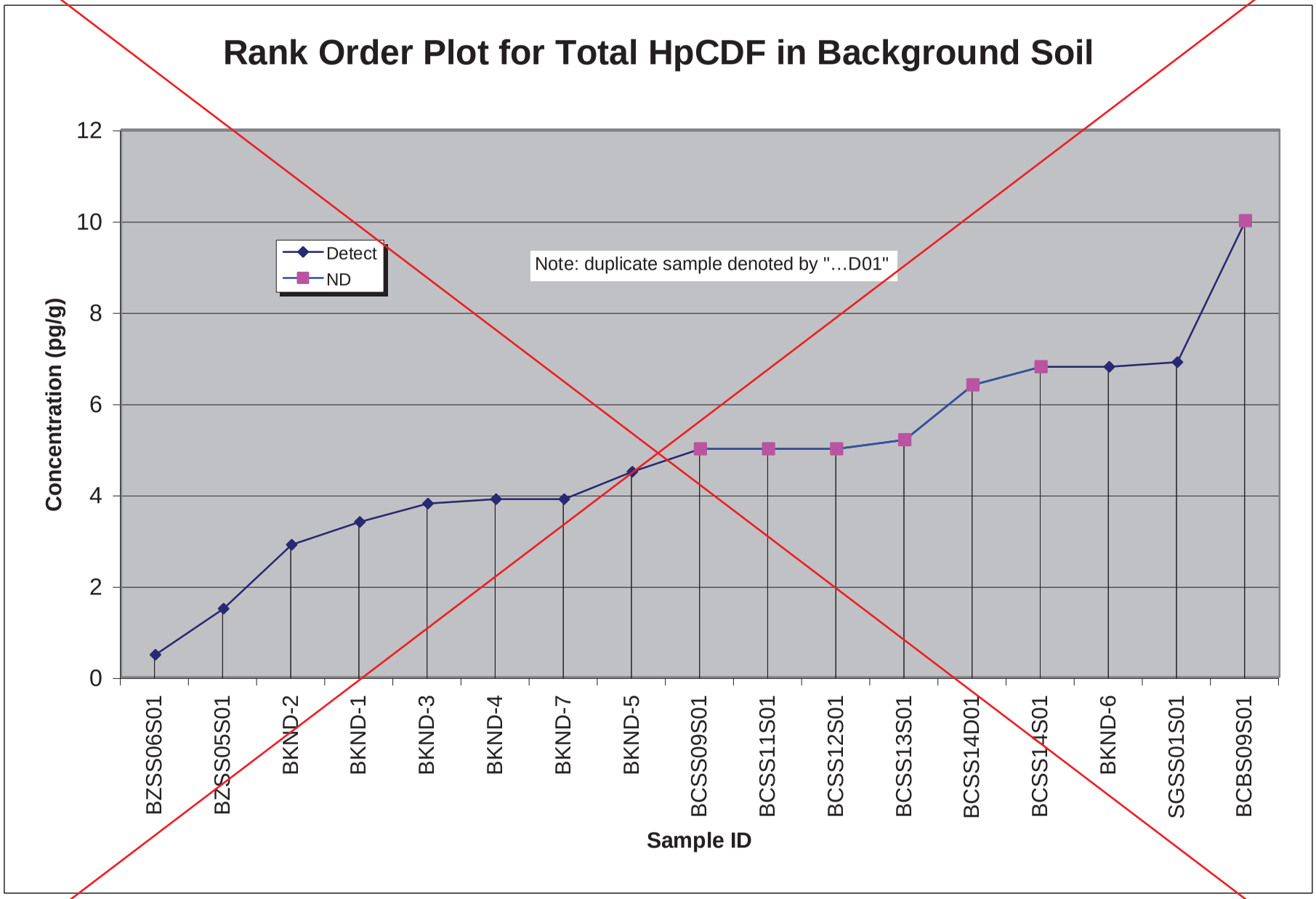

Rank Order Plot for Total PeCDD in Background Soil
Concentration (pg/g)
12
10
8
6
4
2
0
Detect
ND
Note: duplicate sample denoted by "…D01"
BZSS06S01
BZSS05S01
SGSS01S01
BCSS09S01
BCSS11S01
BCSS12S01
BKND-3
BKND-1
BKND-4
BCSS13S01
BKND-5
BKND-6
BKND-7
BKND-2
BCSS14D01
BCSS14S01
BCBS09S01
Sample ID


Rank Order Plot for Total PeCDF in Background Soil
Concentration (pg/g)
35
30
25
20
15
10
5
0
Detect
ND
Note: duplicate sample denoted by "…D01"
BZSS05S01
BZSS06S01
SGSS01S01
BCSS09S01
BCSS11S01
BCSS12S01
BCSS13S01
BCSS14D01
BKND-4
BCSS14S01
BKND-3
BCBS09S01
BKND-1
BKND-5
BKND-2
BKND-7
BKND-6
Sample ID

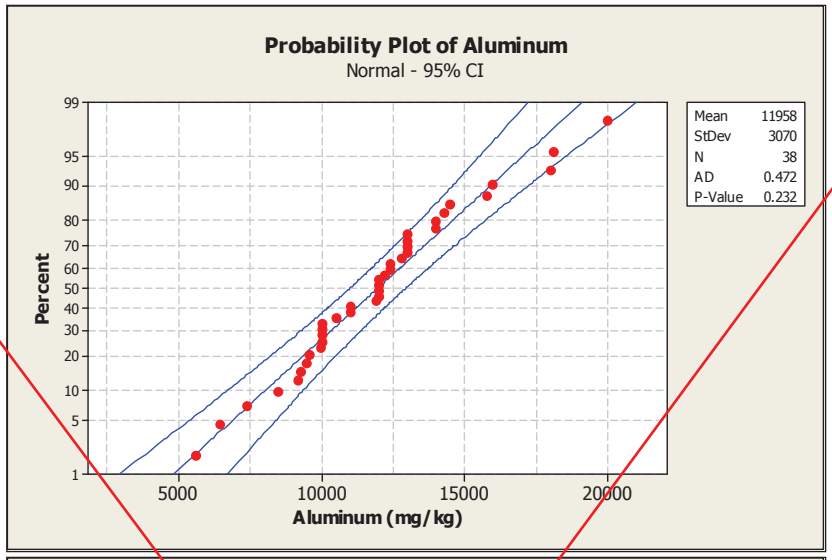

Rank Order Plot for Total HxCDD in Background Soil
Concentration (pg/g)
0
2
4
6
8
10
12
Detect
ND
Note: duplicate sample denoted by "…D01"
BZSS06S01
BZSS05S01
BCSS09S01
BCSS11S01
BCSS12S01
BCSS13S01
BKND-1
BKND-4
BKND-3
BCSS14D01
SGSS01S01
BCSS14S01
BKND-2
BKND-5
BKND-7
BCBS09S01
BKND-6
Sample ID

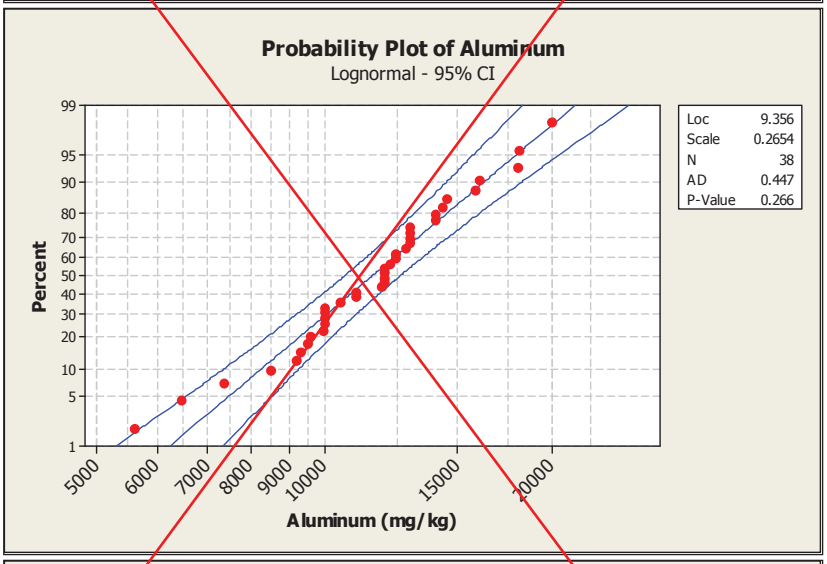

Rank Order Plot for Total HxCDF in Background Soil
Concentration (pg/g)
0
2
4
6
8
10
12
14
16
Detect
ND
Note: duplicate sample denoted by "…D01"
BZSS06S01
BZSS05S01
SGSS01S01
BCSS09S01
BCSS11S01
BCSS12S01
BCSS13S01
BKND-4
BCSS14D01
BKND-1
BCSS14S01
BKND-3
BKND-2
BCBS09S01
BKND-5
BKND-7
BKND-6
Sample ID

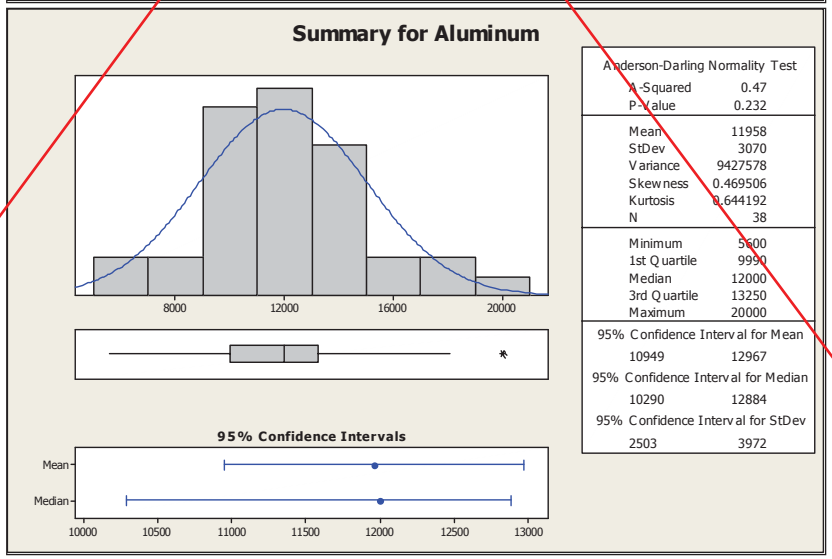

Rank Order Plot for Total HpCDD in Background Soil
Concentration (pg/g)
35
30
25
20
15
10
5
0
Detect
ND
Note: duplicate sample denoted by "…D01"
BZSS06S01
BCSS09S01
BCSS11S01
BCSS12S01
BCSS13S01
BCSS14D01
BCSS14S01
BZSS05S01
BCBS09S01
BKND-2
BKND-1
BKND-3
BKND-4
BKND-7
SGSS01S01
BKND-5
BKND-6
Sample ID


Rank Order Plot for Total HpCDF in Background Soil
Concentration (pg/g)
0
2
4
6
8
10
12
Detect
ND
Note: duplicate sample denoted by "…D01"
BZSS06S01
BZSS05S01
BKND-2
BKND-1
BKND-3
BKND-4
BKND-7
BKND-5
BCSS09S01
BCSS11S01
BCSS12S01
BCSS13S01
BCSS14D01
BCSS14S01
BKND-6
SGSS01S01
BCBS09S01
Sample ID

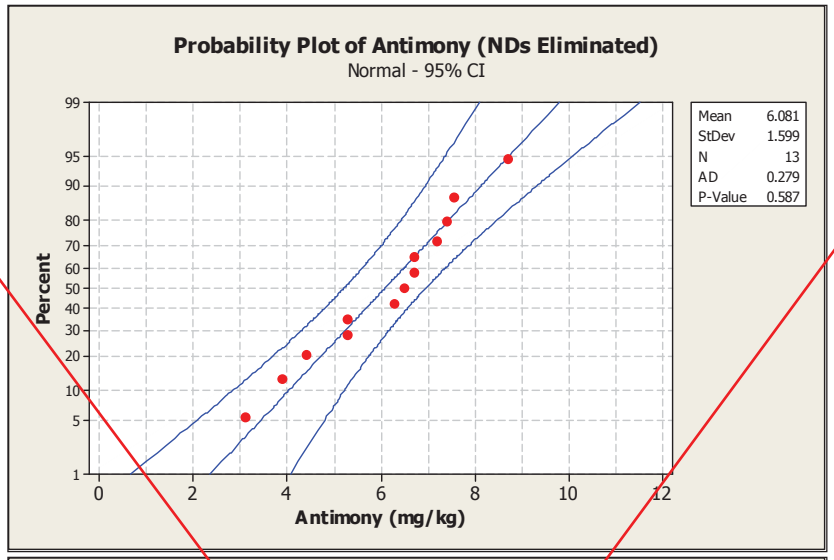
Aluminum
(Page 1 of 1)

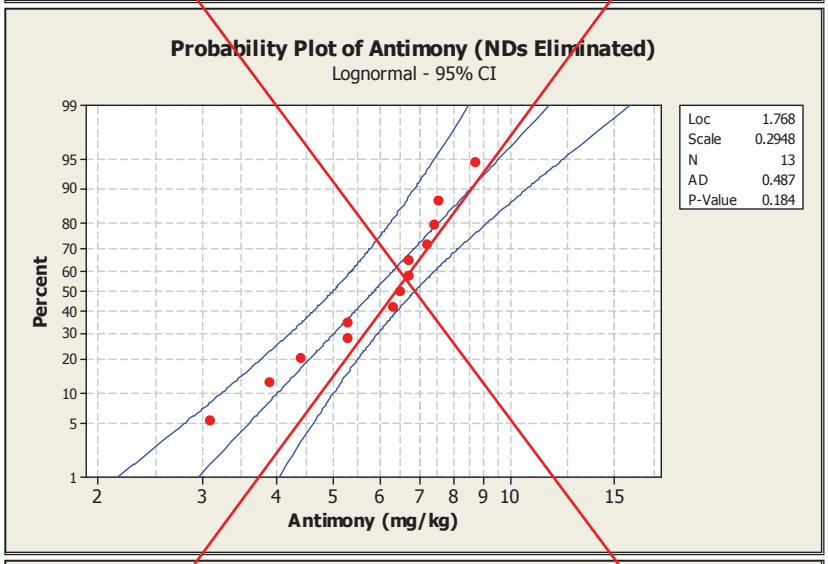


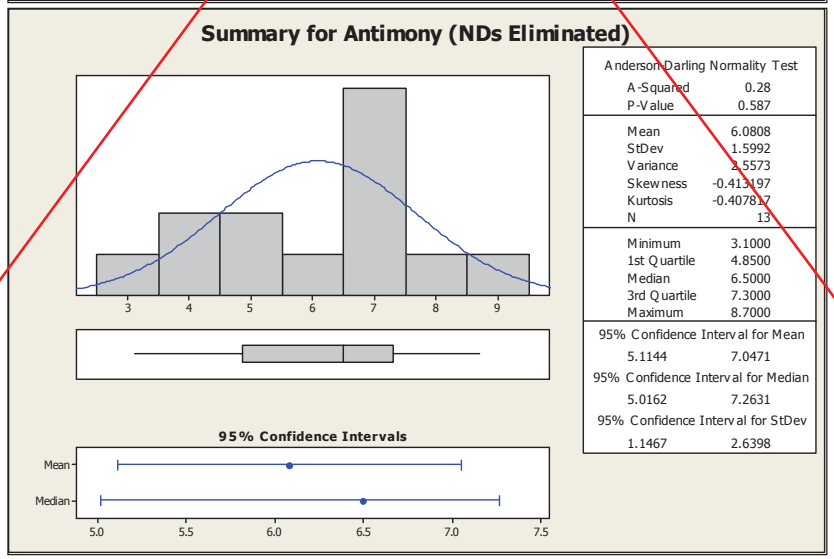




Antimony
(Page 1 of 3)







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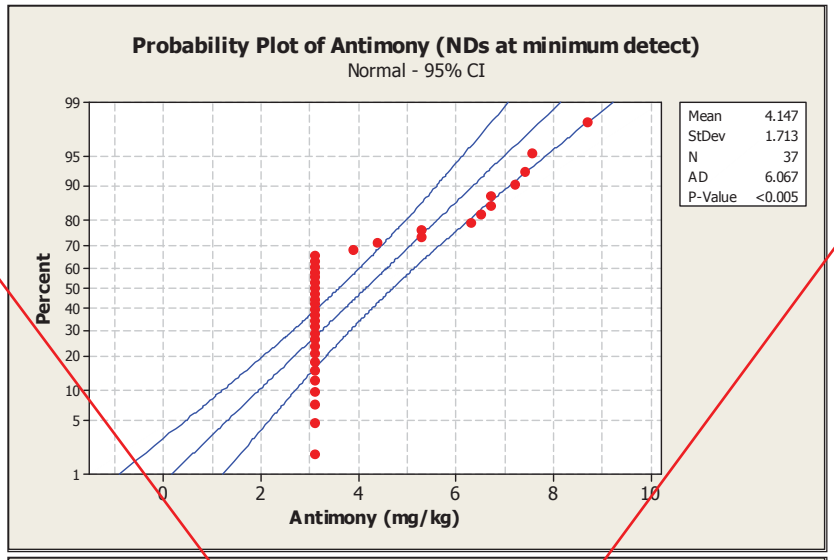

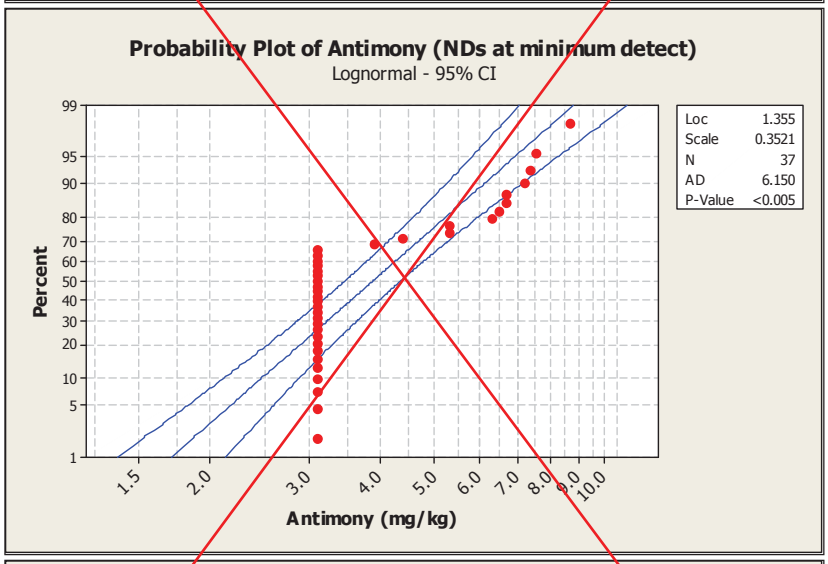

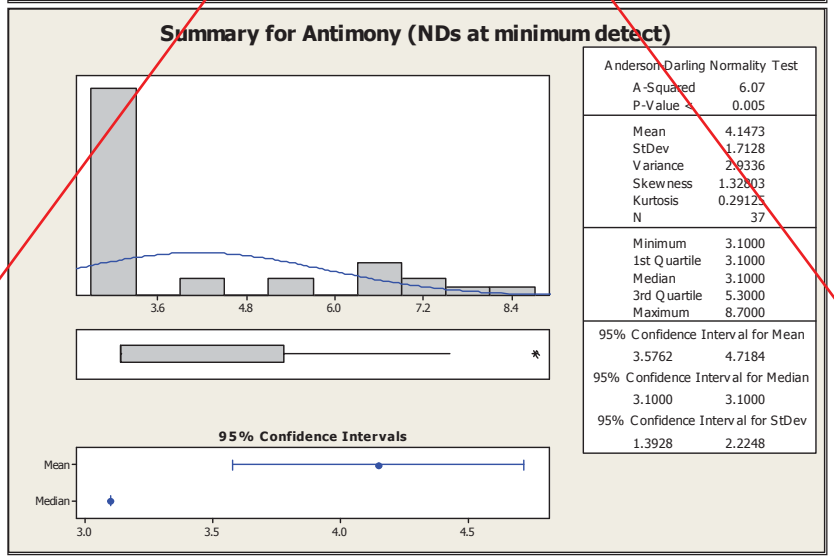

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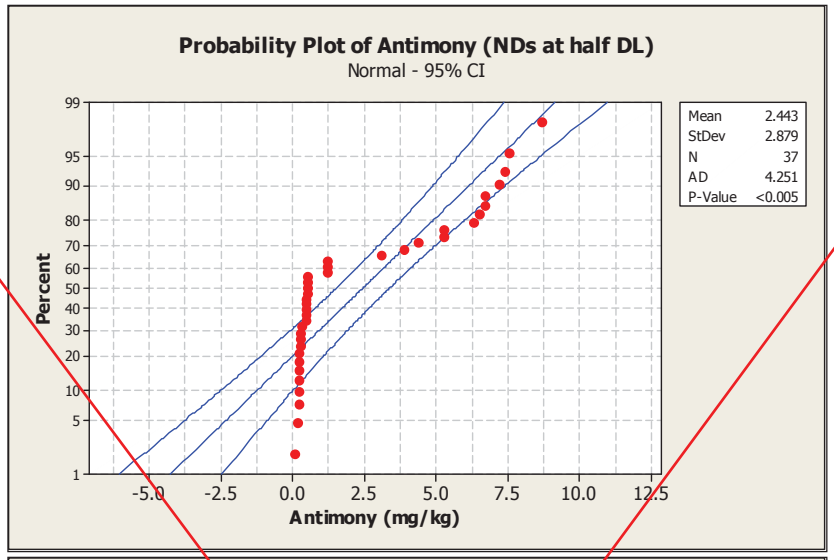

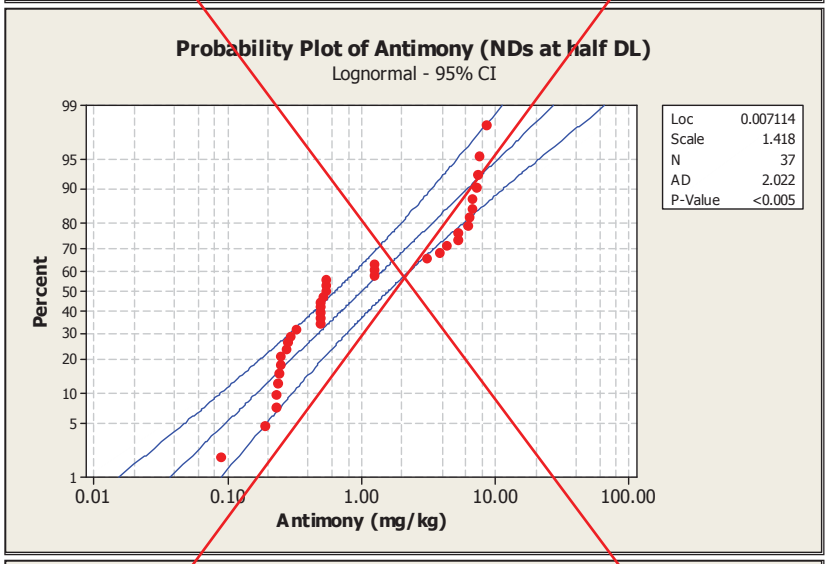

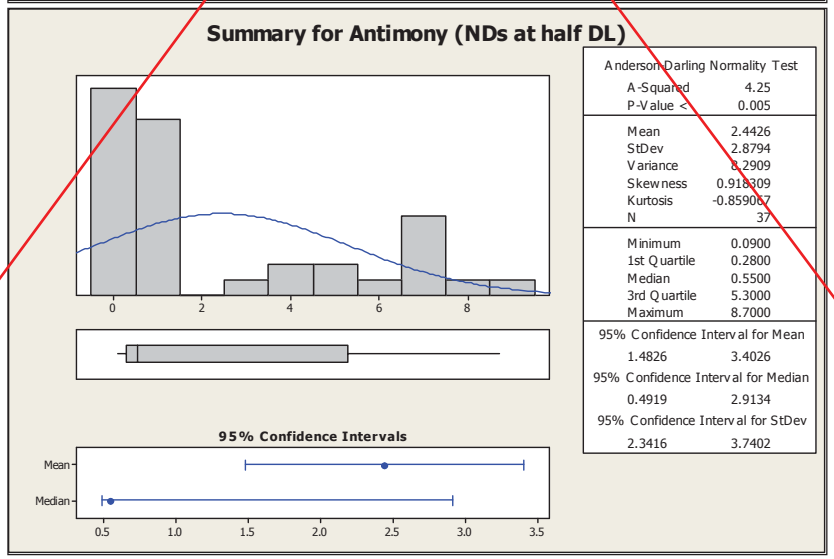

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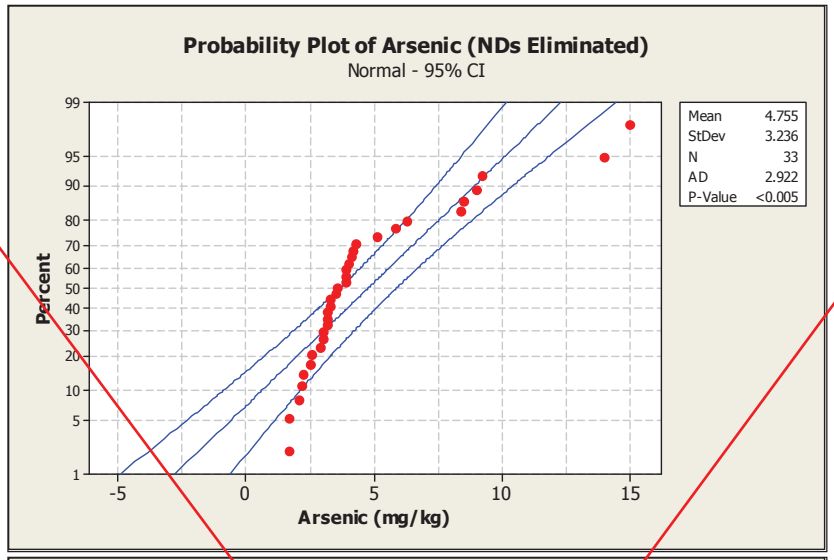

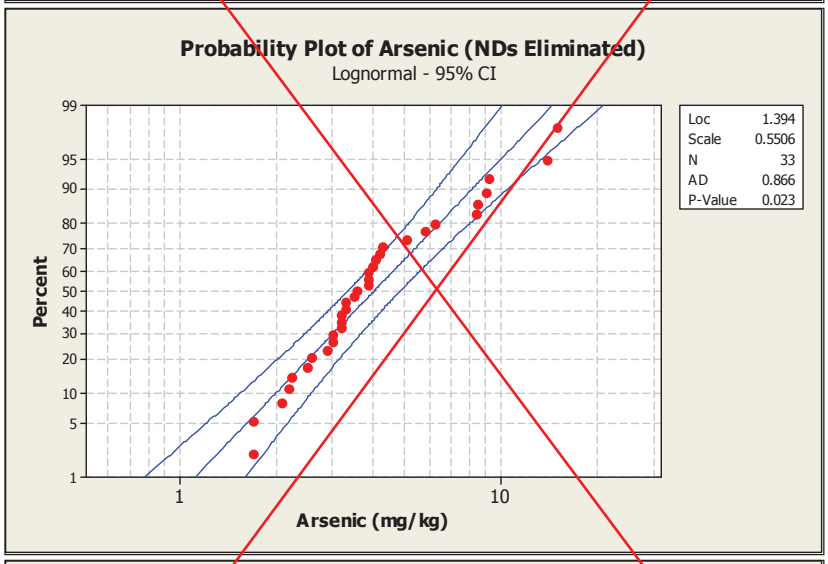

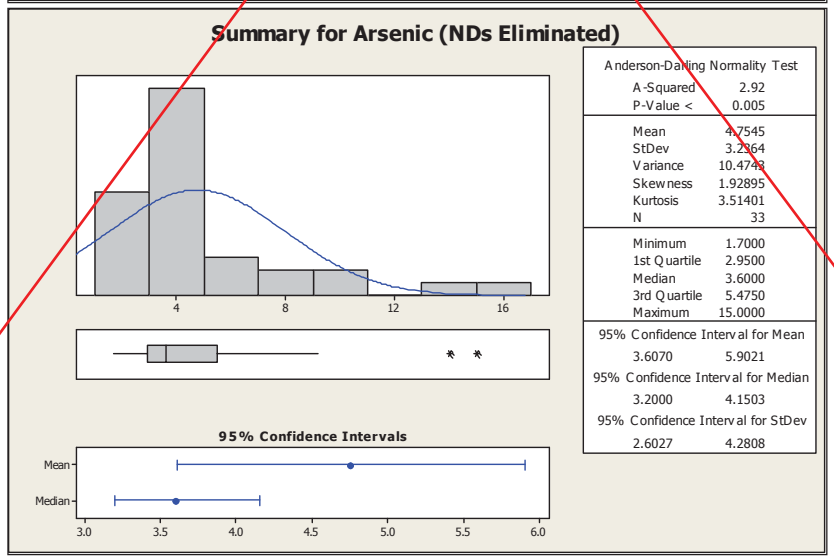

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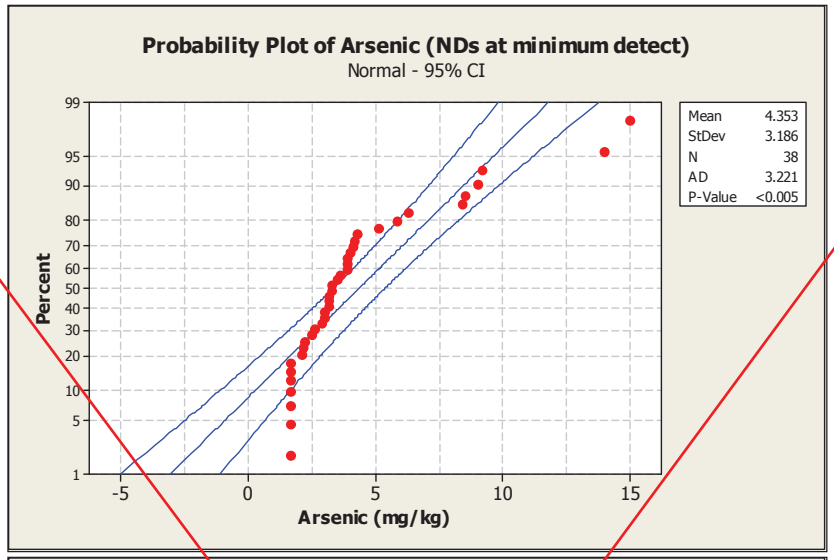

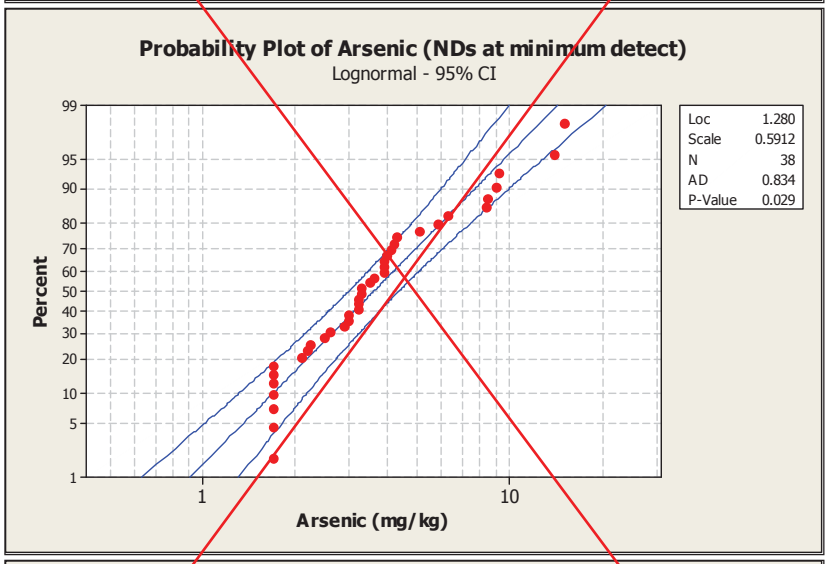

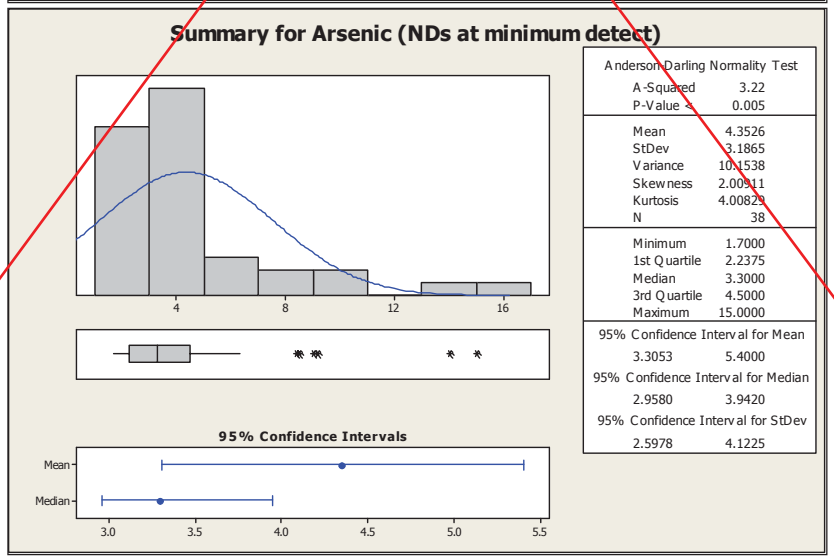

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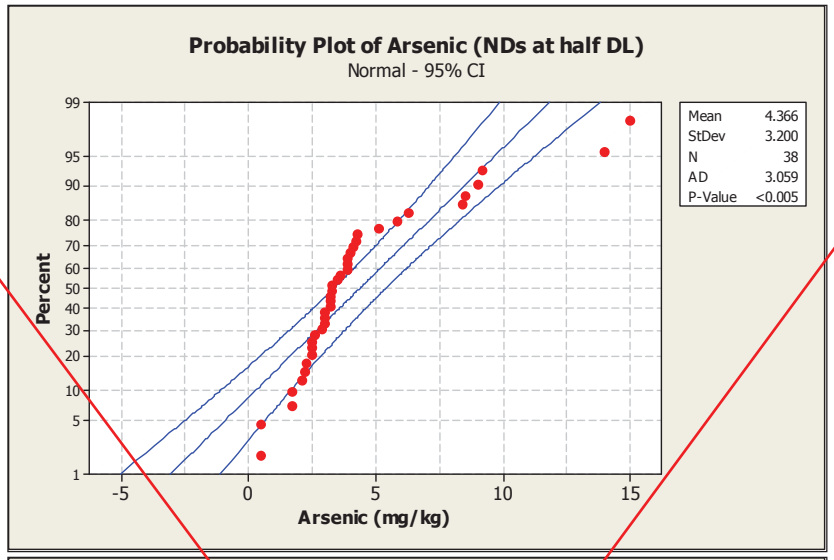

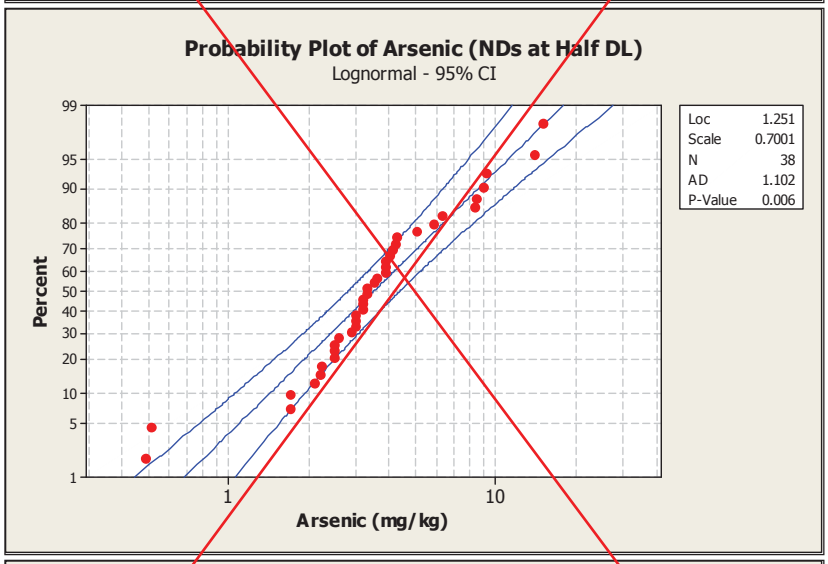

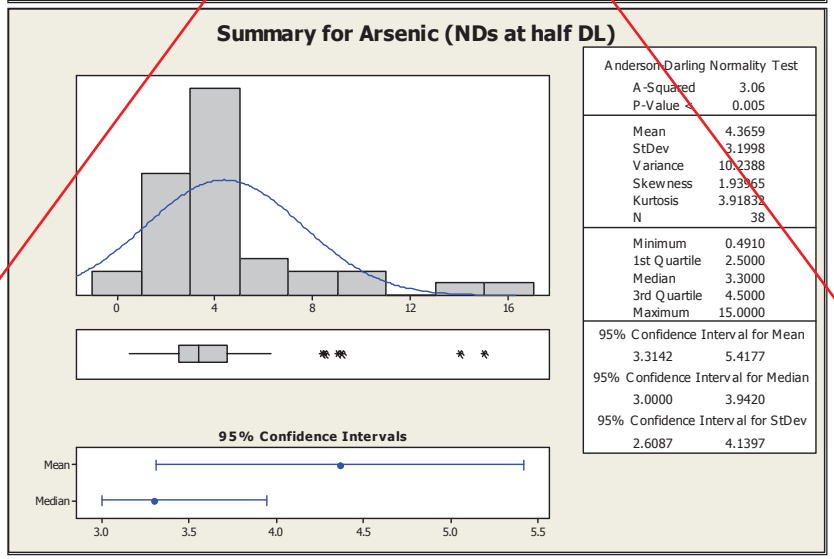

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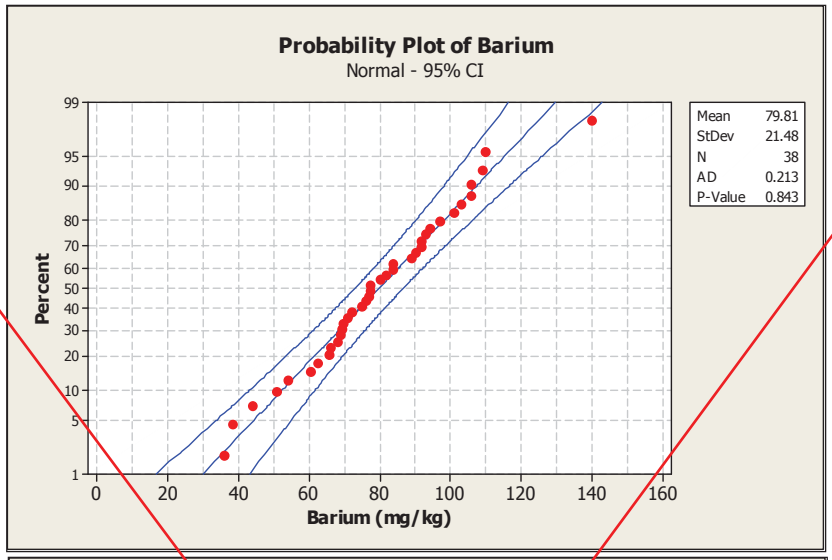

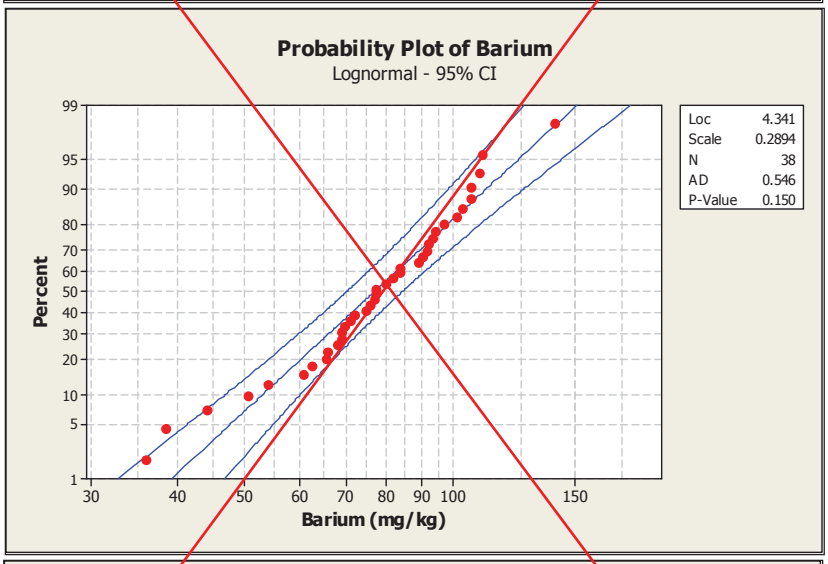

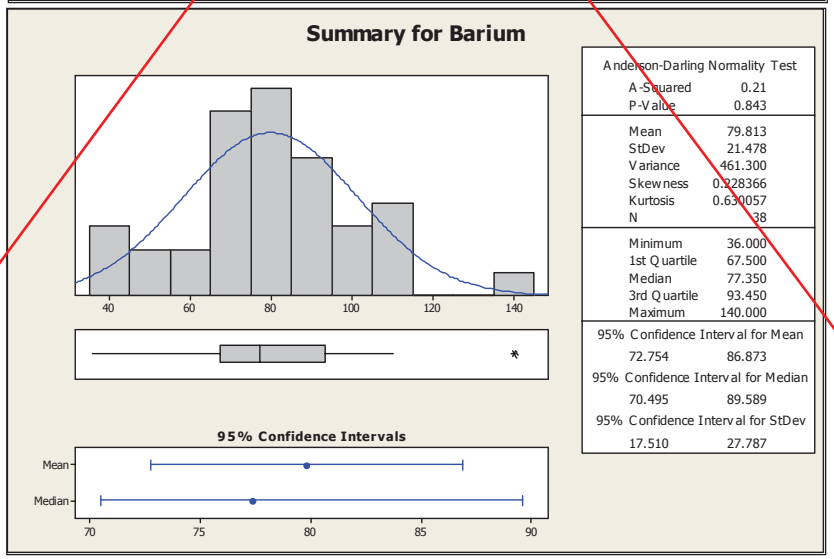

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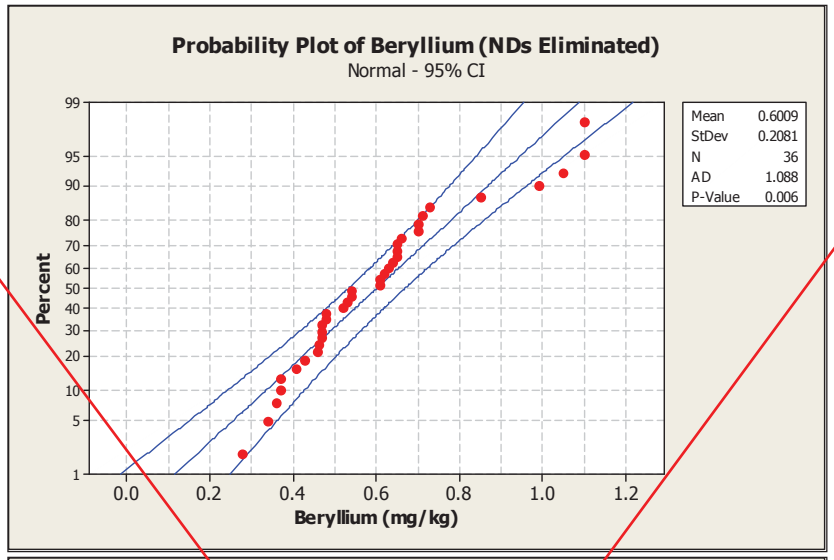

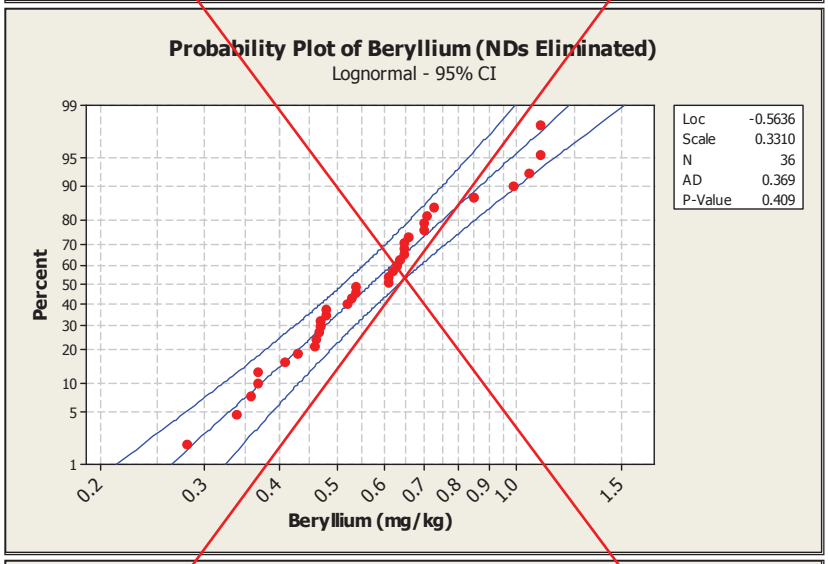

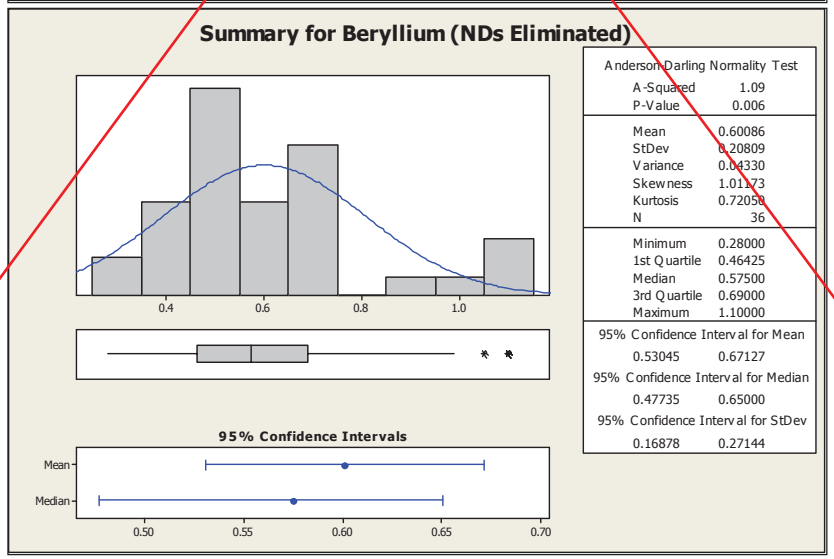

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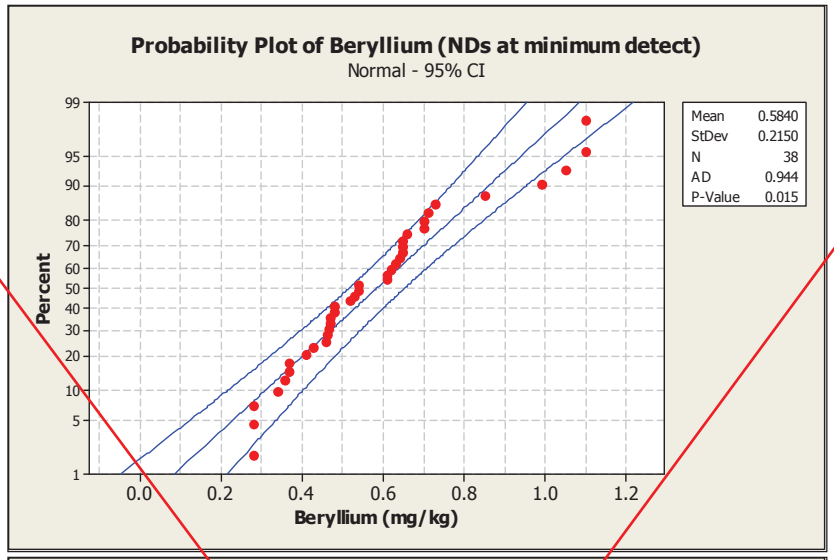

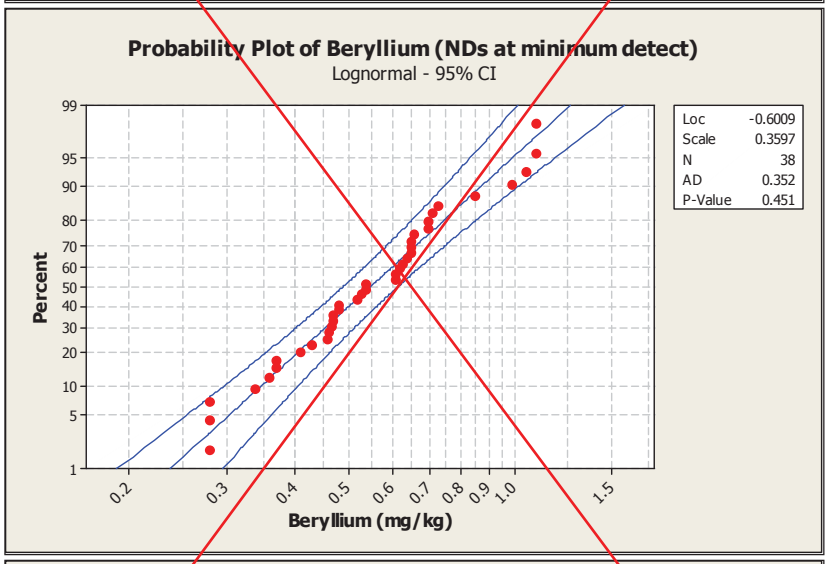

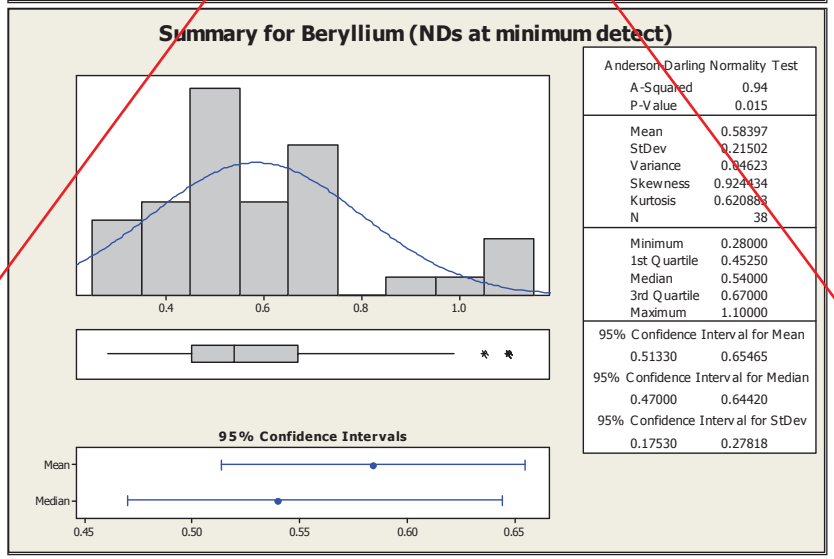

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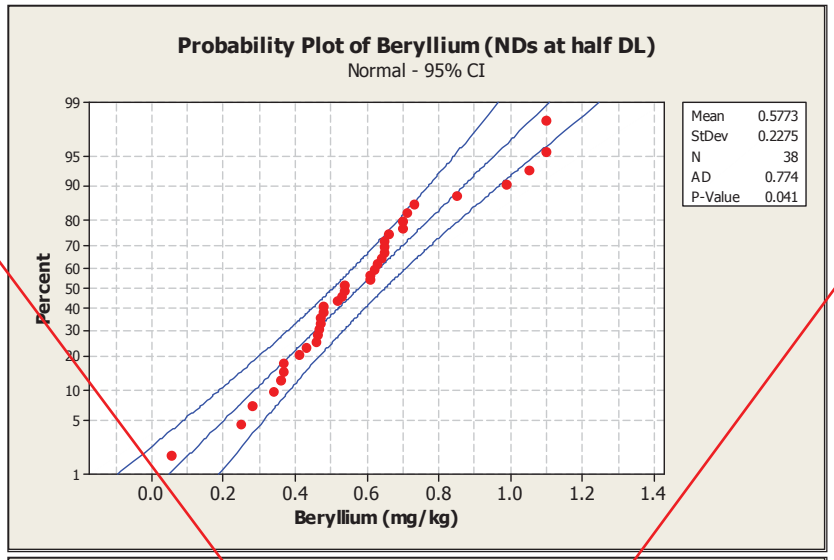

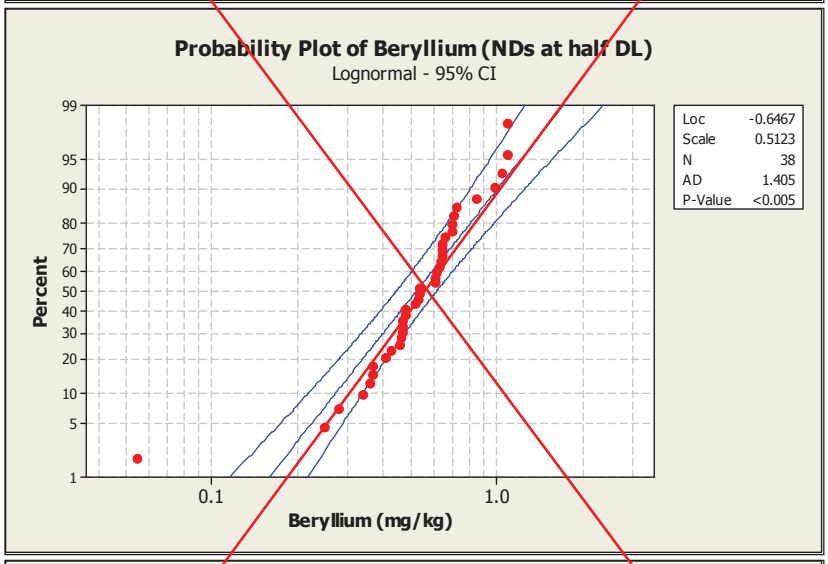

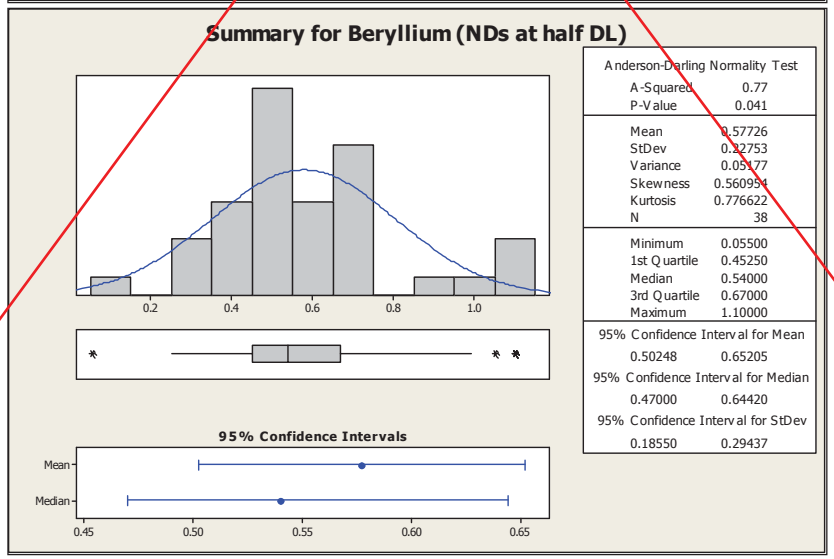

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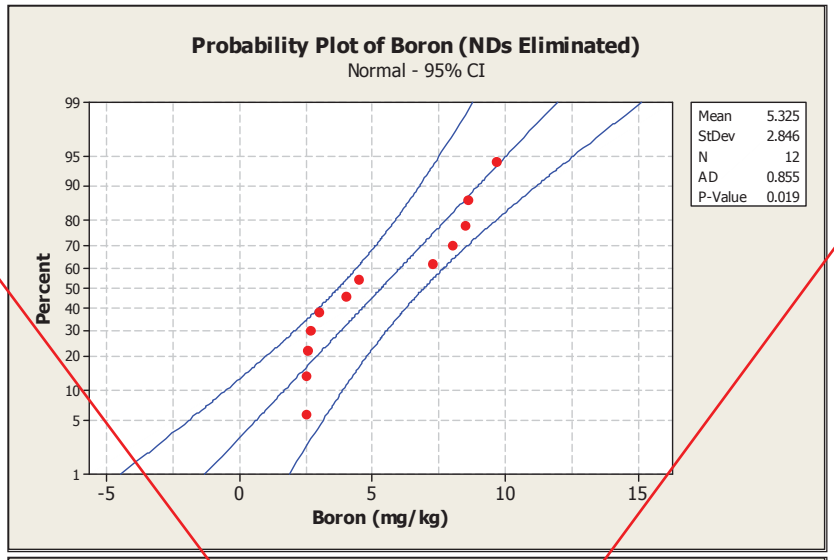

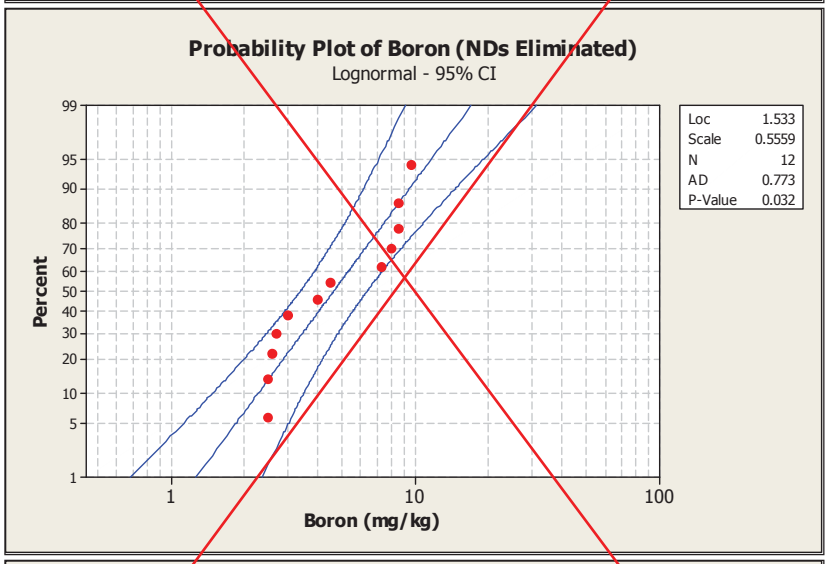

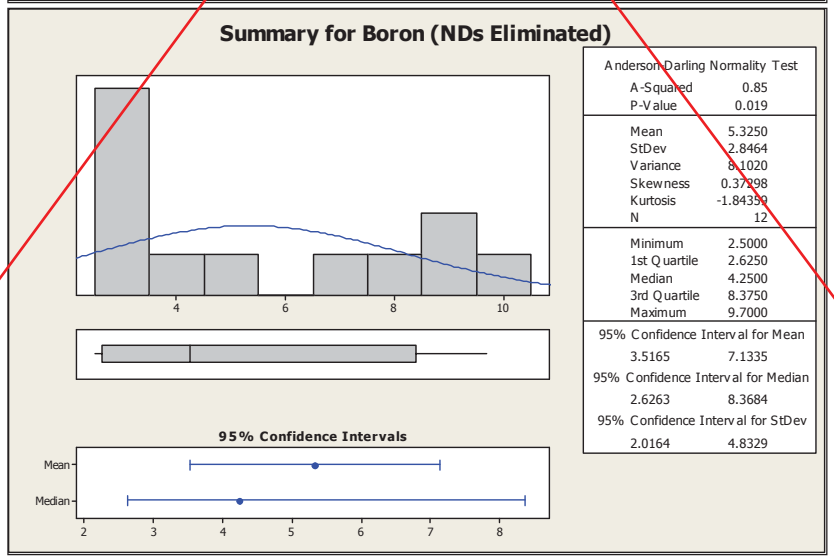

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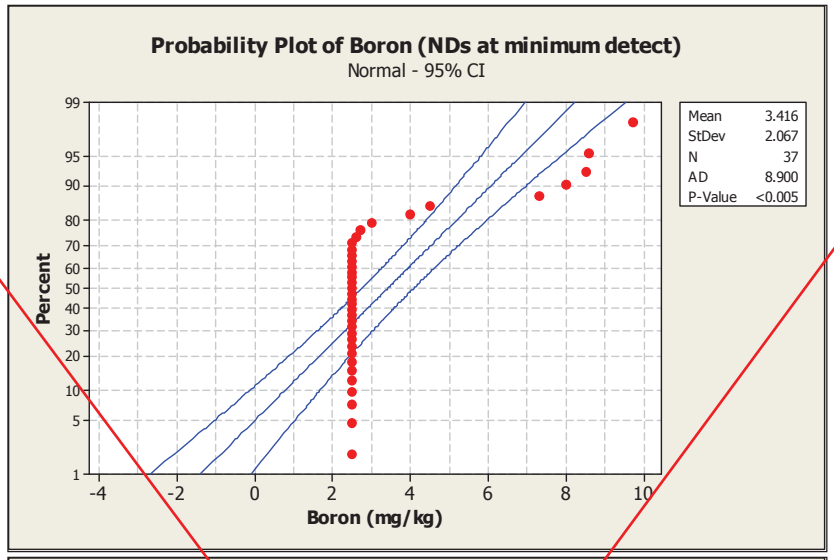

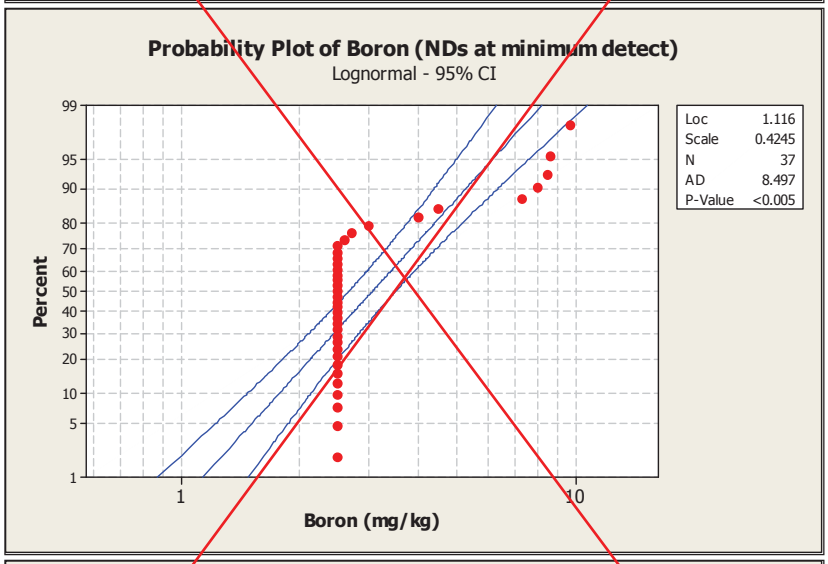

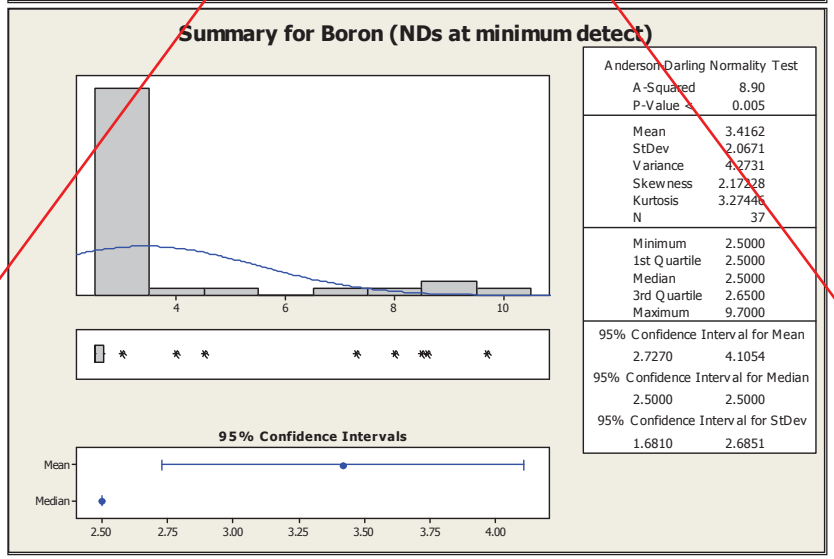

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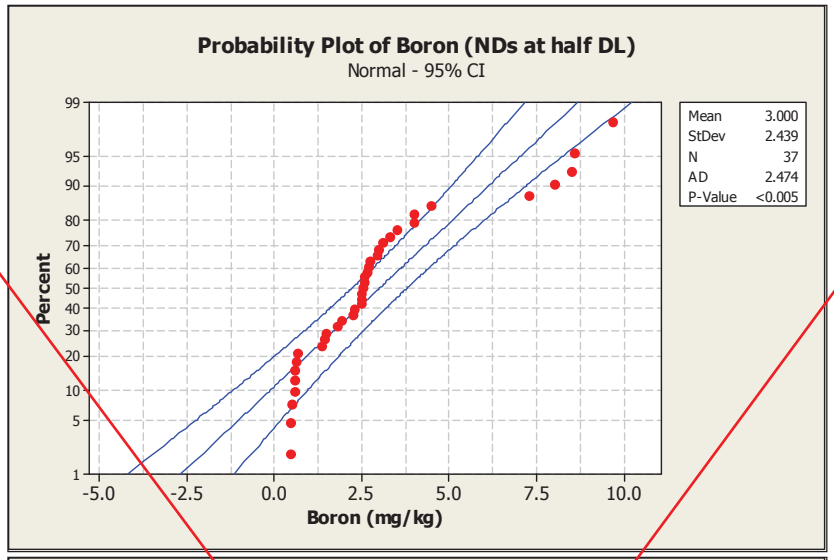

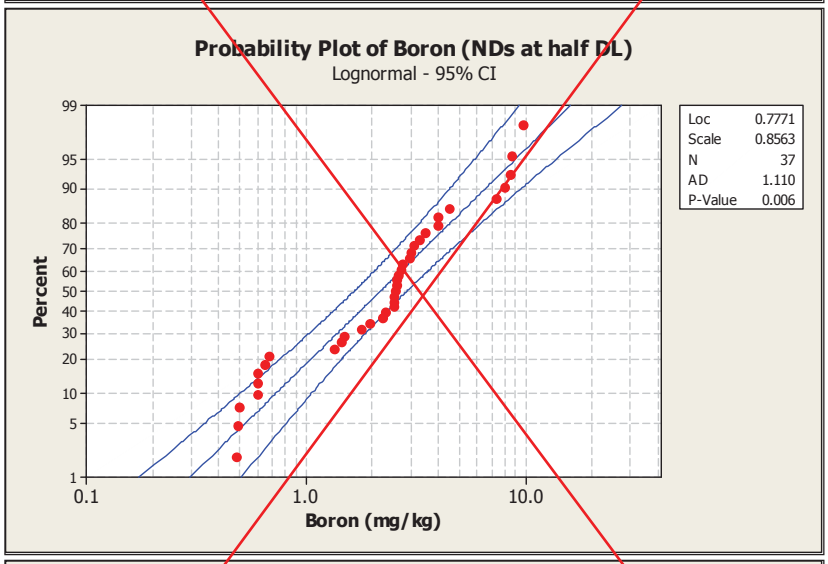

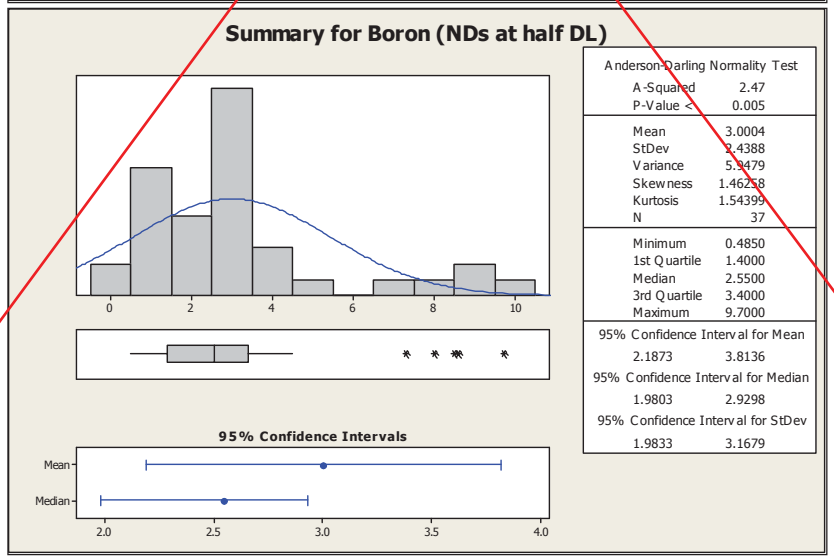

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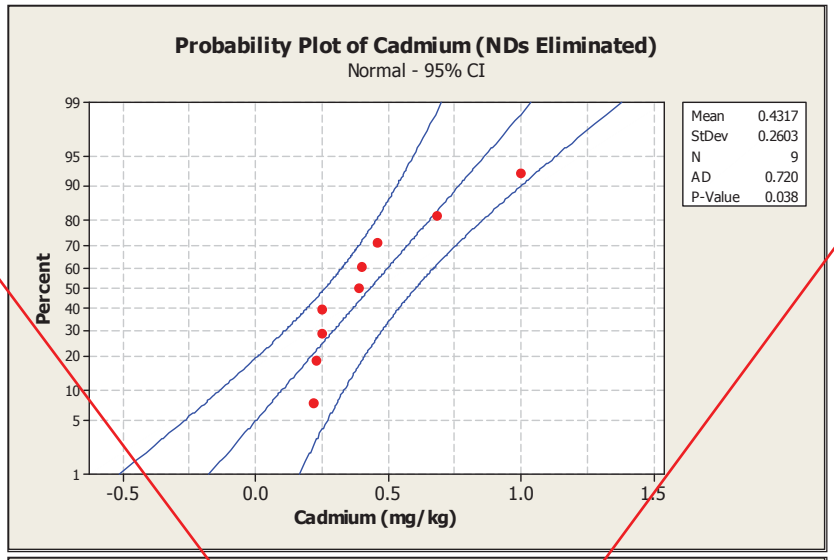

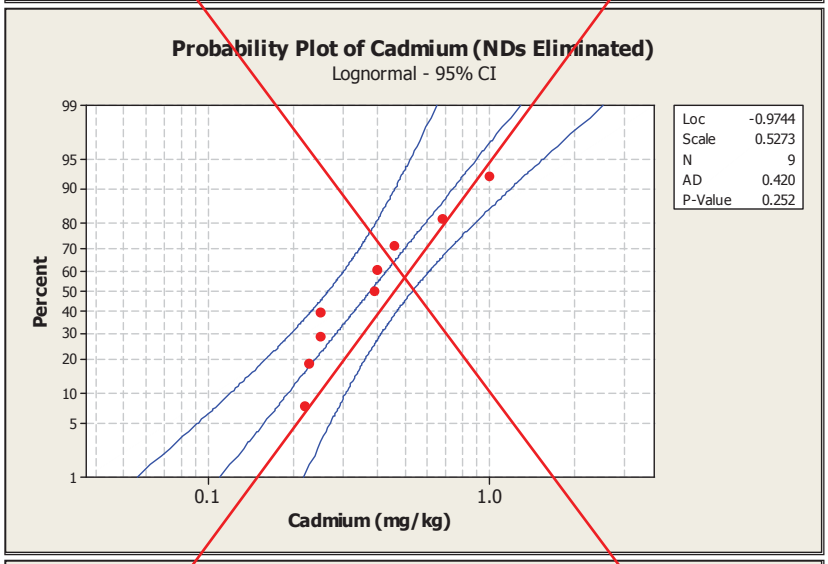

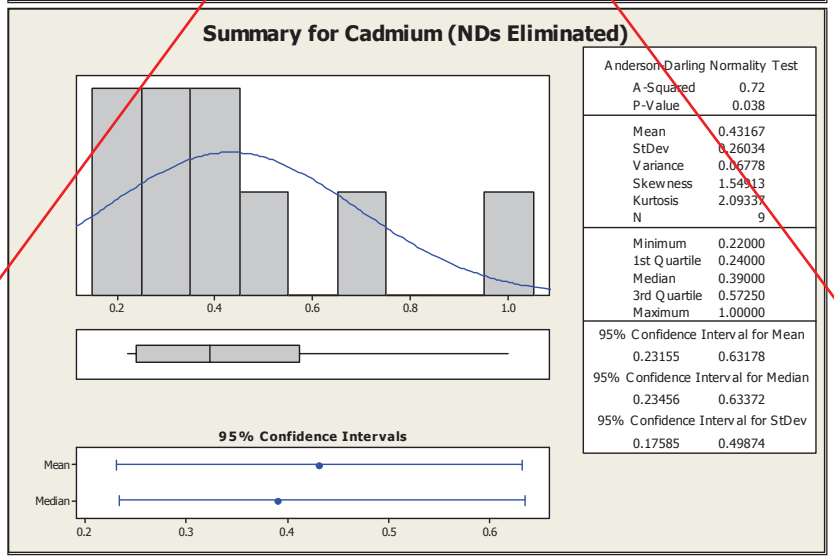

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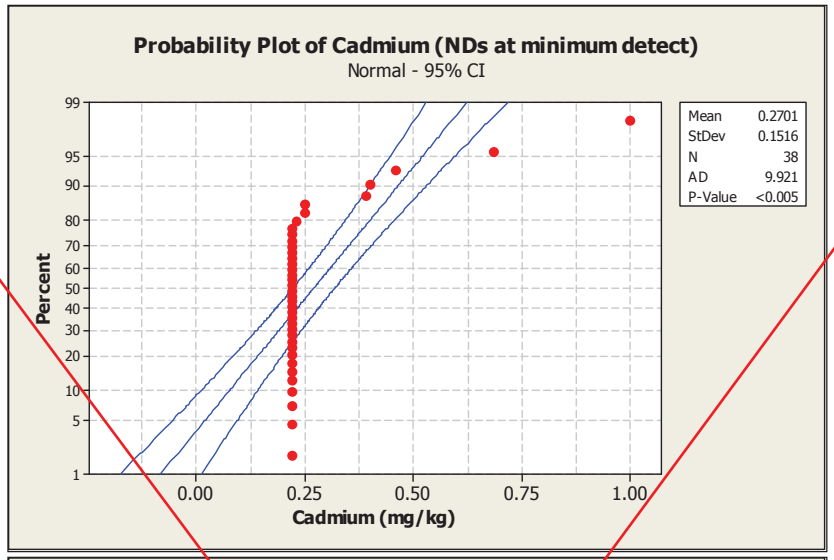

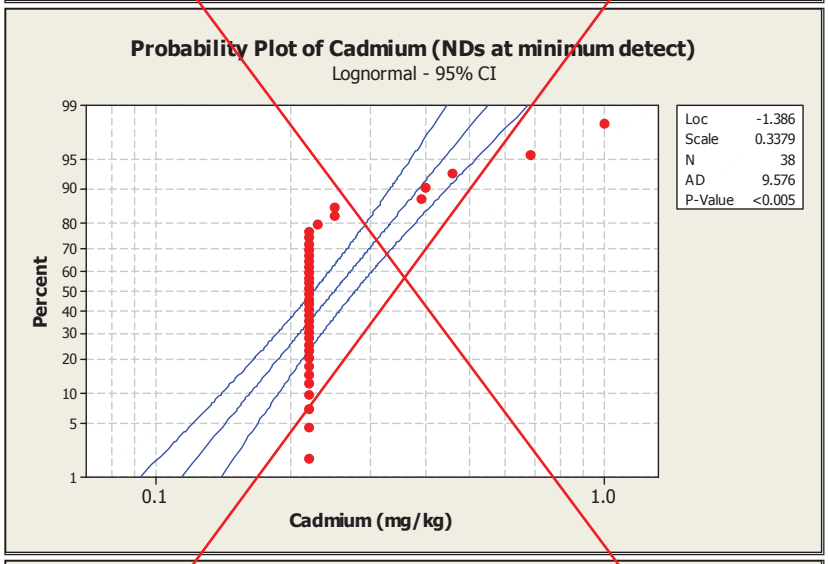

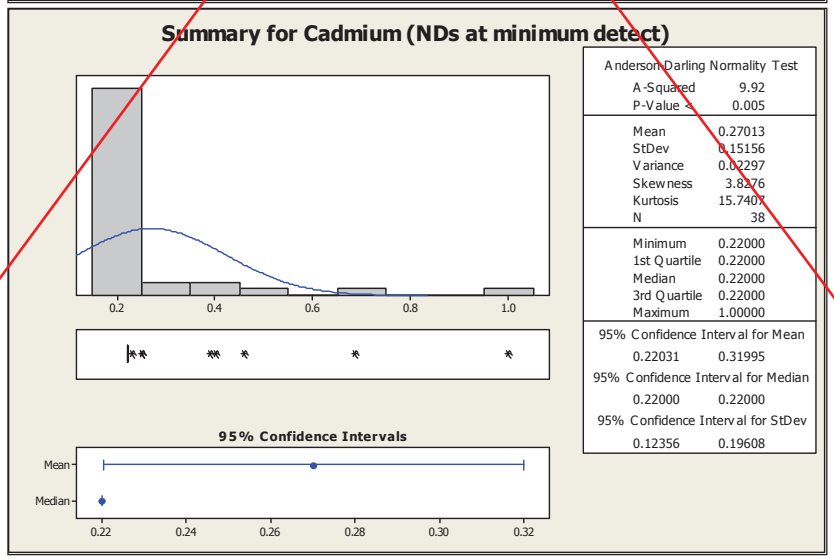

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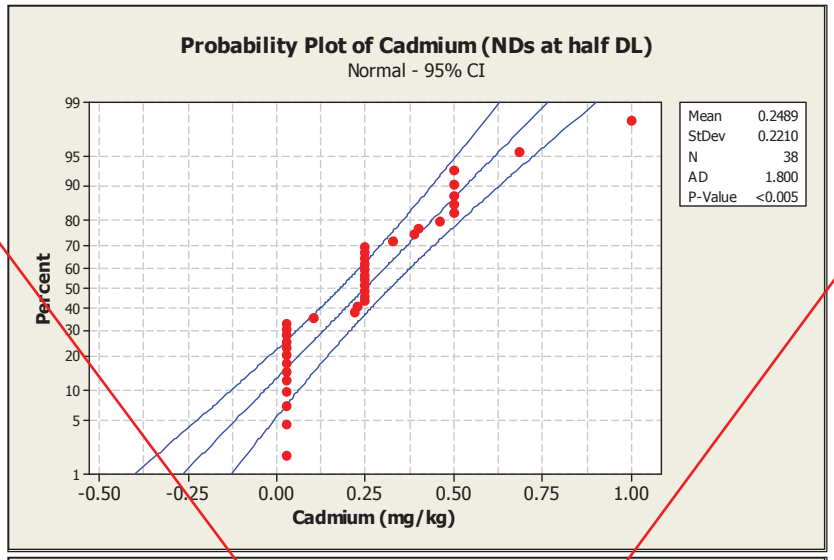

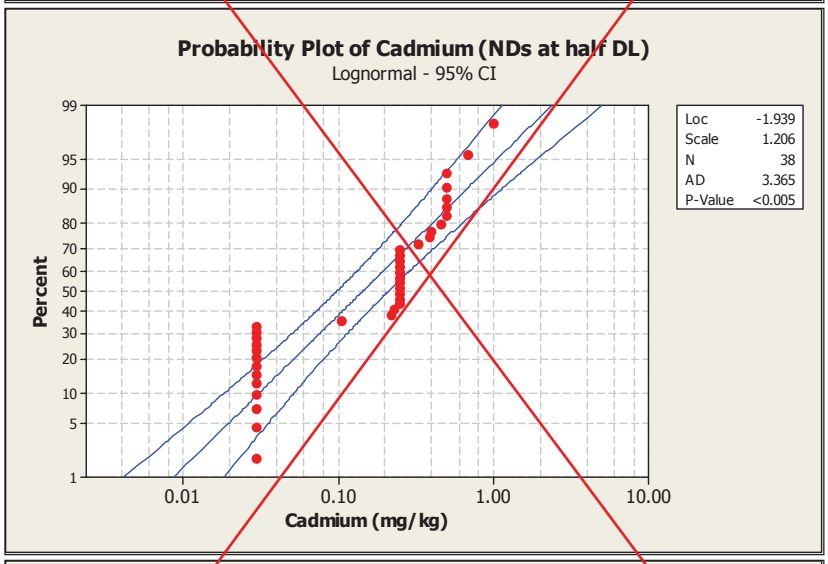

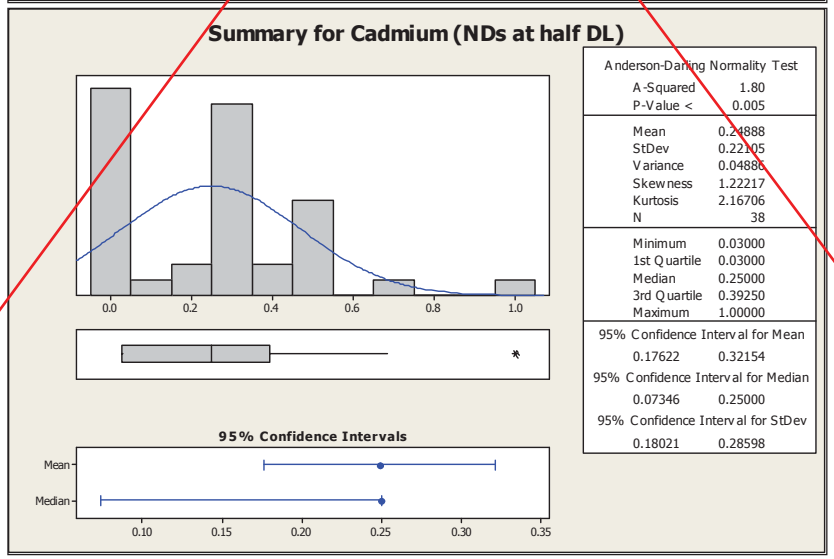

Chromium
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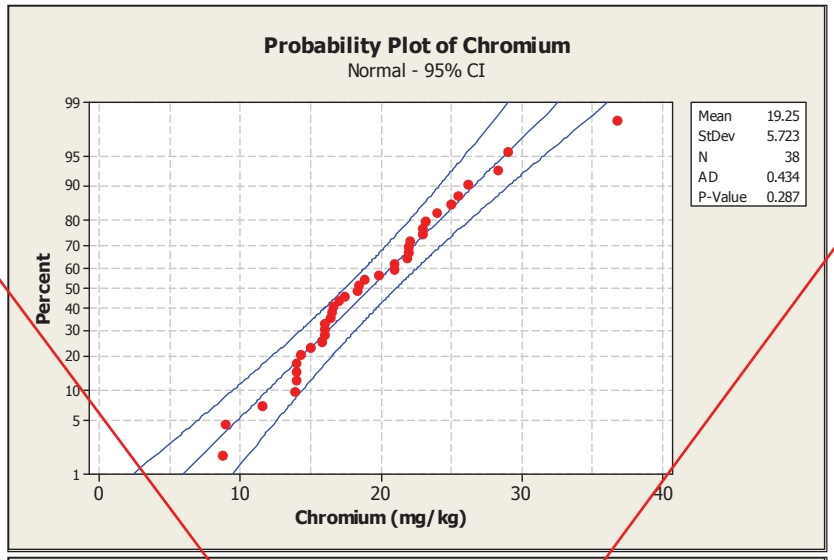
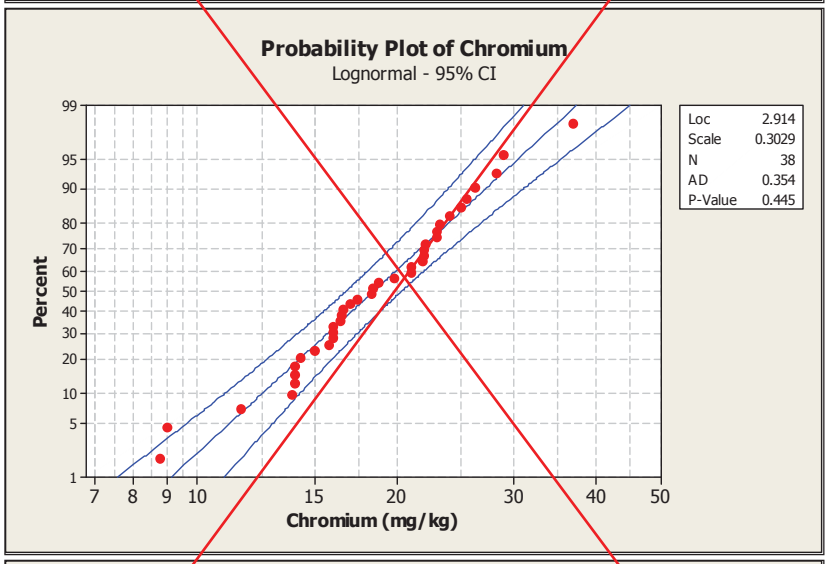
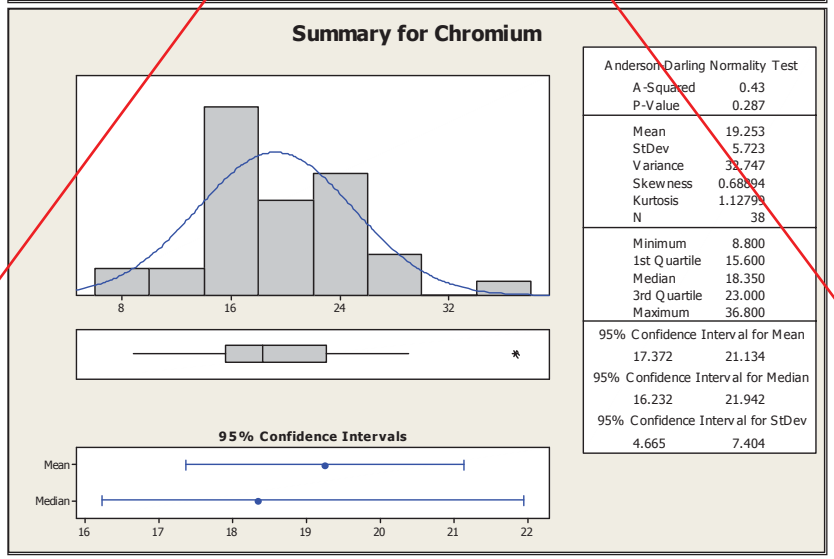
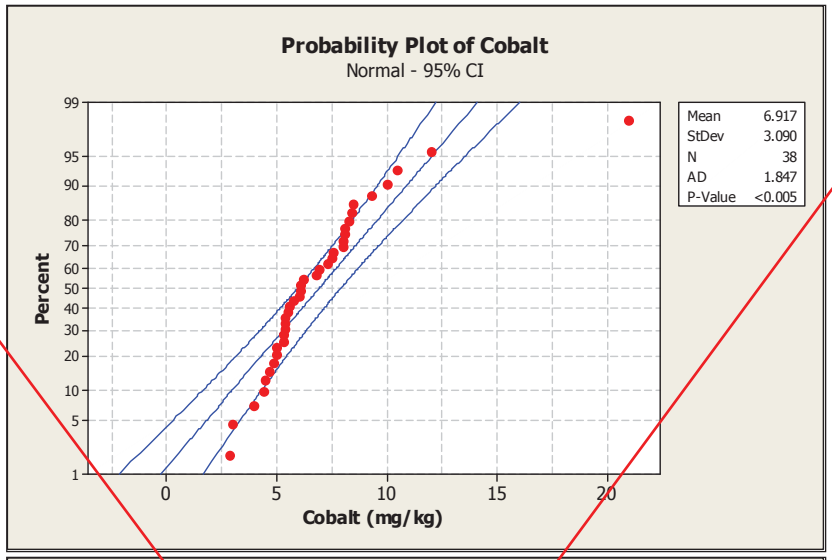
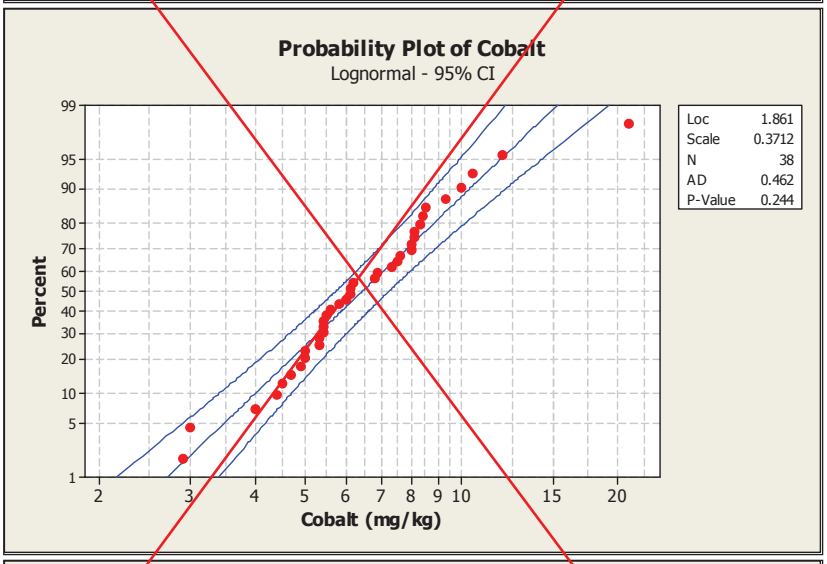


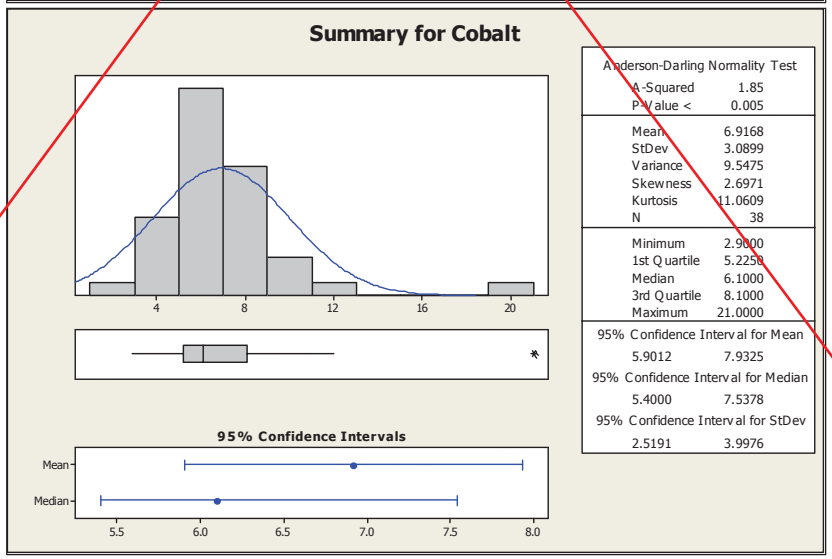




Cobalt


Probability Plot of Cobalt
Normal - 95% CI
Percent
Cobalt (mg/kg)
Mean 6.917
StDev 3.090
N 38
AD 1.847
P-Value <0.005


Probability Plot of Cobalt
Lognormal - 95% CI
Percent
Cobalt (mg/kg)
Loc 1.861
Scale 0.3712
N 38
AD 0.462
P-Value 0.244


Summary for Cobalt
Anderson-Darling Normality Test
A-Squared 1.85
P-Value < 0.005
Mean 6.9168
StDev 3.0899
Variance 9.5475
Skewness 2.6971
Kurtosis 11.0609
N 38
Minimum 2.9000
1st Quartile 5.2250
Median 6.1000
3rd Quartile 8.1000
Maximum 21.0000
95% Confidence Interval for Mean
5.9012 7.9325
95% Confidence Interval for Median
5.4000 7.5378
95% Confidence Interval for StDev
2.5191 3.9976
95% Confidence Intervals
Mean
Median

Copper
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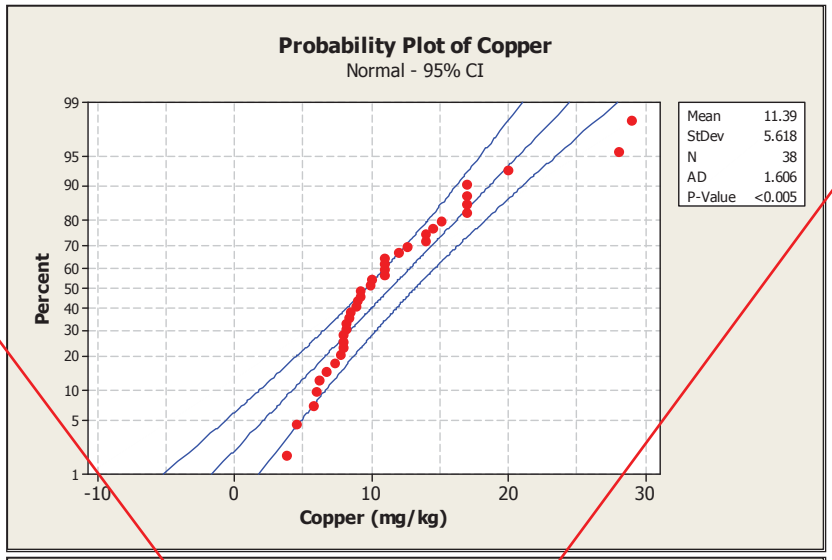

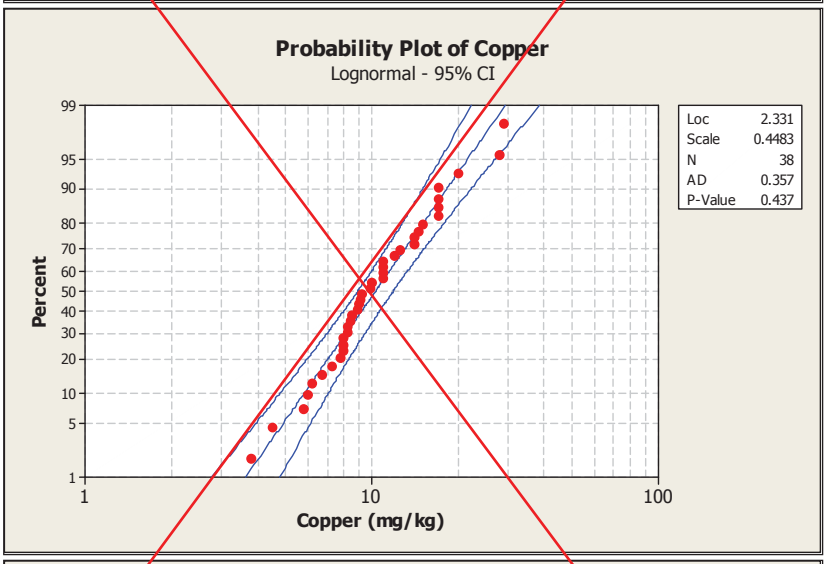

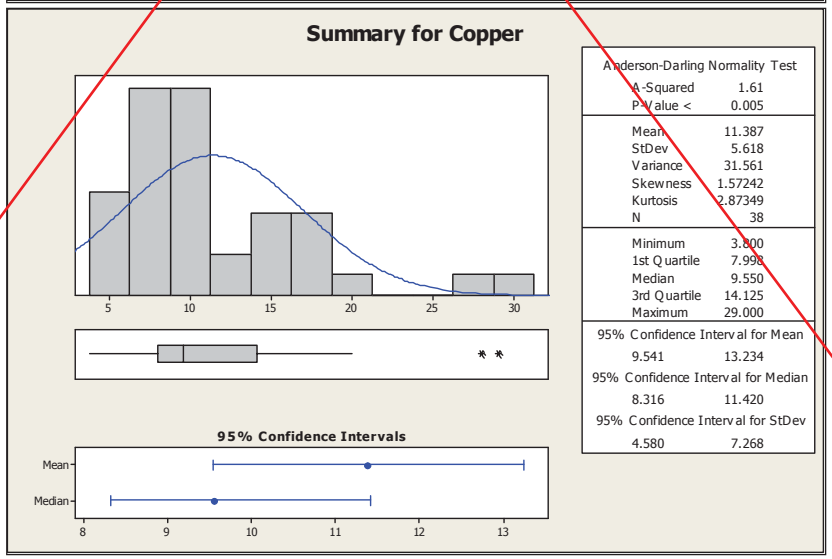

Fluoride
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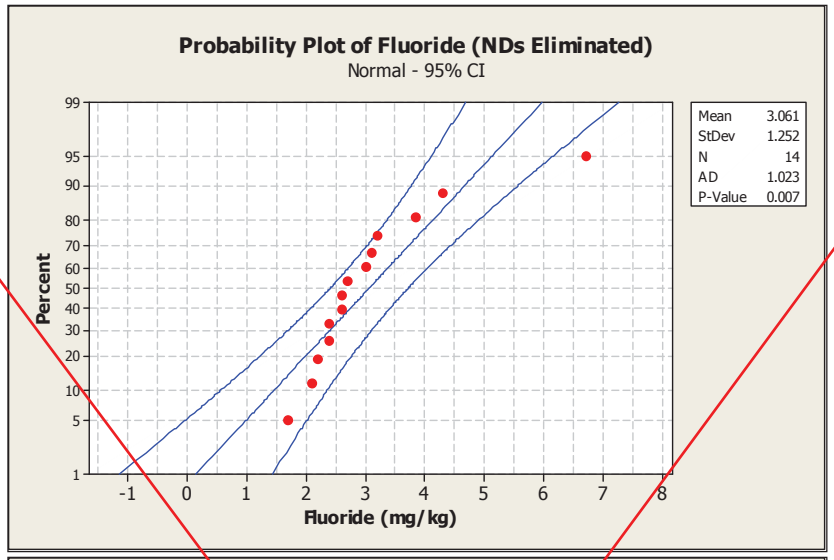
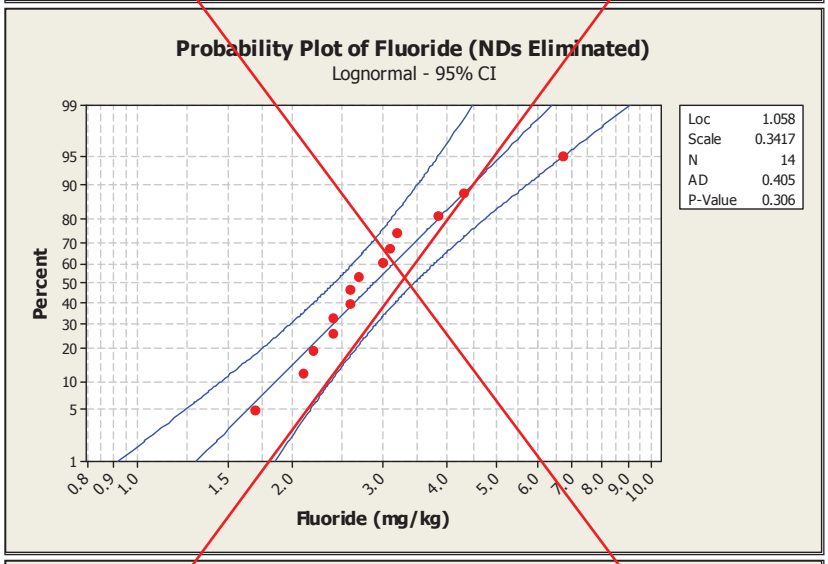
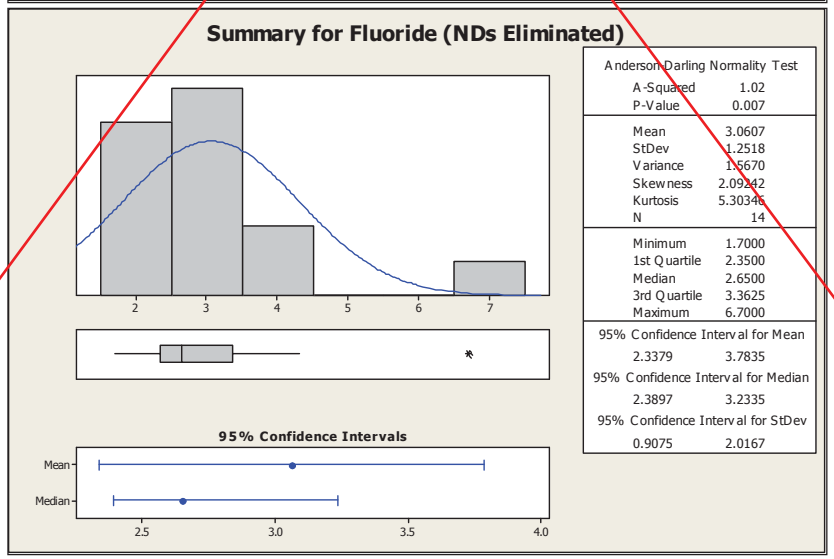
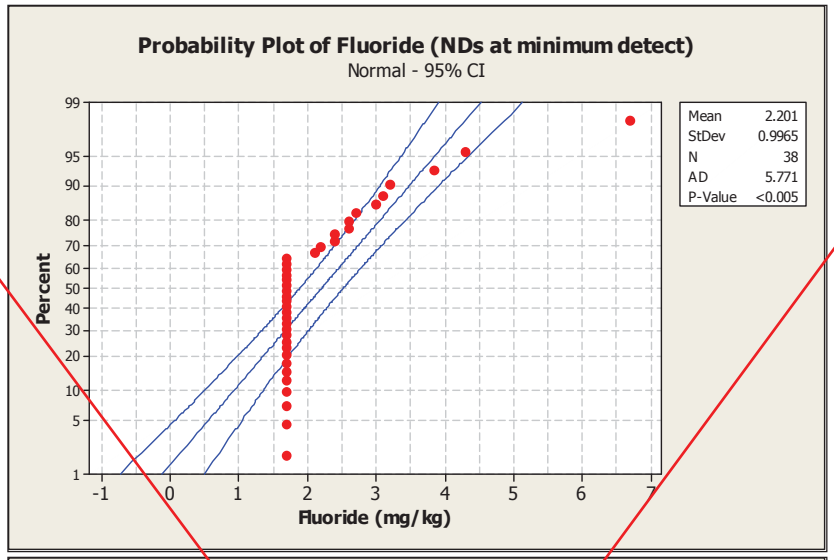
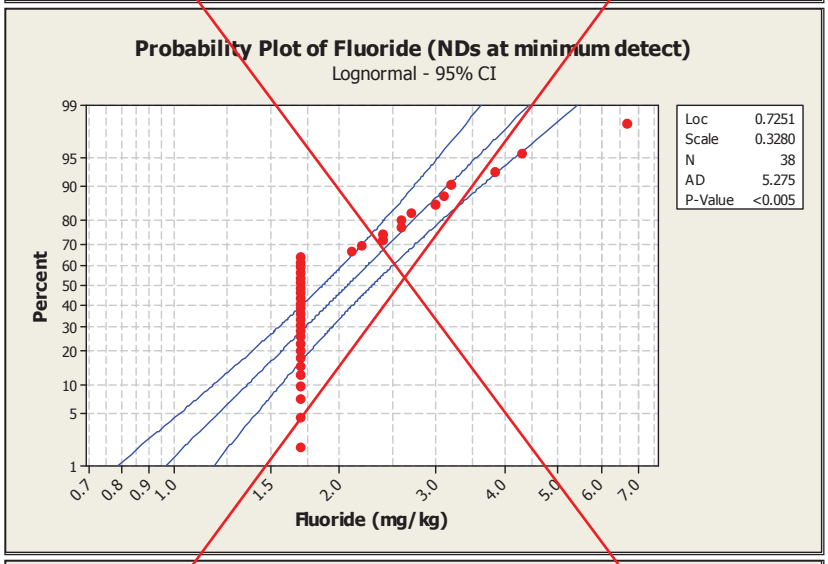


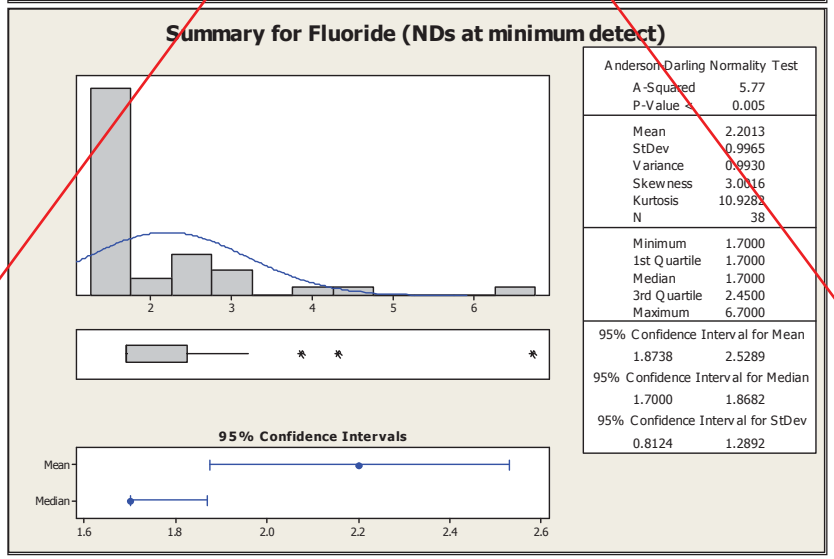




Fluoride
(Page 2 of 3)







Fluoride
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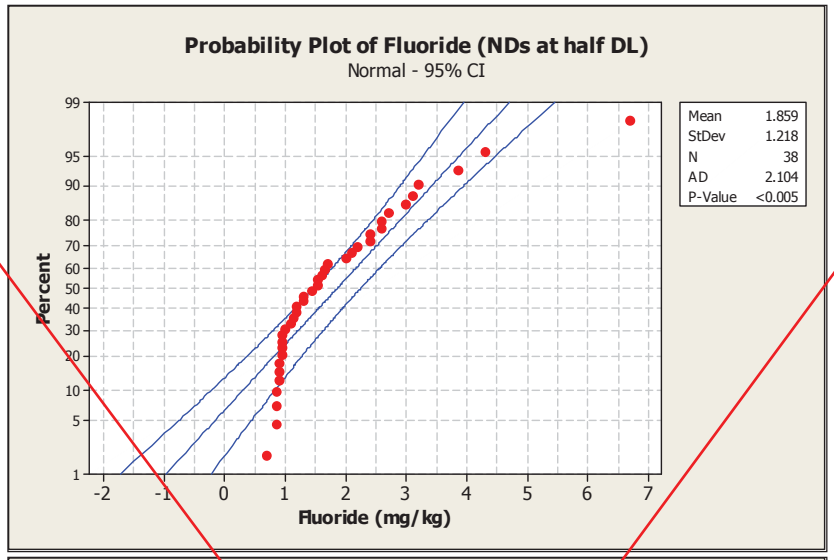

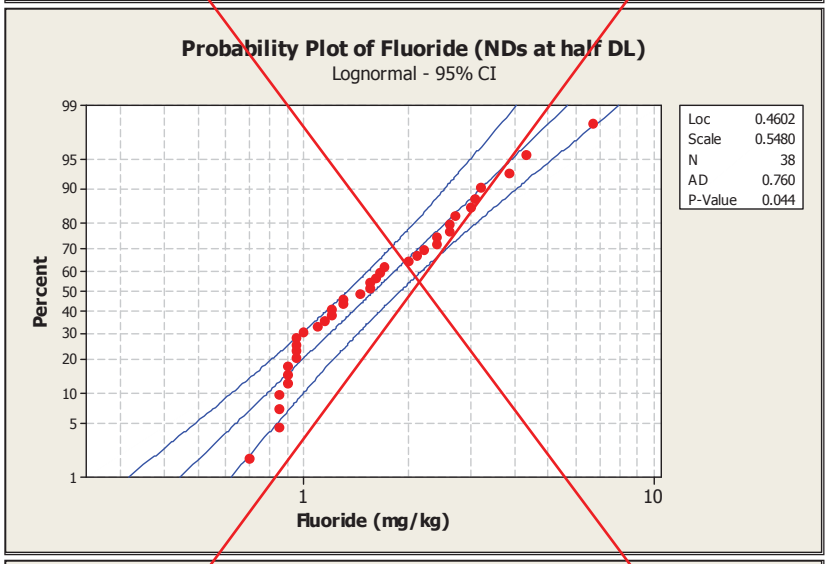

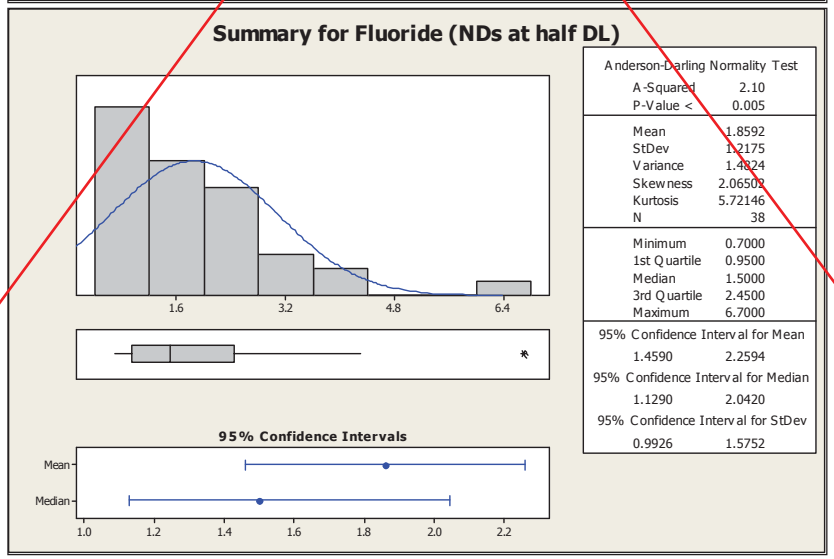

Iron
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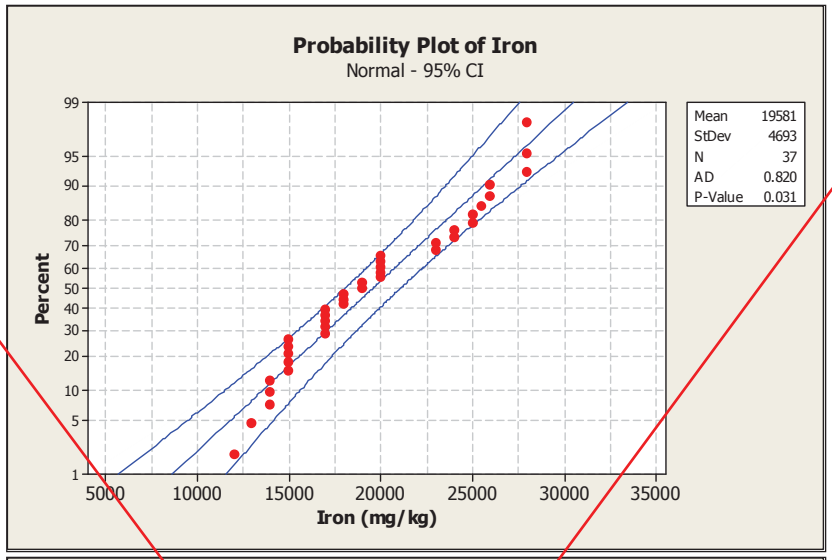
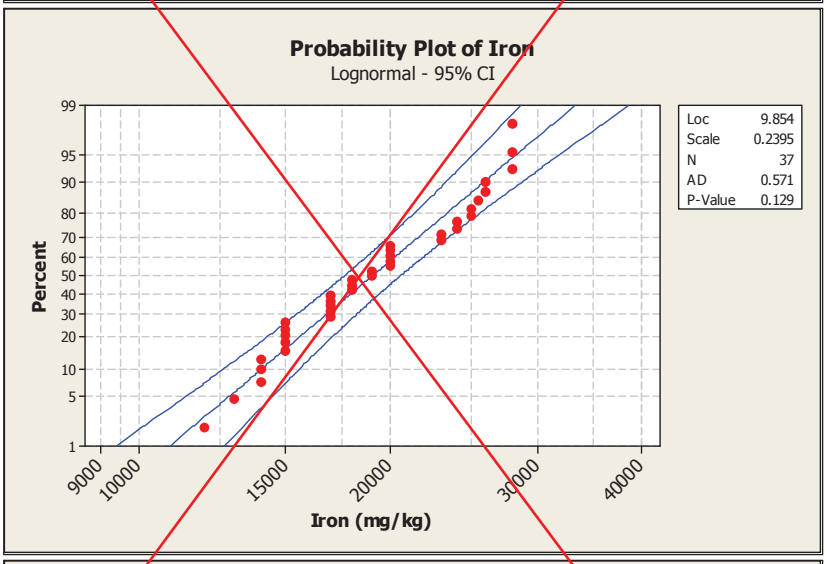
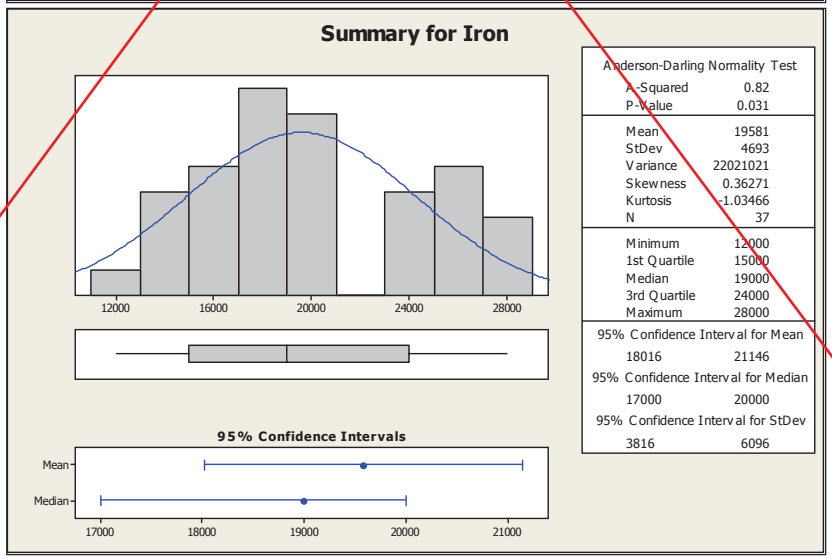
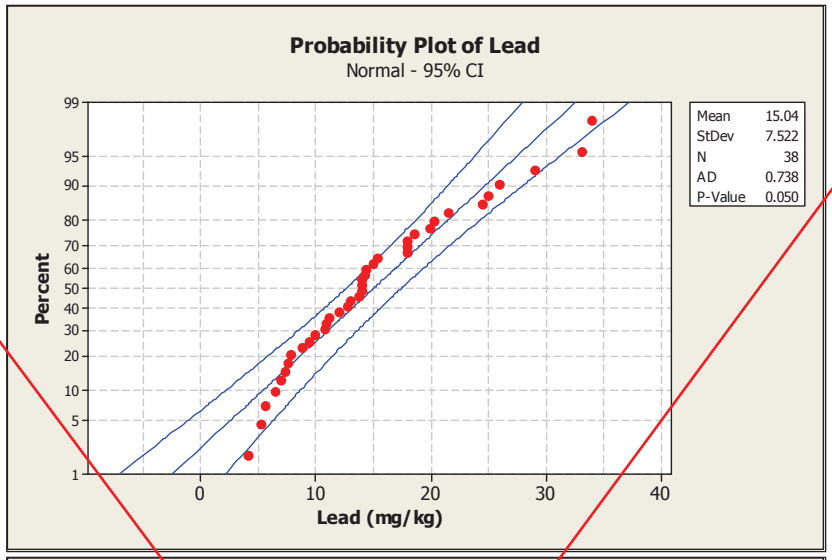
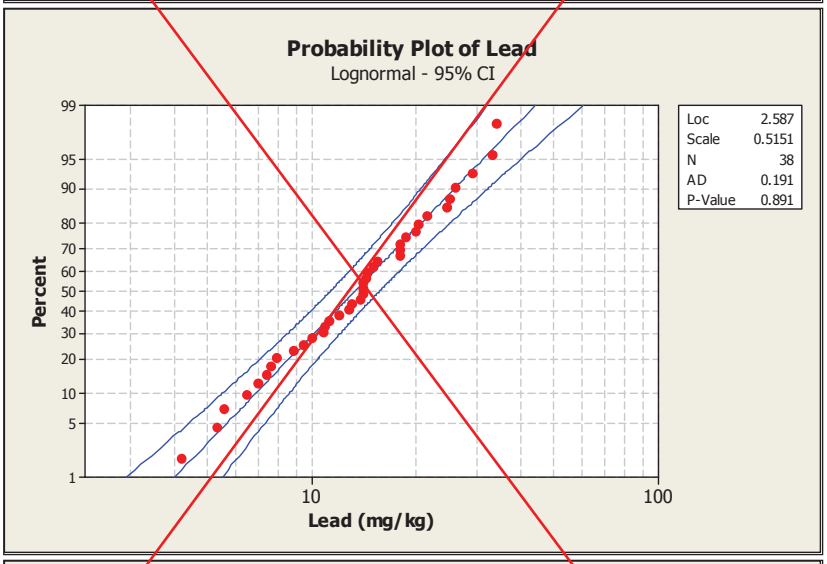


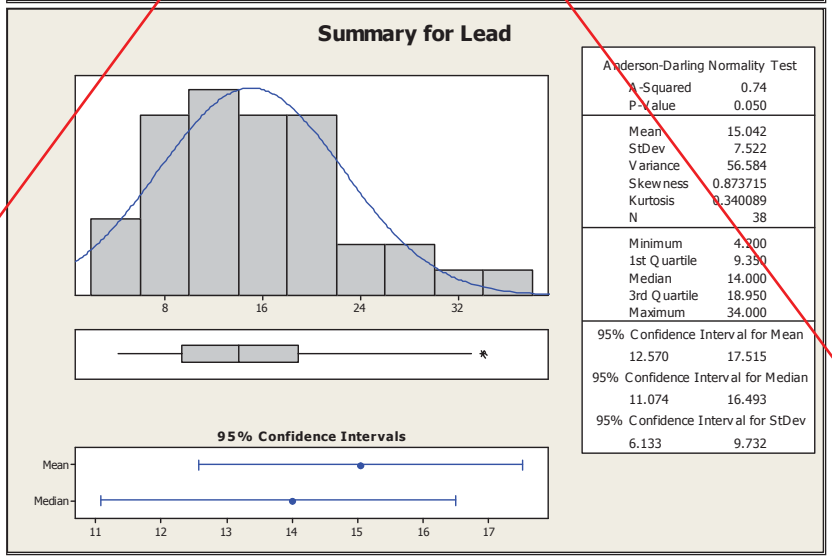




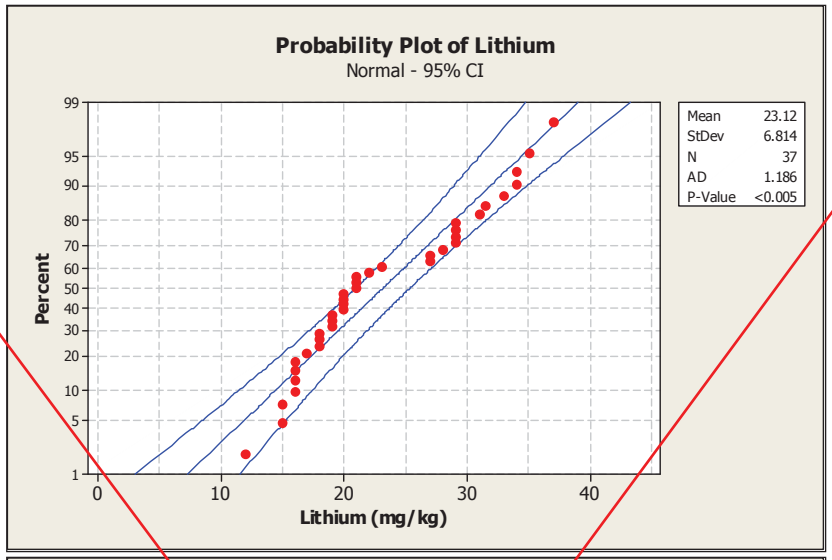
Lead

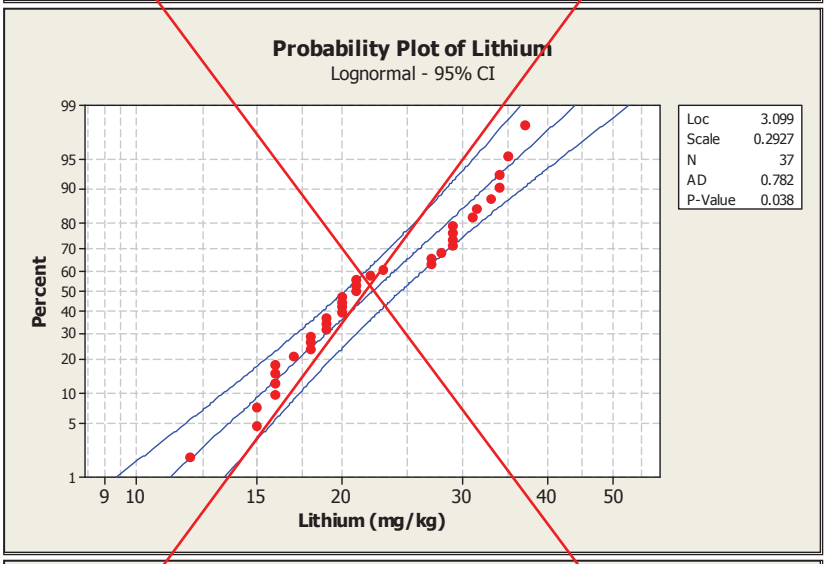

Probability Plot of Lead
Normal - 95% CI
Percent
Lead (mg/kg)
Mean 15.04
StDev 7.522
N 38
AD 0.738
P-Value 0.050

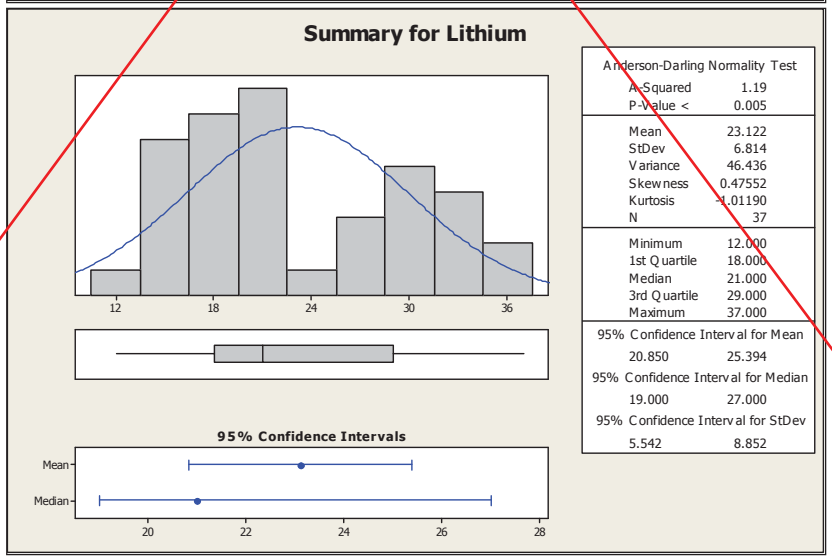

Probability Plot of Lead
Lognormal - 95% CI
Percent
Lead (mg/kg)
Loc 2.587
Scale 0.5151
N 38
AD 0.191
P-Value 0.891


Summary for Lead
Anderson-Darling Normality Test
A-Squared 0.74
P-Value 0.050
Mean 15.042
StDev 7.522
Variance 56.584
Skewness 0.873715
Kurtosis 0.340089
N 38
Minimum 4.200
1st Quartile 9.350
Median 14.000
3rd Quartile 18.950
Maximum 34.000
95% Confidence Interval for Mean
12.570 17.515
95% Confidence Interval for Median
11.074 16.493
95% Confidence Interval for StDev
6.133 9.732
95% Confidence Intervals
Mean
Median

Lithium
(Page 1 of 1)







Manganese
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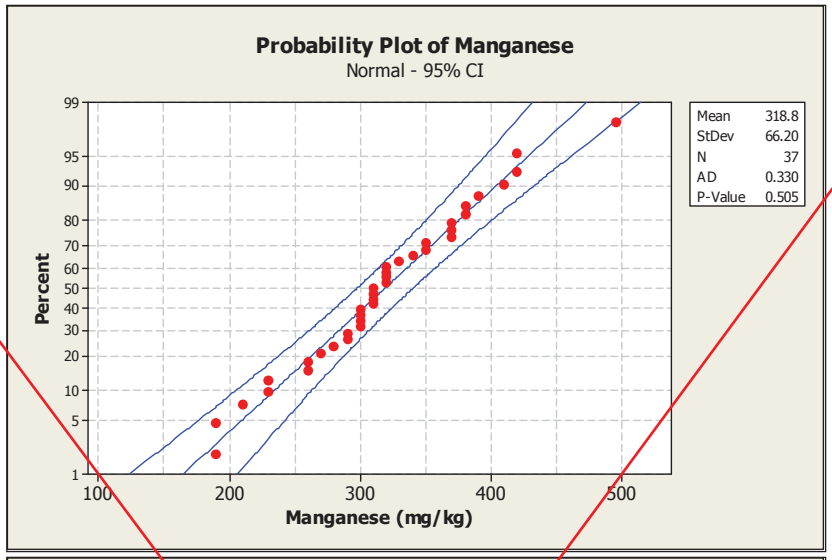

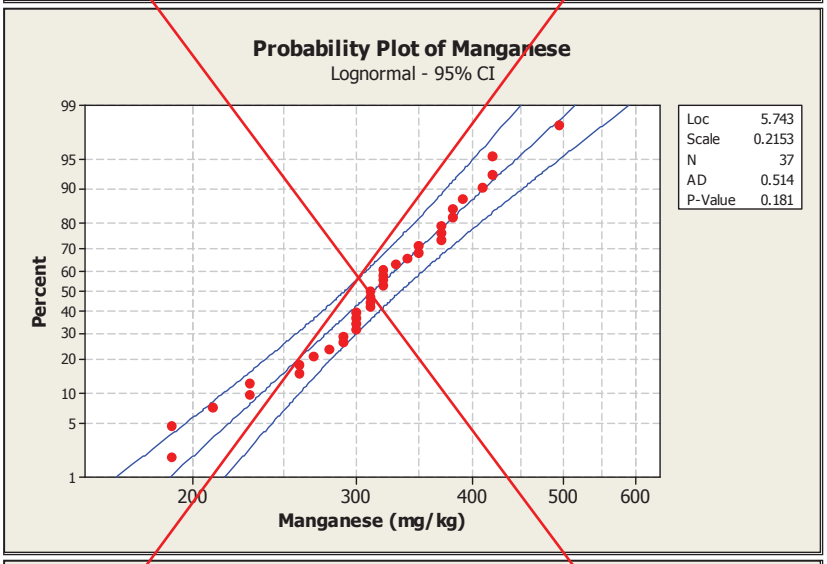

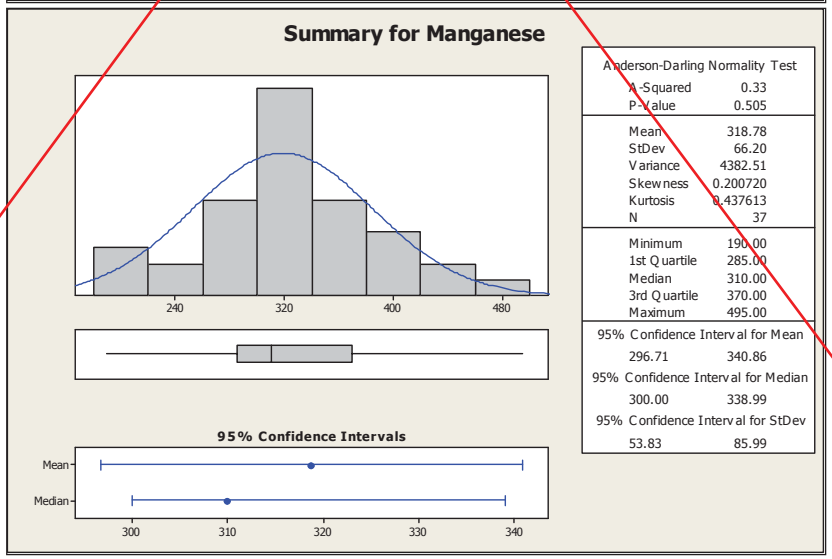

Mercury
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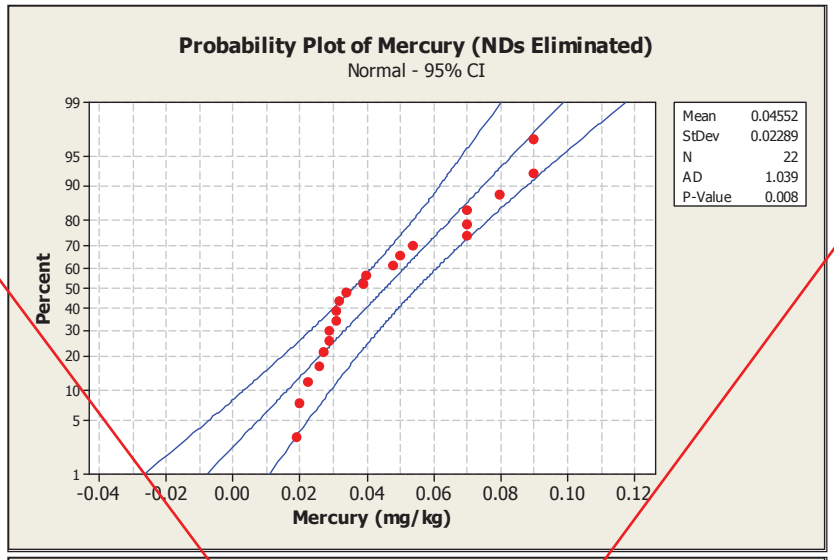

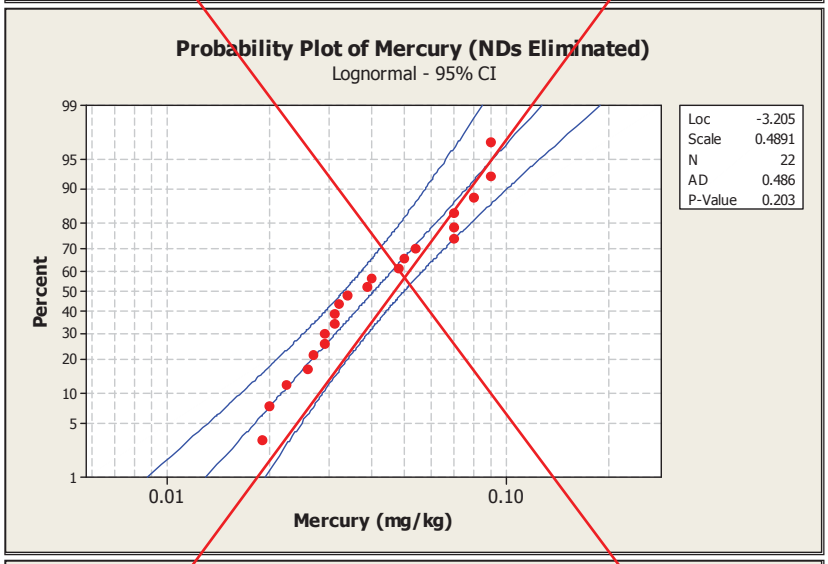

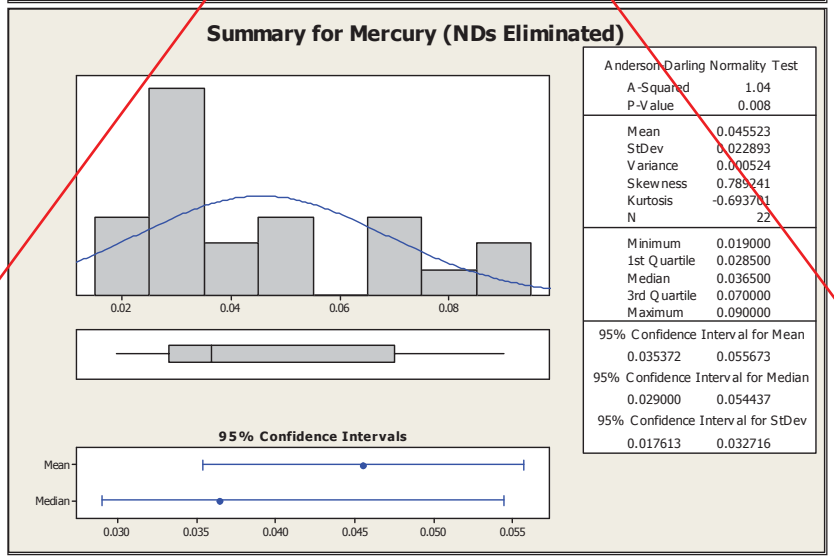

Mercury
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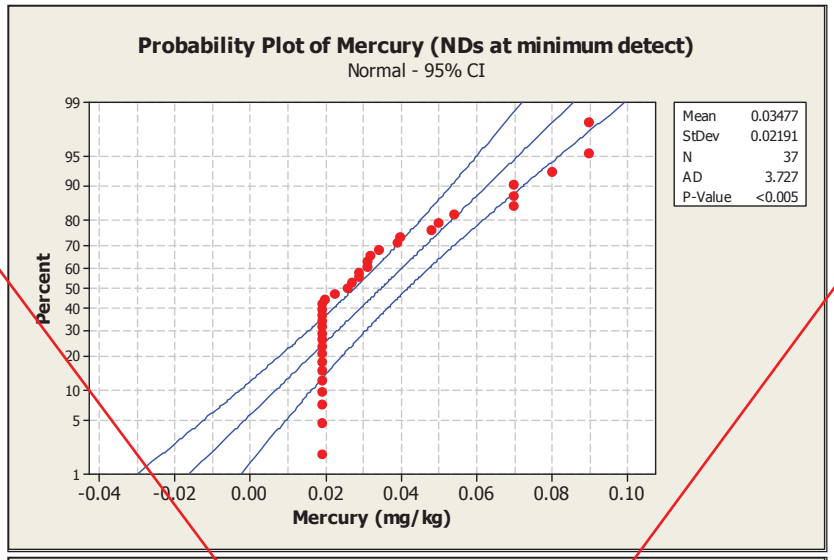
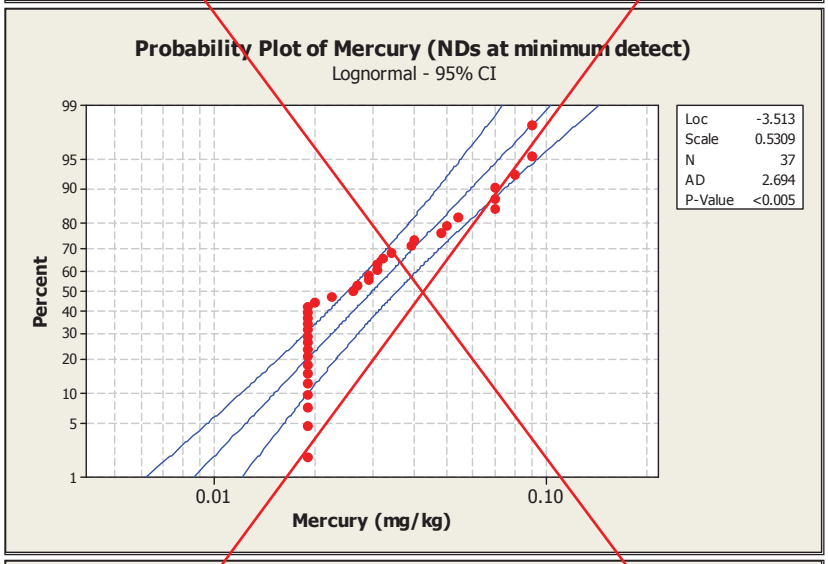
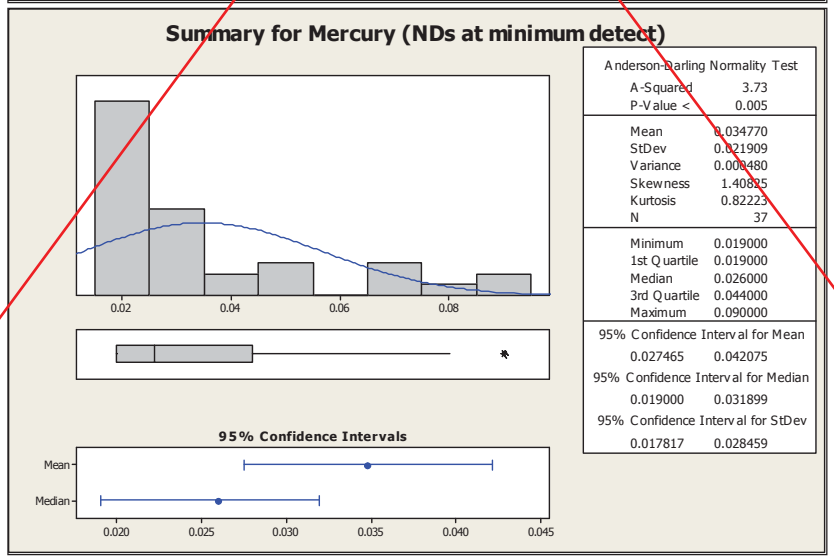
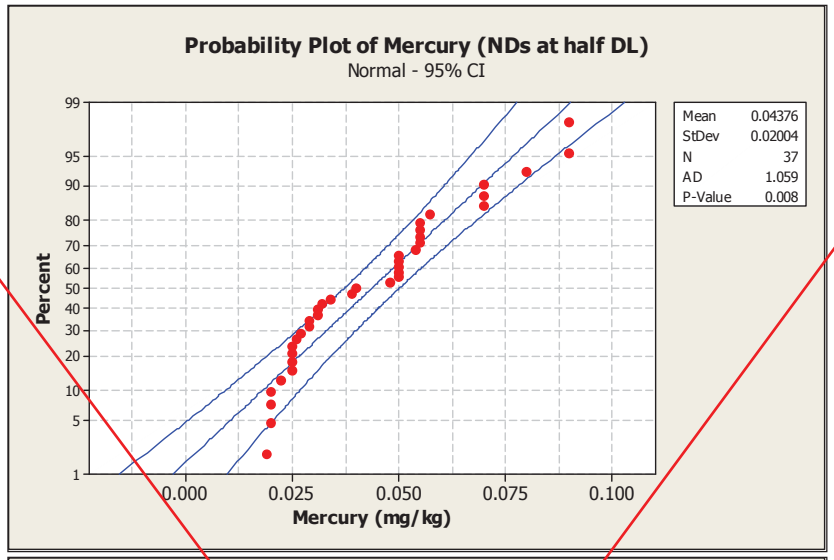
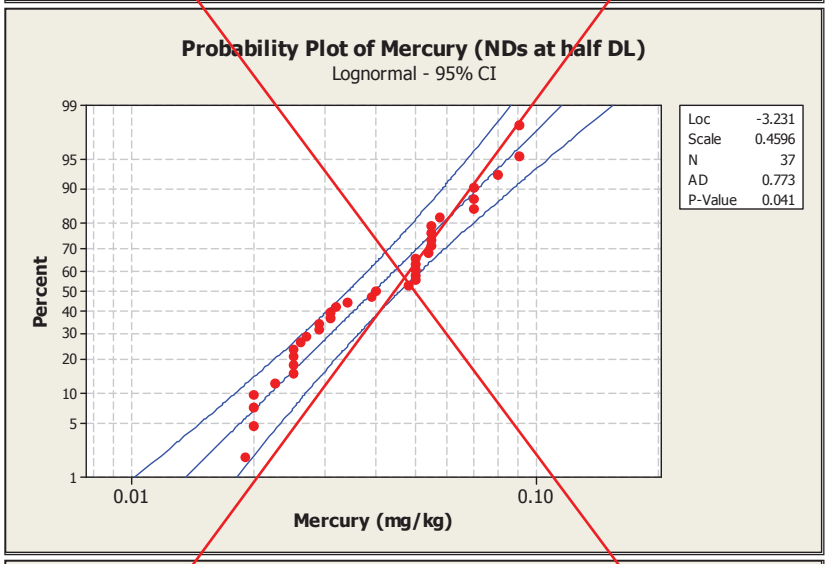


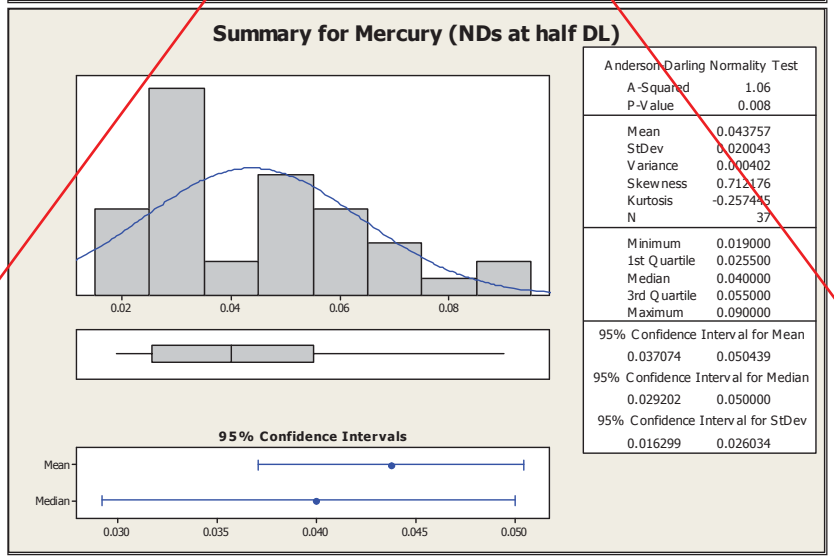




Mercury
(Page 3 of 3)







Molybdenum
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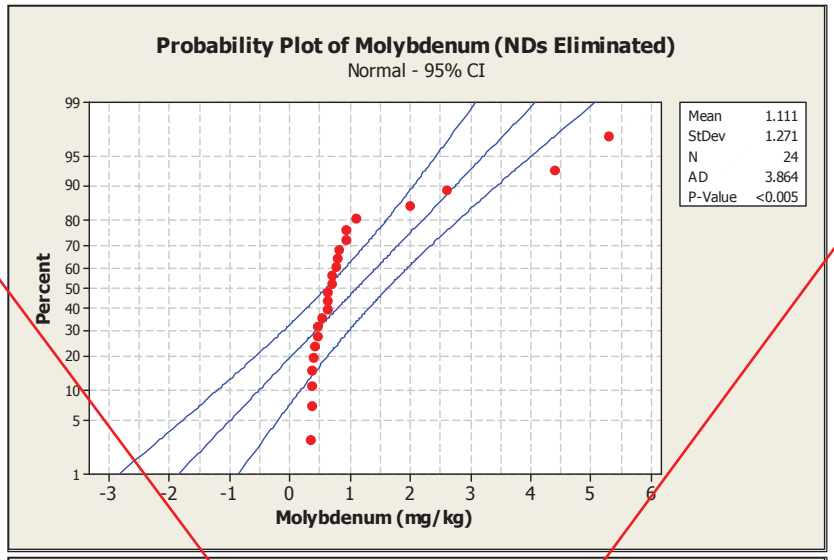
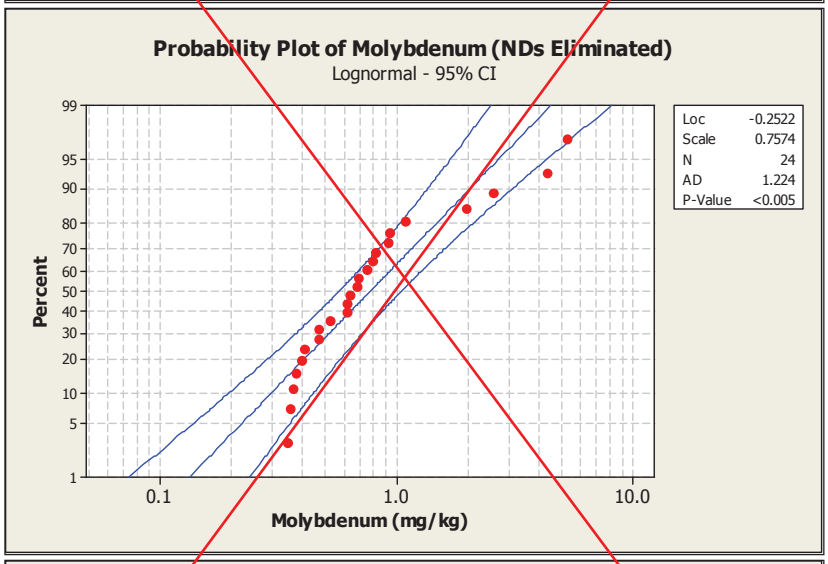
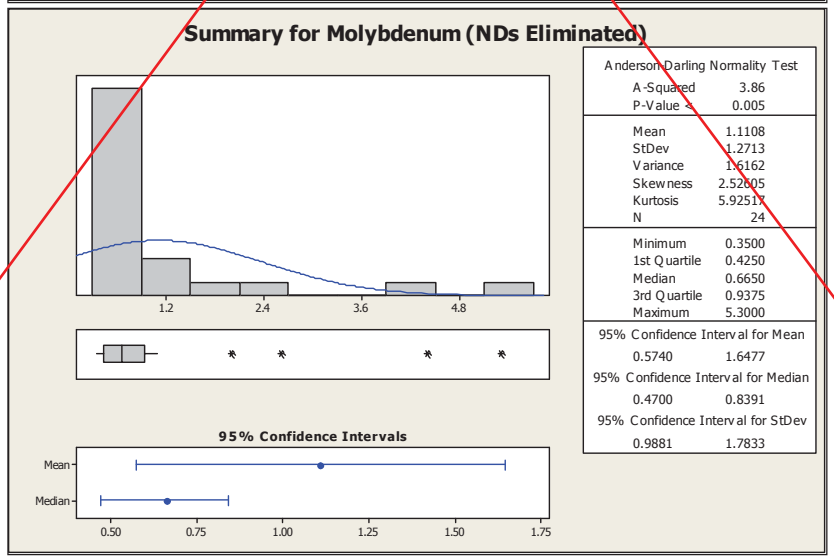
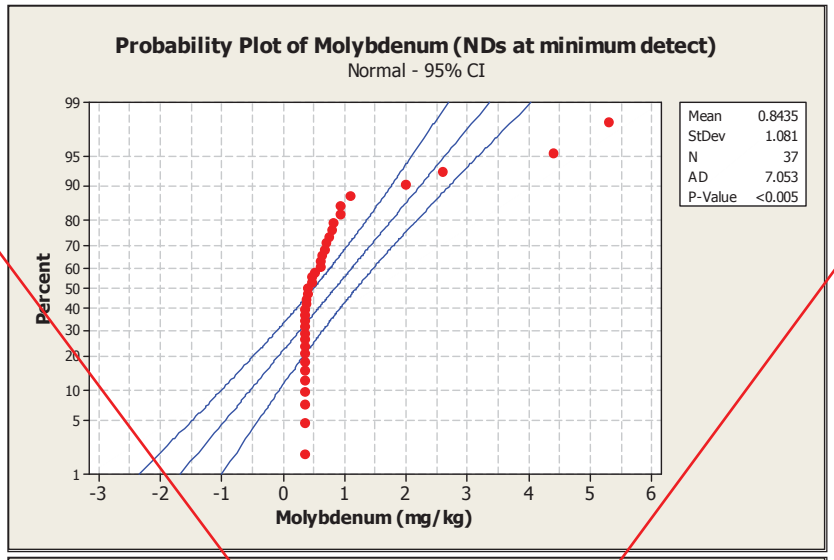
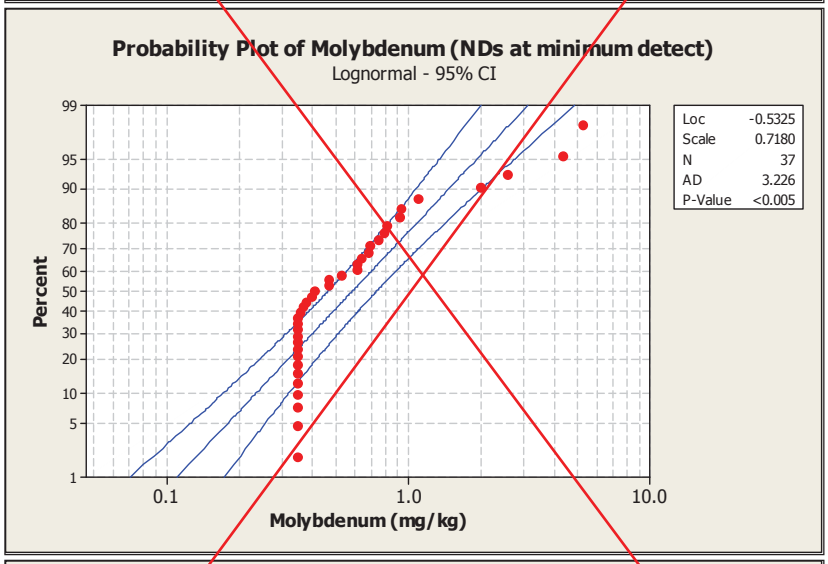


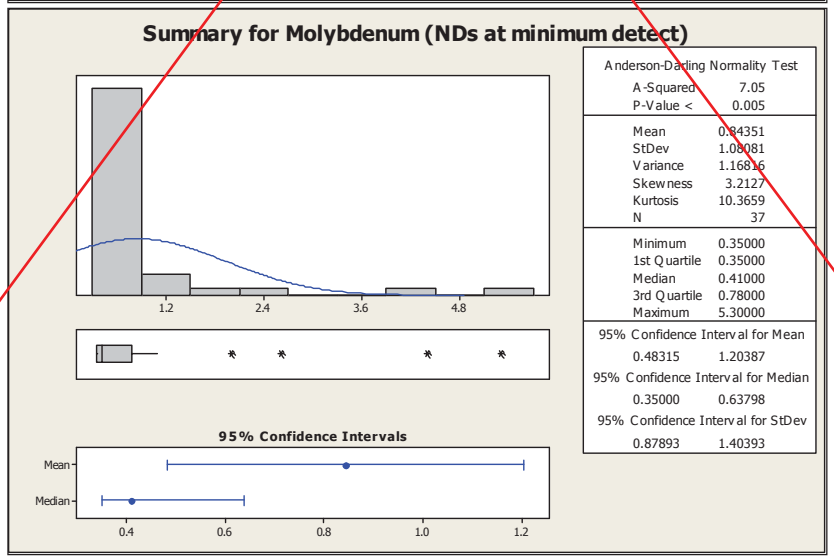




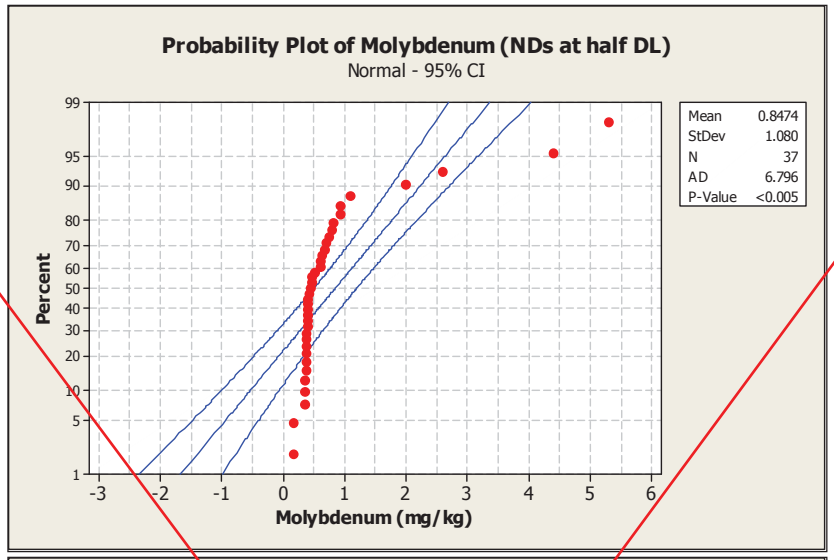
Molybdenum
(Page 2 of 3)

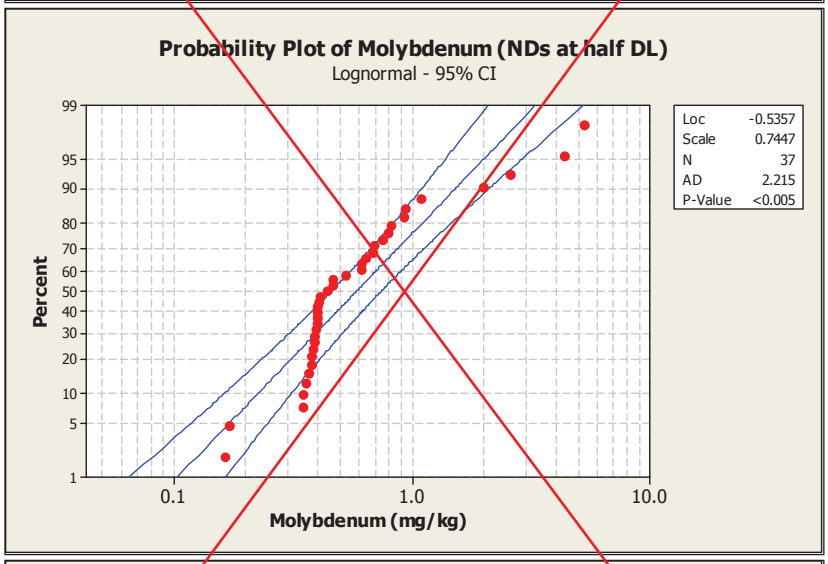


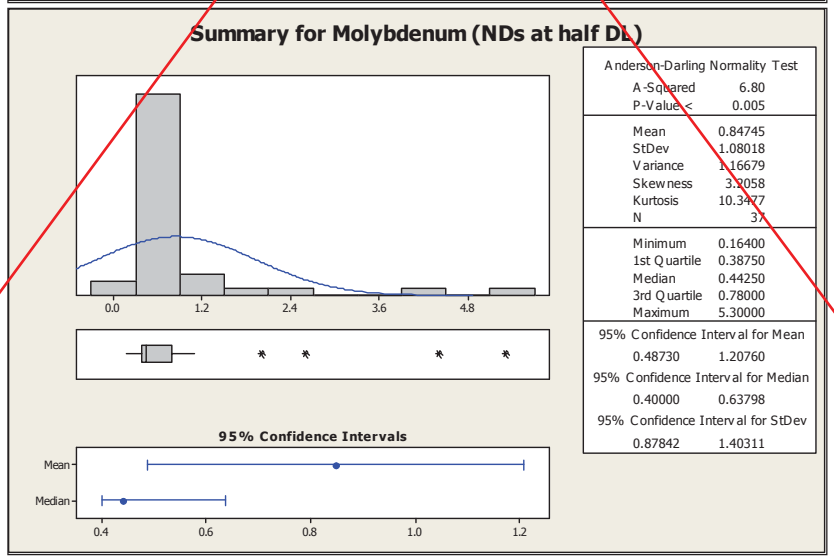




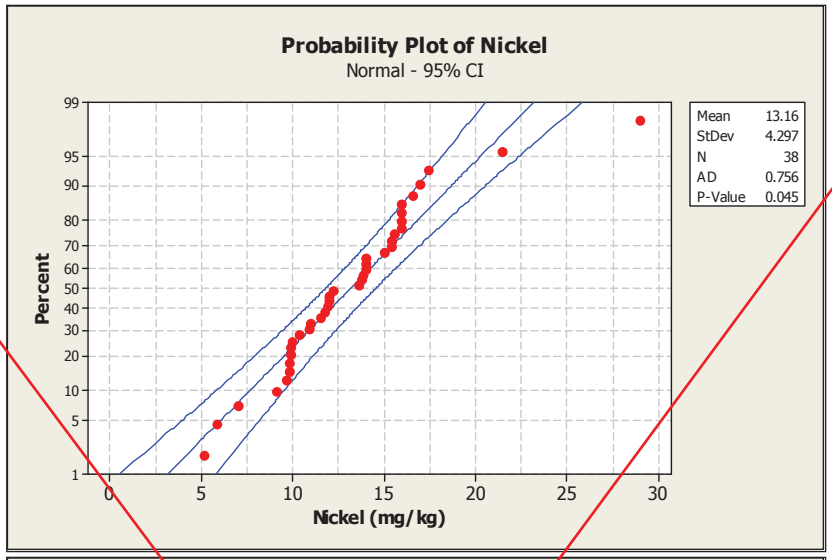
Molybdenum
(Page 3 of 3)

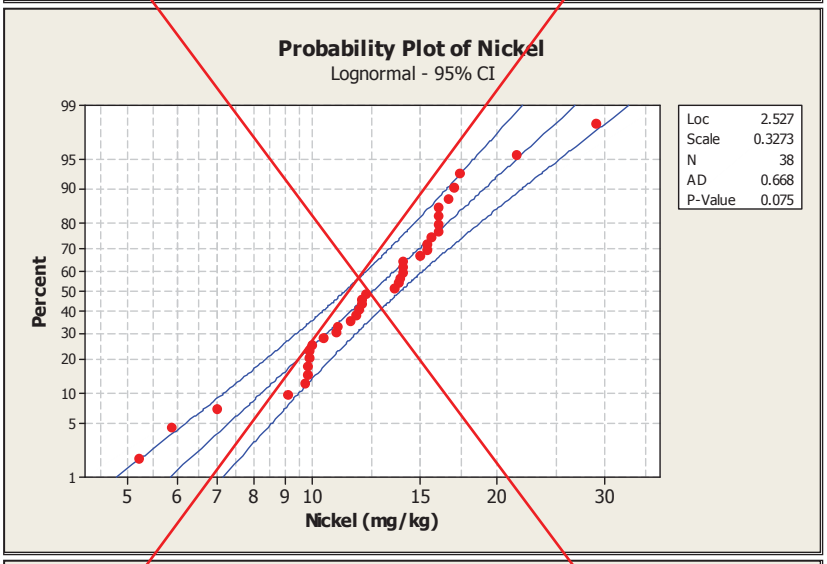


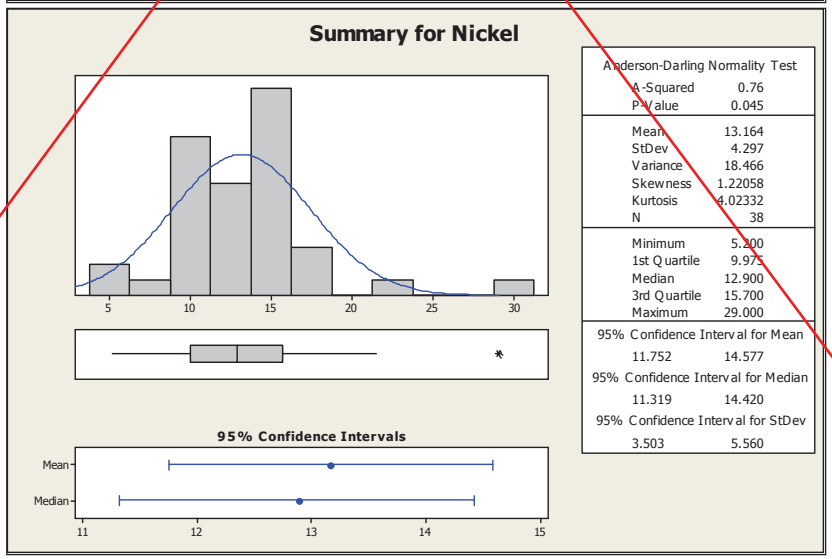




Nickel
(Page 1 of 1)







pH
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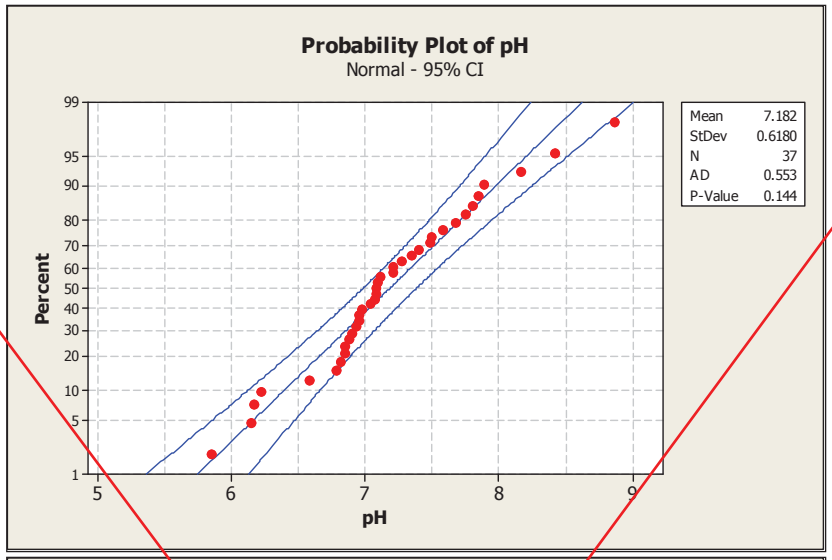
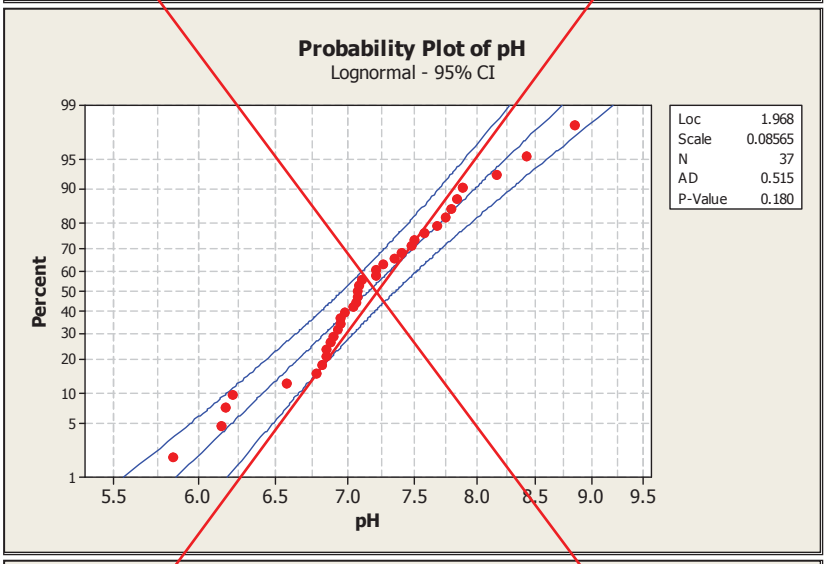
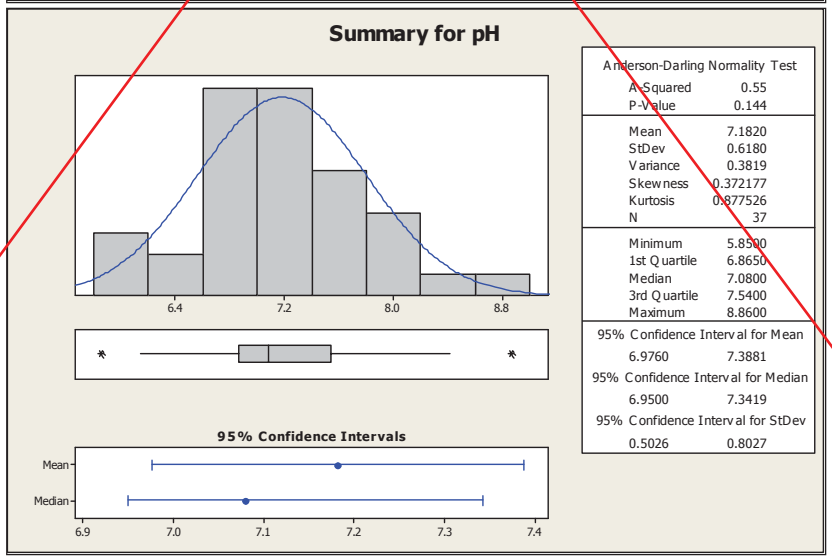
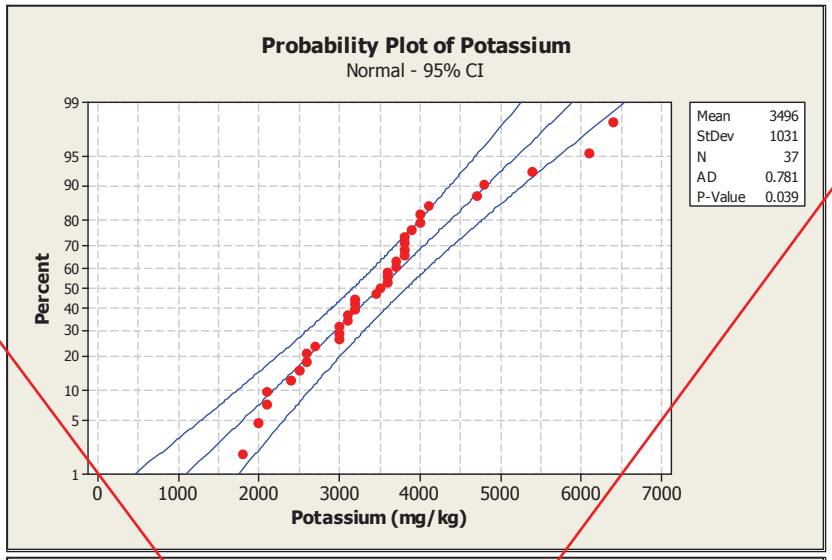
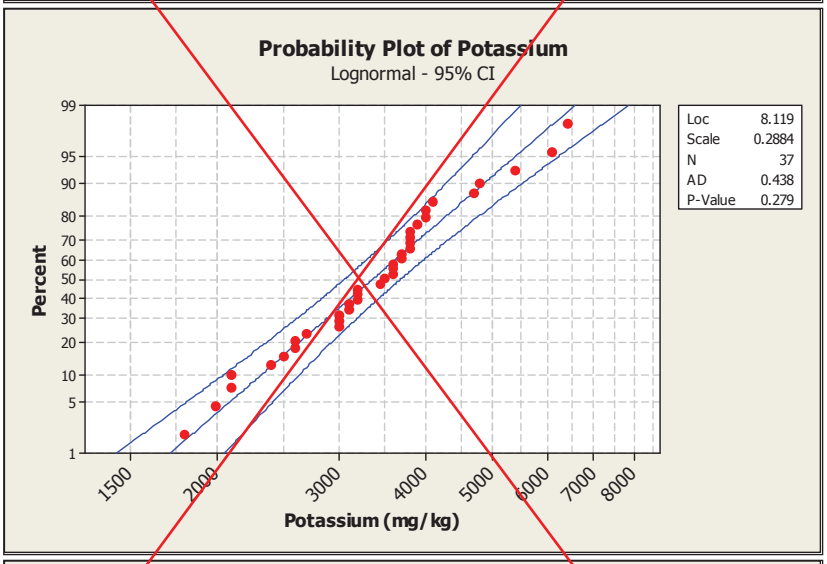

Probability Plot of pH
Normal - 95% CI
Percent
pH
Mean 7.182
StDev 0.6180
N 37
AD 0.553
P-Value 0.144

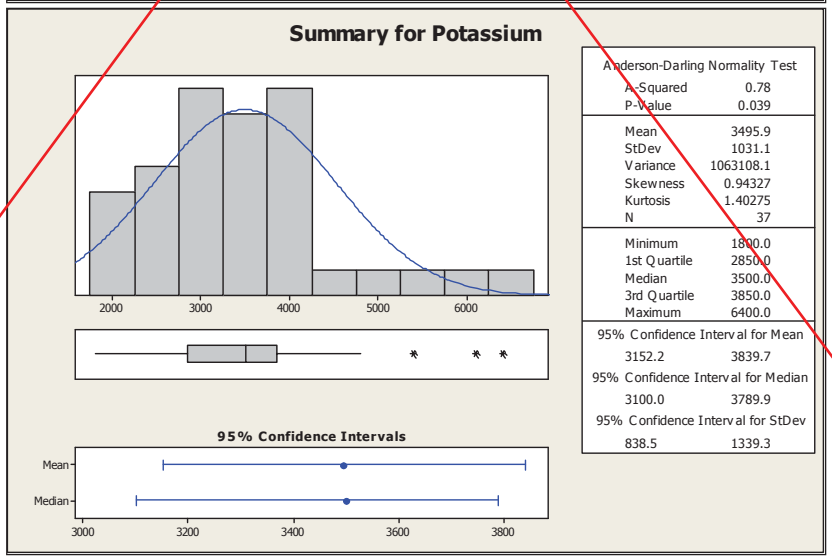

Probability Plot of pH
Lognormal - 95% CI
Percent
pH
Loc 1.968
Scale 0.08565
N 37
AD 0.515
P-Value 0.180


Summary for pH
Anderson-Darling Normality Test
A-Squared 0.55
P-Value 0.144
Mean 7.1820
StDev 0.6180
Variance 0.3819
Skewness 0.372177
Kurtosis 0.877526
N 37
Minimum 5.8500
1st Quartile 6.8650
Median 7.0800
3rd Quartile 7.5400
Maximum 8.8600
95% Confidence Interval for Mean
6.9760 7.3881
95% Confidence Interval for Median
6.9500 7.3419
95% Confidence Interval for StDev
0.5026 0.8027
95% Confidence Intervals
Mean
Median

Potassium
(Page 1 of 1)







Selenium
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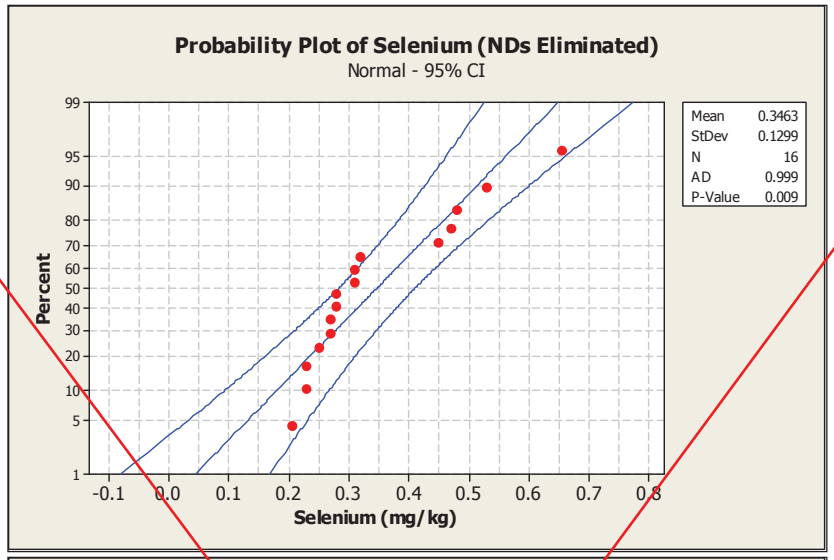

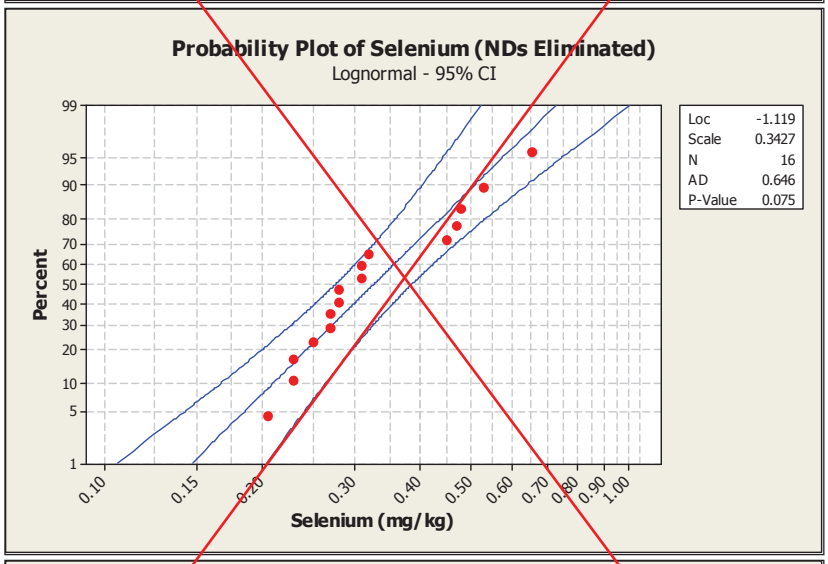

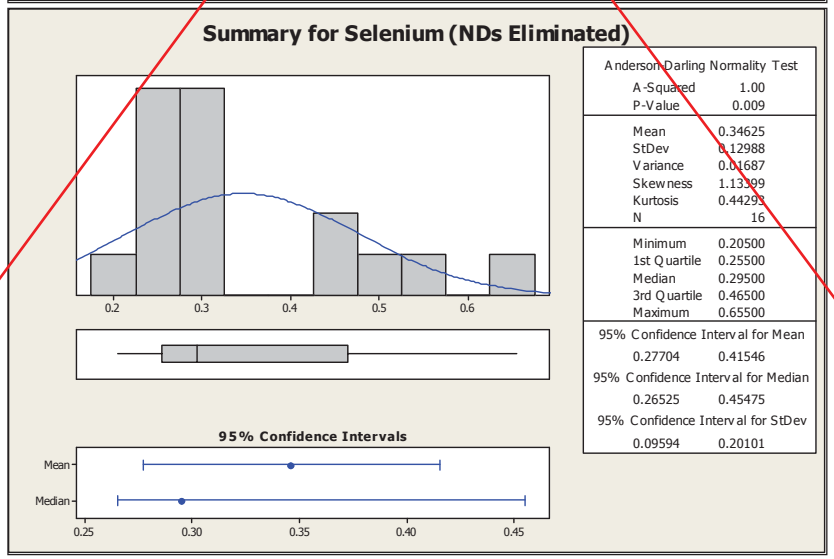

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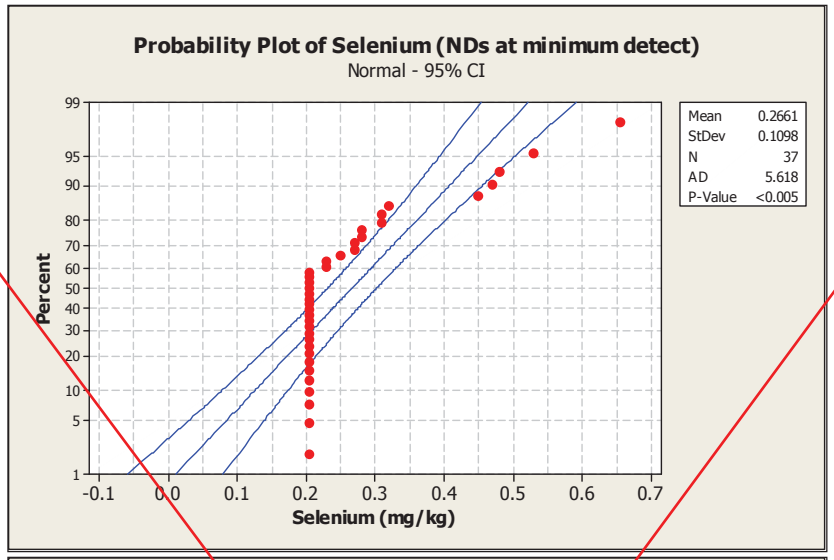

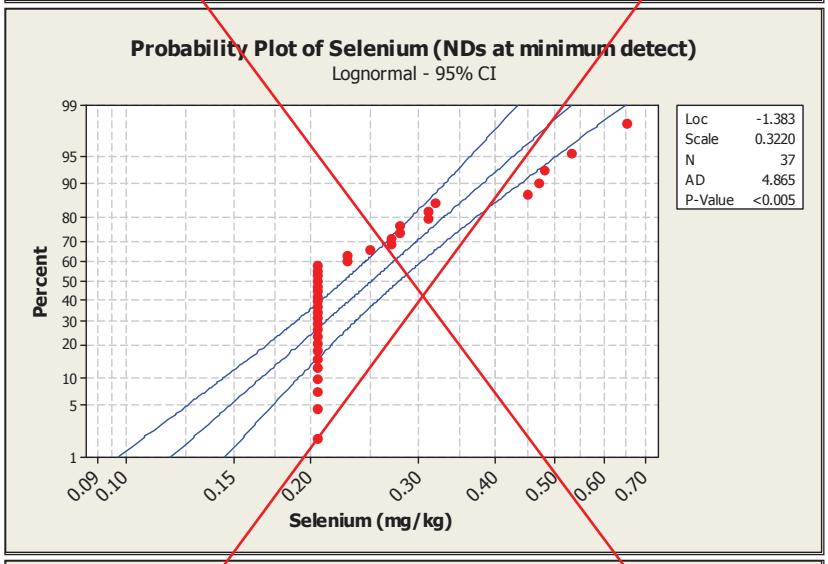

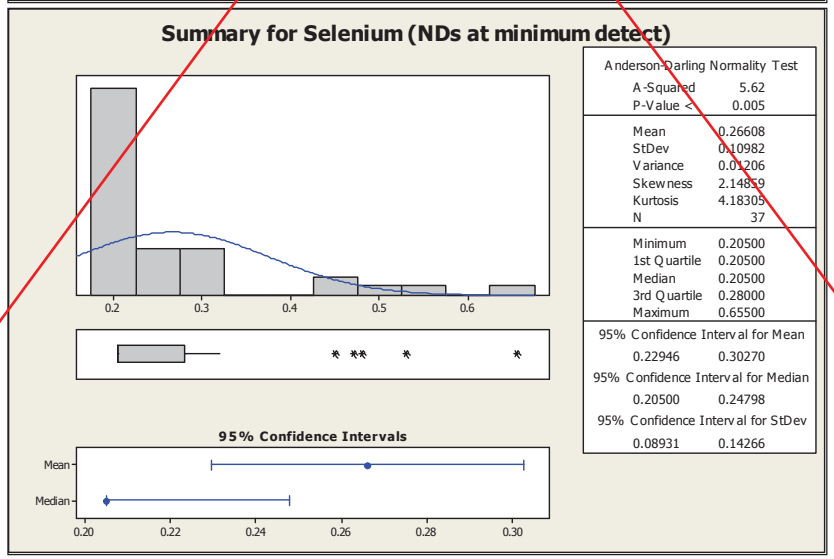

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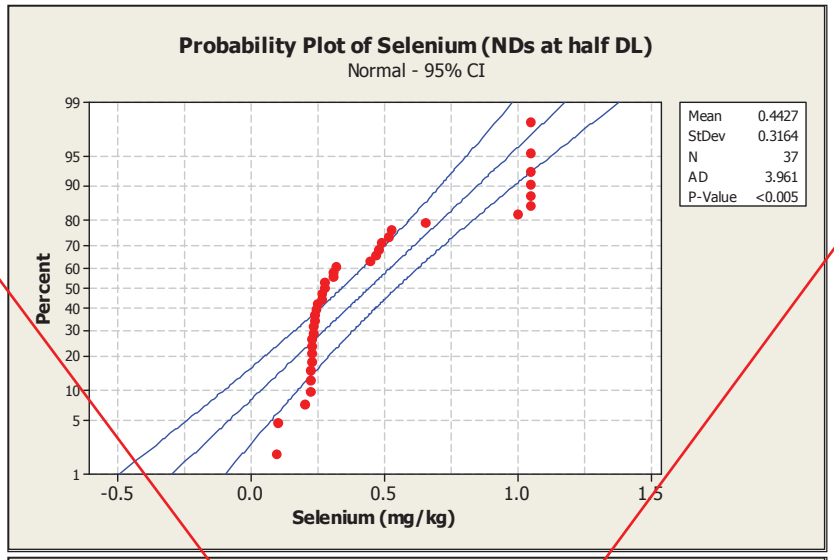

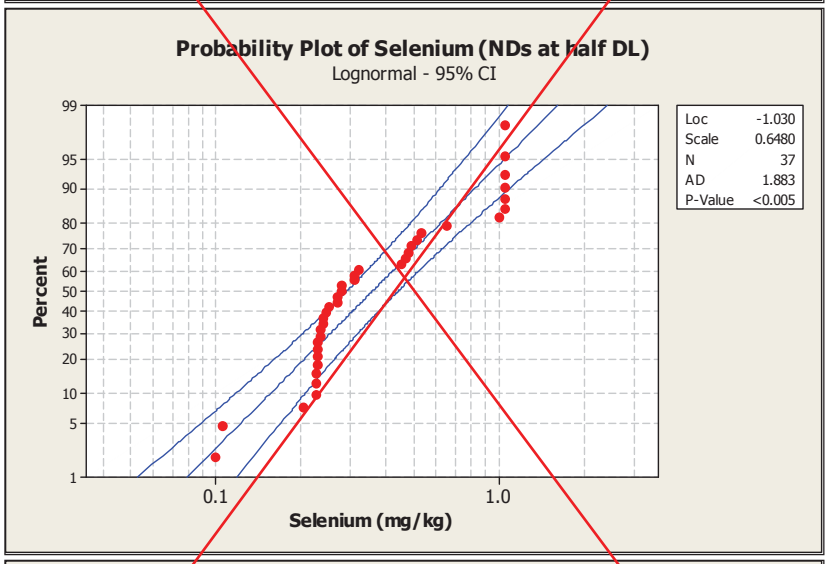

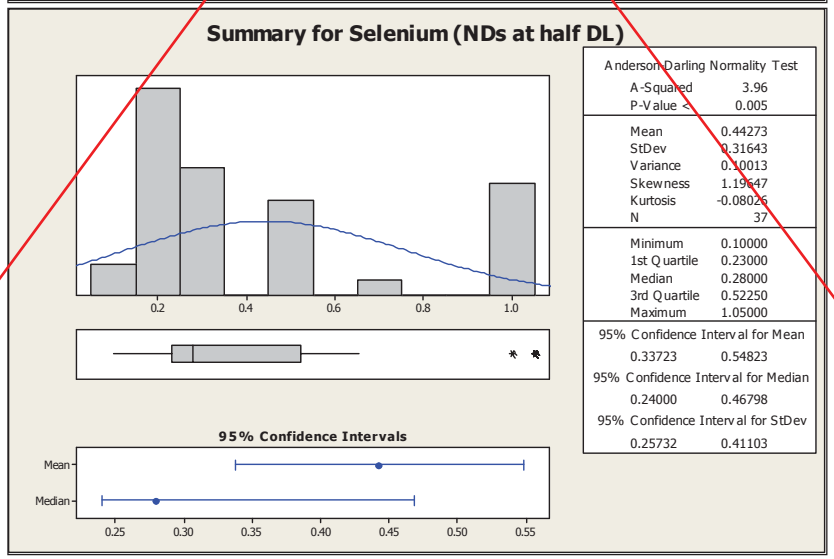

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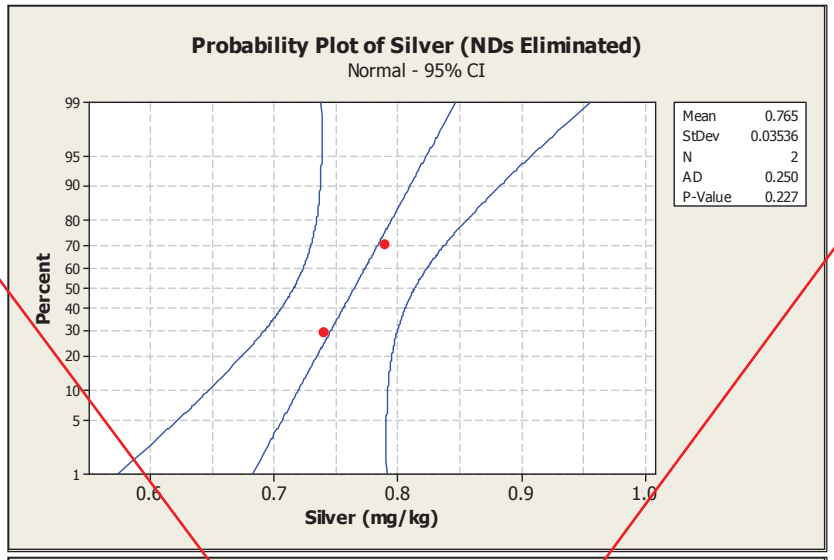

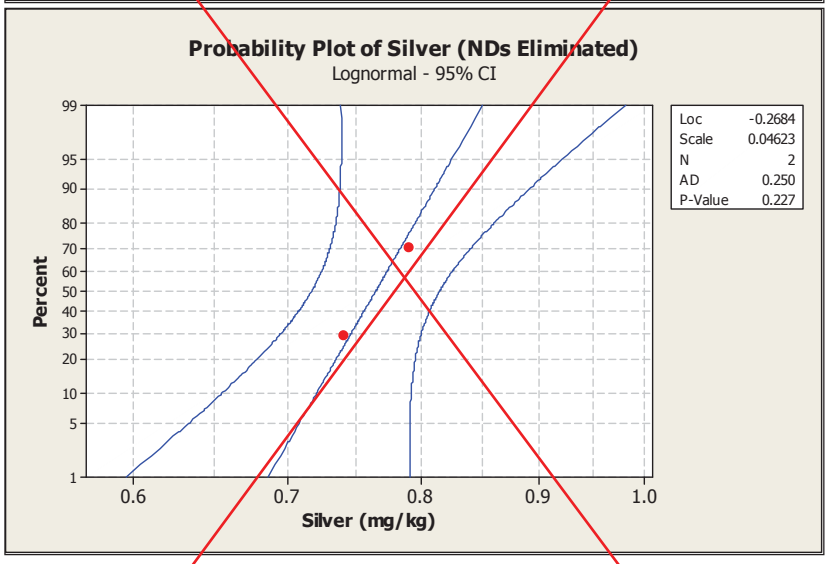

GRAPHICAL SUMMARY NOT PREPARED FOR SILVER WITH "NDs ELIMINATED" DUE TO INSUFFICIENT NUMBER OF DETECTS

Silver
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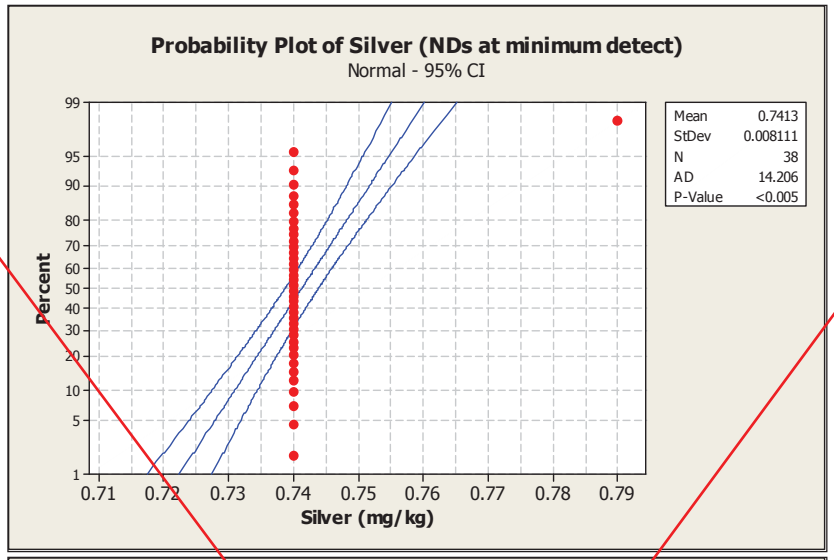

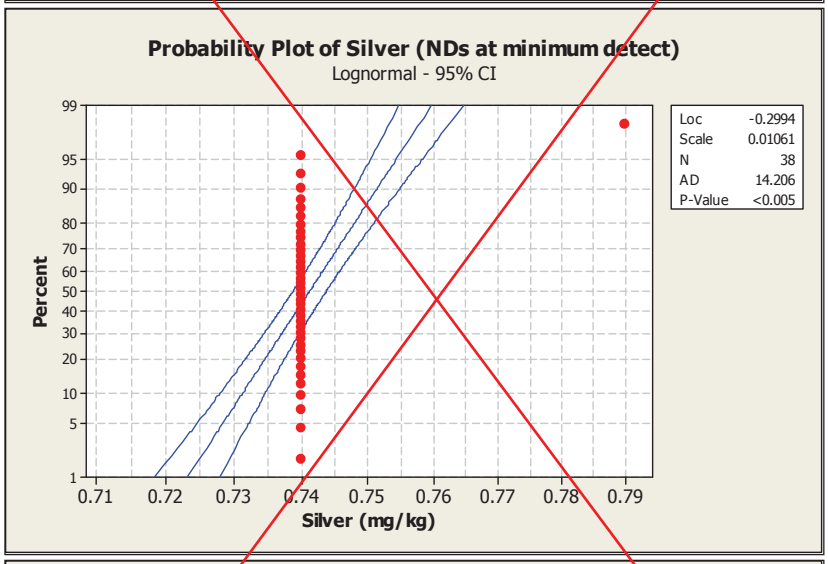

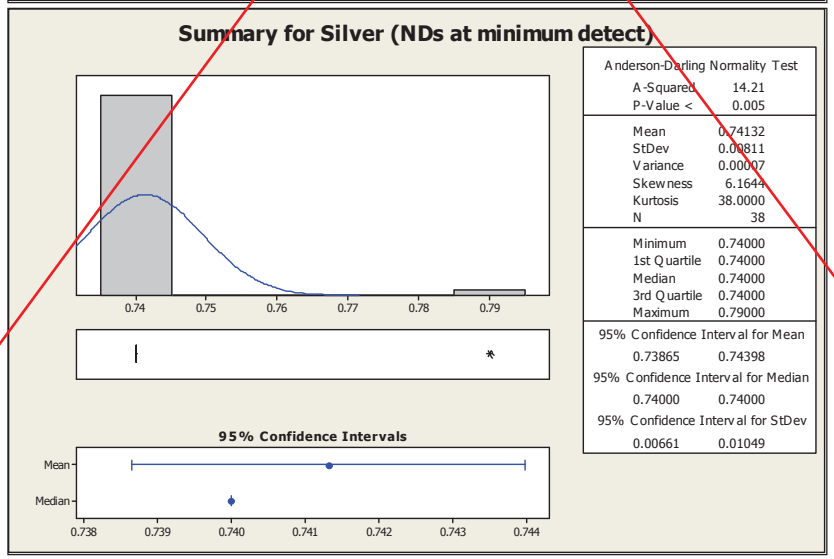

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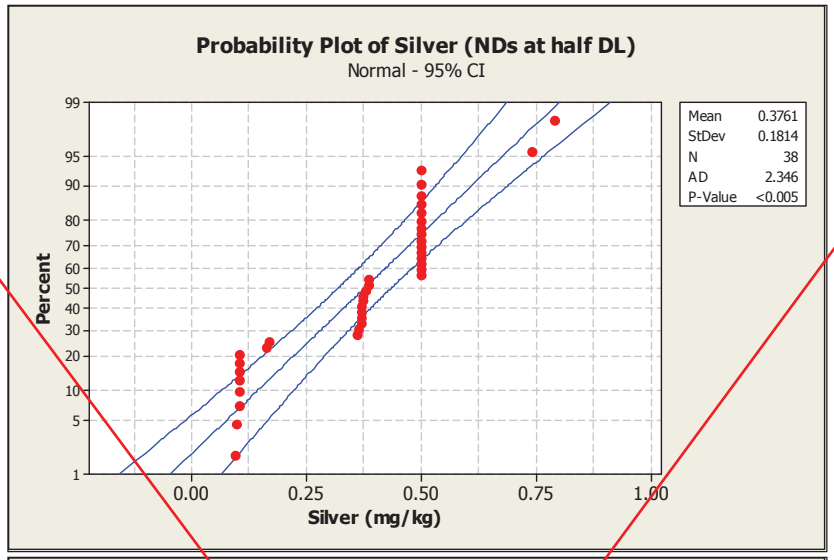

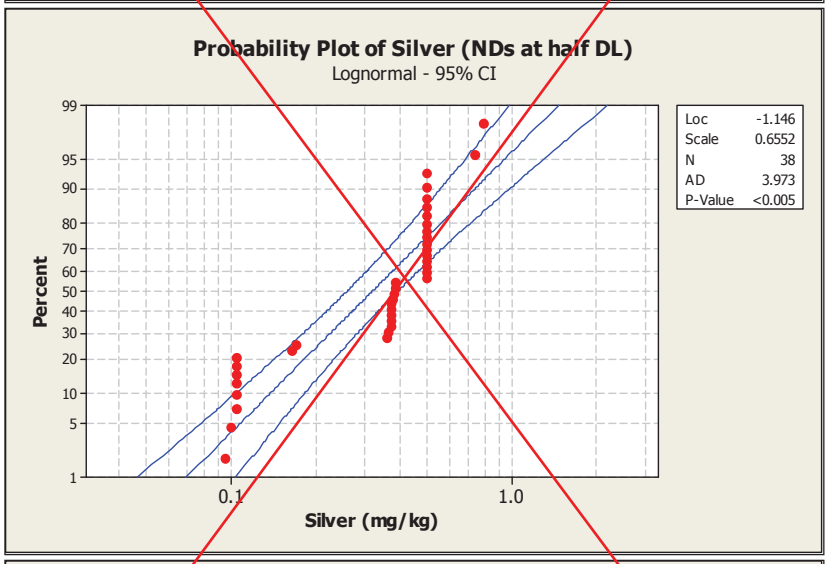

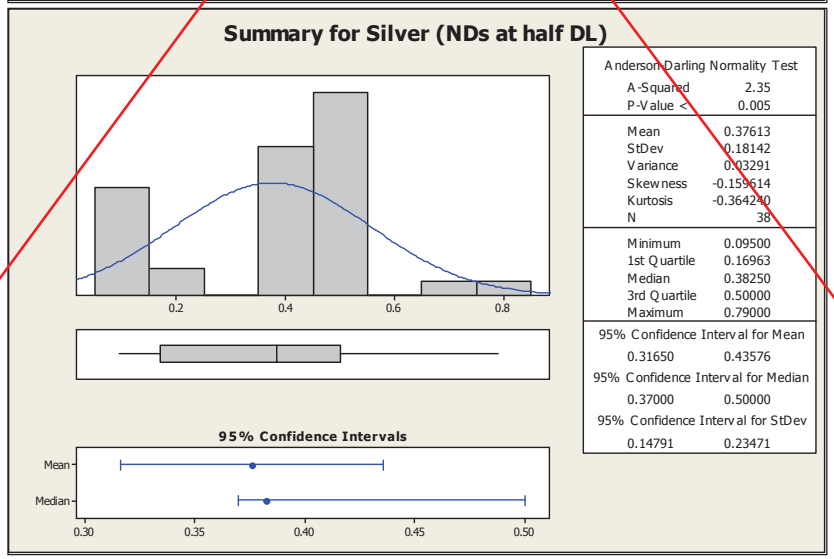

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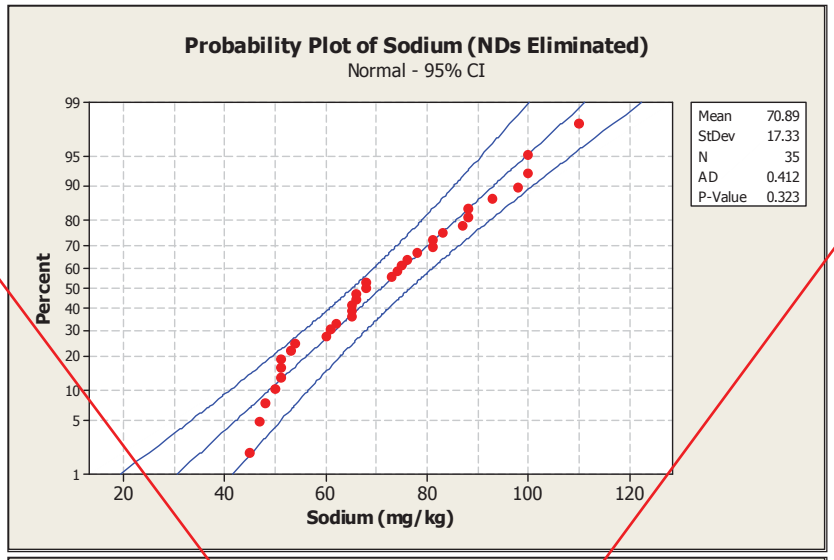

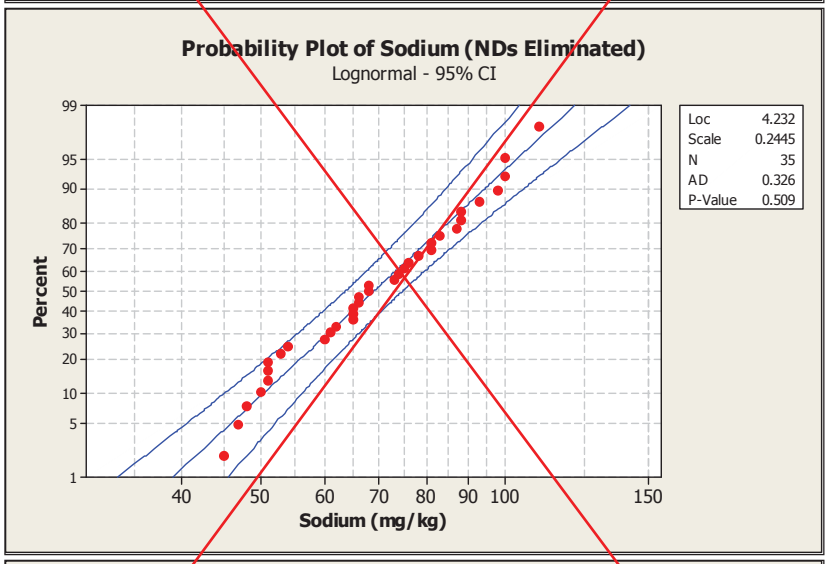

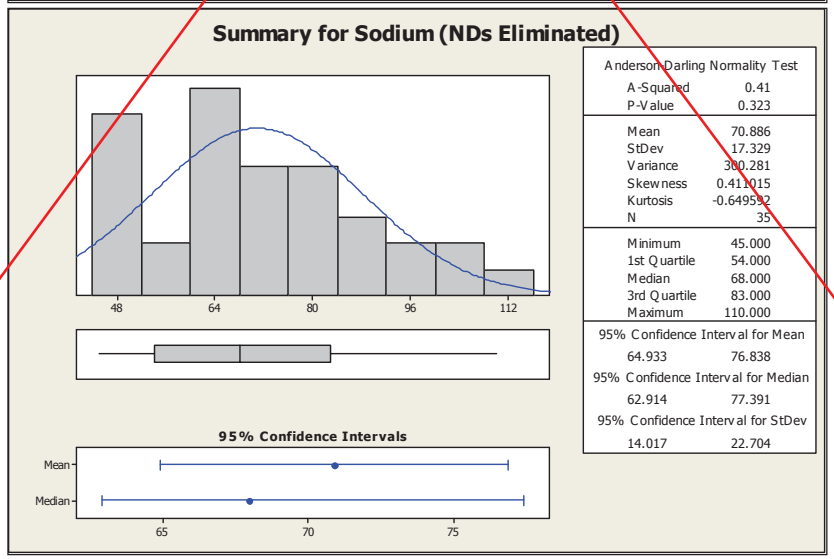

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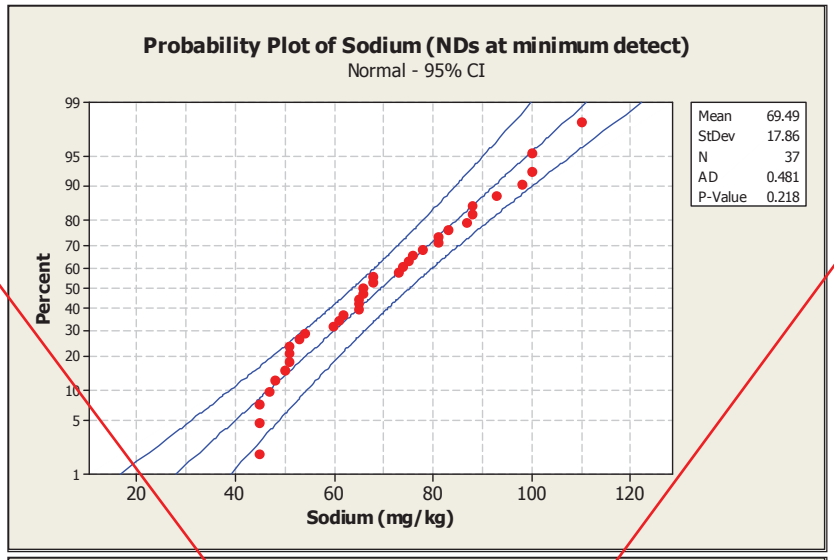

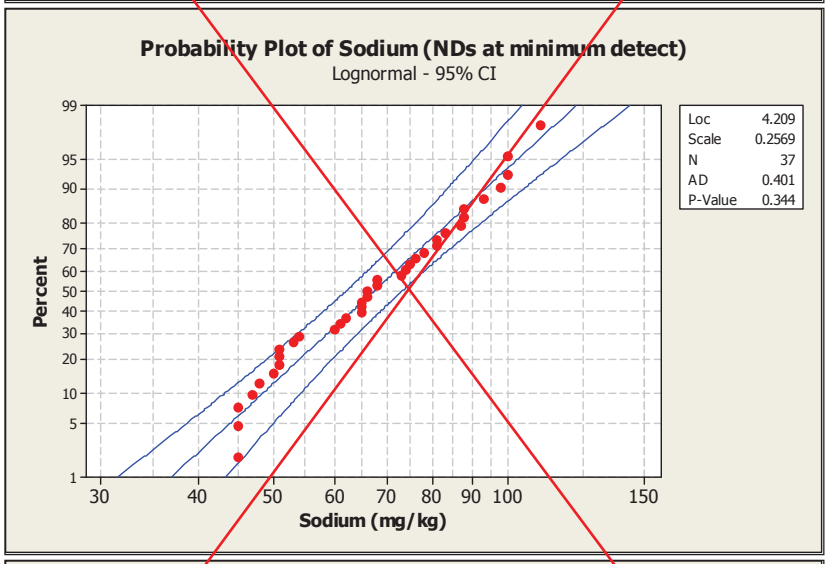

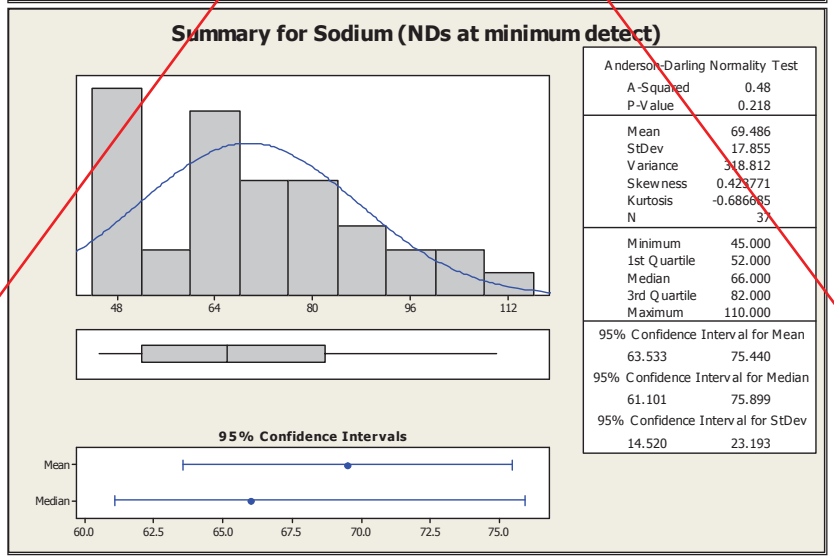

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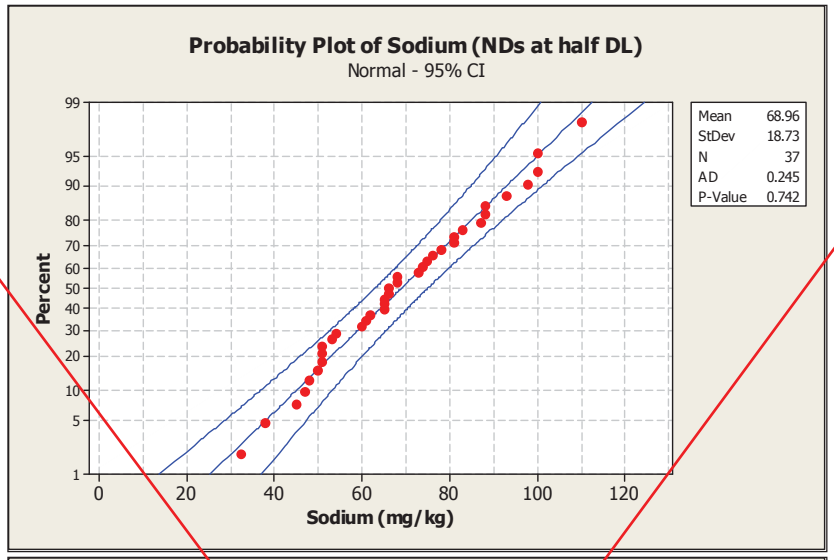

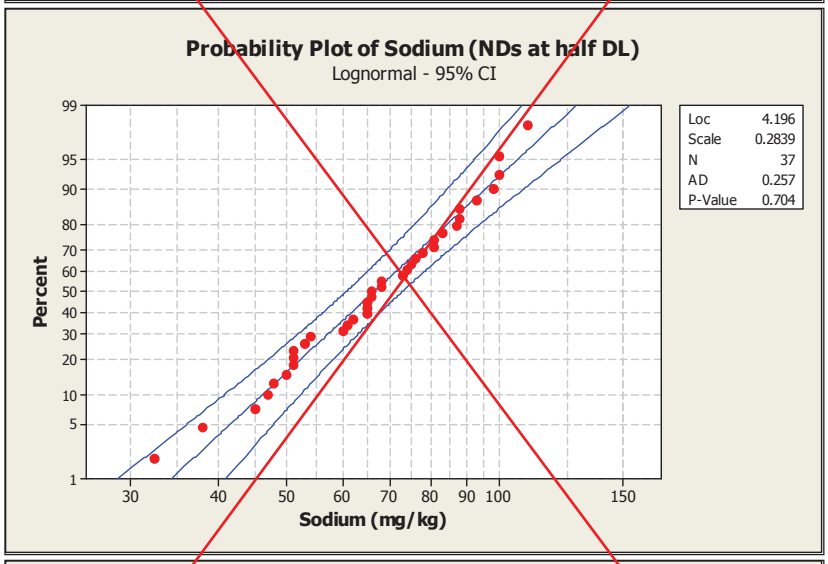

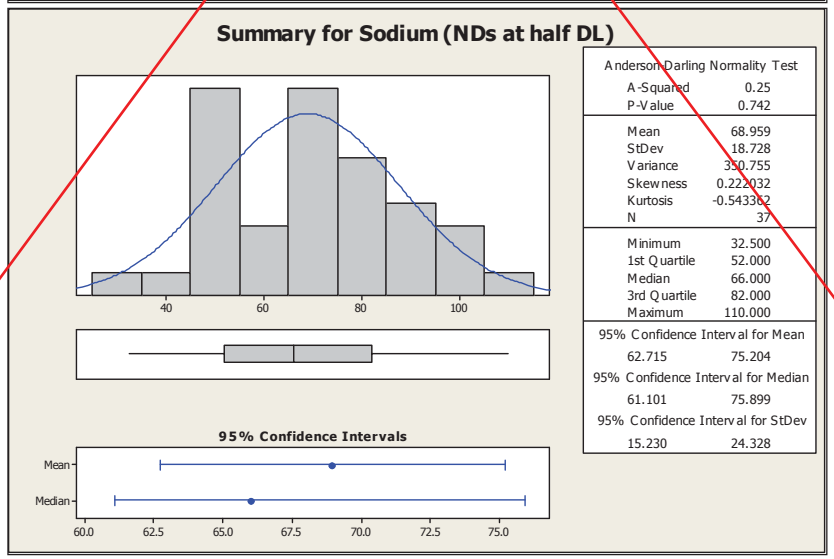

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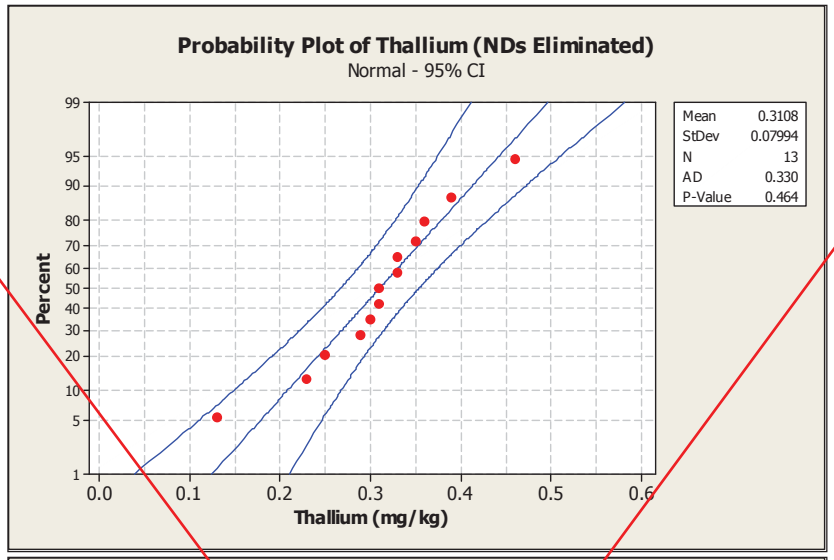

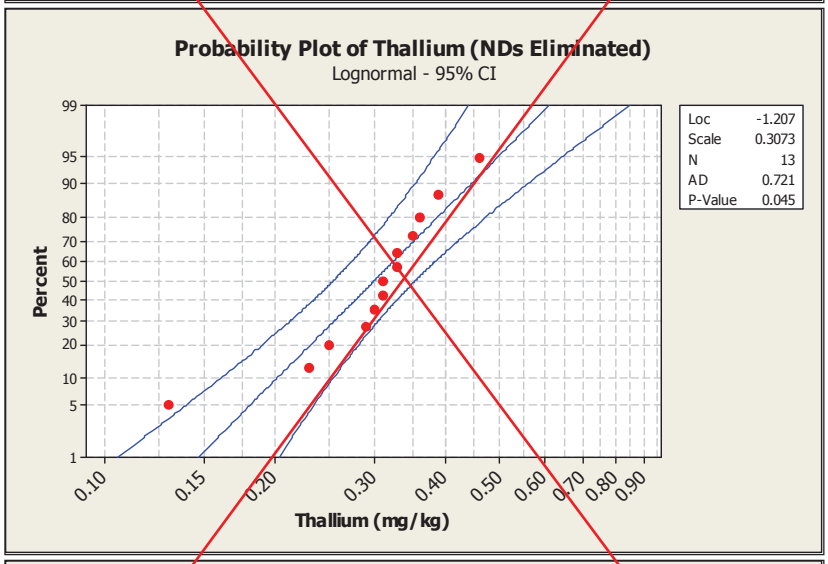

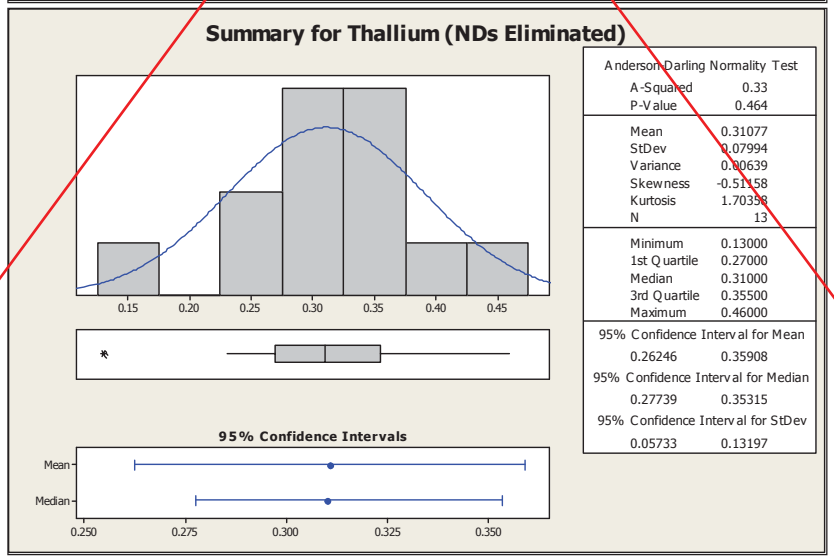

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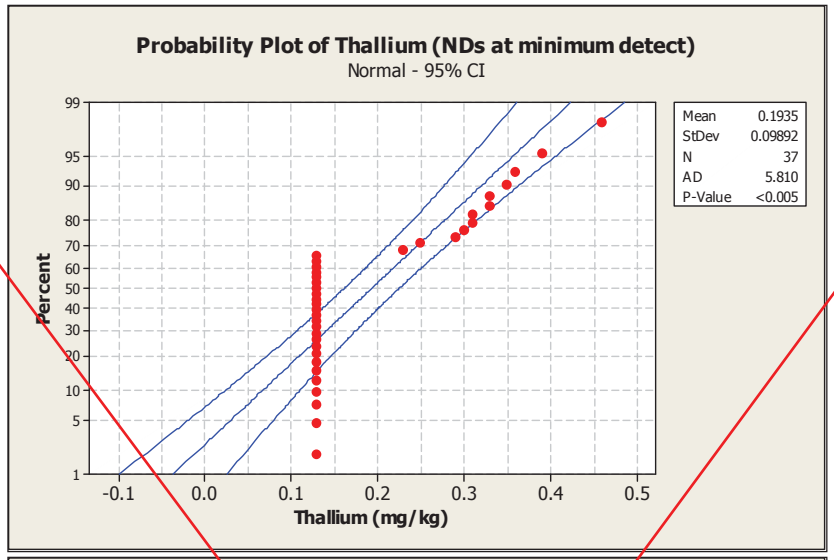

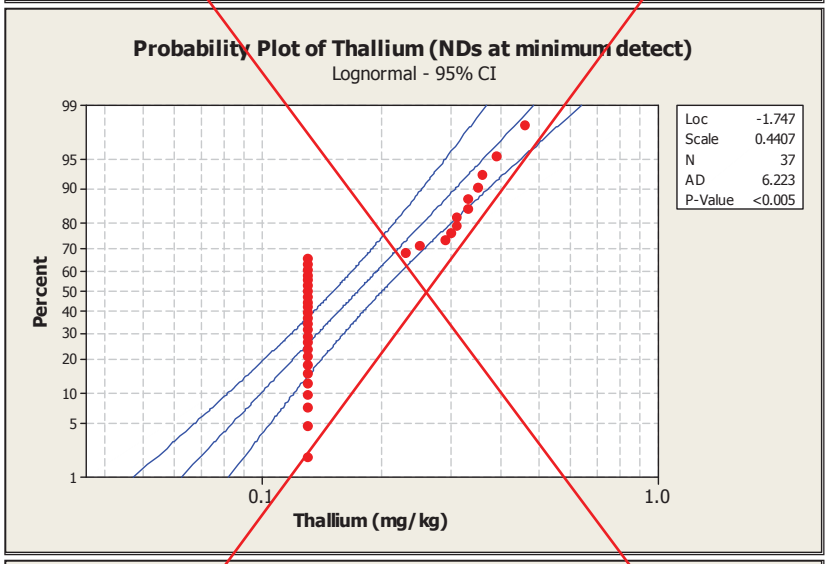

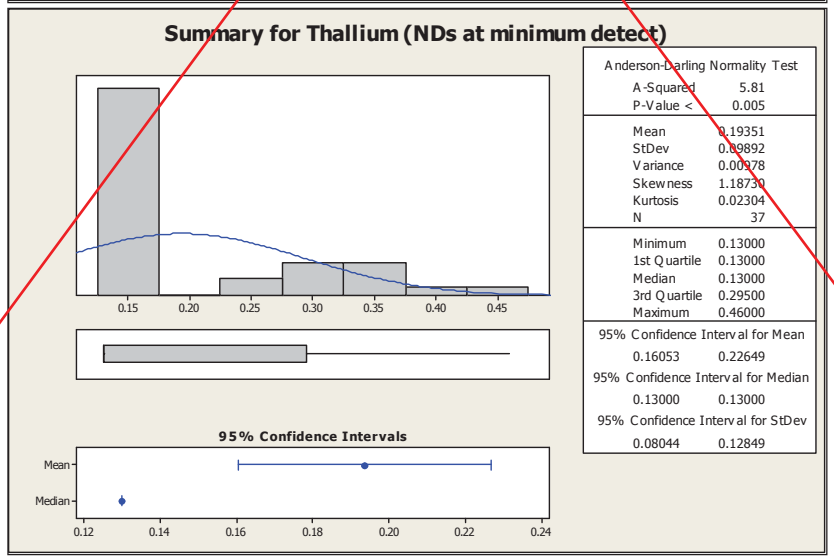

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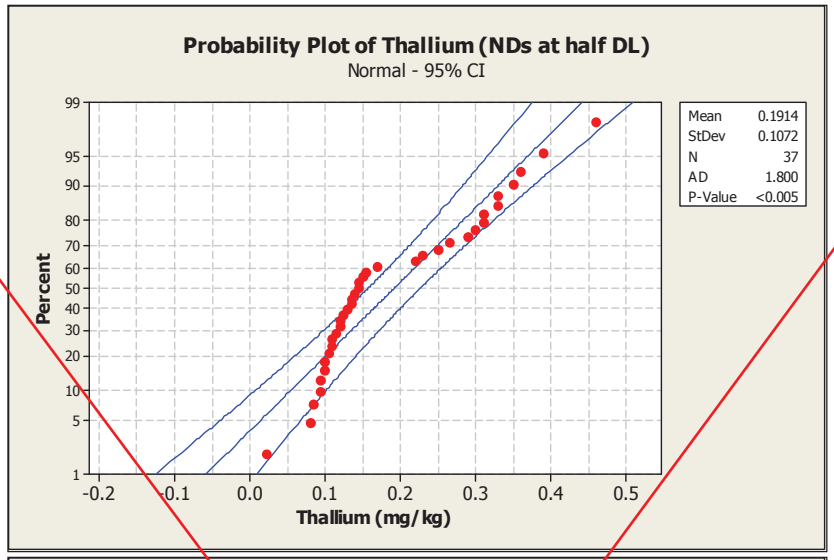

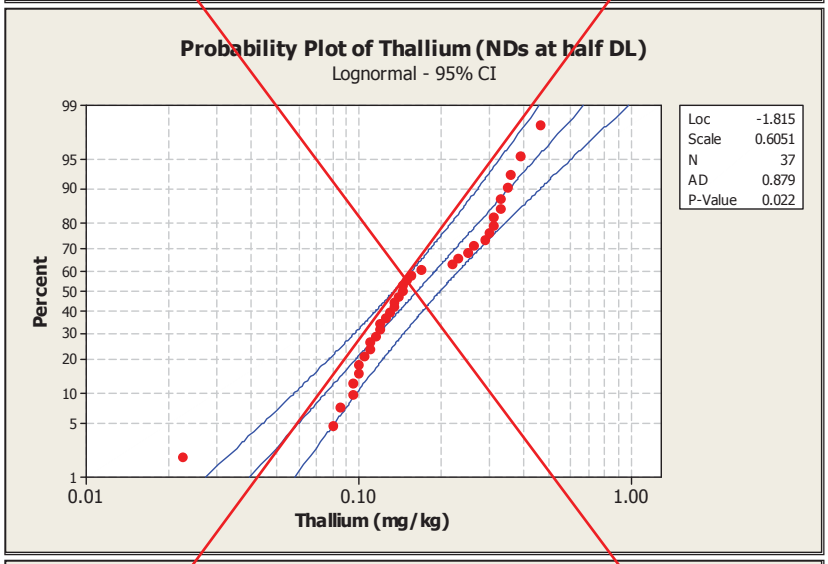

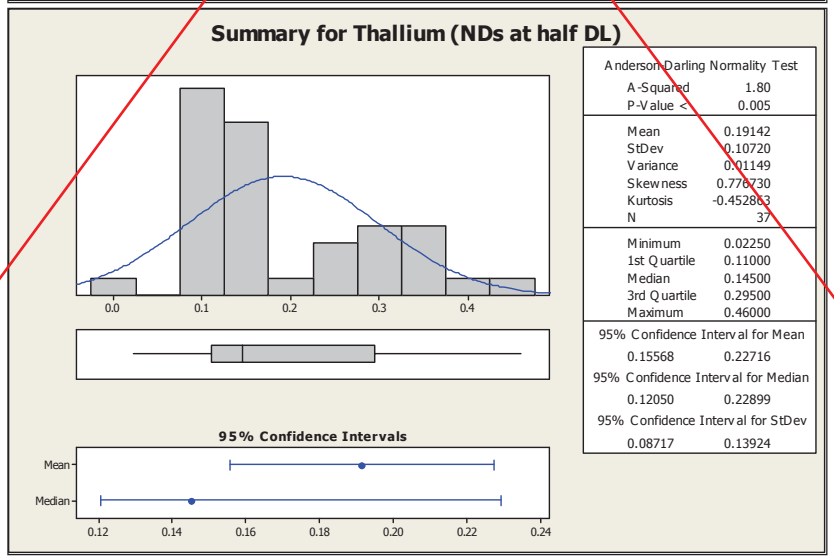

Vanadium
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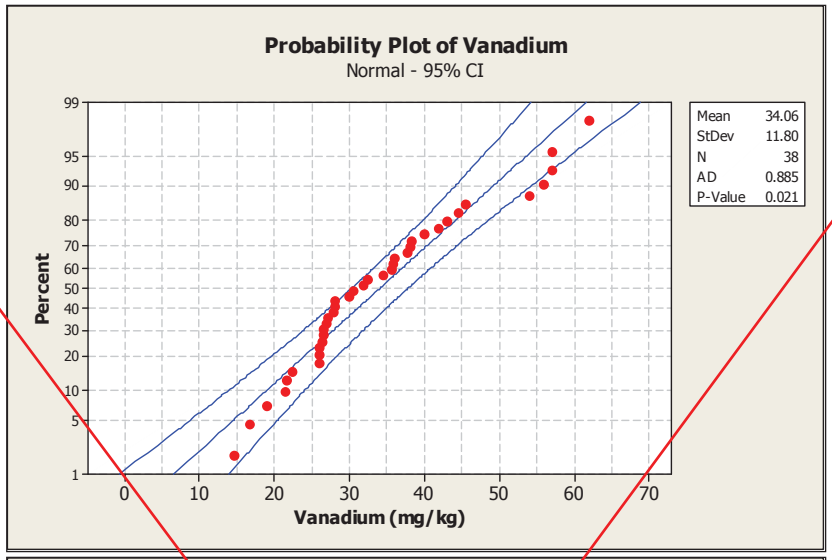
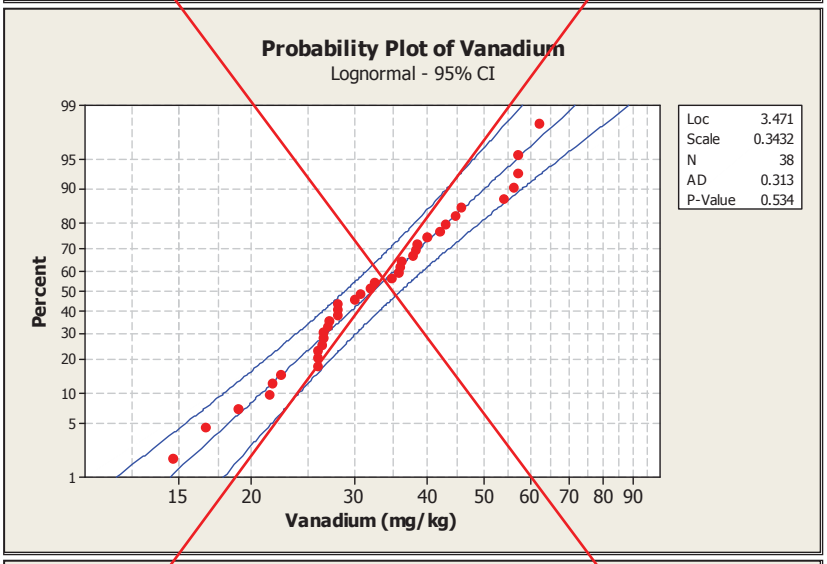
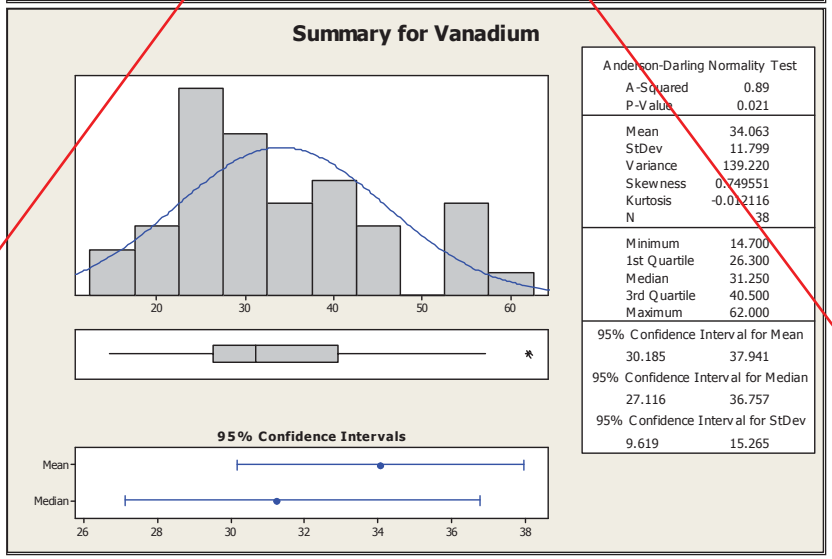
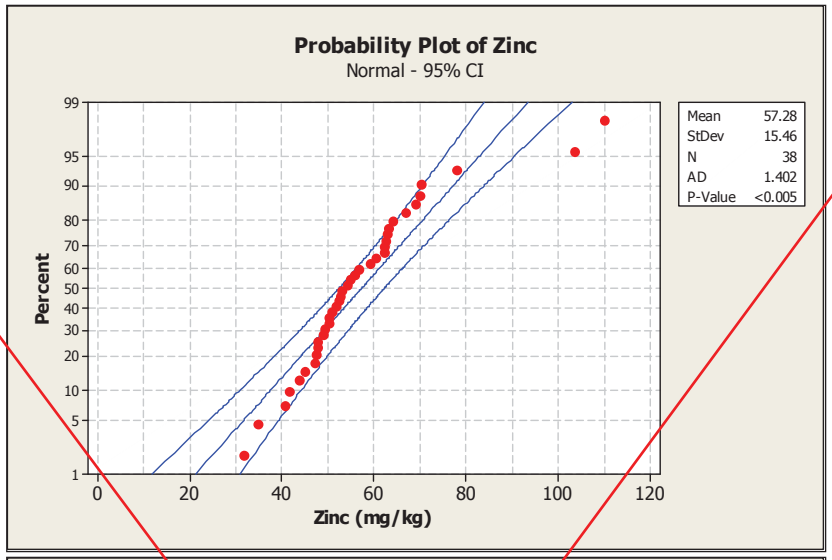
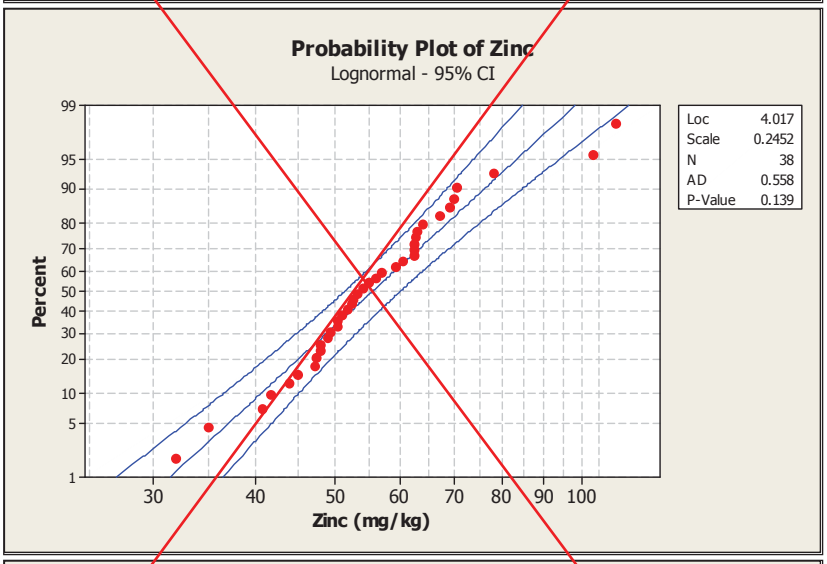


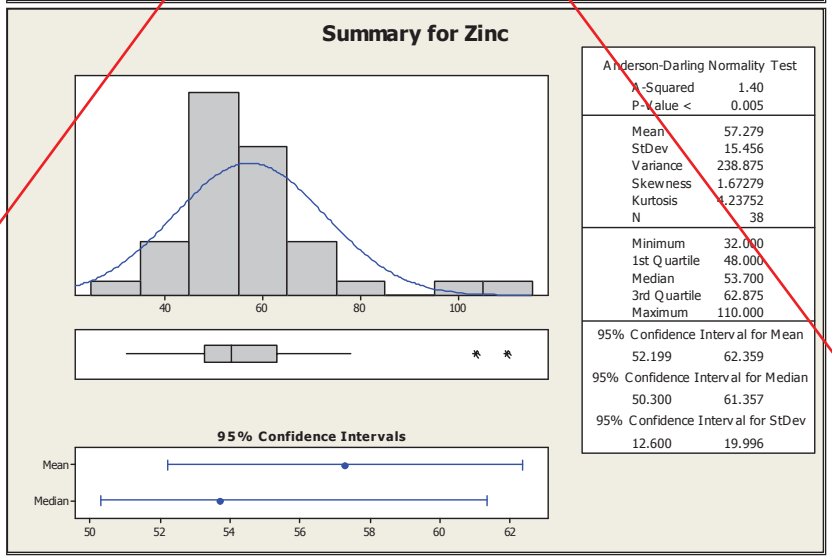




Zinc


Probability Plot of Zinc
Normal - 95% CI
Percent
Zinc (mg/kg)
Mean 57.28
StDev 15.46
N 38
AD 1.402
P-Value <0.005


Probability Plot of Zinc
Lognormal - 95% CI
Percent
Zinc (mg/kg)
Loc 4.017
Scale 0.2452
N 38
AD 0.558
P-Value 0.139


Summary for Zinc
Anderson-Darling Normality Test
A-Squared 1.40
P-Value < 0.005
Mean 57.279
StDev 15.456
Variance 238.875
Skewness 1.67279
Kurtosis 4.23752
N 38
Minimum 32.000
1st Quartile 48.000
Median 53.700
3rd Quartile 62.875
Maximum 110.000
95% Confidence Interval for Mean
52.199 62.359
95% Confidence Interval for Median
50.300 61.357
95% Confidence Interval for StDev
12.600 19.996
95% Confidence Intervals
Mean
Median

Zirconium
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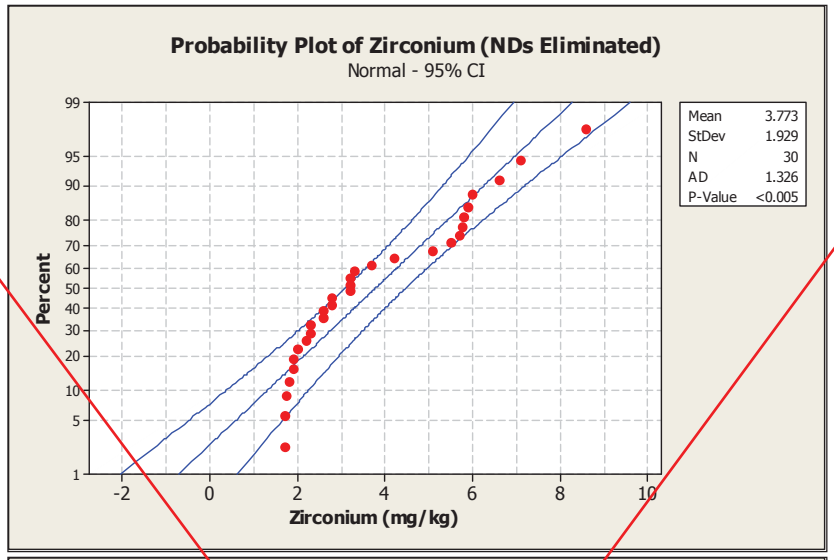

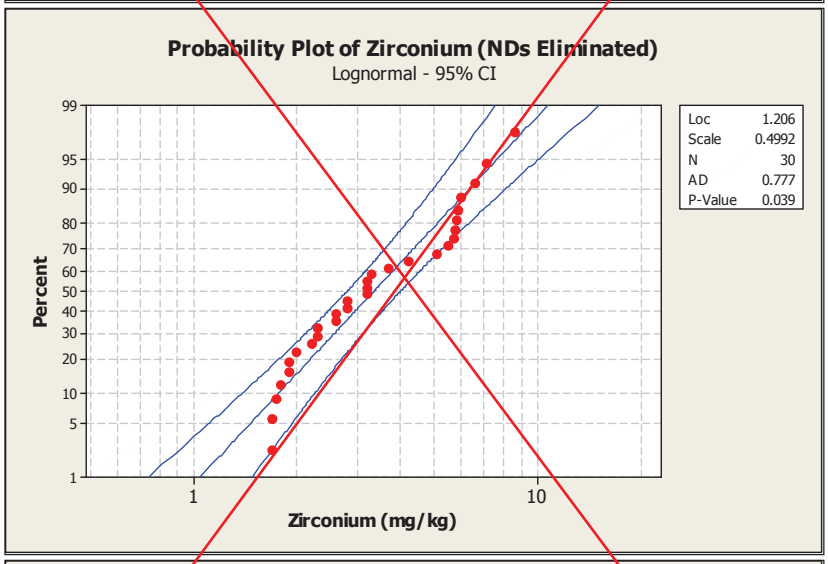

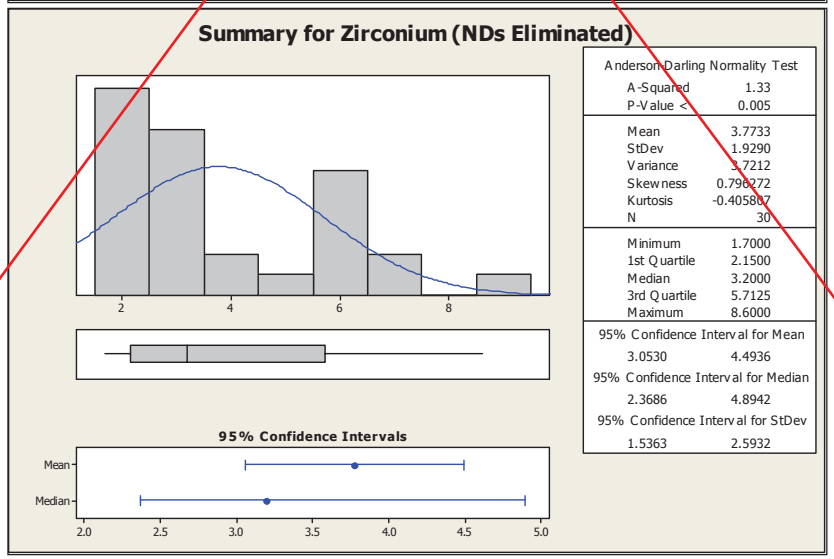

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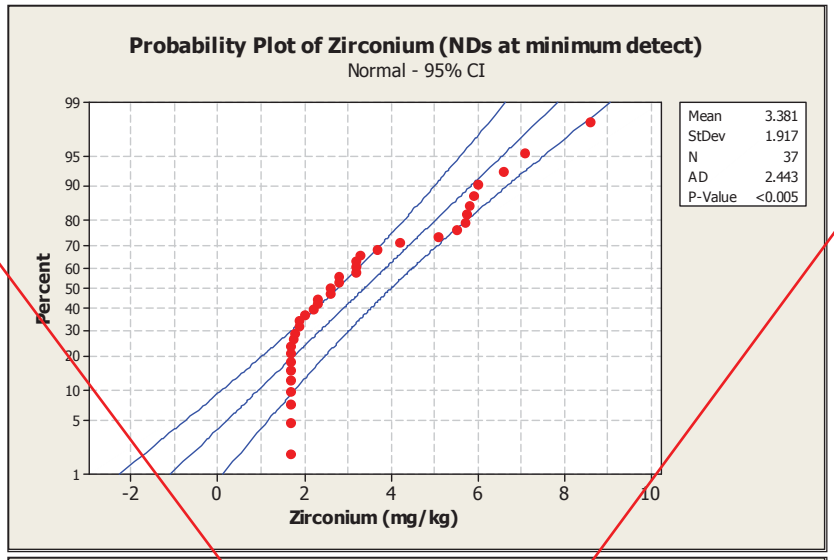

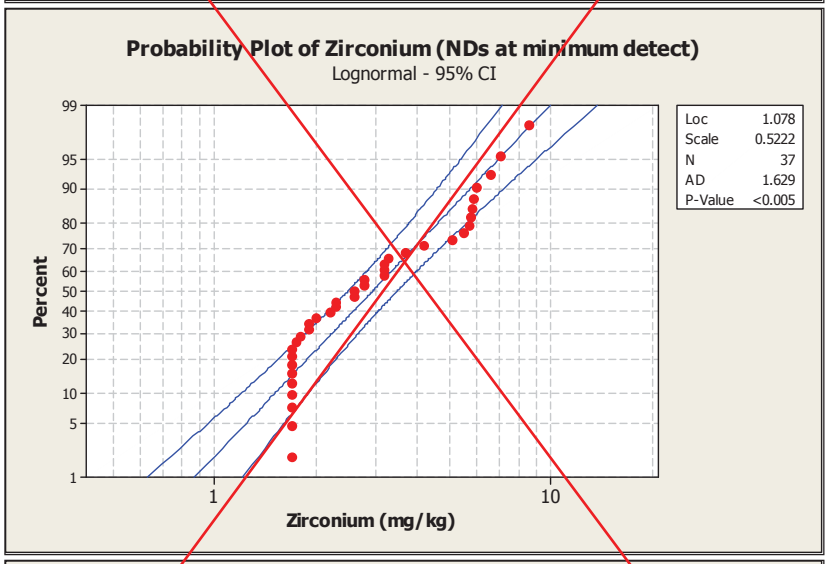

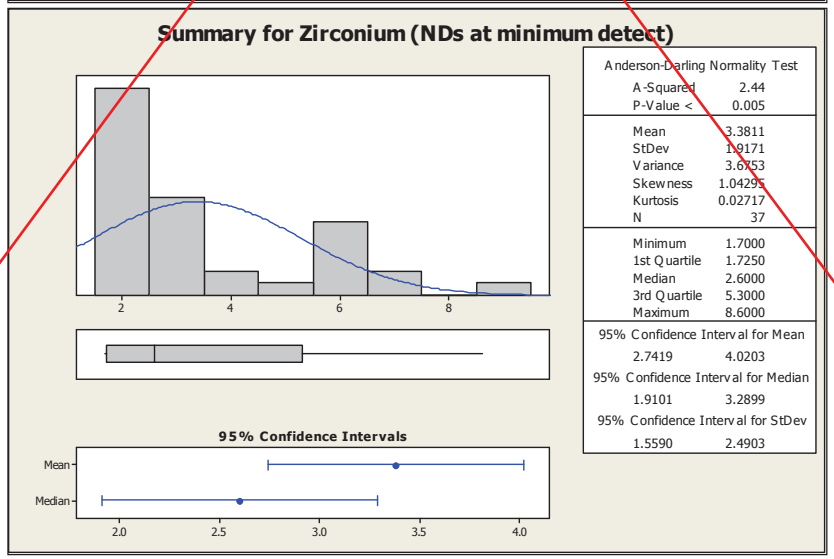

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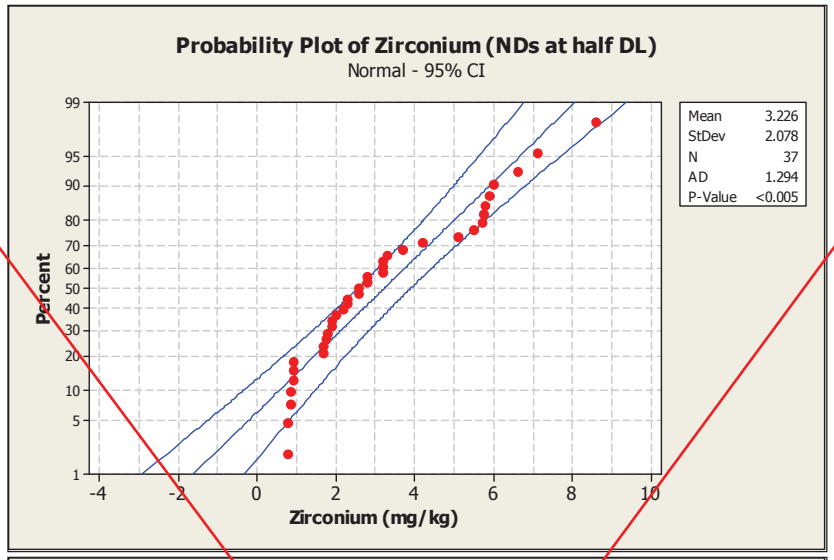

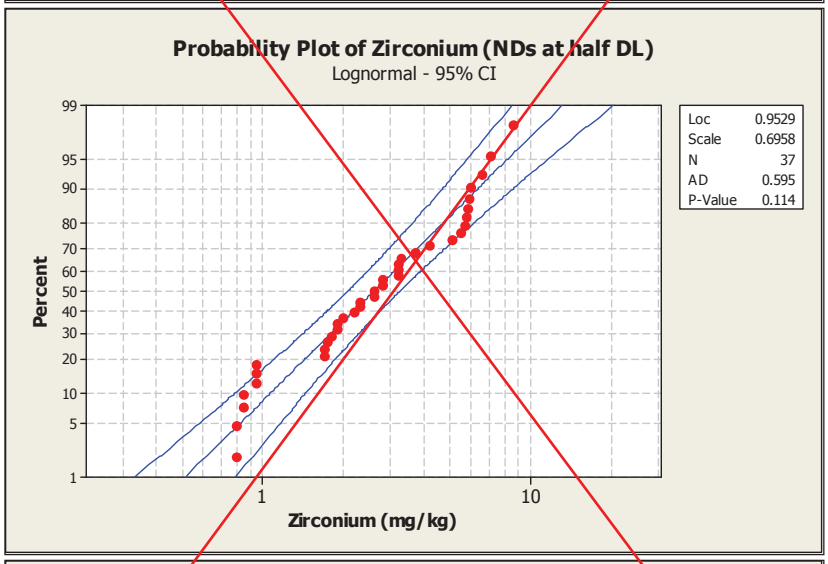

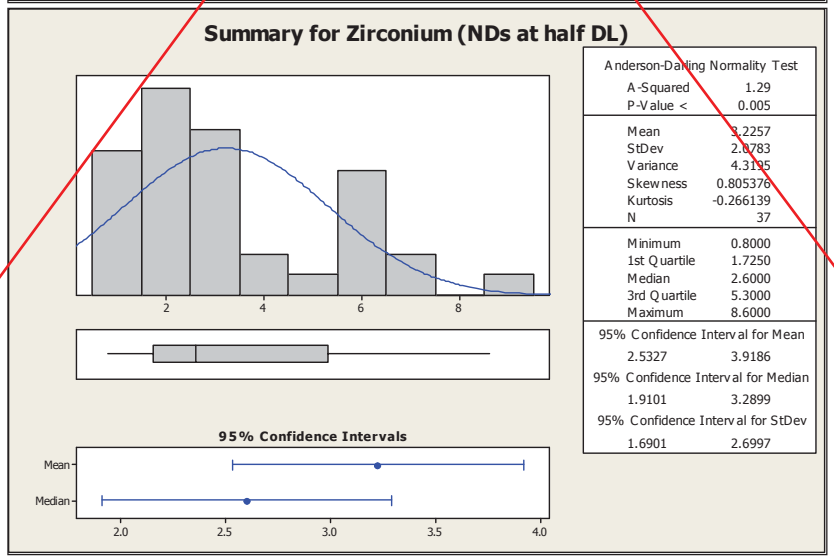

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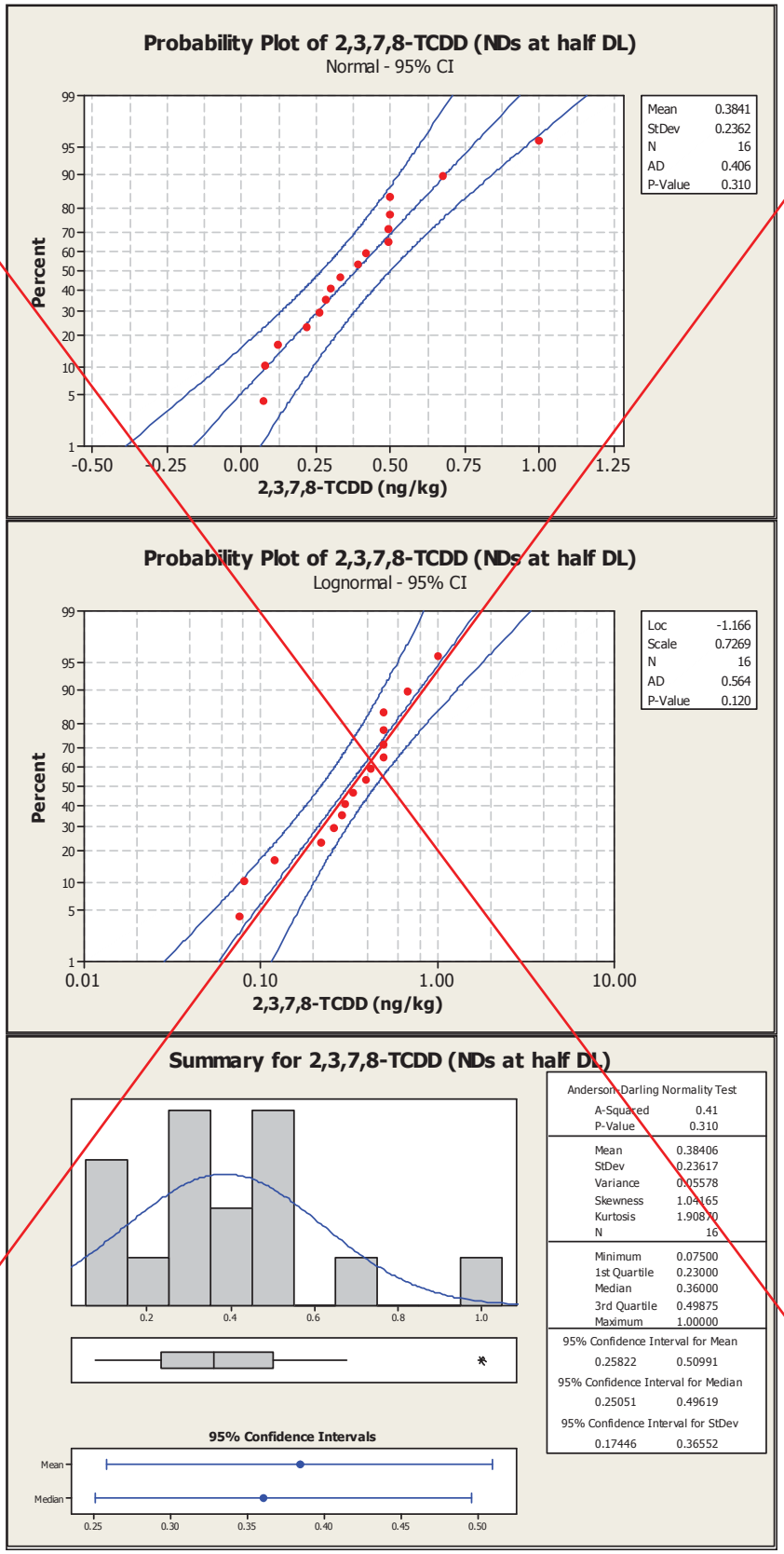

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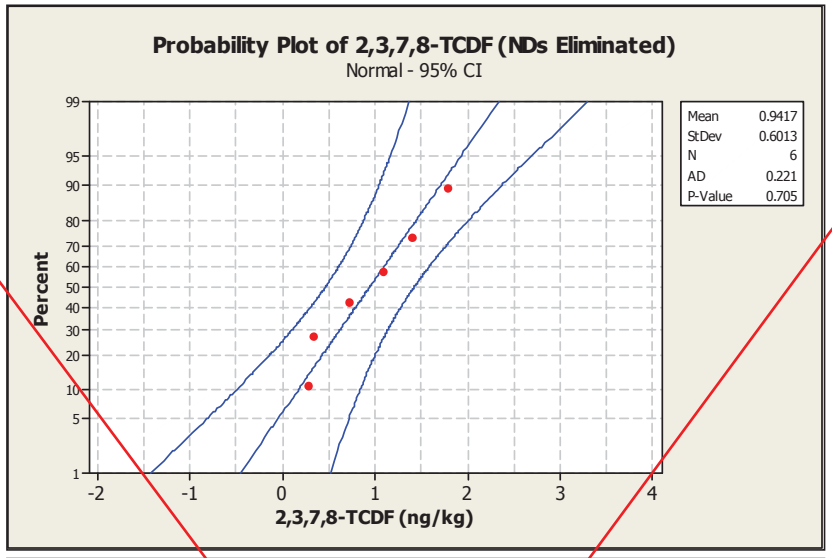

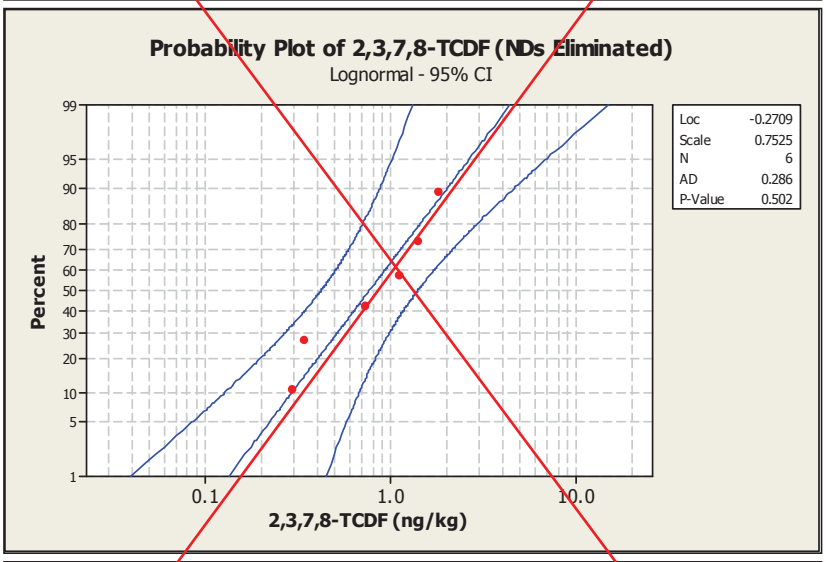

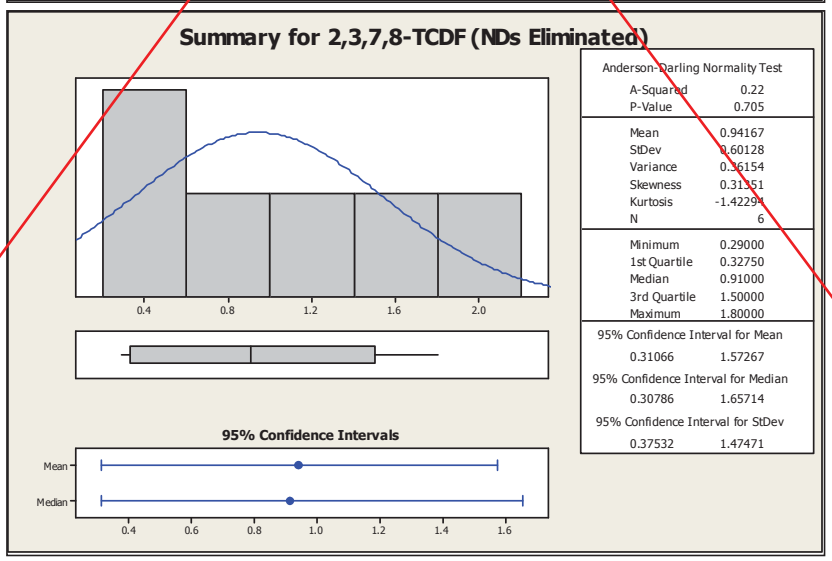

2,3,7,8-TCDF
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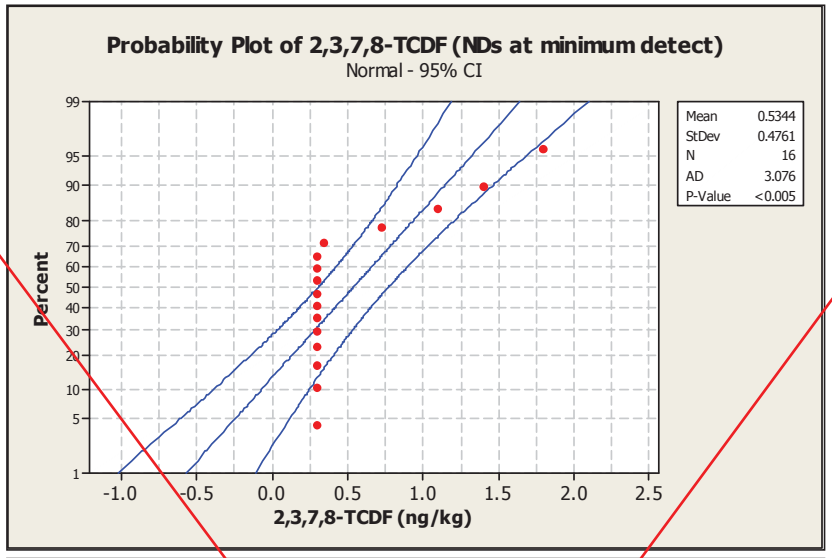
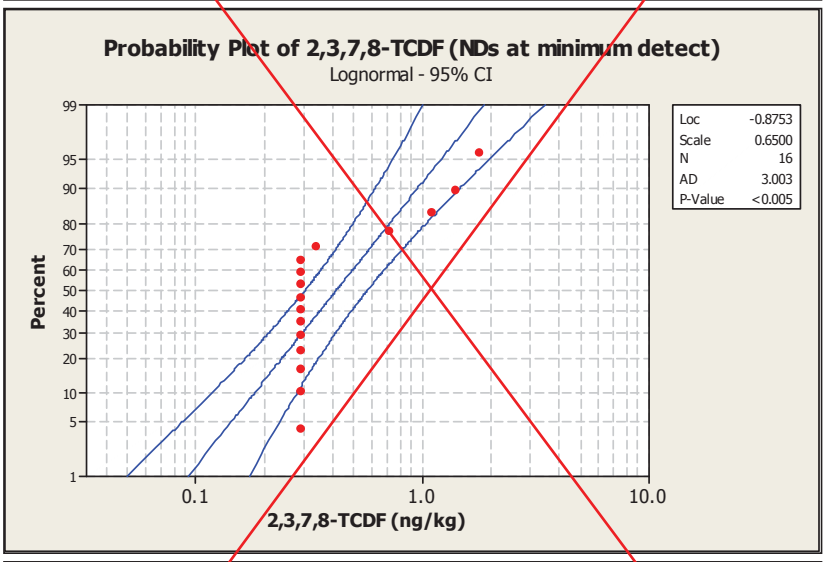
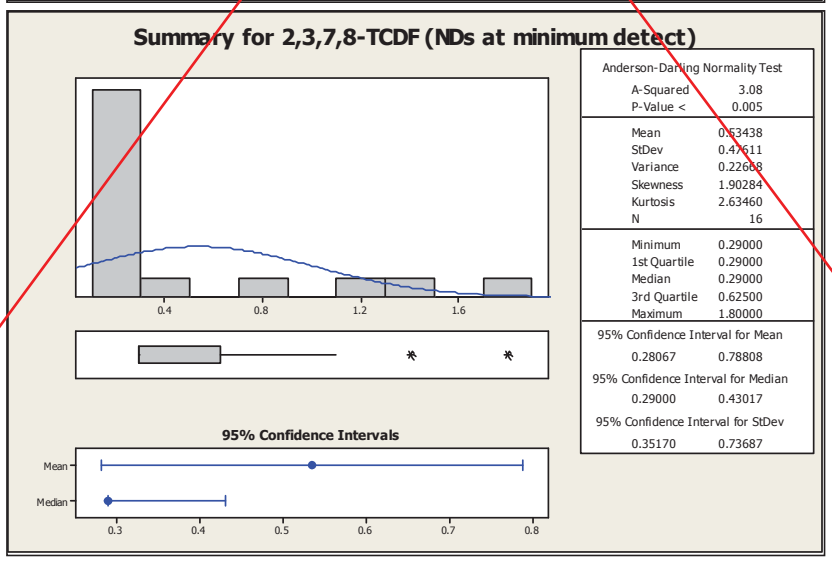
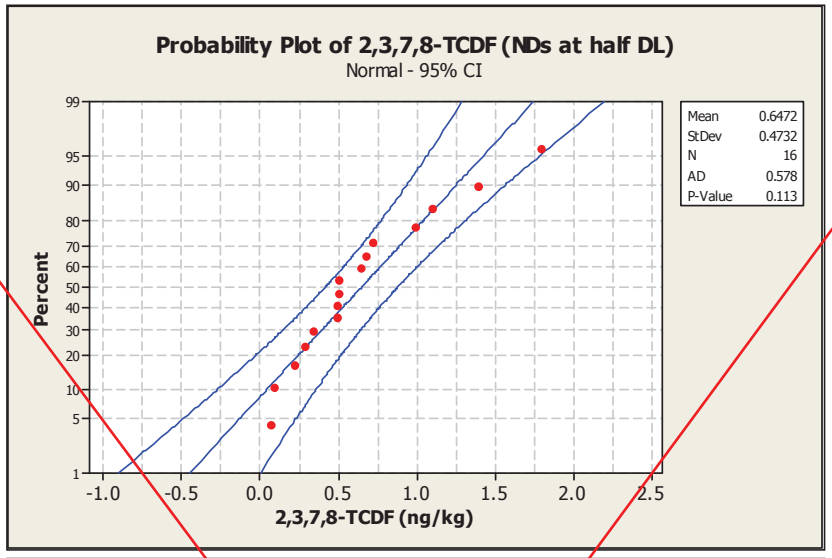
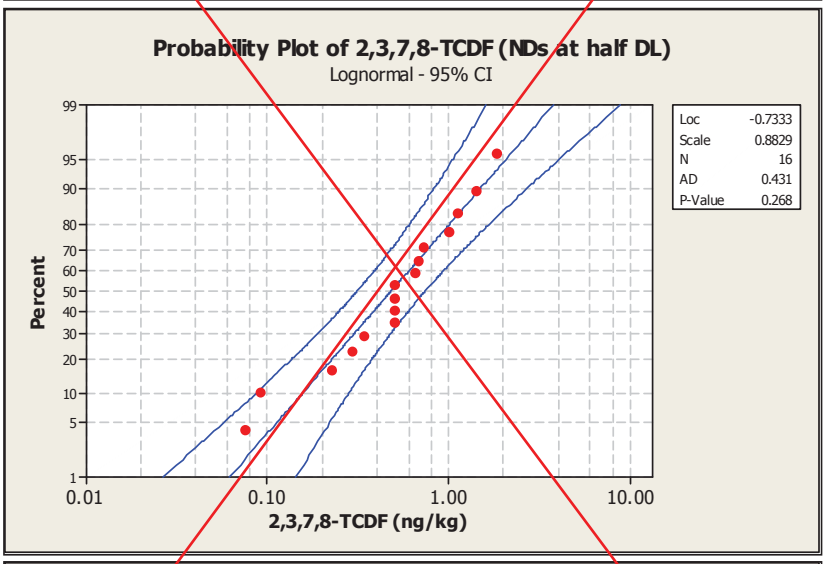


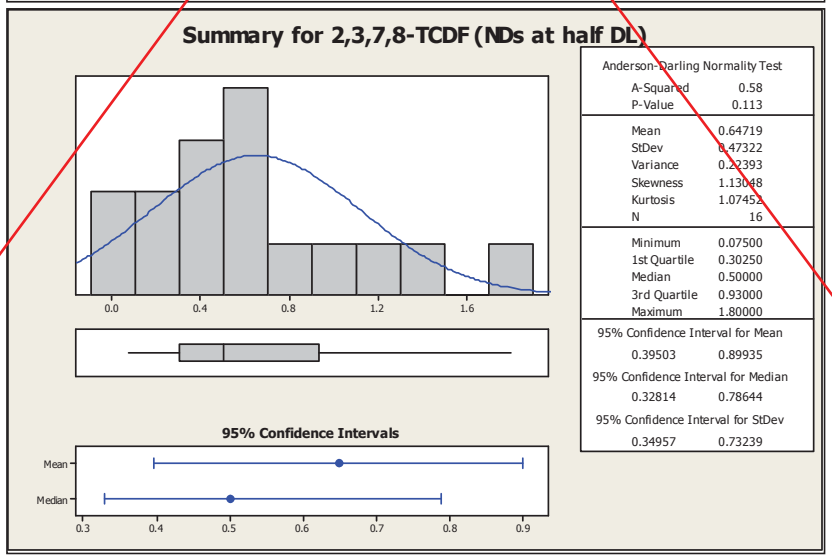




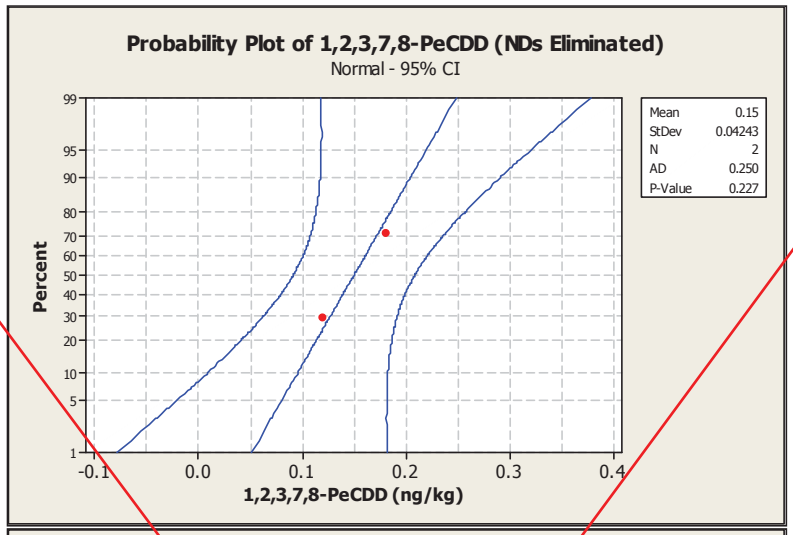
2,3,7,8-TCDF

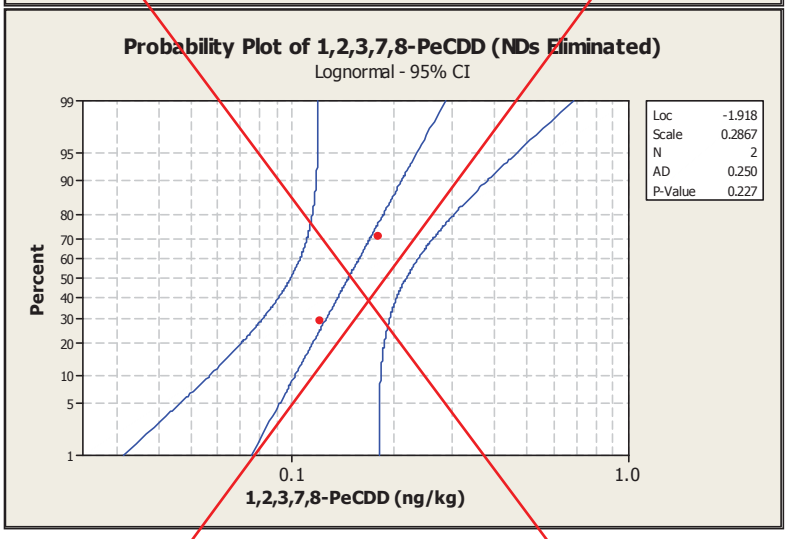

Probability Plot of 2,3,7,8-TCDF (NDs at half DL)
Normal - 95% CI
Percent
2,3,7,8-TCDF (ng/kg)
Mean 0.6472
StDev 0.4732
N 16
AD 0.578
P-Value 0.113


Probability Plot of 2,3,7,8-TCDF (NDs at half DL)
Lognormal - 95% CI
Percent
2,3,7,8-TCDF (ng/kg)
Loc -0.7333
Scale 0.8829
N 16
AD 0.431
P-Value 0.268


Summary for 2,3,7,8-TCDF (NDs at half DL)
Anderson-Darling Normality Test
A-Squared 0.58
P-Value 0.113
Mean 0.64719
StDev 0.47322
Variance 0.22393
Skewness 1.13048
Kurtosis 1.07452
N 16
Minimum 0.07500
1st Quartile 0.30250
Median 0.50000
3rd Quartile 0.93000
Maximum 1.80000
95% Confidence Interval for Mean
0.39503 0.89935
95% Confidence Interval for Median
0.32814 0.78644
95% Confidence Interval for StDev
0.34957 0.73239
95% Confidence Intervals
Mean
Median

1,2,3,7,8-PeCDD





GRAPHICAL SUMMARY NOT PREPARED FOR "NDs ELIMINATED" DUE TO INSUFFICIENT NUMBER OF DETECTS

1,2,3,7,8-PeCDD
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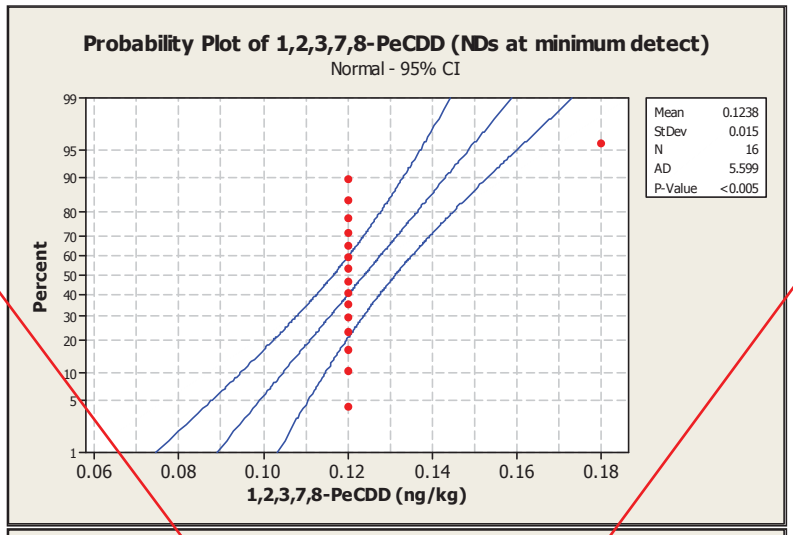
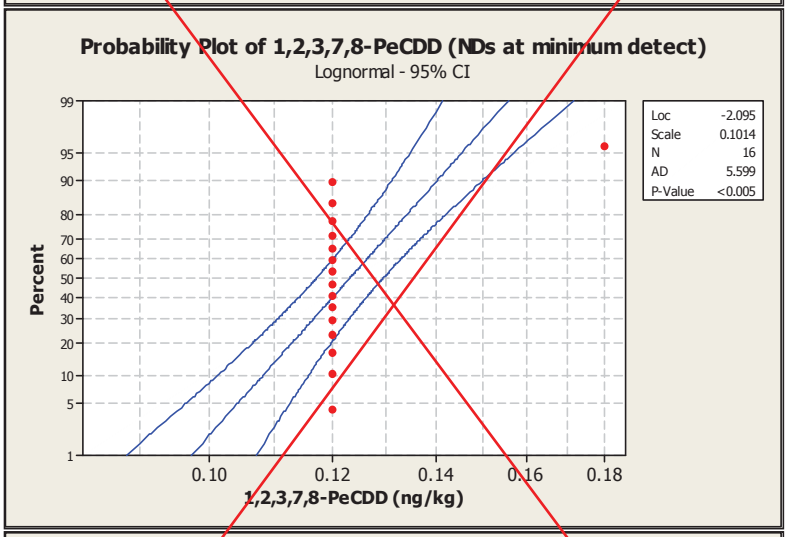
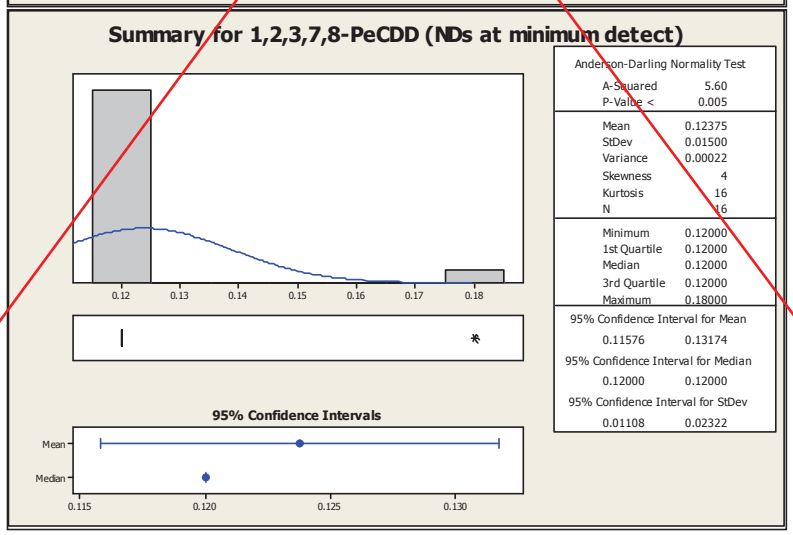
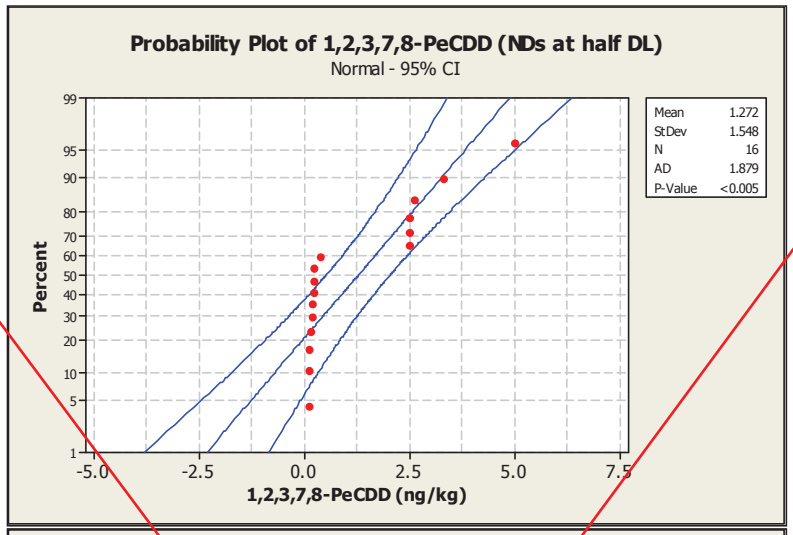
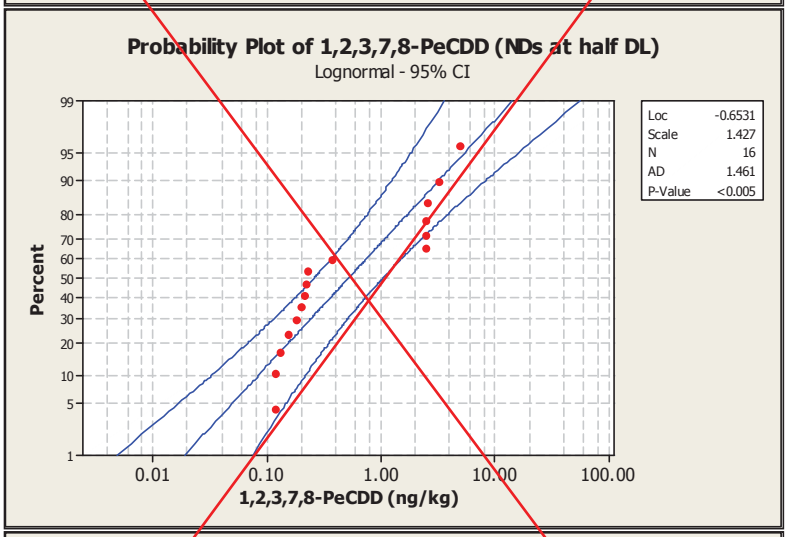


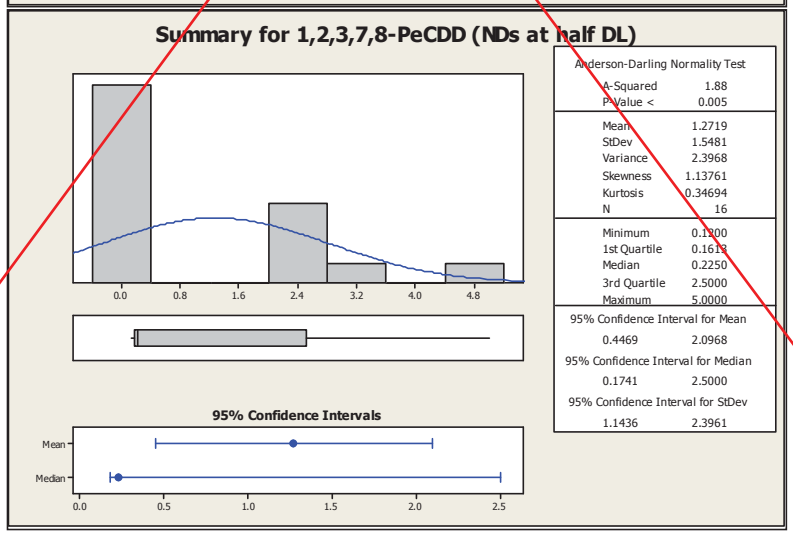




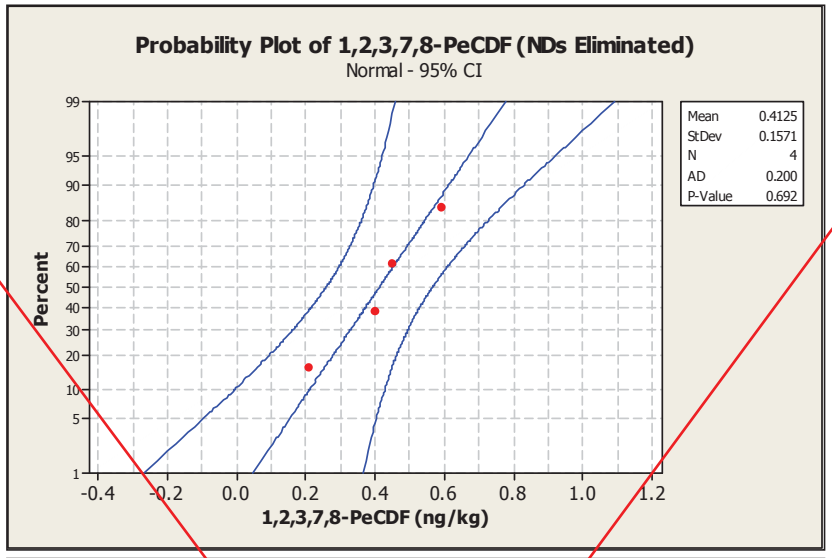
1,2,3,7,8-PeCDD
(Page 3 of 3)

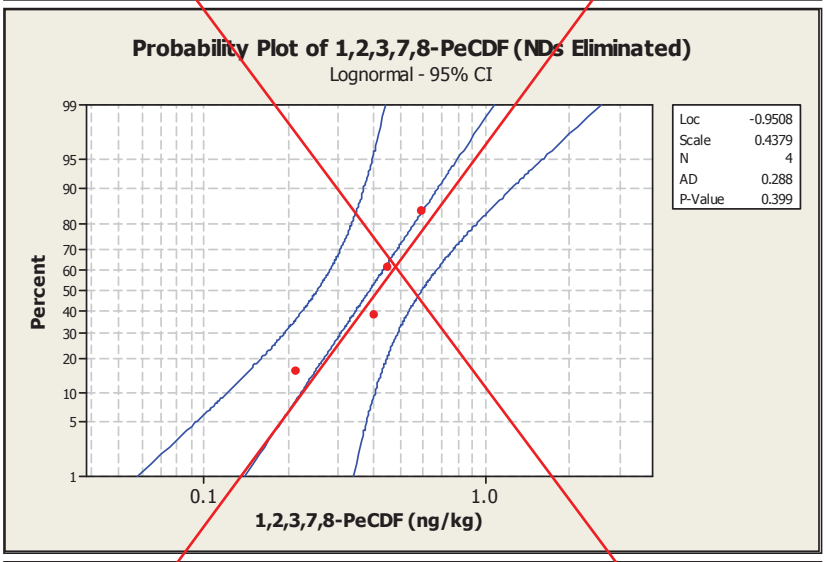


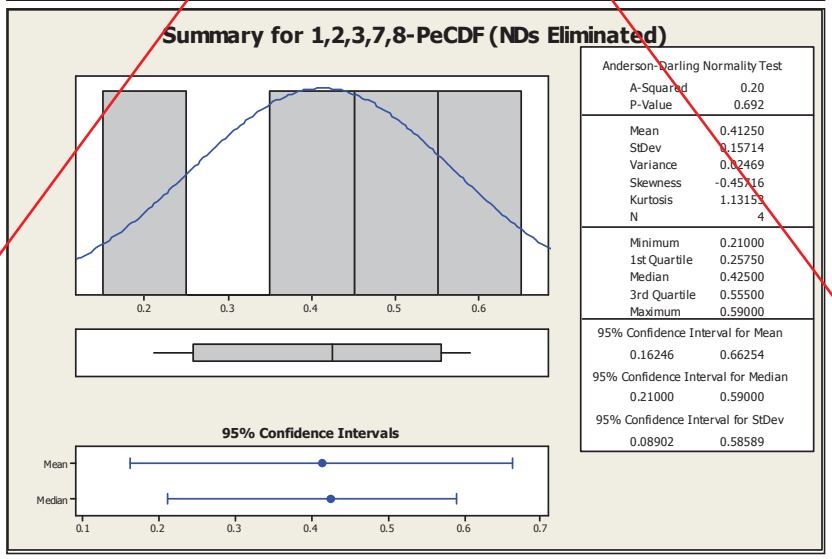




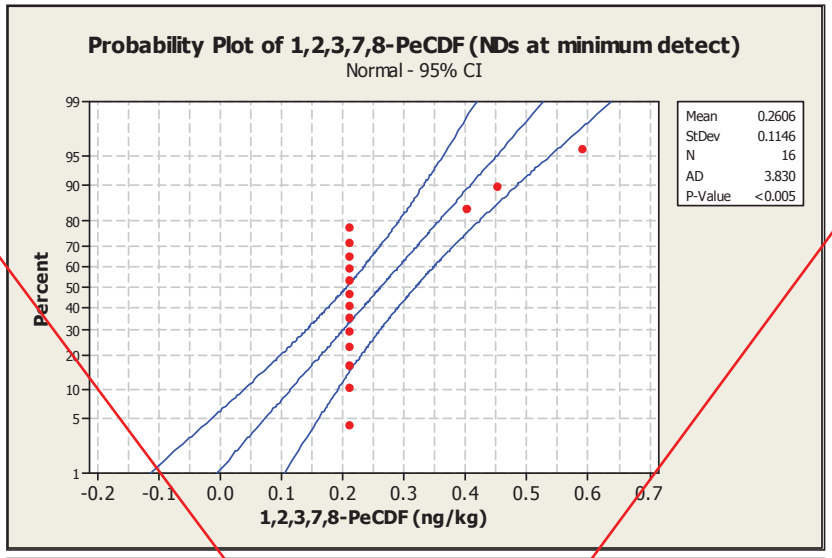
1,2,3,7,8-PeCDF
(Page 1 of 3)

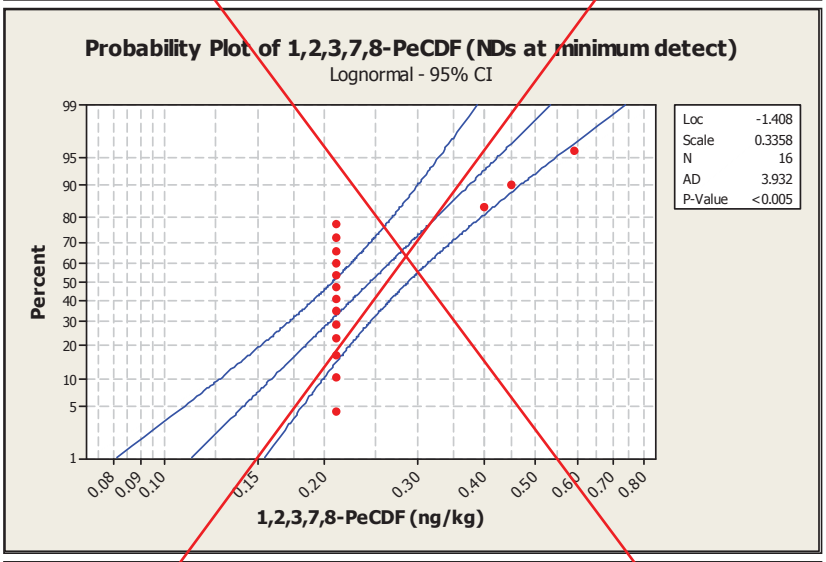


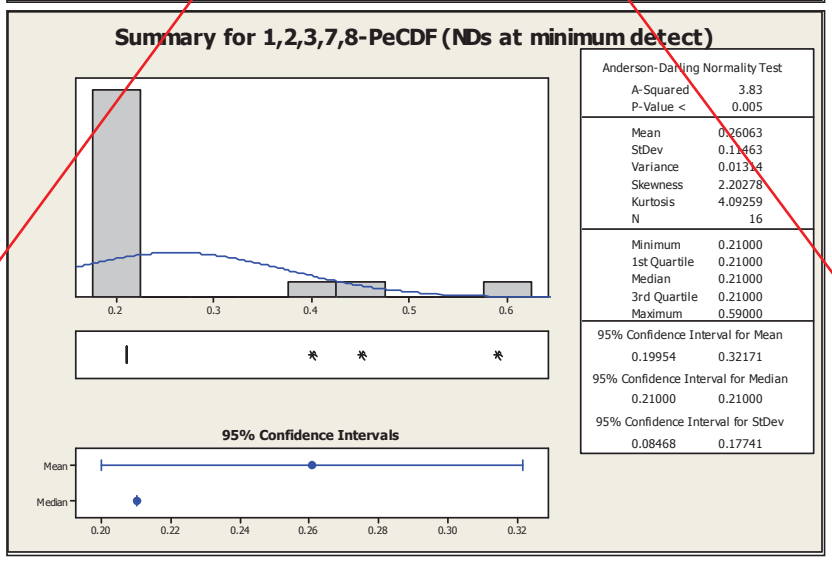




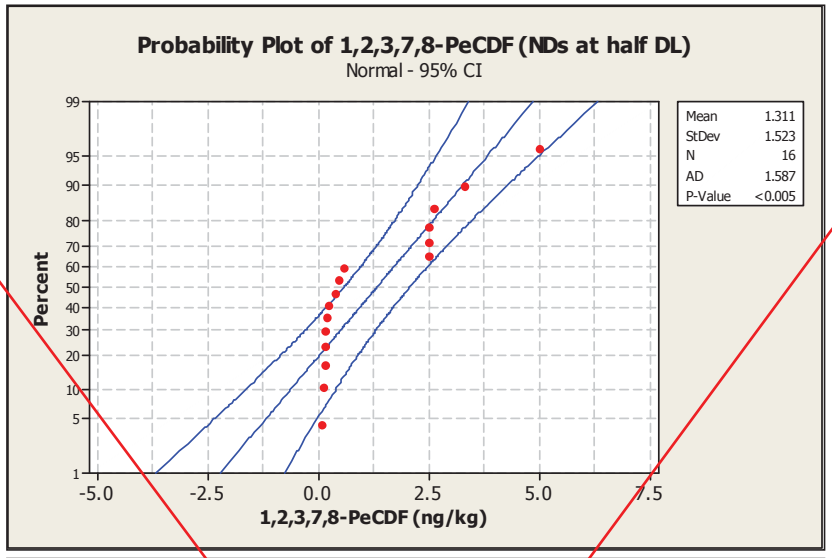
1,2,3,7,8-PeCDF
(Page 2 of 3)

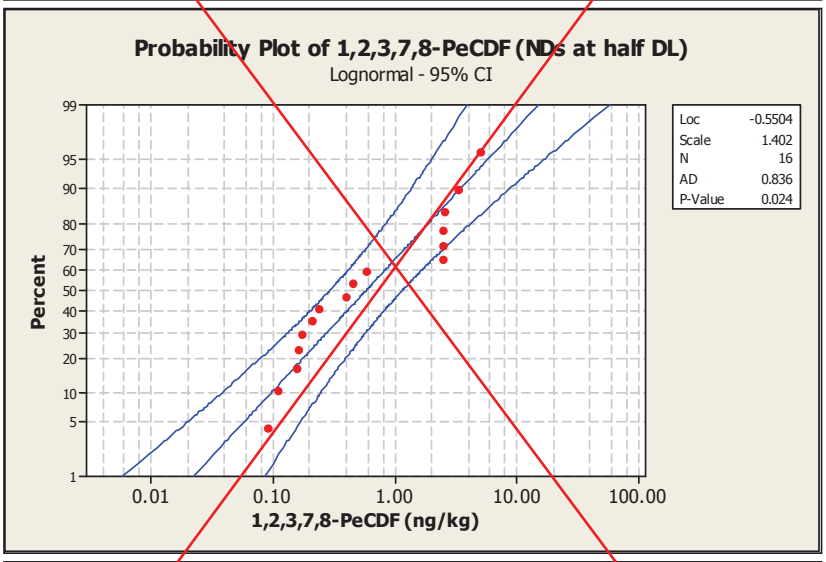


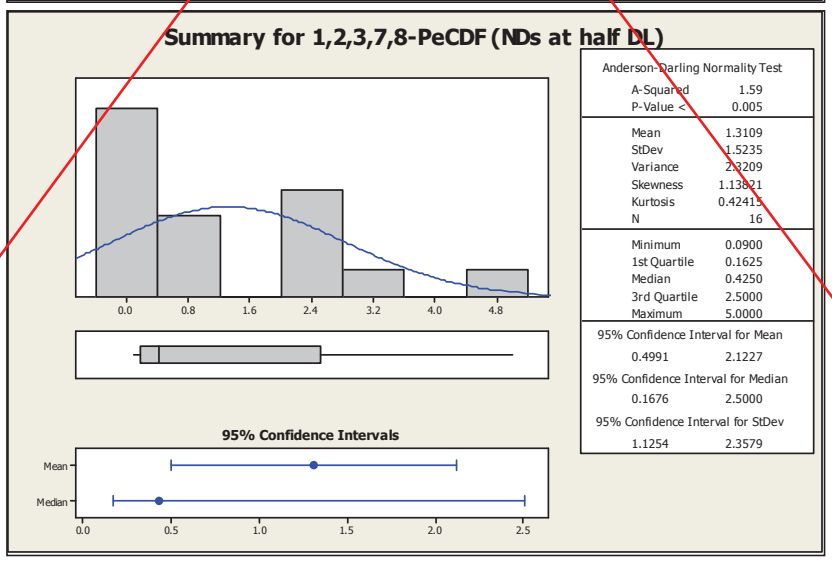




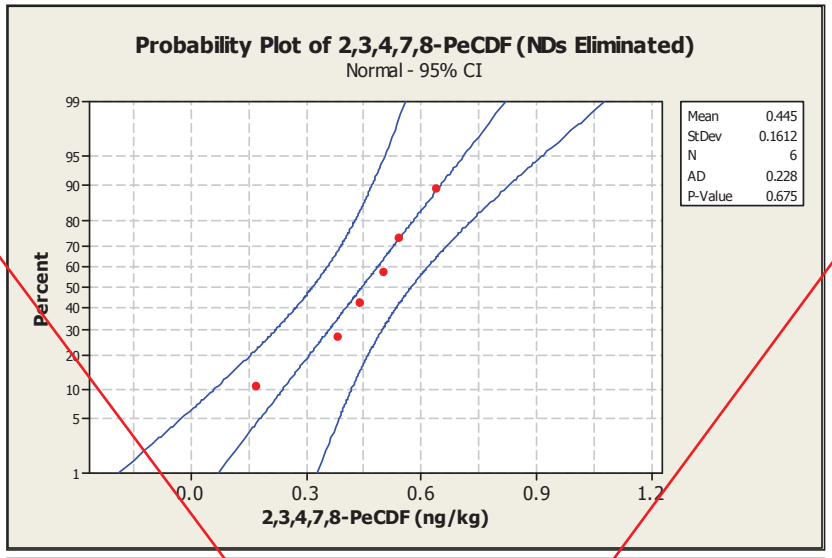
1,2,3,7,8-PeCDF

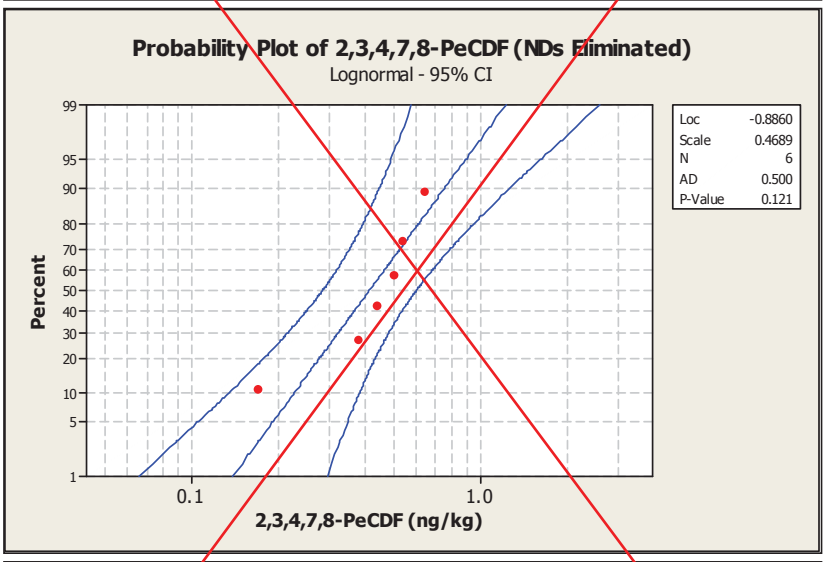

Probability Plot of 1,2,3,7,8-PeCDF (NDs at half DL)
Normal - 95% CI
Percent
1,2,3,7,8-PeCDF (ng/kg)
Mean 1.311
StDev 1.523
N 16
AD 1.587
P-Value <0.005

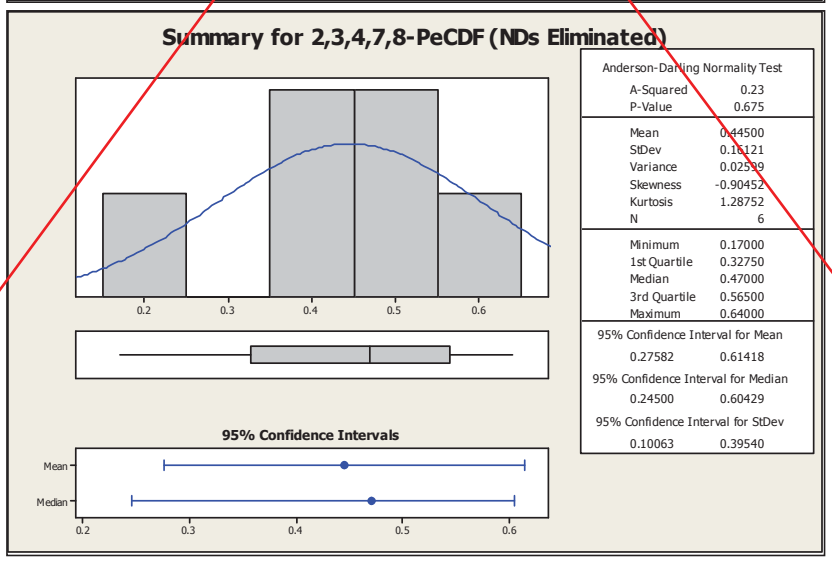

Probability Plot of 1,2,3,7,8-PeCDF (NDs at half DL)
Lognormal - 95% CI
Percent
1,2,3,7,8-PeCDF (ng/kg)
Loc -0.5504
Scale 1.402
N 16
AD 0.836
P-Value 0.024


Summary for 1,2,3,7,8-PeCDF (NDs at half DL)
Anderson-Darling Normality Test
A-Squared 1.59
P-Value < 0.005
Mean 1.3109
StDev 1.5235
Variance 2.3209
Skewness 1.13821
Kurtosis 0.42415
N 16
Minimum 0.0900
1st Quartile 0.1625
Median 0.4250
3rd Quartile 2.5000
Maximum 5.0000
95% Confidence Interval for Mean
0.4991 2.1227
95% Confidence Interval for Median
0.1676 2.5000
95% Confidence Interval for StDev
1.1254 2.3579
95% Confidence Intervals
Mean
Median

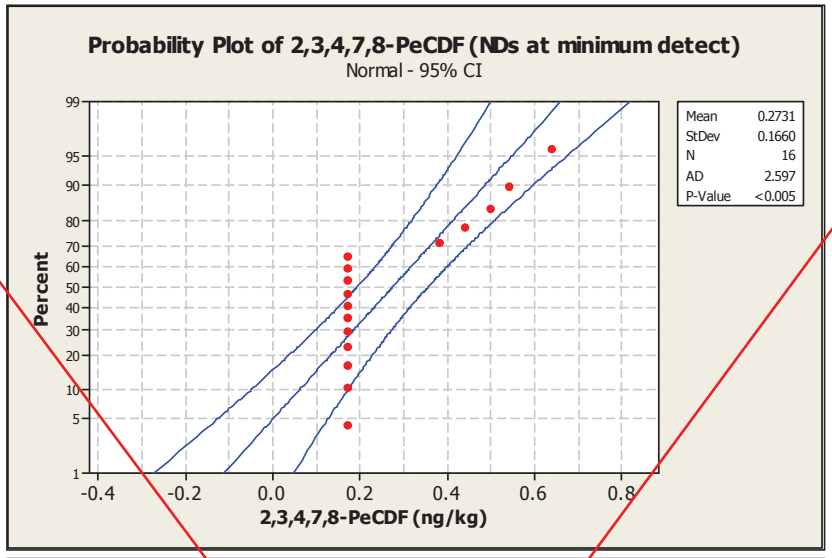
2,3,4,7,8-PeCDF
(Page 1 of 3)

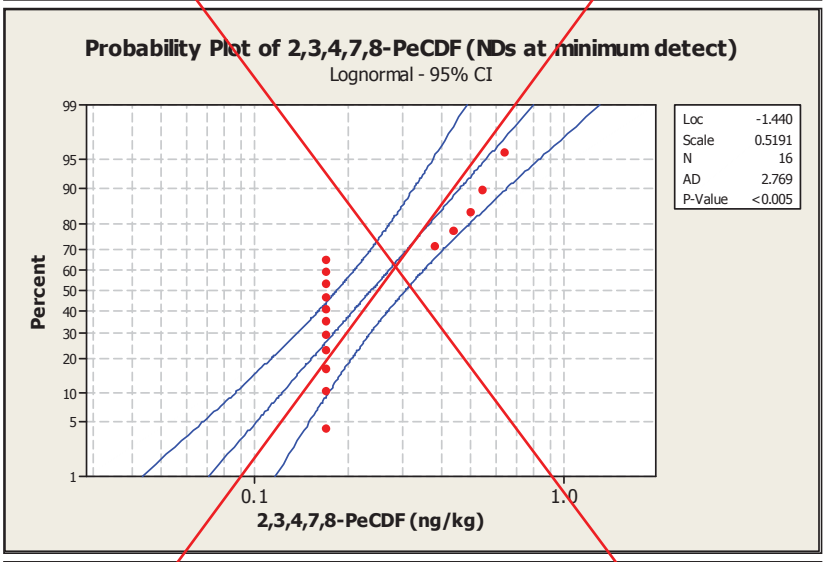


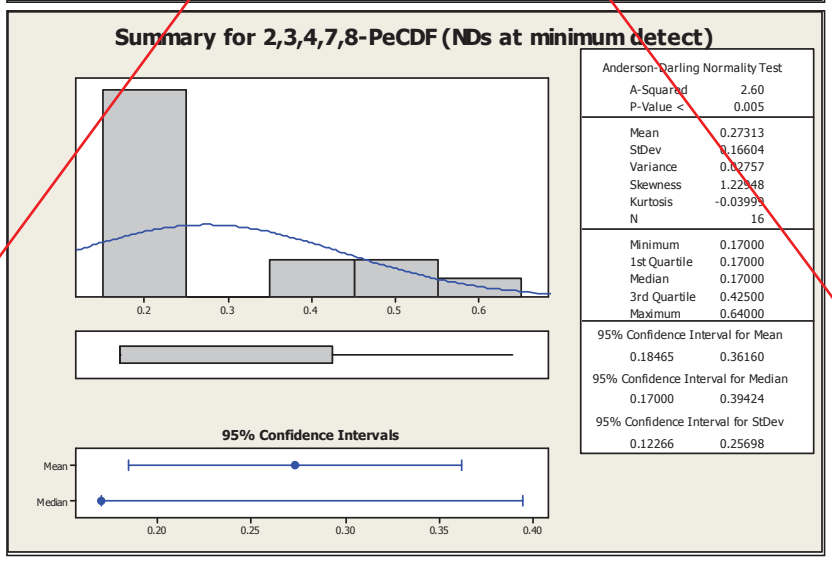




2,3,4,7,8-PeCDF
(Page 2 of 3)







2,3,4,7,8-PeCDF
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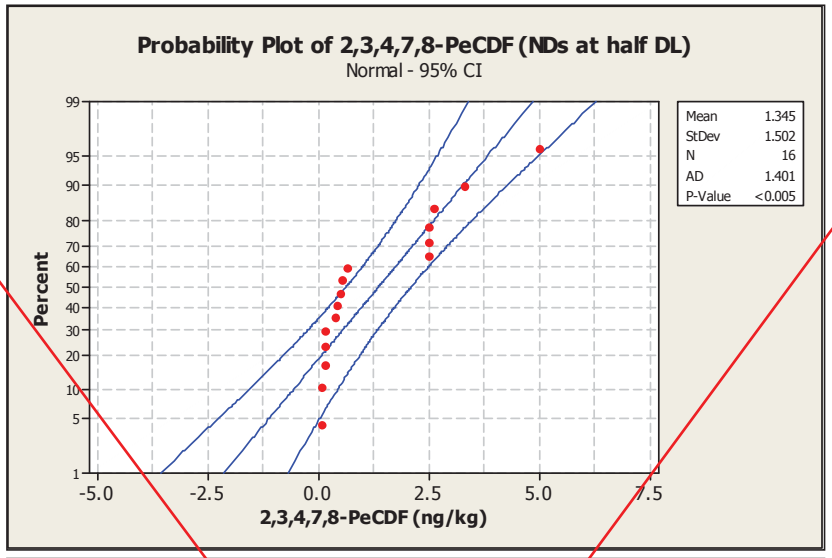
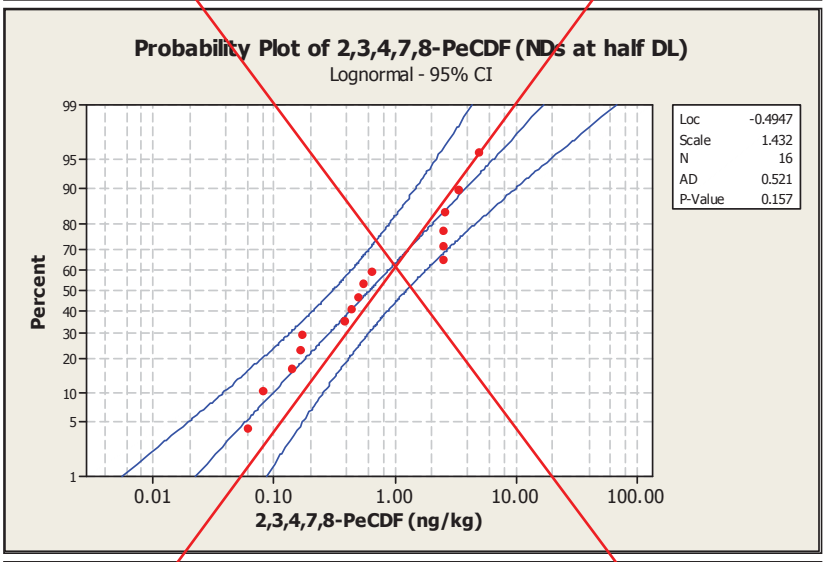
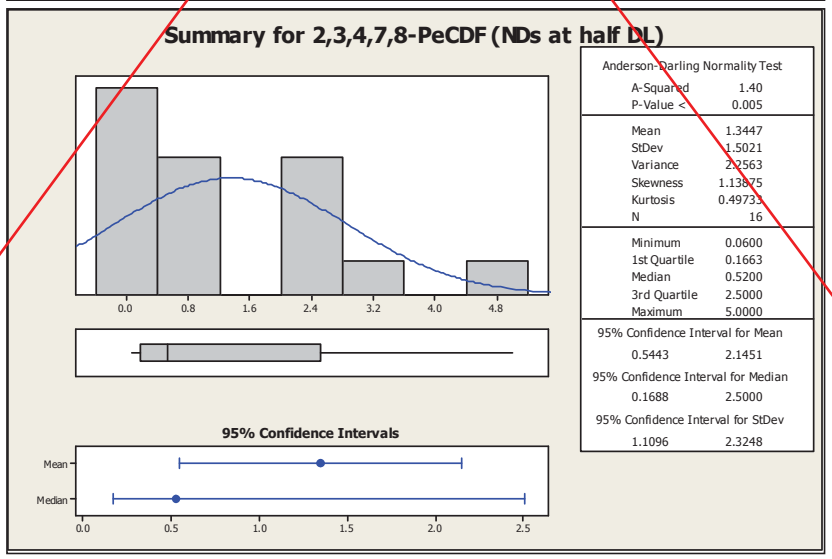
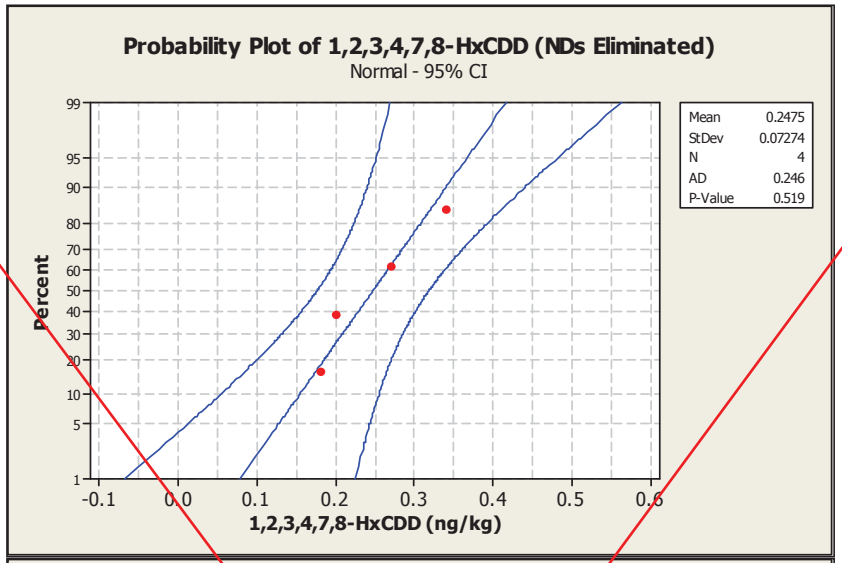
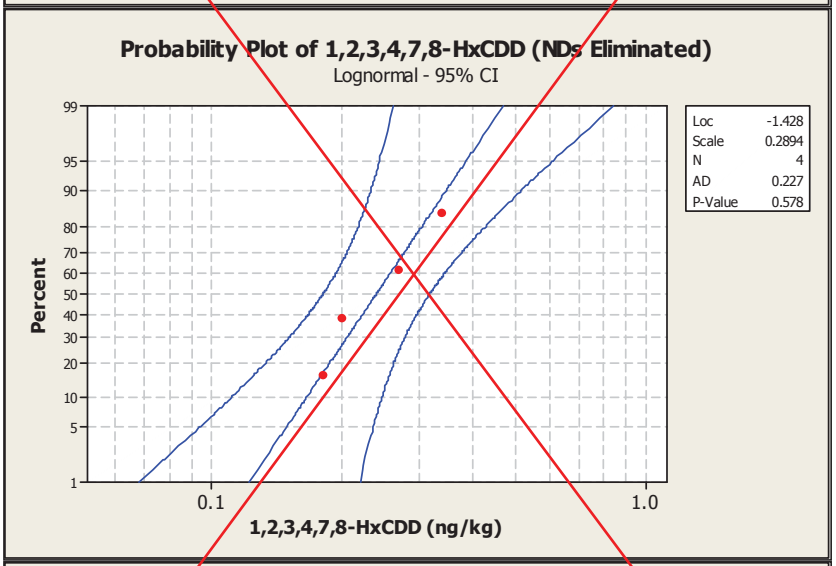


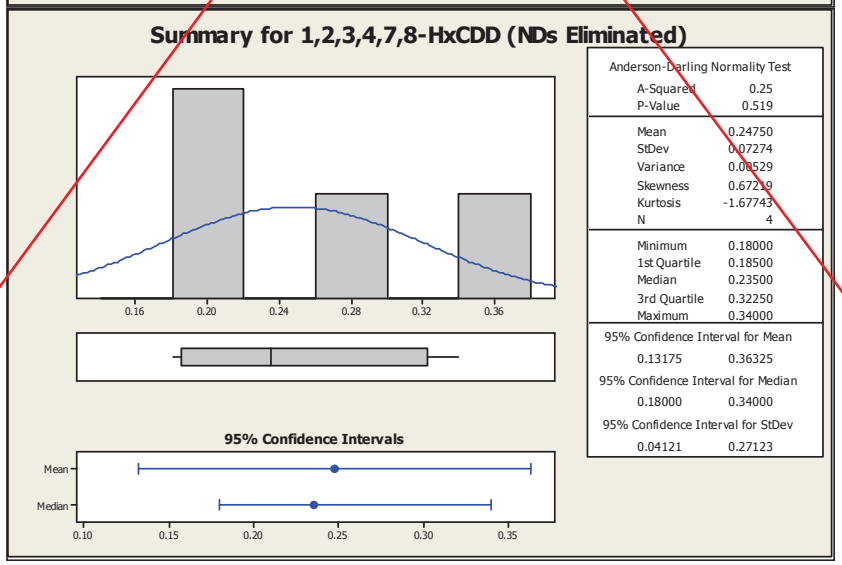




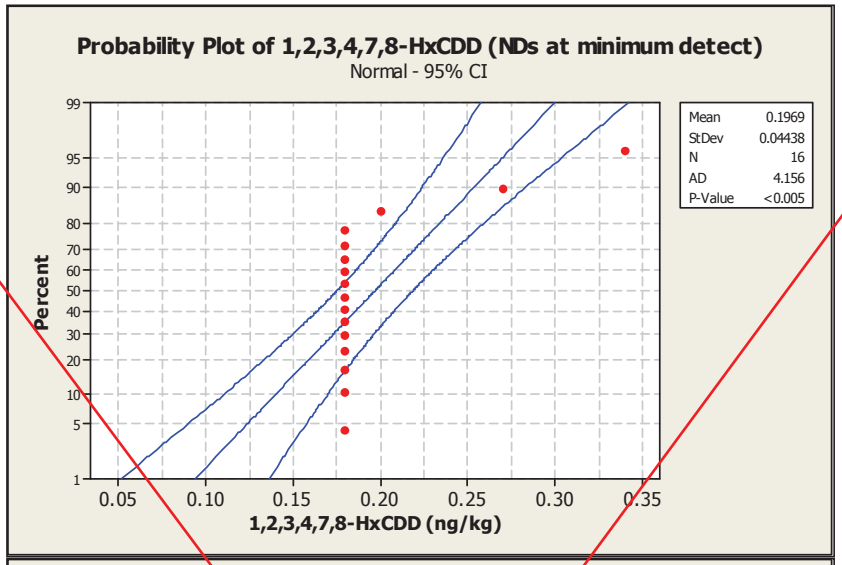
1,2,3,4,7,8-HxCDD
(Page 1 of 3)

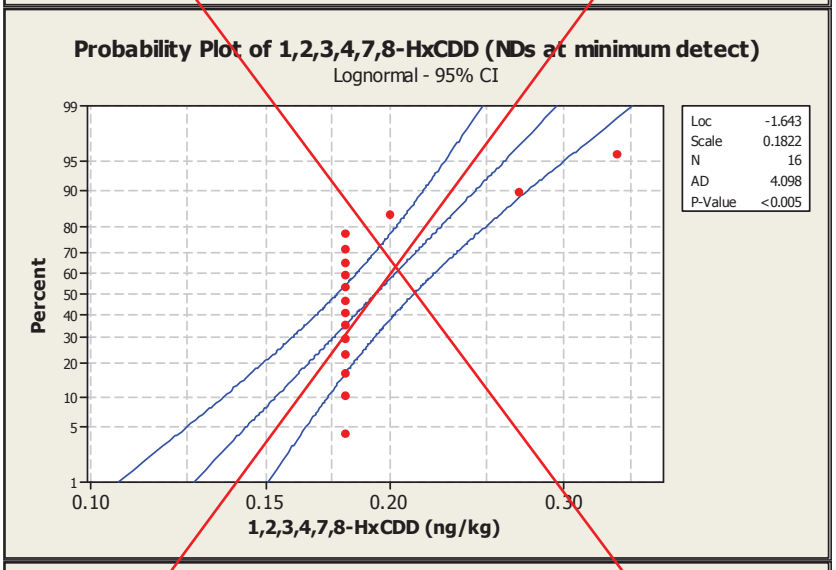


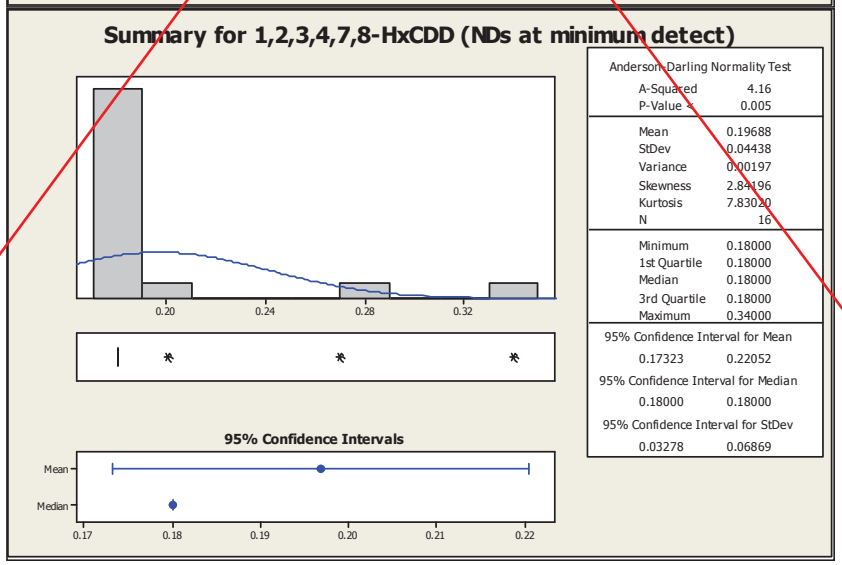




1,2,3,4,7,8-HxCDD
(Page 2 of 3)







1,2,3,4,7,8-HxCDD
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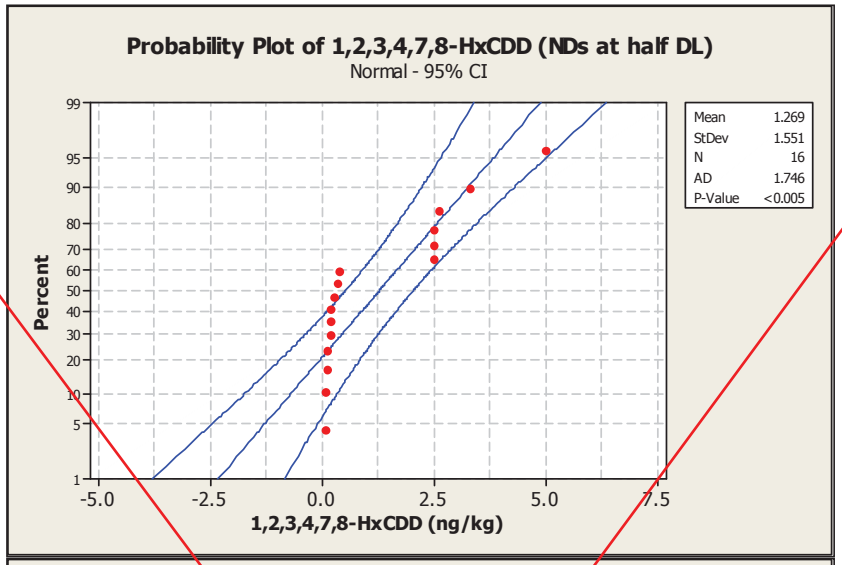
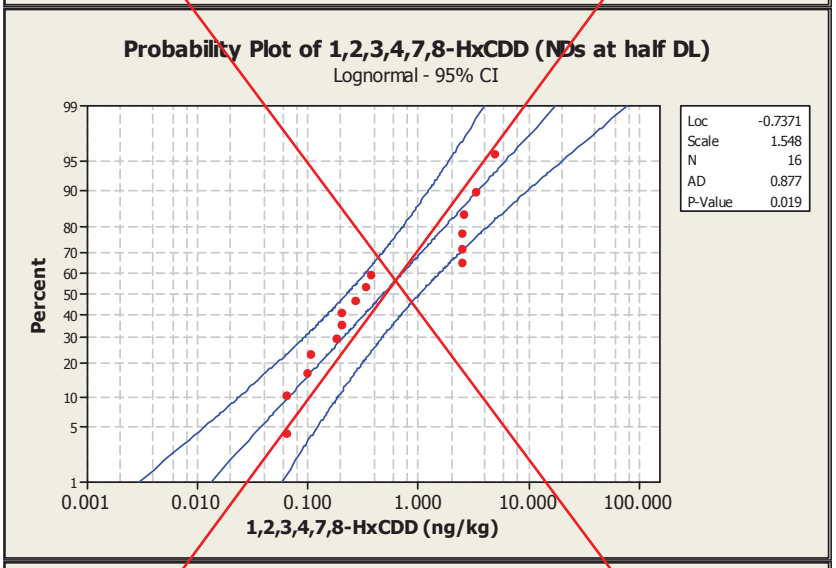
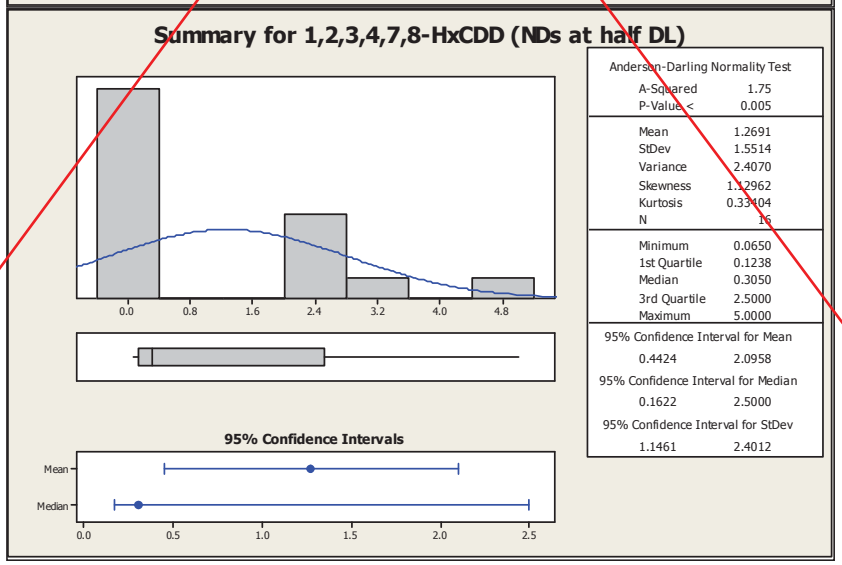
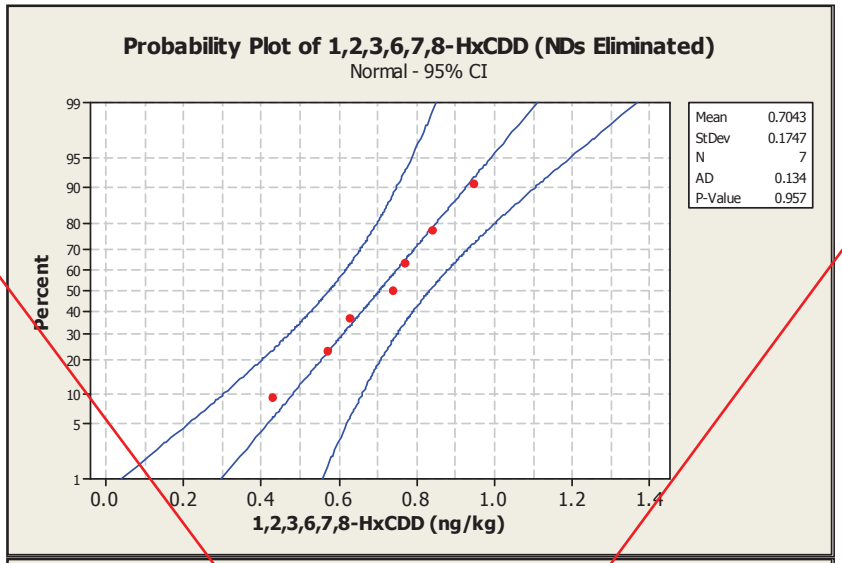
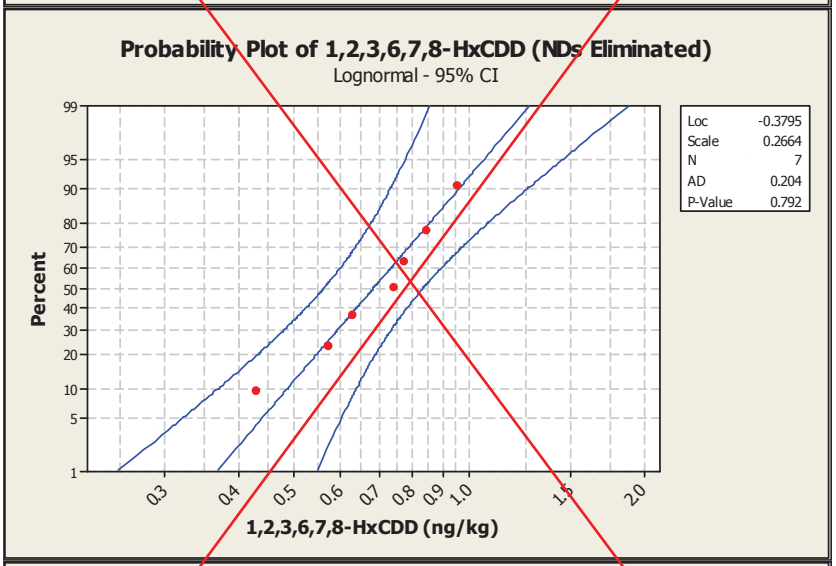


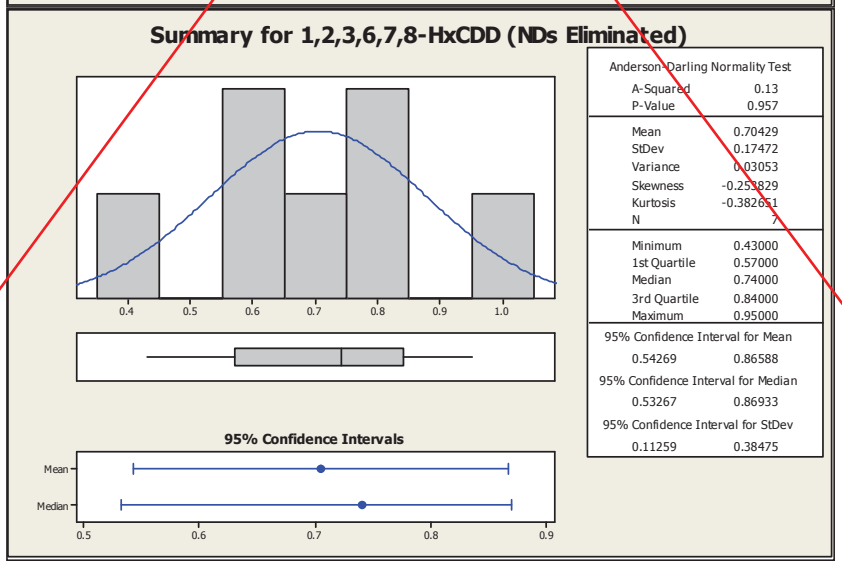




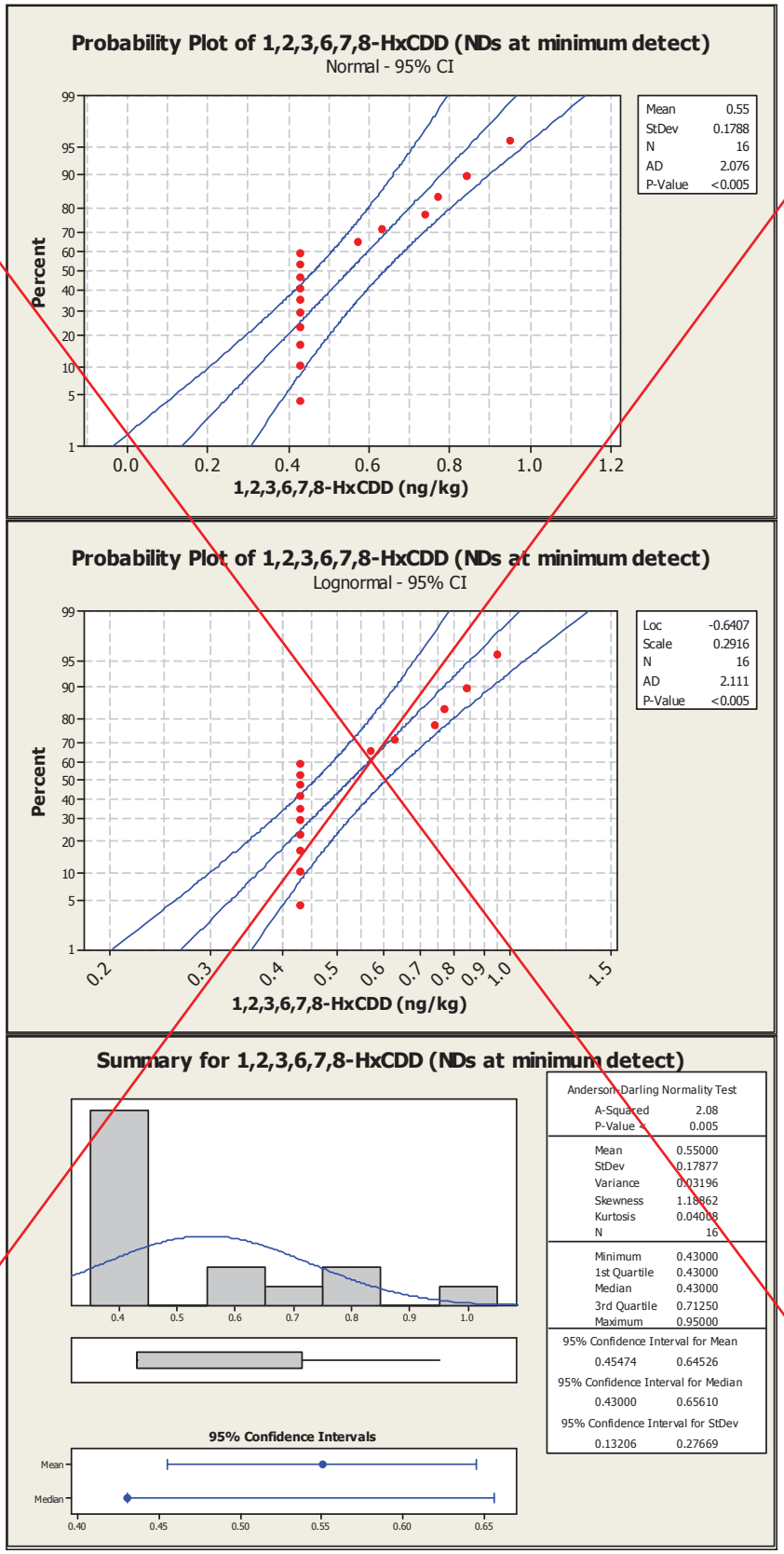
1,2,3,6,7,8-HxCDD
(Page 1 of 3)



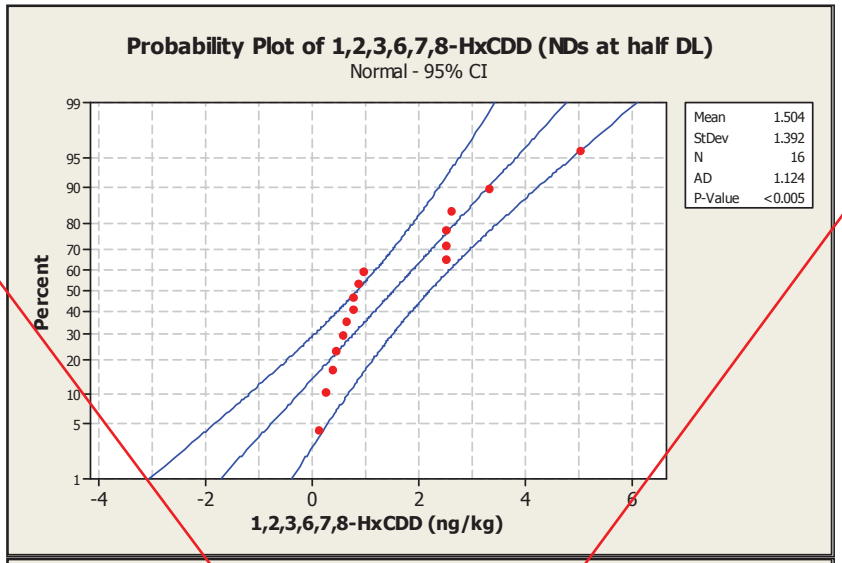


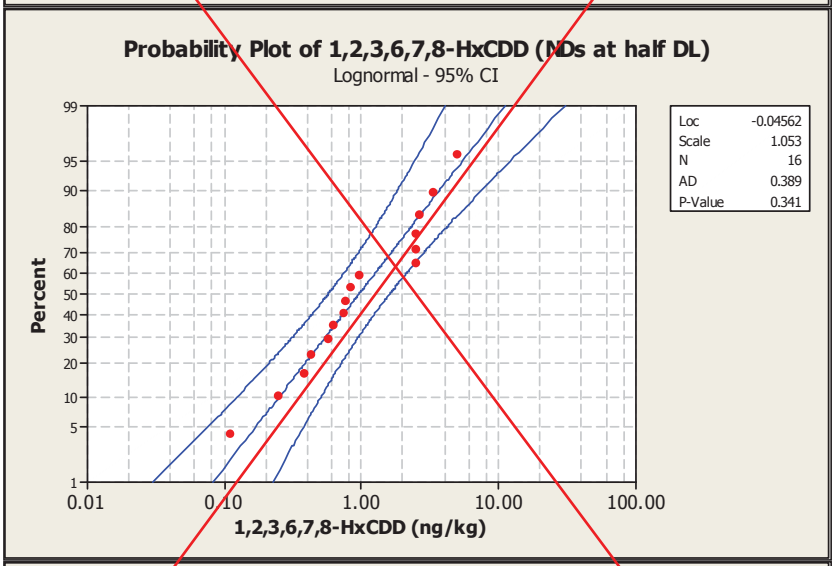


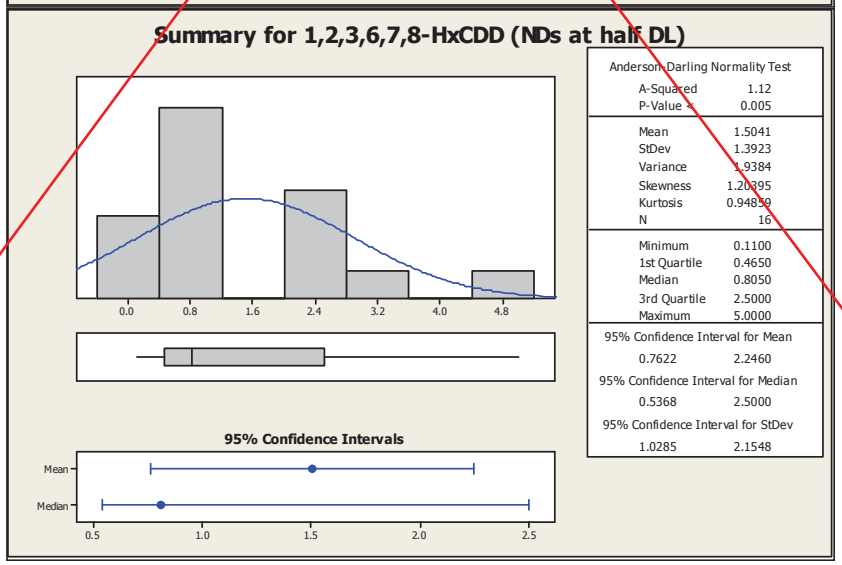
1,2,3,6,7,8-HxCDD
(Page 2 of 3)



1,2,3,6,7,8-HxCDD
(Page 3 of 3)







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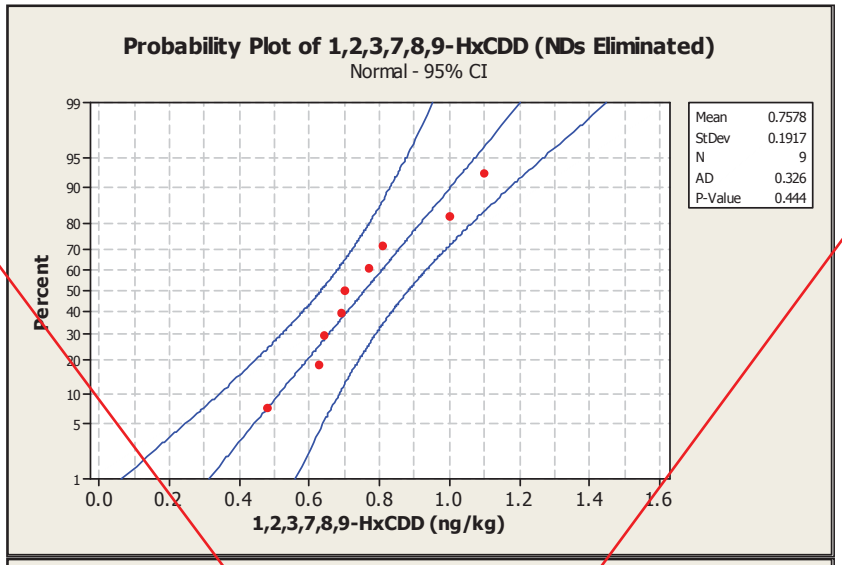

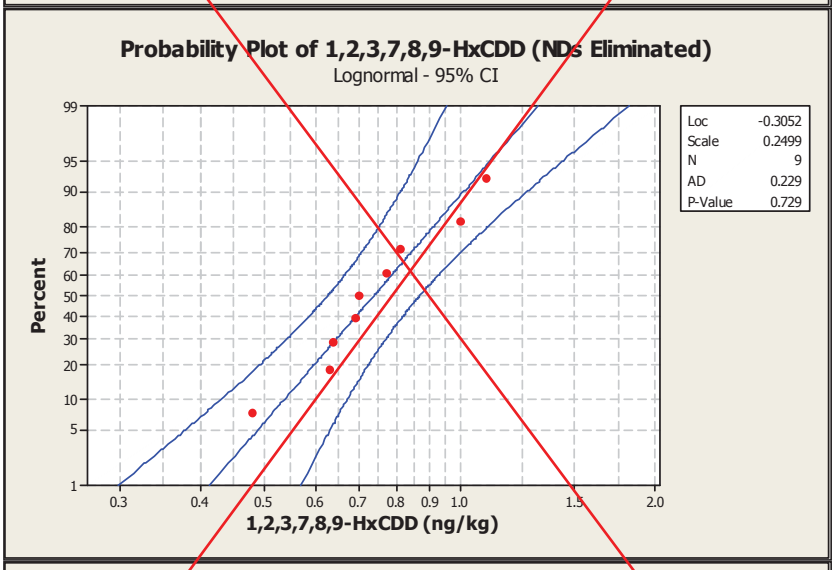

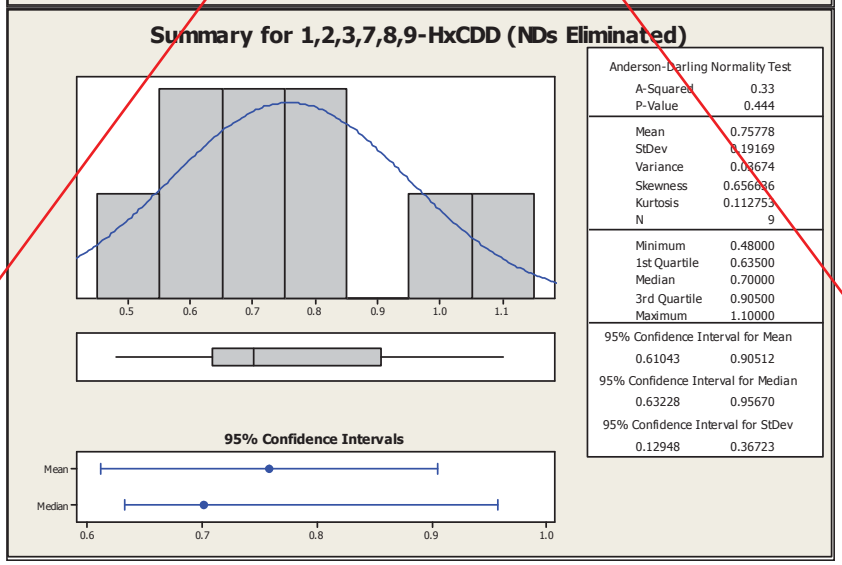

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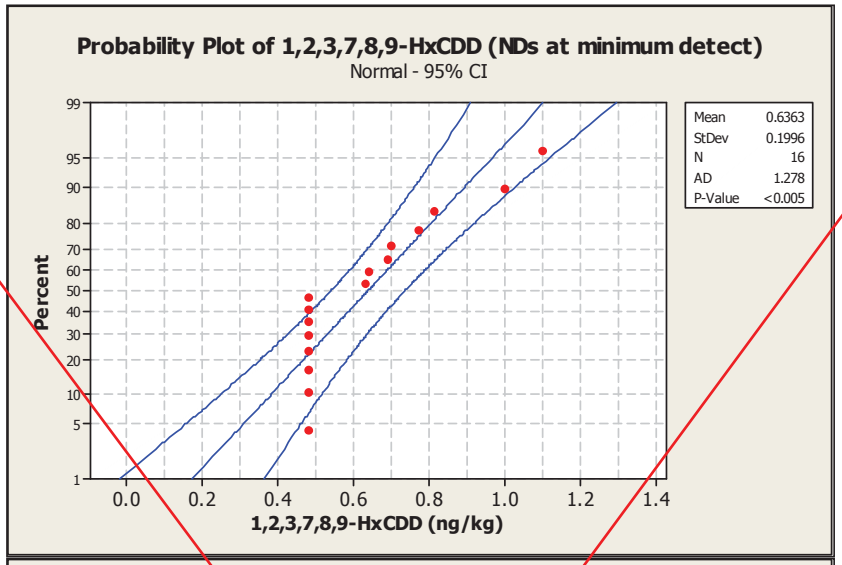

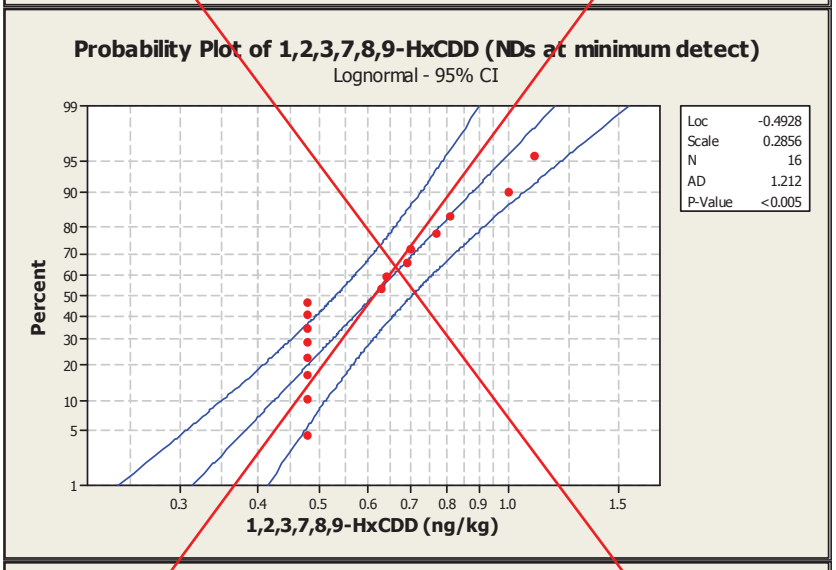

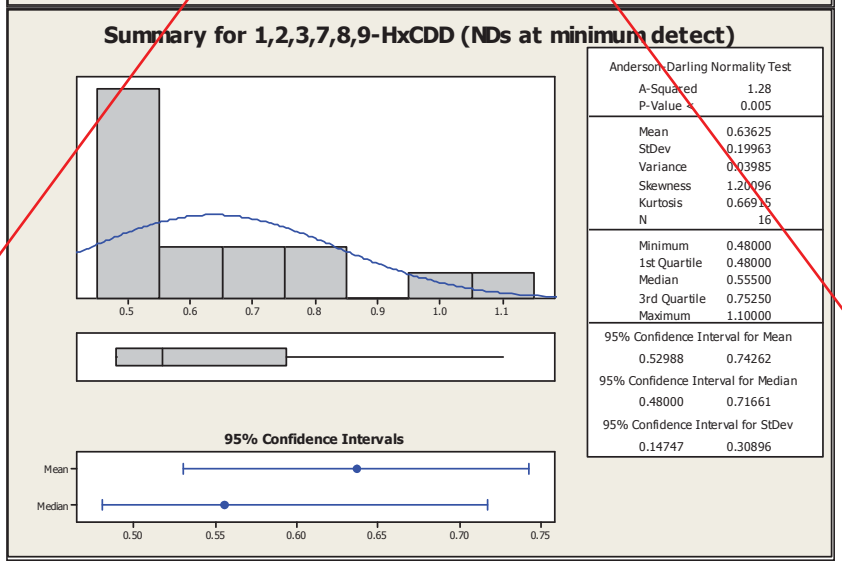

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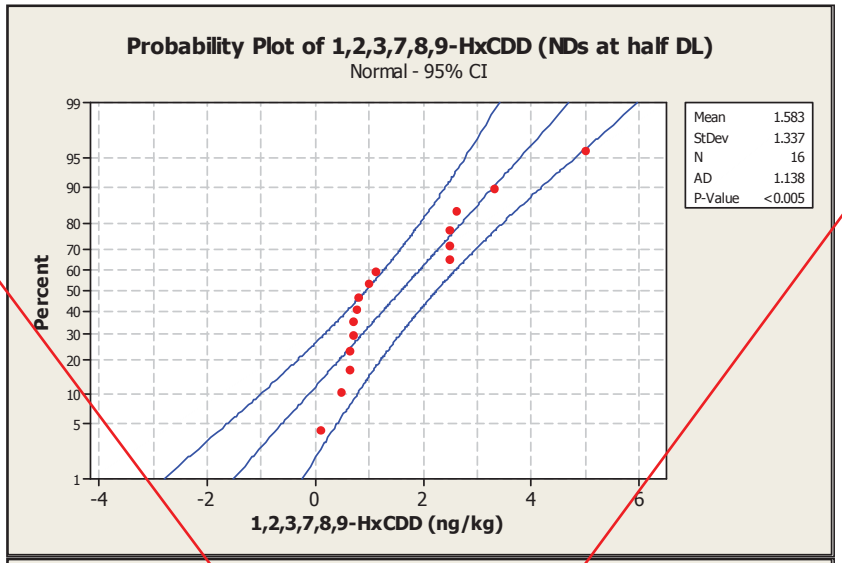

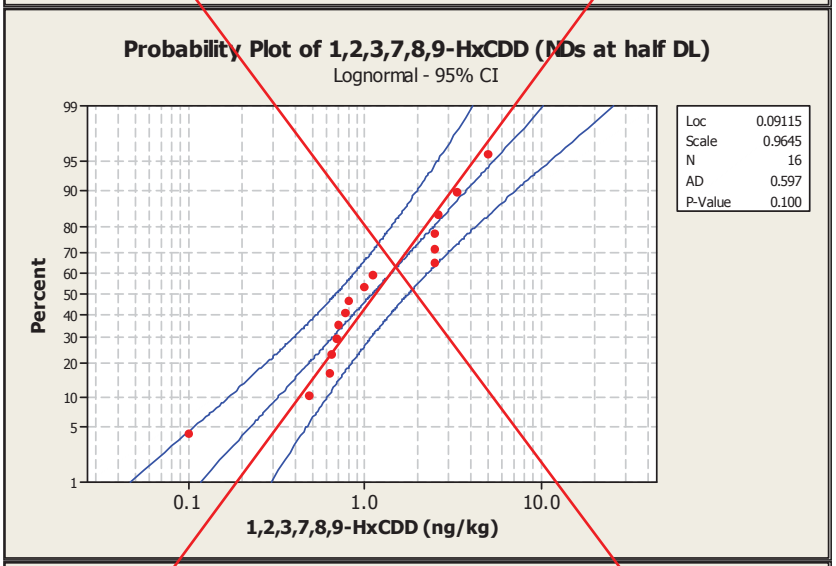

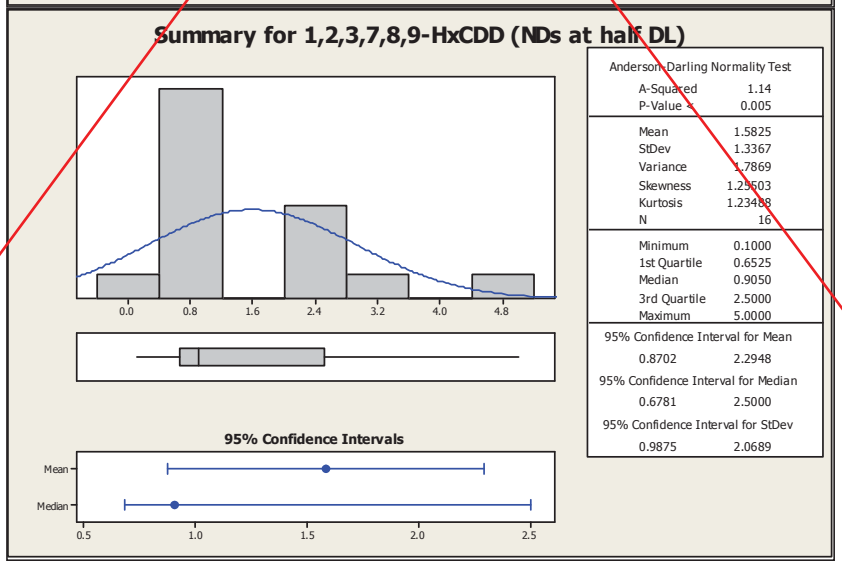

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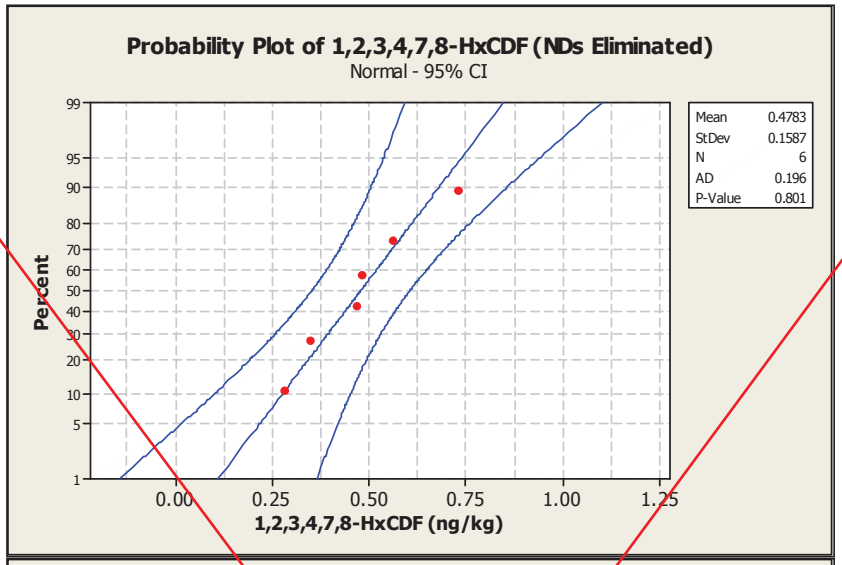

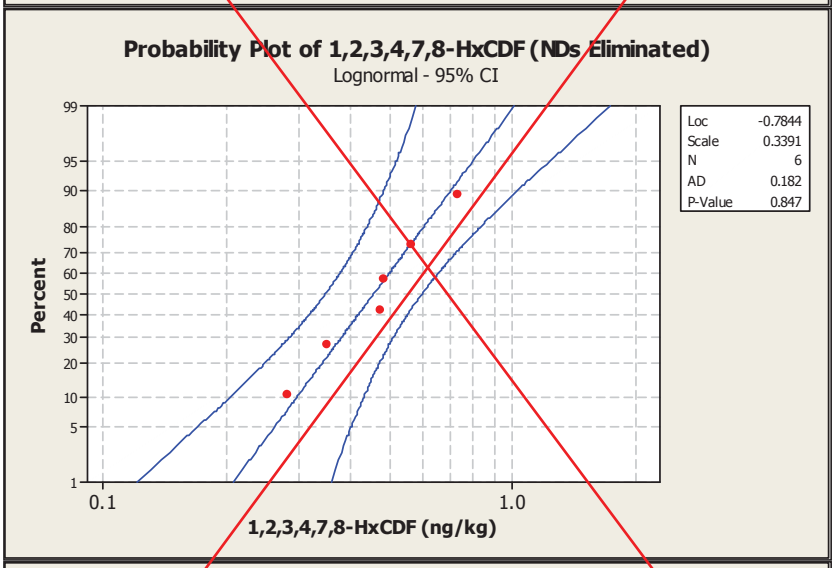

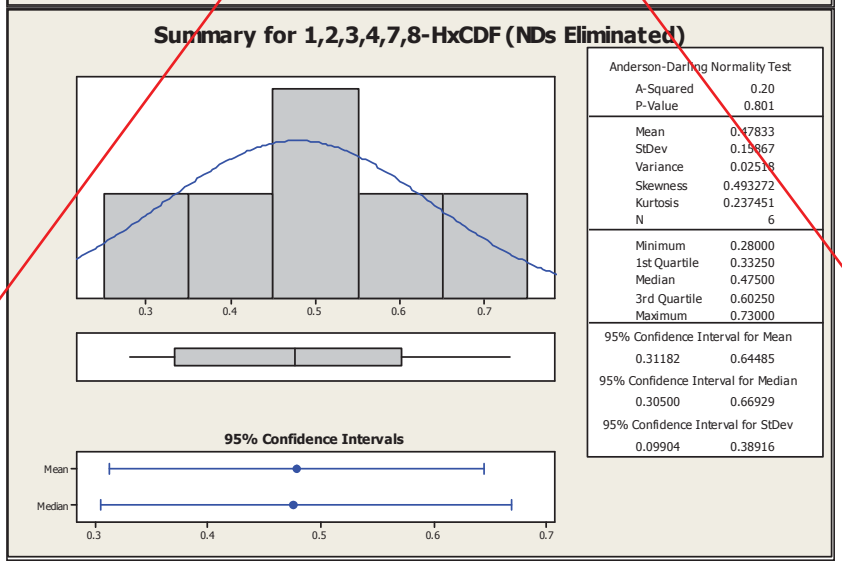

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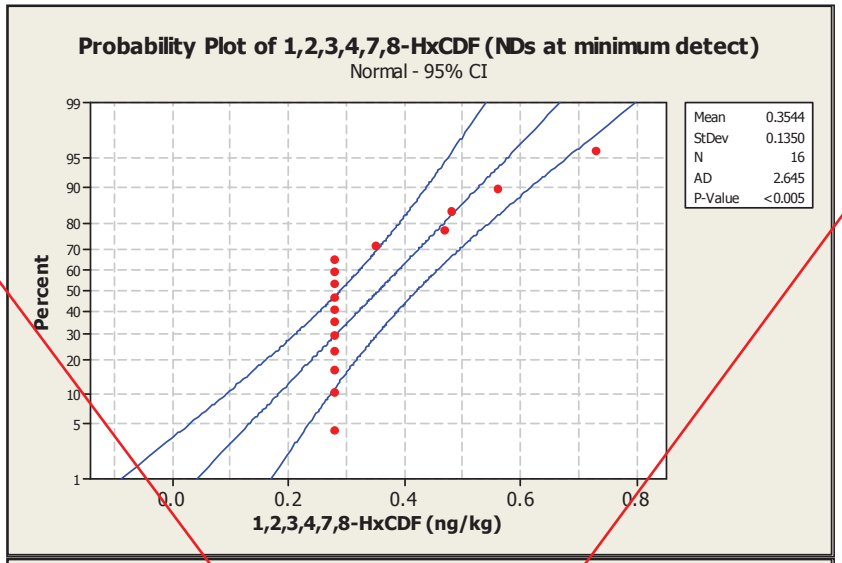

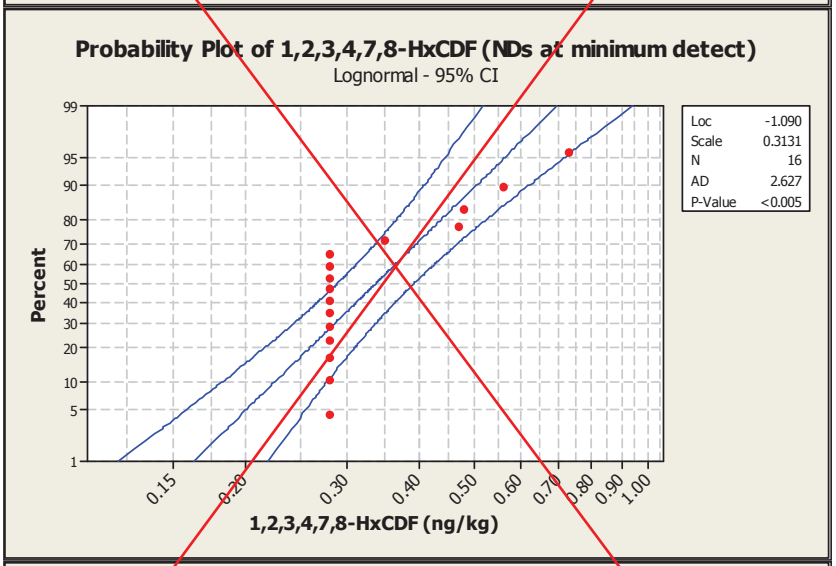

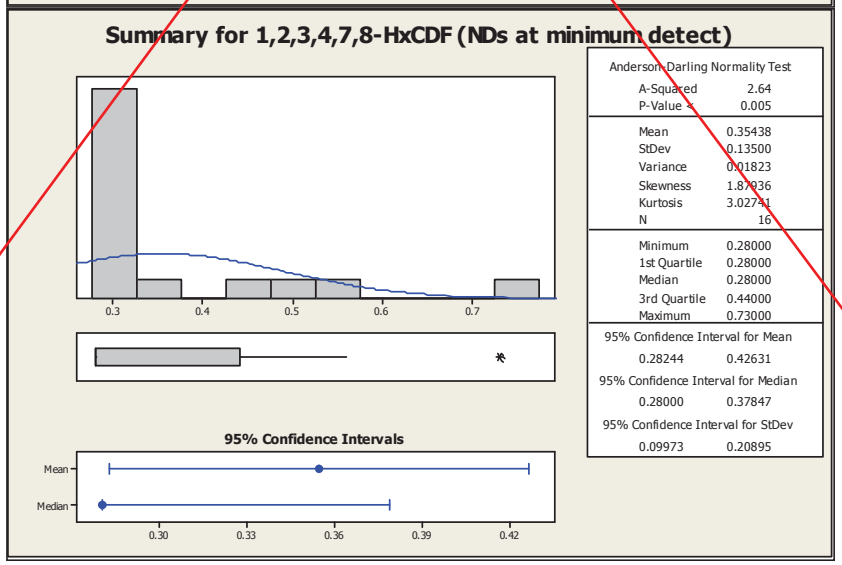

1,2,3,4,7,8-HxCDF
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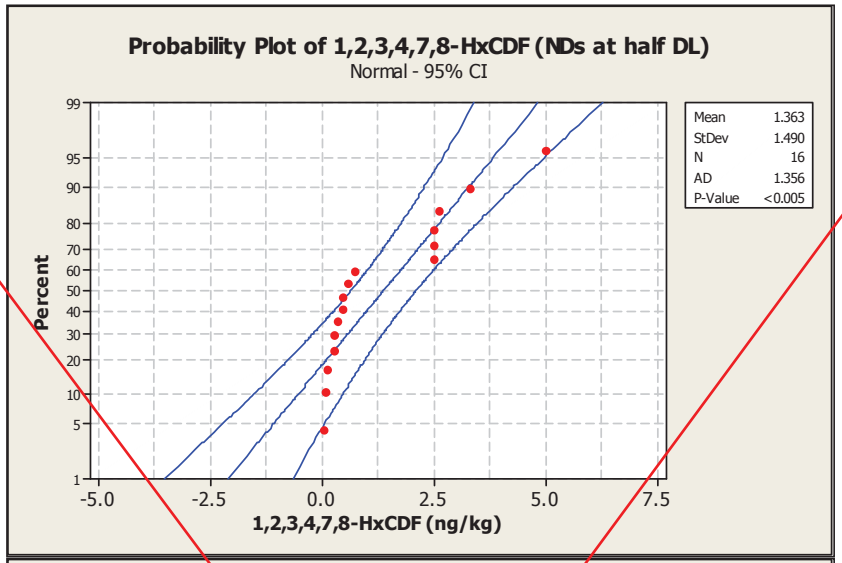

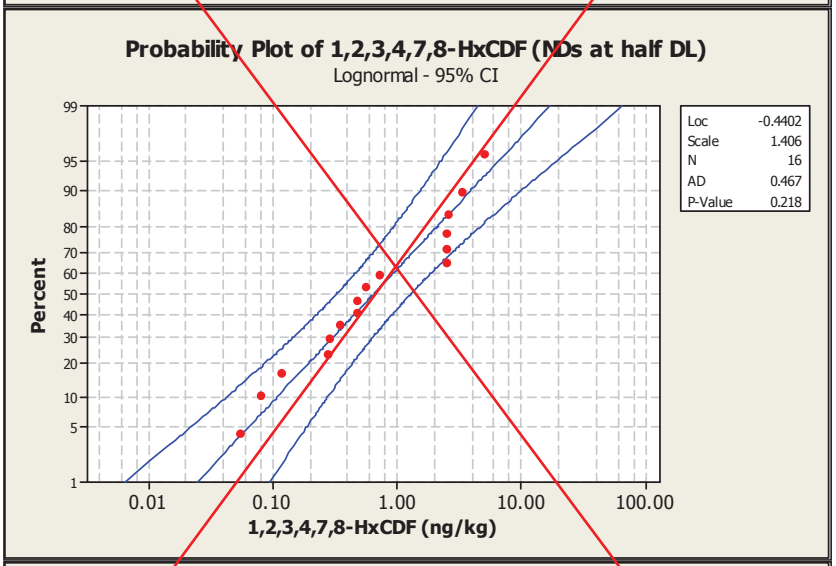

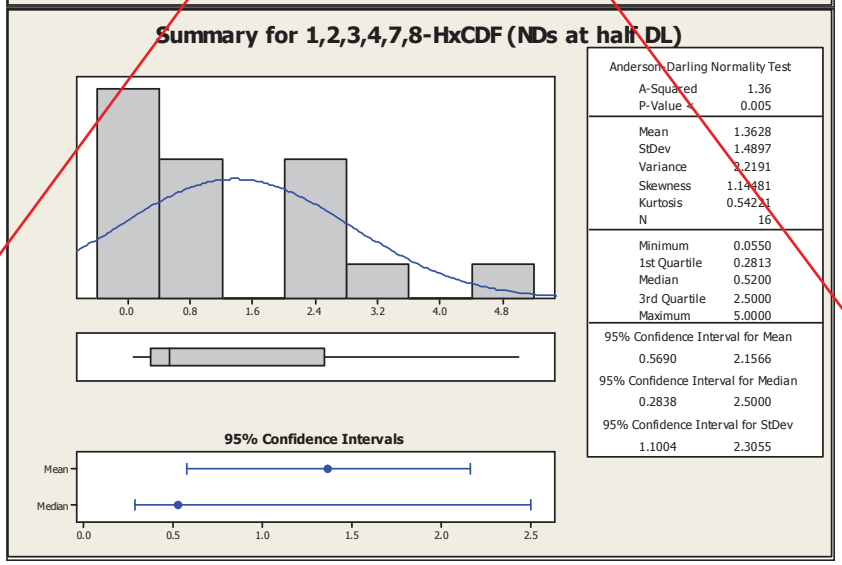

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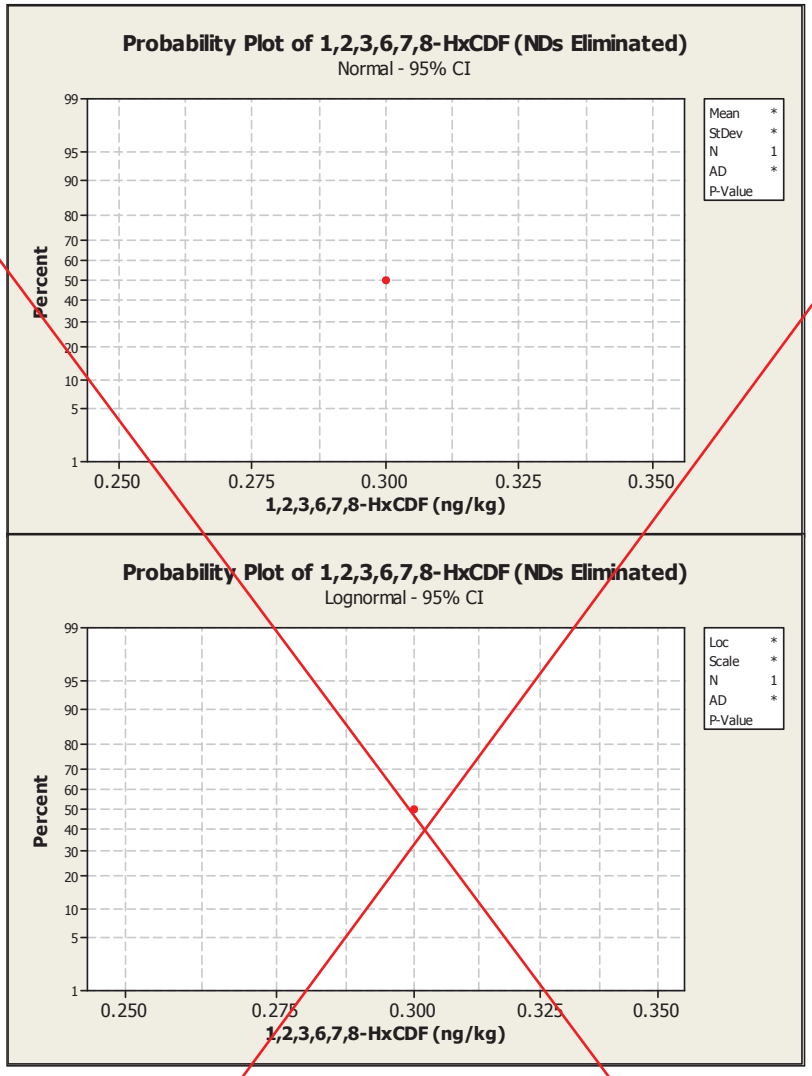

GRAPHICAL SUMMARY NOT PREPARED FOR "NDs ELIMINATED" DUE TO INSUFFICIENT NUMBER OF DETECTS

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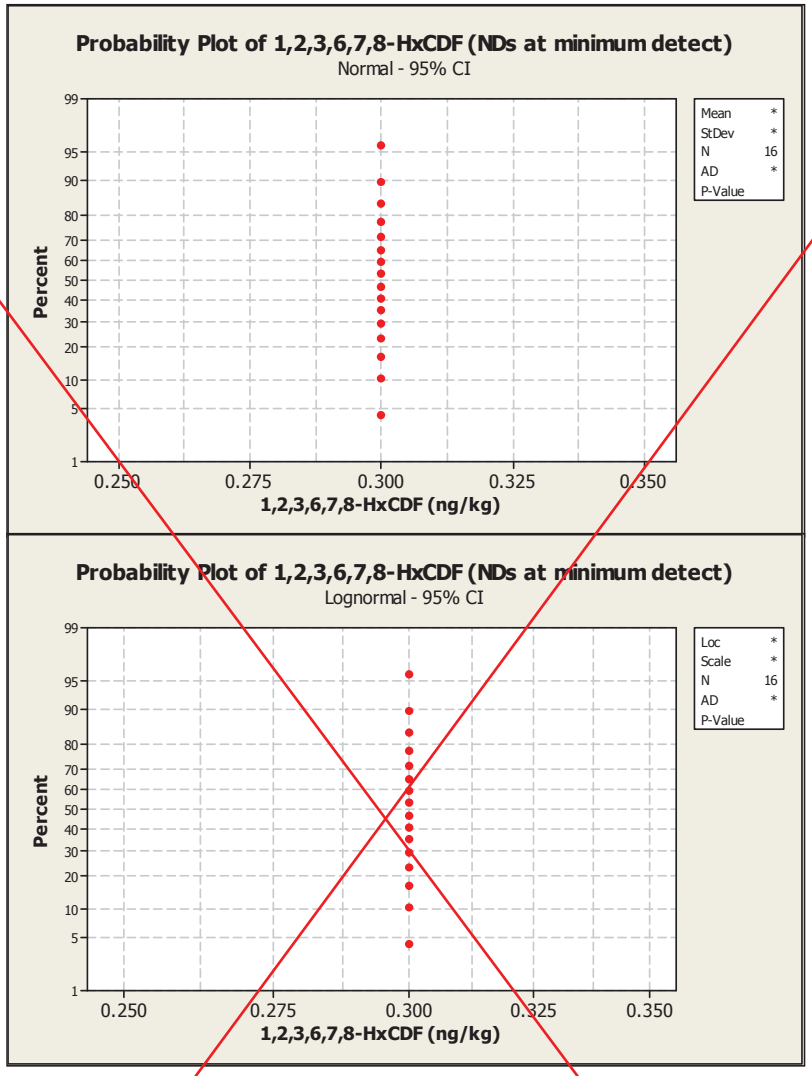

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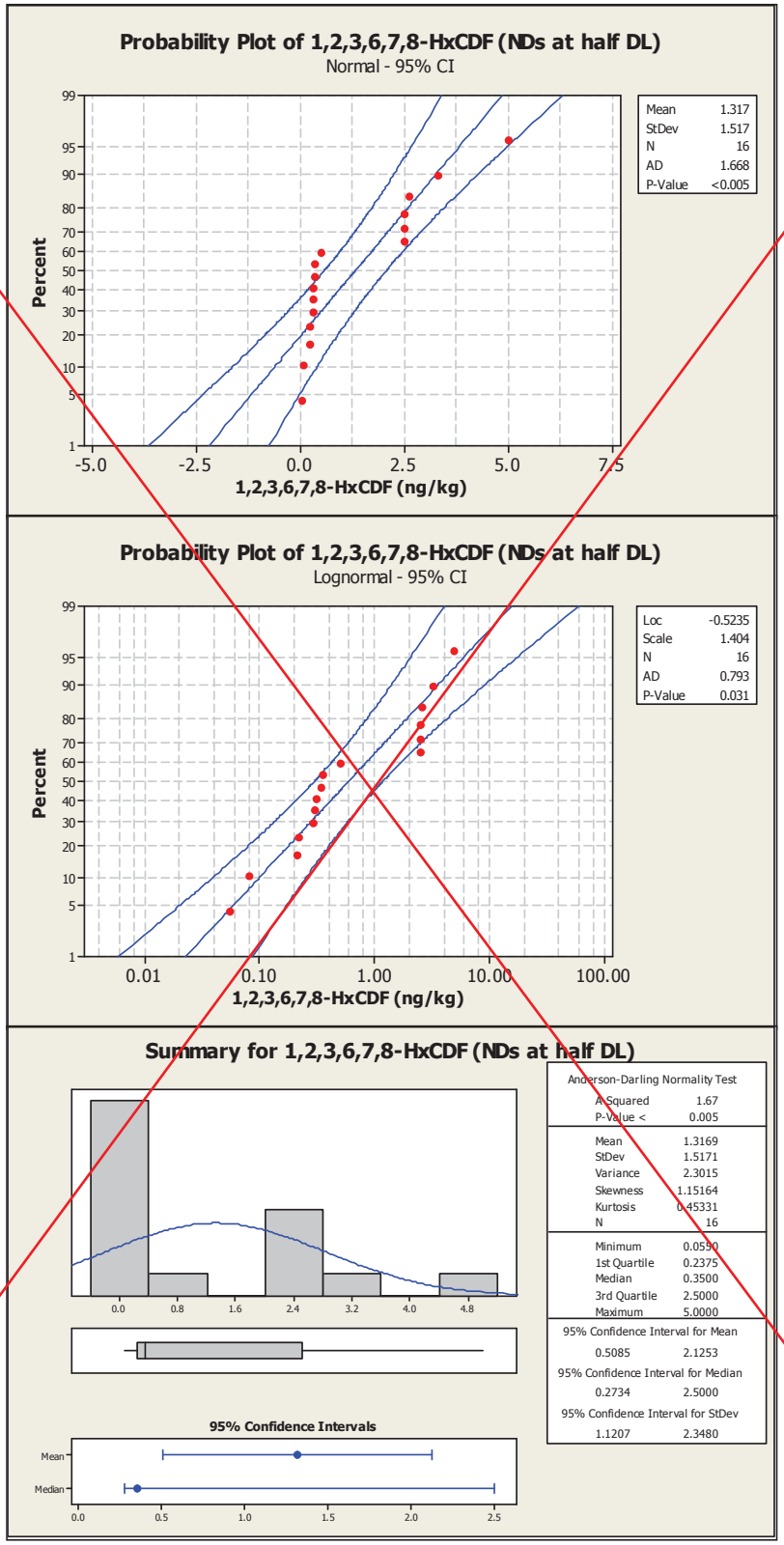

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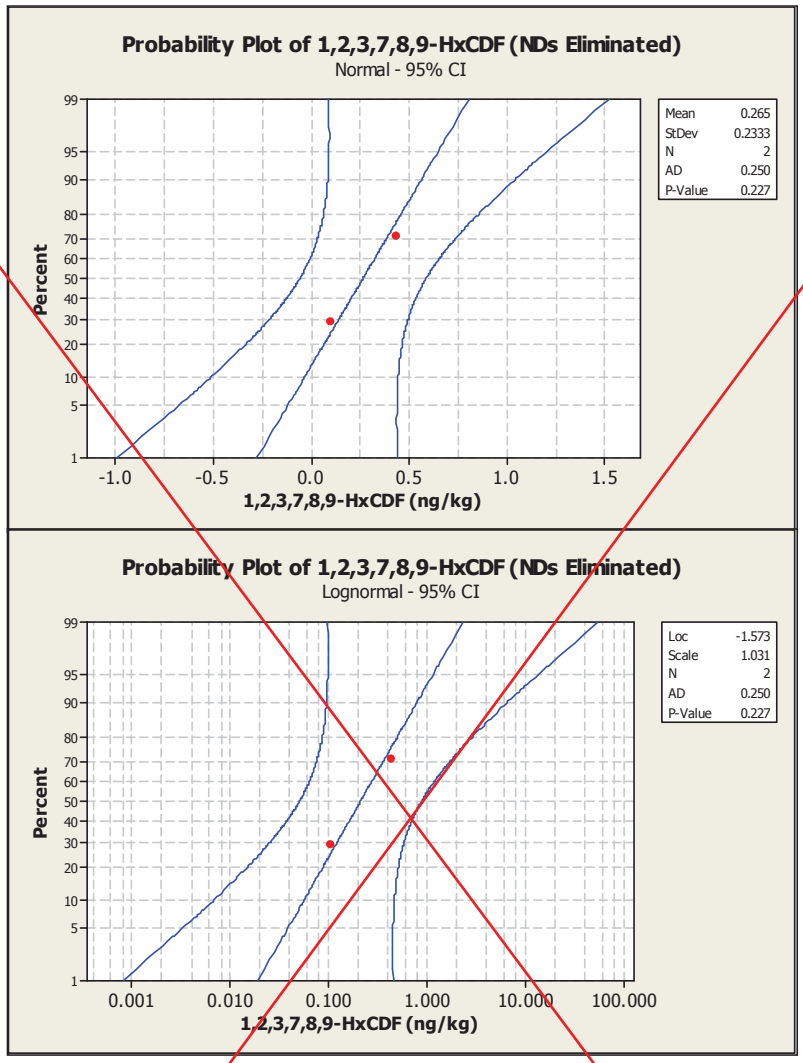

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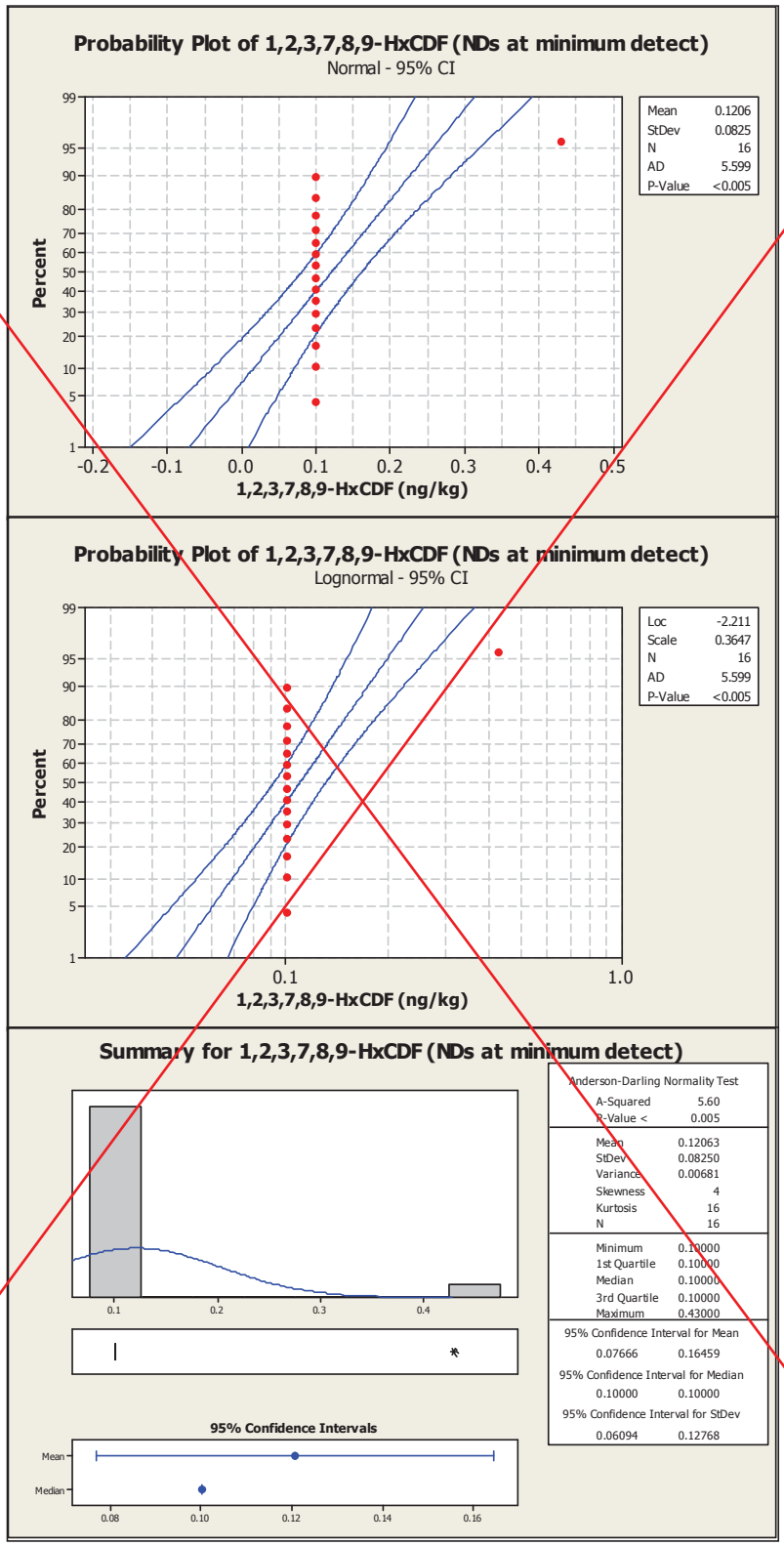

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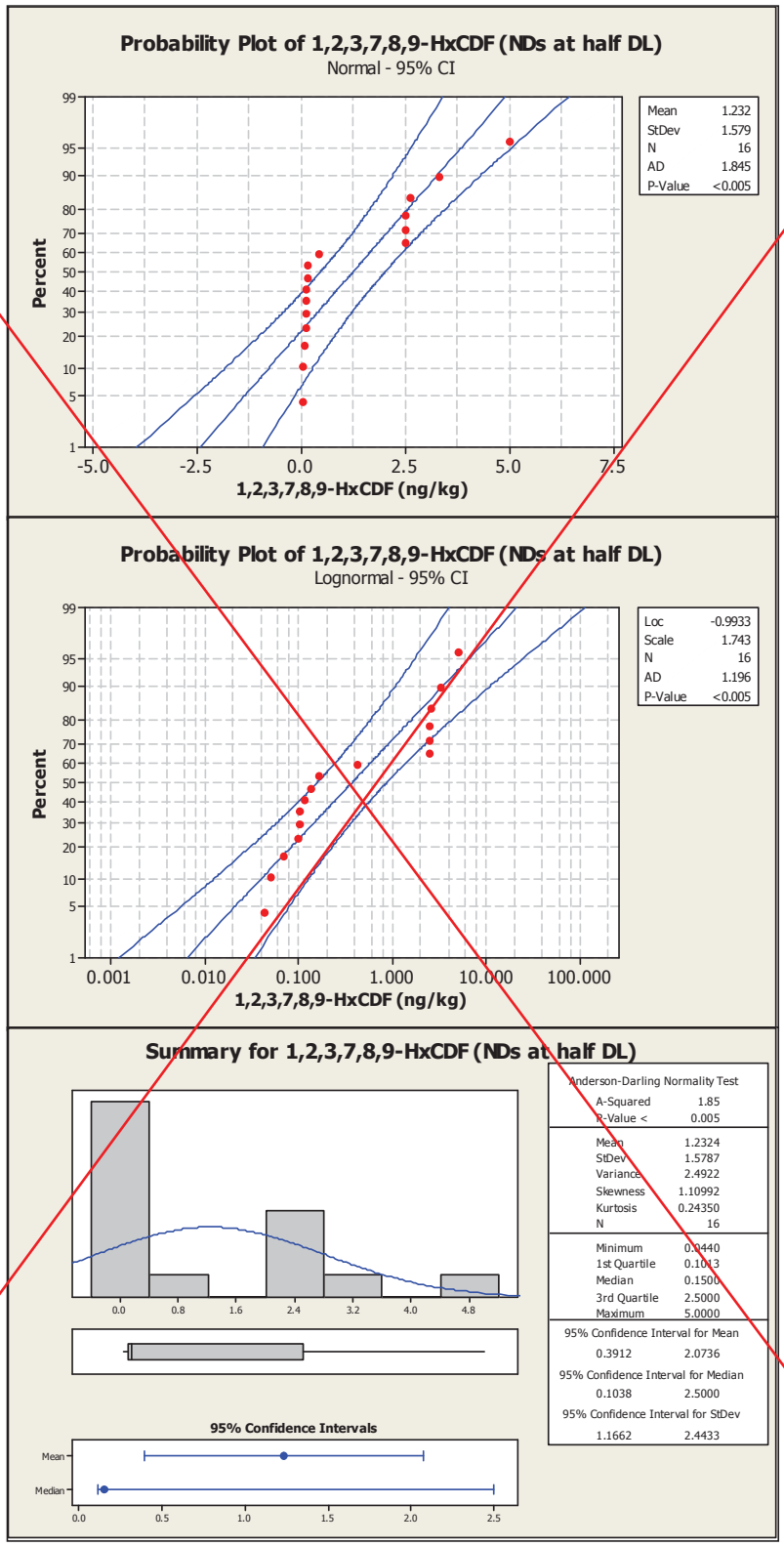

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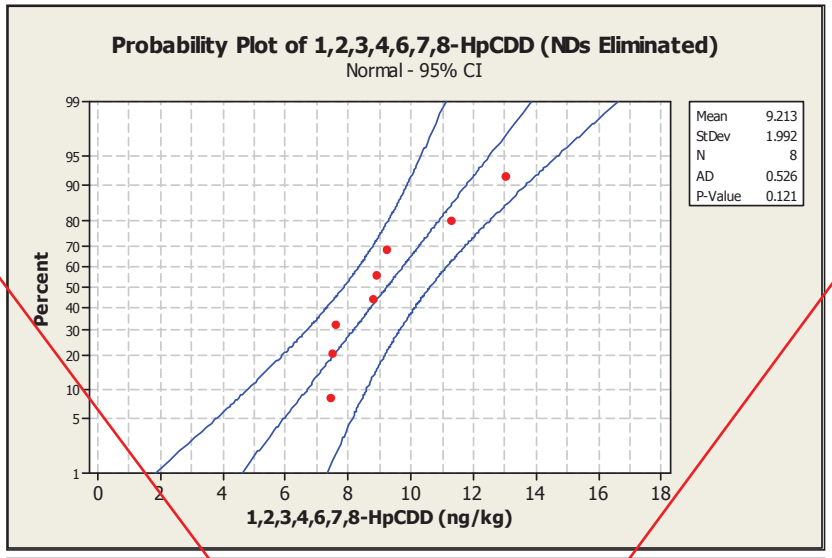

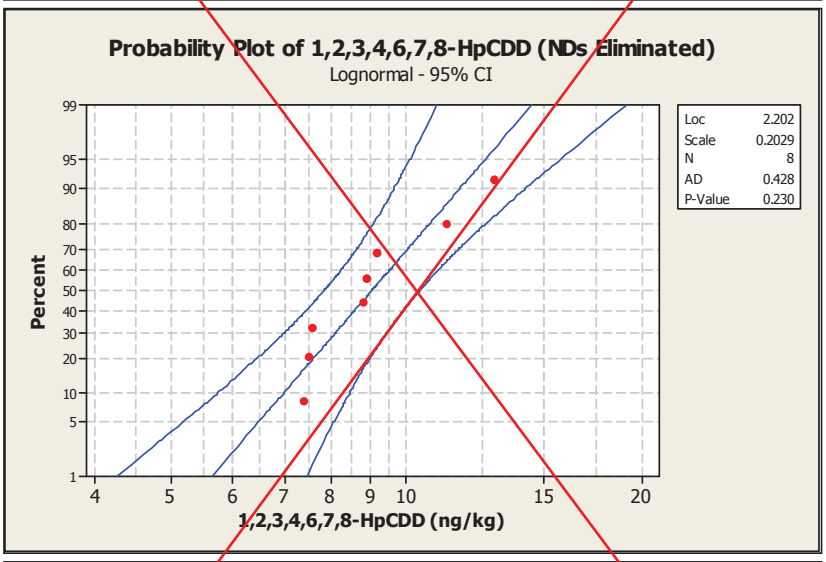

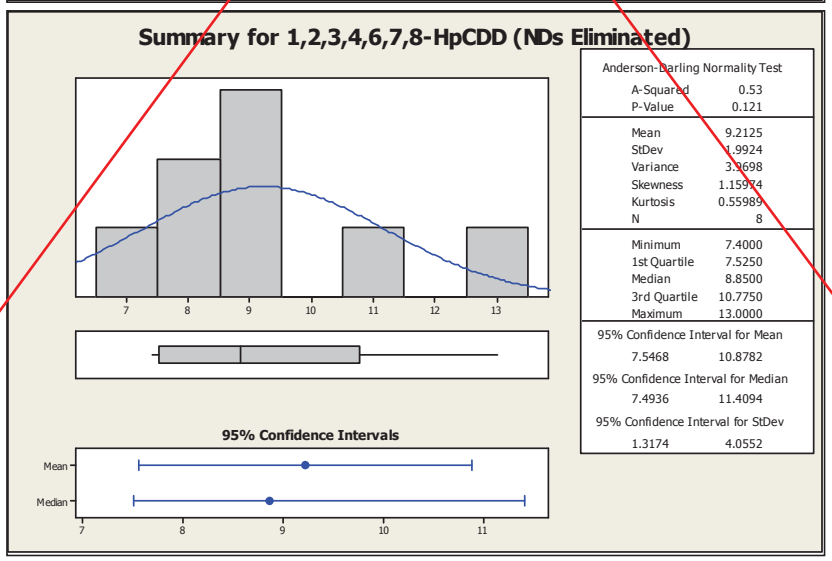

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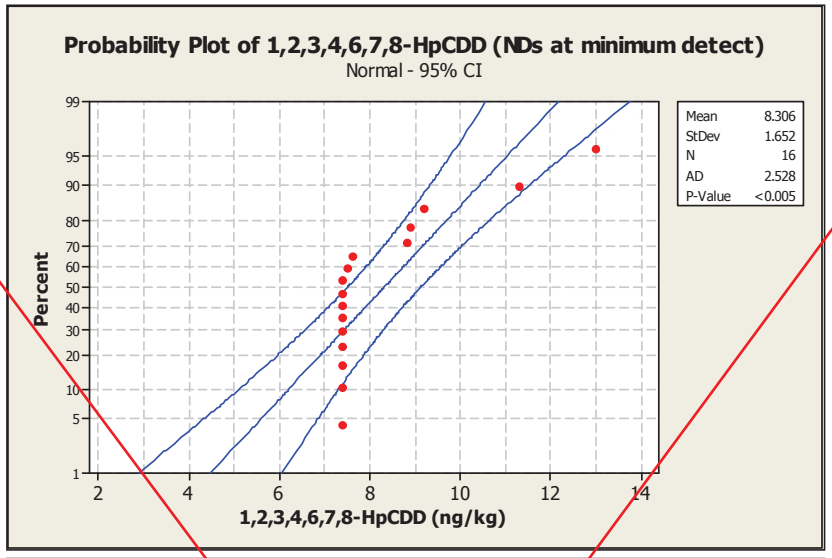

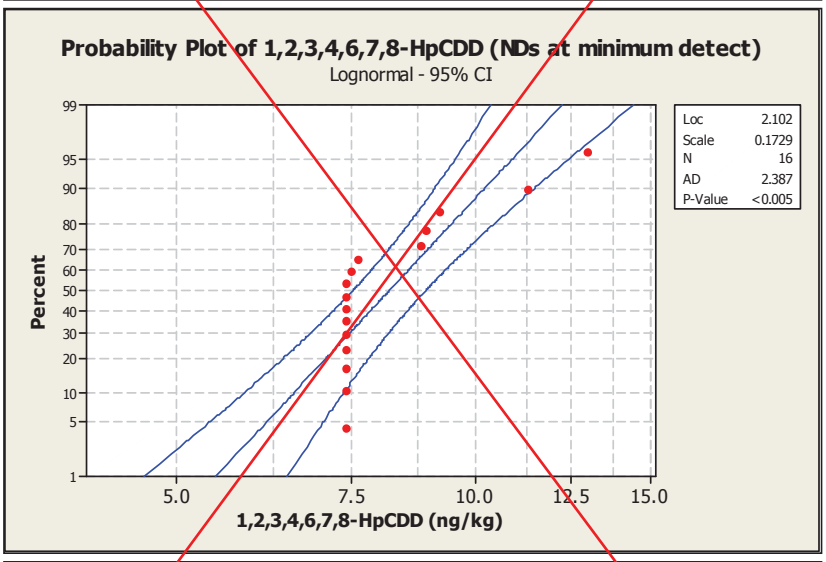

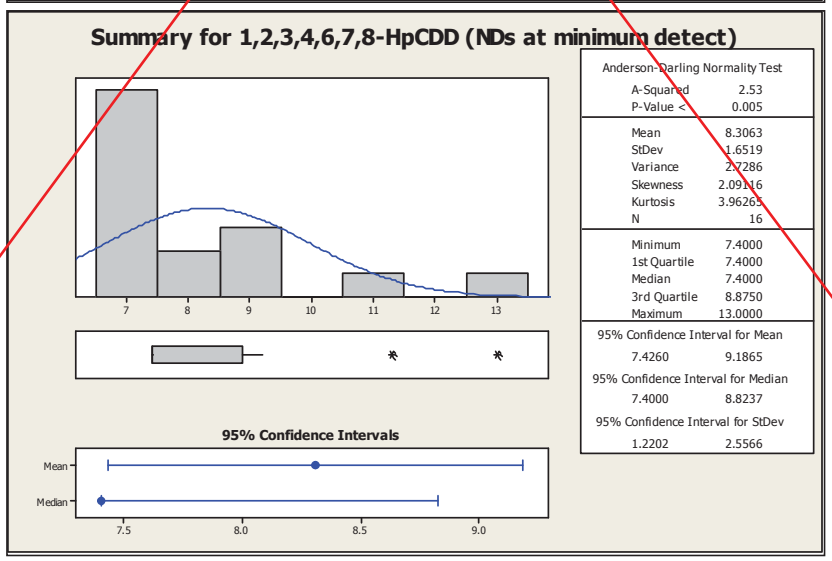

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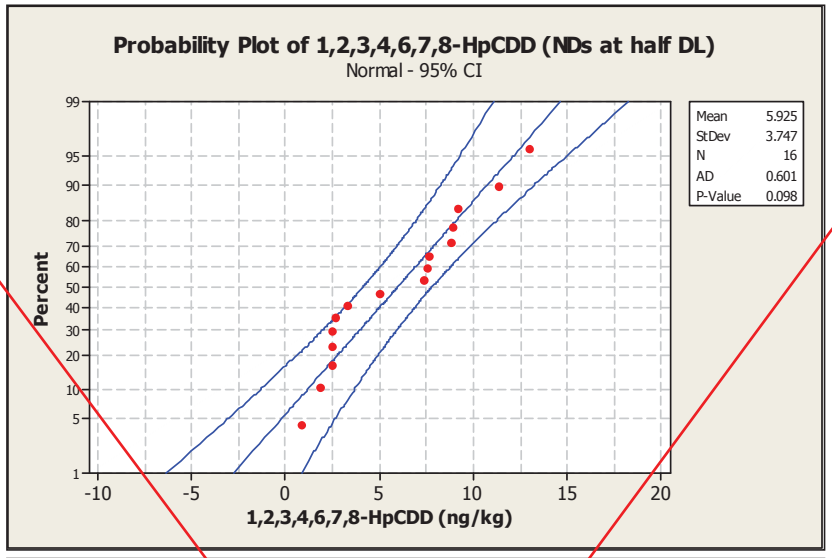

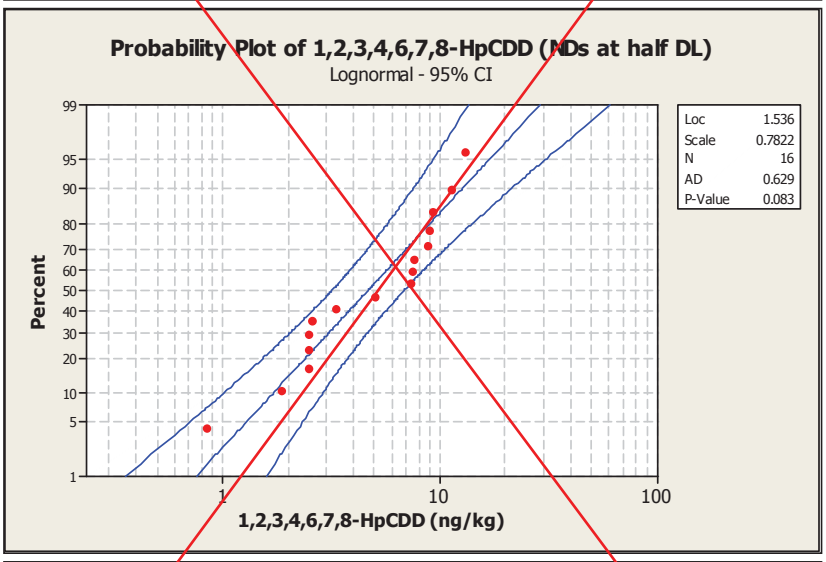

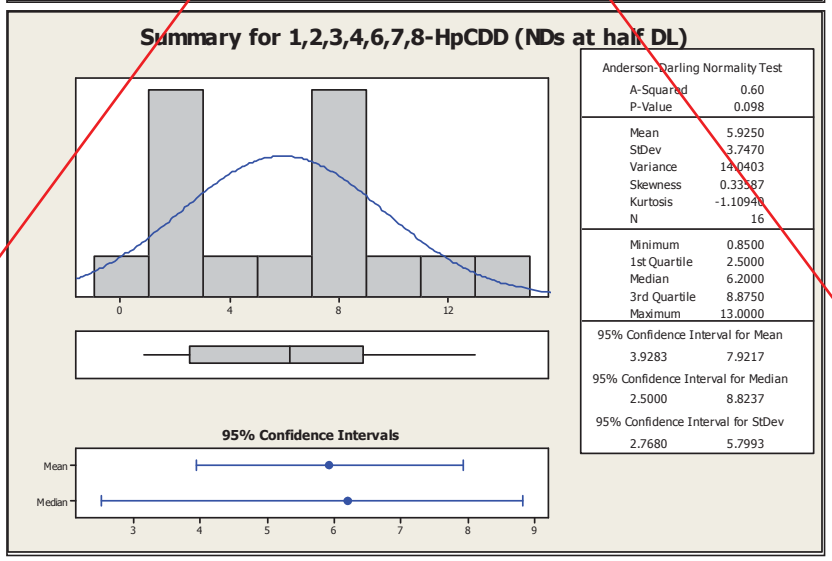

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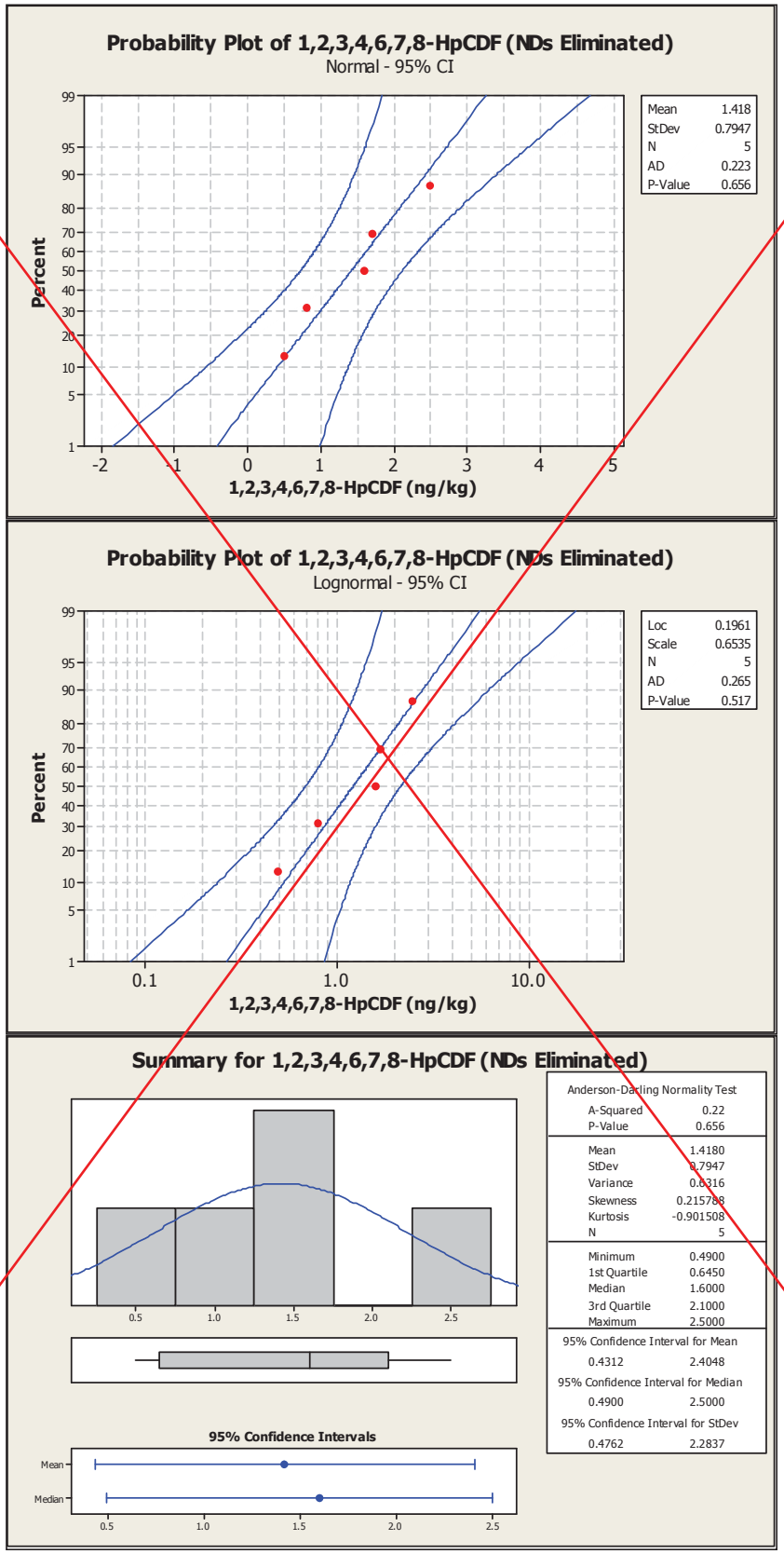

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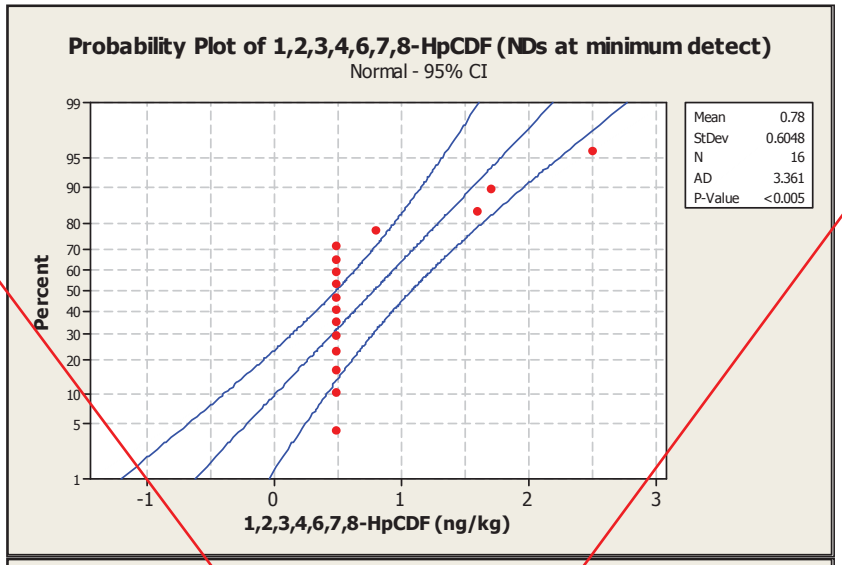

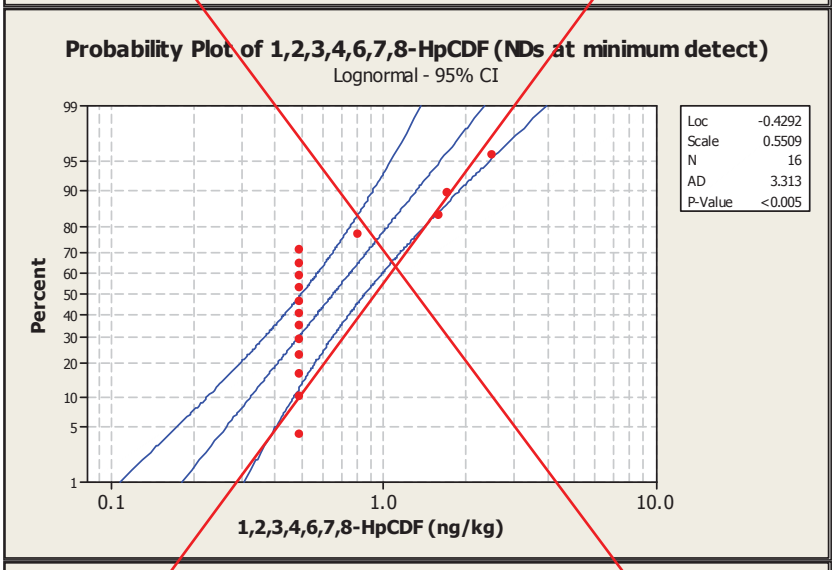

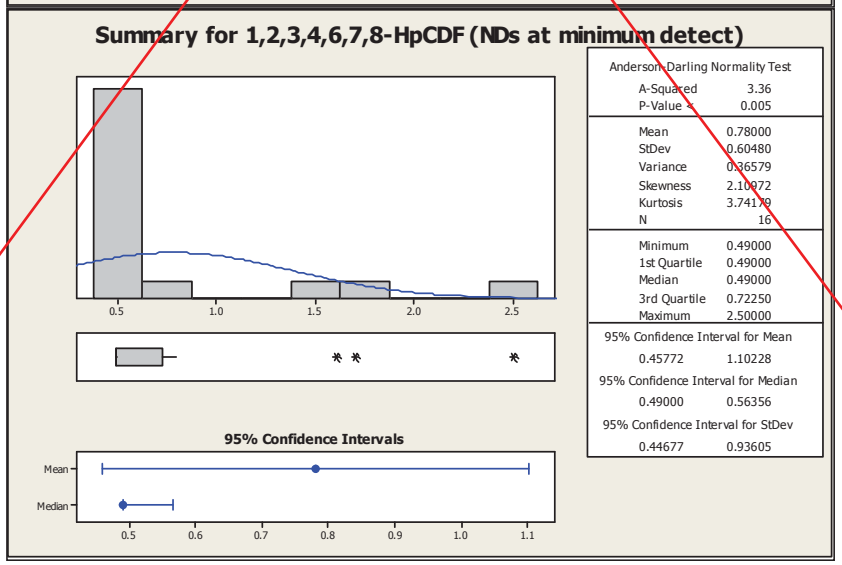

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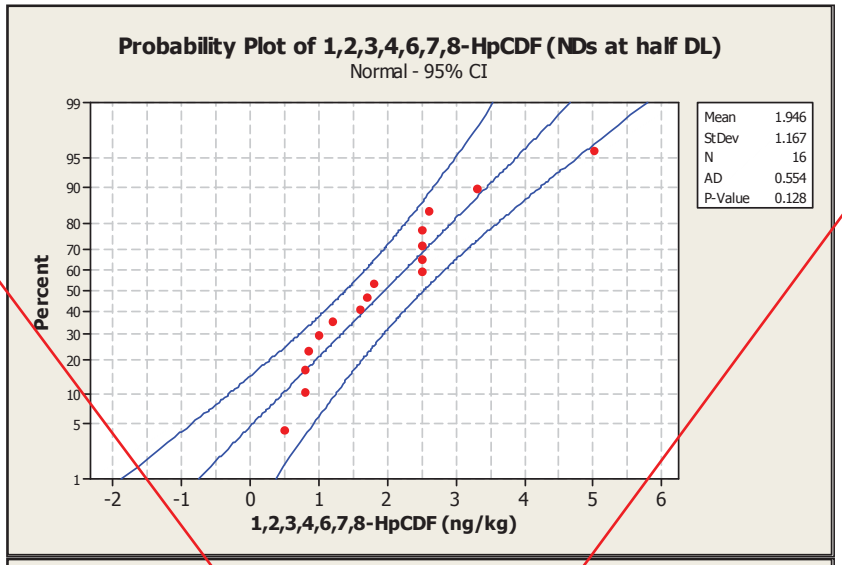

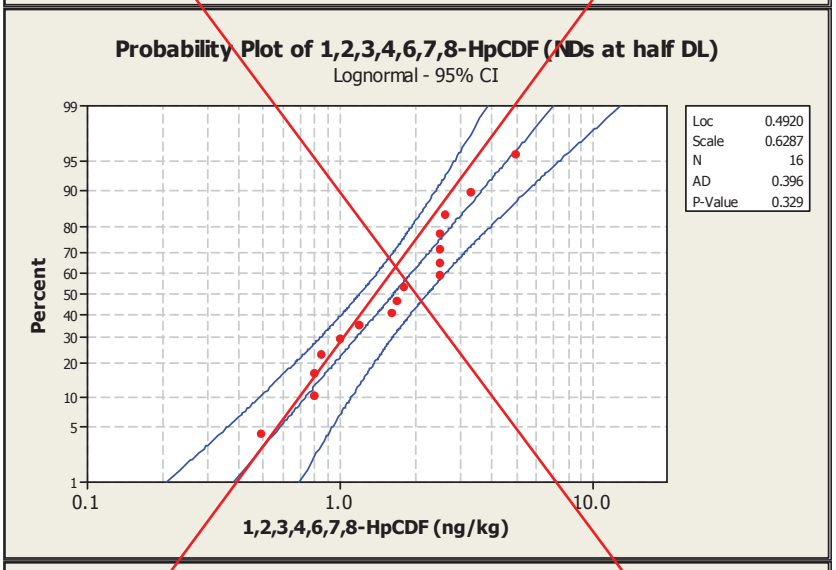

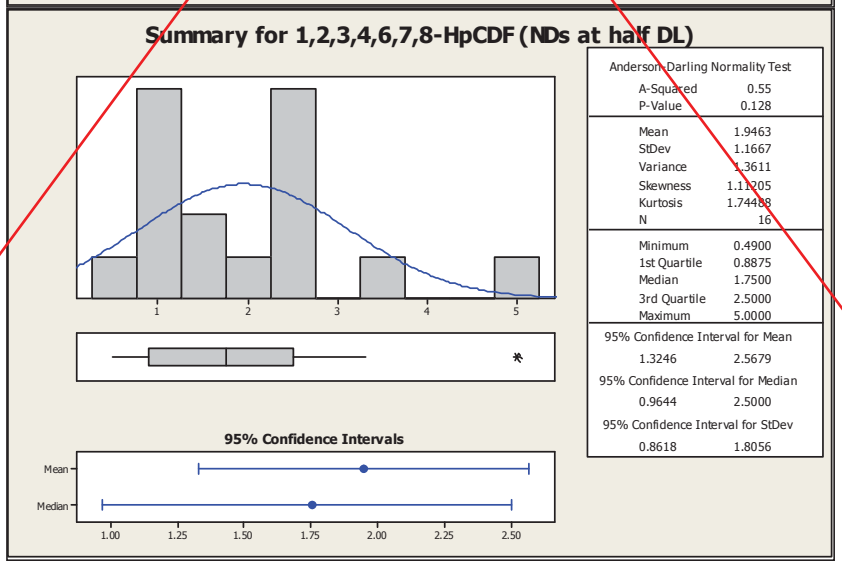

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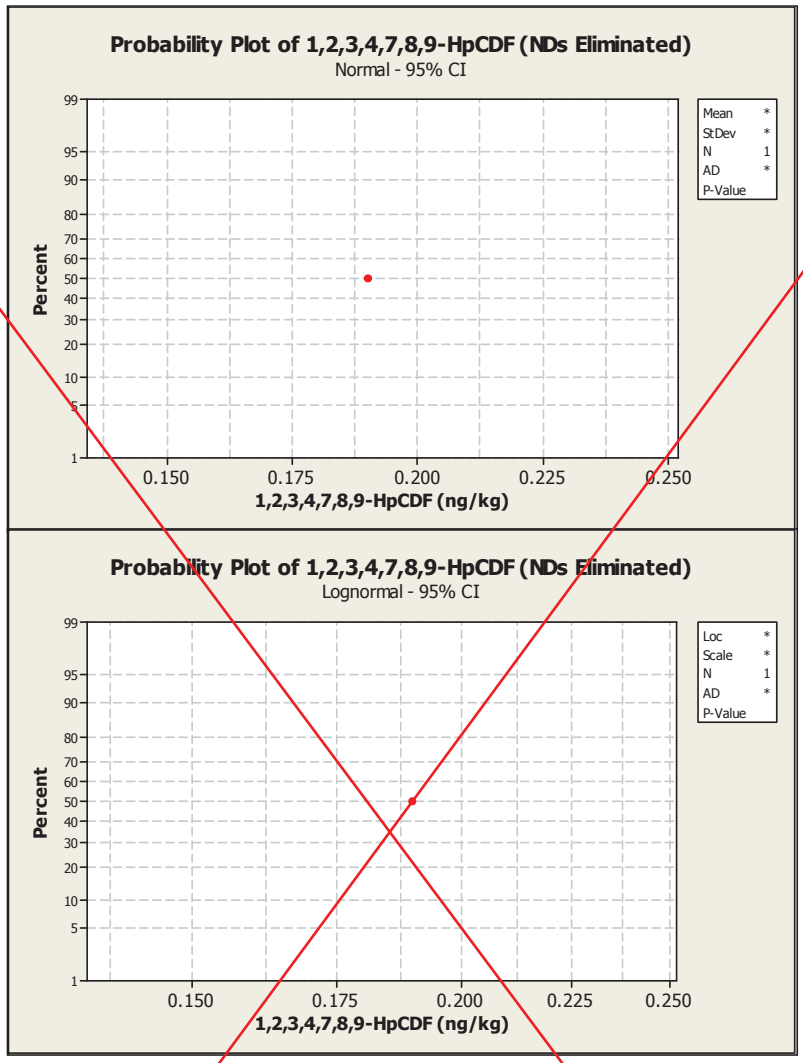
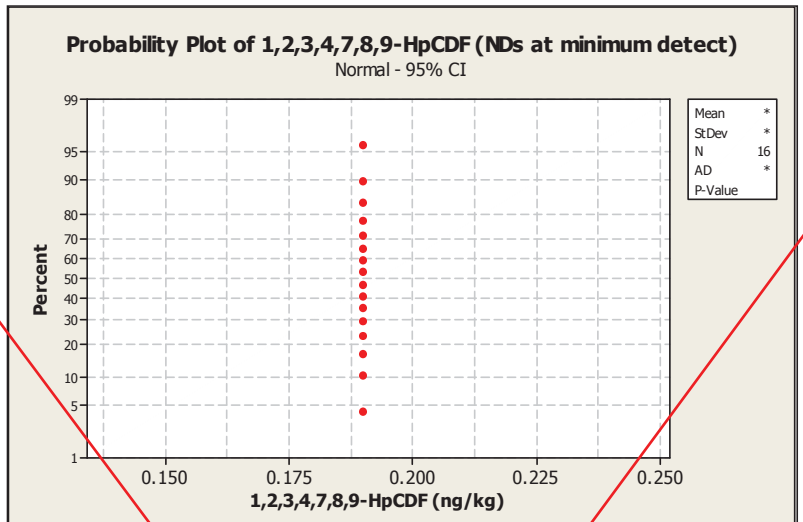
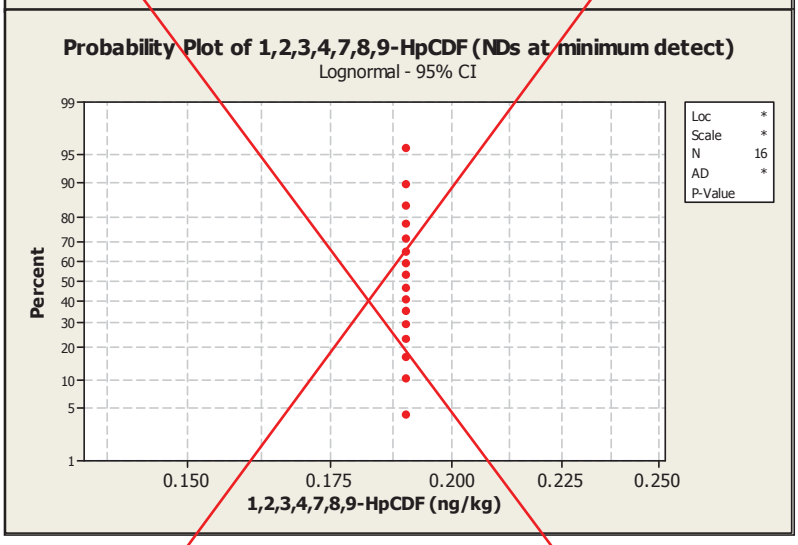


GRAPHICAL SUMMARY NOT PREPARED FOR "NDs ELIMINATED" DUE TO INSUFFICIENT NUMBER OF DETECTS

1,2,3,4,7,8,9-HpCDF
(Page 2 of 3)





GRAPHICAL SUMMARY NOT PREPARED FOR "NDs AT MINIMUM DETECT" DUE TO IDENTICAL VALUES ON ALL SAMPLES

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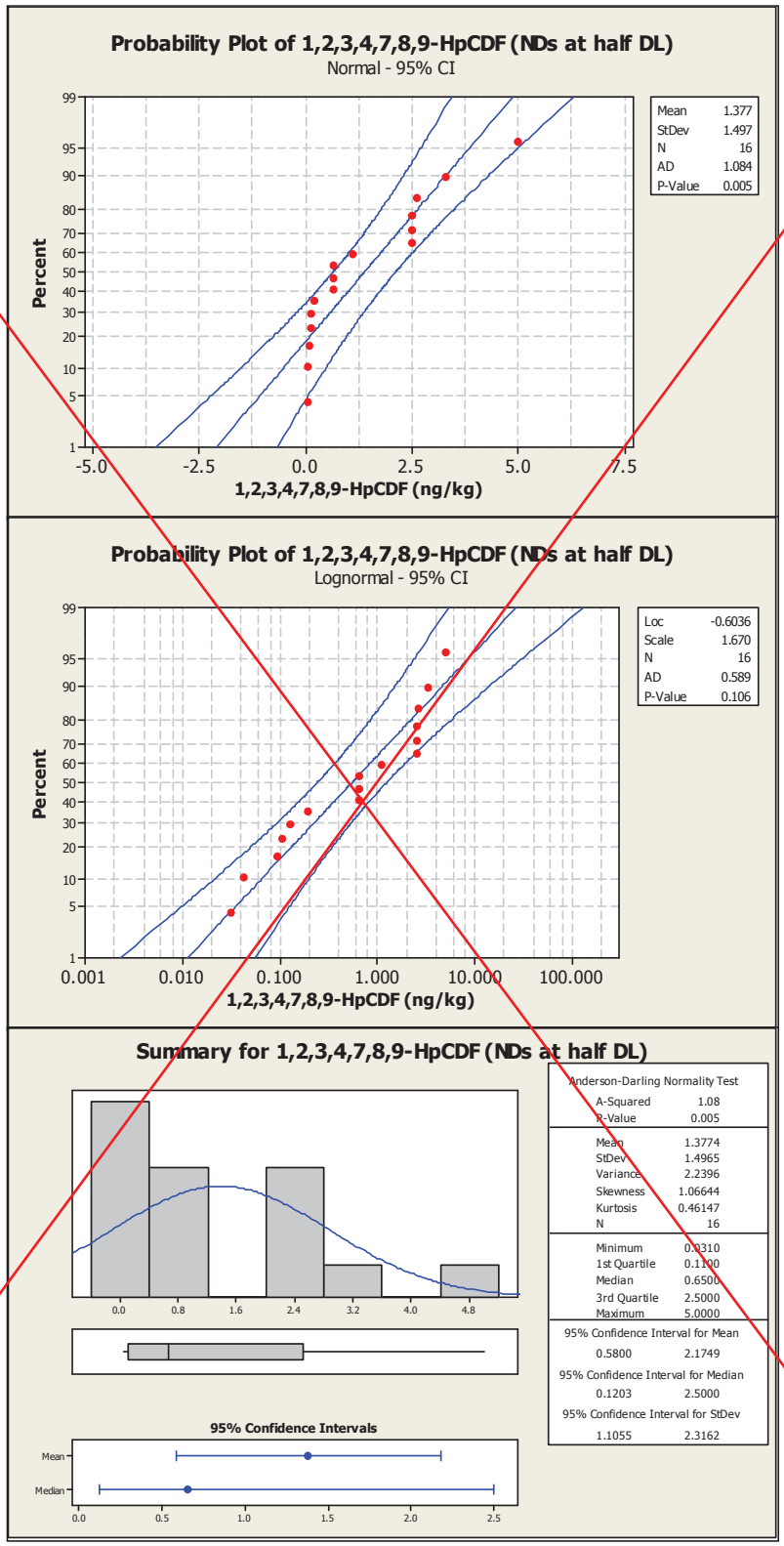

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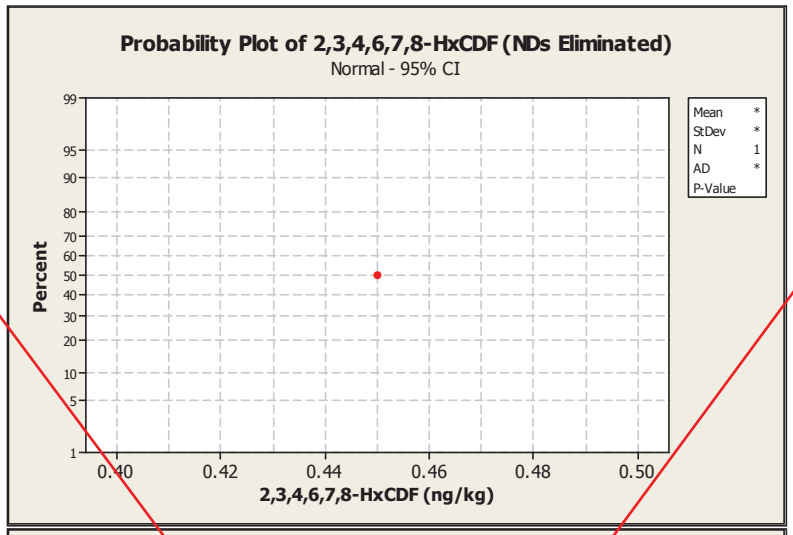

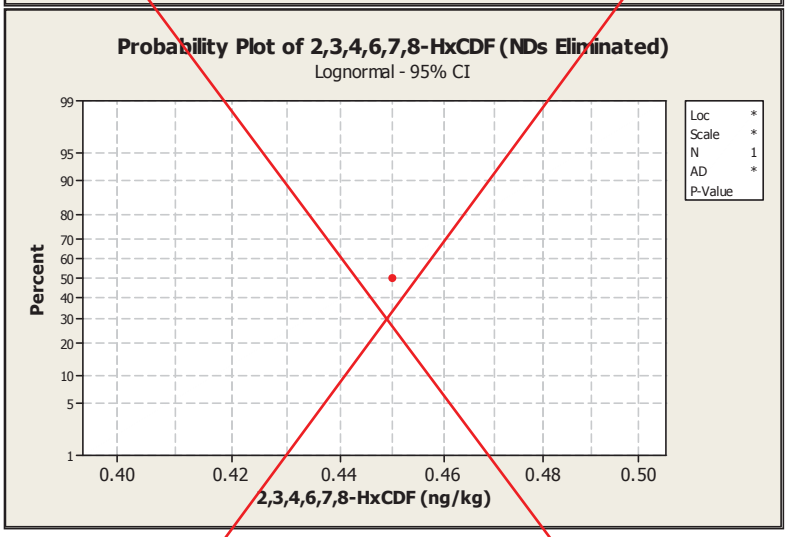

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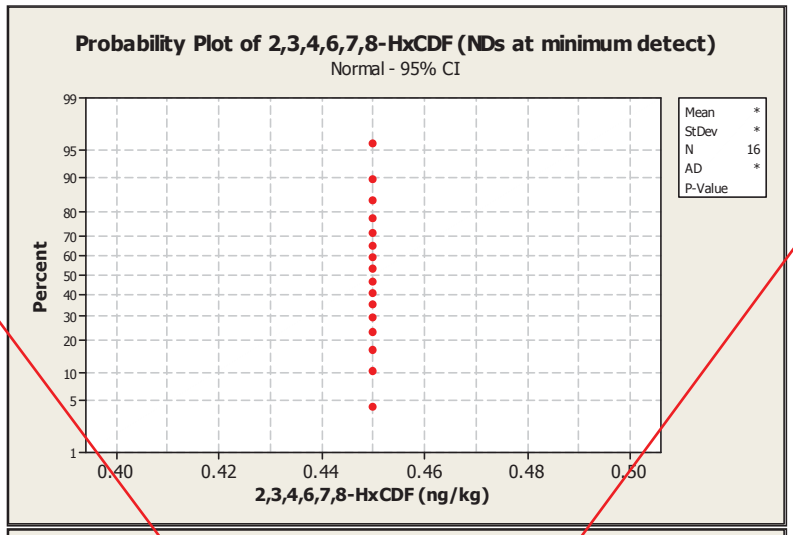

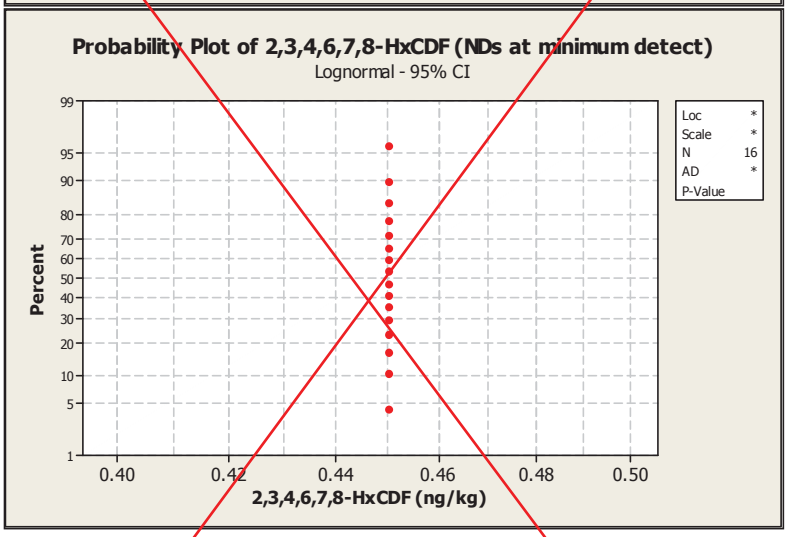

GRAPHICAL SUMMARY NOT PREPARED FOR "NDs AT MINIMUM DETECT DUE TO IDENTICAL VALUES FOR ALL SAMPLES

2,3,4,6,7,8-HxCDF
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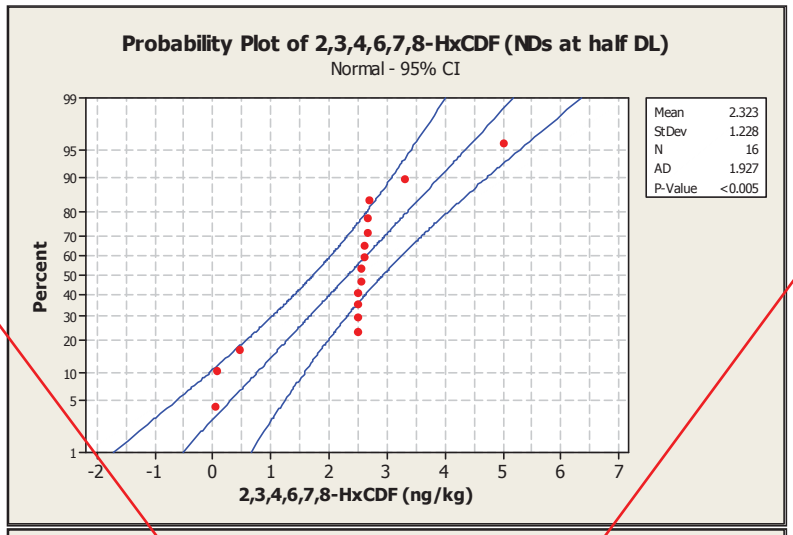

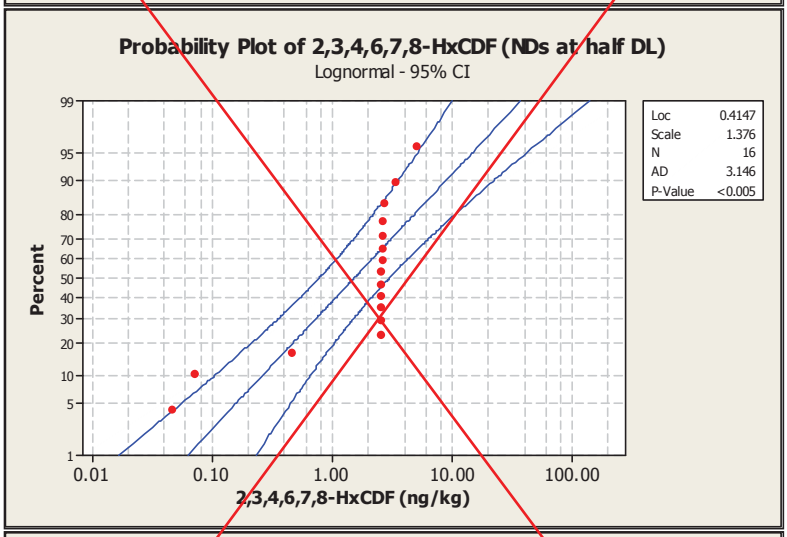

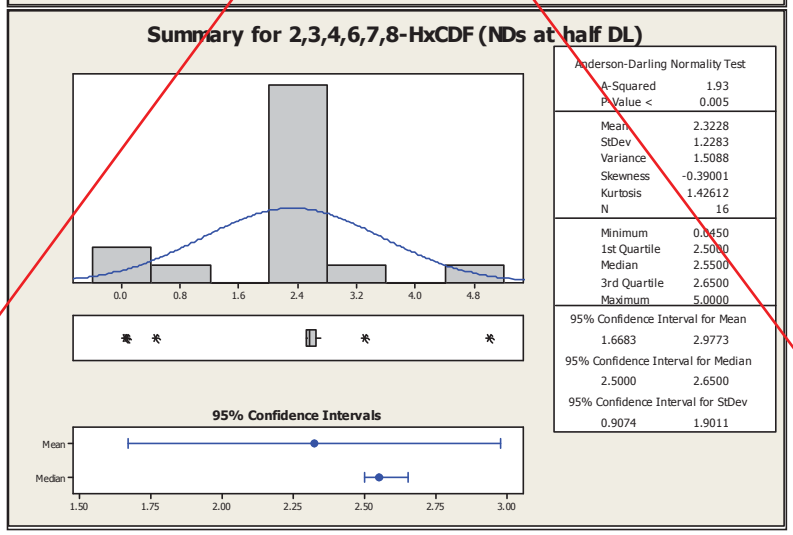

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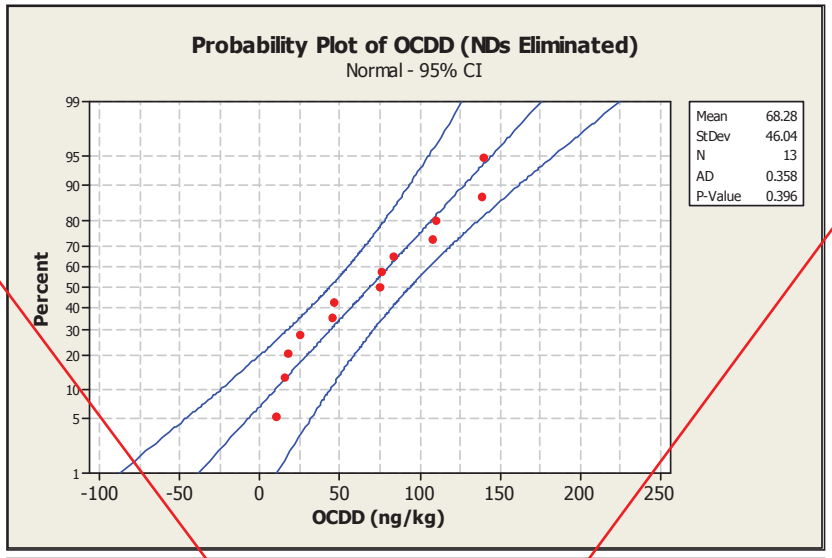

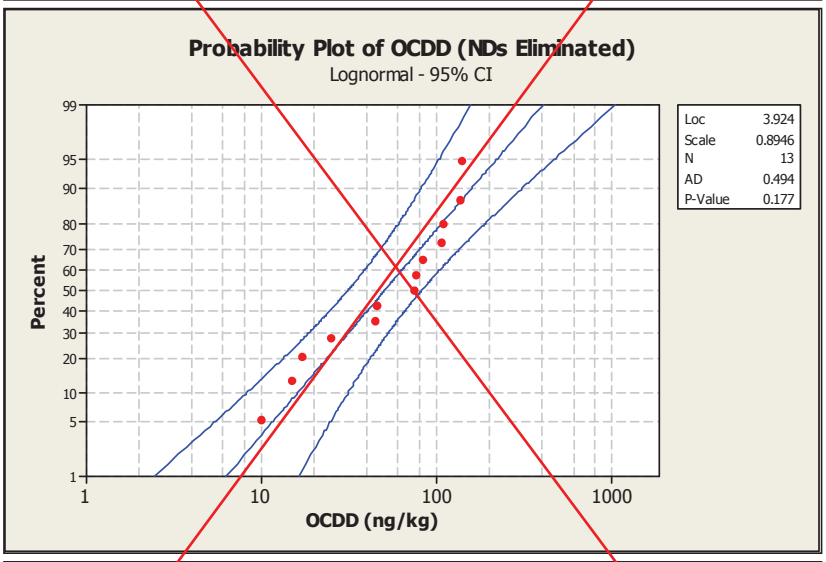

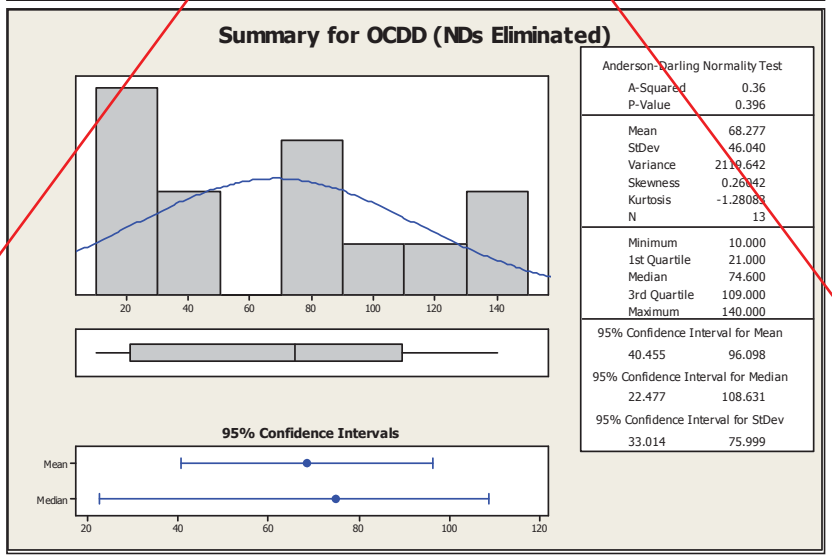

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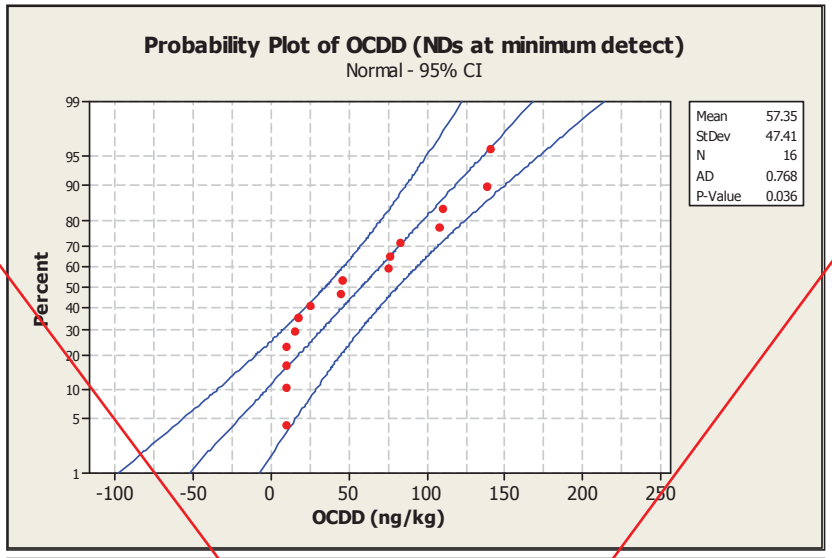

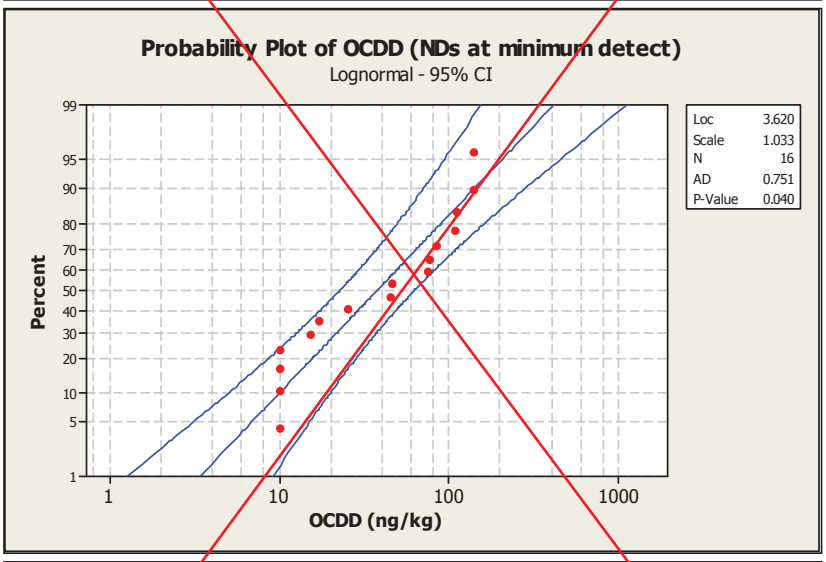

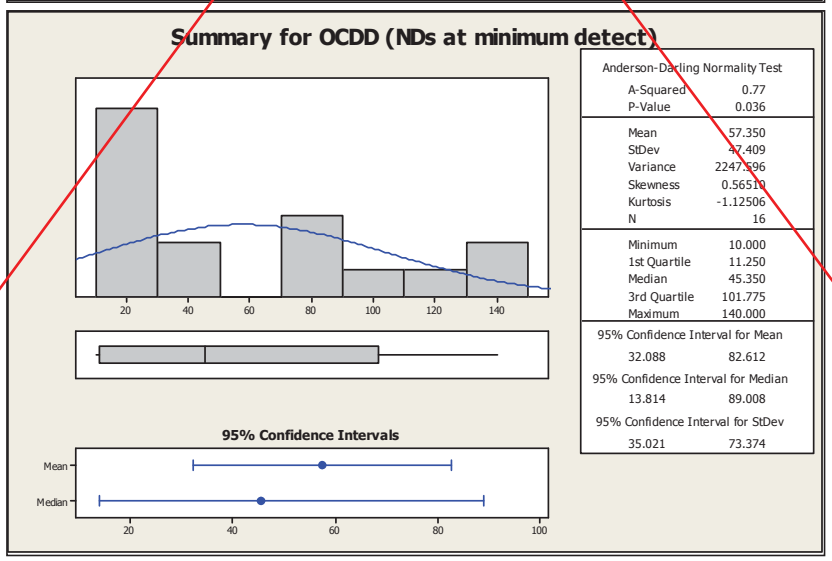

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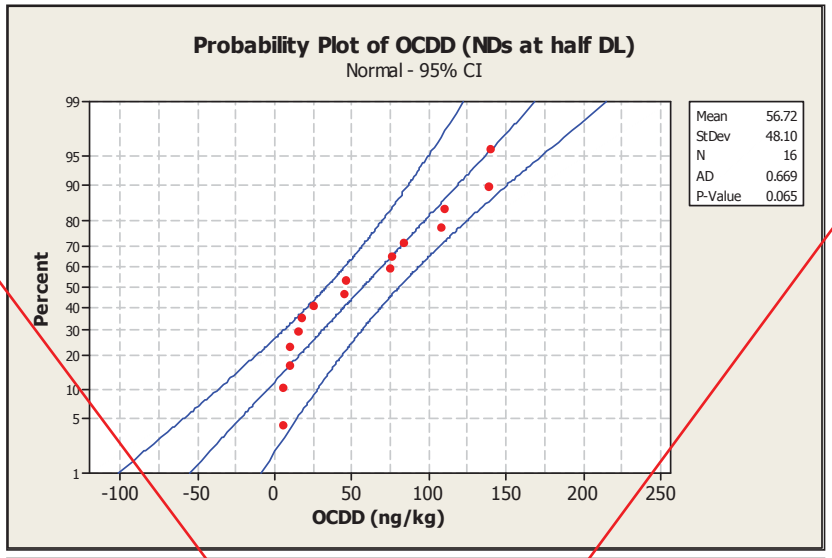

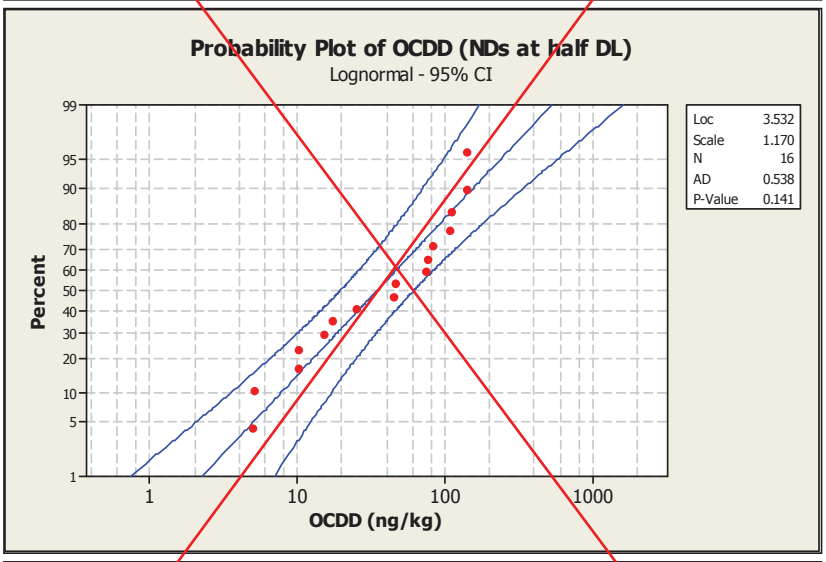

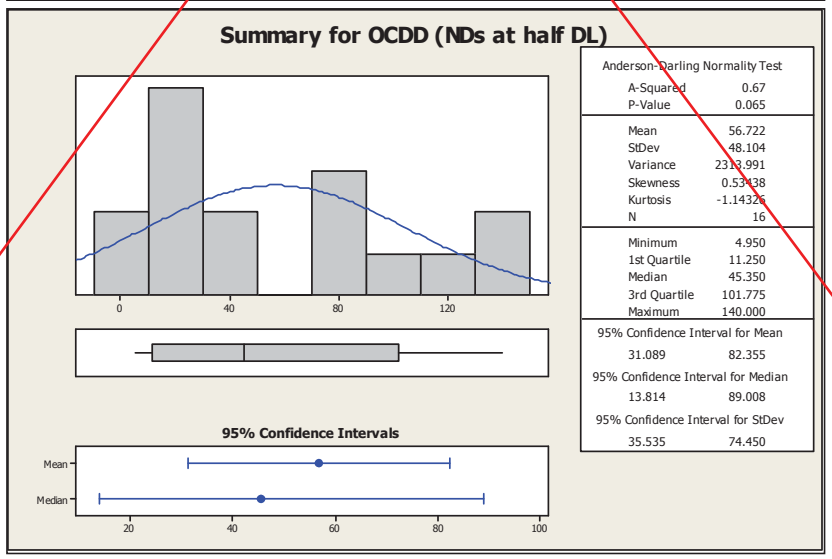

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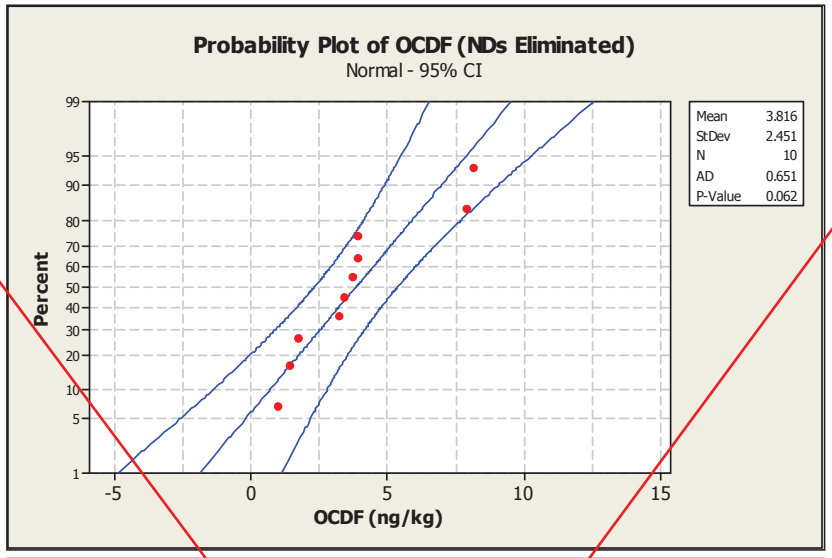

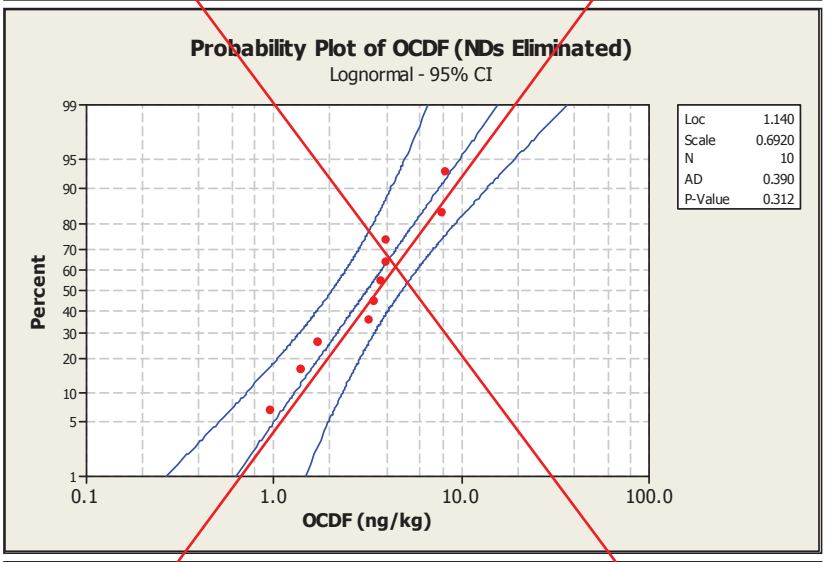

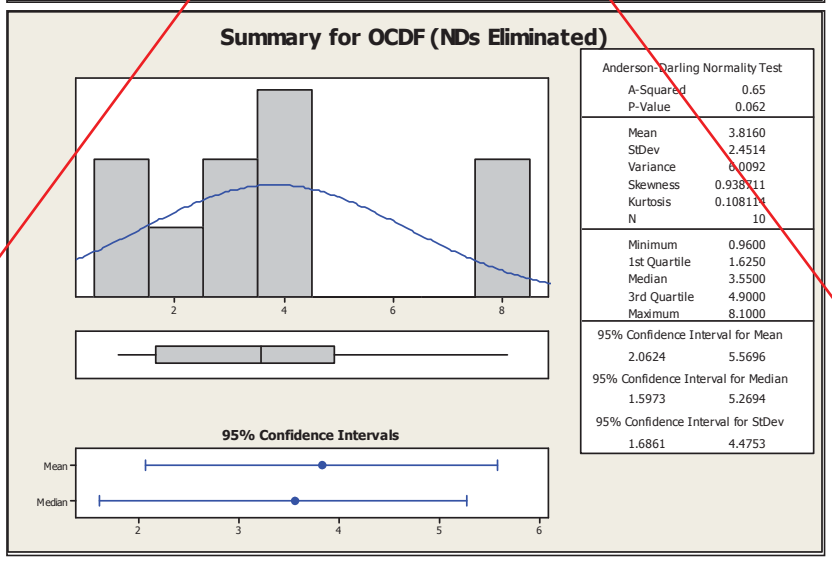

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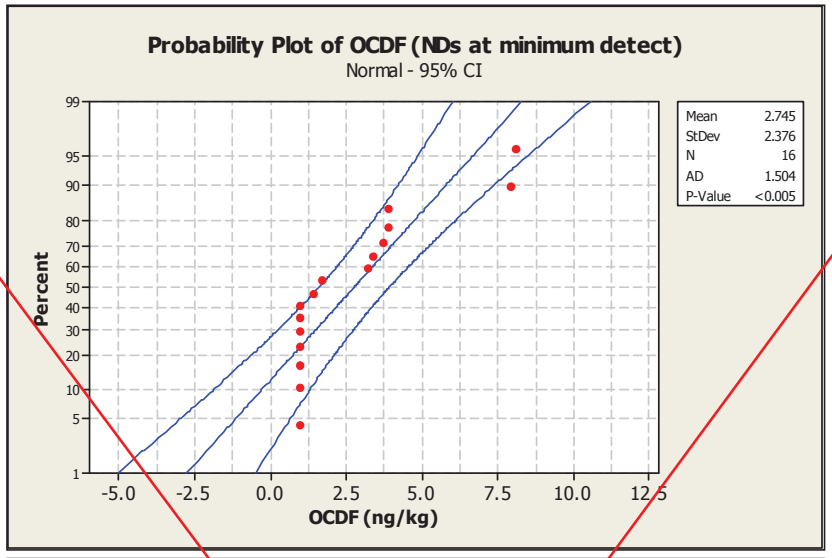

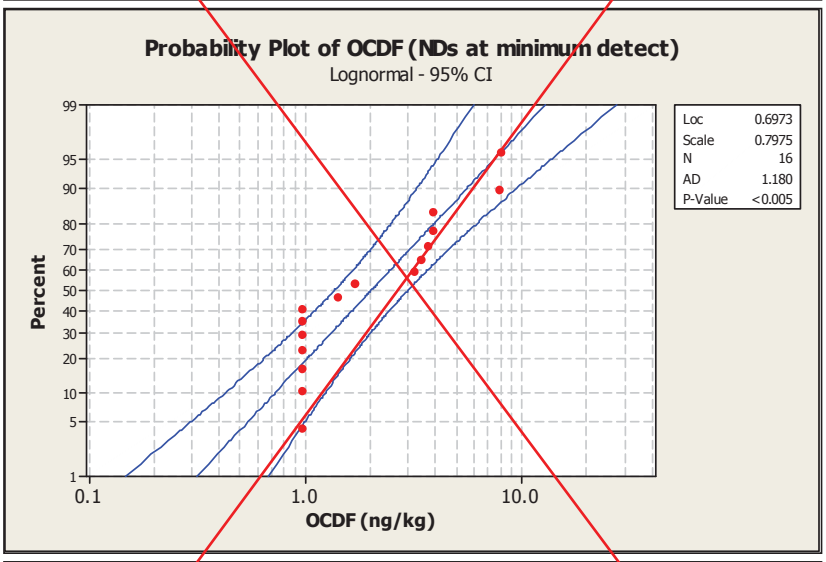

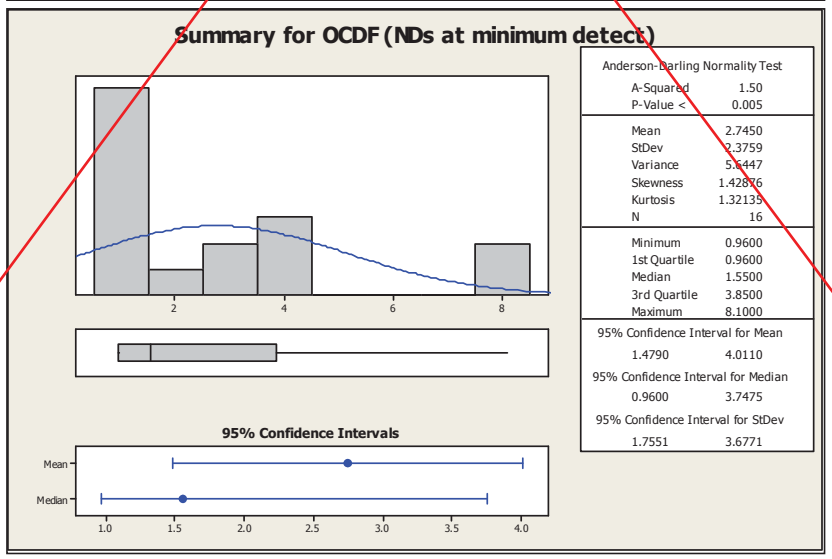

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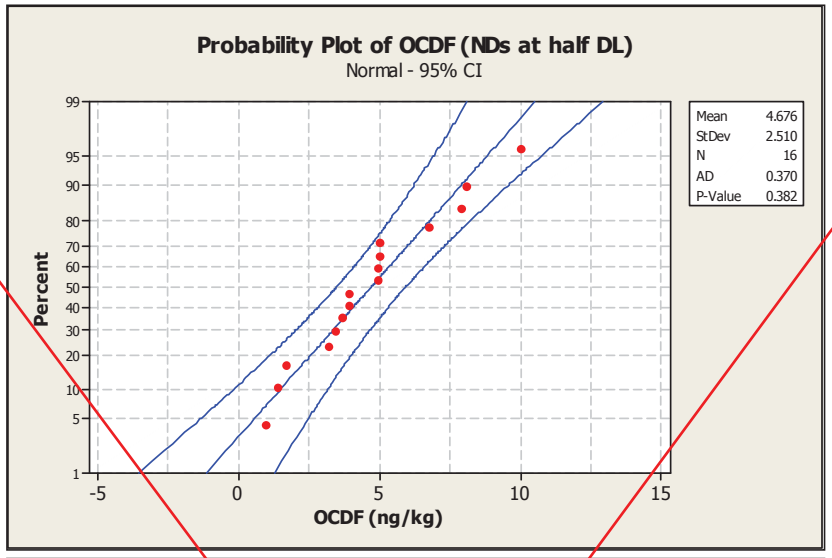

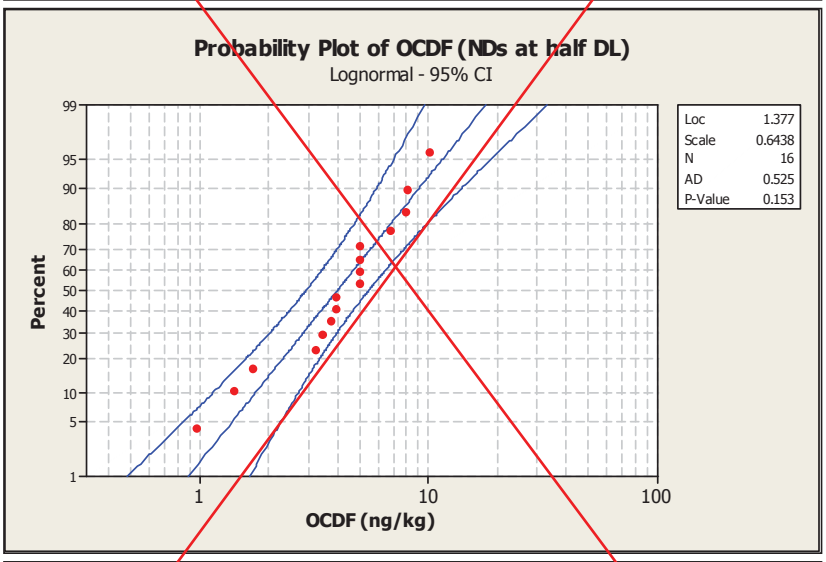

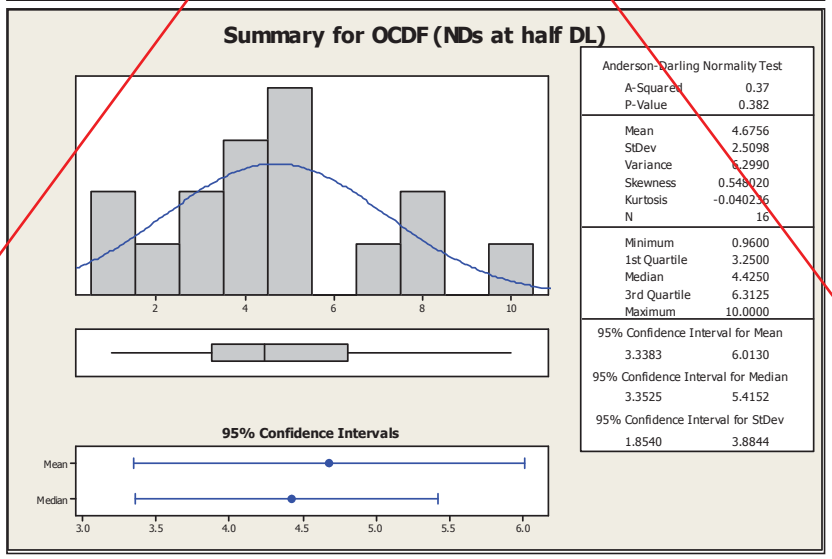

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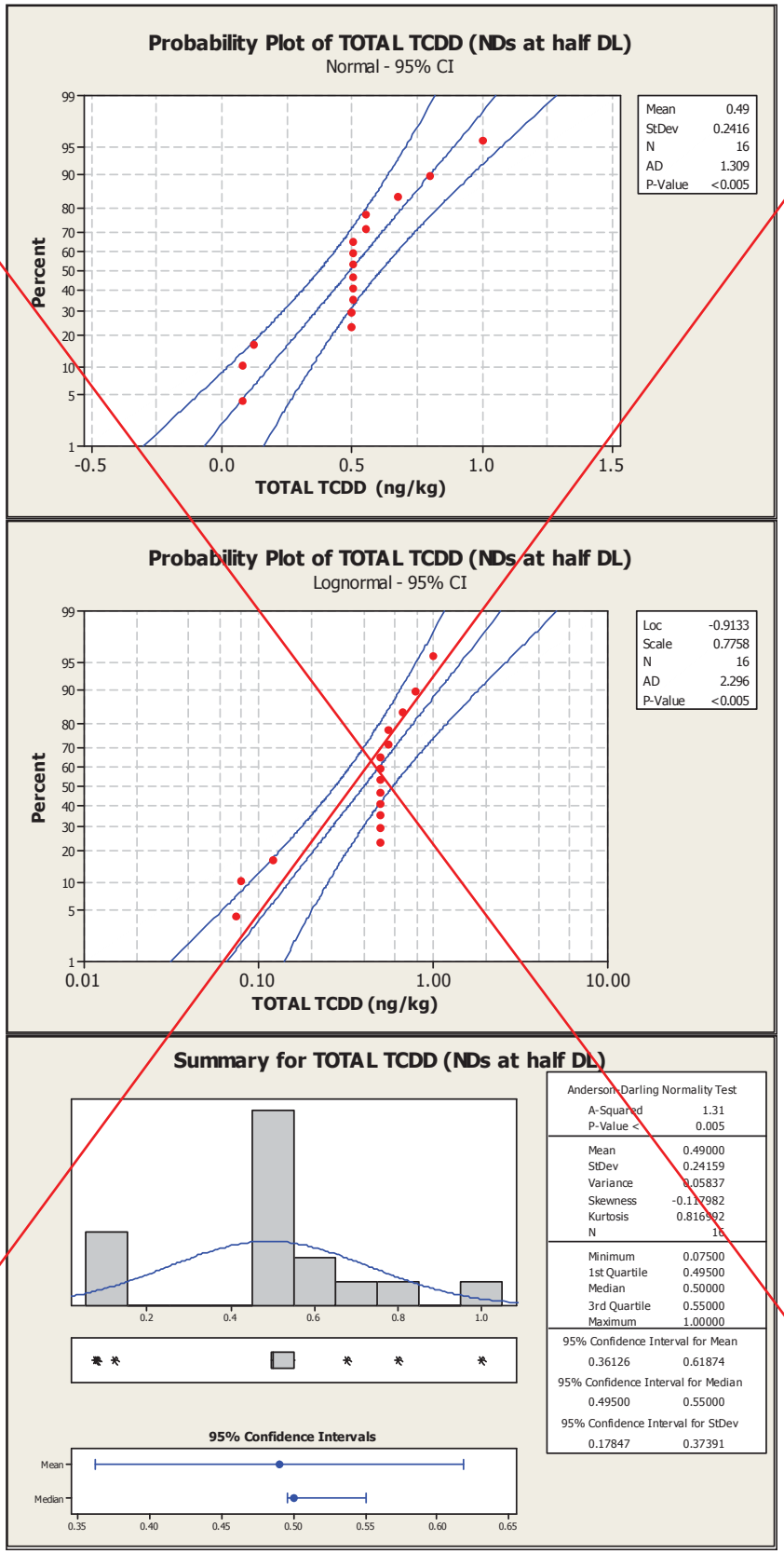

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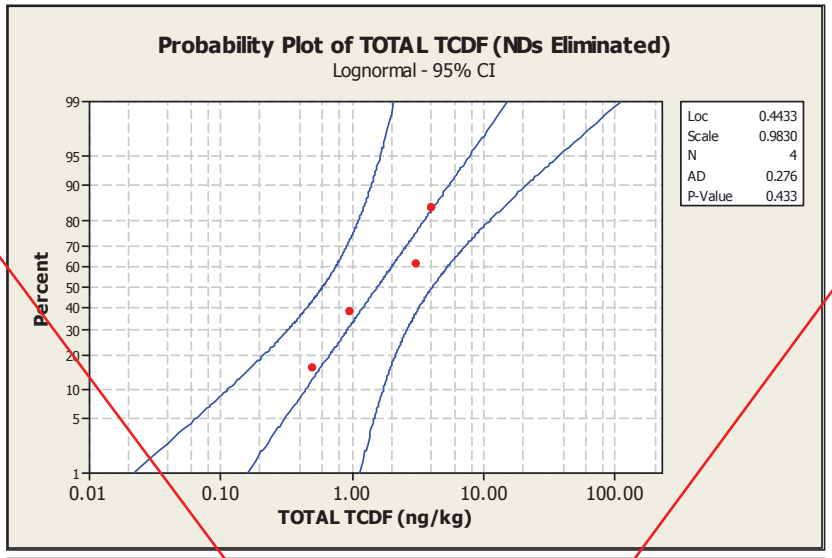

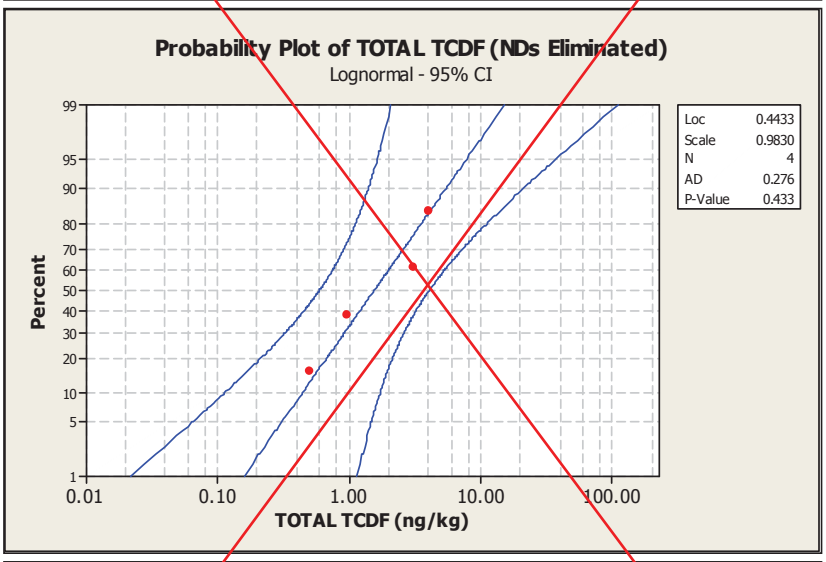

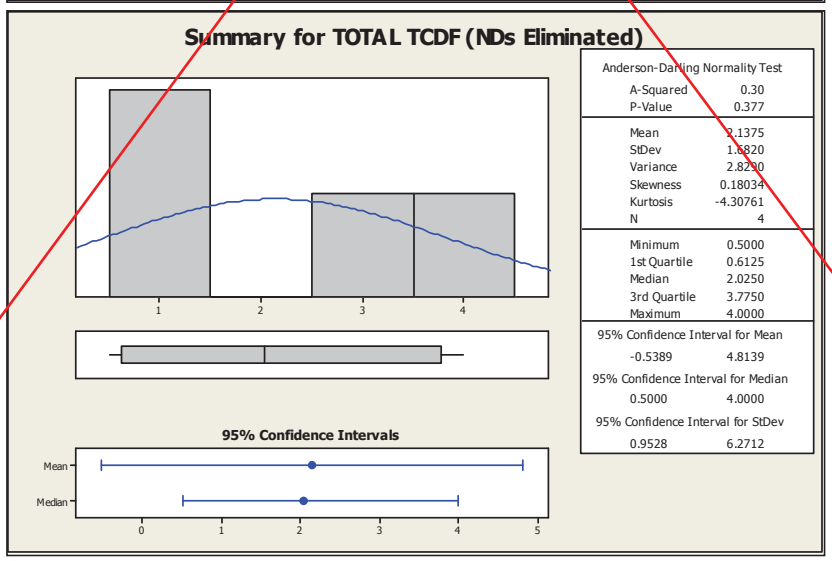

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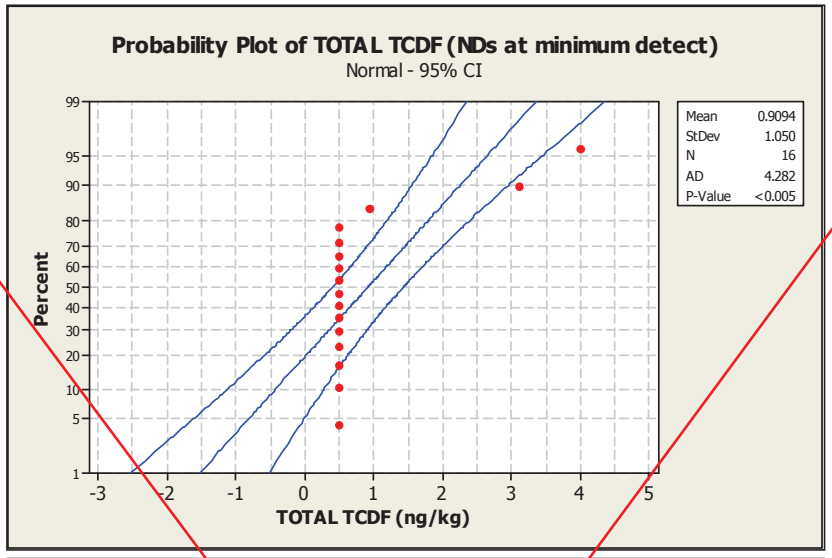

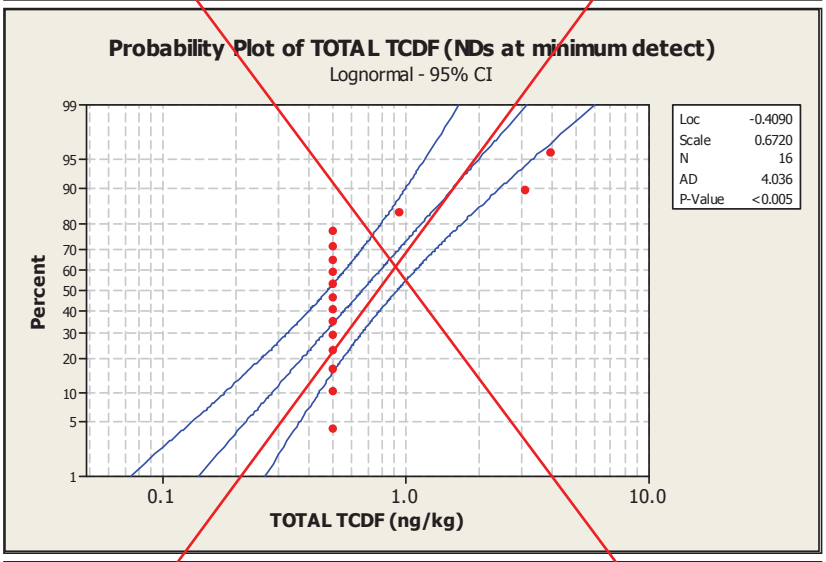

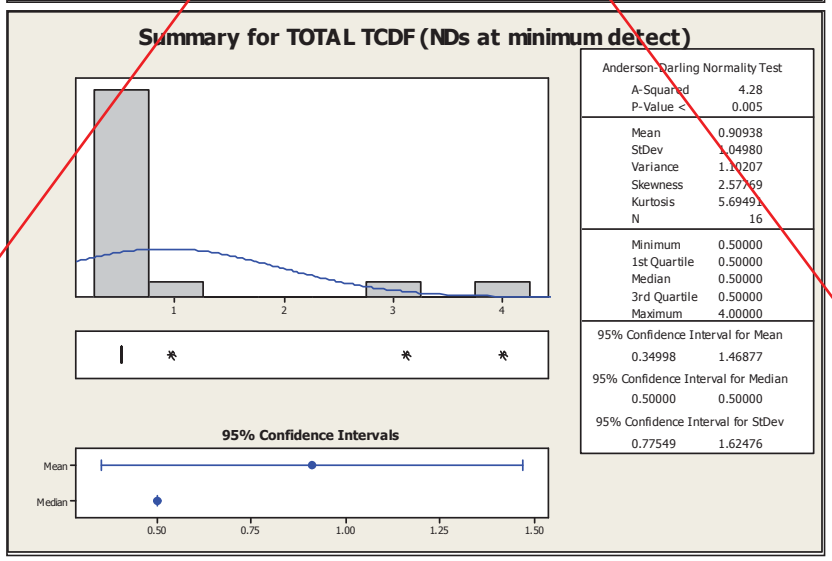

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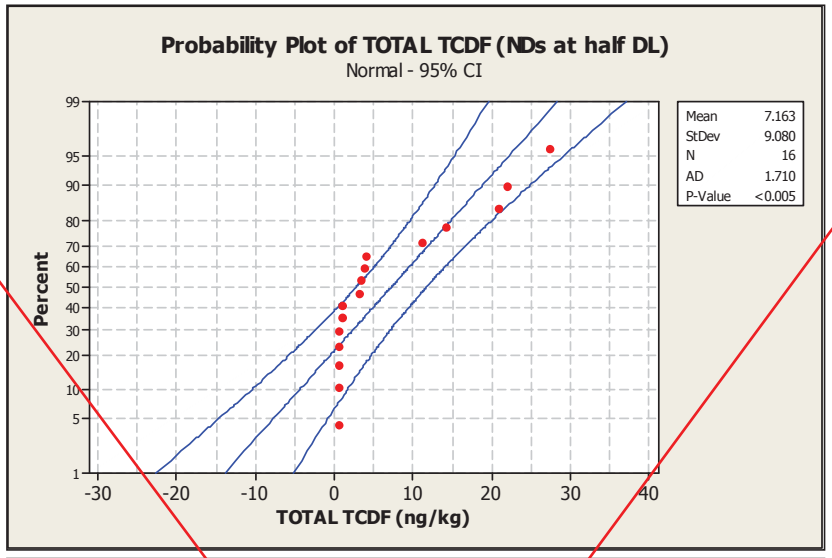

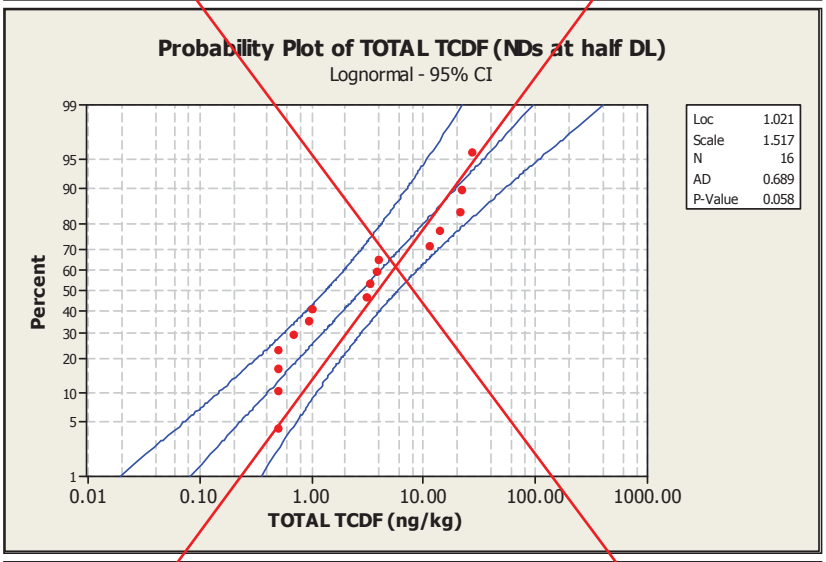

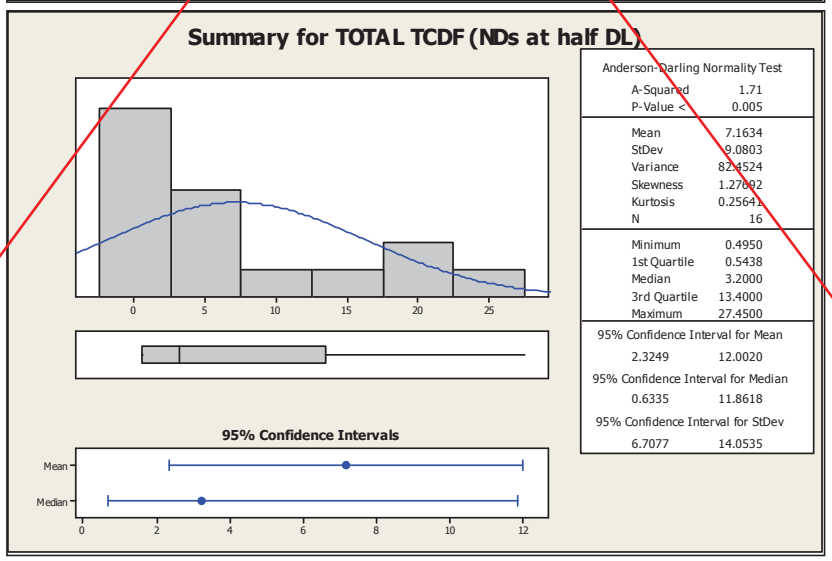

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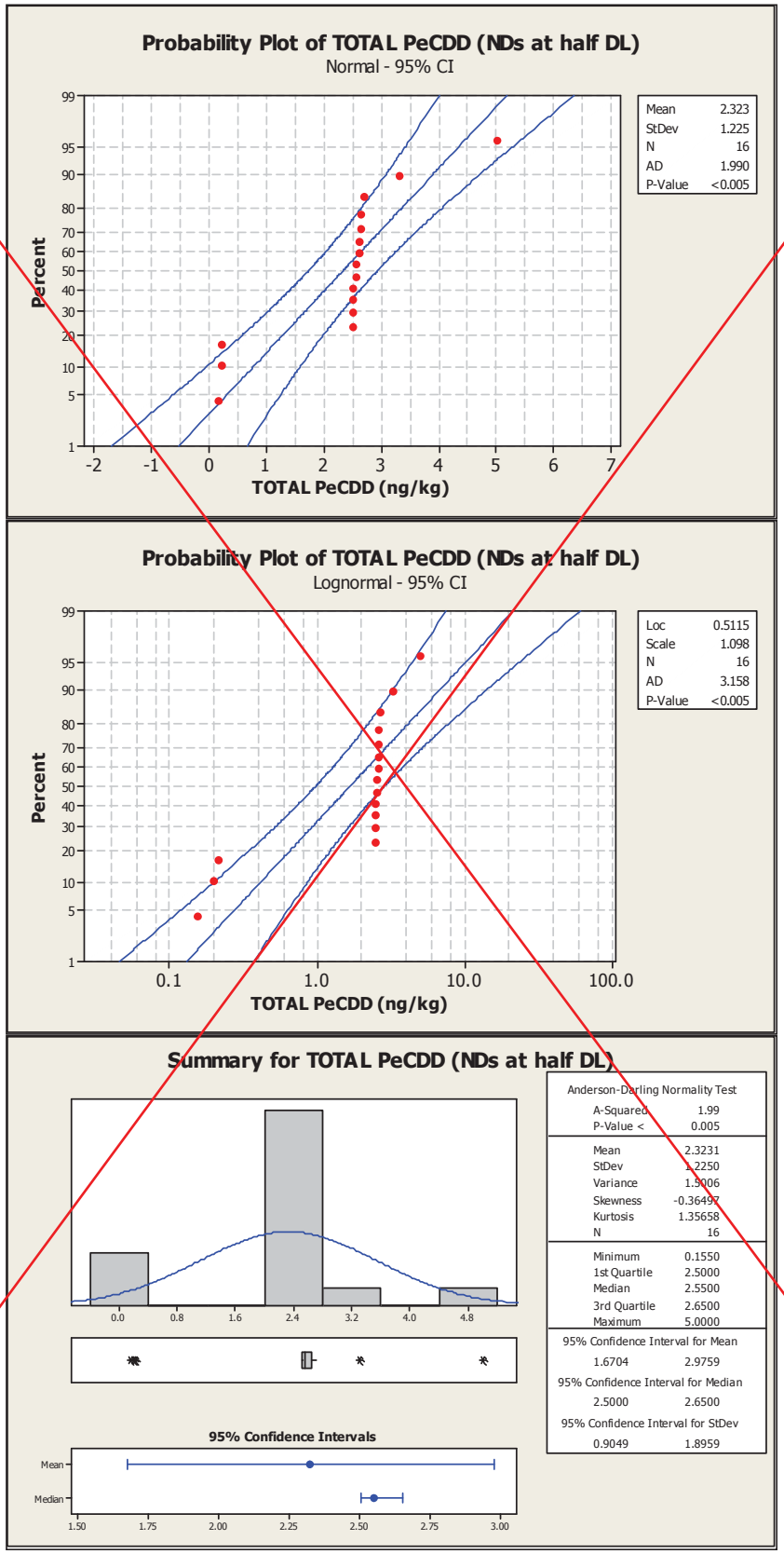

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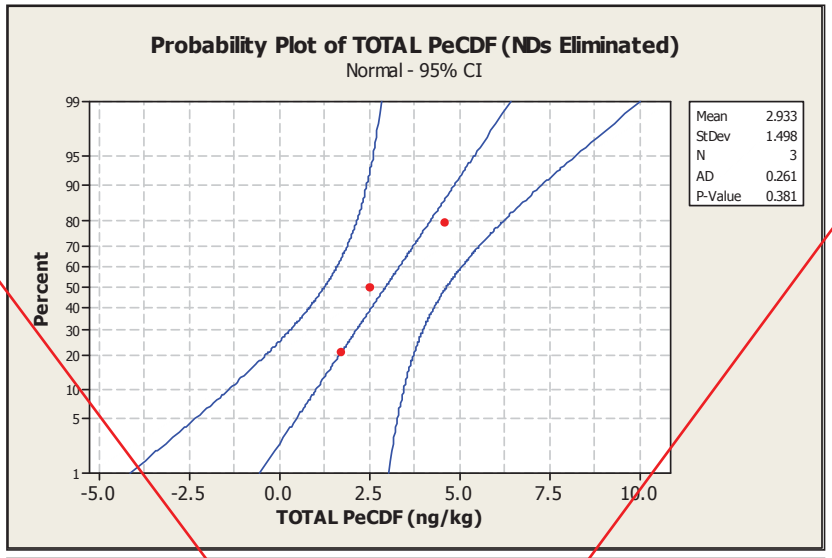

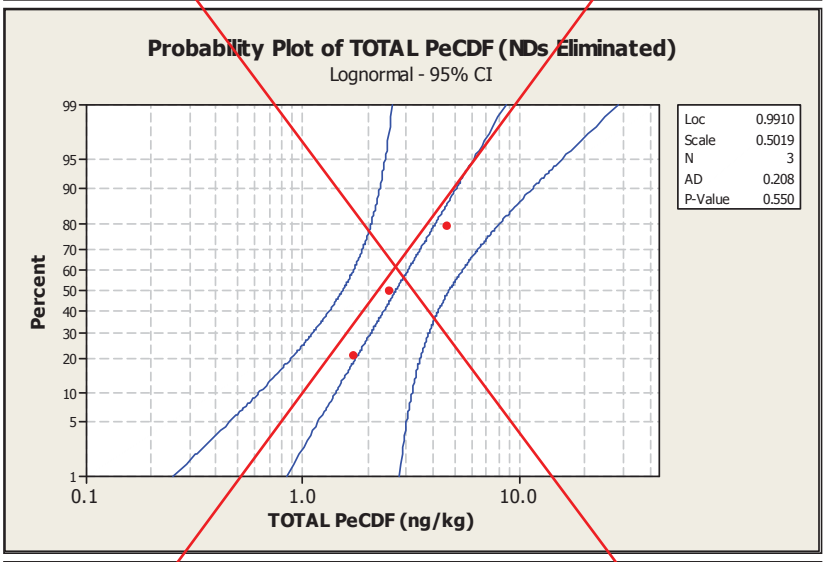

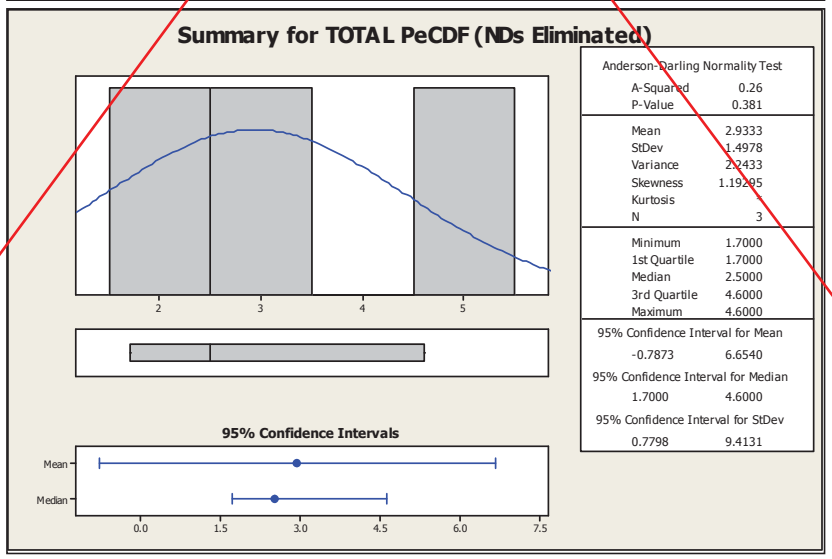

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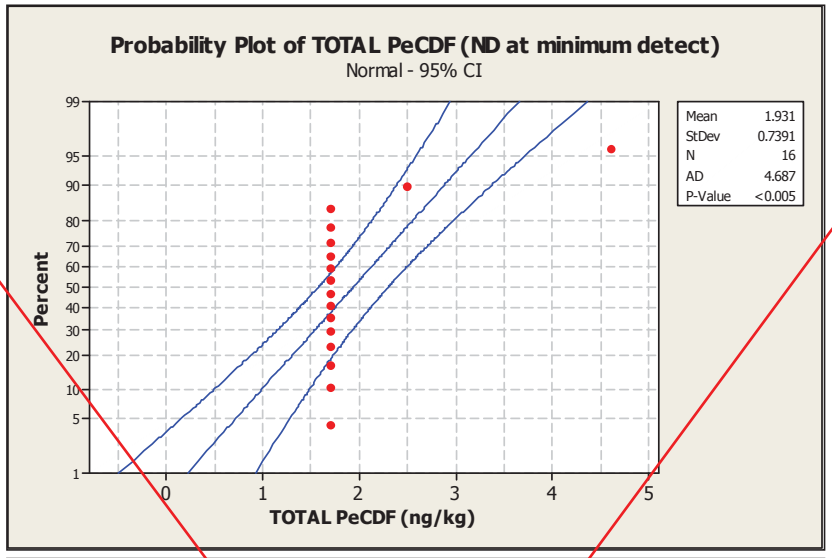

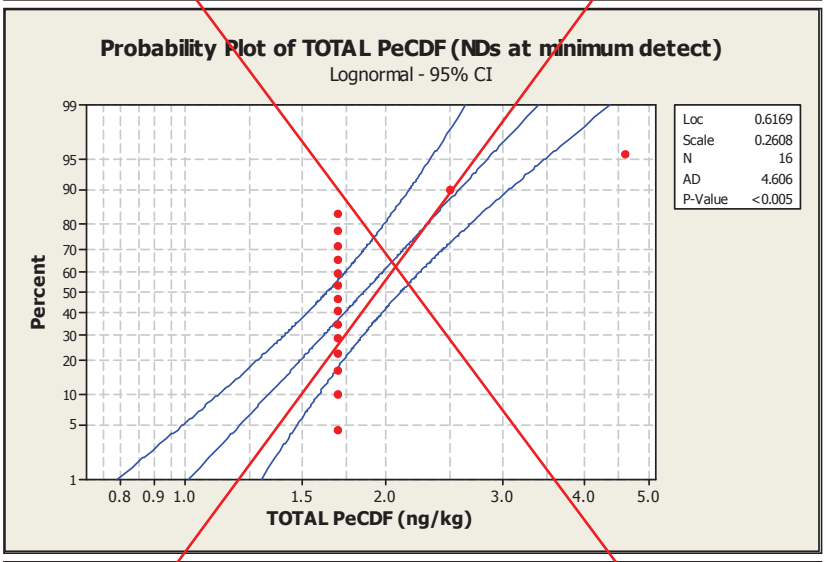

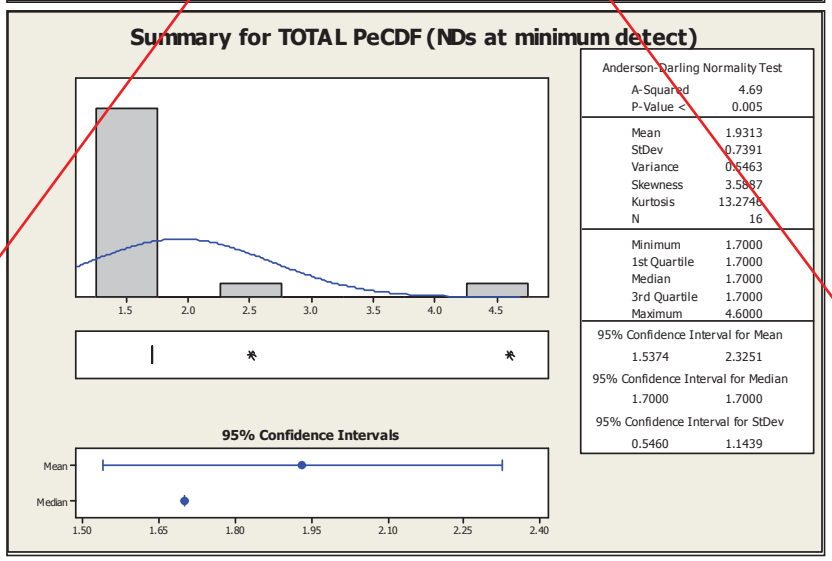

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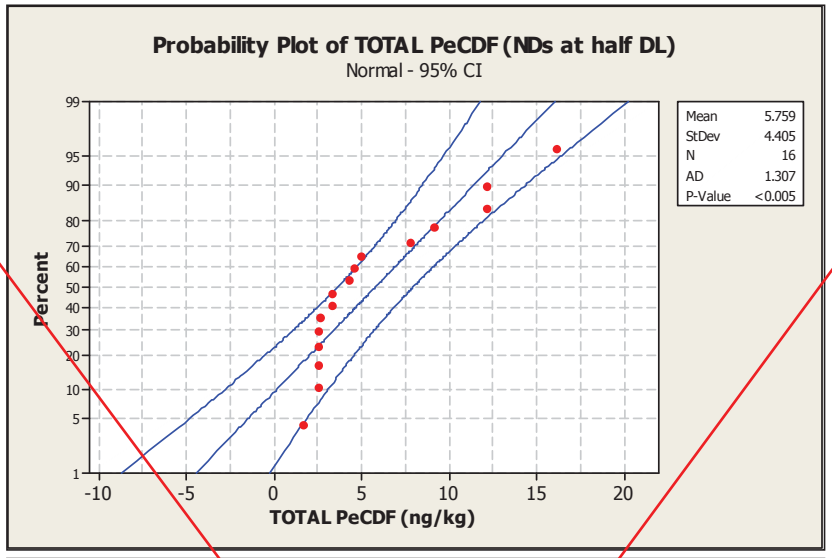

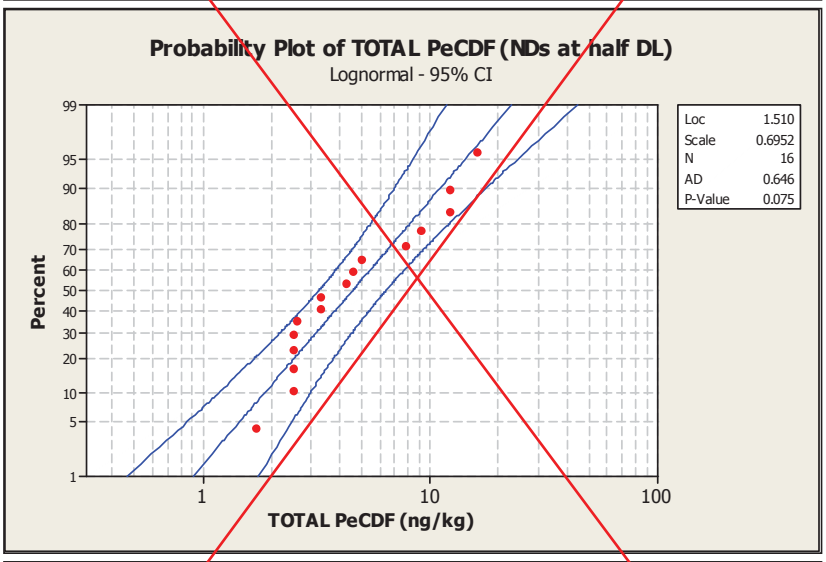

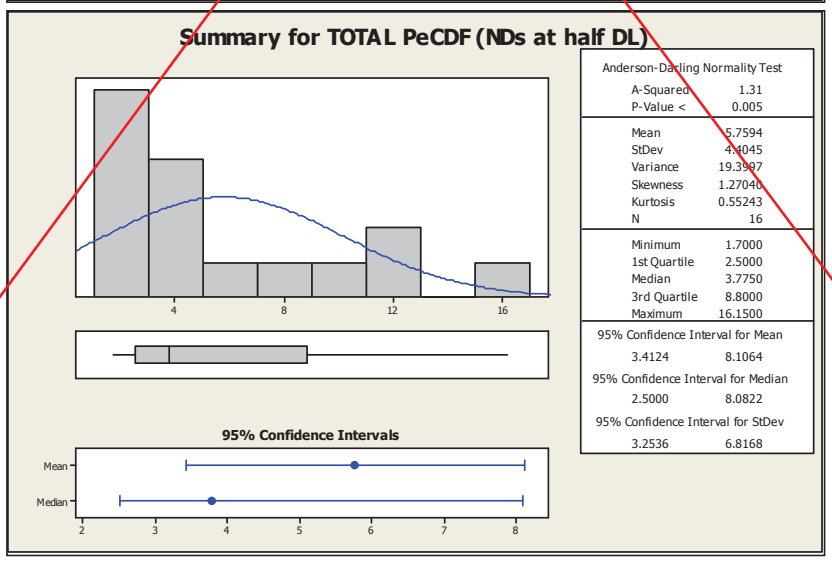

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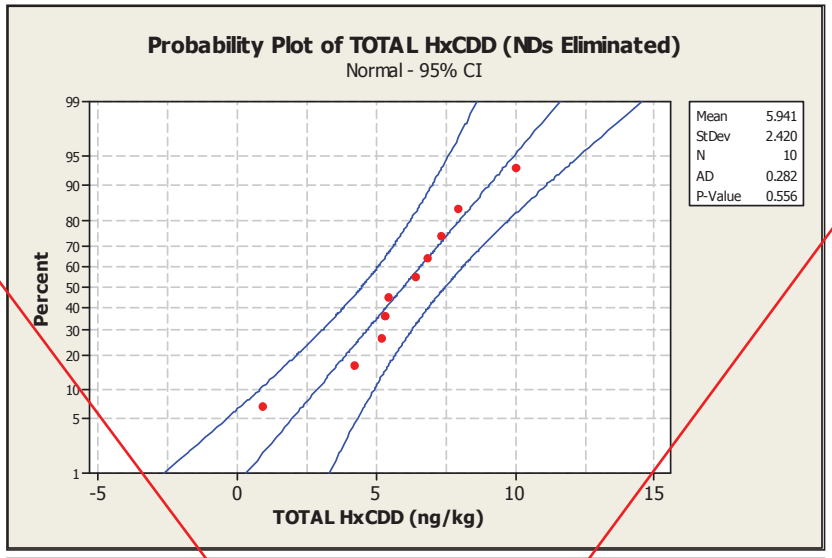

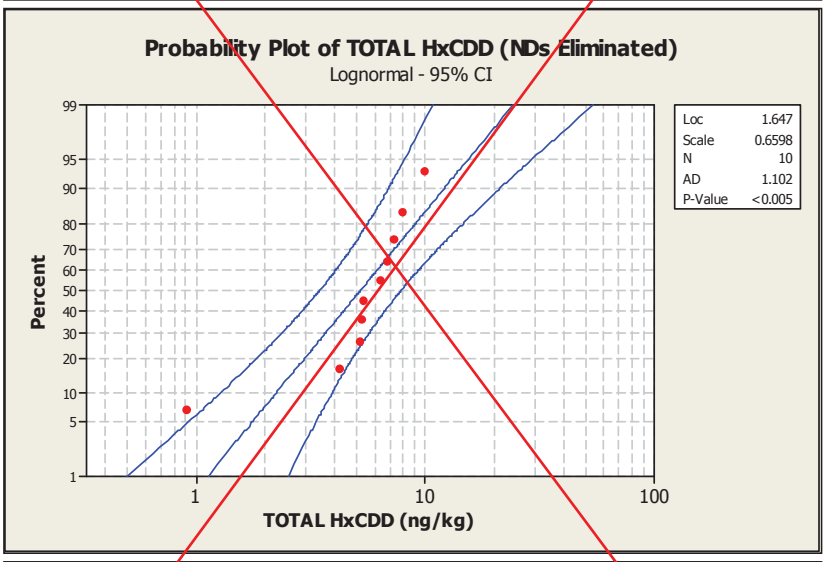

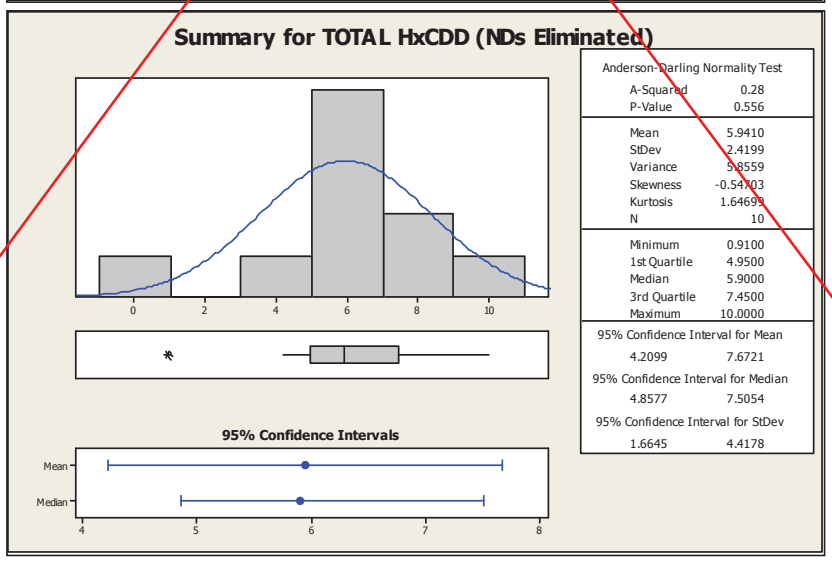

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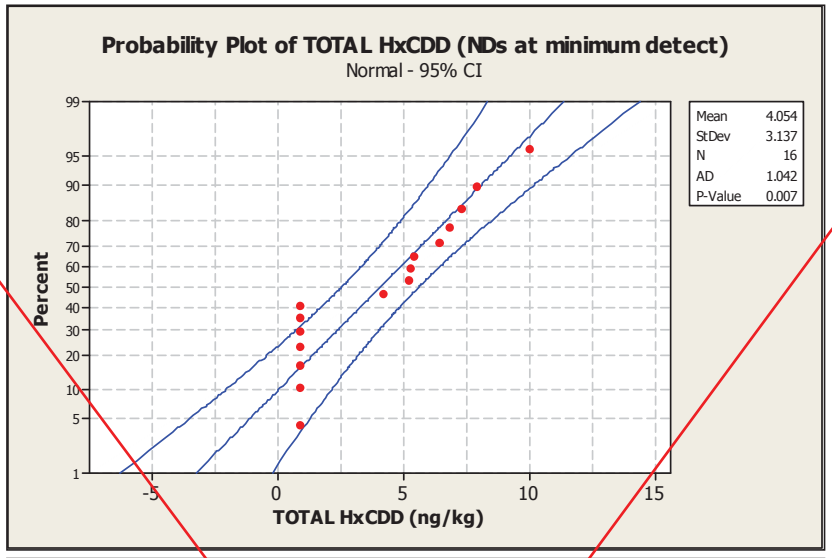

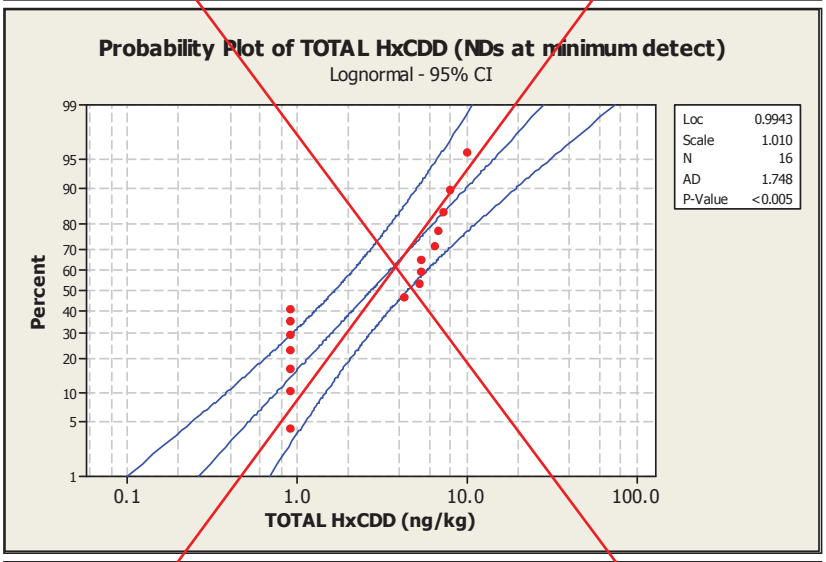

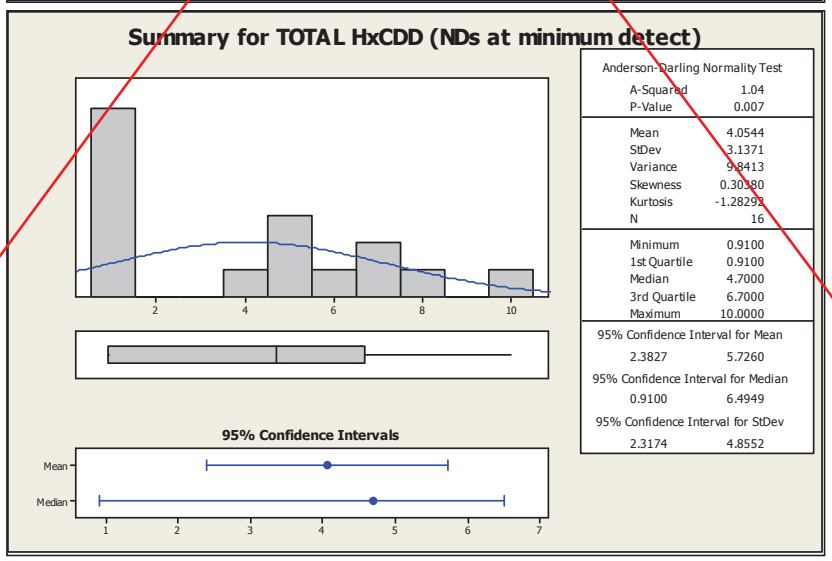

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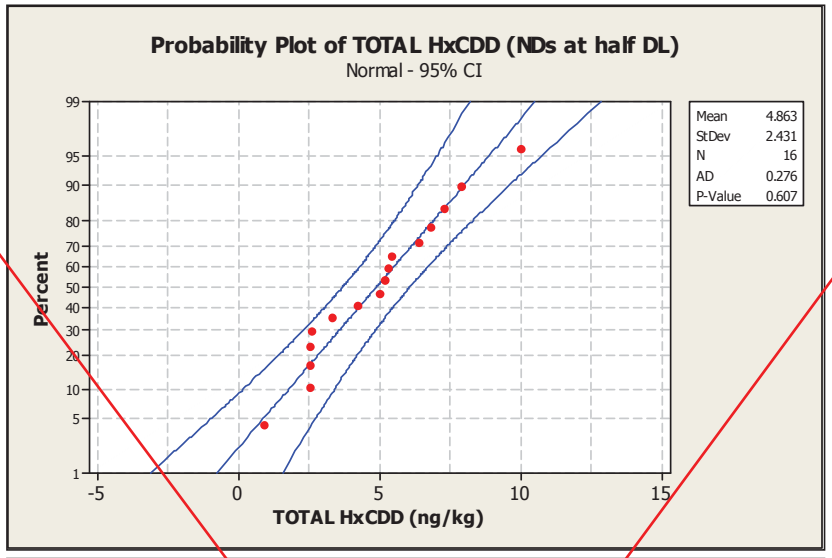

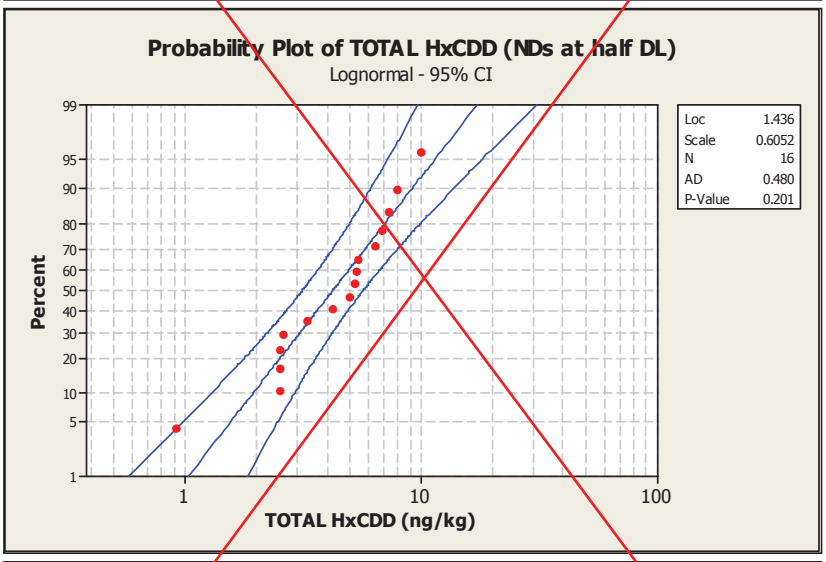

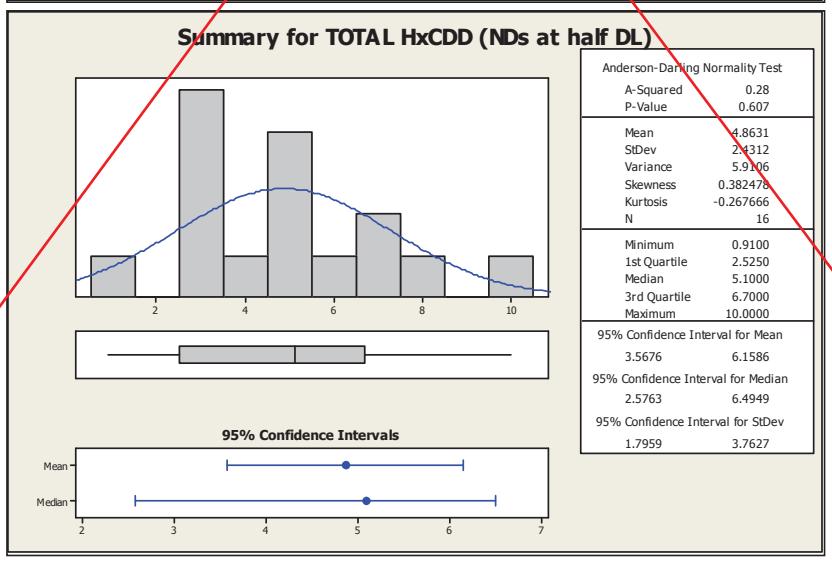

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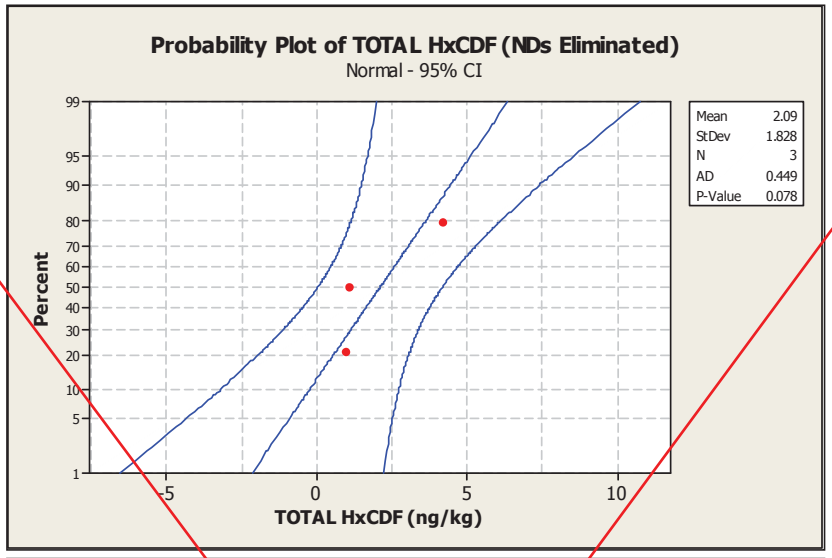

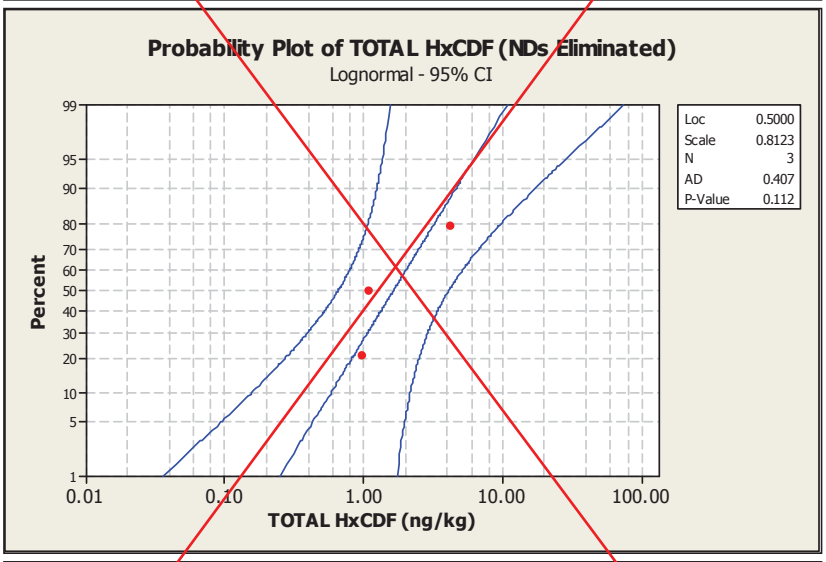

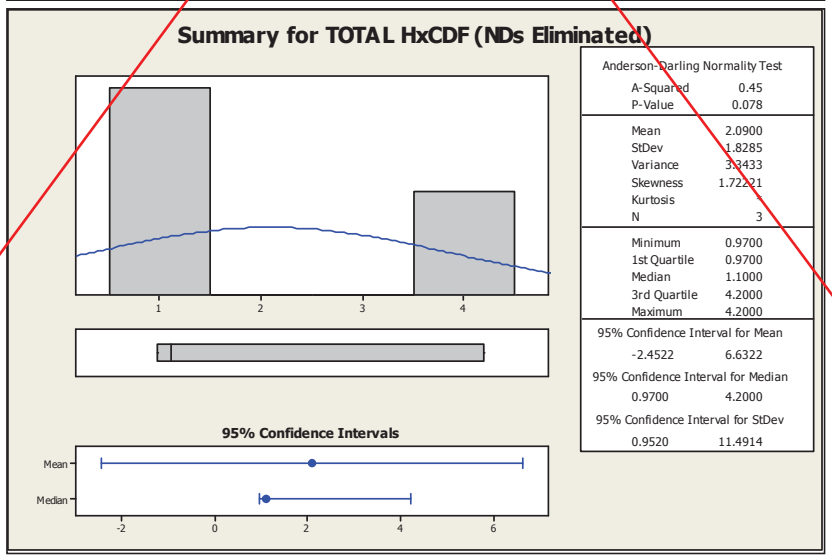

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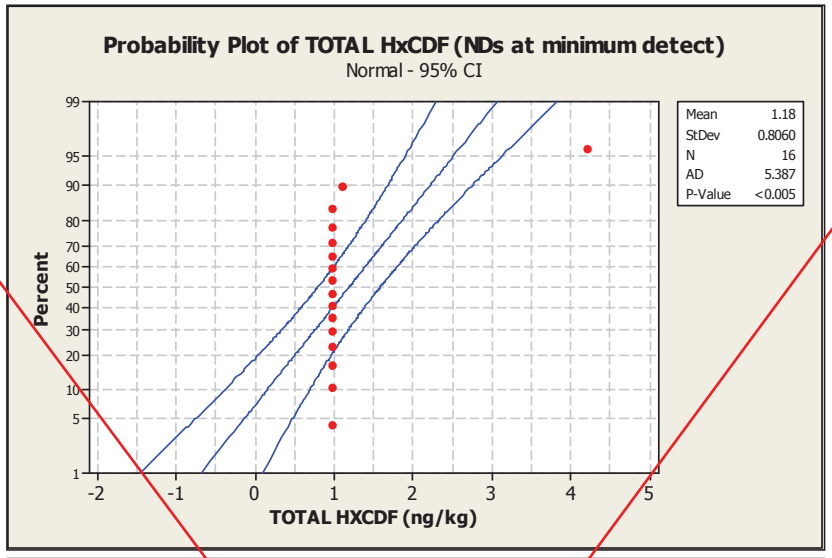

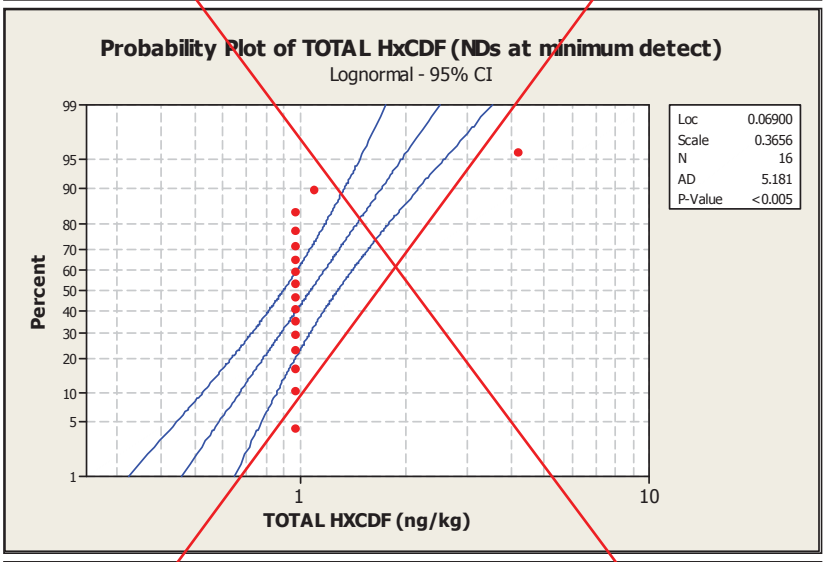

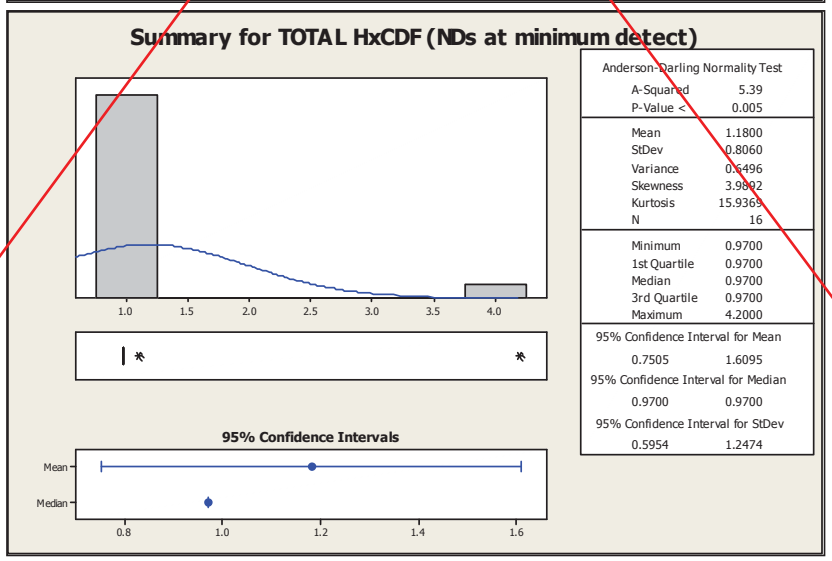

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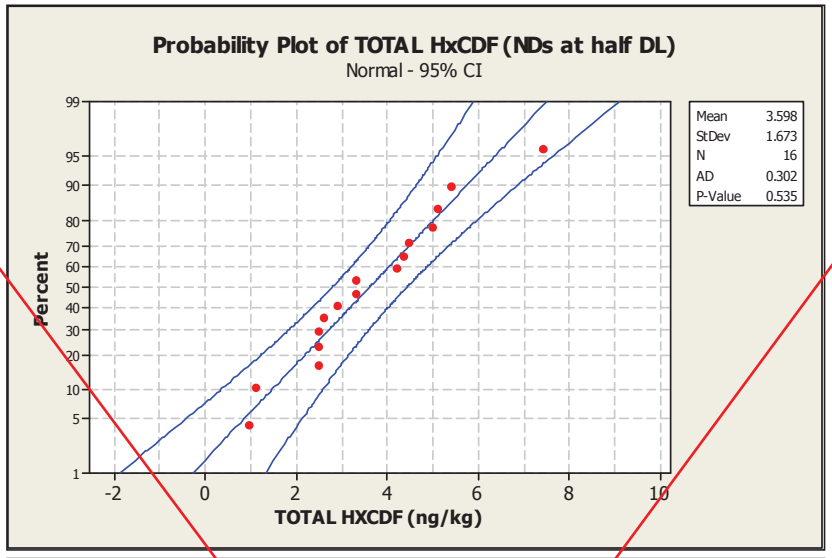

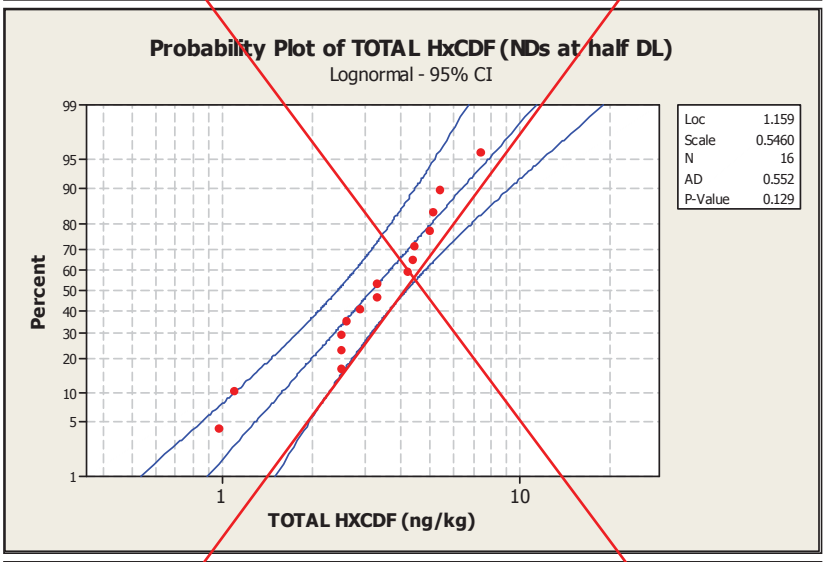

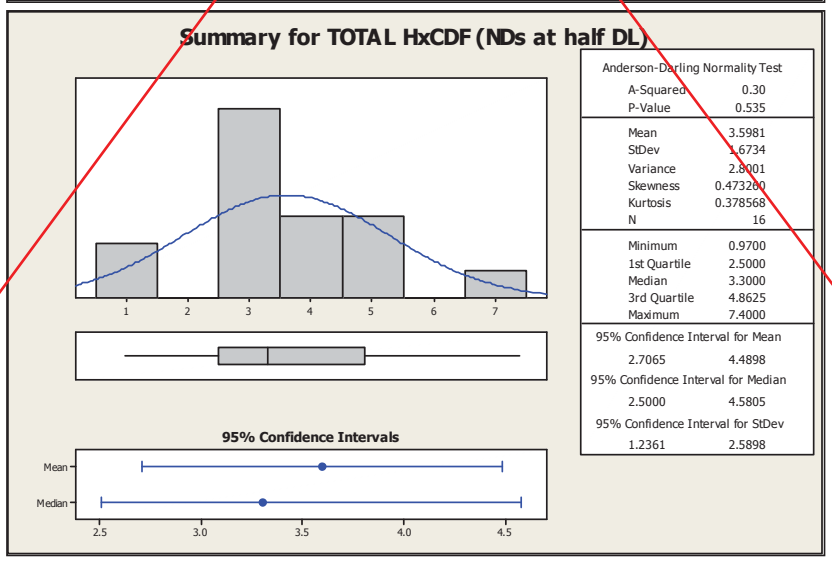

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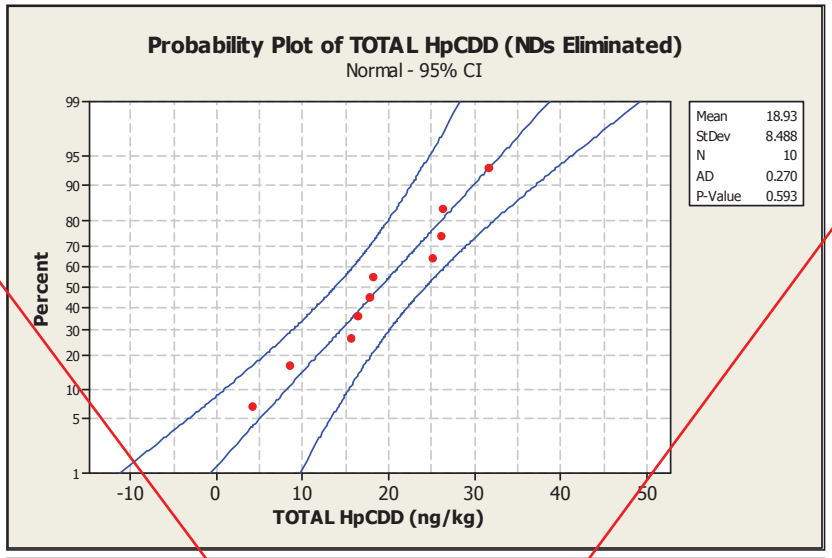

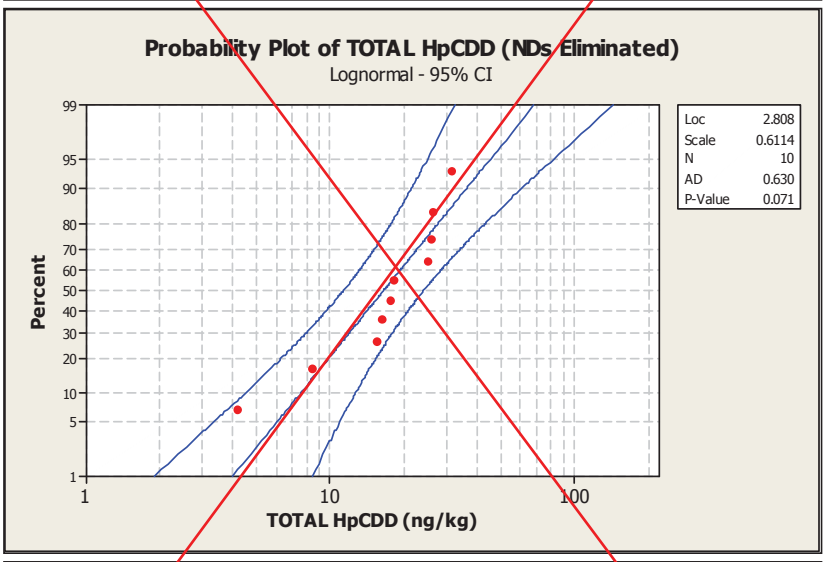

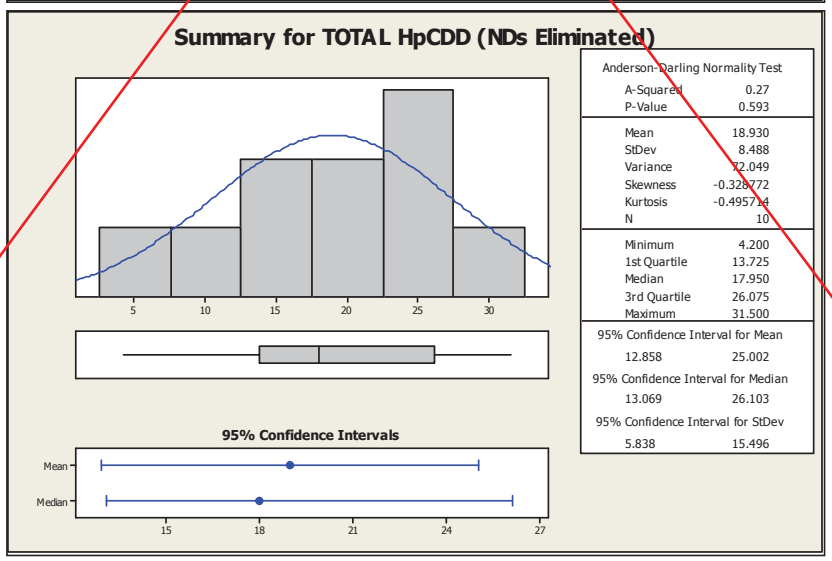

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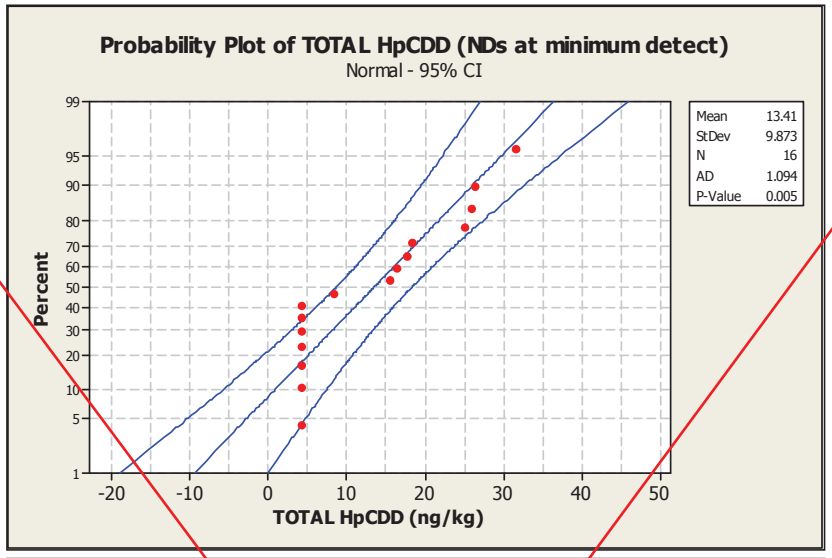

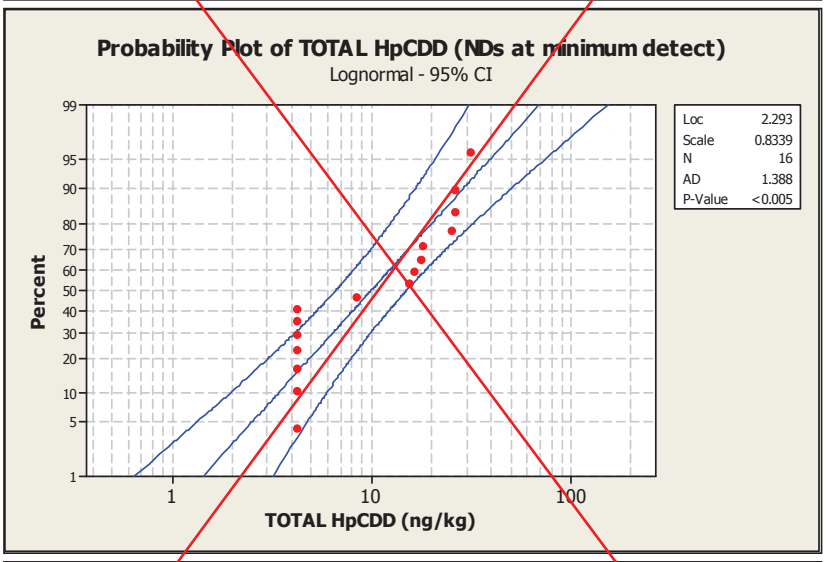

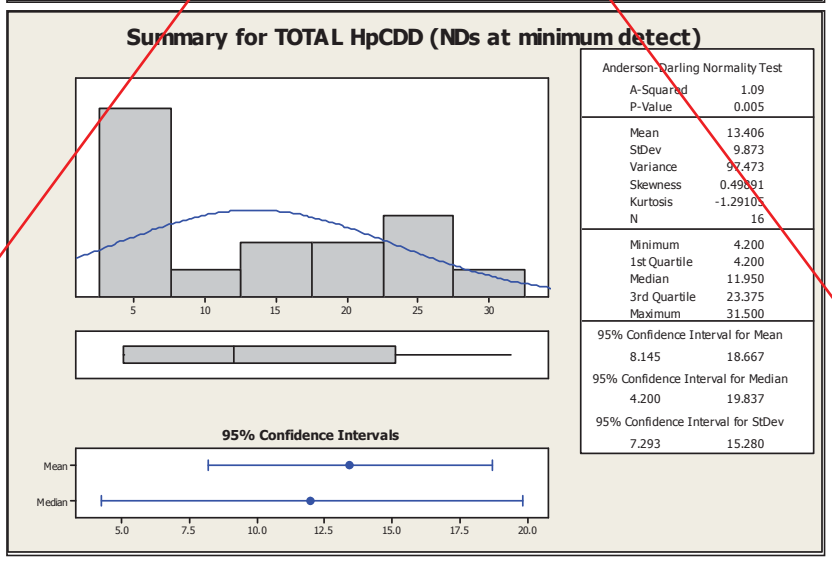

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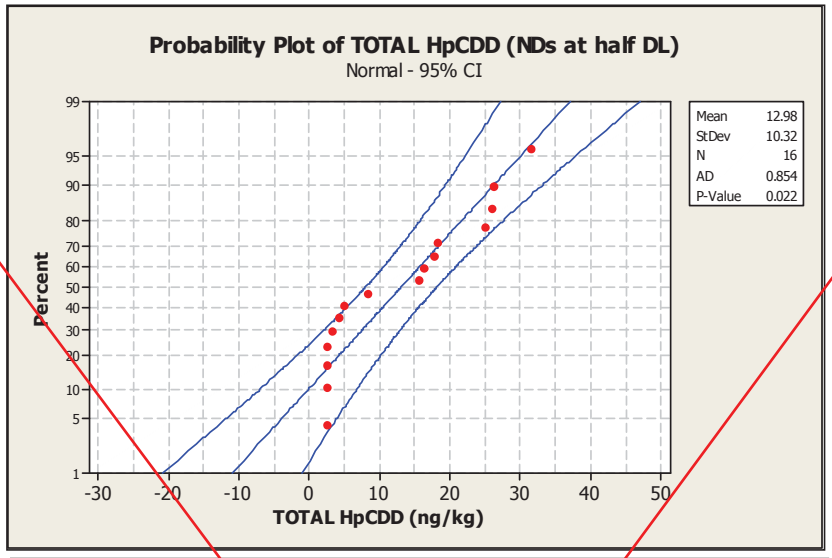

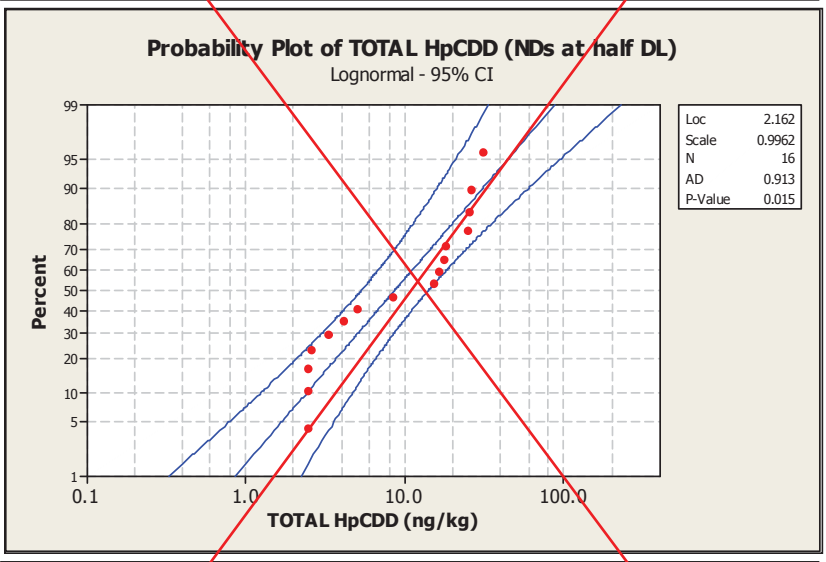

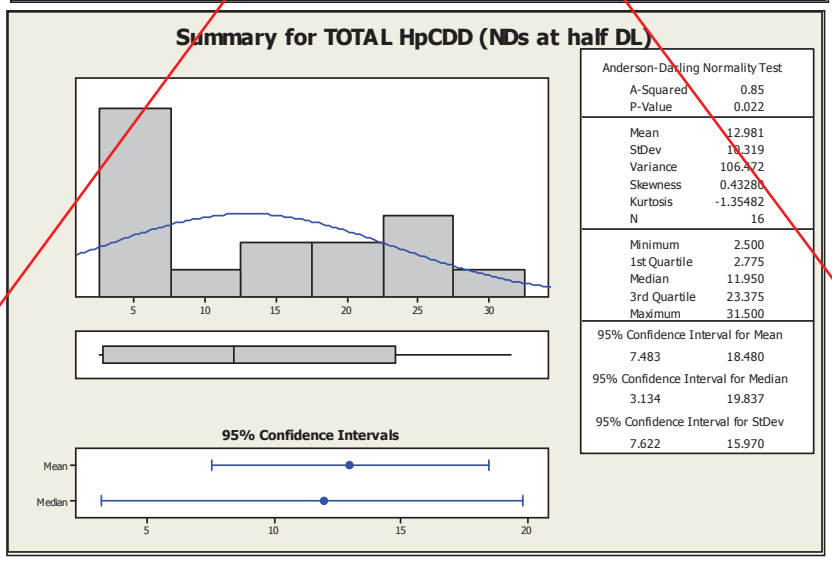

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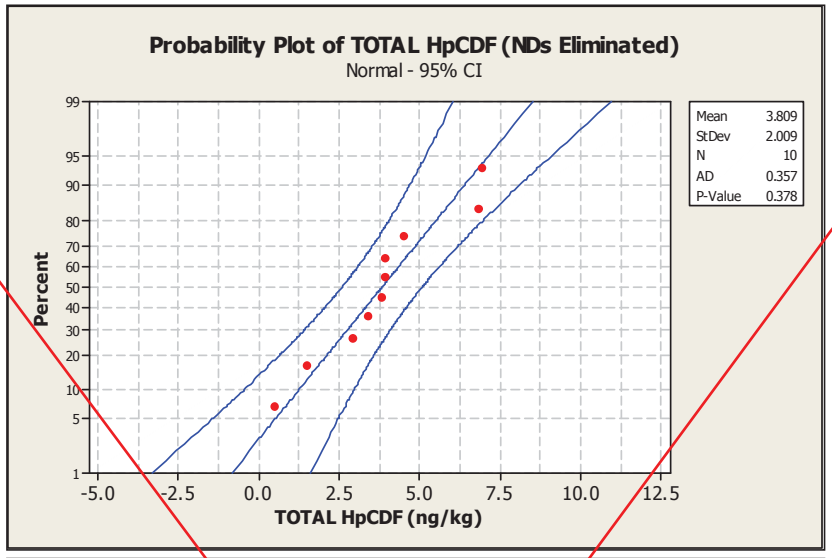

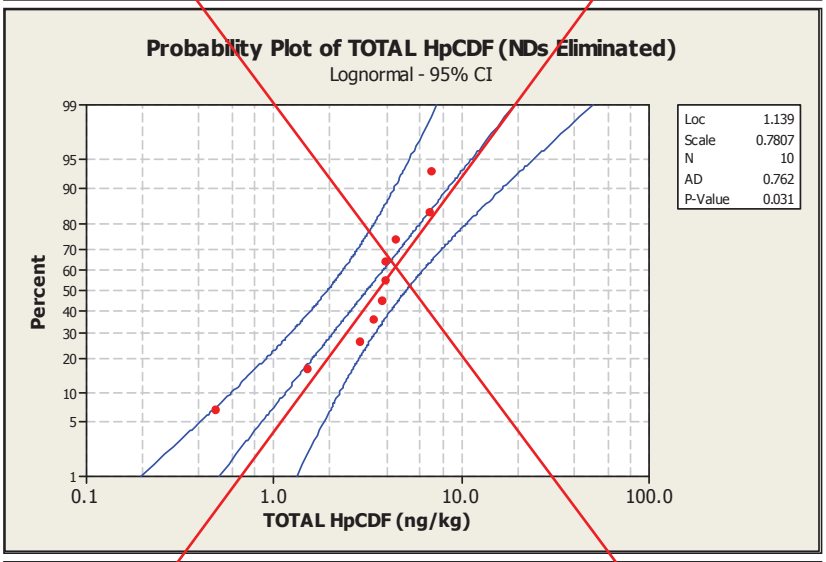

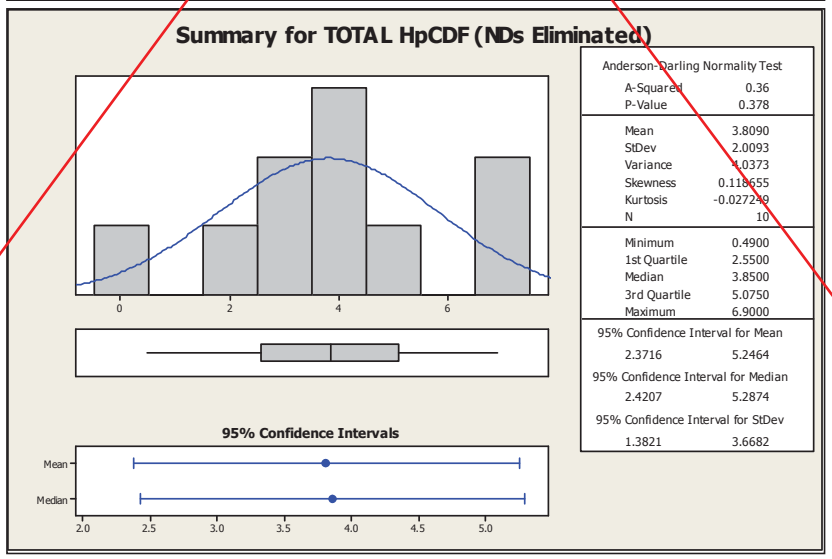

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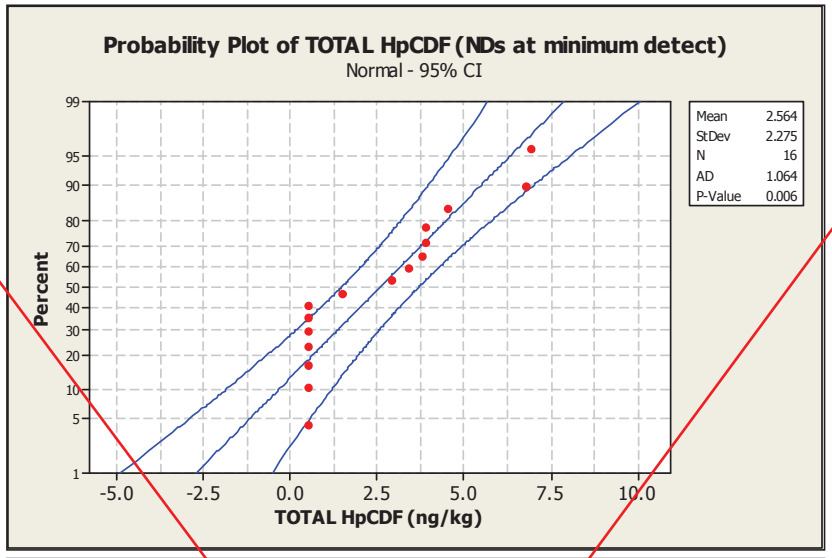

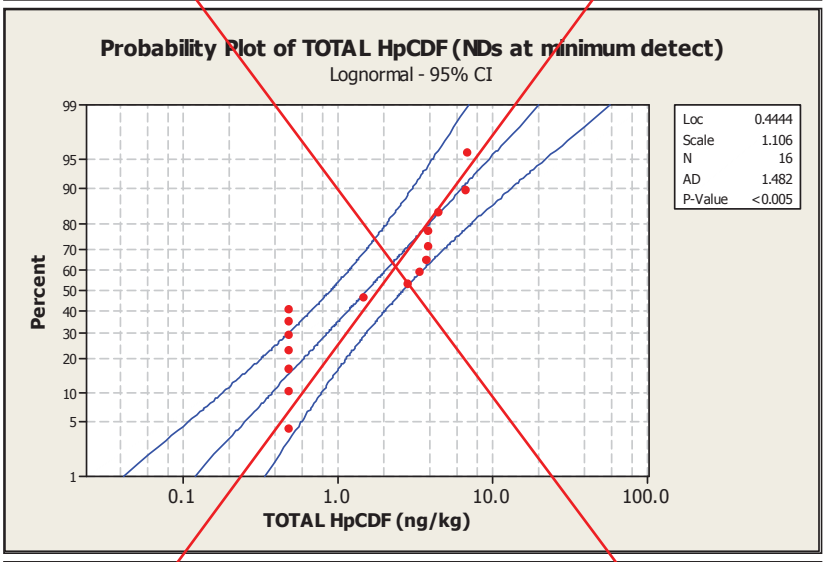

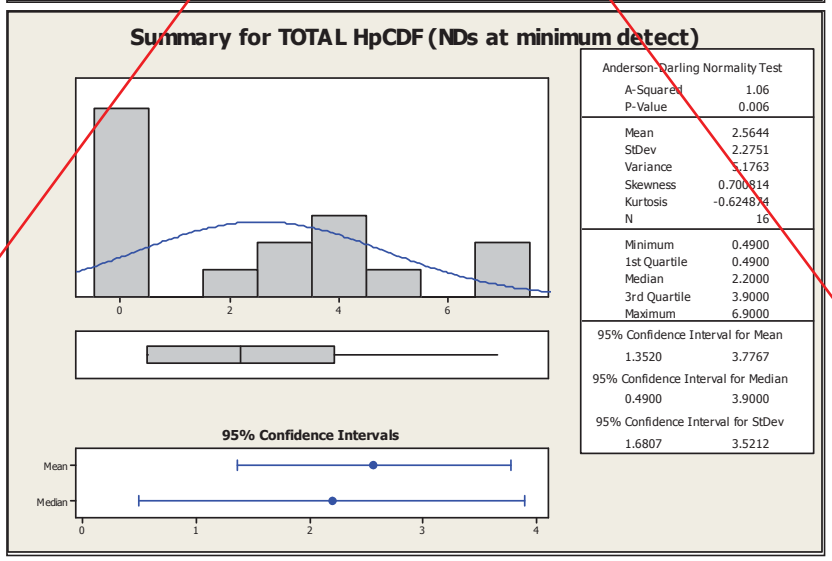

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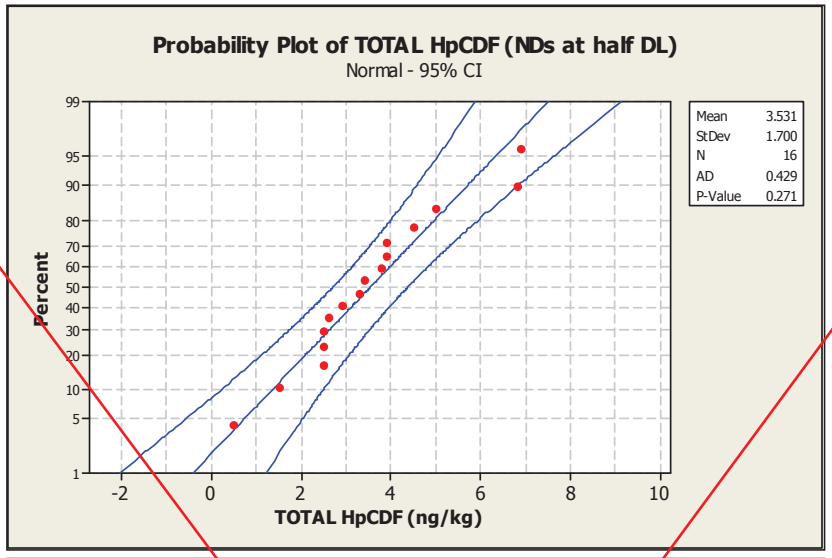

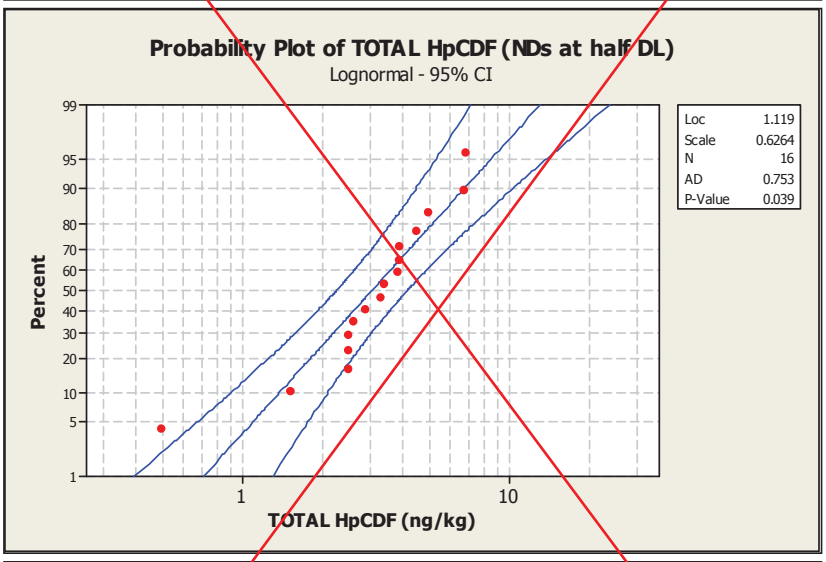

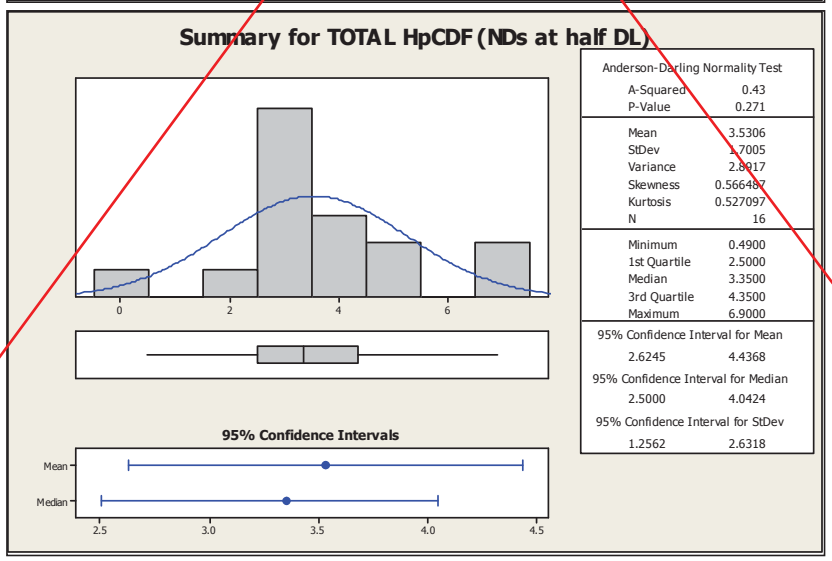

APPENDIX E

GROUNDWATER COMPARISON DATA SET REPORT

GROUNDWATER COMPARISON DATA SET AND COMPARISON CONCENTRATIONS REPORT SANTA SUSANA FIELD LABORATORY VENTURA COUNTY, CALIFORNIA

FINAL

Prepared for:

THE BOEING COMPANY

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

U.S. DEPARTMENT OF ENERGY

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A Groundwater Comparison Concentrations Data Tables and Probability Plots

LIST OF ACRONYMS

Boeing	The Boeing Company
Cal-EPA	California Environmental Protection Agency
COPC	chemical of potential concern
CPEC	chemical of potential ecological concern
DOE	Department of Energy
DTSC	Department of Toxic Substances Control
GSU	Geological Services Unit
GRS	Groundwater Resources Consultants
H&A	Haley & Aldrich
MCL	maximum contaminant level
MWH	MWH Americas, Inc.
NASA	National Aeronautics and Space Administration
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
SRAM	Standardized Risk Assessment Methodology
SSFL	Santa Susana Field Laboratory
VOC	volatile organic compound

SECTION 1

INTRODUCTION

This report presents the Groundwater Comparison Data Set and the process used to define Groundwater Comparison Concentrations for metals, fluoride, and sulfate at the Santa Susana Field Laboratory (SSFL) in Ventura County, California. This report has been prepared by MWH Americas, Inc. (MWH) for The Boeing Company (Boeing), the National Aeronautics and Space Administration (NASA), and the United States Department of Energy (DOE) to support the Resource Conservation and Recovery Act (RCRA) Corrective Action Program at the SSFL. The Groundwater Comparison Data Set and associated Groundwater Comparison Concentrations have been developed for the SSFL under the direction of the California Environmental Protection Agency (Cal-EPA) Department of Toxic Substances Control (DTSC), Geological Services Unit (GSU) Branch.

The Groundwater Comparison Data Set and Comparison Concentrations presented in this report will be used to assist in site characterization and risk assessments for the ongoing RCRA Corrective Action Program at the SSFL. For characterization purposes, the Groundwater Comparison Concentrations will be used as one factor in evaluating whether groundwater quality may have been impacted and if further characterization is needed. In both the human and ecological risk assessments, the Groundwater Comparison Data Set and Comparison Concentrations will be used in the selection of chemicals of potential concern (COPCs) or chemicals of potential ecological concern (CPECs).

This report is organized as follows:

- Section 1 introduces the Groundwater Comparison Data Set and associated Groundwater Comparison Concentrations for the SSFL;

- Section 2 describes the initial groundwater data set, and the process used to review the data and develop the final Groundwater Comparison Data Set and Comparison Concentrations;

- Section 3 provides the final Groundwater Comparison Data Set and Comparison Concentrations;

- Section 4 describes how the Groundwater Comparison Data Set and Comparison Concentrations will be used in characterization and risk assessment;

- Section 5 lists references cited in this document; and,

- Appendix A presents data tables and plots of the groundwater data set used to develop the Groundwater Comparison Concentrations, and the final Groundwater Comparison Data Set.

SECTION 2

DEVELOPMENT PROCESS

The purpose of the SSFL groundwater investigation is to determine the nature and extent of contamination. The program has focused principally on characterizing volatile organic compound (VOC) impacts related to the historical use of solvents at the SSFL. An extensive amount of work has gone into collecting data to assist in understanding and predicting the movement of contaminants in a fractured bedrock aquifer. However, other chemicals have been evaluated in the groundwater program, including metals and selected inorganic compounds. The data collected to describe the presence of metals and other inorganic compounds in groundwater has been concentrated on areas where VOC delineation was needed, although limited groundwater metals analysis has been performed on perimeter monitoring well samples. To date, a total of 390 monitoring locations have been sampled and analyzed for metals resulting in a total of approximately 18,000 analyses.

The groundwater metals data set has concentration variability, which is inherent in these naturally occurring chemicals. Complex site hydrogeology (including stratigraphic and structural variability) and evolving analytical methods over time has resulted in a data set in which the metals and inorganic concentrations in the groundwater monitoring data can vary with location and with time. In addition, due to the potential presence of metal contamination at some RFI sites there was uncertainty that the metals/inorganics data set may not represent the range of naturally occurring concentrations of these constituents (i.e. background). To address potential biases in the data set, DTSC, MWH, and Boeing evaluated the data using the procedures outlined in Section 2.2. The resulting metals data set selected for Groundwater Comparison Data Set and Comparison Concentrations represent a range of metal concentrations expected to occur naturally at the site and that are at or below the maximum background concentration.

Decisions regarding groundwater quality will be made in both the characterization and risk assessment phases of the RCRA Facility Investigation (RFI) and, if warranted, in subsequent phases of the RCRA Corrective Action Program at the SSFL. Because of the conditions described above, a Groundwater Comparison Data Set and associated Groundwater Comparison Concentrations were developed to assist decision-making in the RCRA Corrective Action Program. These tools will be used in both characterization and risk assessment to ensure that decisions are conservative and health-protective.

2.1 INITIAL REVIEW GROUNDWATER DATA SET

The final Groundwater Comparison Data Set and Comparison Concentrations were developed by evaluating SSFL groundwater data for dissolved metals and selected inorganic compounds. SSFL groundwater data include results from approximately 18,000 samples, collected from over 390 wells and piezometers. These data have been collected since the early 1980s and continued data collection is ongoing as part of the SSFL groundwater monitoring program (Haley & Aldrich [H&A], 2005). These data have been collected according to regulatory agency approved sampling and analysis work plans (Groundwater Resources Consultants [GRC], 1995a and 1995b).

For purposes of establishing the final Groundwater Comparison Data Set and Comparison Concentrations, groundwater sampling results for dissolved metals, fluoride, and sulfate collected through the 4th Quarter 2004 were compiled as an "Initial Review" groundwater data set and evaluated following procedures outlined in the following sections. Following protocols in the agency-approved work plans cited above, groundwater samples for metals analysis are filtered to yield dissolved metals concentrations in groundwater. Total (unfiltered) metals concentrations were not considered because these analyses are not representative of groundwater transport conditions and, further, have been measured in only a few wells onsite.

Appendix A presents the initial comprehensive data set evaluated to establish Groundwater Comparison Concentrations for the SSFL. Information for the 25 metals, fluoride, and sulfate included in this data set is summarized in Table 2-1.

2.2 DATA EVALUATION AND REVIEW PROCESS

The Groundwater Comparison Data Set and Comparison Concentrations for the SSFL were developed using a two-component process to evaluate the data set described above. One component was a review of the entire data set for each constituent using a statistical approach. The other component was a more detailed hydrogeologic analysis of populations within the data set to establish a comparison concentration. Each of these components is described further in the following sections. DTSC, MWH and Boeing worked together in the data review and discussions were held at all stages of this process. The findings were reviewed at a series of working meetings during May, June and August 2005.

2.2.1 Data Distribution Review

The first component in the process of establishing the Groundwater Comparison Data Set and Comparison Concentrations was to develop an understanding of the data distribution for each metal. This was accomplished using several tabular and graphical methods. Tables of groundwater data for each constituent were prepared, including sample date, well number, result (concentration or analytical detection level) and laboratory qualifier. These tables are useful for viewing overall trends within the data set based on sampling date, detected versus non detected concentrations, and prevalence of metals in wells. Data tables for all constituents are included in Appendix A.

DTSC and MWH separately evaluated the groundwater data. Graphical methods included preparation of rank-order probability plots for each of the metals and selected inorganic constituents (Appendix A). The rank-order probability plots allow viewing the

entire data set, provides information on data distribution, and aids in identifying different data populations.

The MWH evaluation began with the highest inflection point (a break between data populations) for each metal and the data above that point were removed from the evaluation. The population below this inflection point in the data set, i.e., the resultant data set and associated maximum concentration value, was used as a starting point for the more detailed reviews discussed below. The DTSC evaluation included a review of inflection points in the lower range of concentrations simultaneously with the detailed data review. Both evaluations were considered in the selection of the final groundwater comparison concentration data sets.

2.2.2 Detailed Data and Hydrogeologic Review

The second component in the process of developing the Groundwater Comparison Data Set and Comparison Concentrations involved a more detailed evaluation. The data set was further evaluated using time-series plots, surrounding well data, and soil data to assess whether measured concentrations in well samples represented potential impacts from site operations or represented unimpacted groundwater quality at a given location. Data quality was also considered since analytical methods have improved during the time period over which data was collected.

In this detailed review phase, selected hydrogeologic information was considered to aid in the interpretation of the groundwater data. For example, potential contaminant migration pathways were considered by evaluating groundwater flow directions and comparing results between both up-gradient and down-gradient wells. Depths to groundwater, and the relative completion details of adjacent wells and their concentrations of metals and selected inorganic compounds, were also used to assess if a selected value should be included in the final Groundwater Comparison Concentration Data Set. This review considered both discrete sampling results and entire data sets from specific wells. Sampling dates were considered because of the improvement of analytical

methods over time. Data patterns, especially trends and single anomalous results, were considered in the evaluation. Finally, the presence of other chemical contamination (especially VOCs), and other metals or inorganic compounds was used in the evaluation.

Using best professional judgement, Boeing, MWH, and DTSC reviewers identified wells with sampling results considered potentially impacted or elevated. Based on this determination, all data from individual wells for a specific metal/inorganic were excluded from the final Groundwater Comparison Data Set. It should be noted that potentially impacted or elevated data was excluded from the data set to address uncertainty regarding the potential presence of contamination and to ensure that the Groundwater Comparison Concentration conservatively represented ambient conditions. Following definition of the final data set, the Groundwater Comparison Concentration for each constituent was identified as the highest concentration remaining in the final data set. For some metals with a high proportion of non detect data, detection limits achieved in the last few years were reviewed and selected as the Groundwater Comparison Concentrations.

2.2.3 Assumptions and Considerations

Many assumptions that have been made in evaluation of SSFL groundwater data to develop the Groundwater Comparison Data Set and associated Concentrations. Although the overall analysis represents a best professional judgement and weight-of-evidence approach by Boeing, MWH, and DTSC reviewers, the following assumptions and data considerations were made during the evaluation:

- Uppermost populations that deviate from linearity in rank-order probability plots were eliminated during the initial review.
- Up-gradient and down-gradient wells were assumed to provide information about potential sources of metals and selected inorganic compounds to groundwater at selected sites.
- The lateral and vertical distances of each groundwater monitoring well from SSFL site activities were considered. Wells far from site operations were more likely to be selected in the final comparison data set.

- Depth to groundwater in neighboring wells and their respective concentrations (e.g., higher concentrations at surface decreasing with depth) were considered. In some instances, shallow wells near potential sources were eliminated based on a comparison with neighboring deeper wells.

- Older groundwater monitoring data were considered to carry a lower weight in the evaluation than newer data. This was done because more recent samples typically have lower analytical detection limits.

- Two periods of groundwater metal analyses have been determined to provide anomalous data that cannot be used to characterize groundwater and establish the Groundwater Comparison Data Set and Comparison Concentrations. Specifically, data between the 4th Quarter 2000 through 2nd Quarter 2001, and 4th Quarter 1994 have been eliminated from inclusion in the final Groundwater Comparison Data Set for selected metals/inorganics and from further consideration during characterization and risk assessment. The cause of this anomalous data is considered to be laboratory-related, and resulted in non-repeatable, elevated concentrations (i.e., spikes) from wells across the SSFL over a short period of time. Elimination of this anomalous data resulted in lower comparison values.

- The presence or absence of other potential contaminants, especially VOCs, or metals and selected inorganic compounds in a well was considered in the interpretation of data from that well. For example, some wells were eliminated from the final Groundwater Comparison Concentration Data Set because of either metal or VOC detections in those wells.

- Potential differences in metal and selected inorganic compound concentrations related to geological variability were considered part of naturally occurring conditions at the site.

- Beryllium, mercury, silver, thallium and tin results were characterized by a high proportion of elevated non detects, primarily during early sampling efforts. Based on a historical review of detection limits for these data, Groundwater Comparison Concentrations were established using recently achievable detection limits for each of these metals.

During evaluation of the data set used to develop the Groundwater Comparison Concentrations, some additional data needs were identified. As discussed with DTSC, these additional data needs will be further evaluated during the RFI and additional sampling conducted, if warranted, based on site conditions (e.g., operational history, soil concentrations, etc.). Additional data collection will be performed following protocols in DTSC-approved work plans (GRC, 1995a and 1995b), using recent laboratory methods.

Based on review to date and discussion with DTSC these data needs include:

- More recent data at selected well locations where only early sampling for metals (e.g., 1980s) was conducted;
- Additional constituents based on evaluation of RFI data needs;
- Hexavalent chromium data to supplement existing unspeciated total chromium data; and,
- Aluminum data needed to establish a groundwater comparison data set.

Additional sampling needs will be determined during evaluation and reporting of the RFI data, and discussed with DTSC during the report review process.

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SECTION 3

FINAL GROUNDWATER COMPARISON DATA SET AND COMPARISON CONCENTRATIONS

The final Groundwater Comparison Data Set and Comparison Concentrations for 25 metals, fluoride, and sulfate were established using the procedures described in Section 2. The Groundwater Comparison Concentrations for the 25 metals, fluoride, and sulfate are presented in Table 3-1.

Appendix A presents details of the final Groundwater Comparison Data Set and Comparison Concentrations for each metal and selected inorganic compounds included in this evaluation. Appendix A includes electronic copies for (1) tables of the "Initial Review Groundwater Data Set" considered during the evaluation, (2) the "Final Groundwater Comparison Data Set" determined useable for further evaluation during the RCRA Corrective Action Program at the SSFL, and (3) rank-order probability plots, prepared using the initial data set. Probability plots for the data set are also provided in hard copy format.

As described in Section 2.2.3 and below in Section 4.3, some additional data may be collected based on review findings to date. Although the established Groundwater Comparison Concentrations presented in this report are not expected to change based on the new data, the Final Groundwater Comparison Data Set may change, or new constituents may be added to the list of chemicals. If so, proposed changes to the Final Groundwater Comparison Data Set and associated Groundwater Comparison Concentrations will be documented in a revision of this document or in RFI reports, for DTSC review and approval.

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SECTION 4

USES OF THE GROUNDWATER COMPARISON DATA SET AND COMPARISON CONCENTRATIONS

The Groundwater Comparison Data Set and associated Groundwater Comparison Concentrations will be used to evaluate potential impacts to groundwater quality in the SSFL RCRA Correction Action Program. Since these comparison concentrations are considered to be at or below the maximum concentrations expected to occur naturally, concentrations below these levels will not require further evaluation for characterization or for risk assessment. Concentrations detected above these levels will undergo further evaluation in RFI reports in the context of all site data.

The Groundwater Comparison Data Set and Comparison Concentrations conservatively represent ambient conditions but were not intended to represent the full range of background concentrations. As such they will be used as a conservative threshold to make decisions regarding the need to characterize groundwater concentrations or for risk assessment as described below in Sections 4.1 and 4.2. The Groundwater Comparison Concentrations are considered to be at or below the maximum naturally occurring metals concentrations. Since any data identified as potentially impacted or elevated were removed from the initial groundwater data set, groundwater data with concentrations above the Groundwater Comparison Concentrations may have been removed that are actually naturally occurring. Therefore, concentrations above these comparison concentrations do not necessarily indicate groundwater quality has been impacted.

4.1 USES IN CHARACTERIZATION

For characterization purposes, the Groundwater Comparison Concentrations will be used as one factor in evaluating if groundwater quality may have been impacted and if further characterization is needed. This evaluation will be performed using best professional

judgement in conjunction with other groundwater data (groundwater levels, time-series plots, and surrounding well data) and site data (soil data, historical site use). If the evaluation does not indicate that a constituent is a potential contaminant near an investigational area, further characterization may not be recommended even if some groundwater results are above their respective Groundwater Comparison Concentrations. Site characterization decisions with respect to Groundwater Comparison Concentrations will be described in RFI characterization reports.

4.2 USES IN RISK ASSESSMENT

For risk assessment purposes, these Groundwater Comparison Concentrations are used to select chemicals that will be included in risk assessment. This evaluation will be performed using best professional judgement, in conjunction with other groundwater data (groundwater levels, time-series plots) and other site data (soil data, historical site use) to assess potential groundwater impacts and determine if that chemical should be evaluated in the risk assessment. If the evaluation does not indicate that a constituent is a potential contaminant near an investigational unit or reporting area, then that constituent may not be selected as a COPC or CPEC in the risk assessment even if some groundwater results are above their respective Groundwater Comparison Concentrations.

A second groundwater evaluation, as described in the Standardized Risk Assessment Methodology (SRAM) Work Plan Revision 2 (MWH 2005), may also be performed. In addition to a comparison of all investigational unit groundwater data to a single Groundwater Comparison Concentration (comparison method), a Wilcoxon Rank Sum (WRS) Test may be performed comparing the investigational unit groundwater data set to the entire Final Groundwater Comparison Data Set. If the data set for any metal or inorganic chemical has a low frequency of detection, then an appropriate statistical test will be used.

The WRS Test will only be performed if it is first determined that this is an appropriate test for the groundwater data being evaluated. Criteria such as number of data in the site

groundwater data set, temporal considerations, and depth of groundwater will be used to determine if the WRS Test is appropriate. The WRS Test will not be performed if it has already been determined based on a review of RFI site soil data and historical groundwater data that the metal is present due to site activities. Justification for using the WRS Test on any groundwater data sets will be provided in the RFI reports. The value of the WRS Test is that it compares all the data in two populations. This is done in recognition that an exceedance may not only be a one-time event but may also be within the statistical variability in the data. The use and application of the WRS Test is described in detail in Section 3 of the SRAM (MWH 2005).

Selection of COPCs and CPECs with respect to the Groundwater Comparison Data Set and associated Comparison Concentrations will be described in the risk assessments.

4.3 ADDITIONAL DATA COLLECTION AND DATA NEEDS

Establishment of Groundwater Comparison Concentrations does not preclude further evaluation of background. Because Groundwater Comparison Concentrations may not reflect the full range of naturally occurring metals/inorganics concentrations at the SSFL, the need may arise for establishing background concentrations for one or more constituents, based on data evaluation during RFI reporting or during the Corrective Measures Study. Background ranges would be established based on a review of the groundwater data available at that time, including any additional data obtained from locations across the facility and representative of ambient conditions.

During the evaluation described in Section 2, elevated detection limits and potentially elevated detected concentrations were observed for a number of constituents in groundwater collected early in the investigation. Potentially elevated concentrations were removed from the data set in establishing Groundwater Comparison Concentrations. Since early data represent the only samples collected from some wells, future data collected from these locations may indicate ambient constituent concentrations higher than the proposed Groundwater Comparison Concentrations.

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SECTION 5
LIST OF REFERENCES

California Department of Health Services. 2003. Maximum Contaminant Levels, September. http://www.dhs.ca.gov/ps/ddwem/chemicals/MCL/EPAandDHS.pdf

California Department of Health Services. 2005. Drinking Water Notification Levels. May. http://www.dhs.ca.gov/ps/ddwem/

California Office of Environmental Health Hazard Assessment (OEHHA). 2004. Public Health Goals. April 23. http://www.oehha.ca.gov/water/phg/allphgs.html

Groundwater Resources Consultants (GRC), 1995a. Sampling and Analysis Plan, Hazardous Waste Facility Post-Closure Permit PC-94/95-3-02, Area II, Santa Susana Field laboratory, Rockwell International Corporation, Rocketdyne Division, Ventura County, California. June.

Groundwater Resources Consultants (GRC), 1995b. Sampling and Analysis Plan, Hazardous Waste Facility Post-Closure Permit PC-94/95-3-03, Areas I and III, Santa Susana Field laboratory, Rockwell International Corporation, Rocketdyne Division, Ventura County, California. June.

Haley & Aldrich (H&A), 2005. Report on Annual Groundwater Monitoring, 2004, Santa Susana Field Laboratory, Ventura County, California. February.

MWH Americas, Inc. (MWH). 2005. Standardized Risk Assessment Methodology Work Plan, Revision 2, Santa Susana Field Laboratory, Ventura County, California. June.

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Table 2-1
Summary of Metals and Selected Inorganic Compounds in the SSFL Groundwater Data Set

		Non-Detects			Detects				
Constituent	Sample Size (n)	Number of Non Detects	Range of Detection Limits (µg/L) Min	Range of Detection Limits (µg/L) Max	Number of Detects	Frequency of Detection	Range of Detected Concentrations (µg/L) Min	Range of Detected Concentrations (µg/L) Max	Type of Distribution
Aluminum	1	1	47	47	0	0.0%	--	--	--
Antimony	411	318	0.02	1000	93	22.6%	0.02	6.1	Indeterminate
Arsenic	645	520	0.1	100	125	19.4%	0.12	320	Indeterminate
Barium	639	94	1	500	545	85.3%	3.9	580	Indeterminate
Beryllium	428	413	0.007	100	15	3.5%	0.01	1.8	Indeterminate
Boron	194	77	30	100	117	60.3%	20	2200	Indeterminate
Cadmium	639	565	0.015	5	74	11.6%	0.027	6.1	Indeterminate
Chromium	639	528	0.06	10	111	17.4%	0.22	88	Indeterminate
Cobalt	175	40	0.053	40	135	77.1%	0.056	180	Indeterminate
Copper	421	248	0.16	900	173	41.1%	0.19	70	Indeterminate
Fluoride	600	24	80	500	576	96.0%	70	5400	Indeterminate
Iron	431	205	2.2	500	226	52.4%	3.9	9700	Indeterminate
Lead	647	369	0.098	50	278	43.0%	0.11	120	Indeterminate
Magnesium	534	0	--	--	534	100.0%	20	270000	Indeterminate
Manganese	360	55	1	10	305	84.7%	0.13	18400	Indeterminate
Mercury	639	625	0.05	1	14	2.2%	0.069	0.8	Normal
Molybdenum	308	215	1.3	100	93	30.2%	0.44	130	Indeterminate
Nickel	412	271	0.1	50	141	34.2%	0.1	740	Indeterminate
Selenium	639	524	0.34	40	115	18.0%	0.27	80	Indeterminate
Silver	639	613	0.0006	10	26	4.1%	0.03	420	Indeterminate
Strontium	123	2	300	590	121	98.4%	178	2800	Indeterminate
Thallium	412	358	0.044	500	54	13.1%	0.009	4.7	Indeterminate
Tin	93	87	0.04	500	6	6.5%	0.2	6.5	Normal
Vanadium	168	81	0.096	500	87	51.8%	0.11	37.8	Indeterminate
Zinc	444	50	3	29	394	88.7%	2.2	19000	Indeterminate
Potassium	534	2	1200	1400	532	99.6%	600	62400	Indeterminate
Sodium	560	0	--	--	560	100.0%	24000	1840000	Indeterminate
Sulfate	575	0	--	--	575	100.0%	220	4700000	Indeterminate

Notes:
1. Distributions were tested after removing non detect data.
2. "Indeterminate" indicates that data fit neither a normal nor lognormal distribution.
3. Data summaries represented on this table reflect the 'intial review' data set used to develop the final Groundwater Comparison Concentrations.

µg/L - micrograms per liter

Table 3-1
Groundwater Comparison Concentrations for Metals and Selected Inorganic Compounds

	All Concentrations in µg/L				
Constituent	**SSFL Groundwater Comparison Concentration[a]**	**CA DHS MCLs**	**Ca DHS NLs**	**OEHHA PHGs**	**USEPA PRGs**
Antimony	2.5	6		20	15
Arsenic	7.7	50		0.004	0.05
Barium	150	1,000		2000	2,600
Beryllium	ND < 0.14	4		1	73
Boron	340		1,000		7,300
Cadmium	0.2	5		0.07	18
Chromium	14	50			55,000
Cobalt	1.9				730
Copper	4.7	1,000[b]	1,300	170	1,500
Fluoride	800	2,000		1,000	2,200
Iron	4,100	300[b]			11,000
Lead	11		15	2	
Magnesium	77,000				
Manganese	150	50[b]	500		880
Mercury	ND <0.063	2		1.2	11
Molybdenum	2.2				180
Nickel	17	100		12	730
Selenium	1.6	50			180
Silver	ND <0.17	100[b]			180
Strontium	800				22,000
Thallium	ND< 0.13	2		0.1	2.40
Tin	ND <2.4				22,000
Vanadium	2.6		50		36
Zinc	6,300	5,000[b]			11,000
Potassium	9,600				
Sodium	190,000				
Sulfate	376,000	250,000[b]			

(a) Groundwater Comparison Concentrations represent the maximum value retained in the Final Groundwater Comparison Data Set (Appendix A)

(b) Secondary MCL - Non-health based criterion (i.e. based on aesthetic, discoloration issues).

Note: A Groundwater Comparison Concentration was not established for aluminum because of insufficient data. Dissolved analysis was only conducted on one sample.

ND = Non Detect. Groundwater mercury, silver and tin results greater than values shown will undergo further evaluation.
µg/L = Micrograms per liter
Ca DHS - California Department of Health Services
MCL - Maximum Contaminant Level
NL = Notification Level
OEHHA PHG - Office of Environmental Health Hazard Assessment Public Health Goals
USEPA PRG - United States Environmental Protection Agency Preliminary Remediation Goal for tap water

Sources:
Ca DHS MCLs from http://www.dhs.ca.gov/ps/ddwem/chemicals/MCL/EPAandDHS.pdf
Ca DHS Notification Levels (NL) from DHS website - http://www.dhs.ca.gov/ps/ddwem/
OEHHA PHGs from http://www.oehha.ca.gov/water/phg/allphgs.html

APPENDIX A

GROUNDWATER COMPARISON CONCENTRATIONS DATA TABLES AND PROBABILITY PLOTS

Groundwater Comparison Data Set and Comparison Concentrations Report

Appendix A-1, Initial Review Data Set

The tables in this attachment include all available groundwater results used in the initial review of groundwater data for purposes of determining SSFL RFI Groundwater Comparison Data Set and Comparison Concentrations. Pertinent information and definitions are included below.

Data Set Includes:

1. All available groundwater samples collected through 4th quarter 2004
2. Dissolved sulfate, fluoride and metals only
3. Primary samples, Field duplicates and Split samples
4. No rejected (R) data

Data Qualifier:

U = not detected
J = Estimated value
B = For the purposes of this data set represents qualified data based on contamination in the associated Method Blank.

Well Aquifer:

NS = Near-surface groundwater
Cf = Chatsworth formation groundwater

FLUTe port #: (Flexible Liner Underground Technology)

NA = no FLUTe installed, sample collected from open borehole
P*XXX* = the numerical suffix indicates the port number of the installed FLUTe.
Composite = mixture of samples from all sampled ports of the installed FLUTe

Analytical Laboratories:

AnalTech
Assoc = Associated Laboratories
Babcock = Edward S. Babcock and Sons
BCA-Bak = BC Analytical - Bakersfield
BCA-Glen = BC Analytical - Glendale
Ceimic = Ceimic Corporation
Columbia = Columbia Analytical Services
Del Mar = Del Mar Analytical, Inc.
Del Mar Analytical = Del Mar Analytical, Inc.
E.S. Babcock = Edward S. Babcock and Sons
Eberline = Eberline Services
PacificAnal = Pacific Analytical, Inc.
UNKNOWN = Laboratory name not available
VOC Anal

Tables included in this attachment:

Table name
Aluminum - Table A-1-1
Antimony - Table A-1-2
Arsenic - Table A-1-3
Barium - Table A-1-4
Beryllium - Table A-1-5
Boron - Table A-1-6
Cadmium - Table A-1-7
Chromium - Table A-1-8
Cobalt - Table A-1-9
Copper - Table A-1-10
Fluoride - Table A-1-11
Iron - Table A-1-12
Lead - Table A-1-13
Magnesium - Table A-1-14
Manganese - Table A-1-15
Mercury - Table A-1-16
Molybdenum - Table A-1-17
Nickel - Table A-1-18
Selenium - Table A-1-19
Silver - Table A-1-20
Strontium - Table A-1-21
Thallium - Table A-1-22
Tin - Table A-1-23
Vanadium - Table A-1-24
Zinc - Table A-1-25
Potassium - Table A-1-26
Sodium - Table A-1-27
Sulfate - Table A-1-28

Appendix A-2, Comparison Data Set

This attachment includes tables containing data for use in characterization and risk assessment steps of the SSFL RFI. Data included in these tables are the Groundwter Comparison Data Set, which are limited to values at or below the selected groundwater Comparison Concentrations (see Appendix A-1 for complete data set). Pertinent information and definitions are included below.

Data Set Includes:

1. All available groundwater samples collected through 4th quarter 2004
2. Sulfate, Fluoride and Dissolved Metals only
3. Primary samples, Field duplicates and Split samples
4. Rejected data not included

Data Qualifier:

U = not detected
J = Estimated value
B = for the purposes of this data set represents qualified data with contamination in the associated Method Blank.

Well Aquifer:

NS = Near-surface groundwater
Cf = Chatsworth formation groundwater

FLUTe port #: (Flexible Liner Underground Technology)

NA = no FLUTe installed, sample collected from open borehole
P*XXX* = the numerical suffix indicates the port number of the installed FLUTe.
Composite = mixture of samples from all sampled ports of the installed FLUTe

Analytical Laboratories:

AnalTech
Assoc = Associated Laboratories
Babcock = Edward S. Babcock and Sons
BCA-Bak = BC Analytical - Bakersfield
BCA-Glen = BC Analytical - Glendale
Ceimic = Ceimic Corporation
Columbia = Columbia Analytical Services
Del Mar = Del Mar Analytical, Inc.
Del Mar Analytical = Del Mar Analytical, Inc.
E.S. Babcock = Edward S. Babcock and Sons
Eberline = Eberline Services
PacificAnal = Pacific Analytical, Inc.
UNKNOWN = Laboratory name not available
VOC Anal

Tables included in this Attachment:

Table name
Aluminum Not Included*
Antimony - Table A-2-2
Arsenic - Table A-2-3
Barium - Table A-2-4
Beryllium Not Included*
Boron - Table A-2-6
Cadmium - Table A-2-7
Chromium - Table A-2-8
Cobalt - Table A-2-9
Copper - Table A-2-10
Fluoride - Table A-2-11
Iron - Table A-2-12
Lead - Table A-2-13
Magnesium - Table A-2-14
Manganese - Table A-2-15
Mercury Not Included*
Molybdenum - Table A-2-17
Nickel - Table A-2-18
Selenium - Table A-2-19
Silver Not Included*
Strontium - Table A-2-21
Thallium Not Included*
Tin Not Included*
Vanadium - Table A-2-24
Zinc - Table A-2-25
Potassium - Table A-2-26
Sodium - Table A-2-27
Sulfate - Table A-2-28

* Comparison data sets not included for aluminum, beryllium, mercury, silver, thallium or tin. Groundwater concentrations above detection limits shown will undergo further evaluation.

Appendix A-3, Rank-order Probability Plots

This attachment includes rank-order probability plots for metals and selected inorganic constituents. The probability plot allows viewing the entire data set, provides information on data distribution, and aids in identifying different data populations. For each constituent included in this attachment, both normal and lognormal distribution plots are presented. Final Groundwater Comparison Concentrations (GWCC) are used as a reference point on each plot. Data included in these plots represent all available groundwater results used for the initial review for the Groundwater Comparison Data Set and Comparison Concentrations (see Appendix A-1 for complete data set). Pertinent information and definitions are included below.

Data Set Includes:

1. All available groundwater samples collected through 4th quarter 2004
2. Dissolved sulfate, fluoride and metals only
3. Primary samples, Field duplicates and Split samples
4. Detected values only

Type of Distribution Included:

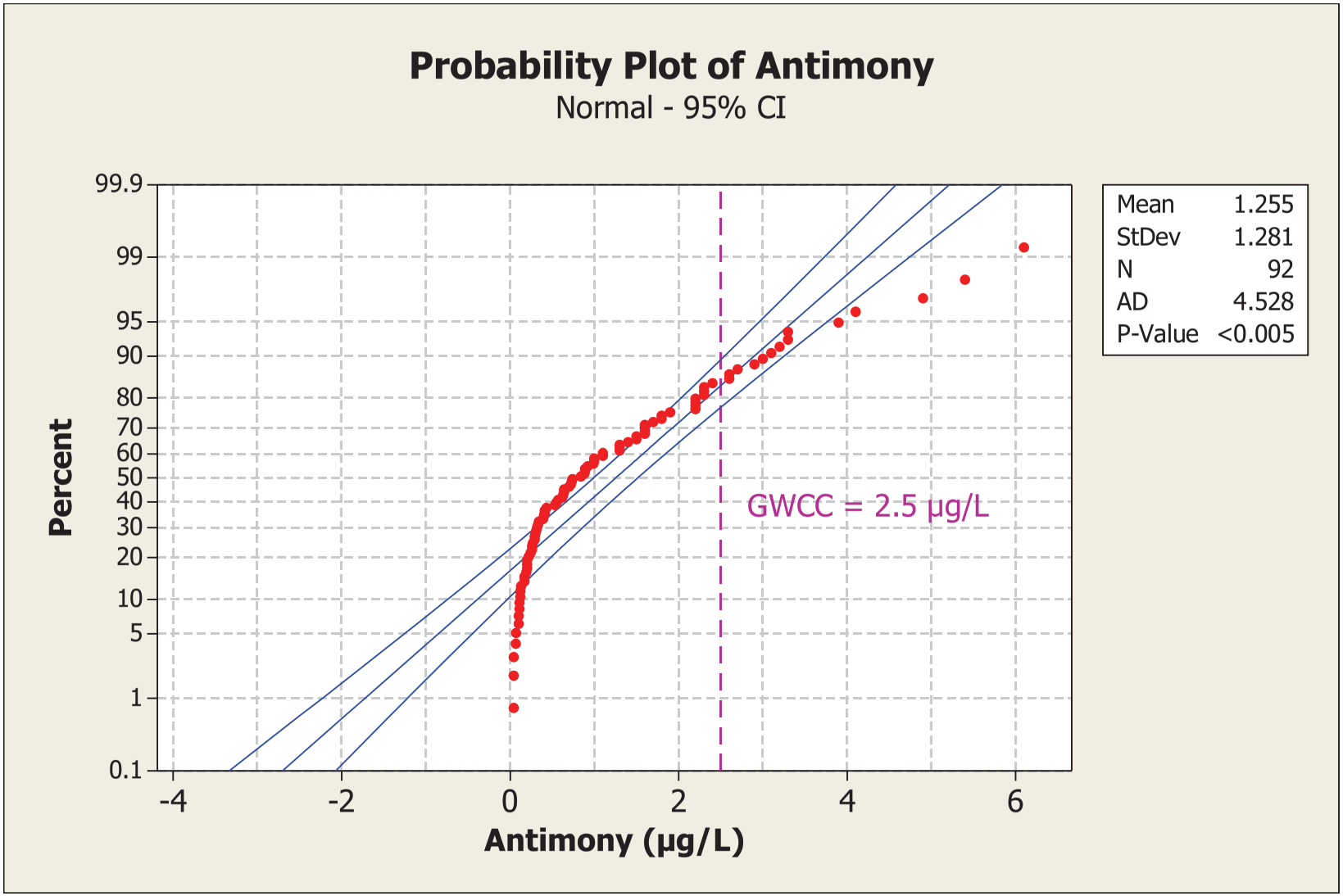
1. Normal
2. Lognormal

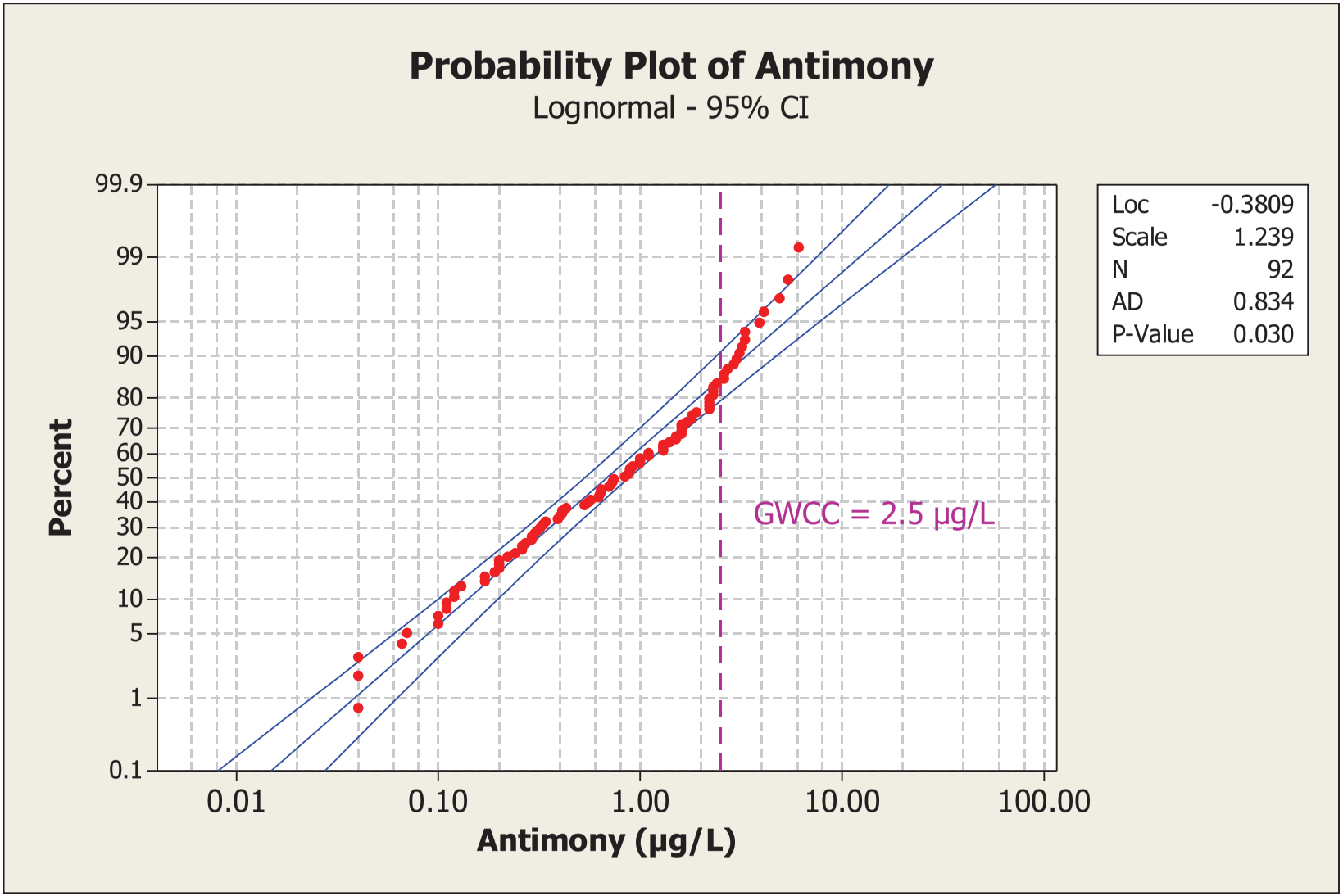
Probability Plots included in this Attachment:

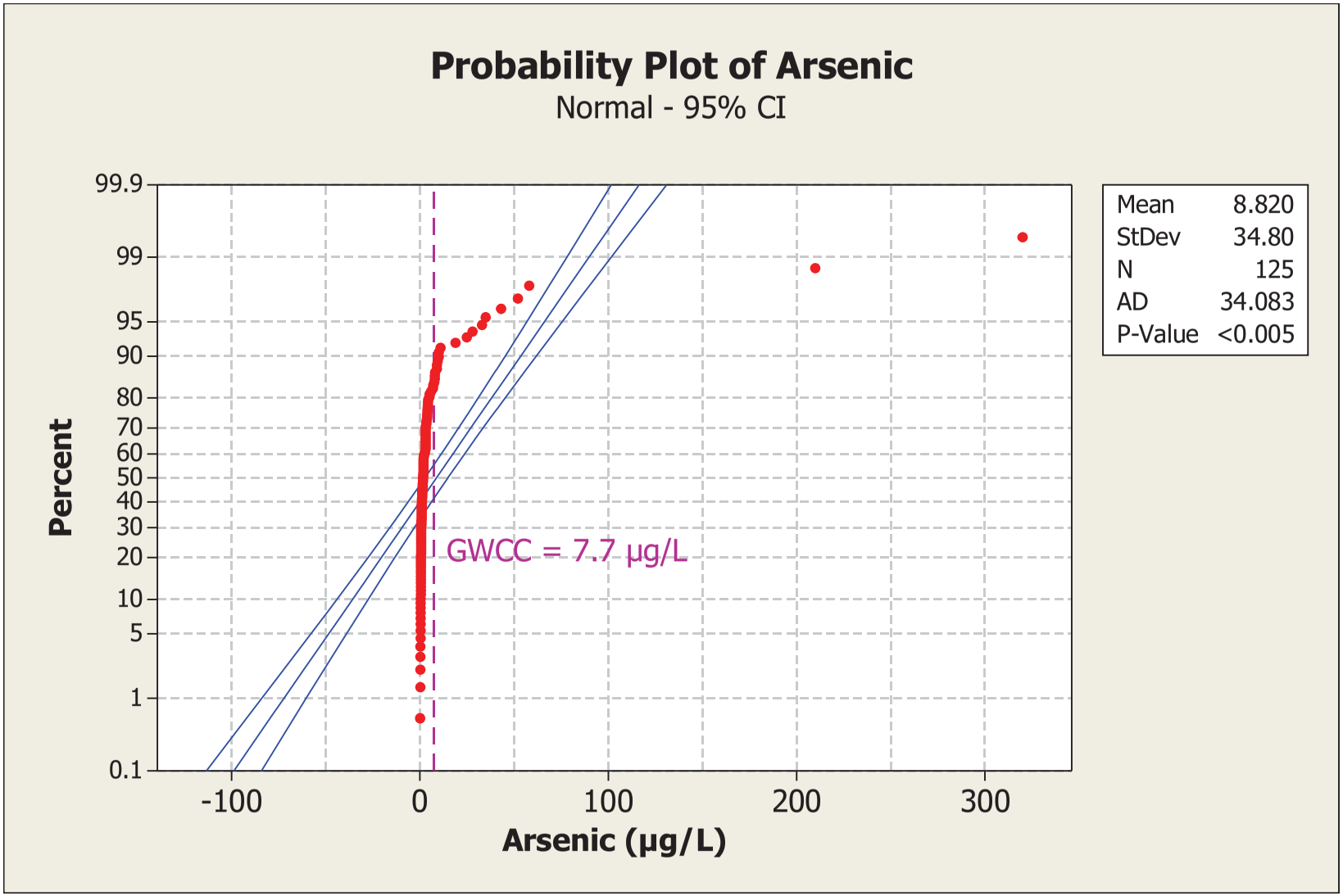
Constituent name
Aluminum Not Included*
Antimony
Arsenic
Barium
Beryllium Not Included*
Boron
Cadmium
Chromium
Cobalt
Copper
Fluoride
Iron
Lead
Magnesium
Manganese
Mercury Not Included*
Molybdenum
Nickel
Selenium
Silver Not Included*
Strontium
Thallium Not Included*
Tin Not Included*
Vanadium
Zinc
Potassium
Sodium
Sulfate

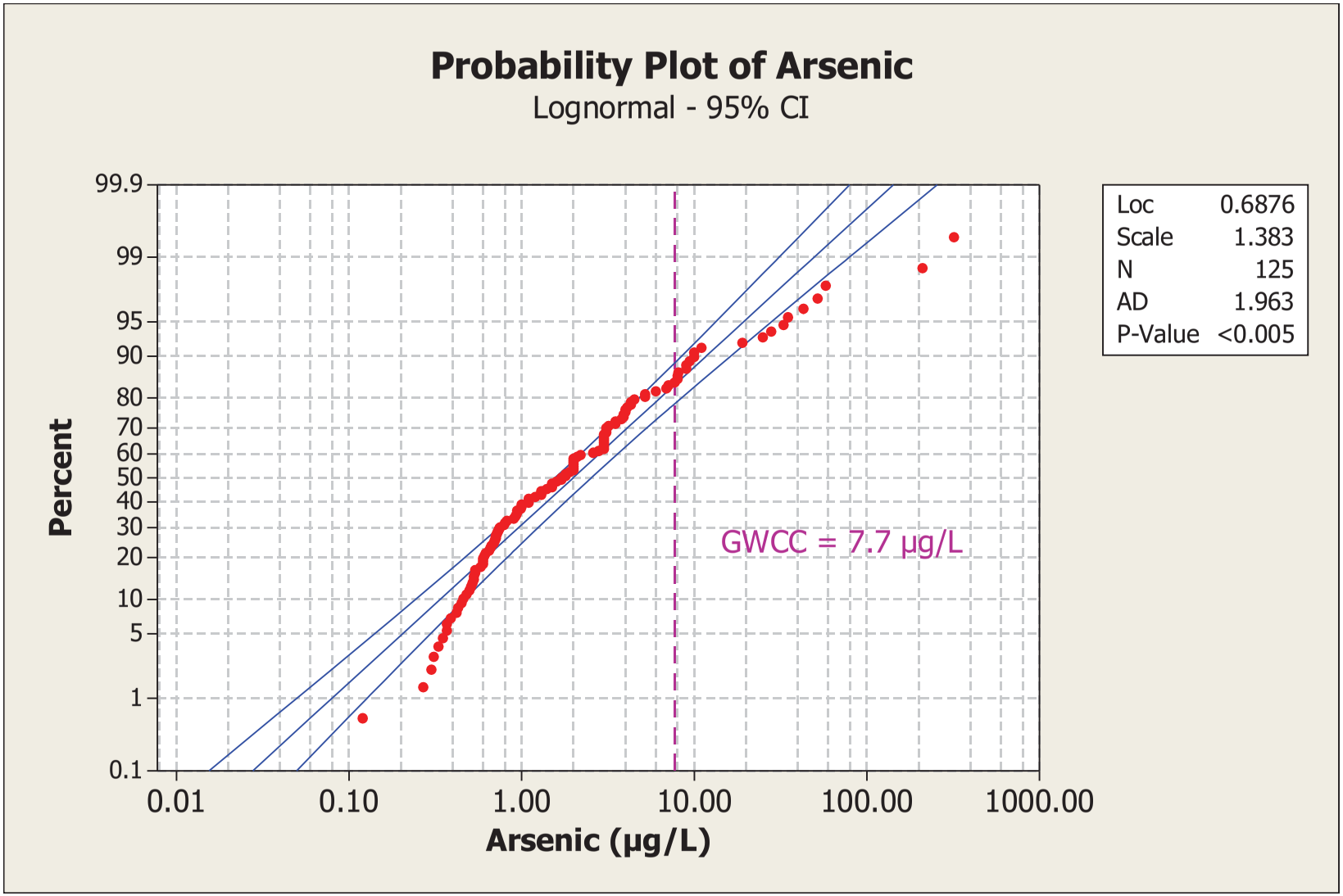
* Probability plots not included for aluminum, beryllium, mercury, silver, thallium or tin.

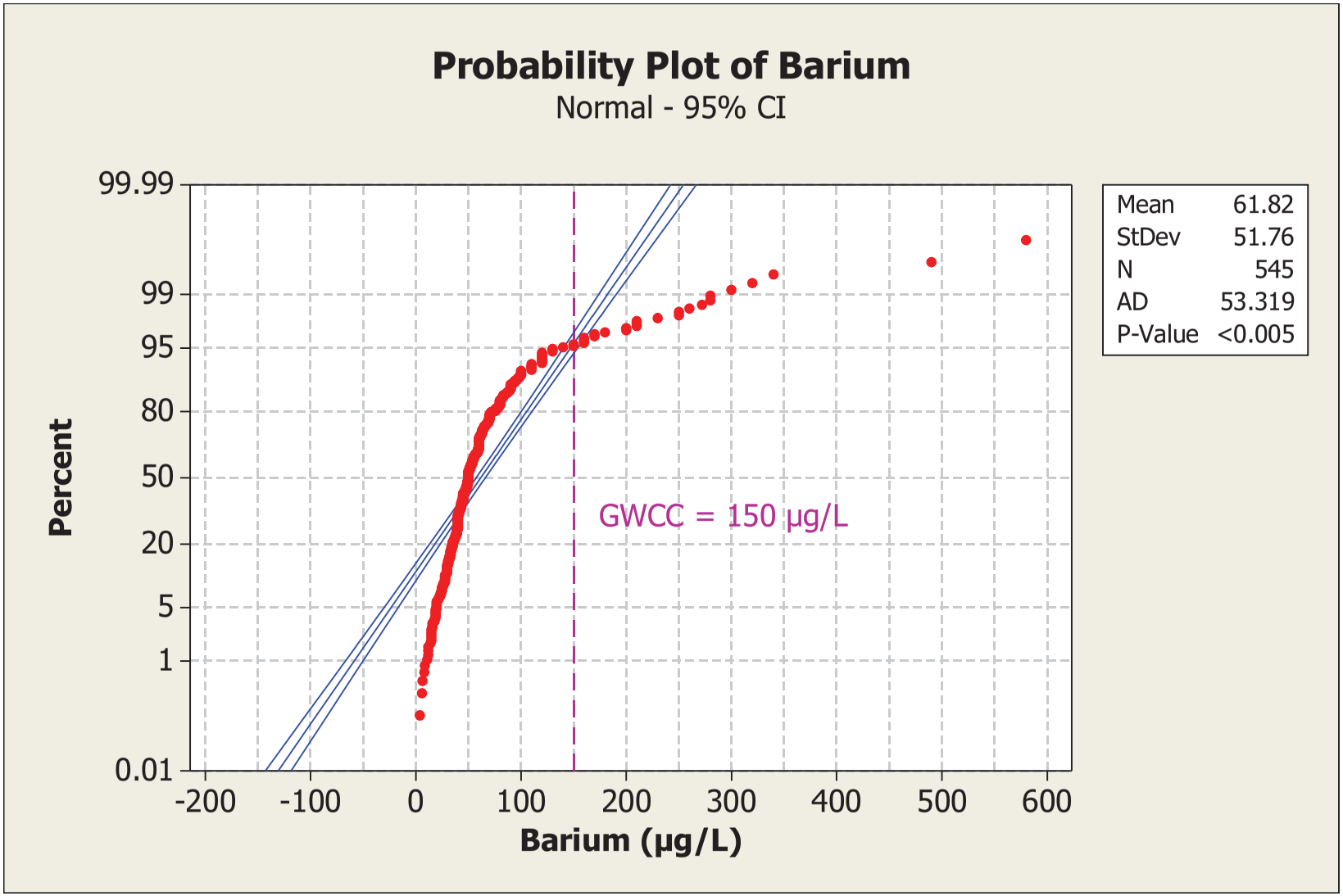
Appendix A Groundwater Comparison Concentrations Data Tables and Probability Plots not provided due to file size

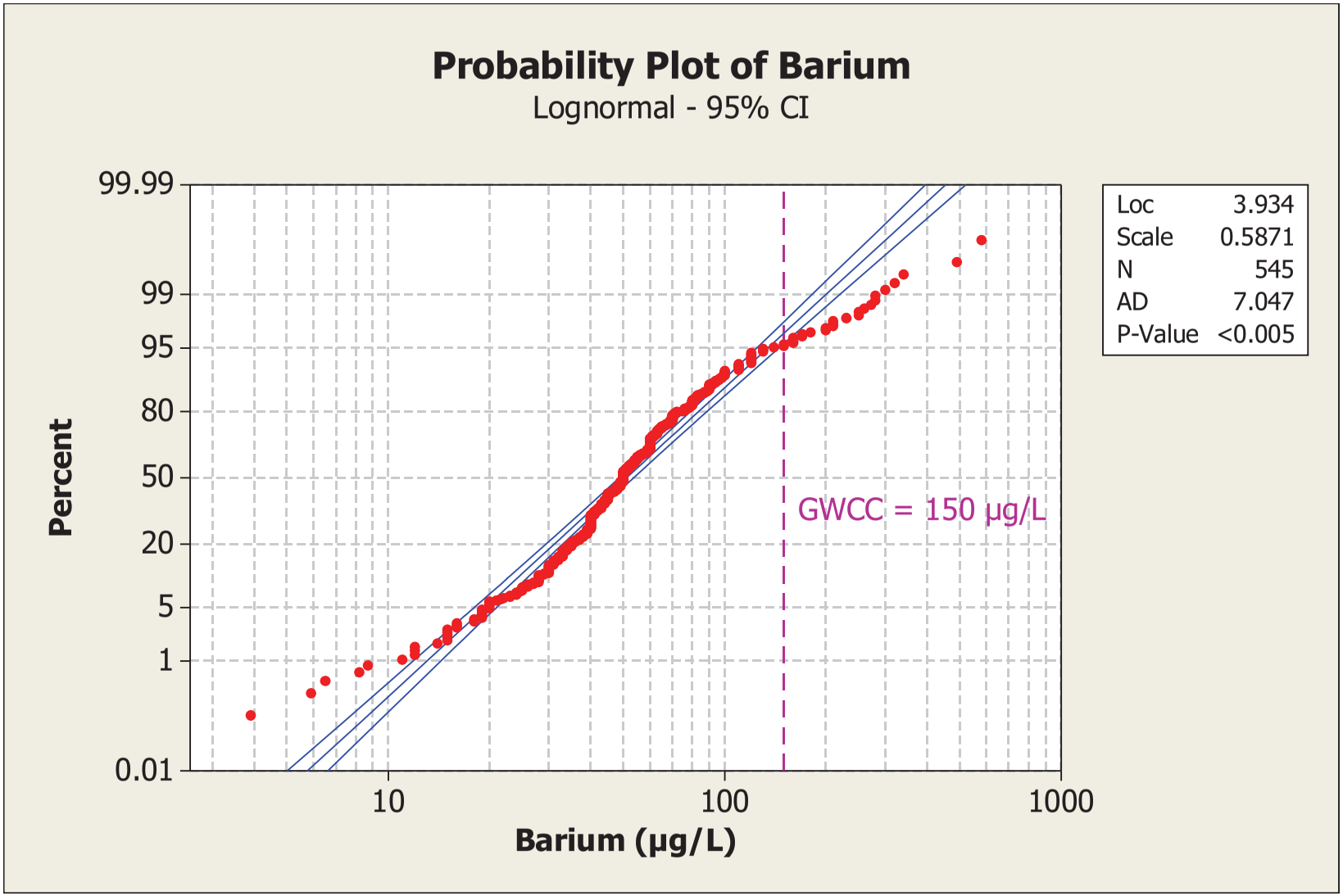

Probability Plot of Antimony
Normal - 95% CI
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
-4
-2
0
2
4
6
Antimony (µg/L)
GWCC = 2.5 µg/L
Mean 1.255
StDev 1.281
N 92
AD 4.528
P-Value <0.005


Probability Plot of Antimony
Lognormal - 95% CI
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
0.01
0.10
1.00
10.00
100.00
Antimony (µg/L)
GWCC = 2.5 µg/L
Loc -0.3809
Scale 1.239
N 92
AD 0.834
P-Value 0.030

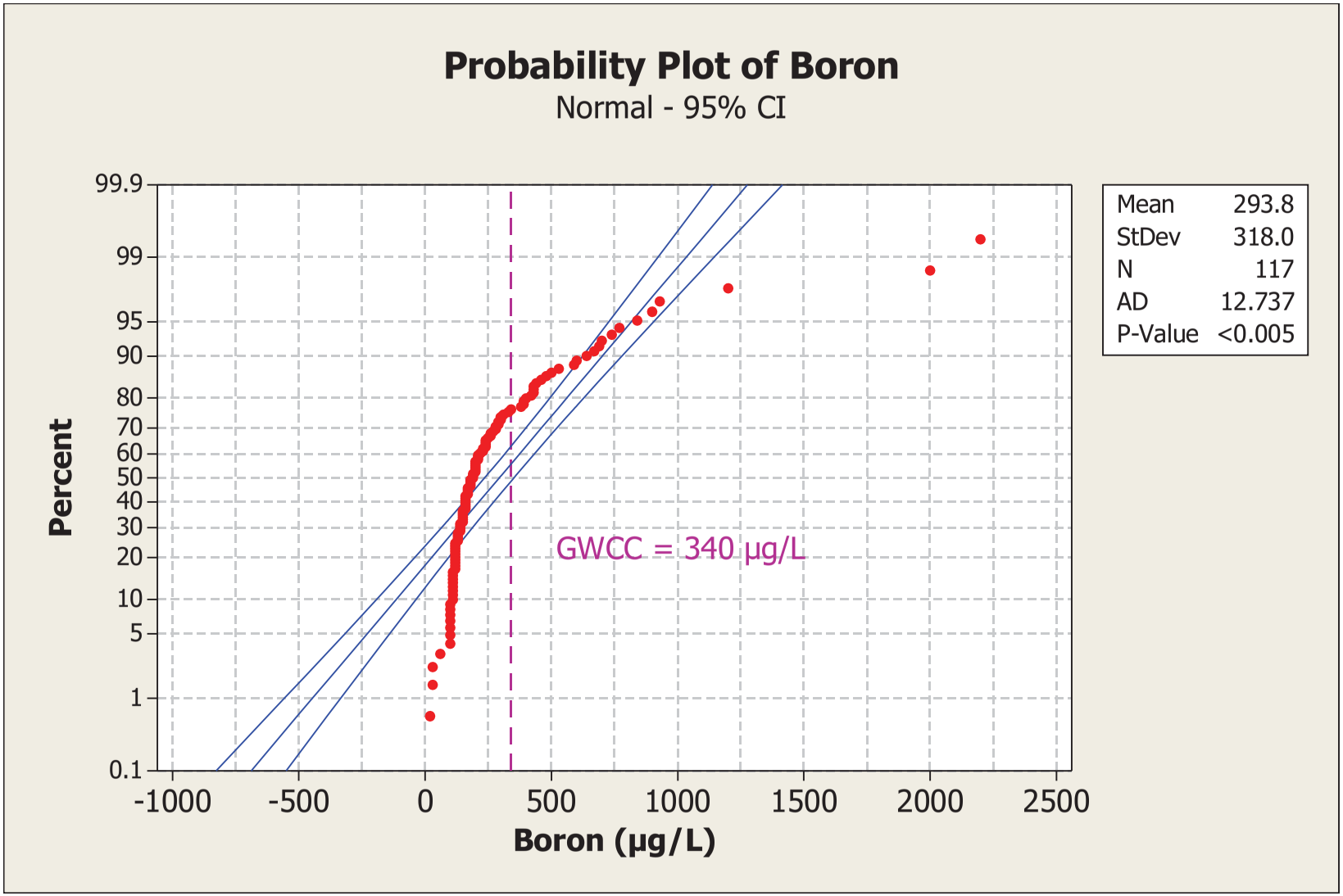

Probability Plot of Arsenic
Normal - 95% CI
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
-100
0
100
200
300
Arsenic (µg/L)
GWCC = 7.7 µg/L
Mean 8.820
StDev 34.80
N 125
AD 34.083
P-Value <0.005

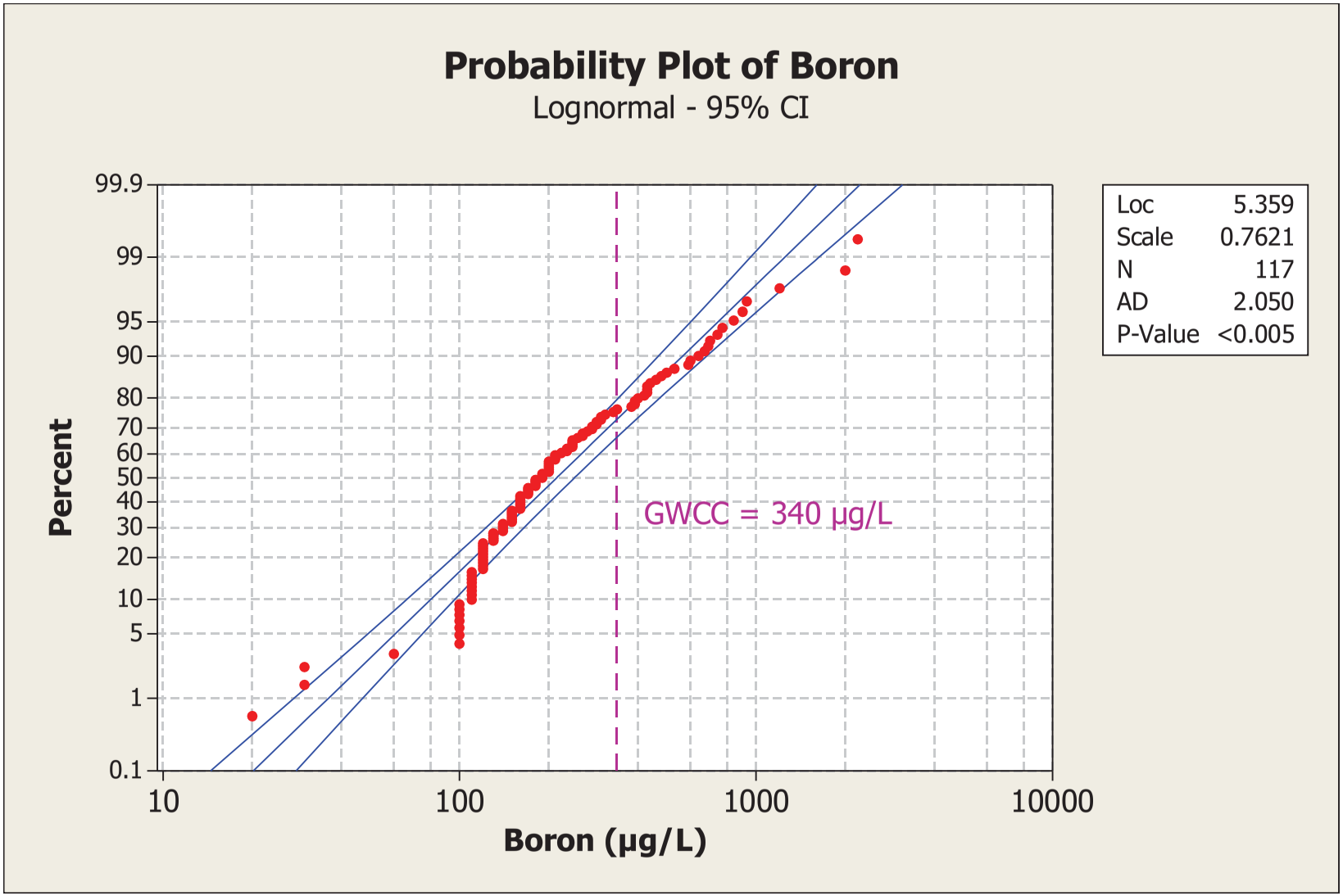

Probability Plot of Arsenic
Lognormal - 95% CI
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
0.01
0.10
1.00
10.00
100.00
1000.00
Arsenic (µg/L)
GWCC = 7.7 µg/L
Loc 0.6876
Scale 1.383
N 125
AD 1.963
P-Value <0.005

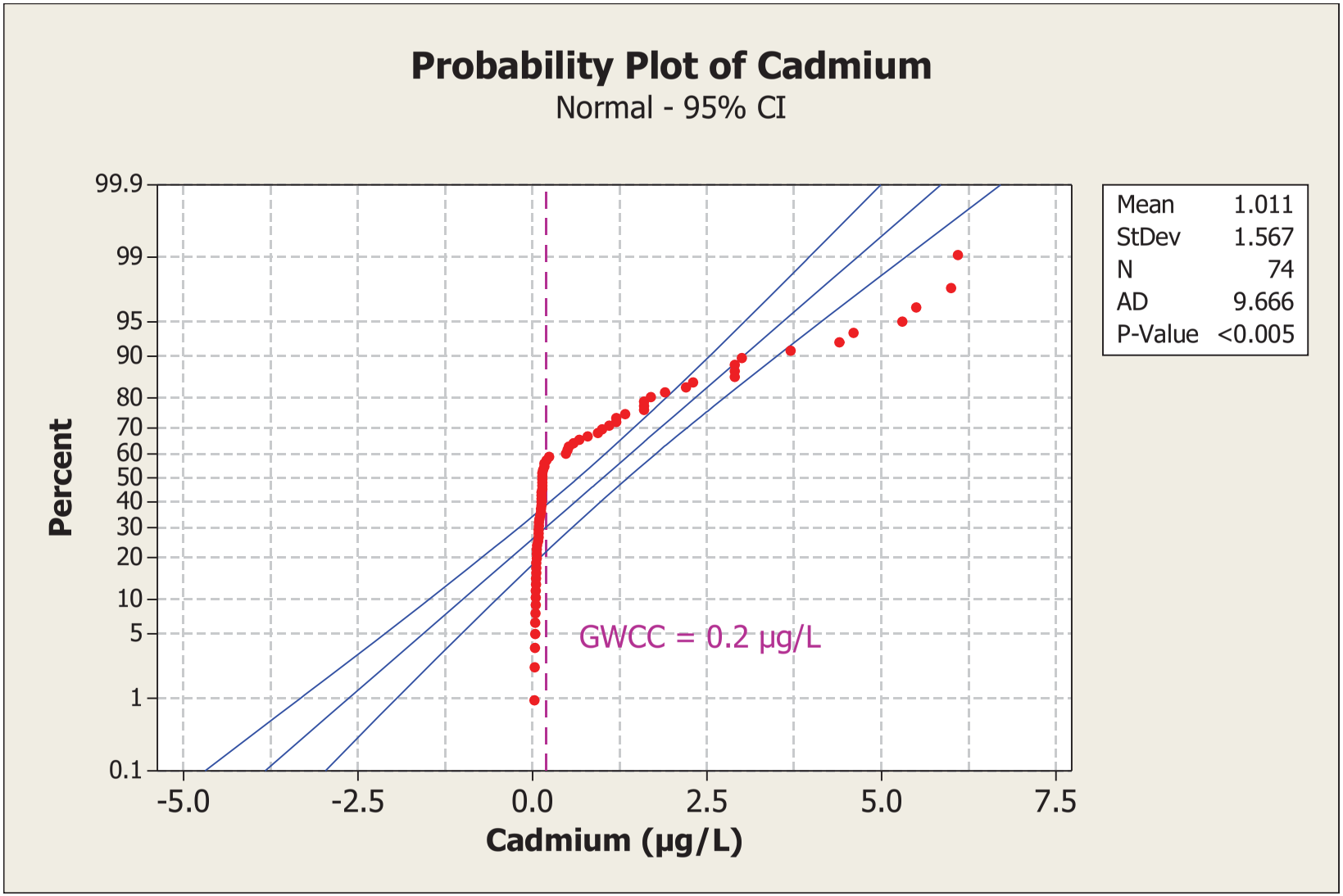

Probability Plot of Barium
Normal - 95% CI
Percent
99.99
99
95
80
50
20
5
1
0.01
-200
-100
0
100
200
300
400
500
600
Barium (µg/L)
GWCC = 150 µg/L
Mean 61.82
StDev 51.76
N 545
AD 53.319
P-Value <0.005

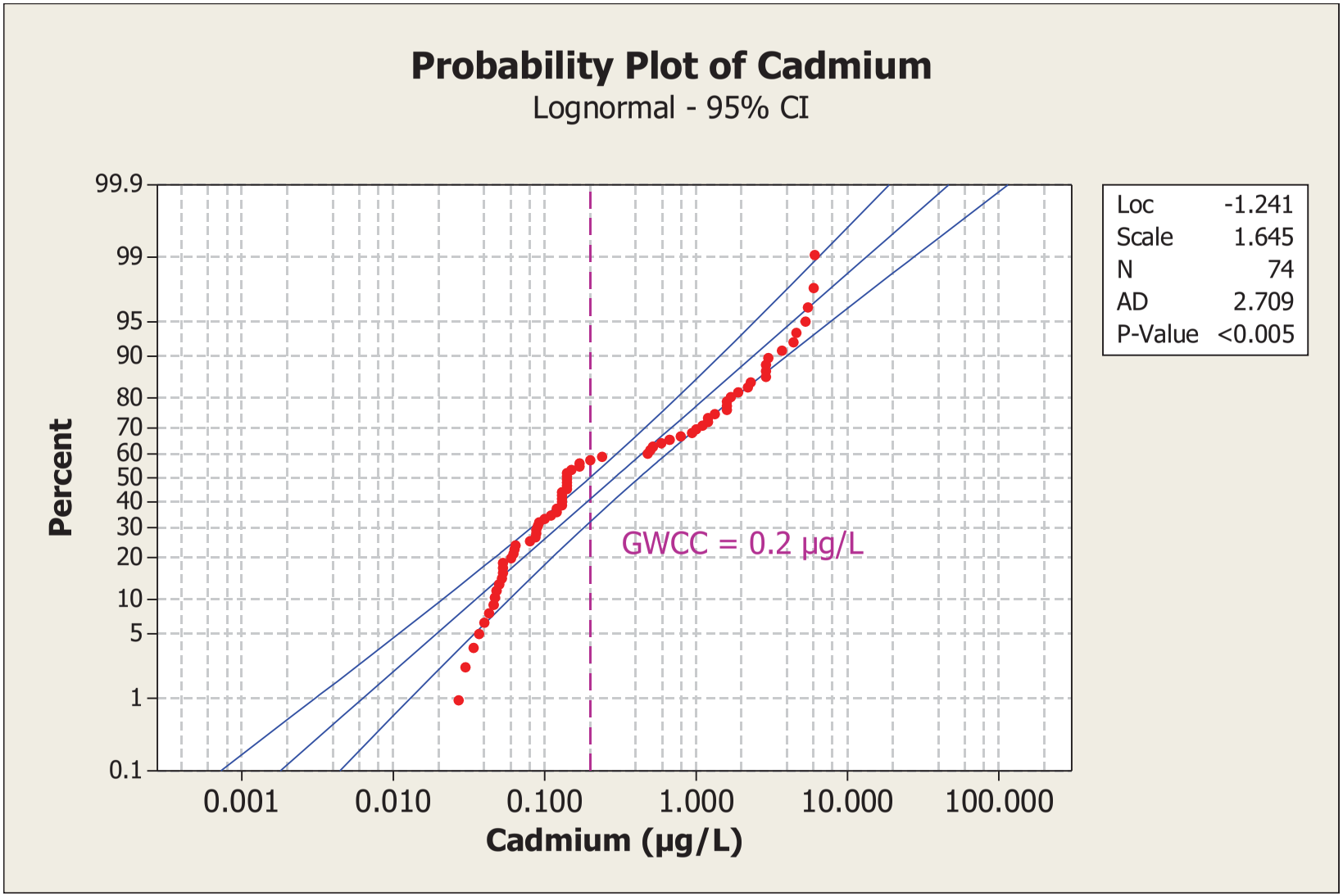

Probability Plot of Barium
Lognormal - 95% CI
Percent
99.99
99
95
80
50
20
5
1
0.01
10
100
1000
Barium (µg/L)
GWCC = 150 µg/L
Loc 3.934
Scale 0.5871
N 545
AD 7.047
P-Value <0.005

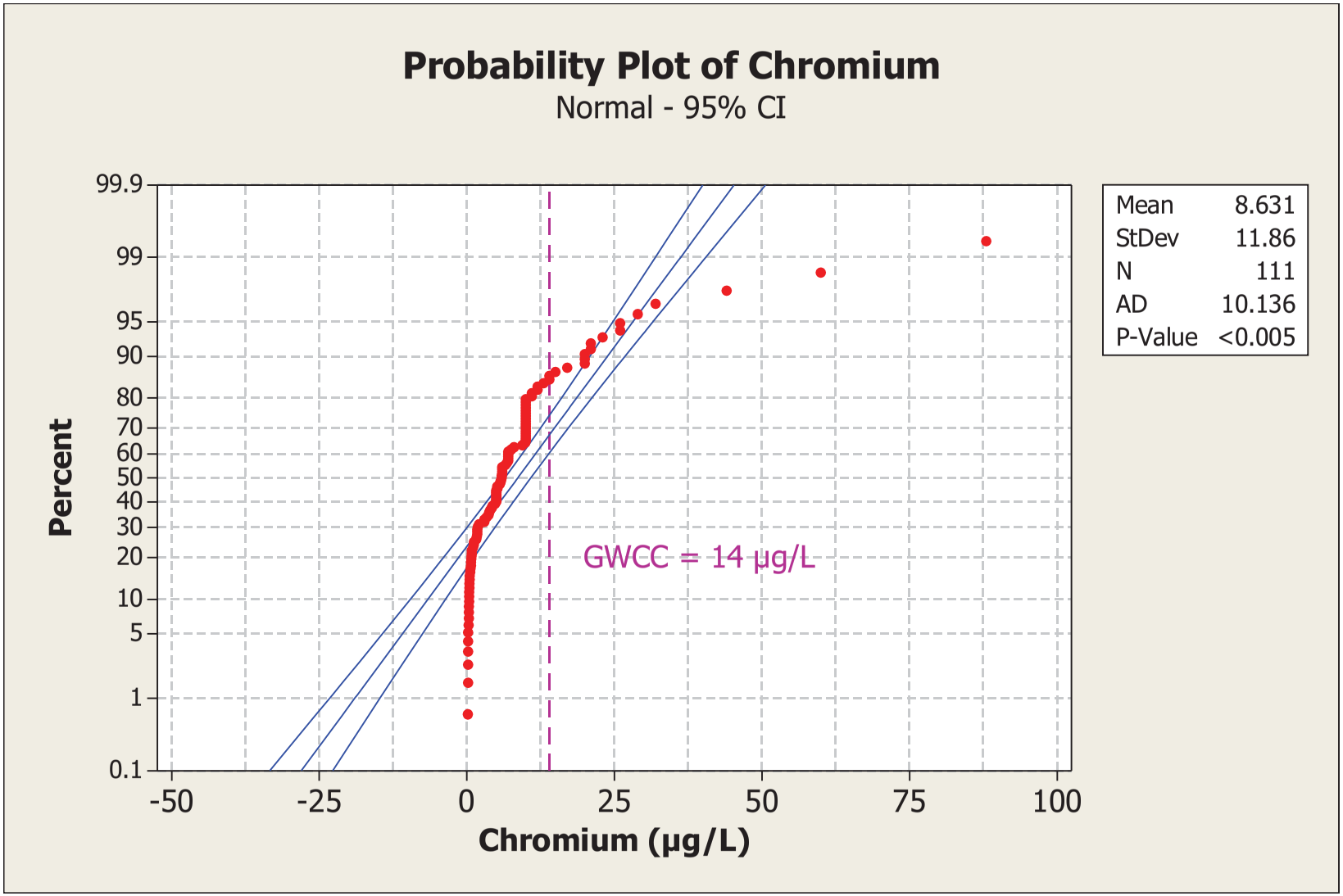
Probability plots are not included for **Beryllium**. Comparison concentrations are based on detection limits for this metal (see main text).

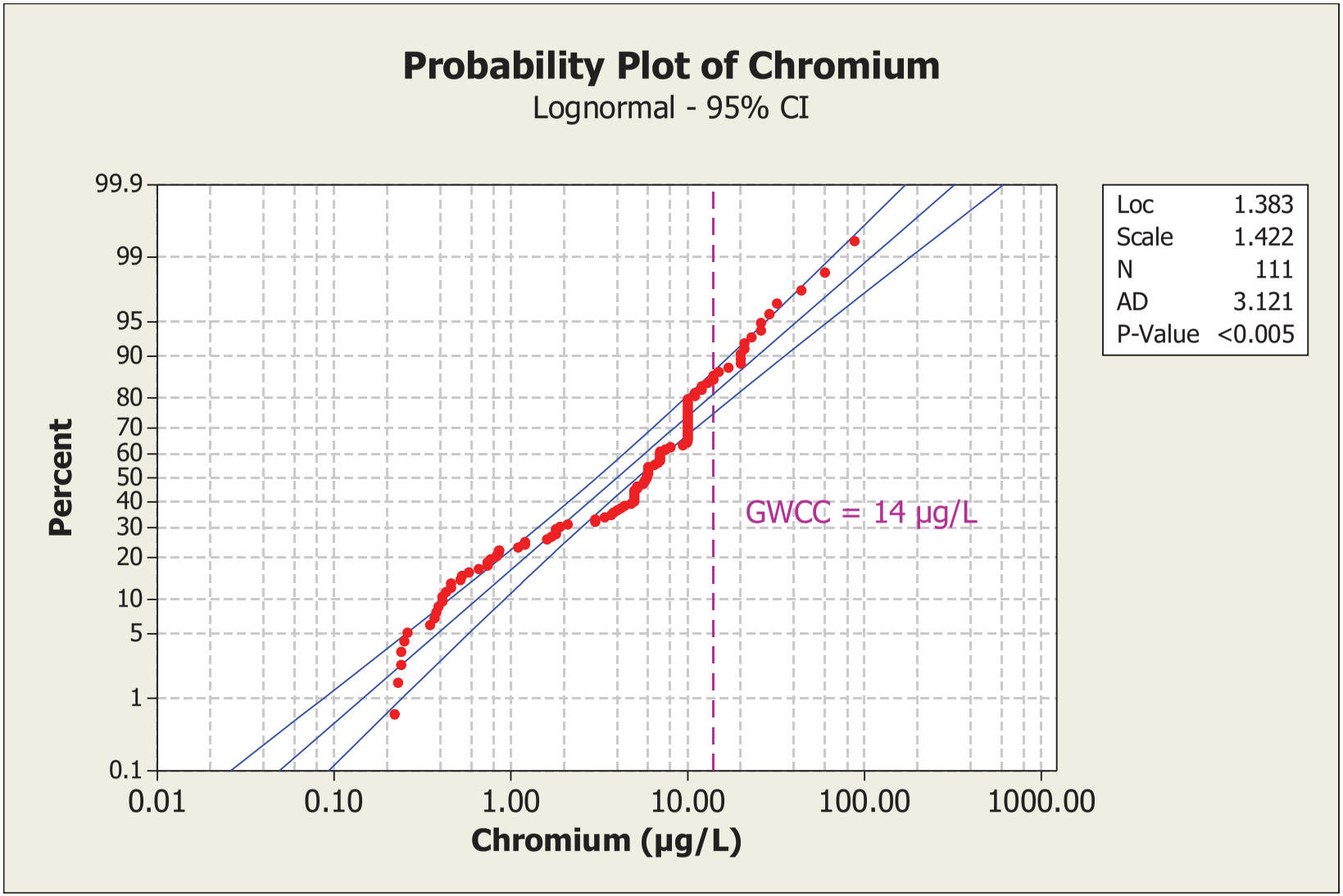

Probability Plot of Boron
Normal - 95% CI
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
-1000
-500
0
500
1000
1500
2000
2500
Boron (µg/L)
GWCC = 340 µg/L
Mean 293.8
StDev 318.0
N 117
AD 12.737
P-Value <0.005

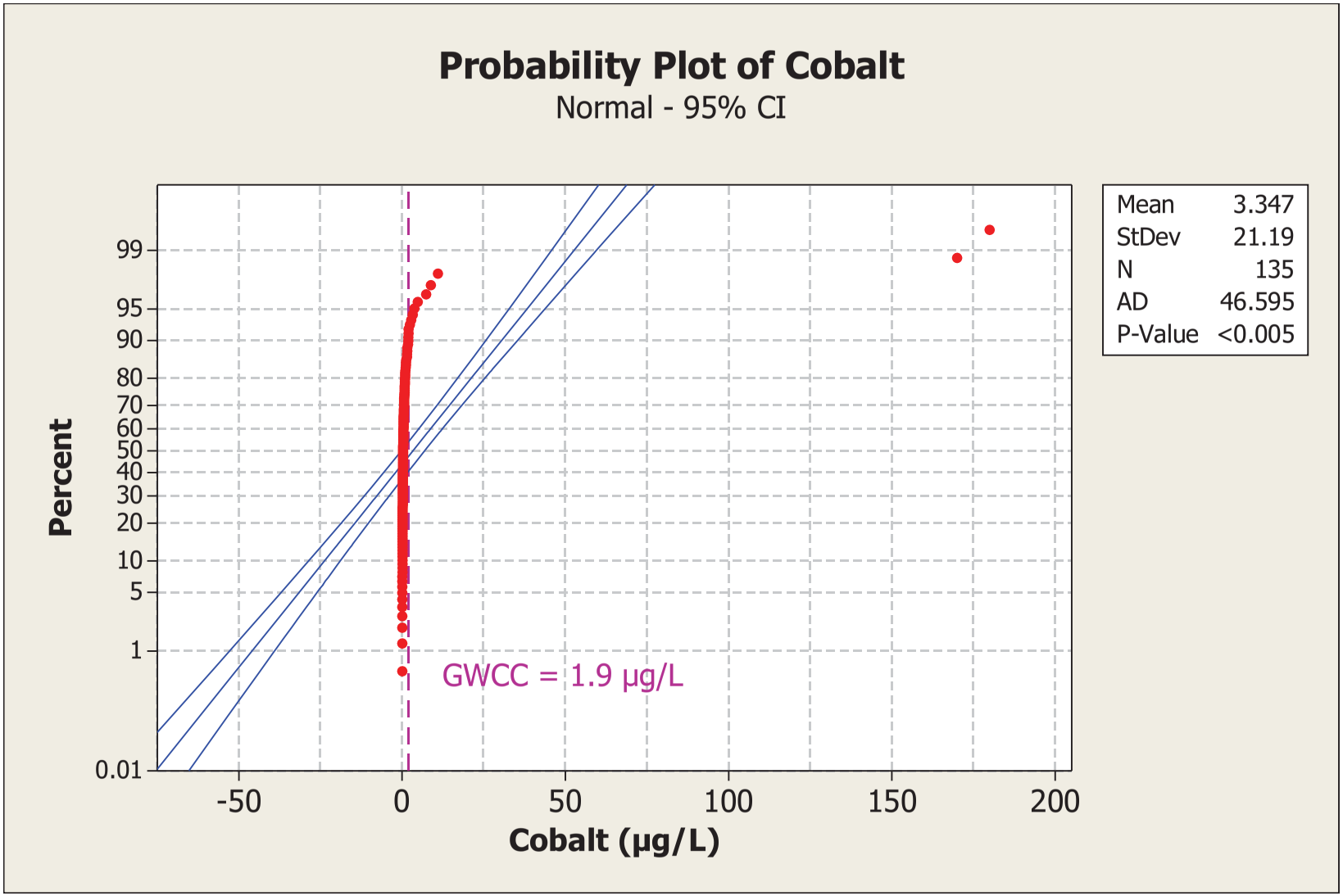

Probability Plot of Boron
Lognormal - 95% CI
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
10
100
1000
10000
Boron (µg/L)
GWCC = 340 µg/L
Loc 5.359
Scale 0.7621
N 117
AD 2.050
P-Value <0.005

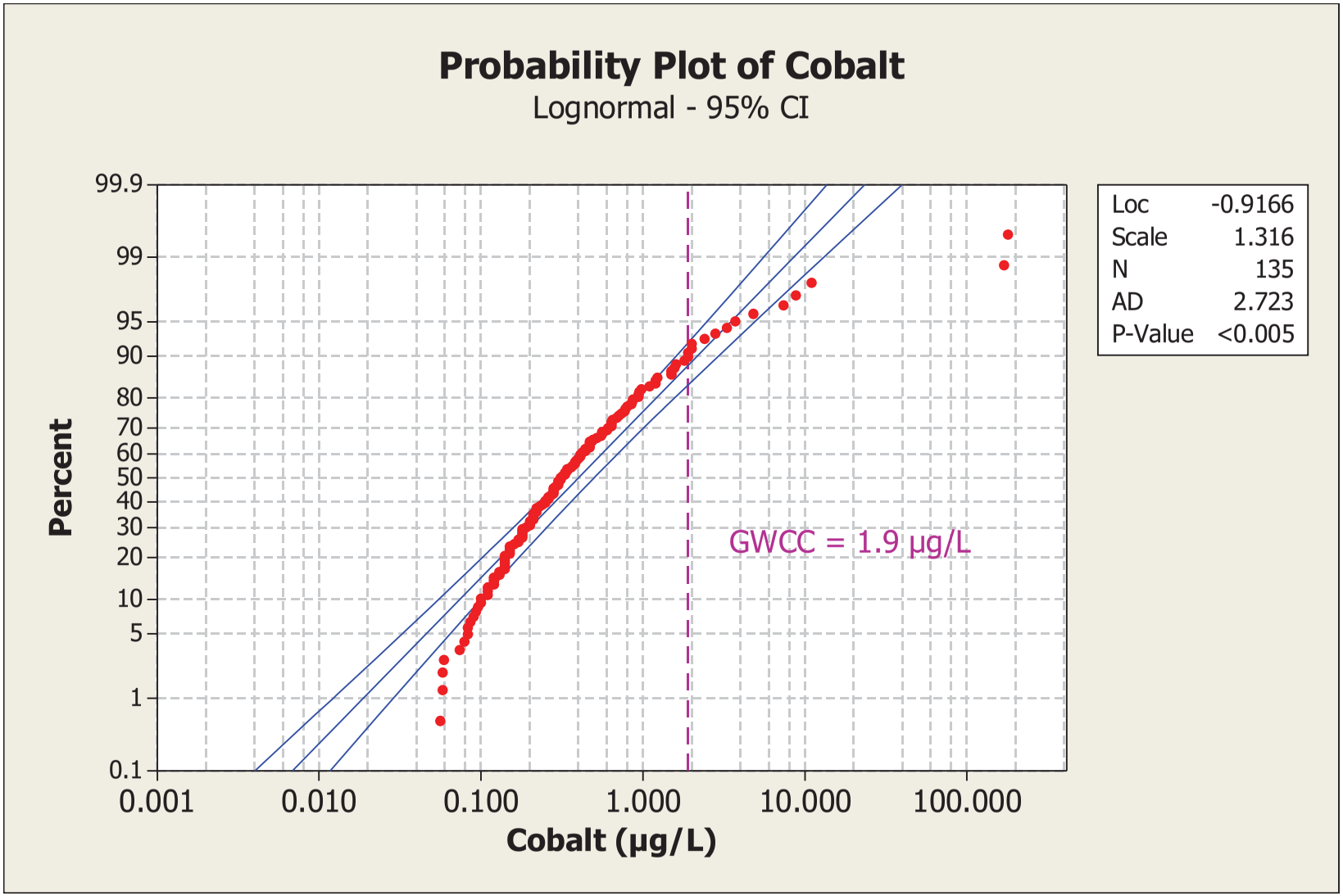

Probability Plot of Cadmium
Normal - 95% CI
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
-5.0
-2.5
0.0
2.5
5.0
7.5
Cadmium (µg/L)
GWCC = 0.2 µg/L
Mean 1.011
StDev 1.567
N 74
AD 9.666
P-Value <0.005

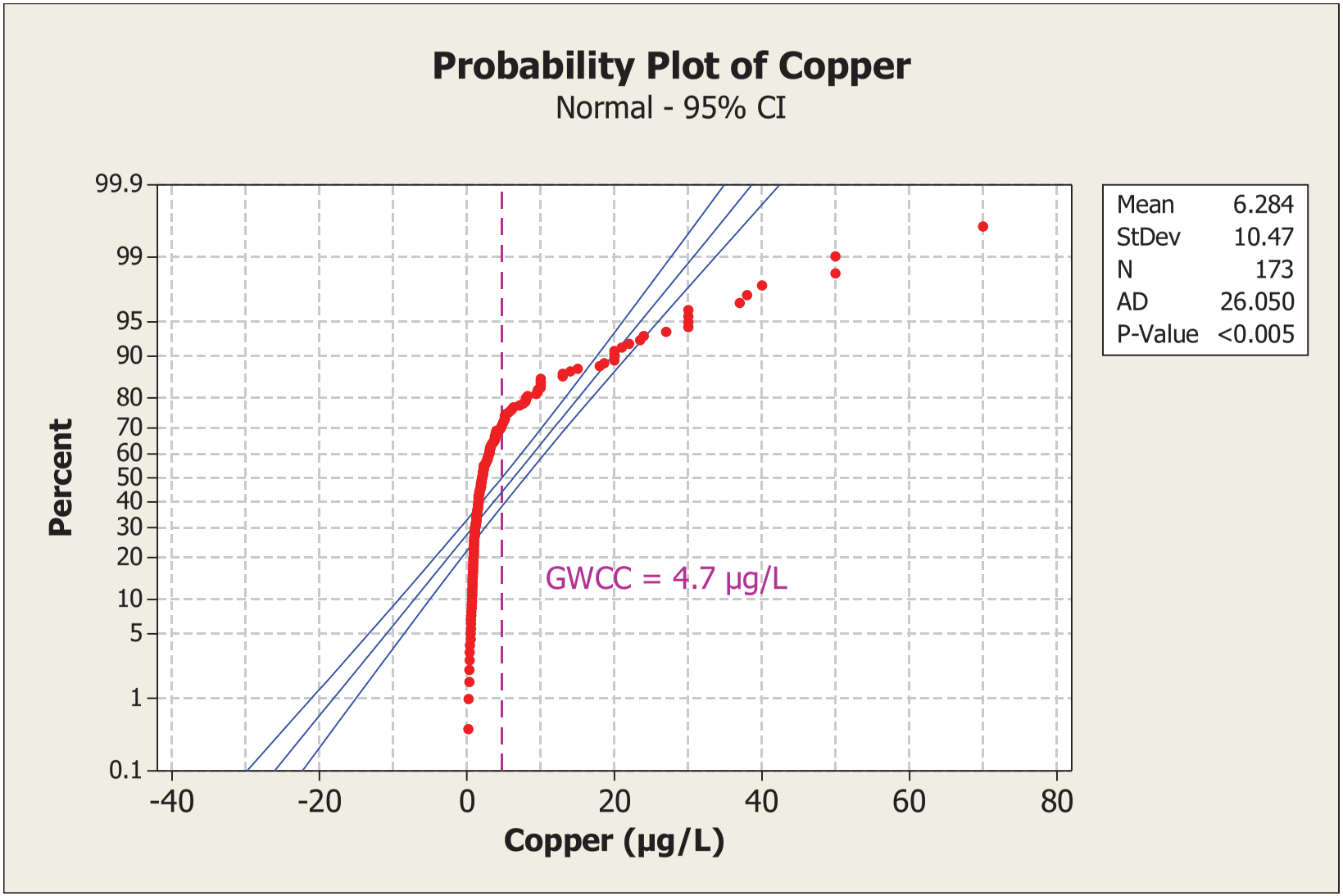

Probability Plot of Cadmium
Lognormal - 95% CI
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
0.001
0.010
0.100
1.000
10.000
100.000
Cadmium (µg/L)
GWCC = 0.2 µg/L
Loc -1.241
Scale 1.645
N 74
AD 2.709
P-Value <0.005

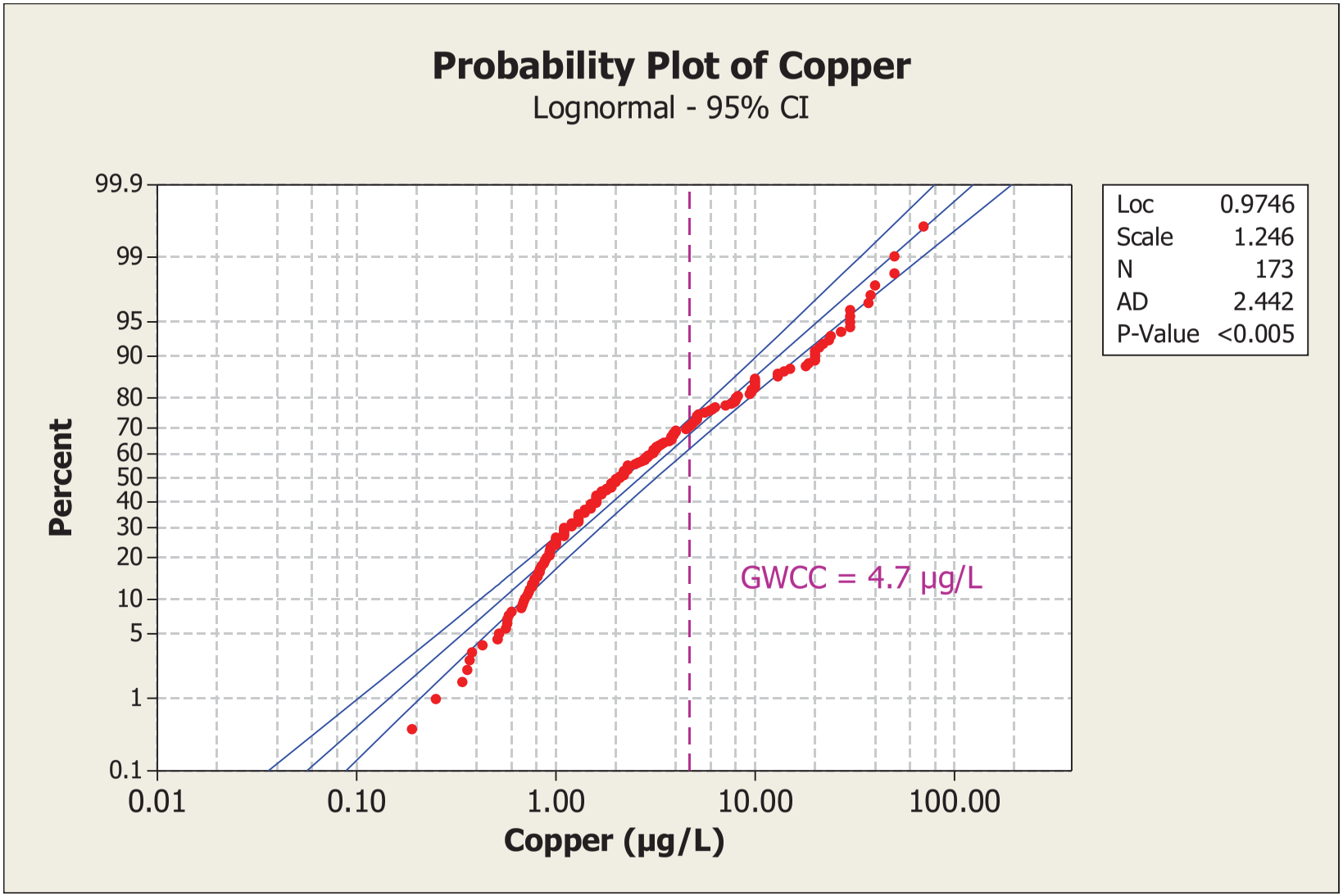

Probability Plot of Chromium
Normal - 95% CI
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
-50
-25
0
25
50
75
100
Chromium (µg/L)
GWCC = 14 µg/L
Mean 8.631
StDev 11.86
N 111
AD 10.136
P-Value <0.005

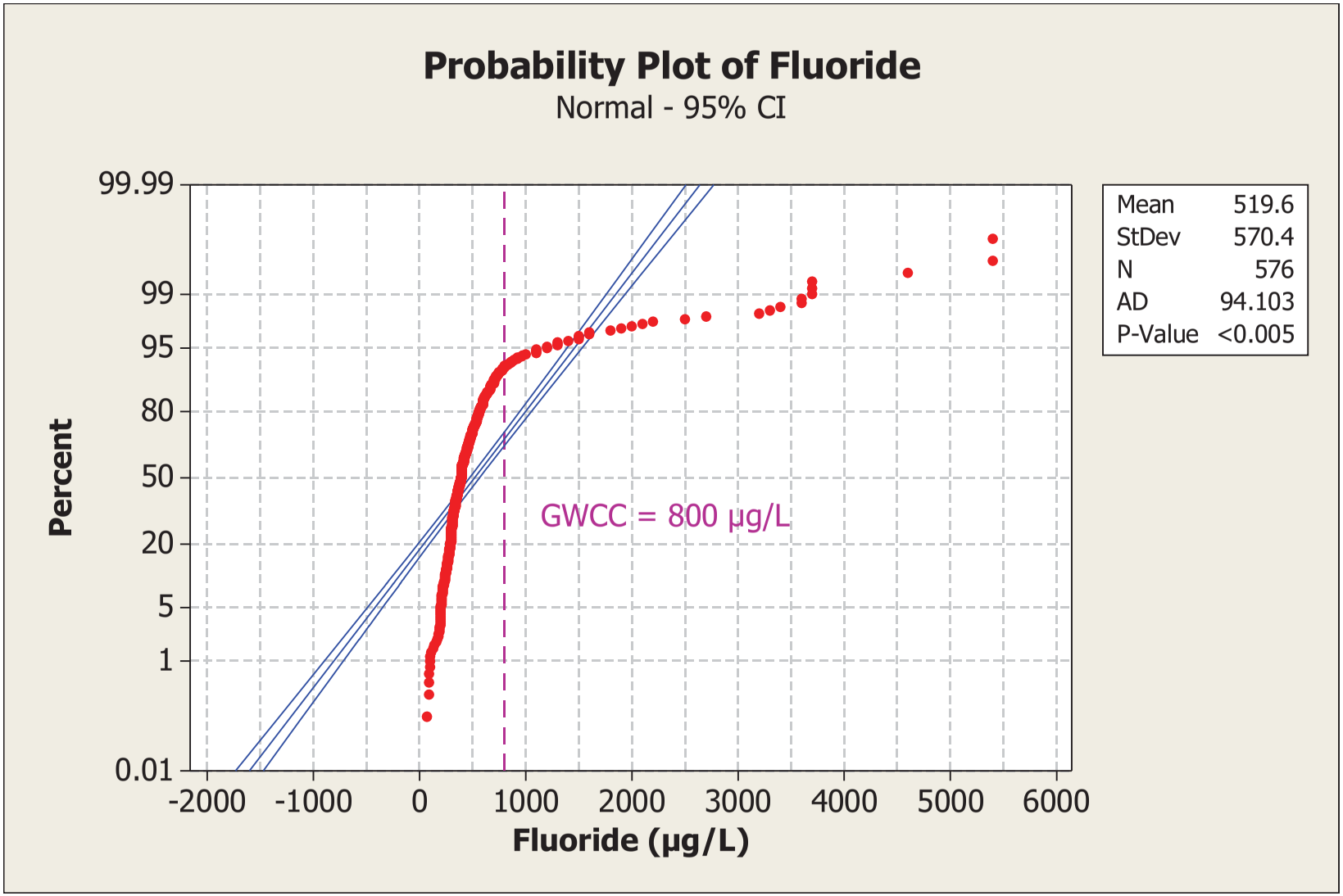

Probability Plot of Chromium
Lognormal - 95% CI
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
0.01
0.10
1.00
10.00
100.00
1000.00
Chromium (µg/L)
GWCC = 14 µg/L
Loc 1.383
Scale 1.422
N 111
AD 3.121
P-Value <0.005

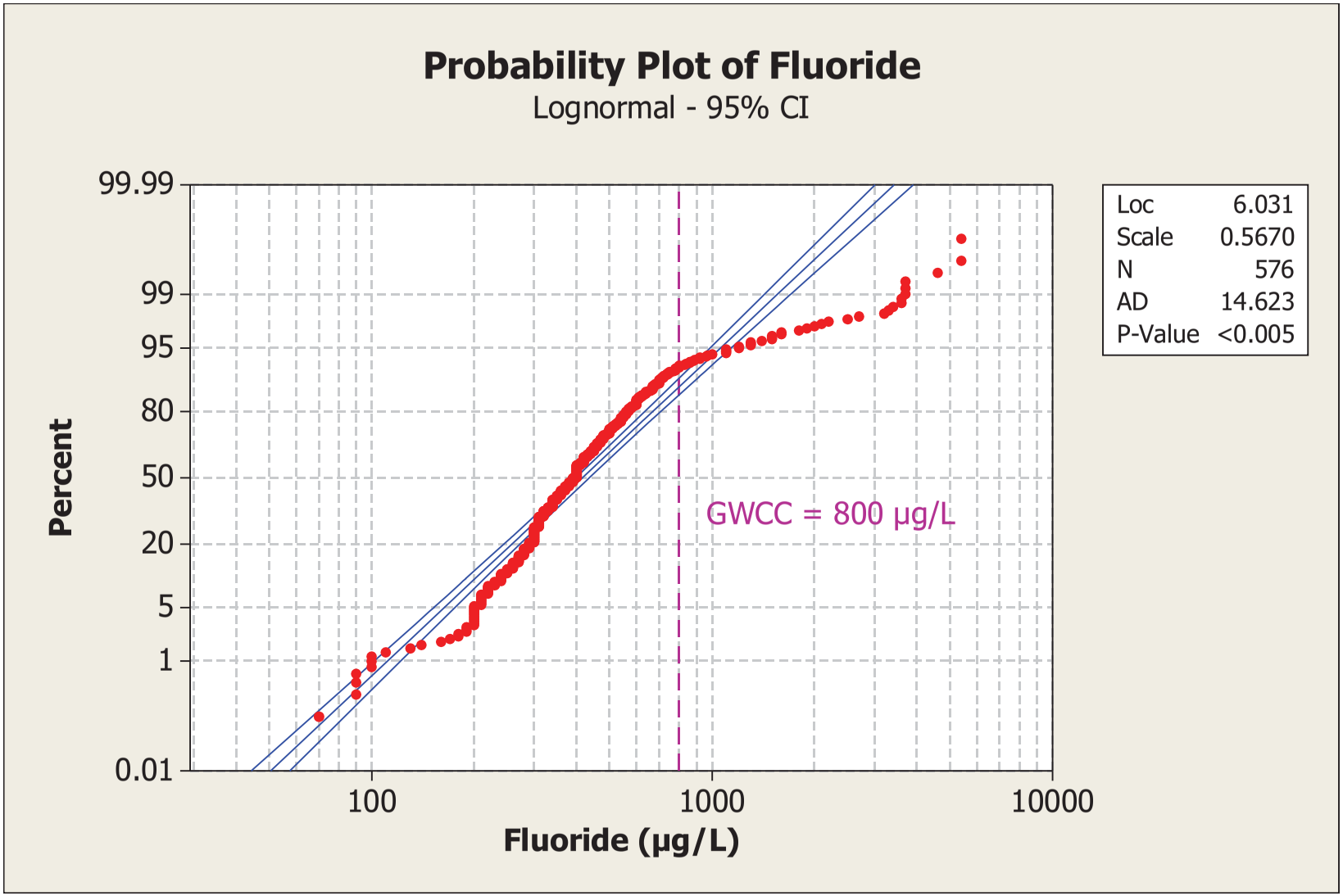

Probability Plot of Cobalt
Normal - 95% CI
Percent
99
95
90
80
70
60
50
40
30
20
10
5
1
0.01
-50
0
50
100
150
200
Cobalt (µg/L)
GWCC = 1.9 µg/L
Mean 3.347
StDev 21.19
N 135
AD 46.595
P-Value <0.005

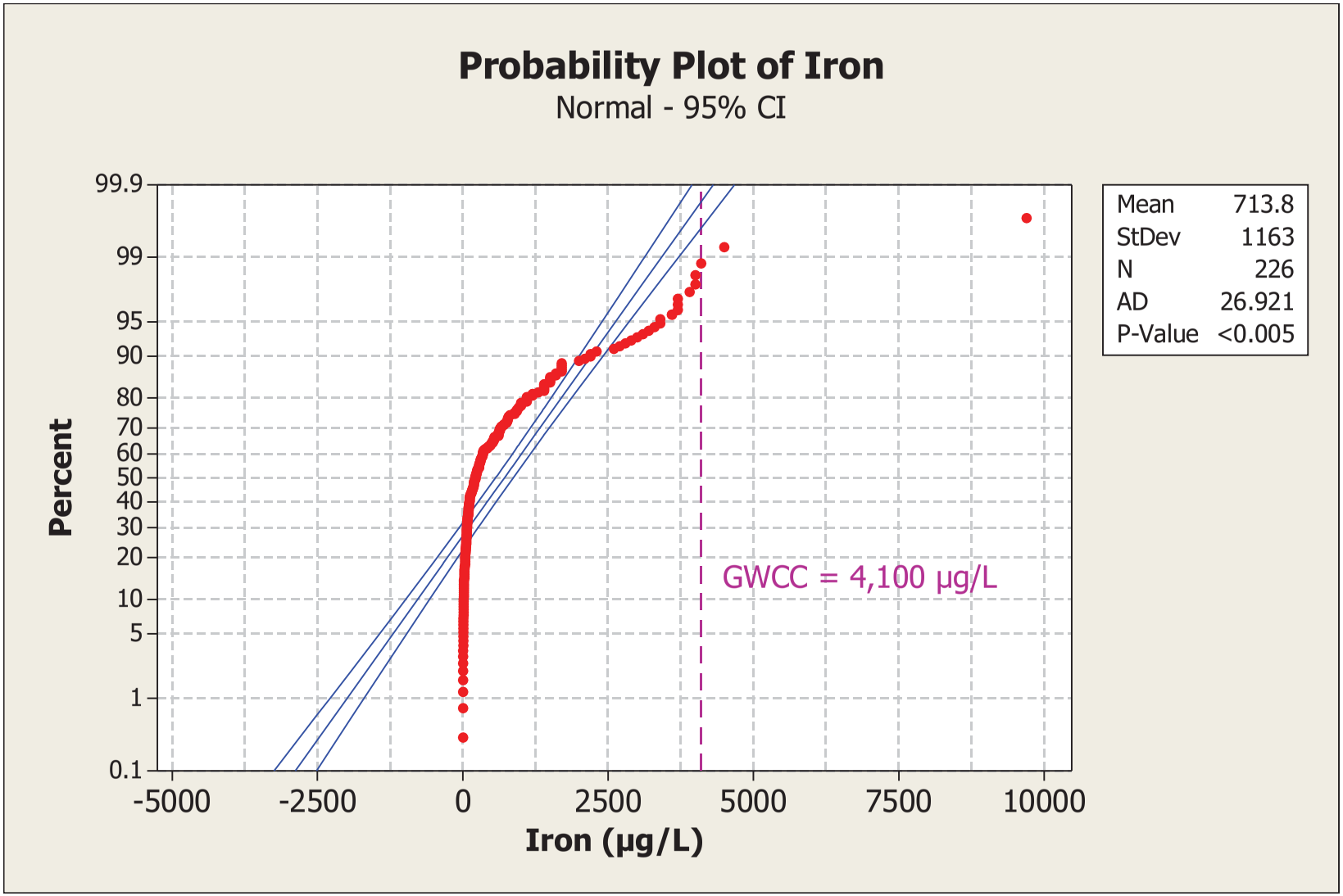

Probability Plot of Cobalt
Lognormal - 95% CI
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
0.001
0.010
0.100
1.000
10.000
100.000
Cobalt (µg/L)
GWCC = 1.9 µg/L
Loc -0.9166
Scale 1.316
N 135
AD 2.723
P-Value <0.005

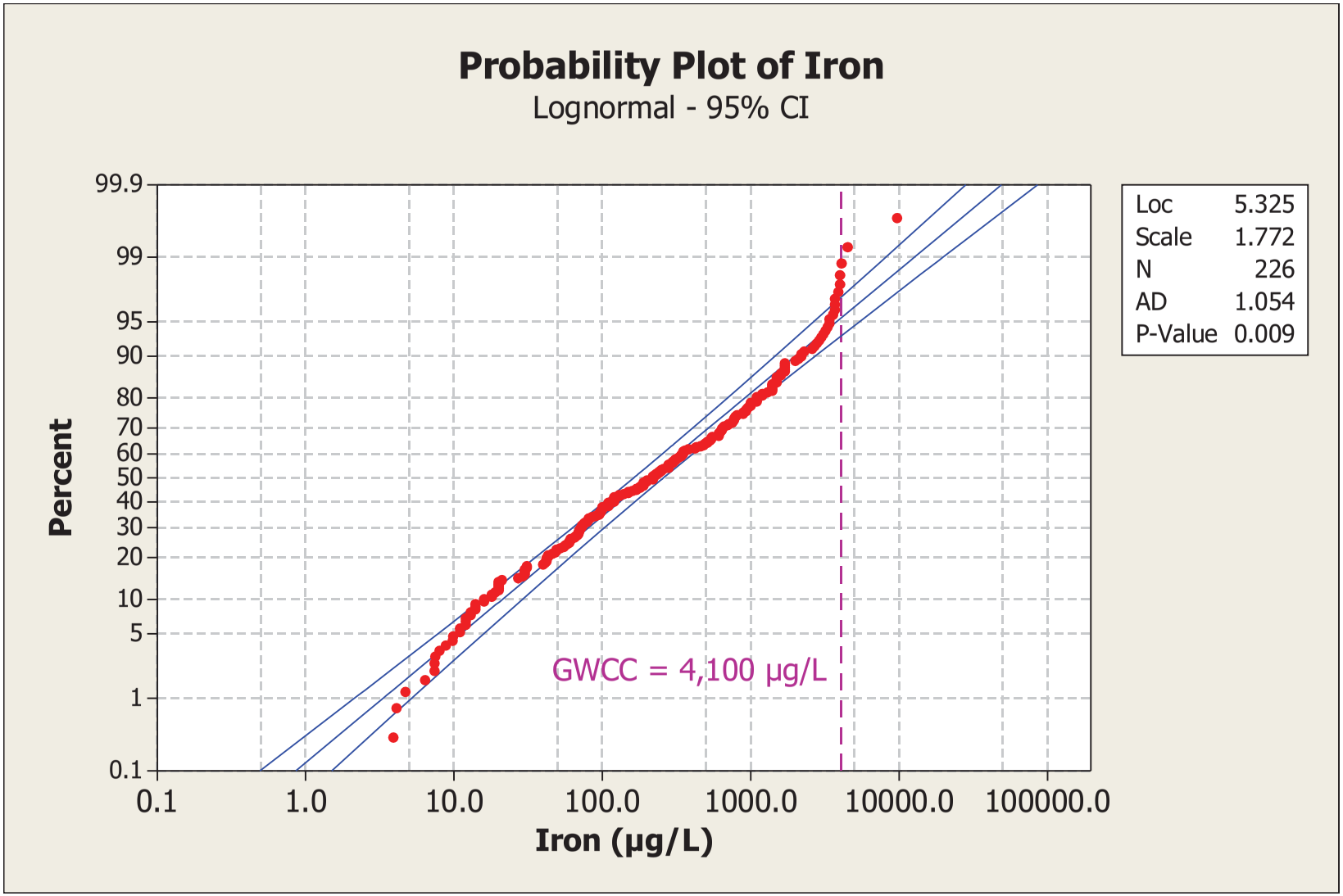

Probability Plot of Copper
Normal - 95% CI
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
-40
-20
0
20
40
60
80
Copper (µg/L)
GWCC = 4.7 µg/L
Mean 6.284
StDev 10.47
N 173
AD 26.050
P-Value <0.005

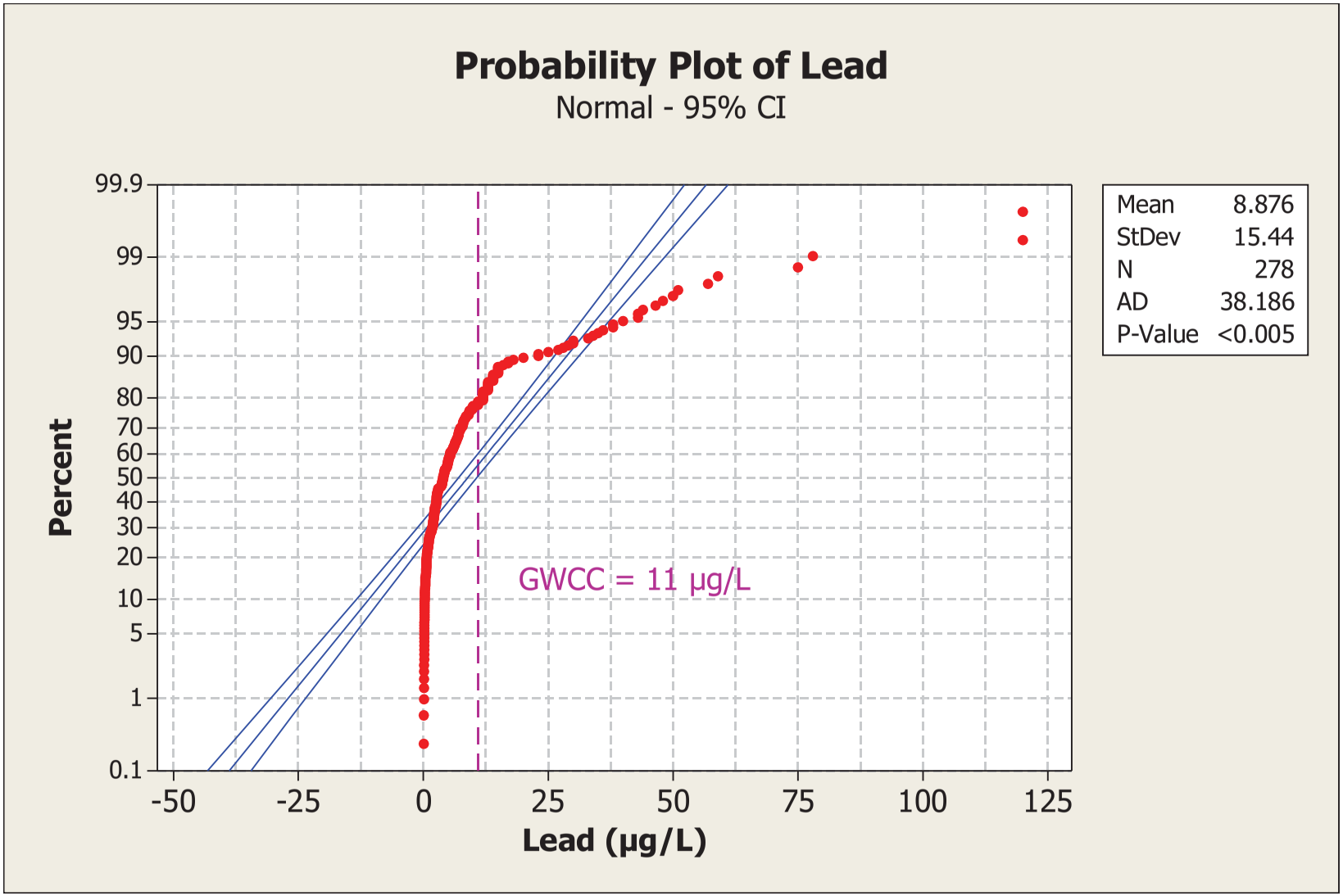

Probability Plot of Copper
Lognormal - 95% CI
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
0.01
0.10
1.00
10.00
100.00
Copper (µg/L)
GWCC = 4.7 µg/L
Loc 0.9746
Scale 1.246
N 173
AD 2.442
P-Value <0.005

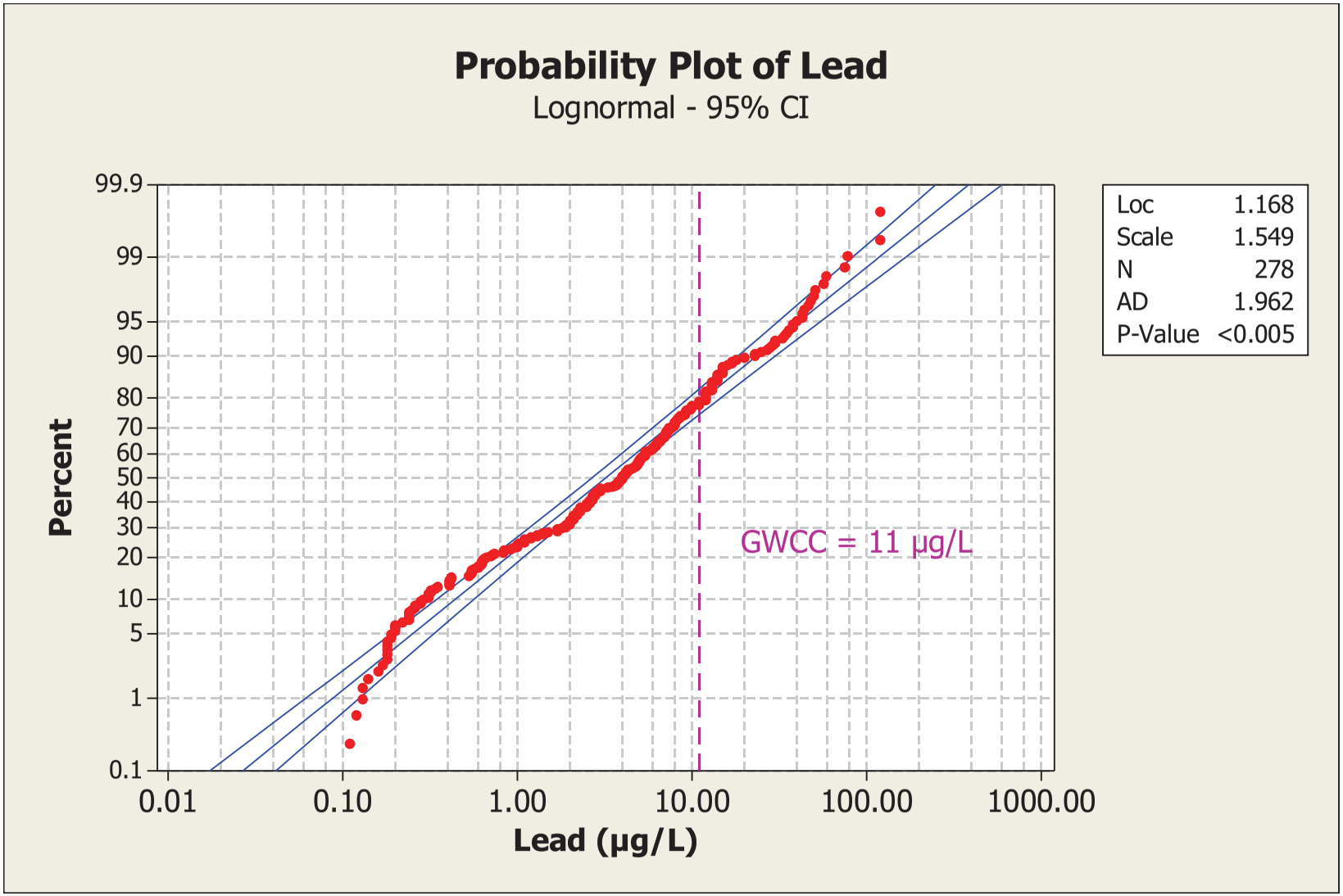

Probability Plot of Fluoride
Normal - 95% CI
Percent
99.99
99
95
80
50
20
5
1
0.01
-2000
-1000
0
1000
2000
3000
4000
5000
6000
Fluoride (µg/L)
GWCC = 800 µg/L
Mean 519.6
StDev 570.4
N 576
AD 94.103
P-Value <0.005

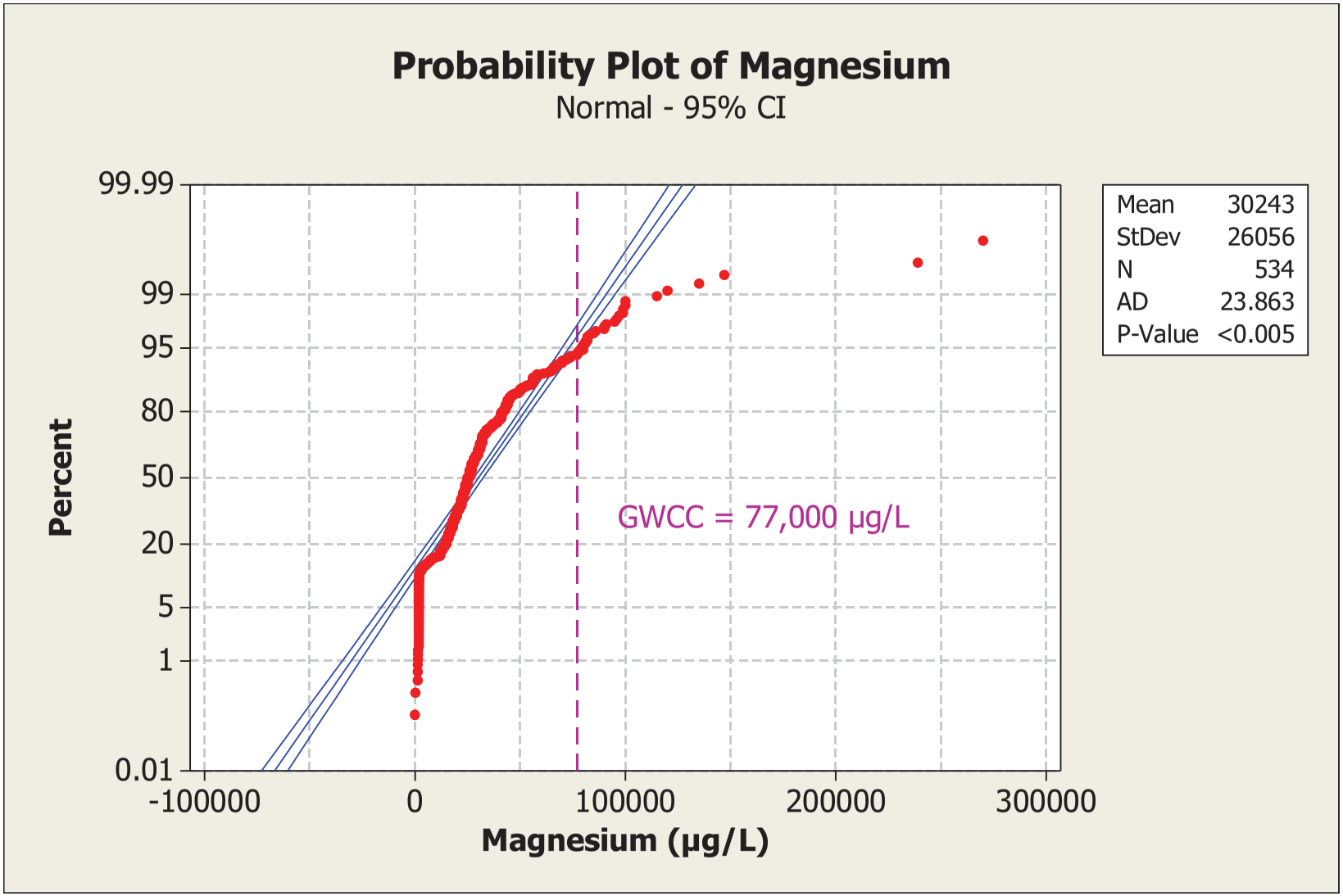

Probability Plot of Fluoride
Lognormal - 95% CI
Percent
99.99
99
95
80
50
20
5
1
0.01
100
1000
10000
Fluoride (µg/L)
GWCC = 800 µg/L
Loc 6.031
Scale 0.5670
N 576
AD 14.623
P-Value <0.005

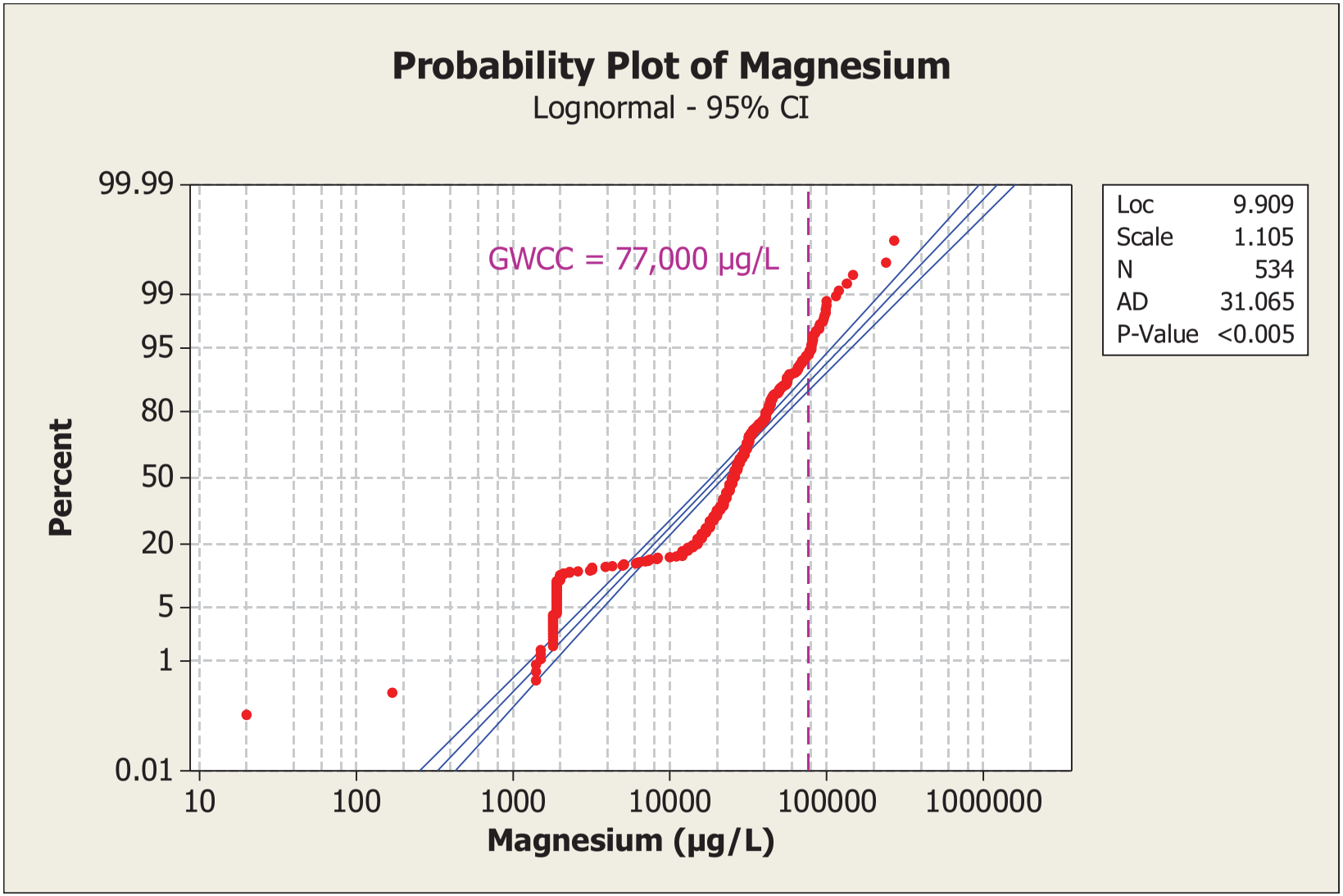

Probability Plot of Iron
Normal - 95% CI
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
-5000
-2500
0
2500
5000
7500
10000
Iron (µg/L)
GWCC = 4,100 µg/L
Mean 713.8
StDev 1163
N 226
AD 26.921
P-Value <0.005

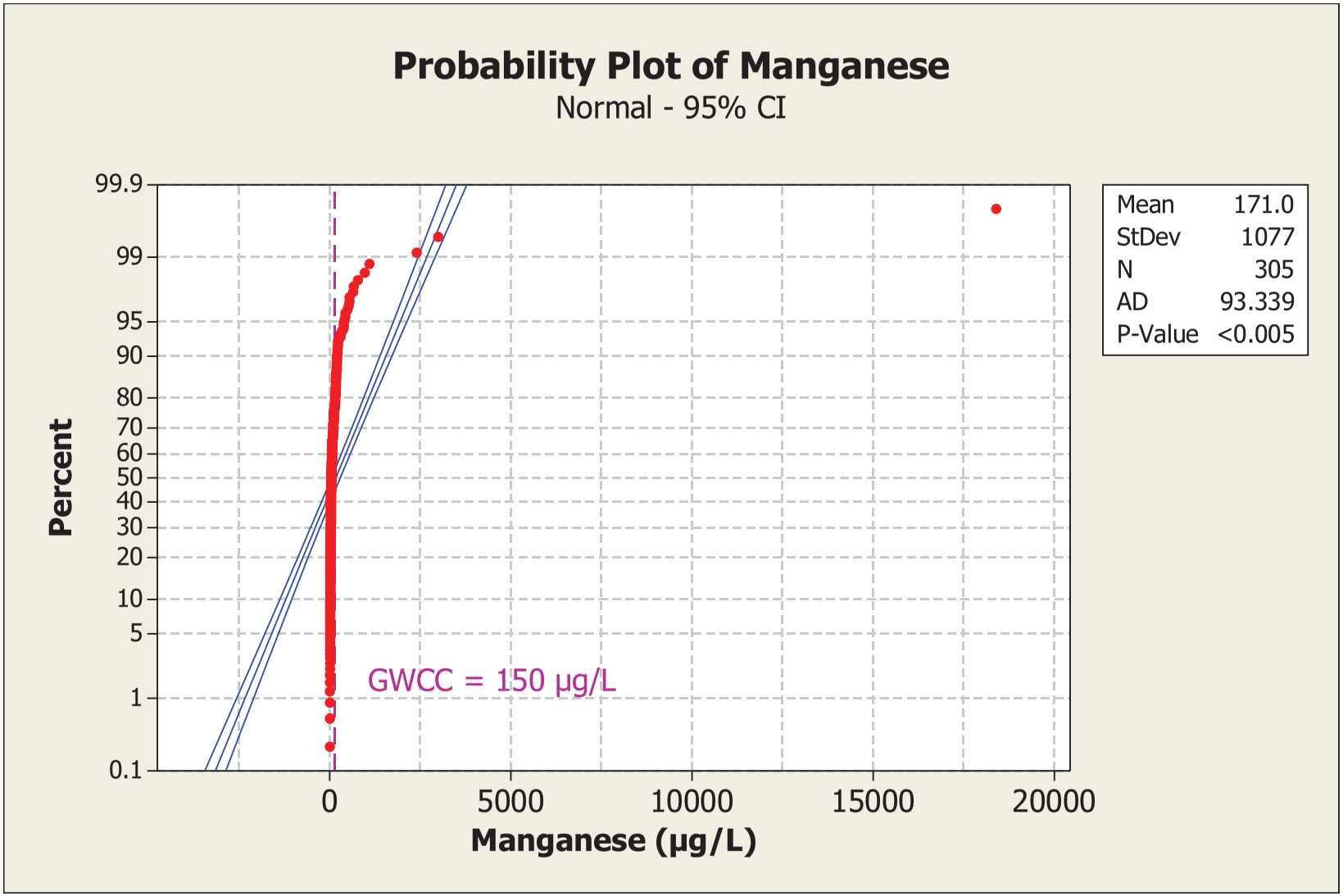

Probability Plot of Iron
Lognormal - 95% CI
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
0.1
1.0
10.0
100.0
1000.0
10000.0
100000.0
Iron (µg/L)
GWCC = 4,100 µg/L
Loc 5.325
Scale 1.772
N 226
AD 1.054
P-Value 0.009

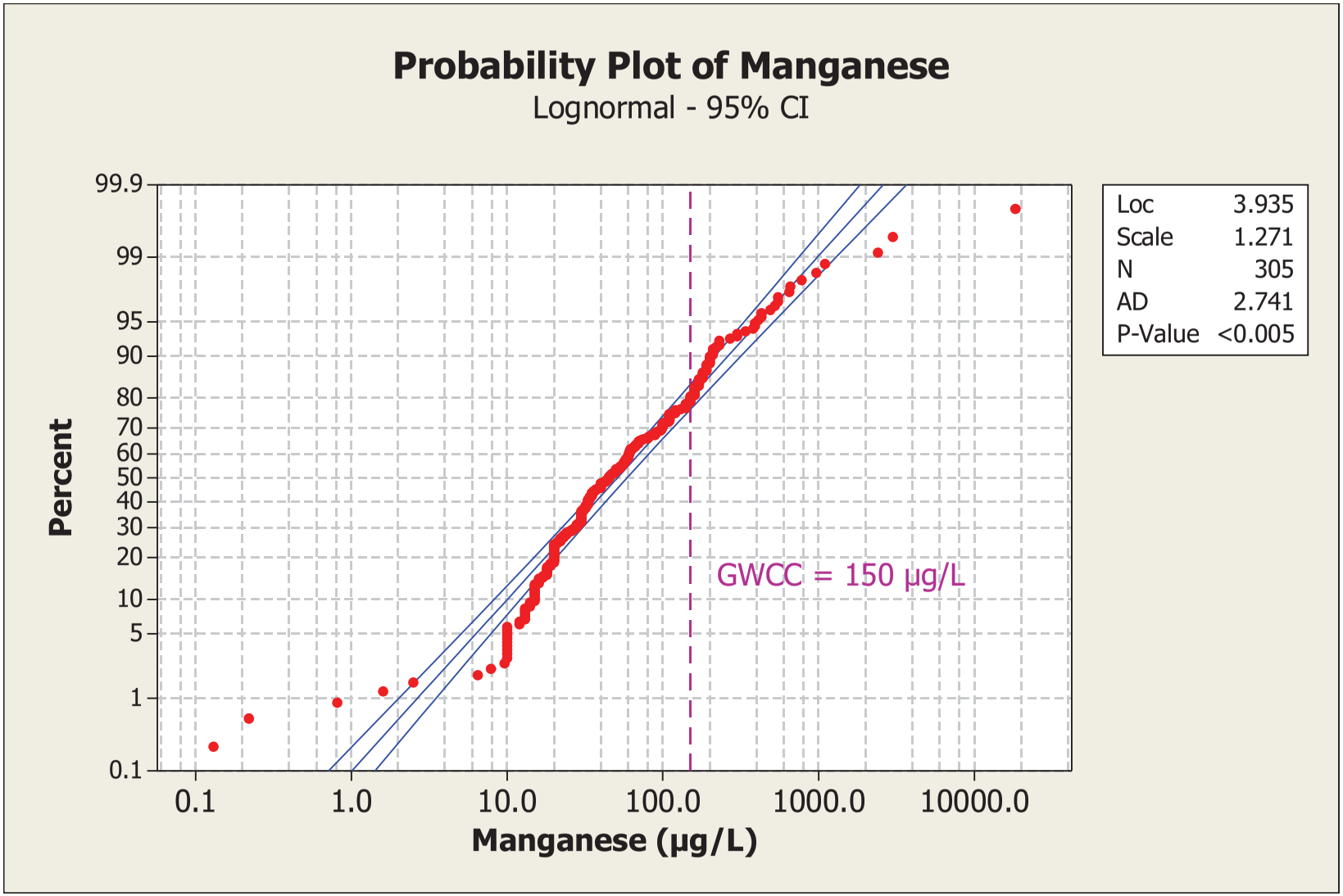

Probability Plot of Lead
Normal - 95% CI
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
-50
-25
0
25
50
75
100
125
Lead (µg/L)
GWCC = 11 µg/L
Mean 8.876
StDev 15.44
N 278
AD 38.186
P-Value <0.005


Probability Plot of Lead
Lognormal - 95% CI
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
0.01
0.10
1.00
10.00
100.00
1000.00
Lead (µg/L)
GWCC = 11 µg/L
Loc 1.168
Scale 1.549
N 278
AD 1.962
P-Value <0.005

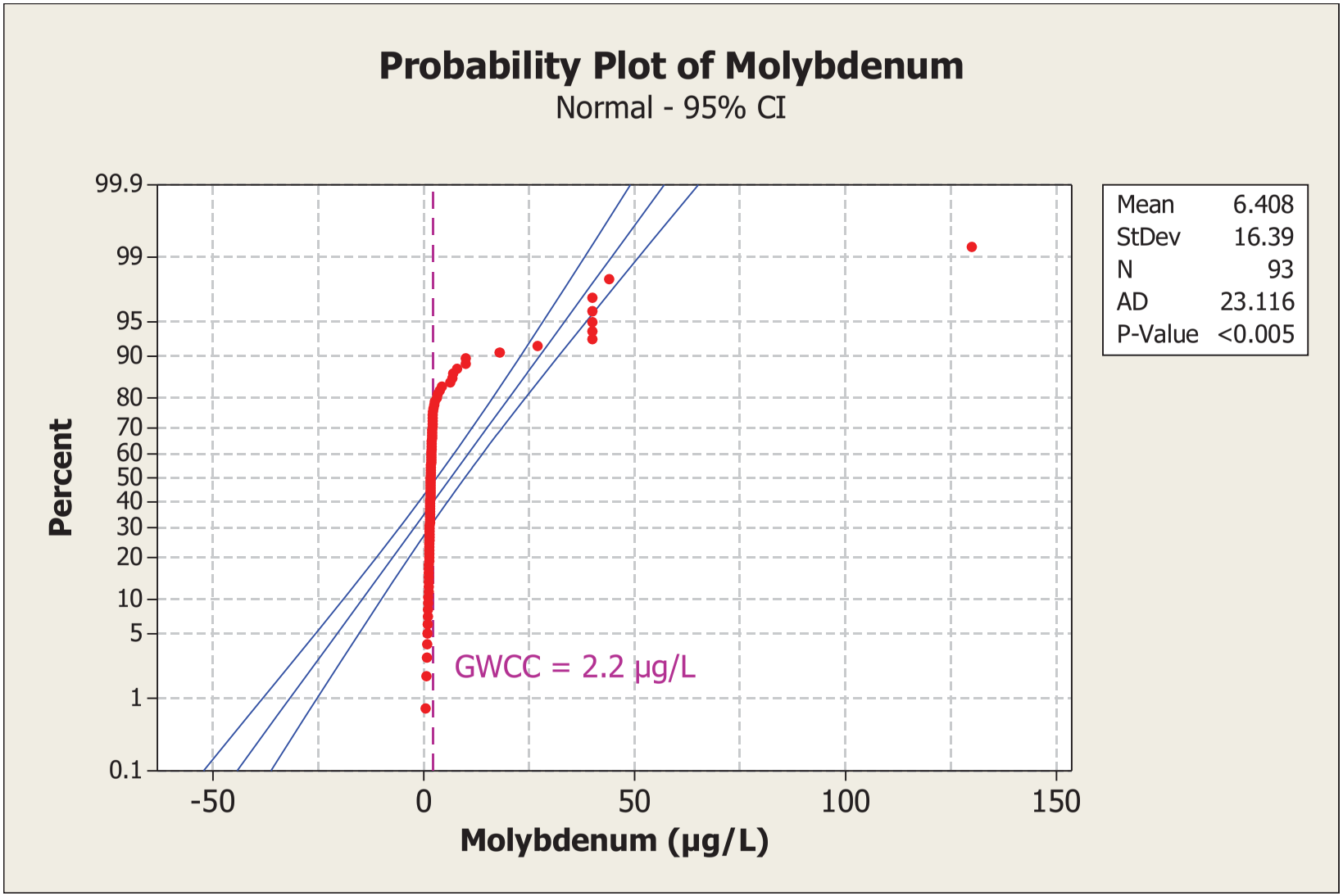

Probability Plot of Magnesium
Normal - 95% CI
Percent
99.99
99
95
80
50
20
5
1
0.01
-100000
0
100000
200000
300000
Magnesium (µg/L)
GWCC = 77,000 µg/L
Mean 30243
StDev 26056
N 534
AD 23.863
P-Value <0.005

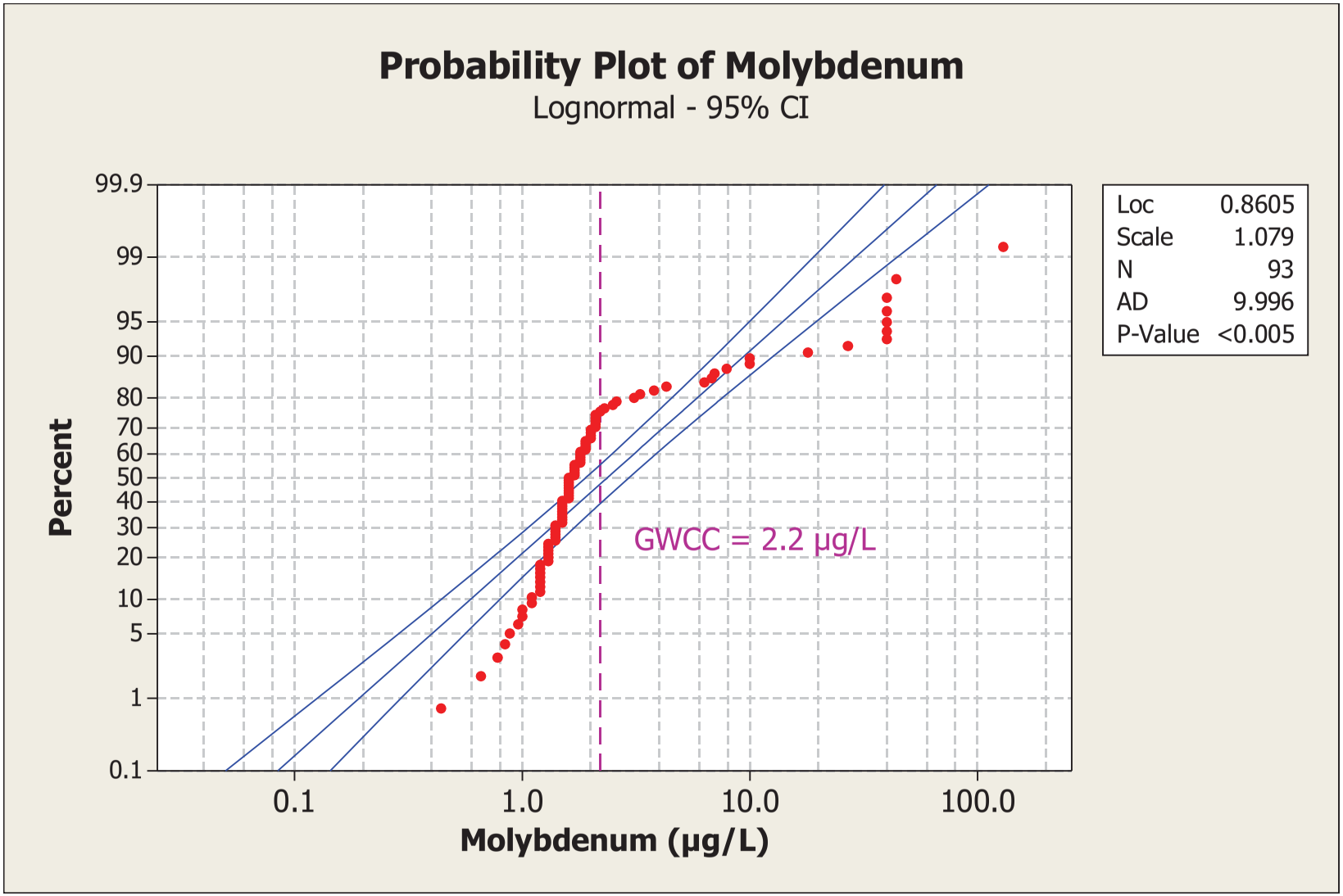

Probability Plot of Magnesium
Lognormal - 95% CI
GWCC = 77,000 µg/L
Percent
99.99
99
95
80
50
20
5
1
0.01
10
100
1000
10000
100000
1000000
Magnesium (µg/L)
Loc 9.909
Scale 1.105
N 534
AD 31.065
P-Value <0.005

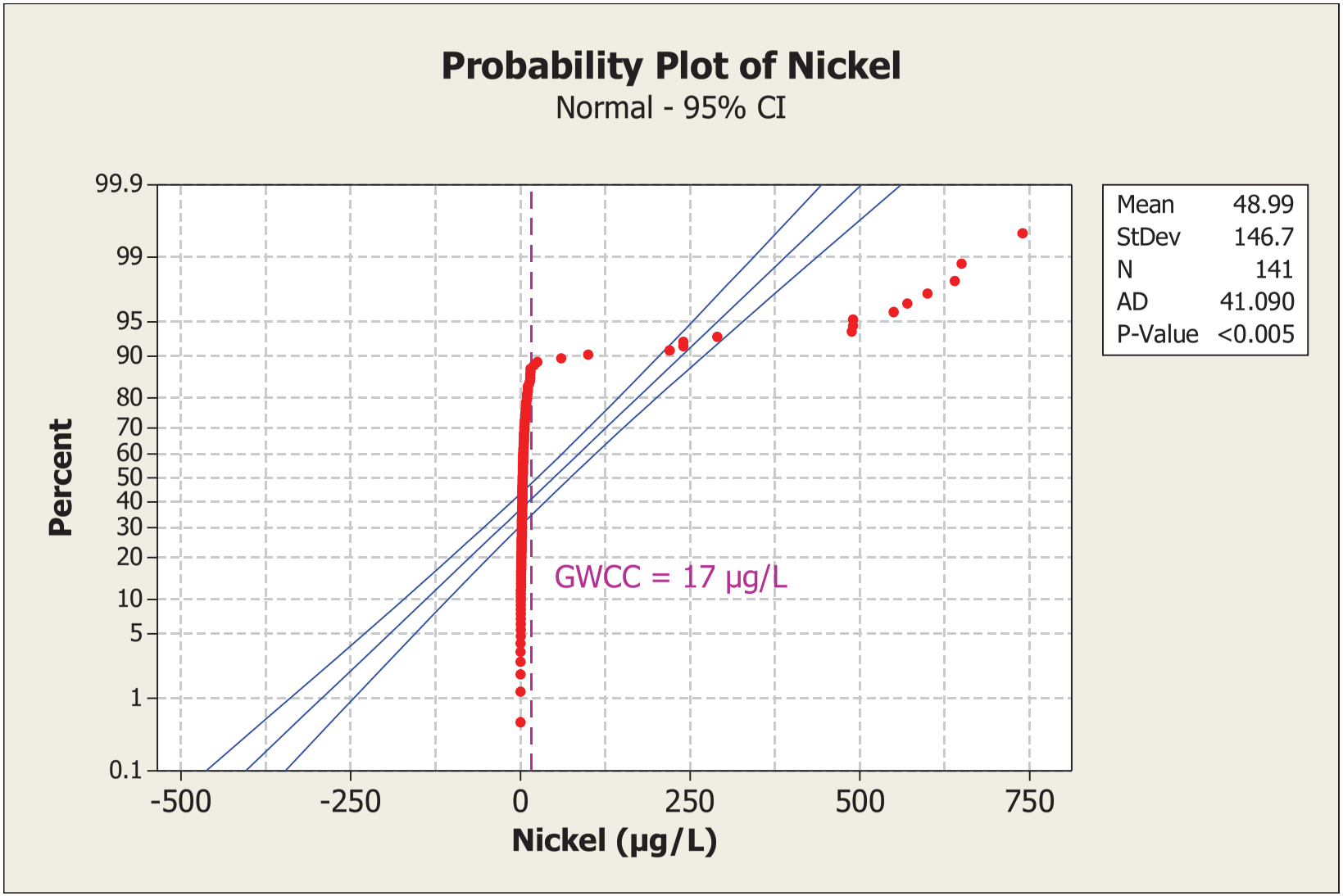

Probability Plot of Manganese
Normal - 95% CI
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
0
5000
10000
15000
20000
Manganese (µg/L)
GWCC = 150 µg/L
Mean 171.0
StDev 1077
N 305
AD 93.339
P-Value <0.005

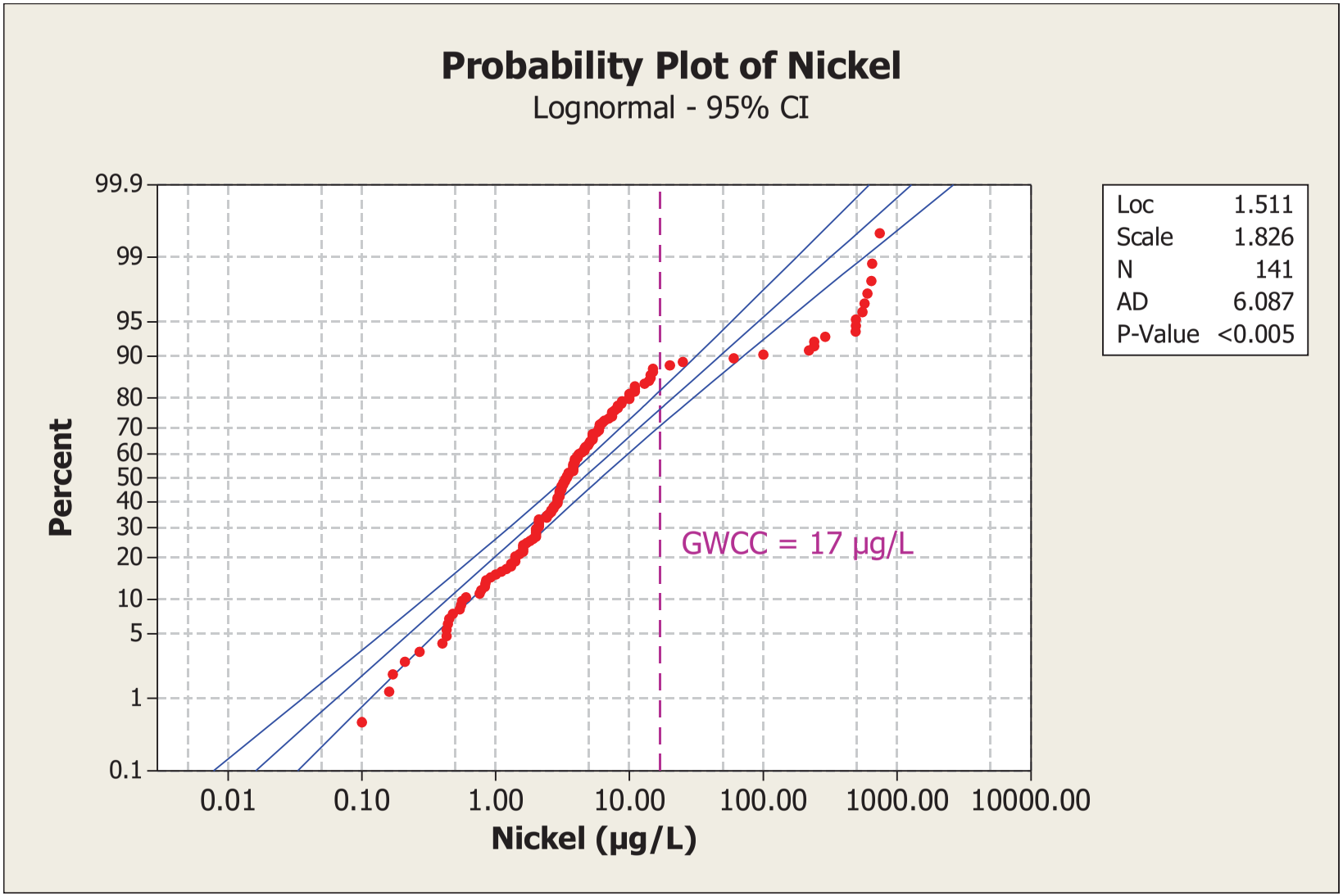

Probability Plot of Manganese
Lognormal - 95% CI
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
0.1
1.0
10.0
100.0
1000.0
10000.0
Manganese (µg/L)
GWCC = 150 µg/L
Loc 3.935
Scale 1.271
N 305
AD 2.741
P-Value <0.005

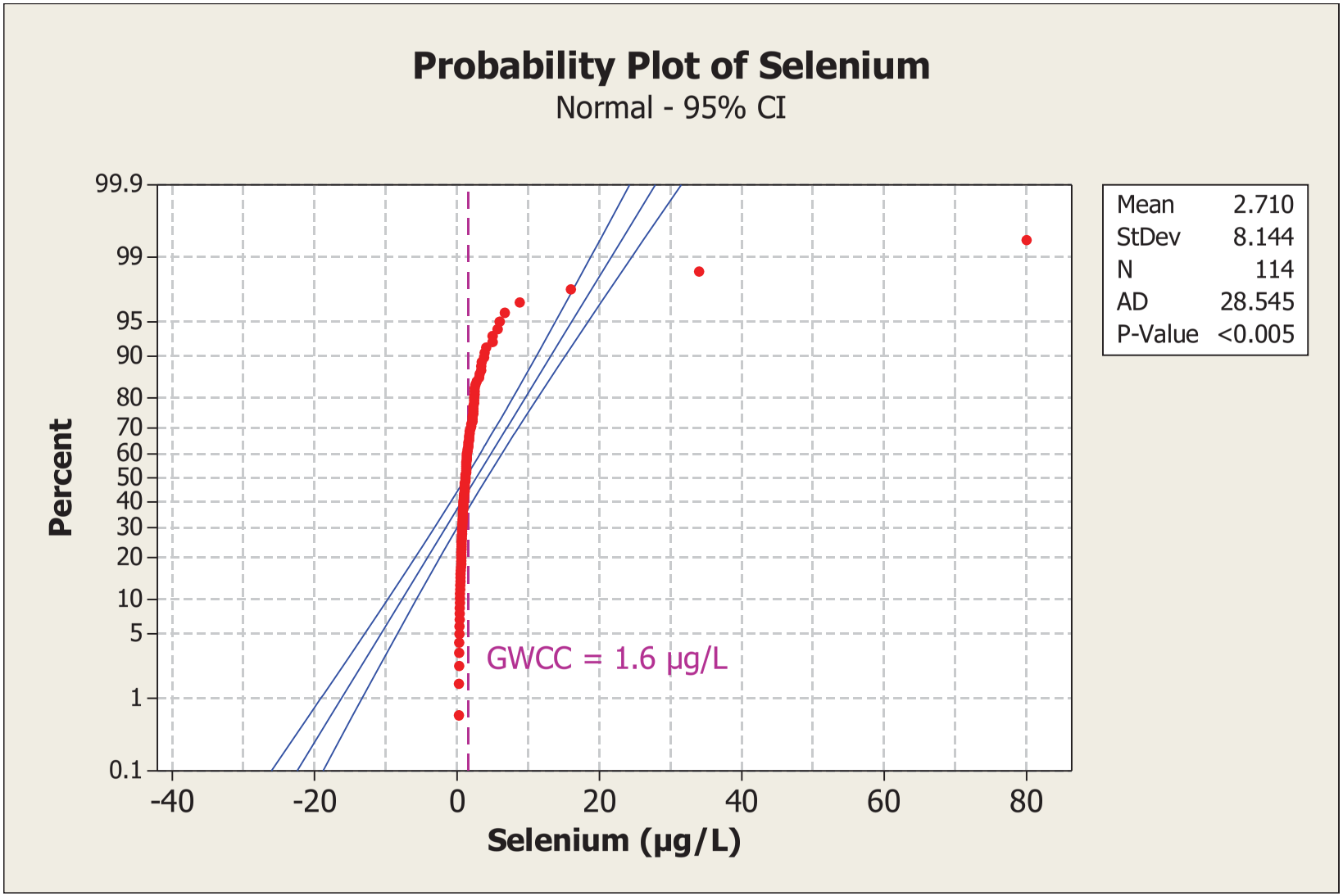
Probability plots are not included for **mercury**. Comparison concentrations are based on detection limits for this metal (see main text).

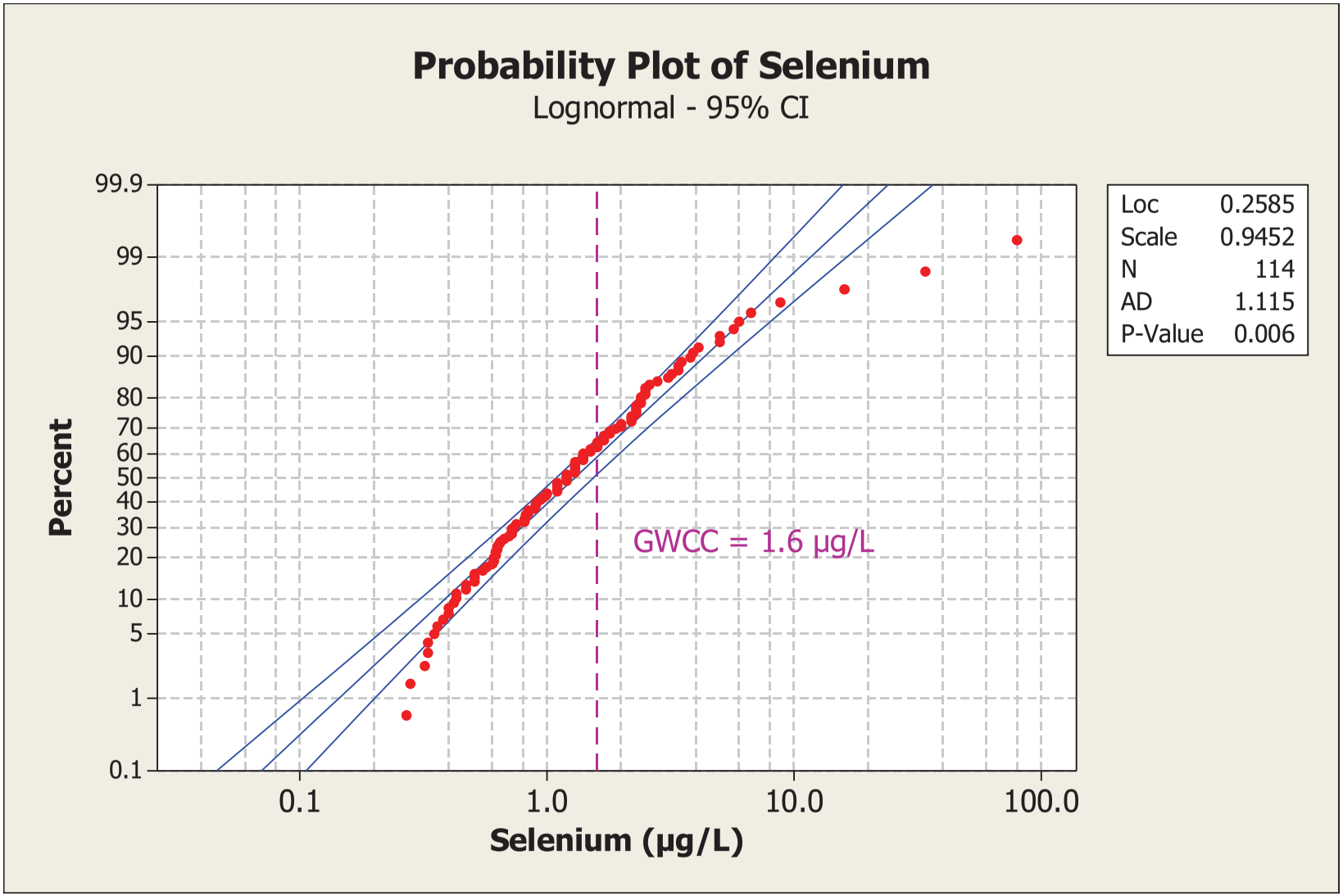

Probability Plot of Molybdenum
Normal - 95% CI
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
-50
0
50
100
150
Molybdenum (µg/L)
GWCC = 2.2 µg/L
Mean 6.408
StDev 16.39
N 93
AD 23.116
P-Value <0.005


Probability Plot of Molybdenum
Lognormal - 95% CI
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
0.1
1.0
10.0
100.0
Molybdenum (µg/L)
GWCC = 2.2 µg/L
Loc 0.8605
Scale 1.079
N 93
AD 9.996
P-Value <0.005

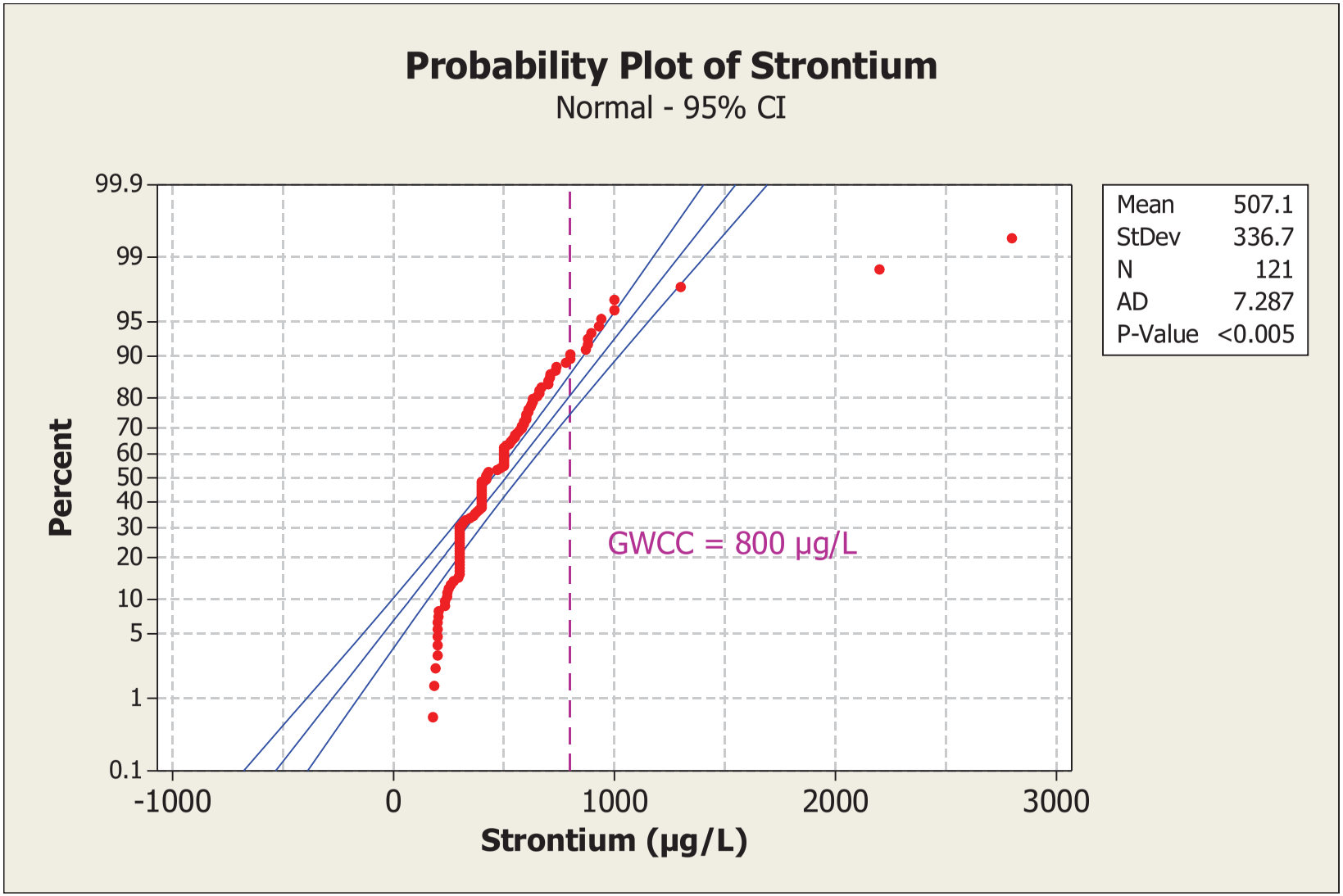

Probability Plot of Nickel
Normal - 95% CI
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
-500
-250
0
250
500
750
Nickel (µg/L)
GWCC = 17 µg/L
Mean 48.99
StDev 146.7
N 141
AD 41.090
P-Value <0.005

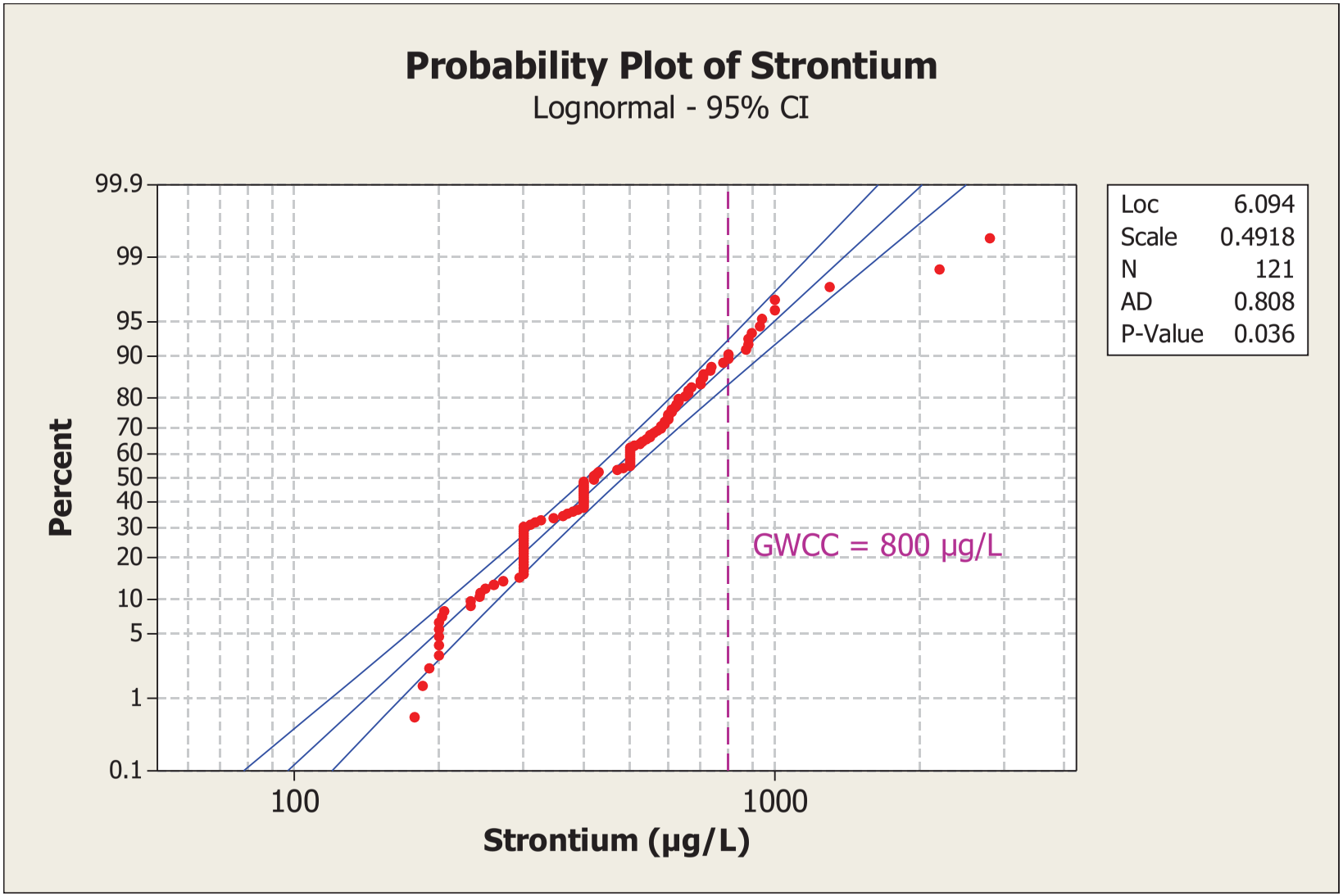

Probability Plot of Nickel
Lognormal - 95% CI
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
0.01
0.10
1.00
10.00
100.00
1000.00
10000.00
Nickel (µg/L)
GWCC = 17 µg/L
Loc 1.511
Scale 1.826
N 141
AD 6.087
P-Value <0.005


Probability Plot of Selenium
Normal - 95% CI
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
-40
-20
0
20
40
60
80
Selenium (µg/L)
GWCC = 1.6 µg/L
Mean 2.710
StDev 8.144
N 114
AD 28.545
P-Value <0.005


Probability Plot of Selenium
Lognormal - 95% CI
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
0.1
1.0
10.0
100.0
Selenium (µg/L)
GWCC = 1.6 µg/L
Loc 0.2585
Scale 0.9452
N 114
AD 1.115
P-Value 0.006

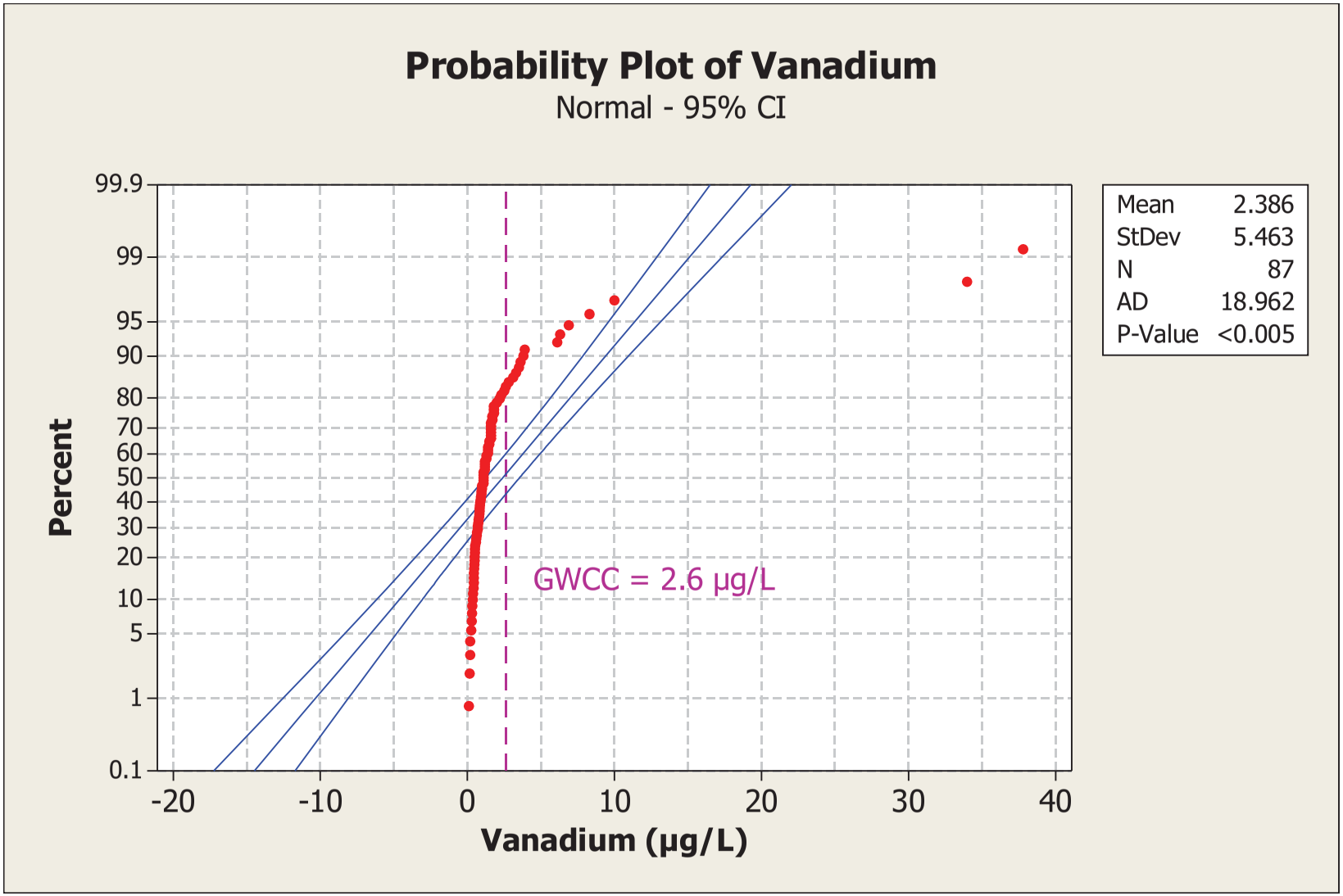
Probability plots are not included for **silver**. Comparison concentrations are based on detection limits for this metal (see main text).

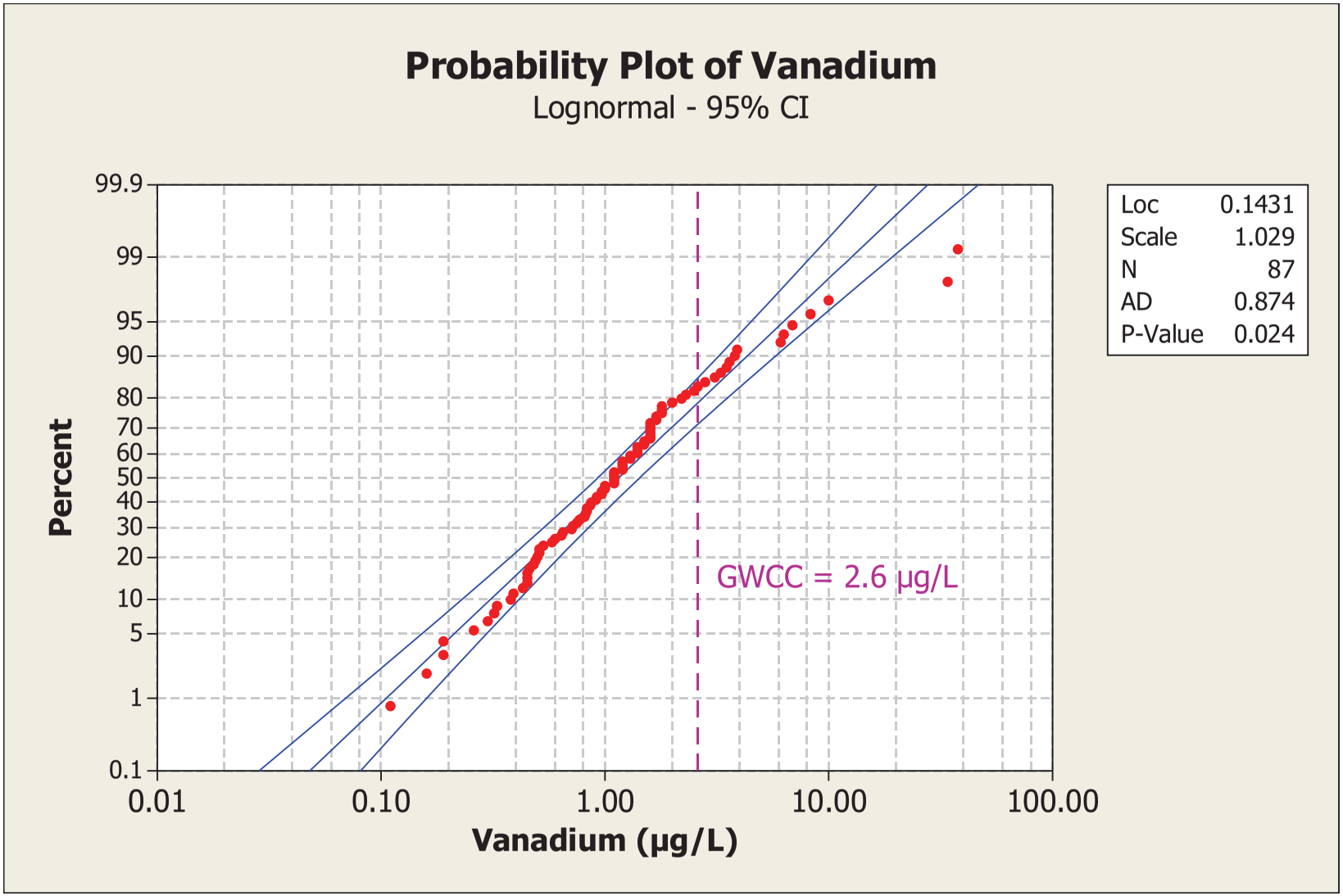

Probability Plot of Strontium
Normal - 95% CI
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
-1000
0
1000
2000
3000
Strontium (µg/L)
GWCC = 800 µg/L
Mean 507.1
StDev 336.7
N 121
AD 7.287
P-Value <0.005

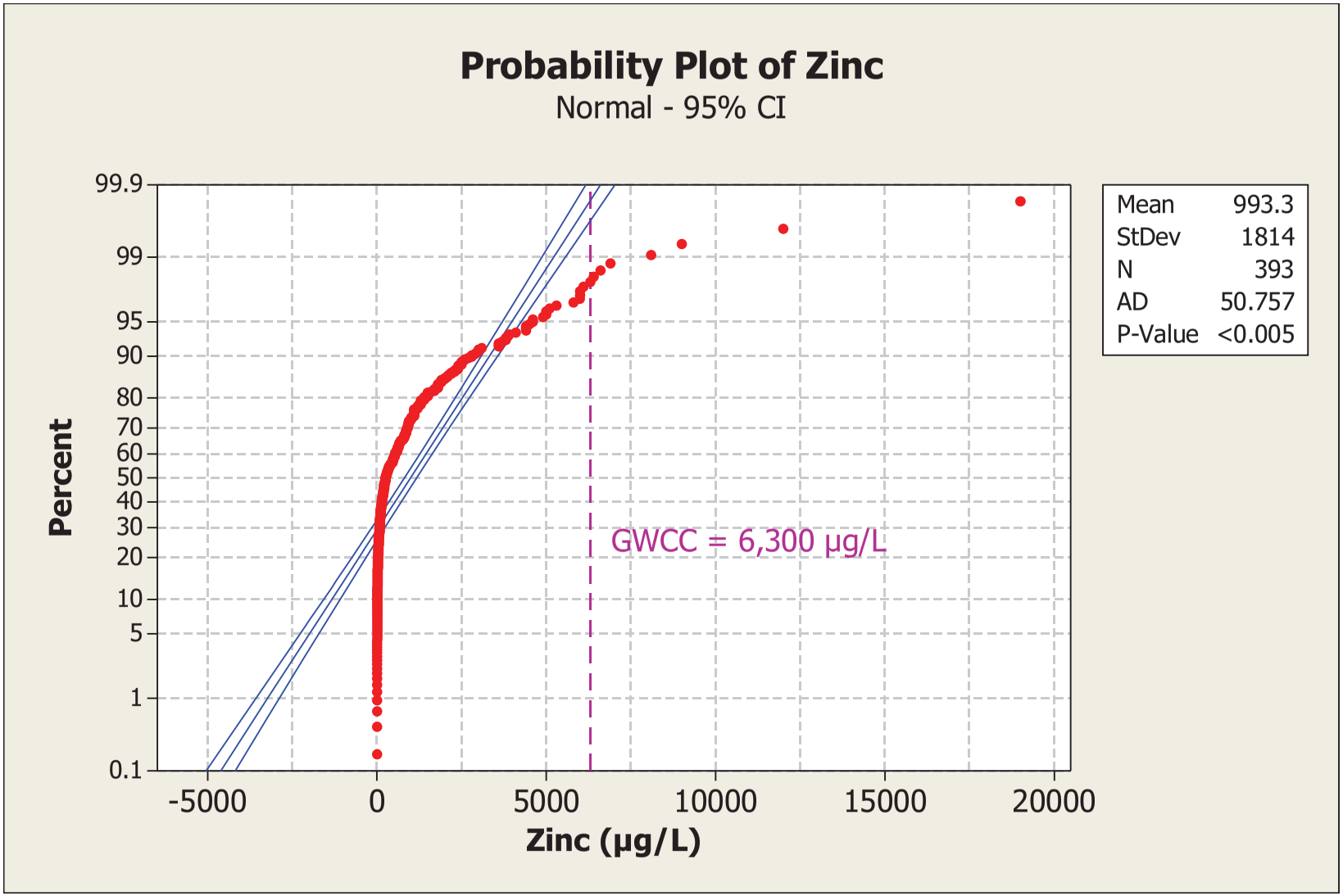

Probability Plot of Strontium
Lognormal - 95% CI
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
100
1000
Strontium (µg/L)
GWCC = 800 µg/L
Loc 6.094
Scale 0.4918
N 121
AD 0.808
P-Value 0.036

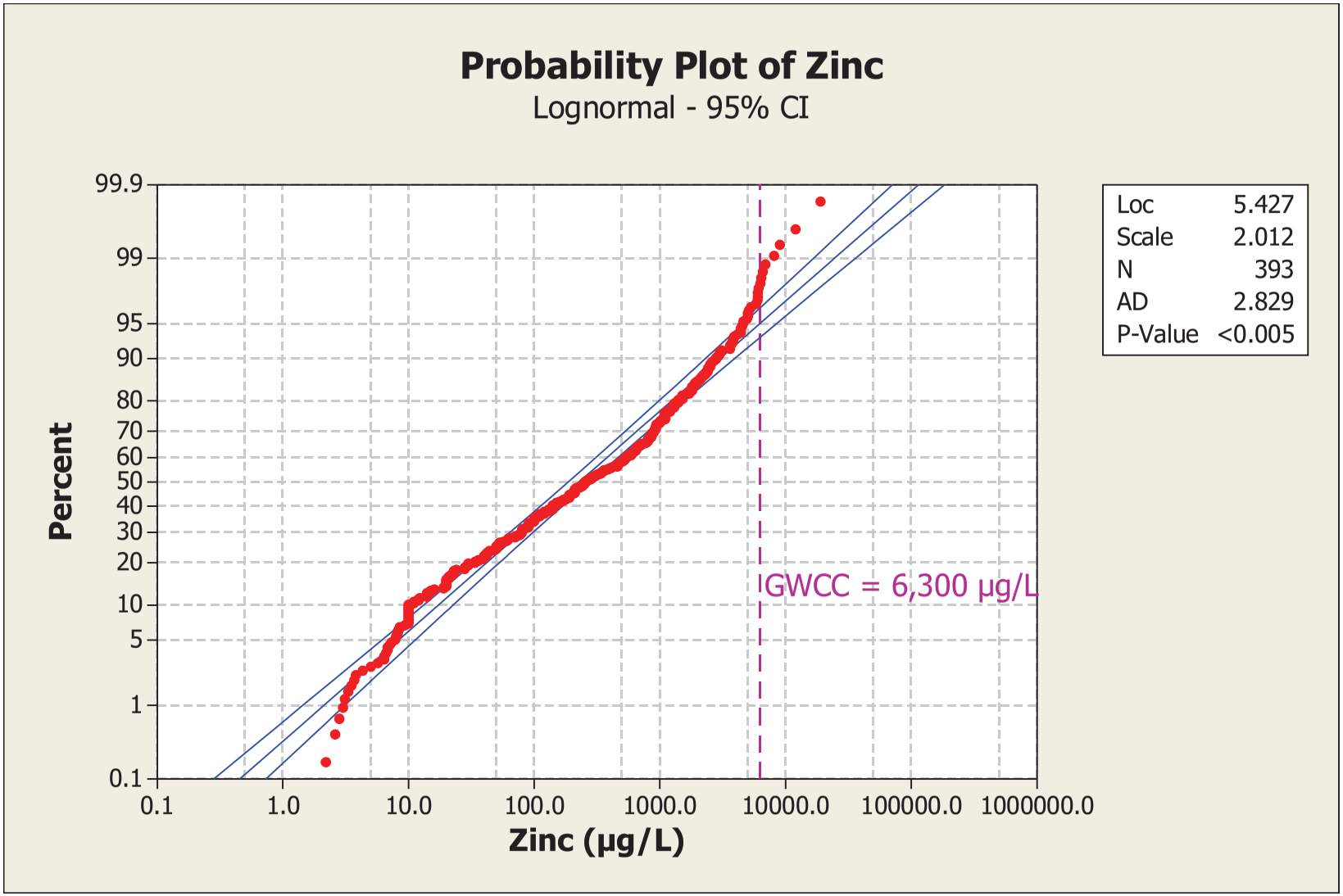
Probability plots are not included for **Thallium**. Comparison concentrations are based on detection limits for this metal (see main text).

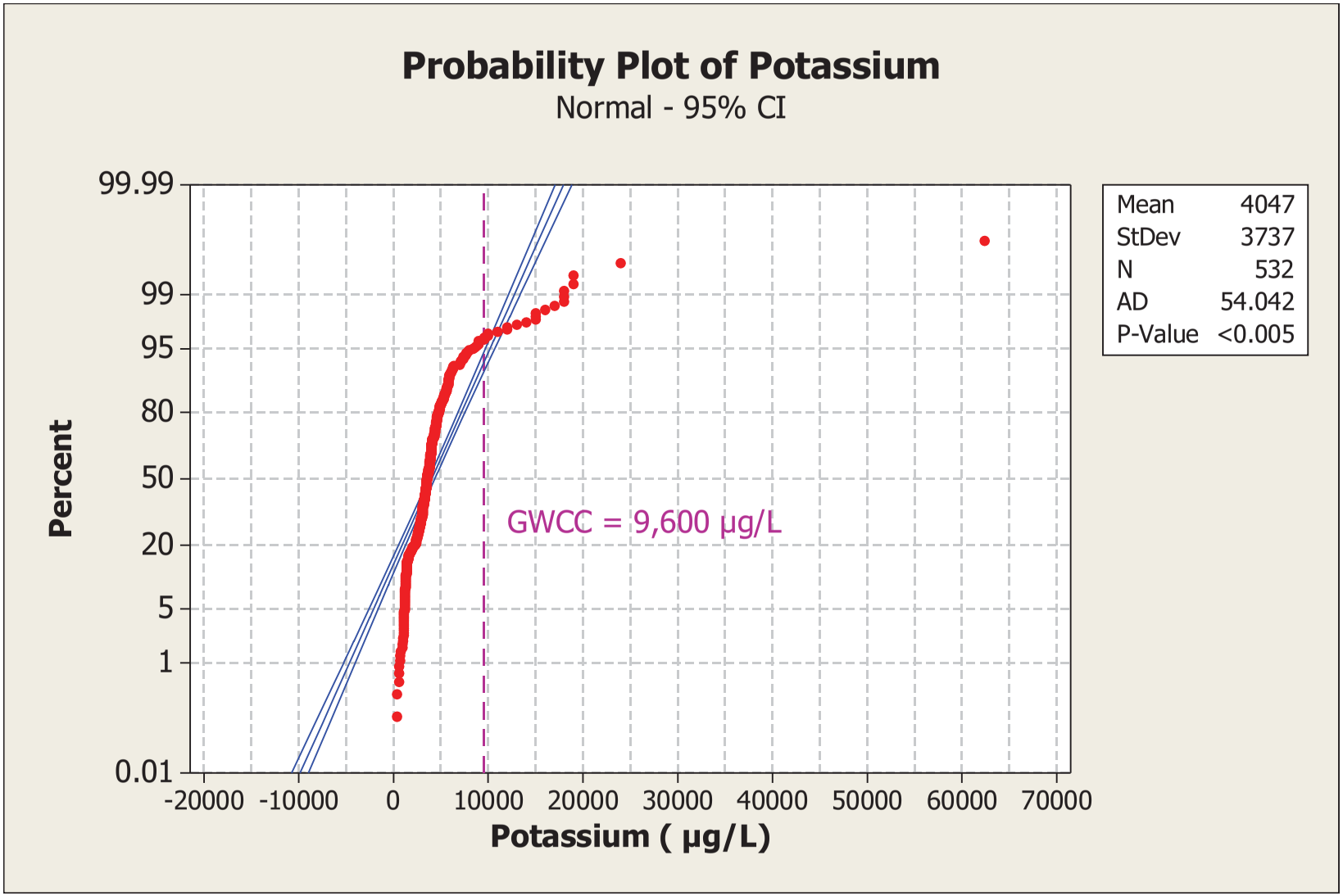
Probability plots are not included for **tin**. Comparison concentrations are based on detection limits for this metal (see main text).

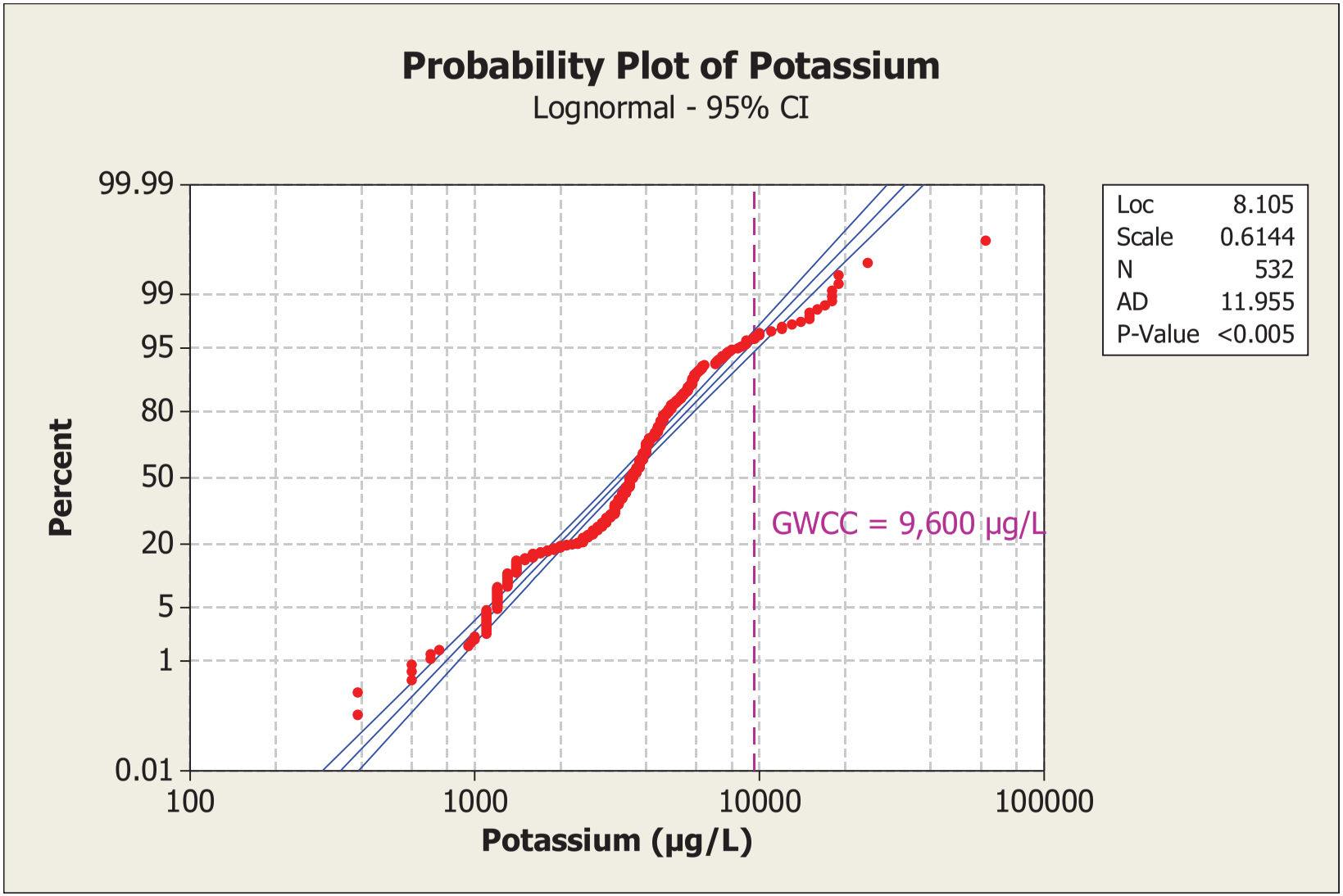

Probability Plot of Vanadium
Normal - 95% CI
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
-20
-10
0
10
20
30
40
Vanadium (µg/L)
GWCC = 2.6 µg/L
Mean 2.386
StDev 5.463
N 87
AD 18.962
P-Value <0.005

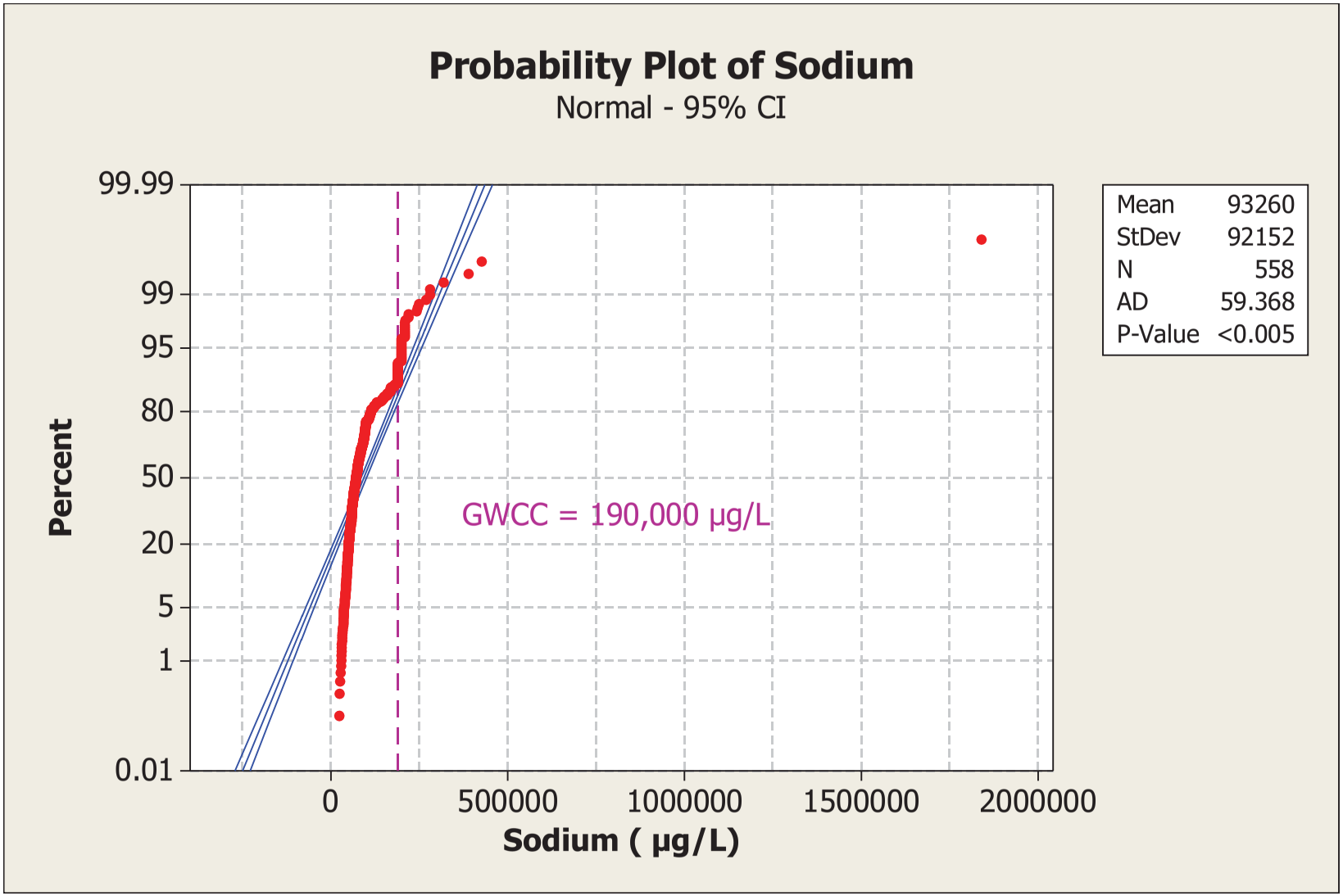

Probability Plot of Vanadium
Lognormal - 95% CI
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
0.01
0.10
1.00
10.00
100.00
Vanadium (µg/L)
GWCC = 2.6 µg/L
Loc 0.1431
Scale 1.029
N 87
AD 0.874
P-Value 0.024

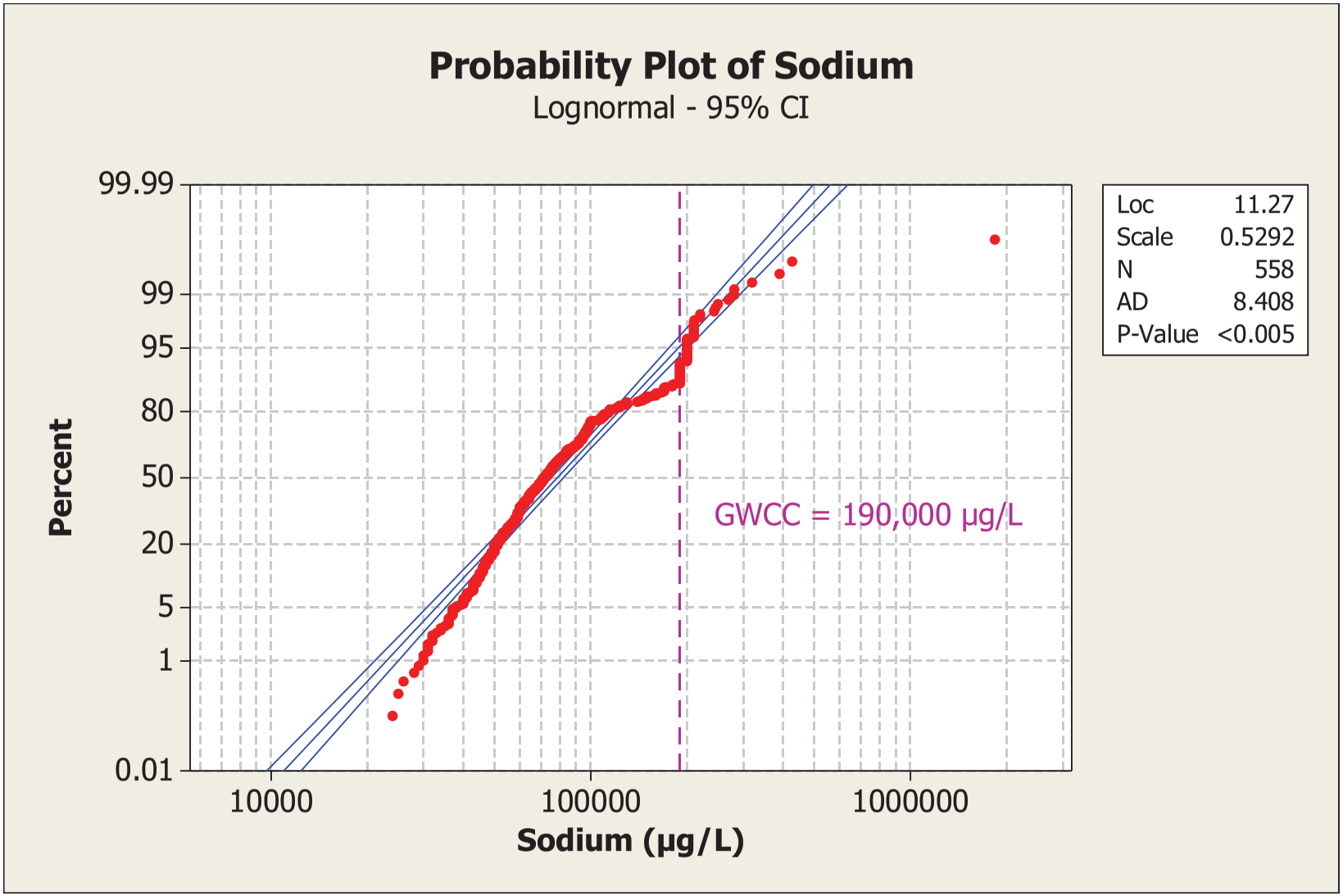

Probability Plot of Zinc
Normal - 95% CI
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
-5000
0
5000
10000
15000
20000
Zinc (µg/L)
GWCC = 6,300 µg/L
Mean 993.3
StDev 1814
N 393
AD 50.757
P-Value <0.005

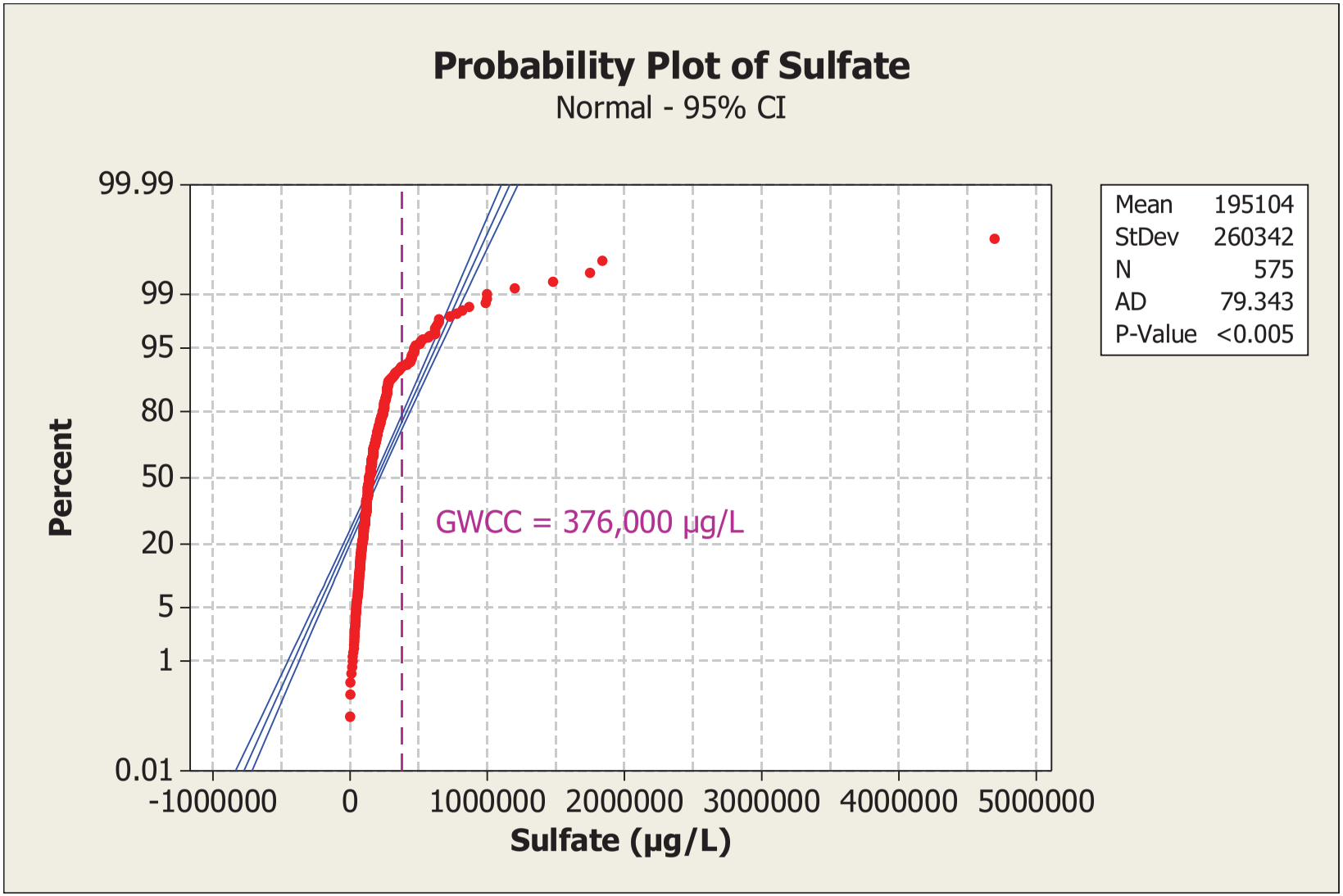

Probability Plot of Zinc
Lognormal - 95% CI
Percent
99.9
99
95
90
80
70
60
50
40
30
20
10
5
1
0.1
0.1
1.0
10.0
100.0
1000.0
10000.0
100000.0
1000000.0
Zinc (µg/L)
GWCC = 6,300 µg/L
Loc 5.427
Scale 2.012
N 393
AD 2.829
P-Value <0.005


Probability Plot of Potassium
Normal - 95% CI
Percent
99.99
99
95
80
50
20
5
1
0.01
-20000
-10000
0
10000
20000
30000
40000
50000
60000
70000
Potassium (µg/L)
GWCC = 9,600 µg/L
Mean 4047
StDev 3737
N 532
AD 54.042
P-Value <0.005


Probability Plot of Potassium
Lognormal - 95% CI
Percent
99.99
99
95
80
50
20
5
1
0.01
100
1000
10000
100000
Potassium (µg/L)
GWCC = 9,600 µg/L
Loc 8.105
Scale 0.6144
N 532
AD 11.955
P-Value <0.005


Probability Plot of Sodium
Normal - 95% CI
Percent
99.99
99
95
80
50
20
5
1
0.01
0
500000
1000000
1500000
2000000
Sodium (µg/L)
GWCC = 190,000 µg/L
Mean 93260
StDev 92152
N 558
AD 59.368
P-Value <0.005


Probability Plot of Sodium
Lognormal - 95% CI
Percent
99.99
99
95
80
50
20
5
1
0.01
10000
100000
1000000
Sodium (µg/L)
GWCC = 190,000 µg/L
Loc 11.27
Scale 0.5292
N 558
AD 8.408
P-Value <0.005


Probability Plot of Sulfate
Normal - 95% CI
Percent
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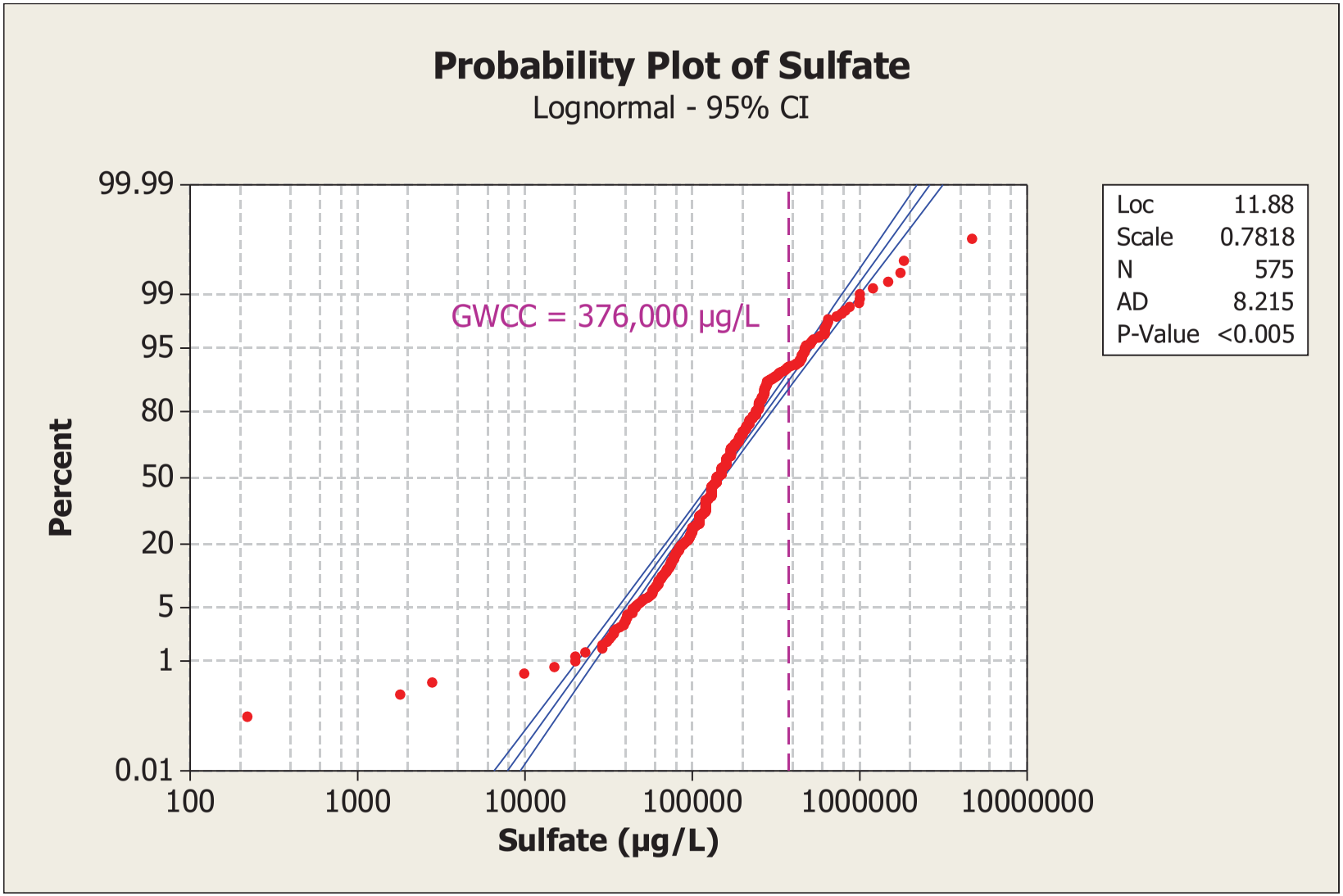
99
95
80
50
20
5
1
0.01
-1000000
0
1000000
2000000
3000000
4000000
5000000
Sulfate (µg/L)
GWCC = 376,000 µg/L
Mean 195104
StDev 260342
N 575
AD 79.343
P-Value <0.005


Probability Plot of Sulfate
Lognormal - 95% CI
Percent
99.99
99
95
80
50
20
5
1
0.01
100
1000
10000
100000
1000000
10000000
Sulfate (µg/L)
GWCC = 376,000 µg/L
Loc 11.88
Scale 0.7818
N 575
AD 8.215
P-Value <0.005

APPENDIX F

SSFL PHYSICAL PARAMETERS TABLES

APPENDIX F
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SSFL PHYSICAL PARAMETERS TABLES

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1.0 Appendix F References Cited

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Appendix F, Table F-1 (Page 1 of 3)

Soil Physical Parameter Results

Corehole	Start Depth (ft)	End Depth (ft)	Average Depth (ft)	Soil Type	Porosity (% Volume)	Reported Moisture Content (% Volume)	Calculated Air Content (% Volume)[a]	Wet bulk density (g/cc)	Dry bulk density (g/cc)	Particle Density (g/cc)	Organic Carbon (% weight)	Reference Document
AABS02S03	10	10	10	silty sand	41.3	7.2	34.1	1.64	1.56	2.66	0.17	This Document
AABS03S02	5	5	5	silty sand	44.1	12.17	31.93	1.65	1.53	2.73	0.18	This Document
AABS06S01	5	5	5	silty sand	41.4	11.82	29.58	1.69	1.58	2.69	1.4	This Document
AABS06S02	12	12	12	silty sand	40.4	11.03	29.37	1.7	1.59	2.66	0.41	This Document
ABSP-198-1	1	1	1	sand		10.2			1.6		0.13	McLaren/Hart, 1994c
ABSP-198-3-DUP3	3	3	3								0.0025	McLaren/Hart, 1994c
ABSP-198-3	3	3	3	sand		10.7			1.47		0.85	McLaren/Hart, 1994c
ABSP-198-3-BD9	3	3	3	sand		9.9			1.62		0.86	McLaren/Hart, 1994c
AFBS09S03	10	10	10	silty sand	44.9	11.08	33.82	1.58	1.47	2.66	0.37	This Document
APTF-1-30-1-1	1	1	1			16			1.76		0.0097	McLaren/Hart, 1994a
APTF-1-30-3-3	3	3	3			16			1.83		0.0099	McLaren/Hart, 1994a
APTF-1-30-3-BD6	3	3	3			23			1.63		0.0092	McLaren/Hart, 1994a
APTF-1-30-5-5	5	5	5			17			1.78		0.0091	McLaren/Hart, 1994a
APTF-1-30-D-3'	3	3	3								0.53	McLaren/Hart, 1994a
APTF-2-35-1-1	1	1	1			13			1.59		0.0028	McLaren/Hart, 1994b
APTF-2-35-1-1-BD7	1	1	1			11			1.3		0.0023	McLaren/Hart, 1994b
APTF-2-35-3-3	3	3	3			11			1.47		0.0027	McLaren/Hart, 1994b
APTF-2-35-D-1'	1	1	1								0.072	McLaren/Hart, 1994b
BCBS03S01	1	1	1	silty sand							1.73	This Document
BPBS14S01	1	1	1			6						This Document
BSBT01S01	0.33	0.33	0.33			1					0.15	MWH, 2003b
BSBT01S01	0.33	0.33	0.33			1					0.51	MWH, 2003b
BSBT01S01	0.33	0.33	0.33			1					0.078	MWH, 2003b
BSBT02S01	0.04	0.04	0.04			1		1.8762	1.67376		0.054	MWH, 2003b
BSBT02S01	0.04	0.04	0.04			1		1.5888	1.43915		0.036	MWH, 2003b
BSBT02S01	0.04	0.04	0.04			1		1.6122	1.5471		0.35	MWH, 2003b
BSBT04S01	0.33	0.33	0.33			5		1.7016	1.6218		0.53	MWH, 2003b
BSBT04S01	0.33	0.33	0.33			5					0.53	MWH, 2003b
BSBT04S01	0.33	0.33	0.33			5					0.53	MWH, 2003b
BVBS02S04	6	6	6	silty sand	36.6	19.62	16.98	1.87	1.68	2.64	0.68	This Document
CLBS06S04	10	10	10	silty sand	46.5	14.88	31.62	1.59	1.44	2.69	0.17	This Document
CLBS31S01	8	8	8	silty sand	42.7	6.22	36.48	1.61	1.55	2.7	0.15	This Document
CLBS38S02	10	10	10	silty sand	38.8	8.16	30.64	1.7	1.62	2.65	0.56	This Document
CLBS39S02	10	10	10	silty sand	37.3	9.1	28.2	1.78	1.69	2.69	0.22	This Document

Appendix F, Table F-1 (Page 2 of 3)

Soil Physical Parameter Results

Corehole	Start Depth (ft)	End Depth (ft)	Average Depth (ft)	Soil Type	Porosity (% Volume)	Reported Moisture Content (% Volume)	Calculated Air Content (% Volume)[a]	Wet bulk density (g/cc)	Dry bulk density (g/cc)	Particle Density (g/cc)	Organic Carbon (% weight)	Reference Document
CLBS39S03	17	17	17	silty sand	27.6	3.14	24.46	1.94	1.9	2.63	0.13	This Document
CLBS40S03	17	17	17	silty sand	39.8	9.13	30.67	1.69	1.6	2.66	0.23	This Document
ECL-78-1-1-Dup	1	1	1								0.1	McLaren/Hart, 1994d
ECL-78-1-1	1	1	1	16					1.31		0.009	McLaren/Hart, 1994d
ECL-78-1-1-BD8	1	1	1	12							0.02	McLaren/Hart, 1994d
ECL-78-3-3	3	3	3	18					1.81		0.004	McLaren/Hart, 1994d
ECL-78-5-5	5	5	5	18					1.79		0.004	McLaren/Hart, 1994d
HVBS37S02	5	5	5	silty sand	37.6	10.51	27.09	1.76	1.66	2.66	0.43	This Document
ILBS01S03	9.5	9.5	9.5	silty sand	45.9	13.51	32.39	1.56	1.43	2.64	0.16	This Document
ILBS01S05	20	20	20	silty sand	40.9	7.14	33.76	1.64	1.57	2.65	0.12	This Document
ILBS01S06	29.5	29.5	29.5	silty sand	37.7	13.2	24.5	1.77	1.64	2.63	0.16	This Document
ILBS01S07	40	40	40	silty sand	35.9	21.87	14.03	1.89	1.67	2.61	0.16	This Document
ILBS02S07	25	25	25	silty sand	36.1	13.36	22.74	1.84	1.71	2.67	0.14	This Document
ILBS05S03	30	30	30	silty sand	43.9	11.14	32.76	1.58	1.46	2.61	0.11	This Document
ILBS08S01	10	10	10	silty sand	37.6	12.49	25.11	1.78	1.65	2.65	0.29	This Document
ILBS09S02	14.5	14.5	14.5	silty sand	39.5	9.29	30.21	1.69	1.6	2.64	0.2	This Document
ILBS12S04	20	20	20	silty sand	33.2	14.21	18.99	1.89	1.75	2.62	0.95	This Document
ILBS15S01	26	26	26	silty sand	40.5	12.54	27.96	1.71	1.58	2.66	0.23	This Document
ILBS30S02	9.5	9.5	9.5	silty sand	34.5	10.16	24.34	1.82	1.72	2.62	0.29	This Document
ILBS31S02	10	10	10	silty sand	39	7.27	31.73	1.66	1.59	2.61	0.35	This Document
ILBS32S02	19.5	19.5	19.5	silty sand	37.9	11.97	25.93	1.76	1.64	2.64	0.28	This Document
ILBS35S02	5	5	5	silty sand	29.1	11.91	17.19	1.98	1.86	2.63	0.3	This Document
ILBS35S03	9.5	9.5	9.5	silty sand	37.3	10.33	26.97	1.76	1.65	2.64	0.2	This Document
ILBS36S02	5.5	5.5	5.5	silty sand	34	8.96	25.04	1.85	1.76	2.66	0.35	This Document
ILBS37S01	15	15	15	silty sand	39.8	8.09	31.71	1.67	1.59	2.64	0.27	This Document
ILBS45S02	7	7	7	sandy silt								This Document
ILBS46S03	15	15	15	sandy silt								This Document
PZ002GT01	24.5	25	24.75	silty sand	30.9	10	20.9	1.94	1.84	2.66		MWH, 2003a
PZ002GT02	79.3	79.8	79.55	sand	23.6	8.8	14.8	2.12	2.03	2.66		MWH, 2003a
PZ003GT01	8.5	9	8.75	silty sand	41.7	7.1	34.6	1.61	1.54	2.64		MWH, 2003a
PZ005GT01	17.5	17.5	17.5	silty sand	35.6	19.8	15.8	1.94	1.75	2.71		MWH, 2003a
SB4.15-2-8					27.3	10.8	16.5	2.03	1.92	2.64	0.033	ICF, 1993
SB5.9-4-16					33.3	16.6	16.7	1.97	1.8	2.7	0.056	ICF, 1993
SB6.1-2-3.5					35.7	13.4	22.3	1.88	1.75	2.72	0.343	ICF, 1993

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Soil Physical Parameter Results

Corehole	Start Depth (ft)	End Depth (ft)	Average Depth (ft)	Soil Type	Porosity (% Volume)	Reported Moisture Content (% Volume)	Calculated Air Content (% Volume)[a]	Wet bulk density (g/cc)	Dry bulk density (g/cc)	Particle Density (g/cc)	Organic Carbon (% weight)	Reference Document
SB7.10-3-3.5					35.7	10.3	25.4	1.83	1.73	2.69	0.205	ICF, 1993
SBHV-3-15					34.1	13.5	20.6	1.89	1.75	2.66	0.046	ICF, 1993
SPA-1-6-1	1	1	1			11			1.6		0.024	McLaren/Hart, 1994e
SPA-1-6-3	3	3	3			9.3			1.68		0.022	McLaren/Hart, 1994e
SPA-1-6-5	5	5	5			25			1.51		0.0031	McLaren/Hart, 1994e
SPA-1-6-6	6	6	6								0.01	McLaren/Hart, 1994e
SPA-2-23-1	1	1	1			6.8			1.2		0.0019	McLaren/Hart, 1994f
SPA-2-23-5	5	5	5			0.8			1.92		0.0021	McLaren/Hart, 1994f
SPA-2-47-1	1	1	1						1.76		0.01	McLaren/Hart, 1994f
SPA-2-47-1-BD3	1	1	1						1.76			McLaren/Hart, 1994f
SPA-2-58-3	3	3	3						2.08			McLaren/Hart, 1994f
SPA-2-58-5	5	5	5						1.92			McLaren/Hart, 1994f
STL-IV-1-16-1	1	1	1			21			1.6		0.0025	McLaren/Hart, 1994g
STL-IV-1-16-1-BD4	1	1	1			22			1.6		0.0026	McLaren/Hart, 1994g
STL-IV-2-15-1	1	1	1			21		2.29	2.08		0.0079	McLaren/Hart, 1994h
STL-IV-2-15-3	3	3	3			20		2.28	2.08		0.0068	McLaren/Hart, 1994h
STL-IV-2-15-5	5	5	5			14		2.54	2.4		0.01	McLaren/Hart, 1994h
Minimum Value					23.6	0.8	14.03	1.56	1.20	2.61	0.0019	
Maximum Value					46.5	25	36.48	2.54	2.4	2.73	1.73	
Average Value					37.4	11.0	26.1	1.8	1.7	2.7	0.2	
Standard Deviation					5.1	5.7	6.3	0.2	0.2	0.0	0.3	
Total Number of Samples with Results					39	69	39	46	70	39	75	

a - Air content (% Volume) = Porosity (% Volume) - Moisture Content (% Volume)

Notes:
1. Where soil type is not identified, no information is available.

Units:
ft = feet
g/cc = grams per cubic centimeter

Appendix F, Table F-2 (Page 1 of 7)

Bedrock Physical Parameter Results

Corehole	Start Depth (ft)	End Depth (ft)	Avg Depth (ft)	Rock Type	Modified Rock Type[a]	Porosity (% Volume)	Calculated Moisture Content (% Volume)[b]	Reported Moisture Content (% Volume)	Calculated Air Content (% Volume)[c]	Wet bulk density (g/cc)	Dry bulk density (g/cc)	Particle Density (g/cc)	Organic Carbon (% weight)	Reference Document
PZ001GT01	39.0	39.5	39.25	weathered sandstone		21.4		4.6	16.8	2.16	2.11	2.69		MWH, 2003a
PZ001GT02	57.0	57.5	57.25	shallow sandstone		15.7		4.3	11.4	2.32	2.27	2.7		MWH, 2003a
PZ003GT02	27.8	28.0	27.9	shallow sandstone		21.0		6.4	14.6	2.16	2.09	2.65		MWH, 2003a
PZ004GT01	12.6	12.8	12.7	weathered sandstone		37.8		4.5	33.3	1.72	1.67	2.69		MWH, 2003a
PZ004GT02	23.8	24.0	23.9	shallow sandstone		22.5		6.9	15.6	2.11	2.05	2.64		MWH, 2003a
PZ004GT03	27.0	27.4	27.2	shallow sandstone		18.7		4.9	13.8	2.25	2.2	2.71		MWH, 2003a
PZ005GT02	36.5	36.5	36.5	shallow sandstone		19.3		5.4	13.9	2.21	2.16	2.67		MWH, 2003a
PZ006GT01	14.0	14.5	14.25	shallow sandstone		15.6		2.1	13.5	2.26	2.24	2.65		MWH, 2003a
PZ006GT02	34.0	34.4	34.2	shallow sandstone		15.2		2.2	13	2.32	2.3	2.71		MWH, 2003a
PZ007GT01	19.4	19.7	19.55	weathered sandstone		39.7		9.5	30.2	1.69	1.6	2.65		MWH, 2003a
PZ007GT02	42.1	42.6	42.35	shallow sandstone		15.9		4.3	11.6	2.29	2.25	2.67		MWH, 2003a
PZ008GT01	37.6	38.0	37.8	shallow sandstone		20.9		5.4	15.5	2.16	2.1	2.66		MWH, 2003a
PZ008GT02	67.4	67.8	67.6	shallow sandstone		18.2		7.2	11	2.22	2.15	2.63		MWH, 2003a
PZ009GT01	19.7	20.0	19.85	weathered sandstone		23.1		5.8	17.3	2.14	2.08	2.7		MWH, 2003a
PZ009GT02	24.7	25.0	24.85	weathered sandstone		7.8		1.4	6.4	2.47	2.45	2.66		MWH, 2003a
PZ009GT03	30.7	31.0	30.85	shallow siltstone		18.0		3.9	14.1	2.28	2.24	2.73		MWH, 2003a
PZ010GT01	42.2	42.7	42.45	shallow sandstone		17.0		5.4	11.6	2.3	2.24	2.7		MWH, 2003a
PZ011GT01	34.0	34.5	34.25	shallow sandstone		18.6		4	14.6	2.21	2.17	2.67		MWH, 2003a
PZ011GT02	56.0	56.5	56.25	weathered sandstone		19.9		6.2	13.7	2.19	2.12	2.65		MWH, 2003a
PZ012GT01	18.0	18.5	18.25	weathered sandstone		21.0		0.7	20.3	2.11	2.1	2.66		MWH, 2003a
PZ012GT02	33.6	34.0	33.8	weathered sandstone		19.4		0.3	19.1	2.13	2.13	2.64		MWH, 2003a
PZ013GT01	13.0	13.6	13.3	weathered sandstone		21.4		7.4	14	2.19	2.12	2.69		MWH, 2003a
PZ013GT02	40.2	40.8	40.5	weathered sandstone		23.0		8	15	2.17	2.09	2.72		MWH, 2003a
PZ013GT03	50.0	50.6	50.3	weathered sandstone		17.2		5.8	11.4	2.26	2.2	2.66		MWH, 2003a
PZ014GT01	10.2	10.8	10.5	weathered sandstone		19.0		3.6	15.4	2.19	2.16	2.66		MWH, 2003a

Appendix F, Table F-2 (Page 2 of 7)

Bedrock Physical Parameter Results

Corehole	Start Depth (ft)	End Depth (ft)	Avg Depth (ft)	Rock Type	Modified Rock Type[a]	Porosity (% Volume)	Calculated Moisture Content (% Volume)[b]	Reported Moisture Content (% Volume)	Calculated Air Content (% Volume)[c]	Wet bulk density (g/cc)	Dry bulk density (g/cc)	Particle Density (g/cc)	Organic Carbon (% weight)	Reference Document
PZ014GT02	37.7	38.2	37.95	weathered sandstone		16.8		4.6	12.2	2.25	2.2	2.65		MWH, 2003a
PZ015GT01	19.0	19.5	19.25	weathered sandstone		19.5		5.5	14	2.2	2.15	2.67		MWH, 2003a
PZ015GT02	45.1	45.6	45.35	weathered sandstone		15.1		4.6	10.5	2.31	2.27	2.67		MWH, 2003a
PZ016GT01	12.4	12.8	12.6	weathered sandstone		16.4		5.4	11	2.29	2.24	2.68		MWH, 2003a
PZ016GT02	44.3	44.6	44.45	weathered sandstone		26.3		8.3	18	2.05	1.96	2.66		MWH, 2003a
PZ016GT03	65.0	65.5	65.25	weathered sandstone		18.5		7	11.5	2.25	2.18	2.68		MWH, 2003a
PZ017GT01	15.7	16.1	15.9	weathered sandstone		20.1		7.1	13	2.2	2.13	2.67		MWH, 2003a
PZ017GT02	44.6	45.0	44.8	weathered sandstone		18.2		6.4	11.8	2.26	2.19	2.68		MWH, 2003a
PZ018GT01	17.5	17.7	17.6	shallow siltstone		29.0		10.4	18.6	2.01	1.9	2.68		MWH, 2003a
C1	301.1	301.2	301.13	interbedded	coarse sandstone									Hurley, 2003
C1	332.1	332.3	332.21	interbedded	coarse sandstone	14.5	15		0	2.41	2.26			Hurley, 2003
C1	332.1	332.3	332.21	interbedded	coarse sandstone	13.3	15		0	2.41	2.26		0.018	Hurley, 2003
C1	301.2	301.5	301.33	interbedded	coarse sandstone	11.9	13		0	2.46	2.33			Hurley, 2003
C1	300.9	301.1	301.00	interbedded	coarse sandstone									Hurley, 2003
C1	300.4	300.9	300.67	interbedded	coarse sandstone									Hurley, 2003
C1	246.8	247.0	246.88	interbedded	banded sandstone	14.8	15		0	2.46	2.31		0.222	Hurley, 2003
C1	564.3	564.8	564.50	interbedded	siltstone						2.49			UW, 2003
C1	572.2	572.7	572.42	interbedded							2.6			UW, 2003
C1	592.8	593.0	593.25	interbedded									0.015	Hurley, 2003
C1	373.4	374.2	373.79	interbedded	coarse sandstone	10.6	11		0	2.35	2.24		0.019	Hurley, 2003
C1	572.2	572.4	572.67	interbedded	siltstone								0.39	Hurley, 2003
C1	564.3	564.5	564.75	interbedded	siltstone								0.689	Hurley, 2003
C1	408.0	408.5	408.25	interbedded	coarse sandstone	13.0	13		0.03	2.45	2.32		0.017	Hurley, 2003
C1	442.2	442.8	442.46	interbedded	coarse sandstone	12.2	13		0	2.44	2.31		0.03	Hurley, 2003
C1	592.8	593.3	593.00	interbedded		16.1	16		0.13	2.46	2.3			UW, 2003
C1	472.8	473.3	473.08	interbedded	siltstone						2.46		0.355	Hurley, 2003
C1	498.5	498.9	498.71	interbedded	siltstone	11.3	12		0	2.52	2.4		0.025	Hurley, 2003
C1	99.8	99.9	99.88	interbedded										Hurley, 2003
C1	547.7	548.1	547.88	interbedded		17.5	17		0.53	2.38	2.21		0.01	Hurley, 2003
C1	45.8	46.0	45.92	interbedded	coarse sandstone	19.3	19		0.25	2.48	2.29		0.008	Hurley, 2003
C1	525.2	525.5	525.33	interbedded	siltstone						2.51		0.399	Hurley, 2003
C1	123.3	123.7	123.46	interbedded	coarse sandstone	12.5	12		0.45	2.36	2.24		0.013	Hurley, 2003
C1	100.5	100.8	100.67	interbedded		13.9	14		0	2.45	2.31			Hurley, 2003
C2	392.5	393.0	392.75	sandstone	coarse sandstone	12.8	13		0	2.45	2.32			Hurley, 2003
C2	231.7	231.9	231.77	sandstone	siltstone	5.1	6		0	2.53	2.47		0.449	Hurley, 2003
C2	199.7	200.0	199.83	sandstone	coarse sandstone	16.3	16		0.33	2.41	2.25			Hurley, 2003
C2	99.2	99.4	99.29	sandstone		8.1	8		0.1	2.47	2.39			Hurley, 2003
C2	18.0	18.5	18.25	sandstone	medium sandstone								0.013	Hurley, 2003
C2	225.3	225.8	225.58	sandstone	coarse sandstone	14.3	14		0.31	2.41	2.27		0.009	Hurley, 2003
C2	133.0	133.4	133.21	sandstone	breccia	7.1	7		0.12	2.66	2.59		0.019	Hurley, 2003
C2	209.8	210.0	209.88	sandstone	breccia	32.6	16		16.6	2.4	2.24		0.022	Hurley, 2003

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Bedrock Physical Parameter Results

Corehole	Start Depth (ft)	End Depth (ft)	Avg Depth (ft)	Rock Type	Modified Rock Type[a]	Porosity (% Volume)	Calculated Moisture Content (% Volume)[b]	Reported Moisture Content (% Volume)	Calculated Air Content (% Volume)[c]	Wet bulk density (g/cc)	Dry bulk density (g/cc)	Particle Density (g/cc)	Organic Carbon (% weight)	Reference Document
C3	257.0	257.7	257.33	sandstone		12.9							0.019	Hurley, 2003
C3	242.2	242.8	242.50	sandstone		14.2							0.019	Hurley, 2003
C3	253.5	254.2	253.88	sandstone	medium sandstone	17.7							0.009	Hurley, 2003
C3	310.0	310.9	310.46	sandstone	fine sandstone	12.6							0.013	Hurley, 2003
C3	323.3	323.8	323.58	sandstone	fine sandstone	16.3	15		1.3	2.39	2.24		0.008	Hurley, 2003
C3	386.2	386.8	386.50	sandstone									0.008	Hurley, 2003
C3	296.7	297.2	296.92	sandstone		13.9							0.013	Hurley, 2003
C3	338.7	339.5	339.09	sandstone		12.1								Hurley, 2003
C3	287.2	287.9	287.54	sandstone		15.1							0.011	Hurley, 2003
C3	346.5	346.9	346.71	sandstone		17.1							0.014	Hurley, 2003
C3	388.7	389.5	389.08	sandstone		16.4							0.012	Hurley, 2003
C3	348.9	349.0	348.94	sandstone	coarse sandstone	14.4	14		0.4	2.44	2.3			Hurley, 2003
C3	426.4	427.0	426.71	sandstone	breccia	12.9							0.013	Hurley, 2003
C3	351.8	352.0	351.92	sandstone	coarse sandstone	13.8	14		0.0	2.45	2.31			Hurley, 2003
C3	437.8	438.1	437.98	sandstone	coarse sandstone	13.4	13		0.4	2.44	2.31			Hurley, 2003
C3	371.9	372.7	372.29	sandstone	medium sandstone	20.7							0.016	Hurley, 2003
C3	441.1	441.8	441.46	sandstone	coarse sandstone	14.0							0.015	Hurley, 2003
C3	444.1	444.3	444.21	sandstone	coarse sandstone	13.0	13		0.0	2.46	2.33			Hurley, 2003
C3	356.8	357.4	357.13	sandstone	coarse sandstone	13.5	14		0.0	2.43	2.29		0.014	Hurley, 2003
C3	109.8	110.0	109.88	sandstone	coarse sandstone	11.8	13		0.0	2.42	2.29			Hurley, 2003
C3	101.5	101.8	101.67	sandstone	medium sandstone	15.4	16		0.0	2.43	2.27			Hurley, 2003
C3	128.0	128.5	128.25	sandstone	coarse sandstone	5.4	13		0.0	2.21	2.08			Hurley, 2003
C3	94.0	94.2	94.08	sandstone		14.6	15		0.0	2.44	2.29			Hurley, 2003
C3	85.6	86.0	85.79	sandstone		12.6							0.013	Hurley, 2003
C3	47.3	47.8	47.58	sandstone	fine sandstone	14.5	15		0.0	2.44	2.29		0.063	Hurley, 2003
C3	34.0	34.5	34.25	sandstone	coarse sandstone	18.3	18		0.2	2.47	2.29		0.009	Hurley, 2003
C3	100.4	100.8	100.63	sandstone	coarse sandstone	15.5	16		0.0	2.38	2.22			Hurley, 2003
C3	408.3	409.0	408.67	sandstone		11.5	12		0.0	2.46	2.34		0.024	Hurley, 2003
C3	415.0	415.4	415.21	sandstone	medium sandstone	16.6							0.014	Hurley, 2003
C3	227.4	227.9	227.67	sandstone		17.0							0.012	Hurley, 2003
C3	219.2	219.7	219.44	sandstone	breccia	9.2	13		0.0	2.46	2.33		0.035	Hurley, 2003
C3	128.0	128.5	128.25	sandstone	coarse sandstone	13.9	13		0.9	2.21	2.08		0.011	Hurley, 2003
C3	196.1	197.2	196.63	sandstone	coarse sandstone	12.1							0.024	Hurley, 2003
C3	397.4	397.9	397.67	sandstone		13.9	14		0.0	2.44	2.3		0.025	Hurley, 2003
C3	186.5	187.5	187.00	sandstone	medium sandstone	14.0							0.015	Hurley, 2003
C3	176.4	176.9	176.67	sandstone	medium sandstone	14.4	15		0.0	2.41	2.26		0.009	Hurley, 2003
C3	164.2	164.6	164.38	sandstone	coarse sandstone	12.0	13		0.0	2.47	2.34		0.015	Hurley, 2003
C3	161.6	161.7	161.63	sandstone	coarse sandstone	11.5	11		0.5	2.48	2.37		0.02	Hurley, 2003
C3	206.7	207.6	207.13	sandstone	fine sandstone	11.2							0.021	Hurley, 2003
C4	360.2	360.8	360.46	sandstone	fine sandstone	8.1	16		0.0	2.35	2.19		0.026	Hurley, 2003
C4	352.8	353.7	353.21	sandstone		15.8							0.021	Hurley, 2003
C4	360.1	360.3	360.17	sandstone	fine sandstone	16.7	17		0.0	2.51	2.34			Hurley, 2003
C4	215.0	215.8	215.38	sandstone	medium sandstone	15.8	16		0.0	2.38	2.22		0.016	Hurley, 2003
C4	374.2	374.8	374.46	sandstone		14.5							0.015	Hurley, 2003
C4	385.0	385.8	385.38	sandstone	coarse sandstone	13.8	15		0.0	2.41	2.26		0.016	Hurley, 2003
C4	394.3	394.7	394.46	sandstone	banded sandstone	15.2							0.8	Hurley, 2003
C4	360.1	360.3	360.17	sandstone	fine sandstone	7.9	17		0.0	2.51	2.34			Hurley, 2003
C4	175.0	175.6	175.29	sandstone	medium sandstone	13.7	14		0.0	2.35	2.21		0.012	Hurley, 2003
C4	207.8	208.1	207.92	sandstone		14.7	15		0.0	2.36	2.21		0.034	Hurley, 2003
C4	199.4	199.5	199.48	sandstone	medium sandstone	14.4	14		0.4	2.42	2.28			Hurley, 2003

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Bedrock Physical Parameter Results

Corehole	Start Depth (ft)	End Depth (ft)	Avg Depth (ft)	Rock Type	Modified Rock Type[a]	Porosity (% Volume)	Calculated Moisture Content (% Volume)[b]	Reported Moisture Content (% Volume)	Calculated Air Content (% Volume)[c]	Wet bulk density (g/cc)	Dry bulk density (g/cc)	Particle Density (g/cc)	Organic Carbon (% weight)	Reference Document
C4	196.7	197.3	196.96	sandstone		14.3							0.006	Hurley, 2003
C4	237.8	238.3	238.08	sandstone	siltstone	14.1							0.623	Hurley, 2003
C4	257.2	258.1	257.63	sandstone	coarse sandstone	13.3	13		0.3	2.42	2.29		0.011	Hurley, 2003
C4	99.8	100.0	99.88	sandstone	coarse sandstone	12.8	13		0.0	2.46	2.33			Hurley, 2003
C4	123.4	123.9	123.67	sandstone	medium sandstone	16.4	17		0.0	2.33	2.16		0.008	Hurley, 2003
C4	188.4	189.0	188.71	sandstone	fine sandstone	18.0	19		0.0	2.34	2.15		0.023	Hurley, 2003
C4	333.4	333.9	333.67	sandstone	siltstone	6.9	7		0.0	2.43	2.36			Hurley, 2003
C4	335.5	335.7	335.58	sandstone	banded sandstone	11.9	12		0.0	2.42	2.3			Hurley, 2003
C4	335.5	335.7	335.58	sandstone	banded sandstone	4.8	5		0.0	2.38	2.33		0.855	Hurley, 2003
C4	335.0	335.3	335.13	sandstone	banded sandstone	6.6	7		0.0	2.53	2.46			Hurley, 2003
C4	225.6	226.1	225.83	sandstone		12.3							0.024	Hurley, 2003
C4	247.4	247.8	247.63	sandstone	coarse sandstone	9.6							0.028	Hurley, 2003
C4	333.4	333.9	333.67	sandstone	siltstone	11.8	5		6.8	2.42	2.37		0.129	Hurley, 2003
C4	298.2	298.8	298.46	sandstone	medium sandstone	12.4	12		0.4	2.45	2.33			Hurley, 2003
C4	298.2	298.8	298.46	sandstone	medium sandstone	14.0	14		0.0	2.46	2.32		0.024	Hurley, 2003
C4	276.3	276.8	276.54	sandstone	coarse sandstone	15.1	15		0.1	2.38	2.23		0.017	Hurley, 2003
C4	265.7	266.3	265.96	sandstone		13.9							0.03	Hurley, 2003
C4	341.8	342.3	342.08	sandstone	fine sandstone	16.8	18		0.0	2.38	2.2		0.019	Hurley, 2003
C4	70.4	71.4	70.92	sandstone	siltstone	14.7	14		0.7	2.45	2.31		1.057	Hurley, 2003
C4	95.6	96.0	95.79	sandstone	fine sandstone	14.6							0.01	Hurley, 2003
C4	62.8	62.9	62.83	sandstone	siltstone	20.4							1.382	Hurley, 2003
C4	27.9	28.2	28.04	sandstone		17.8	19		0.0	2.26	2.07		0.006	Hurley, 2003
C4	38.5	39.3	38.92	sandstone		16.0							0.016	Hurley, 2003
C4	51.3	51.9	51.63	sandstone		15.9	16		0.0	2.39	2.23		0.021	Hurley, 2003
C4	62.8	62.9	62.83	sandstone	siltstone	20.4							0.609	Hurley, 2003
C4	63.7	63.9	63.79	sandstone	siltstone	2.6	3		0.0	2.52	2.49		0.571	Hurley, 2003
C4	137.0	137.9	137.46	sandstone	medium sandstone	12.4	17		0.0	2.36	2.19		0.017	Hurley, 2003
C4	168.2	168.8	168.46	sandstone	coarse sandstone	16.1	16		0.1	2.38	2.22			Hurley, 2003
C4	80.6	81.2	80.88	sandstone	medium sandstone	17.0	17		0.0	2.35	2.18		0.012	Hurley, 2003
C4	125.0	126.2	125.58	sandstone	fine sandstone	17.2	18		0.0	2.37	2.19		0.027	Hurley, 2003
C4	142.3	142.8	142.54	sandstone	banded sandstone	16.4	18		0.0	2.4	2.22		0.99	Hurley, 2003
C4	168.2	168.8	168.46	sandstone	medium sandstone	15.1	15		0.1	2.37	2.22		0.023	Hurley, 2003
C4	156.0	156.8	156.38	sandstone	banded sandstone	13.3							0.452	Hurley, 2003
C4	170.5	170.8	170.60	sandstone	hard sandstone	1.0	1		0.0	2.63	2.62		0.022	Hurley, 2003
C5	119.3	119.7	119.50	sandstone	siltstone	2.6	3		0.0	2.46	2.43		0.492	Hurley, 2003
C5	165.2	165.9	165.54	sandstone	coarse sandstone	13.4	14		0.0	2.46	2.32		0.019	Hurley, 2003
C5	156.5	157.3	156.92	sandstone	coarse sandstone	10.4	11		0.0	2.49	2.38		0.029	Hurley, 2003
C5	133.6	134.4	134.00	sandstone	siltstone	2.3	3		0.0	2.48	2.45		0.259	Hurley, 2003
C5	93.9	94.6	94.25	sandstone	siltstone	6.2	6		0.2	2.45	2.39		0.207	Hurley, 2003
C5	84.2	85.0	84.58	sandstone	coarse sandstone	14.0	14		0.0	2.47	2.33			UW, 2003
C5	73.2	74.1	73.63	sandstone	hard sandstone	4.1	4		0.1	2.48	2.44		0.013	Hurley, 2003
C5	62.5	63.3	62.88	sandstone	coarse sandstone	7.3	7		0.3	2.4	2.33		0.028	Hurley, 2003
C5	146.7	147.2	146.92	sandstone	banded sandstone	14.1	14		0.1	2.48	2.34		0.403	Hurley, 2003
C5	16.7	17.3	16.96	sandstone									0.014	Hurley, 2003
C6	239.5	240.0	239.75	sandstone	hard sandstone	3.6	3		0.6	2.66	2.63		0.005	Hurley, 2003
C6	223.7	224.5	224.08	sandstone	hard sandstone	0.6	0		0.6	2.65	2.65		0.008	Hurley, 2003
C6	213.0	213.7	213.33	sandstone	medium sandstone	14.2	14		0.2	2.41	2.27		0.021	Hurley, 2003
C6	263.3	263.9	263.58	sandstone	coarse sandstone	13.2	13		0.2	2.42	2.29		0.03	Hurley, 2003
C6	263.3	263.9	263.58	sandstone	coarse sandstone	13.6	13		0.6	2.42	2.29			Hurley, 2003
C6	249.3	249.8	249.58	sandstone	coarse sandstone	15.6	14		1.6	2.42	2.28		0.01	Hurley, 2003

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Bedrock Physical Parameter Results

Corehole	Start Depth (ft)	End Depth (ft)	Avg Depth (ft)	Rock Type	Modified Rock Type[a]	Porosity (% Volume)	Calculated Moisture Content (% Volume)[b]	Reported Moisture Content (% Volume)	Calculated Air Content (% Volume)[c]	Wet bulk density (g/cc)	Dry bulk density (g/cc)	Particle Density (g/cc)	Organic Carbon (% weight)	Reference Document
C6	271.0	271.3	271.13	sandstone		9.4	10		0.0	2.43	2.33		0.033	Hurley, 2003
C6	293.0	293.4	293.21	sandstone	banded sandstone	20.2							4.045	Hurley, 2003
C6	301.2	302.1	301.63	sandstone	hard sandstone	14.1							0.008	Hurley, 2003
C6	204.9	205.8	205.33	sandstone	coarse sandstone	11.3	12		0.0	2.47	2.35		0.018	Hurley, 2003
C6	61.0	61.5	61.25	sandstone		11.9							0.019	Hurley, 2003
C6	356.7	357.2	356.92	sandstone	fine sandstone	13.0							0.03	Hurley, 2003
C6	336.3	337.3	336.79	sandstone	breccia	10.1							0.014	Hurley, 2003
C6	310.3	310.9	310.58	sandstone		10.6							0.03	Hurley, 2003
C6	280.8	281.3	281.08	sandstone	coarse sandstone	9.8	10		0.0	2.5	2.4		0.019	Hurley, 2003
C6	109.0	109.7	109.33	sandstone	medium sandstone	11.2							0.019	Hurley, 2003
C6	13.5	14.3	13.92	sandstone	medium sandstone	13.1	14		0.0	2.45	2.31		0.014	Hurley, 2003
C6	21.8	22.5	22.17	sandstone		14.5							0.021	Hurley, 2003
C6	365.6	366.3	365.92	sandstone	fine sandstone	7.7	7		0.7	2.19	2.12		0.264	Hurley, 2003
C6	48.8	49.4	49.13	sandstone		10.7							0.054	Hurley, 2003
C6	81.4	82.0	81.71	sandstone	coarse sandstone	4.9	11		0.0	2.52	2.41		0.017	Hurley, 2003
C6	99.7	100.0	99.83	sandstone	hard sandstone	7.0							0.007	Hurley, 2003
C6	193.7	194.4	194.04	sandstone		15.1							0.019	Hurley, 2003
C6	118.5	119.1	118.79	sandstone	medium sandstone	17.5							0.104	Hurley, 2003
C6	128.5	129.0	128.75	sandstone	coarse sandstone	3.2	4		0.0	2.58	2.54		0.021	Hurley, 2003
C6	142.4	142.8	142.63	sandstone	medium sandstone	12.8	13		0.0	2.44	2.31		0.023	Hurley, 2003
C6	150.7	151.0	150.83	sandstone	banded sandstone	16.5							0.211	Hurley, 2003
C6	161.5	162.3	161.88	sandstone	coarse sandstone	13.6	14		0.0	2.43	2.29		0.018	Hurley, 2003
C6	174.2	175.0	174.58	sandstone		12.3	15		0.0	2.39	2.24		0.024	Hurley, 2003
C6	71.3	72.0	71.67	sandstone		11.6							0.024	Hurley, 2003
C6	426.3	427.1	426.71	sandstone	breccia	10.5	11		0.0	2.49	2.38		0.017	Hurley, 2003
C6	508.6	509.2	508.88	sandstone	banded sandstone	14.3	14		0.3	2.42	2.28		0.292	Hurley, 2003
C6	376.4	377.2	376.79	sandstone	medium sandstone	13.1							0.018	Hurley, 2003
C6	495.3	495.6	495.42	sandstone		11.3	14		0.0	2.41	2.27		0.017	Hurley, 2003
C6	486.4	486.8	486.63	sandstone	siltstone	11.7							0.349	Hurley, 2003
C6	475.5	476.1	475.79	sandstone	coarse sandstone	12.3							0.009	Hurley, 2003
C6	466.3	466.8	466.50	sandstone	medium sandstone	12.5							0.013	Hurley, 2003
C6	456.4	457.3	456.83	sandstone	coarse sandstone	12.5	13		0.0	2.46	2.33		0.017	Hurley, 2003
C6	517.8	518.3	518.00	sandstone	banded sandstone	10.2	10		0.2	2.48	2.38		0.451	Hurley, 2003
C6	426.3	427.1	426.71	sandstone	breccia									Hurley, 2003
C6	417.4	417.9	417.67	sandstone		16.1							0.018	Hurley, 2003
C6	409.7	410.5	410.08	sandstone	breccia	15.6							0.015	Hurley, 2003
C6	396.8	397.7	397.21	sandstone	breccia	6.7							0.018	Hurley, 2003
C6	396.8	397.7	397.21	sandstone	breccia	14.6							0.018	Hurley, 2003
C6	387.6	388.3	387.92	sandstone	hard sandstone	4.0	4		0.0	2.52	2.48		0.013	Hurley, 2003
C6	435.2	435.8	435.46	sandstone	coarse sandstone	13.6							0.012	Hurley, 2003
C7	383.3	384.1	383.71	sandstone	coarse sandstone	7.3	10		0.0	2.51	2.41		0.035	Hurley, 2003
C7	237.7	238.0	237.83	sandstone	breccia								0.017	Hurley, 2003
C7	254.3	255.0	254.63	sandstone	hard sandstone	4.7	4		0.7	2.39	2.35		0.016	Hurley, 2003
C7	265.6	266.3	265.96	sandstone	medium sandstone	18.6	17		1.6	2.44	2.27		0.024	Hurley, 2003
C7	400.3	400.8	400.54	sandstone	siltstone	4.7	4		0.7	2.46	2.42		0.332	Hurley, 2003
C7	412.2	412.8	412.50	sandstone	banded sandstone								0.265	Hurley, 2003
C7	334.3	334.8	334.50	sandstone	medium sandstone								0.04	Hurley, 2003
C7	341.2	342.1	341.63	sandstone	medium sandstone	10.4	10		0.4	2.49	2.39			UW, 2003
C7	354.8	355.0	354.88	sandstone	banded sandstone	11.2	11		0.1	2.49	2.38		1.582	Hurley, 2003
C7	360.3	360.8	360.54	sandstone	medium sandstone	12.7	12		0.7	2.48	2.36		0.022	Hurley, 2003

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Bedrock Physical Parameter Results

Corehole	Start Depth (ft)	End Depth (ft)	Avg Depth (ft)	Rock Type	Modified Rock Type[a]	Porosity (% Volume)	Calculated Moisture Content (% Volume)[b]	Reported Moisture Content (% Volume)	Calculated Air Content (% Volume)[c]	Wet bulk density (g/cc)	Dry bulk density (g/cc)	Particle Density (g/cc)	Organic Carbon (% weight)	Reference Document
C7	392.2	392.7	392.42	sandstone	coarse sandstone	12.0	13		0.0	2.49	2.36		0.034	Hurley, 2003
C7	229.6	229.8	229.67	sandstone	breccia								0.016	Hurley, 2003
C7	165.9	166.7	166.29	sandstone	coarse sandstone	12.9	13		0.0	2.46	2.33		0.02	Hurley, 2003
C7	35.4	35.9	35.67	sandstone	fine sandstone	16.9	17		0.0	2.41	2.24		0.015	Hurley, 2003
C7	80.0	80.8	80.38	sandstone	coarse sandstone	10.6	14		0.0	2.47	2.33		0.018	Hurley, 2003
C7	114.4	115.0	114.71	sandstone	coarse sandstone	12.1	12		0.1	2.48	2.36		0.019	Hurley, 2003
C7	130.9	131.5	131.21	sandstone	coarse sandstone	12.0	13		0.0	2.44	2.31		0.023	Hurley, 2003
C7	156.9	157.8	157.38	sandstone	medium sandstone	14.4	14		0.4	2.45	2.31		0.02	Hurley, 2003
C7	185.5	186.0	185.75	sandstone	fine sandstone	16.7	17		0.0	2.44	2.27		0.03	Hurley, 2003
C7	199.3	199.9	199.63	sandstone	medium sandstone	15.4	16		0.0	2.43	2.27		0.019	Hurley, 2003
C7	207.9	208.7	208.29	sandstone	medium sandstone	11.9	12		0.0	2.5	2.38		0.037	Hurley, 2003
C7	146.1	147.5	146.79	sandstone	coarse sandstone	13.5	12		1.5	2.48	2.36		0.036	Hurley, 2003
C8	369.2	369.8	369.50	sandstone	coarse sandstone	14.4	14		0.4	2.47	2.33		0.012	UW, 2003
C8	356.3	356.8	356.54	sandstone	coarse sandstone	16.3	16		0.3	3.07	2.91		0.013	UW, 2003
C8	338.1	338.6	338.33	sandstone	coarse sandstone	13.5	14		0.0	2.45	2.31		0.0165	UW, 2003
C8	322.7	323.5	323.08	sandstone		10.9	11		0.0	2.07	1.96		0.016	UW, 2003
C8	216.8	217.4	217.08	sandstone		15.7	15		0.7	2.44	2.29			UW, 2003
C8	228.8	229.5	229.13	sandstone	coarse sandstone	13.5	14		0.0	2.46	2.32			UW, 2003
C8	32.3	33.1	32.71	sandstone	coarse sandstone	14.6	15		0.0	2.42	2.27		0.008	UW, 2003
C8	60.0	61.0	60.50	sandstone	coarse sandstone	17.3	18		0.0	2.39	2.21		0.0125	UW, 2003
C8	83.5	84.1	83.79	sandstone		13.1	13		0.1	2.48	2.35		0.015	UW, 2003
C8	104.9	105.8	105.33	sandstone		13.4	13		0.4	2.48	2.35			UW, 2003
C8	122.1	122.8	122.42	sandstone	fine sandstone	14.1	14		0.1	2.45	2.31			UW, 2003
C8	388.3	388.5	388.38	sandstone							2.44		0.354	UW, 2003
C8	144.8	144.8	144.79	sandstone	siltstone						2.34			UW, 2003
C8	167.4	168.0	167.71	sandstone		13.9	14		0.0	2.45	2.31		0.012	UW, 2003
C8	167.4	168.0	167.71	sandstone									0.0165	UW, 2003
C8	176.6	177.3	176.92	sandstone		13.3	14		0.0	2.45	2.31			UW, 2003
C8	199.6	199.9	199.75	sandstone	siltstone						2.4			UW, 2003
C8	322.7	323.5	323.08	sandstone	coarse sandstone								0.016	UW, 2003
C8	398.5	398.8	398.67	sandstone							2.41		0.274	UW, 2003
C8	83.5	84.1	83.79	sandstone									0.0165	UW, 2003
C8	286.8	287.4	287.08	sandstone	coarse sandstone	16.1	16		0.1	2.43	2.27		0.0153	UW, 2003
C8	265.6	266.1	265.83	sandstone							2.41		0.279	UW, 2003
C8	247.3	247.8	247.54	sandstone		15.9	16		0.0	2.78	2.62		0.0125	UW, 2003
C8	77.0	77.7	77.33	sandstone		12.0	12		0.0	2.5	2.38		0.0165	UW, 2003
C8	297.0	297.7	297.33	sandstone	coarse sandstone	14.2	14		0.2	2.47	2.33		0.012	UW, 2003
RD-45	272.5	274.0	273.25	sandstone	medium sandstone	11.9					2.328	2.68	0.05	Golder, 1997
RD-45	209.0	210.0	209.50	sandstone	medium sandstone	10.3					2.336	2.67	0.1	Golder, 1997
RD-45	114.0	115.0	114.50	sandstone	fine sandstone	9.4					2.37	2.69	0.14	Golder, 1997
RD-45	207.0	208.0	207.50	sandstone		13.9								GRC, 1992
RD-45	115.0	116.0	115.50	sandstone	fine sandstone	12.4								GRC, 1992
RD-46B	292.4	292.7	292.54	sandstone		15.4	15		0.4	2.32	2.17			Sterling, 1999
RD-46B	281.8	282.1	281.92	sandstone		1.0	1.8		0.0	2.65	2.632			Sterling, 1999
RD-46B	24.0	24.2	24.08	sandstone		21.0	11.2		9.8	2.18	2.068			Sterling, 1999
RD-46B	358.3	358.6	358.42	sandstone		15.0	10.2		4.8	2.35	2.248			Sterling, 1999
RD-46B	49.8	50.2	50.00	sandstone		13.2	20.7		0.0	2.27	2.063			Sterling, 1999
RD-46B	245.0	245.3	245.17	sandstone		2.9	2.9		0.0	2.62	2.591			Sterling, 1999
RD-46B	210.2	210.5	210.33	sandstone		12.2	13.2		0.0	2.46	2.328			Sterling, 1999
RD-46B	177.8	178.2	178.00	sandstone		13.6	12.4		1.2	2.42	2.296			Sterling, 1999

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Bedrock Physical Parameter Results

Corehole	Start Depth (ft)	End Depth (ft)	Avg Depth (ft)	Rock Type	Modified Rock Type[a]	Porosity (% Volume)	Calculated Moisture Content (% Volume)[b]	Reported Moisture Content (% Volume)	Calculated Air Content (% Volume)[c]	Wet bulk density (g/cc)	Dry bulk density (g/cc)	Particle Density (g/cc)	Organic Carbon (% weight)	Reference Document
RD-46B	140.4	140.8	140.63	sandstone		13.5	11.8		1.7	2.38	2.262			Sterling, 1999
RD-46B	139.4	139.8	139.63	sandstone		1.8	1.7		0.1	1.81	1.793			Sterling, 1999
RD-46B	105.2	105.5	105.33	sandstone		15.2	11.4		3.8	2.4	2.286			Sterling, 1999
RD-46B	70.0	70.4	70.21	sandstone		11.9	9.3		2.6	2.33	2.237			Sterling, 1999
RD-49	40.3	41.0	40.70	interbedded	siltstone	7.2					2.54	2.72	0.39	Golder, 1997
RD-49	68.5	70.0	69.25	interbedded	coarse sandstone	8.7					2.409	2.7	0.15	Golder, 1997
RD-49	62.5	64.0	63.40	interbedded	medium sandstone	10.4					2.313	2.67	0.02	Golder, 1997
RD-49	70.0	71.0	70.50	interbedded		11.8								GRC, 1992
RD-54C	28.0	29.1	28.51	sandstone		12.7					2.328	2.69	0.13	Golder, 1997
RD-55	26.5	28.0	27.25	interbedded	siltstone	10.6					2.333		1.22	Golder, 1997
RD-55	46.0	47.0	46.50	interbedded	siltstone	11.4					2.392	2.7	0.7	Golder, 1997
RD-55	76.4	78.0	77.13	interbedded	medium sandstone	16.8					2.22	2.64	0.07	Golder, 1997
RD-55	90.0	91.1	90.51	interbedded	coarse sandstone	10.5					2.341	2.7	0.15	Golder, 1997
RD-55	46.0	47.0	46.50	interbedded	fine sandstone	12.1								GRC, 1992
RD-55	89.0	90.0	89.50	interbedded	breccia	16.0								GRC, 1992
RD-55	28.0	29.0	28.50	interbedded	fine sandstone	13.6								GRC, 1992
Minimum Value						0.55	0.00	0.30	0	1.69	1.6	2.63	0.005	
Maximum Value						39.7	20.7	10.4	33.3	3.07	2.91	2.73	4.045	
Average Value						13.7	12.5	5.3	3.1	2.4	2.3	2.7	0.1	
Standard Deviation						5.1	4.2	2.3	6.2	0.2	0.1	0.0	0.4	
Total Number of Samples with Results						255	150	34	184	184	204	44	188	

a - Modified rock type identifies the subcategory of a particualar rock type that the corehole is associated with.
Where no modified rock type is identified, no information is available.
b - Moisture content (% Volume) = (Wet bulk density (g/cc) - Dry bulk density (g/cc)) × 1 cc water/1g water
c - Air content (% Volume) = Porosity (% Volume) - Moisture Content (% Volume)

Units:
ft = feet
g/cc = grams per cubic centimeter

APPENDIX G

VAPOR MIGRATION MODELING METHODOLOGY

Exposure to volatile compounds in ambient air via migration from groundwater will not be evaluated quantitatively because no reliable and approved groundwater-to-ambient air model is available for use, the ambient air pathway is likely a minor pathway when compared to direct contact groundwater pathways and there are more robust datasets for volatile compounds in soil. Also, additional information on the indoor air evaluation is provided in *An Updated Approach for Assessing the Vapor Intrusion Pathway Technical Memorandum* (CH2M Hill, 2012). Exposure to volatile compounds in ambient air via soil will be evaluated using the methodology in Appendix B of the SRAM Rev. 2 Addendum.

APPENDIX G

VAPOR MIGRATION MODELING METHODOLOGY
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LIST OF ACRONYMS AND ABBREVIATIONS

ASTM	American Society for Testing and Materials
CFOU	Chatsworth Formation Operable Unit
CSM	Conceptual site model
DTSC	California Department of Toxic Substances Control
ISC3	Industrial Source Complex model
SRAM	Standardized Risk Assessment Methodology
SSFL	Santa Susana Field Laboratory
Surficial OU	Surficial Media Operable Unit
USEPA	U.S. Environmental Protection Agency
VOCs	Volatile organic compounds

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G.1 INTRODUCTION

G.1.1 Background

The objective of this appendix is to supplement the Santa Susana Field Laboratory (SSFL) Standardized Risk Assessment Methodology (SRAM) with a detailed description of the methodologies for modeling the migration of volatile organic compounds (VOCs) from the subsurface into indoor and outdoor air. The methods described in this appendix are intended to provide a consistent approach that can be used in the human health and ecological risk assessment of the potential migration of VOCs by estimating exposure point concentrations in indoor and outdoor air at investigational units at the SSFL. Although each investigational unit is unique, many have similar potential contaminants, exposure pathways, and receptors. In addition, many of the investigational units share similar physical characteristics such as type of geology and depth to groundwater. As such, a consistent technical approach for all units at the SSFL is proposed in the risk assessment process for vapor migration. The vapor migration methodology will be applied to each investigational unit to determine the potential human and ecological risks due to exposures to volatile chemicals present in various media at the Surficial Media Operable Unit (Surficial OU) and Chatsworth Formation Operable Unit (CFOU). As such, Sections 6 and 10 of the main text of the SSFL SRAM contains the details of how the vapor migration evaluation will be incorporated into the cumulative multi-media multi-exposure pathway risk assessment of potential SSFL receptors. In general, the modeling described in this appendix describes how exposure point concentrations are estimated from environmental matrix concentrations. SRAM Sections 6, 8, and 9 describe how these exposure point concentrations are used to estimate receptor exposure.

This appendix presents mathematical equations used to model VOC migration into outdoor and indoor air from soil and groundwater concentrations. The evaluation of the migration of VOCs into outdoor air relies on a model that predicts soil vapor surface-flux from all subsurface sources that is combined with atmospheric dispersion models to predict outdoor air quality. A single model is used to predict indoor air concentrations from all subsurface sources.

The vapor migration models are based on scientifically-accepted equations that predict chemical behavior in the subsurface. The uncertainty associated with the application of these models to specific conditions at SSFL will be reduced to acceptable levels through a DTSC-approved field validation study as described in Section G.2.3.3.

G.1.2 Approach for Evaluating Vapor Migration

The characterization of contamination at SSFL investigational units includes the sampling and analysis of groundwater, surface water, bedrock, soil, sediment, and soil vapor. Concentrations in soil, sediment, and bedrock (collectively termed as bulk soil media) concentrations, groundwater, and soil vapor can all be used as inputs into vapor migration models for predicting indoor and outdoor air quality. The following approach will be used for modeling vapor migration at SSFL for the purposes of estimating both indoor and outdoor air quality:

- Soil vapor concentrations are the preferred input into the vapor migration models and will be collected from investigational units near VOC source areas where technically feasible, e.g., where access and soil thickness are adequate.

- A field validation study for the vapor migration models presented in this appendix will be performed at representative locations onsite to verify the models are performing adequately. If the field validation study shows that the models predict conservative vapor concentrations, then vapor modeling will be used in situations described below.

- Where contaminated groundwater has migrated from source areas, groundwater concentrations will be used as the input into the field-validated vapor models in down-gradient areas. Any existing (and any additional soil gas data collected in this situation as part of the field validation study) will also be used as an input to the vapor migration models. Any indoor or outdoor air concentrations and risks estimated based on groundwater concentrations will be noted in the risk assessment text.

- When soil vapor samples cannot be collected at an investigational unit near VOC source areas, bulk soil media concentrations will be used as inputs to the vapor migration models. Any indoor or outdoor air concentrations and risks estimated based on bulk soil media concentrations will be noted in the risk assessment text.

- When soil vapor samples cannot be collected and multiple sources of VOC are present (e.g., both soil and groundwater contain VOCs), then risks from all sources will be calculated.

- Shallow saturated zones (i.e., near-surface groundwater) essentially eliminate the migration of VOCs from sources below those zones. At those locations vapor from deeper groundwater will not be considered as input into the vapor flux model.

G.1.3 Sources of VOCs

The Surficial OU and CFOU have been locally impacted by chlorinated solvents from surficial spills and subsequent infiltration. These contaminants may then migrate to areas away from the source. VOCs in the subsurface may volatilize to outdoor and indoor air and result in complete

exposure pathways. Figures 1 and 2 depict a generalized conceptual site model (CSM) for human and ecological receptors, respectively. The figures identify exposure pathways for vapor migration at the SSFL. This appendix describes the methods for estimating VOC concentrations in outdoor and indoor air as a result of subsurface vapor migration from the following media:

- CFOU groundwater,
- CFOU unweathered bedrock,
- Surficial OU weathered bedrock,
- Surficial OU soil, and
- Surficial OU shallow groundwater.

Investigational units at SSFL have one or more of these contaminated media. For the purposes of evaluating vapor migration, the following situations will be considered:

1. *"VOC Source Areas" - Investigational units where VOC sources are present in Surficial OU soils, and VOCs are also present in underlying media (i.e.., Surficial OU groundwater, Surficial OU weathered bedrock, CFOU groundwater and/or CFOU unweathered bedrock)* – Soil vapor concentrations represent vapor impacts from all sources below the sample point and will be used as a vapor migration model input. In addition, separate vapor migration calculations will be made to evaluate the contribution of each media to outdoor and indoor air quality for the risk assessment.

   The use of soil gas data for vapor migration model input is preferred and will be used when obtainable. If soil gas data cannot be obtained due to technical or feasibility limitations (e.g., low permeability soils, distance to known sources, insufficient soil thickness), bulk soil data or bulk bedrock data will be used to conduct the risk assessment for the vadose zone impacts.

   For cases where Surficial OU groundwater is present[1] above the CFOU, modeling will be conducted using the Surficial OU groundwater concentrations. Modeling considering CFOU groundwater and/or CFOU bedrock concentrations will not be conducted, because vapor flux through shallow groundwater is not considered significant. If there is no Surficial OU

[1] This would not apply if the Surficial OU groundwater is not continuous over the CFOU impacts or if the presence of Surficial OU groundwater is transient.

groundwater present above the CFOU media, vapor migration calculations will be made to evaluate the contribution of CFOU groundwater using groundwater concentrations as the model input.

2. *"Distal Areas" - Investigational units where no VOC sources are present in Surficial OU soils, but where VOCs are present in underlying media (i.e., Surficial OU or CFOU groundwater and/or bedrock)* – In these cases, no soil VOC sources or impacts are expected. If soil vapor samples have not been collected and field validation and site conditions clearly indicate that soil vapor sampling would not contribute meaningfully to remedial decisions, groundwater concentrations will be used as inputs to the field-validated vapor migration model. For example, this approach will be acceptable if field validation studies demonstrate that it will provide a more conservative estimation of risk. If soil vapor samples are also available separate vapor migration calculations using concentrations from both media will be conducted. The risk assessment will describe the choice of exposure point concentration and the modeling results used to determine that concentration.

   For cases where Surficial OU groundwater is present[2] above the CFOU, modeling will be conducted using the Surficial OU groundwater concentrations. Modeling using CFOU groundwater and/or CFOU bedrock concentrations will not be conducted, because vapor flux through shallow groundwater is not considered significant.

Vapor modeling is used to estimate VOC migration from measured soil vapor and groundwater concentrations. As described above, in certain situations bulk soil media concentrations and groundwater concentrations will be used as inputs into the field-validated vapor migration model. Sampling and analysis of indoor or outdoor air samples is not typically recommended for risk characterization because of the numerous samples (above identified sources, downwind from sources, and upwind, background samples) required and the inherent variability in this type of sample. In contrast, using investigational unit-specific characterization data coupled with SSFL-calibrated fate and transport models is an excellent way for calculating exposure point concentrations for use in risk assessment.

As described below, the steady-state vapor flux model is used to evaluate vapor migration to outdoor air and the Johnson and Ettinger (1991) model is used to assess vapor intrusion to indoor

[2] This would not apply if the Surficial OU groundwater is not continuous over the CFOU impacts or if the presence of Surficial OU groundwater is transient.

air. This use of these models is consistent with the most recent U.S. Environmental Protection Agency (USEPA, 2002) and California Department of Toxic Substances Control (DTSC, 2005) guidance. These models assume volatile compounds migrate to the surface from groundwater or a source in the vadose zone. Where VOC sources exist in both vadose zone and groundwater and soil gas data cannot be obtained due to technical or feasibility limitations (e.g., low permeability soils, distance to known sources), separate calculations of contribution of the media (groundwater and soil matrix data) to outdoor and indoor air concentration are made in order to assess the significance of the vapor migration pathways for each of the media. However, the calculated risks from each medium should not simply be summed, as the observed concentrations may reflect the effect of a single initial source (the chemical concentration in one medium may be the source of contamination of other). Therefore, when multiple sources of VOCs are present, separate risks will be presented for modeled exposure concentrations from each VOC source, but will not be summed. The potential uncertainty of risk from using solely bulk soil or groundwater data will be addressed in the investigational unit-specific assessment uncertainty sections. Investigational units where the uncertainty in vapor migration estimates are large enough to affect risk-based decisions regarding site cleanup may be candidate sites for further characterization (e.g., soil vapor and/or flux measurements). Uncertainty in risk estimates due to the use of soil matrix data will be identified in the risk assessment.

G.2 OUTDOOR AIR

Outdoor air concentrations of volatile compounds from the subsurface will be estimated using a steady-state vapor flux model combined with an outdoor air dispersion model. These two models are discussed separately below.

G.2.1 Vapor Flux Model

The vapor flux model is a steady-state model that simulates vapor flux through the gaseous and aqueous phases of the subsurface to the ground surface. Similar to the Jury vapor flux model (Jury et al. 1983, 1990), the model accounts for upward diffusive flux as well as downward advective flux due to recharge. Unlike the Jury model, the model is a steady-state model and does not account for changes in concentration over time. The equations presented here are based on basic transport principals, including diffusion by Fick's Law and advective transport by Darcy's Law, and represent a refined approach to estimate flux which accounts for the potential transport of vapors through fractures and matrix in the bedrock in addition to the vadose zone soils. The potential for migration through bedrock fractures is not specifically addressed in the Jury model or similarly based models used by USEPA (1996 and 2002b) and American Society

for Testing and Materials (ASTM, 2000), but these models can be used provided the effective diffusivity through the bedrock is appropriately determined to account for the fractures.

The model simulates 1-D vapor flux in a homogenous subsurface extending from the source to the ground surface. VOCs diffuse upward in response to a concentration gradient from a constant concentration source. It is assumed that the VOC concentrations in the aqueous and gaseous phases are in equilibrium. Recharge is assumed to be steady state and advective mass flux of VOCs occurs only in the aqueous phase and that flux is in the downward direction. In contrast, diffusive mass flux of VOCs is directed upward, so advective and diffusive fluxes occur in the opposite direction under this scenario.

G.2.1.1 Diffusive Flux

The diffusive mass transport is described by Fick's 1st Law:

$$F_d = -D_{eff} \times \frac{dC_v}{dZ} \tag{1}$$

where

$$D_{eff} = D_{eff,v} + \frac{1}{H'} D_{eff,w} \tag{2}$$

where

F_d	=	mass flux due to diffusion (µg/m^2-s)
D_{eff}	=	overall effective diffusion coefficient (m^2/s)
$D_{eff,v}$	=	effective diffusion coefficient in the soil vapor phase (m^2/s)
$D_{eff,w}$	=	effective diffusion coefficient in the soil water phase (m^2/s)
C_v	=	sub-surface vapor concentration (µg/m^3-vapor)
Z	=	vertical coordinate measured position upward from the source (*e.g.* elevation) (m)
H'	=	Dimensionless Henry's Law coefficient (m^3-water/m^3-vapor)

G.2.1.2 Liquid Phase Advective Flux

The advective flux in the soil moisture phase is given by the following equation:

$$F_{adv} = (q \times C_w) = \left(q \times \frac{C_v}{H'} \right) \tag{3}$$

where

F_{adv} = mass advective flux in the aqueous phase (µg/m^2-s)
C_w = sub-surface aqueous phase concentration (µg/m^3-water)
q = Darcy flux of the aqueous phase (m/s)

The seepage (Darcy) velocity of water through the vadose zone is the negative of the average steady recharge rate, where

$$q = -R \tag{4}$$

R = average steady recharge rate (m/s)

The seepage velocity is negative since flow is downward and the vertical coordinate has been defined as positive upward. Thus Equation 3 becomes

$$F_{adv} = -\left(R \times \frac{C_v}{H'} \right) \tag{5}$$

G.2.1.3 Total Flux

The total flux due to aqueous and gaseous transport is obtained by adding Equations 1 and 5 yielding the following equation.

$$F = -\left[D_{eff} \times \frac{dC_v}{dZ} \right] - \left(R \times \frac{C_v}{H'} \right) \tag{6}$$

where

F = total mass flux (µg/m^2-s)

Equation 6 can be integrated between two points of known concentration under the conditions of steady recharge (R) and homogenous subsurface properties to obtain a solution for F:

$$F = \frac{R}{H'} \times \frac{C_1 - \left[C_2 \times \exp\left(\frac{R \times L}{D_{eff} \times H'} \right) \right]}{\exp\left(\frac{R \times L}{D_{eff} \times H'} \right) - 1} \tag{7}$$

where

C_1 = sub-surface vapor concentration at the bottom of a subsurface layer (µg/m^3-vapor)

C_2 = sub-surface vapor concentration at the top of a subsurface layer (µg/m^3-vapor)

L = thickness of the subsurface layer (m)

For scenarios with a single homogenous subsurface layer between the source and the ground surface and a VOC concentration of zero at the ground surface, Equation 7 simplifies to:

$$F = \frac{C_{source} R / H'}{\exp\left(\frac{R \times L}{D_{eff} \times H'} \right) - 1} \tag{8}$$

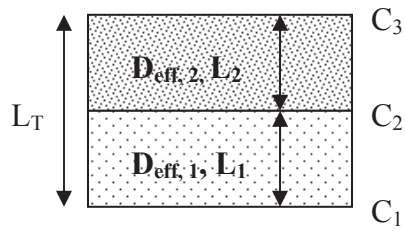
where

C_{source} = sub-surface source vapor concentration (µg/m^3-vapor)

Derivation of Equations 7 and 8 are provided in Attachment 1. It should be noted that D_{eff} and R are not independent and care should be taken in any sensitivity analyses.

G.2.1.4 Effect of Varying Subsurface Conditions on Contaminant Flux

The flux calculated by Equation 7 assumes uniform soil properties. For investigational units with multiple soil and/or bedrock layers, such as investigational units with multiple soil covers and/or bedrock layers, the overall flux is determined by evaluating the flux in each layer. Conservation of mass requires that the flux across each later be equal provided that there is no loss (e.g., biodegradation or generation of chemicals). For example, consider the scenario for estimating flux across two adjacent layers as depicted in the following diagram:



For this scenario, the following equations are used:

$$F_1 = \frac{R}{H'} \times \frac{C_1 - \left[C_2 \times \exp\left(\frac{R \times L_1}{D_{eff,1} \times H'} \right) \right]}{\exp\left(\frac{R \times L_1}{D_{eff,1} \times H'} \right) - 1} \tag{9a}$$

$$F_2 = \frac{R}{H'} \times \frac{C_2 - \left[C_3 \times \exp\left(\frac{R \times L_2}{D_{eff,2} \times H'} \right) \right]}{\exp\left(\frac{R \times L_2}{D_{eff,2} \times H'} \right) - 1} \tag{9b}$$

where

F_1	=	total mass flux through layer 1 (µg/m^2-s)
F_2	=	total mass flux through layer 2 (µg/m^2-s)
$D_{eff,1}$	=	overall effective diffusion coefficient layer 1 (m^2/s)
$D_{eff,2}$	=	overall effective diffusion coefficient layer 2 (m^2/s)
C_1	=	sub-surface vapor concentration at the bottom of a layer 1(µg/m^3-vapor)
C_2	=	sub-surface vapor concentration at the top of a layer 1 and at the bottom of layer 2 (µg/m^3-vapor)
C_3	=	sub-surface vapor concentration at the top of a layer 2 (µg/m^3-vapor)
L_1	=	thickness of layer 1 (m)
L_2	=	thickness of layer 2 (m)

The vapor flux is determined by setting F_1=F_2 and solving for the concentration C_2 at the interface between the layers. Then C_2 is re-substituted into either equation 9a or 9b to obtain the vapor flux. The solution results in calculating the vapor flux using equation 7 using a total effective diffusion coefficient across the thickness of all soil layers:

$$F = \frac{R}{H'} \times \frac{C_1 - \left[C_3 \times \exp\left(\frac{R \times L_T}{H' \times D^T{}_{eff}} \right) \right]}{\exp\left(\frac{R \times L_T}{H' \times D^T{}_{eff}} \right) - 1} \tag{9c}$$

where

$D^T{}_{eff}$ = overall effective diffusion coefficient (m^2/s);
L_T = the total combined thickness of all layers (m);

The total effective diffusion coefficient is the harmonic average of the diffusion coefficients through each layer and is described by:

$$D^T_{eff} = L_T \Big/ \sum \frac{L_i}{D_{eff,i}} \tag{9d}$$

where

$D_{eff,\,i}$ = effective diffusion coefficient through layer i (m^2/s); and
L_i = the thickness of layer, i.

G.2.1.5 Calculation of Effective Diffusion Coefficients

In Equation 2, the effective diffusion coefficient is calculated from the water and vapor phase diffusion coefficients. The effective diffusion coefficient for the water phase is calculated with the assumption that the bedrock fractures are completely air filled and consequently do not contribute to the effective diffusion coefficient. The effective diffusion coefficient for the water phase is determined by:

$$D_{eff,w} = \theta_w \times \tau_w \times D_w \tag{10}$$

where

θ_w = volumetric water content of the matrix (m^3-water/m^3-soil)
τ_w = tortuosity of the aqueous phase (dimensionless)
D_w = molecular diffusion coefficient in water (m^2/s)

Millington and Quirk (1961) provide an empirical relationship for the aqueous phase tortuosity factor and Equation 10 may be re-written as:

$$D_{eff,w} = \theta_w \left(\frac{\theta_w^{7/3}}{n^2} \right) \times D_w \tag{11}$$

where

n = matrix porosity (m^3-void space/m^3-soil)

The diffusion coefficient for the vapor phase assumes that VOCs will diffuse through air-filled fractures and partially saturated matrix. For reference, fracture porosity refers to the space associated solely with bedrock fractures and assumed to be completely air filled. Also, matrix porosity refers to spaces in soil or bedrock that can be filled with air and/or water and does not include space associated with fractures. The fractures are assumed to be smooth channels with a tortuosity of unity. The equation for effective diffusion coefficient in air that accounts for both the fractures and matrix is

$$D_{eff,v} = \left(\phi_f \times D_a\right) + \left[\left(\theta_v\right) \times \tau_v \times D_a\right] \tag{12}$$

where

ϕ_f = fracture porosity (m^3-fractures/m^3-soil)
n = matrix porosity (m^3-void space/m^3-soil)
θ_v = volumetric air content of the matrix (m^3-vapor/m^3-soil)
τ_v = tortuosity of the vapor phase (dimensionless)
D_a = molecular diffusion coefficient in air (m^2/s)

Using the Millington and Quirk (1961) expression for the vapor phase tortuosity factor Equation 12 may be re-written as:

$$D_{eff,v} = \left[\phi_f + \theta_v \left(\frac{\theta_v^{7/3}}{n^2} \right) \right] \times D_a \tag{13}$$

Combining Equations 11, 13 and 2 the effective diffusion (D_{eff}) coefficient is described by:

$$D_{eff} = \left[\theta_w \left(\frac{\theta_w^{7/3}}{n^2} \right) \times \frac{D_w}{H'} \right] + \left\{ \left[\phi_f + \theta_v \left(\frac{\theta_v^{7/3}}{n^2} \right) \right] \times D_a \right\} \tag{14}$$

Equation 14 is used in Equation 7 to estimate vapor mass flux from the sub-surface including transport through bedrock fractures as well as through bedrock matrix. For use in non-fractured media, the percent fracture porosity term is set to zero.

G.2.2 Air Dispersion Modeling

Two air dispersion models are presented in this appendix that may be used to predict the air concentrations of VOCs for risk assessments at SSFL. The first model is the USEPA Q/C simplified air dispersion model that will be used to predict the air concentrations at the source area. The second model is the Industrial Source Complex 3 (ISC3) model that may be used to predict air concentrations down wind of the source area. The ISC3 model allows for more site-specific considerations in the modeling but also requires an additional level of resources to run. The ISC3 model will be used when results of the Q/C dispersion model estimates risks to either onsite or offsite receptors that exceed acceptable criteria. Further discussion of each model is provided below.

G.2.2.1 USEPA Q/C Dispersion Model

USEPA Soil Screening Guidance (1996 and 2002b) presents the Q/C dispersion factor that relates an estimated flux-rate to an outdoor air concentrations directly over the source area by the following equation.

$$C_{outdoor} = \frac{F \times CF_1 \times CF_2}{Q/C} \tag{15}$$

where:

$C_{outdoor}$	=	outdoor air concentration ($\mu g/m^3$)
F	=	total mass flux as calculated from Equation 7 ($\mu g/ m^2$ sec)
Q/C	=	dispersion factor (g/m^2 sec per kg/m^3)
CF_1	=	conversion factor (1×10^{-6} g/μg)
CF_2	=	conversion factor (1×10^{9} μg/kg)

USEPA developed default parameters to estimate default region specific Q/C factors. USEPA developed Q/C parameters using the ISC3 air dispersion model. The Q/C factor can be estimated using the following equation.

$$Q/C = A \times \exp\left[\frac{(\ln A_{site} - B)^2}{C}\right] \quad (16)$$

where

A_{site}	=	*Areal extent of site or subsurface source (acres)*
A	=	*11.9110, USEPA (2002b) default for Los Angeles, CA*
B	=	*18.4385, USEPA (2002b) default for Los Angeles, CA*
C	=	*209.7845, USEPA (2002b) default for Los Angeles, CA*

Other screening models besides the USEPA Q/C model, such as SCREEN3, were considered for providing conservative estimates of onsite air concentrations. A comparison between the Q/C and SCREEN3 model is presented in Attachment 2. The results of the comparison indicate that the Q/C is consistently more conservative than the SCREEN3 model. As such the Q/C model was selected for use.

G.2.2.2 ISC3

The Q/C dispersion model terms assume that the receptor is located directly over the source area. It is anticipated that the use of the Q/C model will be sufficient for most investigational units. The use of the more detailed ISC3 model will be limited to those investigational units where onsite air concentrations exceed an unacceptable risk level and subsequently the downwind air concentrations could also exceed a risk level. In such situations further air dispersion modeling will be done to estimate down wind air concentrations.

An additional model that may be used includes the ISC3 model (USEPA, 1995). The ISC3 is a steady-state Gaussian plume model which can be used to assess pollutant concentrations from a wide variety of sources associated with an industrial complex. This model can account for the following: settling and dry deposition of particles; downwash; area sources; plume rise as a function of downwind distance; separation of point sources; and limited investigational unit-specific terrain adjustment. The use of the ISC3 model requires additional investigational unit-specific inputs describing aerial extent of sub-surface sources; separation of point sources; and terrain adjustments. The investigational unit-specific parameter value inputs required to operate the ISC3 models and their justification will be described in the investigational unit-specific risk assessments. Site data will be used where available and appropriate. Table G-1 lists dispersion air parameters needed to conduct ISC3 modeling and values from input parameter data collected to date. Receptor locations and grid points will depend on the location of the investigational

unit, potential locations of down wind receptors and the SSFL property boundary. For each site, a sufficient number of down wind receptor locations will be included to evaluate sensitive receptor locations.

G.2.3 Input Assumptions

The vapor migration modeling to outdoor air relies upon source concentrations as well as soil and chemical characteristics that describe effective diffusion coefficients.

G.2.3.1 Source Concentrations

These models have been developed using soil vapor concentrations for source concentrations. As such, for investigational units with measured soil vapor VOC concentrations, the measured vapor concentrations can be used directly as inputs in the outdoor air models outlined in Section 2. Soil vapor data collected less than 3 feet deep will not be used.

In certain situations as discussed in Section G.1.2, bulk soil concentrations and groundwater concentrations will be used as inputs into the field-validated vapor migration model (see Section G.2.3.3). In these cases, the uncertainties resulting from an investigational unit modeling approach that depends on hypothetical equilibrium partitioning relationships between water, soil and/or bedrock matrix, and soil gas will be addressed in the investigational unit assessment uncertainty sections to assist in the interpretation of the results. This allows the greatest use of the data currently available in the investigational unit risk assessments.

In cases where the gaseous phase is in contact with the groundwater, soil vapor concentrations can be estimated from measured groundwater concentrations using the Henry's Law relationship as shown in the following equation:

$$C_{source} = C_{groundwater} \times H' \qquad (17)$$

where

C_{source} = vapor concentration in the gaseous (air) phase (µg/m^3-vapor)
$C_{groundwater}$ = aqueous concentration (µg/m^3-water); where ug/m^3 = µg/L x 1000 L/m^3
H' = Henry's Law coefficient (m^3-water/m^3-vapor)

For investigational units where soil vapor data are not available, bulk soil measurements of VOCs maybe used to estimate a soil vapor concentration that can be used in the outdoor air models outlined in Section 2 using the following 3-phase equilibrium equation:

$$C_{source} = C_{soil} \frac{H' \rho_{soil}}{\left(H' \theta_a + \theta_w + \rho_{soil} f_{oc} k_{oc}\right)} \tag{18}$$

where

C_{source}	=	vapor concentration in the gaseous (air) phase (µg/m^3-vapor)
C_{soil}	=	bulk soil concentration (µg/kg-soil);
H'	=	Henry's Law coefficient (m^3-water/m^3-vapor)
f_{oc}	=	soil fraction organic carbon content (kg-organic carbon/kg-soil)
k_{oc}	=	chemical specific organic carbon-water partitioning coefficient (m^3/ kg-soil) m^3/kg = cm^3/g x 10^{-6} m^3/cm^3 x 10^3 g/kg
θ_w	=	water-filled porosity (m^3-water/m^3-soil)
θ_a	=	air-filled porosity (m^3-vapor/m^3-soil)
ρ_{soil}	=	soil dry bulk density (kg/cm^3); kg/m^3 = g/cm^3 x 10^{-3} kg/g x 10^6 m^3/cm^3

For investigational units where surface flux measurements are conducted, the measured fluxes will be used as a direct input into the air dispersion models described in Section G.2.2 if the flux chamber data are determined to be adequate for risk assessment purposes based on the field validation studies discussed further in section G.2.3.3. Risk estimates from modeled fluxes may be presented along with risk estimates from measured flux data, for particular investigational units. In addition, measured flux data will be used to understand the performance of the vapor migration model by comparing measured vapor flux to modeled flux. Thus, the measured vapor flux will also be useful for validating these vapor migration models for use at SSFL is discussed further in Section G.2.3.3.

Input concentrations for the models will be representative of both average (central tendency) and RME (maximum) site conditions. The characteristics of the investigational unit and the exposure area will be considered in making these input concentrations estimates. Average and RME estimates of exposure point concentrations, based on model input parameters, will be combined with other exposure parameters (described in SRAM Section 6) to develop appropriate average and RME risk estimates for the risk assessments.

G.2.3.2 Effective Diffusion Coefficients

The overall effective diffusion coefficient is calculated as described above in Equation 14. The site-specific soil characterization inputs are listed in Table G-2. Inputs related to chemical-specific physical properties of VOCs (e.g., Henry's law constant, solubility, and soil adsorption)

are listed in Table G-3 and are obtained from USEPA (2002a). Inputs for chemicals that are not listed in Table G-3 will be obtained from literature sources or may be approximated (e.g., Lyman et al. 1983). Chemical properties needed for investigational unit risk assessments that are not presented in Table G-3 will be appropriately documented in the investigational unit risk assessments.

G.2.3.3 Field Validation of Vapor Migration Model

The validation of this model for use at the SSFL will be accomplished by characterizing select representative portions of investigational units for vapor migration and air dispersion. A limited number of locations at the SSFL will be selected to represent the various types of conditions that exist and are relevant to the potential vapor migration and air dispersion of VOCs. The results of model validation at an area with representative site characteristics will be sufficient for model validation at investigational units with similar characteristics. Some of the site characteristics that will be considered for further characterization include those described in Section G.1.2 where there is VOC contamination in soil, VOC contamination in CFOU groundwater, VOC contamination in weathered/unweathered bedrock, and varying thickness of soil cover. Other site characteristic groupings may be considered.

A work plan for vapor flux and ambient air sampling at one of the investigational units at SSFL, the Former Liquid Oxygen (LOX) site, has already been proposed and approved by DTSC (MWH 2005). However, the LOX vapor sampling only represents a part of the effort required for field validation of the vapor migration models. Therefore, an additional work plan that describes the entire scope of the field validation study will be submitted for DTSC approval. This field validation study work plan will include how data collected from the LOX site will be used for validation of the models.

The scope of the vapor migration model field validation study will include collection of measured soil gas and vapor flux data in the situations described in Section G.1.3, including source and distal areas. As part of the field validation work, colocated samples will be collected from bulk soil and groundwater media where present in addition to measurement of soil vapor. Air dispersion modeling will be field-validated by the collection of ambient air samples at and downwind of a VOC source area. The results of SSFL field validation/model calibration efforts will be applied to SSFL investigational units with similar characteristics. The submittal of field validation data will also include a quantitative sensitivity and uncertainty analysis of the models. In addition to supporting model validation efforts, the results of the sensitivity and uncertainty analyses will be used to establish appropriate model input parameters (average and RME), in

particular soil/bedrock physical properties, that can be applied at other investigational units. As such, the methods and parameters presented in this appendix to estimate outdoor concentrations may be modified based on the results of model validations and calibrations from the field validation data. At a minimum, the soil/bedrock physical properties presented in this appendix to estimate outdoor concentrations will be updated based on the results of model validations and calibrations from the field validation data. The results of the field validation study will be submitted in a report for DTSC approval. As necessary, the field validation study report will also include modifications or supplements to this appendix for DTSC review and approval.

G.3 INDOOR AIR

G.3.1 Vapor Migration from Subsurface Source to Indoor Air

The potential human exposures via indoor vapor inhalation of VOCs originating in subsurface soil or groundwater are calculated using the model of Johnson and Ettinger (1991). The Johnson and Ettinger model calculates an attenuation factor that relates a soil vapor concentrations from a subsurface source to indoor air. Three transport mechanisms are considered:

- Diffusion through vadose zone soils (as described in Section 2.1 previously for the vapor flux model);
- Convection into the building due to the negative pressure differential between the subsurface and building; and
- Mixing of vapors within a building resulting from building ventilation.

The Johnson and Ettinger (1991) model requires input parameter values to characterize the vadose zone and building characteristics. Investigational unit-specific inputs include depth to volatile source and soil characteristics (porosity, moisture content, fraction organic carbon, hydraulic conductivity). Investigational unit-specific bedrock and soil model input parameter values to be used in the analyses are listed in Table G-3. Where investigational unit-specific data are not available for building parameters to serve as inputs into the Johnson and Ettinger model, available default parameters listed in DTSC (2005) are used as shown in Table G-3.

The attenuation factor, α, calculated by the Johnson and Ettinger (1991) model represents the ratio of concentrations of a volatile compound in indoor air to the soil vapor concentration.

$$\alpha = \frac{C_{building}}{C_{source}} \tag{19}$$

where

$C_{building}$	=	indoor air vapor concentration (µg/m^3-air)
C_{source}	=	sub-surface source vapor concentration (µg/m^3-vapor)

$$\alpha = \left[\left(\frac{D_{eff} \times A_B}{Q_{building} \times L_T}\right) \times \exp\left(\frac{Q_{soil} \times L_{crack}}{D^{crack} \times A_{crack}}\right)\right] \Big/ \left\{\exp\left(\frac{Q_{soil} \times L_{crack}}{D^{crack} \times A_{crack}}\right) + \left(\frac{D_{eff} \times A_B}{Q_{building} \times L_T}\right) + \left(\frac{D_{eff} \times A_B}{Q_{soil} \times L_T}\right)\left[\exp\left(\frac{Q_{soil} \times L_{crack}}{D^{crack} \times A_{crack}}\right) - 1\right]\right\} \tag{20}$$

where

D_{eff}	=	Total overall effective diffusion coefficient (m^2/s)
A_B	=	Area of the enclosed space below grade (m^2)
$Q_{building}$	=	Building ventilation rate (m^3/s)
L_T	=	Source-building separation (m)
Q_{soil}	=	Volumetric flow rate of soil gas into the enclosed space (m^3/s)
L_{crack}	=	Enclosed space foundation or slab thickness (m)
A_{crack}	=	Area of total cracks (m^2)
D_{crack}	=	Effective diffusion coefficient through the cracks (m^2/s) (assumed equivalent to effective diffusion coefficient of the soil layer in contact with the floor).

investigational units with multiple soil and/or bedrock layers, such as investigational units with multiple soil covers and/or bedrock layers, the overall migration into indoor air is determined by evaluating Equation 20 using the overall effective diffusion coefficient. The overall effective diffusion coefficient is the harmonic average of the diffusion coefficients through each layer and is described by:

$$D_{eff}^{T} = L_T \Big/ \sum \frac{L_i}{D_{eff,i}} \tag{21}$$

where

D^T_{eff}	=	overall effective diffusion coefficient (m^2/s);
L_T	=	the total diffusive distance (m);
$D_{eff,\,i}$	=	effective diffusion coefficient through layer i (m^2/s); and
L_i	=	the thickness of layer, i (m).

G.3.2 Input Assumptions

The vapor migration modeling to indoor air relies upon inputs that describe building characteristics, soil and chemical characteristics that describe effective diffusion coefficients, and source concentrations.

G.3.2.1 Building Characteristics

Where existing buildings occur at investigational units and vapor migration into indoor air is a potential concern, available and appropriate building specific parameters will be used. For modeling into future potential structures, USEPA (2002a) and DTSC (2005) default parameters will be used and are listed in Table G-4.

G.3.2.2 Effective Diffusion Coefficients

The overall effective diffusion coefficient is calculated as described above in Equation 14. The methods for addressing fractured bedrock and layered media are also applicable to the vapor intrusion calculations. The site-specific soil characterization inputs are listed in Table G-4. Inputs related to chemical-specific physical properties of VOCs (e.g., Henry's law constant, solubility, and soil adsorption) are listed in Table G-3 and are obtained from USEPA (2002a). Inputs for chemicals that are not listed in Table G-3 will be obtained from literature sources or may be approximated (e.g., Lyman et al. 1983). Chemical properties needed for investigational unit risk assessments that are not presented in Table G-3 will be appropriately documented in the investigational unit risk assessments.

G.3.2.3 Source Concentrations

As with the vapor flux model, the Johnson and Ettinger model is directly applicable to measured soil vapor concentrations and the indoor air concentration would be calculated as:

$$C_{building} = \alpha \times C_{source} \tag{22}$$

Soil vapor data collected less than 3 feet deep will not be used. To calculate the indoor air concentration from a groundwater or soil source concentration, the partitioning relationship in Equations 17 and 18 will used to predict source soil vapor concentrations from groundwater and soil source concentrations, respectively.

The use of soil vapor data for model input is preferred. In certain situations as discussed in Section G.1.2, bulk soil media concentrations and groundwater concentrations will be used as inputs into the field-validated vapor migration model (see Section G.2.3.3). In these cases, the uncertainties resulting from an investigational unit modeling approach that depends on hypothetical equilibrium partitioning relationships between water, soil and/or bedrock matrix, and soil gas will be addressed in the I nvestigational unit assessment uncertainty sections to assist in the interpretation of the results. This allows the greatest use of the data currently available in the investigational unit risk assessments.

Input concentrations for the models will be representative of both average (central tendency) and RME (maximum) site conditions. The characteristics of the investigational unit and the exposure area will be considered in making these input concentrations estimates. Average and RME estimates of exposure point concentrations, based on model input parameters, will be combined with other exposure parameters (described in SRAM Section 6) to develop appropriate average and RME risk estimates.

G.4 SUMMARY

The methodology described in this appendix provides a consistent approach for the assessment risk associated with the potential migration of VOCs into indoor and outdoor air at the investigational units at the SSFL. A modeling strategy with a preferred basis of soil vapor concentrations has been presented. The methodology will be applied to each investigational unit to determine the potential human and ecological risks due to exposures to chemicals present in various media. The suitability of the models, use of soil and/or groundwater sources, or other inputs parameters will be assessed through a field validation study. Appropriate average and RME estimates of exposure point concentrations of VOC in air will be developed using these

models. Sections 6 and 10 of the main text of the SRAM will contain the details of how the evaluation of vapor migration will be incorporated into the cumulative multi-media multi-exposure pathway risk assessment of potential SSFL receptors. The methodology can be applied to assess vapor migration from VOC sources in both Surficial OU and CFOU.

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APPENDIX G

TABLES

Table G-1 (1 of 1)

Parameters Used in ISC3 Modeling

Inputs	Value	Units
Source Inputs		
Source Coordinates	Site-specific	m
Mass Emission Flux	Site-specific[a]	$\mu g/m^2$-sec
Area Source Length	Site-specific	m
Area Source Width	Site-specific	m
Area Source Angle Relative to North that the Source is Facing	Site-specific	degrees
Area Source Release Height	Site-specific	m
Receptor Inputs		
Receptor Coordinates	Site-specific	m
Meteorological Inputs (hourly data for one year) [b]		
Wind Speed	Site-specific	m/s
Wind Direction	Site-specific	degree from North
Ambient Temperature	Site-specific	K
Stability Class (1-6)	Site-specific	unitless
Rural and Urban Mixing Height	Site-specific	m

[a] - Mass emission flux inputs may be from either actual flux measurements or outputs from the vapor flux model (See Section G.2.1). For investigational units where both modeled and measured flux inputs are available, the ISC3 dispersion modeling may be conducted using both modeled and measured fluxes (See Sections G.2.3.1 and G.2.3.3).

[b] - The best available data that is representative of investigational unit-specific conditions.

Table G-2 (1 of 1)

Parameter Values Used in Steady-State Flux Model for Vapor Migration to Outdoor Air

Parameter	Value	Units	Source
Soil bulk density (Qb)	a	kg/m^3	Site-specific
Water recharge (R)	1.00E-09	m/sec	Site-specific based on median groundwater recharge rate of 1.2 inches per year. MWH (2003a)
Organic carbon content of soil (foc)	a	fraction	Site-specific
Volumetric soil water content (θw)	a	m^3/m^3	Site-specific
Volumetric soil air content (θa)	a	m^3/m^3	Site-specific
Soil porosity (ns)	a	m^3/m^3	Site-specific
Volumetric unweathered bedrock water content (θw,ubr)	a	m^3/m^3	Site-specific
Volumetric unweathered bedrock air content (θa,ubr)	a	m^3/m^3	Site-specific
Unweathered bedrock porosity (nubr)	a	m^3/m^3	Site-specific
Unweathered bedrock fractures (ϕubr)	a	m^3/m^3	Site-specific
Volumetric weathered bedrock water content (θw,wbr)	a	m^3/m^3	Site-specific
Volumetric weathered bedrock air content (θa,wbr)	a	m^3/m^3	Site-specific
Weathered bedrock porosity (nwbr)	a	m^3/m^3	Site-specific
Weathered bedrock fractures (ϕwbr)	a	m^3/m^3	Site-specific
Depth to top of contaminated zone (L)	a	m	Site-specific

[a] The parameters presented in this table will be developed using the data presented in Appendix F or additional data obtained during field validation studies.

Table G-3 (1 of 2)

Chemical Property Values Used in Vapor Migration Models(a)

Chemical	Organic carbon partition coefficient, Koc (cm^3/g)	Diffusivity in air, Da (cm^2/s)	Diffusivity in water, Dw (cm^2/s)	Henry's law constant H' (unitless)	Henry's law constant H (atm-m^3/mol)
1,1,1-Trichloroethane	1.10E+02	7.80E-02	8.80E-06	7.03E-01	1.72E-02
1,1,2,2-Tetrachloroethane	9.33E+01	7.10E-02	7.90E-06	1.41E-02	3.44E-04
1,1,2-Trichloro-1,2,2-trifluoroethane	1.11E+04	7.80E-02	8.20E-06	1.97E+01	4.80E-01
1,1,2-Trichloroethane	5.01E+01	7.80E-02	8.80E-06	3.73E-02	9.11E-04
1,1-Dichloroethane	3.16E+01	7.42E-02	1.05E-05	2.30E-01	5.61E-03
1,1-Dichloroethene	5.89E+01	9.00E-02	1.04E-05	1.07E+00	2.60E-02
1,2,3-Trichloropropane	2.20E+01	7.10E-02	7.90E-06	1.67E-02	4.08E-04
1,2,4-Trichlorobenzene	1.78E+03	3.00E-02	8.23E-06	5.81E-02	1.42E-03
1,2,4-Trimethylbenzene	1.35E+03	6.06E-02	7.92E-06	2.52E-01	6.14E-03
1,2-Dibromoethane	2.50E+01	2.17E-02	1.19E-05	3.04E-02	7.41E-04
1,2-Dichlorobenzene	6.17E+02	6.90E-02	7.90E-06	7.77E-02	1.90E-03
1,2-Dichloroethane	1.74E+01	1.04E-01	9.90E-06	4.00E-02	9.77E-04
1,2-Dichloropropane	4.37E+01	7.82E-02	8.73E-06	1.15E-01	2.79E-03
1,3,5-Trimethylbenzene	1.35E+03	6.02E-02	8.67E-06	2.41E-01	5.87E-03
1,3-Dichlorobenzene	1.98E+03	6.92E-02	7.86E-06	1.27E-01	3.09E-03
1,4-Dichlorobenzene	6.17E+02	6.90E-02	7.90E-06	9.82E-02	2.39E-03
2-Butanone	2.30E+00	8.08E-02	9.80E-06	2.29E-03	5.58E-05
Acetone	5.75E-01	1.24E-01	1.14E-05	1.59E-03	3.87E-05
Acrolein	2.76E+00	1.05E-01	1.22E-05	4.99E-03	1.22E-04
Acrylonitrile	5.90E+00	1.22E-01	1.34E-05	4.21E-03	1.03E-04
Benzene	5.89E+01	8.80E-02	9.80E-06	2.27E-01	5.54E-03
Bromodichloromethane	5.50E+01	2.98E-02	1.06E-05	6.54E-02	1.60E-03
Bromoform	8.71E+01	1.49E-02	1.03E-05	2.41E-02	5.88E-04
Bromomethane	1.05E+01	7.28E-02	1.21E-05	2.55E-01	6.22E-03
Carbon disulfide	4.57E+01	1.04E-01	1.00E-05	1.24E+00	3.02E-02
Carbon tetrachloride	1.74E+02	7.80E-02	8.80E-06	1.24E+00	3.03E-02
Chlorobenzene	2.19E+02	7.30E-02	8.70E-06	1.51E-01	3.69E-03
Chloroethane	4.40E+00	2.71E-01	1.15E-05	3.61E-01	8.80E-03
Chloroform	3.98E+01	1.04E-01	1.00E-05	1.50E-01	3.66E-03
Chloromethane	2.12E+00	1.26E-01	6.50E-06	3.61E-01	8.80E-03
cis-1,2-Dichloroethene	3.55E+01	7.36E-02	1.13E-05	1.67E-01	4.07E-03
Dibromochloromethane	6.31E+01	1.96E-02	1.05E-05	3.20E-02	7.81E-04
Dibromomethane	1.26E+01	4.30E-02	8.44E-06	3.52E-02	8.59E-04
Dichlorodifluoromethane	4.57E+02	6.65E-02	9.92E-06	1.40E+01	3.42E-01
Ethylbenzene	3.63E+02	7.50E-02	7.80E-06	3.22E-01	7.86E-03
Isopropylbenzene	4.89E+02	6.50E-02	7.10E-06	4.74E+01	1.16E+00
m,p-Xylene	3.89E+02	7.69E-02	8.44E-06	3.13E-01	7.64E-03
m,p-Xylene	4.07E+02	7.00E-02	7.80E-06	3.00E-01	7.32E-03
Methyl tert-butyl ether	7.26E+00	1.02E-01	1.05E-05	2.56E-02	6.23E-04
Methylene chloride	1.17E+01	1.01E-01	1.17E-05	8.96E-02	2.18E-03
n-Butylbenzene	1.11E+03	5.70E-02	8.12E-06	5.38E-01	1.31E-02
n-Propylbenzene	5.62E+02	6.01E-02	7.83E-06	4.37E-01	1.07E-02
o-Xylene	3.63E+02	8.70E-02	1.00E-05	2.12E-01	5.18E-03
sec-Butylbenzene	9.66E+02	5.70E-02	8.12E-06	5.68E-01	1.39E-02
Styrene	7.76E+02	7.10E-02	8.00E-06	1.12E-01	2.74E-03

Table G-3 (2 of 2)

Chemical Property Values Used in Vapor Migration Models(a)

Chemical	Organic carbon partition coefficient, Koc (cm^3/g)	Diffusivity in air, Da (cm^2/s)	Diffusivity in water, Dw (cm^2/s)	Henry's law constant H' (unitless)	Henry's law constant H (atm-m^3/mol)
tert-Butylbenzene	7.71E+02	5.65E-02	8.02E-06	4.87E-01	1.19E-02
Tetrachloroethene	1.55E+02	7.20E-02	8.20E-06	7.53E-01	1.84E-02
Toluene	1.82E+02	8.70E-02	8.60E-06	2.72E-01	6.62E-03
trans-1,2-Dichloroethene	5.25E+01	7.07E-02	1.19E-05	3.84E-01	9.36E-03
trans-1,3-Dichloropropene	4.57E+01	6.26E-02	1.00E-05	7.24E-01	1.77E-02
Trichloroethene	1.66E+02	7.90E-02	9.10E-06	4.21E-01	1.03E-02
Trichlorofluoromethane	4.97E+02	8.70E-02	9.70E-06	3.97E+00	9.68E-02
Vinyl acetate	5.25E+00	8.50E-02	9.20E-06	2.09E-02	5.10E-04
Vinyl chloride	1.86E+01	1.06E-01	1.23E-05	1.10E+00	2.69E-02

[a] The parameters presented in this table are from USEPA's User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings (USEPA 2003)

Table G-4 (1 of 1)

Parameter Values Used in Model for Vapor Migration to Indoor Air

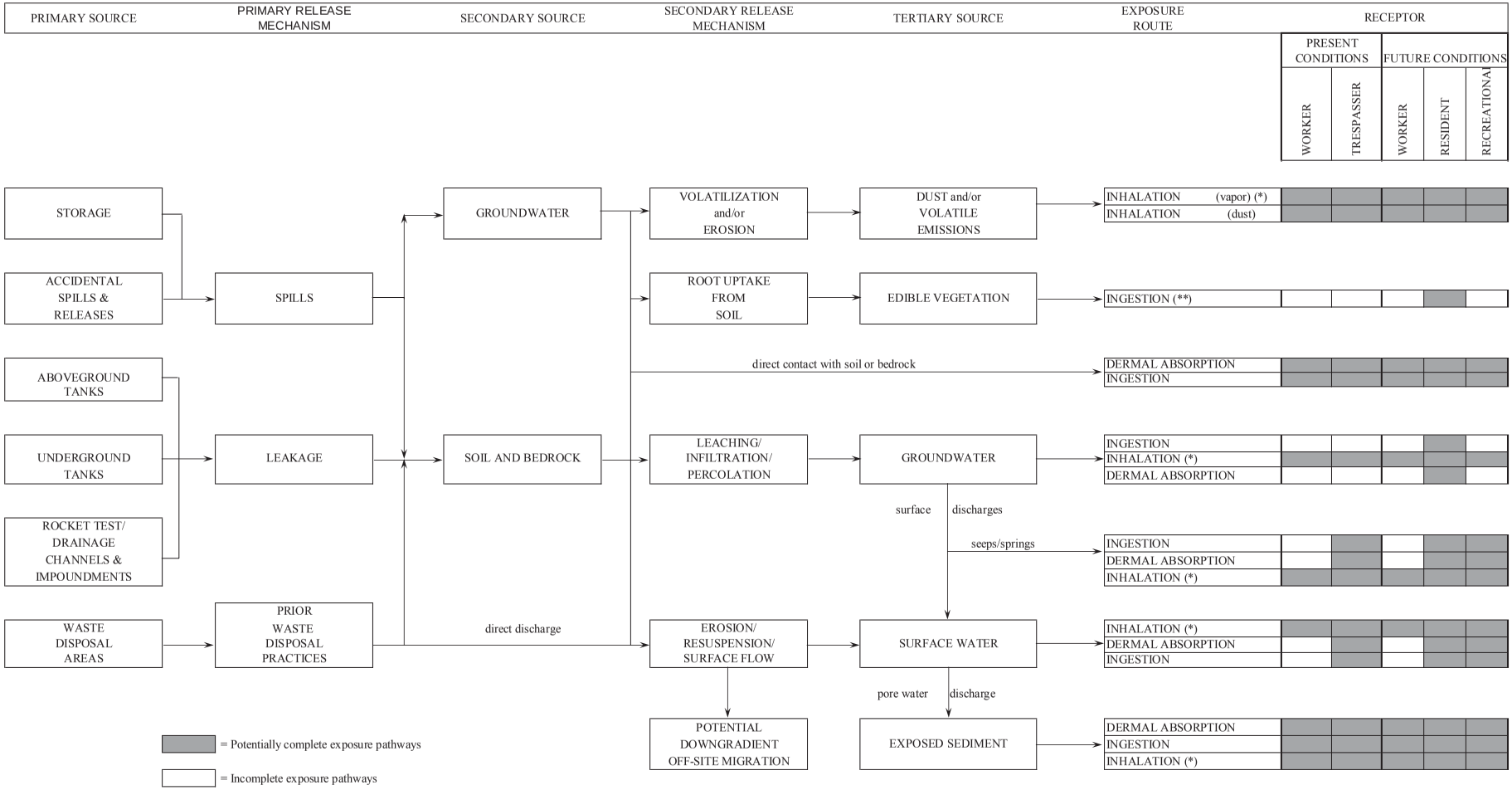
Parameter	Units	Value	Source
Average soil Temperature (Ts)	^{o}C	18	Region-specific, estimated from graph presented in USEPA (2003)
Depth below grade to bottom of enclosed space floor (Lf)	cm	15	USEPA (2002a)
Depth below grade to top of contamination (Lt)	cm	Site-specific	Site-specific
Depth below grade to bottom of contamination (Lb)	cm	Site-specific	Site-specific
Thickness of soil stratum A (h A)	cm	Site-specific	Site-specific
Thickness of weathered bedrock stratum B (h B)	cm	Site-specific	Site-specific
Thickness of unweathered bedrock stratum C (h C)	cm	Site-specific	Site-specific
Soil bulk density (Qb)	g/cm^3	a	Site-specific
Volumetric soil water content (θw)	cm^3/cm^3	a	Site-specific
Volumetric soil air content (θa)	cm^3/cm^3	a	Site-specific
Soil porosity (ns)	cm^3/cm^3	a	Site-specific
Volumetric unweathered bedrock water content (θw,ubr)	cm^3/cm^3	a	Site-specific
Volumetric unweathered bedrock air content (θa,ubr)	cm^3/cm^3	a	Site-specific
Unweathered bedrock porosity (nubr)	cm^3/cm^3	a	Site-specific
Unweathered bedrock fractures (ϕubr)	cm^3/cm^3	a	Site-specific
Volumetric weathered bedrock water content (θw,wbr)	cm^3/cm^3	a	Site-specific
Volumetric weathered bedrock air content (θa,wbr)	cm^3/cm^3	a	Site-specific
Weathered bedrock porosity (nwbr)	cm^3/cm^3	a	Site-specific
Weathered bedrock fractures (ϕwbr)	cm^3/cm^3	a	Site-specific
Soil gas advection rate (Qsoil)	L/min	5	USEPA (2002a)[b]
Enclosed space floor thickness (L crack)	cm	15	USEPA (2002a)
Soil building pressure differential (ΔP)	$(g/cm\text{-}s^2)$	40	USEPA (2002a)
Enclosed space floor length - Residential (LB)	cm	1000	USEPA (2002a)
Enclosed space floor width - Residential (WB)	cm	1000	USEPA (2002a)
Enclosed space height - Residential (HB)	cm	244	USEPA (2002a)
Enclosed space floor length - Commercial (LB)	cm	3048	Site-specific - based on 10,000 ft^2 commercial building.
Enclosed space floor width - Commercial (WB)	cm	3048	Site-specific - based on 10,000 ft^2 commercial building.
Enclosed space height - Commercial (HB)	cm	366	Site-specific - based single story building with 12 foot ceilings.
Crack-to-total area ratio	unitless	0.00038	USEPA (2002a)
Indoor air exchange rate - Residential (ER)	(1/hour)	0.5	DTSC (2005) default value.
Indoor air exchange rate - Commercial (ER)	(1/hour)	1	DTSC (2005) default value.

[a] The parameters presented in this table will be developed using the data presented in Appendix F or additional data obtained during field validation studies.

[b] The default soil gas advection rate of 5 liters per minute assumes a default residential building dimensions. The default soil gas advection ratewill be proportionally increased for future building size, if future building sizes are considered likely exceed the building dimension defaults.

APPENDIX G

FIGURES



Notes:

(*) Exposure limited to volatile compounds as defined in the text; residential and worker receptors include both indoor and outdoor air exposure to volatiles; nonresidental and nonworker receptors include only outdoor air exposure. For residents, inhalation of volatiles from shallow groundwater includes pathways associated with both domestic use and migration to indoor air, whereas, nonresidential exposure includes only migration to indoor and outdoor air for workers and only outdoor air for recreators. Exposure to fugitive dust is limited to non-volatile organic compounds.

(**) Exposure limited to bioaccumulatable compounds as described in the text.

MWH

Santa Susana Field Laboratory (SSFL)
Generalized Conceptual Site Model of Human Exposures

FIGURE
G-1

Project/Boeing SSFL RA/MWH_SRAM2005-Rev2/Figure G-1.ai

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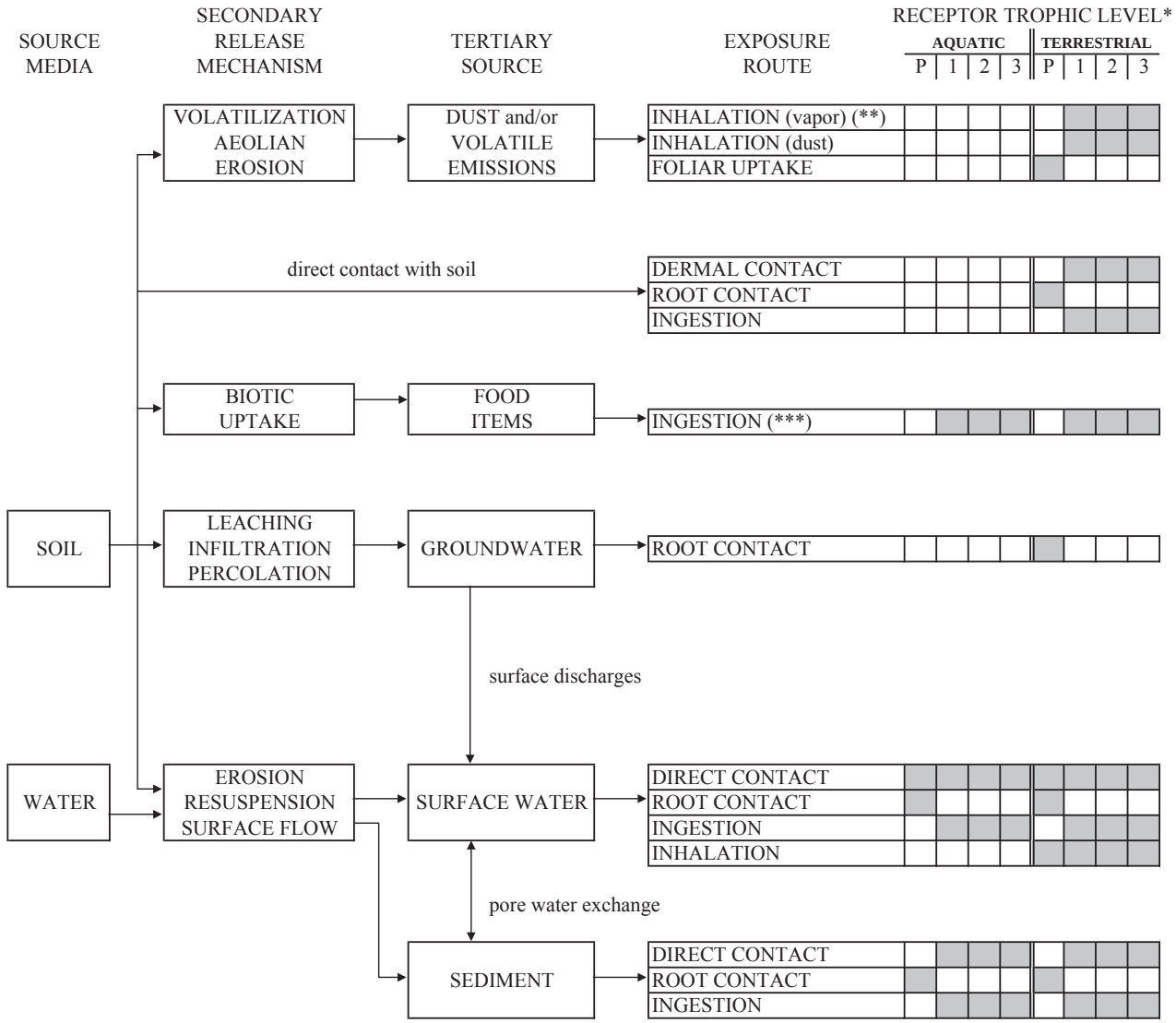


Notes:

(*) Trophic Level: P= Primary producers (e.g., plants); 1=1st consumer (e.g., invertebrates); 2=2nd consumer (e.g., wading birds); 3=3rd consumer (e.g., fish-eating birds)

(**) Exposures limited to volatile compounds as defined in the text.

(***) Exposures limited to bioaccumulatable compounds as described in the text.

MWH

Santa Susana Field Laboratory (SSFL)
Generalized Conceptual Site Model of Ecological Exposures

FIGURE G-2

APPENDIX G

ATTACHMENT G-1

VAPOR MIGRATION MODEL EQUATION DERIVATION

APPENDIX G
ATTACHMENT G-1

VAPOR MIGRATION MODEL EQUATION DERIVATION

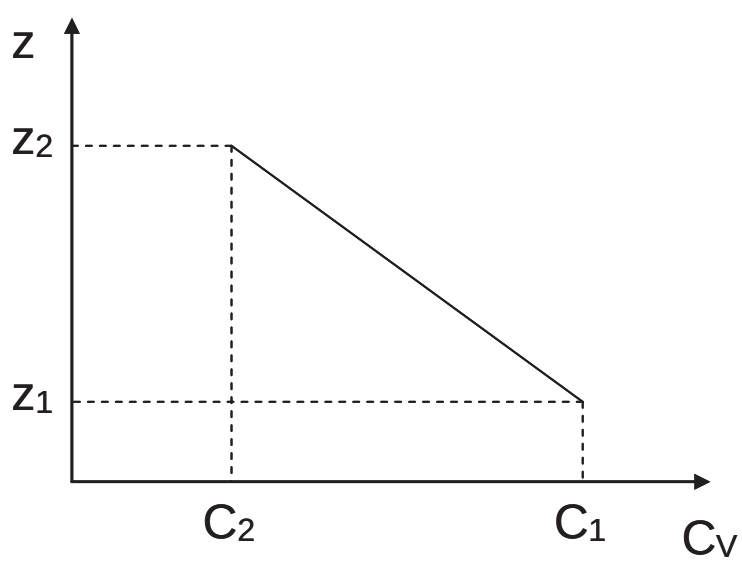
Differential Flux Equation:

$$F = -D_{eff}\frac{dC_v}{dz} - R\frac{C_v}{H} \tag{1}$$

$$F + R\frac{C_v}{H} = -D_{eff}\frac{dC_v}{dz} \tag{2}$$

$$dz = -D_{eff}\frac{dC_v}{F + R\frac{C_v}{H}} \tag{3}$$

Boundary Conditions: $$\begin{cases} z = z_1 \Rightarrow C_v = C_1 \\ z = z_2 \Rightarrow C_v = C_2 \end{cases} \tag{4}$$



Integrating Equation (3)[1] and applying boundary conditions (4) yields:

$$\int_{z1}^{z2} dz = -D_{eff} \cdot \int_{C1}^{C2} \frac{dC_v}{F + R\dfrac{C_v}{H}} \tag{5}$$

$$z\Big]_{z1}^{z2} = -D_{eff} \cdot \left[\frac{H}{R} \ln\left(F + \frac{R}{H} C_v \right) \right]_{C1}^{C2} \tag{6}$$

$$z_2 - z_1 = -D_{eff} \cdot \left[\frac{H}{R} \ln\left(F + \frac{R}{H} C_2 \right) \right] + D_{eff} \cdot \left[\frac{H}{R} \ln\left(F + \frac{R}{H} C_1 \right) \right] \tag{7}$$

$$z_2 - z_1 = D_{eff} \frac{H}{R} \ln\left(\frac{F + \dfrac{R}{H} C_1}{F + \dfrac{R}{H} C_2} \right) \tag{8}$$

Let $L = z_2 - z_1$. Replacing L into Equation (8) and rearranging it yields:

$$\frac{L \cdot R}{D_{eff} \cdot H} = \ln\left(\frac{F + \dfrac{R}{H} C_1}{F + \dfrac{R}{H} C_2} \right) \tag{9}$$

$$\exp\left(\frac{L \cdot R}{D_{eff} \cdot H} \right) = \frac{F + \dfrac{R}{H} C_1}{F + \dfrac{R}{H} C_2} \tag{10}$$

[1] From CRC Standard Math Tables 27th Ed. Integral #27 page 238: $\int \frac{dx}{a + bx} = \frac{1}{b} \ln(a + bx)$

$$\exp\left(\frac{L \cdot R}{D_{eff} \cdot H}\right) \cdot \left(F + \frac{R}{H} C_2\right) = F + \frac{R}{H} C_1 \tag{11}$$

$$F \exp\left(\frac{L \cdot R}{D_{eff} \cdot H}\right) + \frac{R \cdot C_2}{H} \exp\left(\frac{L \cdot R}{D_{eff} \cdot H}\right) = F + \frac{R \cdot C_1}{H} \tag{12}$$

$$\frac{R \cdot C_2}{H} \exp\left(\frac{L \cdot R}{D_{eff} \cdot H}\right) - \frac{R \cdot C_1}{H} = F - F \exp\left(\frac{L \cdot R}{D_{eff} \cdot H}\right) \tag{13}$$

$$\frac{R}{H}\left(C_2 \cdot \exp\left(\frac{L \cdot R}{D_{eff} \cdot H}\right) - C_1\right) = F \cdot \left(1 - \exp\left(\frac{L \cdot R}{D_{eff} \cdot H}\right)\right) \tag{14}$$

$$F = \frac{\frac{R}{H}\left(C_2 \cdot \exp\left(\frac{L \cdot R}{D_{eff} \cdot H}\right) - C_1\right)}{\left(1 - \exp\left(\frac{L \cdot R}{D_{eff} \cdot H}\right)\right)} \tag{15}$$

Multiplying the numerator and denominator of Equation (15) by (-1) yields the equivalent of Equation 7 presented in the Appendix G text:

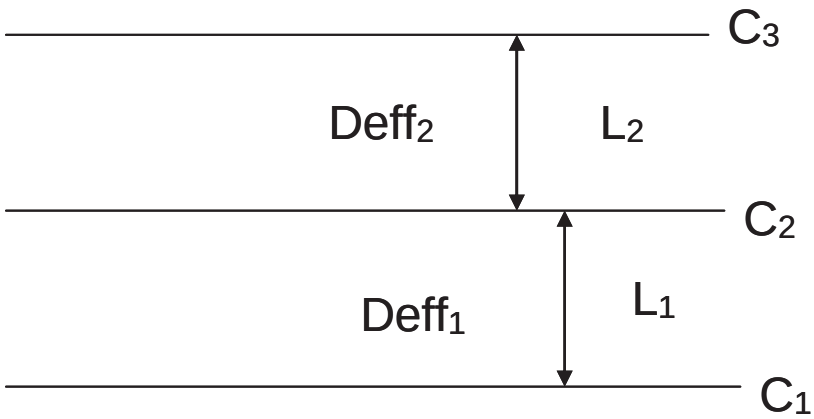
$$F = \frac{R}{H} \frac{\left(C_1 - C_2 \cdot \exp\left(\frac{L \cdot R}{D_{eff} \cdot H}\right)\right)}{\left(\exp\left(\frac{L \cdot R}{D_{eff} \cdot H}\right) - 1\right)} \tag{16}$$

Solving equation (16) for C_2=0 yields the equivalent of Equation 8 presented in the Appendix G text:

$$F = \frac{C_1 R/H}{\left(\exp\left(\frac{L \cdot R}{D_{eff} \cdot H}\right) - 1\right)} \tag{17}$$

Effect of Varying Subsurface Conditions:

Let:



$$F_1 = \frac{R}{H} \frac{\left(C_1 - C_2 \cdot \exp\left(\frac{L_1 \cdot R}{D_{eff1} \cdot H} \right) \right)}{\left(\exp\left(\frac{L_1 \cdot R}{D_{eff1} \cdot H} \right) - 1 \right)} \tag{18}$$

$$F_2 = \frac{R}{H} \frac{\left(C_2 - C_3 \cdot \exp\left(\frac{L_2 \cdot R}{D_{eff2} \cdot H} \right) \right)}{\left(\exp\left(\frac{L_2 \cdot R}{D_{eff2} \cdot H} \right) - 1 \right)} \tag{19}$$

Let:

$$\gamma_1 = \frac{L_1 \cdot R}{D_{eff1} \cdot H} \tag{20}$$

$$\gamma_2 = \frac{L_2 \cdot R}{D_{eff2} \cdot H} \tag{21}$$

Replacing Equations (20) and (21) into Equations (18) and (19) respectively yields:

$$F_1 = \frac{R}{H} \frac{\left(C_1 - C_2 \cdot e^{\gamma_1} \right)}{\left(e^{\gamma_1} - 1 \right)} \tag{22}$$

$$F_2 = \frac{R}{H} \frac{\left(C_2 - C_3 \cdot e^{\gamma_2} \right)}{\left(e^{\gamma_2} - 1 \right)} \tag{23}$$

To satisfy the principle of conservation of mass:

$$F_1 = F_2 \tag{24}$$

$$\frac{R}{H}\frac{\left(C_1 - C_2 \cdot e^{\gamma_1}\right)}{\left(e^{\gamma_1} - 1\right)} = \frac{R}{H}\frac{\left(C_2 - C_3 \cdot e^{\gamma_2}\right)}{\left(e^{\gamma_2} - 1\right)} \tag{25}$$

$$\left(C_1 - C_2 \cdot e^{\gamma_1}\right)\left(e^{\gamma_2} - 1\right) = \left(C_2 - C_3 \cdot e^{\gamma_2}\right)\left(e^{\gamma_1} - 1\right) \tag{26}$$

$$C_1 \cdot e^{\gamma_2} - C_2 \cdot e^{\gamma_1+\gamma_2} - C_1 + C_2 \cdot e^{\gamma_1} = C_2 \cdot e^{\gamma_1} - C_3 \cdot e^{\gamma_1+\gamma_2} - C_2 + C_3 \cdot e^{\gamma_2} \tag{27}$$

$$C_2 \cdot (1 - \cdot e^{\gamma_2+\gamma_1}) = C_1 \cdot (1 - e^{\gamma_2}) + C_3 \cdot e^{\gamma_2} \cdot (1 - e^{\gamma_1}) \tag{28}$$

$$C_2 = \frac{C_1 \cdot (1 - e^{\gamma_2}) + C_3 \cdot e^{\gamma_2} \cdot (1 - e^{\gamma_1})}{(1 - e^{\gamma_2+\gamma_1})} \tag{29}$$

$$F_1 = \frac{R}{H}\frac{\left(C_1 - C_2 \cdot e^{\gamma_1}\right)}{\left(e^{\gamma_1} - 1\right)} \tag{30}$$

$$F_1 = \frac{R}{H}\left(\frac{C_1}{\left(e^{\gamma_1} - 1\right)} - \frac{C_1 \cdot (1 - e^{\gamma_2}) + C_3 \cdot e^{\gamma_2} \cdot (1 - e^{\gamma_1})}{(1 - e^{\gamma_2+\gamma_1})}\frac{e^{\gamma_1}}{\left(e^{\gamma_1} - 1\right)}\right) \tag{31}$$

$$F_1 = \frac{R}{H}\left(\frac{C_1}{\left(e^{\gamma_1} - 1\right)} - \frac{e^{\gamma_1}}{\left(e^{\gamma_1} - 1\right)}\frac{C_1 \cdot (1 - e^{\gamma_2})}{(1 - e^{\gamma_2+\gamma_1})} + \frac{e^{\gamma_1}}{\left(e^{\gamma_1} - 1\right)}\frac{C_3 \cdot e^{\gamma_2} \cdot (e^{\gamma_1} - 1)}{(1 - e^{\gamma_2+\gamma_1})}\right) \tag{32}$$

$$F_1 = \frac{R}{H}\left(\frac{C_1 - C_1 \cdot e^{\gamma_2+\gamma_1} - e^{\gamma_1}C_1 + C_1 \cdot e^{\gamma_1+\gamma_2}}{\left(e^{\gamma_1}-1\right)(1-e^{\gamma_2+\gamma_1})} + \frac{C_3 \cdot e^{\gamma_1+\gamma_2}}{(1-e^{\gamma_2+\gamma_1})}\right) \tag{33}$$

$$F_1 = \frac{R}{H}\left(\frac{C_1 \cdot (1-e^{\gamma_1})}{\left(e^{\gamma_1}-1\right)(1-e^{\gamma_2+\gamma_1})} + \frac{C_3 \cdot e^{\gamma_1+\gamma_2}}{(1-e^{\gamma_2+\gamma_1})}\right) \tag{34}$$

$$F_1 = \frac{R}{H}\left(\frac{-C_1}{(1-e^{\gamma_2+\gamma_1})} + \frac{C_3 \cdot e^{\gamma_1+\gamma_2}}{(1-e^{\gamma_2+\gamma_1})}\right) \tag{35}$$

$$F_1 = \frac{R}{H}\left(\frac{C_1 - C_3 \cdot e^{\gamma_1+\gamma_2}}{e^{\gamma_1+\gamma_2}-1}\right) \tag{36}$$

Replacing the definition of γ_1 and γ_2, Equations (20) and (21), into Equation (36) yields:

$$F_1 = \frac{R}{H}\left(\frac{C_1 - C_3 \cdot e^{\left(\frac{L1 \cdot R}{Deff\,1 \cdot H} + \frac{L2 \cdot R}{Deff\,2 \cdot H}\right)}}{e^{\left(\frac{L1 \cdot R}{Deff\,1 \cdot H} + \frac{L2 \cdot R}{Deff\,2 \cdot H}\right)} - 1}\right) \tag{37}$$

$$F_1 = \frac{R}{H}\left(\frac{C_1 - C_3 \cdot e^{\left(\frac{R}{H}\left(\frac{L1}{Deff\,1} + \frac{L2}{Deff\,2}\right)\right)}}{e^{\left(\frac{R}{H}\left(\frac{L1}{Deff\,1} + \frac{L2}{Deff\,2}\right)\right)} - 1}\right) \tag{38}$$

General Form:

$$F = \frac{R}{H}\left[\frac{C_1 - C_n \exp\left(\frac{R}{H}\sum\frac{L_i}{D_{eff,i}}\right)}{\exp\left(\frac{R}{H}\sum\frac{L_i}{D_{eff,i}}\right) - 1}\right] \tag{39}$$

$$D_{eff,T} = \frac{L_T}{\sum\frac{L_i}{D_{eff,i}}} \tag{40}$$

$$\sum\frac{L_i}{D_{eff,i}} = \frac{L_T}{D_{eff,T}} \tag{41}$$

$$F = \frac{R}{H}\left[\frac{C_1 - C_n \exp\left(\frac{R}{H}\frac{L_T}{D_{eff,T}}\right)}{\exp\left(\frac{R}{H}\frac{L_T}{D_{eff,T}}\right) - 1}\right] \tag{42}$$

Equation 42 is the equivalent of Equation 9c presented in the Appendix G text.

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APPENDIX G

ATTACHMENT G-2

Q/C AND SCREEN3 MODEL COMPARISONS

APPENDIX G
ATTACHMENT G-2

Q/C and SCREEN3 Model Comparisons

Comparison Scenarios

This attachment to Appendix G presents a comparison of the Q/C dispersion factor[1] and the SCREEN3 model for providing estimates of onsite air concentrations from subsurface vapor flux. The estimated annual average outdoor air concentration were calculated using these two dispersion models assuming a unit flux (1 µg/m2/s) and various source sizes (0.5 acres to 30 acres). For this evaluation the sources were assumed to be square. The Q/C model parameter inputs for Los Angeles were used in the Q/C modeling. The SCREEN3 modeling was evaluated using the rural setting, flat terrain, ground level emissions release, and the default meteorological settings. The SCREEN3 evaluation results in the maximum 1-hour concentration given these default conservative settings. In order to compare the SCREEN3 results to the Q/C model results the maximum 1-hour concentration outputs from SCREEN3 were converted to annual concentration using a conversion factor of 0.1[2]. Conversion factors ranging from 0.06 to 0.1 have been reported, although these factors are commonly applied at distances removed from the source. Even at near source locations the 1-hour maximum concentration will likely over-estimate of the annual average, as the 1-hour maximum concentration is reflective of a stable, low wind speed condition which is not reflective of the varied meteorological conditions that exist throughout the year.

Results

Table 1 presents the SCREEN3 modeling results. Table 2 presents the Q/C modeling results. Table 3 presents the model comparison results. The results of the comparison indicate that within the range of site size, the Q/C is consistently more conservative than the SCREEN3 model.

[1] USEPA. 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. Office of Solid Waste and Emergency Response, Washington, DC. OSWER 9355.4-24. December.
[2] The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments, Appendix H. California EPA, Office of Environmental Health Hazard Assessment. August 2003.

Table 1. SCREEN3 Model Results

SCREEN3 - MODEL					
Area		SQRT(area)	Max. 1-hour Concentration	Annual Average Concentration	Distance to Max.
(acres)	(m^2)	(m)	(μg/m3)	(μg/m^3)[a]	(m)
0.5	2025	45.00	1.30E+01	1.30E+00	87
1	4050	63.64	1.93E+01	1.93E+00	95
2	8100	90.00	2.67E+01	2.67E+00	109
5	20250	142.30	3.91E+01	3.91E+00	140
10	40500	201.25	5.07E+01	5.07E+00	178
30	121500	348.57	7.26E+01	7.26E+00	277

[a] Max 1-hour concentration output from SCREEN3 was converted to annual concentration using a conversion factor of 0.1 (The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments, Appendix H. California EPA, Office of Environmental Health Hazard Assessment. August 2003.)

Table 2. Q/C Model Results

SSG (Q/C)		
Site: Los Angeles	A	11.9110
	B	18.4385
	C	209.7845
Area (acres)	Q/C (g/m2/s)/(kg/m^3)	Annual Average Conc. (μg/m^3)
0.5	68.1836	1.47E+01
1	60.2239	1.66E+01
2	53.4376	1.87E+01
5	45.9476	2.18E+01
10	41.2059	2.43E+01
30	34.9995	2.86E+01

Table 3. Model Comparison Results

Source Size (acres)	SCREEN3 Annual Average Conc. ($\mu g/m^3$)	SSG Q/C Annual Average Conc. ($\mu g/m^3$)	Percent Difference of SCREEN3 Result Relative to SSG Q/C Result
0.5	1.30E+00	1.47E+01	-91.1
1	1.93E+00	1.66E+01	-88.4
2	2.67E+00	1.87E+01	-85.8
5	3.91E+00	2.18E+01	-82.0
10	5.07E+00	2.43E+01	-79.1
30	7.26E+00	2.86E+01	-74.6

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APPENDIX H

EXAMPLE HUMAN HEALTH RISK SUMMARY TABLES

Risks for residential and recreational receptors exposed to soil and ephemeral sediment will be estimated using the sum of fractions method, as described in Appendix B of the SRAM Rev. 2 Addendum, and as a result, the risk summary tables for these receptors and pathways will differ from the example tables presented here in Appendix H.

APPENDIX H
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EXAMPLE HUMAN HEALTH RISK SUMMARY TABLES

TABLE	TITLE
H-1	Occurrence, Distribution, and Selection of Chemicals of Potential Concern
H-2	Selection of Exposure Pathways
H-3	Values Used for Daily Intake Calculations
H-4	Medium-Specific Exposure Point Concentration Summary
H-5	Calculation of Noncancer Hazards, Reasonable Maximum Exposure
H-6	Calculation of Cancer Risks, Reasonable Maximum Exposure
H-7	Risk Summary

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Appendix H Table H-1 (1 of 1)

Occurrence, Distribution, and Selection of Chemicals of Potential Concern

Chemical	Minimum[a] Concentration	Minimum Qualifier	Maximum[a] Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Greater Than Background[b] (Yes/No)	Greater Than 5% Detects (Yes/No)	COPC Flag (Yes/No)	Rational for Contaminant Deletion

(a) Minimum/Maximum Detected Concentration
(b) Applies to metals and dioxins/furans only.

Appendix H Table H-2 (1 of 1)

Selection of Exposure Pathways

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway

Appendix H Table H-3 (1 of 1)

Values Used for Daily Intake Calculations

Exposure Route	Parameter Code[a]	Parameter Definition	Units	CTE Value	RME Value

(a) An identifying abbreviation used for each parameter (e.g., IR = ingestion rate).

Appendix H Table H-4 (1 of 1)

Medium-Specific Exposure Point Concentration Summary

Chemical of Potential Concern	Units	CTE EPC	Method of Calculation	RME EPC	Method of Calculation

Appendix H Table H-5 (1 of 1)

Calculation of Non-Cancer Hazards
Reasonable Maximum Exposure

Chemical of Potential Concern	Ingestion Intake (Non Cancer)	Ingestion Intake (Non-Cancer) Units	Dermal Absorption (Non-Cancer)	Dermal Absorption (Non-Cancer) Units	Oral Reference Dose	Oral Reference Dose Units	Ingestion Hazard Quotient	Dermal Hazard Quotient	Inhalation Intake	Inhalation Intake (Non-Cancer) Units	Reference Concentration	Reference Concentration Units	Inhalation Hazard Quotient	Hazard Index
													Total Hazard Index Across All Exposure Routes/Pathways:	

Appendix H Table H-6 (1 of 1)

Calculation of Cancer Risks
Reasonable Maximum Exposure

Chemical of Potential Concern	Ingestion Intake (Cancer)	Ingestion Intake (Cancer) Units	Dermal Absorption (Cancer)	Dermal Absorption (Cancer) Units	Oral Cancer Slope Factor	Oral Cancer Slope Factor Units	Ingestion Risk	Dermal Risk	Inhalation Intake	Inhalation Intake (Cancer) Units	Inhalation Cancer Slope Factor	Inhalation Cancer Slope Factor Units	Inhalation Cancer Risk	Cancer Risk

Total Risk Across All Exposure Routes/Pathways:

Appendix H Table H-7 (1 of 1)

Risk Summary

Medium	Exposure Medium	Exposure Point	Cancer Risk					Hazard Index				
			Ingestion	Dermal	Inhalation	Total	COPC Contributing Majority of Risk	Ingestion	Dermal	Inhalation	Total	COPC Contributing Majority of Risk

APPENDIX I

BIOLOGICAL CONDITIONS REPORT

The Biological Conditions Reports contained in this appendix addresses information regarding federally listed endangered species and sensitive plant and wildlife species possibly present at the SSFL as of March 2005. Additional biological surveys have been conducted at the SSFL since March 2005, as documented in the additional list of reports added to the references section of this appendix.

Addendum to the Biological Conditions Report Santa Susana Field Laboratory Ventura County, California

Prepared for

The Boeing Company

National Aeronautics and Space Administration

and

U.S. Department of Energy

Prepared by

MWH Americas, Inc.
Pasadena, California

and

AMEC Earth & Environmental, Inc.
San Rafael, California

July 2003 / September 2005

This addendum to the Biological Conditions Report (BCR) was prepared for the Santa Susana Field Laboratory (SSFL) in April 2000, and revised in June 2003 and in March 2005, based on additional information gathered since the biological surveys were completed for the original report (Ogden 1998). As stated in the BCR, the original scope of work only included focused surveys on specific RCRA Facility Investigation (RFI) sites and vegetation mapping for the remainder of the SSFL. No protocol surveys were completed due to time and seasonal constraints on the original surveys. This addendum addresses additional information regarding federally listed endangered species and sensitive plant and wildlife species possibly present at the SSFL. The vegetation map was updated in March 2005 based on the results of numerous additional surveys conducted by AMEC, MWH, and Padre between 2000 and 2004. The maps from the original April 1998 Biological Conditions Report are not reproduced in this appendix.

Additional Plant Species

Braunton's milk vetch (*Astragalus brauntonii*) is a perennial herb that is ranked by the California Native Plant Society (CNPS) as extremely rare. Braunton's milk vetch occurs in a variety of plant communities, including chaparral, valley grassland, coastal sage scrub, and closed-cone pine forest. A distinguishing feature of habitats with this plant species is the presence of carbonate substrate in disturbed habitats (CNPS Inventory 1994). Braunton's milk vetch has been identified at nine locations in Ventura County. It was observed during 1999 south of the Former Sodium Disposal Facility at the western edge of the property. It may occur at other locations at the SSFL, and future focused surveys will be completed at investigational units where potential actions will occur.

Plummer's mariposa lily (*Calochortus plummerii*) is a slender-branched perennial that is considered rare, threatened, or endangered in California and elsewhere by the CNPS (i.e., classified as CNPS List 1B). Plummer's mariposa lily occurs in the Santa Monica Mountains in chaparral habitats with granitic and alluvial soils. This plant has been identified at two locations along the Happy Valley drainage: (1) about five feet from the streambed near the terminus of Happy Valley drainage at the SSFL property line and (2) on the slopes adjacent to the drainage at the stream division (MWH 2003a).

Another sensitive plant species, thought to be extinct, has been found in the vicinity of, but not at the SSFL. The San Fernando Valley spineflower (*Chorizanthe parryi* var. *fernandina*) is a Category 1 candidate for listing by the U.S. Fish and Wildlife Service and is currently petitioned for listing at the state level. Habitat for this low, spring-blooming (April to June) annual is thin

soils over rock outcroppings below 762 meters (2500 feet) elevation, usually in association with coastal sage scrub. This species was identified in the past in San Diego County, but recent evidence indicates that these occurrences were incorrectly identified. The CNPS lists the occurrence of this species as greatly limited and considers this California endemic highly sensitive and endangered throughout a part of its range.

In addition to these two plant species, two federally listed threatened species of *Dudleya* may potentially occur onsite, as well as two other endangered plants: Lyon's pentachaeta (*Pentachaeta lyonii*) and California orcutt grass (*Orcuttia californica*). These species were not listed in Table 3-1 of the original report. Additional surveys for all of these potentially occurring plant species will be completed in suitable habitats at investigational units where potential actions will occur.

Additional Wildlife Species

The coast horned lizard (*Phrynosoma coronatum blainvillei*) is classified as a Species of Special Concern by the California Department of Fish and Game. This diurnal lizard occurs in a variety of habitats in southern California and feeds primarily on insects (Zeiner et al. 1988). At SSFL, the coast horned lizard has been observed at the Area II Landfill (MWH 2003b).

A number of sensitive wildlife species were considered as potentially occurring at the SSFL (See Tables 3-2 through 3-5*)*. Federally listed endangered species that could potentially occur at the SSFL but were not listed in these tables include the least Bell's vireo (*Vireo bellii pusillus*), southwestern willow flycatcher (*Empidonax trailii extimus*), arroyo southwestern toad (*Bufo microscaphus californicus*), Quino checkerspot butterfly (*Euphydryas editha quino*), and San Diego fairy shrimp (*Branchinecta sandiegoensis*). These species require protocol surveys at certain times of the year. Protocol surveys were not completed during the original surveys, and habitat for these species is limited at the SSFL. The southern rubber boa (*Charina bottae umbratica*) and southern Pacific rattlesnake (*Crotalis viridis helleri*) are other species of concern in California that may also potentially occur in habitats at the SSFL. Additional surveys will be completed in suitable habitats for sensitive species that may occur at investigational units where potential actions will occur.

BCR Addendum References

MWH. 2003a. Biological Assessment for the Happy Valley Perchlorate Interim Measures Project.

MWH. 2003b. Area I and Area II Landfills Investigation Work Plan - Work Plan Addendum Amendment, SWMU 4.2 and SWMU 5.1, Santa Susana Field Laboratory, Ventura County, California.

Zeiner, D.C., W.F. Laudenslayer, K.E. Mayer, and M. White (eds). 1988. *California's Wildlife. Vol. 1. Amphibians and Reptiles.* California Statewide Wildlife Habitat Relationships System. California State Department of Fish and Game.

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Biological Conditions Report
Santa Susana Field Laboratory
Ventura County, California

Prepared for

Boeing North American,
Rocketdyne Propulsion and Power

and

National Aeronautics and Space Administration

and

U.S. Department of Energy
Energy Technology Engineering Center Division

Prepared by

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April 1998
Project No. 313150002

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SECTION 1
INTRODUCTION

This Biological Conditions Report was prepared as part of the Standardized Risk Assessment Methodology (SRAM) being developed for risk assessments conducted at the Santa Susana Field Laboratory (SSFL) (Figures 1-1 and 1-2). The SSFL is jointly owned by Boeing North American, Inc. and the National Aeronautics and Space Administration (NASA), and it is operated by the Rocketdyne Division (Rocketdyne) of Boeing. A small portion of the SSFL owned by Boeing is leased to the U.S. Department of Energy (DOE). The SSFL is divided into four administrative areas (Areas I, II, III, and IV) and has a 2,000-foot-wide undeveloped area along its southern margin. The SRAM is being developed in support of a Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) at the SSFL. A RCRA Facility Assessment (RFA) was conducted in 1990 for U.S. Environmental Protection Agency (USEPA) and identified 122 Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) within the four administrative areas of the SSFL (ICF 1993a-c). Selected SWMUs and AOCs were identified as requiring further investigation and have been grouped into 39 RFI sites (Figure 1-3). Information regarding materials used and wastes generated, and other environmental programs at the SSFL are summarized elsewhere (Ogden 1996). The Biological Conditions Report summarizes the results of field surveys conducted at the SSFL from 1995-1997, including the presence and distribution of vegetation communities, wildlife species detected, and locations of sensitive plant and animal species at the 39 RFI sites. Field surveys focused primarily on the RFI sites; however, the entire SSFL was surveyed during the 1995–1997 site visits. The information presented in this report will be utilized in developing ecological risk assessments conducted at the SSFL and any additional environmental documentation for actions conducted at the SSFL.

Figure 1-1

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Figure 1-2

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Figure 1-3

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SECTION 2
BIOLOGICAL SURVEY METHODS

2.1 VEGETATION SURVEYS

The SSFL was surveyed several times during the period from June 12, 1995 to February 6, 1997. Detailed surveys of each of the 36 RFI sites were conducted, while vegetation surveys of the open space and large areas between sites were performed using both field mapping and aerial photograph interpretation. The following is a list of the dates when botanical and vegetation surveys were performed at the SSFL:

Survey Periods

June 12-15, 1995	July 29-31, 1996
July 5, 1995	January 14-15, 1997
March 11-15, 1996	February 6, 1997
May 6-8, 1996	

All plant communities were visited and mapped, and all plant species were identified and recorded. Nomenclature for plant species conforms to Munz (1974), while vegetation communities and habitat types follow Holland (1986).

2.2 WILDLIFE SURVEYS

Wildlife surveys were conducted several times during the period from July 5, 1995 through February 6, 1997. The following is a list of the dates when wildlife surveys were performed at the SSFL:

Survey Periods

July 5-7, 1995	May 6-8, 1996
October 23-27, 1995	July 29-31, 1996
December 11-15, 1995	January 14-15, 1997
March 11-15, 1996	February 6, 1997

All habitats were visited, but no trapping or quantitative surveys were performed. All animal species observed were identified and recorded. Nomenclature for birds, mammals,

reptiles, and amphibians conforms to Laudenslayer et al. (1991) and for fish to the American Fisheries Society (AFS 1991).

SECTION 3
EXISTING CONDITIONS OF SSFL

3.1 PHYSICAL SETTING

The SSFL is located 29 miles northwest of downtown Los Angeles, California, in the southeast corner of Ventura County (Figure 1-1). The SSFL occupies approximately 2,700 acres of hilly terrain, with approximately 700 feet of topographic relief near the crest of the Simi Hills. The Simi Hills are bordered on the east by the San Fernando Valley and to the north by the Simi Valley. Most of the land adjacent to the site property is undeveloped and mountainous. About 73 percent of the area within a 5-mile radius of the site is undeveloped. Figure 1-2 shows the general geographic location, property lines, and topography of the facility.

The facility is divided into four administrative areas (Areas I, II, III, and IV) and an open space (Figure 1-3). The areas are owned and operated as follows (SAIC 1991):

- Area I (U.S. Environmental Protection Agency [USEPA] ID Number CAD 093365435) consists of 713 acres located in the northeast portion of the facility. Rocketdyne operates the entire area. Rocketdyne owns 671 acres, and the remaining 42 acres are owned by the National Aeronautics and Space Administration (NASA). The 42-acre NASA property in Area I was formerly owned by the U.S. Air Force.

- Area II (USEPA ID Number CAD 1800090010) consists of 410 acres located in the north-central portion of the site. Area II is owned by NASA and operated by Rocketdyne.

- Area III (USEPA ID Number CAD 093365435) consists of 114 acres and is owned and operated by Rocketdyne.

- Area IV (USEPA ID Number CAD 000629972 and CA 3890090001) consists of 290 acres located in the northwest section of the site. Rocketdyne owns and operates the entire area. A portion of Area IV (90 acres, which houses the Energy Technology Engineering Center [ETEC], a division of the Department of Energy [DOE]), is leased by the DOE and operated by Rocketdyne under

an option to buy contract with the DOE. Five National Pollutant Discharge Elimination System (NPDES) discharge points and drainage channels are located in Area IV.

- The open space consists of 1,200 acres of undeveloped land along the southern boundary of the facility. This naturally vegetated area is owned by Rocketdyne. Industrial activities have never been conducted in this area. Two NPDES discharge points and drainage channels are located in the open space.

3.2 CLIMATE

The climate in the vicinity of the SSFL is classified as Mediterranean subtropical, with mean temperatures ranging from 50°F in the winter to 70°F in the summer. Precipitation on the property averages approximately 18 inches per year, based on meteorological data obtained from the weather station located at the SSFL (ICF 1993a-c).

3.3 SOILS

The soils at the SSFL consist primarily of Quaternary alluvium and the Chatsworth Formation (ICF 1993a-c). Quaternary alluvium is composed of unconsolidated sand, silt, and clay eroded primarily from the surrounding Chatsworth Formation. Depth of the alluvium ranges from a few feet to approximately 40 feet. The Chatsworth Formation is a very thick unit of sandstone bedrock, reaching up to 6,000 feet in thickness within the vicinity of the SSFL. This soil type forms the many sandstone cliffs and lenses that comprise the rock outcrop habitat located throughout the property.

3.4 SURFACE WATER HYDROLOGY

The majority of Areas I, II, III and IV and the open space drain offsite to the south and southwest, and the northern portion of Areas I, II, III, and IV drain to the north (Edelman 1991). Surface water also accumulates in several man-made ponds located throughout the facility, the largest of which is the Silvernale Reservoir (SWMU 6.8) located on the west side of the property. Figure 3-1 (map pocket) shows the known surface water drainages and impoundments on the SSFL (these features are designated as drainages and open water habitat in Figure 3-1). The surface water holding ponds also collect runoff from site-related activities, and recycled water is also pumped into Silvernale Reservoir. The

pond associated with the Building 56 Landfill (SWMU 7.1) site is man-made and reportedly the result of digging into the water table while attempting to construct the foundation of the building (Ueshiro 1995).

3.5 GROUND-WATER HYDROLOGY

Ground water is associated with the two geological formations that occur onsite. Shallow ground water is associated with the Quaternary alluvium layer and generally occurs within canyons and drainages on the facility. Deep ground water is associated with the Chatsworth Formation and is the dominant ground-water system on the property.

The amount of ground water associated with these systems varies with seasonal precipitation. Depth of the shallow ground water ranged from approximately ground surface to 39.3 feet below ground surface (bgs) during 1994 (GRC 1995). The shallow ground-water flow essentially follows the natural topography.

The deep ground water associated with the Chatsworth Formation has been pumped for use at the facility since the 1950's and has affected the depth of the local water table (ICF 1993a-c). The depth of ground water in the Chatsworth Formation ranged from near ground surface to 619.1 feet bgs during 1994 (GRC 1995). A ground-water divide occurs in Area IV, where ground water on the northwest half of Area IV flows to the northwest, and ground water southeast of the divide flows to the east-southeast. Ground-water contours also indicate that ground water in the southwest portion of Area III flows to the southwest. Historic pumping and operation of ground-water extraction and treatment systems since 1987 had created a cone of depression in the ground water in the center of the SSFL. Additional ground-water divides have been identified north and south of the cone of depression.

3.6 BIOLOGICAL FEATURES

Information on vegetation and wildlife was obtained through field reconnaissance surveys conducted in June, July, October, and December 1995, in March and May 1996, and in January and February 1997. The focus of the surveys was to provide information on the biological communities found at the SSFL facility and to identify sensitive biological resources present at the various sites at the SSFL.

3.6.1 Vegetation Communities and Habitat Types

Within the SSFL and open space, 16 different habitat types occur: freshwater marsh, open water, unvegetated drainage channels, coast live oak woodland, southern coast live oak riparian forest, southern willow scrub, mulefat scrub, baccharis scrub, Venturan coastal sage scrub, chaparral, native grassland, nonnative grassland, ruderal, rock outcrop, eucalyptus woodland, and developed. The 16 habitat types and their site-specific characteristics are discussed in the following sections. Rock outcrop occurs throughout the site and may be found within any of the habitat types. Figure 3-1 presents a vegetation map for the SSFL. Plant species observed onsite are presented in Appendix A.

Freshwater Marsh

Freshwater marsh habitat onsite is dominated by perennial, emergent monocots typically 4.2 to 6.5 feet tall. Freshwater marsh occurs in areas that are permanently flooded by standing freshwater. This habitat is characterized by a complex of cattails (*Typha* sp.), bulrush (*Scirpus* sp.), and toad rush (*Juncus bufonius*).

Open Water and Unvegetated Drainage Channels

Open water consists of ponded water with no emergent vegetation. Unvegetated drainages show obvious signs of channeling, have discernible banks and high water marks and show evidence of scouring. The majority of unvegetated drainage channel habitat occurs in the open space in Bell Canyon and can also be found sporadically across the SSFL.

Southern Coast Live Oak Riparian Forest

This habitat represents an open to locally dense evergreen community dominated by coast live oak, with arroyo willow (*Salix lasiolepis*) occurring to a lesser extent. This community type appears to be richer in herbs and poorer in understory shrubs than other riparian communities (Holland 1986). Southern coast live oak riparian forest is associated with bottomlands and outer floodplains along larger streams and occurs on fine-grained, rich alluvium (Holland 1986). At the SSFL facility, shrub species in this association include poison oak (*Toxicodendron diversilobum*) and broom baccharis (*Baccharis sarothroides*).

Southern Willow Scrub

Southern willow scrub is a riparian habitat consisting of dense, broad-leafed, winter-deciduous thickets. This habitat is dominated by willows (*Salix* sp.), with cottonwood (*Populus fremontii*) and sycamore (*Platanus racemosa*) scattered throughout. The dense canopy typically inhibits the development of an understory.

Mulefat Scrub

This habitat on the facility is represented by a herbaceous riparian community dominated by mulefat (*Baccharis salicifolia*) (Holland 1986). This early succession community is maintained by frequent flood disturbance. In the absence of disturbance, most stands could become cottonwood- or sycamore-dominated riparian forests or woodlands. Mulefat scrub is scattered throughout the SSFL.

Coast Live Oak Woodland

Coast live oak woodland typically occurs on north-facing slopes or in shaded ravines, and intergrades with coastal sage scrub or chaparral on drier sites. This habitat is dominated by coast live oak (*Quercus agrifolia*), which is evergreen and reaches a height of 30 to 80 feet. The shrub layer is poorly developed but includes white-flowered currant (*Ribes indecorum*) and Santa Susana tarplant (*Hemizonia minthornii*). The understory is continuous and dominated by nonnative weedy species. Coast live oak woodland occurs throughout the open space and on a majority of the SSFL.

Venturan Coastal Sage Scrub

This habitat is found from the coastal region south of Point Conception to northern Baja California, extending east to the vicinity of the Cajon and San Gorgonio Passes. Typical stands are fairly dense, with bare ground occurring between shrubs, and occur on dry, rocky slopes, usually below 9,800 feet. The coastal sage scrub habitat at the SSFL facility is dominated by California sagebrush (*Artemisia californica*), black sage (*Salvia mellifera*), and laurel sumac (*Malosma laurina*). Venturan coastal sage scrub occurs mainly on the northwest corner of the open space and throughout the SSFL.

Chaparral

Chaparral is composed of broad-leafed sclerophyllous shrubs that grow about 5 to 10 feet tall and form dense, often nearly impenetrable stands. The plants of this association are typically deep rooted. There is usually little or no understory except in openings; considerable leaf litter accumulates, however. This habitat occurs on dry, rocky, often steep north-facing slopes with little soil. Characteristic shrub species include chamise (*Adenostoma fasciculatum*), sugarbush (*Rhus ovata*), and black sage. Chaparral occurs throughout the open space and the SSFL.

Baccharis Scrub

Baccharis scrub is most often found in recently disturbed areas, such as along roadsides, and is characterized by nearly monotypic stands of coyote bush (*Baccharis pilularis* ssp. *consanguinea*). Other associated species include California sagebrush (*Artemisia californica*), deerweed (*Lotus scoparius*), and weedy, nonnative herbs such as tocalote (*Centaurea melitensis*) and black mustard (*Brassica nigra*).

Native Grassland

Native grassland is characterized by a dense herbaceous cover of perennial, tussock-forming grass species, such as foothill stipa (*Stipa lepida*). Native and introduced annuals occur between the bunchgrasses, often exceeding them in cover (Holland 1986). This association generally occurs on fine-textured clay soils that are moist or wet in winter, but very dry in the summer. In addition to *Stipa*, other species present include blue-eyed grass (*Sisyrinchium bellum*), lilac mariposa (*Calochortus splendens*), and soap plant (*Chlorogalum pomeridianum*). At the SSFL, native grassland occurs primarily as small isolated patches within a matrix of nonnative grassland.

Nonnative Grassland

This habitat is a dense to sparse cover of annual grasses often associated with numerous species of showy-flowered, native annual forbs, especially in years of high rainfall. This association occurs on fine-textured, usually clay soils, which are moist or even waterlogged during the winter rainy season and very dry during the summer and fall. Characteristic species on the facility include slender wild oat (*Avena barbata*), soft chess

(*Bromus mollis*), and red brome (*Bromus rubens*). Nonnative grassland occurs throughout the SSFL.

Ruderal Habitat

Ruderal habitat is comprised of many introduced species that can withstand frequent disturbance and/or has been disturbed by human activities. Many of the species in this community are similar to those found in nonnative grasslands; however, ruderal habitats also have a greater percentage of nongrass species and only sparse coverage of the area. Ruderal habitat on the facility is dominated by deerweed, black mustard, and tocalote. Ruderal habitat is widespread on the northern half of the SSFL.

Rock Outcrop

This habitat consists of rock formations where there is only a minor component, typically less than 15 percent ground cover, of vegetation within the area. Rock outcrop habitat can be important to birds of prey for roosting and nesting, while mammals may create dens in the caves formed by the rocks, and reptiles may potentially live in the cracks of boulders. This habitat occurs throughout the SSFL.

Eucalyptus Woodland

Eucalyptus woodland is often represented by a monotypic stand of eucalyptus trees (*Eucalyptus* sp.) with very little understory. These nonnative trees are usually planted for aesthetic reasons, wind breaks, or as shade trees. One large stand of eucalyptus woodland occurs north of the Instrument and Equipment Laboratories (SWMUs 4.3, 4.4, and AOCs).

Developed

Developed areas are associated with many of the sites. An area is considered developed when buildings, paved roads, or other structures are present with only a minimal amount of vegetation. Small areas of lawn and ornamental bushes are often planted in developed habitats. Although this vegetation does support some wildlife species, the habitat is considered very low quality and is primarily used by introduced, common urban species.

3.6.2 Wildlife

Sixty-nine bird species were detected during surveys of the sites at the SSFL facility. The most frequently observed bird species include scrub jay (*Aphelocoma coerulescens*), yellow-rumped warbler (*Dendroica coronata*), turkey vulture (*Cathartes aura*), red-shouldered hawk (*Buteo lineatus elegans*), northern flicker (*Colaptes auratus*), California quail (*Callipepla californica*), and red-winged blackbird (*Agelaius phoeniceus*). A complete list of bird species observed during surveys of the facility is presented in Appendix C. An additional 19 bird species have been documented by SSFL personnel since 1983 and are presented in Appendix D.

Thirteen mammal species were detected on the property, including mule deer (*Odocoileus hemionus*), bobcat (*Felis rufus*), and San Diego black-tailed jackrabbit (*Lepus californica bennettii*). Ten reptile species, including western whiptail (*Cnemidophorus tigris multiscutatus*) and side-blotched lizard (*Uta stansburiana*), were observed on the facility. Three amphibian species, California slender salamander (*Batrachoseps attenuatus*), Pacific tree frog (*Hyla regilla*), and California toad (*Bufo boreas haliophilus*), were also detected. Two species of fish were observed in the ponds located on the SSFL property. Catfish (probably bullhead, *Ameirus* sp.) and goldfish (*Carassius auratus*) were observed. The catfish and goldfish were introduced to these ponds and are probably a source of food for piscivorous (fish-eating) bird species, such as the great blue heron. A complete list of the fish, amphibians, reptiles, and mammals detected at the SSFL facility is presented in Appendix E.

3.6.3 Sensitive Plants

Plant species are designated as sensitive because of their overall rarity, status, unique habitat requirements, and/or restricted distribution (USFWS 1990). In general, it is a combination of these factors that leads to a sensitivity designation. Sensitivity, as it is used herein, does not refer to an increased response to contaminant effects but refers to plant species listed by the USFWS and CDFG. In addition, the CDFG uses the California Native Plant Society (CNPS) listing to determine candidate species for threatened or endangered status. Two sensitive plant species were observed at the SSFL facility. Santa Susana tarplant is located throughout the facility, and southern California black walnut is primarily located in the Burro Flats area and the west end of the SSFL, with solitary individuals sparsely distributed across the SSFL. The locations of these sensitive plants

are shown in Figure 3-2. The sensitive plant species data described in the following sections are summarized in Table 3-1.

The Santa Susana tarplant is listed as rare by the State of California. This shrub typically grows from 2 to 3.5 feet in height on sandstone outcrops. Originally reported from the Santa Susana Pass area, the range of the Santa Susana tarplant is now known to include Castro Peak, Charmlee Park, the vicinity of the Chatsworth Reservoir, and the southwest slope of Calabasas Peak. The primary threat to this sensitive plant species is the continued encroachment of development into its habitat. Botanical surveys conducted for this project located Santa Susana tarplant throughout the SSFL.

Southern California black walnut (*Juglans californica* var. *californica*) is a List 4 CNPS sensitive species (Skinner and Pavlik 1994). List 4 species are defined as those plants that are of limited distribution and whose known populations need to be watched. This deciduous tree typically grows from 15 to 30 feet in height on slopes or canyons from 165 to 3,000 feet elevation. The southern California black walnut is known from the transverse mountain ranges in Ventura and Los Angeles Counties, including the Santa Monica, San Gabriel, and San Bernardino Mountains, and ranges as far south as San Diego County. The principal threat to this sensitive species is urbanization. A population of 23 southern California black walnut trees were located across the Burro Flats area. Four black walnut trees occur adjacent to the ESADA Storage Area (SWMU 7.9). Single California black walnut trees also occur at the Instrument and Equipment Laboratories (SWMUs 4.3, 4.4, and AOC) and in the open space.

3.6.4 Sensitive Wildlife

Fifteen wildlife species were detected on the SSFL property that are considered sensitive by the USFWS or CDFG, or are important indicators of wildlife corridor functions. Locations where sensitive wildlife species were either observed or sign (i.e., tracts, scat) was detected at the facility are shown in Figure 3-2. The following sensitive wildlife species data are summarized in Tables 3-2 through 3-5.

Reptiles

The two-striped garter snake (*Thamnophis hammondi*) is considered a "special animal" by the CDFG. Special animals are defined as biologically rare, very restricted in

distribution, or declining throughout their range; as populations in California that are threatened with extirpation; or as species that are closely associated with a habitat that is declining in the state (in this case, aquatic and riparian habitats). The two-striped garter snake is locally common in aquatic habitats from coastal central California to northwestern Baja California. It prefers rocky streams with protected pools, cattle ponds, marshes, vernal pools, and other shallow bodies of water lacking large aquatic predators (Stebbins 1966). Prey includes invertebrates, frogs, tadpoles, and small fish. The two-striped garter snake is active during the day and at dusk, from early spring to late fall. Individuals were observed in or adjacent to aquatic areas on the SSFL.

Birds

The great blue heron (*Ardea herodias herodias*) is considered a "special animal" by the CDFG. This species is the most widespread of all North American herons (Terres 1980) and is found throughout most of California (Zeiner et al. 1990a). The great blue heron commonly occurs throughout the year as a nonbreeder in open water and is less common along rivers, in croplands, pastures, and foothill ponds (Zeiner et al. 1990a). Nearly 75 percent of its diet is fish (Cogswell 1977), and it also eats small rodents, amphibians, snakes, lizards, insects, crustaceans, and small birds (Zeiner et al. 1990a). This species is considered sensitive at nesting colonies because human disturbance and human activity at a colony may cause nest desertion. This species was observed in or adjacent to aquatic areas on the SSFL. There is a moderate potential for this species to nest in any of the secluded tall trees or snags located at the SSFL facility.

Loggerhead shrike (*Lanius ludovicianus*) is considered a "species of special concern" by the CDFG. This is a fairly common breeding species in southern California. It utilizes a variety of habitats, occurring wherever bushes or trees are scattered on open ground. Loggerhead shrike was observed in nonnative grassland habitat. This species is a yearlong resident in southern California and likely nests at the SSFL.

The southern California rufous-crowned sparrow (*Aimophila ruficeps canescens*) is a CDFG "species of special concern." This species is a resident in Ventura County, preferring grassy or rocky slopes with open scrub at elevations from sea level to 2,000 feet. It forages and nests on the ground, usually near vegetative cover, and maintains year-round territories. This species prefers coastal sage scrub habitats, and its

numbers have been reduced greatly by urban development. Rufous-crowned sparrows were observed at the SSFL.

Birds of Prey

Birds of prey (raptors) as a group are considered sensitive because of loss of foraging areas, their vulnerability to human disturbance, their low population densities, and their position at the top of the food chain. Several species were observed flying over the facility and presumably forage there. Impacts to nesting raptors are covered under specific CDFG permits for take of nesting raptors.

The sharp-shinned hawk (*Accipiter striatus velox*) is considered a “species of special concern” by the CDFG and is distributed throughout North America, Central America, and South America. In California, it is a fairly common migrant and winter resident, although its breeding distribution is poorly documented (Zeiner et al. 1990a). The San Jacinto Mountains north of San Diego County are the documented southern breeding range of this species. During winter, it occupies a variety of habitats and requires a certain amount of dense vegetative cover, but this can be localized and scattered through relatively open country. The sharp-shinned hawk often darts out from a perch to capture unsuspecting avian prey and also hunts in low gliding flights (Zeiner et al. 1990a). One individual of this species was observed flying over the Expendable Launch Vehicle (ELV) Final Assembly Building 206 (SWMU 5.2) during surveys of the property; additionally, SSFL personnel have documented a sighting of this species in the vicinity of the STL-IV Area (SWMU 6.5) in June 1987.

The Cooper's hawk (*Accipiter cooperii*) is considered a "species of special concern" by the CDFG and nests primarily in oak woodlands but occasionally in willows or eucalyptus. This species breeds from late March through June and nests primarily in oak woodlands and occasionally in willows or eucalyptus. Outside of the breeding season, it disperses widely from southern Canada to northern Mexico. It has declined as a breeding species in California primarily because of destruction of oak and riparian woodland. A male and female Cooper's hawk were observed roosting in the oak woodland habitat in the open space and are likely to nest there.

The red-shouldered hawk (*Buteo lineatus elegans*) is common in southern California, occurring in wooded areas on the coastal plain. This species does not have any sensitivity

status at the federal level, although the state regulates the removal of any active nesting locations. The red-shouldered hawk, a carnivore at the top of the food web, is an important indicator of wildlife habitat quality. It readily adapts to wooded urban settings such as parks, rural residential areas, and wooded business parks. Breeding season for these tree-nesting hawks is midwinter through midspring. A single, recently fledged red-shouldered hawk was observed perched on top of a tall test stand at the STL-IV Area (SWMU 6.5), suggesting that nesting occurs on the SSFL property.

The red-tailed hawk (*Buteo jamaicencis*) is probably the most common hawk in urban fringe areas. Similar to the red-shouldered hawk, removal of this species' nest are regulated by the state. In addition, as a carnivore at the top of the food web, the red-tailed hawk is an important indicator of wildlife habitat quality. Several red-tailed hawks were observed flying over the SSFL property.

The turkey vulture (*Cathartes aura*) is considered a declining species in the region, having been eliminated from all coastal sites where it formerly nested. This raptor species is considered sensitive by the CDFG at nesting locations. This species is a fairly common spring and fall migrant in southern California, an uncommon to locally common winter visitor, and a rare to uncommon summer resident. Several turkey vultures were observed roosting on several rock ledges and circling over all portions of the SSFL facility. Based on these observations, there is a moderate potential that they nest onsite, and the species presumably forages throughout the property.

The great horned owl (*Bubo virginianus*) is a fairly common species, occurring in woodlands and forests, often adjacent to open hunting areas. It can also be found foraging and nesting in urban fringe areas. This species does not have any sensitivity status at the state and federal levels other than the regulations covering impacts to raptor nests. The great horned owl is a carnivore at the top of the food chain, and as such it is an important indicator of wildlife habitat quality. Two great horned owls were observed roosting at the top of a power pole northeast of Building 901 at the west end of the Bowl Area and Building 901 Leach Field (SWMU 4.15 and AOC), and were observed nesting adjacent to the Bowl Area.

Mammals

The bobcat (*Felis rufus*) is considered a “harvest species” by the CDFG. A "harvest species" is a CDFG wildlife management term defined as a commercially valuable fur-bearing or trophy animal whose population size or distribution may be influenced by trapping and hunting pressure, as well as habitat loss, and whose relative abundance within a region is a good indicator of the diversity of the ecosystem. The bobcat’s position at the top of the food chain makes it an important indicator of the wildlife habitat quality and wildlife corridor functions. Home range studies conducted by Zezulak and Schwab (1980) in Riverside County indicated home ranges of 1.8 to 20.7 square miles (1,152 to 13,248 acres) with a mean of 10.3 square miles (6,592 acres). Bobcats are, for the most part, nocturnal and require cover and den sites such as rock caves, hollow logs, or very dense brush. Prey includes rabbits, rodents, birds, and occasionally deer. Bobcats also require access to a water source. Bobcat and their sign (e.g., scat and tracks) have been observed throughout the SSFL and open space.

The mule deer (*Odocoileus hemionus*) is considered a “harvest species” by the CDFG. In California, mule deer occur throughout the state with the exception of the San Joaquin Valley and some southeastern desert areas. Locally, mule deer inhabit a variety of habitats, including riparian and oak woodlands, coniferous forest, coastal sage scrub, and chaparral. Suitable habitat is a mosaic of vegetation, providing clearings interspersed with dense brush or tree thickets. Brushy areas and thickets are important for escape cover and thermal regulation. Deer also require a permanent source of water. Mule deer browse and graze, preferring tender new growth of various shrubs such as ceanothus, mountain mahogany, and bitterbrush. Forbs and grasses are important in spring, and mule deer feed heavily on acorns when available, primarily in autumn. They also dig out subterranean mushrooms and commonly frequent salt or mineral licks.

Local populations of mule deer are dispersed and seldom form herds. The usual groups consist of a doe with her fawn or a doe with twin fawns and a pair of yearlings. Bucks usually are solitary. Mule deer establish home ranges to which they restrict their movements. Natural predators of deer include mountain lions, coyotes, and bobcats. Deer populations can decline in response to fragmentation, degradation, or destruction of habitat. Movement corridors may be instrumental in maintaining population continuity and allowing the dispersal of juveniles. Several individuals and sign (i.e., tracks, scat) were observed throughout the SSFL.

The San Diego black-tailed jackrabbit (*Lepus californica bennettii*) is considered a "species of special concern" by the CDFG. This species is found from the coast to the western slope of the coastal mountains up to 6,000 feet. It inhabits open land but requires some shrubs for cover. Typical habitats include early stages of chaparral, open coastal sage scrub, and grasslands near the edges of brush. Grasses and forbs are the rabbit's preferred foods. Chew and Chew (1970) reported a diet of 65 percent shrub browse and 35 percent herbage. Breeding occurs throughout the year, and young are born under shrubs with no special nest structure. Home ranges averaging 45 acres have been recorded in California (Lechleitner 1958). One San Diego black-tailed jackrabbit was observed at the STL-IV Area (SWMU 6.5), and another was observed north of the FSDF (SWMU 7.3).

Species Potentially Occurring at the SSFL

A number of other sensitive wildlife species are either known from the area or have the potential to occur at the facility. Species that are considered to have a high potential to occur at the facility are described in the following paragraphs. These species are known from the surrounding area, and suitable habitats are available at the SSFL. Species that are considered to have a low to moderate potential to occur at the facility are described in Appendix E. The potential for these species to occur is typically low to moderate if the study area is at the edge of the known species range or if adequate amounts of suitable habitat are lacking at the SSFL.

Reptiles

The San Diego horned lizard (*Phrynosoma coronatum blainvillei*) is considered a "species of special concern" by the State of California. This subspecies is endemic to extreme southwestern California, occurring from sea level to elevations of over 8,000 feet, and frequents a variety of habitats from sage scrub and chaparral to coniferous and broadleaf woodlands (Stebbins 1966). It is most often found on sandy or friable soils with open scrub. Habitat requirements include open areas for sunning, bushes for cover, and fine loose soil for rapid burial. Harvester ants are the primary food item of the horned lizard and indicate the potential for the lizard to occur in an area. This taxon is primarily active in late spring (April through May) and early summer (June through July) after which individuals typically estivate. Threats to this species include urban development,

conversion of habitat to agriculture, and collection of individuals for the pet trade (SDHS 1980). Although no San Diego horned lizards were detected at the facility, suitable habitat and prey items for this subspecies occur at the facility, and the San Diego horned lizard is known to occur within the Santa Susana Mountains. There is a high to moderate probability that the San Diego horned lizard occurs onsite in low numbers.

The coastal rosy boa (*Lichanura trivirgata roseofusca*) is considered a fully protected species by the CDFG. This boa is widely but sparsely distributed throughout desert and chaparral habitats in southern California, ranging from western Los Angeles County to eastern San Bernardino County (Zeiner et al. 1988). It occurs in dry rocky brushlands and arid habitats, usually near intermittent streams, but does not require permanent water. It is secretive and chiefly nocturnal and best surveyed for at night. It is declining as a result of habitat alteration and collection for the pet trade. Habitat requirements include vegetation or rock outcrops for shelter and small mammals or birds for prey. There is a high probability that this species occurs at the facility.

The coast patch-nosed snake (*Salvadora hexalepis virgultea*) is considered a “species of special concern” by the CDFG. The distribution of the coast patch-nosed snake includes the coastal slope of southern California and northern Baja California (Stebbins 1966). The species is found in a variety of habitats from sea level to 7,000 feet, including coastal sage scrub, chaparral, riparian, grasslands, and agricultural fields (Zeiner et al. 1988). Its activity patterns are diurnal and it is active most of the year in southern California. It prefers open habitats with friable or sandy soils and enough cover to escape predation. Burrowing rodents are a preferred food source. This uncommon snake is threatened by intensive agricultural practices and urbanization of its habitat. There is a high probability that the coast patch-nosed snake occurs at the SSFL facility.

Birds

The golden eagle (*Aquila chrysaetos canadensis*) enjoys full federal protection under the Bald Eagle Act and is considered a "species of special concern" by the CDFG. Golden eagles are distributed throughout North America, Eurasia, and North Africa (Johnsgard 1990). Golden eagles occur as breeding residents in the western half of the United States and formerly nested in the northeast (Terres 1980; Johnsgard 1990). This species is an uncommon resident throughout California (Zeiner et al. 1990a). Golden eagles forage in grassy and open shrubby habitats and nest primarily on cliffs, with secondary use of large

trees (e.g., oaks and sycamores). Breeding pairs may occupy territories of several square miles, within which they may often use several nest sites, shifting nest sites from year to year. This species has declined regionally because of loss of foraging and nesting habitat to urban and agricultural development, illegal shooting, incidental poisoning of prey species (e.g., ground squirrels and prairie dogs), egg collecting, power line electrocution, and human disturbance at the nest (Snow 1973; Johnsgard 1990; Scott 1985). Facility personnel at the STL-IV Area (SWMU 6.5) documented a golden eagle sighting in November 1989.

Mammals

The ringtail cat (*Bassariscus astutus*) has been given fully protected status by the CDFG. The ringtail cat was previously classified with raccoons in the Procyonidae family but are now placed in their own family, the Bassaricadae. This nocturnal species is seldom observed but is normally associated with steep rocky slopes adjacent to streams. It is also associated with caves and abandoned mines. Home ranges of this species have been estimated at 100 to 1,200 acres (Grinnel et al. 1937). Ringtails require rocky areas not more than 0.6 mile from water. Rocketdyne personnel have reported observation of this species in the Instrument and Equipment Laboratories area in December 1996.

The mountain lion (*Felis concolor*) is considered a "harvest species" by the CDFG, and there is presently a moratorium on mountain lion hunting. Mountain lions typically occur in remote, hilly, or mountainous areas. They require open water sources, such as streams or rock pools, large foraging areas, and rocky shelters or caves for denning. The home range of mountain lions can cover areas as large as 25 to 96 square miles (16,000 to 61,440 acres) for males and 3 to 12 square miles (1,920 to 7,680 acres) for females, with a typical minimum home range of 15 square miles (9,600 acres) per individual (Russell 1978; Hornocker 1970). Mountain lions are chiefly nocturnal but may also be active during the day if undisturbed. This cat is active year-round and may travel up to 25 miles per night in search of food. Prey includes mule deer (up to 60 to 80 percent of diet), rabbits, rodents, coyotes, snakes, and occasionally livestock. Because of its large home range size, this species is susceptible to increased human pressures. No mountain lions were detected at the facility during project surveys, although SSFL personnel have reported sightings. There is a high potential for mountain lions to occur onsite.

The American badger (*Taxidea taxus jeffersoni*) is considered a "species of special concern" and "harvest species" by the CDFG. It is an uncommon resident of level, open areas in grasslands, agricultural areas, and open shrub habitats. It digs large burrows in dry, friable soils and feeds mainly on fossorial mammals: ground squirrels, gophers, rats, mice, etc. Badgers are primarily active during the day but may become more nocturnal when in proximity to humans. The home range of badgers has been measured at 1,327 to 1,549 acres for males and 338 to 751 acres for females in Utah (Lindzey 1978), and 400 to 600 acres in Idaho (Messick and Hornocker 1981). Mating occurs in late summer or early fall, and two to three young are born 183 to 265 days later in March or April (Long 1973). Badgers are known to live at least 11 to 15 years (Messick and Hornocker 1981). Threats to badgers include urban and agricultural development of habitat and possibly excessive trapping and persistent poisons in prey in some areas (Zeiner et al. 1990b). The American badger has been reported by SSFL personnel to have occurred historically onsite; due to its large home range size, it is very difficult to observe. There is a high probability that the American badger occurs at the SSFL facility.

The San Diego desert woodrat (*Neotoma lepida intermedia*) is a "species of special concern" in the state of California. Like other woodrats, it constructs large middens, usually of small twigs, cactus pads, and other plant material. Middens are often constructed under patches of prickly pear or cholla (*Opuntia* spp.), in rock outcrops, or under low trees. Although the middens are easily detectable and several were observed on the SSFL property, trapping is usually necessary to distinguish between the middens of the dusky-footed woodrat (*Neotoma fuscipes*) and those of the desert woodrat. The primary threat to this species is urbanization and habitat degradation. There is a high probability that the San Diego desert woodrat occurs at the SSFL facility.

3.6.5 Habitat Quality

The wildlife and vegetative habitats at the SSFL facility are generally considered to be of high quality. Habitat quality is positively influenced by the availability of several sources of water at the site, relative size of the open space on the property, biological and physical diversity, and connections to larger areas of open space.

Water can play an important role in determining the habitat quality of a site. Areas that have a readily available source of water typically support those vegetative habitats that in turn are able to support a wide variety of wildlife species. Sources of water at the facility

include areas of open water such as Silvernale Reservoir and several ponds, perennial springs, and streams scattered across the facility. These permanent sources of water are high quality resources that may attract wildlife from adjacent open space areas.

The undeveloped areas within the SSFL facility, both in the open space and the natural areas surrounding the developed site areas, consists of a large area of diverse habitats. This diversity is reflected in a wide variety of floral and faunal species occurring at the site. The habitat and species diversity associated with the SSFL property, the physical attributes of the facility, and its geographic location makes the area a potentially important route for effective movement from floral and faunal source units (large habitat areas from which species can migrate to repopulate or maintain current populations in more restricted areas). According to recent studies of wildlife movement within the Santa Susana Mountains, the open space associated with the site may play an important role as a habitat linkage between the Santa Susana Mountains, the Simi Hills, and possibly the San Gabriel Mountains (Edelman 1991; Envicom 1993).

3.6.6 Trophic Relationships

Trophic relationships refer to the interaction of one organism with another on a predator/prey basis; this relationship is often shown as a food web or chain. Positions within the web may include:

- Primary producer – a photosynthetic plant
- Herbivore or primary consumer – the first animal which feeds on a plant
- Secondary consumer – an animal feeding on an herbivore
- Tertiary consumer – an animal feeding on a secondary consumer

Trophic relationships are useful for determining the flow of energy and matter within an ecosystem and for modeling potential chemical exposure through the food web. The food web model developed for the SSFL illustrates trophic relationships among species found on the SSFL (Figure 3-3).

In the trophic model developed for the SSFL, aquatic and terrestrial plants are identified as primary producers. That is, they rely on solar energy and nutrients in the soil, sediment, and/or water for growth and reproduction. Mammals, reptiles, amphibians, fish, birds, and invertebrates are considered herbivores if they eat plants. Some of these

animals, such as birds or fish, are also considered secondary consumers; birds and fish may eat portions of a plant as well as consume species such as invertebrates. Tertiary consumers include carnivorous species such as bobcats, raptors, snakes, toads, and fish.

A complete food chain for the SSFL may include plants, rabbits that eat the plants, and bobcats that eat the rabbits. Another example is that of a piscivorous bird that feeds on fish, which feeds on other fish, invertebrates, and plant matter.

Vegetation Map with Sensitive Species

Santa Susana Field Laboratory

- VENTURAN COASTAL SAGE SCRUB
- VENTURAN COASTAL SAGE SCRUB/CHAPARRAL
- BACCHARIS SCRUB
- CHAPARRAL
- CHAPARRAL/COAST LIVE OAK WOODLAND
- NONNATIVE GRASSLAND
- NATIVE GRASSLAND
- COAST LIVE OAK RIPARIAN FOREST
- COAST LIVE OAK WOODLAND
- FRESHWATER MARSH
- MULEFAT SCRUB
- SOUTHERN WILLOW SCRUB/MULEFAT SCRUB
- SOUTHERN WILLOW SCRUB
- OPEN WATER
- RUDERAL HABITAT
- ROCK OUTCROP
- DEVELOPED
- DISTURBED VEGETATION OVERLAY
- VEGETATION WITH ROCK OUTCROPS OVERLAY
- Drainages

Legend

Sensitive Wildlife

MD	MULE DEER
BC	BOBCAT
TUVU	TURKEY VULTURE
RSHA	RED-SHOULDERED HAWK
BTJ	S.D. BLACK-TAILED JACKRABBIT
RTHA	RED-TAILED HAWK
GBH	GREAT BLUE HERON
GHOW	GREAT HORNED OWL
SSHA	SHARP-SHINNED HAWK
RCSP	RUFOUS-CROWNED SPARROW
DCCO	DOUBLE-CRESTED CORMORANT
TSGS	TWO-STRIPED GARTER SNAKE
COHA	COOPER'S HAWK
LOSH	LOGGERHEAD SHRIKE

Sensitive Plants

HM	SANTA SUSANA MOUNTAIN TARPLANT
BW	SOUTHERN CAL. BLACK WALNUT
QA	VALLEY OAK
QL	COAST LIVE OAK

MAP NOTES:
1. AMEC Earth and Environmental. 2003. Standardized Risk Assessment Methodology Workplan, Surficial Operable Unit, Revision 1, Santa Susana Field Laboratory, Ventura County California. (Biological Conditions Report, Appendix C.) In preparation.
2. Map coordinates in Stateplane, NAD 27, Zone V.
3. Species locations not necessarily to scale.

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MWH

FIGURE 3-1

Figure 3-2

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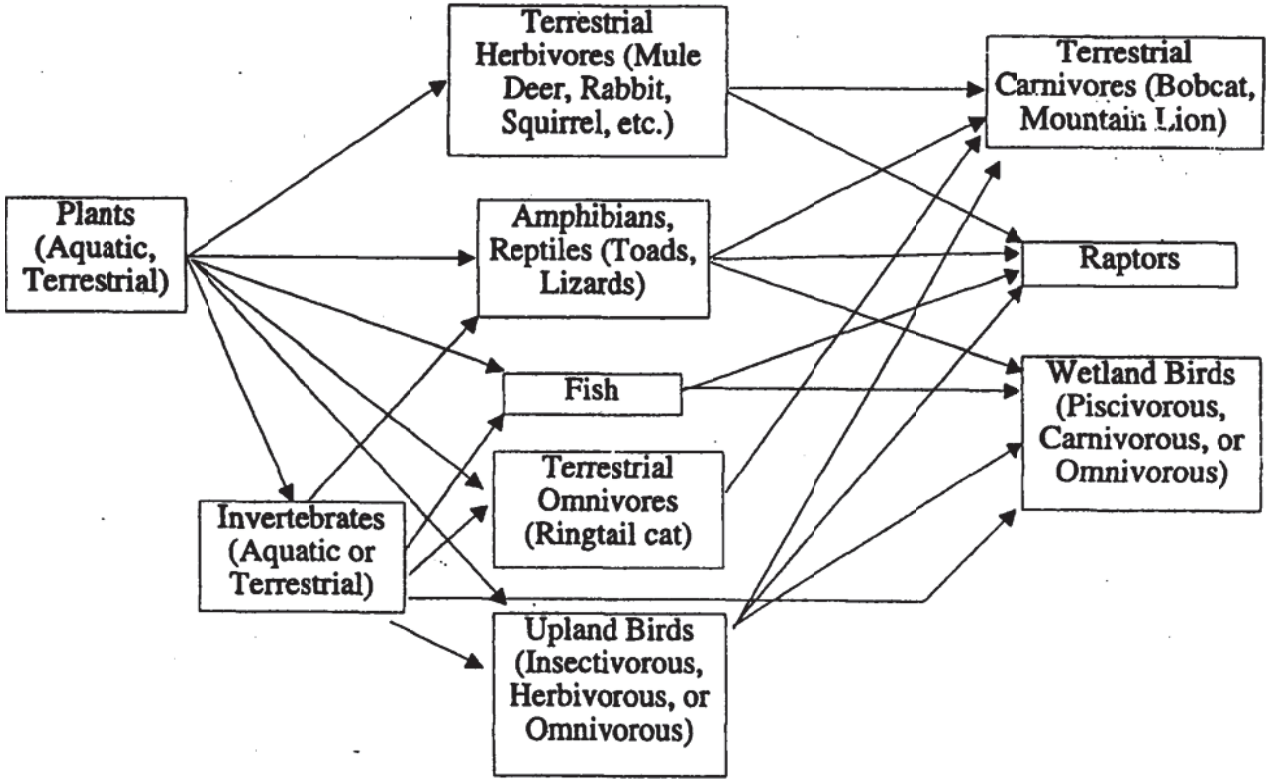

OGDEN

Trophic Model for the Rocketdyne Santa Susana Field Laboratory Facility

FIGURE 3-3

Table 3-1

SENSITIVE PLANT SPECIES OBSERVED OR POTENTIALLY OCCURRING AT THE SSFL FACILITY

Species Name	State Status	Federal Status	Likelihood of Occurrence*
Santa Susana tarplant (*Hemizonia minthornii*)	Rare	--	Observed throughout the SSFL primarily on rock outcrops.
Southern California black walnut (*Juglans californica* var. *californica*)	Candidate (CNPS List 4)	--	Observed 23 trees in the vicinity of Burro Flats and west of the STL-IV Area (SWMU 6.5). Four individuals adjacent to the ESADA Storage Area (SWMU 7.9), and individual trees observed across the SSFL.
Braunton's milkvetch (*Astragalus brauntonii*)	Candidate (CNPS List 1B)	Endangered	Not observed. Suitable habitat present onsite but low potential to occur. Known from fewer than ten extant occurrences, none of which are at or adjacent to the SSFL.
Plummer's mariposa lily (*Calochortus plummerae*)	Candidate (CNPS List 1B)	--	Not observed. Low potential to occur in chaparral habitat onsite. Less common at higher elevations. Has been reported in area of the SSFL but not on or immediately adjacent to the SSFL.
San Fernando Valley spineflower (*Chorizanthe parryi* var. *fernandina*)	Candidate (CNPS List 1A)	Candidate	Not observed. Extremely low potential to occur onsite. Presumed to be extinct.
Santa Monica Mountains dudleya (*Dudleya cymosa* ssp. *ovatifolia*)	Candidate (CNPS List 1B)	Threatened	Not observed. Low potential to occur onsite. Known from fewer than ten occurrences, none of which are at or adjacent to the SSFL.
Many-stemmed dudleya (*Dudleya multicaulis*)	Candidate (CNPS List 1B)	--	Not observed. Low potential to occur in the coastal sage scrub and chaparral habitats onsite. Not reported to occur at or adjacent to the SSFL.

*Likelihood of occurrence is based on known species range and the presence and quality of suitable habitat.

Table 3-2

SENSITIVE REPTILE SPECIES OBSERVED OR POTENTIALLY OCCURRING AT THE SSFL FACILITY

Species Name	State Status	Federal Status	Likelihood of Occurrence*
San Diego horned lizard (*Phrynosoma coronatum blainvillei*)	Species of Special Concern	--	Not observed. High potential to occur in appropriate habitat at the SSFL. Known to occur within the Santa Susana Mountains.
Silvery legless lizard (*Anniella pulchra pulchra*)	Species of Special Concern	--	Not observed. Moderate potential to occur in appropriate habitat (chaparral and coastal scrub) at the SSFL.
Coastal rosy boa (*Lichanura trivirgata roseofusca*)	Protected	--	Not observed. High potential to occur in appropriate habitat (rocky chaparral-covered hillsides and canyons) at the SSFL.
Coast patch-nosed snake (*Salvadora hexalepis virgultea*)	Species of Special Concern	--	Not observed. High potential to occur in appropriate habitat (coastal chaparral) at the SSFL. Widely distributed throughout California.
Two-striped garter snake (*Thamnophis hammondi*)	Special Animal	--	Observed at the Old Conservation Yard (SWMU 7.4), the LETF (SWMU 4.12), the Bravo Area (SWMUs 5.13, 5.14, and 5.15), and at the Perimeter Pond (SWMU 4.17). Expected to occur throughout appropriate habitat at the SSFL.
San Diego mountain king snake (*Lampropeltis zonata pulchra*)	Protected	--	Not observed. Low to moderate potential to occur in the rock outcrop habitat at the SSFL. May be at edge of range.

*Likelihood of occurrence is based on known species range and the presence and quality of suitable habitat.

Table 3-3

SENSITIVE AMPHIBIAN SPECIES POTENTIALLY OCCURRING AT THE SSFL FACILITY

Species Name	State Status	Federal Status	Likelihood of Occurrence*
Western spadefoot toad (*Scaphiopus hammondi*)	Species of Special Concern	--	Not observed. Low to moderate potential to occur at the SSFL. Occurs primarily in native grasslands at lower elevations. Few small patches of native grassland occurs at the SSFL and may not be sufficient to support toad populations.
Southwestern pond turtle (*Clemmys marmorata pallida*)	Species of Special Concern (under review for Protected status)	--	Not observed. Low to moderate potential to occur in the aquatic habitat at the SSFL.
California red-legged frog (*Rana aurora draytoni*)	Species of Special Concern	Threatened	Not observed. Low potential to occur in the aquatic habitat at the SSFL. Uncommon throughout southern California.

*Likelihood of occurrence is based on known species range and the presence and quality of suitable habitat.

Table 3-4

SENSITIVE BIRD SPECIES OBSERVED OR POTENTIALLY OCCURRING AT THE SSFL FACILITY

Species Name	State Status	Federal Status	Likelihood of Occurrence*
Double-crested cormorant (*Phalacrocorax auritus*)	Species of Special Concern	--	Observed on Silvernale Reservoir. There is only a low to moderate probability that this species nests onsite.
Great blue heron (*Ardea herodias herodias*)	Special Animal	--	Observed in freshwater marsh and aquatic habitat at the Silvernale Reservoir adjacent to the SPA (Area II AOC), the Building 56 Landfill (SWMU 7.1), the Bowl Area and Building 901 Leach Field (SWMU 4.15 and AOC), and the CTL-III area (SWMU 4.7). Moderate potential to nest in the large trees at the SSFL.
California gnatcatcher (*Polioptila californica*)	Species of Special Concern	Threatened	Not observed. Low potential to occur in the sage scrub habitat onsite. May be at edge of known range. Focused surveys did not detect gnatcatchers.
Southern California rufous-crowned sparrow (*Aimophila ruficeps canescens*)	Species of Special Concern	--	Observed north of the ECL area (SWMU 6.1, 6.3 and AOC), and between the Alfa Area (SWMUs 5.9, 5.10, and 5.11) and the SPA (Area II AOC).
Loggerhead shrike (*Lanius ludovicianus*)	Species of Special Concern	--	Observed south of the Happy Valley Site (Area II AOC). This species probably nests at the SSFL.
Sharp-shinned hawk (*Accipiter striatus velox*)	Species of Special Concern	--	Observed flying over the ELV Final Assembly Building 206 (SWMU 5.2). Historically documented at the SSFL by Rocketdyne personnel.

Table 3-4

SENSITIVE BIRD SPECIES OBSERVED OR POTENTIALLY OCCURRING AT THE SSFL FACILITY

Species Name	State Status	Federal Status	Likelihood of Occurrence*
Red-shouldered hawk (*Buteo lineatus elegans*) [1]	--	--	Observed evidence of nesting at the SSFL in the vicinity of the STL-IV area.
Red-tailed hawk (*Buteo jamaicencis*) [1]	--	--	Observed roosting in the vicinity of Happy Valley (Area I AOC), and flying over the CTL-III Area (SWMU 4.7), the SPA (Area II AOC), and the Building 56 Landfill (SWMU 7.1).
Turkey vulture (*Cathartes aura*) [1]	--	--	Observed roosting and flying over the entire SSFL and are expected to forage on the property.
Great horned owl (*Bubo virginianus*) [1]	--	--	Observed two owls roosting at the Bowl Area and Building 901 Leach Field (SWMU 4.15 and AOC).
Cooper's hawk (*Accipiter cooperii*)	Species of Special Concern	--	Observed a male and female roosting in the buffer zone. This species has a high probability of nesting onsite.
Golden eagle (*Aquila chrysaetos canadensis*)	Species of Special Concern	Protected	Not observed during biological surveys; however, this species has been historically documented by Rocketdyne personnel.

[1] Although no official status is given for these raptors, raptor nests are protected to varying degrees by separate state regulations. Additionally, raptors are considered important to the ecosystem due to their position at the top of the food chain.

* Likelihood of occurrence is based on known species range and the presence and quality of suitable habitat.

Table 3-5

SENSITIVE MAMMAL SPECIES OBSERVED OR POTENTIALLY OCCURRING AT THE SSFL FACILITY

Species Name	State Status	Federal Status	Likelihood of Occurrence*
Bobcat (*Felis rufus*)	Harvest Species	--	Observed bobcat sign, including scat and tracks, throughout the Buffer Zone and at all the RFI sites except the Bowl Area and Building 901 Leach Field (SWMU 4.15 and AOC). One bobcat was observed foraging in the scrub habitat west of the Perimeter Pond (SWMU 4.17).
Mule deer (*Odocoileus hemionus*)	Harvest Species	--	Observed mule deer or sign, including scat and tracks, throughout the Buffer Zone and at all the RFI sites except the Bowl Area and Building 901 Leach Field (SWMU 4.15 and AOC), the RIHL (SWMU 7.7), and the Former Coal Gasification PDU (SWMU 7.10).
San Diego black-tailed jackrabbit (*Lepus californica bennettii*)	Species of Special Concern	--	Observed one individual at the STL-IV area (SWMU 6.5) and another at the FSDF (SWMU 7.3).
Los Angeles little pocket mouse (*Perognathus longimembris brevinasus*)	Species of Special Concern	(Under review for Endangered or Threatened status)	Not observed. Low to moderate potential to occur in appropriate habitat at the SSFL. A live-trapping study would need to be performed to determine if this subspecies is present at the SSFL.

Table 3-5

SENSITIVE MAMMAL SPECIES OBSERVED OR POTENTIALLY OCCURRING AT THE SSFL FACILITY

Species Name	State Status	Federal Status	Likelihood of Occurrence*
Ringtail (*Bassariscus astutus*)	Protected	--	Reported from Instrument and Equipment Laboratories area in December 1996. Moderate to high potential to occur elsewhere at the SSFL in areas of rock outcrops.
Mountain lion (*Felis concolor*)	Harvest Species	--	Not observed. High potential to occur at the SSFL. Known to occur in the area.
American badger (*Taxidea taxus jeffersoni*)	Species of Special Concern, Harvest Species	--	Not observed. High potential to occur at the SSFL. Known to occur in the area.
San Diego desert woodrat (*Neotoma lepida intermedia*)	Species of Special Concern	--	Not observed during biological surveys; however, this species has been historically documented by SSFL personnel.

*Likelihood of occurrence is based on known species range and the presence and quality of suitable habitat.

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APPENDIX J

LARGE HOME RANGE SPECIES EXPOSURE

Appendix J has been replaced entirely by Appendix G of the SRAM Rev. 2 Addendum.

APPENDIX J
LARGE HOME RANGE SPECIES EXPOSURE
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APPENDIX J

LARGE HOME RANGE SPECIES EXPOSURE

J.1 INTRODUCTION

To complete the Phase I predictive ecological risk assessment for large home range representative species, it is necessary to evaluate their relative exposure across a number of investigational units and across the facility as a whole. This discussion outlines the proposed method for examining the risk to large home range species across the Santa Susana Field Laboratory (SSFL).

There are four representative species at the SSFL with home ranges that are larger than the size of any of the investigational units: bobcat, red-tailed hawk, mule deer, and great blue heron. The remainder of the representative species (e.g., plants, aquatic invertebrates, deer mouse, and thrush) are expected to occupy only one investigational unit. The bobcat, red-tailed hawk, and great blue heron eat a variety of prey species and, therefore, require larger home ranges for foraging. The typical range of home range sizes and diet for these representative species are listed below.

Representative Species	Home Range Size	Diet
Bobcat	1.8 to 20.7 square miles (Zezulak and Schwab 1980)	Mostly rabbits and rodents (75%) with some deer, birds, reptiles, amphibians, invertebrates, and vegetation (Zeiner et al. 1990a)
Red-tailed Hawk	0.3 to 3.8 square miles (Zeiner et al. 1990b)	Small mammals (68%), small birds (17.5%), reptiles and amphibians (7%), and invertebrates (3.2%) (Sherrod 1978)
Mule Deer	0.20 to 1.19 sq. mi. for does (Taber and Dasmann 1958) 0.15 to 3.2 sq. mi. for bucks (Chapman and Feldhammer 1992)	Vegetation (100%)
Great Blue Heron	1.8 to10 miles from nest (Zeiner et al. 1990b, USEPA 1993)	Fish (75%); also small rodents, amphibians, snakes, lizards, insects, crustaceans, and small birds (USEPA 1993, Zeiner et al. 1990b)

There are a variety of developed land and wildlife habitats across the SSFL. The amount of foraging habitat available at each investigational unit will determine the relative proportion of exposure to the large home range species. Based on the types of prey species that the bobcat,

great blue heron, and red-tailed hawk forage on and the types of habitats that occur at the SSFL, the most frequently used habitats of these three species are listed below.

Representative Species	Foraging Habitats	Reference
Bobcat	Native and nonnative grasslands, Venturan coastal sage scrub, chaparral, coast live oak woodlands, rock outcrops, coast live oak riparian forest, and southern cottonwood willow riparian forest	Zeiner et al. 1990a
Red-tailed Hawk	Native and nonnative grasslands, Venturan coastal sage scrub, rock outcrops, and ruderal habitat	Zeiner et al. 1990b
Great Blue Heron	Open water, freshwater marsh, undifferentiated wetlands, waters of the U.S., native and nonnative grasslands	Zeiner et al. 1990b

Native and nonnative grasslands are the primary habitats of rodents and all three of the large home range species include rodents in their diets; therefore, they would be expected to forage in these habitats. Bobcats generally use the cover of scrub, rock outcrops, and trees to stalk and capture prey in the open (Zeiner et al. 1990a). Bobcats are not considered to use dense habitat types like Baccharis scrub, or some of the wetland habitats that do not afford adequate cover. Red-tailed hawks forage over open grasslands and fields, over rock outcrops, and in the more open Venturan coastal sage scrub as opposed to the dense chaparral (Zeiner et al. 1990b). Although hawks use woodlands and riparian habitats for perching or nesting, they generally do not forage in these habitats. The great blue heron is expected to spend the majority of its foraging time in and around the edges of the ponds and marsh, but not in the woodlands (Zeiner et al. 1990b). The herons also may forage in the grasslands on rodents, reptiles, and amphibians.

To calculate the exposure for those species foraging at multiple investigational units, the following assumptions were made:

- To provide a simplified and conservative estimate of risk, the bobcat and red-tailed hawk are assumed to feed exclusively on deer mice. Great blue heron is assumed to ingest a combination of fish, aquatic invertebrates, and deer mice. Great blue heron will not be considered a representative species if aquatic habitat is not present at an investigational unit.

- Large home range species may forage off the SSFL; however, for purposes of this risk assessment, the SSFL is assumed to represent 100 percent of the species home range.

- The chemical concentration calculated for each media (e.g., soil, water, and tissue) evaluated at an investigational unit is assumed to represent chemical concentrations in each of the habitats identified at an investigational unit.
- The fraction of time a large home range species will spend foraging at each investigational unit (i.e., the area use factor) is dependent on the amount of foraging habitat present at an investigational unit.
- Large home range species may spend time off the SSFL; however, for purposes of this risk assessment, each large home range species is assumed to spend 100 percent of their time on the SSFL.

J.2 THREE-STEP PROCESS

The calculation of a representative species exposure and risk at each investigational unit and for the facility as a whole will be an iterative process, progressing from very conservative assumptions to less conservative assumptions. The first and most conservative iteration (Step 1) assumes the large home range species occupies a single investigational unit for 100 percent of its foraging time. The second iteration (Step 2) assumes the large home range species only forages within appropriate habitats encompassing all investigational units (i.e., combined investigational unit risk). The last iteration (Step 3) assumes the large home range species forages in appropriate habitats across the entire facility (as defined by the SSFL property line) and any off-site contaminated areas. Specific steps to calculate risks to large home range species following this iterative process are described below.

J.2.1 Step 1. Calculation of Individual Investigational Unit Risk

Step 1a. Select investigational units for evaluation. Using information provided in the Biological Conditions Report (Appendix I) and methodology described in this SRAM (Sections 9 through 12), select investigational units for evaluation based on (1) appropriate foraging habitat for the large home range species of concern, and (2) the presence of a complete exposure pathway in air, groundwater, soil, sediment, or surface water, of that habitat. Each investigational unit will be evaluated, provided each contains appropriate habitat for the large home range species of concern.

Step 1b. Calculate large home range species exposure at each investigational unit assuming that they forage 100 percent of the time (assume area use factor = 1) at that investigational unit. This

step will provide a conservative method for assessing risk presented by a particular investigational unit.

Step 1c. Calculate the hazard quotient (HQ) based on the methodology described in Step 1b above and in Section 12.1.3 of the SRAM. The relative exposure at each investigational unit will be divided by the TRV to calculate the HQ. If any chemicals of potential environmental concern (CPECs) have similar toxic effects (e.g., polyaromatic hydrocarbons [PAHs]), the HQs will be added together to calculate a hazard index (HI). If the individual investigational unit HQ or HI is less than 1, then a decision identifying no risk to large home range species at 100 percent usage can be made for a site; however, the site will still be evaluated as part of the incremental risk to large home range species. The HQ and/or HI values will be used to rank each investigational unit for potential ecological risk. Proceed to Step 2.

J.2.2 Step 2. Calculation of Reporting Area Risk

Step 2a. Calculate exposure of large home range species at all investigational units with appropriate foraging habitat within a Reporting Area. Relative exposure at each investigational unit within a Reporting Area will be calculated with a species-specific adjusted area use factor based on the percent of foraging habitat provided by each investigational unit divided by the total foraging habitat provided by all investigational units within a Reporting Area.

Step 2b. Calculate the HQ based on methodology previously discussed.

Step 2c. Add chemical-specific HQs for each investigational unit to calculate a "total HQ" for the large home range species. If any CPECs have similar toxic effects (e.g., PAHs), the HQs will be added together to calculate a HI. If the combined investigational unit HQ and/or HI is less than 1, then no additional iterations would be necessary. If the "total HQ" and/or HI is greater than 1, further investigation is necessary. The total HQ or HI values will be used to rank each investigational unit for potential ecological risk and to identify potential contamination "hot spots." Proceed to Step 3.

J.2.3 Step 3. Calculation of SSFL-Wide Risk

Step 3a. Identify and quantify acreage of appropriate habitat for large home range species that is not associated with investigational units, but encompasses the entire facility.

Step 3b. Calculate facility-wide exposure assuming the large home range species evaluated in Step 2 also forage in habitats that are not part of investigational units (i.e., exposed across the

entire facility, not just contaminated sites). Relative exposure at an investigational unit will be calculated with an adjusted area use factor based on the percent of foraging habitat on each investigational unit and foraging habitat outside the investigational units divided by the total foraging habitat on all investigational units. Because this step incorporates all appropriate habitats available at the SSFL, and not just habitats occurring at a given investigational unit, background concentrations of metals and dioxins will be included in the exposure calculations.

Step 3c. Calculate the HQ and/or HI based on previously described methodology. The resulting HQs will be added for each investigational unit and the areas outside investigational units at the SSFL to calculate a facilitywide total HQ for the large home range species. If any CPECs have similar toxic effects (e.g., PAHs), the HQs will be added together to calculate an HI. This HQ and/or HI can be used to support risk management decisions.

The results of this iterative, large home range species risk assessment will be used to facilitate the risk decision and management processes; as described in Section 12 of the SRAM.

J.3 Example Large Home Range Species Exposure and Risk Calculations (Steps 1 through 3)

An example using artificial acreages and the types of habitats on the SSFL for a subset of the investigational units and an artificial chemical data set for the red-tailed hawk is provided in Table 1a. Equations and assumptions used to calculate exposure to the red-tailed hawk are provided below. This example assumes that five investigational units occur at the SSFL with appropriate red-tailed hawk habitat.

Reference Species: Red-tailed Hawk
Home Range: SSFL
Types of Foraging Habitats: Venturan coastal sage scrub, native grassland, nonnative grassland, rock outcrops, and ruderal habitat

The exposure dosage of the red-tailed hawk will be calculated as identified in Section 10 of the SRAM and shown below:

$$D_{rt} = \{(C_d \times R_{rt} \times F_{rtd})/W_{rt}\} \times \Psi_{rt} \times \Theta_{rt} \quad (1)$$

$$R_{rt} = 0.0582 \times W_{rt}^{0.651} \quad (2)$$

$$EPV = D_{rt} \quad (3)$$

$$C_d = C_s \; x \; BSAF \quad (4)$$

where:

D_r = daily dosage to red-tailed hawk from prey, mg/kg-day

C_d = chemical concentration in deer mouse either measured directly or by equation 4, mg/kg

C_s = chemical concentration in soil, mg/kg

$BSAF$ = bioaccumulation factors measured at selected sites or estimated from the literature (if necessary) and applied across the SSFL, unitless

R_{rt} = food intake rate for red-tailed hawk, 0.066 kg/d

F_{rtd} = fraction of deer mouse in red-tailed hawk diet, 1.0 unitless

W_{rt} = mean weight of adult red-tailed hawk, 1.2 kg (Dunning 1993)

Ψ_{rt} = fraction of year spent at SSFL, unitless

Θ_{rt} = fraction of time on SSFL spent in exposure unit, unitless

EPV = exposure point value for the red-tailed hawk, mg/kg-day

Table 1a. CHEMICALS OF POTENTIAL ENVIRONMENTAL CONCERN DETECTED IN SOIL SAMPLES AT EACH INVESTIGATIONAL UNIT (ARTIFICIAL DATA)

CPECs	95 percent UCL of the Mean Soil Concentration (mg/kg)				
	Invest. Unit 1	Invest. Unit 2	Invest. Unit 3	Invest. Unit 4	Invest. Unit 5
Lead	500.0	5.0	30.0	15.0	10.0
Zinc	400.0	60.0	40.0	300.0	320.0
PCB	NA	28.0	6.0	NA	1.0
TPH-diesel	2,000.0	2,500.0	500.0	5,000.0	500.0

NA = not sampled or analyzed

Step 1a. The exposure point values (EPVs) are calculated assuming that the red-tailed hawk uses the entire investigational unit, area use factor = 1 (Table 1b). For this example it was assumed that the biota sediment/soil accumulation factor (BSAF) for each chemical in deer mice is 2.

Table 1b. EXPOSURE POINT VALUES CALCULATED WITH AN AREA USE FACTOR OF 1

	EPVs (mg/kg-day)					
CPECs	Invest. Unit 1	Invest. Unit 2	Invest. Unit 3	Invest. Unit 4	Invest. Unit 5	Reference Dose mg/kg-day
Lead	27.12	0.27	1.63	0.81	0.54	0.014[a]
Zinc	21.69	3.25	2.17	16.27	17.36	14.50[b]
PCB	NA	1.52	0.33	NA	0.05	0.09[c]
TPH-diesel	108.47	135.59	27.12	271.18	27.12	50.0[d]

NA = not sampled or analyzed
[a] No observable adverse effect level (NOAEL) for Japanese quail for relatively soluble lead in acetate form (EFA West 1998).
[b] NOAEL for white leghorn chickens (Sample et al. 1996).
[c] NOAEL for Aroclor 1254 for chickens (EFA West 1998).
[d] NOAEL for mouse multiplied by 0.1 to calculate a NOAEL for red-tailed hawk (ATSDR 1993).

Step 1b. An HQ is calculated for each investigational unit. (Table 1c). Based on this calculation, the majority of chemicals on the sites pose a risk (HQ>1). Zinc and diesel do not pose a risk to red-tailed hawks at investigational unit 3 and zinc does not pose a risk at investigational unit 2 (Table 1c). No PCBs were analyzed in investigational units 1 and 4; therefore, there are no HQs. With the conservative area use factor of 1, CPECs pose a risk to red-tailed hawks. The organic CPECs do not have similar toxic effects; therefore, no HIs will be calculated. The HQs for lead and zinc will be summed to calculate an HI for metals at the investigational unit. Based on the total HQ, all contaminants pose a risk to red-tailed hawks.

Table 1c. HAZARD QUOTIENTS FOR RED-TAILED HAWK ASSUMING AREA USE FACTOR OF 1

	HQs					
CPECs	Invest. Unit 1	Invest. Unit 2	Invest. Unit 3	Invest. Unit 4	Invest. Unit 5	Sum HQ
Lead	1,937.1	19.3	116.4	57.6	38.6	2,169
Zinc	1.5	0.22	0.15	1.12	1.2	4.19
PCB	0	16.9	3.67	0	0.56	21.13
TPH-diesel	2.17	2.71	0.54	5.42	1.54	11.84

Step 2a. To determine the combined risk for the red-tailed hawk from feeding across all five investigational units at the facility, the EPV is recalculated using a revised area use factor based on the amount of hawk habitat at each investigational unit divided by the hawk habitat at all the investigational units (see Table 2a):

Table 2a. ACREAGE OF HABITAT TYPES USED BY RED-TAILED HAWKS AT FIVE INVESTIGATIONAL UNITS

Habitats	Invest. Unit 1	Invest. Unit 2	Invest. Unit 3	Invest. Unit 4	Invest. Unit 5	Total Acreage for All Investigational Units at SSFL	Acreage not in an Invest. Unit	Total Acreage for Entire SSFL
Venturan CSS	1.2	1.2	0.3	2.7	2.1	7.5	92.5	100.0
Native Grassland	0	0	0	0	0	0	2.0	2.0
Nonnative Grassland	0.74	0.46	0.56	1.16	0	2.9	22.1	25.0
Rock Outcrops	0.5	1.7	0.2	0	2.4	4.8	70.2	75.0
Ruderal	1.0	0.1	0.2	3.4	1.7	6.3	187.7	200.0
Total Hawk Habitat	3.4	3.4	1.3	7.3	6.1	21.5	380.5	402.0
Fraction Hawk Habitat per investigational unit (refined area use factor by investigational unit)	0.16	0.16	0.06	0.34	0.28	1.00		

CSS = Coastal sage scrub

The revised EPC (EPV_R) for combined investigational unit risk analysis equals the original EPV times the fraction of hawk habitat per investigational unit divided by the sum of hawk habitat for all investigational units (see Table 2b).

Table 2b. REVISED EXPOSURE POINT VALUES CALCULATED WITH AN AREA USE FACTOR BASED ON HAWK FORAGING HABITAT AT EACH INVESTIGATIONAL UNIT

CPECs	EPV_Rs for Evaluating Combined Unit Risks (mg/kg-day)					
	Invest. Unit 1	Invest. Unit 2	Invest. Unit 3	Invest. Unit 4	Invest. Unit 5	Reference Dose mg/kg-day
Lead	4.34	0.04	0.1	0.28	0.15	0.014[a]
Zinc	3.47	0.52	0.13	5.53	4.86	14.50[b]
PCB	0.0	0.24	0.02	0.0	0.02	0.09[c]
TPH-diesel	17.36	21.69	1.63	92.20	7.59	50.0[d]

a,b,c,d = See Table 1b

Step 2b. The HQs for each investigational unit are recalculated based on the EPV_R. The HQs are totaled to estimate the combined investigational unit total HQ for hawks (Table 2c). If the HQs are less then 1, then no further action is recommended. However, the chemical-specific

HQ-totals for hawk exposure across all investigational units are greater than 1; therefore, proceed to Step 3.

Table 2c. HAZARD QUOTIENTS FOR EACH INVESTIGATIONAL UNIT AND THE COMBINED INVESTIGATIONAL UNIT HAZARD QUOTIENT FOR RED-TAILED HAWKS

CPECs	HQs					
	Invest. Unit 1	Invest. Unit 2	Invest. Unit 3	Invest. Unit 4	Invest. Unit 5	Sum HQ
Lead	310	2.86	7.14	20	10.7	350.7
Zinc	0.24	0.04	0.01	0.38	0.34	2.0
PCB	0.0	2.67	0.22	0.0	0.22	3.11
TPH-diesel	0.35	0.43	0.03	1.84	0.15	2.81

Step 3a. To more realistically estimate risk, hawk exposure will be recalculated using a revised area use factor based on the amount of hawk habitat at each investigational unit divided by the hawk habitat across the entire SSFL (see Table 3a). Background concentrations in soil will be multiplied by the site-specific BSAF for mice to identify the exposure concentrations of chemicals outside the investigational units in order to calculate a combined investigational unit exposure.

Table 3a. FRACTION OF RED-TAILED HAWK HABITAT PROVIDED BY EACH INVESTIGATIONAL UNIT COMPARED TO THE ENTIRE SSFL

Habitats	Invest. Unit 1	Invest. Unit 2	Invest. Unit 3	Invest. Unit 4	Invest. Unit 5	Habitat Not in Invest. Units	Total SSFL
Total Hawk Habitat (acres)	3.4	3.4	1.3	7.3	6.1	380.5	402
Fraction (%) Hawk Habitat on SSFL	0.008	0.009	0.003	0.02	0.02	0.95	

A revised EPC (EPV_R) for the facilitywide risk analysis will equal the original EPV times the fraction of hawk habitat per investigational unit divided by the sum of hawk habitat for the entire SSFL facility (see Table 3b).

Table 3b. REVISED EXPOSURE POINT VALUES CALCULATED WITH A REFINED AREA USE FACTOR BASED ON FRACTION OF HAWK HABITAT AT EACH INVESTIGATIONAL UNIT DIVIDED BY THE TOTAL HAWK HABITAT AT THE SSFL

CPECs	EPV_Rs for Evaluating Facilitywide Risks (mg/kg-day)						
	Invest. Unit 1	Invest. Unit 2	Invest. Unit 3	Invest. Unit 4	Invest. Unit 5	Land outside Invest. Units	Reference Dose mg/kg-day
Lead	0.22	0.002	0.005	0.01	0.008	2.0	0.014[a]
Zinc	0.17	0.03	0.007	0.29	0.26	10.0	14.50[b]
PCB	0.0	0.01	0.001	0.0	0.008	0.0	0.09[c]
TPH-diesel	0.09	1.15	0.08	4.88	0.41	0.5	50.0[d]

a,b,c,d = See Table 1b

Table 3c. HAZARD QUOTIENTS FOR EACH INVESTIGATIONAL UNIT AND FOR THE SSFL USING AN AREA USE FACTOR FOR THE RED-TAILED HAWK BASED ON HABITAT AT EACH INVESTIGATIONAL UNIT DIVIDED BY FRACTION OF HAWK HABITAT AT THE SSFL

CPECs	HQs						
	Invest. Unit 1	Invest. Unit 2	Invest. Unit 3	Invest. Unit 4	Invest. Unit 5	Land outside Invest. Units	Sum HQs
Lead	15.7	0.14	0.36	0.71	0.57	142.86	160.34
Zinc	0.01	0.002	0.004	0.02	0.02	0.0007	0.06
PCB	0.0	0.11	0.01	0.0	0.09	0.0	0.21
TPH-diesel	0.02	0.02	0.002	0.1	0.01	0.0	0.15

Step 3b. The HQs and/or HIs for each investigational unit are recalculated based on the facilitywide EPV_R. The HQs are totaled to estimate the facilitywide HQ-total for hawks (Table 3c). If the HQs are less then 1, then no further action is recommended. However, if the chemical-specific HQ totals for hawk exposure across the SSFL are greater than 1, the risk to large home range species will be further evaluated using risk management criteria.

J.4 REFERENCES

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APPENDIX K

BIOACCUMULATION FACTORS CALCULATIONS

As detailed in Section 10.4 (Appendix C of the SRAM Rev. 2 Addendum), a number of site-specific bioaccumulation factors were inadvertently calculated without the proper conversion of wet to dry tissue weights. All current site-specific BAFs, including those that were corrected with proper wet to dry weight conversions, are included in Tables 10-3 and 10-4 of Appendix C of the SRAM Rev. 2 Addendum. Additionally, Attachment K-9 is no longer applicable due to the fact that a more current soil-to-plant BAF was selected as indicated in Section 10.4 (Appendix C of the SRAM Rev. 2 Addendum).

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BIOACCUMULATION FACTOR CALCULATIONS

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Attachment K-3	Data Used in Aquatic Invertebrate Bioaccumulation Factor Selection
Attachment K-4	Data Used In Aquatic Plant Bioaccumulation Factor Selection
Attachment K-5	Data Used in Fish Bioaccumulation Factor Selection
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Attachment K-9	Data Used to Develop a Soil-to-Plant Biota Accumulation Factor for Perchlorate

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APPENDIX K

ATTACHMENT K-1

SSFL AQUATIC BIOACCUMULATION FACTOR SELECTION

Appendix K, Attachment K-1 (1 of 2)

SSFL Aquatic Bioaccumulation Factor Selection

Chemical	Aquatic Vertebrate							Aquatic Invertebrate							Aquatic Plant						
	Sample Number	Average BAF[a]	BAF SD[a]	Maximum BAF	Selected BAF (approx. 75th%)[b]	Alternate expression of 75th %[c]	Greater BAF[d]	Sample Number	Average BAF[a]	BAF SD[a]	Maximum BAF	Selected BAF (approx. 75th%)[b]	Alternate expression of 75th %[c]	Greater BAF[d]	Sample Number	Average BAF[a]	BAF SD[a]	Maximum BAF	Selected BAF (approx. 75th%)[b]	Alternate expression of 75th %[c]	Greater BAF[d]
1,2,3,4,6,7,8-HpCDD	4	0.023	0.015	0.044	0.025	0.039	0.039	4	0.076	0.060	0.166	0.054	0.136	0.136	4	0.020	0.008	0.028	0.025	0.028	0.028
1,2,3,4,6,7,8-HpCDF	1	0.043	NA	0.043	0.043	NA	0.043	4	0.077	0.042	0.138	0.073	0.119	0.119	4	0.027	0.010	0.038	0.034	0.037	0.037
1,2,3,4,7,8,9-HpCDF								1	0.073	NA	0.073	0.073	NA	0.073							
1,2,3,4,7,8-HxCDD	4	0.206	0.110	0.369	0.169	0.316	0.316	3	0.235	0.124	0.364	0.226	0.359	0.359							
1,2,3,4,7,8-HxCDF	2	0.127	NA	0.138	0.127	NA	0.127	4	0.279	0.137	0.481	0.243	0.416	0.416							
1,2,3,6,7,8-HxCDD	4	0.292	0.215	0.614	0.211	0.508	0.508	4	0.237	0.128	0.421	0.225	0.365	0.365							
1,2,3,6,7,8-HxCDF	3	0.437	0.045	0.487	0.420	0.481	0.481	4	0.263	0.098	0.401	0.246	0.361	0.361							
1,2,3,7,8,9-HxCDD	4	0.111	0.071	0.216	0.085	0.182	0.182	3	0.194	0.084	0.285	0.175	0.278	0.278							
1,2,3,7,8,9-HxCDF																					
1,2,3,7,8-PeCDD	4	0.845	0.528	1.629	0.682	1.373	1.373	4	0.417	0.158	0.646	0.397	0.575	0.575							
1,2,3,7,8-PeCDF	4	0.610	0.306	1.049	0.558	0.916	0.916	4	0.633	0.378	1.159	0.653	1.011	1.011							
2,3,4,6,7,8-HxCDF	2	0.110	NA	0.121	0.110	NA	0.110	4	0.157	0.064	0.246	0.156	0.221	0.221							
2,3,4,7,8-PeCDF	4	1.155	0.446	1.711	1.267	1.601	1.601	4	0.493	0.201	0.744	0.568	0.695	0.695							
2,3,7,8-TCDD	4	1.709	0.788	2.861	1.497	2.497	2.497	4	0.652	0.170	0.840	0.750	0.823	0.823							
2,3,7,8-TCDF	4	0.744	0.370	1.234	0.821	1.114	1.114	4	1.652	0.892	2.662	2.134	2.544	2.544	1	0.071	NA	0.071	0.071	NA	0.071
Acenaphthene																					
Aluminum	4	0.010	0.007	0.020	0.010	0.018	0.018	4	0.023	0.005	0.028	0.025	0.025	0.025	4	0.094	0.068	0.193	0.079	0.163	0.163
Anthracene																					
Antimony	2	1.794	NA	1.965	1.794	NA	1.794	1	0.258	NA	0.258	0.258	NA	0.258	1	0.539	NA	0.539	0.539	NA	0.539
Arsenic								4	0.224	0.083	0.335	0.222	0.307	0.307	2	0.353	NA	0.360	0.353	NA	0.353
Barium	4	0.075	0.026	0.112	0.070	0.101	0.101	4	1.056	0.323	1.491	1.057	1.379	1.379	4	0.254	0.103	0.375	0.295	0.358	0.358
Benzo(a)anthracene								1	1.103	NA	1.103	1.103	NA	1.103							
Benzo(a)pyrene								1	0.560	NA	0.560	0.560	NA	0.560							
Benzo(b)fluoranthene								1	1.357	NA	1.357	1.357	NA	1.357							
Benzo(e)pyrene																					
Benzo(g,h,i)perylene								1	0.640	NA	0.640	0.640	NA	0.640							
Benzo(k)fluoranthene								2	0.794	NA	1.300	0.794	NA	0.794							
Beryllium								3	0.163	0.023	0.188	0.157	0.186	0.186	1	0.328	NA	0.328	0.328	NA	0.328
Boron								2	0.427	NA	0.525	0.427	NA	0.427	2	1.753	NA	2.191	1.753	NA	1.753
Cadmium																					
Chromium	4	0.171	0.104	0.286	0.226	0.274	0.274	4	0.325	0.116	0.426	0.397	0.397	0.397	4	0.440	0.331	0.930	0.338	0.771	0.771
Chrysene								2	1.068	NA	1.833	1.068	NA	1.068							
Cobalt	1	0.030	NA	0.030	0.030	NA	0.030	4	0.072	0.024	0.091	0.090	0.090	0.090	4	0.138	0.087	0.247	0.169	0.225	0.225
Copper	4	0.103	0.016	0.117	0.115	0.115	0.115	4	2.355	0.720	3.303	2.358	3.075	3.075	3	0.214	0.083	0.310	0.168	0.297	0.297
Dibenz(a,h)anthracene								1	3.158	NA	3.158	3.158	NA	3.158							
Fluoranthene	1	0.089	NA	0.089	0.089	NA	0.089	2	0.834	NA	1.458	0.834	NA	0.834							
Fluorene																					
Indeno(1,2,3-cd)pyrene								1	0.632	NA	0.632	0.632	NA	0.632							
Iron	4	0.013	0.008	0.023	0.013	0.020	0.020	4	0.024	0.005	0.029	0.026	0.026	0.026	4	0.120	0.093	0.258	0.096	0.213	0.213
Lead																					
Magnesium	4	0.232	0.039	0.263	0.255	0.255	0.255	4	0.455	0.078	0.566	0.445	0.533	0.533	4	0.470	0.156	0.593	0.528	0.528	0.528
Manganese	4	0.049	0.035	0.101	0.036	0.084	0.084	4	0.731	0.265	0.990	0.865	0.865	0.865	4	0.580	0.391	0.972	0.861	0.971	0.971
Mercury	4	0.855	0.326	1.270	0.846	1.181	1.181	4	0.244	0.057	0.322	0.248	0.301	0.301	1	0.366	NA	0.366	0.366	NA	0.366
Molybdenum	2	0.756	NA	1.092	0.756	NA	0.756														
Naphthalene	1	5.769	NA	5.769	5.769	NA	5.769														
Nickel	4	0.104	0.059	0.164	0.141	0.163	0.163	4	0.259	0.105	0.342	0.342	0.342	0.342	4	0.335	0.249	0.690	0.318	0.584	0.584
OCDD	4	0.012	0.007	0.020	0.017	0.017	0.017	4	0.083	0.091	0.218	0.049	0.174	0.174	4	0.019	0.008	0.028	0.023	0.027	0.027
OCDF	4	0.014	0.007	0.020	0.018	0.018	0.018	4	0.031	0.009	0.043	0.033	0.040	0.040	4	0.024	0.010	0.034	0.032	0.032	0.032
PCB-105	4	118.425	147.284	324.500	124.118	265.709	265.709	4	10.566	12.505	28.647	8.167	23.071	23.071	3	1.011	0.884	1.673	1.353	1.438	1.438
PCB-114	4	130.112	149.762	328.214	163.333	279.874	279.874	4	15.294	18.176	41.500	12.429	33.470	33.470							
PCB-118	4	145.034	175.205	385.915	162.963	320.239	320.239	4	12.674	13.906	32.222	12.014	26.580	26.580	4	0.693	0.789	1.549	1.179	1.483	1.483
PCB-123	4	168.089	196.729	432.813	201.818	364.817	364.817	4	19.311	21.010	48.273	20.417	40.322	40.322							
PCB-126	4	52.748	62.317	140.769	51.813	115.065	115.065	4	7.364	7.599	17.938	6.992	14.963	14.963							
PCB-128	4	122.362	142.027	308.462	157.742	264.389	264.389	4	1.735	1.301	3.184	2.065	3.036	3.036	2	1.403	NA	1.758	1.403	NA	1.403
PCB-138	4	160.109	186.517	408.636	197.692	346.626	346.626	4	9.757	11.167	25.846	7.418	20.925	20.925	4	0.672	0.774	1.536	1.115	1.446	1.446
PCB-153	4	203.836	221.277	471.642	298.592	425.114	425.114	4	13.247	14.452	33.803	11.030	27.699	27.699	4	0.671	0.747	1.385	1.245	1.245	1.245
PCB-156	4	168.684	200.608	439.091	202.308	369.292	369.292	4	13.118	15.839	35.692	12.091	28.958	28.958	1	1.645	NA	1.645	1.645	NA	1.645
PCB-157	4	126.074	158.697	350.185	126.286	284.772	284.772	4	12.264	12.794	29.429	14.037	25.058	25.058							
PCB-167	4	176.217	206.656	450.000	221.429	382.873	382.873	4	16.433	17.339	39.643	19.082	33.772	33.772							
PCB-170	4	233.887	280.501	610.000	285.833	514.388	514.388	4	8.620	8.719	20.333	9.600	17.339	17.339							
PCB-18	2	5.792	NA	10.273	5.792	NA	5.792	2	0.775	NA	1.527	0.775	NA	0.775	2	0.652	NA	1.195	0.652	NA	0.652
PCB-180	4	211.994	232.153	491.364	314.286	444.147	444.147	4	11.003	11.915	27.893	9.455	22.919	22.919	2	1.289	NA	1.568	1.289	NA	1.289
PCB-187	4	245.275	282.047	611.486	322.222	527.322	527.322	4	15.202	15.249	35.657	16.892	30.450	30.450							
PCB-189	2	15.329	NA	26.633	15.329	NA	15.329	2	3.212	NA	6.194	3.212	NA	3.212							
PCB-195	4	190.458	222.298	478.000	253.529	412.756	412.756	4	5.968	5.683	13.353	7.040	11.651	11.651							
PCB-206	4	117.788	122.264	251.000	191.765	240.052	240.052	4	1.805	1.949	4.588	1.312	3.755	3.755							
PCB-209	4	49.036	50.875	102.727	82.188	99.910	99.910														
PCB-28	2	8.113	NA	13.844	8.113	NA	8.113	2	1.899	NA	3.500	1.899	NA	1.899	1	0.088	NA	0.088	0.088	NA	0.088
PCB-44	4	52.810	62.690	139.063	58.889	115.500	115.500	4	3.004	3.898	8.722	2.006	6.902	6.902	4	1.203	1.284	2.439	2.181	2.181	2.181

Appendix K, Attachment K-1 (2 of 2)

SSFL Aquatic Bioaccumulation Factor Selection

	Aquatic Vertebrate							Aquatic Invertebrate							Aquatic Plant						
Chemical	Sample Number	Average BAF[a]	BAF SD[a]	Maximum BAF	Selected BAF (approx. 75th%)[b]	Alternate expression of 75th %[c]	Greater BAF[d]	Sample Number	Average BAF[a]	BAF SD[a]	Maximum BAF	Selected BAF (approx. 75th%)[b]	Alternate expression of 75th %[c]	Greater BAF[d]	Sample Number	Average BAF[a]	BAF SD[a]	Maximum BAF	Selected BAF (approx. 75th%)[b]	Alternate expression of 75th %[c]	Greater BAF[d]
PCB-52	4	78.234	88.760	198.710	90.313	166.994	166.994	4	7.977	9.826	22.344	4.839	17.804	17.804	4	1.073	1.151	2.213	1.913	1.913	1.913
PCB-66	3	73.858	105.637	195.385	22.190	179.495	179.495	4	8.601	9.869	22.885	5.769	18.469	18.469	4	0.860	0.921	1.808	1.488	1.780	1.780
PCB-77	4	9.057	10.123	22.464	11.200	19.180	19.180	4	5.273	6.047	13.875	4.768	11.320	11.320							
PCB-8	2	5.867	NA	11.250	5.867	NA	5.867														
PCB-81	4	60.326	68.367	154.615	66.077	128.692	128.692	2	1.806	NA	3.515	1.806	NA	1.806							
PCB-90/101	4	100.424	111.626	250.455	119.091	212.049	212.049	4	8.080	9.110	21.182	6.048	17.191	17.191	4	0.607	0.671	1.236	1.136	1.136	1.136
Phenanthrene	2	0.261	NA	0.276	0.261	NA	0.261	3	0.721	0.820	1.667	0.279	1.541	1.541							
Pyrene								2	0.591	NA	1.000	0.591	NA	0.591							
Selenium	4	3.045	1.505	4.824	3.280	4.551	4.551	4	2.598	1.033	3.862	2.945	3.631	3.631	2	2.242	NA	2.532	2.242	NA	2.242
Silver								4	0.697	0.303	1.142	0.636	1.000	1.000							
Thallium								3	0.217	0.074	0.296	0.207	0.291	0.291	2	0.351	NA	0.522	0.351	NA	0.351
Vanadium	4	0.013	0.008	0.024	0.011	0.021	0.021	4	0.029	0.009	0.035	0.035	0.035	0.035	4	0.166	0.118	0.303	0.226	0.284	0.284
Zinc	4	0.297	0.108	0.440	0.309	0.405	0.405	4	0.491	0.165	0.658	0.554	0.657	0.657	4	0.212	0.068	0.304	0.212	0.280	0.280

NA = not applicable
(a) Arithmetic average and Standard Deviation (SD) calculated from BAF samples when Sample Number (N) ≥ 3.
(b) Selected BAF (approx. 75th%)- Specific BAFs were calculated for all samples collected. BAF selection based on rank and sample number; N=4, 2nd highest BAF value, N=3 middle BAF value, N=2 the average BAF value and N=1 is the only calculated BAF.
(c) When N = 3 or 4, the average + 1 standard deviation (SD) is an approximation of the 75th percentile BAF.
If the average + SD > maximum measured BAF and N=4, the 2nd from the highest BAF value was reported.
If the average + SD > maximum measured BAF and N=3 the greater of two distribution based approximations, using the following equations, is reported.
1. [(maximum BAF - minimum BAF) x (42/67) + minimum BAF] or 2. [(maximum BAF - middle BAF) x (9/34) + middle BAF]
(d) The greater of the two BAF values which approximate the 75th percentile used for the Applied Daily Dose calculation.

APPENDIX K

ATTACHMENT K-2

SSFL TERRESTRIAL BIOACCUMULATION FACTOR SELECTION

Appendix K, Attachment K-2 (1 of 2)

SSFL Terrestrial Bioaccumulation Factor Selection

Chemical	Terrestrial Vertebrate							Terrestrial Invertebrate							Terrestrial Plant						
	Sample Number	Average BAF[a]	BAF SD[a]	Maximum BAF	Selected BAF (approx. 75th%)[b]	Alternate expression of 75th %[c]	Greater BAF[d]	Sample Number	Average BAF[a]	BAF SD[a]	Maximum BAF	Selected BAF (approx. 75th%)[b]	Alternate expression of 75th %[c]	Greater BAF[d]	Sample Number	Average BAF[a]	BAF SD[a]	Maximum BAF	Selected BAF (approx. 75th%)[b]	Alternate expression of 75th %[c]	Greater BAF[d]
1,2,3,4,6,7,8-HpCDD	4	0.142	0.147	0.348	0.147	0.289	0.289	4	0.351	0.192	0.587	0.420	0.543	0.543	4	0.189	0.136	0.340	0.261	0.325	0.325
1,2,3,4,6,7,8-HpCDF	3	0.310	0.218	0.441	0.430	0.433	0.433	3	0.298	0.242	0.577	0.172	0.540	0.540	3	0.202	0.065	0.261	0.212	0.225	0.225
1,2,3,4,7,8,9-HpCDF																					
1,2,3,4,7,8-HxCDD	1	0.238	NA	0.238	0.238	NA	0.238	2	0.780	NA	0.880	0.780	NA	0.780							
1,2,3,4,7,8-HxCDF	1	0.081	NA	0.081	0.081	NA	0.081	1	0.653	NA	0.653	0.653	NA	0.653							
1,2,3,6,7,8-HxCDD	1	0.215	NA	0.215	0.215	NA	0.215	3	0.689	0.175	0.827	0.748	0.769	0.769	1	0.163	NA	0.163	0.163	NA	0.163
1,2,3,6,7,8-HxCDF	1	0.654	NA	0.654	0.654	NA	0.654	1	0.259	NA	0.259	0.259	NA	0.259							
1,2,3,7,8,9-HxCDD	1	0.179	NA	0.179	0.179	NA	0.179	3	0.678	0.256	0.955	0.630	0.934	0.934							
1,2,3,7,8,9-HxCDF																					
1,2,3,7,8-PeCDD								2	0.878	NA	1.073	0.878	NA	0.878							
1,2,3,7,8-PeCDF								2	0.426	NA	0.458	0.426	NA	0.426							
2,3,4,6,7,8-HxCDF	1	0.536	NA	0.536	0.536	NA	0.536	1	0.559	NA	0.559	0.559	NA	0.559							
2,3,4,7,8-PeCDF	1	0.442	NA	0.442	0.442	NA	0.442	2	0.514	NA	0.711	0.514	NA	0.514							
2,3,7,8-TCDD																					
2,3,7,8-TCDF	1	0.187	NA	0.187	0.187	NA	0.187	4	0.609	0.409	1.160	0.594	1.017	1.017							
Acenaphthene								1	2.407	NA	2.407	2.407	NA	2.407							
Aluminum	4	0.071	0.050	0.127	0.097	0.121	0.121	4	0.270	0.138	0.394	0.370	0.370	0.370	4	0.580	0.223	0.769	0.742	0.742	0.742
Anthracene								1	2.818	NA	2.818	2.818	NA	2.818							
Antimony	2	0.584	NA	0.731	0.584	NA	0.584	4	3.705	4.090	9.814	2.099	7.794	7.794	4	4.187	1.178	5.545	4.626	5.365	5.365
Arsenic								3	0.402	0.242	0.637	0.415	0.474	0.474	3	0.706	0.122	0.784	0.770	0.773	0.773
Barium	4	0.314	0.044	0.365	0.332	0.358	0.358	4	1.746	1.055	2.976	2.274	2.801	2.801	4	0.912	0.229	1.110	1.004	1.004	1.004
Benzo(a)anthracene	1	16.106	NA	16.106	16.106	NA	16.106	1	1.894	NA	1.894	1.894	NA	1.894	1	5.238	NA	5.238	5.238	NA	5.238
Benzo(a)pyrene	1	5.938	NA	5.938	5.938	NA	5.938	1	1.000	NA	1.000	1.000	NA	1.000							
Benzo(b)fluoranthene	1	5.250	NA	5.250	5.250	NA	5.250	1	2.043	NA	2.043	2.043	NA	2.043							
Benzo(e)pyrene								1	1.087	NA	1.087	1.087	NA	1.087							
Benzo(g,h,i)perylene	1	4.521	NA	4.521	4.521	NA	4.521	1	0.531	NA	0.531	0.531	NA	0.531							
Benzo(k)fluoranthene	1	7.813	NA	7.813	7.813	NA	7.813	1	0.893	NA	0.893	0.893	NA	0.893							
Beryllium								3	0.240	0.163	0.403	0.240	0.283	0.283	4	0.523	0.186	0.643	0.606	0.606	0.606
Boron	1	11.511	NA	11.511	11.511	NA	11.511	1	4.644	NA	4.644	4.644	NA	4.644	1	7.395	NA	7.395	7.395	NA	7.395
Cadmium								3	9.223	10.463	20.987	5.724	19.686	19.686	3	5.994	4.810	11.544	3.412	10.804	10.804
Chromium	4	0.109	0.036	0.155	0.120	0.145	0.145	4	1.608	1.075	2.631	2.431	2.431	2.431	4	6.529	2.917	10.203	7.314	9.446	9.446
Chrysene	1	6.380	NA	6.380	6.380	NA	6.380	1	1.864	NA	1.864	1.864	NA	1.864	3	1.365	1.418	2.889	1.124	2.784	2.784
Cobalt	4	0.156	0.098	0.290	0.156	0.253	0.253	3	0.186	0.084	0.266	0.194	0.213	0.213	4	0.486	0.223	0.681	0.665	0.665	0.665
Copper	4	0.650	0.105	0.800	0.644	0.755	0.755	4	8.879	5.843	17.300	7.921	14.721	14.721	4	1.709	0.300	1.992	1.878	1.878	1.878
Dibenz(a,h)anthracene	1	16.477	NA	16.477	16.477	NA	16.4773														
Fluoranthene	1	2.344	NA	2.344	2.344	NA	2.344	2	0.905	NA	1.545	0.905	NA	0.905	3	1.318	1.526	3.030	0.824	2.844	2.844
Fluorene								1	3.939	NA	3.939	3.939	NA	3.939							
Indeno(1,2,3-cd)pyrene	1	7.212	NA	7.212	7.212	NA	7.212	1	0.857	NA	0.857	0.857	NA	0.857							
Iron	4	0.062	0.042	0.118	0.068	0.104	0.104	4	0.285	0.169	0.466	0.373	0.454	0.454	4	0.514	0.177	0.677	0.627	0.627	0.627
Lead								2	0.243	NA	0.378	0.243	NA	0.243	4	1.211	0.929	2.598	0.869	2.140	2.140
Magnesium	4	0.644	0.162	0.796	0.748	0.748	0.748	4	0.837	0.353	1.312	0.883	1.191	1.191	4	1.058	0.123	1.187	1.137	1.181	1.181
Manganese	4	0.100	0.051	0.167	0.112	0.151	0.151	4	0.458	0.287	0.738	0.657	0.657	0.657	4	0.805	0.194	0.994	0.850	0.850	0.850
Mercury								3	1.451	1.833	3.561	0.542	3.285	3.285	2	0.816		1.413	0.816	NA	0.816
Molybdenum	4	1.606	1.304	3.535	1.252	2.910	2.910	4	2.883	3.031	7.198	2.711	5.913	5.913	4	7.304	6.276	16.315	6.837	13.579	13.579
Naphthalene																					
Nickel	4	0.093	0.030	0.133	0.094	0.123	0.123	4	1.374	0.949	2.273	2.100	2.100	2.100	4	5.337	2.364	8.619	5.478	7.701	7.701
OCDD	4	0.097	0.117	0.272	0.049	0.214	0.214	4	0.256	0.215	0.569	0.203	0.472	0.472	4	0.154	0.098	0.237	0.234	0.234	0.234
OCDF	3	0.434	0.505	1.005	0.253	0.939	0.939	3	0.231	0.272	0.544	0.103	0.504	0.504	4	0.234	0.099	0.349	0.284	0.333	0.333
PCB-105	4	1.319	1.381	3.030	1.841	2.700	2.700	4	7.467	5.126	12.500	10.364	10.364	10.364	4	2.304	1.199	3.356	3.303	3.303	3.303
PCB-114	3	3.182	3.406	6.829	2.634	6.588	6.588	4	14.086	12.527	30.903	14.691	26.613	26.613	2	3.684	NA	4.346	3.684	NA	3.684
PCB-118	4	1.610	1.593	3.163	2.799	2.799	2.799	4	8.767	5.788	14.444	11.470	11.470	11.470	4	2.272	1.257	3.509	3.152	3.152	3.152
PCB-123	2	3.381	NA	3.454	3.381	NA	3.381	4	6.629	5.958	12.632	10.828	12.587	12.587	2	3.419	NA	3.516	3.419	NA	3.419
PCB-126	2	1.850	NA	2.051	1.850	NA	1.850	4	4.421	2.770	6.768	5.325	5.325	5.325	2	2.226	NA	2.464	2.226	NA	2.226
PCB-128	4	1.466	1.503	2.979	2.537	2.969	2.969	4	3.169	2.052	5.548	3.807	5.221	5.221	4	1.588	1.039	2.830	2.010	2.627	2.627
PCB-138	4	1.379	1.319	2.578	2.458	2.458	2.458	4	3.750	2.369	6.313	4.467	6.119	6.119	4	1.754	1.101	3.000	2.331	2.855	2.855
PCB-153	4	2.411	2.387	4.750	4.180	4.180	4.180	4	5.229	3.231	8.150	7.067	7.067	7.067	4	1.914	1.171	3.178	2.600	3.085	3.085
PCB-156	4	1.883	2.054	4.438	2.656	3.937	3.937	4	4.290	2.633	6.653	5.800	5.800	5.800	4	1.601	0.892	2.560	2.160	2.493	2.493
PCB-157	4	9.542	17.031	35.029	2.676	26.573	26.573	4	3.693	2.179	5.930	4.594	5.872	5.872	4	1.628	1.002	2.871	1.977	2.630	2.630
PCB-167	4	2.683	2.803	5.325	4.886	4.886	4.886	4	4.243	2.527	6.451	5.880	5.880	5.880	4	1.701	1.069	2.946	2.183	2.771	2.771
PCB-170	4	2.271	2.356	4.442	4.173	4.173	4.173	4	2.574	1.665	4.457	3.250	4.239	4.239	4	1.173	0.739	2.059	1.414	1.913	1.913
PCB-18	1	0.065	NA	0.065	0.065	NA	0.065	1	0.142	NA	0.142	0.142	NA	0.142							
PCB-180	4	2.068	2.083	4.484	3.113	4.150	4.150	4	2.455	1.525	3.778	3.587	3.587	3.587	4	1.219	0.864	2.375	1.274	2.082	2.082
PCB-187	4	0.729	0.516	1.270	1.003	1.245	1.245	4	4.885	3.060	8.052	6.419	7.945	7.945	4	1.572	1.184	3.194	1.521	2.755	2.755
PCB-189	3	3.732	3.302	7.102	3.590	7.033	7.033	4	1.857	1.062	2.591	2.386	2.386	2.386	2	2.164	NA	2.568	2.164	NA	2.164
PCB-195	3	1.932	1.423	3.490	1.607	3.355	3.355	4	1.274	0.645	1.929	1.669	1.918	1.918	1	1.021	NA	1.021	1.021	NA	1.021
PCB-206	3	1.387	0.832	2.038	1.673	1.770	1.770	3	0.527	0.450	0.993	0.492	0.977	0.977	1	0.794	NA	0.794	0.794	NA	0.794
PCB-209	3	1.256	1.173	2.540	0.988	2.429	2.429	3	0.991	0.780	1.586	1.278	1.360	1.360	1	2.443	NA	2.443	2.443	NA	2.443
PCB-28								1	1.680	NA	1.680	1.680	NA	1.680	1	7.963	NA	7.963	7.963	NA	7.963
PCB-44								4	3.289	3.991	9.118	2.203	7.280	7.280	4	2.690	1.297	4.441	2.588	3.987	3.987
PCB-52								4	5.671	5.790	13.670	5.720	11.461	11.461	4	2.921	1.522	4.920	3.079	4.442	4.442
PCB-66	4	0.744	0.596	1.349	1.097	1.340	1.340	4	6.276	4.456	10.941	8.356	10.731	10.731	4	2.276	1.250	3.756	2.869	3.526	3.526
PCB-77	1	0.768	NA	0.768	0.768	NA	0.768	4	3.650	2.586	7.000	3.552	6.237	6.237	3	1.936	1.094	2.833	2.258	2.411	2.411

Appendix K, Attachment K-2 (2 of 2)

SSFL Terrestrial Bioaccumulation Factor Selection

Chemical	Terrestrial Vertebrate							Terrestrial Invertebrate							Terrestrial Plant						
	Sample Number	Average BAF[a]	BAF SD[a]	Maximum BAF	Selected BAF (approx. 75th%)[b]	Alternate expression of 75th %[c]	Greater BAF[d]	Sample Number	Average BAF[a]	BAF SD[a]	Maximum BAF	Selected BAF (approx. 75th%)[b]	Alternate expression of 75th %[c]	Greater BAF[d]	Sample Number	Average BAF[a]	BAF SD[a]	Maximum BAF	Selected BAF (approx. 75th%)[b]	Alternate expression of 75th %[c]	Greater BAF[d]
PCB-8	1	0.372	NA	0.372	0.372	NA	0.372	1	0.217	NA	0.217	0.217	NA	0.217							
PCB-81								4	4.216	2.904	6.949	5.981	5.981	5.981	2	3.000	NA	3.322	3.000	NA	3.000
PCB-90/101	4	0.117	0.107	0.232	0.183	0.224	0.224	4	4.943	3.256	7.937	6.188	6.188	6.188	4	2.405	1.211	3.750	3.103	3.616	3.616
Phenanthrene	1	3.356	NA	3.356	3.356	NA	3.356	2	1.845	NA	2.653	1.845	NA	1.845	4	3.350	3.841	8.889	2.889	7.191	7.191
Pyrene	1	3.622	NA	3.622	3.622	NA	3.622	2	2.917	NA	4.750	2.917	NA	2.917	3	0.932	0.974	1.985	0.750	1.906	1.906
Selenium	2	5.817	NA	5.951	5.817	NA	5.817	1	1.842	NA	1.842	1.842	NA	1.842							
Silver								3	6.209	0.422	6.683	6.071	6.631	6.631	2	1.688	NA	2.055	1.688	NA	1.688
Thallium								3	0.615	0.472	1.101	0.586	1.087	1.087	4	0.374	0.138	0.565	0.360	0.511	0.511
Vanadium	4	0.101	0.067	0.182	0.126	0.168	0.168	4	0.235	0.117	0.329	0.324	0.324	0.324	4	0.498	0.192	0.696	0.612	0.690	0.690
Zinc	4	2.271	1.204	4.019	2.106	3.475	3.475	4	1.980	1.145	3.264	2.233	3.125	3.125	4	1.294	0.331	1.766	1.232	1.625	1.625

NA = not applicable
(a) Arithmetic average and Standard Deviation (SD) calculated from BAF samples when Sample Number (N) $\geq$ 3.
(b) Selected BAF (approx. 75th%)- Specific BAFs were calculated for all samples collected. BAF selection based on rank and sample number; N=4, 2nd highest BAF value, N=3 middle BAF value, N=2 the average BAF value and N=1 is the only calculated BAF.
(c) When N = 3 or 4, the average + 1 standard deviation (SD) is an approximation of the 75th percentile BAF.
If the average + SD > maximum measured BAF and N=4, the 2nd from the highest BAF value was reported.
If the average + SD > maximum measured BAF and N=3 the greater of two distribution based approximations, using the following equation, is reported.
1. [(maximum BAF - minimum BAF) x (42/67) + minimum BAF] or 2. [(maximum BAF - middle BAF) x (9/34) + middle BAF]
(d) The greater of the two BAF values which apprioximate the 75th percentile used for the Applied Daily Dose calculation.

APPENDIX K

ATTACHMENT K-3

DATA USED IN AQUATIC INVERTEBRATE BIOACCUMULATION FACTOR SELECTION

Appendix K, Attachment K-3 (1 of 4)

Data Used in Aquatic Invertebrate Bioaccumulation Factor Selection

CHEMICAL	TISSUE TYPE	TISSUE SAMPLE ID	TISSUE CONCENTRATION (WET WEIGHT)	UNITS	TISSUE VALIDATION QUALIFIER	TISSUE DETECTION LIMIT	SEDIMENT SAMPLE ID	SEDIMENT TYPE	SEDIMENT CONCENTRATION (DRY WEIGHT)	SEDIMENT VALIDATION QUALIFIER	SEDIMENT DETECTION LIMIT
1,2,3,4,6,7,8-HpCDD	AI	R2AI04S01	47.7	pg/g			R2FS04S01	FS	287		
1,2,3,4,6,7,8-HpCDD	AI	R2AI03S01	39.3	pg/g			R2FS03S01	FS	734		
1,2,3,4,6,7,8-HpCDD	AI	R2AI01S01	34.7	pg/g			R2FS01	FS	790		
1,2,3,4,6,7,8-HpCDD	AI	R2AI02S01	39	pg/g			R2FS02S01	FS	957		
1,2,3,4,6,7,8-HpCDF	AI	R2AI04S01	5.38	pg/g			R2FS04S01	FS	39.1		
1,2,3,4,6,7,8-HpCDF	AI	R2AI03S01	7.26	pg/g			R2FS03S01	FS	99.6		
1,2,3,4,6,7,8-HpCDF	AI	R2AI02S01	5.88	pg/g			R2FS02S01	FS	117		
1,2,3,4,6,7,8-HpCDF	AI	R2AI01S01	5.05	pg/g			R2FS01	FS	107.1		
1,2,3,4,7,8,9-HpCDF	AI	R2AI03S01	0.8	pg/g	J		R2FS03S01	FS	10.9		
1,2,3,4,7,8-HxCDD	AI	R2AI04S01	1.43	pg/g	J		R2FS04S01	FS	3.93		
1,2,3,4,7,8-HxCDD	AI	R2AI03S01	1.81	pg/g	J		R2FS03S01	FS	8.02		
1,2,3,4,7,8-HxCDD	AI	R2AI02S01	1.32	pg/g	J		R2FS02S01	FS	11.3		
1,2,3,4,7,8-HxCDF	AI	R2AI04S01	1.15	pg/g	J		R2FS04S01	FS	2.39	J	
1,2,3,4,7,8-HxCDF	AI	R2AI01S01	1.13	pg/g	J		R2FS01	FS	4.645		
1,2,3,4,7,8-HxCDF	AI	R2AI03S01	0.98	pg/g	J		R2FS03S01	FS	4.63		
1,2,3,4,7,8-HxCDF	AI	R2AI02S01	0.96	pg/g	J		R2FS02S01	FS	5.33		
1,2,3,6,7,8-HxCDD	AI	R2AI04S01	6.36	pg/g			R2FS04S01	FS	15.1		
1,2,3,6,7,8-HxCDD	AI	R2AI03S01	7.17	pg/g			R2FS03S01	FS	31.9		
1,2,3,6,7,8-HxCDD	AI	R2AI02S01	6.89	pg/g			R2FS02S01	FS	42.3		
1,2,3,6,7,8-HxCDD	AI	R2AI01S01	5.28	pg/g			R2FS01	FS	37.95		
1,2,3,6,7,8-HxCDF	AI	R2AI04S01	0.85	pg/g	J		R2FS04S01	FS	2.12	J	
1,2,3,6,7,8-HxCDF	AI	R2AI03S01	0.96	pg/g	J		R2FS03S01	FS	3.9		
1,2,3,6,7,8-HxCDF	AI	R2AI01S01	0.92	pg/g	J		R2FS01	FS	3.925		
1,2,3,6,7,8-HxCDF	AI	R2AI02S01	0.77	pg/g	J		R2FS02S01	FS	4.5		
1,2,3,7,8,9-HxCDD	AI	R2AI04S01	2.36	pg/g	J		R2FS04S01	FS	8.27		
1,2,3,7,8,9-HxCDD	AI	R2AI03S01	3.24	pg/g	J		R2FS03S01	FS	18.5		
1,2,3,7,8,9-HxCDD	AI	R2AI02S01	2.81	pg/g	J		R2FS02S01	FS	23.4		
1,2,3,7,8-PeCDD	AI	R2AI04S01	1.55	pg/g	J		R2FS04S01	FS	2.4	J	
1,2,3,7,8-PeCDD	AI	R2AI03S01	1.76	pg/g	J		R2FS03S01	FS	4.43		
1,2,3,7,8-PeCDD	AI	R2AI01S01	1.83	pg/g	J		R2FS01	FS	5.7		
1,2,3,7,8-PeCDD	AI	R2AI02S01	1.79	pg/g	J		R2FS02S01	FS	5.92		
1,2,3,7,8-PeCDF	AI	R2AI04S01	2.84	pg/g	J		R2FS04S01	FS	2.45	J	
1,2,3,7,8-PeCDF	AI	R2AI01S01	2.4	pg/g	J		R2FS01	FS	3.675		
1,2,3,7,8-PeCDF	AI	R2AI02S01	1.65	pg/g	J		R2FS02S01	FS	4.28		
1,2,3,7,8-PeCDF	AI	R2AI03S01	1.83	pg/g	J		R2FS03S01	FS	5.5		
2,3,4,6,7,8-HxCDF	AI	R2AI04S01	0.7	pg/g	J		R2FS04S01	FS	2.85		
2,3,4,6,7,8-HxCDF	AI	R2AI03S01	0.87	pg/g	J		R2FS03S01	FS	5.59		
2,3,4,6,7,8-HxCDF	AI	R2AI01S01	0.74	pg/g	J		R2FS01	FS	5.69		
2,3,4,6,7,8-HxCDF	AI	R2AI02S01	0.63	pg/g	J		R2FS02S01	FS	6.45		
2,3,4,7,8-PeCDF	AI	R2AI04S01	2.5	pg/g	J		R2FS04S01	FS	3.36		
2,3,4,7,8-PeCDF	AI	R2AI01S01	2.13	pg/g	J		R2FS01	FS	3.75		
2,3,4,7,8-PeCDF	AI	R2AI02S01	1.5	pg/g	J		R2FS02S01	FS	4.46		
2,3,4,7,8-PeCDF	AI	R2AI03S01	1.78	pg/g	J		R2FS03S01	FS	5.48		
2,3,7,8-TCDD	AI	R2AI01S01	0.62	pg/g	J		R2FS01	FS	0.7385		
2,3,7,8-TCDD	AI	R2AI04S01	0.27	pg/g	J		R2FS04S01	FS	0.36	J	
2,3,7,8-TCDD	AI	R2AI03S01	0.32	pg/g	J		R2FS03S01	FS	0.59		
2,3,7,8-TCDD	AI	R2AI02S01	0.38	pg/g	J		R2FS02S01	FS	0.795		
2,3,7,8-TCDF	AI	R2AI04S01	15.6	pg/g			R2FS04S01	FS	5.86		
2,3,7,8-TCDF	AI	R2AI01S01	16.1	pg/g			R2FS01	FS	7.545		
2,3,7,8-TCDF	AI	R2AI02S01	9.72	pg/g			R2FS02S01	FS	9.66		
2,3,7,8-TCDF	AI	R2AI03S01	10.7	pg/g			R2FS03S01	FS	13.3		
Aluminum	AI	R2AI01S01	611.724	MG/KG			R2FS01	FS	22184.56085	J	90
Aluminum	AI	R2AI03S01	733.7219	MG/KG			R2FS03S01	FS	28800	J	90
Aluminum	AI	R2AI02S01	643.0556	MG/KG			R2FS02S01	FS	26600	J	90
Aluminum	AI	R2AI04S01	271.7474	MG/KG			R2FS04S01	FS	16790.1739	J	
Antimony	AI	R2AI03S01	0.4649	MG/KG			R2FS03S01	FS	1.8	J	0.2
Arsenic	AI	R2AI01S01	2.0612	MG/KG			R2FS01	FS	6.14655	J	
Arsenic	AI	R2AI03S01	1.4848	MG/KG			R2FS03S01	FS	6.7		
Arsenic	AI	R2AI02S01	1.3892	MG/KG			R2FS02S01	FS	6.8		
Arsenic	AI	R2AI04S01	0.728	MG/KG			R2FS04S01	FS	5.3536	J	
Barium	AI	R2AI04S01	162.0387	MG/KG			R2FS04S01	FS	108.6766		
Barium	AI	R2AI01S01	146.074	MG/KG			R2FS01	FS	138.14025	J	
Barium	AI	R2AI02S01	152.1925	MG/KG			R2FS02S01	FS	159	J	
Barium	AI	R2AI03S01	131.5285	MG/KG			R2FS03S01	FS	183	J	

Appendix K, Attachment K-3 (2 of 4)

Data Used in Aquatic Invertebrate Bioaccumulation Factor Selection

CHEMICAL	TISSUE TYPE	TISSUE SAMPLE ID	TISSUE CONCENTRATION (WET WEIGHT)	UNITS	TISSUE VALIDATION QUALIFIER	TISSUE DETECTION LIMIT	SEDIMENT SAMPLE ID	SEDIMENT TYPE	SEDIMENT CONCENTRATION (DRY WEIGHT)	SEDIMENT VALIDATION QUALIFIER	SEDIMENT DETECTION LIMIT
Benzo(a)anthracene	AI	R2AI04S01	8.6	UG/KG	J		R2FS04S01	FS	7.8	J	
Benzo(a)pyrene	AI	R2AI04S01	8.4	UG/KG	J		R2FS04S01	FS	15	J	
Benzo(b)fluoranthene	AI	R2AI04S01	19	UG/KG	J		R2FS04S01	FS	14		
Benzo(g,h,i)perylene	AI	R2AI04S01	16	UG/KG			R2FS04S01	FS	25		
Benzo(k)fluoranthene	AI	R2AI04S01	13	UG/KG	J		R2FS04S01	FS	10		
Benzo(k)fluoranthene	AI	R2AI01S01	9.8	UG/KG	J		R2FS01	FS	34	J	
Beryllium	AI	R2AI01S01	0.1633	MG/KG			R2FS01	FS	0.8668		
Beryllium	AI	R2AI02S01	0.1729	MG/KG			R2FS02S01	FS	1.1		
Beryllium	AI	R2AI03S01	0.1715	MG/KG			R2FS03S01	FS	1.2		
Boron	AI	R2AI04S01	3.5669	MG/KG			R2FS04S01	FS	6.7929		
Boron	AI	R2AI01S01	3.0976	MG/KG			R2FS01S01	FS	9.4378		
Chromium	AI	R2AI02S01	18.2738	MG/KG			R2FS02S01	FS	42.9	J	
Chromium	AI	R2AI03S01	17.8541	MG/KG			R2FS03S01	FS	45	J	
Chromium	AI	R2AI01S01	10.7463	MG/KG			R2FS01	FS	34.41185	J	
Chromium	AI	R2AI04S01	4.2425	MG/KG			R2FS04S01	FS	25.5232	J	
Chrysene	AI	R2AI04S01	22	UG/KG	J		R2FS04S01	FS	12		
Chrysene	AI	R2AI01S01	13	UG/KG	J		R2FS01	FS	43	J	
Cobalt	AI	R2AI03S01	1.3406	MG/KG			R2FS03S01	FS	14.8	J	
Cobalt	AI	R2AI02S01	1.228	MG/KG			R2FS02S01	FS	13.7	J	
Cobalt	AI	R2AI01S01	0.8049	MG/KG			R2FS01	FS	11.9866	J	
Cobalt	AI	R2AI04S01	0.4108	MG/KG			R2FS04S01	FS	10.3522	J	
Copper	AI	R2AI01S01	110.7506	MG/KG			R2FS01	FS	33.5309	J	2
Copper	AI	R2AI02S01	95.7326	MG/KG			R2FS02S01	FS	40.6	J	2
Copper	AI	R2AI04S01	68.1492	MG/KG			R2FS04S01	FS	31.0081		
Copper	AI	R2AI03S01	80.681	MG/KG			R2FS03S01	FS	51.7	J	2
Dibenz(a,h)anthracene	AI	R2AI04S01	12	UG/KG	J		R2FS04S01	FS	3.8	J	
Fluoranthene	AI	R2AI04S01	35	UG/KG			R2FS04S01	FS	24		
Fluoranthene	AI	R2AI01S01	22	UG/KG			R2FS01	FS	104.5	J	
Indeno(1,2,3-cd)pyrene	AI	R2AI04S01	12	UG/KG	J		R2FS04S01	FS	19		
Iron	AI	R2AI01S01	883.409	MG/KG			R2FS01	FS	30667.42815	J	
Iron	AI	R2AI03S01	1059.1303	MG/KG			R2FS03S01	FS	40600	J	
Iron	AI	R2AI02S01	903.8934	MG/KG			R2FS02S01	FS	37296.0373	J	
Iron	AI	R2AI04S01	403.5741	MG/KG			R2FS04S01	FS	24579.881	J	
Magnesium	AI	R2AI04S01	3294.4665	MG/KG			R2FS04S01	FS	5820.3991		
Magnesium	AI	R2AI01S01	3186.2427	MG/KG			R2FS01	FS	7164.66	J	
Magnesium	AI	R2AI02S01	3581.7333	MG/KG			R2FS02S01	FS	8490	J	
Magnesium	AI	R2AI03S01	3604.5709	MG/KG			R2FS03S01	FS	9330	J	
Manganese	AI	R2AI02S01	441.3493	MG/KG			R2FS02S01	FS	446	J	
Manganese	AI	R2AI01S01	351.936	MG/KG			R2FS01	FS	407.03665	J	
Manganese	AI	R2AI03S01	461.6152	MG/KG			R2FS03S01	FS	668	J	
Manganese	AI	R2AI04S01	164.523	MG/KG			R2FS04S01	FS	434.2689	J	
Mercury	AI	R2AI03S01	0.0967	MG/KG			R2FS03S01	FS	0.3005		
Mercury	AI	R2AI02S01	0.1026	MG/KG			R2FS02S01	FS	0.4134		
Mercury	AI	R2AI01S01	0.0694	MG/KG			R2FS01	FS	0.3288	J	
Mercury	AI	R2AI04S01	0.0367	MG/KG			R2FS04S01	FS	0.1898	J	
Nickel	AI	R2AI02S01	8.3853	MG/KG			R2FS02S01	FS	24.5		
Nickel	AI	R2AI03S01	8.812	MG/KG			R2FS03S01	FS	25.8		
Nickel	AI	R2AI01S01	5.0054	MG/KG			R2FS01	FS	21.56585	J	
Nickel	AI	R2AI04S01	2.1677	MG/KG			R2FS04S01	FS	17.8162	J	
OCDD	AI	R2AI04S01	688	pg/g			R2FS04S01	FS	3150		
OCDD	AI	R2AI01S01	480	pg/g			R2FS01	FS	9850	J	
OCDD	AI	R2AI03S01	303	pg/g			R2FS03S01	FS	8430	J	
OCDD	AI	R2AI02S01	344	pg/g			R2FS02S01	FS	12400	J	
OCDF	AI	R2AI04S01	4.31	pg/g	J		R2FS04S01	FS	101		
OCDF	AI	R2AI03S01	8.13	pg/g			R2FS03S01	FS	250		
OCDF	AI	R2AI02S01	8.75	pg/g			R2FS02S01	FS	314		
OCDF	AI	R2AI01S01	5.62	pg/g	J		R2FS01	FS	273		
PCB-105	AI	SNAI02S01	9.74	ng/g		0.109999999	SNFS02S01	FS	0.34		
PCB-105	AI	SNAI03S01	2.45	ng/g		0.029999999	SNFS03S01	FS	0.3		

Appendix K, Attachment K-3 (3 of 4)

Data Used in Aquatic Invertebrate Bioaccumulation Factor Selection

CHEMICAL	TISSUE TYPE	TISSUE SAMPLE ID	TISSUE CONCENTRATION (WET WEIGHT)	UNITS	TISSUE VALIDATION QUALIFIER	TISSUE DETECTION LIMIT	SEDIMENT SAMPLE ID	SEDIMENT TYPE	SEDIMENT CONCENTRATION (DRY WEIGHT)	SEDIMENT VALIDATION QUALIFIER	SEDIMENT DETECTION LIMIT
PCB-105	AI	SNAI01S01	21.3	ng/g		0.189999998	SNFS01	FS	4		
PCB-105	AI	SNAI04S01	5.16	ng/g		0.029999999	SNFS04S01	FS	41		
PCB-114	AI	SNAI02S01	0.498	ng/g		0.109999999	SNFS02S01	FS	0.012	J	
PCB-114	AI	SNAI03S01	0.174	ng/g		0.029999999	SNFS03S01	FS	0.014	J	
PCB-114	AI	SNAI01S01	1.06	ng/g		0.189999998	SNFS01	FS	0.15		
PCB-114	AI	SNAI04S01	0.251	ng/g		0.029999999	SNFS04S01	FS	1.4		
PCB-118	AI	SNAI02S01	26.1	ng/g		0.109999999	SNFS02S01	FS	0.81		
PCB-118	AI	SNAI03S01	8.53	ng/g		0.029999999	SNFS03S01	FS	0.71		
PCB-118	AI	SNAI01S01	56	ng/g		0.189999998	SNFS01	FS	8.85		
PCB-118	AI	SNAI04S01	12.8	ng/g		0.029999999	SNFS04S01	FS	96		
PCB-123	AI	SNAI02S01	0.531	ng/g		0.109999999	SNFS02S01	FS	0.011	J	
PCB-123	AI	SNAI03S01	0.196	ng/g		0.029999999	SNFS03S01	FS	0.0096	J	
PCB-123	AI	SNAI01S01	1.12	ng/g		0.189999998	SNFS01	FS	0.135		
PCB-123	AI	SNAI04S01	0.256	ng/g		0.029999999	SNFS04S01	FS	0.99		
PCB-126	AI	SNAI02S01	0.287	ng/g		0.109999999	SNFS02S01	FS	0.016	J	
PCB-126	AI	SNAI03S01	0.0909	ng/g		0.029999999	SNFS03S01	FS	0.013	J	
PCB-126	AI	SNAI01S01	0.508	ng/g		0.189999998	SNFS01	FS	0.115		
PCB-126	AI	SNAI04S01	0.166	ng/g		0.029999999	SNFS04S01	FS	1.5		
PCB-128	AI	SNAI02S01	0.987	ng/g		0.109999999	SNFS02S01	FS	0.31		
PCB-128	AI	SNAI03S01	0.537	ng/g		0.029999999	SNFS03S01	FS	0.26		
PCB-128	AI	SNAI01S01	6.43	ng/g		0.189999998	SNFS01	FS	3.9		
PCB-128	AI	SNAI04S01	1.45	ng/g		0.029999999	SNFS04S01	FS	33		
PCB-138	AI	SNAI02S01	33.6	ng/g		0.109999999	SNFS02S01	FS	1.3		
PCB-138	AI	SNAI03S01	8.16	ng/g		0.029999999	SNFS03S01	FS	1.1		
PCB-138	AI	SNAI01S01	84.7	ng/g		0.189999998	SNFS01	FS	15		
PCB-138	AI	SNAI04S01	15.4	ng/g		0.029999999	SNFS04S01	FS	130		
PCB-153	AI	SNAI02S01	24	ng/g		0.109999999	SNFS02S01	FS	0.71		
PCB-153	AI	SNAI03S01	7.39	ng/g		0.029999999	SNFS03S01	FS	0.67		
PCB-153	AI	SNAI01S01	63.3	ng/g		0.189999998	SNFS01	FS	7.9		
PCB-153	AI	SNAI04S01	10.2	ng/g		0.029999999	SNFS04S01	FS	72		
PCB-156	AI	SNAI02S01	4.64	ng/g		0.109999999	SNFS02S01	FS	0.13		
PCB-156	AI	SNAI03S01	1.33	ng/g		0.029999999	SNFS03S01	FS	0.11		
PCB-156	AI	SNAI01S01	6.85	ng/g		0.189999998	SNFS01	FS	1.5		
PCB-156	AI	SNAI04S01	1.76	ng/g		0.029999999	SNFS04S01	FS	14.3		
PCB-157	AI	SNAI02S01	1.03	ng/g		0.109999999	SNFS02S01	FS	0.035	J	
PCB-157	AI	SNAI03S01	0.379	ng/g		0.029999999	SNFS03S01	FS	0.027	J	
PCB-157	AI	SNAI01S01	2.04	ng/g		0.189999998	SNFS01	FS	0.375		
PCB-157	AI	SNAI04S01	0.455	ng/g		0.029999999	SNFS04S01	FS	3		
PCB-167	AI	SNAI02S01	2.22	ng/g		0.109999999	SNFS02S01	FS	0.056		
PCB-167	AI	SNAI03S01	0.935	ng/g		0.029999999	SNFS03S01	FS	0.049		
PCB-167	AI	SNAI01S01	4.7	ng/g		0.189999998	SNFS01	FS	0.69		
PCB-167	AI	SNAI04S01	1.14	ng/g		0.029999999	SNFS04S01	FS	5.8		
PCB-170	AI	SNAI02S01	2.44	ng/g		0.109999999	SNFS02S01	FS	0.12		
PCB-170	AI	SNAI03S01	0.864	ng/g		0.029999999	SNFS03S01	FS	0.09		
PCB-170	AI	SNAI01S01	6.43	ng/g		0.189999998	SNFS01	FS	1.45		
PCB-170	AI	SNAI04S01	1.22	ng/g		0.029999999	SNFS04S01	FS	11		
PCB-18	AI	SNAI01S01	0.336	ng/g		0.189999998	SNFS01S01	FS	0.22		
PCB-18	AI	SNAI04S01	0.0546	ng/g		0.029999999	SNFS04S01	FS	2.5		
PCB-180	AI	SNAI02S01	7.81	ng/g		0.109999999	SNFS02S01	FS	0.28		
PCB-180	AI	SNAI03S01	2.08	ng/g		0.029999999	SNFS03S01	FS	0.22		
PCB-180	AI	SNAI01S01	19.3	ng/g		0.189999998	SNFS01	FS	2.95		
PCB-180	AI	SNAI04S01	2.72	ng/g		0.029999999	SNFS04S01	FS	22		
PCB-187	AI	SNAI02S01	3.53	ng/g		0.109999999	SNFS02S01	FS	0.099		
PCB-187	AI	SNAI03S01	1.25	ng/g		0.029999999	SNFS03S01	FS	0.074		
PCB-187	AI	SNAI01S01	8.88	ng/g		0.189999998	SNFS01	FS	1.1		
PCB-187	AI	SNAI04S01	1.39	ng/g		0.029999999	SNFS04S01	FS	7.5		
PCB-189	AI	SNAI01S01	0.607	ng/g		0.189999998	SNFS01	FS	0.098		
PCB-189	AI	SNAI04S01	0.177	ng/g		0.029999999	SNFS04S01	FS	0.77		
PCB-195	AI	SNAI02S01	0.227	ng/g		0.109999999	SNFS02S01	FS	0.017	J	
PCB-195	AI	SNAI03S01	0.0704	ng/g		0.029999999	SNFS03S01	FS	0.01	J	
PCB-195	AI	SNAI01S01	0.627	ng/g		0.189999998	SNFS01	FS	0.185		
PCB-195	AI	SNAI04S01	0.0906	ng/g		0.029999999	SNFS04S01	FS	1		
PCB-206	AI	SNAI02S01	0.39	ng/g		0.109999999	SNFS02S01	FS	0.085		
PCB-206	AI	SNAI03S01	0.0656	ng/g		0.029999999	SNFS03S01	FS	0.05		

Appendix K, Attachment K-3 (4 of 4)

Data Used in Aquatic Invertebrate Bioaccumulation Factor Selection

CHEMICAL	TISSUE TYPE	TISSUE SAMPLE ID	TISSUE CONCENTRATION (WET WEIGHT)	UNITS	TISSUE VALIDATION QUALIFIER	TISSUE DETECTION LIMIT	SEDIMENT SAMPLE ID	SEDIMENT TYPE	SEDIMENT CONCENTRATION (DRY WEIGHT)	SEDIMENT VALIDATION QUALIFIER	SEDIMENT DETECTION LIMIT
PCB-206	AI	SNAI01S01	0.754	ng/g		0.189999998	SNFS01	FS	0.585		
PCB-206	AI	SNAI04S01	0.136	ng/g		0.029999999	SNFS04S01	FS	4.3		
PCB-28	AI	SNAI01S01	1.12	ng/g		0.189999998	SNFS01	FS	0.32		
PCB-28	AI	SNAI04S01	0.807	ng/g		0.029999999	SNFS04S01	FS	2.7		
PCB-44	AI	SNAI02S01	1.57	ng/g		0.109999999	SNFS02S01	FS	0.18		
PCB-44	AI	SNAI03S01	0.321	ng/g		0.029999999	SNFS03S01	FS	0.16		
PCB-44	AI	SNAI01S01	2.07	ng/g		0.189999998	SNFS01	FS	1.65		
PCB-44	AI	SNAI04S01	0.764	ng/g		0.029999999	SNFS04S01	FS	23		
PCB-52	AI	SNAI02S01	7.15	ng/g		0.109999999	SNFS02S01	FS	0.32		
PCB-52	AI	SNAI03S01	1.5	ng/g		0.029999999	SNFS03S01	FS	0.31		
PCB-52	AI	SNAI01S01	13.7	ng/g		0.189999998	SNFS01	FS	2.95		
PCB-52	AI	SNAI04S01	3.5	ng/g		0.029999999	SNFS04S01	FS	42		
PCB-66	AI	SNAI02S01	5.95	ng/g		0.109999999	SNFS02S01	FS	0.26		
PCB-66	AI	SNAI03S01	1.5	ng/g		0.029999999	SNFS03S01	FS	0.26		
PCB-66	AI	SNAI01S01	11.7	ng/g		0.189999998	SNFS01	FS	2.1		
PCB-66	AI	SNAI04S01	3.37	ng/g		0.029999999	SNFS04S01	FS	19		
PCB-77	AI	SNAI02S01	1.11	ng/g		0.109999999	SNFS02S01	FS	0.08		
PCB-77	AI	SNAI03S01	0.329	ng/g		0.029999999	SNFS03S01	FS	0.069		
PCB-77	AI	SNAI01S01	1.43	ng/g		0.189999998	SNFS01	FS	0.6		
PCB-77	AI	SNAI04S01	0.628	ng/g		0.029999999	SNFS04S01	FS	9.4		
PCB-81	AI	SNAI03S01	0.0457	ng/g		0.029999999	SNFS03S01	FS	0.013	J	
PCB-81	AI	SNAI04S01	0.0942	ng/g		0.029999999	SNFS04S01	FS	0.98		
PCB-90/101	AI	SNAI02S01	23.3	ng/g		0.230000004	SNFS02S01	FS	1.1		
PCB-90/101	AI	SNAI01S01	63.5	ng/g		0.389999986	SNFS01	FS	10.5		
PCB-90/101	AI	SNAI03S01	5.49	ng/g		0.059999999	SNFS03S01	FS	1.1		
PCB-90/101	AI	SNAI04S01	12.1	ng/g		0.059999999	SNFS04S01	FS	120		
Phenanthrene	AI	R2AI04S01	20	UG/KG			R2FS04S01	FS	12		
Phenanthrene	AI	R2AI01S01	17	UG/KG	J		R2FS01	FS	61	J	
Phenanthrene	AI	R2AI02S01	7.4	UG/KG	J		R2FS02S01	FS	34		
Pyrene	AI	R2AI04S01	25	UG/KG			R2FS04S01	FS	25	J	
Pyrene	AI	R2AI01S01	18	UG/KG	J		R2FS01	FS	98.5	J	
Selenium	AI	R2AI04S01	1.4866	MG/KG	J		R2FS04S01	FS	0.3849	J	
Selenium	AI	R2AI01S01	1.3692	MG/KG	J		R2FS01	FS	0.465	J	0.1
Selenium	AI	R2AI02S01	1.5086	MG/KG	J		R2FS02S01	FS	0.72		0.1
Selenium	AI	R2AI03S01	1.4886	MG/KG	J		R2FS03S01	FS	1		0.1
Silver	AI	R2AI01S01	4.151	MG/KG			R2FS01	FS	3.63625		
Silver	AI	R2AI02S01	2.9877	MG/KG			R2FS02S01	FS	4.7		
Silver	AI	R2AI03S01	2.0653	MG/KG			R2FS03S01	FS	4		
Silver	AI	R2AI04S01	0.9336	MG/KG			R2FS04S01	FS	1.8905		
Thallium	AI	R2AI01S01	1.1425	MG/KG			R2FS01	FS	3.86325		
Thallium	AI	R2AI02S01	1.0553	MG/KG			R2FS02S01	FS	5.1		
Thallium	AI	R2AI03S01	0.9326	MG/KG			R2FS03S01	FS	6.3		
Vanadium	AI	R2AI01S01	1.891	MG/KG			R2FS01	FS	54.3846	J	
Vanadium	AI	R2AI03S01	2.2103	MG/KG			R2FS03S01	FS	63.6	J	
Vanadium	AI	R2AI02S01	1.9556	MG/KG			R2FS02S01	FS	63.8	J	
Vanadium	AI	R2AI04S01	0.639	MG/KG			R2FS04S01	FS	38.7394	J	
Zinc	AI	R2AI01S01	222.1501	MG/KG	J		R2FS01	FS	337.74315	J	
Zinc	AI	R2AI04S01	145.931	MG/KG	J		R2FS04S01	FS	263.6441	J	
Zinc	AI	R2AI02S01	194.4929	MG/KG	J		R2FS02S01	FS	399	J	
Zinc	AI	R2AI03S01	107.6003	MG/KG	J		R2FS03S01	FS	403	J	

APPENDIX K

ATTACHMENT K-4

DATA USED IN AQUATIC PLANT BIOACCUMULATION FACTOR SELECTION

Appendix K, Attachment K-4 (1 of 2)

Data Used in Aquatic Plant Bioaccumulation Factor Selection

CHEMICAL	TISSUE TYPE	TISSUE SAMPLE ID	TISSUE CONCENTRATION (WET WEIGHT)	UNITS	TISSUE VALIDATION QUALIFIER	TISSUE DETECTION LIMIT	SEDIMENT SAMPLE ID	SEDIMENT TYPE	SEDIMENT CONCENTRATION (DRY WEIGHT)	SEDIMENT VALIDATION QUALIFIER	SEDIMENT DETECTION LIMIT
1,2,3,4,6,7,8-HpCDD	AP	R2AP01S01	22.3	pg/g			R2FS01	FS	790		
1,2,3,4,6,7,8-HpCDD	AP	R2AP04S01	7.15	pg/g	J		R2FS04S01	FS	287		
1,2,3,4,6,7,8-HpCDD	AP	R2AP02S01	13.2	pg/g	J		R2FS02S01	FS	957		
1,2,3,4,6,7,8-HpCDD	AP	R2AP03S01	8.36	pg/g	J		R2FS03S01	FS	734		
1,2,3,4,6,7,8-HpCDF	AP	R2AP04S01	1.47	pg/g	J		R2FS04S01	FS	39.1		
1,2,3,4,6,7,8-HpCDF	AP	R2AP01S01	3.61	pg/g	J		R2FS01	FS	107.1		
1,2,3,4,6,7,8-HpCDF	AP	R2AP02S01	2.38	pg/g	J		R2FS02S01	FS	117		
1,2,3,4,6,7,8-HpCDF	AP	R2AP03S01	1.61	pg/g	J		R2FS03S01	FS	99.6		
2,3,7,8-TCDF	AP	R2AP03S01	0.94	pg/g	J		R2FS03S01	FS	13.3		
Aluminum	AP	R2AP01S01	4290.2488	MG/KG			R2FS01	FS	22184.56085	J	90
Aluminum	AP	R2AP02S01	2102.5253	MG/KG			R2FS02S01	FS	26600	J	90
Aluminum	AP	R2AP04S01	1119.1406	MG/KG			R2FS04S01	FS	16790.1739	J	
Aluminum	AP	R2AP03S01	1077.9852	MG/KG			R2FS03S01	FS	28800	J	90
Antimony	AP	R2AP03S01	0.9708	MG/KG			R2FS03S01	FS	1.8	J	0.2
Arsenic	AP	R2AP01S01	2.2151	MG/KG			R2FS01	FS	6.14655	J	
Arsenic	AP	R2AP02S01	2.3442	MG/KG			R2FS02S01	FS	6.8		
Barium	AP	R2AP01S01	51.7424	MG/KG			R2FS01	FS	138.14025	J	
Barium	AP	R2AP02S01	46.9592	MG/KG			R2FS02S01	FS	159	J	
Barium	AP	R2AP04S01	23.0078	MG/KG			R2FS04S01	FS	108.6766		
Barium	AP	R2AP03S01	24.9295	MG/KG			R2FS03S01	FS	183	J	
Beryllium	AP	R2AP01S01	0.284	MG/KG			R2FS01	FS	0.8668		
Boron	AP	R2AP04S01	14.8848	MG/KG			R2FS04S01	FS	6.7929		
Boron	AP	R2AP01S01	12.4066	MG/KG			R2FS01S01	FS	9.4378		
Chromium	AP	R2AP01S01	32.0011	MG/KG			R2FS01	FS	34.41185	J	
Chromium	AP	R2AP02S01	14.5181	MG/KG			R2FS02S01	FS	42.9	J	
Chromium	AP	R2AP03S01	12.6424	MG/KG			R2FS03S01	FS	45	J	
Chromium	AP	R2AP04S01	5.375	MG/KG			R2FS04S01	FS	25.5232	J	
Cobalt	AP	R2AP01S01	2.9612	MG/KG			R2FS01	FS	11.9866	J	
Cobalt	AP	R2AP02S01	2.3097	MG/KG			R2FS02S01	FS	13.7	J	
Cobalt	AP	R2AP03S01	1.1952	MG/KG			R2FS03S01	FS	14.8	J	
Cobalt	AP	R2AP04S01	0.5947	MG/KG			R2FS04S01	FS	10.3522	J	
Copper	AP	R2AP01S01	10.3826	MG/KG			R2FS01	FS	33.5309	J	2
Copper	AP	R2AP04S01	5.2129	MG/KG			R2FS04S01	FS	31.0081		
Copper	AP	R2AP03S01	8.4823	MG/KG			R2FS03S01	FS	51.7	J	2
Iron	AP	R2AP01S01	7897.8805	MG/KG			R2FS01	FS	30667.42815	J	
Iron	AP	R2AP02S01	3589.3313	MG/KG			R2FS02S01	FS	37296.0373	J	
Iron	AP	R2AP03S01	2572.8683	MG/KG			R2FS03S01	FS	40600	J	
Iron	AP	R2AP04S01	1519.3359	MG/KG			R2FS04S01	FS	24579.881	J	
Magnesium	AP	R2AP02S01	5034.049	MG/KG			R2FS02S01	FS	8490	J	
Magnesium	AP	R2AP04S01	3074.2188	MG/KG			R2FS04S01	FS	5820.3991		
Magnesium	AP	R2AP01S01	3713.4373	MG/KG			R2FS01	FS	7164.66	J	
Magnesium	AP	R2AP03S01	2248.7624	MG/KG			R2FS03S01	FS	9330	J	
Manganese	AP	R2AP02S01	433.4153	MG/KG			R2FS02S01	FS	446	J	
Manganese	AP	R2AP01S01	350.5239	MG/KG			R2FS01	FS	407.03665	J	
Manganese	AP	R2AP03S01	163.7401	MG/KG			R2FS03S01	FS	668	J	
Manganese	AP	R2AP04S01	105.1562	MG/KG			R2FS04S01	FS	434.2689	J	
Mercury	AP	R2AP01S01	0.1205	MG/KG			R2FS01	FS	0.3288	J	
Nickel	AP	R2AP01S01	14.8776	MG/KG			R2FS01	FS	21.56585	J	
Nickel	AP	R2AP02S01	7.784	MG/KG			R2FS02S01	FS	24.5		
Nickel	AP	R2AP03S01	5.2345	MG/KG			R2FS03S01	FS	25.8		
Nickel	AP	R2AP04S01	2.2852	MG/KG			R2FS04S01	FS	17.8162	J	
OCDD	AP	R2AP01S01	274	pg/g			R2FS01	FS	9850	J	
OCDD	AP	R2AP04S01	73.3	pg/g			R2FS04S01	FS	3150		
OCDD	AP	R2AP02S01	170	pg/g			R2FS02S01	FS	12400	J	
OCDD	AP	R2AP03S01	85.4	pg/g			R2FS03S01	FS	8430	J	
OCDF	AP	R2AP01S01	9.35	pg/g	J		R2FS01	FS	273		
OCDF	AP	R2AP04S01	3.21	pg/g	J		R2FS04S01	FS	101		
OCDF	AP	R2AP02S01	5.66	pg/g	J		R2FS02S01	FS	314		
OCDF	AP	R2AP03S01	3.37	pg/g	J		R2FS03S01	FS	250		
PCB-105	AP	SNAP03S01	0.502	ng/g		0.170000002	SNFS03S01	FS	0.3		
PCB-105	AP	SNAP02S01	0.46	ng/g		0.180000007	SNFS02S01	FS	0.34		
PCB-105	AP	SNAP04S01	0.275	ng/g		0.209999993	SNFS04S01	FS	41		

Appendix K, Attachment K-4 (2 of 2)

Data Used in Aquatic Plant Bioaccumulation Factor Selection

CHEMICAL	TISSUE TYPE	TISSUE SAMPLE ID	TISSUE CONCENTRATION (WET WEIGHT)	UNITS	TISSUE VALIDATION QUALIFIER	TISSUE DETECTION LIMIT	SEDIMENT SAMPLE ID	SEDIMENT TYPE	SEDIMENT CONCENTRATION (DRY WEIGHT)	SEDIMENT VALIDATION QUALIFIER	SEDIMENT DETECTION LIMIT
PCB-118	AP	SNAP03S01	1.1	ng/g		0.170000002	SNFS03S01	FS	0.71		
PCB-118	AP	SNAP02S01	0.955	ng/g		0.180000007	SNFS02S01	FS	0.81		
PCB-118	AP	SNAP01S01	0.339	ng/g		0.219999999	SNFS01	FS	8.85		
PCB-118	AP	SNAP04S01	0.652	ng/g		0.209999993	SNFS04S01	FS	96		
PCB-128	AP	SNAP03S01	0.457	ng/g		0.170000002	SNFS03S01	FS	0.26		
PCB-128	AP	SNAP02S01	0.325	ng/g		0.180000007	SNFS02S01	FS	0.31		
PCB-138	AP	SNAP03S01	1.69	ng/g		0.170000002	SNFS03S01	FS	1.1		
PCB-138	AP	SNAP02S01	1.45	ng/g		0.180000007	SNFS02S01	FS	1.3		
PCB-138	AP	SNAP01S01	0.453	ng/g		0.219999999	SNFS01	FS	15		
PCB-138	AP	SNAP04S01	0.935	ng/g		0.209999993	SNFS04S01	FS	130		
PCB-153	AP	SNAP03S01	0.928	ng/g		0.170000002	SNFS03S01	FS	0.67		
PCB-153	AP	SNAP02S01	0.884	ng/g		0.180000007	SNFS02S01	FS	0.71		
PCB-153	AP	SNAP01S01	0.341	ng/g		0.219999999	SNFS01	FS	7.9		
PCB-153	AP	SNAP04S01	0.628	ng/g		0.209999993	SNFS04S01	FS	72		
PCB-156	AP	SNAP03S01	0.181	ng/g		0.170000002	SNFS03S01	FS	0.11		
PCB-18	AP	SNAP01S01	0.263	ng/g		0.219999999	SNFS01S01	FS	0.22		
PCB-18	AP	SNAP04S01	0.269	ng/g		0.209999993	SNFS04S01	FS	2.5		
PCB-180	AP	SNAP03S01	0.345	ng/g		0.170000002	SNFS03S01	FS	0.22		
PCB-180	AP	SNAP02S01	0.283	ng/g		0.180000007	SNFS02S01	FS	0.28		
PCB-28	AP	SNAP04S01	0.238	ng/g		0.209999993	SNFS04S01	FS	2.7		
PCB-44	AP	SNAP02S01	0.439	ng/g		0.180000007	SNFS02S01	FS	0.18		
PCB-44	AP	SNAP03S01	0.349	ng/g		0.170000002	SNFS03S01	FS	0.16		
PCB-44	AP	SNAP01S01	0.292	ng/g		0.219999999	SNFS01	FS	1.65		
PCB-44	AP	SNAP04S01	0.337	ng/g		0.209999993	SNFS04S01	FS	23		
PCB-52	AP	SNAP02S01	0.708	ng/g		0.180000007	SNFS02S01	FS	0.32		
PCB-52	AP	SNAP03S01	0.593	ng/g		0.170000002	SNFS03S01	FS	0.31		
PCB-52	AP	SNAP01S01	0.456	ng/g		0.219999999	SNFS01	FS	2.95		
PCB-52	AP	SNAP04S01	0.536	ng/g		0.209999993	SNFS04S01	FS	42		
PCB-66	AP	SNAP02S01	0.47	ng/g		0.180000007	SNFS02S01	FS	0.26		
PCB-66	AP	SNAP03S01	0.387	ng/g		0.170000002	SNFS03S01	FS	0.26		
PCB-66	AP	SNAP01S01	0.26	ng/g		0.219999999	SNFS01	FS	2.1		
PCB-66	AP	SNAP04S01	0.351	ng/g		0.209999993	SNFS04S01	FS	19		
PCB-90/101	AP	SNAP02S01	1.36	ng/g		0.370000005	SNFS02S01	FS	1.1		
PCB-90/101	AP	SNAP03S01	1.25	ng/g		0.340000004	SNFS03S01	FS	1.1		
PCB-90/101	AP	SNAP01S01	0.489	ng/g		0.439999998	SNFS01	FS	10.5		
PCB-90/101	AP	SNAP04S01	0.918	ng/g		0.430000007	SNFS04S01	FS	120		
Selenium	AP	R2AP01S01	1.1772	MG/KG	J		R2FS01	FS	0.465	J	0.1
Selenium	AP	R2AP04S01	0.7512	MG/KG	J		R2FS04S01	FS	0.3849	J	
Thallium	AP	R2AP01S01	2.0147	MG/KG			R2FS01	FS	3.86325		
Thallium	AP	R2AP02S01	0.9236	MG/KG			R2FS02S01	FS	5.1		
Vanadium	AP	R2AP02S01	19.3181	MG/KG			R2FS02S01	FS	63.8	J	
Vanadium	AP	R2AP01S01	12.2837	MG/KG			R2FS01	FS	54.3846	J	
Vanadium	AP	R2AP04S01	2.9258	MG/KG			R2FS04S01	FS	38.7394	J	
Vanadium	AP	R2AP03S01	3.8471	MG/KG			R2FS03S01	FS	63.6	J	
Zinc	AP	R2AP01S01	102.5974	MG/KG	J		R2FS01	FS	337.74315	J	
Zinc	AP	R2AP02S01	84.6969	MG/KG	J		R2FS02S01	FS	399	J	
Zinc	AP	R2AP04S01	49.7656	MG/KG	J		R2FS04S01	FS	263.6441	J	
Zinc	AP	R2AP03S01	57.1403	MG/KG	J		R2FS03S01	FS	403	J	

APPENDIX K

ATTACHMENT K-5

DATA USED IN FISH BIOACCUMULATION FACTOR SELECTION

Appendix K, Attachment K-5 (1 of 4)

Data Used in Fish Bioaccumulation Factor Selection

CHEMICAL	TISSUE TYPE	TISSUE SAMPLE ID	TISSUE CONCENTRATION (WET WEIGHT)	UNITS	TISSUE VALIDATION QUALIFIER	TISSUE DETECTION LIMIT	SEDIMENT SAMPLE ID	SEDIMENT TYPE	SEDIMENT CONCENTRATION (DRY WEIGHT)	SEDIMENT VALIDATION QUALIFIER	SEDIMENT DETECTION LIMIT
1,2,3,4,6,7,8-HpCDD	FI	R2FI04S01	12.6	pg/g			R2FS04S01	FS	287		
1,2,3,4,6,7,8-HpCDD	FI	R2FI01S01	20.1	pg/g			R2FS01	FS	790		
1,2,3,4,6,7,8-HpCDD	FI	R2FI03	10.465	pg/g			R2FS03S01	FS	734		
1,2,3,4,6,7,8-HpCDD	FI	R2FI02S01	8.56	pg/g			R2FS02S01	FS	957		
1,2,3,4,6,7,8-HpCDF	FI	R2FI03	4.29	pg/g	J		R2FS03S01	FS	99.6		
1,2,3,4,7,8-HxCDD	FI	R2FI04S01	1.45	pg/g	J		R2FS04S01	FS	3.93		
1,2,3,4,7,8-HxCDD	FI	R2FI01S01	1.7	pg/g	J		R2FS01	FS	10.07		
1,2,3,4,7,8-HxCDD	FI	R2FI02S01	1.73	pg/g	J		R2FS02S01	FS	11.3		
1,2,3,4,7,8-HxCDD	FI	R2FI03	1.055	pg/g	J		R2FS03S01	FS	8.02		
1,2,3,4,7,8-HxCDF	FI	R2FI01S01	0.64	pg/g	J		R2FS01	FS	4.645		
1,2,3,4,7,8-HxCDF	FI	R2FI02S01	0.62	pg/g	J		R2FS02S01	FS	5.33		
1,2,3,6,7,8-HxCDD	FI	R2FI04S01	9.27	pg/g			R2FS04S01	FS	15.1		
1,2,3,6,7,8-HxCDD	FI	R2FI01S01	8.02	pg/g			R2FS01	FS	37.95		
1,2,3,6,7,8-HxCDD	FI	R2FI02S01	7.67	pg/g			R2FS02S01	FS	42.3		
1,2,3,6,7,8-HxCDD	FI	R2FI03	5.18	pg/g	J		R2FS03S01	FS	31.9		
1,2,3,6,7,8-HxCDF	FI	R2FI03	1.9	pg/g	J		R2FS03S01	FS	3.9		
1,2,3,6,7,8-HxCDF	FI	R2FI02S01	1.89	pg/g	J		R2FS02S01	FS	4.5		
1,2,3,6,7,8-HxCDF	FI	R2FI01S01	1.58	pg/g	J		R2FS01	FS	3.925		
1,2,3,7,8,9-HxCDD	FI	R2FI04S01	1.79	pg/g	J		R2FS04S01	FS	8.27		
1,2,3,7,8,9-HxCDD	FI	R2FI01S01	1.8	pg/g	J		R2FS01	FS	21.15		
1,2,3,7,8,9-HxCDD	FI	R2FI03	1.31	pg/g	J		R2FS03S01	FS	18.5		
1,2,3,7,8,9-HxCDD	FI	R2FI02S01	1.65	pg/g	J		R2FS02S01	FS	23.4		
1,2,3,7,8-PeCDD	FI	R2FI04S01	3.91	pg/g	J		R2FS04S01	FS	2.4	J	
1,2,3,7,8-PeCDD	FI	R2FI01S01	3.89	pg/g	J		R2FS01	FS	5.7		
1,2,3,7,8-PeCDD	FI	R2FI03	2.525	pg/g	J		R2FS03S01	FS	4.43		
1,2,3,7,8-PeCDD	FI	R2FI02S01	2.95	pg/g	J		R2FS02S01	FS	5.92		
1,2,3,7,8-PeCDF	FI	R2FI04S01	2.57	pg/g	J		R2FS04S01	FS	2.45	J	
1,2,3,7,8-PeCDF	FI	R2FI01S01	2.05	pg/g	J		R2FS01	FS	3.675		
1,2,3,7,8-PeCDF	FI	R2FI02S01	2.1	pg/g	J		R2FS02S01	FS	4.28		
1,2,3,7,8-PeCDF	FI	R2FI03	1.885	pg/g	J		R2FS03S01	FS	5.5		
2,3,4,6,7,8-HxCDF	FI	R2FI01S01	0.69	pg/g	J		R2FS01	FS	5.69		
2,3,4,6,7,8-HxCDF	FI	R2FI02S01	0.64	pg/g	J		R2FS02S01	FS	6.45		
2,3,4,7,8-PeCDF	FI	R2FI04S01	5.75	pg/g			R2FS04S01	FS	3.36		
2,3,4,7,8-PeCDF	FI	R2FI02S01	5.65	pg/g			R2FS02S01	FS	4.46		
2,3,4,7,8-PeCDF	FI	R2FI01S01	3.68	pg/g	J		R2FS01	FS	3.75		
2,3,4,7,8-PeCDF	FI	R2FI03	3.62	pg/g	J		R2FS03S01	FS	5.48		
2,3,7,8-TCDD	FI	R2FI04S01	1.03	pg/g	J		R2FS04S01	FS	0.36	J	
2,3,7,8-TCDD	FI	R2FI02S01	1.19	pg/g			R2FS02S01	FS	0.795		
2,3,7,8-TCDD	FI	R2FI01S01	1.03	pg/g	J		R2FS01	FS	0.7385		
2,3,7,8-TCDD	FI	R2FI03	0.64	pg/g	J		R2FS03S01	FS	0.59		
2,3,7,8-TCDF	FI	R2FI01S01	9.31	pg/g			R2FS01	FS	7.545		
2,3,7,8-TCDF	FI	R2FI04S01	4.81	pg/g			R2FS04S01	FS	5.86		
2,3,7,8-TCDF	FI	R2FI02S01	4.86	pg/g			R2FS02S01	FS	9.66		
2,3,7,8-TCDF	FI	R2FI03	5.535	pg/g			R2FS03S01	FS	13.3		
Aluminum	FI	R2FI01S01	436.2155	MG/KG			R2FS01	FS	22184.56085	J	90
Aluminum	FI	R2FI03	298.88465	MG/KG			R2FS03S01	FS	28800	J	90
Aluminum	FI	R2FI04S01	145.3744	MG/KG			R2FS04S01	FS	16790.1739	J	
Aluminum	FI	R2FI02S01	44.5379	MG/KG			R2FS02S01	FS	26600	J	90
Antimony	FI	R2FI03	3.5371	MG/KG			R2FS03S01	FS	1.8	J	0.2
Antimony	FI	R2FI04S01	2.3038	MG/KG			R2FS04S01	FS	1.4189	J	
Barium	FI	R2FI01S01	15.4855	MG/KG			R2FS01	FS	138.14025	J	
Barium	FI	R2FI04S01	7.604	MG/KG			R2FS04S01	FS	108.6766		
Barium	FI	R2FI02S01	10.2848	MG/KG			R2FS02S01	FS	159	J	
Barium	FI	R2FI03	9.6364	MG/KG			R2FS03S01	FS	183	J	
Chromium	FI	R2FI04S01	7.3036	MG/KG			R2FS04S01	FS	25.5232	J	
Chromium	FI	R2FI01S01	7.7765	MG/KG			R2FS01	FS	34.41185	J	
Chromium	FI	R2FI03	4.88815	MG/KG			R2FS03S01	FS	45	J	
Chromium	FI	R2FI02S01	2.6293	MG/KG			R2FS02S01	FS	42.9	J	
Cobalt	FI	R2FI01S01	0.3576	MG/KG			R2FS01	FS	11.9866	J	
Copper	FI	R2FI01S01	3.9282	MG/KG			R2FS01	FS	33.5309	J	2
Copper	FI	R2FI04S01	3.576	MG/KG			R2FS04S01	FS	31.0081		
Copper	FI	R2FI02S01	3.7607	MG/KG			R2FS02S01	FS	40.6	J	2
Copper	FI	R2FI03	4.41855	MG/KG			R2FS03S01	FS	51.7	J	2

Appendix K, Attachment K-5 (2 of 4)

Data Used in Fish Bioaccumulation Factor Selection

CHEMICAL	TISSUE TYPE	TISSUE SAMPLE ID	TISSUE CONCENTRATION (WET WEIGHT)	UNITS	TISSUE VALIDATION QUALIFIER	TISSUE DETECTION LIMIT	SEDIMENT SAMPLE ID	SEDIMENT TYPE	SEDIMENT CONCENTRATION (DRY WEIGHT)	SEDIMENT VALIDATION QUALIFIER	SEDIMENT DETECTION LIMIT
Fluoranthene	FI	R2FI01S01	9.3	UG/KG	J		R2FS01	FS	104.5	J	
Iron	FI	R2FI01S01	699.869	MG/KG			R2FS01	FS	30667.42815	J	
Iron	FI	R2FI04S01	309.4069	MG/KG			R2FS04S01	FS	24579.881	J	
Iron	FI	R2FI03	443.8494	MG/KG			R2FS03S01	FS	40600	J	
Iron	FI	R2FI02S01	162.0981	MG/KG			R2FS02S01	FS	37296.0373	J	
Magnesium	FI	R2FI01S01	1882.2157	MG/KG			R2FS01	FS	7164.66	J	
Magnesium	FI	R2FI04S01	1481.681	MG/KG			R2FS04S01	FS	5820.3991		
Magnesium	FI	R2FI02S01	1972.0073	MG/KG			R2FS02S01	FS	8490	J	
Magnesium	FI	R2FI03	1649.55335	MG/KG			R2FS03S01	FS	9330	J	
Manganese	FI	R2FI01S01	41.288	MG/KG			R2FS01	FS	407.03665	J	
Manganese	FI	R2FI04S01	15.4454	MG/KG			R2FS04S01	FS	434.2689	J	
Manganese	FI	R2FI02S01	13.292	MG/KG			R2FS02S01	FS	446	J	
Manganese	FI	R2FI03	18.51875	MG/KG			R2FS03S01	FS	668	J	
Mercury	FI	R2FI04S01	0.241	MG/KG			R2FS04S01	FS	0.1898	J	
Mercury	FI	R2FI03	0.25425	MG/KG			R2FS03S01	FS	0.3005		
Mercury	FI	R2FI01S01	0.2735	MG/KG			R2FS01	FS	0.3288	J	
Mercury	FI	R2FI02S01	0.195	MG/KG			R2FS02S01	FS	0.4134		
Molybdenum	FI	R2FI03	0.7318	MG/KG			R2FS03S01	FS	0.67		
Molybdenum	FI	R2FI04S01	0.2766	MG/KG			R2FS04S01	FS	0.6574		
Naphthalene	FI	R2FI01S01	15	UG/KG	J		R2FS01	FS	2.6	J	
Nickel	FI	R2FI04S01	2.9195	MG/KG			R2FS04S01	FS	17.8162	J	
Nickel	FI	R2FI01S01	3.049	MG/KG			R2FS01	FS	21.56585	J	
Nickel	FI	R2FI03	1.949	MG/KG			R2FS03S01	FS	25.8		
Nickel	FI	R2FI02S01	0.9006	MG/KG			R2FS02S01	FS	24.5		
OCDD	FI	R2FI04S01	62.3	pg/g			R2FS04S01	FS	3150		
OCDD	FI	R2FI01S01	165	pg/g			R2FS01	FS	9850	J	
OCDD	FI	R2FI03	85.15	pg/g			R2FS03S01	FS	8430	J	
OCDD	FI	R2FI02S01	38.4	pg/g			R2FS02S01	FS	12400	J	
OCDF	FI	R2FI04S01	2.03	pg/g	J		R2FS04S01	FS	101		
OCDF	FI	R2FI01S01	4.8	pg/g	J		R2FS01	FS	273		
OCDF	FI	R2FI03	3.125	pg/g	J		R2FS03S01	FS	250		
OCDF	FI	R2FI02S01	1.36	pg/g	J		R2FS02S01	FS	314		
PCB-105	FI	SNFI03	97.35	ng/g		0.105	SNFS03S01	FS	0.3		
PCB-105	FI	SNFI02S01	42.2	ng/g		0.11	SNFS02S01	FS	0.34		
PCB-105	FI	SNFI01S01	85.5	ng/g		0.08	SNFS01	FS	4		
PCB-105	FI	SNFI04S01	152	ng/g		0.12	SNFS04S01	FS	41		
PCB-114	FI	SNFI03	4.595	ng/g		0.105	SNFS03S01	FS	0.014	J	
PCB-114	FI	SNFI02S01	1.96	ng/g		0.11	SNFS02S01	FS	0.012	J	
PCB-114	FI	SNFI01S01	3.6	ng/g		0.08	SNFS01	FS	0.15		
PCB-114	FI	SNFI04S01	6.86	ng/g		0.12	SNFS04S01	FS	1.4		
PCB-118	FI	SNFI03	274	ng/g		0.105	SNFS03S01	FS	0.71		
PCB-118	FI	SNFI02S01	132	ng/g		0.11	SNFS02S01	FS	0.81		
PCB-118	FI	SNFI01S01	238	ng/g		0.08	SNFS01	FS	8.85		
PCB-118	FI	SNFI04S01	419	ng/g		0.12	SNFS04S01	FS	96		
PCB-123	FI	SNFI03	4.155	ng/g		0.105	SNFS03S01	FS	0.0096	J	
PCB-123	FI	SNFI02S01	2.22	ng/g		0.11	SNFS02S01	FS	0.011	J	
PCB-123	FI	SNFI01S01	4.34	ng/g		0.08	SNFS01	FS	0.135		
PCB-123	FI	SNFI04S01	5.52	ng/g		0.12	SNFS04S01	FS	0.99		
PCB-126	FI	SNFI03	1.83	ng/g		0.105	SNFS03S01	FS	0.013	J	
PCB-126	FI	SNFI02S01	0.829	ng/g		0.11	SNFS02S01	FS	0.016	J	
PCB-126	FI	SNFI01S01	1.91	ng/g		0.08	SNFS01	FS	0.115		
PCB-126	FI	SNFI04S01	2.7	ng/g		0.12	SNFS04S01	FS	1.5		
PCB-128	FI	SNFI03	80.2	ng/g		0.105	SNFS03S01	FS	0.26		
PCB-128	FI	SNFI02S01	48.9	ng/g		0.11	SNFS02S01	FS	0.31		
PCB-128	FI	SNFI01S01	73.4	ng/g		0.08	SNFS01	FS	3.9		
PCB-128	FI	SNFI04S01	146	ng/g		0.12	SNFS04S01	FS	33		
PCB-138	FI	SNFI03	449.5	ng/g		0.105	SNFS03S01	FS	1.1		
PCB-138	FI	SNFI02S01	257	ng/g		0.11	SNFS02S01	FS	1.3		
PCB-138	FI	SNFI01S01	426	ng/g		0.08	SNFS01	FS	15		
PCB-138	FI	SNFI04S01	742	ng/g		0.12	SNFS04S01	FS	130		
PCB-153	FI	SNFI03	316	ng/g		0.105	SNFS03S01	FS	0.67		
PCB-153	FI	SNFI02S01	212	ng/g		0.11	SNFS02S01	FS	0.71		
PCB-153	FI	SNFI01S01	299	ng/g		0.08	SNFS01	FS	7.9		

Appendix K, Attachment K-5 (3 of 4)

Data Used in Fish Bioaccumulation Factor Selection

CHEMICAL	TISSUE TYPE	TISSUE SAMPLE ID	TISSUE CONCENTRATION (WET WEIGHT)	UNITS	TISSUE VALIDATION QUALIFIER	TISSUE DETECTION LIMIT	SEDIMENT SAMPLE ID	SEDIMENT TYPE	SEDIMENT CONCENTRATION (DRY WEIGHT)	SEDIMENT VALIDATION QUALIFIER	SEDIMENT DETECTION LIMIT
PCB-153	FI	SNFI04S01	523	ng/g		0.12	SNFS04S01	FS	72		
PCB-156	FI	SNFI03	48.3	ng/g		0.105	SNFS03S01	FS	0.11		
PCB-156	FI	SNFI02S01	26.3	ng/g		0.11	SNFS02S01	FS	0.13		
PCB-156	FI	SNFI01S01	42.2	ng/g		0.08	SNFS01	FS	1.5		
PCB-156	FI	SNFI04S01	74.4	ng/g		0.12	SNFS04S01	FS	14.3		
PCB-157	FI	SNFI03	9.455	ng/g		0.105	SNFS03S01	FS	0.027	J	
PCB-157	FI	SNFI02S01	4.42	ng/g		0.11	SNFS02S01	FS	0.035	J	
PCB-157	FI	SNFI01S01	8.66	ng/g		0.08	SNFS01	FS	0.375		
PCB-157	FI	SNFI04S01	14.2	ng/g		0.12	SNFS04S01	FS	3		
PCB-167	FI	SNFI03	22.05	ng/g		0.105	SNFS03S01	FS	0.049		
PCB-167	FI	SNFI02S01	12.4	ng/g		0.11	SNFS02S01	FS	0.056		
PCB-167	FI	SNFI01S01	19.1	ng/g		0.08	SNFS01	FS	0.69		
PCB-167	FI	SNFI04S01	33.4	ng/g		0.12	SNFS04S01	FS	5.8		
PCB-170	FI	SNFI03	54.9	ng/g		0.105	SNFS03S01	FS	0.09		
PCB-170	FI	SNFI02S01	34.3	ng/g		0.11	SNFS02S01	FS	0.12		
PCB-170	FI	SNFI01S01	45.5	ng/g		0.08	SNFS01	FS	1.45		
PCB-170	FI	SNFI04S01	91.7	ng/g		0.12	SNFS04S01	FS	11		
PCB-18	FI	SNFI01S01	2.26	ng/g		0.08	SNFS01S01	FS	0.22		
PCB-18	FI	SNFI04S01	3.28	ng/g		0.12	SNFS04S01	FS	2.5		
PCB-180	FI	SNFI03	108.1	ng/g		0.105	SNFS03S01	FS	0.22		
PCB-180	FI	SNFI02S01	88	ng/g		0.11	SNFS02S01	FS	0.28		
PCB-180	FI	SNFI01S01	101	ng/g		0.08	SNFS01	FS	2.95		
PCB-180	FI	SNFI04S01	178	ng/g		0.12	SNFS04S01	FS	22		
PCB-187	FI	SNFI03	45.25	ng/g		0.105	SNFS03S01	FS	0.074		
PCB-187	FI	SNFI02S01	31.9	ng/g		0.11	SNFS02S01	FS	0.099		
PCB-187	FI	SNFI01S01	42.1	ng/g		0.08	SNFS01	FS	1.1		
PCB-187	FI	SNFI04S01	68.4	ng/g		0.12	SNFS04S01	FS	7.5		
PCB-189	FI	SNFI01S01	2.61	ng/g		0.08	SNFS01	FS	0.098		
PCB-189	FI	SNFI04S01	3.1	ng/g		0.12	SNFS04S01	FS	0.77		
PCB-195	FI	SNFI03S01	4.78	ng/g		0.09	SNFS03S01	FS	0.01	J	
PCB-195	FI	SNFI02S01	4.31	ng/g		0.11	SNFS02S01	FS	0.017	J	
PCB-195	FI	SNFI01S01	4.27	ng/g		0.08	SNFS01	FS	0.185		
PCB-195	FI	SNFI04S01	7.22	ng/g		0.12	SNFS04S01	FS	1		
PCB-206	FI	SNFI03	12.55	ng/g		0.105	SNFS03S01	FS	0.05		
PCB-206	FI	SNFI02S01	16.3	ng/g		0.11	SNFS02S01	FS	0.085		
PCB-206	FI	SNFI01S01	13.6	ng/g		0.08	SNFS01	FS	0.585		
PCB-206	FI	SNFI04S01	22.1	ng/g		0.12	SNFS04S01	FS	4.3		
PCB-209	FI	SNFI02S01	2.26	ng/g		0.11	SNFS02S01	FS	0.022	J	
PCB-209	FI	SNFI03	1.315	ng/g		0.105	SNFS03S01	FS	0.016	J	
PCB-209	FI	SNFI01S01	1.33	ng/g		0.08	SNFS01	FS	0.165		
PCB-209	FI	SNFI04S01	2.47	ng/g		0.12	SNFS04S01	FS	0.78		
PCB-28	FI	SNFI01S01	4.43	ng/g		0.08	SNFS01	FS	0.32		
PCB-28	FI	SNFI04S01	6.43	ng/g		0.12	SNFS04S01	FS	2.7		
PCB-44	FI	SNFI03	22.25	ng/g		0.105	SNFS03S01	FS	0.16		
PCB-44	FI	SNFI02S01	10.6	ng/g		0.11	SNFS02S01	FS	0.18		
PCB-44	FI	SNFI01S01	19.3	ng/g		0.08	SNFS01	FS	1.65		
PCB-44	FI	SNFI04S01	36.6	ng/g		0.12	SNFS04S01	FS	23		
PCB-52	FI	SNFI03	61.6	ng/g		0.105	SNFS03S01	FS	0.31		
PCB-52	FI	SNFI02S01	28.9	ng/g		0.11	SNFS02S01	FS	0.32		
PCB-52	FI	SNFI01S01	64	ng/g		0.08	SNFS01	FS	2.95		
PCB-52	FI	SNFI04S01	93.2	ng/g		0.12	SNFS04S01	FS	42		
PCB-66	FI	SNFI03	50.8	ng/g		0.105	SNFS03S01	FS	0.26		
PCB-66	FI	SNFI01S01	46.6	ng/g		0.08	SNFS01	FS	2.1		
PCB-66	FI	SNFI04S01	76	ng/g		0.12	SNFS04S01	FS	19		
PCB-77	FI	SNFI03	1.55	ng/g		0.105	SNFS03S01	FS	0.069		
PCB-77	FI	SNFI02S01	0.896	ng/g		0.11	SNFS02S01	FS	0.08		
PCB-77	FI	SNFI01S01	1.4	ng/g		0.08	SNFS01	FS	0.6		
PCB-77	FI	SNFI04S01	2.18	ng/g		0.12	SNFS04S01	FS	9.4		
PCB-8	FI	SNFI03	0.135	ng/g		0.105	SNFS03S01	FS	0.012	J	
PCB-8	FI	SNFI04S01	0.155	ng/g		0.12	SNFS04S01	FS	0.32		
PCB-81	FI	SNFI03	2.01	ng/g		0.105	SNFS03S01	FS	0.013	J	
PCB-81	FI	SNFI02S01	0.859	ng/g		0.11	SNFS02S01	FS	0.013	J	
PCB-81	FI	SNFI01S01	1.7	ng/g		0.08	SNFS01	FS	0.099		

Appendix K, Attachment K-5 (4 of 4)

Data Used in Fish Bioaccumulation Factor Selection

CHEMICAL	TISSUE TYPE	TISSUE SAMPLE ID	TISSUE CONCENTRATION (WET WEIGHT)	UNITS	TISSUE VALIDATION QUALIFIER	TISSUE DETECTION LIMIT	SEDIMENT SAMPLE ID	SEDIMENT TYPE	SEDIMENT CONCENTRATION (DRY WEIGHT)	SEDIMENT VALIDATION QUALIFIER	SEDIMENT DETECTION LIMIT
PCB-81	FI	SNFI04S01	3.37	ng/g		0.12	SNFS04S01	FS	0.98		
PCB-90/101	FI	SNFI03	275.5	ng/g		0.215	SNFS03S01	FS	1.1		
PCB-90/101	FI	SNFI02S01	131	ng/g		0.23	SNFS02S01	FS	1.1		
PCB-90/101	FI	SNFI01S01	296	ng/g		0.16	SNFS01	FS	10.5		
PCB-90/101	FI	SNFI04S01	475	ng/g		0.23999999	SNFS04S01	FS	120		
Phenanthrene	FI	R2FI02S01	9.4	UG/KG	J		R2FS02S01	FS	34		
Phenanthrene	FI	R2FI01S01	15	UG/KG	J		R2FS01	FS	61	J	
Selenium	FI	R2FI04S01	1.8568	MG/KG	J		R2FS04S01	FS	0.3849	J	
Selenium	FI	R2FI01S01	1.525	MG/KG	J		R2FS01	FS	0.465	J	0.1
Selenium	FI	R2FI02S01	2.1028	MG/KG	J		R2FS02S01	FS	0.72		0.1
Selenium	FI	R2FI03	1.1577	MG/KG	J		R2FS03S01	FS	1		0.1
Vanadium	FI	R2FI01S01	1.3265	MG/KG			R2FS01	FS	54.3846	J	
Vanadium	FI	R2FI04S01	0.4094	MG/KG			R2FS04S01	FS	38.7394	J	
Vanadium	FI	R2FI03	0.6418	MG/KG			R2FS03S01	FS	63.6	J	
Vanadium	FI	R2FI02S01	0.498	MG/KG			R2FS02S01	FS	63.8	J	
Zinc	FI	R2FI01S01	148.5098	MG/KG	J		R2FS01	FS	337.74315	J	
Zinc	FI	R2FI04S01	81.5473	MG/KG			R2FS04S01	FS	263.6441	J	
Zinc	FI	R2FI02S01	101.8423	MG/KG	J		R2FS02S01	FS	399	J	
Zinc	FI	R2FI03	74.39345	MG/KG			R2FS03S01	FS	403	J	

APPENDIX K

ATTACHMENT K-6

DATA USED IN TERRESTRIAL VERTEBRATE BIOACCUMULATION FACTOR SELECTION

Appendix K, Attachment K-6 (1 of 3)

Data Used in Terrestrial Vertebrate Bioaccumulation Factor Selection

CHEMICAL	TISSUE TYPE	TISSUE SAMPLE ID	TISSUE CONCENTRATION (WET WEIGHT)	UNITS	TISSUE VALIDATION QUALIFIER	TISSUE DETECTION LIMIT	SOIL SAMPLE ID	SOIL TYPE	SOIL CONCENTRATION (DRY WEIGHT)	SOIL VALIDATION QUALIFIER	SOIL DETECTION LIMIT	PERCENT MOISTURE	BAF Rank
1,2,3,4,6,7,8-HpCDD	MO	CLMO04S01	1.83	pg/g			CLSS04	SS	16.45			0.68	1
1,2,3,4,6,7,8-HpCDD	MO	CLMO06S01	4.56	pg/g			CLSS06S01	SS	97.1			0.68	2
1,2,3,4,6,7,8-HpCDD	MO	CLMO07S01	0.49	pg/g	J		CLSS07S01	SS	41.4			0.68	3
1,2,3,4,6,7,8-HpCDD	MO	CLMO05S01	1.08	pg/g			CLSS05S01	SS	96.6			0.68	4
1,2,3,4,6,7,8-HpCDF	MO	CLMO04S01	0.73	pg/g	J		CLSS04	SS	5.17			0.68	1
1,2,3,4,6,7,8-HpCDF	MO	CLMO06S01	1.14	pg/g			CLSS06S01	SS	8.29			0.68	2
1,2,3,4,6,7,8-HpCDF	MO	CLMO05S01	0.29	pg/g	J		CLSS05S01	SS	15.7			0.68	3
1,2,3,4,7,8-HxCDD	MO	CLMO06S01	0.105	pg/g	J		CLSS06S01	SS	1.38	J		0.68	
1,2,3,4,7,8-HxCDF	MO	CLMO04S01	0.34	pg/g	J		CLSS04	SS	1.335	J		0.68	
1,2,3,6,7,8-HxCDD	MO	CLMO06S01	0.292	pg/g	J		CLSS06S01	SS	4.24			0.68	
1,2,3,6,7,8-HxCDF	MO	CLMO04S01	0.2	pg/g	J		CLSS04	SS	0.955	J		0.68	
1,2,3,7,8,9-HxCDD	MO	CLMO06S01	0.14	pg/g	J		CLSS06S01	SS	2.45	J		0.68	
2,3,4,6,7,8-HxCDF	MO	CLMO04S01	0.12	pg/g	J		CLSS04	SS	0.7	J		0.68	
2,3,4,7,8-PeCDF	MO	CLMO04S01	0.22	pg/g	J		CLSS04	SS	1.555	J		0.68	
2,3,7,8-TCDF	MO	CLMO04S01	0.14	pg/g	J		CLSS04	SS	2.345			0.68	
Aluminum	MO	BVMO07S01	356.2963	MG/KG			BVSS07	SS	8792.5669	J		0.68	1
Aluminum	MO	BVMO08S01	196.9794	MG/KG			BVSS08S01	SS	6350	J	90	0.68	2
Aluminum	MO	BVMO06S01	130.9174	MG/KG			BVSS06S01	SS	9300	J	90	0.68	3
Aluminum	MO	BVMO05S01	39.1943	MG/KG			BVSS05S01	SS	7370	J	90	0.68	4
Antimony	MO	BVMO06S01	0.1451	MG/KG			BVSS06S01	SS	0.62	J	0.2	0.68	
Antimony	MO	BVMO07S01	0.1739	MG/KG			BVSS07	SS	1.2443	J		0.68	
Barium	MO	BVMO07S01	6.3407	MG/KG			BVSS07	SS	54.32885			0.68	1
Barium	MO	BVMO05S01	4.6351	MG/KG			BVSS05S01	SS	43.6	J		0.68	2
Barium	MO	BVMO08S01	4.1648	MG/KG			BVSS08S01	SS	44.2	J		0.68	3
Barium	MO	BVMO06S01	4.6789	MG/KG			BVSS06S01	SS	55.2	J		0.68	4
Benzo(a)anthracene	MO	CLMO05S01	6.7	UG/KG	J		CLSS05S01	SS	1.3	J		0.68	
Benzo(a)pyrene	MO	CLMO05S01	3.8	UG/KG	J		CLSS05S01	SS	2	J		0.68	
Benzo(b)fluoranthene	MO	CLMO05S01	4.2	UG/KG	J		CLSS05S01	SS	2.5			0.68	
Benzo(g,h,i)perylene	MO	CLMO05S01	6.8	UG/KG			CLSS05S01	SS	4.7			0.68	
Benzo(k)fluoranthene	MO	CLMO05S01	5	UG/KG	J		CLSS05S01	SS	2	J		0.68	
Boron	MO	BVMO07S01	5.2914	MG/KG			BVSS07	SS	1.4365			0.68	
Chromium	MO	BVMO07S01	0.756	MG/KG			BVSS07	SS	15.21855	J		0.68	1
Chromium	MO	BVMO05S01	0.4692	MG/KG			BVSS05S01	SS	12.2	J		0.68	2
Chromium	MO	BVMO08S01	0.5867	MG/KG			BVSS08S01	SS	21.5	J		0.68	3
Chromium	MO	BVMO06S01	0.3479	MG/KG			BVSS06S01	SS	14.2	J		0.68	4
Chrysene	MO	CLMO05S01	4.9	UG/KG	J		CLSS05S01	SS	2.4			0.68	
Cobalt	MO	BVMO07S01	0.5235	MG/KG			BVSS07	SS	5.644	J		0.68	
Cobalt	MO	BVMO08S01	0.2346	MG/KG			BVSS08S01	SS	4.7	J		0.68	
Cobalt	MO	BVMO06S01	0.1944	MG/KG			BVSS06S01	SS	5.2	J		0.68	
Cobalt	MO	BVMO05S01	0.087	MG/KG			BVSS05S01	SS	4.5	J		0.68	
Copper	MO	BVMO05S01	2.3301	MG/KG			BVSS05S01	SS	9.1	J	2	0.68	1
Copper	MO	BVMO06S01	1.8553	MG/KG			BVSS06S01	SS	9	J	2	0.68	2
Copper	MO	BVMO07S01	2.5951	MG/KG			BVSS07	SS	13.7714			0.68	3
Copper	MO	BVMO08S01	3.6201	MG/KG			BVSS08S01	SS	19.9	J	2	0.68	4
Dibenz(a,h)anthracene	MO	CLMO05S01	5.8	UG/KG	J		CLSS05S01	SS	1.1	J		0.68	
Fluoranthene	MO	CLMO05S01	3.6	UG/KG	J		CLSS05S01	SS	4.8			0.68	
Indeno(1,2,3-cd)pyrene	MO	CLMO05S01	6	UG/KG			CLSS05S01	SS	2.6			0.68	
Iron	MO	BVMO07S01	624.9383	MG/KG			BVSS07	SS	16583.18595	J		0.68	1
Iron	MO	BVMO08S01	373.6842	MG/KG			BVSS08S01	SS	17288.8158	J		0.68	2
Iron	MO	BVMO06S01	234.1743	MG/KG			BVSS06S01	SS	17534.6113	J		0.68	3
Iron	MO	BVMO05S01	98.3649	MG/KG			BVSS05S01	SS	15027.2345	J		0.68	4
Magnesium	MO	BVMO05S01	688.1517	MG/KG			BVSS05S01	SS	2700	J		0.68	1
Magnesium	MO	BVMO08S01	636.3844	MG/KG			BVSS08S01	SS	2660	J		0.68	2
Magnesium	MO	BVMO07S01	650.6173	MG/KG			BVSS07	SS	3423.9578			0.68	3

Appendix K, Attachment K-6 (2 of 3)

Data Used in Terrestrial Vertebrate Bioaccumulation Factor Selection

CHEMICAL	TISSUE TYPE	TISSUE SAMPLE ID	TISSUE CONCENTRATION (WET WEIGHT)	UNITS	TISSUE VALIDATION QUALIFIER	TISSUE DETECTION LIMIT	SOIL SAMPLE ID	SOIL TYPE	SOIL CONCENTRATION (DRY WEIGHT)	SOIL VALIDATION QUALIFIER	SOIL DETECTION LIMIT	PERCENT MOISTURE	BAF Rank
Magnesium	MO	BVMO06S01	485.7798	MG/KG			BVSS06S01	SS	3470	J		0.68	4
Manganese	MO	BVMO07S01	9.0568	MG/KG	J		BVSS07	SS	169.49945	J		0.68	1
Manganese	MO	BVMO08S01	6.7757	MG/KG	J		BVSS08S01	SS	189	J		0.68	2
Manganese	MO	BVMO05S01	2.8673	MG/KG	J		BVSS05S01	SS	137	J		0.68	3
Manganese	MO	BVMO06S01	4.0367	MG/KG	J		BVSS06S01	SS	223	J		0.68	4
Molybdenum	MO	BVMO06S01	0.1923	MG/KG			BVSS06S01	SS	0.17			0.68	1
Molybdenum	MO	BVMO05S01	0.2483	MG/KG			BVSS05S01	SS	0.62			0.68	2
Molybdenum	MO	BVMO07S01	0.2405	MG/KG			BVSS07	SS	0.8219			0.68	3
Molybdenum	MO	BVMO08S01	0.3009	MG/KG			BVSS08S01	SS	1.3			0.68	4
Nickel	MO	BVMO07S01	0.4005	MG/KG			BVSS07	SS	9.39915	J		0.68	1
Nickel	MO	BVMO05S01	0.1887	MG/KG			BVSS05S01	SS	6.3			0.68	2
Nickel	MO	BVMO08S01	0.3297	MG/KG			BVSS08S01	SS	12.6			0.68	3
Nickel	MO	BVMO06S01	0.1503	MG/KG			BVSS06S01	SS	7.4			0.68	4
OCDD	MO	CLMO04S01	18.3	pg/g			CLSS04	SS	210.5			0.68	1
OCDD	MO	CLMO06S01	14.3	pg/g			CLSS06S01	SS	904			0.68	2
OCDD	MO	CLMO05S01	11	pg/g			CLSS05S01	SS	1000			0.68	3
OCDD	MO	CLMO07S01	4.6	pg/g			CLSS07S01	SS	455			0.68	4
OCDF	MO	CLMO06S01	6.56	pg/g			CLSS06S01	SS	20.4			0.68	1
OCDF	MO	CLMO04S01	0.87	pg/g	J		CLSS04	SS	10.75			0.68	2
OCDF	MO	CLMO05S01	1.09	pg/g	J		CLSS05S01	SS	74.7			0.68	3
PCB-105	MO	BVMO05S01	3.2	ng/g		0.01	BVSS05S01	SS	3.3			0.68	1
PCB-105	MO	BVMO06S01	0.766	ng/g		0.02	BVSS06S01	SS	1.3			0.68	2
PCB-105	MO	BVMO07S01	0.187	ng/g		0.02	BVSS07	SS	1.8			0.68	3
PCB-105	MO	BVMO08S01	0.65	ng/g		0.02	BVSS08S01	SS	25			0.68	4
PCB-114	MO	BVMO05S01	0.177	ng/g		0.01	BVSS05S01	SS	0.081			0.68	1
PCB-114	MO	BVMO06S01	0.0236	ng/g		0.02	BVSS06S01	SS	0.028	J		0.68	2
PCB-114	MO	BVMO08S01	0.0243	ng/g		0.02	BVSS08S01	SS	0.91			0.68	3
PCB-118	MO	BVMO05S01	6.68	ng/g		0.01	BVSS05S01	SS	6.6			0.68	1
PCB-118	MO	BVMO06S01	2.06	ng/g		0.02	BVSS06S01	SS	2.3			0.68	2
PCB-118	MO	BVMO07S01	0.415	ng/g		0.02	BVSS07	SS	3.6			0.68	3
PCB-118	MO	BVMO08S01	2.16	ng/g		0.02	BVSS08S01	SS	57			0.68	4
PCB-123	MO	BVMO05S01	0.105	ng/g		0.01	BVSS05S01	SS	0.095			0.68	
PCB-123	MO	BVMO06S01	0.0307	ng/g		0.02	BVSS06S01	SS	0.029	J		0.68	
PCB-126	MO	BVMO05S01	0.0364	ng/g		0.01	BVSS05S01	SS	0.069			0.68	
PCB-126	MO	BVMO08S01	0.21	ng/g		0.02	BVSS08S01	SS	0.32			0.68	
PCB-128	MO	BVMO06S01	1.43	ng/g		0.02	BVSS06S01	SS	1.5			0.68	1
PCB-128	MO	BVMO05S01	3.41	ng/g		0.01	BVSS05S01	SS	4.2			0.68	2
PCB-128	MO	BVMO08S01	1.11	ng/g		0.02	BVSS08S01	SS	20			0.68	3
PCB-128	MO	BVMO07S01	0.357	ng/g		0.02	BVSS07	SS	6.45			0.68	4
PCB-138	MO	BVMO05S01	13.2	ng/g		0.01	BVSS05S01	SS	16			0.68	1
PCB-138	MO	BVMO06S01	4.72	ng/g		0.02	BVSS06S01	SS	6			0.68	2
PCB-138	MO	BVMO08S01	8.77	ng/g		0.02	BVSS08S01	SS	84			0.68	3
PCB-138	MO	BVMO07S01	1.02	ng/g		0.02	BVSS07	SS	21			0.68	4
PCB-153	MO	BVMO06S01	4.56	ng/g		0.02	BVSS06S01	SS	3			0.68	1
PCB-153	MO	BVMO05S01	10.7	ng/g		0.01	BVSS05S01	SS	8			0.68	2
PCB-153	MO	BVMO08S01	7.61	ng/g		0.02	BVSS08S01	SS	45			0.68	3
PCB-153	MO	BVMO07S01	0.593	ng/g		0.02	BVSS07	SS	10			0.68	4
PCB-156	MO	BVMO05S01	2.13	ng/g		0.01	BVSS05S01	SS	1.5			0.68	1
PCB-156	MO	BVMO06S01	0.527	ng/g		0.02	BVSS06S01	SS	0.62			0.68	2
PCB-156	MO	BVMO08S01	0.812	ng/g		0.02	BVSS08S01	SS	10			0.68	3
PCB-156	MO	BVMO07S01	0.0682	ng/g		0.02	BVSS07	SS	1.15			0.68	4
PCB-157	MO	BVMO05S01	4.82	ng/g		0.01	BVSS05S01	SS	0.43			0.68	1
PCB-157	MO	BVMO06S01	0.137	ng/g		0.02	BVSS06S01	SS	0.16			0.68	2
PCB-157	MO	BVMO08S01	0.212	ng/g		0.02	BVSS08S01	SS	2.1			0.68	3
PCB-157	MO	BVMO07S01	0.0265	ng/g		0.02	BVSS07	SS	0.56			0.68	4
PCB-167	MO	BVMO06S01	0.426	ng/g		0.02	BVSS06S01	SS	0.25			0.68	1
PCB-167	MO	BVMO05S01	1.11	ng/g		0.01	BVSS05S01	SS	0.71			0.68	2
PCB-167	MO	BVMO08S01	0.349	ng/g		0.02	BVSS08S01	SS	3.7			0.68	3
PCB-167	MO	BVMO07S01	0.0695	ng/g		0.02	BVSS07	SS	0.965			0.68	4
PCB-170	MO	BVMO05S01	1.99	ng/g		0.01	BVSS05S01	SS	1.4			0.68	1
PCB-170	MO	BVMO06S01	0.641	ng/g		0.02	BVSS06S01	SS	0.48			0.68	2
PCB-170	MO	BVMO08S01	0.769	ng/g		0.02	BVSS08S01	SS	6.8			0.68	3
PCB-170	MO	BVMO07S01	0.0918	ng/g		0.02	BVSS07	SS	2.5			0.68	4

Appendix K, Attachment K-6 (3 of 3)

Data Used in Terrestrial Vertebrate Bioaccumulation Factor Selection

CHEMICAL	TISSUE TYPE	TISSUE SAMPLE ID	TISSUE CONCENTRATION (WET WEIGHT)	UNITS	TISSUE VALIDATION QUALIFIER	TISSUE DETECTION LIMIT	SOIL SAMPLE ID	SOIL TYPE	SOIL CONCENTRATION (DRY WEIGHT)	SOIL VALIDATION QUALIFIER	SOIL DETECTION LIMIT	PERCENT MOISTURE	BAF Rank
PCB-18	MO	BVMO08S01	0.023	ng/g		0.02	BVSS08S01	SS	1.1			0.68	
PCB-180	MO	BVMO06S01	1.32	ng/g		0.02	BVSS06S01	SS	0.92			0.68	1
PCB-180	MO	BVMO05S01	2.69	ng/g		0.01	BVSS05S01	SS	2.7			0.68	2
PCB-180	MO	BVMO08S01	2.09	ng/g		0.02	BVSS08S01	SS	12			0.68	3
PCB-180	MO	BVMO07S01	0.204	ng/g		0.02	BVSS07	SS	4.95			0.68	4
PCB-187	MO	BVMO05S01	0.39	ng/g		0.01	BVSS05S01	SS	0.96			0.68	1
PCB-187	MO	BVMO06S01	0.0995	ng/g		0.02	BVSS06S01	SS	0.31			0.68	2
PCB-187	MO	BVMO08S01	0.628	ng/g		0.02	BVSS08S01	SS	3.6			0.68	3
PCB-187	MO	BVMO07S01	0.0614	ng/g		0.02	BVSS07	SS	1.95			0.68	4
PCB-189	MO	BVMO05S01	0.2	ng/g		0.01	BVSS05S01	SS	0.088			0.68	1
PCB-189	MO	BVMO06S01	0.0425	ng/g		0.02	BVSS06S01	SS	0.037	J		0.68	2
PCB-189	MO	BVMO08S01	0.0596	ng/g		0.02	BVSS08S01	SS	0.37			0.68	3
PCB-195	MO	BVMO06S01	0.0603	ng/g		0.02	BVSS06S01	SS	0.054			0.68	1
PCB-195	MO	BVMO05S01	0.072	ng/g		0.01	BVSS05S01	SS	0.14			0.68	2
PCB-195	MO	BVMO08S01	0.121	ng/g		0.02	BVSS08S01	SS	0.54			0.68	3
PCB-206	MO	BVMO06S01	0.0978	ng/g		0.02	BVSS06S01	SS	0.15			0.68	1
PCB-206	MO	BVMO05S01	0.166	ng/g		0.01	BVSS05S01	SS	0.31			0.68	2
PCB-206	MO	BVMO08S01	0.144	ng/g		0.02	BVSS08S01	SS	1			0.68	3
PCB-209	MO	BVMO06S01	0.0382	ng/g		0.02	BVSS06S01	SS	0.047	J		0.68	1
PCB-209	MO	BVMO05S01	0.0275	ng/g		0.01	BVSS05S01	SS	0.087			0.68	2
PCB-209	MO	BVMO08S01	0.047	ng/g		0.02	BVSS08S01	SS	0.61			0.68	3
PCB-66	MO	BVMO06S01	0.0993	ng/g		0.02	BVSS06S01	SS	0.23			0.68	1
PCB-66	MO	BVMO05S01	0.158	ng/g		0.01	BVSS05S01	SS	0.45			0.68	2
PCB-66	MO	BVMO07S01	0.0686	ng/g		0.02	BVSS07	SS	0.425			0.68	3
PCB-66	MO	BVMO08S01	0.0487	ng/g		0.02	BVSS08S01	SS	6.1			0.68	4
PCB-77	MO	BVMO06S01	0.0241	ng/g		0.02	BVSS06S01	SS	0.098			0.68	
PCB-8	MO	BVMO08S01	0.0214	ng/g		0.02	BVSS08S01	SS	0.18			0.68	
PCB-90/101	MO	BVMO07S01	0.352	ng/g		0.039999999	BVSS07	SS	4.75			0.68	1
PCB-90/101	MO	BVMO06S01	0.135	ng/g		0.039999999	BVSS06S01	SS	2.3			0.68	2
PCB-90/101	MO	BVMO05S01	0.0849	ng/g		0.029999999	BVSS05S01	SS	8			0.68	3
PCB-90/101	MO	BVMO08S01	0.478	ng/g		0.039999999	BVSS08S01	SS	78			0.68	4
Phenanthrene	MO	CLMO05S01	2.9	UG/KG	J		CLSS05S01	SS	2.7			0.68	
Pyrene	MO	CLMO05S01	5.1	UG/KG			CLSS05S01	SS	4.4	J		0.68	
Selenium	MO	BVMO05S01	0.2666	MG/KG			BVSS05S01	SS	0.14		0.1	0.68	
Selenium	MO	BVMO08S01	0.3455	MG/KG			BVSS08S01	SS	0.19		0.1	0.68	
Vanadium	MO	BVMO07S01	1.4035	MG/KG			BVSS07	SS	24.0803	J		0.68	1
Vanadium	MO	BVMO08S01	0.7064	MG/KG			BVSS08S01	SS	17.5	J		0.68	2
Vanadium	MO	BVMO06S01	0.4789	MG/KG			BVSS06S01	SS	23.7	J		0.68	3
Vanadium	MO	BVMO05S01	0.193	MG/KG			BVSS05S01	SS	18.8	J		0.68	4
Zinc	MO	BVMO05S01	71.1137	MG/KG			BVSS05S01	SS	55.3	J		0.68	1
Zinc	MO	BVMO06S01	37.133	MG/KG			BVSS06S01	SS	55.1	J		0.68	2
Zinc	MO	BVMO08S01	73.6156	MG/KG			BVSS08S01	SS	146	J		0.68	3
Zinc	MO	BVMO07S01	36.4691	MG/KG			BVSS07	SS	82.33795	J		0.68	4

APPENDIX K

ATTACHMENT K-7

DATA USED IN TERRESTRIAL INVERTEBRATE BIOACCUMULATION FACTOR SELECTION

Data Used in Terrestrial Invertebrate Bioaccumulation Factor Selection

CHEMICAL	TISSUE TYPE	TISSUE SAMPLE ID	TISSUE CONCENTRATION (WET WEIGHT)	UNITS	TISSUE VALIDATION QUALIFIER	TISSUE DETECTION LIMIT	SOIL SAMPLE ID	SOIL TYPE	SOIL CONCENTRATION (DRY WEIGHT)	SOIL VALIDATION QUALIFIER	SOIL DETECTION LIMIT	BAF Rank
1,2,3,4,6,7,8-HpCDD	TI	CLTI07S01	24.3	pg/g			CLSS07S01	SS	41.4			1
1,2,3,4,6,7,8-HpCDD	TI	CLTI06S01	40.8	pg/g			CLSS06S01	SS	97.1			2
1,2,3,4,6,7,8-HpCDD	TI	CLTI05S01	23	pg/g			CLSS05S01	SS	96.6			3
1,2,3,4,6,7,8-HpCDD	TI	CLTI04S01	2.59	pg/g			CLSS04	SS	16.45			4
1,2,3,4,6,7,8-HpCDF	TI	CLTI07S01	3.89	pg/g			CLSS07S01	SS	6.74			1
1,2,3,4,6,7,8-HpCDF	TI	CLTI06S01	1.43	pg/g	J		CLSS06S01	SS	8.29			2
1,2,3,4,6,7,8-HpCDF	TI	CLTI05S01	2.27	pg/g			CLSS05S01	SS	15.7			3
1,2,3,4,7,8-HxCDD	TI	CLTI05S01	0.7	pg/g	J		CLSS05S01	SS	1.03	J		
1,2,3,4,7,8-HxCDD	TI	CLTI07S01	0.73	pg/g	J		CLSS07S01	SS	0.83	J		
1,2,3,4,7,8-HxCDF	TI	CLTI07S01	0.49	pg/g	J		CLSS07S01	SS	0.75	J		
1,2,3,6,7,8-HxCDD	TI	CLTI07S01	2.44	pg/g			CLSS07S01	SS	2.95			1
1,2,3,6,7,8-HxCDD	TI	CLTI06S01	3.17	pg/g	J		CLSS06S01	SS	4.24			2
1,2,3,6,7,8-HxCDD	TI	CLTI05S01	1.99	pg/g			CLSS05S01	SS	4.04			3
1,2,3,6,7,8-HxCDF	TI	CLTI07S01	0.38	pg/g	J		CLSS07S01	SS	1.47	J		
1,2,3,7,8,9-HxCDD	TI	CLTI06S01	2.34	pg/g	J		CLSS06S01	SS	2.45	J		1
1,2,3,7,8,9-HxCDD	TI	CLTI07S01	1.09	pg/g	J		CLSS07S01	SS	1.73	J		2
1,2,3,7,8,9-HxCDD	TI	CLTI05S01	0.93	pg/g	J		CLSS05S01	SS	2.07	J		3
1,2,3,7,8-PeCDD	TI	CLTI05S01	0.43	pg/g	J		CLSS05S01	SS	0.63	J		
1,2,3,7,8-PeCDD	TI	CLTI07S01	0.59	pg/g	J		CLSS07S01	SS	0.55	J		
1,2,3,7,8-PeCDF	TI	CLTI05S01	0.13	pg/g	J		CLSS05S01	SS	0.33	J		
1,2,3,7,8-PeCDF	TI	CLTI07S01	0.22	pg/g	J		CLSS07S01	SS	0.48	J		
2,3,4,6,7,8-HxCDF	TI	CLTI07S01	0.35	pg/g	J		CLSS07S01	SS	0.626	J		
2,3,4,7,8-PeCDF	TI	CLTI05S01	0.2	pg/g	J		CLSS05S01	SS	0.63	J		
2,3,4,7,8-PeCDF	TI	CLTI07S01	0.44	pg/g	J		CLSS07S01	SS	0.619	J		
2,3,7,8-TCDF	TI	CLTI06S01	0.94	pg/g	J		CLSS06S01	SS	0.81			1
2,3,7,8-TCDF	TI	CLTI07S01	0.41	pg/g	J		CLSS07S01	SS	0.69			2
2,3,7,8-TCDF	TI	CLTI05S01	0.36	pg/g	J		CLSS05S01	SS	0.72			3
2,3,7,8-TCDF	TI	CLTI04S01	0.421	pg/g		0	CLSS04	SS	2.345			4
Acenaphthene	TI	CLTI06S01	13	UG/KG	J		CLSS06S01	SS	5.4	J		
Aluminum	TI	BVTI07S01	3466.6221	MG/KG			BVSS07	SS	8792.5669	J		1
Aluminum	TI	BVTI05S01	2728.8288	MG/KG			BVSS05S01	SS	7370	J	90	2
Aluminum	TI	BVTI06S01	1996.7576	MG/KG			BVSS06S01	SS	9300	J	90	3
Aluminum	TI	BVTI08S01	643.3884	MG/KG			BVSS08S01	SS	6350	J	90	4
Anthracene	TI	CLTI06S01	31	UG/KG			CLSS06S01	SS	11			
Antimony	TI	BVTI05S01	5.9865	MG/KG			BVSS05S01	SS	0.61	J	0.2	1
Antimony	TI	BVTI06S01	1.3011	MG/KG			BVSS06S01	SS	0.62	J	0.2	2
Antimony	TI	BVTI07S01	2.1256	MG/KG			BVSS07	SS	1.2443	J		3
Antimony	TI	BVTI08S01	0.9343	MG/KG			BVSS08S01	SS	0.78	J	0.2	4
Arsenic	TI	BVTI07S01	2.2118	MG/KG			BVSS07	SS	3.4736	J		1
Arsenic	TI	BVTI06S01	1.5366	MG/KG			BVSS06S01	SS	3.7			2
Arsenic	TI	BVTI08S01	0.4607	MG/KG			BVSS08S01	SS	3			3
Barium	TI	BVTI07S01	161.7032	MG/KG			BVSS07	SS	54.32885			1
Barium	TI	BVTI05S01	99.1441	MG/KG			BVSS05S01	SS	43.6	J		2
Barium	TI	BVTI06S01	48.8723	MG/KG			BVSS06S01	SS	55.2	J		3
Barium	TI	BVTI08S01	37.4504	MG/KG			BVSS08S01	SS	44.2	J		4
Benzo(a)anthracene	TI	CLTI06S01	89	UG/KG	J		CLSS06S01	SS	47	J		
Benzo(a)pyrene	TI	CLTI06S01	60	UG/KG	J	15	CLSS06S01	SS	60	J		
Benzo(b)fluoranthene	TI	CLTI06S01	94	UG/KG	J	15	CLSS06S01	SS	46			
Benzo(e)pyrene	TI	CLTI06S01	50	UG/KG	J	15	CLSS06S01	SS	46	J		
Benzo(g,h,i)perylene	TI	CLTI06S01	34	UG/KG		15	CLSS06S01	SS	64			
Benzo(k)fluoranthene	TI	CLTI06S01	50	UG/KG		15	CLSS06S01	SS	56			
Beryllium	TI	BVTI07S01	0.1308	MG/KG			BVSS07	SS	0.3245			1
Beryllium	TI	BVTI06S01	0.1081	MG/KG			BVSS06S01	SS	0.45			2

Data Used in Terrestrial Invertebrate Bioaccumulation Factor Selection

CHEMICAL	TISSUE TYPE	TISSUE SAMPLE ID	TISSUE CONCENTRATION (WET WEIGHT)	UNITS	TISSUE VALIDATION QUALIFIER	TISSUE DETECTION LIMIT	SOIL SAMPLE ID	SOIL TYPE	SOIL CONCENTRATION (DRY WEIGHT)	SOIL VALIDATION QUALIFIER	SOIL DETECTION LIMIT	BAF Rank
Beryllium	TI	BVTI08S01	0.0254	MG/KG			BVSS08S01	SS	0.33			3
Boron	TI	BVTI07S01	6.6714	MG/KG			BVSS07	SS	1.4365			
Cadmium	TI	BVTI05S01	9.2342	MG/KG			BVSS05S01	SS	0.44			1
Cadmium	TI	BVTI07S01	6.7492	MG/KG			BVSS07	SS	1.1791	J		2
Cadmium	TI	BVTI08S01	3.1579	MG/KG			BVSS08S01	SS	3.3			3
Chromium	TI	BVTI06S01	37.3546	MG/KG			BVSS06S01	SS	14.2	J		1
Chromium	TI	BVTI05S01	29.6577	MG/KG			BVSS05S01	SS	12.2	J		2
Chromium	TI	BVTI07S01	12.6819	MG/KG			BVSS07	SS	15.21855	J		3
Chromium	TI	BVTI08S01	11.5579	MG/KG			BVSS08S01	SS	21.5	J		4
Chrysene	TI	CLTI06S01	110	UG/KG	J		CLSS06S01	SS	59			
Cobalt	TI	BVTI07S01	1.5024	MG/KG			BVSS07	SS	5.644	J		1
Cobalt	TI	BVTI06S01	1.0086	MG/KG			BVSS06S01	SS	5.2	J		2
Cobalt	TI	BVTI08S01	0.4661	MG/KG			BVSS08S01	SS	4.7	J		3
Copper	TI	BVTI05S01	157.4324	MG/KG			BVSS05S01	SS	9.1	J	2	1
Copper	TI	BVTI07S01	109.0848	MG/KG			BVSS07	SS	13.7714			2
Copper	TI	BVTI06S01	56.7937	MG/KG			BVSS06S01	SS	9	J	2	3
Copper	TI	BVTI08S01	79.2562	MG/KG			BVSS08S01	SS	19.9	J	2	4
Fluoranthene	TI	CLTI06S01	170	UG/KG			CLSS06S01	SS	110			
Fluoranthene	TI	CLTI07S01	4.5	UG/KG	J		CLSS07S01	SS	17			
Fluorene	TI	CLTI06S01	13	UG/KG	J		CLSS06S01	SS	3.3	J		
Indeno(1,2,3-cd)pyrene	TI	CLTI06S01	42	UG/KG		15	CLSS06S01	SS	49			
Iron	TI	BVTI07S01	7728.7937	MG/KG			BVSS07	SS	16583.18595	J		1
Iron	TI	BVTI05S01	5608.1081	MG/KG			BVSS05S01	SS	15027.2345	J		2
Iron	TI	BVTI06S01	3806.255	MG/KG			BVSS06S01	SS	17534.6113	J		3
Iron	TI	BVTI08S01	1427.2727	MG/KG			BVSS08S01	SS	17288.8158	J		4
Lead	TI	BVTI07S01	7.6426	MG/KG			BVSS07	SS	20.2189	J		
Lead	TI	BVTI08S01	2.512	MG/KG			BVSS08S01	SS	23.1	J	0.9	
Magnesium	TI	BVTI05S01	3542.3423	MG/KG			BVSS05S01	SS	2700	J		1
Magnesium	TI	BVTI07S01	3022.4193	MG/KG			BVSS07	SS	3423.9578			2
Magnesium	TI	BVTI06S01	2267.1305	MG/KG			BVSS06S01	SS	3470	J		3
Magnesium	TI	BVTI08S01	1331.405	MG/KG			BVSS08S01	SS	2660	J		4
Manganese	TI	BVTI07S01	125.0627	MG/KG			BVSS07	SS	169.49945	J		1
Manganese	TI	BVTI05S01	90	MG/KG			BVSS05S01	SS	137	J		2
Manganese	TI	BVTI06S01	68.0293	MG/KG			BVSS06S01	SS	223	J		3
Manganese	TI	BVTI08S01	25.219	MG/KG			BVSS08S01	SS	189	J		4
Mercury	TI	BVTI07S01	0.0739	MG/KG			BVSS07	SS	0.02075	J		1
Mercury	TI	BVTI08S01	0.0574	MG/KG			BVSS08S01	SS	0.106			2
Mercury	TI	BVTI06S01	0.0516	MG/KG			BVSS06S01	SS	0.2057			3
Molybdenum	TI	BVTI06S01	1.2236	MG/KG			BVSS06S01	SS	0.17			1
Molybdenum	TI	BVTI05S01	1.6811	MG/KG			BVSS05S01	SS	0.62			2
Molybdenum	TI	BVTI07S01	0.9963	MG/KG			BVSS07	SS	0.8219			3
Molybdenum	TI	BVTI08S01	0.5322	MG/KG			BVSS08S01	SS	1.3			4
Nickel	TI	BVTI06S01	16.8175	MG/KG			BVSS06S01	SS	7.4			1
Nickel	TI	BVTI05S01	13.2297	MG/KG			BVSS05S01	SS	6.3			2
Nickel	TI	BVTI07S01	6.6957	MG/KG			BVSS07	SS	9.39915	J		3
Nickel	TI	BVTI08S01	5.1612	MG/KG			BVSS08S01	SS	12.6			4
OCDD	TI	CLTI07S01	259	pg/g			CLSS07S01	SS	455			1
OCDD	TI	CLTI05S01	203	pg/g			CLSS05S01	SS	1000			2
OCDD	TI	CLTI06S01	157	pg/g			CLSS06S01	SS	904			3
OCDD	TI	CLTI04S01	16.6	pg/g			CLSS04	SS	210.5			4
OCDF	TI	CLTI07S01	6.8	pg/g			CLSS07S01	SS	12.5			1
OCDF	TI	CLTI06S01	2.1	pg/g	J		CLSS06S01	SS	20.4			2
OCDF	TI	CLTI05S01	3.53	pg/g			CLSS05S01	SS	74.7			3
PCB-105	TI	BVTI07S01	22.5	ng/g			BVSS07	SS	1.8			1
PCB-105	TI	BVTI05S01	34.2	ng/g			BVSS05S01	SS	3.3			2
PCB-105	TI	BVTI06S01	7.95	ng/g			BVSS06S01	SS	1.3			3
PCB-105	TI	BVTI08S01	22.2	ng/g			BVSS08S01	SS	25			4

Data Used in Terrestrial Invertebrate Bioaccumulation Factor Selection

CHEMICAL	TISSUE TYPE	TISSUE SAMPLE ID	TISSUE CONCENTRATION (WET WEIGHT)	UNITS	TISSUE VALIDATION QUALIFIER	TISSUE DETECTION LIMIT	SOIL SAMPLE ID	SOIL TYPE	SOIL CONCENTRATION (DRY WEIGHT)	SOIL VALIDATION QUALIFIER	SOIL DETECTION LIMIT	BAF Rank
PCB-114	TI	BVTI07S01	0.958	ng/g			BVSS07	SS	0.031	J		1
PCB-114	TI	BVTI05S01	1.19	ng/g			BVSS05S01	SS	0.081			2
PCB-114	TI	BVTI06S01	0.269	ng/g			BVSS06S01	SS	0.028	J		3
PCB-114	TI	BVTI08S01	1.04	ng/g			BVSS08S01	SS	0.91			4
PCB-118	TI	BVTI07S01	52	ng/g			BVSS07	SS	3.6			1
PCB-118	TI	BVTI05S01	75.7	ng/g			BVSS05S01	SS	6.6			2
PCB-118	TI	BVTI06S01	18.8	ng/g			BVSS06S01	SS	2.3			3
PCB-118	TI	BVTI08S01	55.9	ng/g			BVSS08S01	SS	57			4
PCB-123	TI	BVTI05S01	1.2	ng/g			BVSS05S01	SS	0.095			1
PCB-123	TI	BVTI06S01	0.314	ng/g			BVSS06S01	SS	0.029	J		2
PCB-123	TI	BVTI07S01	0.609	ng/g			BVSS07	SS	0.2815			3
PCB-123	TI	BVTI08S01	0.58	ng/g			BVSS08S01	SS	0.65			4
PCB-126	TI	BVTI05S01	0.467	ng/g			BVSS05S01	SS	0.069			1
PCB-126	TI	BVTI07S01	0.41	ng/g			BVSS07	SS	0.077			2
PCB-126	TI	BVTI06S01	0.197	ng/g			BVSS06S01	SS	0.038	J		3
PCB-126	TI	BVTI08S01	0.13	ng/g			BVSS08S01	SS	0.32			4
PCB-128	TI	BVTI05S01	23.3	ng/g			BVSS05S01	SS	4.2			1
PCB-128	TI	BVTI06S01	5.71	ng/g			BVSS06S01	SS	1.5			2
PCB-128	TI	BVTI07S01	17.2	ng/g			BVSS07	SS	6.45			3
PCB-128	TI	BVTI08S01	13.1	ng/g			BVSS08S01	SS	20			4
PCB-138	TI	BVTI05S01	101	ng/g			BVSS05S01	SS	16			1
PCB-138	TI	BVTI06S01	26.8	ng/g			BVSS06S01	SS	6			2
PCB-138	TI	BVTI07S01	75.4	ng/g			BVSS07	SS	21			3
PCB-138	TI	BVTI08S01	53	ng/g			BVSS08S01	SS	84			4
PCB-153	TI	BVTI05S01	65.2	ng/g			BVSS05S01	SS	8			1
PCB-153	TI	BVTI06S01	21.2	ng/g			BVSS06S01	SS	3			2
PCB-153	TI	BVTI07S01	48.6	ng/g			BVSS07	SS	10			3
PCB-153	TI	BVTI08S01	37.8	ng/g			BVSS08S01	SS	45			4
PCB-156	TI	BVTI05S01	9.98	ng/g			BVSS05S01	SS	1.5			1
PCB-156	TI	BVTI07S01	6.67	ng/g			BVSS07	SS	1.15			2
PCB-156	TI	BVTI06S01	2.48	ng/g			BVSS06S01	SS	0.62			3
PCB-156	TI	BVTI08S01	7.05	ng/g			BVSS08S01	SS	10			4
PCB-157	TI	BVTI05S01	2.55	ng/g			BVSS05S01	SS	0.43			1
PCB-157	TI	BVTI06S01	0.735	ng/g			BVSS06S01	SS	0.16			2
PCB-157	TI	BVTI07S01	1.93	ng/g			BVSS07	SS	0.56			3
PCB-157	TI	BVTI08S01	1.68	ng/g			BVSS08S01	SS	2.1			4
PCB-167	TI	BVTI05S01	4.58	ng/g			BVSS05S01	SS	0.71			1
PCB-167	TI	BVTI06S01	1.47	ng/g			BVSS06S01	SS	0.25			2
PCB-167	TI	BVTI07S01	3.64	ng/g			BVSS07	SS	0.965			3
PCB-167	TI	BVTI08S01	3.22	ng/g			BVSS08S01	SS	3.7			4
PCB-170	TI	BVTI05S01	6.24	ng/g			BVSS05S01	SS	1.4			1
PCB-170	TI	BVTI06S01	1.56	ng/g			BVSS06S01	SS	0.48			2
PCB-170	TI	BVTI07S01	5.04	ng/g			BVSS07	SS	2.5			3
PCB-170	TI	BVTI08S01	3.9	ng/g			BVSS08S01	SS	6.8			4
PCB-18	TI	BVTI08S01	0.156	ng/g			BVSS08S01	SS	1.1			
PCB-180	TI	BVTI05S01	10.2	ng/g			BVSS05S01	SS	2.7			1
PCB-180	TI	BVTI06S01	3.3	ng/g			BVSS06S01	SS	0.92			2
PCB-180	TI	BVTI07S01	9.45	ng/g			BVSS07	SS	4.95			3
PCB-180	TI	BVTI08S01	6.55	ng/g			BVSS08S01	SS	12			4
PCB-187	TI	BVTI05S01	7.73	ng/g			BVSS05S01	SS	0.96			1
PCB-187	TI	BVTI06S01	1.99	ng/g			BVSS06S01	SS	0.31			2
PCB-187	TI	BVTI07S01	7.92	ng/g			BVSS07	SS	1.95			3
PCB-187	TI	BVTI08S01	3.63	ng/g			BVSS08S01	SS	3.6			4
PCB-189	TI	BVTI05S01	0.228	ng/g			BVSS05S01	SS	0.088			1
PCB-189	TI	BVTI06S01	0.0883	ng/g			BVSS06S01	SS	0.037	J		2
PCB-189	TI	BVTI07S01	0.314	ng/g			BVSS07	SS	0.145			3
PCB-189	TI	BVTI08S01	0.106	ng/g			BVSS08S01	SS	0.37			4
PCB-195	TI	BVTI05S01	0.27	ng/g			BVSS05S01	SS	0.14			1
PCB-195	TI	BVTI06S01	0.0901	ng/g			BVSS06S01	SS	0.054			2
PCB-195	TI	BVTI07S01	0.31	ng/g			BVSS07	SS	0.315			3
PCB-195	TI	BVTI08S01	0.277	ng/g			BVSS08S01	SS	0.54			4

Data Used in Terrestrial Invertebrate Bioaccumulation Factor Selection

CHEMICAL	TISSUE TYPE	TISSUE SAMPLE ID	TISSUE CONCENTRATION (WET WEIGHT)	UNITS	TISSUE VALIDATION QUALIFIER	TISSUE DETECTION LIMIT	SOIL SAMPLE ID	SOIL TYPE	SOIL CONCENTRATION (DRY WEIGHT)	SOIL VALIDATION QUALIFIER	SOIL DETECTION LIMIT	BAF Rank
PCB-206	TI	BVTI06S01	0.149	ng/g			BVSS06S01	SS	0.15			1
PCB-206	TI	BVTI07S01	0.246	ng/g			BVSS07	SS	0.5			2
PCB-206	TI	BVTI08S01	0.096	ng/g			BVSS08S01	SS	1			3
PCB-209	TI	BVTI05S01	0.138	ng/g			BVSS05S01	SS	0.087			1
PCB-209	TI	BVTI07S01	0.147	ng/g			BVSS07	SS	0.115			2
PCB-209	TI	BVTI08S01	0.0662	ng/g			BVSS08S01	SS	0.61			3
PCB-28	TI	BVTI08S01	0.907	ng/g			BVSS08S01	SS	0.54			
PCB-44	TI	BVTI07S01	1.55	ng/g			BVSS07	SS	0.17			1
PCB-44	TI	BVTI05S01	0.749	ng/g			BVSS05S01	SS	0.34			2
PCB-44	TI	BVTI06S01	0.262	ng/g			BVSS06S01	SS	0.15			3
PCB-44	TI	BVTI08S01	1.05	ng/g			BVSS08S01	SS	12			4
PCB-52	TI	BVTI07S01	7.04	ng/g			BVSS07	SS	0.515			1
PCB-52	TI	BVTI05S01	5.72	ng/g			BVSS05S01	SS	1			2
PCB-52	TI	BVTI06S01	1.3	ng/g			BVSS06S01	SS	0.42			3
PCB-52	TI	BVTI08S01	5.54	ng/g			BVSS08S01	SS	28			4
PCB-66	TI	BVTI07S01	4.65	ng/g			BVSS07	SS	0.425			1
PCB-66	TI	BVTI05S01	3.76	ng/g			BVSS05S01	SS	0.45			2
PCB-66	TI	BVTI06S01	1.2	ng/g			BVSS06S01	SS	0.23			3
PCB-66	TI	BVTI08S01	3.59	ng/g			BVSS08S01	SS	6.1			4
PCB-77	TI	BVTI05S01	1.26	ng/g			BVSS05S01	SS	0.18			1
PCB-77	TI	BVTI07S01	1.03	ng/g			BVSS07	SS	0.29			2
PCB-77	TI	BVTI06S01	0.329	ng/g			BVSS06S01	SS	0.098			3
PCB-77	TI	BVTI08S01	0.83	ng/g			BVSS08S01	SS	1.2			4
PCB-8	TI	BVTI08S01	0.0391	ng/g			BVSS08S01	SS	0.18			
PCB-81	TI	BVTI05S01	0.41	ng/g			BVSS05S01	SS	0.059			1
PCB-81	TI	BVTI07S01	0.308	ng/g			BVSS07	SS	0.0515			2
PCB-81	TI	BVTI06S01	0.0801	ng/g			BVSS06S01	SS	0.023	J		3
PCB-81	TI	BVTI08S01	0.28	ng/g			BVSS08S01	SS	0.62			4
PCB-90/101	TI	BVTI07S01	37.7	ng/g			BVSS07	SS	4.75			1
PCB-90/101	TI	BVTI05S01	49.5	ng/g			BVSS05S01	SS	8			2
PCB-90/101	TI	BVTI06S01	12.2	ng/g			BVSS06S01	SS	2.3			3
PCB-90/101	TI	BVTI08S01	26.7	ng/g			BVSS08S01	SS	78			4
Phenanthrene	TI	CLTI05S01	2.8	UG/KG	J		CLSS05S01	SS	2.7			
Phenanthrene	TI	CLTI06S01	130	UG/KG			CLSS06S01	SS	49			
Pyrene	TI	CLTI06S01	130	UG/KG			CLSS06S01	SS	120	J		
Pyrene	TI	CLTI07S01	76	UG/KG			CLSS07S01	SS	16			
Selenium	TI	BVTI08S01	0.35	MG/KG	J		BVSS08S01	SS	0.19		0.1	
Silver	TI	BVTI08S01	0.7351	MG/KG			BVSS08S01	SS	0.11			1
Silver	TI	BVTI06S01	0.5464	MG/KG			BVSS06S01	SS	0.09			2
Silver	TI	BVTI07S01	1.131	MG/KG			BVSS07	SS	0.19255			3
Thallium	TI	BVTI05S01	2.2014	MG/KG			BVSS05S01	SS	2			1
Thallium	TI	BVTI07S01	0.98	MG/KG			BVSS07	SS	1.67295			2
Thallium	TI	BVTI06S01	0.3639	MG/KG			BVSS06S01	SS	2.3			3
Vanadium	TI	BVTI07S01	7.9271	MG/KG			BVSS07	SS	24.0803	J		1
Vanadium	TI	BVTI05S01	6.0901	MG/KG			BVSS05S01	SS	18.8	J		2
Vanadium	TI	BVTI06S01	4.7923	MG/KG			BVSS06S01	SS	23.7	J		3
Vanadium	TI	BVTI08S01	1.4529	MG/KG			BVSS08S01	SS	17.5	J		4
Zinc	TI	BVTI05S01	180.4955	MG/KG			BVSS05S01	SS	55.3	J		1
Zinc	TI	BVTI07S01	183.8715	MG/KG			BVSS07	SS	82.33795	J		2
Zinc	TI	BVTI06S01	106.5074	MG/KG			BVSS06S01	SS	55.1	J		3
Zinc	TI	BVTI08S01	71.7355	MG/KG			BVSS08S01	SS	146	J		4

APPENDIX K

ATTACHMENT K-8

DATA USED IN TERRESTRIAL PLANT BIOACCUMULATION FACTOR SELECTION

Appendix K, Attachment K-8 (1 of 3)

Data Used in Terrestrial Plant Bioaccumulation Factor Selection

CHEMICAL	TISSUE TYPE	TISSUE SAMPLE ID	TISSUE CONCENTRATION (WET WEIGHT)	UNITS	TISSUE VALIDATION QUALIFIER	TISSUE DETECTION LIMIT	SOIL SAMPLE ID	SOIL TYPE	SOIL CONCENTRATION (DRY WEIGHT)	SOIL VALIDATION QUALIFIER	SOIL DETECTION LIMIT	BAF Rank
1,2,3,4,6,7,8-HpCDD	TP	CLTP04S01	5.6	pg/g			CLSS04	SS	16.45			1
1,2,3,4,6,7,8-HpCDD	TP	CLTP07S01	10.8	pg/g			CLSS07S01	SS	41.4			2
1,2,3,4,6,7,8-HpCDD	TP	CLTP05S01	10.7	pg/g			CLSS05S01	SS	96.6			3
1,2,3,4,6,7,8-HpCDD	TP	CLTP06S01	4.21	pg/g			CLSS06S01	SS	97.1			4
1,2,3,4,6,7,8-HpCDF	TP	CLTP07S01	1.76	pg/g	J		CLSS07S01	SS	6.74			1
1,2,3,4,6,7,8-HpCDF	TP	CLTP05S01	3.33	pg/g	J		CLSS05S01	SS	15.7			2
1,2,3,4,6,7,8-HpCDF	TP	CLTP06S01	1.09	pg/g	J		CLSS06S01	SS	8.29			3
1,2,3,6,7,8-HxCDD	TP	CLTP05S01	0.66	pg/g	J		CLSS05S01	SS	4.04			
Aluminum	TP	BVTP06S01	7151.5293	MG/KG			BVSS06S01	SS	9300	J	90	1
Aluminum	TP	BVTP08S01	4714.4439	MG/KG			BVSS08S01	SS	6350	J	90	2
Aluminum	TP	BVTP07S01	4519.0747	MG/KG			BVSS07	SS	8793	J		3
Aluminum	TP	BVTP05S01	2160.7606	MG/KG			BVSS05S01	SS	7370	J	90	4
Antimony	TP	BVTP05S01	3.3823	MG/KG			BVSS05S01	SS	0.61	J	0.2	1
Antimony	TP	BVTP06S01	2.868	MG/KG			BVSS06S01	SS	0.62	J	0.2	2
Antimony	TP	BVTP08S01	2.9594	MG/KG			BVSS08S01	SS	0.78	J	0.2	3
Antimony	TP	BVTP07S01	3.4619	MG/KG			BVSS07	SS	1.24	J		4
Arsenic	TP	BVTP08S01	2.3509	MG/KG			BVSS08S01	SS	3			1
Arsenic	TP	BVTP06S01	2.8473	MG/KG			BVSS06S01	SS	3.7			2
Arsenic	TP	BVTP07S01	1.9663	MG/KG			BVSS07	SS	3.5	J		3
Barium	TP	BVTP07S01	60.3084	MG/KG			BVSS07	SS	54			1
Barium	TP	BVTP06S01	55.4262	MG/KG			BVSS06S01	SS	55.2	J		2
Barium	TP	BVTP08S01	42.1136	MG/KG			BVSS08S01	SS	44.2	J		3
Barium	TP	BVTP05S01	25.4201	MG/KG			BVSS05S01	SS	43.6	J		4
Benzo(a)anthracene	TP	CLTP04S01	11	UG/KG	J		CLSS04S01	SS	2.1	J		
Beryllium	TP	BVTP06S01	0.2895	MG/KG			BVSS06S01	SS	0.45			1
Beryllium	TP	BVTP07S01	0.1966	MG/KG			BVSS07	SS	0.3245			2
Beryllium	TP	BVTP08S01	0.1965	MG/KG			BVSS08S01	SS	0.33			3
Beryllium	TP	BVTP05S01	0.086	MG/KG			BVSS05S01	SS	0.35			4
Boron	TP	BVTP07S01	10.623	MG/KG			BVSS07	SS	1.4			
Cadmium	TP	BVTP05S01	5.0792	MG/KG			BVSS05S01	SS	0.44			1
Cadmium	TP	BVTP07S01	4.0229	MG/KG			BVSS07	SS	1.2	J		2
Cadmium	TP	BVTP08S01	9.9921	MG/KG			BVSS08S01	SS	3.3			3
Chromium	TP	BVTP06S01	144.8832	MG/KG			BVSS06S01	SS	14.2	J		1
Chromium	TP	BVTP07S01	111.3028	MG/KG			BVSS07	SS	15.21855	J		2
Chromium	TP	BVTP08S01	110.8474	MG/KG			BVSS08S01	SS	21.5	J		3
Chromium	TP	BVTP05S01	42.0052	MG/KG			BVSS05S01	SS	12.2	J		4
Chrysene	TP	CLTP04S01	13	UG/KG	J		CLSS04	SS	4.5	J		1
Chrysene	TP	CLTP07S01	10	UG/KG	J		CLSS07S01	SS	8.9			2
Chrysene	TP	CLTP06S01	4.9	UG/KG	J		CLSS06S01	SS	59			3
Cobalt	TP	BVTP06S01	3.5425	MG/KG			BVSS06S01	SS	5.2	J		1
Cobalt	TP	BVTP08S01	3.125	MG/KG			BVSS08S01	SS	4.7	J		2
Cobalt	TP	BVTP07S01	2.0586	MG/KG			BVSS07	SS	5.644	J		3
Cobalt	TP	BVTP05S01	1.0487	MG/KG			BVSS05S01	SS	4.5	J		4
Copper	TP	BVTP06S01	17.9238	MG/KG			BVSS06S01	SS	9	J	2	1
Copper	TP	BVTP05S01	17.094	MG/KG			BVSS05S01	SS	9.1	J	2	2
Copper	TP	BVTP08S01	32.9484	MG/KG			BVSS08S01	SS	19.9	J	2	3
Copper	TP	BVTP07S01	18.0398	MG/KG			BVSS07	SS	13.7714			4
Fluoranthene	TP	CLTP04S01	20	UG/KG	J		CLSS04	SS	6.6	J		1
Fluoranthene	TP	CLTP07S01	14	UG/KG	J		CLSS07S01	SS	17			2
Fluoranthene	TP	CLTP06S01	11	UG/KG			CLSS06S01	SS	110			3
Iron	TP	BVTP06S01	11871.2509	MG/KG			BVSS06S01	SS	17535	J		1
Iron	TP	BVTP08S01	10831.6195	MG/KG			BVSS08S01	SS	17289	J		2
Iron	TP	BVTP07S01	7739.4481	MG/KG			BVSS07	SS	16583	J		3
Iron	TP	BVTP05S01	4269.6629	MG/KG			BVSS05S01	SS	15027	J		4
Lead	TP	BVTP08S01	60.0221	MG/KG			BVSS08S01	SS	23.1	J	0.9	1
Lead	TP	BVTP06S01	8.1678	MG/KG			BVSS06S01	SS	9.4	J	0.9	2
Lead	TP	BVTP07S01	14.2959	MG/KG			BVSS07	SS	20.2	J		3
Lead	TP	BVTP05S01	8.1475	MG/KG			BVSS05S01	SS	12.2	J	0.9	4
Magnesium	TP	BVTP06S01	4118.9643	MG/KG			BVSS06S01	SS	3470	J		1
Magnesium	TP	BVTP08S01	3023.7832	MG/KG			BVSS08S01	SS	2660	J		2
Magnesium	TP	BVTP07S01	3321.8344	MG/KG			BVSS07	SS	3424			3
Magnesium	TP	BVTP05S01	2527.6097	MG/KG			BVSS05S01	SS	2700	J		4

Appendix K, Attachment K-8 (2 of 3)

Data Used in Terrestrial Plant Bioaccumulation Factor Selection

CHEMICAL	TISSUE TYPE	TISSUE SAMPLE ID	TISSUE CONCENTRATION (WET WEIGHT)	UNITS	TISSUE VALIDATION QUALIFIER	TISSUE DETECTION LIMIT	SOIL SAMPLE ID	SOIL TYPE	SOIL CONCENTRATION (DRY WEIGHT)	SOIL VALIDATION QUALIFIER	SOIL DETECTION LIMIT	BAF Rank
Manganese	TP	BVTP06S01	221.6866	MG/KG			BVSS06S01	SS	223	J		1
Manganese	TP	BVTP08S01	160.7341	MG/KG			BVSS08S01	SS	189	J		2
Manganese	TP	BVTP07S01	142.8571	MG/KG			BVSS07	SS	169	J		3
Manganese	TP	BVTP05S01	73.0625	MG/KG			BVSS05S01	SS	137	J		4
Mercury	TP	BVTP06S01	0.0452	MG/KG			BVSS06S01	SS	0.2057			
Mercury	TP	BVTP08S01	0.1498	MG/KG			BVSS08S01	SS	0.106			
Molybdenum	TP	BVTP06S01	2.7736	MG/KG			BVSS06S01	SS	0.17			1
Molybdenum	TP	BVTP05S01	4.2389	MG/KG			BVSS05S01	SS	0.62			2
Molybdenum	TP	BVTP07S01	2.7597	MG/KG			BVSS07	SS	0.8219			3
Molybdenum	TP	BVTP08S01	3.5163	MG/KG			BVSS08S01	SS	1.3			4
Nickel	TP	BVTP06S01	63.781	MG/KG			BVSS06S01	SS	7.4			1
Nickel	TP	BVTP07S01	51.4915	MG/KG			BVSS07	SS	9.39915	J		2
Nickel	TP	BVTP08S01	48.6526	MG/KG			BVSS08S01	SS	12.6			3
Nickel	TP	BVTP05S01	21.3579	MG/KG			BVSS05S01	SS	6.3			4
OCDD	TP	CLTP07S01	108	pg/g			CLSS07S01	SS	455			1
OCDD	TP	CLTP04S01	49.3	pg/g			CLSS04	SS	210.5			2
OCDD	TP	CLTP05S01	100	pg/g			CLSS05S01	SS	1000			3
OCDD	TP	CLTP06S01	39.2	pg/g			CLSS06S01	SS	904			4
OCDF	TP	CLTP04S01	3.75	pg/g	J		CLSS04	SS	10.75			1
OCDF	TP	CLTP07S01	3.55	pg/g	J		CLSS07S01	SS	12.5			2
OCDF	TP	CLTP06S01	3.26	pg/g	J		CLSS06S01	SS	20.4			3
OCDF	TP	CLTP05S01	10.8	pg/g			CLSS05S01	SS	74.7			4
PCB-105	TP	BVTP08S01	83.9	ng/g			BVSS08S01	SS	25			1
PCB-105	TP	BVTP05S01	10.9	ng/g			BVSS05S01	SS	3.3			2
PCB-105	TP	BVTP07S01	2.72	ng/g			BVSS07	SS	1.8			3
PCB-105	TP	BVTP06S01	1.36	ng/g			BVSS06S01	SS	1.3			4
PCB-114	TP	BVTP05S01	0.352	ng/g			BVSS05S01	SS	0.081			
PCB-114	TP	BVTP08S01	2.75	ng/g			BVSS08S01	SS	0.91			
PCB-118	TP	BVTP08S01	200	ng/g			BVSS08S01	SS	57			1
PCB-118	TP	BVTP05S01	20.8	ng/g			BVSS05S01	SS	6.6			2
PCB-118	TP	BVTP07S01	5.52	ng/g			BVSS07	SS	3.6			3
PCB-118	TP	BVTP06S01	2.06	ng/g			BVSS06S01	SS	2.3			4
PCB-123	TP	BVTP05S01	0.334	ng/g			BVSS05S01	SS	0.095			
PCB-123	TP	BVTP08S01	2.16	ng/g			BVSS08S01	SS	0.65			
PCB-126	TP	BVTP05S01	0.17	ng/g			BVSS05S01	SS	0.069			
PCB-126	TP	BVTP08S01	0.636	ng/g			BVSS08S01	SS	0.32			
PCB-128	TP	BVTP08S01	56.6	ng/g			BVSS08S01	SS	20			1
PCB-128	TP	BVTP05S01	8.44	ng/g			BVSS05S01	SS	4.2			2
PCB-128	TP	BVTP06S01	1.52	ng/g			BVSS06S01	SS	1.5			3
PCB-128	TP	BVTP07S01	3.22	ng/g			BVSS07	SS	6.45			4
PCB-138	TP	BVTP08S01	252	ng/g			BVSS08S01	SS	84			1
PCB-138	TP	BVTP05S01	37.3	ng/g			BVSS05S01	SS	16			2
PCB-138	TP	BVTP06S01	6.31	ng/g			BVSS06S01	SS	6			3
PCB-138	TP	BVTP07S01	13.3	ng/g			BVSS07	SS	21			4
PCB-153	TP	BVTP08S01	143	ng/g			BVSS08S01	SS	45			1
PCB-153	TP	BVTP05S01	20.8	ng/g			BVSS05S01	SS	8			2
PCB-153	TP	BVTP06S01	3.63	ng/g			BVSS06S01	SS	3			3
PCB-153	TP	BVTP07S01	6.7	ng/g			BVSS07	SS	10			4
PCB-156	TP	BVTP08S01	25.6	ng/g			BVSS08S01	SS	10			1
PCB-156	TP	BVTP05S01	3.24	ng/g			BVSS05S01	SS	1.5			2
PCB-156	TP	BVTP06S01	0.532	ng/g			BVSS06S01	SS	0.62			3
PCB-156	TP	BVTP07S01	0.95	ng/g			BVSS07	SS	1.15			4
PCB-157	TP	BVTP08S01	6.03	ng/g			BVSS08S01	SS	2.1			1
PCB-157	TP	BVTP05S01	0.85	ng/g			BVSS05S01	SS	0.43			2
PCB-157	TP	BVTP06S01	0.165	ng/g			BVSS06S01	SS	0.16			3
PCB-157	TP	BVTP07S01	0.355	ng/g			BVSS07	SS	0.56			4
PCB-167	TP	BVTP08S01	10.9	ng/g			BVSS08S01	SS	3.7			1
PCB-167	TP	BVTP05S01	1.55	ng/g			BVSS05S01	SS	0.71			2
PCB-167	TP	BVTP06S01	0.28	ng/g			BVSS06S01	SS	0.25			3
PCB-167	TP	BVTP07S01	0.537	ng/g			BVSS07	SS	0.965			4
PCB-170	TP	BVTP08S01	14	ng/g			BVSS08S01	SS	6.8			1
PCB-170	TP	BVTP05S01	1.98	ng/g			BVSS05S01	SS	1.4			2
PCB-170	TP	BVTP06S01	0.43	ng/g			BVSS06S01	SS	0.48			3
PCB-170	TP	BVTP07S01	0.812	ng/g			BVSS07	SS	2.5			4

Appendix K, Attachment K-8 (3 of 3)

Data Used in Terrestrial Plant Bioaccumulation Factor Selection

CHEMICAL	TISSUE TYPE	TISSUE SAMPLE ID	TISSUE CONCENTRATION (WET WEIGHT)	UNITS	TISSUE VALIDATION QUALIFIER	TISSUE DETECTION LIMIT	SOIL SAMPLE ID	SOIL TYPE	SOIL CONCENTRATION (DRY WEIGHT)	SOIL VALIDATION QUALIFIER	SOIL DETECTION LIMIT	BAF Rank
PCB-180	TP	BVTP08S01	28.5	ng/g			BVSS08S01	SS	12			1
PCB-180	TP	BVTP05S01	3.44	ng/g			BVSS05S01	SS	2.7			2
PCB-180	TP	BVTP06S01	0.826	ng/g			BVSS06S01	SS	0.92			3
PCB-180	TP	BVTP07S01	1.62	ng/g			BVSS07	SS	4.95			4
PCB-187	TP	BVTP08S01	11.5	ng/g			BVSS08S01	SS	3.6			1
PCB-187	TP	BVTP05S01	1.46	ng/g			BVSS05S01	SS	0.96			2
PCB-187	TP	BVTP06S01	0.37	ng/g			BVSS06S01	SS	0.31			3
PCB-187	TP	BVTP07S01	0.738	ng/g			BVSS07	SS	1.95			4
PCB-189	TP	BVTP05S01	0.155	ng/g			BVSS05S01	SS	0.088			
PCB-189	TP	BVTP08S01	0.95	ng/g			BVSS08S01	SS	0.37			
PCB-195	TP	BVTP05S01	0.143	ng/g			BVSS05S01	SS	0.14			
PCB-206	TP	BVTP05S01	0.246	ng/g			BVSS05S01	SS	0.31			
PCB-209	TP	BVTP08S01	1.49	ng/g			BVSS08S01	SS	0.61			
PCB-28	TP	BVTP08S01	4.3	ng/g			BVSS08S01	SS	0.54			
PCB-44	TP	BVTP05S01	1.51	ng/g			BVSS05S01	SS	0.34			1
PCB-44	TP	BVTP07S01	0.44	ng/g			BVSS07	SS	0.17			2
PCB-44	TP	BVTP08S01	29	ng/g			BVSS08S01	SS	12			3
PCB-44	TP	BVTP06S01	0.197	ng/g			BVSS06S01	SS	0.15			4
PCB-52	TP	BVTP05S01	4.92	ng/g			BVSS05S01	SS	1			1
PCB-52	TP	BVTP08S01	86.2	ng/g			BVSS08S01	SS	28			2
PCB-52	TP	BVTP07S01	1.23	ng/g			BVSS07	SS	0.515			3
PCB-52	TP	BVTP06S01	0.544	ng/g			BVSS06S01	SS	0.42			4
PCB-66	TP	BVTP05S01	1.69	ng/g			BVSS05S01	SS	0.45			1
PCB-66	TP	BVTP08S01	17.5	ng/g			BVSS08S01	SS	6.1			2
PCB-66	TP	BVTP07S01	0.54	ng/g			BVSS07	SS	0.425			3
PCB-66	TP	BVTP06S01	0.278	ng/g			BVSS06S01	SS	0.23			4
PCB-77	TP	BVTP05S01	0.51	ng/g			BVSS05S01	SS	0.18			1
PCB-77	TP	BVTP08S01	2.71	ng/g			BVSS08S01	SS	1.2			2
PCB-77	TP	BVTP07S01	0.208	ng/g			BVSS07	SS	0.29			3
PCB-81	TP	BVTP05S01	0.196	ng/g			BVSS05S01	SS	0.059			
PCB-81	TP	BVTP08S01	1.66	ng/g			BVSS08S01	SS	0.62			
PCB-90/101	TP	BVTP05S01	30	ng/g			BVSS05S01	SS	8			1
PCB-90/101	TP	BVTP08S01	242	ng/g			BVSS08S01	SS	78			2
PCB-90/101	TP	BVTP07S01	7.01	ng/g			BVSS07	SS	4.75			3
PCB-90/101	TP	BVTP06S01	2.97	ng/g			BVSS06S01	SS	2.3			4
Phenanthrene	TP	CLTP04S01	24	UG/KG			CLSS04	SS	2.7	J		1
Phenanthrene	TP	CLTP05S01	7.8	UG/KG	J		CLSS05S01	SS	2.7			2
Phenanthrene	TP	CLTP07S01	9.2	UG/KG	J		CLSS07S01	SS	7.1			3
Phenanthrene	TP	CLTP06S01	16	UG/KG			CLSS06S01	SS	49			4
Pyrene	TP	CLTP04S01	13	UG/KG	J		CLSS04	SS	6.55	J		1
Pyrene	TP	CLTP07S01	12	UG/KG	J		CLSS07S01	SS	16			2
Pyrene	TP	CLTP06S01	7.5	UG/KG	J		CLSS06S01	SS	120	J		3
Silver	TP	BVTP07S01	0.2545	MG/KG			BVSS07	SS	0.19255			
Silver	TP	BVTP08S01	0.226	MG/KG			BVSS08S01	SS	0.11			
Thallium	TP	BVTP06S01	1.3	MG/KG			BVSS06S01	SS	2.3			1
Thallium	TP	BVTP08S01	0.7567	MG/KG			BVSS08S01	SS	2.1			2
Thallium	TP	BVTP07S01	0.55	MG/KG			BVSS07	SS	1.67295			3
Thallium	TP	BVTP05S01	0.48	MG/KG			BVSS05S01	SS	2			4
Vanadium	TP	BVTP06S01	16.5028	MG/KG			BVSS06S01	SS	23.7	J		1
Vanadium	TP	BVTP08S01	10.7156	MG/KG			BVSS08S01	SS	17.5	J		2
Vanadium	TP	BVTP07S01	9.8762	MG/KG			BVSS07	SS	24.0803	J		3
Vanadium	TP	BVTP05S01	5.157	MG/KG			BVSS05S01	SS	18.8	J		4
Zinc	TP	BVTP05S01	97.6664	MG/KG			BVSS05S01	SS	55.3	J		1
Zinc	TP	BVTP06S01	67.9	MG/KG			BVSS06S01	SS	55.1	J		2
Zinc	TP	BVTP08S01	172.652	MG/KG			BVSS08S01	SS	146	J		3
Zinc	TP	BVTP07S01	81.7979	MG/KG			BVSS07	SS	82.33795	J		4

APPENDIX K

ATTACHMENT K-9

DATA USED TO DEVELOP A SOIL-TO-PLANT BIOTA ACCUMULATION FACTOR FOR PERCHLORATE

APPENDIX K, ATTACHMENT K-9

DATA USED TO DEVELOP A SOIL-TO-PLANT BIOTA ACCUMULATION FACTOR FOR PERCHLORATE

INTRODUCTION

Perchlorate ($ClO4^-$)[1] has been detected in soils at a few sites at Boeing's Santa Susana Field Laboratory (SSFL). To support effective decision-making, both human health and ecological risk assessments for sites at the SSFL will evaluate potential risks due to exposures to perchlorate in soil. Given recent investigation findings that suggest perchlorate is capable of accumulating in certain plant species (Susarla *et al.* 1999a, Susarla *et al.* 1999b, Susarla *et al.* 1999c, Susarla *et al.* 2000, Smith *et al.* 2001, Ellington *et al.* 2001, Nzengung 1998, Nzengung 2002, Nzengung and Wang 2000, Schnoor *et al.* 2002, van Aken and Schnoor 2002, Sundberg, *et al.* 2003, Tan 2003), exposure scenarios of interest include the ingestion of perchlorate that may bioaccumulate into (a) vegetation (possible exposures to herbivorous wildlife) and (b) hypothetical produce/crops grown in gardens (possible exposures to potential future residents). The soil-to-plant biota accumulation factor (BAF)[2] is a key parameter commonly used to estimate potential exposures due to the ingestion of perchlorate that may accumulate in terrestrial plants which may then be consumed by either human or ecological receptors of concern.

This technical memorandum is intended to support discussions with regulatory agencies regarding the development of an appropriate soil-to-plant BAF for perchlorate that can be applied in performing baseline risk assessments for sites at the SSFL. To this end, provided herein is an overview of available pertinent scientific studies and identification of an appropriate study from which a perchlorate soil-to-plant BAF can be derived. Accordingly, the technical information in this memorandum is presented as follows:

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1 Perchlorate is an oxidizing agent that has been used in solid propellants for rockets and missiles and as ignitable sources for fireworks, road flares, air bag inflators, and matches (Urbansky 1998, Smith *et al.* 2001). In addition, perchlorates have been detected in laboratory waste by-products of perchloric acid. Perchlorate also occurs naturally in nitrate-rich mineral deposits used in fertilizers.

2 A chemical-specific soil-to-plant BAF is used to estimate exposures to perchlorate due to the ingestion of plants by humans and herbivorous wildlife. Specifically, the soil-to-plant BAF is used to determine the concentration of perchlorate in plant tissues according to the following equation:

$C_{plant} = C_{soil} \cdot BAF$ … where C_{plant} is the concentration in plant tissues and C_{soil} is the concentration in soils.

- Identification and acquisition of relevant scientific literature;
- Overview of relevant scientific literature;
- Identification of the preferred study to derive a soil-to-plant BAF for perchlorate; and
- Proposed soil-to-plant BAF for perchlorate.

Dr. Andrew Jackson of Texas Tech University, a recognized expert who has conducted numerous studies on the uptake of perchlorate into plants, was contacted and provided information to develop this memorandum.

IDENTIFICATION AND ACQUISITION OF RELEVANT SCIENTIFIC LITERATURE

Existing available studies published in the peer-reviewed literature were used to derive a soil-to-plant BAF for perchlorate. However, it should be noted that many of studies were designed with other specific objectives in mind (*i.e.*, not specifically designed to develop a soil-to-plant BAF) and, thus are considered to provide "found data" (*i.e.*, opportunistically found data that may be used to develop a soil-to-plant BAF). Only studies that transparently documented the study design, including reporting all of the following information, were considered relevant for this technical memorandum:

- Plant species and plant part (*e.g.*, leaf, stem) tested;
- Exposure media (*e.g.*, soil, irrigation water);
- Exposure duration;
- Measured media concentration;
- Measured plant concentration;
- Sample size; and
- Full citation or full citation of source.

A list of all the studies of the uptake and retention of perchlorate in plants that were reviewed for this technical memorandum is provided in Table 1. As shown, a relatively large number of

papers related to the topic of perchlorate uptake by plants exists in the published literature. Whereas the majority of these studies describe the bioaccumulation of perchlorate into plants from irrigation water, only a few studies provide the necessary data (*i.e.*, measured concentrations of perchlorate in co-located soil and plant tissue samples) required for determining a soil-to-plant BAF. Use of irrigation water studies to derive a soil-to-plant BAF without the essential soil and plant concentration data requires several assumptions to perform the necessary conversion and, therefore, adds an indeterminate level of uncertainty (Dr. Jackson 2004, pers. comm.). Accordingly, more specific criteria used to select among the germane bioaccumulation studies are the following:

- Direct measurements of perchlorate in soils are preferred over measurements in water (*e.g.,* irrigation water, groundwater, hydroponic studies);
- Studies using terrestrial plants were preferred over studies using aquatic plants;
- Plant and soil samples must have been collected from the same approximate locations—*i.e.,* co-located soil and plant tissue samples;
- Measured concentrations of perchlorate in leaf tissue was preferred over concentrations of perchlorate in other plant parts[3]—use of leaf data are considered to provide the most conservative data for calculation of plant BAFs (Dr. Jackson 2004, pers. comm.);
- A continuous source of perchlorate provided/administered to the plant is preferred over a non-continuous source; and
- Field studies are preferred over laboratory/greenhouse studies.

OVERVIEW OF RELEVANT SCIENTIFIC LITERATURE

Based on recent laboratory and field studies, perchlorate has been found to readily bioaccumulate into a number of foodcrops from water (*e.g.,* lettuce, cucumbers, and soybeans) (Susarla *et al*, 1999c and Yu *et al.* 2004). Studies of commercial produce and products available in grocery

[3] Studies have found that much higher concentrations (as much as 7- to 100-fold) of perchlorate were detected in the leaves as compared to other parts of the plant (*e.g.,* stems, roots, seeds) (Susarla *et al.* 1999a, Susarla *et al.* 1999b, Susarla *et al.* 1999c, Susarla *et al.* 2000, Smith *et al.* 2001, Ellington *et al.* 2001, Nzengung 1998, Nzengung 2002, Nzengung and Wang 2000, Schnoor *et al.* 2002, van Aken and Schnoor 2002, Sundberg, *et al.* 2003, Tan 2003).

stores have detected perchlorate in lettuce, mustard greens, milk, and tobacco products (Danelski and Beeman 2003[4]; Sharp and Lunder 2003; Kirk *et al.* 2003; and Ellington *et al.* 2001).

However, only a few of these studies are suitable for determining a soil-to-plant BAF—many of the studies examined the bioaccumulation of perchlorate from irrigation water and did not measure perchlorate levels in the soil.

Studies Investigating the Bioaccumulation of Perchlorate From Water

The peer-reviewed literature is dominated by studies that have examined the uptake and retention of perchlorate into plants from water (*e.g.,* irrigation water, groundwater, hydroponic studies). Seventeen (17) studies of this type were identified. Plants examined include willows, bullrushes, cucumbers, soybeans, lettuce, and parrot feather among others (Table 1).

In general, these studies have found that plants readily bioaccumulate perchlorate from water. In fact, some of these plants are sometimes used to "phyto"-remediate perchlorate-tainted groundwater (AFCEE 2002). These studies often focus on transformation products that are produced as the plant takes up perchlorate. Some studies have found that plants have the potential to reduce perchlorate into chlorate, chloride, and chlorite (Bacchus *et al.* 1999, Susarla *et al.* 1999a, Susarla *et al.* 1999b, Susarla *et al.* 2000, Nzengung 1998, Nzengung *et al.* 1999a, Nzengung *et al.* 1999b, Nzengung 2002, Nzengung and Wang 2000, Schnoor *et al.* 2002, van Aken and Schnoor 2002).

Because the use of irrigation water studies to derive a soil-to-plant BAF requires assumptions that add an indeterminate level of uncertainty (Dr. Jackson 2004, pers. comm.), these studies are not used to derive a soil-to-plant BAF for perchlorate. This conclusion is consistent with the recommendation of Dr. Jackson (2004, pers. comm.). However, these studies are useful for providing a perspective for selecting soil studies. For example, studies examining bioaccumulation from water suggest that much of the perchlorate appears to be sequestered in the leaves of plants compared to other plant parts (Susarla *et al.* 1999a, Susarla *et al.* 1999b, Susarla *et al.* 1999c, Susarla *et al.* 2000, Nzengung 1998, Nzengung 2002, Nzengung and Wang 2000, Schnoor *et al.* 2002, van Aken and Schnoor 2002, Sundberg, *et al.* 2003, Tan 2003).

[4] Danelski and Beeman 2003 and Sharp and Lunder 2003 are not peer-reviewed studies. Consequently, they do not meet the criteria as relevant scientific literature and the studies are not included in Table 1.

Studies Investigating the Bioaccumulation of Perchlorate From Soil

Three (3) pertinent studies were selected as appropriate for deriving a soil-to-plant BAF; a study of perchlorate bioaccumulation in tobacco plants (Ellington *et al.* 2001), a study of perchlorate bioaccumulation in cucumber, lettuce and soybean leaves (Yu *et al.* 2004), and a study perchlorate in water, soil, vegetation and rodents in the Las Vegas Wash (Smith *et al.* 2004).

Brief Summary of Ellington *et al.* (2001). The Ellington *et al.* study (2001) intended to determine if perchlorate could be taken up into tobacco grown on soil amended with Chilean saltpeter, a naturally occurring source of perchlorate. Another study objective was to characterize the persistence of perchlorate in the tobacco plant over time and through a series of industrial processes. The Ellington *et al.* study (2001) was a field study with tobacco growing over a full season in amended soil. The tobacco was collected at the end of the season and 8 samples of tobacco lamina (*i.e.,* leaf without the midrib) analyzed. Perchlorate was detected in all leaf samples collected. Results of the study can be found in Table 2. The leaf and soil concentrations presented in Table 2 are based on the mean of measured concentrations in soil and tobacco lamina presented in the Ellington *et al*. (2001) paper[5].

The amendment process or frequency of amendment is not described in this study. However, the soil was collected several months after the tobacco was collected and measures were taken to ensure that plant material was not included in the soil samples. If this delay in sampling and analyzing the soil had any effects on the resulting soil-to-plant BAF, it would likely result in an overestimate of a soil-to-plant BAF. The perchlorate concentration is unlikely to have increased in the soils without further soil amendments; however, rain or irrigation water may have transported some of the remaining perchlorate away from the root zone. Thus, following the delay, the measured concentrations of perchlorate in the co-located soils would be lower (than if the soil samples were collected at the time of harvest), resulting in a greater estimate of the soil-to-plant BAF.

Brief Summary of Yu *et al.* (2004). Yu *et al.* (2004) studied the uptake of perchlorate into cucumber, soybean, and lettuce grown in sand (50 or 100 g soils) under laboratory conditions. The cucumber plants were watered with varying nutrient solutions of Hydrosol[6] and water to

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5 Mean concentrations were obtained directly from Table 1 of the Ellington *et al*. (2001) paper.

6 Hydrosol is a diluted solution of Peter's All-Purpose Plant Food (20-20-20) (Yu *et al.* 2004). As reported in Yu *et al.* (2004), Peter's Plant Food main components include nitrate, phosphate, magnesium, iron, copper, manganese, zinc, and molybdenum.

determine if nutrients affected the uptake of perchlorate—lettuce and soybean plants were watered with a 100% Hydrosol solution. Depending on the study, plants were exposed over a 4-, 6-, or 8-week period and all studies were performed in the laboratory. For the 4- and 6-week studies, the plants were given a single dose of perchlorate via solution to achieve a desired sand concentration. In the one 8-week study, cucumbers were watered with a 100% Hydrosol solution and the sand was dosed with perchlorate at Week 0 (the start of the study) and at Week 4. Samples of sand and plants (leaves and roots) were collected on a weekly or biweekly basis. Plant sample size ranged from 1 to 5 samples per analysis.

All plants accumulated perchlorate from soils—for cucumber and lettuce, concentrations of perchlorate in soils decreased to nondetectable amounts. For all plants tested, perchlorate was largely sequestered in above ground tissues (primarily leaves) compared to below ground tissues (primarily roots) and perchlorate concentrations in leaf tissue often showed a high degree of variability: both between plants within a treatment and from week to week—up to an order of magnitude in the case of the lettuce study. The authors also conclude that study results suggest that perchlorate exudation, transformation, or transpiration from leaves occurs. Please note that Table 2[7] presents the mean sand concentration at the beginning of the study and the mean leaf tissue burden at the end of the study or when the sand concentration went to non-detectable levels (*i.e.,* negligible perchlorate available for uptake), whichever comes first.

Brief Summary of Smith *et al.* (2004). Smith *et al.* (2004) investigated the correlation between water, vegetation, and soil perchlorate concentrations and rodent exposure in a perchlorate-contaminated area. Traps were set in three designated areas along the Las Vegas Wash. Water, soil, and vegetation samples were collected within 0.25 meters of the traps. The vegetation collected was not identified by species, but rather categorized by type (*e.g.* aquatic grass, leaf litter, or terrestrial broadleaf). Seeds and secondary stems associated with the plant samples were not removed prior to analysis. The authors found that the perchlorate concentrations measured in rodent livers and kidneys were correlated to soil perchlorate concentrations but were not correlated with vegetation concentrations. Based on these findings, the authors concluded that soil contamination is the best predictor of exposure in field rodents. Terrestrial broadleaf vegetation was found to have the highest plant tissue concentrations of perchlorate of all the vegetation type categories studied, and, as such, provides the most conservative estimate of a BAF. This study presented the plant data in terms of wet-weight, but the percent moisture

[7] Please note that the cucumber study that resulted in the greatest perchlorate accumulation into the leaves is presented in Table 2. Mean concentrations were obtained directly from Table 1 of the Yu *et al*. (2004) paper.

content of the vegetation was not presented. Since soil concentrations at the SSFL are reported in dry weight, a soil-to-plant BAF based on dry weight terms is required. Given the lack of the percent moisture of vegetation, using data from this study would require an assumption to convert wet weight to dry weight that would introduce an indeterminate level of uncertainty.

THE PREFERRED STUDY

The Ellington *et al.* (2001) study is selected as the preferred study for deriving a perchlorate BAF. This field study meets all of the criteria stated above. In addition, the plants in the study received a continuous source of perchlorate for a relatively long exposure time. This study also has a sufficiently large sample size to account for statistical variation among the data set. A matrix of all the reviewed studies summarizing aspects of the study based on the key features identified above is provided in Figure 1.

Study Provides Continuous Source of Perchlorate to Plants

The Ellington *et al.* study (2001) was performed using Chilean saltpeter (a known naturally occurring source of perchlorate) amended soil. The soil provided a continuous source of perchlorate, while in the Yu *et al.* (2004) study the laboratory sand was dosed only once with perchlorate for all but one scenario resulting in varying rates of perchlorate uptake. The single scenario where the sand was dosed a second time at 4 weeks, caused a spike in leaf tissue concentrations, but the final concentration at 8 weeks was below the leaf tissue concentration at 4 weeks. Additionally, in the Yu *et al*. (2004) study, the leaf tissue concentrations varied greatly from individual to individual within a treatment group[8] and from week to week, with the extreme being lettuce with an order of magnitude change in concentration measured from Week 4 (753 ppm) to Week 5 (20 ppm). Neither an increasing or decreasing trend in the weekly or bi-weekly results could be discerned. The Smith *et al.* (2004) study was performed in what the authors call "an area highly contaminated with perchlorate". It is assumed that the plants were also provided a continuous source of perchlorate.

Use of Data for Leaves

Both the Ellington *et al.* (2001) study and the Yu *et al.* (2004) study analyzed the leaves of the plants. Although the Smith *et al.* (2004) study primarily analyzed leaves, any seeds or secondary stems associated with the vegetation were not removed prior to analysis. Several studies

[8] Based on standard deviations provided in Table 1 of Yu *et al*. (2004).

observed that the highest concentration of perchlorate in the plant is found in the leaves (Susarla *et al.* 1999a, Susarla *et al.* 1999b, Susarla *et al.* 1999c, Susarla *et al.* 2000, Smith *et al.* 2001, Ellington *et al.* 2001, Nzengung 1998, Nzengung 2002, Nzengung and Wang 2000, Schnoor *et al.* 2002, van Aken and Schnoor 2002, Sundberg, *et al.* 2003, Tan 2003). Dr. Jackson (2004, pers. comm.) noted that if the weight of other parts of the plant (*e.g.,* seeds, fruit, stem) is added to the weight of the leafy portions, the BAF for the whole plant is likely to decrease. Thus, to ensure a conservative estimate, where possible, only data for leaves were considered in deriving the BAF for perchlorate (see Table 2).

Recommendations of Dr. Jackson (Texas Tech University)

Dr. Andrew Jackson of Texas Tech University is a recognized expert who, along with his colleagues at Texas Tech University, has conducted numerous studies on the uptake of perchlorate into plants. In fact, Dr. Jackson recently gave a presentation on the uptake of perchlorate into plants at the American Chemical Society's (ACS) 2004 annual meeting.

Dr. Jackson (2004, pers. comm.), a co-author of the Yu *et al.* (2004) study, recommended that the Ellington *et al.* study (2001)—not the Yu *et al.* (2004) study—be used to derive a soil-to-plant perchlorate BAF. His chief reasons are as follows:

- Study meets all of the minimum reporting requirements for peer-reviewed literature for this technical memorandum including providing the name of the plants tested, sample size, exposure duration, measured plant and source concentrations, and a full citation.
- Study provides data on co-located plant and soil samples.
- Study has a continuous source of perchlorate and a long exposure time (*i.e.,* full growing season).
- Study measured perchlorate concentrations in leaves, where much of the perchlorate is sequestered in plants (leading to conservative estimates of bioaccumulation).

In addition, Dr. Jackson (2004, pers. comm.) has gone back and calculated the pore water concentration for the data in the Yu *et al.* study (2004) as well as other unpublished data and derived uptake factors in the range of 300-fold.

PROPOSED SOIL-TO-PLANT BIOTA ACCUMULATION FACTOR

Perchlorate has been detected in soils at a few sites at the SSFL facility. As previously mentioned, exposure scenarios of interest include the ingestion of perchlorate that may bioaccumulate into (a) vegetation at the facility (possible exposures to herbivorous wildlife) and (b) hypothetical produce/crops grown in future gardens at the facility (possible exposures to potential future residents). To evaluate these exposure scenarios using existing data, a soil-to-plant BAF for perchlorate is required.

The Ellington *et al.* study (2001) reports a mean leaf concentration of 96 mg/kg [dry weight] and a mean soil concentration of 0.3 mg/kg [dry weight]. Accordingly, the proposed soil-to-plant BAF for perchlorate is calculated by dividing the leaf concentration by the soil concentration:

$$\text{Soil-to-Plant BAF} = 96 \text{ mg/kg [dw]}/0.34 \text{ mg/kg [dw]} = 282$$

Dr. Jackson's calculations corroborate this proposed BAF. The Boeing Company proposes to use this soil-to-plant BAF in screening and, if needed, baseline assessments of potential human health and ecological risks.

EPILOG

On 02 February 2005, the Boeing Company submitted this technical memorandum and three articles from the peer-reviewed literature (Ellington *et al.* 2001, Yu *et al.* 2004, Smith *et al.* (2004) to the Department of Toxic Substances Control (DTSC). On 28 February 2005, representatives of the Boeing Company and DTSC held a teleconference to discuss the technical memorandum and to reach agreement on an acceptable soil-to-plant BAF for perchlorate. During the teleconference, DTSC agreed to the proposed soil-to-plant BAF of 282 for use in screening. This agreement was documented in a memorandum from Mr. Michael Anderson (DTSC/HERD) to Mr. Gerard Abrams (DTSC) (DTSC 2005).

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Table 1. Plants Tested for Perchlorate Uptake

Plant	Media	Results	Reference
Lettuce	Water	Found in leaves	Susarla *et al.* 1999a
	Water/Soil conc. reported[1]		Yu *et al.* 2004
Tobacco	Soil	Found in leaves, midrib, cured chewing tobacco, and cigarettes	Ellington *et al.* 2001
	Water		Sundberg *et al.* 2003
Cucumber	Water/Soil conc. reported[1]	Found in leaves (cucumber not tested)	Yu *et al.* 2004
Soybean	Water/Soil conc. reported[1]	Detected in leaves[2]	Yu *et al.* 2004
Parrot Feather (*Myriophyllum aquaticum*)	Water	Detected and transformed into chloride	Susarla *et al.* 1999b
	Water		Susarla *et al.* 1999c
	Water		Nzengung 1998
	Water		Nzengung *et al.* 1999a
	Water		Nzengung 2002
Eucalyptus trees	Water	Uptake of perchlorate and transformation of up to 40% to chloride	Nzengung 1998
	Water		Nzengung *et al.* 1999a
	Water		Nzengung *et al.* 1999b
	Water		Nzengung and Wang 1999
	Water		Nzengung 2002
Willow trees	Water	Uptake of perchlorate and transformation to chloride	Nzengung 1998
	Water		Nzengung *et al.* 1999a
	Water		Nzengung *et al.* 1999b
	Water		Nzengung and Wang 1999
	Water		Nzengung 2002
	Water		Tan 2003
	Water		MWH 2004

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Table 1. Plants Tested for Perchlorate Uptake

Plant	Media	Results	Reference
Eastern cottonwood (poplar)	Water	Uptake of perchlorate and transformation to chlorite, chlorate, and chloride	Nzengung 1998
	Water		Nzengung *et al.* 1999a
	Water		Nzengung and Wang 1999
	Water		Nzengung 2002
	Water		Schnoor *et al.* 2002
	Water		Van Aken and Schnoor 2002
Spinach (minced)	Water	Uptake of perchlorate and transformation to chloride	Nzengung 1998
	Water		Nzengung *et al.* 1999a
	Water		Nzengung 2002
French tarragon (minced)	Water	Uptake of perchlorate and transformation to chloride	Nzengung 1998
	Water		Nzengung *et al.* 1999a
	Water		Nzengung 2002
Peat Moss	Water	Perchlorate sorbs to peat moss very quickly	Nzengung 2002
Tarragon	Water	Uptake of perchlorate inconclusive	Bacchus *et al.* 1999
Sweet gum	Water	Uptake of perchlorate and presence of metabolites chlorate, chlorite, and chloride	Susarla *et al.* 2000
Black willow	Water	Uptake of perchlorate and presence of metabolites chlorate, chlorite, and chloride	Susarla *et al.* 2000
Pickleweed	Water	Uptake of perchlorate and presence of metabolites chlorate, chlorite, and chloride	Susarla *et al.* 2000
	Water		Bacchus *et al.* 1999

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Table 1. Plants Tested for Perchlorate Uptake

Plant	Media	Results	Reference
Smartweed	Water	Uptake of perchlorate and presence of metabolites chlorate, and chlorite	Susarla *et al.* 2000
	Water		Bacchus *et al.* 1999
	Water	Detected in samples from the Bosque and Leon Watershed	Tan 2003
	Water		MWH 2004
Fragrant White water-lily	Water	Uptake of perchlorate and presence of metabolites chlorate, chlorite, and chloride	Susarla *et al.* 2000
	Water		Bacchus *et al.* 1999
Duckmeat	Water	Perchlorate uptake not found	Susarla *et al.* 2000
	Water		Bacchus *et al.* 1999
Blue-hyssop	Water	Uptake of perchlorate	Bacchus *et al.* 1999
Perennial glasswort	Water	Uptake of perchlorate	Bacchus *et al.* 1999
Waterweed	Water	Perchlorate uptake not found	Bacchus *et al.* 1999
Watercress	Water	Uptake of perchlorate	Tan 2003
	Water		MWH 2004
Ash	Water	Uptake of perchlorate	Tan 2003
	Water		MWH 2004
Chinaberry	Water	Uptake of perchlorate	Tan 2003
	Water		MWH 2004
Elm	Water	Uptake of perchlorate	Tan 2003
	Water		MWH 2004
Mulberry	Water	Uptake of perchlorate	Tan 2003
	Water		MWH 2004
Hackberry	Water	Uptake of perchlorate	Tan 2003
	Water		MWH 2004

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Table 1. Plants Tested for Perchlorate Uptake

Plant	Media	Results	Reference
Bullrush	Water/ Sediment	Collected from Longhorn Army Ammunition Plant. Detected in roots and plant.	Smith *et al.* 2001
	Water	Detected in samples collected upstream of Lake Las Vegas, in the Las Vegas Delta Area, and at the Longhorn Army Ammunition Plant.	Parsons 2001
Crabgrass	Soil	Collected from Longhorn Army Ammunition Plant. Detected in seeds and blades.	Smith *et al.* 2001
Cupgrass	Soil	Collected from Longhorn Army Ammunition Plant. Detected in blades.	Smith *et al.* 2001
Goldenrod	Soil	Collected from Longhorn Army Ammunition Plant. Detected in seeds, leaves, stems and roots.	Smith *et al.* 2001
Salt cedar	Water	Detected in samples collected upstream of Lake Las Vegas.	Urbansky *et al.* 2000
	Water/Soil		Parsons 2001
Algae	Water	Collected from the Las Vegas Wash, upstream of Lake Las Vegas, and in the Indian Head Area. Detected perchlorate in sample.	Parsons 2001
	Water	Collected from the Lake Belton, Texas.	MWH 2004
Bermuda grass	Water/Soil	Detected in samples collected upstream of Lake Las Vegas.	Parsons 2001
	Water		Nzengung 2002
Phragmites	Water	Detected in samples collected upstream of Lake	Parsons 2001

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Table 1. Plants Tested for Perchlorate Uptake

Plant	Media	Results	Reference
		Las Vegas.	
Grass (family *Poaceae*)	Water/Soil	Detected in samples collected from the Las Vegas Delta Area.	Parsons 2001
Sago (*Potamogeton pectinatus)*	Water/Soil	Detected in samples collected in Yuma, Arizona	Parsons 2001
Alfalfa	Water/Soil	Detected in samples collected in Yuma, Arizona	Parsons 2001
Arrowweed	Water/Soil	Detected in samples collected in Yuma, Arizona	Parsons 2001
Honey mesquite	Water/Soil	Detected in samples (bean and unidentified) collected in Yuma, Arizona	Parsons 2001
Quail bush	Water/Soil	Detected in samples collected in Yuma, Arizona	Parsons 2001
Johnson grass	Water/Soil	Detected in samples collected from the Alleghany Ballistics Laboratory	Parsons 2001
Saltbush	Water/Soil	Detected in samples collected from the Holloman Air Force Base.	Parsons 2001
Water pepper	Water	Detected in samples collected from the Indian Head Area	Parsons 2001
Hydrilla	Water	Detected in samples collected from the Indian Head Area	Parsons 2001
Lizard's tail (*Saururus cernuus*)	Water/Soil	Detected in samples collected from the Indian Head Area	Parsons 2001
Loblolly pine needles	Water/Soil	Detected in samples collected from the Longhorn	Parsons 2001

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Table 1. Plants Tested for Perchlorate Uptake

Plant	Media	Results	Reference
		Army Ammunition Plant	
Sedge	Water/Soil	Detected in samples collected from the Longhorn Army Ammunition Plant	Parsons 2001

1 – In the Yu *et al.* 2004 study, perchlorate-contaminated water was applied to sand to achieve a specific sand concentration.

2 – The researchers did not report that they also tested the bean and pod of the soybean. Perchlorate was detected in the pod but not the bean (Jackson 2004, pers. comm.).

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Table 2. Plant Uptake Studies

Plant	Type of Study	Study Duration	Perchlorate Concentration (mg/kg-DW)		Soil-to-Plant BAF	Reference	Selection/ Rationale
			Soil	Leaf			
Tobacco leaf	Field, Loamy sand	Season	0.34	96	282	Ellington *et al.* 2001	Selected. 1. Plants exposed throughout growing season. 2. Conducted under field conditions. 3. Continuous source of perchlorate in soils. 4. BAF based on leaves, providing the greatest estimate of the BAF.
Lettuce leaf	Lab-sand; 100% Hydrosol	6 weeks	0.069	20.8	301	Yu *et al.* 2004	Not selected, at the recommendation of Dr. Jackson. 1. Plants exposed for 4 to 8 weeks. 2. Conducted under laboratory conditions. 3. Values are based on a single spiking of lab sand—*i.e.*, plants were not exposed to a continuous source concentration. 4. Different plant uptake factors can be calculated due to the variability in the data. 5. BAF based on leaves, providing the greatest estimate of the BAF.
Cucumber leaf	Lab-sand; 25% Hydrosol /75% water	4 weeks	0.108	219	2029	Yu *et al.* 2004	
Soybean leaf	Lab-sand; 100% Hydrosol	4 weeks	0.128	14.5	113	Yu *et al.* 2004	

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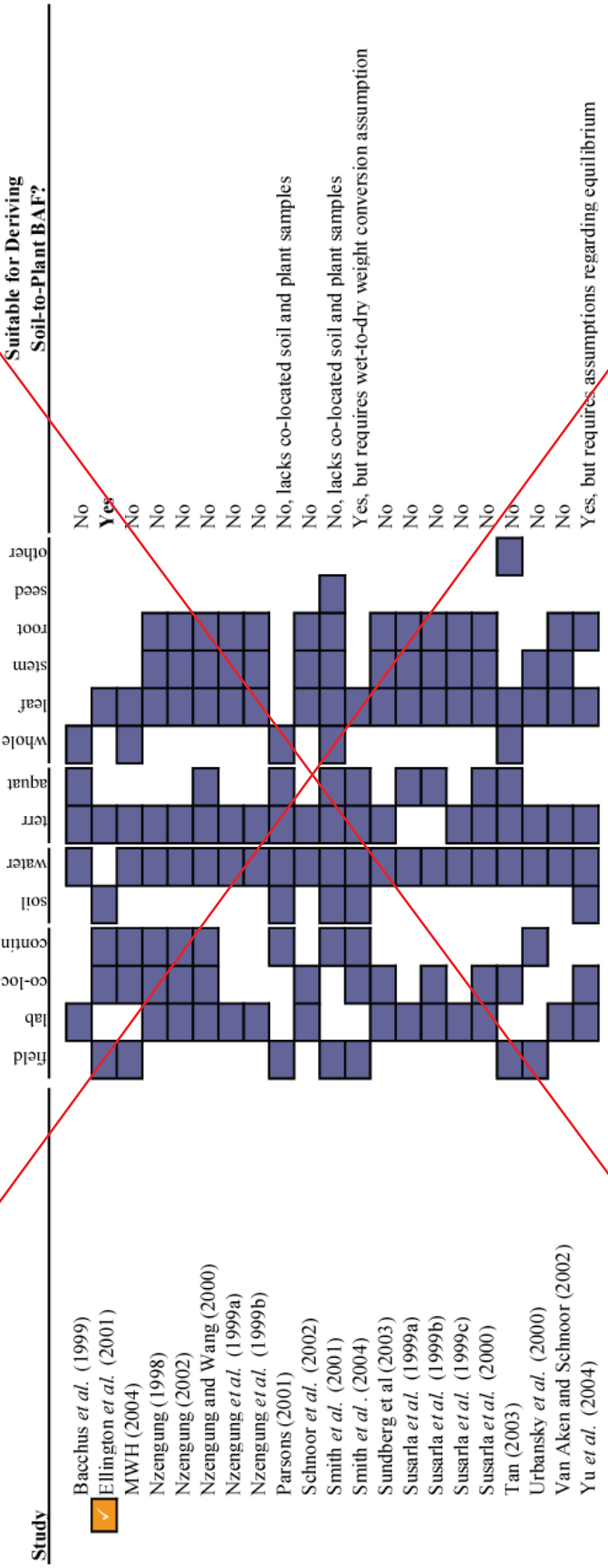
Table 2. Plant Uptake Studies

Plant	Type of Study	Study Duration	Perchlorate Concentration (mg/kg-DW)		Soil-to-Plant BAF	Reference	Selection/ Rationale
			Soil	Leaf			
Terrestrial Broadleaf	Field	--	24.7	No DW concen. reported	--	Smith *et al.* 2004	Not selected. The study reported plant concentrations in wet weight, but did not report the percent moisture content of the vegetation. Use of this study would require an assumption that would result in an indeterminate level of uncertainty.

Source:
- Ellington et al (2001) – Mean soil and tobacco lamina concentrations (from Table 1 of Ellington et al.).
- Yu et al. (2004) – Initial sand concentration and leaf tissue burden at the end of the study or when the sand concentration goes to non-detect, whichever occurs first (from Table 1 of Yu et al.).

Figure 1. Summary Matrix for Perchlorate Bioaccumulation Studies



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APPENDIX A

Process for Selecting the Comprehensive List of Chemicals for Development of Rural Residential Risk-based Screening Levels for Soil at the Santa Susana Field Laboratory, Ventura County, California

PROCESS FOR SELECTING THE COMPREHENSIVE LIST OF CHEMICALS FOR DEVELOPMENT OF RURAL RESIDENTIAL RISK-BASED SCREENING LEVELS FOR SOIL AT THE SANTA SUSANA FIELD LABORATORY VENTURA COUNTY, CALIFORNIA

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ATTACHMENTS

Attachment No.

1 Process for Selecting the Comprehensive List of Chemicals for Development of Rural Residential RBSLs for the SSFL

2a Candidate Comprehensive List of Chemicals for Development of Rural Residential RBSLs for Soil at the SSFL

2b Chemicals to be Eliminated from the Final Comprehensive List of Chemicals (by Criterion)

This technical memorandum describes the process to be used during selection of a Comprehensive List of Chemicals for development of rural residential risk-based screening levels (RR RBSLs) for soil at the Santa Susana Field Laboratory (SSFL). This document has been prepared for the California Environmental Protection Agency (Cal-EPA) Department of Toxic Substances Control (DTSC) on behalf of the Boeing Company (Boeing)

Selection of a Comprehensive List of Chemicals is one of the key steps in an overall process for developing risk-based comparison criteria to be used in future risk assessments and cleanup activities for soil at the SSFL. The general process for selecting a Comprehensive List of Chemicals for RR RBSL development is outlined in Attachment 1, and includes the identification of a *candidate* List of Chemicals for RR RBSL development (i.e., the list of all chemical parameters analyzed for in soils at the SSFL) and a *final* List of Chemicals for RR RBSL development (i.e., those chemicals for which the calculation of RR RBSLs is both possible and necessary).

The *candidate* Comprehensive List of Chemicals for RR RBSL development (Attachment 2a) represents all chemical parameters analyzed for in soil or sediment at the SSFL as part of RCRA Facility Investigations (RFIs). As such, the *candidate* List of Chemicals for RR RBSL development includes:

- Chemical parameters that have been detected in soil or sediment at the SSFL during RFIs, to date.
- Chemical parameters that have been analyzed for in soil or sediment samples collected from the SSFL during RFIs but that have NOT been detected in soil or sediment, to date;
- Chemical parameters that have very low toxicity, do not contribute to overall exposure and risk, or they are already evaluated using other appropriate risk assessment methods (e.g., dioxin/furan homologs, asbestos compounds, and total petroleum hydrocarbons [TPH]); and
- Chemical parameters for which RR RBSL calculation input values (e.g., biota uptake factors and toxicity values) are currently unavailable.

The *candidate* Comprehensive List of Chemicals for RR RBSL development contains a total of 410 chemical parameters (refer to the bottom of Attachment 1). Because it is neither feasible nor necessary to calculate RR RBSLs for all chemical parameters included on the *candidate* Comprehensive List of Chemicals for RR RBSL development (Attachment 2a), some of the chemical categories described above are proposed for elimination during the selection of a *final* Comprehensive List of Chemicals for RR RBSL development. This technical memorandum describes (1) the process to be used during selection of a *final* Comprehensive List of Chemicals

for RR RBSL development, and (2) the manner in which the *final* Comprehensive List of Chemicals for RR RBSL development will be periodically reviewed and updated as new information regarding detected chemicals and RR RBSL calculation input values becomes available.

The process to be used during selection of a *final* Comprehensive List of Chemicals for RR RBSL development includes seven steps, as graphically illustrated in Attachment 1 and summarized below.

1. Identify all possible chemicals in soil or sediment at the SSFL based upon current laboratory analytical procedures used in the RFI program. This list is comprised of the 410 chemical parameters included in the *candidate* Comprehensive List of Chemicals for RR RBSL development (Attachment 2a).

2. Identify those chemical parameters that have never been detected in soil or sediment during RFIs conducted at the SSFL, to date. A total of 123 chemical parameters fall in this category.

3. Remove those chemical parameters that have never been detected in soil or sediment during RFIs conducted at the SSFL, to date, from the *candidate* Comprehensive List of Chemicals for RR RBSL development. Literally thousands of soil and sediment samples have been collected from the SSFL during RFIs. Therefore, the potential for a previously undetected chemical to be detected in soil or sediment at the SSFL during future sampling investigations is low. In the event that a previously undetected chemical is detected in soil or sediment at the SSFL in the future, this potential outcome will be addressed during periodic reviews of the *final* Comprehensive List of Chemicals for RR RBSL development (refer to 'Ongoing' activities in Attachment 1, and below).

4. Identify those chemical parameters that are naturally occurring and have low risk potential, or they are addressed using other appropriate risk assessment methods. For example, several metals and anions are naturally occurring and only toxic to humans at very high environmental concentrations. For many of these naturally occurring and low toxicity chemicals, published chronic toxicity values or uptake factors are not available; thus, RR RBSLs cannot be calculated for these chemicals. Sampling results expressed as total dioxins/furans are evaluated in human health risk assessments (HHRAs) using calculated 2,3,7,8-TCDD toxicity equivalent (TEQ) concentrations; and total petroleum hydrocarbon (TPH) results are evaluated using data for toxic indicator compounds (e.g., benzene, toluene, ethylbenzene and xylenes [BTEX], or polynuclear aromatic hydrocarbons [PAHs]). Because the specific reasons for including chemicals in this category are so varied, additional explanation is provided below for the following

chemicals from the *candidate* Comprehensive List of Chemicals for RR RBSL development that were detected in soil or sediment: acetic acid, metals that are essential nutrients, major anions, polychlorinated biphenyl (PCB) congeners, titanium, TPH compounds, and asbestos.

Acetic Acid. Acetic Acid is a product of biodegradation, and is found or produced naturally in most plants and animals. It is the main acid in vinegars such as white (distilled), cider, balsamic, malt, red wine, white wine, rice and sherry; at concentrations ranging between three and eight percent. The Food and Drug Administration (FDA) classifies acetic acid as "Generally Recognized as Safe (GRAS)" under 21 CFR 184.1005 as a direct food substance and under 21 CFR 582.1005 as a general purpose food additive. Because acetic acid is naturally occurring and has low risk potential, it is not typically evaluated in HHRAs.

Essential Nutrients. Calcium, iron, magnesium, phosphorous, potassium and sodium are essential nutrients. As such, minimum levels of these elements are necessary to ensure good nutrition. They are also homeostatically regulated, and concentrations in environmental media are not likely to correspond to an absorbed dose. Furthermore, many of these essential nutrients are supplied in dietary supplement form, the concentration of which may exceed many times the concentrations detected in SSFL soils. In addition, they are generally toxic only in very high concentrations. Because of their low toxicity, these metals are not typically evaluated in HHRAs.

Anions. Anions such as bromide, chloride, nitrate and sulfate are naturally occurring and only toxic to humans at very high environmental concentrations. These anions are complexed with many different cations in soil. Chemical RBSLs are typically derived for the entire complexed molecule, including the respective anion or cation. Because these molecules have not been speciated at the SSFL, meaningful RBSLs cannot be calculated for them.

PCB Congeners. The mixtures of PCB congeners on the Comprehensive List of Chemicals (Attachment 2a) are specific to each laboratory and their ability to separate all 209 congeners. There are a few pairs and triplicates which are difficult to separate and those are more likely to be similar from laboratory to laboratory. Not all PCB congeners included in Attachment 2a may be requested for RFI reporting. PBC congener analysis is not used as a typical method for characterization, but rather for risk assessment evaluations. Analytical data are currently available for the PCB congeners and congener mixtures included in the

Comprehensive List of Chemicals. However analytical data are not available for all PCB congeners (e.g., PCB-129, PCB-163 and PCB-166). Coplanar PCB congeners will be evaluated using PCB TEQ. RBSLs will also be calculated for Aroclors, which will be evaluated separately from PCB congeners. Non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.

Titanium. Titanium is widely distributed in the earth's crust and is found in almost all living things, rocks, soil, and bodies of water. Titanium is also widely used for biological applications, e.g., hip joint replacements, tooth replacements, and sunscreen. The toxicity of titanium has not yet been quantified, but appears to be low. Because titanium is naturally occurring, used in many biological applications, and appears to have low toxicity, it is not typically evaluated in HHRAs.

TPH. Risk assessment including RBSLs development is not required for TPH mixtures, according to personal communication from Don Greenlee (DTSC) to Bruce Narloch (MWH), dated September 23, 2010. Risks associated with TPH impacts are commonly included in HHRAs based on the petroleum constituent concentrations rather than the TPH results, and historically, carbon range toxicity criteria have not been available or generally accepted by the regulatory community. Calculating RBSLs for mixtures of petroleum is difficult because of the varying or unknown toxicities and chemical properties of many of the individual petroleum hydrocarbon constituents. In addition, when mixtures of petroleum hydrocarbons are present at a site, there are potentially too many individual constituents present for practical evaluation. RBSLs can most accurately be estimated for individual constituents. Finally, even when the nature of the original TPH source is known, the physical, chemical and toxicological properties of the TPH contamination may be very different from the original material due to weathering. For these reasons, TPH will be evaluated using RBSLs for the most well-studied and toxicologically important constituents as individual compounds, such as BTEX and PAHs.

Asbestos. Amosite and chrysotile asbestos fibers have been detected in soil/sediment at the SSFL. Asbestos fibers are not typically evaluated in HHRAs. However, if any detected asbestos fibers are friable, the impacted soil is considered California hazardous waste if the total asbestos represents one percent or more of the sample wet weight (Table II – List of Inorganic Persistent and Bioaccumulative Toxic Substances and Their STLCs; 22 CCR 66261.24(a)(2)(A)), and remedial actions would be necessary.

5. Remove those chemical parameters that have low risk potential, or they are addressed using other appropriate risk assessment methods from the *candidate* Comprehensive List of Chemicals for RR RBSL development.

6. Identify chemical parameters for which input values (e.g., toxicity values or biota uptake factors) necessary for the calculation of RR RBSLs are not currently available. Chemical parameters with missing toxicity values or biota uptake factors are identified by notes within Columns 'I' and 'K' of Attachment 2a. In some cases, it may be possible to identify chemical surrogates or default values for chemical parameters that currently lack toxicity values or biota uptake factors. Technical representatives of the SSFL and DTSC will evaluate chemical parameters for which input values are currently unavailable to determine if information gaps can be filled through the use of chemical surrogates or default values. Chemical parameters for which surrogates and default values cannot be identified will be eliminated from the *candidate* Comprehensive List of Chemicals for RR RBSL development.

7. Remove those chemical parameters for which input values (e.g., toxicity values or biota uptake factors) are not currently available from the *candidate* Comprehensive List of Chemicals for RR RBSL development. In the event that new toxicity information or biota uptake factors become available in the future, this potential outcome will be addressed during periodic reviews of the *final* Comprehensive List of Chemicals for RR RBSL development (refer to 'Ongoing' activities in Attachment 1, and below).

RR RBSLs were calculated for those chemicals on the *final* Comprehensive list of Chemicals for RR RBSL. Calculated RR RBSLs along with various other comparison criteria [e.g., soil background values, analytical reporting limits, suburban residential (SR) RBSLs and ecological RBSLs (EcoRBSLs)] will be populated into a look-up table for the purpose of providing decision-makers the full range of potential cleanup chemical concentrations. In addition to their use as chemical data comparison criteria, human health and EcoRBSLs have also been proposed to be used in SSFL risk assessments using a sum-of-fractions risk calculation methodology.

A graphical illustration depicting the above process for selecting the *final* Comprehensive List of Chemicals for RR RBSL development is shown in Attachment 1. Chemical parameters not detected in soil or sediment at the SSFL are highlighted in green, chemicals not typically evaluated in human health and ecological risk assessments (HHERAs) are highlighted in blue, and chemicals missing RBSL parameters for which an appropriate surrogate cannot be identified are highlighted in gold. The chemical parameters proposed for RR RBSL development are those chemicals without any highlighting. Additional chemical parameters may be added to the *final* Comprehensive List of Chemicals for RR RBSL development, pending the outcome of Step 6, above.

The color-coding in Attachment 1 is mirrored in the *candidate* Comprehensive List of Chemicals for RR RBSL development (Attachment 2a). The purpose of the color-coding is to identify the chemical-specific rationale that will be responsible for the inclusion or exclusion of chemical parameters from the *final* Comprehensive List of Chemicals for RR RBSL development, which will be completed once DTSC agrees to the approach described herein and the SSFL and DTSC technical teams identify those chemical parameters for which RR RBSLs cannot be calculated due to unavailable input parameters. Chemical parameters proposed for elimination from the *final* Comprehensive List of Chemicals for RR RBSL development are color-coded in Attachment 2a and again in Attachment 2b. These two lists can be used to determine which chemicals are proposed for inclusion or exclusion from the *final* Comprehensive List of Chemicals for RR RBSL development, and the justification for their proposed selection or elimination.

The *candidate* Comprehensive List of Chemicals for RR RBSL development (Attachment 2a) also presents the following information, when available:

- typical analytical method and reporting limits;
- 2005 background comparison concentrations;
- log octanol-water partition coefficients (log Kow);
- Residential Soil Regional Screening Levels (RSLs);
- information regarding missing toxicity values and uptake factors;
- soil/sediment detection information; and
- information regarding whether a chemical is typically evaluated in HHERAs. Chemicals not typically evaluated in HHERAs include chemicals that have low risk potential (e.g., essential nutrients), or are addressed by other appropriate methods.

The *final* Comprehensive List of Chemicals for RR RBSL development, determined through the process outlined above, is intended to be updated regularly as new information becomes available. For example, if in the course of future soil or sediment sampling at SSFL a chemical that was previously not detected is detected, then that information would be used to update the status of that chemical in the *final* Comprehensive List of Chemicals for RR RBSL development. In addition, if naturally occurring low toxicity chemicals (e.g., essential nutrients) are detected at high concentrations or in 'hot spots' in the future, then potential risk management options (including the development of RR RBSLs for such chemicals) will be evaluated at that time. While it is not possible to predict when new information will become available, an annual review of information sources will be performed to determine if new information would change the status of any chemicals eliminated from the *final* Comprehensive List of Chemicals for RR

RBSL development. More frequent reviews may be performed based upon risk assessor recommendations and approval of the risk managers.

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ATTACHMENT 1

Process for Selecting the Comprehensive List of Chemicals for Development of Rural Residential RBSLs for the SSFL

Attachment 1

PROCESS FOR SELECTING THE FINAL COMPREHENSIVE LIST OF CHEMICALS FOR DEVELOPMENT OF RURAL RESIDENTIAL RBSLs FOR SOIL AT THE SSFL

STEP	Step #1	Step #2	Step #3	Step #4	Step #5	Step #6	Step#7	Result	Ongoing
TASK	Develop a *candidate* Comprehensive Chemical List consisting of all possible analytes based on laboratory procedures	Identify those chemicals that have not been detected in soil/sediment at the SSFL, to date	Remove those chemicals that have not been detected in soil/sediment, to date, from the *candidate* Comprehensive Chemical List.	Identify those chemicals that have low risk potential, or they are addressed by other appropriate methods	Remove those chemicals identified in Step #4 from the *candidate* Comprehensive Chemical List	Identify chemicals for which RBSL parameters [a] are missing and an appropriate surrogate or default cannot be identified	Create a *final* Comprehensive Chemical List by removing those chemicals missing RBSL input parameters	*final* Comprehensive Chemical List	Ongoing evaluation will occur for all eliminated chemicals. New information[b] will be evaluated and may result in inclusion of a chemical on the *final* Comprehensive Chemical List.
RESULT	This is a comprehensive list of all possible chemical parameters based on analytical methods for soil samples collected during RFIs at the SSFL.	These are chemical parameters that may be appropriate to exclude from the *candidate* Comprehensive Chemical List because they may not be present in soil/sediment.	This step removes from the *candidate* Comprehensive Chemicals List those chemicals that may not be present in soil/sediment.	This step identifies those chemicals that have very low toxicity or otherwise do not contribute to overall exposure and risk[c], or they are already evaluated using other appropriate methods[d].	This step removes from the *candidate* Comprehensive Chemical List those chemicals that have very low toxicity or otherwise do not contribute to overall exposure and risk[c], or they are already evaluated using other appropriate methods[d].	This step identifies those chemicals that have missing RBSL input parameters (e.g., toxicity values or uptake factors) and, therefore, the RBSL calculations cannot be completed.	This step creates the *final* Comprehensive Chemical List by removing those chemicals that are missing RBSL input parameters and therefore cannot have RBSLs calculated.	The *final* Comprehensive Chemical List can be used for site characterization, RBSL calculation, and cleanup determination.	This additional step ensures a process to potentially expand the *final* Comprehensive Chemical List by including newly detected chemicals in soil/sediment or chemicals for which RBSL input parameters were previously missing.
NUMBER	410	123	287	101	186	1	185	185	TBD

[a] E.g., toxicity values, uptake factors

[b] I.e., chemicals detected in soil/sediment in samples collected in the future, toxicity changes, RBSL parameters, etc.

[c] These are naturally occurring and low toxicity chemicals (e.g., essential nutrients); published chronic toxicity values or uptake factors are unavailable for many of these chemicals.

[d] E.g., dioxin/furan homologs, asbestos compounds, TPH

ATTACHMENT 2A

Candidate Comprehensive List of Chemicals for Development of Rural Residential RBSLs for Soil at the SSFL

Attachment 2a

Candidate Comprehensive List of Chemicals for Development of Rural Residential RBSLs for Soil at the SSFL

Analyte	CAS Number	Chemical Class	Typical Analytical Method	Typical Reporting Limit (mg/kg)	2005 Background Comparison Concentration[a] (mg/kg)	LogKow[b]	Resident Soil RSL (mg/kg)	Missing Toxicity Values?	Pathways Affected by Missing Toxicity Values	Missing Uptake Factors?	Pathways Affected	Chemical Selected for Expedited Rural Residential RBSL Development?	Chemical on NASA RBSL List?	Chemical Typically Evaluated in HHERAs?	Chemical Detected in Soil/Sediment?	ND in soil and/or Not Typically Evaluated in HHERAs	Comments
Volatile Organics																	
1,1,1,2-Tetrachloroethane	630206	Volatile Organics	8260B	0.001	-	2.93	1.90E+00	no	-	no	-	no	no	yes	yes		
1,1,1-Trichloroethane	71556	Volatile Organics	8260B	0.002	-	2.49	8.70E+03	no	-	no	-	no	no	yes	yes		
1,1,2,2-Tetrachloroethane	79345	Volatile Organics	8260B	0.002	-	2.39	5.60E-01	no	-	no	-	no	no	yes	yes		
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	Volatile Organics	8260B	0.005	-	3.16	4.30E+04	no	-	no	-	no	no	yes	yes		
1,1,2-Trichloroethane	79005	Volatile Organics	8260B	0.002	-	1.89	1.10E+00	no	-	no	-	no	no	yes	yes		
1,1-Dichloroethane	75343	Volatile Organics	8260B	0.002	-	1.79	3.30E+00	no	-	no	-	no	no	yes	yes		
1,1-Dichloroethene	75354	Volatile Organics	8260B	0.005	-	2.13	2.40E+02	no	-	no	-	yes	no	yes	yes		
1,1-Dichloropropene	563586	Volatile Organics	8260B	0.002	-	2.53	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
1,2,3-Trichlorobenzene	87616	Volatile Organics	8260B	0.005	-	4.05	4.90E+01	no (surrogate identified)	-	no	-	no	no	yes	yes		1,2,4-Trichlorobenzene used as toxicity value surrogate
1,2,3-Trichloropropane	96184	Volatile Organics	8260B	0.001	-	2.27	5.00E-03	NE	NE	NE	NE	yes	no	yes	no	X	Not detected in soil/sediment
1,2,3-Trichloropropene	96195	Volatile Organics	-	-	-	2.78	7.80E-01	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
1,2,4-Trichlorobenzene	120821	Volatile Organics	8260B	0.005	-	4.02	2.20E+01	no	-	no	-	no	no	yes	yes		
1,2,4-Trimethylbenzene	95636	Volatile Organics	8260B	0.002	-	3.63	6.20E+01	no (surrogate identified)	-	no	-	no	no	yes	yes		1,3,5-Trimethylbenzene used as toxicity value surrogate
1,2-Dibromo-3-chloropropane	96128	Volatile Organics	8260B	0.005	-	2.96	5.40E-03	no	-	no	-	yes	no	yes	yes		
1,2-Dibromoethane (EDB)	106934	Volatile Organics	8260B	0.002	-	1.96	3.40E-02	no	-	no	-	no	no	yes	yes		
1,2-Dichlorobenzene	95501	Volatile Organics	8260B	0.002	-	3.43	1.90E+03	no	-	no	-	no	no	yes	yes		
1,2-Dichloroethane	107062	Volatile Organics	8260B	0.001	-	1.48	4.30E-01	no	-	no	-	no	no	yes	yes		
1,2-Dichloroethene	540590	Volatile Organics	-	-	-	2.09	7.00E+02	no (surrogate identified)	-	no	-	no	no	yes	yes		trans-1,2-dichloroethene used as toxicity value surrogate
1,2-Dichloropropane	78875	Volatile Organics	8260B	0.002	-	1.98	9.40E-01	no	-	no	-	no	no	yes	yes		
1,3,5-Trimethylbenzene	108678	Volatile Organics	8260B	0.002	-	3.42	7.80E+02	no	-	no	-	no	no	yes	yes		
1,3-Dichlorobenzene	541731	Volatile Organics	8260B	0.002	-	3.53	-	no	-	no	-	no	no	yes	yes		
1,3-Dichloropropane	142289	Volatile Organics	8260B	0.002	-	2.32	1.60E+03	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
1,3-Dichloropropene	542756	Volatile Organics	-	-	-	2.03	1.70E+00	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
1,4-Dichlorobenzene	106467	Volatile Organics	8260B	0.002	-	3.44	2.40E+00	no	-	no	-	yes	no	yes	yes		
2,2-Dichloro-1,1,1-trifluoroethane	306832	Volatile Organics	-	-	-	2.17	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
2,2-Dichloropropane	594207	Volatile Organics	8260B	0.001	-	2.92	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
2-Butanone (MEK)	78933	Volatile Organics	8260B	0.01	-	0.29	2.80E+04	no	-	no	-	no	no	yes	yes		
2-Chloro-1,1,1-trifluoroethane	75887	Volatile Organics	8260B	0.005	-	3.54	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
2-Chloroethyl vinyl ether	110758	Volatile Organics	8260B	0.005	-	1.17	-	no (surrogate identified)	-	no	-	no	no	yes	yes		Bis(2-chloroethyl)ether used as toxicity value surrogate
2-Chlorotoluene	95498	Volatile Organics	8260B	0.005	-	3.42	1.60E+03	no	-	no	-	no	no	yes	yes		
2-Hexanone	591786	Volatile Organics	8260B	0.01	-	1.38	2.10E+02	no	-	no	-	no	no	yes	yes		
4-Chlorotoluene	106434	Volatile Organics	8260B	0.005	-	3.33	1.60E+03	no	-	no	-	no	no	yes	yes		
4-Methyl-2-pentanone (MIBK)	108101	Volatile Organics	8260B	0.005	-	1.31	5.30E+03	no	-	no	-	no	no	yes	yes		
Acetic Acid	64197	Volatile Organics	-	-	-	-0.17	-	NE	NE	NE	NE	no	no	no	yes	X	Naturally occurring, low-toxicity chemical
Acetone	67641	Volatile Organics	8260B	0.01	-	-0.24	6.10E+04	no	-	no	-	no	yes	yes	yes		
Acetonitrile	75058	Volatile Organics	-	-	-	-1.5E-01	8.70E+02	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Acrolein	107028	Volatile Organics	-	-	-	1.9E-01	1.50E-01	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Acrylonitrile	107131	Volatile Organics	-	-	-	2.1E-01	2.40E-01	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Benzene	71432	Volatile Organics	8260B	0.002	-	2.13	1.10E+00	no	-	no	-	yes	no	yes	yes		
Benzyl chloride	100447	Volatile Organics	-	-	-	2.8E+00	1.00E+00	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Bromobenzene	108861	Volatile Organics	8260B	0.005	-	2.99	3.00E+02	no	-	no	-	no	no	yes	yes		
Bromochloromethane	74975	Volatile Organics	8260B	0.005	-	1.43	1.60E+02	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Bromodichloromethane	75274	Volatile Organics	8260B	0.002	-	2.00	2.70E-01	no	-	no	-	no	no	yes	yes		
Bromoform	75252	Volatile Organics	8260B	0.005	-	2.40	6.20E+01	no	-	no	-	no	no	yes	yes		
Bromomethane	74839	Volatile Organics	8260B	0.005	-	1.19	7.30E+00	no	-	no	-	no	no	yes	yes		
Carbon disulfide	75150	Volatile Organics	-	0.005	-	1.94	8.20E+02	no	-	no	-	no	no	yes	yes		
Carbon tetrachloride	56235	Volatile Organics	8260B	0.001	-	2.83	6.10E-01	no	-	no	-	no	no	yes	yes		
Chlorobenzene	108907	Volatile Organics	8260B	0.002	-	2.84	2.90E+02	no	-	no	-	no	no	yes	yes		
Chloroethane	75003	Volatile Organics	8260B	0.005	-	1.43	1.50E+04	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Chloroform	67663	Volatile Organics	8260B	0.002	-	1.97	2.90E-01	no	-	no	-	no	no	yes	yes		

Attachment 2a

Candidate Comprehensive List of Chemicals for Development of Rural Residential RBSLs for Soil at the SSFL

Analyte	CAS Number	Chemical Class	Typical Analytical Method	Typical Reporting Limit (mg/kg)	2005 Background Comparison Concentration[a] (mg/kg)	LogKow[b]	Resident Soil RSL (mg/kg)	Missing Toxicity Values?	Pathways Affected by Missing Toxicity Values	Missing Uptake Factors?	Pathways Affected	Chemical Selected for Expedited Rural Residential RBSL Development?	Chemical on NASA RBSL List?	Chemical Typically Evaluated in HHERAs?	Chemical Detected in Soil/Sediment?	ND in soil and/or Not Typically Evaluated in HHERAs	Comments
Chloromethane	74873	Volatile Organics	8260B	0.005	-	0.91	1.20E+02	no (surrogate identified)	-	no	-	no	no	yes	yes		Bromomethane used as toxicity value surrogate
Chlorotrifluoroethylene	79389	Volatile Organics	8260B	0.005	-	1.65	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
cis-1,2-Dichloroethene	156592	Volatile Organics	8260B	0.002	-	1.86	1.60E+02	no	-	no	-	yes	no	yes	yes		
cis-1,3-Dichloropropene	10061015	Volatile Organics	8260B	0.002	-	2.06	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Di isopropyl ether	108203	Volatile Organics	8260B	0.005	-	1.88	2.40E+03	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Dibromochloromethane	124481	Volatile Organics	8260B	0.002	-	2.16	6.80E-01	no	-	no	-	no	no	yes	yes		
Dibromomethane	74953	Volatile Organics	8260B	0.001	-	1.70	2.50E+01	no	-	no	-	no	no	yes	yes		
Dichlorodifluoromethane	75718	Volatile Organics	8260B	0.005	-	2.16	9.40E+01	no	-	no	-	no	no	yes	yes		
Dichlorofluoromethane	75434	Volatile Organics	-	-	-	1.55	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Dichlorotrifluoroethane	34077877	Volatile Organics	-	-	-	-	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Difluorochloromethane	75456	Volatile Organics	-	-	-	1.08	5.30E+04	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Ethyl tertiary butyl ether	637923	Volatile Organics	8260B	0.005	-	1.92	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Ethylbenzene	100414	Volatile Organics	8260B	0.002	-	3.15	5.40E+00	no	-	no	-	yes	no	yes	yes		
Hexachlorobutadiene	87683	Volatile Organics	8260B	0.005	-	4.78	6.20E+00	no	-	no	-	no	no	yes	yes		
Isopropylbenzene	98828	Volatile Organics	8260B	0.002	-	3.66	2.10E+03	no	-	no	-	no	no	yes	yes		
m, p-Xylene	136777612	Volatile Organics	8260B	0.005	-	3.12	-	no	-	no (surrogate identified)	-	no	no	yes	yes		Xylenes, Total used as uptake factor surrogate
Methane	74828	Volatile Organics	-	-	-	-	-	NE	NE	NE	NE	no	no	no	no	X	Not detected in soil/sediment
Methylene chloride	75092	Volatile Organics	8260B	0.005	-	1.25	5.60E+01	no	-	no	-	yes	no	yes	yes		
Methyl-tert-butyl- Ether (MTBE)	1634044	Volatile Organics	8260B	0.005	-	1.43	4.30E+01	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
n-butylbenzene	104518	Volatile Organics	8260B	0.005	-	4.38	3.90E+03	no	-	no	-	no	no	yes	yes		
n-Propylbenzene	103651	Volatile Organics	8260B	0.002	-	3.69	3.40E+03	no	-	no	-	no	no	yes	yes		
o-Xylene	95476	Volatile Organics	8260B	0.002	-	3.12	6.90E+02	no	-	no	-	no	yes	yes	yes		
p-Isopropyltoluene	99876	Volatile Organics	8260B	0.002	-	4.10	-	no (surrogate identified)	-	no	-	no	no	yes	yes		Cumene used as toxicity value surrogate
Pyridine	110861	Volatile Organics	-	-	-	8.0E-01	7.80E+01	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
sec-Butylbenzene	135988	Volatile Organics	8260B	0.005	-	4.57	7.80E+03	no	-	no	-	no	no	yes	yes		Cumene used as toxicity value surrogate
Styrene	100425	Volatile Organics	8260B	0.002	-	2.95	6.30E+03	no	-	no	-	no	yes	yes	yes		
tert—Butylbenzene	98066	Volatile Organics	8260B	0.005	-	4.11	7.80E+03	no	-	no	-	no	no	yes	yes		Cumene used as toxicity value surrogate
Tertiary amyl methyl ether	994058	Volatile Organics	8260B	0.005	-	1.92	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Tertiary butyl alcohol	75650	Volatile Organics	8260B	0.005	-	0.73	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Tetrachloroethene	127184	Volatile Organics	8260B	0.002	-	3.40	2.20E+01	no	-	no	-	yes	no	yes	yes		
Tetralin	119642	Volatile Organics	-	-	-	3.49	-	no (surrogate identified)	-	no (surrogate identified)	-	no	no	yes	detected once as a TIC, but used at the site.		Naphthalene used as a toxicity value and uptake factor surrogate.
Toluene	108883	Volatile Organics	8260B	0.002	-	2.73	5.00E+03	no	-	no	-	no	yes	yes	yes		
trans-1,2-Dichloroethene	156605	Volatile Organics	8260B	0.002	-	2.09	1.50E+02	no	-	no	-	no	no	yes	yes		
trans-1,3-Dichloropropene	10061026	Volatile Organics	8260B	0.002	-	2.29	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Trichloroethene	79016	Volatile Organics	8260B	0.002	-	2.42	9.10E-01	no	-	no	-	yes	no	yes	yes		
Trichlorofluoromethane	75694	Volatile Organics	8260B	0.005	-	2.53	7.90E+02	no	-	no	-	no	no	yes	yes		
Vinyl acetate	108054	Volatile Organics	-	-	-	0.73	9.70E+02	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Vinyl chloride	75014	Volatile Organics	8260B	0.002	-	1.62	6.00E-02	no	-	no	-	yes	no	yes	yes		
Xylenes, Total	1330207	Volatile Organics	-	-	-	3.1E+00	6.30E+02	no	-	no	-	no	no	yes	yes		
Metals																	
Aluminum	7429905	Metals	EPA 6010/6020B	10	20,000	-	7.70E+04	no	-	no[d]	-	yes	no	yes	yes		
Antimony	7440360	Metals	EPA 6010/6020B	1	8.7	-	3.10E+01	no	-	no	-	yes	no	yes	yes		
Arsenic	7440382	Metals	EPA 6010/6020B	0.5	15	-	6.10E-01	no	-	no	-	yes	no	yes	yes		
Barium	7440393	Metals	EPA 6010/6020B	0.5	140	-	1.50E+04	no	-	no (surrogate identified)	-	no	no	yes	yes		Estimated transfer coefficient derived using average concentration ratio. See worksheet entitled "Estimated F-Swine."
Beryllium	7440417	Metals	EPA 6010/6020B	0.3	1.1	-	1.60E+02	no	-	no	-	yes	no	yes	yes		

Attachment 2a

Candidate Comprehensive List of Chemicals for Development of Rural Residential RBSLs for Soil at the SSFL

Analyte	CAS Number	Chemical Class	Typical Analytical Method	Typical Reporting Limit (mg/kg)	2005 Background Comparison Concentration[a] (mg/kg)	LogKow[b]	Resident Soil RSL (mg/kg)	Missing Toxicity Values?	Pathways Affected by Missing Toxicity Values	Missing Uptake Factors?	Pathways Affected	Chemical Selected for Expedited Rural Residential RBSL Development?	Chemical on NASA RBSL List?	Chemical Typically Evaluated in HHERAs?	Chemical Detected in Soil/Sediment?	ND in soil and/or Not Typically Evaluated in HHERAs	Comments
Boron	7440428	Metals	EPA 6010/6020B	5	9.7	-	1.60E+04	no	-	yes	fish	no	no	yes	yes		A surrogate or default fish uptake factor was not selected for this chemical, due to the significant uncertainty in doing so, and the uncertainty associated with this pathway in future risk assessments.
Cadmium	7440439	Metals	EPA 6010/6020B	0.2	1.0	-	7.00E+01	no	-	no	-	yes	no	yes	yes		
Calcium	7440702	Metals	EPA 6010/6020B	10	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Essential nutrient - naturally occurring, low-toxicity chemical
Chromium	7440473	Metals	EPA 6010/6020B	1	36.8	-	1.20E+05	no (surrogate identified)	-	no	-	yes	no	yes	yes		Chromium III used as toxicity value surrogate
Chromium VI	18540299	Metals	EPA 7196A or 7199	0.2	-	-	2.90E-01	no	-	no (surrogate identified)	-	yes	no	yes	yes		Chromium used as uptake factor surrogate
Cobalt	7440484	Metals	EPA 6010/6020B	0.5	21	-	2.30E+01	no	-	no	-	no	no	yes	yes		
Copper	7440508	Metals	EPA 6010/6020B	0.2	29	-	3.10E+03	no	-	no	-	yes	no	yes	yes		
Iron	7439896	Metals	EPA 6010/6020B	5	-	-	5.50E+04	NE	NE	NE	NE	no	no	no	yes	X	Essential nutrient - naturally occurring, low-toxicity chemical
Lead	7439921	Metals	EPA 6010/6020B	0.4	34	-	4.00E+02	no	-	no	-	yes	no	yes	yes		
Lithium	7439932	Metals	EPA 6010/6020B	6.3	37	-	1.60E+02	no	-	no	-	yes	no	yes	yes		
Magnesium	7439954	Metals	EPA 6010/6020B	10	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Essential nutrient - naturally occurring, low-toxicity chemical
Manganese	7439965	Metals	EPA 6010/6020B	1	495	-	1.80E+03	no	-	no	-	yes	no	yes	yes		
Mercury	7439976	Metals	EPA 7471A	0.01	0.09	0.62	1.00E+01	no	-	no	-	yes	no	yes	yes		
Methyl mercury	22967926	Metals	1630 (Mod)	**0.00005**	-	0.08	7.80E+00	no	-	no	-	yes	no	yes	yes		
Molybdenum	7439987	Metals	EPA 6010/6020B	0.1	5.3	-	3.90E+02	no	-	no	-	no	no	yes	yes		
Nickel	7440020	Metals	EPA 6010/6020B	0.4	29	-	1.50E+03	no	-	no	-	no	no	yes	yes		
Phosphorus	7723140	Metals	EPA 6010/6020B	50	-	-	1.60E+00	NE	NE	NE	NE	no	no	no	yes	X	Essential nutrient - naturally occurring, low-toxicity chemical
Potassium	7440097	Metals	EPA 6010/6020B	50	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Essential nutrient - naturally occurring, low-toxicity chemical
Selenium	7782492	Metals	EPA 6010/6020B	1	0.66	-	3.90E+02	no	-	no	-	yes	no	yes	yes		
Silver	7440224	Metals	EPA 6010/6020B	0.2	0.79	-	3.90E+02	no	-	no	-	yes	no	yes	yes		
Sodium	7440235	Metals	EPA 6010/6020B	50	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Essential nutrient - naturally occurring, low-toxicity chemical
Strontium	7440246	Metals	EPA 6010/6020B	5	-	-	4.70E+04	no	-	no	-	no	no	yes	yes		
Thallium	7440280	Metals	EPA 6010/6020B	0.2	0.46	-	7.80E-01	no	-	no	-	yes	no	yes	yes		
Tin	7440315	Metals	EPA 6010/6020B	10	-	-	4.70E+04	no	-	no	-	no	no	yes	yes		Estimated transfer coefficient derived using avg concentration ratio. See worksheet entitled "Estimated F-Swine."
Titanium	7440326	Metals	EPA 6010/6020B	2	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Naturally occurring, low-toxicity chemical
Uranium	7440611	Metals	-	-	-	0.23	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Vanadium	7440622	Metals	EPA 6010/6020B	1	62	-	3.90E+02	no	-	no (surrogate identified)	-	no	no	yes	yes		Estimated transfer coefficient derived using average concentration ratio. See worksheet entitled "Estimated F-Swine."
Zinc	7440666	Metals	EPA 6010/6020B	5	110	-	2.30E+04	no	-	no	-	yes	no	yes	yes		
Zirconium	7440677	Metals	EPA 6010/6020B	25	8.6	-	6.30E+00	no	-	no	-	no	no	yes	yes		
Semivolatiles																	
1,2-Diphenylhydrazine/Azobenzene	122667	SVOCs	8270C	0.33	-	3.06	6.10E-01	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
1,4-Dioxane	123911	SVOCs	8260B SIM	0.005	-	-0.27	4.90E+00	no	-	no	-	yes	no	yes	yes		
2,4,5-Trichlorophenol	95954	SVOCs	8270C	0.33	-	3.72	6.10E+03	no	-	no	-	no	no	yes	yes		
2,4,6-Trichlorophenol	88062	SVOCs	8270C	0.33	-	3.69	4.40E+01	no	-	no	-	no	no	yes	yes		
2,4-Dichlorophenol	120832	SVOCs	8270C	0.33	-	2.80	1.80E+02	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
2,4-Dimethylphenol	105679	SVOCs	8270C	0.33	-	2.30	1.20E+03	no	-	no	-	no	no	yes	yes		
2,4-Dinitrophenol	51285	SVOCs	8270C	0.66	-	1.73	1.20E+02	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
2,4-Dinitrotoluene	121142	SVOCs	8270C	0.33	-	2.18	1.60E+00	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
2,6-Dichlorophenol	87650	SVOCs	8270C	0.33	-	2.18	1.80E+02	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
2,6-Dinitrotoluene	606202	SVOCs	8270C	0.33	-	2.18	3.30E-01	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
2-Chloronaphthalene	91587	SVOCs	8270C	0.33	-	3.81	6.30E+03	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
2-Chlorophenol	95578	SVOCs	8270C	0.33	-	2.16	3.90E+02	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment

Attachment 2a

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Analyte	CAS Number	Chemical Class	Typical Analytical Method	Typical Reporting Limit (mg/kg)	2005 Background Comparison Concentration[a] (mg/kg)	LogKow[b]	Resident Soil RSL (mg/kg)	Missing Toxicity Values?	Pathways Affected by Missing Toxicity Values	Missing Uptake Factors?	Pathways Affected	Chemical Selected for Expedited Rural Residential RBSL Development?	Chemical on NASA RBSL List?	Chemical Typically Evaluated in HHERAs?	Chemical Detected in Soil/Sediment?	ND in soil and/or Not Typically Evaluated in HHERAs	Comments
2-Methylphenol	95487	SVOCs	8270C	0.33	-	1.95	3.10E+03	no	-	no	-	no	no	yes	yes		
2-Nitroaniline	88744	SVOCs	8270C	0.33	-	2.02	6.10E+02	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
2-Nitrophenol	88755	SVOCs	8270C	0.33	-	1.91	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
3,3-Dichlorobenzidine	91941	SVOCs	8270C	0.83	-	3.51	1.10E+00	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
3,5-Dimethylphenol	108689	SVOCs	8270C	0.33	-	2.61	-	no (surrogate identified)	-	no	-	no	no	yes	yes		2,4-Dimethylphenol, 2,6-dimethylphenol, and 3,4-dimethyphenol (average)
3-Nitroaniline	99092	SVOCs	8270C	0.33	-	1.47	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
4,6-Dinitro-2-methylphenol	534521	SVOCs	8270C	0.42	-	2.27	4.90E+00	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
4,6-Dinitro-o-cresol	534521	SVOCs	-	-	-	2.13	4.90E+00	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
4-Bromophenyl-phenylether	101553	SVOCs	8270C	0.33	-	4.94	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
4-Chloro-3-methylphenol	59507	SVOCs	8270C	0.33	-	3.10	6.10E+03	no	-	no	-	no	no	yes	yes		
4-Chloroaniline	106478	SVOCs	8270C	0.33	-	1.72	2.40E+00	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
4-Chlorophenyl-phenylether	7005723	SVOCs	8270C	0.33	-	4.69	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
4-Methylphenol	106445	SVOCs	8270C	0.33	-	1.94	6.10E+03	no	-	no	-	no	no	yes	yes		
4-Nitroaniline	100016	SVOCs	8270C	0.83	-	1.39	2.40E+01	no	-	no	-	no	no	yes	yes		
4-Nitrophenol	100027	SVOCs	8270C	0.83	-	1.91	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Aniline	62533	SVOCs	8270C	0.42	-	1.08	8.50E+01	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Benzidine	92875	SVOCs	8270C	1.6	-	1.34	5.00E-04	NE	NE	NE	NE	yes	no	yes	no	X	Not detected in soil/sediment
Benzoic acid	65850	SVOCs	8270C	0.83	-	1.87	2.40E+05	no	-	no	-	no	no	yes	yes		
Benzyl alcohol	100516	SVOCs	8270C	0.33	-	1.10	6.10E+03	no	-	no	-	no	no	yes	yes		
bis(2-Chloroethoxy)methane	111911	SVOCs	8270C	0.33	-	1.30	1.80E+02	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
bis(2-Chloroethyl) ether	111444	SVOCs	8270C	0.33	-	1.29	2.10E-01	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Bis(2-chloroisopropyl)ether	108601	SVOCs	8270C	0.33	-	3.73	4.60E+00	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Bis(2-ethylhexyl)phthalate	117817	SVOCs	8270C (SIM*) PAHs	0.02	-	7.60	3.50E+01	no	-	no	-	no	yes	yes	yes		
Butyl benzyl phthalate	85687	SVOCs	8270C (SIM*) PAHs	0.02	-	4.73	2.60E+02	no	-	no	-	no	no	yes	yes		
Carbazole	86748	SVOCs	8270C	0.33	-	3.72	-	no	-	no	-	no	no	yes	yes		
Dibenzofuran	132649	SVOCs	8270C	0.33	-	4.12	7.80E+01	no	-	no	-	no	no	yes	yes		
Diethyl phthalate	84662	SVOCs	8270C (SIM*) PAHs	0.02	-	2.42	4.90E+04	no	-	no	-	no	no	yes	yes		
Dimethoate	60515	SVOCs	-	-	-	0.78	1.20E+01	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Dimethyl phthalate	131113	SVOCs	8270C (SIM*) PAHs	0.02	-	1.60	-	no (surrogate identified)	-	no	-	no	yes	yes	yes		Diethyl phthalate used as toxicity value surrogate
Di-n-butyl phthalate	84742	SVOCs	8270C (SIM*) PAHs	0.02	-	4.50	6.10E+03	no	-	no	-	no	no	yes	yes		
Di-n-octyl phthalate	117840	SVOCs	8270C (SIM*) PAHs	0.02	-	8.10	6.10E+02	no	-	no	-	no	no	yes	yes		
Diphenylamine	122394	SVOCs	-	-	-	3.3E+00	1.50E+03	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Disulfoton	298044	SVOCs	-	-	-	4.02	2.40E+00	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Ethanone, 1-(2,4,6-Trihydroxyphenyl)-	480660	SVOCs	-	-	-	1.79	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Hexachlorobenzene	118741	SVOCs	8270C	0.33	-	5.86	3.00E-01	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Hexachlorocyclopentadiene	77474	SVOCs	8270C	0.83	-	5.04	3.70E+02	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Hexachloroethane	67721	SVOCs	8270C	0.33	-	4.03	1.20E+01	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Isophorone	78591	SVOCs	8270C	0.33	-	2.62	5.10E+02	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
m-Cresol	108394	SVOCs	-	-	-	1.96	3.10E+03	no	-	no	-	no	no	yes	yes		
Nitrobenzene	98953	SVOCs	8270C	0.33	-	1.81	4.80E+00	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
n-Nitrosodimethylamine	62759	SVOCs	8270C (SIM*) PAHs	0.02	-	-0.57	2.30E-03	no	-	no	-	no	no	yes	yes		
n-Nitroso-di-n-propylamine	621647	SVOCs	8270C	0.33	-	1.33	6.90E-02	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
n-Nitrosodiphenylamine	86306	SVOCs	8270C	0.33	-	3.13	9.90E+01	no	-	no	-	no	no	yes	yes		
Pentachlorophenol	87865	SVOCs	8270C	0.83	-	5.12	8.90E-01	no	-	no	-	yes	no	yes	yes		
Phenol	108952	SVOCs	8270C	0.33	-	1.46	1.80E+04	no	-	no	-	no	no	yes	yes		
Phorate	298022	SVOCs	-	-	-	3.56	1.20E+01	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
PAHs																	
1-Methylnaphthalene	90120	PAHs	8270C (SIM*) PAHs	0.02	-	3.87	1.60E+01	no	-	no	-	no	yes	yes	yes		
2-Methylnaphthalene	91576	PAHs	8270C (SIM*) PAHs	0.02	-	3.86	2.30E+02	no	-	no	-	no	yes	yes	yes		
Acenaphthene	83329	PAHs	8270C (SIM*) PAHs	0.02	-	3.92	3.40E+03	no	-	no	-	no	yes	yes	yes		
Acenaphthylene	208968	PAHs	8270C (SIM*) PAHs	0.02	-	3.94	-	no (surrogate identified)	-	no	-	no	no	yes	yes		Acenaphthene used as toxicity value surrogate
Anthracene	120127	PAHs	8270C (SIM*) PAHs	0.02	-	4.45	1.70E+04	no	-	no	-	no	no	yes	yes		
Benzo(a)anthracene	56553	PAHs	8270C (SIM*) PAHs	0.02	-	5.76	1.50E-01	no	-	no	-	yes	no	yes	yes		
Benzo(a)pyrene	50328	PAHs	8270C (SIM*) PAHs	0.02	-	6.13	1.50E-02	no	-	no	-	yes	no	yes	yes		

Attachment 2a

Candidate Comprehensive List of Chemicals for Development of Rural Residential RBSLs for Soil at the SSFL

Analyte	CAS Number	Chemical Class	Typical Analytical Method	Typical Reporting Limit (mg/kg)	2005 Background Comparison Concentration[a] (mg/kg)	LogKow[b]	Resident Soil RSL (mg/kg)	Missing Toxicity Values?	Pathways Affected by Missing Toxicity Values	Missing Uptake Factors?	Pathways Affected	Chemical Selected for Expedited Rural Residential RBSL Development?	Chemical on NASA RBSL List?	Chemical Typically Evaluated in HHERAs?	Chemical Detected in Soil/Sediment?	ND in soil and/or Not Typically Evaluated in HHERAs	Comments
Benzo(b)fluoranthene	205992	PAHs	8270C (SIM*) PAHs	0.02	-	5.78	1.50E-01	no	-	no	-	yes	no	yes	yes		
Benzo(e)pyrene	192972	PAHs	-	-	-	6.44	-	no (surrogate identified)	-	no	-	no	no	yes	yes		Pyrene used as uptake factor surrogate
Benzo(g,h,i)perylene	191242	PAHs	8270C (SIM*) PAHs	0.02	-	6.63	-	no (surrogate identified)	-	no	-	no	no	yes	yes		Pyrene used as uptake factor surrogate
Benzo(k)fluoranthene	207089	PAHs	8270C (SIM*) PAHs	0.02	-	6.11	1.50E+00	no	-	no	-	yes	no	yes	yes		
Chrysene	218019	PAHs	8270C (SIM*) PAHs	0.02	-	5.81	1.50E+01	no	-	no	-	no	yes	yes	yes		
Dibenz(a,h)anthracene	53703	PAHs	8270C (SIM*) PAHs	0.02	-	6.75	1.50E-02	no	-	no	-	yes	no	yes	yes		
Fluoranthene	206440	PAHs	8270C (SIM*) PAHs	0.02	-	5.16	2.30E+03	no	-	no	-	no	yes	yes	yes		
Fluorene	86737	PAHs	8270C (SIM*) PAHs	0.02	-	4.18	2.30E+03	no	-	no	-	no	no	yes	yes		
Indeno(1,2,3-cd)pyrene	193395	PAHs	8270C (SIM*) PAHs	0.02	-	6.70	1.50E-01	no	-	no	-	no	no	yes	yes		
Naphthalene	91203	PAHs	8270C (SIM*) PAHs	0.02	-	3.30	3.60E+00	no	-	no	-	no	no	yes	yes		
Perylene	198550	PAHs	-	-	-	6.25	-	no (surrogate identified)	-	no	-	no	no	yes	yes		Pyrene used as uptake factor surrogate
Phenanthrene	85018	PAHs	8270C (SIM*) PAHs	0.02	-	4.46	-	no (surrogate identified)	-	no	-	yes	no	yes	yes		Anthracene used as toxicity value surrogate
Pyrene	129000	PAHs	8270C (SIM*) PAHs	0.02	-	4.88	1.70E+03	no	-	no	-	no	yes	yes	yes		
Perchlorate																	
Perchlorate	14797730	Perchlorate	EPA 314.0 ClO4 Soil **	0.004	-	-	5.50E+01	no	-	no (surrogate identified)	-	yes	no	yes	yes		Missing perchlorate transfer factors used an assumed transfer factor value of 1 as recommended by DTSC.
Formaldehyde																	
Formaldehyde	50000	Formaldehyde	EPA 8315A	1	-	0.35	1.20E+04	no	-	no	-	yes	no	yes	yes		
Hydrazine																	
Hydrazine	302012	Hydrazine Compounds	EPA 8315A	0.005	-	-	2.10E-01	no	-	no	-	no	no	yes	yes		
Monomethyl Hydrazine	60344	Hydrazine Compounds	EPA 8315A	0.025	-	-1.05	6.10E+01	no	-	no	-	yes	no	yes	yes		1,2-Dimethylhydrazine used as toxicity value surrogate
Unsymetrical Dimethyl Hydrazine	57147	Hydrazine Compounds	EPA 8315A	0.025	-	-1.19	6.10E+00	no	-	no	-	yes	no	yes	yes		
Anions																	
Ammonia-N	7664417	Anions	EPA 350.3	-	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Naturally occurring, low-toxicity chemical
Bromide	24959679	Anions	300.0/9056A	5	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Naturally occurring, low-toxicity chemical
Chloride	16887006	Anions	300.0/9056A	5	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Naturally occurring, low-toxicity chemical
Chlorine	7782505	Anions	-	-	-	0.85	7.50E+03	NE	NE	NE	NE	no	no	no	no	X	Not detected in soil/sediment
Fluoride	16984488	Anions	300.0/9056A	5	-	-	3.10E+03	no	-	no[d]	-	no	no	yes	yes		
Nitrate-NO3	NO3N	Anions	300.0/9056A	5	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Naturally occurring, low-toxicity chemical
Nitrite-NO2	E-10128	Anions	300.0/9056A	5	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Naturally occurring, low-toxicity chemical
Orthophosphate – PO4	14265442	Anions	300.0/9056A	5	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Naturally occurring, low-toxicity chemical
Sulfate	14808798	Anions	300.0/9056A	5	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Naturally occurring, low-toxicity chemical
PCBs and PCTs																	
Aroclor 1016	12674112	PCBs and PCTs	EPA 8082	0.015	-	5.62	3.90E+00	no	-	no	-	no	no	yes	yes		
Aroclor 1221	11104282	PCBs and PCTs	EPA 8082	0.015	-	4.53	1.40E-01	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Aroclor 1232	11141165	PCBs and PCTs	EPA 8082	0.015	-	4.53	1.40E-01	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Aroclor 1242	53469219	PCBs and PCTs	EPA 8082	0.015	-	6.29	2.20E-01	no	-	no (surrogate identified)	-	no	no	yes	yes		
Aroclor 1248	12672296	PCBs and PCTs	EPA 8082	0.015	-	6.34	2.20E-01	no	-	no (surrogate identified)	-	yes	no	yes	yes		
Aroclor 1254	11097691	PCBs and PCTs	EPA 8082	0.015	-	6.79	2.20E-01	no	-	no	-	yes	no	yes	yes		
Aroclor 1260	11096825	PCBs and PCTs	EPA 8082	0.015	-	8.27	2.20E-01	no	-	no (surrogate identified)	-	yes	no	yes	yes		

Attachment 2a

Candidate Comprehensive List of Chemicals for Development of Rural Residential RBSLs for Soil at the SSFL

Analyte	CAS Number	Chemical Class	Typical Analytical Method	Typical Reporting Limit (mg/kg)	2005 Background Comparison Concentration[a] (mg/kg)	LogKow[b]	Resident Soil RSL (mg/kg)	Missing Toxicity Values?	Pathways Affected by Missing Toxicity Values	Missing Uptake Factors?	Pathways Affected	Chemical Selected for Expedited Rural Residential RBSL Development?	Chemical on NASA RBSL List?	Chemical Typically Evaluated in HHERAs?	Chemical Detected in Soil/Sediment?	ND in soil and/or Not Typically Evaluated in HHERAs	Comments
Aroclor 1262	37324235	PCBs and PCTs	EPA 8082	0.05	-	-	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Aroclor 1268	11100144	PCBs and PCTs	EPA 8082	0.05	-	-	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Aroclor 5432	63496311	PCBs and PCTs	EPA 8082	0.05	-	-	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Aroclor 5442	12642238	PCBs and PCTs	EPA 8082	0.05	-	-	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Aroclor 5460	11126424	PCBs and PCTs	EPA 8082	0.05	-	6.34	-	no (surrogate identified)	-	no (surrogate identified)	-	no	no	yes	yes		PCBs and Aroclor 1254 used as toxicity value and uptake factor surrogate
PCB 101	37680732	PCBs and PCTs	EPA 1668B	0.0001	-	6.98	-	NE	NE	NE	NE	no	no	no	yes	X	Non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
PCB 105	32598144	PCBs and PCTs	EPA 1668B	0.00002	-	6.79	1.10E-01	no	-	no (surrogate identified)	-	yes	no	yes	yes		Evaluated using PCB TEQ
PCB 110	38380039	PCBs and PCTs	EPA 1668B	0.0001	-	6.98	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
PCB 114	74472370	PCBs and PCTs	EPA 1668B	0.00005	-	6.98	1.10E-01	no	-	no (surrogate identified)	-	yes	no	yes	yes		Evaluated using PCB TEQ
PCB 118	31508006	PCBs and PCTs	EPA 1668B	0.00005	-	7.12	1.10E-01	no	-	no (surrogate identified)	-	no	no	yes	yes		Evaluated using PCB TEQ
PCB 119	56558179	PCBs and PCTs	EPA 1668B	0.00005	-	6.98	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
PCB 123	65510443	PCBs and PCTs	EPA 1668B	0.00005	-	6.98	1.10E-01	no	-	no (surrogate identified)	-	no	no	yes	yes		Evaluated using PCB TEQ
PCB 126	57465288	PCBs and PCTs	EPA 1668B	0.00005	-	6.98	3.40E-05	no	-	no (surrogate identified)	-	yes	no	yes	yes		Evaluated using PCB TEQ
PCB 128	38380073	PCBs and PCTs	EPA 1668B	0.00005	-	7.62	-	NE	NE	NE	NE	no	no	no	yes	X	Non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
PCB 132	38380051	PCBs and PCTs	EPA 1668B	0.00005	-	7.62	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
PCB 138	35065282	PCBs and PCTs	EPA 1668B	0.00005	-	7.62	-	NE	NE	NE	NE	no	no	no	yes	X	Non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
PCB 149	38380040	PCBs and PCTs	EPA 1668B	0.00005	-	7.62	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
PCB 151	52663635	PCBs and PCTs	EPA 1668B	0.00005	-	7.62	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
PCB 153	35065271	PCBs and PCTs	EPA 1668B	0.00005	-	7.62	-	NE	NE	NE	NE	no	no	no	yes	X	Non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
PCB 156	38380084	PCBs and PCTs	EPA 1668B	0.00005	-	7.60	1.10E-01	no	-	no (surrogate identified)	-	no	no	yes	yes		Evaluated using PCB TEQ
PCB 157	69782907	PCBs and PCTs	EPA 1668B	0.00005	-	7.62	1.10E-01	no	-	no (surrogate identified)	-	no	no	yes	yes		Evaluated using PCB TEQ
PCB 158	74472427	PCBs and PCTs	EPA 1668B	0.00002	-	7.62	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
PCB 167	52663726	PCBs and PCTs	EPA 1668B	0.00005	-	7.50	1.10E-01	no	-	no (surrogate identified)	-	no	no	yes	yes		Evaluated using PCB TEQ
PCB 168	59291 655	PCBs and PCTs	EPA 1668B	0.00005	-	7.62	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
PCB 169	32774166	PCBs and PCTs	EPA 1668B	0.00005	-	7.41	1.10E-04	no	-	no (surrogate identified)	-	no	no	yes	yes		Evaluated using PCB TEQ

Attachment 2a

Candidate Comprehensive List of Chemicals for Development of Rural Residential RBSLs for Soil at the SSFL

Analyte	CAS Number	Chemical Class	Typical Analytical Method	Typical Reporting Limit (mg/kg)	2005 Background Comparison Concentration[a] (mg/kg)	LogKow[b]	Resident Soil RSL (mg/kg)	Missing Toxicity Values?	Pathways Affected by Missing Toxicity Values	Missing Uptake Factors?	Pathways Affected	Chemical Selected for Expedited Rural Residential RBSL Development?	Chemical on NASA RBSL List?	Chemical Typically Evaluated in HHERAs?	Chemical Detected in Soil/Sediment?	ND in soil and/or Not Typically Evaluated in HHERAs	Comments
PCB 170	35065306	PCBs and PCTs	EPA 1668B	0.00005	-	8.27	-	NE	NE	NE	NE	no	no	no	yes	X	Non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
PCB 177	52663704	PCBs and PCTs	EPA 1668B	0.00005	-	8.27	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
PCB 18	37680652	PCBs and PCTs	EPA 1668B	0.00005	-	5.69	-	NE	NE	NE	NE	no	no	no	yes	X	Non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
PCB 180	35065293	PCBs and PCTs	EPA 1668B	0.00005	-	8.27	-	NE	NE	NE	NE	no	no	no	yes	X	Non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
PCB 183	52663691	PCBs and PCTs	EPA 1668B	0.0001	-	8.27	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
PCB 187	52663680	PCBs and PCTs	EPA 1668B	0.00005	-	8.27	-	NE	NE	NE	NE	no	no	no	yes	X	Non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
PCB 189	39635319	PCBs and PCTs	EPA 1668B	0.00005	-	8.27	1.10E-01	no	-	no (surrogate identified)	-	no	no	yes	yes		Evaluated using PCB TEQ
PCB 194	35694087	PCBs and PCTs	EPA 1668B	0.00005	-	8.91	-	NE	NE	NE	NE	no	no	no	yes	X	Non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
PCB 201	40186718	PCBs and PCTs	EPA 1668B	0.0001	-	8.91	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
PCB 206	40186729	PCBs and PCTs	EPA 1668B	0.0001	-	9.56	-	NE	NE	NE	NE	no	no	no	yes	X	Non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
PCB 28	7012375	PCBs and PCTs	EPA 1668B	0.00005	-	5.69	-	NE	NE	NE	NE	no	no	no	yes	X	Non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
PCB 37	38444905	PCBs and PCTs	EPA 1668B	0.00005	-	5.69	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
PCB 44	41464395	PCBs and PCTs	EPA 1668B	0.00005	-	6.34	-	NE	NE	NE	NE	no	no	no	yes	X	Non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
PCB 49	41464408	PCBs and PCTs	EPA 1668B	0.00005	-	6.34	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
PCB 52	35693993	PCBs and PCTs	EPA 1668B	0.00005	-	6.34	-	NE	NE	NE	NE	no	no	no	yes	X	Non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
PCB 66	32598100	PCBs and PCTs	EPA 1668B	0.00005	-	6.34	-	NE	NE	NE	NE	no	no	no	yes	X	Non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
PCB 70	32598111	PCBs and PCTs	EPA 1668B	0.00005	-	6.34	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
PCB 74	32690930	PCBs and PCTs	EPA 1668B	0.00005	-	6.34	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
PCB 77	32598133	PCBs and PCTs	EPA 1668B	0.00005	-	6.63	3.40E-02	no	-	no (surrogate identified)	-	no	no	yes	yes		Evaluated using PCB TEQ

Attachment 2a

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PCB 81	70362504	PCBs and PCTs	EPA 1668B	0.00005	-	6.34	1.10E-02	no	-	no (surrogate identified)	-	yes	no	yes	yes		Evaluated using PCB TEQ
PCB 87	38380028	PCBs and PCTs	EPA 1668B	0.00005	-	6.98	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
PCB 99	38380017	PCBs and PCTs	EPA 1668B	0.00005	-	6.98	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
PCB 195	52663782	PCBs and PCTs	-	-	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
PCB 8	34883437	PCBs and PCTs	-	-	-	5.09	-	NE	NE	NE	NE	no	no	no	yes	X	Non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
PCB 90/101	E-16015	PCBs and PCTs	-	-	-	8.91	-	NE	NE	NE	NE	no	no	no	yes	X	Non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
15-DiCB	2050682	PCBs and PCTs	EPA 1668B	0.00005	-	6.98	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
208-NoCB	52663771	PCBs and PCTs	EPA 1668B	0.00005	-	6.98	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
3-MoCB	2051629	PCBs and PCTs	EPA 1668B	0.00005	-	6.98	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
PCB TEQ	1746016-PCB TEQ	PCBs and PCTs	-	-	-	-	-	no	-	no (surrogate identified)	-	no	no	yes	yes		PCB 81, PCB 189, and Aroclor 1254 used as surrogates for uptake factors.
128,166-Hexachlorobiphenyl Mixture (128,166-HxCB)	128166HxCB	PCBs and PCTs	-	-	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Carcinogenic effects of coplanar PCB congeners evaluated using PCB TEQ, non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
129,138,163-Hexachlorobiphenyl Mixture (129,138,163-HxCB)	129138163HxCB	PCBs and PCTs	-	-	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Carcinogenic effects of coplanar PCB congeners evaluated using PCB TEQ, non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
153,168-Hexachlorobiphenyl Mixture (153,168-HxCB)	153168HxCB	PCBs and PCTs	-	-	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Carcinogenic effects of coplanar PCB congeners evaluated using PCB TEQ, non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
156,157-Hexachlorobiphenyl Mixture (156,157-HxCB)	156157HxCB	PCBs and PCTs	-	-	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Carcinogenic effects of coplanar PCB congeners evaluated using PCB TEQ, non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
18,30-Trichlorobiphenyl Mixture (18,30-TrCB)	1830TrCB	PCBs and PCTs	-	-	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Carcinogenic effects of coplanar PCB congeners evaluated using PCB TEQ, non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.

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180,193-Heptachlorobiphenyl Mixture (180,193-HpCB)	180193HpCB	PCBs and PCTs	-	-	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Carcinogenic effects of coplanar PCB congeners evaluated using PCB TEQ, non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
20,28-Trichlorobiphenyl Mixture (20,28-TrCB)	2028TrCB	PCBs and PCTs	-	-	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Carcinogenic effects of coplanar PCB congeners evaluated using PCB TEQ, non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
44,47,65-Tetrachlorobiphenyl Mixture (44,47,65-TeCB)	444765TeCB	PCBs and PCTs	-	-	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Carcinogenic effects of coplanar PCB congeners evaluated using PCB TEQ, non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
90,101,113-Pentachlorobiphenyl Mixture (90,101,113-PeCB)	90101113PeCB	PCBs and PCTs	-	-	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Carcinogenic effects of coplanar PCB congeners evaluated using PCB TEQ, non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
Dichlorobiphenyl (total)	25512429	PCBs and PCTs	-	-	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Carcinogenic effects of coplanar PCB congeners evaluated using PCB TEQ, non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
Heptachlorobiphenyl (total)	28655712	PCBs and PCTs	-	-	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Carcinogenic effects of coplanar PCB congeners evaluated using PCB TEQ, non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
Hexachlorobiphenyl (total)	26601649	PCBs and PCTs	-	-	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Carcinogenic effects of coplanar PCB congeners evaluated using PCB TEQ, non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
Monochlorobiphenyl (total)	27323188	PCBs and PCTs	EPA 1668B	0.00005	-	6.98	-	NE	NE	NE	NE	no	no	no	no	X	Not detected in soil/sediment
Pentachlorobiphenyl (total)	25429292	PCBs and PCTs	-	-	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Carcinogenic effects of coplanar PCB congeners evaluated using PCB TEQ, non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
Tetrachlorobiphenyl (total)	26914330	PCBs and PCTs	-	-	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Carcinogenic effects of coplanar PCB congeners evaluated using PCB TEQ, non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.

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Trichlorobiphenyl (total)	25323686	PCBs and PCTs	-	-	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Carcinogenic effects of coplanar PCB congeners evaluated using PCB TEQ, non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
Energetics																	
1,2-Dinitrobenzene	528290	Energetics	-	-	-	1.69	6.10E+00	no	-	no	-	no	no	yes	yes		
1,3,5-Trinitrobenzene	99354	Energetics	EPA 8330A	0.25	-	1.45	2.20E+03	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
1,3-Dinitrobenzene	99650	Energetics	EPA 8330A	0.25	-	1.63	6.10E+00	no	-	no	-	no	no	yes	yes		
1,4-Dinitrobenzene	100254	Energetics	-	-	-	1.46	6.10E+00	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
2,4,6-Trinitrotoluene	118967	Energetics	EPA 8330A	0.25	-	1.60	1.90E+01	no	-	no	-	yes	no	yes	yes		
2,4-diamino-6-nitrotoluene	6629294	Energetics	EPA 8330A	1	-	-	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
2,4-Dinitrotoluene	121142	Energetics	EPA 8330A	0.25	-	2.18	1.60E+00	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
2,6-diamino-4-nitrotoluene	59229753	Energetics	EPA 8330A	1	-	0.55	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
2,6-Dinitrotoluene	606202	Energetics	EPA 8330A	0.25	-	2.18	3.30E-01	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
2-Amino-4,6-dinitrotoluene	35572782	Energetics	EPA 8330A	0.25	-	1.84	1.50E+02	no	-	no	-	no	no	yes	yes		
2-Nitrotoluene	88722	Energetics	EPA 8330A	0.25	-	2.36	2.90E+00	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
3-Nitrotoluene	99081	Energetics	EPA 8330A	0.25	-	2.36	6.10E+00	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
4-Amino-2,6-dinitrotoluene	19406510	Energetics	EPA 8330A	0.25	-	1.84	1.50E+02	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
4-Nitrotoluene	99990	Energetics	EPA 8330A	0.4	-	2.36	3.00E+01	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
HMX	2691410	Energetics	EPA 8330A	0.25	-	0.16	3.80E+03	no	-	no	-	yes	no	yes	yes		
Nitrobenzene	98953	Energetics	EPA 8330A	0.25	-	1.81	4.80E+00	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Nitroglycerin	55630	Energetics	EPA 8330A	5	-	1.51	6.10E+00	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
PETN	78115	Energetics	EPA 8330A	4	-	2.38	1.20E+02	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
RDX	121824	Energetics	EPA 8330A	0.25	-	0.68	5.60E+00	no	-	no	-	no	no	yes	yes		
Tetryl	479458	Energetics	EPA 8330A	0.5	-	1.64	1.20E+02	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Cyanide																	
Cyanide	57125	Cyanide	EPA 9012B	0.5	-	-0.69	2.20E+01	no	-	no	-	yes	no	yes	yes		
Hydrogen Cyanide	74908	Cyanide	-	-	-	-0.25	2.30E+01	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
TPH[c]																	
EFH(C12-C14)	EFHD (C12-C14)	TPH	EPA 8015B	5	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Evaluate using BTEX, PAHs, and other fuel-related chemicals
EFH(C15-C20)	EFHD (C15-C20)	TPH	EPA 8015B	5	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Evaluate using BTEX, PAHs, and other fuel-related chemicals
EFH(C21-C30)	EFHD (C21-C30)	TPH	EPA 8015B	5	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Evaluate using BTEX, PAHs, and other fuel-related chemicals
EFH(C8-C11)	EFHD (C8-C11)	TPH	EPA 8015B	5	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Evaluate using BTEX, PAHs, and other fuel-related chemicals
Oil and Grease	E-10140	TPH	-	-	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Evaluate using BTEX, PAHs, and other fuel-related chemicals
Total Petroleum Hydrocarbons as Diesel – Specific Carbon Ranges	DRO	TPH	EPA 8015B	5	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Evaluate using BTEX, PAHs, and other fuel-related chemicals
Total Petroleum Hydrocarbons as Gasoline (C4-C12)	GRO	TPH	EPA 8015B	5	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Evaluate using BTEX, PAHs, and other fuel-related chemicals
Total Petroleum Hydrocarbons as Kerosene (C30-C40)	KRO	TPH	-	25	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Evaluate using BTEX, PAHs, and other fuel-related chemicals
Total Petroleum Hydrocarbons as Oil (C30-C40)	ORO	TPH	EPA 8015B	25	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Evaluate using BTEX, PAHs, and other fuel-related chemicals
TPH-JP4	JP4	TPH	-	-	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Evaluate using BTEX, PAHs, and other fuel-related chemicals
Pesticides																	
4,4′-DDD	72548	Pesticides	EPA 8081	0.005	-	6.02	2.00E+00	no	-	no	-	no	yes	yes	yes		
4,4′-DDE	72559	Pesticides	EPA 8081	0.005	-	6.51	1.40E+00	no	-	no	-	no	yes	yes	yes		
4,4′-DDT	50293	Pesticides	EPA 8081	0.005	-	6.91	1.70E+00	no	-	no	-	yes	no	yes	yes		
Aldrin	309002	Pesticides	EPA 8081	0.005	-	6.50	2.90E-02	no	-	no	-	yes	no	yes	yes		
Alpha-BHC	319846	Pesticides	EPA 8081	0.005	-	3.80	7.70E-02	no	-	no	-	no	no	yes	yes		
Beta-BHC	319857	Pesticides	EPA 8081	0.005	-	3.78	2.70E-01	no	-	no	-	no	no	yes	yes		
a-Chlordane	5103719	Pesticides	-	-	-	6.3E+00	-	NE	NE	NE	NE	no	no	no	no	X	Not detected in soil/sediment
gamma-Chlordane	5103742	Pesticides	-	-	-	6.3E+00	-	NE	NE	NE	NE	no	no	no	no	X	Not detected in soil/sediment
Chlordane (Technical)	12789036	Pesticides	EPA 8081	0.01	-	6.26	1.60E+00	no	-	no	-	no	no	yes	yes		

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Delta-BHC	319868	Pesticides	EPA 8081	0.01	-	4.14	-	no (surrogate identified)	-	no	-	no	no	yes	yes		Gamma-BHC used as toxicity value surrogate
Dieldrin	60571	Pesticides	EPA 8081	0.005	-	5.40	3.00E-02	no	-	no	-	no	yes	yes	yes		
Endosulfan I	959988	Pesticides	EPA 8081	0.005	-	3.83	-	no (surrogate identified)	-	no	-	yes	no	yes	yes		Endosulfan used as toxicity value surrogate
Endosulfan II	33213659	Pesticides	EPA 8081	0.005	-	3.83	-	no (surrogate identified)	-	no	-	no	no	yes	yes		Endosulfan used as toxicity value surrogate
Endosulfan sulfate	1031078	Pesticides	EPA 8081	0.01	-	3.66	-	no (surrogate identified)	-	no	-	no	no	yes	yes		Endosulfan used as toxicity value surrogate
Endrin	72208	Pesticides	EPA 8081	0.005	-	5.20	1.80E+01	no	-	no	-	no	no	yes	yes		
Endrin aldehyde	7421934	Pesticides	EPA 8081	0.005	-	4.80	-	no (surrogate identified)	-	no	-	no	no	yes	yes		Endrin used as toxicity value surrogate
Endrin ketone	53494705	Pesticides	EPA 8081	0.005	-	4.99	-	no (surrogate identified)	-	no	-	no	no	yes	yes		Endrin used as toxicity value surrogate
Gamma-BHC	58899	Pesticides	EPA 8081	0.005	-	3.72	5.20E-01	no	-	no	-	yes	no	yes	yes		
Heptachlor	76448	Pesticides	EPA 8081	0.005	-	6.10	1.10E-01	no	-	no	-	yes	no	yes	yes		
Heptachlor epoxide	1024573	Pesticides	EPA 8081	0.005	-	4.98	5.30E-02	no	-	no	-	no	no	yes	yes		
Kepone	143500	Pesticides	-	-	-	5.41	4.90E-02	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Methoxychlor	72435	Pesticides	EPA 8081	0.005	-	5.08	3.10E+02	no	-	no	-	no	no	yes	yes		
Methyl parathion	298000	Pesticides	-	-	-	2.86	1.50E+01	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Mirex	2385855	Pesticides	EPA 8081	0.005	-	6.89	2.70E-02	no	-	no	-	yes	no	yes	yes		
Toxaphene	8001352	Pesticides	EPA 8081	0.05	-	5.78	4.40E-01	no	-	no	-	no	no	yes	yes		
Herbicides																	
2,4,5-T	93765	Herbicides	8151A	0.02	-	3.26	6.10E+02	no	-	no	-	no	no	yes	yes		
2,4,5-TP (Silvex)	93721	Herbicides	8151A	0.08	-	3.68	4.90E+02	no	-	no	-	no	no	yes	yes		
2,4-D	94757	Herbicides	8151A	0.02	-	2.62	6.90E+02	no	-	no	-	no	no	yes	yes		
2,4-DB	94826	Herbicides	8151A	0.08	-	3.53	4.90E+02	no	-	no	-	yes	no	yes	yes		
Atrazine	1912249	Herbicides	8141		-	2.14	2.10E+00	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Dalapon	75990	Herbicides	8151A	0.05	-	1.68	1.80E+03	no	-	no	-	no	no	yes	yes		
Dicamba	1918009	Herbicides	8151A	0.04	-	2.14	1.80E+03	no	-	no	-	no	no	yes	yes		
Dichloroprop	120365	Herbicides	8151A	0.08	-	3.03	-	no (surrogate identified)	-	no	-	no	no	yes	yes		
Dinoseb	88857	Herbicides	8151A	0.012	-	3.56	6.10E+01	no	-	no	-	yes	no	yes	yes		
MCPA	94746	Herbicides	8151A	8	-	3.25	3.10E+01	no	-	no	-	no	no	yes	yes		
MCPP	93652	Herbicides	8151A	8	-	3.13	6.10E+01	no	-	no	-	yes	no	yes	yes		
Alcohols																	
Ethanol	64175	Alcohols	EPA 8015B	100	-	-0.14	-	NE	NE	NE	NE	no	no	no	yes	X	Naturally occurring, low-toxicity chemical
Isopropanol	67630	Alcohols	EPA 8015B	100	-	0.28	9.90E+09	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Methanol	67561	Alcohols	EPA 8015B	100	-	-0.63	1.20E+05	NE	NE	NE	NE	no	no	no	yes	X	Naturally occurring, low-toxicity chemical
Terphenyls																	
m-Terphenyl	92068	Terphenyls	EPA 8015B	0.167	-	3.98	-	no (surrogate identified)	-	no (surrogate identified)	-	yes	no	yes	yes		Biphenyl used as toxicity value and uptake factor surrogate
o-Terphenyl	84151	Terphenyls	EPA 8015B	0.167	-	3.98	-	no (surrogate identified)	-	no (surrogate identified)	-	no	no	yes	yes		Biphenyl used as toxicity value and uptake factor surrogate
p-Terphenyl	92944	Terphenyls	EPA 8015B	0.167	-	3.98	-	no (surrogate identified)	-	no (surrogate identified)	-	no	no	yes	yes		Biphenyl used as toxicity value and uptake factor surrogate
Glycols																	
Diethylene Glycol	111466	Glycols	EPA 8015B	50	-	-1.47	-	no (surrogate identified)	-	no	-	no	no	yes	yes		Ethylene glycol monobutyl ether used as toxicity value surrogate
Ethylene Glycol	107211	Glycols	EPA 8015B	50	-	-1.20	1.20E+05	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Propylene Glycol	57556	Glycols	EPA 8015B	50	-	-0.78	1.20E+06	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment

Attachment 2a

Candidate Comprehensive List of Chemicals for Development of Rural Residential RBSLs for Soil at the SSFL

Analyte	CAS Number	Chemical Class	Typical Analytical Method	Typical Reporting Limit (mg/kg)	2005 Background Comparison Concentration[a] (mg/kg)	LogKow[b]	Resident Soil RSL (mg/kg)	Missing Toxicity Values?	Pathways Affected by Missing Toxicity Values	Missing Uptake Factors?	Pathways Affected	Chemical Selected for Expedited Rural Residential RBSL Development?	Chemical on NASA RBSL List?	Chemical Typically Evaluated in HHERAs?	Chemical Detected in Soil/Sediment?	ND in soil and/or Not Typically Evaluated in HHERAs	Comments
Triethylene glycol	112276	Glycols	-	-	-	-1.75	-	no (surrogate identified)	-	no	-	no	no	yes	yes		Diethylene glycol monobutyl ether and diethylene glycol monoethyl were used as toxicity value surrogate
Organic Lead																	
Organic Lead	7439921-O	Organic Lead	-	-	-	4.9E+00	6.10E-03	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Organic Tin																	
Dibutyl tin	1002535	Organic Tin	NOAA Status and Trends	0.0013	-	0.57	1.80E+01	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Monobutyl tin	-	Organic Tin	NOAA Status and Trends	0.005	-	-	1.80E+01	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Tetrabutyl tin	1461252	Organic Tin	NOAA Status and Trends	0.0017	-	9.37	-	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Tributyl tin	688733	Organic Tin	NOAA Status and Trends	0.0018	-	7.35	1.80E+01	NE	NE	NE	NE	no	no	yes	no	X	Not detected in soil/sediment
Dioxin/Furans																	
1,2,3,4,6,7,8-HpCDD	35822469	Dioxins/Furans	EPA 8290/1613B	0.000005	-	8.85	-	no	-	no	-	yes	no	yes	yes		Evaluate using 2,3,7,8-TCDD TEQ
1,2,3,4,6,7,8-HpCDF	67562394	Dioxins/Furans	EPA 8290/1613B	0.000005	-	7.92	-	no	-	no	-	yes	no	yes	yes		Evaluate using 2,3,7,8-TCDD TEQ
1,2,3,4,7,8,9-HpCDF	55673897	Dioxins/Furans	EPA 8290/1613B	0.000005	-	7.92	-	no	-	no	-	yes	no	yes	yes		Evaluate using 2,3,7,8-TCDD TEQ
1,2,3,4,7,8-HxCDD	39227286	Dioxins/Furans	EPA 8290/1613B	0.000005	-	7.80	-	no	-	no	-	yes	no	yes	yes		Evaluate using 2,3,7,8-TCDD TEQ
1,2,3,4,7,8-HxCDF	70648269	Dioxins/Furans	EPA 8290/1613B	0.000005	-	7.92	-	no	-	no	-	yes	no	yes	yes		Evaluate using 2,3,7,8-TCDD TEQ
1,2,3,6,7,8-HxCDD	57653857	Dioxins/Furans	EPA 8290/1613B	0.000005	-	8.21	-	no	-	no	-	yes	no	yes	yes		Evaluate using 2,3,7,8-TCDD TEQ
1,2,3,6,7,8-HxCDF	57117449	Dioxins/Furans	EPA 8290/1613B	0.000005	-	7.92	-	no	-	no	-	yes	no	yes	yes		Evaluate using 2,3,7,8-TCDD TEQ
1,2,3,7,8,9-HxCDD	19408743	Dioxins/Furans	EPA 8290/1613B	0.000005	-	8.21	-	no	-	no	-	yes	no	yes	yes		Evaluate using 2,3,7,8-TCDD TEQ
1,2,3,7,8,9-HxCDF	72918219	Dioxins/Furans	EPA 8290/1613B	0.000005	-	7.58	-	no	-	no	-	yes	no	yes	yes		Evaluate using 2,3,7,8-TCDD TEQ
1,2,3,7,8-PeCDD	40321764	Dioxins/Furans	EPA 8290/1613B	0.000005	-	6.64	-	no	-	no	-	yes	no	yes	yes		Evaluate using 2,3,7,8-TCDD TEQ
1,2,3,7,8-PeCDF	57117416	Dioxins/Furans	EPA 8290/1613B	0.000005	-	6.79	-	no	-	no	-	yes	no	yes	yes		Evaluate using 2,3,7,8-TCDD TEQ
2,3,4,6,7,8-HxCDF	60851345	Dioxins/Furans	EPA 8290/1613B	0.000005	-	7.92	-	no	-	no	-	yes	no	yes	yes		Evaluate using 2,3,7,8-TCDD TEQ
2,3,4,7,8-PeCDF	57117314	Dioxins/Furans	EPA 8290/1613B	0.000005	-	6.92	-	no	-	no	-	yes	no	yes	yes		Evaluate using 2,3,7,8-TCDD TEQ
2,3,7,8-TCDD	1746016	Dioxins/Furans	EPA 8290/1613B	0.000001	-	6.80	4.50E-06	no	-	no	-	yes	no	yes	yes		Evaluate using 2,3,7,8-TCDD TEQ
2,3,7,8-TCDF	51207319	Dioxins/Furans	EPA 8290/1613B	0.000001	-	6.53	-	no	-	no	-	yes	no	yes	yes		Evaluate using 2,3,7,8-TCDD TEQ
OCDD	3268879	Dioxins/Furans	EPA 8290/1613B	0.00001	-	8.20	-	no	-	no	-	yes	no	yes	yes		Evaluate using 2,3,7,8-TCDD TEQ
OCDF	39001020	Dioxins/Furans	EPA 8290/1613B	0.00001	-	8.60	-	no	-	no	-	yes	no	yes	yes		Evaluate using 2,3,7,8-TCDD TEQ
2,3,7,8-TCDD TEQ	1746016-TEQ	Dioxins/Furans	-	-	-	-	4.50E-06	no	-	no	-	no	no	yes	yes		
Total HpCDD	37871004	Dioxins/Furans	EPA 8290/1613B	0.000005	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	As stated in SRAM Rev. 2, "Total" dioxins/furans will not be evaluated in the HHERA
Total HpCDF	38998753	Dioxins/Furans	EPA 8290/1613B	0.000005	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	As stated in SRAM Rev. 2, "Total" dioxins/furans will not be evaluated in the HHERA
Total HxCDD	34465468	Dioxins/Furans	EPA 8290/1613B	0.000005	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	As stated in SRAM Rev. 2, "Total" dioxins/furans will not be evaluated in the HHERA
Total HxCDF	55684941	Dioxins/Furans	EPA 8290/1613B	0.000005	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	As stated in SRAM Rev. 2, "Total" dioxins/furans will not be evaluated in the HHERA
Total PeCDD	36088229	Dioxins/Furans	EPA 8290/1613B	0.000005	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	As stated in SRAM Rev. 2, "Total" dioxins/furans will not be evaluated in the HHERA
Total PeCDF	30402154	Dioxins/Furans	EPA 8290/1613B	0.000005	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	As stated in SRAM Rev. 2, "Total" dioxins/furans will not be evaluated in the HHERA
Total TCDD	41903575	Dioxins/Furans	EPA 8290/1613B	0.000001	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	As stated in SRAM Rev. 2, "Total" dioxins/furans will not be evaluated in the HHERA
Total TCDF	30402143	Dioxins/Furans	EPA 8290/1613B	0.000001	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	As stated in SRAM Rev. 2, "Total" dioxins/furans will not be evaluated in the HHERA
Asbestos																	
Actinolite	77536664	Asbestos	EPA 600/R-93/116	-	-	-	-	NE	NE	NE	NE	no	no	no	no	X	Not detected in soil/sediment
Amosite	12172735	Asbestos	EPA 600/R-93/116	-	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Asbestos fibers evaluated separately
Anthophyllite	17068789	Asbestos	EPA 600/R-93/116	-	-	-	-	NE	NE	NE	NE	no	no	no	no	X	Not detected in soil/sediment
Chrysotile	12001295	Asbestos	EPA 600/R-93/116	-	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Asbestos fibers evaluated separately
Crocidolite	12001284	Asbestos	EPA 600/R-93/116	-	-	-	-	NE	NE	NE	NE	no	no	no	no	X	Not detected in soil/sediment
Tremolite	14567738	Asbestos	EPA 600/R-93/116	-	-	-	-	NE	NE	NE	NE	no	no	no	no	X	Not detected in soil/sediment
Others																	
Molecular Sulfur	63705055	Others	-	-	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Non-specific analytical parameter - RBSLs not applicable

Attachment 2a

Candidate Comprehensive List of Chemicals for Development of Rural Residential RBSLs for Soil at the SSFL

Analyte	CAS Number	Chemical Class	Typical Analytical Method	Typical Reporting Limit (mg/kg)	2005 Background Comparison Concentration[a] (mg/kg)	LogKow[b]	Resident Soil RSL (mg/kg)	Missing Toxicity Values?	Pathways Affected by Missing Toxicity Values	Missing Uptake Factors?	Pathways Affected	Chemical Selected for Expedited Rural Residential RBSL Development?	Chemical on NASA RBSL List?	Chemical Typically Evaluated in HHERAs?	Chemical Detected in Soil/Sediment?	ND in soil and/or Not Typically Evaluated in HHERAs	Comments
Total Kjeldahl Nitrogen	E-10264	Others	SM4500-NORG,C	5	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Non-specific analytical parameter - RBSLs not applicable
Total Organic Carbon	E-10195	Others	SW-846 9060	100	-	-	-	NE	NE	NE	NE	no	no	no	yes	X	Non-specific analytical parameter - RBSLs not applicable

Notes:

- = None established/not applicable.

mg/kg = Milligram per kilogram

NE = Not evaluated

a - Values shown are the 2005 background comparison values presented in SRAM Rev.2 and approved by DTSC. Currently, a new chemical background study is being conducted by DTSC, so these comparison values may change in the future.

b - Values obtained from USEPA's Estimation Programs Interface SuiteTM (EPI Suite) Version 4.00; http://www.epa.gov/opptintr/exposure/pubs/episuitedl.htm (USEPA, 2010), accessed in September 2010, or cited in the online RAIS (http://rais.ornl.gov/cgi-bin/prg/PRG_search?select=chem) chemical-specific factors, accessed in May 2010.

c - Risk assessment including RBSLs development is not required for TPH, according to personal communication from Don Greenlee (DTSC) to Bruce Narloch (MWH), dated September 23, 2010.

d - Biota consumption pathways will be excluded from the Rural Residential RBSLs for aluminum and fluoride, due to the low bioaccumulation potential of aluminum in non-acidic soils and tendency of fluoride to partition into the hard inedible portions of animal tissues (i.e., bones, teeth, eggshells).

Chemicals that have not been detected in soil/sediment at the SSFL, to date.

Chemicals that can be removed from the Comprehensive List of Chemicals based on low risk potential (i.e., naturally occurring and low toxicity, or evaluated using other appropriate methods). Published chronic toxicity values or uptake factors are unavailable for many of these chemicals.

Chemicals that can be removed from the Comprehensive Chemical list due to missing RBSL parameters; no current chemicals fall into this category.

ATTACHMENT 2B

Chemicals to be Eliminated from the Final Comprehensive List of Chemicals (by Criterion)

Attachment 2b

Chemicals to be Eliminated from the Final Comprehensive List of Chemicals (by Criterion)

Analyte	CAS Number	Chemical Class	Rationale for Exclusion
1,1-Dichloropropene	563586	Volatile Organics	Not detected in soil/sediment
1,2,3-Trichloropropane	96184	Volatile Organics	Not detected in soil/sediment
1,2,3-Trichloropropene	96195	Volatile Organics	Not detected in soil/sediment
1,3-Dichloropropane	142289	Volatile Organics	Not detected in soil/sediment
1,3-Dichloropropene	542756	Volatile Organics	Not detected in soil/sediment
2,2-Dichloro-1,1,1-trifluoroethane	306832	Volatile Organics	Not detected in soil/sediment
2,2-Dichloropropane	594207	Volatile Organics	Not detected in soil/sediment
2-Chloro-1,1,1-trifluoroethane	75887	Volatile Organics	Not detected in soil/sediment
Acetonitrile	75058	Volatile Organics	Not detected in soil/sediment
Acrolein	107028	Volatile Organics	Not detected in soil/sediment
Acrylonitrile	107131	Volatile Organics	Not detected in soil/sediment
Benzyl chloride	100447	Volatile Organics	Not detected in soil/sediment
Bromochloromethane	74975	Volatile Organics	Not detected in soil/sediment
Chloroethane	75003	Volatile Organics	Not detected in soil/sediment
Chlorotrifluoroethylene	79389	Volatile Organics	Not detected in soil/sediment
cis-1,3-Dichloropropene	10061015	Volatile Organics	Not detected in soil/sediment
Di isopropyl ether	108203	Volatile Organics	Not detected in soil/sediment
Dichlorofluoromethane	75434	Volatile Organics	Not detected in soil/sediment
Dichlorotrifluoroethane	34077877	Volatile Organics	Not detected in soil/sediment
Difluorochloromethane	75456	Volatile Organics	Not detected in soil/sediment
Ethyl tertiary butyl ether	637923	Volatile Organics	Not detected in soil/sediment
Methane	74828	Volatile Organics	Not detected in soil/sediment
Methyl-tert-butyl- Ether (MTBE)	1634044	Volatile Organics	Not detected in soil/sediment
Pyridine	110861	Volatile Organics	Not detected in soil/sediment
Tertiary amyl methyl ether	994058	Volatile Organics	Not detected in soil/sediment
Tertiary butyl alcohol	75650	Volatile Organics	Not detected in soil/sediment
trans-1,3-Dichloropropene	10061026	Volatile Organics	Not detected in soil/sediment
Vinyl acetate	108054	Volatile Organics	Not detected in soil/sediment
Uranium	7440611	Metals	Not detected in soil/sediment
1,2-Diphenylhydrazine/Azobenzene	122667	SVOCs	Not detected in soil/sediment
2,4-Dichlorophenol	120832	SVOCs	Not detected in soil/sediment
2,4-Dinitrophenol	51285	SVOCs	Not detected in soil/sediment
2,4-Dinitrotoluene	121142	SVOCs	Not detected in soil/sediment
2,6-Dichlorophenol	87650	SVOCs	Not detected in soil/sediment
2,6-Dinitrotoluene	606202	SVOCs	Not detected in soil/sediment
2-Chloronaphthalene	91587	SVOCs	Not detected in soil/sediment
2-Chlorophenol	95578	SVOCs	Not detected in soil/sediment
2-Nitroaniline	88744	SVOCs	Not detected in soil/sediment
2-Nitrophenol	88755	SVOCs	Not detected in soil/sediment
3,3'-Dichlorobenzidine	91941	SVOCs	Not detected in soil/sediment
3-Nitroaniline	99092	SVOCs	Not detected in soil/sediment
4,6-Dinitro-2-methylphenol	534521	SVOCs	Not detected in soil/sediment
4,6-Dinitro-o-cresol	534521	SVOCs	Not detected in soil/sediment
4-Bromophenyl-phenylether	101553	SVOCs	Not detected in soil/sediment
4-Chloroaniline	106478	SVOCs	Not detected in soil/sediment
4-Chlorophenyl-phenylether	7005723	SVOCs	Not detected in soil/sediment
4-Nitrophenol	100027	SVOCs	Not detected in soil/sediment
Aniline	62533	SVOCs	Not detected in soil/sediment
Benzidine	92875	SVOCs	Not detected in soil/sediment
bis(2-Chloroethoxy)methane	111911	SVOCs	Not detected in soil/sediment
bis(2-Chloroethyl) ether	111444	SVOCs	Not detected in soil/sediment
Bis(2-chloroisopropyl)ether	108601	SVOCs	Not detected in soil/sediment
Dimethoate	60515	SVOCs	Not detected in soil/sediment
Diphenylamine	122394	SVOCs	Not detected in soil/sediment
Disulfoton	298044	SVOCs	Not detected in soil/sediment
Ethanone, 1-(2,4,6-Trihydroxyphenyl)-	480660	SVOCs	Not detected in soil/sediment
Hexachlorobenzene	118741	SVOCs	Not detected in soil/sediment
Hexachlorocyclopentadiene	77474	SVOCs	Not detected in soil/sediment
Hexachloroethane	67721	SVOCs	Not detected in soil/sediment
Isophorone	78591	SVOCs	Not detected in soil/sediment
Nitrobenzene	98953	SVOCs	Not detected in soil/sediment
n-Nitroso-di-n-propylamine	621647	SVOCs	Not detected in soil/sediment
Phorate	298022	SVOCs	Not detected in soil/sediment
Chlorine	7782505	Anions	Not detected in soil/sediment
Aroclor 1221	11104282	PCBs and PCTs	Not detected in soil/sediment
Aroclor 1232	11141165	PCBs and PCTs	Not detected in soil/sediment
Aroclor 1262	37324235	PCBs and PCTs	Not detected in soil/sediment
Aroclor 1268	11100144	PCBs and PCTs	Not detected in soil/sediment
Aroclor 5432	63496311	PCBs and PCTs	Not detected in soil/sediment
Aroclor 5442	12642238	PCBs and PCTs	Not detected in soil/sediment
PCB 110	38380039	PCBs and PCTs	Not detected in soil/sediment
PCB 119	56558179	PCBs and PCTs	Not detected in soil/sediment
PCB 132	38380051	PCBs and PCTs	Not detected in soil/sediment
PCB 149	38380040	PCBs and PCTs	Not detected in soil/sediment
PCB 151	52663635	PCBs and PCTs	Not detected in soil/sediment
PCB 158	74472427	PCBs and PCTs	Not detected in soil/sediment
PCB 168	59291 655	PCBs and PCTs	Not detected in soil/sediment
PCB 177	52663704	PCBs and PCTs	Not detected in soil/sediment
PCB 183	52663691	PCBs and PCTs	Not detected in soil/sediment
PCB 201	40186718	PCBs and PCTs	Not detected in soil/sediment
PCB 37	38444905	PCBs and PCTs	Not detected in soil/sediment
PCB 49	41464408	PCBs and PCTs	Not detected in soil/sediment
PCB 70	32598111	PCBs and PCTs	Not detected in soil/sediment
PCB 74	32690930	PCBs and PCTs	Not detected in soil/sediment
PCB 87	38380028	PCBs and PCTs	Not detected in soil/sediment
PCB 99	38380017	PCBs and PCTs	Not detected in soil/sediment
15-DiCB	2050682	PCBs and PCTs	Not detected in soil/sediment
208-NoCB	52663771	PCBs and PCTs	Not detected in soil/sediment
3-MoCB	2051629	PCBs and PCTs	Not detected in soil/sediment
Monochlorobiphenyl (total)	27323188	PCBs and PCTs	Not detected in soil/sediment
1,3,5-Trinitrobenzene	99354	Energetics	Not detected in soil/sediment
1,4-Dinitrobenzene	100254	Energetics	Not detected in soil/sediment
2,4-diamino-6-nitrotoluene	6629294	Energetics	Not detected in soil/sediment
2,4-Dinitrotoluene	121142	Energetics	Not detected in soil/sediment

Attachment 2b

Chemicals to be Eliminated from the Final Comprehensive List of Chemicals (by Criterion)

Analyte	CAS Number	Chemical Class	Rationale for Exclusion
2,6-diamino-4-nitrotoluene	59229753	Energetics	Not detected in soil/sediment
2,6-Dinitrotoluene	606202	Energetics	Not detected in soil/sediment
2-Nitrotoluene	88722	Energetics	Not detected in soil/sediment
3-Nitrotoluene	99081	Energetics	Not detected in soil/sediment
4-Amino-2,6-dinitrotoluene	19406510	Energetics	Not detected in soil/sediment
4-Nitrotoluene	99990	Energetics	Not detected in soil/sediment
Nitrobenzene	98953	Energetics	Not detected in soil/sediment
Nitroglycerin	55630	Energetics	Not detected in soil/sediment
PETN	78115	Energetics	Not detected in soil/sediment
Tetryl	479458	Energetics	Not detected in soil/sediment
Hydrogen Cyanide	74908	Cyanide	Not detected in soil/sediment
a-Chlordane	5103719	Pesticides	Not detected in soil/sediment
gamma-Chlordane	5103742	Pesticides	Not detected in soil/sediment
Kepone	143500	Pesticides	Not detected in soil/sediment
Methyl parathion	298000	Pesticides	Not detected in soil/sediment
Atrazine	1912249	Herbicides	Not detected in soil/sediment
Isopropanol	67630	Alcohols	Not detected in soil/sediment
Ethylene Glycol	107211	Glycols	Not detected in soil/sediment
Propylene Glycol	57556	Glycols	Not detected in soil/sediment
Organic Lead	7439921-O	Organic Lead	Not detected in soil/sediment
Dibutyl tin	1002535	Organic Tin	Not detected in soil/sediment
Monobutyl tin	-	Organic Tin	Not detected in soil/sediment
Tetrabutyl tin	1461252	Organic Tin	Not detected in soil/sediment
Tributyl tin	688733	Organic Tin	Not detected in soil/sediment
Actinolite	77536664	Asbestos	Not detected in soil/sediment
Anthophyllite	17068789	Asbestos	Not detected in soil/sediment
Crocidolite	12001284	Asbestos	Not detected in soil/sediment
Tremolite	14567738	Asbestos	Not detected in soil/sediment
Acetic Acid	64197	Volatile Organics	Naturally occurring, low-toxicity chemical
Calcium	7440702	Metals	Essential nutrient - naturally occurring, low-toxicity chemical
Iron	7439896	Metals	Essential nutrient - naturally occurring, low-toxicity chemical
Magnesium	7439954	Metals	Essential nutrient - naturally occurring, low-toxicity chemical
Phosphorus	7723140	Metals	Essential nutrient - naturally occurring, low-toxicity chemical
Potassium	7440097	Metals	Essential nutrient - naturally occurring, low-toxicity chemical
Sodium	7440235	Metals	Essential nutrient - naturally occurring, low-toxicity chemical
Titanium	7440326	Metals	Naturally occurring, low-toxicity chemical
Ammonia-N	7664417	Anions	Naturally occurring, low-toxicity chemical
Bromide	24959679	Anions	Naturally occurring, low-toxicity chemical
Chloride	16887006	Anions	Naturally occurring, low-toxicity chemical
Nitrate-NO3	NO3N	Anions	Naturally occurring, low-toxicity chemical
Nitrite-NO2	E-10128	Anions	Naturally occurring, low-toxicity chemical
Orthophosphate – PO4	14265442	Anions	Naturally occurring, low-toxicity chemical
Sulfate	14808798	Anions	Naturally occurring, low-toxicity chemical
PCB 101	37680732	PCBs and PCTs	Non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
PCB 105	32598144	PCBs and PCTs	Evaluate using PCB TEQ
PCB 114	74472370	PCBs and PCTs	Evaluate using PCB TEQ
PCB 118	31508006	PCBs and PCTs	Evaluate using PCB TEQ
PCB 123	65510443	PCBs and PCTs	Evaluate using PCB TEQ
PCB 126	57465288	PCBs and PCTs	Evaluate using PCB TEQ
PCB 128	38380073	PCBs and PCTs	Non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
PCB 138	35065282	PCBs and PCTs	Non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
PCB 153	35065271	PCBs and PCTs	Non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
PCB 156	38380084	PCBs and PCTs	Evaluate using PCB TEQ
PCB 157	69782907	PCBs and PCTs	Evaluate using PCB TEQ
PCB 167	52663726	PCBs and PCTs	Evaluate using PCB TEQ
PCB 169	32774166	PCBs and PCTs	Evaluate using PCB TEQ
PCB 170	35065306	PCBs and PCTs	Non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
PCB 18	37680652	PCBs and PCTs	Non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
PCB 180	35065293	PCBs and PCTs	Non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
PCB 187	52663680	PCBs and PCTs	Non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
PCB 189	39635319	PCBs and PCTs	Evaluate using PCB TEQ
PCB 194	35694087	PCBs and PCTs	Non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
PCB 206	40186729	PCBs and PCTs	Non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
PCB 28	7012375	PCBs and PCTs	Non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
PCB 44	41464395	PCBs and PCTs	Non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.

Attachment 2b

Chemicals to be Eliminated from the Final Comprehensive List of Chemicals (by Criterion)

Analyte	CAS Number	Chemical Class	Rationale for Exclusion
PCB 52	35693993	PCBs and PCTs	Non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
PCB 66	32598100	PCBs and PCTs	Non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
PCB 77	32598133	PCBs and PCTs	Evaluate using PCB TEQ
PCB 81	70362504	PCBs and PCTs	Evaluate using PCB TEQ
PCB-195	52663782	PCBs and PCTs	Non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
PCB-8	34883437	PCBs and PCTs	Non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
PCB-90/101	E-16015	PCBs and PCTs	Non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
128,166-HxCB	128166HxCB	PCBs and PCTs	Evaluate using PCB TEQ
129,138,163-HxCB	129138163HxCB	PCBs and PCTs	Non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
153,168-HxCB	153168HxCB	PCBs and PCTs	Non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
156,157-HxCB	156157HxCB	PCBs and PCTs	Evaluate using PCB TEQ
18,30-TrCB	1830TrCB	PCBs and PCTs	Non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
180,193-HpCB	180193HpCB	PCBs and PCTs	Non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
20,28-TrCB	2028TrCB	PCBs and PCTs	Non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
44,47,65-TeCB	444765TeCB	PCBs and PCTs	Non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
90,101,113-PeCB	90101113PeCB	PCBs and PCTs	Non-cancer hazards for PCB congeners lacking available non-cancer toxicity values (e.g., oral RfDs) will not be evaluated quantitatively as per DTSC policy.
Dichlorobiphenyl (total)	25512429	PCBs and PCTs	Evaluate using PCB TEQ
Heptachlorobiphenyl (total)	28655712	PCBs and PCTs	Evaluate using PCB TEQ
Hexachlorobiphenyl (total)	26601649	PCBs and PCTs	Evaluate using PCB TEQ
Pentachlorobiphenyl (total)	25429292	PCBs and PCTs	Evaluate using PCB TEQ
Tetrachlorobiphenyl (total)	26914330	PCBs and PCTs	Evaluate using PCB TEQ
Trichlorobiphenyl (total)	25323686	PCBs and PCTs	Evaluate using PCB TEQ
EFH(C12-C14)	EFHD (C12-C14)	TPH	Evaluate using BTEX, PAHs, and other fuel-related chemicals
EFH(C15-C20)	EFHD (C15-C20)	TPH	Evaluate using BTEX, PAHs, and other fuel-related chemicals
EFH(C21-C30)	EFHD (C21-C30)	TPH	Evaluate using BTEX, PAHs, and other fuel-related chemicals
EFH(C8-C11)	EFHD (C8-C11)	TPH	Evaluate using BTEX, PAHs, and other fuel-related chemicals
Oil and Grease	E-10140	TPH	Evaluate using BTEX, PAHs, and other fuel-related chemicals
Total Petroleum Hydrocarbons as Diesel – Specific Carbon Ranges	DRO	TPH	Evaluate using BTEX, PAHs, and other fuel-related chemicals
Total Petroleum Hydrocarbons as Gasoline (C4-C12)	GRO	TPH	Evaluate using BTEX, PAHs, and other fuel-related chemicals
Total Petroleum Hydrocarbons as Kerosene (C30-C40)	KRO	TPH	Evaluate using BTEX, PAHs, and other fuel-related chemicals
Total Petroleum Hydrocarbons as Oil (C30-C40)	ORO	TPH	Evaluate using BTEX, PAHs, and other fuel-related chemicals
TPH-JP4	JP4	TPH	Evaluate using BTEX, PAHs, and other fuel-related chemicals
Ethanol	64175	Alcohols	Naturally occurring, low-toxicity chemical
Methanol	67561	Alcohols	Naturally occurring, low-toxicity chemical
1,2,3,4,6,7,8-HpCDD	35822469	Dioxins/Furans	Evaluate using 2,3,7,8-TCDD TEQ
1,2,3,4,6,7,8-HpCDF	67562394	Dioxins/Furans	Evaluate using 2,3,7,8-TCDD TEQ
1,2,3,4,7,8,9-HpCDF	55673897	Dioxins/Furans	Evaluate using 2,3,7,8-TCDD TEQ
1,2,3,4,7,8-HxCDD	39227286	Dioxins/Furans	Evaluate using 2,3,7,8-TCDD TEQ
1,2,3,4,7,8-HxCDF	70648269	Dioxins/Furans	Evaluate using 2,3,7,8-TCDD TEQ
1,2,3,6,7,8-HxCDD	57653857	Dioxins/Furans	Evaluate using 2,3,7,8-TCDD TEQ
1,2,3,6,7,8-HxCDF	57117449	Dioxins/Furans	Evaluate using 2,3,7,8-TCDD TEQ
1,2,3,7,8,9-HxCDD	19408743	Dioxins/Furans	Evaluate using 2,3,7,8-TCDD TEQ
1,2,3,7,8,9-HxCDF	72918219	Dioxins/Furans	Evaluate using 2,3,7,8-TCDD TEQ
1,2,3,7,8-PeCDD	40321764	Dioxins/Furans	Evaluate using 2,3,7,8-TCDD TEQ
1,2,3,7,8-PeCDF	57117416	Dioxins/Furans	Evaluate using 2,3,7,8-TCDD TEQ
2,3,4,6,7,8-HxCDF	60851345	Dioxins/Furans	Evaluate using 2,3,7,8-TCDD TEQ
2,3,4,7,8-PeCDF	57117314	Dioxins/Furans	Evaluate using 2,3,7,8-TCDD TEQ
2,3,7,8-TCDD	1746016	Dioxins/Furans	Evaluate using 2,3,7,8-TCDD TEQ
2,3,7,8-TCDF	51207319	Dioxins/Furans	Evaluate using 2,3,7,8-TCDD TEQ
OCDD	3268879	Dioxins/Furans	Evaluate using 2,3,7,8-TCDD TEQ
OCDF	39001020	Dioxins/Furans	Evaluate using 2,3,7,8-TCDD TEQ
Total HpCDD	37871004	Dioxins/Furans	Evaluate using 2,3,7,8-TCDD TEQ
Total HpCDF	38998753	Dioxins/Furans	Evaluate using 2,3,7,8-TCDD TEQ
Total HxCDD	34465468	Dioxins/Furans	Evaluate using 2,3,7,8-TCDD TEQ
Total HxCDF	55684941	Dioxins/Furans	Evaluate using 2,3,7,8-TCDD TEQ
Total PeCDD	36088229	Dioxins/Furans	Evaluate using 2,3,7,8-TCDD TEQ
Total PeCDF	30402154	Dioxins/Furans	Evaluate using 2,3,7,8-TCDD TEQ
Total TCDD	41903575	Dioxins/Furans	Evaluate using 2,3,7,8-TCDD TEQ
Total TCDF	30402143	Dioxins/Furans	Evaluate using 2,3,7,8-TCDD TEQ
Amosite	12172735	Asbestos	Asbestos fibers evaluated separately
Chrysotile	12001295	Asbestos	Asbestos fibers evaluated separately
Molecular Sulfur	63705055	Others	Non-specific analytical parameter - RBSLs not applicable
Total Kjeldahl Nitrogen	E-10264	Others	Non-specific analytical parameter - RBSLs not applicable
Total Organic Carbon	E-10195	Others	Non-specific analytical parameter - RBSLs not applicable
Pending consultation between technical representative of the SSFL and DTSC.			

Attachment 2b

Chemicals to be Eliminated from the Final Comprehensive List of Chemicals (by Criterion)

Analyte	CAS Number	Chemical Class	Rationale for Exclusion
	Chemicals that have not been detected in soil/sediment at the SSFL, to date.		
	Chemicals that can be removed from the *final* Comprehensive List of Chemicals based on low risk potential (i.e., naturally occurring and low toxicity, or evaluated using other appropriate mnethods).		
	Chemicals that can be removed from the *final* Comprehensive List of Chemicals due to missing RBSL parameters; no current chemicals fall into this category.		

APPENDIX B

Human Health Risk-Based Screening Levels for Chemicals in Soil at the Santa Susana Field Laboratory, Ventura County, California

HUMAN HEALTH RISK-BASED SCREENING LEVELS FOR CHEMICALS IN SOIL AT THE SANTA SUSANA FIELD LABORATORY VENTURA COUNTY, CALIFORNIA

Prepared For:

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1 Summary of the Human Health Risk-Based Screening Levels for Chemicals in Soil at the SSFL

ATTACHMENTS

Attachment No.

1 Methodology for the Calculation of Human Health Risk-Based Screening Levels for Chemicals in Soil at the SSFL

2 Responses to DTSC Comments on the Human Health Risk-Based Screening Levels for Chemicals in Soil at the Santa Susana Field Laboratory, Ventura County

This technical memorandum describes the procedures to be used in the calculation of risks for chemicals in human health risk assessments (HHRAs) prepared for the Santa Susana Field Laboratory (SSFL) during Resource Conservation and Recovery Act (RCRA) Facility Investigation and/or Remedial Investigation (RFI/RI) activities. In this technical memorandum, the term "risk" is used to refer to both carcinogenic risk and non-carcinogenic hazard estimates for chemicals in soil HHRAs. This document was prepared for the California Environmental Protection Agency (Cal-EPA) Department of Toxic Substances Control (DTSC) on behalf of the Boeing Company (Boeing) in response to a request made by DTSC during a meeting held on February 17, 2010. This document is intended to supplement the Standardized Risk Assessment Methodology Work Plan, Santa Susana Field Laboratory, Ventura County, California Revision 2 – Final (SRAM Rev. 2) (MWH, 2005).

This technical memorandum presents the approach, methods, and assumptions used to calculate human health risk-based screening levels (HH RBSLs) for chemicals detected in soil (i.e., soil, ephemeral sediment and weathered bedrock) for use in human health risk assessments (HHRAs) prepared for the Santa Susana Field Laboratory (SSFL). Chemicals that have been detected in soil during site investigations at the SSFL were identified using the process outlined in the *Draft Process for Selecting the Comprehensive List of Chemicals Technical Memorandum* (Appendix A of the SRAM Rev. 2 Addendum). The HH RBSLs (Table 1) presented herein supersede all previous HH RBSLs developed for the SSFL, including the previously developed suburban residential and recreational soil RBSLs for chemicals that were derived based on the exposure parameters and assumptions described in the Department of Toxic Substances Control (DTSC)-approved *Standardized Risk Assessment Methodology Work Plan, Revision 2* (hereafter referred to as the SRAM; MWH, 2005). This document has been prepared for the California Environmental Protection Agency (Cal-EPA) Department of Toxic Substances Control (DTSC) on behalf of the Boeing Company (Boeing).

Six sets of HH RBSLs, based on the following exposure scenarios, were calculated: 1) suburban residential RBSLs, 2) SRAM-based suburban residential garden RBSLs, 3) United States Environmental Protection Agency (USEPA) default-based suburban residential garden RBSLs, 4) recreational RBSLs, 5) 40-year rural residential RBSLs, and 6) 30-year rural residential RBSLs. Human health RBSLs were developed for the suburban residential and recreational scenarios based on the following direct soil contact exposure routes: incidental ingestion of soil, dermal contact with soil, and inhalation of dust and volatile constituents in soil. Garden RBSLs were developed for the suburban resident with garden scenario based on the ingestion of fruits and vegetables pathway. Risk estimates for direct soil exposure pathways and the garden pathway are evaluated and reported separately for the suburban resident, as described in Sections 4.1.2 and 6.5 of the SRAM (MWH, 2005). Human health RBSLs were developed for rural residents based upon direct soil contact exposure routes and the following indirect soil exposure

routes: ingestion of fruits and vegetables, ingestion of beef, ingestion of milk, ingestion of poultry, ingestion of eggs, ingestion of swine, and ingestion of fish.

Attachment 1 details the methodology used to calculate soil HH RBSLs for all six scenarios including equations used to calculate direct soil exposure HH RBSLs (Section 2.2), equations used to calculate indirect soil exposure HH RBSLs (Section 2.3), and equations used to calculate total (that is, including all relevant exposure routes) HH RBSLs for soil (Section 2.4). Attachment 1 also details all input parameters used in HH RBSL calculations, which include sources of exposure parameters and physical-chemical properties (Section 3.1), sources of toxicity values (Section 3.3), risk characterization methods utilizing the soil HH RBSLs (Section 4.0), and uncertainties associated with using the soil HH RBSLs (Section 5.0).

Human health RBSLs will be used in estimating carcinogenic and non-carcinogenic risks in future HHRAs prepared for the SSFL using the sum-of-fractions approach, as described in Section 4 of Attachment 1. Additionally, the HH RBSLs presented in this technical memorandum may be used in other steps of the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) process to: 1) determine characterization completeness; and 2) identify soil impact locations for Corrective Measures Study (CMS) recommendations.

REFERENCES

MWH Americas, Inc. (MWH), 2005. Standardized Risk Assessment Methodology (SRAM) Work Plan, Santa Susana Field Laboratory, Ventura County, California. Revision 2 – Final. September. HDMSE00198.

TABLES

Table 1

Summary of the Human Health Risk-Based Screening Levels for Chemicals in Soil at the SSFL

			Suburban Residential Soil RBSL ($RBSL_{so_res}$) [b]			SRAM-based Suburban Residential Garden RBSL ($RBSL_{so_res_g}$) [c]			USEPA default-based Suburban Residential Garden RBSL ($RBSL_{so_res_g}$) [c]			40-year Rural Residential Soil RBSL ($RBSL_{so_RR}$) [d]			30-year Rural Residential Soil RBSL ($RBSL_{so_RR}$) [d]			Recreational Soil RBSL ($RBSL_{so_rec}$) [b]		
Analyte	CAS #	Analyte Synonym [a]	Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Lowest (mg/kg)	Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Lowest (mg/kg)	Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Lowest (mg/kg)	Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Lowest (mg/kg)	Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Lowest (mg/kg)	Composite Recreator Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Lowest (mg/kg)
Inorganic Compounds																				
Aluminum	7429905	Aluminum, Total	-	7.53E+04	7.53E+04	-	-	- [e]	-	-	- [e]	-	7.53E+04	7.53E+04	-	7.53E+04	7.53E+04	-	3.54E+05	3.54E+05
Antimony	7440360	Antimony, Total	-	2.64E+01	2.64E+01	-	1.39E-01	1.39E-01	-	3.68E+00	3.68E+00	-	6.99E-01	6.99E-01	-	6.99E-01	6.99E-01	-	1.23E+02	1.23E+02
Arsenic	7440382	Arsenic, Total	6.58E-02	2.16E+01	6.58E-02	9.92E-05	1.04E-01	9.92E-05	2.91E-03	2.76E+00	2.91E-03	1.70E-04	3.07E-01	1.70E-04	2.28E-04	3.07E-01	2.28E-04	2.46E-01	1.01E+02	2.46E-01
Barium	7440393	Barium, Total	-	1.10E+04	1.10E+04	-	7.15E+01	7.15E+01	-	1.89E+03	1.89E+03	-	8.77E+01	8.77E+01	-	8.77E+01	8.77E+01	-	5.19E+04	5.19E+04
Beryllium	7440417	Beryllium, Total	1.48E+03	3.12E+01	3.12E+01	-	7.16E-01	7.16E-01	-	1.89E+01	1.89E+01	1.03E+03	3.95E+00	3.95E+00	1.38E+03	3.95E+00	3.95E+00	2.07E+04	1.46E+02	1.46E+02
Boron	7440428	Boron, Total	-	1.52E+04	1.52E+04	-	1.49E+01	1.49E+01	-	3.94E+02	3.94E+02	-	4.62E+01	4.62E+01	-	4.62E+01	4.62E+01	-	7.10E+04	7.10E+04
Cadmium	7440439	Cadmium, Total	8.44E+02	4.60E+00 [f]	4.60E+00	-	1.65E-03 [f]	1.65E-03	-	5.46E-02 [f]	5.46E-02	5.91E+02	2.34E-03 [f]	2.34E-03	7.88E+02	2.34E-03 [f]	2.34E-03	1.18E+04	9.06E+00 [f]	9.06E+00
Chromium	7440473	Chromium, Total	-	3.72E+04	3.72E+04	-	5.42E+02	5.42E+02	-	1.43E+04	1.43E+04	-	3.02E+03	3.02E+03	-	3.02E+03	3.02E+03	-	1.74E+05	1.74E+05
Cobalt	7440484	Cobalt, Total	3.94E+02	2.28E+01	2.28E+01	-	9.97E-02	9.97E-02	-	2.63E+00	2.63E+00	2.76E+02	2.17E-01	2.17E-01	3.68E+02	2.17E-01	2.17E-01	5.52E+03	1.06E+02	1.06E+02
Copper	7440508	Copper, Total	-	3.04E+03	3.04E+03	-	1.11E+01	1.11E+01	-	2.92E+02	2.92E+02	-	1.99E+01	1.99E+01	-	1.99E+01	1.99E+01	-	1.42E+04	1.42E+04
Cyanides	57125	Cyanide, Total;	-	4.56E+01	4.56E+01	-	2.78E-02	2.78E-02	-	7.34E-01	7.34E-01	-	1.81E-01	1.81E-01	-	1.81E-01	1.81E-01	-	2.13E+02	2.13E+02
Fluoride	16984488	-	-	3.04E+03	3.04E+03	-	-	-	-	-	-	-	3.04E+03	3.04E+03	-	3.04E+03	3.04E+03	-	1.42E+04	1.42E+04
Hexavalent chromium	18540299	Chromium, Hexavalent; Chromium VI	1.29E+00	2.34E+02	1.29E+00	1.94E-03	1.08E+00	1.94E-03	5.70E-02	2.84E+01	5.70E-02	7.54E-03	5.02E+00	7.54E-03	9.89E-03	5.02E+00	9.89E-03	6.27E+00	1.09E+03	6.27E+00
Lead	7439921	Lead, Total	-	8.00E+01 [g]	8.00E+01	- [g]	6.90E+00 [h]	6.90E+00	- [h]	7.20E+00 [i]	7.20E+00	- [i]	6.00E+00 [j]	6.00E+00	- [j]	6.00E+00 [j]	6.00E+00	- [j]	3.60E+02 [k]	3.60E+02 [k]
Lithium	7439932	Lithium, Total	-	1.52E+02	1.52E+02	-	7.06E-01	7.06E-01	-	1.87E+01	1.87E+01	-	8.95E-01	8.95E-01	-	8.95E-01	8.95E-01	-	7.10E+02	7.10E+02
Manganese	7439965	Manganese, Total	-	6.13E+03	6.13E+03	-	4.00E+01	4.00E+01	-	1.06E+03	1.06E+03	-	1.08E+02	1.08E+02	-	1.08E+02	1.08E+02	-	2.96E+04	2.96E+04
Mercury	7439976	Mercury, Total	-	1.68E+01	1.68E+01	-	5.04E-02	5.04E-02	-	1.33E+00	1.33E+00	-	2.44E-01	2.44E-01	-	2.44E-01	2.44E-01	-	7.82E+01	7.82E+01
Methyl Mercury	22967926	-	-	7.61E+00	7.61E+00	-	1.31E-03	1.31E-03	-	3.46E-02	3.46E-02	-	6.55E-03	6.55E-03	-	6.55E-03	6.55E-03	-	3.55E+01	3.55E+01
Molybdenum	7439987	Molybdenum, Total	-	3.80E+02	3.80E+02	-	1.38E+00	1.38E+00	-	3.65E+01	3.65E+01	-	4.36E+00	4.36E+00	-	4.36E+00	4.36E+00	-	1.78E+03	1.78E+03
Nickel	7440020	Nickel, Total	1.36E+04	9.08E+02	9.08E+02	-	6.07E+00	6.07E+00	-	1.60E+02	1.60E+02	9.55E+03	6.10E+00	6.10E+00	1.27E+04	6.10E+00	6.10E+00	1.91E+05	4.28E+03	4.28E+03
Selenium	7782492	Selenium, Total	-	3.80E+02	3.80E+02	-	1.31E+00	1.31E+00	-	3.45E+01	3.45E+01	-	6.88E-01	6.88E-01	-	6.88E-01	6.88E-01	-	1.78E+03	1.78E+03
Silver	7440224	Silver, Total	-	2.30E+02	2.30E+02	-	1.81E+00	1.81E+00	-	4.77E+01	4.77E+01	-	2.19E+00	2.19E+00	-	2.19E+00	2.19E+00	-	1.07E+03	1.07E+03
Strontium	7440246	Strontium, Total	-	4.56E+04	4.56E+04	-	1.21E+02	1.21E+02	-	3.20E+03	3.20E+03	-	2.48E+02	2.48E+02	-	2.48E+02	2.48E+02	-	2.13E+05	2.13E+05
Thallium	7440280	Thallium, Total	-	7.61E-01	7.61E-01	-	3.60E-03	3.60E-03	-	9.51E-02	9.51E-02	-	5.93E-04	5.93E-04	-	5.93E-04	5.93E-04	-	3.55E+00	3.55E+00
Tin	7440315	Tin, Total	-	4.56E+04	4.56E+04	-	1.01E+02	1.01E+02	-	2.66E+03	2.66E+03	-	1.69E+02	1.69E+02	-	1.69E+02	1.69E+02	-	2.13E+05	2.13E+05
Vanadium	7440622	Vanadium, Total	-	1.88E+02	1.88E+02	-	1.80E+00	1.80E+00	-	4.75E+01	4.75E+01	-	1.07E+01	1.07E+01	-	1.07E+01	1.07E+01	-	8.78E+02	8.78E+02
Zinc	7440666	Zinc, Total	-	2.28E+04	2.28E+04	-	5.38E+01	5.38E+01	-	1.42E+03	1.42E+03	-	3.16E+01	3.16E+01	-	3.16E+01	3.16E+01	-	1.07E+05	1.07E+05
Zirconium	7440677	Zirconium, Total	-	6.09E+00	6.09E+00	-	2.89E-02	2.89E-02	-	7.64E-01	7.64E-01	-	1.74E-01	1.74E-01	-	1.74E-01	1.74E-01	-	2.84E+01	2.84E+01
Energetic Constituents																				
1,2-Dinitrobenzene	528290	o-Dinitrobenzene	-	6.11E+00	6.11E+00	-	8.82E-03	8.82E-03	-	2.33E-01	2.33E-01	-	4.00E-02	4.00E-02	-	4.00E-02	4.00E-02	-	2.85E+01	2.85E+01
1,3-Dinitrobenzene	99650	m-Dinitrobenzene	-	6.11E+00	6.11E+00	-	7.18E-03	7.18E-03	-	1.90E-01	1.90E-01	-	4.33E-02	4.33E-02	-	4.33E-02	4.33E-02	-	2.85E+01	2.85E+01
2,4,6-Trinitrotoluene	118967	-	2.07E+01	3.59E+01	2.07E+01	7.26E-03	4.02E-02	7.26E-03	2.13E-01	1.06E+00	2.13E-01	1.20E-02	1.17E-01	1.20E-02	1.61E-02	1.17E-01	1.61E-02	7.65E+01	1.67E+02	7.65E+01
2-Amino-4,6-dinitrotoluene	35572782	-	-	1.54E+02	1.54E+02	-	2.04E-01	2.04E-01	-	5.40E+00	5.40E+00	-	9.94E-01	9.94E-01	-	9.94E-01	9.94E-01	-	7.18E+02	7.18E+02
HMX	2691410	-	-	3.85E+03	3.85E+03	-	7.26E-01	7.26E-01	-	1.92E+01	1.92E+01	-	4.77E+00	4.77E+00	-	4.77E+00	4.77E+00	-	1.79E+04	1.79E+04
Hydrazine	302012	-	1.73E-01	4.25E+04	1.73E-01	6.67E-07	-	6.67E-07	1.96E-05	-	1.96E-05	3.73E-06	4.25E+04	3.73E-06	4.89E-06	4.25E+04	4.89E-06	4.79E-01	5.96E+05	4.79E-01
RDX	121824	Hexahydro-1,3,5-trinitro-1,3,5-triazine	5.94E+00	2.25E+02	5.94E+00	8.67E-04	1.06E-01	8.67E-04	2.54E-02	2.79E+00	2.54E-02	4.16E-03	6.39E-01	4.16E-03	5.47E-03	6.39E-01	5.47E-03	2.45E+01	1.05E+03	2.45E+01
Perchlorate	14797730	-	-	5.33E+01	5.33E+01	-	1.58E-02	1.58E-02	-	4.18E-01	4.18E-01	-	1.18E-04	1.18E-04	-	1.18E-04	1.18E-04	-	2.49E+02	2.49E+02
Volatile Organic Compounds																				
1,1,1,2-Tetrachloroethane	630206	-	2.87E+00	7.01E+02	2.87E+00	2.36E-02	6.81E+00	2.36E-02	6.93E-01	1.80E+02	6.93E-01	2.48E-02	1.34E+01	2.48E-02	3.34E-02	1.34E+01	3.34E-02	3.29E+01	6.14E+03	3.29E+01
1,1,1-Trichloroethane	71556	-	-	5.74E+03	5.74E+03	-	3.50E+02	3.50E+02	-	9.25E+03	9.25E+03	-	6.58E+02	6.58E+02	-	6.58E+02	6.58E+02	-	7.49E+04	7.49E+04
1,1,2,2-Tetrachloroethane	79345	-	2.88E-01	3.95E+02	2.88E-01	1.64E-03	3.27E+00	1.64E-03	4.80E-02	8.62E+01	4.80E-02	7.99E-04	3.26E+00	7.99E-04	1.08E-03	3.26E+00	1.08E-03	3.29E+00	3.67E+03	3.29E+00
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	Freon 113	-	2.88E+04	2.88E+04	-	7.56E+03	7.56E+03	-	2.00E+05	2.00E+05	-	4.92E+03	4.92E+03	-	4.92E+03	4.92E+03	-	3.94E+05	3.94E+05
1,1,2-Trichloroethane	79005	-	5.33E-01	7.21E-01	5.33E-01	4.03E-03	4.29E-01	4.03E-03	1.18E-01	1.13E+01	1.18E-01	4.61E-03	4.06E-01	4.61E-03	6.21E-03	4.06E-01	6.21E-03	6.71E+00	1.01E+01	6.71E+00
1,1-Dichloroethane	75343	-	1.89E+00	8.16E+02	1.89E+00	4.63E-02	1.95E+01	4.63E-02	1.36E+00	5.15E+02	1.36E+00	3.55E-02	2.92E+01	3.55E-02	4.79E-02	2.92E+01	4.79E-02	2.57E+01	1.03E+04	2.57E+01
1,1-Dichloroethene	75354	-	-	5.58E+01	5.58E+01	-	6.64E+00	6.64E+00	-	1.75E+02	1.75E+02	-	5.68E+00	5.68E+00	-	5.68E+00	5.68E+00	-	7.59E+02	7.59E+02
1,1-Dimethylhydrazine	57147	Unsymetrical Dimethyl Hydrazine	-	7.80E+00	7.80E+00	-	2.48E-04	2.48E-04	-	6.54E-03	6.54E-03	-	1.58E-03	1.58E-03	-	1.58E-03	1.58E-03	-	3.65E+01	3.65E+01
1,2,3-Trichlorobenzene	87616	-	6.11E+01	3.90E+01	3.90E+01	2.40E-01	2.55E-01	2.40E-01	7.04E+00	6.74E+00	6.74E+00	6.06E-02	1.37E-01	6.06E-02	8.21E-02	1.37E-01	8.21E-02	5.21E+02	2.43E+02	2.43E+02
1,2,4-Trichlorobenzene	120821	-	3.09E+01	2.92E+01	2.92E+01	2.39E-01	3.18E+00	2.39E-01	7.01E+00	8.39E+01	7.01E+00	1.08E-02	3.13E-01	1.08E-02	1.47E-02	3.13E-01	1.47E-02	3.26E+02	3.81E+02	3.26E+02
1,2,4-Trimethylbenzene	95636	-	-	3.97E+01	3.97E+01	-	2.93E+00	2.93E+00	-	7.75E+01	7.75E+01	-	2.25E+00	2.25E+00	-	2.25E+00	2.25E+00	-	5.05E+02	5.05E+02
1,2-Dibromo-3-chloropropane	96128	1,2-Dibromo-3-CPA	9.78E-02	1.56E+01	9.78E-02	8.91E-05	4.61E-02	8.91E-05	2.61E-03	1.22E+00	2.61E-03	3.32E-05	3.59E-02	3.32E-05	4.50E-05	3.59E-02	4.50E-05	4.56E-01	7.30E+01	4.56E-01
1,2-Dibromoethane	106934	1,2-Dibromoethane	1.04E-01	5.43E+01	1.04E-01	8.60E-05	1.03E+00	8.60E-05	2.52E-03	2.72E+01	2.52E-03	5.84E-05	1.37E+00	5.84E-05	7.90E-05	1.37E+00	7.90E-05	6.96E-01	6.59E+02	6.96E-01
1,2-Dichlorobenzene	95501	o-Dichlorobenzene	-	1.70E+03	1.70E+03	-	2.50E+01	2.50E+01	-	6.59E+02	6.59E+02	-	1.05E+01	1.05E+01	-	1.05E+01	1.05E+01	-	1.61E+04	1.61E+04
1,2-Dichloroethane	107062	-	2.61E-01	1.51E+01	2.61E-01	4.07E-03	4.24E-01	4.07E-03	1.19E-01	1.12E+01	1.19E-01	5.17E-03	9.55E-01	5.17E-03	6.96E-03	9.55E-01	6.96E-03	3.53E+00	1.99E+02	3.53E+00
1,2-Dichloroethene	540590	1,2-Dichloroethenes	-	9.69E+01	9.69E+01	-	1.16E+00	1.16E+00	-	3.05E+01	3.05E+01	-	1.78E+00	1.78E+00	-	1.78E+00	1.78E+00	-	1.06E+03	1.06E+03
1,2-Dichloropropane	78875	-	4.39E-01	7.19E+00	4.39E-01	8.76E-03	1.05E+01	8.76E-03	2.57E-01	2.77E+02	2.57E-01	6.74E-03	4.98E+00	6.74E-03	9.10E-03	4.98E+00	9.10E-03	5.88E+00	1.00E+02	5.88E+00
1,3,5-Trimethylbenzene	108678	-	-	1.75E+02	1.75E+02	-	2.77E+00	2.77E+00	-	7.30E+01	7.30E+01	-	2.46E+00	2.46E+00	-	2.46E+00	2.46E+00	-	1.69E+03	1.69E+03
1,3-Dichlorobenzene	541731	m-Dichlorobenzene	-	9.15E+02	9.15E+02	-	8.57E+00	8.57E+00	-	2.26E+02	2.26E+02	-	8.68E+00	8.68E+00	-	8.68E+00	8.68E+00	-	7.20E+03	7.20E+03
1,4-Dichlorobenzene	106467	p-Dichlorobenzene	1.33E+00	2.53E+03	1.33E+00	1.40E-01	1.95E+01	1.40E-01	4.09E+00	5.14E+02	4.09E+00	6.05E-03	1.87E+00	6.05E-03	8.21E-03	1.87E+00	8.21E-03	1.82E+01	1.84E+04	1.82E+01
2-Chloroethylvinyl ether	110758	2-Chloroethyl vinyl	4.20E-03	-	4.20E-03	5.45E-05	-	5.45E-05	1.60E-03	-	1.60E-03	1.48E-04	-	1.48E-04	1.97E-04	-	1.97E-04	5.71E-02	-	5.71E-02
2-Hexanone	591786	Methyl butyl ketone	-	1.70E+02	1.70E+02	-	3.18E-01	3.18E-01	-	8.39E+00	8.39E+00	-	1.06E+00	1.06E+00	-	1.06E+00	1.06E+00	-	1.27E+03	1.27E+03
Acetone	67641	-	-	6.01E+04	6.01E+04	-	7.79E+00	7.79E+00	-	2.06E+02	2.06E+02	-	4.63E+01	4.63E+01	-	4.63E+01	4.63E+01	-	3.11E+05	3.11E+05
Benzene	71432	-	1.15E-01	3.61E+01	1.15E-01	3.60E-03	5.31E-01	3.60E-03	1.05E-01	1.40E+01	1.05E-01	4.06E-03	1.14E+00	4.06E-03	5.47E-03	1.14E+00	5.47E-03	1.56E+00	4.11E+02	1.56E+00
Bromobenzene	108861	-	-	2.36E+02	2.36E+02	-	1.87E+00	1.87E+00	-	4.94E+01	4.94E+01	-	3.24E+00	3.24E+00	-	3.24E+00	3.24E+00	-	1.89E+03	1.89E+03
Bromodichloromethane	75274	-	1.95E-01	1.85E+02	1.95E-01	2.47E-03	2.37E+00	2.47E-03	7.24E-02	6.26E+01	7.24E-02	2.05E-03	3.83E+00	2.05E-03	2.77E-03	3.83E+00	2.77E-03	2.54E+00	2.09E+03	2.54E+00
Bromoform	75252	-	6.22E+01	1.56E+03	6.22E+01	4.05E-02	3.29E+00	4.05E-02	1.19E+00	8.68E+01	1.19E+00	6.71E-02	9.51E+00	6.71E-02	9.00E-02	9.51E+00	9.00E-02	2.90E+02	7.30E+03	2.90E+02
Bromomethane	74839	-	-	5.16E+00	5.16E+00	-	7.19E-02	7.19E-02	-	1.90E+00	1.90E+00	-	2.83E-01	2.83E-01	-	2.83E-01	2.83E-01	-	6.61E+01	6.61E+01
Carbon disulfide	75150	-	-	5.42E+02	5.42E+02	-	1.12E+01	1.12E+01	-	2.97E+02	2.97E+02	-	7.58E+00	7.58E+00	-	7.58E+00	7.58E+00	-	6.66E+03	6.66E+03
Carbon tetrachloride	56235	-	7.10E-02	8.74E+01	7.10E-02	3.89E-03	8.63E-01	3.89E-03	1.14E-01	2.28E+01	1.14E-01	3.32E-03	1.50E+00	3.32E-03	4.47E-03	1.50E+00	4.47E-03	9.65E-01	7.85E+02	9.65E-01
Chlorobenzene	108907	Monochlorobenzene	-	1.35E+02	1.35E+02	-	4.34E+00	4.34E+00	-	1.15E+02	1.15E+02	-	4.30E+00	4.30E+00	-	4.30E+00	4.30E+00	-	1.62E+03	1.62E+03
Chloroform	67663	Trichloromethane	7.33E-01	2.98E+02	7.33E-01	1.01E-02	1.16E+00	1.01E-02	2.96E-01	3.05E+01	2.96E-01	4.36E-03	1.04E+00	4.36E-03	5.90E-03	1.04E+00	5.90E-03	9.62E+00	2.37E+03	9.62E+00
Chloromethane	74873	Methyl chloride	-	4.51E+01	4.51E+01	-	5.18E-02	5.18E-02	-	1.37E+00	1.37E+00	-	2.19E-01	2.19E-01	-	2.19E-01	2.19E-01	-	3.46E+02	3.46E+02
cis-1,2-Dichloroethene	156592	cis-1,2-	-	9.22E+00	9.22E+00	-	2.09E-01	2.09E-01	-	5.51E+00	5.51E+00	-	2.20E-01	2.20E-01	-	2.20E-01	2.20E-01	-	1.15E+02	1.15E+02
Cumene	98828	Isopropylbenzene	-	1.51E+03	1.51E+03	-	2.96E+01	2.96E+01	-	7.81E+02	7.81E+02	-	6.31E+01	6.31E+01	-	6.31E+01	6.31E+01	-	1.53E+04	1.53E+04
Dibromochloromethane	124481	-	7.28E+00	1.56E+03	7.28E+00	3.92E-03	2.73E+00	3.92E-03	1.15E-01	7.20E+01	1.15E-01	2.37E-03	3.32E+00	2.37E-03	3.20E-03	3.32E+00	3.20E-03	3.40E+01	7.30E+03	3.40E+01

Table 1

Summary of the Human Health Risk-Based Screening Levels for Chemicals in Soil at the SSFL

			Suburban Residential Soil RBSL ($RBSL_{so_res}$) [b]			SRAM-based Suburban Residential Garden RBSL ($RBSL_{so_res_g}$) [c]			USEPA default-based Suburban Residential Garden RBSL ($RBSL_{so_res_g}$) [c]			40-year Rural Residential Soil RBSL ($RBSL_{so_RR}$) [d]			30-year Rural Residential Soil RBSL ($RBSL_{so_RR}$) [d]			Recreational Soil RBSL ($RBSL_{so_rec}$) [b]		
Analyte	CAS #	Analyte Synonym [a]	Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Lowest (mg/kg)	Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Lowest (mg/kg)	Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Lowest (mg/kg)	Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Lowest (mg/kg)	Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Lowest (mg/kg)	Composite Recreator Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Lowest (mg/kg)
Dibromomethane	74953	-	-	2.23E+01	2.23E+01	-	8.91E-01	8.91E-01	-	2.35E+01	2.35E+01	-	2.60E+00	2.60E+00	-	2.60E+00	2.60E+00	-	2.95E+02	2.95E+02
Dichlorodifluoromethane	75718	Freon 12	-	6.62E+01	6.62E+01	-	2.73E+01	2.73E+01	-	7.20E+02	7.20E+02	-	3.89E+01	3.89E+01	-	3.89E+01	3.89E+01	-	9.20E+02	9.20E+02
Ethylbenzene	100414	-	2.31E+00	2.98E+03	2.31E+00	6.17E-02	2.51E+01	6.17E-02	1.81E+00	6.62E+02	1.81E+00	1.38E-02	1.20E+01	1.38E-02	1.86E-02	1.20E+01	1.86E-02	3.01E+01	2.37E+04	3.01E+01
Methyl ethyl ketone	78933	2-Butanone; 2-Butanone (MEK)	-	2.33E+04	2.33E+04	-	1.03E+01	1.03E+01	-	2.71E+02	2.71E+02	-	5.12E+01	5.12E+01	-	5.12E+01	5.12E+01	-	1.64E+05	1.64E+05
Methyl isobutyl ketone (MIBK)	108101	MIBK; 4-Methyl-2-	-	4.96E+03	4.96E+03	-	4.70E+00	4.70E+00	-	1.24E+02	1.24E+02	-	1.66E+01	1.66E+01	-	1.66E+01	1.66E+01	-	2.69E+04	2.69E+04
Methylene chloride	75092	Dichloromethane	2.97E+00	2.90E+02	2.97E+00	1.06E-02	3.30E-01	1.06E-02	3.12E-01	8.71E+00	3.12E-01	3.83E-03	2.50E-01	3.83E-03	5.19E-03	2.50E-01	5.19E-03	3.71E+01	1.82E+03	3.71E+01
Monomethylhydrazine	60344	Monomethyl Hydrazine	1.24E-03	7.80E+01	1.24E-03	1.47E-08	2.98E-03	1.47E-08	4.30E-07	7.87E-02	4.30E-07	7.64E-08	1.89E-02	7.64E-08	1.00E-07	1.89E-02	1.00E-07	5.81E-03	3.65E+02	5.81E-03
m-Xylene & p-Xylene	136777612	meta- and para-Xylenes; m, p-Xylene	-	4.28E+02	4.28E+02	-	4.96E+01	4.96E+01	-	1.31E+03	1.31E+03	-	1.11E+02	1.11E+02	-	1.11E+02	1.11E+02	-	5.69E+03	5.69E+03
n-Butylbenzene	104518	-	-	8.45E+02	8.45E+02	-	1.67E+01	1.67E+01	-	4.40E+02	4.40E+02	-	1.08E+01	1.08E+01	-	1.08E+01	1.08E+01	-	8.26E+03	8.26E+03
n-Propylbenzene	103651	-	-	3.16E+03	3.16E+03	-	2.98E+01	2.98E+01	-	7.86E+02	7.86E+02	-	2.87E+01	2.87E+01	-	2.87E+01	2.87E+01	-	2.44E+04	2.44E+04
o-Chlorotoluene	95498	2-Chlorotoluene	-	3.37E+02	3.37E+02	-	5.53E+00	5.53E+00	-	1.46E+02	1.46E+02	-	5.26E+00	5.26E+00	-	5.26E+00	5.26E+00	-	3.30E+03	3.30E+03
o-Xylene	95476	-	-	2.86E+02	2.86E+02	-	4.96E+01	4.96E+01	-	1.31E+03	1.31E+03	-	6.06E+01	6.06E+01	-	6.06E+01	6.06E+01	-	3.87E+03	3.87E+03
p-Chlorotoluene	106434	4-Chlorotoluene	-	3.10E+02	3.10E+02	-	5.37E+00	5.37E+00	-	1.42E+02	1.42E+02	-	5.70E+00	5.70E+00	-	5.70E+00	5.70E+00	-	3.10E+03	3.10E+03
p-Cymene	99876	p-Isopropyltoluene	-	1.94E+03	1.94E+03	-	3.22E+01	3.22E+01	-	8.50E+02	8.50E+02	-	1.07E+01	1.07E+01	-	1.07E+01	1.07E+01	-	1.82E+04	1.82E+04
p-Nitroaniline	100016	4-Nitroaniline	3.42E+01	3.13E+02	3.42E+01	8.72E-03	2.58E-01	8.72E-03	2.56E-01	6.80E+00	2.56E-01	3.24E-02	1.33E+00	3.24E-02	4.29E-02	1.33E+00	4.29E-02	1.60E+02	1.46E+03	1.60E+02
sec-Butylbenzene	135988	-	-	1.73E+03	1.73E+03	-	3.39E+01	3.39E+01	-	8.96E+02	8.96E+02	-	1.52E+01	1.52E+01	-	1.52E+01	1.52E+01	-	1.68E+04	1.68E+04
Styrene	100425	Vinylbenzene	-	1.14E+04	1.14E+04	-	4.59E+01	4.59E+01	-	1.21E+03	1.21E+03	-	2.68E+02	2.68E+02	-	2.68E+02	2.68E+02	-	6.49E+04	6.49E+04
tert-Butylbenzene	98066	Dibenzo[b,e][1,4]dioxin, octachloro-	-	1.73E+03	1.73E+03	-	3.22E+01	3.22E+01	-	8.51E+02	8.51E+02	-	1.26E+01	1.26E+01	-	1.26E+01	1.26E+01	-	1.68E+04	1.68E+04
Tetrachloroethene	127184	-	4.16E-01	5.20E+01	4.16E-01	1.38E-03	1.65E+00	1.38E-03	4.04E-02	4.35E+01	4.04E-02	1.53E-04	3.96E-01	1.53E-04	2.07E-04	3.96E-01	2.07E-04	3.52E+00	5.96E+02	3.52E+00
Tetralin	119642	-	8.29E+00	2.78E+02	8.29E+00	-	5.31E+00	5.31E+00	-	1.40E+02	1.40E+02	5.80E+00	2.73E+01	5.80E+00	7.73E+00	2.73E+01	7.73E+00	1.16E+02	2.87E+03	1.16E+02
Toluene	108883	Toluol	-	3.74E+03	3.74E+03	-	1.63E+01	1.63E+01	-	4.31E+02	4.31E+02	-	2.78E+01	2.78E+01	-	2.78E+01	2.78E+01	-	2.39E+04	2.39E+04
trans-1,2-Dichloroethene	156605	-	-	8.53E+01	8.53E+01	-	2.57E+00	2.57E+00	-	6.78E+01	6.78E+01	-	2.57E+00	2.57E+00	-	2.57E+00	2.57E+00	-	1.08E+03	1.08E+03
Trichloroethene	79016	Trichloroethylene	7.97E-01	2.99E+00	7.97E-01	9.81E-03	8.34E-02	9.81E-03	2.88E-01	2.20E+00	2.88E-01	5.52E-03	9.33E-02	5.52E-03	7.46E-03	9.33E-02	7.46E-03	1.01E+01	3.63E+01	1.01E+01
Trichlorofluoromethane	75694	-	-	5.30E+02	5.30E+02	-	5.40E+01	5.40E+01	-	1.43E+03	1.43E+03	-	3.44E+01	3.44E+01	-	3.44E+01	3.44E+01	-	7.10E+03	7.10E+03
Vinyl chloride	75014	-	2.04E-02	5.05E+01	2.04E-02	8.23E-04	2.46E-01	8.23E-04	2.41E-02	6.51E+00	2.41E-02	7.70E-04	4.63E-01	7.70E-04	1.04E-03	4.63E-01	1.04E-03	2.82E-01	4.94E+02	2.82E-01
Xylenes, Total	1330207	Xylene (Total) Isomers	-	4.28E+02	4.28E+02	-	4.96E+01	4.96E+01	-	1.31E+03	1.31E+03	-	1.11E+02	1.11E+02	-	1.11E+02	1.11E+02	-	5.69E+03	5.69E+03
Semi-Volatile Organic Compounds																				
1,4-Dioxane	123911	-	1.93E+01	1.83E+03	1.93E+01	8.37E-04	2.51E-01	8.37E-04	2.46E-02	6.62E+00	2.46E-02	4.45E-03	1.61E+00	4.45E-03	5.83E-03	1.61E+00	5.83E-03	5.32E+01	8.55E+03	5.32E+01
2,4,5-Trichlorophenol	95954	-	-	6.11E+03	6.11E+03	-	3.00E+01	3.00E+01	-	7.92E+02	7.92E+02	-	2.29E+01	2.29E+01	-	2.29E+01	2.29E+01	-	2.85E+04	2.85E+04
2,4,6-Trichlorophenol	88062	-	7.43E+00	6.11E+01	7.43E+00	1.15E-02	2.98E-01	1.15E-02	3.38E-01	7.86E+00	3.38E-01	1.46E-03	8.17E-02	1.46E-03	1.97E-03	8.17E-02	1.97E-03	2.05E+01	2.85E+02	2.05E+01
2,4-Dimethylphenol	105679	-	-	1.22E+03	1.22E+03	-	3.05E+00	3.05E+00	-	8.05E+01	8.05E+01	-	1.80E+01	1.80E+01	-	1.80E+01	1.80E+01	-	5.70E+03	5.70E+03
3,5-Dimethylphenol	108689	-	-	4.40E+02	4.40E+02	-	1.37E+00	1.37E+00	-	3.61E+01	3.61E+01	-	4.82E+00	4.82E+00	-	4.82E+00	4.82E+00	-	2.05E+03	2.05E+03
Benzoic acid	65850	-	-	2.44E+05	2.44E+05	-	4.21E+02	4.21E+02	-	1.11E+04	1.11E+04	-	8.18E+02	8.18E+02	-	8.18E+02	8.18E+02	-	1.14E+06	1.14E+06
Benzyl alcohol	100516	-	-	6.11E+03	6.11E+03	-	4.63E+00	4.63E+00	-	1.22E+02	1.22E+02	-	2.49E+01	2.49E+01	-	2.49E+01	2.49E+01	-	2.85E+04	2.85E+04
bis(2-Ethylhexyl) phthalate	117817	bis(2-	1.73E+02	1.22E+03	1.73E+02	3.26E-01	7.23E+00	3.26E-01	9.56E+00	1.91E+02	9.56E+00	2.83E-02	7.08E-01	2.83E-02	3.70E-02	7.08E-01	3.70E-02	4.79E+02	5.70E+03	4.79E+02
Butyl benzyl phthalate	85687	-	2.74E+02	1.22E+04	2.74E+02	4.89E-01	6.87E+01	4.89E-01	1.43E+01	1.81E+03	1.43E+01	1.99E+00	3.49E+02	1.99E+00	2.62E+00	3.49E+02	2.62E+00	7.56E+02	5.70E+04	7.56E+02
Carbazole	86748	-	2.60E+01	-	2.60E+01	4.06E-02	-	4.06E-02	1.19E+00	-	1.19E+00	8.98E-02	-	8.98E-02	1.20E-01	-	1.20E-01	7.19E+01	-	7.19E+01
Dibenzofuran	132649	-	-	5.47E+01	5.47E+01	-	3.23E-01	3.23E-01	-	8.52E+00	8.52E+00	-	2.93E-01	2.93E-01	-	2.93E-01	2.93E-01	-	2.74E+02	2.74E+02
Diethyl phthalate	84662	-	-	4.89E+04	4.89E+04	-	1.33E+02	1.33E+02	-	3.52E+03	3.52E+03	-	2.08E+02	2.08E+02	-	2.08E+02	2.08E+02	-	2.28E+05	2.28E+05
Dimethyl phthalate	131113	-	-	4.89E+04	4.89E+04	-	6.44E+01	6.44E+01	-	1.70E+03	1.70E+03	-	2.42E+02	2.42E+02	-	2.42E+02	2.42E+02	-	2.28E+05	2.28E+05
Di-n-butyl phthalate	84742	Di-n-butylphthalate	-	6.11E+03	6.11E+03	-	3.37E+01	3.37E+01	-	8.90E+02	8.90E+02	-	3.20E+01	3.20E+01	-	3.20E+01	3.20E+01	-	2.85E+04	2.85E+04
Di-n-octyl phthalate	117840	Di-n-octyl-phthalate	-	6.11E+02	6.11E+02	-	3.61E+00	3.61E+00	-	9.54E+01	9.54E+01	-	1.14E-01	1.14E-01	-	1.14E-01	1.14E-01	-	2.85E+03	2.85E+03
Formaldehyde	50000	-	5.91E+05	1.22E+04	1.22E+04	-	3.70E+00	3.70E+00	-	9.78E+01	9.78E+01	4.14E+05	1.78E+01	1.78E+01	5.52E+05	1.78E+01	1.78E+01	8.27E+06	5.70E+04	5.70E+04
Hexachlorobutadiene	87683	-	6.67E+00	6.11E+01	6.67E+00	1.20E-02	3.44E-01	1.20E-02	3.51E-01	9.10E+00	3.51E-01	2.32E-02	1.08E+00	2.32E-02	3.10E-02	1.08E+00	3.10E-02	1.84E+01	2.85E+02	1.84E+01
m-Cresol	108394	3-Methylphenol	-	3.06E+03	3.06E+03	-	5.72E+00	5.72E+00	-	1.51E+02	1.51E+02	-	2.02E+01	2.02E+01	-	2.02E+01	2.02E+01	-	1.43E+04	1.43E+04
N-Nitrosodimethylamine	62759	Nitrosodimethylamine	3.25E-02	4.89E-01	3.25E-02	9.49E-07	4.49E-05	9.49E-07	2.78E-05	1.19E-03	2.78E-05	4.80E-06	2.80E-04	4.80E-06	6.31E-06	2.80E-04	6.31E-06	8.98E-02	2.28E+00	8.98E-02
N-Nitrosodiphenylamine	86306	-	5.78E+01	-	5.78E+01	7.48E-02	-	7.48E-02	2.19E+00	-	2.19E+00	3.50E-01	-	3.50E-01	4.59E-01	-	4.59E-01	1.60E+02	-	1.60E+02
o-Cresol	95487	2-Methylphenol	-	3.06E+03	3.06E+03	-	5.67E+00	5.67E+00	-	1.50E+02	1.50E+02	-	1.85E+01	1.85E+01	-	1.85E+01	1.85E+01	-	1.43E+04	1.43E+04
p-Chloro-m-cresol	59507	4-Chloro-3-	-	6.11E+03	6.11E+03	-	2.46E+01	2.46E+01	-	6.48E+02	6.48E+02	-	9.94E+01	9.94E+01	-	9.94E+01	9.94E+01	-	2.85E+04	2.85E+04
p-Cresol	106445	4-Methylphenol	-	6.11E+03	6.11E+03	-	1.12E+01	1.12E+01	-	2.97E+02	2.97E+02	-	6.72E+01	6.72E+01	-	6.72E+01	6.72E+01	-	2.85E+04	2.85E+04
Pentachlorophenol	87865	PCP	2.12E+01	2.30E+02	2.12E+01	5.27E-02	1.75E+00	5.27E-02	1.55E+00	4.63E+01	1.55E+00	2.99E-03	2.18E-01	2.99E-03	4.06E-03	2.18E-01	4.06E-03	4.38E+01	1.07E+03	4.38E+01
Phenol	108952	Total Phenols	-	1.83E+04	1.83E+04	-	2.07E+01	2.07E+01	-	5.48E+02	5.48E+02	-	1.12E+02	1.12E+02	-	1.12E+02	1.12E+02	-	8.55E+04	8.55E+04
Polynuclear Aromatic Hydrocarbons																				
1-Methyl naphthalene	90120	1-Methylnaphthalene	7.29E+00	2.85E+03	7.29E+00	2.89E-02	2.17E+01	2.89E-02	8.47E-01	5.72E+02	8.47E-01	5.81E-02	7.14E+01	5.81E-02	7.78E-02	7.14E+01	7.78E-02	3.22E+01	1.61E+04	3.22E+01
2-Methylnaphthalene	91576	Naphthalene, 2-methyl-	-	1.62E+02	1.62E+02	-	1.24E+00	1.24E+00	-	3.26E+01	3.26E+01	-	3.47E+00	3.47E+00	-	3.47E+00	3.47E+00	-	9.18E+02	9.18E+02
Acenaphthene	83329	-	-	3.23E+03	3.23E+03	-	1.87E+01	1.87E+01	-	4.95E+02	4.95E+02	-	9.19E+01	9.19E+01	-	9.19E+01	9.19E+01	-	1.53E+04	1.53E+04
Acenaphthylene	208968	-	-	2.98E+03	2.98E+03	-	1.88E+01	1.88E+01	-	4.97E+02	4.97E+02	-	3.77E+01	3.77E+01	-	3.77E+01	3.77E+01	-	1.49E+04	1.49E+04
Anthracene	120127	-	-	1.64E+04	1.64E+04	-	1.01E+02	1.01E+02	-	2.66E+03	2.66E+03	-	5.07E+02	5.07E+02	-	5.07E+02	5.07E+02	-	7.70E+04	7.70E+04
Benzo(a)anthracene	56553	Benz[a]anthracene	3.87E-01	-	3.87E-01	8.05E-04	-	8.05E-04	2.36E-02	-	2.36E-02	2.03E-03	-	2.03E-03	2.67E-03	-	2.67E-03	9.39E-01	-	9.39E-01
Benzo(a)pyrene	50328	Benzo (a) pyrene	3.87E-02	-	3.87E-02	8.09E-05	-	8.09E-05	2.37E-03	-	2.37E-03	1.32E-04	-	1.32E-04	1.73E-04	-	1.73E-04	9.39E-02	-	9.39E-02
Benzo(b)fluoranthene	205992	Benz[e]acephenanthryl	3.87E-01	-	3.87E-01	8.05E-04	-	8.05E-04	2.36E-02	-	2.36E-02	1.95E-03	-	1.95E-03	2.56E-03	-	2.56E-03	9.39E-01	-	9.39E-01
Benzo(e)pyrene	192972	-	-	1.65E+03	1.65E+03	-	1.08E+01	1.08E+01	-	2.84E+02	2.84E+02	-	2.09E+01	2.09E+01	-	2.09E+01	2.09E+01	-	7.71E+03	7.71E+03
Benzo(ghi)perylene	191242	Benzo (g,h,i) perylene	-	1.65E+03	1.65E+03	-	1.08E+01	1.08E+01	-	2.85E+02	2.85E+02	-	8.61E+00	8.61E+00	-	8.61E+00	8.61E+00	-	7.71E+03	7.71E+03
Benzo(k)fluoranthene	207089	Benzo[k]fluoranthene	3.87E-01	-	3.87E-01	8.09E-04	-	8.09E-04	2.37E-02	-	2.37E-02	1.36E-03	-	1.36E-03	1.78E-03	-	1.78E-03	9.39E-01	-	9.39E-01
Chrysene	218019	-	3.87E+00	-	3.87E+00	8.06E-03	-	8.06E-03	2.36E-01	-	2.36E-01	1.93E-02	-	1.93E-02	2.53E-02	-	2.53E-02	9.39E+00	-	9.39E+00
Dibenzo(a,h)anthracene	53703	Dibenz (a,h)	1.13E-01	-	1.13E-01	2.38E-04	-	2.38E-04	6.98E-03	-	6.98E-03	1.30E-04	-	1.30E-04	1.70E-04	-	1.70E-04	2.75E-01	-	2.75E-01
Fluoranthene	206440	-	-	2.20E+03	2.20E+03	-	1.40E+01	1.40E+01	-	3.71E+02	3.71E+02	-	6.29E+01	6.29E+01	-	6.29E+01	6.29E+01	-	1.03E+04	1.03E+04
Fluorene	86737	-	-	2.18E+03	2.18E+03	-	1.30E+01	1.30E+01	-	3.44E+02	3.44E+02	-	6.52E+01	6.52E+01	-	6.52E+01	6.52E+01	-	1.02E+04	1.02E+04
Indeno(1,2,3-cd)pyrene	193395	Indeno (1,2,3-cd)	3.87E-01	-	3.87E-01	8.13E-04	-	8.13E-04	2.38E-02	-	2.38E-02	4.98E-04	-	4.98E-04	6.50E-04	-	6.50E-04	9.39E-01	-	9.39E-01
Naphthalene	91203	-	1.46E+01	6.81E+02	1.46E+01	-	5.31E+00	5.31E+00	-	1.40E+02	1.40E+02	1.02E+01	2.90E+01	1.02E+01	1.36E+01	2.90E+01	1.36E+01	2.04E+02	4.26E+03	2.04E+02
Perylene	198550	-	-	1.65E+03	1.65E+03	-	1.08E+01	1.08E+01	-	2.84E+02	2.84E+02	-	1.70E+01	1.70E+01	-	1.70E+01	1.70E+01	-	7.71E+03	7.71E+03
Phenanthrene	85018	-	-	1.64E+04	1.64E+04	-	1.01E+02	1.01E+02	-	2.66E+03	2.66E+03	-	4.99E+02	4.99E+02	-	4.99E+02	4.99E+02	-	7.70E+04	7.70E+04
Pyrene	129000	-	-	1.65E+03	1.65E+03	-	1.04E+01	1.04E+01	-	2.74E+02	2.74E+02	-	5.03E+01	5.03E+01	-	5.03E+01	5.03E+01	-	7.71E+03	7.71E+03
Pesticides																				
4,4'-DDD	72548	p,p'-DDD	2.46E+00	-	2.46E+00	4.04E-03	-	4.04E-03	1.18E-01	-	1.18E-01	2.67E-03	-	2.67E-03	3.58E-03	-	3.58E-03	8.26E+00	-	8.26E+00
4,4'-DDE	72559	p,p'-DDE	1.74E+00	-	1.74E+00	2.87E-03	-	2.87E-03	8.40E-02	-	8.40E-02	2.31E-03	-	2.31E-03	3.03E-03	-	3.03E-03	5.83E+00	-	5.83E+00

Table 1

Summary of the Human Health Risk-Based Screening Levels for Chemicals in Soil at the SSFL

			Suburban Residential Soil RBSL ($RBSL_{so_res}$) [b]			SRAM-based Suburban Residential Garden RBSL ($RBSL_{so_res_g}$) [c]			USEPA default-based Suburban Residential Garden RBSL ($RBSL_{so_res_g}$) [c]			40-year Rural Residential Soil RBSL ($RBSL_{so_RR}$) [d]			30-year Rural Residential Soil RBSL ($RBSL_{so_RR}$) [d]			Recreational Soil RBSL ($RBSL_{so_rec}$) [b]		
Analyte	CAS #	Analyte Synonym [a]	Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Lowest (mg/kg)	Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Lowest (mg/kg)	Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Lowest (mg/kg)	Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Lowest (mg/kg)	Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Lowest (mg/kg)	Composite Recreator Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Lowest (mg/kg)
4,4'-DDT	50293	p,p'-DDT	1.74E+00	3.43E+01	1.74E+00	2.87E-03	1.80E-01	2.87E-03	8.42E-02	4.76E+00	8.42E-02	9.48E-04	7.34E-02	9.48E-04	1.24E-03	7.34E-02	1.24E-03	5.83E+00	1.60E+02	5.83E+00
Aldrin	309002	-	3.48E-02	2.06E+00	3.48E-02	5.73E-05	1.08E-02	5.73E-05	1.68E-03	2.85E-01	1.68E-03	4.94E-05	1.08E-02	4.94E-05	6.46E-05	1.08E-02	6.46E-05	1.17E-01	9.61E+00	1.17E-01
alpha-BHC	319846	a-Benzene	2.19E-01	5.49E+02	2.19E-01	3.06E-04	2.44E+00	3.06E-04	8.97E-03	6.45E+01	8.97E-03	2.72E-05	4.74E-01	2.72E-05	3.69E-05	4.74E-01	3.69E-05	7.34E-01	2.56E+03	7.34E-01
beta-BHC	319857	b-Benzene	3.94E-01	-	3.94E-01	5.48E-04	-	5.48E-04	1.61E-02	-	1.61E-02	4.90E-05	-	4.90E-05	6.65E-05	-	6.65E-05	1.32E+00	-	1.32E+00
delta-BHC	319868	d-Benzene	3.28E-01	2.06E+01	3.28E-01	4.87E-04	9.71E-02	4.87E-04	1.43E-02	2.56E+00	1.43E-02	5.08E-05	2.21E-02	5.08E-05	6.90E-05	2.21E-02	6.90E-05	1.10E+00	9.61E+01	1.10E+00
Chlordane (Technical)	12789036	-	1.69E+00	3.43E+01	1.69E+00	2.78E-03	1.80E-01	2.78E-03	8.14E-02	4.74E+00	8.14E-02	2.29E-06	3.28E-04	2.29E-06	3.11E-06	3.28E-04	3.11E-06	5.66E+00	1.60E+02	5.66E+00
Dieldrin	60571	-	3.69E-02	3.43E+00	3.69E-02	5.99E-05	1.77E-02	5.99E-05	1.76E-03	4.67E-01	1.76E-03	9.33E-07	6.10E-04	9.33E-07	1.27E-06	6.10E-04	1.27E-06	1.24E-01	1.60E+01	1.24E-01
Endosulfan I	959988	-	-	4.12E+02	4.12E+02	-	1.84E+00	1.84E+00	-	4.87E+01	4.87E+01	-	5.92E+00	5.92E+00	-	5.92E+00	5.92E+00	-	1.92E+03	1.92E+03
Endosulfan II	33213659	-	-	4.12E+02	4.12E+02	-	1.84E+00	1.84E+00	-	4.87E+01	4.87E+01	-	5.92E+00	5.92E+00	-	5.92E+00	5.92E+00	-	1.92E+03	1.92E+03
Endosulfan sulfate	1031078	-	-	4.12E+02	4.12E+02	-	1.77E+00	1.77E+00	-	4.68E+01	4.68E+01	-	7.28E+00	7.28E+00	-	7.28E+00	7.28E+00	-	1.92E+03	1.92E+03
Endrin	72208	-	-	2.06E+01	2.06E+01	-	1.05E-01	1.05E-01	-	2.79E+00	2.79E+00	-	2.14E-03	2.14E-03	-	2.14E-03	2.14E-03	-	9.61E+01	9.61E+01
Endrin aldehyde	7421934	-	-	2.06E+01	2.06E+01	-	1.03E-01	1.03E-01	-	2.73E+00	2.73E+00	-	5.10E-03	5.10E-03	-	5.10E-03	5.10E-03	-	9.61E+01	9.61E+01
Endrin ketone	53494705	-	-	2.06E+01	2.06E+01	-	1.05E-01	1.05E-01	-	2.76E+00	2.76E+00	-	1.07E-02	1.07E-02	-	1.07E-02	1.07E-02	-	9.61E+01	9.61E+01
gamma-BHC	58899	Lindane	5.37E-01	2.06E+01	5.37E-01	7.38E-04	9.00E-02	7.38E-04	2.16E-02	2.38E+00	2.16E-02	3.93E-04	9.73E-02	3.93E-04	5.31E-04	9.73E-02	5.31E-04	1.80E+00	9.61E+01	1.80E+00
Heptachlor	76448	-	1.44E-01	3.43E+01	1.44E-01	2.37E-04	1.79E-01	2.37E-04	6.94E-03	4.73E+00	6.94E-03	3.66E-04	3.39E-01	3.66E-04	4.81E-04	3.39E-01	4.81E-04	4.84E-01	1.60E+02	4.84E-01
Heptachlor epoxide	1024573	-	1.07E-01	8.92E-01	1.07E-01	1.71E-04	4.53E-03	1.71E-04	5.03E-03	1.20E-01	5.03E-03	2.70E-04	1.20E-02	2.70E-04	3.61E-04	1.20E-02	3.61E-04	3.60E-01	4.16E+00	3.60E-01
MCPA	94746	-	-	3.43E+01	3.43E+01	-	1.31E-01	1.31E-01	-	3.45E+00	3.45E+00	-	2.57E-01	2.57E-01	-	2.57E-01	2.57E-01	-	1.60E+02	1.60E+02
Mirex	2385855	Mirex (DeChlorane)	3.28E-02	1.37E+01	3.28E-02	5.42E-05	7.21E-02	5.42E-05	1.59E-03	1.90E+00	1.59E-03	7.89E-07	2.25E-03	7.89E-07	1.07E-06	2.25E-03	1.07E-06	1.10E-01	6.40E+01	1.10E-01
p,p'-Methoxychlor	72435	Methoxychlor	-	3.43E+02	3.43E+02	-	1.75E+00	1.75E+00	-	4.62E+01	4.62E+01	-	7.19E-01	7.19E-01	-	7.19E-01	7.19E-01	-	1.60E+03	1.60E+03
Toxaphene	8001352	-	4.93E-01	-	4.93E-01	8.05E-04	-	8.05E-04	2.36E-02	-	2.36E-02	1.48E-05	-	1.48E-05	2.01E-05	-	2.01E-05	1.65E+00	-	1.65E+00
Herbicides																				
2,4,5-T	93765	2,4,5-	-	6.86E+02	6.86E+02	-	2.67E+00	2.67E+00	-	7.04E+01	7.04E+01	-	8.88E+00	8.88E+00	-	8.88E+00	8.88E+00	-	3.20E+03	3.20E+03
2,4,5-TP (Silvex)	93721	-	-	5.49E+02	5.49E+02	-	2.44E+00	2.44E+00	-	6.45E+01	6.45E+01	-	8.97E+00	8.97E+00	-	8.97E+00	8.97E+00	-	2.56E+03	2.56E+03
2,4-Dichlorophenoxyacetic Acid (2,4-D)	94757	-	-	6.86E+02	6.86E+02	-	2.13E+00	2.13E+00	-	5.63E+01	5.63E+01	-	4.82E+00	4.82E+00	-	4.82E+00	4.82E+00	-	3.20E+03	3.20E+03
2,4-Dichlorophenoxybutyric acid	94826	2,4-DB	-	5.49E+02	5.49E+02	-	2.29E+00	2.29E+00	-	6.04E+01	6.04E+01	-	7.09E+00	7.09E+00	-	7.09E+00	7.09E+00	-	2.56E+03	2.56E+03
Dalapon	75990	-	-	2.06E+03	2.06E+03	-	2.62E+00	2.62E+00	-	6.92E+01	6.92E+01	-	3.46E+00	3.46E+00	-	3.46E+00	3.46E+00	-	9.61E+03	9.61E+03
Dicamba	1918009	-	-	2.06E+03	2.06E+03	-	4.26E+00	4.26E+00	-	1.13E+02	1.13E+02	-	1.23E+01	1.23E+01	-	1.23E+01	1.23E+01	-	9.61E+03	9.61E+03
2,4-DP (Dichlorprop)	120365	-	-	6.86E+02	6.86E+02	-	2.77E+00	2.77E+00	-	7.33E+01	7.33E+01	-	6.49E+00	6.49E+00	-	6.49E+00	6.49E+00	-	3.20E+03	3.20E+03
Dinoseb	88857	-	-	6.86E+01	6.86E+01	-	2.88E-01	2.88E-01	-	7.61E+00	7.61E+00	-	1.14E+00	1.14E+00	-	1.14E+00	1.14E+00	-	3.20E+02	3.20E+02
MCPP	93652	-	-	6.86E+01	6.86E+01	-	2.49E-01	2.49E-01	-	6.57E+00	6.57E+00	-	6.25E-01	6.25E-01	-	6.25E-01	6.25E-01	-	3.20E+02	3.20E+02
Terphenyls																				
m-Terphenyl	92068	-	6.50E+01	2.90E+04	6.50E+01	1.07E-01	1.58E+02	1.07E-01	3.13E+00	4.17E+03	3.13E+00	7.91E-02	2.29E+02	7.91E-02	1.07E-01	2.29E+02	1.07E-01	1.80E+02	1.40E+05	1.80E+02
o-Terphenyl	84151	-	6.50E+01	2.90E+04	6.50E+01	1.07E-01	1.58E+02	1.07E-01	3.13E+00	4.17E+03	3.13E+00	7.91E-02	2.29E+02	7.91E-02	1.07E-01	2.29E+02	1.07E-01	1.80E+02	1.40E+05	1.80E+02
p-Terphenyl	92944	-	6.50E+01	2.90E+04	6.50E+01	1.07E-01	1.58E+02	1.07E-01	3.13E+00	4.17E+03	3.13E+00	7.91E-02	2.29E+02	7.91E-02	1.07E-01	2.29E+02	1.07E-01	1.80E+02	1.40E+05	1.80E+02
Glycols																				
Diethylene Glycol	111466	-	-	6.11E+03	6.11E+03	-	1.71E-01	1.71E-01	-	4.51E+00	4.51E+00	-	1.09E+00	1.09E+00	-	1.09E+00	1.09E+00	-	2.85E+04	2.85E+04
Triethylene glycol	112276	-	-	2.75E+03	2.75E+03	-	5.29E-02	5.29E-02	-	1.40E+00	1.40E+00	-	3.43E-01	3.43E-01	-	3.43E-01	3.43E-01	-	1.28E+04	1.28E+04
PCDD/PCDFs																				
2,3,7,8-TCDD TEQ	1746016-TEQ	-	4.81E-06	5.05E-05	4.81E-06	7.51E-09	2.52E-07	7.51E-09	2.20E-07	6.66E-06	2.20E-07	3.75E-09	1.43E-07	3.75E-09	4.90E-09	1.43E-07	4.90E-09	1.80E-05	2.36E-04	1.80E-05
Polychlorinated Biphenyls (PCBs)																				
Aroclor 1016	12674112	-	6.63E+00	3.86E+00	3.86E+00	1.38E-02	2.49E-02	1.38E-02	4.04E-01	6.58E-01	4.04E-01	2.83E-02	7.08E-02	2.83E-02	3.75E-02	7.08E-02	3.75E-02	1.61E+01	1.80E+01	1.61E+01
Aroclor 1242	53469219	Aroclor-1242	2.32E-01	1.10E+00	2.32E-01	4.86E-04	7.19E-03	4.86E-04	1.43E-02	1.90E-01	1.43E-02	5.32E-04	9.76E-03	5.32E-04	7.00E-04	9.76E-03	7.00E-04	5.64E-01	5.14E+00	5.64E-01
Aroclor 1248	12672296	-	2.32E-01	1.10E+00	2.32E-01	4.86E-04	7.19E-03	4.86E-04	1.43E-02	1.90E-01	1.43E-02	4.96E-04	9.03E-03	4.96E-04	6.52E-04	9.03E-03	6.52E-04	5.64E-01	5.14E+00	5.64E-01
Aroclor 1254	11097691	-	2.32E-01	1.10E+00	2.32E-01	4.88E-04	7.21E-03	4.88E-04	1.43E-02	1.90E-01	1.43E-02	2.33E-04	4.03E-03	2.33E-04	3.05E-04	4.03E-03	3.05E-04	5.64E-01	5.14E+00	5.64E-01
Aroclor 1260	11096825	-	2.32E-01	1.10E+00	2.32E-01	4.89E-04	7.23E-03	4.89E-04	1.43E-02	1.91E-01	1.43E-02	9.33E-06	1.55E-04	9.33E-06	1.22E-05	1.55E-04	1.22E-05	5.64E-01	5.14E+00	5.64E-01
Aroclor 5460	11126424	-	2.32E-01	1.10E+00	2.32E-01	4.86E-04	7.19E-03	4.86E-04	1.43E-02	1.90E-01	1.43E-02	4.96E-04	9.03E-03	4.96E-04	6.52E-04	9.03E-03	6.52E-04	5.64E-01	5.14E+00	5.64E-01
PCB TEQ	1746016-PCB	-	3.57E-06	3.86E-05	3.57E-06	7.50E-09	2.52E-07	7.50E-09	2.20E-07	6.66E-06	2.20E-07	4.79E-09	1.91E-07	4.79E-09	6.27E-09	1.91E-07	6.27E-09	8.67E-06	1.80E-04	8.67E-06

Notes:

'-' - none established/not applicable.
HQ - hazard quotient
mg/kg - milligrams per kilogram
PCDD/PCDF - polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans
RBSL - Risk-based Screening Level
TCDD - 2,3,7,8-Tetrachlorodibenzo-p-dioxin
TEQ - toxic equivalency

a - Please note that different chemical names have been used for different programs at the SSFL, and there can be additional analyte synonyms than those presented. Therefore, any chemical synonym should be verified using the CAS number listed.
b - Suburban Residential and Recreational Soil RBSLs include the following pathways: ingestion of soil, dermal contact with soil, and inhalation of dust and volatiles from soil.
c - SRAM-based and USEPA Default-based Suburban Residential Garden RBSLs include the ingestion of fruits/vegetables pathway.
d - Rural Residential Soil RBSLs include the following pathways: ingestion of soil, dermal contact with soil, inhalation of dust and volatiles from soil, ingestion of fruits/vegetables, ingestion of beef, ingestion of milk, ingestion of poultry, ingestion of eggs, ingestion of swine, and ingestion of fish.
e - As agreed between DTSC and the Tech Team, food uptake pathways are not evaluated for this chemical.
f - The suburban residential RBSL for non-carcinogenic effect of 4.6 mg/kg was obtained from the HHRA Note Number 3 (DTSC, 2014) per the DTSC. The cadmium RBSLs for non-carcinogenic effects for other receptors were calculated using the exposure assumptions for an adult as described in Section 3.2.1.
g - DTSC, 2009a. The soil concentration (77 mg/kg) that would produce an increase of 1 µg/dL lead in a residential 90th percentile child's blood assuming that background lead contributions from air, water, and homegrown produce are negligible. The soil lead concentration of 77 mg/kg was rounded to 80 mg/kg, per communication with DTSC.
h - DTSC, 2009a. The soil concentration that would produce an increase of 1 µg/dL lead in a residential 90th percentile child's blood assuming that background lead contributions from air and water are negligible and that 100 percent of the child's diet is derived from home-grown produce. Value was estimated using LeadSpread (version 7) and doesn't include contributions from direct soil pathways (e.g., incidental ingestion, dermal contact, and inhalation of dust).
i - DTSC, 2009a. The soil concentration that would produce an increase of 1 µg/dL lead in a residential 90th percentile child's blood assuming that background lead contributions from air and water are negligible and that 25 percent of the child's diet is derived from home-grown produce. Value was estimated using LeadSpread (version 7) and doesn't include contributions from direct soil pathways (e.g., incidental ingestion, dermal contact, and inhalation of dust).
j - DTSC, 2009a. The soil concentration that would produce an increase of 1 µg/dL lead in a residential 90th percentile child's blood assuming that background lead contributions from air and water are negligible and that 100 percent of the child's diet is derived from home-grown produce. Value was estimated using LeadSpread (version 7) and doesn't include contributions from beef, milk, poultry, eggs, swine, and fish, which cannot be evaluated using the LeadSpread model. If these pathways were included, the value would likely be less.
k - DTSC, 2009a. The soil concentration (360 mg/kg) that would produce an increase of 1 µg/dL lead in a residential 90th percentile child's blood assuming that background lead contributions from air, water, and homegrown produce are negligible. An exposure frequency of 1.5 days/week was used in the LeadSpread model, per communication with DTSC.

ATTACHMENT 1

Methodology for the Calculation of Human Health Risk-Based Screening Levels for Chemicals in Soil at the SSFL

METHODOLOGY FOR THE CALCULATION OF HUMAN HEALTH RISK-BASED SCREENING LEVELS FOR CHEMICALS IN SOIL AT THE SSFL TECHNICAL MEMORANDUM
SANTA SUSANA FIELD LABORATORY
VENTURA COUNTY, CALIFORNIA

ATTACHMENT 1: RISK-BASED SCREENING LEVELS CALCULATION APPROACH AND EQUATIONS

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Appendix A Derivation of Risk-Based Screening Levels Equations for the Ingestion of Fish Pathway

1.0 INTRODUCTION

This attachment presents the human health risk assessment (HHRA) approach for the Santa Susana Field Laboratory (SSFL) and the methods and assumptions used to calculate human health risk-based screening levels (HH RBSLs) for chemicals detected in soil (i.e., soil, ephemeral sediment and weathered bedrock) at the SSFL.

1.1 HUMAN HEALTH RISK ASSESSMENT APPROACH

The human health risk assessment approach for the SSFL follows the sum-of-fractions method described in the *Human Health Risk Assessment Sum-of-Fractions Methodology for Chemicals Technical Memorandum, Santa Susana Field Laboratory, Ventura County, California* (MWH, 2010). The sum-of-fractions method for estimating human health risks for chemical constituents involves the computation of HH RBSLs for potential exposure pathways using exposure parameters specific to a given receptor and the toxicity characteristics of each constituent. Constituent concentrations in site media can then be compared to chemical-specific RBSLs to derive risks for each constituent and each receptor. The approach used in the derivation of suburban residential, rural residential and recreational RBSLs for chemical constituents detected in soil at the SSFL is consistent with the general methods for the calculation of RBSLs for soil described in United States Environmental Protection Agency's (USEPA) Risk Assessment Guidance for Superfund: Volume 1, Human Health Evaluation Manual, Part B - Development of Risk-based Preliminary Remediation Goals (RAGS, Part B; USEPA, 1991a).

RBSLs for direct soil exposure pathways and indirect soil exposure pathways, including the ingestion of homegrown fruits and vegetables, beef, milk, poultry, eggs, and swine, were calculated using risk assessment procedures and equations provided in the online USEPA PRGs calculator for radionuclides, RAIS PRGs calculator for chemicals, and various USEPA Guidance documents (USEPA, 2002; USEPA, 2004a, USEPA, 2006; USEPA, 2009a; RAIS, 2006; RAIS, 2010). These equations are based on USEPA's Risk Assessment Guidance for Superfund: Volume 1, Human Health Evaluation Manual, Part A - Baseline Risk Assessment (RAGS, Part A; USEPA, 1989a). Rural residential RBSLs for the ingestion of homegrown fish exposure

pathway were calculated using risk assessment procedures and equations provided by RAIS and the equations presented in the online USEPA PRGs calculator for radionuclides (USEPA, 2006; USEPA, 2009a, RAIS 2010). Soil RBSLs were calculated for the Comprehensive List of Chemicals as documented in the *Process for Selecting the Comprehensive List of Chemicals for Development of Rural Residential Risk-Based Screening Levels for Soil at the Santa Susana Field Laboratory Technical Memorandum* [Appendix A of the Standardized Risk Assessment Methodology Addendum (SRAM Rev. 2 Addendum)]. The human health RBSLs presented herein are conservative and should not be considered *de facto* cleanup standards and should not be applied as such. Multiple sets of human health RBSLs are presented herin. The human health RBSLs that will be applicable to future human health risk assessments will depend on whether the California Senate Bill 990 (SB990) is upheld. In April 2011, the Central District of California Court declared the SB990 unconstitutional in its entirety. As a result, for the residential scenario, the suburban residential and SRAM-based suburban residential garden RBSLs will be applicable in future human health risk assessments. The rural residential RBSLs presented herin are for informational purposes only unless SB990 is upheld. Chemical concentrations detected above RBSLs will not automatically trigger a response action. Final decisions regarding remediation will be based on weight-of-evidence evaluations performed using criteria such as the nine National Contingency Plan (NCP) balancing criteria found in Title 40 of the Code of Federal Regulations (40 CFR) Part 300.430 (e)(9)(iii).

1.2 ORGANIZATION OF THIS DOCUMENT

The remainder of this document is organized as follows:

Section 2.0 **RBSL Calculation Methods** describes the exposure pathways addressed by the RBSLs and presents the equations used to estimated direct soil contact RBSLs, indirect soil contact RBSLs, and total soil RBSLs.

Section 3.0 **Input Parameters Used in the Derivation of the RBSLs** presents the exposure parameters, physical-chemical properties, and toxicity values used in the RBSL

calculations, and describes exposure assessment procedures that are unique to certain chemical classes.

Section 4.0 **Risk Characterization Methods** describes how risks will be estimated for HHRAs prepared for the SSFL using the sum of fractions approach

Section 5.0 **Uncertainty Discussion** presents some of the major uncertainties associated with the suburban residential, rural residential and recreational RBSL calculations.

Section 6.0 **References** presents the references.

2.0 RBSL CALCULATION METHODS

2.1 EXPOSURE PATHWAYS ADDRESSED BY RBSLS

RBSLs are calculated to assess risks for potentially completed exposure pathways. These pathways are depicted in a conceptual site model (CSM). A CSM describes the relationship between contaminant source(s), known or potentially impacted environmental media, potentially exposed receptors, and complete and incomplete exposure pathways between site contaminants and receptors. A generalized CSM for the suburban residential and recreational scenarios at the SSFL is graphically depicted in Figure 1. A generalized CSM for the rural residential scenario at the SSFL is graphically depicted in Figure 2.

Potentially complete soil-based exposure pathways for suburban residents include direct contact with soil (i.e., incidental ingestion of soil, dermal contact with soil, and inhalation of dust and volatile constituents in soil), indirect exposure to soil through the ingestion of homegrown fruits and vegetables, and indirect exposure to constituents in indoor air resulting from vapor intrusion). Potentially complete soil-based exposure pathways for recreators include direct contact with soil (i.e., incidental ingestion of soil, dermal contact with soil, and inhalation of dust and volatile constituents in soil). Potentially complete soil-based exposure pathways for rural residents include direct contact with soil, indirect exposure to soil through the ingestion of homegrown fruits and/or vegetables, ingestion of beef, ingestion of milk, ingestion of poultry, ingestion of eggs, ingestion of swine and ingestion of fish, and indirect exposure to constituents in indoor air. Vapor pathways [i.e., inhalation of volatile organic compounds (VOCs) migrating from subsurface soil to indoor air] have not been included in the updated soil RBSL calculations

because risks from vapor pathways will be evaluated separately using soil vapor data (either measured concentrations or concentrations extrapolated from soil concentrations) and site-specific indoor air models as described in the Department of Toxic Substances Control (DTSC)-approved Standardized Risk Assessment Methodology Work Plan, Revision 2 (hereafter referred to as the SRAM (MWH, 2005). As noted in Section 4.1.2 of the SRAM, the models for estimating exposure point concentrations of chemical constituents in fruits and vegetables are associated with significant uncertainty, and as a result, the ingestion of homegrown fruits and vegetable pathway should be evaluated separately from the direct soil pathways (MWH, 2005). Therefore, soil RBSLs for suburban residents and recreators will be limited to direct soil exposure routes including ingestion of soil, dermal contact with soil, and inhalation of ambient dust and volatile constituents in surficial soil. Soil garden RBSLs for suburban residents will be estimated separately from the direct soil pathways and limited to the ingestion of homegrown fruits and/or vegetables pathway.

Soil RBSLs for rural residents include direct soil exposure routes (ingestion of soil, dermal contact with soil, and inhalation of ambient dust and volatile constituents in surficial soil), ingestion of homegrown fruits and/or vegetables, ingestion of beef, ingestion of milk, ingestion of poultry, ingestion of eggs, ingestion of swine, and ingestion of fish.

Exposure and physical-chemical properties used in the soil RBSL calculations are described in Section 3 and presented in Table 1 through Table 3. Toxicity values used in the soil RBSL calculations are described in Section 3.3 and presented in Table 4. Toxicity equivalence factors (TEFs) used in the soil RBSL calculations for dioxins and furans and "dioxin-like" polychlorinated biphenyl (PCB) congeners are described in Section 3.2 and presented in Table 5.

Human health RBSLs for chemicals in soil are calculated based on both carcinogenic and non-carcinogenic effects, as applicable. Therefore, soil RBSLs were estimated separately for an age-adjusted composite adult and child for carcinogenic effects, and for a child for non-carcinogenic effects using the equations presented in Section 2.2, below. The child was selected for evaluation of non-carcinogenic effects as the most sensitive receptor and is, therefore, protective

of the adult receptor. 40-year rural residential RBSLs for chemicals in soil were calculated as described above in order to be consistent with default PRGs for radionuclides and to allow for the summation of chemical and radionuclide risks to a total cumulative chemical-radionuclide risk estimate. This approach is also consistent with the procedures and equations presented in RAIS (RAIS, 2010).

Soil RBSLs will also be used to quantify risks for potential suburban residential, recreational, and rural residential exposures to ephemeral sediment and weathered bedrock. The potential exposure pathways for ephemeral sediment and weathered bedrock are the same as those for the soil, and the equations and parameters used to calculate RBSLs for ephemeral sediment and weathered bedrock are the same as those used to calculate the soil RBSLs. Therefore, separate human health RBSLs were not calculated for ephemeral sediment and weathered bedrock. Suburban residential, rural residential and recreational RBSLs for soil will be used to estimate risks for all three media.

2.2 DIRECT CONTACT SOIL RBSL CALCULATIONS

The following direct contact soil exposure pathways were included in the suburban residential, rural residential and recreational soil RME RBSL calculations:

- incidental ingestion of soil;
- dermal contact with soil; and
- inhalation of dust and volatile constituents in soil.

Suburban residential, rural residential and recreational RBSLs for carcinogenic effects were estimated for the incidental ingestion of soil pathway using the following equations:

$$RBSL_{so_ing} = \frac{TR \times AT_c}{CSF_o \times EF \times IF_{so} \times 10^{-6} kg / mg} \tag{2-1}$$

where:

$$IF_{so} = \frac{ED_a \times IR_{so_a}}{BW_a} + \frac{ED_c \times IR_{so_c}}{BW_c} \tag{2-2}$$

and where:

$RBSL_{so_ing}$ = suburban residential, rural residential or recreational soil RBSL for incidental ingestion of soil (mg/kg)
TR = target cancer risk of 1 x 10^{-6} (unitless)
AT_c = averaging time for carcinogens (year x 365 days/year)
CSF_o = oral cancer slope factor (milligrams per kilogram [mg/kg]-day)$^{-1}$
EF = suburban resident, rural resident or recreator exposure frequency (days/year)
IF_{so} = age-adjusted composite suburban resident, rural resident or recreator soil ingestion factor (milligrams [mg]-year/kilograms [kg]-day)
ED_a = adult suburban resident, rural resident or recreator exposure duration (years)
IR_{so_a} = adult suburban resident, rural resident or recreator soil ingestion rate (mg/day)
ED_c = child suburban resident, rural resident or recreator exposure duration (years)
IR_{so_c} = child suburban resident, rural resident or recreator soil ingestion rate (mg/day)
BW_a = adult body weight (kg)
BW_c = child body weight (kg)

Suburban residential, rural residential and recreational RBSLs for non-carcinogenic effects were estimated for the incidental ingestion of soil pathway using the following equation:

$$RBSL_{so_ing} = \frac{THQ \times AT_{nc} \times BW_c}{EF \times ED_c \times \left(\frac{1}{RfD_o}\right) \times IR_{so_c} \times 10^{-6}\, kg/mg} \qquad (2\text{-}3)$$

where:

$RBSL_{so_ing}$ = adult suburban resident, rural resident or recreator soil RBSL for incidental ingestion of soil (mg/kg)
THQ = target hazard quotient of 1 (unitless)
AT_{nc} = adult suburban resident, rural resident or recreator averaging time for non-carcinogens (year x 365 days/year)
BW_c = child body weight (kg)
EF = child exposure frequency (days/year)
ED_c = child suburban resident, rural resident or recreator exposure duration (years)
RfD_o = chronic oral reference dose (mg/kg-day)
IR_{so_c} = child suburban resident, rural resident or recreator soil ingestion rate (mg/day)

Suburban residential, rural residential and recreational RBSLs for carcinogenic effects were estimated for the dermal contact soil pathway using the following equations:

$$RBSL_{so_der} = \frac{TR \times AT_c}{CSF_d \times EF \times DF_{so} \times ABS_d \times 10^{-6}\, kg/mg} \tag{2-4}$$

where:

$$DF_{so} = \frac{ED_a \times SA_a \times AF_a}{BW_a} + \frac{ED_c \times SA_c \times AF_c}{BW_c} \tag{2-5}$$

and where:

$RBSL_{so_der}$	= adult suburban resident, rural resident or recreator soil RBSL for dermal contact with soil (mg/kg)
TR	= target cancer risk of 1 x 10^{-6} (unitless)
AT_c	= averaging time for carcinogens (year x 365 days/year)
CSF_d	= dermal cancer slope factor $(mg/kg\text{-}day)^{-1}$
EF	= adult suburban resident, rural resident or recreator exposure frequency (days/year)
DF_{so}	= age-adjusted composite suburban resident, rural resident or recreator dermal contact factor (mg-year/kg-day)
ABS_d	= dermal absorption factor (unitless)
ED_a	= adult suburban resident, rural resident or recreator exposure duration (years)
SA_a	= adult suburban resident, rural resident or recreator skin surface area for dermal exposure (square centimeters [cm^2]/day)
AF_a	= adult suburban resident, rural resident or recreator soil adherence factor (milligram(s) per square centimeter [mg/cm^2])
ED_c	= child resident exposure duration (years)
SA_c	= child suburban resident, rural resident or recreator skin surface area for dermal exposure (cm^2/day)
AF_c	= child suburban resident, rural resident or recreator soil adherence factor (mg/cm^2)
BW_a	= adult suburban resident, rural resident or recreator body weight (kg)
BW_c	= child suburban resident, rural resident or recreator body weight (kg)

Suburban residential, rural residential and recreational RBSLs for non-carcinogenic effects were estimated for the dermal contact soil pathway using the following equation:

$$RBSL_{so_der} = \frac{THQ \times AT_{nc_c} \times BW_c}{EF \times ED_c \times \frac{1}{RfDd} \times SA_{so_c} \times AF_c \times ABS_d \times 10^{-6}\, kg/mg} \tag{2-6}$$

where:

$RBSL_{so_der}$ = suburban resident, rural resident or recreator soil RBSL for dermal contact with soil (mg/kg)
THQ = target hazard quotient of 1 (unitless)
AT_{nc_c} = child suburban resident, rural resident or recreator averaging time for non-carcinogens (year x 365 days/year)
BW_c = child suburban resident, rural resident or recreator body weight (kg)
EF = suburban resident, rural resident or recreator exposure frequency (days/year)
ED_c = child suburban resident, rural resident or recreator exposure duration (years)
RfD_d = chronic dermal reference dose (mg/kg-day)
SA_{so_c} = child suburban resident, rural resident or recreator skin surface area for dermal exposure (cm^2/day)
AF_c = child suburban resident, rural resident or recreator soil adherence factor (mg/cm^2)
ABS_d = dermal absorption factor (unitless)

Suburban residential, rural residential and recreational RBSLs for carcinogenic effects were estimated for the inhalation of dust and volatile constituents in soil pathway using the following equation:

$$RBSL_{so_inh} = \frac{TR \times AT_c}{IUR \times 1000\,\mu g/mg \times EF \times \left(\frac{1}{VF \text{ or } PEF}\right) \times ED \times ET \times \frac{1}{24}\, day/hours} \tag{2-7}$$

where:

$RBSL_{so_inh}$ = suburban resident, rural resident or recreator soil RBSL for inhalation of dust and volatile constituents in soil (mg/kg)
TR = target cancer risk of 1 x 10^{-6} (unitless)
AT_c = averaging time for carcinogens (year x 365 days/year)
IUR = inhalation unit risk (micrograms per cubic meter [$\mu g/m^3$])$^{-1}$
EF = suburban resident, rural resident or recreator exposure frequency (days/year)
VF = volatilization factor (cubic meters per kilogram [m^3/kg]); used for constituents with a molecular weight less than 200 g/mole and a Henry's

law constant greater than 1 x 10^{-5} atm-m3/mole. The equations and site-specific parameters used to calculate VF are provided in Table 6.

PEF = particulate emission factor (m^3/kg); Default USEPA (2009a) value used for constituents with a molecular weight greater than 200 g/mole and a Henry's law constant less than 1 x 10^{-5} atm-m3/mole.

ED = composite suburban resident, rural resident or recreator exposure duration (years).

ET = suburban resident, rural resident or recreator exposure time (hours/day)

Suburban residential, rural residential and recreational soil RBSLs for non-carcinogenic effects were estimated for the inhalation of dust and volatile constituents in soil pathway using the following equation:

$$RBSL_{so_inh} = \frac{THQ \times AT_{nc_c}}{EF \times ED_c \times ET \times \left(\frac{1}{24} day/hours\right) \times \left(\frac{1}{RfC}\right) \times \left(\frac{1}{VF \text{ or } PEF}\right)} \quad (2\text{-}8)$$

where:

$RBSL_{so_inh}$ = suburban resident, rural resident or recreator soil RBSL for inhalation of dust and volatile constituents in soil (mg/kg)

THQ = target hazard quotient of 1 (unitless)

AT_{nc_c} = child suburban resident, rural resident or recreator averaging time for non-carcinogens (year x 365 days/year)

EF = suburban resident, rural resident or recreator exposure frequency (days/year)

ED_c = child suburban resident, rural resident or recreator exposure duration (years)

ET = suburban resident, rural resident or recreator exposure time (hours/day)

RfC = chronic inhalation reference concentration (mg/m^3)

VF = volatilization factor (m^3/kg); used for constituents with a molecular weight less than 200 g/mole and a Henry's law constant greater than 1 x 10^{-5} atm-m^3/mole. The equations and site-specific parameters used to calculate VF are provided in Table 6.

PEF = particulate emission factor (m^3/kg); used for constituents with a molecular weight greater than 200 g/mole and a Henry's law constant less than 1 x 10^{-5} atm-m3/mole.

Suburban residential, rural residential and recreational direct soil contact route-specific RBSLs are presented in Table 7 through Table 10.

2.3 INDIRECT SOIL RBSL CALCULATIONS

The following indirect soil exposure pathways were included in the RME garden RBSL calculations for suburban residents:

- ingestion of fruits and vegetables;

The following indirect soil exposure pathways were included in the RME RBSL calculations for rural residents:

- ingestion of fruits and vegetables,
- ingestion of beef,
- ingestion of milk,
- ingestion of poultry,
- ingestion of eggs,
- ingestion of swine,
- ingestion of fish.

2.3.1 Ingestion of Fruits and Vegetables

Suburban residential and rural residential soil RBSLs for carcinogenic effects were estimated for the ingestion of fruits and vegetables pathway using the following equations:

$$RBSL_{fv} = \frac{C_{fv}}{Bv_{wet} + MLF} \tag{2-9}$$

where:

$$C_{fv} = \frac{TR \times AT_c}{EF \times CSF_o \times \left(IF_{f_res} + IF_{v_res}\right) \times CF_p} \tag{2-10}$$

and where:

$$IF_{f_res} = \frac{ED_{f_rme} \times IR_{fa}}{BW_a} + \frac{ED_c \times IR_{fc}}{BW_c} \tag{2-11}$$

and where:

$$IF_{v_res} = \frac{ED_{f_rme} \times IR_{va}}{BW_a} + \frac{ED_c \times IR_{vc}}{BW_c} \tag{2-12}$$

and where:

$RBSL_{fv}$ = suburban or rural residential soil RBSL for fruits and vegetables pathway (mg/kg)
C_{fv} = target constituent concentration in fruits and vegetables (mg/kg)
Bv_{wet} = soil to plant uptake wet weight (kg/kg)
MLF = plant mass loading factor (unitless)
TR = target cancer risk of 1 x 10^{-6} (unitless)
AT_c = averaging time for carcinogens (year x 365 days/year)
EF = suburban or rural resident exposure frequency (day/year)
CSF_o = oral cancer slope factor $(mg/kg\text{-}day)^{-1}$
IF_{f_res} = age-adjusted composite suburban or rural resident fruit ingestion factor (kg-year/kg-day)
IF_{v_res} = age-adjusted composite suburban or rural resident vegetable ingestion factor (kg-year/kg-day)
CF_p = fraction of produce consumed that is contaminated (unitless)
ED_{f_rme} = composite suburban or rural resident exposure duration (years)
IR_{fa} = adult suburban or rural resident fruit ingestion rate (kg/day)
ED_c = child suburban or rural resident exposure duration (years)
IR_{fc} = child suburban or rural resident fruit ingestion rate (kg/day)
BW_a = adult suburban or rural resident body weight (kg)
BW_c = child suburban or rural resident body weight (kg)
IR_{va} = adult suburban or rural resident vegetable ingestion rate (kg/day)
IR_{vc} = child suburban or rural resident vegetable ingestion rate (kg/day)

Suburban and rural residential soil RBSLs for non-carcinogenic effects were estimated for the ingestion of fruits and vegetables pathway using the following equations:

$$RBSL_{fv} = \frac{C_{fv}}{Bv_{wet} + MLF} \tag{2-13}$$

where:

$$C_{fv} = \frac{THQ \times AT_{nc_c} \times BW_c}{EF \times ED_c \times \left(\frac{1}{RfD_o}\right) \times \left(IR_{fc} + IR_{vc}\right) \times CF_p} \tag{2-14}$$

and where:

$RBSL_{fv}$ = suburban or rural residential soil RBSL for fruits and vegetables pathway (mg/kg)
C_{fv} = target constituent concentration in fruits and vegetables (mg/kg)
Bv_{wet} = soil to plant uptake wet weight (kg/kg)
MLF = plant mass loading factor (unitless)
THQ = target hazard quotient of 1 (unitless)
AT_{nc_c} = child suburban or rural resident averaging time for non-carcinogens (year x 365 days/year)
BW_c = child suburban or rural resident body weight (kilogram[s] [kg])
EF = child suburban or rural resident exposure frequency (day/year)
ED_c = child suburban or rural resident exposure duration (years)
RfDo = oral chronic reference dose (mg/kg-day)
IR_{fc} = child suburban or rural resident fruit ingestion rate (kg/day)
IR_{vc} = child suburban or rural resident vegetable ingestion rate (kg/day)
CF_p = fraction of produce consumed that is contaminated (unitless)

2.3.2 Ingestion of Beef

Rural residential soil RBSLs for carcinogenic effects were estimated for the ingestion of beef pathway using the following equations:

$$RBSL_b = \frac{C_b}{F_b \times \left[\left(Qp_b \times fp_b \times fs_b \times \left(Bv_{dry} + MLF_b\right)\right) + \left(Qs_b \times fp_b\right)\right]} \tag{2-15}$$

where:

$$C_b = \frac{TR \times AT_c}{EF \times CSF_o \times IF_{b_res} \times CF_b} \tag{2-16}$$

and where:

$$IF_{b_res} = \frac{ED_{f_rme} \times IR_{ba_}}{BW_a} + \frac{ED_c \times IR_{bc}}{BW_c} \tag{2-17}$$

and where:

$RBSL_b$ = rural residential soil RBSL for beef pathway (mg/kg)
C_b = target constituent concentration in beef (mg/kg)
F_b = beef transfer coefficient (day/kg)
Qp_b = quantity of pasture ingested – beef cattle (kg/day)
fp_b = fraction of year animal is on site – beef cattle (unitless)
fs_b = fraction of animal's food is from site – beef cattle (unitless)

Bv_{dry} = soil to plant uptake dry weight (kg/kg)
MLF_b = plant mass loading factor – beef pasture (unitless)
Qs_b = quantity of soil ingested – beef cattle (kg/day)
TR = target cancer risk of 1 x 10^{-6} (unitless)
AT_c = averaging time for carcinogens (year x 365 days/year)
EF = rural resident exposure frequency (day/year)
CSF_o = oral cancer slope factor $(mg/kg\text{-}day)^{-1}$
IF_{b_res} = age-adjusted composite rural resident beef ingestion factor (kg-year/kg-day)
CF_b = fraction of beef consumed that is contaminated (unitless)
ED_{f_rme} = adult rural resident exposure duration (years)
IR_{ba} = adult rural resident beef ingestion rate (kg/day)
ED_c = child rural resident exposure duration (years)
IR_{bc} = child rural resident beef ingestion rate (kg/day)
BW_a = adult rural resident body weight (kg)
BW_c = child rural resident body weight (kg)

Rural residential soil RBSLs for non-carcinogenic effects were estimated for the ingestion of beef pathway using the following equations:

$$RBSL_b = \frac{C_b}{F_b \times \left[\left(Qp_b \times fp_b \times fs_b \times \left(Bv_{dry} + MLF_b\right)\right) + \left(Qs_b \times fp_b\right)\right]} \tag{2-18}$$

where:

$$C_b = \frac{THQ \times AT_{nc_c} \times BW_c}{EF \times ED_c \times \left(\frac{1}{RfD_o}\right) \times IR_{bc} \times CF_b} \tag{2-19}$$

and where:

$RBSL_b$ = rural residential soil RBSL for beef pathway (mg/kg)
C_b = target constituent concentration in beef (mg/kg)
F_b = beef transfer coefficient (day/kg)
Qp_b = quantity of pasture ingested – beef cattle (kg/day)
fp_b = fraction of year animal is on site – beef cattle (unitless)
fs_b = fraction of animal's food is from site – beef cattle (unitless)
Bv_{dry} = soil to plant uptake dry weight (kg/kg)
MLF_b = plant mass loading factor –beef pasture (unitless)
Qs_b = quantity of soil ingested – beef cattle (kg/day)
THQ = target hazard quotient of 1 (unitless)
AT_{nc_c} = child rural resident averaging time for non-carcinogens (year x 365 days/year)

BW_c = child rural resident body weight (kg)
EF = rural resident exposure frequency (day/year)
ED_c = child rural resident exposure duration (years)
RfD_o = oral chronic reference dose (mg/kg-day)
IR_{bc} = child rural resident beef ingestion rate (kg/day)
CF_b = fraction of beef consumed that is contaminated (unitless)

2.3.3 Ingestion of Milk

Rural residential soil RBSLs for carcinogenic effects were estimated for the ingestion of milk pathway using the following equations:

$$RBSL_m = \frac{C_m}{F_m \times \left[\left(Qp_m \times fp_m \times fs_m \times \left(Bv_{dry} + MLF_m\right)\right) + \left(Qs_m \times fp_m\right)\right]} \quad (2\text{-}20)$$

where:

$$C_m = \frac{TR \times AT_c}{EF \times CSF_o \times IF_{m_res} \times CF_m} \quad (2\text{-}21)$$

and where:

$$IF_{m_res} = \frac{ED_{f_rme} \times IR_{ma}}{BW_a} + \frac{ED_c \times IR_{mc}}{BW_c} \quad (2\text{-}22)$$

and where:

$RBSL_m$ = rural residential soil RBSL for milk pathway (mg/kg)
C_m = target constituent concentration in milk (mg/kg)
F_m = milk transfer coefficient (day/kg)
Qp_m = quantity of pasture ingested – dairy cattle (kg/day)
fp_m = fraction of year animal is on site – dairy cattle (unitless)
fs_m = fraction of animal's food is from site – dairy cattle (unitless)
Bv_{dry} = soil to plant uptake dry weight (kg/kg)
MLF_m = plant mass loading factor –dairy pasture (unitless)
Qs_m = quantity of soil ingested – dairy cattle (kg/day)
TR = target cancer risk of 1 x 10^{-6} (unitless)
AT_c = averaging time for carcinogens (year x 365 days/year)
EF = rural resident exposure frequency (day/year)
CSF_o = oral cancer slope factor $(mg/kg\text{-}day)^{-1}$
IF_{m_res} = age-adjusted composite rural resident milk ingestion factor (kg-year/kg-day)
CF_m = fraction of milk consumed that is contaminated (unitless)

ED_{f_rme} = adult rural resident exposure duration (years)
IR_{ma} = adult rural resident milk ingestion rate (kg/day)
ED_c = child rural resident exposure duration (years)
IR_{mc} = child rural resident milk ingestion rate (kg/day)
BW_a = adult rural resident body weight (kg)
BW_c = child rural resident body weight (kg)

Rural residential soil RBSLs for non-carcinogenic effects were estimated for the ingestion of milk pathway using the following equations:

$$RBSL_m = \frac{C_m}{F_m \times \left[\left(Qp_m \times fp_m \times fs_m \times \left(Bv_{dry} + MLF_m\right)\right) + \left(Qs_m \times fp_m\right)\right]} \quad (2\text{-}23)$$

where:

$$C_m = \frac{THQ \times AT_{nc_c} \times BW_c}{EF \times ED_c \times \left(\frac{1}{RfD_o}\right) \times IR_{mc} \times CF_m} \quad (2\text{-}24)$$

and where:

C_m = target constituent concentration in milk (mg/kg)
F_m = milk transfer coefficient (day/kg)
Qp_m = quantity of pasture ingested – dairy cattle (kg/day)
fp_m = fraction of year animal is on site – dairy cattle (unitless)
fs_m = fraction of animal's food is from site – dairy cattle (unitless)
Bv_{dry} = soil to plant uptake dry weight (kg/kg)
MLF_m = plant mass loading factor – dairy pasture (unitless)
Qs_m = quantity of soil ingested – dairy cattle (kg/day)
THQ = target hazard quotient of 1 (unitless)
AT_{nc_c} = child rural resident averaging time for non-carcinogens (year x 365 days/year)
BW_c = child rural resident body weight (kg)
EF = rural resident exposure frequency (day/year)
ED_c = child rural resident exposure duration (years)
RfD_o = oral chronic reference dose (mg/kg-day)
IR_{mc} = child rural resident milk ingestion rate (kg/day)
CF_m = fraction of milk consumed that is contaminated (unitless)

2.3.4 Ingestion of Poultry

Rural residential soil RBSLs for carcinogenic effects were estimated for the ingestion of poultry pathway using the following equations, which are based on the equations provided on RAIS (2010) for the beef pathway and use parameters for poultry from USEPA, 2009a:

$$RBSL_p = \frac{C_p}{F_p \times \left[\left(Qp_p \times fp_p \times fs_p \times \left(Bv_{dry} + MLF_p\right)\right) + \left(Qs_p \times fp_p\right)\right]} \quad (2\text{-}25)$$

where:

$$C_p = \frac{TR \times AT_c}{EF \times CSF_o \times IF_{p_res} \times CF_p} \quad (2\text{-}26)$$

and where:

$$IF_{p_res} = \frac{ED_{f_rme} \times IR_{pa}}{BW_a} + \frac{ED_c \times IR_{pc}}{BW_c} \quad (2\text{-}27)$$

and where:

$RBSL_p$ = rural residential soil RBSL for poultry pathway (mg/kg)
C_p = target constituent concentration in poultry (mg/kg)
F_p = poultry transfer coefficient (day/kg)
Qp_p = quantity of pasture ingested – poultry (kg/day)
Fp_p = fraction of year animal is on site – poultry (unitless)
Fs_p = fraction of animal's food is from site – poultry (unitless)
Bv_{dry} = soil to plant uptake dry weight (kg/kg)
MLF_p = plant mass loading factor – poultry pasture (unitless)
Qs_p = quantity of soil ingested – poultry (kg/day)
TR = target cancer risk of 1 x 10^{-6} (unitless)
AT_c = averaging time for carcinogens (year x 365 days/year)
EF = rural resident exposure frequency (day/year)
CSF_o = oral cancer slope factor $(mg/kg\text{-}day)^{-1}$
IF_{p_res} = age-adjusted composite rural resident poultry ingestion factor (kg-year/kg-day)
CF_p = fraction of poultry consumed that is contaminated (unitless)
ED_{f_rme} = adult rural resident exposure duration (years)
IR_{pa} = adult rural resident poultry ingestion rate (kg/day)
ED_c = child rural resident exposure duration (years)
IR_{pc} = child rural resident poultry ingestion rate (kg/day)

BW_a = adult rural resident body weight (kg)
BW_c = child rural resident body weight (kg)

Rural residential soil RBSLs for non-carcinogenic effects were estimated for the ingestion of poultry pathway using the following equations, which are based on the equations provided on RAIS (2010) for the beef pathway and use parameters for poultry from USEPA, 2009a:

$$RBSL_p = \frac{C_p}{F_p \times \left[\left(Qp_p \times fp_p \times fs_p \times \left(Bv_{dry} + MLF_p\right)\right) + \left(Qs_p \times fp_p\right)\right]} \quad (2\text{-}28)$$

where:

$$C_p = \frac{THQ \times AT_{nc_c} \times BW_c}{EF \times ED_c \times \left(\frac{1}{RfD_o}\right) \times IR_{pc} \times CF_p} \quad (2\text{-}29)$$

and where:

$RBSL_p$ = rural residential soil RBSL for poultry pathway (mg/kg)
C_p = target constituent concentration in poultry (mg/kg)
F_p = poultry transfer coefficient (day/kg)
Qp_p = quantity of pasture ingested – poultry (kg/day)
fp_p = fraction of year animal is on site – poultry (unitless)
fs_p = fraction of animal's food is from site – poultry (unitless)
Bv_{dry} = soil to plant uptake dry weight (kg/kg)
MLF_p = plant mass loading factor –poultry pasture (unitless)
Qs_p = quantity of soil ingested – poultry (kg/day)
THQ = target hazard quotient of 1 (unitless)
AT_{nc_c} = child rural resident averaging time for non-carcinogens (year x 365 days/year)
BW_c = child rural resident body weight (kg)
EF = rural resident exposure frequency (day/year)
ED_c = child rural resident exposure duration (years)
RfD_o = oral chronic reference dose (mg/kg-day)
IR_{pc} = child rural resident poultry ingestion rate (kg/day)
CF_p = fraction of poultry consumed that is contaminated (unitless)

2.3.5 Ingestion of Eggs

Rural residential soil RBSLs for carcinogenic effects were estimated for the ingestion of eggs pathway using the following equations, which are based on the equations provided on RAIS (2010) for the beef pathway and use parameters for eggs from USEPA, 2009a:

$$RBSL_e = \frac{C_e}{F_e \times \left[\left(Qp_p \times fp_p \times fs_p \times \left(Bv_{dry} + MLF_p\right)\right) + \left(Qs_p \times fp_p\right)\right]} \quad (2\text{-}30)$$

where:

$$C_e = \frac{TR \times AT_c}{EF \times CSF_o \times IF_{e_res} \times CF_e} \quad (2\text{-}31)$$

and where:

$$IF_{e_res} = \frac{ED_{f_rme} \times IR_{ea}}{BW_a} + \frac{ED_c \times IR_{ec}}{BW_c} \quad (2\text{-}32)$$

and where:

$RBSL_e$ = rural residential soil RBSL for egg pathway (mg/kg)
C_e = target constituent concentration in egg (mg/kg)
F_e = egg transfer coefficient (day/kg)
Qp_p = quantity of pasture ingested – poultry (kg/day)
fp_p = fraction of year animal is on site – poultry (unitless)
fs_p = fraction of animal's food is from site – poultry (unitless)
Bv_{dry} = soil to plant uptake dry weight (kg/kg)
MLF_p = plant mass loading factor – poultry pasture (unitless)
Qs_p = quantity of soil ingested – poultry (kg/day)
TR = target cancer risk of 1 x 10^{-6} (unitless)
AT_c = averaging time for carcinogens (year x 365 days/year)
EF = exposure frequency (day/year)
CSF_o = oral cancer slope factor $(mg/kg\text{-}day)^{-1}$
IF_{e_res} = age-adjusted composite rural resident egg ingestion factor (kg-year/kg-day)
CF_e = fraction of eggs consumed that are contaminated (unitless)
ED_{f_rme} = adult rural resident exposure duration (years)
IR_{ea} = adult rural resident egg ingestion rate (kg/day)
ED_c = child rural resident exposure duration (years)
IR_{ec} = child rural resident egg ingestion rate (kg/day)
BW_a = adult rural resident body weight (kg)
BW_c = child rural resident body weight (kg)

Rural residential soil RBSLs for non-carcinogenic effects were estimated for the ingestion of eggs pathway using the following equations, which are based on the equations provided on RAIS (2010) for the beef pathway and use parameters for eggs from USEPA, 2009a:

$$RBSL_e = \frac{C_e}{F_e \times \left[\left(Qp_p \times fp_p \times fs_p \times \left(Bv_{dry} + MLF_p\right)\right) + \left(Qs_p \times fp_p\right)\right]} \quad (2\text{-}33)$$

where:

$$C_e = \frac{THQ \times AT_{nc_c} \times BW_c}{EF \times ED_c \times \left(\frac{1}{RfD_o}\right) \times IR_{ec} \times CF_e} \quad (2\text{-}34)$$

and where:

$RBSL_e$	= rural residential soil RBSL for egg pathway (mg/kg)
C_e	= target constituent concentration in egg (mg/kg)
F_e	= egg transfer coefficient (day/kg)
Qp_p	= quantity of pasture ingested – poultry (kg/day)
fp_p	= fraction of year animal is on site – poultry (unitless)
fs_p	= fraction of animal's food is from site – poultry (unitless)
Bv_{dry}	= soil to plant uptake dry weight (kg/kg)
MLF_p	= plant mass loading factor –poultry pasture (unitless)
Qs_p	= quantity of soil ingested – poultry (kg/day)
THQ	= target hazard quotient of 1 (unitless)
AT_{nc_c}	= child rural resident averaging time for non-carcinogens (year x 365 days/year)
BW_c	= child rural resident body weight (kg)
EF	= rural resident exposure frequency (day/year)
ED_c	= child resident exposure duration (years)
RfD_o	= oral chronic reference dose (mg/kg-day)
IR_{ec}	= child rural resident egg ingestion rate (kg/day)
CF_e	= fraction of eggs consumed that are contaminated (unitless)

2.3.6 Ingestion of Swine

Rural residential soil RBSLs for carcinogenic effects were estimated for the ingestion of swine pathway using the following equations, which are based on the equations provided on RAIS (2010) for the beef pathway and use parameters for swine from USEPA, 2009a:

$$RBSL_s = \frac{C_s}{F_s \times \left[\left(Qp_s \times fp_s \times fs_s \times \left(Bv_{dry} + MLF_s\right)\right) + \left(Qs_s \times fp_s\right)\right]} \quad (2\text{-}35)$$

where:

$$C_s = \frac{TR \times AT_c}{EF \times CSF_o \times IF_{s_res} \times CF_s} \quad (2\text{-}36)$$

and where:

$$IF_{s_res} = \frac{ED_{f_rme} \times IR_{sa}}{BW_a} + \frac{ED_c \times IR_{sc}}{BW_c} \quad (2\text{-}37)$$

and where:

$RBSL_s$ = rural residential soil RBSL for swine pathway (mg/kg)
C_s = target constituent concentration in swine (mg/kg)
F_s = swine transfer coefficient (day/kg)
Qp_s = quantity of pasture ingested – swine (kg/day)
fp_s = fraction of year animal is on site – swine (unitless)
fs_s = fraction of animal's food is from site – swine (unitless)
Bv_{dry} = soil to plant uptake dry weight (kg/kg)
MLF_s = plant mass loading factor – swine pasture (unitless)
Qs_s = quantity of soil ingested – swine (kg/day)
TR = target cancer risk of 1 x 10^{-6} (unitless)
AT_c = averaging time for carcinogens (year x 365 days/year)
EF = rural resident exposure frequency (day/year)
CSF_o = oral cancer slope factor $(mg/kg\text{-}day)^{-1}$
IF_{s_res} = age-adjusted composite rural resident swine ingestion factor (kg-year/kg-day)
CF_s = fraction of swine consumed that is contaminated (unitless)
ED_{f_rme} = adult rural resident exposure duration (years)
IR_{sa} = adult rural resident swine ingestion rate (kg/day)
ED_c = child rural resident exposure duration (years)
IR_{sc} = child rural resident swine ingestion rate (kg/day)
BW_a = adult rural resident body weight (kg)
BW_c = child rural resident body weight (kg)

Rural residential soil RBSLs for non-carcinogenic effects were estimated for the ingestion of swine pathway using the following equations, which are based on the equations provided on RAIS (2010) for the beef pathway and use parameters for swine from USEPA, 2009a:

$$RBSL_s = \frac{C_s}{F_s \times \left[\left(Qp_s \times fp_s \times fs_s \times \left(Bv_{dry} + MLF_s\right)\right) + \left(Qs_s \times fp_s\right)\right]} \quad (2\text{-}38)$$

where:

$$C_s = \frac{THQ \times AT_{nc_c} \times BW_c}{EF \times ED_c \times \left(\frac{1}{RfD_o}\right) \times IR_{sc} \times CF_s} \quad (2\text{-}39)$$

and where:

$RBSL_s$	= rural residential soil RBSL for swine pathway (mg/kg)
C_s	= target constituent concentration in swine (mg/kg)
F_s	= swine transfer coefficient (day/kg)
Qp_s	= quantity of pasture ingested – swine (kg/day)
fp_s	= fraction of year animal is on site – swine (unitless)
fs_s	= fraction of animal's food is from site – swine (unitless)
Bv_{dry}	= soil to plant uptake dry weight (kg/kg)
MLF_s	= plant mass loading factor –swine pasture (unitless)
Qs_s	= quantity of soil ingested – swine (kg/day)
THQ	= target hazard quotient of 1 (unitless)
AT_{nc_c}	= child rural resident averaging time for non-carcinogens (year x 365 days/year)
BW_c	= child rural resident body weight (kg)
EF	= rural resident exposure frequency (day/year)
ED_c	= child rural resident exposure duration (years)
RfD_o	= oral chronic reference dose (mg/kg-day)
IR_{sc}	= child rural resident swine ingestion rate (kg/day)
CF_s	= fraction of swine consumed that is contaminated (unitless)

2.3.7 Ingestion of Fish

This pathway conservatively assumes that site soil becomes sediment in a future surface water impoundment, and associated chemicals accumulate into fish that are consumed by people. Depending upon the octanol-water partition coefficient (log Kow) of a chemical, a bioconcentration factor (BCF), a bioaccumulation factor (BAF) or a biota sediment accumulation factor (BSAF) were used as the fish accumulation factor for the calculation of the rural residential soil RBSL for the fish pathway. As a result, different rural residential soil RBSL equations are provided depending on the fish uptake factor used. A detailed description of how

fish uptake factors are chosen is further described in Section 3.1.2. A detailed derivation of the fish pathway RBSL equations is provided in Appendix A of this Attachment.

Rural residential soil RBSLs for carcinogenic effects were estimated for the ingestion of fish pathway using the following equations for chemicals using BAFs or BCFs (see Section 3.1.2):

$$RBSL_{fi} = \frac{C_{fi}}{\left(\frac{1}{K_d + \sigma \times \left(\frac{S}{\rho}\right)}\right) \times BCF \text{ or } BAF \times \left(\frac{A_s}{A_w}\right)} \tag{2-40}$$

where:

$$C_{fi} = \frac{TR \times AT_c}{EF \times CSF_o \times IF_{fi_res} \times FI_{fis}} \tag{2-41}$$

and where:

$$IF_{fi_res} = \frac{ED_a \times IR_{fia}}{BW_a} + \frac{ED_c \times IR_{fic}}{BW_c} \tag{2-42}$$

and where:

$RBSL_{fi}$ = rural residential soil RBSL for fish pathway (mg/kg)
C_{fi} = target constituent concentration in fish (mg/kg)
K_d = soil to water partition coefficient (L/kg)
σ = total soil porosity (L pore space/L soil)
S = fraction water content (L water/L pore space)
ρ = soil bulk density (kg/L soil)
BAF = bioaccumulation factor (L/kg)
BCF = bioconcentration factor (L/kg)
A_s = surface area of contaminated site (square meters [m^2])
A_w = surface area of watershed (m^2)
TR = target cancer risk of 1 x 10^{-6} (unitless)
AT_c = averaging time for carcinogens (year x 365 days/year)
EF = rural resident exposure frequency (day/year)
CSF_o = oral cancer slope factor $(mg/kg\text{-}day)^{-1}$

IF_{fi_res} = age-adjusted composite rural resident fish ingestion factor (kg-year/kg-day)
FI_{fis} = fraction of fish consumed that is contaminated (unitless)
ED_a = adult rural resident exposure duration (year)
IR_{fia} = adult rural resident fish ingestion rate (kg/ day)
ED_c = child rural resident exposure duration (year)
IR_{fic} = child rural resident fish ingestion rate (kg/ day)
BW_a = adult rural resident body weight (kg)
BW_c = child rural resident body weight (kg)

Rural residential soil RBSLs for carcinogenic effects were estimated for the ingestion of fish pathway using the following equations for chemicals using BSAFs (see Section 3.1.2):

$$RBSL_{fi} = \frac{TR \times OC_{sed} \times AT_c}{BSAF \times f_{lipid} \times FI_{fis} \times EF \times CSF_o \left(\frac{A_s}{A_W}\right)} \times \frac{1}{IF_{fis_res}} \tag{2-43}$$

where:

$$IF_{fis_res} = \frac{ED_a \times IR_{fisa}}{BW_a} + \frac{ED_c \times IR_{fisc}}{BW_c} \tag{2-44}$$

and where:

$RBSL_{fi}$ = rural residential soil RBSL for fish pathway (mg/kg)
TR = target cancer risk of 1 x 10^{-6} (unitless)
OC_{sed} = fraction of organic carbon in bottom sediment (unitless)
AT_c = averaging time for carcinogens (year x 365 days/year)
BSAF = biota-sediment accumulation factor (unitless)
f_{lipid} = fish lipid content (unitless)
FI_{fis} = fraction of fish consumed that is contaminated (unitless)
EF = rural resident exposure frequency (day/year)
CSF_o = oral cancer slope factor $(mg/kg\text{-}day)^{-1}$
A_s = surface area of contaminated site (square meters [m^2])
A_w = surface area of watershed (m^2)
IF_{fi_res} = age-adjusted composite rural resident fish ingestion factor (kg-year/kg-day)
ED_a = adult rural resident exposure duration (year)
IR_{fisa} = adult rural resident fish ingestion factor (kg-year/kg-day)
BW_a = adult rural resident body weight (kg)
ED_c = child rural resident exposure duration (year)
IR_{fisc} = child rural resident fish ingestion factor (kg-year/kg-day)
BW_c = child rural resident body weight (kg)

Rural residential soil RBSLs for non-carcinogenic effects were estimated for the ingestion of fish pathway using the following equations for chemicals using BAFs or BCFs (see Section 3.1.2):

$$RBSL_{fi} = \frac{C_{fi}}{\left(\frac{1}{K_d + \sigma \times \left(\frac{S}{\rho}\right)}\right) \times BCF \text{ or } BAF \times \left(\frac{A_s}{A_w}\right)} \tag{2-45}$$

where:

$$C_{fi} = \frac{THQ \times AT_{nc_c} \times BW_c}{EF \times ED_c \times \left(\frac{1}{RfD_o}\right) \times IR_{fisc} \times FI_{fis}} \tag{2-46}$$

and where:

$RBSL_{fi}$ = rural residential soil RBSL for fish pathway (mg/kg)
C_{fi} = target constituent concentration in fish (mg/kg)
K_d = soil to water partition coefficient (L/kg)
σ = total soil porosity (L water/L pore space)
S = fraction water content (L water/L pore space)
ρ = soil bulk density (kg/L soil)
BAF = bioaccumulation factor (L/kg)
BCF = bioconcentration factor (L/kg)
A_s = surface area of contaminated site (square meters [m^2])
A_w = surface area of watershed (m^2)
THQ = target hazard quotient of 1 (unitless)
AT_{nc_c} = child rural resident averaging time for non-carcinogens (year x 365 days/year)
BW_c = child rural resident body weight (kg)
EF = rural resident exposure frequency (day/year)
ED_c = child rural resident exposure duration (year)
RfD_o = oral chronic reference dose (mg/kg-day)
IR_{fisc} = child rural resident fish ingestion rate (kg/ day)
FI_{fis} = fraction of fish consumed that is contaminated (unitless)

Rural residential soil RBSLs for non-carcinogenic effects were estimated for the ingestion of fish pathway using the following equations for chemicals with BSAFs as described in Section 3.1.2:

$$RBSL_{fi} = \frac{THQ \times OC_{sed} \times AT_{nc_c} \times BW_c}{BSAF \times f_{lipid} \times IR_{fisc} \times FI_{fis} \times ED_c \times EF \times \left(\frac{1}{RfD_o}\right) \times \left(\frac{A_s}{A_W}\right)} \quad (2\text{-}47)$$

and where:

$RBSL_{fi}$ = rural residential soil RBSL for fish pathway (mg/kg)
THQ = target hazard quotient of 1 (unitless)
OC_{sed} = fraction of organic carbon in bottom sediment (unitless)
AT_{nc_c} = child rural resident averaging time for non-carcinogens (year x 365 days/year)
BW_c = child rural resident body weight (kg)
BSAF = biota-sediment accumulation factor (unitless)
F_{lipid} = fish lipid content (unitless)
IR_{fisc} = child rural resident fish ingestion rate (kg/day)
FI_{fis} = fraction of fish consumed that is contaminated (unitless)
ED_c = child rural resident exposure duration (year)
EF = rural resident exposure frequency (day/year)
RfD_o = oral chronic reference dose (mg/kg-day)
A_s = surface area of contaminated site (square meters [m^2])
A_w = surface area of watershed (m^2)

Suburban residential and rural residential indirect soil contact route-specific RBSLs are presented in Table 11 through Table 14, respectively.

2.4 TOTAL RBSL CALCULATIONS

Total (that is, including all relevant exposure routes) suburban residential, rural residential and recreational RBSLs for chemicals in soil were calculated based on a combination of the exposure route-specific RBSLs presented in Section 2.2 and Section 2.3. In order to calculate a total RBSL that represents a chemical concentration in soil that is protective of all exposure routes at a cumulative target cancer risk of 1 x 10^{-6} or a HI of 1, the target risk or HQ for each exposure route-specific RBSL was apportioned across all pathways (RAIS, 2010).

2.4.1 Total RBSL for Suburban Residents

Total RBSLs for suburban residents for chemicals in soil were estimated using the following equations:

$$RBSL_{so_res} = \frac{1}{SUM} \tag{2-48}$$

where:

$$SUM = \left(\frac{1}{RBSL_{so_ing}}\right) + \left(\frac{1}{RBSL_{so_derm}}\right) + \left(\frac{1}{RBSL_{so_inh}}\right) \tag{2-49}$$

and where:

$RBSL_{so_res}$ = cumulative soil RBSL for suburban residents (mg/kg)
SUM = sum of 1/pathway-specific RBSLs
$RBSL_{so_ing}$ = suburban residential RBSL for incidental ingestion of soil (mg/kg)
$RBSL_{so_der}$ = suburban residential RBSL for dermal contact with soil (mg/kg)
$RBSL_{so_inh}$ = suburban residential RBSL for inhalation of dust and volatile constituents in soil (mg/kg)

2.4.2 Total Garden RBSL for Suburban Residents

The total garden RBSLs for suburban residents for chemicals in soil are limited to the ingestion of homegrown fruits and/or vegetables pathway, so they are equivalent to the fruit and vegetable RBSLs ($RBSL_{fv}$) for suburban residents estimated using Equations 2-9 through 2-14.

2.4.3 Total RBSL for Rural Residents

$$RBSL_{rr_so} = \frac{1}{SUM} \tag{2-52}$$

where:

$$SUM = \left(\frac{1}{RBSL_{so_ing}}\right) + \left(\frac{1}{RBSL_{so_der}}\right) + \left(\frac{1}{RBSL_{so_inh}}\right) + \left(\frac{1}{RBSL_{so_fv}}\right) + \left(\frac{1}{RBSL_{so_b}}\right) +$$

$$\left(\frac{1}{RBSL_{so_m}}\right) + \left(\frac{1}{RBSL_{so_p}}\right) + \left(\frac{1}{RBSL_{so_e}}\right) + \left(\frac{1}{RBSL_{so_s}}\right) + \left(\frac{1}{RBSL_{so_fi}}\right) \tag{2-53}$$

and where:

$RBSL_{rr_so}$ = cumulative rural residential soil RBSL (mg/kg)
SUM = sum of 1/pathway-specific rural residential RBSLs
$RBSL_{so_ing}$ = rural residential RBSL for incidental ingestion of soil (mg/kg)
$RBSL_{so_der}$ = rural residential RBSL for dermal contact with soil (mg/kg)
$RBSL_{so_inh}$ = rural residential RBSL for inhalation of dust and volatile constituents in soil (mg/kg)
$RBSL_{so_fv}$ = rural residential soil RBSL for fruit and vegetable pathway (mg/kg)
$RBSL_{so_b}$ = rural residential soil RBSL for beef pathway (mg/kg)
$RBSL_{so_m}$ = rural residential soil RBSL for milk pathway (mg/kg)
$RBSL_{so_p}$ = rural residential soil RBSL for poultry pathway (mg/kg)
$RBSL_{so_e}$ = rural residential soil RBSL for egg pathway (mg/kg)
$RBSL_{so_s}$ = rural residential soil RBSL for swine pathway (mg/kg)
$RBSL_{so_fi}$ = rural residential soil RBSL for fish pathway (mg/kg)

2.4.4 Total RBSL for Recreators

Total RBSLs for recreators for chemicals in soil were estimated using the following equations:

$$RBSL_{so_rec} = \frac{1}{SUM} \tag{2-54}$$

where:

$$SUM = \left(\frac{1}{RBSL_{so_ing}}\right) + \left(\frac{1}{RBSL_{so_derm}}\right) + \left(\frac{1}{RBSL_{so_inh}}\right) \tag{2-55}$$

and where:

$RBSL_{so_rec}$ = cumulative soil RBSL for recreators (mg/kg)
SUM = sum of 1/pathway-specific RBSLs
$RBSL_{so_ing}$ = recreational RBSL for incidental ingestion of soil (mg/kg)
$RBSL_{so_der}$ = recreational RBSL for dermal contact with soil (mg/kg)
$RBSL_{so_inh}$ = recreational RBSL for inhalation of dust and volatile constituents in soil (mg/kg)

3.0 INPUT PARAMETERS USED IN THE DERIVATION OF THE RBSLS

3.1 EXPOSURE AND PHYSICAL-CHEMICAL PROPERTIES

The exposure parameters and rationale for the updated soil suburban residential, rural residential and recreational pathways are presented in Attachment 1 Tables 1 and 2. The primary sources of exposure parameters used in the updated soil RBSL calculations were RAIS (RAIS, 2006; RAIS, 2010), the USEPA Online PRG Calculator for Radionuclides (USEPA, 2006; USEPA, 2009a), and site-specific values for which the rationale was included in the SRAM (MWH, 2005). Suburban residential and recreational soil RBSLs are primarily based on exposure parameters presented in the SRAM (MWH, 2005) and rural residential soil RBSLs are primarily based on exposure parameters presented in RAIS and the USEPA Online PRG Calculator for Radionuclides (RAIS, 2006; RAIS, 2010; USEPA, 2006; USEPA, 2009a).

For the suburban residential and rural residential receptors, more than one set of RBSLs have been calculated for informational purposes. DTSC requested that 40-year rural residential RBSLs be calculated, however as described in Section 3.1.1, an additional set of 30-year rural residential RBSLs were calculated. As described in Section 2.0, suburban residential garden RBSLs were estimated separately from the suburban residential direct soil RBSLs. Two sets of draft suburban residential garden RBSLs were calculated. Draft suburban residential garden RBSLs were calculated using the exposure parameters presented in the SRAM (MWH, 2005) per DTSC's request. These SRAM-based suburban residential garden RBSLs are conservative because the exposure parameters in the SRAM (MWH, 2005) assume that all produce consumed by the suburban resident are contaminated and include much higher fruit and vegetable intake rates than current USEPA default values. DTSC agreed that a parallel set of draft suburban residential USEPA default-based garden RBSLs could also be calculated using the default exposure parameters presented in the online USEPA PRGs for Radionuclides (USEPA, 2009a) and the RAIS PRGs for Chemicals (RAIS, 2010) for informational purposes.

Soil to whole plant uptake factors and calculation methods consistent with the RAIS PRGs for Chemicals (RAIS, 2010) were used to model concentrations of constituents in homegrown fruits and/or vegetables as requested by DTSC. The soil to plant uptake factors and calculation

methods presented in this technical memorandum supersede the DTSC CalTox model calculation method summarized in Section 5.5 of the SRAM (MWH, 2005). According to DTSC, the whole plant uptake factors and calculation methods summarized in this technical memorandum are expected to yield more accurate risk evaluation than the previous method summarized in the SRAM (MWH, 2005).

Chemical-specific parameters including physical-chemical properties, uptake factors, transfer coefficients, and fish bioaccumulation factors are presented in Table 3.

3.1.1 Chemical-specific Parameters Selection Hierarchy

Chemical-specific parameters used in the soil suburban residential, rural residential and recreational RBSL calculations were either obtained from the following sources, or calculated using equations from these sources:

- Adsorption characteristics of perchlorate in soil. Division of Environmental Chemistry Preprints of Extended Abstracts, 39:60–62, as cited in Environmental Screening Assessment of Perchlorate Replacements, Appendix A (Clausen, et al., 2007).
- Human Health Risk Assessment Note Number 1: Recommended DTSC Default Exposure Factors for Use in Risk Assessment at California Military Facilities. (DTSC, 2011a).
- IAEA's Handbook of Parameter Values for the Prediction of Radionuclide Transfer in Temperate Environment (IAEA, 1994)
- *Uncertainty and variability in human exposures to soil contaminants through home-grown food: a Monte Carlo assessment* (McKone, 1994)
- RAIS (http://rais.ornl.gov/cgi-bin/prg/PRG_search?select=chem) (searched May 2010).
- The Nuclear Waste Management Organization's (NWMO) *Field measurements of the transfer factors for iodine and other trace elements from the Nuclear Waste Management Organization.* (Sheppard et al., 2009)
- Pacific Northwest National Laboratory's (PNNL) *A compendium of transfer factors for agricultural and animal products* (Staven et al., 2003)
- Tsao and Sample. 2005. Literature-derived bioaccumulation models for energetic compounds in plants and soil invertebrates

- Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (USEPA, 2002)
- USEPA RAGS Part E Worksheet to Calculate Dermal Absorption of Organic Chemicals from Aqueous Media (latest version April 2001; USEPA, 2004a)
- USEPA's Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities Appendix B (USEPA, 2005a)
- USEPA's Human Health Risk Assessment Protocol Companion Database (USEPA,2005b)
- USEPA's Estimation Programs Interface (EPI) Suite v4.0 (http://www.epa.gov/opptintr/exposure/pubs/episuitedl.htm) (USEPA, 2010a)
- Review of Perchlorate Ecotoxicity and Bioaccumulation Data to Support Evaluation of Ecological Risks (Yoo et al., 2007)

Chemical-specific parameters are not provided in the sources listed above for every constituent and every exposure pathway included in the suburban residential, rural residential and recreational RBSL calculations. It should be noted that this is also the case for USEPA's PRGs for radionuclides (USEPA, 2009a) (i.e., some pathways are omitted from the total soil PRG calculation when insufficient parameters are available to quantify those pathways). For most constituents lacking chemical-specific parameters, surrogate values were used as documented in the *Process for Selecting the Comprehensive List of Chemicals for Development of Rural Residential Risk-Based Screening Levels for Soil at the Santa Susana Field Laboratory* Technical Memorandum (Appendix A of SRAM Rev. 2 Addendum). The source of each chemical-specific parameter is provided in Table 3. Draft Rural Residential RBSLs for the Expedited List of Chemicals were submitted to DTSC in December 2010. These rural residential RBSLs were calculated using a standard, default exposure duration (ED) of 30 years, in accordance with USEPA's *Supplemental Guidance: "Standard Default Exposure Factors"* (USEPA, 1991b) which recommends a default ED of 30 years for both residential and agricultural scenarios. On March 29, 2011, DTSC provided comments on the exposure assumptions that were used to calculate soil rural residential RBSLs for the Expedited List of Chemicals. In their comments, DTSC requested that an ED of 40 years be used to calculate rural residential RBSLs for chemicals at the SSFL so the human health risk assessments conducted for

the SSFL would comply with all requirements of SB990. DTSC obtained the February 20, 2006 default exposure parameters for USEPA's PRGs for Radionuclides Calculator which were effective as of January 1, 2007 and would comply with SB990. The February 20, 2006 default exposure parameters included in the PRGs for Radionuclides Calculator identified an ED of 40 years for the agricultural receptor. Following a series of communications between DTSC and the responsible parties (RPs) on this issue, DTSC re-iterated their request that rural residential RBSLs be calculated using an ED of 40 years for the agricultural receptor; however, they agreed that a parallel set of rural residential RBSLs could also be calculated based on a 30-year ED for informational purposes. An ED of 40 years is much more conservative than an ED of 30 years as the ED parameter is present in all RBSL equations presented in Section 2.0. The ED is also used to calculate all composite exposure factors presented in Section 2.0.

3.1.2 Fish Accumulation Factors

Depending upon the log Kow of a chemical, a BCF, a BAF or a BSAF were used as the fish accumulation factor for the calculation of the rural residential soil RBSL for the fish pathway. The USEPA recommends using BSAFs for the estimation of concentrations of chemicals in fish for lipophilic chemicals such as dioxins/furans and PCBs, because these classes of chemicals tend to associate preferentially with sediment (USEPA, 2005c), and BSAFs accounts for the transfer of chemicals from sediment to lipids in the fish. The equations used to calculate rural residential soil RBSL for the fish pathway for dioxins/furans and PCBs were developed based on the assumption that these hydrophobic soil chemicals at the SSFL accumulated in pond sediments without significant solubilization in pond water.

BCFs only account for the uptake of chemicals by fish from water passing across their gills. As a result, USEPA recommends using BCFs only for compounds with a log Kow less than 4.0 (USEPA, 2005b). For most organic compounds with log Kow values greater than 4.0, with the exception of dioxins/furans and PCBs, USEPA recommends using BAFs for the estimation of chemical concentrations in fish because BAFs account for fish uptake of a chemical from water (both dissolved and suspended), from sediment and from the food chain (USEPA, 2005c). The BCFs, BAFs and BSAFs used to develop the rural residential soil RBSLs for the fish ingestion pathway are presented in Table 3.

3.2 EXPOSURE ASSESSMENT PROCEDURES UNIQUE TO CERTAIN CHEMICAL CLASSES

3.2.1 Cadmium

Cadmium accumulation can occur in the liver, muscle and kidney but occurs primarily in the kidney (OEHHA, 2006). The accumulation of cadmium in the kidney was found to increase with age until around age 40 to 50, when accumulation of cadmium in the kidney plateaus and then slowly declines with age (OEHHA, 2006). The OEHHA derived an acceptable daily dose (ADD) of 0.0063 micrograms per kilogram per day (ug/kg-day) based on renal toxicity in adults (OEHHA, 2006). Per correspondences with the DTSC on August 18, 2014 and August 19, 2014, cadmium RBSLs for non-carcinogenic effects were based on an adult instead of a child to account for the accumulation of cadmium in the kidney over an extended period of time. The suburban residential RBSL for non-carcinogenic effect of 4.6 mg/kg was obtained from the HHRA Note Number 3 (DTSC, 2014) per the DTSC. The cadmium RBSLs for non-carcinogenic effects for other receptors were calculated using the exposure assumptions for an adult, and an exposure duration and averaging time as presented in Table 1 and 2 for an age-adjusted composite receptor.

3.2.2 Dioxins/Furans

The family of dioxin compounds, hereafter referred to as dioxins, consists of 75 chlorinated dibenzo-p-dioxin (CDD) and 135 chlorinated dibenzofuran (CDF) congeners. Of these compounds, it has been determined that the 2,3,7,8-substituted congeners are toxicologically active with respect to cancer in biological systems (USEPA 1989b). Accordingly, only the 17 2,3,7,8-substituted dioxin congeners are evaluated in risk assessments at the SSFL (USEPA 1989b).

Dioxin toxicity equivalence factors (TEFs) are measures of the relative toxicity of a dioxin or furan congener to the toxicity of 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD). TEFs may be applied to exposure concentrations, dosages, or toxicity values. For risk assessments conducted at the SSFL, dioxin congener-specific TEFs listed in Table 5, which were developed

by the World Health Organization (WHO) and published by Van den Berg et al. (2006), will be applied to the detected concentration of individual congeners from each sample collected to generate congener concentrations relative in toxicity to a concentration of 2,3,7,8-TCDD. Concentrations will then be summed to calculate a 2,3,7,8-TCDD toxicity equivalent (TEQ) concentration for each sample collected. Dioxin/furan data reported as "totals" are not included in this process as individual congeners are already included in TEQ values.

When congener-specific concentrations fall below their respective sample quantitation limits (SQLs), a value of zero will be used for these congeners in the calculation of a cumulative 2,3,7,8-TCDD TEQ value per communication with DTSC in 2010. Human health RBSLs were calculated for dioxin TEQs and will be used to calculate risks for dioxin TEQs in place of specific congeners.

3.2.3 Polychlorinated Biphenyls

As requested by DTSC and described in Section 2.7 of the SRAM (MWH, 2005), potential risks associated with PCBs are assessed in SSFL risk assessments using two different methods: (1) risks associated with the 12 coplanar "dioxin-like" PCB congeners using the TEQ approach (Van den Berg et al., 2006), and (2) risks associated with Aroclor mixtures. Potential risks associated with the 12 PCB congeners and potential risks associated with Aroclor mixtures will be presented separately in the risk assessments, and risks associated with the coplanar PCBs will not be included in the cumulative risk evaluation, but will be used as a separate indicator of dioxin-like activity. Risk estimates using Aroclor mixtures will, however, be include in the cumulative risk evaluation.

Coplanar PCB TEFs are measures of the relative toxicity of a coplanar PCB congener to the toxicity of 2,3,7,8-TCDD. TEFs may be applied to exposure concentrations, dosages, or toxicity values. For risk assessments conducted at the SSFL, coplanar PCB congener-specific TEFs listed in Table 5, which were developed by the WHO and published by Van den B erg et al. (2006), will be applied to the detected concentration of individual congeners from each sample collected to generate congener concentrations relative in toxicity to a concentration of 2,3,7,8-TCDD.

Concentrations will then be summed to calculate a 2,3,7,8-TCDD TEQ concentration for each sample collected, which will be referred to in the risk assessments as a PCB TEQ.

When coplanar PCB congener concentrations fall below their respective SQLs, a value of zero will be used for these congeners in the calculation of a cumulative 2,3,7,8-TCDD TEQ value per communication with DTSC in 2010. Human health RBSLs were calculated for PCB TEQs and will be used to calculate risks for PCB TEQs in place of specific coplanar PCB congeners.

3.2.4 Lead

Section 8.5.1 of the SRAM (MWH, 2005) noted that if lead is selected as a constituent of potential concern (COPC), the LeadSpread model will be used to predict blood lead levels. As a result, suburban residential, recreational and rural residential lead RBSLs were calculated using DTSC's LeadSpread model. The LeadSpread 7 (DTSC 2009a) model was used to calculate lead RBSLs for the suburban resident, rural resident, and recreator per communication with DTSC because the LeadSpread 8 model (DTSC, 2011b) does not include the dietary pathway. The suburban residential and recreational lead RBSLs are equal to the soil concentration that would lead to an incremental increase in blood lead level of up to 1 μg/dL for a 90th percentile child, assuming direct soil exposure pathways and no dietary intake. A 1 μg/dL incremental increase in blood concentration is consistent with Cal-EPA's change in lead toxicity evaluation in 2007, where the 10 μg/dL threshold blood concentration was replaced with a source-specific benchmark change of 1 μg/dL (DTSC, 2011b). For reference, it is worth noting that the current USEPA risk management criterion for lead exposures is a blood-lead concentration of 10 μg/dl (USEPA, 2003). Exposure frequencies provided in Tables 1 and 2 were used to model the blood lead levels in the LeadSpread 7 model. For all other model parameters, default values presented in the LeadSpread 7 model were used. A soil lead concentration of 77 mg/kg resulted in an incremental increase in blood lead level of up to 1 ug/dL for a 90th percentile suburban residential child. The soil lead concentration of 77 mg/kg was rounded to 80 mg/kg, per communication with the DTSC on December 21 and 22, 2011, to become the suburban residential lead RBSL. The soil lead concentration of 80 mg/kg is also consistent with DTSC's interim soil screening level (DTSC 2009a) for lead and Cal-EPA's CHHSL (Cal-EPA, 2009). As

agreed by DTSC (DTSC, 2011c), an exposure frequency of 1.5 days/week, which approximate to an exposure frequency of 75 days/year, was entered into the exposure parameters of the LeadSpread 7 model to calculate the recreational lead RBSL. The rural residential lead RBSL of 6.3 mg/kg, developed per communication with the DTSC on December 21 and 22, 2011, is equal to the soil concentration that would lead to an incremental increase in blood lead level of up to 1 ug/dL for a 90th percentile child who is exposed to lead in soil, respirable dust and homegrown produce. Default parameters in the LeadSpread 7 model are used except for the following: 1) 100 percent of the child's diet was derived from homegrown produce, and 2) background lead contributions from air and water are assumed to be negligible,

The SRAM- and USEPA-default-based garden lead RBSLs of 6.9 mg/kg and 7.2 mg/kg, respectively, are equal to the soil concentrations that the LeadSpread model predicts would lead to an incremental increase in blood lead level of up to 1 ug/dL for a 90th percentile child who is exposed to lead in homegrown produce. Default parameters in the LeadSpread 7 model are used except for the percent of diet derived from home-grown produce. The SRAM-based garden lead RBSL was estimated assuming that 100 percent of the child's diet is derived from homegrown produce. The USEPA default-based garden lead RBSL was estimated assuming that 25 percent of the child's diet is derived from homegrown produce.

3.3 TOXICITY VALUES

Toxicity values for the RBSL calculations were obtained from the following general hierarchy of toxicity information sources:

1. California Environmental Protection Agency Office of Environmental Health Hazard Assessment Toxicity Criteria Database (OEHHA, 2011; OEHHA, 2012; OEHHA, 2013).
2. Integrated Risk Information System (IRIS; USEPA, 2011a; USEPA, 2012).
3. Provisional Peer Reviewed Toxicity Values (PPRTV), as cited in the May 2013 version of the USEPA RSL Tables (USEPA, 2013).
4. Provisional Peer Reviewed Toxicity Values (PPRTV) Appendix, as cited in the May 2013 version of the USEPA RSL Tables (USEPA, 2013).

5. Agency for Toxic Substances and Disease Registry (ATSDR) Minimum Risk Levels (MRLs), as cited in the May 2013 version of the USEPA RSL Tables (USEPA, 2013).

6. Health Effects Assessment Summary Table (HEAST; USEPA 1997a).

7. National Center for Environmental Assessment (NCEA), as cited in the USEPA Region 9 PRG tables (USEPA, 2004b).

8. New Jersey Department of Environmental Protection (NJDEP), as cited in the May 2013 version of the USEPA RSL Tables (USEPA, 2013).

9. Other DTSC-approved sources may be used to develop future toxicity values if values are not available for newly detected chemicals from the other sources in this list.

The toxicity values used in RBSL calculations are presented in Table 4. An exception to the aforementioned hierarchy was the use of the more recently published of non-carcinogenic inhalation reference concentration (RfC) values and reference exposure levels (RELs) from OEHHA. This was done per discussion with the DTSC on December 13, 2013. Another exception to the aforementioned hierarchy was the use of the Cal-EPA ADD of 6.3E-6 mg/kg-day as the oral RfD for cadmium per correspondences with the DTSC on August 18, 2014 and August 19, 2014.

For most constituents lacking toxicity values, surrogate values were used as documented in the *Process for Selecting the Comprehensive List of Chemicals for Development of Rural Residential Risk-Based Screening Levels for Soil at the Santa Susana Field Laboratory* Technical Memorandum (Appendix A of the SRAM Rev. 2 Addendum). The source of each toxicity value is provided in Table 4.

4.0 RISK CHARACTERIZATION METHODS

The sum-of-fractions method will be used to calculate estimates of suburban residential, rural residential, and recreational carcinogenic risk and non-carcinogenic hazard for chemicals in soil using the RBSLs presented in this technical memorandum. In the sum-of-fractions approach, a chemical-specific exposure point concentration (EPC) for a given COPC is divided by the applicable RBSL and multiplied by the target risk level, or the target hazard quotient, that was used to calculated the RBSL. The EPC will be computed using area-averaging, and will be

represented by the 95 percent upper confidence limit (95% UCL) on the mean concentrations, as described in Section 6 of the SRAM (MWH, 2005).

Individual chemical cancer risks will be estimated as follows:

$$Excess\ Cancer\ Risk = \frac{EPC}{RBSL_c} \times TR \tag{4-1}$$

where:

EPC = exposure point concentration (mg/kg, μg/L, or μg/m^3)

$RBSL_c$ = risk-based screening level for cancer effects (mg/kg, μg/L, or μg/m^3)

TR = target cancer risk of 1 x 10^{-6} (unitless)

Cancer risk calculations will be performed for age-adjusted composite adult and child residents and recreators. A total lifetime excess cancer risk will be calculated by first (1) summing individual chemical risks calculated for the complete pathways identified in the CSM, and then (2) summing risks for all COPCs evaluated as potential carcinogens using the following equation:

$$Total\ Lifetime\ Excess\ Cancer\ Risk = \sum \frac{EPC_i}{RBSL_{ci}} \times TR \tag{4-2}$$

where:

EPC_i = exposure point concentration for the ith chemical constituent (mg/kg, μg/L, or μg/m^3)

$RBSL_{ci}$ = risk-based screening level for cancer effects for the ith chemical constituent (mg/kg, μg/L, or μg/m^3)

TR = target cancer risk of 1 x 10^{-6} (unitless)

Hazard quotients (HQ) will be estimated using the following equation:

$$HQ = \frac{EPC}{RBSL_{nc}} \times THQ \tag{4-3}$$

where:

HQ = hazard quotient

EPC = exposure point concentration (mg/kg, µg/L, or µg/m^3)

$RBSL_{nc}$ = risk-based screening level for noncancer effects (mg/kg, µg/L, or µg/m^3)

THQ = target hazard quotient of 1 (unitless)

HQ calculations will be performed for child receptors. For each chemical, HQs will be summed for all complete exposure pathways to estimate the individual chemical HQ. As a first tier analysis, all HQs (e.g., for all chemicals, regardless of target organ) will be summed to conservatively estimate a screening-level hazard index (HI) for each exposure scenario using the following equation:

$$HI = \sum \frac{EPC_i}{RBSL_{nci}} \times THQ \tag{4-4}$$

where:

HI = hazard index

EPC_i = exposure point concentration for the ith chemical constituent (mg/kg, µg/L, or µg/m^3)

$RBSL_{nci}$ = risk-based screening level for noncancer effects for the ith chemical constituent (mg/kg, µg/L, or µg/m^3)

THQ = target hazard quotient of 1 (unitless)

If the screening-level HI exceeds a value of 1, then target organ-specific HIs may be calculated based on target organs as recommended by USEPA (1989a).

The sum-of-fractions approach provides human health risk estimates that are equivalent to risk estimates calculated using forward calculation methods, such as those used to estimate risks

published in previous RCRA Facility Investigation (RFI) reports. The exposure equations and parameters have been updated – to reflect advances in HHRA methods – since earlier RFI reports were submitted to DTSC, so new risk estimates calculated using the methods described in this document may not be equal to to risk estimates presented in those reports. However, if all parameters and equations are made consistent, differences in calculations using the sum of fractions method and the forward calculation method are negligible (i.e., less than one significant figure).

5.0 UNCERTAINTY DISCUSSION

There is some degree of uncertainty associated with nearly all of the exposure assumptions, exposure parameter values, chemical-specific parameter values, and toxicity values used in the calculation of RBSLs. Uncertainties in exposure assumptions, exposure parameters, and toxicity values typically err on the conservative side and result in health protective estimates of risk, or in this case, RBSLs. Following are some of the major uncertainties associated with the suburban residential, rural residential and recreational RBSL calculations:

- There is some uncertainty in the exposure parameters used in the RBSL calculations. In most cases, exposure parameters are upper-bound estimates that result in conservative estimates of exposure, which are protective of human health.

- Uncertainties are introduced into the toxicity assessment when constituents lack toxicity values. For most constituents lacking toxicity values, surrogate values were used (see Table 4). In such instances, there is greater uncertainty than when toxicity values were developed specifically for the compound.

- Reference doses typically have safety factors of 100 to 1,000 incorporated into their development. These safety factors account for the potential of humans to be more sensitive to the chemical than the laboratory animal, for some humans to be more sensitive to the chemical than the general population, and accounts for chronic exposure durations when the toxicity experiments were conducted over shorter durations, etc. Thus, toxicity values are designed to yield conservative estimates of health risk, and to be protective of the overall population.

- Cancer slope factors are upper-bound values that fit carcinogenicity data to a specific mathematical function. The function selected is, in itself, generally conservative with respect to other mathematical functions that fit the data equally well.

- For potential carcinogens, current regulatory guidelines (USEPA, 1989a) use a conservative approach in which it is assumed that any level of exposure to a carcinogen could hypothetically cause cancer (i.e., a non-threshold effect). However, threshold effect levels have been demonstrated to exist for some carcinogens. Thus, assuming a non-threshold mechanism of action for all carcinogens is conservative.

A more detailed discussion of the uncertainties associated with the HHRA process are presented in MWH (2005).

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TABLES

Attachment 1 - Table 1

Exposure Parameters and Rationale for Rural Residential Risk-Based Screening Level Calculations

		40 Year- Rural Resident				30 Year- Rural Resident			
Parameter	**Units**	**Adult Resident**	**Child Resident**	**Age-Adjusted Composite Resident**	**Rationale**	**Adult Resident**	**Child Resident**	**Age-Adjusted Composite Resident**	**Rationale**
General									
BW = body weight	kg	70	15	NA	(a)	70	15	NA	(a)
ED = exposure duration	years	34	6	40	(b)	24	6	30	(c)
EF = exposure frequency	days/year	350	350	350	(b)	350	350	350	(b)
ET = exposure time	hours/day	24	24	24	(a)	24	24	24	(a)
ATc = averaging time for carcinogens	year x 365 days/year	25,550	25,550	25,550	(d)	25,550	25,550	25,550	(d)
ATn = averaging time for non-carcinogens	year x 365 days/year	12410	2190	14600	(e)	8760	2190	10950	(c), (e)
Ingestion of Soil									
IR_{so} = soil ingestion rate	mg/day	100	200	NA	(b)	100	200	NA	(b)
IF_{so_res} = age-adjusted soil ingestion factor	mg-year/kg-day	NA	NA	129	(f), (g)	NA	NA	114	(f), (g)
Dermal Contact with Soil									
SA_{so} = skin surface area for dermal exposure	cm^2/day	5,700	2,800	NA	(a)	5,700	2,800	NA	(a)
AF_{so} = soil adherence factor	mg/cm^2	0.1	0.2	NA	(a), (h)	0.1	0.2	NA	(a), (h)
DF_{so_res} = age-adjusted dermal factor	mg-year/kg-day	NA	NA	501	(a), (g), (h)	NA	NA	419	(a), (g), (h)
Inhalation of Dust									
PEF = particulate emission factor	m^3/kg	1.36E+09	1.36E+09	1.36E+09	(a)	1.36E+09	1.36E+09	1.36E+09	(a)
Ingestion of Fruits and Vegetables									
CF_p = fraction of produce consumed that is contaminated	unitless	1	1	1	(b)	1	1	1	(b)
IR_f = fruit ingestion rate	kg/day	0.0562	0.0148	NA	(b)	0.0562	0.0148	NA	(b)
IR_v = vegetable ingestion rate	kg/day	0.0285	0.0104	NA	(b)	0.0285	0.0104	NA	(b)
IF_{f_res} =age-adjusted fruit ingestion factor	kg-year/kg-day	NA	NA	0.0332	(f), (g)	NA	NA	0.0252	(f), (g)
IF_{v_res} = age-adjusted vegetable ingestion factor	kg-year/kg-day	NA	NA	0.0180	(f), (g)	NA	NA	0.0139	(f), (g)
MLF = plant mass-loading factor	unitless	0.26	0.26	0.26	(c)	0.26	0.26	0.26	(c)
Ingestion of Beef									
CF_b = fraction of beef consumed that is contaminated	unitless	1	1	1	(i)	1	1	1	(i)
fp_b = fraction of year animal is on site - beef cattle	unitless	1	1	1	(i)	1	1	1	(i)
fs_b = fraction of animal's food is on site - beef cattle	unitless	1	1	1	(i)	1	1	1	(i)
IR_b = beef ingestion rate	kg/day	0.138	0.0129	NA	(b)	0.138	0.0129	NA	(b)
IF_{b_res} = age-adjusted beef ingestion factor	kg-year/kg-day	NA	NA	0.0722	(f), (g)	NA	NA	0.0525	(f), (g)
MLF_b = plant mass-loading factor - beef pasture	unitless	0.25	0.25	0.25	(i)	0.25	0.25	0.25	(i)

Attachment 1 - Table 1

Exposure Parameters and Rationale for Rural Residential Risk-Based Screening Level Calculations

		40 Year- Rural Resident				30 Year- Rural Resident			
Parameter	**Units**	**Adult Resident**	**Child Resident**	**Age-Adjusted Composite Resident**	**Rationale**	**Adult Resident**	**Child Resident**	**Age-Adjusted Composite Resident**	**Rationale**
Qp_b = quantity of pasture ingested - beef cattle	kg/day	11.77	11.77	11.77	(b)	11.77	11.77	11.77	(b)
Qs_b = quantity of soil ingested - beef cattle	kg/day	0.39	0.39	0.39	(b)	0.39	0.39	0.39	(b)
Ingestion of Milk									
CF_m = fraction of milk consumed that is contaminated	unitless	1	1	1	(i)	1	1	1	(i)
fp_m = fraction of year animal is on site	unitless	1	1	1	(i)	1	1	1	(i)
fs_m = fraction of animal's food is on site	unitless	1	1	1	(i)	1	1	1	(i)
IR_m = milk ingestion rate	kg/day	0.615	0.265	NA	(b)	0.615	0.265	NA	(b)
IF_{m_res} = age-adjusted milk ingestion factor	kg-year/kg-day	NA	NA	0.405	(f), (g)	NA	NA	0.317	(f), (g)
MLF_m = plant mass-loading factor - dairy pasture	unitless	0.25	0.25	0.25	(i)	0.25	0.25	0.25	(i)
Qp_m = quantity of pasture ingested - dairy cattle	kg/day	16.9	16.9	16.9	(b)	16.9	16.9	16.9	(b)
Qs_m = quantity of soil ingested - dairy cattle	kg/day	0.41	0.41	0.41	(b)	0.41	0.41	0.41	(b)
Ingestion of Poultry									
CF_p = fraction of poultry consumed that is contaminated	unitless	1	1	1	(j)	1	1	1	(j)
Fp_p = fraction of year animal is on site - poultry	unitless	1	1	1	(j)	1	1	1	(j)
Fs_p = fraction of animal's food is on site - poultry	unitless	1	1	1	(j)	1	1	1	(j)
IR_p = poultry ingestion rate	kg/day	0.098	0.0137	NA	(b)	0.098	0.0137	NA	(b)
IF_{p_res} = age-adjusted poultry ingestion factor	kg-year/kg-day	NA	NA	0.0531	(f), (g)	NA	NA	0.039	(f), (g)
MLF_p = plant mass-loading factor - poultry pasture	unitless	0.25	0.25	0.25	(j)	0.25	0.25	0.25	(j)
Qp_p = quantity of pasture ingested - poultry	kg/day	0.2	0.2	0.2	(b)	0.2	0.2	0.2	(b)
Qs_p = quantity of soil ingested - poultry	kg/day	0.022	0.022	0.022	(b)	0.022	0.022	0.022	(b)
Ingestion of Eggs									
CF_e = fraction of eggs consumed that are contaminated	unitless	1	1	1	(j)	1	1	1	(j)
IR_e = egg ingestion rate	kg/day	0.0408	0.00630	NA	(b)	0.04082	0.00630	NA	(b)
IF_{e_res} = age-adjusted egg ingestion factor	kg-year/kg-day	NA	NA	0.0223	(f), (g)	NA	NA	0.0165	(f), (g)
Ingestion of Swine									
CF_s = fraction of swine consumed that is contaminated	unitless	1	1	1	(j)	1	1	1	(j)
fp_s = fraction of year animal is on site	unitless	1	1	1	(j)	1	1	1	(j)
fs_s = fraction of animal's food is on site	unitless	1	1	1	(j)	1	1	1	(j)
IR_s = swine ingestion rate	kg/day	0.0759	0.0123	NA	(b)	0.0759	0.0123	NA	(b)

Attachment 1 - Table 1

Exposure Parameters and Rationale for Rural Residential Risk-Based Screening Level Calculations

		40 Year- Rural Resident				30 Year- Rural Resident			
Parameter	**Units**	**Adult Resident**	**Child Resident**	**Age-Adjusted Composite Resident**	**Rationale**	**Adult Resident**	**Child Resident**	**Age-Adjusted Composite Resident**	**Rationale**
IF_{s_res} = age-adjusted swine ingestion factor	kg-year/kg-day	NA	NA	0.0418	(f), (g)	NA	NA	0.0310	(f), (g)
MLF_s = plant mass-loading factor - pasture	unitless	0.25	0.25	0.25	(j)	0.25	0.25	0.25	(j)
Qp_s = quantity of pasture ingested - swine	kg/day	4.7	4.7	4.7	(b)	4.7	4.7	4.7	(b)
Qs_s = quantity of soil ingested - swine	kg/day	0.37	0.37	0.37	(b)	0.37	0.37	0.37	(b)
Ingestion of Fish									
A_s = surface area of contaminated site	m^2	10,000	10,000	10,000	(b)	10,000	10,000	10,000	(b)
A_w = surface area of watershed	m^2	100,000	100,000	100,000	(b)	100,000	100,000	100,000	(b)
CF_{fi} = fraction of fish consumed that is contaminated	unitless	1	1	1	(j)	1	1	1	(j)
IR_{fi} = fish ingestion rate	kg/day	0.126	0.0178	NA	(b)	0.126	0.0178	NA	(b)
IF_{fi_res} = age-adjusted fish ingestion factor	kg-year/kg-day	NA	NA	0.0681	(f), (g)	NA	NA	0.0501	(f), (g)
S = fraction water content	L water/L pore space	0.3	0.3	0.3	(b)	0.3	0.3	0.3	(b)
ρ = soil bulk density	kg/L soil	1.5	1.5	1.5	(b)	1.5	1.5	1.5	(b)
σ = total soil porosity	L water/L pore space	0.5	0.5	0.5	(b)	0.5	0.5	0.5	(b)
OC_{sed} = fraction or organic carbon in bottom sediment	unitless	0.04	0.04	0.04	(e)	0.04	0.04	0.04	(e)
f_{lipid} = fish lipid content	unitless	0.03	0.03	0.03	(e)	0.03	0.03	0.03	(e)

Notes:
kg = kilogram(s)
L = liter(s)
mg = milligram(s)
m = meter(s)
NA = not applicable
RME = reasonable maximum exposure

(a) USEPA 2002, Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, OSWER 9355.4-24, December 2002.
(b) USEPA 2006 - EPA PRG calculator for radionuclides (http://epa-prgs.ornl.gov/cgi-bin/radionuclides/rprg_search) default parameter. February 20, 2006.
(c) RAIS 2010 - Online RAIS (http://rais.ornl.gov/tools/rais_chemical_prg_guide.html) default parameter from RAIS Preliminary Remediation Goals (PRGs) for Chemicals User's Guide, accessed in May 2010.
(d) USEPA 2002 cancer averaging time (AT) = 70 year exposure duration * 365 days/year.
(e) USEPA 2005a - Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities Appendix B, Table B-4-28. Noncancer AT = ED (year) * 365 days/yr.
(f) USEPA 2009a - EPA PRG calculator for radionuclides (http://epa-prgs.ornl.gov/cgi-bin/radionuclides/rprg_search) default parameter. Ingestion rates were converted to kg/day using a conversion factor of 1 year/365 days.
(g) Composite ingestion and dermal factors were calculated according to cited reference, using the following RAIS-based rationale: Composite Factor = (Child Rate x EDc/BWc) + (Adult Rate x EDa_RME/BWa). The composite dermal contact factor for the farmer (501 mg-yr/kg-day) was calculated using a soil adherence factor of 0.1 mg/cm2, which corresponds with a farmer (>20 yrs of age) per USEPA, 2004a (Exhibit 3-3).

Attachment 1 - Table 1

Exposure Parameters and Rationale for Rural Residential Risk-Based Screening Level Calculations

		40 Year- Rural Resident				30 Year- Rural Resident			
Parameter	**Units**	**Adult Resident**	**Child Resident**	**Age-Adjusted Composite Resident**	**Rationale**	**Adult Resident**	**Child Resident**	**Age-Adjusted Composite Resident**	**Rationale**

(h) USEPA 2004a - Soil adherence factors are recommended reasonable maximum exposure (RME) values for farmers and daycare children (indoors and outdoors) from Exhibit 3-3. RME soil adherence factors for recreators are geometric mean values for adult pipe layers in wet soil and children playing in wet soil from Exhibit 3-3.

(i) RAIS 2006, Preliminary Remediation Goals (PRGs)/Risk Tools/Human Health Risk Exposure Model/Agricultural Land Use/on-site Agricultural Exposure Scenario. September 29, 2006. Available through web archive at the following URL: http//web.archive.org/web/20060929143310/rais.ornl.gov/homepage/tm/for_ag.shtml.

(j) Assumed value - assumed to be the same as the default parameter listed for cattle on RAIS 2010.

Attachment 1 - Table 2

Exposure Parameters and Rationale for Suburban Residential and Recreational Risk-Based Screening Level Calculations

		Suburban Resident				SRAM-based Suburban Residential Garden				USEPA Default-based Suburban Residential Garden				Recreator			
Parameter	Units	Adult Resident	Child Resident	Age-Adjusted Composite Resident	Rationale	Adult Resident	Child Resident	Age-Adjusted Composite Resident	Rationale	Adult Resident	Child Resident	Age-Adjusted Composite Resident	Rationale	Adult Recreator	Child Recreator	Age-Adjusted Composite Recreator	Rationale
General																	
BW = body weight	kg	70	15	NA	(a)	70	15	NA	(a)	70	15	NA	(c)	70	15	NA	(a)
ED = exposure duration	years	24	6	30	(a)	24	6	30	(a)	24	6	30	(c)	24	6	30	(a)
EF = exposure frequency	days/year	350	350	350	(a)	350	350	350	(a)	350	350	350	(c)	75	75	75	(c)
ET = exposure time	hours/day	24	24	24	(a)	24	24	24	(a)	24	24	24	(c)	8	8	8	(a)
ATc = averaging time for carcinogens	year x 365 days/year	27,375	27,375	27,375	(a), (b)	27,375	27,375	27,375	(a), (b)	25,550	25,550	25,550	(b), (c)	27,375	27,375	27,375	(a), (b)
ATn = averaging time for non-carcinogens	year x 365 days/year	8,760	2,190	NA	(a), (d)	8,760	2,190	10,950	(a), (d)	8,760	2,190	10,950	(c), (d)	8760	2190	10,950	(a), (d)
Ingestion of Soil																	
IR_{so} = soil ingestion rate	mg/day	100	200	NA	(a)	NA	NA	NA	NA	NA	NA	NA	NA	100	200	NA	(a)
IF_{so_res} = age-adjusted soil ingestion factor	mg-year/kg-day	NA	NA	114	(a)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	114	(a)
Dermal Contact with Soil																	
SA_{so} = skin surface area for dermal exposure	cm^2/day	5,700	2,800	NA	(a)	NA	NA	NA	NA	NA	NA	NA	NA	5,700	2,800	NA	(a)
AF_{so} = soil adherence factor	mg/cm^2	0.07	0.2	NA	(a)	NA	NA	NA	NA	NA	NA	NA	NA	0.6	0.2	NA	(f)
DF_{so_res} = age-adjusted dermal factor	mg-year/kg-day	NA	NA	361	(c)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,397	(c)
Inhalation of Dust																	
PEF = particulate emission factor	m^3/kg	1.36E+09	1.36E+09	1.36E+09	(e)	NA	NA	NA	NA	NA	NA	NA	NA	1.36E+09	1.36E+09	1.36E+09	(e)
Ingestion of Fruits and Vegetables																	
CF_p = fraction of produce consumed that is contaminated	unitless	NA	NA	NA	NA	1	1	1	(a)	0.25	0.25	0.25	(e)	NA	NA	NA	NA
IR_f = fruit ingestion rate	kg/day	NA	NA	NA	NA	0.3773	0.08145	NA	(a)	0.0562	0.0148	NA	(c)	NA	NA	NA	NA
IR_v = vegetable ingestion rate	kg/day	NA	NA	NA	NA	0.3248	0.0849	NA	(a)	0.0285	0.0104	NA	(c)	NA	NA	NA	NA
IF_{f_res} =age-adjusted fruit ingestion factor	kg-year/kg-day	NA	NA	NA	NA	NA	NA	0.1619	(c)	NA	NA	0.0252	(c)	NA	NA	NA	NA
IF_{v_res} = age-adjusted vegetable ingestion factor	kg-year/kg-day	NA	NA	NA	NA	NA	NA	0.1453	(c)	NA	NA	0.0139	(c)	NA	NA	NA	NA
MLF = plant mass-loading factor	unitless	NA	NA	NA	NA	0.26	0.26	0.26	(c)	0.26	0.26	0.26	(c)	NA	NA	NA	NA

Notes:
kg = kilogram(s)
L = liter(s)
mg = milligram(s)
m = meter(s)
NA = not applicable
RME = reasonable maximum exposure

(a) SRAM 2005 - Site-specific values provided in SRAM Tables 5-2 to 5-5 (MWH, 2005). Adult and child SRAM-based suburban residential garden fruit and vegetable ingestion rates were adjusted to units of kg/day using the adult and child body weights of 70 and 15 kg, respectively.
(b) Cancer averaging time (AT) (year x 365 days/year) = Cancer averaging time (AT) years * 365 days/year. SRAM-based AT is for 75 years; USEPA default-based AT is 70 years.
(c) RAIS 2010 - Online RAIS (http://rais.ornl.gov/tools/rais_chemical_prg_guide.html) default parameter from RAIS Preliminary Remediation Goals (PRGs) for Chemicals User's Guide, accessed in May 2010. Age-adjusted intake factors calculated using RAIS-based rationale: (Child Ingestion Rate x EDc/BWc) + (Adult Ingestion Rate x EDa_RME/Bwa).
(d) Noncancer AT = ED (year) * 365 days/yr.
(e) USEPA 2009a - EPA PRG calculator for radionuclides (http://epa-prgs.ornl.gov/cgi-bin/radionuclides/rprg_search) default parameter. Ingestion rates were converted to kg/day using a conversion factor of 1 year/365 days.
(f) USEPA 2004a - RME soil adherence factors for adult and child recreators are geometric mean values for adult pipe layers in wet soil and children playing in wet soil from Exhibit 3-3, respectively.

Attachment 1 - Table 3

Physical Chemical Properties Used in Suburban Residential, Rural Residential and Recreational Risk-Based Screening Level Calculations

Analyte	CAS#	Analyte Synonym [a]	Log of Octanol-Water Partition Coefficient log Kow (unitless)	Source	Organic Carbon Partition Coefficient Koc (cm^3/g)	Source	Soil to Plant Uptake Wet Weight Bv_{wet} (kg/kg)	Source	Soil to Plant Uptake Dry Weight Bv_{dry} (kg/kg)	Source	Beef Transfer Coefficient F_b (day/kg)	Source	Milk Transfer Coefficient F_m (day/kg)	Source	Poultry Transfer Coefficient F_p (day/kg)	Source	Egg Transfer Coefficient F_e (day/kg)	Source	Swine Transfer Coefficient F_s (day/kg)	Source	Fish Accumulation Factors BCF/BAF or BSAF (L/kg or unitless)	Source	Soil to Water Partition Coefficient Kd (cm^3/g)	Source	Dermal Absorption Fraction ABS_{dir} (unitless)	Source	Henry's Law Constant H ($atm\text{-}m^3/mole$)	Source	Molecular Weight MW (g/mole)	Source	VOC? [b]	Volitilization Factor VF (m^3/kg)	Source	Henry's Law Constant H (unitless)	Source	Diffusivity in Air Di_a (cm^2/s)	Source	Diffusivity in Water Di_w (cm^2/s)	Source	Apparent Diffusivity D_a (cm^2/s)	Source	Log Animal Fat Transfer Coefficient $logBa_{af}$ (day/kg)	Source
Inorganic Compounds																																										
Aluminum	7429905	Aluminum, Total	na		NA		NA		NA		NA		NA		NA		NA		NA		NA		1.50E+03	RAIS 2010	0.01	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		NA
Antimony	7440360	Antimony, Total	na		NA		1.00E-02	RAIS 2010	5.00E-02	RAIS 2010	4.00E-05	RAIS 2010	2.50E-05	RAIS 2010	9.30E-02	Sheppard et al. 2009	7.90E-02	Sheppard et al. 2009	6.50E-03	Sheppard et al. 2009	4.00E+01	BCF; USEPA 2005b	4.50E+01	RAIS 2010	0.01	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		NA
Arsenic	7440382	Arsenic, Total	na		NA		1.00E-02	RAIS 2010	4.00E-02	RAIS 2010	2.00E-03	RAIS 2010	6.00E-05	RAIS 2010	3.50E-01	Sheppard et al. 2009	3.80E-01	Sheppard et al. 2009	2.50E-02	Sheppard et al. 2009	1.14E+02	BCF; USEPA 2005b	2.90E+01	RAIS 2010	0.03	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		NA
Barium	7440393	Barium, Total	na		NA		3.00E-03	RAIS 2010	1.00E-01	RAIS 2010	2.00E-04	RAIS 2010	4.80E-04	RAIS 2010	9.00E-03	IAEA 1994	9.00E-01	IAEA 1994	4.87E-04	Average concentration ratio [c]	6.33E+02	BCF; USEPA 2005b	4.10E+01	RAIS 2010	0.01	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		NA
Beryllium	7440417	Beryllium, Total	na		NA		2.50E-03	RAIS 2010	1.00E-02	RAIS 2010	1.00E-03	RAIS 2010	9.00E-07	RAIS 2010	3.40E-02	Sheppard et al. 2009	7.80E-03	Sheppard et al. 2009	4.00E-03	Sheppard et al. 2009	6.20E+01	BCF; USEPA 2005b	7.90E+02	RAIS 2010	0.01	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		NA
Boron	7440428	Boron, Total	na		NA		1.00E+00	RAIS 2010	4.00E+00	RAIS 2010	8.00E-04	RAIS 2010	1.50E-03	RAIS 2010	2.40E-01	Sheppard et al. 2009	2.20E-01	Sheppard et al. 2009	1.00E-02	Sheppard et al. 2009	na		3.00E+00	RAIS 2010	0.01	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		NA
Cadmium	7440439	Cadmium, Total	na		NA		1.38E-01	RAIS 2010	5.50E-01	RAIS 2010	4.00E-04	RAIS 2010	1.00E-03	RAIS 2010	1.06E-01	USEPA 2005b	2.50E-03	USEPA 2005b	1.91E-04	USEPA 2005b	9.07E+02	BCF; USEPA 2005b	7.50E+01	RAIS 2010	0.001	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		NA
Chromium	7440473	Chromium, Total	na		NA		1.00E-04	RAIS 2010	4.00E-02	RAIS 2010	9.00E-03	RAIS 2010	1.00E-05	RAIS 2010	4.80E-02	Sheppard et al. 2009	3.30E-02	Sheppard et al. 2009	2.80E-03	Sheppard et al. 2009	1.90E+01	BCF; USEPA 2005b	1.80E+06	RAIS 2010	0.01	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		NA
Cobalt	7440484	Cobalt, Total	na		NA		2.30E-02	RAIS 2010	5.40E-02	RAIS 2010	1.00E-04	RAIS 2010	7.00E-05	RAIS 2010	2.00E+00	IAEA 1994	1.00E-01	IAEA 1994	2.00E-03	IAEA 1994	3.00E+02	BAF; RAIS 2010	4.50E+01	RAIS 2010	0.01	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		NA
Copper	7440508	Copper, Total	na		NA		8.00E-02	RAIS 2010	8.00E-01	RAIS 2010	9.00E-03	RAIS 2010	1.50E-03	RAIS 2010	5.00E-01	IAEA 1994	5.00E-01	IAEA 1994	2.20E-02	IAEA 1994	2.00E+02	BAF; RAIS 2010	3.50E+01	RAIS 2010	0.01	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		NA
Cyanides	57125	Cyanide, Total; Cyanide	-2.50E-01	RAIS 2010	NA		1.77E+00	RAIS 2010	8.75E+00	RAIS 2010	3.10E-07	RAIS 2010	9.90E-08	RAIS 2010	6.68E-06	USEPA 2005b	3.82E-06	USEPA 2005b	1.10E-05	USEPA 2005b	3.16E+00	BCF; RAIS 2010	9.90E+00	RAIS 2010	0.01	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		NA
Fluoride	16984488	-	na		NA		NA		NA		NA		NA		NA		NA		NA		NA		na	RAIS 2010	0.01	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		NA
Hexavalent chromium	18540299	Chromium, Hexavalent; Chromium VI	na		NA		1.88E-03	RAIS 2013	7.50E-03	RAIS 2013	5.50E-03	RAIS 2013	1.50E-03	RAIS 2013	4.80E-02	Surrogate - Chromium; Sheppard et al. 2009	3.30E-02	Surrogate - Chromium; Sheppard et al. 2009	2.80E-03	Surrogate - Chromium; Sheppard et al. 2009	3.16E+00	BCF; USEPA 2005b	1.90E+01	RAIS 2010	0	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		NA
Lead	7439921	Lead, Total	na		NA		7.60E-04	RAIS 2010	9.00E-02	RAIS 2010	4.00E-04	RAIS 2010	3.00E-04	RAIS 2010	3.90E-01	Sheppard et al. 2009	5.50E-02	Sheppard et al. 2009	2.10E-02	Sheppard et al. 2009	9.00E-02	BCF; USEPA 2005b	9.00E+02	RAIS 2010	0.01	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		NA
Lithium	7439932	Lithium, Total	na		NA		6.25E-03	RAIS 2010	2.50E-02	RAIS 2010	1.00E-02	RAIS 2010	2.00E-02	RAIS 2010	1.50E-01	Sheppard et al. 2009	9.90E-01	Sheppard et al. 2009	5.60E-03	Sheppard et al. 2009	3.60E+00	BAF; Sheppard et al. 2009	3.00E+02	RAIS 2010	0.01	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		NA
Manganese	7439965	Manganese, Total	na		NA		6.88E-02	RAIS 2010	6.80E-01	RAIS 2010	5.00E-04	RAIS 2010	3.00E-05	RAIS 2010	5.00E-02	IAEA 1994	6.00E-02	IAEA 1994	3.60E-03	IAEA 1994	4.00E+02	BAF; RAIS 2010	6.50E+01	RAIS 2010	0.01	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		NA
Mercury	7439976	Mercury, Total	6.20E-01	RAIS 2010	NA		3.00E-01	RAIS 2010	1.00E+00	RAIS 2010	1.00E-02	RAIS 2010	4.70E-04	RAIS 2010	2.39E-02	USEPA 2005b	2.39E-02	USEPA 2005b	3.39E-05	USEPA 2005b	3.16E+00	BCF; RAIS 2010	5.20E+01	RAIS 2010	0.01	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		NA
Methyl Mercury	22967926	-	8.00E-02	McKone 1994	NA		6.92E+00	McKone 1994	3.46E+01	McKone 1994	7.80E-04	USEPA 2005b	3.38E-04	USEPA 2005b	3.58E-03	USEPA 2005b	3.58E-03	USEPA 2005b	5.07E-06	USEPA 2005b	1.00E+03	BAF; RAIS 2010	7.00E+03	USEPA 2005b	0.01	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		NA
Molybdenum	7439987	Molybdenum, Total	na		NA		8.00E-02	RAIS 2010	4.00E-01	RAIS 2010	1.00E-03	RAIS 2010	1.70E-03	RAIS 2010	1.00E+00	IAEA 1994	9.00E-01	IAEA 1994	1.90E-03	Sheppard et al. 2009	1.00E+01	BAF; RAIS 2010	2.00E+01	RAIS 2010	0.01	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		NA
Nickel	7440020	Nickel, Total	na		NA		5.00E-02	RAIS 2010	1.80E-01	RAIS 2010	5.00E-03	RAIS 2010	1.60E-02	RAIS 2010	4.20E-01	Sheppard et al. 2009	1.00E-01	Staven et al. 2003	2.50E-01	Sheppard et al. 2009	7.80E+01	BCF; USEPA 2005b	6.50E+01	RAIS 2010	0.01	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		NA
Selenium	7782492	Selenium, Total	na		NA		1.00E-01	RAIS 2010	5.00E-01	RAIS 2010	1.00E-01	RAIS 2010	1.00E-02	RAIS 2010	1.13E+00	USEPA 2005b	1.13E+00	USEPA 2005b	1.88E-01	USEPA 2005b	1.29E+02	BCF; USEPA 2005b	5.00E+00	RAIS 2010	0.01	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		NA
Silver	7440224	Silver, Total	na		NA		2.16E-05	RAIS 2010	1.00E+00	RAIS 2010	3.00E-03	RAIS 2010	5.00E-05	RAIS 2010	2.00E+00	IAEA 1994	1.90E-01	Sheppard et al. 2009	2.00E-02	IAEA 1994	8.77E+01	BCF; USEPA 2005b	8.30E+00	RAIS 2010	0.01	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		NA
Strontium	7440246	Strontium, Total	na		NA		2.05E-01	RAIS 2010	1.10E+00	RAIS 2010	8.00E-03	RAIS 2010	2.80E-03	RAIS 2010	8.00E-02	IAEA 1994	2.00E-01	IAEA 1994	4.00E-02	IAEA 1994	6.00E+01	BCF; RAIS 2010	3.50E+01	RAIS 2010	0.01	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		NA
Thallium	7440280	Thallium, Total	na		NA		1.00E-03	RAIS 2010	4.00E-03	RAIS 2010	4.00E-02	RAIS 2010	2.00E-03	RAIS 2010	1.70E+00	Sheppard et al. 2009	1.00E+00	Sheppard et al. 2009	1.50E-02	Sheppard et al. 2009	1.00E+04	BCF; USEPA 2005b	7.10E+01	RAIS 2010	0.01	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		NA
Tin	7440315	Tin, Total	na		NA		3.00E-01	RAIS 2010	1.00E+00	RAIS 2010	1.00E-02	RAIS 2010	1.00E-03	RAIS 2010	1.90E+00	Sheppard et al. 2009	1.00E+00	Staven et al. 2003	4.27E-02	Average concentration ratio [c]	3.00E+03	BCF; RAIS 2010	2.50E+02	RAIS 2010	0.01	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		NA
Vanadium	7440622	Vanadium, Total	na		NA		1.38E-03	RAIS 2010	5.50E-03	RAIS 2010	2.50E-03	RAIS 2010	2.00E-05	RAIS 2010	2.80E-02	Sheppard et al. 2009	1.60E-01	Sheppard et al. 2009	4.16E-03	Average concentration ratio [c]	2.20E+00	BAF; Sheppard et al. 2009	1.00E+03	RAIS 2010	0.01	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		NA
Zinc	7440666	Zinc, Total	na		NA		2.64E-01	RAIS 2010	9.90E-01	RAIS 2010	1.00E-01	RAIS 2010	1.00E-02	RAIS 2010	8.75E-03	USEPA 2005b	8.75E-03	USEPA 2005b	1.28E-04	USEPA 2005b	2.06E+03	BCF; USEPA 2005b	6.20E+01	RAIS 2010	0.01	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		NA
Zirconium	7440677	Zirconium, Total	na		NA		1.00E-04	RAIS 2010	1.00E-03	RAIS 2010	1.00E-06	RAIS 2010	5.50E-07	RAIS 2010	7.40E-02	Sheppard et al. 2009	6.80E-02	Sheppard et al. 2009	8.80E-03	Sheppard et al. 2009	3.00E+02	BCF; RAIS 2010	3.00E+03	RAIS 2010	0.01	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		NA
Energetic Constituents																																										
1,2-Dinitrobenzene	528290	o-Dinitrobenzene	1.69E+00	RAIS 2010	3.59E+02	RAIS 2010	8.06E-01	RAIS 2010	4.03E+00	RAIS 2010	1.22E-06	RAIS 2010	3.87E-07	RAIS 2010	1.29E-03	USEPA 2005c	7.39E-04	USEPA 2005c	2.12E-03	USEPA 2005c	1.45E+01	BCF; RAIS 2010	2.15E+00	USEPA 2002	0.10	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		-2.03E+00	USEPA 2005c
1,3-Dinitrobenzene	99650	m-Dinitrobenzene	1.49E+00	RAIS 2010	3.52E+02	RAIS 2010	1.05E+00	RAIS 2010	5.26E+00	RAIS 2010	7.73E-07	RAIS 2010	2.44E-07	RAIS 2010	9.13E-04	USEPA 2005c	5.22E-04	USEPA 2005c	1.50E-03	USEPA 2005c	5.93E+00	BCF; RAIS 2010	4.40E+00	USEPA 2005b	0.10	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		-2.19E+00	USEPA 2005c
2,4,6-Trinitrotoluene	118967	-	1.60E+00	RAIS 2010	2.81E+03	RAIS 2010	9.09E-01	RAIS 2010	4.54E+00	RAIS 2010	9.95E-07	RAIS 2010	3.15E-07	RAIS 2010	1.11E-03	USEPA 2005c	6.33E-04	USEPA 2005c	1.82E-03	USEPA 2005c	9.70E+00	BCF; RAIS 2010	3.70E-01	USEPA 2005b	0.032	USEPA, 2004	NA		NA		no	NA		NA		NA		NA		NA		-2.10E+00	USEPA 2005c
2-Amino-4,6-dinitrotoluene	35572782	-	1.84E+00	RAIS 2010	2.83E+02	RAIS 2010	6.60E-01	RAIS 2010	3.30E+00	RAIS 2010	1.73E-06	RAIS 2010	5.47E-07	RAIS 2010	1.66E-03	USEPA 2005c	9.48E-04	USEPA 2005c	2.72E-03	USEPA 2005c	7.56E+00	BCF; RAIS 2010	1.70E+00	USEPA 2002	0.006	USEPA, 2004	NA		NA		no	NA		NA		NA		NA		NA		-1.93E+00	USEPA 2005c
HMX	2691410	-	1.60E-01	RAIS 2010	5.32E+02	RAIS 2010	6.22E+00	RAIS 2010	3.11E+01	RAIS 2010	3.61E-08	RAIS 2010	1.14E-08	RAIS 2010	5.69E-05	USEPA 2005c	3.25E-05	USEPA 2005c	9.34E-05	USEPA 2005c	5.00E-01	BCF; RAIS 2010	3.19E+00	USEPA 2002	0.006	USEPA, 2004	NA		NA		no	NA		NA		NA		NA		NA		-3.39E+00	USEPA 2005c
Hydrazine	302012	-	-2.07E+00	RAIS 2010	NA		1.27E+02	RAIS 2010	6.28E+02	RAIS 2010	2.00E-10	RAIS 2010	6.30E-11	RAIS 2010	6.68E-06	USEPA 2005c	3.82E-06	USEPA 2005c	1.10E-05	USEPA 2005c	1.50E+05	BCF; RAIS 2010	na		0.10	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		-4.32E+00	USEPA 2005c
RDX	121824	Hexahydro-1,3,5-trinitro-1,3,5-triazine	8.70E-01	RAIS 2010	8.91E+01	RAIS 2010	2.41E+00	RAIS 2010	1.20E+01	RAIS 2010	1.85E-07	RAIS 2010	5.86E-08	RAIS 2010	2.77E-04	USEPA 2005c	1.58E-04	USEPA 2005c	4.55E-04	USEPA 2005c	2.00E+00	BCF; RAIS 2010	5.35E-01	USEPA 2002	0.015	USEPA, 2004	NA		NA		no	NA		NA		NA		NA		NA		-2.70E+00	USEPA 2005c
Perchlorate	14797730	-	na		NA		3.90E+00	Tsao and Sample 2005	1.95E+01	Tsao and Sample 2005	1.00E+00	Assumed value	1.00E+00	Assumed value	1.00E+00	Assumed value	1.00E+00	Assumed value	1.00E+00	Assumed value	4.40E-01	BCF; Yoo et al. 2007	8.30E-01	Susarla et al. 1999	0.01	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		na
Volatile Organic Compounds																																										
1,1,1,2-Tetrachloroethane	630206	-	2.93E+00	RAIS 2010	8.60E+01	RAIS 2010	1.54E-01	RAIS 2010	7.69E-01	RAIS 2010	2.13E-05	RAIS 2010	6.72E-06	RAIS 2010	7.44E-03	USEPA 2005c	4.25E-03	USEPA 2005c	1.22E-02	USEPA 2005c	4.00E+01	BCF; RAIS 2010	3.00E+00	USEPA 2005b	0	DTSC 2011	2.50E-03	EPI Suite v4.0	167.85	EPI Suite v4.0	yes	9.13E+03	USEPA 2002	1.02E-01	RAIS 2010	4.82E-02	RAIS 2010	9.10E-06	RAIS 2010	8.40E-05	USEPA 2002	-1.27E+00	USEPA 2005c
1,1,1-Trichloroethane	71556	-	2.49E+00	RAIS 2010	4.39E+01	RAIS 2010	2.77E-01	RAIS 2010	1.38E+00	RAIS 2010	7.73E-06	RAIS 2010	2.44E-06	RAIS 2010	4.33E-03	USEPA 2005c	2.48E-03	USEPA 2005c	7.12E-03	USEPA 2005c	5.00E+00	BCF; RAIS 2010	2.20E-01	USEPA 2005b	0	DTSC 2011	1.72E-02	EPI Suite v4.0	133.41	EPI Suite v4.0	yes	1.14E+03	USEPA 2002	7.03E-01	RAIS 2010	6.48E-02	RAIS 2010	9.60E-06	RAIS 2010	5.36E-03	USEPA 2002	-1.51E+00	USEPA 2005c
1,1,2,2-Tetrachloroethane	79345	-	2.39E+00	RAIS 2010	9.49E+01	RAIS 2010	1.16E-01	RAIS 2010	5.80E+00	RAIS 2010	6.14E-06	RAIS 2010	1.94E-06	RAIS 2010	1.78E-03	USEPA 2005c	2.16E-03	USEPA 2005c	6.22E-03	USEPA 2005c	1.38E+01	BCF; RAIS 2010	1.98E-01	USEPA 2005b	0	DTSC 2011	3.57E-04	EPI Suite v4.0	167.85	EPI Suite v4.0	yes	5.24E+03	USEPA 2002	1.89E-01	RAIS 2010	7.29E-02	RAIS 2010	9.29E-06	RAIS 2010	1.34E-04	USEPA 2002	-1.57E+00	USEPA 2005c
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	Freon 113	3.16E+00	RAIS 2010	1.97E+02	RAIS 2010	1.13E-01	RAIS 2010	5.66E-01	RAIS 2010	3.61E-05	RAIS 2010	1.14E-05	RAIS 2010	9.52E-03	USEPA 2005c	5.44E-03	USEPA 2005c	1.56E-02	USEPA 2005c	4.96E+01	BCF; RAIS 2010	1.18E+00	USEPA 2002	0	DTSC 2011	5.26E-01	EPI Suite v4.0	187.38	EPI Suite v4.0	yes	9.32E+02	USEPA 2002	2.15E+01	RAIS 2010	3.76E-02	RAIS 2010	8.59E-06	RAIS 2010	8.05E-03	USEPA 2002	-1.17E+00	USEPA 2005c
1,1,2-Trichloroethane	79005	-	1.89E+00	RAIS 2010	6.07E+01	RAIS 2010	6.17E-01	RAIS 2010	3.09E+00	RAIS 2010	1.94E-06	RAIS 2010	6.13E-07	RAIS 2010	1.80E-03	USEPA 2005c	1.03E-03	USEPA 2005c	2.95E-03	USEPA 2005c	5.00E+00	BCF; RAIS 2010	1.00E-01	USEPA 2005b	0	DTSC 2011	8.24E-04	EPI Suite v4.0	133.41	EPI Suite v4.0	yes	3.47E+03	USEPA 2002	3.37E-02	RAIS 2010	6.69E-02	RAIS 2010	1.00E-05	RAIS 2010	5.82E-04	USEPA 2002	-1.89E+00	USEPA 2005c
1,1-Dichloroethane	75343	-	1.79E+00	RAIS 2010	3.18E+01	RAIS 2010	7.05E-01	RAIS 2010	3.53E+00	RAIS 2010	1.54E-06	RAIS 2010	4.87E-07	RAIS 2010	1.53E-03	USEPA 2005c	8.73E-04	USEPA 2005c	2.51E-03	USEPA 2005c	7.05E+00	BCF; RAIS 2010	6.00E-02	USEPA 2005b	0	DTSC 2011	5.62E-03	EPI Suite v4.0	98.96	EPI Suite v4.0	yes	1.18E+03	USEPA 2002	2.30E-01	RAIS 2010	8.36E-02	RAIS 2010	1.06E-05	RAIS 2010	5.03E-03	USEPA 2002	-1.96E+00	USEPA 2005c
1,1-Dichloroethene	75354	-	2.13E+00	RAIS 2010	3.18E+01	RAIS 2010	4.48E-01	RAIS 2010	2.24E+00	RAIS 2010	3.37E-06	RAIS 2010	1.07E-06	RAIS 2010	2.61E-03	USEPA 2005c	1.49E-03	USEPA 2005c	4.28E-03	USEPA 2005c	1.30E+01	BCF; RAIS 2010	1.20E-01	USEPA 2005b	0	DTSC 2011	2.61E-02	EPI Suite v4.0	96.94	EPI Suite v4.0	yes	7.75E+02	USEPA 2002	1.07E+00	RAIS 2010	8.63E-02	RAIS 2010	1.10E-05	RAIS 2010	1.16E-02	USEPA 2002	-1.73E+00	USEPA 2005c
1,1-Dimethylhydrazine	57147	Unsymetrical Dimethyl Hydrazine	-1.19E+00	RAIS 2010	1.20E+01	RAIS 2010	3.77E+01	RAIS 2010	1.89E+02	RAIS 2010	1.61E-09	RAIS 2010	5.10E-10	RAIS 2010	6.68E-06	USEPA 2005c	3.82E-06	USEPA 2005c	1.10E-05	USEPA 2005c	3.16E+00	BCF; RAIS 2010	7.20E-02	USEPA 2002	0	DTSC 2011	6.95E-08	EPI Suite v4.0	60.10	EPI Suite v4.0	no	NA		NA		NA		NA		NA		-4.32E+00	USEPA 2005c
1,2,3-Trichlorobenzene	87616	-	4.05E+00	RAIS 2010	1.38E+03	RAIS 2010	3.45E-02	RAIS 2010	1.72E-01	RAIS 2010	2.81E-04	RAIS 2010	8.86E-05	RAIS 2010	1.98E-02	USEPA 2005c	1.13E-02	USEPA 2005c	3.25E-02	USEPA 2005c	8.99E+02	BAF; EPI Suite v4.0	1.93E+01	USEPA 2005b	0	DTSC 2011	1.25E-03	EPI Suite v4.0	181.45	EPI Suite v4.0	yes	3.55E+04	USEPA 2002	5.11E-02	RAIS 2010	3.95E-02	RAIS 2010	8.38E-06	RAIS 2010	5.54E-06	USEPA 2002	-8.50E-01	USEPA 2005c
1,2,4-Trichlorobenzene	120821	-	4.02E+00	RAIS 2010	1.36E+03	RAIS 2010	3.59E-02	RAIS 2010	1.79E-01	RAIS 2010	2.62E-04	RAIS 2010	8.27E-05	RAIS 2010	1.94E-02	USEPA 2005c	1.11E-02	USEPA 2005c	3.19E-02	USEPA 2005c	1.01E+03	BAF; EPI Suite v4.0	3.60E+00	USEPA 2005b	0	DTSC 2011	1.42E-03	EPI Suite v4.0	181.45	EPI Suite v4.0	yes	1.46E+04	USEPA 2002	5.81E-02	RAIS 2010	3.96E-02	RAIS 2010	8.40E-06	RAIS 2010	3.30E-05	USEPA 2002	-8.58E-01	USEPA 2005c
1,2,4-Trimethylbenzene	95636	-	3.63E+00	RAIS 2010	6.14E+02	RAIS 2010	6.04E-02	RAIS 2010	3.02E-01	RAIS 2010	1.07E-04	RAIS 2010	3.37E-05	RAIS 2010	1.46E-02	USEPA 2005c	8.37E-03	USEPA 2005c	2.41E-02	USEPA 2005c	1.20E+02	BCF; RAIS 2010	3.68E+00	USEPA 2002	0	DTSC 2011	6.16E-03	EPI Suite v4.0	120.20	EPI Suite v4.0	yes	5.74E+03	USEPA 2002	2.52E-01	RAIS 2010	6.07E-02	RAIS 2010	7.92E-06	RAIS 2010	2.13E-04	USEPA 2002	-9.80E-01	USEPA 2005c
1,2-Dibromo-3-chloropropane	96128	1,2-Dibromo-3-C/PA	2.96E+00	RAIS 2010	1.16E+02	RAIS 2010	1.48E-01	RAIS 2010	7.39E-01	RAIS 2010	2.28E-05	RAIS 2010	7.20E-06	RAIS 2010	7.69E-03	USEPA 2005c	4.39E-03	USEPA 2005c	1.26E-02	USEPA 2005c	1.15E+01	BCF; RAIS 2010	1.70E-01	USEPA 2005b	0	DTSC 2011	1.47E-04	EPI Suite v4.0	236.33	EPI Suite v4.0	no	NA		NA		NA		NA		NA		-1.26E+00	USEPA 2005c
1,2-Dibromoethane	106934	1,2-Dibromoethane (EDB)	1.96E+00	RAIS 2010	3.96E+01	RAIS 2010	5.62E-01	RAIS 2010	2.81E+00	RAIS 2010	2.28E-06	RAIS 2010	7.20E-07	RAIS 2010	2.01E-03	USEPA 2005c	1.15E-03	USEPA 2005c	3.30E-03	USEPA 2005c	1.50E+01	BCF; RAIS 2010	2.38E-01	USEPA 2002	0	DTSC 2011	6.50E-04	EPI Suite v4.0	187.86	EPI Suite v4.0	yes	6.27E+03	USEPA 2002	2.66E-02	RAIS 2010	4.30E-02	RAIS 2010	1.04E-05	RAIS 2010	1.78E-04	USEPA 2002	-1.84E+00	USEPA 2005c
1,2-Dichlorobenzene	95501	o-Dichlorobenzene	3.43E+00	RAIS 2010	3.83E+02	RAIS 2010	7.89E-02	RAIS 2010	3.95E-01	RAIS 2010	6.73E-05	RAIS 2010	2.13E-05	RAIS 2010	1.23E-02	USEPA 2005c	7.05E-03	USEPA 2005c	2.03E-02	USEPA 2005c	2.70E+02	BCF; RAIS 2010	3.79E+00	USEPA 2005b	0	DTSC 2011	1.92E-03	EPI Suite v4.0	147.00	EPI Suite v4.0	yes	1.08E+04	USEPA 2002	7.85E-02	RAIS 2010	5.62E-02	RAIS 2010	8.92E-06	RAIS 2010	6.02E-05	USEPA 2002	-1.05E+00	USEPA 2005c
1,2-Dichloroethane	107062	-	1.48E+00	RAIS 2010	3.96E+01	RAIS 2010	1.07E+00	RAIS 2010	5.33E+00	RAIS 2010	7.55E-07	RAIS 2010	2.39E-07	RAIS 2010	8.97E-04	USEPA 2005c	5.13E-04	USEPA 2005c	1.47E-03	USEPA 2005c	4.40E+00	BCF; RAIS 2010	3.50E-02	USEPA 2005b	0	DTSC 2011	1.18E-03	EPI Suite v4.0	98.96	EPI Suite v4.0	yes	2.14E+03	USEPA 2002	4.82E-02	RAIS 2010	8.57E-02	RAIS 2010	1.10E-05	RAIS 2010	1.53E-03	USEPA 2002	-2.19E+00	USEPA 2005c
1,2-Dichloroethene	540590	1,2-Dichloroethenes	2.09E+00	RAIS 2010	3.96E+01	RAIS 2010	4.72E-01	RAIS 2010	2.36E+00	RAIS 2010	3.08E-06	RAIS 2010	9.72E-07	RAIS 2010	2.45E-03	USEPA 2005c	1.40E-03	USEPA 2005c	4.03E-03	USEPA 2005c	1.11E+01	BCF; RAIS 2010

Attachment 1 - Table 3

Physical Chemical Properties Used in Suburban Residential, Rural Residential and Recreational Risk-Based Screening Level Calculations

Analyte	CAS#	Analyte Synonym [a]	Log of Octanol-Water Partition Coefficient log Kow (unitless)	Source	Organic Carbon Partition Coefficient Koc (cm^3/g)	Source	Soil to Plant Uptake Wet Weight Bv_{wet} (kg/kg)	Source	Soil to Plant Uptake Dry Weight Bv_{dry} (kg/kg)	Source	Beef Transfer Coefficient F_b (day/kg)	Source	Milk Transfer Coefficient F_m (day/kg)	Source	Poultry Transfer Coefficient F_p (day/kg)	Source	Egg Transfer Coefficient F_e (day/kg)	Source	Swine Transfer Coefficient F_s (day/kg)	Source	Fish Accumulation Factors BCF/BAF or BSAF (L/kg or unitless)	Source	Soil to Water Partition Coefficient Kd (cm^3/g)	Source	Dermal Absorption Fraction ABS_{dir} (unitless)	Source	Henry's Law Constant H (atm-m^3/mole)	Source	Molecular Weight MW (g/mole)	Source	VOC? [b]	Volitilization Factor VF (m^3/kg)	Source	Henry's Law Constant H (unitless)	Source	Diffusivity in Air Di_a (cm^2/s)	Source	Diffusivity in Water Di_w (cm^2/s)	Source	Apparent Diffusivity D_a (cm^2/s)	Source	Log Animal Fat Transfer Coefficient $logBa_{af}$ (day/kg)	Source
m-Xylene & p-Xylene	136777612	meta- and para-Xylenes; m, p-Xylene	3.12E+00	Surrogate - Xylenes, Total; RAIS 2010	3.83E+02	Surrogate - Xylenes, Total; RAIS 2010	1.19E-01	Surrogate - Xylenes, Total; RAIS 2010	5.97E-01	Surrogate - Xylenes, Total; RAIS 2010	3.30E-05	Surrogate - Xylenes, Total; RAIS 2010	1.04E-05	Surrogate - Xylenes, Total; RAIS 2010	9.14E-03	Surrogate - Xylenes, Total; USEPA 2005c	5.22E-03	Surrogate - Xylenes, Total; USEPA 2005c	1.50E-02	Surrogate - Xylenes, Total; USEPA 2005c	1.41E+01	BCF; Surrogate - Xylenes, Total; RAIS 2010	2.30E+00	Surrogate - Xylenes, Total; USEPA 2002	0	DTSC 2011	7.18E-03	EPI Suite v4.0	106.17	EPI Suite v4.0	yes	4.22E+03	Surrogate - Xylenes, Total; USEPA 2002	2.12E-01	Surrogate - Xylenes, Total; RAIS 2010	8.47E-02	Surrogate - Xylenes, Total; RAIS 2010	9.90E-06	Surrogate - Xylenes, Total; RAIS 2010	3.92E-04	Surrogate - Xylenes, Total; USEPA 2002	-1.19E+00	Surrogate - Xylenes, Total; USEPA 2002
n-Butylbenzene	104518	-	4.38E+00	RAIS 2010	1.48E+03	RAIS 2010	2.22E-02	RAIS 2010	1.11E-01	RAIS 2010	6.00E-04	RAIS 2010	1.90E-04	RAIS 2010	2.36E-02	USEPA 2005c	1.35E-02	USEPA 2005c	3.88E-02	USEPA 2005c	3.18E+02	BAF; EPI Suite v4.0	8.88E+00	USEPA 2002	0	DTSC 2011	1.59E-02	EPI Suite v4.0	134.22	EPI Suite v4.0	yes	5.90E+03	USEPA 2002	6.50E-01	RAIS 2010	5.28E-02	RAIS 2010	7.33E-06	RAIS 2010	2.01E-04	USEPA 2002	-7.73E-01	USEPA 2005c
n-Propylbenzene	103651	-	3.69E+00	RAIS 2010	8.13E+02	RAIS 2010	5.58E-02	RAIS 2010	2.79E-01	RAIS 2010	1.22E-04	RAIS 2010	3.87E-05	RAIS 2010	1.54E-02	USEPA 2005c	8.78E-03	USEPA 2005c	2.52E-02	USEPA 2005c	1.26E+02	BCF; RAIS 2010	4.88E+00	USEPA 2002	0	DTSC 2011	1.05E-02	EPI Suite v4.0	120.20	EPI Suite v4.0	yes	5.07E+03	USEPA 2002	4.29E-01	RAIS 2010	6.02E-02	RAIS 2010	7.83E-06	RAIS 2010	2.72E-04	USEPA 2002	-9.60E-01	USEPA 2005c
o-Chlorotoluene	95498	2-Chlorotoluene	3.42E+00	RAIS 2010	3.83E+02	RAIS 2010	8.00E-02	RAIS 2010	4.00E-01	RAIS 2010	6.58E-05	RAIS 2010	2.08E-05	RAIS 2010	1.22E-02	USEPA 2005c	6.99E-03	USEPA 2005c	2.01E-02	USEPA 2005c	6.61E+01	BCF; RAIS 2010	2.30E+00	USEPA 2002	0	DTSC 2011	3.57E-03	EPI Suite v4.0	129.59	EPI Suite v4.0	yes	5.89E+03	USEPA 2002	1.46E-01	RAIS 2010	6.29E-02	RAIS 2010	8.72E-06	RAIS 2010	2.02E-04	USEPA 2002	-1.06E+00	USEPA 2005c
o-Xylene	95476	-	3.12E+00	RAIS 2010	3.83E+02	RAIS 2010	1.19E-01	RAIS 2010	5.97E-01	RAIS 2010	3.30E-05	RAIS 2010	1.04E-05	RAIS 2010	9.14E-03	USEPA 2005c	5.22E-03	USEPA 2005c	1.50E-02	USEPA 2005c	1.41E+01	BCF; RAIS 2010	7.30E-01	USEPA 2005b	0	DTSC 2011	5.18E-03	EPI Suite v4.0	103.17	EPI Suite v4.0	yes	2.80E+03	USEPA 2002	2.12E-01	RAIS 2010	6.89E-02	RAIS 2010	8.53E-06	RAIS 2010	8.94E-04	USEPA 2002	-1.19E+00	USEPA 2005c
p-Chlorotoluene	106434	4-Chlorotoluene	3.33E+00	RAIS 2010	3.75E+02	RAIS 2010	9.02E-02	RAIS 2010	4.51E-01	RAIS 2010	5.34E-05	RAIS 2010	1.69E-05	RAIS 2010	1.13E-02	USEPA 2005c	6.43E-03	USEPA 2005c	1.85E-02	USEPA 2005c	5.82E+01	BCF; RAIS 2010	2.25E+00	USEPA 2002	0	DTSC 2011	4.38E-03	EPI Suite v4.0	129.59	EPI Suite v4.0	yes	5.29E+03	USEPA 2002	1.79E-01	RAIS 2010	6.26E-02	RAIS 2010	8.66E-06	RAIS 2010	2.50E-04	USEPA 2002	-1.09E+00	USEPA 2005c
p-Cymene	99876	p-Isopropyltoluene	4.10E+00	RAIS 2010	1.12E+03	RAIS 2010	3.22E-02	RAIS 2010	1.61E-01	RAIS 2010	3.15E-04	RAIS 2010	9.95E-05	RAIS 2010	2.04E-02	USEPA 2005c	1.16E-02	USEPA 2005c	3.35E-02	USEPA 2005c	5.22E+02	BAF; EPI Suite v4.0	6.72E+00	USEPA 2002	0	DTSC 2011	1.10E-02	EPI Suite v4.0	134.22	EPI Suite v4.0	yes	6.18E+03	USEPA 2002	4.50E-01	RAIS 2010	5.27E-02	RAIS 2010	7.32E-06	RAIS 2010	1.83E-04	USEPA 2002	-8.37E-01	USEPA 2005c
p-Nitroaniline	100016	4-Nitroaniline	1.39E+00	RAIS 2010	1.09E+02	RAIS 2010	1.20E+00	RAIS 2010	6.02E+00	RAIS 2010	6.14E-07	RAIS 2010	1.94E-07	RAIS 2010	7.62E-04	USEPA 2005c	4.36E-04	USEPA 2005c	1.25E-03	USEPA 2005c	4.00E+00	BCF; RAIS 2010	6.54E-01	USEPA 2002	0	DTSC 2011	1.26E-09	EPI Suite v4.0	138.13	EPI Suite v4.0	no	NA		NA		NA		NA		NA		-2.26E+00	USEPA 2005c
sec-Butylbenzene	135988	-	4.57E+00	RAIS 2010	1.33E+03	RAIS 2010	1.72E-02	RAIS 2010	8.61E-02	RAIS 2010	9.29E-04	RAIS 2010	2.94E-04	RAIS 2010	2.56E-02	USEPA 2005c	1.46E-02	USEPA 2005c	4.21E-02	USEPA 2005c	4.24E+02	BAF; EPI Suite v4.0	7.98E+00	USEPA 2002	0	DTSC 2011	1.76E-02	EPI Suite v4.0	134.22	EPI Suite v4.0	yes	5.33E+03	USEPA 2002	7.20E-01	RAIS 2010	5.28E-02	RAIS 2010	7.33E-06	RAIS 2010	2.47E-04	USEPA 2002	-7.38E-01	USEPA 2005c
Styrene	100425	Vinylbenzene	2.95E+00	RAIS 2010	4.46E+02	RAIS 2010	1.50E-01	RAIS 2010	7.49E-01	RAIS 2010	2.23E-05	RAIS 2010	7.04E-06	RAIS 2010	7.60E-03	USEPA 2005c	4.35E-03	USEPA 2005c	1.25E-02	USEPA 2005c	1.35E+01	BCF; RAIS 2010	1.20E+02	USEPA 2005b	0	DTSC 2011	2.75E-03	EPI Suite v4.0	104.15	EPI Suite v4.0	yes	4.45E+04	USEPA 2002	1.12E-01	RAIS 2010	7.11E-02	RAIS 2010	8.78E-06	RAIS 2010	3.53E-06	USEPA 2002	-1.27E+00	USEPA 2005c
tert-Butylbenzene	98066	Dibenzo[b,e][1,4]dioxin, octachloro-	4.11E+00	RAIS 2010	1.00E+03	RAIS 2010	3.18E-02	RAIS 2010	1.59E-01	RAIS 2010	3.22E-04	RAIS 2010	1.02E-04	RAIS 2010	2.05E-02	USEPA 2005c	1.17E-02	USEPA 2005c	3.37E-02	USEPA 2005c	3.93E+02	BAF; EPI Suite v4.0	6.00E+00	USEPA 2002	0	DTSC 2011	1.32E-02	EPI Suite v4.0	134.22	EPI Suite v4.0	yes	5.33E+03	USEPA 2002	5.40E-01	RAIS 2010	5.30E-02	RAIS 2010	7.37E-06	RAIS 2010	2.46E-04	USEPA 2002	-8.35E-01	USEPA 2005c
Tetrachloroethene	127184	-	3.40E+00	RAIS 2010	9.49E+01	RAIS 2010	8.21E-02	RAIS 2010	4.11E-01	RAIS 2010	6.28E-05	RAIS 2010	1.98E-05	RAIS 2010	1.20E-02	USEPA 2005c	6.87E-03	USEPA 2005c	1.97E-02	USEPA 2005c	5.20E+01	BCF; RAIS 2010	3.10E-01	USEPA 2005b	0	DTSC 2011	1.77E-02	EPI Suite v4.0	165.83	EPI Suite v4.0	yes	1.40E+03	USEPA 2002	7.24E-01	RAIS 2010	5.05E-02	RAIS 2010	9.46E-06	RAIS 2010	3.56E-03	USEPA 2002	-1.07E+00	USEPA 2005c
Tetralin	119642	-	3.30E+00	Surrogate - Naphthalene; RAIS 2010	1.54E+03	Surrogate - Naphthalene; RAIS 2010	9.39E-02	Surrogate - Naphthalene; RAIS 2010	4.69E-01	Surrogate - Naphthalene; RAIS 2010	4.99E-05	Surrogate - Naphthalene; RAIS 2010	1.58E-05	Surrogate - Naphthalene; RAIS 2010	1.09E-02	Surrogate - Naphthalene; USEPA 2005c	6.25E-03	Surrogate - Naphthalene; USEPA 2005c	1.80E-02	Surrogate - Naphthalene; USEPA 2005c	8.45E+01	Surrogate - Naphthalene; BCF RAIS 2010	3.00E+02	Surrogate - Naphthalene; USEPA 2005b	0	DTSC 2011	1.36E-03	EPI Suite v4.0	132.21	EPI Suite v4.0	yes	1.08E+05	USEPA 2002	5.58E-02	EPI Suite v4.	6.05E-02	Surrogate - Naphthalene; RAIS 2010	8.38E-06	Surrogate - Naphthalene; RAIS 2010	5.99E-07	USEPA 2002	-1.11E+00	USEPA 2005c
Toluene	108883	Toluol	2.73E+00	RAIS 2010	2.34E+02	RAIS 2010	2.01E-01	RAIS 2010	1.00E+00	RAIS 2010	1.34E-05	RAIS 2010	4.24E-06	RAIS 2010	5.88E-03	USEPA 2005c	3.36E-03	USEPA 2005c	9.66E-03	USEPA 2005c	8.32E+00	BCF; RAIS 2010	3.60E-01	USEPA 2005b	0	DTSC 2011	6.64E-03	EPI Suite v4.0	92.14	EPI Suite v4.0	yes	1.78E+03	USEPA 2002	2.71E-01	RAIS 2010	7.78E-02	RAIS 2010	9.20E-06	RAIS 2010	2.20E-03	USEPA 2002	-1.38E+00	USEPA 2005c
trans-1,2-Dichloroethene	156605	-	2.09E+00	RAIS 2010	3.96E+01	RAIS 2010	4.72E-01	RAIS 2010	2.36E+00	RAIS 2010	3.08E-06	RAIS 2010	9.72E-07	RAIS 2010	2.45E-03	USEPA 2005c	1.40E-03	USEPA 2005c	4.03E-03	USEPA 2005c	1.11E+01	BCF; RAIS 2010	1.00E-01	USEPA 2005b	0	DTSC 2011	4.08E-03	EPI Suite v4.0	96.94	EPI Suite v4.0	yes	1.44E+03	USEPA 2002	1.67E-01	RAIS 2010	8.76E-02	RAIS 2010	1.12E-05	RAIS 2010	3.37E-03	USEPA 2002	-1.76E+00	USEPA 2005c
Trichloroethene	79016	Trichloroethylene (TCE)	2.42E+00	RAIS 2010	6.07E+01	RAIS 2010	3.04E-01	RAIS 2010	1.52E+00	RAIS 2010	6.58E-06	RAIS 2010	2.08E-06	RAIS 2010	3.94E-03	USEPA 2005c	2.25E-03	USEPA 2005c	6.48E-03	USEPA 2005c	1.60E+01	BCF; RAIS 2010	3.30E-01	USEPA 2005b	0	DTSC 2011	9.85E-03	EPI Suite v4.0	131.39	EPI Suite v4.0	yes	1.55E+03	USEPA 2002	4.03E-01	RAIS 2010	6.87E-02	RAIS 2010	1.02E-05	RAIS 2010	2.91E-03	USEPA 2002	-1.55E+00	USEPA 2005c
Trichlorofluoromethane	75694	-	2.53E+00	RAIS 2010	4.39E+01	RAIS 2010	2.62E-01	RAIS 2010	1.31E+00	RAIS 2010	8.47E-06	RAIS 2010	2.68E-06	RAIS 2010	4.57E-03	USEPA 2005c	2.61E-03	USEPA 2005c	7.50E-03	USEPA 2005c	2.17E+01	BCF; RAIS 2010	2.40E-01	USEPA 2005b	0	DTSC 2011	9.70E-02	EPI Suite v4.0	137.37	EPI Suite v4.0	yes	7.43E+02	USEPA 2002	3.97E+00	RAIS 2010	6.54E-02	RAIS 2010	1.00E-05	RAIS 2010	1.27E-02	USEPA 2002	-1.49E+00	USEPA 2005c
Vinyl chloride	75014	-	1.62E+00	RAIS 2010	2.17E+01	RAIS 2010	8.85E-01	RAIS 2010	4.42E+00	RAIS 2010	1.04E-06	RAIS 2010	3.29E-07	RAIS 2010	1.15E-03	USEPA 2005c	6.56E-04	USEPA 2005c	1.89E-03	USEPA 2005c	5.47E+00	BCF; RAIS 2010	3.70E-02	USEPA 2005b	0	DTSC 2011	2.78E-02	EPI Suite v4.0	62.50	EPI Suite v4.0	yes	6.16E+02	USEPA 2002	1.14E+00	RAIS 2010	1.07E-01	RAIS 2010	1.20E-05	RAIS 2010	1.84E-02	USEPA 2002	-2.09E+00	USEPA 2005c
Xylenes, Total	1330207	Xylene (Total) Isomers	3.12E+00	RAIS 2010	3.83E+02	RAIS 2010	1.19E-01	RAIS 2010	5.97E-01	RAIS 2010	3.30E-05	RAIS 2010	1.04E-05	RAIS 2010	9.14E-03	USEPA 2005c	5.22E-03	USEPA 2005c	1.50E-02	USEPA 2005c	1.41E+01	BCF; RAIS 2010	2.30E+00	USEPA 2002	0	DTSC 2011	5.18E-03	EPI Suite v4.0	106.17	EPI Suite v4.0	yes	4.22E+03	USEPA 2002	2.12E-01	RAIS 2010	8.47E-02	RAIS 2010	9.90E-06	RAIS 2010	3.92E-04	USEPA 2002	-1.19E+00	USEPA 2005c
Semi-Volatile Organic Compounds																																										
1,4-Dioxane	123911	-	-2.70E-01	RAIS 2010	2.63E+00	RAIS 2010	1.10E+01	RAIS 2010	5.52E+01	RAIS 2010	1.34E-08	RAIS 2010	4.24E-09	RAIS 2010	1.95E-05	USEPA 2005c	1.11E-05	USEPA 2005c	3.20E-05	USEPA 2005c	5.00E-01	BCF; RAIS 2010	1.00E-02	USEPA 2005b	0.10	DTSC 2011	4.80E-06	EPI Suite v4.0	88.11	EPI Suite v4.0	no	NA		NA		NA		NA		NA		-3.86E+00	USEPA 2005c
2,4,5-Trichlorophenol	95954	-	3.72E+00	RAIS 2010	1.78E+03	RAIS 2010	5.36E-02	RAIS 2010	2.68E-01	RAIS 2010	1.31E-04	RAIS 2010	4.15E-05	RAIS 2010	1.57E-02	USEPA 2005c	8.98E-03	USEPA 2005c	2.58E-02	USEPA 2005c	5.33E+02	BCF; RAIS 2010	1.60E+01	USEPA 2005b	0.10	DTSC 2011	1.62E-06	EPI Suite v4.0	197.45	EPI Suite v4.0	no	NA		NA		NA		NA		NA		-9.50E-01	USEPA 2005c
2,4,6-Trichlorophenol	88062	-	3.69E+00	RAIS 2010	1.78E+03	RAIS 2010	5.58E-02	RAIS 2010	2.79E-01	RAIS 2010	1.22E-04	RAIS 2010	3.87E-05	RAIS 2010	1.54E-02	USEPA 2005c	8.78E-03	USEPA 2005c	2.52E-02	USEPA 2005c	8.80E+01	BCF; RAIS 2010	7.60E-01	USEPA 2005b	0.10	DTSC 2011	2.60E-06	EPI Suite v4.0	197.45	EPI Suite v4.0	no	NA		NA		NA		NA		NA		-9.60E-01	USEPA 2005c
2,4-Dimethylphenol	105679	-	2.30E+00	RAIS 2010	4.92E+02	RAIS 2010	3.57E-01	RAIS 2010	1.78E+00	RAIS 2010	4.99E-06	RAIS 2010	1.58E-06	RAIS 2010	3.34E-03	USEPA 2005c	1.91E-03	USEPA 2005c	5.48E-03	USEPA 2005c	1.53E+01	BCF; RAIS 2010	3.20E+01	USEPA 2005b	0.10	DTSC 2011	9.51E-07	EPI Suite v4.0	122.17	EPI Suite v4.0	no	NA		NA		NA		NA		NA		-1.62E+00	USEPA 2005c
3,5-Dimethylphenol	108689	-	2.61E+00	EPI Suite v4.0	4.82E+02	EPI Suite v4	2.36E-01	McKone 1994	1.18E+00	McKone 1994	1.02E-05	McKone 1994	3.22E-06	McKone 1994	5.06E-03	USEPA 2005c	2.89E-03	USEPA 2005c	8.32E-03	USEPA 2005c	1.65E+01	BCF; EPI Suite v4.0	2.89E+00	USEPA 2002	0.10	DTSC 2011	6.14E-07	EPI Suite v4.0	122.17	EPI Suite v4.0	no	NA		NA		NA		NA		NA		-1.44E+00	USEPA 2005c
Benzoic acid	65850	-	1.87E+00	RAIS 2010	1.66E+01	RAIS 2010	6.34E-01	RAIS 2010	3.17E+00	RAIS 2010	1.85E-06	RAIS 2010	5.86E-07	RAIS 2010	1.74E-03	USEPA 2005c	9.95E-04	USEPA 2005c	2.86E-03	USEPA 2005c	3.16E+00	BCF; RAIS 2010	6.00E-03	USEPA 2005b	0.10	DTSC 2011	3.81E-08	EPI Suite v4.0	122.12	EPI Suite v4.0	no	NA		NA		NA		NA		NA		-1.91E+00	USEPA 2005c
Benzyl alcohol	100516	-	1.10E+00	RAIS 2010	2.15E+01	RAIS 2010	1.77E+00	RAIS 2010	8.86E+00	RAIS 2010	3.15E-07	RAIS 2010	9.95E-08	RAIS 2010	4.40E-04	USEPA 2005c	2.51E-04	USEPA 2005c	7.23E-04	USEPA 2005c	1.37E+00	BCF; RAIS 2010	1.20E-01	USEPA 2005b	0.10	DTSC 2011	3.37E-07	EPI Suite v4.0	108.14	EPI Suite v4.0	no	NA		NA		NA		NA		NA		-2.50E+00	USEPA 2005c
bis(2-Ethylhexyl) phthalate	117817	bis(2-ethylhexyl)phthalate	7.60E+00	RAIS 2010	1.20E+05	RAIS 2010	3.01E-04	RAIS 2010	1.50E-03	RAIS 2010	9.95E-01	RAIS 2010	3.15E-01	RAIS 2010	1.00E-02	USEPA 2005c	5.71E-03	USEPA 2005c	1.64E-02	USEPA 2005c	1.04E+03	BAF; EPI Suite v4.0	7.20E+02	USEPA 2002	0.10	DTSC 2011	2.70E-07	EPI Suite v4.0	390.57	EPI Suite v4.0	no	NA		NA		NA		NA		NA		-1.15E+00	USEPA 2005c
Butyl benzyl phthalate	85687	-	4.73E+00	RAIS 2010	7.16E+03	RAIS 2010	1.39E-02	RAIS 2010	6.95E-02	RAIS 2010	1.34E-03	RAIS 2010	4.24E-04	RAIS 2010	2.71E-02	USEPA 2005c	1.55E-02	USEPA 2005c	4.45E-02	USEPA 2005c	4.01E+01	BAF; EPI Suite v4.0	8.70E+03	USEPA 2005b	0.10	DTSC 2011	1.26E-06	EPI Suite v4.0	312.37	EPI Suite v4.0	no	NA		NA		NA		NA		NA		-7.14E-01	USEPA 2005c
Carbazole	86748	-	3.72E+00	RAIS 2010	9.16E+03	RAIS 2010	5.36E-02	RAIS 2010	2.68E-01	RAIS 2010	1.31E-04	RAIS 2010	4.15E-05	RAIS 2010	1.57E-02	USEPA 2005c	8.98E-03	USEPA 2005c	2.58E-02	USEPA 2005c	1.70E+02	BCF; RAIS 2010	5.50E+01	USEPA 2002	0.10	DTSC 2011	1.16E-07	EPI Suite v4.0	167.12	EPI Suite v4.0	no	NA		NA		NA		NA		NA		-9.50E-01	USEPA 2005c
Dibenzofuran	132649	-	4.12E+00	RAIS 2010	9.16E+03	RAIS 2010	3.14E-02	RAIS 2010	1.57E-01	RAIS 2010	3.30E-04	RAIS 2010	1.04E-04	RAIS 2010	2.06E-02	USEPA 2005c	1.18E-02	USEPA 2005c	3.39E-02	USEPA 2005c	1.38E+03	BAF; EPI Suite v4.0	5.50E+01	USEPA 2002	0.10	DTSC 2011	2.13E-04	EPI Suite v4.0	168.20	EPI Suite v4.0	yes	1.42E+05	USEPA 2002	8.71E-03	RAIS 2010	4.10E-02	RAIS 2010	7.38E-06	RAIS 2010	3.46E-07	USEPA 2002	-8.32E-01	USEPA 2005c
Diethyl phthalate	84662	-	2.42E+00	RAIS 2010	1.05E+02	RAIS 2010	3.04E-01	RAIS 2010	1.52E+00	RAIS 2010	6.58E-06	RAIS 2010	2.08E-06	RAIS 2010	3.94E-03	USEPA 2005c	2.25E-03	USEPA 2005c	6.48E-03	USEPA 2005c	1.84E+01	BCF; RAIS 2010	6.30E-01	USEPA 2002	0.10	DTSC 2011	6.10E-07	EPI Suite v4.0	222.24	EPI Suite v4.0	no	NA		NA		NA		NA		NA		-1.55E+00	USEPA 2005c
Dimethyl phthalate	131113	-	1.60E+00	RAIS 2010	3.16E+01	RAIS 2010	9.09E-01	RAIS 2010	4.54E+00	RAIS 2010	9.95E-07	RAIS 2010	3.15E-07	RAIS 2010	1.11E-03	USEPA 2005c	6.33E-04	USEPA 2005c	1.82E-03	USEPA 2005c	5.28E+00	BCF; RAIS 2010	3.40E-01	USEPA 2005b	0.10	DTSC 2011	1.97E-07	EPI Suite v4.0	194.19	EPI Suite v4.0	no	NA		NA		NA		NA		NA		-2.10E+00	USEPA 2005c
Di-n-butyl phthalate	84742	Di-n-butylphthalate	4.50E+00	RAIS 2010	1.16E+03	RAIS 2010	1.89E-02	RAIS 2010	9.45E-02	RAIS 2010	7.91E-04	RAIS 2010	2.50E-04	RAIS 2010	2.49E-02	USEPA 2005c	1.42E-02	USEPA 2005c	4.09E-02	USEPA 2005c	1.59E+02	BAF; EPI Suite v4.0	6.96E+00	USEPA 2002	0.10	DTSC 2011	1.81E-06	EPI Suite v4.0	278.35	EPI Suite v4.0	no	NA		NA		NA		NA		NA		-7.50E-01	USEPA 2005c
Di-n-octyl phthalate	117840	Di-n-octyl-phthalate	8.10E+00	RAIS 2010	1.41E+05	RAIS 2010	1.54E-04	RAIS 2010	7.72E-04	RAIS 2010	3.15E+00	RAIS 2010	9.95E-01	RAIS 2010	5.72E-03	USEPA 2005c	3.27E-03	USEPA 2005c	9.40E-03	USEPA 2005c	3.43E+01	BAF; EPI Suite v4.0	1.30E+07	USEPA 2005b	0.10	DTSC 2011	2.57E-06	EPI Suite v4.0	390.57	EPI Suite v4.0	no	NA		NA		NA		NA		NA		-1.39E+00	USEPA 2005c
Formaldehyde	50000	-	3.50E-01	RAIS 2010	1.00E+00	RAIS 2010	4.82E+00	RAIS 2010	2.41E+01	RAIS 2010	5.60E-08	RAIS 2010	1.77E-08	RAIS 2010	8.88E-05	USEPA 2005c	5.08E-05	USEPA 2005c	1.46E-04	USEPA 2005c	3.16E+00	BCF; RAIS 2010	2.00E-02	USEPA 2005b	0.10	DTSC 2011	3.37E-07	EPI Suite v4.0	30.03	EPI Suite v4.0	no	NA		NA		NA		NA		NA		-3.20E+00	USEPA 2005c
Hexachlorobutadiene	87683	-	4.78E+00	RAIS 2010	8.45E+02	RAIS 2010	1.30E-02	RAIS 2010	6.50E-02	RAIS 2010	1.51E-03	RAIS 2010	4.76E-04	RAIS 2010	2.75E-02	USEPA 2005c	1.57E-02	USEPA 2005c	4.51E-02	USEPA 2005c	2.34E+04	BAF; EPI Suite v4.0	7.60E+03	USEPA 2005b	0.10	DTSC 2011	1.03E-02	EPI Suite v4.0	260.76	EPI Suite v4.0	no	NA		NA		NA		NA		NA		-7.07E-01	USEPA 2005c
m-Cresol	108394	3-Methylphenol	1.96E+00	RAIS 2010	3.00E+02	RAIS 2010	5.62E-01	RAIS 2010	2.81E+00	RAIS 2010	2.28E-06	RAIS 2010	7.20E-07	RAIS 2010	2.01E-03	USEPA 2005c	1.15E-03	USEPA 2005c	3.30E-03	USEPA 2005c	9.12E+00	BCF; RAIS 2010	8.50E-01	USEPA 2005b	0.10	DTSC 2011	8.56E-07	EPI Suite v4.0	108.14	EPI Suite v4.0	no	NA		NA		NA		NA		NA		-1.84E+00	USEPA 2005c
N-Nitrosodimethylamine	62759	Nitrosodimethylamine	-5.70E-01	RAIS 2010	2.28E+01	RAIS 2010	1.65E+01	RAIS 2010	8.24E+01	RAIS 2010	6.73E-09	RAIS 2010	2.13E-09	RAIS 2010	8.79E-06	USEPA 2005c	5.02E-06	USEPA 2005c	1.44E-05	USEPA 2005c	3.16E+00	BCF; RAIS 2010	1.37E-01	USEPA 2002	0.10	DTSC 2011	1.82E-06	EPI Suite v4.0	74.08	EPI Suite v4.0	no	NA		NA		NA		NA		NA		-4.20E+00	USEPA 2005c
N-Nitrosodiphenylamine	86306	-	3.13E+00	RAIS 2010	2.63E+03	RAIS 2010	1.18E-01	RAIS 2010	5.89E-01	RAIS 2010	3.37E-05	RAIS 2010	1.07E-05	RAIS 2010	9.23E-03	USEPA 2005c	5.28E-03	USEPA 2005c	1.52E-02	USEPA 2005c	2.13E+01	BCF; RAIS 2010	2.00E+02	USEPA 2005b	0.10	DTSC 2011	1.21E-06	EPI Suite v4.0	198.23	EPI Suite v4.0	no	NA		NA		NA		NA		NA		-1.18E+00	USEPA 2005c
o-Cresol	95487	2-Methylphenol	1.95E+00	RAIS 2010	3.07E+02	RAIS 2010	5.69E-01	RAIS 2010	2.85E+00	RAIS 2010	2.23E-06	RAIS 2010	7.04E-07	RAIS 2010	1.98E-03	USEPA 2005c	1.13E-03	USEPA 2005c	3.25E-03	USEPA 2005c	1.07E+01	BCF; RAIS 2010	8.30E-01	USEPA 2005b	0.10	DTSC 2011	1.20E-06	EPI Suite v4.0	108.14	EPI Suite v4.0	no	NA		NA		NA		NA		NA		-1.85E+00	USEPA 2005c
p-Chloro-m-cresol	59507	4-Chloro-3-Methylphenol	3.10E+00	RAIS 2010	4.92E+02	RAIS 2010	1.23E-01	RAIS 2010	6.13E-01	RAIS 2010	3.15E-05	RAIS 2010	9.95E-06	RAIS 2010	8.95E-03	USEPA 2005c	5.11E-03	USEPA 2005c	1.47E-02	USEPA 2005c	8.50E+00	BCF; RAIS 2010	2.95E+00	USEPA 2002	0.10	DTSC 2011	2.45E-06	EPI Suite v4.0	142.59	EPI Suite v4.0	no	NA		NA		NA		NA		NA		-1.19E+00	USEPA 2005c
p-Cresol	106445	4-Methylphenol	1.94E+00	RAIS 2010	3.00E+02	RAIS 2010	5.77E-01	RAIS 2010	2.89E+00	RAIS 2010	2.18E-06	RAIS 2010	6.88E-07	RAIS 2010	1.95E-03	USEPA 2005c	1.11E-03	USEPA 2005c	3.20E-03	USEPA 2005c	8.85E+00	BCF; RAIS 2010	1.20E+01	USEPA 2005b	0.10	DTSC 2011	1.00E-

Attachment 1 - Table 3

Physical Chemical Properties Used in Suburban Residential, Rural Residential and Recreational Risk-Based Screening Level Calculations

Analyte	CAS#	Analyte Synonym [a]	Log of Octanol-Water Partition Coefficient log Kow (unitless)	Source	Organic Carbon Partition Coefficient Koc (cm^3/g)	Source	Soil to Plant Uptake Wet Weight Bv_{wet} (kg/kg)	Source	Soil to Plant Uptake Dry Weight Bv_{dry} (kg/kg)	Source	Beef Transfer Coefficient F_b (day/kg)	Source	Milk Transfer Coefficient F_m (day/kg)	Source	Poultry Transfer Coefficient F_p (day/kg)	Source	Egg Transfer Coefficient F_e (day/kg)	Source	Swine Transfer Coefficient F_s (day/kg)	Source	Fish Accumulation Factors BCF/BAF or BSAF (L/kg or unitless)	Source	Soil to Water Partition Coefficient Kd (cm^3/g)	Source	Dermal Absorption Fraction ABS_{dar} (unitless)	Source	Henry's Law Constant H (atm-m^3/mole)	Source	Molecular Weight MW (g/mole)	Source	VOC? [b]	Volitilization Factor VF (m^3/kg)	Source	Henry's Law Constant H (unitless)	Source	Diffusivity in Air Di_a (cm^2/s)	Source	Diffusivity in Water Di_w (cm^2/s)	Source	Apparent Diffusivity D_s (cm^2/s)	Source	Log Animal Fat Transfer Coefficient $logBa_{af}$ (day/kg)	Source
Endosulfan I	959988	-	3.83E+00	RAIS 2010	6.76E+03	RAIS 2010	4.62E-02	RAIS 2010	2.31E-01	RAIS 2010	1.69E-04	RAIS 2010	5.34E-05	RAIS 2010	1.71E-02	USEPA 2005c	9.75E-03	USEPA 2005c	2.80E-02	USEPA 2005c	1.56E+02	BCF; RAIS 2010	4.06E+01	USEPA 2002	0.05	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		-9.14E-01	USEPA 2005c
Endosulfan II	33213659	-	3.83E+00	RAIS 2010	6.76E+03	RAIS 2010	4.62E-02	RAIS 2010	2.31E-01	RAIS 2010	1.69E-04	RAIS 2010	5.34E-05	RAIS 2010	1.71E-02	USEPA 2005c	9.75E-03	USEPA 2005c	2.80E-02	USEPA 2005c	1.56E+02	BCF; RAIS 2010	4.06E+01	USEPA 2002	0.05	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		-9.14E-01	USEPA 2005c
Endosulfan sulfate	1031078	-	3.66E+00	RAIS 2010	9.85E+03	RAIS 2010	5.80E-02	RAIS 2010	2.90E-01	RAIS 2010	1.14E-04	RAIS 2010	3.61E-05	RAIS 2010	1.50E-02	USEPA 2005c	8.57E-03	USEPA 2005c	2.46E-02	USEPA 2005c	1.21E+02	BCF; RAIS 2010	5.91E+01	USEPA 2002	0.05	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		-9.70E-01	USEPA 2005c
Endrin	72208	-	5.20E+00	RAIS 2010	2.01E+04	RAIS 2010	7.42E-03	RAIS 2010	3.71E-02	RAIS 2010	3.96E-03	RAIS 2010	1.25E-03	RAIS 2010	2.97E-02	USEPA 2005c	1.70E-02	USEPA 2005c	4.88E-02	USEPA 2005c	3.08E+04	BAF; EPI Suite v4.0	2.50E+01	USEPA 2005b	0.05	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		-6.73E-01	USEPA 2005c
Endrin aldehyde	7421934	-	4.80E+00	RAIS 2010	3.27E+03	RAIS 2010	1.27E-02	RAIS 2010	6.33E-02	RAIS 2010	1.58E-03	RAIS 2010	4.98E-04	RAIS 2010	2.76E-02	USEPA 2005c	1.58E-02	USEPA 2005c	4.54E-02	USEPA 2005c	1.01E+04	BAF; EPI Suite v4.0	1.96E+01	USEPA 2002	0.05	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		-7.05E-01	USEPA 2005c
Endrin ketone	53494705	-	4.99E+00	RAIS 2010	9.72E+03	RAIS 2010	9.82E-03	RAIS 2010	4.91E-02	RAIS 2010	2.44E-03	RAIS 2010	7.72E-04	RAIS 2010	2.89E-02	USEPA 2005c	1.65E-02	USEPA 2005c	4.74E-02	USEPA 2005c	1.41E+04	BAF; EPI Suite v4.0	5.83E+01	USEPA 2002	0.05	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		-6.86E-01	USEPA 2005c
gamma-BHC	58899	Lindane	3.72E+00	RAIS 2010	2.81E+03	RAIS 2010	5.36E-02	RAIS 2010	2.68E-01	RAIS 2010	1.31E-04	RAIS 2010	4.15E-05	RAIS 2010	1.57E-02	USEPA 2005c	8.98E-03	USEPA 2005c	2.58E-02	USEPA 2005c	3.72E+02	BCF; RAIS 2010	1.69E+01	USEPA 2002	0.05	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		-9.50E-01	USEPA 2005c
Heptachlor	76448	-	6.10E+00	RAIS 2010	4.13E+04	RAIS 2010	2.23E-03	RAIS 2010	1.12E-02	RAIS 2010	3.15E-02	RAIS 2010	9.95E-03	RAIS 2010	2.69E-02	USEPA 2005c	1.54E-02	USEPA 2005c	4.42E-02	USEPA 2005c	1.44E+05	BAF; EPI Suite v4.0	2.10E+05	USEPA 2005b	0.05	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		-7.17E-01	USEPA 2005c
Heptachlor epoxide	1024573	-	4.98E+00	RAIS 2010	1.01E+04	RAIS 2010	9.96E-03	RAIS 2010	4.98E-02	RAIS 2010	2.39E-03	RAIS 2010	7.54E-04	RAIS 2010	2.88E-02	USEPA 2005c	1.65E-02	USEPA 2005c	4.73E-02	USEPA 2005c	5.58E+04	BAF; EPI Suite v4.0	1.30E+04	USEPA 2005b	0.05	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		-6.87E-01	USEPA 2005c
MCPA	94746	-	3.25E+00	RAIS 2010	2.96E+01	RAIS 2010	1.00E-01	RAIS 2010	5.02E-01	RAIS 2010	4.45E-05	RAIS 2010	1.40E-05	RAIS 2010	1.04E-02	USEPA 2005c	5.96E-03	USEPA 2005c	1.71E-02	USEPA 2005c	3.16E+00	BCF; RAIS 2010	1.78E-01	USEPA 2002	0.05	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		-1.13E+00	USEPA 2005c
Mirex	2385855	Mirex (DeChlorane)	6.89E+00	RAIS 2010	3.57E+05	RAIS 2010	7.77E-04	RAIS 2010	3.88E-03	RAIS 2010	1.94E-01	RAIS 2010	6.13E-02	RAIS 2010	1.81E-02	USEPA 2005c	1.04E-02	USEPA 2005c	2.98E-02	USEPA 2005c	1.56E+06	BAF; EPI Suite v4.0	2.14E+03	USEPA 2002	0.05	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		-8.87E-01	USEPA 2005c
p,p'-Methoxychlor	72435	Methoxychlor	5.08E+00	RAIS 2010	2.69E+04	RAIS 2010	8.71E-03	RAIS 2010	4.36E-02	RAIS 2010	3.01E-03	RAIS 2010	9.50E-04	RAIS 2010	2.93E-02	USEPA 2005c	1.67E-02	USEPA 2005c	4.81E-02	USEPA 2005c	9.00E+03	BAF; EPI Suite v4.0	1.61E+02	USEPA 2002	0.05	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		-6.79E-01	USEPA 2005c
Toxaphene	8001352	-	5.78E+00	RAIS 2010	7.72E+04	RAIS 2010	3.42E-03	RAIS 2010	1.71E-02	RAIS 2010	1.51E-02	RAIS 2010	4.76E-03	RAIS 2010	2.91E-02	USEPA 2005c	1.66E-02	USEPA 2005c	4.77E-02	USEPA 2005c	2.78E+05	BAF; EPI Suite v4.0	4.63E+02	USEPA 2002	0.05	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		-6.83E-01	USEPA 2005c
Herbicides																																										
2,4,5-T	93765	2,4,5-Trichlorophenoxyacetic acid	3.31E+00	RAIS 2010	1.07E+02	RAIS 2010	9.26E-02	RAIS 2010	4.63E-01	RAIS 2010	5.10E-05	RAIS 2010	1.61E-05	RAIS 2010	1.10E-02	USEPA 2005c	6.31E-03	USEPA 2005c	1.81E-02	USEPA 2005c	3.16E+00	BCF; RAIS 2010	6.42E-01	USEPA 2002	0.05	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		-1.10E+00	USEPA 2005c
2,4,5-TP (Silvex)	93721	-	3.80E+00	RAIS 2010	1.75E+02	RAIS 2010	4.81E-02	RAIS 2010	2.41E-01	RAIS 2010	1.58E-04	RAIS 2010	4.98E-05	RAIS 2010	1.67E-02	USEPA 2005c	9.54E-03	USEPA 2005c	2.74E-02	USEPA 2005c	3.16E+00	BCF; RAIS 2010	1.05E+00	USEPA 2002	0.05	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		-9.24E-01	USEPA 2005c
2,4-Dichlorophenoxyacetic Acid (2,4-D)	94757	-	2.81E+00	RAIS 2010	2.96E+01	RAIS 2010	1.81E-01	RAIS 2010	9.03E-01	RAIS 2010	1.61E-05	RAIS 2010	5.10E-06	RAIS 2010	6.47E-03	USEPA 2005c	3.70E-03	USEPA 2005c	1.06E-02	USEPA 2005c	3.16E+00	BCF; RAIS 2010	1.78E-01	USEPA 2002	0.05	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		-1.34E+00	USEPA 2005c
2,4-Dichlorophenoxybutyric acid	94826	2,4-DB	3.53E+00	RAIS 2010	9.84E+01	RAIS 2010	6.90E-02	RAIS 2010	3.45E-01	RAIS 2010	8.47E-05	RAIS 2010	2.68E-05	RAIS 2010	1.35E-02	USEPA 2005c	7.70E-03	USEPA 2005c	2.21E-02	USEPA 2005c	3.16E+00	BCF; RAIS 2010	5.90E-01	USEPA 2002	0.05	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		-1.02E+00	USEPA 2005c
Dalapon	75990	-	1.68E+00	RAIS 2010	3.23E+00	RAIS 2010	8.17E-01	RAIS 2010	4.08E+00	RAIS 2010	1.20E-06	RAIS 2010	3.78E-07	RAIS 2010	1.27E-03	USEPA 2005c	7.27E-04	USEPA 2005c	2.09E-03	USEPA 2005c	7.22E+00	BCF; RAIS 2010	1.94E-02	USEPA 2002	0.05	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		-2.04E+00	USEPA 2005c
Dicamba	1918009	-	2.21E+00	RAIS 2010	2.90E+01	RAIS 2010	4.02E-01	RAIS 2010	2.01E+00	RAIS 2010	4.05E-06	RAIS 2010	1.28E-06	RAIS 2010	2.93E-03	USEPA 2005c	1.68E-03	USEPA 2005c	4.82E-03	USEPA 2005c	3.16E+00	BCF; RAIS 2010	1.74E-01	USEPA 2002	0.05	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		-1.68E+00	USEPA 2005c
2,4-DP (Dichlorprop)	120365	-	3.43E+00	RAIS 2013	4.85E+01	RAIS 2013	7.89E-02	RAIS 2013	3.95E-01	RAIS 2013	6.73E-05	RAIS 2013	2.13E-05	RAIS 2013	1.23E-02	USEPA 2005c	7.05E-03	USEPA 2005c	2.03E-02	USEPA 2005c	3.16E+00	BCF; RAIS 2013	2.91E-01	USEPA 2002	0.05	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		-1.05E+00	USEPA 2005c
Dinoseb	88857	-	3.56E+00	RAIS 2010	4.29E+03	RAIS 2010	6.63E-02	RAIS 2010	3.32E-01	RAIS 2010	9.08E-05	RAIS 2010	2.87E-05	RAIS 2010	1.38E-02	USEPA 2005c	7.90E-03	USEPA 2005c	2.27E-02	USEPA 2005c	6.17E+01	BCF; RAIS 2010	2.57E+01	USEPA 2002	0.05	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		-1.01E+00	USEPA 2005c
MCPP	93652	-	3.13E+00	RAIS 2010	4.85E+01	RAIS 2010	1.18E-01	RAIS 2010	5.89E-01	RAIS 2010	3.37E-05	RAIS 2010	1.07E-05	RAIS 2010	9.23E-03	USEPA 2005c	5.28E-03	USEPA 2005c	1.52E-02	USEPA 2005c	3.16E+00	BCF; RAIS 2010	2.91E-01	USEPA 2002	0.05	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		-1.18E+00	USEPA 2005c
Terphenyls																																										
m-Terphenyl	92068	-	3.98E+00	Surrogate - 1,1-biphenyl; RAIS 2010	5.13E+03	Surrogate - 1,1-biphenyl; RAIS 2010	3.79E-02	Surrogate - 1,1-biphenyl; RAIS 2010	1.89E-01	Surrogate - 1,1-biphenyl; RAIS 2010	2.39E-04	Surrogate - 1,1-biphenyl; RAIS 2010	7.54E-05	Surrogate - 1,1-biphenyl; RAIS 2010	1.89E-02	Surrogate - 1,1-biphenyl; USEPA 2005c	1.08E-02	Surrogate - 1,1-biphenyl; USEPA 2005c	3.11E-02	Surrogate - 1,1-biphenyl; USEPA 2005c	4.37E+02	BCF; Surrogate - 1,1-biphenyl; RAIS 2010	3.08E+01	USEPA 2002	0.10	DTSC 2011	NA		NA		no	NA		NA		NA		NA		-8.70E-01	Surrogate - 1,1-biphenyl; USEPA 2005c
o-Terphenyl	84151	-	3.98E+00	Surrogate - 1,1-biphenyl; RAIS 2010	5.13E+03	Surrogate - 1,1-biphenyl; RAIS 2010	3.79E-02	Surrogate - 1,1-biphenyl; RAIS 2010	1.89E-01	Surrogate - 1,1-biphenyl; RAIS 2010	2.39E-04	Surrogate - 1,1-biphenyl; RAIS 2010	7.54E-05	Surrogate - 1,1-biphenyl; RAIS 2010	1.89E-02	Surrogate - 1,1-biphenyl; USEPA 2005c	1.08E-02	Surrogate - 1,1-biphenyl; USEPA 2005c	3.11E-02	Surrogate - 1,1-biphenyl; USEPA 2005c	4.37E+02	BCF; Surrogate - 1,1-biphenyl; RAIS 2010	3.08E+01	USEPA 2002	0.10	DTSC 2011	NA		NA		no	NA		NA		NA		NA		-8.70E-01	Surrogate - 1,1-biphenyl; USEPA 2005c
p-Terphenyl	92944	-	3.98E+00	Surrogate - 1,1-biphenyl; RAIS 2010	5.13E+03	Surrogate - 1,1-biphenyl; RAIS 2010	3.79E-02	Surrogate - 1,1-biphenyl; RAIS 2010	1.89E-01	Surrogate - 1,1-biphenyl; RAIS 2010	2.39E-04	Surrogate - 1,1-biphenyl; RAIS 2010	7.54E-05	Surrogate - 1,1-biphenyl; RAIS 2010	1.89E-02	Surrogate - 1,1-biphenyl; USEPA 2005c	1.08E-02	Surrogate - 1,1-biphenyl; USEPA 2005c	3.11E-02	Surrogate - 1,1-biphenyl; USEPA 2005c	4.37E+02	BCF; Surrogate - 1,1-biphenyl; RAIS 2010	3.08E+01	USEPA 2002	0.10	DTSC 2011	NA		NA		no	NA		NA		NA		NA		-8.70E-01	Surrogate - 1,1-biphenyl; USEPA 2005c
Glycols																																										
Diethylene Glycol	111466	-	-1.47E+00	RAIS 2010	1.00E+00	RAIS 2010	5.48E+01	RAIS 2010	2.74E+02	RAIS 2010	8.47E-10	RAIS 2010	2.68E-10	RAIS 2010	6.68E-06	USEPA 2005c	3.82E-06	USEPA 2005c	1.10E-05	USEPA 2005c	3.16E+00	BCF; RAIS 2010	6.00E-03	USEPA 2002	0.10	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		-4.32E+00	USEPA 2005c
Triethylene glycol	112276	-	-1.75E+00	EPI Suite v4.0	1.00E+01	EPI Suite v4	7.97E+01	McKone 1994	3.99E+02	McKone 1994	4.45E-10	McKone 1994	1.40E-10	McKone 1994	6.68E-06	USEPA 2005c	3.82E-06	USEPA 2005c	1.10E-05	USEPA 2005c	3.16E+00	BCF; RAIS 2010	6.00E-02	USEPA 2002	0.10	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		-4.32E+00	USEPA 2005c
PCDD/PCDFs																																										
2,3,7,8-TCDD TEQ	1746016-TEQ	-	6.80E+00	RAIS 2010	2.49E+05	RAIS 2010	8.76E-04	RAIS 2010	4.38E-03	RAIS 2010	1.58E-01	RAIS 2010	4.98E-02	RAIS 2010	1.92E-02	USEPA 2005c	1.10E-02	USEPA 2005c	3.16E-02	USEPA 2005c	9.00E-02	BSAF; USEPA 2005b	3.89E+04	USEPA 2005b	0.03	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		-8.62E-01	USEPA 2005c
Polychlorinated Biphenyls (PCBs)																																										
Aroclor 1016	12674112	-	5.62E+00	RAIS 2010	4.77E+04	RAIS 2010	4.24E-03	RAIS 2010	2.12E-02	RAIS 2010	1.04E-02	RAIS 2010	3.29E-03	RAIS 2010	2.97E-02	USEPA 2005c	1.70E-02	USEPA 2005c	4.88E-02	USEPA 2005c	2.00E+00	BSAF; USEPA 2005b	3.92E+03	USEPA 2005b	0.15	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		-6.73E-01	USEPA 2005c
Aroclor 1242	53469219	Aroclor-1242	6.29E+00	RAIS 2010	7.81E+04	RAIS 2010	1.73E-03	RAIS 2010	8.65E-03	RAIS 2010	4.87E-02	RAIS 2010	1.54E-02	RAIS 2010	2.51E-02	USEPA 2005c	1.43E-02	USEPA 2005c	4.12E-02	USEPA 2005c	2.00E+00	BSAF; Surrogate Aroclor 1254; USEPA 2005b	4.69E+02	USEPA 2002	0.15	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		-7.47E-01	USEPA 2005c
Aroclor 1248	12672296	-	6.34E+00	RAIS 2010	7.65E+04	RAIS 2010	1.62E-03	RAIS 2010	8.10E-03	RAIS 2010	5.47E-02	RAIS 2010	1.73E-02	RAIS 2010	2.46E-02	USEPA 2005c	1.40E-02	USEPA 2005c	4.04E-02	USEPA 2005c	2.00E+00	BSAF; Surrogate Aroclor 1254; USEPA 2005b	4.59E+02	USEPA 2002	0.15	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		-7.56E-01	USEPA 2005c
Aroclor 1254	11097691	-	6.79E+00	RAIS 2010	1.31E+05	RAIS 2010	8.88E-04	RAIS 2010	4.44E-03	RAIS 2010	1.54E-01	RAIS 2010	4.87E-02	RAIS 2010	1.94E-02	USEPA 2005c	1.11E-02	USEPA 2005c	3.18E-02	USEPA 2005c	2.00E+00	BSAF; USEPA 2005b	2.45E+04	USEPA 2005b	0.15	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		-8.59E-01	USEPA 2005c
Aroclor 1260	11096825	-	8.27E+00	RAIS 2010	3.50E+05	RAIS 2010	1.23E-04	RAIS 2010	6.15E-04	RAIS 2010	4.66E+00	RAIS 2010	1.47E+00	RAIS 2010	5.05E-03	USEPA 2005c	2.89E-03	USEPA 2005c	8.30E-03	USEPA 2005c	2.00E+00	BSAF; Surrogate Aroclor 1254; USEPA 2005b	2.10E+03	USEPA 2002	0.15	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		-1.44E+00	USEPA 2005c
Aroclor 5460	11126424	-	6.34E+00	EPI Suite v4.0	8.13E+04	EPI Suite v4	1.62E-03	McKone 1994	8.10E-03	McKone 1994	5.47E-02	McKone 1994	1.73E-02	McKone 1994	2.46E-02	USEPA 2005c	1.40E-02	USEPA 2005c	4.04E-02	USEPA 2005c	2.00E+00	BSAF; Surrogate Aroclor 1254; USEPA 2005b	4.88E+02	USEPA 2002	0.15	DTSC 2011	NA		NA		no	NA		NA		NA		NA		NA		-7.56E-01	USEPA 2005c
PCB TEQ	1746016-PCB TEQ	-	6.63E+00	Surrogate - PCB-77; RAIS 2013	7.81E+04	Surrogate - PCB-77; RAIS 2013	1.10E-03	Surrogate - PCB-77; RAIS 2013	5.50E-03	Surrogate - PCB-77; RAIS 2013	1.07E-01	Surrogate - PCB-77; RAIS 2013	3.37E-02	Surrogate - PCB-77; RAIS 2013	2.46E-02	Surrogate - PCB-81; USEPA 2005c	1.40E-02	Surrogate - PCB-81; USEPA 2005c	4.04E-02	Surrogate - PCB-81; USEPA 2005c	2.00E+00	BSAF; Surrogate Aroclor 1254; USEPA 2005b	2.10E+03	Surrogate - PCB-189; USEPA 2002	0.15	DTSC 2011	NA		NA		no	NA		NA		NA		NA		-7.56E-01	Surrogate - PCB-81; USEPA 2005c

Notes:

atm-m^3/mole = atmosphere time cubic meter per mole
BAF = bioaccumulation factors
BCF = bioconcentration factors
BSAF = biota-sediment accumulation factor
cm^2 = centimeters squared
cm^3 = cubic centimeters
g = gram
kg = kilogram
L = liter
m^3 = cubic meters
mg = milligrams
NA = not applicable
na = not available
PCB - polychlorinated biphenyls
PCDD/PCDF - polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans
s = second
TCDD - 2,3,7,8-Tetrachlorodibenzo-p-dioxin
NA = Not applicable in the suburban residential and recreational risk-based screening levels (RBSLs) calculations.
TEQ - toxic equivalency

Chemical-specific factors or sources for chemicals on the expedited list that have been updated since the expedited risk-based screening levels were submitted.

a - Please note that different chemical names have been used for different programs at the SSFL, and there can be additional analyte synonyms than those presented. Therefore, any chemical synonym should be verified using the CAS number listed.
b - A volatile organic compound is any analyte with a molecular weight less than 200 g/mole and a Henry's law constant greater than 1E-5 atm-m^3/mole.
c - Derived from average of beef and/or poultry concentration ratios. Concentration ratios (unitless) = daily dry matter intake (kg/day) * transfer coefficients (d/kg).

Primary Sources

DTSC 2011a - Human Health Risk Assessment Note Number 1: Recommended DTSC Default Exposure Factors for Use in Risk Assessment at California Hazardous Waste Sites and Permitted Facilities. May 20, 2011.
EPI Suite v4.0 - USEPA's Estimation Programs Interface Suite™ Version 4.00; http://www.epa.gov/opptintr/exposure/pubs/episuitedl.htm (USEPA, 2010a)
RAIS 2010 - Online RAIS (http://rais.ornl.gov/cgi-bin/prg/PRG_search?select=chem) chemical-specific factors, accessed in May 2010.
USEPA 2002 - Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, USEPA, 2002. Values were estimated using the following equations from this document:

Attachment 1 - Table 3

Physical Chemical Properties Used in Suburban Residential, Rural Residential and Recreational Risk-Based Screening Level Calculations

Analyte	CAS#	Analyte Synonym [a]	Log of Octanol-Water Partition Coefficient log Kow (unitless)	Source	Organic Carbon Partition Coefficient Koc (cm^3/g)	Source	Soil to Plant Uptake Wet Weight Bv_{wet} (kg/kg)	Source	Soil to Plant Uptake Dry Weight Bv_{dry} (kg/kg)	Source	Beef Transfer Coefficient F_b (day/kg)	Source	Milk Transfer Coefficient F_m (day/kg)	Source	Poultry Transfer Coefficient F_p (day/kg)	Source	Egg Transfer Coefficient F_e (day/kg)	Source	Swine Transfer Coefficient F_s (day/kg)	Source	Fish Accumulation Factors BCF/BAF or BSAF (L/kg or unitless)	Source	Soil to Water Partition Coefficient Kd (cm^3/g)	Source	Dermal Absorption Fraction ABS_{der} (unitless)	Source	Henry's Law Constant H ($atm\text{-}m^3/mole$)	Source	Molecular Weight MW (g/mole)	Source	VOC? [b]	Volitilization Factor VF (m^3/kg)	Source	Henry's Law Constant H (unitless)	Source	Diffusivity in Air Di_a (cm^2/s)	Source	Diffusivity in Water Di_w (cm^2/s)	Source	Apparent Diffusivity D_s (cm^2/s)	Source	Log Animal Fat Transfer Coefficient $logBa_{fat}$ (day/kg)	Source
Soil to Water Partition Coefficient (Kd) = Koc*foc, assuming that the foc=0.006 g/g																																										
Volatilization Factor (VF; calculated for chemicals with a Henry's Law constant of 1 x 10^{-5} atm-m^3/mole or greater and with a molecular weight of less than 200 g/mole) = (Q/C x ((3.14 * D_a x T)$^{1/2}$) * 10^{-4})(2 * ρ_b * D_{Si})																																										
Apparent Diffusivity (D_{Si}) = ($\theta_a^{10/3}$ * Di_a * (H' + $\theta_w^{10/3}$) * Di_w)/n2)/(ρb * Kd + θ_w + θ_a * H')																																										
USEPA 2004 - Risk Assessment Guidance for Superfund (RAGS), Volume I: Human Health Evaluation Manual (Parts E, Supplemental Guidance for Dermal Risk Assessment) Interim. Future Development Table 1. Last Update: September, 2004. http://www.epa.gov/oswer/riskassessment/ragse/index.htm.																																										
USEPA 2005b - Human Health Risk Assessment Protocol Companion Database, USEPA, 2005b.																																										
USEPA 2005c - Appendix A of Human Health Assessment Protocol for Hazardous Waste Combustion Facilities, USEPA, 2005b. Values estimated using the following equations from this document:																																										
Poultry Transfer Coefficient (F_p) = $10^{log\ Ba\ fat}$ x 0.14;																																										
Egg Transfer Coefficient (F_e) - $10^{log\ Ba\ fat}$ x 0.08; or																																										
Swine Transfer Coefficient (F_s) = $10^{log\ Ba\ fat}$ x 0.23; where:																																										
Log Animal Fat Transfer Coefficient (log Ba_{fat}) = -0.099 x (log Kow)^2 + 1.07 x log Kow - 3.56 for analytes with log Kow values between -0.67 and 8.2. Transfer Coefficients for analytes with log Kow values less than -0.67 were calculated using a log Kow value of -0.67. Transfer Coefficients for analytes with log Kow values greater than 8.2 were calculated using a log Kow value of 8.2 (USEPA, 2005c).																																										

Supplemental Sources

IAEA 1994 - International Atomic Energy Agency. 1994. *Handbook of Parameter Values for the Prediction of Radionuclide Transfer in Temperate Environment*. Tech. Rep. Ser. No. 364, Vienna, Austria.

McKone 1994 - McKone, T. E. 1994. Uncertainty and variability in human exposures to soil contaminants through home-grown food: a Monte Carlo assessment. Risk Anal. 14(4):449-463. Values estimated using the following equations/assumptions from this document:

Soil to Plant Uptake Wet Weight (Bvwet) = 7.7 x Kow-0.58

Soil to Plant Uptake Dry Weight (Bv_{dry}) = wet weight soil to plant uptake factor converted to dry weight with a dry-to-wet weight fraction of 0.2.

Beef Transfer Coefficient (F_b) = 2.5 x 10^{-8} x Kow

Milk Transfer Coefficient (F_m) = 7.9*10^{-9}*Kow

Sheppard et al., 2009. Field measurements of the transfer factors for iodine and other trace elements. Nuclear Waste Management Organization. NWMO-TR-2009-35. December.

Staven, L.H., B.A. Napier, K. Rhodes, and D.L. Strenge. 2003. A compendium of transfer factors for agricultural and animal products. Pacific Northwest National Laboratory, operated by Battelle for the U.S. Department of Engery. PNNL-13421. June.

Susarla, S., G. Wood, S., Lewis, N. Wolfe, and S. McCutcheon. 1999. Adsorption characteristics of perchlorate in soil. Division of Environmental Chemistry Preprints of Extended Abstracts, 39:60–62, as cited in Environmental Screening Assessment of Perchlorate Replacements, Appendix A (Clausen, et al., 2007).

Tsao and Sample 2005. Literature-derived bioaccumulation models for energetic compounds in plants and soil invertebrates. June.

Soil to Plant Uptake Dry Weight (Bvdry) = mean uptake factor for dicot and monocot plants.

Soil to Plant Uptake Wet Weight (Bvwet) = dry weight soil to plant uptake factor converted to wet weight with a dry-to-wet weight fraction of 0.2.

Yoo L., B. Sample, K. Taylor, C.L Tseo, and C. McCarthy. 2007. Review of Perchlorate Ecotoxicity and Bioaccumulation Data to Support Evaluation of Ecological Risks. Submitted for publication as proceedings of the meeting by Chemical Propulsion Information Analysis Center (CPIAC).

Egg Transfer Coefficient (F_e) - Mean of quail eggs BCFs.

Fish Accumulation Factors - Mean of geometric mean of fish BCFs.

Attachment 1 - Table 4

Toxicity Values Used in Suburban Residential, Rural Residential and Recreational Risk-Based Screening Level Calculations

Analyte	CAS #	Analyte Synonym[a]	GI ABS[b]	Oral CSF $(mg/kg\text{-}day)^{-1}$		Dermal CSF $(mg/kg\text{-}day)^{-1}$		Inhalation URF $(\mu g/m^3)^{-1}$		Oral Reference Dose (mg/kg-day)		Dermal Reference Dose (mg/kg-day)		Inhalation RfC (mg/m^3)	
				Value	Source	Value	Source	Value	Source	Value	Source	Value	Source	Value	Source
Inorganic Compounds															
Aluminum	7429905	Aluminum, Total	100%	NTV		NTV		NTV		1.0E+00	PPRTV	1.0E+00	route-to-route	5.0E-03	PPRTV
Antimony	7440360	Antimony, Total	15%	NTV		NTV		NTV		4.0E-04	IRIS 2011	6.0E-05	route-to-route	1.4E-03	route-to-route
Arsenic	7440382	Arsenic, Total	95%	9.5E+00	OEHHA 2011	9.5E+00	route-to-route	3.3E-03	OEHHA 2011	3.0E-04	IRIS 2011	3.0E-04	route-to-route	1.5E-05	OEHHA 2011
Barium	7440393	Barium, Total	7.0%	NTV		NTV		NTV		2.0E-01	IRIS 2011	1.4E-02	route-to-route	5.0E-04	HEAST
Beryllium	7440417	Beryllium, Total	0.7%	NTV		NTV		2.4E-03	OEHHA 2011	2.0E-03	IRIS 2011	1.4E-05	route-to-route	7.0E-06	OEHHA 2013
Boron	7440428	Boron, Total	100%	NTV		NTV		NTV		2.0E-01	IRIS 2011	2.0E-01	route-to-route	2.0E-02	HEAST
Cadmium	7440439	Cadmium, Total	2.5%	NTV		NTV		4.2E-03	OEHHA 2011	6.3E-06	DTSC 2014	1.6E-07	route-to-route	1.0E-05	ATSDR
Chromium	7440473	Chromium, Total	1.3%	NTV		NTV		NTV		1.5E+00	Surrogate - Chromium (III); IRIS 2011	2.0E-02	route-to-route	5.3E+00	route-to-route
Cobalt	7440484	Cobalt, Total	100%	NTV		NTV		9.0E-03	PPRTV	3.0E-04	PPRTV	3.0E-04	route-to-route	6.0E-06	PPRTV
Copper	7440508	Copper, Total	100%	NTV		NTV		NTV		4.0E-02	HEAST	4.0E-02	route-to-route	1.0E-01	OEHHA 2011
Cyanides	57125	Cyanide, Total; Cyanide	100%	NTV		NTV		NTV		6.0E-04	IRIS 2013	6.0E-04	route-to-route	8.0E-04	RSLs User's Guide
Fluoride	16984488	-	100%	NTV		NTV		NTV		4.0E-02	OEHHA 2011	4.0E-02	route-to-route	1.3E-02	OEHHA 2011
Hexavalent chromium	18540299	Chromium, Hexavalent; Chromium VI	100%	5.0E-01	NJDEP	5.0E-01	route-to-route	1.5E-01	OEHHA 2011	3.0E-03	IRIS 2011	3.0E-03	route-to-route	2.0E-04	OEHHA 2013
Lead	7439921	Lead, Total	100%	NTV		NTV		NTV		NTV		NTV		NTV	
Lithium	7439932	Lithium, Total	100%	NTV		NTV		NTV		2.0E-03	PPRTV	2.0E-03	route-to-route	7.0E-03	route-to-route
Manganese	7439965	Manganese, Total	4%	NTV		NTV		NTV		1.4E-01	IRIS 2011	5.6E-03	route-to-route	9.0E-05	OEHHA 2013
Mercury	7439976	Mercury, Total	7%	NTV		NTV		NTV		3.0E-04	IRIS 2011 (based on HgCl2)	2.1E-05	route-to-route	3.0E-05	OEHHA 2011
Methyl Mercury	22967926	-	100%	NTV		NTV		NTV		1.0E-04	IRIS 2011	1.0E-04	route-to-route	3.5E-04	route-to-route
Molybdenum	7439987	Molybdenum, Total	100%	NTV		NTV		NTV		5.0E-03	IRIS 2011	5.0E-03	route-to-route	1.8E-02	route-to-route
Nickel	7440020	Nickel, Total	4%	NTV		NTV		2.6E-04	OEHHA 2011	2.0E-02	IRIS 2011	8.0E-04	route-to-route	5.0E-05	OEHHA 2011
Selenium	7782492	Selenium, Total	55%	NTV		NTV		NTV		5.0E-03	IRIS 2011	5.0E-03	route-to-route	2.0E-02	Cal EPA
Silver	7440224	Silver, Total	4%	NTV		NTV		NTV		5.0E-03	IRIS 2011	2.0E-04	route-to-route	1.8E-02	route-to-route
Strontium	7440246	Strontium, Total	100%	NTV		NTV		NTV		6.0E-01	IRIS 2011	6.0E-01	route-to-route	2.1E+00	route-to-route
Thallium	7440280	Thallium, Total	100%	NTV		NTV		NTV		1.0E-05	PPRTV Appendix	1.0E-05	route-to-route	3.5E-05	route-to-route
Tin	7440315	Tin, Total	100%	NTV		NTV		NTV		6.0E-01	HEAST	6.0E-01	route-to-route	2.1E+00	route-to-route
Vanadium	7440622	Vanadium, Total	2.6%	NTV		NTV		NTV		5.0E-03	RSLs User's Guide	1.3E-04	route-to-route	1.0E-04	ATSDR
Zinc	7440666	Zinc, Total	100%	NTV		NTV		NTV		3.0E-01	IRIS 2011	3.0E-01	route-to-route	1.1E+00	route-to-route
Zirconium	7440677	Zirconium, Total	100%	NTV		NTV		NTV		8.0E-05	PPRTV	8.0E-05	route-to-route	2.8E-04	route-to-route
Energetic Constituents			100%												
1,2-Dinitrobenzene	528290	o-Dinitrobenzene	100%	NTV		NTV		NTV		1.0E-04	PPRTV	1.0E-04	route-to-route	3.5E-04	route-to-route
1,3-Dinitrobenzene	99650	m-Dinitrobenzene	100%	NTV		NTV		NTV		1.0E-04	IRIS 2011	1.0E-04	route-to-route	3.5E-04	route-to-route
2,4,6-Trinitrotoluene	118967	-	100%	3.0E-02	IRIS 2011	3.0E-02	route-to-route	8.6E-06	route-to-route	5.0E-04	IRIS 2011	5.0E-04	route-to-route	1.8E-03	route-to-route
2-Amino-4,6-dinitrotoluene	35572782	-	100%	NTV		NTV		NTV		2.0E-03	RSLs User's Guide	2.0E-03	route-to-route	7.0E-03	route-to-route
HMX	2691410	-	100%	NTV		NTV		NTV		5.0E-02	IRIS 2011	5.0E-02	route-to-route	1.8E-01	route-to-route
Hydrazine	302012	-	100%	3.0E+00	IRIS 2011	3.0E+00	route-to-route	4.9E-03	IRIS 2011	NTV		NTV		3.0E-05	PPRTV
RDX	121824	Hexahydro-1,3,5-trinitro-1,3,5-triazine	100%	1.1E-01	IRIS 2011	1.1E-01	route-to-route	3.1E-05	route-to-route	3.0E-03	IRIS 2011	3.0E-03	route-to-route	1.1E-02	route-to-route
Perchlorate	14797730	-	100%	NTV		NTV		NTV		7.0E-04	IRIS 2011	7.0E-04	route-to-route	2.5E-03	route-to-route
Volatile Organic Compounds															
1,1,1,2-Tetrachloroethane	630206	-	100%	2.6E-02	IRIS 2011	2.6E-02	route-to-route	7.40E-06	IRIS 2011	3.0E-02	IRIS 2011	3.0E-02	route-to-route	1.1E-01	route-to-route
1,1,1-Trichloroethane	71556	-	100%	NTV		NTV		NTV		2.0E+00	IRIS 2011	2.0E+00	route-to-route	5.0E+00	IRIS 2011
1,1,2,2-Tetrachloroethane	79345	-	100%	2.7E-01	OEHHA 2011	2.7E-01	route-to-route	5.8E-05	OEHHA 2011	2.0E-02	IRIS 2011	2.0E-02	route-to-route	7.0E-02	route-to-route
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	Freon 113	100%	NTV		NTV		NTV		3.0E+01	IRIS 2011	3.0E+01	route-to-route	3.0E+01	HEAST
1,1,2-Trichloroethane	79005	-	100%	7.2E-02	OEHHA 2011	7.2E-02	route-to-route	1.6E-05	OEHHA 2011	4.0E-03	IRIS 2011	4.0E-03	route-to-route	2.0E-04	PPRTV Appendix
1,1-Dichloroethane	75343	-	100%	5.7E-03	OEHHA 2011	5.7E-03	route-to-route	1.6E-06	OEHHA 2011	2.0E-01	PPRTV	2.0E-01	route-to-route	7.0E-01	route-to-route
1,1-Dichloroethene	75354	-	100%	NTV		NTV		NTV		5.0E-02	IRIS 2011	5.0E-02	route-to-route	7.0E-02	OEHHA 2011
1,1-Dimethylhydrazine	57147	Unsymetrical Dimethyl Hydrazine	100%	NTV		NTV		NTV		1.0E-04	PPRTV Appendix	1.0E-04	route-to-route	2.0E-06	PPRTV Appendix
1,2,3-Trichlorobenzene	87616	-	100%	3.6E-03	Surrogate - 1,2,4-Trichlorobenzene; OEHHA 2011	3.6E-03	route-to-route	1.0E-06	route-to-route	8.0E-04	PPRTV Appendix	8.0E-04	route-to-route	2.8E-03	route-to-route
1,2,4-Trichlorobenzene	120821	-	100%	3.6E-03	OEHHA 2011	3.6E-03	route-to-route	1.0E-06	route-to-route	1.0E-02	IRIS 2011	1.0E-02	route-to-route	2.0E-03	PPRTV

Attachment 1 - Table 4

Toxicity Values Used in Suburban Residential, Rural Residential and Recreational Risk-Based Screening Level Calculations

Analyte	CAS #	Analyte Synonym[a]	GI ABS[b]	Oral CSF (mg/kg-day)$^{-1}$		Dermal CSF (mg/kg-day)$^{-1}$		Inhalation URF (µg/m^3)$^{-1}$		Oral Reference Dose (mg/kg-day)		Dermal Reference Dose (mg/kg-day)		Inhalation RfC (mg/m^3)	
				Value	Source	Value	Source	Value	Source	Value	Source	Value	Source	Value	Source
1,2,4-Trimethylbenzene	95636	-	100%	NTV		NTV		NTV		1.0E-02	Surrogate - 1,3,5-Trimethylbenzene; PPRTV Appendix	1.0E-02	route-to-route	7.0E-03	PPRTV
1,2-Dibromo-3-chloropropane	96128	1,2-Dibromo-3-CPA	100%	7.0E+00	OEHHA 2011	7.0E+00	route-to-route	2.0E-03	OEHHA 2011	2.0E-04	PPRTV	2.0E-04	route-to-route	2.0E-04	IRIS 2011
1,2-Dibromoethane	106934	1,2-Dibromoethane (EDB)	100%	3.6E+00	OEHHA 2011	3.6E+00	route-to-route	7.1E-05	OEHHA 2011	9.0E-03	IRIS 2011	9.0E-03	route-to-route	9.0E-03	IRIS 2013
1,2-Dichlorobenzene	95501	o-Dichlorobenzene	100%	NTV		NTV		NTV		9.0E-02	IRIS 2011	9.0E-02	route-to-route	2.0E-01	HEAST
1,2-Dichloroethane	107062	-	100%	4.7E-02	OEHHA 2011	4.7E-02	route-to-route	2.1E-05	OEHHA 2011	6.0E-03	PPRTV Appendix	6.0E-03	route-to-route	7.0E-03	PPRTV Appendix
1,2-Dichloroethene	540590	1,2-Dichloroethenes	100%	NTV		NTV		NTV		9.0E-03	HEAST	9.0E-03	route-to-route	6.0E-02	Surrogate - trans-1,2-dichloroethene; PPRTV
1,2-Dichloropropane	78875	-	100%	3.6E-02	OEHHA 2011	3.6E-02	route-to-route	1.0E-05	OEHHA 2011	9.0E-02	ATSDR	9.0E-02	route-to-route	4.0E-03	IRIS 2011
1,3,5-Trimethylbenzene	108678	-	100%	NTV		NTV		NTV		1.0E-02	PPRTV Appendix	1.0E-02	route-to-route	3.5E-02	route-to-route
1,3-Dichlorobenzene	541731	m-Dichlorobenzene	100%	NTV		NTV		NTV		3.0E-02	NCEA	3.0E-02	route-to-route	1.1E-01	route-to-route
1,4-Dichlorobenzene	106467	p-Dichlorobenzene	100%	5.4E-03	OEHHA 2011	5.4E-03	route-to-route	1.1E-05	OEHHA 2011	7.0E-02	ATSDR	7.0E-02	route-to-route	8.0E-01	IRIS 2011
2-Chloroethylvinyl ether	110758	2-Chloroethyl vinyl ether	100%	2.5E+00	Surrogate - Bis(2-chloroethyl)ether; OEHHA 2011	2.5E+00	route-to-route	7.1E-04	Surrogate - Bis(2-chloroethyl)ether; OEHHA 2011	NTV		NTV		NTV	
2-Hexanone	591786	Methyl butyl ketone	100%	NTV		NTV		NTV		5.0E-03	IRIS 2011	5.0E-03	route-to-route	3.0E-02	IRIS 2011
Acetone	67641	-	100%	NTV		NTV		NTV		9.0E-01	IRIS 2011	9.0E-01	route-to-route	3.1E+01	ATSDR
Benzene	71432	-	100%	1.0E-01	OEHHA 2011	1.0E-01	route-to-route	2.9E-05	OEHHA 2011	4.0E-03	IRIS 2011	4.0E-03	route-to-route	3.0E-02	IRIS 2013
Bromobenzene	108861	-	100%	NTV		NTV		NTV		8.0E-03	IRIS 2011	8.0E-03	route-to-route	6.0E-02	IRIS 2011
Bromodichloromethane	75274	-	100%	1.3E-01	OEHHA 2011	1.3E-01	route-to-route	3.7E-05	OEHHA 2011	2.0E-02	IRIS 2011	2.0E-02	route-to-route	7.0E-02	route-to-route
Bromoform	75252	-	100%	1.1E-02	OEHHA 2011	1.1E-02	route-to-route	1.1E-06	IRIS 2011	2.0E-02	IRIS 2011	2.0E-02	route-to-route	7.0E-02	route-to-route
Bromomethane	74839	-	100%	NTV		NTV		NTV		1.4E-03	IRIS 2011	1.4E-03	route-to-route	5.0E-03	OEHHA 2011
Carbon disulfide	75150	-	100%	NTV		NTV		NTV		1.0E-01	IRIS 2011	1.0E-01	route-to-route	7.0E-01	IRIS 2011
Carbon tetrachloride	56235	-	100%	1.5E-01	OEHHA 2011	1.5E-01	route-to-route	4.2E-05	OEHHA 2011	4.0E-03	IRIS 2011	4.0E-03	route-to-route	1.0E-01	IRIS 2013
Chlorobenzene	108907	Monochlorobenzene	100%	NTV		NTV		NTV		2.0E-02	IRIS 2011	2.0E-02	route-to-route	5.0E-02	PPRTV Appendix
Chloroform	67663	Trichloromethane	100%	3.1E-02	OEHHA 2011	3.1E-02	route-to-route	5.3E-06	OEHHA 2011	1.0E-02	IRIS 2011	1.0E-02	route-to-route	3.0E-01	OEHHA 2013
Chloromethane	74873	Methyl chloride	100%	NTV		NTV		NTV		1.4E-03	Surrogate - Bromomethane; IRIS 2011	1.4E-03	route-to-route	9.0E-02	IRIS 2011
cis-1,2-Dichloroethene	156592	cis-1,2-Dichloroethylene	100%	NTV		NTV		NTV		2.0E-03	IRIS 2011	2.0E-03	route-to-route	7.0E-03	route-to-route
Cumene	98828	Isopropylbenzene	100%	NTV		NTV		NTV		1.0E-01	IRIS 2011	1.0E-01	route-to-route	4.0E-01	IRIS 2011
Dibromochloromethane	124481	-	100%	9.4E-02	OEHHA 2011	9.4E-02	route-to-route	2.7E-05	OEHHA 2011	2.0E-02	IRIS 2011	2.0E-02	route-to-route	7.0E-02	route-to-route
Dibromomethane	74953	-	100%	NTV		NTV		NTV		1.0E-02	HEAST	1.0E-02	route-to-route	4.0E-03	PPRTV Appendix
Dichlorodifluoromethane	75718	Freon 12	100%	NTV		NTV		NTV		2.0E-01	IRIS 2011	2.0E-01	route-to-route	1.0E-01	PPRTV Appendix
Ethylbenzene	100414	-	100%	1.1E-02	OEHHA 2011	1.1E-02	route-to-route	2.5E-06	OEHHA 2011	1.0E-01	IRIS 2011	1.0E-01	route-to-route	2.0E+00	OEHHA 2013
Methyl ethyl ketone	78933	2-Butanone; 2-Butanone (MEK)	100%	NTV		NTV		NTV		6.0E-01	IRIS 2011	6.0E-01	route-to-route	5.0E+00	IRIS 2011
Methyl isobutyl ketone (MIBK)	108101	MIBK; 4-Methyl-2-pentanone	100%	NTV		NTV		NTV		8.0E-02	HEAST	8.0E-02	route-to-route	3.0E+00	IRIS 2011
Methylene chloride	75092	Dichloromethane	100%	1.4E-02	OEHHA 2011	1.4E-02	route-to-route	1.0E-06	OEHHA 2011	6.0E-03	IRIS 2013	6.0E-03	route-to-route	6.0E-01	IRIS 2013
Monomethylhydrazine	60344	Monomethyl Hydrazine	100%	5.5E+02	Surrogate - 1,2-Dimethylhydrazine; OEHHA 2011	5.5E+02	route-to-route	1.0E-03	PPRTV Appendix	1.0E-03	PPRTV	1.0E-03	route-to-route	2.0E-05	PPRTV Appendix
m-Xylene & p-Xylene	136777612	meta- and para-Xylenes; m, p-Xylene	100%	NTV		NTV		NTV		2.0E-01	IRIS 2013	2.0E-01	route-to-route	1.0E-01	IRIS 2013
n-Butylbenzene	104518	-	100%	NTV		NTV		NTV		5.0E-02	PPRTV	5.0E-02	route-to-route	1.8E-01	route-to-route
n-Propylbenzene	103651	-	100%	NTV		NTV		NTV		1.0E-01	PPRTV Appendix	1.0E-01	route-to-route	1.0E+00	PPRTV Appendix
o-Chlorotoluene	95498	2-Chlorotoluene	100%	NTV		NTV		NTV		2.0E-02	IRIS 2011	2.0E-02	route-to-route	7.0E-02	route-to-route
o-Xylene	95476	-	100%	NTV		NTV		NTV		2.0E-01	IRIS 2013	2.0E-01	route-to-route	1.0E-01	IRIS 2013
p-Chlorotoluene	106434	4-Chlorotoluene	100%	NTV		NTV		NTV		2.0E-02	PPRTV Appendix	2.0E-02	route-to-route	7.0E-02	route-to-route
p-Cymene	99876	p-Isopropyltoluene	100%	NTV		NTV		NTV		1.0E-01	Surrogate - Cumene; IRIS 2011	1.0E-01	route-to-route	4.0E-01	Surrogate - Cumene; IRIS 2011
p-Nitroaniline	100016	4-Nitroaniline	100%	2.0E-02	PPRTV	2.0E-02	route-to-route	5.7E-06	route-to-route	4.0E-03	PPRTV	4.0E-03	route-to-route	6.0E-03	PPRTV
sec-Butylbenzene	135988	-	100%	NTV		NTV		NTV		1.0E-01	PPRTV Appendix	1.0E-01	route-to-route	4.0E-01	Surrogate - Cumene IRIS 2011
Styrene	100425	Vinylbenzene	100%	NTV		NTV		NTV		2.0E-01	IRIS 2011	2.0E-01	route-to-route	9.0E-01	OEHHA 2011
tert-Butylbenzene	98066	Dibenzo[b,e][1,4]dioxin, octachloro-	100%	NTV		NTV		NTV		1.0E-01	PPRTV Appendix	1.0E-01	route-to-route	4.0E-01	Surrogate - Cumene IRIS 2011
Tetrachloroethene	127184	-	100%	5.4E-01	OEHHA 2011	5.4E-01	route-to-route	5.9E-06	OEHHA 2011	6.0E-03	IRIS 2012	6.0E-03	route-to-route	4.0E-02	IRIS 2012
Tetralin	119642	-	100%	NTV		NTV		3.4E-05	Surrogate - Naphthalene; OEHHA 2011	2.0E-02	Surrogate - Naphthalene; IRIS 2011	2.0E-02	route-to-route	3.0E-03	Surrogate - Naphthalene; IRIS 2011
Toluene	108883	Toluol	100%	NTV		NTV		NTV		8.0E-02	IRIS 2011	8.0E-02	route-to-route	5.0E+00	IRIS 2013

Attachment 1 - Table 4

Toxicity Values Used in Suburban Residential, Rural Residential and Recreational Risk-Based Screening Level Calculations

Analyte	CAS #	Analyte Synonym[a]	GI ABS[b]	Oral CSF (mg/kg-day)$^{-1}$		Dermal CSF (mg/kg-day)$^{-1}$		Inhalation URF (µg/m^3)$^{-1}$		Oral Reference Dose (mg/kg-day)		Dermal Reference Dose (mg/kg-day)		Inhalation RfC (mg/m^3)	
				Value	Source	Value	Source	Value	Source	Value	Source	Value	Source	Value	Source
trans-1,2-Dichloroethene	156605	-	100%	NTV		NTV		NTV		2.0E-02	IRIS 2011	2.0E-02	route-to-route	6.0E-02	PPRTV
Trichloroethene	79016	Trichloroethylene (TCE)	100%	4.6E-02	IRIS 2012	4.6E-02	route-to-route	4.8E-06	IRIS 2012 [g]	5.0E-04	IRIS 2012	5.0E-04	route-to-route	2.0E-03	IRIS 2012
Trichlorofluoromethane	75694	-	100%	NTV		NTV		NTV		3.0E-01	IRIS 2011	3.0E-01	route-to-route	7.0E-01	HEAST
Vinyl chloride	75014	-	100%	2.7E-01	OEHHA 2011	2.7E-01	route-to-route	7.8E-05	OEHHA 2011	3.0E-03	IRIS 2011	3.0E-03	route-to-route	1.0E-01	IRIS 2011
Xylenes, Total	1330207	Xylene (Total) Isomers	100%	NTV		NTV		NTV		2.0E-01	IRIS 2013	2.0E-01	route-to-route	1.0E-01	IRIS 2013
Semi-Volatile Organic Compounds															
1,4-Dioxane	123911	-	100%	2.7E-02	OEHHA 2011	2.7E-02	route-to-route	7.7E-06	OEHHA 2011	3.0E-02	IRIS 2011	3.0E-02	route-to-route	3.0E-02	IRIS 2013
2,4,5-Trichlorophenol	95954	-	100%	NTV		NTV		NTV		1.0E-01	IRIS 2011	1.0E-01	route-to-route	3.5E-01	route-to-route
2,4,6-Trichlorophenol	88062	-	100%	7.0E-02	OEHHA 2011	7.0E-02	route-to-route	2.0E-05	OEHHA 2011	1.0E-03	PPRTV	1.0E-03	route-to-route	3.5E-03	route-to-route
2,4-Dimethylphenol	105679	-	100%	NTV		NTV		NTV		2.0E-02	IRIS 2011	2.0E-02	route-to-route	7.0E-02	route-to-route
3,5-Dimethylphenol	108689	-	100%	NTV		NTV		NTV		7.2E-03	Average Surrogate Value [e]	7.2E-03	route-to-route	2.5E-02	route-to-route
Benzoic acid	65850	-	100%	NTV		NTV		NTV		4.0E+00	IRIS 2011	4.0E+00	route-to-route	1.4E+01	route-to-route
Benzyl alcohol	100516	-	100%	NTV		NTV		NTV		1.0E-01	PPRTV	1.0E-01	route-to-route	3.5E-01	route-to-route
bis(2-Ethylhexyl) phthalate	117817	bis(2-ethylhexyl)phthalate	100%	3.0E-03	OEHHA 2011	3.0E-03	route-to-route	2.4E-06	OEHHA 2011	2.0E-02	IRIS 2011	2.0E-02	route-to-route	7.0E-02	route-to-route
Butyl benzyl phthalate	85687	-	100%	1.9E-03	PPRTV	1.9E-03	route-to-route	5.4E-07	route-to-route	2.0E-01	IRIS 2011	2.0E-01	route-to-route	7.0E-01	route-to-route
Carbazole	86748	-	100%	2.0E-02	HEAST	2.0E-02	route-to-route	5.7E-06	route-to-route	NTV		NTV		NTV	
Dibenzofuran	132649	-	100%	NTV		NTV		NTV		1.0E-03	PPRTV Appendix	1.0E-03	route-to-route	3.5E-03	route-to-route
Diethyl phthalate	84662	-	100%	NTV		NTV		NTV		8.0E-01	IRIS 2011	8.0E-01	route-to-route	2.8E+00	route-to-route
Dimethyl phthalate	131113	-	100%	NTV		NTV		NTV		8.0E-01	Surrogate - Diethyl phthalate; IRIS 2011	8.0E-01	route-to-route	2.8E+00	route-to-route
Di-n-butyl phthalate	84742	Di-n-butylphthalate	100%	NTV		NTV		NTV		1.0E-01	IRIS 2011	1.0E-01	route-to-route	3.5E-01	route-to-route
Di-n-octyl phthalate	117840	Di-n-octyl-phthalate	100%	NTV		NTV		NTV		1.0E-02	PPRTV	1.0E-02	route-to-route	3.5E-02	route-to-route
Formaldehyde	50000	-	100%	NTV		NTV		6.0E-06	OEHHA 2011	2.0E-01	IRIS 2011	2.0E-01	route-to-route	9.0E-03	OEHHA 2013
Hexachlorobutadiene	87683	-	100%	7.8E-02	IRIS 2011	7.8E-02	route-to-route	2.2E-05	IRIS 2011	1.0E-03	PPRTV	1.0E-03	route-to-route	3.5E-03	route-to-route
m-Cresol	108394	3-Methylphenol	100%	NTV		NTV		NTV		5.0E-02	IRIS 2011	5.0E-02	route-to-route	6.0E-01	OEHHA 2011
N-Nitrosodimethylamine	62759	Nitrosodimethylamine	100%	1.6E+01	OEHHA 2011	1.6E+01	route-to-route	4.6E-03	OEHHA 2011	8.0E-06	PPRTV	8.0E-06	route-to-route	4.0E-05	PPRTV Appendix
N-Nitrosodiphenylamine	86306	-	100%	9.0E-03	OEHHA 2011	9.0E-03	route-to-route	2.6E-06	OEHHA 2011	NTV		NTV		NTV	
o-Cresol	95487	2-Methylphenol	100%	NTV		NTV		NTV		5.0E-02	IRIS 2011	5.0E-02	route-to-route	6.0E-01	OEHHA 2011
p-Chloro-m-cresol	59507	4-Chloro-3-Methylphenol	100%	NTV		NTV		NTV		1.0E-01	PPRTV Appendix	1.0E-01	route-to-route	3.5E-01	route-to-route
p-Cresol	106445	4-Methylphenol	100%	NTV		NTV		NTV		1.0E-01	ATSDR	1.0E-01	route-to-route	6.0E-01	OEHHA 2011
Pentachlorophenol	87865	PCP	76%	1.8E-02	OEHHA 2011	1.8E-02	route-to-route	5.1E-06	OEHHA 2011	5.0E-03	IRIS 2011	5.0E-03	route-to-route	1.8E-02	route-to-route
Phenol	108952	Total Phenols	100%	NTV		NTV		NTV		3.0E-01	IRIS 2011	3.0E-01	route-to-route	2.0E-01	OEHHA 2011
Polynuclear Aromatic Hydrocarbons															
1-Methyl naphthalene	90120	1-Methylnaphthalene	89%	2.9E-02	PPRTV	2.9E-02	route-to-route	8.3E-06	route-to-route	7.0E-02	ATSDR	7.0E-02	route-to-route	2.5E-01	route-to-route
2-Methylnaphthalene	91576	Naphthalene, 2-methyl-	89%	NTV		NTV		NTV		4.0E-03	IRIS 2011	4.0E-03	route-to-route	1.4E-02	route-to-route
Acenaphthene	83329	-	89%	NTV		NTV		NTV		6.0E-02	IRIS 2011	6.0E-02	route-to-route	2.1E-01	route-to-route
Acenaphthylene	208968	-	89%	NTV		NTV		NTV		6.0E-02	Surrogate - Acenaphthene; IRIS 2011	6.0E-02	route-to-route	2.1E-01	route-to-route
Anthracene	120127	-	89%	NTV		NTV		NTV		3.0E-01	IRIS 2011	3.0E-01	route-to-route	1.1E+00	route-to-route
Benzo(a)anthracene	56553	Benz[a]anthracene	89%	1.2E+00	OEHHA 2011	1.2E+00	route-to-route	1.1E-04	OEHHA 2011	NTV		NTV		NTV	
Benzo(a)pyrene	50328	Benzo (a) pyrene	89%	1.2E+01	OEHHA 2011	1.2E+01	route-to-route	1.1E-03	OEHHA 2011	NTV		NTV		NTV	
Benzo(b)fluoranthene	205992	Benz[e]acephenanthrylene 1	89%	1.2E+00	OEHHA 2011	1.2E+00	route-to-route	1.1E-04	OEHHA 2011	NTV		NTV		NTV	
Benzo(e)pyrene	192972	-	89%	NTV		NTV		NTV		3.0E-02	Surrogate - Pyrene; IRIS 2011	3.0E-02	route-to-route	1.1E-01	route-to-route
Benzo(ghi)perylene	191242	Benzo (g,h,i) perylene	89%	NTV		NTV		NTV		3.0E-02	Surrogate - Pyrene; IRIS 2011	3.0E-02	route-to-route	1.1E-01	route-to-route
Benzo(k)fluoranthene	207089	Benzo[k]fluoranthene	89%	1.2E+00	OEHHA 2011	1.2E+00	route-to-route	1.1E-04	OEHHA 2011	NTV		NTV		NTV	
Chrysene	218019	-	89%	1.2E-01	OEHHA 2011	1.2E-01	route-to-route	1.1E-05	OEHHA 2011	NTV		NTV		NTV	
Dibenzo(a,h)anthracene	53703	Dibenz (a,h) anthracene	89%	4.1E+00	OEHHA 2011	4.1E+00	route-to-route	1.2E-03	OEHHA 2011	NTV		NTV		NTV	
Fluoranthene	206440	-	89%	NTV		NTV		NTV		4.0E-02	IRIS 2011	4.0E-02	route-to-route	1.4E-01	route-to-route
Fluorene	86737	-	89%	NTV		NTV		NTV		4.0E-02	IRIS 2011	4.0E-02	route-to-route	1.4E-01	route-to-route
Indeno(1,2,3-cd)pyrene	193395	Indeno (1,2,3-cd) pyrene	100%	1.2E+00	OEHHA 2011	1.2E+00	route-to-route	1.1E-04	OEHHA 2011	NTV		NTV		NTV	
Naphthalene	91203	-	89%	NTV		NTV		3.4E-05	OEHHA 2011	2.0E-02	IRIS 2011	2.0E-02	route-to-route	9.0E-03	OEHHA 2012
Perylene	198550	-	100%	NTV		NTV		NTV		3.0E-02	Surrogate - Pyrene IRIS 2011	3.0E-02	route-to-route	1.1E-01	route-to-route
Phenanthrene	85018	-	89%	NTV		NTV		NTV		3.0E-01	Surrogate - Anthracene; IRIS 2011	3.0E-01	route-to-route	1.1E+00	route-to-route
Pyrene	129000	-	89%	NTV		NTV		NTV		3.0E-02	IRIS 2011	3.0E-02	route-to-route	1.1E-01	route-to-route

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Toxicity Values Used in Suburban Residential, Rural Residential and Recreational Risk-Based Screening Level Calculations

Analyte	CAS #	Analyte Synonym[a]	GI ABS[b]	Oral CSF (mg/kg-day)$^{-1}$		Dermal CSF (mg/kg-day)$^{-1}$		Inhalation URF (µg/m^3)$^{-1}$		Oral Reference Dose (mg/kg-day)		Dermal Reference Dose (mg/kg-day)		Inhalation RfC (mg/m^3)	
				Value	Source	Value	Source	Value	Source	Value	Source	Value	Source	Value	Source
Pesticides															
4,4'-DDD	72548	p,p'-DDD	100%	2.4E-01	IRIS 2011	2.4E-01	route-to-route	6.9E-05	OEHHA 2011	NTV		NTV		NTV	
4,4'-DDE	72559	p,p'-DDE	100%	3.4E-01	IRIS 2011	3.4E-01	route-to-route	9.7E-05	OEHHA 2011	NTV		NTV		NTV	
4,4'-DDT	50293	p,p'-DDT	80%	3.4E-01	OEHHA 2011	3.4E-01	route-to-route	9.7E-05	OEHHA 2011	5.0E-04	IRIS 2011	5.0E-04	route-to-route	1.8E-03	route-to-route
Aldrin	309002	-	100%	1.7E+01	OEHHA 2011	1.7E+01	route-to-route	4.9E-03	OEHHA 2011	3.0E-05	IRIS 2011	3.0E-05	route-to-route	1.1E-04	route-to-route
alpha-BHC	319846	a-Benzene Hexachloride	100%	2.7E+00	OEHHA 2011	2.7E+00	route-to-route	7.7E-04	OEHHA 2011	8.0E-03	ATSDR	8.0E-03	route-to-route	2.8E-02	route-to-route
beta-BHC	319857	b-Benzene Hexachloride	100%	1.5E+00	OEHHA 2011	1.5E+00	route-to-route	4.3E-04	OEHHA 2011	NTV		NTV		NTV	
delta-BHC	319868	d-Benzene Hexachloride	100%	1.8E+00	Average Surrogate Value [d]	1.8E+00	route-to-route	5.0E-04	Average Surrogate Value [d]	3.0E-04	Surrogate - gamma-BHC; IRIS 2011	3.0E-04	route-to-route	1.1E-03	route-to-route
Chlordane (Technical)	12789036	-	100%	3.5E-01	IRIS 2011	3.5E-01	route-to-route	1.0E-04	IRIS 2011	5.0E-04	IRIS 2011	5.0E-04	route-to-route	7.0E-04	IRIS 2011
Dieldrin	60571	-	100%	1.6E+01	OEHHA 2011	1.6E+01	route-to-route	4.6E-03	OEHHA 2011	5.0E-05	IRIS 2011	5.0E-05	route-to-route	1.8E-04	route-to-route
Endosulfan I	959988	-	100%	NTV		NTV		NTV		6.0E-03	Surrogate - Endosulfan; IRIS 2011	6.0E-03	route-to-route	2.1E-02	route-to-route
Endosulfan II	33213659	-	100%	NTV		NTV		NTV		6.0E-03	Surrogate - Endosulfan; IRIS 2011	6.0E-03	route-to-route	2.1E-02	route-to-route
Endosulfan sulfate	1031078	-	100%	NTV		NTV		NTV		6.0E-03	Surrogate - Endosulfan; IRIS 2011	6.0E-03	route-to-route	2.1E-02	route-to-route
Endrin	72208	-	100%	NTV		NTV		NTV		3.0E-04	IRIS 2011	3.0E-04	route-to-route	1.1E-03	route-to-route
Endrin aldehyde	7421934	-	100%	NTV		NTV		NTV		3.0E-04	Surrogate - Endrin; IRIS 2011	3.0E-04	route-to-route	1.1E-03	route-to-route
Endrin ketone	53494705	-	100%	NTV		NTV		NTV		3.0E-04	Surrogate - Endrin; IRIS 2011	3.0E-04	route-to-route	1.1E-03	route-to-route
gamma-BHC	58899	Lindane	100%	1.1E+00	OEHHA 2011	1.1E+00	route-to-route	3.1E-04	OEHHA 2011	3.0E-04	IRIS 2011	3.0E-04	route-to-route	1.1E-03	route-to-route
Heptachlor	76448	-	100%	4.1E+00	OEHHA 2011	4.1E+00	route-to-route	1.2E-03	OEHHA 2011	5.0E-04	IRIS 2011	5.0E-04	route-to-route	1.8E-03	route-to-route
Heptachlor epoxide	1024573	-	100%	5.5E+00	OEHHA 2011	5.5E+00	route-to-route	5.2E-03	OEHHA 2011	1.3E-05	IRIS 2011	1.3E-05	route-to-route	4.6E-05	route-to-route
MCPA	94746	-	100%	NTV		NTV		NTV		5.0E-04	IRIS 2011	5.0E-04	route-to-route	1.8E-03	route-to-route
Mirex	2385855	Mirex (DeChlorane)	100%	1.8E+01	OEHHA 2011	1.8E+01	route-to-route	5.1E-03	OEHHA 2011	2.0E-04	IRIS 2011	2.0E-04	route-to-route	7.0E-04	route-to-route
p,p'-Methoxychlor	72435	Methoxychlor	100%	NTV		NTV		NTV		5.0E-03	IRIS 2011	5.0E-03	route-to-route	1.8E-02	route-to-route
Toxaphene	8001352	-	100%	1.2E+00	OEHHA 2011	1.2E+00	route-to-route	3.4E-04	OEHHA 2011	NTV		NTV		NTV	
Herbicides															
2,4,5-T	93765	2,4,5-Trichlorophenoxyacetic acid	100%	NTV		NTV		NTV		1.0E-02	IRIS 2011	1.0E-02	route-to-route	3.5E-02	route-to-route
2,4,5-TP (Silvex)	93721	-	100%	NTV		NTV		NTV		8.0E-03	IRIS 2011	8.0E-03	route-to-route	2.8E-02	route-to-route
2,4-Dichlorophenoxyacetic Acid (2,4-D)	94757	-	>90%	NTV		NTV		NTV		1.0E-02	IRIS 2011	1.0E-02	route-to-route	3.5E-02	route-to-route
2,4-Dichlorophenoxybutyric acid	94826	2,4-DB	100%	NTV		NTV		NTV		8.0E-03	IRIS 2011	8.0E-03	route-to-route	2.8E-02	route-to-route
Dalapon	75990	-	100%	NTV		NTV		NTV		3.0E-02	IRIS 2011	3.0E-02	route-to-route	1.1E-01	route-to-route
Dicamba	1918009	-	100%	NTV		NTV		NTV		3.0E-02	IRIS 2011	3.0E-02	route-to-route	1.1E-01	route-to-route
2,4-DP (Dichlorprop)	120365	-	100%	NTV		NTV		NTV		1.0E-02	Surrogate - 2,4-Dichlorophenoxyacetic Acid (2,4-D); IRIS 2011	1.0E-02	route-to-route	3.5E-02	route-to-route
Dinoseb	88857	-	100%	NTV		NTV		NTV		1.0E-03	IRIS 2011	1.0E-03	route-to-route	3.5E-03	route-to-route
MCPP	93652	-	100%	NTV		NTV		NTV		1.0E-03	IRIS 2011	1.0E-03	route-to-route	3.5E-03	route-to-route
Terphenyls															
m-Terphenyl	92068	-	100%	8.0E-03	Surrogate - Biphenyl; IRIS 2013	8.0E-03	route-to-route	2.3E-06	route-to-route	5.0E-01	Surrogate - Biphenyl; IRIS 2013	5.0E-01	route-to-route	4.0E-04	Surrogate - Biphenyl; PPRTV Appendix
o-Terphenyl	84151	-	100%	8.0E-03	Surrogate - Biphenyl; IRIS 2013	8.0E-03	route-to-route	2.3E-06	route-to-route	5.0E-01	Surrogate - Biphenyl; IRIS 2013	5.0E-01	route-to-route	4.0E-04	Surrogate - Biphenyl; PPRTV Appendix
p-Terphenyl	92944	-	100%	8.0E-03	Surrogate - Biphenyl; IRIS 2013	8.0E-03	route-to-route	2.3E-06	route-to-route	5.0E-01	Surrogate - Biphenyl; IRIS 2013	5.0E-01	route-to-route	4.0E-04	Surrogate - Biphenyl; PPRTV Appendix
Glycols															
Diethylene Glycol	111466	-	100%	NTV		NTV		NTV		1.0E-01	Surrogate - Ethylene glycol monobutyl ether; IRIS 2011	1.0E-01	route-to-route	1.6E+00	Surrogate - Ethylene glycol monobutyl ether; IRIS 2011
Triethylene glycol	112276	-	100%	NTV		NTV		NTV		4.5E-02	Average Surrogate Value [f]	4.5E-02	route-to-route	1.6E-01	route-to-route
Total Petroleum Hydrocarbons[c]															
PCDD/PCDFs															

Attachment 1 - Table 4

Toxicity Values Used in Suburban Residential, Rural Residential and Recreational Risk-Based Screening Level Calculations

Analyte	CAS #	Analyte Synonym[a]	GI ABS[b]	Oral CSF (mg/kg-day)$^{-1}$		Dermal CSF (mg/kg-day)$^{-1}$		Inhalation URF (µg/m^3)$^{-1}$		Oral Reference Dose (mg/kg-day)		Dermal Reference Dose (mg/kg-day)		Inhalation RfC (mg/m^3)	
				Value	Source	Value	Source	Value	Source	Value	Source	Value	Source	Value	Source
2,3,7,8-TCDD TEQ	1746016-TEQ	-	70%	1.3E+05	OEHHA 2011	1.3E+05	route-to-route	3.8E+01	OEHHA 2011	7.0E-10	IRIS 2012	7.0E-10	route-to-route	4.0E-08	OEHHA 2011
Polychlorinated Biphenyls (PCBs)															
Aroclor 1016	12674112	-	81%	7.0E-02	RSLs User's Guide	7.0E-02	route-to-route	2.0E-05	RSLs User's Guide	7.0E-05	IRIS 2011	7.0E-05	route-to-route	2.5E-04	route-to-route
Aroclor 1242	53469219	Aroclor-1242	81%	2.0E+00	RSLs User's Guide	2.0E+00	route-to-route	5.7E-04	RSLs User's Guide	2.0E-05	Surrogate - Aroclor 1254; IRIS 2011	2.0E-05	route-to-route	7.0E-05	route-to-route
Aroclor 1248	12672296	-	81%	2.0E+00	RSLs User's Guide	2.0E+00	route-to-route	5.7E-04	RSLs User's Guide	2.0E-05	Surrogate - Aroclor 1254; IRIS 2011	2.0E-05	route-to-route	7.0E-05	route-to-route
Aroclor 1254	11097691	-	81%	2.0E+00	RSLs User's Guide	2.0E+00	route-to-route	5.7E-04	RSLs User's Guide	2.0E-05	IRIS 2011	2.0E-05	route-to-route	7.0E-05	route-to-route
Aroclor 1260	11096825	-	81%	2.0E+00	RSLs User's Guide	2.0E+00	route-to-route	5.7E-04	RSLs User's Guide	2.0E-05	Surrogate - Aroclor 1254; IRIS 2011	2.0E-05	route-to-route	7.0E-05	route-to-route
Aroclor 5460	11126424	-	81%	2.0E+00	Surrogate - Aroclor 1254; RSLs User's Guide	2.0E+00	route-to-route	5.7E-04	Surrogate - Aroclor 1254; RSLs User's Guide	2.0E-05	Surrogate - Aroclor 1254; IRIS 2011	2.0E-05	route-to-route	7.0E-05	route-to-route
PCB TEQ	1746016-PCB TEQ	-	81%	1.3E+05	Surrogate - 2,3,7,8-TCDD; OEHHA 2011	1.3E+05	route-to-route	3.8E+01	Surrogate - 2,3,7,8-TCDD; OEHHA 2011	7.0E-10	Surrogate - 2,3,7,8-TCDD; IRIS 2012	7.0E-10	route-to-route	4.0E-08	Surrogate - 2,3,7,8-TCDD; OEHHA 2011

Notes:

a - Please note that different chemical names have been used for different programs at the SSFL, and there can be additional analyte synonyms than those presented. Therefore, any chemical synonym should be verified using the CAS number listed.

b - Values from Risk Assessment Guidance for Superfund (RAGS): Volume I - Human Health Evaluation Manual, Part E, Supplemental Guidance for Dermal Risk Assessment. (USEPA 2004a). Where a default value is not available, a value of 100% has been entered in accordance with RAGS Part E guidance that no adjustment needs to be made to derive the dermal toxicity values. The actual oral absorption may be less than 100%.

c - Risk assessment including risk-based screening levels (RBSLs) development is not required for TPH, according to personal communication from Don Greenlee (DTSC) to Bruce Narloch (MWH), dated September 23, 2010.

d - Averages of oral cancer slope factors and inhalation unit risk factors for alpha-BHC (OEHHA, 2011), beta-BHC (OEHHA, 2011) and gamma-BHC (OEHHA, 2011) were used as surrogate oral cancer slope factor and inhalation unit risk factor values.

e - Average of oral reference doses for 2,4,-dimethylphenol (IRIS 2011), 2,6-dimethylphenol (USEPA, 2011b) and 3,4-dimethylphenol (USEPA, 2011b) was used as a oral reference dose surrogate value.

f - Average of oral reference doses for diethylene glycol monobutyl ether (USEPA, 2011a) and diethylene glycol monoethyl ether (USEPA, 2011a) was used as a oral reference dose surrogate value.

g - The inhalation URF for trichloroethene accounts for the mutagenic mode of action, as explained in IRIS (USEPA, 2012).

ATSDR - Agency for Toxic Substances and Disease Registry Minimum Risk Levels (MRLs), as cited in the Regional Screening Levels (RSL) for Chemical Contaminants at Superfund Sites tables (USEPA, 2013).
Cal EPA - California Environmental Protection Agency , as cited in the Regional Screening Levels (RSL) for Chemical Contaminants at Superfund Sites tables (USEPA, 2013).
DTSC 2014 - Human Health Risk Assessment Note Number 3. July 14, 2014.
IRIS 2011 - Integrated Risk Information System (IRIS) Online database. http://www.epa.gov/ iriswebp/iris/subst/index.html accessed in June 2011 (USEPA, 2011a).
IRIS 2012 - Integrated Risk Information System (IRIS) Online database. http://www.epa.gov/ iriswebp/iris/subst/index.html accessed in October 2012 (USEPA, 2012).
IRIS 2013 - Integrated Risk Information System (IRIS) Online database. http://www.epa.gov/ iriswebp/iris/subst/index.html accessed in December 2013 (USEPA, 2013).
NCEA - National Center for Environmental Assessment, as cited in USEPA Region 9 PRG tables (USEPA, 2004b). Chemical is not included in the USEPA Regional Screening Levels (RSL) for Chemical Contaminants at Superfund Sites tables (USEPA, 2013).
NJDEP - New Jersey Department of Environmental Protection, as cited in the Regional Screening Levels (RSL) for Chemical Contaminants at Superfund Sites tables (USEPA, 2013).
OEHHA 2011 - Office of Environmental Health Hazard Assessment (OEHHA) Toxicity Criteria Database, online. http://www.oehha.ca.gov/risk/ChemicalDB/index.asp accessed in June 2011 (OEHHA, 2011).
OEHHA 2012 - Office of Environmental Health Hazard Assessment (OEHHA) Toxicity Criteria Database, online. http://www.oehha.ca.gov/risk/ChemicalDB/index.asp accessed October 2012 (OEHHA, 2012).
OEHHA 2013 - Office of Environmental Health Hazard Assessment (OEHHA) Toxicity Criteria Database, online. http://www.oehha.ca.gov/risk/ChemicalDB/index.asp accessed November 2013 (OEHHA, 2013).
PPRTV - Provisional Peer Reviewed Toxicity Values, as cited in the Regional Screening Levels (RSL) for Chemical Contaminants at Superfund Sites tables (USEPA, 2013).
PPRTV Appendix - Provisional Peer Reviewed Toxicity Values Appendix, as cited in the Regional Screening Levels (RSL) for Chemical Contaminants at Superfund Sites tables (USEPA, 2013).
HEAST - Health Effects Assessment Summary Tables, FY-1997 Update. EPA/540/R-97/036. July 1997 (USEPA, 1997a).
RSLs User's Guide (USEPA, 2013) - USEPA Regional Screening Levels include notes for values which deviate from standard procedures in the RSLs User's Guide.

Toxicity values or sources for chemicals on the expedited list that have been updated since the expedited risk-based screening levels were submitted.

CSF - cancer slope factor
GI ABS - gastrointestinal absorption
mg/kg-day - milligrams per kilogram per day
mg/m^3 - milligrams per cubic meter
NTV - no toxicity value
PCDD/PCDF - polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans
RfC - reference concentration
RfD - reference dose
TCDD - 2,3,7,8-Tetrachlorodibenzo-p-dioxin
TEQ - toxic equivalency
µg/m^3 - microgram per cubic meter
URF - unit risk factor

Attachment 1 - Table 5

Dioxin and Coplanar PCB Toxicity Equivalent Factors for Humans

Chemical	Chemical Synonym	WHO 2005 TEF [a] (unitless)
Chlorinated Dibenzo-p-dioxins		
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	1,2,3,4,6,7,8-HpCDD	0.01
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	1,2,3,4,7,8-HxCDD	0.1
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	1,2,3,6,7,8-HxCDD	0.1
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	1,2,3,7,8,9-HxCDD	0.1
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	1,2,3,7,8-PeCDD	1
2,3,7,8-Tetrachlorodibenzo-p-dioxin	2,3,7,8-TCDD	1
Octachlorodibenzo-p-dioxin	OCDD	0.0003
Chlorinated Dibenzofurans		
1,2,3,4,6,7,8-Heptachlorodibenzofuran	1,2,3,4,6,7,8-HpCDF	0.01
1,2,3,4,7,8,9-Heptachlorodibenzofuran	1,2,3,4,7,8,9-HpCDF	0.01
1,2,3,4,7,8-Hexachlorodibenzofuran	1,2,3,4,7,8-HxCDF	0.1
1,2,3,6,7,8-Hexachlorodibenzofuran	1,2,3,6,7,8-HxCDF	0.1
1,2,3,7,8,9-Hexachlorodibenzofuran	1,2,3,7,8,9-HxCDF	0.1
1,2,3,7,8-Pentachlorodibenzofuran	1,2,3,7,8-PeCDF	0.03
2,3,4,6,7,8-Hexachlorodibenzofuran	2,3,4,6,7,8-HxCDF	0.1
2,3,4,7,8-Pentachlorodibenzofuran	2,3,4,7,8-PeCDF	0.3
2,3,7,8-Tetrachlorodibenzofuran	2,3,7,8-TCDF	0.1
Octachlorodibenzofuran	OCDF	0.0003
Non-ortho Substituted Polychlorinated biphenyls		
PCB-77 (3,3',4,4')		0.0001
PCB-81 (3,4,4',5)		0.0003
PCB-126 (3,3',4,4',5)		0.1
PCB-169 (3,3',4,4',5,5')		0.03
Mono-ortho Substituted Polychlorinated biphenyls		
PCB-105 (2,3,3',4,4')		0.00003
PCB-114 (2,3,4,4',5)		0.00003
PCB-118 (2,3',4,4',5)		0.00003
PCB-123 (2',3,4,4',5')		0.00003
PCB-156 (2,3,3',4,4',5)		0.00003
PCB-157 (2,3,3',4,4',5')		0.00003
PCB-167 (2,3',4,4',5,5')		0.00003
PCB-189 (2,3,3',4,4',5,5')		0.00003

Attachment 1 - Table 5

Dioxin and Coplanar PCB Toxicity Equivalent Factors for Humans

Chemical	Chemical Synonym	WHO 2005 TEF [a] (unitless)

Notes:
PCB - Polychlorinated biphenyl
TEF - toxic equivalency factor
WHO - World Health Organization

[a] Toxic equivalency factors relative to 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) were developed for evaluation of dioxins, furans, and dioxin-like polychlorinated biphenyls by the World Heath Organization, and are published in van den Berg, et al (2006).

Attachment 1 - Table 6

Parameters and Equations Used to Calculate the Soil Volitilization Factor (VF)

Parameter	Units	Variable Name	Value	Source
Inversion of the Ratio of the Mean Air Concentration to the Volatilization Flux	(g/m^2-s per kg/m^3)	Q/Cvol	45.9	Site-Specific Value Calculated; see below
Constant A	(unitless)	A	11.9110	Constants for Los Angeles in USEPA 2002
Constant B	(unitless)	B	18.4385	
Constant C	(unitless)	C	209.7845	
Site area	(acre)	Asite	5	USEPA 2002
Apparent Diffusivity	(cm^3/sec)	D_A	chemical-specific	Calculated; see below
Exposure interval	(sec)	T	9.50E+08	USEPA 2002
Dry soil bulk density	(g/cm^3)	ρb	1.5	USEPA 2002
Air-filled soil porosity	(Lair/Lsoil)	theta_a	0.28	USEPA 2002
Diffusivity in air	(cm^2/s)	Di	chemical-specific	USEPA 2002
Diffusivity in water	(cm^2/s)	Dw	chemical-specific	RAIS 2010
Dimensionless Henry's law constant	(unitless)	H'	chemical-specific	Various (Refer to Attachment 1 - Table 3)
Water-filled soil porosity	(Lwater/Lsoil)	theta_w	0.15	USEPA 2002
Total soil porosity	(Lpore/Lsoil)	n	0.43	USEPA 2002
Soil particle density	(g/cm^3)	ρs	2.65	USEPA 2002
Soil-water partition coefficient	(cm^3/g)	Kd	chemical-specific	Various (Refer to Attachment 1 - Table 3)
Fraction organic carbon in soil	(g/g)	foc	0.006	USEPA 2002

Equations:

$$VF = Q/C_{vol} \times \frac{(3.14 \times D_A \times T)^{1/2} \times 10^{-4} m^2/cm^2}{2 \times \rho_b \times D_A}$$

where:

$$Q/C_{vol} = A \times \exp\left[\frac{(\ln A_{site} - B)^2}{C}\right]$$; and

$$D_A = \frac{(\phi_a^{10/3} \times D_i \times H' + \phi_w^{10/3} \times D_w)/n^2}{\rho_b \times K_d + \phi_w + \phi_a \times H'}$$

Attachment 1 - Table 7

Direct Soil Contact Pathway-Specific Suburban Residential Risk-Based Screening Levels

			Soil Ingestion ($RBSL_{so_ing}$)		Soil Dermal Contact ($RBSL_{so_der}$)		Inhalation of Dust/Vapors ($RBSL_{so_inh}$)	
			Composite Resident Cancer (10^{-6})	Child Noncancer (HQ=1)	Composite Resident Cancer (10^{-6})	Child Noncancer (HQ=1)	Composite Resident Cancer (10^{-6})	Child Noncancer (HQ=1)
Analyte	**CAS #**	**Analyte Synonyms [a]**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**
Inorganic Compounds								
Aluminum	7429905	Aluminum, Total	NC	7.8E+04	NC	2.8E+06	NC	7.1E+06
Antimony	7440360	Antimony, Total	NC	3.1E+01	NC	1.7E+02	NC	2.0E+06
Arsenic	7440382	Arsenic, Total	7.2E-02	2.3E+01	7.6E-01	2.8E+02	1.1E+03	2.1E+04
Barium	7440393	Barium, Total	NC	1.6E+04	NC	3.9E+04	NC	7.1E+05
Beryllium	7440417	Beryllium, Total	NC	1.6E+02	NC	3.9E+01	1.5E+03	9.9E+03
Boron	7440428	Boron, Total	NC	1.6E+04	NC	5.6E+05	NC	2.8E+07
Cadmium	7440439	Cadmium, Total	NC	NC	NC	NC	8.4E+02	NC
Chromium	7440473	Chromium, Total	NC	1.2E+05	NC	5.4E+04	NC	7.4E+09
Cobalt	7440484	Cobalt, Total	NC	2.3E+01	NC	8.4E+02	3.9E+02	8.5E+03
Copper	7440508	Copper, Total	NC	3.1E+03	NC	1.1E+05	NC	1.4E+08
Cyanides	57125	Cyanide, Total; Cyanide	NC	4.7E+01	NC	1.7E+03	NC	1.1E+06
Fluoride	16984488	-	NC	3.1E+03	NC	1.1E+05	NC	1.8E+07
Hexavalent chromium	18540299	Chromium, Hexavalent; Chromium VI	1.4E+00	2.3E+02	NC	NC	2.4E+01	2.8E+05
Lead	7439921	Lead, Total	NC	NC	NC	NC	NC	NC
Lithium	7439932	Lithium, Total	NC	1.6E+02	NC	5.6E+03	NC	9.9E+06
Manganese	7439965	Manganese, Total	NC	1.1E+04	NC	1.6E+04	NC	1.3E+05
Mercury	7439976	Mercury, Total	NC	2.3E+01	NC	5.9E+01	NC	4.3E+04
Methyl Mercury	22967926	-	NC	7.8E+00	NC	2.8E+02	NC	5.0E+05
Molybdenum	7439987	Molybdenum, Total	NC	3.9E+02	NC	1.4E+04	NC	2.5E+07
Nickel	7440020	Nickel, Total	NC	1.6E+03	NC	2.2E+03	1.4E+04	7.1E+04
Selenium	7782492	Selenium, Total	NC	3.9E+02	NC	1.4E+04	NC	2.8E+07
Silver	7440224	Silver, Total	NC	3.9E+02	NC	5.6E+02	NC	2.5E+07
Strontium	7440246	Strontium, Total	NC	4.7E+04	NC	1.7E+06	NC	3.0E+09
Thallium	7440280	Thallium, Total	NC	7.8E-01	NC	2.8E+01	NC	5.0E+04
Tin	7440315	Tin, Total	NC	4.7E+04	NC	1.7E+06	NC	3.0E+09
Vanadium	7440622	Vanadium, Total	NC	3.9E+02	NC	3.6E+02	NC	1.4E+05
Zinc	7440666	Zinc, Total	NC	2.3E+04	NC	8.4E+05	NC	1.5E+09
Zirconium	7440677	Zirconium, Total	NC	6.3E+00	NC	2.2E+02	NC	4.0E+05
Energetic Constituents								
1,2-Dinitrobenzene	528290	o-Dinitrobenzene	NC	7.8E+00	NC	2.8E+01	NC	5.0E+05

Attachment 1 - Table 7

Direct Soil Contact Pathway-Specific Suburban Residential Risk-Based Screening Levels

			Soil Ingestion ($RBSL_{so_ing}$)		Soil Dermal Contact ($RBSL_{so_der}$)		Inhalation of Dust/Vapors ($RBSL_{so_inh}$)	
			Composite Resident Cancer (10^{-6})	Child Noncancer (HQ=1)	Composite Resident Cancer (10^{-6})	Child Noncancer (HQ=1)	Composite Resident Cancer (10^{-6})	Child Noncancer (HQ=1)
Analyte	**CAS #**	**Analyte Synonyms [a]**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**
1,3-Dinitrobenzene	99650	m-Dinitrobenzene	NC	7.8E+00	NC	2.8E+01	NC	5.0E+05
2,4,6-Trinitrotoluene	118967	-	2.3E+01	3.9E+01	2.3E+02	4.4E+02	4.1E+05	2.5E+06
2-Amino-4,6-dinitrotoluene	35572782	-	NC	1.6E+02	NC	9.3E+03	NC	9.9E+06
HMX	2691410	-	NC	3.9E+03	NC	2.3E+05	NC	2.5E+08
Hydrazine	302012	-	2.3E-01	NC	7.2E-01	NC	7.2E+02	4.3E+04
RDX	121824	Hexahydro-1,3,5-trinitro-1,3,5-triazine	6.2E+00	2.3E+02	1.3E+02	5.6E+03	1.1E+05	1.5E+07
Perchlorate	14797730	-	NC	5.5E+01	NC	2.0E+03	NC	3.5E+06
Volatile Organic Compounds								
1,1,1,2-Tetrachloroethane	630206	-	2.6E+01	2.3E+03	NC	NC	3.2E+00	1.0E+03
1,1,1-Trichloroethane	71556	-	NC	1.6E+05	NC	NC	NC	6.0E+03
1,1,2,2-Tetrachloroethane	79345	-	2.5E+00	1.6E+03	NC	NC	3.3E-01	5.3E+02
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	Freon 113	NC	2.3E+06	NC	NC	NC	2.9E+04
1,1,2-Trichloroethane	79005	-	9.5E+00	3.1E+02	NC	NC	5.6E-01	7.2E-01
1,1-Dichloroethane	75343	-	1.2E+02	1.6E+04	NC	NC	1.9E+00	8.6E+02
1,1-Dichloroethene	75354	-	NC	3.9E+03	NC	NC	NC	5.7E+01
1,1-Dimethylhydrazine	57147	Unsymetrical Dimethyl Hydrazine	NC	7.8E+00	NC	NC	NC	2.8E+03
1,2,3-Trichlorobenzene	87616	-	1.9E+02	6.3E+01	NC	NC	9.0E+01	1.0E+02
1,2,4-Trichlorobenzene	120821	-	1.9E+02	7.8E+02	NC	NC	3.7E+01	3.0E+01
1,2,4-Trimethylbenzene	95636	-	NC	7.8E+02	NC	NC	NC	4.2E+01
1,2-Dibromo-3-chloropropane	96128	1,2-Dibromo-3-CPA	9.8E-02	1.6E+01	NC	NC	1.8E+03	2.8E+05
1,2-Dibromoethane	106934	1,2-Dibromoethane (EDB)	1.9E-01	7.0E+02	NC	NC	2.3E-01	5.9E+01
1,2-Dichlorobenzene	95501	o-Dichlorobenzene	NC	7.0E+03	NC	NC	NC	2.2E+03
1,2-Dichloroethane	107062	-	1.5E+01	4.7E+02	NC	NC	2.7E-01	1.6E+01
1,2-Dichloroethene	540590	1,2-Dichloroethenes	NC	7.0E+02	NC	NC	NC	1.1E+02
1,2-Dichloropropane	78875	-	1.9E+01	7.0E+03	NC	NC	4.5E-01	7.2E+00
1,3,5-Trimethylbenzene	108678	-	NC	7.8E+02	NC	NC	NC	2.3E+02
1,3-Dichlorobenzene	541731	m-Dichlorobenzene	NC	2.3E+03	NC	NC	NC	1.5E+03
1,4-Dichlorobenzene	106467	p-Dichlorobenzene	1.3E+02	5.5E+03	NC	NC	1.3E+00	4.7E+03
2-Chloroethylvinyl ether	110758	2-Chloroethyl vinyl ether	2.7E-01	NC	NC	NC	4.3E-03	NC

Attachment 1 - Table 7

Direct Soil Contact Pathway-Specific Suburban Residential Risk-Based Screening Levels

			Soil Ingestion ($RBSL_{so_ing}$)		Soil Dermal Contact ($RBSL_{so_der}$)		Inhalation of Dust/Vapors ($RBSL_{so_inh}$)	
			Composite Resident Cancer (10^{-6})	Child Noncancer (HQ=1)	Composite Resident Cancer (10^{-6})	Child Noncancer (HQ=1)	Composite Resident Cancer (10^{-6})	Child Noncancer (HQ=1)
Analyte	CAS #	Analyte Synonyms [a]	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
2-Hexanone	591786	Methyl butyl ketone	NC	3.9E+02	NC	NC	NC	3.0E+02
Acetone	67641	-	NC	7.0E+04	NC	NC	NC	4.1E+05
Benzene	71432	-	6.8E+00	3.1E+02	NC	NC	1.2E-01	4.1E+01
Bromobenzene	108861	-	NC	6.3E+02	NC	NC	NC	3.8E+02
Bromodichloromethane	75274	-	5.3E+00	1.6E+03	NC	NC	2.0E-01	2.1E+02
Bromoform	75252	-	6.2E+01	1.6E+03	NC	NC	3.2E+06	9.9E+07
Bromomethane	74839	-	NC	1.1E+02	NC	NC	NC	5.4E+00
Carbon disulfide	75150	-	NC	7.8E+03	NC	NC	NC	5.8E+02
Carbon tetrachloride	56235	-	4.6E+00	3.1E+02	NC	NC	7.2E-02	1.2E+02
Chlorobenzene	108907	Monochlorobenzene	NC	1.6E+03	NC	NC	NC	1.5E+02
Chloroform	67663	Trichloromethane	2.2E+01	7.8E+02	NC	NC	7.6E-01	4.8E+02
Chloromethane	74873	Methyl chloride	NC	1.1E+02	NC	NC	NC	7.7E+01
cis-1,2-Dichloroethene	156592	cis-1,2-Dichloroethylene	NC	1.6E+02	NC	NC	NC	9.8E+00
Cumene	98828	Isopropylbenzene	NC	7.8E+03	NC	NC	NC	1.9E+03
Dibromochloromethane	124481	-	7.3E+00	1.6E+03	NC	NC	1.3E+05	9.9E+07
Dibromomethane	74953	-	NC	7.8E+02	NC	NC	NC	2.3E+01
Dichlorodifluoromethane	75718	Freon 12	NC	1.6E+04	NC	NC	NC	6.7E+01
Ethylbenzene	100414	-	6.2E+01	7.8E+03	NC	NC	2.4E+00	4.8E+03
Methyl ethyl ketone	78933	2-Butanone; 2-Butanone (MEK)	NC	4.7E+04	NC	NC	NC	4.6E+04
Methyl isobutyl ketone (MIBK)	108101	MIBK; 4-Methyl-2-pentanone	NC	6.3E+03	NC	NC	NC	2.4E+04
Methylene chloride	75092	Dichloromethane	4.9E+01	4.7E+02	NC	NC	3.2E+00	7.6E+02
Monomethylhydrazine	60344	Monomethyl Hydrazine	1.2E-03	7.8E+01	NC	NC	3.5E+03	2.8E+04
m-Xylene & p-Xylene	136777612	meta- and para-Xylenes; m, p-Xylene	NC	1.6E+04	NC	NC	NC	4.4E+02
n-Butylbenzene	104518	-	NC	3.9E+03	NC	NC	NC	1.1E+03
n-Propylbenzene	103651	-	NC	7.8E+03	NC	NC	NC	5.3E+03
o-Chlorotoluene	95498	2-Chlorotoluene	NC	1.6E+03	NC	NC	NC	4.3E+02
o-Xylene	95476	-	NC	1.6E+04	NC	NC	NC	2.9E+02
p-Chlorotoluene	106434	4-Chlorotoluene	NC	1.6E+03	NC	NC	NC	3.9E+02
p-Cymene	99876	p-Isopropyltoluene	NC	7.8E+03	NC	NC	NC	2.6E+03
p-Nitroaniline	100016	4-Nitroaniline	3.4E+01	3.1E+02	NC	NC	6.2E+05	8.5E+06

Attachment 1 - Table 7

Direct Soil Contact Pathway-Specific Suburban Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Soil Ingestion ($RBSL_{so_ing}$) Composite Resident Cancer (10^{-6}) (mg/kg)	Soil Ingestion ($RBSL_{so_ing}$) Child Noncancer (HQ=1) (mg/kg)	Soil Dermal Contact ($RBSL_{so_der}$) Composite Resident Cancer (10^{-6}) (mg/kg)	Soil Dermal Contact ($RBSL_{so_der}$) Child Noncancer (HQ=1) (mg/kg)	Inhalation of Dust/Vapors ($RBSL_{so_inh}$) Composite Resident Cancer (10^{-6}) (mg/kg)	Inhalation of Dust/Vapors ($RBSL_{so_inh}$) Child Noncancer (HQ=1) (mg/kg)
sec-Butylbenzene	135988	-	NC	7.8E+03	NC	NC	NC	2.2E+03
Styrene	100425	Vinylbenzene	NC	1.6E+04	NC	NC	NC	4.2E+04
tert-Butylbenzene	98066	Dibenzo[b,e][1,4]dioxin, octachloro-	NC	7.8E+03	NC	NC	NC	2.2E+03
Tetrachloroethene	127184	-	1.3E+00	4.7E+02	NC	NC	6.2E-01	5.8E+01
Tetralin	119642	-	NC	1.6E+03	NC	NC	8.3E+00	3.4E+02
Toluene	108883	Toluol	NC	6.3E+03	NC	NC	NC	9.3E+03
trans-1,2-Dichloroethene	156605	-	NC	1.6E+03	NC	NC	NC	9.0E+01
Trichloroethene	79016	Trichloroethylene (TCE)	1.5E+01	3.9E+01	NC	NC	8.4E-01	3.2E+00
Trichlorofluoromethane	75694	-	NC	2.3E+04	NC	NC	NC	5.4E+02
Vinyl chloride	75014	-	2.5E+00	2.3E+02	NC	NC	2.1E-02	6.4E+01
Xylenes, Total	1330207	Xylene (Total) Isomers	NC	1.6E+04	NC	NC	NC	4.4E+02
Semi-Volatile Organic Compounds								
1,4-Dioxane	123911	-	2.5E+01	2.3E+03	8.0E+01	8.4E+03	4.6E+05	4.3E+07
2,4,5-Trichlorophenol	95954	-	NC	7.8E+03	NC	2.8E+04	NC	5.0E+08
2,4,6-Trichlorophenol	88062	-	9.8E+00	7.8E+01	3.1E+01	2.8E+02	1.8E+05	5.0E+06
2,4-Dimethylphenol	105679	-	NC	1.6E+03	NC	5.6E+03	NC	9.9E+07
3,5-Dimethylphenol	108689	-	NC	5.6E+02	NC	2.0E+03	NC	3.6E+07
Benzoic acid	65850	-	NC	3.1E+05	NC	1.1E+06	NC	2.0E+10
Benzyl alcohol	100516	-	NC	7.8E+03	NC	2.8E+04	NC	5.0E+08
bis(2-Ethylhexyl) phthalate	117817	bis(2-ethylhexyl)phthalate	2.3E+02	1.6E+03	7.2E+02	5.6E+03	1.5E+06	9.9E+07
Butyl benzyl phthalate	85687	-	3.6E+02	1.6E+04	1.1E+03	5.6E+04	6.5E+06	9.9E+08
Carbazole	86748	-	3.4E+01	NC	1.1E+02	NC	6.2E+05	NC
Dibenzofuran	132649	-	NC	7.8E+01	NC	2.8E+02	NC	5.2E+02
Diethyl phthalate	84662	-	NC	6.3E+04	NC	2.2E+05	NC	4.0E+09
Dimethyl phthalate	131113	-	NC	6.3E+04	NC	2.2E+05	NC	4.0E+09
Di-n-butyl phthalate	84742	Di-n-butylphthalate	NC	7.8E+03	NC	2.8E+04	NC	5.0E+08
Di-n-octyl phthalate	117840	Di-n-octyl-phthalate	NC	7.8E+02	NC	2.8E+03	NC	5.0E+07
Formaldehyde	50000	-	NC	1.6E+04	NC	5.6E+04	5.9E+05	1.3E+07
Hexachlorobutadiene	87683	-	8.8E+00	7.8E+01	2.8E+01	2.8E+02	1.6E+05	5.0E+06
m-Cresol	108394	3-Methylphenol	NC	3.9E+03	NC	1.4E+04	NC	8.5E+08
N-Nitrosodimethylamine	62759	Nitrosodimethylamine	4.3E-02	6.3E-01	1.4E-01	2.2E+00	7.7E+02	5.7E+04

Attachment 1 - Table 7

Direct Soil Contact Pathway-Specific Suburban Residential Risk-Based Screening Levels

			Soil Ingestion ($RBSL_{so_ing}$)		Soil Dermal Contact ($RBSL_{so_der}$)		Inhalation of Dust/Vapors ($RBSL_{so_inh}$)	
Analyte	**CAS #**	**Analyte Synonyms [a]**	**Composite Resident Cancer (10^{-6}) (mg/kg)**	**Child Noncancer (HQ=1) (mg/kg)**	**Composite Resident Cancer (10^{-6}) (mg/kg)**	**Child Noncancer (HQ=1) (mg/kg)**	**Composite Resident Cancer (10^{-6}) (mg/kg)**	**Child Noncancer (HQ=1) (mg/kg)**
N-Nitrosodiphenylamine	86306	-	7.6E+01	NC	2.4E+02	NC	1.4E+06	NC
o-Cresol	95487	2-Methylphenol	NC	3.9E+03	NC	1.4E+04	NC	8.5E+08
p-Chloro-m-cresol	59507	4-Chloro-3-Methylphenol	NC	7.8E+03	NC	2.8E+04	NC	5.0E+08
p-Cresol	106445	4-Methylphenol	NC	7.8E+03	NC	2.8E+04	NC	8.5E+08
Pentachlorophenol	87865	PCP	3.8E+01	3.9E+02	4.8E+01	5.6E+02	7.0E+05	2.5E+07
Phenol	108952	Total Phenols	NC	2.3E+04	NC	8.4E+04	NC	2.8E+08
Polynuclear Aromatic Hydrocarbons								
1-Methyl naphthalene	90120	1-Methylnaphthalene	2.4E+01	5.5E+03	5.0E+01	1.3E+04	1.3E+01	1.1E+04
2-Methylnaphthalene	91576	Naphthalene, 2-methyl-	NC	3.1E+02	NC	7.4E+02	NC	6.1E+02
Acenaphthene	83329	-	NC	4.7E+03	NC	1.1E+04	NC	1.3E+05
Acenaphthylene	208968	-	NC	4.7E+03	NC	1.1E+04	NC	3.0E+04
Anthracene	120127	-	NC	2.3E+04	NC	5.6E+04	NC	2.8E+06
Benzo(a)anthracene	56553	Benz[a]anthracene	5.7E-01	NC	1.2E+00	NC	3.2E+04	NC
Benzo(a)pyrene	50328	Benzo (a) pyrene	5.7E-02	NC	1.2E-01	NC	3.2E+03	NC
Benzo(b)fluoranthene	205992	Benz[e]acephenanthrylene 1	5.7E-01	NC	1.2E+00	NC	3.2E+04	NC
Benzo(e)pyrene	192972	-	NC	2.3E+03	NC	5.6E+03	NC	1.5E+08
Benzo(ghi)perylene	191242	Benzo (g,h,i) perylene	NC	2.3E+03	NC	5.6E+03	NC	1.5E+08
Benzo(k)fluoranthene	207089	Benzo[k]fluoranthene	5.7E-01	NC	1.2E+00	NC	3.2E+04	NC
Chrysene	218019	-	5.7E+00	NC	1.2E+01	NC	3.2E+05	NC
Dibenzo(a,h)anthracene	53703	Dibenz (a,h) anthracene	1.7E-01	NC	3.5E-01	NC	3.0E+03	NC
Fluoranthene	206440	-	NC	3.1E+03	NC	7.4E+03	NC	2.0E+08
Fluorene	86737	-	NC	3.1E+03	NC	7.4E+03	NC	1.8E+05
Indeno(1,2,3-cd)pyrene	193395	Indeno (1,2,3-cd) pyrene	5.7E-01	NC	1.2E+00	NC	3.2E+04	NC
Naphthalene	91203	-	NC	1.6E+03	NC	3.7E+03	1.5E+01	1.8E+03
Perylene	198550	-	NC	2.3E+03	NC	5.6E+03	NC	1.5E+08
Phenanthrene	85018	-	NC	2.3E+04	NC	5.6E+04	NC	3.1E+06
Pyrene	129000	-	NC	2.3E+03	NC	5.6E+03	NC	1.5E+08
Pesticides								
4,4'-DDD	72548	p,p'-DDD	2.9E+00	NC	1.8E+01	NC	5.1E+04	NC
4,4'-DDE	72559	p,p'-DDE	2.0E+00	NC	1.3E+01	NC	3.7E+04	NC

Attachment 1 - Table 7

Direct Soil Contact Pathway-Specific Suburban Residential Risk-Based Screening Levels

			Soil Ingestion ($RBSL_{so_ing}$)		Soil Dermal Contact ($RBSL_{so_der}$)		Inhalation of Dust/Vapors ($RBSL_{so_inh}$)	
			Composite Resident	Child	Composite Resident	Child	Composite Resident	Child
			Cancer (10^{-6})	Noncancer (HQ=1)	Cancer (10^{-6})	Noncancer (HQ=1)	Cancer (10^{-6})	Noncancer (HQ=1)
Analyte	**CAS #**	**Analyte Synonyms [a]**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**
4,4'-DDT	50293	p,p'-DDT	2.0E+00	3.9E+01	1.3E+01	2.8E+02	3.7E+04	2.5E+06
Aldrin	309002	-	4.0E-02	2.3E+00	2.6E-01	1.7E+01	7.2E+02	1.5E+05
alpha-BHC	319846	a-Benzene Hexachloride	2.5E-01	6.3E+02	1.6E+00	4.5E+03	4.6E+03	4.0E+07
beta-BHC	319857	b-Benzene Hexachloride	4.6E-01	NC	2.9E+00	NC	8.2E+03	NC
delta-BHC	319868	d-Benzene Hexachloride	3.8E-01	2.3E+01	2.4E+00	1.7E+02	7.1E+03	1.5E+06
Chlordane (Technical)	12789036	-	2.0E+00	3.9E+01	1.2E+01	2.8E+02	3.5E+04	9.9E+05
Dieldrin	60571	-	4.3E-02	3.9E+00	2.7E-01	2.8E+01	7.7E+02	2.5E+05
Endosulfan I	959988	-	NC	4.7E+02	NC	3.4E+03	NC	3.0E+07
Endosulfan II	33213659	-	NC	4.7E+02	NC	3.4E+03	NC	3.0E+07
Endosulfan sulfate	1031078	-	NC	4.7E+02	NC	3.4E+03	NC	3.0E+07
Endrin	72208	-	NC	2.3E+01	NC	1.7E+02	NC	1.5E+06
Endrin aldehyde	7421934	-	NC	2.3E+01	NC	1.7E+02	NC	1.5E+06
Endrin ketone	53494705	-	NC	2.3E+01	NC	1.7E+02	NC	1.5E+06
gamma-BHC	58899	Lindane	6.2E-01	2.3E+01	3.9E+00	1.7E+02	1.1E+04	1.5E+06
Heptachlor	76448	-	1.7E-01	3.9E+01	1.1E+00	2.8E+02	3.0E+03	2.5E+06
Heptachlor epoxide	1024573	-	1.2E-01	1.0E+00	7.9E-01	7.3E+00	6.9E+02	6.5E+04
MCPA	94746	-	NC	3.9E+01	NC	2.8E+02	NC	2.5E+06
Mirex	2385855	Mirex (DeChlorane)	3.8E-02	1.6E+01	2.4E-01	1.1E+02	7.0E+02	9.9E+05
p,p'-Methoxychlor	72435	Methoxychlor	NC	3.9E+02	NC	2.8E+03	NC	2.5E+07
Toxaphene	8001352	-	5.7E-01	NC	3.6E+00	NC	1.0E+04	NC
Herbicides								
2,4,5-T	93765	2,4,5-Trichlorophenoxyacetic acid	NC	7.8E+02	NC	5.6E+03	NC	5.0E+07
2,4,5-TP (Silvex)	93721	-	NC	6.3E+02	NC	4.5E+03	NC	4.0E+07
2,4-Dichlorophenoxyacetic Acid (2,4-D)	94757	-	NC	7.8E+02	NC	5.6E+03	NC	5.0E+07
2,4-Dichlorophenoxybutyric acid	94826	2,4-DB	NC	6.3E+02	NC	4.5E+03	NC	4.0E+07
Dalapon	75990	-	NC	2.3E+03	NC	1.7E+04	NC	1.5E+08
Dicamba	1918009	-	NC	2.3E+03	NC	1.7E+04	NC	1.5E+08
2,4-DP (Dichlorprop)	120365	-	NC	7.8E+02	NC	5.6E+03	NC	5.0E+07
Dinoseb	88857	-	NC	7.8E+01	NC	5.6E+02	NC	5.0E+06
MCPP	93652	-	NC	7.8E+01	NC	5.6E+02	NC	5.0E+06

Attachment 1 - Table 7

Direct Soil Contact Pathway-Specific Suburban Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Soil Ingestion ($RBSL_{so_ing}$) Composite Resident Cancer (10^{-6}) (mg/kg)	Soil Ingestion ($RBSL_{so_ing}$) Child Noncancer (HQ=1) (mg/kg)	Soil Dermal Contact ($RBSL_{so_der}$) Composite Resident Cancer (10^{-6}) (mg/kg)	Soil Dermal Contact ($RBSL_{so_der}$) Child Noncancer (HQ=1) (mg/kg)	Inhalation of Dust/Vapors ($RBSL_{so_inh}$) Composite Resident Cancer (10^{-6}) (mg/kg)	Inhalation of Dust/Vapors ($RBSL_{so_inh}$) Child Noncancer (HQ=1) (mg/kg)
Terphenyls								
m-Terphenyl	92068	-	8.6E+01	3.9E+04	2.7E+02	1.4E+05	1.6E+06	5.7E+05
o-Terphenyl	84151	-	8.6E+01	3.9E+04	2.7E+02	1.4E+05	1.6E+06	5.7E+05
p-Terphenyl	92944	-	8.6E+01	3.9E+04	2.7E+02	1.4E+05	1.6E+06	5.7E+05
Glycols								
Diethylene Glycol	111466	-	NC	7.8E+03	NC	2.8E+04	NC	2.3E+09
Triethylene glycol	112276	-	NC	3.5E+03	NC	1.3E+04	NC	2.2E+08
PCDD/PCDFs								
2,3,7,8-TCDD TEQ	1746016-TEQ	-	5.3E-06	5.5E-05	5.6E-05	6.5E-04	9.3E-02	5.7E+01
Polychlorinated Biphenyls (PCBs)								
Aroclor 1016	12674112	-	9.8E+00	5.5E+00	2.1E+01	1.3E+01	1.8E+05	3.5E+05
Aroclor 1242	53469219	Aroclor-1242	3.4E-01	1.6E+00	7.2E-01	3.7E+00	6.2E+03	9.9E+04
Aroclor 1248	12672296	-	3.4E-01	1.6E+00	7.2E-01	3.7E+00	6.2E+03	9.9E+04
Aroclor 1254	11097691	-	3.4E-01	1.6E+00	7.2E-01	3.7E+00	6.2E+03	9.9E+04
Aroclor 1260	11096825	-	3.4E-01	1.6E+00	7.2E-01	3.7E+00	6.2E+03	9.9E+04
Aroclor 5460	11126424	-	3.4E-01	1.6E+00	7.2E-01	3.7E+00	6.2E+03	9.9E+04
PCB TEQ	1746016-PCB TEQ	-	5.3E-06	5.5E-05	1.1E-05	1.3E-04	9.3E-02	5.7E+01

Notes:

'-' - none established/not applicable.
HQ - hazard quotient
mg/kg - milligrams per kilogram
NC - not calculated
PCB - polychlorinated biphenyl
PCDD/PCDF - polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans
RBSL - Risk-Based Screening Level
TCDD - 2,3,7,8-Tetrachlorodibenzo-p-dioxin

Attachment 1 - Table 7

Direct Soil Contact Pathway-Specific Suburban Residential Risk-Based Screening Levels

			Soil Ingestion ($RBSL_{so_ing}$)		Soil Dermal Contact ($RBSL_{so_der}$)		Inhalation of Dust/Vapors ($RBSL_{so_inh}$)	
			Composite Resident	Child	Composite Resident	Child	Composite Resident	Child
Analyte	CAS #	Analyte Synonyms [a]	Cancer (10^{-6}) (mg/kg)	Noncancer (HQ=1) (mg/kg)	Cancer (10^{-6}) (mg/kg)	Noncancer (HQ=1) (mg/kg)	Cancer (10^{-6}) (mg/kg)	Noncancer (HQ=1) (mg/kg)

TEQ - toxic equivalency

a - Please note that different chemical names have been used for different programs at the SSFL, and there can be additional analyte synonyms than those presented. Therefore, any chemical synonym should be verified using the CAS number listed.

Attachment 1- Table 8

Direct Soil Contact Pathway-Specific 40-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Soil Ingestion ($RBSL_{so_ing}$) Composite Farmer Cancer (10^{-6}) (mg/kg)	Soil Ingestion ($RBSL_{so_ing}$) Child Noncancer (HQ=1) (mg/kg)	Soil Dermal Contact ($RBSL_{so_der}$) Composite Farmer Cancer (10^{-6}) (mg/kg)	Soil Dermal Contact ($RBSL_{so_der}$) Child Noncancer (HQ=1) (mg/kg)	Inhalation of Dust/Vapors ($RBSL_{so_inh}$) Composite Farmer Cancer (10^{-6}) (mg/kg)	Inhalation of Dust/Vapors ($RBSL_{so_inh}$) Child Noncancer (HQ=1) (mg/kg)
Inorganic Compounds								
Aluminum	7429905	Aluminum, Total	NC	7.8E+04	NC	2.8E+06	NC	7.1E+06
Antimony	7440360	Antimony, Total	NC	3.1E+01	NC	1.7E+02	NC	2.0E+06
Arsenic	7440382	Arsenic, Total	6.0E-02	2.3E+01	5.1E-01	2.8E+02	7.5E+02	2.1E+04
Barium	7440393	Barium, Total	NC	1.6E+04	NC	3.9E+04	NC	7.1E+05
Beryllium	7440417	Beryllium, Total	NC	1.6E+02	NC	3.9E+01	1.0E+03	9.9E+03
Boron	7440428	Boron, Total	NC	1.6E+04	NC	5.6E+05	NC	2.8E+07
Cadmium	7440439	Cadmium, Total	NC	4.6E+00 [b]	NC	2.0E+01 [b]	5.9E+02	1.4E+04 [b]
Chromium	7440473	Chromium, Total	NC	1.2E+05	NC	5.4E+04	NC	7.4E+09
Cobalt	7440484	Cobalt, Total	NC	2.3E+01	NC	8.4E+02	2.8E+02	8.5E+03
Copper	7440508	Copper, Total	NC	3.1E+03	NC	1.1E+05	NC	1.4E+08
Cyanides	57125	Cyanide, Total; Cyanide	NC	4.7E+01	NC	1.7E+03	NC	1.1E+06
Fluoride	16984488	-	NC	3.1E+03	NC	1.1E+05	NC	1.8E+07
Hexavalent chromium	18540299	Chromium, Hexavalent; Chromium VI	1.1E+00	2.3E+02	NC	NC	1.7E+01	2.8E+05
Lead	7439921	Lead, Total	NC	NC	NC	NC	NC	NC
Lithium	7439932	Lithium, Total	NC	1.6E+02	NC	5.6E+03	NC	9.9E+06
Manganese	7439965	Manganese, Total	NC	1.1E+04	NC	1.6E+04	NC	1.3E+05
Mercury	7439976	Mercury, Total	NC	2.3E+01	NC	5.9E+01	NC	4.3E+04
Methyl Mercury	22967926	-	NC	7.8E+00	NC	2.8E+02	NC	5.0E+05
Molybdenum	7439987	Molybdenum, Total	NC	3.9E+02	NC	1.4E+04	NC	2.5E+07
Nickel	7440020	Nickel, Total	NC	1.6E+03	NC	2.2E+03	9.5E+03	7.1E+04
Selenium	7782492	Selenium, Total	NC	3.9E+02	NC	1.4E+04	NC	2.8E+07
Silver	7440224	Silver, Total	NC	3.9E+02	NC	5.6E+02	NC	2.5E+07
Strontium	7440246	Strontium, Total	NC	4.7E+04	NC	1.7E+06	NC	3.0E+09
Thallium	7440280	Thallium, Total	NC	7.8E-01	NC	2.8E+01	NC	5.0E+04
Tin	7440315	Tin, Total	NC	4.7E+04	NC	1.7E+06	NC	3.0E+09
Vanadium	7440622	Vanadium, Total	NC	3.9E+02	NC	3.6E+02	NC	1.4E+05
Zinc	7440666	Zinc, Total	NC	2.3E+04	NC	8.4E+05	NC	1.5E+09
Zirconium	7440677	Zirconium, Total	NC	6.3E+00	NC	2.2E+02	NC	4.0E+05
Energetic Constituents								
1,2-Dinitrobenzene	528290	o-Dinitrobenzene	NC	7.8E+00	NC	2.8E+01	NC	5.0E+05
1,3-Dinitrobenzene	99650	m-Dinitrobenzene	NC	7.8E+00	NC	2.8E+01	NC	5.0E+05
2,4,6-Trinitrotoluene	118967	-	1.9E+01	3.9E+01	1.5E+02	4.4E+02	2.9E+05	2.5E+06

Attachment 1- Table 8

Direct Soil Contact Pathway-Specific 40-year Rural Residential Risk-Based Screening Levels

			Soil Ingestion ($RBSL_{so_ing}$)		Soil Dermal Contact ($RBSL_{so_der}$)		Inhalation of Dust/Vapors ($RBSL_{so_inh}$)	
Analyte	**CAS #**	**Analyte Synonyms [a]**	**Composite Farmer Cancer (10^{-6}) (mg/kg)**	**Child Noncancer (HQ=1) (mg/kg)**	**Composite Farmer Cancer (10^{-6}) (mg/kg)**	**Child Noncancer (HQ=1) (mg/kg)**	**Composite Farmer Cancer (10^{-6}) (mg/kg)**	**Child Noncancer (HQ=1) (mg/kg)**
2-Amino-4,6-dinitrotoluene	35572782	-	NC	1.6E+02	NC	9.3E+03	NC	9.9E+06
HMX	2691410	-	NC	3.9E+03	NC	2.3E+05	NC	2.5E+08
Hydrazine	302012	-	1.9E-01	NC	4.9E-01	NC	5.1E+02	4.3E+04
RDX	121824	Hexahydro-1,3,5-trinitro-1,3,5-triazine	5.2E+00	2.3E+02	8.8E+01	5.6E+03	7.9E+04	1.5E+07
Perchlorate	14797730	-	NC	5.5E+01	NC	2.0E+03	NC	3.5E+06
Volatile Organic Compounds								
1,1,1,2-Tetrachloroethane	630206	-	2.2E+01	2.3E+03	NC	NC	2.3E+00	1.0E+03
1,1,1-Trichloroethane	71556	-	NC	1.6E+05	NC	NC	NC	6.0E+03
1,1,2,2-Tetrachloroethane	79345	-	2.1E+00	1.6E+03	NC	NC	2.3E-01	5.3E+02
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	Freon 113	NC	2.3E+06	NC	NC	NC	2.9E+04
1,1,2-Trichloroethane	79005	-	7.9E+00	3.1E+02	NC	NC	4.0E-01	7.2E-01
1,1-Dichloroethane	75343	-	1.0E+02	1.6E+04	NC	NC	1.3E+00	8.6E+02
1,1-Dichloroethene	75354	-	NC	3.9E+03	NC	NC	NC	5.7E+01
1,1-Dimethylhydrazine	57147	Unsymetrical Dimethyl Hydrazine	NC	7.8E+00	NC	NC	NC	2.8E+03
1,2,3-Trichlorobenzene	87616	-	1.6E+02	6.3E+01	NC	NC	6.3E+01	1.0E+02
1,2,4-Trichlorobenzene	120821	-	1.6E+02	7.8E+02	NC	NC	2.6E+01	3.0E+01
1,2,4-Trimethylbenzene	95636	-	NC	7.8E+02	NC	NC	NC	4.2E+01
1,2-Dibromo-3-chloropropane	96128	1,2-Dibromo-3-CPA	8.1E-02	1.6E+01	NC	NC	1.2E+03	2.8E+05
1,2-Dibromoethane	106934	1,2-Dibromoethane (EDB)	1.6E-01	7.0E+02	NC	NC	1.6E-01	5.9E+01
1,2-Dichlorobenzene	95501	o-Dichlorobenzene	NC	7.0E+03	NC	NC	NC	2.2E+03
1,2-Dichloroethane	107062	-	1.2E+01	4.7E+02	NC	NC	1.9E-01	1.6E+01
1,2-Dichloroethene	540590	1,2-Dichloroethenes	NC	7.0E+02	NC	NC	NC	1.1E+02
1,2-Dichloropropane	78875	-	1.6E+01	7.0E+03	NC	NC	3.1E-01	7.2E+00
1,3,5-Trimethylbenzene	108678	-	NC	7.8E+02	NC	NC	NC	2.3E+02
1,3-Dichlorobenzene	541731	m-Dichlorobenzene	NC	2.3E+03	NC	NC	NC	1.5E+03
1,4-Dichlorobenzene	106467	p-Dichlorobenzene	1.1E+02	5.5E+03	NC	NC	9.4E-01	4.7E+03
2-Chloroethylvinyl ether	110758	2-Chloroethyl vinyl ether	2.3E-01	NC	NC	NC	3.0E-03	NC
2-Hexanone	591786	Methyl butyl ketone	NC	3.9E+02	NC	NC	NC	3.0E+02
Acetone	67641	-	NC	7.0E+04	NC	NC	NC	4.1E+05
Benzene	71432	-	5.7E+00	3.1E+02	NC	NC	8.2E-02	4.1E+01
Bromobenzene	108861	-	NC	6.3E+02	NC	NC	NC	3.8E+02
Bromodichloromethane	75274	-	4.4E+00	1.6E+03	NC	NC	1.4E-01	2.1E+02

Attachment 1- Table 8

Direct Soil Contact Pathway-Specific 40-year Rural Residential Risk-Based Screening Levels

			Soil Ingestion ($RBSL_{so_ing}$)		Soil Dermal Contact ($RBSL_{so_der}$)		Inhalation of Dust/Vapors ($RBSL_{so_inh}$)	
Analyte	CAS #	Analyte Synonyms [a]	Composite Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Composite Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Composite Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)
Bromoform	75252	-	5.2E+01	1.6E+03	NC	NC	2.3E+06	9.9E+07
Bromomethane	74839	-	NC	1.1E+02	NC	NC	NC	5.4E+00
Carbon disulfide	75150	-	NC	7.8E+03	NC	NC	NC	5.8E+02
Carbon tetrachloride	56235	-	3.8E+00	3.1E+02	NC	NC	5.1E-02	1.2E+02
Chlorobenzene	108907	Monochlorobenzene	NC	1.6E+03	NC	NC	NC	1.5E+02
Chloroform	67663	Trichloromethane	1.8E+01	7.8E+02	NC	NC	5.3E-01	4.8E+02
Chloromethane	74873	Methyl chloride	NC	1.1E+02	NC	NC	NC	7.7E+01
cis-1,2-Dichloroethene	156592	cis-1,2-Dichloroethylene	NC	1.6E+02	NC	NC	NC	9.8E+00
Cumene	98828	Isopropylbenzene	NC	7.8E+03	NC	NC	NC	1.9E+03
Dibromochloromethane	124481	-	6.0E+00	1.6E+03	NC	NC	9.2E+04	9.9E+07
Dibromomethane	74953	-	NC	7.8E+02	NC	NC	NC	2.3E+01
Dichlorodifluoromethane	75718	Freon 12	NC	1.6E+04	NC	NC	NC	6.7E+01
Ethylbenzene	100414	-	5.2E+01	7.8E+03	NC	NC	1.7E+00	4.8E+03
Methyl ethyl ketone	78933	2-Butanone; 2-Butanone (MEK)	NC	4.7E+04	NC	NC	NC	4.6E+04
Methyl isobutyl ketone (MIBK)	108101	MIBK; 4-Methyl-2-pentanone	NC	6.3E+03	NC	NC	NC	2.4E+04
Methylene chloride	75092	Dichloromethane	4.1E+01	4.7E+02	NC	NC	2.2E+00	7.6E+02
Monomethylhydrazine	60344	Monomethyl Hydrazine	1.0E-03	7.8E+01	NC	NC	2.5E+03	2.8E+04
m-Xylene & p-Xylene	136777612	meta- and para-Xylenes; m, p-Xylene	NC	1.6E+04	NC	NC	NC	4.4E+02
n-Butylbenzene	104518	-	NC	3.9E+03	NC	NC	NC	1.1E+03
n-Propylbenzene	103651	-	NC	7.8E+03	NC	NC	NC	5.3E+03
o-Chlorotoluene	95498	2-Chlorotoluene	NC	1.6E+03	NC	NC	NC	4.3E+02
o-Xylene	95476	-	NC	1.6E+04	NC	NC	NC	2.9E+02
p-Chlorotoluene	106434	4-Chlorotoluene	NC	1.6E+03	NC	NC	NC	3.9E+02
p-Cymene	99876	p-Isopropyltoluene	NC	7.8E+03	NC	NC	NC	2.6E+03
p-Nitroaniline	100016	4-Nitroaniline	2.8E+01	3.1E+02	NC	NC	4.3E+05	8.5E+06
sec-Butylbenzene	135988	-	NC	7.8E+03	NC	NC	NC	2.2E+03
Styrene	100425	Vinylbenzene	NC	1.6E+04	NC	NC	NC	4.2E+04
tert-Butylbenzene	98066	Dibenzo[b,e][1,4]dioxin, octachloro-	NC	7.8E+03	NC	NC	NC	2.2E+03
Tetrachloroethene	127184	-	1.1E+00	4.7E+02	NC	NC	4.3E-01	5.8E+01
Tetralin	119642	-	NC	1.6E+03	NC	NC	5.8E+00	3.4E+02
Toluene	108883	Toluol	NC	6.3E+03	NC	NC	NC	9.3E+03

Attachment 1- Table 8

Direct Soil Contact Pathway-Specific 40-year Rural Residential Risk-Based Screening Levels

			Soil Ingestion ($RBSL_{so_ing}$)		Soil Dermal Contact ($RBSL_{so_der}$)		Inhalation of Dust/Vapors ($RBSL_{so_inh}$)	
Analyte	**CAS #**	**Analyte Synonyms [a]**	**Composite Farmer Cancer (10^{-6}) (mg/kg)**	**Child Noncancer (HQ=1) (mg/kg)**	**Composite Farmer Cancer (10^{-6}) (mg/kg)**	**Child Noncancer (HQ=1) (mg/kg)**	**Composite Farmer Cancer (10^{-6}) (mg/kg)**	**Child Noncancer (HQ=1) (mg/kg)**
trans-1,2-Dichloroethene	156605	-	NC	1.6E+03	NC	NC	NC	9.0E+01
Trichloroethene	79016	Trichloroethylene (TCE)	1.2E+01	3.9E+01	NC	NC	5.9E-01	3.2E+00
Trichlorofluoromethane	75694	-	NC	2.3E+04	NC	NC	NC	5.4E+02
Vinyl chloride	75014	-	2.1E+00	2.3E+02	NC	NC	1.4E-02	6.4E+01
Xylenes, Total	1330207	Xylene (Total) Isomers	NC	1.6E+04	NC	NC	NC	4.4E+02
Semi-Volatile Organic Compounds								
1,4-Dioxane	123911	-	2.1E+01	2.3E+03	5.4E+01	8.4E+03	3.2E+05	4.3E+07
2,4,5-Trichlorophenol	95954	-	NC	7.8E+03	NC	2.8E+04	NC	5.0E+08
2,4,6-Trichlorophenol	88062	-	8.1E+00	7.8E+01	2.1E+01	2.8E+02	1.2E+05	5.0E+06
2,4-Dimethylphenol	105679	-	NC	1.6E+03	NC	5.6E+03	NC	9.9E+07
3,5-Dimethylphenol	108689	-	NC	5.6E+02	NC	2.0E+03	NC	3.6E+07
Benzoic acid	65850	-	NC	3.1E+05	NC	1.1E+06	NC	2.0E+10
Benzyl alcohol	100516	-	NC	7.8E+03	NC	2.8E+04	NC	5.0E+08
bis(2-Ethylhexyl) phthalate	117817	bis(2-ethylhexyl)phthalate	1.9E+02	1.6E+03	4.9E+02	5.6E+03	1.0E+06	9.9E+07
Butyl benzyl phthalate	85687	-	3.0E+02	1.6E+04	7.7E+02	5.6E+04	4.6E+06	9.9E+08
Carbazole	86748	-	2.8E+01	NC	7.3E+01	NC	4.3E+05	NC
Dibenzofuran	132649	-	NC	7.8E+01	NC	2.8E+02	NC	5.2E+02
Diethyl phthalate	84662	-	NC	6.3E+04	NC	2.2E+05	NC	4.0E+09
Dimethyl phthalate	131113	-	NC	6.3E+04	NC	2.2E+05	NC	4.0E+09
Di-n-butyl phthalate	84742	Di-n-butylphthalate	NC	7.8E+03	NC	2.8E+04	NC	5.0E+08
Di-n-octyl phthalate	117840	Di-n-octyl-phthalate	NC	7.8E+02	NC	2.8E+03	NC	5.0E+07
Formaldehyde	50000	-	NC	1.6E+04	NC	5.6E+04	4.1E+05	1.3E+07
Hexachlorobutadiene	87683	-	7.3E+00	7.8E+01	1.9E+01	2.8E+02	1.1E+05	5.0E+06
m-Cresol	108394	3-Methylphenol	NC	3.9E+03	NC	1.4E+04	NC	8.5E+08
N-Nitrosodimethylamine	62759	Nitrosodimethylamine	3.5E-02	6.3E-01	9.1E-02	2.2E+00	5.4E+02	5.7E+04
N-Nitrosodiphenylamine	86306	-	6.3E+01	NC	1.6E+02	NC	9.5E+05	NC
o-Cresol	95487	2-Methylphenol	NC	3.9E+03	NC	1.4E+04	NC	8.5E+08
p-Chloro-m-cresol	59507	4-Chloro-3-Methylphenol	NC	7.8E+03	NC	2.8E+04	NC	5.0E+08
p-Cresol	106445	4-Methylphenol	NC	7.8E+03	NC	2.8E+04	NC	8.5E+08
Pentachlorophenol	87865	PCP	3.2E+01	3.9E+02	3.2E+01	5.6E+02	4.9E+05	2.5E+07
Phenol	108952	Total Phenols	NC	2.3E+04	NC	8.4E+04	NC	2.8E+08
Polynuclear Aromatic Hydrocarbons								
1-Methyl naphthalene	90120	1-Methylnaphthalene	2.0E+01	5.5E+03	3.4E+01	1.3E+04	9.4E+00	1.1E+04

Attachment 1- Table 8

Direct Soil Contact Pathway-Specific 40-year Rural Residential Risk-Based Screening Levels

			Soil Ingestion ($RBSL_{so_ing}$)		Soil Dermal Contact ($RBSL_{so_der}$)		Inhalation of Dust/Vapors ($RBSL_{so_inh}$)	
Analyte	**CAS #**	**Analyte Synonyms [a]**	**Composite Farmer Cancer (10^{-6}) (mg/kg)**	**Child Noncancer (HQ=1) (mg/kg)**	**Composite Farmer Cancer (10^{-6}) (mg/kg)**	**Child Noncancer (HQ=1) (mg/kg)**	**Composite Farmer Cancer (10^{-6}) (mg/kg)**	**Child Noncancer (HQ=1) (mg/kg)**
2-Methylnaphthalene	91576	Naphthalene, 2-methyl-	NC	3.1E+02	NC	7.4E+02	NC	6.1E+02
Acenaphthene	83329	-	NC	4.7E+03	NC	1.1E+04	NC	1.3E+05
Acenaphthylene	208968	-	NC	4.7E+03	NC	1.1E+04	NC	3.0E+04
Anthracene	120127	-	NC	2.3E+04	NC	5.6E+04	NC	2.8E+06
Benzo(a)anthracene	56553	Benz[a]anthracene	4.7E-01	NC	8.1E-01	NC	2.3E+04	NC
Benzo(a)pyrene	50328	Benzo (a) pyrene	4.7E-02	NC	8.1E-02	NC	2.3E+03	NC
Benzo(b)fluoranthene	205992	Benz[e]acephenanthrylene 1	4.7E-01	NC	8.1E-01	NC	2.3E+04	NC
Benzo(e)pyrene	192972	-	NC	2.3E+03	NC	5.6E+03	NC	1.5E+08
Benzo(ghi)perylene	191242	Benzo (g,h,i) perylene	NC	2.3E+03	NC	5.6E+03	NC	1.5E+08
Benzo(k)fluoranthene	207089	Benzo[k]fluoranthene	4.7E-01	NC	8.1E-01	NC	2.3E+04	NC
Chrysene	218019	-	4.7E+00	NC	8.1E+00	NC	2.3E+05	NC
Dibenzo(a,h)anthracene	53703	Dibenz (a,h) anthracene	1.4E-01	NC	2.4E-01	NC	2.1E+03	NC
Fluoranthene	206440	-	NC	3.1E+03	NC	7.4E+03	NC	2.0E+08
Fluorene	86737	-	NC	3.1E+03	NC	7.4E+03	NC	1.8E+05
Indeno(1,2,3-cd)pyrene	193395	Indeno (1,2,3-cd) pyrene	4.7E-01	NC	8.1E-01	NC	2.3E+04	NC
Naphthalene	91203	-	NC	1.6E+03	NC	3.7E+03	1.0E+01	1.8E+03
Perylene	198550	-	NC	2.3E+03	NC	5.6E+03	NC	1.5E+08
Phenanthrene	85018	-	NC	2.3E+04	NC	5.6E+04	NC	3.1E+06
Pyrene	129000	-	NC	2.3E+03	NC	5.6E+03	NC	1.5E+08
Pesticides								
4,4'-DDD	72548	p,p'-DDD	2.4E+00	NC	1.2E+01	NC	3.6E+04	NC
4,4'-DDE	72559	p,p'-DDE	1.7E+00	NC	8.6E+00	NC	2.6E+04	NC
4,4'-DDT	50293	p,p'-DDT	1.7E+00	3.9E+01	8.6E+00	2.8E+02	2.6E+04	2.5E+06
Aldrin	309002	-	3.3E-02	2.3E+00	1.7E-01	1.7E+01	5.1E+02	1.5E+05
alpha-BHC	319846	a-Benzene Hexachloride	2.1E-01	6.3E+02	1.1E+00	4.5E+03	3.2E+03	4.0E+07
beta-BHC	319857	b-Benzene Hexachloride	3.8E-01	NC	1.9E+00	NC	5.8E+03	NC
delta-BHC	319868	d-Benzene Hexachloride	3.2E-01	2.3E+01	1.6E+00	1.7E+02	5.0E+03	1.5E+06
Chlordane (Technical)	12789036	-	1.6E+00	3.9E+01	8.3E+00	2.8E+02	2.5E+04	9.9E+05
Dieldrin	60571	-	3.5E-02	3.9E+00	1.8E-01	2.8E+01	5.4E+02	2.5E+05
Endosulfan I	959988	-	NC	4.7E+02	NC	3.4E+03	NC	3.0E+07
Endosulfan II	33213659	-	NC	4.7E+02	NC	3.4E+03	NC	3.0E+07
Endosulfan sulfate	1031078	-	NC	4.7E+02	NC	3.4E+03	NC	3.0E+07
Endrin	72208	-	NC	2.3E+01	NC	1.7E+02	NC	1.5E+06
Endrin aldehyde	7421934	-	NC	2.3E+01	NC	1.7E+02	NC	1.5E+06

Attachment 1- Table 8

Direct Soil Contact Pathway-Specific 40-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Soil Ingestion ($RBSL_{so_ing}$) Composite Farmer Cancer (10^{-6}) (mg/kg)	Soil Ingestion ($RBSL_{so_ing}$) Child Noncancer (HQ=1) (mg/kg)	Soil Dermal Contact ($RBSL_{so_der}$) Composite Farmer Cancer (10^{-6}) (mg/kg)	Soil Dermal Contact ($RBSL_{so_der}$) Child Noncancer (HQ=1) (mg/kg)	Inhalation of Dust/Vapors ($RBSL_{so_inh}$) Composite Farmer Cancer (10^{-6}) (mg/kg)	Inhalation of Dust/Vapors ($RBSL_{so_inh}$) Child Noncancer (HQ=1) (mg/kg)
Endrin ketone	53494705	-	NC	2.3E+01	NC	1.7E+02	NC	1.5E+06
gamma-BHC	58899	Lindane	5.2E-01	2.3E+01	2.7E+00	1.7E+02	8.0E+03	1.5E+06
Heptachlor	76448	-	1.4E-01	3.9E+01	7.1E-01	2.8E+02	2.1E+03	2.5E+06
Heptachlor epoxide	1024573	-	1.0E-01	1.0E+00	5.3E-01	7.3E+00	4.8E+02	6.5E+04
MCPA	94746	-	NC	3.9E+01	NC	2.8E+02	NC	2.5E+06
Mirex	2385855	Mirex (DeChlorane)	3.2E-02	1.6E+01	1.6E-01	1.1E+02	4.9E+02	9.9E+05
p,p'-Methoxychlor	72435	Methoxychlor	NC	3.9E+02	NC	2.8E+03	NC	2.5E+07
Toxaphene	8001352	-	4.7E-01	NC	2.4E+00	NC	7.3E+03	NC
Herbicides								
2,4,5-T	93765	2,4,5-Trichlorophenoxyacetic acid	NC	7.8E+02	NC	5.6E+03	NC	5.0E+07
2,4,5-TP (Silvex)	93721	-	NC	6.3E+02	NC	4.5E+03	NC	4.0E+07
2,4-Dichlorophenoxyacetic Acid (2,4-D)	94757	-	NC	7.8E+02	NC	5.6E+03	NC	5.0E+07
2,4-Dichlorophenoxybutyric acid	94826	2,4-DB	NC	6.3E+02	NC	4.5E+03	NC	4.0E+07
Dalapon	75990	-	NC	2.3E+03	NC	1.7E+04	NC	1.5E+08
Dicamba	1918009	-	NC	2.3E+03	NC	1.7E+04	NC	1.5E+08
2,4-DP (Dichlorprop)	120365	-	NC	7.8E+02	NC	5.6E+03	NC	5.0E+07
Dinoseb	88857	-	NC	7.8E+01	NC	5.6E+02	NC	5.0E+06
MCPP	93652	-	NC	7.8E+01	NC	5.6E+02	NC	5.0E+06
Terphenyls								
m-Terphenyl	92068	-	7.1E+01	3.9E+04	1.8E+02	1.4E+05	1.1E+06	5.7E+05
o-Terphenyl	84151	-	7.1E+01	3.9E+04	1.8E+02	1.4E+05	1.1E+06	5.7E+05
p-Terphenyl	92944	-	7.1E+01	3.9E+04	1.8E+02	1.4E+05	1.1E+06	5.7E+05
Glycols								
Diethylene Glycol	111466	-	NC	7.8E+03	NC	2.8E+04	NC	2.3E+09
Triethylene glycol	112276	-	NC	3.5E+03	NC	1.3E+04	NC	2.2E+08
PCDD/PCDFs								
2,3,7,8-TCDD TEQ	1746016-TEQ	-	4.4E-06	5.5E-05	3.7E-05	6.5E-04	6.5E-02	5.7E+01
Polychlorinated Biphenyls (PCBs)								

Attachment 1- Table 8

Direct Soil Contact Pathway-Specific 40-year Rural Residential Risk-Based Screening Levels

			Soil Ingestion ($RBSL_{so_ing}$)		Soil Dermal Contact ($RBSL_{so_der}$)		Inhalation of Dust/Vapors ($RBSL_{so_inh}$)	
Analyte	**CAS #**	**Analyte Synonyms [a]**	**Composite Farmer Cancer (10^{-6}) (mg/kg)**	**Child Noncancer (HQ=1) (mg/kg)**	**Composite Farmer Cancer (10^{-6}) (mg/kg)**	**Child Noncancer (HQ=1) (mg/kg)**	**Composite Farmer Cancer (10^{-6}) (mg/kg)**	**Child Noncancer (HQ=1) (mg/kg)**
Aroclor 1016	12674112	-	8.1E+00	5.5E+00	1.4E+01	1.3E+01	1.2E+05	3.5E+05
Aroclor 1242	53469219	Aroclor-1242	2.8E-01	1.6E+00	4.9E-01	3.7E+00	4.4E+03	9.9E+04
Aroclor 1248	12672296	-	2.8E-01	1.6E+00	4.9E-01	3.7E+00	4.4E+03	9.9E+04
Aroclor 1254	11097691	-	2.8E-01	1.6E+00	4.9E-01	3.7E+00	4.4E+03	9.9E+04
Aroclor 1260	11096825	-	2.8E-01	1.6E+00	4.9E-01	3.7E+00	4.4E+03	9.9E+04
Aroclor 5460	11126424	-	2.8E-01	1.6E+00	4.9E-01	3.7E+00	4.4E+03	9.9E+04
PCB TEQ	1746016-PCB TEQ	-	4.4E-06	5.5E-05	7.5E-06	1.3E-04	6.5E-02	5.7E+01

Notes:
'-' - none established/not applicable.
HQ - hazard quotient
mg/kg - milligrams per kilogram
NC - not calculated
PCDD/PCDF - polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans
RBSL - Risk-Based Screening Level
TCDD - 2,3,7,8-Tetrachlorodibenzo-p-dioxin
TEQ - toxic equivalency

a - Please note that different chemical names have been used for different programs at the SSFL, and there can be additional analyte synonyms than those presented. Therefore, any chemical synonym should be verified using the CAS number listed.
b - The cadmium RBSLs for non-carcinogenic effects were calculated using the exposure assumptions for an adult as described in Section 3.2.1.

Attachment 1 - Table 9

Direct Soil Contact Pathway-Specific 30-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Soil Ingestion ($RBSL_{so_ing}$) Composite Farmer Cancer (10^{-6}) (mg/kg)	Soil Ingestion ($RBSL_{so_ing}$) Child Noncancer (HQ=1) (mg/kg)	Soil Dermal Contact ($RBSL_{so_der}$) Composite Farmer Cancer (10^{-6}) (mg/kg)	Soil Dermal Contact ($RBSL_{so_der}$) Child Noncancer (HQ=1) (mg/kg)	Inhalation of Dust/Vapors ($RBSL_{so_inh}$) Composite Farmer Cancer (10^{-6}) (mg/kg)	Inhalation of Dust/Vapors ($RBSL_{so_inh}$) Child Noncancer (HQ=1) (mg/kg)
Inorganic Compounds								
Aluminum	7429905	Aluminum, Total	NC	7.8E+04	NC	2.8E+06	NC	7.1E+06
Antimony	7440360	Antimony, Total	NC	3.1E+01	NC	1.7E+02	NC	2.0E+06
Arsenic	7440382	Arsenic, Total	6.7E-02	2.3E+01	6.1E-01	2.8E+02	1.0E+03	2.1E+04
Barium	7440393	Barium, Total	NC	1.6E+04	NC	3.9E+04	NC	7.1E+05
Beryllium	7440417	Beryllium, Total	NC	1.6E+02	NC	3.9E+01	1.4E+03	9.9E+03
Boron	7440428	Boron, Total	NC	1.6E+04	NC	5.6E+05	NC	2.8E+07
Cadmium	7440439	Cadmium, Total	NC	4.6E+00 [b]	NC	2.0E+01 [b]	7.9E+02	1.4E+04 [b]
Chromium	7440473	Chromium, Total	NC	1.2E+05	NC	5.4E+04	NC	7.4E+09
Cobalt	7440484	Cobalt, Total	NC	2.3E+01	NC	8.4E+02	3.7E+02	8.5E+03
Copper	7440508	Copper, Total	NC	3.1E+03	NC	1.1E+05	NC	1.4E+08
Cyanides	57125	Cyanide, Total; Cyanide	NC	4.7E+01	NC	1.7E+03	NC	1.1E+06
Fluoride	16984488	-	NC	3.1E+03	NC	1.1E+05	NC	1.8E+07
Hexavalent chromium	18540299	Chromium, Hexavalent; Chromium VI	1.3E+00	2.3E+02	NC	NC	2.2E+01	2.8E+05
Lead	7439921	Lead, Total	NC	NC	NC	NC	NC	NC
Lithium	7439932	Lithium, Total	NC	1.6E+02	NC	5.6E+03	NC	9.9E+06
Manganese	7439965	Manganese, Total	NC	1.1E+04	NC	1.6E+04	NC	1.3E+05
Mercury	7439976	Mercury, Total	NC	2.3E+01	NC	5.9E+01	NC	4.3E+04
Methyl Mercury	22967926	-	NC	7.8E+00	NC	2.8E+02	NC	5.0E+05
Molybdenum	7439987	Molybdenum, Total	NC	3.9E+02	NC	1.4E+04	NC	2.5E+07
Nickel	7440020	Nickel, Total	NC	1.6E+03	NC	2.2E+03	1.3E+04	7.1E+04
Selenium	7782492	Selenium, Total	NC	3.9E+02	NC	1.4E+04	NC	2.8E+07
Silver	7440224	Silver, Total	NC	3.9E+02	NC	5.6E+02	NC	2.5E+07
Strontium	7440246	Strontium, Total	NC	4.7E+04	NC	1.7E+06	NC	3.0E+09
Thallium	7440280	Thallium, Total	NC	7.8E-01	NC	2.8E+01	NC	5.0E+04
Tin	7440315	Tin, Total	NC	4.7E+04	NC	1.7E+06	NC	3.0E+09
Vanadium	7440622	Vanadium, Total	NC	3.9E+02	NC	3.6E+02	NC	1.4E+05
Zinc	7440666	Zinc, Total	NC	2.3E+04	NC	8.4E+05	NC	1.5E+09
Zirconium	7440677	Zirconium, Total	NC	6.3E+00	NC	2.2E+02	NC	4.0E+05
Energetic Constituents								
1,2-Dinitrobenzene	528290	o-Dinitrobenzene	NC	7.8E+00	NC	2.8E+01	NC	5.0E+05

Attachment 1 - Table 9

Direct Soil Contact Pathway-Specific 30-year Rural Residential Risk-Based Screening Levels

			Soil Ingestion ($RBSL_{so_ing}$)		Soil Dermal Contact ($RBSL_{so_der}$)		Inhalation of Dust/Vapors ($RBSL_{so_inh}$)	
Analyte	**CAS #**	**Analyte Synonyms [a]**	**Composite Farmer Cancer (10^{-6}) (mg/kg)**	**Child Noncancer (HQ=1) (mg/kg)**	**Composite Farmer Cancer (10^{-6}) (mg/kg)**	**Child Noncancer (HQ=1) (mg/kg)**	**Composite Farmer Cancer (10^{-6}) (mg/kg)**	**Child Noncancer (HQ=1) (mg/kg)**
1,3-Dinitrobenzene	99650	m-Dinitrobenzene	NC	7.8E+00	NC	2.8E+01	NC	5.0E+05
2,4,6-Trinitrotoluene	118967	-	2.1E+01	3.9E+01	1.8E+02	4.4E+02	3.9E+05	2.5E+06
2-Amino-4,6-dinitrotoluene	35572782	-	NC	1.6E+02	NC	9.3E+03	NC	9.9E+06
HMX	2691410	-	NC	3.9E+03	NC	2.3E+05	NC	2.5E+08
Hydrazine	302012	-	2.1E-01	NC	5.8E-01	NC	6.8E+02	4.3E+04
RDX	121824	Hexahydro-1,3,5-trinitro-1,3,5-triazine	5.8E+00	2.3E+02	1.1E+02	5.6E+03	1.1E+05	1.5E+07
Perchlorate	14797730	-	NC	5.5E+01	NC	2.0E+03	NC	3.5E+06
Volatile Organic Compounds								
1,1,1,2-Tetrachloroethane	630206	-	2.5E+01	2.3E+03	NC	NC	3.0E+00	1.0E+03
1,1,1-Trichloroethane	71556	-	NC	1.6E+05	NC	NC	NC	6.0E+03
1,1,2,2-Tetrachloroethane	79345	-	2.4E+00	1.6E+03	NC	NC	3.0E-01	5.3E+02
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	Freon 113	NC	2.3E+06	NC	NC	NC	2.9E+04
1,1,2-Trichloroethane	79005	-	8.9E+00	3.1E+02	NC	NC	5.3E-01	7.2E-01
1,1-Dichloroethane	75343	-	1.1E+02	1.6E+04	NC	NC	1.8E+00	8.6E+02
1,1-Dichloroethene	75354	-	NC	3.9E+03	NC	NC	NC	5.7E+01
1,1-Dimethylhydrazine	57147	Unsymetrical Dimethyl Hydrazine	NC	7.8E+00	NC	NC	NC	2.8E+03
1,2,3-Trichlorobenzene	87616	-	1.8E+02	6.3E+01	NC	NC	8.4E+01	1.0E+02
1,2,4-Trichlorobenzene	120821	-	1.8E+02	7.8E+02	NC	NC	3.4E+01	3.0E+01
1,2,4-Trimethylbenzene	95636	-	NC	7.8E+02	NC	NC	NC	4.2E+01
1,2-Dibromo-3-chloropropane	96128	1,2-Dibromo-3-CPA	9.1E-02	1.6E+01	NC	NC	1.7E+03	2.8E+05
1,2-Dibromoethane	106934	1,2-Dibromoethane (EDB)	1.8E-01	7.0E+02	NC	NC	2.1E-01	5.9E+01
1,2-Dichlorobenzene	95501	o-Dichlorobenzene	NC	7.0E+03	NC	NC	NC	2.2E+03
1,2-Dichloroethane	107062	-	1.4E+01	4.7E+02	NC	NC	2.5E-01	1.6E+01
1,2-Dichloroethene	540590	1,2-Dichloroethenes	NC	7.0E+02	NC	NC	NC	1.1E+02
1,2-Dichloropropane	78875	-	1.8E+01	7.0E+03	NC	NC	4.2E-01	7.2E+00
1,3,5-Trimethylbenzene	108678	-	NC	7.8E+02	NC	NC	NC	2.3E+02
1,3-Dichlorobenzene	541731	m-Dichlorobenzene	NC	2.3E+03	NC	NC	NC	1.5E+03
1,4-Dichlorobenzene	106467	p-Dichlorobenzene	1.2E+02	5.5E+03	NC	NC	1.3E+00	4.7E+03
2-Chloroethylvinyl ether	110758	2-Chloroethyl vinyl ether	2.6E-01	NC	NC	NC	4.0E-03	NC
2-Hexanone	591786	Methyl butyl ketone	NC	3.9E+02	NC	NC	NC	3.0E+02
Acetone	67641	-	NC	7.0E+04	NC	NC	NC	4.1E+05

Attachment 1 - Table 9

Direct Soil Contact Pathway-Specific 30-year Rural Residential Risk-Based Screening Levels

			Soil Ingestion ($RBSL_{so_ing}$)		Soil Dermal Contact ($RBSL_{so_der}$)		Inhalation of Dust/Vapors ($RBSL_{so_inh}$)	
Analyte	**CAS #**	**Analyte Synonyms [a]**	**Composite Farmer Cancer (10^{-6}) (mg/kg)**	**Child Noncancer (HQ=1) (mg/kg)**	**Composite Farmer Cancer (10^{-6}) (mg/kg)**	**Child Noncancer (HQ=1) (mg/kg)**	**Composite Farmer Cancer (10^{-6}) (mg/kg)**	**Child Noncancer (HQ=1) (mg/kg)**
Benzene	71432	-	6.4E+00	3.1E+02	NC	NC	1.1E-01	4.1E+01
Bromobenzene	108861	-	NC	6.3E+02	NC	NC	NC	3.8E+02
Bromodichloromethane	75274	-	4.9E+00	1.6E+03	NC	NC	1.9E-01	2.1E+02
Bromoform	75252	-	5.8E+01	1.6E+03	NC	NC	3.0E+06	9.9E+07
Bromomethane	74839	-	NC	1.1E+02	NC	NC	NC	5.4E+00
Carbon disulfide	75150	-	NC	7.8E+03	NC	NC	NC	5.8E+02
Carbon tetrachloride	56235	-	4.3E+00	3.1E+02	NC	NC	6.7E-02	1.2E+02
Chlorobenzene	108907	Monochlorobenzene	NC	1.6E+03	NC	NC	NC	1.5E+02
Chloroform	67663	Trichloromethane	2.1E+01	7.8E+02	NC	NC	7.1E-01	4.8E+02
Chloromethane	74873	Methyl chloride	NC	1.1E+02	NC	NC	NC	7.7E+01
cis-1,2-Dichloroethene	156592	cis-1,2-Dichloroethylene	NC	1.6E+02	NC	NC	NC	9.8E+00
Cumene	98828	Isopropylbenzene	NC	7.8E+03	NC	NC	NC	1.9E+03
Dibromochloromethane	124481	-	6.8E+00	1.6E+03	NC	NC	1.2E+05	9.9E+07
Dibromomethane	74953	-	NC	7.8E+02	NC	NC	NC	2.3E+01
Dichlorodifluoromethane	75718	Freon 12	NC	1.6E+04	NC	NC	NC	6.7E+01
Ethylbenzene	100414	-	5.8E+01	7.8E+03	NC	NC	2.2E+00	4.8E+03
Methyl ethyl ketone	78933	2-Butanone; 2-Butanone (MEK)	NC	4.7E+04	NC	NC	NC	4.6E+04
Methyl isobutyl ketone (MIBK)	108101	MIBK; 4-Methyl-2-pentanone	NC	6.3E+03	NC	NC	NC	2.4E+04
Methylene chloride	75092	Dichloromethane	4.6E+01	4.7E+02	NC	NC	3.0E+00	7.6E+02
Monomethylhydrazine	60344	Monomethyl Hydrazine	1.2E-03	7.8E+01	NC	NC	3.3E+03	2.8E+04
m-Xylene & p-Xylene	136777612	meta- and para-Xylenes; m, p-Xylene	NC	1.6E+04	NC	NC	NC	4.4E+02
n-Butylbenzene	104518	-	NC	3.9E+03	NC	NC	NC	1.1E+03
n-Propylbenzene	103651	-	NC	7.8E+03	NC	NC	NC	5.3E+03
o-Chlorotoluene	95498	2-Chlorotoluene	NC	1.6E+03	NC	NC	NC	4.3E+02
o-Xylene	95476	-	NC	1.6E+04	NC	NC	NC	2.9E+02
p-Chlorotoluene	106434	4-Chlorotoluene	NC	1.6E+03	NC	NC	NC	3.9E+02
p-Cymene	99876	p-Isopropyltoluene	NC	7.8E+03	NC	NC	NC	2.6E+03
p-Nitroaniline	100016	4-Nitroaniline	3.2E+01	3.1E+02	NC	NC	5.8E+05	8.5E+06
sec-Butylbenzene	135988	-	NC	7.8E+03	NC	NC	NC	2.2E+03
Styrene	100425	Vinylbenzene	NC	1.6E+04	NC	NC	NC	4.2E+04

Attachment 1 - Table 9

Direct Soil Contact Pathway-Specific 30-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Soil Ingestion ($RBSL_{so_ing}$) Composite Farmer Cancer (10^{-6}) (mg/kg)	Soil Ingestion ($RBSL_{so_ing}$) Child Noncancer (HQ=1) (mg/kg)	Soil Dermal Contact ($RBSL_{so_der}$) Composite Farmer Cancer (10^{-6}) (mg/kg)	Soil Dermal Contact ($RBSL_{so_der}$) Child Noncancer (HQ=1) (mg/kg)	Inhalation of Dust/Vapors ($RBSL_{so_inh}$) Composite Farmer Cancer (10^{-6}) (mg/kg)	Inhalation of Dust/Vapors ($RBSL_{so_inh}$) Child Noncancer (HQ=1) (mg/kg)
tert-Butylbenzene	98066	Dibenzo[b,e][1,4]dioxin, octachloro-	NC	7.8E+03	NC	NC	NC	2.2E+03
Tetrachloroethene	127184	-	1.2E+00	4.7E+02	NC	NC	5.8E-01	5.8E+01
Tetralin	119642	-	NC	1.6E+03	NC	NC	7.7E+00	3.4E+02
Toluene	108883	Toluol	NC	6.3E+03	NC	NC	NC	9.3E+03
trans-1,2-Dichloroethene	156605	-	NC	1.6E+03	NC	NC	NC	9.0E+01
Trichloroethene	79016	Trichloroethylene (TCE)	1.4E+01	3.9E+01	NC	NC	7.9E-01	3.2E+00
Trichlorofluoromethane	75694	-	NC	2.3E+04	NC	NC	NC	5.4E+02
Vinyl chloride	75014	-	2.4E+00	2.3E+02	NC	NC	1.9E-02	6.4E+01
Xylenes, Total	1330207	Xylene (Total) Isomers	NC	1.6E+04	NC	NC	NC	4.4E+02
Semi-Volatile Organic Compounds								
1,4-Dioxane	123911	-	2.4E+01	2.3E+03	6.4E+01	8.4E+03	4.3E+05	4.3E+07
2,4,5-Trichlorophenol	95954	-	NC	7.8E+03	NC	2.8E+04	NC	5.0E+08
2,4,6-Trichlorophenol	88062	-	9.1E+00	7.8E+01	2.5E+01	2.8E+02	1.7E+05	5.0E+06
2,4-Dimethylphenol	105679	-	NC	1.6E+03	NC	5.6E+03	NC	9.9E+07
3,5-Dimethylphenol	108689	-	NC	5.6E+02	NC	2.0E+03	NC	3.6E+07
Benzoic acid	65850	-	NC	3.1E+05	NC	1.1E+06	NC	2.0E+10
Benzyl alcohol	100516	-	NC	7.8E+03	NC	2.8E+04	NC	5.0E+08
bis(2-Ethylhexyl) phthalate	117817	bis(2-ethylhexyl)phthalate	2.1E+02	1.6E+03	5.8E+02	5.6E+03	1.4E+06	9.9E+07
Butyl benzyl phthalate	85687	-	3.4E+02	1.6E+04	9.2E+02	5.6E+04	6.1E+06	9.9E+08
Carbazole	86748	-	3.2E+01	NC	8.7E+01	NC	5.8E+05	NC
Dibenzofuran	132649	-	NC	7.8E+01	NC	2.8E+02	NC	5.2E+02
Diethyl phthalate	84662	-	NC	6.3E+04	NC	2.2E+05	NC	4.0E+09
Dimethyl phthalate	131113	-	NC	6.3E+04	NC	2.2E+05	NC	4.0E+09
Di-n-butyl phthalate	84742	Di-n-butylphthalate	NC	7.8E+03	NC	2.8E+04	NC	5.0E+08
Di-n-octyl phthalate	117840	Di-n-octyl-phthalate	NC	7.8E+02	NC	2.8E+03	NC	5.0E+07
Formaldehyde	50000	-	NC	1.6E+04	NC	5.6E+04	5.5E+05	1.3E+07
Hexachlorobutadiene	87683	-	8.2E+00	7.8E+01	2.2E+01	2.8E+02	1.5E+05	5.0E+06
m-Cresol	108394	3-Methylphenol	NC	3.9E+03	NC	1.4E+04	NC	8.5E+08
N-Nitrosodimethylamine	62759	Nitrosodimethylamine	4.0E-02	6.3E-01	1.1E-01	2.2E+00	7.2E+02	5.7E+04
N-Nitrosodiphenylamine	86306	-	7.1E+01	NC	1.9E+02	NC	1.3E+06	NC
o-Cresol	95487	2-Methylphenol	NC	3.9E+03	NC	1.4E+04	NC	8.5E+08
p-Chloro-m-cresol	59507	4-Chloro-3-Methylphenol	NC	7.8E+03	NC	2.8E+04	NC	5.0E+08

Attachment 1 - Table 9

Direct Soil Contact Pathway-Specific 30-year Rural Residential Risk-Based Screening Levels

			Soil Ingestion ($RBSL_{so_ing}$)		Soil Dermal Contact ($RBSL_{so_der}$)		Inhalation of Dust/Vapors ($RBSL_{so_inh}$)	
Analyte	**CAS #**	**Analyte Synonyms [a]**	**Composite Farmer Cancer (10^{-6}) (mg/kg)**	**Child Noncancer (HQ=1) (mg/kg)**	**Composite Farmer Cancer (10^{-6}) (mg/kg)**	**Child Noncancer (HQ=1) (mg/kg)**	**Composite Farmer Cancer (10^{-6}) (mg/kg)**	**Child Noncancer (HQ=1) (mg/kg)**
p-Cresol	106445	4-Methylphenol	NC	7.8E+03	NC	2.8E+04	NC	8.5E+08
Pentachlorophenol	87865	PCP	3.5E+01	3.9E+02	3.9E+01	5.6E+02	6.5E+05	2.5E+07
Phenol	108952	Total Phenols	NC	2.3E+04	NC	8.4E+04	NC	2.8E+08
Polynuclear Aromatic Hydrocarbons								
1-Methyl naphthalene	90120	1-Methylnaphthalene	2.2E+01	5.5E+03	4.0E+01	1.3E+04	1.2E+01	1.1E+04
2-Methylnaphthalene	91576	Naphthalene, 2-methyl-	NC	3.1E+02	NC	7.4E+02	NC	6.1E+02
Acenaphthene	83329	-	NC	4.7E+03	NC	1.1E+04	NC	1.3E+05
Acenaphthylene	208968	-	NC	4.7E+03	NC	1.1E+04	NC	3.0E+04
Anthracene	120127	-	NC	2.3E+04	NC	5.6E+04	NC	2.8E+06
Benzo(a)anthracene	56553	Benz[a]anthracene	5.3E-01	NC	9.7E-01	NC	3.0E+04	NC
Benzo(a)pyrene	50328	Benzo (a) pyrene	5.3E-02	NC	9.7E-02	NC	3.0E+03	NC
Benzo(b)fluoranthene	205992	Benz[e]acephenanthrylene 1	5.3E-01	NC	9.7E-01	NC	3.0E+04	NC
Benzo(e)pyrene	192972	-	NC	2.3E+03	NC	5.6E+03	NC	1.5E+08
Benzo(ghi)perylene	191242	Benzo (g,h,i) perylene	NC	2.3E+03	NC	5.6E+03	NC	1.5E+08
Benzo(k)fluoranthene	207089	Benzo[k]fluoranthene	5.3E-01	NC	9.7E-01	NC	3.0E+04	NC
Chrysene	218019	-	5.3E+00	NC	9.7E+00	NC	3.0E+05	NC
Dibenzo(a,h)anthracene	53703	Dibenz (a,h) anthracene	1.6E-01	NC	2.8E-01	NC	2.8E+03	NC
Fluoranthene	206440	-	NC	3.1E+03	NC	7.4E+03	NC	2.0E+08
Fluorene	86737	-	NC	3.1E+03	NC	7.4E+03	NC	1.8E+05
Indeno(1,2,3-cd)pyrene	193395	Indeno (1,2,3-cd) pyrene	5.3E-01	NC	9.7E-01	NC	3.0E+04	NC
Naphthalene	91203	-	NC	1.6E+03	NC	3.7E+03	1.4E+01	1.8E+03
Perylene	198550	-	NC	2.3E+03	NC	5.6E+03	NC	1.5E+08
Phenanthrene	85018	-	NC	2.3E+04	NC	5.6E+04	NC	3.1E+06
Pyrene	129000	-	NC	2.3E+03	NC	5.6E+03	NC	1.5E+08
Pesticides								
4,4'-DDD	72548	p,p'-DDD	2.7E+00	NC	1.5E+01	NC	4.8E+04	NC
4,4'-DDE	72559	p,p'-DDE	1.9E+00	NC	1.0E+01	NC	3.4E+04	NC
4,4'-DDT	50293	p,p'-DDT	1.9E+00	3.9E+01	1.0E+01	2.8E+02	3.4E+04	2.5E+06
Aldrin	309002	-	3.8E-02	2.3E+00	2.0E-01	1.7E+01	6.8E+02	1.5E+05
alpha-BHC	319846	a-Benzene Hexachloride	2.4E-01	6.3E+02	1.3E+00	4.5E+03	4.3E+03	4.0E+07
beta-BHC	319857	b-Benzene Hexachloride	4.3E-01	NC	2.3E+00	NC	7.7E+03	NC
delta-BHC	319868	d-Benzene Hexachloride	3.5E-01	2.3E+01	1.9E+00	1.7E+02	6.6E+03	1.5E+06

Attachment 1 - Table 9

Direct Soil Contact Pathway-Specific 30-year Rural Residential Risk-Based Screening Levels

			Soil Ingestion ($RBSL_{so_ing}$)		Soil Dermal Contact ($RBSL_{so_der}$)		Inhalation of Dust/Vapors ($RBSL_{so_inh}$)	
Analyte	**CAS #**	**Analyte Synonyms [a]**	**Composite Farmer Cancer (10^{-6}) (mg/kg)**	**Child Noncancer (HQ=1) (mg/kg)**	**Composite Farmer Cancer (10^{-6}) (mg/kg)**	**Child Noncancer (HQ=1) (mg/kg)**	**Composite Farmer Cancer (10^{-6}) (mg/kg)**	**Child Noncancer (HQ=1) (mg/kg)**
Chlordane (Technical)	12789036	-	1.8E+00	3.9E+01	9.9E+00	2.8E+02	3.3E+04	9.9E+05
Dieldrin	60571	-	4.0E-02	3.9E+00	2.2E-01	2.8E+01	7.2E+02	2.5E+05
Endosulfan I	959988	-	NC	4.7E+02	NC	3.4E+03	NC	3.0E+07
Endosulfan II	33213659	-	NC	4.7E+02	NC	3.4E+03	NC	3.0E+07
Endosulfan sulfate	1031078	-	NC	4.7E+02	NC	3.4E+03	NC	3.0E+07
Endrin	72208	-	NC	2.3E+01	NC	1.7E+02	NC	1.5E+06
Endrin aldehyde	7421934	-	NC	2.3E+01	NC	1.7E+02	NC	1.5E+06
Endrin ketone	53494705	-	NC	2.3E+01	NC	1.7E+02	NC	1.5E+06
gamma-BHC	58899	Lindane	5.8E-01	2.3E+01	3.2E+00	1.7E+02	1.1E+04	1.5E+06
Heptachlor	76448	-	1.6E-01	3.9E+01	8.5E-01	2.8E+02	2.8E+03	2.5E+06
Heptachlor epoxide	1024573	-	1.2E-01	1.0E+00	6.3E-01	7.3E+00	6.4E+02	6.5E+04
MCPA	94746	-	NC	3.9E+01	NC	2.8E+02	NC	2.5E+06
Mirex	2385855	Mirex (DeChlorane)	3.5E-02	1.6E+01	1.9E-01	1.1E+02	6.5E+02	9.9E+05
p,p'-Methoxychlor	72435	Methoxychlor	NC	3.9E+02	NC	2.8E+03	NC	2.5E+07
Toxaphene	8001352	-	5.3E-01	NC	2.9E+00	NC	9.7E+03	NC
Herbicides								
2,4,5-T	93765	2,4,5-Trichlorophenoxyacetic acid	NC	7.8E+02	NC	5.6E+03	NC	5.0E+07
2,4,5-TP (Silvex)	93721	-	NC	6.3E+02	NC	4.5E+03	NC	4.0E+07
2,4-Dichlorophenoxyacetic Acid (2,4-D)	94757	-	NC	7.8E+02	NC	5.6E+03	NC	5.0E+07
2,4-Dichlorophenoxybutyric acid	94826	2,4-DB	NC	6.3E+02	NC	4.5E+03	NC	4.0E+07
Dalapon	75990	-	NC	2.3E+03	NC	1.7E+04	NC	1.5E+08
Dicamba	1918009	-	NC	2.3E+03	NC	1.7E+04	NC	1.5E+08
2,4-DP (Dichlorprop)	120365	-	NC	7.8E+02	NC	5.6E+03	NC	5.0E+07
Dinoseb	88857	-	NC	7.8E+01	NC	5.6E+02	NC	5.0E+06
MCPP	93652	-	NC	7.8E+01	NC	5.6E+02	NC	5.0E+06
Terphenyls								
m-Terphenyl	92068	-	8.0E+01	3.9E+04	2.2E+02	1.4E+05	1.4E+06	5.7E+05
o-Terphenyl	84151	-	8.0E+01	3.9E+04	2.2E+02	1.4E+05	1.4E+06	5.7E+05
p-Terphenyl	92944	-	8.0E+01	3.9E+04	2.2E+02	1.4E+05	1.4E+06	5.7E+05
Glycols								

Attachment 1 - Table 9

Direct Soil Contact Pathway-Specific 30-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Soil Ingestion ($RBSL_{so_ing}$) Composite Farmer Cancer (10^{-6}) (mg/kg)	Soil Ingestion ($RBSL_{so_ing}$) Child Noncancer (HQ=1) (mg/kg)	Soil Dermal Contact ($RBSL_{so_der}$) Composite Farmer Cancer (10^{-6}) (mg/kg)	Soil Dermal Contact ($RBSL_{so_der}$) Child Noncancer (HQ=1) (mg/kg)	Inhalation of Dust/Vapors ($RBSL_{so_inh}$) Composite Farmer Cancer (10^{-6}) (mg/kg)	Inhalation of Dust/Vapors ($RBSL_{so_inh}$) Child Noncancer (HQ=1) (mg/kg)
Diethylene Glycol	111466	-	NC	7.8E+03	NC	2.8E+04	NC	2.3E+09
Triethylene glycol	112276	-	NC	3.5E+03	NC	1.3E+04	NC	2.2E+08
PCDD/PCDFs								
2,3,7,8-TCDD TEQ	1746016-TEQ	-	4.9E-06	5.5E-05	4.5E-05	6.5E-04	8.7E-02	5.7E+01
Polychlorinated Biphenyls (PCBs)								
Aroclor 1016	12674112	-	9.1E+00	5.5E+00	1.7E+01	1.3E+01	1.7E+05	3.5E+05
Aroclor 1242	53469219	Aroclor-1242	3.2E-01	1.6E+00	5.8E-01	3.7E+00	5.8E+03	9.9E+04
Aroclor 1248	12672296	-	3.2E-01	1.6E+00	5.8E-01	3.7E+00	5.8E+03	9.9E+04
Aroclor 1254	11097691	-	3.2E-01	1.6E+00	5.8E-01	3.7E+00	5.8E+03	9.9E+04
Aroclor 1260	11096825	-	3.2E-01	1.6E+00	5.8E-01	3.7E+00	5.8E+03	9.9E+04
Aroclor 5460	11126424	-	3.2E-01	1.6E+00	5.8E-01	3.7E+00	5.8E+03	9.9E+04
PCB TEQ	1746016-PCB TEQ	-	4.9E-06	5.5E-05	8.9E-06	1.3E-04	8.7E-02	5.7E+01

Notes:
'-' - none established/not applicable.
HQ - hazard quotient
mg/kg - milligrams per kilogram
NC - not calculated
PCDD/PCDF - polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans
RBSL - Risk-Based Screening Level
TCDD - 2,3,7,8-Tetrachlorodibenzo-p-dioxin
TEQ - toxic equivalency

a - Please note that different chemical names have been used for different programs at the SSFL, and there can be additional analyte synonyms than those presented. Therefore, any chemical synonym should be verified using the CAS number listed.
b - The cadmium RBSLs for non-carcinogenic effects were calculated using the exposure assumptions for an adult as described in Section 3.2.1.

Attachment 1 - Table 10

Direct Soil Contact Pathway-Specific Recreational Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Soil Ingestion ($RBSL_{so_ing}$) Composite Recreator Cancer (10^{-6}) (mg/kg)	Soil Ingestion ($RBSL_{so_ing}$) Child Noncancer (HQ=1) (mg/kg)	Soil Dermal Contact ($RBSL_{so_der}$) Composite Recreator Cancer (10^{-6}) (mg/kg)	Soil Dermal Contact ($RBSL_{so_der}$) Child Noncancer (HQ=1) (mg/kg)	Inhalation of Dust/Vapors ($RBSL_{so_inh}$) Composite Recreator Cancer (10^{-6}) (mg/kg)	Inhalation of Dust/Vapors ($RBSL_{so_inh}$) Child Noncancer (HQ=1) (mg/kg)
Inorganic Compounds								
Aluminum	7429905	Aluminum, Total	NC	3.7E+05	NC	1.3E+07	NC	9.9E+07
Antimony	7440360	Antimony, Total	NC	1.5E+02	NC	7.8E+02	NC	2.8E+07
Arsenic	7440382	Arsenic, Total	3.4E-01	1.1E+02	9.2E-01	1.3E+03	1.5E+04	3.0E+05
Barium	7440393	Barium, Total	NC	7.3E+04	NC	1.8E+05	NC	9.9E+06
Beryllium	7440417	Beryllium, Total	NC	7.3E+02	NC	1.8E+02	2.1E+04	1.4E+05
Boron	7440428	Boron, Total	NC	7.3E+04	NC	2.6E+06	NC	4.0E+08
Cadmium	7440439	Cadmium, Total	NC	2.1E+01 [b]	NC	1.6E+01 [b]	1.2E+04	2.0E+05 [b]
Chromium	7440473	Chromium, Total	NC	5.5E+05	NC	2.5E+05	NC	1.0E+11
Cobalt	7440484	Cobalt, Total	NC	1.1E+02	NC	3.9E+03	5.5E+03	1.2E+05
Copper	7440508	Copper, Total	NC	1.5E+04	NC	5.2E+05	NC	2.0E+09
Cyanides	57125	Cyanide, Total; Cyanide	NC	2.2E+02	NC	7.8E+03	NC	1.6E+07
Fluoride	16984488	-	NC	1.5E+04	NC	5.2E+05	NC	2.6E+08
Hexavalent chromium	18540299	Chromium, Hexavalent; Chromium VI	6.4E+00	1.1E+03	NC	NC	3.3E+02	4.0E+06
Lead	7439921	Lead, Total	NC	NC	NC	NC	NC	NC
Lithium	7439932	Lithium, Total	NC	7.3E+02	NC	2.6E+04	NC	1.4E+08
Manganese	7439965	Manganese, Total	NC	5.1E+04	NC	7.3E+04	NC	1.8E+06
Mercury	7439976	Mercury, Total	NC	1.1E+02	NC	2.7E+02	NC	6.0E+05
Methyl Mercury	22967926	-	NC	3.7E+01	NC	1.3E+03	NC	6.9E+06
Molybdenum	7439987	Molybdenum, Total	NC	1.8E+03	NC	6.5E+04	NC	3.5E+08
Nickel	7440020	Nickel, Total	NC	7.3E+03	NC	1.0E+04	1.9E+05	9.9E+05
Selenium	7782492	Selenium, Total	NC	1.8E+03	NC	6.5E+04	NC	4.0E+08
Silver	7440224	Silver, Total	NC	1.8E+03	NC	2.6E+03	NC	3.5E+08
Strontium	7440246	Strontium, Total	NC	2.2E+05	NC	7.8E+06	NC	4.2E+10
Thallium	7440280	Thallium, Total	NC	3.7E+00	NC	1.3E+02	NC	6.9E+05
Tin	7440315	Tin, Total	NC	2.2E+05	NC	7.8E+06	NC	4.2E+10
Vanadium	7440622	Vanadium, Total	NC	1.8E+03	NC	1.7E+03	NC	2.0E+06
Zinc	7440666	Zinc, Total	NC	1.1E+05	NC	3.9E+06	NC	2.1E+10
Zirconium	7440677	Zirconium, Total	NC	2.9E+01	NC	1.0E+03	NC	5.6E+06
Energetic Constituents								

Attachment 1 - Table 10

Direct Soil Contact Pathway-Specific Recreational Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Soil Ingestion ($RBSL_{so_ing}$) Composite Recreator Cancer (10^{-6}) (mg/kg)	Soil Ingestion ($RBSL_{so_ing}$) Child Noncancer (HQ=1) (mg/kg)	Soil Dermal Contact ($RBSL_{so_der}$) Composite Recreator Cancer (10^{-6}) (mg/kg)	Soil Dermal Contact ($RBSL_{so_der}$) Child Noncancer (HQ=1) (mg/kg)	Inhalation of Dust/Vapors ($RBSL_{so_inh}$) Composite Recreator Cancer (10^{-6}) (mg/kg)	Inhalation of Dust/Vapors ($RBSL_{so_inh}$) Child Noncancer (HQ=1) (mg/kg)
1,2-Dinitrobenzene	528290	o-Dinitrobenzene	NC	3.7E+01	NC	1.3E+02	NC	6.9E+06
1,3-Dinitrobenzene	99650	m-Dinitrobenzene	NC	3.7E+01	NC	1.3E+02	NC	6.9E+06
2,4,6-Trinitrotoluene	118967	-	1.1E+02	1.8E+02	2.7E+02	2.0E+03	5.8E+06	3.5E+07
2-Amino-4,6-dinitrotoluene	35572782	-	NC	7.3E+02	NC	4.3E+04	NC	1.4E+08
HMX	2691410	-	NC	1.8E+04	NC	1.1E+06	NC	3.5E+09
Hydrazine	302012	-	1.1E+00	NC	8.7E-01	NC	1.0E+04	6.0E+05
RDX	121824	Hexahydro-1,3,5-trinitro-1,3,5-triazine	2.9E+01	1.1E+03	1.6E+02	2.6E+04	1.6E+06	2.1E+08
Perchlorate	14797730	-	NC	2.6E+02	NC	9.1E+03	NC	4.9E+07
Volatile Organic Compounds								
1,1,1,2-Tetrachloroethane	630206	-	1.2E+02	1.1E+04	NC	NC	4.5E+01	1.4E+04
1,1,1-Trichloroethane	71556	-	NC	7.3E+05	NC	NC	NC	8.3E+04
1,1,2,2-Tetrachloroethane	79345	-	1.2E+01	7.3E+03	NC	NC	4.6E+00	7.4E+03
1,1,2-Trichloro-1,2,2-trifluor	76131	Freon 113	NC	1.1E+07	NC	NC	NC	4.1E+05
1,1,2-Trichloroethane	79005	-	4.4E+01	1.5E+03	NC	NC	7.9E+00	1.0E+01
1,1-Dichloroethane	75343	-	5.6E+02	7.3E+04	NC	NC	2.7E+01	1.2E+04
1,1-Dichloroethene	75354	-	NC	1.8E+04	NC	NC	NC	7.9E+02
1,1-Dimethylhydrazine	57147	Unsymetrical Dimethyl Hydrazine	NC	3.7E+01	NC	NC	NC	4.0E+04
1,2,3-Trichlorobenzene	87616	-	8.9E+02	2.9E+02	NC	NC	1.3E+03	1.5E+03
1,2,4-Trichlorobenzene	120821	-	8.9E+02	3.7E+03	NC	NC	5.2E+02	4.2E+02
1,2,4-Trimethylbenzene	95636	-	NC	3.7E+03	NC	NC	NC	5.9E+02
1,2-Dibromo-3-chloropropan	96128	1,2-Dibromo-3-CPA	4.6E-01	7.3E+01	NC	NC	2.5E+04	4.0E+06
1,2-Dibromoethane	106934	1,2-Dibromoethane (EDB)	8.9E-01	3.3E+03	NC	NC	3.2E+00	8.2E+02
1,2-Dichlorobenzene	95501	o-Dichlorobenzene	NC	3.3E+04	NC	NC	NC	3.1E+04
1,2-Dichloroethane	107062	-	6.8E+01	2.2E+03	NC	NC	3.7E+00	2.2E+02
1,2-Dichloroethene	540590	1,2-Dichloroethenes	NC	3.3E+03	NC	NC	NC	1.6E+03
1,2-Dichloropropane	78875	-	8.9E+01	3.3E+04	NC	NC	6.3E+00	1.0E+02
1,3,5-Trimethylbenzene	108678	-	NC	3.7E+03	NC	NC	NC	3.2E+03
1,3-Dichlorobenzene	541731	m-Dichlorobenzene	NC	1.1E+04	NC	NC	NC	2.1E+04
1,4-Dichlorobenzene	106467	p-Dichlorobenzene	5.9E+02	2.6E+04	NC	NC	1.9E+01	6.6E+04

Attachment 1 - Table 10

Direct Soil Contact Pathway-Specific Recreational Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Soil Ingestion ($RBSL_{so_ing}$)		Soil Dermal Contact ($RBSL_{so_der}$)		Inhalation of Dust/Vapors ($RBSL_{so_inh}$)	
			Composite Recreator Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Composite Recreator Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Composite Recreator Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)
2-Chloroethylvinyl ether	110758	2-Chloroethyl vinyl ether	1.3E+00	NC	NC	NC	6.0E-02	NC
2-Hexanone	591786	Methyl butyl ketone	NC	1.8E+03	NC	NC	NC	4.2E+03
Acetone	67641	-	NC	3.3E+05	NC	NC	NC	5.7E+06
Benzene	71432	-	3.2E+01	1.5E+03	NC	NC	1.6E+00	5.7E+02
Bromobenzene	108861	-	NC	2.9E+03	NC	NC	NC	5.3E+03
Bromodichloromethane	75274	-	2.5E+01	7.3E+03	NC	NC	2.8E+00	2.9E+03
Bromoform	75252	-	2.9E+02	7.3E+03	NC	NC	4.5E+07	1.4E+09
Bromomethane	74839	-	NC	5.1E+02	NC	NC	NC	7.6E+01
Carbon disulfide	75150	-	NC	3.7E+04	NC	NC	NC	8.2E+03
Carbon tetrachloride	56235	-	2.1E+01	1.5E+03	NC	NC	1.0E+00	1.7E+03
Chlorobenzene	108907	Monochlorobenzene	NC	7.3E+03	NC	NC	NC	2.1E+03
Chloroform	67663	Trichloromethane	1.0E+02	3.7E+03	NC	NC	1.1E+01	6.7E+03
Chloromethane	74873	Methyl chloride	NC	5.1E+02	NC	NC	NC	1.1E+03
cis-1,2-Dichloroethene	156592	cis-1,2-Dichloroethylene	NC	7.3E+02	NC	NC	NC	1.4E+02
Cumene	98828	Isopropylbenzene	NC	3.7E+04	NC	NC	NC	2.6E+04
Dibromochloromethane	124481	-	3.4E+01	7.3E+03	NC	NC	1.8E+06	1.4E+09
Dibromomethane	74953	-	NC	3.7E+03	NC	NC	NC	3.2E+02
Dichlorodifluoromethane	75718	Freon 12	NC	7.3E+04	NC	NC	NC	9.3E+02
Ethylbenzene	100414	-	2.9E+02	3.7E+04	NC	NC	3.4E+01	6.7E+04
Methyl ethyl ketone	78933	2-Butanone; 2-Butanone (MEK)	NC	2.2E+05	NC	NC	NC	6.5E+05
Methyl isobutyl ketone (MIB	108101	MIBK; 4-Methyl-2-pentanone	NC	2.9E+04	NC	NC	NC	3.4E+05
Methylene chloride	75092	Dichloromethane	2.3E+02	2.2E+03	NC	NC	4.4E+01	1.1E+04
Monomethylhydrazine	60344	Monomethyl Hydrazine	5.8E-03	3.7E+02	NC	NC	5.0E+04	4.0E+05
m-Xylene & p-Xylene	136777612	meta- and para-Xylenes; m, p-Xylene	NC	7.3E+04	NC	NC	NC	6.2E+03
n-Butylbenzene	104518	-	NC	1.8E+04	NC	NC	NC	1.5E+04
n-Propylbenzene	103651	-	NC	3.7E+04	NC	NC	NC	7.4E+04
o-Chlorotoluene	95498	2-Chlorotoluene	NC	7.3E+03	NC	NC	NC	6.0E+03
o-Xylene	95476	-	NC	7.3E+04	NC	NC	NC	4.1E+03
p-Chlorotoluene	106434	4-Chlorotoluene	NC	7.3E+03	NC	NC	NC	5.4E+03

Attachment 1 - Table 10

Direct Soil Contact Pathway-Specific Recreational Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Soil Ingestion ($RBSL_{so_ing}$) Composite Recreator Cancer (10^{-6}) (mg/kg)	Soil Ingestion ($RBSL_{so_ing}$) Child Noncancer (HQ=1) (mg/kg)	Soil Dermal Contact ($RBSL_{so_der}$) Composite Recreator Cancer (10^{-6}) (mg/kg)	Soil Dermal Contact ($RBSL_{so_der}$) Child Noncancer (HQ=1) (mg/kg)	Inhalation of Dust/Vapors ($RBSL_{so_inh}$) Composite Recreator Cancer (10^{-6}) (mg/kg)	Inhalation of Dust/Vapors ($RBSL_{so_inh}$) Child Noncancer (HQ=1) (mg/kg)
p-Cymene	99876	p-Isopropyltoluene	NC	3.7E+04	NC	NC	NC	3.6E+04
p-Nitroaniline	100016	4-Nitroaniline	1.6E+02	1.5E+03	NC	NC	8.7E+06	1.2E+08
sec-Butylbenzene	135988	-	NC	3.7E+04	NC	NC	NC	3.1E+04
Styrene	100425	Vinylbenzene	NC	7.3E+04	NC	NC	NC	5.8E+05
tert-Butylbenzene	98066	Dibenzo[b,e][1,4]dioxin, octachloro-	NC	3.7E+04	NC	NC	NC	3.1E+04
Tetrachloroethene	127184	-	5.9E+00	2.2E+03	NC	NC	8.7E+00	8.2E+02
Tetralin	119642	-	NC	7.3E+03	NC	NC	1.2E+02	4.7E+03
Toluene	108883	Toluol	NC	2.9E+04	NC	NC	NC	1.3E+05
trans-1,2-Dichloroethene	156605	-	NC	7.3E+03	NC	NC	NC	1.3E+03
Trichloroethene	79016	Trichloroethylene (TCE)	6.9E+01	1.8E+02	NC	NC	1.2E+01	4.5E+01
Trichlorofluoromethane	75694	-	NC	1.1E+05	NC	NC	NC	7.6E+03
Vinyl chloride	75014	-	1.2E+01	1.1E+03	NC	NC	2.9E-01	9.0E+02
Xylenes, Total	1330207	Xylene (Total) Isomers	NC	7.3E+04	NC	NC	NC	6.2E+03
Semi-Volatile Organic Compounds								
1,4-Dioxane	123911	-	1.2E+02	1.1E+04	9.7E+01	3.9E+04	6.4E+06	6.0E+08
2,4,5-Trichlorophenol	95954	-	NC	3.7E+04	NC	1.3E+05	NC	6.9E+09
2,4,6-Trichlorophenol	88062	-	4.6E+01	3.7E+02	3.7E+01	1.3E+03	2.5E+06	6.9E+07
2,4-Dimethylphenol	105679	-	NC	7.3E+03	NC	2.6E+04	NC	1.4E+09
3,5-Dimethylphenol	108689	-	NC	2.6E+03	NC	9.4E+03	NC	5.0E+08
Benzoic acid	65850	-	NC	1.5E+06	NC	5.2E+06	NC	2.8E+11
Benzyl alcohol	100516	-	NC	3.7E+04	NC	1.3E+05	NC	6.9E+09
bis(2-Ethylhexyl) phthalate	117817	bis(2-ethylhexyl)phthalate	1.1E+03	7.3E+03	8.7E+02	2.6E+04	2.1E+07	1.4E+09
Butyl benzyl phthalate	85687	-	1.7E+03	7.3E+04	1.4E+03	2.6E+05	9.1E+07	1.4E+10
Carbazole	86748	-	1.6E+02	NC	1.3E+02	NC	8.7E+06	NC
Dibenzofuran	132649	-	NC	3.7E+02	NC	1.3E+03	NC	7.3E+03
Diethyl phthalate	84662	-	NC	2.9E+05	NC	1.0E+06	NC	5.6E+10
Dimethyl phthalate	131113	-	NC	2.9E+05	NC	1.0E+06	NC	5.6E+10
Di-n-butyl phthalate	84742	Di-n-butylphthalate	NC	3.7E+04	NC	1.3E+05	NC	6.9E+09
Di-n-octyl phthalate	117840	Di-n-octyl-phthalate	NC	3.7E+03	NC	1.3E+04	NC	6.9E+08
Formaldehyde	50000	-	NC	7.3E+04	NC	2.6E+05	8.3E+06	1.8E+08

Attachment 1 - Table 10

Direct Soil Contact Pathway-Specific Recreational Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Soil Ingestion ($RBSL_{so_ing}$) Composite Recreator Cancer (10^{-6}) (mg/kg)	Soil Ingestion ($RBSL_{so_ing}$) Child Noncancer (HQ=1) (mg/kg)	Soil Dermal Contact ($RBSL_{so_der}$) Composite Recreator Cancer (10^{-6}) (mg/kg)	Soil Dermal Contact ($RBSL_{so_der}$) Child Noncancer (HQ=1) (mg/kg)	Inhalation of Dust/Vapors ($RBSL_{so_inh}$) Composite Recreator Cancer (10^{-6}) (mg/kg)	Inhalation of Dust/Vapors ($RBSL_{so_inh}$) Child Noncancer (HQ=1) (mg/kg)
Hexachlorobutadiene	87683	-	4.1E+01	3.7E+02	3.4E+01	1.3E+03	2.3E+06	6.9E+07
m-Cresol	108394	3-Methylphenol	NC	1.8E+04	NC	6.5E+04	NC	1.2E+10
N-Nitrosodimethylamine	62759	Nitrosodimethylamine	2.0E-01	2.9E+00	1.6E-01	1.0E+01	1.1E+04	7.9E+05
N-Nitrosodiphenylamine	86306	-	3.5E+02	NC	2.9E+02	NC	1.9E+07	NC
o-Cresol	95487	2-Methylphenol	NC	1.8E+04	NC	6.5E+04	NC	1.2E+10
p-Chloro-m-cresol	59507	4-Chloro-3-Methylphenol	NC	3.7E+04	NC	1.3E+05	NC	6.9E+09
p-Cresol	106445	4-Methylphenol	NC	3.7E+04	NC	1.3E+05	NC	1.2E+10
Pentachlorophenol	87865	PCP	1.8E+02	1.8E+03	5.8E+01	2.6E+03	9.7E+06	3.5E+08
Phenol	108952	Total Phenols	NC	1.1E+05	NC	3.9E+05	NC	4.0E+09
Polynuclear Aromatic Hydrocarbons								
1-Methyl naphthalene	90120	1-Methylnaphthalene	1.1E+02	2.6E+04	6.0E+01	6.1E+04	1.9E+02	1.5E+05
2-Methylnaphthalene	91576	Naphthalene, 2-methyl-	NC	1.5E+03	NC	3.5E+03	NC	8.6E+03
Acenaphthene	83329	-	NC	2.2E+04	NC	5.2E+04	NC	1.9E+06
Acenaphthylene	208968	-	NC	2.2E+04	NC	5.2E+04	NC	4.2E+05
Anthracene	120127	-	NC	1.1E+05	NC	2.6E+05	NC	3.9E+07
Benzo(a)anthracene	56553	Benz[a]anthracene	2.7E+00	NC	1.5E+00	NC	4.5E+05	NC
Benzo(a)pyrene	50328	Benzo (a) pyrene	2.7E-01	NC	1.5E-01	NC	4.5E+04	NC
Benzo(b)fluoranthene	205992	Benz[e]acephenanthrylene 1	2.7E+00	NC	1.5E+00	NC	4.5E+05	NC
Benzo(e)pyrene	192972	-	NC	1.1E+04	NC	2.6E+04	NC	2.1E+09
Benzo(ghi)perylene	191242	Benzo (g,h,i) perylene	NC	1.1E+04	NC	2.6E+04	NC	2.1E+09
Benzo(k)fluoranthene	207089	Benzo[k]fluoranthene	2.7E+00	NC	1.5E+00	NC	4.5E+05	NC
Chrysene	218019	-	2.7E+01	NC	1.5E+01	NC	4.5E+06	NC
Dibenzo(a,h)anthracene	53703	Dibenz (a,h) anthracene	7.8E-01	NC	4.2E-01	NC	4.1E+04	NC
Fluoranthene	206440	-	NC	1.5E+04	NC	3.5E+04	NC	2.8E+09
Fluorene	86737	-	NC	1.5E+04	NC	3.5E+04	NC	2.6E+06
Indeno(1,2,3-cd)pyrene	193395	Indeno (1,2,3-cd) pyrene	2.7E+00	NC	1.5E+00	NC	4.5E+05	NC
Naphthalene	91203	-	NC	7.3E+03	NC	1.7E+04	2.0E+02	2.5E+04
Perylene	198550	-	NC	1.1E+04	NC	2.6E+04	NC	2.1E+09
Phenanthrene	85018	-	NC	1.1E+05	NC	2.6E+05	NC	4.3E+07
Pyrene	129000	-	NC	1.1E+04	NC	2.6E+04	NC	2.1E+09

Attachment 1 - Table 10

Direct Soil Contact Pathway-Specific Recreational Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Soil Ingestion ($RBSL_{so_ing}$) Composite Recreator Cancer (10^{-6}) (mg/kg)	Soil Ingestion ($RBSL_{so_ing}$) Child Noncancer (HQ=1) (mg/kg)	Soil Dermal Contact ($RBSL_{so_der}$) Composite Recreator Cancer (10^{-6}) (mg/kg)	Soil Dermal Contact ($RBSL_{so_der}$) Child Noncancer (HQ=1) (mg/kg)	Inhalation of Dust/Vapors ($RBSL_{so_inh}$) Composite Recreator Cancer (10^{-6}) (mg/kg)	Inhalation of Dust/Vapors ($RBSL_{so_inh}$) Child Noncancer (HQ=1) (mg/kg)
Pesticides								
4,4'-DDD	72548	p,p'-DDD	1.3E+01	NC	2.2E+01	NC	7.2E+05	NC
4,4'-DDE	72559	p,p'-DDE	9.4E+00	NC	1.5E+01	NC	5.1E+05	NC
4,4'-DDT	50293	p,p'-DDT	9.4E+00	1.8E+02	1.5E+01	1.3E+03	5.1E+05	3.5E+07
Aldrin	309002	-	1.9E-01	1.1E+01	3.1E-01	7.8E+01	1.0E+04	2.1E+06
alpha-BHC	319846	a-Benzene Hexachloride	1.2E+00	2.9E+03	1.9E+00	2.1E+04	6.4E+04	5.6E+08
beta-BHC	319857	b-Benzene Hexachloride	2.1E+00	NC	3.5E+00	NC	1.2E+05	NC
delta-BHC	319868	d-Benzene Hexachloride	1.8E+00	1.1E+02	2.9E+00	7.8E+02	9.9E+04	2.1E+07
Chlordane (Technical)	12789036	-	9.1E+00	1.8E+02	1.5E+01	1.3E+03	5.0E+05	1.4E+07
Dieldrin	60571	-	2.0E-01	1.8E+01	3.3E-01	1.3E+02	1.1E+04	3.5E+06
Endosulfan I	959988	-	NC	2.2E+03	NC	1.6E+04	NC	4.2E+08
Endosulfan II	33213659	-	NC	2.2E+03	NC	1.6E+04	NC	4.2E+08
Endosulfan sulfate	1031078	-	NC	2.2E+03	NC	1.6E+04	NC	4.2E+08
Endrin	72208	-	NC	1.1E+02	NC	7.8E+02	NC	2.1E+07
Endrin aldehyde	7421934	-	NC	1.1E+02	NC	7.8E+02	NC	2.1E+07
Endrin ketone	53494705	-	NC	1.1E+02	NC	7.8E+02	NC	2.1E+07
gamma-BHC	58899	Lindane	2.9E+00	1.1E+02	4.8E+00	7.8E+02	1.6E+05	2.1E+07
Heptachlor	76448	-	7.8E-01	1.8E+02	1.3E+00	1.3E+03	4.2E+04	3.5E+07
Heptachlor epoxide	1024573	-	5.8E-01	4.7E+00	9.5E-01	3.4E+01	9.6E+03	9.0E+05
MCPA	94746	-	NC	1.8E+02	NC	1.3E+03	NC	3.5E+07
Mirex	2385855	Mirex (DeChlorane)	1.8E-01	7.3E+01	2.9E-01	5.2E+02	9.7E+03	1.4E+07
p,p'-Methoxychlor	72435	Methoxychlor	NC	1.8E+03	NC	1.3E+04	NC	3.5E+08
Toxaphene	8001352	-	2.7E+00	NC	4.4E+00	NC	1.5E+05	NC
Herbicides								
2,4,5-T	93765	2,4,5-Trichlorophenoxyacetic acid	NC	3.7E+03	NC	2.6E+04	NC	6.9E+08
2,4,5-TP (Silvex)	93721	-	NC	2.9E+03	NC	2.1E+04	NC	5.6E+08
2,4-Dichlorophenoxyacetic A	94757	-	NC	3.7E+03	NC	2.6E+04	NC	6.9E+08
2,4-Dichlorophenoxybutyric a	94826	2,4-DB	NC	2.9E+03	NC	2.1E+04	NC	5.6E+08
Dalapon	75990	-	NC	1.1E+04	NC	7.8E+04	NC	2.1E+09
Dicamba	1918009	-	NC	1.1E+04	NC	7.8E+04	NC	2.1E+09

Attachment 1 - Table 10

Direct Soil Contact Pathway-Specific Recreational Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Soil Ingestion ($RBSL_{so_ing}$) Composite Recreator Cancer (10^{-6}) (mg/kg)	Soil Ingestion ($RBSL_{so_ing}$) Child Noncancer (HQ=1) (mg/kg)	Soil Dermal Contact ($RBSL_{so_der}$) Composite Recreator Cancer (10^{-6}) (mg/kg)	Soil Dermal Contact ($RBSL_{so_der}$) Child Noncancer (HQ=1) (mg/kg)	Inhalation of Dust/Vapors ($RBSL_{so_inh}$) Composite Recreator Cancer (10^{-6}) (mg/kg)	Inhalation of Dust/Vapors ($RBSL_{so_inh}$) Child Noncancer (HQ=1) (mg/kg)
2,4-DP (Dichlorprop)	120365	-	NC	3.7E+03	NC	2.6E+04	NC	6.9E+08
Dinoseb	88857	-	NC	3.7E+02	NC	2.6E+03	NC	6.9E+07
MCPP	93652	-	NC	3.7E+02	NC	2.6E+03	NC	6.9E+07
Terphenyls								
m-Terphenyl	92068	-	4.0E+02	1.8E+05	3.3E+02	6.5E+05	2.2E+07	7.9E+06
o-Terphenyl	84151	-	4.0E+02	1.8E+05	3.3E+02	6.5E+05	2.2E+07	7.9E+06
p-Terphenyl	92944	-	4.0E+02	1.8E+05	3.3E+02	6.5E+05	2.2E+07	7.9E+06
Glycols								
Diethylene Glycol	111466	-	NC	3.7E+04	NC	1.3E+05	NC	3.2E+10
Triethylene glycol	112276	-	NC	1.6E+04	NC	5.9E+04	NC	3.1E+09
PCDD/PCDFs								
2,3,7,8-TCDD TEQ	1746016-TEQ	-	2.5E-05	2.6E-04	6.7E-05	3.0E-03	1.3E+00	7.9E+02
Polychlorinated Biphenyls (PCBs)								
Aroclor 1016	12674112	-	4.6E+01	2.6E+01	2.5E+01	6.1E+01	2.5E+06	4.9E+06
Aroclor 1242	53469219	Aroclor-1242	1.6E+00	7.3E+00	8.7E-01	1.7E+01	8.7E+04	1.4E+06
Aroclor 1248	12672296	-	1.6E+00	7.3E+00	8.7E-01	1.7E+01	8.7E+04	1.4E+06
Aroclor 1254	11097691	-	1.6E+00	7.3E+00	8.7E-01	1.7E+01	8.7E+04	1.4E+06
Aroclor 1260	11096825	-	1.6E+00	7.3E+00	8.7E-01	1.7E+01	8.7E+04	1.4E+06
Aroclor 5460	11126424	-	1.6E+00	7.3E+00	8.7E-01	1.7E+01	8.7E+04	1.4E+06
PCB TEQ	1746016-PCB TEQ	-	2.5E-05	2.6E-04	1.3E-05	6.1E-04	1.3E+00	7.9E+02

Notes:
'-' - none established/not applicable.
HQ - hazard quotient
mg/kg - milligrams per kilogram

Attachment 1 - Table 10

Direct Soil Contact Pathway-Specific Recreational Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Soil Ingestion ($RBSL_{so_ing}$)		Soil Dermal Contact ($RBSL_{so_der}$)		Inhalation of Dust/Vapors ($RBSL_{so_inh}$)	
			Composite Recreator Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Composite Recreator Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Composite Recreator Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)

NC - not calculated
PCB - polychlorinated biphenyl
PCDD/PCDF - polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans
RBSL - Risk-Based Screening Level
TCDD - 2,3,7,8-Tetrachlorodibenzo-p-dioxin
TEQ - toxic equivalency

a - Please note that different chemical names have been used for different programs at the SSFL, and there can be additional analyte synonyms than those presented. Therefore, any chemical synonym should be verified using the CAS number listed.
b - The cadmium RBSLs for non-carcinogenic effects were calculated using the exposure assumptions for an adult as described in Section 3.2.1.

Attachment 1 - Table 11

SRAM-based Suburban Residential Garden Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Fruits/Vegetables: Target Chemical Concentration in Fruits and Vegetables (C_{fv})		Fruits/Vegetables: Soil RBSL for Fruits and Vegetables Pathway ($RBSL_{fv_g}$)	
			Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)
Inorganic Compounds						
Aluminum	7429905	Aluminum, Total	NC	9.4E+01	NC	NC
Antimony	7440360	Antimony, Total	NC	3.8E-02	NC	1.4E-01
Arsenic	7440382	Arsenic, Total	2.7E-05	2.8E-02	9.9E-05	1.0E-01
Barium	7440393	Barium, Total	NC	1.9E+01	NC	7.2E+01
Beryllium	7440417	Beryllium, Total	NC	1.9E-01	NC	7.2E-01
Boron	7440428	Boron, Total	NC	1.9E+01	NC	1.5E+01
Cadmium	7440439	Cadmium, Total	NC	6.6E-04 [b]	NC	1.6E-03
Chromium	7440473	Chromium, Total	NC	1.4E+02	NC	5.4E+02
Cobalt	7440484	Cobalt, Total	NC	2.8E-02	NC	1.0E-01
Copper	7440508	Copper, Total	NC	3.8E+00	NC	1.1E+01
Cyanides	57125	Cyanide, Total; Cyanide	NC	5.6E-02	NC	2.8E-02
Fluoride	16984488	-	NC	3.8E+00	NC	NC
Hexavalent chromium	18540299	Chromium, Hexavalent; Chromium VI	5.1E-04	2.8E-01	1.9E-03	1.1E+00
Lead	7439921	Lead, Total	NC	NC	NC	NC
Lithium	7439932	Lithium, Total	NC	1.9E-01	NC	7.1E-01
Manganese	7439965	Manganese, Total	NC	1.3E+01	NC	4.0E+01
Mercury	7439976	Mercury, Total	NC	2.8E-02	NC	5.0E-02
Methyl Mercury	22967926	-	NC	9.4E-03	NC	1.3E-03
Molybdenum	7439987	Molybdenum, Total	NC	4.7E-01	NC	1.4E+00
Nickel	7440020	Nickel, Total	NC	1.9E+00	NC	6.1E+00
Selenium	7782492	Selenium, Total	NC	4.7E-01	NC	1.3E+00
Silver	7440224	Silver, Total	NC	4.7E-01	NC	1.8E+00
Strontium	7440246	Strontium, Total	NC	5.6E+01	NC	1.2E+02
Thallium	7440280	Thallium, Total	NC	9.4E-04	NC	3.6E-03
Tin	7440315	Tin, Total	NC	5.6E+01	NC	1.0E+02
Vanadium	7440622	Vanadium, Total	NC	4.7E-01	NC	1.8E+00
Zinc	7440666	Zinc, Total	NC	2.8E+01	NC	5.4E+01
Zirconium	7440677	Zirconium, Total	NC	7.5E-03	NC	2.9E-02
Energetic Constituents						
1,2-Dinitrobenzene	528290	o-Dinitrobenzene	NC	9.4E-03	NC	8.8E-03
1,3-Dinitrobenzene	99650	m-Dinitrobenzene	NC	9.4E-03	NC	7.2E-03

Attachment 1 - Table 11

SRAM-based Suburban Residential Garden Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Fruits/Vegetables: Target Chemical Concentration in Fruits and Vegetables (C_{fv})		Fruits/Vegetables: Soil RBSL for Fruits and Vegetables Pathway ($RBSL_{fv_g}$)	
			Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)
2,4,6-Trinitrotoluene	118967	-	8.5E-03	4.7E-02	7.3E-03	4.0E-02
2-Amino-4,6-dinitrotoluene	35572782	-	NC	1.9E-01	NC	2.0E-01
HMX	2691410	-	NC	4.7E+00	NC	7.3E-01
Hydrazine	302012	-	8.5E-05	NC	6.7E-07	NC
RDX	121824	Hexahydro-1,3,5-trinitro-1,3,5-triazine	2.3E-03	2.8E-01	8.7E-04	1.1E-01
Perchlorate	14797730	-	NC	6.6E-02	NC	1.6E-02
Volatile Organic Compounds						
1,1,1,2-Tetrachloroethane	630206	-	9.8E-03	2.8E+00	2.4E-02	6.8E+00
1,1,1-Trichloroethane	71556	-	NC	1.9E+02	NC	3.5E+02
1,1,2,2-Tetrachloroethane	79345	-	9.4E-04	1.9E+00	1.6E-03	3.3E+00
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	Freon 113	NC	2.8E+03	NC	7.6E+03
1,1,2-Trichloroethane	79005	-	3.5E-03	3.8E-01	4.0E-03	4.3E-01
1,1-Dichloroethane	75343	-	4.5E-02	1.9E+01	4.6E-02	1.9E+01
1,1-Dichloroethene	75354	-	NC	4.7E+00	NC	6.6E+00
1,1-Dimethylhydrazine	57147	Unsymetrical Dimethyl Hydrazine	NC	9.4E-03	NC	2.5E-04
1,2,3-Trichlorobenzene	87616	-	7.1E-02	7.5E-02	2.4E-01	2.6E-01
1,2,4-Trichlorobenzene	120821	-	7.1E-02	9.4E-01	2.4E-01	3.2E+00
1,2,4-Trimethylbenzene	95636	-	NC	9.4E-01	NC	2.9E+00
1,2-Dibromo-3-chloropropane	96128	1,2-Dibromo-3-CPA	3.6E-05	1.9E-02	8.9E-05	4.6E-02
1,2-Dibromoethane	106934	1,2-Dibromoethane (EDB)	7.1E-05	8.5E-01	8.6E-05	1.0E+00
1,2-Dichlorobenzene	95501	o-Dichlorobenzene	NC	8.5E+00	NC	2.5E+01
1,2-Dichloroethane	107062	-	5.4E-03	5.6E-01	4.1E-03	4.2E-01
1,2-Dichloroethene	540590	1,2-Dichloroethenes	NC	8.5E-01	NC	1.2E+00
1,2-Dichloropropane	78875	-	7.1E-03	8.5E+00	8.8E-03	1.0E+01
1,3,5-Trimethylbenzene	108678	-	NC	9.4E-01	NC	2.8E+00
1,3-Dichlorobenzene	541731	m-Dichlorobenzene	NC	2.8E+00	NC	8.6E+00
1,4-Dichlorobenzene	106467	p-Dichlorobenzene	4.7E-02	6.6E+00	1.4E-01	1.9E+01
2-Chloroethylvinyl ether	110758	2-Chloroethyl vinyl ether	1.0E-04	NC	5.4E-05	NC
2-Hexanone	591786	Methyl butyl ketone	NC	4.7E-01	NC	3.2E-01
Acetone	67641	-	NC	8.5E+01	NC	7.8E+00
Benzene	71432	-	2.5E-03	3.8E-01	3.6E-03	5.3E-01

Attachment 1 - Table 11

SRAM-based Suburban Residential Garden Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Fruits/Vegetables: Target Chemical Concentration in Fruits and Vegetables (C_{fv})		Fruits/Vegetables: Soil RBSL for Fruits and Vegetables Pathway ($RBSL_{fv_g}$)	
			Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)
Bromobenzene	108861	-	NC	7.5E-01	NC	1.9E+00
Bromodichloromethane	75274	-	2.0E-03	1.9E+00	2.5E-03	2.4E+00
Bromoform	75252	-	2.3E-02	1.9E+00	4.0E-02	3.3E+00
Bromomethane	74839	-	NC	1.3E-01	NC	7.2E-02
Carbon disulfide	75150	-	NC	9.4E+00	NC	1.1E+01
Carbon tetrachloride	56235	-	1.7E-03	3.8E-01	3.9E-03	8.6E-01
Chlorobenzene	108907	Monochlorobenzene	NC	1.9E+00	NC	4.3E+00
Chloroform	67663	Trichloromethane	8.2E-03	9.4E-01	1.0E-02	1.2E+00
Chloromethane	74873	Methyl chloride	NC	1.3E-01	NC	5.2E-02
cis-1,2-Dichloroethene	156592	cis-1,2-Dichloroethylene	NC	1.9E-01	NC	2.1E-01
Cumene	98828	Isopropylbenzene	NC	9.4E+00	NC	3.0E+01
Dibromochloromethane	124481	-	2.7E-03	1.9E+00	3.9E-03	2.7E+00
Dibromomethane	74953	-	NC	9.4E-01	NC	8.9E-01
Dichlorodifluoromethane	75718	Freon 12	NC	1.9E+01	NC	2.7E+01
Ethylbenzene	100414	-	2.3E-02	9.4E+00	6.2E-02	2.5E+01
Methyl ethyl ketone	78933	2-Butanone; 2-Butanone (MEK)	NC	5.6E+01	NC	1.0E+01
Methyl isobutyl ketone (MIBK)	108101	MIBK; 4-Methyl-2-pentanone	NC	7.5E+00	NC	4.7E+00
Methylene chloride	75092	Dichloromethane	1.8E-02	5.6E-01	1.1E-02	3.3E-01
Monomethylhydrazine	60344	Monomethyl Hydrazine	4.6E-07	9.4E-02	1.5E-08	3.0E-03
m-Xylene & p-Xylene	136777612	meta- and para-Xylenes; m, p-Xylene	NC	1.9E+01	NC	5.0E+01
n-Butylbenzene	104518	-	NC	4.7E+00	NC	1.7E+01
n-Propylbenzene	103651	-	NC	9.4E+00	NC	3.0E+01
o-Chlorotoluene	95498	2-Chlorotoluene	NC	1.9E+00	NC	5.5E+00
o-Xylene	95476	-	NC	1.9E+01	NC	5.0E+01
p-Chlorotoluene	106434	4-Chlorotoluene	NC	1.9E+00	NC	5.4E+00
p-Cymene	99876	p-Isopropyltoluene	NC	9.4E+00	NC	3.2E+01
p-Nitroaniline	100016	4-Nitroaniline	1.3E-02	3.8E-01	8.7E-03	2.6E-01
sec-Butylbenzene	135988	-	NC	9.4E+00	NC	3.4E+01
Styrene	100425	Vinylbenzene	NC	1.9E+01	NC	4.6E+01
tert-Butylbenzene	98066	Dibenzo[b,e][1,4]dioxin, octachloro-	NC	9.4E+00	NC	3.2E+01

Attachment 1 - Table 11

SRAM-based Suburban Residential Garden Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Fruits/Vegetables: Target Chemical Concentration in Fruits and Vegetables (C_{fv})		Fruits/Vegetables: Soil RBSL for Fruits and Vegetables Pathway ($RBSL_{fv_g}$)	
			Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)
Tetrachloroethene	127184	-	4.7E-04	5.6E-01	1.4E-03	1.6E+00
Tetralin	119642	-	NC	1.9E+00	NC	5.3E+00
Toluene	108883	Toluol	NC	7.5E+00	NC	1.6E+01
trans-1,2-Dichloroethene	156605	-	NC	1.9E+00	NC	2.6E+00
Trichloroethene	79016	Trichloroethylene (TCE)	5.5E-03	4.7E-02	9.8E-03	8.3E-02
Trichlorofluoromethane	75694	-	NC	2.8E+01	NC	5.4E+01
Vinyl chloride	75014	-	9.4E-04	2.8E-01	8.2E-04	2.5E-01
Xylenes, Total	1330207	Xylene (Total) Isomers	NC	1.9E+01	NC	5.0E+01
Semi-Volatile Organic Compounds						
1,4-Dioxane	123911	-	9.4E-03	2.8E+00	8.4E-04	2.5E-01
2,4,5-Trichlorophenol	95954	-	NC	9.4E+00	NC	3.0E+01
2,4,6-Trichlorophenol	88062	-	3.6E-03	9.4E-02	1.2E-02	3.0E-01
2,4-Dimethylphenol	105679	-	NC	1.9E+00	NC	3.0E+00
3,5-Dimethylphenol	108689	-	NC	6.8E-01	NC	1.4E+00
Benzoic acid	65850	-	NC	3.8E+02	NC	4.2E+02
Benzyl alcohol	100516	-	NC	9.4E+00	NC	4.6E+00
bis(2-Ethylhexyl) phthalate	117817	bis(2-ethylhexyl)phthalate	8.5E-02	1.9E+00	3.3E-01	7.2E+00
Butyl benzyl phthalate	85687	-	1.3E-01	1.9E+01	4.9E-01	6.9E+01
Carbazole	86748	-	1.3E-02	NC	4.1E-02	NC
Dibenzofuran	132649	-	NC	9.4E-02	NC	3.2E-01
Diethyl phthalate	84662	-	NC	7.5E+01	NC	1.3E+02
Dimethyl phthalate	131113	-	NC	7.5E+01	NC	6.4E+01
Di-n-butyl phthalate	84742	Di-n-butylphthalate	NC	9.4E+00	NC	3.4E+01
Di-n-octyl phthalate	117840	Di-n-octyl-phthalate	NC	9.4E-01	NC	3.6E+00
Formaldehyde	50000	-	NC	1.9E+01	NC	3.7E+00
Hexachlorobutadiene	87683	-	3.3E-03	9.4E-02	1.2E-02	3.4E-01
m-Cresol	108394	3-Methylphenol	NC	4.7E+00	NC	5.7E+00
N-Nitrosodimethylamine	62759	Nitrosodimethylamine	1.6E-05	7.5E-04	9.5E-07	4.5E-05
N-Nitrosodiphenylamine	86306	-	2.8E-02	NC	7.5E-02	NC
o-Cresol	95487	2-Methylphenol	NC	4.7E+00	NC	5.7E+00
p-Chloro-m-cresol	59507	4-Chloro-3-Methylphenol	NC	9.4E+00	NC	2.5E+01
p-Cresol	106445	4-Methylphenol	NC	9.4E+00	NC	1.1E+01
Pentachlorophenol	87865	PCP	1.4E-02	4.7E-01	5.3E-02	1.8E+00

Attachment 1 - Table 11

SRAM-based Suburban Residential Garden Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Fruits/Vegetables: Target Chemical Concentration in Fruits and Vegetables (C_{fv})		Fruits/Vegetables: Soil RBSL for Fruits and Vegetables Pathway ($RBSL_{fv_g}$)	
			Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)
Phenol	108952	Total Phenols	NC	2.8E+01	NC	2.1E+01
Polynuclear Aromatic Hydrocarbons						
1-Methyl naphthalene	90120	1-Methylnaphthalene	8.8E-03	6.6E+00	2.9E-02	2.2E+01
2-Methylnaphthalene	91576	Naphthalene, 2-methyl-	NC	3.8E-01	NC	1.2E+00
Acenaphthene	83329	-	NC	5.6E+00	NC	1.9E+01
Acenaphthylene	208968	-	NC	5.6E+00	NC	1.9E+01
Anthracene	120127	-	NC	2.8E+01	NC	1.0E+02
Benzo(a)anthracene	56553	Benz[a]anthracene	2.1E-04	NC	8.1E-04	NC
Benzo(a)pyrene	50328	Benzo (a) pyrene	2.1E-05	NC	8.1E-05	NC
Benzo(b)fluoranthene	205992	Benz[e]acephenanthrylene 1	2.1E-04	NC	8.1E-04	NC
Benzo(e)pyrene	192972	-	NC	2.8E+00	NC	1.1E+01
Benzo(ghi)perylene	191242	Benzo (g,h,i) perylene	NC	2.8E+00	NC	1.1E+01
Benzo(k)fluoranthene	207089	Benzo[k]fluoranthene	2.1E-04	NC	8.1E-04	NC
Chrysene	218019	-	2.1E-03	NC	8.1E-03	NC
Dibenzo(a,h)anthracene	53703	Dibenz (a,h) anthracene	6.2E-05	NC	2.4E-04	NC
Fluoranthene	206440	-	NC	3.8E+00	NC	1.4E+01
Fluorene	86737	-	NC	3.8E+00	NC	1.3E+01
Indeno(1,2,3-cd)pyrene	193395	Indeno (1,2,3-cd) pyrene	2.1E-04	NC	8.1E-04	NC
Naphthalene	91203	-	NC	1.9E+00	NC	5.3E+00
Perylene	198550	-	NC	2.8E+00	NC	1.1E+01
Phenanthrene	85018	-	NC	2.8E+01	NC	1.0E+02
Pyrene	129000	-	NC	2.8E+00	NC	1.0E+01
Pesticides						
4,4'-DDD	72548	p,p'-DDD	1.1E-03	NC	4.0E-03	NC
4,4'-DDE	72559	p,p'-DDE	7.5E-04	NC	2.9E-03	NC
4,4'-DDT	50293	p,p'-DDT	7.5E-04	4.7E-02	2.9E-03	1.8E-01
Aldrin	309002	-	1.5E-05	2.8E-03	5.7E-05	1.1E-02
alpha-BHC	319846	a-Benzene Hexachloride	9.4E-05	7.5E-01	3.1E-04	2.4E+00
beta-BHC	319857	b-Benzene Hexachloride	1.7E-04	NC	5.5E-04	NC
delta-BHC	319868	d-Benzene Hexachloride	1.4E-04	2.8E-02	4.9E-04	9.7E-02
Chlordane (Technical)	12789036	-	7.3E-04	4.7E-02	2.8E-03	1.8E-01
Dieldrin	60571	-	1.6E-05	4.7E-03	6.0E-05	1.8E-02

Attachment 1 - Table 11

SRAM-based Suburban Residential Garden Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Fruits/Vegetables: Target Chemical Concentration in Fruits and Vegetables (C_{fv})		Fruits/Vegetables: Soil RBSL for Fruits and Vegetables Pathway ($RBSL_{fv_g}$)	
			Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)
Endosulfan I	959988	-	NC	5.6E-01	NC	1.8E+00
Endosulfan II	33213659	-	NC	5.6E-01	NC	1.8E+00
Endosulfan sulfate	1031078	-	NC	5.6E-01	NC	1.8E+00
Endrin	72208	-	NC	2.8E-02	NC	1.1E-01
Endrin aldehyde	7421934	-	NC	2.8E-02	NC	1.0E-01
Endrin ketone	53494705	-	NC	2.8E-02	NC	1.0E-01
gamma-BHC	58899	Lindane	2.3E-04	2.8E-02	7.4E-04	9.0E-02
Heptachlor	76448	-	6.2E-05	4.7E-02	2.4E-04	1.8E-01
Heptachlor epoxide	1024573	-	4.6E-05	1.2E-03	1.7E-04	4.5E-03
MCPA	94746	-	NC	4.7E-02	NC	1.3E-01
Mirex	2385855	Mirex (DeChlorane)	1.4E-05	1.9E-02	5.4E-05	7.2E-02
p,p'-Methoxychlor	72435	Methoxychlor	NC	4.7E-01	NC	1.7E+00
Toxaphene	8001352	-	2.1E-04	NC	8.1E-04	NC
Herbicides						
2,4,5-T	93765	2,4,5-Trichlorophenoxyacetic acid	NC	9.4E-01	NC	2.7E+00
2,4,5-TP (Silvex)	93721	-	NC	7.5E-01	NC	2.4E+00
2,4-Dichlorophenoxyacetic Acid (2,4-D)	94757	-	NC	9.4E-01	NC	2.1E+00
2,4-Dichlorophenoxybutyric acid	94826	2,4-DB	NC	7.5E-01	NC	2.3E+00
Dalapon	75990	-	NC	2.8E+00	NC	2.6E+00
Dicamba	1918009	-	NC	2.8E+00	NC	4.3E+00
2,4-DP (Dichlorprop)	120365	-	NC	9.4E-01	NC	2.8E+00
Dinoseb	88857	-	NC	9.4E-02	NC	2.9E-01
MCPP	93652	-	NC	9.4E-02	NC	2.5E-01
Terphenyls						
m-Terphenyl	92068	-	3.2E-02	4.7E+01	1.1E-01	1.6E+02
o-Terphenyl	84151	-	3.2E-02	4.7E+01	1.1E-01	1.6E+02
p-Terphenyl	92944	-	3.2E-02	4.7E+01	1.1E-01	1.6E+02
Glycols						
Diethylene Glycol	111466	-	NC	9.4E+00	NC	1.7E-01
Triethylene glycol	112276	-	NC	4.2E+00	NC	5.3E-02

Attachment 1 - Table 11

SRAM-based Suburban Residential Garden Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Fruits/Vegetables: Target Chemical Concentration in Fruits and Vegetables (C_{fv})		Fruits/Vegetables: Soil RBSL for Fruits and Vegetables Pathway ($RBSL_{fv_g}$)	
			Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)
PCDD/PCDFs						
2,3,7,8-TCDD TEQ	1746016-TEQ	-	2.0E-09	6.6E-08	7.5E-09	2.5E-07
Polychlorinated Biphenyls (PCBs)						
Aroclor 1016	12674112	-	3.6E-03	6.6E-03	1.4E-02	2.5E-02
Aroclor 1242	53469219	Aroclor-1242	1.3E-04	1.9E-03	4.9E-04	7.2E-03
Aroclor 1248	12672296	-	1.3E-04	1.9E-03	4.9E-04	7.2E-03
Aroclor 1254	11097691	-	1.3E-04	1.9E-03	4.9E-04	7.2E-03
Aroclor 1260	11096825	-	1.3E-04	1.9E-03	4.9E-04	7.2E-03
Aroclor 5460	11126424	-	1.3E-04	1.9E-03	4.9E-04	7.2E-03
PCB TEQ	1746016-PCB TEQ	-	2.0E-09	6.6E-08	7.5E-09	2.5E-07

Notes:
'-' - none established/not applicable.
HQ - hazard quotient
mg/kg - milligrams per kilogram
NC - not calculated
PCB - polychlorinated biphenyl
PCDD/PCDF - polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans
RBSL - Risk-Based Screening Level
TCDD - 2,3,7,8-Tetrachlorodibenzo-p-dioxin
TEQ - toxic equivalency

a - Please note that different chemical names have been used for different programs at the SSFL, and there can be additional analyte synonyms than those presented. Therefore, any chemical synonym should be verified using the CAS number listed.
b - The cadmium RBSLs for non-carcinogenic effects were calculated using the exposure assumptions for an adult as described in Section 3.2.1.

Attachment 1 - Table 12

USEPA Default-based Suburban Residential Garden Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Fruits/Vegetables: Target Chemical Concentration in Fruits and Vegetables (C_{fv})		Fruits/Vegetables: Soil RBSL for Fruits and Vegetables Pathway ($RBSL_{fv_g}$)	
			Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)
Inorganic Compounds						
Aluminum	7429905	Aluminum, Total	NC	2.5E+03	NC	NC
Antimony	7440360	Antimony, Total	NC	9.9E-01	NC	3.7E+00
Arsenic	7440382	Arsenic, Total	7.9E-04	7.4E-01	2.9E-03	2.8E+00
Barium	7440393	Barium, Total	NC	5.0E+02	NC	1.9E+03
Beryllium	7440417	Beryllium, Total	NC	5.0E+00	NC	1.9E+01
Boron	7440428	Boron, Total	NC	5.0E+02	NC	3.9E+02
Cadmium	7440439	Cadmium, Total	NC	2.2E-02 [b]	NC	5.5E-02
Chromium	7440473	Chromium, Total	NC	3.7E+03	NC	1.4E+04
Cobalt	7440484	Cobalt, Total	NC	7.4E-01	NC	2.6E+00
Copper	7440508	Copper, Total	NC	9.9E+01	NC	2.9E+02
Cyanides	57125	Cyanide, Total; Cyanide	NC	1.5E+00	NC	7.3E-01
Fluoride	16984488	-	NC	9.9E+01	NC	NC
Hexavalent chromium	18540299	Chromium, Hexavalent; Chromium VI	1.5E-02	7.4E+00	5.7E-02	2.8E+01
Lead	7439921	Lead, Total	NC	NC	NC	NC
Lithium	7439932	Lithium, Total	NC	5.0E+00	NC	1.9E+01
Manganese	7439965	Manganese, Total	NC	3.5E+02	NC	1.1E+03
Mercury	7439976	Mercury, Total	NC	7.4E-01	NC	1.3E+00
Methyl Mercury	22967926	-	NC	2.5E-01	NC	3.5E-02
Molybdenum	7439987	Molybdenum, Total	NC	1.2E+01	NC	3.7E+01
Nickel	7440020	Nickel, Total	NC	5.0E+01	NC	1.6E+02
Selenium	7782492	Selenium, Total	NC	1.2E+01	NC	3.4E+01
Silver	7440224	Silver, Total	NC	1.2E+01	NC	4.8E+01
Strontium	7440246	Strontium, Total	NC	1.5E+03	NC	3.2E+03
Thallium	7440280	Thallium, Total	NC	2.5E-02	NC	9.5E-02
Tin	7440315	Tin, Total	NC	1.5E+03	NC	2.7E+03
Vanadium	7440622	Vanadium, Total	NC	1.2E+01	NC	4.7E+01
Zinc	7440666	Zinc, Total	NC	7.4E+02	NC	1.4E+03
Zirconium	7440677	Zirconium, Total	NC	2.0E-01	NC	7.6E-01
Energetic Constituents						

Attachment 1 - Table 12

USEPA Default-based Suburban Residential Garden Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Fruits/Vegetables: Target Chemical Concentration in Fruits and Vegetables (C_{fv})		Fruits/Vegetables: Soil RBSL for Fruits and Vegetables Pathway ($RBSL_{fv_g}$)	
			Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)
1,2-Dinitrobenzene	528290	o-Dinitrobenzene	NC	2.5E-01	NC	2.3E-01
1,3-Dinitrobenzene	99650	m-Dinitrobenzene	NC	2.5E-01	NC	1.9E-01
2,4,6-Trinitrotoluene	118967	-	2.5E-01	1.2E+00	2.1E-01	1.1E+00
2-Amino-4,6-dinitrotoluene	35572782	-	NC	5.0E+00	NC	5.4E+00
HMX	2691410	-	NC	1.2E+02	NC	1.9E+01
Hydrazine	302012	-	2.5E-03	NC	2.0E-05	NC
RDX	121824	Hexahydro-1,3,5-trinitro-1,3,5-triazine	6.8E-02	7.4E+00	2.5E-02	2.8E+00
Perchlorate	14797730	-	NC	1.7E+00	NC	4.2E-01
Volatile Organic Compounds						
1,1,1,2-Tetrachloroethane	630206	-	2.9E-01	7.4E+01	6.9E-01	1.8E+02
1,1,1-Trichloroethane	71556	-	NC	5.0E+03	NC	9.2E+03
1,1,2,2-Tetrachloroethane	79345	-	2.8E-02	5.0E+01	4.8E-02	8.6E+01
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	Freon 113	NC	7.4E+04	NC	2.0E+05
1,1,2-Trichloroethane	79005	-	1.0E-01	9.9E+00	1.2E-01	1.1E+01
1,1-Dichloroethane	75343	-	1.3E+00	5.0E+02	1.4E+00	5.1E+02
1,1-Dichloroethene	75354	-	NC	1.2E+02	NC	1.8E+02
1,1-Dimethylhydrazine	57147	Unsymetrical Dimethyl Hydrazine	NC	2.5E-01	NC	6.5E-03
1,2,3-Trichlorobenzene	87616	-	2.1E+00	2.0E+00	7.0E+00	6.7E+00
1,2,4-Trichlorobenzene	120821	-	2.1E+00	2.5E+01	7.0E+00	8.4E+01
1,2,4-Trimethylbenzene	95636	-	NC	2.5E+01	NC	7.7E+01
1,2-Dibromo-3-chloropropane	96128	1,2-Dibromo-3-CPA	1.1E-03	5.0E-01	2.6E-03	1.2E+00
1,2-Dibromoethane	106934	1,2-Dibromoethane (EDB)	2.1E-03	2.2E+01	2.5E-03	2.7E+01
1,2-Dichlorobenzene	95501	o-Dichlorobenzene	NC	2.2E+02	NC	6.6E+02
1,2-Dichloroethane	107062	-	1.6E-01	1.5E+01	1.2E-01	1.1E+01
1,2-Dichloroethene	540590	1,2-Dichloroethenes	NC	2.2E+01	NC	3.1E+01
1,2-Dichloropropane	78875	-	2.1E-01	2.2E+02	2.6E-01	2.8E+02
1,3,5-Trimethylbenzene	108678	-	NC	2.5E+01	NC	7.3E+01
1,3-Dichlorobenzene	541731	m-Dichlorobenzene	NC	7.4E+01	NC	2.3E+02
1,4-Dichlorobenzene	106467	p-Dichlorobenzene	1.4E+00	1.7E+02	4.1E+00	5.1E+02

Attachment 1 - Table 12

USEPA Default-based Suburban Residential Garden Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Fruits/Vegetables: Target Chemical Concentration in Fruits and Vegetables (C_{fv})		Fruits/Vegetables: Soil RBSL for Fruits and Vegetables Pathway ($RBSL_{fv_g}$)	
			Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)
2-Chloroethylvinyl ether	110758	2-Chloroethyl vinyl ether	3.0E-03	NC	1.6E-03	NC
2-Hexanone	591786	Methyl butyl ketone	NC	1.2E+01	NC	8.4E+00
Acetone	67641	-	NC	2.2E+03	NC	2.1E+02
Benzene	71432	-	7.5E-02	9.9E+00	1.1E-01	1.4E+01
Bromobenzene	108861	-	NC	2.0E+01	NC	4.9E+01
Bromodichloromethane	75274	-	5.7E-02	5.0E+01	7.2E-02	6.3E+01
Bromoform	75252	-	6.8E-01	5.0E+01	1.2E+00	8.7E+01
Bromomethane	74839	-	NC	3.5E+00	NC	1.9E+00
Carbon disulfide	75150	-	NC	2.5E+02	NC	3.0E+02
Carbon tetrachloride	56235	-	5.0E-02	9.9E+00	1.1E-01	2.3E+01
Chlorobenzene	108907	Monochlorobenzene	NC	5.0E+01	NC	1.1E+02
Chloroform	67663	Trichloromethane	2.4E-01	2.5E+01	3.0E-01	3.1E+01
Chloromethane	74873	Methyl chloride	NC	3.5E+00	NC	1.4E+00
cis-1,2-Dichloroethene	156592	cis-1,2-Dichloroethylene	NC	5.0E+00	NC	5.5E+00
Cumene	98828	Isopropylbenzene	NC	2.5E+02	NC	7.8E+02
Dibromochloromethane	124481	-	7.9E-02	5.0E+01	1.2E-01	7.2E+01
Dibromomethane	74953	-	NC	2.5E+01	NC	2.4E+01
Dichlorodifluoromethane	75718	Freon 12	NC	5.0E+02	NC	7.2E+02
Ethylbenzene	100414	-	6.8E-01	2.5E+02	1.8E+00	6.6E+02
Methyl ethyl ketone	78933	2-Butanone; 2-Butanone (MEK)	NC	1.5E+03	NC	2.7E+02
Methyl isobutyl ketone (MIBK)	108101	MIBK; 4-Methyl-2-pentanone	NC	2.0E+02	NC	1.2E+02
Methylene chloride	75092	Dichloromethane	5.3E-01	1.5E+01	3.1E-01	8.7E+00
Monomethylhydrazine	60344	Monomethyl Hydrazine	1.4E-05	2.5E+00	4.3E-07	7.9E-02
m-Xylene & p-Xylene	136777612	meta- and para-Xylenes; m, p-Xylene	NC	5.0E+02	NC	1.3E+03
n-Butylbenzene	104518	-	NC	1.2E+02	NC	4.4E+02
n-Propylbenzene	103651	-	NC	2.5E+02	NC	7.9E+02
o-Chlorotoluene	95498	2-Chlorotoluene	NC	5.0E+01	NC	1.5E+02
o-Xylene	95476	-	NC	5.0E+02	NC	1.3E+03
p-Chlorotoluene	106434	4-Chlorotoluene	NC	5.0E+01	NC	1.4E+02
p-Cymene	99876	p-Isopropyltoluene	NC	2.5E+02	NC	8.5E+02

Attachment 1 - Table 12

USEPA Default-based Suburban Residential Garden Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Fruits/Vegetables: Target Chemical Concentration in Fruits and Vegetables (C_{fv}) Composite Resident Cancer (10^{-6}) (mg/kg)	Fruits/Vegetables: Target Chemical Concentration in Fruits and Vegetables (C_{fv}) Child Noncancer (HQ=1) (mg/kg)	Fruits/Vegetables: Soil RBSL for Fruits and Vegetables Pathway ($RBSL_{fv_g}$) Composite Resident Cancer (10^{-6}) (mg/kg)	Fruits/Vegetables: Soil RBSL for Fruits and Vegetables Pathway ($RBSL_{fv_g}$) Child Noncancer (HQ=1) (mg/kg)
p-Nitroaniline	100016	4-Nitroaniline	3.7E-01	9.9E+00	2.6E-01	6.8E+00
sec-Butylbenzene	135988	-	NC	2.5E+02	NC	9.0E+02
Styrene	100425	Vinylbenzene	NC	5.0E+02	NC	1.2E+03
tert-Butylbenzene	98066	Dibenzo[b,e][1,4]dioxin, octachloro-	NC	2.5E+02	NC	8.5E+02
Tetrachloroethene	127184	-	1.4E-02	1.5E+01	4.0E-02	4.4E+01
Tetralin	119642	-	NC	5.0E+01	NC	1.4E+02
Toluene	108883	Toluol	NC	2.0E+02	NC	4.3E+02
trans-1,2-Dichloroethene	156605	-	NC	5.0E+01	NC	6.8E+01
Trichloroethene	79016	Trichloroethylene (TCE)	1.6E-01	1.2E+00	2.9E-01	2.2E+00
Trichlorofluoromethane	75694	-	NC	7.4E+02	NC	1.4E+03
Vinyl chloride	75014	-	2.8E-02	7.4E+00	2.4E-02	6.5E+00
Xylenes, Total	1330207	Xylene (Total) Isomers	NC	5.0E+02	NC	1.3E+03
Semi-Volatile Organic Compounds						
1,4-Dioxane	123911	-	2.8E-01	7.4E+01	2.5E-02	6.6E+00
2,4,5-Trichlorophenol	95954	-	NC	2.5E+02	NC	7.9E+02
2,4,6-Trichlorophenol	88062	-	1.1E-01	2.5E+00	3.4E-01	7.9E+00
2,4-Dimethylphenol	105679	-	NC	5.0E+01	NC	8.0E+01
3,5-Dimethylphenol	108689	-	NC	1.8E+01	NC	3.6E+01
Benzoic acid	65850	-	NC	9.9E+03	NC	1.1E+04
Benzyl alcohol	100516	-	NC	2.5E+02	NC	1.2E+02
bis(2-Ethylhexyl) phthalate	117817	bis(2-ethylhexyl)phthalate	2.5E+00	5.0E+01	9.6E+00	1.9E+02
Butyl benzyl phthalate	85687	-	3.9E+00	5.0E+02	1.4E+01	1.8E+03
Carbazole	86748	-	3.7E-01	NC	1.2E+00	NC
Dibenzofuran	132649	-	NC	2.5E+00	NC	8.5E+00
Diethyl phthalate	84662	-	NC	2.0E+03	NC	3.5E+03
Dimethyl phthalate	131113	-	NC	2.0E+03	NC	1.7E+03
Di-n-butyl phthalate	84742	Di-n-butylphthalate	NC	2.5E+02	NC	8.9E+02
Di-n-octyl phthalate	117840	Di-n-octyl-phthalate	NC	2.5E+01	NC	9.5E+01
Formaldehyde	50000	-	NC	5.0E+02	NC	9.8E+01
Hexachlorobutadiene	87683	-	9.6E-02	2.5E+00	3.5E-01	9.1E+00

Attachment 1 - Table 12

USEPA Default-based Suburban Residential Garden Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Fruits/Vegetables: Target Chemical Concentration in Fruits and Vegetables (C_{fv})		Fruits/Vegetables: Soil RBSL for Fruits and Vegetables Pathway ($RBSL_{fv_g}$)	
			Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)
m-Cresol	108394	3-Methylphenol	NC	1.2E+02	NC	1.5E+02
N-Nitrosodimethylamine	62759	Nitrosodimethylamine	4.7E-04	2.0E-02	2.8E-05	1.2E-03
N-Nitrosodiphenylamine	86306	-	8.3E-01	NC	2.2E+00	NC
o-Cresol	95487	2-Methylphenol	NC	1.2E+02	NC	1.5E+02
p-Chloro-m-cresol	59507	4-Chloro-3-Methylphenol	NC	2.5E+02	NC	6.5E+02
p-Cresol	106445	4-Methylphenol	NC	2.5E+02	NC	3.0E+02
Pentachlorophenol	87865	PCP	4.1E-01	1.2E+01	1.5E+00	4.6E+01
Phenol	108952	Total Phenols	NC	7.4E+02	NC	5.5E+02
Polynuclear Aromatic Hydrocarbons						
1-Methyl naphthalene	90120	1-Methylnaphthalene	2.6E-01	1.7E+02	8.5E-01	5.7E+02
2-Methylnaphthalene	91576	Naphthalene, 2-methyl-	NC	9.9E+00	NC	3.3E+01
Acenaphthene	83329	-	NC	1.5E+02	NC	4.9E+02
Acenaphthylene	208968	-	NC	1.5E+02	NC	5.0E+02
Anthracene	120127	-	NC	7.4E+02	NC	2.7E+03
Benzo(a)anthracene	56553	Benz[a]anthracene	6.2E-03	NC	2.4E-02	NC
Benzo(a)pyrene	50328	Benzo (a) pyrene	6.2E-04	NC	2.4E-03	NC
Benzo(b)fluoranthene	205992	Benz[e]acephenanthrylene 1	6.2E-03	NC	2.4E-02	NC
Benzo(e)pyrene	192972	-	NC	7.4E+01	NC	2.8E+02
Benzo(ghi)perylene	191242	Benzo (g,h,i) perylene	NC	7.4E+01	NC	2.9E+02
Benzo(k)fluoranthene	207089	Benzo[k]fluoranthene	6.2E-03	NC	2.4E-02	NC
Chrysene	218019	-	6.2E-02	NC	2.4E-01	NC
Dibenzo(a,h)anthracene	53703	Dibenz (a,h) anthracene	1.8E-03	NC	7.0E-03	NC
Fluoranthene	206440	-	NC	9.9E+01	NC	3.7E+02
Fluorene	86737	-	NC	9.9E+01	NC	3.4E+02
Indeno(1,2,3-cd)pyrene	193395	Indeno (1,2,3-cd) pyrene	6.2E-03	NC	2.4E-02	NC
Naphthalene	91203	-	NC	5.0E+01	NC	1.4E+02
Perylene	198550	-	NC	7.4E+01	NC	2.8E+02
Phenanthrene	85018	-	NC	7.4E+02	NC	2.7E+03
Pyrene	129000	-	NC	7.4E+01	NC	2.7E+02
Pesticides						

Attachment 1 - Table 12

USEPA Default-based Suburban Residential Garden Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Fruits/Vegetables: Target Chemical Concentration in Fruits and Vegetables (C_{fv})		Fruits/Vegetables: Soil RBSL for Fruits and Vegetables Pathway ($RBSL_{fv_g}$)	
			Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)
4,4'-DDD	72548	p,p'-DDD	3.1E-02	NC	1.2E-01	NC
4,4'-DDE	72559	p,p'-DDE	2.2E-02	NC	8.4E-02	NC
4,4'-DDT	50293	p,p'-DDT	2.2E-02	1.2E+00	8.4E-02	4.8E+00
Aldrin	309002	-	4.4E-04	7.4E-02	1.7E-03	2.9E-01
alpha-BHC	319846	a-Benzene Hexachloride	2.8E-03	2.0E+01	9.0E-03	6.4E+01
beta-BHC	319857	b-Benzene Hexachloride	5.0E-03	NC	1.6E-02	NC
delta-BHC	319868	d-Benzene Hexachloride	4.1E-03	7.4E-01	1.4E-02	2.6E+00
Chlordane (Technical)	12789036	-	2.1E-02	1.2E+00	8.1E-02	4.7E+00
Dieldrin	60571	-	4.7E-04	1.2E-01	1.8E-03	4.7E-01
Endosulfan I	959988	-	NC	1.5E+01	NC	4.9E+01
Endosulfan II	33213659	-	NC	1.5E+01	NC	4.9E+01
Endosulfan sulfate	1031078	-	NC	1.5E+01	NC	4.7E+01
Endrin	72208	-	NC	7.4E-01	NC	2.8E+00
Endrin aldehyde	7421934	-	NC	7.4E-01	NC	2.7E+00
Endrin ketone	53494705	-	NC	7.4E-01	NC	2.8E+00
gamma-BHC	58899	Lindane	6.8E-03	7.4E-01	2.2E-02	2.4E+00
Heptachlor	76448	-	1.8E-03	1.2E+00	6.9E-03	4.7E+00
Heptachlor epoxide	1024573	-	1.4E-03	3.2E-02	5.0E-03	1.2E-01
MCPA	94746	-	NC	1.2E+00	NC	3.4E+00
Mirex	2385855	Mirex (DeChlorane)	4.1E-04	5.0E-01	1.6E-03	1.9E+00
p,p'-Methoxychlor	72435	Methoxychlor	NC	1.2E+01	NC	4.6E+01
Toxaphene	8001352	-	6.2E-03	NC	2.4E-02	NC
Herbicides						
2,4,5-T	93765	2,4,5-Trichlorophenoxyacetic acid	NC	2.5E+01	NC	7.0E+01
2,4,5-TP (Silvex)	93721	-	NC	2.0E+01	NC	6.4E+01
2,4-Dichlorophenoxyacetic Acid (2,4-D)	94757	-	NC	2.5E+01	NC	5.6E+01
2,4-Dichlorophenoxybutyric acid	94826	2,4-DB	NC	2.0E+01	NC	6.0E+01
Dalapon	75990	-	NC	7.4E+01	NC	6.9E+01
Dicamba	1918009	-	NC	7.4E+01	NC	1.1E+02
2,4-DP (Dichlorprop)	120365	-	NC	2.5E+01	NC	7.3E+01

Attachment 1 - Table 12

USEPA Default-based Suburban Residential Garden Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Fruits/Vegetables: Target Chemical Concentration in Fruits and Vegetables (C_{fv})		Fruits/Vegetables: Soil RBSL for Fruits and Vegetables Pathway ($RBSL_{fv_g}$)	
			Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)
Dinoseb	88857	-	NC	2.5E+00	NC	7.6E+00
MCPP	93652	-	NC	2.5E+00	NC	6.6E+00
Terphenyls						
m-Terphenyl	92068	-	9.3E-01	1.2E+03	3.1E+00	4.2E+03
o-Terphenyl	84151	-	9.3E-01	1.2E+03	3.1E+00	4.2E+03
p-Terphenyl	92944	-	9.3E-01	1.2E+03	3.1E+00	4.2E+03
Glycols						
Diethylene Glycol	111466	-	NC	2.5E+02	NC	4.5E+00
Triethylene glycol	112276	-	NC	1.1E+02	NC	1.4E+00
PCDD/PCDFs						
2,3,7,8-TCDD TEQ	1746016-TEQ	-	5.7E-08	1.7E-06	2.2E-07	6.7E-06
Polychlorinated Biphenyls (PCBs)						
Aroclor 1016	12674112	-	1.1E-01	1.7E-01	4.0E-01	6.6E-01
Aroclor 1242	53469219	Aroclor-1242	3.7E-03	5.0E-02	1.4E-02	1.9E-01
Aroclor 1248	12672296	-	3.7E-03	5.0E-02	1.4E-02	1.9E-01
Aroclor 1254	11097691	-	3.7E-03	5.0E-02	1.4E-02	1.9E-01
Aroclor 1260	11096825	-	3.7E-03	5.0E-02	1.4E-02	1.9E-01
Aroclor 5460	11126424	-	3.7E-03	5.0E-02	1.4E-02	1.9E-01
PCB TEQ	1746016-PCB TEQ	-	5.7E-08	1.7E-06	2.2E-07	6.7E-06

Notes:
'-' - none established/not applicable.
HQ - hazard quotient
mg/kg - milligrams per kilogram
NC - not calculated
PCDD/PCDF - polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans

Attachment 1 - Table 12

USEPA Default-based Suburban Residential Garden Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Fruits/Vegetables			
			Target Chemical Concentration in Fruits and Vegetables (C_{fv})		Soil RBSL for Fruits and Vegetables Pathway ($RBSL_{fv_g}$)	
			Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Composite Resident Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)

RBSL - Risk-Based Screening Level
TCDD - 2,3,7,8-Tetrachlorodibenzo-p-dioxin
TEQ - toxic equivalency

a - Please note that different chemical names have been used for different programs at the SSFL, and there can be additional analyte synonyms than those presented. Therefore, any chemical synonym should be verified using the CAS number listed.
b - The cadmium RBSLs for non-carcinogenic effects were calculated using the exposure assumptions for an adult as described in Section 3.2.1.

Attachment 1 - Table 13

Indirect Soil Contact Pathway-Specific 40-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Fruits/Vegetables: Target Chemical Concentration in Fruits and Vegetables (C_{fv})		Fruits/Vegetables: Soil RBSL for Fruits and Vegetables Pathway ($RBSL_{fv}$)		Beef: Target Chemical Concentration in Beef (C_b)		Beef: Soil RBSL for Beef Pathway ($RBSL_b$)	
			Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)
Inorganic Compounds										
Aluminum	7429905	Aluminum, Total	NC	6.2E+02	NC	NC	NC	1.2E+03	NC	NC
Antimony	7440360	Antimony, Total	NC	2.5E-01	NC	9.2E-01	NC	4.9E-01	NC	3.1E+03
Arsenic	7440382	Arsenic, Total	1.5E-04	1.9E-01	5.6E-04	6.9E-01	1.1E-04	3.6E-01	1.4E-02	4.8E+01
Barium	7440393	Barium, Total	NC	1.2E+02	NC	4.7E+02	NC	2.4E+02	NC	2.7E+05
Beryllium	7440417	Beryllium, Total	NC	1.2E+00	NC	4.7E+00	NC	2.4E+00	NC	7.0E+02
Boron	7440428	Boron, Total	NC	1.2E+02	NC	9.9E+01	NC	2.4E+02	NC	6.0E+03
Cadmium	7440439	Cadmium, Total	NC	5.4E-03 [b]	NC	1.4E-02	NC	3.3E-03 [b]	NC	8.5E-01
Chromium	7440473	Chromium, Total	NC	9.3E+02	NC	3.6E+03	NC	1.8E+03	NC	5.3E+04
Cobalt	7440484	Cobalt, Total	NC	1.9E-01	NC	6.6E-01	NC	3.6E-01	NC	9.2E+02
Copper	7440508	Copper, Total	NC	2.5E+01	NC	7.3E+01	NC	4.9E+01	NC	4.2E+02
Cyanides	57125	Cyanide, Total; Cyanide	NC	3.7E-01	NC	1.8E-01	NC	7.3E-01	NC	2.2E+04
Fluoride	16984488	-	NC	2.5E+01	NC	NC	NC	4.9E+01	NC	NC
Hexavalent chromium	18540299	Chromium, Hexavalent; Chromium VI	2.9E-03	1.9E+00	1.1E-02	7.1E+00	2.0E-03	3.6E+00	1.1E-01	1.9E+02
Lead	7439921	Lead, Total	NC	NC	NC	NC	NC	NC	NC	NC
Lithium	7439932	Lithium, Total	NC	1.2E+00	NC	4.7E+00	NC	2.4E+00	NC	6.7E+01
Manganese	7439965	Manganese, Total	NC	8.7E+01	NC	2.6E+02	NC	1.7E+02	NC	3.0E+04
Mercury	7439976	Mercury, Total	NC	1.9E-01	NC	3.3E-01	NC	3.6E-01	NC	2.4E+00
Methyl Mercury	22967926	-	NC	6.2E-02	NC	8.6E-03	NC	1.2E-01	NC	3.8E-01
Molybdenum	7439987	Molybdenum, Total	NC	3.1E+00	NC	9.1E+00	NC	6.1E+00	NC	7.5E+02
Nickel	7440020	Nickel, Total	NC	1.2E+01	NC	4.0E+01	NC	2.4E+01	NC	8.9E+02
Selenium	7782492	Selenium, Total	NC	3.1E+00	NC	8.6E+00	NC	6.1E+00	NC	6.6E+00
Silver	7440224	Silver, Total	NC	3.1E+00	NC	1.2E+01	NC	6.1E+00	NC	1.3E+02
Strontium	7440246	Strontium, Total	NC	3.7E+02	NC	8.0E+02	NC	7.3E+02	NC	5.6E+03
Thallium	7440280	Thallium, Total	NC	6.2E-03	NC	2.4E-02	NC	1.2E-02	NC	9.0E-02
Tin	7440315	Tin, Total	NC	3.7E+02	NC	6.7E+02	NC	7.3E+02	NC	4.8E+03
Vanadium	7440622	Vanadium, Total	NC	3.1E+00	NC	1.2E+01	NC	6.1E+00	NC	7.1E+02
Zinc	7440666	Zinc, Total	NC	1.9E+02	NC	3.6E+02	NC	3.6E+02	NC	2.4E+02
Zirconium	7440677	Zirconium, Total	NC	5.0E-02	NC	1.9E-01	NC	9.7E-02	NC	2.9E+04
Energetic Constituents										
1,2-Dinitrobenzene	528290	o-Dinitrobenzene	NC	6.2E-02	NC	5.8E-02	NC	1.2E-01	NC	2.0E+03
1,3-Dinitrobenzene	99650	m-Dinitrobenzene	NC	6.2E-02	NC	4.7E-02	NC	1.2E-01	NC	2.4E+03
2,4,6-Trinitrotoluene	118967	-	4.8E-02	3.1E-01	4.1E-02	2.7E-01	3.4E-02	6.1E-01	6.0E+02	1.1E+04
2-Amino-4,6-dinitrotoluene	35572782	-	NC	1.2E+00	NC	1.3E+00	NC	2.4E+00	NC	3.3E+04
HMX	2691410	-	NC	3.1E+01	NC	4.8E+00	NC	6.1E+01	NC	4.5E+06
Hydrazine	302012	-	4.8E-04	NC	3.7E-06	NC	3.4E-04	NC	2.3E+02	NC

Attachment 1 - Table 13

Indirect Soil Contact Pathway-Specific 40-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Fruits/Vegetables: Target Chemical Concentration in Fruits and Vegetables (C_{fv})		Fruits/Vegetables: Soil RBSL for Fruits and Vegetables Pathway ($RBSL_{fv}$)		Beef: Target Chemical Concentration in Beef (C_b)		Beef: Soil RBSL for Beef Pathway ($RBSL_b$)	
			Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)
RDX	121824	Hexahydro-1,3,5-trinitro-1,3,5-triazine	1.3E-02	1.9E+00	4.9E-03	7.0E-01	9.2E-03	3.6E+00	3.4E+02	1.4E+05
Perchlorate	14797730	-	NC	4.3E-01	NC	1.0E-01	NC	8.5E-01	NC	3.6E-03
Volatile Organic Compounds										
1,1,1,2-Tetrachloroethane	630206	-	5.5E-02	1.9E+01	1.3E-01	4.5E+01	3.9E-02	3.6E+01	1.5E+02	1.4E+05
1,1,1-Trichloroethane	71556	-	NC	1.2E+03	NC	2.3E+03	NC	2.4E+03	NC	1.6E+07
1,1,2,2-Tetrachloroethane	79345	-	5.3E-03	1.2E+01	9.2E-03	2.2E+01	3.7E-03	2.4E+01	2.8E+01	1.8E+05
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	Freon 113	NC	1.9E+04	NC	5.0E+04	NC	3.6E+04	NC	1.0E+08
1,1,2-Trichloroethane	79005	-	2.0E-02	2.5E+00	2.3E-02	2.8E+00	1.4E-02	4.9E+00	1.8E+02	6.3E+04
1,1-Dichloroethane	75343	-	2.5E-01	1.2E+02	2.6E-01	1.3E+02	1.8E-01	2.4E+02	2.6E+03	3.5E+06
1,1-Dichloroethene	75354	-	NC	3.1E+01	NC	4.4E+01	NC	6.1E+01	NC	6.1E+05
1,1-Dimethylhydrazine	57147	Unsymetrical Dimethyl Hydrazine	NC	6.2E-02	NC	1.6E-03	NC	1.2E-01	NC	3.4E+04
1,2,3-Trichlorobenzene	87616	-	4.0E-01	5.0E-01	1.3E+00	1.7E+00	2.8E-01	9.7E-01	1.9E+02	6.4E+02
1,2,4-Trichlorobenzene	120821	-	4.0E-01	6.2E+00	1.3E+00	2.1E+01	2.8E-01	1.2E+01	2.0E+02	8.5E+03
1,2,4-Trimethylbenzene	95636	-	NC	6.2E+00	NC	1.9E+01	NC	1.2E+01	NC	1.6E+04
1,2-Dibromo-3-chloropropane	96128	1,2-Dibromo-3-CPA	2.0E-04	1.2E-01	5.0E-04	3.0E-01	1.4E-04	2.4E-01	5.3E-01	8.8E+02
1,2-Dibromoethane	106934	1,2-Dibromoethane (EDB)	4.0E-04	5.6E+00	4.8E-04	6.8E+00	2.8E-04	1.1E+01	3.4E+00	1.3E+05
1,2-Dichlorobenzene	95501	o-Dichlorobenzene	NC	5.6E+01	NC	1.6E+02	NC	1.1E+02	NC	2.0E+05
1,2-Dichloroethane	107062	-	3.0E-02	3.7E+00	2.3E-02	2.8E+00	2.2E-02	7.3E+00	4.3E+02	1.5E+05
1,2-Dichloroethene	540590	1,2-Dichloroethenes	NC	5.6E+00	NC	7.6E+00	NC	1.1E+01	NC	1.1E+05
1,2-Dichloropropane	78875	-	4.0E-02	5.6E+01	4.9E-02	6.9E+01	2.8E-02	1.1E+02	3.3E+02	1.3E+06
1,3,5-Trimethylbenzene	108678	-	NC	6.2E+00	NC	1.8E+01	NC	1.2E+01	NC	2.3E+04
1,3-Dichlorobenzene	541731	m-Dichlorobenzene	NC	1.9E+01	NC	5.7E+01	NC	3.6E+01	NC	5.8E+04
1,4-Dichlorobenzene	106467	p-Dichlorobenzene	2.6E-01	4.3E+01	7.8E-01	1.3E+02	1.9E-01	8.5E+01	3.4E+02	1.6E+05
2-Chloroethylvinyl ether	110758	2-Chloroethyl vinyl ether	5.7E-04	NC	3.0E-04	NC	4.0E-04	NC	1.1E+01	NC
2-Hexanone	591786	Methyl butyl ketone	NC	3.1E+00	NC	2.1E+00	NC	6.1E+00	NC	1.3E+05
Acetone	67641	-	NC	5.6E+02	NC	5.1E+01	NC	1.1E+03	NC	1.2E+08
Benzene	71432	-	1.4E-02	2.5E+00	2.0E-02	3.5E+00	1.0E-02	4.9E+00	1.0E+02	4.8E+04
Bromobenzene	108861	-	NC	5.0E+00	NC	1.2E+01	NC	9.7E+00	NC	3.4E+04
Bromodichloromethane	75274	-	1.1E-02	1.2E+01	1.4E-02	1.6E+01	7.8E-03	2.4E+01	9.0E+01	2.8E+05
Bromoform	75252	-	1.3E-01	1.2E+01	2.3E-01	2.2E+01	9.2E-02	2.4E+01	6.7E+02	1.8E+05
Bromomethane	74839	-	NC	8.7E-01	NC	4.7E-01	NC	1.7E+00	NC	4.6E+04
Carbon disulfide	75150	-	NC	6.2E+01	NC	7.4E+01	NC	1.2E+02	NC	1.5E+06
Carbon tetrachloride	56235	-	9.5E-03	2.5E+00	2.2E-02	5.7E+00	6.7E-03	4.9E+00	2.9E+01	2.1E+04
Chlorobenzene	108907	Monochlorobenzene	NC	1.2E+01	NC	2.9E+01	NC	2.4E+01	NC	1.0E+05
Chloroform	67663	Trichloromethane	4.6E-02	6.2E+00	5.6E-02	7.6E+00	3.3E-02	1.2E+01	3.9E+02	1.4E+05
Chloromethane	74873	Methyl chloride	NC	8.7E-01	NC	3.4E-01	NC	1.7E+00	NC	6.1E+04

Attachment 1 - Table 13

Indirect Soil Contact Pathway-Specific 40-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Fruits/Vegetables: Target Chemical Concentration in Fruits and Vegetables (C_{fv})		Fruits/Vegetables: Soil RBSL for Fruits and Vegetables Pathway ($RBSL_{fv}$)		Beef: Target Chemical Concentration in Beef (C_b)		Beef: Soil RBSL for Beef Pathway ($RBSL_b$)	
			Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)
cis-1,2-Dichloroethene	156592	cis-1,2-Dichloroethylene	NC	1.2E+00	NC	1.4E+00	NC	2.4E+00	NC	3.3E+04
Cumene	98828	Isopropylbenzene	NC	6.2E+01	NC	2.0E+02	NC	1.2E+02	NC	1.6E+05
Dibromochloromethane	124481	-	1.5E-02	1.2E+01	2.2E-02	1.8E+01	1.1E-02	2.4E+01	1.0E+02	2.3E+05
Dibromomethane	74953	-	NC	6.2E+00	NC	5.9E+00	NC	1.2E+01	NC	1.9E+05
Dichlorodifluoromethane	75718	Freon 12	NC	1.2E+02	NC	1.8E+02	NC	2.4E+02	NC	2.3E+06
Ethylbenzene	100414	-	1.3E-01	6.2E+01	3.5E-01	1.7E+02	9.2E-02	1.2E+02	2.6E+02	3.4E+05
Methyl ethyl ketone	78933	2-Butanone; 2-Butanone (MEK)	NC	3.7E+02	NC	6.8E+01	NC	7.3E+02	NC	4.8E+07
Methyl isobutyl ketone (MIBK)	108101	MIBK; 4-Methyl-2-pentanone	NC	5.0E+01	NC	3.1E+01	NC	9.7E+01	NC	2.3E+06
Methylene chloride	75092	Dichloromethane	1.0E-01	3.7E+00	6.0E-02	2.2E+00	7.2E-02	7.3E+00	1.8E+03	1.8E+05
Monomethylhydrazine	60344	Monomethyl Hydrazine	2.6E-06	6.2E-01	8.2E-08	2.0E-02	1.8E-06	1.2E+00	4.5E-01	3.0E+05
m-Xylene & p-Xylene	136777612	meta- and para-Xylenes; m, p-Xylene	NC	1.2E+02	NC	3.3E+02	NC	2.4E+02	NC	7.1E+05
n-Butylbenzene	104518	-	NC	3.1E+01	NC	1.1E+02	NC	6.1E+01	NC	2.2E+04
n-Propylbenzene	103651	-	NC	6.2E+01	NC	2.0E+02	NC	1.2E+02	NC	1.5E+05
o-Chlorotoluene	95498	2-Chlorotoluene	NC	1.2E+01	NC	3.7E+01	NC	2.4E+01	NC	4.6E+04
o-Xylene	95476	-	NC	1.2E+02	NC	3.3E+02	NC	2.4E+02	NC	7.1E+05
p-Chlorotoluene	106434	4-Chlorotoluene	NC	1.2E+01	NC	3.5E+01	NC	2.4E+01	NC	5.3E+04
p-Cymene	99876	p-Isopropyltoluene	NC	6.2E+01	NC	2.1E+02	NC	1.2E+02	NC	7.4E+04
p-Nitroaniline	100016	4-Nitroaniline	7.1E-02	2.5E+00	4.9E-02	1.7E+00	5.1E-02	4.9E+00	1.1E+03	1.1E+05
sec-Butylbenzene	135988	-	NC	6.2E+01	NC	2.2E+02	NC	1.2E+02	NC	3.0E+04
Styrene	100425	Vinylbenzene	NC	1.2E+02	NC	3.0E+02	NC	2.4E+02	NC	9.0E+05
tert-Butylbenzene	98066	Dibenzo[b,e][1,4]dioxin, octachloro-	NC	6.2E+01	NC	2.1E+02	NC	1.2E+02	NC	7.2E+04
Tetrachloroethene	127184	-	2.6E-03	3.7E+00	7.7E-03	1.1E+01	1.9E-03	7.3E+00	3.6E+00	1.4E+04
Tetralin	119642	-	NC	1.2E+01	NC	3.5E+01	NC	2.4E+01	NC	5.5E+04
Toluene	108883	Toluol	NC	5.0E+01	NC	1.1E+02	NC	9.7E+01	NC	4.8E+05
trans-1,2-Dichloroethene	156605	-	NC	1.2E+01	NC	1.7E+01	NC	2.4E+01	NC	2.5E+05
Trichloroethene	79016	Trichloroethylene (TCE)	3.1E-02	3.1E-01	5.5E-02	5.5E-01	2.2E-02	6.1E-01	1.6E+02	4.3E+03
Trichlorofluoromethane	75694	-	NC	1.9E+02	NC	3.6E+02	NC	3.6E+02	NC	2.3E+06
Vinyl chloride	75014	-	5.3E-03	1.9E+00	4.6E-03	1.6E+00	3.7E-03	3.6E+00	6.5E+01	6.3E+04
Xylenes, Total	1330207	Xylene (Total) Isomers	NC	1.2E+02	NC	3.3E+02	NC	2.4E+02	NC	7.1E+05
Semi-Volatile Organic Compounds										
1,4-Dioxane	123911	-	5.3E-02	1.9E+01	4.7E-03	1.7E+00	3.7E-02	3.6E+01	4.3E+03	4.2E+06
2,4,5-Trichlorophenol	95954	-	NC	6.2E+01	NC	2.0E+02	NC	1.2E+02	NC	1.4E+05
2,4,6-Trichlorophenol	88062	-	2.0E-02	6.2E-01	6.4E-02	2.0E+00	1.4E-02	1.2E+00	1.8E+01	1.5E+03
2,4-Dimethylphenol	105679	-	NC	1.2E+01	NC	2.0E+01	NC	2.4E+01	NC	2.0E+05

Attachment 1 - Table 13

Indirect Soil Contact Pathway-Specific 40-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Fruits/Vegetables: Target Chemical Concentration in Fruits and Vegetables (C_{fv})		Fruits/Vegetables: Soil RBSL for Fruits and Vegetables Pathway ($RBSL_{fv}$)		Beef: Target Chemical Concentration in Beef (C_b)		Beef: Soil RBSL for Beef Pathway ($RBSL_b$)	
			Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)
3,5-Dimethylphenol	108689	-	NC	4.5E+00	NC	9.0E+00	NC	8.7E+00	NC	5.0E+04
Benzoic acid	65850	-	NC	2.5E+03	NC	2.8E+03	NC	4.9E+03	NC	6.5E+07
Benzyl alcohol	100516	-	NC	6.2E+01	NC	3.1E+01	NC	1.2E+02	NC	3.6E+06
bis(2-Ethylhexyl) phthalate	117817	bis(2-ethylhexyl)phthalate	4.8E-01	1.2E+01	1.8E+00	4.8E+01	3.4E-01	2.4E+01	1.0E-01	7.3E+00
Butyl benzyl phthalate	85687	-	7.5E-01	1.2E+02	2.7E+00	4.5E+02	5.3E-01	2.4E+02	9.6E+01	4.4E+04
Carbazole	86748	-	7.1E-02	NC	2.3E-01	NC	5.1E-02	NC	6.0E+01	NC
Dibenzofuran	132649	-	NC	6.2E-01	NC	2.1E+00	NC	1.2E+00	NC	7.1E+02
Diethyl phthalate	84662	-	NC	5.0E+02	NC	8.8E+02	NC	9.7E+02	NC	6.9E+06
Dimethyl phthalate	131113	-	NC	5.0E+02	NC	4.2E+02	NC	9.7E+02	NC	1.7E+07
Di-n-butyl phthalate	84742	Di-n-butylphthalate	NC	6.2E+01	NC	2.2E+02	NC	1.2E+02	NC	3.4E+04
Di-n-octyl phthalate	117840	Di-n-octyl-phthalate	NC	6.2E+00	NC	2.4E+01	NC	1.2E+01	NC	1.2E+00
Formaldehyde	50000	-	NC	1.2E+02	NC	2.4E+01	NC	2.4E+02	NC	1.5E+07
Hexachlorobutadiene	87683	-	1.8E-02	6.2E-01	6.7E-02	2.3E+00	1.3E-02	1.2E+00	2.1E+00	2.0E+02
m-Cresol	108394	3-Methylphenol	NC	3.1E+01	NC	3.8E+01	NC	6.1E+01	NC	7.3E+05
N-Nitrosodimethylamine	62759	Nitrosodimethylamine	8.9E-05	5.0E-03	5.3E-06	3.0E-04	6.3E-05	9.7E-03	9.6E+00	1.5E+03
N-Nitrosodiphenylamine	86306	-	1.6E-01	NC	4.2E-01	NC	1.1E-01	NC	3.2E+02	NC
o-Cresol	95487	2-Methylphenol	NC	3.1E+01	NC	3.7E+01	NC	6.1E+01	NC	7.4E+05
p-Chloro-m-cresol	59507	4-Chloro-3-Methylphenol	NC	6.2E+01	NC	1.6E+02	NC	1.2E+02	NC	3.6E+05
p-Cresol	106445	4-Methylphenol	NC	6.2E+01	NC	7.4E+01	NC	1.2E+02	NC	1.5E+06
Pentachlorophenol	87865	PCP	7.9E-02	3.1E+00	3.0E-01	1.2E+01	5.6E-02	6.1E+00	4.5E+00	4.8E+02
Phenol	108952	Total Phenols	NC	1.9E+02	NC	1.4E+02	NC	3.6E+02	NC	7.4E+06
Polynuclear Aromatic Hydrocarbons										
1-Methyl naphthalene	90120	1-Methylnaphthalene	4.9E-02	4.3E+01	1.6E-01	1.4E+02	3.5E-02	8.5E+01	3.2E+01	7.8E+04
2-Methylnaphthalene	91576	Naphthalene, 2-methyl-	NC	2.5E+00	NC	8.2E+00	NC	4.9E+00	NC	4.5E+03
Acenaphthene	83329	-	NC	3.7E+01	NC	1.2E+02	NC	7.3E+01	NC	6.1E+04
Acenaphthylene	208968	-	NC	3.7E+01	NC	1.2E+02	NC	7.3E+01	NC	5.9E+04
Anthracene	120127	-	NC	1.9E+02	NC	6.6E+02	NC	3.6E+02	NC	1.1E+05
Benzo(a)anthracene	56553	Benz[a]anthracene	1.2E-03	NC	4.5E-03	NC	8.4E-04	NC	1.7E-02	NC
Benzo(a)pyrene	50328	Benzo (a) pyrene	1.2E-04	NC	4.5E-04	NC	8.4E-05	NC	7.2E-04	NC
Benzo(b)fluoranthene	205992	Benz[e]acephenanthrylene 1	1.2E-03	NC	4.5E-03	NC	8.4E-04	NC	1.6E-02	NC
Benzo(e)pyrene	192972	-	NC	1.9E+01	NC	7.1E+01	NC	3.6E+01	NC	3.3E+02
Benzo(ghi)perylene	191242	Benzo (g,h,i) perylene	NC	1.9E+01	NC	7.1E+01	NC	3.6E+01	NC	1.0E+02
Benzo(k)fluoranthene	207089	Benzo[k]fluoranthene	1.2E-03	NC	4.5E-03	NC	8.4E-04	NC	7.6E-03	NC
Chrysene	218019	-	1.2E-02	NC	4.5E-02	NC	8.4E-03	NC	1.5E-01	NC
Dibenzo(a,h)anthracene	53703	Dibenz (a,h) anthracene	3.5E-04	NC	1.3E-03	NC	2.5E-04	NC	5.2E-04	NC
Fluoranthene	206440	-	NC	2.5E+01	NC	9.3E+01	NC	4.9E+01	NC	3.5E+03
Fluorene	86737	-	NC	2.5E+01	NC	8.6E+01	NC	4.9E+01	NC	2.5E+04
Indeno(1,2,3-cd)pyrene	193395	Indeno (1,2,3-cd) pyrene	1.2E-03	NC	4.6E-03	NC	8.4E-04	NC	2.0E-03	NC

Attachment 1 - Table 13

Indirect Soil Contact Pathway-Specific 40-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Fruits/Vegetables: Target Chemical Concentration in Fruits and Vegetables (C_{fv})		Fruits/Vegetables: Soil RBSL for Fruits and Vegetables Pathway ($RBSL_{fv}$)		Beef: Target Chemical Concentration in Beef (C_b)		Beef: Soil RBSL for Beef Pathway ($RBSL_b$)	
			Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)
Naphthalene	91203	-	NC	1.2E+01	NC	3.5E+01	NC	2.4E+01	NC	5.5E+04
Perylene	198550	-	NC	1.9E+01	NC	7.1E+01	NC	3.6E+01	NC	2.4E+02
Phenanthrene	85018	-	NC	1.9E+02	NC	6.7E+02	NC	3.6E+02	NC	1.1E+05
Pyrene	129000	-	NC	1.9E+01	NC	6.9E+01	NC	3.6E+01	NC	4.8E+03
Pesticides										
4,4'-DDD	72548	p,p'-DDD	5.9E-03	NC	2.3E-02	NC	4.2E-03	NC	4.6E-02	NC
4,4'-DDE	72559	p,p'-DDE	4.2E-03	NC	1.6E-02	NC	3.0E-03	NC	1.1E-02	NC
4,4'-DDT	50293	p,p'-DDT	4.2E-03	3.1E-01	1.6E-02	1.2E+00	3.0E-03	6.1E-01	4.3E-03	8.8E-01
Aldrin	309002	-	8.4E-05	1.9E-02	3.2E-04	7.1E-02	5.9E-05	3.6E-02	2.2E-04	1.3E-01
alpha-BHC	319846	a-Benzene Hexachloride	5.3E-04	5.0E+00	1.7E-03	1.6E+01	3.7E-04	9.7E+00	3.8E-01	1.0E+04
beta-BHC	319857	b-Benzene Hexachloride	9.5E-04	NC	3.1E-03	NC	6.7E-04	NC	7.2E-01	NC
delta-BHC	319868	d-Benzene Hexachloride	7.9E-04	1.9E-01	2.7E-03	6.4E-01	5.6E-04	3.6E-01	3.2E-01	2.1E+02
Chlordane (Technical)	12789036	-	4.1E-03	3.1E-01	1.55E-02	1.2E+00	2.9E-03	6.1E-01	2.0E-02	4.2E+00
Dieldrin	60571	-	8.9E-05	3.1E-02	3.4E-04	1.2E-01	6.3E-05	6.1E-02	2.7E-03	2.6E+00
Endosulfan I	959988	-	NC	3.7E+00	NC	1.2E+01	NC	7.3E+00	NC	7.1E+03
Endosulfan II	33213659	-	NC	3.7E+00	NC	1.2E+01	NC	7.3E+00	NC	7.1E+03
Endosulfan sulfate	1031078	-	NC	3.7E+00	NC	1.2E+01	NC	7.3E+00	NC	9.5E+03
Endrin	72208	-	NC	1.9E-01	NC	7.0E-01	NC	3.6E-01	NC	2.4E+01
Endrin aldehyde	7421934	-	NC	1.9E-01	NC	6.8E-01	NC	3.6E-01	NC	5.6E+01
Endrin ketone	53494705	-	NC	1.9E-01	NC	6.9E-01	NC	3.6E-01	NC	3.8E+01
gamma-BHC	58899	Lindane	1.3E-03	1.9E-01	4.1E-03	5.9E-01	9.2E-04	3.6E-01	1.1E+00	4.3E+02
Heptachlor	76448	-	3.5E-04	3.1E-01	1.3E-03	1.2E+00	2.5E-04	6.1E-01	2.3E-03	5.6E+00
Heptachlor epoxide	1024573	-	2.6E-04	8.1E-03	9.6E-04	3.0E-02	1.8E-04	1.6E-02	2.0E-02	1.7E+00
MCPA	94746	-	NC	3.1E-01	NC	8.6E-01	NC	6.1E-01	NC	1.5E+03
Mirex	2385855	Mirex (DeChlorane)	7.9E-05	1.2E-01	3.0E-04	4.8E-01	5.6E-05	2.4E-01	8.6E-05	3.7E-01
p,p'-Methoxychlor	72435	Methoxychlor	NC	3.1E+00	NC	1.2E+01	NC	6.1E+00	NC	5.2E+02
Toxaphene	8001352	-	1.2E-03	NC	4.5E-03	NC	8.4E-04	NC	1.6E-02	NC
Herbicides										
2,4,5-T	93765	2,4,5-Trichlorophenoxyacetic acid	NC	6.2E+00	NC	1.8E+01	NC	1.2E+01	NC	2.7E+04
2,4,5-TP (Silvex)	93721	-	NC	5.0E+00	NC	1.6E+01	NC	9.7E+00	NC	1.0E+04
2,4-Dichlorophenoxyacetic Acid (2,4-D)	94757	-	NC	6.2E+00	NC	1.4E+01	NC	1.2E+01	NC	5.4E+04
2,4-Dichlorophenoxybutyric acid	94826	2,4-DB	NC	5.0E+00	NC	1.5E+01	NC	9.7E+00	NC	1.5E+04
Dalapon	75990	-	NC	1.9E+01	NC	1.7E+01	NC	3.6E+01	NC	5.9E+05
Dicamba	1918009	-	NC	1.9E+01	NC	2.8E+01	NC	3.6E+01	NC	3.3E+05
2,4-DP (Dichlorprop)	120365	-	NC	6.2E+00	NC	1.8E+01	NC	1.2E+01	NC	2.3E+04
Dinoseb	88857	-	NC	6.2E-01	NC	1.9E+00	NC	1.2E+00	NC	1.8E+03

Attachment 1 - Table 13

Indirect Soil Contact Pathway-Specific 40-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Fruits/Vegetables: Target Chemical Concentration in Fruits and Vegetables (C_{fv})		Fruits/Vegetables: Soil RBSL for Fruits and Vegetables Pathway ($RBSL_{fv}$)		Beef: Target Chemical Concentration in Beef (C_b)		Beef: Soil RBSL for Beef Pathway ($RBSL_b$)	
			Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)
MCPP	93652	-	NC	6.2E-01	NC	1.6E+00	NC	1.2E+00	NC	3.5E+03
Terphenyls										
m-Terphenyl	92068	-	1.8E-01	3.1E+02	6.0E-01	1.0E+03	1.3E-01	6.1E+02	9.5E+01	4.6E+05
o-Terphenyl	84151	-	1.8E-01	3.1E+02	6.0E-01	1.0E+03	1.3E-01	6.1E+02	9.5E+01	4.6E+05
p-Terphenyl	92944	-	1.8E-01	3.1E+02	6.0E-01	1.0E+03	1.3E-01	6.1E+02	9.5E+01	4.6E+05
Glycols										
Diethylene Glycol	111466	-	NC	6.2E+01	NC	1.1E+00	NC	1.2E+02	NC	4.4E+07
Triethylene glycol	112276	-	NC	2.8E+01	NC	3.5E-01	NC	5.5E+01	NC	2.6E+07
PCDD/PCDFs										
2,3,7,8-TCDD TEQ	1746016-TEQ	-	1.1E-08	4.3E-07	4.2E-08	1.7E-06	7.8E-09	8.5E-07	1.5E-08	1.6E-06
Polychlorinated Biphenyls (PCBs)										
Aroclor 1016	12674112	-	2.0E-02	4.3E-02	7.7E-02	1.6E-01	1.4E-02	8.5E-02	3.9E-01	2.3E+00
Aroclor 1242	53469219	Aroclor-1242	7.1E-04	1.2E-02	2.7E-03	4.7E-02	5.1E-04	2.4E-02	3.0E-03	1.5E-01
Aroclor 1248	12672296	-	7.1E-04	1.2E-02	2.7E-03	4.7E-02	5.1E-04	2.4E-02	2.7E-03	1.3E-01
Aroclor 1254	11097691	-	7.1E-04	1.2E-02	2.7E-03	4.8E-02	5.1E-04	2.4E-02	9.7E-04	4.7E-02
Aroclor 1260	11096825	-	7.1E-04	1.2E-02	2.7E-03	4.8E-02	5.1E-04	2.4E-02	3.2E-05	1.6E-03
Aroclor 5460	11126424	-	7.1E-04	1.2E-02	2.7E-03	4.7E-02	5.1E-04	2.4E-02	2.7E-03	1.3E-01
PCB TEQ	1746016-PCB TEQ	-	1.1E-08	4.3E-07	4.2E-08	1.7E-06	7.8E-09	8.5E-07	2.1E-08	2.3E-06

Notes:
'-' - none established/not applicable.
HQ - hazard quotient
mg/kg - milligrams per kilogram
NC - not calculated
PCDD/PCDF - polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans
RBSL - Risk-Based Screening Level
TCDD - 2,3,7,8-Tetrachlorodibenzo-p-dioxin
TEQ - toxic equivalency

Attachment 1 - Table 13

Indirect Soil Contact Pathway-Specific 40-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Fruits/Vegetables				Beef			
			Target Chemical Concentration in Fruits and Vegetables (C_{fv})		Soil RBSL for Fruits and Vegetables Pathway ($RBSL_{fv}$)		Target Chemical Concentration in Beef (C_b)		Soil RBSL for Beef Pathway ($RBSL_b$)	
			Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)

a - Please note that different chemical names have been used for different programs at the SSFL, and there can be additional analyte synonyms than those presented. Therefore, any chemical synonym should be verified using the CAS number listed.

b - The cadmium RBSLs for non-carcinogenic effects were calculated using the exposure assumptions for an adult as described in Section 3.2.1.

Attachment 1 - Table 13

Indirect Soil Contact Pathway-Specific 40-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Milk: Target Chemical Concentration in Milk (C_m) Farmer Cancer (10^{-6}) (mg/kg)	Milk: Target Chemical Concentration in Milk (C_m) Child Noncancer (HQ=1) (mg/kg)	Milk: Soil RBSL for Milk Pathway ($RBSL_m$) Farmer Cancer (10^{-6}) (mg/kg)	Milk: Soil RBSL for Milk Pathway ($RBSL_m$) Child Noncancer (HQ=1) (mg/kg)	Poultry: Target Chemical Concentration in Poultry (C_p) Farmer Cancer (10^{-6}) (mg/kg)	Poultry: Target Chemical Concentration in Poultry (C_p) Child Noncancer (HQ=1) (mg/kg)	Poultry: Soil RBSL for Poultry Pathway ($RBSL_p$) Farmer Cancer (10^{-6}) (mg/kg)	Poultry: Soil RBSL for Poultry Pathway ($RBSL_p$) Child Noncancer (HQ=1) (mg/kg)
Inorganic Compounds										
Aluminum	7429905	Aluminum, Total	NC	5.9E+01	NC	NC	NC	1.1E+03	NC	NC
Antimony	7440360	Antimony, Total	NC	2.4E-02	NC	1.7E+02	NC	4.6E-01	NC	6.0E+01
Arsenic	7440382	Arsenic, Total	1.9E-05	1.8E-02	6.0E-02	5.6E+01	1.4E-04	3.4E-01	5.2E-03	1.2E+01
Barium	7440393	Barium, Total	NC	1.2E+01	NC	3.9E+03	NC	2.3E+02	NC	2.8E+05
Beryllium	7440417	Beryllium, Total	NC	1.2E-01	NC	2.7E+04	NC	2.3E+00	NC	9.1E+02
Boron	7440428	Boron, Total	NC	1.2E+01	NC	1.1E+02	NC	2.3E+02	NC	1.1E+03
Cadmium	7440439	Cadmium, Total	NC	7.5E-04 [b]	NC	5.4E-02	NC	4.7E-03 [b]	NC	2.4E-01
Chromium	7440473	Chromium, Total	NC	8.9E+01	NC	1.7E+06	NC	1.7E+03	NC	4.5E+05
Cobalt	7440484	Cobalt, Total	NC	1.8E-02	NC	4.6E+01	NC	3.4E-01	NC	2.1E+00
Copper	7440508	Copper, Total	NC	2.4E+00	NC	8.7E+01	NC	4.6E+01	NC	3.9E+02
Cyanides	57125	Cyanide, Total; Cyanide	NC	3.5E-02	NC	2.3E+03	NC	6.9E-01	NC	5.6E+04
Fluoride	16984488	-	NC	2.4E+00	NC	NC	NC	4.6E+01	NC	NC
Hexavalent chromium	18540299	Chromium, Hexavalent; Chromium VI	3.6E-04	1.8E-01	5.1E-02	2.5E+01	2.7E-03	3.4E+00	7.8E-01	9.7E+02
Lead	7439921	Lead, Total	NC	NC	NC	NC	NC	NC	NC	NC
Lithium	7439932	Lithium, Total	NC	1.2E-01	NC	1.2E+00	NC	2.3E+00	NC	2.0E+02
Manganese	7439965	Manganese, Total	NC	8.3E+00	NC	1.7E+04	NC	1.6E+02	NC	1.5E+04
Mercury	7439976	Mercury, Total	NC	1.8E-02	NC	1.7E+00	NC	3.4E-01	NC	5.3E+01
Methyl Mercury	22967926	-	NC	5.9E-03	NC	3.0E-02	NC	1.1E-01	NC	4.6E+00
Molybdenum	7439987	Molybdenum, Total	NC	3.0E-01	NC	1.5E+01	NC	5.7E+00	NC	3.8E+01
Nickel	7440020	Nickel, Total	NC	1.2E+00	NC	9.6E+00	NC	2.3E+01	NC	5.0E+02
Selenium	7782492	Selenium, Total	NC	3.0E-01	NC	2.3E+00	NC	5.7E+00	NC	2.9E+01
Silver	7440224	Silver, Total	NC	3.0E-01	NC	2.7E+02	NC	5.7E+00	NC	1.0E+01
Strontium	7440246	Strontium, Total	NC	3.5E+01	NC	5.4E+02	NC	6.9E+02	NC	2.9E+04
Thallium	7440280	Thallium, Total	NC	5.9E-04	NC	6.3E-02	NC	1.1E-02	NC	9.2E-02
Tin	7440315	Tin, Total	NC	3.5E+01	NC	1.6E+03	NC	6.9E+02	NC	1.3E+03
Vanadium	7440622	Vanadium, Total	NC	3.0E-01	NC	3.1E+03	NC	5.7E+00	NC	2.8E+03
Zinc	7440666	Zinc, Total	NC	1.8E+01	NC	8.3E+01	NC	3.4E+02	NC	1.5E+05
Zirconium	7440677	Zirconium, Total	NC	4.7E-03	NC	1.8E+03	NC	9.1E-02	NC	1.7E+01
Energetic Constituents										
1,2-Dinitrobenzene	528290	o-Dinitrobenzene	NC	5.9E-03	NC	2.1E+02	NC	1.1E-01	NC	1.0E+02
1,3-Dinitrobenzene	99650	m-Dinitrobenzene	NC	5.9E-03	NC	2.6E+02	NC	1.1E-01	NC	1.1E+02
2,4,6-Trinitrotoluene	118967	-	6.0E-03	3.0E-02	2.3E+02	1.2E+03	4.6E-02	5.7E-01	4.2E+01	5.3E+02
2-Amino-4,6-dinitrotoluene	35572782	-	NC	1.2E-01	NC	3.6E+03	NC	2.3E+00	NC	1.9E+03
HMX	2691410	-	NC	3.0E+00	NC	4.9E+05	NC	5.7E+01	NC	1.6E+05
Hydrazine	302012	-	6.0E-05	NC	9.0E+01	NC	4.6E-04	NC	5.5E-01	NC

Attachment 1 - Table 13

Indirect Soil Contact Pathway-Specific 40-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Milk: Target Chemical Concentration in Milk (C_m) Farmer Cancer (10^{-6}) (mg/kg)	Milk: Target Chemical Concentration in Milk (C_m) Child Noncancer (HQ=1) (mg/kg)	Milk: Soil RBSL for Milk Pathway ($RBSL_m$) Farmer Cancer (10^{-6}) (mg/kg)	Milk: Soil RBSL for Milk Pathway ($RBSL_m$) Child Noncancer (HQ=1) (mg/kg)	Poultry: Target Chemical Concentration in Poultry (C_p) Farmer Cancer (10^{-6}) (mg/kg)	Poultry: Target Chemical Concentration in Poultry (C_p) Child Noncancer (HQ=1) (mg/kg)	Poultry: Soil RBSL for Poultry Pathway ($RBSL_p$) Farmer Cancer (10^{-6}) (mg/kg)	Poultry: Soil RBSL for Poultry Pathway ($RBSL_p$) Child Noncancer (HQ=1) (mg/kg)
RDX	121824	Hexahydro-1,3,5-trinitro-1,3,5-triazine	1.6E-03	1.8E-01	1.3E+02	1.5E+04	1.2E-02	3.4E+00	1.8E+01	5.0E+03
Perchlorate	14797730	-	NC	4.1E-02	NC	1.2E-04	NC	8.0E-01	NC	2.0E-01
Volatile Organic Compounds										
1,1,1,2-Tetrachloroethane	630206	-	6.9E-03	1.8E+00	5.9E+01	1.5E+04	5.3E-02	3.4E+01	3.1E+01	2.0E+04
1,1,1-Trichloroethane	71556	-	NC	1.2E+02	NC	1.7E+06	NC	2.3E+03	NC	1.5E+06
1,1,2,2-Tetrachloroethane	79345	-	6.7E-04	1.2E+00	1.1E+01	1.9E+04	5.1E-03	2.3E+01	3.5E+00	1.6E+04
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	Freon 113	NC	1.8E+03	NC	1.1E+07	NC	3.4E+04	NC	1.9E+07
1,1,2-Trichloroethane	79005	-	2.5E-03	2.4E-01	7.2E+01	6.8E+03	1.9E-02	4.6E+00	1.5E+01	3.7E+03
1,1-Dichloroethane	75343	-	3.2E-02	1.2E+01	1.0E+03	3.8E+05	2.4E-01	2.3E+02	2.0E+02	1.9E+05
1,1-Dichloroethene	75354	-	NC	3.0E+00	NC	6.5E+04	NC	5.7E+01	NC	4.2E+04
1,1-Dimethylhydrazine	57147	Unsymetrical Dimethyl Hydrazine	NC	5.9E-03	NC	3.6E+03	NC	1.1E-01	NC	4.5E+02
1,2,3-Trichlorobenzene	87616	-	5.0E-02	4.7E-02	7.5E+01	7.1E+01	3.8E-01	9.1E-01	1.8E+02	4.3E+02
1,2,4-Trichlorobenzene	120821	-	5.0E-02	5.9E-01	7.9E+01	9.3E+02	3.8E-01	1.1E+01	1.8E+02	5.5E+03
1,2,4-Trimethylbenzene	95636	-	NC	5.9E-01	NC	1.8E+03	NC	1.1E+01	NC	5.9E+03
1,2-Dibromo-3-chloropropane	96128	1,2-Dibromo-3-CPA	2.6E-05	1.2E-02	2.1E-01	9.6E+01	2.0E-04	2.3E-01	1.2E-01	1.4E+02
1,2-Dibromoethane	106934	1,2-Dibromoethane (EDB)	5.0E-05	5.3E-01	1.3E+00	1.4E+04	3.8E-04	1.0E+01	3.0E-01	8.1E+03
1,2-Dichlorobenzene	95501	o-Dichlorobenzene	NC	5.3E+00	NC	2.2E+04	NC	1.0E+02	NC	5.5E+04
1,2-Dichloroethane	107062	-	3.8E-03	3.5E-01	1.7E+02	1.6E+04	2.9E-02	6.9E+00	2.9E+01	6.7E+03
1,2-Dichloroethene	540590	1,2-Dichloroethenes	NC	5.3E-01	NC	1.2E+04	NC	1.0E+01	NC	7.7E+03
1,2-Dichloropropane	78875	-	5.0E-03	5.3E+00	1.3E+02	1.4E+05	3.8E-02	1.0E+02	3.0E+01	8.0E+04
1,3,5-Trimethylbenzene	108678	-	NC	5.9E-01	NC	2.5E+03	NC	1.1E+01	NC	6.1E+03
1,3-Dichlorobenzene	541731	m-Dichlorobenzene	NC	1.8E+00	NC	6.3E+03	NC	3.4E+01	NC	1.8E+04
1,4-Dichlorobenzene	106467	p-Dichlorobenzene	3.3E-02	4.1E+00	1.4E+02	1.7E+04	2.5E-01	8.0E+01	1.4E+02	4.3E+04
2-Chloroethylvinyl ether	110758	2-Chloroethyl vinyl ether	7.2E-05	NC	4.4E+00	NC	5.5E-04	NC	6.5E-01	NC
2-Hexanone	591786	Methyl butyl ketone	NC	3.0E-01	NC	1.4E+04	NC	5.7E+00	NC	5.9E+03
Acetone	67641	-	NC	5.3E+01	NC	1.3E+07	NC	1.0E+03	NC	4.6E+06
Benzene	71432	-	1.8E-03	2.4E-01	4.0E+01	5.2E+03	1.4E-02	4.6E+00	1.0E+01	3.4E+03
Bromobenzene	108861	-	NC	4.7E-01	NC	3.7E+03	NC	9.1E+00	NC	5.4E+03
Bromodichloromethane	75274	-	1.4E-03	1.2E+00	3.5E+01	3.0E+04	1.1E-02	2.3E+01	8.2E+00	1.8E+04
Bromoform	75252	-	1.6E-02	1.2E+00	2.7E+02	1.9E+04	1.2E-01	2.3E+01	8.5E+01	1.6E+04
Bromomethane	74839	-	NC	8.3E-02	NC	4.9E+03	NC	1.6E+00	NC	1.9E+03
Carbon disulfide	75150	-	NC	5.9E+00	NC	1.6E+05	NC	1.1E+02	NC	9.0E+04
Carbon tetrachloride	56235	-	1.2E-03	2.4E-01	1.2E+01	2.3E+03	9.2E-03	4.6E+00	5.6E+00	2.8E+03
Chlorobenzene	108907	Monochlorobenzene	NC	1.2E+00	NC	1.1E+04	NC	2.3E+01	NC	1.4E+04
Chloroform	67663	Trichloromethane	5.8E-03	5.9E-01	1.5E+02	1.6E+04	4.4E-02	1.1E+01	3.5E+01	8.9E+03
Chloromethane	74873	Methyl chloride	NC	8.3E-02	NC	6.5E+03	NC	1.6E+00	NC	2.3E+03

Attachment 1 - Table 13

Indirect Soil Contact Pathway-Specific 40-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Milk: Target Chemical Concentration in Milk (C_m) Farmer Cancer (10^{-6}) (mg/kg)	Milk: Target Chemical Concentration in Milk (C_m) Child Noncancer (HQ=1) (mg/kg)	Milk: Soil RBSL for Milk Pathway ($RBSL_m$) Farmer Cancer (10^{-6}) (mg/kg)	Milk: Soil RBSL for Milk Pathway ($RBSL_m$) Child Noncancer (HQ=1) (mg/kg)	Poultry: Target Chemical Concentration in Poultry (C_p) Farmer Cancer (10^{-6}) (mg/kg)	Poultry: Target Chemical Concentration in Poultry (C_p) Child Noncancer (HQ=1) (mg/kg)	Poultry: Soil RBSL for Poultry Pathway ($RBSL_p$) Farmer Cancer (10^{-6}) (mg/kg)	Poultry: Soil RBSL for Poultry Pathway ($RBSL_p$) Child Noncancer (HQ=1) (mg/kg)
cis-1,2-Dichloroethene	156592	cis-1,2-Dichloroethylene	NC	1.2E-01	NC	3.5E+03	NC	2.3E+00	NC	1.9E+03
Cumene	98828	Isopropylbenzene	NC	5.9E+00	NC	1.7E+04	NC	1.1E+02	NC	5.9E+04
Dibromochloromethane	124481	-	1.9E-03	1.2E+00	4.1E+01	2.5E+04	1.5E-02	2.3E+01	1.1E+01	1.7E+04
Dibromomethane	74953	-	NC	5.9E-01	NC	2.1E+04	NC	1.1E+01	NC	1.0E+04
Dichlorodifluoromethane	75718	Freon 12	NC	1.2E+01	NC	2.5E+05	NC	2.3E+02	NC	1.7E+05
Ethylbenzene	100414	-	1.6E-02	5.9E+00	1.0E+02	3.7E+04	1.2E-01	1.1E+02	7.1E+01	6.5E+04
Methyl ethyl ketone	78933	2-Butanone; 2-Butanone (MEK)	NC	3.5E+01	NC	5.2E+06	NC	6.9E+02	NC	1.7E+06
Methyl isobutyl ketone (MIBK)	108101	MIBK; 4-Methyl-2-pentanone	NC	4.7E+00	NC	2.5E+05	NC	9.1E+01	NC	9.9E+04
Methylene chloride	75092	Dichloromethane	1.3E-02	3.5E-01	7.2E+02	2.0E+04	9.8E-02	6.9E+00	1.1E+02	7.7E+03
Monomethylhydrazine	60344	Monomethyl Hydrazine	3.3E-07	5.9E-02	1.8E-01	3.2E+04	2.5E-06	1.1E+00	1.2E-02	5.5E+03
m-Xylene & p-Xylene	136777612	meta- and para-Xylenes; m, p-Xylene	NC	1.2E+01	NC	7.7E+04	NC	2.3E+02	NC	1.3E+05
n-Butylbenzene	104518	-	NC	3.0E+00	NC	2.4E+03	NC	5.7E+01	NC	2.6E+04
n-Propylbenzene	103651	-	NC	5.9E+00	NC	1.6E+04	NC	1.1E+02	NC	5.8E+04
o-Chlorotoluene	95498	2-Chlorotoluene	NC	1.2E+00	NC	5.0E+03	NC	2.3E+01	NC	1.2E+04
o-Xylene	95476	-	NC	1.2E+01	NC	7.7E+04	NC	2.3E+02	NC	1.3E+05
p-Chlorotoluene	106434	4-Chlorotoluene	NC	1.2E+00	NC	5.7E+03	NC	2.3E+01	NC	1.3E+04
p-Cymene	99876	p-Isopropyltoluene	NC	5.9E+00	NC	8.1E+03	NC	1.1E+02	NC	5.4E+04
p-Nitroaniline	100016	4-Nitroaniline	9.0E-03	2.4E-01	4.4E+02	1.1E+04	6.9E-02	4.6E+00	7.1E+01	4.7E+03
sec-Butylbenzene	135988	-	NC	5.9E+00	NC	3.3E+03	NC	1.1E+02	NC	5.0E+04
Styrene	100425	Vinylbenzene	NC	1.2E+01	NC	9.7E+04	NC	2.3E+02	NC	1.4E+05
tert-Butylbenzene	98066	Dibenzo[b,e][1,4]dioxin, octachloro-	NC	5.9E+00	NC	7.9E+03	NC	1.1E+02	NC	5.4E+04
Tetrachloroethene	127184	-	3.3E-04	3.5E-01	1.5E+00	1.5E+03	2.5E-03	6.9E+00	1.4E+00	3.7E+03
Tetralin	119642	-	NC	1.2E+00	NC	5.9E+03	NC	2.3E+01	NC	1.3E+04
Toluene	108883	Toluol	NC	4.7E+00	NC	5.2E+04	NC	9.1E+01	NC	5.7E+04
trans-1,2-Dichloroethene	156605	-	NC	1.2E+00	NC	2.7E+04	NC	2.3E+01	NC	1.7E+04
Trichloroethene	79016	Trichloroethylene (TCE)	3.9E-03	3.0E-02	6.2E+01	4.7E+02	3.0E-02	5.7E-01	2.0E+01	3.9E+02
Trichlorofluoromethane	75694	-	NC	1.8E+01	NC	2.5E+05	NC	3.4E+02	NC	2.2E+05
Vinyl chloride	75014	-	6.7E-04	1.8E-01	2.6E+01	6.8E+03	5.1E-03	3.4E+00	4.6E+00	3.1E+03
Xylenes, Total	1330207	Xylene (Total) Isomers	NC	1.2E+01	NC	7.7E+04	NC	2.3E+02	NC	1.3E+05
Semi-Volatile Organic Compounds										
1,4-Dioxane	123911	-	6.7E-03	1.8E+00	1.7E+03	4.5E+05	5.1E-02	3.4E+01	2.3E+02	1.6E+05
2,4,5-Trichlorophenol	95954	-	NC	5.9E+00	NC	1.6E+04	NC	1.1E+02	NC	5.8E+04
2,4,6-Trichlorophenol	88062	-	2.6E-03	5.9E-02	7.1E+00	1.6E+02	2.0E-02	1.1E+00	1.0E+01	5.8E+02
2,4-Dimethylphenol	105679	-	NC	1.2E+00	NC	2.2E+04	NC	2.3E+01	NC	1.6E+04

Attachment 1 - Table 13

Indirect Soil Contact Pathway-Specific 40-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Milk: Target Chemical Concentration in Milk (C_m) Farmer Cancer (10^{-6}) (mg/kg)	Milk: Target Chemical Concentration in Milk (C_m) Child Noncancer (HQ=1) (mg/kg)	Milk: Soil RBSL for Milk Pathway ($RBSL_m$) Farmer Cancer (10^{-6}) (mg/kg)	Milk: Soil RBSL for Milk Pathway ($RBSL_m$) Child Noncancer (HQ=1) (mg/kg)	Poultry: Target Chemical Concentration in Poultry (C_p) Farmer Cancer (10^{-6}) (mg/kg)	Poultry: Target Chemical Concentration in Poultry (C_p) Child Noncancer (HQ=1) (mg/kg)	Poultry: Soil RBSL for Poultry Pathway ($RBSL_p$) Farmer Cancer (10^{-6}) (mg/kg)	Poultry: Soil RBSL for Poultry Pathway ($RBSL_p$) Child Noncancer (HQ=1) (mg/kg)
3,5-Dimethylphenol	108689	-	NC	4.3E-01	NC	5.4E+03	NC	8.2E+00	NC	5.3E+03
Benzoic acid	65850	-	NC	2.4E+02	NC	6.9E+06	NC	4.6E+03	NC	3.7E+06
Benzyl alcohol	100516	-	NC	5.9E+00	NC	3.8E+05	NC	1.1E+02	NC	1.4E+05
bis(2-Ethylhexyl) phthalate	117817	bis(2-ethylhexyl)phthalate	6.0E-02	1.2E+00	4.1E-02	8.0E-01	4.6E-01	2.3E+01	6.3E+02	3.2E+04
Butyl benzyl phthalate	85687	-	9.5E-02	1.2E+01	3.9E+01	4.8E+03	7.2E-01	2.3E+02	3.1E+02	9.8E+04
Carbazole	86748	-	9.0E-03	NC	2.4E+01	NC	6.9E-02	NC	3.5E+01	NC
Dibenzofuran	132649	-	NC	5.9E-02	NC	7.8E+01	NC	1.1E+00	NC	5.4E+02
Diethyl phthalate	84662	-	NC	4.7E+01	NC	7.5E+05	NC	9.1E+02	NC	6.2E+05
Dimethyl phthalate	131113	-	NC	4.7E+01	NC	1.8E+06	NC	9.1E+02	NC	8.4E+05
Di-n-butyl phthalate	84742	Di-n-butylphthalate	NC	5.9E+00	NC	3.8E+03	NC	1.1E+02	NC	5.0E+04
Di-n-octyl phthalate	117840	Di-n-octyl-phthalate	NC	5.9E-01	NC	1.3E-01	NC	1.1E+01	NC	2.8E+04
Formaldehyde	50000	-	NC	1.2E+01	NC	1.6E+06	NC	2.3E+02	NC	5.3E+05
Hexachlorobutadiene	87683	-	2.3E-03	5.9E-02	8.5E-01	2.2E+01	1.8E-02	1.1E+00	7.5E+00	4.9E+02
m-Cresol	108394	3-Methylphenol	NC	3.0E+00	NC	7.9E+04	NC	5.7E+01	NC	4.5E+04
N-Nitrosodimethylamine	62759	Nitrosodimethylamine	1.1E-05	4.7E-04	3.8E+00	1.6E+02	8.6E-05	9.1E-03	5.9E-01	6.3E+01
N-Nitrosodiphenylamine	86306	-	2.0E-02	NC	1.3E+02	NC	1.5E-01	NC	8.7E+01	NC
o-Cresol	95487	2-Methylphenol	NC	3.0E+00	NC	7.9E+04	NC	5.7E+01	NC	4.5E+04
p-Chloro-m-cresol	59507	4-Chloro-3-Methylphenol	NC	5.9E+00	NC	4.0E+04	NC	1.1E+02	NC	6.6E+04
p-Cresol	106445	4-Methylphenol	NC	5.9E+00	NC	1.6E+05	NC	1.1E+02	NC	9.0E+04
Pentachlorophenol	87865	PCP	1.0E-02	3.0E-01	1.8E+00	5.3E+01	7.6E-02	5.7E+00	3.2E+01	2.4E+03
Phenol	108952	Total Phenols	NC	1.8E+01	NC	8.0E+05	NC	3.4E+02	NC	3.4E+05
Polynuclear Aromatic Hydrocarbons										
1-Methyl naphthalene	90120	1-Methylnaphthalene	6.2E-03	4.1E+00	1.3E+01	8.5E+03	4.7E-02	8.0E+01	2.3E+01	3.9E+04
2-Methylnaphthalene	91576	Naphthalene, 2-methyl-	NC	2.4E-01	NC	4.9E+02	NC	4.6E+00	NC	2.3E+03
Acenaphthene	83329	-	NC	3.5E+00	NC	6.7E+03	NC	6.9E+01	NC	3.3E+04
Acenaphthylene	208968	-	NC	3.5E+00	NC	6.4E+03	NC	6.9E+01	NC	3.3E+04
Anthracene	120127	-	NC	1.8E+01	NC	1.3E+04	NC	3.4E+02	NC	1.5E+05
Benzo(a)anthracene	56553	Benz[a]anthracene	1.5E-04	NC	6.7E-03	NC	1.1E-03	NC	5.2E-01	NC
Benzo(a)pyrene	50328	Benzo (a) pyrene	1.5E-05	NC	2.9E-04	NC	1.1E-04	NC	5.8E-02	NC
Benzo(b)fluoranthene	205992	Benz[e]acephenanthrylene 1	1.5E-04	NC	6.4E-03	NC	1.1E-03	NC	5.2E-01	NC
Benzo(e)pyrene	192972	-	NC	1.8E+00	NC	3.6E+01	NC	3.4E+01	NC	1.7E+04
Benzo(ghi)perylene	191242	Benzo (g,h,i) perylene	NC	1.8E+00	NC	1.1E+01	NC	3.4E+01	NC	2.2E+04
Benzo(k)fluoranthene	207089	Benzo[k]fluoranthene	1.5E-04	NC	3.1E-03	NC	1.1E-03	NC	5.8E-01	NC
Chrysene	218019	-	1.5E-03	NC	6.0E-02	NC	1.1E-02	NC	5.3E+00	NC
Dibenzo(a,h)anthracene	53703	Dibenz (a,h) anthracene	4.4E-05	NC	2.1E-04	NC	3.4E-04	NC	2.3E-01	NC
Fluoranthene	206440	-	NC	2.4E+00	NC	3.9E+02	NC	4.6E+01	NC	1.9E+04
Fluorene	86737	-	NC	2.4E+00	NC	2.8E+03	NC	4.6E+01	NC	2.1E+04
Indeno(1,2,3-cd)pyrene	193395	Indeno (1,2,3-cd) pyrene	1.5E-04	NC	8.0E-04	NC	1.1E-03	NC	7.7E-01	NC

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Analyte	CAS #	Analyte Synonyms [a]	Milk: Target Chemical Concentration in Milk (C_m) Farmer Cancer (10^{-6}) (mg/kg)	Milk: Target Chemical Concentration in Milk (C_m) Child Noncancer (HQ=1) (mg/kg)	Milk: Soil RBSL for Milk Pathway ($RBSL_m$) Farmer Cancer (10^{-6}) (mg/kg)	Milk: Soil RBSL for Milk Pathway ($RBSL_m$) Child Noncancer (HQ=1) (mg/kg)	Poultry: Target Chemical Concentration in Poultry (C_p) Farmer Cancer (10^{-6}) (mg/kg)	Poultry: Target Chemical Concentration in Poultry (C_p) Child Noncancer (HQ=1) (mg/kg)	Poultry: Soil RBSL for Poultry Pathway ($RBSL_p$) Farmer Cancer (10^{-6}) (mg/kg)	Poultry: Soil RBSL for Poultry Pathway ($RBSL_p$) Child Noncancer (HQ=1) (mg/kg)
Naphthalene	91203	-	NC	1.2E+00	NC	5.9E+03	NC	2.3E+01	NC	1.3E+04
Perylene	198550	-	NC	1.8E+00	NC	2.6E+01	NC	3.4E+01	NC	1.8E+04
Phenanthrene	85018	-	NC	1.8E+01	NC	1.2E+04	NC	3.4E+02	NC	1.5E+05
Pyrene	129000	-	NC	1.8E+00	NC	5.3E+02	NC	3.4E+01	NC	1.5E+04
Pesticides										
4,4'-DDD	72548	p,p'-DDD	7.5E-04	NC	1.9E-02	NC	5.7E-03	NC	2.8E+00	NC
4,4'-DDE	72559	p,p'-DDE	5.3E-04	NC	4.4E-03	NC	4.0E-03	NC	2.4E+00	NC
4,4'-DDT	50293	p,p'-DDT	5.3E-04	3.0E-02	1.8E-03	9.8E-02	4.0E-03	5.7E-01	3.1E+00	4.4E+02
Aldrin	309002	-	1.1E-05	1.8E-03	8.9E-05	1.5E-02	8.1E-05	3.4E-02	4.8E-02	2.0E+01
alpha-BHC	319846	a-Benzene Hexachloride	6.7E-05	4.7E-01	1.5E-01	1.1E+03	5.1E-04	9.1E+00	2.5E-01	4.6E+03
beta-BHC	319857	b-Benzene Hexachloride	1.2E-04	NC	2.9E-01	NC	9.2E-04	NC	4.6E-01	NC
delta-BHC	319868	d-Benzene Hexachloride	1.0E-04	1.8E-02	1.3E-01	2.3E+01	7.6E-04	3.4E-01	3.6E-01	1.6E+02
Chlordane (Technical)	12789036	-	5.2E-04	3.0E-02	8.2E-03	4.7E-01	3.9E-03	5.7E-01	2.1E+00	3.0E+02
Dieldrin	60571	-	1.1E-05	3.0E-03	1.1E-03	2.9E-01	8.6E-05	5.7E-02	3.7E-02	2.4E+01
Endosulfan I	959988	-	NC	3.5E-01	NC	7.8E+02	NC	6.9E+00	NC	3.4E+03
Endosulfan II	33213659	-	NC	3.5E-01	NC	7.8E+02	NC	6.9E+00	NC	3.4E+03
Endosulfan sulfate	1031078	-	NC	3.5E-01	NC	1.0E+03	NC	6.9E+00	NC	3.5E+03
Endrin	72208	-	NC	1.8E-02	NC	2.7E+00	NC	3.4E-01	NC	1.5E+02
Endrin aldehyde	7421934	-	NC	1.8E-02	NC	6.2E+00	NC	3.4E-01	NC	1.5E+02
Endrin ketone	53494705	-	NC	1.8E-02	NC	4.2E+00	NC	3.4E-01	NC	1.5E+02
gamma-BHC	58899	Lindane	1.6E-04	1.8E-02	4.3E-01	4.7E+01	1.2E-03	3.4E-01	6.3E-01	1.7E+02
Heptachlor	76448	-	4.4E-05	3.0E-02	9.2E-04	6.1E-01	3.4E-04	5.7E-01	1.7E-01	2.9E+02
Heptachlor epoxide	1024573	-	3.3E-05	7.7E-04	7.9E-03	1.9E-01	2.5E-04	1.5E-02	1.1E-01	6.3E+00
MCPA	94746	-	NC	3.0E-02	NC	1.6E+02	NC	5.7E-01	NC	3.2E+02
Mirex	2385855	Mirex (DeChlorane)	1.0E-05	1.2E-02	3.5E-05	4.1E-02	7.6E-05	2.3E-01	5.8E-02	1.7E+02
p,p'-Methoxychlor	72435	Methoxychlor	NC	3.0E-01	NC	5.8E+01	NC	5.7E+00	NC	2.4E+03
Toxaphene	8001352	-	1.5E-04	NC	6.4E-03	NC	1.1E-03	NC	5.2E-01	NC
Herbicides										
2,4,5-T	93765	2,4,5-Trichlorophenoxyacetic acid	NC	5.9E-01	NC	2.9E+03	NC	1.1E+01	NC	6.3E+03
2,4,5-TP (Silvex)	93721	-	NC	4.7E-01	NC	1.1E+03	NC	9.1E+00	NC	4.6E+03
2,4-Dichlorophenoxyacetic Acid (2,4-D)	94757	-	NC	5.9E-01	NC	5.8E+03	NC	1.1E+01	NC	7.0E+03
2,4-Dichlorophenoxybutyric acid	94826	2,4-DB	NC	4.7E-01	NC	1.7E+03	NC	9.1E+00	NC	4.8E+03
Dalapon	75990	-	NC	1.8E+00	NC	6.4E+04	NC	3.4E+01	NC	3.0E+04
Dicamba	1918009	-	NC	1.8E+00	NC	3.6E+04	NC	3.4E+01	NC	2.5E+04
2,4-DP (Dichlorprop)	120365	-	NC	5.9E-01	NC	2.5E+03	NC	1.1E+01	NC	6.1E+03
Dinoseb	88857	-	NC	5.9E-02	NC	2.0E+02	NC	1.1E+00	NC	6.0E+02

Attachment 1 - Table 13

Indirect Soil Contact Pathway-Specific 40-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Milk: Target Chemical Concentration in Milk (C_m) Farmer Cancer (10^{-6}) (mg/kg)	Milk: Target Chemical Concentration in Milk (C_m) Child Noncancer (HQ=1) (mg/kg)	Milk: Soil RBSL for Milk Pathway ($RBSL_m$) Farmer Cancer (10^{-6}) (mg/kg)	Milk: Soil RBSL for Milk Pathway ($RBSL_m$) Child Noncancer (HQ=1) (mg/kg)	Poultry: Target Chemical Concentration in Poultry (C_p) Farmer Cancer (10^{-6}) (mg/kg)	Poultry: Target Chemical Concentration in Poultry (C_p) Child Noncancer (HQ=1) (mg/kg)	Poultry: Soil RBSL for Poultry Pathway ($RBSL_p$) Farmer Cancer (10^{-6}) (mg/kg)	Poultry: Soil RBSL for Poultry Pathway ($RBSL_p$) Child Noncancer (HQ=1) (mg/kg)
MCPP	93652	-	NC	5.9E-02	NC	3.8E+02	NC	1.1E+00	NC	6.5E+02
Terphenyls										
m-Terphenyl	92068	-	2.3E-02	3.0E+01	3.8E+01	5.0E+04	1.7E-01	5.7E+02	8.3E+01	2.8E+05
o-Terphenyl	84151	-	2.3E-02	3.0E+01	3.8E+01	5.0E+04	1.7E-01	5.7E+02	8.3E+01	2.8E+05
p-Terphenyl	92944	-	2.3E-02	3.0E+01	3.8E+01	5.0E+04	1.7E-01	5.7E+02	8.3E+01	2.8E+05
Glycols										
Diethylene Glycol	111466	-	NC	5.9E+00	NC	4.8E+06	NC	1.1E+02	NC	3.1E+05
Triethylene glycol	112276	-	NC	2.7E+00	NC	2.8E+06	NC	5.1E+01	NC	9.6E+04
PCDD/PCDFs										
2,3,7,8-TCDD TEQ	1746016-TEQ	-	1.4E-09	4.1E-08	5.9E-09	1.8E-07	1.1E-08	8.0E-07	7.5E-06	5.7E-04
Polychlorinated Biphenyls (PCBs)										
Aroclor 1016	12674112	-	2.6E-03	4.1E-03	1.6E-01	2.5E-01	2.0E-02	8.0E-02	8.7E+00	3.5E+01
Aroclor 1242	53469219	Aroclor-1242	9.0E-05	1.2E-03	1.2E-03	1.6E-02	6.9E-04	2.3E-02	3.7E-01	1.2E+01
Aroclor 1248	12672296	-	9.0E-05	1.2E-03	1.1E-03	1.4E-02	6.9E-04	2.3E-02	3.8E-01	1.3E+01
Aroclor 1254	11097691	-	9.0E-05	1.2E-03	3.9E-04	5.1E-03	6.9E-04	2.3E-02	4.9E-01	1.6E+01
Aroclor 1260	11096825	-	9.0E-05	1.2E-03	1.3E-05	1.7E-04	6.9E-04	2.3E-02	1.9E+00	6.3E+01
Aroclor 5460	11126424	-	9.0E-05	1.2E-03	1.1E-03	1.4E-02	6.9E-04	2.3E-02	3.8E-01	1.3E+01
PCB TEQ	1746016-PCB TEQ	-	1.4E-09	4.1E-08	8.7E-09	2.6E-07	1.1E-08	8.0E-07	5.9E-06	4.4E-04

Notes:
'-' - none established/not applicable.
HQ - hazard quotient
mg/kg - milligrams per kilogram
NC - not calculated
PCDD/PCDF - polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans
RBSL - Risk-Based Screening Level
TCDD - 2,3,7,8-Tetrachlorodibenzo-p-dioxin
TEQ - toxic equivalency

Attachment 1 - Table 13

Indirect Soil Contact Pathway-Specific 40-year Rural Residential Risk-Based Screening Levels

			Milk				Poultry			
			Target Chemical Concentration in Milk (C_m)		Soil RBSL for Milk Pathway ($RBSL_m$)		Target Chemical Concentration in Poultry (C_p)		Soil RBSL for Poultry Pathway ($RBSL_p$)	
Analyte	CAS #	Analyte Synonyms [a]	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)

a - Please note that different chemical names have been used for different programs at the SSFL, and there can be additional analyte synonyms than those presented. Therefore, any chemical synonym should be verified using the CAS number listed.

b - The cadmium RBSLs for non-carcinogenic effects were calculated using the exposure assumptions for an adult as described in Section 3.2.1.

Attachment 1 - Table 13

Indirect Soil Contact Pathway-Specific 40-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Eggs: Target Chemical Concentration in Eggs (C_e) Farmer Cancer (10^{-6}) (mg/kg)	Eggs: Target Chemical Concentration in Eggs (C_e) Child Noncancer (HQ=1) (mg/kg)	Eggs: Soil RBSL for Eggs Pathway ($RBSL_e$) Farmer Cancer (10^{-6}) (mg/kg)	Eggs: Soil RBSL for Eggs Pathway ($RBSL_e$) Child Noncancer (HQ=1) (mg/kg)	Swine: Target Chemical Concentration in Swine (C_s) Farmer Cancer (10^{-6}) (mg/kg)	Swine: Target Chemical Concentration in Swine (C_s) Child Noncancer (HQ=1) (mg/kg)	Swine: Soil RBSL for Swine Pathway ($RBSL_s$) Farmer Cancer (10^{-6}) (mg/kg)	Swine: Soil RBSL for Swine Pathway ($RBSL_s$) Child Noncancer (HQ=1) (mg/kg)
Inorganic Compounds										
Aluminum	7429905	Aluminum, Total	NC	2.5E+03	NC	NC	NC	1.3E+03	NC	NC
Antimony	7440360	Antimony, Total	NC	9.9E-01	NC	1.5E+02	NC	5.1E-01	NC	4.4E+01
Arsenic	7440382	Arsenic, Total	3.4E-04	7.4E-01	1.1E-02	2.4E+01	1.8E-04	3.8E-01	4.2E-03	8.8E+00
Barium	7440393	Barium, Total	NC	5.0E+02	NC	6.0E+03	NC	2.5E+02	NC	2.6E+05
Beryllium	7440417	Beryllium, Total	NC	5.0E+00	NC	8.6E+03	NC	2.5E+00	NC	4.0E+02
Boron	7440428	Boron, Total	NC	5.0E+02	NC	2.6E+03	NC	2.5E+02	NC	1.2E+03
Cadmium	7440439	Cadmium, Total	NC	1.1E-02 [b]	NC	2.5E+01	NC	6.1E-03 [b]	NC	7.7E+00
Chromium	7440473	Chromium, Total	NC	3.7E+03	NC	1.4E+06	NC	1.9E+03	NC	3.9E+05
Cobalt	7440484	Cobalt, Total	NC	7.4E-01	NC	9.0E+01	NC	3.8E-01	NC	1.1E+02
Copper	7440508	Copper, Total	NC	9.9E+01	NC	8.6E+02	NC	5.1E+01	NC	4.3E+02
Cyanides	57125	Cyanide, Total; Cyanide	NC	1.5E+00	NC	2.1E+05	NC	7.6E-01	NC	1.6E+03
Fluoride	16984488	-	NC	9.9E+01	NC	NC	NC	5.1E+01	NC	NC
Hexavalent chromium	18540299	Chromium, Hexavalent; Chromium VI	6.5E-03	7.4E+00	2.7E+00	3.1E+03	3.5E-03	3.8E+00	7.9E-01	8.6E+02
Lead	7439921	Lead, Total	NC	NC	NC	NC	NC	NC	NC	NC
Lithium	7439932	Lithium, Total	NC	5.0E+00	NC	6.5E+01	NC	2.5E+00	NC	2.7E+02
Manganese	7439965	Manganese, Total	NC	3.5E+02	NC	2.8E+04	NC	1.8E+02	NC	1.0E+04
Mercury	7439976	Mercury, Total	NC	7.4E-01	NC	1.1E+02	NC	3.8E-01	NC	1.8E+03
Methyl Mercury	22967926	-	NC	2.5E-01	NC	9.9E+00	NC	1.3E-01	NC	1.5E+02
Molybdenum	7439987	Molybdenum, Total	NC	1.2E+01	NC	9.1E+01	NC	6.3E+00	NC	9.7E+02
Nickel	7440020	Nickel, Total	NC	5.0E+01	NC	4.6E+03	NC	2.5E+01	NC	4.2E+01
Selenium	7782492	Selenium, Total	NC	1.2E+01	NC	6.4E+01	NC	6.3E+00	NC	8.7E+00
Silver	7440224	Silver, Total	NC	1.2E+01	NC	2.4E+02	NC	6.3E+00	NC	5.1E+01
Strontium	7440246	Strontium, Total	NC	1.5E+03	NC	2.6E+04	NC	7.6E+02	NC	2.8E+03
Thallium	7440280	Thallium, Total	NC	2.5E-02	NC	3.4E-01	NC	1.3E-02	NC	5.4E-01
Tin	7440315	Tin, Total	NC	1.5E+03	NC	5.5E+03	NC	7.6E+02	NC	2.9E+03
Vanadium	7440622	Vanadium, Total	NC	1.2E+01	NC	1.1E+03	NC	6.3E+00	NC	9.7E+02
Zinc	7440666	Zinc, Total	NC	7.4E+02	NC	3.2E+05	NC	3.8E+02	NC	4.8E+05
Zirconium	7440677	Zirconium, Total	NC	2.0E-01	NC	4.0E+01	NC	1.0E-01	NC	7.4E+00
Energetic Constituents										
1,2-Dinitrobenzene	528290	o-Dinitrobenzene	NC	2.5E-01	NC	3.8E+02	NC	1.3E-01	NC	2.9E+00
1,3-Dinitrobenzene	99650	m-Dinitrobenzene	NC	2.5E-01	NC	4.2E+02	NC	1.3E-01	NC	3.2E+00
2,4,6-Trinitrotoluene	118967	-	1.1E-01	1.2E+00	1.8E+02	2.0E+03	5.8E-02	6.3E-01	1.4E+00	1.5E+01
2-Amino-4,6-dinitrotoluene	35572782	-	NC	5.0E+00	NC	7.2E+03	NC	2.5E+00	NC	5.5E+01
HMX	2691410	-	NC	1.2E+02	NC	6.1E+05	NC	6.3E+01	NC	4.6E+03
Hydrazine	302012	-	1.1E-03	NC	2.3E+00	NC	5.8E-04	NC	1.8E-02	NC

Attachment 1 - Table 13

Indirect Soil Contact Pathway-Specific 40-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Eggs: Target Chemical Concentration in Eggs (C_e) Farmer Cancer (10^{-6}) (mg/kg)	Eggs: Target Chemical Concentration in Eggs (C_e) Child Noncancer (HQ=1) (mg/kg)	Eggs: Soil RBSL for Eggs Pathway ($RBSL_e$) Farmer Cancer (10^{-6}) (mg/kg)	Eggs: Soil RBSL for Eggs Pathway ($RBSL_e$) Child Noncancer (HQ=1) (mg/kg)	Swine: Target Chemical Concentration in Swine (C_s) Farmer Cancer (10^{-6}) (mg/kg)	Swine: Target Chemical Concentration in Swine (C_s) Child Noncancer (HQ=1) (mg/kg)	Swine: Soil RBSL for Swine Pathway ($RBSL_s$) Farmer Cancer (10^{-6}) (mg/kg)	Swine: Soil RBSL for Swine Pathway ($RBSL_s$) Child Noncancer (HQ=1) (mg/kg)
RDX	121824	Hexahydro-1,3,5-trinitro-1,3,5-triazine	3.0E-02	7.4E+00	7.6E+01	1.9E+04	1.6E-02	3.8E+00	6.0E-01	1.4E+02
Perchlorate	14797730	-	NC	1.7E+00	NC	4.4E-01	NC	8.9E-01	NC	9.5E-03
Volatile Organic Compounds										
1,1,1,2-Tetrachloroethane	630206	-	1.3E-01	7.4E+01	1.3E+02	7.8E+04	6.7E-02	3.8E+01	1.1E+00	6.0E+02
1,1,1-Trichloroethane	71556	-	NC	5.0E+03	NC	5.8E+06	NC	2.5E+03	NC	4.4E+04
1,1,2,2-Tetrachloroethane	79345	-	1.2E-02	5.0E+01	1.4E+01	5.9E+04	6.5E-03	2.5E+01	1.2E-01	4.6E+02
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	Freon 113	NC	7.4E+04	NC	7.4E+07	NC	3.8E+04	NC	5.8E+05
1,1,2-Trichloroethane	79005	-	4.5E-02	9.9E+00	6.4E+01	1.4E+04	2.4E-02	5.1E+00	5.1E-01	1.1E+02
1,1-Dichloroethane	75343	-	5.7E-01	5.0E+02	8.4E+02	7.3E+05	3.1E-01	2.5E+02	6.7E+00	5.6E+03
1,1-Dichloroethene	75354	-	NC	1.2E+02	NC	1.6E+05	NC	6.3E+01	NC	1.2E+03
1,1-Dimethylhydrazine	57147	Unsymetrical Dimethyl Hydrazine	NC	2.5E-01	NC	1.7E+03	NC	1.3E-01	NC	1.3E+01
1,2,3-Trichlorobenzene	87616	-	9.1E-01	2.0E+00	7.6E+02	1.7E+03	4.9E-01	1.0E+00	6.4E+00	1.3E+01
1,2,4-Trichlorobenzene	120821	-	9.1E-01	2.5E+01	7.6E+02	2.1E+04	4.9E-01	1.3E+01	6.4E+00	1.7E+02
1,2,4-Trimethylbenzene	95636	-	NC	2.5E+01	NC	2.2E+04	NC	1.3E+01	NC	1.8E+02
1,2-Dibromo-3-chloropropane	96128	1,2-Dibromo-3-CPA	4.7E-04	5.0E-01	4.8E-01	5.1E+02	2.5E-04	2.5E-01	3.9E-03	4.0E+00
1,2-Dibromoethane	106934	1,2-Dibromoethane (EDB)	9.1E-04	2.2E+01	1.2E+00	3.1E+04	4.9E-04	1.1E+01	1.0E-02	2.3E+02
1,2-Dichlorobenzene	95501	o-Dichlorobenzene	NC	2.2E+02	NC	2.1E+05	NC	1.1E+02	NC	1.7E+03
1,2-Dichloroethane	107062	-	6.9E-02	1.5E+01	1.2E+02	2.6E+04	3.7E-02	7.6E+00	9.5E-01	1.9E+02
1,2-Dichloroethene	540590	1,2-Dichloroethenes	NC	2.2E+01	NC	2.9E+04	NC	1.1E+01	NC	2.2E+02
1,2-Dichloropropane	78875	-	9.1E-02	2.2E+02	1.2E+02	3.0E+05	4.9E-02	1.1E+02	9.9E-01	2.3E+03
1,3,5-Trimethylbenzene	108678	-	NC	2.5E+01	NC	2.3E+04	NC	1.3E+01	NC	1.8E+02
1,3-Dichlorobenzene	541731	m-Dichlorobenzene	NC	7.4E+01	NC	6.9E+04	NC	3.8E+01	NC	5.4E+02
1,4-Dichlorobenzene	106467	p-Dichlorobenzene	6.0E-01	1.7E+02	5.7E+02	1.6E+05	3.2E-01	8.9E+01	4.7E+00	1.3E+03
2-Chloroethylvinyl ether	110758	2-Chloroethyl vinyl ether	1.3E-03	NC	2.7E+00	NC	7.0E-04	NC	2.1E-02	NC
2-Hexanone	591786	Methyl butyl ketone	NC	1.2E+01	NC	2.2E+04	NC	6.3E+00	NC	1.7E+02
Acetone	67641	-	NC	2.2E+03	NC	1.7E+07	NC	1.1E+03	NC	1.3E+05
Benzene	71432	-	3.3E-02	9.9E+00	4.2E+01	1.3E+04	1.7E-02	5.1E+00	3.4E-01	9.8E+01
Bromobenzene	108861	-	NC	2.0E+01	NC	2.0E+04	NC	1.0E+01	NC	1.6E+02
Bromodichloromethane	75274	-	2.5E-02	5.0E+01	3.4E+01	6.7E+04	1.3E-02	2.5E+01	2.7E-01	5.1E+02
Bromoform	75252	-	3.0E-01	5.0E+01	3.5E+02	5.9E+04	1.6E-01	2.5E+01	2.8E+00	4.5E+02
Bromomethane	74839	-	NC	3.5E+00	NC	7.1E+03	NC	1.8E+00	NC	5.4E+01
Carbon disulfide	75150	-	NC	2.5E+02	NC	3.4E+05	NC	1.3E+02	NC	2.6E+03
Carbon tetrachloride	56235	-	2.2E-02	9.9E+00	2.3E+01	1.1E+04	1.2E-02	5.1E+00	1.9E-01	8.2E+01
Chlorobenzene	108907	Monochlorobenzene	NC	5.0E+01	NC	5.3E+04	NC	2.5E+01	NC	4.1E+02
Chloroform	67663	Trichloromethane	1.1E-01	2.5E+01	1.4E+02	3.4E+04	5.6E-02	1.3E+01	1.2E+00	2.6E+02
Chloromethane	74873	Methyl chloride	NC	3.5E+00	NC	8.6E+03	NC	1.8E+00	NC	6.5E+01

Attachment 1 - Table 13

Indirect Soil Contact Pathway-Specific 40-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Eggs: Target Chemical Concentration in Eggs (C_e) Farmer Cancer (10^{-6}) (mg/kg)	Eggs: Target Chemical Concentration in Eggs (C_e) Child Noncancer (HQ=1) (mg/kg)	Eggs: Soil RBSL for Eggs Pathway ($RBSL_e$) Farmer Cancer (10^{-6}) (mg/kg)	Eggs: Soil RBSL for Eggs Pathway ($RBSL_e$) Child Noncancer (HQ=1) (mg/kg)	Swine: Target Chemical Concentration in Swine (C_s) Farmer Cancer (10^{-6}) (mg/kg)	Swine: Target Chemical Concentration in Swine (C_s) Child Noncancer (HQ=1) (mg/kg)	Swine: Soil RBSL for Swine Pathway ($RBSL_s$) Farmer Cancer (10^{-6}) (mg/kg)	Swine: Soil RBSL for Swine Pathway ($RBSL_s$) Child Noncancer (HQ=1) (mg/kg)
cis-1,2-Dichloroethene	156592	cis-1,2-Dichloroethylene	NC	5.0E+00	NC	7.1E+03	NC	2.5E+00	NC	5.4E+01
Cumene	98828	Isopropylbenzene	NC	2.5E+02	NC	2.2E+05	NC	1.3E+02	NC	1.8E+03
Dibromochloromethane	124481	-	3.5E-02	5.0E+01	4.4E+01	6.4E+04	1.9E-02	2.5E+01	3.6E-01	4.9E+02
Dibromomethane	74953	-	NC	2.5E+01	NC	3.8E+04	NC	1.3E+01	NC	2.9E+02
Dichlorodifluoromethane	75718	Freon 12	NC	5.0E+02	NC	6.4E+05	NC	2.5E+02	NC	4.9E+03
Ethylbenzene	100414	-	3.0E-01	2.5E+02	3.0E+02	2.5E+05	1.6E-01	1.3E+02	2.4E+00	1.9E+03
Methyl ethyl ketone	78933	2-Butanone; 2-Butanone (MEK)	NC	1.5E+03	NC	6.4E+06	NC	7.6E+02	NC	4.8E+04
Methyl isobutyl ketone (MIBK)	108101	MIBK; 4-Methyl-2-pentanone	NC	2.0E+02	NC	3.7E+05	NC	1.0E+02	NC	2.8E+03
Methylene chloride	75092	Dichloromethane	2.3E-01	1.5E+01	4.6E+02	2.9E+04	1.2E-01	7.6E+00	3.6E+00	2.2E+02
Monomethylhydrazine	60344	Monomethyl Hydrazine	5.9E-06	2.5E+00	5.0E-02	2.1E+04	3.2E-06	1.3E+00	3.9E-04	1.6E+02
m-Xylene & p-Xylene	136777612	meta- and para-Xylenes; m, p-Xylene	NC	5.0E+02	NC	5.0E+05	NC	2.5E+02	NC	3.9E+03
n-Butylbenzene	104518	-	NC	1.2E+02	NC	9.8E+04	NC	6.3E+01	NC	7.9E+02
n-Propylbenzene	103651	-	NC	2.5E+02	NC	2.2E+05	NC	1.3E+02	NC	1.8E+03
o-Chlorotoluene	95498	2-Chlorotoluene	NC	5.0E+01	NC	4.7E+04	NC	2.5E+01	NC	3.7E+02
o-Xylene	95476	-	NC	5.0E+02	NC	5.0E+05	NC	2.5E+02	NC	3.9E+03
p-Chlorotoluene	106434	4-Chlorotoluene	NC	5.0E+01	NC	4.8E+04	NC	2.5E+01	NC	3.7E+02
p-Cymene	99876	p-Isopropyltoluene	NC	2.5E+02	NC	2.0E+05	NC	1.3E+02	NC	1.6E+03
p-Nitroaniline	100016	4-Nitroaniline	1.6E-01	9.9E+00	2.9E+02	1.8E+04	8.7E-02	5.1E+00	2.3E+00	1.4E+02
sec-Butylbenzene	135988	-	NC	2.5E+02	NC	1.9E+05	NC	1.3E+02	NC	1.5E+03
Styrene	100425	Vinylbenzene	NC	5.0E+02	NC	5.2E+05	NC	2.5E+02	NC	4.0E+03
tert-Butylbenzene	98066	Dibenzo[b,e][1,4]dioxin, octachloro-	NC	2.5E+02	NC	2.0E+05	NC	1.3E+02	NC	1.6E+03
Tetrachloroethene	127184	-	6.0E-03	1.5E+01	5.7E+00	1.4E+04	3.2E-03	7.6E+00	4.7E-02	1.1E+02
Tetralin	119642	-	NC	5.0E+01	NC	4.8E+04	NC	2.5E+01	NC	3.8E+02
Toluene	108883	Toluol	NC	2.0E+02	NC	2.2E+05	NC	1.0E+02	NC	1.7E+03
trans-1,2-Dichloroethene	156605	-	NC	5.0E+01	NC	6.5E+04	NC	2.5E+01	NC	5.0E+02
Trichloroethene	79016	Trichloroethylene (TCE)	7.1E-02	1.2E+00	8.4E+01	1.5E+03	3.8E-02	6.3E-01	6.7E-01	1.1E+01
Trichlorofluoromethane	75694	-	NC	7.4E+02	NC	8.5E+05	NC	3.8E+02	NC	6.6E+03
Vinyl chloride	75014	-	1.2E-02	7.4E+00	1.9E+01	1.2E+04	6.5E-03	3.8E+00	1.5E-01	9.0E+01
Xylenes, Total	1330207	Xylene (Total) Isomers	NC	5.0E+02	NC	5.0E+05	NC	2.5E+02	NC	3.9E+03
Semi-Volatile Organic Compounds										
1,4-Dioxane	123911	-	1.2E-01	7.4E+01	9.8E+02	6.0E+05	6.5E-02	3.8E+01	7.7E+00	4.6E+03
2,4,5-Trichlorophenol	95954	-	NC	2.5E+02	NC	2.2E+05	NC	1.3E+02	NC	1.8E+03
2,4,6-Trichlorophenol	88062	-	4.7E-02	2.5E+00	4.2E+01	2.2E+03	2.5E-02	1.3E+00	3.5E-01	1.8E+01
2,4-Dimethylphenol	105679	-	NC	5.0E+01	NC	6.1E+04	NC	2.5E+01	NC	4.7E+02

Attachment 1 - Table 13

Indirect Soil Contact Pathway-Specific 40-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Eggs: Target Chemical Concentration in Eggs (C_e) Farmer Cancer (10^{-6}) (mg/kg)	Eggs: Target Chemical Concentration in Eggs (C_e) Child Noncancer (HQ=1) (mg/kg)	Eggs: Soil RBSL for Eggs Pathway ($RBSL_e$) Farmer Cancer (10^{-6}) (mg/kg)	Eggs: Soil RBSL for Eggs Pathway ($RBSL_e$) Child Noncancer (HQ=1) (mg/kg)	Swine: Target Chemical Concentration in Swine (C_s) Farmer Cancer (10^{-6}) (mg/kg)	Swine: Target Chemical Concentration in Swine (C_s) Child Noncancer (HQ=1) (mg/kg)	Swine: Soil RBSL for Swine Pathway ($RBSL_s$) Farmer Cancer (10^{-6}) (mg/kg)	Swine: Soil RBSL for Swine Pathway ($RBSL_s$) Child Noncancer (HQ=1) (mg/kg)
3,5-Dimethylphenol	108689	-	NC	1.8E+01	NC	2.0E+04	NC	9.1E+00	NC	1.5E+02
Benzoic acid	65850	-	NC	9.9E+03	NC	1.4E+07	NC	5.1E+03	NC	1.1E+05
Benzyl alcohol	100516	-	NC	2.5E+02	NC	5.4E+05	NC	1.3E+02	NC	4.1E+03
bis(2-Ethylhexyl) phthalate	117817	bis(2-ethylhexyl)phthalate	1.1E+00	5.0E+01	2.6E+03	1.2E+05	5.8E-01	2.5E+01	2.3E+01	1.0E+03
Butyl benzyl phthalate	85687	-	1.7E+00	5.0E+02	1.3E+03	3.7E+05	9.2E-01	2.5E+02	1.1E+01	3.0E+03
Carbazole	86748	-	1.6E-01	NC	1.4E+02	NC	8.7E-02	NC	1.2E+00	NC
Dibenzofuran	132649	-	NC	2.5E+00	NC	2.0E+03	NC	1.3E+00	NC	1.6E+01
Diethyl phthalate	84662	-	NC	2.0E+03	NC	2.3E+06	NC	1.0E+03	NC	1.8E+04
Dimethyl phthalate	131113	-	NC	2.0E+03	NC	3.2E+06	NC	1.0E+03	NC	2.4E+04
Di-n-butyl phthalate	84742	Di-n-butylphthalate	NC	2.5E+02	NC	1.9E+05	NC	1.3E+02	NC	1.6E+03
Di-n-octyl phthalate	117840	Di-n-octyl-phthalate	NC	2.5E+01	NC	1.1E+05	NC	1.3E+01	NC	8.7E+02
Formaldehyde	50000	-	NC	5.0E+02	NC	2.0E+06	NC	2.5E+02	NC	1.5E+04
Hexachlorobutadiene	87683	-	4.2E-02	2.5E+00	3.1E+01	1.9E+03	2.2E-02	1.3E+00	2.7E-01	1.5E+01
m-Cresol	108394	3-Methylphenol	NC	1.2E+02	NC	1.7E+05	NC	6.3E+01	NC	1.3E+03
N-Nitrosodimethylamine	62759	Nitrosodimethylamine	2.0E-04	2.0E-02	2.5E+00	2.4E+02	1.1E-04	1.0E-02	1.9E-02	1.8E+00
N-Nitrosodiphenylamine	86306	-	3.6E-01	NC	3.6E+02	NC	1.9E-01	NC	3.0E+00	NC
o-Cresol	95487	2-Methylphenol	NC	1.2E+02	NC	1.7E+05	NC	6.3E+01	NC	1.3E+03
p-Chloro-m-cresol	59507	4-Chloro-3-Methylphenol	NC	2.5E+02	NC	2.5E+05	NC	1.3E+02	NC	2.0E+03
p-Cresol	106445	4-Methylphenol	NC	2.5E+02	NC	3.4E+05	NC	1.3E+02	NC	2.6E+03
Pentachlorophenol	87865	PCP	1.8E-01	1.2E+01	1.3E+02	9.2E+03	9.7E-02	6.3E+00	1.2E+00	7.5E+01
Phenol	108952	Total Phenols	NC	7.4E+02	NC	1.3E+06	NC	3.8E+02	NC	9.8E+03
Polynuclear Aromatic Hydrocarbons										
1-Methyl naphthalene	90120	1-Methylnaphthalene	1.1E-01	1.7E+02	9.7E+01	1.5E+05	6.0E-02	8.9E+01	8.1E-01	1.2E+03
2-Methylnaphthalene	91576	Naphthalene, 2-methyl-	NC	9.9E+00	NC	8.6E+03	NC	5.1E+00	NC	6.8E+01
Acenaphthene	83329	-	NC	1.5E+02	NC	1.3E+05	NC	7.6E+01	NC	1.0E+03
Acenaphthylene	208968	-	NC	1.5E+02	NC	1.3E+05	NC	7.6E+01	NC	1.0E+03
Anthracene	120127	-	NC	7.4E+02	NC	5.8E+05	NC	3.8E+02	NC	4.7E+03
Benzo(a)anthracene	56553	Benz[a]anthracene	2.7E-03	NC	2.2E+00	NC	1.5E-03	NC	1.9E-02	NC
Benzo(a)pyrene	50328	Benzo (a) pyrene	2.7E-04	NC	2.4E-01	NC	1.5E-04	NC	2.1E-03	NC
Benzo(b)fluoranthene	205992	Benz[e]acephenanthrylene 1	2.7E-03	NC	2.2E+00	NC	1.5E-03	NC	1.9E-02	NC
Benzo(e)pyrene	192972	-	NC	7.4E+01	NC	6.6E+04	NC	3.8E+01	NC	5.4E+02
Benzo(ghi)perylene	191242	Benzo (g,h,i) perylene	NC	7.4E+01	NC	8.4E+04	NC	3.8E+01	NC	6.9E+02
Benzo(k)fluoranthene	207089	Benzo[k]fluoranthene	2.7E-03	NC	2.4E+00	NC	1.5E-03	NC	2.1E-02	NC
Chrysene	218019	-	2.7E-02	NC	2.2E+01	NC	1.5E-02	NC	1.9E-01	NC
Dibenzo(a,h)anthracene	53703	Dibenz (a,h) anthracene	8.0E-04	NC	9.6E-01	NC	4.3E-04	NC	8.3E-03	NC
Fluoranthene	206440	-	NC	9.9E+01	NC	7.4E+04	NC	5.1E+01	NC	6.0E+02
Fluorene	86737	-	NC	9.9E+01	NC	8.1E+04	NC	5.1E+01	NC	6.5E+02
Indeno(1,2,3-cd)pyrene	193395	Indeno (1,2,3-cd) pyrene	2.7E-03	NC	3.2E+00	NC	1.5E-03	NC	2.8E-02	NC

Attachment 1 - Table 13

Indirect Soil Contact Pathway-Specific 40-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Eggs: Target Chemical Concentration in Eggs (C_e) Farmer Cancer (10^{-6}) (mg/kg)	Eggs: Target Chemical Concentration in Eggs (C_e) Child Noncancer (HQ=1) (mg/kg)	Eggs: Soil RBSL for Eggs Pathway ($RBSL_e$) Farmer Cancer (10^{-6}) (mg/kg)	Eggs: Soil RBSL for Eggs Pathway ($RBSL_e$) Child Noncancer (HQ=1) (mg/kg)	Swine: Target Chemical Concentration in Swine (C_s) Farmer Cancer (10^{-6}) (mg/kg)	Swine: Target Chemical Concentration in Swine (C_s) Child Noncancer (HQ=1) (mg/kg)	Swine: Soil RBSL for Swine Pathway ($RBSL_s$) Farmer Cancer (10^{-6}) (mg/kg)	Swine: Soil RBSL for Swine Pathway ($RBSL_s$) Child Noncancer (HQ=1) (mg/kg)
Naphthalene	91203	-	NC	5.0E+01	NC	4.8E+04	NC	2.5E+01	NC	3.8E+02
Perylene	198550	-	NC	7.4E+01	NC	6.9E+04	NC	3.8E+01	NC	5.7E+02
Phenanthrene	85018	-	NC	7.4E+02	NC	5.8E+05	NC	3.8E+02	NC	4.7E+03
Pyrene	129000	-	NC	7.4E+01	NC	5.5E+04	NC	3.8E+01	NC	4.5E+02
Pesticides										
4,4'-DDD	72548	p,p'-DDD	1.4E-02	NC	1.2E+01	NC	7.3E-03	NC	1.0E-01	NC
4,4'-DDE	72559	p,p'-DDE	9.6E-03	NC	1.0E+01	NC	5.1E-03	NC	8.7E-02	NC
4,4'-DDT	50293	p,p'-DDT	9.6E-03	1.2E+00	1.3E+01	1.7E+03	5.1E-03	6.3E-01	1.1E-01	1.4E+01
Aldrin	309002	-	1.9E-04	7.4E-02	2.0E-01	7.8E+01	1.0E-04	3.8E-02	1.7E-03	6.4E-01
alpha-BHC	319846	a-Benzene Hexachloride	1.2E-03	2.0E+01	1.1E+00	1.7E+04	6.5E-04	1.0E+01	8.8E-03	1.4E+02
beta-BHC	319857	b-Benzene Hexachloride	2.2E-03	NC	1.9E+00	NC	1.2E-03	NC	1.6E-02	NC
delta-BHC	319868	d-Benzene Hexachloride	1.8E-03	7.4E-01	1.5E+00	6.1E+02	9.7E-04	3.8E-01	1.3E-02	4.9E+00
Chlordane (Technical)	12789036	-	9.3E-03	1.2E+00	8.6E+00	1.1E+03	5.0E-03	6.3E-01	7.4E-02	9.4E+00
Dieldrin	60571	-	2.0E-04	1.2E-01	1.5E-01	9.3E+01	1.1E-04	6.3E-02	1.3E-03	7.7E-01
Endosulfan I	959988	-	NC	1.5E+01	NC	1.3E+04	NC	7.6E+00	NC	1.0E+02
Endosulfan II	33213659	-	NC	1.5E+01	NC	1.3E+04	NC	7.6E+00	NC	1.0E+02
Endosulfan sulfate	1031078	-	NC	1.5E+01	NC	1.3E+04	NC	7.6E+00	NC	1.1E+02
Endrin	72208	-	NC	7.4E-01	NC	5.5E+02	NC	3.8E-01	NC	4.5E+00
Endrin aldehyde	7421934	-	NC	7.4E-01	NC	5.6E+02	NC	3.8E-01	NC	4.6E+00
Endrin ketone	53494705	-	NC	7.4E-01	NC	5.5E+02	NC	3.8E-01	NC	4.5E+00
gamma-BHC	58899	Lindane	3.0E-03	7.4E-01	2.6E+00	6.6E+02	1.6E-03	3.8E-01	2.2E-02	5.3E+00
Heptachlor	76448	-	8.0E-04	1.2E+00	7.0E-01	1.1E+03	4.3E-04	6.3E-01	6.0E-03	9.0E+00
Heptachlor epoxide	1024573	-	5.9E-04	3.2E-02	4.4E-01	2.4E+01	3.2E-04	1.6E-02	3.8E-03	2.0E-01
MCPA	94746	-	NC	1.2E+00	NC	1.2E+03	NC	6.3E-01	NC	9.5E+00
Mirex	2385855	Mirex (DeChlorane)	1.8E-04	5.0E-01	2.4E-01	6.6E+02	9.7E-05	2.5E-01	2.1E-03	5.4E+00
p,p'-Methoxychlor	72435	Methoxychlor	NC	1.2E+01	NC	9.2E+03	NC	6.3E+00	NC	7.5E+01
Toxaphene	8001352	-	2.7E-03	NC	2.2E+00	NC	1.5E-03	NC	1.9E-02	NC
Herbicides										
2,4,5-T	93765	2,4,5-Trichlorophenoxyacetic acid	NC	2.5E+01	NC	2.4E+04	NC	1.3E+01	NC	1.9E+02
2,4,5-TP (Silvex)	93721	-	NC	2.0E+01	NC	1.7E+04	NC	1.0E+01	NC	1.4E+02
2,4-Dichlorophenoxyacetic Acid (2,4-D)	94757	-	NC	2.5E+01	NC	2.7E+04	NC	1.3E+01	NC	2.1E+02
2,4-Dichlorophenoxybutyric acid	94826	2,4-DB	NC	2.0E+01	NC	1.8E+04	NC	1.0E+01	NC	1.4E+02
Dalapon	75990	-	NC	7.4E+01	NC	1.2E+05	NC	3.8E+01	NC	8.8E+02
Dicamba	1918009	-	NC	7.4E+01	NC	9.4E+04	NC	3.8E+01	NC	7.2E+02
2,4-DP (Dichlorprop)	120365	-	NC	2.5E+01	NC	2.3E+04	NC	1.3E+01	NC	1.8E+02
Dinoseb	88857	-	NC	2.5E+00	NC	2.3E+03	NC	1.3E+00	NC	1.8E+01

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Indirect Soil Contact Pathway-Specific 40-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Eggs: Target Chemical Concentration in Eggs (C_e) Farmer Cancer (10^{-6}) (mg/kg)	Eggs: Target Chemical Concentration in Eggs (C_e) Child Noncancer (HQ=1) (mg/kg)	Eggs: Soil RBSL for Eggs Pathway ($RBSL_e$) Farmer Cancer (10^{-6}) (mg/kg)	Eggs: Soil RBSL for Eggs Pathway ($RBSL_e$) Child Noncancer (HQ=1) (mg/kg)	Swine: Target Chemical Concentration in Swine (C_s) Farmer Cancer (10^{-6}) (mg/kg)	Swine: Target Chemical Concentration in Swine (C_s) Child Noncancer (HQ=1) (mg/kg)	Swine: Soil RBSL for Swine Pathway ($RBSL_s$) Farmer Cancer (10^{-6}) (mg/kg)	Swine: Soil RBSL for Swine Pathway ($RBSL_s$) Child Noncancer (HQ=1) (mg/kg)
MCPP	93652	-	NC	2.5E+00	NC	2.5E+03	NC	1.3E+00	NC	1.9E+01
Terphenyls										
m-Terphenyl	92068	-	4.1E-01	1.2E+03	3.4E+02	1.0E+06	2.2E-01	6.3E+02	2.9E+00	8.4E+03
o-Terphenyl	84151	-	4.1E-01	1.2E+03	3.4E+02	1.0E+06	2.2E-01	6.3E+02	2.9E+00	8.4E+03
p-Terphenyl	92944	-	4.1E-01	1.2E+03	3.4E+02	1.0E+06	2.2E-01	6.3E+02	2.9E+00	8.4E+03
Glycols										
Diethylene Glycol	111466	-	NC	2.5E+02	NC	1.2E+06	NC	1.3E+02	NC	9.0E+03
Triethylene glycol	112276	-	NC	1.1E+02	NC	3.7E+05	NC	5.7E+01	NC	2.8E+03
PCDD/PCDFs										
2,3,7,8-TCDD TEQ	1746016-TEQ	-	2.5E-08	1.7E-06	3.1E-05	2.2E-03	1.3E-08	8.9E-07	2.7E-07	1.8E-05
Polychlorinated Biphenyls (PCBs)										
Aroclor 1016	12674112	-	4.7E-02	1.7E-01	3.6E+01	1.3E+02	2.5E-02	8.9E-02	3.1E-01	1.1E+00
Aroclor 1242	53469219	Aroclor-1242	1.6E-03	5.0E-02	1.5E+00	4.7E+01	8.7E-04	2.5E-02	1.3E-02	3.9E-01
Aroclor 1248	12672296	-	1.6E-03	5.0E-02	1.6E+00	4.8E+01	8.7E-04	2.5E-02	1.4E-02	4.0E-01
Aroclor 1254	11097691	-	1.6E-03	5.0E-02	2.0E+00	6.2E+01	8.7E-04	2.5E-02	1.8E-02	5.1E-01
Aroclor 1260	11096825	-	1.6E-03	5.0E-02	7.8E+00	2.4E+02	8.7E-04	2.5E-02	6.8E-02	2.0E+00
Aroclor 5460	11126424	-	1.6E-03	5.0E-02	1.6E+00	4.8E+01	8.7E-04	2.5E-02	1.4E-02	4.0E-01
PCB TEQ	1746016-PCB TEQ	-	2.5E-08	1.7E-06	2.4E-05	1.7E-03	1.3E-08	8.9E-07	2.1E-07	1.4E-05

Notes:
'-' - none established/not applicable.
HQ - hazard quotient
mg/kg - milligrams per kilogram
NC - not calculated
PCDD/PCDF - polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans
RBSL - Risk-Based Screening Level
TCDD - 2,3,7,8-Tetrachlorodibenzo-p-dioxin
TEQ - toxic equivalency

Attachment 1 - Table 13

Indirect Soil Contact Pathway-Specific 40-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Eggs				Swine			
			Target Chemical Concentration in Eggs (C_e)		Soil RBSL for Eggs Pathway ($RBSL_e$)		Target Chemical Concentration in Swine (C_s)		Soil RBSL for Swine Pathway ($RBSL_s$)	
			Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)

a - Please note that different chemical names have been used for different programs at the SSFL, and there can be additional analyte synonyms than those presented. Therefore, any chemical synonym should be verified using the CAS number listed.

b - The cadmium RBSLs for non-carcinogenic effects were calculated using the exposure assumptions for an adult as described in Section 3.2.1.

Attachment 1 - Table 13

Indirect Soil Contact Pathway-Specific 40-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Fish: Target Chemical Concentration in Fish (C_{fi}) Farmer Cancer (10^{-6}) (mg/kg)	Fish: Target Chemical Concentration in Fish (C_{fi}) Child Noncancer (HQ=1) (mg/kg)	Fish: Soil RBSL for Fish Pathway ($RBSL_{fi}$) Farmer Cancer (10^{-6}) (mg/kg)	Fish: Soil RBSL for Fish Pathway ($RBSL_{fi}$) Child Noncancer (HQ=1) (mg/kg)
Inorganic Compounds						
Aluminum	7429905	Aluminum, Total	NC	8.8E+02	NC	NC
Antimony	7440360	Antimony, Total	NC	3.5E-01	NC	4.0E+00
Arsenic	7440382	Arsenic, Total	1.1E-04	2.6E-01	2.9E-04	6.7E-01
Barium	7440393	Barium, Total	NC	1.8E+02	NC	1.1E+02
Beryllium	7440417	Beryllium, Total	NC	1.8E+00	NC	2.2E+02
Boron	7440428	Boron, Total	NC	1.8E+02	NC	NC
Cadmium	7440439	Cadmium, Total	NC	3.7E-03 [b]	NC	3.0E-03
Chromium	7440473	Chromium, Total	NC	1.3E+03	NC	1.2E+09
Cobalt	7440484	Cobalt, Total	NC	2.6E-01	NC	4.0E-01
Copper	7440508	Copper, Total	NC	3.5E+01	NC	6.2E+01
Cyanides	57125	Cyanide, Total; Cyanide	NC	5.3E-01	NC	1.7E+01
Fluoride	16984488	-	NC	3.5E+01	NC	NC
Hexavalent chromium	18540299	Chromium, Hexavalent; Chromium VI	2.1E-03	2.6E+00	1.3E-01	1.6E+02
Lead	7439921	Lead, Total	NC	NC	NC	NC
Lithium	7439932	Lithium, Total	NC	1.8E+00	NC	1.5E+03
Manganese	7439965	Manganese, Total	NC	1.2E+02	NC	2.0E+02
Mercury	7439976	Mercury, Total	NC	2.6E-01	NC	4.3E+01
Methyl Mercury	22967926	-	NC	8.8E-02	NC	6.2E+00
Molybdenum	7439987	Molybdenum, Total	NC	4.4E+00	NC	8.8E+01
Nickel	7440020	Nickel, Total	NC	1.8E+01	NC	1.5E+02
Selenium	7782492	Selenium, Total	NC	4.4E+00	NC	1.7E+00
Silver	7440224	Silver, Total	NC	4.4E+00	NC	4.2E+00
Strontium	7440246	Strontium, Total	NC	5.3E+02	NC	3.1E+03
Thallium	7440280	Thallium, Total	NC	8.8E-03	NC	6.2E-04
Tin	7440315	Tin, Total	NC	5.3E+02	NC	4.4E+02
Vanadium	7440622	Vanadium, Total	NC	4.4E+00	NC	2.0E+04
Zinc	7440666	Zinc, Total	NC	2.6E+02	NC	8.0E+01
Zirconium	7440677	Zirconium, Total	NC	7.0E-02	NC	7.0E+00
Energetic Constituents						
1,2-Dinitrobenzene	528290	o-Dinitrobenzene	NC	8.8E-02	NC	1.4E-01
1,3-Dinitrobenzene	99650	m-Dinitrobenzene	NC	8.8E-02	NC	6.7E-01
2,4,6-Trinitrotoluene	118967	-	3.6E-02	4.4E-01	1.7E-02	2.1E-01
2-Amino-4,6-dinitrotoluene	35572782	-	NC	1.8E+00	NC	4.2E+00
HMX	2691410	-	NC	4.4E+01	NC	2.9E+03
Hydrazine	302012	-	3.6E-04	NC	NC	NC

Attachment 1 - Table 13

Indirect Soil Contact Pathway-Specific 40-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Fish: Target Chemical Concentration in Fish (C_{fi}) Farmer Cancer (10^{-6}) (mg/kg)	Fish: Target Chemical Concentration in Fish (C_{fi}) Child Noncancer (HQ=1) (mg/kg)	Fish: Soil RBSL for Fish Pathway ($RBSL_{fi}$) Farmer Cancer (10^{-6}) (mg/kg)	Fish: Soil RBSL for Fish Pathway ($RBSL_{fi}$) Child Noncancer (HQ=1) (mg/kg)
RDX	121824	Hexahydro-1,3,5-trinitro-1,3,5-triazine	9.7E-03	2.6E+00	3.1E-02	8.4E+00
Perchlorate	14797730	-	NC	6.2E-01	NC	1.3E+01
Volatile Organic Compounds						
1,1,1,2-Tetrachloroethane	630206	-	4.1E-02	2.6E+01	3.2E-02	2.0E+01
1,1,1-Trichloroethane	71556	-	NC	1.8E+03	NC	1.1E+03
1,1,2,2-Tetrachloroethane	79345	-	4.0E-03	1.8E+01	8.9E-04	3.9E+00
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	Freon 113	NC	2.6E+04	NC	6.8E+03
1,1,2-Trichloroethane	79005	-	1.5E-02	3.5E+00	6.0E-03	1.4E+00
1,1-Dichloroethane	75343	-	1.9E-01	1.8E+02	4.3E-02	4.0E+01
1,1-Dichloroethene	75354	-	NC	4.4E+01	NC	7.4E+00
1,1-Dimethylhydrazine	57147	Unsymetrical Dimethyl Hydrazine	NC	8.8E-02	NC	4.8E-02
1,2,3-Trichlorobenzene	87616	-	3.0E-01	7.0E-01	6.4E-02	1.5E-01
1,2,4-Trichlorobenzene	120821	-	3.0E-01	8.8E+00	1.1E-02	3.2E-01
1,2,4-Trimethylbenzene	95636	-	NC	8.8E+00	NC	2.8E+00
1,2-Dibromo-3-chloropropane	96128	1,2-Dibromo-3-CPA	1.5E-04	1.8E-01	3.6E-05	4.1E-02
1,2-Dibromoethane	106934	1,2-Dibromoethane (EDB)	3.0E-04	7.9E+00	6.7E-05	1.8E+00
1,2-Dichlorobenzene	95501	o-Dichlorobenzene	NC	7.9E+01	NC	1.1E+01
1,2-Dichloroethane	107062	-	2.3E-02	5.3E+00	7.0E-03	1.6E+00
1,2-Dichloroethene	540590	1,2-Dichloroethenes	NC	7.9E+00	NC	2.4E+00
1,2-Dichloropropane	78875	-	3.0E-02	7.9E+01	8.1E-03	2.1E+01
1,3,5-Trimethylbenzene	108678	-	NC	8.8E+00	NC	2.9E+00
1,3-Dichlorobenzene	541731	m-Dichlorobenzene	NC	2.6E+01	NC	1.1E+01
1,4-Dichlorobenzene	106467	p-Dichlorobenzene	2.0E-01	6.2E+01	6.1E-03	1.9E+00
2-Chloroethylvinyl ether	110758	2-Chloroethyl vinyl ether	4.3E-04	NC	3.2E-04	NC
2-Hexanone	591786	Methyl butyl ketone	NC	4.4E+00	NC	2.2E+00
Acetone	67641	-	NC	7.9E+02	NC	4.7E+02
Benzene	71432	-	1.1E-02	3.5E+00	5.5E-03	1.8E+00
Bromobenzene	108861	-	NC	7.0E+00	NC	4.6E+00
Bromodichloromethane	75274	-	8.2E-03	1.8E+01	2.5E-03	5.3E+00
Bromoform	75252	-	9.7E-02	1.8E+01	9.9E-02	1.8E+01
Bromomethane	74839	-	NC	1.2E+00	NC	8.3E-01
Carbon disulfide	75150	-	NC	8.8E+01	NC	8.6E+00
Carbon tetrachloride	56235	-	7.1E-03	3.5E+00	4.3E-03	2.1E+00
Chlorobenzene	108907	Monochlorobenzene	NC	1.8E+01	NC	5.3E+00
Chloroform	67663	Trichloromethane	3.5E-02	8.8E+00	4.8E-03	1.2E+00
Chloromethane	74873	Methyl chloride	NC	1.2E+00	NC	6.2E-01

Attachment 1 - Table 13

Indirect Soil Contact Pathway-Specific 40-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Fish: Target Chemical Concentration in Fish (C_{fi}) Farmer Cancer (10^{-6}) (mg/kg)	Fish: Target Chemical Concentration in Fish (C_{fi}) Child Noncancer (HQ=1) (mg/kg)	Fish: Soil RBSL for Fish Pathway ($RBSL_{fi}$) Farmer Cancer (10^{-6}) (mg/kg)	Fish: Soil RBSL for Fish Pathway ($RBSL_{fi}$) Child Noncancer (HQ=1) (mg/kg)
cis-1,2-Dichloroethene	156592	cis-1,2-Dichloroethylene	NC	1.8E+00	NC	2.7E-01
Cumene	98828	Isopropylbenzene	NC	8.8E+01	NC	1.1E+02
Dibromochloromethane	124481	-	1.1E-02	1.8E+01	2.7E-03	4.1E+00
Dibromomethane	74953	-	NC	8.8E+00	NC	6.0E+00
Dichlorodifluoromethane	75718	Freon 12	NC	1.8E+02	NC	2.1E+02
Ethylbenzene	100414	-	9.7E-02	8.8E+01	1.5E-02	1.3E+01
Methyl ethyl ketone	78933	2-Butanone; 2-Butanone (MEK)	NC	5.3E+02	NC	2.1E+02
Methyl isobutyl ketone (MIBK)	108101	MIBK; 4-Methyl-2-pentanone	NC	7.0E+01	NC	3.6E+01
Methylene chloride	75092	Dichloromethane	7.7E-02	5.3E+00	4.1E-03	2.8E-01
Monomethylhydrazine	60344	Monomethyl Hydrazine	1.9E-06	8.8E-01	1.1E-06	5.0E-01
m-Xylene & p-Xylene	136777612	meta- and para-Xylenes; m, p-Xylene	NC	1.8E+02	NC	3.0E+02
n-Butylbenzene	104518	-	NC	4.4E+01	NC	1.2E+01
n-Propylbenzene	103651	-	NC	8.8E+01	NC	3.5E+01
o-Chlorotoluene	95498	2-Chlorotoluene	NC	1.8E+01	NC	6.4E+00
o-Xylene	95476	-	NC	1.8E+02	NC	1.0E+02
p-Chlorotoluene	106434	4-Chlorotoluene	NC	1.8E+01	NC	7.1E+00
p-Cymene	99876	p-Isopropyltoluene	NC	8.8E+01	NC	1.1E+01
p-Nitroaniline	100016	4-Nitroaniline	5.4E-02	3.5E+00	1.0E-01	6.6E+00
sec-Butylbenzene	135988	-	NC	8.8E+01	NC	1.7E+01
Styrene	100425	Vinylbenzene	NC	1.8E+02	NC	1.6E+04
tert-Butylbenzene	98066	Dibenzo[b,e][1,4]dioxin, octachloro-	NC	8.8E+01	NC	1.4E+01
Tetrachloroethene	127184	-	2.0E-03	5.3E+00	1.6E-04	4.2E-01
Tetralin	119642	-	NC	1.8E+01	NC	6.2E+02
Toluene	108883	Toluol	NC	7.0E+01	NC	3.9E+01
trans-1,2-Dichloroethene	156605	-	NC	1.8E+01	NC	3.2E+00
Trichloroethene	79016	Trichloroethylene (TCE)	2.3E-02	4.4E-01	6.3E-03	1.2E-01
Trichlorofluoromethane	75694	-	NC	2.6E+02	NC	4.1E+01
Vinyl chloride	75014	-	4.0E-03	2.6E+00	9.9E-04	6.6E-01
Xylenes, Total	1330207	Xylene (Total) Isomers	NC	1.8E+02	NC	3.0E+02
Semi-Volatile Organic Compounds						
1,4-Dioxane	123911	-	4.0E-02	2.6E+01	8.7E-02	5.8E+01
2,4,5-Trichlorophenol	95954	-	NC	8.8E+01	NC	2.6E+01
2,4,6-Trichlorophenol	88062	-	1.5E-02	8.8E-01	1.5E-03	8.6E-02
2,4-Dimethylphenol	105679	-	NC	1.8E+01	NC	3.7E+02

Attachment 1 - Table 13

Indirect Soil Contact Pathway-Specific 40-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Fish: Target Chemical Concentration in Fish (C_{fi}) Farmer Cancer (10^{-6}) (mg/kg)	Fish: Target Chemical Concentration in Fish (C_{fi}) Child Noncancer (HQ=1) (mg/kg)	Fish: Soil RBSL for Fish Pathway ($RBSL_{fi}$) Farmer Cancer (10^{-6}) (mg/kg)	Fish: Soil RBSL for Fish Pathway ($RBSL_{fi}$) Child Noncancer (HQ=1) (mg/kg)
3,5-Dimethylphenol	108689	-	NC	6.3E+00	NC	1.1E+01
Benzoic acid	65850	-	NC	3.5E+03	NC	1.2E+03
Benzyl alcohol	100516	-	NC	8.8E+01	NC	1.4E+02
bis(2-Ethylhexyl) phthalate	117817	bis(2-ethylhexyl)phthalate	3.6E-01	1.8E+01	2.5E+00	1.2E+02
Butyl benzyl phthalate	85687	-	5.6E-01	1.8E+02	1.2E+03	3.8E+05
Carbazole	86748	-	5.4E-02	NC	1.7E-01	NC
Dibenzofuran	132649	-	NC	8.8E-01	NC	3.5E-01
Diethyl phthalate	84662	-	NC	7.0E+02	NC	2.8E+02
Dimethyl phthalate	131113	-	NC	7.0E+02	NC	5.9E+02
Di-n-butyl phthalate	84742	Di-n-butylphthalate	NC	8.8E+01	NC	3.9E+01
Di-n-octyl phthalate	117840	Di-n-octyl-phthalate	NC	8.8E+00	NC	3.3E+07
Formaldehyde	50000	-	NC	1.8E+02	NC	6.7E+01
Hexachlorobutadiene	87683	-	1.4E-02	8.8E-01	4.5E-02	2.9E+00
m-Cresol	108394	3-Methylphenol	NC	4.4E+01	NC	4.6E+01
N-Nitrosodimethylamine	62759	Nitrosodimethylamine	6.7E-05	7.0E-03	5.0E-05	5.3E-03
N-Nitrosodiphenylamine	86306	-	1.2E-01	NC	1.1E+01	NC
o-Cresol	95487	2-Methylphenol	NC	4.4E+01	NC	3.8E+01
p-Chloro-m-cresol	59507	4-Chloro-3-Methylphenol	NC	8.8E+01	NC	3.2E+02
p-Cresol	106445	4-Methylphenol	NC	8.8E+01	NC	1.2E+03
Pentachlorophenol	87865	PCP	6.0E-02	4.4E+00	3.0E-03	2.2E-01
Phenol	108952	Total Phenols	NC	2.6E+02	NC	6.8E+02
Polynuclear Aromatic Hydrocarbons						
1-Methyl naphthalene	90120	1-Methylnaphthalene	3.7E-02	6.2E+01	1.1E-01	1.8E+02
2-Methylnaphthalene	91576	Naphthalene, 2-methyl-	NC	3.5E+00	NC	7.0E+00
Acenaphthene	83329	-	NC	5.3E+01	NC	7.7E+02
Acenaphthylene	208968	-	NC	5.3E+01	NC	5.9E+01
Anthracene	120127	-	NC	2.6E+02	NC	1.0E+04
Benzo(a)anthracene	56553	Benz[a]anthracene	8.9E-04	NC	1.3E+00	NC
Benzo(a)pyrene	50328	Benzo (a) pyrene	8.9E-05	NC	3.6E-01	NC
Benzo(b)fluoranthene	205992	Benz[e]acephenanthrylene 1	8.9E-04	NC	8.0E-02	NC
Benzo(e)pyrene	192972	-	NC	2.6E+01	NC	2.7E+03
Benzo(ghi)perylene	191242	Benzo (g,h,i) perylene	NC	2.6E+01	NC	4.5E+04
Benzo(k)fluoranthene	207089	Benzo[k]fluoranthene	8.9E-04	NC	5.7E+00	NC
Chrysene	218019	-	8.9E-03	NC	2.7E+00	NC
Dibenzo(a,h)anthracene	53703	Dibenz (a,h) anthracene	2.6E-04	NC	1.0E-02	NC
Fluoranthene	206440	-	NC	3.5E+01	NC	1.0E+04
Fluorene	86737	-	NC	3.5E+01	NC	8.1E+02
Indeno(1,2,3-cd)pyrene	193395	Indeno (1,2,3-cd) pyrene	8.9E-04	NC	1.5E+01	NC

Attachment 1 - Table 13

Indirect Soil Contact Pathway-Specific 40-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Fish: Target Chemical Concentration in Fish (C_{fi}) Farmer Cancer (10^{-6}) (mg/kg)	Fish: Target Chemical Concentration in Fish (C_{fi}) Child Noncancer (HQ=1) (mg/kg)	Fish: Soil RBSL for Fish Pathway ($RBSL_{fi}$) Farmer Cancer (10^{-6}) (mg/kg)	Fish: Soil RBSL for Fish Pathway ($RBSL_{fi}$) Child Noncancer (HQ=1) (mg/kg)
Naphthalene	91203	-	NC	1.8E+01	NC	6.2E+02
Perylene	198550	-	NC	2.6E+01	NC	3.3E+03
Phenanthrene	85018	-	NC	2.6E+02	NC	7.9E+03
Pyrene	129000	-	NC	2.6E+01	NC	3.2E+03
Pesticides						
4,4'-DDD	72548	p,p'-DDD	4.5E-03	NC	4.1E-03	NC
4,4'-DDE	72559	p,p'-DDE	3.2E-03	NC	2.8E-02	NC
4,4'-DDT	50293	p,p'-DDT	3.2E-03	4.4E-01	5.4E-03	7.6E-01
Aldrin	309002	-	6.3E-05	2.6E-02	1.3E-03	5.3E-01
alpha-BHC	319846	a-Benzene Hexachloride	4.0E-04	7.0E+00	2.8E-05	4.9E-01
beta-BHC	319857	b-Benzene Hexachloride	7.1E-04	NC	5.0E-05	NC
delta-BHC	319868	d-Benzene Hexachloride	6.0E-04	2.6E-01	5.2E-05	2.3E-02
Chlordane (Technical)	12789036	-	3.1E-03	4.4E-01	2.3E-06	3.3E-04
Dieldrin	60571	-	6.7E-05	4.4E-02	9.4E-07	6.1E-04
Endosulfan I	959988	-	NC	5.3E+00	NC	1.4E+01
Endosulfan II	33213659	-	NC	5.3E+00	NC	1.4E+01
Endosulfan sulfate	1031078	-	NC	5.3E+00	NC	2.6E+01
Endrin	72208	-	NC	2.6E-01	NC	2.1E-03
Endrin aldehyde	7421934	-	NC	2.6E-01	NC	5.1E-03
Endrin ketone	53494705	-	NC	2.6E-01	NC	1.1E-02
gamma-BHC	58899	Lindane	9.7E-04	2.6E-01	4.4E-04	1.2E-01
Heptachlor	76448	-	2.6E-04	4.4E-01	3.8E-03	6.4E+00
Heptachlor epoxide	1024573	-	1.9E-04	1.1E-02	4.5E-04	2.7E-02
MCPA	94746	-	NC	4.4E-01	NC	3.9E-01
Mirex	2385855	Mirex (DeChlorane)	6.0E-05	1.8E-01	8.2E-07	2.4E-03
p,p'-Methoxychlor	72435	Methoxychlor	NC	4.4E+00	NC	7.9E-01
Toxaphene	8001352	-	8.9E-04	NC	1.5E-05	NC
Herbicides						
2,4,5-T	93765	2,4,5-Trichlorophenoxyacetic acid	NC	8.8E+00	NC	2.1E+01
2,4,5-TP (Silvex)	93721	-	NC	7.0E+00	NC	2.6E+01
2,4-Dichlorophenoxyacetic Acid (2,4-D)	94757	-	NC	8.8E+00	NC	7.7E+00
2,4-Dichlorophenoxybutyric acid	94826	2,4-DB	NC	7.0E+00	NC	1.5E+01
Dalapon	75990	-	NC	2.6E+01	NC	4.4E+00
Dicamba	1918009	-	NC	2.6E+01	NC	2.3E+01
2,4-DP (Dichlorprop)	120365	-	NC	8.8E+00	NC	1.1E+01
Dinoseb	88857	-	NC	8.8E-01	NC	3.7E+00

Attachment 1 - Table 13

Indirect Soil Contact Pathway-Specific 40-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Fish: Target Chemical Concentration in Fish (C_{fi})		Fish: Soil RBSL for Fish Pathway ($RBSL_{fi}$)	
			Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)
MCPP	93652	-	NC	8.8E-01	NC	1.1E+00
Terphenyls						
m-Terphenyl	92068	-	1.3E-01	4.4E+02	9.5E-02	3.1E+02
o-Terphenyl	84151	-	1.3E-01	4.4E+02	9.5E-02	3.1E+02
p-Terphenyl	92944	-	1.3E-01	4.4E+02	9.5E-02	3.1E+02
Glycols						
Diethylene Glycol	111466	-	NC	8.8E+01	NC	2.9E+01
Triethylene glycol	112276	-	NC	4.0E+01	NC	2.0E+01
PCDD/PCDFs						
2,3,7,8-TCDD TEQ	1746016-TEQ	-	NC	NC	1.2E-06	9.1E-05
Polychlorinated Biphenyls (PCBs)						
Aroclor 1016	12674112	-	NC	NC	1.0E-01	4.1E-01
Aroclor 1242	53469219	Aroclor-1242	NC	NC	3.6E-03	1.2E-01
Aroclor 1248	12672296	-	NC	NC	3.6E-03	1.2E-01
Aroclor 1254	11097691	-	NC	NC	3.6E-03	1.2E-01
Aroclor 1260	11096825	-	NC	NC	3.6E-03	1.2E-01
Aroclor 5460	11126424	-	NC	NC	3.6E-03	1.2E-01
PCB TEQ	1746016-PCB TEQ	-	NC	NC	5.5E-08	4.1E-06

Notes:
'-' - none established/not applicable.
HQ - hazard quotient
mg/kg - milligrams per kilogram
NC - not calculated
PCDD/PCDF - polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans
RBSL - Risk-Based Screening Level
TCDD - 2,3,7,8-Tetrachlorodibenzo-p-dioxin
TEQ - toxic equivalency

Attachment 1 - Table 13

Indirect Soil Contact Pathway-Specific 40-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Fish			
			Target Chemical Concentration in Fish (C_{fi})		Soil RBSL for Fish Pathway ($RBSL_{fi}$)	
			Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)

a - Please note that different chemical names have been used for different programs at the SSFL, and there can be additional analyte synonyms than those presented. Therefore, any chemical synonym should be verified using the CAS number listed.

b - The cadmium RBSLs for non-carcinogenic effects were calculated using the exposure assumptions for an adult as described in Section 3.2.1.

Attachment 1 - Table 14

Indirect Soil Contact Pathway-Specific 30-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Fruits/Vegetables: Target Chemical Concentration in Fruits and Vegetables (C_{fv})		Fruits/Vegetables: Soil RBSL for Fruits and Vegetables Pathway ($RBSL_{fv}$)		Beef: Target Chemical Concentration in Beef (C_b)		Beef: Soil RBSL for Beef Pathway ($RBSL_b$)	
			Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)
Inorganic Compounds										
Aluminum	7429905	Aluminum, Total	NC	6.2E+02	NC	NC	NC	1.2E+03	NC	NC
Antimony	7440360	Antimony, Total	NC	2.5E-01	NC	9.2E-01	NC	4.9E-01	NC	3.1E+03
Arsenic	7440382	Arsenic, Total	2.0E-04	1.9E-01	7.3E-04	6.9E-01	1.5E-04	3.6E-01	1.9E-02	4.8E+01
Barium	7440393	Barium, Total	NC	1.2E+02	NC	4.7E+02	NC	2.4E+02	NC	2.7E+05
Beryllium	7440417	Beryllium, Total	NC	1.2E+00	NC	4.7E+00	NC	2.4E+00	NC	7.0E+02
Boron	7440428	Boron, Total	NC	1.2E+02	NC	9.9E+01	NC	2.4E+02	NC	6.0E+03
Cadmium	7440439	Cadmium, Total	NC	5.4E-03 [b]	NC	1.4E-02	NC	3.3E-03 [b]	NC	8.5E-01
Chromium	7440473	Chromium, Total	NC	9.3E+02	NC	3.6E+03	NC	1.8E+03	NC	5.3E+04
Cobalt	7440484	Cobalt, Total	NC	1.9E-01	NC	6.6E-01	NC	3.6E-01	NC	9.2E+02
Copper	7440508	Copper, Total	NC	2.5E+01	NC	7.3E+01	NC	4.9E+01	NC	4.2E+02
Cyanides	57125	Cyanide, Total; Cyanide	NC	3.7E-01	NC	1.8E-01	NC	7.3E-01	NC	2.2E+04
Fluoride	16984488	-	NC	2.5E+01	NC	NC	NC	4.9E+01	NC	NC
Hexavalent chromium	18540299	Chromium, Hexavalent; Chromium VI	3.7E-03	1.9E+00	1.4E-02	7.1E+00	2.8E-03	3.6E+00	1.5E-01	1.9E+02
Lead	7439921	Lead, Total	NC	NC	NC	NC	NC	NC	NC	NC
Lithium	7439932	Lithium, Total	NC	1.2E+00	NC	4.7E+00	NC	2.4E+00	NC	6.7E+01
Manganese	7439965	Manganese, Total	NC	8.7E+01	NC	2.6E+02	NC	1.7E+02	NC	3.0E+04
Mercury	7439976	Mercury, Total	NC	1.9E-01	NC	3.3E-01	NC	3.6E-01	NC	2.4E+00
Methyl Mercury	22967926	-	NC	6.2E-02	NC	8.6E-03	NC	1.2E-01	NC	3.8E-01
Molybdenum	7439987	Molybdenum, Total	NC	3.1E+00	NC	9.1E+00	NC	6.1E+00	NC	7.5E+02
Nickel	7440020	Nickel, Total	NC	1.2E+01	NC	4.0E+01	NC	2.4E+01	NC	8.9E+02
Selenium	7782492	Selenium, Total	NC	3.1E+00	NC	8.6E+00	NC	6.1E+00	NC	6.6E+00
Silver	7440224	Silver, Total	NC	3.1E+00	NC	1.2E+01	NC	6.1E+00	NC	1.3E+02
Strontium	7440246	Strontium, Total	NC	3.7E+02	NC	8.0E+02	NC	7.3E+02	NC	5.6E+03
Thallium	7440280	Thallium, Total	NC	6.2E-03	NC	2.4E-02	NC	1.2E-02	NC	9.0E-02
Tin	7440315	Tin, Total	NC	3.7E+02	NC	6.7E+02	NC	7.3E+02	NC	4.8E+03
Vanadium	7440622	Vanadium, Total	NC	3.1E+00	NC	1.2E+01	NC	6.1E+00	NC	7.1E+02
Zinc	7440666	Zinc, Total	NC	1.9E+02	NC	3.6E+02	NC	3.6E+02	NC	2.4E+02
Zirconium	7440677	Zirconium, Total	NC	5.0E-02	NC	1.9E-01	NC	9.7E-02	NC	2.9E+04
Energetic Constituents										
1,2-Dinitrobenzene	528290	o-Dinitrobenzene	NC	6.2E-02	NC	5.8E-02	NC	1.2E-01	NC	2.0E+03
1,3-Dinitrobenzene	99650	m-Dinitrobenzene	NC	6.2E-02	NC	4.7E-02	NC	1.2E-01	NC	2.4E+03
2,4,6-Trinitrotoluene	118967	-	6.2E-02	3.1E-01	5.3E-02	2.7E-01	4.6E-02	6.1E-01	8.2E+02	1.1E+04
2-Amino-4,6-dinitrotoluene	35572782	-	NC	1.2E+00	NC	1.3E+00	NC	2.4E+00	NC	3.3E+04
HMX	2691410	-	NC	3.1E+01	NC	4.8E+00	NC	6.1E+01	NC	4.5E+06
Hydrazine	302012	-	6.2E-04	NC	4.9E-06	NC	4.6E-04	NC	3.1E+02	NC

Attachment 1 - Table 14

Indirect Soil Contact Pathway-Specific 30-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Fruits/Vegetables: Target Chemical Concentration in Fruits and Vegetables (C_{fv})		Fruits/Vegetables: Soil RBSL for Fruits and Vegetables Pathway ($RBSL_{fv}$)		Beef: Target Chemical Concentration in Beef (C_b)		Beef: Soil RBSL for Beef Pathway ($RBSL_b$)	
			Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)
RDX	121824	Hexahydro-1,3,5-trinitro-1,3,5-triazine	1.7E-02	1.9E+00	6.4E-03	7.0E-01	1.3E-02	3.6E+00	4.7E+02	1.4E+05
Perchlorate	14797730	-	NC	4.3E-01	NC	1.0E-01	NC	8.5E-01	NC	3.6E-03
Volatile Organic Compounds										
1,1,1,2-Tetrachloroethane	630206	-	7.2E-02	1.9E+01	1.7E-01	4.5E+01	5.4E-02	3.6E+01	2.0E+02	1.4E+05
1,1,1-Trichloroethane	71556	-	NC	1.2E+03	NC	2.3E+03	NC	2.4E+03	NC	1.6E+07
1,1,2,2-Tetrachloroethane	79345	-	6.9E-03	1.2E+01	1.2E-02	2.2E+01	5.2E-03	2.4E+01	3.8E+01	1.8E+05
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	Freon 113	NC	1.9E+04	NC	5.0E+04	NC	3.6E+04	NC	1.0E+08
1,1,2-Trichloroethane	79005	-	2.6E-02	2.5E+00	3.0E-02	2.8E+00	1.9E-02	4.9E+00	2.5E+02	6.3E+04
1,1-Dichloroethane	75343	-	3.3E-01	1.2E+02	3.4E-01	1.3E+02	2.4E-01	2.4E+02	3.5E+03	3.5E+06
1,1-Dichloroethene	75354	-	NC	3.1E+01	NC	4.4E+01	NC	6.1E+01	NC	6.1E+05
1,1-Dimethylhydrazine	57147	Unsymetrical Dimethyl Hydrazine	NC	6.2E-02	NC	1.6E-03	NC	1.2E-01	NC	3.4E+04
1,2,3-Trichlorobenzene	87616	-	5.2E-01	5.0E-01	1.8E+00	1.7E+00	3.9E-01	9.7E-01	2.6E+02	6.4E+02
1,2,4-Trichlorobenzene	120821	-	5.2E-01	6.2E+00	1.8E+00	2.1E+01	3.9E-01	1.2E+01	2.7E+02	8.5E+03
1,2,4-Trimethylbenzene	95636	-	NC	6.2E+00	NC	1.9E+01	NC	1.2E+01	NC	1.6E+04
1,2-Dibromo-3-chloropropane	96128	1,2-Dibromo-3-CPA	2.7E-04	1.2E-01	6.5E-04	3.0E-01	2.0E-04	2.4E-01	7.2E-01	8.8E+02
1,2-Dibromoethane	106934	1,2-Dibromoethane (EDB)	5.2E-04	5.6E+00	6.3E-04	6.8E+00	3.9E-04	1.1E+01	4.7E+00	1.3E+05
1,2-Dichlorobenzene	95501	o-Dichlorobenzene	NC	5.6E+01	NC	1.6E+02	NC	1.1E+02	NC	2.0E+05
1,2-Dichloroethane	107062	-	4.0E-02	3.7E+00	3.0E-02	2.8E+00	3.0E-02	7.3E+00	5.9E+02	1.5E+05
1,2-Dichloroethene	540590	1,2-Dichloroethenes	NC	5.6E+00	NC	7.6E+00	NC	1.1E+01	NC	1.1E+05
1,2-Dichloropropane	78875	-	5.2E-02	5.6E+01	6.4E-02	6.9E+01	3.9E-02	1.1E+02	4.5E+02	1.3E+06
1,3,5-Trimethylbenzene	108678	-	NC	6.2E+00	NC	1.8E+01	NC	1.2E+01	NC	2.3E+04
1,3-Dichlorobenzene	541731	m-Dichlorobenzene	NC	1.9E+01	NC	5.7E+01	NC	3.6E+01	NC	5.8E+04
1,4-Dichlorobenzene	106467	p-Dichlorobenzene	3.5E-01	4.3E+01	1.0E+00	1.3E+02	2.6E-01	8.5E+01	4.7E+02	1.6E+05
2-Chloroethylvinyl ether	110758	2-Chloroethyl vinyl ether	7.5E-04	NC	4.0E-04	NC	5.6E-04	NC	1.5E+01	NC
2-Hexanone	591786	Methyl butyl ketone	NC	3.1E+00	NC	2.1E+00	NC	6.1E+00	NC	1.3E+05
Acetone	67641	-	NC	5.6E+02	NC	5.1E+01	NC	1.1E+03	NC	1.2E+08
Benzene	71432	-	1.9E-02	2.5E+00	2.6E-02	3.5E+00	1.4E-02	4.9E+00	1.4E+02	4.8E+04
Bromobenzene	108861	-	NC	5.0E+00	NC	1.2E+01	NC	9.7E+00	NC	3.4E+04
Bromodichloromethane	75274	-	1.4E-02	1.2E+01	1.8E-02	1.6E+01	1.1E-02	2.4E+01	1.2E+02	2.8E+05
Bromoform	75252	-	1.7E-01	1.2E+01	3.0E-01	2.2E+01	1.3E-01	2.4E+01	9.3E+02	1.8E+05
Bromomethane	74839	-	NC	8.7E-01	NC	4.7E-01	NC	1.7E+00	NC	4.6E+04
Carbon disulfide	75150	-	NC	6.2E+01	NC	7.4E+01	NC	1.2E+02	NC	1.5E+06
Carbon tetrachloride	56235	-	1.2E-02	2.5E+00	2.9E-02	5.7E+00	9.3E-03	4.9E+00	4.0E+01	2.1E+04
Chlorobenzene	108907	Monochlorobenzene	NC	1.2E+01	NC	2.9E+01	NC	2.4E+01	NC	1.0E+05
Chloroform	67663	Trichloromethane	6.0E-02	6.2E+00	7.4E-02	7.6E+00	4.5E-02	1.2E+01	5.4E+02	1.4E+05

Attachment 1 - Table 14

Indirect Soil Contact Pathway-Specific 30-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Fruits/Vegetables: Target Chemical Concentration in Fruits and Vegetables (C_{fv})		Fruits/Vegetables: Soil RBSL for Fruits and Vegetables Pathway ($RBSL_{fv}$)		Beef: Target Chemical Concentration in Beef (C_b)		Beef: Soil RBSL for Beef Pathway ($RBSL_b$)	
			Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)
Chloromethane	74873	Methyl chloride	NC	8.7E-01	NC	3.4E-01	NC	1.7E+00	NC	6.1E+04
cis-1,2-Dichloroethene	156592	cis-1,2-Dichloroethylene	NC	1.2E+00	NC	1.4E+00	NC	2.4E+00	NC	3.3E+04
Cumene	98828	Isopropylbenzene	NC	6.2E+01	NC	2.0E+02	NC	1.2E+02	NC	1.6E+05
Dibromochloromethane	124481	-	2.0E-02	1.2E+01	2.9E-02	1.8E+01	1.5E-02	2.4E+01	1.4E+02	2.3E+05
Dibromomethane	74953	-	NC	6.2E+00	NC	5.9E+00	NC	1.2E+01	NC	1.9E+05
Dichlorodifluoromethane	75718	Freon 12	NC	1.2E+02	NC	1.8E+02	NC	2.4E+02	NC	2.3E+06
Ethylbenzene	100414	-	1.7E-01	6.2E+01	4.5E-01	1.7E+02	1.3E-01	1.2E+02	3.6E+02	3.4E+05
Methyl ethyl ketone	78933	2-Butanone; 2-Butanone (MEK)	NC	3.7E+02	NC	6.8E+01	NC	7.3E+02	NC	4.8E+07
Methyl isobutyl ketone (MIBK)	108101	MIBK; 4-Methyl-2-pentanone	NC	5.0E+01	NC	3.1E+01	NC	9.7E+01	NC	2.3E+06
Methylene chloride	75092	Dichloromethane	1.3E-01	3.7E+00	7.8E-02	2.2E+00	9.9E-02	7.3E+00	2.5E+03	1.8E+05
Monomethylhydrazine	60344	Monomethyl Hydrazine	3.4E-06	6.2E-01	1.1E-07	2.0E-02	2.5E-06	1.2E+00	6.2E-01	3.0E+05
m-Xylene & p-Xylene	136777612	meta- and para-Xylenes; m, p-Xylene	NC	1.2E+02	NC	3.3E+02	NC	2.4E+02	NC	7.1E+05
n-Butylbenzene	104518	-	NC	3.1E+01	NC	1.1E+02	NC	6.1E+01	NC	2.2E+04
n-Propylbenzene	103651	-	NC	6.2E+01	NC	2.0E+02	NC	1.2E+02	NC	1.5E+05
o-Chlorotoluene	95498	2-Chlorotoluene	NC	1.2E+01	NC	3.7E+01	NC	2.4E+01	NC	4.6E+04
o-Xylene	95476	-	NC	1.2E+02	NC	3.3E+02	NC	2.4E+02	NC	7.1E+05
p-Chlorotoluene	106434	4-Chlorotoluene	NC	1.2E+01	NC	3.5E+01	NC	2.4E+01	NC	5.3E+04
p-Cymene	99876	p-Isopropyltoluene	NC	6.2E+01	NC	2.1E+02	NC	1.2E+02	NC	7.4E+04
p-Nitroaniline	100016	4-Nitroaniline	9.3E-02	2.5E+00	6.4E-02	1.7E+00	7.0E-02	4.9E+00	1.5E+03	1.1E+05
sec-Butylbenzene	135988	-	NC	6.2E+01	NC	2.2E+02	NC	1.2E+02	NC	3.0E+04
Styrene	100425	Vinylbenzene	NC	1.2E+02	NC	3.0E+02	NC	2.4E+02	NC	9.0E+05
tert-Butylbenzene	98066	Dibenzo[b,e][1,4]dioxin, octachloro-	NC	6.2E+01	NC	2.1E+02	NC	1.2E+02	NC	7.2E+04
Tetrachloroethene	127184	-	3.5E-03	3.7E+00	1.0E-02	1.1E+01	2.6E-03	7.3E+00	5.0E+00	1.4E+04
Tetralin	119642	-	NC	1.2E+01	NC	3.5E+01	NC	2.4E+01	NC	5.5E+04
Toluene	108883	Toluol	NC	5.0E+01	NC	1.1E+02	NC	9.7E+01	NC	4.8E+05
trans-1,2-Dichloroethene	156605	-	NC	1.2E+01	NC	1.7E+01	NC	2.4E+01	NC	2.5E+05
Trichloroethene	79016	Trichloroethylene (TCE)	4.1E-02	3.1E-01	7.2E-02	5.5E-01	3.0E-02	6.1E-01	2.2E+02	4.3E+03
Trichlorofluoromethane	75694	-	NC	1.9E+02	NC	3.6E+02	NC	3.6E+02	NC	2.3E+06
Vinyl chloride	75014	-	6.9E-03	1.9E+00	6.0E-03	1.6E+00	5.2E-03	3.6E+00	8.9E+01	6.3E+04
Xylenes, Total	1330207	Xylene (Total) Isomers	NC	1.2E+02	NC	3.3E+02	NC	2.4E+02	NC	7.1E+05
Semi-Volatile Organic Compounds										
1,4-Dioxane	123911	-	6.9E-02	1.9E+01	6.1E-03	1.7E+00	5.2E-02	3.6E+01	5.9E+03	4.2E+06
2,4,5-Trichlorophenol	95954	-	NC	6.2E+01	NC	2.0E+02	NC	1.2E+02	NC	1.4E+05

Attachment 1 - Table 14

Indirect Soil Contact Pathway-Specific 30-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Fruits/Vegetables: Target Chemical Concentration in Fruits and Vegetables (C_{fv})		Fruits/Vegetables: Soil RBSL for Fruits and Vegetables Pathway ($RBSL_{fv}$)		Beef: Target Chemical Concentration in Beef (C_b)		Beef: Soil RBSL for Beef Pathway ($RBSL_b$)	
			Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)
2,4,6-Trichlorophenol	88062	-	2.7E-02	6.2E-01	8.4E-02	2.0E+00	2.0E-02	1.2E+00	2.5E+01	1.5E+03
2,4-Dimethylphenol	105679	-	NC	1.2E+01	NC	2.0E+01	NC	2.4E+01	NC	2.0E+05
3,5-Dimethylphenol	108689	-	NC	4.5E+00	NC	9.0E+00	NC	8.7E+00	NC	5.0E+04
Benzoic acid	65850	-	NC	2.5E+03	NC	2.8E+03	NC	4.9E+03	NC	6.5E+07
Benzyl alcohol	100516	-	NC	6.2E+01	NC	3.1E+01	NC	1.2E+02	NC	3.6E+06
bis(2-Ethylhexyl) phthalate	117817	bis(2-ethylhexyl)phthalate	6.2E-01	1.2E+01	2.4E+00	4.8E+01	4.6E-01	2.4E+01	1.4E-01	7.3E+00
Butyl benzyl phthalate	85687	-	9.8E-01	1.2E+02	3.6E+00	4.5E+02	7.3E-01	2.4E+02	1.3E+02	4.4E+04
Carbazole	86748	-	9.3E-02	NC	3.0E-01	NC	7.0E-02	NC	8.2E+01	NC
Dibenzofuran	132649	-	NC	6.2E-01	NC	2.1E+00	NC	1.2E+00	NC	7.1E+02
Diethyl phthalate	84662	-	NC	5.0E+02	NC	8.8E+02	NC	9.7E+02	NC	6.9E+06
Dimethyl phthalate	131113	-	NC	5.0E+02	NC	4.2E+02	NC	9.7E+02	NC	1.7E+07
Di-n-butyl phthalate	84742	Di-n-butylphthalate	NC	6.2E+01	NC	2.2E+02	NC	1.2E+02	NC	3.4E+04
Di-n-octyl phthalate	117840	Di-n-octyl-phthalate	NC	6.2E+00	NC	2.4E+01	NC	1.2E+01	NC	1.2E+00
Formaldehyde	50000	-	NC	1.2E+02	NC	2.4E+01	NC	2.4E+02	NC	1.5E+07
Hexachlorobutadiene	87683	-	2.4E-02	6.2E-01	8.8E-02	2.3E+00	1.8E-02	1.2E+00	2.9E+00	2.0E+02
m-Cresol	108394	3-Methylphenol	NC	3.1E+01	NC	3.8E+01	NC	6.1E+01	NC	7.3E+05
N-Nitrosodimethylamine	62759	Nitrosodimethylamine	1.2E-04	5.0E-03	7.0E-06	3.0E-04	8.7E-05	9.7E-03	1.3E+01	1.5E+03
N-Nitrosodiphenylamine	86306	-	2.1E-01	NC	5.5E-01	NC	1.5E-01	NC	4.5E+02	NC
o-Cresol	95487	2-Methylphenol	NC	3.1E+01	NC	3.7E+01	NC	6.1E+01	NC	7.4E+05
p-Chloro-m-cresol	59507	4-Chloro-3-Methylphenol	NC	6.2E+01	NC	1.6E+02	NC	1.2E+02	NC	3.6E+05
p-Cresol	106445	4-Methylphenol	NC	6.2E+01	NC	7.4E+01	NC	1.2E+02	NC	1.5E+06
Pentachlorophenol	87865	PCP	1.0E-01	3.1E+00	3.9E-01	1.2E+01	7.7E-02	6.1E+00	6.1E+00	4.8E+02
Phenol	108952	Total Phenols	NC	1.9E+02	NC	1.4E+02	NC	3.6E+02	NC	7.4E+06
Polynuclear Aromatic Hydrocarbons										
1-Methyl naphthalene	90120	1-Methylnaphthalene	6.4E-02	4.3E+01	2.1E-01	1.4E+02	4.8E-02	8.5E+01	4.4E+01	7.8E+04
2-Methylnaphthalene	91576	Naphthalene, 2-methyl-	NC	2.5E+00	NC	8.2E+00	NC	4.9E+00	NC	4.5E+03
Acenaphthene	83329	-	NC	3.7E+01	NC	1.2E+02	NC	7.3E+01	NC	6.1E+04
Acenaphthylene	208968	-	NC	3.7E+01	NC	1.2E+02	NC	7.3E+01	NC	5.9E+04
Anthracene	120127	-	NC	1.9E+02	NC	6.6E+02	NC	3.6E+02	NC	1.1E+05
Benzo(a)anthracene	56553	Benz[a]anthracene	1.6E-03	NC	5.9E-03	NC	1.2E-03	NC	2.3E-02	NC
Benzo(a)pyrene	50328	Benzo (a) pyrene	1.6E-04	NC	5.9E-04	NC	1.2E-04	NC	9.9E-04	NC
Benzo(b)fluoranthene	205992	Benz[e]acephenanthrylene 1	1.6E-03	NC	5.9E-03	NC	1.2E-03	NC	2.2E-02	NC
Benzo(e)pyrene	192972	-	NC	1.9E+01	NC	7.1E+01	NC	3.6E+01	NC	3.3E+02
Benzo(ghi)perylene	191242	Benzo (g,h,i) perylene	NC	1.9E+01	NC	7.1E+01	NC	3.6E+01	NC	1.0E+02
Benzo(k)fluoranthene	207089	Benzo[k]fluoranthene	1.6E-03	NC	5.9E-03	NC	1.2E-03	NC	1.0E-02	NC
Chrysene	218019	-	1.6E-02	NC	5.9E-02	NC	1.2E-02	NC	2.0E-01	NC
Dibenzo(a,h)anthracene	53703	Dibenz (a,h) anthracene	4.6E-04	NC	1.7E-03	NC	3.4E-04	NC	7.1E-04	NC

Attachment 1 - Table 14

Indirect Soil Contact Pathway-Specific 30-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Fruits/Vegetables: Target Chemical Concentration in Fruits and Vegetables (C_{fv})		Fruits/Vegetables: Soil RBSL for Fruits and Vegetables Pathway ($RBSL_{fv}$)		Beef: Target Chemical Concentration in Beef (C_b)		Beef: Soil RBSL for Beef Pathway ($RBSL_b$)	
			Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)
Fluoranthene	206440	-	NC	2.5E+01	NC	9.3E+01	NC	4.9E+01	NC	3.5E+03
Fluorene	86737	-	NC	2.5E+01	NC	8.6E+01	NC	4.9E+01	NC	2.5E+04
Indeno(1,2,3-cd)pyrene	193395	Indeno (1,2,3-cd) pyrene	1.6E-03	NC	6.0E-03	NC	1.2E-03	NC	2.7E-03	NC
Naphthalene	91203	-	NC	1.2E+01	NC	3.5E+01	NC	2.4E+01	NC	5.5E+04
Perylene	198550	-	NC	1.9E+01	NC	7.1E+01	NC	3.6E+01	NC	2.4E+02
Phenanthrene	85018	-	NC	1.9E+02	NC	6.7E+02	NC	3.6E+02	NC	1.1E+05
Pyrene	129000	-	NC	1.9E+01	NC	6.9E+01	NC	3.6E+01	NC	4.8E+03
Pesticides										
4,4'-DDD	72548	p,p'-DDD	7.8E-03	NC	3.0E-02	NC	5.8E-03	NC	6.4E-02	NC
4,4'-DDE	72559	p,p'-DDE	5.5E-03	NC	2.1E-02	NC	4.1E-03	NC	1.5E-02	NC
4,4'-DDT	50293	p,p'-DDT	5.5E-03	3.1E-01	2.1E-02	1.2E+00	4.1E-03	6.1E-01	6.0E-03	8.8E-01
Aldrin	309002	-	1.1E-04	1.9E-02	4.2E-04	7.1E-02	8.2E-05	3.6E-02	3.0E-04	1.3E-01
alpha-BHC	319846	a-Benzene Hexachloride	6.9E-04	5.0E+00	2.2E-03	1.6E+01	5.2E-04	9.7E+00	5.3E-01	1.0E+04
beta-BHC	319857	b-Benzene Hexachloride	1.2E-03	NC	4.0E-03	NC	9.3E-04	NC	9.8E-01	NC
delta-BHC	319868	d-Benzene Hexachloride	1.0E-03	1.9E-01	3.6E-03	6.4E-01	7.7E-04	3.6E-01	4.4E-01	2.1E+02
Chlordane (Technical)	12789036	-	5.3E-03	3.1E-01	2.04E-02	1.2E+00	4.0E-03	6.1E-01	2.8E-02	4.2E+00
Dieldrin	60571	-	1.2E-04	3.1E-02	4.4E-04	1.2E-01	8.7E-05	6.1E-02	3.8E-03	2.6E+00
Endosulfan I	959988	-	NC	3.7E+00	NC	1.2E+01	NC	7.3E+00	NC	7.1E+03
Endosulfan II	33213659	-	NC	3.7E+00	NC	1.2E+01	NC	7.3E+00	NC	7.1E+03
Endosulfan sulfate	1031078	-	NC	3.7E+00	NC	1.2E+01	NC	7.3E+00	NC	9.5E+03
Endrin	72208	-	NC	1.9E-01	NC	7.0E-01	NC	3.6E-01	NC	2.4E+01
Endrin aldehyde	7421934	-	NC	1.9E-01	NC	6.8E-01	NC	3.6E-01	NC	5.6E+01
Endrin ketone	53494705	-	NC	1.9E-01	NC	6.9E-01	NC	3.6E-01	NC	3.8E+01
gamma-BHC	58899	Lindane	1.7E-03	1.9E-01	5.4E-03	5.9E-01	1.3E-03	3.6E-01	1.5E+00	4.3E+02
Heptachlor	76448	-	4.6E-04	3.1E-01	1.7E-03	1.2E+00	3.4E-04	6.1E-01	3.1E-03	5.6E+00
Heptachlor epoxide	1024573	-	3.4E-04	8.1E-03	1.3E-03	3.0E-02	2.5E-04	1.6E-02	2.7E-02	1.7E+00
MCPA	94746	-	NC	3.1E-01	NC	8.6E-01	NC	6.1E-01	NC	1.5E+03
Mirex	2385855	Mirex (DeChlorane)	1.0E-04	1.2E-01	4.0E-04	4.8E-01	7.7E-05	2.4E-01	1.2E-04	3.7E-01
p,p'-Methoxychlor	72435	Methoxychlor	NC	3.1E+00	NC	1.2E+01	NC	6.1E+00	NC	5.2E+02
Toxaphene	8001352	-	1.6E-03	NC	5.9E-03	NC	1.2E-03	NC	2.2E-02	NC
Herbicides										
2,4,5-T	93765	2,4,5-Trichlorophenoxyacetic acid	NC	6.2E+00	NC	1.8E+01	NC	1.2E+01	NC	2.7E+04
2,4,5-TP (Silvex)	93721	-	NC	5.0E+00	NC	1.6E+01	NC	9.7E+00	NC	1.0E+04
2,4-Dichlorophenoxyacetic Acid (2,4-D)	94757	-	NC	6.2E+00	NC	1.4E+01	NC	1.2E+01	NC	5.4E+04
2,4-Dichlorophenoxybutyric acid	94826	2,4-DB	NC	5.0E+00	NC	1.5E+01	NC	9.7E+00	NC	1.5E+04

Attachment 1 - Table 14

Indirect Soil Contact Pathway-Specific 30-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Fruits/Vegetables: Target Chemical Concentration in Fruits and Vegetables (C_{fv})		Fruits/Vegetables: Soil RBSL for Fruits and Vegetables Pathway ($RBSL_{fv}$)		Beef: Target Chemical Concentration in Beef (C_b)		Beef: Soil RBSL for Beef Pathway ($RBSL_b$)	
			Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)
Dalapon	75990	-	NC	1.9E+01	NC	1.7E+01	NC	3.6E+01	NC	5.9E+05
Dicamba	1918009	-	NC	1.9E+01	NC	2.8E+01	NC	3.6E+01	NC	3.3E+05
2,4-DP (Dichlorprop)	120365	-	NC	6.2E+00	NC	1.8E+01	NC	1.2E+01	NC	2.3E+04
Dinoseb	88857	-	NC	6.2E-01	NC	1.9E+00	NC	1.2E+00	NC	1.8E+03
MCPP	93652	-	NC	6.2E-01	NC	1.6E+00	NC	1.2E+00	NC	3.5E+03
Terphenyls										
m-Terphenyl	92068	-	2.3E-01	3.1E+02	7.8E-01	1.0E+03	1.7E-01	6.1E+02	1.3E+02	4.6E+05
o-Terphenyl	84151	-	2.3E-01	3.1E+02	7.8E-01	1.0E+03	1.7E-01	6.1E+02	1.3E+02	4.6E+05
p-Terphenyl	92944	-	2.3E-01	3.1E+02	7.8E-01	1.0E+03	1.7E-01	6.1E+02	1.3E+02	4.6E+05
Glycols										
Diethylene Glycol	111466	-	NC	6.2E+01	NC	1.1E+00	NC	1.2E+02	NC	4.4E+07
Triethylene glycol	112276	-	NC	2.8E+01	NC	3.5E-01	NC	5.5E+01	NC	2.6E+07
PCDD/PCDFs										
2,3,7,8-TCDD TEQ	1746016-TEQ	-	1.4E-08	4.3E-07	5.5E-08	1.7E-06	1.1E-08	8.5E-07	2.0E-08	1.6E-06
Polychlorinated Biphenyls (PCBs)										
Aroclor 1016	12674112	-	2.7E-02	4.3E-02	1.0E-01	1.6E-01	2.0E-02	8.5E-02	5.3E-01	2.3E+00
Aroclor 1242	53469219	Aroclor-1242	9.3E-04	1.2E-02	3.6E-03	4.7E-02	7.0E-04	2.4E-02	4.2E-03	1.5E-01
Aroclor 1248	12672296	-	9.3E-04	1.2E-02	3.6E-03	4.7E-02	7.0E-04	2.4E-02	3.7E-03	1.3E-01
Aroclor 1254	11097691	-	9.3E-04	1.2E-02	3.6E-03	4.8E-02	7.0E-04	2.4E-02	1.3E-03	4.7E-02
Aroclor 1260	11096825	-	9.3E-04	1.2E-02	3.6E-03	4.8E-02	7.0E-04	2.4E-02	4.5E-05	1.6E-03
Aroclor 5460	11126424	-	9.3E-04	1.2E-02	3.6E-03	4.7E-02	7.0E-04	2.4E-02	3.7E-03	1.3E-01
PCB TEQ	1746016-PCB TEQ	-	1.4E-08	4.3E-07	5.5E-08	1.7E-06	1.1E-08	8.5E-07	2.9E-08	2.3E-06

Notes:
'-' - none established/not applicable.
HQ - hazard quotient
mg/kg - milligrams per kilogram
NC - not calculated
PCDD/PCDF - polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans
RBSL - Risk-Based Screening Level
TCDD - 2,3,7,8-Tetrachlorodibenzo-p-dioxin
TEQ - toxic equivalency

Attachment 1 - Table 14

Indirect Soil Contact Pathway-Specific 30-year Rural Residential Risk-Based Screening Levels

			Fruits/Vegetables				Beef			
			Target Chemical Concentration in Fruits and Vegetables (C_{fv})		Soil RBSL for Fruits and Vegetables Pathway ($RBSL_{fv}$)		Target Chemical Concentration in Beef (C_b)		Soil RBSL for Beef Pathway ($RBSL_b$)	
Analyte	**CAS #**	**Analyte Synonyms [a]**	**Farmer Cancer (10^{-6}) (mg/kg)**	**Child Noncancer (HQ=1) (mg/kg)**	**Farmer Cancer (10^{-6}) (mg/kg)**	**Child Noncancer (HQ=1) (mg/kg)**	**Farmer Cancer (10^{-6}) (mg/kg)**	**Child Noncancer (HQ=1) (mg/kg)**	**Farmer Cancer (10^{-6}) (mg/kg)**	**Child Noncancer (HQ=1) (mg/kg)**

a - Please note that different chemical names have been used for different programs at the SSFL, and there can be additional analyte synonyms than those presented. Therefore, any chemical synonym should be verified using the CAS number listed.

b - The cadmium RBSLs for non-carcinogenic effects were calculated using the exposure assumptions for an adult as described in Section 3.2.1.

Attachment 1 - Table 14

Indirect Soil Contact Pathway-Specific 30-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Milk: Target Chemical Concentration in Milk (C_m) Farmer Cancer (10^{-6}) (mg/kg)	Milk: Target Chemical Concentration in Milk (C_m) Child Noncancer (HQ=1) (mg/kg)	Milk: Soil RBSL for Milk Pathway ($RBSL_m$) Farmer Cancer (10^{-6}) (mg/kg)	Milk: Soil RBSL for Milk Pathway ($RBSL_m$) Child Noncancer (HQ=1) (mg/kg)	Poultry: Target Chemical Concentration in Poultry (C_p) Farmer Cancer (10^{-6}) (mg/kg)	Poultry: Target Chemical Concentration in Poultry (C_p) Child Noncancer (HQ=1) (mg/kg)	Poultry: Soil RBSL for Poultry Pathway ($RBSL_p$) Farmer Cancer (10^{-6}) (mg/kg)	Poultry: Soil RBSL for Poultry Pathway ($RBSL_p$) Child Noncancer (HQ=1) (mg/kg)
Inorganic Compounds										
Aluminum	7429905	Aluminum, Total	NC	5.9E+01	NC	NC	NC	1.1E+03	NC	NC
Antimony	7440360	Antimony, Total	NC	2.4E-02	NC	1.7E+02	NC	4.6E-01	NC	6.0E+01
Arsenic	7440382	Arsenic, Total	2.4E-05	1.8E-02	7.6E-02	5.6E+01	2.0E-04	3.4E-01	7.0E-03	1.2E+01
Barium	7440393	Barium, Total	NC	1.2E+01	NC	3.9E+03	NC	2.3E+02	NC	2.8E+05
Beryllium	7440417	Beryllium, Total	NC	1.2E-01	NC	2.7E+04	NC	2.3E+00	NC	9.1E+02
Boron	7440428	Boron, Total	NC	1.2E+01	NC	1.1E+02	NC	2.3E+02	NC	1.1E+03
Cadmium	7440439	Cadmium, Total	NC	7.5E-04 [b]	NC	5.4E-02	NC	4.7E-03 [b]	NC	2.4E-01
Chromium	7440473	Chromium, Total	NC	8.9E+01	NC	1.7E+06	NC	1.7E+03	NC	4.5E+05
Cobalt	7440484	Cobalt, Total	NC	1.8E-02	NC	4.6E+01	NC	3.4E-01	NC	2.1E+00
Copper	7440508	Copper, Total	NC	2.4E+00	NC	8.7E+01	NC	4.6E+01	NC	3.9E+02
Cyanides	57125	Cyanide, Total; Cyanide	NC	3.5E-02	NC	2.3E+03	NC	6.9E-01	NC	5.6E+04
Fluoride	16984488	-	NC	2.4E+00	NC	NC	NC	4.6E+01	NC	NC
Hexavalent chromium	18540299	Chromium, Hexavalent; Chromium VI	4.6E-04	1.8E-01	6.5E-02	2.5E+01	3.7E-03	3.4E+00	1.1E+00	9.7E+02
Lead	7439921	Lead, Total	NC	NC	NC	NC	NC	NC	NC	NC
Lithium	7439932	Lithium, Total	NC	1.2E-01	NC	1.2E+00	NC	2.3E+00	NC	2.0E+02
Manganese	7439965	Manganese, Total	NC	8.3E+00	NC	1.7E+04	NC	1.6E+02	NC	1.5E+04
Mercury	7439976	Mercury, Total	NC	1.8E-02	NC	1.7E+00	NC	3.4E-01	NC	5.3E+01
Methyl Mercury	22967926	-	NC	5.9E-03	NC	3.0E-02	NC	1.1E-01	NC	4.6E+00
Molybdenum	7439987	Molybdenum, Total	NC	3.0E-01	NC	1.5E+01	NC	5.7E+00	NC	3.8E+01
Nickel	7440020	Nickel, Total	NC	1.2E+00	NC	9.6E+00	NC	2.3E+01	NC	5.0E+02
Selenium	7782492	Selenium, Total	NC	3.0E-01	NC	2.3E+00	NC	5.7E+00	NC	2.9E+01
Silver	7440224	Silver, Total	NC	3.0E-01	NC	2.7E+02	NC	5.7E+00	NC	1.0E+01
Strontium	7440246	Strontium, Total	NC	3.5E+01	NC	5.4E+02	NC	6.9E+02	NC	2.9E+04
Thallium	7440280	Thallium, Total	NC	5.9E-04	NC	6.3E-02	NC	1.1E-02	NC	9.2E-02
Tin	7440315	Tin, Total	NC	3.5E+01	NC	1.6E+03	NC	6.9E+02	NC	1.3E+03
Vanadium	7440622	Vanadium, Total	NC	3.0E-01	NC	3.1E+03	NC	5.7E+00	NC	2.8E+03
Zinc	7440666	Zinc, Total	NC	1.8E+01	NC	8.3E+01	NC	3.4E+02	NC	1.5E+05
Zirconium	7440677	Zirconium, Total	NC	4.7E-03	NC	1.8E+03	NC	9.1E-02	NC	1.7E+01
Energetic Constituents										
1,2-Dinitrobenzene	528290	o-Dinitrobenzene	NC	5.9E-03	NC	2.1E+02	NC	1.1E-01	NC	1.0E+02
1,3-Dinitrobenzene	99650	m-Dinitrobenzene	NC	5.9E-03	NC	2.6E+02	NC	1.1E-01	NC	1.1E+02
2,4,6-Trinitrotoluene	118967	-	7.7E-03	3.0E-02	3.0E+02	1.2E+03	6.2E-02	5.7E-01	5.7E+01	5.3E+02
2-Amino-4,6-dinitrotoluene	35572782	-	NC	1.2E-01	NC	3.6E+03	NC	2.3E+00	NC	1.9E+03
HMX	2691410	-	NC	3.0E+00	NC	4.9E+05	NC	5.7E+01	NC	1.6E+05
Hydrazine	302012	-	7.7E-05	NC	1.1E+02	NC	6.2E-04	NC	7.4E-01	NC

Attachment 1 - Table 14

Indirect Soil Contact Pathway-Specific 30-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Milk: Target Chemical Concentration in Milk (C_m) Farmer Cancer (10^{-6}) (mg/kg)	Milk: Target Chemical Concentration in Milk (C_m) Child Noncancer (HQ=1) (mg/kg)	Milk: Soil RBSL for Milk Pathway ($RBSL_m$) Farmer Cancer (10^{-6}) (mg/kg)	Milk: Soil RBSL for Milk Pathway ($RBSL_m$) Child Noncancer (HQ=1) (mg/kg)	Poultry: Target Chemical Concentration in Poultry (C_p) Farmer Cancer (10^{-6}) (mg/kg)	Poultry: Target Chemical Concentration in Poultry (C_p) Child Noncancer (HQ=1) (mg/kg)	Poultry: Soil RBSL for Poultry Pathway ($RBSL_p$) Farmer Cancer (10^{-6}) (mg/kg)	Poultry: Soil RBSL for Poultry Pathway ($RBSL_p$) Child Noncancer (HQ=1) (mg/kg)
RDX	121824	Hexahydro-1,3,5-trinitro-1,3,5-triazine	2.1E-03	1.8E-01	1.7E+02	1.5E+04	1.7E-02	3.4E+00	2.5E+01	5.0E+03
Perchlorate	14797730	-	NC	4.1E-02	NC	1.2E-04	NC	8.0E-01	NC	2.0E-01
Volatile Organic Compounds										
1,1,1,2-Tetrachloroethane	630206	-	8.9E-03	1.8E+00	7.5E+01	1.5E+04	7.2E-02	3.4E+01	4.3E+01	2.0E+04
1,1,1-Trichloroethane	71556	-	NC	1.2E+02	NC	1.7E+06	NC	2.3E+03	NC	1.5E+06
1,1,2,2-Tetrachloroethane	79345	-	8.5E-04	1.2E+00	1.4E+01	1.9E+04	6.9E-03	2.3E+01	4.7E+00	1.6E+04
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	Freon 113	NC	1.8E+03	NC	1.1E+07	NC	3.4E+04	NC	1.9E+07
1,1,2-Trichloroethane	79005	-	3.2E-03	2.4E-01	9.2E+01	6.8E+03	2.6E-02	4.6E+00	2.1E+01	3.7E+03
1,1-Dichloroethane	75343	-	4.0E-02	1.2E+01	1.3E+03	3.8E+05	3.3E-01	2.3E+02	2.8E+02	1.9E+05
1,1-Dichloroethene	75354	-	NC	3.0E+00	NC	6.5E+04	NC	5.7E+01	NC	4.2E+04
1,1-Dimethylhydrazine	57147	Unsymetrical Dimethyl Hydrazine	NC	5.9E-03	NC	3.6E+03	NC	1.1E-01	NC	4.5E+02
1,2,3-Trichlorobenzene	87616	-	6.4E-02	4.7E-02	9.6E+01	7.1E+01	5.2E-01	9.1E-01	2.5E+02	4.3E+02
1,2,4-Trichlorobenzene	120821	-	6.4E-02	5.9E-01	1.0E+02	9.3E+02	5.2E-01	1.1E+01	2.5E+02	5.5E+03
1,2,4-Trimethylbenzene	95636	-	NC	5.9E-01	NC	1.8E+03	NC	1.1E+01	NC	5.9E+03
1,2-Dibromo-3-chloropropane	96128	1,2-Dibromo-3-CPA	3.3E-05	1.2E-02	2.7E-01	9.6E+01	2.7E-04	2.3E-01	1.6E-01	1.4E+02
1,2-Dibromoethane	106934	1,2-Dibromoethane (EDB)	6.4E-05	5.3E-01	1.7E+00	1.4E+04	5.2E-04	1.0E+01	4.1E-01	8.1E+03
1,2-Dichlorobenzene	95501	o-Dichlorobenzene	NC	5.3E+00	NC	2.2E+04	NC	1.0E+02	NC	5.5E+04
1,2-Dichloroethane	107062	-	4.9E-03	3.5E-01	2.2E+02	1.6E+04	4.0E-02	6.9E+00	3.9E+01	6.7E+03
1,2-Dichloroethene	540590	1,2-Dichloroethenes	NC	5.3E-01	NC	1.2E+04	NC	1.0E+01	NC	7.7E+03
1,2-Dichloropropane	78875	-	6.4E-03	5.3E+00	1.7E+02	1.4E+05	5.2E-02	1.0E+02	4.0E+01	8.0E+04
1,3,5-Trimethylbenzene	108678	-	NC	5.9E-01	NC	2.5E+03	NC	1.1E+01	NC	6.1E+03
1,3-Dichlorobenzene	541731	m-Dichlorobenzene	NC	1.8E+00	NC	6.3E+03	NC	3.4E+01	NC	1.8E+04
1,4-Dichlorobenzene	106467	p-Dichlorobenzene	4.3E-02	4.1E+00	1.7E+02	1.7E+04	3.5E-01	8.0E+01	1.9E+02	4.3E+04
2-Chloroethylvinyl ether	110758	2-Chloroethyl vinyl ether	9.2E-05	NC	5.6E+00	NC	7.5E-04	NC	8.8E-01	NC
2-Hexanone	591786	Methyl butyl ketone	NC	3.0E-01	NC	1.4E+04	NC	5.7E+00	NC	5.9E+03
Acetone	67641	-	NC	5.3E+01	NC	1.3E+07	NC	1.0E+03	NC	4.6E+06
Benzene	71432	-	2.3E-03	2.4E-01	5.1E+01	5.2E+03	1.9E-02	4.6E+00	1.4E+01	3.4E+03
Bromobenzene	108861	-	NC	4.7E-01	NC	3.7E+03	NC	9.1E+00	NC	5.4E+03
Bromodichloromethane	75274	-	1.8E-03	1.2E+00	4.5E+01	3.0E+04	1.4E-02	2.3E+01	1.1E+01	1.8E+04
Bromoform	75252	-	2.1E-02	1.2E+00	3.4E+02	1.9E+04	1.7E-01	2.3E+01	1.2E+02	1.6E+04
Bromomethane	74839	-	NC	8.3E-02	NC	4.9E+03	NC	1.6E+00	NC	1.9E+03
Carbon disulfide	75150	-	NC	5.9E+00	NC	1.6E+05	NC	1.1E+02	NC	9.0E+04
Carbon tetrachloride	56235	-	1.5E-03	2.4E-01	1.5E+01	2.3E+03	1.2E-02	4.6E+00	7.6E+00	2.8E+03
Chlorobenzene	108907	Monochlorobenzene	NC	1.2E+00	NC	1.1E+04	NC	2.3E+01	NC	1.4E+04
Chloroform	67663	Trichloromethane	7.4E-03	5.9E-01	2.0E+02	1.6E+04	6.0E-02	1.1E+01	4.7E+01	8.9E+03

Attachment 1 - Table 14

Indirect Soil Contact Pathway-Specific 30-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Milk: Target Chemical Concentration in Milk (C_m) Farmer Cancer (10^{-6}) (mg/kg)	Milk: Target Chemical Concentration in Milk (C_m) Child Noncancer (HQ=1) (mg/kg)	Milk: Soil RBSL for Milk Pathway ($RBSL_m$) Farmer Cancer (10^{-6}) (mg/kg)	Milk: Soil RBSL for Milk Pathway ($RBSL_m$) Child Noncancer (HQ=1) (mg/kg)	Poultry: Target Chemical Concentration in Poultry (C_p) Farmer Cancer (10^{-6}) (mg/kg)	Poultry: Target Chemical Concentration in Poultry (C_p) Child Noncancer (HQ=1) (mg/kg)	Poultry: Soil RBSL for Poultry Pathway ($RBSL_p$) Farmer Cancer (10^{-6}) (mg/kg)	Poultry: Soil RBSL for Poultry Pathway ($RBSL_p$) Child Noncancer (HQ=1) (mg/kg)
Chloromethane	74873	Methyl chloride	NC	8.3E-02	NC	6.5E+03	NC	1.6E+00	NC	2.3E+03
cis-1,2-Dichloroethene	156592	cis-1,2-Dichloroethylene	NC	1.2E-01	NC	3.5E+03	NC	2.3E+00	NC	1.9E+03
Cumene	98828	Isopropylbenzene	NC	5.9E+00	NC	1.7E+04	NC	1.1E+02	NC	5.9E+04
Dibromochloromethane	124481	-	2.5E-03	1.2E+00	5.2E+01	2.5E+04	2.0E-02	2.3E+01	1.5E+01	1.7E+04
Dibromomethane	74953	-	NC	5.9E-01	NC	2.1E+04	NC	1.1E+01	NC	1.0E+04
Dichlorodifluoromethane	75718	Freon 12	NC	1.2E+01	NC	2.5E+05	NC	2.3E+02	NC	1.7E+05
Ethylbenzene	100414	-	2.1E-02	5.9E+00	1.3E+02	3.7E+04	1.7E-01	1.1E+02	9.6E+01	6.5E+04
Methyl ethyl ketone	78933	2-Butanone; 2-Butanone (MEK)	NC	3.5E+01	NC	5.2E+06	NC	6.9E+02	NC	1.7E+06
Methyl isobutyl ketone (MIBK)	108101	MIBK; 4-Methyl-2-pentanone	NC	4.7E+00	NC	2.5E+05	NC	9.1E+01	NC	9.9E+04
Methylene chloride	75092	Dichloromethane	1.6E-02	3.5E-01	9.2E+02	2.0E+04	1.3E-01	6.9E+00	1.5E+02	7.7E+03
Monomethylhydrazine	60344	Monomethyl Hydrazine	4.2E-07	5.9E-02	2.3E-01	3.2E+04	3.4E-06	1.1E+00	1.6E-02	5.5E+03
m-Xylene & p-Xylene	136777612	meta- and para-Xylenes; m, p-Xylene	NC	1.2E+01	NC	7.7E+04	NC	2.3E+02	NC	1.3E+05
n-Butylbenzene	104518	-	NC	3.0E+00	NC	2.4E+03	NC	5.7E+01	NC	2.6E+04
n-Propylbenzene	103651	-	NC	5.9E+00	NC	1.6E+04	NC	1.1E+02	NC	5.8E+04
o-Chlorotoluene	95498	2-Chlorotoluene	NC	1.2E+00	NC	5.0E+03	NC	2.3E+01	NC	1.2E+04
o-Xylene	95476	-	NC	1.2E+01	NC	7.7E+04	NC	2.3E+02	NC	1.3E+05
p-Chlorotoluene	106434	4-Chlorotoluene	NC	1.2E+00	NC	5.7E+03	NC	2.3E+01	NC	1.3E+04
p-Cymene	99876	p-Isopropyltoluene	NC	5.9E+00	NC	8.1E+03	NC	1.1E+02	NC	5.4E+04
p-Nitroaniline	100016	4-Nitroaniline	1.2E-02	2.4E-01	5.6E+02	1.1E+04	9.3E-02	4.6E+00	9.6E+01	4.7E+03
sec-Butylbenzene	135988	-	NC	5.9E+00	NC	3.3E+03	NC	1.1E+02	NC	5.0E+04
Styrene	100425	Vinylbenzene	NC	1.2E+01	NC	9.7E+04	NC	2.3E+02	NC	1.4E+05
tert-Butylbenzene	98066	Dibenzo[b,e][1,4]dioxin, octachloro-	NC	5.9E+00	NC	7.9E+03	NC	1.1E+02	NC	5.4E+04
Tetrachloroethene	127184	-	4.3E-04	3.5E-01	1.9E+00	1.5E+03	3.5E-03	6.9E+00	1.9E+00	3.7E+03
Tetralin	119642	-	NC	1.2E+00	NC	5.9E+03	NC	2.3E+01	NC	1.3E+04
Toluene	108883	Toluol	NC	4.7E+00	NC	5.2E+04	NC	9.1E+01	NC	5.7E+04
trans-1,2-Dichloroethene	156605	-	NC	1.2E+00	NC	2.7E+04	NC	2.3E+01	NC	1.7E+04
Trichloroethene	79016	Trichloroethylene (TCE)	5.0E-03	3.0E-02	7.9E+01	4.7E+02	4.1E-02	5.7E-01	2.7E+01	3.9E+02
Trichlorofluoromethane	75694	-	NC	1.8E+01	NC	2.5E+05	NC	3.4E+02	NC	2.2E+05
Vinyl chloride	75014	-	8.5E-04	1.8E-01	3.3E+01	6.8E+03	6.9E-03	3.4E+00	6.3E+00	3.1E+03
Xylenes, Total	1330207	Xylene (Total) Isomers	NC	1.2E+01	NC	7.7E+04	NC	2.3E+02	NC	1.3E+05
Semi-Volatile Organic Compounds										
1,4-Dioxane	123911	-	8.5E-03	1.8E+00	2.1E+03	4.5E+05	6.9E-02	3.4E+01	3.2E+02	1.6E+05
2,4,5-Trichlorophenol	95954	-	NC	5.9E+00	NC	1.6E+04	NC	1.1E+02	NC	5.8E+04

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Analyte	CAS #	Analyte Synonyms [a]	Milk: Target Chemical Concentration in Milk (C_m) Farmer Cancer (10^{-6}) (mg/kg)	Milk: Target Chemical Concentration in Milk (C_m) Child Noncancer (HQ=1) (mg/kg)	Milk: Soil RBSL for Milk Pathway ($RBSL_m$) Farmer Cancer (10^{-6}) (mg/kg)	Milk: Soil RBSL for Milk Pathway ($RBSL_m$) Child Noncancer (HQ=1) (mg/kg)	Poultry: Target Chemical Concentration in Poultry (C_p) Farmer Cancer (10^{-6}) (mg/kg)	Poultry: Target Chemical Concentration in Poultry (C_p) Child Noncancer (HQ=1) (mg/kg)	Poultry: Soil RBSL for Poultry Pathway ($RBSL_p$) Farmer Cancer (10^{-6}) (mg/kg)	Poultry: Soil RBSL for Poultry Pathway ($RBSL_p$) Child Noncancer (HQ=1) (mg/kg)
2,4,6-Trichlorophenol	88062	-	3.3E-03	5.9E-02	9.1E+00	1.6E+02	2.7E-02	1.1E+00	1.4E+01	5.8E+02
2,4-Dimethylphenol	105679	-	NC	1.2E+00	NC	2.2E+04	NC	2.3E+01	NC	1.6E+04
3,5-Dimethylphenol	108689	-	NC	4.3E-01	NC	5.4E+03	NC	8.2E+00	NC	5.3E+03
Benzoic acid	65850	-	NC	2.4E+02	NC	6.9E+06	NC	4.6E+03	NC	3.7E+06
Benzyl alcohol	100516	-	NC	5.9E+00	NC	3.8E+05	NC	1.1E+02	NC	1.4E+05
bis(2-Ethylhexyl) phthalate	117817	bis(2-ethylhexyl)phthalate	7.7E-02	1.2E+00	5.2E-02	8.0E-01	6.2E-01	2.3E+01	8.6E+02	3.2E+04
Butyl benzyl phthalate	85687	-	1.2E-01	1.2E+01	4.9E+01	4.8E+03	9.8E-01	2.3E+02	4.2E+02	9.8E+04
Carbazole	86748	-	1.2E-02	NC	3.0E+01	NC	9.3E-02	NC	4.7E+01	NC
Dibenzofuran	132649	-	NC	5.9E-02	NC	7.8E+01	NC	1.1E+00	NC	5.4E+02
Diethyl phthalate	84662	-	NC	4.7E+01	NC	7.5E+05	NC	9.1E+02	NC	6.2E+05
Dimethyl phthalate	131113	-	NC	4.7E+01	NC	1.8E+06	NC	9.1E+02	NC	8.4E+05
Di-n-butyl phthalate	84742	Di-n-butylphthalate	NC	5.9E+00	NC	3.8E+03	NC	1.1E+02	NC	5.0E+04
Di-n-octyl phthalate	117840	Di-n-octyl-phthalate	NC	5.9E-01	NC	1.3E-01	NC	1.1E+01	NC	2.8E+04
Formaldehyde	50000	-	NC	1.2E+01	NC	1.6E+06	NC	2.3E+02	NC	5.3E+05
Hexachlorobutadiene	87683	-	3.0E-03	5.9E-02	1.1E+00	2.2E+01	2.4E-02	1.1E+00	1.0E+01	4.9E+02
m-Cresol	108394	3-Methylphenol	NC	3.0E+00	NC	7.9E+04	NC	5.7E+01	NC	4.5E+04
N-Nitrosodimethylamine	62759	Nitrosodimethylamine	1.4E-05	4.7E-04	4.8E+00	1.6E+02	1.2E-04	9.1E-03	8.0E-01	6.3E+01
N-Nitrosodiphenylamine	86306	-	2.6E-02	NC	1.6E+02	NC	2.1E-01	NC	1.2E+02	NC
o-Cresol	95487	2-Methylphenol	NC	3.0E+00	NC	7.9E+04	NC	5.7E+01	NC	4.5E+04
p-Chloro-m-cresol	59507	4-Chloro-3-Methylphenol	NC	5.9E+00	NC	4.0E+04	NC	1.1E+02	NC	6.6E+04
p-Cresol	106445	4-Methylphenol	NC	5.9E+00	NC	1.6E+05	NC	1.1E+02	NC	9.0E+04
Pentachlorophenol	87865	PCP	1.3E-02	3.0E-01	2.3E+00	5.3E+01	1.0E-01	5.7E+00	4.4E+01	2.4E+03
Phenol	108952	Total Phenols	NC	1.8E+01	NC	8.0E+05	NC	3.4E+02	NC	3.4E+05
Polynuclear Aromatic Hydrocarbons										
1-Methyl naphthalene	90120	1-Methylnaphthalene	7.9E-03	4.1E+00	1.6E+01	8.5E+03	6.4E-02	8.0E+01	3.2E+01	3.9E+04
2-Methylnaphthalene	91576	Naphthalene, 2-methyl-	NC	2.4E-01	NC	4.9E+02	NC	4.6E+00	NC	2.3E+03
Acenaphthene	83329	-	NC	3.5E+00	NC	6.7E+03	NC	6.9E+01	NC	3.3E+04
Acenaphthylene	208968	-	NC	3.5E+00	NC	6.4E+03	NC	6.9E+01	NC	3.3E+04
Anthracene	120127	-	NC	1.8E+01	NC	1.3E+04	NC	3.4E+02	NC	1.5E+05
Benzo(a)anthracene	56553	Benz[a]anthracene	1.9E-04	NC	8.6E-03	NC	1.6E-03	NC	7.1E-01	NC
Benzo(a)pyrene	50328	Benzo (a) pyrene	1.9E-05	NC	3.7E-04	NC	1.6E-04	NC	7.9E-02	NC
Benzo(b)fluoranthene	205992	Benz[e]acephenanthrylene 1	1.9E-04	NC	8.2E-03	NC	1.6E-03	NC	7.1E-01	NC
Benzo(e)pyrene	192972	-	NC	1.8E+00	NC	3.6E+01	NC	3.4E+01	NC	1.7E+04
Benzo(ghi)perylene	191242	Benzo (g,h,i) perylene	NC	1.8E+00	NC	1.1E+01	NC	3.4E+01	NC	2.2E+04
Benzo(k)fluoranthene	207089	Benzo[k]fluoranthene	1.9E-04	NC	3.9E-03	NC	1.6E-03	NC	7.8E-01	NC
Chrysene	218019	-	1.9E-03	NC	7.7E-02	NC	1.6E-02	NC	7.1E+00	NC
Dibenzo(a,h)anthracene	53703	Dibenz (a,h) anthracene	5.6E-05	NC	2.7E-04	NC	4.6E-04	NC	3.1E-01	NC

Attachment 1 - Table 14

Indirect Soil Contact Pathway-Specific 30-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Milk: Target Chemical Concentration in Milk (C_m) Farmer Cancer (10^{-6}) (mg/kg)	Milk: Target Chemical Concentration in Milk (C_m) Child Noncancer (HQ=1) (mg/kg)	Milk: Soil RBSL for Milk Pathway ($RBSL_m$) Farmer Cancer (10^{-6}) (mg/kg)	Milk: Soil RBSL for Milk Pathway ($RBSL_m$) Child Noncancer (HQ=1) (mg/kg)	Poultry: Target Chemical Concentration in Poultry (C_p) Farmer Cancer (10^{-6}) (mg/kg)	Poultry: Target Chemical Concentration in Poultry (C_p) Child Noncancer (HQ=1) (mg/kg)	Poultry: Soil RBSL for Poultry Pathway ($RBSL_p$) Farmer Cancer (10^{-6}) (mg/kg)	Poultry: Soil RBSL for Poultry Pathway ($RBSL_p$) Child Noncancer (HQ=1) (mg/kg)
Fluoranthene	206440	-	NC	2.4E+00	NC	3.9E+02	NC	4.6E+01	NC	1.9E+04
Fluorene	86737	-	NC	2.4E+00	NC	2.8E+03	NC	4.6E+01	NC	2.1E+04
Indeno(1,2,3-cd)pyrene	193395	Indeno (1,2,3-cd) pyrene	1.9E-04	NC	1.0E-03	NC	1.6E-03	NC	1.0E+00	NC
Naphthalene	91203	-	NC	1.2E+00	NC	5.9E+03	NC	2.3E+01	NC	1.3E+04
Perylene	198550	-	NC	1.8E+00	NC	2.6E+01	NC	3.4E+01	NC	1.8E+04
Phenanthrene	85018	-	NC	1.8E+01	NC	1.2E+04	NC	3.4E+02	NC	1.5E+05
Pyrene	129000	-	NC	1.8E+00	NC	5.3E+02	NC	3.4E+01	NC	1.5E+04
Pesticides										
4,4'-DDD	72548	p,p'-DDD	9.6E-04	NC	2.4E-02	NC	7.8E-03	NC	3.8E+00	NC
4,4'-DDE	72559	p,p'-DDE	6.8E-04	NC	5.6E-03	NC	5.5E-03	NC	3.3E+00	NC
4,4'-DDT	50293	p,p'-DDT	6.8E-04	3.0E-02	2.2E-03	9.8E-02	5.5E-03	5.7E-01	4.2E+00	4.4E+02
Aldrin	309002	-	1.4E-05	1.8E-03	1.1E-04	1.5E-02	1.1E-04	3.4E-02	6.6E-02	2.0E+01
alpha-BHC	319846	a-Benzene Hexachloride	8.5E-05	4.7E-01	2.0E-01	1.1E+03	6.9E-04	9.1E+00	3.4E-01	4.6E+03
beta-BHC	319857	b-Benzene Hexachloride	1.5E-04	NC	3.7E-01	NC	1.2E-03	NC	6.2E-01	NC
delta-BHC	319868	d-Benzene Hexachloride	1.3E-04	1.8E-02	1.6E-01	2.3E+01	1.0E-03	3.4E-01	4.8E-01	1.6E+02
Chlordane (Technical)	12789036	-	6.6E-04	3.0E-02	1.0E-02	4.7E-01	5.3E-03	5.7E-01	2.8E+00	3.0E+02
Dieldrin	60571	-	1.4E-05	3.0E-03	1.4E-03	2.9E-01	1.2E-04	5.7E-02	5.0E-02	2.4E+01
Endosulfan I	959988	-	NC	3.5E-01	NC	7.8E+02	NC	6.9E+00	NC	3.4E+03
Endosulfan II	33213659	-	NC	3.5E-01	NC	7.8E+02	NC	6.9E+00	NC	3.4E+03
Endosulfan sulfate	1031078	-	NC	3.5E-01	NC	1.0E+03	NC	6.9E+00	NC	3.5E+03
Endrin	72208	-	NC	1.8E-02	NC	2.7E+00	NC	3.4E-01	NC	1.5E+02
Endrin aldehyde	7421934	-	NC	1.8E-02	NC	6.2E+00	NC	3.4E-01	NC	1.5E+02
Endrin ketone	53494705	-	NC	1.8E-02	NC	4.2E+00	NC	3.4E-01	NC	1.5E+02
gamma-BHC	58899	Lindane	2.1E-04	1.8E-02	5.5E-01	4.7E+01	1.7E-03	3.4E-01	8.6E-01	1.7E+02
Heptachlor	76448	-	5.6E-05	3.0E-02	1.2E-03	6.1E-01	4.6E-04	5.7E-01	2.3E-01	2.9E+02
Heptachlor epoxide	1024573	-	4.2E-05	7.7E-04	1.0E-02	1.9E-01	3.4E-04	1.5E-02	1.4E-01	6.3E+00
MCPA	94746	-	NC	3.0E-02	NC	1.6E+02	NC	5.7E-01	NC	3.2E+02
Mirex	2385855	Mirex (DeChlorane)	1.3E-05	1.2E-02	4.4E-05	4.1E-02	1.0E-04	2.3E-01	7.9E-02	1.7E+02
p,p'-Methoxychlor	72435	Methoxychlor	NC	3.0E-01	NC	5.8E+01	NC	5.7E+00	NC	2.4E+03
Toxaphene	8001352	-	1.9E-04	NC	8.2E-03	NC	1.6E-03	NC	7.1E-01	NC
Herbicides										
2,4,5-T	93765	2,4,5-Trichlorophenoxyacetic acid	NC	5.9E-01	NC	2.9E+03	NC	1.1E+01	NC	6.3E+03
2,4,5-TP (Silvex)	93721	-	NC	4.7E-01	NC	1.1E+03	NC	9.1E+00	NC	4.6E+03
2,4-Dichlorophenoxyacetic Acid (2,4-D)	94757	-	NC	5.9E-01	NC	5.8E+03	NC	1.1E+01	NC	7.0E+03
2,4-Dichlorophenoxybutyric acid	94826	2,4-DB	NC	4.7E-01	NC	1.7E+03	NC	9.1E+00	NC	4.8E+03

Attachment 1 - Table 14

Indirect Soil Contact Pathway-Specific 30-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Milk: Target Chemical Concentration in Milk (C_m) Farmer Cancer (10^{-6}) (mg/kg)	Milk: Target Chemical Concentration in Milk (C_m) Child Noncancer (HQ=1) (mg/kg)	Milk: Soil RBSL for Milk Pathway ($RBSL_m$) Farmer Cancer (10^{-6}) (mg/kg)	Milk: Soil RBSL for Milk Pathway ($RBSL_m$) Child Noncancer (HQ=1) (mg/kg)	Poultry: Target Chemical Concentration in Poultry (C_p) Farmer Cancer (10^{-6}) (mg/kg)	Poultry: Target Chemical Concentration in Poultry (C_p) Child Noncancer (HQ=1) (mg/kg)	Poultry: Soil RBSL for Poultry Pathway ($RBSL_p$) Farmer Cancer (10^{-6}) (mg/kg)	Poultry: Soil RBSL for Poultry Pathway ($RBSL_p$) Child Noncancer (HQ=1) (mg/kg)
Dalapon	75990	-	NC	1.8E+00	NC	6.4E+04	NC	3.4E+01	NC	3.0E+04
Dicamba	1918009	-	NC	1.8E+00	NC	3.6E+04	NC	3.4E+01	NC	2.5E+04
2,4-DP (Dichlorprop)	120365	-	NC	5.9E-01	NC	2.5E+03	NC	1.1E+01	NC	6.1E+03
Dinoseb	88857	-	NC	5.9E-02	NC	2.0E+02	NC	1.1E+00	NC	6.0E+02
MCPP	93652	-	NC	5.9E-02	NC	3.8E+02	NC	1.1E+00	NC	6.5E+02
Terphenyls										
m-Terphenyl	92068	-	2.9E-02	3.0E+01	4.9E+01	5.0E+04	2.3E-01	5.7E+02	1.1E+02	2.8E+05
o-Terphenyl	84151	-	2.9E-02	3.0E+01	4.9E+01	5.0E+04	2.3E-01	5.7E+02	1.1E+02	2.8E+05
p-Terphenyl	92944	-	2.9E-02	3.0E+01	4.9E+01	5.0E+04	2.3E-01	5.7E+02	1.1E+02	2.8E+05
Glycols										
Diethylene Glycol	111466	-	NC	5.9E+00	NC	4.8E+06	NC	1.1E+02	NC	3.1E+05
Triethylene glycol	112276	-	NC	2.7E+00	NC	2.8E+06	NC	5.1E+01	NC	9.6E+04
PCDD/PCDFs										
2,3,7,8-TCDD TEQ	1746016-TEQ	-	1.8E-09	4.1E-08	7.6E-09	1.8E-07	1.4E-08	8.0E-07	1.0E-05	5.7E-04
Polychlorinated Biphenyls (PCBs)										
Aroclor 1016	12674112	-	3.3E-03	4.1E-03	2.0E-01	2.5E-01	2.7E-02	8.0E-02	1.2E+01	3.5E+01
Aroclor 1242	53469219	Aroclor-1242	1.2E-04	1.2E-03	1.6E-03	1.6E-02	9.3E-04	2.3E-02	5.0E-01	1.2E+01
Aroclor 1248	12672296	-	1.2E-04	1.2E-03	1.4E-03	1.4E-02	9.3E-04	2.3E-02	5.2E-01	1.3E+01
Aroclor 1254	11097691	-	1.2E-04	1.2E-03	5.0E-04	5.1E-03	9.3E-04	2.3E-02	6.6E-01	1.6E+01
Aroclor 1260	11096825	-	1.2E-04	1.2E-03	1.7E-05	1.7E-04	9.3E-04	2.3E-02	2.6E+00	6.3E+01
Aroclor 5460	11126424	-	1.2E-04	1.2E-03	1.4E-03	1.4E-02	9.3E-04	2.3E-02	5.2E-01	1.3E+01
PCB TEQ	1746016-PCB TEQ	-	1.8E-09	4.1E-08	1.1E-08	2.6E-07	1.4E-08	8.0E-07	8.0E-06	4.4E-04

Notes:
'-' - none established/not applicable.
HQ - hazard quotient
mg/kg - milligrams per kilogram
NC - not calculated
PCDD/PCDF - polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans
RBSL - Risk-Based Screening Level
TCDD - 2,3,7,8-Tetrachlorodibenzo-p-dioxin
TEQ - toxic equivalency

Attachment 1 - Table 14

Indirect Soil Contact Pathway-Specific 30-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Milk				Poultry			
			Target Chemical Concentration in Milk (C_m)		Soil RBSL for Milk Pathway ($RBSL_m$)		Target Chemical Concentration in Poultry (C_p)		Soil RBSL for Poultry Pathway ($RBSL_p$)	
			Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)

a - Please note that different chemical names have been used for different programs at the SSFL, and there can be additional analyte synonyms than those presented. Therefore, any chemical synonym should be verified using the CAS number listed.

b - The cadmium RBSLs for non-carcinogenic effects were calculated using the exposure assumptions for an adult as described in Section 3.2.1.

Attachment 1 - Table 14

Indirect Soil Contact Pathway-Specific 30-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Eggs: Target Chemical Concentration in Eggs (C_e) Farmer Cancer (10^{-6}) (mg/kg)	Eggs: Target Chemical Concentration in Eggs (C_e) Child Noncancer (HQ=1) (mg/kg)	Eggs: Soil RBSL for Eggs Pathway ($RBSL_e$) Farmer Cancer (10^{-6}) (mg/kg)	Eggs: Soil RBSL for Eggs Pathway ($RBSL_e$) Child Noncancer (HQ=1) (mg/kg)	Swine: Target Chemical Concentration in Swine (C_s) Farmer Cancer (10^{-6}) (mg/kg)	Swine: Target Chemical Concentration in Swine (C_s) Child Noncancer (HQ=1) (mg/kg)	Swine: Soil RBSL for Swine Pathway ($RBSL_s$) Farmer Cancer (10^{-6}) (mg/kg)	Swine: Soil RBSL for Swine Pathway ($RBSL_s$) Child Noncancer (HQ=1) (mg/kg)
Inorganic Compounds										
Aluminum	7429905	Aluminum, Total	NC	2.5E+03	NC	NC	NC	1.3E+03	NC	NC
Antimony	7440360	Antimony, Total	NC	9.9E-01	NC	1.5E+02	NC	5.1E-01	NC	4.4E+01
Arsenic	7440382	Arsenic, Total	4.7E-04	7.4E-01	1.5E-02	2.4E+01	2.5E-04	3.8E-01	5.7E-03	8.8E+00
Barium	7440393	Barium, Total	NC	5.0E+02	NC	6.0E+03	NC	2.5E+02	NC	2.6E+05
Beryllium	7440417	Beryllium, Total	NC	5.0E+00	NC	8.6E+03	NC	2.5E+00	NC	4.0E+02
Boron	7440428	Boron, Total	NC	5.0E+02	NC	2.6E+03	NC	2.5E+02	NC	1.2E+03
Cadmium	7440439	Cadmium, Total	NC	1.1E-02 [b]	NC	2.5E+01	NC	6.1E-03 [b]	NC	7.7E+00
Chromium	7440473	Chromium, Total	NC	3.7E+03	NC	1.4E+06	NC	1.9E+03	NC	3.9E+05
Cobalt	7440484	Cobalt, Total	NC	7.4E-01	NC	9.0E+01	NC	3.8E-01	NC	1.1E+02
Copper	7440508	Copper, Total	NC	9.9E+01	NC	8.6E+02	NC	5.1E+01	NC	4.3E+02
Cyanides	57125	Cyanide, Total; Cyanide	NC	1.5E+00	NC	2.1E+05	NC	7.6E-01	NC	1.6E+03
Fluoride	16984488	-	NC	9.9E+01	NC	NC	NC	5.1E+01	NC	NC
Hexavalent chromium	18540299	Chromium, Hexavalent; Chromium VI	8.8E-03	7.4E+00	3.6E+00	3.1E+03	4.7E-03	3.8E+00	1.1E+00	8.6E+02
Lead	7439921	Lead, Total	NC	NC	NC	NC	NC	NC	NC	NC
Lithium	7439932	Lithium, Total	NC	5.0E+00	NC	6.5E+01	NC	2.5E+00	NC	2.7E+02
Manganese	7439965	Manganese, Total	NC	3.5E+02	NC	2.8E+04	NC	1.8E+02	NC	1.0E+04
Mercury	7439976	Mercury, Total	NC	7.4E-01	NC	1.1E+02	NC	3.8E-01	NC	1.8E+03
Methyl Mercury	22967926	-	NC	2.5E-01	NC	9.9E+00	NC	1.3E-01	NC	1.5E+02
Molybdenum	7439987	Molybdenum, Total	NC	1.2E+01	NC	9.1E+01	NC	6.3E+00	NC	9.7E+02
Nickel	7440020	Nickel, Total	NC	5.0E+01	NC	4.6E+03	NC	2.5E+01	NC	4.2E+01
Selenium	7782492	Selenium, Total	NC	1.2E+01	NC	6.4E+01	NC	6.3E+00	NC	8.7E+00
Silver	7440224	Silver, Total	NC	1.2E+01	NC	2.4E+02	NC	6.3E+00	NC	5.1E+01
Strontium	7440246	Strontium, Total	NC	1.5E+03	NC	2.6E+04	NC	7.6E+02	NC	2.8E+03
Thallium	7440280	Thallium, Total	NC	2.5E-02	NC	3.4E-01	NC	1.3E-02	NC	5.4E-01
Tin	7440315	Tin, Total	NC	1.5E+03	NC	5.5E+03	NC	7.6E+02	NC	2.9E+03
Vanadium	7440622	Vanadium, Total	NC	1.2E+01	NC	1.1E+03	NC	6.3E+00	NC	9.7E+02
Zinc	7440666	Zinc, Total	NC	7.4E+02	NC	3.2E+05	NC	3.8E+02	NC	4.8E+05
Zirconium	7440677	Zirconium, Total	NC	2.0E-01	NC	4.0E+01	NC	1.0E-01	NC	7.4E+00
Energetic Constituents										
1,2-Dinitrobenzene	528290	o-Dinitrobenzene	NC	2.5E-01	NC	3.8E+02	NC	1.3E-01	NC	2.9E+00
1,3-Dinitrobenzene	99650	m-Dinitrobenzene	NC	2.5E-01	NC	4.2E+02	NC	1.3E-01	NC	3.2E+00
2,4,6-Trinitrotoluene	118967	-	1.5E-01	1.2E+00	2.4E+02	2.0E+03	7.9E-02	6.3E-01	1.9E+00	1.5E+01
2-Amino-4,6-dinitrotoluene	35572782	-	NC	5.0E+00	NC	7.2E+03	NC	2.5E+00	NC	5.5E+01
HMX	2691410	-	NC	1.2E+02	NC	6.1E+05	NC	6.3E+01	NC	4.6E+03
Hydrazine	302012	-	1.5E-03	NC	3.1E+00	NC	7.9E-04	NC	2.4E-02	NC

Attachment 1 - Table 14

Indirect Soil Contact Pathway-Specific 30-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Eggs: Target Chemical Concentration in Eggs (C_e) Farmer Cancer (10^{-6}) (mg/kg)	Eggs: Target Chemical Concentration in Eggs (C_e) Child Noncancer (HQ=1) (mg/kg)	Eggs: Soil RBSL for Eggs Pathway ($RBSL_e$) Farmer Cancer (10^{-6}) (mg/kg)	Eggs: Soil RBSL for Eggs Pathway ($RBSL_e$) Child Noncancer (HQ=1) (mg/kg)	Swine: Target Chemical Concentration in Swine (C_s) Farmer Cancer (10^{-6}) (mg/kg)	Swine: Target Chemical Concentration in Swine (C_s) Child Noncancer (HQ=1) (mg/kg)	Swine: Soil RBSL for Swine Pathway ($RBSL_s$) Farmer Cancer (10^{-6}) (mg/kg)	Swine: Soil RBSL for Swine Pathway ($RBSL_s$) Child Noncancer (HQ=1) (mg/kg)
RDX	121824	Hexahydro-1,3,5-trinitro-1,3,5-triazine	4.0E-02	7.4E+00	1.0E+02	1.9E+04	2.1E-02	3.8E+00	8.1E-01	1.4E+02
Perchlorate	14797730	-	NC	1.7E+00	NC	4.4E-01	NC	8.9E-01	NC	9.5E-03
Volatile Organic Compounds										
1,1,1,2-Tetrachloroethane	630206	-	1.7E-01	7.4E+01	1.8E+02	7.8E+04	9.1E-02	3.8E+01	1.4E+00	6.0E+02
1,1,1-Trichloroethane	71556	-	NC	5.0E+03	NC	5.8E+06	NC	2.5E+03	NC	4.4E+04
1,1,2,2-Tetrachloroethane	79345	-	1.6E-02	5.0E+01	2.0E+01	5.9E+04	8.7E-03	2.5E+01	1.6E-01	4.6E+02
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	Freon 113	NC	7.4E+04	NC	7.4E+07	NC	3.8E+04	NC	5.8E+05
1,1,2-Trichloroethane	79005	-	6.1E-02	9.9E+00	8.7E+01	1.4E+04	3.3E-02	5.1E+00	6.9E-01	1.1E+02
1,1-Dichloroethane	75343	-	7.8E-01	5.0E+02	1.1E+03	7.3E+05	4.1E-01	2.5E+02	9.1E+00	5.6E+03
1,1-Dichloroethene	75354	-	NC	1.2E+02	NC	1.6E+05	NC	6.3E+01	NC	1.2E+03
1,1-Dimethylhydrazine	57147	Unsymetrical Dimethyl Hydrazine	NC	2.5E-01	NC	1.7E+03	NC	1.3E-01	NC	1.3E+01
1,2,3-Trichlorobenzene	87616	-	1.2E+00	2.0E+00	1.0E+03	1.7E+03	6.6E-01	1.0E+00	8.6E+00	1.3E+01
1,2,4-Trichlorobenzene	120821	-	1.2E+00	2.5E+01	1.0E+03	2.1E+04	6.6E-01	1.3E+01	8.6E+00	1.7E+02
1,2,4-Trimethylbenzene	95636	-	NC	2.5E+01	NC	2.2E+04	NC	1.3E+01	NC	1.8E+02
1,2-Dibromo-3-chloropropane	96128	1,2-Dibromo-3-CPA	6.3E-04	5.0E-01	6.5E-01	5.1E+02	3.4E-04	2.5E-01	5.3E-03	4.0E+00
1,2-Dibromoethane	106934	1,2-Dibromoethane (EDB)	1.2E-03	2.2E+01	1.7E+00	3.1E+04	6.6E-04	1.1E+01	1.3E-02	2.3E+02
1,2-Dichlorobenzene	95501	o-Dichlorobenzene	NC	2.2E+02	NC	2.1E+05	NC	1.1E+02	NC	1.7E+03
1,2-Dichloroethane	107062	-	9.4E-02	1.5E+01	1.6E+02	2.6E+04	5.0E-02	7.6E+00	1.3E+00	1.9E+02
1,2-Dichloroethene	540590	1,2-Dichloroethenes	NC	2.2E+01	NC	2.9E+04	NC	1.1E+01	NC	2.2E+02
1,2-Dichloropropane	78875	-	1.2E-01	2.2E+02	1.7E+02	3.0E+05	6.6E-02	1.1E+02	1.3E+00	2.3E+03
1,3,5-Trimethylbenzene	108678	-	NC	2.5E+01	NC	2.3E+04	NC	1.3E+01	NC	1.8E+02
1,3-Dichlorobenzene	541731	m-Dichlorobenzene	NC	7.4E+01	NC	6.9E+04	NC	3.8E+01	NC	5.4E+02
1,4-Dichlorobenzene	106467	p-Dichlorobenzene	8.2E-01	1.7E+02	7.7E+02	1.6E+05	4.4E-01	8.9E+01	6.3E+00	1.3E+03
2-Chloroethylvinyl ether	110758	2-Chloroethyl vinyl ether	1.8E-03	NC	3.6E+00	NC	9.4E-04	NC	2.9E-02	NC
2-Hexanone	591786	Methyl butyl ketone	NC	1.2E+01	NC	2.2E+04	NC	6.3E+00	NC	1.7E+02
Acetone	67641	-	NC	2.2E+03	NC	1.7E+07	NC	1.1E+03	NC	1.3E+05
Benzene	71432	-	4.4E-02	9.9E+00	5.7E+01	1.3E+04	2.4E-02	5.1E+00	4.6E-01	9.8E+01
Bromobenzene	108861	-	NC	2.0E+01	NC	2.0E+04	NC	1.0E+01	NC	1.6E+02
Bromodichloromethane	75274	-	3.4E-02	5.0E+01	4.6E+01	6.7E+04	1.8E-02	2.5E+01	3.7E-01	5.1E+02
Bromoform	75252	-	4.0E-01	5.0E+01	4.8E+02	5.9E+04	2.1E-01	2.5E+01	3.8E+00	4.5E+02
Bromomethane	74839	-	NC	3.5E+00	NC	7.1E+03	NC	1.8E+00	NC	5.4E+01
Carbon disulfide	75150	-	NC	2.5E+02	NC	3.4E+05	NC	1.3E+02	NC	2.6E+03
Carbon tetrachloride	56235	-	2.9E-02	9.9E+00	3.1E+01	1.1E+04	1.6E-02	5.1E+00	2.5E-01	8.2E+01
Chlorobenzene	108907	Monochlorobenzene	NC	5.0E+01	NC	5.3E+04	NC	2.5E+01	NC	4.1E+02
Chloroform	67663	Trichloromethane	1.4E-01	2.5E+01	2.0E+02	3.4E+04	7.6E-02	1.3E+01	1.6E+00	2.6E+02

Attachment 1 - Table 14

Indirect Soil Contact Pathway-Specific 30-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Eggs: Target Chemical Concentration in Eggs (C_e) Farmer Cancer (10^{-6}) (mg/kg)	Eggs: Target Chemical Concentration in Eggs (C_e) Child Noncancer (HQ=1) (mg/kg)	Eggs: Soil RBSL for Eggs Pathway ($RBSL_e$) Farmer Cancer (10^{-6}) (mg/kg)	Eggs: Soil RBSL for Eggs Pathway ($RBSL_e$) Child Noncancer (HQ=1) (mg/kg)	Swine: Target Chemical Concentration in Swine (C_s) Farmer Cancer (10^{-6}) (mg/kg)	Swine: Target Chemical Concentration in Swine (C_s) Child Noncancer (HQ=1) (mg/kg)	Swine: Soil RBSL for Swine Pathway ($RBSL_s$) Farmer Cancer (10^{-6}) (mg/kg)	Swine: Soil RBSL for Swine Pathway ($RBSL_s$) Child Noncancer (HQ=1) (mg/kg)
Chloromethane	74873	Methyl chloride	NC	3.5E+00	NC	8.6E+03	NC	1.8E+00	NC	6.5E+01
cis-1,2-Dichloroethene	156592	cis-1,2-Dichloroethylene	NC	5.0E+00	NC	7.1E+03	NC	2.5E+00	NC	5.4E+01
Cumene	98828	Isopropylbenzene	NC	2.5E+02	NC	2.2E+05	NC	1.3E+02	NC	1.8E+03
Dibromochloromethane	124481	-	4.7E-02	5.0E+01	6.0E+01	6.4E+04	2.5E-02	2.5E+01	4.8E-01	4.9E+02
Dibromomethane	74953	-	NC	2.5E+01	NC	3.8E+04	NC	1.3E+01	NC	2.9E+02
Dichlorodifluoromethane	75718	Freon 12	NC	5.0E+02	NC	6.4E+05	NC	2.5E+02	NC	4.9E+03
Ethylbenzene	100414	-	4.0E-01	2.5E+02	4.0E+02	2.5E+05	2.1E-01	1.3E+02	3.3E+00	1.9E+03
Methyl ethyl ketone	78933	2-Butanone; 2-Butanone (MEK)	NC	1.5E+03	NC	6.4E+06	NC	7.6E+02	NC	4.8E+04
Methyl isobutyl ketone (MIBK)	108101	MIBK; 4-Methyl-2-pentanone	NC	2.0E+02	NC	3.7E+05	NC	1.0E+02	NC	2.8E+03
Methylene chloride	75092	Dichloromethane	3.2E-01	1.5E+01	6.2E+02	2.9E+04	1.7E-01	7.6E+00	4.9E+00	2.2E+02
Monomethylhydrazine	60344	Monomethyl Hydrazine	8.0E-06	2.5E+00	6.7E-02	2.1E+04	4.3E-06	1.3E+00	5.3E-04	1.6E+02
m-Xylene & p-Xylene	136777612	meta- and para-Xylenes; m, p-Xylene	NC	5.0E+02	NC	5.0E+05	NC	2.5E+02	NC	3.9E+03
n-Butylbenzene	104518	-	NC	1.2E+02	NC	9.8E+04	NC	6.3E+01	NC	7.9E+02
n-Propylbenzene	103651	-	NC	2.5E+02	NC	2.2E+05	NC	1.3E+02	NC	1.8E+03
o-Chlorotoluene	95498	2-Chlorotoluene	NC	5.0E+01	NC	4.7E+04	NC	2.5E+01	NC	3.7E+02
o-Xylene	95476	-	NC	5.0E+02	NC	5.0E+05	NC	2.5E+02	NC	3.9E+03
p-Chlorotoluene	106434	4-Chlorotoluene	NC	5.0E+01	NC	4.8E+04	NC	2.5E+01	NC	3.7E+02
p-Cymene	99876	p-Isopropyltoluene	NC	2.5E+02	NC	2.0E+05	NC	1.3E+02	NC	1.6E+03
p-Nitroaniline	100016	4-Nitroaniline	2.2E-01	9.9E+00	4.0E+02	1.8E+04	1.2E-01	5.1E+00	3.2E+00	1.4E+02
sec-Butylbenzene	135988	-	NC	2.5E+02	NC	1.9E+05	NC	1.3E+02	NC	1.5E+03
Styrene	100425	Vinylbenzene	NC	5.0E+02	NC	5.2E+05	NC	2.5E+02	NC	4.0E+03
tert-Butylbenzene	98066	Dibenzo[b,e][1,4]dioxin, octachloro-	NC	2.5E+02	NC	2.0E+05	NC	1.3E+02	NC	1.6E+03
Tetrachloroethene	127184	-	8.2E-03	1.5E+01	7.7E+00	1.4E+04	4.4E-03	7.6E+00	6.4E-02	1.1E+02
Tetralin	119642	-	NC	5.0E+01	NC	4.8E+04	NC	2.5E+01	NC	3.8E+02
Toluene	108883	Toluol	NC	2.0E+02	NC	2.2E+05	NC	1.0E+02	NC	1.7E+03
trans-1,2-Dichloroethene	156605	-	NC	5.0E+01	NC	6.5E+04	NC	2.5E+01	NC	5.0E+02
Trichloroethene	79016	Trichloroethylene (TCE)	9.6E-02	1.2E+00	1.1E+02	1.5E+03	5.1E-02	6.3E-01	9.1E-01	1.1E+01
Trichlorofluoromethane	75694	-	NC	7.4E+02	NC	8.5E+05	NC	3.8E+02	NC	6.6E+03
Vinyl chloride	75014	-	1.6E-02	7.4E+00	2.6E+01	1.2E+04	8.7E-03	3.8E+00	2.1E-01	9.0E+01
Xylenes, Total	1330207	Xylene (Total) Isomers	NC	5.0E+02	NC	5.0E+05	NC	2.5E+02	NC	3.9E+03
Semi-Volatile Organic Compounds										
1,4-Dioxane	123911	-	1.6E-01	7.4E+01	1.3E+03	6.0E+05	8.7E-02	3.8E+01	1.0E+01	4.6E+03
2,4,5-Trichlorophenol	95954	-	NC	2.5E+02	NC	2.2E+05	NC	1.3E+02	NC	1.8E+03

Attachment 1 - Table 14

Indirect Soil Contact Pathway-Specific 30-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Eggs: Target Chemical Concentration in Eggs (C_e) Farmer Cancer (10^{-6}) (mg/kg)	Eggs: Target Chemical Concentration in Eggs (C_e) Child Noncancer (HQ=1) (mg/kg)	Eggs: Soil RBSL for Eggs Pathway ($RBSL_e$) Farmer Cancer (10^{-6}) (mg/kg)	Eggs: Soil RBSL for Eggs Pathway ($RBSL_e$) Child Noncancer (HQ=1) (mg/kg)	Swine: Target Chemical Concentration in Swine (C_s) Farmer Cancer (10^{-6}) (mg/kg)	Swine: Target Chemical Concentration in Swine (C_s) Child Noncancer (HQ=1) (mg/kg)	Swine: Soil RBSL for Swine Pathway ($RBSL_s$) Farmer Cancer (10^{-6}) (mg/kg)	Swine: Soil RBSL for Swine Pathway ($RBSL_s$) Child Noncancer (HQ=1) (mg/kg)
2,4,6-Trichlorophenol	88062	-	6.3E-02	2.5E+00	5.6E+01	2.2E+03	3.4E-02	1.3E+00	4.7E-01	1.8E+01
2,4-Dimethylphenol	105679	-	NC	5.0E+01	NC	6.1E+04	NC	2.5E+01	NC	4.7E+02
3,5-Dimethylphenol	108689	-	NC	1.8E+01	NC	2.0E+04	NC	9.1E+00	NC	1.5E+02
Benzoic acid	65850	-	NC	9.9E+03	NC	1.4E+07	NC	5.1E+03	NC	1.1E+05
Benzyl alcohol	100516	-	NC	2.5E+02	NC	5.4E+05	NC	1.3E+02	NC	4.1E+03
bis(2-Ethylhexyl) phthalate	117817	bis(2-ethylhexyl)phthalate	1.5E+00	5.0E+01	3.6E+03	1.2E+05	7.9E-01	2.5E+01	3.1E+01	1.0E+03
Butyl benzyl phthalate	85687	-	2.3E+00	5.0E+02	1.8E+03	3.7E+05	1.2E+00	2.5E+02	1.5E+01	3.0E+03
Carbazole	86748	-	2.2E-01	NC	2.0E+02	NC	1.2E-01	NC	1.6E+00	NC
Dibenzofuran	132649	-	NC	2.5E+00	NC	2.0E+03	NC	1.3E+00	NC	1.6E+01
Diethyl phthalate	84662	-	NC	2.0E+03	NC	2.3E+06	NC	1.0E+03	NC	1.8E+04
Dimethyl phthalate	131113	-	NC	2.0E+03	NC	3.2E+06	NC	1.0E+03	NC	2.4E+04
Di-n-butyl phthalate	84742	Di-n-butylphthalate	NC	2.5E+02	NC	1.9E+05	NC	1.3E+02	NC	1.6E+03
Di-n-octyl phthalate	117840	Di-n-octyl-phthalate	NC	2.5E+01	NC	1.1E+05	NC	1.3E+01	NC	8.7E+02
Formaldehyde	50000	-	NC	5.0E+02	NC	2.0E+06	NC	2.5E+02	NC	1.5E+04
Hexachlorobutadiene	87683	-	5.7E-02	2.5E+00	4.2E+01	1.9E+03	3.0E-02	1.3E+00	3.6E-01	1.5E+01
m-Cresol	108394	3-Methylphenol	NC	1.2E+02	NC	1.7E+05	NC	6.3E+01	NC	1.3E+03
N-Nitrosodimethylamine	62759	Nitrosodimethylamine	2.8E-04	2.0E-02	3.3E+00	2.4E+02	1.5E-04	1.0E-02	2.6E-02	1.8E+00
N-Nitrosodiphenylamine	86306	-	4.9E-01	NC	4.9E+02	NC	2.6E-01	NC	4.0E+00	NC
o-Cresol	95487	2-Methylphenol	NC	1.2E+02	NC	1.7E+05	NC	6.3E+01	NC	1.3E+03
p-Chloro-m-cresol	59507	4-Chloro-3-Methylphenol	NC	2.5E+02	NC	2.5E+05	NC	1.3E+02	NC	2.0E+03
p-Cresol	106445	4-Methylphenol	NC	2.5E+02	NC	3.4E+05	NC	1.3E+02	NC	2.6E+03
Pentachlorophenol	87865	PCP	2.5E-01	1.2E+01	1.8E+02	9.2E+03	1.3E-01	6.3E+00	1.6E+00	7.5E+01
Phenol	108952	Total Phenols	NC	7.4E+02	NC	1.3E+06	NC	3.8E+02	NC	9.8E+03
Polynuclear Aromatic Hydrocarbons										
1-Methyl naphthalene	90120	1-Methylnaphthalene	1.5E-01	1.7E+02	1.3E+02	1.5E+05	8.1E-02	8.9E+01	1.1E+00	1.2E+03
2-Methylnaphthalene	91576	Naphthalene, 2-methyl-	NC	9.9E+00	NC	8.6E+03	NC	5.1E+00	NC	6.8E+01
Acenaphthene	83329	-	NC	1.5E+02	NC	1.3E+05	NC	7.6E+01	NC	1.0E+03
Acenaphthylene	208968	-	NC	1.5E+02	NC	1.3E+05	NC	7.6E+01	NC	1.0E+03
Anthracene	120127	-	NC	7.4E+02	NC	5.8E+05	NC	3.8E+02	NC	4.7E+03
Benzo(a)anthracene	56553	Benz[a]anthracene	3.7E-03	NC	2.9E+00	NC	2.0E-03	NC	2.5E-02	NC
Benzo(a)pyrene	50328	Benzo (a) pyrene	3.7E-04	NC	3.3E-01	NC	2.0E-04	NC	2.8E-03	NC
Benzo(b)fluoranthene	205992	Benz[e]acephenanthrylene 1	3.7E-03	NC	2.9E+00	NC	2.0E-03	NC	2.5E-02	NC
Benzo(e)pyrene	192972	-	NC	7.4E+01	NC	6.6E+04	NC	3.8E+01	NC	5.4E+02
Benzo(ghi)perylene	191242	Benzo (g,h,i) perylene	NC	7.4E+01	NC	8.4E+04	NC	3.8E+01	NC	6.9E+02
Benzo(k)fluoranthene	207089	Benzo[k]fluoranthene	3.7E-03	NC	3.2E+00	NC	2.0E-03	NC	2.8E-02	NC
Chrysene	218019	-	3.7E-02	NC	3.0E+01	NC	2.0E-02	NC	2.6E-01	NC
Dibenzo(a,h)anthracene	53703	Dibenz (a,h) anthracene	1.1E-03	NC	1.3E+00	NC	5.8E-04	NC	1.1E-02	NC

Attachment 1 - Table 14

Indirect Soil Contact Pathway-Specific 30-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Eggs: Target Chemical Concentration in Eggs (C_e) Farmer Cancer (10^{-6}) (mg/kg)	Eggs: Target Chemical Concentration in Eggs (C_e) Child Noncancer (HQ=1) (mg/kg)	Eggs: Soil RBSL for Eggs Pathway ($RBSL_e$) Farmer Cancer (10^{-6}) (mg/kg)	Eggs: Soil RBSL for Eggs Pathway ($RBSL_e$) Child Noncancer (HQ=1) (mg/kg)	Swine: Target Chemical Concentration in Swine (C_s) Farmer Cancer (10^{-6}) (mg/kg)	Swine: Target Chemical Concentration in Swine (C_s) Child Noncancer (HQ=1) (mg/kg)	Swine: Soil RBSL for Swine Pathway ($RBSL_s$) Farmer Cancer (10^{-6}) (mg/kg)	Swine: Soil RBSL for Swine Pathway ($RBSL_s$) Child Noncancer (HQ=1) (mg/kg)
Fluoranthene	206440	-	NC	9.9E+01	NC	7.4E+04	NC	5.1E+01	NC	6.0E+02
Fluorene	86737	-	NC	9.9E+01	NC	8.1E+04	NC	5.1E+01	NC	6.5E+02
Indeno(1,2,3-cd)pyrene	193395	Indeno (1,2,3-cd) pyrene	3.7E-03	NC	4.3E+00	NC	2.0E-03	NC	3.7E-02	NC
Naphthalene	91203	-	NC	5.0E+01	NC	4.8E+04	NC	2.5E+01	NC	3.8E+02
Perylene	198550	-	NC	7.4E+01	NC	6.9E+04	NC	3.8E+01	NC	5.7E+02
Phenanthrene	85018	-	NC	7.4E+02	NC	5.8E+05	NC	3.8E+02	NC	4.7E+03
Pyrene	129000	-	NC	7.4E+01	NC	5.5E+04	NC	3.8E+01	NC	4.5E+02
Pesticides										
4,4'-DDD	72548	p,p'-DDD	1.8E-02	NC	1.6E+01	NC	9.8E-03	NC	1.4E-01	NC
4,4'-DDE	72559	p,p'-DDE	1.3E-02	NC	1.4E+01	NC	6.9E-03	NC	1.2E-01	NC
4,4'-DDT	50293	p,p'-DDT	1.3E-02	1.2E+00	1.7E+01	1.7E+03	6.9E-03	6.3E-01	1.5E-01	1.4E+01
Aldrin	309002	-	2.6E-04	7.4E-02	2.7E-01	7.8E+01	1.4E-04	3.8E-02	2.3E-03	6.4E-01
alpha-BHC	319846	a-Benzene Hexachloride	1.6E-03	2.0E+01	1.4E+00	1.7E+04	8.7E-04	1.0E+01	1.2E-02	1.4E+02
beta-BHC	319857	b-Benzene Hexachloride	2.9E-03	NC	2.6E+00	NC	1.6E-03	NC	2.1E-02	NC
delta-BHC	319868	d-Benzene Hexachloride	2.5E-03	7.4E-01	2.0E+00	6.1E+02	1.3E-03	3.8E-01	1.7E-02	4.9E+00
Chlordane (Technical)	12789036	-	1.3E-02	1.2E+00	1.2E+01	1.1E+03	6.7E-03	6.3E-01	1.0E-01	9.4E+00
Dieldrin	60571	-	2.8E-04	1.2E-01	2.1E-01	9.3E+01	1.5E-04	6.3E-02	1.8E-03	7.7E-01
Endosulfan I	959988	-	NC	1.5E+01	NC	1.3E+04	NC	7.6E+00	NC	1.0E+02
Endosulfan II	33213659	-	NC	1.5E+01	NC	1.3E+04	NC	7.6E+00	NC	1.0E+02
Endosulfan sulfate	1031078	-	NC	1.5E+01	NC	1.3E+04	NC	7.6E+00	NC	1.1E+02
Endrin	72208	-	NC	7.4E-01	NC	5.5E+02	NC	3.8E-01	NC	4.5E+00
Endrin aldehyde	7421934	-	NC	7.4E-01	NC	5.6E+02	NC	3.8E-01	NC	4.6E+00
Endrin ketone	53494705	-	NC	7.4E-01	NC	5.5E+02	NC	3.8E-01	NC	4.5E+00
gamma-BHC	58899	Lindane	4.0E-03	7.4E-01	3.6E+00	6.6E+02	2.1E-03	3.8E-01	3.0E-02	5.3E+00
Heptachlor	76448	-	1.1E-03	1.2E+00	9.5E-01	1.1E+03	5.8E-04	6.3E-01	8.2E-03	9.0E+00
Heptachlor epoxide	1024573	-	8.0E-04	3.2E-02	6.0E-01	2.4E+01	4.3E-04	1.6E-02	5.1E-03	2.0E-01
MCPA	94746	-	NC	1.2E+00	NC	1.2E+03	NC	6.3E-01	NC	9.5E+00
Mirex	2385855	Mirex (DeChlorane)	2.5E-04	5.0E-01	3.3E-01	6.6E+02	1.3E-04	2.5E-01	2.8E-03	5.4E+00
p,p'-Methoxychlor	72435	Methoxychlor	NC	1.2E+01	NC	9.2E+03	NC	6.3E+00	NC	7.5E+01
Toxaphene	8001352	-	3.7E-03	NC	2.9E+00	NC	2.0E-03	NC	2.5E-02	NC
Herbicides										
2,4,5-T	93765	2,4,5-Trichlorophenoxyacetic acid	NC	2.5E+01	NC	2.4E+04	NC	1.3E+01	NC	1.9E+02
2,4,5-TP (Silvex)	93721	-	NC	2.0E+01	NC	1.7E+04	NC	1.0E+01	NC	1.4E+02
2,4-Dichlorophenoxyacetic Acid (2,4-D)	94757	-	NC	2.5E+01	NC	2.7E+04	NC	1.3E+01	NC	2.1E+02
2,4-Dichlorophenoxybutyric acid	94826	2,4-DB	NC	2.0E+01	NC	1.8E+04	NC	1.0E+01	NC	1.4E+02

Attachment 1 - Table 14

Indirect Soil Contact Pathway-Specific 30-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Eggs: Target Chemical Concentration in Eggs (C_e) Farmer Cancer (10^{-6}) (mg/kg)	Eggs: Target Chemical Concentration in Eggs (C_e) Child Noncancer (HQ=1) (mg/kg)	Eggs: Soil RBSL for Eggs Pathway ($RBSL_e$) Farmer Cancer (10^{-6}) (mg/kg)	Eggs: Soil RBSL for Eggs Pathway ($RBSL_e$) Child Noncancer (HQ=1) (mg/kg)	Swine: Target Chemical Concentration in Swine (C_s) Farmer Cancer (10^{-6}) (mg/kg)	Swine: Target Chemical Concentration in Swine (C_s) Child Noncancer (HQ=1) (mg/kg)	Swine: Soil RBSL for Swine Pathway ($RBSL_s$) Farmer Cancer (10^{-6}) (mg/kg)	Swine: Soil RBSL for Swine Pathway ($RBSL_s$) Child Noncancer (HQ=1) (mg/kg)
Dalapon	75990	-	NC	7.4E+01	NC	1.2E+05	NC	3.8E+01	NC	8.8E+02
Dicamba	1918009	-	NC	7.4E+01	NC	9.4E+04	NC	3.8E+01	NC	7.2E+02
2,4-DP (Dichlorprop)	120365	-	NC	2.5E+01	NC	2.3E+04	NC	1.3E+01	NC	1.8E+02
Dinoseb	88857	-	NC	2.5E+00	NC	2.3E+03	NC	1.3E+00	NC	1.8E+01
MCPP	93652	-	NC	2.5E+00	NC	2.5E+03	NC	1.3E+00	NC	1.9E+01
Terphenyls										
m-Terphenyl	92068	-	5.5E-01	1.2E+03	4.7E+02	1.0E+06	2.9E-01	6.3E+02	3.9E+00	8.4E+03
o-Terphenyl	84151	-	5.5E-01	1.2E+03	4.7E+02	1.0E+06	2.9E-01	6.3E+02	3.9E+00	8.4E+03
p-Terphenyl	92944	-	5.5E-01	1.2E+03	4.7E+02	1.0E+06	2.9E-01	6.3E+02	3.9E+00	8.4E+03
Glycols										
Diethylene Glycol	111466	-	NC	2.5E+02	NC	1.2E+06	NC	1.3E+02	NC	9.0E+03
Triethylene glycol	112276	-	NC	1.1E+02	NC	3.7E+05	NC	5.7E+01	NC	2.8E+03
PCDD/PCDFs										
2,3,7,8-TCDD TEQ	1746016-TEQ	-	3.4E-08	1.7E-06	4.2E-05	2.2E-03	1.8E-08	8.9E-07	3.7E-07	1.8E-05
Polychlorinated Biphenyls (PCBs)										
Aroclor 1016	12674112	-	6.3E-02	1.7E-01	4.9E+01	1.3E+02	3.4E-02	8.9E-02	4.2E-01	1.1E+00
Aroclor 1242	53469219	Aroclor-1242	2.2E-03	5.0E-02	2.1E+00	4.7E+01	1.2E-03	2.5E-02	1.8E-02	3.9E-01
Aroclor 1248	12672296	-	2.2E-03	5.0E-02	2.1E+00	4.8E+01	1.2E-03	2.5E-02	1.8E-02	4.0E-01
Aroclor 1254	11097691	-	2.2E-03	5.0E-02	2.7E+00	6.2E+01	1.2E-03	2.5E-02	2.4E-02	5.1E-01
Aroclor 1260	11096825	-	2.2E-03	5.0E-02	1.1E+01	2.4E+02	1.2E-03	2.5E-02	9.2E-02	2.0E+00
Aroclor 5460	11126424	-	2.2E-03	5.0E-02	2.1E+00	4.8E+01	1.2E-03	2.5E-02	1.8E-02	4.0E-01
PCB TEQ	1746016-PCB TEQ	-	3.4E-08	1.7E-06	3.3E-05	1.7E-03	1.8E-08	8.9E-07	2.9E-07	1.4E-05

Notes:
'-' - none established/not applicable.
HQ - hazard quotient
mg/kg - milligrams per kilogram
NC - not calculated
PCDD/PCDF - polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans
RBSL - Risk-Based Screening Level
TCDD - 2,3,7,8-Tetrachlorodibenzo-p-dioxin
TEQ - toxic equivalency

Attachment 1 - Table 14

Indirect Soil Contact Pathway-Specific 30-year Rural Residential Risk-Based Screening Levels

			Eggs				Swine			
			Target Chemical Concentration in Eggs (C_e)		Soil RBSL for Eggs Pathway ($RBSL_e$)		Target Chemical Concentration in Swine (C_s)		Soil RBSL for Swine Pathway ($RBSL_s$)	
Analyte	CAS #	Analyte Synonyms [a]	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)

a - Please note that different chemical names have been used for different programs at the SSFL, and there can be additional analyte synonyms than those presented. Therefore, any chemical synonym should be verified using the CAS number listed.

b - The cadmium RBSLs for non-carcinogenic effects were calculated using the exposure assumptions for an adult as described in Section 3.2.1.

Attachment 1 - Table 14

Indirect Soil Contact Pathway-Specific 30-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Fish: Target Chemical Concentration in Fish (C_{fi}) Farmer Cancer (10^{-6}) (mg/kg)	Fish: Target Chemical Concentration in Fish (C_{fi}) Child Noncancer (HQ=1) (mg/kg)	Fish: Soil RBSL for Fish Pathway ($RBSL_{fi}$) Farmer Cancer (10^{-6}) (mg/kg)	Fish: Soil RBSL for Fish Pathway ($RBSL_{fi}$) Child Noncancer (HQ=1) (mg/kg)
Inorganic Compounds						
Aluminum	7429905	Aluminum, Total	NC	8.8E+02	NC	NC
Antimony	7440360	Antimony, Total	NC	3.5E-01	NC	4.0E+00
Arsenic	7440382	Arsenic, Total	1.5E-04	2.6E-01	3.9E-04	6.7E-01
Barium	7440393	Barium, Total	NC	1.8E+02	NC	1.1E+02
Beryllium	7440417	Beryllium, Total	NC	1.8E+00	NC	2.2E+02
Boron	7440428	Boron, Total	NC	1.8E+02	NC	NC
Cadmium	7440439	Cadmium, Total	NC	3.7E-03 [b]	NC	3.0E-03
Chromium	7440473	Chromium, Total	NC	1.3E+03	NC	1.2E+09
Cobalt	7440484	Cobalt, Total	NC	2.6E-01	NC	4.0E-01
Copper	7440508	Copper, Total	NC	3.5E+01	NC	6.2E+01
Cyanides	57125	Cyanide, Total; Cyanide	NC	5.3E-01	NC	1.7E+01
Fluoride	16984488	-	NC	3.5E+01	NC	NC
Hexavalent chromium	18540299	Chromium, Hexavalent; Chromium VI	2.9E-03	2.6E+00	1.8E-01	1.6E+02
Lead	7439921	Lead, Total	NC	NC	NC	NC
Lithium	7439932	Lithium, Total	NC	1.8E+00	NC	1.5E+03
Manganese	7439965	Manganese, Total	NC	1.2E+02	NC	2.0E+02
Mercury	7439976	Mercury, Total	NC	2.6E-01	NC	4.3E+01
Methyl Mercury	22967926	-	NC	8.8E-02	NC	6.2E+00
Molybdenum	7439987	Molybdenum, Total	NC	4.4E+00	NC	8.8E+01
Nickel	7440020	Nickel, Total	NC	1.8E+01	NC	1.5E+02
Selenium	7782492	Selenium, Total	NC	4.4E+00	NC	1.7E+00
Silver	7440224	Silver, Total	NC	4.4E+00	NC	4.2E+00
Strontium	7440246	Strontium, Total	NC	5.3E+02	NC	3.1E+03
Thallium	7440280	Thallium, Total	NC	8.8E-03	NC	6.2E-04
Tin	7440315	Tin, Total	NC	5.3E+02	NC	4.4E+02
Vanadium	7440622	Vanadium, Total	NC	4.4E+00	NC	2.0E+04
Zinc	7440666	Zinc, Total	NC	2.6E+02	NC	8.0E+01
Zirconium	7440677	Zirconium, Total	NC	7.0E-02	NC	7.0E+00
Energetic Constituents						
1,2-Dinitrobenzene	528290	o-Dinitrobenzene	NC	8.8E-02	NC	1.4E-01
1,3-Dinitrobenzene	99650	m-Dinitrobenzene	NC	8.8E-02	NC	6.7E-01
2,4,6-Trinitrotoluene	118967	-	4.9E-02	4.4E-01	2.4E-02	2.1E-01
2-Amino-4,6-dinitrotoluene	35572782	-	NC	1.8E+00	NC	4.2E+00
HMX	2691410	-	NC	4.4E+01	NC	2.9E+03
Hydrazine	302012	-	4.9E-04	NC	NC	NC

Attachment 1 - Table 14

Indirect Soil Contact Pathway-Specific 30-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Fish			
			Target Chemical Concentration in Fish (C_{fi})		Soil RBSL for Fish Pathway ($RBSL_{fi}$)	
			Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)
RDX	121824	Hexahydro-1,3,5-trinitro-1,3,5-triazine	1.3E-02	2.6E+00	4.2E-02	8.4E+00
Perchlorate	14797730	-	NC	6.2E-01	NC	1.3E+01
Volatile Organic Compounds						
1,1,1,2-Tetrachloroethane	630206	-	5.6E-02	2.6E+01	4.3E-02	2.0E+01
1,1,1-Trichloroethane	71556	-	NC	1.8E+03	NC	1.1E+03
1,1,2,2-Tetrachloroethane	79345	-	5.4E-03	1.8E+01	1.2E-03	3.9E+00
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	Freon 113	NC	2.6E+04	NC	6.8E+03
1,1,2-Trichloroethane	79005	-	2.0E-02	3.5E+00	8.1E-03	1.4E+00
1,1-Dichloroethane	75343	-	2.6E-01	1.8E+02	5.8E-02	4.0E+01
1,1-Dichloroethene	75354	-	NC	4.4E+01	NC	7.4E+00
1,1-Dimethylhydrazine	57147	Unsymetrical Dimethyl Hydrazine	NC	8.8E-02	NC	4.8E-02
1,2,3-Trichlorobenzene	87616	-	4.0E-01	7.0E-01	8.7E-02	1.5E-01
1,2,4-Trichlorobenzene	120821	-	4.0E-01	8.8E+00	1.5E-02	3.2E-01
1,2,4-Trimethylbenzene	95636	-	NC	8.8E+00	NC	2.8E+00
1,2-Dibromo-3-chloropropane	96128	1,2-Dibromo-3-CPA	2.1E-04	1.8E-01	4.9E-05	4.1E-02
1,2-Dibromoethane	106934	1,2-Dibromoethane (EDB)	4.0E-04	7.9E+00	9.1E-05	1.8E+00
1,2-Dichlorobenzene	95501	o-Dichlorobenzene	NC	7.9E+01	NC	1.1E+01
1,2-Dichloroethane	107062	-	3.1E-02	5.3E+00	9.5E-03	1.6E+00
1,2-Dichloroethene	540590	1,2-Dichloroethenes	NC	7.9E+00	NC	2.4E+00
1,2-Dichloropropane	78875	-	4.0E-02	7.9E+01	1.1E-02	2.1E+01
1,3,5-Trimethylbenzene	108678	-	NC	8.8E+00	NC	2.9E+00
1,3-Dichlorobenzene	541731	m-Dichlorobenzene	NC	2.6E+01	NC	1.1E+01
1,4-Dichlorobenzene	106467	p-Dichlorobenzene	2.7E-01	6.2E+01	8.3E-03	1.9E+00
2-Chloroethylvinyl ether	110758	2-Chloroethyl vinyl ether	5.8E-04	NC	4.4E-04	NC
2-Hexanone	591786	Methyl butyl ketone	NC	4.4E+00	NC	2.2E+00
Acetone	67641	-	NC	7.9E+02	NC	4.7E+02
Benzene	71432	-	1.5E-02	3.5E+00	7.5E-03	1.8E+00
Bromobenzene	108861	-	NC	7.0E+00	NC	4.6E+00
Bromodichloromethane	75274	-	1.1E-02	1.8E+01	3.4E-03	5.3E+00
Bromoform	75252	-	1.3E-01	1.8E+01	1.3E-01	1.8E+01
Bromomethane	74839	-	NC	1.2E+00	NC	8.3E-01
Carbon disulfide	75150	-	NC	8.8E+01	NC	8.6E+00
Carbon tetrachloride	56235	-	9.7E-03	3.5E+00	5.9E-03	2.1E+00
Chlorobenzene	108907	Monochlorobenzene	NC	1.8E+01	NC	5.3E+00
Chloroform	67663	Trichloromethane	4.7E-02	8.8E+00	6.5E-03	1.2E+00

Attachment 1 - Table 14

Indirect Soil Contact Pathway-Specific 30-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Fish: Target Chemical Concentration in Fish (C_{fi}) Farmer Cancer (10^{-6}) (mg/kg)	Fish: Target Chemical Concentration in Fish (C_{fi}) Child Noncancer (HQ=1) (mg/kg)	Fish: Soil RBSL for Fish Pathway ($RBSL_{fi}$) Farmer Cancer (10^{-6}) (mg/kg)	Fish: Soil RBSL for Fish Pathway ($RBSL_{fi}$) Child Noncancer (HQ=1) (mg/kg)
Chloromethane	74873	Methyl chloride	NC	1.2E+00	NC	6.2E-01
cis-1,2-Dichloroethene	156592	cis-1,2-Dichloroethylene	NC	1.8E+00	NC	2.7E-01
Cumene	98828	Isopropylbenzene	NC	8.8E+01	NC	1.1E+02
Dibromochloromethane	124481	-	1.5E-02	1.8E+01	3.6E-03	4.1E+00
Dibromomethane	74953	-	NC	8.8E+00	NC	6.0E+00
Dichlorodifluoromethane	75718	Freon 12	NC	1.8E+02	NC	2.1E+02
Ethylbenzene	100414	-	1.3E-01	8.8E+01	2.0E-02	1.3E+01
Methyl ethyl ketone	78933	2-Butanone; 2-Butanone (MEK)	NC	5.3E+02	NC	2.1E+02
Methyl isobutyl ketone (MIBK)	108101	MIBK; 4-Methyl-2-pentanone	NC	7.0E+01	NC	3.6E+01
Methylene chloride	75092	Dichloromethane	1.0E-01	5.3E+00	5.6E-03	2.8E-01
Monomethylhydrazine	60344	Monomethyl Hydrazine	2.6E-06	8.8E-01	1.5E-06	5.0E-01
m-Xylene & p-Xylene	136777612	meta- and para-Xylenes; m, p-Xylene	NC	1.8E+02	NC	3.0E+02
n-Butylbenzene	104518	-	NC	4.4E+01	NC	1.2E+01
n-Propylbenzene	103651	-	NC	8.8E+01	NC	3.5E+01
o-Chlorotoluene	95498	2-Chlorotoluene	NC	1.8E+01	NC	6.4E+00
o-Xylene	95476	-	NC	1.8E+02	NC	1.0E+02
p-Chlorotoluene	106434	4-Chlorotoluene	NC	1.8E+01	NC	7.1E+00
p-Cymene	99876	p-Isopropyltoluene	NC	8.8E+01	NC	1.1E+01
p-Nitroaniline	100016	4-Nitroaniline	7.3E-02	3.5E+00	1.4E-01	6.6E+00
sec-Butylbenzene	135988	-	NC	8.8E+01	NC	1.7E+01
Styrene	100425	Vinylbenzene	NC	1.8E+02	NC	1.6E+04
tert-Butylbenzene	98066	Dibenzo[b,e][1,4]dioxin, octachloro-	NC	8.8E+01	NC	1.4E+01
Tetrachloroethene	127184	-	2.7E-03	5.3E+00	2.1E-04	4.2E-01
Tetralin	119642	-	NC	1.8E+01	NC	6.2E+02
Toluene	108883	Toluol	NC	7.0E+01	NC	3.9E+01
trans-1,2-Dichloroethene	156605	-	NC	1.8E+01	NC	3.2E+00
Trichloroethene	79016	Trichloroethylene (TCE)	3.2E-02	4.4E-01	8.5E-03	1.2E-01
Trichlorofluoromethane	75694	-	NC	2.6E+02	NC	4.1E+01
Vinyl chloride	75014	-	5.4E-03	2.6E+00	1.4E-03	6.6E-01
Xylenes, Total	1330207	Xylene (Total) Isomers	NC	1.8E+02	NC	3.0E+02
Semi-Volatile Organic Compounds						
1,4-Dioxane	123911	-	5.4E-02	2.6E+01	1.2E-01	5.8E+01
2,4,5-Trichlorophenol	95954	-	NC	8.8E+01	NC	2.6E+01

Attachment 1 - Table 14

Indirect Soil Contact Pathway-Specific 30-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Fish: Target Chemical Concentration in Fish (C_{fi}) Farmer Cancer (10^{-6}) (mg/kg)	Fish: Target Chemical Concentration in Fish (C_{fi}) Child Noncancer (HQ=1) (mg/kg)	Fish: Soil RBSL for Fish Pathway ($RBSL_{fi}$) Farmer Cancer (10^{-6}) (mg/kg)	Fish: Soil RBSL for Fish Pathway ($RBSL_{fi}$) Child Noncancer (HQ=1) (mg/kg)
2,4,6-Trichlorophenol	88062	-	2.1E-02	8.8E-01	2.0E-03	8.6E-02
2,4-Dimethylphenol	105679	-	NC	1.8E+01	NC	3.7E+02
3,5-Dimethylphenol	108689	-	NC	6.3E+00	NC	1.1E+01
Benzoic acid	65850	-	NC	3.5E+03	NC	1.2E+03
Benzyl alcohol	100516	-	NC	8.8E+01	NC	1.4E+02
bis(2-Ethylhexyl) phthalate	117817	bis(2-ethylhexyl)phthalate	4.9E-01	1.8E+01	3.4E+00	1.2E+02
Butyl benzyl phthalate	85687	-	7.7E-01	1.8E+02	1.7E+03	3.8E+05
Carbazole	86748	-	7.3E-02	NC	2.4E-01	NC
Dibenzofuran	132649	-	NC	8.8E-01	NC	3.5E-01
Diethyl phthalate	84662	-	NC	7.0E+02	NC	2.8E+02
Dimethyl phthalate	131113	-	NC	7.0E+02	NC	5.9E+02
Di-n-butyl phthalate	84742	Di-n-butylphthalate	NC	8.8E+01	NC	3.9E+01
Di-n-octyl phthalate	117840	Di-n-octyl-phthalate	NC	8.8E+00	NC	3.3E+07
Formaldehyde	50000	-	NC	1.8E+02	NC	6.7E+01
Hexachlorobutadiene	87683	-	1.9E-02	8.8E-01	6.1E-02	2.9E+00
m-Cresol	108394	3-Methylphenol	NC	4.4E+01	NC	4.6E+01
N-Nitrosodimethylamine	62759	Nitrosodimethylamine	9.1E-05	7.0E-03	6.8E-05	5.3E-03
N-Nitrosodiphenylamine	86306	-	1.6E-01	NC	1.5E+01	NC
o-Cresol	95487	2-Methylphenol	NC	4.4E+01	NC	3.8E+01
p-Chloro-m-cresol	59507	4-Chloro-3-Methylphenol	NC	8.8E+01	NC	3.2E+02
p-Cresol	106445	4-Methylphenol	NC	8.8E+01	NC	1.2E+03
Pentachlorophenol	87865	PCP	8.1E-02	4.4E+00	4.1E-03	2.2E-01
Phenol	108952	Total Phenols	NC	2.6E+02	NC	6.8E+02
Polynuclear Aromatic Hydrocarbons						
1-Methyl naphthalene	90120	1-Methylnaphthalene	5.0E-02	6.2E+01	1.4E-01	1.8E+02
2-Methylnaphthalene	91576	Naphthalene, 2-methyl-	NC	3.5E+00	NC	7.0E+00
Acenaphthene	83329	-	NC	5.3E+01	NC	7.7E+02
Acenaphthylene	208968	-	NC	5.3E+01	NC	5.9E+01
Anthracene	120127	-	NC	2.6E+02	NC	1.0E+04
Benzo(a)anthracene	56553	Benz[a]anthracene	1.2E-03	NC	1.8E+00	NC
Benzo(a)pyrene	50328	Benzo (a) pyrene	1.2E-04	NC	4.9E-01	NC
Benzo(b)fluoranthene	205992	Benz[e]acephenanthrylene 1	1.2E-03	NC	1.1E-01	NC
Benzo(e)pyrene	192972	-	NC	2.6E+01	NC	2.7E+03
Benzo(ghi)perylene	191242	Benzo (g,h,i) perylene	NC	2.6E+01	NC	4.5E+04
Benzo(k)fluoranthene	207089	Benzo[k]fluoranthene	1.2E-03	NC	7.7E+00	NC
Chrysene	218019	-	1.2E-02	NC	3.7E+00	NC
Dibenzo(a,h)anthracene	53703	Dibenz (a,h) anthracene	3.6E-04	NC	1.4E-02	NC

Attachment 1 - Table 14

Indirect Soil Contact Pathway-Specific 30-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Fish: Target Chemical Concentration in Fish (C_{fi}) Farmer Cancer (10^{-6}) (mg/kg)	Fish: Target Chemical Concentration in Fish (C_{fi}) Child Noncancer (HQ=1) (mg/kg)	Fish: Soil RBSL for Fish Pathway ($RBSL_{fi}$) Farmer Cancer (10^{-6}) (mg/kg)	Fish: Soil RBSL for Fish Pathway ($RBSL_{fi}$) Child Noncancer (HQ=1) (mg/kg)
Fluoranthene	206440	-	NC	3.5E+01	NC	1.0E+04
Fluorene	86737	-	NC	3.5E+01	NC	8.1E+02
Indeno(1,2,3-cd)pyrene	193395	Indeno (1,2,3-cd) pyrene	1.2E-03	NC	2.0E+01	NC
Naphthalene	91203	-	NC	1.8E+01	NC	6.2E+02
Perylene	198550	-	NC	2.6E+01	NC	3.3E+03
Phenanthrene	85018	-	NC	2.6E+02	NC	7.9E+03
Pyrene	129000	-	NC	2.6E+01	NC	3.2E+03
Pesticides						
4,4'-DDD	72548	p,p'-DDD	6.1E-03	NC	5.5E-03	NC
4,4'-DDE	72559	p,p'-DDE	4.3E-03	NC	3.8E-02	NC
4,4'-DDT	50293	p,p'-DDT	4.3E-03	4.4E-01	7.4E-03	7.6E-01
Aldrin	309002	-	8.6E-05	2.6E-02	1.7E-03	5.3E-01
alpha-BHC	319846	a-Benzene Hexachloride	5.4E-04	7.0E+00	3.8E-05	4.9E-01
beta-BHC	319857	b-Benzene Hexachloride	9.7E-04	NC	6.8E-05	NC
delta-BHC	319868	d-Benzene Hexachloride	8.1E-04	2.6E-01	7.1E-05	2.3E-02
Chlordane (Technical)	12789036	-	4.2E-03	4.4E-01	3.1E-06	3.3E-04
Dieldrin	60571	-	9.1E-05	4.4E-02	1.3E-06	6.1E-04
Endosulfan I	959988	-	NC	5.3E+00	NC	1.4E+01
Endosulfan II	33213659	-	NC	5.3E+00	NC	1.4E+01
Endosulfan sulfate	1031078	-	NC	5.3E+00	NC	2.6E+01
Endrin	72208	-	NC	2.6E-01	NC	2.1E-03
Endrin aldehyde	7421934	-	NC	2.6E-01	NC	5.1E-03
Endrin ketone	53494705	-	NC	2.6E-01	NC	1.1E-02
gamma-BHC	58899	Lindane	1.3E-03	2.6E-01	6.0E-04	1.2E-01
Heptachlor	76448	-	3.6E-04	4.4E-01	5.2E-03	6.4E+00
Heptachlor epoxide	1024573	-	2.6E-04	1.1E-02	6.2E-04	2.7E-02
MCPA	94746	-	NC	4.4E-01	NC	3.9E-01
Mirex	2385855	Mirex (DeChlorane)	8.1E-05	1.8E-01	1.1E-06	2.4E-03
p,p'-Methoxychlor	72435	Methoxychlor	NC	4.4E+00	NC	7.9E-01
Toxaphene	8001352	-	1.2E-03	NC	2.0E-05	NC
Herbicides						
2,4,5-T	93765	2,4,5-Trichlorophenoxyacetic acid	NC	8.8E+00	NC	2.1E+01
2,4,5-TP (Silvex)	93721	-	NC	7.0E+00	NC	2.6E+01
2,4-Dichlorophenoxyacetic Acid (2,4-D)	94757	-	NC	8.8E+00	NC	7.7E+00
2,4-Dichlorophenoxybutyric acid	94826	2,4-DB	NC	7.0E+00	NC	1.5E+01

Attachment 1 - Table 14

Indirect Soil Contact Pathway-Specific 30-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Fish: Target Chemical Concentration in Fish (C_{fi}) Farmer Cancer (10^{-6}) (mg/kg)	Fish: Target Chemical Concentration in Fish (C_{fi}) Child Noncancer (HQ=1) (mg/kg)	Fish: Soil RBSL for Fish Pathway ($RBSL_{fi}$) Farmer Cancer (10^{-6}) (mg/kg)	Fish: Soil RBSL for Fish Pathway ($RBSL_{fi}$) Child Noncancer (HQ=1) (mg/kg)
Dalapon	75990	-	NC	2.6E+01	NC	4.4E+00
Dicamba	1918009	-	NC	2.6E+01	NC	2.3E+01
2,4-DP (Dichlorprop)	120365	-	NC	8.8E+00	NC	1.1E+01
Dinoseb	88857	-	NC	8.8E-01	NC	3.7E+00
MCPP	93652	-	NC	8.8E-01	NC	1.1E+00
Terphenyls						
m-Terphenyl	92068	-	1.8E-01	4.4E+02	1.3E-01	3.1E+02
o-Terphenyl	84151	-	1.8E-01	4.4E+02	1.3E-01	3.1E+02
p-Terphenyl	92944	-	1.8E-01	4.4E+02	1.3E-01	3.1E+02
Glycols						
Diethylene Glycol	111466	-	NC	8.8E+01	NC	2.9E+01
Triethylene glycol	112276	-	NC	4.0E+01	NC	2.0E+01
PCDD/PCDFs						
2,3,7,8-TCDD TEQ	1746016-TEQ	-	NC	NC	1.7E-06	9.1E-05
Polychlorinated Biphenyls (PCBs)						
Aroclor 1016	12674112	-	NC	NC	1.4E-01	4.1E-01
Aroclor 1242	53469219	Aroclor-1242	NC	NC	4.9E-03	1.2E-01
Aroclor 1248	12672296	-	NC	NC	4.9E-03	1.2E-01
Aroclor 1254	11097691	-	NC	NC	4.9E-03	1.2E-01
Aroclor 1260	11096825	-	NC	NC	4.9E-03	1.2E-01
Aroclor 5460	11126424	-	NC	NC	4.9E-03	1.2E-01
PCB TEQ	1746016-PCB TEQ	-	NC	NC	7.5E-08	4.1E-06

Notes:
'-' - none established/not applicable.
HQ - hazard quotient
mg/kg - milligrams per kilogram
NC - not calculated
PCDD/PCDF - polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans
RBSL - Risk-Based Screening Level
TCDD - 2,3,7,8-Tetrachlorodibenzo-p-dioxin
TEQ - toxic equivalency

Attachment 1 - Table 14

Indirect Soil Contact Pathway-Specific 30-year Rural Residential Risk-Based Screening Levels

Analyte	CAS #	Analyte Synonyms [a]	Fish			
			Target Chemical Concentration in Fish (C_{fi})		Soil RBSL for Fish Pathway ($RBSL_{fi}$)	
			Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)	Farmer Cancer (10^{-6}) (mg/kg)	Child Noncancer (HQ=1) (mg/kg)

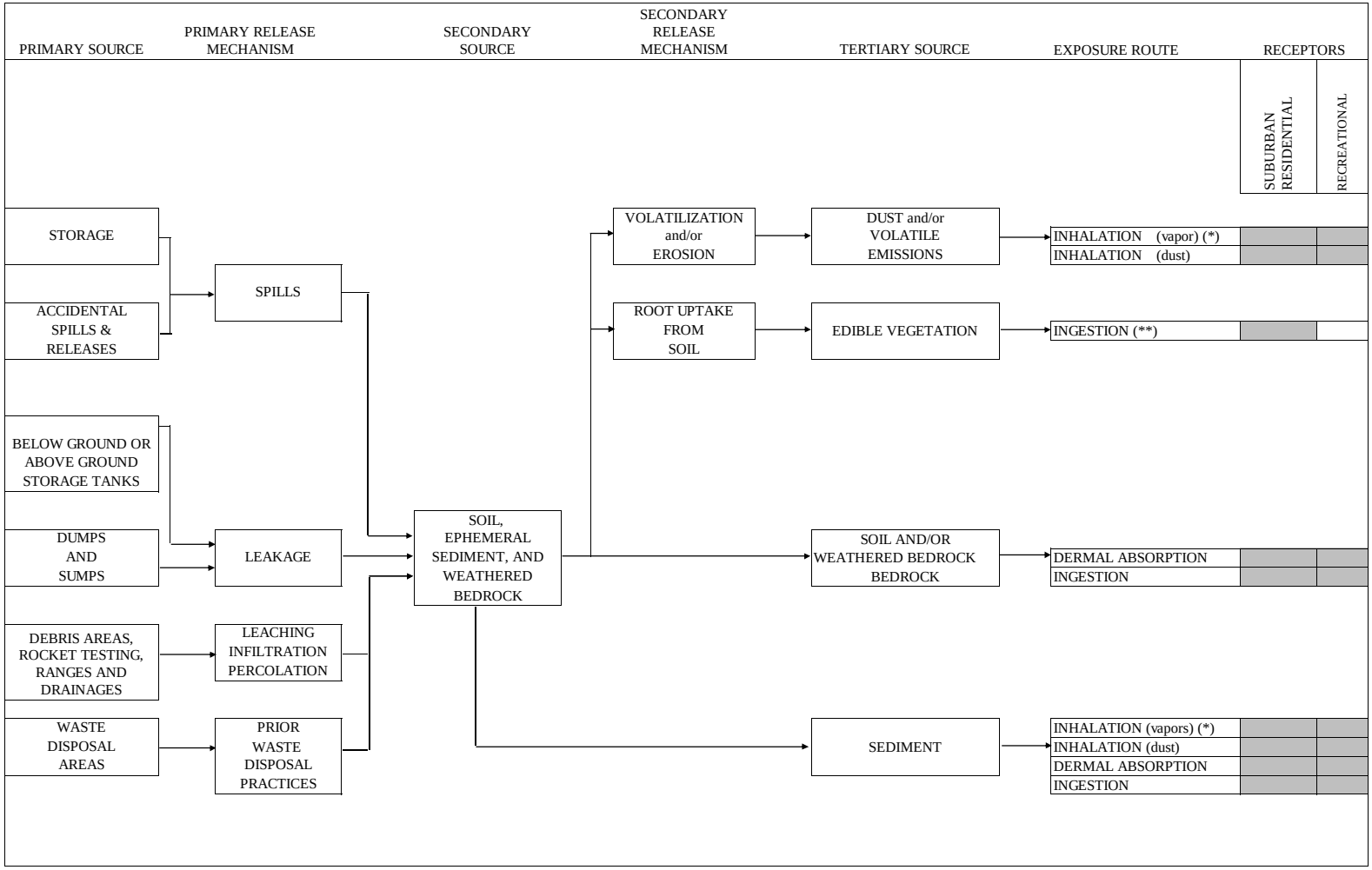
a - Please note that different chemical names have been used for different programs at the SSFL, and there can be additional analyte synonyms than those presented. Therefore, any chemical synonym should be verified using the CAS number listed.

b - The cadmium RBSLs for non-carcinogenic effects were calculated using the exposure assumptions for an adult as described in Section 3.2.1.

FIGURES

Figure 1

Conceptual Site Model for Hypothetical Future Suburban Residential and Recreational Receptors Exposed to Soil, Ephemeral Sediment, and Weathered Bedrock
Santa Susana Field Laboratory (SSFL)



NOTES:

(*) Exposure to vapors refers to volatile organic compounds (VOCs). While both residential and recreational receptors are exposed to outdoor vapors, only residential receptors are exposed to indoor vapors. Residential indoor air vapor intrusion risks arising from soil vapor or VOC volatilization from groundwater will be evaluated as described in the technical memorandum entitled Recommended Approach for Assessing the Vapor Intrusion Pathway, Boeing RCRA Facility Investigation Project, Santa Susana Field Laboratory, Ventura County, California (CH2M HILL, 2013).

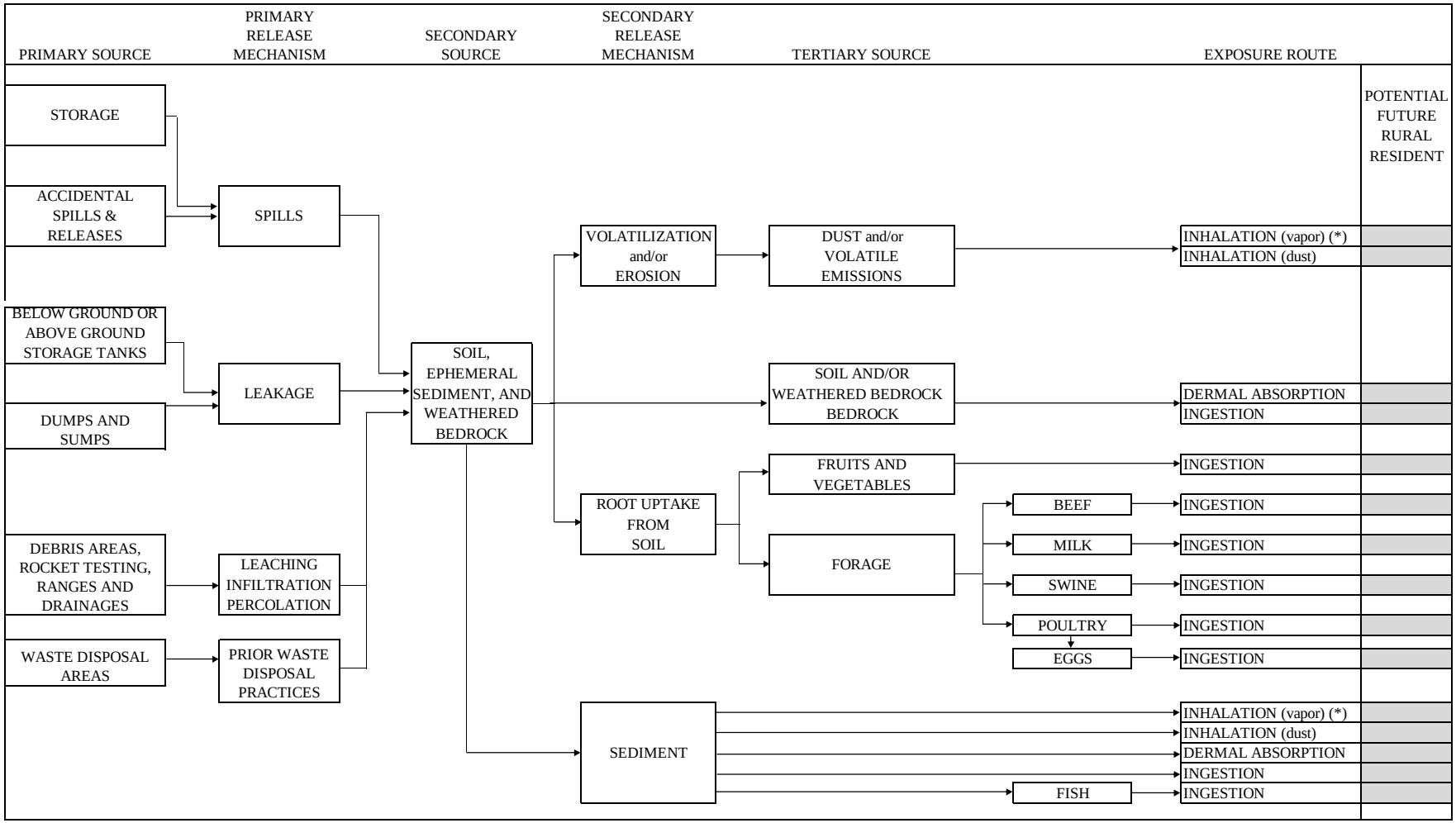
(**) Separate risk-based screening levels were calculated for the ingestion of edible vegetation pathway as described in text.

- potentially complete exposure route quantitatively evaluated in risk assessments

- incomplete exposure route not evaluated in risk assessments

Figure 2

Conceptual Site Model for Hypothetical Future Rural Residents Exposed to Soil, Ephemeral Sediment, and Weathered Bedrock
Santa Susana Field Laboratory (SSFL)



NOTES:
(*) Exposure to vapors refers to volatile organic compounds (VOCs). Rural residential receptors are exposed to both outdoor and indoor vapors. Residential indoor air vapor intrusion risks arising from soil vapor and/or VOC volatilization from groundwater will be evaluated as described in An Updated Approach for Assessing the Vapor Intrusion Pathway, Boeing RCRA Facility Investigation Project, Santa Susana Field Laboratory, California (CH2M Hill, 2011)

- potentially complete exposure pathways evaluated in this risk assessment

- incomplete exposure pathways not evaluated in this risk assessment

ATTACHMENT 1 – APPENDIX A

Derivation of Risk-Based Screening Levels Equations for the Ingestion of Fish Pathway

METHODOLOGY FOR THE CALCULATION OF HUMAN HEALTH RISK-BASED SCREENING LEVELS FOR CHEMICALS IN SOIL AT THE SSFL TECHNICAL MEMORANDUM
SANTA SUSANA FIELD LABORATORY
VENTURA COUNTY, CALIFORNIA

ATTACHMENT 1 - APPENDIX A:
Derivation of Risk-Based Screening Levels Equations for the Ingestion of Fish Pathway

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1.2 DERIVATION OF $RBSL_{FI}$ EQUATION FOR USE WITH BSAFS 6

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LIST OF ACRONYMS AND ABBREVIATIONS

AT	averaging time
BAF	bioaccumulation factor
BCF	bioconcentration factor
BSAF	biota sediment accumulation factor
BW	body weight
CSF_o	oral cancer slope factor
ED	exposure duration
EF	exposure frequency
EPC	exposure point concentration
IR_{fi}	fish ingestion rate
kg	kilogram(s)
Kow	octanol-water partition coefficient
L	liter
mg	milligram(s)
mg/kg	milligram(s) per kilogram
ml	milliliter
RAIS	Risk Assessment Information System
RBSL	risk-based screening level
RfD_o	oral chronic reference dose

1.0 DERIVATION OF SOIL RBSL EQUATIONS FOR FISH

Current USEPA risk equations, available on the Risk Assessment Information System (RAIS) website (RAIS, 2010) and in USEPA guidance documents, do not provide a method for calculating a chemical contaminant concentration in soil that equates with a target health risk level associated with the consumption of fish (i.e., a risk-based soil screening level for fish consumption, $RBSL_{fi}$). The USEPA does provide an equation that relates the risk from eating radionuclide contaminated fish with the radionuclide concentration in soil (USEPA, 1997). Although not directly applicable to chemical risk, the radionuclide risk equation can be used to derive an equation for calculating soil RBSLs for fish ingestion for use in the rural residential exposure scenario at the SSFL.

Depending upon the octanol-water partition coefficient (log Kow) of a chemical, a bioconcentration factor (BCF), a bioaccumulation factor (BAF) or a biota sediment accumulation factor (BSAF) will be used as the fish accumulation factor for the calculation of the rural residential soil RBSL for the fish pathway. As described in USEPA's *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities* (2005), BCFs represent the ratio of a chemical concentration in the fish to the chemical concentration in the water that the fish is exposed (USEPA, 2005); therefore, BCFs only account for the uptake of chemicals by fish from water passing across their gills. As a result, USEPA recommends using BCFs only for compounds with a log Kow less than 4.0 (USEPA, 2005). BAFs are similar to BCFs in that they account for the fish to water column chemical concentration ratio. However, BAFs also account for fish uptake of a chemical from water (both dissolved and suspended), from sediment and from the food chain (USEPA, 2005). Therefore, for most organic compounds with log Kow values greater than 4.0, with the exception of dioxins/furans and PCBs, USEPA recommends using BAFs for the estimation of chemical concentrations in (USEPA, 2005). USEPA recommends using BSAFs for the estimation of concentrations of chemicals in fish for lipophilic chemicals such as dioxins/furans and PCBs, because these classes of chemicals tend to associate preferentially with sediment (USEPA, 2005), and BSAFs accounts for the transfer of chemicals from sediment to lipids in the fish. The equations used to calculate rural residential soil RBSL

for the fish pathway for dioxins/furans and PCBs were developed based on the assumption that these hydrophobic soil chemicals at the SSFL accumulated in pond sediments without significant solubilization in pond water. As a result of the use of two different fish uptake factors, two different rural residential soil RBSL equations are derived below.

1.1 DERIVATION OF SOIL RBSL EQUATION FOR FISH FOR USE WITH BCFS AND BAFS

Derivation of the soil RBSL equation is based on the radiological risk equation from Appendix C of USEPA (1997):

$$Risk_{fi} = CSF_o \times \left(C_{so} \times \left(\frac{1}{K_d + \sigma\left(\frac{S}{\rho}\right)} \right) \times \frac{A_s}{A_w} \right) \times BCF \text{ or } BAF \times IR_{fi} \times CF \times ED$$

Equation 1

where:

$Risk_{fi}$ = cancer risk from eating radionuclide contaminated fish (unitless)
CSF_o = oral cancer slope factor (risk/pCi)
C_{so} = radionuclide concentration in soil (pCi/g)
K_d = soil to water partition coefficient (ml/g)
σ = total soil porosity (L pore space / L soil)
S = fraction water content (L water / L pore space)
ρ = soil bulk density (kg / L soil)
A_s = surface area of contaminated site (square meters [m^2])
A_w = surface area of the watershed (m^2)
BAF = bioaccumulation factor (pCi/kg per pCi/L; specify for radionuclides)
BCF = bioconcentration factor (pCi/kg per pCi/L; specify for radionuclides)
IR_f = fish ingestion rate (g/yr)
CF = conversion factor – water (1,000 ml/L)
ED = exposure duration – residential (30 year)

The term $\left(\frac{1}{K_d + \sigma\left(\frac{S}{\rho}\right)}\right)$ allows for the partitioning of contaminants in soil to groundwater (Appendix C, USEPA, 1997), and the ratio $\left(\frac{A_s}{A_w}\right)$ represents a dilution factor for the radionuclide in stormwater runoff.

Together, the term $\left(C_{so} \times \left(\frac{1}{K_d + \sigma\left(\frac{S}{\rho}\right)}\right) \times \frac{A_s}{A_w}\right)$ represents the radionuclide concentration in water. The BCF or BAF accounts for the uptake of the radionuclide from water to fish.

The equation for risk due to chemical exposures from consumption of contaminated fish is similar to that for radionuclides, but is not identical, as shown below:

$$Risk_{fi} = CSF_o \text{ x } daily\ intake \quad \text{(p 8-6, USEPA, 1989)}$$

Equation 2

Where

$$Daily\ intake = C_{so} \times \left(\frac{IR_{fi} \times EF \times ED}{BW \times AT}\right)$$

And where

$Risk_{fi}$ = cancer risk from eating radionuclide contaminated fish (unitless)
CSF_o = oral cancer slope factor $(mg/kg\text{-}day)^{-1}$
C_{so} = analyte concentration in soil (mg/kg)
IR_{fi} = fish intake rate (mg/day)
EF = exposure frequency (days / yr)
BW = body weight (kg)
AT = averaging time (years)

Similar to Equation 1 for radionuclides, the generic contact rate (CR) for ingestion of chemically-contaminated fish must be modified to account for the partitioning of the contaminant from:

Soil to water: $\left(\frac{1}{K_d + \sigma\left(\frac{S}{\rho}\right)}\right) \times \frac{A_s}{A_w}$

Uptake from water to fish: BCF or BAF

Fraction of fish ingested that is contaminated: FI_{fi}

Therefore, Equation 1 was used to modify Equation 2 as follows:

$$Risk_{fi} = CSF \times \left(\left(\frac{1}{K_d + \sigma\left(\frac{S}{\rho}\right)}\right) \times \frac{As}{Aw}\right) \times BCF\ or\ BAF \times \left(\frac{IR_{fi} \times EF \times ED}{BW \times AT}\right) \times FI_{fi}$$

Equation 3

Where the term $C_{so} \times \left(\left(\frac{1}{K_d + \sigma\left(\frac{S}{\rho}\right)}\right) \times \frac{A_s}{A_w}\right) \times BCF\ or\ BAF$ is the exposure point concentration (EPC) for chemicals in fish. The receptor's daily intake rate of contaminated fish is:

$\left(\frac{IR_{fi} \times EF \times ED}{BW \times AT}\right) \times FI_{fi}$.

Solving Equation 3 for Cs:

$$C_{so} = \frac{Risk_{fi}}{CSF_o \times \left(\left(\frac{1}{K_d + \sigma\left(\frac{S}{\rho}\right)} \right) \times \frac{A_s}{A_w} \right) \times BCF \text{ or } BAF \times \left(\frac{IR_{fi} \times EF \times ED}{BW \times AT} \right) \times FI_{fi}}$$

Equation 4

To determine the value for $Risk_{fi}$, the PRG equation describing a risk-based contaminant concentration in fish was used (RAIS, 2010):

$$C_{fi} = \frac{TR \times BW \times AT}{\left(CSF_o \text{ or } \frac{1}{RfD_o} \right) \times IR_f \times ED \times EF \times FI_{fi}}$$

Equation 5

where:

TR = target risk or hazard index (unitless)
CSF = oral cancer slope factor $(mg/kg\text{-}day)^{-1}$
RfD_o = oral chronic noncancer reference dose (mg/kg-day)

Substituting $Risk_{fi}$ for TR, using CSF_o for the toxicity value, and solving for $Risk_{fi}$:

$$Risk_{fi} = C_{fi} \times \frac{CSF_o \times IR_{fi} \times ED \times EF \times FI_{fi}}{BW \times AT}$$

Equation 6

Substituting Equation 6 into Equation 4:

$$C_{so} = \frac{C_{so} \times \left(\frac{CSF_o \times IR_f \times ED \times EF \times FI_f}{BW \times AT} \right)}{CSF \times \left(\frac{1}{K_d + \sigma\left(\frac{S}{\rho}\right)} \right) \times \frac{A_s}{A_w} \times BCF \text{ or } BAF \times \left(\frac{IR_f \times EF \times ED}{BW \times AT} \right) \times FI_f}$$

Thus:

$$RBSL_{fi} = C_{so} = \frac{C_{fi}}{\left(\frac{1}{K_d + \sigma\left(\frac{S}{\rho}\right)}\right) \times \frac{A_s}{A_w} \times BCF \text{ or } BAF}$$

Equation 7

Equation 7 presents the risk-based soil screening level ($RBSL_{fi}$) for a contaminant where exposure occurs through ingestion of fish that have accumulated the contaminant from surrounding water.

1.2 DERIVATION OF $RBSL_{FI}$ EQUATION FOR USE WITH BSAFS

As described in Section 1.0, for lipophilic compounds like dioxins/furans and PCBs, USEPA recommends using a BSAF to estimate the transfer of chemicals from sediment to lipids in fish. BSAFs are a more reliable measure of bioaccumulation potential because of the analytical difficulties in measuring dissolved dioxin/furan or PCB concentrations in surface water (USEPA, 2005). An equation that could be used to calculate RBSLs for the fish ingestion pathway using BSAF values was not found in the literature. Therefore, the Equation 10, for the $RBSL_{fi}$ value shown below, was derived by combining the Equations 8 and 9 as follows:

$$C_{fi} = \left(\frac{C_{sed}}{OC_{sed}}\right) \times BSAF \times f_{lipid}$$

Equation 8

Equation 8 provides the COPC concentration in fish tissue as described in Table B-4-28, Appendix B (USEPA, 2005), where:

C_{fi} = chemical concentration in fish (mg COPC/kg fish wet tissue)
C_{sed} = chemical concentration in sediment (mg/day)
OC_{sed} = concentration of chemical absorbed to the organic carbon component of sediment (mg/kg)
BSAF = biota-sediment accumulation factor (unitless)

f_{lipid} = fish lipd content (unitless)

The BSAF is defined in Section 4.3.4.1 of USEPA's *Exposure and Human Health Reassessment of 2,3,7,8-TCDD and Related Compounds National Academy of Sciences Review Draft* where the BSAF is equal to C_{lipid} / C_{OC} [mg COPC/kg lipid tissue]/[mg COPC/kg sediment] (2003). In comments by the Department of Toxic Substances Control (DTSC) Human and Ecological Risk Office (HERO), dated September 8, 2010, on the *Rural Residential Risk-Based Screening Levels for Chemicals in Soil, Draft Technical Memorandum* (MWH, 2009), HERO assumed a value of 0.03 for use at the SSFL for the fish lipid content, which corresponds with the greater likelihood of a rural resident raising warm water catfish as opposed to cold water trout or salmon.

Equation 9 is derived from Table C-17, Appendix C of USEPA's *Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities* (2005), and defines the cancer risk resulting from indirect exposure to carcinogenic COPCs.

$$Risk_{fi} = \left(\frac{I \times ED \times EF \times CSF_o}{AT \times 365} \right) \qquad \textbf{Equation 9}$$

where:

$Risk_{fi}$ = lifetime cancer risk through indirect exposure to a carcinogen (unitless) as a result of fish ingestion BSAF = biota-sediment accumulation factor (unitless)

I = daily intake of a COPC from animal tissue (mg COPC/kg BW per day); where daily intake from fish ingestion is defined as:

$$I = If_i = C_{fi} \times CR_{fi} \times FI_{fi}$$

and where:

CR_{fi} = consumption rate of fish (kg/kg-day fresh weight)

FI_{fi} = fraction of fish consumed that is contaminated (unitless); HERO assumed FI_{fis} = 1 (DTSC/HERO, 2010).

ED = exposure duration (yr)

EF = exposure frequency (days/yr)

ED = exposure duration (yr)

CSF_o = oral cancer slope factor $(mg/kg\text{-}day)^{-1}$

AT = averaging time for carcinogens (yr) * 365 days/yr

The substitution of the term I_{fi} into Equation 9 as follows:

$$Risk_{fi} = \left[\frac{\left(C_{fi} \times CR_{fi} \times F_{fi}\right) \times ED \times EF \times CSF_o}{AT \times 365} \right]$$

Then, substituting Equation 8 for C_{fi} results in:

$$Risk_{fi} = \left[\frac{\left(\frac{C_{sed}}{OC_{sed} \times BSAF \times f_{lipid}} \right) \times CR_{fi} \times F_{fi} \times ED \times EF \times CSF_o}{AT \times 365} \right]$$

Assuming that, $C_{sed} = C_{so} = RBSL_{soil}$ and solve for $RBSL_{soil}$.

Let: $Risk_{fi} = \left(\frac{IR_{fi}(kg/day)}{BW(kg)} \right)$

And let: $Risk_{fi}$ = *Target Risk (TR)*,

The resulting soil RBSL then equals:

$$RBSL_{so} = \left[\frac{\left(TR \times OC_{sed}\right) \times \left(AT \times BW \times 365\right)}{\left(BSAF \times f_{lipid}\right) \times \left(IR_{fi} \times F_{fi} \times ED \times EF \times CSF_o\right)} \right] \qquad \textbf{Equation 10}$$

For the carcinogenic $RBSL_{so}$, the IR_{fi}, ED and BW terms are incorporated into an age-adjusted fish ingestion factor (IF_{fis_res}) where:

$$IF_{fis_res}\left(kg - yr / kg - d\right) = \left(\frac{ED_a \times IR_{fia}}{BW_a} \right) + \left(\frac{ED_c \times IR_{fic}}{BW_c} \right)$$

where:

ED_a = adult rural resident exposure duration (year)
IR_{fia} = adult rural resident fish ingestion rate (kg/ day)
BW_a = adult rural resident body weight (kg)
ED_c = child rural resident exposure duration (year)
IR_{fic} = child rural resident fish ingestion rate (kg/ day)
BW_c = child rural resident body weight (kg)

For carcinogens, Equation 10 becomes this soil RBSL for the fish ingestion pathway:

$$RBSL_{fi} = \frac{TR \times OC_{sed} \times AT_c}{BSAF \times f_{lipid} \times FI_{fis} \times EF \times CSF_o \left(\frac{A_s}{A_W} \right)} \times \frac{1}{IF_{fis_res}}$$ **Equation 11**

where:

$$IF_{fis_res} = \frac{ED_a \times IR_{fisa}}{BW_a} + \frac{ED_c \times IR_{fisc}}{BW_c} \quad (2\text{-}44)$$

and where:

$RBSL_{fi}$ = rural residential soil RBSL for fish pathway (mg/kg)
TR = target cancer risk of 1 x 10^{-6} (unitless)
OC_{sed} = fraction of organic carbon in bottom sediment (unitless)
AT_c = averaging time for carcinogens (year x day/year)
BSAF = biota-sediment accumulation factor (unitless)
f_{lipid} = fish lipid content (unitless)
FI_{fis} = fraction of fish consumed that is contaminated (unitless)
EF = rural resident exposure frequency (day/year)
CSF_o = oral cancer slope factor $(mg/kg\text{-}day)^{-1}$
A_s = surface area of contaminated site (square meters [m^2])
A_w = surface area of watershed (m^2)
IF_{fi_res} = age-adjusted composite rural resident fish ingestion factor (kg-year/kg-day)
ED_a = adult rural resident exposure duration (year)
IR_{fisa} = adult rural resident fish ingestion factor (kg-year/kg-day)
BW_a = adult rural resident body weight (kg)
ED_c = child rural resident exposure duration (year)
IR_{fisc} = child rural resident fish ingestion factor (kg-year/kg-day)
BW_c = child rural resident body weight (kg)

For non-carcinogens, Equation 10 applies only to child exposures and becomes this soil RBSL for the fish ingestion pathway:

$$RBSL_{fi} = \frac{THQ \times OC_{sed} \times AT_{nc_c} \times BW_c}{BSAF \times f_{lipid} \times IR_{fisc} \times FI_{fis} \times ED_c \times EF \times \left(\frac{1}{RfD_o}\right) \times \left(\frac{A_s}{A_W}\right)}$$ **Equation 12**

and where:

$RBSL_{fi}$ = rural residential soil RBSL for fish pathway (mg/kg)
THQ = target hazard quotient of 1 (unitless)
OC_{sed} = fraction of organic carbon in bottom sediment (unitless)
AT_{nc_c} = child rural resident averaging time for non-carcinogens (year x day/year)
BW_c = child rural resident body weight (kg)
BSAF = biota-sediment accumulation factor (unitless)
f_{lipid} = fish lipid content (unitless)
IR_{fisc} = child rural resident fish ingestion factor (kg-year/kg-day)
FI_{fis} = fraction of fish consumed that is contaminated (unitless)
ED_c = child rural resident exposure duration (year)
EF = rural resident exposure frequency (day/year)
RfD_o = oral chronic reference dose (mg/kg-day)
A_s = surface area of contaminated site (square meters [m^2])
A_w = surface area of watershed (m^2)

3.0 REFERENCES

Department of Toxic Substances Control / Human and Ecological Risk Office (DTSC/HERO). 2010. Comments on the *Rural Residential Risk-Based Screening Levels for Chemicals in Soil, Draft Technical Memorandum* (MWH, 2009) dated September 8.

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ATTACHMENT 2

Responses to DTSC Comments on the Human Health Risk-Based Screening Levels for Chemicals in Soil at the Santa Susana Field Laboratory, Ventura County, California

Department of Toxic Substances Control

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Edmund G. Brown Jr.
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TO: Roger Paulson, Senior Hazardous Substance Engineer
Brownfields and Environmental Restoration Program
DTSC

FROM: Donald V. Greenlee, Ph.D., DABT
Staff Toxicologist

DATE: May 16, 2012

SUBJECT: HERO Comments on the Technical Memo entitled "Human Health Risk-Based Screening Levels for Chemicals in Soil at the Santa Susana Field Laboratory, Ventura County, California" dated February 1, 2012

PCA: 22120 Site Code: 530033-48

These responses were prepared by MWH on behalf of The Boeing Company (Boeing).

The Human and Ecological Risk Office (HERO) of the Department of Toxic Substances Control (DTSC) reviewed MWH's Technical Memo entitled "Human Health Risk-Based Screening Levels for Chemicals in Soil at the Santa Susana Field Laboratory, Ventura County, California," dated February 1, 2012. This document included Attachment 1 (Risk-Based Screening Levels Calculation Approach and Equations) and Attachment 2 (Human Health Risk-Based Screening Level Calculations for Chemicals in Soil (electronic copy)). The Human Health Risk-Based Screening Levels for Chemicals in Soil Technical Memo and included attachments are herein referred to collectively as the "HH-RBSL TM."

This review was performed to ensure that risk assessment calculations for RFI sites at the Santa Susana Field Laboratory (SSFL) are performed in accordance with the appropriate guidance, ie, either the rural residential exposure scenario using default USEPA parameters in use as of January 2007, coinciding with the promulgation of SB990, or the suburban residential exposure scenario using exposure parameters identified in MWH's Standardized Risk Assessment Methodology – Revision 2 (SRAM-2; June 2005). Construction of SRAM-2 was a joint effort between HERO and MWH. Documents reviewed, in part, for preparation of HERO's comments included those listed below.

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MWH Americas Inc, "Standardized Risk Assessment Methodology-Revision 2 (SRAM-2)," September 2005, available on DTSC's webpage for the Santa Susana Field Laboratory at the following URL: http://www.dtsc.ca.gov/SiteCleanup/Santa_Susana_Field_Lab/index.cfm.

This review focused on the text portion of the HH-RBSL TM and on RBSL calculations provided in accompanying spreadsheets for six distinct receptor scenarios discussed below. RBSL values for each of these scenarios are summarized in Table 1 of the HH-RBSL TM.

Background

The Santa Susanna Field Lab (SSFL; the Site) is located on 2,850 acres of hilly terrain in the southeast corner of Ventura County, approximately 29 miles northwest of downtown Los Angeles, California. The Site was used from 1948 to 2006 as a test site for rocket engine research and development and for development of nuclear power. Soil and groundwater at the Site are known to be impacted by chemicals, including metals, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs) including polynuclear aromatic hydrocarbons (PAHs), dioxins/furans and polychlorinated biphenyls (PCBs), and chlorinated pesticides. In certain portions of the Site soils are also impacted with radionuclides. The Site is currently in the RCRA Facility Investigation (RFI) phase. For those portions of the Site subject to risk-based evaluation (ie, areas formerly operated by Boeing Company), risk assessment will play an integral role in identifying areas for cleanup and eventual Site closure.

In October 2007, the California state legislature passed Senate Bill 990 (SB990), which required that when calculating human health risks at SSFL, rural residential standards were to be used. The rural residential exposure scenario envisions one possible future use of the Site by an agricultural occupant sustained by vegetables, fruits, grains and animal products (eg, milk, beef, eggs, poultry, swine and fish) produced on-Site. The rural residential exposure scenario thus evaluates health risks associated with direct contact of Site contaminants (eg, soil ingestion, dermal absorption and inhalation) and indirect contact of Site contaminants (eg, dietary intake). In the HH-RBSL TM, rural residential RBSLs (rr-RBSLs) were calculated for two different scenarios, one assuming an exposure duration of 40 yrs, the other (at Boeing's option) using an exposure duration of 30 yrs.

Considering SB990 aside, an alternative risk assessment approach is to consider exposures to the suburban resident, with and without a backyard garden, as well as to Site recreators. These scenarios were originally defined in the Standardized Risk Assessment Methodology-Version 2 (SRAM-2; MWH, 2005) that was developed in a joint effort between Boeing and HERO staff. In the HH-RBSL TM, soil RBSLs were calculated for the suburban resident, a child recreator and separately (in accordance with SRAM-2) for a garden exposure. At Boeing's option, RBSLs were also calculated for a garden exposure using USEPA default exposure parameters. Thus, soil RBSLs were calculated for six distinct receptor scenarios.

General Comments

HERO reviewed RBSL calculations for all six receptor scenarios discussed above. As listed at the top of Table 1 (Summary of the Human Health Risk-Based Screening Levels for Chemicals in Soil at the SSFL), these scenarios can be abbreviated as follows:

- Suburban Residential Soil RBSLs
- SRAM-based Suburban Residential Garden RBSLs
- USEPA Default-based Suburban Residential Garden RBSLs
- 40-Year Rural Residential Soil RBSLs
- 30-Year Rural Residential Soil RBSLs
- Recreational Soil RBSLs

While HERO reviewed all above receptor scenarios, this does not imply that HERO endorses application of the USEPA Default-based Suburban Residential Garden RBSLs nor the 30-Year Rural Residential Soil RBSLs—these were selected at Boeing's option. Important distinctions between these scenarios are shown in the table below. RBSLs were calculated using equations supplied in the HH-RBSL TM and different exposure parameter inputs as necessary to accommodate each exposure.

Parameter*	Suburban Resident	SRAM-Based Suburban Res Garden	USEPA-Default Based Res Garden	40-Yr Rural Resident	30-Yr Rural Resident	Recreator
AT_{cancer} (yrs)	75	75	70	70	70	75
ED (yrs)	30	30	30	40	30	30
Soil ing/derm/inh	Yes	No	No	Yes	Yes	Yes
Fruits/vegs only	No	Yes	Yes	No	No	No
Farm	No	No	No	Yes	Yes	No
Others	EPA	SRAM	EPA	EPA	EPA	SRAM

* AT_{cancer} = averaging time for carcinogens
ED = chemical exposure duration
Soil ing/derm/inh = ingestion, dermal absorption and dust/ambient vapor inhalation exposures
Fruits/vegs = consumption of fruits and vegetables from an on-site garden
Farm = consumption of on-site raised fruits/vegetables, beef, cow milk, poultry, eggs, swine and fish.
Others = sources of other exposure factors. The main difference between the 30-year and 40-year rural residential exposures is the additional 10-year exposure duration, which yields increases in all dietary exposures for the 40-year resident compared to the 30-year resident. The 40-yr ED is one of several USEPA default parameters that were available as of January 2007 when SB990 was enacted. In addition, this ED was chosen to coincide with EPA's 40-yr ED guidance for radiological risk evaluation available as of January 2007.

HERO found that all RBSL calculations were performed in accordance with equations supplied in the HH-RBSL TM. These equations were approved earlier by HERO and were based on guidance provided by USEPA (USEPA, 1989; USEPA, 1991; USEPA, 2009). RBSLs were not developed for soil vapor VOCs that may be inhaled from VOC-impacted indoor air because health risks associated with this exposure pathway will be determined differently, using default attenuation factors applicable to existing or future

Site buildings (CH2M Hill, 2011). Because a soil RBSL equation for contaminated fish consumption was unavailable, this RBSL equation had to be derived. Appendix A in Attachment 1 of the HH-RBSL TM contains this derivation. HERO spot-checked RBSLs calculated for each chemical class within the list of COPCs. Observed differences between MWH-derived RBSLs and HERO calculations were attributable to differences in input parameters to the equations, such as outdated toxicity values, variances in publically-available physical parameters used to calculate volatilization factors for volatile organic compounds (VOCs), and, in limited instances, differences in the dermal absorption fraction (ABS) values used to evaluate dermal exposures. These and other observations are discussed in detail below. Pending HERO approval of Boeing's response to these comments, HERO recommends that Boeing submit a complete list of updated toxicity values for all COPCs for review and approval by HERO prior to preparation of RBSLs for the complete list all COPCs at SSFL.

Comment noted. Please refer to specific comments.

Specific Comments on the Text of the HH-RBSL Technical Memo Entitled "Human Health Risk-Based Screening Levels for Chemicals in Soil at the Santa Susana Field Laboratory, Ventura County, California," MWH, Feb 2012): Specific comments relating to the text are listed below.

1) **Page 3, Section 2.1 (RBSL Calculation Methods/Exposure Pathways Addressed by RBSLs):** The first paragraph in this section refers to Figure 1 (Conceptual Site Model (CSM) for Residential and Recreational Receptors) and Figure 2 (CSM for Rural Residential Receptors). Questions that arose upon review of these two models were as follows:

    - Why do the Primary (release) Sources differ between these two CSMs? The Pistol Practice Ranges were omitted from Fig 1. Please explain.

    - The last sentence in the single-starred note at the bottom of Figure 1 states that the VOC inhalation pathway in ambient air associated with diffusion of VOCs from groundwater "has been shown to be insignificant at SSFL," and therefore was excluded from RBSL evaluation. Please provide justification to support this conclusion—was this decision made jointly with DTSC?

    - In both Figures 1 and 2, please provide an additional term under inhalation exposure routes to designate that dust or vapor inhalation is from ambient (or outdoor) air. Also in Fig 1, designate whether the inhalation pathway associated with sediment refers to vapor, dust or both.

    - In Fig 2, why have the inhalation/dermal/ingestion exposure routes associated with Sediment been omitted? This is inconsistent with Fig 1—please explain.

- The two figures have been revised to include the same primary (release) sources.
- The last sentence in the single-starred note at the bottom of Figure 1 has been removed to avoid confusion because Figure 1 and Figure 2 only present the exposure pathways applicable to soil, ephemeral sediment and weathered bedrock.
- Agreed. Figure 1 and Figure 2 have been revised to indicate only the ambient air pathway has been included in the calculation of risk-based screening levels (RBSLs).
- Figure 1 and Figure 2 have been revised for consistency.

2) **Page 4, Section 2.1 (RBSL Calculation Methods/Exposure Pathways Addressed by RBSLs):** The last complete paragraph on page 4 states that RBSLs were calculated as described above in this Section in order to be consistent with PRGs for radionuclides and to allow for summation of radionuclide risks to a total cumulative chemical-radionuclide risk estimate. This statement is only true if health risks associated with chemical exposures are estimated for the same exposure duration as they are for radionuclide exposures, ie, typically 40 yrs. Yet, in this document, some RBSLs are calculated for both the Suburban and Rural Resident using exposure durations of 30 yrs (Attachment 1, Tables 1 and 2). Thus, the above statement should be qualified to state that residential RBSLs calculated for a duration of 40 yrs can be added to radionuclide PRGs that were also derived for a 40 yr exposure duration.

Agreed. The recommended change has been incorporated in Section 2.1.

3) **Page 8, Section 2.1 (RBSL Calculation Methods/Exposure Pathways Addressed by RBSLs):** The explanation of the PEF parameter shown below Equation 2-7 has a formatting problem. Please either add a reference for the EPA default PEF value, or refer the reader to the table containing your calculation of the EPA default PEF value, as appropriate. The age-adjusted composite suburban resident, rural resident or recreator exposure duration (ED; years) listed under Equation 2-7 is not mathematically defined in this section--please add it.

Agreed. The recommended change has been incorporated in Section 2.1. The age-adjusted composite exposure duration has been revised to composite exposure duration, and as a result, the parameter was not mathematically defined.

4) **Page 18, Section 2.3.5 (Indirect Soil RBSL Calculations/Ingestion of Eggs):** Parameters included in Equation 2-30 are defined at the top of page 18, including

what should be the "adult resident egg ingestion rate (kg/day)" and the "child resident egg ingestion rate (kg/day)." Both of these terms were mislabeled as "poultry ingestion rates," please make these corrections.

Agreed. The recommended change has been incorporated in Section 2.3.5.

5) **Page 22, Section 2.3.7 (Ingestion of Fish):** The averaging time for carcinogens variable listed under Equation 2.42 shows the units as "year x day/year." HERO recommends that this should read "year x 365 days/year." Please make this correction throughout this section (ie, top of p 23, top and bottom of p 24) or offer justification for retaining the current designation.

Agreed. The recommended change has been incorporated in Section 2.3.7.

6) **Page 23, Section 2.3.7 (Ingestion of Fish):** The variable "F_{lipid}" shown at the top of the page is usually not capitalized, and thus should be ""f_{lipid}." In Equation 2-46 at the bottom of the page, the variable shown as "IF_{fisc}" should be "IR_{fisc}." The same change should be made to this variable as it is defined at the top of p 24. Similarly, at the bottom of p 24, the definition of the term "IR_{fisc}" should read "child rural resident fish ingestion rate (kg/day)," not "…fish ingestion factor (kg-year/kg-day)." Otherwise, the RBSL units will not be in "mg/kg."

Agreed. The recommended change has been incorporated in Section 2.3.7.

7) **Page 27, Section 3.1 (Exposure and Physical-Chemical Properties):** The first sentence in this section refers the reader to exposure parameters presented in Tables 1 and 2. As determined from the table titles, this reference should be to Attachment 1, Tables 1 and 2.

Agreed. The recommended change has been incorporated in Section 3.1.

8) **Page 27, First Paragraph, Section 3.1 (Exposure and Physical-Chemical Properties):** In this section, the purpose of calculating rural residential RBSLs (rr-RBSLs; both 30 yr and 40 yr exposure duration (ED) RBSLs) and suburban residential RBSLs (s-RBSLs; with or without SRAM-based garden RBSLs or USEPA default-based garden RBSLs), and the fact that the rr-RBSLs are based on USEPA default input parameters, while input parameters for s-RBSLs are based on SRAM-2, have not clearly been made. It is important to inform the reader that only one set of residential RBSLs will be applied at SSFL, and not all. Otherwise, this becomes confusing. HERO recommends stating DTSC's position, which is that the 40-yr rr-RBSLs will be applied at SSFL unless this approach is legally overturned, in which case the s-RBSLs combined with the SRAM-based suburban residential garden RBSLs would be applicable.

Comment noted. The recommended change has been incorporated in Section 3.1.

9) **Page 29, Last Paragraph, Section 3.1.1 (Chemical-specific Parameters Selection Hierarchy):** The discussion about the 40 yr exposure duration (ED) does not include the consequence of using this variable, ie, all composite exposure factors (ie, direct soil and dermal ingestion/absorption, and indirect dietary ingestion rates) were extended, thus increasing exposures beyond the 30 yr ED. HERO recommends that the significance of this change be briefly discussed.

Agreed. The recommended change has been incorporated in Section 3.1.1.

10) **Page 33, Section 3.2.3 (Lead):** HERO recommends the following edits to this section. Starting on the third sentence from the end of the paragraph that comprises most of this page**:**

"As agreed by DTSC (DTSC, 2011b), and as listed on the Oak Ridge National Laboratory's Risk Assessment Information System (RAIS) website as of September 29, 2006, under the 'On-site Recreational Scenario,' the recommended exposure frequency of 75 days/yr was referenced as the 'median value of 0 to 150 days/yr in OSWER Directive 9285.6-03, EPA 1991.' Thus, an exposure frequency of 75 days/yr was entered into the exposure parameters of the LeadSpread 7 model to calculate the recreational lead RBSL of 360 mg/kg."

The first sentence of the paragraph beginning three lines from the end of this page should be edited as follows:

"The SRAM- and USEPA-default-based garden lead suburban residential RBSLs of 5.9 mg/kg and 16.1 mg/kg, respectively, are equal to…in homegrown produce. Default parameters in the LeadSpread 7 model are used except for the percent of diet derived from home-grown produce (100% and 25%, respectively) and SRAM-2 and USEPA-specified parameters (child resident skin area = 2800 cm/day; soil ingestion rate = 200 mg/day), lead in background air = 0 = lead in water, lead in market basket = 0 = lead in home-grown produce." Default settings used by OEHHA to derive the lead CHHSL of 80 mg/kg for the child resident are available in Table 1 of their document entitled "Revised California Human Health Screening Levels for Lead," September 2009. In summary, HERO's calculated soil lead RBSLs were as shown in the table below. LeadSpread 7 calculations are discussed in detail in the Specific Comments Section. Please make appropriate corrections.

Receptor	Lead Soil RBSL (mg/kg)	Important Parameter
Suburban Resident	38.7	Soil ingestion = 200 mg/day, not default 100 mg/day
Rural Resident	6.0	% Home-grown produce = 100%
Recreator	188	Child recreator; Days/wk = 1.44

SRAM-garden	5.9	% Home-grown produce = 100%
EPA-garden	16.1	% Home-grown produce = 25%

The SRAM-based and USEPA-based suburban residential garden lead RBSL only evaluated the ingestion of produce pathway because risk estimates for direct soil exposure pathways are evaluated and reported separately for the suburban resident. For the USEPA-based suburban residential garden lead RBSL, the lead in market basket pathway was included because only 25 percent of the fruits and vegetables are homegrown.

11) **Page 34, Section 3.3 (Toxicity Values):** Please check reference number 10 against the list of references. It is not clear whether item number 10 is correctly referenced. On page 35, the paragraph following item #11 states that the lower RfC value between that listed by IRIS and by OEHHA REL values was used in order to be consistent with the DTSC vapor intrusion model, which uses the lower of these values. Note that although this practice ensures use of the more conservative and health protective non-cancer inhalation toxicity value, it may not be the best choice from a toxicological perspective.

Comment noted. A new Provisional Peer Reviewed Toxicity Value (PPRTV) was published for zirconium in the May 2013 USEPA RSL tables and, as a result, the new PPRTV will replace the previous zirconium toxicity value.

12) **Page 38, Section 5.0 (Uncertainty Discussion):** The fourth bullet point from the top of this page contains a critical spelling error, ie "Cancer slop factors" instead of "Cancer slope factors."

Agreed. The recommended change has been incorporated in Section 5.0.

Specific Comments on the Tables Included with MWH's Technical Memo Entitled "Human Health Risk-Based Screening Levels for Chemicals in Soil at the Santa Susana Field Laboratory, Ventura County, California," MWH, Feb 2012): Specific comments relating to tables in the above Technical Memo are listed below.

13) **Attachment 1 – Table 2 (Exposure Parameters and Rationale for Suburban Residential and Recreational Risk-Based Screening Level Calculations):** HERO reviewed exposure parameters listed in Table 1 (rural residential receptors) and Table 2, which encompassed all receptors and exposure pathways for which RBSLs were calculated in the HH-RBSL TM. All listed parameters were consistent with previous discussions between HERO and Boeing. Recommended minor edits to Table 2 are mentioned below.

    Footnote (a) refers to SRAM-2 for fruit and vegetable (f/v) ingestion rates. Because SRAM-2 listed f/v ingestion rates in units of "g/kg-day" and the units cited in Table 2 are "kg/day," a notation should be added to footnote (a) to indicate

that f/v ingestion rates listed in SRAM-2 were multiplied by 70 kg (BW_{adult}) or 15 kg (BW_{child}).

Footnote (b) is inaccurate and confuses carcinogenic averaging times (either 70 or 75 yrs) with exposure durations (either 30 or 40 yrs). Please revise. Footnote (f) should be revised by striking the first sentence and citing this footnote only for the soil adherence factor for adult and child recreators.

Agreed. The recommended change has been incorporated in Attachment 1 – Table 2.

14) **Attachment 1 – Table 3 (Physical Chemical Properties Used in Suburban Residential, Rural Residential and Recreational Risk-Based Screening Level Calculations):** HERO compared VOC volatilization factors (VFs) listed in Table 3 for a select group of 14 VOCs with VFs calculated for the same VOCs using input parameters supplied in the VLOOKUP worksheet that accompanies DTSC's Johnson & Ettinger soil gas vapor intrusion modeling program. While the differences between most of the VFs listed in Table 3 and those HERO calculated were less than 2-fold, the VFs for naphthalene and styrene were 5-fold higher in Table 3 than those calculated by HERO. The greatest difference in input parameters for calculation of VFs appeared to be values for the soil:water partition coefficient (Kd). HERO calculated the Kd values using the organic carbon partition coefficient (Koc) and the fraction of organic carbon in the soil (0.006), ie:

$$Kd = Koc * foc \qquad \text{(USEPA, 1996)}$$

The significance of this difference is that RBSLs calculated for naphthalene and styrene inhalation from ambient vapors will be 5-fold higher using the VFs provided in Table 3 versus if the VFs were calculated using Kd values calculated as shown above. Please explain this discrepancy.

When a chemical-specific, published value was available for a given constituent, the published value was used. When a chemical-specific, published value was not available for a given constituent, a Kd value was calculated according to the equation cited above.

For 18 chemicals (at least one compound per chemical class), HERO spot-checked all parameters listed on Table 3 against values listed in the cited references. Our findings are summarized in the table below. Please make appropriate corrections.

Chemical	Table 3 Value	Value per Reference	References & Notes (x)
Dermal ABS values for:			
2-Amino-4,6-dinitrotoluene	0.1	0.006	USEPA, 2004

2-Methylnaphthalene	0.1	0.15	DTSC, 1999
2,4,6-Trinitrotoluene	0.1	0.032	USEPA, 2004
Cobalt	0.001	0.010	DTSC, 1999
Glycols	0.05	0.10	DTSC, 1999; (2)
HMX	0.1	0.006	USEPA, 2004
RDX	0.1	0.015	USEPA, 2004
Terphenyls	0.05	0.10	DTSC, 1999; (1)
Hexavalent chrome:			
Soil/Wet Plant Uptake (kg/kg)	1.00E-4	1.88E-3	RAIS, 2012
Soil/Dry Plant Uptake (kg/kg)	4.00E-2	7.5E-3	RAIS, 2012
Beef Transfer Coefficient (d/kg)	9.0E-3	5.50E-3	RAIS, 2012
Milk Transfer Coefficient (d/kg)	1.00E-5	1.5E-3	RAIS, 2012
Perclorate: Soil/Wet Plant Uptake (kg/kg)	3.9	(unknown)	Add reference (3)
Polychlorinated Biphenyls (PCBs)–Fish BSAFs:			
2,3,7,8-TCDD TEQ; Aroclor s 1016 and 1254			Note (4)
PCB TEQ:			
Soil to plant uptake wet wt; soil to plant uptake			
dry wt, beef and milk transfer coefficients			Note (5)

Note (1): Terphenyls are one type of aromatic hydrocarbon, but do not contain fused rings as polyaromatic hydrocarbons do. According to Table 2 in the DTSC's Preliminary Endangerment Assessment Manual (DTSC, 1999), the ABS for terphenyls should thus be 0.10 corresponding to "Other Organic Chemicals."

Note (2): Glycols are not listed in Table 2 of DTSC, 1999. Therefore, the corresponding ABS should be 0.10 for "other organic chemicals."

Note (3): Reference to Tsao & Sample, 2005 was not provided in document.

Note (4): The source of fish biosediment accumulation factors (BSAFs) appears to be USEPA, 2005b shown in the references at the bottom of Table 3, not the listed USEPA, 2005a.

Note (5): RAIS Transfer Coefficients have apparently been recently updated and no longer include soil to plant wet weight uptake factors, soil to plant dry weight uptake factors, beef or milk transfer coefficients for either surrogates used for the PCB TEQ (ie, PCB 81 and/or PCB189). Two potential surrogates for which these values are listed on RAIS are PCB-77 and "High/low/lowest risk PCBs." Because the beef and milk transfer coefficients for PCB-77 are approximately double those for "High/low/lowest risk PCBs," perhaps the conservative approach is to adopt PCB-77 as the surrogate. Please choose one of these surrogates to replace PCB 81 and PCB 189, explain your choice, and replace the corresponding transfer coefficients for PCBs 81 and 189 within the four categories mentioned above.

References:

DTSC, 1999. Preliminary Endangerment Assessment Manual, Table 2 (Screening Level Dermal Absorption Fractions (ABS) from Soil), 1999. Available at: www.dtsc.ca.gov.

RAIS, 2012. Risk Assessment Information System

USEPA, 2004. "Risk Assessment Guidance for Superfund (RAGS), Volume I, Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment." August 2004. Updates to Exhibit 3-4, September 2004. Available at: www.epa.gov/oswer/riskassessment/ragse/index.htm.

Agreed. The recommended change has been incorporated in Attachment 1 – Table 3. Please note PCB-77 was conservatively used as the surrogate for PCB TEQ for all parameters obtained from RAIS as recommended.

The reference to Clausen, et al, 2007 at the bottom of Table 3 was insufficient to find this reference. Please provide the complete reference. Also, the reference to Tsao and Sample, 2005 was omitted from the list of references--please add it.

Agreed. The recommended changes have been incorporated in Attachment 1 – Table 3.

15) **Attachment 1 – Table 4 (Toxicity Values Used in Suburban Residential, Rural Residential and Recreational Risk-Based Screening Level Calculations):** During review of RBSL calculations, HERO noted that toxicity values for the following compounds should be updated to those shown in the table below:

Analyte	Path	Cancer SF or URF	Ref	Reference Dose or Conc	Ref
Arsenic	Ing	9.5 $(mg/kg\text{-}d)^{-1}$	OE		
PCE	Inh			2.0E-3 mg/m^3	IR
TCE	Ing	4.64E-2 $(mg/kg\text{-}d)^{-1}$	IR		
	Inh	4.8E-6 $(ug/m^3)^{-1}$	IR		
Naphthalene	Inh			9.0E-3 mg/m^3	OE
2,3,7,8-TCDD	Ing			7.0E-10 mg/kg-d	OE
PCB TEQ	Ing			7.0E-10 mg/kg-d	IR

* Abbreviations: Inh = inhalation, Ing = ingestion; IR = USEPA IRIS; OE = OEHHA Toxicity Criteria Database or Reference Exposure Levels; Ref = reference source for quoted toxicity value; SF = slope factor; URF = unit risk factor. All toxicity values cited for the ingestion pathway also apply to the dermal absorption pathway. Toxicity value corrections for 2,3,7,8-TCDD apply to both 2,3,7,8-TCDD TEQs and PCB TEQs. The CSFo and URF for TCE account for early life exposures to its mutagenic action as explained in IRIS using EPA's ADAF calculator (USEPA, 2012).

Because toxicity values have a major impact on calculation of health risks and RBSLs, HERO recommends that all toxicity values used to calculate RBSLs be thoroughly reviewed to ensure that the most recent and reliable values are used. Please implement this quality assurance step prior to generating further versions of RBSLs.

Agreed. The recommended change has been incorporated in Attachment 1 – Table 4.

16) **Attachment 1 – Table 6 (Parameters and Equations Used to Calculate the Soil Volatilization Factor (VF)):** To improve clarity, this table needs to be edited. First, a short note should be added informing the reader that calculation of volatilization factors (VFs) was tailored to the Site by using a site-specific value for Q/C_{vol}. The Site-specific Q/C_{vol} (45.94 g/m^2-s per kg/m^3) is less than the default Q/C_{vol} (68.18 g/m^2-s per kg/m^3) supplied by USEPA. The smaller the VF, the smaller the corresponding soil RBSL. Hence, this was a conservative, health protective approach. The equation for calculation of the Q/C_{vol} parameter (inverse of the mean concentration to the volatilization flux) should be shown

along with the values for variables A, B, C and A_{site} (5 acres). In addition, corrections to the two equations shown on Table 6 are also needed as follows:

$$VF = Q/C_{\mathbf{vol}} \times \mathbf{\{(}((3.14 \times D_A \times T)^{1/2}) \times 10^{-4}\ m^2/cm^2\}/(2 \times \rho_b \times D_A)$$

$$D_A = \{((\theta_a^{10/3} \times D_i \times H') + (\theta_w^{10/3} \times \mathbf{D_w}))/n^2\}/\{(\rho_b \times K_d) + \theta_w + (\theta_a \times H')\}$$

Finally, the following terms need to be defined under "Parameters" in Table 6:

Inversion of mean concentration to volatilization flux	Q/C_{vol}	45.94 (g/m^2-s per kg/m^3)
Diffusivity in air	D_i	chemical specific (cm^2/s)
Unitless Henry's Law Constant	H'	chemical specific
Diffusivity in water	D_w	chemical specific (cm^2/s)
Soil-water Partition Coefficient	K_d	chemical specific (cm^3/g)

Agreed. The recommended change has been incorporated in Attachment 1 – Table 6.

Attachment 1-Table 7 (Direct Soil Contact Route-Specific Suburban Residential Risk-Based Screening Levels): HERO spot-checked soil RBSLs for approximately 19 compounds, apportioned such that RBSLs were checked for at least one compound per COPC chemical class. RBSLs for the soil ingestion, dermal absorption and dust/vapor inhalation pathways were calculated in accordance with methods explained in the HH-RBSL TM. However, for 12 of the 19 COPCs examined, cancer RBSLs seemed to have consistently been rounded upwards, thus corresponding to cancer risks of 1.1E-6 instead of 1.0E-6. Five of the other COPCs were associated only with non-carcinogenic RBSLs, and two others required updates to toxicity values. Selected examples are shown in the table above. Please offer an explanation for the above observation.

The rounding issue has been resolved, as indicated in an e-mail from DTSC (Don Greenlee) to MWH (Bruce Narloch) on October 24, 2012. DTSC noted no action is needed by MWH after a further review of RBSL calculations. Please refer to Comment No. 15 for COPCs with updates to toxicity values.

Other discrepancies between RBSLs calculated by HERO and those shown in Table 7 were attributable to differences in input parameters previously mentioned. For example, soil dermal RBSLs for the meta-, ortho- and para-terphenyls listed on page 6 of Table 7 were calculated using a dermal absorption

	Listed Cancer RBSL (mg/kg)	HERO Cancer RBSL (mg/kg;	Path	Listed Non-cancer RBSL	HERO Non-cancer RBSL	Path

		1.0E-6 risk)		(mg/kg)	(mg/kg; 1.0 HQ)	
Arsenic	0.46	0.44	ing			
	1.1E3	1.0E3	inh			
Chrome (6+)	1.4	1.3	ing			
Perchlorate	NA	NA		2.0E3	1.9E3	drm
1,1-Dichloroethane	1.2E2	1.1E2	ing			
	3.8E2	3.6E2	drm			
PCE	1.3	1.2	ing			
TCE	1.2E2	1.09E2	ing			
1,4-Dioxane	2.5E1	2.4E1	ing			
	8.0E1	7.3E1	drm			
	4.6E5	4.3E5	inh			
Benzo(a)pyrene	5.7E-2	5.5E-2	ing			
	1.2E-1	1.1E-1	drm			
	3.2E3	3.0E3	inh			
DDT	2.0E0	1.9E0	ing			
	1.3E1	1.2E1	drm			
	3.7E4	3.4E4	inh			

*Path = exposure pathway: ingestion (ing), dermal (drm), inhalation (inh). NA = not applicable.

(ABS_d) fraction of 0.05 instead of 0.10. Consequently, these RBSLs are 2-fold too high. Similarly, RBSLs calculated for diethylene glycol and triethylene glycol were also 2-fold too high because an ABS_d of 0.05 was used instead of an ABS_d of 0.10. Please use the ABS_d of 0.10 to recalculate the cancer and non-cancer dermal soil RBSLs for terphenyls and glycols, as well as ABS values for other compounds as discussed in detail in Comment #14.

Agreed. The recommended change has been incorporated in Attachment 1 – Table 7.

Oral/dermal cancer RBSLs for arsenic and TCE, and the inhalation cancer RBSL for TCE need to be recalculated using updated cancer slope factors/unit risk factors as discussed under Comment #15. Similarly, non-cancer inhalation RBSLs for PCE and naphthalene, and non-cancer oral/dermal RBSLs for the 2,3,7,8-TCDD TEQ and the PCB TEQ should be recalculated using updated inhalation reference concentrations and oral reference concentrations, respectively.

Agreed. The recommended change has been incorporated in Attachment 1 – Table 7.

A soil RBSL for lead of 80 mg/kg was listed for the Child Suburban Resident on Table 1 (Summary of the Human Health Risk-Based Screening Levels for Chemicals in Soil at the SSFL) enclosed with the HH-RBSL TM. However, a soil lead RBSL was not listed in Attachment 1 - Table 10. HERO estimates the lead RBSL for the Child Recreator should be 38.7 mg/kg, and not the 80 mg/kg value listed on Table 1. We derived the 38.7 mg lead/kg soil value by using the “goal-

seek" function of Excel in LeadSpread 7 and solved for the soil lead concentration that would correspond to an incremental increase of 1 ug lead/deciliter blood in the 90th percentile child. Additional LeadSpread 7 settings were as follows:

Lead in air	0	Soil ingestion rate	200 mg/day
Lead in water	0	Lead in market basket	0 mg/kg
% Home grown produce	0	Lead in home-grown produce	0 mg/kg
Respirable dust	1.5 ug/m^3		
Days per week	7		
Skin area – child resident	2800 cm^2		

Doubling the child soil ingestion rate (per Attachment 1, Table 1: Exposure Parameters and Rationale for Rural Residential Risk-Based Screening Level Calculations) over the default 100 mg/day used by OEHHA to calculate their residential child lead CHHSL of 80 mg/kg was the main factor contributing to the 38.7 mg/kg soil lead RBSL recommended here. Please correct the soil lead RBSL specified for the suburban residential child in Table 1.

Please note that the lead RBSL for the suburban resident is consistent with the proposed lead RBSL discussed in e-mail correspondence between MWH (Bruce Narloch) and DTSC (Don Greenlee) on December 21, 2011. DTSC noted the revised lead CHHSLs of 80 mg/kg should be used for a suburban resident.

When calculating RBSLs for the inhalation pathway, it would be helpful to indicate on Table 7 and similar tables for the other receptors whether the COPC was treated as a VOC or as particulate (eg, naphthalene under the PAH category). Currently, this decision is embedded in an Excel formula in Attachment 2a, Table 2 (Direct Soil contact Pathway-Specific Suburban Residential Soil Risk-Based Screening Level Calculations) which the reader will not see. This would facilitate a reader's understanding of how the inhalation RBSL was calculated.

Comment noted. Please note the classification of whether an analyte was treated as a VOC is presented in Attachment 1 Table 3. A footnote is also presented to describe the method that was used to determine the classification.

The two right-hand columns in Table-7 list soil RBSLs for cancer and non-cancer outcomes associated with inhalation of dusts/vapors. HERO has recommended that the Suburban Residential RBSLs be calculated using procedures listed in SRAM-2. However, soil RBSLs associated with exposures to ambient VOC vapors for the Suburban Residential scenario were calculated using a default USEPA method (ie, USEPA, 2002) and default USEPA soil physical properties, but Site-specific volatilization factors (Attachment 1–Table 3 and Table 6). HERO compared predicted ambient VOC concentrations calculated using the

vapor flux model described in Appendix G of SRAM-2 with ambient VOC concentrations calculated using the soil RBSL divided by a chemical-specific volatilization factor (VF). Input parameters used were common to both methods, including soil physical properties outlined in Table 6 of the HH-RBSL TM and chemical physical properties obtained from the VLOOKUP table accompanying DTSC's Johnson & Ettinger soil gas vapor intrusion model. We found that use of the USEPA's VF method over-predicted ambient outdoor VOC concentrations by 10-50 fold compared with ambient VOC concentrations determined using the SRAM-2 vapor flux method. Therefore, the VF method used by MWH to calculate VOC inhalation RBSLs appeared to be sufficiently protective of public health, and HERO does not object to use of this calculation method.

Comment noted.

17) **Attachment 1 – Table 8 (Direct Soil Contact Route-Specific 40-year Rural Residential Risk-Based Screening Levels):** The same comments made for Attachment 1 – Table 7 with respect to updating dermal ABS_d values and toxicity values applies to Table 8. Otherwise, these direct exposure RBSLs were calculated appropriately using the correct receptor exposure parameters as shown on Table 1 and USEPA equations. The same applies to Table 9 (Direct Soil Contact Route-Specific 30-year Rural Residential Risk-Based Screening Levels) and, with the exception of the RBSL for lead (see Comment #19), it applies to Table 10 (Direct Soil Contact Route-Specific Recreational Risk-Based Screening Levels). RBSLs for indirect exposures to the rural resident (ie, dietary exposures to rural residents for 40-year (Table 13) and 30-year exposure durations (Table 14)) were also calculated correctly, although updating oral toxicity factors becomes all the more important for dietary exposures as explained in Comment #20 below.

Agreed. The recommended changes have been incorporated in Attachment 1 – Table 8.

18) **Attachment 1 – Table 10 (Direct Soil Contact Route-Specific Recreational Risk-Based Screening Levels):** A soil RBSL for lead of 360 mg/kg was listed for the Child Recreator on Table 1 (Summary of the Human Health Risk-Based Screening Levels for Chemicals in Soil at the SSFL) enclosed with the HH-RBSLs Tech Memo. However, a soil lead RBSL was not listed in Attachment 1 - Table 10. HERO estimates the lead RBSL for the Child Recreator should be 188 mg/kg, and not the 360 mg/kg value listed on Table 1. We derived the 188 mg lead/kg soil value by using the "goal-seek" function of Excel in LeadSpread 7 and solved for the soil lead concentration that would correspond to an incremental increase of 1 ug lead/deciliter blood in the 90th percentile child. Additional LeadSpread 7 settings were as follows:

Lead in air	0
Lead in water	0
% Home grown produce	0
Respirable dust	1.5 ug/m^3
Days per week	1.44
Skin area – child resident	2800 cm^2
Soil ingestion rate	200 mg/day
Lead in market basket	0 mg/kg
Lead in home-grown produce	0 mg/kg

Please correct the soil lead RBSL specified for the child recreator in Table 1.

Please note that the lead RBSL for the recreator is consistent with the proposed lead RBSLs discussed in e-mail correspondence between MWH (Bruce Narloch) and DTSC (Don Greenlee) on December 22, 2011. DTSC agreed with calculating a recreator lead RBSL using the same assumptions as the 80 mg/kg CHHSLs except for an exposure frequency of 1.5 days per week.

19) **Attachment 1-Table 11 (SRAM-based Suburban Residential Garden Risk-Based Screening Levels):** Note that updating oral toxicity values (cancer and non-cancer) are important to the dietary RBSL calculations because only oral exposures are considered for all seven dietary pathways. This applies to both Table 11 and Table 12 (USEPA Default-based Suburban Residential Garden Risk-Based Screening Levels).

Agreed.

HERO noted that no soil RBSLs for lead were listed in Attachment 1 - Table 11, although a soil lead RBSL of 6.9 mg/kg for the SRAM-based Suburban Residential garden pathway was listed in Table 1 enclosed in the RBSL TM. HERO estimates that the lead RBSL is 5.9 mg/kg, and not the 6.9 mg/kg value shown in Table 1. We derived the 5.9 mg lead/kg soil value by using the "goal-seek" function of Excel in LeadSpread 7 and solving for the soil lead concentration that would correspond to an incremental increase of 1 ug lead/deciliter blood in the 90th percentile child. Additional LeadSpread 7 settings were as follows:

Lead in air	0
Lead in water	0
% Home grown produce	100
Respirable dust	1.5 ug/m^3
Skin area – child resident	2800 cm^2
Soil ingestion rate	200 mg/day
Lead in market basket	0 mg/kg
Lead in home-grown produce	0 mg/kg

Please correct the soil lead RBSL specified in Table 1.

The SRAM-based suburban residential garden lead RBSL only evaluated the ingestion of produce pathway because risk estimates for direct soil exposure pathways and consumption of homegrown fruits and vegetables are evaluated and reported separately for the suburban resident.

20) **Attachment 1-Table 12 (USEPA Default-based Suburban Residential Garden Risk-Based Screening Levels):** HERO noted that a soil RBSL for lead was not listed in Attachment 1 - Table 12, although a soil lead RBSL of 7.2 mg/kg for the USEPA Default-based Suburban Residential garden pathway was listed on Table 1 enclosed in the HH-RBSL TM. HERO estimates the lead RBSL for the USEPA default suburban residential garden pathway as 16.1 mg/kg, and not the 7.2 mg/kg value shown in Table 1. This value differs from the 5.9 mg/kg discussed in Comment #20 above because the USEPA default garden produce exposures assume that only 25% of the produce that is consumed is contaminated. Hence, we derived the 16.1 mg lead/kg soil value by using the "goal-seek" function of Excel in LeadSpread 7 as described in Comment #20 except that the "% Home grown produce" was set at 25%. Please correct the soil lead RBSL specified in Table 1.

Please note that a USEPA Default-based Suburban Residential Garden RBSL for lead was not listed in Attachment 1- Table 12 because garden RBSLs for lead were not calculated using target chemical concentration in fruits and vegetables like other analytes. Please note all RBSLs for lead are presented in Table 1. The USEPA Default-based suburban residential garden lead RBSL only evaluated the ingestion of produce pathway because risk estimates for direct soil exposure pathways and consumption of homegrown fruits and vegetables are evaluated and reported separately for the suburban resident. The lead in home-grown produce was calculated within the LeadSpread model and the default lead in market basket value within the LeadSpread model was used.

Conclusions and Recommendations

Overall, RBSL calculation spreadsheets for the six receptor exposure scenarios identified in Table 1 (Summary of the Human Health Risk-Based Screening Levels for Chemicals in Soil at the SSFL) were performed correctly using previously agreed upon exposure parameters. Common to all RBSL calculations was the need to update selected toxicity values, and for dermal exposures corrections to the dermal absorption fraction were needed for Energetic Constituents, Glycols and Terphenyls. HERO provided corrected soil lead RBSLs based on exposure inputs to LeadSpread-7 that we thought were appropriate.

REFERENCES

California Department of Toxic Substances Control (DTSC), "Preliminary Endangerment Assessment Guidance Manual," 1999. Available at: www.dtsc.ca.gov.

CH2M Hill, "An Updated Approach for Assessing the Vapor Intrusion Pathway, Boeing RCRA Facility Investigation Project, Santa Susana Field Laboratory, California" (CH2M Hill, 2011).

MWH Americas Inc, "Standardized Risk Assessment Methodology-Revision 2 (SRAM-2)," September 2005, available on DTSC's webpage for the Santa Susana Field Laboratory at the following URL: http://www.dtsc.ca.gov/SiteCleanup/Santa_Susana_Field_Lab/index.cfm.

USEPA, 2012. "Modeling Approach and Extrapolation Method" (Section II.B.1.3 for CSF_{oral}) and "Inhalation Unit Risk" (Section II.C.1.1 for URF), Integrated Risk Information System, September 28, 2011. Available at: http://www.epa.gov/iris/subst/0199.htm.

USEPA, 2009. "Preliminary Remediation Goals for Radionuclides." July, 2009. Available at: www.epa-prgs.ornl.gov/radionuclides/equations.shtml.

USEPA, 2004. "Risk Assessment Guidance for Superfund (RAGS), Volume I, Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment." August 2004. Available at: www.epa.gov/oswer/riskassessment/ragse/index.htm.

U.S. EPA, 1996. Soil Screening Guidance: User's Guide. Publication 9355.4-23. April 1996.

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USEPA, 1989. "Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A – Baseline Risk Assessment)." December 1989.

Reviewed by:

William Bosan, Ph.D.
Senior Toxicologist
Human and Ecological Risk Office

Boeing Response to DTSC Review Comments, Dated 4 June 2014, on the Draft Standardized Risk Assessment Methodology Revision 2 Addendum for the Santa Susana Field Laboratory, Ventura County, California

No.	Page, Section	Comment	Response
General Comment			
1		Based on the amount of information reviewed, the overall quality of the SRAM-2 'Revision including text, tables, figures and RBSL calculations were excellent. Self-explanatory comments are provided below according to the document orientation, eg, Attachment-1, Appendix B, etc.	Comment noted.
Specific Comments			
1	**Attachment 1, Page 7-3, Section 7.3**	(Chemical-Specific Toxicity Criteria): The updated hierarchy for selection of sources to provide toxicity values is listed in Appendix B of the SRAM-2 Addendum. HERO recommends that Table 3 of HERO HHRA Note Number 3, which pertains only to VOCs, be added to this list for selected Inhalation Unit Risk Factors (URFs) and RTCs or RELs, as discussed in more detail under "Appendix B" below.	The text in section 3.3 will be revised to clarify when RELs were used. Please also refer to our response to Comment No. 4, below, for additional detail regarding when RELs will be used in preference to RfCs.

No.	Page, Section	Comment	Response
2	**Appendix B, TM-Attachment 1, Page 3, Section 2.1 (Exposure Pathways Addressed by RBSLs)**	The two Conceptual Site Model (CSM) figures mentioned in the first paragraph (ie, Figure 1 (Suburban Residential and Recreational CSM) and Figure 2 (Rural Residential CSM) should be harmonized to ensure consistency. The following observations pertaining to these figures were made: **Figure 1:** The double asterisk footnote that refers to ingestion of edible vegetation states that "Exposure is limited to bioaccumulatable compounds as described in the text." After reviewing the text, no discussion of bioaccumulatable compounds was found in reference to chemical uptake into garden vegetables/fruits. Further, it is not necessary to have "bioaccumulation" in order to be exposed to toxic levels of chemicals taken up by plants. Thus, it is HERO's opinion that the above statement be removed from the double asterisk footnote in Figure 1. The single-asterisk footnote needs to be reconciled with the footnote in Figure 2. In Figure 1, this footnote refers to the inhalation pathway for vapors and it states: "Exposure is limited to volatile compounds; residential receptors include both indoor and outdoor air exposure to volatiles; recreational receptors include only outdoor air exposure. For residents, inhalation of volatiles from groundwater beneath a site includes migration to indoor air, but does not include groundwater-to-ambient air pathways because these pathways have been shown to be insignificant at the SSFL."	All suggested edits will be made as described above except for the single-asterisk footnote in Figure 1 which will be revised to, "Exposure to vapors refers to volatile organic compounds (VOCs). While both residential and recreational receptors are exposed to outdoor vapors, only residential receptors are exposed to indoor vapors. Residential indoor air vapor intrusion risks arising from soil vapor or VOC volatilization from groundwater will be evaluated as described in the technical memorandum entitled *Recommended Approach for Assessing the Vapor Intrusion Pathway, Boeing RCRA Facility Investigation Project, Santa Susana Field Laboratory, Ventura County, California* (CH2M HILL, 2013)."

No.	Page, Section	Comment	Response
		In view of the fact that these are soil RBSLs, not groundwater RBSLs, HERO recommends the following reconstruction of the above paragraph: "Exposure to vapors refers to volatile organic compounds (VOCs). While both residential and recreational receptors are exposed to outdoor vapors, only residential receptors are also exposed to indoor vapors. Residential indoor air vapor intrusion risks arising from soil vapor and/or VOC volatilization from groundwater will be evaluated separately as described in the technical memorandum entitled "An Updated Approach for Assessing the Vapor Intrusion Pathway, Boeing RCRA Facility Investigation Project, Santa Susana Field Laboratory, California" (CH2M Hill, 2011). Finally, under the secondary release mechanism labeled as "Sediment", please add a fourth box labeled "Inhalation (dust)" under the column labeled "Exposure Route." This will aid consistency with Figure 2. **Figure 2:** Please re-word the footnote denoted with a single asterisk. The same wording suggested for Figure 1 above can be used.	
3	**Page 34, Section 3.2.3 (Lead)**	A misprint was noted on page 34 towards the end of the paragraph carried over from page 33 ("…which approximate to an exposure frequency of 75 days/week, was entered…"). This should read 75 days/year.	Agreed. The text in Section 3.2.3 will be revised as requested.

<table>
<tr><th>No.</th><th>Page, Section</th><th>Comment</th><th>Response</th></tr>
<tr><td>4</td><td>Page 35, Section 3.3 (Toxicity Values)</td><td>As documented in HERO Note 3 (available at: http://www.dtsc.ca.gov/assessingrisk/ humanrisk2.cfm), _____HERO has recently revised their recommended methodology for application of USEPA Region- IX Regional Screening Level (RSL) values. In general, this document supports EPA's selection of the majority of RSL values listed in the RSL tables (http://www.epa.gov/region9/superfund/prg/).
1. As a corollary, the toxicity values used by USEPA are also generally endorsed, although exceptions exist for VOCs. Table 3 in HHRA Note 3 lists the more protective cancer inhalation unit risk factor (IUR) or non-cancer reference concentration/Reference Exposure Level (RfC/REL) for several VOCs. Please ensure that toxicity values for those VOCs on the expedited chemical list (yellow highlighted VOCs on Attachment 1-Table 4 in Appendix B of the SRAM-2 Revision) coincide with those shown on HERO HHRA Note 3. This includes the following VOCs and toxicity value corrections:
<table>
<tr><th>VOC</th><th>RfC or REL (mg/m^3)</th></tr>
<tr><td>Carbon tetrachloride</td><td>4.0E-2</td></tr>
<tr><td>Methylene chloride</td><td>4.0E-1</td></tr>
<tr><td>Tetrachloroethvlene</td><td>3.5E-2</td></tr>
<tr><td>Toluene</td><td>3.0E-1</td></tr>
</table>
HERO recognizes that the remainder of toxicity values on Table 4-Appendix B (non- highlighted values) will be revised later, prior to finalizing risk evaluations for RFI sites.</td><td>Please note that during a telephone call between Dr. Bruce Narloch (MWH) and Dr. Don Greenlee (DTSC) held on December 13, 2013, the issue of inhalation RELs vs. RfCs was discussed. Specifically, MWH inquired as to whether DTSC has a policy regarding the preferred use of inhalation RELs (published by OEHHA) over RfCs (published by EPA), or whether it made sense to use the most recently published inhalation toxicity values regardless of the source (i.e., OEHHA or EPA). Don stated that DTSC doesn't have a policy regarding the preferred use of inhalation RELs over RfCs, and that it makes sense to him to use the most recently published values. Based on the above, the RBSLs should not be changed since they reflect DTSC's prior input and agreement on the approach.</td></tr>
</table>

<table>
<tr><th>No.</th><th>Page, Section</th><th>Comment</th><th>Response</th></tr>
<tr><td></td><td></td><td>
At that time, Table 3 of HHRA Note 3 should be used to ensure that IURs/RfCs/RELs for all listed VOCs applicable to Boeing's portion of SSFL are updated.

Other corrections to toxicity values for chemicals on the expedited list (yellow highlight in Attachment 1-Table 4) and otherwise that are not included in HERO HHRA Note 3 included the following:
<table>
<tr><th>Chemical</th><th>RfC or REL (mg/m^3)</th><th>URF $(ug/m^3)^{-1}$</th><th>Reference</th></tr>
<tr><td>1,2-Dibromoethane</td><td>8.0E-4</td><td>--</td><td>OEHHA</td></tr>
<tr><td>Chrysene</td><td>--</td><td>1.1E-5</td><td>OEHHA</td></tr>
</table>

This is not an all-inclusive list because HERO understands that toxicity value corrections throughout Table 4 will be addressed prior to site closures. HERO also noted that the URF for trichloroethylene in Table 4 referred to footnote "g" but this footnote was not included in the legend. Please add it if it is important.

One minor note: the acronym REL refers to Reference Exposure Level, not "recommended exposure limits" as stated at the bottom of page 35 in Appendix B, Section 3.3.
</td><td></td></tr>
</table>

No.	Page, Section	Comment	Response
5	**RBSL Calculation Spreadsheets, 30-Year Rural Residential Spreadsheets**	The Exposure Parameters worksheet (ie, "Att2c Tb4 Exposure Parameters") enclosed within the "HHRA RBSL Workbooks_4_USEPA_30 yr RR" Excel spreadsheets is missing the following input values under the following categories: <u>General:</u> Exposure Frequency <u>Dermal Contact with Soil:</u> Skin surface areas for rural residential child and farmer	Agreed. The spreadsheet will be revised to include the requested exposure input values.
6	**RBSL Calculation Spreadsheets, USEPA-based Suburban Residential Garden RBSL Calculations**	Within the Excel spreadsheets entitled "HH RBSL Workbooks_3_ 40 yr ED RR_Garden," the value for the fraction of produce consumed by the Suburban Resident that is contaminated (CF_p = 0.25) is not specified on Att2b_Tb2_Res-garden RBSL worksheet, nor is it specified on Att2b_Tb5_Exposure Parameters worksheet. Please ensure that all input parameters are listed, and organize them such that the reader clearly understands which parameter values pertain to a certain worksheet.	Agreed. The Att2b_Tb2_Res-garden RBSL work-sheet and the Att2b_Tb5_Exposure Parameters worksheet will be revised to specify the assumed CFp value of 0.25.
7	**RBSL Calculation Spreadsheets, Volatilization Factor Worksheet**	The Volatilization Factor (VF) worksheets, entitled "Att 2a_Tb8_VF" in spreadsheets "HHRBSL Workbooks_2_Suburban_ Garden_Rec" and in "HHRBSL Workbooks_3_USEPA_ 40-yr ED RR_Garden" and entitled "Att 2c_Tb7_VF" in spreadsheets "HHRBSL Workbooks_ 4_USEPA_30 yr ED RR" are consistently missing the diffusivity in water parameter, (ie, D_w) from the numerator in the apparent diffusivity (DA) equation as follows:	The apparent diffusivity equation presented in the spreadsheet is missing the diffusivity in water parameter and will be revised. However, please note the apparent diffusivity and subsequent VFs were calculated correctly within the 'chem-specific factors' spreadsheet, and neither the VFs nor RBSLs for VOCs require revision.

No.	Page, Section	Comment	Response
		$D_A = \{(\phi_a^{(10/3)} \times D_i \times H') + (\phi_w^{(10/3)} \times D_w)\}/\text{denominator}$ Please ensure that this equation is accurate per Equation 4-8 in USEPA's "Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites," (December 2002), and recalculate VFs and soil RBSLs for VOCs.	
8	**RBSL Calculation Spreadsheets, General**	RBSL Calculation Spreadsheets: HERO spot-checked soil RBSL calculations for a variety of chemicals using the following exposure scenarios: Suburban Residential SRAM-based Suburban Residential Garden USEPA Default-based Suburban Residential Garden Rural Residential 30-Year Rural Residential Recreational Receptor With the exception of the equation for the Volatilization Factor (VF) mentioned above, RBSL equations were identical to those supplied in USEPA-Region IX's RSL Table User's Guide, where exposure parameters were either USEPA default values or those supplied in SRAM-2, as appropriate. Chemical-specific parameters were provided from referenced, publically-available information. Except for the VF and related estimates of exposures to VOCs in ambient air, soil RBSLs were correctly calculated.	Comment noted. Please also refer to our response to Comment No. 7, above.

The Boeing Company
Santa Susana Field Laboratory
5800 Woolsey Canyon Road
Canoga Park, CA 91304-1148

Via FedEx

October 14, 2014
In reply, refer to SHEA-114988

Mr. Roger N. Paulson, P.E.
SSFL-Boeing Sites Project Manager
Department of Toxic Substances Control
8800 Cal Center Drive
Sacramento, California 95826-3200

Dear Mr. Paulson:

Subject: Errata Package for Final Standardized Risk Assessment Methodology Work Plan Revision 2 Addendum, Santa Susana Field Laboratory, Ventura County, California

The Boeing Company (Boeing) herewith submits an errata package consisting of replacement text and tables for the *Final Standardized Risk Assessment Methodology Work Plan Revision 2 Addendum, Santa Susana Field Laboratory, Ventura County, California* (SRAM Addendum), dated August 2014. Also included are complete electronic replacements for the original electronic copies.

Following submittal of the SRAM Addendum to the Department of Toxic Substances Control (DTSC), MWH Americas Inc. (MWH) discovered that DTSC guidance regarding the evaluation of noncancer hazards for cadmium were not consistently applied during the derivation of human health risk-based screening levels (RBSLs) for all human exposure scenarios. Specifically, DTSC Office of Human and Ecological Risk (HERO) Human Health Risk Assessment (HHRA) Note 3, dated July 14, 2014, recommends that evaluations of the noncancer hazard associated with cadmium be performed based on an adult exposure scenario rather than a child, or age-adjusted, exposure scenario. While this guidance was correctly applied to the derivation of human health RBSLs for cadmium for a suburban resident, it was not consistently applied during the derivation of RBSLs for cadmium for other human receptors. This errata package corrects this error.

Please remove and discard Appendix B in the hard copy documents that were submitted to you on August 21, 2014 and replace it with the enclosed text and tables. Boeing is also providing this replacement package for all hard copies distributed, and replacing all electronic copies with a revised complete electronic document.

If you have any questions regarding this transmittal, please call me at (818) 466-8776.

Sincerely,

Michael O. Bower, P.E.
Project Manager
Environment, Health and Safety

Enclosures: Errata for Final Standardized Risk Assessment Methodology Work Plan Revision 2 Addendum (5 copies)

Mark Malinowski, DTSC (w/o attachment)
Donald Greenlee, DTSC (1 hard copy, 1 electronic copy)
DTSC Chatsworth Regional Records Office (1 hard copy, 1 electronic copy)
Susan Bouguez, Simi Valley Library (1 hard copy)
Sandi Banks, Platt Branch Library (1 hard copy)
Robert Marshall, Urban Archives Center, CSUN Oviatt Library (1 hard copy)
Alexa Stamets (electronic only)
Dixie Hambrick (w/o attachment)
Ben Stewart (w/o attachment)

APPENDIX C

Ecological Exposure Assessment Updates for Use in Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura County, California - Technical Memorandum

ECOLOGICAL EXPOSURE UDPATES FOR USE IN ECOLOGICAL RISK ASSESSMENTS
TECHNICAL MEMORANDUM
SANTA SUSANA FIELD LABORATORY
VENTURA COUNTY, CALIFORNIA

Prepared For:

THE BOEING COMPANY

Prepared By:

Bruce A. Narloch, Ph.D.
Risk Assessment Project Director

Kristi M. Rettmann, M.S.
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Valerie C. Chen, M.S.
Risk Assessor

MWH Americas, Inc.
300 N. Lake Avenue, Suite 400
Pasadena, CA 91101

August 2014

This technical memorandum describes updated ecological exposure assessment methodologies for use in the preparation of ecological risk assessments (ERAs) for the Santa Susana Field Laboratory (SSFL). This document has been prepared for the California Environmental Protection Agency (Cal-EPA) Department of Toxic Substances Control (DTSC) on behalf of the Boeing Company (Boeing), National Aeronautics and Space Administration (NASA), and U.S. Department of Energy (DOE) as agreed during a meeting between the DTSC, Boeing, NASA and DOE held on February 17, 2010 in response to DTSC comments on previous risk assessments included in Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Group Reports.

ERAs prepared for the SSFL, to date, have been performed in accordance with the *Standardized Risk Assessment Methodology for the SSFL (SRAM) Work Plan, Santa Susana Field Laboratory, Ventura County, California. Revision 2 – Final* (SRAM) (MWH, 2005). The SRAM (MWH, 2005) documents the methods and assumptions to be used in a ”forward” calculation of ecological exposure doses and hazards to avian and mammalian indicator receptors from exposure to constituents of potential ecological concern (CPECs) in environmental media. In the *Draft Proposed Approaches for Streamlining Future Ecological Risk Assessments at the Santa Susana Field Laboratory - Technical Memorandum* (MWH, 2009), an alternative to the forward calculation of dose and hazard is proposed in which ecological risk-based screening levels (EcoRBSLs) are back-calculated for each CPEC and then compared to a medium-specific exposure point concentration (EPC) using a “sum-of-fractions” approach for the derivation of ecological hazard quotients (HQs).

Because the “sum-of-fractions” approach for ecological HQ derivation represents a fundamental change in the way ecological exposures will be quantified in future ERAs prepared for the SSFL, sections of the SRAM (MWH, 2005) that describe ecological exposure assessment require updating. In addition, DTSC has requested clarification of, or revisions to, the manner in which ecological exposures are quantified as discussed during the February 17, 2010 meeting. This technical memorandum documents revisions to the exposure assessment methods described in the SRAM (MWH, 2005) related to (1) the ”sum-of-fractions” approach for ecological HQ derivation, and (2) clarification of, or revisions to, the manner in which ecological exposures will be quantified in future ERAs prepared for the SSFL.

The ecological exposure assessment methods that are the subject of this technical memorandum are contained within Sections 3.2, 9 and 10 of the SRAM (MWH, 2005). In order to eliminate potential redundancies or inconsistencies between the exposure assessment methods presented in this technical memorandum and those described in the SRAM (MWH, 2005), Sections 3.2, 9 and 10 have been updated

in their entirety and are contained in Attachments 1, 2 and 3, respectively, of this technical memorandum. Updates to text in Sections 3.2, 9 and 10 were originally provided in redline to facilitate DTSC's review of these changes. Upon DTSC review and concurrence of the redline changes in Attachments 1, 2 and 3, changes were accepted, and these attachments now replace Sections 3.2, 9 and 10 in the SRAM (MWH, 2005). In addition to text updates, this technical memorandum includes revisions to tables, figures and attachments, as noted below.

The following figure in Section 3.2 of the SRAM (MWH, 2005) has been revised:

- Figure 3-2 Ecological Risk Assessment Selection of Chemicals of Potential Ecological Concern.

The following tables and appendix in the SRAM (MWH, 2005) have been deleted because ESLs will not be used in future ecological risk assessments conducted for the SSFL; EcoRBSLs, the replacement for ESLs, are presented in the *Ecological Risk-Based Screening Levels for Use in Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura County, California - Technical Memorandum* (Appendix F of the *Standardized Risk Assessment Methodology Rev.2 Addendum* [SRAM Rev.2 Addendum]):

- Table 3-2 Criteria for Evaluating Levels of Detection for Sediment and Water Samples;
- Table 3-3 Terrestrial Mammalian Ecological Screening Levels;
- Table 3-4 Terrestrial Avian Ecological Screening Levels;
- Table 3-5 Terrestrial Invertebrate Ecological Screening Levels; and
- Appendix C – Ecological Screening Level Calculations.

The following table in Section 9 of the SRAM (MWH, 2005) has been deleted, because the information is contained in an updated version of Figure 9-2 (see below):

- Table 9-2 Summary of Generalized Ecological Conceptual Site Model.

The following table and figure in Section 9 of the SRAM (MWH, 2005) have been revised:

- Table 9-3 Summary of Assessment Goals and Endpoints; and
- Figure 9-2 Generalized Conceptual Site Model of Ecological Receptors.

The following table in Section 10 of the SRAM (MWH, 2005) has been revised and renumbered (see Table 10-2, 10-3, 10-4, and 10-8, below):

- Table 10-1 BAF Study Sampling Locations and Analyses;
- Table 10-2 Site-Specific Aquatic Bioaccumulation Factors – Santa Susana Field Laboratory;
- Table 10-3 Site-Specific Terrestrial Bioaccumulation Factors – Santa Susana Field Laboratory; and
- Table 10-4 Life History Parameters Used in Quantifying Ecological Exposures

The following tables have been added to Section 10:

- Table 10-1 Dioxin/Furan and Coplanar PCB Toxicity Equivalent Factors for Ecological Receptors;
- Table 10-2 BAF Study Sampling Locations and Analyses;
- Table 10-3 Site-Specific Aquatic Bioaccumulation Factors – Santa Susana Field Laboratory;
- Table 10-4 Site-Specific Terrestrial Bioaccumulation Factors – Santa Susana Field Laboratory;
- Table 10-5 Summary of Aquatic Bioaccumulation Factors for Chemicals Detected in Sediment;
- Table 10-6 Summary of Terrestrial Bioaccumulation Factors for Chemicals Detected in Soil;
- Table 10-7 Summary of Input Parameters Used to Calculate Regression-Based Bioaccumulation Models;
- Table 10-8 Rationale for Selection of Point Estimate-based BAFs vs. Regression-based BAFs for Select Chemicals; and
- Table 10-9 Life History Parameters Used in Quantifying Ecological Exposures.

Finally, it should be noted that updates described herein only pertain to the exposure assessment portion of the "sum-of-fractions" approach; remaining aspects of this approach are described in the *Ecological Effects Characterization Updates for Use in Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura County, California – Technical Memorandum* (Appendix D of the SRAM Rev.2

Addendum) and the *Ecological Risk-Based Screening Levels for Use in Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura County, California -Technical Memorandum* (Appendix F of the SRAM Rev.2 Addendum).

REFERENCES

MWH Americas, Inc. (MWH), 2005. Standardized Risk Assessment Methodology (SRAM) Work Plan, Santa Susana Field Laboratory, Ventura County, California. Revision 2 – Final. September. HDMSE00198.

MWH. 2009. *Draft Proposed Approaches for Streamlining Future Ecological Risk Assessments at the Santa Susana Field Laboratory - Technical Memorandum.*

ATTACHMENTS

Attachment 1 – Updates to Section 3.2, Standardized Risk Assessment Methodology (SRAM) Work Plan, Santa Susana Field Laboratory, Ventura County, California. Revision 2 – Final

Attachment 2 – Updates to Section 9, Standardized Risk Assessment Methodology (SRAM) Work Plan, Santa Susana Field Laboratory, Ventura County, California. Revision 2 – Final

Attachment 3 – Updates to Section 10, Standardized Risk Assessment Methodology (SRAM) Work Plan, Santa Susana Field Laboratory, Ventura County, California. Revision 2 – Final

Attachment 4 – Lists of Updated References, Tables and Figures

ATTACHMENT 1

Updates to Section 3.2, Standardized Risk Assessment Methodology (SRAM) Work Plan, Santa Susana Field Laboratory, Ventura County, California. Revision 2 – Final

3.2 Additional Criteria for Selection of Chemicals of Potential Ecological Concern

Selection of CPECs can vary from the selection of COPCs for human health risk assessments. Exposure pathways, chemical detection limits, and mode of toxic action for ecological receptors may differ significantly from human receptors. Therefore, additional criteria for selection of CPECs have been added to the COPC screening methods described above to further identify data that are adequate for conducting an ecological risk assessment. The decision process for the selection of CPECs is summarized on Figure 3-2 and is discussed in more detail below.

Analytical detection limits for soil, sediment, and water samples may not be sufficiently sensitive to detect concentrations reported to cause adverse effects in ecological receptors, particularly in aquatic systems. RDLs for USEPA CLP methods are presented in Table 3-1. To assure that chemicals are not eliminated as CPECs if their analytical detection limits are not sufficiently low to detect chemical concentrations that could cause adverse effects, a toxicity screening step has been included in the CPEC selection process. As described in Section 3.2.1, ecological risk-based screening levels (EcoRBSLs) will be used for the purpose of evaluating analytical detection limits in the CPEC selection process. The application of EcoRBSLs in the CPEC selection process is described in Section 3.2.2.

3.2.1 EcoRBSLs as Screening Levels

As discussed in Section 3.2, an additional step is included in the CPEC selection process to assure that chemicals with analytical detection limits (*e.g.*, SQLs) exceeding a level of ecological concern are not eliminated as CPECs. In general, if SQLs exceed EcoRBSLs, then those chemicals with SQLs exceeding EcoRBSLs will be carried forward as CPECs in the ecological risk assessment. Since EcoRBSLs were developed for screening purposes only, they are not intended and should not be used as toxicological benchmarks for establishing cleanup levels.

EcoRBSLs were developed for both aquatic and terrestrial habitats. For aquatic habitats, EcoRBSLs were developed for fresh surface water and sediment. For surface water, EcoRBSLs used to screen SQLs are based on the lower of available water quality criteria, such as the USEPA's National Recommended Water Quality Criteria (USEPA, 2009) for protection of the water column community, or Low toxicity reference value (TRV)-based EcoRBSLs derived for higher trophic level receptors (e.g., great blue heron) using exposure values and models described in Section 10.7 and conservative, chronic toxicity criteria. For sediment, EcoRBSLs are based on the lower of sediment screening benchmarks, such as those included in MacDonald et al. (2000), for the protection of the benthic invertebrate community, or low TRV-based

EcoRBSLs derived for higher trophic level receptors (e.g., great blue heron) using exposure values and models described in Section 10.7 and conservative, chronic toxicity criteria. For terrestrial habitats, EcoRBSLs were obtained directly from appropriate sources for terrestrial plants and invertebrates. EcoRBSLs for terrestrial mammals and avian species were derived using exposure values and models described in Section 10.7 and conservative, chronic toxicity criteria. Because avian and mammalian EcoRBSLs developed for SSFL are derived using site-specific data, these EcoRBSLs are only applicable for environmental conditions and ecological receptors found at the Facility. For terrestrial plants and invertebrates, EcoRBSLs are based on toxicity-concentration data reported in the scientific literature.

The methods used to derive EcoRBSLs, and the EcoRBSLs themselves, are presented in the *Ecological Risk-based Screening Levels for Use in Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura County, California - Technical Memorandum* (Appendix F of the SRAM Rev.2 Addendum). It should be noted that EcoRBSLs were only be calculated for chemicals that have been historically detected in ecological-relevant (i.e., ephemeral surface water, permanent surface water, near-surface groundwater, and seeps and springs) media at the SSFL. This approach results in the possibility that a new chemical not previously detected at the SSFL will not have an EcoRBSL to conduct an SQL comparison, as described above. In the event that a new chemical not previously detected at the SSFL is detected in the future, a process similar to that outlined in the *Process for Selecting the Comprehensive List of Chemicals for Development of Rural Residential Risk-Based Screening Levels for Soil - Technical Memorandum* (Appendix A of the SRAM Rev.2 Addendum) will be used to determine whether an EcoRBSL should be developed for the chemical.

3.2.2 Application of EcoRBSLs in the CPEC Selection Process

This section describes the application of aquatic habitat (surface water and sediment) and terrestrial habitat (soil) EcoRBSLs in the CPEC selection process for ecological risk assessments to be conducted at the SSFL. EcoRBSLs will be used in the CPEC selection process to ensure that SQLs for chemicals in soil and water samples are sufficiently low to detect a chemical concentration that could pose a risk to ecological receptors.

For aquatic habitats, the lowest chemical-specific EcoRBSLs will be compared to investigational unit SQLs for chemicals measured in water. For terrestrial habitats, the lowest chemical-specific low TRV-based EcoRBSL will be used for comparison to investigational unit SQLs for chemicals measured in soil. Because SQLs are sample-specific detection limits, each chemical

data set will comprise a range of SQLs. Therefore, only a portion of the SQLs in a data set may actually exceed the chemical-specific EcoRBSL, while the remaining SQLs will be lower than the EcoRBSL. Depending on the sample size, there may be a sufficient number of samples in a data set with SQLs less than EcoRBSLs to ensure that chemicals are not present at levels that could pose an ecological risk. For the purpose of CPEC selection, if there are a sufficient number of the SQLs in a data set below the EcoRBSLs to conclude that the chemical is not present at concentrations that could pose an ecological risk, and all other criteria are met, then the chemical will be excluded as a CPEC. If SQLs for 50 percent (%) or more of the non-detect sample results exceed the chemical's EcoRBSL, then the chemical will be further evaluated using the decision rules listed below to determine if the chemical should be retained as a CPEC:

- If only one sample was analyzed for a given non-detect chemical and the SQL for that chemical exceeds its respective EcoRBSL, then the chemical should be retained as a CPEC. However, if there is no known or suspected use of the chemical at the site, and the chemical was not detected in any other site media, then it may be appropriate to exclude the chemical as a CPEC and note this exclusion in the Uncertainty Analysis discussion.

- If a chemical cannot be analyzed at a SQL equivalent to, or lower than, the EcoRBSL for a non-detect chemical, then it may be appropriate to exclude the chemical as a CPEC. Other information, including site history and attribution, as well as whether or not the chemical was detected in other site media, should be considered before excluding such a chemical as a CPEC.

- If the highest SQL for a non-detect chemical exceeds that chemical's EcoRBSL, but the arithmetic mean SQL is equal to or lower than the EcoRBSL, then the chemical will not be retained as a CPEC.

- If SQLs for a non-detect chemical exceed that chemical's EcoRBSL, but there were no detected concentrations of other chemicals within that chemical class (e.g., dioxins/furans or PCB congeners) and there is no known or suspected use of the chemical at the site, then the chemical will not be retained as a CPEC.

Justification (*i.e.*, sample size, frequency of detection, number of SQLs below the EcoRBSL) will be presented in the risk assessment in cases where a chemical with one or more SQLs exceeding the EcoRBSL is excluded as a CPEC.

ATTACHMENT 2

Updates to Section 9, Standardized Risk Assessment Methodology (SRAM) Work Plan, Santa Susana Field Laboratory, Ventura County, California. Revision 2 – Final

SECTION 9

9 ECOLOGICAL RISK ASSESSMENT PROBLEM FORMULATION

The steps of an ecological risk assessment are outlined in DTSC guidance (1996) and are shown in the risk assessment flowchart on Figure 1-1. Problem formulation is the first step in the ecological risk assessment process and is intended to establish the scope of the ecological risk assessment and identify major factors to be considered. Key components of the problem formulation are the identification of representative ecological receptors, selection of CPECs, analysis of complete or potentially complete exposure pathways, and exposure routes, identification of assessment endpoints, and the development of a conceptual site model. Although the problem formulation contains the majority of the information needed to complete a Scoping Assessment as described in *Guidance for Ecological Risk Assessments at Hazardous Waste Sites and Permitted Facilities. Part B: Scoping Assessment* (DTSC, 1996), further clarification of this process is warranted. As defined by DTSC (1996), a scoping-level ERA consists of a chemical, physical and biological characterization of the site, and an evaluation of the potential for complete exposure pathways between ecological receptors and chemical stressors. Each RFI report should include an expanded discussion of exposure media, habitats and receptors to reflect site-specific conditions as described further in the sections below.

To facilitate the identification of ecological receptors and potentially complete exposure pathways for the purpose of evaluating potential biological effects, a biological characterization of the SSFL was conducted. The results of the biological surveys are reported in the *Biological Conditions Report, Santa Susana Field Laboratory, Ventura County, California* (provided in Appendix I). The Biological Conditions Report (BCR) describes vegetation communities and plant and wildlife species that were observed or could potentially occur at the SSFL. The BCR provides information on an SSFL-wide basis; however, detailed vegetation mapping, wildlife, and sensitive species occurrences have been prepared for certain units currently being investigated as part of the corrective action provisions of the RFI. While the BCR provides an overview of existing biological conditions for the SSFL, the identification of representative species and exposure pathways must be conducted on an investigational unit basis and reported in unit-specific ecological risk assessments.

The BCR will be used as a basis to prepare the biological characterization of a given investigational unit evaluated in an ecological risk assessment. Additional site visits, vegetation mapping, and biological surveys may also be performed. The types of information obtained for the investigational unit from the BCR or site visits will include:

- identification of vegetation communities and other habitat types found at the specific unit and associated exposure area that may be potentially affected by unit-related chemicals or remediation,
- identification of species and biological communities present or potentially present at the investigational unit or associated exposure area,
- identification of species that are considered to be essential to, or indicative of, normal ecosystem or biological community functions, and
- identification of special status species and their habitats at the investigational unit or associated exposure area.

The BCR contains extensive information concerning habitats and species observed throughout the SSFL. Evaluations of each unit and adjacent areas will be performed to gain additional understanding of the area and species interactions at that particular unit.

9.1 IDENTIFICATION OF ECOLOGICAL RECEPTORS

An ecological receptor is an organism, population, or community that is potentially exposed to chemicals, either onsite or as a result of chemical migration to offsite areas. The purpose of identifying unit-specific ecological receptors is to focus the analysis on the potential for chemicals to adversely affect the specific biological resources present at the investigational unit. Sensitive species onsite or potentially occurring onsite can also be identified. All wildlife and plant species occurring in the vicinity of the investigational unit are potential ecological receptors. The general trophic relationships between ecological receptors at the SSFL are shown on Figure 9-1. Because it is neither practical nor necessary to evaluate the potential risk to every organism occurring at an investigational unit, representative species are chosen to represent groups of ecological receptors with similar life histories or sensitivities. Representative species are ecological receptors that are (1) potentially exposed to chemicals that originated at the investigational unit and (2) related to the unit-specific assessment endpoints as described in Section 9.6. In some instances, however, representative species are surrogate species that are similar to unit-specific ecological receptors with respect to their life history requirements, but are better supported (*e.g.*, have regulatory approved exposure factors) and/or are better studied (*e.g.*, more complete toxicity information).

9.1.1 Method for Selecting Representative Species

DTSC recommends that representative species selected for a given investigational unit include a primary producer, a primary consumer, and higher level consumers (DTSC 1996). Furthermore, DTSC guidance suggests that California species of special concern, federally and state-listed threatened or endangered

species, and species that are proposed for federal or state listing be included as representative species (DTSC 1996). Representative species will be identified using the following criteria:

- Species considered essential to, or indicative of, healthy functioning ecosystems
- Species vital to the structure and function of the food web (*e.g.*, principal prey species or top predators, based on trophic relationships)
- Species that represent ecological niches or guilds
- Species for which toxicological data are readily available in the literature
- Species that link viable exposure pathways and CPECs
- Species that provide protective estimates of exposure and risk to other members of the guild
- Species considered sensitive by federal or state regulatory agencies

The biological, toxicological, and societal criteria listed above are summarized for potential representative species found at the SSFL in Table 9-1. The assessment endpoints in this table are discussed further in Sections 9.6.1 and 10.

9.1.2 Representative Species

Based on the information provided in Table 9-1, representative species that meet most of the requirements were selected and identified. Due to the variety of plant species observed throughout the SSFL and the lack of information concerning invertebrate receptors (*e.g.*, species occurring at the SSFL), generic lower trophic level aquatic and terrestrial species were identified as representative species. Lower trophic level receptors generally uptake chemicals through direct contact with abiotic media; therefore, the more complex exposure models that incorporate life history information and which are used for higher trophic level species, are not appropriate. Proposed general representative species for the SSFL ecological risk assessments include:

- ”water column community” to include aquatic plants (aquatic primary producer), aquatic invertebrates (aquatic primary consumer), fish (aquatic primary consumer), and the embryonic/larval stage of amphibians (aquatic primary/secondary consumer);
- great blue heron (aquatic tertiary consumer);
- terrestrial plants (terrestrial primary producer);
- soil invertebrates (terrestrial detritivore/primary consumer);
- deer mouse (terrestrial primary/secondary consumer);
- hermit thrush (terrestrial primary/secondary consumer);
- mule deer (terrestrial primary consumer);
- red-tailed hawk (terrestrial secondary/tertiary consumer); and

- bobcat (terrestrial secondary/tertiary consumer).

Ecological receptors from each of the trophic levels in aquatic and terrestrial habitats were chosen as representative species. The food web interactions for these species are shown on Figure 9-1. Not all of the representative species listed above will be evaluated for each investigational unit; only those associated with the habitats occurring at that unit will be evaluated. For example, aquatic receptors would not be evaluated at units with only terrestrial habitat types. Therefore, it is likely that a subset of the representative species listed above will be evaluated in each of the unit-specific ecological risk assessments.

Aquatic plants, aquatic invertebrates, fish, and the embryonic/larval stage of amphibians (i.e., the water column community) represent receptors with potential exposures to chemicals in sediment and surface water, and are prey species for fish-eating birds, such as the great blue heron (*Ardea herodias*). In addition to being a food source, aquatic plants provide refuge and nesting habitats for various species. Aquatic invertebrates and fish were selected because they may bioconcentrate or bioaccumulate chemicals through the food chain. The great blue heron was included as a receptor species because it is at the top of the aquatic food chain. The aquatic representative species were chosen to increase the specificity of the risk assessments, and expand the representation of feeding guilds and prey species.

Terrestrial plants were chosen because they provide forage for herbivores, (*i.e.*, may bioaccumulate and expose higher trophic levels to unit-related chemicals) are directly exposed to chemicals in the soil, and are indicative of the status of wildlife habitat. The California state-protected Santa Susana tarplant (*Hemizonia minthornii*) was not specifically chosen as a representative species because it may have low potential for exposure to CPECs at most investigational units since it grows out of small pockets of soil covering bedrock. In general, only limited toxicological information exists for plant species. For each unit, a qualitative assessment of effects of site-related chemicals on vegetation will be made by comparing factors such as abundance and diversity between areas with detected chemical concentrations and site-specific reference locations (see Section 11.1.4, Section 12.1.5, and Appendix I).

Soil invertebrates were selected because they provide forage for insectivores (*i.e.*, may bioaccumulate and expose higher trophic levels to investigational unit-related chemicals) and are directly exposed to chemicals in the soil.

The deer mouse was chosen because it is prevalent throughout the SSFL, it is a prey species for carnivores (*e.g.*, raptors and bobcats), it is a burrowing mammal, and it represents several exposure

pathways. The deer mouse is directly exposed to soil and has complete ingestion exposure pathways for both insects and plants.

The mule deer was selected as a representative species because its diet consists almost entirely of vegetation, it has a relatively large home range, and its rate of food consumption is relatively high as compared to other species.

The hermit thrush was selected because it is representative of a primary and secondary consumer, is observed frequently at the SSFL, and has a high ingestion rate relative to body weight.

The red-tailed hawk and bobcat were chosen as representative species because of their prevalence on the SSFL, and because as high trophic level carnivores, they are exposed to chemicals though ingestion of a number of different prey items.

Due to the lack of relevant toxicity data in the peer-reviewed literature, adult amphibians and reptiles were not quantitatively evaluated in the ecological risk assessments for SSFL (Sparling *et al*. 2000). As no special-status amphibian species are found in the ponds at SSFL, ambient water quality criteria (AWQC) are anticipated to be protective of early-life stage exposures of amphibian embryos and tadpoles (DTSC 2005a). Evaluation of adult amphibians and reptiles with respect to terrestrial habitat will be discussed further in Section 9.6.1.

9.2 Identification of Complete or Potentially Complete Exposure Pathways

An exposure pathway is the means by which a representative species is exposed to a CPEC. A complete exposure pathway must include four components: (1) a source and mechanism of chemical release, (2) a retention or transport mechanism through an environmental medium, (3) a point of potential contact with the impacted medium (*i.e.*, an exposure point), and (4) an exposure route (a mechanism of uptake) at the exposure point USEPA (1989c). The exposure pathway is considered incomplete if any of the four components are determined to be absent, with the exception that the transport mechanism is not required if the ecological receptor is in direct contact with the release point of the CPEC. Exposure to ecological receptors may occur directly through primary exposure pathways or indirectly through secondary exposure pathways (*e.g.*, exposures through food webs). Potential exposure pathways evaluated for the ecological risk assessments are discussed below.

9.2.1 Surface Water

Potential ephemeral or permanent surface water pathways include direct and/or dermal contact, root contact, ingestion, and inhalation of vapors. Terrestrial organisms (e.g., deer mouse, mule deer, bobcat, hermit thrush, and red-tailed hawk) may be dermally exposed to waterborne CPECs as a result of wading in contaminated waters, and aquatic receptors may be exposed through osmotic exchange or respiration of surface waters. However, dermal exposures have been identified as not typically contributing to risks (USEPA 2000a, 2000b) and will not be evaluated for terrestrial receptors.

Ingestion of CPECs in ephemeral or permanent surface water and seeps/spring presents a complete exposure route for terrestrial receptors (e.g., deer mouse, mule deer, bobcat, and hermit thrush). Red-tailed hawk water requirements are met in most instances from food intake (Zeiner *et al*. 1990b); therefore, incidental ingestion of CPECs in ephemeral or permanent surface water will not be evaluated for the red-tailed hawk. Ingestion of CPECs in ephemeral or permanent surface water presents a complete exposure route for aquatic receptors (e.g., aquatic plants, aquatic invertebrates, amphibians, and great blue heron).

Ephemeral surface water exposure pathways for amphibians are only applicable when ephemeral fresh surface water is present for the duration of an amphibian's breeding cycle. Amphibians require adequate persistence of suitable aquatic habitat to complete their embryonic and larval stages. Although no sensitive amphibian species have been observed at the SSFL; the California red-legged frog (*Rana draytonii*) is a federally listed, threatened species potentially found at or in the vicinity of the SSFL. The California Wildlife Habitat Relationship System (DTSC, 2010) states that the California red-legged frog requires permanent or nearly-permanent pools for larval development, which can take from 11 to 20 weeks for tadpoles to reach metamorphosis. Species with shorter ephemeral water life-cycle requirements than the red-legged frog that are known to occur, or potentially may occur, at the SSFL were investigated to be conservative in future evaluations of amphibians at SSFL sites. Both the California toad (*Bufo boreas halophilus*) and the Pacific tree frog (*Pseudacris egilla*) are such species. These two amphibians have an average larval stage lasting approximately four weeks plus a 7- to 10-day period for eggs to hatch, for an average duration of up to six weeks (DTSC, 2010). Therefore, if it is determined that an ephemeral surface water body will persist for at least six weeks at a given SSFL site, then it will be assumed that the site provides potential habitat for amphibians and hazards to this receptor group will be evaluated. This determination will be based on the duration of ephemeral surface water present on a site-by-site basis, as determined by the biological assessment conducted for the site and historical information regarding surface water persistence.

Surface water exposure pathways for fish (e.g., uptake by biota, ingestion and direct contact) are potentially complete only for permanent surface water bodies because fish are unlikely to be present in ephemeral surface water. CPECs in ephemeral surface water may be taken up by terrestrial plants whose roots are in contact with surface water and/or pore water; therefore, root contact represents a complete exposure route for terrestrial plants. CPECs in ephemeral or permanent surface water may be taken up by aquatic plants (*e.g.*, algae and emergent plants); therefore, direct contact and root contact represent complete exposure routes for aquatic plants. . Inhalation of vapors from contaminated surface water may also occur, but this is a less than significant exposure route when compared to direct contact and ingestion; therefore, this pathway will not be evaluated.

9.2.2 Sediment

Potential exposure pathways to ephemeral or permanent sediments are evaluated for those units containing surface water bodies (*e.g.*, ponds, streams). Receptors such as the great blue heron that forage in ephemeral or permanent surface water bodies may incidentally ingest CPECs in sediments associated with prey species such as benthic invertebrates or fish; therefore, incidental ingestion and exposure to CPECs in ephemeral or permanent sediment via food-chain uptake represent potentially complete exposure pathways for the great blue heron.

Terrestrial receptors may have direct contact with or incidentally ingest CPECs in permanent sediments while wading or drinking from a water source, but these pathways are considered less than significant due to the expected minimal duration of this exposure. Incidental ingestion of ephemeral sediment by terrestrial receptors may occur while foraging, grazing on vegetation, or grooming, and is a complete exposure route for the deer mouse, the hermit thrush, and mule deer. Additionally, terrestrial receptors (i.e., deer mouse, hermit thrush, mule deer, bobcat, and red-tailed) that forage in areas of ephemeral surface water bodies may incidentally ingest CPECs in ephemeral sediments associated with prey species such as soil invertebrates and deer mice; therefore, incidental ingestion and exposure to CPECs in ephemeral sediment via food-chain uptake represents a potentially complete exposure pathway for terrestrial receptors.

Aquatic receptors may be directly exposed to sediment-associated contaminants by direct contact and by osmotic exchange, respiration, or ventilation of sediments in the water column or in pore water. Ephemeral sediment exposure pathways for amphibians are only applicable when ephemeral surface water is present for the duration of an amphibian's breeding cycle as presented previously in Section 9.2.1.

Sediment exposure pathways for fish (e.g., uptake by biota, ingestion and direct contact) are potentially complete only for permanent surface water bodies because fish are unlikely to be present in ephemeral surface water.

Incidental ingestion of, dermal contact with, and food-chain uptake of CPECs in ephemeral or permanent sediment is a complete exposure pathway for aquatic invertebrates. Emergent aquatic plants may be exposed to CPECs in permanent sediments through root contact and direct contact with contaminated sediments, which represents a complete exposure route for aquatic plants. Exposure through root contact with CPECs in ephemeral sediment represents a complete exposure pathway..

9.2.3 Soil

For purposes of ecological risk assessments at the SSFL, only soil to a depth of six feet bgs will be evaluated (DTSC 1998b). Burrowing animals may be exposed to CPECs at substantially deeper soil depths than other species. It was with this consideration that the soil depth interval of up to six feet bgs forms the basis for ecological risk assessments. While the zero to six foot depth interval is appropriate for the burrowing animals (*e.g.*, deer mouse), this depth interval is not appropriate for most other terrestrial receptors that would only be exposed to CPECs in "surface" soils (*i.e.*, no more than two feet deep) (See Section 10.2).

Dermal contact, foliar deposition (deposition of soil or dust on plant leaves), and ingestion are the potential exposure routes for CPECs in soil for terrestrial receptors. The dermal contact pathway is considered less significant than other exposure pathways such as soil and food ingestion. In addition, the parameters needed to estimate dermal exposure are lacking for both bird and mammalian wildlife (USEPA 2000a, 2000b). Terrestrial plants may be exposed to soil CPECs in the soil by foliar deposition or via root uptake. Incidental ingestion of soil by terrestrial target receptors may occur while foraging, grazing on vegetation, or grooming, and is a complete exposure route for the deer mouse, the hermit thrush, and mule deer. Incidental ingestion of soil by higher trophic level terrestrial target receptors may occur while foraging, grazing on vegetation, or grooming, yet is a potentially complete but insignificant exposure route for the bobcat and red-tailed hawk. Soil invertebrates directly consume soil in order to meet nutritional requirements; therefore, this represents a complete exposure pathway for this receptor.

9.2.4 Soil Vapor

Exposure routes of airborne CPECs in soil, weathered bedrock and groundwater include inhalation of vapors and/or dust. Airborne CPECs are usually limited to burrowing animals that may be exposed to

CPECs while in their burrow or while digging or foraging. While aerial dispersion of volatile emissions may be potentially complete for surface-dwelling terrestrial wildlife species, they are considered less significant relative to other routes of exposure (USEPA 2005c); therefore, this pathway will not be evaluated for these receptors. Exposure to CPECs in burrow air is a complete exposure pathway for only the deer mouse.

9.2.5 Groundwater

At many sites, groundwater is considered to be inaccessible to representative species (*i.e.*, groundwater occurs at depths greater than six feet bgs) (see Section 10.2, *Soil Depth Intervals For Terrestrial Representative Species*). However, representative species may be exposed to CPECs in groundwater, for example where groundwater comes to the surface in seeps or springs and plant roots can come into contact with groundwater that is near the ground surface (See Section 10.2).

Potentially complete and incomplete exposure pathways for Chatsworth formation groundwater, near-surface groundwater, and groundwater that appear as seeps/springs are distinctly different. Potential exposure pathways for Chatsworth formation groundwater are incomplete for all representative species. However, constituents in Chatsworth formation groundwater may migrate to near-surface water through vertical migration and vapor transport. Near-surface groundwater may daylight at the surface as seeps/springs. In addition, seeps/springs may flow into downgradient ephemeral or permanent surface water bodies. Terrestrial plants may be exposed to near-surface groundwater and/or seeps/springs through root contact. Based on prior discussions with DTSC, the depth to which terrestrial plants may be exposed to near-surface groundwater is limited to six feet bgs. Groundwater below this depth is not considered to represent a complete exposure pathway.

The deer mouse, hermit thrush, mule deer, and bobcat may be exposed to CPECs in seeps/springs through incidental ingestion and direct contact. However, as described in Section 9.2.1, direct and/or dermal exposures have been identified as not typically contributing to risks (USEPA 2000a, 2000b) and will not be evaluated for terrestrial receptors. Additionally, as described in Section 9.2.1, the water requirements for the red-tailed hawk are met in most instances from food intake (Zeiner *et al*. 1990b); therefore, incidental ingestion of CPECs in seeps/springs will not be evaluated for the red-tailed hawk.

9.2.6 Food Webs

Ecological receptors may be exposed to CPECs originating from soil, weathered bedrock, surface water, sediment, seeps/springs, and groundwater indirectly through the ingestion of food items in contact with

these media that have bioaccumulated CPECs. Exposure to CPECs through the ingestion of food items is a potentially complete exposure pathway for amphibians, the deer mouse, mule deer, bobcat, hermit thrush, and red-tailed hawk. Exposure to CPECs via aquatic prey that originate from fresh ephemeral surface water and sediment during the wet season is a potentially complete but insignificant exposure pathway for the deer mouse, mule deer, bobcat, and red-tailed hawk because these species forage primarily on terrestrial biota rather than aquatic food items. Exposure to CPECs in terrestrial biota via the ingestion of food items is a potentially complete but insignificant exposure pathway for the great blue heron because the majority of great blue heron food is assumed to be obtained in aquatic habitats. Exposure to CPECs in aquatic prey from permanent and ephemeral water bodies is a potentially complete exposure pathway for amphibians, fish, and the great blue heron. A food web showing the relationship between receptors at the SSFL is provided on Figure 9-1. For example, higher trophic level fauna (*e.g.*, red-tailed hawk and bobcat) may be exposed to chemicals accumulated by prey species (*e.g.*, deer mouse). Representative species exposure through ingestion of prey will be evaluated using food web models as described in Section 10.

9.3 Integration of Representative Species and Exposure Pathways

Not all representative species occur at each investigational unit, just as not all potential exposure pathways are applicable to each investigational unit and/or representative species. To determine which pathways and representative species are appropriate for ecological risk assessment at each of the investigational units on the SSFL, the following questions will be addressed:

- What habitats and representative species are present?

  The presence or absence of certain habitats at an investigational unit will determine the representative species evaluated for that investigational unit. For example, if no water is present, there is no need to evaluate aquatic receptors.

- Which CPECs are present?

  Selection of CPECs for ecological risk assessment purposes will follow the procedure described in Sections 3.1 and 3.2. If no CPECs are present at the site or investigational unit, then there is no exposure.

- Of the relevant pathways, which ones apply to the representative species present?

  Once the representative species, CPECs, and potential exposure pathways have been derived for the investigational unit, pathways that link the representative species and CPECs will be evaluated.

Once a chemical is selected as a CPEC, its physicochemical properties will be used to determine if it may be transported to representative species via identified exposure pathways. Potential pathways for each representative species are identified in Figure 9-2. CPECs specific to a particular pathway and representative species will be selected by physicochemical properties (*e.g.*, molecular weight, Henry's law constant). The effects of physicochemical properties on routes of exposure and representative species uptake are discussed further in Section 10.

9.4 ECOLOGICAL CONCEPTUAL SITE MODEL

The ecological CSM is a diagrammatic representation of potential sources of CPECs, primary and secondary exposure pathways, and ecological receptors that may be exposed to CPECs via a particular pathway. The generalized CSM on Figure 9-2 evaluates potentially complete and significant exposure pathways for the SSFL and integrates biotic and abiotic exposure routes; it is an example of the individual CSMs that will be created for each investigational unit.

9.5 SELECTION OF EXPOSURE AREAS

As defined in Section 1.7, an “exposure area” is the minimum area that will sustain an assumed exposure for ecological receptors. Accordingly, an exposure area for a particular representative species is the area where the species occurs and may come into contact with unit-specific chemicals. For the purposes of an ecological risk assessment, with few exceptions, an exposure area is defined as an individual area, called an investigational unit, of the SSFL that has been delineated based on the presence of chemicals and past operations. Either individually or combined into groups, the SWMUs and AOCs, defined under the Corrective Action requirements of RCRA, are considered units. For the SSFL ecological risk assessments, an exposure area will be the investigational unit.

In addition, an exposure area may be the home range of the representative species and may potentially encompass several units and areas outside the investigational units. The water column community as described in Section 9.1.2, is limited to areas of ephemeral or permanent surface water; therefore, their exposure area is defined by the limits of the water body. As terrestrial plants are sessile, the exposure area for plants will be the area of the individual unit. Similarly, as soil invertebrates are considered not to move great distances, the exposure area for soil invertebrates will be the area of the investigational unit. Determining the exposure area for the other representative species depends on life history requirements and home range of the receptor as well as and the type and amount of habitat present at an investigational unit, the area of the investigational unit and the distribution of suitable habitat throughout the SSFL.

There are three representative species at the SSFL with home ranges that are larger than the size of any of the investigational units: bobcat, red-tailed hawk, and mule deer. The typical home range sizes, typical dietary items consumed and actual percentage of dietary items used in the ERA (Table 10-7) for these receptors are listed below.

Representative Species	Home Range Size	Typical Dietary Items	Site-specific Dietary Item Percentages[a]
Bobcat	1.8 to 20.7 sq. mi. (Zezulak and Schwab 1980)	Mostly rabbits and rodents with some deer, birds, reptiles, amphibians, invertebrates, and vegetation (Zeiner *et al*. 1990a)	100% Deer mouse
Red-tailed Hawk	0.3 to 3.8 sq. mi. (Zeiner *et al*. 1990b)	Small mammals, small birds, reptiles and amphibians, and invertebrates (Sherrod 1978)	100% Deer mouse
Mule Deer	0.20 to 1.19 sq. mi. for does (Taber and Dasmann 1958) 0.15 to 3.2 sq. mi. for bucks (Chapman and Feldhammer 1992)	Vegetation	100% Vegetation

Note:
[a]Site-specific dietary item percentages are reported in Table 10-7.

There are a variety of developed land and wildlife habitats across the SSFL. The amount of foraging habitat available at each investigational unit will determine the relative proportion of exposure that particular unit contributes to the total exposure of the large home-range representative species. Based on the types of prey species or food items of the bobcat, mule deer, and red-tailed hawk and the types of habitats that occur at the SSFL, the habitats that these three species would be expected to most frequently use on the facility are listed below.

Representative Species	Foraging Habitats	Reference
Bobcat	Native and nonnative grasslands, Venturan coastal sage scrub, chaparral, coast live oak woodlands, rock outcrops, coast live oak riparian forest, and southern cottonwood willow riparian forest	Zeiner *et al*. 1990a
Red-tailed Hawk	Native and nonnative grasslands, Venturan coastal sage scrub, rock outcrops, ruderal habitat	Zeiner *et al*. 1990b
Mule Deer	Native and nonnative grasslands, coast live oak woodlands, coast live oak riparian forest,	Wallmo 1978, 1981

Representative Species	Foraging Habitats	Reference
	southern cottonwood willow riparian forest, Venturan coastal sage scrub, and chaparral.	

Native and nonnative grasslands are the primary habitats of rodents and all four of the large home range species include rodents in their diets; therefore, they would be expected to forage in these habitats. Bobcats generally use the cover of scrub, rock outcrops, and trees to stalk and capture prey in the open (Zeiner *et al*. 1990a). Bobcats are not considered to use dense habitat types like Baccharis scrub or some of the wetland habitats that do not afford adequate cover. Red-tailed hawks forage over open grasslands and fields, over rock outcrops, and in the more open Venturan coastal sage scrub as opposed to dense chaparral (Zeiner *et al*. 1990b). Although hawks use woodlands and riparian habitats for perching or nesting, they generally do not forage in these habitats. Mule deer are expected to forage primarily on small branches and leaves of trees, and occasionally on new scrub growth and grasses (Wallmo 1978, 1981).

As presented in the *Draft Proposed Approaches for Streamlining Future Ecological Risk Assessments Technical Memorandum* (MWH, 2009), large home range receptors (e.g., red-tailed hawk) will be evaluated only at a combined investigation unit scale, or a facility-wide scale. Specific steps to calculate risks to large home range representative species are described in more detail in the *Draft Large Home Range Receptor Ecological Risk Assessment Methodology, Santa Susana Field Laboratory, Ventura County, California – Technical Memorandum* (Appendix G of the SRAM Rev.2 Addendum).

9.6 ENDPOINTS

An assessment endpoint is an explicit expression of the environmental value that is to be protected (USEPA 1992d). Selection of assessment endpoints is designed to focus the ecological risk assessment on those ecological features or resources that have substantial aesthetic, social, or economic value or are important in the biological functions or biodiversity of the system. Definition of appropriate assessment endpoints avoids making decisions on the basis of trivial or insignificant effects.

A measurement endpoint is a measurable ecological characteristic that is related to the valued characteristic chosen as the assessment endpoint. Measurement endpoints often are expressed as the statistical or arithmetic summaries of the observations that make up the measurement. (USEPA 1992d)

Successful ecological assessments are based on adequate definition of assessment endpoints and their associated measurement endpoints (Beanlands and Duinker 1983; Suter 1993). Establishing appropriate assessment and measurement endpoints requires that ecological species and functions purportedly at risk be identified and that some measurable aspect of these values be defined (Barnthouse *et al*. 1986; USEPA 1989c,d, 1992d; Norton *et al*. 1992; Suter 1993). This element is crucial because both assessment and measurement endpoints must be specific and relevant and should be limited to organisms that spend a significant portion of their lives or derive a significant portion of their diet or physiological needs from the investigational unit. The relationship between the assessment goals, assessment endpoints, and measurement endpoints is shown in Table 9-3.

9.6.1 Assessment Endpoints

Assessment endpoints are formal expressions of the actual environmental values to be protected from risk (Suter 1993). They need to be specific and should be tied directly to specific ecological values requiring protection. Well-crafted assessment endpoints provide a clear, logical connection between regulatory policy goals and anticipated ecotoxicological investigations. The assessment goal for the SSFL is to protect wildlife and plant species from certain chronic or acute effects resulting from site-related chemicals. This goal is used as a basis for defining assessment endpoints applicable to all sites, as follows:

1. Protect terrestrial avian carnivores (e.g., red-tailed hawk) by limiting acute and chronic adverse effects of direct and/or secondary exposure to site-related CPECs on growth, survival, and reproduction.
2. Protect terrestrial mammalian carnivores (e.g., bobcat) by limiting acute and chronic adverse effects of direct and/or secondary exposure to site-related CPECs on growth, survival, and reproduction.
3. Protect terrestrial mammalian omnivores (e.g., deer mouse) by limiting acute and chronic adverse effects of direct and/or secondary exposure to site-related CPECs on growth, survival, and reproduction.
4. Protect terrestrial avian omnivores (e.g., hermit thrush) by limiting acute and chronic adverse effects of direct and/or secondary exposure to site-related CPECs on growth, survival, and reproduction.
5. Protect terrestrial mammalian herbivores (e.g., mule deer) by limiting acute and chronic adverse effects of direct and/or secondary exposure to site-related CPECs on growth, survival, and reproduction.
6. Protect the abundance and diversity of native terrestrial vegetation by limiting acute and chronic adverse effects from exposure to site-related CPECs.

7. Protect semi-aquatic piscivorous birds (e.g., great blue heron) by limiting acute and chronic adverse effects of direct and/or secondary exposure to site-related CPECs on growth, survival, and reproduction.
8. Protect the abundance and diversity of benthic invertebrate community by limiting acute and chronic adverse effects from exposure to site-related CPECs.
9. Protect the abundance and diversity of terrestrial invertebrate community by limiting acute and chronic adverse effects from exposure to site-related CPECs.
10. Protect the abundance of wetland and aquatic vegetation by limiting acute and chronic adverse effects from exposure to site-related CPECs.
11. Protect the embryonic/larval life stage of amphibians by limiting acute and chronic adverse effects of direct and/or secondary exposure to site-related CPECs on growth, survival, and reproduction.
12. Protect the abundance and diversity of the water column community (e.g., aquatic plants, aquatic invertebrates, fish, and embryonic/larval amphibians) by limiting acute and chronic adverse effects from exposure to site-related CPECs.

Adult amphibians and reptiles are not included as assessment endpoints due to the lack of sufficient toxicological data for these organisms. Because adult amphibians and reptiles represent important species within the SSFL ecosystem, however, they will be evaluated qualitatively by comparison to terrestrial species in similar trophic levels.

Assessment endpoints for each investigational unit will vary depending on the types of contamination, habitat, and receptors that occur on each site.

9.6.2 Measurement Endpoints

For the purposes of SSFL ecological risk assessments, measurement endpoints include survival, reproductive impairment, reduction of growth, and other less serious effects to individuals that are most relevant to assessment endpoints (*e.g.*, protection of populations and communities of concern and their food sources). Not all of these measurement endpoints will be assessed by direct measure of the ecological population, rather they are evaluated during exposure and effect analysis and risk characterization through exposure modeling associated with applicable media for each receptor (Section 10.4, Section 11) and by estimation of HQs (Section 12) through comparison of CPEC concentrations in applicable media to NOAEL-based and LOAEL-based EcoRBSLs. These EcoRBSLs are presented in the *Ecological Risk-Based Screening Levels for Use in Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura California Technical Memorandum* (Appendix F of the SRAM Rev.2 Addendum).

Indicators of aquatic and terrestrial habitat quality as well as field observations will provide a "weight of evidence approach" to qualitatively assess measurement endpoints during this risk assessment. Information collected during development of the BCR or site investigation (*e.g.*, soil or rock staining) will then be used to further support or refute the results of the conservative assumptions made during the risk assessment.

ATTACHMENT 3

Updates to Section 10, Standardized Risk Assessment Methodology (SRAM) Work Plan, Santa Susana Field Laboratory, Ventura County, California. Revision 2 – Final

SECTION 10

10 ECOLOGICAL EXPOSURE ASSESSMENT

Assessing the potential for adverse effects to ecological receptors due to contact with environmental chemicals requires the estimation of exposure to these chemicals. Such exposure estimation is a critical step in the ecological risk assessment process. Exposure estimates are also needed to quantitatively evaluate the relative importance of various chemical sources or pathways when considering remediation strategies. Exposure analysis attempts to quantify the magnitude or type of actual and/or potential exposures of ecological receptors to site-specific chemicals, termed chemical stressors. This section identifies methods for characterizing representative species exposure to chemicals identified at the investigational units.

10.1 Calculation of Exposure Point Concentrations

For ecological risk assessments at the SSFL, the RME scenario will be evaluated. RME EPCs will be calculated using area-averaging, and will be represented by the UCL as recommended by the latest version of USEPA's ProUCL. The method selected for calculation of the UCL will be based on the results of statistical tests to determine the type of data distribution.

Terrestrial species at the SSFL have been identified and described in the BCR (Appendix I). Based on the listing of known terrestrial mammalian, avian, and plant species at the SSFL, representative species' were selected as ecological receptors to be evaluated in site-specific ecological risk assessments at the SSFL (Section 9). These include representative prey species (*e.g.*, plants, soil invertebrates), primary/secondary consumers (*e.g.*, hermit thrush, deer mouse), avian carnivore (*e.g.*, red-tailed hawk), mammalian carnivores (*e.g.*, bobcat), large mammalian herbivores (*e.g.*, mule deer), and semi-aquatic avian piscivores (e.g., great blue heron). Potential risks to these representative species will be used to infer potential risks to other taxonomically and trophically related ecological receptors that may occur at an investigational unit. As previously described, potential hazards to terrestrial plants will be qualitatively assessed as described in Section 12.1.5. Of the representative classes of species selected as potential terrestrial receptors for ecological risk assessment at the SSFL, prey species and the primary/secondary consumers would have the greatest and most significant direct contact with soils. Higher trophic terrestrial species such as the avian and mammalian carnivores are primarily exposed to CPECs through the consumption of prey species. Therefore, direct contact with soil will be evaluated for primary and secondary consumers and for the mule deer. Burrowing animals may be exposed to CPECs at substantially deeper soil depths than other species (see Section 9.2.3 and 10.2 for further details regarding soil depth intervals).

For aquatic receptors, current EPCs will be calculated from the available surface water (unfiltered samples) and sediment concentration data using the same approach as was described above for soil. Data from unfiltered surface water samples provide a protective measure of exposure to aquatic biota and are appropriate for estimating current surface water (drinking water) exposures to terrestrial biota. At some sites, future discharge of the groundwater to the surface may result in hypothetical future exposures to contaminants in groundwater. Future exposures predicted using fate and transport models are derived using groundwater data (mostly filtered samples). Consequences to risk estimates associated with future surface water exposures due to the use of filtered versus unfiltered samples will be discussed in the uncertainty analysis of the risk assessments.

These water and sediment EPCs will be used as the measures of exposure for aquatic receptors for ecological risk characterization.

The upper stratum or biotic zone for sediment is considered the top two centimeters. This upper stratum is thought to be most important from an ecological perspective because most of the biota associated with sediments are found in this stratum. However, to account for the possible resuspension of sediments, all sediment concentration data up to a depth of two feet bgs will be used for developing sediment EPCs.

10.6.1 Dioxins/Furans and PCBs

Some chemicals have been shown to act through similar mechanisms or on the same target organ, and thus can be considered to have additive effects on organisms. For instance, coplanar PCBs and dioxins/furans are believed to exhibit similar toxic action to that of 2,3,7,8-TCDD, but with differing relative degrees of toxicity among the individual coplanar PCB and dioxin/furan congeners. These compounds are all highly lipophilic and persistent and readily bioaccumulate in food chains. As with 2,3,7,8-TCDD, at certain doses they all may cause body weight loss, thymic atrophy, dermal lesions, impairment of immune responses, hepatotoxicity, carcinogenesis, teratogenicity, and reproductive toxicity (Safe 1990). Dioxin/furan and coplanar PCB TEFs (Table 10-1) are measures of the relative toxicity of a dioxin/furan or coplanar PCB congener to the toxicity of 2,3,7,8-TCDD, and may be applied to exposure concentrations, dosages, or toxicity values (Van den Berg et al. 1998, 2006). For ecological risk assessments conducted at the SSFL, dioxin/furan and coplanar PCB congener-specific TEFs for mammals, birds, and fish will be applied to the concentration of individual dioxin/furan and coplanar PCB congeners, respectively, from each sample collected to generate congener concentrations relative in toxicity to a concentration of 2,3,7,8-TCDD. Concentrations will then be summed to calculate a 2,3,7,8-TCDD toxicity equivalent (TEQ) and a PCB TEQ (i.e., coplanar PCBs) concentration for each sample

collected. It should be noted that while the fish TEFs used to derive a 2,3,7,8-TCDD TEQ and a PCB TEQ enable evaluation of only one component (i.e., fish) of the water column community, they are still at least partially representative of the water column community. However, the uncertainty of the conservative assumption to use TEQs derived from TEF's applicable to fish to ultimately evaluate water column community will be discussed in the uncertainty section of future ERAs at the SSFL. Further discussion of TEQs are presented in Section 12.1.1 and Section 12.1.2.

Dioxin/furan and coplanar PCB data reported as "totals" will not be included in this process as individual congeners are already included in TEQ values. When congener-specific concentrations fall below their respective SQLs, a value of zero will be used for these congeners in the calculation of a cumulative 2,3,7,8-TCDD TEQ value per communication with DTSC in 2010. 2,3,7,8-TCDD TEQ and PCB TEQ concentrations will be used to calculate the 2,3,7,8-TCDD HQ and an HQ for the coplanar PCB TEQ, as described further in Section 12.1.2.

It should be noted that TEFs are unavailable for non-coplanar PCB congeners, therefore risks from non-coplanar PCB congeners will be evaluated through risk estimates calculated for Aroclors. This is consistent with DTSC policy and the risk evaluation approach used in human health risk assessments conducted at the SSFL.

10.2 Soil Depth Intervals for Terrestrial Representative Species

The purpose of this section is to clarify the approach, and to identify and establish species-specific soil depth intervals for evaluation in ecological risk assessments at the SSFL. An important factor to consider when evaluating a species' exposure to soil is the species' habitat use.

Plants. It should be noted that in ecological risk assessments for SSFL, calculation of exposures to plants are considered only in regard to calculating exposures to higher trophic level biota that consume plants—potential risks to plants themselves are evaluated using field observations (see Sections 11.4 and 12.1.5). Accordingly, only the root zones of plants that are likely to be food sources for representative plant consumers are considered in ecological risk assessments for SSFL. In general, herbaceous grasses and forbs are considered the preferred food for small mammals (as represented by the deer mouse). Mule deer browse and graze, preferring forbs, grasses, and tender new growth of various shrubs (*e.g.*, ceanothus, bitterbrush) (Zeiner *et al*. 1990a).

Clearly, the root zone depth will vary depending on environmental variables such as soil type and moisture content, and on the plant species. Most herbaceous grasses and forbs occurring on the SSFL are considered to have relatively shallow root systems (*i.e.*, less than two feet bgs). Raven *et al*. (1986) reports that much of the root hairs, and thus much of the root absorption, is found in surface soils. Moreover, in an article published in SETAC News 1998 that discusses the soil depths accessed by plants, the author recommends a soil depth of 39 inches bgs for plants (B. Davis 2000). Accordingly, for the most part, the soil depth interval used to calculate the uptake of CPECs into plants consumed by representative herbivores will be zero to two feet bgs.

Soil Invertebrates. Although some soil invertebrates (*e.g.*, earthworms) may burrow up to three feet in depth, they generally consume vegetation and detritus in surface soils (Nuutinen and Butt, 2002). As with plants, the calculation of exposures to soil invertebrates is important in estimating exposures to insectivorous consumers (*e.g.*, hermit thrush, deer mouse). As both the hermit thrush and deer mouse primarily glean insects from the ground or in vegetation—*i.e.*, glean soil invertebrates that are primarily exposed to surface soils. Accordingly, the soil depth interval used to evaluate risks and the uptake of CPECs into soil invertebrates consumed by insectivores will be zero to two feet bgs.

Deer Mouse. A number of small mammal species live on the surface or in shallow burrows. However, some small mammal species will construct burrows in deeper soils. Accordingly, to address potential exposures to CPECs in deeper soils, a soil depth interval of up to six feet bgs was considered for the deer mouse.

Consistent with DTSC's (1998b) EcoNOTE No. 1, the soil depth interval with greatest potential exposure and risk will be selected as the soil depth interval for assessing exposure and risk to burrowing animals in the risk assessment. Accordingly, the zero to two feet bgs, zero to four feet bgs, and zero to six feet bgs depth intervals will be evaluated to determine which soil depth interval is likely to pose the greatest exposure and risk. The soil depth interval representing the greatest potential exposure and risk will be selected using a concentration-toxicity screen. For each chemical detected within a depth interval the toxicity-adjusted concentration will be calculated as the measured concentration divided by the appropriate EcoRBSL. Next, the sum of chemical-specific toxicity-screen results within each depth interval will be calculated. The soil depth interval with highest summed concentration-toxicity value will be selected to evaluate potential risks to the deer mouse.

Mule Deer. The primary exposure route for larger herbivorous mammals is through the consumption of aboveground vegetation. In particular, the mule deer grazes or browses, preferring tender new growth of

various forbs, grasses, and shrubs (Zeiner *et al*. 1990a). Accordingly, direct contact with surface soil (zero to two feet bgs) will be evaluated for the mule deer.

Red-Tailed Hawk and Bobcat. The primary exposure route to higher trophic species such as the red-tailed hawk and the bobcat is through the consumption of prey species. Therefore, direct contact with soil will not be evaluated for the red-tailed hawk and bobcat.

10.3 Estimation of VOC Concentrations in Burrow Air

Burrow air concentrations may either be measured directly or estimated, for example using a steady-state soil to burrow air partitioning model (Hope 1995). To evaluate these options, burrow air VOC concentrations estimated using the Hope (1995) model were compared against soil vapor measurements taken within the same area of the SSFL as the soil samples. Measured soil vapor concentrations were found to be greater than the modeled burrow air concentrations. Because soil vapor measurements account for VOC vapor migration from all potential sources and represent measured rather than modeled data, soil vapor data will be used to estimate EPCs for airborne VOCs in burrows—modeled concentrations will only be used when VOCs are detected in the soil horizon of interest and measured soil vapor data are not available. The estimated burrow air EPCs will be used to calculate the applied daily dose for the deer mouse.

Generally, directly measured soil vapor data will be used, in preference to bulk soil data, to estimate concentrations of volatile CPECs in burrow air. Additionally, directly measured soil vapor data will be collected as part of data gap analyses to the extent possible. When directly measured soil vapor data are not available, soil vapor concentrations will be modeled from bulk soil concentrations using Equation 18 in Appendix G of SRAM Rev. 2 (MWH, 2005).

Soil vapor concentrations will not be modeled from groundwater due to the uncertainty associated with the variable depth from groundwater to animal burrows, and uncertainties in attenuation modelling between these media. The following guidelines for when to perform bulk soil-to-soil vapor extrapolations are as follows:

1. *A VOC is detected in bulk soil but is not detected in soil vapor (however, all detections in bulk soil are collocated with soil vapor sampling locations)* – Concentrations of VOCs in burrow air will not be estimated from bulk soil.

2. *A VOC is detected in bulk soil and soil vapor (all detections in bulk soil are collocated with soil vapor sampling locations)* – Soil vapor concentrations, in preference to bulk soil concentrations, will be used to estimate concentrations of VOCs in burrow air.

3. *A VOC is detected in bulk soil and soil vapor (detections in bulk soil are not collocated with soil vapor sampling locations)* – All soil vapor concentrations, in preference to bulk soil concentrations, will be used to estimate concentrations of VOCs in burrow air. Where a bulk soil sample analyzed for this VOC is not collocated with any soil vapor samples analyzed for this VOC, extrapolated soil vapor concentrations from bulk soil concentrations will be used to supplement the measured soil vapor concentrations.

4. *A VOC is detected in bulk soil (and soil vapor samples are not available)* – Concentrations of VOCs in burrow air will be estimated from bulk soil data.

Finally, it should be noted that collocation of sample locations is dependent on soil characteristics. Classification of the collocation of bulk soil and soil vapor sample locations will be determined on a site-by-site basis.

In the event that this approach suggests risks to burrowing animals, additional evaluations may be performed in order to estimate an EPC for VOCs in burrow air.

10.4 Biota Sediment/Soil Accumulation Factors

Biota sediment/soil accumulation factors (BAFs) will be used to estimate aquatic and terrestrial receptor tissue concentrations from sediment and soil concentration data, respectively. The estimated concentrations will subsequently be used for calculation of exposures in food chain models described in Section 10.5 through 10.7, as well as to estimate dietary exposures that will be integrated in EcoRBSLs.

The relationship between chemical concentration in soil or sediment and tissue is described by Equation 10-1:

$$BAF = C_{tissue} / C_{soil/sed} \quad (10\text{-}1)$$

Where:

BAF	=	bioaccumulation factor (unitless)
C_{tissue}	=	concentration in tissue (mg/kg dry weight)
$C_{soil/sed}$	=	concentration in soil or sediment (mg/kg dry weight)

To validate exposure models for higher trophic levels species presented later in this section, paired biotic and abiotic chemistry samples have been collected for use in calculating site-specific BAFs. The data used to derive BAFs for the SSFL include (1) collocated soil and terrestrial organism samples, and (2) collocated sediment and aquatic organism samples. Throughout this section, collocated tissue and soil or sediment samples are referred to as "paired data" or "paired samples." Four sites were selected and approved by the DTSC for the BAF study (Ogden 2000d). Two sites, the Bravo Area (SWMUs 5.13, 5.14, and 5.15) and the Component Test Laboratory III (CTL-III) (SWMU 4.7), were sampled for soil and collocated terrestrial organisms consisting of various plants, invertebrates, and vertebrates. The other two locations, the R2A/R2B Ponds (SWMU 5.26) and the Silvernale Reservoir (SWMU 6.8), were sampled for sediments and collocated aquatic organisms consisting of plants, invertebrates, and fish.

Soil and tissue samples collected at the Bravo Area were analyzed for metals and PCB congeners. Soil and tissue samples collected at CTL-III were analyzed for PAHs and dioxins. Sediment and tissue samples collected at the R2A/R2B Ponds were analyzed for metals, PAHs, and dioxins. Sediment and tissue samples collected at Silvernale Reservoir were analyzed for PCB congeners. Metals, PAHs, PCBs, and dioxins were analyzed by USEPA Methods 6010B/7000, 8270, 1668, and 1613B, respectively. All analytical data were validated. The sample locations, sample media, numbers of samples collected from each media, and the analytes of interest are summarized in Table 10-2. Sampling and analysis for this study were performed as outlined in the DTSC-approved work plan (Ogden 2000d). Description of the field and analytical procedures used for this sampling event and individual sample results will be presented in the RFI report.

Only paired (soil-tissue or sediment-tissue) data in which a given analyte was detected in *both* soil and sediment and tissue were used to derive BAFs. Normalization by the fraction of organic carbon measured in soil and sediment was not done in the present calculations because total organic carbon (TOC) data were not available for all soil and sediment samples. Furthermore, normalization of tissue data by lipid content is not necessary for this particular set of BAFs because the BAFs are intended for use in calculating food chain exposures. The same measures of tissue-specific lipid concentrations would then be used in the exposure models, thus cancelling out the initial lipid normalization.

The following method was used to calculate BAFs at the SSFL. First, the ratio of tissue chemical concentration to soil or sediment chemical concentration was calculated for each set of paired (collocated) data. Next, the 75th percentile of the distribution of individual BAFs was estimated for each tissue type, as follows, for data sets with one to four paired samples:

- 1 paired sample – the single ratio was selected as the BAF.
- 2 paired samples – the average of the two ratios was selected as the BAF.
- 3 paired samples – If the approximate 75th percentile ratio (calculated as the average plus one standard deviation) was less than the maximum value, then it was selected as the BAF. If the average plus one standard deviation was greater than the maximum sample, then the approximate 75th percentile was estimated as the midpoint between the arithmetic mean ratio and the maximum ratio.
- 4 paired samples – If the approximate 75th percentile ratio (calculated as the average plus one standard deviation) was less than the maximum value, then it was selected as the BAF. If the average plus one standard deviation was greater than the maximum sample, then the second highest value was selected as the BAF.

Given that the site-specific soil-to-mammal BAFs for PAHs are based on a single soil sample and collocated small mammal tissue sample, use of the site-specific soil-to-small mammal BAFs for PAHs was discontinued. Instead, due to the unacceptable uncertainty in using BAFs calculated with only a single collocated soil and mammal tissue sample pair, a soil-to-small mammal BAF of "1" for all PAHs will be used in the calculation of EcoRBSLs for the SSFL and in future risk assessments performed at the SSFL. On September 6, 2013, DTSC/ERAS approved the use of a soil-to-mammal BAF of "1" used in the development of EcoRBSLs for PAHs for the SSFL.

Additionally, it should be noted that during a review of site-specific BAF values in October 2011, it was determined that two tissue samples used to derive the original aquatic invertebrate BAFs for PCBs (Appendix K) were inadvertently reported in wet weight and not adjusted prior to calculating aquatic invertebrate BAFs. The laboratory was unable to report a percent moisture for these two samples; therefore, a value of 78% was used to adjust the tissue samples from wet to dry weights prior to the recalculation of the aquatic invertebrate BAFs for PCBs. This 78% moisture is the geometric mean of water compositions of aquatic invertebrates as listed in Table 4-1 of USEPA's Wildlife Exposure Factors Handbook (1993). The recalculated aquatic invertebrate BAFs for PCBs that were recalculated are included in Table 10-3. It was also determined that one tissue sample used to derive the original site-specific terrestrial invertebrate BAFs for some inorganics and PCBs (Appendix K) were inadvertently reported in wet weight and not adjusted prior to calculating these terrestrial BAFs. Subsequently, terrestrial invertebrate BAFs for some inorganics and PCBs were recalculated using the average percent moisture of the other three terrestrial invertebrate samples (56.07%). The recalculated terrestrial invertebrate BAFs for some inorganics and are included in Table 10-4. No other apparent errors in the

wet to dry weight conversion in data used to calculate other site-specific aquatic and terrestrial BAFs were found.

All analytical data for tissues except for the terrestrial vertebrate (*i.e.*, deer mouse) data were reported on a dry weight basis, consistent with analytical data for soil and sediment. The mouse tissue data were converted to a dry weight basis using percent moisture content for mouse tissue as reported in the Wildlife Exposure Factors Handbook (USEPA 1993b). Therefore, all reported BAFs were derived on a dry weight basis.

The spreadsheets used to calculate the site-specific BAFs are presented in Appendix K. Tables 10-3 and 10-4 present the final site-specific BAFs for aquatic and terrestrial receptors, respectively.

The following detailed hierarchy of sources for the derivation of chemical-specific aquatic and terrestrial BAFs will be used when site-specific BAFs are unavailable for a given chemical. The hierarchies that will be used to select proposed literature-derived, chemical-specific BAFs for aquatic receptors are as follows:

Aquatic Invertebrate BAF Hierarchy of Sources:

1. SSFL Site-specific values (MWH, 2005)
2. *Biota-Sediment Accumulation Factors for Invertebrates* (Bechtel Jacobs, 1998a)
3. Region 6 Combustor Guidance – Log K_{ow} models for aquatic invertebrates (USEPA, 1999)
4. USEPA Biota-Sediment Accumulation Factor (BSAF) Data Set, Version 1. http://www.epa.gov/med/Prods_Pubs/bsaf.htm (USEPA, 2008)

Aquatic Plant BAF Hierarchy of Sources:

1. SSFL Site-specific values (MWH, 2005)
2. *Guidance for Developing Ecological Soil Screening Levels (EcoSSLs): Attachment 4-1 Exposure Factors and Bioaccumulation Models for Derivation of Wildlife Eco-SSLs* - Regression models for organics (USEPA, 2007)

Fish BAF Hierarchy of Sources:

1. SSFL Site-specific values (MWH, 2005)

2. *The Incidence and Severity of Sediment Contamination in Surface Waters of the United States, Volume 1: National Sediment Quality Survey.* Appendix D. EPA 823-R-97-006. (USEPA, 1997)

3. *Bioaccumulation Factor Approach Analysis for metals and Polar Organic Compounds.* (PTI, 1995)

4. *Trophic Transfer and Biomagnification Potential of Contaminants in Aquatic Ecosystems*, Reviews of Environmental Contamination and Toxicology, Vol. 16:21-89 (Suedel et al., 1994).

The hierarchies that will be used to select proposed literature-derived, chemical-specific BAFs for terrestrial receptors are as follows:

Terrestrial Plant BAF Hierarchy of Sources:

1. SSFL Site-specific values (MWH, 2005)

2. Eco-SSLs (USEPA, 2007)

3. *Uptake of Inorganic Chemicals from Soil by Plant Leaves* (Efroymson et al., 2001)

4. *Empirical models for the uptake of inorganic chemicals from soil by plants* (Bechtel Jacobs, 1998b)

5. *Literature-derived Bioaccumulation Models for Energetic Compounds in Plants and Soil Invertebrates Technical Memorandum* (CH2M Hill, 2005)

6. *A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture* – values for inorganics (Baes et al., 1984)

Soil Invertebrate BAF Hierarchy of Sources:

1. SSFL Site-specific values (MWH, 2005)

2. Eco-SSLs (USEPA, 2007)

3. *Development and Validation of Bioaccumulation Models for Earthworms* (Sample et al., 1998a) and *Literature-derived bioaccumulation models for earthworms* (Sample et al., 1999).

4. *Literature-derived Bioaccumulation Models for Energetic Compounds in Plants and Soil Invertebrates Technical Memorandum* (CH2M Hill, 2005)

Small Mammal BAF Hierarchy of Sources:

1. SSFL Site-specific values (MWH, 2005)

2. Eco-SSLs (USEPA, 2007)

3. *Development and Validation of Bioaccumulation Models for Small Mammals* (Sample et al, 1998b).

4. *A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture* – values for inorganics (Baes et al., 1984)

Tables 10-5 and 10-6 present the summary of both site-specific and literature-derived BAFs for aquatic and terrestrial receptors, respectively.

Either empirical values, values derived from equations based on the log Kow for a chemical, or regression-based equations (Table 10-7) will be obtained from the above sources. Chemicals for which no BAF can be derived; either directly from a source in the hierarchy or for which no suitable surrogate can be chosen will be assigned a default value of 1. In cases where a default BAF value of 1 is used in ecological risk assessments, it is assumed that it is based on a dry weight relationship. BAF values obtained from the scientific literature will be converted to a dry weight basis, if necessary.

During the finalization of Low and High-TRV based EcoRBSLs for chemicals in surficial media, there appeared to be regression-based BAFs for some chemicals that result in extreme low or extreme high EcoRBSLs. It was determined that this is because an EcoRBSL calculated using regression-based BAFs only accounts for a point estimate in the regression model. Specifically, when an EcoRBSL falls outside the range of the data that were used to generate the regression, the resulting EcoRBSL can be an extreme low or an extreme high value. This assumption was confirmed when point estimate BAFs (e.g., a 90th percentile, median, or mean) from the same studies used to derive the regression-based BAFs were used to estimate EcoRBSLs (Table 10-8).

The following rationale was used to determine whether point estimate BAF or regression-based BAFs should be used for chemicals that have regression-based BAFs.

1. If an EcoRBSL that is calculated using a regression-based BAF does not fall within the range of data used to derive the regression-based BAF, then the point estimate BAF should be used;
2. If an EcoRBSL that is calculated using a regression-based BAF is within the range of data used to derive the regression-based BAF, then the regression-based BAF should be used; or

3. If an EcoRBSL is calculated using a regression-based BAF, and the range of data used to derive the regression-based BAF is not available, then the regression-based BAF should be used.

If a point estimate BAF is selected over a regression-based BAF for any receptor based on the above criteria, then EcoRBSLs for all receptors for that chemical will be calculated using the point estimate BAF.

The following rationale was used to select an appropriate point estimate of the when calculating point estimate-based EcoRBSLs:

1. Use the point estimate value recommended by the source from which the regression-based BAF was derived. For example, USEPA recommends that the median point estimate value be used when use of the regression-based BAF resulted in Ecological Soil Screening Levels (EcoSSLs) outside of the range of data used to derive the regression-based BAF (USEPA, 2007).
2. Use the 90th percentile point estimate of the BAF when the source from which the regression-based BAF was derived does not recommend a specific point estimate value. The 90th percentile point estimate of the BAF was previously selected for the calculation of EcoRBSLs for RDX.

Perchlorate has been detected in soils at all sites. To support effective decision-making for these few sites, both human health and ecological risk assessments will evaluate potential risks due to exposures to perchlorate in soil. Based on the latest bioaccumulation information that has been reviewed, a regression-based soil-to-plant model, as well as a soil-to-invertebrate model, will be used. Regressions are generally preferred over BAF values (expressed as a mean, median or 95th percentile) because they are valid over the entire range of values included in the regression. Since bioaccumulation is a non-linear process, a single BAF value is only accurate at the soil concentration for which it was derived, and has poor predictability for soil concentrations above and below this value. A regression-based soil-to-invertebrate model could not be located; however, a BAF of 0.281 was derived from CH2M HILL's technical memorandum, *Literature-derived Bioaccumulation Models for Energetic Compounds in Plants and Soil Invertebrates* (CH2M Hill, 2005). It should be noted that groundwater at SSFL wherein perchlorate has been detected is typically located well below root zones. However, unit-specific conditions will be considered when estimating potential perchlorate exposures to biota at SSFL. If new information suggests the need, a (water-to-plant) BAF for perchlorate will be developed.

10.5 Estimation of CPEC Concentrations in Representative Aquatic Prey Species

As presented in Section 10.4, BAFs will be used to estimate aquatic and terrestrial receptor tissue concentrations from sediment and soil concentration data, respectively. Estimation of CPEC

concentrations in prey items will be calculated based on the predicted exposure pathways previously discussed in Section 9.2. Information on the habitats and prey of the representative species used in determining appropriate exposure scenarios is provided in Section 9.

Aquatic Invertebrate

Aquatic invertebrates are potentially exposed to chemicals in sediment, food, and the water column. As presented in Section 9.1.2, aquatic invertebrates will be evaluated as part of the "water column community." To estimate exposure to higher tropic level organisms that consume aquatic invertebrates (e.g., great blue heron), chemical concentrations in aquatic invertebrate tissues will either be estimated by multiplying the sediment concentration by the site-specific sediment-to-aquatic invertebrate BAF.

For upper trophic level receptors, the CPEC concentrations within prey aquatic invertebrates at the SSFL will be estimated using the protocol presented in the *Ecological Risk-Based Screening Levels for Use in Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura California - Technical Memorandum* (Appendix F of the SRAM Rev.2 Addendum).

Fish

Fish are potentially exposed to chemicals in sediment, food, and the water column. As presented in Section 9.1.2, fish will be evaluated as part of the "water column community." To estimate exposure to higher trophic level organisms that consume fish (e.g., great blue heron), the chemical body burden in fish is either estimated by multiplying the sediment concentration by the site-specific sediment-to-fish BAF.

For upper trophic level receptors, the chemical body burden found in prey fish at the SSFL will be estimated using the protocol presented in the *Ecological Risk-Based Screening Levels for Use in Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura California - Technical Memorandum* (Appendix F of the SRAM Rev.2 Addendum).

10.6 Estimation of CPEC Concentrations in Representative Terrestrial Prey Species

As presented in Section 10.4, BAFs will be used to estimate aquatic and terrestrial receptor tissue concentrations from sediment and soil concentration data, respectively. Estimation of CPEC concentrations in prey items will be calculated based on the predicted exposure pathways previously discussed in Section 9.2. Information on the habitats and prey of the representative species used in determining appropriate exposure scenarios is provided in Section 9.

10.6.1 Terrestrial Plant

Terrestrial plants may be exposed to chemicals by foliar deposition (*e.g.*, rain splash), root contact, or foliar uptake (vapor or dust). Chemical uptake by plants may be affected by chemical concentrations, physiochemical properties of the chemical, and the physical processes of the plant itself. For example, some plants are able to regulate the uptake of chemicals that are also important nutrients, or may sequester potentially toxic compounds so they do not adversely affect the plant. To estimate exposure to higher trophic level organisms (e.g., deer mouse, mule deer, and hermit thrush) that consume terrestrial plants, concentrations in plant tissues will be estimated by multiplying soil concentrations by the site-specific soil-to-plant BAF.

For upper trophic level receptors, the CPEC concentrations in terrestrial plants at the SSFL will be estimated using the protocol presented in the *Ecological Risk-Based Screening Levels for Use in Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura California - Technical Memorandum* (Appendix F of the SRAM Rev.2 Addendum).

10.6.2 Soil Invertebrate

Terrestrial invertebrates are exposed to chemicals in the soil through direct contact and ingestion. To estimate exposure to higher trophic level organisms (e.g., deer mouse and hermit thrush) that consume terrestrial invertebrate tissues, concentrations in terrestrial invertebrate tissues will be estimated by multiplying the soil concentration by the site-specific soil-to-terrestrial invertebrate BAF.

For upper trophic level receptors, the chemical body burden found in prey soil invertebrates at the SSFL will be estimated using the protocol presented in the *Ecological Risk-Based Screening Levels for Use in Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura California - Technical Memorandum* (Appendix F of the SRAM Rev.2 Addendum).

10.6.3 Deer Mouse

Exposure of deer mouse to CPECs through direct contact with soil, inhalation of soil vapor, ingestion of water and prey, and incidental ingestion of soil represent complete pathways. To estimate exposures of higher trophic level organisms that consume deer mice (e.g., bobcat and red-tailed hawk), concentrations of chemicals in the deer mouse will be calculated using the site-specific soil-to-small mammal bioaccumulation factor.

For upper trophic level receptors, the chemical body burden found in prey deer mice at the SSFL will be estimated using the protocol presented in the *Ecological Risk-Based Screening Levels for Use in*

Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura California - Technical Memorandum (Appendix F of the SRAM Rev.2 Addendum).

10.7 Exposure Models for Representative Species

The previous sections have presented the estimation of CPEC concentrations in prey items. This section presents the approach for modeling exposure for representative species to abiotic and biotic media at the SSFL. Exposure modeling for representative aquatic and terrestrial species is incorporated into the EcoRBSLs defined in the sum-of-fractions approach as presented in the *Proposed Approaches for Streamlining Future Ecological Risk Assessments at the SSFL Technical Memorandum* (MWH, 2009). These EcoRBSLs are receptor-specific models that account for the life history of each representative species, with the specific exposure aspect of the EcoRBSL equation identified in yellow just below the equation. The exposure aspect of the EcoRBSL equation shown in Equation 10-2 below assumes a representative species (e.g., deer mouse) with consumption of plants, invertebrates and/or soil. Further information on the sum-of-fractions approach and full lists of EcoRBSLs is presented in the *Ecological Risk-Based Screening Levels for Use in Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura California - Technical Memorandum* (Appendix F of the SRAM Rev.2 Addendum).

The following exposure model assumes ingestion of terrestrial invertebrates and plants, and incidental ingestion of soil:

$$EcoRBSL_{dsi} = \frac{THQ \times TRV_{mi} \times W_d}{\theta_d \times \psi_d \times \left[\left(BAF_{ti} \times R_d \times F_{tid}\right) + \left(BAF_{tp} \times R_d \times F_{tpd}\right) + \left(R_d \times F_{sd}\right)\right]} \quad (10\text{-}2)$$

Where:

$EcoRBSL_{dsi}$	=	deer mouse risk-based screening level for chemical ‘i', in soil, mg/kg
THQ	=	target hazard quotient, unitless
TRV_{mi}	=	mammalian toxicity reference value for chemical ‘i', mg/kg-d
W_d	=	mean weight of adult deer mouse, kg (Table 10-9)
Θ_d	=	fraction of time on SSFL spent in exposure unit, default of 1
Ψ_d	=	fraction of year spent at SSFL, unitless (Table 10-9)
BAF_{ti}	=	chemical-specific bioaccumulation factor for terrestrial invertebrates, dry weight/dry weight
R_d	=	food intake rate of deer mouse, kg/d (dry weight) (Table 10-9)
F_{tid}	=	fraction of terrestrial invertebrate in deer mouse diet, unitless (Table 10-9)

BAF_{tp}	=	chemical-specific bioaccumulation factor for terrestrial plants, dry weight/dry weight
F_{tpd}	=	fraction of terrestrial plant in deer mouse diet, unitless (Table 10-9)
F_{sd}	=	fraction of soil in deer mouse diet, unitless (Table 10-9)

Applicable receptor-based toxicity reference values (TRVs) and media-based benchmarks are described in Section 11.

Terrestrial receptors may be exposed to chemicals present in soil, sediments, soil vapor, and surface water through ingestion, inhalation, or direct contact with abiotic media. They may also be exposed through ingestion of prey items that have been exposed to chemicals present at the exposure unit. Terrestrial receptors are also mobile and may be exposed to chemicals and concentrations in varying media as they move between habitat types and sites. Dermal contact, inhalation, and ingestion are the three possible exposure routes through which a terrestrial receptor may come in contact with a chemical.

Dermal and inhalation routes were not included in the development of potential exposures because the contribution from these routes of exposure to overall risks has been shown to be generally less than one percent (USEPA 2000a, b). As presented in Section 9.2.4, inhalation pathways will only be considered for the deer mouse since this is a representative burrowing organism. Inhalation of chemicals will be considered negligible for surface dwelling large mammals and birds (USEPA 2000a). Exposures to volatile compounds are minimal for surface-dwelling terrestrial receptors because of the nature of the chemical (volatile compounds volatilize from soil and surface water to the air where they are rapidly diluted and dispersed). Conversely, burrowing animals may be exposed to volatile compounds during use of burrows, where dispersion and dilution of vapors is likely to be reduced compared to the surface. Therefore, inhalation exposure of volatile compounds in burrow air will be estimated for the deer mouse as described in Section 10.7.2.

The ingestion exposure route is the primary exposure route that will be evaluated for terrestrial receptors at the SSFL. Higher trophic level animals tend to consume a variety of prey species; estimates of ingestion exposure must also account for diversity, seasonality, and proportionality of the prey items in the diet. Additionally, animals may favor one habitat over another or vary their use of habitats depending on seasonality and reproductive needs. Oral ingestion exposure calculations should also account for spatial factors. Food, habitat, and life history parameters used in the exposure models for representative species are listed in Table 10-9.

If the representative species' home range is smaller than the exposure area (*i.e.*, for plants, invertebrates, thrush, deer mouse, and great blue heron), area-use factors will be set to one—the representative species is considered to spend 100 percent of its time within the exposure area. However, if the representative species' home range is greater than the exposure area (*i.e.*, red-tailed hawk, mule deer, and bobcat) the representative species is considered to spend a portion of its time within the exposure area. As presented in Section 9.5 and the *Draft Proposed Approaches for Streamlining Future Ecological Risk Assessments Technical Memorandum* (MWH, 2009), large home range receptors (e.g., red-tailed hawk, mule deer, and bobcat) will be evaluated at the RFI group level, and on a combined investigation unit scale, or a facility-wide scale. Specific steps for calculating risks to large home range representative species on a combined unit scale, or facility-wide scale are described in more detail in the *Large Home Range Receptors Ecological Risk Assessment Methodology, Santa Susana Field Laboratory, Ventura County, California - Technical Memorandum* (Appendix G of the SRAM Rev.2 Addendum).

10.7.1 Great Blue Heron

The great blue heron and other aquatic foraging birds are potentially exposed to chemicals by direct contact with soil, sediment, and surface water; inhalation of air; and ingestion of soil, sediment, water, and prey items. However, exposure to CPECs in terrestrial biota via the ingestion of food items is a potentially complete but insignificant exposure pathway for the great blue heron because the majority of the great blue heron's diet is assumed to be obtained in aquatic habitats (e.g., surface water and sediment). Therefore, to estimate exposure of the great blue heron to CPECs in ephemeral or permanent surface water and sediment, ingestion will be considered as the primary and most significant exposure route. The generalized exposure model presented in Section 10.7 will be modified to estimate site CPEC exposure to the great blue heron via ingestion of aquatic invertebrates and fish, ingestion of surface water, and incidental ingestion of sediment. These exposure media were selected based on relevance to existing toxicological criteria (see Section 11) for piscivorous birds.

The food intake rate (R_h) for the great blue heron is calculated from predictive equations presented in Nagy (2001) for carnivorous birds. The water intake rate is calculated using Equation 3-15 from USEPA (1993b). This equation is based on metabolic energy requirements. Therefore, as presented in Table 10-9, the sum of the dietary fractions is 1.0. Beyer *et al*. (1994) as well as others (*e.g.*, USEPA 1993b) have presented estimates of soil ingestion as percentages of the diet. Because soil ingestion does not contribute to metabolic energy requirements, these fractional amounts have been added to the total ingestion rate.

10.7.2 Deer Mouse

As presented in Section 9.2, exposure of the deer mouse to CPECs through direct contact with soil; inhalation of soil vapor; ingestion of water and prey; and incidental ingestion of soil represent complete pathways. Deer mice are known to inhabit a variety of habitats, including all terrestrial habitats on the SSFL. They are primarily granivores, but are also known to regularly eat small invertebrates. Therefore, exposure models for consumption of both plants and invertebrates were selected. Chemical concentrations in terrestrial plants will be estimated by multiplying the soil concentration by the site-specific soil-to-terrestrial plant BAF. Additionally, chemical concentrations in the terrestrial invertebrates will be estimated by multiplying the soil concentration by the site-specific soil-to-soil invertebrate BAF. The generalized exposure model presented in Section 10.7 will be used to estimate exposure to site CPECs for the deer mouse via ingestion of terrestrial plants and soil invertebrates, incidental ingestion of soil, and ingestion of water.

The food intake rate (R_d) for the deer mouse is taken from Nagy (2001). The water intake rate is calculated from Equation 3-17 from USEPA (1993b). These equations are based on metabolic energy requirements. Therefore, as presented in Table 10-9, the sum of the dietary fractions is 1.0. Beyer *et al*. (1994) as well as others (*e.g.*, USEPA 1993b) have presented estimates of soil ingestion as percentages of the diet. Because soil ingestion does not contribute to metabolic energy requirements, these fractional amounts have been added to the total ingestion rate.

Generally, it is not necessary to model exposure for the inhalation pathway (*e.g.*, deer mouse exposed to burrow air), because burrow air VOC concentrations will usually be used directly to model HQs using no observed adverse effect level-based (NOAEL-based) toxicity reference values (Low TRVs) and lowest observed adverse effect level-based (LOAEL-based) TRVs (High TRVs) derived or reported in the same investigational units as burrow air concentrations (mg/m^3). Both Low TRVs and High TRVs for inhalation exposures are described in the updated Section 11, presented in the *Ecological Effects Characterization Updates for Use in Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura County, California - Technical Memorandum* (Appendix D of the SRAM Rev.2 Addendum).

10.7.3 Hermit Thrush

As presented in Section 9.2, exposure of hermit thrush to CPECs through intake of food, water, and incidental ingestion of soil represent complete exposure pathways. Thrush may inhabit a variety of habitats, including many of the terrestrial habitats on the SSFL. Thrush primarily forage on insects, spiders, worms, and other invertebrates (Zeiner *et al*. 1990b), but are also known to regularly eat berries,

fruits, and seeds. Therefore, exposure models for consumption of both plants and invertebrates were selected. Chemical concentrations in terrestrial plants will be estimated by multiplying the soil concentration by the site-specific soil-to-terrestrial plant BAF. Additionally, chemical concentrations in the terrestrial invertebrates will be estimated by multiplying the soil concentration by the site-specific soil-to-soil invertebrate BAF. The generalized exposure model as presented in Section 10.7 will be modified to estimate exposure of site CPECs to the hermit thrush via ingestion of terrestrial plant and soil invertebrates, incidental ingestion of soil, and ingestion of water.

The food intake rate (R_{th}) for the hermit thrush is calculated from predictive equations presented in Nagy (2001) for passerines. The water intake rate is calculated from Equation 3-15 from USEPA (1993b). These equations are based on metabolic energy requirements. Therefore, as presented in Table 10-9, the sum of the dietary fractions is 1.0. Beyer *et al*. (1994) as well as others (*e.g.*, USEPA 1993b) have presented estimates of soil ingestion as percentages of the diet. Because soil ingestion does not contribute to metabolic energy requirements, these fractional amounts have been added to the total ingestion rate.

10.7.4 Mule Deer

For the purpose of this evaluation, it is assumed that the primary exposure routes for mule deer are food ingestion, water ingestion, and incidental soil ingestion. Mule deer are known to inhabit a variety of habitats, including all terrestrial habitats on the SSFL. They are primarily herbivores, and an exposure model based primarily on consumption of plants was selected. Chemical concentrations in the plants will be estimated by multiplying the soil concentration by the site-specific soil-to-terrestrial plant BAFs. The generalized exposure model as presented in Section 10.7 will be modified to estimate exposure of site CPECs to the mule deer via ingestion of terrestrial plants and incidental ingestion of soil.

The food intake rate (R_d) for the mule deer is taken from Nagy (2001). The water intake rate is calculated from Equation 3-17 from USEPA (1993b). These equations are based on metabolic energy requirements. Therefore, as presented in Table 10-9, the sum of the dietary fractions is 1.0. Beyer *et al*. (1994) as well as others (*e.g.*, USEPA 1993b) have presented estimates of soil ingestion as percentages of the diet. Because soil ingestion does not contribute to metabolic energy requirements, these fractional amounts have been added to the total ingestion rate.

10.7.5 Red-Tailed Hawk

As presented in Section 9.2, the only complete exposure pathway for the red-tailed hawk is through ingestion of prey items. For purposes of this work plan, deer mice were chosen as representative prey for the hawk and will comprise 100 percent of the red-tailed hawk's diet. While red-tailed hawk are also

potentially exposed to chemicals via direct contact with soils (dermal contact) and inhalation of air, these exposure routes will not be evaluated as discussed previously. Red-tailed hawk water requirements are met in most instances from food intake (Zeiner *et al*. 1990b); therefore, uptake of surface water was not factored into the model. Incidental soil ingestion is considered a negligible pathway compared to the ingestion of prey; therefore, that pathway is not evaluated. Chemical concentrations in deer mice will be estimated by multiplying the soil concentration by the site-specific soil-to-small mammal BAF. The generalized exposure model as presented in Section 10.7 will be modified to estimate exposure of site CPECs to the red-tailed hawk via ingestion of prey (e.g., deer mouse).

The food intake rate (R_{rt}) for the red-tailed hawk is calculated from predictive equations presented in Nagy (2001) for carnivorous birds. This equation is based on metabolic energy requirements. Therefore, as presented in Table 10-9, the sum of the dietary fractions is 1.0.

For upper trophic level receptors, the chemical body burden found in prey deer mice at the SSFL will be estimated using the protocol presented in the *Ecological Risk-Based Screening Levels for Use in Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura California - Technical Memorandum* (Appendix F of the SRAM Rev.2 Addendum).

10.7.6. Bobcat

The bobcat is potentially exposed to chemicals through direct contact with soil, inhalation of air, ingestion of water and prey, and incidental ingestion of soil. For purposes of this work plan, the bobcat is primarily exposed to chemicals through the ingestion of contaminated prey and/or ingestion of surface water. In the exposure model, deer mice were chosen as representative of bobcat prey and will comprise 100 percent of the bobcat's diet. While bobcat are also potentially exposed to chemicals via direct contact with soils (dermal contact) and inhalation of air, these exposure routes will not be evaluated as discussed previously in Section 10.6. Incidental soil ingestion is considered a negligible pathway compared to the ingestion of prey; therefore, that pathway is not evaluated. Chemical concentrations in deer mice will be estimated by multiplying the soil concentration by the site-specific soil-to-small mammal BAF. The generalized exposure model as presented in Section 10.7 will be modified to estimate site CPEC exposure to the bobcat via ingestion of prey (e.g., deer mouse) and ingestion of surface water.

The food intake rate (R_{rt}) for the red-tailed hawk is calculated from predictive equations presented in Nagy (2001) for carnivorous mammals. The water intake rate is calculated from Equation 3-17 from USEPA (1993b). These equations are based on metabolic energy requirements. Therefore, as presented in Table 10-9, the sum of the dietary fractions is 1.0.

For upper trophic level receptors, the chemical body burden found in prey deer mice at the SSFL will be estimated using the protocol presented in the *Ecological Risk-Based Screening Levels for Use in Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura California - Technical Memorandum* (Appendix F of the SRAM Rev.2 Addendum).

It should be noted that during the risk assessment methodology revision process leading up the SRAM Rev.2 Addendum, ecological exposure parameters were re-evaluated and some were revised. In some cases, such as with the water intake rates, minimum home range parameters, and some lifespan information, those values were inadvertently left off of Table 10-4 of the SRAM. Revisions were also made to reflect more current data or to better reflect the feeding guild that each receptor is intended to represent. For example, the great blue heron represents an upper-level consumer in aquatic environments; therefore, the dietary prey item percentages of the great blue heron were revised to 75% fish and 25% invertebrate, with a 5% sediment ingestion in order to better reflect this feeding guild and current thinking with respect to dietary items for the great blue heron. A similar rationale was used to re-evaluate the dietary prey item percentages for the deer mouse. Based upon available literature as well as utilizing this receptor to better represent a mammalian insectivore consumer in terrestrial environments. Revised exposure parameters are presented in Table 10-9.

10.8 Large Home Range Species Exposure

As presented in Section 9.5 and the *Draft Proposed Approaches for Streamlining Future Ecological Risk Assessments Technical Memorandum* (MWH, 2009), large home range receptors (e.g., red-tailed hawk, mule deer, and bobcat) will be evaluated only at a combined investigation unit scale, or a facility-wide scale. Specific steps to calculate EPCs for large home range representative species are described in more detail in the *Large Home Range Receptor Ecological Risk Assessment Methodology, Santa Susana Field Laboratory, Ventura County, California - Technical Memorandum* (Appendix G of the SRAM Rev.2 Addendum).

ATTACHMENT 4

Lists of Updated References, Tables and Figures

UPDATED REFERENCES, TABLES AND FIGURES

These lists of sources, tables and figures are not comprehensive and only include references, tables and figures that have been updated or added to SRAM Rev. 2 (MWH, 2005) in Attachments 1, 2 and 3 of the Ecological Exposure Assessment Updates Technical Memorandum.

ATTACHMENT 1 – UPDATES TO SECTION 3.2, STANDARDIZED RISK ASSESSMENT METHODOLOGY (SRAM) WORK PLAN, SANTA SUSANA FIELD LABORATORY, VENTURA COUNTY, CALIFORNIA. REVISION 2 – FINAL

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Figure

Figure 3-2 Ecological Risk Assessment, Selection of Chemicals of Potential Ecological Concern

ATTACHMENT 2 – UPDATES TO SECTION 9, STANDARDIZED RISK ASSESSMENT METHODOLOGY (SRAM) WORK PLAN, SANTA SUSANA FIELD LABORATORY, VENTURA COUNTY, CALIFORNIA. REVISION 2 – FINAL

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Table

Table 9-3 Summary of Assessment and Measurement Endpoints

Figure

Figure 9-2 Generalized Conceptual Site Model of Ecological Exposures

ATTACHMENT 3 – UPDATES TO SECTION 10, STANDARDIZED RISK ASSESSMENT METHODOLOGY (SRAM) WORK PLAN, SANTA SUSANA FIELD LABORATORY, VENTURA COUNTY, CALIFORNIA. REVISION 2 – FINAL

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Tables

Table 10-5 Summary of Terrestrial Bioaccumulation Factors for Chemicals Detected in Soil

Table 10-6 Summary of Input Parameters Used to Calculate Regression-Based Bioaccumulation Models

Table 10-7 Summary of Input Parameters Used to Calculate Regression-based Bioaccumulation Models

Table 10-8 Rationale for Selection of Point Estimate-based BAFs vs. Regression-based BAFs for Select Chemicals

Table 10-9 Life History Parameters Used in Quantifying Ecological Exposures

FIGURES

Figure 3-2

Ecological Risk Assessment
Selection of Chemicals of Potential Ecological Concern

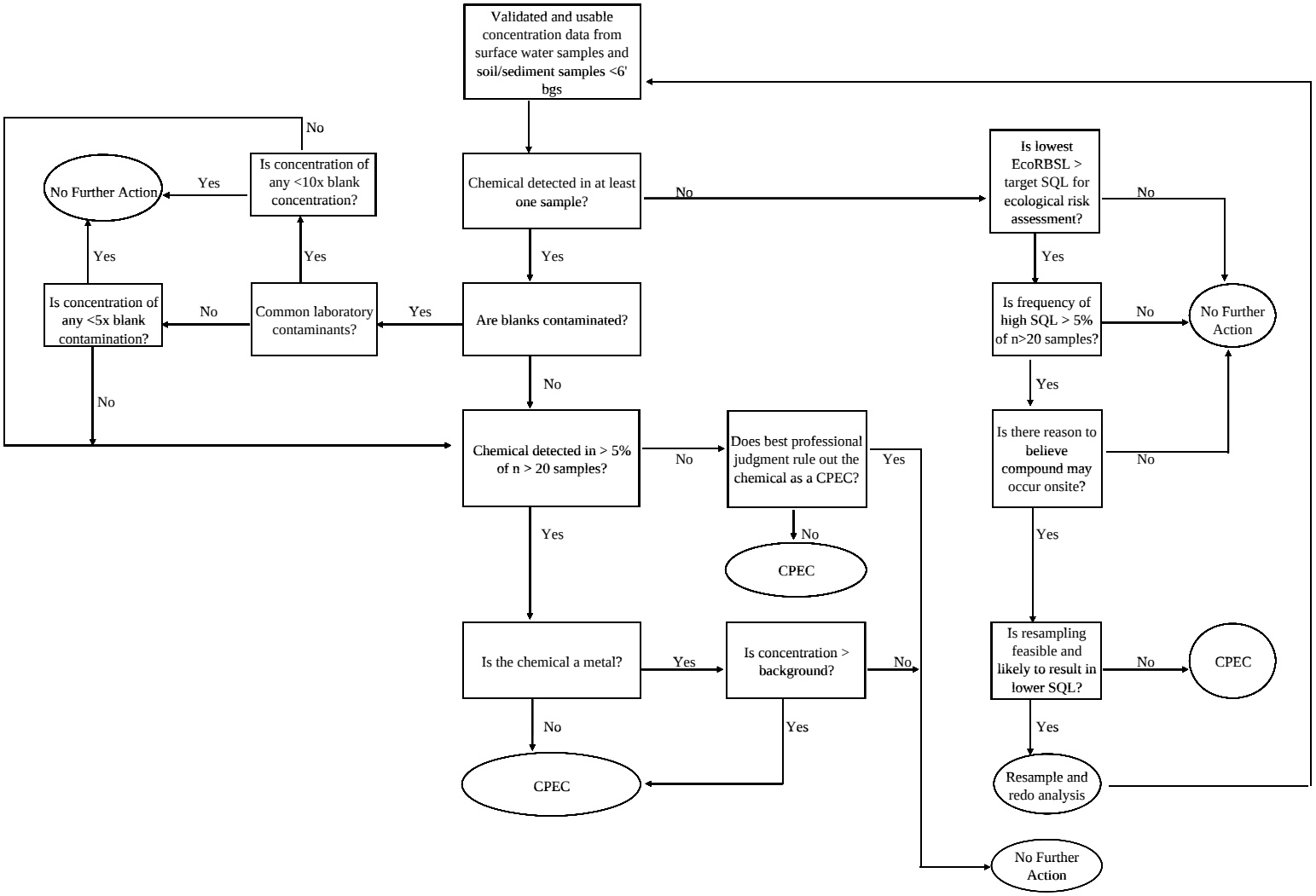

Figure 9-2 Generalized Conceptual Site Model of Ecological Exposures
Santa Susana Field Laboratory, Ventura County, California

Source Media	Secondary Release Mechanisms	Tertiary Source	Exposure Routes	Receptors: Aquatic			Aquatic/Terrestrial		Terrestrial					
				Plants	Invertebrates	Fish	Amphibians	Great Blue Heron	Plants	Invertebrates	Deer Mouse	Mule Deer	Bobcat	Hermit Thrush	Red-tailed Hawk
Soil and Weathered Bedrock; Waste/Direct Discharge	Volatilization and/or Erosion	Dust and/or Volatile Emissions	Inhalation (ambient air) [a]	○	○	○	●	●	○	○	●	●	●	●	●
			Inhalation (burrow air) [a]	○	○	○	○	○	○	○	●	○	○	○	○
			Inhalation (dust)	○	○	○	●	●	○	○	●	●	●	●	●
			Foliar Uptake	○	○	○	○	○	●	○	○	○	○	○	○
	Biotic Uptake	Food Items	Ingestion	○	○	○	●	●	○	●	●	●	●	●	●
Soil and Weathered Bedrock		Surface Soil or Weathered Bedrock	Incidental Ingestion	○	○	○	●	●	○	●	●	●	●	●	●
			Direct Contact	○	○	○	●	●	○	●	●	●	●	●	●
			Root Contact	○	○	○	○	○	●	○	○	○	○	○	○
Waste/Direct Discharge	Runoff	Permanent Fresh Surface Water	Food-Chain Uptake	○	●	●	●	●	○	○	○	○	○	○	○
			Ingestion/Incidental Ingestion [b]	○	●	●	●	●	○	○	●	●	●	●	●
			Direct Contact	●	●	●	●	●	○	○	●	●	●	●	●
			Root Contact	●	○	○	○	○	○	○	○	○	○	○	○
		Permanent Fresh Sediment	Food-Chain Uptake	○	●	●	●	●	○	○	○	○	○	○	○
			Ingestion/Incidental Ingestion	○	●	●	●	●	○	○	●	●	●	●	●
			Direct Contact	●	●	●	●	●	○	○	●	●	●	●	●
			Root Contact	●	○	○	○	○	○	○	○	○	○	○	○
		Ephemeral Fresh Surface Water - Wet Season [c]	Food-Chain Uptake [d,e]	○	●	○	●	●	○	○	●	●	●	●	●
			Ingestion/Incidental Ingestion [b]	○	●	○	●	●	○	○	●	●	●	●	●
			Direct Contact	●	●	○	●	●	○	○	●	●	●	●	●
			Root Contact	●	○	○	○	○	●	○	○	○	○	○	○
		Ephemeral sediment - Wet Season [c,f]	Food-Chain Uptake [d,e]	○	●	○	●	●	○	○	●	●	●	●	●
			Ingestion/Incidental Ingestion	○	●	○	●	●	○	○	●	●	●	●	●
			Direct Contact	○	●	○	●	●	○	○	●	●	●	●	●
			Root Contact	●	○	○	○	○	●	○	○	○	○	○	○
		Seeps/Springs [g]	Ingestion/Incidental Ingestion	○	○	○	●	●	○	○	●	●	●	●	●
			Food-Chain Uptake [d,e]	○	○	○	●	●	○	○	●	●	●	●	●
			Direct Contact	●	●	○	●	●	●	○	●	●	●	●	●
			Root Contact	●	○	○	○	○	●	○	○	○	○	○	○
	Leaching Infiltration Percolation	Near-Surface Groundwater [h]	Ingestion/Incidental Ingestion	○	○	○	○	○	○	○	○	○	○	○	○
			Food-Chain Uptake [d,e]	○	○	○	●	●	○	○	●	●	●	●	●
			Direct Contact	○	○	○	○	○	○	○	○	○	○	○	○
			Root Contact	○	○	○	○	○	●	○	○	○	○	○	○
		Chatsworth Formation Groundwater [i]	Ingestion/Incidental Ingestion	○	○	○	○	○	○	○	○	○	○	○	○
			Direct Contact	○	○	○	○	○	○	○	○	○	○	○	○
			Root Contact	○	○	○	○	○	○	○	○	○	○	○	○

Complete Exposure Pathway
Potentially Complete but Insignificant Pathway
Incomplete Pathway
Complete Exposure Pathway
Potentially Complete but Insignificant Pathway
Incomplete Pathway

Figure 9-2 Generalized Conceptual Site Model of Ecological Exposures
Santa Susana Field Laboratory, Ventura County, California

Notes:

[a] Migration of volatile chemicals from groundwater to ambient or burrow air can also occur. However, this pathway is not displayed in this conceptual site model.

[b] Ingestion of surface water is not a significant pathway for red-tailed hawk because water requirements for red-tailed hawk are met mostly through food intake as described in the SRAM (MWH, 2005).

[c] Complete ephemeral fresh surface water and fresh sediment exposure pathways for aquatic stage of amphibian life cycle is only applicable when ephemeral surface water is present for the duration of a breeding cycle, and only for the great blue heron when ephemeral fresh surface water and fresh sediment are present at a site.

[d] Ingestion of terrestrial plants, ingestion of prey items, or organisms who consume terrestrial plants with exposure to ephemeral fresh surface water, seeps/springs or near-surface groundwater.

[e] Exposures to CPECs in ephemeral fresh surface water, seeps/springs, and near-surface groundwater through plant consumption by higher trophic level receptors will be quantified through EPCs in soil, assuming that CPECs in these media are also present in co-located soil samples.

[f] The potentially complete pathways for ephemeral sediment during the dry season are the same as the potentially complete pathways for surface soil and weathered bedrock.

[g] Potentially complete exposure pathways presented for seeps and/or springs are applicable to seeps and/or springs that do and do not flow into surface water.

[h] Near-surface groundwater may or may not discharge at the surface as seeps and/or springs.

[i] Chemicals in Chatsworth formation groundwater may migrate to near-surface water through vapor transport for volatile chemicals and vertical migration of Chatsworth formation groundwater to near-surface groundwater.

TABLES

Table 9-3

Summary of Assessment and Measurement Endpoints
Santa Susana Field Laboratory, Ventura County, California

Assessment Endpoint	Receptor	Measures of	
		Exposure	Effect
Protect terrestrial avian carnivore populations by limiting acute and chronic adverse effects of direct and/or secondary exposure to site-related CPECs on growth, survival and reproduction.	Red-Tailed Hawk	Evaluate quantitatively through exposure models associated with ingestion of prey items (e.g., deer mouse).	Model HQs through comparison of CPEC soil concentrations to soil EcoRBSLs derived from available avian NOAEL-based and LOAEL-based TRVs.
Protect terrestrial mammalian carnivore populations by limiting acute and chronic adverse effects of direct and/or secondary exposure to site-related CPECs on growth, survival and reproduction.	Bobcat	Evaluate quantitatively through exposure models associated with ingestion of prey items (e.g., deer mouse) and ingestion of surface water.	Model HQs through comparison of CPEC soil and surface water concentrations to soil and surface water EcoRBSLs derived from available mammalian NOAEL-based and LOAEL-based TRVs.
Protect terrestrial mammalian omnivore populations by limiting acute and chronic adverse effects of direct and/or secondary exposure to site-related CPECs on growth, survival and reproduction.	Deer Mouse	Evaluate quantitatively through exposure models associated with incidental soil ingestion, food-chain uptake, inhalation of burrow air, and ingestion of seeps, springs or surface water.	Model HQs through comparison of CPEC soil, soil vapor, and surface water concentrations to soil, soil vapor, and surface water EcoRBSLs derived from available mammalian NOAEL-based and LOAEL-based TRVs.
Protect terrestrial avian omnivore populations by limiting adverse acute and chronic effects of direct and/or secondary exposure to site-related CPECs on growth, survival and reproduction.	Hermit Thrush	Evaluate quantitatively through exposure models associated with incidental soil ingestion, food-chain uptake, and ingestion of seeps, springs or surface water.	Model HQs through comparison of CPEC soil and surface water concentrations to soil and surface water EcoRBSLs derived from available avian NOAEL-based and LOAEL-based TRVs.

Table 9-3

Summary of Assessment and Measurement Endpoints
Santa Susana Field Laboratory, Ventura County, California

Assessment Endpoint	Receptor	Measures of	
		Exposure	**Effect**
Protect terrestrial mammalian herbivore populations by limiting acute and chronic adverse effects from direct and/or secondary exposure to site-related CPECs on growth, survival and reproduction.	Mule Deer	Evaluate quantitatively through exposure models associated with incidental soil ingestion, food-chain uptake, and ingestion of seeps, springs or surface water.	Model HQs through comparison of CPEC soil and surface water concentrations to soil and surface water EcoRBSLs derived from available mammalian NOAEL-based and LOAEL-based TRVs.
Protect the abundance and diversity of native terrestrial vegetation by limiting acute and chronic adverse effects from exposure to site-related CPECs.	Terrestrial Vegetation	Terrestrial plant survey results will be reviewed to qualitatively determine whether terrestrial plants are stressed from potential exposure to soil, seeps/springs, ephemeral surface water, and/or near-surface groundwater at a site; and/or semi-quantitatively through exposure models associated with root contact.	If stressed plants are observed at a site, model HQs through comparison of CPEC soil and seeps/springs/ephemeral surface water/near-surface groundwater to soil and water EcoRBSLs derived from available soil terrestrial plant and solution-based terrestrial plant benchmarks.
Protect semi-aquatic piscivorous avian populations by limiting acute and chronic adverse effects of direct and/or secondary exposure to site-related CPECs on growth, survival and reproduction.	Great Blue Heron	If surface water is present at a site, evaluate quantitatively through exposure models associated with aquatic food-chain uptake, incidental ingestion of sediment, and ingestion of surface water.	Model HQs through comparison of CPEC sediment and surface water concentrations to sediment and surface water EcoRBSLs derived from available avian NOAEL-based and LOAEL-based TRVs.
Protect the abundance and diversity of benthic invertebrate community by limiting acute and chronic adverse effects from exposure to site-related CPECs.	Benthic Invertebrates	Evaluate qualitatively and/or semi-quantitatively through exposure associated with ingestion of dietary items and sediment contact.	Model HQs through comparison of CPEC sediment concentrations to sediment EcoRBSLs derived from available sediment quality benchmarks.

Table 9-3

Summary of Assessment and Measurement Endpoints
Santa Susana Field Laboratory, Ventura County, California

Assessment Endpoint	Receptor	Measures of	
		Exposure	**Effect**
Protect the abundance and diversity of terrestrial invertebrate community by limiting acute and chronic adverse effects of exposure to site-related CPECs.	Terrestrial Invertebrates	Evaluate qualitatively and/or semi-quantitatively through exposure associated with ingestion of dietary items and soil contact.	Model HQs through comparison of CPEC soil concentrations to soil invertebrate EcoRBSLs derived from available soil invertebrate benchmarks.
Protect the abundance and diversity of wetland and aquatic vegetation by limiting acute and chronic adverse effects from exposure to site-related CPECs.	Wetland and aquatic vegetation	Evaluate qualitatively through results of site-specific vegetation survey; and/or semi-quantitatively through exposure models associated with root contact.	• Indicators of habitat quality (e.g., vegetation survey results). • Compare CPEC concentrations in sediment to terrestrial plant toxicity benchmarks.
Protect the embryonic/larval life stage of amphibian populations by limiting acute and chronic adverse effects of direct and/or secondary exposure to site-related CPECs on growth, survival and reproduction.	Embryonic/ Larval life Stage of Amphibians	If surface water is present for the duration of an average breeding cycle of representative amphibians found at SSFL, evaluate semi-quantitatively as part of the 'water column community' through exposure associated with incidental ingestion of ephemeral surface water and sediment, dermal contact with ephemeral surface water and sediment, and ingestion of prey (e.g., aquatic invertebrates and aquatic plants).	Compare CPEC concentrations in surface water and sediment to surface water and sediment EcoRBSLs derived from available sediment and surface water quality benchmarks. EcoRBSL
Protect the abundance and diversity of water column community by limiting acute and chronic adverse effects of exposure to site-related CPECs.	Aquatic plants, aquatic invertebrates, fish and embryonic/ larval amphibians	Evaluate semi-quantitatively as part of the 'water column community' through exposure associated with incidental ingestion of surface water and ingestion of prey items (e.g., aquatic vegetation, aquatic invertebrates, fish, or amphibians depending on the trophic level of the receptor).	Compare CPEC concentrations in surface water to surface water EcoRBSLs derived from available surface water quality benchmarks.

Table 10-1

Dioxin/Furan and Coplanar PCB Toxicity Equivalent Factors for Ecological Receptors

2,3,7,8 Substituted Dioxin/Furan Congener	Mammalian WHO TEF [a] (unitless)	Avian WHO TEF [a] (unitless)	Fish WHO TEF [a] (unitless)
2,3,7,8-TCDD	1	1	1
1,2,3,7,8-PeCDD	1	1	1
1,2,3,4,7,8-HxCDD	0.1	0.05	0.5
1,2,3,6,7,8-HxCDD	0.1	0.01	0.01
1,2,3,7,8,9-HxCDD	0.1	0.1	0.01
1,2,3,4,6,7,8-HpCDD	0.01	0.001	0.001
OCDD	0.0003	0.0001	0.0001
2,3,7,8-TCDF	0.1	1	0.05
1,2,3,7,8-PeCDF	0.03	0.1	0.05
2,3,4,7,8-PeCDF	0.3	1	0.5
1,2,3,4,7,8-HxCDF	0.1	0.1	0.1
1,2,3,6,7,8-HxCDF	0.1	0.1	0.1
2,3,4,6,7,8-HxCDF	0.1	0.1	0.1
1,2,3,7,8,9-HxCDF	0.1	0.1	0.1
1,2,3,4,6,7,8-HpCDF	0.01	0.01	0.01
1,2,3,4,7,8,9-HpCDF	0.01	0.01	0.01
OCDF	0.0003	0.0001	0.0001
Coplanar PCB Congener	**Mammalian WHO TEF [a] (unitless)**	**Avian WHO TEF [a] (unitless)**	**Fish WHO TEF [a] (unitless)**
PCB-77 (3,3',4,4')	0.0001	0.05	0.0001
PCB-81 (3,4,4',5)	0.0003	0.1	0.0005
PCB-105 (2,3,3',4,4')	0.00003	0.0001	0.000005
PCB-114 (2,3,4,4',5)	0.00003	0.0001	0.000005
PCB-118 (2,3',4,4',5)	0.00003	0.00001	0.000005
PCB-123 (2',3,4,4',5')	0.00003	0.00001	0.000005
PCB-126 (3,3',4,4',5)	0.1	0.1	0.005
PCB-156 (2,3,3',4,4',5)	0.00003	0.0001	0.000005
PCB-157 (2,3,3',4,4',5')	0.00003	0.0001	0.000005
PCB-167 (2,3',4,4',5,5')	0.00003	0.00001	0.000005
PCB-169 (3,3',4,4',5,5')	0.03	0.001	0.00005
PCB-189 (2,3,3',4,4',5,5')	0.00003	0.00001	0.000005

Notes:

[a] Van den Berg et al. (2006)

[b] Van den Berg et al. (1998)

HxCDD/HxCDF - hexachlorodibenzo dioxins/furans
HpCDD/HpCDF - heptachlorodibenzo dioxins/furans
OCDD/OCDF - octachlorodibenzo dioxins/furans
PCB - polychlorinated biphenyl
PeCDD/PeCDF - pentachlorodibenzo dioxins/furans
TCDD/TCDF - tetrachlorodibenzo dioxins/furans
TEF - toxicity equivalence factor
WHO - World Health Organization

Table 10-2

BAF Study Sampling Locations and Analyses [a]

Ecological receptor	Locations	Media Sampled	Number of samples	Analyses
Fish	R2A/R2B Ponds (SWMU 5.26) Silvernale Reservoir (SWMU 6.8)	Tissue, sediment	4 4	Metals, PAHs, dioxins PCB congeners
Aquatic Invertebrate	R2A/R2B Ponds (SWMU 5.26) Silvernale Reservoir (SWMU 6.8)	Tissue, sediment	4 4	Metals, PAHs, dioxins PCB congeners
Terrestrial Vertebrate	Bravo Area (SWMU 5.13, 5.14, 5.15) Component Test Laboratory III (SWMU 4.7)	Tissue, soil	4 4	Metals, PCB congeners PAHs, dioxins
Terrestrial Invertebrate	Bravo Area (SWMU 5.13, 5.14, 5.15) Component Test Laboratory III (SWMU 4.7)	Tissue, soil	4 4	Metals, PCB congeners PAHs, dioxins
Aquatic Plant	R2A/R2B Ponds (SWMU 5.26) Silvernale Reservoir (SWMU 6.8)	Tissue, sediment	4 4	Metals, PAHs, dioxins PCB congeners
Terrestrial Plant	Bravo Area (SWMU 5.13, 5.14, 5.15) Component Test Laboratory III (SWMU 4.7)	Tissue, soil	4 4	Metals, PCB congeners PAHs, dioxins

Notes:

[a] The data used to derive BAFs for the SSFL include (1) colocated soil and terrestrial organism samples, and (2) colocated sediment and aquatic organism samples.

[b] Sites chosen for BAF study as approved by the DTSC.

[c] Metals, PAHs, PCBs, and dioxins analyzed by USEPA Methods 6010B/7000, 8270, 1668, and 1613B, respectively

BAF - biota soil/sediment accumulation factor

PAH - polycyclic aromatic hydrocartbons

PCB - polychlorinated biphenyl

SWMU - Solid waste mangement unit

Table 10-3

Site-Specific Aquatic Bioaccumulation Factors - Santa Susana Field Laboratory

Chemical	Fish		Aquatic Invertebrates [a]		Aquatic Plants	
	BAF [b] (unitless)	Sample Size [c]	BAF [b] (unitless)	Sample Size [c]	BAF [b] (unitless)	Sample Size [c]
1,2,3,4,6,7,8-HpCDD	3.9E-02	4	1.4E-01	4	2.8E-02	4
1,2,3,4,6,7,8-HpCDF	4.3E-02	1	1.2E-01	4	3.7E-02	4
1,2,3,4,7,8,9-HpCDF	-	-	7.3E-02	1	-	-
1,2,3,4,7,8-HxCDD	3.2E-01	4	3.6E-01	3	-	-
1,2,3,4,7,8-HxCDF	1.3E-01	2	4.2E-01	4	-	-
1,2,3,6,7,8-HxCDD	5.1E-01	4	3.6E-01	4	-	-
1,2,3,6,7,8-HxCDF	4.8E-01	3	3.6E-01	4	-	-
1,2,3,7,8,9-HxCDD	1.8E-01	4	2.8E-01	3	-	-
1,2,3,7,8-PeCDD	1.4E+00	4	5.7E-01	4	-	-
1,2,3,7,8-PeCDF	9.2E-01	4	1.0E+00	4	-	-
2,3,4,6,7,8-HxCDF	1.1E-01	2	2.2E-01	4	-	-
2,3,4,7,8-PeCDF	1.6E+00	4	6.9E-01	4	-	-
2,3,7,8-TCDD	2.5E+00	4	8.2E-01	4	-	-
2,3,7,8-TCDF	1.1E+00	4	2.5E+00	4	7.1E-02	1
Aluminum	1.8E-02	4	2.5E-02	4	1.6E-01	4
Antimony	1.8E+00	2	2.6E-01	1	5.4E-01	1
Anthracene	-	-	-	-	-	-
Arsenic	-	-	3.1E-01	4	3.5E-01	2
Barium	1.0E-01	4	1.4E+00	4	3.6E-01	4
Benzo(a)anthracene	-	-	1.1E+00	1	-	-
Benzo(a)pyrene	-	-	5.6E-01	1	-	-
Benzo(b)fluoranthene	-	-	1.4E+00	1	-	-
Benzo(g,h,i)perylene	-	-	6.4E-01	1	-	-
Benzo(k)fluoranthene	-	-	7.9E-01	2	-	-
Beryllium	-	-	1.9E-01	3	3.3E-01	1
Boron	-	-	4.3E-01	2	1.8E+00	2
Cadmium	-	-	-	-	-	-
Chromium	2.7E-01	4	4.0E-01	4	7.7E-01	4
Chrysene	-	-	1.1E+00	2	-	-
Cobalt	3.0E-02	1	9.0E-02	4	2.3E-01	4
Copper	1.2E-01	4	3.1E+00	4	3.0E-01	3
Dibenz(a,h)anthracene	-	-	3.2E+00	1	-	-
Fluoranthene	8.9E-02	1	8.3E-01	2	-	-
Fluorene	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	-	-	6.3E-01	1	-	-
Iron	2.0E-02	4	2.6E-02	4	2.1E-01	4
Lead	-	-	-	-	-	-
Magnesium	2.5E-01	4	5.3E-01	4	5.3E-01	4
Manganese	8.4E-02	4	8.6E-01	4	9.7E-01	4
Mercury	1.2E+00	4	3.0E-01	4	3.7E-01	1
Molybdenum	7.6E-01	2	-	-	-	-
Naphthalene	5.8E+00	1	-	-	-	-
Nickel	1.6E-01	4	3.4E-01	4	5.8E-01	4
OCDD	1.7E-02	4	1.7E-01	4	2.7E-02	4
OCDF	1.8E-02	4	4.0E-02	4	3.2E-02	4
PCB-105	2.7E+02	4	3.6E+01	4	1.4E+00	3
PCB-114	2.8E+02	4	5.4E+01	4	-	-
PCB-118	3.2E+02	4	4.9E+01	4	1.5E+00	4
PCB-123	3.6E+02	4	8.1E+01	4	-	-
PCB-126	1.2E+02	4	2.8E+01	4	-	-
PCB-128	2.6E+02	4	7.8E+00	4	1.4E+00	2
PCB-138	3.5E+02	4	3.3E+01	4	1.4E+00	4
PCB-153	4.3E+02	4	4.7E+01	4	1.2E+00	4
PCB-156	3.7E+02	4	5.1E+01	4	1.6E+00	1
PCB-157	2.8E+02	4	5.4E+01	4	-	-
PCB-167	3.8E+02	4	7.4E+01	4	-	-
PCB-170	5.1E+02	4	3.7E+01	4	-	-
PCB-18	5.8E+00	2	8.1E-01	2	6.5E-01	2

Table 10-3

Site-Specific Aquatic Bioaccumulation Factors - Santa Susana Field Laboratory

Chemical	Fish		Aquatic Invertebrates [a]		Aquatic Plants	
	BAF [b] (unitless)	Sample Size [c]	BAF [b] (unitless)	Sample Size [c]	BAF [b] (unitless)	Sample Size [c]
PCB-180	4.4E+02	4	4.0E+01	4	1.3E+00	2
PCB-187	5.3E+02	4	6.6E+01	4	-	-
PCB-189	1.5E+01	2	3.6E+00	2	-	-
PCB-195	4.1E+02	4	2.7E+01	4	-	-
PCB-206	2.4E+02	4	5.8E+00	4	-	-
PCB-209	1.0E+02	4	-	-	-	-
PCB-28	8.1E+00	2	2.4E+00	2	8.8E-02	1
PCB-44	1.2E+02	4	8.7E+00	4	2.2E+00	4
PCB-52	1.7E+02	4	2.2E+01	4	1.9E+00	4
PCB-66	1.8E+02	3	2.3E+01	4	1.8E+00	4
PCB-77	1.9E+01	4	2.0E+01	4	-	-
PCB-8	5.9E+00	2	-	-	-	-
PCB-81	1.3E+02	4	8.3E+00	2	-	-
PCB-90/101	2.1E+02	4	2.1E+01	4	1.1E+00	4
Total PCB/Aroclor[d]	2.4E+02	-	3.2E+01	-	1.4E+00	-
Phenanthrene	2.6E-01	2	1.5E+00	3	-	-
Pyrene	-	-	5.9E-01	2	-	-
Selenium	4.6E+00	4	3.6E+00	4	2.2E+00	2
Silver	-	-	1.0E+00	4	-	-
Thallium	-	-	2.9E-01	3	3.5E-01	2
Vanadium	2.1E-02	4	3.5E-02	4	2.8E-01	4
Zinc	4.1E-01	4	6.6E-01	4	2.8E-01	4

Notes:

a. In October 2011, it was determined that two tissue sample used to derive aquatic invertebrate BAFs for PCBs in SRAM Rev. 2 (MWH, 2005) were reported in wet tissue weight and not adjusted prior to calculating aquatic invertebrate BAFs. As a result, aquatic invertebrate BAFs for PCBs were recalculated. The lab was unable to report a % moisture for these two samples, therefore, a value of 78% was used to adjust the tissue samples from wet to dry weights prior to the recalculation of the aquatic invertebrate BAFs for PCBs. This 78% moisture is the geometric mean of water compositions of aquatic invertebrates as listed in Table 4-1 of USEPA's Wildlife Exposure Factors Handbook (1993).

b. The bioaccumulation factor (BAF) is calculated as the ratio of tissue chemical concentration to soil chemical concentration, when the sample size = 1 the value is the ratio, when the sample size = 2 the BAF value is the mean of the two measured ratios, when the sample size = 3 or 4, the BAF is an approximation of the 75th percentile distribution of the concentration ratio values.

c. Number of tissue chemical concentration to soil chemical concentration ratios used to calculate the BAF.

d. BAF for total PCB or Aroclors is based on the arithmetic mean of the PCB congener-specific BAFs.

"-" chemical either not analysed for or analytical data not sufficient for calculating a BAF

BAF - bioaccumulation factor

Table 10-4

Site-Specific Terrestrial Bioaccumulation Factors - Santa Susana Field Laboratory

Chemical	Soil to Terrestrial Vertebrates		Soil to Terrestrial Invertebrates [a]		Soil to Terrestrial Plants	
	BAF [b] (unitless)	Sample Size [c]	BAF [b] (unitless)	Sample Size [c]	BAF [b] (unitless)	Sample Size [c]
1,2,3,4,6,7,8-HpCDD	2.9E-01	4	5.4E-01	4	3.2E-01	4
1,2,3,4,6,7,8-HpCDF	4.3E-01	3	5.4E-01	3	2.3E-01	3
1,2,3,4,7,8-HxCDD	2.4E-01	1	7.8E-01	2	-	-
1,2,3,4,7,8-HxCDF	8.1E-02	1	6.5E-01	1	-	-
1,2,3,6,7,8-HxCDD	2.2E-01	1	7.7E-01	3	1.6E-01	1
1,2,3,6,7,8-HxCDF	6.5E-01	1	2.6E-01	1	-	-
1,2,3,7,8,9-HxCDD	1.8E-01	1	9.3E-01	3	-	-
1,2,3,7,8-PeCDD	-	-	8.8E-01	2	-	-
1,2,3,7,8-PeCDF	-	-	4.3E-01	2	-	-
2,3,4,6,7,8-HxCDF	5.4E-01	1	5.6E-01	1	-	-
2,3,4,7,8-PeCDF	4.4E-01	1	5.1E-01	2	-	-
2,3,7,8-TCDF	1.9E-01	1	1.0E+00	4	-	-
Acenaphthene	-	-	2.4E+00	1	-	-
Aluminum	1.2E-01	4	3.7E-01	4	7.4E-01	4
Anthracene	-	-	2.8E+00	1	-	-
Antimony	5.8E-01	2	7.9E+00	4	5.4E+00	4
Arsenic	-	-	6.2E-01	3	7.7E-01	3
Barium	3.6E-01	4	2.9E+00	4	1.0E+00	4
Benzo(a)anthracene	1.6E+01	1	1.9E+00	1	5.2E+00	1
Benzo(a)pyrene	5.9E+00	1	1.0E+00	1	-	-
Benzo(b)fluoranthene	5.3E+00	1	2.0E+00	1	-	-
Benzo(e)pyrene	-	-	1.1E+00	1	-	-
Benzo(g,h,i)perylene	4.5E+00	1	5.3E-01	1	-	-
Benzo(k)fluoranthene	7.8E+00	1	8.9E-01	1	-	-
Beryllium	-	-	3.9E-01	3	6.1E-01	4
Boron	1.2E+01	1	4.6E+00	1	7.4E+00	1
Cadmium	-	-	2.0E+01	3	1.1E+01	3
Chromium	1.5E-01	4	2.4E+00	4	9.4E+00	4
Chrysene	6.4E+00	1	1.9E+00	1	2.8E+00	3
Cobalt	2.5E-01	4	2.6E-01	3	6.6E-01	4
Copper	7.6E-01	4	1.5E+01	4	1.9E+00	4
Dibenz(a,h)anthracene	1.6E+01	1	-	-	-	-
Fluoranthene	2.3E+00	1	9.1E-01	2	2.8E+00	3
Fluorene	-	-	3.9E+00	1	-	-
Indeno(1,2,3-cd)pyrene	7.2E+00	1	8.6E-01	1	-	-
Iron	1.0E-01	4	4.4E-01	4	6.3E-01	4
Lead	-	-	3.1E-01	2	2.1E+00	4
Magnesium	7.5E-01	4	1.3E+00	4	1.2E+00	4
Manganese	1.5E-01	4	7.3E-01	4	8.5E-01	4
Mercury	-	-	3.4E+00	3	8.2E-01	2
Molybdenum	2.9E+00	4	5.9E+00	4	1.4E+01	4
Naphthalene	-	-	-	-	-	-
Nickel	1.2E-01	4	2.1E+00	4	7.7E+00	4
OCDD	2.1E-01	4	4.7E-01	4	2.3E-01	4
OCDF	9.4E-01	3	5.0E-01	3	3.3E-01	4
PCB-105	2.7E+00	4	1.2E+01	4	3.3E+00	4
PCB-114	6.6E+00	3	2.6E+01	4	3.7E+00	2
PCB-118	2.8E+00	4	1.4E+01	4	3.2E+00	4
PCB-123	3.4E+00	2	1.3E+01	4	3.4E+00	2
PCB-126	1.8E+00	2	5.3E+00	4	2.2E+00	2
PCB-128	3.0E+00	4	5.1E+00	4	2.6E+00	4
PCB-138	2.5E+00	4	6.0E+00	4	2.9E+00	4
PCB-153	4.2E+00	4	7.1E+00	4	3.1E+00	4
PCB-156	3.9E+00	4	5.8E+00	4	2.5E+00	4
PCB-157	2.7E+01	4	5.7E+00	4	2.6E+00	4
PCB-167	4.9E+00	4	5.9E+00	4	2.8E+00	4
PCB-170	4.2E+00	4	4.1E+00	4	1.9E+00	4

Table 10-4

Site-Specific Terrestrial Bioaccumulation Factors - Santa Susana Field Laboratory

Chemical	Soil to Terrestrial Vertebrates		Soil to Terrestrial Invertebrates [a]		Soil to Terrestrial Plants	
	BAF [b] (unitless)	Sample Size [c]	BAF [b] (unitless)	Sample Size [c]	BAF [b] (unitless)	Sample Size [c]
PCB-18	6.5E-02	1	3.2E-01	1	-	-
PCB-180	4.2E+00	4	3.6E+00	4	2.1E+00	4
PCB-187	1.2E+00	4	7.7E+00	4	2.8E+00	4
PCB-189	7.0E+00	3	2.4E+00	4	2.2E+00	2
PCB-195	3.4E+00	3	1.9E+00	4	1.0E+00	1
PCB-206	1.8E+00	3	9.6E-01	3	7.9E-01	1
PCB-209	2.4E+00	3	1.4E+00	3	2.4E+00	1
PCB-28	-	-	3.8E+00	1	8.0E+00	1
PCB-44	-	-	7.3E+00	4	4.0E+00	4
PCB-52	-	-	1.1E+01	4	4.4E+00	4
PCB-66	1.3E+00	4	1.1E+01	4	3.5E+00	4
PCB-77	7.7E-01	1	6.1E+00	4	2.4E+00	3
PCB-8	3.7E-01	1	4.9E-01	1	-	-
PCB-81	-	-	6.0E+00	4	3.0E+00	2
PCB-90/101	2.2E-01	4	6.2E+00	4	3.6E+00	4
Total PCB/Aroclor [d]	3.9E+00	-	6.7E+00	-	3.0E+00	-
Phenanthrene	3.4E+00	1	1.8E+00	2	7.2E+00	4
Pyrene	3.6E+00	1	2.9E+00	2	1.9E+00	3
Selenium	5.8E+00	2	4.2E+00	1	-	-
Silver	-	-	1.4E+01	3	1.7E+00	2
Thallium	-	-	1.1E+00	3	5.1E-01	4
Vanadium	1.7E-01	4	3.2E-01	4	6.9E-01	4
Zinc	3.5E+00	4	3.0E+00	4	1.6E+00	4

Notes:

a. In October 2011, it was determined that one tissue sample used to derive terrestrial invertebrate BAFs for inorganics and PCBs in SRAM Rev. 2 (MWH, 2005) was reported in wet tissue weight and not adjusted prior to calculating terrestrial invertebrate BAFs. As a result, terrestrial invertebrate BAFs for some metals and PCBs were recalculated using the average percent moisture of the other three terrestrial invertebrate samples (56.07% moisture).

b. The bioaccumulation factor (BAF) is calculated as the ratio of tissue chemical concentration to soil chemical concentration, when the sample size = 1 the value is the ratio, when the sample size = 2 the BAF value is the mean of the two measured ratios, when the sample size = 3 or 4, the BAF is an approximation of the 75th percentile distribution of the concentration ratio values.

c. Number of tissue chemical concentration to soil chemical concentration ratios used to calculate the BAF.

d. BAF for total PCB or Aroclors is based on the arithmetic mean of the PCB congener-specific BAFs.

"-" chemical either not analysed for or analytical data not sufficient for calculating a BAF

BAF - bioaccumulation factor

Table 10-5
Summary of Aquatic Bioaccumulation Factors for Chemicals Detected in Sediment

Santa Susana Field Laboratory, Ventura County, California

Chemical	CAS#	Surrogate Used	Fish BAF (dry weight/dry weight)	Fish BAF Source	Aquatic Invertebrate BAF (dry weight/dry weight)	Aquatic Invertebrate BAF Source	Aquatic Plants BAF (dry weight/dry weight)	Aquatic Plants BAF Source	Log Kow	Source
Inorganic Compounds										
Aluminum	7429905	--	0.018	MWH, 2005 [b]	0.025	MWH, 2005 [a,b]	0.16	MWH, 2005 [b]	0.33	USEPA, 2011
Antimony	7440360	--	1.8	MWH, 2005 [b]	0.26	MWH, 2005 [a,b]	0.54	MWH, 2005 [b]	0.73	USEPA, 2011
Arsenic	7440382	--	0.012	PTI, 1995	0.31	MWH, 2005 [a,b]	0.35	MWH, 2005 [b]	0.68	USEPA, 2011
Barium	7440393	--	0.10	MWH, 2005 [b]	1.4	MWH, 2005 [a,b]	0.36	MWH, 2005 [b]	0.23	USEPA, 2011
Beryllium	7440417	--	1	Default	0.19	MWH, 2005 [a,b]	0.33	MWH, 2005 [b]	-0.57	USEPA, 2011
Boron	7440428	--	1	Default	0.43	MWH, 2005 [a,b]	1.8	MWH, 2005 [b]	0.23	USEPA, 2011
Cadmium	7440439	--	0.785	PTI, 1995	Regression	Bechtel Jacobs, 1998a	0.364	USEPA, 1999	-0.07	USEPA, 2011
Chromium	7440473	--	0.27	MWH, 2005 [b]	0.40	MWH, 2005 [a,b]	0.77	MWH, 2005 [b]	0.23	USEPA, 2011
Cobalt	7440484	--	0.030	MWH, 2005 [b]	0.090	MWH, 2005 [a,b]	0.23	MWH, 2005 [b]	0.23	USEPA, 2011
Copper	7440508	--	0.12	MWH, 2005 [b]	3.1	MWH, 2005 [a,b]	0.30	MWH, 2005 [b]	-0.57	USEPA, 2011
Fluoride	7782414	--	1	Default	1	Default	1	Default	0.22	USEPA, 2011
Lead	7439921	--	0.1797	PTI, 1995	Regression	Bechtel Jacobs, 1998a	0.045	USEPA, 1999	0.73	USEPA, 2011
Manganese	7439965	--	0.084	MWH, 2005 [b]	0.86	MWH, 2005 [a,b]	0.97	MWH, 2005 [b]	0.23	USEPA, 2011
Mercury	7439976	--	1.2	MWH, 2005 [b]	0.30	MWH, 2005 [a,b]	0.37	MWH, 2005 [b]	0.62	USEPA, 2011
Molybdenum	7439987	--	0.76	MWH, 2005 [b]	1	Default	1	Default	0.23	USEPA, 2011
Nickel	7440020	--	0.16	MWH, 2005 [b]	0.34	MWH, 2005 [a,b]	0.58	MWH, 2005 [b]	-0.57	USEPA, 2011
Phosphorus	7723140	--	1	Default	1	Default	1	Default	-0.27	USEPA, 2011
Selenium	7782492	--	4.6	MWH, 2005 [b]	3.6	MWH, 2005 [a,b]	2.2	MWH, 2005 [b]	0.24	USEPA, 2011
Silver	7440224	--	1	Default	1.0	MWH, 2005 [a,b]	0.4	USEPA, 1999	0.23	USEPA, 2011
Strontium	7440246	--	1	Default	1	Default	1	Default	0.23	USEPA, 2011
Thallium	7440280	--	1	Default	0.29	MWH, 2005 [a,b]	0.35	MWH, 2005 [b]	0.23	USEPA, 2011
Tin	7440315	--	1	Default	1	Default	1	Default	1.29	USEPA, 2011
Titanium	7440326	--	1	Default	1	Default	1	Default	0.23	USEPA, 2011
Zinc	7440666	--	0.41	MWH, 2005 [b]	0.66	MWH, 2005 [a,b]	0.28	MWH, 2005 [b]	-0.47	USEPA, 2011
Energetic Constituents										
1,2-Dinitrobenzene	528290	--	1	Default	1	Default	1	Default	1.69	USEPA, 2011

Table 10-5
Summary of Aquatic Bioaccumulation Factors for Chemicals Detected in Sediment

Santa Susana Field Laboratory, Ventura County, California

Chemical	CAS#	Surrogate Used	Fish BAF (dry weight/dry weight)	Fish BAF Source	Aquatic Invertebrate BAF (dry weight/dry weight)	Aquatic Invertebrate BAF Source	Aquatic Plants BAF (dry weight/dry weight)	Aquatic Plants BAF Source	Log Kow	Source
1,3-Dinitrobenzene	99650	--	1	Default	7.13	USEPA, 1999. Converted to dry weight with a conversion factor of 5.99.	1	Default	1.49	USEPA, 2011
2,4,6-Trinitrotoluene	118967	--	1	Default	1	Default	1	Default	1.6	USEPA, 2011
2,4-diamino-6-nitrotoluene	6629294	--	1	Default	1	Default	1	Default	--	USEPA, 2011
2,4-Dinitrotoluene	121142	--	1	Default	347	USEPA, 1999. Converted to dry weight with a conversion factor of 5.99.	1	Default	1.98	USEPA, 2011
2-Amino-4,6-dinitrotoluene	35572782	--	1	Default	1	Default	1	Default	1.84	USEPA, 2011
2-Nitrotoluene	88722	--	1	Default	1	Default	1	Default	2.30	USEPA, 2011
3-Nitrotoluene	99081	--	1	Default	1	Default	1	Default	2.45	USEPA, 2011
4-Amino-2,6-dinitrotoluene	19406510	--	1	Default	1	Default	1	Default	1.84	USEPA, 2011
4-Nitrotoluene	99990	--	1	Default	1	Default	1	Default	2.37	USEPA, 2011
HMX	2691410	--	1	Default	1	Default	1	Default	0.16	USEPA, 2011
Nitroglycerin	55630	--	1	Default	1	Default	1	Default	1.62	USEPA, 2011
Perchlorate	14797730	--	1	Default	1	Default	1	Default	NA	USEPA, 2011
PETN	78115	--	1	Default	1	Default	1	Default	2.38	USEPA, 2011
RDX	121824	--	1	Default	1	Default	1	Default	0.87	USEPA, 2011
Tetryl	479458	--	1	Default	1	Default	1	Default	1.64	USEPA, 2011
Volatile Organic Compounds										
1,1,1,2-Tetrachloroethane	630206	--	1	Default	1	Default	1	Default	2.93	USEPA, 2011
1,1,1-Trichloroethane	71556	--	1.0	USEPA, 1997	1	Default	1	Default	2.49	USEPA, 2011

Table 10-5
Summary of Aquatic Bioaccumulation Factors for Chemicals Detected in Sediment

Santa Susana Field Laboratory, Ventura County, California

Chemical	CAS#	Surrogate Used	Fish BAF (dry weight/dry weight)	Fish BAF Source	Aquatic Invertebrate BAF (dry weight/dry weight)	Aquatic Invertebrate BAF Source	Aquatic Plants BAF (dry weight/dry weight)	Aquatic Plants BAF Source	Log Kow	Source
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	--	1	Default	166	Log Kow model from USEPA, 1999** Converted to dry weight with a conversion factor of 5.99.	2.00	Log Kow model for nonionic organics from USEPA, 2007**	3.16	USEPA, 2011
1,1-Dichloroethane	75343	--	1.0	USEPA, 1997	1	Default	1	Default	1.79	USEPA, 2011
1,1-Dichloroethene	75354	--	1.0	USEPA, 1997	1	Default	1	Default	2.13	USEPA, 2011
1,1-Dichloropropene	563586	--	1	Default	1	Default	1	Default	2.53	USEPA, 2011
1,2,4-Trimethylbenzene	95636	--	1	Default	402	Log Kow model from USEPA, 1999** Converted to dry weight with a conversion factor of 5.99.	1.56	Log Kow model for nonionic organics from USEPA, 2007**	3.63	USEPA, 2011
1,2-Dibromoethane	106934	--	1	Default	1	Default	1	Default	1.96	USEPA, 2011
1,2-Dichlorobenzene	95501	--	1.0	USEPA, 1997	276	Log Kow model from USEPA, 1999** Converted to dry weight with a conversion factor of 5.99.	1.73	Log Kow model for nonionic organics from USEPA, 2007**	3.43	USEPA, 2011
1,2-Dichloroethane	107062	--	1.0	USEPA, 1997	1	Default	1	Default	1.48	USEPA, 2011
1,2-Dichloropropane	78875	--	1.0	USEPA, 1997	1	Default	1	Default	1.98	USEPA, 2011
1,3,5-Trimethylbenzene	108678	--	1	Default	271	Log Kow model from USEPA, 1999** Converted to dry weight with a conversion factor of 5.99.	1.74	Log Kow model for nonionic organics from USEPA, 2007**	3.42	USEPA, 2011

Table 10-5
Summary of Aquatic Bioaccumulation Factors for Chemicals Detected in Sediment

Santa Susana Field Laboratory, Ventura County, California

Chemical	CAS#	Surrogate Used	Fish BAF (dry weight/dry weight)	Fish BAF Source	Aquatic Invertebrate BAF (dry weight/dry weight)	Aquatic Invertebrate BAF Source	Aquatic Plants BAF (dry weight/dry weight)	Aquatic Plants BAF Source	Log Kow	Source
1,3-Dichlorobenzene	541731	--	1.0	USEPA, 1997	333	Log Kow model from USEPA, 1999** Converted to dry weight with a conversion factor of 5.99.	1.64	Log Kow model for nonionic organics from USEPA, 2007**	3.53	USEPA, 2011
1,3-Dichloropropane	142289	--	1	Default	1	Default	1	Default	2.0	USEPA, 2011
1,4-Dichlorobenzene	106467	--	1.0	USEPA, 1997	281	Log Kow model from USEPA, 1999** Converted to dry weight with a conversion factor of 5.99.	1.72	Log Kow model for nonionic organics from USEPA, 2007**	3.44	USEPA, 2011
2-Chloroethylvinyl ether	110758	--	1	Default	1	Default	1	Default	1.17	USEPA, 2011
2-Hexanone	591786	--	1	Default	1	Default	1	Default	1.38	USEPA, 2011
Acetone	67641	--	1.0	USEPA, 1997	1	Default	1	Default	-0.24	USEPA, 2011
Benzene	71432	--	1.0	USEPA, 1997	1	Default	1	Default	2.13	USEPA, 2011
Bromide	24959679	--	1	Default	1	Default	1	Default	0.63	USEPA, 2011
Bromochloromethane	74975	--	1	Default	1	Default	1	Default	1.41	USEPA, 2011
Bromodichloromethane	75274	Dichloromethane - fish BAF	1.0	USEPA, 1997	18.6	Log Kow model from USEPA, 1999** Converted to dry weight with a conversion factor of 5.99.	1	Default	2	USEPA, 2011

Table 10-5
Summary of Aquatic Bioaccumulation Factors for Chemicals Detected in Sediment

Santa Susana Field Laboratory, Ventura County, California

Chemical	CAS#	Surrogate Used	Fish BAF (dry weight/dry weight)	Fish BAF Source	Aquatic Invertebrate BAF (dry weight/dry weight)	Aquatic Invertebrate BAF Source	Aquatic Plants BAF (dry weight/dry weight)	Aquatic Plants BAF Source	Log Kow	Source
Bromomethane	74839	--	1	Default	1	Default	1	Default	1.19	USEPA, 2011
Carbon Disulfide	75150	--	1	Default	1	Default	1	Default	1.94	USEPA, 2011
Chloroethane	75003	--	1	Default	1	Default	1	Default	1.43	USEPA, 2011
Chloroform	67663	--	1.0	USEPA, 1997	17.6	Log Kow model from USEPA, 1999** Converted to dry weight with a conversion factor of 5.99.	1	Default	1.97	USEPA, 2011
Chloromethane	74873	--	1	Default	1	Default	1	Default	0.91	USEPA, 2011
cis-1,2-Dichloroethene	156592	--	1.0	USEPA, 1997	1	Default	1	Default	1.86	USEPA, 2011
cis-1,3-Dichloropropene	10061015	--	1	Default	1	Default	1	Default	2.06	USEPA, 2011
Cumene	98828	--	1	Default	426	Log Kow model from USEPA, 1999** Converted to dry weight with a conversion factor of 5.99.	1.53	Log Kow model for nonionic organics from USEPA, 2007**	3.66	USEPA, 2011
Dibromomethane	74953	--	1	Default	1	Default	1	Default	1.7	USEPA, 2011
Dichlorodifluoromethane	75718	--	1.0	USEPA, 1997	1	Default	1	Default	2.16	USEPA, 2011
Ethylbenzene	100414	--	1.0	USEPA, 1997	163	Log Kow model from USEPA, 1999** Converted to dry weight with a conversion factor of 5.99.	2.01	Log Kow model for nonionic organics from USEPA, 2007**	3.15	USEPA, 2011
Methyl isobutyl ketone (MIBK)	108101	--	1	Default	1	Default	1	Default	1.31	USEPA, 2011
Methyl-tert-butyl- Ether (MTBE)	1634044	--	1	Default	1	Default	1	Default	0.94	USEPA, 2011
Methylene chloride	75092	--	1.0	USEPA, 1997	1	Default	1	Default	1.25	USEPA, 2011

Table 10-5
Summary of Aquatic Bioaccumulation Factors for Chemicals Detected in Sediment

Santa Susana Field Laboratory, Ventura County, California

Chemical	CAS#	Surrogate Used	Fish BAF (dry weight/dry weight)	Fish BAF Source	Aquatic Invertebrate BAF (dry weight/dry weight)	Aquatic Invertebrate BAF Source	Aquatic Plants BAF (dry weight/dry weight)	Aquatic Plants BAF Source	Log Kow	Source
m-Xylene & p-Xylene	136777612	m-Xylene/p-Xylene	1.0	USEPA, 1997	179	Log Kow model from USEPA, 1999** Converted to dry weight with a conversion factor of 5.99.	1.95	Log Kow model for nonionic organics from USEPA, 2007**	3.20	USEPA, 2011
n-Butylbenzene	104518	--	1	Default	1654	Log Kow model from USEPA, 1999** Converted to dry weight with a conversion factor of 5.99.	1.05	Log Kow model for nonionic organics from USEPA, 2007**	4.38	USEPA, 2011
Nitrobenzene	98953	--	1	Default	14	USEPA, 1999. Converted to dry weight with a conversion factor of 5.99.	1	Default	1.85	USEPA, 2011
n-Propylbenzene	103651	--	1	Default	450	Log Kow model from USEPA, 1999** Converted to dry weight with a conversion factor of 5.99.	1.51	Log Kow model for nonionic organics from USEPA, 2007**	3.69	USEPA, 2011
o-Xylene	95476	--	1.0	USEPA, 1997	154	Log Kow model from USEPA, 1999** Converted to dry weight with a conversion factor of 5.99.	2.04	Log Kow model for nonionic organics from USEPA, 2007**	3.12	USEPA, 2011

Table 10-5
Summary of Aquatic Bioaccumulation Factors for Chemicals Detected in Sediment

Santa Susana Field Laboratory, Ventura County, California

Chemical	CAS#	Surrogate Used	Fish BAF (dry weight/dry weight)	Fish BAF Source	Aquatic Invertebrate BAF (dry weight/dry weight)	Aquatic Invertebrate BAF Source	Aquatic Plants BAF (dry weight/dry weight)	Aquatic Plants BAF Source	Log Kow	Source
p-Cymene	99876	--	1	Default	976	Log Kow model from USEPA, 1999** Converted to dry weight with a conversion factor of 5.99.	1.22	Log Kow model for nonionic organics from USEPA, 2007**	4.1	USEPA, 2011
sec-Butylbenzene	135988	--	1	Default	2,367	Log Kow model from USEPA, 1999** Converted to dry weight with a conversion factor of 5.99.	0.95	Log Kow model for nonionic organics from USEPA, 2007**	4.57	USEPA, 2011
Styrene	100425	--	1	Default	1	Default	1	Default	2.95	USEPA, 2011
tert-Butylbenzene	98066	--	1	Default	994	Log Kow model from USEPA, 1999** Converted to dry weight with a conversion factor of 5.99.	1.21	Log Kow model for nonionic organics from USEPA, 2007**	4.11	USEPA, 2011
Tetralin	119642	--	1	Default	309	Log Kow model from USEPA, 1999** Converted to dry weight with a conversion factor of 5.99.	1.68	Log Kow model for nonionic organics from USEPA, 2007**	3.49	USEPA, 2011

Table 10-5
Summary of Aquatic Bioaccumulation Factors for Chemicals Detected in Sediment

Santa Susana Field Laboratory, Ventura County, California

Chemical	CAS#	Surrogate Used	Fish BAF (dry weight/dry weight)	Fish BAF Source	Aquatic Invertebrate BAF (dry weight/dry weight)	Aquatic Invertebrate BAF Source	Aquatic Plants BAF (dry weight/dry weight)	Aquatic Plants BAF Source	Log Kow	Source
Tetrachloroethene	127184	--	1.0	USEPA, 1997	261	Log Kow model from USEPA, 1999** Converted to dry weight with a conversion factor of 5.99.	1.76	Log Kow model for nonionic organics from USEPA, 2007**	3.4	USEPA, 2011
Toluene	108883	--	1.0	USEPA, 1997	73.7	Log Kow model from USEPA, 1999** Converted to dry weight with a conversion factor of 5.99.	2.50	Log Kow model for nonionic organics from USEPA, 2007**	2.73	USEPA, 2011
trans-1,2-Dichloroethene	156605	--	1.0	USEPA, 1997	1	Default	1	Default	2.09	USEPA, 2011
trans-1,3-Dichloropropene	10061026	--	1	Default	1	Default	1	Default	2.03	USEPA, 2011
Trichloroethene	79016	--	1.0	USEPA, 1997	1	Default	1	Default	2.42	USEPA, 2011
Vinyl chloride	75014	--	1	Default	3.7	USEPA, 1999. Converted to dry weight with a conversion factor of 5.99.	1	Default	1.62	USEPA, 2011
Semi-Volatile Organic Compounds										
1,2-Dibromo-3-chloropropane	96128	--	1	Default	1	Default	1	Default	2.96	USEPA, 2011
2,6-Dinitrotoluene	606202	--	1	Default	1	Default	1	Default	2.1	USEPA, 2011
Benzoic Acid	65850	--	1	Default	1	Default	1	Default	1.87	USEPA, 2011
bis(2-Ethylhexyl) phthalate	117817	--	1.0	USEPA, 1997	717,508	Log Kow model from USEPA, 1999** Converted to dry weight with a conversion factor of 5.99.	0.19	Log Kow model for nonionic organics from USEPA, 2007**	7.6	USEPA, 2011

Table 10-5
Summary of Aquatic Bioaccumulation Factors for Chemicals Detected in Sediment

Santa Susana Field Laboratory, Ventura County, California

Chemical	CAS#	Surrogate Used	Fish BAF (dry weight/dry weight)	Fish BAF Source	Aquatic Invertebrate BAF (dry weight/dry weight)	Aquatic Invertebrate BAF Source	Aquatic Plants BAF (dry weight/dry weight)	Aquatic Plants BAF Source	Log Kow	Source
Bromoform	75252	--	1.0	USEPA, 1997	1	Default	1	Default	2.4	USEPA, 2011
Butyl benzyl phthalate	85687	--	1.0	USEPA, 1997	3,201	Log Kow model from USEPA, 1999** Converted to dry weight with a conversion factor of 5.99.	0.87	Log Kow model for nonionic organics from USEPA, 2007**	4.73	USEPA, 2011
Dibromochloromethane	124481	--	1.0	USEPA, 1997	1	Default	1	Default	2.16	USEPA, 2011
Dimethyl phthalate	131113	--	1.0	USEPA, 1997	1	Default	1	Default	1.6	USEPA, 2011
Di-n-butyl phthalate	84742	--	1.0	USEPA, 1997	2,075	Log Kow model from USEPA, 1999** Converted to dry weight with a conversion factor of 5.99.	0.984	Log Kow model for nonionic organics from USEPA, 2007**	4.5	USEPA, 2011
Formaldehyde	50000	--	1	Default	1	Default	1	Default	0.35	USEPA, 2011
Hexachlorobutadiene	87683	--	1.0	USEPA, 1997	2.6	USEPA, 1999. Converted to dry weight with a conversion factor of 5.99.	0.85	Log Kow model for nonionic organics from USEPA, 2007**	4.78	USEPA, 2011
n-Nitrosodimethylamine	62759	--	1.0	USEPA, 1997	1	Default	1	Default	-0.57	USEPA, 2011
p-cresol	106445	--	1	Default	1	Default	1	Default	1.94	USEPA, 2011
Polynuclear Aromatic Hydrocarbons										
Acenaphthene	83329	--	0.29	USEPA, 1997	695	Log Kow model from USEPA, 1999** Converted to dry weight with a conversion factor of 5.99.	1.34	Log Kow model for nonionic organics from USEPA, 2007**	3.92	USEPA, 2011

Table 10-5
Summary of Aquatic Bioaccumulation Factors for Chemicals Detected in Sediment

Santa Susana Field Laboratory, Ventura County, California

Chemical	CAS#	Surrogate Used	Fish BAF (dry weight/dry weight)	Fish BAF Source	Aquatic Invertebrate BAF (dry weight/dry weight)	Aquatic Invertebrate BAF Source	Aquatic Plants BAF (dry weight/dry weight)	Aquatic Plants BAF Source	Log Kow	Source
Anthracene	120127	--	0.29	USEPA, 1997	1,888	Log Kow model from USEPA, 1999** Converted to dry weight with a conversion factor of 5.99.	1.01	Log Kow model for nonionic organics from USEPA, 2007**	4.45	USEPA, 2011
Benzo(a)anthracene	56553	--	0.29	USEPA, 1997	1.1	MWH, 2005 [a]	0.51	Log Kow model for nonionic organics from USEPA, 2007**	5.76	USEPA, 2011
Benzo(a)pyrene	50328	--	0.29	USEPA, 1997	0.56	MWH, 2005 [a]	0.42	Log Kow model for nonionic organics from USEPA, 2007**	6.13	USEPA, 2011
Benzo(b)fluoranthene	205992	--	0.29	USEPA, 1997	1.4	MWH, 2005 [a]	0.50	Log Kow model for nonionic organics from USEPA, 2007**	5.78	USEPA, 2011
Benzo(e)pyrene	192972	Benzo(a)pyrene - Fish BAF, Aquatic Invertebrate BAF	0.29	USEPA, 1997	0.56	MWH, 2005 [a]	0.35	Log Kow model for nonionic organics from USEPA, 2007**	6.44	USEPA, 2011
Benzo(ghi)perylene	191242	Benzo(a)pyrene - Fish BAF	0.29	USEPA, 1997	0.64	MWH, 2005 [a]	0.320	Log Kow model for nonionic organics from USEPA, 2007**	6.63	USEPA, 2011
Benzo(k)fluoranthene	207089	--	0.29	USEPA, 1997	0.79	MWH, 2005 [a]	0.421	Log Kow model for nonionic organics from USEPA, 2007**	6.11	USEPA, 2011
Chrysene	218019	--	0.29	USEPA, 1997	1.1	MWH, 2005 [a]	0.493	Log Kow model for nonionic organics from USEPA, 2007**	5.81	USEPA, 2011

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Santa Susana Field Laboratory, Ventura County, California

Chemical	CAS#	Surrogate Used	Fish BAF (dry weight/dry weight)	Fish BAF Source	Aquatic Invertebrate BAF (dry weight/dry weight)	Aquatic Invertebrate BAF Source	Aquatic Plants BAF (dry weight/dry weight)	Aquatic Plants BAF Source	Log Kow	Source
Dibenzo(a,h)anthracene	53703	--	0.29	USEPA, 1997	3.2	MWH, 2005 [a]	0.301	Log Kow model for nonionic organics from USEPA, 2007**	6.75	USEPA, 2011
Fluoranthene	206440	--	0.089	MWH, 2005 [b]	0.83	MWH, 2005 [a]	0.695	Log Kow model for nonionic organics from USEPA, 2007**	5.16	USEPA, 2011
Fluorene	86737	--	0.29	USEPA, 1997	1,135	Log Kow model from USEPA, 1999** Converted to dry weight with a conversion factor of 5.99.	1.17	Log Kow model for nonionic organics from USEPA, 2007**	4.18	USEPA, 2011
Indeno(1,2,3-cd)pyrene	193395	--	0.29	USEPA, 1997	0.63	MWH, 2005 [a]	0.309	Log Kow model for nonionic organics from USEPA, 2007**	6.7	USEPA, 2011
Phenanthrene	85018	--	0.26	MWH, 2005 [b]	1.5	MWH, 2005 [a]	1.01	Log Kow model for nonionic organics from USEPA, 2007**	4.46	USEPA, 2011
Pyrene	129000	--	0.29	USEPA, 1997	0.59	MWH, 2005 [a]	0.806	Log Kow model for nonionic organics from USEPA, 2007**	4.88	USEPA, 2011
Pesticides										
4,4'-DDD	72548	--	0.28	USEPA, 1997	36,459	Log Kow model from USEPA, 1999** Converted to dry weight with a conversion factor of 5.99.	0.44	Log Kow model for nonionic organics from USEPA, 2007**	6.02	USEPA, 2011

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Summary of Aquatic Bioaccumulation Factors for Chemicals Detected in Sediment

Santa Susana Field Laboratory, Ventura County, California

Chemical	CAS#	Surrogate Used	Fish BAF (dry weight/dry weight)	Fish BAF Source	Aquatic Invertebrate BAF (dry weight/dry weight)	Aquatic Invertebrate BAF Source	Aquatic Plants BAF (dry weight/dry weight)	Aquatic Plants BAF Source	Log Kow	Source
Terphenyls										
o-Terphenyl	84151	--	1	Default	14,201	Log Kow model from USEPA, 1999** Converted to dry weight with a conversion factor of 5.99.	0.575	Log Kow model for nonionic organics from USEPA, 2007**	5.52	USEPA, 2011
p-Terphenyl	92944	--	1	Default	37,153	Log Kow model from USEPA, 1999** Converted to dry weight with a conversion factor of 5.99.	0.439	Log Kow model for nonionic organics from USEPA, 2007**	6.03	USEPA, 2011
Total Petroleum Hydrocarbons										
TPH-Diesel Range Organics (DRO)	DRO	--	1	Default	1	Default	1	Default	--	USEPA, 2011
TPH-Gasoline Range Organics (GRO)	GRO	--	1	Default	1	Default	1	Default	--	USEPA, 2011
TPH-Kerosene Range Organics (KRO)	KRO	--	1	Default	1	Default	1	Default	--	USEPA, 2011
TPH-Oil Range Organics (ORO)	ORO	--	1	Default	1	Default	1	Default	--	USEPA, 2011
PCDD/PCDF										
2,3,7,8-TCDD_TEQ_Bird	1746016-TEQ_Bird	2,3,7,8-TCDD	2.5	MWH, 2005 [b]	0.82	MWH, 2005 [a]	0.293	Log Kow model for nonionic organics from USEPA, 2007**	6.8	USEPA, 2011
Polychlorinated Biphenyls (PCBs)										
Aroclor 1016	12674112	--	1.85	USEPA, 1997	3.2	USEPA, 1999. Converted to dry weight with a conversion factor of 5.99.	0.55	Log Kow model for nonionic organics from USEPA, 2007**	5.62	USEPA, 2011

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Aroclor 1254	11097691	--	1.85	USEPA, 1997	Regression	Bechtel Jacobs, 1998a	0.34	Log Kow model for nonionic organics from USEPA, 2007**	6.5	USEPA, 2011
PCB_TEQ_Bird (Coplanar PCBs)	1746016-PCB TEQ_Bird	2,3,7,8-TCDD	2.5	MWH, 2005 [b]	0.82	MWH, 2005 [a]	0.293	Log Kow model for nonionic organics from USEPA, 2007**	6.8	USEPA, 2011
PCB-105	32598144	--	265.709479	MWH, 2005 b	36.03758508	MWH, 2005 b	1.4377509	MWH, 2005	6.79	USEPA, 2008
PCB-114	74472370	--	279.873909	MWH, 2005 b	53.91674768	MWH, 2005 b	0.266	Log Kow model for nonionic organics from USEPA, 2007**	6.98	USEPA, 2008
PCB-123	65510443	--	364.817444	MWH, 2005 b	80.94288902	MWH, 2005 b	0.266	Log Kow model for nonionic organics from USEPA, 2007**	6.98	USEPA, 2008
PCB-126	57465288	--	115.064967	MWH, 2005 b	28.23186733	MWH, 2005 b	0.266	Log Kow model for nonionic organics from USEPA, 2007**	6.98	USEPA, 2008
PCB-156	38380084	--	369.29196	MWH, 2005 b	50.51783438	MWH, 2005 b	1.6454545	MWH, 2005	7.6	USEPA, 2008
PCB-157	69782907	--	284.771633	MWH, 2005 b	54.46658533	MWH, 2005 b	0.190	Log Kow model for nonionic organics from USEPA, 2007**	7.62	USEPA, 2008
PCB-167	52663726	--	382.873141	MWH, 2005 b	73.91900937	MWH, 2005 b	0.202	Log Kow model for nonionic organics from USEPA, 2007**	7.5	USEPA, 2008

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Chemical	CAS#	Surrogate Used	Fish BAF (dry weight/dry weight)	Fish BAF Source	Aquatic Invertebrate BAF (dry weight/dry weight)	Aquatic Invertebrate BAF Source	Aquatic Plants BAF (dry weight/dry weight)	Aquatic Plants BAF Source	Log Kow	Source
PCB-169	32774166	PCB-167	382.873141	MWH, 2005 b	73.91900937	MWH, 2005 b	0.190	Log Kow model for nonionic organics from USEPA, 2007**	7.62	USEPA, 2008
PCB-189	39635319	--	15.3293135	MWH, 2005 b	3.628307545	MWH, 2005 b	0.135	Log Kow model for nonionic organics from USEPA, 2007**	8.27	USEPA, 2008
PCB-77	32598133	--	19.1802263	MWH, 2005 b	19.8430372	MWH, 2005 b	0.320	Log Kow model for nonionic organics from USEPA, 2007**	6.63	USEPA, 2008
PCB-81	70362504	--	128.692382	MWH, 2005 b	8.348375091	MWH, 2005 b	0.373	Log Kow model for nonionic organics from USEPA, 2007**	6.34	USEPA, 2008
Chemical Parameters										
Chloride	16887006	--	1	Default	1	Default	1	Default	0.54	USEPA, 2011
Nitrate	NO3N	--	1	Default	1	Default	1	Default	0.21	USEPA, 2011
Nitrite-NO2	E-10128	--	1	Default	1	Default	1	Default	0.0564	USEPA, 2011
Sulfate	14808798	--	1	Default	1	Default	1	Default	-2.2	USEPA, 2011

Notes:

BAF - Bioaccumulation factor
BSAF - Biota to sediment accumulation factor
DDD - dichlorodiphenyldichloroethane
DDE - dichlorodiphenyldichloroethylene
HMX - high melting explosive
Log Kow - Log of octanol water partition coefficient
RDX - Research Department Explosive
TCDD -Tetrachlorodibenzodioxin
TEQ - toxicity equivalent
USEPA - U.S. Environmental Protection Agency

"--" Indicates value could not be found, or not applicable.
** Used log Kow model as noted below except where chemical-specific bioaccumulatoin factors are available:
Sediment to plant: BSAF for organics with log Kows between 3 and 8 were derived using log BSAF = -0.229*(logKow)+1.0237 (unrinsed plants, USEPA, 2007)
Sediment to aquatic invetebrate: Concentration in aquatic invertebrate calculated from log Kow using model for organics with log Kows between 3 and 8 from USEPA, 1999. Caqinvert = 10^((0.819*logKow)-1.146).

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Santa Susana Field Laboratory, Ventura County, California

Chemical	CAS#	Surrogate Used	Fish BAF (dry weight/dry weight)	Fish BAF Source	Aquatic Invertebrate BAF (dry weight/dry weight)	Aquatic Invertebrate BAF Source	Aquatic Plants BAF (dry weight/dry weight)	Aquatic Plants BAF Source	Log Kow	Source

[a] Previous BAFs included in MWH 2005 were presented in scientific notation. However, they have been updated to equivalent numeric values for this technical memorandum.

[b] In October 2011, it was determined that sediment to benthic invertebrate values taken from USEPA, 1999 were in units of wet tissue weight/dry sediment weight. As a result, aquatic invertebrate BAFs selected from USEPA, 1999 were recalculated using a conversion factor of 5.99, the same conversion factor used by USEPA, 1999 to convert sample weights from dry to wet. Recalculated BAFs are presented here.

Sources:

Bechtel-Jacobs Company, LLC. 1998a. Biota Sediment Accumulation Factors for Invertebrates: Review and Recommendations for the Oak Ridge Reservation. Bethel Jacobs Company LLC, Oak Ridge, Tennessee. BJC/OR-112. BAF units are in dry tissue weight (mg/kg) / dry sediment weight (mg/kg).

MWH Americas, Inc. (MWH) 2005. Standardized Risk Assessment Methodology (SRAM) Work Plan, Santa Susana Field Laboratory, Ventura County, California. Revision 2 – Final. September. HDMSE00198. BAF units are in dry weight tissue/dry weight medium and are in pg/g for dioxins/furans, mg/kg for metals, ng/g for PCBs and ug/kg PAHs.

PTI Environmental Services. 1995. Bioaccumulation Factor Approach Analysis for metals and Polar Organic Compounds. CA0U-03-03. October. BAF units are in dry weight tissue/dry weight sediment.

USEPA. 2011. Estimation Program Interfce (EPI) Suite Software (EPI Kow v1.68). http://www.epa.gov/oppt/exposure/pubs/episuite.htm. Searched December 2011. As recommended by this software, estimated values were only used when experimental (measured) values were unavailable within the database.

USEPA, 2007. Exposure Factors and Bioaccumulation Models for Derivation of Wildlife Eco-SSLs - Regression models for organics. BAF regression formula derived from dry weight/dry weight values.

USEPA. 1999. Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities. Peer Review Draft. November. Aquatic invertebrate BAFs were converted from wet tissue weight in source document to dry tissue weight-based BAFs. BAF units presented here are mg/kg (dry tissue weight) / mg/kg (dry sediment weight).

USEPA. 1997. The Incidence and Severity of Sediment Contamination in Surface Waters of the United States, Volume 1: National Sediment Quality Survey. Appendix D. EPA 823-R-97-006. September. BAF values in dry tissue weight/dry sediment weight.

Table 10-6
Summary of Terrestrial Bioaccumulation Factors for Chemicals Detected in Soil
Santa Susana Field Laboratory, Ventura County, California

Chemical	CAS#	Surrogate Used	Terrestrial Plant BAF (dry weight/dry weight)	Terrestrial Plant BAF Source	Soil Invertebrate BAF (dry weight/dry weight)	Soil Invertebrate BAF Source	Small Mammal BAF (dry weight/dry weight)	Small Mammal BAF Source	LogKow	LogKow Source
Inorganic Compounds										
Aluminum	7429905	--	0.74	MWH, 2005 [a]	0.37	MWH, 2005 [a]	0.12	MWH, 2005 [a]	0.33	USEPA, 2011
Antimony	7440360	--	5.4	MWH, 2005 [a]	7.9	MWH, 2005 [a,b]	0.58	MWH, 2005 [a]	0.73	USEPA, 2011
Arsenic	7440382	--	0.77	MWH, 2005 [a]	0.62	MWH, 2005 [a,b]	0.0149	90th percentile from Sample et al., 1998	0.68	USEPA, 2011
Barium	7440393	--	1.0	MWH, 2005 [a]	2.9	MWH, 2005 [a,b]	0.36	MWH, 2005 [a]	0.23	USEPA, 2011
Beryllium	7440417	--	0.61	MWH, 2005 [a]	0.39	MWH, 2005 [a,b]	1	Default	-0.57	USEPA, 2011
Boron	7440428	--	7.4	MWH, 2005 [a]	4.6	MWH, 2005 [a,b]	12	MWH, 2005 [a]	0.23	USEPA, 2011
Cadmium	7440439	--	11	MWH, 2005 [a]	20	MWH, 2005 [a,b]	3.9905	90th percentile from Sample et al., 1998	-0.07	USEPA, 2011
Chromium	7440473	--	9.4	MWH, 2005 [a]	2.4	MWH, 2005 [a]	0.15	MWH, 2005 [a]	0.23	USEPA, 2011
Cobalt	7440484	--	0.66	MWH, 2005 [a]	0.26	MWH, 2005 [a,b]	0.25	MWH, 2005 [a]	0.23	USEPA, 2011
Copper	7440508	--	1.9	MWH, 2005 [a]	15	MWH, 2005 [a,b]	0.76	MWH, 2005 [a]	-0.57	USEPA, 2011
Cyanides	57125	--	1	Default	1	Default	1	Default	-0.250	USEPA, 2011
Fluoride	7782414	--	1	Default	1	Default	1	Default	0.22	USEPA, 2011
Hexavalent Chromium	18540299	Chromium	9.4	MWH, 2005 [a]	2.4	MWH, 2005 [a]	0.15	MWH, 2005 [a]	--	USEPA, 2011
Lead	7439921	--	2.1	MWH, 2005 [a]	0.31	MWH, 2005 [a,b]	0.2864	90th percentile from Sample et al., 1998	0.73	USEPA, 2011
Lithium	7439932	--	1	Default	1	Default	1	Default	-0.77	USEPA, 2011
Manganese	7439965	--	0.85	MWH, 2005 [a]	0.73	MWH, 2005 [a,b]	0.15	MWH, 2005 [a]	0.23	USEPA, 2011
Mercury	7439976	--	0.82	MWH, 2005 [a]	3.4	MWH, 2005 [a,b]	0.192	Sample et al., 1998	0.62	USEPA, 2011
Methyl Mercury	22967926	--	1	Default	1	Default	1	Default	0.08	USEPA, 2011
Molybdenum	7439987	--	14	MWH, 2005 [a]	5.9	MWH, 2005 [a,b]	2.9	MWH, 2005 [a]	0.23	USEPA, 2011
Nickel	7440020	--	7.7	MWH, 2005 [a]	2.1	MWH, 2005 [a]	0.12	MWH, 2005 [a]	-0.57	USEPA, 2011
Phosphorus	7723140	--	3.5	1984	1	Default	1	Default	-0.27	USEPA, 2011

Table 10-6
Summary of Terrestrial Bioaccumulation Factors for Chemicals Detected in Soil
Santa Susana Field Laboratory, Ventura County, California

Chemical	CAS#	Surrogate Used	Terrestrial Plant BAF (dry weight/dry weight)	Terrestrial Plant BAF Source	Soil Invertebrate BAF (dry weight/dry weight)	Soil Invertebrate BAF Source	Small Mammal BAF (dry weight/dry weight)	Small Mammal BAF Source	LogKow	LogKow Source
Selenium	7782492	--	Regression	Bechtel Jacobs, 1998b	4.2	MWH, 2005 [a,b]	5.8	MWH, 2005 [a]	0.24	USEPA, 2011
Silver	7440224	--	1.7	MWH, 2005 [a]	14	MWH, 2005 [a,b]	0.004	USEPA, 2007	0.23	USEPA, 2011
Strontium	7440246	--	1	Default	1	Default	1	Default	0.23	USEPA, 2011
Thallium	7440280	--	0.51	MWH, 2005 [a]	1.1	MWH, 2005 [a]	1	Default	0.23	USEPA, 2011
Tin	7440315	--	1	Default	1	Default	1	Default	1.29	USEPA, 2011
Titanium	7440326	--	1	Default	1	Default	1	Default	0.23	USEPA, 2011
Vanadium	7440622	--	0.69	MWH, 2005 [a]	0.32	MWH, 2005 [a]	0.17	MWH, 2005 [a]	0.23	USEPA, 2011
Zinc	7440666	--	1.6	MWH, 2005 [a]	3.0	MWH, 2005 [a,b]	3.5	MWH, 2005 [a]	-0.47	USEPA, 2011
Zirconium	7440677	--	1	Default	1	Default	1	Default	-0.57	USEPA, 2011
Energetic Constituents										
1,2-Dinitrobenzene	528290	--	1	Default	1	Default	1	Default	1.69	USEPA, 2011
1,3-Dinitrobenzene	99650	--	1	Default	1	Default	1	Default	1.49	USEPA, 2011
2,4,6-Trinitrotoluene	118967	--	3.53	CH2M HILL, 2005	0.0581	CH2M HILL, 2005	1	Default	1.60	USEPA, 2011
2-Amino-4,6-Dinitrotoluene	35572782	--	7.5	90th percentile from CH2M HILL, 2005	7.77	Calculated 90th Percentile Using Data in CH2M HILL, 2005	1	Default	1.84	USEPA, 2011
HMX	2691410	--	Regression	CH2M HILL, 2005	0.313	CH2M HILL, 2005	1	Default	0.16	USEPA, 2011
Hydrazine	302012	--	1	Default	1	Default	1	Default	-2.07	USEPA, 2011
Monomethylhydrazine	60344	--	1	Default	1	Default	1	Default	-1.05	USEPA, 2011
Perchlorate	14797730	--	95% UPL on the Regression	CH2M HILL, 2005	0.281	CH2M HILL, 2005	1	Default	NA	USEPA, 2011

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RDX	121824	--	0.43	USEPA, 2007	8.8	Calculated 90th percentile BAF value using available data from CH2M HILL, 2005	1	Default	0.87	USEPA, 2011
Volatile Organic Compounds										
1,1,1,2-Tetrachloroethane	630206	--	1	Default	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	2.93	USEPA, 2011
1,1,1-Trichloroethane	71556	--	1	Default	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	2.49	USEPA, 2011
1,1,2,2-Tetrachloroethane	79345	--	1	Default	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	2.39	USEPA, 2011
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	--	1.996	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	3.16	USEPA, 2011
1,1,2-Trichloroethane	79005	--	1	Default	1	Default	1	Default	1.89	USEPA, 2011
1,1-Dichloroethane	75343	--	1	Default	1	Default	1	Default	1.79	USEPA, 2011
1,1-Dichloroethene	75354	--	1	Default	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	2.13	USEPA, 2011

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1,2,3-Trichlorobenzene	87616	--	1.25	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	4.05	USEPA, 2011
1,2,4-Trichlorobenzene	120821	--	1.27	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	4.02	USEPA, 2011
1,2,4-Trimethylbenzene	95636	--	1.56	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	3.63	USEPA, 2011
1,2-Dibromoethane	106934	--	1	Default	1	Default	1	Default	1.96	USEPA, 2011
1,2-Dichlorobenzene	95501	--	1.73	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	3.43	USEPA, 2011
1,2-Dichloroethane	107062	--	1	Default	1	Default	1	Default	1.48	USEPA, 2011
1,2-Dichloroethene	540590	--	1	Default	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	2.00	USEPA, 2011
1,2-Dichloropropane	78875	--	1	Default	1	Default	1	Default	1.98	USEPA, 2011

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1,3,5-Trimethylbenzene	108678	--	1.74	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	3.42	USEPA, 2011
1,3-Dichlorobenzene	541731	--	1.64	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	3.53	USEPA, 2011
1,4-Dichlorobenzene	106467	--	1.72	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	3.44	USEPA, 2011
2-Chloroethylvinyl ether	110758	--	1	Default	1	Default	1	Default	1.17	USEPA, 2011
2-Hexanone	591786	--	1	Default	1	Default	1	Default	1.38	USEPA, 2011
Acetone	67641	--	1	Default	1	Default	1	Default	-0.24	USEPA, 2011
Acetic Acid	64197	--	1	Default	1	Default	1	Default	-0.17	USEPA, 2011
Benzene	71432	--	1	Default	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	2.13	USEPA, 2011
Bromide	24959679	--	1	Default	1	Default	1	Default	0.63	USEPA, 2011
Bromobenzene	108861	--	1	Default	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	2.99	USEPA, 2011

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Bromodichloromethane	75274	--	1	Default	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	2	USEPA, 2011
Bromomethane	74839	--	1	Default	1	Default	1	Default	1.19	USEPA, 2011
Carbon Disulfide	75150	--	1	Default	1	Default	1	Default	1.94	USEPA, 2011
Carbon Tetrachloride	56235	--	1	Default	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	2.83	USEPA, 2011
Chlorobenzene	108907	--	1	Default	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	2.84	USEPA, 2011
Chloroform	67663	--	1	Default	1	Default	1	Default	1.97	USEPA, 2011
Chloromethane	74873	--	1	Default	1	Default	1	Default	0.91	USEPA, 2011
cis-1,2-Dichloroethene	156592	--	1	Default	1	Default	1	Default	1.86	USEPA, 2011
Cumene	98828	--	1.53	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	3.66	USEPA, 2011
Dibenzofuran	132649	--	1.20	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	4.12	USEPA, 2011
Dibromomethane	74953	--	1	Default	1	Default	1	Default	1.7	USEPA, 2011
Dichlorodifluoromethane	75718	--	1	Default	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	2.16	USEPA, 2011

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Ethylbenzene	100414	--	2.01	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	3.15	USEPA, 2011
Methyl ethyl ketone	78933	--	1	Default	1	Default	1	Default	0.29	USEPA, 2011
Methyl isobutyl ketone (MIBK)	108101	--	1	Default	1	Default	1	Default	1.31	USEPA, 2011
Methylene chloride	75092	--	1	Default	1	Default	1	Default	1.25	USEPA, 2011
m-Xylene & p-Xylene	136777612	--	1.95	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	3.2	USEPA, 2011
n-Butylbenzene	104518	--	1.05	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	4.38	USEPA, 2011
n-Propylbenzene	103651	--	1.51	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	3.69	USEPA, 2011
o-Chlorotoluene	95498	--	1.74	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	3.42	USEPA, 2011

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o-Xylene	95476	--	2.04	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	3.12	USEPA, 2011
p-Chlorotoluene	106434	--	1.82	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	3.33	USEPA, 2011
p-Cymene	99876	--	1.22	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	4.1	USEPA, 2011
sec-Butylbenzene	135988	--	0.949	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	4.57	USEPA, 2011
Styrene	100425	--	1	Default	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	2.95	USEPA, 2011
tert-Butylbenzene	98066	--	1.21	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	4.11	USEPA, 2011

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Tetralin	119642	--	1.68	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	3.49	USEPA, 2011
Tetrachloroethene	127184	--	1.76	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	3.4	USEPA, 2011
Toluene	108883	--	1	Default	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	2.73	USEPA, 2011
trans-1,2-Dichloroethene	156605	--	1	Default	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	2.09	USEPA, 2011
Trichloroethene	79016	--	1	Default	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	2.42	USEPA, 2011
Trichlorofluoromethane	75694	--	1	Default	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	2.53	USEPA, 2011
Vinyl chloride	75014	--	1	Default	1	Default	1	Default	1.62	USEPA, 2011

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Xylenes, Total	1330207	--	2.00	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	3.16	USEPA, 2011
Semi-Volatile Organic Compounds										
1,1-Dimethylhydrazine	57147	--	1	Default	1	Default	1	Default	-1.19	USEPA, 2011
1,2-Dibromo-3-chloropropane	96128	--	1	Default	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	2.96	USEPA, 2011
1,4-Dioxane	123911	--	1	Default	1	Default	1	Default	-0.27	USEPA, 2011
2,4,5-Trichlorophenol	95954	--	1.49	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	3.72	USEPA, 2011
2,4,6-Trichlorophenol	88062	--	1.51	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	3.69	USEPA, 2011
2,4-Dimethylphenol	105679	--	1	Default	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	2.3	USEPA, 2011
3,5-Dimethylphenol	108689	--	1	Default	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	2.35	USEPA, 2011

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Benzoic acid	65850	--	1	Default	1	Default	1	Default	1.87	USEPA, 2011
Benzyl alcohol	100516	--	1	Default	1	Default	1	Default	1.1	USEPA, 2011
bis(2-Ethylhexyl) phthalate	117817	--	0.19	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	7.6	USEPA, 2011
Bromoform	75252	--	1	Default	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	2.4	USEPA, 2011
Butyl benzyl phthalate	85687	--	0.872	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	4.73	USEPA, 2011
Carbazole	86748	--	1.49	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	3.72	USEPA, 2011
Dibromochloromethane	124481	--	1	Default	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	2.16	USEPA, 2011
Diethyl phthalate	84662	--	1	Default	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	2.42	USEPA, 2011
Dimethyl phthalate	131113	--	1	Default	1	Default	1	Default	1.6	USEPA, 2011

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Di-n-butyl phthalate	84742	--	0.984	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	4.5	USEPA, 2011
Di-n-octyl phthalate	117840	--	1	Default	1	Default	1	Default	8.1	USEPA, 2011
Formaldehyde	50000	--	1	Default	1	Default	1	Default	0.35	USEPA, 2011
Hexachlorobutadiene	87683	--	0.849	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	4.78	USEPA, 2011
m-Cresol	108394	o-Cresol	1	Default	1	Default	1	Default	1.96	USEPA, 2011
n-Nitrosodimethylamine	62759	--	1	Default	1	Default	1	Default	-0.57	USEPA, 2011
n-Nitrosodiphenylamine	86306	--	2.03	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	3.13	USEPA, 2011
o-Cresol	95487	--	1	Default	1	Default	1	Default	1.95	USEPA, 2011
p-Chloro-m-cresol	59507	2-Chlorophenol	2.06	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	3.1	USEPA, 2011
p-Cresol	106445	o-Cresol	1	Default	1	Default	1	Default	1.94	USEPA, 2011
Pentachlorophenol	87865	--	5.93	USEPA, 2007	14.63	USEPA, 2007	1	Default	5.12	USEPA, 2011
Phenol	108952	--	1	Default	1	Default	1	Default	1.46	USEPA, 2011
p-Nitroaniline	100016	--	1	Default	1	Default	1	Default	1.39	USEPA, 2011

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Polynuclear Aromatic Hydrocarbons										
1-Methyl naphthalene	90120	--	1.37	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	DTSC, 2013	3.87	USEPA, 2011
2-Methylnaphthalene	91576	--	1.38	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	DTSC, 2013	3.86	USEPA, 2011
Acenaphthene	83329	--	7.3	Median from USEPA, 2007	2.4	MWH, 2005 [a]	1	DTSC, 2013	3.92	USEPA, 2011
Acenaphthylene	208968	--	0.50	Median Calculated Using Data in USEPA, 2007	22.9	USEPA, 2007	1	DTSC, 2013	3.94	USEPA, 2011
Anthracene	120127	--	1.5	Median from USEPA, 2007	2.8	MWH, 2005 [a]	1	DTSC, 2013	4.45	USEPA, 2011
Benzo(a)anthracene	56553	--	5.2	MWH, 2005 [a]	1.9	MWH, 2005 [a]	1	DTSC, 2013	5.76	USEPA, 2011
Benzo(a)pyrene	50328	--	0.10	Median from USEPA, 2007	1.0	MWH, 2005 [a]	1	DTSC, 2013	6.13	USEPA, 2011
Benzo(b)fluoranthene	205992	--	0.31	USEPA, 2007	2.0	MWH, 2005 [a]	1	DTSC, 2013	5.78	USEPA, 2011
Benzo(e)pyrene	192972	--	0.19	USEPA, 2007	1.1	MWH, 2005 [a]	1	DTSC, 2013	6.44	USEPA, 2011
Benzo(ghi)perylene	191242	--	0.21	Median from USEPA, 2007	0.53	MWH, 2005 [a]	1	DTSC, 2013	6.63	USEPA, 2011
Benzo(k)fluoranthene	207089	--	0.235	Median from USEPA, 2007	0.89	MWH, 2005 [a]	1	DTSC, 2013	6.11	USEPA, 2011

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Chrysene	218019	--	2.8	MWH, 2005 [a]	1.9	MWH, 2005 [a]	1	DTSC, 2013	5.81	USEPA, 2011
Dibenzo(a,h)anthracene	53703	--	0.13	USEPA, 2007	2.31	USEPA, 2007	1	DTSC, 2013	6.75	USEPA, 2011
Fluoranthene	206440	--	2.8	MWH, 2005 [a]	0.91	MWH, 2005 [a]	1	DTSC, 2013	5.16	USEPA, 2011
Fluorene	86737	--	7.3	Median from USEPA, 2007	3.9	MWH, 2005 [a]	1	DTSC, 2013	4.18	USEPA, 2011
Indeno(1,2,3-cd)pyrene	193395	--	0.309	Log Kow model for nonionic organics from USEPA, 2007**	0.86	MWH, 2005 [a]	1	DTSC, 2013	6.7	USEPA, 2011
Naphthalene	91203	--	12.2	USEPA, 2007	4.4	USEPA, 2007	1	DTSC, 2013	3.3	USEPA, 2011
Perylene	198550	--	0.391	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	DTSC, 2013	6.25	USEPA, 2011
Phenanthrene	85018	--	7.2	MWH, 2005 [a]	1.8	MWH, 2005 [a]	1	DTSC, 2013	4.46	USEPA, 2011
Pyrene	129000	--	1.9	MWH, 2005 [a]	2.9	MWH, 2005 [a]	1	DTSC, 2013	4.88	USEPA, 2011
Pesticides										
4,4'-DDD	72548	--	0.442	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	6.02	USEPA, 2011
4,4'-DDE	72559	--	0.341	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	6.51	USEPA, 2011

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4,4'-DDT	50293	--	0.276	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	6.91	USEPA, 2011
Aldrin	309002	--	0.343	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	6.5	USEPA, 2011
alpha-BHC	319846	--	1.42	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	3.8	USEPA, 2011
beta-BHC	319857	--	1.44	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	3.78	USEPA, 2011
Chlordane (Technical)	12789036	--	0.40	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	6.22	USEPA, 2011

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delta-BHC	319868	--	1.19	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	4.14	USEPA, 2011
Dieldrin	60571	--	0.612	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	5.4	USEPA, 2011
Endosulfan I	959988	--	1.40	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	3.83	USEPA, 2011
Endosulfan II	33213659	Endosulfan I	1.40	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	3.83	USEPA, 2011
Endosulfan sulfate	1031078	--	1.53	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	3.66	USEPA, 2011

Table 10-6
Summary of Terrestrial Bioaccumulation Factors for Chemicals Detected in Soil
Santa Susana Field Laboratory, Ventura County, California

Chemical	CAS#	Surrogate Used	Terrestrial Plant BAF (dry weight/dry weight)	Terrestrial Plant BAF Source	Soil Invertebrate BAF (dry weight/dry weight)	Soil Invertebrate BAF Source	Small Mammal BAF (dry weight/dry weight)	Small Mammal BAF Source	LogKow	LogKow Source
Endrin	72208	--	0.681	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	5.2	USEPA, 2011
Endrin aldehyde	7421934	--	0.840	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	4.8	USEPA, 2011
Endrin ketone	53494705	--	0.760	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	4.99	USEPA, 2011
gamma-BHC	58899	--	1.49	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	3.72	USEPA, 2011
Heptachlor	76448	--	0.423	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	6.1	USEPA, 2011

Table 10-6
Summary of Terrestrial Bioaccumulation Factors for Chemicals Detected in Soil
Santa Susana Field Laboratory, Ventura County, California

Chemical	CAS#	Surrogate Used	Terrestrial Plant BAF (dry weight/dry weight)	Terrestrial Plant BAF Source	Soil Invertebrate BAF (dry weight/dry weight)	Soil Invertebrate BAF Source	Small Mammal BAF (dry weight/dry weight)	Small Mammal BAF Source	LogKow	LogKow Source
Heptachlor epoxide	1024573	--	0.764	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	4.98	USEPA, 2011
MCPA	94746	--	1.90	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	3.25	USEPA, 2011
Mirex	2385855	--	0.279	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	6.89	USEPA, 2011
p,p'-Methoxychlor	72435	--	0.725	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	5.08	USEPA, 2011
Toxaphene	8001352	--	0.47	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	5.90	USEPA, 2011
Herbicides										

Table 10-6
Summary of Terrestrial Bioaccumulation Factors for Chemicals Detected in Soil
Santa Susana Field Laboratory, Ventura County, California

Chemical	CAS#	Surrogate Used	Terrestrial Plant BAF (dry weight/dry weight)	Terrestrial Plant BAF Source	Soil Invertebrate BAF (dry weight/dry weight)	Soil Invertebrate BAF Source	Small Mammal BAF (dry weight/dry weight)	Small Mammal BAF Source	LogKow	LogKow Source
2,4,5-T	93765	--	1.84	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	3.31	USEPA, 2011
2,4,5-TP (Silvex)	93721	--	1.42	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	3.8	USEPA, 2011
2,4-Dichlorophenoxyacetic Acid (2,4-D)	94757	--	1	Default	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	2.81	USEPA, 2011
2,4-Dichlorophenoxybutyric acid	94826	--	1.64	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	3.53	USEPA, 2011
2,4-DP (Dichlorprop)	120365	--	1.73	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	3.43	USEPA, 2013
Dalapon	75990	--	1	Default	1	Default	1	Default	0.78	USEPA, 2011
Dicamba	1918009	--	1	Default	1	Default	1	Default	2.21	USEPA, 2011

Table 10-6
Summary of Terrestrial Bioaccumulation Factors for Chemicals Detected in Soil
Santa Susana Field Laboratory, Ventura County, California

Chemical	CAS#	Surrogate Used	Terrestrial Plant BAF (dry weight/dry weight)	Terrestrial Plant BAF Source	Soil Invertebrate BAF (dry weight/dry weight)	Soil Invertebrate BAF Source	Small Mammal BAF (dry weight/dry weight)	Small Mammal BAF Source	LogKow	LogKow Source
Dinoseb	88857	--	1.62	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	3.56	USEPA, 2011
MCPP	93652	--	2.03	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	3.13	USEPA, 2011
Terphenyls										
m-Terphenyl	92068	--	0.575	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	5.52	USEPA, 2011
o-Terphenyl	84151	--	0.57	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	5.52	USEPA, 2011
p-Terphenyl	92944	--	0.44	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	6.03	USEPA, 2011
Glycols										
Diethylene Glycol	111466	--	1	Default	1	Default	1	Default	-1.47	USEPA, 2011
Triethylene glycol	112276	--	1	Default	1	Default	1	Default	-1.75	USEPA, 2011

Table 10-6
Summary of Terrestrial Bioaccumulation Factors for Chemicals Detected in Soil
Santa Susana Field Laboratory, Ventura County, California

Chemical	CAS#	Surrogate Used	Terrestrial Plant BAF (dry weight/dry weight)	Terrestrial Plant BAF Source	Soil Invertebrate BAF (dry weight/dry weight)	Soil Invertebrate BAF Source	Small Mammal BAF (dry weight/dry weight)	Small Mammal BAF Source	LogKow	LogKow Source
Total Petroleum Hydrocarbons										
TPH-Diesel Range Organics (DRO)	DRO	--	1	Default	1	Default	1	Default	--	USEPA, 2011
TPH-Gasoline Range Organics (GRO)	GRO	--	1	Default	1	Default	1	Default	--	USEPA, 2011
PCDD/PCDFs										
2,3,7,8-TCDD_TEQ_Bird	1746016-TEQ_Bird	2,3,7,8-TCDD	0.293	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	6.8	USEPA, 2011
2,3,7,8-TCDD_TEQ_Mammal	1746016-TEQ_Mammal	2,3,7,8-TCDD	0.293	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	6.8	USEPA, 2011
Polychlorinated Biphenyls (PCBs)										
Aroclor 1016	12674112	--	0.545	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	5.62	USEPA, 2011
Aroclor 1242	53469219	--	0.383	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	6.29	USEPA, 2011

Table 10-6
Summary of Terrestrial Bioaccumulation Factors for Chemicals Detected in Soil
Santa Susana Field Laboratory, Ventura County, California

Chemical	CAS#	Surrogate Used	Terrestrial Plant BAF (dry weight/dry weight)	Terrestrial Plant BAF Source	Soil Invertebrate BAF (dry weight/dry weight)	Soil Invertebrate BAF Source	Small Mammal BAF (dry weight/dry weight)	Small Mammal BAF Source	LogKow	LogKow Source
Aroclor 1248	12672296	--	0.40	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	6.2	USEPA, 2011
Aroclor 1254	11097691	--	0.34	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	6.5	USEPA, 2011
Aroclor 1260	11096825	Aroclor 1254	0.20	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	7.55	USEPA, 2011
Aroclor 5460	11126424	--	0.34	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	6.50	USEPA, 2011
PCB_TEQ_Bird (Coplanar PCBs)	1746016-PCB TEQ_Bird	2,3,7,8-TCDD	0.293	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	6.8	USEPA, 2011

Table 10-6
Summary of Terrestrial Bioaccumulation Factors for Chemicals Detected in Soil
Santa Susana Field Laboratory, Ventura County, California

Chemical	CAS#	Surrogate Used	Terrestrial Plant BAF (dry weight/dry weight)	Terrestrial Plant BAF Source	Soil Invertebrate BAF (dry weight/dry weight)	Soil Invertebrate BAF Source	Small Mammal BAF (dry weight/dry weight)	Small Mammal BAF Source	LogKow	LogKow Source
PCB_TEQ_Mammal (Coplanar PCBs)	1746016-PCB TEQ_Mammal	2,3,7,8-TCDD	0.293	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	6.8	USEPA, 2011
PCB-105	32598144	--	3.303	MWH, 2005	10	MWH, 2005	2.70046902	MWH, 2005	6.79	USEPA, 2008
PCB-114	74472370	--	3.684	MWH, 2005	27	MWH, 2005	6.58789339	MWH, 2005	6.98	USEPA, 2008
PCB-118	31508006	--	3.152	MWH, 2005	11	MWH, 2005	2.79891304	MWH, 2005	7.12	USEPA, 2008
PCB-123	65510443	--	3.419	MWH, 2005	13	MWH, 2005	3.38106851	MWH, 2005	6.98	USEPA, 2008
PCB-126	57465288	--	2.226	MWH, 2005	5.325	MWH, 2005	1.84966599	MWH, 2005	6.98	USEPA, 2008
PCB-156	38380084	--	2.5	MWH, 2005	5.8	MWH, 2005	3.93746534	MWH, 2005	7.6	USEPA, 2008
PCB-157	69782907	--	2.6	MWH, 2005	5.9	MWH, 2005	26.572553	MWH, 2005	7.62	USEPA, 2008
PCB-167	52663726	--	2.8	MWH, 2005	5.88	MWH, 2005	4.88556338	MWH, 2005	7.5	USEPA, 2008
PCB-169	32774166	--	0.190	Log Kow model for nonionic organics from USEPA, 2007**	Log Kow model	Log Kow model from USEPA, 2007**	1	Default	7.62	USEPA, 2008
PCB-189	39635319	--	2.164	MWH, 2005	2.386	MWH, 2005	7.03347059	MWH, 2005	8.27	USEPA, 2008
PCB-77	32598133	--	2.4	MWH, 2005	6.2	MWH, 2005	0.7684949	MWH, 2005	6.63	USEPA, 2008
PCB-81	70362504	--	3	MWH, 2005	5.981	MWH, 2005	1	Default	6.34	USEPA, 2008
Chemical Parameters		--								

Table 10-6
Summary of Terrestrial Bioaccumulation Factors for Chemicals Detected in Soil
Santa Susana Field Laboratory, Ventura County, California

Chemical	CAS#	Surrogate Used	Terrestrial Plant BAF (dry weight/dry weight)	Terrestrial Plant BAF Source	Soil Invertebrate BAF (dry weight/dry weight)	Soil Invertebrate BAF Source	Small Mammal BAF (dry weight/dry weight)	Small Mammal BAF Source	LogKow	LogKow Source
Ammonia-N	7664417	--	1	Default	1	Default	1	Default	-1.38	USEPA, 2011
Chloride	16887006	--	1	Default	1	Default	1	Default	0.54	USEPA, 2011
Nitrate	NO3N	--	1	Default	1	Default	1	Default	0.21	USEPA, 2011
Nitrite-NO2	E-10128	--	1	Default	1	Default	1	Default	0.06	USEPA, 2011
Orthophosphate – PO4	14265442	--	1	Default	1	Default	1	Default	-0.77	USEPA, 2011
Sulfate	14808798	--	1	Default	1	Default	1	Default	-2.2	USEPA, 2011

Notes:

BAF - Bioaccumulation factor
BHC - benzene hexachloride
DDD - dichlorodiphenyldichloroethane
DDE - dichlorodiphenyldichloroethylene
DDT - dichlorodiphenyltrichloroethane
HMX - high melting explosive
Log Kow - Log of octanol water partition coefficient
MCPA - 2-methyl-4-chlorophenoxyacetic acid
MCPP - meta-Chlorophenylpiperazine
RDX - Research Department Explosive
TCDD - Tetrachlorodibenzo-p-dioxin
TEQ - toxicity equivalent

"--" Indicates value could not be found, or not applicable.
** Used log Kow model as noted below:

Soil to plant: BAF for organics with log Kows between 3 and 8 were derived using log BAF = -0.229*(logKow)+1.0237 (unrinsed plants, USEPA, 2007)

Soil to invetebrate: Concentration in worm calculated from log Kow between 2 and 8 using model from USEPA, 2007. Average Foc (0.00234) from soils at SSFL was used as listed in Appendix F of the SRAM. Cworm=10^((0.87*logKow)-2)*Csoil/(foc*10^((0.679*logKow)+0.663).

[a] Previous BAFs included in MWH 2005 were presented in scientific notation. However, they have been updated to equivalent numeric values for this technical memorandum.

[b] In October 2011, it was determined that one tissue sample used to derive terrestrial invertebrate BAFs for inorganics and PCBs in SRAM Rev. 2 (MWH, 2005) was reported in wet tissue weight and not adjusted to dry tissue weight prior to calculating terrestrial invertebrate BAFs. As a result, terrestrial invertebrate BAFs for some metals and PCBs were recalculated after converting the wet tissue weight concentration to dry tissue weight using the average percent moisture of the other three terrestrial invertebrate samples (56.07% moisture). Recalculated BAFs are only presented for some metals as some values did not change and PCBs are being evaluated using the PCB TEQ for coplanar PCBs.

Sources:

Baes, C. F., III, R.D. Sharp, A.L. Sjoreen, and R.W. Shor (Baes, et al.). 1984. A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture. ORNL-5786. Oak Ridge National Laboratory, Oak Ridge, Tennessee. BAF units are in dry weight tissue/dry weight soil.

Bechtel-Jacobs Company, LLC. 1998b. Empirical models for the uptake of inorganic chemicals from soil by plants. Bechtel Jacobs Company LLC, Oak Ridge, Tennessee. BJC/OR-133. BAF units are in dry tissue weight (mg/kg) / dry soil weight (mg/kg).

CH2M HILL. 2005. Technical Memorandum, Literature-derived Bioaccumulation Models for Energetic Compounds in Plants and Soil Invertebrates. June.

DTSC. 2013. Email received on September 9, 2013 from Brian Faulkner of the DTSC indicating agreement to use a BAF of '1' for the soil-to-mammal BAF for all PAHs.

Table 10-6
Summary of Terrestrial Bioaccumulation Factors for Chemicals Detected in Soil
Santa Susana Field Laboratory, Ventura County, California

Chemical	CAS#	Surrogate Used	Terrestrial Plant BAF (dry weight/dry weight)	Terrestrial Plant BAF Source	Soil Invertebrate BAF (dry weight/dry weight)	Soil Invertebrate BAF Source	Small Mammal BAF (dry weight/dry weight)	Small Mammal BAF Source	LogKow	LogKow Source

MWH Americas, Inc. (MWH), 2005. Standardized Risk Assessment Methodology (SRAM) Work Plan, Santa Susana Field Laboratory, Ventura County, California. Revision 2 – Final. September. HDMSE00198. Previous values in SRAM were presented in scientific notation, however, they have been updated to reflect standard numeric values used for toxicity reference values (TRVs), benchmarks, and ecological risk-based screening levels (EcoRBSLs). BAF units are in dry weight tissue/dry weight soil and are in pg/g for dioxins/furans, mg/kg for metals, ng/g for PCBs and ug/kg PAHs.

Sample, B., J.J. Beauchamp, R.A. Efroymson, and G.W. Suter. 1998. Development and Validation of Bioaccumulation Models for Small Mammals. Oak Ridge National Laboratory. ES/ER/TM-219. February. BAF units are in dry tissue weight (mg/kg) / dry soil weight (mg/kg).

USEPA. 2013. Estimation Program Interfce (EPI) Suite Software (EPI Kow v1.68). http://www.epa.gov/oppt/exposure/pubs/episuite.htm. Searched February 2013. As recommended by this software, estimated values were only used when experimental (measured) values were unavailable within the database.

USEPA. 2011. Estimation Program Interfce (EPI) Suite Software (EPI Kow v1.68). http://www.epa.gov/oppt/exposure/pubs/episuite.htm. Searched December 2011. As recommended by this software, estimated values were only used when experimental (measured) values were unavailable within the database.

USEPA. 2008. Estimation Program Interfce (EPI) Suite Software (EPI Kow v1.68). http://www.epa.gov/oppt/exposure/pubs/episuite.htm. As recommended by this software, estimated values were only used when experimental (measured) values were unavailable within the database.

Table 10-7
Summary of Input Parameters Used to Calculate Regression-based Bioaccumulation Models
Santa Susana Field Laboratory, Ventura County, California

Constituent	Aquatic Invertebrate Regression Model [a,c]			Terrestrial Plant Regression Model [b,c]		
	B0	B1	Reference	B0	B1	Reference
Cadmium	0.0395	0.692	Bechtel Jacobs, 1998a	na	na	na
Lead	-0.776	0.801	Bechtel Jacobs, 1998a	na	na	na
Perchlorate	na	na	na	2.41	0.589	CH2M HILL, 2005
Selenium	na	na	na	-0.678	1.10	Bechtel Jacobs, 1998b
HMX	na	na	na	2.77	0.530	CH2M HILL, 2005
Aroclor 1254	1.60	0.939	Bechtel Jacobs, 1998a	na	na	na

Notes:

[a] Regression model input parameters are used to model from sediment to aquatic invertebrates for specific constituents as noted in Table 10-5.

[b] Regression model input parameters are used to model from soil to plant for specific constituents as noted in Table 10-6

[c] Regression model = log(y) - a' + b; where a' = log-transformed y intercept and b = slope

HMX - high melting explosive

na - Not applicable

Sources:

Bechtel-Jacobs Company, LLC. (Bechtel-Jacobs). 1998a. Biota Sediment Accumulation Factors for Invertebrates: Review and Recommendations for the Oak Ridge Reservation. Bechtel Jacobs Company LLC, Oak Ridge, Tennessee. BJC/OR-112.

CH2M HILL. 2005. Literature-derived Bioaccumulation Models for Energetic Compounds in Plants and Soil Invertebrates. Technical Memorandum. June.

Table 10-8
Rationale for Selection of Point Estimate-based BAFs vs. Regression-based BAFs for Select Chemicals
Santa Susana Field Laboratory, Ventura County, California

Chemical	Applicable soil or sediment-to-receptor pathway	Source	Current Low TRV-Based EcoRBSLs Calculated Using Regression-Based BAF (mg/kg)						Potential Low TRV-Based EcoRBSLs Calculated Using Point Estimate-Based BAF (mg/kg)						Are All EcoRBSLs[a] in the Range of Soil/Sediment Values Used to Develop Regression?	Use Point Estimate BAF for EcoRBSL Calculation Instead of Regression-based BAF? [b]
			Deer Mouse	Hermit Thrush	Mule Deer	Red-tailed Hawk	Bobcat	Blue Heron	Deer Mouse	Hermit Thrush	Mule Deer	Red-tailed Hawk	Bobcat	Blue Heron		
Arsenic	Mammal	Sample et al., 1998	NA	NA	NA	**68,000**	**5,930**	NA	NA	NA	NA	**4,770**	**650**	NA	**No**	**Yes[1]**
Cadmium	Aquatic Invertebrate	Bechtel Jacobs, 1998a	NA	NA	NA	NA	NA	**15**	NA	NA	NA	NA	NA	**8.0**	na	**No[3]**
	Mammal	Sample et al., 1998	NA	NA	NA	**210**	**7.8**	NA	NA	NA	NA	**2.3**	**0.45**	NA	**No**	**Yes[1]**
Lead	Aquatic Invertebrate	Bechtel Jacobs, 1998a	NA	NA	NA	NA	NA	**1.1**	NA	NA	NA	NA	NA	**1.3**	na	**No[3]**
	Mammal	Sample et al., 1998	NA	NA	NA	**0.018**	**1860**	NA	NA	NA	NA	**0.63**	**110**	NA	**No**	**Yes[1]**
Selenium	Plant	Bechtel Jacobs, 1998b	**0.10**	**0.39**	**2.2**	NA	NA	NA	**0.065**	**0.28**	**0.41**	NA	NA	NA	Yes	**No[2]**
2-Amino-4,6-Dinitrotoluene	Plant	CH2M Hill, 2005	**0.018**	**0.000043**	**1.1**	NA	NA	NA	**0.061**	**0.0060**	**0.33**	NA	NA	NA	**No**	**Yes[1]**
	Terrestrial Invertebrate	CH2M Hill, 2005			NA						NA				**No**	**Yes[1]**
Acenaphthene	Plant	USEPA, 2007	**250**	**3.1**	**81,900**	NA	NA	NA	**63**	**1.1**	**220**	NA	NA	NA	**No**	**Yes[1]**

Table 10-8
Rationale for Selection of Point Estimate-based BAFs vs. Regression-based BAFs for Select Chemicals
Santa Susana Field Laboratory, Ventura County, California

Chemical	Applicable soil or sediment-to-receptor pathway	Source	Current Low TRV-Based EcoRBSLs Calculated Using Regression-Based BAF (mg/kg)						Potential Low TRV-Based EcoRBSLs Calculated Using Point Estimate-Based BAF (mg/kg)						Are All EcoRBSLs[a] in the Range of Soil/Sediment Values Used to Develop Regression?	Use Point Estimate BAF for EcoRBSL Calculation Instead of Regression-based BAF? [b]
			Deer Mouse	Hermit Thrush	Mule Deer	Red-tailed Hawk	Bobcat	Blue Heron	Deer Mouse	Hermit Thrush	Mule Deer	Red-tailed Hawk	Bobcat	Blue Heron		
Acenaphthylene	Plant	USEPA, 2007	**27**	**1.1**	**28,600**	NA	NA	NA	**26**	**0.33**	**3,150**	NA	NA	NA	**No**	**Yes[1]**
Anthracene	Plant	USEPA, 2007	**210**	**2.8**	**28,000**	NA	NA	NA	**140**	**2.2**	**1,080**	NA	NA	NA	**No**	**Yes[1]**
Benzo(a)pyrene	Plant	USEPA, 2007	**5.0**	**130**	**120**	NA	NA	NA	**5.1**	**140**	**130**	NA	NA	NA	**No**	**Yes[1]**
Benzo(ghi)perylene	Plant	USEPA, 2007	**5.2**	**130**	**22**	NA	NA	NA	**7.4**	**210**	**67**	NA	NA	NA	**No**	**Yes[1]**
Benzo(k)fluoranthene	Plant	USEPA, 2007	**5.6**	**150**	**210**	NA	NA	NA	**4.9**	**140**	**60**	NA	NA	NA	**No**	**Yes[1]**
Fluorene	Plant	USEPA, 2007	**150**	**1.9**	**81,900**	NA	NA	NA	**55**	**0.89**	**220**	NA	NA	NA	**No**	**Yes[1]**
HMX	Plant	CH2M Hill, 2005	**110**	NA	**960**	NA	NA	NA	**2.6**	NA	**7.0**	NA	NA	NA	Yes	**No[2]**
Aroclor 1254	Aquatic Invertebrate	Bechtel Jacobs, 1998a	NA	NA	NA	NA	NA	**0.23**	NA	NA	NA	NA	NA	**0.16**	na	**No[3]**

Notes:
Indicates EcoRBSLs derived using point estimate BAFs that differ from EcoRBSLs derived using regression-based BAFs by more than 1 order of magnitude.
[a] Calculated using the regression-based BAF
[b] Rationale for determining when to use the point estimate BAF vs. a regression-based BAF in the calculation of an EcoRBSL is provided in footnotes 1 through 4, below. For a complete explanation to determine when to use the point estimate BAF vs. a regression-based BAF, refer to Section 10.4 of Appendix C of the SRAM Rev. 2 Addendum (MWH, 2014).

Table 10-8
Rationale for Selection of Point Estimate-based BAFs vs. Regression-based BAFs for Select Chemicals
Santa Susana Field Laboratory, Ventura County, California

Chemical	Applicable soil or sediment-to-receptor pathway	Source	Current Low TRV-Based EcoRBSLs Calculated Using Regression-Based BAF (mg/kg)						Potential Low TRV-Based EcoRBSLs Calculated Using Point Estimate-Based BAF (mg/kg)						Are All EcoRBSLs[a] in the Range of Soil/Sediment Values Used to Develop Regression?	Use Point Estimate BAF for EcoRBSL Calculation Instead of Regression-based BAF? [b]
			Deer Mouse	Hermit Thrush	Mule Deer	Red-tailed Hawk	Bobcat	Blue Heron	Deer Mouse	Hermit Thrush	Mule Deer	Red-tailed Hawk	Bobcat	Blue Heron		

[1] The point estimate BAF was selected for derivation of EcoRBSLs for this chemical, because EcoRBSLs calculated using the regression-based BAF do not fall within the range of the data used to derive the regression-based BAF.

[2.] The regression-based BAF was selected for derivation of EcoRBSLs for this chemical, because the EcoRBSLs calculated using the regression-based BAF fall within the range of data used to derive the regression-based BAF.

[3] The regression-based BAF was selected for derivation of EcoRBSLs for this chemical, because the range of data used to derive the regression-based BAF is not available.

BAF - bioaccumulation factor
EcoRBSL - ecological risk-based screening level
HMX - high melting explosive
mg/kg - milligram per kilogram
na - not available
NA - not applicable
USEPA - United States Environmental Protection Agency

Table 10-9

Life History Parameters Used in Quantifying Ecological Exposures
Santa Susana Field Laboratory, Ventura County, California

Reference Species	Great Blue Heron	Source	Deer Mouse	Source	Hermit Thrush	Source	Red-Tailed Hawk	Source	Bobcat	Source	Mule Deer	Source
Body Weight (kg)	2.204	USEPA, 1993; Page 2-8; Adult female [a]	0.0179	Nagy, 2001; Table 1	0.02913	Dunning, 2008 [b]	1.224	USEPA, 1993; Page 2-82; Adult female [a]	10	Jameson and Peeters, 2004. [c]	39.1	Nagy, 2001; Table 1
Food Intake Rate (kg/d)	0.140	Nagy, 2001 Equation carnivorous birds [d]	0.00381	Nagy, 2001; Table 1	0.0063	Nagy, 2001 Equation for passerines [e]	0.095	Nagy, 2001 Equation for carnivorous birds [d]	0.332	Nagy, 2001 Equation for carnivorous mammals [f]	1.565	Nagy, 2001; Table 1
Water Intake Rate (L/d)	0.10	USEPA, 1993; Equation 3-15 [g]	0.0026	USEPA, 1993; Equation 3-17 [h]	0.0055	USEPA, 1993; Equation 3-15 [g]	na		0.79	USEPA, 1993; Equation 3-17 [h]	2.7	USEPA, 1993; Equation 3-17 [h]
Prey Items (F) (Fraction of diet)	Fish (0.75)	Zeiner et al., 1990a; USEPA, 1993	Plant (0.50)	USEPA, 1993	Invertebrates (0.61)	USEPA, 1993 [k]	Deer mice (1.0)		Deer mice (1.0)		Plant (1.0)	
	Invertebrates (0.25)	Zeiner et al., 1990a; USEPA, 1993	Invertebrates (0.50)	USEPA, 1993	Plant (0.39)	USEPA, 1993 [k]	Soil (na)		Soil (na)		Soil (0.02)	Beyer et al., 1994 [l]
	Sediment (0.02)	ORNL, 1994; CH2MHill, 2004; Beyer et al., 1994 [i]	Soil (0.02)	Beyer et al., 1994 [j]	Soil (0.0208)	ORNL, 1994 [k]						
Area Use	Dependent on habitat and size of site		1		1		Dependent on habitat and size of site		Dependent on habitat and size of site		Dependent on habitat and size of site	
Minimum Home Range (acres)	na		na		na		192	Zeiner et al., 1990a	1152	Zeiner et al., 1990b	128	Zeiner et al., 1990b
Fraction of year spent at SSFL (Ψ)	1		1		1		1		1		1	
Lifespan (years)	15	Naumann, 2002	1.6	Brown and Zeng, 1989	8.7	Naumann, 2002	18	USEPA, 1993	10-14	Zeiner et al., 1990b	8	Chapman and Feldhamer, 1992
Fraction of Time in Burrow	na		0.75		na		na		na		na	
Soil Depth Interval (ft bgs)	na		0-2, 0-4, or 0-6		0-2		0-2, 0-4, or 0-6		0-2, 0-4, or 0-6		0-2	

Notes:

[a] Body weight for adult female.

[b] Mean wet weight for hermit thrush.

[c] Based on a body weight range of 5 to 15 kg (Jameson and Peeters, 2004).

[d] Derived using the feeding rate equation for carnivorous birds (Nagy, 2001) and presented body weight.

[e] Derived using the feeding rate equation for passerines (Nagy, 2001) and presented body weight.

[f] Derived using the feeding rate equation for carnivorous mammals (Nagy, 2001) and presented body weight.

[g] Derived using the drinking water ingestion equation for birds (USEPA, 1993) and presented body weight.

[h] Derived using the drinking water ingestion equation for mammals (USEPA, 1993) and presented body weight.

[i] Sediment ingestion for the great blue heron is most likely negligible. A sediment ingestion of 2 %, a minimum percent soil ingestion reported in Beyer et al (1994), will be conservatively assumed.

[j] White-footed mouse used as a surrogate for the deer mouse.

[k] American Robin used as a surrogate for the hermit thrush.

[l] Minimum soil ingestion rate was conservatively assumed for the mule deer.

ft bgs - Feet below ground surface
kg - Kilograms
L/d - Liters per day
na - Not applicable
ORNL - Oak Ridge National Laboratory
USEPA - U.S. Environmental Protection Agency

Sources:

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APPENDIX D

Ecological Effects Characterization Updates for Chemicals for Use in Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura County, California - Technical Memorandum

ECOLOGICAL EFFECTS CHARACTERIZATION UDPATES FOR CHEMICALS FOR USE IN ECOLOGICAL RISK ASSESSMENTS TECHNICAL MEMORANDUM SANTA SUSANA FIELD LABORATORY VENTURA COUNTY, CALIFORNIA

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This technical memorandum describes updated ecological effects characterization information for use in the preparation of ecological risk assessments (ERAs) for the Santa Susana Field Laboratory (SSFL). This document has been prepared for the California Environmental Protection Agency (Cal-EPA) Department of Toxic Substances Control (DTSC) on behalf of the Boeing Company (Boeing), National Aeronautics and Space Administration (NASA), and U.S. Department of Energy (DOE) as agreed during a meeting between the DTSC, Boeing, NASA and DOE held on February 17, 2010 in response to DTSC comments on previous risk assessments included in Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Group Reports.

Since publication of the *Standardized Risk Assessment Methodology (SRAM) Work Plan, Santa Susana Field Laboratory, Ventura County, California Revision 2 – Final* (SRAM) (MWH, 2005), there have been significant updates to available toxicological information, as well as the need to develop ecological risk-based screening levels (EcoRBSLs) for an expanded list of chemicals detected across all media at the SSFL (Attachment 1). In addition, it was agreed during the February 17, 2010 meeting that it is appropriate to include lowest-observed-adverse-effects level (LOAEL)-based High toxicity reference values (TRVs) for chemicals in order to evaluate a range of potential hazards to ecological receptors. This technical memorandum documents revisions and updates to the ecological effects characterization information presented in Section 11 and Appendix C of the SRAM (MWH, 2005) related to:

- development of medium-based benchmarks and TRVs for birds and mammals for all chemicals historically detected in media across the SSFL (refer to Attachment 1);
- detailed hierarchies of peer-reviewed literature or technical publications used to select generalized medium-based (e.g., sediment, surface water, soil invertebrate, and terrestrial plant) benchmarks, and Low and High TRVs for birds and mammals;
- updates to medium-specific benchmarks to be used as EcoRBSLs for surface water and sediment;
- updates to medium-specific benchmarks to be used as EcoRBSLs for soil invertebrates, and selection of both soil and soil solution-based terrestrial plant benchmarks to be used as EcoRBSLs for terrestrial plants; and
- updates to no-observed-adverse-effects level (NOAEL)-based Low TRVs, and the derivation of new LOAEL-based High TRVs, for evaluating potential ecological hazards to birds and mammals associated with exposure pathways other than the inhalation pathway.

In order to eliminate potential redundancies or inconsistencies between the ecological effects characterization information presented in this technical memorandum and the information presented in the SRAM (MWH, 2005), revisions to text in Section 11 of the SRAM (MWH, 2005) are were originally provided in redline/strikeout (Attachment 2). Upon DTSC review and concurrence of the redline changes in Attachment 2, the changes were accepted and this attachment now replaces Section 11 in the SRAM (MWH, 2005).

Appendix C of the SRAM (MWH, 2005) describes the methods used to derive environmental screening levels (ESLs) for use in ERAs conducted at the SSFL. As noted in the *Ecological Exposure Assessment Updates for Use in Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura County, California - Technical Memorandum* (Appendix C of the *Standardized Risk Assessment Methodology Rev.2 Addendum* [SRAM Rev.2 Addendum]), Appendix C has been deleted because EcoRBSLs will replace ESLs in future ERAs conducted at the SSFL. The EcoRBSLs are presented in the *Ecological Risk-Based Screening Levels to be Used in Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura County, California - Technical Memorandum* (Appendix F of the SRAM Rev.2 Addendum). Information related to ecological effects characterization contained in Appendix C of the SRAM has been superseded by the updated and expanded ecological effects characterization information presented in this technical memorandum. Additionally, information related to mammalian toxicity reference values for the inhalation pathway contained in Appendix C of the SRAM has been superseded by the *Inhalation Toxicity Reference Value Updates for Use in Ecological Risk Assessments at the Santa Susana Field Laboratory - Technical Memorandum* (Appendix E of the SRAM Rev.2 Addendum).

In addition to text updates, tables have been re-organized, updated or added as described below:

Table No.	Description	Status
Table 11-1	Summary of Toxicity Data Used to Derive Medium-based Benchmarks for the SSFL	New
Table 11-2	Summary of Toxicity Data Used to Derive Toxicity Reference Values for the SSFL	New
Table 11-3	Summary of Selected Benchmarks for Surface Water	Replaces Table 11-1 in Section 11 of SRAM Rev. 2
Table 11-4	Summary of Selected Benchmarks for Sediment	Replaces Table 11-2 in Section 11 of SRAM Rev. 2
Table 11-5	Summary of Selected Benchmarks for Soil Invertebrates	Replaces Table 11-3 in Section 11 of SRAM Rev. 2; updates and expands upon the toxicity information contained in Attachment C3

		in Appendix C of SRAM Rev. 2
Table 11-6	Summary of Selected Benchmarks for Terrestrial Plants	New
Table 11-7	Summary of Selected Soil Solution Benchmarks for Terrestrial Plants	New
Table 11-8	Summary of Selected Toxicity Reference Values for Avian Receptors	Updates and expands upon the toxicity information contained in Attachment C2 in Appendix C of SRAM Rev. 2
Table 11-9	Summary of Selected Toxicity Reference Values for Mammalian Receptors	Updates and expands upon the toxicity information contained in Attachment C1- in Appendix C of SRAM Rev. 2

In this technical memorandum, all medium-specific (e.g., surface water, soil invertebrate, and terrestrial plant) toxicity values will be referred to as "benchmarks," and NOAEL- or LOAEL-based effects characterization values for birds and mammals are referred to as "TRVs."

REFERENCES

MWH Americas, Inc. (MWH), 2005. *Standardized Risk Assessment Methodology (SRAM) Work Plan, Santa Susana Field Laboratory, Ventura County, California. Revision 2 – Final.* September. HDMSE00198.

ATTACHMENTS

Attachment 1 – List of Chemicals Historically Detected at the SSFL - by Media

Attachment 2 – Updates to Section 11, Standardized Risk Assessment Methodology (SRAM) Work Plan, Santa Susana Field Laboratory, Ventura County, California. Revision 2 – Final.

Attachment 3 – Lists of Updated References and Table

ATTACHMENT 1

List of Chemicals Historically Detected at the SSFL - by Media

Attachment 1
List of Chemicals Historically Detected at the SSFL - by Media

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil [a]	Chemicals Detected in Soil Vapor [b]	Chemicals Detected in Ephemeral Surface Water [c]	Chemicals Detected in Permanent Surface Water [c]	Chemicals Detected in Ephemeral Sediment [d]	Chemicals Detected in Permanent Sediment [d]	Chemicals Detected in Near-Surface Groundwater [e]	Chemicals Detected in Seeps/ Springs [e]
Inorganic Compounds			X		X	X	X	X		X
Aluminum	7429905	Aluminum, Total	X			X		X	X	
Aluminum, dissolved	7429905-D	-				X			X	
Antimony	7440360	Antimony, Total	X			X		X	X	
Antimony, dissolved	7440360-D	-				X			X	
Arsenic	7440382	Arsenic, Total	X			X	X	X	X	
Arsenic, dissolved	7440382-D	-				X			X	
Barium	7440393	Barium, Total	X		X	X		X	X	X
Barium, dissolved	7440393-D	-			X	X			X	
Beryllium	7440417	Beryllium, Total	X			X	X	X	X	
Beryllium, dissolved	7440417-D	-				X			X	
Boron	7440428	Boron, Total	X			X		X	X	
Boron, dissolved	7440428-D	-				X			X	X
Cadmium	7440439	Cadmium, Total	X			X		X	X	
Cadmium, dissolved	7440439-D	-				X			X	
Chromium	7440473	Chromium, Total	X			X	X	X	X	X
Chromium, dissolved	7440473-D	-			X	X			X	
Cobalt	7440484	Cobalt, Total	X			X		X	X	
Cobalt, dissolved	7440484-D	-				X			X	
Copper	7440508	Copper, Total	X			X	X	X	X	
Copper, dissolved	7440508-D	-			X	X			X	
Cyanides	57125	Cyanide, Total	X			X				
Fluoride	7782414	-	X			X		X	X	X
Hexavalent Chromium	18540299	Chromium, Hexavalent	X			X				
Hexavalent Chromium, dissolved	18540299-D	-								
Hydrogen Cyanide	74908	-								
Lead	7439921	Lead, Total	X		X	X	X	X	X	
Lead, dissolved	7439921-D	-				X			X	
Lithium	7439932	Lithium, Total	X							
Lithium, dissolved	7439932-D	-								
Manganese	7439965	Manganese, Total	X			X		X	X	
Manganese, dissolved	7439965-D	-			X	X			X	
Mercury	7439976	Mercury, Total	X			X	X	X		
Mercury, dissolved	7439976-D	-				X				
Methyl Mercury	22967926	-	X							
Molybdenum	7439987	Molybdenum, Total	X			X		X	X	
Molybdenum, dissolved	7439987-D	-				X			X	
Nickel	7440020	Nickel, Total	X			X	X	X	X	X
Nickel, dissolved	7440020-D	-			X	X			X	
Phosphorus	7723140	-	X			X		X		
Phosphorus, dissolved	7723140-D	-				X				
Selenium	7782492	Selenium, Total	X			X		X	X	
Selenium, dissolved	7782492-D	-				X			X	
Silica, dissolved	7631869-D	-							X	X
Silver	7440224	Silver, Total	X			X		X	X	
Silver, dissolved	7440224-D	-				X				
Strontium	7440246	Strontium, Total	X			X		X	X	
Strontium, dissolved	7440246-D	-				X			X	X
Thallium	7440280	Thallium, Total	X			X		X	X	
Thallium, dissolved	7440280-D	-				X			X	
Tin	7440315	Tin, Total	X					X		
Tin, dissolved	7440315-D	-								
Titanium	7440326	Titanium, Total	X			X		X		
Titanium, dissolved	7440326-D	-				X				
Tritium	10028178	Tritium, Total								
Uranium	7440611	Uranium-238								
Vanadium	7440622	Vanadium, Total	X			X			X	X
Vanadium, dissolved	7440622-D	-				X			X	
Zinc	7440666	Zinc, Total	X			X	X	X	X	X
Zinc, dissolved	7440666-D	-				X			X	X
Zirconium	7440677	Zirconium, Total	X							
Zirconium, dissolved	7440677-D	-								
Energetic Constituents			X		X	X		X		
1,2-Dinitrobenzene	528290	o-Dinitrobenzene	X					X		
1,2-Diphenylhydrazine	122667	-				X				
1,3-Dinitrobenzene	99650	m-Dinitrobenzene	X					X		
1,4-Dinitrobenzene	100254	p-Dinitrobenzene								
2,4,6-Trinitrotoluene	118967	-	X					X		
2,4-diamino-6-nitrotoluene	6629294	-						X		
2,4-Dinitrotoluene	121142	-				X		X		
2-Amino-4,6-dinitrotoluene	35572782	-	X					X		
2-Nitrotoluene	88722	-						X		
3-Nitrotoluene	99081	-						X		
4-Amino-2,6-dinitrotoluene	19406510	4-Am-2,6-DNT						X		
4-Nitrotoluene	99990	-						X		
HMX	2691410	-	X					X		
Hydrazine	302012	-	X							
Monomethylhydrazine	60344	-	X							
Nitroglycerin	55630	-						X		
Perchlorate	14797730	-	X		X	X		X	X	
PETN	78115	-						X		
RDX	121824	-	X					X		
Volatile Organic Compounds			X			X	X	X		X
1,1,1,2-Tetrachloroethane	630206	-	X					X		
1,1,1-Trichloroethane	71556	-	X	X		X		X	X	
1,1,2,2-Tetrachloroethane	79345	-	X			X				
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	Freon 113	X	X		X		X	X	

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List of Chemicals Historically Detected at the SSFL - by Media

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil [a]	Chemicals Detected in Soil Vapor [b]	Chemicals Detected in Ephemeral Surface Water [c]	Chemicals Detected in Permanent Surface Water [c]	Chemicals Detected in Ephemeral Sediment [d]	Chemicals Detected in Permanent Sediment [d]	Chemicals Detected in Near-Surface Groundwater [e]	Chemicals Detected in Seeps/ Springs [e]
1,1,2-Trichloroethane	79005	-	X	X		X			X	
1,1-Dichloroethane	75343	-	X	X		X		X	X	
1,1-Dichloroethene	75354	-	X	X		X		X	X	X
1,1-Dichloropropene	563586	-						X		
1,2,3-Trichlorobenzene	87616	-	X	X						
1,2,3-Trichloropropane	96184	-							X	
1,2,3-Trichloropropene	96195	1-Propene, 1,2,3-trichloro- 1								
1,2,4-Trichlorobenzene	120821	-	X	X		X				
1,2,4-Trimethylbenzene	95636	-	X	X				X		
1,2-Dibromoethane	106934	-	X					X		
1,2-Dichloro-1,1,2-trifluoroethane	354234	Ethane,1,2-dichloro-1,1,2-trifluoro								
1,2-Dichlorobenzene	95501	o-Dichlorobenzene	X	X		X		X	X	
1,2-Dichloroethane	107062	-	X	X		X		X	X	
1,2-Dichloroethene	540590	1,2-Dichloroethenes	X	X					X	
1,2-Dichloropropane	78875	-	X	X		X		X		
1,3,5-Trimethylbenzene	108678	-	X	X				X		
1,3-Dichlorobenzene	541731	m-Dichlorobenzene	X	X		X		X		
1,3-Dichloropropane	142289	-						X		
1,3-Dichloropropene	542756	-		X						
1,4-Dichlorobenzene	106467	p-Dichlorobenzene	X			X		X	X	
1-Chlorohexane	544105	-								
1-Hexanol	111273	-								
1-Octanol	111875	-								
2,2-Dichloro-1,1,1-trifluoroethane	306832	Freon 123							X	
2-Chloro-1,1,1-trifluoroethane	75887	2-chloro-1,1,1-trifluoroethane, 1								
2-Chloroethylvinyl ether	110758	2-Chloroethyl vinyl ether	X			X		X		
2-Chloronaphthalene	91587	-				X				
2-Chlorophenol	95578	-				X				
2-Fluorobiphenyl	321608	2-FBP								
2-Hexanone	591786	Methyl butyl ketone	X	X				X		
2-Nitrophenol	88755	o-Nitrophenol				X			X	
3-Chloro-2(Chloromethyl)-1-Propene	1871574	-							X	
4-Bromofluorobenzene	460004	1,4-Bromofluorobenzene								
Acetone	67641	-	X	X		X	X	X	X	X
Acrolein	107028					X				
Acrylonitrile	107131					X				
Benzene	71432	-	X	X		X		X	X	
Benzene, 1-Bromo-3-fluoro-	1073069	1-Bromo-3-fluoro-Benzene								
Biphenyl	92524	1,1'-Biphenyl							X	
bis(2-Chloroethyl) ether	111444	s-Dichloroethylether				X			X	
Bromide	24959679	-	X					X		X
Bromobenzene	108861	-	X							
Bromochloromethane	74975	-						X		
Bromodichloromethane	75274	-	X			X		X	X	X
Bromomethane	74839	-	X			X		X		X
Butyl Cyclooctane	BUTC8	-								
Carbon Disulfide	75150	-	X	X				X	X	X
Carbon Tetrachloride	56235	-	X	X		X			X	
Chlorobenzene	108907	Monochlorobenzene	X	X		X				
Freon 22 (Chlorodifluoromethane)	75456	Freon 22		X						
Chloroethane	75003	Ethyl chloride		X		X		X		
Chloroform	67663	Trichloromethane	X	X		X		X	X	X
Chloromethane	74873	Methyl chloride	X	X		X		X	X	X
Chlorotrifluoroethylene	79389	Chlorotrifluoroethene								
cis-1,2-Dichloroethene	156592	cis-1,2-Dichloroethylene	X	X		X		X	X	X
cis-1,3-Dichloropropene	10061015	-				X		X		
Cumene	98828	Isopropylbenzene	X	X				X		
Decanol	112301	-								
Dibenzofuran	132649	-	X							
Dibromofluoromethane	1868537	-		X						
Dibromomethane	74953	-	X					X		
Dichloro Alkene	DCALK	-								
Dichlorodifluoromethane	75718	Freon 12	X	X				X	X	
Dichlorofluoromethane	75434	Freon 21								
Dichloromethylpropene	DCMTHYLPRPN	-								
Dichloropropene, NOS	26952238	Dichloropropene								
Dichlorotrifluoroethane	34077877	286 Dichlorotrifluoroethane								
Dimethyl Decene	DMDCN	-								
Dimethyl Undecane	79004834	-								
Diphenyl ether	101848	-							X	
Ethylbenzene	100414	-	X	X		X		X		
Formic acid, octyl ester	112323	Octyl Ester Formic Acid								
Heptanal	111717	p-Nitrotoluene								
Isocyanomethane	593759	-								
Methyl ethyl ketone	78933	2-Butanone	X	X					X	
Methyl isobutyl ketone (MIBK)	108101	4-Methyl-2-pentanone	X					X		
Methyl sulfide	75183	-							X	
Methyl-tert-butyl- Ether (MTBE)	1634044	-						X		
Methylene chloride	75092	Dichloromethane	X	X		X	X	X	X	X
m-Xylene	108383	meta-Xylene				X				
m-Xylene & p-Xylene	136777612	meta- and para-Xylenes	X	X		X	X			X

Attachment 1
List of Chemicals Historically Detected at the SSFL - by Media

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil [a]	Chemicals Detected in Soil Vapor [b]	Chemicals Detected in Ephemeral Surface Water [c]	Chemicals Detected in Permanent Surface Water [c]	Chemicals Detected in Ephemeral Sediment [d]	Chemicals Detected in Permanent Sediment [d]	Chemicals Detected in Near-Surface Groundwater [e]	Chemicals Detected in Seeps/ Springs [e]
Naphthalene, 1-(2-Propenyl)-	2489863	1-(2-Propenyl)-Naphthalene								
n-Butylbenzene	104518	-	X	X				X		
n-Hexane	110543	-							X	
Nitrobenzene	98953	-				X		X	X	
n-Propylbenzene	103651	-	X	X				X		
o + p Xylene	E-14095	-								
o-Chlorotoluene	95498	2-Chlorotoluene	X							
Octanal	124130	-								
o-Xylene	95476	-	X	X				X		
p-Chlorotoluene	106434	4-Chlorotoluene	X							
p-Cymene	99876	p-Isopropyltoluene	X	X				X		
Propanoic Acid, 2-Methyl-, ethyl ester	97621	Ethyl Ester 2-Methyl-Propanoic Acid								
sec-Butylbenzene	135988	-	X	X				X		
Styrene	100425	Vinylbenzene	X	X			X	X		
tert-Butylbenzene	98066	-	X	-				X		
Tetralin	119642	-	X				X			
Tetrachloroethene	127184	-	X	X		X		X	X	X
Tetrachloropropene	60320185	-								
Tetrahydrofuran	109999	Tetrahydrofuran (THF)								
Toluene	108883	Toluol	X	X		X	X	X	X	X
trans-1,2-Dichloroethene	156605	-	X	X		X		X	X	X
Trichloroethene	79016	Trichloroethylene (TCE)	X	X		X		X	X	X
Trichlorofluoromethane	75694	-	X	X		X			X	
Trimethyl Decane	98060549	-								
Trimethylcyclopentane Isomer	30498647	-								
Trimethylcyclopentane Isomer	30498647	-								
Undecane	1120214	-								
Vinyl acetate	108054	-								
Vinyl chloride	75014	-	X	X		X		X	X	X
Xylenes, Total	1330207	Xylene (Total) Isomers	X	X		X			X	
Semi-Volatile Organic Compounds			X			X	X	X		X
1,1-Dimethylhydrazine	57147	-	X							
1,1'-Phenylene-Bis-Ethanone	704007	-								
1,2-Dibromo-3-chloropropane	96128	1,2-Dibromo-3-CPA	X					X		
1,4-Dioxane	123911	-	X						X	
2,4,5-Trichlorophenol	95954	-	X							
2,4,6-Trichlorophenol	88062	-	X			X			X	
2,4-Dichlorophenol	120832					X				
2,4-Dimethylphenol	105679	-	X			X				
2,4-Dinitrophenol	51285					X				
2,6-Dinitrotoluene	606202	-				X		X		
2-Butoxyethoxyethanol	112345	Ethanol, 2-(2-butoxyethoxy)- 1								
2-Naphthaleneethanol	1485070	2-Naphthalene ethanol								
2-n-Butoxyethanol	111762	Butoxycellosolve							X	
3,3'-Dichlorobenzidine	91941	-				X				
3,5-Dimethylphenol	108689	-	X							
4,6-Dinitro-o-cresol	534521	4,6-Dinitro-2-Methylphenol				X				
4-Bromophenyl phenyl ether	101553					X				
4-Chlorophenylphenyl ether	7005723					X				
4-Nitrophenol	100027	-				X			X	
Amino hexanoic acid	60322	-								
Benzidine	92875	-				X				
Benzoic acid	65850	-	X				X			
Benzophenone	119619	-								
Benzyl alcohol	100516	-	X							
bis(2-Chloroethoxy)methane	111911	-				X			X	
bis(2-Chloroisopropyl)ether	39638329	-				X				
bis(2-Ethylhexyl) phthalate	117817	bis(2-ethylhexyl)phthalate	X			X	X	X	X	
Bromoform	75252	-	X			X		X	X	X
Butyl benzyl phthalate	85687	-	X			X	X	X		
Carbazole	86748	-	X							
Decamethylcyclopentasiloxane	541026	Decamethyl Siloxane								
Dibenzyl Ether	103504	-							X	
Dibromochloromethane	124481	-	X			X		X	X	X
Diethyl phthalate	84662	-	X			X			X	
Dimethyl phthalate	131113	-	X			X		X		
Di-n-butyl phthalate	84742	Di-n-butylphthalate	X			X		X	X	
Di-n-octyl phthalate	117840	Di-n-octyl-phthalate	X			X			X	
Ethanone, 1-(2,4,6-Trihydroxyphenyl)-	480660	1-(2,4,6-Trihydroxyphenyl)-Ethanone								
Formaldehyde	50000	-	X			X		X	X	
Hexachlorobenzene	118741					X				
Hexachlorobutadiene	87683	-	X			X		X		
Hexachlorocyclopentadiene	77474	-				X				
Hexachloroethane	67721					X				
Hexanoic Acid	142621	-								
Isobutanol	78831	1-Propanol, 2-Methyl-								
Isophorone	78591	-				X				
Isopropanol	67630	Isopropyl alcohol							X	
m-Cresol	108394	3-Methylphenol	X							
n-Butanoic acid	107926	Butyric acid								

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n-Nitrosodimethylamine	62759	Nitrosodimethylamine	X			X		X	X	
n-Nitrosodi-n-propylamine	621647	n-Nitrosodipropylamine				X			X	
n-Nitrosodiphenylamine	86306	-	X			X			X	
o-Cresol	95487	-	X							
p-Chloro-m-cresol	59507	4-Chloro-3-Methylphenol	X			X				
p-Cresol	106445	4-Methylphenol	X				X			
Pentachlorophenol	87865	PCP	X			X			X	
Pentadecane	629629	-								
Phenol	108952	Total Phenols	X			X			X	
p-Nitroaniline	100016	4-Nitroaniline	X							
Tetrachlorophenol	25167833	-								
Tetramethylurea	632224	-							X	
Polynuclear Aromatic Hydrocarbons			X			X		X		
1-Methyl naphthalene	90120	1-Methylnaphthalene	X							
2-Methylnaphthalene	91576	Naphthalene, 2-methyl-	X	X						
Acenaphthene	83329	-	X			X		X		
Acenaphthylene	208968	-	X			X				
Anthracene	120127	-	X			X		X		
Benzo(a)anthracene	56553	Benz[a]anthracene	X			X		X		
Benzo(a)pyrene	50328	Benzo (a) pyrene	X	X		X		X		
Benzo(b)fluoranthene	205992	Benz[e]acephenanthrylene 1	X			X		X		
Benzo(e)pyrene	192972	-	X					X		
Benzo(ghi)perylene	191242	Benzo (g,h,i) perylene	X			X		X		
Benzo(k)fluoranthene	207089	Benzo[k]fluoranthene	X			X		X		
Chrysene	218019	-	X			X		X		
Dibenzo(a,h)anthracene	53703	Dibenz (a,h) anthracene	X			X		X		
Fluoranthene	206440	-	X			X		X		
Fluorene	86737	-	X	X		X		X		
Indeno(1,2,3-cd)pyrene	193395	Indeno (1,2,3-cd) pyrene	X			X		X		
Naphthalene	91203	-	X	X		X			X	
Perylene	198550	-	X							
Phenanthrene	85018	-	X	X		X		X		
Pyrene	129000	-	X			X		X		
Pesticides			X			X	X			
4,4'-DDD	72548	p,p'-DDD	X			X	X		X	
4,4'-DDE	72559	p,p'-DDE	X			X			X	
4,4'-DDT	50293	p,p'-DDT	X			X			X	
Aldrin	309002	-	X			X			X	
alpha-BHC	319846	a-Benzene Hexachloride	X			X			X	
beta-BHC	319857	b-Benzene Hexachloride	X			X			X	
Chlordane (Technical)	12789036	-	X							
delta-BHC	319868	d-Benzene Hexachloride	X			X			X	
Dieldrin	60571	-	X			X			X	
Endosulfan I	959988	-	X			X			X	
Endosulfan II	33213659	-	X			X			X	
Endosulfan sulfate	1031078	-	X			X			X	
Endrin	72208	-	X			X			X	
Endrin aldehyde	7421934	-	X			X			X	
Endrin ketone	53494705	-	X							
gamma-BHC	58899	Lindane	X			X			X	
Heptachlor	76448	-	X			X			X	
Heptachlor epoxide	1024573	-	X			X				
Kepone	143500	-								
MCPA	94746	-	X							
Mercaptans	109795	-								
Mirex	2385855	Mirex (DeChlorane)	X							
p,p'-Methoxychlor	72435	-	X							
Toxaphene	8001352	-	X			X				
Herbicides			X							
2,4,5-T	93765	2,4,5-Trichlorophenoxyacetic acid	X							
2,4,5-TP (Silvex)	93721	-	X							
2,4-Dichlorophenoxyacetic Acid (2,4-D)	94757	-	X						X	
2,4-Dichlorophenoxybutyric acid	94826	-	X							
2,4-DP (Dichlorprop)	120365	Dichlorprop	X							
Dalapon	75990	-	X							
Dicamba	1918009	-	X							
Dinoseb	88857	-	X						X	
MCPP	93652	-	X							
Terphenyls			X					X		
m-terphenyl	92068	-	X							
o-terphenyl	84151	-	X					X		
p-Terphenyl	92944	-	X					X		
Glycols		-	X							
Diethylene Glycol	111466	-	X							
Triethylene glycol	112276	-	X							
Total Petroleum Hydrocarbons			X			X		X		
TPH-Diesel Range Organics (DRO)	DRO	Diesel	X					X	X	
TPH-Gasoline Range Organics (GRO)	GRO	Gasoline	X					X		
TPH-Kerosene Range Organics (KRO)	KRO	Kerosene						X	X	
TPH-Oil Range Organics (ORO)	ORO	Oil Range Organics						X		
PCDD/PCDFs			X			X		X		
2,3,4,6,7,8-Hexachlorodibenzofuran	60851345	-	X			X		X		

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2,3,7,8-TCDD_TEQ_Bird	1746016-TEQ_Bird	-	X			X		X		
2,3,7,8-TCDD_TEQ_Fish	1746016-TEQ_Fish	-				X		X		
2,3,7,8-TCDD_TEQ_Mammal	1746016-TEQ_Mammal	-	X			X		X		
Octachlorodibenzofuran	39001020	OCDF	X			X		X	X	
Octachlorodibenzo-p-dioxin	3268879	-	X					X	X	
Polychlorinated Biphenyls (PCBs)			X			X		X		
Aroclor 1016	12674112	-	X			X		X		
Aroclor 1221	11104282	-				X				
Aroclor 1232	11141165	-				X				
Aroclor 1242	53469219	Aroclor-1242	X			X				
Aroclor 1248	12672296	-	X			X				
Aroclor 1254	11097691	-	X			X		X		
Aroclor 1260	11096825	-	X			X				
Aroclor 5460	11126424	-	X							
PCB_TEQ_Bird (Coplanar PCBs)	1746016-PCB TEQ_Bird	-	X			X		X		
PCB_TEQ_Fish (Coplanar PCBs)	1746016-PCB TEQ_Fish	-				X		X		
PCB_TEQ_Mammal (Coplanar PCBs)	1746016-PCB TEQ_Mammal	-	X			X		X		
PCB-194	35694087	-	X							
Chemical Parameters			X		X	X		X		X
Ammonia-N	7664417	Nitrogen, as Ammonia	X						X	
Chloride	16887006	-	X		X	X		X	X	X
Nitrite-NO2	E-10128	-	X			X		X		
Oil content	E-10140	-				X				
Orthophosphate – PO4	14265442	-	X							
Sulfate	14808798	-	X		X	X		X	X	X

Notes:

[a] Chemicals detected in Groups 1A, 4, 6, 7, 8, 1B, 5, 10, 3 (WCT only), and 9 (Silvernale only) surface soil.

[b] Chemicals detected in Groups 1A, 4, 6, 7, 8, 1B, 5, 10, 3 (WCT only), and 9 (Silvernale only) soil vapor.

[c] Chemicals detected in Groups 4 (Coca only), 6 (SRE only), 1B, 5, 10, 3 (WCT only), and 9 (Silvernale only) surface water.

[d] Chemicals detected in Groups 4 (Coca only), 6 (SRE only), 1B, 5, 10, 3 (WCT only), and 9 (Silvernale only) sediment.

[e] Chemicals detected in site wide near-surface groundwater, seeps, and springs.

DDD - Dichlorodiphenyldichloroethane
DDE - Dichlorodiphenyldichloroethylene
DDT - Dichlorodiphenyltrichloroethane
PCB - Polychlorinated biphenyl
TCDD -Tetrachlorodibenzodioxin
TEQ - toxicity equivalent
X - Analyte was detected in the indicated medium

ATTACHMENT 2

Updates to Section 11, Standardized Risk Assessment Methodology (SRAM) Work Plan, Santa Susana Field Laboratory, Ventura County, California. Revision 2 – Final

SECTION 11

11 ECOLOGICAL EFFECTS ASSESSMENT

Literature-derived ecological effects data are necessary for evaluating potential effects to ecological receptors in lieu of empirically measuring site-specific effects in ecological receptors. Literature-derived effects data, however, are not available for every medium or every species, and occasionally the absence of toxicity data can limit the ability to quantify potential risks to certain species for specific pathways. Availability of toxicity benchmarks was one of the parameters used to select representative species for the SSFL (Section 9).

DTSC generally recommends that toxicity values be expressed as either medium-specific benchmarks (concentrations in abiotic media), or toxicity reference values (TRVs), intakes of chemicals averaged over time and body weight. Medium-specific benchmarks are used for receptors whose exposure is best described by the medium in which they live. For example, water-column receptors (e.g., aquatic plants, aquatic invertebrates, fish, and the embryonic/larval stage of amphibians), benthic invertebrates, and terrestrial plants and soil invertebrates are evaluated using surface water, sediment, and soil benchmarks, respectively (with separate soil benchmarks for terrestrial plants and soil invertebrates). Because some plants experience exposure to near-surface groundwater, soil solution benchmarks represent additional medium-specific benchmarks for this receptor group.

In contrast to the receptors described above, birds and mammals integrate exposure over multiple media, primarily through ingestion, but also through inhalation under some scenarios. To adequately evaluate these exposures, dose-based effect values or TRVs are necessary. For simplicity, all medium-specific toxicity reference concentrations will be referred to as “benchmarks,” and dose-based effects values will be referred to as “TRVs.”

Benchmarks and TRVs are generally derived either directly from the results of laboratory or field toxicity tests reported in peer-reviewed literature or other technical publications, and refer to both the type and magnitude (concentration or dosage) of observed toxicity.

Descriptions of the benchmarks and TRVs to be used in ERAs conducted at the SSFL are presented in Sections 11.1 and 11.2, respectively.

For derivation of benchmarks and TRVs, the most appropriate toxicity value applicable to the assessment endpoints described in Section 9.6 will be used. Generally, these assessment endpoints are established to

protect species populations and abundance of food and prey species. Growth, survival and reproductive effects are considered to be toxic endpoints that directly impact populations, and, therefore, these are the types of toxic endpoints that were preferentially used for derivation of benchmarks and TRVs. When toxicity data representing these endpoints were not available, toxicity data were selected whose endpoints were considered to have less direct impact on ecological receptors, yet are still ecologically relevant at the population level. Therefore, the selection of appropriate toxicity studies and toxic endpoints for derivation of benchmarks and TRVs used to calculate ecological risk-based screening levels (EcoRBSLs) will consider the established assessment endpoints presented in Section 9.6 as well as the nature of other "less serious" toxic effects and the relative magnitude of their no effects levels.

Medium-specific benchmarks and TRVs for use at the SSFL are listed in Tables 11-1 and 11-2, respectively, and are described in the following subsections. Included in Tables 11-1 and 11-2 are the assessment endpoints or receptor groups to be evaluated for each medium, the type or source of benchmarks, the basis of each benchmark, and the manner in which the benchmark will be applied in ERAs conducted at the SSFL.

11.1 Medium-specific Benchmarks

The majority of available effects concentration-based values (i.e., aquatic and terrestrial benchmarks) for surface water, soil invertebrates and terrestrial plants are presented as a single set of calculated values (e.g., lowest observed effects concentrations [LOECs] Maximum Acceptable Toxicant Concentrations [MATCs]) as provided in appropriate peer-reviewed literature or technical publications used to derive medium-specific benchmarks. The values found in Efroymson et al. (1997b) are based solely on LOECs while USEPA's Eco-SSLs are based upon either geometric means of EC10, EC20 and MATC values or are LOEC-based. For this reason, only one set of medium-specific benchmarks was developed for each of the following: surface water, soil invertebrates, and terrestrial plants (both soil and soil solution benchmarks). Since these single lists of effect concentrations are a combination of published benchmark values that represent effect levels, values adjusted to a "no effect" level, as well as true "no effect" levels, the selected surface water, soil invertebrate, and terrestrial plant benchmarks are referred to simply as "low benchmarks" (in contrast to TRVs which are derived as NOAEL-equivalent "low TRVs" and LOAEL-equivalent "high TRVs"; refer to Section 11.2). Sediment benchmarks typically include both "no effect" values (e.g., threshold effects concentrations [TECs]) and "mid-level" values (e.g., probable effects concentrations [PECs]) in the appropriate peer-reviewed literature or technical publications (i.e., secondary sources) used to derive these benchmarks. Therefore, both low and high benchmarks were selected for sediment.

11.1.1 Aquatic Receptors

Surface water benchmarks are applicable to the water-column community (i.e., aquatic plants, aquatic invertebrates, fish, and embryonic/larval life stage of amphibians) exposed to surface water via direct contact/gill absorption and ingestion of prey items as summarized in Table 9-3. Surface water benchmarks are available in peer-reviewed literature and technical publications such as the National Recommended Water Quality Criteria (NRWQC) (USEPA, 2009). The NRWQC are intended to prevent significant toxic effects and to be protective of acute and chronic exposures at the lower 5th percentile of the distribution of species with a safety factor of two NRWQC are calculated with higher emphasis on the most sensitive species for which reliable toxicity data are available. Thus, their use as surface water benchmarks implies that they will be protective of all water-column organisms (i.e., aquatic plants, aquatic invertebrates, fish, and the embryonic/larval stage of amphibians) found in aquatic habitats at the SSFL. It is worth noting that NRWQC are also applicable, relevant and appropriate requirements (ARARs) for surface water and, as such, are applicable as numeric remedial action objectives (RAOs) for the SSFL. The freshwater quality criteria values presented in the California Toxics Rule (USEPA, 2000) are typically the same values as presented in the NRWQC (USEPA, 2009). For these reasons, the California Toxics Rule and NRWQC values were chosen together as the first sources in the hierarchy for selecting surface water benchmarks. When a chemical had a value in both of these sources, the lower of the two was selected as the surface water benchmark.

Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota (Suter and Tsao, 1996) was chosen as the second source in the hierarchy because it is a widely accepted and heavily used peer-reviewed literature and technical publication with an abundance of applicable ecological toxicity benchmarks that were developed for use in ERAs. *A Compilation of Water Quality Goals*, published by the California Water Quality Control Board (CWQCB, 2011) was chosen as the third source in the hierarchy because it is a compilation of surface water quality criteria and toxicological effect levels published in other primary sources, but it contains such information for literally hundreds of chemicals. The *Screening Quick Reference Tables (SQuiRTs)*, published by the National Oceanic and Atmospheric Administration (NOAA) (Buchman, 2008) was selected as the last source in the hierarchy because it, too, is a compilation surface water quality criteria and toxicological effect levels published in other primary sources, but it contains such information for fewer chemicals than does CWQCB (2011).

As noted in Section 11.1, since this single list of effect concentrations is a combination of published values that represent effect levels, values adjusted to a “no effect” level, as well as true “no effect” levels,

the selected surface water values are referred to simply as "benchmarks." The available surface water benchmarks for chemicals detected in surface water at the SSFL are presented in Table 11-3.

Surface water benchmarks were selected according to the following hierarchy of sources:

1. Freshwater quality criteria values from California Toxics Rule (USEPA, 2000) and NRWQC (USEPA, 2009). The lower of the two sources was used in instances where both sources had a value for a given chemical.
2. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota (Suter and Tsao, 1996)
3. California Water Quality Control Board - A Compilation of Water Quality Goals (CWQCB, 2011)
4. National Oceanic and Atmospheric Administration (NOAA) Screening Quick Reference Tables (SQuiRTs) (Buchman, 2008)

The above hierarchy was followed in a step-wise manner, so that the first source listed was searched for available toxicity information, followed by the next source in the hierarchy, until available and adequate toxicity information was found. Sources lower in the hierarchy were not searched if a higher-level source provided adequate toxicity information for a given chemical. If no suitable chemical-specific toxicity information was found in any of the sources listed in the above hierarchy, a chemical with structural similarity was selected as a surrogate, as applicable. In those cases where an appropriate chemical surrogate could not be identified, and therefore, benchmarks are lacking, such chemicals will be selected as CPECs when detected, and evaluated in the uncertainty analysis sections of any future ERAs.

Surface water benchmarks were developed for purposes of deriving EcoRBSLs to be used in ERAs prepared for the SSFL. Given that EcoRBSLs for surface water are concentration-based, the benchmarks presented in Table 11-3 will serve as surface water EcoRBSLs for use in ERAs conducted at the SSFL as described in the *Ecological Risk-Based Screening Levels to be Used in Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura County, California – Technical Memorandum* (Appendix F of the SRAM Rev.2 Addendum).

11.1.2 Sediment-associated Receptors

Sediment benchmarks are applicable to benthic invertebrates exposed to sediment through incidental ingestion of sediment, dermal contact with sediment and ingestion of prey items as summarized in Table 9-3. Both High and Low sediment Benchmarks are available in peer-reviewed literature and technical

publications (i.e., secondary or compilation sources) and do not require the application of uncertainty factors (UFs). The hierarchy used to select Low and High sediment Benchmarks is listed below; benchmarks are presented in Table 11-4.

1. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems (MacDonald et al., 2000)
2. Freshwater sediment benchmarks from NOAA Screening Quick Reference Tables (SQuiRTs) (Buchman, 2008)
3. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Sediment-Associated Biota (Jones et al., 1997)
4. USEPA Region III Freshwater Sediment Screening Benchmarks (Searched July 2011) (USEPA, 2011b)
5. Technical Evaluation of the Intervention Values for Soil/Sediment and Groundwater – Human and Ecotoxicological Risk Assessment and Derivation of Risk Limits for Soil, Aquatic Sediment and Groundwater (Lijzen et al., 2001)

Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems (MacDonald et al., 2000) was chosen as the first source in the hierarchy because it is a widely accepted and heavily used peer-reviewed literature and technical publication that includes both consensus-based threshold effect concentrations (TECs) and probable effect concentrations (PECs) for a variety of inorganic and organic chemicals. The *SQuiRT*s (Buchman, 2008) was selected as the second source in the hierarchy because, although it is a secondary source, this compilation of sediment effect levels also provides TECs and PECs, in addition to other types of effect concentrations. *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Sediment-Associated Biota* (Jones et al., 1997) was selected as the third source in the hierarchy because this compilation of sediment effect levels also includes TECs and PECs, as well as no effect concentrations (NECs); however, this source is much older than Buchman (2008). *USEPA Region III Freshwater Sediment Screening Benchmarks* (USEPA, 2011) was chosen as the fourth source in the hierarchy because, although it includes sediment effect levels for chemicals not present in the first three sources, the nature of the effect levels (e.g., NEC, TEC or PEC) is not listed. *Technical Evaluation of the Intervention Values for Soil/Sediment and Groundwater - Human and Ecotoxicological Risk Assessment and Derivation of Risk Limits for Soil, Aquatic Sediment and Groundwater* (Lijzen et al., 2001) was chosen as the last source in the hierarchy because sediment effect concentrations contained therein represent serious risk

concentrations (SRCs) for aquatic sediment that are not directly comparable to the TECs and PECs presented in other sources within the hierarchy. Although not directly comparable to TECs and PECs, the SRCs published in Lijzen (2001) provide some means to evaluate potential sediment toxicity for chemicals not included in the other sources.

Decision rules regarding the application of the above hierarchy were consistent with those rules described in Section 11.1.1. In general, Low sediment benchmarks were selected in the following order, as available:

TEC > TEL > ERL/T20 > MET > AET > ESB > SQB.

Where:

TEC	=	threshold effects concentration
TEL	=	threshold effect level
ERL/T20	=	effects range low
MET	=	minimal effects threshold
AET	=	apparent effects threshold
ESB	=	equilibrium partitioning sediment benchmark
SQB	=	sediment quality benchmark

Additionally, high sediment benchmarks were selected in the following order, as available:

PEC > PEL > ERM/T50 > UET > SRC

Where:

PEC	=	probable effects concentration
PEL	=	probable effect level
ERM/T50	=	effects range median
UET	=	upper effects threshold
SRC	=	serious risk concentration

Freshwater sediment criteria were preferentially used; however, when freshwater sediment criteria were not available, estuarine or marine sediment values were used.

Sediment benchmarks were developed for purposes of deriving EcoRBSLs to be used in ERAs prepared for the SSFL. Given that EcoRBSLs for sediment are concentration-based, the benchmarks presented in Table 11-4 will serve as sediment EcoRBSLs for use in ERAs conducted at the SSFL as described in the *Ecological Risk-Based Screening Levels to be Used in Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura County, California – Technical Memorandum* (Appendix F of the SRAM Rev.2 Addendum).

11.1.3 Soil Invertebrates

Benchmarks for soil invertebrates are applicable to terrestrial invertebrates that are exposed to soil through ingestion of dietary items and soil contact as summarized in Table 9-3. Soil invertebrate benchmarks are available in peer-reviewed literature and technical publications such as USEPA's Eco-SSLs (various dates) and Efroymson *et al*. (1997a). The soil invertebrate benchmarks published in USEPA's Eco-SSLs are based upon either geometric means of EC10, EC20 and MATC values or are LOEC-based, while the values found in Efroymson et al (1997a) are based solely on LOECs. For this reason, only one set of medium-specific benchmarks were developed for soil invertebrates. As noted in Section 11.1, since this single list of effect concentrations is a combination of published values that represent various effect levels, the selected soil invertebrate values are referred to simply as "benchmarks."

The benchmarks for soil invertebrates are presented in Table 11-5 and were selected according to the following hierarchy of sources:

1. Soil invertebrate Eco-SSLs (USEPA, various dates)
2. Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Processes (Efroymson et al., 1997a)
3. Soil invertebrate benchmarks extracted from other published sources, e.g., Canadian Council of Ministers of the Environment (CCME) (various dates)[1]; Parmelee et al., 1997 (PCBs); Robidoux et al., 2000 (2,4,6-Trinitrotoluene); Simini et al., 2006 (energetic); Neuhauser et al., 1985 (VOCs); Hartenstein et al., 1981 (cobalt)

[1] CCME values were chosen based upon the most conservative to the least conservative (i.e., agricultural, parkland, commercial, and then industrial).

4. Soil invertebrate benchmarks from the Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities (USEPA, 1999)

The USEPA's Eco-SSLs for soil invertebrates (USEPA, various dates) were chosen as the first source in the hierarchy because they are widely accepted and heavily used peer-reviewed literature and technical publications, and generally include the most recent toxicity information for soil invertebrates. *Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Processes* (Efroymson et al., 1997a) was chosen as the second source in the hierarchy because, although it is also a widely accepted and heavily used peer-reviewed literature and technical publication, it is not as recent as USEPA's Eco-SSLs. The other published sources listed third in the hierarchy were equally weighted, and were used to supplement soil invertebrate effect concentrations for chemicals that were not included in the first two sources. The USEPA's *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities* (USEPA, 1999) was chosen as the last source in the hierarchy because this "peer-review draft" document was never finalized; therefore, the soil invertebrate effect concentrations contained therein could potentially include inaccuracies or errors.

Decision rules regarding the application of the above hierarchy were consistent with those rules described in Section 11.1.1.

Soil invertebrate benchmarks were developed for purposes of deriving EcoRBSLs to be used in ERAs conducted at the SSFL. Given that EcoRBSLs for soil invertebrate benchmarks are concentration-based, the benchmarks presented in Table 11-5 will serve as soil invertebrate EcoRBSLs for use in ERAs conducted at the SSFL as described in the *Ecological Risk-Based Screening Levels to be Used in Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura County, California – Technical Memorandum* (Appendix F of the SRAM Rev.2 Addendum).

11.1.4 Terrestrial Plants

Soil- and soil solution-based benchmarks for terrestrial plants are applicable to terrestrial plants with potential exposure to soil, seeps/springs, ephemeral surface water, and/or near-surface groundwater as summarized in Table 9-3. Soil and soil solution benchmarks for terrestrial plants are available in peer-reviewed literature and technical publications such as USEPA's Eco-SSLs (various dates), Efroymson et al. (1997b), and Hulzebos et al. (1993). The values found in Efroymson et al. (1997b) are based solely on LOECs while USEPA's Eco-SSLs are based upon either geometric means of EC10, EC20 and MATC values or are LOEC-based. For this reason, only one set of medium-specific benchmarks will each be

developed for soil- and soil solution-based benchmarks. As noted in Section 11.1, since this single list of effect concentrations is a combination of published benchmark values that represent effect levels, values adjusted to a "no effect" level, as well as true "no effect" levels, the terrestrial plant values (both soil and soil solution-based) selected are referred to simply as "benchmarks."

Terrestrial plant soil benchmarks are presented in Table 11-6, and were selected according to the following hierarchy of sources:

1. Plant Eco-SSLs (USEPA, various dates)
2. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision (Efroymson et al., 1997b)
3. Phytotoxicity studies with Latuca sativa in soil and nutrient solution (Hulzebos et al., 1993)
4. Plant benchmarks extracted from other published sources, e.g., CCME, various dates (organics and pesticides); Adema and Hanzen, 1989 (perchlorate); and Sims and Overcash, 1983 (PAHs)
5. Plant benchmarks reported in the Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities (USEPA, 1999).

The USEPA's Eco-SSLs for terrestrial plants (USEPA, various dates) were chosen as the first source in the hierarchy because they are widely accepted and heavily used peer-reviewed literature and technical publications, and generally include the most recent toxicity information for terrestrial plants. *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants* (Efroymson et al., 1997b) was chosen as the second source in the hierarchy because, although it is also a widely accepted and heavily used peer-reviewed literature and technical publication, it is not as recent as USEPA's Eco-SSLs. *Phytotoxicity studies with Latuca sativa in soil and nutrient* (Hulzebos et al., 1993) was chosen as the third source in the hierarchy because it is dated, but it contains plant effect concentrations for chemicals not included in the first two sources. The other published sources listed fourth in the hierarchy were equally weighted, and were used to supplement plant effect concentrations for chemicals that were not included in the first three sources. The USEPA's *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities* (USEPA, 1999) was chosen as the last source in the hierarchy because this "peer review draft" document was never finalized; therefore, the plant effect concentrations contained therein could potentially include inaccuracies or errors.

Decision rules regarding the application of the above hierarchy were consistent with those rules described in Section 11.1.1.

Soil solution-based terrestrial plant benchmarks were developed to evaluate potential effects of CPECs in seeps/springs and near-surface groundwater on terrestrial plants. Available soil solution phytotoxicity data for terrestrial plants are very limited; therefore, an effort to provide as much quantitative evaluation of terrestrial plants exposed to CPECs in seeps/springs and near-surface groundwater was deemed necessary. Only one source of soil solution-based terrestrial plant effect levels was deemed to be adequate for use at the SSFL, Efroymson et al. (1997b). Therefore, values from this source were used as the soil solution-based terrestrial plant benchmarks for the SSFL and are presented in Table 11-7. Given that Efroymson et al. (1997b) is a peer-reviewed and technical publication (i.e., a secondary or compilation sources), application of UFs is not required.

Soil and soil solution-based plant benchmarks for terrestrial plants are presented in Tables 11-6 and 11-7, respectively, and represent screening levels. These screening levels will serve as the terrestrial plant soil EcoRBSLs and soil solution-based plant EcoRBSLs for use in ERAs conducted at the SSFL as described in the *Ecological Risk-Based Screening Levels to be Used in Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura County, California – Technical Memorandum* (Appendix F of the SRAM Rev.2 Addendum).

11.1.5 Uncertainty Factors for Medium-specific Benchmarks

As presented in Section 11.1, only one set of medium-specific benchmarks will be developed for each of the following: surface water, soil invertebrates, and terrestrial plants (both soil and soil solution benchmarks). All of the benchmarks for surface water, soil invertebrates, and terrestrial plants (both soil and soil solution) were obtained from appropriate peer-reviewed literature or technical publications (i.e., secondary or compilation sources), which provide values that do not require the application of additional UFs. The majority of the benchmarks derived for soil invertebrates were obtained from appropriate peer-reviewed literature or technical publications (i.e., secondary or compilation sources), which provide values that do not require the application of additional UFs, with the exception of one primary source (i.e., Neuhauser et al., 1985). For the value obtained from Neuhauser et al (1985), a UF of 5 was applied to adjust LC_{50} values to a chronic LOEC-equivalent value. It should be noted soil invertebrate benchmarks obtained from Efroymson et al. (1997a) for several chemicals were based on LC_{50} values. However, Efroymson et al. (1997a) applied a UF of 5 to these LC_{50} values to adjust them to LOEC-equivalent values. Therefore, these adjusted values were adopted “as is” for consistency with Efroymson

et al., 1997a. Additionally, EC_{50} values from two primary sources (Adema and Henzen, 1989; Hulzebos et al., 1993) were selected as terrestrial plant benchmarks (Table 11-6). Efroymson et al. (1997b) recommended EC_{50} values cited in both Hulzebos et al. (1993) and Adema and Henzen (1989) without the application of UFs. For consistency with Efroymson et al. (1997b), UFs were not applied to plant benchmarks reported in Adema and Henzen (1989) and Hulzebos et al. (1993).

Should it become necessary in the future to derive additional medium-specific benchmarks from primary sources for additional chemicals detected at the SSFL, benchmarks with endpoints that reflect a level of impact will be adjusted to LOEC-equivalent values through the application of UFs. The following UFs will be applied to benchmarks from additional primary sources in order to arrive at LOEC-equivalent low benchmarks:

- A UF of 5 will be used to adjust LC_{50} benchmarks to LOEC-equivalent benchmarks;
- A UF of 2 will be used to adjust acute or subchronic endpoints to chronic endpoints;
- UFs will be combined as necessary.

It should be noted that LC_{50} values are only used in the absence of other toxicity data for a given chemical, regardless of whether LC_{50} values are derived from a primary or secondary source. LC_{50} values from a primary source are modified to represent LOEC-equivalent values, as indicated above. LC_{50} values from a secondary source were modified by the source authors to represent LOEC-equivalent values.

11.2 Toxicity Reference Values for Birds and Mammals

TRVs for use at the SSFL are summarized in Table 11-2; including the assessment endpoints, the type of TRVs, the basis of each TRV and the manner in which the TRV will be applied in ERAs conducted for the SSFL.

11.2.1 Birds

Terrestrial avian TRVs are applicable to the red-tailed hawk (exposed to soil), the hermit thrush (exposed to soil and surface water), and the great blue heron (exposed to surface water and sediment). Avian TRVs were developed using the methods described below and were used to derive of Low and High TRVs for the calculation of EcoRBSLs and for birds.

Avian TRVs are available in peer-reviewed literature and technical publications such as Navy/Biological Technical Advisory Group (BTAG) (DTSC, 2009) and USEPA's Eco-SSLs (various dates). In cases where appropriate toxicity information for a given chemical was available, chronic NOAELs or NOAEL-based toxicity values were selected to derive Low TRVs, and chronic LOAELs or LOAEL-based toxicity values were selected to derive High TRVs. If necessary, the application of appropriate UFs was performed as described in Section 11.2.3 below.

Per discussions with DTSC on July 28, 2011 the following steps for deriving avian TRVs from the information presented in USEPA's Eco-SSLs were agreed upon. The USEPA recommended NOAEL-based TRV will be used to derive the Low TRV for that chemical without any uncertainty factors applied. If there are three or more LOAELs available for growth and/or reproduction, the geometric mean of those LOAELs will be used to derive the High TRV for that chemical. If less than three LOAELs for growth and/or reproduction are available, then the lowest bounded LOAEL higher than either the geometric mean of NOAELs or the lowest bounded LOAEL higher than the selected NOAEL TRV will be used as the High TRV.

If no toxicity values were available for a particular compound, appropriate surrogate chemical chronic NOAELs were used as applicable. Surrogate chemicals were selected based on structural chemistry, specifically, the active moiety/functional group of the chemical, and are expected to exhibit toxicity equal to, or greater than, the particular compound without toxicity values. In those cases where appropriate chemical surrogates could not be identified, and therefore, TRVs are lacking, such chemicals will be selected as COPECs when detected, and evaluated in the uncertainty analysis sections of any future ERAs.

From an ecological standpoint, basing a Low TRV on a NOAEL may be unduly conservative because exceedance of a NOAEL does not necessarily imply an adverse effect at the receptor population level. The U.S. Navy and the BTAG along with other consultants and federal agencies produced a consensus publication (Engineering Field Activity, West; EFA West) in 1998. EFA West and the BTAG proposed both conservative Low TRVs for use in screening and High TRVs that represent a mid-range adverse effect level; these values are collectively referred to as the BTAG TRVs. The BTAG TRVs were intended to be used as screening values to quickly identify sites that were clean and those sites where impacts were likely to occur. It should be noted that, as initially agreed among the BTAG participants, these draft TRVs were only to be used at Navy sites in the San Francisco Bay area. Nevertheless, DTSC has sanctioned the use of High TRVs to estimate the upper limit of an estimated hazard quotient with the

caveat that if the value is exceeded, the adverse effect upon which the TRV was derived can be assumed to occur (DTSC 2000). A small mammal health protective goal based on effects to an individual is not consistently demonstrated through the BTAG selection of High TRVs. High TRV endpoints range from, for example, a High TRV LOAEL for effect of a 50 percent reduction in rat fetuses (PCBs) to a High TRV LOAEL for hair loss (thallium). Therefore, BTAG High TRVs are not always appropriate for protection against population level ecological effects. The population level ecological significance of the critical effect was taken into consideration, and professional judgment was applied in the use of BTAG High TRVs as high TRVs for use in ERAs prepared for the SSFL. In 2009, DTSC published a list of Low and High TRVs based on the BTAG TRVs, and provided updates for several chemicals (DTSC, 2009). These updated values were utilized, when available for a given chemical, for the derivation of Low and High TRV values for avian receptors evaluated in ERAs prepared for the SSFL.

Avian TRVs to be used in ERAs conducted at the SSFL were selected according to the following hierarchies of sources:

1. Currently Recommended U.S. Environmental Protection Agency Region 9 Biological Technical Assistance Group (BTAG) Low and High Avian Toxicity Reference Values (TRVs) (DTSC, 2009)
2. Avian TRVs from the Eco-SSLs (USEPA, various dates)
3. Avian TRVs from the Oak Ridge National Laboratory (ORNL) Toxicological Benchmarks for Wildlife: 1996 Revision (Sample et al., 1996)
4. Avian TRVs extracted from other published sources, e.g., Schafer et al., 1983 (VOCs and PAHs); Hill and Camardese, 1986 (pesticides/herbicides); Patton and Dieter, 1980 (PAHs); Hill et al., 1975 (phthalates); and USACHPPM, 2007 (perchlorate)[2]
5. Avian TRVs from the Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities (USEPA, 1999)

The BTAG TRVs (DTSC, 2009) were chosen as the first source in the hierarchy in accordance with HERD Eco Note Number: 4 (DTSC, 2000). The USEPA's Eco-SSLs for birds (USEPA, various dates) were chosen as the second source in the hierarchy because they are widely accepted and heavily used peer-reviewed literature and technical publications, and generally include the most recent toxicity information for birds. *Toxicological Benchmarks for Wildlife: 1996 Revision* (Sample et al., 1996) was

[2] Note that some of these sources are restricted to acute toxicity data. Chronic values were estimated through application of uncertainty factors.

chosen as the third source in the hierarchy because, although it is also a widely accepted and heavily used peer-reviewed literature and technical publication, it is not as recent as USEPA's Eco-SSLs. The other published sources listed fourth in the hierarchy were equally weighted, and were used to supplement avian TRVs for chemicals that were not included in the first three sources. The USEPA's *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities* (USEPA, 1999) was chosen as the last source in the hierarchy because this "peer review draft" document was never finalized; therefore, the avian TRVs contained therein could potentially include inaccuracies or errors.

The above hierarchies were followed in a step-wise manner, so that the first source listed was searched for available toxicity information, followed by the next source in the hierarchy, until available and adequate toxicity information was found. Sources lower in the hierarchy were not searched if a higher-level source provided adequate toxicity information for a given chemical. If no suitable chemical-specific toxicity information was found in any of the sources listed in the above hierarchies, a chemical with structural similarity was selected as a surrogate, as applicable. In those cases where an appropriate chemical surrogate could not be identified, and therefore, TRVs are lacking, such chemicals will be selected as COPECs when detected, and evaluated in the uncertainty analysis sections of any future ERAs.

Since a 2,3,7,8-TCDD toxicity equivalence (TEQ) EcoRBSL and a medium-specific coplanar PCB TEQ EcoRBSL will be calculated, avian TRVs for individual dioxin/furan and coplanar PCB congeners will not be developed. Further details regarding TEQ EcoRBSL derivation methods are presented in the *Ecological Risk-Based Screening Levels to be Used in Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura County, California – Technical Memorandum* (Appendix F of the SRAM Rev.2 Addendum).

Avian Low TRVs and High TRVs for the SSFL are presented in Table 11-8.

11.2.2 Mammals

Terrestrial mammals may be exposed to contaminants through the ingestion of dietary items and incidental soil, dermal and inhalation exposure routes. The dermal route of exposure will not be evaluated in ERAs prepared for the SSFL because dermal toxicity values are not available for mammals, and the uncertainty in extrapolating between the oral and dermal routes of exposure. The derivation of terrestrial mammalian TRVs for the ingestion and inhalation routes of exposure are described below.

Terrestrial mammalian TRVs for ingestion are applicable to the bobcat, deer mouse and mule deer (exposed to soil and surface water). Terrestrial mammalian TRVs for inhalation by burrowing receptors

are applicable to the deer mouse (exposed to soil vapor in burrows), and are presented in the *Inhalation Toxicity Reference Value Updates for Use in Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura California Technical Memorandum* (Appendix E of the SRAM Rev.2 Addendum). Mammalian TRVs were developed using the methods described below and were to derive Low and High TRVs for ingestion for the calculation of EcoRBSLs and for mammals.

Mammalian TRVs for ingestion are available in peer-reviewed literature and technical publications such as IRIS (2011b), ATSDR (various dates), Navy/Biological Technical Advisory Group (BTAG) (DTSC, 2009), and USEPA's Eco-SSLs (various dates). In cases were appropriate toxicity information for a given chemical was available, chronic NOAELs or NOAEL-based toxicity values were selected to derive Low TRVs, and chronic LOAELs or LOAEL-based toxicity values were selected to derive High TRVs. If necessary, the application of appropriate UFs was performed as described in Section 11.2.3 below.

If mammalian TRVs for ingestion were derived from information in USEPA's Eco-SSLs, the lowest NOAEL, or the geometric mean of NOAELs, for reproduction and growth, was used to derive the Low TRV for that chemical, and if a LOAEL for that same study is available, it was used as the high TRV for that chemical. If the mammalian Eco-SSL for a given chemical was based on a geometric mean of NOAELs, the lowest bounded LOAEL higher than the geometric mean of NOAELs was used as the high TRV. If terrestrial mammalian TRVs for ingestion were based on a toxicity study listed in ATSDR, the study used to derive the Minimal Risk Level (MRL) was selected, and when multiple MRLs were available, the MRL derived from the study with the longest (chronic) exposure was selected as the TRV.

If no toxicity values were available for a particular compound, appropriate surrogate chemical chronic NOAELs were used as the mammalian ingestion TRVs, as applicable. Surrogate chemicals were selected based on structural chemistry, specifically, the active moiety/functional group of the chemical, and are expected to exhibit toxicity equal to, or greater than, the particular compound without toxicity values. In those cases where appropriate chemical surrogates could not be identified, and therefore, TRVs are lacking, such chemicals will be selected as COPECs when detected, and evaluated in the uncertainty analysis sections of any future ERAs.

From an ecological standpoint, basing a Low TRV on a NOAEL may be unduly conservative because exceedance of a NOAEL does not necessarily imply an adverse effect at the receptor population level. The U.S. Navy and the BTAG along with other consultants and federal agencies produced a consensus publication (Engineering Field Activity, West; EFA West) in 1998. EFA West and the BTAG proposed both conservative Low TRVs for use in screening and High TRVs that represent a mid-range adverse

effect level; these values are collectively referred to as the BTAG TRVs. The BTAG TRVs were intended to be used as screening values to quickly identify sites that were clean and those sites where impacts were likely to occur. It should be noted that, as initially agreed among the BTAG participants, these draft TRVs were only to be used at Navy sites in the San Francisco Bay area. Nevertheless, DTSC has sanctioned the use of High TRVs to estimate the upper limit of an estimated hazard quotient with the caveat that if the value is exceeded, the adverse effect upon which the TRV was derived can be assumed to occur (DTSC, 2000). A small mammal health protective goal based on effects to an individual is not consistently demonstrated through the BTAG selection of High TRVs. High TRV endpoints range from, for example, a High TRV LOAEL for effect of a 50 percent reduction in rat fetuses (PCBs) to a High TRV LOAEL for hair loss (thallium). Therefore, BTAG High TRVs are not always appropriate for protection against population level ecological effects. The population level ecological significance of the critical effect was taken into consideration, and professional judgment was applied in the use of BTAG High TRVs as High TRVs for use in ERAs prepared for the SSFL. In 2009, DTSC published a list of Low and High TRVs based on the BTAG TRVs, and provided updates for several chemicals (DTSC, 2009). These updated values were utilized, when available for a given chemical, for the derivation of Low and High TRV values for mammalian receptors evaluated in ERAs prepared for the SSFL.

Terrestrial mammalian TRVs for ingestion to be used in ERAs conducted at the SSFL were selected according to the following hierarchies of sources:

1. Currently Recommended U.S. Environmental Protection Agency Region 9 Biological Technical Assistance Group (BTAG) low and high Mammalian Toxicity Reference Values (TRVs) (DTSC, 2009)
2. Mammalian TRVs from the Eco-SSLs (USEPA, various dates)
3. Mammalian TRVs from the ORNL Toxicological Benchmarks for Wildlife: 1996 Revision (Sample et al., 1996)
4. Mammalian TRVs extracted from the IRIS Database (Searched May to July 2011a; February 2013) (USEPA, 2011a; 2013)
5. Mammalian toxicity data extracted from chemical-specific ATSDR Toxicological Profiles (Searched May to July 2011) (ATSDR, various dates)
6. Mammalian TRVs extracted from other published sources, e.g., USACHPPM, 2002 (SVOCs); and USACHPPM, 2007 (perchlorate)

The BTAG TRVs (DTSC, 2009) were chosen as the first source in the hierarchy in accordance with HERD Eco Note Number: 4 (DTSC, 2000). The USEPA's Eco-SSLs for mammals (USEPA, various dates) were chosen as the second source in the hierarchy because they are widely accepted and heavily used peer-reviewed literature and technical publications, and generally include the most recent toxicity information for mammals. *Toxicological Benchmarks for Wildlife: 1996 Revision* (Sample et al., 1996) was chosen as the third source in the hierarchy because, although it is also a widely accepted and heavily used peer-reviewed literature and technical publication, it is not as recent as USEPA's Eco-SSLs. The other published sources listed fourth in the hierarchy were equally weighted, and were used to supplement mammalian TRVs for chemicals that were not included in the first three sources. The USEPA's *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities* (USEPA, 1999) was chosen as the last source in the hierarchy because this "peer review draft" document was never finalized; therefore, the mammalian TRVs contained therein could potentially include inaccuracies or errors.

The above hierarchies were followed in a step-wise manner, so that the first source listed was searched for available toxicity information, followed by the next source in the hierarchy, until available and adequate toxicity information was found. Sources lower in the hierarchy were not searched if a higher-level source provided adequate toxicity information for a given chemical. If no suitable chemical-specific toxicity information was found in any of the sources listed in the above hierarchies, a chemical with structural similarity was selected as a surrogate, as applicable. In those cases where an appropriate chemical surrogate could not be identified, a TRV was not selected for that particular chemical.

Since a 2,3,7,8-TCDD toxicity equivalence (TEQ) EcoRBSL and a medium-specific coplanar PCBs TEQ EcoRBSL will be calculated, mammalian TRVs for individual dioxin and coplanar PCB congeners were not developed. Further details regarding TEQ EcoRBSL derivation methods are presented in the *Ecological Risk-Based Screening Levels to be Used in Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura County, California – Technical Memorandum* (MWH, 2011).

Mammalian Low TRVs and High TRVs for ingestion for the SSFL are presented in Table 11-9 for ingestion. Both mammalian Low and High TRVs for inhalation can be found in the *Inhalation Toxicity Reference Value Updates for Use in Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura California Technical Memorandum* (Appendix E of the SRAM Rev.2 Addendum)

11.2.3 Uncertainty Factors for Avian and Mammalian TRVs

LOAELs and other TRVs with endpoints that reflect a level of impact are adjusted to a NOAEL-equivalent value through the application of UFs. The following UFs were applied to TRVs in order to arrive at NOAEL-equivalent low TRVs:

- A UF of 5 was used to adjust LOAEL TRVs to NOAEL-equivalent TRVs;
- A UF of 2 was used to adjust acute or subchronic endpoints to chronic endpoints;
- A UF of 100 was to adjust LD_{50} values to chronic NOAEL-equivalent values.
- UFs were combined as necessary.

It should be noted that LD_{50} values were only used in absence of other toxicity data for a given chemical.

A determination regarding whether or not a mammalian toxicity study represented subchronic or chronic exposures was based either on the duration of the experiment relative to the lifespan of the test species, or because the exposure occurred during a critical lifestage (e.g., mating, gestation, lactation). A mammalian toxicity study was determined to be chronic if exposure was at least 50 percent of a species' lifespan, based on technical support information presented in the Great Lakes Water Quality Initiative Wildlife Criteria (USEPA, 1995a,b) and Sample et al. (1996). For example, an exposure of one year or greater was considered to represent chronic exposure for studies on laboratory rodents, which have life spans of about two years. Reproductive and development periods (e.g., mating, gestation, or lactation) are particularly sensitive life stages due to the stressed condition of the adults and the rapid growth and differentiation occurring within the embryo (Sample et al., 1996). Because benchmarks are intended to evaluate the potential for adverse effects on wildlife populations, consistent with SSFL assessment endpoints and Sample et al. (1996), exposures that occurred during most of a species' reproductive/development period (i.e., critical life stage) were considered to represent chronic exposures.

There is limited information available concerning the life spans of birds used in toxicity tests. Therefore, consistent with Sample et al. (1996), avian studies with exposure durations greater than 10 weeks were considered to represent chronic studies.

Sources of avian and mammalian TRVs, such as IRIS (2011b), ATSDR (various dates), BTAG (DTSC, 2009), and USEPA's Eco-SSLs (various dates) occasionally apply different UFs than those noted above to adjust a toxicity value to a chronic NOAEL. If the details of a study were not presented or were not

sufficiently complete to determine whether or not that study was chronic, then the interpretation made by the source document was used. In the case of secondary sources, such as BTAG (DTSC, 2009) and Sample et al., (1996), the final derived chronic NOAEL was used for the Low TRV and the final chronic LOAEL was used as the High TRV for both avian and mammalian TRVs without the application of additional UFs.

11.3 Critical Tissue Concentrations

Critical tissue concentrations are chemical concentrations in organism tissue that correlate to the absence of adverse effects. As an additional line of evidence, terrestrial and/or aquatic receptor tissue concentrations can be measured in tissue samples collected from the field for comparison to critical tissue concentrations published in the literature. Alternatively, terrestrial and/or aquatic receptor tissue concentrations can be estimated using site-specific BAFs or literature-based BAFs. Critical tissue concentrations have not been developed for the SSFL to date. In the event that critical tissue concentrations are deemed useful for ERA weight-of-evidence evaluations in the future they will be developed in consultation with DTSC. Additional lines of evidence will be discussed, as appropriate, in the uncertainty section of the ERA.

ATTACHMENT 3

Lists of Updated References and Table

UPDATED REFERENCES AND TABLES

These lists of sources and tables are not comprehensive and only include references and tables that have been updated or added to SRAM Rev. 2 (MWH, 2005) in Attachment 2 of the Ecological Effects Characterization Updates Technical Memorandum.

ATTACHMENT 2 – UPDATES TO SECTION 11, STANDARDIZED RISK ASSESSMENT METHODOLOGY (SRAM) WORK PLAN, SANTA SUSANA FIELD LABORATORY, VENTURA COUNTY, CALIFORNIA. REVISION 2 – FINAL

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Table 11-1
Summary of Toxicity Data Used to Derive Medium-based Benchmarks for the SSFL
Santa Susana Field Laboratory

Medium	Assessment Endpoint	Type	Basis	Description	Application
Surface Water	Water Column Community	NRWQC	CCC, estimated CCC	• An estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed to indefinitely without resulting in an unacceptable effect (USEPA, 2000 & 2009).	Benchmark
		SCV	Tier II	• Geometric mean of the LOEC and NOEC (Suter and Tsao, 1996).	
		Estimated NOEC	Adjusted LOEC	• A UF of 5 (LOEC to NOEC) applied to chronic LOEC in source (CVRWQCB, 2007). • A UF of 10 (LOEC to NOEC and acute to chronic) applied to acute LOEC in source (CVRWQCB, 2007).	
		ESL	Adjusted LOEC or NOEC	• USEPA Region 5 Water Ecological Screening Level based upon toxicity study/exposure to mink (Buchman, 2008).	
		NRWQC	chronic value	• Applicable or relevant and appropriate requirements (ARARs) providing the basis for screening benchmarks for contaminants in water (Suter and Tsao, 1996). • Final acute values (FAVs) derived by the geometric mean of quotients of at least three LC_{50}s (Suter and Tsao, 1996).	
Sediment	Benthic Invertebrate Community	NOEC-equivalent Benchmark	AETm	• A benchmark based upon relationships between sediment concentrations and observed toxicity bioassay results or observed benthic community impacts. • The highest concentration associated with a non-toxic sample.	Low Benchmark
			ERL	• 10th percentile of analyte concentrations in a dataset containing results of sediment toxicity bioassay where toxicity are not observed.	
			ESB	• Derived from FCV or SCV using equilibrium partitioning. • Same level of protection in sediment as the FCV or SCV's protection in surface water.	
			Region III ESB		
			SQB	• Derived from SCV using equilibrium partitioning (Jones et al., 1997). • Same level of protection in sediment as the SCV's protection in surface water.	
			T20m	• Chemical concentrations corresponding to a 20% probability of observing toxicity in a logistic regression model based on a 10-day marine amphipod survival test (Buchman, 2008).	
			TEC	• Consensus-based value which sediment toxicity are not expected below this value. • Based on various benchmarks including TELs, ERLs, LELs, METs, and SQALs (MacDonald et al., 2000).	
			TEL	• A threshold concentration where effects are anticipated above this value (MacDonald et al., 2000). • Based on sediment concentrations in a database of chemical concentrations and sediment toxicity bioassays or benthic community metrics.	
			TELm		

Table 11-1
Summary of Toxicity Data Used to Derive Medium-based Benchmarks for the SSFL
Santa Susana Field Laboratory

Medium	Assessment Endpoint	Type	Basis	Description	Application
Sediment			PEC	• Consensus-based value which harmful effects are expected above this value. • Based on various benchmarks including PEL_S, ERMs, SELs, and TETs (MacDonald et al., 2000).	High Benchmark
			PELm	• A threshold concentration where toxicity are anticipated above this value. • Based on sediment concentrations in a database of chemical concentrations and sediment toxicity bioassays or benthic community metrics.	
			SRC	• Chemical concentration at which serious negative effects in an ecosystem may occur (Lijzen et al., 2001).	
			T50m	• Chemical concentrations corresponding to a 50% probability of observing toxicity in a logistic regression model based on a 10-day marine amphipod survival test.	
			UET	• Derived by NOAA as the lowest AET from a compilation of endpoints.	
Soil	Soil Invertebrates	LOEC-equivalent Benchmark	EC_{10}/MATC	• Geometric mean of EC_{10}s and MATCs used in the development of the USEPA Eco-SSL. • USEPA Eco-SSLs are concentrations of contaminants in soil that are protective of the respective ecological receptors that are directly or indirectly exposed to soil.	Benchmark
			EC_{20}	• Geometric mean of EC_{20}s used in the development of the USEPA Eco-SSL. • USEPA Eco-SSLs are concentrations of contaminants in soil that are protective of the respective ecological receptors that are directly or indirectly exposed to soil.	
			LC_{50}	• A UF of 5 was applied to LC_{50} to derive benchmark; applied in source (Efroymson et al., 1997a). • A UF of 5 (LC_{50} to NOEC) was applied to the LC_{50} from Neuhauser et al., 1985, consistent with Efroymson et al., 1997a.	
			LOEC	• Lowest observed effect concentration indicated in study.	
			MATC	• Geometric mean of MATC calculated in source (USEPA Eco-SSLs).	
			NOEC	• Either a study NOEC or another endpoint (i.e., LOEC, etc) was adjusted to derive a NOEC in the secondary source.	
			SQG_E	• Derived by CCME using toxicological data to determine the threshold level of effects for ecological receptors directly exposed to soil.	

Table 11-1
Summary of Toxicity Data Used to Derive Medium-based Benchmarks for the SSFL
Santa Susana Field Laboratory

Medium	Assessment Endpoint	Type	Basis	Description	Application
Soil	Terrestrial Plants	LOEC-equivalent Benchmark	EC_{20}	• Geometric mean of EC_{20}s used in the development of the USEPA Eco-SSL. • USEPA Eco-SSLs are concentrations of contaminants in soil that are protective of the respective ecological receptors that are directly or indirectly exposed to soil.	Benchmark
			EC_{20}/MATC	• Geometric mean of EC_{20}s and MATCs used in the development of the Eco-SSL. • USEPA Eco-SSLs are concentrations of contaminants in soil that are protective of the respective ecological receptors that are directly or indirectly exposed to soil.	
			EC_{50}	• Soil concentration that results in an adverse effect in 50% of the organisms tested. Reported concentration derived by rounding the test concentration down to 1 significant figure in Efroymson et al. 1997b.	
			LOEC	• The source derived a terrestrial plant benchmark based on a LOEC.	
			MATC	• Geometric mean of MATCs used in the development of the USEPA Eco-SSL. • USEPA Eco-SSLs are concentrations of contaminants in soil that are protective of the respective ecological receptors that are directly or indirectly exposed to soil.	
			MATC/NOEC	• Geometric mean of MATCs and NOECs used in the development of the Eco-SSL. • USEPA Eco-SSLs are concentrations of contaminants in soil that are protective of the respective ecological receptors that are directly or indirectly exposed to soil.	
			NOAEL	• A study NOAEL was used in the source to derive a benchmark. No UF was applied.	
			NOEC	• Either a study NOEC was used in the source to derive a benchmark, or NOEC was obtained from a toxicity study. No UF was applied.	
			SQG_E	• Derived by CCME using toxicological data to determine the threshold level of effects for ecological receptors directly exposed to soil.	
Near-surface Groundwater	Terrestrial Plants	NOEC-equivalent Benchmark	EC50	• Source developed a solution-based terrestrial plant benchmark based on a EC50.	Benchmark
			LOEC	• Source developed a solution-based terrestrial plant benchmark based on a LOEC.	
			Benchmark	• Solution-based terrestrial plant benchmark derived in source.	

Table 11-1
Summary of Toxicity Data Used to Derive Medium-based Benchmarks for the SSFL
Santa Susana Field Laboratory

Medium	Assessment Endpoint	Type	Basis	Description	Application

Notes:

AET - apparent effects threshold
AETm - marine apparent effects threshold
CCC - criterion continuous concentration
CCME - Canadian Council of Ministers of the Environment
EC_{10} - effect concentration for 10% of test population
EC_{20} - effect concentration for 20% of test population
EC_{50} - effect concentration for 50% of test population
Eco-SSL - Ecological Soil Screening Level
ERL - effect range low
ERM - effect range median
ESB - equilibrium partitioning sediment benchmark
ESL - ecological screening level
FCV - Final Chronic Values
LC_{50} - lethal concentration to 50% of test population
LD_{50} - lethal dose to 50% of test population
LEL - lowest effect levels
LOAEL - lowest observed adverse effect level
LOEC - lowest observed effect concentration
MATC - maximum acceptable toxicant concentration
MEL - minimal effect thresholds
NOAA - National Oceanic and Atmospheric Administration
NOAEL - no observed adverse effect level
NOEC - no observed effect concentration
NOEL - no observed effect level
NRWQC - National Recommended Water Quality Criteria
PEC - probable effect concentration
PELs - probable effect levels
PELm - marine probable effect level
Region III ESB - equilibrium partitioning sediment benchmark
SCV - secondary chronic value
SELs - severe effect levels
SQALs - sediment quality advisory levels
SQG_E - Ecological Soil Quality Guideline
SRC - serious risk concentration
T20m - Chemical concentrations corresponding to 20% probability of observing toxicity in marine amphipod tests
T50m - Chemical concentrations corresponding to 50% probability of observing toxicity in marine amphipod tests
TEC - threshold effect concentration
TEL - threshold effect level
TELm - marine threshold effect level

Table 11-1
Summary of Toxicity Data Used to Derive Medium-based Benchmarks for the SSFL
Santa Susana Field Laboratory

Medium	Assessment Endpoint	Type	Basis	Description	Application

TETs - toxic effect thresholds
TRV - toxicity reference value
UET - upper effects threshold
UF - uncertainty factor
USEPA - U.S. Environmental Protection Agency

Table 11-2
Summary of Toxicity Data Used to Derive Toxicity Reference Values for the SSFL
Santa Susana Field Laboratory

Medium	Assessment Endpoint	Type	Basis	Description	Application
Soil	Avian	NOAEL-equivalent Toxicity Value	Adjusted LC_{50}	• A UF of 100 (LC_{50} to NOEC) applied to LC_{50}.	Low TRV
			Adjusted LD_{50}	• A UF of 100 (LD_{50} to NOAEL) applied to LD_{50}.	
			Adjusted LOAEL	• A UF of 5 (LOAEL to NOAEL) applied to LOAEL. A UF of 2 (subchronic to chronic) also applied to LOAEL that are from subchronic studies.	
			Low TRV	• Low TRV developed by Biological Technical Assistance Group (BTAG).	
			NOAEL	• Either a study NOAEL or a low TRV was adjusted to derive a NOAEL in the secondary source. A UF of 2 (subchronic to chronic) also applied to NOAEL that are from subchronic studies.	
		LOAEL-equivalent Toxicity Value	High TRV	• High TRV developed by Biological Technical Assistance Group (BTAG).	High TRV
			Adjusted LC_{50}	• A UF of 5 (LC_{50} to LOAEL) applied to LC_{50}. A UF of 2 (subchronic to chronic) also applied to LOAEL that are from subchronic studies.	
			Adjusted LD_{50}	• A UF of 5 (LD_{50} to LOAEL) applied to LD_{50}. A UF of 2 (subchronic to chronic) also applied to LOAEL that are from subchronic studies.	
			Adjusted LOAEL	• A UF of 2 (subchronic to chronic) also applied to LOAEL that are from subchronic studies.	
Soil	Mammal	NOAEL-equivalent Toxicity Value	BMDL10	• Modeled value in source comparable to a NOAEL. The BMDL is not limited to one of the experimental doses. • A UF of 2 (subchronic to chronic) also applied to BMDL10 that are modeled from subchronic studies.	Low TRV
			Adjusted LEL	• Comparable to a LOAEL. A UF of 5 (LEL to NOAEL) applied to LEL. • A UF of 2 (subchronic to chronic) also applied to LEL that are derived from subchronic studies.	
			Adjusted LOAEL	• A UF of 5 (LOAEL to NOAEL) applied to LOAEL. • A UF of 2 (subchronic to chronic) also applied to LOAEL that are from subchronic studies.	
			Low TRV	• Low TRV developed by Biological Technical Assistance Group (BTAG).	
			NOAEL	• Either a study NOAEL or low TRV was derived by adjusting endpoints such as LOAEL in the secondary source. • A UF of 2 (subchronic to chronic) also applied to NOAEL that are from subchronic studies.	
			NOEL	• A study NOEL was used. • A UF of 2 (subchronic to chronic) also applied to NOEL that are from subchronic studies.	

Table 11-2
Summary of Toxicity Data Used to Derive Toxicity Reference Values for the SSFL
Santa Susana Field Laboratory

Medium	Assessment Endpoint	Type	Basis	Description	Application
Soil	Mammal	LOAEL-equivalent Toxicity Value	BMD10/BMDL10	• Modeled value in source comparable to a LOAEL. The BMD10/BMDL10 is not limited to one of the experimental doses. • A UF of 2 (subchronic to chronic) also applied to BMD10 that are modeled from subchronic studies.	High TRV
			High TRV	• High TRV developed by Biological Technical Assistance Group (BTAG).	
			LEL	• Comparable to a LOAEL. • A UF of 2 (subchronic to chronic) also applied to LEL that are derived from subchronic studies.	
			LOAEL	• A study LOAEL was used. • A UF of 2 (subchronic to chronic) also applied to LOAEL that are from subchronic studies.	
			MLE	• MLE at 10% increase in incidence. • Comparable to a LOAEL. No UF applied.	

Notes:

BMD10 - maximum likelihood estimate of the dose corresponding to 10% risk
BMDL10 - 95% lower confidence limit on the maximum likelihood estimate of the dose corresponding to 10% risk
Eco-SSL - Ecological Soil Screening Level
ERL - effect range low
ERM - effect range median
LC_{50} - lethal concentration to 50% of test population
LD_{50} - lethal dose to 50% of test population
LEL - lowest effect levels
LOAEL - lowest observed adverse effect level
MLE - Maximum likelihood estimate
NOAEL - no observed adverse effect level
NOEC - no observed effect concentration
TRV - toxicity reference value
UF - uncertainty factor
USEPA - U.S. Environmental Protection Agency

Table 11-3
Summary of Selected Benchmarks for Surface Water

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Surface Water or Seeps and Springs [a]	TRV Information					
				Surrogate Chemical	Benchmark (µg/L)	Study Endpoint	Criteria Type	Comments	Reference
Inorganic Compounds									
Aluminum	7429905	Aluminum, Total	X	--	87	CCC	NRWQC	--	USEPA, 2009 [b]
Aluminum, dissolved	7429905-D	-	X	Aluminum	87	CCC	NRWQC	Value in NRWQC is for total aluminum.	USEPA, 2009 [b]
Antimony	7440360	Antimony, Total	X	--	30	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Antimony, dissolved	7440360-D	-	X	Antimony	30	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 b
Arsenic	7440382	Arsenic, Total	X	--	150	CCC	NRWQC	Conversion factor (CF) of 1 was	USEPA, 2000 & 2009 [b]
Arsenic, dissolved	7440382-D	-	X	--	150	CCC	NRWQC	--	USEPA, 2000 & 2009 [b]
Barium	7440393	Barium, Total	X	--	4	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Barium, dissolved	7440393-D	-	X	Barium	4	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Beryllium	7440417	Beryllium, Total	X	--	0.66	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Beryllium, dissolved	7440417-D	-	X	Beryllium	0.66	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 b
Boron	7440428	Boron, Total	X	--	1.6	secondary chronic value	Tier II Value		Suter and Tsao, 1996 [b]
Boron, dissolved	7440428-D	-	X	Boron	1.6	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Cadmium	7440439	Cadmium, Total	X	--	0.28	CCC*	NRWQC	CF of 1.101672-[(ln hardness)(0.041838)] was applied to the dissolved value.	USEPA, 2000 & 2009 [b]
Cadmium, dissolved	7440439-D	-	X	--	0.25	CCC*	NRWQC	--	USEPA, 2000 & 2009 [b]
Chromium	7440473	Chromium, Total	X	Chromium (III)	86	CCC*	NRWQC	CF of 0.860 was applied to the dissolved value.	USEPA, 2000 & 2009 [b]
Chromium, dissolved	7440473-D	-	X	Chromium (III)	74	CCC*	NRWQC	--	USEPA, 2000 & 2009 [b]
Cobalt	7440484	Cobalt, Total	X	--	23	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Cobalt, dissolved	7440484-D	-	X	Cobalt	23	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Copper	7440508	Copper, Total	X	--	9.4	CCC*	NRWQC	CF of 0.960 was applied to the dissolved value.	USEPA, 2000 & 2009 [b]
Copper, dissolved	7440508-D	-	X	--	9.0	CCC*	NRWQC	--	USEPA, 2000 & 2009 [b]
Cyanides	57125	Cyanide, Total	X	--	5.2	CCC	NRWQC		USEPA, 2000 & 2009 [b]
Fluoride	7782414	-	X	--	--	--	--	--	--

Table 11-3
Summary of Selected Benchmarks for Surface Water

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Surface Water or Seeps and Springs [a]	TRV Information					
				Surrogate Chemical	Benchmark (µg/L)	Study Endpoint	Criteria Type	Comments	Reference
Hexavalent Chromium	18540299	Chromium, Hexavalent	X	--	11.4	CCC	NRWQC	CF of 0.962 was applied.	USEPA, 2000 & 2009 [b]
Lead	7439921	Lead, Total	X	--	3.2	CCC*	NRWQC	CF of 1.46203-[(ln hardness)(0.145712)] was applied to the dissolved value.	USEPA, 2000 & 2009 [b]
Lead, dissolved	7439921-D	-	X	--	2.5	CCC*	NRWQC	--	USEPA, 2000 & 2009 [b]
Manganese	7439965	Manganese, Total	X	--	120	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Manganese, dissolved	7439965-D	-	X	Manganese	120	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Mercury	7439976	Mercury, Total	X	--	0.91	CCC	NRWQC	CF of 0.85 was applied to the dissolved value.	USEPA, 2009 [b]
Mercury, dissolved	7439976-D	-	X	--	0.77	CCC	NRWQC	--	USEPA, 2009 [b]
Molybdenum	7439987	Molybdenum, Total	X	--	370	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Molybdenum, dissolved	7439987-D	-	X	Molybdenum	370	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Nickel	7440020	Nickel, Total	X	--	52	CCC*	NRWQC	CF of 0.997 was applied to the dissolved value.	USEPA, 2000 & 2009 [b]
Nickel, dissolved	7440020-D	-	X	--	52	CCC*	NRWQC	--	USEPA, 2000 & 2009 [b]
Selenium	7782492	Selenium, Total	X	--	5.0	CCC	NRWQC	--	USEPA, 2000 & 2009 [b]
Selenium, dissolved	7782492-D	-	X	--	4.6	CCC	NRWQC	--	USEPA, 2000 & 2009 [b]
Silica, dissolved	7631869-D	-	X	--	--	--	--	--	--
Silver	7440224	Silver, Total	X	--	0.38	estimated CCC**	NRWQC	CF of 0.85 was applied to the dissolved value.	USEPA, 2009 [b]
Silver, dissolved	7440224-D	-	X	--	0.32	estimated CCC**	NRWQC	CCC not available. Divided CMC (3.2 µg/L) by 10.	USEPA, 2009 [b]
Strontium	7440246	Strontium, Total	X	--	1500	secondary chronic value	Tier II Value		Suter and Tsao, 1996 [b]
Strontium, dissolved	7440246-D	-	X	Strontium	1500	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Thallium	7440280	Thallium, Total	X	--	12	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Thallium, dissolved	7440280-D	-	X	Thallium	12	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Titanium	7440326	Titanium, Total	X	--	2,000	Acute value	--	British Columbia Water Quality Guidelines	Buchman, 2008 [b]

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Chemical	CAS#	Chemical Synonym	Chemicals Detected in Surface Water or Seeps and Springs [a]	TRV Information					
				Surrogate Chemical	Benchmark (µg/L)	Study Endpoint	Criteria Type	Comments	Reference
Titanium, dissolved	7440326-D	-	X	Titanium	2,000	Acute value	--	British Columbia Water Quality Guidelines	Buchman, 2008 [b]
Vanadium	7440622	Vanadium, Total	X	--	20	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Vanadium, dissolved	7440622-D	-	X	Vanadium	20	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Zinc	7440666	Zinc, Total	X	--	122	CCC*	NRWQC	CF of 0.978 was applied to the dissolved value.	USEPA, 2000 & 2009 [b]
Zinc, dissolved	7440666-D	-	X	--	120	CCC*	NRWQC	--	USEPA, 2000 & 2009 [b]
Energetic Constituents									
1,2-Diphenylhydrazine	122667	-	X	--	270	Acute LOEC	toxicity study	--	CWQCB, 2011 [b]
2,4-Dinitrotoluene	121142	-	X	--	230	Chronic LOEC	toxicity study	--	CWQCB, 2011 [b]
Perchlorate	14797730	-	X	--	--	--	--	--	--
Volatile Organic Compounds									
1,1,1-Trichloroethane	71556	-	X	--	11	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
1,1,2,2-Tetrachloroethane	79345	-	X	--	610	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	Freon 113	X	--	--	--	--	--	--
1,1,2-Trichloroethane	79005	-	X	--	1200	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
1,1-Dichloroethane	75343	-	X	--	47	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
1,1-Dichloroethene	75354	-	X	--	25	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
1,2,4-Trichlorobenzene	120821	-	X	--	110	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
1,2-Dichlorobenzene	95501	o-Dichlorobenzene	X	--	14	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
1,2-Dichloroethane	107062	-	X	--	910	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
1,2-Dichloropropane	78875	-	X	--	5,700	Chronic LOEC	toxicity study	--	CWQCB, 2011 [b]
1,3-Dichlorobenzene	541731	m-Dichlorobenzene	X	--	71	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
1,4-Dichlorobenzene	106467	p-Dichlorobenzene	X	--	15	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
2-Chloroethylvinyl ether	110758	2-Chloroethyl vinyl ether	X	bis(2-chloroethyl) ether	122	Chronic LOEC	toxicity study	--	CWQCB, 2011 [b]
2-Chloronaphthalene	91587	-	X	--	1600	Acute LOEC	toxicity study	--	CWQCB, 2011 [b]
2-Chlorophenol	95578	-	X	--	4,380	Acute LOEC	toxicity study	--	CWQCB, 2011 [b]
2-Nitrophenol	88755	o-Nitrophenol	X	--	230	Acute LOEC	toxicity study	--	CWQCB, 2011 [b]

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Acetone	67641	-	X	--	1500	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Acrolein	107028		X	--	3	CCC	NRWQC	--	USEPA, 2009 [b]
Acrylonitrile	107131		X	--	7,550	Acute LOEC	toxicity study	--	CWQCB, 2011 [b]
Benzene	71432	-	X	--	130	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
bis(2-Chloroethyl) ether	111444	s-Dichloroethylether	X	--	122	Chronic LOEC	toxicity study	--	CWQCB, 2011 [b]
Bromide	24959679	-	X	--	--	--	--	--	--
Bromodichloromethane	75274	-	X	--	11,000	Acute LOEC	toxicity study	--	CWQCB, 2011 [b]
Bromomethane	74839	-	X	--	11,000	Acute LOEC	toxicity study	--	CWQCB, 2011 [b]
Carbon Disulfide	75150	-	X	--	0.92	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Carbon Tetrachloride	56235	-	X	--	9.8	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Chlorobenzene	108907	Monochlorobenzene	X	--	64	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Chloroethane	75003	Ethyl chloride	X	--	--	--	--	--	--
Chloroform	67663	Trichloromethane	X	--	28	secondary chronic value	Tier II Value		Suter and Tsao, 1996 [b]
Chloromethane	74873	Methyl chloride	X	--	11,000	Acute LOEC	toxicity study	--	CWQCB, 2011 [b]
cis-1,2-Dichloroethene	156592	cis-1,2-Dichloroethylene	X	1,2-Dichloroethene	590	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
cis-1,3-Dichloropropene	10061015	-	X	1,3-Dichloropropene	0.055	secondary chronic value	Tier II Value		Suter and Tsao, 1996 [b]
Ethylbenzene	100414	-	X	--	7.3	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Methylene chloride	75092	Dichloromethane	X	--	2200	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
m-Xylene	108383	meta-Xylene	X	Xylenes, Total	13	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
m-Xylene & p-Xylene	136777612	meta- and para-Xylenes	X	Xylenes, Total	13	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Nitrobenzene	98953	-	X	--	27,000	Acute LOEC	toxicity study	--	CWQCB, 2011 [b]
Tetrachloroethene	127184	-	X	--	98	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Toluene	108883	Toluol	X	--	9.8	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
trans-1,2-Dichloroethene	156605	-	X	1,2-Dichloroethene	590	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
trans-1,3-Dichloropropene	10061026	-	X	Dichloropropenes	244	Chronic LOEC	toxicity study	--	CWQCB, 2011 [b]
Trichloroethene	79016	Trichloroethylene (TCE)	X	--	47	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Trichlorofluoromethane	75694	-	X	--	11,000	Acute LOEC	toxicity study	--	CWQCB, 2011 [b]

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Vinyl chloride	75014	-	X	--	930	ESL	adjusted LOEC or NOEC	USEPA Region 5 water ESLs	Buchman, 2008 [b]
Xylenes, Total	1330207	Xylene (Total) Isomers	X	--	13	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Semi-Volatile Organic Compounds									
2,4,6-Trichlorophenol	88062	-	X	--	970	Chronic LOEC	toxicity study	--	CWQCB, 2011 [b]
2,4-Dichlorophenol	120832		X	--	365	Chronic LOEC	toxicity study	--	CWQCB, 2011 [b]
2,4-Dimethylphenol	105679	-	X	--	2,120	Acute LOEC	toxicity study	--	CWQCB, 2011 [b]
2,4-Dinitrophenol	51285		X	--	230	Acute LOEC	toxicity study	--	CWQCB, 2011 [b]
2,6-Dinitrotoluene	606202	-	X	--	230	Chronic LOEC	toxicity study	--	CWQCB, 2011 [b]
3,3'-Dichlorobenzidine	91941	-	X	--	--	--	--	--	--
4,6-Dinitro-o-cresol	534521	4,6-Dinitro-2-Methylphenol	X	--	230	Acute LOEC	toxicity study	--	CWQCB, 2011 [b]
4-Bromophenyl phenyl ether	101553		X	--	1.5	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
4-Chlorophenylphenyl ether	7005723		X	--	--	--	--	--	--
4-Nitrophenol	100027	-	X	--	300	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Benzidine	92875	-	X	--	3.9	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
bis(2-Chloroethoxy)methane	111911	-	X	--	11,000	Acute LOEL	--	Canadian Water Quality Guidelines	Buchman, 2008 [b]
bis(2-Chloroisopropyl)ether	39638329	-	X	--	122	Chronic LOEC	toxicity study	--	CWQCB, 2011 [b]
bis(2-Ethylhexyl) phthalate	117817	bis(2-ethylhexyl)phthalate	X	--	3	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Bromoform	75252	-	X	--	11,000	Acute LOEC	toxicity study	--	CWQCB, 2011 [b]
Butyl benzyl phthalate	85687	-	X	--	19	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Dibromochloromethane	124481	-	X	--	11,000	Acute LOEC	toxicity study	--	CWQCB, 2011 [b]
Diethyl phthalate	84662	-	X	--	210	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Dimethyl phthalate	131113	-	X	Diethyl phthalate	210	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Di-n-butyl phthalate	84742	Di-n-butylphthalate	X	--	35	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Di-n-octyl phthalate	117840	Di-n-octyl-phthalate	X	--	708	chronic value	Lowest Chronic Value	daphnids	Suter and Tsao, 1996 [b]
Formaldehyde	50000	-	X	--	--	--	--	--	--
Hexachlorobenzene	118741		X	--	250	Acute LOEC	toxicity study	--	CWQCB, 2011 [b]
Hexachlorobutadiene	87683	-	X	--	9.3	Chronic LOEC	toxicity study	--	CWQCB, 2011 [b]
Hexachlorocyclopentadiene	77474	-	X	--	5.2	Chronic LOEC	toxicity study	--	CWQCB, 2011 [b]

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Hexachloroethane	67721		X	--	12	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Isophorone	78591	-	X	--	117,000	Acute LOEC	toxicity study	--	CWQCB, 2011 [b]
n-Nitrosodimethylamine	62759	Nitrosodimethylamine	X	--	5,850	Acute LOEC	toxicity study	--	CWQCB, 2011 [b]
n-Nitrosodi-n-propylamine	621647	n-Nitrosodipropylamine	X	--	--	--	--	--	--
n-Nitrosodiphenylamine	86306	-	X	--	210	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
p-Chloro-m-cresol	59507	4-Chloro-3-Methylphenol	X	--	30	Acute LOEC	toxicity study	--	CWQCB, 2011 [b]
Pentachlorophenol	87865	PCP	X	--	15	CCC**	NRWQC	--	USEPA, 2000 & 2009 [b]
Phenol	108952	Total Phenols	X	--	200	chronic value	Lowest Chronic Value	lowest fish EC20	Suter and Tsao, 1996 [b]
Polynuclear Aromatic Hydrocarbons									
Acenaphthene	83329	-	X	--	23	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Acenaphthylene	208968	-	X	--	4840	chronic no effect level	toxicity study	ORNL aquatic biota Tier II	Buchman, 2008 [b]
Anthracene	120127	-	X	--	0.73	chronic no effect level	toxicity study	ORNL aquatic biota Tier II	Buchman, 2008 [b]
Benzo(a)anthracene	56553	Benz[a]anthracene	X	--	0.027	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Benzo(a)pyrene	50328	Benzo (a) pyrene	X	--	0.014	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Benzo(b)fluoranthene	205992	Benz[e]acephenanthrylene 1	X	--	9.07	ESL	adjusted LOEC or NOEC	USEPA Region 5 water ESLs	Buchman, 2008 [b]
Benzo(ghi)perylene	191242	Benzo (g,h,i) perylene	X	--	7.64	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Benzo(k)fluoranthene	207089	Benzo[k]fluoranthene	X	--	--	--	--	--	--
Chrysene	218019	-	X	--	0.014	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Dibenzo(a,h)anthracene	53703	Dibenz (a,h) anthracene	X	--	0.014	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Fluoranthene	206440	-	X	--	6.16	chronic value	NAWQC	value developed by USEPA for use in deriving sediment criteria	Suter and Tsao, 1996 [b]
Fluorene	86737	-	X	--	3.9	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Indeno(1,2,3-cd)pyrene	193395	Indeno (1,2,3-cd) pyrene	X	--	4.31	ESL	adjusted LOEC or NOEC	USEPA Region 5 water ESLs	Buchman, 2008 [b]
Naphthalene	91203	-	X	--	12	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]

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Phenanthrene	85018	-	X	--	6.3	chronic value	NAWQC	Value developed by USEPA for use in deriving sediment criteria	Suter and Tsao, 1996 [b]
Pyrene	129000	-	X	--	0.025	chronic value	--	Canadian Water Quality Guidelines	Buchman, 2008 [b]
Pesticides									
4,4'-DDD	72548	p,p'-DDD	X	total DDT	0.001	CCC	NRWQC	--	USEPA, 2000 & 2009 [b]
4,4'-DDE	72559	p,p'-DDE	X	total DDT	0.001	CCC	NRWQC	--	USEPA, 2000 & 2009 [b]
4,4'-DDT	50293	p,p'-DDT	X	total DDT	0.001	CCC	NRWQC	--	USEPA, 2000 & 2009 [b]
Aldrin	309002	-	X	--	0.30	estimated CCC	NRWQC	CCC not available. Divided CMC (3 ug/L) by 10.	USEPA, 2000 & 2009 [b]
alpha-BHC	319846	a-Benzene Hexachloride	X	BHC	2.2	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
beta-BHC	319857	b-Benzene Hexachloride	X	BHC	2.2	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
delta-BHC	319868	d-Benzene Hexachloride	X	BHC	2.2	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Dieldrin	60571	-	X	--	0.056	CCC	NRWQC	--	USEPA, 2000 & 2009 b
Endosulfan I	959988	-	X	--	0.051	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Endosulfan II	33213659	-	X	--	0.051	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Endosulfan sulfate	1031078	-	X	--	0.051	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
Endrin	72208	-	X	--	0.036	CCC	NRWQC	--	USEPA, 2000 & 2009 b
Endrin aldehyde	7421934	-	X	Endrin	0.036	CCC	NRWQC	--	USEPA, 2000 & 2009 [b]
gamma-BHC	58899	Lindane	X	--	0.095	estimated CCC	NRWQC	CCC not available. Divided CMC (0.95 ug/L) by 10.	USEPA, 2000
Heptachlor	76448	-	X	--	0.0038	CCC	NRWQC	--	USEPA, 2000 & 2009 b
Heptachlor epoxide	1024573	-	X	--	0.0038	CCC	NRWQC	--	USEPA, 2000 & 2009 [b]
Toxaphene	8001352	-	X	--	0.019	secondary chronic value	Tier II Value	--	Suter and Tsao, 1996 [b]
PCDD/PCDFs									
1,2,3,4,6,7,8-Heptachlorodibenzofuran	67562394	1,2,3,4,6,7,8-HpCDF	X	2,3,7,8-TCDD	0.00001	Chronic LOEC	toxicity study	--	CWQCB, 2011 [b]
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	35822469	1,2,3,4,6,7,8-HpCDD	X	2,3,7,8-TCDD	0.00001	Chronic LOEC	toxicity study	--	CWQCB, 2011 [b]

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1,2,3,4,7,8,9-Heptachlorodibenzofuran	55673897	1,2,3,4,7,8,9-HpCDF	X	2,3,7,8-TCDD	0.00001	Chronic LOEC	toxicity study	--	CWQCB, 2011 [b]
1,2,3,4,7,8-Hexachlorodibenzofuran	70648269	1,2,3,4,7,8-HxCDF	X	2,3,7,8-TCDD	0.00001	Chronic LOEC	toxicity study	--	CWQCB, 2011 [b]
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	39227286	1,2,3,4,7,8-HxCDD	X	2,3,7,8-TCDD	0.00001	Chronic LOEC	toxicity study	--	CWQCB, 2011 [b]
1,2,3,6,7,8-Hexachlorodibenzofuran	57117449	1,2,3,6,7,8-HxCDF	X	2,3,7,8-TCDD	0.00001	Chronic LOEC	toxicity study	--	CWQCB, 2011 [b]
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	57653857	1,2,3,6,7,8-HxCDD	X	2,3,7,8-TCDD	0.00001	Chronic LOEC	toxicity study	--	CWQCB, 2011 [b]
1,2,3,7,8,9-Hexachlorodibenzofuran	72918219	1,2,3,7,8,9-HxCDF	X	2,3,7,8-TCDD	0.00001	Chronic LOEC	toxicity study	--	CWQCB, 2011 [b]
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	19408743	1,2,3,7,8,9-HxCDD	X	2,3,7,8-TCDD	0.00001	Chronic LOEC	toxicity study	--	CWQCB, 2011 [b]
1,2,3,7,8-Pentachlorodibenzofuran	57117416	1,2,3,7,8-PeCDF	X	2,3,7,8-TCDD	0.00001	Chronic LOEC	toxicity study	--	CWQCB, 2011 [b]
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	40321764	1,2,3,7,8-PeCDD	X	2,3,7,8-TCDD	0.00001	Chronic LOEC	toxicity study	--	CWQCB, 2011 [b]
2,3,4,6,7,8-Hexachlorodibenzofuran	60851345	-	X	2,3,7,8-TCDD	0.00001	Chronic LOEC	toxicity study	--	CWQCB, 2011 [b]
2,3,4,7,8-Pentachlorodibenzofuran	57117314	2,3,4,7,8-PeCDF	X	2,3,7,8-TCDD	0.00001	Chronic LOEC	toxicity study	--	CWQCB, 2011 [b]
2,3,7,8-TCDD	1746016	2,3,7,8-Tetrachlorodibenzo-p-dioxin	X	--	0.00001	Chronic LOEC	toxicity study	--	CWQCB, 2011 [b]
2,3,7,8-TCDD_TEQ_Fish [c]	1746016-TEQ_Fish	-	X	2,3,7,8-TCDD	0.00001	Chronic LOEC	toxicity study	--	CWQCB, 2011 [b]
Octachlorodibenzofuran	39001020	OCDF	X	2,3,7,8-TCDD	0.00001	Chronic LOEC	toxicity study	--	CWQCB, 2011 [b]
Polychlorinated Biphenyls (PCBs)									
Aroclor 1016	12674112	-	X	total PCBs	0.014	CCC	NRWQC	--	USEPA, 2000 & 2009 b
Aroclor 1221	11104282	-	X	total PCBs	0.014	CCC	NRWQC	--	USEPA, 2000 & 2009 b
Aroclor 1232	11141165	-	X	total PCBs	0.014	CCC	NRWQC	--	USEPA, 2000 & 2009 b
Aroclor 1242	53469219	Aroclor-1242	X	total PCBs	0.014	CCC	NRWQC	--	USEPA, 2000 & 2009 b
Aroclor 1248	12672296	-	X	total PCBs	0.014	CCC	NRWQC	--	USEPA, 2000 & 2009 b
Aroclor 1254	11097691	-	X	total PCBs	0.014	CCC	NRWQC	--	USEPA, 2000 & 2009 b
Aroclor 1260	11096825	-	X	total PCBs	0.014	CCC	NRWQC	--	USEPA, 2000 & 2009 b
PCB_TEQ_Fish (Coplanar PCBs) [c]	1746016-PCB TEQ_Fish	-	X	2,3,7,8-TCDD	0.00001	Chronic LOEC	toxicity study	--	CWQCB, 2011 [b]
PCB-105	32598144	1,1'-Biphenyl, 2,3,3',4,4'-pentachloro-	X	2,3,7,8-TCDD	0.00001	Chronic LOEC	toxicity study	--	CWQCB, 2011 [b]
PCB-114	74472370	PCB 114 (BZ)	X	2,3,7,8-TCDD	0.00001	Chronic LOEC	toxicity study	--	CWQCB, 2011 [b]

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PCB-118	31508006	-	X	2,3,7,8-TCDD	0.00001	Chronic LOEC	toxicity study	--	CWQCB, 2011 [b]
PCB-123	65510443	123-PeCB	X	2,3,7,8-TCDD	0.00001	Chronic LOEC	toxicity study	--	CWQCB, 2011 [b]
PCB-126	57465288	-	X	2,3,7,8-TCDD	0.00001	Chronic LOEC	toxicity study	--	CWQCB, 2011 [b]
PCB-156	38380084	1,1'-Biphenyl, 2,3,3',4,4',5-hexachloro-	X	2,3,7,8-TCDD	0.00001	Chronic LOEC	toxicity study	--	CWQCB, 2011 [b]
PCB-157	69782907	PCB 157 (BZ)	X	2,3,7,8-TCDD	0.00001	Chronic LOEC	toxicity study	--	CWQCB, 2011 [b]
PCB-167	52663726	167-HxCB	X	2,3,7,8-TCDD	0.00001	Chronic LOEC	toxicity study	--	CWQCB, 2011 [b]
PCB-169	32774166	-	X	2,3,7,8-TCDD	0.00001	Chronic LOEC	toxicity study	--	CWQCB, 2011 [b]
PCB-189	39635319	-	X	2,3,7,8-TCDD	0.00001	Chronic LOEC	toxicity study	--	CWQCB, 2011 [b]
PCB-77	32598133	77-TeCB	X	2,3,7,8-TCDD	0.00001	Chronic LOEC	toxicity study	--	CWQCB, 2011 [b]
PCB-81	70362504	81-TeCB	X	2,3,7,8-TCDD	0.00001	Chronic LOEC	toxicity study	--	CWQCB, 2011 [b]
Chemical Parameters									
Chloride	16887006	-	X	--	230,000	CCC	NRWQC	53 FR 19028	USEPA, 2009 [b]
Chlorine	7782505	-	X	--	11	CCC	NRWQC	Gold book	USEPA, 2009 [b]
Nitrate	NO3N	-	X	--	--	--	--	--	--
Nitrite-NO2	E-10128	-	X	--	--	--	--	--	--
Oil content	E-10140	-	X	--	--	--	--	--	--
Sulfate	14808798	-	X	--	--	--	--	--	--

Notes:

[a] Chemicals detected in Groups 4 (Coca only), 6 (SRE only), 1B, 5, 10, 3 (WCT only), and 9 (Silvernale only) surface water.

[b] Indicates reference is a secondary or compilation source.

[c] A 2,3,7,8-TCDD TEQ and a PCB_TEQ_Fish for coplanar PCBs will be used to calculate EcoRBSLs for use in evaluation of the water column community. While the fish TEFs used to derive a 2,3,7,8-TCDD TEQ and a coplanar PCB TEQ enable evaluation of only one component (i.e., fish) of the water column community, fish are partially representative of the water column community. Uncertainties associated with the use of TEQs derived from TEF's applicable to fish to ultimately evaluate the WCC will be discussed in the uncertainty section of future ERAs at the SSFL.

Indicates final TRV
-- not available, could not be located, or not applicable.

* NRWQC is hardness dependent and TRV value is provided for a hardness of 100 mg/L
** NRWQC criteria is pH dependent on 7.8 pH
CCC - criterion continuous concentration
CWQCB - California Water Quality Control Board
DDD - dichlorodiphenyldichloroethane
ESL - ecological screening level
LOEC - lowest observed effect concentration
Low TRV - no effect toxicity reference value
NOEC - no observed effect concentration

Table 11-3
Summary of Selected Benchmarks for Surface Water

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Surface Water or Seeps and Springs [a]	TRV Information					
				Surrogate Chemical	Benchmark (µg/L)	Study Endpoint	Criteria Type	Comments	Reference

NRWQC - National Recommended Water Quality Criteria
ORNL - Oak Ridge National Laboratory
PCDD/PCDF - polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans
PRG - preliminary remediation goal
SW - surface water
TEQ - toxicity equivalent
TRV - toxicity reference value
USEPA - U.S. Environmental Protection Agency
µg/L microgram per liter
X - Analyte was detected in the indicated medium

Hierarchy of Sources:

1. The lower of either a.) USEPA (California Toxics Rule, CTR). 2000. Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California; Rule. Fed. Reg. 65: 31712-31719, or b.) USEPA. 2009. National Recommended Water Quality Criteria. Office of Science and Technology.
2. California Water Resources Control Board (CWQCB). 2011. A Compilation of Water Quality Goals, 16th Edition. California Environmental Protection Agency. April 2011 update. An acute LOEC is only selected as a benchmark when a chronic LOEC is unavailable.
3. Suter, G.W., II and C.L. Tsao. 1996. Toxicological benchmarks for screening potential contaminants of concern for effects on aquatic biota: 1996 revision. ES/ER/TM-96/R2. Health Sciences Research Division, Oak Ridge, Tennessee.
4. Buchman, M. F. 2008. NOAA Screening Quick Reference Tables. NOAA OR&R Report 08-1, Seattle, WA. Office of Response and Restoration Division. National Oceanic and Atmospheric Administration.
5. Suitable surrogate.

Table 11-4
Summary of Selected Benchmarks for Sediment

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Sediment [a]	Surrogate Used	TRV Information					
					Low Benchmark (mg/kg)	Criteria Type	Reference	High Benchmark (mg/kg)	Criteria Type	Reference
Inorganic Compounds										
Aluminum	7429905	Aluminum, Total	X	--	25,500	TEL	Buchman, 2008 [b]	--	--	--
Antimony	7440360	Antimony, Total	X	--	2	ERL	USEPA, 2011 [b]	3	UET	Buchman, 2008 [b]
Arsenic	7440382	Arsenic, Total	X	--	9.79	TEC	MacDonald et al., 2000 [b]	33	PEC	MacDonald et al., 2000 [b]
Barium	7440393	Barium, Total	X	--	48	AETm	Buchman, 2008 [b]	--	--	--
Beryllium	7440417	Beryllium, Total	X	--	--	--	--	--	--	--
Boron	7440428	Boron, Total	X	--	--	--	--	--	--	--
Cadmium	7440439	Cadmium, Total	X	--	0.99	TEC	MacDonald et al., 2000 [b]	4.98	PEC	MacDonald et al., 2000 [b]
Chromium	7440473	Chromium, Total	X	--	43.4	TEC	MacDonald et al., 2000 [b]	111	PEC	MacDonald et al., 2000 [b]
Cobalt	7440484	Cobalt, Total	X	--	10	AETm	Buchman, 2008 [b]	--	--	--
Copper	7440508	Copper, Total	X	--	31.6	TEC	MacDonald et al., 2000 [b]	149	PEC	MacDonald et al., 2000 [b]
Fluoride	7782414	-	X	--	--	--	--	--	--	--
Lead	7439921	Lead, Total	X	--	35.8	TEC	MacDonald et al., 2000 [b]	128	PEC	MacDonald et al., 2000 [b]
Manganese	7439965	Manganese, Total	X	--	630	TEL	Buchman, 2008 [b]	1100	UET	Buchman, 2008 [b]
Mercury	7439976	Mercury, Total	X	--	0.18	TEC	MacDonald et al., 2000 [b]	1.06	PEC	MacDonald et al., 2000 [b]
Molybdenum	7439987	Molybdenum, Total	X	--	--	--	--	--	--	--
Nickel	7440020	Nickel, Total	X	--	22.7	TEC	MacDonald et al., 2000 [b]	48.6	PEC	MacDonald et al., 2000 [b]
Selenium	7782492	Selenium, Total	X	--	1	AETm	Buchman, 2008 [b]	--	--	--
Silver	7440224	Silver, Total	X	--	1	ERL/ESB	USEPA, 2011 [b]	4.5	UET	Buchman, 2008 [b]
Strontium	7440246	Strontium, Total	X	--	--	--	--	--	--	--
Thallium	7440280	Thallium, Total	X	--	--	--	--	--	--	--
Tin	7440315	Tin, Total	X	--	0.048	TELm	Buchman, 2008 [b]	--	--	--
Titanium	7440326	Titanium, Total	X	--	--	--	--	--	--	--

Table 11-4
Summary of Selected Benchmarks for Sediment

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Sediment [a]	Surrogate Used	TRV Information					
					Low Benchmark (mg/kg)	Criteria Type	Reference	High Benchmark (mg/kg)	Criteria Type	Reference
Zinc	7440666	Zinc, Total	X	--	121	TEC	MacDonald et al., 2000 [b]	459	PEC	MacDonald et al., 2000 [b]
Energetic Constituents										
1,2-Dinitrobenzene	528290	o-Dinitrobenzene	X	--	--	--	--	--	--	--
1,3-Dinitrobenzene	99650	m-Dinitrobenzene	X	--	--	--	--	--	--	--
2,4,6-Trinitrotoluene	118967	-	X	--	0.092	Region III ESB	USEPA, 2011 [b]	--	--	--
2,4-diamino-6-nitrotoluene	6629294	-	X	--	--	--	--	--	--	--
2,4-Dinitrotoluene	121142	-	X	--	0.0416	Region III ESB	USEPA, 2011 [b]	--	--	--
2-Amino-4,6-Dinitrotoluene	35572782	-	X	2,4-dinitrotoluene	0.0416	Region III ESB	USEPA, 2011 [b]	--	--	--
2-Nitrotoluene	88722	-	X	4-Nitrotoluene	4.06	Region III ESB	USEPA, 2011 [b]	--	--	--
3-Nitrotoluene	99081	-	X	4-Nitrotoluene	4.06	Region III ESB	USEPA, 2011 [b]	--	--	--
4-Amino-2,6-dinitrotoluene	19406510	4-Am-2,6-DNT	X	2,6-dinitrotoluene	0.0416	Region III ESB	USEPA, 2011 [b]	--	--	--
4-Nitrotoluene	99990	-	X	--	4.06	Region III ESB	USEPA, 2011 [b]	--	--	--
HMX	2691410	-	X	--	--	--	--	--	--	--
Nitroglycerin	55630	-	X	--	--	--	--	--	--	--
Perchlorate	14797730	-	X	--	--	--	--	--	--	--
PETN	78115	-	X	--	--	--	--	--	--	--
RDX	121824	-	X	--	0.013	Region III ESB	USEPA, 2011 [b]	--	--	--
Tetryl	479458	-	X	--	--	--	--	--	--	--
Volatile Organic Compounds										
1,1,1,2-Tetrachloroethane	630206	-	X	--	--	--	--	--	--	--
1,1,1-Trichloroethane	71556	-	X	--	0.03	secondary chronic value	Jones et al., 1997	--	--	--
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	Freon 113	X	--	--	--	--	--	--	--
1,1-Dichloroethane	75343	-	X	--	0.027	secondary chronic value	Jones et al., 1997	--	--	--
1,1-Dichloroethene	75354	-	X	--	0.031	secondary chronic value	Jones et al., 1997	--	--	--

Table 11-4
Summary of Selected Benchmarks for Sediment

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Sediment [a]	Surrogate Used	TRV Information					
					Low Benchmark (mg/kg)	Criteria Type	Reference	High Benchmark (mg/kg)	Criteria Type	Reference
1,1-Dichloropropene	563586	-	X	--	--	--	--	--	--	--
1,2,4-Trimethylbenzene	95636	-	X	--	--	--	--	--	--	--
1,2-Dibromoethane	106934	-	X	--	--	--	--	--	--	--
1,2-Dichlorobenzene	95501	o-Dichlorobenzene	X	--	0.013	AETm	Buchman, 2008 [b]	--	--	--
1,2-Dichloroethane	107062	-	X	--	0.25	secondary chronic value	Jones et al., 1997	--	--	--
1,2-Dichloropropane	78875	-	X	--	--	--	--	--	--	--
1,3,5-Trimethylbenzene	108678	-	X	--	--	--	--	--	--	--
1,3-Dichlorobenzene	541731	m-Dichlorobenzene	X	1,2-Dichlorobenzene	0.013	AETm	Buchman, 2008 [b]	--	--	--
1,3-Dichloropropane	142289	-	X	--	--	--	--	--	--	--
1,4-Dichlorobenzene	106467	p-Dichlorobenzene	X	--	0.11	AETm	Buchman, 2008 [b]	--	--	--
2-Chloroethylvinyl ether	110758	2-Chloroethyl vinyl ether	X	--	--	--	--	--	--	--
2-Hexanone	591786	Methyl butyl ketone	X	--	0.022	secondary chronic value	Jones et al., 1997	--	--	--
Acetone	67641	-	X	--	0.0087	secondary chronic value	Jones et al., 1997	--	--	--
Benzene	71432	-	X	--	0.16	secondary chronic value	Jones et al., 1997	--	--	--
Bromide	24959679	-	X	--	--	--	--	--	--	--
Bromochloromethane	74975	-	X	--	--	--	--	--	--	--
Bromodichloromethane	75274	-	X	--	--	--	--	--	--	--
Bromomethane	74839	-	X	--	--	--	--	--	--	--
Carbon Disulfide	75150	-	X	--	0.00085	secondary chronic value	Jones et al., 1997	--	--	--
Chloroethane	75003	Ethyl chloride	X	--	--	--	--	--	--	--
Chloroform	67663	Trichloromethane	X	--	--	--	--	--	--	--
Chloromethane	74873	Methyl chloride	X	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	156592	cis-1,2-Dichloroethylene	X	1,1-Dichloroethene	0.031	secondary chronic value	Jones et al., 1997	--	--	--
cis-1,3-Dichloropropene	10061015	-	X	--	--	--	--	--	--	--

Table 11-4
Summary of Selected Benchmarks for Sediment

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Sediment [a]	Surrogate Used	TRV Information					
					Low Benchmark (mg/kg)	Criteria Type	Reference	High Benchmark (mg/kg)	Criteria Type	Reference
Cumene	98828	Isopropylbenzene	X	--	0.086	Region III ESB	USEPA, 2011 [b]	--	--	--
Dibromomethane	74953	-	X	--	--	--	--	--	--	--
Dichlorodifluoromethane	75718	Freon 12	X	--	--	--	--	--	--	--
Ethylbenzene	100414	-	X	--	0.004	AETm	Buchman, 2008 [b]	--	--	--
Methyl isobutyl ketone (MIBK)	108101	4-Methyl-2-pentanone	X	--	0.033	secondary chronic value	Jones et al., 1997	--	--	--
Methyl-tert-butyl- Ether (MTBE)	1634044	-	X	--	--	--	--	--	--	--
Methylene chloride	75092	Dichloromethane	X	--	0.37	secondary chronic value	Jones et al., 1997	--	--	--
m-Xylene & p-Xylene	136777612	meta- and para-Xylenes	X	xylenes, total	0.16	secondary chronic value	Jones et al., 1997	--	--	--
n-Butylbenzene	104518	-	X	--	--	--	--	--	--	--
Nitrobenzene	98953	-	X	--	0.021	AETm	Buchman, 2008 [b]	--	--	--
n-Propylbenzene	103651	-	X	--	--	--	--	--	--	--
o-Xylene	95476	-	X	xylenes, total	0.16	secondary chronic value	Jones et al., 1997	--	--	--
p-Cymene	99876	p-Isopropyltoluene	X	cumene	0.086	Region III ESB	USEPA, 2011 [b]	--	--	--
sec-Butylbenzene	135988	-	X	cumene	0.086	Region III ESB	USEPA, 2011 [b]	--	--	--
Styrene	100425	Vinylbenzene	X	--	0.559	Region III ESB	USEPA, 2011 [b]	--	--	--
tert-Butylbenzene	98066	-	X	cumene	0.086	Region III ESB	USEPA, 2011 [b]	--	--	--
Tetralin	119642	-	X	Naphthalene	0.176	TEC	MacDonald et al., 2000 [b]	0.561	PEC	MacDonald et al., 2000 [b]
Tetrachloroethene	127184	-	X	--	0.41	secondary chronic value	Jones et al., 1997	--	--	--
Toluene	108883	Toluol	X	--	0.05	secondary chronic value	Jones et al., 1997	--	--	--
trans-1,2-Dichloroethene	156605	-	X	1,2-Dichloroethene	0.40	secondary chronic value	Jones et al., 1997	--	--	--

Table 11-4
Summary of Selected Benchmarks for Sediment

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Sediment [a]	Surrogate Used	TRV Information					
					Low Benchmark (mg/kg)	Criteria Type	Reference	High Benchmark (mg/kg)	Criteria Type	Reference
trans-1,3-Dichloropropene	10061026	-	X	--	--	--	--	--	--	--
Trichloroethene	79016	Trichloroethylene (TCE)	X	--	0.0969	Region III ESB	USEPA, 2011 [b]	--	--	--
Vinyl chloride	75014	-	X	--	--	--	--	--	--	--
Semi-Volatile Organic Compounds										
1,2-Dibromo-3-chloropropane	96128	1,2-Dibromo-3-CPA	X	--	--	--	--	--	--	--
2,6-Dinitrotoluene	606202	-	X	2,4-dinitrotoluene	0.0416	Region III ESB	USEPA, 2011 [b]	--	--	--
Benzoic acid	65850	-	X	--	0.065	AETm	Buchman, 2008 [b]	--	--	--
bis(2-Ethylhexyl) phthalate	117817	bis(2-ethylhexyl)phthalate	X	--	0.18	TELm	Buchman, 2008 [b]	2.6	PELm	Buchman, 2008 [b]
Bromoform	75252	-	X	--	0.654	Region III ESB	USEPA, 2011 [b]	--	--	--
Butyl benzyl phthalate	85687	-	X	--	10.9	Region III ESB	USEPA, 2011 [b]	48	serious risk concentration	Lijzen et al., 2001
Dibromochloromethane	124481	-	X	--	--	--	--	--	--	--
Dimethyl phthalate	131113	-	X	--	0.006	AETm	Buchman, 2008 [b]	--	--	--
Di-n-butyl phthalate	84742	Di-n-butylphthalate	X	--	0.058	AETm	Buchman, 2008 [b]	0.11	UET	Buchman, 2008 [b]
Formaldehyde	50000	-	X	--	--	--	--	--	--	--
Hexachlorobutadiene	87683	-	X	--	0.0013	AETm	Buchman, 2008 [b]	--	--	--
n-Nitrosodimethylamine	62759	Nitrosodimethylamine	X	--	0.028	AETm	Buchman, 2008 [b]	--	--	--
p-Cresol	106445	4-Methylphenol	X	--	0.10	AETm	Buchman, 2008 [b]	--	--	--
Polynuclear Aromatic Hydrocarbons										
Acenaphthene	83329	-	X	--	0.0067	--	USEPA, 2011 [b]	0.29	UET	Buchman, 2008 [b]
Anthracene	120127	-	X	--	0.0572	TEC	MacDonald et al., 2000 [b]	0.845	PEC	MacDonald et al., 2000 [b]
Benzo(a)anthracene	56553	Benz[a]anthracene	X	--	0.108	TEC	MacDonald et al., 2000 [b]	1.05	PEC	MacDonald et al., 2000 [b]
Benzo(a)pyrene	50328	Benzo (a) pyrene	X	--	0.15	TEC	MacDonald et al., 2000 [b]	1.45	PEC	MacDonald et al., 2000 [b]

Table 11-4
Summary of Selected Benchmarks for Sediment

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Sediment [a]	Surrogate Used	TRV Information					
					Low Benchmark (mg/kg)	Criteria Type	Reference	High Benchmark (mg/kg)	Criteria Type	Reference
Benzo(b)fluoranthene	205992	Benz[e]acephenanthrylene 1	X	--	1.8	AETm	Buchman, 2008 [b]	--	--	--
Benzo(e)pyrene	192972	-	X	Pyrene	0.195	TEC	MacDonald et al., 2000 [b]	1.52	PEC	MacDonald et al., 2000 [b]
Benzo(ghi)perylene	191242	Benzo (g,h,i) perylene	X	--	0.17	--	USEPA, 2011 [b]	0.3	UET	Buchman, 2008 [b]
Benzo(k)fluoranthene	207089	Benzo[k]fluoranthene	X	--	0.0272	TEL	Buchman, 2008 [b]	13.4	UET	Buchman, 2008 [b]
Chrysene	218019	-	X	--	0.166	TEC	MacDonald et al., 2000 [b]	1.29	PEC	MacDonald et al., 2000 [b]
Dibenzo(a,h)anthracene	53703	Dibenz (a,h) anthracene	X	--	0.033	TEC	MacDonald et al., 2000 [b]	0.1	UET	Buchman, 2008 [b]
Fluoranthene	206440	-	X	--	0.423	TEC	MacDonald et al., 2000 [b]	2.23	PEC	MacDonald et al., 2000 [b]
Fluorene	86737	-	X	--	0.0774	TEC	MacDonald et al., 2000 [b]	0.536	PEC	MacDonald et al., 2000 [b]
Indeno(1,2,3-cd)pyrene	193395	Indeno (1,2,3-cd) pyrene	X	--	0.01732	TEL	Buchman, 2008 [b]	0.33	UET	MacDonald et al., 2000 [b]
Phenanthrene	85018	-	X	--	0.204	TEC	MacDonald et al., 2000 [b]	1.17	PEC	MacDonald et al., 2000 [b]
Pyrene	129000	-	X	--	0.195	TEC	MacDonald et al., 2000 [b]	1.52	PEC	MacDonald et al., 2000 [b]
Pesticides										
4,4'-DDD	72548	p,p'-DDD	X	--	0.00488	TEC	MacDonald et al., 2000 [b]	0.028	PEC	MacDonald et al., 2000 [b]
Terphenyls										
o-Terphenyl	84151	-	X	--	--	--	--	--	--	--
p-Terphenyl	92944	-	X	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons										--
TPH-Diesel Range Organics (DRO)	DRO	Diesel	X	--	--	--	--	--	--	--
TPH-Gasoline Range Organics (GRO)	GRO	Gasoline	X	--	--	--	--	--	--	--
TPH-Kerosene Range Organics (KRO)	KRO	Kerosene	X	--	--	--	--	--	--	--
TPH-Oil Range Organics (ORO)	ORO	Oil Range Organics	X	--	--	--	--	--	--	--
PCDD/PCDFs[c]										
1,2,3,4,6,7,8-Heptachlorodibenzofuran	67562394	1,2,3,4,6,7,8-HpCDF	X	2,3,7,8-TCDD	0.00000085	TEL	Buchman, 2008 [b]	0.0000088	UET	Buchman, 2008 [b]
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	35822469	1,2,3,4,6,7,8-HpCDD	X	2,3,7,8-TCDD	0.00000085	TEL	Buchman, 2008 [b]	0.0000088	UET	Buchman, 2008 [b]

Table 11-4
Summary of Selected Benchmarks for Sediment

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Sediment [a]	Surrogate Used	TRV Information					
					Low Benchmark (mg/kg)	Criteria Type	Reference	High Benchmark (mg/kg)	Criteria Type	Reference
1,2,3,4,7,8,9-Heptachlorodibenzofuran	55673897	1,2,3,4,7,8,9-HpCDF	X	2,3,7,8-TCDD	0.00000085	TEL	Buchman, 2008 [b]	0.0000088	UET	Buchman, 2008 [b]
1,2,3,4,7,8-Hexachlorodibenzofuran	70648269	1,2,3,4,7,8-HxCDF	X	2,3,7,8-TCDD	0.00000085	TEL	Buchman, 2008 [b]	0.0000088	UET	Buchman, 2008 [b]
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	39227286	1,2,3,4,7,8-HxCDD	X	2,3,7,8-TCDD	0.00000085	TEL	Buchman, 2008 [b]	0.0000088	UET	Buchman, 2008 [b]
1,2,3,6,7,8-Hexachlorodibenzofuran	57117449	1,2,3,6,7,8-HxCDF	X	2,3,7,8-TCDD	0.00000085	TEL	Buchman, 2008 [b]	0.0000088	UET	Buchman, 2008 [b]
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	57653857	1,2,3,6,7,8-HxCDD	X	2,3,7,8-TCDD	0.00000085	TEL	Buchman, 2008 [b]	0.0000088	UET	Buchman, 2008 [b]
1,2,3,7,8,9-Hexachlorodibenzofuran	72918219	1,2,3,7,8,9-HxCDF	X	2,3,7,8-TCDD	0.00000085	TEL	Buchman, 2008 [b]	0.0000088	UET	Buchman, 2008 [b]
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	19408743	1,2,3,7,8,9-HxCDD	X	2,3,7,8-TCDD	0.00000085	TEL	Buchman, 2008 [b]	0.0000088	UET	Buchman, 2008 [b]
1,2,3,7,8-Pentachlorodibenzofuran	57117416	1,2,3,7,8-PeCDF	X	2,3,7,8-TCDD	0.00000085	TEL	Buchman, 2008 [b]	0.0000088	UET	Buchman, 2008 [b]
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	40321764	1,2,3,7,8-PeCDD	X	2,3,7,8-TCDD	0.00000085	TEL	Buchman, 2008 [b]	0.0000088	UET	Buchman, 2008 [b]
2,3,4,6,7,8-Hexachlorodibenzofuran	60851345	-	X	2,3,7,8-TCDD	0.00000085	TEL	Buchman, 2008 [b]	0.0000088	UET	Buchman, 2008 [b]
2,3,4,7,8-Pentachlorodibenzofuran	57117314	2,3,4,7,8-PeCDF	X	2,3,7,8-TCDD	0.00000085	TEL	Buchman, 2008 [b]	0.0000088	UET	Buchman, 2008 [b]
2,3,7,8-TCDD	1746016	2,3,7,8-Tetrachlorodibenzo-p-dioxin	X	--	0.00000085	TEL	Buchman, 2008 [b]	0.0000088	UET	Buchman, 2008 [b]
2,3,7,8-Tetrachlorodibenzofuran	51207319	2,3,7,8-TCDF	X	2,3,7,8-TCDD	0.00000085	TEL	Buchman, 2008 [b]	0.0000088	UET	Buchman, 2008 [b]
Octachlorodibenzofuran	39001020	OCDF	X	2,3,7,8-TCDD	0.00000085	TEL	Buchman, 2008 [b]	0.0000088	UET	Buchman, 2008 [b]
Octachlorodibenzo-p-dioxin	3268879	-	X	2,3,7,8-TCDD	0.00000085	TEL	Buchman, 2008 [b]	0.0000088	UET	Buchman, 2008 [b]
Polychlorinated Biphenyls (PCBs)[c]										
Aroclor 1016	12674112	-	X	Aroclor 1254	0.0598	TEC	Buchman, 2008 [b]	0.34	UET	Buchman, 2008 [b]
Aroclor 1254	11097691	-	X	--	0.0598	TEC	Buchman, 2008 [b]	0.34	UET	Buchman, 2008 [b]
PCB-105	32598144	1,1'-Biphenyl, 2,3,3',4,4'-pentachloro-	X	2,3,7,8-TCDD	0.00000085	TEL	Buchman, 2008 [b]	0.0000088	UET	Buchman, 2008 [b]
PCB-114	74472370	PCB 114 (BZ)	X	2,3,7,8-TCDD	0.00000085	TEL	Buchman, 2008 [b]	0.0000088	UET	Buchman, 2008 [b]
PCB-123	65510443	123-PeCB	X	2,3,7,8-TCDD	0.00000085	TEL	Buchman, 2008 [b]	0.0000088	UET	Buchman, 2008 [b]

Table 11-4
Summary of Selected Benchmarks for Sediment

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Sediment [a]	Surrogate Used	TRV Information					
					Low Benchmark (mg/kg)	Criteria Type	Reference	High Benchmark (mg/kg)	Criteria Type	Reference
PCB-126	57465288	-	X	2,3,7,8-TCDD	0.00000085	TEL	Buchman, 2008 [b]	0.0000088	UET	Buchman, 2008 [b]
PCB-156	38380084	1,1'-Biphenyl, 2,3,3',4,4',5-hexachloro-	X	2,3,7,8-TCDD	0.00000085	TEL	Buchman, 2008 [b]	0.0000088	UET	Buchman, 2008 [b]
PCB-157	69782907	PCB 157 (BZ)	X	2,3,7,8-TCDD	0.00000085	TEL	Buchman, 2008 [b]	0.0000088	UET	Buchman, 2008 [b]
PCB-167	52663726	167-HxCB	X	2,3,7,8-TCDD	0.00000085	TEL	Buchman, 2008 [b]	0.0000088	UET	Buchman, 2008 [b]
PCB-169	32774166	-	X	2,3,7,8-TCDD	0.00000085	TEL	Buchman, 2008 [b]	0.0000088	UET	Buchman, 2008 [b]
PCB-189	39635319	-	X	2,3,7,8-TCDD	0.00000085	TEL	Buchman, 2008 [b]	0.0000088	UET	Buchman, 2008 [b]
PCB-77	32598133	77-TeCB	X	2,3,7,8-TCDD	0.00000085	TEL	Buchman, 2008 [b]	0.0000088	UET	Buchman, 2008 [b]
PCB-81	70362504	81-TeCB	X	2,3,7,8-TCDD	0.00000085	TEL	Buchman, 2008 [b]	0.0000088	UET	Buchman, 2008 [b]
Chemical Parameters										
Chloride	16887006	-	X	--	--	--	--	--	--	--
Nitrate	NO3N	-	X	--	--	--	--	--	--	--
Nitrite-NO2	E-10128	-	X	--	--	--	--	--	--	--
Sulfate	14808798	-	X	--	--	--	--	--	--	--

Notes:

[a] Chemicals detected in Groups 4 (Coca only), 6 (SRE only), 1B, 5, 10, 3 (WCT only), and 9 (Silvernale only) sediment.

[b] Indicates reference is a secondary or compilation source.

[c] Dioxins/furans and coplanar PCBs for the sediment benthic community exposed to chemicals in sediment will be evaluated by the individual congeners. No TEQ will be calculated because no applicable toxic equivalence factors are available for the sediment benthic community.

Indicates final TRV

-- not available, could not be located, or not applicable.

AET - apparent effects threshold ('m' = marine)
DDD - dichlorodiphenyldichloroethane
ERL - effect range low
ESB - equilibrium partitioning sediment benchmark
High TRV - mid level effect toxicity reference value
Low TRV - no effect toxicity reference value
mg/kg - milligrams per kilogram
PCDD/PCDF - polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans
PEC - probable effect concentration ('m' = marine)
PEL - probable effect level ('m' = marine)
T20m - Chemical concentrations corresponding to 20% probability of observing toxicity in marine amphipod tests.

Table 11-4
Summary of Selected Benchmarks for Sediment

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Sediment [a]	Surrogate Used	TRV Information					
					Low Benchmark (mg/kg)	Criteria Type	Reference	High Benchmark (mg/kg)	Criteria Type	Reference

T50m - Chemical concentrations corresponding to 50% probability of observing toxicity in marine amphipod tests.
TCDD -Tetrachlorodibenzodioxin
TEC - threshold effect concentration
TEL -threshold effect level ('m' = marine)
TEQ - toxicity equivalent
TRV - toxicity reference value
UET - upper effects threshold
X - Analyte was detected in the indicated medium

Hierarchy of Sources:

1. MacDonald, D.D., C.G. Ingersoll, and T.A. Berger. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. *Arch. Environ. Toxicol. Chem.* 39:20-31.
2. Buchman, M. F. 2008. NOAA Screening Quick Reference Tables. NOAA OR&R Report 08-1, Seattle, WA. Office of Response and Restoration Division. National Oceanic and Atmospheric Administration.
3. Jones, D.S. and G.W. Suter II. 1997. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Sediment-Associated Biota: 1997 Revision. ES/ER/TM-95/R4.
4. USEPA. 2011. Region III Freshwater screening benchmarks. (http://www.epa.gov/reg3hwmd/risk/eco/btag/sbv/fwsed/screenbench.htm) Searched July 2011.
5. Lijzen et al. (2001) (Additional source added by CH2M Hill)
6. Suitable surrogate.

Table 11-5
Summary of Selected Benchmarks for Soil Invertebrates

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil or Ephemeral Sediment [a]	TRV Information										
				Surrogate Used	Test Species	Soil Concentration (mg/kg)	Exposure Duration	Study Endpoint	Effects	Comments	Reference	LOEC to NOEC UF	LC50 to NOEC	Final Benchmark (mg/kg)
Inorganic Compounds														
Aluminum	7429905	Aluminum, Total	X	--	--	--	--	--	--	--	--	--	--	--
Antimony	7440360	Antimony, Total	X	--	Soil Invertebrate	--	chronic	EC_{20}	reproduction	Eco-SSL based on geometric mean of three EC20s ranging from 30 to 194 mg/kg	USEPA Eco-SSLs for Antimony (USEPA, 2005f) [b]	1	1	78
Arsenic	7440382	Arsenic, Total	X	--	Earthworm	68	56 days	Caused 56% reduction in the number of cocoons produced per worm at 68 mg/kg	reproduction /growth	Benchmark adjusted from 68 mg/kg to 60 mg/kg based on study in source	Efroymson et al., 1997a [b]	1	1	60
Barium	7440393	Barium, Total	X	--	Soil Invertebrate	--	chronic	EC_{20}	reproduction	Eco-SSL based on geometric mean of three EC20s ranging from 165 to 585 mg/kg	USEPA Eco-SSLs for Barium (USEPA, 2005g) [b]	1	1	330
Beryllium	7440417	Beryllium, Total	X	--	Soil Invertebrate	--	chronic	EC_{20}	reproduction	Eco-SSL based on geometric mean of three EC20s ranging from 28 to 52 mg/kg	USEPA Eco-SSLs for Beryllium (USEPA, 2005h) [b]	1	1	40
Boron	7440428	Boron, Total	X	--	--	--	--	--	--	--	--	--	--	--
Cadmium	7440439	Cadmium, Total	X	--	Soil Invertebrate	--	chronic	MATC/ EC10	reproduction /growth/population	Eco-SSL based on geometric mean of one EC10 and nine MATCs ranging from 6-600 mg/kg	USEPA Eco-SSLs for Cadmium (USEPA, 2005c) [b]	1	1	140
Chromium	7440473	Chromium, Total	X	--	--	--	--	SQG_E	protection of environment	The ecological soil contact guideline for the protection of plants and soil invertebrates in agricultural setting was selected	CCME, 1999a [b]	1	1	64
Cobalt	7440484	Cobalt, Total	X	--	Earthworm	300	--	NOEC	growth inhibition	NOEC = 300 mg/kg and LOEC = 3,000 mg/kg	Hartenstein et al., 1981	1	1	300
Copper	7440508	Copper, Total	X	--	Soil Invertebrate	--	--	MATC/ EC10	Reproduction/Growth	Eco-SSL based on geometric mean of four EC10s and six MATCs ranging from 27 to 188 mg/kg	USEPA Eco-SSLs for Copper (USEPA, 2007h) [b]	1	1	80
Cyanides	57125	Cyanide, Total	X	Free cyanide	--	--	--	SQG_E	protection of environment	The ecological soil contact guideline for the protection of plants and soil invertebrates in agricultural setting was selected	CCME, 1999b [b]	1	1	0.9
Fluoride	7782414	-	X	--	--	--	--	--	--	--	--	--	--	--
Hexavalent Chromium	18540299	Chromium, Hexavalent	X	--	Earthworm	2	60 days	75% reduction in survival at 2 ppm LOEC (lowest concentration tested)	reduced survival	A UF of 5 was applied in source because effect is greater than an EC50	Efroymson et al., 1997a [b]	1	1	0.4

Table 11-5
Summary of Selected Benchmarks for Soil Invertebrates

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil or Ephemeral Sediment [a]	TRV Information								LOEC to NOEC UF	LC50 to NOEC	Final Benchmark (mg/kg)
				Surrogate Used	Test Species	Soil Concentration (mg/kg)	Exposure Duration	Study Endpoint	Effects	Comments	Reference			
Lead	7439921	Lead, Total	X	--	Soil Invertebrate	--	chronic	MATC	reproduction	Eco-SSL based on geometric mean of four MATCs ranging from 894-3162 mg/kg	USEPA Eco-SSLs for Lead (USEPA, 2005e) [b]	1	1	1700
Lithium	7439932	Lithium, Total	X	--	--	--	--	--	--	--	--	--	--	--
Manganese	7439965	Manganese, Total	X	--	Soil Invertebrate	--	chronic	EC_{20}	Reproduction	Eco-SSL based on geometric mean of three EC20s ranging from 116 to 1209 mg/kg	USEPA Eco-SSLs for Manganese (USEPA, 2007e) [b]	1	1	450
Mercury	7439976	Mercury, Total	X	--	Earthworm	0.5	60 days	65% reduction in survival at 0.5 mg/kg LOEC	Survival	A UF of 5 was applied in source because effect is greater than an EC50	Efroymson et al., 1997a [b]	1	1	0.1
Methyl Mercury	22967926	-	X	--	Earthworm	2.5	12 weeks	NOEC	segment regeneration	UFs applied in source; Wet weight NOAEL of 1 mg/kg converted to dry weight in source.	USEPA SLERA Protocol (USEPA 1999) [b]	1	1	2.5
Molybdenum	7439987	Molybdenum, Total	X	--	--	--	--	--	--	--	--	--	--	--
Nickel	7440020	Nickel, Total	X	--	Springtail/earthworm	--	chronic	MATC	reproduction	Eco-SSL based on geometric mean of five MATCs ranging from 173 to 423 mg/kg	USEPA Eco-SSLs for Nickel (USEPA, 2007g) [b]	1	1	280
Selenium	7782492	Selenium, Total	X	--	Soil Invertebrate	--	chronic	EC_{20}	Reproduction	Eco-SSL based on geometric mean of three EC20s ranging from 3.4 to 4.7 mg/kg	USEPA Eco-SSLs for Selenium (USEPA, 2007a) [b]	1	1	4.1
Silver	7440224	Silver, Total	X	--	--	--	--	--	--	--	--	--	--	--
Strontium	7440246	Strontium, Total	X	--	--	--	--	--	--	--	--	--	--	--
Thallium	7440280	Thallium, Total	X	--	--	--	--	SQG_E	protection of environment	The ecological soil contact guideline for the protection of plants and soil invertebrates in agricultural setting was selected	CCME, 1999c [b]	1	1	1.4
Tin	7440315	Tin, Total	X	--	--	--	--	--	--	--	--	--	--	--
Titanium	7440326	Titanium, Total	X	--	--	--	--	--	--	--	--	--	--	--
Vanadium	7440622	Vanadium, Total	X	--	--	--	--	SQG_E	protection of environment	The ecological soil contact guideline for the protection of plants and soil invertebrates in agricultural setting was selected	CCME, 1999d [b]	1	1	130
Zinc	7440666	Zinc, Total	X	--	Soil Invertebrate	--	Chronic	EC_{10} / MATC	Reproduction/ population	Eco-SSL based on geometric mean of four EC10s and two MATCs ranging from 35 to 355 mg/kg	USEPA Eco-SSLs for Zinc (USEPA, 2007c) [b]	1	1	120
Zirconium	7440677	Zirconium, Total	X	--	--	--	--	--	--	--	--	--	--	--
Energetic Constituents						--								

Table 11-5
Summary of Selected Benchmarks for Soil Invertebrates

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil or Ephemeral Sediment [a]	TRV Information										
				Surrogate Used	Test Species	Soil Concentration (mg/kg)	Exposure Duration	Study Endpoint	Effects	Comments	Reference	LOEC to NOEC UF	LC50 to NOEC	Final Benchmark (mg/kg)
1,2-Dinitrobenzene	528290	o-Dinitrobenzene	X	--	--	--	--	--	--	--	--	--	--	--
1,3-Dinitrobenzene	99650	m-Dinitrobenzene	X	Nitrobenzene	Earthworm	--	chronic	LOEC	mortality	UF of 5 applied to LC50 value in source	Efroymson et al., 1997a [b]	1	1	40
2,4,6-Trinitrotoluene	118967	-	X	--	Earthworm	55	56 days	NOEC	number of cocoons, hatching success, juvenile	Reproduction - chronic	Robidoux et al., 2000	1	1	55
2-Amino-4,6-Dinitrotoluene	35572782	-	X	2,4-Dinitrotoluene	Earthworm	20.3	chronic	NOEC	reproduction - cocoon production	Cocoon production and juvenile production NOECs available in study. The lower NOEC is chosen	Simini et al., 2006	1	1	20.3
HMX	2691410	-	X	--	Earthworm	6.5	chronic	NOEC	reproduction - juvenile production	Cocoon production and juvenile production NOECs available in study. The lower NOEC is chosen	Simini et al., 2006	1	1	6.5
Hydrazine	302012	-	X	--	--	--	--	--	--	--	--	--	--	--
Monomethylhydrazine	60344	-	X	--	--	--	--	--	--	--	--	--	--	--
Perchlorate	14797730	-	X	--	--	--	--	--	--	--	--	--	--	--
RDX	121824	-	X	--	Earthworm	95	chronic	LOEC	number of cocoons, hatching success	LOEC listed as 95 mg/kg and NOEC listed as <95 mg/kg in source.	Robidoux et al., 2000	5	1	19
Volatile Organic Compounds						--								
1,1,1,2-Tetrachloroethane	630206	-	X	--	--	--	--	--	--	--	--	--	--	--
1,1,1-Trichloroethane	71556	-	X	--	--	--	--	--	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	79345	-	X	--	--	--	--	--	--	--	--	--	--	--
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	Freon 113	X	--	--	--	--	--	--	--	--	--	--	--
1,1,2-Trichloroethane	79005	-	X	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	75343	-	X	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene	75354	-	X	--	--	--	--	--	--	--	--	--	--	--
1,2,3-Trichlorobenzene	87616	-	X	--	Earthworm	115	14 days	LC_{50}	mortality	A UF of 5 was applied in source	Efroymson et al., 1997a [b]	1	1	20
1,2,4-Trichlorobenzene	120821	-	X	--	Earthworm	127	14 days	LC_{50}	mortality	A UF of 5 was applied in source	Efroymson et al., 1997a [b]	1	1	20
1,2,4-Trimethylbenzene	95636	-	X	Xylenes, Total	--	--	--	SQG_E	protection of environment	The ecological soil contact guideline for the protection of plants and soil invertebrates in agricultural setting for fine surface soil was selected	CCME, 2004a [b]	1	1	65
1,2-Dibromoethane	106934	-	X	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	95501	o-Dichlorobenzene	X	--	--	--	--	--	--	--	--	--	--	--

Table 11-5
Summary of Selected Benchmarks for Soil Invertebrates

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil or Ephemeral Sediment [a]	TRV Information										
				Surrogate Used	Test Species	Soil Concentration (mg/kg)	Exposure Duration	Study Endpoint	Effects	Comments	Reference	LOEC to NOEC UF	LC50 to NOEC	Final Benchmark (mg/kg)
1,2-Dichloroethane	107062	-	X	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloroethene	540590	1,2-Dichloroethenes	X	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloropropane	78875	-	X	--	Earthworm	3880	14 days	LC_{50}	Survival	A UF of 5 was applied in source	Efroymson et al., 1997a [b]	1	1	700
1,3,5-Trimethylbenzene	108678	-	X	Xylenes, Total	--	--	--	SQG_E	protection of environment	The ecological soil contact guideline for the protection of plants and soil invertebrates in agricultural setting for fine surface soil was selected	CCME, 2004a [b]	1	1	65
1,3-Dichlorobenzene	541731	m-Dichlorobenzene	X	1,4-Dichlorobenzene	Earthworm	128	--	LC_{50}	mortality	A UF of 5 was applied in source	Efroymson et al., 1997a [b]	1	1	20
1,4-Dichlorobenzene	106467	p-Dichlorobenzene	X	--	Earthworm	128	--	LC_{50}	mortality	A UF of 5 was applied in source	Efroymson et al., 1997a [b]	1	1	20
2-Chloroethylvinyl ether	110758	2-Chloroethyl vinyl ether	X	--	Earthworm	740	acute	LC_{50}	mortality	--	Neuhauser et al., 1985	1	100	7.4
2-Hexanone	591786	Methyl butyl ketone	X	--	--	--	--	--	--	--	--	--	--	--
Acetone	67641	-	X	--	--	--	--	--	--	--	--	--	--	--
Acetic Acid	64197	-	X	--	--	--	--	--	--	--	--	--	--	--
Benzene	71432	-	X	--	--	--	--	SQG_E	protection of environment	The ecological soil contact guideline for the protection of plants and soil invertebrates in agricultural setting for course surface soil was selected	CCME, 2004b [b]	1	1	31
Bromide	24959679	-	X	--	--	--	--	--	--	--	--	--	--	--
Bromobenzene	108861	-	X	Benzene	--	--	--	SQG_E	protection of environment	The ecological soil contact guideline for the protection of plants and soil invertebrates in agricultural setting for course surface soil was selected	CCME, 2004b [b]	1	1	31
Bromodichloromethane	75274	-	X	--	--	--	--	--	--	--	--	--	--	--
Bromomethane	74839	-	X	--	--	--	--	--	--	--	--	--	--	--
Carbon Disulfide	75150	-	X	--	--	--	--	--	--	--	--	--	--	--
Carbon Tetrachloride	56235	-	X	--	--	--	--	--	--	--	--	--	--	--
Chlorobenzene	108907	Monochlorobenzene	X	--	Earthworm	240	--	LC_{50}	mortality	A UF of 5 was applied in source	Efroymson et al., 1997a [b]	1	1	40
Chloroform	67663	Trichloromethane	X	--	--	--	--	--	--	--	--	--	--	--
Chloromethane	74873	Methyl chloride	X	--	--	--	--	--	--	--	--	--	--	--

Table 11-5
Summary of Selected Benchmarks for Soil Invertebrates

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil or Ephemeral Sediment [a]	TRV Information										
				Surrogate Used	Test Species	Soil Concentration (mg/kg)	Exposure Duration	Study Endpoint	Effects	Comments	Reference	LOEC to NOEC UF	LC50 to NOEC	Final Benchmark (mg/kg)
cis-1,2-Dichloroethene	156592	cis-1,2-Dichloroethylene	X	--	--	--	--	--	--	--	--	--	--	--
Cumene	98828	Isopropylbenzene	X	--	--	--	--	--	--	--	--	--	--	--
Dibenzofuran	132649	-	X	LMW-PAH	springtail/potworm/earthworm	29	--	MATC/ EC10	reproduction / growth	--	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [b]	1	1	29
Dibromomethane	74953	-	X	--	--	--	--	--	--	--	--	--	--	--
Dichlorodifluoromethane	75718	Freon 12	X	--	--	--	--	--	--	--	--	--	--	--
Ethylbenzene	100414	-	X	--	--	--	--	SQG_E	protection of environment	The ecological soil contact guideline for the protection of plants and soil invertebrates in agricultural setting for course surface soil was selected	CCME, 2004c [b]	1	1	55
Methyl ethyl ketone	78933	2-Butanone	X	--	--	--	--	--	--	--	--	--	--	--
Methyl isobutyl ketone (MIBK)	108101	4-Methyl-2-pentanone	X	--	--	--	--	--	--	--	--	--	--	--
Methylene chloride	75092	Dichloromethane	X	--	--	--	--	--	--	--	--	--	--	--
m-Xylene & p-Xylene	136777612	meta- and para-Xylenes	X	Xylenes, Total	--	--	--	SQG_E	protection of environment	The ecological soil contact guideline for the protection of plants and soil invertebrates in agricultural setting for fine surface soil was selected	CCME, 2004a [b]	1	1	65
n-Butylbenzene	104518	-	X	--	--	--	--	--	--	--	--	--	--	--
n-Propylbenzene	103651	-	X	--	--	--	--	--	--	--	--	--	--	--
o-Chlorotoluene	95498	2-Chlorotoluene	X	1,4-Dichlorobenzene	Earthworm	128	--	LC_{50}	mortality	A UF of 5 was applied in source	Efroymson et al., 1997a [b]	1	1	20

Table 11-5
Summary of Selected Benchmarks for Soil Invertebrates

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil or Ephemeral Sediment [a]	TRV Information										
				Surrogate Used	Test Species	Soil Concentration (mg/kg)	Exposure Duration	Study Endpoint	Effects	Comments	Reference	LOEC to NOEC UF	LC50 to NOEC	Final Benchmark (mg/kg)
o-Xylene	95476	-	X	Xylenes, Total	--	--	--	SQG_E	protection of environment	The ecological soil contact guideline for the protection of plants and soil invertebrates in agricultural setting for fine surface soil was selected	CCME, 2004a [b]	1	1	65
p-Chlorotoluene	106434	4-Chlorotoluene	X	1,4-Dichlorobenzene	Earthworm	128	--	LC_{50}	mortality	A UF of 5 was applied in source	Efroymson et al., 1997a [b]	1	1	20
p-Cymene	99876	p-Isopropyltoluene	X	--	--	--	--	--	--	--	--	--	--	--
sec-Butylbenzene	135988	-	X	--	--	--	--	--	--	--	--	--	--	--
Styrene	100425	Vinylbenzene	X	--	--	--	--	--	--	--	--	--	--	--
tert-Butylbenzene	98066	-	X	--	--	--	--	--	--	--	--	--	--	--
Tetralin	119642	-	X	Naphthalene	springtail/potworm/earthworm	29	--	MATC/ EC10	reproduction / growth	Eco-SSL based on geometric mean of 11 EC_{10}s and MATC ranging from 8 to 175 mg/kg	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [b]	1	1	29
Tetrachloroethene	127184	-	X	--	--	--	--	--	--	--	--	--	--	--
Toluene	108883	Toluol	X	--	--	--	--	SQG_E	protection of environment	The ecological soil contact guideline for the protection of plants and soil invertebrates in agricultural setting for course surface soil was selected	CCME, 2004d [b]	1	1	75
trans-1,2-Dichloroethene	156605	-	X	--	--	--	--	--	--	--	--	--	--	--
Trichloroethene	79016	Trichloroethylene (TCE)	X	--	--	--	--	SQG_E	protection of environment	The ecological soil contact guideline for the protection of plants and soil invertebrates in agricultural setting was selected	CCME, 2006 [b]	1	1	3
Trichlorofluoromethane	75694	-	X	--	--	--	--	--	--	--	--	--	--	--
Vinyl chloride	75014	-	X	--	--	--	--	--	--	--	--	--	--	--

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				Surrogate Used	Test Species	Soil Concentration (mg/kg)	Exposure Duration	Study Endpoint	Effects	Comments	Reference	LOEC to NOEC UF	LC50 to NOEC	Final Benchmark (mg/kg)
Xylenes, Total	1330207	Xylene (Total) Isomers	X	--	--	--	--	SQG_E	protection of environment	The ecological soil contact guideline for the protection of plants and soil invertebrates in agricultural setting for fine surface soil was selected	CCME, 2004a [b]	1	1	65
Semi-Volatile Organic Compounds						--								
1,1-Dimethylhydrazine	57147	-	X	--	--	--	--	--	--	--	--	--	--	--
1,2-Dibromo-3-chloropropane	96128	1,2-Dibromo-3-CPA	X	--	--	--	--	--	--	--	--	--	--	--
1,4-Dioxane	123911	-	X	--	--	--	--	--	--	--	--	--	--	--
2,4,5-Trichlorophenol	95954	-	X	--	Earthworm	46	14	LOEC	survival LC50	UFs applied in source	Efroymson et al., 1997a [b]	1	1	9
2,4,6-Trichlorophenol	88062	-	X	--	Earthworm	58	56	LOEC	cocoon production	UFs applied in source	Efroymson et al., 1997a [b]	1	1	10
2,4-Dimethylphenol	105679	-	X	--	--	--	--	--	--	--	--	--	--	--
3,5-Dimethylphenol	108689	-	X	--	--	--	--	--	--	--	--	--	--	--
Benzoic acid	65850	-	X	--	--	--	--	--	--	--	--	--	--	--
Benzyl alcohol	100516	-	X	--	--	--	--	--	--	--	--	--	--	--
bis(2-Ethylhexyl) phthalate	117817	bis(2-ethylhexyl)phthalate	X	--	--	--	--	--	--	--	--	--	--	--
Bromoform	75252	-	X	--	--	--	--	--	--	--	--	--	--	--
Butyl benzyl phthalate	85687	-	X	--	--	--	--	--	--	--	--	--	--	--
Carbazole	86748	-	X	LMW-PAH	springtail/potworm/earthworm	29	--	MATC/ EC10	reproduction / growth	--	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [b]	1	1	29
Dibromochloromethane	124481	-	X	--	--	--	--	--	--	--	--	--	--	--
Diethyl phthalate	84662	-	X	--	--	--	--	--	--	--	--	--	--	--
Dimethyl phthalate	131113	-	X	--	Earthworm	1064	14 days	LC_{50}	mortality	A UF of 5 was applied in source	Efroymson et al., 1997a [b]	1	1	200
Di-n-butyl phthalate	84742	Di-n-butylphthalate	X	--	--	--	--	--	--	--	--	--	--	--
Di-n-octyl phthalate	117840	Di-n-octyl-phthalate	X	--	--	--	--	--	--	--	--	--	--	--
Formaldehyde	50000	-	X	--	--	--	--	--	--	--	--	--	--	--
Hexachlorobutadiene	87683	-	X	--	--	--	--	--	--	--	--	--	--	--
m-Cresol	108394	3-Methylphenol	X	--	--	--	--	--	--	--	--	--	--	--
n-Nitrosodimethylamine	62759	Nitrosodimethylamine	X	n-Nitrosodiphenylamine	Earthworm	109	14 days	LC_{50}	survival	A UF of 5 was applied in source	Efroymson et al., 1997a [b]	1	1	20
n-Nitrosodiphenylamine	86306	-	X	--	Earthworm	109	14 days	LC_{50}	survival	A UF of 5 was applied in source	Efroymson et al., 1997a [b]	1	1	20
o-Cresol	95487	-	X	--	--	--	--	--	--	--	--	--	--	--
p-Chloro-m-cresol	59507	4-Chloro-3-Methylphenol	X	--	--	--	--	--	--	--	--	--	--	--
p-Cresol	106445	4-Methylphenol	X	--	--	--	--	--	--	--	--	--	--	--

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				Surrogate Used	Test Species	Soil Concentration (mg/kg)	Exposure Duration	Study Endpoint	Effects	Comments	Reference	LOEC to NOEC UF	LC50 to NOEC	Final Benchmark (mg/kg)
Pentachlorophenol	87865	PCP	X	--	Soil Invertebrate	--	Chronic	MATC	reproduction	Eco-SSL based on geometric mean of four MATCs ranging from 14 to 85 mg/kg.	USEPA Eco-SSLs for Pentachlorophenol (USEPA, 2007f) [b]	1	1	31
Phenol	108952	Total Phenols	X	--	Earthworm	188	14 days	LC_{50}	Survival	A UF of 5 was applied in source	Efroymson et al., 1997a [b]	1	1	30
p-Nitroaniline	100016	4-Nitroaniline	X	--	--	--	--	--	--	--	--	--	--	--
Polynuclear Aromatic Hydrocarbons						--								
1-Methyl naphthalene	90120	1-Methylnaphthalene	X	LMW-PAH	springtail/potworm/earthworm	29	--	MATC/ EC10	reproduction / growth	Eco-SSL based on geometric mean of 11 EC_{10}s and MATC ranging from 8 to 175 mg/kg	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [b]	1	1	29
2-Methylnaphthalene	91576	Naphthalene, 2-methyl-	X	LMW-PAH	springtail/potworm/earthworm	29	--	MATC/ EC10	reproduction / growth	Eco-SSL based on geometric mean of 11 EC_{10}s and MATC ranging from 8 to 175 mg/kg	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [b]	1	1	29
Acenaphthene	83329	-	X	LMW-PAH	springtail/potworm/earthworm	29	--	MATC/ EC10	reproduction / growth	Eco-SSL based on geometric mean of 11 EC_{10}s and MATC ranging from 8 to 175 mg/kg	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [b]	1	1	29
Acenaphthylene	208968	-	X	LMW-PAH	springtail/potworm/earthworm	29	--	MATC/ EC10	reproduction / growth	Eco-SSL based on geometric mean of 11 EC_{10}s and MATC ranging from 8 to 175 mg/kg	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [b]	1	1	29
Anthracene	120127	-	X	LMW-PAH	springtail/potworm/earthworm	29	--	MATC/ EC10	reproduction / growth	Eco-SSL based on geometric mean of 11 EC_{10}s and MATC ranging from 8 to 175 mg/kg	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [b]	1	1	29
Benzo(a)anthracene	56553	Benz[a]anthracene	X	HMW-PAH	springtail/potworm/earthworm	18	--	MATC/ EC10	reproduction / growth	Eco-SSL based on geometric mean of six EC_{10}s and MATCs ranging from 10 to 80 mg/kg	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [b]	1	1	18
Benzo(a)pyrene	50328	Benzo (a) pyrene	X	HMW-PAH	springtail/potworm/earthworm	18	--	MATC/ EC10	reproduction / growth	Eco-SSL based on geometric mean of six EC_{10}s and MATCs ranging from 10 to 80 mg/kg	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [b]	1	1	18
Benzo(b)fluoranthene	205992	Benz[e]acephenanthrylene 1	X	HMW-PAH	springtail/potworm/earthworm	18	--	MATC/ EC10	reproduction / growth	Eco-SSL based on geometric mean of six EC_{10}s and MATCs ranging from 10 to 80 mg/kg	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [b]	1	1	18

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Benzo(e)pyrene	192972	-	X	HMW-PAH	springtail/potworm/earthworm	18	--	MATC/ EC10	reproduction / growth	Eco-SSL based on geometric mean of six EC_{10}s and MATCs ranging from 10 to 80 mg/kg	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [b]	1	1	18
Benzo(ghi)perylene	191242	Benzo (g,h,i) perylene	X	HMW-PAH	springtail/potworm/earthworm	18	--	MATC/ EC10	reproduction / growth	Eco-SSL based on geometric mean of six EC_{10}s and MATCs ranging from 10 to 80 mg/kg	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [b]	1	1	18
Benzo(k)fluoranthene	207089	Benzo[k]fluoranthene	X	HMW-PAH	springtail/potworm/earthworm	18	--	MATC/ EC10	reproduction / growth	Eco-SSL based on geometric mean of six EC_{10}s and MATCs ranging from 10 to 80 mg/kg	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [b]	1	1	18
Chrysene	218019	-	X	HMW-PAH	springtail/potworm/earthworm	18	--	MATC/ EC10	reproduction / growth	Eco-SSL based on geometric mean of six EC_{10}s and MATCs ranging from 10 to 80 mg/kg	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [b]	1	1	18
Dibenzo(a,h)anthracene	53703	Dibenz (a,h) anthracene	X	HMW-PAH	springtail/potworm/earthworm	18	--	MATC/ EC10	reproduction / growth	Eco-SSL based on geometric mean of six EC_{10}s and MATCs ranging from 10 to 80 mg/kg	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [b]	1	1	18
Fluoranthene	206440	-	X	LMW-PAH	springtail/potworm/earthworm	29	--	MATC/ EC10	reproduction / growth	Eco-SSL based on geometric mean of 11 EC_{10}s and MATC ranging from 8 to 175 mg/kg	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [b]	1	1	29
Fluorene	86737	-	X	LMW-PAH	springtail/potworm/earthworm	29	--	MATC/ EC10	reproduction / growth	Eco-SSL based on geometric mean of 11 EC_{10}s and MATC ranging from 8 to 175 mg/kg	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [b]	1	1	29
Indeno(1,2,3-cd)pyrene	193395	Indeno (1,2,3-cd) pyrene	X	HMW-PAH	springtail/potworm/earthworm	18	--	MATC/ EC10	reproduction / growth	Eco-SSL based on geometric mean of six EC_{10}s and MATCs ranging from 10 to 80 mg/kg	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [b]	1	1	18
Naphthalene	91203	-	X	LMW-PAH	springtail/potworm/earthworm	29	--	MATC/ EC10	reproduction / growth	Eco-SSL based on geometric mean of 11 EC_{10}s and MATC ranging from 8 to 175 mg/kg	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [b]	1	1	29
Perylene	198550	-	X	LMW-PAH	springtail/potworm/earthworm	29	--	MATC/ EC10	reproduction / growth	Eco-SSL based on geometric mean of 11 EC_{10}s and MATC ranging from 8 to 175 mg/kg	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [b]	1	1	29

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				Surrogate Used	Test Species	Soil Concentration (mg/kg)	Exposure Duration	Study Endpoint	Effects	Comments	Reference	LOEC to NOEC UF	LC50 to NOEC	Final Benchmark (mg/kg)
Phenanthrene	85018	-	X	LMW-PAH	springtail/potworm/earthworm	29	--	MATC/ EC10	reproduction / growth	Eco-SSL based on geometric mean of 11 EC_{10}s and MATC ranging from 8 to 175 mg/kg	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [b]	1	1	29
Pyrene	129000	-	X	HMW-PAH	springtail/potworm/earthworm	18	--	MATC/ EC10	reproduction / growth	Eco-SSL based on geometric mean of six EC_{10}s and MATCs ranging from 10 to 80 mg/kg	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [b]	1	1	18
Pesticides						--								
4,4'-DDD	72548	p,p'-DDD	X	4,4'-DDT	--	--	--	SQG_E	protection of environment	The ecological soil contact guideline for the protection of plants and soil invertebrates in agricultural setting was selected	CCME, 1999e [b]	1	1	12
4,4'-DDE	72559	p,p'-DDE	X	4,4'-DDT	--	--	--	SQG_E	protection of environment	The ecological soil contact guideline for the protection of plants and soil invertebrates in agricultural setting was selected	CCME, 1999e [b]	1	1	12
4,4'-DDT	50293	p,p'-DDT	X	--	--	--	--	SQG_E	protection of environment	The ecological soil contact guideline for the protection of plants and soil invertebrates in agricultural setting was selected	CCME, 1999e [b]	1	1	12
Aldrin	309002	-	X	--	--	--	--	--	--	--	--	--	--	--
alpha-BHC	319846	a-Benzene Hexachloride	X	--	--	--	--	--	--	--	--	--	--	--
beta-BHC	319857	b-Benzene Hexachloride	X	--	--	--	--	--	--	--	--	--	--	--
Chlordane (Technical)	12789036	-	X	--	--	--	--	--	--	--	--	--	--	--
delta-BHC	319868	d-Benzene Hexachloride	X	--	--	--	--	--	--	--	--	--	--	--
Dieldrin	60571	-	X	--	--	--	--	--	--	--	--	--	--	--
Endosulfan I	959988	-	X	--	--	--	--	--	--	--	--	--	--	--
Endosulfan II	33213659	-	X	--	--	--	--	--	--	--	--	--	--	--
Endosulfan sulfate	1031078	-	X	--	--	--	--	--	--	--	--	--	--	--
Endrin	72208	-	X	--	--	--	--	--	--	--	--	--	--	--
Endrin aldehyde	7421934	-	X	--	--	--	--	--	--	--	--	--	--	--
Endrin ketone	53494705	-	X	--	--	--	--	--	--	--	--	--	--	--
gamma-BHC	58899	Lindane	X	--	--	--	--	--	--	--	--	--	--	--
Heptachlor	76448	-	X	--	--	--	--	--	--	--	--	--	--	--
Heptachlor epoxide	1024573	-	X	--	--	--	--	--	--	--	--	--	--	--
MCPA	94746	-	X	--	--	--	--	--	--	--	--	--	--	--
Mirex	2385855	Mirex (DeChlorane)	X	--	--	--	--	--	--	--	--	--	--	--
p,p'-Methoxychlor	72435	-	X	--	--	--	--	--	--	--	--	--	--	--

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Toxaphene	8001352	-	X	--	--	--	--	--	--	--	--	--	--	--
Herbicides						--								
2,4,5-T	93765	2,4,5-Trichlorophenoxyacetic acid	X	--	--	--	--	--	--	--	--	--	--	--
2,4,5-TP (Silvex)	93721	-	X	--	--	--	--	--	--	--	--	--	--	--
2,4-Dichlorophenoxyacetic Acid (2,4-D)	94757	-	X	--	--	--	--	--	--	--	--	--	--	--
2,4-Dichlorophenoxybutyric acid	94826	-	X	--	--	--	--	--	--	--	--	--	--	--
2,4-DP (Dichlorprop)	120365	Dichlorprop	X	--	--	--	--	--	--	--	--	--	--	--
Dalapon	75990	-	X	--	--	--	--	--	--	--	--	--	--	--
Dicamba	1918009	-	X	--	--	--	--	--	--	--	--	--	--	--
Dinoseb	88857	-	X	--	--	--	--	--	--	--	--	--	--	--
MCPP	93652	-	X	--	--	--	--	--	--	--	--	--	--	--
Terphenyls						--								
m-Terphenyl	92068	-	X	--	--	--	--	--	--	--	--	--	--	--
o-terphenyl	84151	-	X	--	--	--	--	--	--	--	--	--	--	--
p-Terphenyl	92944	-	X	--	--	--	--	--	--	--	--	--	--	--
Glycols		-				--								
Diethylene Glycol	111466	-	X	--	--	--	--	--	--	--	--	--	--	--
Triethylene glycol	112276	-	X	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons						--								
TPH-Diesel Range Organics (DRO)	DRO	Diesel	X	--	--	--	--	--	--	--	--	--	--	--
TPH-Gasoline Range Organics (GRO)	GRO	Gasoline	X	--	--	--	--	--	--	--	--	--	--	--
PCDD/PCDFs[c]dei						--								
1,2,3,4,6,7,8-Heptachlorodibenzofuran	67562394	1,2,3,4,6,7,8-HpCDF	X	2,3,7,8-TCDD	Earthworm	5	85 days	NOEC	mortality	UFs applied in source	USEPA SLERA Protocol (USEPA 1999) [b]	1	1	0.5
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	35822469	1,2,3,4,6,7,8-HpCDD	X	2,3,7,8-TCDD	Earthworm	5	85 days	NOEC	mortality	UFs applied in source	USEPA SLERA Protocol (USEPA 1999) [b]	1	1	0.5
1,2,3,4,7,8,9-Heptachlorodibenzofuran	55673897	1,2,3,4,7,8,9-HpCDF	X	2,3,7,8-TCDD	Earthworm	5	85 days	NOEC	mortality	UFs applied in source	USEPA SLERA Protocol (USEPA 1999) [b]	1	1	0.5
1,2,3,4,7,8-Hexachlorodibenzofuran	70648269	1,2,3,4,7,8-HxCDF	X	2,3,7,8-TCDD	Earthworm	5	85 days	NOEC	mortality	UFs applied in source	USEPA SLERA Protocol (USEPA 1999) [b]	1	1	0.5
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	39227286	1,2,3,4,7,8-HxCDD	X	2,3,7,8-TCDD	Earthworm	5	85 days	NOEC	mortality	UFs applied in source	USEPA SLERA Protocol (USEPA 1999) [b]	1	1	0.5
1,2,3,6,7,8-Hexachlorodibenzofuran	57117449	1,2,3,6,7,8-HxCDF	X	2,3,7,8-TCDD	Earthworm	5	85 days	NOEC	mortality	UFs applied in source	USEPA SLERA Protocol (USEPA 1999) [b]	1	1	0.5
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	57653857	1,2,3,6,7,8-HxCDD	X	2,3,7,8-TCDD	Earthworm	5	85 days	NOEC	mortality	UFs applied in source	USEPA SLERA Protocol (USEPA 1999) [b]	1	1	0.5

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1,2,3,7,8,9-Hexachlorodibenzofuran	72918219	1,2,3,7,8,9-HxCDF	X	2,3,7,8-TCDD	Earthworm	5	85 days	NOEC	mortality	UFs applied in source	USEPA SLERA Protocol (USEPA 1999) [b]	1	1	0.5
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	19408743	1,2,3,7,8,9-HxCDD	X	2,3,7,8-TCDD	Earthworm	5	85 days	NOEC	mortality	UFs applied in source	USEPA SLERA Protocol (USEPA 1999) [b]	1	1	0.5
1,2,3,7,8-Pentachlorodibenzofuran	57117416	1,2,3,7,8-PeCDF	X	2,3,7,8-TCDD	Earthworm	5	85 days	NOEC	mortality	UFs applied in source	USEPA SLERA Protocol (USEPA 1999) [b]	1	1	0.5
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	40321764	1,2,3,7,8-PeCDD	X	2,3,7,8-TCDD	Earthworm	5	85 days	NOEC	mortality	UFs applied in source	USEPA SLERA Protocol (USEPA 1999) [b]	1	1	0.5
2,3,4,6,7,8-Hexachlorodibenzofuran	60851345	-	X	2,3,7,8-TCDD	Earthworm	5	85 days	NOEC	mortality	UFs applied in source	USEPA SLERA Protocol (USEPA 1999) [b]	1	1	0.5
2,3,4,7,8-Pentachlorodibenzofuran	57117314	2,3,4,7,8-PeCDF	X	2,3,7,8-TCDD	Earthworm	5	85 days	NOEC	mortality	UFs applied in source	USEPA SLERA Protocol (USEPA 1999) [b]	1	1	0.5
2,3,7,8-TCDD	1746016	2,3,7,8-Tetrachlorodibenzo-p-dioxin	X	2,3,7,8-TCDD	Earthworm	5	85 days	NOEC	mortality	UFs applied in source	USEPA SLERA Protocol (USEPA 1999) [b]	1	1	0.5
2,3,7,8-Tetrachlorodibenzofuran	51207319	2,3,7,8-TCDF	X	2,3,7,8-TCDD	Earthworm	5	85 days	NOEC	mortality	UFs applied in source	USEPA SLERA Protocol (USEPA 1999) [b]	1	1	0.5
Octachlorodibenzofuran	39001020	OCDF	X	2,3,7,8-TCDD	Earthworm	5	85 days	NOEC	mortality	UFs applied in source	USEPA SLERA Protocol (USEPA 1999) [b]	1	1	0.5
Octachlorodibenzo-p-dioxin	3268879	-	X	2,3,7,8-TCDD	Earthworm	5	85 days	NOEC	mortality	UFs applied in source	USEPA SLERA Protocol (USEPA 1999) [b]	1	1	0.5
Polychlorinated Biphenyls (PCBs)[c]dei						--								
Aroclor 1016	12674112	-	X	Aroclor 1254	Earthworm	500	7 day	NOEC	abundance	--	Parmelee et al., 1997	1	1	500
Aroclor 1242	53469219	Aroclor-1242	X	Aroclor 1254	Earthworm	500	7 day	NOEC	abundance	--	Parmelee et al., 1997	1	1	500
Aroclor 1248	12672296	-	X	Aroclor 1254	Earthworm	500	7 day	NOEC	abundance	--	Parmelee et al., 1997	1	1	500
Aroclor 1254	11097691	-	X	--	Earthworm	500	7 day	NOEC	abundance	--	Parmelee et al., 1997	1	1	500
Aroclor 1260	11096825	-	X	Aroclor 1254	Earthworm	500	7 day	NOEC	abundance	--	Parmelee et al., 1997	1	1	500
Aroclor 5460	11126424	-	X	Aroclor 1254	Earthworm	500	7 day	NOEC	abundance	--	Parmelee et al., 1997	1	1	500
PCB-105	32598144	1,1'-Biphenyl, 2,3,3',4,4'-pentachloro-	X	2,3,7,8-TCDD	Earthworm	5	85 days	NOEC	mortality	UFs applied in source	USEPA SLERA Protocol (USEPA 1999) [b]	1	1	0.5
PCB-114	74472370	PCB 114 (BZ)	X	2,3,7,8-TCDD	Earthworm	5	85 days	NOEC	mortality	UFs applied in source	USEPA SLERA Protocol (USEPA 1999) [b]	1	1	0.5
PCB-118	31508006	-	X	2,3,7,8-TCDD	Earthworm	5	85 days	NOEC	mortality	UFs applied in source	USEPA SLERA Protocol (USEPA 1999) [b]	1	1	0.5

Table 11-5
Summary of Selected Benchmarks for Soil Invertebrates

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil or Ephemeral Sediment [a]	TRV Information										
				Surrogate Used	Test Species	Soil Concentration (mg/kg)	Exposure Duration	Study Endpoint	Effects	Comments	Reference	LOEC to NOEC UF	LC50 to NOEC	Final Benchmark (mg/kg)
PCB-123	65510443	123-PeCB	X	2,3,7,8-TCDD	Earthworm	5	85 days	NOEC	mortality	UFs applied in source	USEPA SLERA Protocol (USEPA 1999) [b]	1	1	0.5
PCB-126	57465288	-	X	2,3,7,8-TCDD	Earthworm	5	85 days	NOEC	mortality	UFs applied in source	USEPA SLERA Protocol (USEPA 1999) [b]	1	1	0.5
PCB-156	38380084	1,1'-Biphenyl, 2,3,3',4,4',5-hexachloro-	X	2,3,7,8-TCDD	Earthworm	5	85 days	NOEC	mortality	UFs applied in source	USEPA SLERA Protocol (USEPA 1999) [b]	1	1	0.5
PCB-157	69782907	PCB 157 (BZ)	X	2,3,7,8-TCDD	Earthworm	5	85 days	NOEC	mortality	UFs applied in source	USEPA SLERA Protocol (USEPA 1999) [b]	1	1	0.5
PCB-167	52663726	167-HxCB	X	2,3,7,8-TCDD	Earthworm	5	85 days	NOEC	mortality	UFs applied in source	USEPA SLERA Protocol (USEPA 1999) [b]	1	1	0.5
PCB-169	32774166	-	X	2,3,7,8-TCDD	Earthworm	5	85 days	NOEC	mortality	UFs applied in source	USEPA SLERA Protocol (USEPA 1999) [b]	1	1	0.5
PCB-189	39635319	-	X	2,3,7,8-TCDD	Earthworm	5	85 days	NOEC	mortality	UFs applied in source	USEPA SLERA Protocol (USEPA 1999) [b]	1	1	0.5
PCB-77	32598133	77-TeCB	X	2,3,7,8-TCDD	Earthworm	5	85 days	NOEC	mortality	UFs applied in source	USEPA SLERA Protocol (USEPA 1999) [b]	1	1	0.5
PCB-81	70362504	81-TeCB	X	2,3,7,8-TCDD	Earthworm	5	85 days	NOEC	mortality	UFs applied in source	USEPA SLERA Protocol (USEPA 1999) [b]	1	1	0.5
Chemical Parameters					--									
Ammonia-N	7664417	Nitrogen, as Ammonia	X	--	--	--	--	--	--	--	--	--	--	--
Chloride	16887006	-	X	--	--	--	--	--	--	--	--	--	--	--
Nitrate	NO3N	-	X	--	--	--	--	--	--	--	--	--	--	--
Nitrite-NO2	E-10128	-	X	--	--	--	--	--	--	--	--	--	--	--
Orthophosphate – PO4	14265442	-	X	--	--	--	--	--	--	--	--	--	--	--
Sulfate	14808798	-	X	--	--	--	--	--	--	--	--	--	--	--

Notes:

[a] Chemicals detected in Groups 1A, 4, 6, 7, 8, 1B, 5, 10, 3 (WCT only), and 9 (Silvernale only) surface soil.

[b] Indicates reference is a secondary or compilation source.

[c] Dioxins/furans for soil invertebrates exposed to chemicals in soil or ephemeral sediment will be evaluated by the individual congeners. No TEQ will be calculated because no applicable toxic equivalence factors are available for soil invertebrates.

Indicates final TRV
-- not available, could not be located, or not applicable.

DDD - dichlorodiphenyldichloroethane
DDE - dichlorodiphenyldichloroethylene
DDT - dichlorodiphenyltrichloroethane
EC10 - effective concentration where 10% of test population shows effect being measures
EC20 - effective concentration where 20% of test population shows effect being measures
LC50 - lethal concentration to 50% of test population
LOEC - lowest observed effect concentration

Table 11-5
Summary of Selected Benchmarks for Soil Invertebrates

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil or Ephemeral Sediment [a]	TRV Information										
				Surrogate Used	Test Species	Soil Concentration (mg/kg)	Exposure Duration	Study Endpoint	Effects	Comments	Reference	LOEC to NOEC UF	LC50 to NOEC	Final Benchmark (mg/kg)

NOEC - no observed effect concentration
Low TRV - no effect toxicity reference value
MATC - maximum acceptable toxicant concentration
mg/kg - milligrams per kilogram
PCDD/PCDF - polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans
SQC_E - ecological soil quality criteria
TRV - toxicity reference value
UF - uncertainty factor
X - Analyte was detected in the indicated medium

Hierarchy of Sources:

1. USEPA Eco-SSLs (various dates)
2. Efroymson, R.A., M.E. Will, and G.W. Sutter. 1997a. Toxicological Benchmarks for Contaminants of Potential Concern for Effects in Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision. ES/ER/TM-126/R2. (Efroymson et al., 1997a)
3. Sverdrup, L.E., T. Nielsen, and P.H. Krogh. 2002. Soil ecotoxicity of polycyclic aromatic hydrocarbons in relation to soil sorption, lipophilicity, and water solubility. Environ. Sci. Technol. 36: 2429-2435. (Sverdrup et al., 2002)
4. Literature review resulted in the following sources, some noted in ECOTOX: Canadian Council of Ministers of the Environment (CCME) (various dates) Parmelee et al., 1997 (PCBs); Robidoux et al., 2000 (2,4,6-Trinitrotoluene); Simini et al., 2006 (energetics); Neuhauser et al., 1985 (VOCs); Hartenstein et al., 1981 (cobalt)
5. Screening Level Ecological Risk Assessment (SLERA) Protocol for Hazardous Waste Combustion Facilities (USEPA, 1999)
6. Suitable surrogates

Table 11-6
Summary of Selected Benchmarks for Terrestrial Plants in Soil

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil or Ephemeral Sediment [a]	TRV Information									
				Surrogate Used	Plant Species	Soil Concentration (mg/kg)	Exposure Duration	Study Endpoint	Effects	Comments	Reference	Uncertainty Factor	Final Benchmark (mg/kg)
Inorganic Compounds													
Aluminum	7429905	Aluminum, Total	X	--	White clover	50	--	LOEC	30% reduction in seedling establishment	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997b; no study duration provided	Efroymson et al., 1997b [b]	1	50
Antimony	7440360	Antimony, Total	X	--	Plant sp.	5	--	LOEC	unspecified toxic effects	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997b; no study duration provided	Efroymson et al., 1997b [b]	1	5
Arsenic	7440382	Arsenic, Total	X	--	ryegrass, cotton, rice	18	--	MATC	growth	geometric mean of 3 studies ranging 4 to 69 mg/kg	USEPA Eco-SSLs for Arsenic (USEPA, 2005b) [b]	1	18
Barium	7440393	Barium, Total	X	--	Barley	500	14 day	LOEC	38% reduction in shoot growth study	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997b.	Efroymson et al., 1997b [b]	1	500
Beryllium	7440417	Beryllium, Total	X	--	Plant sp.	10	--	LOEC	unspecified toxic effects	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997b; no study duration provided	Efroymson et al., 1997b [b]	1	10
Boron	7440428	Boron, Total	X	--	Corn	0.5	49 day	LOEC	37% decrease in shoot weight/growth	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997b.	Efroymson et al., 1997b [b]	1	0.5
Cadmium	7440439	Cadmium, Total	X	--	Plant sp.	32	--	MATC	growth	geometric mean of 13 studies ranging 9 to 79 mg/kg	USEPA Eco-SSLs for Cadmium (USEPA, 2005c)	1	32
Chromium	7440473	Chromium, Total	X	--	Soybean	1	3 day	NOEC	no effect on shoot weight; seedling study in loam soil	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997b.	Efroymson et al., 1997b [b]	1	1
Cobalt	7440484	Cobalt, Total	X	--	alfalfa, barley, raddish	13	--	EC_{20}	growth	geometric mean of 6 studies ranging 0.60 to 45.2 mg/kg	USEPA Eco-SSLs for Cadmium (USEPA, 2005d)	1	13
Copper	7440508	Copper, Total	X	--	Plant sp.	70	--	EC_{20}/ MATC	growth	geometric mean of 6 studies ranging 16 to 251 mg/kg	USEPA Eco-SSLs for Copper (USEPA, 2007h) [b]	1	70
Cyanides	57125	Cyanide, Total	X	--	--	0.9	--	SQG_E	protection of environment	The ecological soil contact guideline for the protection of plants and soil invertebrates in agricultural setting was selected.	CCME, 1999b [b]	1	0.9
Fluoride	7782414	-	X	--	Plant sp.	200	--	LOEC	phytotoxic effects	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997b; no study duration provided	Efroymson et al., 1997b [b]	1	200
Hexavalent Chromium	18540299	Chromium, Hexavalent	X	--	Soybean	30	3 day	LOEC	30% reduction in fresh weight; seedling study in loam soil	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997b.	Efroymson et al., 1997b [b]	1	30
Lead	7439921	Lead, Total	X	--	Pine, red maple, clover, ryegrass	115	--	MATC	growth	geometric mean of 5 studies ranging 22 to 316 mg/kg	USEPA Eco-SSLs for Lead (USEPA, 2005e) [b]	1	115
Lithium	7439932	Lithium, Total	X	--	sweet orange seedlings	2	6 months	LOEC	phytotoxic effects	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997b.	Efroymson et al., 1997b [b]	1	2
Manganese	7439965	Manganese, Total	X	--	barley, cotton, nile grass	220	--	MATC	growth	geometric mean of 4 studies ranging 71 to 707 mg/kg	USEPA Eco-SSLs for Manganese (USEPA, 2007e) [b]	1	220
Mercury	7439976	Mercury, Total	X	--	Plant sp.	0.3	--	LOEC	10th percentile of LOAEL	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997b; no study duration provided	Efroymson et al., 1997b [b]	1	0.3
Methyl Mercury	22967926	-	X	--	--	--	--	--	--	--	--	--	--
Molybdenum	7439987	Molybdenum, Total	X	--	Plant sp.	2	--	LOEC	phytotoxic effects	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997b; no study duration provided	Efroymson et al., 1997b [b]	1	2
Nickel	7440020	Nickel, Total	X	--	alfalfa, barley, brassica	38	--	EC_{20}/ MATC	growth	geometric mean of 11 studies ranging 7 to 177 mg/kg	USEPA Eco-SSLs for Nickel (USEPA, 2007g) [b]	1	38
Selenium	7782492	Selenium, Total	X	--	alfalfa, barley, brassica	0.52	--	EC_{20}/ MATC	growth	geometric mean of 11 studies ranging 0.1 to 1.6 mg/kg	USEPA Eco-SSLs for Selenium (USEPA, 2007a) [b]	1	0.52
Silver	7440224	Silver, Total	X	--	Soybean, wheat, corn	560	--	MATC	growth	geometric mean of 4 studies ranging 316 to 3,162 mg/kg	USEPA Eco-SSLs for Silver (USEPA, 2006) [b]	1	560
Strontium	7440246	Strontium, Total	X	--	--	--	--	--	--	--	--	--	--

Table 11-6
Summary of Selected Benchmarks for Terrestrial Plants in Soil

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil or Ephemeral Sediment [a]	TRV Information									
				Surrogate Used	Plant Species	Soil Concentration (mg/kg)	Exposure Duration	Study Endpoint	Effects	Comments	Reference	Uncertainty Factor	Final Benchmark (mg/kg)
Thallium	7440280	Thallium, Total	X	--	Plant sp.	1	--	LOEC	10th percentile of LOAEL	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997b; no study duration provided	Efroymson et al., 1997b [b]	1	1
Tin	7440315	Tin, Total	X	--	Bush beans	50	--	NOEC	no effect on shoot weight	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997b; no study duration provided	Efroymson et al., 1997b [b]	1	50
Titanium	7440326	Titanium, Total	X	--	--	--	--	--	--	--	--	--	--
Vanadium	7440622	Vanadium, Total	X	--	Plant sp.	50	--	LOEC	phytotoxic effects	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997b; no study duration provided	Efroymson et al., 1997b [b]	1	50
Zinc	7440666	Zinc, Total	X	--	d	160	--	MATC/ NOEC	growth	geometric mean of 10 studies rangning 143 to 185 mg/kg	USEPA Eco-SSLs for Zinc (USEPA, 2007c) [b]	1	160
Zirconium	7440677	Zirconium, Total	X	--	--	--	--	--	--	--	--	--	--
Energetic Constituents													
1,2-Dinitrobenzene	528290	o-Dinitrobenzene	X	--	--	--	--	--	--	--	--	--	--
1,3-Dinitrobenzene	99650	m-Dinitrobenzene	X	--	--	--	--	--	--	--	--	--	--
2,4,6-Trinitrotoluene	118967	-	X	--	--	--	--	--	--	--	--	--	--
2-Amino-4,6-Dinitrotoluene	35572782	-	X	--	--	--	--	--	--	--	--	--	--
HMX	2691410	-	X	--	--	--	--	--	--	--	--	--	--
Hydrazine	302012	-	X	--	--	--	--	--	--	--	--	--	--
Monomethylhydrazine	60344	-	X	--	--	--	--	--	--	--	--	--	--
Perchlorate	14797730	-	X	--	Oats	107	17 day	EC_{50}	50% reduction in biomass	EC50 for oats was chosen because they are closer to native grasses than vegetables	Adema and Henzen, 1989	1	107
RDX	121824	-	X	--	--	--	--	--	--	--	--	--	--
Volatile Organic Compounds													
1,1,1,2-Tetrachloroethane	630206	-	X	--	--	--	--	--	--	--	--	--	--
1,1,1-Trichloroethane	71556	-	X	Trichloroethane	Lettuce (Lactuca sativa)	1000	14 day	EC_{50}	50% reduction in growth	Source was noted in Efroymson et al., 1997b which did not apply a UF to any EC50 values. This precedent was observed only for the Hulzebos et al., 1993 source.	Hulzebos et al., 1993	1	1000
1,1,2,2-Tetrachloroethane	79345	-	X	--	--	--	--	--	--	--	--	--	--
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	Freon 113	X	--	--	--	--	--	--	--	--	--	--
1,1,2-Trichloroethane	79005	-	X	Trichloroethane	Lettuce (Lactuca sativa)	1000	14 day	EC_{50}	50% reduction in growth	Source was noted in Efroymson et al., 1997b which did not apply a UF to any EC50 values. This precedent was observed only for the Hulzebos et al., 1993 source.	Hulzebos et al., 1993	1	1000
1,1-Dichloroethane	75343	-	X	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene	75354	-	X	--	--	--	--	--	--	--	--	--	--
1,2,3-Trichlorobenzene	87616	-	X	1,2,4-Trichlorobenzene	Lettuce (Lactuca sativa)	48	14 day	EC_{50}	50% reduction in growth	Source was noted in Efroymson et al., 1997b which did not apply a UF to any EC50 values. This precedent was observed only for the Hulzebos et al., 1993 source.	Hulzebos et al., 1993	1	48
1,2,4-Trichlorobenzene	120821	-	X	--	Lettuce (Lactuca sativa)	48	14 day	EC_{50}	50% reduction in growth	Source was noted in Efroymson et al., 1997b which did not apply a UF to any EC50 values. This precedent was observed only for the Hulzebos et al., 1993 source.	Hulzebos et al., 1993	1	48
1,2,4-Trimethylbenzene	95636	-	X	o-xylene	Lettuce (Lactuca sativa)	1000	14 day	EC_{50}	50% reduction in growth	Source was noted in Efroymson et al., 1997b which did not apply a UF to any EC50 values. This precedent was observed only for the Hulzebos et al., 1993 source.	Hulzebos et al., 1993	1	1000
1,2-Dibromoethane	106934	-	X	--	--	--	--	--	--	--	--	--	--

Table 11-6
Summary of Selected Benchmarks for Terrestrial Plants in Soil

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil or Ephemeral Sediment [a]	TRV Information									
				Surrogate Used	Plant Species	Soil Concentration (mg/kg)	Exposure Duration	Study Endpoint	Effects	Comments	Reference	Uncertainty Factor	Final Benchmark (mg/kg)
1,2-Dichlorobenzene	95501	o-Dichlorobenzene	X	1,4-Dichlorobenzene	Lettuce (Lactuca sativa)	248	14 day	EC_{50}	50% reduction in growth	Source was noted in Efroymson et al., 1997b which did not apply a UF to any EC50 values. This precedent was observed only for the Hulzebos et al., 1993 source.	Hulzebos et al., 1993	1	248
1,2-Dichloroethane	107062	-	X	--	--	--	--	--	--	--	--	--	--
1,2-Dichloroethene	540590	1,2-Dichloroethenes	X	--	--	--	--	--	--	--	--	--	--
1,2-Dichloropropane	78875	-	X	--	--	--	--	--	--	--	--	--	--
1,3,5-Trimethylbenzene	108678	-	X	o-xylene	Lettuce (Lactuca sativa)	1000	14 day	EC_{50}	50% reduction in growth	Source was noted in Efroymson et al., 1997b which did not apply a UF to any EC50 values. This precedent was observed only for the Hulzebos et al., 1993 source.	Hulzebos et al., 1993	1	1000
1,3-Dichlorobenzene	541731	m-Dichlorobenzene	X	1,4-Dichlorobenzene	Lettuce (Lactuca sativa)	248	14 day	EC_{50}	50% reduction in growth	Source was noted in Efroymson et al., 1997b which did not apply a UF to any EC50 values. This precedent was observed only for the Hulzebos et al., 1993 source.	Hulzebos et al., 1993	1	248
1,4-Dichlorobenzene	106467	p-Dichlorobenzene	X	--	Lettuce (Lactuca sativa)	248	14 day	EC_{50}	50% reduction in growth	Source was noted in Efroymson et al., 1997b which did not apply a UF to any EC50 values. This precedent was observed only for the Hulzebos et al., 1993 source.	Hulzebos et al., 1993	1	248
2-Chloroethylvinyl ether	110758	2-Chloroethyl vinyl ether	X	--	--	--	--	--	--	--	--	--	--
2-Hexanone	591786	Methyl butyl ketone	X	--	--	--	--	--	--	--	--	--	--
Acetone	67641	-	X	--	--	--	--	--	--	--	--	--	--
Acetic Acid	64197	-	X	--	--	--	--	--	--	--	--	--	--
Benzene	71432	-	X	--	--	31	--	SQG_E	protection of environment	The ecological soil contact guideline for the protection of plants and soil invertebrates in agricultural setting for course surface soil was selected.	CCME, 2004b [b]	1	31
Bromide	24959679	-	X	--	--	--	--	--	--	--	--	--	--
Bromobenzene	108861	-	X	Benzene	--	31	--	SQG_E	protection of environment	The ecological soil contact guideline for the protection of plants and soil invertebrates in agricultural setting for course surface soil was selected.	CCME, 2004b [b]	1	31
Bromodichloromethane	75274	-	X	--	--	--	--	--	--	--	--	--	--
Bromomethane	74839	-	X	--	--	--	--	--	--	--	--	--	--
Carbon Disulfide	75150	-	X	--	--	--	--	--	--	--	--	--	--
Carbon Tetrachloride	56235	-	X	--	--	--	--	--	--	--	--	--	--
Chlorobenzene	108907	Monochlorobenzene	X	--	Lettuce (Lactuca sativa)	1000	14 day	EC_{50}	50% reduction in growth	Source was noted in Efroymson et al., 1997b which did not apply a UF to any EC50 values. This precedent was observed only for the Hulzebos et al., 1993 source.	Hulzebos et al., 1993	1	1000
Chloroform	67663	Trichloromethane	X	--	--	--	--	--	--	--	--	--	--
Chloromethane	74873	Methyl chloride	X	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	156592	cis-1,2-Dichloroethylene	X	--	--	--	--	--	--	--	--	--	--

Table 11-6
Summary of Selected Benchmarks for Terrestrial Plants in Soil

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil or Ephemeral Sediment [a]	TRV Information									
				Surrogate Used	Plant Species	Soil Concentration (mg/kg)	Exposure Duration	Study Endpoint	Effects	Comments	Reference	Uncertainty Factor	Final Benchmark (mg/kg)
Cumene	98828	Isopropylbenzene	X	--	--	--	--	--	--	--	--	--	--
Dibenzofuran	132649	-	X	--	--	--	--	--	--	--	--	--	--
Dibromomethane	74953	-	X	--	--	--	--	--	--	--	--	--	--
Dichlorodifluoromethane	75718	Freon 12	X	--	--	--	--	--	--	--	--	--	--
Ethylbenzene	100414	-	X	--	--	55	--	SQG_E	protection of environment	The ecological soil contact guideline for the protection of plants and soil invertebrates in agricultural setting for course surface soil was selected.	CCME, 2004c [b]	1	55
Methyl ethyl ketone	78933	2-Butanone	X	--	--	--	--	--	--	--	--	--	--
Methyl isobutyl ketone (MIBK)	108101	4-Methyl-2-pentanone	X	--	--	--	--	--	--	--	--	--	--
Methylene chloride	75092	Dichloromethane	X	--	--	--	--	--	--	--	--	--	--
m-Xylene & p-Xylene	136777612	meta- and para-Xylenes	X	o-xylene	Lettuce (Lactuca sativa)	1000	14 day	EC_{50}	50% reduction in growth	Source was noted in Efroymson et al., 1997b which did not apply a UF to any EC50 values. This precedent was observed only for the Hulzebos et al., 1993 source.	Hulzebos et al., 1993	1	1000
n-Butylbenzene	104518	-	X	--	--	--	--	--	--	--	--	--	--
n-Propylbenzene	103651	-	X	--	--	--	--	--	--	--	--	--	--
o-Chlorotoluene	95498	2-Chlorotoluene	X	--	--	--	--	--	--	--	--	--	--
o-Xylene	95476	-	X	--	Lettuce (Lactuca sativa)	1000	14 day	EC_{50}	50% reduction in growth	Source was noted in Efroymson et al., 1997b which did not apply a UF to any EC50 values. This precedent was observed only for the Hulzebos et al., 1993 source.	Hulzebos et al., 1993	1	1000
p-Chlorotoluene	106434	4-Chlorotoluene	X	--	--	--	--	--	--	--	--	--	--
p-Cymene	99876	p-Isopropyltoluene	X	--	--	--	--	--	--	--	--	--	--
sec-Butylbenzene	135988	-	X	--	--	--	--	--	--	--	--	--	--
Styrene	100425	Vinylbenzene	X	--	Lettuce (Lactuca sativa)	320	14 day	EC_{50}	50% reduction in growth	Source was noted in Efroymson et al., 1997b which did not apply a UF to any EC50 values. This precedent was observed only for the Hulzebos et al., 1993 source.	Hulzebos et al., 1993	1	320
tert-Butylbenzene	98066	-	X	--	--	--	--	--	--	--	--	--	--
Tetralin	119642	-	X	Naphthalene	Lettuce (Lactuca sativa)	100	14 day	EC_{50}	50% reduction in growth	Source was noted in Efroymson et al., 1997b which did not apply a UF to any EC50 values. This precedent was observed only for the Hulzebos et al., 1993 source.	Hulzebos et al., 1993	1	100
Tetrachloroethene	127184	-	X	--	Lettuce (Lactuca sativa)	1000	14 day	EC_{50}	50% reduction in growth	Source was noted in Efroymson et al., 1997b which did not apply a UF to any EC50 values. This precedent was observed only for the Hulzebos et al., 1993 source.	Hulzebos et al., 1993	1	1000
Toluene	108883	Toluol	X	--	corn	200	21 day	LOEC	30% reduction in fresh weight	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997b.	Efroymson et al., 1997b [b]	1	200
trans-1,2-Dichloroethene	156605	-	X	--	--	--	--	--	--	--	--	--	--
Trichloroethene	79016	Trichloroethylene (TCE)	X	--	--	3	--	SQG_E	protection of environment	The ecological soil contact guideline for the protection of plants and soil invertebrates in agricultural setting was selected.	CCME, 2006 [b]	1	3

Table 11-6
Summary of Selected Benchmarks for Terrestrial Plants in Soil

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil or Ephemeral Sediment [a]	TRV Information									
				Surrogate Used	Plant Species	Soil Concentration (mg/kg)	Exposure Duration	Study Endpoint	Effects	Comments	Reference	Uncertainty Factor	Final Benchmark (mg/kg)
Trichlorofluoromethane	75694	-	X	--	--	--	--	--	--	--	--	--	--
Vinyl chloride	75014	-	X	--	--	--	--	--	--	--	--	--	--
Xylenes, Total	1330207	Xylene (Total) Isomers	X	o-xylene	Lettuce (Lactuca sativa)	1000	14 day	EC_{50}	50% reduction in growth	Source was noted in Efroymson et al., 1997b which did not apply a UF to any EC50 values. This precedent was observed only for the Hulzebos et al., 1993 source.	Hulzebos et al., 1993	1	1000
Semi-Volatile Organic Compounds													
1,1-Dimethylhydrazine	57147	-	X	--	--	--	--	--	--	--	--	--	--
1,2-Dibromo-3-chloropropane	96128	1,2-Dibromo-3-CPA	X	--	--	--	--	--	--	--	--	--	--
1,4-Dioxane	123911	-	X	--	--	--	--	--	--	--	--	--	--
2,4,5-Trichlorophenol	95954	-	X	--	Lettuce (Lactuca sativa)	4	14 day	EC_{50}	unspecified growth effects	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997b.	Efroymson et al., 1997b [b]	1	4
2,4,6-Trichlorophenol	88062	-	X	2,4,5-Trichlorophenol	Lettuce (Lactuca sativa)	4	14 day	EC_{50}	unspecified growth effects	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997b.	Efroymson et al., 1997b [b]	1	4
2,4-Dimethylphenol	105679	-	X	--	--	--	--	--	--	--	--	--	--
3,5-Dimethylphenol	108689	-	X	--	--	--	--	--	--	--	--	--	--
Benzoic acid	65850	-	X	--	--	--	--	--	--	--	--	--	--
Benzyl alcohol	100516	-	X	--	--	--	--	--	--	--	--	--	--
bis(2-Ethylhexyl) phthalate	117817	bis(2-ethylhexyl)phthalate	X	--	Lettuce (Lactuca sativa)	1000	14 day	EC_{50}	50% reduction in growth	Source was noted in Efroymson et al., 1997b which did not apply a UF to any EC50 values. This precedent was observed only for the Hulzebos et al., 1993 source.	Hulzebos et al., 1993	1	1000
Bromoform	75252	-	X	--	--	--	--	--	--	--	--	--	--
Butyl benzyl phthalate	85687	-	X	--	--	--	--	--	--	--	--	--	--
Carbazole	86748	-	X	Anthracene	--	2.0	--	NOEC	unspecified effects	No observed phytotoxic effects to wheat, rye, corn at conc of 1,200 ug/L; study duration not provided	Sims and Overcash, 1983 [b]	1	2.0
Dibromochloromethane	124481	-	X	--	--	--	--	--	--	--	--	--	--
Diethyl phthalate	84662	-	X	--	Lettuce (Lactuca sativa)	134	14 day	EC_{50}	50% reduction in growth	Source was noted in Efroymson et al., 1997b which did not apply a UF to any EC50 values. This precedent was observed only for the Hulzebos et al., 1993 source.	Hulzebos et al., 1993	1	134
Dimethyl phthalate	131113	-	X	Diethyl phthalate	Lettuce (Lactuca sativa)	134	14 day	EC_{50}	50% reduction in growth	Source was noted in Efroymson et al., 1997b which did not apply a UF to any EC50 values. This precedent was observed only for the Hulzebos et al., 1993 source.	Hulzebos et al., 1993	1	134
Di-n-butyl phthalate	84742	Di-n-butylphthalate	X	--	Plant sp.	200	21 day	LOEC	29-34% reduction in fresh weight	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997b.	Efroymson et al., 1997b [b]	1	200
Di-n-octyl phthalate	117840	Di-n-octyl-phthalate	X	Di-n-butyl phthalate	Plant sp.	200	21 day	LOEC	29-34% reduction in fresh weight	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997b.	Efroymson et al., 1997b [b]	1	200
Formaldehyde	50000	-	X	--	--	--	--	--	--	--	--	--	--
Hexachlorobutadiene	87683	-	X	--	--	--	--	--	--	--	--	--	--
m-Cresol	108394	3-Methylphenol	X	--	Lettuce (Lactuca sativa)	96	14 day	EC_{50}	50% reduction in growth	Source was noted in Efroymson et al., 1997b which did not apply a UF to any EC50 values. This precedent was observed only for the Hulzebos et al., 1993 source.	Hulzebos et al., 1993	1	96
n-Nitrosodimethylamine	62759	Nitrosodimethylamine	X	--	--	--	--	--	--	--	--	--	--
n-Nitrosodiphenylamine	86306	-	X	--	--	--	--	--	--	--	--	--	--

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				Surrogate Used	Plant Species	Soil Concentration (mg/kg)	Exposure Duration	Study Endpoint	Effects	Comments	Reference	Uncertainty Factor	Final Benchmark (mg/kg)
o-Cresol	95487	-	X	--	Lettuce (Lactuca sativa)	100	14 day	EC_{50}	50% reduction in growth	Source was noted in Efroymson et al., 1997b which did not apply a UF to any EC50 values. This precedent was observed only for the Hulzebos et al., 1993 source.	Hulzebos et al., 1993	1	100
p-Chloro-m-cresol	59507	4-Chloro-3-Methylphenol	X	o-cresol	Lettuce (Lactuca sativa)	100	14 day	EC_{50}	50% reduction in growth	Source was noted in Efroymson et al., 1997b which did not apply a UF to any EC50 values. This precedent was observed only for the Hulzebos et al., 1993 source.	Hulzebos et al., 1993	1	100
p-Cresol	106445	4-Methylphenol	X	o-cresol	Lettuce (Lactuca sativa)	100	14 day	EC_{50}	50% reduction in growth	Source was noted in Efroymson et al., 1997b which did not apply a UF to any EC50 values. This precedent was observed only for the Hulzebos et al., 1993 source.	Hulzebos et al., 1993	1	100
Pentachlorophenol	87865	PCP	X	--	alfalfa/turnip/ raddish	5	--	EC_{50}	growth	geometric mean of 3 studies all 5 mg/kg	USEPA Eco-SSLs for Pentachlorophenol (USEPA, 2007f) [b]	1	5
Phenol	108952	Total Phenols	X	--	Lettuce (Lactuca sativa)	70	--	EC_{50}	50% reduction in growth	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997b; no study duration provided	Efroymson et al., 1997b [b]	1	70
p-Nitroaniline	100016	4-Nitroaniline	X	--	--	--	--	--	--	--	--	--	--
Polynuclear Aromatic Hydrocarbons													
1-Methyl naphthalene	90120	1-Methylnaphthalene	X	Naphthalene	Lettuce (Lactuca sativa)	100	14 day	EC_{50}	50% reduction in growth	Source was noted in Efroymson et al., 1997b which did not apply a UF to any EC50 values. This precedent was observed only for the Hulzebos et al., 1993 source.	Hulzebos et al., 1993	1	100
2-Methylnaphthalene	91576	Naphthalene, 2-methyl-	X	Naphthalene	Lettuce (Lactuca sativa)	100	14 day	EC_{50}	50% reduction in growth	Source was noted in Efroymson et al., 1997b which did not apply a UF to any EC50 values. This precedent was observed only for the Hulzebos et al., 1993 source.	Hulzebos et al., 1993	1	100
Acenaphthene	83329	-	X	--	Plant sp.	20	14 day	LOEC	10th percentile of LOAEL	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997b.	Efroymson et al., 1997b [b]	1	20
Acenaphthylene	208968	-	X	Acenaphthene	Plant sp.	20	14 day	LOEC	10th percentile of LOAEL	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997b.	Efroymson et al., 1997b [b]	1	20
Anthracene	120127	-	X	--	Plant sp.	2.0	--	NOEC	unspecified effects	No observed phytotoxic effects to wheat, rye, corn at conc of 1,200 ug/L; study duration not provided	Sims and Overcash, 1983 [b]	1	2.0
Benzo(a)anthracene	56553	Benz[a]anthracene	X	--	Plant sp.	1.5	--	NOEC	unspecified effects	No observed phytotoxic effects to wheat, rye, corn at conc of 1,200 ug/L; study duration not provided	Sims and Overcash, 1983 [b]	1	1.5
Benzo(a)pyrene	50328	Benzo (a) pyrene	X	--	Plant sp.	1.2	--	NOEC	unspecified effects	No observed phytotoxic effects to wheat, rye, corn at conc of 1,200 ug/L; study duration not provided	Sims and Overcash, 1983 [b]	1	1.2
Benzo(b)fluoranthene	205992	Benz[e]acephenanthrylene 1	X	Benzo(a)pyrene	Plant sp.	1.2	--	NOEC	unspecified effects	No observed phytotoxic effects to wheat, rye, corn at conc of 1,200 ug/L; study duration not provided	Sims and Overcash, 1983 [b]	1	1.2
Benzo(e)pyrene	192972	-	X	Benzo(a)pyrene	Plant sp.	1.2	--	NOEC	unspecified effects	No observed phytotoxic effects to wheat, rye, corn at conc of 1,200 ug/L; study duration not provided	Sims and Overcash, 1983 [b]	1	1.2
Benzo(ghi)perylene	191242	Benzo (g,h,i) perylene	X	Benzo(a)pyrene	Plant sp.	1.2	--	NOEC	unspecified effects	No observed phytotoxic effects to wheat, rye, corn at conc of 1,200 ug/L; study duration not provided	Sims and Overcash, 1983 [b]	1	1.2
Benzo(k)fluoranthene	207089	Benzo[k]fluoranthene	X	Benzo(a)pyrene	Plant sp.	1.2	--	NOEC	unspecified effects	No observed phytotoxic effects to wheat, rye, corn at conc of 1,200 ug/L; study duration not provided	Sims and Overcash, 1983 [b]	1	1.2
Chrysene	218019	-	X	Benzo(a)pyrene	Plant sp.	1.2	--	NOEC	unspecified effects	No observed phytotoxic effects to wheat, rye, corn at conc of 1,200 ug/L; study duration not provided	Sims and Overcash, 1983 [b]	1	1.2

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Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil or Ephemeral Sediment [a]	TRV Information									
				Surrogate Used	Plant Species	Soil Concentration (mg/kg)	Exposure Duration	Study Endpoint	Effects	Comments	Reference	Uncertainty Factor	Final Benchmark (mg/kg)
Dibenzo(a,h)anthracene	53703	Dibenz (a,h) anthracene	X	Benzo(a)pyrene	Plant sp.	1.2	--	NOEC	unspecified effects	No observed phytotoxic effects to wheat, rye, corn at conc of 1,200 ug/L; study duration not provided	Sims and Overcash, 1983 [b]	1	1.2
Fluoranthene	206440	-	X	--	Plant sp.	1.9	--	NOEC	unspecified effects	No observed phytotoxic effects to wheat, rye, corn at conc of 1,200 ug/L; study duration not provided	Sims and Overcash, 1983 [b]	1	1.9
Fluorene	86737	-	X	--	Plant sp.	1.2	--	NOEC	unspecified effects	No observed phytotoxic effects to wheat, rye, corn at conc of 1,200 ug/L; study duration not provided	Sims and Overcash, 1983 [b]	1	1.2
Indeno(1,2,3-cd)pyrene	193395	Indeno (1,2,3-cd) pyrene	X	Benzo(a)pyrene	Plant sp.	1.2	--	NOEC	unspecified effects	No observed phytotoxic effects to wheat, rye, corn at conc of 1,200 ug/L; study duration not provided	Sims and Overcash, 1983 [b]	1	1.2
Naphthalene	91203	-	X	--	Lettuce (Lactuca sativa)	100	14 day	EC_{50}	50% reduction in growth	Source was noted in Efroymson et al., 1997b which did not apply a UF to any EC50 values. This precedent was observed only for the Hulzebos et al., 1993 source.	Hulzebos et al., 1993	1	100
Perylene	198550	-	X	--	--	--	--	--	--	--	--	--	--
Phenanthrene	85018	-	X	Benzo(a)pyrene	Plant sp.	1.2	--	NOEC	unspecified effects	No observed phytotoxic effects to wheat, rye, corn at conc of 1,200 ug/L; study duration not provided	Sims and Overcash, 1983 [b]	1	1.2
Pyrene	129000	-	X	Benzo(a)pyrene	Plant sp.	1.2	--	NOEC	unspecified effects	No observed phytotoxic effects to wheat, rye, corn at conc of 1,200 ug/L; study duration not provided	Sims and Overcash, 1983 [b]	1	1.2
Pesticides													
4,4'-DDD	72548	p,p'-DDD	X	4,4'-DDT	--	12	--	SQG_E	protection of environment	The ecological soil contact guideline for the protection of plants and soil invertebrates in agricultural setting was selected.	CCME, 1999e [b]	1	12
4,4'-DDE	72559	p,p'-DDE	X	4,4'-DDT	--	12	--	SQG_E	protection of environment	The ecological soil contact guideline for the protection of plants and soil invertebrates in agricultural setting was selected.	CCME, 1999e [b]	1	12
4,4'-DDT	50293	p,p'-DDT	X	--	--	12	--	SQG_E	protection of environment	The ecological soil contact guideline for the protection of plants and soil invertebrates in agricultural setting was selected.	CCME, 1999e [b]	1	12
Aldrin	309002	-	X	--	--	--	--	--	--	--	--	--	--
alpha-BHC	319846	a-Benzene Hexachloride	X	beta-BHC	Lettuce (Lactuca sativa)	1000	14 day	EC_{50}	50% reduction in growth	Source was noted in Efroymson et al., 1997b which did not apply a UF to any EC50 values. This precedent was observed only for the Hulzebos et al., 1993 source.	Hulzebos et al., 1993	1	1000
beta-BHC	319857	b-Benzene Hexachloride	X	--	Lettuce (Lactuca sativa)	1000	14 day	EC_{50}	50% reduction in growth	Source was noted in Efroymson et al., 1997b which did not apply a UF to any EC50 values. This precedent was observed only for the Hulzebos et al., 1993 source.	Hulzebos et al., 1993	1	1000
Chlordane (Technical)	12789036	-	X	--	--	--	--	--	--	--	--	--	--
delta-BHC	319868	d-Benzene Hexachloride	X	beta-BHC	Lettuce (Lactuca sativa)	1000	14 day	EC_{50}	50% reduction in growth	Source was noted in Efroymson et al., 1997b which did not apply a UF to any EC50 values. This precedent was observed only for the Hulzebos et al., 1993 source.	Hulzebos et al., 1993	1	1000
Dieldrin	60571	-	X	--	--	--	--	--	--	--	--	--	--
Endosulfan I	959988	-	X	Endosulfan	Lettuce (Lactuca sativa)	1000	14 day	EC_{50}	50% reduction in growth	Source was noted in Efroymson et al., 1997b which did not apply a UF to any EC50 values. This precedent was observed only for the Hulzebos et al., 1993 source.	Hulzebos et al., 1993	1	1000
Endosulfan II	33213659	-	X	Endosulfan	Lettuce (Lactuca sativa)	1000	14 day	EC_{50}	50% reduction in growth	Source was noted in Efroymson et al., 1997b which did not apply a UF to any EC50 values. This precedent was observed only for the Hulzebos et al., 1993 source.	Hulzebos et al., 1993	1	1000

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				Surrogate Used	Plant Species	Soil Concentration (mg/kg)	Exposure Duration	Study Endpoint	Effects	Comments	Reference	Uncertainty Factor	Final Benchmark (mg/kg)
Endosulfan sulfate	1031078	-	X	Endosulfan	Lettuce (Lactuca sativa)	1000	14 day	EC_{50}	50% reduction in growth	Source was noted in Efroymson et al., 1997b which did not apply a UF to any EC50 values. This precedent was observed only for the Hulzebos et al., 1993 source.	Hulzebos et al., 1993	1	1000
Endrin	72208	-	X	--	--	--	--	--	--	--	--	--	--
Endrin aldehyde	7421934	-	X	--	--	--	--	--	--	--	--	--	--
Endrin ketone	53494705	-	X	--	--	--	--	--	--	--	--	--	--
gamma-BHC	58899	Lindane	X	beta-BHC	Lettuce (Lactuca sativa)	1000	14 day	EC_{50}	50% reduction in growth	Source was noted in Efroymson et al., 1997b which did not apply a UF to any EC50 values. This precedent was observed only for the Hulzebos et al., 1993 source.	Hulzebos et al., 1993	1	1000
Heptachlor	76448	-	X	--	Carrot	1000	--	NOAEL	unspecified effects	chronic NOAEL so no UF applied by USEPA 1999	USEPA SLERA Protocol (USEPA, 1999) [b]	1	1000
Heptachlor epoxide	1024573	-	X	Heptachlor	Carrot	1000	--	NOAEL	unspecified effects	chronic NOAEL so no UF applied by USEPA 1999	USEPA SLERA Protocol (USEPA, 1999) [b]	1	1000
MCPA	94746	-	X	--	--	--	--	--	--	--	--	--	--
Mirex	2385855	Mirex (DeChlorane)	X	--	--	--	--	--	--	--	--	--	--
p,p'-Methoxychlor	72435	-	X	--	--	--	--	--	--	--	--	--	--
Toxaphene	8001352	-	X	--	--	--	--	--	--	--	--	--	--
Herbicides													
2,4,5-T	93765	2,4,5-Trichlorophenoxyacetic acid	X	--	--	--	--	--	--	--	--	--	--
2,4,5-TP (Silvex)	93721	-	X	--	--	--	--	--	--	--	--	--	--
2,4-Dichlorophenoxyacetic Acid (2,4-D)	94757	-	X	--	--	--	--	--	--	--	--	--	--
2,4-Dichlorophenoxybutyric acid	94826	-	X	--	--	--	--	--	--	--	--	--	--
2,4-DP (Dichlorprop)	120365	Dichlorprop	X	--	--	--	--	--	--	--	--	--	--
Dalapon	75990	-	X	--	--	--	--	--	--	--	--	--	--
Dicamba	1918009	-	X	--	--	--	--	--	--	--	--	--	--
Dinoseb	88857	-	X	--	--	--	--	--	--	--	--	--	--
MCPP	93652	-	X	--	--	--	--	--	--	--	--	--	--
Terphenyls													
m-Terphenyl	92068	-	X	Biphenyl	Lettuce (Lactuca sativa)	68	14 day	EC_{50}	50% reduction in growth	Source was noted in Efroymson et al., 1997b which did not apply a UF to any EC50 values. This precedent was observed only for the Hulzebos et al., 1993 source.	Hulzebos et al., 1993	1	68
o-terphenyl	84151	-	X	--	--	--	--	--	--	--	--	--	--
p-Terphenyl	92944	-	X	--	--	--	--	--	--	--	--	--	--
Glycols		-											
Diethylene Glycol	111466	-	X	--	--	--	--	--	--	--	--	--	--
Triethylene glycol	112276	-	X	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons													
TPH-Diesel Range Organics (DRO)	DRO	Diesel	X	--	--	--	--	--	--	--	--	--	--
TPH-Gasoline Range Organics (GRO)	GRO	Gasoline	X	--	--	--	--	--	--	--	--	--	--
PCDD/PCDFs[c]dei													
1,2,3,4,6,7,8-Heptachlorodibenzofuran	67562394	1,2,3,4,6,7,8-HpCDF	X	--	--	--	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	35822469	1,2,3,4,6,7,8-HpCDD	X	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran	55673897	1,2,3,4,7,8,9-HpCDF	X	--	--	--	--	--	--	--	--	--	--

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1,2,3,4,7,8-Hexachlorodibenzofuran	70648269	1,2,3,4,7,8-HxCDF	X	--	--	--	--	--	--	--	--	--	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	39227286	1,2,3,4,7,8-HxCDD	X	--	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-Hexachlorodibenzofuran	57117449	1,2,3,6,7,8-HxCDF	X	--	--	--	--	--	--	--	--	--	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	57653857	1,2,3,6,7,8-HxCDD	X	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran	72918219	1,2,3,7,8,9-HxCDF	X	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	19408743	1,2,3,7,8,9-HxCDD	X	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8-Pentachlorodibenzofuran	57117416	1,2,3,7,8-PeCDF	X	--	--	--	--	--	--	--	--	--	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	40321764	1,2,3,7,8-PeCDD	X	--	--	--	--	--	--	--	--	--	--
2,3,4,6,7,8-Hexachlorodibenzofuran	60851345	-	X	--	--	--	--	--	--	--	--	--	--
2,3,4,7,8-Pentachlorodibenzofuran	57117314	2,3,4,7,8-PeCDF	X	--	--	--	--	--	--	--	--	--	--
2,3,7,8-TCDD	1746016	2,3,7,8-Tetrachlorodibenzo-p-dioxin	X	--	--	--	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzofuran	51207319	2,3,7,8-TCDF	X	--	--	--	--	--	--	--	--	--	--
Octachlorodibenzofuran	39001020	OCDF	X	--	--	--	--	--	--	--	--	--	--
Octachlorodibenzo-p-dioxin	3268879	-	X	--	--	--	--	--	--	--	--	--	--
Polychlorinated Biphenyls (PCBs)[c]dei													
Aroclor 1016	12674112	-	X	PCBs	pigweed	40	--	LOEC	22% reduction in fresh weight	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997b; no study duration provided	Efroymson et al., 1997b [b]	1	40
Aroclor 1242	53469219	Aroclor-1242	X	PCBs	pigweed	40	--	LOEC	22% reduction in fresh weight	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997b; no study duration provided	Efroymson et al., 1997b [b]	1	40
Aroclor 1248	12672296	-	X	PCBs	pigweed	40	--	LOEC	22% reduction in fresh weight	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997b; no study duration provided	Efroymson et al., 1997b [b]	1	40
Aroclor 1254	11097691	-	X	PCBs	pigweed	40	--	LOEC	22% reduction in fresh weight	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997b; no study duration provided	Efroymson et al., 1997b [b]	1	40
Aroclor 1260	11096825	-	X	PCBs	pigweed	40	--	LOEC	22% reduction in fresh weight	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997b; no study duration provided	Efroymson et al., 1997b [b]	1	40
Aroclor 5460	11126424	-	X	PCBs	pigweed	40	--	LOEC	22% reduction in fresh weight	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997b; no study duration provided	Efroymson et al., 1997b [b]	1	40
PCB-105	32598144	1,1'-Biphenyl, 2,3,3',4,4'-pentachloro-	X	--	--	--	--	--	--	--	--	--	--
PCB-114	74472370	PCB 114 (BZ)	X	--	--	--	--	--	--	--	--	--	--
PCB-118	31508006	-	X	--	--	--	--	--	--	--	--	--	--
PCB-123	65510443	123-PeCB	X	--	--	--	--	--	--	--	--	--	--
PCB-126	57465288	-	X	--	--	--	--	--	--	--	--	--	--
PCB-156	38380084	1,1'-Biphenyl, 2,3,3',4,4',5-hexachloro-	X	--	--	--	--	--	--	--	--	--	--
PCB-157	69782907	PCB 157 (BZ)	X	--	--	--	--	--	--	--	--	--	--
PCB-167	52663726	167-HxCB	X	--	--	--	--	--	--	--	--	--	--
PCB-169	32774166	-	X	--	--	--	--	--	--	--	--	--	--
PCB-189	39635319	-	X	--	--	--	--	--	--	--	--	--	--

Table 11-6
Summary of Selected Benchmarks for Terrestrial Plants in Soil

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil or Ephemeral Sediment [a]	TRV Information									
				Surrogate Used	Plant Species	Soil Concentration (mg/kg)	Exposure Duration	Study Endpoint	Effects	Comments	Reference	Uncertainty Factor	Final Benchmark (mg/kg)
PCB-77	32598133	77-TeCB	X	--	--	--	--	--	--	--	--	--	--
PCB-81	70362504	81-TeCB	X	--	--	--	--	--	--	--	--	--	--
Chemical Parameters										--			
Ammonia-N	7664417	Nitrogen, as Ammonia	X	--	--	--	--	--	--	--	--	--	--
Chloride	16887006	-	X	--	--	--	--	--	--	--	--	--	--
Nitrate	NO3N	-	X	--	--	--	--	--	--	--	--	--	--
Nitrite-NO2	E-10128	-	X	--	--	--	--	--	--	--	--	--	--
Orthophosphate – PO4	14265442	-	X	--	--	--	--	--	--	--	--	--	--
Sulfate	14808798	-	X	--	--	--	--	--	--	--	--	--	--

Notes:

[a] Chemicals detected in Groups 1A, 4, 6, 7, 8, 1B, 5, 10, 3 (WCT only), and 9 (Silvernale only) surface soil.

[b] Indicates reference is a secondary or compilation source.

[c] Dioxins/furans and coplanar PCBs for terrestrial plants exposed to chemicals in soil or ephemeral sediment will be evaluated by the individual congeners. No TEQ will be calculated because no applicable toxic equivalence factors are available for terrestrial plants.

Indicates final TRV
-- not available, could not be located, or not applicable.

DDD - dichlorodiphenyldichloroethane
DDE - dichlorodiphenyldichloroethylene
DDT - dichlorodiphenyltrichloroethane
EC20 - effective concentration where 20% of test population shows effect being measures
EC50 - effective concentration where 50% of test population shows effect being measures
LOEC - lowest observed effect concentration
Low TRV - no effect toxicity reference value
MATC - maximum acceptable toxicant concentration
mg/kg - milligrams per kilogram
NOAEL - no observed adverse effect level
NOEC - no observed effect concentration
PCDD/PCDF - polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans
SQC_E - ecological soil quality criteria
TEQ - toxicity equivalent
TRV - toxicity reference value
X - Analyte was detected in the indicated medium

Hierarchy of Sources:

1. United States Environmental Protection Agency (USEPA) Ecological Soil Screening Levels (Eco-SSLs) (various dates)
2. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision (Efroymson et al., 1997b)
3. Phytotoxicity studies with Latuca sativa in soil and nutrient solution (Hulzebos et al., 1993)
4. Plant benchmarks extracted from other published sources, e.g., CCME, various dates (organics and pesticides); Adema and Hanzen, 1989 (perchlorate); and Sims and Overcash, 1983 (PAHs)
5. Plant benchmarks reported in the Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities (USEPA, 1999).
6. Suitable surrogate.

Table 11-7
Summary of Selected Solution-based Benchmarks for Terrestrial Plants

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Ephemeral Surface Water, Seeps and Springs or Near-Surface Groundwater [a, b]	TRV Information									
				Surrogate Used	Test Species	Soil Solution Concentration (mg/L)	Exposure Duration	Study Endpoint	Effects	Comments	Reference	Uncertainty Factor	Final Benchmark (mg/L)
Inorganic Compounds													
Aluminum	7429905	Aluminum, Total	X	--	--	--	--	--	--	Efroymson et al. 1997 did not indicate which study used to develop 0.3 mg/L.	Efroymson et al. 1997b [c]	--	0.3
Aluminum, dissolved	7429905-D	-	X	Aluminum	--	--	--	--	--	Efroymson et al. 1997 did not indicate which study used to develop 0.3 mg/L.	Efroymson et al. 1997b [c]	--	0.3
Antimony	7440360	Antimony, Total	X	--	--	--	--	--	--	--	--	--	--
Antimony, dissolved	7440360-D	-	X	--	--	--	--	--	--	--	--	--	--
Arsenic	7440382	Arsenic, Total	X	--	cluster bean	0.001	5 days	LOEC	root length	Final low TRV based on screening benchmark in Efroymson et al. 1997	Efroymson et al. 1997b [c]	--	0.001
Arsenic, dissolved	7440382-D	-	X	Arsenic	cluster bean	0.001	5 days	LOEC	root length	Final low TRV based on screening benchmark in Efroymson et al. 1997	Efroymson et al. 1997b [c]	--	0.001
Barium	7440393	Barium, Total	X	--	--	--	--	--	--	--	--	--	--
Barium, dissolved	7440393-D	-	X	--	--	--	--	--	--	--	--	--	--
Beryllium	7440417	Beryllium, Total	X	--	bush bean	0.5	48 days	LOEC	plant weight	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997	Efroymson et al. 1997b [c]	--	0.5
Beryllium, dissolved	7440417-D	-	X	Beryllium	bush bean	0.5	48 days	LOEC	plant weight	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997	Efroymson et al. 1997b [c]	--	0.5
Boron	7440428	Boron, Total	X	--	--	--	--	--	--	Efroymson et al. 1997 did not indicate which study used to develop 1 mg/L.	Efroymson et al. 1997b [c]	--	1
Boron, dissolved	7440428-D	-	X	Boron	--	--	--	--	--	Efroymson et al. 1997 did not indicate which study used to develop 1 mg/L.	Efroymson et al. 1997b [c]	--	1
Cadmium	7440439	Cadmium, Total	X	--	--	--	--	--	--	Efroymson et al. 1997 did not indicate which study used to develop 0.1 mg/L.	Efroymson et al. 1997b [c]	--	0.1
Cadmium, dissolved	7440439-D	-	X	Cadmium	--	--	--	--	--	Efroymson et al. 1997 did not indicate which study used to develop 0.1 mg/L.	Efroymson et al. 1997b [c]	--	0.1
Chromium	7440473	Chromium, Total	X	Trivalent chromium	chrysanthemum	0.052	21 days	LOEC	stem and leaf weights	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	0.05
Chromium, dissolved	7440473-D	-	X	Trivalent chromium	chrysanthemum	0.052	21 days	LOEC	stem and leaf weights	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	0.05
Cobalt	7440484	Cobalt, Total	X	--	bush beans/chrysanthemum	0.06	21 days	LOEC	leaf or root weight	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	0.06
Cobalt, dissolved	7440484-D	-	X	Cobalt	bush beans/chrysanthemum	0.06	21 days	LOEC	leaf or root weight	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	0.06
Copper	7440508	Copper, Total	X	--	--	--	--	--	--	Efroymson et al. 1997 did not indicate which study used to develop 0.06 mg/L.	Efroymson et al. 1997b [c]	--	0.06
Copper, dissolved	7440508-D	-	X	Copper	--	--	--	--	--	Efroymson et al. 1997 did not indicate which study used to develop 0.06 mg/L.	Efroymson et al. 1997b [c]	--	0.06
Fluoride	7782414	-	X	--	--	5	--	--	reduction in plant growth	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	5

Table 11-7
Summary of Selected Solution-based Benchmarks for Terrestrial Plants

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Ephemeral Surface Water, Seeps and Springs or Near-Surface Groundwater [a, b]	TRV Information									
				Surrogate Used	Test Species	Soil Solution Concentration (mg/L)	Exposure Duration	Study Endpoint	Effects	Comments	Reference	Uncertainty Factor	Final Benchmark (mg/L)
Lead	7439921	Lead, Total	X	--	--	--	--	--	--	Efroymson et al. 1997 did not indicate which study used to develop 0.02 mg/L.	Efroymson et al. 1997b [c]	--	0.02
Lead, dissolved	7439921-D	-	X	Lead	--	--	--	--	--	Efroymson et al. 1997 did not indicate which study used to develop 0.02 mg/L.	Efroymson et al. 1997b [c]	--	0.02
Manganese	7439965	Manganese, Total	X	--	cotton	4	18 days	LOEC	root and leaf weight	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	4
Manganese, dissolved	7439965-D	-	X	Manganese	cotton	4	18 days	LOEC	root and leaf weight	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	4
Molybdenum	7439987	Molybdenum, Total	X	--	--	0.5	--	LOEC	plant growth	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	0.5
Molybdenum, dissolved	7439987-D	-	X	Molybdenum	--	0.5	--	LOEC	plant growth	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	0.5
Nickel	7440020	Nickel, Total	X	--	--	--	--	--	--	Efroymson et al. 1997 did not indicate which study used to develop 0.5 mg/L.	Efroymson et al. 1997b [c]	--	0.5
Nickel, dissolved	7440020-D	-	X	Nickel	--	--	--	--	--	Efroymson et al. 1997 did not indicate which study used to develop 0.5 mg/L.	Efroymson et al. 1997b [c]	--	0.5
Selenium	7782492	Selenium, Total	X	--	bush bean	0.79	--	LOEC	root weight	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	0.7
Selenium, dissolved	7782492-D	-	X	Selenium	bush bean	0.79	--	LOEC	root weight	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	0.7
Silica, dissolved	7631869-D	-	X	--	--	--	--	--	--	--	--	--	--
Silver	7440224	Silver, Total	X	--	bush bean	0.17	13 days	LOEC	leaf weight	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	0.1
Strontium	7440246	Strontium, Total	X	--	--	--	--	--	--	--	--	--	--
Strontium, dissolved	7440246-D	-	X	--	--	--	--	--	--	--	--	--	--
Thallium	7440280	Thallium, Total	X	--	spruce	0.02	7 days	LOEC	root length	Final low TRV based on screening benchmark in Section 3.1.26 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	0.02
Thallium, dissolved	7440280-D	-	X	Thallium	spruce	0.02	7 days	LOEC	root length	Final low TRV based on screening benchmark in Section 3.1.26 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	0.02
Vanadium	7440622	Vanadium, Total	X	--	lettuce	0.2	45 days	LOEC	plant weight	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	0.2
Vanadium, dissolved	7440622-D	-	X	Vanadium	lettuce	0.2	45 days	LOEC	plant weight	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	0.2
Zinc	7440666	Zinc, Total	X	--	clover, barrel medic and lucene	0.41	46 days	LOEC	plant weight	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	0.4
Zinc, dissolved	7440666-D	-	X	Zinc	clover, barrel medic and lucene	0.41	46 days	LOEC	plant weight	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	0.4
Energetic Constituents													
Perchlorate	14797730	-	X	--	--	--	--	--	--	--	--	--	--

Table 11-7
Summary of Selected Solution-based Benchmarks for Terrestrial Plants

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Ephemeral Surface Water, Seeps and Springs or Near-Surface Groundwater [a, b]	TRV Information									
				Surrogate Used	Test Species	Soil Solution Concentration (mg/L)	Exposure Duration	Study Endpoint	Effects	Comments	Reference	Uncertainty Factor	Final Benchmark (mg/L)
Volatile Organic Compounds													
1,1,1-Trichloroethane	71556	-	X	--	lettuce	104	--	EC50	growth	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	100
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	Freon 113	X	--	--	--	--	--	--	--	--	--	--
1,1,2-Trichloroethane	79005	-	X	1,1,1-Trichloroethane	lettuce	104	--	EC50	growth	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	100
1,1-Dichloroethane	75343	-	X	1,1,1-Trichloroethane	lettuce	104	--	EC50	growth	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	100
1,1-Dichloroethene	75354	-	X	1,1,1-Trichloroethane	lettuce	104	--	EC50	growth	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	100
1,2,3-Trichloropropane	96184	-	X	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	95501	o-Dichlorobenzene	X	--	--	--	--	--	--	--	--	--	--
1,2-Dichloroethane	107062	-	X	1,1,1-Trichloroethane	lettuce	104	--	EC50	growth	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	100
1,2-Dichloroethene	540590	1,2-Dichloroethenes	X	1,1,1-Trichloroethane	lettuce	104	--	EC50	growth	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	100
1,4-Dichlorobenzene	106467	p-Dichlorobenzene	X	--	--	--	--	--	--	--	--	--	--
2,2-Dichloro-1,1,1-trifluoroethane	306832	Freon 123	X	--	--	--	--	--	--	--	--	--	--
2-Nitrophenol	88755	o-Nitrophenol	X	4-Nitrophenol	chinese cabbage	12.3	21 days	LOEC	root length	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	10
3-Chloro-2(Chloromethyl)-1-Propene	1871574	-	X	--	--	--	--	--	--	--	--	--	--
Acetone	67641	-	X	--	--	--	--	--	--	--	--	--	--
Benzene	71432	-	X	--	--	--	--	--	--	--	--	--	--
Biphenyl	92524	1,1'-Biphenyl	X	--	lettuce	2.1	16 days	EC50	fresh weight shoot	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	2
bis(2-Chloroethyl) ether	111444	s-Dichloroethylether	X	--	--	--	--	--	--	--	--	--	--
Bromide	24959679	-	X	--	--	--	--	--	--	--	--	--	--
Bromodichloromethane	75274	-	X	--	--	--	--	--	--	--	--	--	--
Bromomethane	74839	-	X	--	--	--	--	--	--	--	--	--	--
Carbon Disulfide	75150	-	X	--	--	--	--	--	--	--	--	--	--
Carbon Tetrachloride	56235	-	X	--	--	--	--	--	--	--	--	--	--
Chloroform	67663	Trichloromethane	X	--	--	--	--	--	--	--	--	--	--
Chloromethane	74873	Methyl chloride	X	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	156592	cis-1,2-Dichloroethylene	X	1,1,1-Trichloroethane	lettuce	104	--	EC50	growth	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	100
Dichlorodifluoromethane	75718	Freon 12	X	--	--	--	--	--	--	--	--	--	--
Diphenyl ether	101848	-	X	--	--	--	--	--	--	--	--	--	--

Table 11-7
Summary of Selected Solution-based Benchmarks for Terrestrial Plants

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Ephemeral Surface Water, Seeps and Springs or Near-Surface Groundwater [a, b]	TRV Information									
				Surrogate Used	Test Species	Soil Solution Concentration (mg/L)	Exposure Duration	Study Endpoint	Effects	Comments	Reference	Uncertainty Factor	Final Benchmark (mg/L)
Methyl ethyl ketone	78933	2-Butanone	X	--	--	--	--	--	--	--	--	--	--
Methyl sulfide	75183	-	X	--	--	--	--	--	--	--	--	--	--
Methylene chloride	75092	Dichloromethane	X	--	--	--	--	--	--	--	--	--	--
m-Xylene & p-Xylene	136777612	meta- and para-Xylenes	X	Total xylenes	sugar beet	100	2 days	LOEC	root length	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	100
n-Hexane	110543	-	X	--	--	--	--	--	--	--	--	--	--
Nitrobenzene	98953	-	X	--	autumn olive	8	2 days	LOEC	photosynthesis, transpiration	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	8
Tetrachloroethene	127184	-	X	--	lettuce	12	--	EC50	growth	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	10
Toluene	108883	Toluol	X	--	lettuce	16	16 days	EC50	fresh weight shoot	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	10
trans-1,2-Dichloroethene	156605	-	X	1,1,1-Trichloroethane	lettuce	104	--	EC50	growth	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	100
Trichloroethene	79016	Trichloroethylene (TCE)	X	Tetrachloroethene	lettuce	12	--	EC50	growth	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	10
Trichlorofluoromethane	75694	-	X	--	--	--	--	--	--	--	--	--	--
Vinyl chloride	75014	-	X	--	--	--	--	--	--	--	--	--	--
Xylenes, Total	1330207	Xylene (Total) Isomers	X	--	sugar beet	100	2 days	LOEC	root length	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	100
Semi-Volatile Organic Compounds													
1,4-Dioxane	123911	-	X	--	--	--	--	--	--	--	--	--	--
2,4,6-Trichlorophenol	88062	-	X	--	chinese cabbage	12.7	21 days	LOEC	root length	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	10
2-n-Butoxyethanol	111762	Butoxycellosolve	X	--	--	--	--	--	--	--	--	--	--
4-Nitrophenol	100027	-	X	--	chinese cabbage	12.3	21 days	LOEC	root length	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	10
bis(2-Chloroethoxy)methane	111911	-	X	--	--	--	--	--	--	--	--	--	--
bis(2-Ethylhexyl) phthalate	117817	bis(2-ethylhexyl)phthalate	X	Diethyl phthalate	lettuce	25	--	EC50	growth	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	20
Bromoform	75252	-	X	--	--	--	--	--	--	--	--	--	--
Dibenzyl Ether	103504	-	X	--	--	--	--	--	--	--	--	--	--
Dibromochloromethane	124481	-	X	--	--	--	--	--	--	--	--	--	--
Diethyl phthalate	84662	-	X	--	lettuce	25	--	EC50	growth	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	20
Di-n-butyl phthalate	84742	Di-n-butylphthalate	X	Diethyl phthalate	lettuce	25	--	EC50	growth	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	20
Di-n-octyl phthalate	117840	Di-n-octyl-phthalate	X	Diethyl phthalate	lettuce	25	--	EC50	growth	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	20
Formaldehyde	50000	-	X	--	--	--	--	--	--	--	--	--	--

Table 11-7
Summary of Selected Solution-based Benchmarks for Terrestrial Plants

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Ephemeral Surface Water, Seeps and Springs or Near-Surface Groundwater [a, b]	TRV Information									
				Surrogate Used	Test Species	Soil Solution Concentration (mg/L)	Exposure Duration	Study Endpoint	Effects	Comments	Reference	Uncertainty Factor	Final Benchmark (mg/L)
Isopropanol	67630	Isopropyl alcohol	X	--	--	--	--	--	--	--	--	--	--
n-Nitrosodimethylamine	62759	Nitrosodimethyl amine	X	--	--	--	--	--	--	--	--	--	--
n-Nitrosodi-n-propylamine	621647	n-Nitrosodipropyl amine	X	--	--	--	--	--	--	--	--	--	--
n-Nitrosodiphenylamine	86306	-	X	--	--	--	--	--	--	--	--	--	--
Pentachlorophenol	87865	PCP	X	--	lettuce	0.03	16 days	EC50	fresh weight shoot	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	0.03
Phenol	108952	Total Phenols	X	--	lettuce	14	16 days	EC50	fresh weight shoot	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	10
Tetramethylurea	632224	-	X	--	--	--	--	--	--	--	--	--	--
Polynuclear Aromatic Hydrocarbons													
Naphthalene	91203	-	X	--	lettuce	13	16 days	EC50	growth	Final low TRV based on screening benchmark in Table 1 of Efroymson et al. 1997.	Efroymson et al. 1997b [c]	--	10
Pesticides													
4,4'-DDD	72548	p,p'-DDD	X	--	--	--	--	--	--	--	--	--	--
4,4'-DDE	72559	p,p'-DDE	X	--	--	--	--	--	--	--	--	--	--
4,4'-DDT	50293	p,p'-DDT	X	--	--	--	--	--	--	--	--	--	--
Aldrin	309002	-	X	--	--	--	--	--	--	--	--	--	--
alpha-BHC	319846	a-Benzene Hexachloride	X	--	--	--	--	--	--	--	--	--	--
beta-BHC	319857	b-Benzene Hexachloride	X	--	--	--	--	--	--	--	--	--	--
delta-BHC	319868	d-Benzene Hexachloride	X	--	--	--	--	--	--	--	--	--	--
Dieldrin	60571	-	X	--	--	--	--	--	--	--	--	--	--
Endosulfan I	959988	-	X	--	--	--	--	--	--	--	--	--	--
Endosulfan II	33213659	-	X	--	--	--	--	--	--	--	--	--	--
Endosulfan sulfate	1031078	-	X	--	--	--	--	--	--	--	--	--	--
Endrin	72208	-	X	--	--	--	--	--	--	--	--	--	--
Endrin aldehyde	7421934	-	X	--	--	--	--	--	--	--	--	--	--
gamma-BHC	58899	Lindane	X	--	--	--	--	--	--	--	--	--	--
Heptachlor	76448	-	X	--	--	--	--	--	--	--	--	--	--
Herbicides													
2,4-Dichlorophenoxyacetic Acid (2,4-D)	94757	-	X	--	--	--	--	--	--	--	--	--	--
Dinoseb	88857	-	X	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons													
TPH-Diesel Range Organics (DRO)	DRO	Diesel	X	--	--	--	--	--	--	--	--	--	--
TPH-Kerosene Range Organics (KRO)	KRO	Kerosene	X	--	--	--	--	--	--	--	--	--	--
PCDD/PCDFs [d]													
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	35822469	1,2,3,4,6,7,8-HpCDD	X	--	--	--	--	--	--	--	--	--	--
Octachlorodibenzofuran	39001020	OCDF	X	--	--	--	--	--	--	--	--	--	--
Octachlorodibenzo-p-dioxin	3268879	-	X	--	--	--	--	--	--	--	--	--	--

Table 11-7
Summary of Selected Solution-based Benchmarks for Terrestrial Plants

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Ephemeral Surface Water, Seeps and Springs or Near-Surface Groundwater [a, b]	TRV Information									
				Surrogate Used	Test Species	Soil Solution Concentration (mg/L)	Exposure Duration	Study Endpoint	Effects	Comments	Reference	Uncertainty Factor	Final Benchmark (mg/L)
Chemical Parameters													
Ammonia-N	7664417	Nitrogen, as Ammonia	X	--	--	--	--	--	--	--	--	--	--
Chloride	16887006	-	X	--	--	--	--	--	--	--	--	--	--
Nitrate	NO3N	-	X	--	--	--	--	--	--	--	--	--	--
Sulfate	14808798	-	X	--	--	--	--	--	--	--	--	--	--

Notes:

[a] Chemicals detected in Groups 4 (Coca only), 6 (SRE only), 1B, 5, 10, 3 (WCT only), and 9 (Silvernale only) surface water.

[b] Chemicals detected in site wide near-surface groundwater, seeps, and springs.

[c] Indicates reference is a secondary or compilation source.

[d] Dioxins/furans for terrestrial plants exposed to chemicals in ephemeral surface water, seeps and springs, and near-surface ground water will be evaluated by the individual congeners. No TEQ will be calculated because no applicable toxic equivalence factors are available for terrestrial plants.

Indicates final TRV

-- not available, could not be located, or not applicable.

DDD = dichlorodiphenyldichloroethane
DDE = dichlorodiphenyldichloroethylene
DDT = dichlorodiphenyltrichloroethane
EC50 - effective concentration where 50% of test population shows effect being measures
LOEC - lowest observed effect concentration
Low TRV - no effect toxicity reference value
mg/L - milligrams per liter
PCDD/PCDF - polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans
X - Analyte was detected in the indicated medium

Table 11-8
Summary of Selected Toxicity Reference Values for Avian Receptors

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil or Ephemeral Sediment [a]	Chemicals Detected in Surface Water or Seeps and Springs [b]	Surrogate Used	Derivation of Low TRV														Derivation of High TRV												
						Toxicity Information									Conversion Factors					Toxicity Information									Conversion Factors			
						Test Species	Exposure Duration	Toxicity Value (mg/kg-d)	Study Endpoint	Type	Effects	Comments	Primary Source	Citation	Acute LD50 to chronic NOAEL UF	LOAEL to NOAEL UF	Subchronic-to-Chronic UF	2005 WHO TEF	Final Low TRV (mg/kg-d)	Test Species	Exposure Duration	Toxicity Value (mg/kg-d)	Study Endpoint	Type	Effects	Comments	Primary Source	Citation	LD50 to LOAEL UF	Subchronic to Chronic UF	2005 WHO TEF	Final High TRV (mg/kg-d)
Inorganic Compounds																																
Aluminum	7429905	Aluminum, Total	X	X	--	Ringed Dove	4 months	109.7	NOAEL	chronic	Reproduction	during critical lifestage	Carriere et al., 1986	Sample et al., 1996 [c]	1	1	1	--	109.7	--	--	--	--	--	--	--	--	--	--	--	--	--
Aluminum, dissolved	7429905-D	-		X	Aluminum	Ringed Dove	4 months	109.7	NOAEL	chronic	Reproduction	during critical lifestage	Carriere et al., 1986	Sample et al., 1996 [c]	1	1	1	--	109.7	--	--	--	--	--	--	--	--	--	--	--	--	--
Antimony	7440360	Antimony, Total	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Antimony, dissolved	7440360-D	-		X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Arsenic	7440382	Arsenic, Total	X	X	--	Mallard Duck	--	5.5	Low TRV	--	Reproduction	--	Stanley et al., 1994	DTSC, 2009 [c]	1	1	1	--	5.5	Mallard Duck	--	22.0	High TRV	--	reproduction	--	Stanley et al., 1994	DTSC, 2009 [c]	1	1	--	22.0
Arsenic, dissolved	7440382-D	-		X	Arsenic	Mallard Duck	--	5.5	Low TRV	--	Reproduction	--	Stanley et al., 1994	DTSC, 2009 [c]	1	1	1	--	5.5	Mallard Duck	--	22.0	High TRV	--	reproduction	--	Stanley et al., 1994	DTSC, 2009 [c]	1	1	--	22.0
Barium	7440393	Barium, Total	X	X	--	Chicken	4 weeks	20.8	NOAEL	subchronic	Mortality	Subchronic to chronic UF applied in source	Johnson et al., 1960	Sample et al., 1996 [c]	1	1	1	--	20.8	Chicken	4 weeks	41.7	LOAEL	subchronic	mortality	Subchronic to chronic UF applied in source	Johnson et al., 1960	Sample et al., 1996 [c]	1	1	--	41.7
Barium, dissolved	7440393-D	-		X	Barium	Chicken	4 weeks	20.8	NOAEL	subchronic	Mortality	Subchronic to chronic UF applied in source	Johnson et al., 1960	Sample et al., 1996 [c]	1	1	1	--	20.8	Chicken	4 weeks	41.7	LOAEL	subchronic	mortality	Subchronic to chronic UF applied in source	Johnson et al., 1960	Sample et al., 1996 [c]	1	1	--	41.7
Beryllium	7440417	Beryllium, Total	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Beryllium, dissolved	7440417-D	-		X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Boron	7440428	Boron, Total	X	X	--	Mallard Duck	3 weeks prior, after and during reproduction	28.8	NOAEL	chronic	Reproduction - reduced egg fertility and duckling growth	during critical lifestage	Smith and Anders, 1989	Sample et al., 1996 [c]	1	1	1	--	28.8	Mallard Duck	3 weeks prior, after and during reproduction	100	LOAEL	chronic	reproduction - reduced egg fertility and duckling growth	dosing during critical lifestage	Smith and Anders, 1989	Sample et al., 1996 [c]	1	1	--	100
Boron, dissolved	7440428-D	-		X	Boron	Mallard Duck	3 weeks prior, after and during reproduction	28.8	NOAEL	chronic	Reproduction - reduced egg fertility and duckling growth	during critical lifestage	Smith and Anders, 1989	Sample et al., 1996 [c]	1	1	1	--	28.8	Mallard Duck	3 weeks prior, after and during reproduction	100	LOAEL	chronic	reproduction - reduced egg fertility and duckling growth	dosing during critical lifestage	Smith and Anders, 1989	Sample et al., 1996 [c]	1	1	--	100
Cadmium	7440439	Cadmium, Total	X	X	--	Wood Duck	--	0.7	Low TRV	--	Kidney histology	--	Mayack et al., 1981	DTSC, 2009 [c]	1	1	1	--	0.70	Mallard Duck	--	10.4	High TRV	--	Kidney histology	--	Richardson et al., 1974	DTSC, 2009 [c]	1	1	--	10.4
Cadmium, dissolved	7440439-D	-		X	Cadmium	Wood Duck	--	0.7	Low TRV	--	Kidney histology	--	Mayack et al., 1981	DTSC, 2009 [c]	1	1	1	--	0.70	Mallard Duck	--	10.4	High TRV	--	Reproductive, systemic effects	--	Richardson et al., 1974	DTSC, 2009 [c]	1	1	--	10.4
Chromium	7440473	Chromium, Total	X	X	--	Chicken, duck, turkey	various	2.66	NOAEL	--	Reproduction, growth	TRV based upon geometric mean of 12 studies selected by USEPA to derive avian Eco-SSL	--	USEPA Eco-SSLs for Chromium (USEPA, 2008) [c]	1	1	1	--	2.66	chicken/duck/ turkey	Various	16	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	--	USEPA Eco-SSLs for Chromium (USEPA, 2008) [c]	1	1	--	16
Chromium, dissolved	7440473-D	-		X	Chromium	Chicken, duck, turkey	various	2.66	NOAEL	--	Reproduction, growth	TRV based upon geometric mean of 12 studies selected by USEPA to derive avian Eco-SSL	--	USEPA Eco-SSLs for Chromium (USEPA, 2008) [c]	1	1	1	--	2.66	chicken/duck/ turkey	Various	16	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	--	USEPA Eco-SSLs for Chromium (USEPA, 2008) [c]	1	1	--	16
Cobalt	7440484	Cobalt, Total	X	X	--	Chicken and duck	Various	7.61	NOAEL	--	Growth	geometric mean of 5 studies	--	USEPA Eco-SSLs for Cobalt (USEPA, 2005d) [c]	1	1	1	--	7.61	chicken/duck	Various	18.00	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	--	USEPA Eco-SSLs for Cobalt (USEPA, 2005d) [c]	1	1	--	18
Cobalt, dissolved	7440484-D	-		X	Cobalt	Chicken and duck	Various	7.61	NOAEL	--	Growth	geometric mean of 5 studies	--	USEPA Eco-SSLs for Cobalt (USEPA, 2005d) [c]	1	1	1	--	7.61	chicken/duck	Various	18.00	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	--	USEPA Eco-SSLs for Cobalt (USEPA, 2005d) [c]	1	1	--	18
Copper	7440508	Copper, Total	X	X	--	Chicken	--	2.3	Low TRV	--	Growth	--	Norvell et al., 1975	DTSC, 2009 [c]	1	1	1	--	2.3	Chicken	--	52.3	High TRV	--	Growth, gizzard erosion	--	Jensen and Maurice, 1978	DTSC, 2009 [c]	1	1	--	52.3
Copper, dissolved	7440508-D	-		X	Copper	Chicken	--	2.3	Low TRV	--	Growth	--	Norvell et al., 1975	DTSC, 2009 [c]	1	1	1	--	2.3	Chicken	--	52.3	High TRV	--	Growth, gizzard erosion	--	Jensen and Maurice, 1978	DTSC, 2009 [c]	1	1	--	52.3
Cyanides	57125	Cyanide, Total	X	X	--	American Kestrel	--	4	LD50	acute	Mortality	--	Wiemeyer et al., 1986	USEPA SLERA Protocol (USEPA, 1999) [c]	100	1	1	--	0.040	American Kestrel	--	4	LD50	acute	Mortality	--	Wiemeyer et al., 1986	USEPA SLERA Protocol (USEPA, 1999) [c]	10	1	--	0.4
Fluoride	7782414	-	X	X	--	Screech Owl	5-6 months	7.8	NOAEL	chronic	fertility, hatching success	during critical lifestage	Pattee et al., 1988	Sample et al., 1996 [c]	1	1	1	--	7.8	Screech Owl	5-6 months	32	LOAEL	chronic	fertility and hatching success	critical lifestage	Pattee et al., 1988	Sample et al., 1996 [c]	1	1	--	32
Hexavalent Chromium	18540299	Chromium, Hexavalent	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lead	7439921	Lead, Total	X	X	--	Quail	--	0.014	Low TRV	--	Reproduction	--	Edens et al., 1967	DTSC, 2009 [c]	1	1	1	--	0.014	Chicken	--	8.75	High TRV	--	reproduction	--	Edens and Garlich,	DTSC, 2009 [c]	1	1	--	8.75
Lead, dissolved	7439921-D	-		X	Lead	Quail	--	0.014	Low TRV	--	Reproduction	--	Edens et al., 1967	DTSC, 2009 [c]	1	1	1	--	0.014	Chicken	--	8.75	High TRV	--	reproduction	--	Edens and Garlich,	DTSC, 2009 [c]	1	1	--	8.75
Lithium	7439932	Lithium, Total	X		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Manganese	7439965	Manganese, Total	X	X	--	Quail	--	77.6	Low TRV	--	Neurobehavioral	--	Laskey and Edens, 1985	DTSC, 2009 [c]	1	1	1	--	77.6	Quail	--	776	High TRV	--	Neurobehavioral	--	Laskey and Edens, 1985	DTSC, 2009 [c]	1	1	--	776
Manganese, dissolved	7439965-D	-		X	Manganese	Quail	--	77.6	Low TRV	--	Neurobehavioral	--	Laskey and Edens, 1985	DTSC, 2009 [c]	1	1	1	--	77.6	Quail	--	776	High TRV	--	Neurobehavioral	--	Laskey and Edens, 1985	DTSC, 2009 [c]	1	1	--	776
Mercury	7439976	Mercury, Total	X	X	--	Japanese Quail	1 year	0.45	NOAEL	chronic	reproduction - decreased fertility/hatchability	--	Hill and Schaffner, 1976	Sample et al., 1996 [c]	1	1	1	--	0.45	Japanese Quail	1 year	0.9	LOAEL	chronic	reproduction - decreased fertility/hatchability	--	Hill and Schaffner, 1976	Sample et al., 1996 [c]	1	1	--	0.9
Mercury, dissolved	7439976-D	-		X	--	Japanese Quail	1 year	0.45	NOAEL	chronic	reproduction - decreased fertility/hatchability	--	Hill and Schaffner, 1976	Sample et al., 1996 [c]	1	1	1	--	0.45	Japanese Quail	1 year	0.9	LOAEL	chronic	reproductction - decreased fertility/hatchability	--	Hill and Schaffner, 1976	Sample et al., 1996 [c]	1	1	--	0.9
Methyl Mercury	22967926	-	X		--	Mallard Duck	--	0.039	Low TRV	--	Reproduction	--	USEPA, 1995	DTSC, 2009 [c]	1	1	1	--	0.039	Mallard Duck	--	0.18	High TRV	--	mortality, neurological	--	USEPA, 1995	DTSC, 2009 [c]	1	1	--	0.18
Molybdenum	7439987	Molybdenum, Total	X	X	--	Chicken	21 days	3.5	NOAEL	chronic	reproduction - embryonic viability	during critical lifestage	Lepore and Miller, 1965	Sample et al., 1996 [c]	1	1	1	--	3.5	Chicken	21 days	35.3	LOAEL	chronic	reproduction - embryonic viability	critical lifestage	Lepore and Miller, 1965	Sample et al., 1996 [c]	1	1	--	35.3
Molybdenum, dissolved	7439987-D	-		X	Molybdenum	Chicken	21 days	3.5	NOAEL	chronic	reproduction - embryonic viability	during critical lifestage	Lepore and Miller, 1965	Sample et al., 1996 [c]	1	1	1	--	3.5	Chicken	21 days	35.3	LOAEL	chronic	reproduction - embryonic viability	critical lifestage	Lepore and Miller, 1965	Sample et al., 1996 [c]	1	1	--	35.3
Nickel	7440020	Nickel, Total	X	X	--	Mallard Duck	--	1.38	Low TRV	--	Growth	--	Cain and Pafford, 1981	DTSC, 2009 [c]	1	1	1	--	1.38	Mallard Duck	--	56.3	High TRV	--	Growth	--	Cain and Pafford, 1981	DTSC, 2009 [c]	1	1	--	56.3
Nickel, dissolved	7440020-D	-		X	Nickel	Mallard Duck	--	1.38	Low TRV	--	Growth	--	Cain and Pafford, 1981	DTSC, 2009 [c]	1	1	1	--	1.38	Mallard Duck	--	56.3	High TRV	--	Growth	--	Cain and Pafford, 1981	DTSC, 2009 [c]	1	1	--	56.3
Selenium	7782492	Selenium, Total	X	X	--	Mallard Duck	--	0.23	Low TRV	--	Reproduction	--	Heinz et al., 1989	DTSC, 2009 [c]	1	1	1	--	0.23	Mallard Duck	--	0.93	High TRV	--	reproduction	--	Heinz et al., 1989	DTSC, 2009 [c]	1	1	--	0.93
Selenium, dissolved	7782492-D	-		X	Selenium	Mallard Duck	--	0.23	Low TRV	--	Reproduction	--	Heinz et al., 1989	DTSC, 2009 [c]	1	1	1	--	0.23	Mallard Duck	--	0.93	High TRV	--	reproduction	--	Heinz et al., 1989	DTSC, 2009 [c]	1	1	--	0.93
Silica, Dissolved	7631869-D	-		X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Silver	7440224	Silver, Total	X	X	--	Turkey	5 weeks	20.2	LOAEL	subchronic	Growth	--	Jensen et al., 1974	USEPA Eco-SSLs for Silver (USEPA, 2006) [c]	1	5	2	--	2.02	Turkey/chick en	Various	60	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	--	USEPA Eco-SSLs for Silver (USEPA, 2006) [c]	1	1	--	60
Silver, dissolved	7440224-D	-		X	Silver	Turkey	5 weeks	20.2	LOAEL	subchronic	Growth	--	Jensen et al., 1974	USEPA Eco-SSLs for Silver (USEPA, 2006) [c]	1	5	2	--	2.02	Turkey/chick en	Various	60	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	--	USEPA Eco-SSLs for Silver (USEPA, 2006) [c]	1	1	--	60
Strontium	7440246	Strontium, Total	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Strontium, dissolved	7440246-D	-		X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Thallium	7440280	Thallium, Total	X	X	Thallium sulfate	Starling	--	34.6	LD_{50}	acute	Mortality	No study duration was provided	Schafer, 1972	Schafer et al., 1983 [c]	100	1	1	--	0.346	Starling	--	34.6	LD_{50}	acute	Mortality	No study duration was provided	Schafer, 1972	Schafer et al., 1983 [c]	10	1	--	3.46

Table 11-8
Summary of Selected Toxicity Reference Values for Avian Receptors

						Derivation of Low TRV														Derivation of High TRV												
						Toxicity Information								Conversion Factors						Toxicity Information									Conversion Factors			
Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil or Ephemeral Sediment [a]	Chemicals Detected in Surface Water or Seeps and Springs [b]	Surrogate Used	Test Species	Exposure Duration	Toxicity Value (mg/kg-d)	Study Endpoint	Type	Effects	Comments	Primary Source	Citation	Acute LD50 to chronic NOAEL UF	LOAEL to NOAEL UF	Subchronic-to-Chronic UF	2005 WHO TEF	Final Low TRV (mg/kg-d)	Test Species	Exposure Duration	Toxicity Value (mg/kg-d)	Study Endpoint	Type	Effects	Comments	Primary Source	Citation	LD50 to LOAEL UF	Subchronic to Chronic UF	2005 WHO TEF	Final High TRV (mg/kg-d)
Thallium, dissolved	7440280-D	-		X	Thallium sulfate	Starling	--	34.6	LD_{50}	acute	Mortality	No study duration was provided	Schafer, 1972	Schafer et al., 1983 [c]	100	1	1	--	0.346	Starling	--	34.6	LD_{50}	acute	Mortality	No study duration was provided	Schafer, 1972	Schafer et al., 1983 [c]	10	1	--	3.46
Tin	7440315	Tin, Total	X		--	Japanese Quail	6 weeks	6.8	NOAEL	Chronic	Reproduction	critical lifestage	Schlatterer et al., 1993	Sample et al., 1996 [c]	1	1	1	--	6.8	Japanese Quail	6 weeks	16.9	LOAEL	chronic	reproduction	critical lifestage	Schlatterer et al., 1993	Sample et al., 1996 [c]	1	1	--	16.9
Titanium	7440326	Titanium, Total	X	X	Titanium dioxide	Red-Winged Blackbird	--	100	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	100	1	1	--	1.0	Red-Winged Blackbird	--	100	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	10	1	--	10
Titanium, dissolved	7440326-D	-		X	Titanium dioxide	Red-Winged Blackbird	--	100	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	100	1	1	--	1.0	Red-Winged Blackbird	--	100	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	10	1	--	10
Vanadium	7440622	Vanadium, Total	X	X	--	Chicken	5 weeks	0.344	NOAEL	subchronic	Growth	--	Hill, 1979	USEPA Eco-SSLs for Vanadium (USEPA, 2005a) [c]	1	1	1	--	0.344	chicken/quail	Various	1.7	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	--	USEPA Eco-SSLs for Vanadium (USEPA, 2005a) [c]	1	1	--	1.7
Vanadium, dissolved	7440622-D	-		X	Vanadium	Chicken	5 weeks	0.344	NOAEL	subchronic	Growth	--	Hill, 1979	USEPA Eco-SSLs for Vanadium (USEPA, 2005a) [c]	1	1	1	--	0.344	chicken/quail	Various	1.7	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	--	USEPA Eco-SSLs for Vanadium (USEPA, 2005a) [c]	1	1	--	1.7
Zinc	7440666	Zinc, Total	X	X	--	Mallard Duck	--	17.2	Low TRV	--	Growth, reproduction, multiple organs	--	Gasaway and Buss, 1972	DTSC, 2009 [c]	1	1	1	--	17.2	Mallard Duck	--	172	High TRV	--	Growth, reproduction, multiple organs	--	Gasaway and Buss, 1972	DTSC, 2009 [c]	1	1	--	172
Zinc, dissolved	7440666-D	-		X	Zinc	Mallard Duck	--	17.2	Low TRV	--	Growth, reproduction, multiple organs	--	Gasaway and Buss, 1972	DTSC, 2009 [c]	1	1	1	--	17.2	Mallard Duck	--	172	High TRV	--	Growth, reproduction, multiple organs	--	Gasaway and Buss, 1972	DTSC, 2009 [c]	1	1	--	172
Zirconium	7440677	Zirconium, Total	X		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Energetic Constituents																																
1,2-Dinitrobenzene	528290	o-Dinitrobenzene	X		1,3-Dinitrobenzene	Red-Winged Blackbird	--	42.2	LD_{50}	acute	Mortality	No study duration was provided	Schafer, 1972	Schafer et al., 1983 [c]	100	1	1	--	0.42	Red-Winged Blackbird	--	42.2	LD_{50}	acute	Mortality	No study duration was provided	Schafer, 1972	Schafer et al., 1983 [c]	10	1	--	4.22
1,2-Diphenylhydrazine	122667	-		X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dinitrobenzene	99650	m-Dinitrobenzene	X		--	Red-Winged Blackbird	--	42.2	LD_{50}	acute	Mortality	--	Schafer, 1972	Schafer et al., 1983 [c]	100	1	1	--	0.42	Red-Winged Blackbird	--	42.2	LD50	acute	Mortality	--	Schafer, 1972	Schafer et al., 1983 [c]	10	1	--	4.2
2,4,6-Trinitrotoluene	118967	-	X		--	Northern Bob White	90 days	0.07	NOAEL	subchronic	Mortality	(UF) of 100 was applied to account for interspecific UFs applied in source: variability (UF of 10) and to extrapolate from a single subchronic study (UF of 10).	--	USACHPPM, 2001 [c]	1	1	1	--	0.070	Northern Bob White	90 days	1.8	LOAEL	subchronic	Mortality	UF applied in source.	--	USACHPPM, 2001 [c]	1	1	--	1.8
2,4-Dinitrotoluene	121142	-		X	--	Northern Bob White	60 days	0.01	NOAEL	subchronic	Increases in relative kidney weight, plasma uric acid trends.	UF of 10 applied in source for subchronic to chronic; UF of 10 applied in source for species differences	Johnson et al., 2005	USACHPPM, 2006 [c]	1	1	1	--	0.010	Northern Bob White	60 days	1.3	LOAEL	subchronic	Increases in relative kidney weight, plasma uric acid trends.	UF of 4 applied in source for subchronic to chronic	Johnson et al., 2005	USACHPPM, 2006 [c]	1	1	--	1.3
2-Amino-4,6-Dinitrotoluene	35572782	-	X		2,4-Dinitrotoluene	Northern Bob White	60 days	0.01	NOAEL	subchronic	Increases in relative kidney weight, plasma uric acid trends.	UF of 10 applied in source for subchronic to chronic; UF of 10 applied in source for species differences	Johnson et al., 2005	USACHPPM, 2006 c	1	1	1	--	0.010	Northern Bob White	60 days	1.3	LOAEL	subchronic	Increases in relative kidney weight, plasma uric acid trends.	UF of 4 applied in source for subchronic to chronic	Johnson et al., 2005	USACHPPM, 2006 c	1	1	--	1.3
HMX	2691410	-	X		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hydrazine	302012	-	X		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Monomethylhydrazine	60344	-	X		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Perchlorate	14797730	-	X	X	--	Bob White Quail	8 weeks	13	NOAEL	subchronic	Decreased tibia length	UF of 10 applied to 130 mg/kg-d since only one species from a single taxonomic order are represented in study selected to derive the recommended TRV-low value.	McNabb et al., 2004	USACHPPM, 2007 [c]	1	1	1	--	13	Bob White Quail	8 weeks	26	LOAEL	subchronic	decreased tibia length	UF of 10 applied to 261 mg/kg-d since only one species froma single taxonomic order are represented in study selected to derive the recommended TRV-low value.	McNabb et al., 2004	USACHPPM, 2007 [c]	1	1	--	26
RDX	121824	-	X		--	Northern Bob White	14-d	3.65	NOAEL	chronic	decrease egg production	TRVs derived using the Benchmark dose approach/consensus based value; during critical lifestage	Gogal et al., 2001	USACHPPM, 2002 [c]	1	1	1	--	3.65	Northern Bob White	14-d	8.14	LOAEL	chronic	decrease egg production	TRVs derived using the Benchmark dose approach/consensus based value; during critical lifestage	Gogal et al., 2001	USACHPPM, 2002 [c]	1	1	--	8.14
Volatile Organic Compounds																																
1,1,1,2-Tetrachloroethane	630206	-	X		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,1-Trichloroethane	71556	-	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	79345	-	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	Freon 113	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2-Trichloroethane	79005	-	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	75343	-	X	X	1,2 Dichloroethane	Chicken	2 year	17.2	NOAEL	chronic	reproduction - egg production	--	Alumot et al., 1976	Sample et al., 1996 [c]	1	1	1	--	17.2	Chicken	2 years	34.4	LOAEL	chronic	reproduction - egg production	--	Alumot et al., 1976	Sample et al., 1996 [c]	1	1	--	34.4
1,1-Dichloroethene	75354	-	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,3-Trichlorobenzene	87616	-	X		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,4-Trichlorobenzene	120821	-	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,4-Trimethylbenzene	95636	-	X		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dibromoethane	106934	-	X		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	95501	o-Dichlorobenzene	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloroethane	107062	-	X	X	--	Chicken	2 year	17.2	NOAEL	chronic	reproduction - egg production	--	Alumot et al., 1976	Sample et al., 1996 [c]	1	1	1	--	17.2	Chicken	2 years	34.4	LOAEL	chronic	reproduction - egg production	--	Alumot et al., 1976	Sample et al., 1996 [c]	1	1	--	34.4
1,2-Dichloroethene	540590	1,2-Dichloroethenes	X		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloropropane	78875	-	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3,5-Trimethylbenzene	108678	-	X		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	541731	m-Dichlorobenzene	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	106467	p-Dichlorobenzene	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Chloroethylvinyl ether	110758	2-Chloroethyl vinyl ether	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Chloronaphthalene	91587	-		X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Chlorophenol	95578	-		X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 11-8
Summary of Selected Toxicity Reference Values for Avian Receptors

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil or Ephemeral Sediment [a]	Chemicals Detected in Surface Water or Seeps and Springs [b]	Surrogate Used	Derivation of Low TRV														Derivation of High TRV												
						Toxicity Information									Conversion Factors					Toxicity Information									Conversion Factors			
						Test Species	Exposure Duration	Toxicity Value (mg/kg-d)	Study Endpoint	Type	Effects	Comments	Primary Source	Citation	Acute LD50 to chronic NOAEL UF	LOAEL to NOAEL UF	Subchronic-to-Chronic UF	2005 WHO TEF	Final Low TRV (mg/kg-d)	Test Species	Exposure Duration	Toxicity Value (mg/kg-d)	Study Endpoint	Type	Effects	Comments	Primary Source	Citation	LD50 to LOAEL UF	Subchronic to Chronic UF	2005 WHO TEF	Final High TRV (mg/kg-d)
2-Hexanone	591786	Methyl butyl ketone	X		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Nitrophenol	88755	o-Nitrophenol		X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acetone	67641	-	X	X	--	Japanese Quail	5 days	5464	NOAEL	acute	No overt signs of toxicity	Converted from a dose of 20000 mg/kg using a body BW of 0.04125 kg for quail (Selton & Siegel, 1974) and an average intake rate from control group and low dose group (11.27 g/day); (20000 mg/kg x 0.01127 g/day)/0.04125 kg	--	Hill and Camardese, 1986	1	1	2	--	2732	--	--	--	--	--	--	--	--	--	--	--	--	--
Acetic Acid	64197	-	X		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acrolein	107028			X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Acrylonitrile	107131			X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzene	71432	-	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
bis(2-Chloroethyl) ether	111444	s-Dichloroethylether		X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromide	24959679	-	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromobenzene	108861	-	X		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromodichloromethane	75274	-	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromomethane	74839	-	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carbon Disulfide	75150	-	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carbon Tetrachloride	56235	-	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chlorobenzene	108907	Monochlorobenzene	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroethane	75003	Ethyl chloride		X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroform	67663	Trichloromethane	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloromethane	74873	Methyl chloride	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	156592	cis-1,2-Dichloroethylene	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	10061015			X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cumene	98828	Isopropylbenzene	X		--	Red-Winged Blackbird	--	98	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	100	1	1	--	0.98	Red-Winged Blackbird	--	98	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	10	1	--	9.8
Dibenzofuran	132649	-	X		--	Red-Winged Blackbird	--	102	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	100	1	1	--	1.02	Red-Winged Blackbird	--	102	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	10	1	--	10.2
Dibromomethane	74953	-	X		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dichlorodifluoromethane	75718	Freon 12	X		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethylbenzene	100414	-	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methyl ethyl ketone	78933	2-Butanone	X		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methyl isobutyl ketone (MIBK)	108101	4-Methyl-2-pentanone	X		--	Red-Winged Blackbird	--	100	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	100	1	1	--	1.0	Red-Winged Blackbird	--	100	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	10	1	--	10
Methylene chloride	75092	Dichloromethane	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
m-Xylene	108383	meta-Xylene		X	Xylenes, Total	Japanese Quail	5 days	1452	NOAEL	acute	No overt signs of toxicity	Converted from a dose of 5000 mg/kg using a BW of 0.04125 kg for quail (Selton & Siegel, 1974) and an average intake rate from control group (11.98 g/day); (5000 mg/kg x 0.01198 g/day)/0.04125 kg	--	Hill and Camardese, 1986	1	1	2	--	726	--	--	--	--	--	--	--	--	--	--	--	--	--
m-Xylene & p-Xylene	136777612	meta- and para-Xylenes	X	X	Xylenes, Total	Japanese Quail	5 days	1452	NOAEL	acute	No overt signs of toxicity	Converted from a dose of 5000 mg/kg using a BW of 0.04125 kg for quail (Selton & Siegel, 1974) and an average intake rate from control group (11.98 g/day); (5000 mg/kg x 0.01198 g/day)/0.04125 kg	--	Hill and Camardese, 1986	1	1	2	--	726	--	--	--	--	--	--	--	--	--	--	--	--	--
n-Butylbenzene	104518	-	X		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrobenzene	98953	-		X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
n-Propylbenzene	103651	-	X		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
o-Chlorotoluene	95498	2-Chlorotoluene	X		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
o-Xylene	95476	-	X		Xylenes, Total	Japanese Quail	5 days	1452	NOAEL	acute	No overt signs of toxicity	Converted from a dose of 5000 mg/kg using a BW of 0.04125 kg for quail (Selton & Siegel, 1974) and an average intake rate from control group (11.98 g/day); (5000 mg/kg x 0.01198 g/day)/0.04125 kg	--	Hill and Camardese, 1986	1	1	2	--	726	--	--	--	--	--	--	--	--	--	--	--	--	--
p-Chlorotoluene	106434	4-Chlorotoluene	X		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
p-Cymene	99876	p-Isopropyltoluene	X		--	Red-Winged Blackbird	--	316	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	100	1	1	--	3.16	Red-Winged Blackbird	--	316	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	10	1	--	31.6
sec-Butylbenzene	135988	-	X		Cumene	Red-Winged Blackbird	--	98	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	100	1	1	--	0.98	Red-Winged Blackbird	--	98	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	10	1	--	9.8
Styrene	100425	Vinylbenzene	X		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
tert-Butylbenzene	98066	-	X		Cumene	Red-Winged Blackbird	--	98	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	100	1	1	--	0.98	Red-Winged Blackbird	--	98	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	10	1	--	9.8

Table 11-8
Summary of Selected Toxicity Reference Values for Avian Receptors

						Derivation of Low TRV														Derivation of High TRV												
						Toxicity Information									Conversion Factors					Toxicity Information									Conversion Factors			
Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil or Ephemeral Sediment [a]	Chemicals Detected in Surface Water or Seeps and Springs [b]	Surrogate Used	Test Species	Exposure Duration	Toxicity Value (mg/kg-d)	Study Endpoint	Type	Effects	Comments	Primary Source	Citation	Acute LD50 to chronic NOAEL UF	LOAEL to NOAEL UF	Subchronic-to-Chronic UF	2005 WHO TEF	Final Low TRV (mg/kg-d)	Test Species	Exposure Duration	Toxicity Value (mg/kg-d)	Study Endpoint	Type	Effects	Comments	Primary Source	Citation	LD50 to LOAEL UF	Subchronic to Chronic UF	2005 WHO TEF	Final High TRV (mg/kg-d)
Tetralin	119642	-	X		Naphthalene	Mallard Duck	7 months	208	LOAEL	chronic	Increased liver weight and blood flow to liver	Converted from a dose of 4,000 mg/kg using an ingestion rate of 52 g/day (Nagy 2001) and an average BW of 1,000 g.	--	Patton and Dieter, 1980	1	5	1	--	41.6	Mallard Duck	--	208	LOAEL	chronic	increased liver weight and blood flow to liver	Converted from a dose of 4,000 mg/kg using an ingestion rate of 52 g/day (Nagy 2001) and an average BW of 1,000 g.	--	Patton and Dieter, 1980	1	1	--	208
Tetrachloroethene	127184	-	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Toluene	108883	Toluol	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
trans-1,2-Dichloroethene	156605	-	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
trans-1,3-Dichloropropene	10061026	-		X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichloroethene	79016	Trichloroethylene (TCE)	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichlorofluoromethane	75694	-	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vinyl chloride	75014	-	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Xylenes, Total	1330207	Xylene (Total) Isomers	X	X	--	Japanese Quail	5 days	1452	NOAEL	acute	No overt signs of toxicity	Converted from a dose of 5000 mg/kg using a BW of 0.04125 kg for quail (Selton & Siegel, 1974) and an average intake rate from control group (11.98 g/day); (5000 mg/kg x 0.01198 g/day)/0.04125 kg	--	Hill and Camardese, 1986	1	1	2	--	726	--	--	--	--	--	--	--	--	--	--	--	--	--
Semi-Volatile Organic Compounds																		--														
1,1-Dimethylhydrazine	57147	-	X		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dibromo-3-chloropropane	96128	1,2-Dibromo-3-CPA	X		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,4-Dioxane	123911	-	X		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4,5-Trichlorophenol	95954	-	X		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4,6-Trichlorophenol	88062	-	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-Dichlorophenol	120832			X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-Dimethylphenol	105679	-	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-Dinitrophenol	51285			X	--	Red-Winged Blackbird	--	13.3	LD_{50}	acute	Mortality	--	Schafer, 1972	Schafer et al., 1983 [c]	100	1	1	--	0.13	Red-Winged Blackbird	--	13.3	LD_{50}	acute	Mortality	--	Schafer, 1972	Schafer et al., 1983 [c]	10	1	--	1.33
2,6-Dinitrotoluene	606202	-		X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
3,3'-Dichlorobenzidine	91941	-		X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
3,5-Dimethylphenol	108689	-	X		--	Red-Winged Blackbird	--	113	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	100	1	1	--	1.13	Red-Winged Blackbird	--	113	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	10	1	--	11.3
4,6-Dinitro-o-cresol	534521	4,6-Dinitro-2-Methylphenol		X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Bromophenyl phenyl ether	101553			X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Chlorophenylphenyl ether	7005723			X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Nitrophenol	100027	-		X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzidine	92875	-		X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzoic acid	65850	-	X		--	Red-Winged Blackbird	--	100	LD_{50}	acute	Mortality	No study duration was provided	Schafer, 1972	Schafer et al., 1983 [c]	100	1	1	--	1.0	Red-Winged Blackbird	--	100	LD_{50}	acute	Mortality	No study duration was provided	Schafer, 1972	Schafer et al., 1983 [c]	10	1	--	10
Benzyl alcohol	100516	-	X		Benzoic acid	Red-Winged Blackbird	--	100	LD_{50}	acute	Mortality	No study duration was provided	Schafer, 1972	Schafer et al., 1983 [c]	100	1	1	--	1.0	Red-Winged Blackbird	--	100	LD_{50}	acute	Mortality	No study duration was provided	Schafer, 1972	Schafer et al., 1983 [c]	10	1	--	10
bis(2-Chloroethoxy)methane	111911	-		X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
bis(2-Chloroisopropyl)ether	39638329	-		X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
bis(2-Ethylhexyl) phthalate	117817	bis(2-ethylhexyl)phthalate	X	X	--	Ringed dove	4 weeks	1.1	NOAEL	chronic	No significant reproductive effects	during critical lifestage	Peakall, 1974	Sample et al., 1996 [c]	1	1	1	--	1.1	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromoform	75252	-	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Butyl benzyl phthalate	85687	-	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carbazole	86748	-	X		anthracene	Red-Winged Blackbird	--	111	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	100	1	1	--	1.11	Red-Winged Blackbird	--	111	LD50	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	10	1	--	11.1
Dibromochloromethane	124481	-	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Diethyl phthalate	84662	-	X	X	Dimethyl phthalate	Red-Winged Blackbird	--	100	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	100	1	1	--	1.0	Red-Winged Blackbird	--	100	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	10	1	--	10
Dimethyl phthalate	131113	-	X	X	--	Red-Winged Blackbird	--	100	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	100	1	1	--	1.0	Red-Winged Blackbird	--	100	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	10	1	--	10
Di-n-butyl phthalate	84742	Di-n-butylphthalate	X	X	--	Ringed dove	4 weeks	0.11	NOAEL	chronic	reproductive - eggshell thickness and permeability	during critical lifestage	Peakall, 1974	Sample et al., 1996 [c]	1	1	1	--	0.11	Ringed dove	4 weeks	1.1	LOAEL	chronic	reproductive - eggshell thickness and permeability	critical lifestage	Peakall, 1974	Sample et al., 1996 [c]	1	1	--	1.1
Di-n-octyl phthalate	117840	Di-n-octyl-phthalate	X	X	--	Ring-Necked Pheasant	10 days	293	LD_{50}	acute	Mortality	Converted from a dose of 5000 mg/kg using a BW of 0.04125 kg for pheasant, and an intake rate of 2.42 g/d (galliformes; Nagy 2001); (5000 mg/kg x 0.00242 g/day)/0.04125 kg	--	Hill et al., 1975	100	1	1	--	2.9	Ring-Necked Pheasant	10 days	293	LD_{50}	acute	Mortality	Converted from a dose of 5000 mg/kg using a BW of 0.04125 kg for pheasant, and an intake rate of 2.42 g/d (galliformes; Nagy 2001); (5000 mg/kg x 0.00242 g/day)/0.04125 kg	--	Hill et al. 1975	10	1	--	29.3
Formaldehyde	50000	-	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hexachlorobenzene	118741			X	--	Japanese Quail	5 days	53	NOAEL	acute	No overt signs of toxicity	Converted from a dose of 200 mg/kg using a body BW of 0.04125 kg for quail (Selton & Siegel, 1974) and an average intake rate of 10.87 g/day; (200 mg/kg x 0.01087 g/day)/0.04125 kg	--	Hill and Camardese, 1986	1	1	2	--	26	--	--	--	--	--	--	--	--	--	--	--	--	--
Hexachlorobutadiene	87683	-	X	X	--	Japanese Quail	3 months	3.185	NOAEL	chronic	No overt signs of toxicity	--	Schwertz et al., 1974	USEPA SLERA Protocol (USEPA, 1999) [c]	1	1	1	--	3.19	--	--	--	--	--	--	--	--	--	--	--	--	--
Hexachlorocyclopentadiene	77474	-		X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hexachloroethane	67721			X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Isophorone	78591	-		X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
m-Cresol	108394	3-Methylphenol	X		--	Red-Winged Blackbird	--	113	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	100	1	1	--	1.13	Red-Winged Blackbird	--	113	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	10	1	--	11.3
n-Nitrosodimethylamine	62759	Nitrosodimethylamine	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
n-Nitrosodi-n-propylamine	621647	n-Nitrosodipropylamine		X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 11-8
Summary of Selected Toxicity Reference Values for Avian Receptors

						Derivation of Low TRV														Derivation of High TRV													
						Toxicity Information									Conversion Factors					Toxicity Information									Conversion Factors				
Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil or Ephemeral Sediment [a]	Chemicals Detected in Surface Water or Seeps and Springs [b]	Surrogate Used	Test Species	Exposure Duration	Toxicity Value (mg/kg-d)	Study Endpoint	Type	Effects	Comments	Primary Source	Citation	Acute LD50 to chronic NOAEL UF	LOAEL to NOAEL UF	Subchronic-to-Chronic UF	2005 WHO TEF	Final Low TRV (mg/kg-d)	Test Species	Exposure Duration	Toxicity Value (mg/kg-d)	Study Endpoint	Type	Effects	Comments	Primary Source	Citation	LD50 to LOAEL UF	Subchronic to Chronic UF	2005 WHO TEF	Final High TRV (mg/kg-d)
n-Nitrosodiphenylamine	86306	-	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
o-Cresol	95487	-	X		p-Cresol	Red-Winged Blackbird	--	96	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	100	1	1	--	0.96	Red-Winged Blackbird	--	96	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	10	1	--	9.6
p-Chloro-m-cresol	59507	4-Chloro-3-Methylphenol	X	X	m-cresol	Red-Winged Blackbird	--	113	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	100	1	1	--	1.13	Red-Winged Blackbird	--	113	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	10	1	--	11.3
p-Cresol	106445	4-Methylphenol	X		--	Red-Winged Blackbird	--	96	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	100	1	1	--	0.96	Red-Winged Blackbird	--	96	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	10	1	--	9.6
Pentachlorophenol	87865	PCP	X	X	--	Chicken	1 week	6.73	NOAEL	Subchronic	Growth	--	Stedman et al., 1980	USEPA Eco-SSLs for Pentachlorophenol (USEPA, 2007f) [c]	1	1	1	--	6.73	chicken/duck	Various	52	LOAEL	--	Growth	Geometric mean of LOAEL for growth	--	USEPA Eco-SSLs for Pentachlorophenol (USEPA, 2007f) [c]	1	1	--	52
Phenol	108952	Total Phenols	X	X	--	Red-Winged Blackbird	--	113	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	100	1	1	--	1.13	Red-Winged Blackbird	--	113	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	10	1	--	11.3
p-Nitroaniline	100016	4-Nitroaniline	X		--	Red-Winged Blackbird	--	75	LD_{50}	acute	Mortality	No study duration was provided	Schafer, 1972	Schafer et al., 1983 [c]	100	1	1	--	0.75	Red-Winged Blackbird	--	75	LD_{50}	acute	Mortality	No study duration was provided	Schafer, 1972	Schafer et al., 1983 [c]	10	1	--	7.5
Polynuclear Aromatic Hydrocarbons																		--															
1-Methyl naphthalene	90120	1-Methylnaphthalene	X		Naphthalene	Mallard Duck	7 months	208	LOAEL	chronic	Increased liver weight and blood flow to liver	Converted from a dose of 4,000 mg/kg using an ingestion rate of 52 g/day (Nagy 2001) and an average BW of 1,000 g.	--	Patton and Dieter, 1980	1	5	1	--	41.6	Mallard Duck	--	208	LOAEL	chronic	increased liver weight and blood flow to liver	Converted from a dose of 4,000 mg/kg using an ingestion rate of 52 g/day (Nagy 2001) and an average BW of 1,000 g.	--	Patton and Dieter, 1980	1	1	--	208
2-Methylnaphthalene	91576	Naphthalene, 2-methyl-	X		Naphthalene	Mallard Duck	7 months	208	LOAEL	chronic	Increased liver weight and blood flow to liver	Converted from a dose of 4,000 mg/kg using an ingestion rate of 52 g/day (Nagy 2001) and an average BW of 1,000 g.	--	Patton and Dieter, 1980	1	5	1	--	41.6	Mallard Duck	--	208	LOAEL	chronic	increased liver weight and blood flow to liver	Converted from a dose of 4,000 mg/kg using an ingestion rate of 52 g/day (Nagy 2001) and an average BW of 1,000 g.	--	Patton and Dieter, 1980	1	1	--	208
Acenaphthene	83329	-	X	X	--	Red-Winged Blackbird	--	101	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	100	1	1	--	1.01	Red-Winged Blackbird	--	101	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	10	1	--	10.1
Acenaphthylene	208968	-	X	X	Acenaphthene	Red-Winged Blackbird	--	101	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	100	1	1	--	1.01	Red-Winged Blackbird	--	101	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	10	1	--	10.1
Anthracene	120127	-	X	X	--	Red-Winged Blackbird	--	111	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	100	1	1	--	1.11	Red-Winged Blackbird	--	111	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	10	1	--	11.1
Benzo(a)anthracene	56553	Benz[a]anthracene	X	X	Benzo(a)pyrene	Chicken	34 days	39.4	NOAEL	Subchronic	Reproductive - fertility and malformation	Dietary conc = 559 mg/kg, BW = 1.5 kg, food consumption rate = 0.106 kg/day; Dose or toxicity value 559 mg/kg * 0.106 kg/day / 1.5 kg = 39.4 mg/kg-BW-day.	--	Rigdon and Neal, 1963	1	1	2	--	19.7	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	50328	Benzo (a) pyrene	X	X	--	Chicken	34 days	39.4	NOAEL	Subchronic	Reproductive - fertility and malformation	Dietary conc = 559 mg/kg, BW = 1.5 kg, food consumption rate = 0.106 kg/day; Dose or toxicity value 559 mg/kg * 0.106 kg/day / 1.5 kg = 39.4 mg/kg-BW-day.	--	Rigdon and Neal, 1963	1	1	2	--	19.7	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(b)fluoranthene	205992	Benz[e]acephenanthrylene 1	X	X	Benzo(a)pyrene	Chicken	34 days	39.4	NOAEL	Subchronic	Reproductive - fertility and malformation	Dietary conc = 559 mg/kg, BW = 1.5 kg, food consumption rate = 0.106 kg/day; Dose or toxicity value 559 mg/kg * 0.106 kg/day / 1.5 kg = 39.4 mg/kg-BW-day.	--	Rigdon and Neal, 1963	1	1	2	--	19.7	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(e)pyrene	192972	-	X		Benzo(a)pyrene	Chicken	34 days	39.4	NOAEL	Subchronic	Reproductive - fertility and malformation	Dietary conc = 559 mg/kg, BW = 1.5 kg, food consumption rate = 0.106 kg/day; Dose or toxicity value 559 mg/kg * 0.106 kg/day / 1.5 kg = 39.4 mg/kg-BW-day.	--	Rigdon and Neal, 1963	1	1	2	--	19.7	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(ghi)perylene	191242	Benzo (g,h,i) perylene	X	X	--	Chicken	34 days	39.4	NOAEL	Subchronic	Reproductive - fertility and malformation	Dietary conc = 559 mg/kg, BW = 1.5 kg, food consumption rate = 0.106 kg/day; Dose or toxicity value 559 mg/kg * 0.106 kg/day / 1.5 kg = 39.4 mg/kg-BW-day.	--	Rigdon and Neal, 1963	1	1	2	--	19.7	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(k)fluoranthene	207089	Benzo[k]fluoranthene	X	X	--	Chicken	34 days	39.4	NOAEL	Subchronic	Reproductive - fertility and malformation	Dietary conc = 559 mg/kg, BW = 1.5 kg, food consumption rate = 0.106 kg/day; Dose or toxicity value 559 mg/kg * 0.106 kg/day / 1.5 kg = 39.4 mg/kg-BW-day.	--	Rigdon and Neal, 1963	1	1	2	--	19.7	--	--	--	--	--	--	--	--	--	--	--	--
Chrysene	218019	-	X	X	Benzo(a)pyrene	Chicken	34 days	39.4	NOAEL	Subchronic	Reproductive - fertility and malformation	Dietary conc = 559 mg/kg, BW = 1.5 kg, food consumption rate = 0.106 kg/day; Dose or toxicity value 559 mg/kg * 0.106 kg/day / 1.5 kg = 39.4 mg/kg-BW-day.	--	Rigdon and Neal, 1963	1	1	2	--	19.7	--	--	--	--	--	--	--	--	--	--	--	--

Table 11-8
Summary of Selected Toxicity Reference Values for Avian Receptors

						Derivation of Low TRV														Derivation of High TRV												
						Toxicity Information									Conversion Factors					Toxicity Information									Conversion Factors			
Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil or Ephemeral Sediment [a]	Chemicals Detected in Surface Water or Seeps and Springs [b]	Surrogate Used	Test Species	Exposure Duration	Toxicity Value (mg/kg-d)	Study Endpoint	Type	Effects	Comments	Primary Source	Citation	Acute LD50 to chronic NOAEL UF	LOAEL to NOAEL UF	Subchronic-to-Chronic UF	2005 WHO TEF	Final Low TRV (mg/kg-d)	Test Species	Exposure Duration	Toxicity Value (mg/kg-d)	Study Endpoint	Type	Effects	Comments	Primary Source	Citation	LD50 to LOAEL UF	Subchronic to Chronic UF	2005 WHO TEF	Final High TRV (mg/kg-d)
Dibenzo(a,h)anthracene	53703	Dibenz (a,h) anthracene	X	X	Benzo(a)pyrene	Chicken	34 days	39.4	NOAEL	Subchronic	Reproductive - fertility and malformation	Dietary conc = 559 mg/kg, BW = 1.5 kg, food consumption rate = 0.106 kg/day; Dose or toxicity value 559 mg/kg * 0.106 kg/day / 1.5 kg = 39.4 mg/kg-BW-day.	--	Rigdon and Neal, 1963	1	1	2	--	19.7	--	--	--	--	--	--	--	--	--	--	--	--	--
Fluoranthene	206440	-	X	X	Benzo(a)pyrene	Chicken	34 days	39.4	NOAEL	Subchronic	Reproductive - fertility and malformation	Dietary conc = 559 mg/kg, BW = 1.5 kg, food consumption rate = 0.106 kg/day; Dose or toxicity value 559 mg/kg * 0.106 kg/day / 1.5 kg = 39.4 mg/kg-BW-day.	--	Rigdon and Neal, 1963	1	1	2	--	19.7	--	--	--	--	--	--	--	--	--	--	--	--	--
Fluorene	86737	-	X	X	--	Red-Winged Blackbird	--	101	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	100	1	1	--	1.01	Red-Winged Blackbird	--	101	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	10	1	--	10.1
Indeno(1,2,3-cd)pyrene	193395	Indeno (1,2,3-cd) pyrene	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	91203	-	X	X	--	Mallard Duck	7 months	208	LOAEL	chronic	Increased liver weight and blood flow to liver	Converted from a dose of 4,000 mg/kg using an ingestion rate of 52 g/day (Nagy 2001) and an average BW of 1,000 g.	--	Patton and Dieter, 1980	1	5	1	--	41.6	Mallard Duck	--	208	LOAEL	chronic	increased liver weight and blood flow to liver	Converted from a dose of 4,000 mg/kg using an ingestion rate of 52 g/day (Nagy 2001) and an average BW of 1,000 g.	--	Patton and Dieter, 1980	1	1	--	208
Perylene	198550	-	X		Benzo(a)pyrene	Chicken	34 days	39.4	NOAEL	Subchronic	Reproductive - fertility and malformation	Dietary conc = 559 mg/kg, BW = 1.5 kg, food consumption rate = 0.106 kg/day; Dose or toxicity value 559 mg/kg * 0.106 kg/day / 1.5 kg = 39.4 mg/kg-BW-day.	--	Rigdon and Neal, 1963	1	1	2	--	19.7	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenanthrene	85018	-	X	X	--	Red-Winged Blackbird	--	113	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	100	1	1	--	1.13	Red-Winged Blackbird	--	113	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	10	1	--	11.3
Pyrene	129000	-	X	X	Benzo(a)pyrene	Chicken	34 days	39.4	NOAEL	Subchronic	Reproductive - fertility and malformation	Dietary conc = 559 mg/kg, BW = 1.5 kg, food consumption rate = 0.106 kg/day; Dose or toxicity value 559 mg/kg * 0.106 kg/day / 1.5 kg = 39.4 mg/kg-BW-day.	--	Rigdon and Neal, 1963	1	1	2	--	19.7	--	--	--	--	--	--	--	--	--	--	--	--	--
Pesticides																																
4,4'-DDD	72548	p,p'-DDD	X	X	4,4'-DDT	Pelican	--	0.009	Low TRV	--	Reproduction	--	USEPA, 1995	DTSC, 2009 [c]	1	1	1	--	0.0090	Mallard Duck	--	1.5	High TRV	--	Reproduction	--	USEPA, 1995	DTSC, 2009 [c]	1	1	--	1.5
4,4'-DDE	72559	p,p'-DDE	X	X	Low TRV: 4,4'-DDT	Pelican	--	0.009	Low TRV	--	Reproduction	--	USEPA, 1995	DTSC, 2009 [c]	1	1	1	--	0.0090	Mallard Duck	--	0.6	High TRV	--	Reproduction	--	USEPA, 1995	DTSC, 2009 [c]	1	1	--	0.6
4,4'-DDT	50293	p,p'-DDT	X	X	--	Pelican	--	0.009	Low TRV	--	Reproduction	--	USEPA, 1995	DTSC, 2009 [c]	1	1	1	--	0.0090	Mallard	--	1.5	High TRV	--	Reproduction	--	USEPA, 1995	DTSC, 2009 [c]	1	1	--	1.5
Aldrin	309002	-	X	X	--	Japanese Quail	5 days	6.2	NOAEL	acute	No overt signs of toxicity	Converted from a dose of 25 mg/kg using a BW of 0.04125 kg for quail (Selton & Siegel, 1974) and an average control group intake rate of 10.24 g/day; (25 mg/kg x 0.01024 g/day)/0.04125 kg	--	Hill and Camardese, 1986	1	1	2	--	3.1	Japanese Quail	5 days	13.5	LOAEL	acute	mortality	Converted from a dose of 50 mg/kg using a BW of 0.04125 kg for quail (Selton & Siegel, 1974) and an average control group intake rate of 10.24 g/day; (50 mg/kg x 0.01024 g/day)/0.04125 kg	--	Hill and Camardese, 1986	1	2	--	6.74
alpha-BHC	319846	a-Benzene Hexachloride	X	X	BHC-mixed isomers	Japanese Quail	90 days	0.56	NOAEL	chronic	reproduction - egg hatchability and egg volume	during critical lifestage	Vos et al., 1971	Sample et al., 1996 [c]	1	1	1	--	0.56	Japanese Quail	90 days	2.25	LOAEL	chronic	reproduction - egg hatchability and egg volume	critical life stage	Vos et al., 1971	Sample et al., 1996 [c]	1	1	--	2.25
beta-BHC	319857	b-Benzene Hexachloride	X	X	BHC-mixed isomers	Japanese Quail	90 days	0.56	NOAEL	chronic	reproduction - egg hatchability and egg volume	during critical lifestage	Vos et al., 1971	Sample et al., 1996 [c]	1	1	1	--	0.56	Japanese Quail	90 days	2.25	LOAEL	chronic	reproduction - egg hatchability and egg volume	critical life stage	Vos et al., 1971	Sample et al., 1996 [c]	1	1	--	2.25
Chlordane (Technical)	12789036	-	X		Chlordane	Red-Winged Blackbird	84 days (>10 weeks = chronic)	2.14	NOAEL	chronic	Mortality	--	Stickel et al., 1983	Sample et al., 1996 [c]	1	1	1	--	2.14	Red-Winged Blackbird	84 days (>10 weeks = chronic)	10.7	LOAEL	chronic	Mortality	--	Stickel et al., 1983	Sample et al., 1996 [c]	1	1	--	10.7
delta-BHC	319868	d-Benzene Hexachloride	X	X	BHC-mixed isomers	Japanese Quail	90 days	0.56	NOAEL	chronic	reproduction - egg hatchability and egg volume	during critical lifestage	Vos et al., 1971	Sample et al., 1996 [c]	1	1	1	--	0.56	Japanese Quail	90 days	2.25	LOAEL	chronic	reproduction - egg hatchability and egg volume	critical life stage	Vos et al., 1971	Sample et al., 1996 [c]	1	1	--	2.25
Dieldrin	60571	-	X	X	--	Mallard Duck	24 days	0.0709	NOAEL	Subchronic	Growth	--	Nebeker et al., 1992	USEPA Eco-SSLs for Dieldrin (USEPA, 2007d) [c]	1	1	1	--	0.0709	Various	Various	0.8	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	--	USEPA Eco-SSLs for Dieldrin (USEPA, 2007d) [c]	1	1	--	0.8
Endosulfan I	959988	-	X	X	Endosulfan	Gray Partridge	4 weeks	10	NOAEL	chronic	Reproduction	during critical lifestage	Abiola, 1992	Sample et al., 1996 [c]	1	1	1	--	10	--	--	--	--	--	--	--	--	--	--	--	--	--
Endosulfan II	33213659	-	X	X	Endosulfan	Gray Partridge	4 weeks	10	NOAEL	chronic	Reproduction	during critical lifestage	Abiola, 1992	Sample et al., 1996 [c]	1	1	1	--	10	--	--	--	--	--	--	--	--	--	--	--	--	--
Endosulfan sulfate	1031078	-	X	X	Endosulfan	Gray Partridge	4 weeks	10	NOAEL	chronic	Reproduction	during critical lifestage	Abiola, 1992	Sample et al., 1996 [c]	1	1	1	--	10	--	--	--	--	--	--	--	--	--	--	--	--	--
Endrin	72208	-	X	X	--	Screech Owl	>83 days	0.01	NOAEL	chronic	Reproductive success	during critical lifestage	Fleming et al., 1982	Sample et al., 1996 [c]	1	1	1	--	0.010	Screech Owl	>83 days	0.1	LOAEL	chronic	reproductive success	critical lifestage	Fleming et al., 1982	Sample et al., 1996 [c]	1	1	--	0.1
Endrin aldehyde	7421934	-	X	X	Endrin	Screech Owl	>83 days	0.01	NOAEL	chronic	Reproduction - egg production and hatching success	during critical lifestage	Fleming et al., 1982	Sample et al., 1996 [c]	1	1	1	--	0.010	Screech Owl	>83 days	0.1	LOAEL	chronic	reproductive success	critical lifestage	Fleming et al., 1982	Sample et al., 1996 [c]	1	1	--	0.1
Endrin ketone	53494705	-	X		Endrin	Screech Owl	>83 days	0.01	NOAEL	chronic	Reproduction - egg production and hatching success	during critical lifestage	Fleming et al., 1982	Sample et al., 1996 [c]	1	1	1	--	0.010	Screech Owl	>83 days	0.1	LOAEL	chronic	reproductive success	critical lifestage	Fleming et al., 1982	Sample et al., 1996 [c]	1	1	--	0.1
gamma-BHC	58899	Lindane	X	X	--	Mallard Duck	8 weeks	2	NOAEL	chronic	reproduction	during critical lifestage	Chakravarty and Lahiri, 1986; Chakravarty et al., 1986	Sample et al., 1996 [c]	1	1	1	--	2.0	Mallard Duck	8 weeks	20	LOAEL	chronic	reproduction	critical lifestage	Chakravarty and Lahiri, 1986; Chakravarty et al., 1986	Sample et al., 1996 [c]	1	1	--	20
Heptachlor	76448	-	X	X	--	Japanese Quail	5 days	13	LOAEL	acute	signs of toxicity	Converted from a dose of 50 mg/kg using a BW of 0.04125 kg for quail (Selton & Siegel, 1974) and an average control group intake rate of 10.82 g/day; (50 mg/kg x 0.01082 g/day)/0.04125 kg	--	Hill and Camardese, 1986	1	5	2	--	1.3	Japanese Quail	5 days	13.12	LOAEL	acute	signs of toxicity	Converted from a dose of 50 mg/kg using a BW of 0.04125 kg for quail (Selton & Siegel, 1974) and an average control group intake rate of 10.82 g/day; (50 mg/kg x 0.01082 g/day)/0.04125 kg	--	Hill and Camardese, 1986	1	2	--	6.56

Table 11-8
Summary of Selected Toxicity Reference Values for Avian Receptors

						Derivation of Low TRV														Derivation of High TRV												
						Toxicity Information									Conversion Factors					Toxicity Information									Conversion Factors			
Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil or Ephemeral Sediment [a]	Chemicals Detected in Surface Water or Seeps and Springs [b]	Surrogate Used	Test Species	Exposure Duration	Toxicity Value (mg/kg-d)	Study Endpoint	Type	Effects	Comments	Primary Source	Citation	Acute LD50 to chronic NOAEL UF	LOAEL to NOAEL UF	Subchronic-to-Chronic UF	2005 WHO TEF	Final Low TRV (mg/kg-d)	Test Species	Exposure Duration	Toxicity Value (mg/kg-d)	Study Endpoint	Type	Effects	Comments	Primary Source	Citation	LD50 to LOAEL UF	Subchronic to Chronic UF	2005 WHO TEF	Final High TRV (mg/kg-d)
Heptachlor epoxide	1024573	-	X	X	Heptachlor	Japanese Quail	5 days	13	LOAEL	acute	signs of toxicity	Converted from a dose of 50 mg/kg using a BW of 0.04125 kg for quail (Selton & Siegel, 1974) and an average control group intake rate of 10.82 g/day; (50 mg/kg x 0.01082 g/day)/0.04125 kg	--	Hill and Camardese, 1986	1	5	2	--	1.3	Japanese Quail	5 days	13.12	LOAEL	acute	signs of toxicity	Converted from a dose of 50 mg/kg using a BW of 0.04125 kg for quail (Selton & Siegel, 1974) and an average control group intake rate of 10.82 g/day; (50 mg/kg x 0.01082 g/day)/0.04125 kg	--	Hill and Camardese, 1986	1	2	--	6.56
MCPA	94746	-	X		MCPB	Japanese Quail	5 days	293	NOAEL	acute	No overt signs of toxicity	Converted from a dose of 5000 mg/kg using a BW of 0.04125 kg for quail, and an intake rate of 2.42 g/day (galliformes, Nagy 2001). (plants metabolize to MCPA per study)	--	Hill and Camardese, 1986	1	1	2	--	147	--	--	--	--	--	--	--	--	--	--	--	--	--
Mirex	2385855	Mirex (DeChlorane)	X		--	Japanese Quail	5 days	131	NOAEL	acute	No overt signs of toxicity	Converted from a dose of 2236 mg/kg using a BW of 0.04125 kg for quail, and an intake rate of 2.42 g/day (galliformes, Nagy 2001); (2236 mg/kg x 0.00242 kg/day)/0.04125 kg	--	Hill and Camardese, 1986	1	1	2	--	66	--	--	--	--	--	--	--	--	--	--	--	--	--
p,p'-Methoxychlor	72435	-	X		--	Japanese Quail	5 days	293	NOAEL	acute	No overt signs of toxicity	Converted from a dose of 5000 mg/kg using a BW of 0.04125 kg for quail and an intake rate of 2.42 g/day (galliformes, Nagy 2001); (5000 mg/kg x 0.00242 kg/day)/0.04125 kg	--	Hill and Camardese, 1986	1	1	2	--	147	--	--	--	--	--	--	--	--	--	--	--	--	--
Toxaphene	8001352	-	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Herbicides																																
2,4,5-T	93765	2,4,5-Trichlorophenoxyacetic acid	X		--	--	--	--	--	--	--	--		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4,5-TP (Silvex)	93721	-	X		--	Japanese Quail	5 days	293	NOAEL	acute	No overt signs of toxicity	Converted from a dose of 5000 mg/kg using a BW of 0.04125 kg for quail and an intake rate of 2.42 g/day (galliformes, Nagy 2001); (5000 mg/kg x 0.00242 kg/day)/0.04125 kg	--	Hill and Camardese, 1986	1	1	2	--	147	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-Dichlorophenoxyacetic Acid (2,4-D)	94757	-	X		--	Japanese Quail	5 days	293	NOAEL	acute	No overt signs of toxicity	Converted from a dose of 5000 mg/kg using a BW of 0.04125 kg for quail and an intake rate of 2.42 g/day (galliformes, Nagy 2001); (5000 mg/kg x 0.00242 kg/day)/0.04125 kg	--	Hill and Camardese, 1986	1	1	2	--	147	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-Dichlorophenoxybutyric acid	94826	-	X		--	Japanese Quail	5 days	293	NOAEL	acute	No overt signs of toxicity	Converted from a dose of 5000 mg/kg using a BW of 0.04125 kg for quail and an intake rate of 2.42 g/day (galliformes, Nagy 2001); (5000 mg/kg x 0.00242 kg/day)/0.04125 kg	--	Hill and Camardese, 1986	1	1	2	--	147	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-DP (Dichlorprop)	120365	Dichlorprop	X		2,4-Dichlorophenoxyacetic Acid (2,4-D)	Japanese Quail	5 days	293	NOAEL	acute	No overt signs of toxicity	Converted from a dose of 5000 mg/kg using a BW of 0.04125 kg for quail and an intake rate of 2.42 g/day (galliformes, Nagy 2001); (5000 mg/kg x 0.00242 kg/day)/0.04125 kg	--	Hill and Camardese, 1986	1	1	2	--	147	--	--	--	--	--	--	--	--	--	--	--	--	--
Dalapon	75990	-	X		--	Japanese Quail	5 days	293	NOAEL	acute	No overt signs of toxicity	Converted from a dose of 5000 mg/kg using a BW of 0.04125 kg for quail and an intake rate of 2.42 g/day (galliformes, Nagy 2001); (5000 mg/kg x 0.00242 kg/day)/0.04125 kg	--	Hill and Camardese, 1986	1	1	2	--	147	--	--	--	--	--	--	--	--	--	--	--	--	--
Dicamba	1918009	-	X		--	Japanese Quail	5 days	667	NOAEL	acute	No overt signs of toxicity	Converted from a dose of 2,236 mg/kg using a BW of 0.04125 kg for quail and an intake rate of 12.31 g/day; (2236 mg/kg x 0.01231 kg/day)/0.04125 kg	--	Hill and Camardese, 1986	1	1	2	--	334	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 11-8
Summary of Selected Toxicity Reference Values for Avian Receptors

						Derivation of Low TRV														Derivation of High TRV												
						Toxicity Information									Conversion Factors					Toxicity Information									Conversion Factors			
Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil or Ephemeral Sediment [a]	Chemicals Detected in Surface Water or Seeps and Springs [b]	Surrogate Used	Test Species	Exposure Duration	Toxicity Value (mg/kg-d)	Study Endpoint	Type	Effects	Comments	Primary Source	Citation	Acute LD50 to chronic NOAEL UF	LOAEL to NOAEL UF	Subchronic-to-Chronic UF	2005 WHO TEF	Final Low TRV (mg/kg-d)	Test Species	Exposure Duration	Toxicity Value (mg/kg-d)	Study Endpoint	Type	Effects	Comments	Primary Source	Citation	LD50 to LOAEL UF	Subchronic to Chronic UF	2005 WHO TEF	Final High TRV (mg/kg-d)
Dinoseb	88857	-	X		2,4-Dinitrophenol	Red-Winged Blackbird	--	13.3	LD_{50}	acute	Mortality	No study duration was provided	Schafer, 1972	Schafer et al., 1983 [c]	100	1	1	--	0.133	Red-Winged Blackbird	--	13.3	LD_{50}	acute	Mortality	No study duration was provided	Schafer, 1972	Schafer et al., 1983 [c]	10	1	--	1.33
MCPP	93652	-	X		MCPB	Japanese Quail	5 days	293	NOAEL	acute	No overt signs of toxicity	Converted from a dose of 5000 mg/kg using a BW of 0.04125 kg for quail and an intake rate of 2.42 g/day (galliformes, Nagy 2001); (5000 mg/kg x 0.00242 kg/day)/0.04125 kg	--	Hill and Camardese, 1986	1	1	2	--	147	--	--	--	--	--	--	--	--	--	--	--	--
Terphenyls																																
m-Terphenyl	92068	-	X		1,1-biphenyl	Red-Winged Blackbird	--	96	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	100	1	1	--	0.96	Red-Winged Blackbird	--	96	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	10	1	--	9.6
o-terphenyl	84151	-	X		1,1-biphenyl	Red-Winged Blackbird	--	96	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	100	1	1	--	0.96	Red-Winged Blackbird	--	96	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	10	1	--	9.6
p-Terphenyl	92944	-	X		1,1-biphenyl	Red-Winged Blackbird	--	96	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	100	1	1	--	0.96	Red-Winged Blackbird	--	96	LD_{50}	acute	Mortality	No study duration was provided	--	Schafer et al., 1983 [c]	10	1	--	9.6
Glycols		-																														
Diethylene Glycol	111466	-	X		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Triethylene glycol	112276	-	X		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons																																
TPH-Diesel Range Organics (DRO)	DRO	Diesel	X		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TPH-Gasoline Range Organics (GRO)	GRO	Gasoline	X		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PCDD/PCDFs[d]ei																																
2,3,7,8-TCDD_TEQ_Bird	1746016-TEQ_Bird	-	X	X	2,3,7,8-TCDD	Ring-necked Pheasant	10 weeks	0.000014	NOAEL	chronic	Reproduction	--	Nosek et al., 1992	Sample et al., 1996 [c]	1	1	1	1	0.000014	Ring-necked Pheasant	10 weeks	0.00014	LOAEL	chronic	reproduction	--	Nosek et al., 1992	Sample et al., 1996 [c]	1	1	1	0.00014
Polychlorinated Biphenyls (PCBs)[d]ei																																
Aroclor 1016	12674112	-	X	X	Aroclor 1254	Ring-necked Pheasant	17 weeks	0.18	NOAEL	chronic	Reproduction - reduced egg hatchability	--	Dahlgren et al., 1972	Sample et al., 1996 [c]	1	1	1	--	0.18	Ring-necked Pheasant	17 weeks	1.8	LOAEL	chronic	reproduction - reduced egg hatchability	--	Dahlgren et al., 1972	Sample et al., 1996 [c]	1	1	--	1.8
Aroclor 1221	11104282	-		X	Aroclor 1254	Ring-necked Pheasant	17 weeks	0.18	NOAEL	chronic	Reproduction - reduced egg hatchability	--	Dahlgren et al., 1972	Sample et al., 1996 [c]	1	1	1	--	0.18	Ring-necked Pheasant	17 weeks	1.8	LOAEL	chronic	reproduction - reduced egg hatchability	--	Dahlgren et al., 1972	Sample et al., 1996 [c]	1	1	--	1.8
Aroclor 1232	11141165	-		X	Aroclor 1254	Ring-necked Pheasant	17 weeks	0.18	NOAEL	chronic	Reproduction - reduced egg hatchability	--	Dahlgren et al., 1972	Sample et al., 1996 [c]	1	1	1	--	0.18	Ring-necked Pheasant	17 weeks	1.8	LOAEL	chronic	reproduction - reduced egg hatchability	--	Dahlgren et al., 1972	Sample et al., 1996 [c]	1	1	--	1.8
Aroclor 1242	53469219	Aroclor-1242	X	X	Aroclor 1254	Ring-necked Pheasant	17 weeks	0.18	NOAEL	chronic	Reproduction - reduced egg hatchability	--	Dahlgren et al., 1972	Sample et al., 1996 [c]	1	1	1	--	0.18	Ring-necked Pheasant	17 weeks	1.8	LOAEL	chronic	reproduction - reduced egg hatchability	--	Dahlgren et al., 1972	Sample et al., 1996 [c]	1	1	--	1.8
Aroclor 1248	12672296	-	X	X	Aroclor 1254	Ring-necked Pheasant	17 weeks	0.18	NOAEL	chronic	Reproduction - reduced egg hatchability	--	Dahlgren et al., 1972	Sample et al., 1996 [c]	1	1	1	--	0.18	Ring-necked Pheasant	17 weeks	1.8	LOAEL	chronic	reproduction - reduced egg hatchability	--	Dahlgren et al., 1972	Sample et al., 1996 [c]	1	1	--	1.8
Aroclor 1254	11097691	-	X	X	--	Ring-necked Pheasant	17 weeks	0.18	NOAEL	chronic	Reproduction - reduced egg hatchability	--	Dahlgren et al., 1972	Sample et al., 1996 [c]	1	1	1	--	0.18	Ring-necked Pheasant	17 weeks	1.8	LOAEL	chronic	reproduction - reduced egg hatchability	--	Dahlgren et al., 1972	Sample et al., 1996 [c]	1	1	--	1.8
Aroclor 1260	11096825	-	X	X	Aroclor 1254	Ring-necked Pheasant	17 weeks	0.18	NOAEL	chronic	Reproduction - reduced egg hatchability	--	Dahlgren et al., 1972	Sample et al., 1996 [c]	1	1	1	--	0.18	Ring-necked Pheasant	17 weeks	1.8	LOAEL	chronic	reproduction - reduced egg hatchability	--	Dahlgren et al., 1972	Sample et al., 1996 [c]	1	1	--	1.8
Aroclor 5460	11126424	-	X		Aroclor 1254	Ring-necked Pheasant	17 weeks	0.18	NOAEL	chronic	Reproduction - reduced egg hatchability	--	Dahlgren et al., 1972	Sample et al., 1996 [c]	1	1	1	--	0.18	Ring-necked Pheasant	17 weeks	1.8	LOAEL	chronic	reproduction - reduced egg hatchability	--	Dahlgren et al., 1972	Sample et al., 1996 [c]	1	1	--	1.8
PCB_TEQ_Bird (Coplanar PCBs)	1746016-PCB TEQ_Bird	-	X	X	2,3,7,8-TCDD	Ring-necked Pheasant	10 weeks	0.000014	NOAEL	chronic	Reproduction	--	Nosek et al., 1992	Sample et al., 1996 [c]	1	1	1	1	0.000014	Ring-necked Pheasant	10 weeks	0.00014	LOAEL	chronic	reproduction	--	Nosek et al., 1992	Sample et al., 1996 [c]	1	1	1	0.00014
PCB-105	32598144	1,1'-Biphenyl, 2,3,3',4,4'-pentachloro-	X	X	2,3,7,8-TCDD	Ring-necked Pheasant	10 weeks	0.000014	NOAEL	chronic	Reproduction	--		Sample et al., 1996 [c]	1	1	1	0.0001	0.14	Ring-necked Pheasant	10 weeks	0.00014	LOAEL	chronic	reproduction	--		Sample et al., 1996 [c]	1	1	0.0001	1.4
PCB-114	74472370	PCB 114 (BZ)	X	X	2,3,7,8-TCDD	Ring-necked Pheasant	--	0.0000143	NOAEL	chronic	Reproduction	--		Sample et al., 1996 [c]	1	1	1	0.0001	0.143	Ring-necked Pheasant	--	0.000143	LOAEL	chronic	reproduction	--		Sample et al., 1996 [c]	1	1	0.0001	1.43
PCB-118	31508006	-	X	X	2,3,7,8-TCDD	Ring-necked Pheasant	10 weeks	0.0000140	NOAEL	chronic	Reproduction	--		Sample et al., 1996 [c]	1	1	1	0.00001	1.4	Ring-necked Pheasant	10 weeks	0.00014	LOAEL	chronic	reproduction	--		Sample et al., 1996 [c]	1	1	0.00001	14
PCB-123	65510443	123-PeCB	X	X	2,3,7,8-TCDD	Ring-necked Pheasant	--	0.0000143	NOAEL	chronic	Reproduction	--		Sample et al., 1996 [c]	1	1	1	0.00001	1.43	Ring-necked Pheasant	--	0.000143	LOAEL	chronic	reproduction	--		Sample et al., 1996 [c]	1	1	0.00001	14.3
PCB-126	57465288	-	X	X	2,3,7,8-TCDD	Ring-necked Pheasant	--	0.0000143	NOAEL	chronic	Reproduction	--		Sample et al., 1996 [c]	1	1	1	0.1	0.000143	Ring-necked Pheasant	--	0.000143	LOAEL	chronic	reproduction	--		Sample et al., 1996 [c]	1	1	0.1	0.00143
PCB-156	38380084	1,1'-Biphenyl, 2,3,3',4,4',5-hexachloro-	X	X	2,3,7,8-TCDD	Ring-necked Pheasant	10 weeks	0.000014	NOAEL	chronic	Reproduction	--		Sample et al., 1996 [c]	1	1	1	0.0001	0.14	Ring-necked Pheasant	10 weeks	0.00014	LOAEL	chronic	reproduction	--		Sample et al., 1996 [c]	1	1	0.0001	1.4
PCB-157	69782907	PCB 157 (BZ)	X	X	2,3,7,8-TCDD	Ring-necked Pheasant	--	0.0000143	NOAEL	chronic	Reproduction	--		Sample et al., 1996 [c]	1	1	1	0.0001	0.143	Ring-necked Pheasant	--	0.000143	LOAEL	chronic	reproduction	--		Sample et al., 1996 [c]	1	1	0.0001	1.43
PCB-167	52663726	167-HxCB	X	X	2,3,7,8-TCDD	Ring-necked Pheasant	10 weeks	0.000014	NOAEL	chronic	Reproduction	--		Sample et al., 1996 [c]	1	1	1	0.00001	1.4	Ring-necked Pheasant	10 weeks	0.00014	LOAEL	chronic	reproduction	--		Sample et al., 1996 [c]	1	1	0.00001	14
PCB-169	32774166	-	X	X	2,3,7,8-TCDD	Ring-necked Pheasant	10 weeks	0.000014	NOAEL	chronic	Reproduction	--		Sample et al., 1996 [c]	1	1	1	0.001	0.014	Ring-necked Pheasant	10 weeks	0.00014	LOAEL	chronic	reproduction	--		Sample et al., 1996 [c]	1	1	0.001	0.14
PCB-189	39635319	-	X	X	2,3,7,8-TCDD	Ring-necked Pheasant	--	0.0000143	NOAEL	chronic	Reproduction	--		Sample et al., 1996 [c]	1	1	1	0.00001	1.43	Ring-necked Pheasant	--	0.000143	LOAEL	chronic	reproduction	--		Sample et al., 1996 [c]	1	1	0.00001	14.3
PCB-77	32598133	77-TeCB	X	X	2,3,7,8-TCDD	Ring-necked Pheasant	--	0.0000143	NOAEL	chronic	Reproduction	--		Sample et al., 1996 [c]	1	1	1	0.05	0.00029	Ring-necked Pheasant	--	0.000143	LOAEL	chronic	reproduction	--		Sample et al., 1996 [c]	1	1	0.05	0.00286
PCB-81	70362504	81-TeCB	X	X	2,3,7,8-TCDD	Ring-necked Pheasant	--	0.0000143	NOAEL	chronic	Reproduction	--		Sample et al., 1996 [c]	1	1	1	0.1	0.000143	Ring-necked Pheasant	--	0.000143	LOAEL	chronic	reproduction	--		Sample et al., 1996 [c]	1	1	0.1	0.00143
Chemical Parameters																																
Ammonia-N	7664417	Nitrogen, as Ammonia	X		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloride	16887006	-	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chlorine	7782505	-		X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrate	NO3N	-	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrite-NO2	E-10128	-	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Oil content	E-10140	-		X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Orthophosphate – PO4	14265442	-	X		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfate	14808798	-	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Hierarchy of Sources:

1. Currently Recommended U.S. Environmental Protection Agency Region 9 Biological Technical Assistance Group (BTAG) Mammalian and Avian Toxicity Reference Values (TRVs) (DTSC, 2009)
2. Ecological Soil Screening Levels (Eco-SSLs) (USEPA, various dates)

Table 11-8
Summary of Selected Toxicity Reference Values for Avian Receptors

						Derivation of Low TRV														Derivation of High TRV												
						Toxicity Information									Conversion Factors					Toxicity Information									Conversion Factors			
Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil or Ephemeral Sediment [a]	Chemicals Detected in Surface Water or Seeps and Springs [b]	Surrogate Used	Test Species	Exposure Duration	Toxicity Value (mg/kg-d)	Study Endpoint	Type	Effects	Comments	Primary Source	Citation	Acute LD50 to chronic NOAEL UF	LOAEL to NOAEL UF	Subchronic-to-Chronic UF	2005 WHO TEF	Final Low TRV (mg/kg-d)	Test Species	Exposure Duration	Toxicity Value (mg/kg-d)	Study Endpoint	Type	Effects	Comments	Primary Source	Citation	LD50 to LOAEL UF	Subchronic to Chronic UF	2005 WHO TEF	Final High TRV (mg/kg-d)

3. Oak Ridge National Laboratory (ORNL) Toxicological Benchmarks for Wildlife: 1996 Revision (Sample et al., 1996)
4. Literature review resulted in the following sources, some noted in ECOTOX: Schafer et al., 1983 (VOCs and PAHs); Hill and Camardese, 1986 (pesticides/herbicides); Patton and Dieter, 1980 (PAHs), Hill et al., 1975 (phthalates); Rigdon and Neal, 1963 (PAHs); and USACHPPM, 2001, 2002, 2006 and 2007 (Energetics).
5. Screening Level Ecological Risk Assessment (SLERA) Protocol for Hazardous Waste Combustion Facilities (USEPA, 1999)
6. Suitable surrogates

Notes:

[a] Chemicals detected in Groups 1A, 4, 6, 7, and 8 surface soil, or detected in Groups 4 (Coca only), 6 (SRE only), 1B, 5, 10, 3 (WCT only), and 9 (Silvernale only) surface water..

[b] Chemicals detected in Groups 4 (Coca only), 6 (SRE only), 1B, 5, 10, 3 (WCT only), and 9 (Silvernale only) surface water.

[c] Indicates reference is a secondary or compilation source.

[d] Dioxins/furans and coplanar PCBs for birds exposed to chemicals in soil, ephemeral sediment, surface water, or seeps and springs will be evaluated using the 2,3,7,8-TCDD_TEQ_Bird and PCB_TEQ_Bird (Coplanar PCBs), respectively, and not by individual congeners.

Indicates final TRV
-- not available, could not be located, or not applicable.

BW - body weight
DDD - dichlorodiphenyldichloroethane
DDE - dichlorodiphenyldichloroethylene
DDT - dichlorodiphenyltrichloroethane
g/day - grams per day
High TRV - mid level effect toxicity reference value
kg - kilograms
LC50 - lethal concentration to 50% of test population
LD50 - lethal dose to 50% of test population
LOAEL - lowest observed adverse effect level
Low TRV - no effect toxicity reference value
mg/kg - milligrams per kilogram
mg/kg-d - milligrams per kilogram - day
NOAEL - no observed adverse effect level
TEF - toxic equivalency factor
TEQ toxicity equivalent
TRV toxicity reference value
UF uncertainty factor
WHO World Health Organization
X - Analyte was detected in the indicated medium

Table 11-9
Summary of Selected Toxicity Reference Values for Mammalian Receptors

						Derivation of Low TRV														Derivation of High TRV												
						Toxicity Information									Conversion Factors					Toxicity Information									Conversion Factors			
Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil or Ephemeral Sediment [a]	Detected in Surface Water or Seeps and Springs [b]	Surrogate Used	Test Species	Body Weight (kg)	Duration	Low Toxicity Value (mg/kg-d)	Endpoint	Type	Effects	Additional Comments	Citation	LD50 to Chronic NOAEL	LOAEL-to-NOAEL UF	Subchronic-to-Chronic UF	2005 WHO TEF	Final Low TRV (mg/kg-d)	Test Species	Body Weight	Duration	High Toxicity Value (mg/kg-d)	Endpoint	Type	Effects	Additional Comments	Citation	LD50 to LOAEL	Subchronic-to-Chronic UF	2005 WHO TEF	Final High TRV (mg/kg-d)
Inorganic Compounds																																
Aluminum	7429905	Aluminum, Total	X	X	--	mouse	0.03	3 generations	1.93	NOAEL	Chronic	reproduction	NOAEL not determined in study; LOAEL adjusted to NOAEL in Sample et al.	Sample et al., 1996 [c]	1	1	1	--	1.93	mouse	0.03	3 generations	19.300	LOAEL	Chronic	reproduction	--	Sample et al., 1996 [c]	1	1	--	19.3
Aluminum, dissolved	7429905-D	-		X	Aluminum	mouse	0.03	3 generations	1.93	NOAEL	Chronic	reproduction	NOAEL not determined in study; LOAEL adjusted to NOAEL in Sample et al.	Sample et al., 1996 [c]	1	1	1	--	1.93	mouse	0.03	3 generations	19.300	LOAEL	Chronic	reproduction	--	Sample et al., 1996 [c]	1	1	--	19.3
Antimony	7440360	Antimony, Total	X	X	--	Rat	0.33	31 days gestation	0.0590	NOAEL	Chronic	reproduction - progeny weight	--	USEPA Eco-SSLs for Antimony (USEPA, 2005f) [c]	1	1	1	--	0.0590	rat/mouse	--	various	2.8	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	USEPA Eco-SSLs for Antimony (USEPA, 2005f) [c]	1	1	--	2.8
Antimony, dissolved	7440360-D	-		X	Antimony	Rat	0.33	31 days gestation	0.0590	NOAEL	Chronic	reproduction - progeny weight	--	USEPA Eco-SSLs for Antimony (USEPA, 2005f) [c]	1	1	1	--	0.0590	rat/mouse	--	various	2.8	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	USEPA Eco-SSLs for Antimony (USEPA, 2005f) [c]	1	1	--	2.8
Arsenic	7440382	Arsenic, Total	X	X	--	Rat	--	--	0.32	Low TRV	--	Growth, cancer, serum chemistries	--	DTSC, 2009 [c]	1	1	1	--	0.32	rat	--	--	4.7	High TRV	--	kidney, pulmonary	--	DTSC, 2009 [c]	1	1	--	4.7
Arsenic, dissolved	7440382-D	-		X	Arsenic	Rat	--	--	0.32	Low TRV	--	Growth, cancer, serum chemistries	--	DTSC, 2009 [c]	1	1	1	--	0.32	rat	--	--	4.7	High TRV	--	kidney, pulmonary	--	DTSC, 2009 [c]	1	1	--	4.7
Barium	7440393	Barium, Total	X	X	--	rat/mouse	--	Various	51.8	NOAEL	--	reproduction and growth	Geometric mean of NOAEL for reproduction and growth	USEPA Eco-SSLs for Barium (USEPA, 2005g) [c]	1	1	1	--	51.8	rat/mouse	--	various	83	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	USEPA Eco-SSLs for Barium (USEPA, 2005g) [c]	1	1	--	83
Barium, dissolved	7440393-D	-		X	Barium	rat/mouse	--	Various	51.8	NOAEL	--	reproduction and growth	Geometric mean of NOAEL for reproduction and growth	USEPA Eco-SSLs for Barium (USEPA, 2005g) [c]	1	1	1	--	51.8	rat/mouse	--	various	83	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	USEPA Eco-SSLs for Barium (USEPA, 2005g) [c]	1	1	--	83
Beryllium	7440417	Beryllium, Total	X	X	--	rat	0.486	1464 days	0.532	NOAEL	Chronic	Survival - lifespan	No LOAEL presented for study	USEPA Eco-SSLs for Beryllium (USEPA, 2005h) [c]	1	1	1	--	0.532	dog	13.8	172 weeks	1.4	Maximum likelihood estimate	Chronic	small intestinal lesions	--	USEPA, 2010a [c]	1	1	--	1.4
Beryllium, dissolved	7440417-D	-		X	Beryllium	rat	0.486	1464 days	0.532	NOAEL	Chronic	Survival - lifespan	No LOAEL presented for study	USEPA Eco-SSLs for Beryllium (USEPA, 2005h) [c]	1	1	1	--	0.532	dog	13.8	172 weeks	1.4	Maximum likelihood estimate	Chronic	small intestinal lesions	--	USEPA, 2010a [c]	1	1	--	1.4
Boron	7440428	Boron, Total	X	X	--	rat	0.35	3 generations	28	NOAEL	Chronic	reproduction	--	Sample et al., 1996 [c]	1	1	1	--	28	rat	0.35	3 generations	93.6	LOAEL	Chronic	reproduction	--	Sample et al., 1996 [c]	1	1	--	93.6
Boron, dissolved	7440428-D	-		X	Boron	rat	0.35	3 generations	28	NOAEL	Chronic	reproduction	--	Sample et al., 1996 [c]	1	1	1	--	28	rat	0.35	3 generations	93.6	LOAEL	Chronic	reproduction	--	Sample et al., 1996 [c]	1	1	--	93.6
Cadmium	7440439	Cadmium, Total	X	X	--	mouse	--	--	0.06	Low TRV	--	reproduction	--	DTSC, 2009 [c]	1	1	1	--	0.06	mouse	--	--	2.64	High TRV	--	reproductive	--	DTSC, 2009 [c]	1	1	--	2.64
Cadmium, dissolved	7440439-D	-		X	Cadmium	mouse	--	--	0.06	Low TRV	--	reproduction	--	DTSC, 2009 [c]	1	1	1	--	0.06	mouse	--	--	2.64	High TRV	--	reproductive	--	DTSC, 2009 [c]	1	1	--	2.64
Chromium	7440473	Chromium, Total	X	X	--	rat/mouse/pig/cattle	--	Various	2.40	NOAEL	--	growth	Geometric mean of NOAEL for growth	USEPA Eco-SSLs for Chromium (USEPA, 2008) [c]	1	1	1	--	2.40	mouse/rat/pig/cattle	--	various	58	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	USEPA Eco-SSLs for Chromium (USEPA, 2008) [c]	1	1	--	58
Chromium, dissolved	7440473-D	-		X	Chromium	rat/mouse/pig/cattle	--	Various	2.40	NOAEL	--	growth	Geometric mean of NOAEL for growth	USEPA Eco-SSLs for Chromium (USEPA, 2008) [c]	1	1	1	--	2.40	mouse/rat/pig/cattle	--	various	58	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	USEPA Eco-SSLs for Chromium (USEPA, 2008) [c]	1	1	--	58
Cobalt	7440484	Cobalt, Total	X	X	--	rat	--	--	1.2	Low TRV	--	reproduction	--	DTSC, 2009 [c]	1	1	1	--	1.2	rat	--	--	20	High TRV	--	reproductive	--	DTSC, 2009 [c]	1	1	--	20
Cobalt, dissolved	7440484-D	-		X	Cobalt	rat	--	--	1.2	Low TRV	--	reproduction	--	DTSC, 2009 [c]	1	1	1	--	1.2	rat	--	--	20	High TRV	--	reproductive	--	DTSC, 2009 [c]	1	1	--	20
Copper	7440508	Copper, Total	X	X	--	mouse	--	--	2.67	Low TRV	--	Immunotoxicity	--	DTSC, 2009 [c]	1	1	1	--	2.67	mouse	--	--	632	High TRV	--	mortality, growth, water consumption	--	DTSC, 2009 [c]	1	1	--	632
Copper, dissolved	7440508-D	-		X	Copper	mouse	--	--	2.67	Low TRV	--	Immunotoxicity	--	DTSC, 2009 [c]	1	1	1	--	2.67	mouse	--	--	632	High TRV	--	mortality, growth, water consumption	--	DTSC, 2009 [c]	1	1	--	632
Cyanides	57125	Cyanide, Total	X	X	--	rat	0.273	gestation and lactation, a critical lifestage	68.7	NOAEL	Chronic	reproductive - reduced offspring growth and food consumption	No LOAEL for NOAEL study	Sample et al., 1996 [c]	1	1	1	--	68.7	--	--	--	--	--	--	--	--	--	--	--	--
Fluoride	7782414	-	X	X	--	mink	1.0	382 days	31.37	NOAEL	Chronic	Reproduction - survivorship of kits	--	Sample et al., 1996 [c]	1	1	1	--	31.37	mink	1.0	382 days	52.75	LOAEL	Chronic	Reproduction - survivorship of kits	--	Sample et al., 1996 [c]	1	1	--	52.75
Hexavalent Chromium	18540299	Chromium, Hexavalent	X	X	--	rat/mouse	--	Various	9.24	NOAEL	--	reproduction and growth	Geometric mean of NOAEL for reproduction and growth	USEPA Eco-SSLs for Chromium (USEPA, 2008) [c]	1	1	1	--	9.24	mouse/rat	--	various	38	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	USEPA Eco-SSLs for Chromium (USEPA, 2008) [c]	1	1	--	38
Lead	7439921	Lead, Total	X	X	--	rat	--	--	1.0	Low TRV	--	kidney	--	DTSC, 2009 [c]	1	1	1	--	1	mouse	--	--	241	High TRV	--	growth, liver, kidney	--	DTSC, 2009 [c]	1	1	--	241
Lead, dissolved	7439921-D	-		X	Lead	rat	--	--	1.0	Low TRV	--	kidney	--	DTSC, 2009 [c]	1	1	1	--	1	mouse	--	--	241	High TRV	--	growth, liver, kidney	--	DTSC, 2009 [c]	1	1	--	241
Lithium	7439932	Lithium, Total	X		--	rat	0.35	10 days; gestation	9.4	NOAEL	Chronic	Reproduction - reduced number of offsprings and offspring weight	--	Sample et al., 1996 [c]	1	1	1	--	9.4	rat	0.35	10 days; gestation	18.8	LOAEL	Chronic	Reproduction - reduced number of offsprings and offspring weight	--	Sample et al., 1996 [c]	1	1	--	18.8
Manganese	7439965	Manganese, Total	X	X	--	mouse	--	--	13.7	Low TRV	--	Reproductive	--	DTSC, 2009 [c]	1	1	1	--	13.7	mouse	--	--	159	High TRV	--	Reproductive	--	DTSC, 2009 [c]	1	1	--	159
Manganese, dissolved	7439965-D	-		X	Manganese	mouse	--	--	13.7	Low TRV	--	Reproductive	--	DTSC, 2009 [c]	1	1	1	--	13.7	mouse	--	--	159	High TRV	--	Reproductive	--	DTSC, 2009 [c]	1	1	--	159
Mercury	7439976	Mercury, Total	X	X	--	mink	1	6 months	1.0	NOAEL	Chronic	reproduction	--	Sample et al., 1996 [c]	1	1	1	--	1	--	--	--	--	--	--	--	--	--	--	--	--

Table 11-9
Summary of Selected Toxicity Reference Values for Mammalian Receptors

						Derivation of Low TRV														Derivation of High TRV												
						Toxicity Information									Conversion Factors					Toxicity Information									Conversion Factors			
Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil or Ephemeral Sediment [a]	Detected in Surface Water or Seeps and Springs [b]	Surrogate Used	Test Species	Body Weight (kg)	Duration	Low Toxicity Value (mg/kg-d)	Endpoint	Type	Effects	Additional Comments	Citation	LD50 to Chronic NOAEL	LOAEL-to-NOAEL UF	Subchronic-to-Chronic UF	2005 WHO TEF	Final Low TRV (mg/kg-d)	Test Species	Body Weight	Duration	High Toxicity Value (mg/kg-d)	Endpoint	Type	Effects	Additional Comments	Citation	LD50 to LOAEL	Subchronic-to-Chronic UF	2005 WHO TEF	Final High TRV (mg/kg-d)
Mercury, dissolved	7439976-D	-		X	Mercury	mink	1	6 months	1.0	NOAEL	Chronic	reproduction	--	Sample et al., 1996 [c]	1	1	1	--	1	--	--	--	--	--	--	--	--	--	--	--	--	--
Methyl Mercury - large mammal	22967926	--	X		--	mink	--	--	0.027	Low TRV	--	mortality, anorexia, neurological	--	DTSC, 2009 [c]	1	1	1	--	0.027	mink	--	--	0.27	High TRV	--	mortality, anorexia, neurological	--	DTSC, 2009 [c]	1	1	--	0.27
Methyl Mercury - small mammal	22967926	--	X		--	rat	--	--	0.25	Low TRV	--	reproductive, developmental	--	DTSC, 2009 [c]	1	1	1	--	0.25	rat	--	--	4.0	High TRV	--	reproductive, developmental	--	DTSC, 2009 [c]	1	1	--	4
Molybdenum	7439987	Molybdenum, Total	X	X	--	mouse	0.03	3 generations	0.26	NOAEL	Chronic	reproduction - reduced reproductive success	NOAEL not determined in study; LOAEL adjusted to NOAEL in Sample et al.	Sample et al., 1996 [c]	1	1	1	--	0.26	mouse	0.03	3 generations	2.6	LOAEL	Chronic	reproduction - reduced reproductive success	--	Sample et al., 1996 [c]	1	1	--	2.6
Molybdenum, dissolved	7439987-D	-		X	Molybdenum	mouse	0.03	3 generations	0.26	NOAEL	Chronic	reproduction - reduced reproductive success	NOAEL not determined in study; LOAEL adjusted to NOAEL in Sample et al.	Sample et al., 1996 [c]	1	1	1	--	0.26	mouse	0.03	3 generations	2.6	LOAEL	Chronic	reproduction - reduced reproductive success	--	Sample et al., 1996 [c]	1	1	--	2.6
Nickel	7440020	Nickel, Total	X	X	--	rat	--	--	0.133	Low TRV	--	Reproductive	--	DTSC, 2009 [c]	1	1	1	--	0.133	rat	--	--	31.6	High TRV	--	Reproductive	--	DTSC, 2009 [c]	1	1	--	31.6
Nickel, dissolved	7440020-D	-		X	Nickel	rat	--	--	0.133	Low TRV	--	Reproductive	--	DTSC, 2009 [c]	1	1	1	--	0.133	rat	--	--	31.6	High TRV	--	Reproductive	--	DTSC, 2009 [c]	1	1	--	31.6
Selenium	7782492	Selenium, Total	X	X	--	mouse	--	--	0.05	Low TRV	--	Liver	--	DTSC, 2009 [c]	1	1	1	--	0.05	mouse	--	--	1.21	High TRV	--	Reproductive	--	DTSC, 2009 [c]	1	1	--	1.21
Selenium, dissolved	7782492-D	-		X	Selenium	mouse	--	--	0.05	Low TRV	--	Liver	--	DTSC, 2009 [c]	1	1	1	--	0.05	mouse	--	--	1.21	High TRV	--	Reproductive	--	DTSC, 2009 [c]	1	1	--	1.21
Silica, dissolved	7631869-D	-		X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Silver	7440224	Silver, Total	X	X	--	pig	8.86	40 days	60.2	LOAEL	Subchronic	Growth - body weight	--	USEPA Eco-SSLs for Silver (USEPA, 2006) [c]	1	5	2	--	6.02	pig/rat	--	various	119	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	USEPA Eco-SSLs for Silver (USEPA, 2006) [c]	1	1	--	119
Silver, dissolved	7440224-D	-		X	Silver	pig	8.86	40 days	60.2	LOAEL	Subchronic	Growth - body weight	--	USEPA Eco-SSLs for Silver (USEPA, 2006) [c]	1	5	2	--	6.02	pig/rat	--	various	119	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	USEPA Eco-SSLs for Silver (USEPA, 2006) [c]	1	1	--	119
Strontium	7440246	Strontium, Total	X	X	--	rat	0.35	3 years	263	NOAEL	Chronic	Body weight and bone changes	No LOAEL presented for study	Sample et al., 1996 [c]	1	1	1	--	263	rat	0.0019	3 years	380	LOAEL	Chronic	bone mineralization and structure	--	USEPA, 2010a [c]	1	1	--	380
Strontium, dissolved	7440246-D	-		X	Strontium	rat	0.35	3 years	263	NOAEL	Chronic	Body weight and bone changes	No LOAEL presented for study	Sample et al., 1996 [c]	1	1	1	--	263	rat	0.0019	3 years	380	LOAEL	Chronic	bone mineralization and structure	--	USEPA, 2010a [c]	1	1	--	380
Thallium	7440280	Thallium, Total	X	X	--	rat	--	--	0.48	Low TRV	--	hair loss	--	DTSC, 2009 [c]	1	1	1	--	0.48	rat	--	--	1.43	High TRV	--	hair loss	--	DTSC, 2009 [c]	1	1	--	1.43
Thallium, dissolved	7440280-D	-		X	Thallium	rat	--	--	0.48	Low TRV	--	hair loss	--	DTSC, 2009 [c]	1	1	1	--	0.48	rat	--	--	1.43	High TRV	--	hair loss	--	DTSC, 2009 [c]	1	1	--	1.43
Tin	7440315	Tin, Total	X		bis(Tributyltin)oxide	mouse	0.03	10 days; gestation	23.4	NOAEL	Chronic	reproduction - reduced fetal weight and fetal survival; increased litter resorption	--	Sample et al., 1996 [c]	1	1	1	--	23.4	mouse	0.03	10 days; gestation	35	LOAEL	Chronic	reproduction - reduced fetal weight and fetal survival; increased litter resorption	--	Sample et al., 1996 [c]	1	1	--	35
Titanium	7440326	Titanium, Total	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Titanium, dissolved	7440326-D	-		X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vanadium	7440622	Vanadium, Total	X	X	--	mouse	0.0471	12 days days, gestation	4.16	NOAEL	Chronic	reproduction/growth	EcoSSL states NOAEL of 4.16 but did not specify growth or reproduction	USEPA Eco-SSLs for Vanadium (USEPA, 2005a) [c]	1	1	1	--	4.16	mouse/rat/sheep/pig	--	various	9.4	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	USEPA Eco-SSLs for Vanadium (USEPA, 2005a) [c]	1	1	--	9.4
Vanadium, dissolved	7440622-D	-		X	Vanadium	mouse	0.0471	12 days days, gestation	4.16	NOAEL	Chronic	reproduction/growth	EcoSSL states NOAEL of 4.16 but did not specify growth or reproduction	USEPA Eco-SSLs for Vanadium (USEPA, 2005a) [c]	1	1	1	--	4.16	mouse/rat/sheep/pig	--	various	9.4	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	USEPA Eco-SSLs for Vanadium (USEPA, 2005a) [c]	1	1	--	9.4
Zinc	7440666	Zinc, Total	X	X	--	mouse	--	--	9.60	Low TRV	--	pancreatic,adrenal cortex	--	DTSC, 2009 [c]	1	1	1	--	9.6	rat	--	--	411	High TRV	--	developmental	--	DTSC, 2009 [c]	1	1	--	411
Zinc, dissolved	7440666-D	-		X	Zinc	mouse	--	--	9.60	Low TRV	--	pancreatic,adrenal cortex	--	DTSC, 2009 [c]	1	1	1	--	9.6	rat	--	--	411	High TRV	--	developmental	--	DTSC, 2009 [c]	1	1	--	411
Zirconium	7440677	Zirconium, Total	X		--	mouse	0.03	lifetime	1.74	NOAEL	Chronic	Lifespan	--	Sample et al., 1996 [c]	1	1	1	--	1.74	--	--	--	--	--	--	--	--	--	--	--	--
Energetic Constituents																																
1,2-Dinitrobenzene	528290	o-Dinitrobenzene	X		1,3-Dinitrobenzene	rat	--	16 weeks	0.40	NOAEL	Subchronic	increased splenic weight	--	USEPA, 2010a [c]	1	1	2	--	0.20	rat	--	16 weeks	1.1	LOAEL	Subchronic	increased splenic weight	Converted with ratio of ppm to mg/kg-day doses for NOAEL	USEPA, 2010a [c]	1	2	--	0.53
1,2-Diphenylhydrazine	122667	-		X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dinitrobenzene	99650	m-Dinitrobenzene	X		--	rat	--	16 weeks	0.40	NOAEL	Subchronic	increased splenic weight	--	USEPA, 2010a [c]	1	1	2	--	0.20	rat	--	16 weeks	1.1	LOAEL	Subchronic	increased splenic weight	Converted with ratio of ppm to mg/kg-day doses for NOAEL	USEPA, 2010a [c]	1	2	--	0.53
2,4,6-Trinitrotoluene	118967	-	X		--	dog	--	26 weeks	0.5	LOAEL	Subchronic	liver toxicity	--	USEPA, 2010a [c]	1	5	2	--	0.05	dog	--	25 weeks	0.5	LOAEL	Subchronic	liver toxicity	--	USEPA, 2010a [c]	1	2	--	0.25
2,4-Dinitrotoluene	121142	-		X	--	dog	--	2 years	0.2	NOAEL	Subchronic	Neurotoxicity, heinz bodies and biliary tract hyperplasia	--	USEPA, 2010a [c]	1	1	2	--	0.1	dog	--	2 years	1.5	LOAEL	Subchronic	Neurotoxicity, heinz bodies and biliary tract hyperplasia	--	USEPA, 2010a [c]	1	2	--	0.75
2-Amino-4,6-Dinitrotoluene	35572782	-	X		2,4-Dinitrotoluene	dog	--	2 years	0.2	NOAEL	Subchronic	Neurotoxicity, heinz bodies and biliary tract hyperplasia	--	USEPA, 2010a [c]	1	1	2	--	0.1	dog	--	2 years	1.5	LOAEL	Subchronic	Neurotoxicity, heinz bodies and biliary tract hyperplasia	--	USEPA, 2010a [c]	1	2	--	0.75
HMX	2691410	-	X		--	rat	--	13 weeks	50	NOAEL	Subchronic	hepatic lesions	--	USEPA, 2010a [c]	1	1	2	--	25	rat	--	13 weeks	150	LOAEL	Subchronic	hepatic lesions	--	USEPA, 2010a [c]	1	2	--	75
Hydrazine	302012	-	X		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 11-9
Summary of Selected Toxicity Reference Values for Mammalian Receptors

						Derivation of Low TRV														Derivation of High TRV												
						Toxicity Information									Conversion Factors					Toxicity Information									Conversion Factors			
Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil or Ephemeral Sediment [a]	Detected in Surface Water or Seeps and Springs [b]	Surrogate Used	Test Species	Body Weight (kg)	Duration	Low Toxicity Value (mg/kg-d)	Endpoint	Type	Effects	Additional Comments	Citation	LD50 to Chronic NOAEL	LOAEL-to-NOAEL UF	Subchronic-to-Chronic UF	2005 WHO TEF	Final Low TRV (mg/kg-d)	Test Species	Body Weight	Duration	High Toxicity Value (mg/kg-d)	Endpoint	Type	Effects	Additional Comments	Citation	LD50 to LOAEL	Subchronic-to-Chronic UF	2005 WHO TEF	Final High TRV (mg/kg-d)
Monomethylhydrazine	60344	-	X		1,2-Dimethylhydrazine	mouse	--	5 months	0.75	LOAEL	Subchronic	hepatic	Study used to derive MRL in ATSDR	ATSDR, 1997 [c]	1	5	2	--	0.075	mouse	--	5 months	0.75	LOAEL	Subchronic	hepatic	Study used to derive MRL in ATSDR	ATSDR, 1997 [c]	1	2	--	0.38
Perchlorate	14797730	-	X	X	--	rabbit	--	3 months	6.4	NOAEL	Chronic	Nervous system effects	UF of 100 applied (due to lack of details in original study) within USACHPPM 2007	USACHPPM, 2007 [c]	1	1	1	--	6.4	rabbit	--	3 months	32	LOAEL	Chronic	Nervous system effects	UF of 20 applied (due to lack of details in original study) within US CHPPM 2007	USACHPPM, 2007	1	1	--	32
RDX	121824	-	X		--	rat	--	2 years	0.3	NOAEL	Chronic	inflammation of the prostate	--	USEPA, 2011 [c]	1	1	1	--	0.3	rat	--	2 years	1.5	LOAEL	Chronic	inflammation of the prostate	--	USEPA, 2010a [c]	1	1	--	1.5
Volatile Organic Compounds																																
1,1,1,2-Tetrachloroethane	630206	-	X		--	rat	--	103 weeks	89.3	LOAEL	Chronic	kidney/liver toxicity	--	USEPA, 2010a [c]	1	5	1	--	17.9	rat	--	103 weeks	89.3	LOAEL	Chronic	kidney/liver toxicity	--	USEPA, 2010a [c]	1	1	--	89.3
1,1,1-Trichloroethane	71556	-	X	X	--	mouse	0.035	2 generations	1,000	NOAEL	Chronic	reproductive	--	Sample et al., 1996 [c]	1	1	1	--	1,000	mouse	0.03	90 days	5064.36	BMD10	Subchronic	body weight	--	USEPA, 2010a [c]	1	2	--	2532.18
1,1,2,2-Tetrachloroethane	79345	-	X	X	--	mouse	--	14 weeks	40	NOAEL	Subchronic	hepatotoxicity	Table 3-2, Study 42.	ATSDR, 2008 [c]	1	1	2	--	20	mouse	--	14 weeks	80	LOAEL	Subchronic	hepatotoxicity	Table 3-2, Study 42.	ATSDR, 2008 [c]	1	2	--	40
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	Freon 113	X	X	--	human	--	2.77 years	273	NOAEL	Subchronic	no adverse medical symptoms observed	--	USEPA, 2010a [c]	1	1	2	--	136.5	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2-Trichloroethane	79005	-	X	X	--	mouse	--	90 days	3.9	NOAEL	Subchronic	liver toxicity	--	USEPA, 2010a [c]	1	1	2	--	2.0	mouse	--	90 days	44	LOAEL	Subchronic	liver toxicity	--	USEPA, 2010a [c]	1	2	--	22
1,1-Dichloroethane	75343	-	X	X	1,2-Dichloroethane	mouse	0.035	2 generations	50	NOAEL	Chronic	reproduction	No LOAEL for NOAEL study	Sample et al., 1996 [c]	1	1	1	--	50	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene	75354	-	X	X	--	dog	10	97 days	2.5	NOAEL	Subchronic	mortality, body weight, blood chemistry, liver histology	NOAEL provided in Sample et al. adjusted to chronic	Sample et al., 1996 [c]	1	1	1	--	2.5	rat	--	2 years	6.6	BMD10	Chronic	liver toxicity	--	USEPA, 2010a [c]	1	1	--	6.6
1,2,3-Trichlorobenzene	87616	-	X		1,2,4-Trichlorobenzene	rat	--	Subchronic	14.8	NOAEL	Subchronic	reproductive study - adrenal gland weight	--	USEPA, 2010a [c]	1	1	2	--	7.40	rat	--	Subchronic	53.6	LOAEL	Subchronic	vacuolization of zona fasiculata in the cortex	--	USEPA, 2010a [c]	1	2	--	26.8
1,2,4-Trichlorobenzene	120821	-	X	X	--	rat	--	Subchronic	14.8	NOAEL	Subchronic	reproductive study - adrenal gland weight	--	USEPA, 2010a [c]	1	1	2	--	7.40	rat	--	Subchronic	53.6	LOAEL	Subchronic	vacuolization of zona fasiculata in the cortex	--	USEPA, 2010a [c]	1	2	--	26.8
1,2,4-Trimethylbenzene	95636	-	X		Xylenes	mouse	0.03	10 days; gestation	2.06	NOAEL	Chronic	reproduction - fetal weights and fetal malformities	--	Sample et al., 1996 [c]	1	1	1	--	2.06	mouse	0.03	10 days; gestation	2.6	LOAEL	Chronic	reproduction - fetal weights and fetal malformities	--	Sample et al., 1996 [c]	1	1	--	2.6
1,2-Dibromoethane	106934	-	X		--	rat	--	49 weeks	27	LOAEL	Subchronic	testicular atrophy, liver peliosis and adrenal cortical degeneration	--	USEPA, 2010a [c]	1	5	2	--	2.7	rat	--	49 weeks	27	LOAEL	Subchronic	testicular atrophy, liver peliosis and adrenal cortical degeneration	--	USEPA, 2010a [c]	1	2	--	13.5
1,2-Dichlorobenzene	95501	o-Dichlorobenzene	X	X	--	rat	--	103 weeks	85.7	NOAEL	Chronic	renal tubular regeneration, renal lesions	No LOAEL for NOAEL study	USEPA, 2010a [c]	1	1	1	--	85.7	mouse	--	103 weeks	86	LOAEL	Chronic	renal tubular regeneration	5 days/week; without adjustment is 120 mg/kg-day	ATSDR, 2006b [c]	1	1	--	86
1,2-Dichloroethane	107062	-	X	X	--	mouse	0.035	2 generations	50	NOAEL	Chronic	reproduction	No LOAEL for NOAEL study	Sample et al., 1996 [c]	1	1	1	--	50	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloroethene	540590	1,2-Dichloroethenes	X		Low TRV: 1,2-Dichloroethene High TRV: trans-1,2-Dichloroethene	mouse	0.03	90 days	45.2	NOAEL	Subchronic	body/organ weight, blood chemistry, hepatic function	NOAEL provided in Sample et al. adjusted to chronic; No LOAEL for NOAEL study	Sample et al., 1996 [c]	1	1	1	--	45.2	mouse	--	90 days	175	LOAEL	Subchronic	hepatic	Study used to derive MRL in ATSDR	ATSDR, 1996 [c]	1	2	--	87.5
1,2-Dichloropropane	78875	-	X	X	--	rat	--	13 weeks	71	LOAEL	Subchronic	systematic - slight anemia	ATSDR Table 2-2; Study 27/28. LOAEL prior to 5day/week adjustment 100 mg/kg-day	ATSDR, 1989 [c]	1	5	2	--	7.1	rat	--	13 weeks	71	LOAEL	Subchronic	systematic - slight anemia	ATSDR Table 2-2; Study 27/28. LOAEL prior to 5day/week adjustment 100 mg/kg-day	ATSDR, 1989 [c]	1	2	--	36
1,3,5-Trimethylbenzene	108678	-	X		Xylenes	mouse	0.03	10 days; gestation	2.06	NOAEL	Chronic	reproduction - fetal weights and fetal malformities	--	Sample et al., 1996 [c]	1	1	1	--	2.06	mouse	0.03	10 days; gestation	2.6	LOAEL	Chronic	reproduction - fetal weights and fetal malformities	--	Sample et al., 1996 [c]	1	1	--	2.6
1,3-Dichlorobenzene	541731	m-Dichlorobenzene	X	X	--	rat	--	90 days	147	LOAEL	Subchronic	increased cytoplasmic vacuolization in pituitary pars distalis	--	ATSDR, 2006a [c]	1	5	2	--	14.7	rat	--	90 days	147	LOAEL	Subchronic	increased cytoplasmic vacuolization in pituitary pars distalis	--	ATSDR, 2006a [c]	1	2	--	73.5
1,4-Dichlorobenzene	106467	p-Dichlorobenzene	X	X	--	beagle dog	--	1 year	7.1	NOAEL	Subchronic	hepatic	NOAEL is 10mg/kg-d before exposure time adjustment	ATSDR, 2006a [c]	1	1	2	--	3.6	beagle dog	--	1 year	36	LOAEL	Subchronic	hepatic	NOAEL is 10mg/kg-d before exposure time adjustment	ATSDR, 2006a [c]	1	2	--	18
2-Chloroethylvinyl ether	110758	2-Chloroethyl vinyl ether	X	X	bis(2-Chloroisopropyl) ether	mouse	--	up to 104 weeks	35.8	NOAEL	Chronic	Decrease in hemoglobin and possible erythrocyte destruction	--	USEPA, 2010a [c]	1	1	1	--	35.8	mouse	--	up to 104 weeks	198	LOAEL	Chronic	Decrease in hemoglobin and possible erythrocyte destruction	--	USEPA, 2010a [c]	1	1	--	198
2-Chloronaphthalene	91587	-		X	--	mouse	--	13 weeks	250	NOAEL	Subchronic	growth, mortality, organ toxicity	--	USEPA, 2011 [c]	1	1	2	--	125	mouse	--	13 weeks	600	LOAEL	Subchronic	growth, mortality, organ toxicity	--	USEPA, 2010a [c]	1	2	--	300
2-Chlorophenol	95578	-		X	--	rat	--	10 weeks before breeding through weening	5	NOAEL	Chronic	reproductive effects	--	USEPA, 2010a [c]	1	1	1	--	5	rat	--	10 weeks prior to breeding through weening	50	LOAEL	Chronic	reproductive effects	--	USEPA, 2010a [c]	1	1	--	50
2-Hexanone	591786	Methyl butyl ketone	X		--	rat	0.71	13 months	5	BMDL10	Chronic	axonal swelling	--	USEPA, 2010a [c]	1	1	1	--	5	rat	0.71	13 months	36.1	BMD10	Chronic	axonal swelling	--	USEPA, 2010a [c]	1	1	--	36.1
2-Nitrophenol	88755	o-Nitrophenol		X	2,4-Dinitrophenol	rat	--	6 months	5.4	NOAEL	Subchronic	growth	Supporting studies in IRIS because principal study is based on humans	USEPA, 2010a [c]	1	1	2	--	2.7	--	--	--	--	--	--	--	--	--	--	--	--

Table 11-9
Summary of Selected Toxicity Reference Values for Mammalian Receptors

						Derivation of Low TRV														Derivation of High TRV												
						Toxicity Information									Conversion Factors					Toxicity Information									Conversion Factors			
Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil or Ephemeral Sediment [a]	Detected in Surface Water or Seeps and Springs [b]	Surrogate Used	Test Species	Body Weight (kg)	Duration	Low Toxicity Value (mg/kg-d)	Endpoint	Type	Effects	Additional Comments	Citation	LD50 to Chronic NOAEL	LOAEL-to-NOAEL UF	Subchronic-to-Chronic UF	2005 WHO TEF	Final Low TRV (mg/kg-d)	Test Species	Body Weight	Duration	High Toxicity Value (mg/kg-d)	Endpoint	Type	Effects	Additional Comments	Citation	LD50 to LOAEL	Subchronic-to-Chronic UF	2005 WHO TEF	Final High TRV (mg/kg-d)
Acetone	67641	-	X	X	--	rat	0.35	90 days	10	NOAEL	Subchronic	kidney and liver toxicity	NOAEL provided in Sample et al. adjusted to chronic	Sample et al., 1996 [c]	1	1	1	--	10	rat	0.35	90 days	50	LOAEL	Subchronic	kidney and liver toxicity	NOAEL provided in Sample et al. adjusted to chronic	Sample et al., 1996 [c]	1	1	--	50
Acetic Acid	64197	-	X		Ethyl Acetate	rat	0.035	90 days	90	NOAEL	Subchronic	mortality and weight loss	NOAEL provided in Sample et al. adjusted to chronic	Sample et al., 1996 [c]	1	1	1	--	90	rat	0.035	90 days	360	LOAEL	Subchronic	mortality and weight loss	LOAEL provided in Sample et al. adjusted to chronic	Sample et al., 1996 [c]	1	1	--	360
Acrolein	107028			X	--	rat	--	--	0.05	NOAEL	Chronic	Survival	--	USEPA, 2011 [c]	1	1	1	--	0.05	rat	--	--	0.5	FEL	Chronic	Survival	--	USEPA, 2010a [c]	1	1	--	0.5
Acrylonitrile	107131			X	--	rat	--	23-26 months	4.2	NOAEL	Chronic	Hematological Effects	--	ATSDR, 1990 [c]	1	1	1	--	4.2	rat	--	23-26 months	14	LOAEL	Chronic	Hematological Effects	--	ATSDR, 1990 [c]	1	1	--	14
Benzene	71432	-	X	X	--	mouse	0.03	7 days; gestation	26.36	NOAEL	Chronic	reproduction - maternal mortality, embryonic resorption, fetal weights	NOAEL not determined in study; LOAEL adjusted to NOAEL in Sample et al.	Sample et al., 1996 [c]	1	1	1	--	26.36	mouse	0.03	7 days; gestation	263.6	LOAEL	Chronic	reproduction - maternal mortality, embryonic resorption, fetal weights	--	Sample et al., 1996 [c]	1	1	--	263.6
bis(2-Chloroethyl) ether	111444	s-Dichloroethyl ether		X	bis(2-Chloroisopropyl) ether	mouse	--	up to 104 weeks	35.8	NOAEL	Chronic	Decrease in hemoglobin and possible erythrocyte destruction	--	USEPA, 2010a [c]	1	1	1	--	35.8	mouse	--	up to 104 weeks	198	LOAEL	Chronic	Decrease in hemoglobin and possible erythrocyte destruction	--	USEPA, 2010a [c]	1	1	--	198
Bromide	24959679	-	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromobenzene	108861	-	X		--	mouse	0.03	90 days	24.1	BMDL10	Subchronic	hepatocellular cytomegaly	--	USEPA, 2010a [c]	1	1	2	--	12.05	mouse	0.03	90 days	41.1	BMD10	Subchronic	hepatocellular cytomegaly	--	USEPA, 2010a [c]	1	2	--	20.6
Bromodichloromethane	75274	-	X	X	--	rat	--	102 weeks	17.9	LOAEL	Chronic	Renal cytomegaly	LOAEL in IRIS already adjusted for 5days/week	USEPA, 2010a [c]	1	5	1	--	3.58	rat	--	102 weeks	17.9	LOAEL	Chronic	Renal cytomegaly	LOAEL in IRIS already adjusted for 5days/week	USEPA, 2010a [c]	1	1	--	17.9
Bromomethane	74839	-	X	X	--	rat	--	13 weeks	1.4	NOAEL	Subchronic	Epithelial hyperplasia of the forestomach	Value in IRIS adjusted for 5days/week	USEPA, 2010a [c]	1	1	2	--	0.70	rat	--	13 weeks	7.1	LOAEL	Subchronic	Epithelial hyperplasia of the forestomach	Value in IRIS adjusted for 5days/week	USEPA, 2010a [c]	1	2	--	3.6
Carbon Disulfide	75150	-	X	X	--	rabbit	1.13	34 weeks before breeding through gestation	11	NOAEL	Chronic	fetal toxicity/malformations	No LOAEL for NOAEL study	USEPA, 2010a [c]	1	1	1	--	11	--	--	--	--	--	--	--	--	--	--	--	--
Carbon Tetrachloride	56235	-	X	X	--	rat	0.35	2 years	16	NOAEL	Chronic	reproduction	No LOAEL presented for study	Sample et al., 1996 [c]	1	1	1	--	16	--	--	--	--	--	--	--	--	--	--	--	--	--
Chlorobenzene	108907	Monochlorobenzene	X	X	--	dog	--	13 weeks	19	NOAEL	Subchronic	histopathologic changes in liver	beagle dogs	USEPA, 2010a [c]	1	1	2	--	9.5	dog	--	13 weeks	39	LOAEL	Subchronic	histopathologic changes in liver	beagle dogs	USEPA, 2010a [c]	1	2	--	20
Chloroethane	75003	Ethyl chloride		X	Low TRV: 1,2-Dichloroethene High TRV: trans-1,2-Dichloroethene	mouse	0.03	90 days	45.2	NOAEL	Subchronic	body/organ weight, blood chemistry, hepatic function	NOAEL provided in Sample et al. adjusted to chronic; No LOAEL for NOAEL study	Sample et al., 1996 [c]	1	1	1	--	45.2	mouse	--	90 days	175	LOAEL	Subchronic	hepatic	Study used to derive MRL in ATSDR	ATSDR, 1996 [c]	1	2	--	87.5
Chloroform	67663	Trichloromethane	X	X	--	rat	0.35	13 weeks	15	NOAEL	Subchronic	liver, kidney and gonad condition	NOAEL provided in Sample et al. adjusted to chronic	Sample et al., 1996 [c]	1	1	1	--	15	rat	0.35	13 weeks	41	LOAEL	Subchronic	liver, kidney and gonad condition	NOAEL provided in Sample et al. adjusted to chronic	Sample et al., 1996 [c]	1	1	--	41
Chloromethane	74873	Methyl chloride	X	X	Bromomethane	rat	--	13 weeks	1.4	NOAEL	Subchronic	Epithelial hyperplasia of the forestomach	Value in IRIS adjusted for 5days/week	USEPA, 2010a [c]	1	1	2	--	0.70	rat	--	13 weeks	7.1	LOAEL	Subchronic	Epithelial hyperplasia of the forestomach	Value in IRIS adjusted for 5days/week	USEPA, 2010a [c]	1	2	--	3.6
cis-1,2-Dichloroethene	156592	cis-1,2-Dichloroethylene	X	X	Low TRV: 1,2-Dichloroethene	mouse	0.03	90 days	45.2	NOAEL	Subchronic	body/organ weight, blood chemistry, hepatic function	No LOAEL presented for study; NOAEL provided in Sample et al. adjusted to chronic	Sample et al., 1996 [c]	1	1	1	--	45.2	rat	--	90 days	97	LOAEL	Subchronic	decreased hematocrit	Study used to derive MRL in ATSDR	ATSDR, 1996 [c]	1	2	--	49
cis-1,3-Dichloropropene	10061015	-		X	1,3-Dichloropropene	rat	--	2 years	3.4	BMDL10	Chronic	forestomach histopathology	--	USEPA, 2010a [c]	1	1	1	--	3.4	rat	--	2 years	5.1	BMD10	Chronic	forestomach histopathology	--	USEPA, 2010a [c]	1	1	--	5.1
Cumene	98828	Isopropylbenzene	X		--	rat	--	194 days	110	NOAEL	Subchronic	Increased average kidney weight	Value in IRIS adjusted for 5days/week	USEPA, 2010a [c]	1	1	2	--	55	rat	--	194 days	331	LOAEL	Subchronic	Increased average kidney weight	Value in IRIS adjusted for 5days/week	USEPA, 2010a [c]	1	2	--	166
Dibenzofuran	132649	-	X		LMW-PAH	rat	0.247	6 weeks	65.6	NOAEL	Subchronic	growth	NOAEL used to develop LMW-PAH Eco-SSL	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	1	--	65.6	rabbit/mouse/rat	--	various	356	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	--	356
Dibromomethane	74953	-	X		Methylene chloride	rat	0.35	2 years	5.85	NOAEL	Chronic	Liver histology	--	Sample et al., 1996 [c]	1	1	1	--	5.85	rat	0.35	2 years	50	LOAEL	Chronic	Liver histology	--	Sample et al., 1996 [c]	1	1	--	50
Dichlorodifluoromethane	75718	Freon 12	X		--	rat	--	2 years	15	NOAEL	Chronic	reduced body weight	--	USEPA, 2010a [c]	1	1	1	--	15	rat	--	2 years	150	LOAEL	Chronic	reduced body weight	--	USEPA, 2010a [c]	1	1	--	150
Ethylbenzene	100414	-	X	X	--	rat	--	182 days	97.1	NOAEL	Subchronic	liver and kidney toxicity	IRIS value adjusted for 5/7 days	USEPA, 2010a [c]	1	1	2	--	48.6	rat	--	182 days	291	LOAEL	Subchronic	liver and kidney toxicity	IRIS value adjusted for 5/7 days	USEPA, 2010a [c]	1	2	--	146
Methyl ethyl ketone	78933	2-Butanone	X		--	rat	0.35	2 generations	1,771	NOAEL	Chronic	reproduction - number of pups/liter, pup survivorship and pup body weight	--	Sample et al., 1996 [c]	1	1	1	--	1,771	rat	0.35	2 generations	4,571	LOAEL	Chronic	reproduction - number of pups/liter, pup survivorship and pup body weight	--	Sample et al., 1996 [c]	1	1	--	4,571
Methyl isobutyl ketone (MIBK)	108101	4-Methyl-2-pentanone	X		High TRV: Methyl ethyl ketone	rat	0.35	13 weeks	25	NOAEL	Subchronic	Liver and kidney function	No LOAEL presented for study; NOAEL provided in Sample et al. adjusted to chronic	Sample et al., 1996 [c]	1	1	2	--	12.5	rat	0.35	2 generations	4,571	LOAEL	Chronic	reproduction - number of pups/liter, pup survivorship and pup body weight	--	Sample et al., 1996 [c]	1	1	--	4571
Methylene chloride	75092	Dichloromethane	X	X	--	rat	0.35	2 years	5.85	NOAEL	Chronic	Liver histology	--	Sample et al., 1996 [c]	1	1	1	--	5.85	rat	0.35	2 years	50	LOAEL	Chronic	Liver histology	--	Sample et al., 1996 [c]	1	1	--	50

Table 11-9
Summary of Selected Toxicity Reference Values for Mammalian Receptors

						Derivation of Low TRV														Derivation of High TRV													
						Toxicity Information									Conversion Factors					Toxicity Information									Conversion Factors			
Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil or Ephemeral Sediment [a]	Detected in Surface Water or Seeps and Springs [b]	Surrogate Used	Test Species	Body Weight (kg)	Duration	Low Toxicity Value (mg/kg-d)	Endpoint	Type	Effects	Additional Comments	Citation	LD50 to Chronic NOAEL	LOAEL-to-NOAEL UF	Subchronic-to-Chronic UF	2005 WHO TEF	Final Low TRV (mg/kg-d)	Test Species	Body Weight	Duration	High Toxicity Value (mg/kg-d)	Endpoint	Type	Effects	Additional Comments	Citation	LD50 to LOAEL	Subchronic-to-Chronic UF	2005 WHO TEF	Final High TRV (mg/kg-d)
m-Xylene	108383	meta-Xylene		X	Xylenes	mouse	0.03	10 days; gestation	2.06	NOAEL	Chronic	reproduction - fetal weights and fetal malformities	--	Sample et al., 1996 [c]	1	1	1	--	2.06	mouse	0.03	10 days; gestation	2.6	LOAEL	Chronic	reproduction - fetal weights and fetal malformities	--	Sample et al., 1996 [c]	1	1	--	2.6
m-Xylene & p-Xylene	136777612	meta- and para-Xylenes	X	X	Xylenes	mouse	0.03	10 days; gestation	2.06	NOAEL	Chronic	reproduction - fetal weights and fetal malformities	--	Sample et al., 1996 [c]	1	1	1	--	2.06	mouse	0.03	10 days; gestation	2.6	LOAEL	Chronic	reproduction - fetal weights and fetal malformities	--	Sample et al., 1996 [c]	1	1	--	2.6
n-Butylbenzene	104518	-	X		Ethylbenzene	rat	--	182 days	97.1	NOAEL	Subchronic	liver and kidney toxicity	IRIS value adjusted for 5/7 days	USEPA, 2010a [c]	1	1	2	--	48.6	rat	--	182 days	291	LOAEL	Subchronic	liver and kidney toxicity	IRIS value adjusted for 5/7 days	USEPA, 2010a [c]	1	2	--	146
Nitrobenzene	98953	-		X	--	rat	--	90 days	1.8	$BMDL_{1SD}$	Subchronic	Increased methemoglobin levels	--	USEPA, 2011 [c]	1	1	2	--	0.9	rat	--	90 days	3.0	BMD_{1SD}	Subchronic	Increased methemoglobin levels	--	USEPA, 2010a [c]	1	2	--	1.5
n-Propylbenzene	103651	-	X		Ethylbenzene	rat	--	182 days	97.1	NOAEL	Subchronic	liver and kidney toxicity	IRIS value adjusted for 5/7 days	USEPA, 2010a [c]	1	1	2	--	48.6	rat	--	182 days	291	LOAEL	Subchronic	liver and kidney toxicity	IRIS value adjusted for 5/7 days	USEPA, 2010a [c]	1	2	--	146
o-Chlorotoluene	95498	2-Chlorotoluene	X		--	rat	--	15 weeks	20	NOAEL	Subchronic	decrease body weight	--	USEPA, 2010a [c]	1	1	2	--	10	rat	--	15 weeks	80	LOAEL	Subchronic	decrease body weight	--	USEPA, 2010a [c]	1	2	--	40
o-Xylene	95476	-	X		Xylenes	mouse	0.03	10 days; gestation	2.06	NOAEL	Chronic	reproduction - fetal weights and fetal malformities	--	Sample et al., 1996 [c]	1	1	1	--	2.06	mouse	0.03	10 days; gestation	2.6	LOAEL	Chronic	reproduction - fetal weights and fetal malformities	--	Sample et al., 1996 [c]	1	1	--	2.6
p-Chlorotoluene	106434	4-Chlorotoluene	X		o-Chlorotoluene	rat	--	15 weeks	20	NOAEL	Subchronic	decrease body weight	--	USEPA, 2010a [c]	1	1	2	--	10	rat	--	15 weeks	80	LOAEL	Subchronic	decrease body weight	--	USEPA, 2010a [c]	1	2	--	40
p-Cymene	99876	p-Isopropyltoluene	X		Cumene	rat	--	194 days	110	NOAEL	Subchronic	Increased average kidney weight	Value in IRIS adjusted for 5days/week	USEPA, 2010a [c]	1	1	2	--	55	rat	--	194 days	331	LOAEL	Subchronic	Increased average kidney weight	Value in IRIS adjusted for 5days/week	USEPA, 2010a [c]	1	2	--	166
sec-Butylbenzene	135988	-	X		Cumene	rat	--	194 days	110	NOAEL	Subchronic	Increased average kidney weight	Value in IRIS adjusted for 5days/week	USEPA, 2010a [c]	1	1	2	--	55	rat	--	194 days	331	LOAEL	Subchronic	Increased average kidney weight	Value in IRIS adjusted for 5days/week	USEPA, 2010a [c]	1	2	--	166
Styrene	100425	Vinylbenzene	X		--	dog	--	560 days	200	NOAEL	Subchronic	red blood cell and liver effects	--	USEPA, 2010a [c]	1	1	2	--	100	dog	--	560 days	400	LOAEL	Subchronic	red blood cell and liver effects	--	USEPA, 2010a [c]	1	2	--	200
tert-Butylbenzene	98066	-	X		Cumene	rat	--	194 days	110	NOAEL	Subchronic	Increased average kidney weight	Value in IRIS adjusted for 5days/week	USEPA, 2010a [c]	1	1	2	--	55	rat	--	194 days	331	LOAEL	Subchronic	Increased average kidney weight	Value in IRIS adjusted for 5days/week	USEPA, 2010a [c]	1	2	--	166
Tetralin	119642	-	X		Naphthalene	rat	0.247	6 weeks	65.6	NOAEL	Subchronic	growth	NOAEL used to develop LMW-PAH Eco-SSL	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	1	--	65.6	rabbit/mouse/rat	--	various	356	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	--	356
Tetrachloroethene	127184	-	X	X	--	mouse	0.03	6 weeks	1.4	NOAEL	Subchronic	hepatotoxicity	Sub-chronic adjusted to chronic in Sample et al.	Sample et al., 1996 [c]	1	1	1	--	1.4	mouse	0.03	6 weeks	7	NOAEL	Subchronic	hepatotoxicity	Sub-chronic adjusted to chronic in Sample et al.	Sample et al., 1996 [c]	1	1	--	7
Toluene	108883	Toluol	X	X	--	mouse	0.03	7 days; gestation	26	NOAEL	Chronic	reproduction	NOAEL not determined in study; LOAEL adjusted to NOAEL in	Sample et al., 1996 [c]	1	1	1	--	26	mouse	0.03	7 days; gestation	260	LOAEL	Chronic	reproduction	--	Sample et al., 1996 [c]	1	1	--	260
trans-1,2-Dichloroethene	156605	-	X	X	Low TRV: 1,2-Dichloroethene	mouse	0.03	90 days	45.2	NOAEL	Subchronic	body/organ weight, blood chemistry, hepatic function	No LOAEL presented for study; NOAEL provided in Sample et al. adjusted to	Sample et al., 1996 [c]	1	1	1	--	45.2	mouse	--	90 days	175	LOAEL	Subchronic	hepatic	Study used to derive MRL in ATSDR	ATSDR, 1996 [c]	1	2	--	87.5
trans-1,3-Dichloropropene	10061026	-		X	1,3-Dichloropropene	rat	--	2 years	3.4	BMDL10	Chronic	forestomach histopathology	--	USEPA, 2010a [c]	1	1	1	--	3.4	rat	--	2 years	5.1	BMD10	Chronic	forestomach histopathology	--	USEPA, 2010a [c]	1	1	--	5.1
Trichloroethene	79016	Trichloroethylene (TCE)	X	X	--	mouse	0.03	6 weeks	0.7	NOAEL	Subchronic	liver toxicity	NOAEL not determined in study; LOAEL extrapolated to NOAEL. NOAEL and LOAEL provided in Sample et al. adjusted to	Sample et al., 1996 [c]	1	1	1	--	0.7	mouse	0.03	6 weeks	7	LOAEL	Subchronic	liver toxicity	NOAEL and LOAEL provided in Sample et al. adjusted to chronic	Sample et al., 1996 [c]	1	1	--	7
Trichlorofluoromethane	75694	-	X	X	--	rat/mice	--	78 weeks	349	LOAEL	Chronic	survival and histopathology	Value in IRIS adjusted for 5days/week	USEPA, 2010a [c]	1	5	1	--	69.8	rat/mice	--	78 weeks	349	LOAEL	Chronic	survival and histopathology	Value in IRIS adjusted for 5days/week	USEPA, 2010a [c]	1	1	--	349
Vinyl chloride	75014	-	X	X	--	rat	0.35	lifetime (~144 weeks)	0.17	NOAEL	Chronic	longevity, mortality	NOAEL not determined in study; LOAEL adjusted to NOAEL in	Sample et al., 1996 [c]	1	1	1	--	0.17	rat	0.35	lifetime (~144 weeks)	1.7	LOAEL	Chronic	longevity, mortality	--	Sample et al., 1996 [c]	1	1	--	1.7
Xylenes, Total	1330207	Xylene (Total) Isomers	X	X	--	mouse	0.03	10 days; gestation	2.06	NOAEL	Chronic	reproduction - fetal weights and fetal malformities	--	Sample et al., 1996 [c]	1	1	1	--	2.06	mouse	0.03	10 days; gestation	2.6	LOAEL	Chronic	reproduction - fetal weights and fetal malformities	--	Sample et al., 1996 [c]	1	1	--	2.6
Semi-Volatile Organic Compounds																																	
1,1-Dimethylhydrazine	57147	-	X		1,2-Dimethylhydrazine	mouse	--	5 months	0.75	LOAEL	Subchronic	hepatic	Study used to derive MRL in ATSDR	ATSDR, 1997 [c]	1	5	2	--	0.075	mouse	--	5 months	0.75	LOAEL	Subchronic	hepatic	Study used to derive MRL in ATSDR	ATSDR, 1997 [c]	1	2	--	0.38
1,2-Dibromo-3-chloropropane	96128	1,2-Dibromo-3-CPA	X		--	rabbit	--	10 weeks	1.34	LOAEL	Subchronic	Reproductive - abnormal sperm morphology; decreased spermatogenesis	5 days/week; Without adjustment is 1.88 mg/kg-day	ATSDR, 1992 [c]	1	5	2	--	0.134	rabbit	--	10 weeks	1.34	LOAEL	Subchronic	Reproductive - abnormal sperm morphology; decreased spermatogenesis	5 days/week; Without adjustment is 1.88 mg/kg-day	ATSDR, 1992 [c]	1	2	--	0.671
1,4-Dioxane	123911	-	X		--	rat	0.35	10 days; gestation	0.5	NOAEL	chronic	reproduction - maternal toxicity and reduced fetal weights	--	Sample et al., 1996 [c]	1	1	1	--	0.5	rat	0.35	10 days; gestation	1.0	LOAEL	chronic	reproduction - maternal toxicity and reduced fetal weights	--	Sample et al., 1996 [c]	1	1	--	1.0
2,4,5-Trichlorophenol	95954	-	X		--	rat	--	98 days	100	NOAEL	Subchronic	liver and kidney toxicity	--	USEPA, 2010a [c]	1	1	2	--	50	rat	--	98 days	300	LOAEL	Subchronic	liver and kidney toxicity	--	USEPA, 2010a [c]	1	2	--	150
2,4,6-Trichlorophenol	88062	-	X	X	2,4,5-Trichlorophenol	rat	--	98 days	100	NOAEL	Subchronic	liver and kidney toxicity	--	USEPA, 2010a [c]	1	1	2	--	50	rat	--	98 days	300	LOAEL	Subchronic	liver and kidney toxicity	--	USEPA, 2010a [c]	1	2	--	150
2,4-Dichlorophenol	120832			X	--	rat	--	multi-generation	0.3	NOAEL	Subchronic to chronic	reproduction	--	USEPA, 2010a [c]	1	1	1	--	0.3	rat	--	multi-generation	3.0	LOAEL	Chronic	reproduction	--	USEPA, 2010a [c]	1	1	--	3

Table 11-9
Summary of Selected Toxicity Reference Values for Mammalian Receptors

						Derivation of Low TRV														Derivation of High TRV												
						Toxicity Information									Conversion Factors					Toxicity Information									Conversion Factors			
Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil or Ephemeral Sediment [a]	Detected in Surface Water or Seeps and Springs [b]	Surrogate Used	Test Species	Body Weight (kg)	Duration	Low Toxicity Value (mg/kg-d)	Endpoint	Type	Effects	Additional Comments	Citation	LD50 to Chronic NOAEL	LOAEL-to-NOAEL UF	Subchronic-to-Chronic UF	2005 WHO TEF	Final Low TRV (mg/kg-d)	Test Species	Body Weight	Duration	High Toxicity Value (mg/kg-d)	Endpoint	Type	Effects	Additional Comments	Citation	LD50 to LOAEL	Subchronic-to-Chronic UF	2005 WHO TEF	Final High TRV (mg/kg-d)
2,4-Dimethylphenol	105679	-	X	X	--	mouse	--	90 days	50	NOAEL	Subchronic	clinical signs, hematology	--	USEPA, 2010a [c]	1	1	2	--	25	mouse	--	90 days	250	LOAEL	Subchronic	clinical signs, hematology	--	USEPA, 2010a [c]	1	2	--	125
2,4-Dinitrophenol	51285			X	--	rat	--	6 months	5.4	NOAEL	Subchronic	growth	Supporting studies in IRIS because principal study is based on humans	USEPA, 2010a [c]	1	1	2	--	2.7	--	--	--	--	--	--	--	--	--	--	--	--	--
2,6-Dinitrotoluene	606202	-		X	--	dog	--	4-13 weeks	4	LOAEL	Subchronic	Hematological	--	ATSDR, 1998 [c]	1	5	2	--	0.4	dog	--	4-13 weeks	4	LOAEL	Subchronic	Hematological	--	ATSDR, 1998 [c]	1	2	--	2
3,3'-Dichlorobenzidine	91941	-		X	2,4-Dichlorophenol	rat	--	multi-generation	0.3	NOAEL	Subchronic to chronic	reproduction	--	USEPA, 2010a [c]	1	1	1	--	0.3	rat	--	multi-generation	3.0	LOAEL	Chronic	reproduction	--	USEPA, 2010a [c]	1	1	--	3
3,5-Dimethylphenol	108689	-	X		2,4-Dimethylphenol, 2,6-Dimethylphenol, and 3,4-Dimethylphenol	Various	--	Various	50, 0.6, 1.4	NOAEL	Subchronic	Various	Average of Low TRVs of 2,4-Dimethylphenol, 2,6-Dimethylphenol, and 3,4-Dimethylphenol	USEPA, 2010a [c]	1	1	2	--	8.7	Various	--	Various	250, 6, 14	LOAEL	Subchronic	Various	Average of High TRVs of 2,4-Dimethylphenol, 2,6-Dimethylphenol, and 3,4-Dimethylphenol	USEPA, 2010a [c]	1	2	--	45
4,6-Dinitro-o-cresol	534521	4,6-Dinitro-2-Methylphenol		X	2,4-Dinitrophenol	rat	--	6 months	5.4	NOAEL	Subchronic	growth	Supporting studies in IRIS because principal study is based on humans	USEPA, 2010a [c]	1	1	2	--	2.7	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Bromophenyl phenyl ether	101553			X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Chlorophenylphenyl ether	7005723			X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Nitrophenol	100027	-		X	2,4-Dinitrophenol	rat	--	6 months	5.4	NOAEL	Subchronic	growth	Supporting studies in IRIS because principal study is based on humans	USEPA, 2010a [c]	1	1	2	--	2.7	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzidine	92875	-		X	--	mouse	--	33 months	2.7	LOAEL	Chronic	Brain cell vacuolization; liver cell alterations in females	--	USEPA, 2010a [c]	1	5	1	--	0.54	mouse	--	33 months	2.7	LOAEL	Chronic	Brain cell vacuolization; liver cell alterations in females	--	USEPA, 2010a [c]	1	1	--	2.7
Benzoic acid	65850	-	X		--	human	70	NA	4.4	NOAEL	Chronic	no adverse medical symptoms observed	--	USEPA, 2010a [c]	1	1	1	--	4.4	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzyl alcohol	100516	-	X		Benzoic Acid	human	70	NA	4.4	NOAEL	Chronic	no adverse medical symptoms observed	--	USEPA, 2010a [c]	1	1	1	--	4.4	--	--	--	--	--	--	--	--	--	--	--	--	--
bis(2-Chloroethoxy)methane	111911	-		X	bis(2-Chloroisopropyl) ether	mouse	--	up to 104 weeks	35.8	NOAEL	Chronic	Decrease in hemoglobin and possible erythrocyte destruction	--	USEPA, 2010a [c]	1	1	1	--	35.8	mouse	--	up to 104 weeks	198	LOAEL	Chronic	Decrease in hemoglobin and possible erythrocyte destruction	--	USEPA, 2010a [c]	1	1	--	198
bis(2-Chloroisopropyl)ether	39638329	-		X	--	mouse	--	up to 104 weeks	35.8	NOAEL	Chronic	Decrease in hemoglobin and possible erythrocyte destruction	--	USEPA, 2010a [c]	1	1	1	--	35.8	mouse	--	up to 104 weeks	198	LOAEL	Chronic	Decrease in hemoglobin and possible erythrocyte destruction	--	USEPA, 2010a [c]	1	1	--	198
bis(2-Ethylhexyl) phthalate	117817	bis(2-ethylhexyl)phthalate	X	X	--	mouse	0.03	105 days	18.3	NOAEL	Chronic	reproduction	--	Sample et al., 1996 [c]	1	1	1	--	18.3	mouse	0.03	105 days	183	LOAEL	Chronic	reproduction	--	Sample et al., 1996 [c]	1	1	--	183
Bromoform	75252	-	X	X	--	rat	--	13 weeks	17.9	NOAEL	Subchronic	hepatic lesions	Value in IRIS adjusted for 5days/week	USEPA, 2010a [c]	1	1	2	--	8.95	rat	--	13 weeks	35.7	LOAEL	Subchronic	hepatic lesions	Value in IRIS adjusted for 5days/week	USEPA, 2010a [c]	1	2	--	17.9
Butyl benzyl phthalate	85687	-	X	X	--	rat	0.3	26 weeks	159	NOAEL	Subchronic	increased liver to body weight and liver to brain weight ratios	Value in IRIS adjusted for 5days/week	USEPA, 2010a [c]	1	1	2	--	79.5	rat	0.3	26 weeks	470	LOAEL	Subchronic	increased liver to body weight and liver to brain weight ratios	--	USEPA, 2010a [c]	1	2	--	235
Carbazole	86748	-	X		Anthracene	rat	0.247	6 weeks	65.6	NOAEL	Subchronic	growth	NOAEL used to develop LMW-PAH Eco-SSL	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	1	--	65.6	rabbit/mouse/rat	--	various	356	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	--	356
Dibromochloromethane	124481	-	X	X	--	rat	--	13 weeks	21.4	NOAEL	Subchronic	hepatic lesions	--	USEPA, 2010a [c]	1	1	2	--	10.7	rat	--	13 weeks	42.9	LOAEL	Subchronic	hepatic lesions	--	USEPA, 2010a [c]	1	2	--	21.5
Diethyl phthalate	84662	-	X	X	--	Mouse	0.03	105 days	4583	NOAEL	Chronic	Reproduction	--	Sample et al., 1996 [c]	1	1	1	--	4583	--	--	--	--	--	--	--	--	--	--	--	--	--
Dimethyl phthalate	131113	-	X	X	Diethylphthalate	Mouse	0.03	105 days	4583	NOAEL	Chronic	Reproduction	--	Sample et al., 1996 [c]	1	1	1	--	4583	--	--	--	--	--	--	--	--	--	--	--	--	--
Di-n-butyl phthalate	84742	Di-n-butylphthalate	X	X	--	mouse	0.03	105 days	550	NOAEL	Chronic	reproduction - reduced litters/pairs, live pups/litter, etc	--	Sample et al., 1996 [c]	1	1	1	--	550	mouse	0.03	105 days	1833	LOAEL	Chronic	reproduction - reduced litters/pairs, live pups/litter, etc	--	Sample et al., 1996 [c]	1	1	--	1833
Di-n-octyl phthalate	117840	Di-n-octyl-phthalate	X	X	--	rat	--	13 weeks	40.8	NOAEL	Subchronic	Hepatic	Study used to derive MRL in ATSDR	ATSDR, 1997b [c]	1	1	2	--	20.4	rat	--	13 weeks	402.9	LOAEL	Subchronic	Hepatic	Study used to derive MRL in ATSDR	ATSDR, 1997b [c]	1	2	--	201.5
Formaldehyde	50000	-	X	X	--	dog	12	gestation through lactation	9.4	NOAEL	Chronic	reproduction	No LOAEL presented for study	Sample et al., 1996 [c]	1	1	1	--	9.4	rat	--	12, 18 or 24 months	82	LOAEL	chronic	histopathology, reduced weight gain	--	USEPA, 2010a [c]	1	1	--	82
Hexachlorobenzene	118741			X	--	rat	--	130 weeks	0.08	NOAEL	Chronic	liver toxicity	--	USEPA, 2010a [c]	1	1	1	--	0.08	rat	--	130 weeks	0.29	LOAEL	Chronic	liver toxicity	--	USEPA, 2010a [c]	1	1	--	0.29
Hexachlorobutadiene	87683	-	X	X	--	mouse	--	13 weeks	0.2	LOAEL	Subchronic	tubular degeneration	Study used to derive MRL in ATSDR	ATSDR, 1994 [c]	1	5	2	--	0.02	mouse	--	13 weeks	0.2	LOAEL	Subchronic	tubular degeneration	Study used to derive MRL in ATSDR	ATSDR, 1994 [c]	1	2	--	0.1
Hexachlorocyclopentadiene	77474	-		X	--	rat	--	13 weeks	6	BMDL10	Subchronic	stomach lesions	--	USEPA, 2010a [c]	1	1	2	--	3	rat	--	13 weeks	11	BMD10	Subchronic	stomach lesions	Value in IRIS adjusted for 5days/week	USEPA, 2010a [c]	1	2	--	5.5
Hexachloroethane	67721			X	--	rat	--	16 weeks	1	NOAEL	Subchronic	Effects to kidney	--	USEPA, 2010a [c]	1	1	2	--	0.5	rat	--	16 weeks	15	LOAEL	Subchronic	Effects to kidney	--	USEPA, 2010a [c]	1	2	--	7.5
Isophorone	78591	-		X	--	dog	--	90 days	150	NOAEL	Subchronic	systemic	--	USEPA, 2010a [c]	1	1	2	--	75	rat	--	2 years	179	LEL	Chronic	kidney pathology	--	USEPA, 2010a [c]	1	1	--	179
m-Cresol	108394	3-Methylphenol	X		o-Cresol	mink	1.0	6 months	219.2	NOAEL	Chronic	reproduction	--	Sample et al., 1996 [c]	1	1	1	--	219.2	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 11-9
Summary of Selected Toxicity Reference Values for Mammalian Receptors

						Derivation of Low TRV														Derivation of High TRV												
						Toxicity Information									Conversion Factors					Toxicity Information									Conversion Factors			
Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil or Ephemeral Sediment [a]	Detected in Surface Water or Seeps and Springs [b]	Surrogate Used	Test Species	Body Weight (kg)	Duration	Low Toxicity Value (mg/kg-d)	Endpoint	Type	Effects	Additional Comments	Citation	LD50 to Chronic NOAEL	LOAEL-to-NOAEL UF	Subchronic-to-Chronic UF	2005 WHO TEF	Final Low TRV (mg/kg-d)	Test Species	Body Weight	Duration	High Toxicity Value (mg/kg-d)	Endpoint	Type	Effects	Additional Comments	Citation	LD50 to LOAEL	Subchronic-to-Chronic UF	2005 WHO TEF	Final High TRV (mg/kg-d)
n-Nitrosodimethylamine	62759	Nitrosodimethylamine	X	X	Tetryl	rat	--	90 days	1.42	NOAEL	Subchronic	reduced body weight	UF of 10 applied (subchronic to chronic) within USACHPPM 2002.	USACHPPM, 2002 [c]	1	1	1	--	1.42	rat	--	90 days	17.2	LOAEL	Subchronic	reduced body weight	UF of 4 applied (LOAEL-based approximate TRV from a subchronic LOAEL)	USACHPPM, 2002	1	1	--	17.2
n-Nitrosodi-n-propylamine	621647	n-Nitrosodipropylamine		X	Tetryl	rat	--	90 days	1.42	NOAEL	Subchronic	reduced body weight	UF of 10 applied (subchronic to chronic) within USACHPPM 2002.	USACHPPM, 2002 [c]	1	1	1	--	1.42	rat	--	90 days	17.2	LOAEL	Subchronic	reduced body weight	UF of 4 applied (LOAEL-based approximate TRV from a subchronic LOAEL)	USACHPPM, 2002	1	1	--	17.2
n-Nitrosodiphenylamine	86306	-	X	X	Tetryl	rat	--	90 days	1.42	NOAEL	Subchronic	reduced body weight	UF of 10 applied (subchronic to chronic) within USACHPPM 2002.	USACHPPM, 2002 [c]	1	1	1	--	1.42	rat	--	90 days	17.2	LOAEL	Subchronic	reduced body weight	UF of 4 applied (LOAEL-based approximate TRV from a subchronic LOAEL)	USACHPPM, 2002	1	1	--	17.2
o-Cresol	95487	-	X		--	mink	1.0	6 months	219.2	NOAEL	Chronic	reproduction	--	Sample et al., 1996 [c]	1	1	1	--	219.2	--	--	--	--	--	--	--	--	--	--	--	--	--
p-Chloro-m-cresol	59507	4-Chloro-3-Methylphenol	X	X	2-Chlorophenol	rat	--	10 weeks before breeding through weaning	5	NOAEL	Chronic	reproductive effects	--	USEPA, 2010a [c]	1	1	1	--	5	rat	--	10 weeks prior to breeding through weaning	50	LOAEL	Chronic	reproductive effects	--	USEPA, 2010a [c]	1	1	--	50
p-Cresol	106445	4-Methylphenol	X		o-Cresol	mink	1.0	6 months	219.2	NOAEL	Chronic	reproduction	--	Sample et al., 1996 [c]	1	1	1	--	219.2	--	--	--	--	--	--	--	--	--	--	--	--	--
Pentachlorophenol	87865	PCP	X	X	--	Various	Various	Various	8.42	geometric mean of NOAEL	Various	Growth and reproduction	geometric mean of NOAEL values for reproduction and growth in	USEPA Eco-SSLs for Pentachlorophenol (USEPA, 2007f) [c]	1	1	1	--	8.42	mink/sheep/rat/mouse	--	Various	23	LOAEL	Chronic	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	USEPA Eco-SSLs for Pentachlorophenol (USEPA, 2007f) [c]	1	1	--	23
Phenol	108952	Total Phenols	X	X	--	rat	--	10 days; gestation	93	BMDL10	Chronic	reproduction - decreased naternal weight gain	--	USEPA, 2010a [c]	1	1	1	--	93	rat	--	10 days; gestation	157	BMD10	Chronic	reproduction - decreased naternal weight gain	--	USEPA, 2010a [c]	1	1	--	157
p-Nitroaniline	100016	4-Nitroaniline	X		2,4-Dinitrophenol	rat	--	6 months	5.4	NOAEL	Subchronic	growth	Supporting studies in IRIS because principal study is based on humans	USEPA, 2010a [c]	1	1	2	--	2.7	--	--	--	--	--	--	--	--	--	--	--	--	--
Polynuclear Aromatic Hydrocarbons																																
1-Methyl naphthalene	90120	1-Methylnaphthalene	X		LMW-PAH	rat	0.247	6 weeks	65.6	NOAEL	Subchronic	growth	NOAEL used to develop LMW-PAH Eco-SSL	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	1	--	65.6	rabbit/mouse/rat	--	various	356	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	--	356
2-Methylnaphthalene	91576	Naphthalene, 2-methyl-	X		LMW-PAH	rat	0.247	6 weeks	65.6	NOAEL	Subchronic	growth	NOAEL used to develop LMW-PAH Eco-SSL	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	1	--	65.6	rabbit/mouse/rat	--	various	356	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	--	356
Acenaphthene	83329	-	X	X	LMW-PAH	rat	0.247	6 weeks	65.6	NOAEL	Subchronic	growth	NOAEL used to develop LMW-PAH Eco-SSL	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	1	--	65.6	rabbit/mouse/rat	--	various	356	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	--	356
Acenaphthylene	208968	-	X	X	LMW-PAH	rat	0.247	6 weeks	65.6	NOAEL	Subchronic	growth	NOAEL used to develop LMW-PAH Eco-SSL	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	1	--	65.6	rabbit/mouse/rat	--	various	356	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	--	356
Anthracene	120127	-	X	X	LMW-PAH	rat	0.247	6 weeks	65.6	NOAEL	Subchronic	growth	NOAEL used to develop LMW-PAH Eco-SSL	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	1	--	65.6	rabbit/mouse/rat	--	various	356	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	--	356
Benzo(a)anthracene	56553	Benz[a]anthracene	X	X	HMW-PAH	mouse	0.038	65 weeks	0.615	NOAEL	chronic	mortality	NOAEL of study used to calculate HMW-PAH Eco-SSL	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	1	--	0.615	rat/mouse/guinea pig	--	various	38	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	--	38
Benzo(a)pyrene	50328	Benzo (a) pyrene	X	X	HMW-PAH	mouse	0.038	65 weeks	0.615	NOAEL	chronic	mortality	NOAEL of study used to calculate HMW-PAH Eco-SSL	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	1	--	0.615	rat/mouse/guinea pig	--	various	38	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	--	38
Benzo(b)fluoranthene	205992	Benz[e]acephenanthrylene 1	X	X	HMW-PAH	mouse	0.038	65 weeks	0.615	NOAEL	chronic	mortality	NOAEL of study used to calculate HMW-PAH Eco-SSL	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	1	--	0.615	rat/mouse/guinea pig	--	various	38	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	--	38
Benzo(e)pyrene	192972	-	X		HMW-PAH	mouse	0.038	65 weeks	0.615	NOAEL	chronic	mortality	NOAEL of study used to calculate HMW-PAH Eco-SSL	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	1	--	0.615	rat/mouse/guinea pig	--	various	38	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	--	38

Table 11-9
Summary of Selected Toxicity Reference Values for Mammalian Receptors

						Derivation of Low TRV														Derivation of High TRV												
						Toxicity Information									Conversion Factors					Toxicity Information									Conversion Factors			
Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil or Ephemeral Sediment [a]	Detected in Surface Water or Seeps and Springs [b]	Surrogate Used	Test Species	Body Weight (kg)	Duration	Low Toxicity Value (mg/kg-d)	Endpoint	Type	Effects	Additional Comments	Citation	LD50 to Chronic NOAEL	LOAEL-to-NOAEL UF	Subchronic-to-Chronic UF	2005 WHO TEF	Final Low TRV (mg/kg-d)	Test Species	Body Weight	Duration	High Toxicity Value (mg/kg-d)	Endpoint	Type	Effects	Additional Comments	Citation	LD50 to LOAEL	Subchronic-to-Chronic UF	2005 WHO TEF	Final High TRV (mg/kg-d)
Benzo(ghi)perylene	191242	Benzo (g,h,i) perylene	X	X	HMW-PAH	mouse	0.038	65 weeks	0.615	NOAEL	chronic	mortality	NOAEL of study used to calculate HMW-PAH Eco-SSL	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	1	--	0.615	rat/mouse/guinea pig	--	various	38	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	--	38
Benzo(k)fluoranthene	207089	Benzo[k]fluoranthene	X	X	HMW-PAH	mouse	0.038	65 weeks	0.615	NOAEL	chronic	mortality	NOAEL of study used to calculate HMW-PAH Eco-SSL	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	1	--	0.615	rat/mouse/guinea pig	--	various	38	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	--	38
Chrysene	218019	-	X	X	HMW-PAH	mouse	0.038	65 weeks	0.615	NOAEL	chronic	mortality	NOAEL of study used to calculate HMW-PAH Eco-SSL	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	1	--	0.615	rat/mouse/guinea pig	--	various	38	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	--	38
Dibenzo(a,h)anthracene	53703	Dibenz (a,h) anthracene	X	X	HMW-PAH	mouse	0.038	65 weeks	0.615	NOAEL	chronic	mortality	NOAEL of study used to calculate HMW-PAH Eco-SSL	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	1	--	0.615	rat/mouse/guinea pig	--	various	38	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	--	38
Fluoranthene	206440	-	X	X	LMW-PAH	rat	0.247	6 weeks	65.6	NOAEL	Subchronic	growth	NOAEL used to develop LMW-PAH Eco-SSL	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	1	--	65.6	rabbit/mouse/rat	--	various	356	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	--	356
Fluorene	86737	-	X	X	LMW-PAH	rat	0.247	6 weeks	65.6	NOAEL	Subchronic	growth	NOAEL used to develop LMW-PAH Eco-SSL	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	1	--	65.6	rabbit/mouse/rat	--	various	356	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	--	356
Indeno(1,2,3-cd)pyrene	193395	Indeno (1,2,3-cd) pyrene	X	X	HMW-PAH	mouse	0.038	65 weeks	0.615	NOAEL	chronic	mortality	NOAEL of study used to calculate HMW-PAH Eco-SSL	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	1	--	0.615	rat/mouse/guinea pig	--	various	38	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	--	38
Naphthalene	91203	-	X	X	LMW-PAH	rat	0.247	6 weeks	65.6	NOAEL	Subchronic	growth	NOAEL used to develop LMW-PAH Eco-SSL	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	1	--	65.6	rabbit/mouse/rat	--	various	356	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	--	356
Perylene	198550	-	X		LMW-PAH	rat	0.247	6 weeks	65.6	NOAEL	Subchronic	growth	NOAEL used to develop LMW-PAH Eco-SSL	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	1	--	65.6	rabbit/mouse/rat	--	various	356	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	--	356
Phenanthrene	85018	-	X	X	LMW-PAH	rat	0.247	6 weeks	65.6	NOAEL	Subchronic	growth	NOAEL used to develop LMW-PAH Eco-SSL	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	1	--	65.6	rabbit/mouse/rat	--	various	356	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	--	356
Pyrene	129000	-	X	X	HMW-PAH	mouse	0.038	65 weeks	0.615	NOAEL	chronic	mortality	NOAEL of study used to calculate HMW-PAH Eco-SSL	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	1	--	0.615	rat/mouse/guinea pig	--	various	38	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	USEPA Eco-SSLs for Polycyclic Aromatic Hydrocarbons (USEPA, 2007b) [c]	1	1	--	38
Pesticides																																
4,4'-DDD	72548	p,p'-DDD	X	X	4,4'-DDT	rat	--	--	0.8	Low TRV	--	reproductive	--	DTSC, 2009 [c]	1	1	1	--	0.8	rat	--	--	16	High TRV	--	reproductive	--	DTSC, 2009 [c]	1	1	--	16
4,4'-DDE	72559	p,p'-DDE	X	X	4,4'-DDT	rat	--	--	0.8	Low TRV	--	reproductive	--	DTSC, 2009 [c]	1	1	1	--	0.8	rat	--	--	16	High TRV	--	reproductive	--	DTSC, 2009 [c]	1	1	--	16
4,4'-DDT	50293	p,p'-DDT	X	X	--	rat	--	--	0.8	Low TRV	--	reproductive	--	DTSC, 2009 [c]	1	1	1	--	0.8	rat	--	--	16	High TRV	--	reproductive	--	DTSC, 2009 [c]	1	1	--	16
Aldrin	309002	-	X	X	--	rat	--	--	0.1	Low TRV	--	Neurobehavioral	--	DTSC, 2009 [c]	1	1	1	--	0.1	rat	--	--	1.0	High TRV	--	Neurobehavioral	--	DTSC, 2009 [c]	1	1	--	1
alpha-BHC	319846	a-Benzene Hexachloride	X	X	gamma-BHC	rat	--	--	0.05	Low TRV	--	reproduction	--	DTSC, 2009 [c]	1	1	1	--	0.05	mouse	--	--	3.75	High TRV	--	devlopmental	--	DTSC, 2009 [c]	1	1	--	3.75
beta-BHC	319857	b-Benzene Hexachloride	X	X	--	rat	0.35	13 weeks	0.4	NOAEL	Subchronic	growth, blood chemistry, organ histology	NOAEL and LOAEL provided in Sample et al. adjusted to chronic	Sample et al., 1996 [c]	1	1	1	--	0.4	rat	0.35	13 weeks	2	LOAEL	Subchronic	growth, blood chemistry, organ histology	NOAEL and LOAEL provided in Sample et al. adjusted to chronic	Sample et al., 1996 [c]	1	1	--	2
Chlordane (Technical)	12789036	-	X		Chlordane	mouse	0.03	6 generations	4.58	NOAEL	Chronic	reproduction	NOAEL rounded within Sample et. al., 1996	Sample et al., 1996 [c]	1	1	1	--	4.58	mouse	0.03	6 generations	9.16	LOAEL	Chronic	reproduction	LOAEL rounded within Sample et. al., 1996	Sample et al., 1996 [c]	1	1	--	9.16
delta-BHC	319868	d-Benzene Hexachloride	X	X	gamma-BHC	rat	--	--	0.05	Low TRV	--	reproduction	--	DTSC, 2009 [c]	1	1	1	--	0.05	mouse	--	--	3.75	High TRV	--	devlopmental	--	DTSC, 2009 [c]	1	1	--	3.75
Dieldrin	60571	-	X	X	--	rat	0.156	750 days	0.015	NOAEL	Chronic	reproduction - progeny numbers	--	USEPA Eco-SSLs for Dieldrin (2007d) [c]	1	1	1	--	0.015	mouse/rat/deer/dog/rabbit	--	Various	1.3	LOAEL	--	Growth and Reproduction	Geometric mean of LOAEL for reproduction and growth	USEPA Eco-SSLs for Dieldrin (2007d) [c]	1	1	--	1.3
Endosulfan I	959988	-	X	X	Endosulfan	rat	0.35	30 days	0.15	NOAEL	Subchronic	reproduction, blood chemistry (not during gestation)	No LOAEL presented for study; NOAEL provided in Sample et al. adjusted to chronic	Sample et al., 1996 [c]	1	1	1	--	0.15	rat	--	2 years	2.9	LOAEL	Chronic	reduced body weight gain, increased incidence of glomerulonephrosis and blood vessel aneurysms	--	USEPA, 2010a [c]	1	1	--	2.9
Endosulfan II	33213659	-	X	X	Endosulfan	rat	0.35	30 days	0.15	NOAEL	Subchronic	reproduction, blood chemistry (not during gestation)	No LOAEL presented for study; NOAEL provided in Sample et al. adjusted to chronic	Sample et al., 1996 [c]	1	1	1	--	0.15	rat	--	2 years	2.9	LOAEL	Chronic	reduced body weight gain, increased incidence of glomerulonephrosis and blood vessel aneurysms	--	USEPA, 2010a [c]	1	1	--	2.9

Table 11-9
Summary of Selected Toxicity Reference Values for Mammalian Receptors

						Derivation of Low TRV														Derivation of High TRV												
						Toxicity Information									Conversion Factors					Toxicity Information									Conversion Factors			
Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil or Ephemeral Sediment [a]	Detected in Surface Water or Seeps and Springs [b]	Surrogate Used	Test Species	Body Weight (kg)	Duration	Low Toxicity Value (mg/kg-d)	Endpoint	Type	Effects	Additional Comments	Citation	LD50 to Chronic NOAEL	LOAEL-to-NOAEL UF	Subchronic-to-Chronic UF	2005 WHO TEF	Final Low TRV (mg/kg-d)	Test Species	Body Weight	Duration	High Toxicity Value (mg/kg-d)	Endpoint	Type	Effects	Additional Comments	Citation	LD50 to LOAEL	Subchronic-to-Chronic UF	2005 WHO TEF	Final High TRV (mg/kg-d)
Endosulfan sulfate	1031078	-	X	X	Endosulfan	rat	0.35	30 days	0.15	NOAEL	Subchronic	reproduction, blood chemistry (not during gestation)	No LOAEL presented for study; NOAEL provided in Sample et al. adjusted to chronic	Sample et al., 1996 [c]	1	1	1	--	0.15	rat	--	2 years	2.9	LOAEL	Chronic	reduced body weight gain, increased incidence of glomerulonephrosis and blood vessel aneurysms	--	USEPA, 2010a [c]	1	1	--	2.9
Endrin	72208	-	X	X	--	mouse	0.03	120 days	0.092	NOAEL	Chronic	reproduction - parental survival, litter size and number of young per day	NOAEL not determined in study; LOAEL adjusted to NOAEL in Sample et al.	Sample et al., 1996 [c]	1	1	1	--	0.092	mouse	0.03	120 days	0.92	LOAEL	Chronic	reproduction - parental survival, litter size and number of young per day	--	Sample et al., 1996 [c]	1	1	--	0.92
Endrin aldehyde	7421934	-	X	X	Endrin	mouse	0.03	120 days	0.092	NOAEL	Chronic	reproduction - parental survival, litter size and number of young per day	NOAEL not determined in study; LOAEL adjusted to NOAEL in Sample et al.	Sample et al., 1996 [c]	1	1	1	--	0.092	mouse	0.03	120 days	0.92	LOAEL	Chronic	reproduction - parental survival, litter size and number of young per day	--	Sample et al., 1996 [c]	1	1	--	0.92
Endrin ketone	53494705	-	X		Endrin	mouse	0.03	120 days	0.092	NOAEL	Chronic	reproduction - parental survival, litter size and number of young per day	NOAEL not determined in study; LOAEL adjusted to NOAEL in Sample et al.	Sample et al., 1996 [c]	1	1	1	--	0.092	mouse	0.03	120 days	0.92	LOAEL	Chronic	reproduction - parental survival, litter size and number of young per day	--	Sample et al., 1996 [c]	1	1	--	0.92
gamma-BHC	58899	Lindane	X	X	--	rat	--	--	0.05	Low TRV	--	reproduction	--	DTSC, 2009 [c]	1	1	1	--	0.05	mouse	--	--	3.75	High TRV	--	devlopmental	--	DTSC, 2009 [c]	1	1	--	3.75
Heptachlor	76448	-	X	X	--	rat	--	--	0.13	Low TRV	--	reproductive	--	DTSC, 2009 [c]	1	1	1	--	0.13	rat	--	--	6.8	High TRV	--	devlopmental	--	DTSC, 2009 [c]	1	1	--	6.8
Heptachlor epoxide	1024573	-	X	X	--	dog	--	60 weeks	0.0125	LEL	Subchronic	increased liver to body weight ratio	23 to 27 weeks of age	USEPA, 2010a [c]	1	5	2	--	0.00125	dog	--	60 weeks	0.0125	LEL	Subchronic	increased liver to body weight ratio	23 to 27 weeks of age	USEPA, 2010a [c]	1	2	--	0.00625
MCPA	94746	-	X		--	dog	--	52 weeks	0.15	NOAEL	Subchronic	liver and kidney toxicity	--	USEPA, 2010a [c]	1	1	2	--	0.075	dog	--	52 weeks	0.75	LOAEL	Subchronic	liver and kidney toxicity	--	USEPA, 2010a [c]	1	2	--	0.38
Mirex	2385855	Mirex (DeChlorane)	X		--	rat	0.120/0.100	104 weeks	0.07	NOAEL	Chronic	Liver and thyroid effects	--	USEPA, 2010a [c]	1	1	1	--	0.07	rat	0.120/0.100	104 weeks	0.7	LOAEL	Chronic	Liver and thyroid effects	-	USEPA, 2010a [c]	1	1	--	0.7
p,p'-Methoxychlor	72435	-	X		--	rat	--	--	2.5	Low TRV	--	reproductive	--	DTSC, 2009 [c]	1	1	1	--	2.5	rat	--	--	50	High TRV	--	reproduction	--	DTSC, 2009 [c]	1	1	--	50
Toxaphene	8001352	-	X	X	--	rat	0.35	3 generations (>1 year)	8	NOAEL	Chronic	reproductive	--	Sample et al., 1996 [c]	1	1	1	--	8	--	--	--	--	--	--	--	--	--	--	--	--	--
Herbicides																																
2,4,5-T	93765	2,4,5-Trichlorophenoxyacetic acid	X		--	rat	--	2 years	3	NOEL	chronic	increased urinary coproporphyrins	--	USEPA, 2012	1	1	1	--	3	rat	--	2 years	10	LOAEL	chronic	increased urinary coproporphyrins	--	USEPA, 2012	1	1	--	10
2,4,5-TP (Silvex)	93721	-	X		--	dog	--	2 years	0.75	NOAEL	subchronic	hepatic changes	--	USEPA, 2012	1	1	2	--	0.38	dog	--	2 years	2.5	LOAEL	Subchronic	hepatic changes	--	USEPA, 2012	1	2	--	1.3
2,4-Dichlorophenoxyacetic Acid (2,4-D)	94757	-	X		--	rat	--	91 days	1.0	NOAEL	Subchronic	hematologic, hepatic and renal toxicity	--	USEPA, 2012	1	1	2	--	0.50	rat	--	91 days	5.0	LOAEL	Subchronic	hematologic, hepatic and renal toxicity	--	USEPA, 2012	1	2	--	2.5
2,4-Dichlorophenoxybutyric acid	94826	-	X		--	dog	--	90 days	8	NOAEL	Subchronic	internal hemorrhage, mortality	--	USEPA, 2010a [c]	1	1	2	--	4	dog	--	90 days	25	LOAEL	Subchronic	internal hemorrhage, mortality	--	USEPA, 2010a [c]	1	2	--	13
2,4-DP (Dichlorprop)	120365	Dichlorprop	X		2,4-Dichlorophenoxyacetic Acid (2,4-D)	rat	--	91 days	1.0	NOAEL	Subchronic	hematologic, hepatic and renal toxicity	--	USEPA, 2012	1	1	2	--	0.50	rat	--	91 days	5.0	LOAEL	Subchronic	hematologic, hepatic and renal toxicity	--	USEPA, 2012	1	2	--	2.5
Dalapon	75990	-	X		--	rat	--	2 years	8.45	NOEL	Chronic	Increased kidney body weight ratio	--	USEPA, 2010a [c]	1	1	1	--	8.45	rat	--	2 years	28.17	LEL	Chronic	Increased kidney body weight ratio	--	USEPA, 2010a [c]	1	1	--	28.17
Dicamba	1918009	-	X		--	rabbit	--	--	3	NOEL	chronic	reproduction	--	USEPA, 2011 [c]	1	1	1	--	3	rabbit	--	--	10	LEL	chronic	reproduction	--	USEPA, 2010a [c]	1	1	--	10
Dinoseb	88857	-	X		--	rat	--	29 weeks	1	LEL	Chronic	reproduction - decreased fetal weight	3 generations	USEPA, 2010a [c]	1	5	1	--	0.2	rat	--	29 weeks	1	LEL	Chronic	reproduction - decreased fetal weight	3 generations	USEPA, 2010a [c]	1	1	--	1
MCPP	93652	-	X		--	rat	--	90 days	3	NOEL	Subchronic	increased absolute and relative kidney weights	--	USEPA, 2010a [c]	1	1	2	--	1.5	rat	--	90 days	9	LEL	Subchronic	increased absolute and relative kidney weights	--	USEPA, 2010a [c]	1	2	--	4.5
Terphenyls																																
m-Terphenyl	92068	-	X		1,1-Biphenyl	rat	--	--	50	NOAEL	Chronic	kidney damage	--	USEPA, 2010a [c]	1	1	1	--	50	rat	--	NA	250	LOAEL	Chronic	kidney damage	--	USEPA, 2010a [c]	1	1	--	250
o-terphenyl	84151	-	X		1,1-Biphenyl	rat	--	--	50	NOAEL	Chronic	kidney damage	--	USEPA, 2010a [c]	1	1	1	--	50	rat	--	NA	250	LOAEL	Chronic	kidney damage	--	USEPA, 2010a [c]	1	1	--	250
p-Terphenyl	92944	-	X		1,1-Biphenyl	rat	--	--	50	NOAEL	Chronic	kidney damage	--	USEPA, 2010a [c]	1	1	1	--	50	rat	--	NA	250	LOAEL	Chronic	kidney damage	--	USEPA, 2010a [c]	1	1	--	250
Glycols		-																														
Diethylene Glycol	111466	-	X		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Triethylene glycol	112276	-	X		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons																																
TPH-Diesel Range Organics (DRO)	DRO	Diesel	X		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TPH-Gasoline Range Organics (GRO)	GRO	Gasoline	X		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PCDD/PCDFs[d]ei																																
2,3,7,8-TCDD_TEQ_Mammal	1746016-TEQ_Mammal	-	X	X	2,3,7,8-TCDD	rat	0.35	3 generations (>1 year)	0.000001	NOAEL	Chronic	reproduction - fertility and neonatal	--	Sample et al., 1996 [c]	1	1	1	1	0.000001	rat	0.35	3 generations (>1 year)	0.00001	LOAEL	Chronic	reproduction - fertility and neonatal	--	Sample et al., 1996 [c]	1	1	1	0.00001
Polychlorinated Biphenyls (PCBs)[d]ei																																
Aroclor 1016	12674112	-	X	X	--	mink	1.0	18 months	1.37	NOAEL	Chronic	reproduction	--	Sample et al., 1996 [c]	1	1	1	--	1.37	mink	1.0	18 months	3.43	LOAEL	Chronic	reproduction	--	Sample et al., 1996 [c]	1	1	--	3.43
Aroclor 1221	11104282	-		X	Aroclor 1016	mink	1.0	18 months	1.37	NOAEL	Chronic	reproduction	--	Sample et al., 1996 [c]	1	1	1	--	1.37	mink	1.0	18 months	3.43	LOAEL	Chronic	reproduction	--	Sample et al., 1996 [c]	1	1	--	3.43
Aroclor 1232	11141165	-		X	Aroclor 1254	oldfield mouse	0.014	12 months	0.068	NOAEL	Chronic	reproduction - reduced number of liters, offspring weights and offspring survival.	--	Sample et al., 1996 [c]	1	1	1	--	0.068	oldfield mouse	0.014	12 months	0.68	LOAEL	Chronic	reproduction - reduced number of liters, offspring weights and offspring survival	--	Sample et al., 1996 [c]	1	1	--	0.68

Table 11-9
Summary of Selected Toxicity Reference Values for Mammalian Receptors

						Derivation of Low TRV														Derivation of High TRV												
						Toxicity Information									Conversion Factors					Toxicity Information									Conversion Factors			
Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil or Ephemeral Sediment [a]	Detected in Surface Water or Seeps and Springs [b]	Surrogate Used	Test Species	Body Weight (kg)	Duration	Low Toxicity Value (mg/kg-d)	Endpoint	Type	Effects	Additional Comments	Citation	LD50 to Chronic NOAEL	LOAEL-to-NOAEL UF	Subchronic-to-Chronic UF	2005 WHO TEF	Final Low TRV (mg/kg-d)	Test Species	Body Weight	Duration	High Toxicity Value (mg/kg-d)	Endpoint	Type	Effects	Additional Comments	Citation	LD50 to LOAEL	Subchronic-to-Chronic UF	2005 WHO TEF	Final High TRV (mg/kg-d)
Aroclor 1242	53469219	Aroclor-1242	X	X	--	mink	1.0	7 months	0.069	NOAEL	Chronic	reproduction - reproductive failure	NOAEL not determined in study; LOAEL adjusted to NOAEL in Sample et al	Sample et al., 1996 [c]	1	1	1	--	0.069	mink	1.0	7 months	0.69	LOAEL	Chronic	reproduction - reproductive failure	--	Sample et al., 1996 [c]	1	1	--	0.69
Aroclor 1248	12672296	-	X	X	--	Rhesus monkey	5.0	14 months	0.01	NOAEL	Chronic	reproduction	NOAEL not determined in study; LOAEL adjusted to NOAEL in Sample et al	Sample et al., 1996 [c]	1	1	1	--	0.01	Rhesus monkey	5.0	14 months	0.1	LOAEL	Chronic	reproduction	--	Sample et al., 1996 [c]	1	1	--	0.1
Aroclor 1254	11097691	-	X	X	--	oldfield mouse	0.014	12 months	0.068	NOAEL	Chronic	reproduction - reduced number of liters, offspring weights and offspring survival.	NOAEL not determined in study; LOAEL adjusted to NOAEL in Sample et al	Sample et al., 1996 [c]	1	1	1	--	0.068	oldfield mouse	0.014	12 months	0.68	LOAEL	Chronic	reproduction - reduced number of liters, offspring weights and offspring survival.	--	Sample et al., 1996 [c]	1	1	--	0.68
Aroclor 1260	11096825	-	X	X	Aroclor 1254	oldfield mouse	0.014	12 months	0.068	NOAEL	Chronic	reproduction - reduced number of liters, offspring weights and offspring survival.	NOAEL not determined in study; LOAEL adjusted to NOAEL in Sample et al	Sample et al., 1996 [c]	1	1	1	--	0.068	oldfield mouse	0.014	12 months	0.68	LOAEL	Chronic	reproduction - reduced number of liters, offspring weights and offspring survival.	--	Sample et al., 1996 [c]	1	1	--	0.68
Aroclor 5460	11126424	-	X		Aroclor 1254	oldfield mouse	0.014	12 months	0.068	NOAEL	Chronic	reproduction - reduced number of liters, offspring weights and offspring survival.	NOAEL not determined in study; LOAEL adjusted to NOAEL in Sample et al	Sample et al., 1996 [c]	1	1	1	--	0.068	oldfield mouse	0.014	12 months	0.68	LOAEL	Chronic	reproduction - reduced number of liters, offspring weights and offspring survival.	--	Sample et al., 1996 [c]	1	1	--	0.68
PCB_TEQ_Mammal (Coplanar PCBs)	1746016-PCB TEQ_Mammal	-	X	X	2,3,7,8-TCDD	rat	0.35	3 generations (>1 year)	0.000001	NOAEL	Chronic	reproduction - fertility and neonatal	--	Sample et al., 1996 [c]	1	1	1	1	0.000001	rat	0.35	3 generations (>1 year)	0.00001	LOAEL	Chronic	reproduction - fertility and neonatal	--	Sample et al., 1996 [c]	1	1	1	0.00001
PCB-105	32598144	1,1'-Biphenyl, 2,3,3',4,4'-pentachloro-	X	X	2,3,7,8-TCDD	rat	0.35	3 generations (>1 year)	0.000001	NOAEL	Chronic	reproduction - fertility and neonatal	--	Sample et al., 1996 [c]	1	1	1	0.00003	0.03	rat	0.35	3 generations (>1 year)	0.00001	LOAEL	Chronic	reproduction - fertility and neonatal	--	Sample et al., 1996 [c]	1	1	0.00003	0.3
PCB-114	74472370	PCB 114 (BZ)	X	X	2,3,7,8-TCDD	rat	0.35	3 generations (>1 year)	0.000001	NOAEL	Chronic	reproduction - fertility and neonatal	--	Sample et al., 1996 [c]	1	1	1	0.00003	0.03	rat	0.35	3 generations (>1 year)	0.00001	LOAEL	Chronic	reproduction - fertility and neonatal	--	Sample et al., 1996 [c]	1	1	0.00003	0.3
PCB-118	31508006	-	X	X	2,3,7,8-TCDD	rat	0.35	3 generations (>1 year)	0.000001	NOAEL	Chronic	reproduction - fertility and neonatal	--	Sample et al., 1996 [c]	1	1	1	0.00003	0.03	rat	0.35	3 generations (>1 year)	0.00001	LOAEL	Chronic	reproduction - fertility and neonatal	--	Sample et al., 1996 [c]	1	1	0.00003	0.3
PCB-123	65510443	123-PeCB	X	X	2,3,7,8-TCDD	rat	0.35	3 generations (>1 year)	0.000001	NOAEL	Chronic	reproduction - fertility and neonatal	--	Sample et al., 1996 [c]	1	1	1	0.00003	0.03	rat	0.35	3 generations (>1 year)	0.00001	LOAEL	Chronic	reproduction - fertility and neonatal	--	Sample et al., 1996 [c]	1	1	0.00003	0.3
PCB-126	57465288	-	X	X	2,3,7,8-TCDD	rat	0.35	3 generations (>1 year)	0.000001	NOAEL	Chronic	reproduction - fertility and neonatal	--	Sample et al., 1996 [c]	1	1	1	0.1	0.00001	rat	0.35	3 generations (>1 year)	0.00001	LOAEL	Chronic	reproduction - fertility and neonatal	--	Sample et al., 1996 [c]	1	1	0.1	0.0001
PCB-156	38380084	1,1'-Biphenyl, 2,3,3',4,4',5-hexachloro-	X	X	2,3,7,8-TCDD	rat	0.35	3 generations (>1 year)	0.000001	NOAEL	Chronic	reproduction - fertility and neonatal	--	Sample et al., 1996 [c]	1	1	1	0.00003	0.03	rat	0.35	3 generations (>1 year)	0.00001	LOAEL	Chronic	reproduction - fertility and neonatal	--	Sample et al., 1996 [c]	1	1	0.00003	0.3
PCB-157	69782907	PCB 157 (BZ)	X	X	2,3,7,8-TCDD	rat	0.35	3 generations (>1 year)	0.000001	NOAEL	Chronic	reproduction - fertility and neonatal	--	Sample et al., 1996 [c]	1	1	1	0.00003	0.03	rat	0.35	3 generations (>1 year)	0.00001	LOAEL	Chronic	reproduction - fertility and neonatal	--	Sample et al., 1996 [c]	1	1	0.00003	0.3
PCB-167	52663726	167-HxCB	X	X	2,3,7,8-TCDD	rat	0.35	3 generations (>1 year)	0.000001	NOAEL	Chronic	reproduction - fertility and neonatal	--	Sample et al., 1996 [c]	1	1	1	0.00003	0.03	rat	0.35	3 generations (>1 year)	0.00001	LOAEL	Chronic	reproduction - fertility and neonatal	--	Sample et al., 1996 [c]	1	1	0.00003	0.3
PCB-169	32774166	-	X	X	2,3,7,8-TCDD	rat	0.35	3 generations (>1 year)	0.000001	NOAEL	Chronic	reproduction - fertility and neonatal	--	Sample et al., 1996 [c]	1	1	1	0.03	0.00003	rat	0.35	3 generations (>1 year)	0.00001	LOAEL	Chronic	reproduction - fertility and neonatal	--	Sample et al., 1996 [c]	1	1	0.03	0.0003
PCB-189	39635319	-	X	X	2,3,7,8-TCDD	rat	0.35	3 generations (>1 year)	0.000001	NOAEL	Chronic	reproduction - fertility and neonatal	--	Sample et al., 1996 [c]	1	1	1	0.00003	0.03	rat	0.35	3 generations (>1 year)	0.00001	LOAEL	Chronic	reproduction - fertility and neonatal	--	Sample et al., 1996 [c]	1	1	0.00003	0.3
PCB-77	32598133	77-TeCB	X	X	2,3,7,8-TCDD	rat	0.35	3 generations (>1 year)	0.000001	NOAEL	Chronic	reproduction - fertility and neonatal	--	Sample et al., 1996 [c]	1	1	1	0.0001	0.01	rat	0.35	3 generations (>1 year)	0.00001	LOAEL	Chronic	reproduction - fertility and neonatal	--	Sample et al., 1996 [c]	1	1	0.0001	0.1
PCB-81	70362504	81-TeCB	X	X	2,3,7,8-TCDD	rat	0.35	3 generations (>1 year)	0.000001	NOAEL	Chronic	reproduction - fertility and neonatal	--	Sample et al., 1996 [c]	1	1	1	0.0003	0.003	rat	0.35	3 generations (>1 year)	0.00001	LOAEL	Chronic	reproduction - fertility and neonatal	--	Sample et al., 1996 [c]	1	1	0.0003	0.03
Chemical Parameters																																
Ammonia-N	7664417	Nitrogen, as Ammonia	X		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloride	16887006	-	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chlorine	7782505	-		X	--	rat	--	2 years	14.4	NOAEL	Chronic	no observed adverse effects	--	USEPA, 2011 [c]	1	1	1	--	14.4	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrate	NO3N	-	X	X	--	guinea pig	0.86	143 to 204 days	507	NOAEL	Chronic	reproduction	--	Sample et al., 1996 [c]	1	1	1	--	507	guinea pig	0.86	143 to 204 days	1130	LOAEL	Chronic	reproduction	--	Sample et al., 1996 [c]	1	1	--	1130
Nitrite-NO2	E-10128	-	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Oil content	E-10140	-		X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Orthophosphate – PO4	14265442	-	X		--	rat	--	--	0.015	NOAEL	Chronic	Parturition mortality; forelimb hair loss	--	USEPA, 2011 [c]	1	1	1	--	0.015	rat	--	--	0.075	LOAEL	Chronic	Parturition mortality; forelimb hair loss	--	USEPA, 2010a [c]	1	1	--	0.075
Sulfate	14808798	-	X	X	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Hierarchy of Sources:
1. Currently Recommended U.S. Environmental Protection Agency Region 9 Biological Technical Assistance Group (BTAG) Mammalian and Avian Toxicity Reference Values (TRVs) (DTSC, 2009)
2. Ecological Soil Screening Levels (Eco-SSLs) (USEPA, various dates)
3. Oak Ridge National Laboratory (ORNL) Toxicological Benchmarks for Wildlife: 1996 Revision (Sample et al., 1996)
4. USEPA Integrated Risk Information System (IRIS) database (USEPA, 2010a; USEPA, 2011; USEPA, 2012).
5. Agency for Toxic Substances and Disease Registry (ATSDR) toxicological profiles (ATSDR, various dates)
6. Literature review resulted in the following sources: USCHPPM, 2002 (SVOCs) and USCHPPM, 2007 (perchlorate)
7. Suitable surrogates

Notes:
[a] Chemicals detected in Groups 1A, 4, 6, 7, 8, 1B, 5, 10, 3 (WCT only), and 9 (Silvernale only) surface soil.
[b] Chemicals detected in Groups 4 (Coca only), 6 (SRE only), 1B, 5, 10, 3 (WCT only), and 9 (Silvernale only) surface water.
[c] Indicates reference is a secondary or compilation source.
[d] Dioxins/furans and coplanar PCBs for mammals exposed to chemicals in soil, ephemeral sediment, surface water, or seeps and springs will be evaluated using the 2,3,7,8-TCDD_TEQ_Mammal and PCB_TEQ_Mammal (Coplanar PCBs), respectively, and not by individual congeners.

Table 11-9
Summary of Selected Toxicity Reference Values for Mammalian Receptors

						Derivation of Low TRV														Derivation of High TRV											
						Toxicity Information									Conversion Factors					Toxicity Information								Conversion Factors			
Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil or Ephemeral Sediment [a]	Detected in Surface Water or Seeps and Springs [b]	Surrogate Used	Test Species	Body Weight (kg)	Duration	Low Toxicity Value (mg/kg-d)	Endpoint	Type	Effects	Additional Comments	Citation	LD50 to Chronic NOAEL	LOAEL-to-NOAEL UF	Subchronic-to-Chronic UF	2005 WHO TEF	Final Low TRV (mg/kg-d)	Test Species	Body Weight	Duration	High Toxicity Value (mg/kg-d)	Endpoint	Type	Effects	Additional Comments	Citation	LD50 to LOAEL	Subchronic-to-Chronic UF	2005 WHO TEF	Final High TRV (mg/kg-d)

Indicates final TRV

-- = Not available, or could not be located

BMD10 - maximum likelihood estimate of the dose corresponding to 10% risk

BMDL10 - 95% lower confidence limit on the maximum likelihood estimate of the dose corresponding to 10% risk

DDD - dichlorodiphenyldichloroethane

DDE - dichlorodiphenyldichloroethylene

DDT - dichlorodiphenyltrichloroethane

FEL - frank effect level

High TRV - mid level effect toxicity reference value

HMW -PAH - high molecular weight polycyclic aromatic hydrocarbons

kg - kilogram

LEL - lowest effect level

LD50 - lethal dose to 50% of test population

LMW -PAH - low molecular weight polycyclic aromatic hydrocarbons

LOAEL - lowest observed adverse effect level

Low TRV - no effect toxicity reference value

mg/kg-d - milligrams per kilogram per day

NOAEL - no observed adverse effect level

NOEL - no observed effect level

PCDD/PCDF - polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans

TCDD - Tetrachlorodibenzo-p-dioxin

TEQ - toxicity equivalent

TEF - toxic equivalency factor

TRV - toxicity reference value

UF - uncertainty factor

WHO - World Health Organization

X - Analyte was detected in the indicated medium

APPENDIX E

Inhalation Toxicity Reference Value Updates for Use in Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura County, California - Technical Memorandum

INHALATION TOXICITY REFERENCE VALUES UPDATES FOR USE IN ECOLOGICAL RISK ASSESSMENTS TECHNICAL MEMORANDUM
SANTA SUSANA FIELD LABORATORY
VENTURA COUNTY, CALIFORNIA

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INTRODUCTION

This technical memorandum documents updated mammalian inhalation toxicity reference values (TRVs) for use in the preparation of ecological risk assessments (ERAs) for the Santa Susana Field Laboratory (SSFL). This document was prepared for the California Environmental Protection Agency (Cal-EPA) Department of Toxic Substances Control (DTSC) on behalf of the Boeing Company (Boeing), National Aeronautics and Space Administration (NASA), and U.S. Department of Energy (DOE) as agreed during a meeting between DTSC, Boeing, NASA and DOE held on February 17, 2010 in response to DTSC comments on previous risk assessments included in Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Group Reports.

BACKGROUND

Inhalation TRVs cited in the *Standardized Risk Assessment Methodology (SRAM) Work Plan, Santa Susana Field Laboratory, Ventura County, California. Revision 2 – Final* (MWH, 2005) and used in previous ERAs prepared for the SSFL were provided by Michael Anderson of the DTSC based on values developed for, and applied at, Edwards Air Force Base (Edwards AFB). These mammalian inhalation TRVs were also recommended for use at the SSFL by DTSC, as documented in the SRAM (MWH, 2005). During a recent review of these mammalian inhalation TRVs, toxicologists representing the SSFL were unable to verify some of the "adjusted NOAEL-equivalent TRV" values included in the table of TRVs developed for Edwards AFB. Documentation of the assumptions and calculations used to derive TRVs for Edwards AFB was not included with the table, and some discrepancies could not be resolved. Inconsistencies in the derivation of the mammalian inhalation TRVs developed for Edwards AFB, as identified during the SSFL review, included errors in the interpretation of toxicological study information, dose adjustment calculations, unit conversions, and uncertainty factor application. For some chemicals, additional unexplained uncertainty factors were applied to derive the final TRVs.

In addition, toxicological studies referenced in the derivation of the Edwards AFB inhalation TRVs included both no-observed-adverse-effect-levels (NOAELs) and lowest-observed-adverse-effect-levels (LOAELs); however, separate NOAEL- and LOAEL-based TRVs (i.e., low TRV and high TRV) values were not developed. Although inhalation high TRVs, based on LOAELs,

were not included in the SRAM (MWH, 2005), they have been, and will continue to be, used in RFI risk assessments prepared for the SSFL. Therefore, this technical memorandum provides high TRVs as an update to the ERA process for the SSFL.

TRV REVIEW PROCEDURES AND PROPOSED MAMMALIAN INHALATION TRVS

In order to correct omissions or inconsistencies in the inhalation low TRVs developed for Edwards AFB, and to develop LOAEL-based high TRVs for use at the SSFL, the process used to derive mammalian inhalation TRVs was re-visited. The process used to derive low TRVs and high TRVs is described below, followed by a description of inconsistencies encountered in the previous TRV derivation process. Updated inhalation TRVs for chemicals detected in soil vapor and groundwater at the SSFL are listed in Table 1. Tables detailing toxicological data used to derive low TRVs and high TRVs are included as Attachment 1 and Attachment 2, respectively.

Inhalation TRVs for use in future ERAs at the SSFL were derived according to the following procedures:

- Toxicological study information cited in the derivation of previous TRVs was verified.
- Surrogate chemicals were used to develop TRVs for chemicals for which inhalation toxicity data were not available.
- Where available, a NOAEL was used to derive the low TRV. Where a NOAEL was not available, a LOAEL was used, and a LOAEL-to-NOAEL extrapolation uncertainty factor was applied.
- The LOAEL selected to derive the high TRV was from the same toxicological study that was recommended for the low TRV derivation. NOAEL and LOAEL values, in units of parts per million (ppm), were converted to units of milligrams per cubic meter (mg/m^3).
- Unit converted values were adjusted to a 24-hour per day, 7-day per week equivalent concentration.
- Unitless uncertainty factors were applied to dose-time adjusted TRV, as described below.

Inhalation TRV Review Procedures

Test species, toxicological endpoint, test duration, effect level (i.e., NOAEL or LOAEL), and exposure duration for volatile analytes detected in soil vapor, groundwater, or soil at the SSFL

were obtained from either the primary literature or toxicological profiles on the Agency for Toxic Substances and Disease Registry (ATSDR) website, as cited in the inhalation TRV table developed for Edwards AFB. During this review, inconsistencies between the toxicological information that was used to derive inhalation TRVs for Edwards AFB and the primary or secondary source were occasionally identified. These differences are summarized later in this technical memorandum. Updated low TRVs and new high TRVs for all detected analytes were derived from the previously recommended study, with the exception of a high TRV for 1,2-dichloroethane. Based upon email communication with Brian Faulkner of DTSC on October 14, 2010, it was agreed that there is insufficient data available for 1,2-dichloroethane with which to appropriately address the uncertainties created by the narrow concentration range from no effect to lethal toxicity as well as the wide species variability within the available studies. As a result, a high TRV for 1,2-dichloroethane was not derived. The original NOAEL cited in the TRV table developed for Edwards AFB was used to derive a low TRV for 1,2-dichloroethane.

Use of Surrogates for Chemicals without Sufficient Toxicological Information

There are 22 volatile analytes that have been detected in soil vapor or groundwater at the SSFL for which sufficient toxicity data are not available to derive inhalation TRVs. In such cases, a surrogate chemical was identified and used, where appropriate. These analytes, and the selected surrogate chemicals, are listed in the table below.

Detected Analyte	Surrogate Chemical
cis-1,2-dichloroethene	1,2-dichloroethene
trans-1,2-dichloroethene	1,2-dichloroethene
1,2,3-trichlorobenzene	1,4-dichlorobenzene
1,2,4-trichlorobenzene	1,4-dichlorobenzene
1,2-dichlorobenzene	1,4-dichlorobenzene
1,3-dichlorobenzene	1,4-dichlorobenzene
fluorine	benzo(a)pyrene
phenanthrene	benzo(a)pyrene
cumene	ethylbenzene
n-butylbenzene	ethylbenzene
n-propylbenzene	ethylbenzene
sec-butylbenzene	ethylbenzene
tert-butylbenzene	ethylbenzene
difluorodichloromethane	chlorodifluoromethane/freon 22
1,1,2-trichloro-1,2,2-	chlorodifluoromethane/freon 22

trifluoroethane	
trichlorofluoromethane	chlorodifluoromethane/freon 22
2-methylnaphthalene	napthalene
1,2,4-trimethylbenzene	total xylenes
1,3,5-trimethylbenzene	total xylenes
m- & p-xylenes	total xylenes
o-xylene	total xylenes
p-cymene	total xylenes

Concentration Conversions and Exposure Time Adjustments

Selected inhalation NOAELs and LOAELs, in units of ppm, were converted to non-adjusted TRVs, in units of mg/m^3, using the following formula (Equation 1):

$$Non - adjusted\ TRV\ (mg/m^3) = \frac{NOAEL\ or\ LOAEL\ (ppm) \times Molecular\ weight}{24.45}$$

In cases where toxicological data for a surrogate chemical were used to calculate a TRV for a detected analyte, the molecular weight of the surrogate chemical was used in the concentration unit conversion.

Non-adjusted low TRVs and high TRVs were converted to time-adjusted TRVs representing a 24-hour per day, 7-day per week exposure scenario according to the following conversion (Equation 2):

$$time - adjusted\ TRV = \frac{non - adjusted\ TRV \times daily\ exposure\ duration \times weekly\ exposure\ frequency}{24\ hours/day\ \times\ 7\ days/week}$$

The dose-time converted NOAEL value for chlorodifluoromethane was performed in the Environmental Protection Agency's (EPA's) Integrated Risk Information System (IRIS) database summary for this chemical. All other dose-time conversions were performed as shown in Attachments 1 and 2. In cases where the number of days per week of exposure was not specified in ATSDR, a continuous, 7-day per week test exposure was assumed. If the actual exposure of the study was less than seven days per week, the actual time-adjusted TRV would be lower than the time-adjusted TRV presented. This 7-day per week exposure assumption will be noted as an uncertainty in future ERAs.

Application of Uncertainty Factors

Exposure time-adjusted TRVs were converted to final low TRVs and high TRVs through application of uncertainty factors, which normalize for exposure duration and effects level. An uncertainty factor of two was applied to convert time-adjusted TRVs that were based on toxicity studies of subchronic exposures to calculate chronic exposure duration TRVs. For low TRVs, uncertainty factors of 100 and 10 were applied to convert LC_{50} and LOAEL-based time-adjusted TRVs, respectively, to final chronic NOAEL-based TRVs. For high TRVs, an uncertainty factor of 10 was used to convert LC_{50}-based time-adjusted TRVs to chronic LOAEL-based TRVs. As a result of discussion during the September 9, 2010 teleconference with DTSC, no uncertainty factor was applied to convert LC_{20}-based time-adjusted TRVs to final chronic LOAEL-based TRVs for 1,1-dichloroethene and carbon tetrachloride. For these chemicals, LOAEL-based TRVs were derived from the same study and concentration as NOAEL-based TRVs, which also did not incorporate a lethal concentration-to-NOAEL uncertainty factor. Potential uncertainties associated with inhalation TRVs for 1,1-dichloroethene and carbon tetrachloride will be described in the risk characterization and uncertainty analysis portions of future ERAs that evaluate these chemicals.

Corrections to Inhalation TRVs Developed for Edwards AFB

The NOAEL-based TRVs developed for Edwards AFB were calculated according to the same procedures as the low TRVs presented in Table 1. However, final adjusted NOAEL-equivalent TRVs were not equal to low TRVs for all detected analytes. Omissions or inconsistencies identified during the SSFL review of inhalation TRVs developed for Edwards AFB are described below, and include the following:

- Toxicological study information could not be verified.
- Errors were found in the interpretation of toxicological study information, or dose adjustment calculations.
- Errors were found in concentration unit conversions.
- Uncertainty factors were inconsistently applied during the derivation of NOAEL-equivalent TRVs.
- Unexplained adjustment factors were applied to TRVs for some chemicals.

Toxicological Study Information Review

Omissions or inconsistencies related to toxicological study information include incorrect reporting of the NOAEL and LOAEL effects levels, exposure duration, and dose, as described below.

- The fluorene TRV, based on a surrogate chemical, benzo(a)pyrene, is calculated as a NOAEL-based TRV; however, the reported effect level for benzo(a)pyrene was a LOAEL (Thyssen, et al., 1981, as cited in ATSDR, 1995). A LOAEL-to-NOAEL extrapolation uncertainty factor was not applied in the TRV developed for Edwards AFB. As a result, the fluorene TRV was in error by a factor of five. The effect level recorded for phenanthrene, for which benzo(a)pyrene is also a surrogate, was correct.
- The previously derived TRV for toluene was based on a LOAEL, with a LOAEL-to-NOAEL extrapolation uncertainty factor applied. However, a NOAEL was also reported in the selected toxicological study (Aranyi, et al, 1985, as cited in ATSDR, 2000). Therefore, the reported NOAEL was used to derive an updated low TRV value for toluene in this technical memorandum.
- The exposure time for chlorodifluoromethane (surrogate for dichlorodifluoromethane, 1,1,2-trichloro-1,2,2-trifluoroethane, and trichlorofluoromethane) listed in the inhalation TRV table developed for Edwards AFB was 24 hours per day, while the exposure time in the selected toxicological study was stated as 6 hours per day (Palmer et al., 1978 as cited in IRIS, 2010). The previous TRV was based on the time-adjusted NOAEL value presented in EPA's IRIS summary, which was adjusted for exposure duration.
- The exposure time for trichloroethene (TCE) listed in the inhalation TRV table developed for Edwards AFB was 24 hours per day, while the exposure time in the toxicological study was stated as 8 hours per day (Arito et al., 1994).
- The NOAEL reported for benzo(a)pyrene (surrogate analyte for fluorene and phenanthrene) in ATSDR is in units of mg/m^3 (Thyssen, et al., 1981, as cited in ATSDR, 1995). In the table of TRVs developed for Edwards AFB, however, this NOAEL was placed under the column heading "Dose Reported in Study" in units of ppm.
- The "Exposure Duration" column in the table of TRVs developed for Edwards AFB included cells that did not specify the number of days per week of exposure during the toxicity test. The reason for this missing information was not specified, and the assumption of a 7-day per week exposure scenario was not explicitly stated.

Review of Toxicological Study Interpretation and Intermediate Calculations

Errors or inconsistencies in the interpretation of toxicology studies or dose conversion calculations are described below.

- The TRV for total xylenes, as well as TRVs for chemicals for which total xylenes is used as a surrogate (1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, m- & p-xylene, o-xylene and p-cymene), are based on a subchronic LOAEL; in the TRV derivation for Edwards AFB, this was classified as a chronic LOAEL. A subchronic-to-chronic extrapolation uncertainty factor was not applied previously. Therefore, the previous low TRV for total xylenes, and chemicals for which total xylenes is used as a surrogate analyte, was greater than the updated low TRV by a factor of two.

- The molecular weight recorded for chloromethane in the TRV table developed for Edwards AFB is equal to the molecular weight for chloroethane. This incorrect molecular weight was used in TRV calculations, but was not used in the derivation of the final adjusted NOAEL-equivalent TRV for chloromethane (see 3rd bullet under "Incorrect Concentration Unit Conversion," below).

- An uncertainty factor of 10 to account for toxicologically non-sensitive-to-sensitive endpoint conversion was added to the TRV for chlorodifluoromethane (surrogate for dichlorodifluoromethane, 1,1,2-trichloro-1,2,2-trifluoroethane and trichlorofluoromethane). This uncertainty factor is not typically applied to TRVs developed for ERAs. However, because there are uncertainties associated with this study (i.e., non-sensitive endpoint and limited data), an uncertainty factor of 10 was applied in the derivation of updated TRVs for chlorodifluoromethane and chemicals for which chlorodifluoromethane is a surrogate, consistent with the Edwards AFB inhalation TRVs.

- In the TRV table developed for Edwards AFB, the equation converting non-adjusted TRVs to a 24¬ hour per day, 7-day per week exposure is presented twice, in two side-by-side columns. In the first time-adjustment column for cis-1,2-dichloroethene, the equation used as input an unidentified number not equal to the non-adjusted TRV presented in the table. The equation presented in the second column used the non-adjusted TRV divided by a total uncertainty factor of 10. The number calculated in the second equation was used to derive the final TRV for cis-1,2-dichloroethene.

Incorrect Concentration Unit Conversion

The TRV table developed for Edwards AFB included two columns with the header "Non-adjusted TRV (mg/m3)" where the NOAEL or LOAEL, in units of ppm, is converted to units of mg/m^3. For some chemicals, the same non-adjusted TRV is included in both columns. For other chemicals, inconsistencies in the unit conversion calculation or in the application of extrapolation uncertainty or other unexplained factors resulted in differences between these two columns. The following bullets refer to these columns with identical headers as "TRV(1)" and "TRV(2)." The TRVs used in previous risk assessments conducted for the SSFL were calculated based on the non-adjusted TRVs in column TRV(2).

- For analytes for which 1,4-dichlorobenzene is a surrogate (1,2,3-trichlorobenzene, 1,2,4-trichlorobenzene, 1,2-dichlorobenzene, and 1,3-dichlorobenzene), the values in TRV(1) represent a unit conversion calculated based on the NOAEL for 1,4 dichlorobenzene and the detected analyte molecular weight. However, the TRV(2) column contains a TRV calculated based on the NOAEL and molecular weight for 1,4-dichlorobenzene. For the proposed TRVs included in this technical memorandum, concentration unit conversions were based on the molecular weight of the surrogate analyte. Final TRVs for chemicals for which 1,4-dichlorobenzene is a surrogate in the table developed for Edwards AFB were based on the TRV(2) column, and are equal to the updated low TRV values in this technical memorandum.

- For 2-methylnaphthalene, the value in TRV(1) is based on the reported LOAEL for naphthalene (the surrogate chemical) and the molecular weight for 2-methylnaphthalene. The second TRV(2) value for 2-methylnaphthalene is based on the LOAEL and molecular weight of the surrogate, naphthalene, divided by a total extrapolation uncertainty factor of five. The updated non-adjusted TRV for 2-methylnaphthalene in this technical memorandum is based on the LOAEL and molecular weight for naphthalene.

- The non-adjusted TRV for chloromethane in column TRV(1) was calculated based on the molecular weight of chloroethane. The non-adjusted TRV for chloromethane in column TRV(2) was calculated based on the molecular weight for chloromethane, and a total extrapolation uncertainty factor was applied. The updated non-adjusted TRV for chloromethane in this technical memorandum is based on the LOAEL and molecular weight for chloromethane.

- The value of 0.9 mg/m^3, in TRV(1) for fluorene and in TRV(2) for flourene and phenanthrene, is not equal to the non-adjusted NOAEL for benzo(a)pyrene (i.e., the recommended surrogate chemical). The value in TRV(1) for phenanthrene is equal to the NOAEL for benzo(a)pyrene of 9.5 mg/m^3, as presented in ATSDR, "converted" to units of mg/m^3 (please refer to the 5th bullet under "Toxicological Study Information Review," above). The correct NOAEL concentration units for the benzo(a)pyrene were applied in this technical memorandum.

- The value for methyl ethyl ketone in the TRV(1) column is 2,948.9 mg/m^3, corresponding to a NOAEL dose of 1,000 ppm. The value in the TRV(2) column is 2,978 mg/m^3, which is the inhalation low TRV that was used in previous ERAs conducted for the SSFL. The correct non-adjusted TRV of 2,949 mg/m^3 was calculated using a molecular weight of 72.1, and rounded from 2,948.9 mg/m^3 to 2,949 mg/m^3.

Incorrect Application of Uncertainty Factors

Issues related to incorrect or inconsistent application of uncertainty factors are described below.

- The total uncertainty factor, which is the product of the LOAEL-to-NOAEL and subchronic-to chronic uncertainty factors, was applied to the non-adjusted TRV in TRV(1) to derive the non-adjusted TRV in TRV(2) for the following ten chemicals:

1,1,2-trichloroethane, 1,1-dichloroethene, 1,2-dichloroethene, 2-hexanone, 2-methylnaphthalene, carbon tetrachloride, cis-1,2-dichloroethene, chloromethane, naphthalene, trans-1,2-dichloroethene. Although TRV(1) should have been used to derive the time-adjusted, chronic NOAEL-equivalent TRV for these chemicals, TRV(2) was mistakenly used to derive the time-adjusted, chronic NOAEL-equivalent TRV. This error resulted in a double application of the total uncertainty factor for these chemicals.

Application of Unexplained Factors

The application of adjustment factors with no explanation or documented scientific basis includes the following:

- An unexplained factor of approximately five was applied to the unit-converted TRV in the TRV(1) column to calculate the value in the TRV(2) column for the following chemicals: 1,1,1-trichloroethane, 1,1-dichloroethane, carbon disulfide, and chloroform. The total uncertainty factor for those chemicals was two; therefore, the unexplained factor of five cannot be attributed to the total uncertainty factor.
- An unexplained factor of approximately 50 was applied to the non-adjusted TRV in the TRV(1) column to calculate the value in the TRV(2) column for methylene chloride. The total uncertainty factor for methylene chloride was 10; therefore, the unexplained factor of five cannot be attributed to the total uncertainty factor.

The final two columns in the table of inhalation TRVs developed for Edwards AFB have the same column headings but different values. These two columns, labeled "Adjusted NOAEL-Equivalent TRV" with units of mg/m^3, are identified below as "TRV(3)" and "TRV(4)." Values in the TRV(3) and TRV(4) columns were calculated based on the values in the TRV(1) and TRV(2) columns divided by the total uncertainty factor, respectively. The mammalian inhalation TRVs used in previous risk assessments conducted for the SSFL are the values presented in the TRV(4) column.

Most differences between the updated low TRVs included in Table 1 and Attachment 1, and values in the TRV(4) column of the table of inhalation TRVs developed for Edwards AFB are due to the inconsistencies listed above. In addition, an incorrect total uncertainty factor of two, rather than 10, was applied to the time-adjusted TRV to derive final adjusted NOAEL-equivalent TRVs for 2-hexanone and methylene chloride. No total uncertainty factor was applied to the time-adjusted TRV for phenanthrene to derive a final adjusted NOAEL-equivalent TRV; however, an uncertainty factor of five should have been applied. Finally, the adjusted NOAEL-

equivalent TRV for carbon tetrachloride in column TRV(3) was calculated using the value in column TRV(2), rather than the value in TRV(1).

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TABLES AND ATTACHMENTS

Table 1 - Inhalation Toxicity Reference Values for Terrestrial Mammals

Attachment 1 - Calculation of NOAEL-Based Inhalation Low TRVs for Terrestrial Mammals

Attachment 2 - Calculation of LOAEL-Based Inhalation High TRVs for Terrestrial Mammals

TABLES

Table 1
Inhalation Toxicity Reference Values for Terrestrial Mammals
Santa Susana Field Laboratory

Analyte	Surrogate	Previous NOAEL-equivalent TRV [1] (mg/m^3)	Proposed Updated TRVs	
			Low TRV (mg/m^3)	High TRV (mg/m^3)
1,1,1-Trichloroethane	--	38.2	191	573
1,1,2-Trichloroethane	--	0.057	0.81	8.1
1,1-Dichloroethane	--	36	181	361
1,1-Dichloroethene	--	0.60	5.9	30
1,3-Dichloropropene	--	4.1	4.1	16
1,2,3-Trichlorobenzene	1,4-Dichlorobenzene	50	50	159
1,2,4-Trichlorobenzene	1,4-Dichlorobenzene	50	50	159
1,2,4-Trimethylbenzene	Xylenes, Total	15.5	7.8	39
1,2-Dichlorobenzene	1,4-Dichlorobenzene	50	50	159
1,2-Dichloroethane [2]	--	42	42	--
1,2-Dichloroethene	--	1.9	19	94
1,2-Dichloropropane	--	1.2	1.2	6.2
1,3,5-Trimethylbenzene	Xylenes, Total	15.5	7.8	39
1,3-Dichlorobenzene	1,4-Dichlorobenzene	50	50	159
1,4-Dichlorobenzene	--	50	50	159
Methyl ethyl ketone	--	869	860	2,581
2-Hexanone	--	2.4	4.9	24
2-Methylnaphthalene	Naphthalene	0.38	1.9	9.4
Acetone	--	1305	1,307	6,533
Benzene	--	0.57	0.57	2.9
Benzo(a)pyrene	--	na	0.36	1.8
Carbon Disulfide	--	0.24	1.2	5.9
Carbon Tetrachloride	--	0.63	6.3	31
Chlorobenzene	--	58	58	173
Chloroethane	--	992	992	3,263
Chloroform	--	0.24	1.2	6.1
Chloromethane	--	0.74	3.8	19
cis-1,2-Dichloroethene	1,2-Dichloroethene	1.9	19	94
Dichlorodifluoromethane	Freon 22	90.9	909	44,200
Ethylbenzene	--	23	23	116
Freon 22 (Chlorodifluoromethane)	--	na	909	44,200
Fluorene	Benzo(a)pyrene	0.17	0.36	1.8
1,1,2-Trichloro-1,2,2-trifluoroethane	Freon 22	90.9	909	44,200

Table 1
Inhalation Toxicity Reference Values for Terrestrial Mammals
Santa Susana Field Laboratory

Analyte	Surrogate	Previous NOAEL-equivalent TRV [1] (mg/m^3)	Proposed Updated TRVs	
			Low TRV (mg/m^3)	High TRV (mg/m^3)
Cumene	Ethylbenzene	23	23	116
m-Xylene & p-Xylene	Xylenes, Total	15.5	7.8	39
Methylene chloride	--	0.87	8.7	43
Naphthalene	--	0.38	1.9	9.4
n-Butylbenzene	Ethylbenzene	23	23	116
n-Propylbenzene	Ethylbenzene	23	23	116
o-Xylene	Xylenes, Total	15.5	7.8	39
p-Cymene	Xylenes, Total	15.5	7.8	39
Phenanthrene	Benzo(a)pyrene	0.17	0.36	1.8
sec-Butylbenzene	Ethylbenzene	23	23	116
Styrene	--	38	192	682
tert-Butylbenzene	Ethylbenzene	23	23	116
Tetrachloroethene	--	24	24	121
Toluene	--	0.084	0.17	0.42
trans-1,2-Dichloroethene	1,2-Dichloroethene	1.9	19	94
Trichloroethene	--	6.4	6.4	32
Trichlorofluoromethane	Freon 22	90.9	909	44,200
Vinyl chloride	--	0.56	0.55	2.7
Xylenes, Total	--	15.5	7.8	39

Notes:

na - not applicable. Analyte is a surrogate for chemicals detected at SSFL, and was not listed in Attachment C-4.

mg/m^3 - milligrams per cubic meter

NOAEL - no-observed-effects-level

TRV - toxicity reference value

[1] Previous NOAEL-equvalent TRVs reported in Appendix C, Attachment C-4 of the SRAM (MWH, 2005).

[2] Based upon email communication with Brian Faulkner of the Department of Toxic Substances Control on October 14, 2010, it was agreed that there is insufficient data available for 1,2-dichloroethane to appropriately address the uncertainties created by the narrow concentration range from no effect to lethal toxicity as well as the wide species variability within the available studies. As a result, a high TRV for 1,2-dichloroethane will not be developed at this time.

ATTACHMENT 1

Calculation of NOAEL-Based Inhalation Low TRVs for Terrestrial Mammals

Attachment 1
Calculation of NOAEL-Based Inhalation Low TRVs for Terrestrial Mammals
Santa Susana Field Laboratory

Analyte	Surrogate [1]	Test Species	Endpoint	Test Duration	Chronic/ Subchronic	Effect level	Exposure Duration [2]	Molecular Weight	Dose Reported in the Study (ppm)	Non-adjusted TRV (mg/m^3)	Dose-time Adjustment [3] (to 24-hrs/day, 7-days/week)	TRV adjusted for exposure time	Extrapolation Uncertainty Factors LC50 to Chronic NOAEL 100	LOAEL to NOAEL 5	Subchronic to Chronic 2	Low TRV (mg/m^3)	Source
1,1,1-Trichloroethane	--	Gerbil	neurological	3 months	Subchronic	NOAEL	24 hrs/day	133	70	382	382*24hrs/24hrs = 382	382	1	1	2	191	1
1,1,2-Trichloroethane	--	Mouse	survival (LC50)	Exposed for 6 hours in 1 day; Observed for 14 days	Subchronic	LC50	6 hours/day, 1 day	133	416	2,270	2270*6hrs/24hrs*1day/7days = 81	81	100	1	1	0.81	2
1,1-Dichloroethane	--	Cat	hepatic, renal, hematopoetic	13 weeks	Subchronic	NOAEL	6 hrs/day, 5 days/wk	99	500	2,024	2024*6hrs/24hrs*5days/7days = 361	361	1	1	2	181	3
1,1-Dichloroethene	--	Guinea Pig	survival	90 days	Subchronic	LOAEL	24 hrs/day	97	15	59	59*24hrs/24hrs = 59	59	1	5	2	5.9	4
1,3-Dichloropropene	--	Mouse	respiratory	2 years	Chronic	NOAEL	6 hrs/day, 5 days/wk	111	5	23	23*5days/7days*6hrs/24hrs = 4.1	4.1	1	1	1	4.1	5
1,2,3-Trichlorobenzene	1,4-Dichlorobenzene	Rat	hepatic	16 weeks	Subchronic	NOAEL	6 hrs/day; 7 days/wk	181	66	397	397*6hrs/24hours = 99	99	1	1	2	50	6
1,2,4-Trichlorobenzene	1,4-Dichlorobenzene	Rat	hepatic	16 weeks	Subchronic	NOAEL	6 hrs/day; 7 days/wk	181	66	397	397*6hrs/24hours = 99	99	1	1	2	50	6
1,2,4-Trimethylbenzene	Xylenes, Total	Rat	behavior (rotarod performance, spontaneity)	6 months	Subchronic	LOAEL	6 hrs/day, 5 days/wk	120	100	434	434*6 hrs/24 hrs*5 days/7 days = 78	78	1	5	2	8	7
1,2-Dichlorobenzene	1,4-Dichlorobenzene	Rat	hepatic	16 weeks	Subchronic	NOAEL	6 hrs/day; 7 days/wk	147	66	396.8	397*6hrs/24hours = 99	99	1	1	2	50	6
1,2-Dichloroethane [4]	--	Rat	systemic	2 years	Chronic	NOAEL	7 hrs/day, 5 days/wk	99	50	202	202*7hrs/24hrs*5days/7days = 42	42	1	1	1	42	8
1,2-Dichloroethene	--	Rat	systemic	8 or 16 weeks	Subchronic	LOAEL	8 hrs/day; 5 days/wk	97	200	793	793*8hrs/24hrs*5days/7days = 189	189	1	5	2	19	9
1,2-Dichloropropane	--	Rat	respiratory	13 weeks	Subchronic	LOAEL	6 hrs/day, 5 days/wk	113	15	69	69*6hrs/24hrs*5days/7days = 12	12	1	5	2	1.2	10
1,3,5-Trimethylbenzene	Xylenes, Total	Rat	behavior (rotarod performance, spontaneity)	6 months	Subchronic	LOAEL	6 hrs/day, 5 days/wk	120	100	434	434*6 hrs/24 hrs*5 days/7 days = 78	78	1	5	2	8	7
1,3-Dichlorobenzene	1,4-Dichlorobenzene	Rat	hepatic	16 weeks	Subchronic	NOAEL	6 hrs/day; 7 days/wk	147	66	397	397*6hrs/24hours = 99	99	1	1	2	50	6
1,4-Dichlorobenzene	--	Rat	hepatic	16 weeks	Subchronic	NOAEL	6 hrs/day; 7 days/wk	147	66	397	397*6hrs/24hours = 99	99	1	1	2	50	6
Methyl ethyl ketone	--	Mouse	development	10 days (gestation 6-15 days)	Chronic	NOAEL	7 hrs/day [5]	72	1,000	2,949	2,949*7hrs/24hrs = 860	860	1	1	1	860	11
2-Hexanone	--	Rat	neurological	6 months	Subchronic	LOAEL	8 hrs/day; 5 days/wk	100	50	205	205*8hrs/24hrs*5days/7days = 49	49	1	5	2	4.9	12
2-Methylnaphthalene	Naphthalene	Mouse	respiratory	104 weeks	Chronic	LOAEL	6 hrs/day, 5 days/wk	142	10	52.4	52*6hrs/24hrs*5days/7days = 9.4	9.4	1	5	1	1.9	13
Acetone	--	Rat	developmental	14 days (gestation day 6 - 19)	Chronic	NOAEL	6 hrs/day; 7 days/wk	58	2,200	5,226	5,226*6hrs/24hrs = 1,307	1,307	1	1	1	1,307	14
Benzene	--	Mouse	systemic (decreased CFU-E lympocytes and RBCs)	32 days; 66 days; 178 days	Subchronic	LOAEL	6 hrs/day, 5 days/wk	78	10	32	32*6hrs/24hrs*5days/7days = 5.7	5.7	1	5	2	0.57	15
Benzo(a)pyrene	--	Hamster	Cancer	109 weeks	Chronic	LOAEL	3-4.5 hrs/day; 7 days/wk	166	na	9.5	9.5*4.5 hrs/24 hrs = 1.8	1.8	1	5	1	0.36	16
Carbon Disulfide	--	Rat	cardio	1-6 months	Subchronic	NOAEL	5-8 hrs/day; 5 days/wk	76	3.2	10	10*8hrs/24hrs*5days/7days = 2.4	2.4	1	1	2	1.2	17
Carbon Tetrachloride	--	Guinea Pig	survival	90 days	Subchronic	LOAEL	24 hrs/day	154	10	63	63*24hrs/24hrs*7days/7days = 63	63	1	5	2	6.3	18
Chlorobenzene	--	Rat	hepatic, renal	2 generation	Chronic	NOAEL	6 hrs/day; 7 days/wk	113	50	230	230*6hrs/24hrs = 58	58	1	1	1	58	19
Chloroethane	--	Mouse	development	10 days (gestation 6-15 days)	Chronic	NOAEL	6 hrs/day [5]	65	1,504	3,969	3969*6hrs/24hrs = 992	992	1	1	1	992	20
Chloroform	--	Mouse	renal	13 weeks	Subchronic	NOAEL	6 hrs/day; 7 days/wk	119	1.99	9.7	9.7*6hrs/24hrs = 2.4	2.4	1	1	2	1.2	21
Chloromethane	--	Mouse	neurological	18 or 24 months	Chronic	LOAEL	6 hrs/day, 5 days/wk	50	51	105	105*6hrs/24hrs*5days/7days = 19	19	1	5	1	3.8	22
cis-1,2-Dichloroethene	1,2-Dichloroethene	Rat	systemic	8 or 16 weeks	Subchronic	LOAEL	8 hrs/day; 5 days/wk	97	200	793	793*8hrs/24hrs*5days/7days = 189	189	1	5	2	19	9
Dichlorodifluoromethane	Freon 22	Rat	maternal wt. gain	10 days (gestation 6-15 days)	Chronic	NOAEL	6 hrs/day [5]	121	1,000	3,537	dose-time adjusted value from IRIS	909	1	1	1	909	23
Ethylbenzene	--	Rat	systemic	2,5,9 or 16 weeks	Subchronic	LOAEL	6 hrs/day, 5 days/wk	106	300	1,303	1,303*6 hours/24 hrs*5 days/7 days = 233	233	1	5	2	23	24

Attachment 1
Calculation of NOAEL-Based Inhalation Low TRVs for Terrestrial Mammals
Santa Susana Field Laboratory

Analyte	Surrogate [1]	Test Species	Endpoint	Test Duration	Chronic/ Subchronic	Effect level	Exposure Duration [2]	Molecular Weight	Dose Reported in the Study (ppm)	Non-adjusted TRV (mg/m^3)	Dose-time Adjustment [3] (to 24-hrs/day, 7-days/week)	TRV adjusted for exposure time	Extrapolation Uncertainty Factors: LC50 to Chronic NOAEL 100	LOAEL to NOAEL 5	Subchronic to Chronic 2	Low TRV (mg/m^3)	Source
Freon 22 (Chlorodifluoromethane)	--	Rat	maternal wt. gain	10 days (gestation 6-15 days)	Chronic	NOAEL	6 hrs/day [5]	121	1,000	3,537	dose-time adjusted value from IRIS	909	1	1	1	909	23
Fluorene	Benzo(a)pyrene	Hamster	cancer	109 weeks	Chronic	LOAEL	3-4.5 hrs/day; 7 days/wk	166	na	9.5	9.5*4.5 hrs/24 hrs = 1.8	1.8	1	5	1	0.36	16
1,1,2-Trichloro-1,2,2-trifluoroethane	Freon 22	Rat	maternal wt. gain	10 days (gestation 6-15 days)	Chronic	NOAEL	6 hrs/day [5]	187	1,000	3,537	dose-time adjusted value from IRIS	909	1	1	1	909	23
Cumene	Ethylbenzene	Rat	systemic	2,5,9 or 16 weeks	Subchronic	LOAEL	6 hrs/day, 5 days/wk	120	300	1,303	1,303*6 hours/24 hrs*5 days/7 days = 233	233	1	5	2	23	24
m-Xylene & p-Xylene	Xylenes, Total	Rat	behavior (rotarod performance, spontaneity)	6 months	Subchronic	LOAEL	6 hrs/day, 5 days/wk	na	100	434	434*6 hrs/24 hrs*5 days/7 days = 78	78	1	5	2	8	7
Methylene chloride	--	Rat	hepatic, renal	100 days	Subchronic	LOAEL	24 hrs/day	85	25	87	87*24hrs/24hrs = 87	87	1	5	2	8.7	25
Naphthalene	--	Mouse	respiratory	104 weeks	Chronic	LOAEL	6 hrs/day, 5 days/wk	128	10	52	52*6hrs/24hrs*5days/7days = 9.4	9.4	1	5	1	1.9	13
n-Butylbenzene	Ethylbenzene	Rat	systemic	2,5,9 or 16 weeks	Subchronic	LOAEL	6 hrs/day, 5 days/wk	134	300	1,303	1,303*6 hours/24 hrs*5 days/7 days = 233	233	1	5	2	23	24
n-Propylbenzene	Ethylbenzene	Rat	systemic	2,5,9 or 16 weeks	Subchronic	LOAEL	6 hrs/day, 5 days/wk	120	300	1,303	1,303*6 hours/24 hrs*5 days/7 days = 233	233	1	5	2	23	24
o-Xylene	Xylenes, Total	Rat	behavior (rotarod performance, spontaneity)	6 months	Subchronic	LOAEL	6 hrs/day, 5 days/wk	106	100	434	434*6 hrs/24 hrs*5 days/7 days = 78	78	1	5	2	8	7
p-Cymene	Xylenes, Total	Rat	behavior (rotarod performance, spontaneity)	6 months	Subchronic	LOAEL	6 hrs/day, 5 days/wk	134	100	434	434*6 hrs/24 hrs*5 days/7 days = 78	78	1	5	2	8	7
Phenanthrene	Benzo(a)pyrene	Hamster	cancer	109 weeks	Chronic	LOAEL	3-4.5 hrs/day; 7 days/wk	178	na	9.5	9.5*4.5hrs/24hrs = 1.8	1.8	1	5	1	0.36	16
sec-Butylbenzene	Ethylbenzene	Rat	systemic	2,5,9 or 16 weeks	Subchronic	LOAEL	6 hrs/day, 5 days/wk	134	300	1,303	1,303*6 hours/24 hrs*5 days/7 days = 233	233	1	5	2	23	24
Styrene	--	Rat	neurological	3 months	Subchronic	NOAEL	24 hrs/day	104	90	383	33*24hrs/24hrs*7days/7days = 383	383	1	1	2	192	26
tert-Butylbenzene	Ethylbenzene	Rat	systemic	2,5,9 or 16 weeks	Subchronic	LOAEL	6 hrs/day, 5 days/wk	134	300	1,303	1,303*6 hours/24 hrs*5 days/7 days = 233	233	1	5	2	23	24
Tetrachloroethene	--	Mouse	systemic (lung congestion, heptatocellular degeneration, necrosis)	103 weeks	Chronic	LOAEL	6 hrs/day, 5 days/wk	166	100	678	678*6 hrs/24 hrs*5 days/7 days = 121	121	1	5	1	24	27
Toluene	--	Rat	immune (increased susceptibility to infection)	4 weeks	Subchronic	NOAEL	3 hrs/day, 5 days/wk	92	1	3.8	3.8*3 hrs/24 hrs*5 days/7 days = 0.34	0.34	1	1	2	0.17	28
trans-1,2-Dichloroethene	1,2-Dichloroethene	Rat	systemic	8 or 16 weeks	Subchronic	LOAEL	8 hrs/day; 5 days/wk	97	200	793	793*8hrs/24hrs*5days/7days = 189	189	1	5	2	19	9
Trichloroethene	--	Rat	behavior (decrased wakefulness, heart rate)	6 weeks	Subchronic	LOAEL	8 hrs/day; 5 days/wk	131	50	269	269*8 hrs/24 hrs*5 days/7 days =64	64	1	5	2	6.4	29
Trichlorofluoromethane	Freon 22	Rat	maternal wt. gain	10 days (gestation 6-15 days)	Chronic	NOAEL	6 hrs/day [5]	137	1,000	3,537	dose-time adjusted value from IRIS	909	1	1	1	909	23
Vinyl chloride	--	Rat	hepatic	6 months	Subchronic	LOAEL	6 hrs/day; 6 days/wk	63	10	26	26*6 hrs/24 hrs*6 days/7 days = 5.5	5.5	1	5	2	0.55	30
Xylenes, Total	--	Rat	behavior (rotarod performance, spontaneity)	6 months	Subchronic	LOAEL	6 hrs/day, 5 days/wk	106	100	434	434*6 hrs/24 hrs*5 days/7 days = 78	78	1	5	2	7.8	7

Notes:

- Toxicological studies used to develop Toxicity Reference Values (TRVs) were provided by the California Environmental Protection Agency's Department of Toxic Substances Control's Human and Ecological Risk Division (DTSC/HERD).

[1] TRVs for chemicals without sufficient toxicological study data are equal to the TRVs developed for the selected surrogate chemical.

[2] In some cases, the expsoure duration was reported in 'hrs / day' and number of days per week of exposure was not specified in ATSDR. For the purpose of TRV derivation, a continuous, 7 day per week test exposure was assumed.

[3] In cases where the exposure duration was reported as a range (e.g. 3-4.5 hrs / day), the upper end of the range was used in the dose-time adjustment, consistent with the TRVs developed for Edwards Air Force Base by DTSC.

[4] The toxicological study recommended by DTSC for derivation of a TRV-low for 1,2-dichloroethane did not identify a LOAEL concentration. Therefore, the recommended NOAEL for 1,2-dichloroethane was used to derive a TRV-low. To calculate a TRV-high, a study reporting a LOAEL was selected from the ATSDR toxicological profile for 1,2-dichloroethane.

[5] The exposure duration listed for this analyte was a range of days during gestation totaling more than one week. Continuous 7-day per week exposure during this period was assumed.

kg - kilogram
IRIS - Integrated Risk Information System
LC50 - lethal concentration, 50% (concentration causing mortality in 50% of test organisms)
LOAEL - lowest observed adverse effects level
na - Not available
NOAEL - no observed adverse effects level
mg/m^3 - milligrams per cubic meter
ppm - parts per million
TRV - toxicity reference value

Attachment 1
Calculation of NOAEL-Based Inhalation Low TRVs for Terrestrial Mammals
Santa Susana Field Laboratory

Analyte	Surrogate [1]	Test Species	Endpoint	Test Duration	Chronic/ Subchronic	Effect level	Exposure Duration [2]	Molecular Weight	Dose Reported in the Study (ppm)	Non-adjusted TRV (mg/m^3)	Dose-time Adjustment [3] (to 24-hrs/day, 7-days/week)	TRV adjusted for exposure time	Extrapolation Uncertainty Factors: LC50 to Chronic NOAEL 100	LOAEL to NOAEL 5	Subchronic to Chronic 2	Low TRV (mg/m^3)	Source

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ATTACHMENT 2

Calculation of LOAEL-Based Inhalation High TRVs for Terrestrial Mammals

Attachment 2
Calculation of LOAEL-Based Inhalation High TRVs for Terrestrial Mammals
Santa Susana Field Laboratory

Analyte	Surrogate [1]	Test Species	Endpoint	Test Duration	Chronic/ Subchronic	Effect level	Exposure Duration [2]	Molecular Weight	Dose Reported in the Study (ppm)	Non-adjusted TRV (mg/m^3)	Dose-time Adjustment [3] (to 24-hrs/day, 7-days/week)	TRV adjusted for exposure time	High TRV Notes	Extrapolation Uncertainty Factors: LC50 to Chronic LOAEL 10	Extrapolation Uncertainty Factors: Subchronic to Chronic 2	High TRV (mg/m^3)	Source [6]
1,1,1-Trichloroethane	--	Gerbil	neurological	3 months	Subchronic	LOAEL	24 hrs/day	133	210	1,146	1,146*24hrs/24hrs = 1,146	1,146	Serious LOAEL	1	2	573	1
1,1,2-Trichloroethane	--	Mouse	survival (LC50)	Exposed for 6 hours in 1 day; Observed for 14 days	Subchronic	LC50	6 hours/day, 1 day	133	416	2,270	2,270*6hrs/24hrs*1days/7days = 81	81	Serious LC50	10	1	8.1	2
1,1-Dichloroethane	--	Cat	hepatic, renal, hematopoetic	13 weeks	Subchronic	LOAEL	6 hrs/day, 5 days/wk	99	1,000	4,047	4,047*6hrs/24hrs*5days/7days = 723	723	Serious LOAEL	1	2	361	3
1,1-Dichloroethene	--	Guinea Pig	survival	90 days	Subchronic	LOAEL	24 hrs/day	97	15	59	59*24hrs/24hrs = 59	59	Serious LOAEL	1	2	30	4
1,3-Dichloropropene	--	Mouse	respiratory	2 years	Chronic	LOAEL	6 hrs/day, 5 days/wk	111	20	91	91*6hrs/24hrs*5days/7days = 16	16	Less Serious	1	1	16	5
1,2,3-Trichlorobenzene	1,4-Dichlorobenzene	Rat	hepatic	16 weeks	Subchronic	LOAEL	6 hrs/day; 7 days/wk	181	211	1,269	1,269*6hrs/24hours = 317	317	Less Serious	1	2	159	6
1,2,4-Trichlorobenzene	1,4-Dichlorobenzene	Rat	hepatic	16 weeks	Subchronic	LOAEL	6 hrs/day; 7 days/wk	181	211	1,269	1,269*6hrs/24hours = 317	317	Less Serious	1	2	159	6
1,2,4-Trimethylbenzene	Xylenes, Total	Rat	behavior (rotarod performance, spontaneity)	6 months	Subchronic	LOAEL	6 hrs/day, 5 days/wk	120	100	434	434*6 hrs/24 hrs*5 days/7 days = 78	78	Less Serious	1	2	39	7
1,2-Dichlorobenzene	1,4-Dichlorobenzene	Rat	hepatic	16 weeks	Subchronic	LOAEL	6 hrs/day; 7 days/wk	147	211	1,269	1,269*6hrs/24hours = 317	317	Less Serious	1	2	159	6
1,2-Dichloroethane [4]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloroethene	--	Rat	systemic	8 or 16 weeks	Subchronic	LOAEL	8 hrs/day; 5 days/wk	97	200	793	793*8hrs/24hrs*5days/7days = 189	189	Serious LOAEL	1	2	94	9
1,2-Dichloropropane	--	Rat	respiratory	13 weeks	Subchronic	LOAEL	6 hrs/day, 5 days/wk	113	15	69	69*6hrs/24hrs*5days/7days = 12	12	NA	1	2	6.2	10
1,3,5-Trimethylbenzene	Xylenes, Total	Rat	behavior (rotarod performance, spontaneity)	6 months	Subchronic	LOAEL	6 hrs/day, 5 days/wk	120	100	434	434*6 hrs/24 hrs*5 days/7 days = 78	78	Less Serious	1	2	39	7
1,3-Dichlorobenzene	1,4-Dichlorobenzene	Rat	hepatic	16 weeks	Subchronic	LOAEL	6 hrs/day; 7 days/wk	147	211	1,269	1269*6hrs/24hours = 317	317	Less Serious	1	2	159	6
1,4-Dichlorobenzene	--	Rat	hepatic	16 weeks	Subchronic	LOAEL	6 hrs/day; 7 days/wk	147	211	1,269	1269*6hrs/24hours = 317	317	Less Serious	1	2	159	6
Methyl ethyl ketone	--	Mouse	developmental	10 days (gestation day 6-15)	Chronic	LOAEL	7 hrs/day [5]	72	3,000	8,848	8,848*7hrs/24hrs = 2,581	2,581	Serious LOAEL	1	1	2,581	11
2-Hexanone	--	Rat	neurological	6 months	Subchronic	LOAEL	8 hrs/day; 5 days/wk	100	50	205	205*8hrs/24hrs*5days/7days = 49	49	Serious LOAEL	1	2	24	12
2-Methylnaphthalene	Naphthalene	Mouse	respiratory	104 weeks	Chronic	LOAEL	6 hrs/day, 5 days/wk	142	10	52	52*6hrs/24hrs*5days/7days = 9.4	9.4	Less Serious	1	1	9.4	13
Acetone	--	Rat	developmental	14 days (gestation day 6 - 19)	Chronic	LOAEL	6 hrs/day; 7 days/wk	58	11,000	26,130	26,130*6hrs/24hrs = 6,533	6,533	Less Serious	1	1	6,533	14
Benzene	--	Mouse	systemic (decreased CFU-E lymphocytes and RBCs)	32 days; 66 days; 178 days	Subchronic	LOAEL	6 hrs/day, 5 days/wk	78	10	32	32*6hrs/24hrs*5days/7days = 5.7	5.7	Only 10ppm tested;	1	2	2.9	15
Benzo(a)pyrene	--	Hamster	cancer	109 weeks	Chronic	LOAEL	3-4.5 hrs/day; 7 days/wk	166	na	10	9.5*4.5hrs/24 hrs = 1.8	1.8	Serious LOAEL	1	1	1.8	16
Carbon Disulfide	--	Rat	cardio	1-6 months	Subchronic	LOAEL	5-8 hrs/day; 5 days/wk	76	16	50	50*8hrs/24hrs*5days/7days = 12	12	Serious LOAEL	1	2	5.9	17
Carbon Tetrachloride	--	Guinea Pig	survival	90 days	Subchronic	LOAEL	24 hrs/day	154	10	63	63*24hrs/24hrs*7days/7days = 63	63	Serious LOAEL	1	2	31	18
Chlorobenzene	--	Rat	hepatic, renal	2 generation	Chronic	LOAEL	6 hrs/day; 7 days/wk	113	150	691	691*6hrs/24hrs = 173	173	Less Serious	1	1	173	19

Attachment 2
Calculation of LOAEL-Based Inhalation High TRVs for Terrestrial Mammals
Santa Susana Field Laboratory

Analyte	Surrogate [1]	Test Species	Endpoint	Test Duration	Chronic/ Subchronic	Effect level	Exposure Duration [2]	Molecular Weight	Dose Reported in the Study (ppm)	Non-adjusted TRV (mg/m^3)	Dose-time Adjustment [3] (to 24-hrs/day, 7-days/week)	TRV adjusted for exposure time	High TRV Notes	Extrapolation Uncertainty Factors		High TRV (mg/m^3)	Source [6]
														LC50 to Chronic LOAEL 10	Subchronic to Chronic 2		
Chloroethane	--	Mouse	developmental	10 days (gestation 6 to 15)	Chronic	LOAEL	6 hrs/day [5]	65	4,946	13,052	13,052*6hrs/24hrs = 3,263	3,263	Less Serious	1	1	3,263	20
Chloroform	--	Mouse	renal	13 weeks	Subchronic	LOAEL	6 hrs/day; 7 days/wk	119	10	49	49*6hrs/24hrs = 12	12	Less Serious	1	2	6.1	21
Chloromethane	--	Mouse	neurological	18 months or 24 months	Chronic	LOAEL	6 hrs/day, 5 days/wk	50	51	105	105*6hrs/24hrs*5days/7days = 19	19	Less Serious	1	1	19	22
cis-1,2-Dichloroethene	1,2-Dichloroethene	Rat	systemic	8 or 16 weeks	Subchronic	LOAEL	8 hrs/day; 5 days/wk	97	200	793	793*8hrs/24hrs*5days/7days = 189	189	Serious LOAEL	1	2	94	9
Dichlorodifluoromethane	Freon 22	Rat	maternal wt. gain	10 days (gestation 6 to 15)	Chronic	LOAEL	6 hrs/day [5]	121	50,000	176,800	176,800*6hrs/24hrs*7days/7days = 44,200	44,200	NA	1	1	44,200	23
Ethylbenzene	--	Rat	systemic (blood and renal effects)	2,5,9 or 16 weeks	Subchronic	LOAEL	6 hrs/day, 5 days/wk	106	300	1,303	1,303*6 hours/24 hrs*5 days/7 days = 233	233	NA	1	2	116	24
Freon 22 (Chlorodifluoromethane)	--	Rat	reduced maternal wt. gain	10 days (gestation 6 to 15)	Chronic	LOAEL	6 hrs/day [5]	121	50,000	176,800	176,800*6hrs/24hrs*7days/7days = 44,200	44,200	NA	1	1	44,200	23
Fluorene	Benzo(a)pyrene	Hamster	cancer	109 weeks	Chronic	LOAEL	3-4.5 hrs/day; 7 days/wk	166	na	9.5	9.5*4.5hrs/24 hrs = 1.8	1.8	Serious LOAEL	1	1	1.8	16
1,1,2-Trichloro-1,2,2-trifluoroethane	Freon 22	Rat	maternal wt. gain	10 days (gestation 6 to 15)	Chronic	LOAEL	6 hrs/day [5]	187	50,000	176,800	176,800*6hrs/24hrs*7days/7days = 44,200	44,200	NA	1	1	44,200	23
Cumene	Ethylbenzene	Rat	systemic (blood and renal effects)	2,5,9 or 16 weeks	Subchronic	LOAEL	6 hrs/day, 5 days/wk	120	300	1,303	1,303*6 hours/24 hrs*5 days/7 days = 233	233	NA	1	2	116	24
m-Xylene & p-Xylene	Xylenes, Total	Rat	behavior (rotarod performance, spontaneity)	6 months	Subchronic	LOAEL	6 hrs/day, 5 days/wk	na	100	434	434*6 hrs/24 hrs*5 days/7 days = 78	78	Less Serious	1	2	39	7
Methylene chloride	--	Rat	hepatic, renal	100 days	Subchronic	LOAEL	24 hrs/day	85	25	87	87*24hrs/24hrs = 87	87	Less Serious	1	2	43	25
Naphthalene	--	Mouse	respiratory	104 weeks	Chronic	LOAEL	6 hrs/day, 5 days/wk	128	10	52	52*6hrs/24hrs*5days/7days = 9.4	9.4	Less Serious	1	1	9.4	13
n-Butylbenzene	Ethylbenzene	Rat	systemic (blood and renal effects)	2,5,9 or 16 weeks	Subchronic	LOAEL	6 hrs/day, 5 days/wk	134	300	1,303	1,303*6 hours/24 hrs*5 days/7 days = 233	233	NA	1	2	116	24
n-Propylbenzene	Ethylbenzene	Rat	systemic (blood and renal effects)	2,5,9 or 16 weeks	Subchronic	LOAEL	6 hrs/day, 5 days/wk	120	300	1,303	1,303*6 hours/24 hrs*5 days/7 days = 233	233	NA	1	2	116	24
o-Xylene	Xylenes, Total	Rat	behavior (rotarod performance, spontaneity)	6 months	Subchronic	LOAEL	6 hrs/day, 5 days/wk	106	100	434	434*6 hrs/24 hrs*5 days/7 days = 78	78	Less Serious	1	2	39	7
p-Cymene	Xylenes, Total	Rat	behavior (rotarod performance, spontaneity)	6 months	Subchronic	LOAEL	6 hrs/day, 5 days/wk	134	100	434	434*6 hrs/24 hrs*5 days/7 days = 78	78	Less Serious	1	2	39	7
Phenanthrene	Benzo(a)pyrene	Hamster	cancer	109 weeks	Chronic	LOAEL	3-4.5 hrs/day; 7 days/wk	178	na	9.5	9.5*4.5hrs/24hrs = 1.8	1.8	Serious LOAEL	1	1	1.8	16
sec-Butylbenzene	Ethylbenzene	Rat	systemic (blood and renal effects)	2,5,9 or 16 weeks	Subchronic	LOAEL	6 hrs/day, 5 days/wk	134	300	1,303	1,303*6 hours/24 hrs*5 days/7 days = 233	233	NA	1	2	116	24
Styrene	--	Rat	neurological	3 months	Subchronic	LOAEL	24 hrs/day	104	320	1,363	1,363*24hrs/24hrs = 1,363	1,363	Less Serious	1	2	682	26
tert-Butylbenzene	Ethylbenzene	Rat	systemic (blood and renal effects)	2,5,9 or 16 weeks	Subchronic	LOAEL	6 hrs/day, 5 days/wk	134	300	1,303	1,303*6 hours/24 hrs*5 days/7 days = 233	233	NA	1	2	116	24

Attachment 2
Calculation of LOAEL-Based Inhalation High TRVs for Terrestrial Mammals
Santa Susana Field Laboratory

Analyte	Surrogate [1]	Test Species	Endpoint	Test Duration	Chronic/ Subchronic	Effect level	Exposure Duration [2]	Molecular Weight	Dose Reported in the Study (ppm)	Non-adjusted TRV (mg/m^3)	Dose-time Adjustment [3] (to 24-hrs/day, 7-days/week)	TRV adjusted for exposure time	High TRV Notes	Extrapolation Uncertainty Factors: LC50 to Chronic LOAEL 10	Extrapolation Uncertainty Factors: Subchronic to Chronic 2	High TRV (mg/m^3)	Source [6]
Tetrachloroethene	--	Mouse	systemic (lung congestion, heptatocellular degeneration, necrosis)	103 weeks	Chronic	LOAEL	6 hrs/day, 5 days/wk	166	100	678	678*6 hrs/24 hrs*5 days/7 days = 121	121	Serious LOAEL	1	1	121	27
Toluene	--	Rat	immune (increased susceptibility to infection)	4 weeks	Subchronic	LOAEL	3 hrs/day, 5 days/wk	92	2.5	9.4	9.4*3 hrs/24 hrs*5 days/7 days = 0.84	0.84	Less Serious	1	2	0.42	28
trans-1,2-Dichloroethene	1,2-Dichloroethene	Rat	systemic	8 or 16 weeks	Subchronic	LOAEL	8 hrs/day; 5 days/wk	97	200	793	793*8hrs/24hrs*5days/7days = 189	189	Serious LOAEL	1	2	94	9
Trichloroethene	--	Rat	behavior (decreased wakefulness, heart rate)	6 weeks	Subchronic	LOAEL	8 hrs/day; 5 days/wk	131	50	269	269*8 hrs/24 hrs*5 days/7 days =64	64	NA	1	2	32	29
Trichlorofluoromethane	Freon 22	Rat	maternal wt. gain	10 days (gestation 6 to 15)	Chronic	LOAEL	6 hrs/day [5]	137	50,000	176,800	176,800*6hrs/24hrs*7days/7days = 44,200	44,200	NA	1	1	44,200	23
Vinyl chloride	--	Rat	hepatic, cardio	6 months	Subchronic	LOAEL	6 hrs/day; 6 days/wk	63	10	26	26*6 hrs/24 hrs*6 days/7 days = 5.5	5.5	Less Serious	1	2	2.7	30
Xylenes, Total	--	Rat	behavior (rotarod performance, spontaneity)	6 months	Subchronic	LOAEL	6 hrs/day, 5 days/wk	106	100	434	434*6 hrs/24 hrs*5 days/7 days = 78	78	Less Serious	1	2	39	7

Notes:

- Toxicological studies used to develop Toxicity Reference Values (TRVs) were provided by the California Environmental Protection Agency's Department of Toxic Substances Control's Human and Ecological Risk Division (DTSC/HERD).

[1] TRVs for chemicals without sufficient toxicological study data are equal to the TRVs developed for the selected surrogate chemical.

[2] In some cases, the exposure duration was reported in 'hrs / day' and number of days per week of exposure was not specified in ATSDR. For the purpose of TRV derivation, a continuous, 7-day per week test exposure was assumed.

[3] In cases where the exposure duration was reported as a range (e.g. 3-4.5 hrs / day), the upper end of the range was used in the dose-time adjustment, consistent with the TRVs developed for Edwards Air Force Base by DTSC.

[4] Based upon email communication with Brian Faulkner of DTSC on October 14, 2010, it was agreed that there is insufficient data available for 1,2-dichloroethane to appropriately address the uncertainties created by the narrow concentration range from no effect to lethal toxicity as well as the wide species variability within the available studies. As a result, a high TRV for 1,2-dichloroethane will not be developed at this time.

[5] The exposure duration listed for this analyte was a range of days during gestation totaling more than one week. Continuous 7-day per week exposure during this period was assumed.

[6] Source number listed can be found in Attachment 1.

kg - kilogram
LC50 - lethal concentration, 50% (concentration causing mortality in 50% of test organisms)
LOAEL - lowest observed adverse effects level
na - Not available
NA - Not applicable
NOAEL - no observed adverse effects level
mg/m^3 - milligrams per cubic meter
ppm - parts per million
TRV - toxicity reference value

APPENDIX F

Ecological Risk-Based Screening Levels for Use in Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura County, California - Technical Memorandum

ECOLOGICAL RISK-BASED SCREENING LEVELS FOR USE IN ECOLOGICAL RISK ASSESSMENTS
TECHNICAL MEMORANDUM
SANTA SUSANA FIELD LABORATORY
VENTURA COUNTY, CALIFORNIA

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This technical memorandum presents ecological risk-based screening levels (EcoRBSLs) and risk characterization updates for use in the preparation of ecological risk assessments (ERAs) for the Santa Susana Field Laboratory (SSFL). This document has been prepared for the California Environmental Protection Agency (Cal-EPA) Department of Toxic Substances Control (DTSC) on behalf of the Boeing Company (Boeing), National Aeronautics and Space Administration (NASA), and U.S. Department of Energy (DOE) as agreed during a meeting between the DTSC, Boeing, NASA and DOE held on February 17, 2010 in response to DTSC comments on previous risk assessments included in Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Group Reports.

ERAs prepared for the SSFL, to date, have been performed in accordance with the *Standardized Risk Assessment Methodology for the SSFL (SRAM) Work Plan, Santa Susana Field Laboratory, Ventura County, California. Revision 2 – Final* (MWH, 2005). The SRAM (MWH, 2005) documents the methods and assumptions to be used in a ”forward” calculation of ecological exposure doses and hazards to avian and mammalian indicator receptors from exposure to constituents of potential ecological concern (CPECs) in environmental media. In the *Draft Proposed Approaches for Streamlining Future Ecological Risk Assessments at the Santa Susana Field Laboratory - Technical Memorandum* (MWH, 2009), an alternative to the forward calculation of dose and hazard was proposed in which EcoRBSLs are back-calculated for each CPEC and then compared to a site- and medium-specific exposure point concentration (EPC) using a “sum-of-fractions” approach for the derivation of chemical-specific ecological hazard quotients (HQs).

Because the “sum-of-fractions” approach for ecological HQ derivation represents a fundamental change in the way ecological risks will be characterized in future ERAs prepared for the SSFL, sections of the SRAM that describe ecological risk characterization required updating. In addition to presenting EcoRBSLs, this technical memorandum documents revisions to the risk characterization methods described in the SRAM (MWH, 2005) related to (1) the ”sum-of-fractions” approach for ecological HQ derivation, and (2) the derivation and use of the Low and High EcoRBSLs.

Since publication of the SRAM, there have been significant updates to available toxicological information for previously identified CPECs, and an expanded list of chemicals detected across all ecologically-relevant media at the SSFL has been developed. The expanded list of chemicals detected in all ecologically-relevant media at the SSFL is provided in Attachment 1 of the *Draft Ecological Exposure Assessment Updates to be Used in Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura County, California - Technical Memorandum* (Appendix F of the *Standardized Risk Assessment*

Methodology Rev.2 Addendum [SRAM Rev.2 Addendum]). The chemicals noted as detected in soil and sediment (both ephemeral and permanent) in Attachment 1 of MWH were determined through the process outlined in the *Process for Selecting the Comprehensive List of Chemicals for Development of Rural Residential Risk-Based Screening Levels for Santa Susana Field Laboratory, Ventura County, California - Technical Memorandum* (Appendix A of the SRAM Rev.2 Addendum). The list of chemicals that are noted as detected in the remaining ecologically-relevant media (i.e., ephemeral surface water, permanent surface water, near-surface groundwater, and seeps and springs) was developed based upon the most current 2011 sampling performed at the SSFL, and using a process similar to that outlined in the *Process for Selecting the Comprehensive List of Chemicals for Development of Rural Residential Risk-Based Screening Levels for Santa Susana Field Laboratory, Ventura County, California - Technical Memorandum* (Appendix A of the SRAM Rev.2 Addendum). This list will be updated as new information becomes available, such as when a chemical that was not previously detected at the SSFL is detected, or on an annual basis to determine if new toxicological information for a chemical becomes available.

The ecological risk characterization methods that are a subject of this technical memorandum are contained within Section 12 of the SRAM (MWH, 2005). In order to eliminate potential redundancies or inconsistencies between the revised risk characterization methods presented in this technical memorandum and those described in the SRAM (MWH, 2005), Section 12 of the SRAM (MWH, 2005) has been updated in its entirety and is contained in Attachment 1 of this technical memorandum. Updates to text in Section 12 were originally provided in redline to facilitate DTSC's review of these changes. Upon DTSC's review and concurrence of the redline changes in Attachment 1, changes were accepted and this attachment now replaces Section 12 in the SRAM (MWH, 2005). In addition to text updates, this technical memorandum includes revisions to SRAM (MWH, 2005) attachments, as noted below.

Appendix C in the SRAM (MWH, 2005) has been deleted because ESLs will not be used in future ecological risk assessments conducted for the SSFL. The EcoRBSLs, presented in Tables 12-1 through 12-5 of this technical memorandum replace ESLs. EcoRBSL is a term that refers to both published, medium-specific benchmarks for lower trophic level receptors (e.g., for soil invertebrates, terrestrial plants, the water column community, and the sediment benthic community), as presented in the *Draft Ecological Effects Characterization Updates to be Used in Ecological Risk Assessments at the Santa Susana Field Laboratory – Technical Memorandum* (Appendix D of the SRAM Rev.2 Addendum), and calculated dose-equivalent medium concentrations for mammals and birds. The following tables and attachments have been added to Section 12:

- Table 12-1 Summary of the Lowest Ecological Risk-based Screening Levels by Media;
- Table 12-2 Summary of the Ecological Risk-Based Screening Levels for Chemicals Detected in Ephemeral/Permanent Surface Water, Seeps/Springs, and/or Near-surface Groundwater;
- Table 12-3 Summary of the Ecological Risk-Based Screening Levels for Chemicals Detected Ephemeral and/or Permanent Sediment;
- Table 12-4 Summary of the Ecological Risk-Based Screening Levels for Chemicals Detected in Soil; and
- Table 12-5 Summary of the Ecological Risk-Based Screening Levels for Chemicals Detected in Soil Vapor

REFERENCES

MWH Americas, Inc. (MWH), 2005. Standardized Risk Assessment Methodology (SRAM) Work Plan, Santa Susana Field Laboratory, Ventura County, California. Revision 2 – Final. September. HDMSE00198.

MWH, 2009. *Draft Proposed Approaches for Streamlining Future Ecological Risk Assessments at the Santa Susana Field Laboratory - Technical Memorandum*. July.

ATTACHMENTS

Attachment 1 – Updates to Section 12, *Standardized Risk Assessment Methodology (SRAM) Work Plan, Santa Susana Field Laboratory, Ventura County, California*. Revision 2 – Final.

Attachment 2 – Lists of Updated References, Tables, and Figures

Attachment 3 – Responses to DTSC Comments on the Ecological Risk-Based Screening Level Technical Memorandum

ATTACHMENT 1

Updates to Section 12, *Standardized Risk Assessment Methodology (SRAM) Work Plan, Santa Susana Field Laboratory, Ventura County, California*. Revision 2 – Final

SECTION 12

12 ECOLOGICAL RISK CHARACTERIZATION

Risk characterization combines information concerning exposure to chemicals with information about the potential effects of those chemicals to estimate potential ecological risks to representative species. Risk characterization addresses the following questions:

- Are ecological receptors currently exposed to site-related CPECs at levels capable of causing harm, or is future exposure of receptors likely?
- If adverse ecological effects are observed or predicted, what are the types, extent, and severity of effects?
- What are the principal uncertainties associated with the risk characterization?

Generally, a weight-of-evidence approach is used in ecological risk characterization. In other words, the physicochemical properties, bioavailability, historical site use, and areal distribution of CPECs, in addition to the quantitative risk estimates, are used to determine the potential for ecological risk. Moreover, the suitability of available habitat at a given investigational unit for ecological receptor species of concern is determined. The ecological risk characterization process is described in the following sections:

- Section 12.1 describes the risk estimation methodology,
- Section 12.2 presents the weight-of-evidence analysis and risk description methodology.
- Section 12.3 discusses the uncertainty analysis methodology.
- Section 12.4 describes ecological risk decision criteria and the manner in which site recommendations are made with respect to ecological risks.

12.1 RISK ESTIMATION METHODOLOGY

The general approach and specific methods that will be used to quantify risks to ecological receptors from exposure to contaminated media at the SSFL are described in the following subsections.

12.1.1 Sum-of-Fractions Approach

As presented in the *Draft Proposed Approaches for Streamlining Future Ecological Risk Assessments at the Santa Susana Field Laboratory – Technical Memorandum*, potential risk to ecological receptors will be quantified using a sum-of-fractions approach (MWH, 2009). This

method employs medium- and chemical-specific ecological risk-based screening levels (i.e., EcoRBSLs), expressed as media concentrations for soil, sediment, surface water, and soil vapor. Risks will then be estimated by calculating chemical-specific HQs as the ratio of the chemical-specific exposure concentration (*i.e.*, the EPC) to the applicable EcoRBSL. Risks will be estimated by calculating HQs and HIs, using Low and High EcoRBSLs, as described in the following subsections.

12.1.1.1 Hazard Quotients

In the sum-of-fractions approach, a medium- and chemical-specific EcoRBSL is compared to a chemical-specific EPC for a given CPEC. The chemical-specific HQ is calculated by dividing a chemical-specific EPC by the chemical-specific EcoRBSL for a given CPEC. Ecological HQs will be estimated using the following equation:

$$\mathrm{HQ} = \frac{\mathrm{EPC}}{\mathrm{EcoRBSL}} \qquad \text{(Equation 12-1)}$$

Where:

HQ = hazard quotient

EPC = exposure point concentration

EcoRBSL = ecological risk-based screening level

Ecological HQs and HIs, as discussed in Section 10.1, will be calculated assuming a RME-based EPC for each representative species at each RFI site. Ecological HQs estimated for the RME scenario will be calculated using both Low benchmark- or Low TRV-based EcoRBSLs and High benchmark- or High TRV-based EcoRBSLs. Each of these exposure values will be considered qualitatively in the uncertainty analysis section of the risk assessment. Benchmarks and TRVs used to derive the EcoRBSLs used in HQ calculations are discussed further in Section 11. Low benchmark- or Low TRV-based EcoRBSLs will be referred to as Low EcoRBSLs, and High benchmark- or High TRV-based EcoRBSLs will be referred to as High EcoRBSLs.

If a chemical-specific HQ exceeds a value of 1 for an ecological receptor when using the Low EcoRBSL, then the chemical-specific HQ using the High EcoRBSL will be calculated. If calculated, both HQs, based on the Low EcoRBSL and on the High EcoRBSL, will be presented in the risk assessment.

If the chemical-specific HQ based on the Low EcoRBSL is less than 1 for an ecological receptor, and the uncertainty is deemed acceptable, then it is inferred that there exists a negligible potential for adverse effects for that chemical in that medium. Ecological HQs less than 1 will also be presented in the risk assessment. The likelihood of an adverse effect to the representative species will be evaluated with respect to other lines of evidence, including but not limited to uncertainties in exposure or toxicity information, as discussed in Sections 12.2 and 12.3, respectively. As presented in Section 10.6.1, EPCs will be derived for dioxins/furans and for coplanar PCBs as the 2,3,7,8-TCDD TEQ and coplanar PCB TEQ, respectively. The EPCs for the 2,3,7,8-TCDD TEQ and the coplanar PCB TEQ will be divided by their respective EcoRBSLs to derive a 2,3,7,8-TCDD TEQ HQ and a coplanar PCB TEQ HQ.

Ecological HQs for individual non-coplanar PCB congeners will not be evaluated, because as presented in Section 3.2.1, TEFs are unavailable for non-coplanar PCB congeners. This is consistent with DTSC policy and the risk evaluation approach used in human health risk assessments conducted at the SSFL. Therefore risks from non-coplanar PCB congeners will be evaluated through risk estimates calculated for Aroclors.

12.1.1.2 Hazard Indices

HQs are chemical- and exposure- pathway specific; however, representative species (i.e., birds and mammals) present at a RFI site are usually exposed to more than one chemical and pathway. HIs are calculated to determine the potential cumulative effects of exposure to multiple chemicals and through multiple exposure pathways for each representative ecological receptor. As described in the *Incremental Risk Calculation Methodology for Human Health and Ecological Risk Assessments Prepared for the Santa Susana Field Laboratory, Ventura County, California - Technical Memorandum* (Appendix I of the SRAM Rev.2 Addendum), chemical-specific HQs for CPECs will not be summed to a single cumulative HI for each ecological receptor. Rather, chemical-specific HQs for each ecological receptor across all applicable exposure pathways and media will be combined by chemical class, as appropriate, to estimate total, cumulative site risk estimates for each ecological receptor. Since HQs are considered to be additive only for those chemicals that act through similar mechanisms or on the same target organ, chemical-specific HQs for organic CPECs of similar chemical class (i.e. organochlorine pesticides, dioxins/furans, PCBs, LMW PAHs, HMW PAHs, and Aroclors) will be summed to obtain chemical class-specific hazard indices (HI). HQs for individual chemicals will be used for inorganic chemicals as they do not all act similarly on the same target organs. A number of inorganics technically have multiple target organs or mechanisms of action; therefore, including

the same HQ for an inorganic chemical in more than one target organ-specific HQ would potentially be considered "double counting" of exposure and risk.

As described in Section 12.1.1, ecological HQs will be calculated for the 2,3,7,8-TCDD TEQ and the coplanar PCB congener TEQ separately. However, because dioxins/furans and coplanar PCB congeners act by similar toxicological mechanisms, the 2,3,7,8-TCDD TEQ HQ and the coplanar PCB congener TEQ HQ will be summed to a cumulative HI. In addition to estimating the, cumulative HI for the 2,3,7,8-TCDD TEQ and coplanar PCB TEQ, an HI will also be estimated for Aroclor mixtures, as appropriate. However, the estimated HI for Aroclor mixtures and the HI for 2,3,7,8-TCDD TEQ and coplanar PCB TEQ will not be summed to avoid potential "double counting" of exposure and risk.

12.1.1.3 Range of Risk Estimates

In order to provide a range of risk estimates for each ecological receptor, HQs and HIs calculated using Low EcoRBSLs as well as those calculated using High EcoRBSLs will be presented in ERAs conducted for the SSFL. While HQs and HIs calculated using Low EcoRBSLs are conservative and are based mostly on no-observed-effect concentrations (NOECs) or no-observed-adverse-effect levels (NOAELs), with some exceptions as noted in Section 11.1.3 of the *Ecological Effects Characterization Updates for Chemicals for Use in Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura County, California – Technical Memorandum* (Appendix D of the SRAM Rev.2 Addendum), use of NOECs or NOAELs alone provides an incomplete picture of risk to ecological receptors. In order to provide a more complete assessment of risk to ecological receptors, a second level of HQs and HIs calculated using High EcoRBSLs, based primarily on lowest-observed-effect concentrations (LOECs) or lowest-observed-adverse-effect-levels (LOAELs), will be developed. An HQ or HI based on Low EcoRBSLs with a value greater than or equal to 1 suggests that additional evaluation is required. An HI calculated using High EcoRBSLs with a value greater than or equal to 1 indicates exposure exceeds levels associated with adverse effects. A range of ecological risk estimates will allow for more informed risk management decisions to be made for each RFI site, as described in Section 12.4. Chemicals for which the HQ > 1 or chemical class HI > 1 based on the High EcoRBSL, will be retained for further ecological evaluation, or analysis of remedial alternatives in the feasibility study (FS). An additional, sample-specific comparison of media concentrations to EcoRBSLs will be performed and evaluated spatially to identify potential hot spots using procedures described in the *Hot Spot Evaluation Technical Memorandum Prepared*

for the Santa Susana Field Laboratory, Ventura County, California (Appendix J of the SRAM Rev.2 Addendum).

12.1.2 Ecological RBSLs

In order to calculate ecological HQs and HIs as described in Sections 12.1.1.1 and 12.1.1.2, medium- and chemical-specific EcoRBSLs will be selected or derived in accordance with general methods for the calculation of RBSLs described in U.S. Environmental Protection Agency's (USEPA's) RAGS, Part B – Development of Risk-based Preliminary Remediation Goals (USEPA, 1991). Specific methods and assumptions for quantifying exposures to higher trophic level ecological receptors will be consistent with the following guidance documents or reference materials:

- *Guidance for Ecological Risk Assessment at Hazardous Waste Sites and Permitted Facilities.* (DTSC, 1996).
- *HERD Ecological Risk Assessment Notes: Numbers 1-6.* (DTSC, 1998 – 2009).
- *Risk Assessment Guidance for Superfund. Volume II: Environmental Evaluation Manual.* Interim Final. (USEPA, 1989)
- *Wildlife Exposure Factors Handbook* (USEPA, 1993).
- *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments, Interim Final* (USEPA, 1997).
- *Guidelines for Ecological Risk Assessment* (USEPA, 1998).

EcoRBSLs in each medium will only be calculated for chemicals that have been detected in ecologically relevant media at the SSFL. Attachment 1 of the *Ecological Effects Characterization Updates for Chemicals for Use in Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura County, California – Technical Memorandum* (Appendix D of the SRAM Rev.2 Addendum) presents the chemicals that have been detected in each medium at the SSFL.

It should be noted that while Low EcoRBSLs are conservative and are based mostly on no-observed-effect concentrations (NOECs) or no-observed-adverse-effect levels (NOAELs), with some exceptions as noted in Section 11.1.3 of the *Ecological Effects Characterization Updates for Chemicals for Use in Ecological Risk Assessments at the Santa Susana Field Laboratory – Technical Memorandum* (Appendix D of the SRAM Rev.2 Addendum), use of NOECs or

NOAELs alone provides an incomplete picture of risk to ecological receptors. In order to provide a more complete assessment of risk to ecological receptors, a second level of EcoRBSLs (i.e., High EcoRBSLs), based primarily on lowest-observed-effect concentrations (LOECs) or lowest-observed-adverse-effect-levels (LOAELs) were developed. A range of ecological risk estimates calculated based on Low EcoRBSLs and High EcoRBSLs will allow for more informed risk management decisions to be made for each RFI site.

EcoRBSLs were derived for completed exposure pathways for each ecological receptor for detected chemicals in ephemeral or permanent surface water, near-surface groundwater, sediment, soil, and/or soil vapor, as applicable. Exposure pathways for each ecological receptor considered in the derivation of EcoRBSLs are described in the *Ecological Exposure Assessment Updates for Use in Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura County, California – Technical Memorandum* (Appendix C of the SRAM Rev.2 Addendum) and depicted in the generalized ecological CSM. As described in the *Ecological Effects Characterization Updates for Use in Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura County, California – Technical Memorandum* (Appendix C of the SRAM Rev.2 Addendum), the selected medium-specific benchmarks for surface water, soil invertebrates, and terrestrial plants (both soil and soil-solution benchmarks) are a combination of concentration-based published benchmark values that represent effect levels, as well as true "no effect" levels. Therefore, selected benchmarks for surface water, soil invertebrates, and terrestrial plants (both soil and soil solution) noted in the *Ecological Effects Characterization Updates for Use in Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura County, California – Technical Memorandum* (Appendix C of the SRAM Rev.2 Addendum) are also referred to simply as "EcoRBSLs".

EcoRBSLs for surface water, soil invertebrates, and terrestrial plants are equivalent to their respective medium-specific benchmarks; therefore, these EcoRBSLs will be reported in the same number of significant figures as the source documents from which the benchmarks were selected. Since avian and mammalian EcoRBSLs are calculated rather than derived from published values, EcoRBSLs with values less than 1,000 will be reported using two significant figures and values greater than 1,000 will be reported using three significant figures.

Equations used to derive EcoRBSLs for each ecological receptor are presented below. The EcoRBSL equations are based on exposure models as presented in the *Ecological Exposure Assessment Updates for Use in Ecological Risk Assessments at the Santa Susana Field*

Laboratory, Ventura County, California – Technical Memorandum (Appendix C of the SRAM Rev.2 Addendum), with exposure assumptions used in the derivation of EcoRBSLs presented in Table 10-7 and described in Section 10.7 of that document. Ecological effects criteria used in the derivation of EcoRBSLs are discussed in Attachment 2 and provided in Tables 11-3 to 11-9 of the *Ecological Effects Characterization Updates for Chemicals for Use in Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura County, California – Technical Memorandum* (Appendix D of the SRAM Rev.2 Addendum). The lowest EcoRBSLs by media are presented in Table 12-1, and individual medium-based and receptor-based EcoRBSLs are presented in Tables 12-2 through 12-5.

12.1.2.1 EcoRBSLs for Representative Species in Aquatic Habitats

EcoRBSLs were developed for representative species in aquatic habitats that may be exposed to chemicals detected in surface water (ephemeral or permanent) or sediment (ephemeral or permanent) as follows:

- Water column communities (e.g., aquatic plants, aquatic invertebrates, fish, and the embryonic/larval stage of amphibians) that may be directly exposed to chemicals detected in surface waters.
- Benthic invertebrates exposed to chemicals detected in sediments.
- Birds and mammals (i.e., deer mouse, hermit thrush, mule deer, bobcat, and great blue heron) exposed to chemicals in surface water via ingestion (Note: derivation of water EcoRBSLs for terrestrial receptors is described in Section 12.1.2.2).
- Semi-aquatic birds (i.e., great blue heron) exposed to detected chemicals in sediment via ingestion.

Water EcoRBSLs (summarized in Table 12-2) and sediment EcoRBSLs (summarized in Table 12-3) are described for each receptor group below.

<u>Water Column Community</u>

As described in Sections 9.2.1 and 9.2.2, the water column community includes aquatic plants, aquatic invertebrates, and the embryonic/larval stage of amphibians, and are potentially exposed to chemicals in ephemeral or permanent surface water, seeps/springs, and food chain uptake. Additionally, as noted in Section 11.1, the majority of available effects concentration-based values for surface water are presented as a single set of values as provided in appropriate peer-reviewed literature or technical publications used to derive medium-specific benchmarks. This single list of effect concentrations is a combination of published benchmark values that represent

effect levels, values adjusted to a "no effect" level, as well as true "no effect" levels. As a result, the single set of EcoRBSLs for the water column community exposed to detected chemicals in ephemeral or permanent surface water and/or seeps/springs (Table 12-2) are equivalent to selected surface water benchmarks (Table 11-3).

Sediment Benthic Community

The sediment benthic community is comprised of benthic invertebrates that inhabit the litter or sediment of permanent surface water bodies. Low and High sediment EcoRBSLs for the sediment benthic community exposed to detected chemicals in permanent sediment were derived as described below. Sediment EcoRBSLs for the sediment benthic community (Table 12-3) are equivalent to the selected sediment benchmarks (Table 11-4).

Great Blue Heron

As presented in Sections 9.2.1 and 9.2.2, the great blue heron is potentially exposed to chemicals in ephemeral or permanent surface water or seeps/springs and sediment. As a result, Low and High EcoRBSLs for the great blue heron exposed to detected chemicals in ephemeral or permanent surface water and/or seeps/springs, were calculated as described below. Additionally, Low and High EcoRBSLs for the great blue heron exposed to detected chemicals in ephemeral or permanent sediment were calculated as described below. Equations 12-2 and 12-3 are based upon metabolic energy requirements and are derived from Hope (1995).

Surface Water

Surface water EcoRBSLs for the great blue heron (Table 12-2) were calculated using the following equation:

$$EcoRBSL_{gbswi} = \frac{THQ \times TRV_{avi} \times W_{gb}}{\Theta_{gb} \times \Psi_{gb} \times Q_{gb}} \qquad \text{(Equation 12-2)}$$

Where:

$EcoRBSL_{gbswi}$ = great blue heron risk-based screening level for chemical i in surface water, mg/L (Table 12-2)

THQ = target hazard quotient, unitless

TRV_{avi} = avian toxicity reference value for chemical i, mg/kg-d (Table 11-8)

W_{gb} = mean weight of great blue heron, kg (Table 10-7)

Θ_{gb} = fraction of time on SSFL spent in exposure unit, unitless (default of 1)

Ψ_{gb} = fraction of year spent at SSFL, unitless (Table 10-7)

Q_{gb} = calculated water intake of great blue heron, L/d (Table 10-7)

Sediment

The following model considers ingestion of aquatic invertebrates and fish, and incidental ingestion of sediment, based on prey information presented in Section 10.7.1 for the great blue heron. As a result, Low and High EcoRBSLs for the great blue heron exposed to detected chemicals in ephemeral and/or permanent sediment (Table 12-3) were calculated using the following equation:

$$EcoRBSL_{gbsedi} = \frac{THQ \times TRV_{avi} \times W_{gb}}{\Theta_{gb} \times \Psi_{gb} \times [(BAF_{ai} \times R_{gb} \times F_{ai}) + (BAF_f \times R_{gb} \times F_f) + (R_{gb} \times F_{sed})]} \qquad \text{(Equation 12-3)}$$

Where:

$EcoRBSL_{gbsedi}$ = great blue heron risk-based screening level for chemical i in sediment, mg/kg (Table 12-3)

THQ = target hazard quotient, unitless

TRV_{avi} = avian toxicity reference value for chemical i, mg/kg-d (Table 11-8)

W_{gb} = mean weight of adult great blue heron, kg (Table 10-7)

Θ_{gb} = fraction of time on SSFL spent in exposure unit, unitless (default of 1)

Ψ_{gb} = fraction of year spent at SSFL, unitless (Table 10-7)

BAF_{ai} = chemical-specific bioaccumulation factor for aquatic invertebrates, dry weight/dry weight (Table 10-5)

R_{gb} = food intake rate of great blue heron diet, kg/d (dry weight) (Table 10-7)

F_{ai} = fraction of aquatic invertebrates in great blue heron diet, unitless (Table 10-7)

BAF_f = chemical-specific bioaccumulation factor for fish, dry weight/dry weight (Table 10-5)

F_f = fraction of fish in great blue heron diet, unitless (Table 10-7)

F_{sed} = fraction of sediment in great blue heron diet, unitless (Table 10-7)

12.1.2.2 EcoRBSLs for Representative Species in Terrestrial Habitats

EcoRBSLs were calculated for terrestrial plants, soil invertebrates, deer mouse, hermit thrush, mule deer, red-tailed hawk, and bobcat based upon completed exposure pathways outlined in Section 9 and are summarized for each receptor below.

Terrestrial Plants

As described in Section 9.2.3, terrestrial plants may be exposed to chemicals in soil by foliar deposition or via root uptake. Terrestrial plants may also be exposed to CPECs in ephemeral surface water, near-surface groundwater, and/or seeps/springs through root contact (Section 9.2.5). The majority of available effects concentration-based values for terrestrial plants (both soil and soil solution) are presented as a single set of values for soil, and a single set for soil solution, as provided in appropriate peer-reviewed literature or technical publications used to derive medium-specific benchmarks (refer to Section 11.1). These lists of effect concentrations are compilations of published benchmark values that represent effect levels, values adjusted to a "no effect" level, as well as true "no effect" levels. As a result, a single set of EcoRBSLs for terrestrial plants exposed to chemicals detected in soil (Table 12-4) are equivalent to the selected terrestrial plant soil benchmarks (Table 11-6). In addition, a single set of EcoRBSLs for terrestrial plants exposed to detected chemicals in ephemeral surface water, near-surface groundwater, and/or seeps/springs (Table 12-2) are equivalent to the selected solution-based terrestrial plant benchmarks (Table 11-9).

Soil Invertebrates

Soil invertebrates are exposed to chemicals in soil through direct contact and ingestion. Additionally, as noted in Section 11.1, the majority of available effects concentration-based values for soil invertebrates are presented as a single set of values as provided in appropriate peer-reviewed literature or technical publications used to derive medium-specific benchmarks. This single list of effect concentrations is a combination of published benchmark values that represent effect levels, values adjusted to a "no effect" level, as well as true "no effect" levels. As a result, the single set of EcoRBSLs for soil invertebrates exposed to detected chemicals in soil (Table 12-4) are equivalent to the selected soil invertebrate benchmarks (Table 11-5).

Deer Mouse

As described in Sections 9.2 and 10.7.2, exposure of the deer mouse to CPECs through direct contact with soil, inhalation of soil vapor, ingestion of water, and prey (i.e., plants and invertebrates), and incidental ingestion of soil represent complete pathways. Therefore, an exposure models that integrates consumption of terrestrial plants, soil invertebrates, and soil was selected for calculation of both Low and High EcoRBSLs for the deer mouse exposed to detected chemicals in soil. Additionally, Low and High soil vapor EcoRBSLs for chemicals detected in soil vapor (Table 12-5) and Low and High EcoRBSLs for chemicals detected in ephemeral or

permanent surface water, seeps/springs, and/or near-surface groundwater (Table 12-2) were calculated for the deer mouse, as described below.

Soil

The following model considers ingestion of soil invertebrates and terrestrial plants, and incidental ingestion of soil. Soil EcoRBSLs for deer mouse were calculated using the following equation:

$$EcoRBSL_{dsi} = \frac{THQ \times TRV_{mi} \times W_d}{\Theta_d \times \Psi_d \times \left[(BAF_{ti} \times R_d \times F_{tid}) + (BAF_{tp} \times R_d \times F_{tpd}) + (R_d \times F_{sd})\right]} \quad \text{(Equation 12-4)}$$

Where:

$EcoRBSL_{dsi}$	=	deer mouse risk-based screening level for chemical i in soil, mg/kg (Table 12-4)
THQ	=	target hazard quotient, unitless
TRV_{mi}	=	mammalian toxicity reference value for chemical i, mg/kg-d (Table 11-9)
W_d	=	mean weight of adult deer mouse, kg (Table 10-7)
Θ_d	=	fraction of time on SSFL spent in exposure unit, unitless (default of 1)
Ψ_d	=	fraction of year spent at SSFL, unitless (Table 10-7)
BAF_{ti}	=	chemical-specific bioaccumulation factor for terrestrial invertebrates, dry weight/dry weight (Table 10-6)
R_d	=	food intake rate of deer mouse, kg/d (dry weight) (Table 10-7)
F_{tid}	=	fraction of terrestrial invertebrate in deer mouse diet, unitless (Table 10-7)
BAF_{tp}	=	chemical-specific bioaccumulation factor for the terrestrial plants, dry weight/dry weight (Table 10-6)
F_{tpd}	=	fraction of terrestrial plant in deer mouse diet, unitless (Table 10-7)
F_{sd}	=	fraction of soil in deer mouse diet, unitless (Table 10-7)

Soil Vapor

Both Low and High EcoRBSLs for soil vapor were derived for the deer mouse, using Low and High inhalation TRVs as presented in the *Inhalation Toxicity Reference Value Updates for Use in Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura County, California – Technical Memorandum* (Appendix E of the SRAM Rev.2 Addendum). In that document, inhalation TRVs were adjusted for continuous exposure (i.e., 24-hours per day/seven days per week) and, therefore, soil vapor EcoRBSLs for the deer mouse were adjusted for time

actually spent in burrows, equal to 0.75 percent of each day (Table 10-7). As a result, soil vapor EcoRBSLs for the deer mouse were calculated using the following equation:

$$EcoRBSL_{dsvi} = \frac{THQ \times TRV_{mi}}{B_d} \qquad \text{(Equation 12-5)}$$

Where:

$EcoRBSL_{dsvi}$	=	deer mouse risk-based screening level for chemical i in soil vapor, mg/m^3 (Table 12-5)
THQ	=	target hazard quotient, unitless
TRV_{mi}	=	mammalian soil vapor inhalation toxicity reference value for chemical, i, mg/m^3 (See Attachments 1 and 2 of Appendix E of the SRAM Rev.2 Addendum)
B_d	=	fraction of day spent in burrow, unitless (Table 10-7)

Surface Water

Water EcoRBSLs for the deer mouse were calculated using the following equation:

$$EcoRBSL_{dswi} = \frac{THQ \times TRV_{mi} \times W_d}{\Theta_d \times \Psi_d \times Q_d} \qquad \text{(Equation 12-6)}$$

Where:

$EcoRBSL_{dswi}$	=	deer mouse risk-based screening level for chemical i in surface water, mg/L (Table 12-2)
THQ	=	target hazard quotient, unitless
TRV_{mi}	=	mammalian toxicity reference value for chemical i, mg/kg-d (Table 11-9)
W_d	=	mean weight of deer mouse, kg (Table 10-7)
Θ_d	=	fraction of time on SSFL spent in exposure unit, unitless (default of 1)
Ψ_d	=	fraction of year spent at SSFL, unitless (Table 10-7)
Q_d	=	calculated water intake of deer mouse, L/d (Table 10-7)

Hermit Thrush

As described in Section 10.7.3, the hermit thrush is primarily exposed to chemicals through intake of prey items (i.e., plants and invertebrates), ingestion of soil, and ingestion of water. Therefore, an exposure model that integrates consumption of both terrestrial plants and soil invertebrates was selected for calculation of Low and High EcoRBSLs for the hermit thrush exposed to detected chemicals in soil (Table 12-4). Additionally, Low and High EcoRBSLs were calculated for the hermit thrush exposed to detected chemicals in ephemeral or permanent surface water, seeps/springs, and/or near-surface groundwater, as described below.

Soil

Low and High EcoRBSLs for the hermit thrush exposed to chemicals detected in soil were calculated using the following equation:

$$RBSL_{thsi} = \frac{THQ \times TRV_{avi} \times W_{th}}{\Theta_{th} \times \Psi_{th} \times \left[(BAF_{ti} \times R_{th} \times F_{tith}) + (BAF_{tp} \times R_{th} \times F_{tpth}) + (R_{th} \times F_s)\right]} \qquad \text{(Equation 12-7)}$$

Where:

$RBSL_{thsi}$	=	thrush risk-based screening level for chemical i in soil, mg/kg (Table 12-4)
THQ	=	target hazard quotient, unitless
TRV_{avi}	=	avian toxicity reference value for chemical i, mg/kg-d (Table 11-8)
W_{th}	=	mean weight of adult thrush, kg (Table 10-7)
Θ_{th}	=	fraction of time on SSFL spent in exposure unit, unitless (default of 1)
Ψ_{th}	=	fraction of year spent at SSFL, unitless (Table 10-7)
BAF_{ti}	=	chemical-specific bioaccumulation factor for terrestrial invertebrates, dry weight/dry weight (Table 10-6)
R_{th}	=	food intake rate of thrush diet, kg/d (dry weight)
F_{tith}	=	fraction of terrestrial invertebrates in thrush diet, unitless (Table 10-7)
BAF_{tp}	=	chemical-specific bioaccumulation factor for the terrestrial plants, dry weight/dry weight (Table 10-6)
F_{tpth}	=	fraction of terrestrial plants in thrush diet, unitless (Table 10-7)
F_s	=	fraction of soil in thrush diet, unitless (Table 10-7)

Surface Water

Low and High EcoRBSLs for the hermit thrush exposed to chemicals detected in ephemeral or permanent surface water, seeps/springs, and/or near-surface groundwater were calculated using the following equation:

$$EcoRBSL_{thswi} = \frac{THQ \times TRV_{avi} \times W_{th}}{\Theta_{th} \times \Psi_{th} \times Q_{th}} \qquad \text{(Equation 12-8)}$$

Where:

$EcoRBSL_{thswi}$	=	hermit thrush risk-based screening level for chemical i in surface water, mg/L (Table 12-2)
THQ	=	target hazard quotient, unitless
TRV_{avi}	=	avian toxicity reference value for chemical i, mg/kg-d (Table 11-8)
W_{th}	=	mean weight of hermit thrush, kg (Table 10-7)
Θ_{th}	=	fraction of time on SSFL spent in exposure unit, unitless (default of 1)
Ψ_{th}	=	fraction of year spent at SSFL, unitless (Table 10-7)
Q_{th}	=	calculated water intake of hermit thrush, L/d (Table 10-7)

Mule Deer

For the purpose of this evaluation, it is assumed that the primary exposure routes for mule deer are ingestion of terrestrial plants, ingestion of water, and incidental soil ingestion. Therefore, exposure models for consumption of terrestrial plants were selected for calculation of Low and High EcoRBSLs for the mule deer exposed to detected chemicals in soil (Table 12-4). Additionally, Low and High EcoRBSLs were calculated for the mule deer exposed to detected chemicals in ephemeral or permanent surface water, seeps/springs, and/or near-surface groundwater (Table 12-2), as described below.

Soil

Low and High EcoRBSLs for mule deer exposed to chemicals detected in soil were calculated using the following equation:

$$EcoRBSL_{mdsi} = \frac{THQ \times TRV_{mi} \times W_{md}}{\Theta_{md} \times \Psi_{md} \times \left[\left(BAF_{tp} \times R_{md} \times F_{tpmd}\right) + \left(R_{md} \times F_{smd}\right)\right]} \qquad \text{(Equation 12-9)}$$

Where:

$EcoRBSL_{mdsi}$	=	mule deer risk-based screening level for chemical i in soil, mg/kg (Table 12-4)
THQ	=	target hazard quotient, unitless
TRV_{mi}	=	mammalian toxicity reference value for chemical i, mg/kg-d (Table 11-9)
W_{md}	=	mean weight of adult mule deer, kg (Table 10-7)
Θ_{md}	=	fraction of time on SSFL spent in exposure unit, unitless (default of 1)
Ψ_{md}	=	fraction of year spent at SSFL, unitless (Table 10-7)
BAF_{tp}	=	chemical-specific bioaccumulation factor for the terrestrial plants, dry weight/dry weight (Table 10-6)
R_{md}	=	food intake rate of mule deer diet, kg/d (dry weight) (Table 10-7)
F_{tpmd}	=	fraction of terrestrial plants in mule deer diet, unitless (Table 10-7)
F_{smd}	=	fraction of soil in mule deer diet, unitless (Table 10-7)

Surface Water

Low and High EcoRBSLs for the mule deer exposed to chemicals detected in ephemeral or permanent surface water, seeps/springs, and/or near-surface groundwater were calculated using the following equation:

$$EcoRBSL_{mdswi} = \frac{THQ \times TRV_{mi} \times W_{md}}{\Theta_{md} \times \Psi_{md} \times Q_{md}} \qquad \text{(Equation 12-10)}$$

Where:

$EcoRBSL_{mdswi}$	=	mule deer risk-based screening level for chemical i in surface water, mg/L (Table 12-2)
THQ	=	target hazard quotient, unitless
TRV_{mi}	=	mammalian toxicity reference value for chemical i, mg/kg-d (Table 11-9)
W_{md}	=	mean weight of mule deer, kg (Table 10-7)
Θ_{md}	=	fraction of time on SSFL spent in exposure unit, unitless (default of 1)
Ψ_{md}	=	fraction of year spent at SSFL, unitless (Table 10-7)
Q_{md}	=	calculated water intake of mule deer, L/d (Table 10-7)

<u>Red-Tailed Hawk</u>

As described in Sections 9.2 and 10.7.5, the only complete exposure pathway for the red-tailed hawk is through ingestion of prey items (i.e., deer mice). As a result, Low and High EcoRBSLs

for red-tailed hawk exposed to detected chemicals in soil (Table 12-4) were calculated using the following equation:

$$EcoRBSL_{rtsi} = \frac{THQ \times TRV_{avi} \times W_{rt}}{\Theta_{rt} \times \Psi_{rt} \times BAF_d \times R_{rt} \times F_{drt}} \qquad \text{(Equation 12-11)}$$

Where:

$RBSL_{rtsi}$	=	red-tailed hawk risk-based screening level for chemical i in soil, mg/kg (Table 12-4)
THQ	=	target hazard quotient, unitless
TRV_{avi}	=	avian toxicity reference value for chemical i, mg/kg-d (Table 11-8)
W_{rt}	=	mean weight of adult red-tailed hawk, kg (Table 10-7)
Θ_{rt}	=	fraction of time on SSFL spent in exposure unit, unitless (default of 1)
Ψ_{rt}	=	fraction of year spent at SSFL, unitless (Table 10-7)
BAF_d	=	chemical-specific bioaccumulation factor for deer mouse, dry weight/dry weight (Table 10-6)
R_{rt}	=	food intake rate of red-tailed hawk diet, kg/d (dry weight) (Table 10-7)
F_{drt}	=	fraction of deer mouse in red-tailed hawk diet, unitless (Table 10-7)

Bobcat

As described in Section 10.7.6, the bobcat is potentially exposed to chemicals through direct contact with soil, inhalation of air, ingestion of water and prey, and incidental ingestion of soil. However for the purpose of this work plan, the bobcat is primarily exposed to chemicals through the ingestion of contaminated prey and ingestion of water. Therefore, exposure models for consumption of deer mice were selected for calculation of Low and High EcoRBSLs for the bobcat exposed to detected chemicals in soil (Table 12-4). Additionally, Low and High EcoRBSLs were calculated for the bobcat exposed to detected chemicals in ephemeral or permanent surface water, seeps/springs, and/or near-surface groundwater (Table 12-2) as described below.

Soil

Low and High soil EcoRBSLs for bobcat were calculated using the following equation:

$$EcoRBSL_{bcsi} = \frac{THQ \times TRV_{mi} \times W_{bc}}{\Theta_{bc} \times \Psi_{bc} \times BAF_d \times R_{bc} \times F_{dbc}} \qquad \text{(Equation 12-12)}$$

Where:

$EcoRBSL_{bcsi}$	=	bobcat risk-based screening level for chemical i in soil, mg/kg (Table 12-4)
THQ	=	target hazard quotient, unitless
TRV_{mi}	=	mammalian toxicity reference value for chemical i, mg/kg-d (Table 11-9)
W_{bc}	=	mean weight of adult bobcat, kg (Table 10-7)
Θ_{bc}	=	fraction of time on SSFL spent in exposure unit, unitless (default of 1)
Ψ_{bc}	=	fraction of year spent at SSFL, unitless (Table 10-7)
BAF_d	=	chemical-specific bioaccumulation factor for deer mouse, dry weight/dry weight (Table 10-6)
R_{bc}	=	food intake rate of bobcat diet, kg/d (dry weight) (Table 10-7)
F_{dbc}	=	fraction of deer mouse in bobcat diet, unitless (Table 10-7)

Surface Water

Low and High soil EcoRBSLs for the bobcat were calculated using the following equation:

$$EcoRBSL_{bcswi} = \frac{THQ \times TRV_{mi} \times W_{bc}}{\Theta_{bc} \times \Psi_{bc} \times Q_{bc}} \qquad \text{(Equation 12-13)}$$

Where:

$EcoRBSL_{bcswi}$	=	bobcat risk-based screening level for chemical i in surface water, mg/L (Table 12-2)
THQ	=	target hazard quotient, unitless
TRV_{mi}	=	mammalian toxicity reference value for chemical i, mg/kg-d (Table 11-9)
W_{bc}	=	mean weight of bobcat, kg (Table 10-7)
Ψ_{bc}	=	fraction of year spent at SSFL, unitless (Table 10-7)
Θ_{bc}	=	fraction of time on SSFL spent in exposure unit, unitless (default of 1)
Q_{bc}	=	calculated water intake of bobcat, L/d (Table 10-7)

12.1.3 Large Home Range Species Risk Calculations

Species with large home ranges (*e.g.*, red-tailed hawk, bobcat, and mule deer) may be exposed to chemicals at more than one RFI site, as described in Sections 9 and 10. As described in the *Draft Proposed Approaches for Streamlining Future Ecological Risk Assessments Technical Memorandum* (MWH, 2009), large home range receptors (e.g., mule deer, red-tailed hawk, and bobcat) will be evaluated at the RFI group level, and on a combined investigation unit scale, or a

facility-wide scale. Specific steps for calculating risks to large home range representative species on a combined investigation unit scale, or a facility-wide scale are described in more detail in the *Large Home Range Receptor Ecological Risk Assessment Methodology Technical Memorandum, Santa Susana Field Laboratory, Ventura County, California* (Appendix G of the SRAM Rev.2 Addendum).

12.1.4 Evaluation of Plants in Ecological Risk Assessments

Plants are identified as assessment endpoints, specifically to protect the abundance and diversity of native terrestrial vegetation by limiting acute and chronic adverse effects from exposure to site-related CPECs. As described in Section 9.2.3, terrestrial plants may be exposed to soil CPECs by foliar deposition or via root uptake. Additionally, as presented in Section 9.2.5, terrestrial plants may be exposed to ephemeral surface water, near-surface groundwater, and/or seeps/springs through root contact. Based on prior discussions with DTSC, the depth to which terrestrial plants may be exposed to near-surface groundwater is limited to six feet bgs.

For ERAs performed for the SSFL, a weight-of-evidence approach for the evaluation of potential impacts of CPECs on terrestrial and aquatic plants will be performed Terrestrial plant survey results will be reviewed to determine whether terrestrial plants are stressed at a site. Overall, if no evidence of terrestrial plant stress is observed at a site, then no further assessment of potential impacts to terrestrial plants will be conducted. If terrestrial plants are determined to be stressed at a site, the following evaluations described below will be conducted if CPECs are found in those media:

- Concentrations of CPECs in soil will be compared to available terrestrial plant soil EcoRBSLs and HQs will be calculated to determine whether soil is a potential source of plant stress.
- If seeps/springs, or ephemeral surface water are present then seeps/springs or ephemeral surface water concentrations of CPECs will be compared to available solution-based terrestrial plant EcoRBSLs and HQs will be calculated to determine whether seeps/springs or ephemeral surface water is a potential source of plant stress.
- Near-surface groundwater concentrations of CPECs will be compared to available solution-based terrestrial plant EcoRBSLs and HQs will be calculated to determine whether near-surface groundwater is a potential source of plant stress.

- If the potential source of plant stress cannot be identified based on the results of the above CPEC screening procedures, then alternative evaluation may be conducted with the agreement of risk managers and agencies.

If none of the above-mentioned media is determined to be a potential source of plant stress, terrestrial plants will be evaluated qualitatively with uncertainties noted in the ERA.

12.1.5 Evaluation of Potential Inter-Site Sediment Migration

The potential for significant migration of CPECs from the RFI site under evaluation to a downgradient RFI site through transport of sediment will be evaluated in each risk assessment for a RFI Group. If a mechanism for sediment transport is suggested by the direction and slope of the land or by the presence of creeks or ditches connecting the two RFI sites, this determination will be initially described in each site-specific risk assessment and fully discussed in the risk assessment for the appropriate Reporting Area. Evaluation of the potential impacts of sediment migration to a downgradient RFI site will be identified by a comparison of the ecological habitats, receptors, and exposure pathways that are relevant to the RFI site under evaluation and the downgradient RFI site as follows:

1. If the ecological receptors and exposure pathways are identical at the RFI site under evaluation and the downgradient RFI site, then it will be assumed that ecological risks at the downgradient RFI site could be as high as those at that RFI site under evaluation. In these cases, it is conservatively assumed that no attenuation or dilution occurs during sediment transport, and that the concentrations of CPECs at an adjacent downgradient RFI site could be as high as those at the RFI site under evaluation. Therefore, if the risk assessment for the RFI site under evaluation shows a potential unacceptable risk, then it will be assumed that risks at the adjacent RFI site may also be unacceptable. Alternatively, if the risk assessment for the investigational unit under evaluation concludes that risks are acceptable, then it will be assumed that risks at the downgradient site are also acceptable.

2. If the ecological receptors and exposure pathways are more sensitive at the downgradient RFI site as compared to the RFI site under evaluation, then additional quantitative assessment will be performed using the sediment concentration data from the RFI site under evaluation and applying that data to the more sensitive ecological conditions at the downgradient RFI site. In general, for ecological risk assessment an aquatic habitat will be considered more sensitive than a terrestrial habitat.

The initial comparison of ecological receptors, exposure pathways, and habitats will be described in the RFI site risk assessments. Should quantitative evaluation of potential impacts to a downgradient RFI site be necessary, such evaluations will follow the methods as described in the SRAM or SRAM Rev.2 Addendum updates, and will be presented as an attachment to the risk assessment for the RFI site or RFI Group.

12.2 Weight-of-Evidence Analysis and Risk Description

A weight-of-evidence approach will be used to evaluate the risk to each representative species from different chemicals and the likelihood of adverse effects, taking into account factors such as the following: resulting HQ or HI values; past chemical use history at the site (*i.e.*, a CPEC was used primarily in one portion of the site); habitat suitability for ecological receptors of concern (i.e., ratio of appropriate habitat onsite to appropriate habitat offsite); physicochemical properties of chemicals (*i.e.*, chemical form in the environment, persistence, and mobility); bioavailability of chemicals (i.e., is a chemical bound to soil or in a form that is not readily absorbed); exposure assumptions (i.e., assuming a thrush spends 100 percent of its time in the most contaminated portion of the site); uncertainty factors used in derivation of toxicity criteria; and the uncertainty analysis discussed in Section 12.3. Using all lines of evidence, an overall, qualitative estimate of the risk to each representative species will be determined in conjunction with the quantitative HQs and HIs for each ecological receptor evaluated.

Evaluating potential risk to ecological receptors will be an iterative process. The calculated HQs or HIs and the weight-of-evidence analysis will be used to support recommendations for the next phase of work, if necessary. It is possible that there will be HQs and HIs for chemicals and groups, respectively, that are greater than 1. An HQ or HI value of 1 calculated based on the Low EcoRBSL will not be an absolute point of departure for ecological risk; rather, it will be used as a guideline. To simplify the risk description process, the value of one will be used as the point of reference for evaluating the environmental significance of HQs or HIs. As noted in Sections 10.1 and 12.1.1, HQs and HIs will be calculated based on the UCL (RME) exposures for each representative species at each RFI site. If the RME HQ or HI calculated using the Low EcoRBSL is less than 1, then risks to ecological receptors will be considered *de minimis* and no further action with respect to ecological risk assessment will be proposed if the uncertainty in the risk estimate is deemed acceptable (Figure 12-1). If the RME HQ or HI calculated using the Low EcoRBSL is greater than 1, then the mean HQ or HI values will be examined along with HQ or HI values calculated based on the High EcoRBSL (if available). The likelihood of an adverse effect to representative species will depend on the magnitude of the HQ and/or HI, the

general toxicity of the chemical and its endpoint being evaluated, the bioavailability of the chemical, and other site-specific factors that will be taken into account in the weight-of-evidence analysis. For instance, an HQ of 10 based on a UCL exposure concentration may be calculated for a terrestrial mammal exposed to lead using a TRV based on a soluble form of lead. However, only total lead was measured onsite and the HQ would be expected to be less than 10 due to expected lower bioavailability of total versus soluble lead. Existing habitats onsite will be considered; however, the entire site is evaluated for exposure to account for any future changes in onsite land use in.

The need for refinement of exposure and toxicity assumptions will be made using professional judgment according to the flowchart on Figure 12-1. Uncertainty associated with each component of the ecological risk assessment will be identified as described below. Risk decision criteria will be based on the risk characterization, and recommendations to risk managers will be made as discussed in Section 12.4.

12.3 Uncertainty Analysis

Estimates of the potential for adverse effects from exposure to CPECs must often be made with imperfect information (data gaps) and may include several sources of uncertainty. To ensure that risk management decisions protective of ecological receptors are made despite these uncertainties, conservative assumptions are made that may overestimate rather than underestimate potential risks to these receptors. The principal common sources of uncertainty in the ecological risk assessment are described below and should be considered when evaluating risk estimates and when formulating risk management decisions for any investigational unit.

The uncertainty analysis section of the ecological risk assessment will summarize assumptions made for each element of the assessment and will evaluate the validity, strengths, and weaknesses of the analyses, as well as qualify the uncertainties associated with each risk estimate. This analysis addresses uncertainty associated with each component of the assessment: hazard identification, representative species, exposure estimation, toxicity criteria, and risk characterization. An important step in the ecological risk assessment will be to identify data gaps that may hinder or prevent the determination of potential risk and that need to be filled to facilitate such a determination.

<u>Hazard Identification and Quantification</u>

Uncertainty may be introduced in the selection and quantification (*i.e.*, statistical estimation of environmental concentrations) of CPECs due to incomplete site chemical characterization. A

comprehensive site characterization has been completed at each RFI site with input from DTSC; therefore it is unlikely that chemicals are under-represented. Uncertainty is also introduced by the possibility that some detection limits were not adequate to detect CPEC concentrations capable of inducing long-term chronic adverse effects in ecological receptors. There is uncertainty surrounding the substitution of the SQL for non-detected chemical concentrations that are greater than toxicity criteria. Uncertainty in these components will be qualitatively evaluated for each RFI site.

Receptor Selection

Knowledge of the potential suite of ecological receptors at the SSFL is based on previous field observations over several dates during different seasons. The range of representative species evaluated in ecological risk assessments conducted at the SSFL encompasses the range of potential receptors at the site. Therefore, it is unlikely that ecological receptors are under-represented in the species inventory. Uncertainties associated with representative species selection, diet, habitat use, ranges, and biology will be discussed qualitatively. Uncertainty concerning representation of feeding guilds and trophic levels at the facility is likely to be low, based on biological surveys of the facility and life history information available for most of the species.

Exposure Estimation

Uncertainty arises from the selection of exposure pathways and the quantitative estimation of contaminant uptakes. Factors that might reduce exposure rates, such as bioavailability from soil or surface water; degradation rates in soil or surface water; metabolic transformation in vegetation or invertebrates; receptor avoidance of contaminated soils, sediments, or surface water; dilution over distance; or frequency of receptor exposure to contaminated media, could add uncertainty to results. The collection of paired abiotic and biotic samples for exposure model validation could reduce some of these uncertainties, and is an option that can be explored in the future if deemed necessary. Uncertainties associated with exposure model assumptions and calculations will be discussed qualitatively.

Toxicity Criteria

Applicability of literature-derived toxicity data depends upon types of results available and methods used to arrive at these results. Test endpoints produced by laboratory and field tests may be reported as formally defined toxicological endpoints or as less stringently defined measures of mortality or sublethal effect; variations in format introduce a source of error when combined into

a single TRV or benchmark. Thus, seemingly equivalent toxicity values may be significantly different owing to differences in test protocols, test conditions, or responses of individual organisms (Lewis *et al*. 1990).

For some CPECs lacking toxicity values, surrogate values will be used in the calculation of EcoRBSLs and HQs. In such instances, there is greater uncertainty than when chemical-specific TRVs or benchmarks are used. Uncertainty surrounding toxicity criteria will be evaluated qualitatively.

Risk Characterization

The sum-of-fractions approach, as described in Section 12.1.2, compares two point estimates, one for exposure (i.e., EPC) and one for effect (i.e., EcoRBSL), to determine their magnitude relative to each other. Each of these single point estimates actually represents a data set with a unique set of statistical characteristics that strongly influence the assessment of actual risk and the quantification of uncertainty. Focusing the risk characterization on a quotient of two numbers that have uncertainty associated with each creates additional uncertainty. Uncertainty associated with the risk characterization step will be qualitatively assessed.

12.4 Ecological Risk Decision Criteria

Ecological decisions made with the information provided in an ecological risk assessment will be based on a weight-of-evidence analysis as discussed in Section 12.2 and further described below. Information that will be synthesized and evaluated in the weight-of-evidence analysis includes:

- Identified CPECs and potential exposure pathways
- Uncertainties in modeled tissue concentration
- Uncertainties in available toxicity information
- Persistence and bioaccumulation potential
- Life history, home range and foraging habits of representative species of concern

In addition, the weight-of-evidence analysis will consider the toxicological endpoint of the toxicity value used to calculate the HQ and/or HI, the magnitude of any uncertainty factors used to develop the final toxicity value, the uncertainty contained in exposure models, the quality of the onsite habitat relative to offsite habitat, and the range of representative species evaluated. Risk, relative to selected assessment endpoints (Section 9), will be characterized after this weight-of-evidence analysis is completed.

Based on the weight-of-evidence analysis, one of three following recommendations will be made to risk managers:

1. No further action with respect to ecological risk will be recommended for an RFI sites or site combinations where *de minimus* risk (RME HQ<1 or HI<1, where applicable, calculated using the Low EcoRBSL) to ecological receptors is identified for small home range species (*i.e.*, representative species that spend the majority of their life span within a RFI site) and large home range species (*i.e.*, representative species that spend the majority of their life span outside of RFI sites or forage across multiple RFI sites). Any additional weight-of-evidence analysis for large home range receptors will be discussed further in the *Large Home Range Receptor Ecological Risk Assessment Methodology Technical Memorandum, Santa Susana Field Laboratory, Ventura County, California* (Appendix G of the SRAM Rev.2 Addendum).

2. Further evaluation by risk managers will be recommended for RFI sites or site combinations where the RME HQ and/or HI (where applicable) calculated based on Low EcoRBSLs exceeds 1. This evaluation may include consideration of the weight-of-evidence analysis described above, further ecological assessment such as a Phase II validation study or a refined USEPA Step 3A evaluation, or an evaluation of remedial alternatives (including no action). As appropriate, natural resource trustees, including the California Department of Fish and Game and the United States Fish and Wildlife Service, must be consulted in the selection of a remedial alternative.

3. A Phase III Impact Assessment may be recommended for RFI sites or RFI site combinations where potential risk to ecological receptors is identified, and where it is determined that remediation may cause adverse effects to ecological receptors or their habitats.

ATTACHMENT 2

Lists of Updated References, Tables, and Figures

UPDATED REFERENCES

This list of sources is supplemental to the References section of SRAM Rev. 2 (MWH, 2005) and only includes references that have been updated or added.

CH2M Hill, 2013. *Large Home Range Receptor Ecological Risk Assessment Methodology, Santa Susana Field Laboratory, Ventura County, California – Technical Memorandum*. Draft. October 14.

DTSC. 2010. Email communication from Donald Greenlee, Staff Toxicologist, Office of Human and Ecological Risk (OHER), Department of Toxic Substances Control, to Dixie Hambrick, MWH Americas, Inc., dated March 4.

MWH. 2009. *Draft Proposed Approaches for Streamlining Future Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura County, California – Technical Memorandum.*

Van den Berg, M., L. Birnbaum, A.T.C. Bosveld, M. Denison, M. De Vito, W. Farland, M. Feeley, H. Fiedler, H. Hakansson, A. Hanberg, L. Haws, M. Rose, R.E. Peterson, S. Safe, D. Schrenk, C. Tohyama, A. Tritscher, J. Tuomisto, M. Tysklind, and N. Walker. 2006. *The World Health Organization Re-evaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds.* Toxicological Sciences. July 7. Http://www.who.int/ipcsassessment/tef_update/en/index.html.

UPDATED LIST OF TABLES

This list of tables is supplemental to the tables contained in SRAM Rev. 2 (MWH, 2005) and only includes tables that have been updated or added.

Table 12-1 Summary of the Lowest Ecological Risk-based Screening Levels by Media

Table 12-2 Summary of the Ecological Risk-Based Screening Levels for Chemicals Detected in Ephemeral/Permanent Surface Water, Seeps/Springs, and/or Near-surface Groundwater

Table 12-3 Summary of the Ecological Risk-Based Screening Levels for Chemicals Detected Ephemeral and/or Permanent Sediment

Table 12-4 Summary of the Ecological Risk-Based Screening Levels for Chemicals Detected in Soil

Table 12-5 Summary of the Ecological Risk-Based Screening Levels for Chemicals Detected in Soil Vapor

UPDATED LIST OF FIGURES

This figure is supplemental to the figures contained in SRAM Rev. 2 (MWH, 2005) and only includes one figure from Section 12 that has been updated.

Figure 12-1 Ecological Risk Characterization Flowchart

ATTACHMENT 3

Responses to DTSC Comments on the Ecological Risk-Based Screening Level Technical Memorandum

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DATE: 1/26/2012

SUBJECT: REVIEW OF DRAFT ECOLOGICAL RISK BASED SCREENING LEVELS FOR USE IN ECOLOGICAL RISK ASSESSMENTS AT THE SANTA SUSANA FIELD LABORATORY, VENTURA COUNTY, CA.

PCA: 22120 Site Code: 300032 MPC: 38

These responses were prepared by MWH on behalf of The Boeing Company (Boeing).

Background

The Santa Susana Field Laboratory (SSFL) occupies approximately 2850 acres and is located 29 miles northwest of downtown Los Angeles, in the Simi Hills of Ventura County. SSFL is jointly owned by The Boeing Company and National Aeronautics and Space Foundation (NASA), and 90 acres of the Boeing-owned property is leased by the Department of Energy (DOE). Primary site activities at SSFL have included research and development of liquid and solid fueled rocket engines and associated components, which began in 1948, and nuclear energy research, which was also conducted on site

within areas leased to DOE. On-site activities peaked in the 1950's through 1970's, and mostly ended by 2005. The site is divided into four administrative areas (Areas I, II, III, and IV) and within each administrative area there are multiple RFI areas.

Previously, Ecological Screening Levels (ESLs) were developed to be used in the characterization of contaminated sites at the SSFL (MWH, 2005). In the more recent technical memorandum "Proposed Approaches for Streamlining Future Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura County, California (MWH, 2009), the respondents proposed using a "sum of fractions approach" for assessing risk. This method will employ chemical-, medium- and receptor-specific ecological risk-based screening leve!s (EcoRBSLs). The EcoRBSLs can be either medium-specific benchmarks for lower trophic level receptors (e.g., for soil invertebrates, terrestrial plants, the water column community, and the sediment benthic community), or they can be calculated dose-equivalent medium concentrations for mammals and birds. The EcoRBSLs will be compared to site exposure point concentrations to calculate ecological HQs/HIs for both chemicals and radionuclides for each of the selected receptors, rather than forward calculations of dose that were used in risk assessments for the site previously.

Unlike the ESLs, the EcoRBSLs have been calculated for both no-effect levels (low EcoRBSLs) and effect-based levels (high EcoRBSLs) for upper level trophic receptors (birds and mammals) in order to provide more information for risk management decision-making. High EcoRBSL values were also developed, in order to evaluate soil vapor exposures for the deer mouse in a previously submitted technical memorandum (MWH, 2011a). The toxicity reference values (TRVs) for plants, invertebrates, and soil vapor exposures in the deer mouse were previously developed as media concentrations based (rather than dose-based), and are equivalents of the EcoRBSLs; therefore, the values presented in the report were already presented in previous technical memoranda (MWH, 2011a, and MWH, 2011b) that have been reviewed and accepted by ERAS. The TRVs that are dose-based (birds and mammals) were used to back-calculate concentration-based EcoRBSLs for media (soil/sediment/surface water), using site-specific or literature-derived exposure factors. These include some factors that were approved previously in SRAM rev 2 (MWH, 2005), as well as some that have been proposed for revision in the current report.

One of the consequences of this current revision will be that Appendix C in the SRAM rev 2(MWH, 2005) will be deleted because the ESLs will not be used in future activities conducted at the SSFL. The EcoRBSLs, presented in Tables 12-1 through 12-5 of this report, will replace the ESLs for future ecological risk assessments.

Document Reviewed

ERAS reviewed the technical memorandum “Ecological Risk Based Screening Levels for Ecological Risk Assessments at the Susana Field Laboratory, Venture County, CA", hereafter referred to as the "the report". The report was prepared by MWH and was received as an e-mail attachment from Bruce Narloch (MWH) to Brian Faulkner dated 11/24/2011. An excel spreadsheet with the RBSL calculations, named "Draft EcoRBSL Workbook (11-23-2011).xls" was provided in a separate email on the same date. The ecological risk characterization methods that are the primary subject of the report are contained within Section 12 of the SRAM rev 2 (MWH, 2005). In order to eliminate potential redundancies or inconsistencies between the revised risk characterization methods presented in this technical memorandum with those described in the SRAM (MWH, 2005), Section 12 of the SRAM (MWH, 2005) has been updated in its entirety and the revised text is contained as the Attachment 1 portion of the report in redline/strikeout. ERAS also reviewed the previously updated sections of SRAM Rev 2, which include revised sections 3.2, 9, 10 (MWH, 2010) and 11 (MWH, 2011) for context and information connected to the revisions of SRAM rev 2 section 12, and several guidance documents and references that have been utilized in the revised SRAM sections or spreadsheets (including Bechtel Jacobs Company LLC, 1998, USEPA 2005, USEPA 2007a, b, c and d, and Sample *et al* 2008).

Scope of the Review

The report was reviewed for scientific content related to ecological risk assessment. ERAS assumes that the sampling procedures, analytical methods, and Quality Assurance/Quality Control (QA/QC) procedures were reviewed previously in the assessment process by regional personnel. Grammatical or typographical errors that do not affect the interpretation of the text may or may not have been noted. Related discussions within other portions of the report, not specifically referenced, should be appropriately revised to reflect these comments as well. Content in this memo that is reproduced from the report in the specific comments is presented in bold italic.

General Comments

1. Given that both low and high TRV-based EcoRBSLs have now been developed and proposed for avian and mammalian receptors at SSFL, as presented in the report, ERAS questions the need to continue using both the Central Tendency Estimate (CTE) and Reasonable Maximum Exposure (RME) to estimate ranges of hazard. The use of both the CTE and RME, along with the high and low EcoRBSLs, will generate four HQs/HIs per constituent. ERAS notes that the CTE HQ/HI estimates have been removed from the HHRA methodology (Donald Greenlee, Pers Com) and suggests that, given that high and low TRV-based EcoRBSLs are to be used in future risk assessments for describing risk ranges from a range of no effect to potential effect level, perhaps the CTE calculations for ecological receptors should be eliminated for future ecological

risk assessments as well. This would help to streamline the ecological risk assessment process. If the respondents disagree, it would be useful to have a more detailed description in the text as to how the CTE HQs for high and low EcoRBSLs will add value to the weight of evidence evaluation and risk management decision-making. Also, ERAS will defer to risk managers if they are of the opinion that having both CTE and RME HQs/HIs, for both the no-effect and effect-based Eco-RBSLs would be useful management decision-making.

Agreed. References to Central Tendency Estimate (CTE) were removed from all applicable text, tables and figures, thereby streamlining the ecological risk assessment process.

Specific Comments

1. Section 12.1.1 (Hazard Quotients), page 4 "As presented in Section 10.6.1, EPCs will be derived for dioxins/furans as the 2,3,7,8-TCDD TEQ and for coplanar PCBs as the coplanar PCB TEQ, as described in Section 10.6.1." Correct for redundancy.

   Agreed. The sentence, which now appears in Section 12.1.1.1, was revised as follows: "As presented in Section 10.6.1, EPCs will be derived for dioxins/furans and coplanar PCBs as the 2,3,7,8-TCDD TEQ and coplanar PCB TEQ, respectively."

2. Section 12.1.2 (Hazard Index), Pages 5-6. This revised section does not exclusively discuss the Hazard Index (HI), the last newly added paragraph describes risk characterization using both HQs and HIs. There is nothing incorrect about the text, it just seems like it would be more appropriate in another section, or the section name should be revised to better reflect the newly added text.

   Agreed. The last paragraph in the previous version of Section 12.1.2 (Hazard Index) was included in a new section (Section 12.1.1.2) titled "Hazard Indices". Please note that, for additional clarification regarding how HQs and HIs will be derived and used in making risk management decisions, Section 12.1 was reorganized into subsections 12.1.1 titled "Sum-of-Fractions Approach", 12.1.1.1 titled "Hazard Quotients", 12.1.1.2 titled "Hazard Indices", and 12.1.1.3 titled "Range of Risk Estimates".

3. Section 12.1.2 (Hazard Index), Page 6. **"An HQ or HI based on Low EcoRBSLs with a value greater than or equal to 1 suggests that additional evaluation is required"**. ERAS agrees with this approach, as it is consistent with DTSC guidance (1997). It would be useful if the potential components of such an evaluation could be described in more detail in the report so that concurrence on

the approach could be reached. As stated in previous reviews (DTSC 2007, 2008a, 2008b, 2010), ERAS would not support use of a separate set of non-DTSC approved BERA TRVS, or the use of BERA TRV based EcoRBSLs, to be used in additional evaluation to eliminate CPECs without risk management input; however, a side by side comparison as part of a weight of evidence evaluation would be acceptable. Also, this statement is not consistent with the last section of the text (section 12-4), which only discusses the need for additional evaluation if the HQ/HI> 1 based on the high EcoRBSL(see specific comment 6), and does not clearly state what, if any, actions should be undertaken if the Low EcoRBSL HQ is > 1 but the high EcoRBSL HQ < 1. Please revise section 12.4 of the report to be consistent with this statement.

Agreed. Text in Section 12.4 was revised to clarify how HQs and HIs calculated based on Low RBSLs and High RBSLs will be used to make risk management decisions, and the nature of any further evaluations.

4. Section 12.1.3 (Ecological RBSLs), page 6. **"HERD Ecological Risk Assessment Notes: Numbers 1-5. (DTSC, 1998 - 2003)."** ERAS recommends updating this to include Econote 6 (DTSC, 2009). This document represents a revision to the cadmium toxicity reference value (TRV) for birds used by regulatory agencies and resource trustees in California for predictive ecological risk assessments. The revised cadmium TRV (0.7 mg/kg-day) is listed in the calculations in the spreadsheet, so perhaps updating the text was just an oversight.

Agreed. Econote 6 (DTSC, 2009) was added to Section 12.1.2 (Ecological RBSLs), formerly known as Section 12.1.3, and to the updated References list (Attachment 3).

5. Section 12.1.1.2 (EcoRBSLs for Representative Species in Terrestrial Habitats/ Terrestrial Plants), page 11. **"These lists of effect concentrations are compilations of published benchmark values that represent effect levels, values adjusted to a "no effect" level, as well as true "no effect"' levels."** Most plant TRVs are not adjusted to a "no effect" level; this is also true for the soil invertebrate TRVs used to calculate the EcoRBSLs. Most of these are acutely lethal doses, concentrations such as LC_{50}s, divided by an uncertainty factor of as little as 5, to estimate a LOAEL. As such, if these EcoRBSLs are exceeded, it is generally more likely that impacts will occur to these communities than if the low EcoRBSLs are exceeded for mammals and birds, although there is also a large degree of uncertainty regarding these TRVs, as they are often based on acute studies which may not be accurate predictors of chronic effects. This comment is primarily informational and meant for the DTSC project managers; no response from the respondent is required.

Comment noted.

6. Section 12.4 (Ecological Risk Decision Criteria), page 28. ERAS agrees with many of the described criteria, namely that *de minimus* risk likely exists for samples in which the HQ/HI < 1 for low EcoRBSL, and that evaluation by risk managers is recommended if HQ/HI > 1 for samples compared the high EcoRBSL, as above these levels indicates that adverse effects are expected (see SRAM rev 2, 2005) However, DTSC ecological risk assessment guidance (DTSC, for HQs/HIs > 1 for low TRV doses is that such circumstances also merit risk management input regarding the need for additional evaluation or action (see DTSC Ecological Risk Assessment Guidance, DTSC 1996 and HERD Econote 4, DTSC 2000), and as such ERAS recommends that the risk decision criteria be revised to reflect this. Perhaps adding text to last section, regarding the potential for recommending a Phase III impact Assessment, that explicitly discusses the range in with the HQ/HI > 1 for the low EcoRBSL but is <1 for the high EcoRBSL, would help to clarify this.

Please refer to response to Specific Comment #3.

7. Table 12-5 (Summary of the Ecological Risk-Based Screening Levels for Chemicals Detected in Soil Vapor). Please add a note referencing the soil inhalation Technical Memorandum (MWH, 2011) to the notes for this table.

Agreed. A footnote was added to reference the Inhalation Toxicity Reference Value Updates for Use in Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura County, California Technical Memorandum (MWH and CH2M Hill, 2011).

8. Figure 12-1 (Ecological Risk Characterization Flowchart). ERAS has identified several issues with this flowchart that should be considered for revision. One, the use of the CTE HQ for low TRV seems unnecessary, as if the CTE HQ/HI > 1, then the HQ/HI will also be > 1 for the RME-based EcoRBSL. Also, no role is provided for using the CTE for TRV High (what will it be used for? See also general comment. Finally, there are two “yes" answers for RME question box, which seems to demonstrate the need for an additional yes/no question to separate these arrows. See attachment 1 to this memorandum. The figure does provide direction as to how to proceed through the risk characterization that ERAS suggested should be presented in more detail in section 12.4, so need to tie that section and the flowchart together better (see also specific comment 6).

Comment noted. As noted in General Comment #1, CTE HQs and HIs was removed from the Technical Memorandum. Section 12.4 and Figure 12-1 were revised as

appropriate.

General Comments, "Draft EcoRBSL Workbook (11-23-2011)"

1. ERAS reproduced the calculations of several EcoRBSLs for each media and found no errors in the spreadsheet calculations of the EcoRBSLs. Review of the TRVs, exposure parameters, and other spreadsheets provided also did not result in finding any errors.

   Comment noted.

Specific Comments; "Draft EcoRBSL Workbook {11-23-2011)"

1. Table 10-6 (Summary of Terrestrial Bioaccumulation Factors for Chemicals Detected in Soil). In the column named "Soil Invertebrate BAF (dry weight/dry weight)", the BAF for many chemicals is listed as "Log Kow model". If single BAFs were calculated using the log kow model from EPA the actual BAFs should be listed in the table to facilitate review.

   Comment noted. Please note that the soil to invertebrate log Kow model equation [Cworm=10^((0.87*logKow)-2)*Csoil/(foc*10^((0.679*logKow)+0.663)] includes the soil concentration variable in this Log equation. As a result, the BAF value is dependent on the soil EcoRBSL, and listing an actual BAF value in the table could be misleading for readers.

2. Table 10-6 (Summary of Terrestrial Bioaccumulation Factors for Chemicals Detected in Soil). PAHs for which sites specific data are lacking for small mammals are set to BAF = 0, with citation from EPA guidance (Guidance for Developing Ecological Soil Screening Levels, USEPA, 2007). In this guidance it is assumed that all PAHs do not bioaccumulate or biomagnify in terrestrial mammals, based on rapid metabolism and excretion of PAHs. However, this assumption that the BAFs for all PAHs=0 is contradicted by actual data collected at SSFL, where no soil to mammal BAF for detected PAHs was found to = 0; in fact. BAFs ranged up to 16 (MWH, 2005). ERAS recommends that PAHs for which data were not available (Acenaphthene, Acenaphthylene, Anthracene, Benzo(e)pyrene, Fluorene, and Naphthalene) be assigned default BAFs of 1, rather than 0, so potential food web exposures will be considered as a complete pathway for these chemicals. Using a default BAF of 1 for organic compounds is consistent with USEPA guidance (USEPA, 2005) and with the SRAM rev 2 (2005). This concern regarding the assumption that bioaccumulation of PAHs in small mammal tissues is zero (diet for carnivores) was also commented on by a reviewer of the EcoSSL document for PAHs (USEPA, 2007).

Setting the soil to mammal BAFs = 1 essentially assumes that the concentration present in the biota is equal to the soil concentration. ERAS agrees that is an arbitrary assumption but no more so than setting the BAF = 0 without data to support the development of a representative value. Setting the BAF to 1 at least allows the pathway to be considered in the ecological risk assessment. It can also be seen from the other PAH BAFs from SSFL that this may still underestimate concentrations in tissue for many PAHs, while it may be an overestimate for others. In the EPA bioaccumulation guidance (2000), there is a list of three possible approaches for determining bioaccumulation factors (BAFs), given in order of the Agency's preference:

"1. A field-measured BAF, using animals living at or near the top of the food chain.

2. A laboratory-measured BCF, multiplied by an appropriate factor (food chain multiplier, or FCM), reflecting the difference between the laboratory organisms and the field organisms.

3. A BCF modeled from a chemical's octanol-water partitioning coefficient, multiplied by an appropriate FCM."

If a default BAF = 1 of is not acceptable, ERAS recommends that the most preferred EPA options; either field measured BAFs or a laboratory measured BAF should be developed through validation studies. This would either substantiate the claim that soil to mammal BAFs are zero for these chemicals, or result in data that could be used to calculate site specific BAFs. ERAS notes that setting an unknown BAF = 0 essentially eliminates potentially complete exposure pathways from consideration.

Given that the site-specific soil-to-mammal BAFs for PAHs are based on a single soil sample and collocated small mammal tissue sample, use of the site-specific soil-to-small mammal BAFs for BAFs will be discontinued. Instead, due to the unacceptable uncertainty in using BAFs calculated with only a single collocated soil and mammal tissue sample pair, a default soil-to-small mammal BAF of "1" for *all* PAHs will be used in the calculation of EcoRBSLs for the SSFL and in future risk assessments performed at the SSFL. This practice should have very little impact on future ecological risk assessment conclusions or risk management decisions because the lowest, most conservative Eco RBSLs for two PAHs are almost always associated with the deer mouse or hermit thrush (which do not utilize soil-to-small mammal BAFs). On September 6, 2013, Brian Faulkner of DTSC/ERAS approved of the use of a soil-to-mammal BAF of "1" used in the development of EcoRBSLs for PAHs for the SSFL.

3. Table 10-6 (Summary of Terrestrial Bioaccumulation Factors for Chemicals Detected in Soil). A footnote in the table indicates that values were revised based

on an error regarding wet weight/dry weight of a sample. This should be discussed in the text, for information purposes. Was this discovered as part of a full data review and if so, was anything else found or changed? ERAS suggests that this review be described in the technical memorandum.

Agreed. Additional detail was added Section 10.4 of the Ecological Exposure Assessment Updates for Use in Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura County, California Technical Memorandum (Appendix D of the SRAM Rev. 2 Addendum).

4. (Ecological Exposure Parameters worksheet). Dietary parameters have been changed from the values in SRAM rev 2 (2005) and lack explanation or reference. For example, the deer mouse diet is 50% plants/ 50% invertebrates in the table, with no reference given, while previously the deer mouse diet was 70% plants/30% invertebrates (see SRAM rev 2, 2005, Table 10-4). Please identify and provide a rationale and references (if available) for any changes made to dietary parameters, for example, if new data has become available regarding the diets, or if they were modified to simplify food web calculations, which appears to be the case for some of the receptors.

Please note that dietary parameters that have changed from SRAM Rev. 2 (MWH, 2005), and the rationale and references for any updated dietary parameters, are presented in Section 10.7 and in Table 10-8 'Life History Parameters Used in Quantifying Ecological Exposures' of the Ecological Exposure Assessment Updates for Use in Ecological Risk Assessments at the Santa Susan Field Laboratory, Ventura County, California Technical Memorandum (MWH, 2010) (Appendix D of the SRAM Rev. 2 Addendum).

Conclusions

ERAS supports/accepts most of the revisions made to the SRAM rev 2, section 12, but has some issues that need to be addressed or clarified. If there are any questions regarding these comments contact Brian Faulkner by phone at (916) 255-6625 or e-mail at bfaulkne@dtsc.ca.gov.

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TABLES

Table 12-1

Summary of the Lowest Ecological Risk-based Screening Levels by Media

Chemical	CAS#	Chemical Synonym	Water				Sediment		Soil				Soil Vapor	
					Lowest		Lowest				Lowest			
			Terrestrial Plant RBSL [g] (mg/L)	Water Column Community RBSL [g] (mg/L)	Low TRV-Based RBSL [g, h] (mg/L)	High TRV-Based RBSL [g, h] (mg/L)	Low TRV-Based RBSL [g, h] (mg/kg)	High TRV-Based RBSL [g, h] (mg/kg)	Terrestrial Plants RBSL [g] (mg/kg)	Soil Invertebrates RBSL [g] (mg/kg)	Low TRV-Based RBSL [g, h] (mg/kg)	High TRV-Based RBSL [g, h] (mg/kg)	Low TRV-Based RBSL [g] (mg/m^3)	High TRV-Based RBSL [g] (mg/m^3)
Inorganic Compounds														
Aluminum	7429905	Aluminum, Total	0.3	0.087	13	130	25,500	NTV	50	NTV	16	160	NA	NA
Aluminum, dissolved	7429905-D	-	0.3	0.087	13	130	NC	NC	NC	NC	NC	NC	NA	NA
Antimony	7440360	Antimony, Total	NTV	0.03	0.40	19	2	3	5	78	0.042	2.0	NA	NA
Antimony, dissolved	7440360-D	-	NTV	0.03	0.40	19	NC	NC	NC	NC	NC	NC	NA	NA
Arsenic	7440382	Arsenic, Total	0.001	0.15	2.2	32	9.79	33	18	60	2.1	31	NA	NA
Arsenic, dissolved	7440382-D	-	0.001	0.15	2.2	32	NC	NC	NC	NC	NC	NC	NA	NA
Barium	7440393	Barium, Total	NTV	0.004	110	220	48	1,490	500	330	44	89	NA	NA
Barium, dissolved	7440393-D	-	NTV	0.004	110	220	NC	NC	NC	NC	NC	NC	NA	NA
Beryllium	7440417	Beryllium, Total	0.5	0.00066	3.6	9.5	NTV	NTV	10	40	4.8	13	NA	NA
Beryllium, dissolved	7440417-D	-	0.5	0.00066	3.6	9.5	NC	NC	NC	NC	NC	NC	NA	NA
Boron	7440428	Boron, Total	1	0.0016	150	530	520	1,800	0.5	NTV	22	73	NA	NA
Boron, dissolved	7440428-D	-	1	0.0016	150	530	NC	NC	NC	NC	NC	NC	NA	NA
Cadmium	7440439	Cadmium, Total	0.1	0.00028	0.41	18	0.99	4.98	32	140	0.019	0.81	NA	NA
Cadmium, dissolved	7440439-D	-	0.1	0.00025	0.41	18	NC	NC	NC	NC	NC	NC	NA	NA
Chromium	7440473	Chromium, Total	0.05	0.086	14	84	43.4	111	1	64	1.9	14	NA	NA
Chromium, dissolved	7440473-D	-	0.05	0.074	14	84	NC	NC	NC	NC	NC	NC	NA	NA
Cobalt	7440484	Cobalt, Total	0.06	0.023	8.1	95	10	4,380	13.0	300	12	190	NA	NA
Cobalt, dissolved	7440484-D	-	0.06	0.023	8.1	95	NC	NC	NC	NC	NC	NC	NA	NA
Copper	7440508	Copper, Total	0.06	0.0094	12	280	31.6	149	70	80	1.1	24	NA	NA
Copper, dissolved	7440508-D	-	0.06	0.0090	12	280	NC	NC	NC	NC	NC	NC	NA	NA
Cyanides	57125	Cyanide, Total	NC	0.0052	0.21	2.1	NC	NC	0.9	0.9	0.18	1.8	NA	NA
Fluoride	7782414	-	5	NTV	41	170	120	490	200	NTV	35	140	NA	NA
Hexavalent Chromium	18540299	Hexavalent	NC	0.0114	62	260	NC	NC	30	0.4	7.3	30	NA	NA
Lead	7439921	Lead, Total	0.02	0.0032	0.074	46	1.1	128	115	1,700	0.062	39	NA	NA
Lead, dissolved	7439921-D	-	0.02	0.0025	0.074	46	NC	NC	NC	NC	NC	NC	NA	NA
Lithium	7439932	Lithium, Total	NC	NC	NC	NC	NC	NC	2	NTV	43	87	NA	NA
Manganese	7439965	Manganese, Total	4	0.12	93	1,070	630	1,100	220	450	79	920	NA	NA
Manganese, dissolved	7439965-D	-	4	0.12	93	1,070	NC	NC	NC	NC	NC	NC	NA	NA
Mercury	7439976	Mercury, Total	NC	0.00091	2.4	4.7	0.18	1.06	0.3	0.1	0.87	1.7	NA	NA
Mercury, dissolved	7439976-D	-	NC	0.00077	2.4	4.7	NC	NC	NC	NC	NC	NC	NA	NA
Methyl Mercury	22967926	-	NC	NC	NC	NC	NC	NC	NTV	2.5	0.18	0.82	NA	NA
Molybdenum	7439987	Molybdenum, Total	0.5	0.37	1.8	18	66	660	2	NTV	0.13	1.3	NA	NA
Molybdenum, dissolved	7439987-D	-	0.5	0.37	1.8	18	NC	NC	NC	NC	NC	NC	NA	NA
Nickel	7440020	Nickel, Total	0.5	0.052	0.90	210	22.7	48.6	38	280	0.13	30	NA	NA
Nickel, dissolved	7440020-D	-	0.5	0.052	0.90	210	NC	NC	NC	NC	NC	NC	NA	NA
Selenium	7782492	Selenium, Total	0.7	0.0050	0.34	4.9	0.84	3.4	0.52	4.1	0.10	1.5	NA	NA
Selenium, dissolved	7782492-D	-	0.7	0.0046	0.34	4.9	NC	NC	NC	NC	NC	NC	NA	NA
Silica, dissolved	7631869-D	-	NTV	NTV	NC	NC	NC	NC	NC	NC	NC	NC	NA	NA
Silver	7440224	Silver, Total	0.1	0.00038	11	320	1	4.5	560	NTV	0.99	29	NA	NA
Silver, dissolved	7440224-D	-	NC	0.00032	11	320	NC	NC	NC	NC	NC	NC	NA	NA
Strontium	7440246	Strontium, Total	NTV	1.5	1,780	2,570	NTV	NTV	NTV	NTV	1,210	1,750	NA	NA
Strontium, dissolved	7440246-D	-	NTV	1.5	1,780	2,570	NC	NC	NC	NC	NC	NC	NA	NA
Thallium	7440280	Thallium, Total	0.02	0.012	1.8	9.7	6.5	65	1	1.4	1.8	8.2	NA	NA

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Chemical	CAS#	Chemical Synonym	Water				Sediment		Soil				Soil Vapor	
					Lowest		Lowest				Lowest			
			Terrestrial Plant RBSL [g] (mg/L)	Water Column Community RBSL [g] (mg/L)	Low TRV-Based RBSL [g, h] (mg/L)	High TRV-Based RBSL [g, h] (mg/L)	Low TRV-Based RBSL [g, h] (mg/kg)	High TRV-Based RBSL [g, h] (mg/kg)	Terrestrial Plants RBSL [g] (mg/kg)	Soil Invertebrates RBSL [g] (mg/kg)	Low TRV-Based RBSL [g, h] (mg/kg)	High TRV-Based RBSL [g, h] (mg/kg)	Low TRV-Based RBSL [g] (mg/m^3)	High TRV-Based RBSL [g] (mg/m^3)
Thallium, dissolved	7440280-D	-	0.02	0.012	1.8	9.7	NC	NC	NC	NC	NC	NC	NA	NA
Tin	7440315	Tin, Total	NC	NC	NC	NC	0.048	260	50	NTV	31	77	NA	NA
Titanium	7440326	Titanium, Total	NC	2	5.3	53	15	150	NTV	NTV	4.5	45	NA	NA
Titanium, dissolved	7440326-D	-	NC	2	5.3	53	NC	NC	NC	NC	NC	NC	NA	NA
Vanadium	7440622	Vanadium, Total	0.2	0.02	1.8	9.0	NC	NC	50	130	3.3	16	NA	NA
Vanadium, dissolved	7440622-D	-	0.2	0.02	1.8	9.0	NC	NC	NC	NC	NC	NC	NA	NA
Zinc	7440666	Zinc, Total	0.4	0.12	65	910	121	459	160	120	19	320	NA	NA
Zinc, dissolved	7440666-D	-	0.4	0.12	65	910	NC	NC	NC	NC	NC	NC	NA	NA
Zirconium	7440677	Zirconium, Total	NC	NC	NC	NC	NC	NC	NTV	NTV	8.0	NTV	NA	NA
Energetic Constituents														
1,2-Dinitrobenzene	528290	o-Dinitrobenzene	NC	NC	NC	NC	6.5	65	NTV	NTV	0.92	2.5	NA	NA
1,2-Diphenylhydrazine	122667	-	NC	0.27	NTV	NTV	NC	NC	NC	NC	NC	NC	NA	NA
1,3-Dinitrobenzene	99650	m-Dinitrobenzene	NC	NC	NC	NC	2.6	26	NTV	40	0.92	2.5	NA	NA
2,4,6-Trinitrotoluene	118967	-	NC	NC	NC	NC	0.092	28	NTV	55	0.13	0.65	NA	NA
2,4-diamino-6-nitrotoluene	6629294	-	NC	NC	NC	NC	NTV	NTV	NC	NC	NC	NC	NA	NA
2,4-Dinitrotoluene	121142	-	NC	0.23	0.053	5.1	0.0018	0.23	NC	NC	NC	NC	NA	NA
2-Amino-4,6-dinitrotoluene	35572782	-	NC	NC	NC	NC	0.0416	20	NTV	20.3	0.0060	0.46	NA	NA
2-Nitrotoluene	88722	-	NC	NC	NC	NC	4.06	NTV	NC	NC	NC	NC	NA	NA
3-Nitrotoluene	99081	-	NC	NC	NC	NC	4.06	NTV	NC	NC	NC	NC	NA	NA
4-Amino-2,6-dinitrotoluene	19406510	4-Am-2,6-DNT	NC	NC	NC	NC	0.0416	NTV	NC	NC	NC	NC	NA	NA
4-Nitrotoluene	99990	-	NC	NC	NC	NC	4.06	NTV	NC	NC	NC	NC	NA	NA
HMX	2691410	-	NC	NC	NC	NC	NTV	NTV	NTV	6.5	110	630	NA	NA
Hydrazine	302012	-	NC	NC	NC	NC	NC	NC	NTV	NTV	NTV	NTV	NA	NA
Monomethylhydrazine	60344	-	NC	NC	NC	NC	NC	NC	NTV	NTV	0.35	1.7	NA	NA
Nitroglycerin	55630	-	NC	NC	NC	NC	NTV	NTV	NC	NC	NC	NC	NA	NA
Perchlorate	14797730	-	NTV	NTV	43	140	200	400	107	NTV	0.50	7.7	NA	NA
PETN	78115	-	NC	NC	NC	NC	NTV	NTV	NC	NC	NC	NC	NA	NA
RDX	121824	-	NC	NC	NC	NC	0.013	130	NTV	19	0.30	1.5	NA	NA
Tetryl	479458	-	NC	NC	NC	NC	NTV	NTV	NC	NC	NC	NC	NA	NA
Volatile Organic Compounds														
1,1,1,2-Tetrachloroethane	630206	-	NC	NC	NC	NC	NTV	NTV	NTV	NTV	38	190	NA	NA
1,1,1-Trichloroethane	71556	-	100	0.011	6,760	17,100	0.03	NTV	1,000	NTV	2,460	6,240	250	760
1,1,2,2-Tetrachloroethane	79345	-	NC	0.61	140	270	NC	NC	NTV	NTV	51	100	NA	NA
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	Freon 113	NTV	NTV	920	NTV	NTV	NTV	NTV	NTV	220	NTV	1,210	58,900
1,1,2-Trichloroethane	79005	-	100	1.2	13	150	NC	NC	1,000	NTV	9.0	100	1.1	11
1,1-Dichloroethane	75343	-	100	0.047	91	180	0.027	530	NTV	NTV	78	160	240	480
1,1-Dichloroethene	75354	-	100	0.025	17	45	0.031	NTV	NTV	NTV	6.9	18	7.9	40
1,1-Dichloropropene	563586	-	NC	NC	NC	NC	NTV	NTV	NC	NC	NC	NC	NA	NA
1,2,3-Trichlorobenzene	87616	-	NC	NC	NC	NC	NC	NC	48	20	10	37	66	210
1,2,3-Trichloropropane	96184	-	NTV	NC	NC	NC	NC	NC	NC	NC	NC	NC	NA	NA
1,2,4-Trichlorobenzene	120821	-	NC	0.11	50	180	NC	NC	48	20	10	37	66	210
1,2,4-Trimethylbenzene	95636	-	NC	NC	NC	NC	NTV	NTV	1,000	65	3.1	4.0	10	52
1,2-Dibromoethane	106934	-	NC	NC	NC	NC	NTV	NTV	NTV	NTV	12	62	NA	NA
1,2-Dichlorobenzene	95501	o-Dichlorobenzene	NTV	0.014	580	580	0.013	NTV	248	NTV	130	130	66	210

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			Terrestrial Plant RBSL [g] (mg/L)	Water Column Community RBSL [g] (mg/L)	Low TRV-Based RBSL [g, h] (mg/L)	High TRV-Based RBSL [g, h] (mg/L)	Low TRV-Based RBSL [g, h] (mg/kg)	High TRV-Based RBSL [g, h] (mg/kg)	Terrestrial Plants RBSL [g] (mg/kg)	Soil Invertebrates RBSL [g] (mg/kg)	Low TRV-Based RBSL [g, h] (mg/kg)	High TRV-Based RBSL [g, h] (mg/kg)	Low TRV-Based RBSL [g] (mg/m^3)	High TRV-Based RBSL [g] (mg/m^3)
1,2-Dichloroethane	107062	-	100	0.91	91	180	0.25	530	NTV	NTV	78	160	56	NTV
1,2-Dichloroethene	540590	1,2-Dichloroethenes	100	NC	NC	NC	NC	NC	NTV	NTV	130	250	25	130
1,2-Dichloropropane	78875	-	NC	5.7	48	240	NTV	NTV	NTV	700	33	160	1.7	8.3
1,3,5-Trimethylbenzene	108678	-	NC	NC	NC	NC	NTV	NTV	1,000	65	3.2	4.1	10	52
1,3-Dichlorobenzene	541731	m-Dichlorobenzene	NC	0.071	99	500	0.013	NTV	248	20	23	110	66	210
1,3-Dichloropropane	142289	-	NC	NC	NC	NC	NTV	NTV	NC	NC	NC	NC	NA	NA
1,3-Dichloropropene	542756	-	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	5.4	22
1,4-Dichlorobenzene	106467	p-Dichlorobenzene	NTV	0.015	24	120	0.11	NTV	248	20	5.6	28	NA	NA
2,2-Dichloro-1,1,1-trifluoroethane	306832	Freon 123	NTV	NC	NC	NC	NC	NC	NC	NC	NC	NC	NA	NA
2-Chloroethylvinyl ether	110758	2-Chloroethyl vinyl ether	NC	0.122	240	1,340	NTV	NTV	NTV	7.4	160	910	NA	NA
2-Chloronaphthalene	91587	-	NC	1.6	840	2,030	NC	NC	NC	NC	NC	NC	NA	NA
2-Chlorophenol	95578	-	NC	4	34	340	NC	NC	NC	NC	NC	NC	NA	NA
2-Hexanone	591786	Methyl butyl ketone	NC	NC	NC	NC	0.022	NTV	NTV	NTV	23	170	6.5	33
2-Nitrophenol	88755	o-Nitrophenol	10	0.23	18	NTV	NC	NC	NC	NC	NC	NC	NA	NA
3-Chloro-2(Chloromethyl)-1-Propene	1871574	-	NTV	NC	NC	NC	NC	NC	NC	NC	NC	NC	NA	NA
Acetone	67641	-	NTV	1.5	68	340	0.0087	NTV	NTV	NTV	46	230	1,740	8,710
Acetic Acid	64197	-	NC	NC	NC	NC	NC	NC	NTV	NTV	410	1,660	NA	NA
Acrolein	107028		NC	0.003	0.34	3.4	NC	NC	NC	NC	NC	NC	NA	NA
Acrylonitrile	107131		NC	8	28	95	NC	NC	NC	NC	NC	NC	NA	NA
Benzene	71432	-	NTV	0.13	180	1,780	0.16	NTV	31	31	73	730	0.76	3.8
Biphenyl	92524	1,1'-Biphenyl	2	NC	NC	NC	NC	NC	NC	NC	NC	NC	NA	NA
bis(2-Chloroethyl) ether	111444	s-Dichloroethylether	NTV	0.122	240	1,340	NC	NC	NC	NC	NC	NC	NA	NA
Bromide	24959679	-	NTV	NTV	NC	NC	NTV	NTV	NTV	NTV	NTV	NTV	NA	NA
Bromobenzene	108861	-	NC	NC	NC	NC	NC	NC	31	31	25	43	NA	NA
Bromochloromethane	74975	-	NC	NC	NC	NC	NTV	NTV	NC	NC	NC	NC	NA	NA
Bromodichloromethane	75274	-	NTV	11	24	120	NTV	NTV	NTV	NTV	10	51	NA	NA
Bromomethane	74839	-	NTV	11	4.7	24	NTV	NTV	NTV	NTV	3.2	16	NA	NA
Carbon Disulfide	75150	-	NTV	0.00092	74	NC	0.00085	NTV	NTV	NTV	51	NTV	1.6	7.9
Carbon Tetrachloride	56235	-	NTV	0.0098	110	NTV	NC	NC	NTV	NTV	35	NTV	8.4	42
Chlorobenzene	108907	Monochlorobenzene	NC	0.064	64	130	NC	NC	1,000	40	21	43	77	230
Chloroethane	75003	Ethyl chloride	NC	NTV	310	590	NTV	NTV	NC	NC	NC	NC	1,320	4,350
Chloroform	67663	Trichloromethane	NTV	0.028	100	280	NTV	NTV	NTV	NTV	69	190	1.6	8.1
Chloromethane	74873	Methyl chloride	NTV	11	4.7	24	NTV	NTV	NTV	NTV	3.2	16	5.0	25
cis-1,2-Dichloroethene	156592	Dichloroethylene	100	0.59	310	330	0.031	NTV	NTV	NTV	210	220	25	130
cis-1,3-Dichloropropene	10061015	-	NC	0.000055	23	34	NTV	NTV	NC	NC	NC	NC	NA	NA
Cumene	98828	Isopropylbenzene	NC	NC	NC	NC	0.086	1.4	NTV	NTV	1.3	13	31	160
Dibenzofuran	132649	-	NC	NC	NC	NC	NC	NC	NTV	29	1.2	12	NA	NA
Dibromofluoromethane	1868537	-	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NTV	NTV
Dibromomethane	74953	-	NC	NC	NC	NC	NTV	NTV	NTV	NTV	27	230	NA	NA
Dichlorodifluoromethane	75718	Freon 12	NTV	NC	NC	NC	NTV	NTV	NTV	NTV	41	410	1,210	58,900
Diphenyl ether	101848	-	NTV	NC	NC	NC	NC	NC	NC	NC	NC	NC	NA	NA
Ethylbenzene	100414	-	NC	0.0073	330	980	0.004	NTV	55	55	79	240	31	160
Methyl ethyl ketone	78933	2-Butanone	NTV	NC	NC	NC	NC	NC	NTV	NTV	8,160	21,100	1,150	3,440

Table 12-1

Summary of the Lowest Ecological Risk-based Screening Levels by Media

Chemical	CAS#	Chemical Synonym	Water				Sediment		Soil				Soil Vapor	
					Lowest		Lowest				Lowest			
			Terrestrial Plant RBSL [g] (mg/L)	Water Column Community RBSL [g] (mg/L)	Low TRV-Based RBSL [g, h] (mg/L)	High TRV-Based RBSL [g, h] (mg/L)	Low TRV-Based RBSL [g, h] (mg/kg)	High TRV-Based RBSL [g, h] (mg/kg)	Terrestrial Plants RBSL [g] (mg/kg)	Soil Invertebrates RBSL [g] (mg/kg)	Low TRV-Based RBSL [g, h] (mg/kg)	High TRV-Based RBSL [g, h] (mg/kg)	Low TRV-Based RBSL [g] (mg/m^3)	High TRV-Based RBSL [g] (mg/m^3)
Methyl isobutyl ketone (MIBK)	108101	pentanone	NC	NC	NC	NC	0.033	150	NTV	NTV	4.5	45	NA	NA
Methyl sulfide	75183	-	NTV	NC	NC	NC	NC	NC	NC	NC	NC	NC	NA	NA
Methyl-tert-butyl- Ether (MTBE)	1634044	-	NC	NC	NC	NC	NTV	NTV	NC	NC	NC	NC	NA	NA
Methylene chloride	75092	Dichloromethane	NTV	2.2	40	340	0.37	NTV	NTV	NTV	27	230	12	58
m-Xylene	108383	meta-Xylene	NC	0.013	14	18	NC	NC	NC	NC	NC	NC	NA	NA
m-Xylene & p-Xylene	136777612	meta- and para-Xylenes	100	0.013	14	18	0.16	NTV	1,000	65	3.3	4.2	10	52
n-Butylbenzene	104518	-	NC	NC	NC	NC	NTV	NTV	NTV	NTV	61	180	31	160
n-Hexane	110543	-	NTV	NC	NC	NC	NC	NC	NC	NC	NC	NC	NA	NA
Nitrobenzene	98953	-	8	27	6.1	10	0.021	NTV	NC	NC	NC	NC	NA	NA
n-Propylbenzene	103651	-	NC	NC	NC	NC	NTV	NTV	NTV	NTV	73	220	31	160
o-Chlorotoluene	95498	2-Chlorotoluene	NC	NC	NC	NC	NC	NC	NTV	20	16	63	NA	NA
o-Xylene	95476	-	NC	NC	NC	NC	0.16	NTV	1,000	65	3.4	4.3	10	52
p-Chlorotoluene	106434	4-Chlorotoluene	NC	NC	NC	NC	NC	NC	NTV	20	16	64	NA	NA
p-Cymene	99876	p-Isopropyltoluene	NC	NC	NC	NC	0.086	2.0	NTV	NTV	3.7	37	10	52
sec-Butylbenzene	135988	-	NC	NC	NC	NC	0.026	0.26	NTV	NTV	0.98	9.8	31	160
Styrene	100425	Vinylbenzene	NC	NC	NC	NC	0.559	NTV	320	NTV	210	420	260	910
tert-Butylbenzene	98066	-	NC	NC	NC	NC	0.062	0.62	NTV	NTV	1.1	11	31	160
Tetralin	119642	-	NC	NC	NC	NC	0.18	0.56	100	29	58	290	NA	NA
Tetrachloroethene	127184	-	10	0.098	9.5	47	0.41	NTV	1,000	NTV	2.2	11	32	160
Toluene	108883	Toluol	10	0.0098	180	1,760	0.05	NTV	200	75	59	590	0.22	0.56
trans-1,2-Dichloroethene	156605	-	100	0.59	310	590	0.40	NTV	NTV	NTV	130	240	25	130
trans-1,3-Dichloropropene	10061026	-	NC	0.244	23	34	NTV	NTV	NC	NC	NC	NC	NA	NA
Trichloroethene	79016	(TCE)	10	0.047	4.7	47	0.0969	NTV	3	3	1.8	18	8.5	43
Trichlorofluoromethane	75694	-	NTV	11	470	2,360	NC	NC	NTV	NTV	170	850	1,210	58,900
Vinyl chloride	75014	-	NTV	0.93	1.1	11	NTV	NTV	NTV	NTV	0.78	7.8	0.73	3.7
Xylenes, Total	1330207	Isomers	100	0.013	14	18	NC	NC	1,000	65	3.4	4.2	10	52
Semi-Volatile Organic Compounds														
1,1-Dimethylhydrazine	57147	-	NC	NC	NC	NC	NC	NC	NTV	NTV	0.35	1.7	NA	NA
1,2-Dibromo-3-chloropropane	96128	1,2-Dibromo-3-CPA	NC	NC	NC	NC	NTV	NTV	NTV	NTV	0.28	1.4	NA	NA
1,4-Dioxane	123911	-	NTV	NC	NC	NC	NC	NC	NTV	NTV	2.3	4.6	NA	NA
2,4,5-Trichlorophenol	95954	-	NC	NC	NC	NC	NC	NC	4	9	75	220	NA	NA
2,4,6-Trichlorophenol	88062	-	10	0.97	340	1,010	NC	NC	4	10	75	230	NA	NA
2,4-Dichlorophenol	120832		NC	0.365	2.0	20	NC	NC	NC	NC	NC	NC	NA	NA
2,4-Dimethylphenol	105679	-	NC	2.12	170	840	NC	NC	NTV	NTV	65	330	NA	NA
2,4-Dinitrophenol	51285		NC	0.23	0.70	7.0	NC	NC	NC	NC	NC	NC	NA	NA
2,6-Dinitrotoluene	606202	-	NC	0.23	2.7	14	0.0416	NTV	NC	NC	NC	NC	NA	NA
2-n-Butoxyethanol	111762	Butoxycellosolve	NTV	NC	NC	NC	NC	NC	NC	NC	NC	NC	NA	NA
3,3'-Dichlorobenzidine	91941	-	NC	NTV	2.0	20	NC	NC	NC	NC	NC	NC	NA	NA
3,5-Dimethylphenol	108689	-	NC	NC	NC	NC	NC	NC	NTV	NTV	2.6	26	NA	NA
4,6-Dinitro-o-cresol	534521	Methylphenol	NC	0.23	18	NTV	NC	NC	NC	NC	NC	NC	NA	NA
4-Bromophenyl phenyl ether	101553		NC	0.0015	NTV	NTV	NC	NC	NC	NC	NC	NC	NA	NA
4-Chlorophenylphenyl ether	7005723		NC	NTV	NTV	NTV	NC	NC	NC	NC	NC	NC	NA	NA
4-Nitrophenol	100027	-	10	0.3	18	NTV	NC	NC	NC	NC	8.0	NC	NA	NA

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Summary of the Lowest Ecological Risk-based Screening Levels by Media

Chemical	CAS#	Chemical Synonym	Water				Sediment		Soil				Soil Vapor	
					Lowest		Lowest				Lowest			
			Terrestrial Plant RBSL [g] (mg/L)	Water Column Community RBSL [g] (mg/L)	Low TRV-Based RBSL [g, h] (mg/L)	High TRV-Based RBSL [g, h] (mg/L)	Low TRV-Based RBSL [g, h] (mg/kg)	High TRV-Based RBSL [g, h] (mg/kg)	Terrestrial Plants RBSL [g] (mg/kg)	Soil Invertebrates RBSL [g] (mg/kg)	Low TRV-Based RBSL [g, h] (mg/kg)	High TRV-Based RBSL [g, h] (mg/kg)	Low TRV-Based RBSL [g] (mg/m^3)	High TRV-Based RBSL [g] (mg/m^3)
Benzidine	92875	-	NC	0.0039	3.6	18	NC	NC	NC	NC	NC	NC	NA	NA
Benzoic acid	65850	-	NC	NC	NC	NC	0.065	150	NTV	NTV	4.5	45	NA	NA
Benzyl alcohol	100516	-	NC	NC	NC	NC	NC	NC	NTV	NTV	4.5	45	NA	NA
bis(2-Chloroethoxy)methane	111911	-	NTV	11	240	1,340	NC	NC	NC	NC	NC	NC	NA	NA
bis(2-Chloroisopropyl)ether	39638329	-	NC	0.122	240	1,340	NC	NC	NC	NC	NC	NC	NA	NA
bis(2-Ethylhexyl) phthalate	117817	bis(2-ethylhexyl)phthalate	20	0.003	5.8	1,240	0.000097	2.6	1,000	NTV	0.32	65	NA	NA
Bromoform	75252	-	NTV	11	60	120	0.654	NTV	NTV	NTV	23	45	NA	NA
Butyl benzyl phthalate	85687	-	NC	0.019	540	1,590	10.9	48	NTV	NTV	90	260	NA	NA
Carbazole	86748	-	NC	NC	NC	NC	NC	NC	2.0	29	1.5	15	NA	NA
Dibenzyl Ether	103504	-	NTV	NC	NC	NC	NC	NC	NC	NC	NC	NC	NA	NA
Dibromochloromethane	124481	-	NTV	11	72	140	NTV	NTV	NTV	NTV	29	59	NA	NA
Diethyl phthalate	84662	-	20	0.21	5.3	53	NC	NC	134	NTV	2.3	23	NA	NA
Dimethyl phthalate	131113	-	NC	0.21	5.3	53	0.006	150	134	200	4.5	45	NA	NA
Di-n-butyl phthalate	84742	Di-n-butylphthalate	20	0.035	0.58	5.8	0.0033	0.033	200	NTV	0.11	1.1	NA	NA
Di-n-octyl phthalate	117840	Di-n-octyl-phthalate	20	0.708	15	150	NC	NC	200	NTV	13	130	NA	NA
Formaldehyde	50000	-	NTV	NTV	64	550	NTV	NTV	NTV	NTV	43	380	NA	NA
Hexachlorobenzene	118741		NC	0.25	0.54	2.0	NC	NC	NC	NC	NC	NC	NA	NA
Hexachlorobutadiene	87683	-	NC	0.0093	0.14	0.68	0.0013	NTV	NTV	NTV	0.022	0.11	NA	NA
Hexachlorocyclopentadiene	77474	-	NC	0.0052	20	37	NC	NC	NC	NC	3.0	5.6	NA	NA
Hexachloroethane	67721		NC	0.012	3.4	51	NC	NC	NC	NC	NC	NC	NA	NA
Isophorone	78591	-	NC	117	510	1,210	NC	NC	NC	NC	NC	NC	NA	NA
Isopropanol	67630	Isopropyl alcohol	NTV	NC	NC	NC	NC	NC	NC	NC	NC	NC	NA	NA
m-Cresol	108394	3-Methylphenol	NC	NC	NC	NC	NC	NC	96	NTV	5.1	51	NA	NA
n-Nitrosodimethylamine	62759	e	NTV	5.85	9.6	120	0.028	NTV	NTV	20	6.5	79	NA	NA
n-Nitrosodi-n-propylamine	621647	Nitrosodipropylamin	NTV	NTV	9.6	120	NC	NC	NC	NC	NC	NC	NA	NA
n-Nitrosodiphenylamine	86306	-	NTV	0.21	9.6	120	NC	NC	NTV	20	2.3	28	NA	NA
o-Cresol	95487	-	NC	NC	NC	NC	NC	NC	100	NTV	4.3	43	NA	NA
p-Chloro-m-cresol	59507	Methylphenol	NC	0.03	6.0	60	NC	NC	100	NTV	1.7	17	NA	NA
p-Cresol	106445	4-Methylphenol	NC	NC	NC	NC	0.10	150	100	NTV	4.3	43	NA	NA
Pentachlorophenol	87865	PCP	0.03	0.015	36	160	NC	NC	5	31	2.8	10	NA	NA
Phenol	108952	Total Phenols	10	0.2	6.0	60	NC	NC	70	30	5.1	51	NA	NA
p-Nitroaniline	100016	4-Nitroaniline	NC	NC	NC	NC	NC	NC	NTV	NTV	3.4	34	NA	NA
Tetramethylurea	632224	-	NTV	NC	NC	NC	NC	NC	NC	NC	NC	NC	NA	NA
Polynuclear Aromatic Hydrocarbons														
1-Methyl naphthalene	90120	1-Methylnaphthalene	NC	NC	NC	NC	NC	NC	100	29	52	260	NA	NA
2-Methylnaphthalene	91576	Naphthalene, 2-methyl-	NC	NC	NC	NC	NC	NC	100	29	53	260	NA	NA
Acenaphthene	83329	-	NC	0.023	5.3	53	0.0067	0.29	20	29	1.1	11	NA	NA
Acenaphthylene	208968	-	NC	4.84	5.3	53	NC	NC	20	29	0.33	3.3	NA	NA
Anthracene	120127	-	NC	0.00073	5.9	59	0.037	0.37	2.0	29	2.2	22	NA	NA
Benzo(a)anthracene	56553	Benz[a]anthracene	NC	0.000027	4.2	260	0.108	1.05	1.5	18	0.81	50	NA	NA
Benzo(a)pyrene	50328	Benzo (a) pyrene	NC	0.000014	4.2	260	0.15	1.45	1.2	18	5.1	310	NA	NA
Benzo(b)fluoranthene	205992	Benz[e]acephenanthrylene 1	NC	0.00907	4.2	260	1.8	NTV	1.2	18	2.4	150	NA	NA

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Chemical	CAS#	Chemical Synonym	Water				Sediment		Soil				Soil Vapor	
					Lowest		Lowest				Lowest			
			Terrestrial Plant RBSL [g] (mg/L)	Water Column Community RBSL [g] (mg/L)	Low TRV-Based RBSL [g, h] (mg/L)	High TRV-Based RBSL [g, h] (mg/L)	Low TRV-Based RBSL [g, h] (mg/kg)	High TRV-Based RBSL [g, h] (mg/kg)	Terrestrial Plants RBSL [g] (mg/kg)	Soil Invertebrates RBSL [g] (mg/kg)	Low TRV-Based RBSL [g, h] (mg/kg)	High TRV-Based RBSL [g, h] (mg/kg)	Low TRV-Based RBSL [g] (mg/m^3)	High TRV-Based RBSL [g] (mg/m^3)
Benzo(e)pyrene	192972	-	NC	NC	NC	NC	0.195	1.52	1.2	18	4.4	270	NA	NA
Benzo(ghi)perylene	191242	Benzo (g,h,i) perylene	NC	0.00764	4.2	260	0.17	0.3	1.2	18	7.4	460	NA	NA
Benzo(k)fluoranthene	207089	e	NC	NTV	4.2	260	0.0272	13.4	1.2	18	4.9	310	NA	NA
Chrysene	218019	-	NC	0.000014	4.2	260	0.166	1.29	1.2	18	1.2	76	NA	NA
Dibenzo(a,h)anthracene	53703	anthracene	NC	0.000014	4.2	260	0.033	0.1	1.2	18	2.3	140	NA	NA
Fluoranthene	206440	-	NC	0.00616	100	2,400	0.423	2.23	1.9	29	54	880	NA	NA
Fluorene	86737	-	NC	0.0039	5.3	53	0.056	0.536	1.2	29	0.89	8.9	0.48	2.4
Indeno(1,2,3-cd)pyrene	193395	pyrene	NC	0.00431	4.2	260	0.01732	0.33	1.2	18	4.8	300	NA	NA
Naphthalene	91203	-	10	0.012	220	1,100	NC	NC	100	29	26	130	2.5	12
Perylene	198550	-	NC	NC	NC	NC	NC	NC	NTV	29	10	220	NA	NA
Phenanthrene	85018	-	NC	0.0063	6.0	60	0.204	1.17	1.2	29	1.3	13	0.48	2.4
Pyrene	129000	-	NC	0.000025	4.2	260	0.195	1.52	1.2	18	1.2	73	NA	NA
Pesticides														
4,4'-DDD	72548	p,p'-DDD	NTV	0.000001	0.047	7.9	0.000016	0.0026	12	12	0.0051	0.85	NA	NA
4,4'-DDE	72559	p,p'-DDE	NTV	0.000001	0.047	3.2	NC	NC	12	12	0.0041	0.28	NA	NA
4,4'-DDT	50293	p,p'-DDT	NTV	0.000001	0.047	7.9	NC	NC	12	12	0.0035	0.58	NA	NA
Aldrin	309002	-	NTV	0.00030	0.68	6.8	NC	NC	NTV	NTV	0.057	0.57	NA	NA
alpha-BHC	319846	Hexachloride	NTV	0.0022	0.34	12	NC	NC	1,000	NTV	0.073	2.9	NA	NA
beta-BHC	319857	Hexachloride	NTV	0.0022	2.7	12	NC	NC	1,000	NTV	0.59	2.9	NA	NA
Chlordane (Technical)	12789036	-	NC	NC	NC	NC	NC	NC	NTV	NTV	1.1	5.6	NA	NA
delta-BHC	319868	Hexachloride	NTV	0.0022	0.34	12	NC	NC	1,000	NTV	0.067	2.6	NA	NA
Dieldrin	60571	-	NTV	0.000056	0.10	4.2	NC	NC	NTV	NTV	0.013	0.58	NA	NA
Endosulfan I	959988	-	NTV	0.000051	1.0	20	NC	NC	1,000	NTV	0.22	4.2	NA	NA
Endosulfan II	33213659	-	NTV	0.000051	1.0	20	NC	NC	1,000	NTV	0.22	4.2	NA	NA
Endosulfan sulfate	1031078	-	NTV	0.000051	1.0	20	NC	NC	1,000	NTV	0.23	4.4	NA	NA
Endrin	72208	-	NTV	0.000036	0.053	0.53	NC	NC	NTV	NTV	0.0079	0.079	NA	NA
Endrin aldehyde	7421934	-	NTV	0.000036	0.053	0.53	NC	NC	NTV	NTV	0.0092	0.092	NA	NA
Endrin ketone	53494705	-	NC	NC	NC	NC	NC	NC	NTV	NTV	0.0086	0.086	NA	NA
gamma-BHC	58899	Lindane	NTV	0.000095	0.34	25	NC	NC	1,000	NTV	0.075	5.6	NA	NA
Heptachlor	76448	-	NTV	0.0000038	0.88	35	NC	NC	1,000	NTV	0.087	3.6	NA	NA
Heptachlor epoxide	1024573	-	NC	0.0000038	0.0084	0.042	NC	NC	1,000	NTV	0.0013	0.0065	NA	NA
MCPA	94746	-	NC	NC	NC	NC	NC	NC	NTV	NTV	0.12	0.61	NA	NA
Mirex	2385855	Mirex (DeChlorane)	NC	NC	NC	NC	NC	NC	NTV	NTV	0.034	0.34	NA	NA
p,p'-Methoxychlor	72435	-	NC	NC	NC	NC	NC	NC	NTV	NTV	2.5	50	NA	NA
Toxaphene	8001352	-	NC	0.000019	54	NTV	NC	NC	NTV	NTV	5.8	NTV	NA	NA
Herbicides														
2,4,5-T	93765	2,4,5-Trichlorophenoxyacetic acid	NC	NC	NC	NC	NC	NC	NTV	NTV	4.8	16	NA	NA
2,4,5-TP (Silvex)	93721	-	NC	NC	NC	NC	NC	NC	NTV	NTV	0.55	1.8	NA	NA
2,4-Dichlorophenoxyacetic Acid (2,4-D)	94757	-	NTV	NC	NC	NC	NC	NC	NTV	NTV	1.1	5.5	NA	NA
2,4-Dichlorophenoxybutyric acid	94826	-	NC	NC	NC	NC	NC	NC	NTV	NTV	6.2	19	NA	NA
2,4-DP (Dichlorprop)	120365	Dichlorprop	NC	NC	NC	NC	NC	NC	NTV	NTV	0.79	3.9	NA	NA

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					Lowest		Lowest				Lowest			
			Terrestrial Plant RBSL [g] (mg/L)	Water Column Community RBSL [g] (mg/L)	Low TRV-Based RBSL [g, h] (mg/L)	High TRV-Based RBSL [g, h] (mg/L)	Low TRV-Based RBSL [g, h] (mg/kg)	High TRV-Based RBSL [g, h] (mg/kg)	Terrestrial Plants RBSL [g] (mg/kg)	Soil Invertebrates RBSL [g] (mg/kg)	Low TRV-Based RBSL [g, h] (mg/kg)	High TRV-Based RBSL [g, h] (mg/kg)	Low TRV-Based RBSL [g] (mg/m^3)	High TRV-Based RBSL [g] (mg/m^3)
Dalapon	75990	-	NC	NC	NC	NC	NC	NC	NTV	NTV	39	130	NA	NA
Dicamba	1918009	-	NC	NC	NC	NC	NC	NC	NTV	NTV	14	46	NA	NA
Dinoseb	88857	-	NTV	NC	NC	NC	NC	NC	NTV	NTV	0.18	1.5	NA	NA
MCPP	93652	-	NC	NC	NC	NC	NC	NC	NTV	NTV	2.5	7.4	NA	NA
Terphenyls														
m-Terphenyl	92068	-	NC	NC	NC	NC	NC	NC	68	NTV	0.67	6.7	NA	NA
o-terphenyl	84151	-	NC	NC	NC	NC	0.0043	0.043	NTV	NTV	0.67	6.7	NA	NA
p-Terphenyl	92944	-	NC	NC	NC	NC	0.0016	0.016	NTV	NTV	0.54	5.4	NA	NA
Glycols														
Diethylene Glycol	111466	-	NC	NC	NC	NC	NC	NC	NTV	NTV	NTV	NTV	NA	NA
Triethylene glycol	112276	-	NC	NC	NC	NC	NC	NC	NTV	NTV	NTV	NTV	NA	NA
Total Petroleum Hydrocarbons														
TPH-Diesel Range Organics (DRO)	DRO	Diesel	NTV	NC	NC	NC	NTV	NTV	NTV	NTV	NTV	NTV	NA	NA
TPH-Gasoline Range Organics (GRO)	GRO	Gasoline	NC	NC	NC	NC	NTV	NTV	NTV	NTV	NTV	NTV	NA	NA
TPH-Kerosene Range Organics (KRO)	KRO	Kerosene	NTV	NC	NC	NC	NTV	NTV	NC	NC	NC	NC	NA	NA
TPH-Oil Range Organics (ORO)	ORO	Oil Range Organics	NC	NC	NC	NC	NTV	NTV	NC	NC	NC	NC	NA	NA
PCDD/PCDFs [i]														
1,2,3,4,6,7,8-Heptachlorodibenzofuran	67562394	1,2,3,4,6,7,8-HpCDF	NC	0.00000001	NA	NA	0.00000085	0.0000088	NTV	0.5	NA	NA	NA	NA
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	35822469	HpCDD	NTV	0.00000001	NA	NA	0.00000085	0.0000088	NTV	0.5	NA	NA	NA	NA
1,2,3,4,7,8,9-Heptachlorodibenzofuran	55673897	1,2,3,4,7,8,9-HpCDF	NC	0.00000001	NA	NA	0.00000085	0.0000088	NTV	0.5	NA	NA	NA	NA
1,2,3,4,7,8-Hexachlorodibenzofuran	70648269	1,2,3,4,7,8-HxCDF	NC	0.00000001	NA	NA	0.00000085	0.0000088	NTV	0.5	NA	NA	NA	NA
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	39227286	1,2,3,4,7,8-HxCDD	NC	0.00000001	NA	NA	0.00000085	0.0000088	NTV	0.5	NA	NA	NA	NA
1,2,3,6,7,8-Hexachlorodibenzofuran	57117449	1,2,3,6,7,8-HxCDF	NC	0.00000001	NA	NA	0.00000085	0.0000088	NTV	0.5	NA	NA	NA	NA
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	57653857	1,2,3,6,7,8-HxCDD	NC	0.00000001	NA	NA	0.00000085	0.0000088	NTV	0.5	NA	NA	NA	NA
1,2,3,7,8,9-Hexachlorodibenzofuran	72918219	1,2,3,7,8,9-HxCDF	NC	0.00000001	NA	NA	0.00000085	0.0000088	NTV	0.5	NA	NA	NA	NA
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	19408743	1,2,3,7,8,9-HxCDD	NC	0.00000001	NA	NA	0.00000085	0.0000088	NTV	0.5	NA	NA	NA	NA
1,2,3,7,8-Pentachlorodibenzofuran	57117416	1,2,3,7,8-PeCDF	NC	0.00000001	NA	NA	0.00000085	0.0000088	NTV	0.5	NA	NA	NA	NA
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	40321764	1,2,3,7,8-PeCDD	NC	0.00000001	NA	NA	0.00000085	0.0000088	NTV	0.5	NA	NA	NA	NA
2,3,4,6,7,8-Hexachlorodibenzofuran	60851345	-	NC	0.00000001	NA	NA	0.00000085	0.0000088	NTV	0.5	NA	NA	NA	NA
2,3,4,7,8-Pentachlorodibenzofuran	57117314	2,3,4,7,8-PeCDF	NC	0.00000001	NA	NA	0.00000085	0.0000088	NTV	0.5	NA	NA	NA	NA
2,3,7,8-TCDD	1746016	2,3,7,8-Tetrachlorodibenzo-p-dioxin	NC	0.00000001	NA	NA	0.00000085	0.0000088	NTV	0.5	NA	NA	NA	NA
2,3,7,8-Tetrachlorodibenzofuran	51207319	2,3,7,8-TCDF	NC	0.00000001	NA	NA	0.00000085	0.0000088	NTV	0.5	NA	NA	NA	NA
2,3,7,8-TCDD_TEQ_Bird	1746016-TEQ_Bird	-	NA	NA	0.000074	0.00074	0.00011	0.0011	NA	NA	0.0000057	0.000057	NA	NA
2,3,7,8-TCDD_TEQ_Fish	1746016-TEQ_Fish	-	NA	0.00000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,7,8-TCDD_TEQ_Mammal	1746016-TEQ_Mammal	-	NA	NA	0.0000068	0.000068	NA	NA	NA	NA	0.00000050	0.0000050	NA	NA
Octachlorodibenzofuran	39001020	OCDF	NTV	0.00000001	NA	NA	0.00000085	0.0000088	NTV	0.5	NA	NA	NA	NA
Octachlorodibenzo-p-dioxin	3268879	-	NTV	NC	NA	NA	0.00000085	0.0000088	NTV	0.5	NA	NA	NA	NA
Polychlorinated Biphenyls (PCBs) [i]														
Aroclor 1016	12674112	-	NC	0.000014	0.95	9.5	0.0598	0.34	40	500	0.12	1.2	NA	NA

Table 12-1

Summary of the Lowest Ecological Risk-based Screening Levels by Media

Chemical	CAS#	Chemical Synonym	Water				Sediment		Soil				Soil Vapor	
					Lowest		Lowest				Lowest			
			Terrestrial Plant RBSL [g] (mg/L)	Water Column Community RBSL [g] (mg/L)	Low TRV-Based RBSL [g, h] (mg/L)	High TRV-Based RBSL [g, h] (mg/L)	Low TRV-Based RBSL [g, h] (mg/kg)	High TRV-Based RBSL [g, h] (mg/kg)	Terrestrial Plants RBSL [g] (mg/kg)	Soil Invertebrates RBSL [g] (mg/kg)	Low TRV-Based RBSL [g, h] (mg/kg)	High TRV-Based RBSL [g, h] (mg/kg)	Low TRV-Based RBSL [g] (mg/m^3)	High TRV-Based RBSL [g] (mg/m^3)
Aroclor 1221	11104282	-	NC	0.000014	0.95	9.5	NC	NC	NC	NC	0.18	1.8	NA	NA
Aroclor 1232	11141165	-	NC	0.000014	0.46	4.6	NC	NC	NC	NC	0.082	0.82	NA	NA
Aroclor 1242	53469219	Aroclor-1242	NC	0.000014	0.47	4.7	NC	NC	40	500	0.043	0.43	NA	NA
Aroclor 1248	12672296	-	NC	0.000014	0.068	0.68	NC	NC	40	500	0.0064	0.064	NA	NA
Aroclor 1254	11097691	-	NC	0.000014	0.46	4.6	0.0598	0.34	40	500	0.039	0.39	NA	NA
Aroclor 1260	11096825	-	NC	0.000014	0.46	4.6	NC	NC	40	500	0.025	0.25	NA	NA
Aroclor 5460	11126424	-	NC	NC	NC	NC	NC	NC	40	500	0.039	0.39	NA	NA
PCB_TEQ_Bird (Coplanar PCBs)	1746016-PCB TEQ_Bird	-	NA	NA	0.000074	0.00074	0.00011	0.0011	NA	NA	0.0000057	0.000057	NA	NA
PCB_TEQ_Fish (Coplanar PCBs)	1746016-PCB TEQ_Fish	-	NA	0.00000001	NA	NA	0.00000085	0.0000088	NA	NA	NA	NA	NA	NA
PCB_TEQ_Mammal (Coplanar PCBs)	1746016-PCB TEQ_Mammal	-	NA	NA	0.0000068	0.000068	NA	NA	NA	NA	0.00000050	0.0000050	NA	NA
PCB-105	32598144	2,3,3',4,4'-pentachloro-	NC	0.00000001	NA	NA	0.00000085	0.0000088	NTV	0.5	NA	NA	NA	NA
PCB-114	74472370	PCB 114 (BZ)	NC	0.00000001	NA	NA	0.00000085	0.0000088	NTV	0.5	NA	NA	NA	NA
PCB-118	31508006	-	NC	0.00000001	NA	NA	NC	NC	NTV	0.5	NA	NA	NA	NA
PCB-123	65510443	123-PeCB	NC	0.00000001	NA	NA	0.00000085	0.0000088	NTV	0.5	NA	NA	NA	NA
PCB-126	57465288	-	NC	0.00000001	NA	NA	0.00000085	0.0000088	NTV	0.5	NA	NA	NA	NA
PCB-156	38380084	1,1'-Biphenyl, 2,3,3',4,4',5-hexachloro-	NC	0.00000001	NA	NA	0.00000085	0.0000088	NTV	0.5	NA	NA	NA	NA
PCB-157	69782907	PCB 157 (BZ)	NC	0.00000001	NA	NA	0.00000085	0.0000088	NTV	0.5	NA	NA	NA	NA
PCB-167	52663726	167-HxCB	NC	0.00000001	NA	NA	0.00000085	0.0000088	NTV	0.5	NA	NA	NA	NA
PCB-169	32774166	-	NC	0.00000001	NA	NA	0.00000085	0.0000088	NTV	0.5	NA	NA	NA	NA
PCB-189	39635319	-	NC	0.00000001	NA	NA	0.00000085	0.0000088	NTV	0.5	NA	NA	NA	NA
PCB-77	32598133	77-TeCB	NC	0.00000001	NA	NA	0.00000085	0.0000088	NTV	0.5	NA	NA	NA	NA
PCB-81	70362504	81-TeCB	NC	0.00000001	NA	NA	0.00000085	0.0000088	NTV	0.5	NA	NA	NA	NA
Chemical Parameters														
Ammonia-N	7664417	Nitrogen, as Ammonia	NTV	NC	NC	NC	NC	NC	NTV	NTV	NTV	NTV	NA	NA
Chloride	16887006	-	NTV	230	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NA	NA
Chlorine	7782505	-	NC	0.011	97	NTV	NC	NC	NC	NC	NC	NC	NA	NA
Nitrate	NO3N	-	NTV	NTV	3,420	7,630	NTV	NTV	NTV	NTV	2,340	5,200	NA	NA
Nitrite-NO2	E-10128	-	NC	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NA	NA
Oil content	E-10140	-	NC	NTV	NTV	NTV	NC	NC	NC	NC	NC	NC	NA	NA
Orthophosphate – PO4	14265442	-	NC	NC	NC	NC	NC	NC	NTV	NTV	0.069	0.35	NA	NA
Sulfate	14808798	-	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NA	NA

Notes:

[a] Chemicals detected in Groups 4 (Coca only), 6 (SRE only), 1B, 5, 10, 3 (WCT only), and 9 (Silvernale only) surface water.

[b] Chemicals detected in site wide seeps and springs.

[c] Chemicals detected in site wide near-surface groundwater.

[d] Chemicals detected in Groups 4 (Coca only), 6 (SRE only), 1B, 5, 10, 3 (WCT only), and 9 (Silvernale only) sediment.

[e] Chemicals detected in Groups 1A, 4, 6, 7, 8, 1B, 5, 10, 3 (WCT only), and 9 (Silvernale only) surface soil.

Table 12-1

Summary of the Lowest Ecological Risk-based Screening Levels by Media

Chemical	CAS#	Chemical Synonym	Water				Sediment		Soil				Soil Vapor	
					Lowest		Lowest				Lowest			
			Terrestrial Plant RBSL [g] (mg/L)	Water Column Community RBSL [g] (mg/L)	Low TRV-Based RBSL [g, h] (mg/L)	High TRV-Based RBSL [g, h] (mg/L)	Low TRV-Based RBSL [g, h] (mg/kg)	High TRV-Based RBSL [g, h] (mg/kg)	Terrestrial Plants RBSL [g] (mg/kg)	Soil Invertebrates RBSL [g] (mg/kg)	Low TRV-Based RBSL [g, h] (mg/kg)	High TRV-Based RBSL [g, h] (mg/kg)	Low TRV-Based RBSL [g] (mg/m^3)	High TRV-Based RBSL [g] (mg/m^3)

[f] Chemicals detected in Groups 1A, 4, 6, 7, 8, 1B, 3, 5, 9, and 10 soil vapor.

[g] Calculated with a target hazard quotient of 1. EcoRBSLs for surface water, soil invertebrates, sediment, and terrestrial plants are equivalent to their respective medium-specific benchmarks; therefore, these EcoRBSLs were reported in the same number of significant figures as the source documents from which the benchmarks were selected. Avian and mammalian EcoRBSLs are calculated rather than derived from published values; therefore, EcoRBSLs with values less than 1,000 were reported using two significant figures and values greater than 1,000 were reported using three significant figures.

[h] Lowest Low and lowest High TRV-based RBSLs for water and soil are selected from the EcoRBSLs for upper trophic level receptors. Lowest Low and lowest High sediment RBSLs are selected as the lower of the sediment benthic community and the great blue heron sediment EcoRBSLs.

[i] As there are no toxicity equivalency factors (TEFs) available for terrestrial plants, soil invertebrates, and the sediment bethic community, no EcoRBSLs for 2,3,7,8-TCDD TEQ and PCB TEQ (Coplanar PCBs) were derived for these receptor groups. Since EcoRBSLs for 2,3,7,8-TCDD TEQ and PCB TEQ (Coplanar PCBs) only apply to mammals, birds, and fish (i.e., the water column community), individual dioxin/furan and coplanar PCB congeners are presented for evaluation of terrestrial plants, soil invertebrates, and the sediment benthic community exposed to these chemicals in applicable media.

-- Not available, or could not be located
BHC - benzene hexachloride
DDD - dichlorodiphenyldichloroethane
DDE - dichlorodiphenyldichloroethylene
DDT - dichlorodiphenyltrichloroethane
High TRV - mid level effect toxicity reference value
HMX - high melting explosive
Low TRV - no effect toxicity reference value
MCPA - 2-methyl-4-chlorophenoxyacetic acid
MCPP - meta-Chlorophenylpiperazine
mg/kg - milligrams per kilogram
mg/L - milligrams per liter
NA - not applicable
NC - not calculated
NTV - no toxicity value
PCB - polychlorinated biphenyl
PCDD/PCDF - polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans
PETN - pentaerythritol tetranitrate
RBSL - risk-based screening level
RDX - Research Department Explosive
TCDD - Tetrachlorodibenzo-p-dioxin
TEQ - toxicity equivalent
X - Analyte was detected in the indicated medium

Table 12-2
Summary of the Ecological Risk-Based Screening Levels for Chemicals Detected in Ephemeral/Permanent Surface Water, Seeps/Springs, and/or Near-surface Groundwater

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Ephemeral or Permanent Surface Water or Seeps and Springs [a]	Chemicals Detected in Ephemeral or Permanent Surface Water [a]	Chemicals Detected in Ephemeral Surface Water, Seeps and Springs, or Near-Surface Groundwater [b]	Terrestrial Plants	Water Column Community	Great Blue Heron		Deer Mouse		Hermit Thrush		Mule Deer		Bobcat		Lowest RBSL			
						Benchmark-Based RBSL [c] (mg/L)	Benchmark-Based RBSL [c] (mg/L)	Low TRV-Based RBSL [c] (mg/L)	High TRV-Based RBSL [c] (mg/L)	Low TRV-Based RBSL [c] (mg/L)	High TRV-Based RBSL [c] (mg/L)	Low TRV-Based RBSL [c] (mg/L)	High TRV-Based RBSL [c] (mg/L)	Low TRV-Based RBSL [c] (mg/L)	High TRV-Based RBSL [c] (mg/L)	Low TRV-Based RBSL [c] (mg/L)	High TRV-Based RBSL [c] (mg/L)	Low TRV-Based RBSL [c,d] (mg/L)	Receptor	High TRV-Based RBSL [c,d] (mg/L)	Receptor
Inorganic Compounds																					
Aluminum	7429905	Aluminum, Total	X	X	X	0.3	0.087	2,410	NTV	13	130	580	NTV	28	280	25	250	13	Deer Mouse	130	Deer Mouse
Aluminum, dissolved	7429905-D	-	X	X	X	0.3	0.087	2,410	NTV	13	130	580	NTV	28	280	25	250	13	Deer Mouse	130	Deer Mouse
Antimony	7440360	Antimony, Total	X	X	X	NTV	0.03	NTV	NTV	0.40	19	NTV	NTV	0.86	41	0.75	36	0.40	Deer Mouse	19	Deer Mouse
Antimony, dissolved	7440360-D	-	X	X	X	NTV	0.03	NTV	NTV	0.40	19	NTV	NTV	0.86	41	0.75	36	0.40	Deer Mouse	19	Deer Mouse
Arsenic	7440382	Arsenic, Total	X	X	X	0.001	0.15	120	480	2.2	32	29	120	4.7	68	4.1	60	2.2	Deer Mouse	32	Deer Mouse
Arsenic, dissolved	7440382-D	-	X	X	X	0.001	0.15	120	480	2.2	32	29	120	4.7	68	4.1	60	2.2	Deer Mouse	32	Deer Mouse
Barium	7440393	Barium, Total	X	X	X	NTV	0.004	460	920	350	560	110	220	750	1,210	660	1,060	110	Hermit Thrush	220	Hermit Thrush
Barium, dissolved	7440393-D	-	X	X	X	NTV	0.004	460	920	350	560	110	220	750	1,210	660	1,060	110	Hermit Thrush	220	Hermit Thrush
Beryllium	7440417	Beryllium, Total	X	X	X	0.5	0.00066	NTV	NTV	3.6	9.5	NTV	NTV	7.8	20	6.8	18	3.6	Deer Mouse	9.5	Deer Mouse
Beryllium, dissolved	7440417-D	-	X	X	X	0.5	0.00066	NTV	NTV	3.6	9.5	NTV	NTV	7.8	20	6.8	18	3.6	Deer Mouse	9.5	Deer Mouse
Boron	7440428	Boron, Total	X	X	X	1	0.0016	630	2,200	190	630	150	530	410	1,360	360	1,190	150	Hermit Thrush	530	Hermit Thrush
Boron, dissolved	7440428-D	-	X	X	X	1	0.0016	630	2,200	190	630	150	530	410	1,360	360	1,190	150	Hermit Thrush	530	Hermit Thrush
Cadmium	7440439	Cadmium, Total	X	X	X	0.1	0.00028	15	230	0.41	18	3.7	55	0.87	38	0.76	34	0.41	Deer Mouse	18	Deer Mouse
Cadmium, dissolved	7440439-D	-	X	X	X	0.1	0.00025	15	230	0.41	18	3.7	55	0.87	38	0.76	34	0.41	Deer Mouse	18	Deer Mouse
Chromium	7440473	Chromium, Total	X	X	X	0.05	0.086	59	350	16	390	14	84	35	850	31	740	14	Hermit Thrush	84	Hermit Thrush
Chromium, dissolved	7440473-D	-	X	X	X	0.05	0.074	59	350	16	390	14	84	35	850	31	740	14	Hermit Thrush	84	Hermit Thrush
Cobalt	7440484	Cobalt, Total	X	X	X	0.06	0.023	170	400	8.1	140	40	95	17	290	15	250	8.1	Deer Mouse	95	Hermit Thrush
Cobalt, dissolved	7440484-D	-	X	X	X	0.06	0.023	170	400	8.1	140	40	95	17	290	15	250	8.1	Deer Mouse	95	Hermit Thrush
Copper	7440508	Copper, Total	X	X	X	0.06	0.0094	51	1,150	18	4,270	12	280	39	9,210	34	8,040	12	Hermit Thrush	280	Hermit Thrush
Copper, dissolved	7440508-D	-	X	X	X	0.06	0.0090	51	1,150	18	4,270	12	280	39	9,210	34	8,040	12	Hermit Thrush	280	Hermit Thrush
Cyanides	57125	Cyanide, Total	X	X		NC	0.0052	0.88	8.8	460	NTV	0.21	2.1	1,000	NTV	870	NTV	0.21	Hermit Thrush	2.1	Hermit Thrush
Fluoride	7782414	-	X	X	X	5	NTV	170	700	210	360	41	170	460	770	400	670	41	Hermit Thrush	170	Hermit Thrush
Hexavalent Chromium	18540299	Chromium, Hexavalent	X	X		NC	0.0114	NTV	NTV	62	260	NTV	NTV	130	550	120	480	62	Deer Mouse	260	Deer Mouse
Lead	7439921	Lead, Total	X	X	X	0.02	0.0032	0.31	190	6.8	1,630	0.074	46	15	3,510	13	3,060	0.074	Hermit Thrush	46	Hermit Thrush
Lead, dissolved	7439921-D	-	X	X	X	0.02	0.0025	0.31	190	6.8	1,630	0.074	46	15	3,510	13	3,060	0.074	Hermit Thrush	46	Hermit Thrush
Manganese	7439965	Manganese, Total	X	X	X	4	0.12	1,710	17,100	93	1,070	410	4,090	200	2,320	170	2,020	93	Deer Mouse	1,070	Deer Mouse
Manganese, dissolved	7439965-D	-	X	X	X	4	0.12	1,710	17,100	93	1,070	410	4,090	200	2,320	170	2,020	93	Deer Mouse	1,070	Deer Mouse
Mercury	7439976	Mercury, Total	X	X		NC	0.00091	9.9	20	6.8	NTV	2.4	4.7	15	NTV	13	NTV	2.4	Hermit Thrush	4.7	Hermit Thrush
Mercury, dissolved	7439976-D	-	X	X		NC	0.00077	9.9	20	6.8	NTV	2.4	4.7	15	NTV	13	NTV	2.4	Hermit Thrush	4.7	Hermit Thrush
Molybdenum	7439987	Molybdenum, Total	X	X	X	0.5	0.37	77	780	1.8	18	18	190	3.8	38	3.3	33	1.8	Deer Mouse	18	Deer Mouse
Molybdenum, dissolved	7439987-D	-	X	X	X	0.5	0.37	77	780	1.8	18	18	190	3.8	38	3.3	33	1.8	Deer Mouse	18	Deer Mouse
Nickel	7440020	Nickel, Total	X	X	X	0.5	0.052	30	1,240	0.90	210	7.3	300	1.9	460	1.7	400	0.90	Deer Mouse	210	Deer Mouse
Nickel, dissolved	7440020-D	-	X	X	X	0.5	0.052	30	1,240	0.90	210	7.3	300	1.9	460	1.7	400	0.90	Deer Mouse	210	Deer Mouse
Selenium	7782492	Selenium, Total	X	X	X	0.7	0.0050	5.1	20	0.34	8.2	1.2	4.9	0.73	18	0.64	15	0.34	Deer Mouse	4.9	Hermit Thrush
Selenium, dissolved	7782492-D	-	X	X	X	0.7	0.0046	5.1	20	0.34	8.2	1.2	4.9	0.73	18	0.64	15	0.34	Deer Mouse	4.9	Hermit Thrush
Silica, dissolved	7631869-D	-	X		X	NTV	NTV	NC	NC	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NC	NA	NC	NA
Silver	7440224	Silver, Total	X	X	X	0.1	0.00038	44	1,320	41	800	11	320	88	1,730	77	1,510	11	Hermit Thrush	320	Hermit Thrush
Silver, dissolved	7440224-D	-	X	X		NC	0.00032	44	1,320	41	800	11	320	88	1,730	77	1,510	11	Hermit Thrush	320	Hermit Thrush
Strontium	7440246	Strontium, Total	X	X	X	NTV	1.5	NTV	NTV	1,780	2,570	NTV	NTV	3,830	5,540	3,340	4,830	1,780	Deer Mouse	2,570	Deer Mouse
Strontium, dissolved	7440246-D	-	X	X	X	NTV	1.5	NTV	NTV	1,780	2,570	NTV	NTV	3,830	5,540	3,340	4,830	1,780	Deer Mouse	2,570	Deer Mouse
Thallium	7440280	Thallium, Total	X	X	X	0.02	0.012	7.6	76	3.2	9.7	1.8	18	7.0	21	6.1	18	1.8	Hermit Thrush	9.7	Deer Mouse
Thallium, dissolved	7440280-D	-	X	X	X	0.02	0.012	7.6	76	3.2	9.7	1.8	18	7.0	21	6.1	18	1.8	Hermit Thrush	9.7	Deer Mouse
Titanium	7440326	Titanium, Total	X	X		NC	2	22	220	NTV	NTV	5.3	53	NTV	NTV	NTV	NTV	5.3	Hermit Thrush	53	Hermit Thrush
Titanium, dissolved	7440326-D	-	X	X		NC	2	22	220	NTV	NTV	5.3	53	NTV	NTV	NTV	NTV	5.3	Hermit Thrush	53	Hermit Thrush
Vanadium	7440622	Vanadium, Total	X	X	X	0.2	0.02	7.6	37	28	64	1.8	9.0	61	140	53	120	1.8	Hermit Thrush	9.0	Hermit Thrush
Vanadium, dissolved	7440622-D	-	X	X	X	0.2	0.02	7.6	37	28	64	1.8	9.0	61	140	53	120	1.8	Hermit Thrush	9.0	Hermit Thrush
Zinc	7440666	Zinc, Total	X	X	X	0.4	0.122	380	3,780	65	2,780	91	910	140	5,990	120	5,230	65	Deer Mouse	910	Hermit Thrush
Zinc, dissolved	7440666-D	-	X	X	X	0.4	0.12	380	3,780	65	2,780	91	910	140	5,990	120	5,230	65	Deer Mouse	910	Hermit Thrush
Energetic Constituents						NC															
1,2-Diphenylhydrazine	122667	-	X	X		NC	0.27	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
2,4-Dinitrotoluene	121142	-	X	X		NC	0.23	0.22	29	0.68	5.1	0.053	6.9	1.5	11	1.3	9.5	0.053	Hermit Thrush	5.1	Deer Mouse
Perchlorate	14797730	-	X	X	X	NTV	NTV	290	570	43	220	69	140	93	470	81	410	43	Deer Mouse	140	Hermit Thrush
Volatile Organic Compounds						NC															
1,1,1-Trichloroethane	71556	-	X	X	X	100	0.011	NTV	NTV	6,760	17,100	NTV	NTV	14,600	36,900	12,700	32,200	6,760	Deer Mouse	17,100	Deer Mouse
1,1,2,2-Tetrachloroethane	79345	-	X	X		NC	0.61	NTV	NTV	140	270	NTV	NTV	290	580	250	510	140	Deer Mouse	270	Deer Mouse
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	Freon 113	X	X	X	NTV	NTV	NTV	NTV	920	NTV	NTV	NTV	1,990	NTV	1,740	NTV	920	Deer Mouse	NTV	NA
1,1,2-Trichloroethane	79005	-	X	X	X	100	1.2	NTV	NTV	13	150	NTV	NTV	28	320	25	280	13	Deer Mouse	150	Deer Mouse
1,1-Dichloroethane	75343	-	X	X	X	100	0.047	380	760	340	NTV	91	180	730	NTV	640	NTV	91	Hermit Thrush	180	Hermit Thrush
1,1-Dichloroethene	75354	-	X	X	X	100	0.025	NTV	NTV	17	45	NTV	NTV	36	96	32	84	17	Deer Mouse	45	Deer Mouse
1,2,4-Trichlorobenzene	120821	-	X	X		NC	0.11	NTV	NTV	50	180	NTV	NTV	110	390	94	340	50	Deer Mouse	180	Deer Mouse
1,2-Dichlorobenzene	95501	o-Dichlorobenzene	X	X	X	NTV	0.014	NTV	NTV	580	580	NTV	NTV	1,250	1,250	1,090	1,090	580	Deer Mouse	580	Deer Mouse
1,2-Dichloroethane	107062	-	X	X	X	100	0.91	380	760	340	NTV	91	180	730	NTV	640	NTV	91	Hermit Thrush	180	Hermit Thrush
1,2-Dichloropropane	78875	-	X	X		NC	5.7	NTV	NTV	48	240	NTV	NTV	100	520	91	450	48	Deer Mouse	240	Deer Mouse
1,3-Dichlorobenzene	541731	m-Dichlorobenzene	X	X		NC	0.071	NTV	NTV	99	500	NTV	NTV	210	1,070	190	930	99	Deer Mouse	500	Deer Mouse
1,4-Dichlorobenzene	106467	p-Dichlorobenzene	X	X	X	NTV	0.015	NTV	NTV	24	120	NTV	NTV	52	260	45	230	24	Deer Mouse	120	Deer Mouse
2-Chloroethylvinyl ether	110758	2-Chloroethyl vinyl ether	X	X		NC	0.122	NTV	NTV	240	1,340	NTV	NTV	520	2,890	460	2,520	240	Deer Mouse	1,340	Deer Mouse
2-Chloronaphthalene	91587	-	X	X		NC	1.6	NTV	NTV	840	2,030	NTV	NTV	1,820	4,370	1,590	3,810	840	Deer Mouse	2,030	Deer Mouse
2-Chlorophenol	95578	-	X	X		NC	4.38	NTV	NTV	34	340	NTV	NTV	73	730	64	640	34	Deer Mouse	340	Deer Mouse
2-Nitrophenol	88755	o-Nitrophenol	X	X	X	10	0.23	NTV	NTV	18	NTV	NTV	NTV	39	NTV	34	NTV	18	Deer Mouse	NTV	NA
Acetone	67641	-	X	X	X	NTV	1.5	60,100	NTV	68	340	14,400	NTV	150	730	130	640	68	Deer Mouse	340	Deer Mouse
Acrolein	107028		X	X		NC	0.003	NTV	NTV	0.34	3.4	NTV	NTV	0.73	7.3	0.64	6.4	0.34	Deer Mouse	3.4	Deer Mouse
Acrylonitrile	107131		X	X		NC	7.55	NTV	NTV	28	95	NTV	NTV	61	200	53	180	28	Deer Mouse	95	Deer Mouse
Benzene	71432	-	X	X	X	NTV	0.13	NTV	NTV	180	1,780	NTV	NTV	380	3,840	340	3,350	180	Deer Mouse	1,780	Deer Mouse
bis(2-Chloroethyl) ether	111444	s-Dichloroethylether	X	X	X	NTV	0.122	NTV	NTV	240	1,340	NTV	NTV	520	2,890	460	2,520	240	Deer Mouse	1,340	Deer Mouse
Bromide	24959679	-	X		X	NTV	NTV	NC	NC	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NC	NA	NC	NA
Bromodichloromethane	75274	-	X	X	X	NTV	11	NTV	NTV	24	120	NTV	NTV	52	260	46	230	24	Deer Mouse	120	Deer Mouse

Table 12-2
Summary of the Ecological Risk-Based Screening Levels for Chemicals Detected in Ephemeral/Permanent Surface Water, Seeps/Springs, and/or Near-surface Groundwater

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Ephemeral or Permanent Surface Water or Seeps and Springs [a]	Chemicals Detected in Ephemeral or Permanent Surface Water [a]	Chemicals Detected in Ephemeral Surface Water, Seeps and Springs, or Near-Surface Groundwater [b]	Terrestrial Plants	Water Column Community	Great Blue Heron		Deer Mouse		Hermit Thrush		Mule Deer		Bobcat		Lowest RBSL			
						Benchmark-Based RBSL [c] (mg/L)	Benchmark-Based RBSL [c] (mg/L)	Low TRV-Based RBSL [c] (mg/L)	High TRV-Based RBSL [c] (mg/L)	Low TRV-Based RBSL [c] (mg/L)	High TRV-Based RBSL [c] (mg/L)	Low TRV-Based RBSL [c] (mg/L)	High TRV-Based RBSL [c] (mg/L)	Low TRV-Based RBSL [c] (mg/L)	High TRV-Based RBSL [c] (mg/L)	Low TRV-Based RBSL [c] (mg/L)	High TRV-Based RBSL [c] (mg/L)	Low TRV-Based RBSL [c,d] (mg/L)	Receptor	High TRV-Based RBSL [c,d] (mg/L)	Receptor
Bromomethane	74839	-	X	X	X	NTV	11	NTV	NTV	4.7	24	NTV	NTV	10	52	8.9	45	4.7	Deer Mouse	24	Deer Mouse
Carbon Disulfide	75150	-	X		X	NTV	0.00092	NC	NC	74	NTV	NTV	NTV	160	NTV	140	NTV	74	Deer Mouse	NC	NA
Carbon Tetrachloride	56235	-	X	X	X	NTV	0.0098	NTV	NTV	110	NTV	NTV	NTV	230	NTV	200	NTV	110	Deer Mouse	NTV	NA
Chlorobenzene	108907	Monochlorobenzene	X	X		NC	0.064	NTV	NTV	64	130	NTV	NTV	140	280	120	250	64	Deer Mouse	130	Deer Mouse
Chloroethane	75003	Ethyl chloride	X	X		NC	NTV	NTV	NTV	310	590	NTV	NTV	660	1,280	570	1,110	310	Deer Mouse	590	Deer Mouse
Chloroform	67663	Trichloromethane	X	X	X	NTV	0.028	NTV	NTV	100	280	NTV	NTV	220	600	190	520	100	Deer Mouse	280	Deer Mouse
Chloromethane	74873	Methyl chloride	X	X	X	NTV	11	NTV	NTV	4.7	24	NTV	NTV	10	52	8.9	45	4.7	Deer Mouse	24	Deer Mouse
cis-1,2-Dichloroethene	156592	cis-1,2-Dichloroethylene	X	X	X	100	0.59	NTV	NTV	310	330	NTV	NTV	660	710	570	620	310	Deer Mouse	330	Deer Mouse
cis-1,3-Dichloropropene	10061015	-	X	X		NC	0.000055	NTV	NTV	23	34	NTV	NTV	50	74	43	65	23	Deer Mouse	34	Deer Mouse
Ethylbenzene	100414	-	X	X		NC	0.0073	NTV	NTV	330	980	NTV	NTV	710	2,120	620	1,850	330	Deer Mouse	980	Deer Mouse
Methylene chloride	75092	Dichloromethane	X	X	X	NTV	2.2	NTV	NTV	40	340	NTV	NTV	85	730	74	640	40	Deer Mouse	340	Deer Mouse
m-Xylene	108383	meta-Xylene	X	X		NC	0.013	16,000	NTV	14	18	3,830	NTV	30	38	26	33	14	Deer Mouse	18	Deer Mouse
m-Xylene & p-Xylene	136777612	meta- and para-Xylenes	X	X	X	100	0.013	16,000	NTV	14	18	3,830	NTV	30	38	26	33	14	Deer Mouse	18	Deer Mouse
Nitrobenzene	98953	-	X	X	X	8	27	NTV	NTV	6.1	10	NTV	NTV	13	22	11	19	6.1	Deer Mouse	10	Deer Mouse
Tetrachloroethene	127184	-	X	X	X	10	0.098	NTV	NTV	9.5	47	NTV	NTV	20	100	18	89	9.5	Deer Mouse	47	Deer Mouse
Toluene	108883	Toluol	X	X	X	10	0.0098	NTV	NTV	180	1,760	NTV	NTV	380	3,790	330	3,310	180	Deer Mouse	1,760	Deer Mouse
trans-1,2-Dichloroethene	156605	-	X	X	X	100	0.59	NTV	NTV	310	590	NTV	NTV	660	1,280	570	1,110	310	Deer Mouse	590	Deer Mouse
trans-1,3-Dichloropropene	10061026	-	X	X		NC	0.244	NTV	NTV	23	34	NTV	NTV	50	74	43	65	23	Deer Mouse	34	Deer Mouse
Trichloroethene	79016	Trichloroethylene (TCE)	X	X	X	10	0.047	NTV	NTV	4.7	47	NTV	NTV	10	100	8.9	89	4.7	Deer Mouse	47	Deer Mouse
Trichlorofluoromethane	75694	-	X	X	X	NTV	11	NTV	NTV	470	2,360	NTV	NTV	1,020	5,090	890	4,440	470	Deer Mouse	2,360	Deer Mouse
Vinyl chloride	75014	-	X	X	X	NTV	0.93	NTV	NTV	1.1	11	NTV	NTV	2.5	25	2.2	22	1.1	Deer Mouse	11	Deer Mouse
Xylenes, Total	1330207	Xylene (Total) Isomers	X	X	X	100	0.013	16,000	NTV	14	18	3,830	NTV	30	38	26	33	14	Deer Mouse	18	Deer Mouse
Semi-Volatile Organic Compounds						NC															
2,4,6-Trichlorophenol	88062	-	X	X	X	10	0.97	NTV	NTV	340	1,010	NTV	NTV	730	2,190	640	1,910	340	Deer Mouse	1,010	Deer Mouse
2,4-Dichlorophenol	120832		X	X		NC	0.365	NTV	NTV	2.0	20	NTV	NTV	4.4	44	3.8	38	2.0	Deer Mouse	20	Deer Mouse
2,4-Dimethylphenol	105679	-	X	X		NC	2.12	NTV	NTV	170	840	NTV	NTV	360	1,820	320	1,590	170	Deer Mouse	840	Deer Mouse
2,4-Dinitrophenol	51285		X	X		NC	0.23	2.9	29	18	NTV	0.70	7.0	39	NTV	34	NTV	0.70	Hermit Thrush	7.0	Hermit Thrush
2,6-Dinitrotoluene	606202	-	X	X		NC	0.23	NTV	NTV	2.7	14	NTV	NTV	5.8	29	5.1	25	2.7	Deer Mouse	14	Deer Mouse
3,3'-Dichlorobenzidine	91941	-	X	X		NC	NTV	NTV	NTV	2.0	20	NTV	NTV	4.4	44	3.8	38	2.0	Deer Mouse	20	Deer Mouse
4,6-Dinitro-o-cresol	534521	4,6-Dinitro-2-Methylphenol	X	X		NC	0.23	NTV	NTV	18	NTV	NTV	NTV	39	NTV	34	NTV	18	Deer Mouse	NTV	NA
4-Bromophenyl phenyl ether	101553		X	X		NC	0.0015	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
4-Chlorophenylphenyl ether	7005723		X	X		NC	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
4-Nitrophenol	100027	-	X	X	X	10	0.3	NTV	NTV	18	NTV	NTV	NTV	39	NTV	34	NTV	18	Deer Mouse	NTV	NA
Benzidine	92875	-	X	X		NC	0.0039	NTV	NTV	3.6	18	NTV	NTV	7.9	39	6.9	34	3.6	Deer Mouse	18	Deer Mouse
bis(2-Chloroethoxy)methane	111911	-	X	X	X	NTV	11	NTV	NTV	240	1,340	NTV	NTV	520	2,890	460	2,520	240	Deer Mouse	1,340	Deer Mouse
bis(2-Chloroisopropyl)ether	39638329	-	X	X		NC	0.122	NTV	NTV	240	1,340	NTV	NTV	520	2,890	460	2,520	240	Deer Mouse	1,340	Deer Mouse
bis(2-Ethylhexyl) phthalate	117817	bis(2-ethylhexyl)phthalate	X	X	X	20	0.003	24	NTV	120	1,240	5.8	NTV	270	2,670	230	2,330	5.8	Hermit Thrush	1,240	Deer Mouse
Bromoform	75252	-	X	X	X	NTV	11	NTV	NTV	60	120	NTV	NTV	130	260	110	230	60	Deer Mouse	120	Deer Mouse
Butyl benzyl phthalate	85687	-	X	X		NC	0.019	NTV	NTV	540	1,590	NTV	NTV	1,160	3,420	1,010	2,990	540	Deer Mouse	1,590	Deer Mouse
Dibromochloromethane	124481	-	X	X	X	NTV	11	NTV	NTV	72	140	NTV	NTV	160	310	140	270	72	Deer Mouse	140	Deer Mouse
Diethyl phthalate	84662	-	X	X	X	20	0.21	22	220	31,000	NTV	5.3	53	66,800	NTV	58,300	NTV	5.3	Hermit Thrush	53	Hermit Thrush
Dimethyl phthalate	131113	-	X	X		NC	0.21	22	220	31,000	NTV	5.3	53	66,800	NTV	58,300	NTV	5.3	Hermit Thrush	53	Hermit Thrush
Di-n-butyl phthalate	84742	Di-n-butylphthalate	X	X	X	20	0.035	2.4	24	3,720	12,400	0.58	5.8	8,020	26,700	6,990	23,300	0.58	Hermit Thrush	5.8	Hermit Thrush
Di-n-octyl phthalate	117840	Di-n-octyl-phthalate	X	X	X	20	0.708	65	650	140	1,360	15	150	300	2,940	260	2,560	15	Hermit Thrush	150	Hermit Thrush
Formaldehyde	50000	-	X	X	X	NTV	NTV	NTV	NTV	64	550	NTV	NTV	140	1,200	120	1,040	64	Deer Mouse	550	Deer Mouse
Hexachlorobenzene	118741		X	X		NC	0.25	580	NTV	0.54	2.0	140	NTV	1.2	4.2	1.0	3.7	0.54	Deer Mouse	2.0	Deer Mouse
Hexachlorobutadiene	87683	-	X	X		NC	0.0093	70	NTV	0.14	0.68	17	NTV	0.29	1.5	0.25	1.3	0.14	Deer Mouse	0.68	Deer Mouse
Hexachlorocyclopentadiene	77474	-	X	X		NC	0.0052	NTV	NTV	20	37	NTV	NTV	44	80	38	70	20	Deer Mouse	37	Deer Mouse
Hexachloroethane	67721		X	X		NC	0.012	NTV	NTV	3.4	51	NTV	NTV	7.3	110	6.4	95	3.4	Deer Mouse	51	Deer Mouse
Isophorone	78591	-	X	X		NC	117	NTV	NTV	510	1,210	NTV	NTV	1,090	2,610	950	2,280	510	Deer Mouse	1,210	Deer Mouse
n-Nitrosodimethylamine	62759	Nitrosodimethylamine	X	X	X	NTV	5.85	NTV	NTV	9.6	120	NTV	NTV	21	250	18	220	9.6	Deer Mouse	120	Deer Mouse
n-Nitrosodi-n-propylamine	621647	n-Nitrosodipropylamine	X	X	X	NTV	NTV	NTV	NTV	9.6	120	NTV	NTV	21	250	18	220	9.6	Deer Mouse	120	Deer Mouse
n-Nitrosodiphenylamine	86306	-	X	X	X	NTV	0.21	NTV	NTV	9.6	120	NTV	NTV	21	250	18	220	9.6	Deer Mouse	120	Deer Mouse
p-Chloro-m-cresol	59507	4-Chloro-3-Methylphenol	X	X		NC	0.03	25	250	34	340	6.0	60	73	730	64	640	6.0	Hermit Thrush	60	Hermit Thrush
Pentachlorophenol	87865	PCP	X	X	X	0.03	0.015	150	1,140	57	160	36	270	120	340	110	290	36	Hermit Thrush	160	Deer Mouse
Phenol	108952	Total Phenols	X	X	X	10	0.2	25	250	630	1,060	6.0	60	1,360	2,290	1,180	2,000	6.0	Hermit Thrush	60	Hermit Thrush
Polynuclear Aromatic Hydrocarbons						NC															
Acenaphthene	83329	-	X	X		NC	0.023	22	220	440	2,400	5.3	53	960	5,190	830	4,530	5.3	Hermit Thrush	53	Hermit Thrush
Acenaphthylene	208968	-	X	X		NC	4.84	22	220	440	2,400	5.3	53	960	5,190	830	4,530	5.3	Hermit Thrush	53	Hermit Thrush
Anthracene	120127	-	X	X		NC	0.00073	24	240	440	2,400	5.9	59	960	5,190	830	4,530	5.9	Hermit Thrush	59	Hermit Thrush
Benzo(a)anthracene	56553	Benz[a]anthracene	X	X		NC	0.000027	430	NTV	4.2	260	100	NTV	9.0	550	7.8	480	4.2	Deer Mouse	260	Deer Mouse
Benzo(a)pyrene	50328	Benzo (a) pyrene	X	X		NC	0.000014	430	NTV	4.2	260	100	NTV	9.0	550	7.8	480	4.2	Deer Mouse	260	Deer Mouse
Benzo(b)fluoranthene	205992	Benz[e]acephenanthrylene 1	X	X		NC	0.00907	430	NTV	4.2	260	100	NTV	9.0	550	7.8	480	4.2	Deer Mouse	260	Deer Mouse
Benzo(ghi)perylene	191242	Benzo (g,h,i) perylene	X	X		NC	0.00764	430	NTV	4.2	260	100	NTV	9.0	550	7.8	480	4.2	Deer Mouse	260	Deer Mouse
Benzo(k)fluoranthene	207089	Benzo[k]fluoranthene	X	X		NC	NTV	430	NTV	4.2	260	100	NTV	9.0	550	7.8	480	4.2	Deer Mouse	260	Deer Mouse
Chrysene	218019	-	X	X		NC	0.000014	430	NTV	4.2	260	100	NTV	9.0	550	7.8	480	4.2	Deer Mouse	260	Deer Mouse
Dibenzo(a,h)anthracene	53703	Dibenz (a,h) anthracene	X	X		NC	0.000014	430	NTV	4.2	260	100	NTV	9.0	550	7.8	480	4.2	Deer Mouse	260	Deer Mouse
Fluoranthene	206440	-	X	X		NC	0.00616	430	NTV	440	2,400	100	NTV	960	5,190	830	4,530	100	Hermit Thrush	2,400	Deer Mouse

Table 12-2
Summary of the Ecological Risk-Based Screening Levels for Chemicals Detected in Ephemeral/Permanent Surface Water, Seeps/Springs, and/or Near-surface Groundwater

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Ephemeral or Permanent Surface Water or Seeps and Springs [a]	Chemicals Detected in Ephemeral or Permanent Surface Water [a]	Chemicals Detected in Ephemeral Surface Water, Seeps and Springs, or Near-Surface Groundwater [b]	Terrestrial Plants	Water Column Community	Great Blue Heron		Deer Mouse		Hermit Thrush		Mule Deer		Bobcat		Lowest RBSL			
						Benchmark-Based RBSL [c] (mg/L)	Benchmark-Based RBSL [c] (mg/L)	Low TRV-Based RBSL [c] (mg/L)	High TRV-Based RBSL [c] (mg/L)	Low TRV-Based RBSL [c] (mg/L)	High TRV-Based RBSL [c] (mg/L)	Low TRV-Based RBSL [c] (mg/L)	High TRV-Based RBSL [c] (mg/L)	Low TRV-Based RBSL [c] (mg/L)	High TRV-Based RBSL [c] (mg/L)	Low TRV-Based RBSL [c] (mg/L)	High TRV-Based RBSL [c] (mg/L)	Low TRV-Based RBSL [c,d] (mg/L)	Receptor	High TRV-Based RBSL [c,d] (mg/L)	Receptor
Fluorene	86737	-	X	X		NC	0.0039	22	220	440	2,400	5.3	53	960	5,190	830	4,530	5.3	Hermit Thrush	53	Hermit Thrush
Indeno(1,2,3-cd)pyrene	193395	Indeno (1,2,3-cd) pyrene	X	X		NC	0.00431	NTV	NTV	4.2	260	NTV	NTV	9.0	550	7.8	480	4.2	Deer Mouse	260	Deer Mouse
Naphthalene	91203	-	X	X	X	10	0.012	920	4,580	440	2,400	220	1,100	960	5,190	830	4,530	220	Hermit Thrush	1,100	Hermit Thrush
Phenanthrene	85018	-	X	X		NC	0.0063	25	250	440	2,400	6.0	60	960	5,190	830	4,530	6.0	Hermit Thrush	60	Hermit Thrush
Pyrene	129000	-	X	X		NC	0.000025	430	NTV	4.2	260	100	NTV	9.0	550	7.8	480	4.2	Deer Mouse	260	Deer Mouse
Pesticides						NC															
4,4'-DDD	72548	p,p'-DDD	X	X	X	NTV	0.000001	0.20	33	5.4	110	0.047	7.9	12	230	10	200	0.047	Hermit Thrush	7.9	Hermit Thrush
4,4'-DDE	72559	p,p'-DDE	X	X	X	NTV	0.000001	0.20	13	5.4	110	0.047	3.2	12	230	10	200	0.047	Hermit Thrush	3.2	Hermit Thrush
4,4'-DDT	50293	p,p'-DDT	X	X	X	NTV	0.000001	0.20	33	5.4	110	0.047	7.9	12	230	10	200	0.047	Hermit Thrush	7.9	Hermit Thrush
Aldrin	309002	-	X	X	X	NTV	0.00030	68	150	0.68	6.8	16	36	1.5	15	1.3	13	0.68	Deer Mouse	6.8	Deer Mouse
alpha-BHC	319846	a-Benzene Hexachloride	X	X	X	NTV	0.0022	12	49	0.34	25	3.0	12	0.73	55	0.64	48	0.34	Deer Mouse	12	Hermit Thrush
beta-BHC	319857	b-Benzene Hexachloride	X	X	X	NTV	0.0022	12	49	2.7	14	3.0	12	5.8	29	5.1	25	2.7	Deer Mouse	12	Hermit Thrush
delta-BHC	319868	d-Benzene Hexachloride	X	X	X	NTV	0.0022	12	49	0.34	25	3.0	12	0.73	55	0.64	48	0.34	Deer Mouse	12	Hermit Thrush
Dieldrin	60571	-	X	X	X	NTV	0.000056	1.6	18	0.10	8.8	0.37	4.2	0.22	19	0.19	17	0.10	Deer Mouse	4.2	Hermit Thrush
Endosulfan I	959988	-	X	X	X	NTV	0.000051	220	NTV	1.0	20	53	NTV	2.2	42	1.9	37	1.0	Deer Mouse	20	Deer Mouse
Endosulfan II	33213659	-	X	X	X	NTV	0.000051	220	NTV	1.0	20	53	NTV	2.2	42	1.9	37	1.0	Deer Mouse	20	Deer Mouse
Endosulfan sulfate	1031078	-	X	X	X	NTV	0.000051	220	NTV	1.0	20	53	NTV	2.2	42	1.9	37	1.0	Deer Mouse	20	Deer Mouse
Endrin	72208	-	X	X	X	NTV	0.000036	0.22	2.2	0.62	6.2	0.053	0.53	1.3	13	1.2	12	0.053	Hermit Thrush	0.53	Hermit Thrush
Endrin aldehyde	7421934	-	X	X	X	NTV	0.000036	0.22	2.2	0.62	6.2	0.053	0.53	1.3	13	1.2	12	0.053	Hermit Thrush	0.53	Hermit Thrush
gamma-BHC	58899	Lindane	X	X	X	NTV	0.000095	44	440	0.34	25	11	110	0.73	55	0.64	48	0.34	Deer Mouse	25	Deer Mouse
Heptachlor	76448	-	X	X	X	NTV	0.0000038	29	140	0.88	46	6.9	35	1.9	99	1.7	86	0.88	Deer Mouse	35	Hermit Thrush
Heptachlor epoxide	1024573	-	X	X		NC	0.0000038	29	140	0.0084	0.042	6.9	35	0.018	0.091	0.016	0.079	0.0084	Deer Mouse	0.042	Deer Mouse
Toxaphene	8001352	-	X	X		NC	0.000019	NTV	NTV	54	NTV	NTV	NTV	120	NTV	100	NTV	54	Deer Mouse	NTV	NA
PCDD/PCDFs [e]						NC															
1,2,3,4,6,7,8-Heptachlorodibenzofuran	67562394	1,2,3,4,6,7,8-HpCDF	X	X		NC	0.00000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	35822469	1,2,3,4,6,7,8-HpCDD	X	X	X	NTV	0.00000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8,9-Heptachlorodibenzofuran	55673897	1,2,3,4,7,8,9-HpCDF	X	X		NC	0.00000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8-Hexachlorodibenzofuran	70648269	1,2,3,4,7,8-HxCDF	X	X		NC	0.00000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	39227286	1,2,3,4,7,8-HxCDD	X	X		NC	0.00000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,6,7,8-Hexachlorodibenzofuran	57117449	1,2,3,6,7,8-HxCDF	X	X		NC	0.00000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	57653857	1,2,3,6,7,8-HxCDD	X	X		NC	0.00000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8,9-Hexachlorodibenzofuran	72918219	1,2,3,7,8,9-HxCDF	X	X		NC	0.00000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	19408743	1,2,3,7,8,9-HxCDD	X	X		NC	0.00000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8-Pentachlorodibenzofuran	57117416	1,2,3,7,8-PeCDF	X	X		NC	0.00000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	40321764	1,2,3,7,8-PeCDD	X	X		NC	0.00000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,6,7,8-Hexachlorodibenzofuran	60851345	-	X	X		NC	0.00000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,7,8-Pentachlorodibenzofuran	57117314	2,3,4,7,8-PeCDF	X	X		NC	0.00000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,7,8-TCDD	1746016	2,3,7,8-Tetrachlorodibenzo-p-dioxin	X	X		NC	0.00000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,7,8-Tetrachlorodibenzofuran	51207319	2,3,7,8-TCDF	X	X		NC	0.00000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,7,8-TCDD_TEQ_Bird	1746016-TEQ_Bird	-	X	X		NA	NA	0.00031	0.0031	NA	NA	0.000074	0.00074	NA	NA	NA	NA	0.000074	Hermit Thrush	0.00074	Hermit Thrush
2,3,7,8-TCDD_TEQ_Fish	1746016-TEQ_Fish	-	X	X		NA	0.00000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,7,8-TCDD_TEQ_Mammal	1746016-TEQ_Mammal	-	X	X		NA	NA	NA	NA	0.0000068	0.000068	NA	NA	0.000015	0.00015	0.000013	0.00013	0.0000068	Deer Mouse	0.000068	Deer Mouse
Octachlorodibenzofuran	39001020	OCDF	X	X	X	NTV	0.00000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Polychlorinated Biphenyls (PCBs) [e]						NC															
Aroclor 1016	12674112	-	X	X		NC	0.000014	4.0	40	9.3	23	0.95	9.5	20	50	17	44	0.95	Hermit Thrush	9.5	Hermit Thrush
Aroclor 1221	11104282	-	X	X		NC	0.000014	4.0	40	9.3	23	0.95	9.5	20	50	17	44	0.95	Hermit Thrush	9.5	Hermit Thrush
Aroclor 1232	11141165	-	X	X		NC	0.000014	4.0	40	0.46	4.6	0.95	9.5	0.99	9.9	0.86	8.6	0.46	Deer Mouse	4.6	Deer Mouse
Aroclor 1242	53469219	Aroclor-1242	X	X		NC	0.000014	4.0	40	0.47	4.7	0.95	9.5	1.0	10	0.88	8.8	0.47	Deer Mouse	4.7	Deer Mouse
Aroclor 1248	12672296	-	X	X		NC	0.000014	4.0	40	0.068	0.68	0.95	9.5	0.15	1.5	0.13	1.3	0.068	Deer Mouse	0.68	Deer Mouse
Aroclor 1254	11097691	-	X	X		NC	0.000014	4.0	40	0.46	4.6	0.95	9.5	0.99	9.9	0.86	8.6	0.46	Deer Mouse	4.6	Deer Mouse
Aroclor 1260	11096825	-	X	X		NC	0.000014	4.0	40	0.46	4.6	0.95	9.5	0.99	9.9	0.86	8.6	0.46	Deer Mouse	4.6	Deer Mouse
PCB_TEQ_Bird (Coplanar PCBs)	1746016-PCB TEQ_Bird	-	X	X		NA	NA	0.00031	0.0031	NA	NA	0.000074	0.00074	NA	NA	NA	NA	0.000074	Hermit Thrush	0.00074	Hermit Thrush
PCB_TEQ_Fish (Coplanar PCBs)	1746016-PCB TEQ_Fish	-	X	X		NA	0.00000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB_TEQ_Mammal (Coplanar PCBs)	1746016-PCB TEQ_Mammal	-	X	X		NA	NA	NA	NA	0.0000068	0.000068	NA	NA	0.000015	0.00015	0.000013	0.00013	0.0000068	Deer Mouse	0.000068	Deer Mouse
PCB-105	32598144	1,1'-Biphenyl, 2,3,3',4,4'-pentachloro	X	X		NC	0.00000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-114	74472370	PCB 114 (BZ)	X	X		NC	0.00000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-118	31508006	-	X	X		NC	0.00000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-123	65510443	123-PeCB	X	X		NC	0.00000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-126	57465288	-	X	X		NC	0.00000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-156	38380084	2,3,3',4,4',5-hexachloro-	X	X		NC	0.00000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-157	69782907	PCB 157 (BZ)	X	X		NC	0.00000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-167	52663726	167-HxCB	X	X		NC	0.00000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-169	32774166	-	X	X		NC	0.00000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-189	39635319	-	X	X		NC	0.00000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 12-2
Summary of the Ecological Risk-Based Screening Levels for Chemicals Detected in Ephemeral/Permanent Surface Water, Seeps/Springs, and/or Near-surface Groundwater

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Ephemeral or Permanent Surface Water or Seeps and Springs [a]	Chemicals Detected in Ephemeral or Permanent Surface Water [a]	Chemicals Detected in Ephemeral Surface Water, Seeps and Springs, or Near-Surface Groundwater [b]	Terrestrial Plants	Water Column Community	Great Blue Heron		Deer Mouse		Hermit Thrush		Mule Deer		Bobcat		Lowest RBSL			
						Benchmark-Based RBSL [c] (mg/L)	Benchmark-Based RBSL [c] (mg/L)	Low TRV-Based RBSL [c] (mg/L)	High TRV-Based RBSL [c] (mg/L)	Low TRV-Based RBSL [c] (mg/L)	High TRV-Based RBSL [c] (mg/L)	Low TRV-Based RBSL [c] (mg/L)	High TRV-Based RBSL [c] (mg/L)	Low TRV-Based RBSL [c] (mg/L)	High TRV-Based RBSL [c] (mg/L)	Low TRV-Based RBSL [c] (mg/L)	High TRV-Based RBSL [c] (mg/L)	Low TRV-Based RBSL [c,d] (mg/L)	Receptor	High TRV-Based RBSL [c,d] (mg/L)	Receptor
PCB-77	32598133	77-TeCB	X	X		NC	0.00000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-81	70362504	81-TeCB	X	X		NC	0.00000001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Parameters						NC															
Chloride	16887006	-	X	X	X	NTV	230	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
Chlorine	7782505	-	X	X		NC	0.011	NTV	NTV	97	NTV	NTV	NTV	210	NTV	180	NTV	97	Deer Mouse	NTV	NA
Nitrate	NO3N	-	X	X	X	NTV	NTV	NTV	NTV	3,420	7,630	NTV	NTV	7,390	16,500	6,450	14,400	3,420	Deer Mouse	7,630	Deer Mouse
Nitrite-NO2	E-10128	-	X	X		NC	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
Oil content	E-10140	-	X	X		NC	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
Sulfate	14808798	-	X	X	X	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA

Notes:

[a] Chemicals detected in Groups 4 (Coca only), 6 (SRE only), 1B, 5, 10, 3 (WCT only), and 9 (Silvernale only) surface water or site wide seeps and springs.

[b] Chemicals detected in site wide near-surface groundwater, seeps, and springs.

[c] Calculated with a target hazard quotient of 1. EcoRBSLs for terrestrial plants and the water column community are equivalent to their respective medium-specific benchmarks; therefore, these EcoRBSLs were reported in the same number of significant figures as the source documents from which the benchmarks were selected. Avian and mammalian EcoRBSLs are calculated rather than derived from published values; therefore, EcoRBSLs with values less than 1,000 were reported using two significant figures and values greater than 1,000 were reported using three significant figures.

[d] Lowest Low and lowest High TRV-based RBSL selected from the EcoRBSLs for upper trophic level receptors only.

[e] As there are no toxicity equivalency factors (TEFs) available for plants, no EcoRBSLs for 2,3,7,8-TCDD TEQ and PCB TEQ (Coplanar PCBs) were derived. Since water EcoRBSLs for 2,3,7,8-TCDD TEQ and PCB TEQ (Coplanar PCBs) only apply to mammals, birds, and fish (i.e., water column community), individual dioxin/furan and coplanar PCB congeners are presented for evaluation of plants exposed to these chemicals in water media.

-- Not available, or could not be located
DDT - dichlorodiphenyltrichloroethane
High TRV - mid level effect toxicity reference value
Low TRV - no effect toxicity reference value
mg/L - milligrams per liter
NA - not applicable
NC - not calculated
NTV - no toxicity value
PCDD/PCDF - polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans
RBSL - risk-based screening level
TCDD - Tetrachlorodibenzo-p-dioxin
TEQ - toxicity equivalent
X - Analyte was detected in the indicated medium

Table 12-3
Summary of the Ecological Risk-Based Screening Levels for Chemicals Detected in Ephemeral and/or Permanent Sediment

				Sediment Benthic Community		Great Blue Heron		Lowest RBSL			
Chemical	**CAS#**	**Chemical Synonym**	**Chemicals Detected in Ephermal or Perennial Sediment [a]**	**Low Benchmark-Based RBSL [b] (mg/kg)**	**High Benchmark-Based RBSL [b] (mg/kg)**	**Low TRV-Based RBSL [b] (mg/kg)**	**High TRV-Based RBSL [b] (mg/kg)**	**Low TRV-Based RBSL [b, c] (mg/kg)**	**Receptor**	**High TRV-Based RBSL [b, c] (mg/kg)**	**Receptor**
Inorganic Compounds											
Aluminum	7429905	Aluminum, Total	X	25,500	NTV	43,800	NTV	25,500	Sediment Benthic Community	NTV	NA
Antimony	7440360	Antimony, Total	X	2	3	NTV	NTV	2	Sediment Benthic Community	3	Sediment Benthic Community
Arsenic	7440382	Arsenic, Total	X	9.79	33	820	3,280	9.79	Sediment Benthic Community	33	Sediment Benthic Community
Barium	7440393	Barium, Total	X	48	NTV	740	1,490	48	Sediment Benthic Community	1,490	Great Blue Heron
Beryllium	7440417	Beryllium, Total	X	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
Boron	7440428	Boron, Total	X	NTV	NTV	520	1,800	520	Great Blue Heron	1,800	Great Blue Heron
Cadmium	7440439	Cadmium, Total	X	0.99	4.98	15	250	0.99	Sediment Benthic Community	4.98	Sediment Benthic Community
Chromium	7440473	Chromium, Total	X	43.4	111	130	780	43.4	Sediment Benthic Community	111	Sediment Benthic Community
Cobalt	7440484	Cobalt, Total	X	10	NTV	1,850	4,380	10	Sediment Benthic Community	4,380	Great Blue Heron
Copper	7440508	Copper, Total	X	31.6	149	41	940	31.6	Sediment Benthic Community	149	Sediment Benthic Community
Fluoride	7782414	-	X	NTV	NTV	120	490	120	Great Blue Heron	490	Great Blue Heron
Lead	7439921	Lead, Total	X	35.8	128	1.1	830	1.1	Great Blue Heron	128	Sediment Benthic Community
Manganese	7439965	Manganese, Total	X	630	1,100	4,090	40,900	630	Sediment Benthic Community	1,100	Sediment Benthic Community
Mercury	7439976	Mercury, Total	X	0.18	1.06	7.2	14	0.18	Sediment Benthic Community	1.06	Sediment Benthic Community
Molybdenum	7439987	Molybdenum, Total	X	NTV	NTV	66	660	66	Great Blue Heron	660	Great Blue Heron
Nickel	7440020	Nickel, Total	X	22.7	48.6	96	3,900	22.7	Sediment Benthic Community	48.6	Sediment Benthic Community
Selenium	7782492	Selenium, Total	X	1	NTV	0.84	3.4	0.84	Great Blue Heron	3.4	Great Blue Heron
Silver	7440224	Silver, Total	X	1	4.5	31	930	1	Sediment Benthic Community	4.5	Sediment Benthic Community
Strontium	7440246	Strontium, Total	X	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
Thallium	7440280	Thallium, Total	X	NTV	NTV	6.5	65	6.5	Great Blue Heron	65	Great Blue Heron
Tin	7440315	Tin, Total	X	0.048	NTV	110	260	0.048	Sediment Benthic Community	260	Great Blue Heron
Titanium	7440326	Titanium, Total	X	NTV	NTV	15	150	15	Great Blue Heron	150	Great Blue Heron
Zinc	7440666	Zinc, Total	X	121	459	560	5,560	121	Sediment Benthic Community	459	Sediment Benthic Community
Energetic Constituents											
1,2-Dinitrobenzene	528290	o-Dinitrobenzene	X	NTV	NTV	6.5	65	6.5	Great Blue Heron	65	Great Blue Heron
1,3-Dinitrobenzene	99650	m-Dinitrobenzene	X	NTV	NTV	2.6	26	2.6	Great Blue Heron	26	Great Blue Heron
2,4,6-Trinitrotoluene	118967	-	X	0.092	NTV	1.1	28	0.092	Sediment Benthic Community	28	Great Blue Heron
2,4-diamino-6-nitrotoluene	6629294	-	X	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
2,4-Dinitrotoluene	121142	-	X	0.0416	NTV	0.0018	0.23	0.0018	Great Blue Heron	0.23	Great Blue Heron
2-Amino-4,6-Dinitrotoluene	35572782	-	X	0.0416	NTV	0.15	20	0.0416	Sediment Benthic Community	20	Great Blue Heron
2-Nitrotoluene	88722	-	X	4.06	NTV	NTV	NTV	4.06	Sediment Benthic Community	NTV	NA
3-Nitrotoluene	99081	-	X	4.06	NTV	NTV	NTV	4.06	Sediment Benthic Community	NTV	NA
4-Amino-2,6-dinitrotoluene	19406510	4-Am-2,6-DNT	X	0.0416	NTV	NTV	NTV	0.0416	Sediment Benthic Community	NTV	NA
4-Nitrotoluene	99990	-	X	4.06	NTV	NTV	NTV	4.06	Sediment Benthic Community	NTV	NA
HMX	2691410	-	X	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
Nitroglycerin	55630	-	X	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
Perchlorate	14797730	-	X	NTV	NTV	200	400	200	Great Blue Heron	400	Great Blue Heron
PETN	78115	-	X	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
RDX	121824	-	X	0.013	NTV	56	130	0.013	Sediment Benthic Community	130	Great Blue Heron
Tetryl	479458	-	X	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
Volatile Organic Compounds											
1,1,1,2-Tetrachloroethane	630206	-	X	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
1,1,1-Trichloroethane	71556	-	X	0.03	NTV	NTV	NTV	0.03	Sediment Benthic Community	NTV	NA
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	Freon 113	X	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
1,1-Dichloroethane	75343	-	X	0.027	NTV	270	530	0.027	Sediment Benthic Community	530	Great Blue Heron
1,1-Dichloroethene	75354	-	X	0.031	NTV	NTV	NTV	0.031	Sediment Benthic Community	NTV	NA
1,1-Dichloropropene	563586	-	X	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA

Table 12-3
Summary of the Ecological Risk-Based Screening Levels for Chemicals Detected in Ephemeral and/or Permanent Sediment

				Sediment Benthic Community		Great Blue Heron		Lowest RBSL			
Chemical	CAS#	Chemical Synonym	Chemicals Detected in Ephermal or Perennial Sediment [a]	Low Benchmark-Based RBSL [b] (mg/kg)	High Benchmark-Based RBSL [b] (mg/kg)	Low TRV-Based RBSL [b] (mg/kg)	High TRV-Based RBSL [b] (mg/kg)	Low TRV-Based RBSL [b, c] (mg/kg)	Receptor	High TRV-Based RBSL [b, c] (mg/kg)	Receptor
1,2,4-Trimethylbenzene	95636	-	X	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
1,2-Dibromoethane	106934	-	X	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
1,2-Dichlorobenzene	95501	o-Dichlorobenzene	X	0.013	NTV	NTV	NTV	0.013	Sediment Benthic Community	NTV	NA
1,2-Dichloroethane	107062	-	X	0.25	NTV	270	530	0.25	Sediment Benthic Community	530	Great Blue Heron
1,2-Dichloropropane	78875	-	X	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
1,3,5-Trimethylbenzene	108678	-	X	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
1,3-Dichlorobenzene	541731	m-Dichlorobenzene	X	0.013	NTV	NTV	NTV	0.013	Sediment Benthic Community	NTV	NA
1,3-Dichloropropane	142289	-	X	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
1,4-Dichlorobenzene	106467	p-Dichlorobenzene	X	0.11	NTV	NTV	NTV	0.11	Sediment Benthic Community	NTV	NA
2-Chloroethylvinyl ether	110758	2-Chloroethyl vinyl ether	X	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
2-Hexanone	591786	Methyl butyl ketone	X	0.022	NTV	NTV	NTV	0.022	Sediment Benthic Community	NTV	NA
Acetone	67641	-	X	0.0087	NTV	42,200	NTV	0.0087	Sediment Benthic Community	NTV	NA
Benzene	71432	-	X	0.16	NTV	NTV	NTV	0.16	Sediment Benthic Community	NTV	NA
Bromide	24959679	-	X	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
Bromochloromethane	74975	-	X	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
Bromodichloromethane	75274	-	X	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
Bromomethane	74839	-	X	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
Carbon Disulfide	75150	-	X	0.00085	NTV	NTV	NTV	0.00085	Sediment Benthic Community	NTV	NA
Chloroethane	75003	Ethyl chloride	X	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
Chloroform	67663	Trichloromethane	X	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
Chloromethane	74873	Methyl chloride	X	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
cis-1,2-Dichloroethene	156592	cis-1,2-Dichloroethylene	X	0.031	NTV	NTV	NTV	0.031	Sediment Benthic Community	NTV	NA
cis-1,3-Dichloropropene	10061015	-	X	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
Cumene	98828	Isopropylbenzene	X	0.086	NTV	0.14	1.4	0.086	Sediment Benthic Community	1.4	Great Blue Heron
Dibromomethane	74953	-	X	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
Dichlorodifluoromethane	75718	Freon 12	X	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
Ethylbenzene	100414	-	X	0.004	NTV	NTV	NTV	0.004	Sediment Benthic Community	NTV	NA
Methyl isobutyl ketone (MIBK)	108101	4-Methyl-2-pentanone	X	0.033	NTV	15	150	0.033	Sediment Benthic Community	150	Great Blue Heron
Methyl-tert-butyl- Ether (MTBE)	1634044	-	X	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
Methylene chloride	75092	Dichloromethane	X	0.37	NTV	NTV	NTV	0.37	Sediment Benthic Community	NTV	NA
m-Xylene & p-Xylene	136777612	meta- and para-Xylenes	X	0.16	NTV	250	NTV	0.16	Sediment Benthic Community	NTV	NA
n-Butylbenzene	104518	-	X	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
Nitrobenzene	98953	-	X	0.021	NTV	NTV	NTV	0.021	Sediment Benthic Community	NTV	NA
n-Propylbenzene	103651	-	X	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
o-Xylene	95476	-	X	0.16	NTV	290	NTV	0.16	Sediment Benthic Community	NTV	NA
p-Cymene	99876	p-Isopropyltoluene	X	0.086	NTV	0.20	2.0	0.086	Sediment Benthic Community	2.0	Great Blue Heron
sec-Butylbenzene	135988	-	X	0.086	NTV	0.026	0.26	0.026	Great Blue Heron	0.26	Great Blue Heron
Styrene	100425	Vinylbenzene	X	0.559	NTV	NTV	NTV	0.559	Sediment Benthic Community	NTV	NA
tert-Butylbenzene	98066	-	X	0.086	NTV	0.062	0.62	0.062	Great Blue Heron	0.62	Great Blue Heron
Tetralin	119642	-	X	0.18	0.56	8.4	42	0.18	Sediment Benthic Community	0.56	Sediment Benthic Community
Tetrachloroethene	127184	-	X	0.41	NTV	NTV	NTV	0.41	Sediment Benthic Community	NTV	NA
Toluene	108883	Toluol	X	0.05	NTV	NTV	NTV	0.05	Sediment Benthic Community	NTV	NA

Table 12-3
Summary of the Ecological Risk-Based Screening Levels for Chemicals Detected in Ephemeral and/or Permanent Sediment

				Sediment Benthic Community		Great Blue Heron		Lowest RBSL			
Chemical	**CAS#**	**Chemical Synonym**	**Chemicals Detected in Ephermal or Perennial Sediment [a]**	**Low Benchmark-Based RBSL [b] (mg/kg)**	**High Benchmark-Based RBSL [b] (mg/kg)**	**Low TRV-Based RBSL [b] (mg/kg)**	**High TRV-Based RBSL [b] (mg/kg)**	**Low TRV-Based RBSL [b, c] (mg/kg)**	**Receptor**	**High TRV-Based RBSL [b, c] (mg/kg)**	**Receptor**
trans-1,2-Dichloroethene	156605	-	X	0.40	NTV	NTV	NTV	0.40	Sediment Benthic Community	NTV	NA
trans-1,3-Dichloropropene	10061026	-	X	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
Trichloroethene	79016	Trichloroethylene (TCE)	X	0.0969	NTV	NTV	NTV	0.0969	Sediment Benthic Community	NTV	NA
Vinyl chloride	75014	-	X	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
Semi-Volatile Organic Compounds											
1,2-Dibromo-3-chloropropane	96128	1,2-Dibromo-3-CPA	X	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
2,6-Dinitrotoluene	606202	-	X	0.0416	NTV	NTV	NTV	0.0416	Sediment Benthic Community	NTV	NA
Benzoic acid	65850	-	X	0.065	NTV	15	150	0.065	Sediment Benthic Community	150	Great Blue Heron
bis(2-Ethylhexyl) phthalate	117817	bis(2-ethylhexyl)phthalate	X	0.18	2.6	0.00010	NTV	0.000097	Great Blue Heron	2.6	Sediment Benthic Community
Bromoform	75252	-	X	0.654	NTV	NTV	NTV	0.654	Sediment Benthic Community	NTV	NA
Butyl benzyl phthalate	85687	-	X	10.9	48	NTV	NTV	10.9	Sediment Benthic Community	48	Sediment Benthic Community
Dibromochloromethane	124481	-	X	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
Dimethyl phthalate	131113	-	X	0.006	NTV	15	150	0.006	Sediment Benthic Community	150	Great Blue Heron
Di-n-butyl phthalate	84742	Di-n-butylphthalate	X	0.058	0.11	0.0033	0.033	0.0033	Great Blue Heron	0.033	Great Blue Heron
Formaldehyde	50000	-	X	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
Hexachlorobutadiene	87683	-	X	0.0013	NTV	35	NTV	0.0013	Sediment Benthic Community	NTV	NA
n-Nitrosodimethylamine	62759	Nitrosodimethylamine	X	0.028	NTV	NTV	NTV	0.028	Sediment Benthic Community	NTV	NA
p-Cresol	106445	4-Methylphenol	X	0.10	NTV	15	150	0.10	Sediment Benthic Community	150	Great Blue Heron
Polynuclear Aromatic Hydrocarbons											
Acenaphthene	83329	-	X	0.0067	0.29	0.092	0.92	0.0067	Sediment Benthic Community	0.29	Sediment Benthic Community
Anthracene	120127	-	X	0.0572	0.845	0.037	0.37	0.037	Great Blue Heron	0.37	Great Blue Heron
Benzo(a)anthracene	56553	Benz[a]anthracene	X	0.108	1.05	600	NTV	0.108	Sediment Benthic Community	1.05	Sediment Benthic Community
Benzo(a)pyrene	50328	Benzo (a) pyrene	X	0.15	1.45	820	NTV	0.15	Sediment Benthic Community	1.45	Sediment Benthic Community
Benzo(b)fluoranthene	205992	Benz[e]acephenanthrylene 1	X	1.8	NTV	540	NTV	1.8	Sediment Benthic Community	NTV	NA
Benzo(e)pyrene	192972	-	X	0.195	1.52	820	NTV	0.195	Sediment Benthic Community	1.52	Sediment Benthic Community
Benzo(ghi)perylene	191242	Benzo (g,h,i) perylene	X	0.17	0.3	780	NTV	0.17	Sediment Benthic Community	0.3	Sediment Benthic Community
Benzo(k)fluoranthene	207089	Benzo[k]fluoranthene	X	0.0272	13.4	710	NTV	0.0272	Sediment Benthic Community	13.4	Sediment Benthic Community
Chrysene	218019	-	X	0.166	1.29	620	NTV	0.166	Sediment Benthic Community	1.29	Sediment Benthic Community
Dibenzo(a,h)anthracene	53703	Dibenz (a,h) anthracene	X	0.033	0.1	300	NTV	0.033	Sediment Benthic Community	0.1	Sediment Benthic Community
Fluoranthene	206440	-	X	0.423	2.23	1,050	NTV	0.423	Sediment Benthic Community	2.23	Sediment Benthic Community
Fluorene	86737	-	X	0.0774	0.536	0.056	0.56	0.056	Great Blue Heron	0.536	Sediment Benthic Community
Indeno(1,2,3-cd)pyrene	193395	Indeno (1,2,3-cd) pyrene	X	0.01732	0.33	NTV	NTV	0.01732	Sediment Benthic Community	0.33	Sediment Benthic Community
Phenanthrene	85018	-	X	0.204	1.17	30	300	0.204	Sediment Benthic Community	1.17	Sediment Benthic Community
Pyrene	129000	-	X	0.195	1.52	810	NTV	0.195	Sediment Benthic Community	1.52	Sediment Benthic Community
Pesticides											
4,4'-DDD	72548	p,p'-DDD	X	0.00488	0.028	0.000016	0.0026	0.000016	Great Blue Heron	0.0026	Great Blue Heron
Terphenyls											

Table 12-3
Summary of the Ecological Risk-Based Screening Levels for Chemicals Detected in Ephemeral and/or Permanent Sediment

				Sediment Benthic Community		Great Blue Heron		Lowest RBSL			
Chemical	**CAS#**	**Chemical Synonym**	**Chemicals Detected in Ephermal or Perennial Sediment [a]**	**Low Benchmark-Based RBSL [b] (mg/kg)**	**High Benchmark-Based RBSL [b] (mg/kg)**	**Low TRV-Based RBSL [b] (mg/kg)**	**High TRV-Based RBSL [b] (mg/kg)**	**Low TRV-Based RBSL [b, c] (mg/kg)**	**Receptor**	**High TRV-Based RBSL [b, c] (mg/kg)**	**Receptor**
o-Terphenyl	84151	-	X	NTV	NTV	0.0043	0.043	0.0043	Great Blue Heron	0.043	Great Blue Heron
p-Terphenyl	92944	-	X	NTV	NTV	0.0016	0.016	0.0016	Great Blue Heron	0.016	Great Blue Heron
Total Petroleum Hydrocarbons											
TPH-Diesel Range Organics (DRO)	DRO	Diesel	X	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
TPH-Gasoline Range Organics (GRO)	GRO	Gasoline	X	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
TPH-Kerosene Range Organics (KRO)	KRO	Kerosene	X	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
TPH-Oil Range Organics (ORO)	ORO	Oil Range Organics	X	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
PCDD/PCDFs [d]											
1,2,3,4,6,7,8-Heptachlorodibenzofuran	67562394	1,2,3,4,6,7,8-HpCDF	X	0.00000085	0.0000088	NA	NA	0.00000085	Sediment Benthic Community	0.0000088	Sediment Benthic Community
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	35822469	1,2,3,4,6,7,8-HpCDD	X	0.00000085	0.0000088	NA	NA	0.00000085	Sediment Benthic Community	0.0000088	Sediment Benthic Community
1,2,3,4,7,8,9-Heptachlorodibenzofuran	55673897	1,2,3,4,7,8,9-HpCDF	X	0.00000085	0.0000088	NA	NA	0.00000085	Sediment Benthic Community	0.0000088	Sediment Benthic Community
1,2,3,4,7,8-Hexachlorodibenzofuran	70648269	HxCDF	X	0.00000085	0.0000088	NA	NA	0.00000085	Sediment Benthic Community	0.0000088	Sediment Benthic Community
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	39227286	1,2,3,4,7,8-HxCDD	X	0.00000085	0.0000088	NA	NA	0.00000085	Sediment Benthic Community	0.0000088	Sediment Benthic Community
1,2,3,6,7,8-Hexachlorodibenzofuran	57117449	HxCDF	X	0.00000085	0.0000088	NA	NA	0.00000085	Sediment Benthic Community	0.0000088	Sediment Benthic Community
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	57653857	1,2,3,6,7,8-HxCDD	X	0.00000085	0.0000088	NA	NA	0.00000085	Sediment Benthic Community	0.0000088	Sediment Benthic Community
1,2,3,7,8,9-Hexachlorodibenzofuran	72918219	HxCDF	X	0.00000085	0.0000088	NA	NA	0.00000085	Sediment Benthic Community	0.0000088	Sediment Benthic Community
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	19408743	1,2,3,7,8,9-HxCDD	X	0.00000085	0.0000088	NA	NA	0.00000085	Sediment Benthic Community	0.0000088	Sediment Benthic Community
1,2,3,7,8-Pentachlorodibenzofuran	57117416	1,2,3,7,8-PeCDF	X	0.00000085	0.0000088	NA	NA	0.00000085	Sediment Benthic Community	0.0000088	Sediment Benthic Community
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	40321764	1,2,3,7,8-PeCDD	X	0.00000085	0.0000088	NA	NA	0.00000085	Sediment Benthic Community	0.0000088	Sediment Benthic Community
2,3,4,6,7,8-Hexachlorodibenzofuran	60851345	-	X	0.00000085	0.0000088	NA	NA	0.00000085	Sediment Benthic Community	0.0000088	Sediment Benthic Community
2,3,4,7,8-Pentachlorodibenzofuran	57117314	2,3,4,7,8-PeCDF	X	0.00000085	0.0000088	NA	NA	0.00000085	Sediment Benthic Community	0.0000088	Sediment Benthic Community
2,3,7,8-TCDD	1746016	2,3,7,8-Tetrachlorodibenzo-p-dioxin	X	0.00000085	0.0000088	NA	NA	0.00000085	Sediment Benthic Community	0.0000088	Sediment Benthic Community
2,3,7,8-Tetrachlorodibenzofuran	51207319	2,3,7,8-TCDF	X	0.00000085	0.0000088	NA	NA	0.00000085	Sediment Benthic Community	0.0000088	Sediment Benthic Community
2,3,7,8-TCDD_TEQ_Bird	1746016-TEQ_Bird	-	X	NA	NA	0.00011	0.0011	0.00011	Great Blue Heron	0.0011	Great Blue Heron
2,3,7,8-TCDD_TEQ_Mammal	1746016-TEQ_Mammal	-	X	NA	NA	NA	NA	NA	NA	NA	NA
Octachlorodibenzofuran	39001020	OCDF	X	0.00000085	0.0000088	NA	NA	0.00000085	Sediment Benthic Community	0.0000088	Sediment Benthic Community
Octachlorodibenzo-p-dioxin	3268879	-	X	0.00000085	0.0000088	NA	NA	0.00000085	Sediment Benthic Community	0.0000088	Sediment Benthic Community
Polychlorinated Biphenyls (PCBs) [d]											
Aroclor 1016	12674112	-	X	0.0598	0.34	1.3	13	0.0598	Sediment Benthic Community	0.34	Sediment Benthic Community
Aroclor 1254	11097691	-	X	0.0598	0.34	0.23	2.6	0.0598	Sediment Benthic Community	0.34	Sediment Benthic Community
PCB_TEQ_Bird (Coplanar PCBs)	1746016-PCB TEQ_Bird	-	X	NA	NA	0.00011	0.0011	0.00011	Great Blue Heron	0.0011	Great Blue Heron
PCB_TEQ_Mammal (Coplanar PCBs)	1746016-PCB TEQ_Mammal	-	X	NA	NA	NA	NA	NA	NA	NA	NA
PCB-105	32598144	1,1'-Biphenyl, 2,3,3',4,4'-pentachloro-	X	0.00000085	0.0000088	NA	NA	0.00000085	Sediment Benthic Community	0.0000088	Sediment Benthic Community
PCB-114	74472370	PCB 114 (BZ)	X	0.00000085	0.0000088	NA	NA	0.00000085	Sediment Benthic Community	0.0000088	Sediment Benthic Community

Table 12-3
Summary of the Ecological Risk-Based Screening Levels for Chemicals Detected in Ephemeral and/or Permanent Sediment

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Ephermal or Perennial Sediment [a]	Sediment Benthic Community		Great Blue Heron		Lowest RBSL			
				Low Benchmark-Based RBSL [b] (mg/kg)	High Benchmark-Based RBSL [b] (mg/kg)	Low TRV-Based RBSL [b] (mg/kg)	High TRV-Based RBSL [b] (mg/kg)	Low TRV-Based RBSL [b, c] (mg/kg)	Receptor	High TRV-Based RBSL [b, c] (mg/kg)	Receptor
PCB-123	65510443	123-PeCB	X	0.00000085	0.0000088	NA	NA	0.00000085	Sediment Benthic Community	0.0000088	Sediment Benthic Community
PCB-126	57465288	-	X	0.00000085	0.0000088	NA	NA	0.00000085	Sediment Benthic Community	0.0000088	Sediment Benthic Community
PCB-156	38380084	1,1'-Biphenyl, 2,3,3',4,4',5-hexachloro-	X	0.00000085	0.0000088	NA	NA	0.00000085	Sediment Benthic Community	0.0000088	Sediment Benthic Community
PCB-157	69782907	PCB 157 (BZ)	X	0.00000085	0.0000088	NA	NA	0.00000085	Sediment Benthic Community	0.0000088	Sediment Benthic Community
PCB-167	52663726	167-HxCB	X	0.00000085	0.0000088	NA	NA	0.00000085	Sediment Benthic Community	0.0000088	Sediment Benthic Community
PCB-169	32774166	-	X	0.00000085	0.0000088	NA	NA	0.00000085	Sediment Benthic Community	0.0000088	Sediment Benthic Community
PCB-189	39635319	-	X	0.00000085	0.0000088	NA	NA	0.00000085	Sediment Benthic Community	0.0000088	Sediment Benthic Community
PCB-77	32598133	77-TeCB	X	0.00000085	0.0000088	NA	NA	0.00000085	Sediment Benthic Community	0.0000088	Sediment Benthic Community
PCB-81	70362504	81-TeCB	X	0.00000085	0.0000088	NA	NA	0.00000085	Sediment Benthic Community	0.0000088	Sediment Benthic Community
Chemical Parameters											
Chloride	16887006	-	X	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
Nitrate	NO3N	-	X	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
Nitrite-NO2	E-10128	-	X	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
Sulfate	14808798	-	X	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA

Notes:

[a] Chemicals detected in Groups 4 (Coca only), 6 (SRE only), 1B, 5, 10, 3 (WCT only), and 9 (Silvernale only) sediment.

[b] Calculated with a target hazard quotient of 1. EcoRBSLs for the sediment benthic community are equivalent to their respective medium-specific benchmarks; therefore, these EcoRBSLs were reported in the same number of significant figures as the source documents from which the benchmarks were selected. Avian EcoRBSLs are calculated rather than derived from published values; therefore, EcoRBSLs with values less than 1,000 were reported using two significant figures and values greater than 1,000 were reported using three significant figures.

[c] Lowest Low and lowest High TRV-based EcoRBSL selected as the lower of the sediment benthic community and the great blue heron EcoRBSLs.

[d] As there are no toxicity equivalency factors (TEFs) available for the sediment bethic community, no EcoRBSLs for 2,3,7,8-TCDD TEQ and PCB TEQ (Coplanar PCBs) were derived. Since sediment EcoRBSLs for 2,3,7,8-TCDD TEQ and PCB TEQ (Coplanar PCBs) only apply to mammals and birds, individual dioxin/furan and coplanar PCB congeners are presented for evaluation of the sediment benthic community exposed to these chemicals in sediment.

-- Not available, or could not be located
DDD - dichlorodiphenyldichloroethane
High TRV - mid level effect toxicity reference value
Low TRV - no effect toxicity reference value
mg/kg - milligrams per kilogram
NA - not applicable
NTV - no toxicity value
PCDD/PCDF - polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans
RBSL - risk-based screening level
TCDD - Tetrachlorodibenzo-p-dioxin
TEQ - toxicity equivalent
X - Analyte was detected in the indicated medium

Table 12-4
Summary of the Ecological Risk-Based Screening Levels for Chemicals Detected in Soil

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil or Ephemeral Sediment [a]	Terrestrial Plants	Soil Invertebrates	Deer Mouse		Hermit Thrush		Mule Deer		Red-tailed Hawk		Bobcat		Lowest RBSL			
				Benchmark-Based RBSL [b] (mg/kg)	Benchmark-Based RBSL [b] (mg/kg)	Low TRV-Based RBSL [b] (mg/kg)	High TRV-Based RBSL [b] (mg/kg)	Low TRV-Based RBSL [b] (mg/kg)	High TRV-Based RBSL [b] (mg/kg)	Low TRV-Based RBSL [b] (mg/kg)	High TRV-Based RBSL [b] (mg/kg)	Low TRV-Based RBSL [b] (mg/kg)	High TRV-Based RBSL [b] (mg/kg)	Low TRV-Based RBSL [b] (mg/kg)	High TRV-Based RBSL [b] (mg/kg)	Low TRV-Based RBSL [b, c] mg/kg	Receptor	High TRV-Based RBSL [b,c] mg/kg	Receptor
Inorganic Compounds																			
Aluminum	7429905	Aluminum, Total	X	50	NTV	16	160	950	NTV	63	630	11,700	NTV	480	4,810	16	Deer Mouse	160	Deer Mouse
Antimony	7440360	Antimony, Total	X	5	78	0.042	2.0	NTV	NTV	0.27	13	NTV	NTV	3.0	140	0.042	Deer Mouse	2.0	Deer Mouse
Arsenic	7440382	Arsenic, Total	X	18	60	2.1	31	36	150	10	150	4,770	19,100	650	9,510	2.1	Deer Mouse	31	Deer Mouse
Barium	7440393	Barium, Total	X	500	330	120	200	44	89	1,260	2,020	750	1,510	4,370	7,000	44	Hermit Thrush	89	Hermit Thrush
Beryllium	7440417	Beryllium, Total	X	10	40	4.8	13	NTV	NTV	21	56	NTV	NTV	16	42	4.8	Deer Mouse	13	Deer Mouse
Boron	7440428	Boron, Total	X	0.5	NTV	22	73	23	81	94	320	32	110	73	250	22	Deer Mouse	73	Deer Mouse
Cadmium	7440439	Cadmium, Total	X	32	140	0.019	0.81	0.20	3.0	0.14	6.1	2.3	34	0.45	20	0.019	Deer Mouse	0.81	Deer Mouse
Chromium	7440473	Chromium, Total	X	1	64	1.9	46	2.4	14	6.3	150	240	1,420	500	12,000	1.9	Deer Mouse	14	Hermit Thrush
Cobalt	7440484	Cobalt, Total	X	13	300	12	190	80	190	44	730	390	920	140	2,380	12	Deer Mouse	190	Deer Mouse
Copper	7440508	Copper, Total	X	70	80	1.5	350	1.1	24	35	8,320	39	900	110	25,200	1.1	Hermit Thrush	24	Hermit Thrush
Cyanides	57125	Cyanide, Total	X	0.9	0.9	320	NTV	0.18	1.8	1,680	NTV	0.52	5.2	2,070	NTV	0.18	Hermit Thrush	1.8	Hermit Thrush
Fluoride	7782414	-	X	200	NTV	140	240	35	140	770	1,290	100	410	950	1,590	35	Hermit Thrush	140	Hermit Thrush
Hexavalent Chromium	18540299	Chromium,	X	30	0.4	7.3	30	NTV	NTV	24	100	NTV	NTV	1,920	7,890	7.3	Deer Mouse	30	Deer Mouse
Lead	7439921	Lead, Total	X	115	1,700	3.8	910	0.062	39	12	2,790	0.63	400	110	25,400	0.062	Hermit Thrush	39	Hermit Thrush
Lithium	7439932	Lithium, Total	X	2	NTV	43	87	NTV	NTV	230	460	NTV	NTV	280	570	43	Deer Mouse	87	Deer Mouse
Manganese	7439965	Manganese, Total	X	220	450	79	920	450	4,500	390	4,560	6,650	66,500	2,740	31,800	79	Deer Mouse	920	Deer Mouse
Mercury	7439976	Mercury, Total	X	0.3	0.1	2.2	NTV	0.87	1.7	30	NTV	30	61	160	NTV	0.87	Hermit Thrush	1.7	Hermit Thrush
Methyl Mercury	22967926	-	X	NTV	2.5	1.2	18	0.18	0.82	0.66	6.6	0.50	2.3	0.81	8.1	0.18	Hermit Thrush	0.82	Hermit Thrush
Molybdenum	7439987	Molybdenum, Total	X	2	NTV	0.13	1.3	1.8	18	0.48	4.8	16	160	2.7	27	0.13	Deer Mouse	1.3	Deer Mouse
Nickel	7440020	Nickel, Total	X	38	280	0.13	30	1.5	60	0.43	100	150	5,940	33	7,780	0.13	Deer Mouse	30	Deer Mouse
Selenium	7782492	Selenium, Total	X	0.52	4.1	0.10	2.4	0.39	1.5	2.2	40	0.51	2.1	0.26	6.3	0.10	Deer Mouse	1.5	Hermit Thrush
Silver	7440224	Silver, Total	X	560	NTV	3.5	69	0.99	29	88	1,740	6,530	194,000	45,400	897,000	0.99	Hermit Thrush	29	Hermit Thrush
Strontium	7440246	Strontium, Total	X	NTV	NTV	1,210	1,750	NTV	NTV	6,440	9,310	NTV	NTV	7,930	11,500	1,210	Deer Mouse	1,750	Deer Mouse
Thallium	7440280	Thallium, Total	X	1	1.4	2.8	8.2	1.8	18	23	67	4.5	45	14	43	1.8	Hermit Thrush	8.2	Deer Mouse
Tin	7440315	Tin, Total	X	50	NTV	110	160	31	77	570	860	88	220	710	1,060	31	Hermit Thrush	77	Hermit Thrush
Titanium	7440326	Titanium, Total	X	NTV	NTV	NTV	NTV	4.5	45	NTV	NTV	13	130	NTV	NTV	4.5	Hermit Thrush	45	Hermit Thrush
Vanadium	7440622	Vanadium, Total	X	50	130	37	84	3.3	16	150	330	27	130	750	1,690	3.3	Hermit Thrush	16	Hermit Thrush
Zinc	7440666	Zinc, Total	X	160	120	19	820	32	320	150	6,240	64	640	83	3,570	19	Deer Mouse	320	Hermit Thrush
Zirconium	7440677	Zirconium, Total	X	NTV	NTV	8.0	NTV	NTV	NTV	43	NTV	NTV	NTV	52	NTV	8.0	Deer Mouse	NTV	NA
Energetic Constituents																			
1,2-Dinitrobenzene	528290	o-Dinitrobenzene	X	NTV	NTV	0.92	2.5	1.9	19	4.9	13	5.5	55	6.0	16	0.92	Deer Mouse	2.5	Deer Mouse
1,3-Dinitrobenzene	99650	m-Dinitrobenzene	X	NTV	40	0.92	2.5	1.9	19	4.9	13	5.5	55	6.0	16	0.92	Deer Mouse	2.5	Deer Mouse
2,4,6-Trinitrotoluene	118967	-	X	NTV	55	0.13	0.65	0.23	5.8	0.35	1.8	0.91	23	1.5	7.5	0.13	Deer Mouse	0.65	Deer Mouse
2-Amino-4,6-dinitrotoluene	35572782	-	X	NTV	20.3	0.061	0.46	0.0060	0.78	0.33	280	0.13	17	3.0	23	0.0060	Hermit Thrush	0.46	Deer Mouse
HMX	2691410	-	X	NTV	6.5	110	630	NTV	NTV	960	7,000	NTV	NTV	750	2,260	110	Deer Mouse	630	Deer Mouse
Hydrazine	302012	-	X	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
Monomethylhydrazine	60344	-	X	NTV	NTV	0.35	1.7	NTV	NTV	1.8	9.2	NTV	NTV	2.3	11	0.35	Deer Mouse	1.7	Deer Mouse
Perchlorate	14797730	-	X	107	NTV	0.50	7.7	2.5	8.0	2.7	40	170	340	190	960	0.50	Deer Mouse	7.7	Deer Mouse
RDX	121824	-	X	NTV	19	0.30	1.5	3.0	6.8	17	83	47	110	9.0	45	0.30	Deer Mouse	1.5	Deer Mouse
Volatile Organic Compounds																			
1,1,1,2-Tetrachloroethane	630206	-	X	NTV	NTV	38	190	NTV	NTV	440	2,190	NTV	NTV	540	2,690	38	Deer Mouse	190	Deer Mouse
1,1,1-Trichloroethane	71556	-	X	1,000	NTV	2,460	6,240	NTV	NTV	24,500	62,000	NTV	NTV	30,200	76,300	2,460	Deer Mouse	6,240	Deer Mouse
1,1,2,2-Tetrachloroethane	79345	-	X	NTV	NTV	51	100	NTV	NTV	490	980	NTV	NTV	600	1,210	51	Deer Mouse	100	Deer Mouse
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	Freon 113	X	NTV	NTV	220	NTV	NTV	NTV	1,690	NTV	NTV	NTV	4,120	NTV	220	Deer Mouse	NTV	NA
1,1,2-Trichloroethane	79005	-	X	1,000	NTV	9.0	100	NTV	NTV	48	540	NTV	NTV	59	660	9.0	Deer Mouse	100	Deer Mouse
1,1-Dichloroethane	75343	-	X	NTV	NTV	230	NTV	78	160	1,220	NTV	220	440	1,510	NTV	78	Hermit Thrush	160	Hermit Thrush
1,1-Dichloroethene	75354	-	X	NTV	NTV	6.9	18	NTV	NTV	61	160	NTV	NTV	75	200	6.9	Deer Mouse	18	Deer Mouse
1,2,3-Trichlorobenzene	87616	-	X	48	20	10	37	NTV	NTV	150	530	NTV	NTV	220	810	10	Deer Mouse	37	Deer Mouse
1,2,4-Trichlorobenzene	120821	-	X	48	20	10	37	NTV	NTV	140	520	NTV	NTV	220	810	10	Deer Mouse	37	Deer Mouse
1,2,4-Trimethylbenzene	95636	-	X	1,000	65	3.1	4.0	NTV	NTV	33	41	NTV	NTV	62	78	3.1	Deer Mouse	4.0	Deer Mouse
1,2-Dibromoethane	106934	-	X	NTV	NTV	12	62	NTV	NTV	66	330	NTV	NTV	81	410	12	Deer Mouse	62	Deer Mouse
1,2-Dichlorobenzene	95501	o-Dichlorobenzene	X	248	NTV	130	130	NTV	NTV	1,220	1,220	NTV	NTV	2,580	2,580	130	Deer Mouse	130	Deer Mouse
1,2-Dichloroethane	107062	-	X	NTV	NTV	230	NTV	78	160	1,220	NTV	220	440	1,510	NTV	78	Hermit Thrush	160	Hermit Thrush
1,2-Dichloroethene	540590	1,2-Dichloroethenes	X	NTV	NTV	130	250	NTV	NTV	1,110	2,140	NTV	NTV	1,360	2,640	130	Deer Mouse	250	Deer Mouse
1,2-Dichloropropane	78875	-	X	NTV	700	33	160	NTV	NTV	170	870	NTV	NTV	220	1,080	33	Deer Mouse	160	Deer Mouse
1,3,5-Trimethylbenzene	108678	-	X	1,000	65	3.2	4.1	NTV	NTV	29	37	NTV	NTV	62	78	3.2	Deer Mouse	4.1	Deer Mouse
1,3-Dichlorobenzene	541731	m-Dichlorobenzene	X	248	20	23	110	NTV	NTV	220	1,100	NTV	NTV	440	2,220	23	Deer Mouse	110	Deer Mouse
1,4-Dichlorobenzene	106467	p-Dichlorobenzene	X	248	20	5.6	28	NTV	NTV	51	260	NTV	NTV	110	540	5.6	Deer Mouse	28	Deer Mouse
2-Chloroethylvinyl ether	110758	2-Chloroethyl vinyl ether	X	NTV	7.4	160	910	NTV	NTV	880	4,850	NTV	NTV	1,080	5,970	160	Deer Mouse	910	Deer Mouse
2-Hexanone	591786	Methyl butyl ketone	X	NTV	NTV	23	170	NTV	NTV	120	880	NTV	NTV	150	1,090	23	Deer Mouse	170	Deer Mouse
Acetone	67641	-	X	NTV	NTV	46	230	12,400	NTV	240	1,220	35,300	NTV	300	1,510	46	Deer Mouse	230	Deer Mouse

Table 12-4
Summary of the Ecological Risk-Based Screening Levels for Chemicals Detected in Soil

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil or Ephemeral Sediment [a]	Terrestrial Plants	Soil Invertebrates	Deer Mouse		Hermit Thrush		Mule Deer		Red-tailed Hawk		Bobcat		Lowest RBSL			
				Benchmark-Based RBSL [b] (mg/kg)	Benchmark-Based RBSL [b] (mg/kg)	Low TRV-Based RBSL [b] (mg/kg)	High TRV-Based RBSL [b] (mg/kg)	Low TRV-Based RBSL [b] (mg/kg)	High TRV-Based RBSL [b] (mg/kg)	Low TRV-Based RBSL [b] (mg/kg)	High TRV-Based RBSL [b] (mg/kg)	Low TRV-Based RBSL [b] (mg/kg)	High TRV-Based RBSL [b] (mg/kg)	Low TRV-Based RBSL [b] (mg/kg)	High TRV-Based RBSL [b] (mg/kg)	Low TRV-Based RBSL [b, c] mg/kg	Receptor	High TRV-Based RBSL [b,c] mg/kg	Receptor
Acetic Acid	64197	-	X	NTV	NTV	410	1,660	NTV	NTV	2,200	8,820	NTV	NTV	2,710	10,900	410	Deer Mouse	1,660	Deer Mouse
Benzene	71432	-	X	31	31	73	730	NTV	NTV	650	6,460	NTV	NTV	790	7,950	73	Deer Mouse	730	Deer Mouse
Bromide	24959679	-	X	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
Bromobenzene	108861	-	X	31	31	25	43	NTV	NTV	300	500	NTV	NTV	360	620	25	Deer Mouse	43	Deer Mouse
Bromodichloromethane	75274	-	X	NTV	NTV	10	51	NTV	NTV	88	440	NTV	NTV	110	540	10	Deer Mouse	51	Deer Mouse
Bromomethane	74839	-	X	NTV	NTV	3.2	16	NTV	NTV	17	87	NTV	NTV	21	110	3.2	Deer Mouse	16	Deer Mouse
Carbon Disulfide	75150	-	X	NTV	NTV	51	NTV	NTV	NTV	270	NTV	NTV	NTV	330	NTV	51	Deer Mouse	NTV	NA
Carbon Tetrachloride	56235	-	X	NTV	NTV	35	NTV	NTV	NTV	390	NTV	NTV	NTV	480	NTV	35	Deer Mouse	NTV	NA
Chlorobenzene	108907	Monochlorobenzene	X	1,000	40	21	43	NTV	NTV	230	480	NTV	NTV	290	590	21	Deer Mouse	43	Deer Mouse
Chloroform	67663	Trichloromethane	X	NTV	NTV	69	190	NTV	NTV	370	1,000	NTV	NTV	450	1,240	69	Deer Mouse	190	Deer Mouse
Chloromethane	74873	Methyl chloride	X	NTV	NTV	3.2	16	NTV	NTV	17	87	NTV	NTV	21	110	3.2	Deer Mouse	16	Deer Mouse
cis-1,2-Dichloroethene	156592	cis-1,2-Dichloroethylene	X	NTV	NTV	210	220	NTV	NTV	1,110	1,190	NTV	NTV	1,360	1,460	210	Deer Mouse	220	Deer Mouse
Cumene	98828	Isopropylbenzene	X	NTV	NTV	83	250	1.3	13	880	2,660	13	130	1,660	4,990	1.3	Hermit Thrush	13	Hermit Thrush
Dibenzofuran	132649	-	X	NTV	29	89	480	1.2	12	1,340	7,270	13	130	1,980	10,700	1.2	Hermit Thrush	12	Hermit Thrush
Dibromomethane	74953	-	X	NTV	NTV	27	230	NTV	NTV	140	1,220	NTV	NTV	180	1,510	27	Deer Mouse	230	Deer Mouse
Dichlorodifluoromethane	75718	Freon 12	X	NTV	NTV	41	410	NTV	NTV	370	3,670	NTV	NTV	450	4,520	41	Deer Mouse	410	Deer Mouse
Ethylbenzene	100414	-	X	55	55	79	240	NTV	NTV	600	1,790	NTV	NTV	1,460	4,390	79	Deer Mouse	240	Deer Mouse
Methyl ethyl ketone	78933	2-Butanone	X	NTV	NTV	8,160	21,100	NTV	NTV	43,400	112,000	NTV	NTV	53,400	138,000	8,160	Deer Mouse	21,100	Deer Mouse
Methyl isobutyl ketone (MIBK)	108101	4-Methyl-2-pentanone	X	NTV	NTV	58	21,100	4.5	45	310	112,000	13	130	380	138,000	4.5	Hermit Thrush	45	Hermit Thrush
Methylene chloride	75092	Dichloromethane	X	NTV	NTV	27	230	NTV	NTV	140	1,220	NTV	NTV	180	1,510	27	Deer Mouse	230	Deer Mouse
m-Xylene & p-Xylene	136777612	meta- and para-	X	1,000	65	3.3	4.2	1,080	NTV	26	33	9,390	NTV	62	78	3.3	Deer Mouse	4.2	Deer Mouse
n-Butylbenzene	104518	-	X	NTV	NTV	61	180	NTV	NTV	1,130	3,400	NTV	NTV	1,460	4,390	61	Deer Mouse	180	Deer Mouse
n-Propylbenzene	103651	-	X	NTV	NTV	73	220	NTV	NTV	790	2,380	NTV	NTV	1,460	4,390	73	Deer Mouse	220	Deer Mouse
o-Chlorotoluene	95498	2-Chlorotoluene	X	NTV	20	16	63	NTV	NTV	140	570	NTV	NTV	300	1,210	16	Deer Mouse	63	Deer Mouse
o-Xylene	95476	-	X	1,000	65	3.4	4.3	1,100	NTV	25	32	9,390	NTV	62	78	3.4	Deer Mouse	4.3	Deer Mouse
p-Chlorotoluene	106434	4-Chlorotoluene	X	NTV	20	16	64	NTV	NTV	140	540	NTV	NTV	300	1,210	16	Deer Mouse	64	Deer Mouse
p-Cymene	99876	p-Isopropyltoluene	X	NTV	NTV	75	230	3.7	37	1,110	3,350	41	410	1,660	4,990	3.7	Hermit Thrush	37	Hermit Thrush
sec-Butylbenzene	135988	-	X	NTV	NTV	65	200	1.0	9.8	1,420	4,270	13	130	1,660	4,990	0.98	Hermit Thrush	9.8	Hermit Thrush
Styrene	100425	Vinylbenzene	X	320	NTV	210	420	NTV	NTV	2,450	4,900	NTV	NTV	3,020	6,030	210	Deer Mouse	420	Deer Mouse
tert-Butylbenzene	98066	-	X	NTV	NTV	75	230	1.1	11	1,120	3,360	13	130	1,660	4,990	1.1	Hermit Thrush	11	Hermit Thrush
Tetralin	119642	-	X	100	29	100	560	58	290	970	5,240	540	2,690	1,980	10,700	58	Hermit Thrush	290	Hermit Thrush
Tetrachloroethene	127184	-	X	1,000	NTV	2.2	11	NTV	NTV	20	98	NTV	NTV	42	210	2.2	Deer Mouse	11	Deer Mouse
Toluene	108883	Toluol	X	200	75	59	590	NTV	NTV	640	6,370	NTV	NTV	780	7,840	59	Deer Mouse	590	Deer Mouse
trans-1,2-Dichloroethene	156605	-	X	NTV	NTV	130	240	NTV	NTV	1,110	2,140	NTV	NTV	1,360	2,640	130	Deer Mouse	240	Deer Mouse
Trichloroethene	79016	Trichloroethylene	X	3	3	1.8	18	NTV	NTV	17	170	NTV	NTV	21	210	1.8	Deer Mouse	18	Deer Mouse
Trichlorofluoromethane	75694	-	X	NTV	NTV	170	850	NTV	NTV	1,710	8,550	NTV	NTV	2,100	10,500	170	Deer Mouse	850	Deer Mouse
Vinyl chloride	75014	-	X	NTV	NTV	0.78	7.8	NTV	NTV	4.2	42	NTV	NTV	5.1	51	0.78	Deer Mouse	7.8	Deer Mouse
Xylenes, Total	1330207	Xylene (Total) Isomers	X	1,000	65	3.4	4.2	1,090	NTV	26	32	9,390	NTV	62	78	3.4	Deer Mouse	4.2	Deer Mouse
Semi-Volatile Organic Compounds																			
1,1-Dimethylhydrazine	57147	-	X	NTV	NTV	0.35	1.7	NTV	NTV	1.8	9.2	NTV	NTV	2.3	11	0.35	Deer Mouse	1.7	Deer Mouse
1,2-Dibromo-3-chloropropane	96128	1,2-Dibromo-3-CPA	X	NTV	NTV	0.28	1.4	NTV	NTV	3.3	16	NTV	NTV	4.0	20	0.28	Deer Mouse	1.4	Deer Mouse
1,4-Dioxane	123911	-	X	NTV	NTV	2.3	4.6	NTV	NTV	12	24	NTV	NTV	15	30	2.3	Deer Mouse	4.6	Deer Mouse
2,4,5-Trichlorophenol	95954	-	X	4	9	75	220	NTV	NTV	830	2,490	NTV	NTV	1,510	4,520	75	Deer Mouse	220	Deer Mouse
2,4,6-Trichlorophenol	88062	-	X	4	10	75	230	NTV	NTV	820	2,450	NTV	NTV	1,510	4,520	75	Deer Mouse	230	Deer Mouse
2,4-Dimethylphenol	105679	-	X	NTV	NTV	65	330	NTV	NTV	610	3,060	NTV	NTV	750	3,770	65	Deer Mouse	330	Deer Mouse
3,5-Dimethylphenol	108689	-	X	NTV	NTV	22	120	2.6	26	210	1,100	15	150	260	1,360	2.6	Hermit Thrush	26	Hermit Thrush
Benzoic acid	65850	-	X	NTV	NTV	20	NTV	4.5	45	110	NTV	13	130	130	NTV	4.5	Hermit Thrush	45	Hermit Thrush
Benzyl alcohol	100516	-	X	NTV	NTV	20	NTV	4.5	45	110	NTV	13	130	130	NTV	4.5	Hermit Thrush	45	Hermit Thrush
bis(2-Ethylhexyl) phthalate	117817	bis(2-ethylhexyl)phthalate	X	1,000	NTV	6.5	65	0.32	NTV	2,160	21,600	14	NTV	550	5,520	0.32	Hermit Thrush	65	Deer Mouse
Bromoform	75252	-	X	NTV	NTV	23	45	NTV	NTV	220	440	NTV	NTV	270	540	23	Deer Mouse	45	Deer Mouse
Butyl benzyl phthalate	85687	-	X	NTV	NTV	90	260	NTV	NTV	2,230	6,580	NTV	NTV	2,400	7,090	90	Deer Mouse	260	Deer Mouse
Carbazole	86748	-	X	2.0	29	98	530	1.5	15	1,090	5,910	113,000	140	1,980	10,700	1.5	Hermit Thrush	15	Hermit Thrush
Dibromochloromethane	124481	-	X	NTV	NTV	29	59	NTV	NTV	260	530	NTV	NTV	320	650	29	Deer Mouse	59	Deer Mouse
Diethyl phthalate	84662	-	X	134	NTV	11,500	NTV	2.3	23	112,000	NTV	13	130	138,000	NTV	2.3	Hermit Thrush	23	Hermit Thrush
Dimethyl phthalate	131113	-	X	134	200	21,100	NTV	4.5	45	112,000	NTV	13	130	138,000	NTV	4.5	Hermit Thrush	45	Hermit Thrush
Di-n-butyl phthalate	84742	Di-n-butylphthalate	X	200	NTV	670	2,220	0.11	1.1	13,700	45,600	1.4	14	16,600	55,300	0.11	Hermit Thrush	1.1	Hermit Thrush
Di-n-octyl phthalate	117840	Di-n-octyl-phthalate	X	200	NTV	94	930	13	130	500	4,930	38	380	620	6,070	13	Hermit Thrush	130	Hermit Thrush
Formaldehyde	50000	-	X	NTV	NTV	43	380	NTV	NTV	230	2,010	NTV	NTV	280	2,470	43	Deer Mouse	380	Deer Mouse
Hexachlorobutadiene	87683	-	X	NTV	NTV	0.022	0.11	3.0	NTV	0.57	2.9	41	NTV	0.60	3.0	0.022	Deer Mouse	0.11	Deer Mouse

Table 12-4
Summary of the Ecological Risk-Based Screening Levels for Chemicals Detected in Soil

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil or Ephemeral Sediment [a]	Terrestrial Plants	Soil Invertebrates	Deer Mouse		Hermit Thrush		Mule Deer		Red-tailed Hawk		Bobcat		Lowest RBSL			
				Benchmark-Based RBSL [b] (mg/kg)	Benchmark-Based RBSL [b] (mg/kg)	Low TRV-Based RBSL [b] (mg/kg)	High TRV-Based RBSL [b] (mg/kg)	Low TRV-Based RBSL [b] (mg/kg)	High TRV-Based RBSL [b] (mg/kg)	Low TRV-Based RBSL [b] (mg/kg)	High TRV-Based RBSL [b] (mg/kg)	Low TRV-Based RBSL [b] (mg/kg)	High TRV-Based RBSL [b] (mg/kg)	Low TRV-Based RBSL [b] (mg/kg)	High TRV-Based RBSL [b] (mg/kg)	Low TRV-Based RBSL [b, c] mg/kg	Receptor	High TRV-Based RBSL [b,c] mg/kg	Receptor
m-Cresol	108394	3-Methylphenol	X	96	NTV	1,010	NTV	5.1	51	5,370	NTV	15	150	6,610	NTV	5.1	Hermit Thrush	51	Hermit Thrush
n-Nitrosodimethylamine	62759	Nitrosodimethylamin	X	NTV	20	6.5	79	NTV	NTV	35	420	NTV	NTV	43	520	6.5	Deer Mouse	79	Deer Mouse
n-Nitrosodiphenylamine	86306	-	X	NTV	20	2.3	28	NTV	NTV	17	210	NTV	NTV	43	520	2.3	Deer Mouse	28	Deer Mouse
o-Cresol	95487	-	X	100	NTV	1,010	NTV	4.3	43	5,370	NTV	12	120	6,610	NTV	4.3	Hermit Thrush	43	Hermit Thrush
p-Chloro-m-cresol	59507	Methylphenol	X	100	NTV	8.2	82	1.7	17	60	600	15	150	150	1,510	1.7	Hermit Thrush	17	Hermit Thrush
p-Cresol	106445	4-Methylphenol	X	100	NTV	1,010	NTV	4.3	43	5,370	NTV	12	120	6,610	NTV	4.3	Hermit Thrush	43	Hermit Thrush
Pentachlorophenol	87865	PCP	X	5	31	3.8	10	2.8	21	35	97	87	670	250	690	2.8	Hermit Thrush	10	Deer Mouse
Phenol	108952	Total Phenols	X	70	30	430	720	5.1	51	2,280	3,850	15	150	2,800	4,730	5.1	Hermit Thrush	51	Hermit Thrush
p-Nitroaniline	100016	4-Nitroaniline	X	NTV	NTV	12	NTV	3.4	34	66	NTV	9.7	97	81	NTV	3.4	Hermit Thrush	34	Hermit Thrush
Polynuclear Aromatic Hydrocarbons																			
1-Methyl naphthalene	90120	1-Methylnaphthalene	X	100	29	95	510	52	260	1,180	6,390	540	2,690	1,980	10,700	52	Hermit Thrush	260	Hermit Thrush
2-Methylnaphthalene	91576	Naphthalene, 2-methyl-	X	100	29	95	520	53	260	1,170	6,350	540	2,690	1,980	10,700	53	Hermit Thrush	260	Hermit Thrush
Acenaphthene	83329	-	X	20	29	63	340	1.1	11	220	1,220	13	130	1,980	10,700	1.1	Hermit Thrush	11	Hermit Thrush
Acenaphthylene	208968	-	X	20	29	26	140	0.33	3.3	3,150	17,100	13	130	1,980	10,700	0.33	Hermit Thrush	3.3	Hermit Thrush
Anthracene	120127	-	X	2.0	29	140	770	2.2	22	1,080	5,850	14	140	1,980	10,700	2.2	Hermit Thrush	22	Hermit Thrush
Benzo(a)anthracene	56553	Benz[a]anthracene	X	1.5	18	0.81	50	28	NTV	2.9	180	250	NTV	19.0	1,150	0.81	Deer Mouse	50	Deer Mouse
Benzo(a)pyrene	50328	Benzo (a) pyrene	X	1.2	18	5.1	310	140	NTV	130	7,910	250	NTV	19.0	1,150	5.1	Deer Mouse	310	Deer Mouse
Benzo(b)fluoranthene	205992	Benz[e]acephenanthrylene 1	X	1.2	18	2.4	150	66	NTV	47	2,880	250	NTV	19.0	1,150	2.4	Deer Mouse	150	Deer Mouse
Benzo(e)pyrene	192972	-	X	1.2	18	4.4	270	120	NTV	73	4,520	250	NTV	19	1,150	4.4	Deer Mouse	270	Deer Mouse
Benzo(ghi)perylene	191242	Benzo (g,h,i) perylene	X	1.2	18	7.4	460	210	NTV	67	4,130	250	NTV	19.0	1,150	7.4	Deer Mouse	460	Deer Mouse
Benzo(k)fluoranthene	207089	Benzo[k]fluoranthene	X	1.2	18	4.9	310	140	NTV	60	3,720	250	NTV	19.0	1,150	4.9	Deer Mouse	310	Deer Mouse
Chrysene	218019	-	X	1.2	18	1.2	76	41	NTV	5.5	340	250	NTV	19.0	1,150	1.2	Deer Mouse	76	Deer Mouse
Dibenzo(a,h)anthracene	53703	anthracene	X	1.2	18	2.3	140	61	NTV	100	6,330	250	NTV	19.0	1,150	2.3	Deer Mouse	140	Deer Mouse
Fluoranthene	206440	-	X	1.9	29	160	880	54	NTV	570	3,110	250	NTV	1,980	10,700	54	Hermit Thrush	880	Deer Mouse
Fluorene	86737	-	X	1.2	29	55	300	0.89	8.9	220	1,220	13	130	1,980	10,700	0.89	Hermit Thrush	8.9	Hermit Thrush
Indeno(1,2,3-cd)pyrene	193395	Indeno (1,2,3-cd) pyrene	X	1.2	18	4.8	300	NTV	NTV	47	2,880	NTV	NTV	19.0	1,150	4.8	Deer Mouse	300	Deer Mouse
Naphthalene	91203	-	X	100	29	37	200	26	130	130	730	540	2,690	1,980	10,700	26	Hermit Thrush	130	Hermit Thrush
Perylene	198550	-	X	NTV	29	41	220	10	NTV	3,990	21,600	250	NTV	1,980	10,700	10	Hermit Thrush	220	Deer Mouse
Phenanthrene	85018	-	X	1.2	29	68	370	1.3	13	230	1,230	15.0	150	1,980	10,700	1.3	Hermit Thrush	13	Hermit Thrush
Pyrene	129000	-	X	1.2	18	1.2	73	36	NTV	8.0	490	250	NTV	19.0	1,150	1.2	Deer Mouse	73	Deer Mouse
Pesticides																			
4,4'-DDD	72548	p,p'-DDD	X	12	12	0.55	11	0.0051	0.85	43	870	0.12	19	24	480	0.0051	Hermit Thrush	0.85	Hermit Thrush
4,4'-DDE	72559	p,p'-DDE	X	12	12	0.45	9.0	0.0041	0.28	55	1,110	0.12	7.8	24	480	0.0041	Hermit Thrush	0.28	Hermit Thrush
4,4'-DDT	50293	p,p'-DDT	X	12	12	0.38	7.6	0.0035	0.58	67	1,350	0.12	19	24	480	0.0035	Hermit Thrush	0.58	Hermit Thrush
Aldrin	309002	-	X	NTV	NTV	0.057	0.57	1.4	3.1	6.9	69	40	87	3.0	30	0.057	Deer Mouse	0.57	Deer Mouse
alpha-BHC	319846	a-Benzene Hexachloride	X	1,000	NTV	0.073	5.5	0.72	2.9	0.87	65	7.2	29	1.5	110	0.073	Deer Mouse	2.9	Hermit Thrush
beta-BHC	319857	b-Benzene Hexachloride	X	1,000	NTV	0.59	2.9	0.73	2.9	6.8	34	7.2	29	12	60	0.59	Deer Mouse	2.9	Deer Mouse
Chlordane (Technical)	12789036	-	X	NTV	NTV	2.9	5.8	1.1	5.6	270	550	28	140	140	280	1.1	Hermit Thrush	5.6	Hermit Thrush
delta-BHC	319868	d-Benzene Hexachloride	X	1,000	NTV	0.067	5.1	0.65	2.6	1.0	77	7.2	29	1.5	110	0.067	Deer Mouse	2.6	Hermit Thrush
Dieldrin	60571	-	X	NTV	NTV	0.013	1.1	0.052	0.58	0.59	51	0.92	10	0.45	39	0.013	Deer Mouse	0.58	Hermit Thrush
Endosulfan I	959988	-	X	1,000	NTV	0.22	4.2	13	NTV	2.6	51	130	NTV	4.5	87	0.22	Deer Mouse	4.2	Deer Mouse
Endosulfan II	33213659	-	X	1,000	NTV	0.22	4.2	13	NTV	2.6	51	130	NTV	4.5	87	0.22	Deer Mouse	4.2	Deer Mouse
Endosulfan sulfate	1031078	-	X	1,000	NTV	0.23	4.4	13	NTV	2.4	47	130	NTV	4.5	87	0.23	Deer Mouse	4.4	Deer Mouse
Endrin	72208	-	X	NTV	NTV	0.088	0.88	0.0079	0.079	3.3	33	0.13	1.3	2.8	28	0.0079	Hermit Thrush	0.079	Hermit Thrush
Endrin aldehyde	7421934	-	X	NTV	NTV	0.10	1.0	0.0092	0.092	2.7	27	0.13	1.3	2.8	28	0.0092	Hermit Thrush	0.092	Hermit Thrush
Endrin ketone	53494705	-	X	NTV	NTV	0.095	0.95	0.0086	0.086	2.9	29	0.13	1.3	2.8	28	0.0086	Hermit Thrush	0.086	Hermit Thrush
gamma-BHC	58899	Lindane	X	1,000	NTV	0.075	5.6	2.6	26	0.83	62	26	260	1.5	110	0.075	Deer Mouse	5.6	Deer Mouse
Heptachlor	76448	-	X	1,000	NTV	0.087	4.5	0.72	3.6	7.3	380	17	85	3.9	210	0.087	Deer Mouse	3.6	Hermit Thrush
Heptachlor epoxide	1024573	-	X	1,000	NTV	0.0013	0.0065	1.1	5.6	0.040	0.20	17	85	0.038	0.19	0.0013	Deer Mouse	0.0065	Deer Mouse
MCPA	94746	-	X	NTV	NTV	0.12	0.61	220	NTV	0.97	4.9	1,900	NTV	2.3	11	0.12	Deer Mouse	0.61	Deer Mouse
Mirex	2385855	Mirex (DeChlorane)	X	NTV	NTV	0.034	0.34	26	NTV	5.8	58	850	NTV	2.1	21	0.034	Deer Mouse	0.34	Deer Mouse
p,p'-Methoxychlor	72435	-	X	NTV	NTV	2.5	50	120	NTV	84	1,680	1,900	NTV	75	1,510	2.5	Deer Mouse	50	Deer Mouse
Toxaphene	8001352	-	X	NTV	NTV	5.8	NTV	NTV	NTV	410	NTV	NTV	NTV	240	NTV	5.8	Deer Mouse	NTV	NA
Herbicides																			

Table 12-4
Summary of the Ecological Risk-Based Screening Levels for Chemicals Detected in Soil

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil or Ephemeral Sediment [a]	Terrestrial Plants	Soil Invertebrates	Deer Mouse		Hermit Thrush		Mule Deer		Red-tailed Hawk		Bobcat		Lowest RBSL			
				Benchmark-Based RBSL [b] (mg/kg)	Benchmark-Based RBSL [b] (mg/kg)	Low TRV-Based RBSL [b] (mg/kg)	High TRV-Based RBSL [b] (mg/kg)	Low TRV-Based RBSL [b] (mg/kg)	High TRV-Based RBSL [b] (mg/kg)	Low TRV-Based RBSL [b] (mg/kg)	High TRV-Based RBSL [b] (mg/kg)	Low TRV-Based RBSL [b] (mg/kg)	High TRV-Based RBSL [b] (mg/kg)	Low TRV-Based RBSL [b] (mg/kg)	High TRV-Based RBSL [b] (mg/kg)	Low TRV-Based RBSL [b, c] mg/kg	Receptor	High TRV-Based RBSL [b,c] mg/kg	Receptor
2,4,5-T	93765	2,4,5-Trichlorophenoxyacetic acid	X	NTV	NTV	4.8	16	NTV	NTV	40	130	NTV	NTV	90	300	4.8	Deer Mouse	16	Deer Mouse
2,4,5-TP (Silvex)	93721	-	X	NTV	NTV	0.55	1.8	190	NTV	6.5	22	1,900	NTV	11	38	0.55	Deer Mouse	1.8	Deer Mouse
2,4-Dichlorophenoxyacetic Acid (2,4-D)	94757	-	X	NTV	NTV	1.1	5.5	290	NTV	12	61	1,900	NTV	15	75	1.1	Deer Mouse	5.5	Deer Mouse
2,4-Dichlorophenoxybutyric acid	94826	-	X	NTV	NTV	6.2	19	200	NTV	60	190	1,900	NTV	120	380	6.2	Deer Mouse	19	Deer Mouse
2,4-DP (Dichlorprop)	120365	Dichlorprop	X	NTV	NTV	0.79	3.9	210	NTV	7.1	36	1,900	NTV	15	75	0.79	Deer Mouse	3.9	Deer Mouse
Dalapon	75990	-	X	NTV	NTV	39	130	660	NTV	210	690	1,900	NTV	250	850	39	Deer Mouse	130	Deer Mouse
Dicamba	1918009	-	X	NTV	NTV	14	46	1,510	NTV	73	240	4,310	NTV	90	300	14	Deer Mouse	46	Deer Mouse
Dinoseb	88857	-	X	NTV	NTV	0.31	1.5	0.18	1.8	3.1	15	1.7	17	6.0	30	0.18	Hermit Thrush	1.5	Deer Mouse
MCPP	93652	-	X	NTV	NTV	2.5	7.4	220	NTV	18	55	1,900	NTV	45	140	2.5	Deer Mouse	7.4	Deer Mouse
Terphenyls																			
m-Terphenyl	92068	-	X	68	NTV	42	210	0.67	6.7	2,100	10,500	12	120	1,510	7,540	0.67	Hermit Thrush	6.7	Hermit Thrush
o-terphenyl	84151	-	X	NTV	NTV	42	210	0.67	6.7	2,100	10,500	12	120	1,510	7,540	0.67	Hermit Thrush	6.7	Hermit Thrush
p-Terphenyl	92944	-	X	NTV	NTV	34	170	0.54	5.4	2,720	13,600	189,000	120	1,510	7,540	0.54	Hermit Thrush	5.4	Hermit Thrush
Glycols																			
Diethylene Glycol	111466	-	X	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
Triethylene glycol	112276	-	X	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
Total Petroleum Hydrocarbons																			
TPH-Diesel Range Organics (DRO)	DRO	Diesel	X	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
TPH-Gasoline Range Organics (GRO)	GRO	Gasoline	X	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
PCDD/PCDFs [d]																			
1,2,3,4,6,7,8-Heptachlorodibenzofuran	67562394	1,2,3,4,6,7,8-HpCDF	X	NTV	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	35822469	HpCDD	X	NTV	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8,9-Heptachlorodibenzofuran	55673897	1,2,3,4,7,8,9-HpCDF	X	NTV	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8-Hexachlorodibenzofuran	70648269	1,2,3,4,7,8-HxCDF	X	NTV	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	39227286	1,2,3,4,7,8-HxCDD	X	NTV	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,6,7,8-Hexachlorodibenzofuran	57117449	1,2,3,6,7,8-HxCDF	X	NTV	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	57653857	1,2,3,6,7,8-HxCDD	X	NTV	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8,9-Hexachlorodibenzofuran	72918219	1,2,3,7,8,9-HxCDF	X	NTV	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	19408743	1,2,3,7,8,9-HxCDD	X	NTV	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8-Pentachlorodibenzofuran	57117416	1,2,3,7,8-PeCDF	X	NTV	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	40321764	1,2,3,7,8-PeCDD	X	NTV	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,6,7,8-Hexachlorodibenzofuran	60851345	-	X	NTV	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,4,7,8-Pentachlorodibenzofuran	57117314	2,3,4,7,8-PeCDF	X	NTV	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,7,8-TCDD	1746016	2,3,7,8-Tetrachlorodibenzo-p-dioxin	X	NTV	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,7,8-Tetrachlorodibenzofuran	51207319	2,3,7,8-TCDF	X	NTV	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,3,7,8-TCDD_TEQ_Bird	1746016-TEQ_Bird	-	X	NA	NA	NA	NA	0.0000057	0.000057	NA	NA	0.00018	0.0018	NA	NA	0.0000057	Hermit Thrush	0.000057	Hermit Thrush
2,3,7,8-TCDD_TEQ_Mammal	1746016-TEQ_Mammal	-	X	NA	NA	0.00000050	0.0000050	NA	NA	0.000080	0.00080	NA	NA	0.000030	0.00030	0.00000050	Deer Mouse	0.0000050	Deer Mouse
Octachlorodibenzofuran	39001020	OCDF	X	NTV	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Octachlorodibenzo-p-dioxin	3268879	-	X	NTV	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Polychlorinated Biphenyls (PCBs) [d]																			
Aroclor 1016	12674112	-	X	40	500	1.1	2.8	0.12	1.2	61	150	2.3	23	41	100	0.12	Hermit Thrush	1.2	Hermit Thrush
Aroclor 1242	53469219	Aroclor-1242	X	40	500	0.043	0.43	0.091	0.91	4.3	43	2.3	23	2.1	21	0.043	Deer Mouse	0.43	Deer Mouse
Aroclor 1248	12672296	-	X	40	500	0.0064	0.064	0.094	0.94	0.59	5.9	2.3	23	0.30	3.0	0.0064	Deer Mouse	0.064	Deer Mouse
Aroclor 1254	11097691	-	X	40	500	0.039	0.39	0.083	0.83	4.7	47	2.3	23	2.1	21	0.039	Deer Mouse	0.39	Deer Mouse
Aroclor 1260	11096825	-	X	40	500	0.025	0.25	0.053	0.53	7.8	78	2.3	23	2.1	21	0.025	Deer Mouse	0.25	Deer Mouse
Aroclor 5460	11126424	-	X	40	500	0.039	0.39	0.083	0.83	4.7	47	2.3	23	2.1	21	0.039	Deer Mouse	0.39	Deer Mouse
PCB_TEQ_Bird (Coplanar PCBs)	1746016-PCB TEQ_Bird	-	X	NA	NA	NA	NA	0.0000057	0.000057	NA	NA	0.00018	0.0018	NA	NA	0.0000057	Hermit Thrush	0.000057	Hermit Thrush
PCB_TEQ_Mammal (Coplanar PCBs)	1746016-PCB TEQ_Mammal	-	X	NA	NA	0.00000050	0.0000050	NA	NA	0.000080	0.00080	NA	NA	0.000030	0.00030	0.00000050	Deer Mouse	0.0000050	Deer Mouse
PCB-105	32598144	1,1'-Biphenyl, 2,3,3',4,4'-pentachloro-	X	NTV	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-114	74472370	PCB 114 (BZ)	X	NTV	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-118	31508006	-	X	NTV	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-123	65510443	123-PeCB	X	NTV	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 12-4
Summary of the Ecological Risk-Based Screening Levels for Chemicals Detected in Soil

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil or Ephemeral Sediment [a]	Terrestrial Plants	Soil Invertebrates	Deer Mouse		Hermit Thrush		Mule Deer		Red-tailed Hawk		Bobcat		Lowest RBSL			
				Benchmark-Based RBSL [b] (mg/kg)	Benchmark-Based RBSL [b] (mg/kg)	Low TRV-Based RBSL [b] (mg/kg)	High TRV-Based RBSL [b] (mg/kg)	Low TRV-Based RBSL [b] (mg/kg)	High TRV-Based RBSL [b] (mg/kg)	Low TRV-Based RBSL [b] (mg/kg)	High TRV-Based RBSL [b] (mg/kg)	Low TRV-Based RBSL [b] (mg/kg)	High TRV-Based RBSL [b] (mg/kg)	Low TRV-Based RBSL [b] (mg/kg)	High TRV-Based RBSL [b] (mg/kg)	Low TRV-Based RBSL [b, c] mg/kg	Receptor	High TRV-Based RBSL [b,c] mg/kg	Receptor
PCB-126	57465288	-	X	NTV	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-156	38380084	1,1'-Biphenyl, 2,3,3',4,4',5-hexachloro-	X	NTV	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-157	69782907	PCB 157 (BZ)	X	NTV	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-167	52663726	167-HxCB	X	NTV	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-169	32774166	-	X	NTV	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-189	39635319	-	X	NTV	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-77	32598133	77-TeCB	X	NTV	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB-81	70362504	81-TeCB	X	NTV	0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Parameters																			
Ammonia-N	7664417	Nitrogen, as Ammonia	X	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
Chloride	16887006	-	X	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
Nitrate	NO3N	-	X	NTV	NTV	2,340	5,200	NTV	NTV	12,400	27,700	NTV	NTV	15,300	34,100	2,340	Deer Mouse	5200	Deer Mouse
Nitrite-NO2	E-10128	-	X	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA
Orthophosphate – PO4	14265442	-	X	NTV	NTV	0.069	0.35	NTV	NTV	0.37	1.8	NTV	NTV	0.45	2.3	0.069	Deer Mouse	0.35	Deer Mouse
Sulfate	14808798	-	X	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NTV	NA	NTV	NA

Notes:

[a] Chemicals detected in Groups 1A, 4, 6, 7, 8, 1B, 5, 10, 3 (WCT only), and 9 (Silvernale only) surface soil or Groups 4 (Coca only), 6 (SRE only), 1B, 5, 10, 3 (WCT only), and 9 (Silvernale only) sediment.

[b] Calculated with a target hazard quotient of 1. EcoRBSLs for soil invertebrates and terrestrial plants are equivalent to their respective medium-specific benchmarks; therefore, these EcoRBSLs were reported in the same number of significant figures as the source documents from which the benchmarks were selected. Avian and mammalian EcoRBSLs are calculated rather than derived from published values; therefore, EcoRBSLs with values less than 1,000 were reported using two significant figures and values greater than 1,000 were reported using three significant figures.

[c] Lowest Low and lowest High TRV-based RBSL selected from the EcoRBSLs for upper trophic level receptors only.

[d] As there are no toxicity equivalency factors (TEFs) available for terrestrial plants or soil invertebrates, no EcoRBSLs for 2,3,7,8-TCDD TEQ and PCB TEQ (Coplanar PCBs) were derived. Since EcoRBSLs for 2,3,7,8-TCDD TEQ and PCB TEQ (Coplanar PCBs) only apply to mammals and birds, individual dioxin/furan and coplanar PCB congeners are presented for evaluation of terrestrial plants and soil invertebrates exposed to these chemicals in soil.

-- Not available, or could not be located
BHC - benzene hexachloride
DDD - dichlorodiphenyldichloroethane
DDE - dichlorodiphenyldichloroethylene
DDT - dichlorodiphenyltrichloroethane
EPV - exposure point value
High TRV - mid level effect toxicity reference value
HMX - high melting explosive
Low TRV - no effect toxicity reference value
MCPA - 2-methyl-4-chlorophenoxyacetic acid
MCPP - meta-Chlorophenylpiperazine
mg/kg - milligrams per kilogram
NA - not applicable
NTV - no toxicity value
PCDD/PCDF - polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans
RBSL - risk-based screening level
RDX - Research Department Explosive
TCDD - Tetrachlorodibenzo-p-dioxin
TEQ - toxicity equivalent
X - Analyte was detected in the indicated medium

Table 12-5
Summary of the Ecological Risk-Based Screening Levels for Chemicals Detected in Soil Vapor

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil Vapor [a]	Deer Mouse Low TRV-Based RBSL [b] (mg/m^3)	Deer Mouse High TRV-Based RBSL [b] (mg/m^3)
Volatile Organic Compounds					
1,1,1-Trichloroethane	71556	-	X	250	760
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	Freon 113	X	1,210	58,900
1,1,2-Trichloroethane	79005	-	X	1.1	11
1,1-Dichloroethane	75343	-	X	240	480
1,1-Dichloroethene	75354	-	X	7.9	40
1,2,3-Trichlorobenzene	87616	-	X	66	210
1,2,4-Trichlorobenzene	120821	-	X	66	210
1,2,4-Trimethylbenzene	95636	-	X	10	52
1,2-Dichlorobenzene	95501	o-Dichlorobenzene	X	66	210
1,2-Dichloroethane	107062	-	X	56	NTV
1,2-Dichloroethene	540590	1,2-Dichloroethenes	X	25	130
1,2-Dichloropropane	78875	-	X	1.7	8.3
1,3,5-Trimethylbenzene	108678	-	X	10	52
1,3-Dichlorobenzene	541731	m-Dichlorobenzene	X	66	210
1,3-Dichloropropene	542756	-	X	5.4	22
2-Hexanone	591786	Methyl butyl ketone	X	6.5	33
Acetone	67641	-	X	1,740	8,710
Benzene	71432	-	X	0.76	3.8
Carbon Disulfide	75150	-	X	1.6	7.9
Carbon Tetrachloride	56235	-	X	8.4	42
Chlorobenzene	108907	Monochlorobenzene	X	77	230
Freon 22 (Chlorodifluoromethane)	75456	Freon 22	X	1,210	58,900
Chloroethane	75003	Ethyl chloride	X	1,320	4,350
Chloroform	67663	Trichloromethane	X	1.6	8.1
Chloromethane	74873	Methyl chloride	X	5.0	25
cis-1,2-Dichloroethene	156592	cis-1,2-Dichloroethylene	X	25	130
Cumene	98828	Isopropylbenzene	X	31	160
Dibromofluoromethane	1868537	-	X	NTV	NTV
Dichlorodifluoromethane	75718	Freon 12	X	1,210	58,900
Ethylbenzene	100414	-	X	31	160
Methyl ethyl ketone	78933	2-Butanone	X	1,150	3,440
Methylene chloride	75092	Dichloromethane	X	12	58
m-Xylene & p-Xylene	136777612	meta- and para-Xylenes	X	10	52
n-Butylbenzene	104518	-	X	31	160
n-Propylbenzene	103651	-	X	31	160
o-Xylene	95476	-	X	10	52
p-Cymene	99876	p-Isopropyltoluene	X	10	52
sec-Butylbenzene	135988	-	X	31	160
Styrene	100425	Vinylbenzene	X	260	910
tert-Butylbenzene	98066	-	-	31	160
Tetrachloroethene	127184	-	X	32	160
Toluene	108883	Toluol	X	0.22	0.56
trans-1,2-Dichloroethene	156605	-	X	25	130
Trichloroethene	79016	Trichloroethylene (TCE)	X	8.5	43
Trichlorofluoromethane	75694	-	X	1,210	58,900
Vinyl chloride	75014	-	X	0.73	3.7
Xylenes, Total	1330207	Xylene (Total) Isomers	X	10	52

Table 12-5
Summary of the Ecological Risk-Based Screening Levels for Chemicals Detected in Soil Vapor

Chemical	CAS#	Chemical Synonym	Chemicals Detected in Soil Vapor [a]	Deer Mouse	
				Low TRV-Based RBSL [b] (mg/m^3)	High TRV-Based RBSL [b] (mg/m^3)
Polynuclear Aromatic Hydrocarbons					
Fluorene	86737	-	X	0.48	2.4
Naphthalene	91203	-	X	2.5	12
Phenanthrene	85018	-	X	0.48	2.4

Notes:

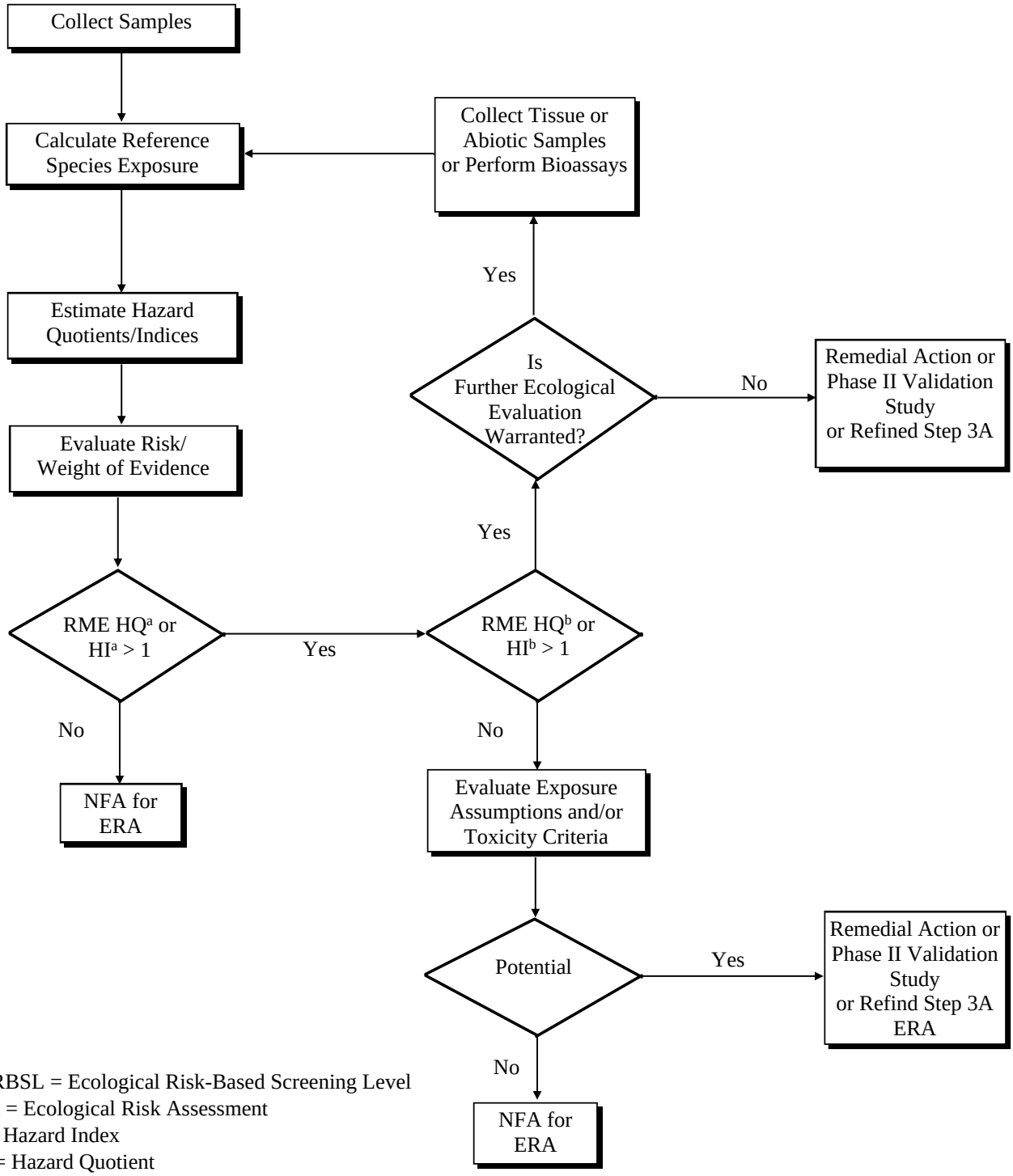
[a] Chemicals detected in Groups 1A, 4, 6, 7, 8, 1B, 3, 5, 9, and 10 soil vapor.

[b] Derivation of the Low and High TRV values used to calculate the Low TRV-Based and High TRV-Based inhalation RBSLs is provided in the Inhalation Toxicity Reference Values Updates for Use in Ecological Risk Assessments at the Santa Susana Field Laboratory, Ventura County, California, as presented in Appendix E of the SRAM Rev. 2 Addendum (MWH, 2014).

mg/m^3 - milligrams per cubic meter
NTV - no toxicity value
RBSL - risk-based screening level
TRV - toxicity reference value

FIGURES

Figure 12-1
Risk Characterization Flowchart



EcoRBSL = Ecological Risk-Based Screening Level
ERA = Ecological Risk Assessment
HI = Hazard Index
HQ = Hazard Quotient
NFA = No Further Action
RME = Reasonable Maximum Exposure

[a] Calculated based on a Low EcoRBSL.

[b] Calculated based on a High EcoRBSL.

APPENDIX G

Large Home Range Receptor Ecological Risk Assessment Methodology, Santa Susana Field Laboratory, Ventura County, California - Technical Memorandum

LARGE HOME RANGE RECEPTOR ECOLOGICAL RISK ASSESSMENT METHODOLOGY
SANTA SUSANA FIELD LABORATORY
VENTURA COUNTY, CALIFORNIA

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ACRONYMS AND ABBREVIATIONS

AUF	area use factor
BTV	background threshold value
CPEC	constituent of potential ecological concern
DOE	United States Department of Defense
DTSC	Department of Toxic Substances Control
EcoRBSL	ecological risk-based screening level
EPC	exposure point concentration
ERA	ecological risk assessment
GIS	graphic information system
HI	hazard index
HMW PAH	high molecular weight polyaromatic hydrocarbon
HQ	hazard quotient
IDW	inverse distance weight
LHR	large home range
LMW PAH	low molecular weight polyaromatic hydrocarbon
mg/kg	milligram(s) per kilogram
MWH	Montgomery Watson Harza
NASA	National Aeronautics and Space Administration
NFEC	Naval Facilities Engineering Command
PAH	polyaromatic hydrocarbon
PCB	polychlorinated biphenyl
SRAM	Standardized Risk Assessment Methodology
SSFL	Santa Susana Field Laboratory
TM	technical memorandum/memoranda
TNRCC	Texas Natural Resources Conservation Commission
USEPA	United States Environmental Protection Agency

INTRODUCTION

This technical memorandum (TM) documents the updated methodology for estimating potential risks to large home range (LHR) receptors as part of the ecological risk assessments (ERAs) prepared for the Santa Susana Field Laboratory (SSFL). This document was prepared for the California Environmental Protection Agency (Cal-EPA) Department of Toxic Substances Control (DTSC) on behalf of the Boeing Company (Boeing).

The LHR ERA methodology presented herein replaces Section 12.1.3 (Large Home Range Species Risk Calculations) and Appendix J (Large Home Range Species Exposure) and provides inserts to the revised Section 12.2 (Weight-of-Evidence Analysis and Risk Description) and Section 12.3 (Uncertainty Analysis) of the Standardized Risk Assessment Methodology (SRAM; MWH Americas, Inc. 2005) as presented in the *Revised and Expanded Ecological Risk-based Screening Levels Technical Memorandum* (Submitted to DTSC in 2011, with the most recent update submitted February 2013). Text sections, tables, figures, and equations are numbered so that this TM can be inserted into the updated Section 12.

This TM also uses information from the other ecological risk assessment TMs prepared to update the SRAM including the following:

- *Proposed Approaches for Streamlining Future Ecological Risk Assessments (Draft) TM* – Submitted to DTSC July, 2009.
- *Ecological Exposure Assessment Updates for Use in Ecological Risk Assessment TM* – Appendix C of the SRAM Rev. 2 Addendum.
- *Ecological Effects Characterization Updates for Use in Ecological Risk Assessments TM* – Appendix D of the SRAM Rev. 2 Addendum.
- *Ecological Risk-based Screening Levels (EcoRBSLs)for Use in Ecological Risk Assessments* TM –Appendix F of the SRAM Rev. 2 Addendum.
- *Incremental Risk Calculation Methodology for Human Health and Ecological Risk Assessments TM* – Appendix I of the SRAM Rev. 2 Addendum.

SRAM REVISION 2, SECTION 12 LARGE HOME RANGE RECEPTOR ERA UPDATES

12.1.3 Large Home Range Receptor Risk Calculations

[Replacement text for Section 12.1.3 of Appendix F of the SRAM Rev. 2 Addendum]

Representative species with large home ranges (e.g., red-tailed hawk, mule deer, and bobcat) may be exposed to chemicals at more than one RFI site. The red-tailed hawk, mule deer, and bobcat are collectively referred to as “large home range receptors” (LHR receptors) for ERA evaluation at the SSFL. As described in the *Draft Proposed Approaches for Streamlining Future Ecological Risk Assessments Technical Memorandum* (submitted to DTSC July, 2009), LHR Receptors will be evaluated at the Subarea level and on a Facility-wide scale.

The primary differences between the RFI Site ERAs and the Subarea and Facility-wide LHR Receptor ERAs are: geographic scale (Subarea or Facility-wide vs. RFI Site), representative

species (LHR receptors vs. small home range receptors), and estimation of risk (spatial modeling vs. area-weighted averages). Subareas, habitat types, and sampling locations at the SSFL are shown on Figure 12-2.

Subarea LHR Receptor ERAs – The objective of the Subarea LHR Receptor ERA is to evaluate potential risks of chemicals of potential ecological concern (CPECs) on receptors whose foraging range is larger than individual RFI Sites, but smaller than the full SSFL facility. These receptors may move among/between RFI Sites to access suitable habitat areas. The Subarea LHR Receptor ERA will be completed using the red-tailed hawk, bobcat, and mule deer. Data collected from all portions of the SSFL will be used to develop the Subarea LHR Receptor ERA, but reporting will be limited to the Boeing subareas due to the regulatory agreements DOE and NASA have with DTSC for cleanup of the DOE and NASA subareas at SSFL.

Facility-wide LHR Receptor ERA - A Facility-wide LHR Receptor ERA will be completed to evaluate potential risks of CPECs on LHR receptors whose foraging range is larger than Subareas. The LHR receptors may move among/between Subareas to access contiguous suitable habitat types. The Facility-wide LHR Receptor ERA will be completed using the same methods and will be completed in parallel with the Subarea LHR Receptor ERA (i.e., CPECs will be evaluated on both the Subarea and Facility-wide basis).

12.1.3.1 Large Home Range Receptors and Habitats

Three of the identified terrestrial representative species for ERAs conducted at the SSFL have home ranges that are larger than the size of any of the RFI sites: red-tailed hawk, mule deer, and bobcat. These species forage and/or prey on a wider variety of species and, therefore, require larger home ranges for foraging. The typical foraging ranges and diets of these receptors are presented in Table 12-6.

There are a variety of habitats across the SSFL, and the amount of foraging habitat available at in each Subarea will determine the relative proportion of exposure to the LHR receptors. A limited selection of habitats that may be suitable to the LHR receptors was presented in the SRAM (MWH, 2005). This list was reviewed in context with the updated habitat mapping and additional habitats that may be suitable under current conditions will be included in the LHR Receptor ERAs. In addition, disturbed habitats and/or developed areas that may potentially revert to native habitats under future conditions will also be included as potentially suitable habitats. The habitats that are currently identified as potentially suitable under either current or future conditions are presented in Table 12-7 and shown for each receptor and in Figure 12-3 (red-tailed hawk), Figure 12-4 (mule deer), and Figure 12-5 (bobcat).

Red-tailed hawks forage over open grasslands and fields, over rock outcrops, and in the more open Venturan coastal sage scrub as opposed to the dense chaparral (Zeiner et al., 1990a). In general, native and nonnative grasslands provide forage for the mule deer and are the primary habitats of rodents, which provide prey for red-tailed hawk and bobcat. Mule deer may forage among grasslands, fields, scrub, and woodlands. They are less likely to be found in rocky outcrops and marshy areas. Bobcats generally use the cover of scrub, rocky outcrops, and trees to stalk and capture prey in the open (Zeiner et al., 1990b). Bobcats are not considered to use dense habitat types like Baccharis scrub or wetland habitats that do not afford adequate cover.

12.1.4.2 Estimation of Risk

The estimation of risk on a Subarea or Facility-wide basis will be completed following the flow diagram presented in Figure 12-6 using a geostatistical spatial (GIS-based) risk model developed for the SSFL.

The selection of CPECs was defined in Section 3.1 of the SRAM Rev. 2 (MWH, 2005) and the updated Section 3.2 as presented in the *Ecological Exposure Updates for Use in Ecological Risk Assessments TM (*Appendix C of the SRAM Rev.2 Addendum*).* In summary, CPECs are those chemicals that have been detected at least once at the SSFL that meet data quality requirements for use in ERAs. The exposure medium for LHR receptors are soils 0 to 2 ft bgs.

SSFL CPECs will be reviewed and those that are bioaccumulative will be carried forth to the Subarea and Facility-wide LHR Receptor ERAs. Bioaccumulative potential for chemicals detected at the SSFL was established using the following sources and/or criteria (Table 12-8):

- Naval Facilities Engineering Command list of bioaccumulative chemicals (NAVFAC, 2001)
- Texas Natural Resources Conservation Commission list of bioaccumulative chemicals (TNRCC, 2006)
- LogKow greater than 4.2 (USEPA, 2000)
- Bioaccumulation factor greater than 1 (USEPA, 2007)
- Similar to bioaccumulative chemical or suspected to be bioaccumulative

Potential risks from bioaccumulative CPECs will be calculated as shown in Equations 12-14 below:

$$\text{HQ} = \frac{\text{EPC}}{\text{EcoRBSL}} \; x \; \text{AUF} \qquad \text{(Equation 12-14)}$$

Where:

HQ = hazard quotient
EPC = exposure point concentration (mg/kg)
EcoRBSL = ecological risk-based screening level (mg/kg)
AUF = area use factor (unitless)

Estimated risks (represented as HQs) are calculated for each receptor/CPEC pair using the maximum detected value at each sampling location (0-2 ft bgs), the chemical- and receptor-specific EcoRBSLs developed for the SSFL and presented in the *EcoRBSLs* TM (Appendix F of the SRAM Rev.2 Addendum), and area use factors (AUFs) as defined below. Data for bioaccumulative CPECs at each sampling location will be reduced to a single value using SSFL protocols for reduction of duplicates whereby the maximum detected value if at least one result is a detect will be used or one-half the minimum non-detect if all results are non-detect.

The resulting sample location-specific HQs will be interpolated across the Subarea (or Facility) to produce an estimated risk contour. Interpolation is a procedure used to predict values for locations lacking measured data (Childs, 2004). A general schematic of the interpolation process is shown in Figure 12-7. There are several interpolation methods and selection of the best method is a function of the distribution of sample points and the phenomenon being studied. The Inverse Distance Weight (IDW) method will be used for the Subarea and/or Facility-wide LHR Receptor ERAs. IDW is a geostatistical interpolation method that generally allows for more advanced prediction. The Subarea or Facility is divided into a grid of equal sized "cells". The IDW interpolation method determines values for cells without measured data using a linear-weighted combination of the nearest measured sample points. The weight assigned is a function of the distance between an input point (sample location) and the output cell location. The greater the distance, the less influence the input point has on the output cell. The resulting contour provides a visual estimation of potential risks. Data from throughout the SSFL including Boeing, NASA, and DOE subareas are considered in the interpolation process. Baseline, AUF-adjusted, and Incremental risk estimates for the Subareas and Facility-wide will be completed as follows:

Baseline Risk. The baseline risk model provides the most conservative estimate of potential risks. Baseline HQs will be calculated for each LHR receptor/CPEC pair using the Low EcoRBSL and an AUF of 1. Resulting HQs will be interpolated across the SSFL facility to produce a baseline risk contour. There will be only one Baseline contour for each LHR receptor/CPEC pair as the contours at the Subarea level and the Facility-wide level will be identical due to the use of an AUF of 1.

If there are no HQs>1 for the LHR receptor/CPEC pair, then the potential for unacceptable risk is considered low and the CPEC will be dropped from further evaluation in the LHR Receptor ERA unless the CPEC belongs to one of the groups of chemicals for which hazard indices will be calculated (described in Section 12.1.4.3). Receptor/CPEC pairs with HQs>1 will be carried forth for AUF-adjusted risk estimation.

AUF-Adjusted Risk. The AUF-adjusted risk model will be completed for both the Subarea and Facility-wide LHR Receptor ERAs. The AUF-adjusted risk model provides a more realistic estimate of potential risks by incorporating site-specific information on availability of suitable habitat, habitats preferred by each receptor, and the receptors typical foraging range. The habitat types considered suitable for each receptor (Shown on Table 12-7) are selected within the GIS model and can be changed as needed depending on potential future use of the site. AUF-adjusted risk estimates will be completed for each receptor/CPEC pair showing a potential for risk under the Baseline model (i.e., had HQs>1), and will be calculated using both Low and High EcoRBSLs to provide a range of potential risk estimates. The calculation of Subarea and Facility-wide receptor-specific AUFs is described below.

Subarea receptor-specific AUFs will be calculated as shown in Equation 12-15 below, and are the fraction of receptor-suitable habitat in the Subarea divided by the receptor's foraging range. Most of the Boeing Subareas are smaller than the foraging ranges of the LHR receptors, therefore, incorporation of foraging range provides the most realistic risk estimate.

$$Subarea\ AUF\ =\ \frac{Receptor-suitable\ habitat\ (acres)}{Receptor\ foraging\ range\ (acres)} \qquad \text{(Equation 12-15)}$$

The Facility-wide receptor-specific AUFs will be calculated as shown in Equation 12-16 below. The SSFL Facility acreage is larger than the foraging ranges of any of the LHR receptors being evaluated, and there is no physical impediment to restrict usage of the areas inside vs. outside the Facility by the LHR receptors. Specifically, LHR receptors may use any portion of the Facility or cross outside the Facility boundaries while they forage. In addition, the model includes many habitat areas that are currently disturbed and/or developed therefore limiting the available forage/prey within the SSFL boundary. Use of the foraging range based AUF as calculated for the Subarea LHR Receptor ERA would be overly conservative as it would assume that receptors spend 100% of their time within the Facility boundaries. The Facility-wide AUFs will be calculated as the acres of receptor suitable habitat in the SSFL divided by the total habitat in the SSFL. This estimate assumes that 100% of suitable habitat might be used, but allows for potential foraging offsite, providing a more realistic measure of potential usage.

$$Facility-wide\ AUF\ =\ \frac{Receptor-suitable\ habitat\ (acres)}{Total\ habitat\ (acres)} \qquad \text{(Equation 12-16)}$$

Receptor-specific AUFs for each Subarea and for the SSFL Facility are presented in Table 12-9.

AUF-adjusted HQs will be interpolated across the Subarea and/or Facility to produce an AUF-adjusted risk contour for each receptor/CPEC pair. If there are no HQs>1 for the receptor/CPEC pair, then the potential for unacceptable risk is considered low and the CPEC will be dropped from further evaluation in the LHR Receptor ERA unless the CPEC belongs to one of the groups of chemicals for which hazard indices will be calculated (described in Section 12.1.4.3). LHR receptor/CPEC pairs with HQs>1 will be carried forth to the weight-of-evidence analysis and Risk Description (Section 12.2) for further evaluation. CPECs for which background threshold values (BTVs) are available will also be carried forth to the incremental risk estimation.

Incremental Risk. Incremental risk is the additional risk that a receptor may incur from site-related exposure to chemicals above and beyond the risk that may result from exposure to background concentrations. Incremental risks will be calculated for LHR receptor/CPEC pairs that have BTVs and that show potential risks under the AUF-adjusted risk model (HQs>1) as shown in Figure 12-6. Use of background in the ERA process was described in the *Incremental Risk Calculation Methodology for Human Health and Ecological Risk Assessments TM (*Appendix I of the SRAM Rev.2 Addendum). However, since the GIS risk model calculates risks on a point-by-point basis for measured data and then interpolates those across the site, the calculation of incremental risks to LHR receptors will be calculated as follows (Equation 12-17).

$$Incremental\ HQ\ =\ \frac{[Soil]_i - [BTV]}{EcoRBSL}\ \ x\ \ AUF \qquad \text{(Equation 12-17)}$$

Where:

HQ = hazard quotient
$Soil_i$ = soil concentration at location i
BTV = background threshold value
EcoRBSL = ecological risk-based screening level (mg/Kg)
AUF = area use factor (unitless)

The incremental HQs will then be interpolated across the Subarea and/or Facility-wide to produce an incremental risk contour.

The incremental risk estimates will be evaluated along with the Baseline and AUF-adjusted risk estimates in the weight-of-evidence analysis and Risk Description (Section 12.2).

12.1.4.3 Hazard Indices

Hazard indices (HIs) will be calculated for chemicals with similar mechanisms or that act on the same target organ as described in Section 12.1.2. Ecological HIs will be calculated for the following chemical groups:

- Organochlorine pesticides
- Dioxins/furans
- Aroclors
- PCBs
- LMW PAHs
- HMW PAHs

Chemical-specific HQs for CPECs with similar mechanisms will be summed prior to interpolation across the Subarea and/or Facility to provide a HI risk contour. The results will be evaluated along with the other risk estimates in the weight-of-evidence analysis and risk description section

12.2 Weight-of-Evidence Analysis and Risk Description

[Insert the following text at the end of Section 12.2 of Appendix F of the SRAM Rev.2 Addendum]

The evaluation of potential risks to LHR receptors will be an iterative process and will generally follow the procedures presented in Section 12.2. A weight-of-evidence approach will be used and will include evaluation of habitat suitability for each LHR receptor, point estimates of potential risk, potential outliers that may result in an over/under-estimation of potential risks in the interpolation process, risk contours (interpolation figures), results using Low vs. High EcoRBSLs, physiochemical properties of CPECs, potential bioavailability of CPECs, exposure assumptions, and uncertainties.

Results of the weight-of-evidence analysis will be used in conjunction with the risk contours to assist risk managers in identifying portions of the Subarea and/or Facility that should be recommended for risk management consideration as described in Section 12.4 with the following additional considerations:

- Contoured areas of the Subarea and/or Facility with HQs or HIs <1 under Baseline assumptions will be considered *de minimus* if uncertainties are considered acceptable and will be recommended for no further action (NFA) with respect to the LHR receptor ERA.
- Contoured areas of the Subarea and/or Facility showing potential risks (HQs or HIs>1) under Baseline assumptions but showing no or limited risks under AUF-adjusted assumptions at the Low EcoRBSL will be considered *de minimus* if uncertainties are considered acceptable and will be recommended for NFA with respect to the LHR receptor ERA.
- Contoured areas of the Subarea and/or Facility showing potential risks (HQs or HIs>1) under Baseline and AUF-adjusted assumptions at the Low EcoRBSL, but not showing potential risks using AUF-adjusted assumptions and the High EcoRBSL (HQs or HIs<1) will be recommended for NFA or risk management consideration based on the weight-of-evidence evaluation.
- Contoured areas of the Subarea and/or Facility showing potential risks (HQs or HIs>1) under Baseline and AUF-adjusted assumptions at the High EcoRBSL will be recommended for further evaluation of risk management consideration based on the weight-of-evidence evaluation.

12.3 Uncertainty Analysis

[Insert text at end of Section 12.3 of Appendix F of the SRAM Rev.2 Addendum]

Large Home Range Risk Characterization

Estimation of potential risks to LHR receptors uses a combination of point estimates and GIS spatial modeling using IDW interpolation to develop risk contours and estimate potential risks for portions of the Facility with little or no measured data. Interpolation is a prediction tool and may over- or under-estimate potential risks depending on the availability of measured data. Results should be reviewed along with other lines of evidence for any risk management decisions.

EXAMPLE RISK CALCULATIONS AND CONTOURS

Example risk calculations are presented in Table EX-1 for the mule deer exposure to nickel including:

- Baseline HQs
- Subarea AUFs and HQs
- Incremental risks

Example Baseline and AUF-Adjusted Risk Contours are presented for the following:

- Red-tailed Hawk -
  - Figure EX-1 - Baseline Dioxin/Furan using Low EcoRBSL (Subarea/Facility-wide)
  - Figure EX-2 - AUF Dioxin/Furan using the Low EcoRBSL (Subarea)
- Mule Deer

- Figure EX-3 - Baseline Nickel using Low EcoRBSL (Subarea/Facility-wide)
- Figure EX-4 - AUF Nickel using Low EcoRBSL (Subarea)
- Figure EX-5 - AUF Nickel using High EcoRBSL (Subarea)
- Figure EX-6 - Incremental Nickel using Low EcoRBSL (Subarea)
- Figure EX-7 - Baseline Dioxin/Furan using Low EcoRBSL (Subarea/Facility-wide)
- Figure EX-8 - AUF Dioxin/Furan using Low EcoRBSL (Subarea)
- Figure EX-9 - AUF Dioxin/Furan using Low EcoRBSL (Facility-wide)

REFERENCES

References not listed below were previously presented in the SRAM Rev. 2 (MWH, 2005)

Childs, C. 2004. Interpolating Surfaces in ArcGIS Spatial Analyst. ArcUser: July-September. Accessed through: http://www.esri.com/news/arcuser/0704/files/interpolating.pdf .

MWH Americas, Inc. (MWH), 2005. Standardized Risk Assessment Methodology (SRAM) Work Plan, Santa Susana Field Laboratory, Ventura County, California. Revision 2 – Final. September. HDMSE00198.

MWH. 2009. Draft Proposed Approaches for Streamlining Future Ecological Risk Assessments Technical Memorandum. July.

Table 12-6
Large Home Range Receptor Foraging Ranges and Diets
Large Home Range Receptor Ecological Risk Assessment Methodology - Santa Susana Field Laboratory

Representative Species	Foraging Range (Acres)	Diet
Red-tailed Hawk	192 (Ecological Exposure Assessment Updates TM, revised Table 10-7)	Small mammals, small birds, reptiles, amphibians, and invertebrates (Sherrod, 1978). Diet is assumed to be 100% deer mice for purposes of ERAs completed for SSFL (see Ecological Exposure Assessment Updates TM, revised Table 10-7)
Bobcat	1152 (Ecological Exposure Assessment Updates TM, revised Table 10-7)	Mostly rabbits and rodents with some deer, birds, reptiles, amphibians, invertebrates, and vegetation (Zeiner et al., 1990b). Diet is assumed to be 100% deer mice for purposes of ERAs completed for SSFL (see Ecological Exposure Assessment Updates TM, revised Table 10-7)
Mule Deer	128 (Ecological Exposure Assessment Updates TM, revised Table 10-7)	Vegetation (100%) Diet is assumed to be 100% plants for purposes of ERAs completed for SSFL (see Ecological Exposure Assessment Updates TM, revised Table 10-7)

Notes:
TM - Technical Memorandum

Table 12-7

Summary of Potentially Suitable Habitats for Large Home Range Receptors

Large Home Range Receptor Ecological Risk Assessment Methodology - Santa Susana Field Laboratory

Vegetation Type	Red-tailed Hawk	Mule Deer	Bobcat
Baccharis Scrub		●	
Chaparral		●	●
Chaparral/Venturan Coastal Sage Scrub		●	●
Coast Live Oak Riparian Forest		●	●
Coast Live Oak Woodland	●	●	●
Developed	●	●	●
Disturbed	●		
Disturbed Chaparral	●	●	●
Disturbed Chaparral/Coast Live Oak Woodland	●	●	●
Disturbed Mulefat Scrub		●	
Disturbed Native Grassland	●	●	●
Disturbed Nonnative Grassland	●	●	●
Disturbed Venturan Coastal Sage Scrub	●	●	●
Disturbed Venturan Coastal Sage Scrub\Chaparral		●	●
Disturbed Wetland			
Eucalyptus Woodland	●		
Freshwater Marsh			
Mulefat Scrub		●	
Native Grassland	●	●	●
Nonnative Grassland	●	●	●
Open Water			
Rock Outcrop	●		●
Rock Outcrop/Chaparral	●		●
Rock Outcrop/Chaparral/Coast Live Oak Woodland	●		●
Rock Outcrop/Chaparral/Venturan Coastal Sage Scrub	●		●
Rock Outcrop/Coast Live Oak Woodland	●		●
Rock Outcrop/Disturbed Venturan Coastal Sage Scrub	●		●
Rock Outcrop/Nonnative Grassland	●		●
Rock Outcrop/Venturan Coastal Sage Scrub	●		●
Ruderal Habitat	●		
Southern Willow Scrub		●	●
Southern Willow Scrub/Mulefat Scrub		●	●
Unknown			
Venturan Coastal Sage Scrub	●	●	●
Waters of the US			
Wetland			

Note:

Habitats selected are those that were used for the example risk contours. Habitat types will be reviewed and finalized during completion of the large home range receptor ecological risk assessment.

Table 12-8
Bioaccumulative Chemicals Detected in Soil
Large Home Range Receptor Ecological Risk Assessment Methodology - Santa Susana Field Laboratory

Chemical	CAS#	log Kow	Bioaccumulative	NAVFAC	Notes
Inorganic Compounds					
Aluminum	7429905	0.33	N		
Antimony	7440360	0.73	N		
Arsenic	7440382	0.68	Y	Y	logKow less than 4.2, but on NAVFAC list
Barium	7440393	0.23	N		
Beryllium	7440417	-0.57	N		
Boron	7440428	0.23	N		
Cadmium	7440439	-0.07	Y	Y	logKow less than 4.2, but on NAVFAC list
Chromium	7440473	0.23	N		
Cobalt	7440484	0.23	N		
Copper	7440508	-0.57	Y	Y	logKow less than 4.2, but on NAVFAC list
Cyanides	57125	-0.25	N		
Fluoride	7782414	0.22	N		
Hexavalent Chromium	18540299	-	Y	Y	
Lead	7439921	0.73	Y	Y	logKow less than 4.2, but on NAVFAC list
Lithium	7439932	-0.77	N		
Manganese	7439965	0.23	N		
Mercury	7439976	-0.47	Y		
Methyl Mercury	22967926	0.08	Y	Y	logKow less than 4.2, but on NAVFAC list
Molybdenum	7439987	0.23	N		
Nickel	7440020	-0.57	Y	Y	logKow less than 4.2, but on NAVFAC list
Selenium	7782492	0.24	Y	Y	logKow less than 4.2, but on NAVFAC list
Silver	7440224	0.23	Y	Y	logKow less than 4.2, but on NAVFAC list
Strontium	7440246	0.23	N		
Thallium	7440280	0.23	N		
Tin	7440315	1.29	N		
Titanium	7440326	0.23	N		
Vanadium	7440622	1.98	N		
Zinc	7440666	-0.47	Y	Y	logKow less than 4.2, but on NAVFAC list
Zirconium	7440677	-0.57	N		
Dioxins/Furans					
DioxinFuran_TEQ_Mammal	1746016-TEQ_Mammal	6.8	Y	Y	
DioxinFuran_TEQ_Bird	1746016-TEQ_Bird	6.8	Y	Y	
PCB_TEQ_Mammal	1746016-PCB TEQ_Mammal	6.8	Y	Y	
PCB_TEQ_Bird	1746016-PCB TEQ_Bird	6.8	Y	Y	

Table 12-8
Bioaccumulative Chemicals Detected in Soil
Large Home Range Receptor Ecological Risk Assessment Methodology - Santa Susana Field Laboratory

Chemical	CAS#	log Kow	Bioaccumulative	NAVFAC	Notes
Energetic Constituents					
1,2-Dinitrobenzene	528290	1.69	N		
1,4-Dinitrobenzene	100254	1.46	N		
2,4,6-Trinitrotoluene	118967	1.6	Y		bioaccumulation factor >1 in USEPA (2007)
2-Amino-4,6-Dinitrotoluene	35572782	1.84	N		
HMX	2691410	0.16	N		
Monomethylhydrazine	60344	-1.05	N		
Perchlorate	14797730	-	Y		suspected to be bioaccumulative
RDX	121824	0.68	Y		suspected to be bioaccumulative
Herbicides					
2,4-Dichlorophenoxybutyric acid	94826	3.53	N		
2,4,5-TP (Silvex)	93721	3.68	N		
Dalapon	75990	0.78	N		
Dicamba	1918009	2.14	N		
Dinoseb	88857	3.56	N		
MCPP	93652	3.13	N		
Terphenyls					
m-Terphenyl	92068	5.52	Y		
p-Terphenyl	92944	6.03	Y		
Pesticides					
4,4'-DDD	72548	6.02	Y	Y	
4,4'-DDE	72559	6.51	Y	Y	
4,4'-DDT	50293	6.91	Y	Y	
Aldrin	309002	6.5	Y	Y	
alpha-BHC	319846	3.8	Y	Y	logKow less than 4.2, but on NAVFAC list
beta-BHC	319857	3.78	Y	Y	logKow less than 4.2, but on NAVFAC list
delta-BHC	319868	4.14	Y	Y	logKow less than 4.2, but on NAVFAC list
Chlordane (Technical)	12789036	6.26	Y		
Dieldrin	60571	5.4	Y	Y	
Endosulfan I	959988	3.83	Y	Y	logKow less than 4.2, but on NAVFAC list
Endosulfan II	33213659	3.83	Y	Y	logKow less than 4.2, but on NAVFAC list
Endosulfan sulfate	1031078	3.66	Y		retained using endosulfan I/II as surrogate
Endrin	72208	5.2	Y	Y	
Endrin aldehyde	7421934	4.8	Y		
Endrin ketone	53494705	4.99	Y		
gamma-BHC	58899	3.72	Y	Y	logKow less than 4.2, but on NAVFAC list
Heptachlor	76448	6.1	Y	Y	
Heptachlor epoxide	1024573	4.98	Y	Y	
MCPA	94746	3.25	N		
Mercaptans	109795	2.28	N		
Mirex	2385855	6.89	Y	Y	
p,p'-Methoxychlor	72435	5.08	Y	Y	

Table 12-8
Bioaccumulative Chemicals Detected in Soil
Large Home Range Receptor Ecological Risk Assessment Methodology - Santa Susana Field Laboratory

Chemical	CAS#	log Kow	Bioaccumulative	NAVFAC	Notes
Toxaphene	8001352	5.9	Y		
Polychlorinated Biphenyls (PCBs)					
Aroclor 1016	12674112	5.62	Y	Y	
Aroclor 1221	11104282	4.65	Y	Y	
Aroclor 1232	11141165	4.65	Y	Y	
Aroclor 1242	53469219	6.29	Y	Y	
Aroclor 1248	12672296	6.2	Y	Y	
Aroclor 1254	11097691	6.5	Y	Y	
Aroclor 1260	11096825	7.55	Y	Y	
Aroclor 5460	11126424	6.34	Y		
Decachlorobiphenyl	2051243	10.2	Y		
PCB_Total Non-Coplanar		6.79	Y		
Polynuclear Aromatic Hydrocarbons					
1-Methyl naphthalene	90120	3.87	N		
2-Methylnaphthalene	91576	3.86	N		
Acenaphthene	83329	3.92	Y	Y	logKow less than 4.2, but on NAVFAC list
Acenaphthylene	208968	3.94	Y	Y	logKow less than 4.2, but on NAVFAC list
Anthracene	120127	4.45	Y	Y	logKow less than 4.2, but on NAVFAC list
Benzo(a)anthracene	56553	5.76	Y	Y	
Benzo(a)pyrene	50328	6.13	Y	Y	
Benzo(b)fluoranthene	205992	5.78	Y	Y	
Benzo(e)pyrene	192972	6.44	Y		
Benzo(ghi)perylene	191242	6.63	Y	Y	
Benzo(k)fluoranthene	207089	6.11	Y	Y	
Chrysene	218019	5.81	Y	Y	
Dibenzo(a,h)anthracene	53703	6.75	Y	Y	
Fluoranthene	206440	5.16	Y	Y	
Fluorene	86737	4.18	Y	Y	logKow less than 4.2, but on NAVFAC list
Indeno(1,2,3-cd)pyrene	193395	6.7	Y	Y	
Naphthalene	91203	3.3	Y		bioaccumulation factor >1 in USEPA (2007)
Perylene	198550	6.25	Y		
Phenanthrene	85018	4.46	Y	Y	logKow less than 4.2, but on NAVFAC list
Pyrene	129000	4.88	Y	Y	
Semi-Volatile Organic Compounds					
1,1-Dimethylhydrazine	57147	-1.19	N		
1,2-Dibromo-3-chloropropane	96128	2.96	N		
1,4-Dioxane	123911	-0.27	N		
2,4,5-Trichlorophenol	95954	3.45	N		
2,4,6-Trichlorophenol	88062	3.45	N		
2,4-Dimethylphenol	105679	2.3	N		
3,5-Dimethylphenol	108689	2.35	N		
4-Nitrophenol	100027	1.91	N		
Benzidine	92875	1.34	N		
Benzoic acid	65850	1.87	N		
Benzyl alcohol	100516	1.1	N		

Table 12-8
Bioaccumulative Chemicals Detected in Soil
Large Home Range Receptor Ecological Risk Assessment Methodology - Santa Susana Field Laboratory

Chemical	CAS#	log Kow	Bioaccumulative	NAVFAC	Notes
bis(2-Ethylhexyl) phthalate	117817	7.6	Y		LogKow > 4.2 but phthalates not generally considered bioaccumulative
Bromoform	75252	2.4	N		
Butyl benzyl phthalate	85687	4.73	Y		LogKow > 4.2 but phthalates not generally considered bioaccumulative
Carbazole	86748	3.72	N		
Dibromochloromethane	124481	2.16	N		
Diethyl phthalate	84662	2.42	N		
Dimethyl phthalate	131113	1.6	N		
Di-n-butyl phthalate	84742	4.5	Y		LogKow > 4.2 but phthalates not generally considered bioaccumulative
Di-n-octyl phthalate	117840	8.1	Y		LogKow > 4.2 but phthalates not generally considered bioaccumulative
Formaldehyde	50000	0.35	N		
Hexachlorobutadiene	87683	4.78	Y	Y	
Hexachlorocyclopentadiene	77474	5.04	Y	Y	
m-Cresol	108394	1.96	N		
n-Nitrosodimethylamine	62759	-0.57	N		
n-Nitrosodiphenylamine	86306	3.13	N		
o-Cresol	95487	1.95	N		
p-Chloro-m-cresol	59507	3.1	N		
p-Cresol	106445	1.94	N		
Pentachlorophenol	87865	5.12	Y	Y	
Pentadecane	629629	7.71	Y		
Phenol	108952	1.46	N		
p-Nitroaniline	100016	1.39	N		
Tetrachlorophenol	25167833	4.45	Y		
Volatile Organic Compounds					
1,1,1,2-Tetrachloroethane	630206	2.93	N		
1,1,1-Trichloroethane	71556	2.49	N		
1,1,2,2-Tetrachloroethane	79345	2.39	N		
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	3.16	N		
1,1,2-Trichloroethane	79005	1.89	N		
1,1-Dichloroethane	75343	1.79	N		
1,1-Dichloroethene	75354	2.13	N		
1,2,3-Trichlorobenzene	87616	4.05	N		
1,2,3-Trichloropropane	96184	2.27	N		
1,2,4-Trichlorobenzene	120821	4.02	Y	Y	logKow less than 4.2, but on NAVFAC list
1,2,4-Trimethylbenzene	95636	3.63	N		
1,2-Dibromoethane	106934	1.96	N		
1,2-Dichlorobenzene	95501	3.43	Y	Y	logKow less than 4.2, but on NAVFAC list
1,2-Dichloroethane	107062	1.48	N		
1,2-Dichloroethene	540590	2	N		
1,2-Dichloropropane	78875	1.98	N		

Table 12-8
Bioaccumulative Chemicals Detected in Soil
Large Home Range Receptor Ecological Risk Assessment Methodology - Santa Susana Field Laboratory

Chemical	CAS#	log Kow	Bioaccumulative	NAVFAC	Notes
1,3,5-Trimethylbenzene	108678	3.42	N		
1,3-Dichlorobenzene	541731	3.53	Y	Y	logKow less than 4.2, but on NAVFAC list
1,4-Dichlorobenzene	106467	3.44	Y	Y	logKow less than 4.2, but on NAVFAC list
1-Chlorohexane	544105	3.54	N		
2-Chloro-1,1,1-trifluoroethane	75887	1.99	N		
2-Chloroethylvinyl ether	110758	1.17	N		
2-Fluorobiphenyl	321608	3.96	N		
2-Hexanone	591786	1.38	N		
Acetic Acid	64197	0.09	N		
Acetone	67641	-0.24	N		
Benzene	71432	2.13	N		
Bromide	24959679	0.63	N		
Bromobenzene	108861	2.99	N		
Bromodichloromethane	75274	2	N		
Bromomethane	74839	1.19	N		
Carbon Disulfide	75150	1.94	N		
Carbon Tetrachloride	56235	2.83	N		
Chlorobenzene	108907	2.84	N		
Chloroethane	75003	1.43	N		
Chloroform	67663	1.97	N		
Chloromethane	74873	0.91	N		
Chlorotrifluoroethylene	79389	1.65	N		
cis-1,2-Dichloroethene	156592	1.86	N		
cis-1,3-Dichloropropene	10061015	2.06	N		
Cumene	98828	3.66	N		
Dibenzofuran	132649	4.12	N		
Dibromomethane	74953	1.7	N		
Dichlorodifluoromethane	75718	2.16	N		
Ethylbenzene	100414	3.15	N		
Methyl ethyl ketone	78933	0.29	N		
Methyl isobutyl ketone (MIBK)	108101	1.31	N		
Methylene chloride	75092	1.25	N		
m-Xylene	108383	3.2	N		
m-Xylene & p-Xylene	136777612	3.2	N		
n-Butylbenzene	104518	4.38	Y		
n-Propylbenzene	103651	3.69	N		
o-Chlorotoluene	95498	3.42	N		
o-Xylene	95476	3.12	N		
p-Chlorotoluene	106434	3.33	N		
p-Cymene	99876	4.1	N		
sec-Butylbenzene	135988	4.57	Y		
Styrene	100425	2.95	N		
tert-Butylbenzene	98066	4.11	N		
Tetrachloroethene	127184	3.4	N		
Toluene	108883	2.73	N		
trans-1,2-Dichloroethene	156605	2.09	N		
Trichloroethene	79016	2.42	N		
Trichlorofluoromethane	75694	2.53	N		
Undecane	1120214	5.74	Y		
Vinyl chloride	75014	1.62	N		
Xylenes, Total	1330207	3.16	N		
Total Petroleum Hydrocarbons					

Table 12-8
Bioaccumulative Chemicals Detected in Soil
Large Home Range Receptor Ecological Risk Assessment Methodology - Santa Susana Field Laboratory

Chemical	CAS#	log Kow	Bioaccumulative	NAVFAC	Notes
TPH-Diesel Range Organics (DRO)	DRO	--	N		
TPH-Gasoline Range Organics (GRO)	GRO	--	N		
TPH-JP4	JP4	--	N		
TPH-Kerosene Range Organics (KRO)	KRO	--	N		
TPH-Oil Range Organics (ORO)	ORO	--	N		

Notes:
NAVFAC = Naval Facilities Engineering Command - Bioaccumulation in the Ecological Risk (ERA) Process (2001) Appendix A, Table 1.

TNRCC = Texas Natural Resource Conservation Commission - Table 3-1 in Update to Guidance for Conducting Ecological Risk Assessments at Remediation Sites in Texas RG-263 (Revised) January 2006 Version

Chemicals were considered bioaccumulative if they met one of the following critieria:
1) Listed in Table 1 of NAVFAC (2001)
2) Listed in Table 3-1 of TNRCC (2006)
3) log Kow was greater than 4.2 (a value above which chemicals tend to bioaccumulate; USEPA 2000)
4) Other reason - similar to bioaccumulative chemical, has BAF >1, or suspected to be bioaccumulative

Table 12-9
Calculation of Area Use Factors
Large Home Range Receptor Ecological Risk Assessment Methodology - Santa Susana Field Laboratory

Exposure Area	Acres of Habitat	Red-tailed Hawk		Mule Deer		Bobcat	
		Suitable Habitat (Acres)	AUF[a,b]	Suitable Habitat (Acres)	AUF[a,b]	Suitable Habitat (Acres)	AUF[a,b]
Boeing RFI Subarea 1A Central	21.9	19.0	0.0991	12.2	0.0954	19.2	0.0167
Boeing RFI Subarea 1A North	122.7	76.1	0.3961	86.8	0.6782	120.9	0.1050
Boeing RFI Subarea 1A South	346.5	109.2	0.5688	274.2	1	343.3	0.2980
Boeing RFI Subarea 1B North	233.5	140.6	0.7325	117.3	0.9166	227.5	0.1975
Boeing RFI Subarea 1B Southeast	101.7	59.5	0.3099	75.2	0.5876	93.9	0.0815
Boeing RFI Subarea 1B Southwest	83.1	72.5	0.3774	31.1	0.2427	67.2	0.0583
Boeing RFI Subarea 5/9 North	58.3	45.7	0.2380	28.7	0.2244	52.3	0.0454
Boeing RFI Subarea 5/9 South	168.0	136.8	0.7127	103.2	0.8060	155.9	0.1353
Boeing RFI Subarea 10	794.8	205.2	1	777.0	1	781.4	0.6783
SSFL Facility	2772.8	713.8	0.2574	1950.0	0.7032	1019.7	0.3678

Notes:

AUFs larger than 1 are defaulted to 1 for risk estimates.

AUFs were calculated using suitable habitats currently activated in the GIS Risk Model (see Table 12-7), and will change if suitable habitats are added/removed from the risk model during completion of the large home range receptor ecological risk assessment.

[a]Foraging range-based AUF will be used for Subarea-level ERAs.

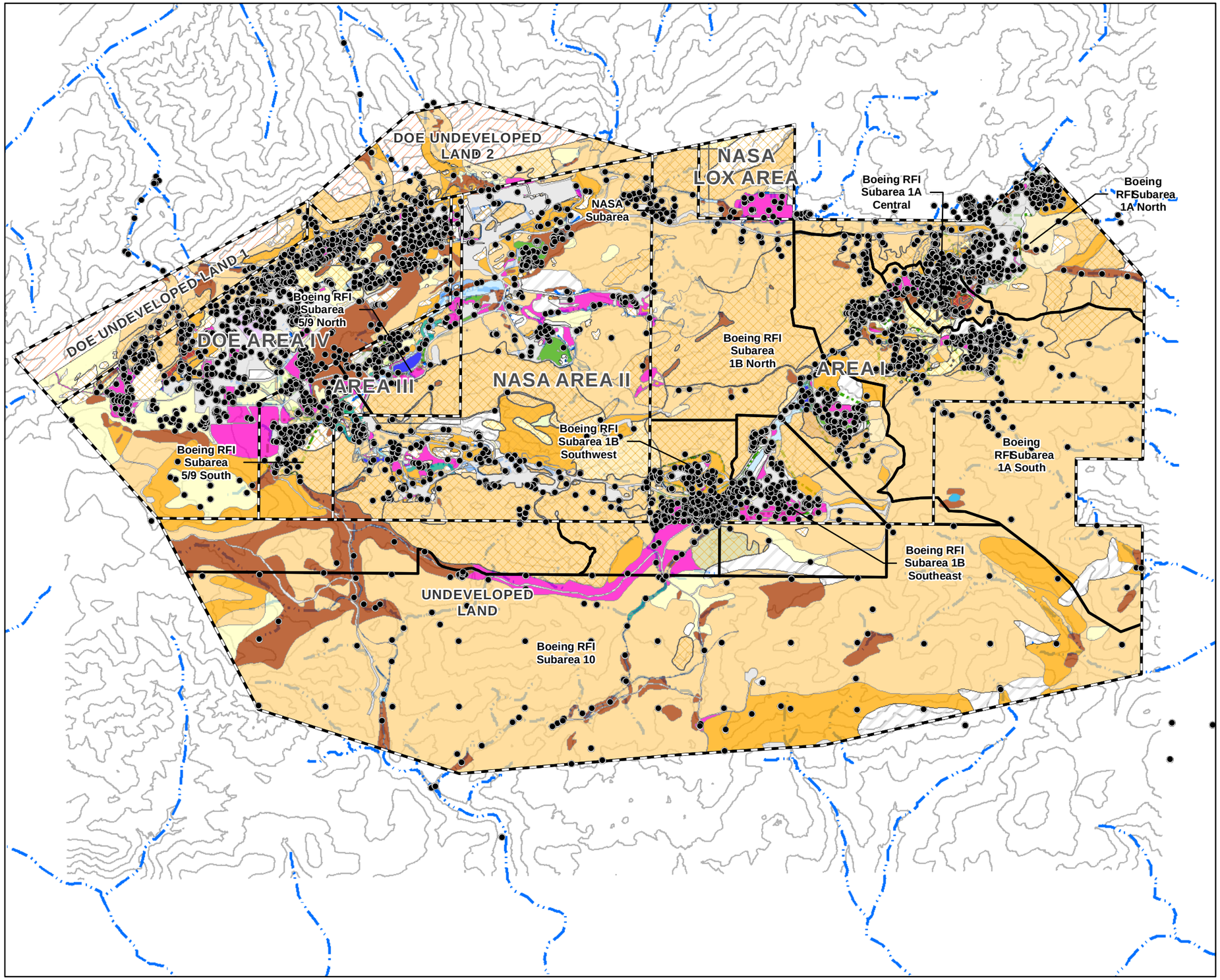
$$\text{Foraging range-based AUF} = \frac{\text{Receptor-suitable habitat in Subarea (ac)}}{\text{Receptor foraging range (ac)}}$$

where:

Receptor	Foraging Range (ac)
Red-tailed Hawk	192
Bobcat	1152
Mule Deer	128

[b]Habitat-based AUF will be used for the Facility-wide ERA.

$$\text{Habitat-based AUF} = \frac{\text{Receptor-suitable habitat in SSFL Facility (ac)}}{\text{Total habitat in SSFL Facility (ac)}}$$



LEGEND

- Reported Sample Location
- No Data Available/Outside Facility Boundary
- Non-Boeing Administrative Area

Site Vegetation

- Disturbed Vegetation
- Coast Live Oak Riparian Forest
- Coast Live Oak Woodland
- Developed
- Rock Outcrop
- Rock Outcrop/Chaparral
- Rock Outcrop/Chaparral/Coast Live Oak Woodland
- Rock Outcrop/Chaparral/Venturan Coastal Sage Scrub
- Rock Outcrop/Coast Live Oak Woodland
- Rock Outcrop/Disturbed Venturan Coastal Sage Scrub
- Rock Outcrop/Venturan Coastal Sage Scrub
- Southern Willow Scrub
- Southern Willow Scrub/Mulefat Scrub

Unsuitable Bobcat Habitat

- Baccharis Scrub
- Chaparral
- Chaparral/Venturan Coastal Sage Scrub
- Eucalyptus Woodland
- Freshwater Marsh
- Mulefat Scrub
- Native Grassland
- Nonnative Grassland
- Not Surveyed
- Open Water
- Rock Outcrop/Nonnative Grassland
- Ruderal Habitat
- Unknown
- Venturan Coastal Sage Scrub
- Waters of the US
- Wetland
- 100 ft Topo Contour
- Drainage Channel
- Boeing RFI SIte
- Boeing Subarea
- Administrative Boundary

N

0 750 1,500
Feet
1 in = 1,500 ft

FIGURE 12-2
Sample Locations for Risk Assessment Model
Large Home Range Receptor Ecological Risk Assessment Methodology Technical Memorandum
Santa Susana Field Laboratory, Ventura County, California

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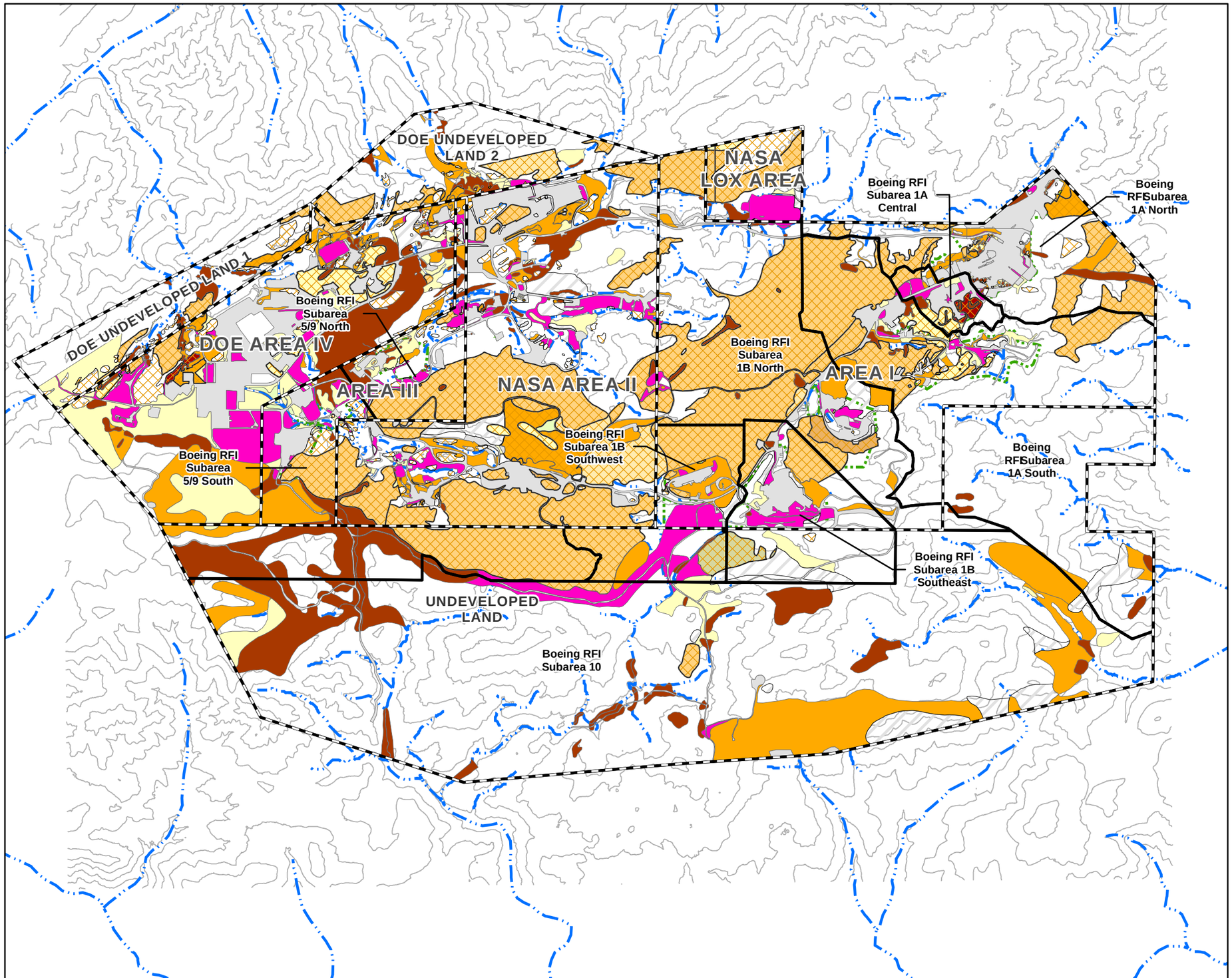

LEGEND

- 100 ft Topo Contour
- Drainage Channel
- Boeing RFI SIte
- Administrative Boundary

Suitable Red-Tailed Hawk Habitat

- Disturbed Vegetation
- Coast Live Oak Woodland
- Developed
- Eucalyptus Woodland
- Native Grassland
- Nonnative Grassland
- Rock Outcrop
- Rock Outcrop/Chaparral
- Rock Outcrop/Chaparral/Coast Live Oak Woodland
- Rock Outcrop/Chaparral/Venturan Coastal Sage Scrub
- Rock Outcrop/Coast Live Oak Woodland
- Rock Outcrop/Disturbed Venturan Coastal Sage Scrub
- Rock Outcrop/Nonnative Grassland
- Rock Outcrop/Venturan Coastal Sage Scrub
- Ruderal Habitat
- Venturan Coastal Sage Scrub
- Unsuitable Habitat or Outside Facility Boundary

N

0 750 1,500
Feet
1 in = 1,500 ft

FIGURE 12-3
Suitable Habitat Types for Red-tailed Hawk
Large Home Range Receptor Ecological Risk Assessment Methodology Technical Memorandum
Santa Susana Field Laboratory, Ventura County, California

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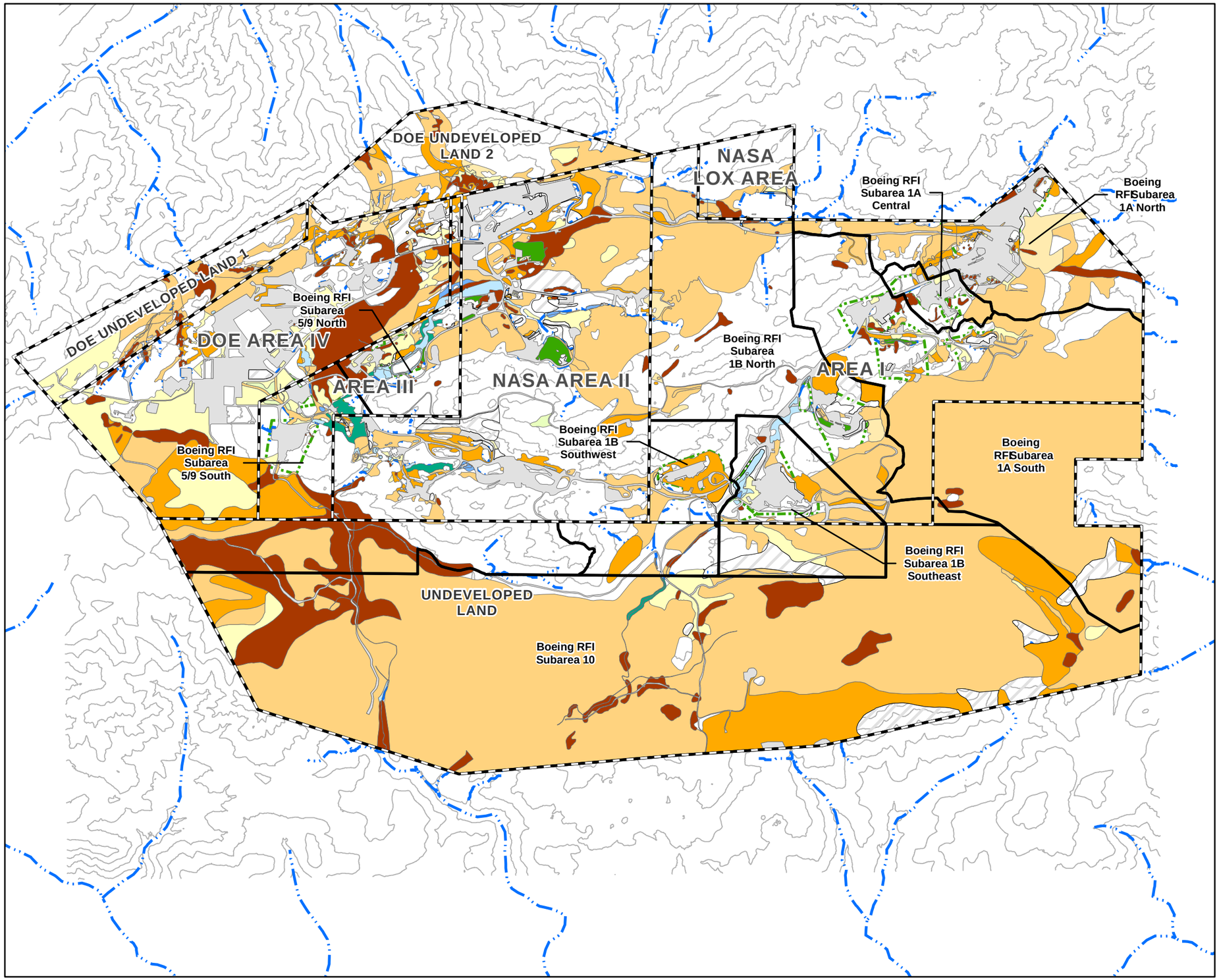

LEGEND

- 100 ft Topo Contour
- Drainage Channel
- Boeing RFI SIte
- Administrative Boundary

Suitable Deer Mule Habitat

- Disturbed Vegetation
- Baccharis Scrub
- Chaparral
- Chaparral/Venturan Coastal Sage Scrub
- Coast Live Oak Riparian Forest
- Coast Live Oak Woodland
- Developed
- Mulefat Scrub
- Native Grassland
- Nonnative Grassland
- Southern Willow Scrub
- Southern Willow Scrub/Mulefat Scrub
- Venturan Coastal Sage Scrub
- Unsuitable Habitat or Outside Facility Boundary

N

0 750 1,500
Feet
1 in = 1,500 ft

FIGURE 12-4
Suitable Habitat Types for Mule Deer
Large Home Range Receptor Ecological Risk Assessment Methodology Technical Memorandum
Santa Susana Field Laboratory, Ventura County, California

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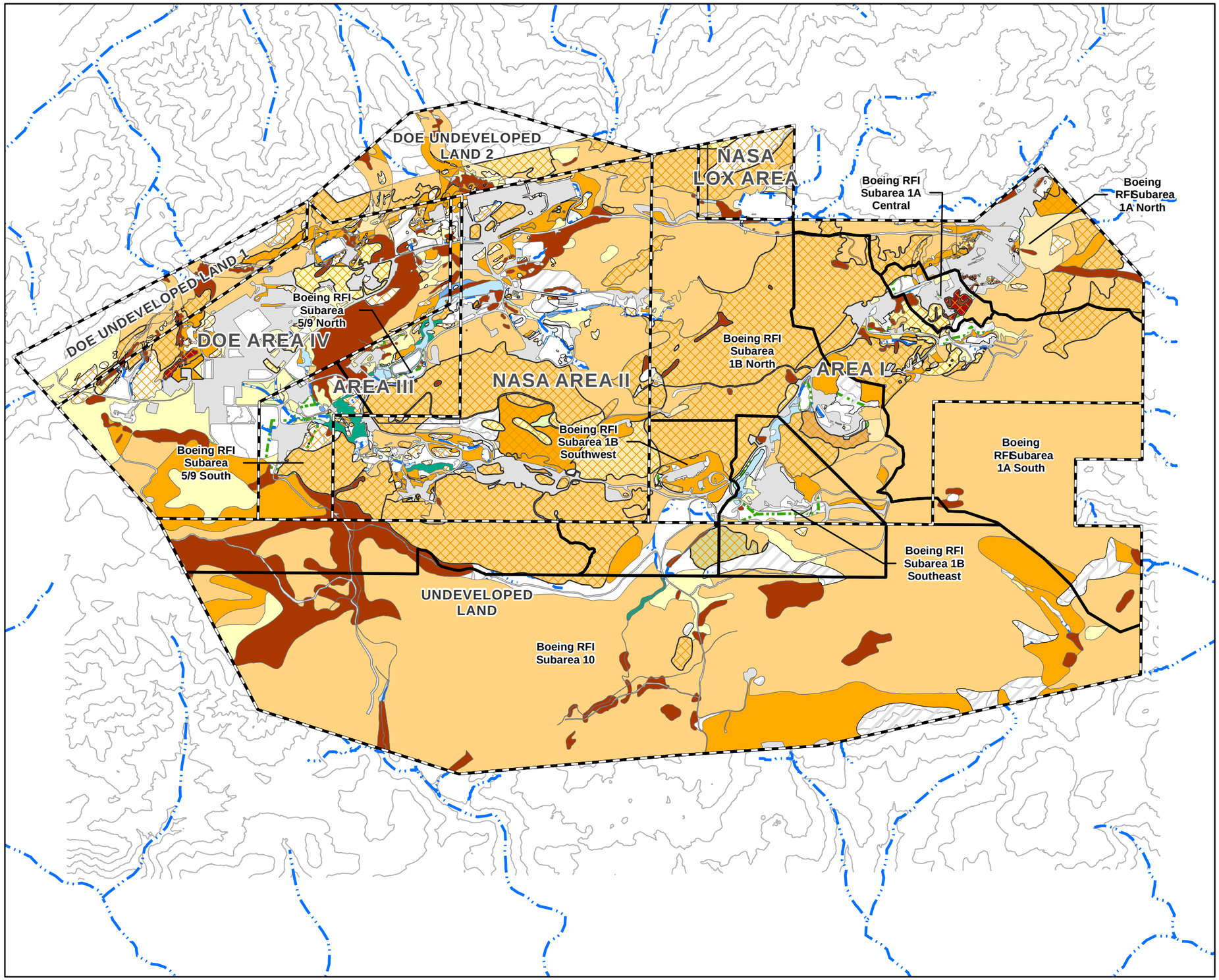

LEGEND

- 100 ft Topo Contour
- Drainage Channel
- Boeing RFI SIte
- Administrative Boundary

Suitable Bobcat Habitat

- Disturbed Vegetation
- Chaparral
- Chaparral/Venturan Coastal Sage Scrub
- Coast Live Oak Riparian Forest
- Coast Live Oak Woodland
- Developed
- Native Grassland
- Nonnative Grassland
- Rock Outcrop
- Rock Outcrop/Chaparral
- Rock Outcrop/Chaparral/Coast Live Oak Woodland
- Rock Outcrop/Chaparral/Venturan Coastal Sage Scrub
- Rock Outcrop/Coast Live Oak Woodland
- Rock Outcrop/Disturbed Venturan Coastal Sage Scrub
- Rock Outcrop/Nonnative Grassland
- Rock Outcrop/Venturan Coastal Sage Scrub
- Southern Willow Scrub
- Southern Willow Scrub/Mulefat Scrub
- Venturan Coastal Sage Scrub
- Unsuitable Habitat or Outside Facility Boundary

N

0 750 1,500
Feet
1 in = 1,500 ft

FIGURE 12-5
Suitable Habitat Types for Bobcat
Large Home Range Receptor Ecological Risk Assessment Methodology Technical Memorandum
Santa Susana Field Laboratory, Ventura County, California

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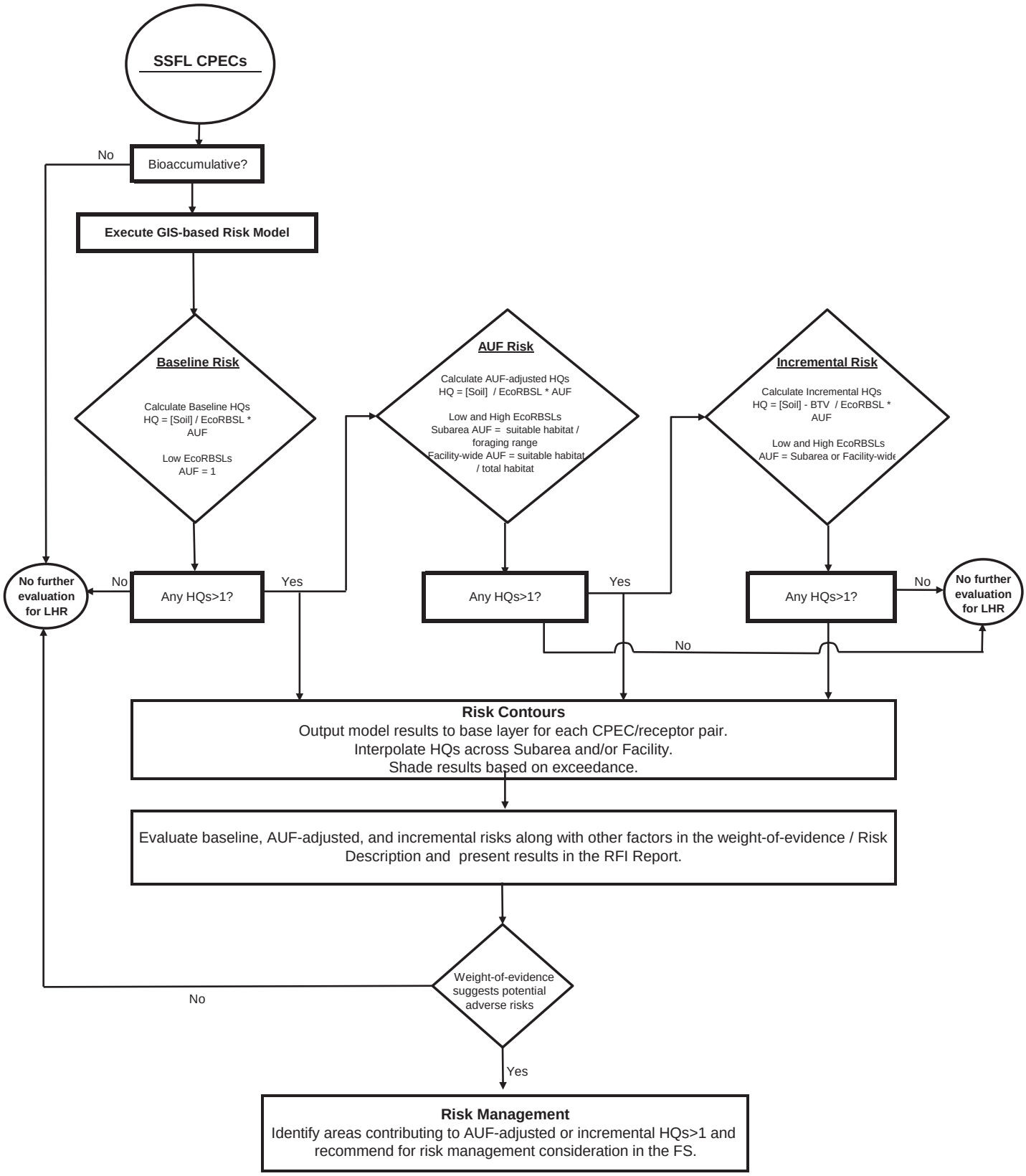


FIGURE 12-6
Flow Diagram for Evaluation of Ecological Risks to Large Home Range Receptors
Large Home Range Receptor Ecological Risk Assessment Methodology Technical Memorandum
Santa Susana Field Laboratory, Ventura County, California

Table EX-1
Example Calculations for Mule Deer Exposure to Nickel - Baseline, AUF, and Incremental
Large Home Range Receptor Ecological Risk Assessment Methodology - Santa Susana Field Laboratory

Subarea	Location	Depth Group	Analyte	Max Result	Unit	Qualifier	Receptor	RBSLType	EcoRBSL	Mule Deer Baseline HQ	Subarea Acres	Foraging Range	Mule Deer Subarea AUF	Mule Deer AUF HQ	BTV	Mule Deer Incremental HQ
Boeing RFI Subarea 1A Central	BSBK04	0-2	Nickel	74	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	172.09	21.9	128	0.0954	16.41	64.2	2.17
Boeing RFI Subarea 1A Central	AFBS0085	0-2	Nickel	51.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	120.23	21.9	128	0.0954	11.47	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0111	0-2	Nickel	38.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	89.07	21.9	128	0.0954	8.49	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0084	0-2	Nickel	32.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	74.65	21.9	128	0.0954	7.12	64.2	0.00
Boeing RFI Subarea 1A Central	BSBK05	0-2	Nickel	26	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	60.47	21.9	128	0.0954	5.77	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0144	0-2	Nickel	24.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	56.98	21.9	128	0.0954	5.43	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0093	0-2	Nickel	23.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	55.58	21.9	128	0.0954	5.30	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS05	0-2	Nickel	23	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	53.49	21.9	128	0.0954	5.10	64.2	0.00
Boeing RFI Subarea 1A Central	BSBK03	0-2	Nickel	23	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	53.49	21.9	128	0.0954	5.10	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0095	0-2	Nickel	22.1	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	51.40	21.9	128	0.0954	4.90	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0093	0-2	Nickel	21.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	50.47	21.9	128	0.0954	4.81	64.2	0.00
Boeing RFI Subarea 1A Central	BSTS07S01	0-2	Nickel	21	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	48.84	21.9	128	0.0954	4.66	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0094	0-2	Nickel	20.8	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	48.37	21.9	128	0.0954	4.61	64.2	0.00
Boeing RFI Subarea 1A Central	BSBK02	0-2	Nickel	20	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	46.51	21.9	128	0.0954	4.44	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0072	0-2	Nickel	19.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	45.58	21.9	128	0.0954	4.35	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0115	0-2	Nickel	16.5	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	38.37	21.9	128	0.0954	3.66	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS37	0-2	Nickel	16	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	37.21	21.9	128	0.0954	3.55	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0113	0-2	Nickel	14.7	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	34.19	21.9	128	0.0954	3.26	64.2	0.00
Boeing RFI Subarea 1A Central	HVBS13	0-2	Nickel	14.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	33.49	21.9	128	0.0954	3.19	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS39	0-2	Nickel	14	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	32.56	21.9	128	0.0954	3.10	64.2	0.00
Boeing RFI Subarea 1A Central	HVBS30	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	21.9	128	0.0954	2.88	64.2	0.00
Boeing RFI Subarea 1A Central	HVBS12	0-2	Nickel	12.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	29.30	21.9	128	0.0954	2.79	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS06	0-2	Nickel	12.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	29.30	21.9	128	0.0954	2.79	64.2	0.00
Boeing RFI Subarea 1A Central	HVBS03	0-2	Nickel	12.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	28.14	21.9	128	0.0954	2.68	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS35	0-2	Nickel	12	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	27.91	21.9	128	0.0954	2.66	64.2	0.00
Boeing RFI Subarea 1A Central	BSBK51	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	21.9	128	0.0954	2.66	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS0139	0-2	Nickel	12	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	27.91	21.9	128	0.0954	2.66	64.2	0.00
Boeing RFI Subarea 1A Central	HNBS0016	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	21.9	128	0.0954	2.66	64.2	0.00
Boeing RFI Subarea 1A Central	HNBS0015	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	21.9	128	0.0954	2.66	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0151	0-2	Nickel	12	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	27.91	21.9	128	0.0954	2.66	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0073	0-2	Nickel	11.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	26.74	21.9	128	0.0954	2.55	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0083	0-2	Nickel	11.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	26.74	21.9	128	0.0954	2.55	64.2	0.00
Boeing RFI Subarea 1A Central	BSTC30S02	0-2	Nickel	11.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	26.51	21.9	128	0.0954	2.53	64.2	0.00
Boeing RFI Subarea 1A Central	HNBS0007	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	21.9	128	0.0954	2.44	64.2	0.00
Boeing RFI Subarea 1A Central	BSBK12	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	21.9	128	0.0954	2.44	64.2	0.00
Boeing RFI Subarea 1A Central	BSBK48	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	21.9	128	0.0954	2.44	64.2	0.00
Boeing RFI Subarea 1A Central	BSBK53	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	21.9	128	0.0954	2.44	64.2	0.00
Boeing RFI Subarea 1A Central	BSTS23	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	21.9	128	0.0954	2.44	64.2	0.00
Boeing RFI Subarea 1A Central	HNBS0018	0-2	Nickel	11	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	25.58	21.9	128	0.0954	2.44	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS0153	0-2	Nickel	10.8	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	25.12	21.9	128	0.0954	2.40	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS0137	0-2	Nickel	10.6	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	24.65	21.9	128	0.0954	2.35	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0105	0-2	Nickel	10.4	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	24.19	21.9	128	0.0954	2.31	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS15	0-2	Nickel	10.4	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	24.19	21.9	128	0.0954	2.31	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS0160	0-2	Nickel	10.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	24.19	21.9	128	0.0954	2.31	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS0121	0-2	Nickel	10.4	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	24.19	21.9	128	0.0954	2.31	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0107	0-2	Nickel	10.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	23.95	21.9	128	0.0954	2.28	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0114	0-2	Nickel	10.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	23.95	21.9	128	0.0954	2.28	64.2	0.00

Boeing RFI Subarea 1A Central	BSBS0153	0-2	Nickel	10.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.95	21.9	128	0.0954	2.28	64.2	0.00
Boeing RFI Subarea 1A Central	BSBK13	0-2	Nickel	10.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.49	21.9	128	0.0954	2.24	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0145	0-2	Nickel	10.1	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	23.49	21.9	128	0.0954	2.24	64.2	0.00
Boeing RFI Subarea 1A Central	BSBK0054	0-2	Nickel	10	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	23.26	21.9	128	0.0954	2.22	64.2	0.00
Boeing RFI Subarea 1A Central	BSBK0058	0-2	Nickel	10	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	23.26	21.9	128	0.0954	2.22	64.2	0.00
Boeing RFI Subarea 1A Central	BSBK11	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	21.9	128	0.0954	2.22	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS26	0-2	Nickel	10	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	23.26	21.9	128	0.0954	2.22	64.2	0.00
Boeing RFI Subarea 1A Central	HVBF42	0-2	Nickel	10	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	23.26	21.9	128	0.0954	2.22	64.2	0.00
Boeing RFI Subarea 1A Central	BSBK0057	0-2	Nickel	10	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	23.26	21.9	128	0.0954	2.22	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS0133	0-2	Nickel	9.9	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	23.02	21.9	128	0.0954	2.20	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS0154	0-2	Nickel	9.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.02	21.9	128	0.0954	2.20	64.2	0.00
Boeing RFI Subarea 1A Central	HNBS0011	0-2	Nickel	9.9	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	23.02	21.9	128	0.0954	2.20	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS0136	0-2	Nickel	9.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.02	21.9	128	0.0954	2.20	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0080	0-2	Nickel	9.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.79	21.9	128	0.0954	2.17	64.2	0.00
Boeing RFI Subarea 1A Central	HNBS0006	0-2	Nickel	9.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.79	21.9	128	0.0954	2.17	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS26	0-2	Nickel	9.6	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	22.33	21.9	128	0.0954	2.13	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0129	0-2	Nickel	9.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.33	21.9	128	0.0954	2.13	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0153	0-2	Nickel	9.6	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	22.33	21.9	128	0.0954	2.13	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS0158	0-2	Nickel	9.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.09	21.9	128	0.0954	2.11	64.2	0.00
Boeing RFI Subarea 1A Central	BSBK50	0-2	Nickel	9.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.09	21.9	128	0.0954	2.11	64.2	0.00
Boeing RFI Subarea 1A Central	HNBS0004	0-2	Nickel	9.4	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	21.86	21.9	128	0.0954	2.08	64.2	0.00
Boeing RFI Subarea 1A Central	HVBS11	0-2	Nickel	9.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.86	21.9	128	0.0954	2.08	64.2	0.00
Boeing RFI Subarea 1A Central	HVBS0108	0-2	Nickel	9.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.86	21.9	128	0.0954	2.08	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS23	0-2	Nickel	9.4	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	21.86	21.9	128	0.0954	2.08	64.2	0.00
Boeing RFI Subarea 1A Central	BSTS29S02	0-2	Nickel	9.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.63	21.9	128	0.0954	2.06	64.2	0.00
Boeing RFI Subarea 1A Central	BSBK0055	0-2	Nickel	9.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	21.63	21.9	128	0.0954	2.06	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0161	0-2	Nickel	9.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.63	21.9	128	0.0954	2.06	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0152	0-2	Nickel	9.27	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	21.56	21.9	128	0.0954	2.06	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0070	0-2	Nickel	9.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.40	21.9	128	0.0954	2.04	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS33	0-2	Nickel	9.1	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	21.16	21.9	128	0.0954	2.02	64.2	0.00
Boeing RFI Subarea 1A Central	BSTS29S01	0-2	Nickel	9.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.16	21.9	128	0.0954	2.02	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0116	0-2	Nickel	9.1	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	21.16	21.9	128	0.0954	2.02	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0124	0-2	Nickel	9.1	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	21.16	21.9	128	0.0954	2.02	64.2	0.00
Boeing RFI Subarea 1A Central	BSBK0056	0-2	Nickel	9	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	20.93	21.9	128	0.0954	2.00	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS25	0-2	Nickel	9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.93	21.9	128	0.0954	2.00	64.2	0.00
Boeing RFI Subarea 1A Central	HVBS19	0-2	Nickel	9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.93	21.9	128	0.0954	2.00	64.2	0.00
Boeing RFI Subarea 1A Central	HNBS0003	0-2	Nickel	9	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	20.93	21.9	128	0.0954	2.00	64.2	0.00
Boeing RFI Subarea 1A Central	HVBF17	0-2	Nickel	9	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	20.93	21.9	128	0.0954	2.00	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS24	0-2	Nickel	9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.93	21.9	128	0.0954	2.00	64.2	0.00
Boeing RFI Subarea 1A Central	HNBS0005	0-2	Nickel	8.9	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	20.70	21.9	128	0.0954	1.97	64.2	0.00
Boeing RFI Subarea 1A Central	BSBK49	0-2	Nickel	8.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.70	21.9	128	0.0954	1.97	64.2	0.00
Boeing RFI Subarea 1A Central	HVBF19	0-2	Nickel	8.9	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	20.70	21.9	128	0.0954	1.97	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS0164	0-2	Nickel	8.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.47	21.9	128	0.0954	1.95	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0103	0-2	Nickel	8.8	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	20.47	21.9	128	0.0954	1.95	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS0133	0-2	Nickel	8.8	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	20.47	21.9	128	0.0954	1.95	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0106	0-2	Nickel	8.7	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	20.23	21.9	128	0.0954	1.93	64.2	0.00
Boeing RFI Subarea 1A Central	HNBS0002	0-2	Nickel	8.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.23	21.9	128	0.0954	1.93	64.2	0.00
Boeing RFI Subarea 1A Central	HNBS0017	0-2	Nickel	8.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.00	21.9	128	0.0954	1.91	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0130	0-2	Nickel	8.5	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	19.77	21.9	128	0.0954	1.89	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS0139	0-2	Nickel	8.5	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	19.77	21.9	128	0.0954	1.89	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0128	0-2	Nickel	8.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	19.53	21.9	128	0.0954	1.86	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS0159	0-2	Nickel	8.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	19.53	21.9	128	0.0954	1.86	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0121	0-2	Nickel	8.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	19.30	21.9	128	0.0954	1.84	64.2	0.00
Boeing RFI Subarea 1A Central	HNBS0001	0-2	Nickel	8.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	19.30	21.9	128	0.0954	1.84	64.2	0.00
Boeing RFI Subarea 1A Central	BSBK01	0-2	Nickel	8.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	19.30	21.9	128	0.0954	1.84	64.2	0.00

Boeing RFI Subarea 1A Central	AFBS43	0-2	Nickel	8.2	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	19.07	21.9	128	0.0954	1.82	64.2	0.00
Boeing RFI Subarea 1A Central	LFBS0108	0-2	Nickel	8.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	19.07	21.9	128	0.0954	1.82	64.2	0.00
Boeing RFI Subarea 1A Central	HNBS0002	0-2	Nickel	8.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	19.07	21.9	128	0.0954	1.82	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0104	0-2	Nickel	8.1	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	18.84	21.9	128	0.0954	1.80	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0079	0-2	Nickel	8.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	18.84	21.9	128	0.0954	1.80	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0122	0-2	Nickel	8	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	18.60	21.9	128	0.0954	1.77	64.2	0.00
Boeing RFI Subarea 1A Central	HVBS42	0-2	Nickel	8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	18.60	21.9	128	0.0954	1.77	64.2	0.00
Boeing RFI Subarea 1A Central	HVBS41	0-2	Nickel	8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	18.60	21.9	128	0.0954	1.77	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS36	0-2	Nickel	8	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	18.60	21.9	128	0.0954	1.77	64.2	0.00
Boeing RFI Subarea 1A Central	HVBF15	0-2	Nickel	7.9	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	18.37	21.9	128	0.0954	1.75	64.2	0.00
Boeing RFI Subarea 1A Central	HVBF18	0-2	Nickel	7.8	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	18.14	21.9	128	0.0954	1.73	64.2	0.00
Boeing RFI Subarea 1A Central	HVBF14	0-2	Nickel	7.7	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	17.91	21.9	128	0.0954	1.71	64.2	0.00
Boeing RFI Subarea 1A Central	HVBF20	0-2	Nickel	7.6	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	17.67	21.9	128	0.0954	1.69	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS22	0-2	Nickel	7.5	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	17.44	21.9	128	0.0954	1.66	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0123	0-2	Nickel	7.5	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	17.44	21.9	128	0.0954	1.66	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0090	0-2	Nickel	7.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	17.44	21.9	128	0.0954	1.66	64.2	0.00
Boeing RFI Subarea 1A Central	HNBS0013	0-2	Nickel	7.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	17.44	21.9	128	0.0954	1.66	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0076	0-2	Nickel	7.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	17.21	21.9	128	0.0954	1.64	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS21	0-2	Nickel	7.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	16.98	21.9	128	0.0954	1.62	64.2	0.00
Boeing RFI Subarea 1A Central	HNBS0009	0-2	Nickel	7.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	16.98	21.9	128	0.0954	1.62	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0116	0-2	Nickel	7.2	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	16.74	21.9	128	0.0954	1.60	64.2	0.00
Boeing RFI Subarea 1A Central	BSTS10	0-2	Nickel	7.2	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	16.74	21.9	128	0.0954	1.60	64.2	0.00
Boeing RFI Subarea 1A Central	HNBS0027	0-2	Nickel	7.1	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	16.51	21.9	128	0.0954	1.57	64.2	0.00
Boeing RFI Subarea 1A Central	BSBK17	0-2	Nickel	7.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	16.51	21.9	128	0.0954	1.57	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS22	0-2	Nickel	7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	16.28	21.9	128	0.0954	1.55	64.2	0.00
Boeing RFI Subarea 1A Central	HVBS39	0-2	Nickel	7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	16.28	21.9	128	0.0954	1.55	64.2	0.00
Boeing RFI Subarea 1A Central	HVBS38	0-2	Nickel	7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	16.28	21.9	128	0.0954	1.55	64.2	0.00
Boeing RFI Subarea 1A Central	BSTS24	0-2	Nickel	6.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	16.05	21.9	128	0.0954	1.53	64.2	0.00
Boeing RFI Subarea 1A Central	HVBS18	0-2	Nickel	6.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	15.81	21.9	128	0.0954	1.51	64.2	0.00
Boeing RFI Subarea 1A Central	BSTS22	0-2	Nickel	6.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	15.81	21.9	128	0.0954	1.51	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS0163	0-2	Nickel	6.71	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	15.60	21.9	128	0.0954	1.49	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS0162	0-2	Nickel	6.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	15.58	21.9	128	0.0954	1.49	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS34	0-2	Nickel	6.6	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	15.35	21.9	128	0.0954	1.46	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS62	0-2	Nickel	6.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	15.35	21.9	128	0.0954	1.46	64.2	0.00
Boeing RFI Subarea 1A Central	BSTC25S06	0-2	Nickel	6.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	14.88	21.9	128	0.0954	1.42	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS0134	0-2	Nickel	6.2	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	14.42	21.9	128	0.0954	1.38	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS38	0-2	Nickel	6.1	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	14.19	21.9	128	0.0954	1.35	64.2	0.00
Boeing RFI Subarea 1A Central	BSTS20	0-2	Nickel	6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	13.95	21.9	128	0.0954	1.33	64.2	0.00
Boeing RFI Subarea 1A Central	BSTS09	0-2	Nickel	6	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	13.95	21.9	128	0.0954	1.33	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS42	0-2	Nickel	5.8	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	13.49	21.9	128	0.0954	1.29	64.2	0.00
Boeing RFI Subarea 1A Central	HNBS0010	0-2	Nickel	5.8	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	13.49	21.9	128	0.0954	1.29	64.2	0.00
Boeing RFI Subarea 1A Central	BSTS21	0-2	Nickel	5.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	13.26	21.9	128	0.0954	1.26	64.2	0.00
Boeing RFI Subarea 1A Central	BSBK52	0-2	Nickel	5.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	12.56	21.9	128	0.0954	1.20	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS40	0-2	Nickel	5.2	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	12.09	21.9	128	0.0954	1.15	64.2	0.00
Boeing RFI Subarea 1A Central	HZBS0005	0-2	Nickel	4.8	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	11.16	21.9	128	0.0954	1.06	64.2	0.00
Boeing RFI Subarea 1A Central	HZBS0005	0-2	Nickel	4.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	10.00	21.9	128	0.0954	0.95	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS0163	0-2	Nickel	4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	9.30	21.9	128	0.0954	0.89	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0078	0-2	Nickel	4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	9.30	21.9	128	0.0954	0.89	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0147	0-2	Nickel	2.79	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	6.49	21.9	128	0.0954	0.62	64.2	0.00
Boeing RFI Subarea 1A North	A1BS01	0-2	Nickel	133	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	309.30	122.7	128	0.6782	209.77	64.2	108.51
Boeing RFI Subarea 1A North	A1BS0068	0-2	Nickel	85.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	198.37	122.7	128	0.6782	134.54	64.2	33.28
Boeing RFI Subarea 1A North	A1BS0102	0-2	Nickel	29.6	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	68.84	122.7	128	0.6782	46.69	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0101	0-2	Nickel	29.4	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	68.37	122.7	128	0.6782	46.37	64.2	0.00
Boeing RFI Subarea 1A North	A1BS03	0-2	Nickel	28.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	65.35	122.7	128	0.6782	44.32	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0087	0-2	Nickel	26.5	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	61.63	122.7	128	0.6782	41.80	64.2	0.00

Boeing RFI Subarea 1A North	ILBS0232	0-2	Nickel	25.4	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	59.07	122.7	128	0.6782	40.06	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0248	0-2	Nickel	24.5	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	56.98	122.7	128	0.6782	38.64	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0108	0-2	Nickel	24	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	55.81	122.7	128	0.6782	37.85	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0097	0-2	Nickel	23.9	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	55.58	122.7	128	0.6782	37.70	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0349	0-2	Nickel	23.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	55.35	122.7	128	0.6782	37.54	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0373	0-2	Nickel	21.8	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	50.70	122.7	128	0.6782	34.38	64.2	0.00
Boeing RFI Subarea 1A North	ILBS40	0-2	Nickel	21	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	48.84	122.7	128	0.6782	33.12	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0370	0-2	Nickel	20.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	48.37	122.7	128	0.6782	32.81	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0086	0-2	Nickel	20.1	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	46.74	122.7	128	0.6782	31.70	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0118	0-2	Nickel	19.2	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	44.65	122.7	128	0.6782	30.28	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0371	0-2	Nickel	18.9	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	43.95	122.7	128	0.6782	29.81	64.2	0.00
Boeing RFI Subarea 1A North	NDET5026	0-2	Nickel	18	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	41.86	122.7	128	0.6782	28.39	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0211	0-2	Nickel	18	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	41.86	122.7	128	0.6782	28.39	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0091	0-2	Nickel	17.8	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	41.40	122.7	128	0.6782	28.07	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0075	0-2	Nickel	17.7	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	41.16	122.7	128	0.6782	27.92	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0089	0-2	Nickel	17.4	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	40.47	122.7	128	0.6782	27.44	64.2	0.00
Boeing RFI Subarea 1A North	ENBS0043	0-2	Nickel	17.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	40.23	122.7	128	0.6782	27.29	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0164	0-2	Nickel	17	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	39.53	122.7	128	0.6782	26.81	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0114	0-2	Nickel	16.9	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	39.30	122.7	128	0.6782	26.66	64.2	0.00
Boeing RFI Subarea 1A North	ILTS05	0-2	Nickel	16.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	37.91	122.7	128	0.6782	25.71	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0074	0-2	Nickel	16.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	37.91	122.7	128	0.6782	25.71	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0212	0-2	Nickel	16	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	37.21	122.7	128	0.6782	25.24	64.2	0.00
Boeing RFI Subarea 1A North	ENBS0056	0-2	Nickel	16	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	37.21	122.7	128	0.6782	25.24	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0223	0-2	Nickel	16	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	37.21	122.7	128	0.6782	25.24	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0375	0-2	Nickel	15.9	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	36.98	122.7	128	0.6782	25.08	64.2	0.00
Boeing RFI Subarea 1A North	ENBS0044	0-2	Nickel	15.8	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	36.74	122.7	128	0.6782	24.92	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0365	0-2	Nickel	15.8	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	36.74	122.7	128	0.6782	24.92	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0372	0-2	Nickel	15.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	35.58	122.7	128	0.6782	24.13	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0373	0-2	Nickel	15.1	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	35.12	122.7	128	0.6782	23.82	64.2	0.00
Boeing RFI Subarea 1A North	ILBS93	0-2	Nickel	15	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	34.88	122.7	128	0.6782	23.66	64.2	0.00
Boeing RFI Subarea 1A North	A1BS10	0-2	Nickel	15	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	34.88	122.7	128	0.6782	23.66	64.2	0.00
Boeing RFI Subarea 1A North	ILBS44	0-2	Nickel	15	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	34.88	122.7	128	0.6782	23.66	64.2	0.00
Boeing RFI Subarea 1A North	ILBS25	0-2	Nickel	15	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	34.88	122.7	128	0.6782	23.66	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0213	0-2	Nickel	15	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	34.88	122.7	128	0.6782	23.66	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0137	0-2	Nickel	15	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	34.88	122.7	128	0.6782	23.66	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0224	0-2	Nickel	15	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	34.88	122.7	128	0.6782	23.66	64.2	0.00
Boeing RFI Subarea 1A North	ENBS0044	0-2	Nickel	14.9	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	34.65	122.7	128	0.6782	23.50	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0367	0-2	Nickel	14.9	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	34.65	122.7	128	0.6782	23.50	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0366	0-2	Nickel	14.8	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	34.42	122.7	128	0.6782	23.34	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0079	0-2	Nickel	14.8	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	34.42	122.7	128	0.6782	23.34	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0111	0-2	Nickel	14.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	34.19	122.7	128	0.6782	23.19	64.2	0.00
Boeing RFI Subarea 1A North	ENBS0066	0-2	Nickel	14.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	33.72	122.7	128	0.6782	22.87	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0093	0-2	Nickel	14.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	33.26	122.7	128	0.6782	22.55	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0374	0-2	Nickel	14.2	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	33.02	122.7	128	0.6782	22.40	64.2	0.00
Boeing RFI Subarea 1A North	ILBS14	0-2	Nickel	14	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.56	122.7	128	0.6782	22.08	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0182	0-2	Nickel	14	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.56	122.7	128	0.6782	22.08	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0193	0-2	Nickel	14	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.56	122.7	128	0.6782	22.08	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0212	0-2	Nickel	14	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.56	122.7	128	0.6782	22.08	64.2	0.00
Boeing RFI Subarea 1A North	B1BS0065	0-2	Nickel	14	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	32.56	122.7	128	0.6782	22.08	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0179	0-2	Nickel	14	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	32.56	122.7	128	0.6782	22.08	64.2	0.00
Boeing RFI Subarea 1A North	B1BS0073	0-2	Nickel	14	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.56	122.7	128	0.6782	22.08	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0144	0-2	Nickel	14	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.56	122.7	128	0.6782	22.08	64.2	0.00
Boeing RFI Subarea 1A North	B1BS0063	0-2	Nickel	14	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	32.56	122.7	128	0.6782	22.08	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0369	0-2	Nickel	13.9	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	32.33	122.7	128	0.6782	21.92	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0122	0-2	Nickel	13.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.09	122.7	128	0.6782	21.77	64.2	0.00

Boeing RFI Subarea 1A North	BGSS01	0-2	Nickel	13.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.09	122.7	128	0.6782	21.77	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0073	0-2	Nickel	13.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	31.86	122.7	128	0.6782	21.61	64.2	0.00
Boeing RFI Subarea 1A North	A1TS48	0-2	Nickel	13.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	31.40	122.7	128	0.6782	21.29	64.2	0.00
Boeing RFI Subarea 1A North	A1BS04	0-2	Nickel	13.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	31.16	122.7	128	0.6782	21.13	64.2	0.00
Boeing RFI Subarea 1A North	ENBS0068	0-2	Nickel	13.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.70	122.7	128	0.6782	20.82	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0158	0-2	Nickel	13.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.47	122.7	128	0.6782	20.66	64.2	0.00
Boeing RFI Subarea 1A North	ENBS0037	0-2	Nickel	13.1	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	30.47	122.7	128	0.6782	20.66	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0083	0-2	Nickel	13.1	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	30.47	122.7	128	0.6782	20.66	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0194	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	122.7	128	0.6782	20.50	64.2	0.00
Boeing RFI Subarea 1A North	B1BS23	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	122.7	128	0.6782	20.50	64.2	0.00
Boeing RFI Subarea 1A North	B1BS0066	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	122.7	128	0.6782	20.50	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0156	0-2	Nickel	13	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	30.23	122.7	128	0.6782	20.50	64.2	0.00
Boeing RFI Subarea 1A North	ILBS38	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	122.7	128	0.6782	20.50	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0201	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	122.7	128	0.6782	20.50	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0166	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	122.7	128	0.6782	20.50	64.2	0.00
Boeing RFI Subarea 1A North	B1BS0060	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	122.7	128	0.6782	20.50	64.2	0.00
Boeing RFI Subarea 1A North	B1BS0061	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	122.7	128	0.6782	20.50	64.2	0.00
Boeing RFI Subarea 1A North	NDET5028	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	122.7	128	0.6782	20.50	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0239	0-2	Nickel	12.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	29.53	122.7	128	0.6782	20.03	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0077	0-2	Nickel	12.7	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	29.53	122.7	128	0.6782	20.03	64.2	0.00
Boeing RFI Subarea 1A North	B1BS0156	0-2	Nickel	12.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	29.53	122.7	128	0.6782	20.03	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0368	0-2	Nickel	12.4	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	28.84	122.7	128	0.6782	19.56	64.2	0.00
Boeing RFI Subarea 1A North	ENBS0068	0-2	Nickel	12.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	28.84	122.7	128	0.6782	19.56	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0092	0-2	Nickel	12.2	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	28.37	122.7	128	0.6782	19.24	64.2	0.00
Boeing RFI Subarea 1A North	ENBS0047	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	122.7	128	0.6782	18.93	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0180	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	122.7	128	0.6782	18.93	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0374	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	122.7	128	0.6782	18.93	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0157	0-2	Nickel	12	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	27.91	122.7	128	0.6782	18.93	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0173	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	122.7	128	0.6782	18.93	64.2	0.00
Boeing RFI Subarea 1A North	B1BS0053	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	122.7	128	0.6782	18.93	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0191	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	122.7	128	0.6782	18.93	64.2	0.00
Boeing RFI Subarea 1A North	B1BS29	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	122.7	128	0.6782	18.93	64.2	0.00
Boeing RFI Subarea 1A North	A1TS0058A	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	122.7	128	0.6782	18.93	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0195	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	122.7	128	0.6782	18.93	64.2	0.00
Boeing RFI Subarea 1A North	NDET5027	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	122.7	128	0.6782	18.93	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0206	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	122.7	128	0.6782	18.93	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0119	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	122.7	128	0.6782	18.93	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0166	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	122.7	128	0.6782	18.93	64.2	0.00
Boeing RFI Subarea 1A North	B1BS0224	0-2	Nickel	11.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.44	122.7	128	0.6782	18.61	64.2	0.00
Boeing RFI Subarea 1A North	ENBS0038	0-2	Nickel	11.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.44	122.7	128	0.6782	18.61	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0067	0-2	Nickel	11.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.44	122.7	128	0.6782	18.61	64.2	0.00
Boeing RFI Subarea 1A North	A1TS49	0-2	Nickel	11.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.21	122.7	128	0.6782	18.45	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0120	0-2	Nickel	11.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	26.98	122.7	128	0.6782	18.30	64.2	0.00
Boeing RFI Subarea 1A North	A1BS11	0-2	Nickel	11.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	26.98	122.7	128	0.6782	18.30	64.2	0.00
Boeing RFI Subarea 1A North	B1BS0222	0-2	Nickel	11.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	26.51	122.7	128	0.6782	17.98	64.2	0.00
Boeing RFI Subarea 1A North	ENBS0072	0-2	Nickel	11.4	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	26.51	122.7	128	0.6782	17.98	64.2	0.00
Boeing RFI Subarea 1A North	ILTS02	0-2	Nickel	11.4	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	26.51	122.7	128	0.6782	17.98	64.2	0.00
Boeing RFI Subarea 1A North	ENBS0063	0-2	Nickel	11.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	26.28	122.7	128	0.6782	17.82	64.2	0.00
Boeing RFI Subarea 1A North	A1BS07	0-2	Nickel	11.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	26.05	122.7	128	0.6782	17.66	64.2	0.00
Boeing RFI Subarea 1A North	B1BS0225	0-2	Nickel	11.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.81	122.7	128	0.6782	17.51	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0176	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	122.7	128	0.6782	17.35	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0185	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	122.7	128	0.6782	17.35	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0186	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	122.7	128	0.6782	17.35	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0187	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	122.7	128	0.6782	17.35	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0170	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	122.7	128	0.6782	17.35	64.2	0.00

Boeing RFI Subarea 1A North	ILBS0202	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	122.7	128	0.6782	17.35	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0205	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	122.7	128	0.6782	17.35	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0241	0-2	Nickel	11	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	25.58	122.7	128	0.6782	17.35	64.2	0.00
Boeing RFI Subarea 1A North	B1BS22	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	122.7	128	0.6782	17.35	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0209	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	122.7	128	0.6782	17.35	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0141	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	122.7	128	0.6782	17.35	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0134	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	122.7	128	0.6782	17.35	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0136	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	122.7	128	0.6782	17.35	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0160	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	122.7	128	0.6782	17.35	64.2	0.00
Boeing RFI Subarea 1A North	ENBS0069	0-2	Nickel	11	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	25.58	122.7	128	0.6782	17.35	64.2	0.00
Boeing RFI Subarea 1A North	A1TS03	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	122.7	128	0.6782	17.35	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0142	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	122.7	128	0.6782	17.35	64.2	0.00
Boeing RFI Subarea 1A North	ILBS01	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	122.7	128	0.6782	17.35	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0143	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	122.7	128	0.6782	17.35	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0140	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	122.7	128	0.6782	17.35	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0148	0-2	Nickel	11	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	25.58	122.7	128	0.6782	17.35	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0034	0-2	Nickel	11	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	25.58	122.7	128	0.6782	17.35	64.2	0.00
Boeing RFI Subarea 1A North	B1BS0223	0-2	Nickel	10.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.35	122.7	128	0.6782	17.19	64.2	0.00
Boeing RFI Subarea 1A North	B1BS0231	0-2	Nickel	10.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.35	122.7	128	0.6782	17.19	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0123	0-2	Nickel	10.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.12	122.7	128	0.6782	17.03	64.2	0.00
Boeing RFI Subarea 1A North	A1BS08	0-2	Nickel	10.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.12	122.7	128	0.6782	17.03	64.2	0.00
Boeing RFI Subarea 1A North	A1TS31	0-2	Nickel	10.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	24.88	122.7	128	0.6782	16.88	64.2	0.00
Boeing RFI Subarea 1A North	A1TS45	0-2	Nickel	10.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	24.88	122.7	128	0.6782	16.88	64.2	0.00
Boeing RFI Subarea 1A North	A1TS11	0-2	Nickel	10.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	24.88	122.7	128	0.6782	16.88	64.2	0.00
Boeing RFI Subarea 1A North	ENBS0042	0-2	Nickel	10.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	24.42	122.7	128	0.6782	16.56	64.2	0.00
Boeing RFI Subarea 1A North	ENBS0045	0-2	Nickel	10.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	24.19	122.7	128	0.6782	16.40	64.2	0.00
Boeing RFI Subarea 1A North	A1TS19	0-2	Nickel	10.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	24.19	122.7	128	0.6782	16.40	64.2	0.00
Boeing RFI Subarea 1A North	ENBS0041	0-2	Nickel	10.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.95	122.7	128	0.6782	16.25	64.2	0.00
Boeing RFI Subarea 1A North	A1TS07	0-2	Nickel	10.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.72	122.7	128	0.6782	16.09	64.2	0.00
Boeing RFI Subarea 1A North	B1BS27	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	122.7	128	0.6782	15.77	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0159	0-2	Nickel	10	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	23.26	122.7	128	0.6782	15.77	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0133	0-2	Nickel	10	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	23.26	122.7	128	0.6782	15.77	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0207	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	122.7	128	0.6782	15.77	64.2	0.00
Boeing RFI Subarea 1A North	A1BS09	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	122.7	128	0.6782	15.77	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0222	0-2	Nickel	10	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	23.26	122.7	128	0.6782	15.77	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0175	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	122.7	128	0.6782	15.77	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0146	0-2	Nickel	10	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	23.26	122.7	128	0.6782	15.77	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0125	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	122.7	128	0.6782	15.77	64.2	0.00
Boeing RFI Subarea 1A North	B1BS0070	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	122.7	128	0.6782	15.77	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0208	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	122.7	128	0.6782	15.77	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0171	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	122.7	128	0.6782	15.77	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0180	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	122.7	128	0.6782	15.77	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0174	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	122.7	128	0.6782	15.77	64.2	0.00
Boeing RFI Subarea 1A North	B1BS0052	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	122.7	128	0.6782	15.77	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0053	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	122.7	128	0.6782	15.77	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0283	0-2	Nickel	9.92	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	23.07	122.7	128	0.6782	15.65	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0138	0-2	Nickel	9.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.02	122.7	128	0.6782	15.61	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0112	0-2	Nickel	9.9	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	23.02	122.7	128	0.6782	15.61	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0172	0-2	Nickel	9.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.02	122.7	128	0.6782	15.61	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0177	0-2	Nickel	9.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.02	122.7	128	0.6782	15.61	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0210	0-2	Nickel	9.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.02	122.7	128	0.6782	15.61	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0149	0-2	Nickel	9.9	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	23.02	122.7	128	0.6782	15.61	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0080	0-2	Nickel	9.9	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	23.02	122.7	128	0.6782	15.61	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0238	0-2	Nickel	9.7	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	22.56	122.7	128	0.6782	15.30	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0235	0-2	Nickel	9.6	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	22.33	122.7	128	0.6782	15.14	64.2	0.00

Boeing RFI Subarea 1A North	ILBS0190	0-2	Nickel	9.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.33	122.7	128	0.6782	15.14	64.2	0.00
Boeing RFI Subarea 1A North	B1BS21	0-2	Nickel	9.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.33	122.7	128	0.6782	15.14	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0147	0-2	Nickel	9.6	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	22.33	122.7	128	0.6782	15.14	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0140	0-2	Nickel	9.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.33	122.7	128	0.6782	15.14	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0203	0-2	Nickel	9.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.33	122.7	128	0.6782	15.14	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0277	0-2	Nickel	9.59	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	22.30	122.7	128	0.6782	15.13	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0189	0-2	Nickel	9.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.09	122.7	128	0.6782	14.98	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0135	0-2	Nickel	9.5	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	22.09	122.7	128	0.6782	14.98	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0233	0-2	Nickel	9.5	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	22.09	122.7	128	0.6782	14.98	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0099	0-2	Nickel	9.41	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	21.88	122.7	128	0.6782	14.84	64.2	0.00
Boeing RFI Subarea 1A North	A1BS05	0-2	Nickel	9.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.86	122.7	128	0.6782	14.83	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0242	0-2	Nickel	9.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	21.63	122.7	128	0.6782	14.67	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0275	0-2	Nickel	9.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	21.63	122.7	128	0.6782	14.67	64.2	0.00
Boeing RFI Subarea 1A North	B1BS0064	0-2	Nickel	9.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	21.63	122.7	128	0.6782	14.67	64.2	0.00
Boeing RFI Subarea 1A North	B1BS0074	0-2	Nickel	9.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.63	122.7	128	0.6782	14.67	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0139	0-2	Nickel	9.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.40	122.7	128	0.6782	14.51	64.2	0.00
Boeing RFI Subarea 1A North	A1BS14	0-2	Nickel	9.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.40	122.7	128	0.6782	14.51	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0242	0-2	Nickel	9.1	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	21.16	122.7	128	0.6782	14.35	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0260	0-2	Nickel	9.1	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	21.16	122.7	128	0.6782	14.35	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0124	0-2	Nickel	9.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.16	122.7	128	0.6782	14.35	64.2	0.00
Boeing RFI Subarea 1A North	A1BS06	0-2	Nickel	9.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.16	122.7	128	0.6782	14.35	64.2	0.00
Boeing RFI Subarea 1A North	B1BS0221	0-2	Nickel	9.09	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.14	122.7	128	0.6782	14.34	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0098	0-2	Nickel	9.04	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.02	122.7	128	0.6782	14.26	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0110	0-2	Nickel	9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.93	122.7	128	0.6782	14.20	64.2	0.00
Boeing RFI Subarea 1A North	B1BS28	0-2	Nickel	9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.93	122.7	128	0.6782	14.20	64.2	0.00
Boeing RFI Subarea 1A North	ILBS18	0-2	Nickel	9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.93	122.7	128	0.6782	14.20	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0230	0-2	Nickel	9	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	20.93	122.7	128	0.6782	14.20	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0167	0-2	Nickel	8.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.70	122.7	128	0.6782	14.04	64.2	0.00
Boeing RFI Subarea 1A North	A1SS02	0-2	Nickel	8.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.47	122.7	128	0.6782	13.88	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0117	0-2	Nickel	8.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.23	122.7	128	0.6782	13.72	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0204	0-2	Nickel	8.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	19.77	122.7	128	0.6782	13.41	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0168	0-2	Nickel	8.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	19.53	122.7	128	0.6782	13.25	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0231	0-2	Nickel	8.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	19.30	122.7	128	0.6782	13.09	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0261	0-2	Nickel	8.26	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	19.21	122.7	128	0.6782	13.03	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0192	0-2	Nickel	8.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	18.84	122.7	128	0.6782	12.78	64.2	0.00
Boeing RFI Subarea 1A North	B1BS0070	0-2	Nickel	8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	18.60	122.7	128	0.6782	12.62	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0381	0-2	Nickel	7.9	mg/kg	UJ	Mule Deer	Low TRV-Based RBSL	0.43	18.37	122.7	128	0.6782	12.46	64.2	0.00
Boeing RFI Subarea 1A North	A1TS47	0-2	Nickel	7.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	18.14	122.7	128	0.6782	12.30	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0165	0-2	Nickel	7.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	17.91	122.7	128	0.6782	12.14	64.2	0.00
Boeing RFI Subarea 1A North	ILBS92	0-2	Nickel	7.7	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	17.91	122.7	128	0.6782	12.14	64.2	0.00
Boeing RFI Subarea 1A North	A1TS12	0-2	Nickel	7.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	17.67	122.7	128	0.6782	11.99	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0276	0-2	Nickel	7.26	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	16.88	122.7	128	0.6782	11.45	64.2	0.00
Boeing RFI Subarea 1A North	ILBS94	0-2	Nickel	6.8	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	15.81	122.7	128	0.6782	10.73	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0121	0-2	Nickel	6.6	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	15.35	122.7	128	0.6782	10.41	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0231	0-2	Nickel	6.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	14.65	122.7	128	0.6782	9.94	64.2	0.00
Boeing RFI Subarea 1A North	B-1-01	0-2	Nickel	6.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	14.19	122.7	128	0.6782	9.62	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0278	0-2	Nickel	6.08	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	14.14	122.7	128	0.6782	9.59	64.2	0.00
Boeing RFI Subarea 1A North	B-1-02	0-2	Nickel	6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	13.95	122.7	128	0.6782	9.46	64.2	0.00
Boeing RFI Subarea 1A North	B-1-03	0-2	Nickel	5.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	13.72	122.7	128	0.6782	9.31	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0243	0-2	Nickel	5.5	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	12.79	122.7	128	0.6782	8.67	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0085	0-2	Nickel	5.45	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	12.67	122.7	128	0.6782	8.60	64.2	0.00
Boeing RFI Subarea 1A North	A1TS30	0-2	Nickel	2.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	4.88	122.7	128	0.6782	3.31	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0102	0-2	Nickel	199	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	462.79	346.5	128	1.0000	462.79	64.2	313.49
Boeing RFI Subarea 1A South	LFBS43	0-2	Nickel	128	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	297.67	346.5	128	1.0000	297.67	64.2	148.37
Boeing RFI Subarea 1A South	LFBS44	0-2	Nickel	94.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	219.77	346.5	128	1.0000	219.77	64.2	70.47

Boeing RFI Subarea 1A South	CNBS0085	0-2	Nickel	61.7	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	143.49	346.5	128	1.0000	143.49	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0002	0-2	Nickel	45.2	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	105.12	346.5	128	1.0000	105.12	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0001	0-2	Nickel	31.4	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	73.02	346.5	128	1.0000	73.02	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0003	0-2	Nickel	28.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	65.81	346.5	128	1.0000	65.81	64.2	0.00
Boeing RFI Subarea 1A South	LFSS08	0-2	Nickel	28	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	65.12	346.5	128	1.0000	65.12	64.2	0.00
Boeing RFI Subarea 1A South	LFR-2	0-2	Nickel	27	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	62.79	346.5	128	1.0000	62.79	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0032	0-2	Nickel	26.7	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	62.09	346.5	128	1.0000	62.09	64.2	0.00
Boeing RFI Subarea 1A South	LFBS31	0-2	Nickel	24	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	55.81	346.5	128	1.0000	55.81	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0144	0-2	Nickel	22.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	51.86	346.5	128	1.0000	51.86	64.2	0.00
Boeing RFI Subarea 1A South	LFBS45	0-2	Nickel	21.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	49.30	346.5	128	1.0000	49.30	64.2	0.00
Boeing RFI Subarea 1A South	CNBS33	0-2	Nickel	21	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	48.84	346.5	128	1.0000	48.84	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0155	0-2	Nickel	21	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	48.84	346.5	128	1.0000	48.84	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0336	0-2	Nickel	20.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	48.14	346.5	128	1.0000	48.14	64.2	0.00
Boeing RFI Subarea 1A South	HVBS54	0-2	Nickel	20	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	46.51	346.5	128	1.0000	46.51	64.2	0.00
Boeing RFI Subarea 1A South	LFBS86	0-2	Nickel	20	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	46.51	346.5	128	1.0000	46.51	64.2	0.00
Boeing RFI Subarea 1A South	HZET0507	0-2	Nickel	19.9	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	46.28	346.5	128	1.0000	46.28	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0256	0-2	Nickel	19.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	44.88	346.5	128	1.0000	44.88	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0013	0-2	Nickel	19.1	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	44.42	346.5	128	1.0000	44.42	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0130	0-2	Nickel	18.7	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	43.49	346.5	128	1.0000	43.49	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0337	0-2	Nickel	18.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	43.26	346.5	128	1.0000	43.26	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0332	0-2	Nickel	18.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	42.56	346.5	128	1.0000	42.56	64.2	0.00
Boeing RFI Subarea 1A South	CNBS55	0-2	Nickel	18	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	41.86	346.5	128	1.0000	41.86	64.2	0.00
Boeing RFI Subarea 1A South	HVBF35	0-2	Nickel	18	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	41.86	346.5	128	1.0000	41.86	64.2	0.00
Boeing RFI Subarea 1A South	ENBS0052	0-2	Nickel	17.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	40.70	346.5	128	1.0000	40.70	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0125	0-2	Nickel	17.4	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	40.47	346.5	128	1.0000	40.47	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0124	0-2	Nickel	17.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	40.23	346.5	128	1.0000	40.23	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0045	0-2	Nickel	17.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	40.23	346.5	128	1.0000	40.23	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0264	0-2	Nickel	17.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	40.23	346.5	128	1.0000	40.23	64.2	0.00
Boeing RFI Subarea 1A South	HVTC19S21	0-2	Nickel	17	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	39.53	346.5	128	1.0000	39.53	64.2	0.00
Boeing RFI Subarea 1A South	CNBS58	0-2	Nickel	17	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	39.53	346.5	128	1.0000	39.53	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0335	0-2	Nickel	16.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	38.84	346.5	128	1.0000	38.84	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0334	0-2	Nickel	16.6	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	38.60	346.5	128	1.0000	38.60	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0166	0-2	Nickel	16	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	37.21	346.5	128	1.0000	37.21	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0165	0-2	Nickel	16	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	37.21	346.5	128	1.0000	37.21	64.2	0.00
Boeing RFI Subarea 1A South	ENBS0036	0-2	Nickel	16	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	37.21	346.5	128	1.0000	37.21	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0327	0-2	Nickel	16	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	37.21	346.5	128	1.0000	37.21	64.2	0.00
Boeing RFI Subarea 1A South	LFBS69	0-2	Nickel	16	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	37.21	346.5	128	1.0000	37.21	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0333	0-2	Nickel	15.9	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	36.98	346.5	128	1.0000	36.98	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0326	0-2	Nickel	15.9	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	36.98	346.5	128	1.0000	36.98	64.2	0.00
Boeing RFI Subarea 1A South	ENBS0146	0-2	Nickel	15.6	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	36.28	346.5	128	1.0000	36.28	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0254	0-2	Nickel	15.4	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	35.81	346.5	128	1.0000	35.81	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0307	0-2	Nickel	15.4	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	35.81	346.5	128	1.0000	35.81	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0145	0-2	Nickel	15.2	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	35.35	346.5	128	1.0000	35.35	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0081	0-2	Nickel	15.1	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	35.12	346.5	128	1.0000	35.12	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0212	0-2	Nickel	15	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	34.88	346.5	128	1.0000	34.88	64.2	0.00
Boeing RFI Subarea 1A South	LFBS70	0-2	Nickel	15	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	34.88	346.5	128	1.0000	34.88	64.2	0.00
Boeing RFI Subarea 1A South	HVBK19	0-2	Nickel	15	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	34.88	346.5	128	1.0000	34.88	64.2	0.00
Boeing RFI Subarea 1A South	LFBS89	0-2	Nickel	15	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	34.88	346.5	128	1.0000	34.88	64.2	0.00
Boeing RFI Subarea 1A South	LFBS59	0-2	Nickel	15	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	34.88	346.5	128	1.0000	34.88	64.2	0.00
Boeing RFI Subarea 1A South	HVBD95	0-2	Nickel	15	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	34.88	346.5	128	1.0000	34.88	64.2	0.00
Boeing RFI Subarea 1A South	HVTC12S06	0-2	Nickel	15	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	34.88	346.5	128	1.0000	34.88	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0270	0-2	Nickel	15	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	34.88	346.5	128	1.0000	34.88	64.2	0.00
Boeing RFI Subarea 1A South	ENBS0144	0-2	Nickel	14.9	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	34.65	346.5	128	1.0000	34.65	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0211	0-2	Nickel	14.8	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	34.42	346.5	128	1.0000	34.42	64.2	0.00
Boeing RFI Subarea 1A South	AFBS0112	0-2	Nickel	14.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	34.19	346.5	128	1.0000	34.19	64.2	0.00

Boeing RFI Subarea 1A South	ENBS0143	0-2	Nickel	14.4	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	33.49	346.5	128	1.0000	33.49	64.2	0.00
Boeing RFI Subarea 1A South	ENBS0053	0-2	Nickel	14.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	33.26	346.5	128	1.0000	33.26	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0029	0-2	Nickel	14.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	33.26	346.5	128	1.0000	33.26	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0006	0-2	Nickel	14.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	33.26	346.5	128	1.0000	33.26	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0104	0-2	Nickel	14.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	33.02	346.5	128	1.0000	33.02	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S02	0-2	Nickel	14.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	33.02	346.5	128	1.0000	33.02	64.2	0.00
Boeing RFI Subarea 1A South	CNBS74	0-2	Nickel	14	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.56	346.5	128	1.0000	32.56	64.2	0.00
Boeing RFI Subarea 1A South	LFBS15	0-2	Nickel	14	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.56	346.5	128	1.0000	32.56	64.2	0.00
Boeing RFI Subarea 1A South	HVBF0045	0-2	Nickel	14	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.56	346.5	128	1.0000	32.56	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S36	0-2	Nickel	14	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.56	346.5	128	1.0000	32.56	64.2	0.00
Boeing RFI Subarea 1A South	LFBS58	0-2	Nickel	14	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.56	346.5	128	1.0000	32.56	64.2	0.00
Boeing RFI Subarea 1A South	LFBS85	0-2	Nickel	14	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.56	346.5	128	1.0000	32.56	64.2	0.00
Boeing RFI Subarea 1A South	HVBK21	0-2	Nickel	14	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.56	346.5	128	1.0000	32.56	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0268	0-2	Nickel	13.9	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	32.33	346.5	128	1.0000	32.33	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0080	0-2	Nickel	13.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	31.86	346.5	128	1.0000	31.86	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0126	0-2	Nickel	13.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	31.86	346.5	128	1.0000	31.86	64.2	0.00
Boeing RFI Subarea 1A South	ENBS0051	0-2	Nickel	13.6	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	31.63	346.5	128	1.0000	31.63	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0134	0-2	Nickel	13.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	31.63	346.5	128	1.0000	31.63	64.2	0.00
Boeing RFI Subarea 1A South	ENBS0050	0-2	Nickel	13.5	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	31.40	346.5	128	1.0000	31.40	64.2	0.00
Boeing RFI Subarea 1A South	ENBS0054	0-2	Nickel	13.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	31.40	346.5	128	1.0000	31.40	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0324	0-2	Nickel	13.4	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	31.16	346.5	128	1.0000	31.16	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0240	0-2	Nickel	13.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	30.93	346.5	128	1.0000	30.93	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0174	0-2	Nickel	13.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.70	346.5	128	1.0000	30.70	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0123	0-2	Nickel	13.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.70	346.5	128	1.0000	30.70	64.2	0.00
Boeing RFI Subarea 1A South	LFBS87	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	346.5	128	1.0000	30.23	64.2	0.00
Boeing RFI Subarea 1A South	HVBS49	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	346.5	128	1.0000	30.23	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0135	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	346.5	128	1.0000	30.23	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0153	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	346.5	128	1.0000	30.23	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S03	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	346.5	128	1.0000	30.23	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0287	0-2	Nickel	13	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	30.23	346.5	128	1.0000	30.23	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0171	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	346.5	128	1.0000	30.23	64.2	0.00
Boeing RFI Subarea 1A South	HVBF0044	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	346.5	128	1.0000	30.23	64.2	0.00
Boeing RFI Subarea 1A South	HVBD96	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	346.5	128	1.0000	30.23	64.2	0.00
Boeing RFI Subarea 1A South	HZET0508	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	346.5	128	1.0000	30.23	64.2	0.00
Boeing RFI Subarea 1A South	CNBS38	0-2	Nickel	13	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	30.23	346.5	128	1.0000	30.23	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0195	0-2	Nickel	12.7	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	29.53	346.5	128	1.0000	29.53	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0047	0-2	Nickel	12.7	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	29.53	346.5	128	1.0000	29.53	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0040	0-2	Nickel	12.6	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	29.30	346.5	128	1.0000	29.30	64.2	0.00
Boeing RFI Subarea 1A South	HVBK20	0-2	Nickel	12.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	29.30	346.5	128	1.0000	29.30	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0305	0-2	Nickel	12.5	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	29.07	346.5	128	1.0000	29.07	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0083	0-2	Nickel	12.5	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	29.07	346.5	128	1.0000	29.07	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0034	0-2	Nickel	12.4	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	28.84	346.5	128	1.0000	28.84	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0191	0-2	Nickel	12.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	28.60	346.5	128	1.0000	28.60	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0031	0-2	Nickel	12.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	28.60	346.5	128	1.0000	28.60	64.2	0.00
Boeing RFI Subarea 1A South	HVTC16S05	0-2	Nickel	12.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	28.14	346.5	128	1.0000	28.14	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0241	0-2	Nickel	12.1	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	28.14	346.5	128	1.0000	28.14	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0295	0-2	Nickel	12.1	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	28.14	346.5	128	1.0000	28.14	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0194	0-2	Nickel	12.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	28.14	346.5	128	1.0000	28.14	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0124	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	346.5	128	1.0000	27.91	64.2	0.00
Boeing RFI Subarea 1A South	HVBS59	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	346.5	128	1.0000	27.91	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0152	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	346.5	128	1.0000	27.91	64.2	0.00
Boeing RFI Subarea 1A South	HVBS33	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	346.5	128	1.0000	27.91	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S09	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	346.5	128	1.0000	27.91	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0140	0-2	Nickel	12	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	27.91	346.5	128	1.0000	27.91	64.2	0.00
Boeing RFI Subarea 1A South	HVTC12S01	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	346.5	128	1.0000	27.91	64.2	0.00

Boeing RFI Subarea 1A South	CNBS73	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	346.5	128	1.0000	27.91	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S31	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	346.5	128	1.0000	27.91	64.2	0.00
Boeing RFI Subarea 1A South	LFR-3	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	346.5	128	1.0000	27.91	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S08	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	346.5	128	1.0000	27.91	64.2	0.00
Boeing RFI Subarea 1A South	BZSS05	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	346.5	128	1.0000	27.91	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S44	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	346.5	128	1.0000	27.91	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S14	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	346.5	128	1.0000	27.91	64.2	0.00
Boeing RFI Subarea 1A South	HVTC16S06	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	346.5	128	1.0000	27.91	64.2	0.00
Boeing RFI Subarea 1A South	HVBS61	0-2	Nickel	11.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.67	346.5	128	1.0000	27.67	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0242	0-2	Nickel	11.8	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	27.44	346.5	128	1.0000	27.44	64.2	0.00
Boeing RFI Subarea 1A South	HVBS64	0-2	Nickel	11.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.44	346.5	128	1.0000	27.44	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0277	0-2	Nickel	11.8	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	27.44	346.5	128	1.0000	27.44	64.2	0.00
Boeing RFI Subarea 1A South	HVBS67	0-2	Nickel	11.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.44	346.5	128	1.0000	27.44	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0338	0-2	Nickel	11.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.44	346.5	128	1.0000	27.44	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0122	0-2	Nickel	11.7	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	27.21	346.5	128	1.0000	27.21	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S06	0-2	Nickel	11.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.21	346.5	128	1.0000	27.21	64.2	0.00
Boeing RFI Subarea 1A South	ENBS0035	0-2	Nickel	11.6	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	26.98	346.5	128	1.0000	26.98	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0007	0-2	Nickel	11.5	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	26.74	346.5	128	1.0000	26.74	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0323	0-2	Nickel	11.5	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	26.74	346.5	128	1.0000	26.74	64.2	0.00
Boeing RFI Subarea 1A South	HVTC11S53	0-2	Nickel	11.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	26.74	346.5	128	1.0000	26.74	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0152	0-2	Nickel	11.5	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	26.74	346.5	128	1.0000	26.74	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0141	0-2	Nickel	11.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	26.74	346.5	128	1.0000	26.74	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S18	0-2	Nickel	11.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	26.51	346.5	128	1.0000	26.51	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0030	0-2	Nickel	11.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	26.28	346.5	128	1.0000	26.28	64.2	0.00
Boeing RFI Subarea 1A South	HVBS65	0-2	Nickel	11.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	26.28	346.5	128	1.0000	26.28	64.2	0.00
Boeing RFI Subarea 1A South	HVBS88	0-2	Nickel	11.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	26.28	346.5	128	1.0000	26.28	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0253	0-2	Nickel	11.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	26.28	346.5	128	1.0000	26.28	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0148	0-2	Nickel	11.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	26.28	346.5	128	1.0000	26.28	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0011	0-2	Nickel	11.2	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	26.05	346.5	128	1.0000	26.05	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0109	0-2	Nickel	11.2	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	26.05	346.5	128	1.0000	26.05	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0266	0-2	Nickel	11.1	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	25.81	346.5	128	1.0000	25.81	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0100	0-2	Nickel	11.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.81	346.5	128	1.0000	25.81	64.2	0.00
Boeing RFI Subarea 1A South	LFBS70	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	346.5	128	1.0000	25.58	64.2	0.00
Boeing RFI Subarea 1A South	HVBK17	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	346.5	128	1.0000	25.58	64.2	0.00
Boeing RFI Subarea 1A South	LFBS57	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	346.5	128	1.0000	25.58	64.2	0.00
Boeing RFI Subarea 1A South	LFBS04	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	346.5	128	1.0000	25.58	64.2	0.00
Boeing RFI Subarea 1A South	LFBS42	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	346.5	128	1.0000	25.58	64.2	0.00
Boeing RFI Subarea 1A South	CNBS44	0-2	Nickel	11	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	25.58	346.5	128	1.0000	25.58	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0193	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	346.5	128	1.0000	25.58	64.2	0.00
Boeing RFI Subarea 1A South	BZSS05	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	346.5	128	1.0000	25.58	64.2	0.00
Boeing RFI Subarea 1A South	LFBS14	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	346.5	128	1.0000	25.58	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S12	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	346.5	128	1.0000	25.58	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S13	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	346.5	128	1.0000	25.58	64.2	0.00
Boeing RFI Subarea 1A South	HVTC11S04	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	346.5	128	1.0000	25.58	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S15	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	346.5	128	1.0000	25.58	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S05	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	346.5	128	1.0000	25.58	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S11	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	346.5	128	1.0000	25.58	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S07	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	346.5	128	1.0000	25.58	64.2	0.00
Boeing RFI Subarea 1A South	HVTC11S10	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	346.5	128	1.0000	25.58	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S25	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	346.5	128	1.0000	25.58	64.2	0.00
Boeing RFI Subarea 1A South	HVTC10S11	0-2	Nickel	10.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.35	346.5	128	1.0000	25.35	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0112	0-2	Nickel	10.8	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	25.12	346.5	128	1.0000	25.12	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0102	0-2	Nickel	10.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.12	346.5	128	1.0000	25.12	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0082	0-2	Nickel	10.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.12	346.5	128	1.0000	25.12	64.2	0.00
Boeing RFI Subarea 1A South	HVBS63	0-2	Nickel	10.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	24.88	346.5	128	1.0000	24.88	64.2	0.00

Boeing RFI Subarea 1A South	HZBS0022	0-2	Nickel	10.7	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	24.88	346.5	128	1.0000	24.88	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0162	0-2	Nickel	10.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	24.65	346.5	128	1.0000	24.65	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0124	0-2	Nickel	10.6	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	24.65	346.5	128	1.0000	24.65	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0227	0-2	Nickel	10.6	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	24.65	346.5	128	1.0000	24.65	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0103	0-2	Nickel	10.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	24.65	346.5	128	1.0000	24.65	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0146	0-2	Nickel	10.5	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	24.42	346.5	128	1.0000	24.42	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0008	0-2	Nickel	10.5	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	24.42	346.5	128	1.0000	24.42	64.2	0.00
Boeing RFI Subarea 1A South	LFBS38	0-2	Nickel	10.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	24.42	346.5	128	1.0000	24.42	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0027	0-2	Nickel	10.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.95	346.5	128	1.0000	23.95	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0107	0-2	Nickel	10.2	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	23.72	346.5	128	1.0000	23.72	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0220	0-2	Nickel	10.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.72	346.5	128	1.0000	23.72	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0129	0-2	Nickel	10.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.72	346.5	128	1.0000	23.72	64.2	0.00
Boeing RFI Subarea 1A South	HVBS89	0-2	Nickel	10.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.72	346.5	128	1.0000	23.72	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0142	0-2	Nickel	10.1	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	23.49	346.5	128	1.0000	23.49	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0306	0-2	Nickel	10.1	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	23.49	346.5	128	1.0000	23.49	64.2	0.00
Boeing RFI Subarea 1A South	HVTC11S12	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	346.5	128	1.0000	23.26	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S39	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	346.5	128	1.0000	23.26	64.2	0.00
Boeing RFI Subarea 1A South	HVTC11S05	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	346.5	128	1.0000	23.26	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0172	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	346.5	128	1.0000	23.26	64.2	0.00
Boeing RFI Subarea 1A South	CNBS72	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	346.5	128	1.0000	23.26	64.2	0.00
Boeing RFI Subarea 1A South	LFBS23	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	346.5	128	1.0000	23.26	64.2	0.00
Boeing RFI Subarea 1A South	HVBS51	0-2	Nickel	9.96	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.16	346.5	128	1.0000	23.16	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0157	0-2	Nickel	9.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.02	346.5	128	1.0000	23.02	64.2	0.00
Boeing RFI Subarea 1A South	HVBF33	0-2	Nickel	9.8	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	22.79	346.5	128	1.0000	22.79	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0186	0-2	Nickel	9.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.79	346.5	128	1.0000	22.79	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S10	0-2	Nickel	9.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.79	346.5	128	1.0000	22.79	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0128	0-2	Nickel	9.7	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	22.56	346.5	128	1.0000	22.56	64.2	0.00
Boeing RFI Subarea 1A South	HZET0501	0-2	Nickel	9.7	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	22.56	346.5	128	1.0000	22.56	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0192	0-2	Nickel	9.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.56	346.5	128	1.0000	22.56	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0136	0-2	Nickel	9.7	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	22.56	346.5	128	1.0000	22.56	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0206	0-2	Nickel	9.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.33	346.5	128	1.0000	22.33	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0127	0-2	Nickel	9.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.33	346.5	128	1.0000	22.33	64.2	0.00
Boeing RFI Subarea 1A South	HVTC10S12	0-2	Nickel	9.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.33	346.5	128	1.0000	22.33	64.2	0.00
Boeing RFI Subarea 1A South	CNBS35	0-2	Nickel	9.5	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	22.09	346.5	128	1.0000	22.09	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0174	0-2	Nickel	9.5	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	22.09	346.5	128	1.0000	22.09	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0180	0-2	Nickel	9.42	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.91	346.5	128	1.0000	21.91	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0293	0-2	Nickel	9.42	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	21.91	346.5	128	1.0000	21.91	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0158	0-2	Nickel	9.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.86	346.5	128	1.0000	21.86	64.2	0.00
Boeing RFI Subarea 1A South	ENBS0049	0-2	Nickel	9.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.86	346.5	128	1.0000	21.86	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0110	0-2	Nickel	9.4	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	21.86	346.5	128	1.0000	21.86	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0173	0-2	Nickel	9.4	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	21.86	346.5	128	1.0000	21.86	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0184	0-2	Nickel	9.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.86	346.5	128	1.0000	21.86	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0159	0-2	Nickel	9.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.40	346.5	128	1.0000	21.40	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0126	0-2	Nickel	9.2	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	21.40	346.5	128	1.0000	21.40	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0009	0-2	Nickel	9.2	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	21.40	346.5	128	1.0000	21.40	64.2	0.00
Boeing RFI Subarea 1A South	LFTS12	0-2	Nickel	9.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.40	346.5	128	1.0000	21.40	64.2	0.00
Boeing RFI Subarea 1A South	CNBS66	0-2	Nickel	9.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.40	346.5	128	1.0000	21.40	64.2	0.00
Boeing RFI Subarea 1A South	CNBS43	0-2	Nickel	9.2	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	21.40	346.5	128	1.0000	21.40	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0039	0-2	Nickel	9.1	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	21.16	346.5	128	1.0000	21.16	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0117	0-2	Nickel	9.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.16	346.5	128	1.0000	21.16	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0010	0-2	Nickel	9.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.16	346.5	128	1.0000	21.16	64.2	0.00
Boeing RFI Subarea 1A South	HVBD94	0-2	Nickel	9.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.16	346.5	128	1.0000	21.16	64.2	0.00
Boeing RFI Subarea 1A South	HVBS72	0-2	Nickel	9.1	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	21.16	346.5	128	1.0000	21.16	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0170	0-2	Nickel	9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.93	346.5	128	1.0000	20.93	64.2	0.00
Boeing RFI Subarea 1A South	HVBS97	0-2	Nickel	9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.93	346.5	128	1.0000	20.93	64.2	0.00

Boeing RFI Subarea 1A South	LFBS0220	0-2	Nickel	9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.93	346.5	128	1.0000	20.93	64.2	0.00
Boeing RFI Subarea 1A South	LFBS06	0-2	Nickel	9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.93	346.5	128	1.0000	20.93	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0151	0-2	Nickel	9	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	20.93	346.5	128	1.0000	20.93	64.2	0.00
Boeing RFI Subarea 1A South	CNBS57	0-2	Nickel	9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.93	346.5	128	1.0000	20.93	64.2	0.00
Boeing RFI Subarea 1A South	LFBS20	0-2	Nickel	9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.93	346.5	128	1.0000	20.93	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0185	0-2	Nickel	8.98	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.88	346.5	128	1.0000	20.88	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S41	0-2	Nickel	8.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.70	346.5	128	1.0000	20.70	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0221	0-2	Nickel	8.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.47	346.5	128	1.0000	20.47	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S45	0-2	Nickel	8.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.47	346.5	128	1.0000	20.47	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0023	0-2	Nickel	8.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.23	346.5	128	1.0000	20.23	64.2	0.00
Boeing RFI Subarea 1A South	LFBS88	0-2	Nickel	8.7	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	20.23	346.5	128	1.0000	20.23	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0147	0-2	Nickel	8.7	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	20.23	346.5	128	1.0000	20.23	64.2	0.00
Boeing RFI Subarea 1A South	HVBS98	0-2	Nickel	8.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.00	346.5	128	1.0000	20.00	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0121	0-2	Nickel	8.5	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	19.77	346.5	128	1.0000	19.77	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0101	0-2	Nickel	8.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	19.77	346.5	128	1.0000	19.77	64.2	0.00
Boeing RFI Subarea 1A South	HVBK22	0-2	Nickel	8.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	19.77	346.5	128	1.0000	19.77	64.2	0.00
Boeing RFI Subarea 1A South	LFBS81	0-2	Nickel	8.5	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	19.77	346.5	128	1.0000	19.77	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0187	0-2	Nickel	8.4	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	19.53	346.5	128	1.0000	19.53	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0108	0-2	Nickel	8.4	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	19.53	346.5	128	1.0000	19.53	64.2	0.00
Boeing RFI Subarea 1A South	LFTS08	0-2	Nickel	8.4	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	19.53	346.5	128	1.0000	19.53	64.2	0.00
Boeing RFI Subarea 1A South	HVBF0043	0-2	Nickel	8.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	19.53	346.5	128	1.0000	19.53	64.2	0.00
Boeing RFI Subarea 1A South	LFBS79	0-2	Nickel	8.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	19.30	346.5	128	1.0000	19.30	64.2	0.00
Boeing RFI Subarea 1A South	HVBD93	0-2	Nickel	8.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	19.30	346.5	128	1.0000	19.30	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0154	0-2	Nickel	8.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	19.30	346.5	128	1.0000	19.30	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0125	0-2	Nickel	8.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	19.30	346.5	128	1.0000	19.30	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0145	0-2	Nickel	8.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	19.30	346.5	128	1.0000	19.30	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0084	0-2	Nickel	8.22	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	19.12	346.5	128	1.0000	19.12	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0164	0-2	Nickel	8.22	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	19.12	346.5	128	1.0000	19.12	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0038	0-2	Nickel	8.2	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	19.07	346.5	128	1.0000	19.07	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0172	0-2	Nickel	8.2	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	19.07	346.5	128	1.0000	19.07	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0125	0-2	Nickel	8.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	19.07	346.5	128	1.0000	19.07	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0156	0-2	Nickel	8.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	19.07	346.5	128	1.0000	19.07	64.2	0.00
Boeing RFI Subarea 1A South	LFSS02	0-2	Nickel	8.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	18.84	346.5	128	1.0000	18.84	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0104	0-2	Nickel	8.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	18.84	346.5	128	1.0000	18.84	64.2	0.00
Boeing RFI Subarea 1A South	HVBD98	0-2	Nickel	8.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	18.84	346.5	128	1.0000	18.84	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0087	0-2	Nickel	8.1	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	18.84	346.5	128	1.0000	18.84	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0163	0-2	Nickel	8.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	18.84	346.5	128	1.0000	18.84	64.2	0.00
Boeing RFI Subarea 1A South	LFBS29	0-2	Nickel	8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	18.60	346.5	128	1.0000	18.60	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0162	0-2	Nickel	7.99	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	18.58	346.5	128	1.0000	18.58	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0162	0-2	Nickel	7.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	18.37	346.5	128	1.0000	18.37	64.2	0.00
Boeing RFI Subarea 1A South	HVBF02	0-2	Nickel	7.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	18.37	346.5	128	1.0000	18.37	64.2	0.00
Boeing RFI Subarea 1A South	CNBS65	0-2	Nickel	7.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	18.37	346.5	128	1.0000	18.37	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0179	0-2	Nickel	7.74	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	18.00	346.5	128	1.0000	18.00	64.2	0.00
Boeing RFI Subarea 1A South	HVBS66	0-2	Nickel	7.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	17.91	346.5	128	1.0000	17.91	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0121	0-2	Nickel	7.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	17.91	346.5	128	1.0000	17.91	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0088	0-2	Nickel	7.6	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	17.67	346.5	128	1.0000	17.67	64.2	0.00
Boeing RFI Subarea 1A South	HVBF34	0-2	Nickel	7.6	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	17.67	346.5	128	1.0000	17.67	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0025	0-2	Nickel	7.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	17.44	346.5	128	1.0000	17.44	64.2	0.00
Boeing RFI Subarea 1A South	CNBS34	0-2	Nickel	7.5	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	17.44	346.5	128	1.0000	17.44	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0075	0-2	Nickel	7.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	17.44	346.5	128	1.0000	17.44	64.2	0.00
Boeing RFI Subarea 1A South	ENBS0048	0-2	Nickel	7.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	17.44	346.5	128	1.0000	17.44	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S22	0-2	Nickel	7.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	17.44	346.5	128	1.0000	17.44	64.2	0.00
Boeing RFI Subarea 1A South	CNBS36	0-2	Nickel	7.5	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	17.44	346.5	128	1.0000	17.44	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0024	0-2	Nickel	7.39	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	17.19	346.5	128	1.0000	17.19	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0026	0-2	Nickel	7.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	16.98	346.5	128	1.0000	16.98	64.2	0.00

Boeing RFI Subarea 1A South	CNBS41	0-2	Nickel	7.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	16.98	346.5	128	1.0000	16.98	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0178	0-2	Nickel	7.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	16.98	346.5	128	1.0000	16.98	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0106	0-2	Nickel	7.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	16.98	346.5	128	1.0000	16.98	64.2	0.00
Boeing RFI Subarea 1A South	LFTS07	0-2	Nickel	7.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	16.74	346.5	128	1.0000	16.74	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0139	0-2	Nickel	7.16	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	16.65	346.5	128	1.0000	16.65	64.2	0.00
Boeing RFI Subarea 1A South	LFBS30	0-2	Nickel	7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	16.28	346.5	128	1.0000	16.28	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0189	0-2	Nickel	7	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	16.28	346.5	128	1.0000	16.28	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0033	0-2	Nickel	7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	16.28	346.5	128	1.0000	16.28	64.2	0.00
Boeing RFI Subarea 1A South	HVBS96	0-2	Nickel	7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	16.28	346.5	128	1.0000	16.28	64.2	0.00
Boeing RFI Subarea 1A South	LFBS35	0-2	Nickel	7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	16.28	346.5	128	1.0000	16.28	64.2	0.00
Boeing RFI Subarea 1A South	LFBS48	0-2	Nickel	6.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	16.05	346.5	128	1.0000	16.05	64.2	0.00
Boeing RFI Subarea 1A South	LFBS47	0-2	Nickel	6.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	15.81	346.5	128	1.0000	15.81	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0218	0-2	Nickel	6.8	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	15.81	346.5	128	1.0000	15.81	64.2	0.00
Boeing RFI Subarea 1A South	LFSS01	0-2	Nickel	6.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	15.81	346.5	128	1.0000	15.81	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0296	0-2	Nickel	6.77	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	15.74	346.5	128	1.0000	15.74	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0086	0-2	Nickel	6.6	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	15.35	346.5	128	1.0000	15.35	64.2	0.00
Boeing RFI Subarea 1A South	HVBF01	0-2	Nickel	6.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	15.35	346.5	128	1.0000	15.35	64.2	0.00
Boeing RFI Subarea 1A South	LFBS67	0-2	Nickel	6.6	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	15.35	346.5	128	1.0000	15.35	64.2	0.00
Boeing RFI Subarea 1A South	CNBS32	0-2	Nickel	6.5	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	15.12	346.5	128	1.0000	15.12	64.2	0.00
Boeing RFI Subarea 1A South	HVBD97	0-2	Nickel	6.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	14.88	346.5	128	1.0000	14.88	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0044	0-2	Nickel	6.4	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	14.88	346.5	128	1.0000	14.88	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0190	0-2	Nickel	6.4	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	14.88	346.5	128	1.0000	14.88	64.2	0.00
Boeing RFI Subarea 1A South	LFBS39	0-2	Nickel	6.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	14.88	346.5	128	1.0000	14.88	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0118	0-2	Nickel	6.4	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	14.88	346.5	128	1.0000	14.88	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0161	0-2	Nickel	6.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	14.42	346.5	128	1.0000	14.42	64.2	0.00
Boeing RFI Subarea 1A South	CNBS56	0-2	Nickel	6.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	14.19	346.5	128	1.0000	14.19	64.2	0.00
Boeing RFI Subarea 1A South	LFBS46	0-2	Nickel	6.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	14.19	346.5	128	1.0000	14.19	64.2	0.00
Boeing RFI Subarea 1A South	BGSS02	0-2	Nickel	5.9	mg/kg	B	Mule Deer	Low TRV-Based RBSL	0.43	13.72	346.5	128	1.0000	13.72	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0004	0-2	Nickel	5.9	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	13.72	346.5	128	1.0000	13.72	64.2	0.00
Boeing RFI Subarea 1A South	CNBS42	0-2	Nickel	5.6	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	13.02	346.5	128	1.0000	13.02	64.2	0.00
Boeing RFI Subarea 1A South	CNBS37	0-2	Nickel	5.6	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	13.02	346.5	128	1.0000	13.02	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0043	0-2	Nickel	5.6	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	13.02	346.5	128	1.0000	13.02	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0105	0-2	Nickel	5.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	12.56	346.5	128	1.0000	12.56	64.2	0.00
Boeing RFI Subarea 1A South	CNBS46	0-2	Nickel	5.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	12.33	346.5	128	1.0000	12.33	64.2	0.00
Boeing RFI Subarea 1A South	HVBF03	0-2	Nickel	5.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	12.33	346.5	128	1.0000	12.33	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0042	0-2	Nickel	5	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	11.63	346.5	128	1.0000	11.63	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0149	0-2	Nickel	4.4	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	10.23	346.5	128	1.0000	10.23	64.2	0.00
Boeing RFI Subarea 1A South	B-12-03	0-2	Nickel	2.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	6.51	346.5	128	1.0000	6.51	64.2	0.00
Boeing RFI Subarea 1A South	B-12-02	0-2	Nickel	2.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	6.28	346.5	128	1.0000	6.28	64.2	0.00
Boeing RFI Subarea 1A South	HVBS69	0-2	Nickel	2.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	6.05	346.5	128	1.0000	6.05	64.2	0.00
Boeing RFI Subarea 1A South	LFBS19	0-2	Nickel	2.5	mg/kg	U	Mule Deer	Low TRV-Based RBSL	0.43	5.81	346.5	128	1.0000	5.81	64.2	0.00
Boeing RFI Subarea 1A South	B-12-01	0-2	Nickel	0.75	mg/kg	U	Mule Deer	Low TRV-Based RBSL	0.43	1.74	346.5	128	1.0000	1.74	64.2	0.00
Boeing RFI Subarea 1B North	R1BS09	0-2	Nickel	340	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	790.70	233.5	128	0.9166	724.79	64.2	587.93
Boeing RFI Subarea 1B North	BABS1054	0-2	Nickel	100	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	232.56	233.5	128	0.9166	213.17	64.2	76.32
Boeing RFI Subarea 1B North	AABS1103	0-2	Nickel	58.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	136.98	233.5	128	0.9166	125.56	64.2	0.00
Boeing RFI Subarea 1B North	AABS1104	0-2	Nickel	55.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	130.00	233.5	128	0.9166	119.16	64.2	0.00
Boeing RFI Subarea 1B North	BABS1163	0-2	Nickel	53	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	123.26	233.5	128	0.9166	112.98	64.2	0.00
Boeing RFI Subarea 1B North	R1BS1031	0-2	Nickel	46	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	106.98	233.5	128	0.9166	98.06	64.2	0.00
Boeing RFI Subarea 1B North	BABS1140	0-2	Nickel	44	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	102.33	233.5	128	0.9166	93.80	64.2	0.00
Boeing RFI Subarea 1B North	BABS1055	0-2	Nickel	43	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	100.00	233.5	128	0.9166	91.66	64.2	0.00
Boeing RFI Subarea 1B North	ENBS0023	0-2	Nickel	40.5	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	94.19	233.5	128	0.9166	86.33	64.2	0.00
Boeing RFI Subarea 1B North	BABS1139	0-2	Nickel	28	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	65.12	233.5	128	0.9166	59.69	64.2	0.00
Boeing RFI Subarea 1B North	LXTS0008	0-2	Nickel	26	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	60.47	233.5	128	0.9166	55.42	64.2	0.00
Boeing RFI Subarea 1B North	BABS1023	0-2	Nickel	25.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	59.53	233.5	128	0.9166	54.57	64.2	0.00
Boeing RFI Subarea 1B North	A2BS1142	0-2	Nickel	24.2	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	56.28	233.5	128	0.9166	51.59	64.2	0.00

Boeing RFI Subarea 1B North	BABS1137	0-2	Nickel	23	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	53.49	233.5	128	0.9166	49.03	64.2	0.00
Boeing RFI Subarea 1B North	R1BS01	0-2	Nickel	22	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	51.16	233.5	128	0.9166	46.90	64.2	0.00
Boeing RFI Subarea 1B North	ENBS0025	0-2	Nickel	22	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	51.16	233.5	128	0.9166	46.90	64.2	0.00
Boeing RFI Subarea 1B North	R1BS0021	0-2	Nickel	21.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	49.53	233.5	128	0.9166	45.41	64.2	0.00
Boeing RFI Subarea 1B North	A2TS06S01	0-2	Nickel	20	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	46.51	233.5	128	0.9166	42.63	64.2	0.00
Boeing RFI Subarea 1B North	BABS1031	0-2	Nickel	20	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	46.51	233.5	128	0.9166	42.63	64.2	0.00
Boeing RFI Subarea 1B North	A2BS02	0-2	Nickel	19	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	44.19	233.5	128	0.9166	40.50	64.2	0.00
Boeing RFI Subarea 1B North	BABS1138	0-2	Nickel	19	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	44.19	233.5	128	0.9166	40.50	64.2	0.00
Boeing RFI Subarea 1B North	ENBS0055	0-2	Nickel	18.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	43.49	233.5	128	0.9166	39.86	64.2	0.00
Boeing RFI Subarea 1B North	ENBS0022	0-2	Nickel	18.6	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	43.26	233.5	128	0.9166	39.65	64.2	0.00
Boeing RFI Subarea 1B North	A2BS03	0-2	Nickel	18	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	41.86	233.5	128	0.9166	38.37	64.2	0.00
Boeing RFI Subarea 1B North	A2BS01	0-2	Nickel	18	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	41.86	233.5	128	0.9166	38.37	64.2	0.00
Boeing RFI Subarea 1B North	BATS27	0-2	Nickel	17.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	41.63	233.5	128	0.9166	38.16	64.2	0.00
Boeing RFI Subarea 1B North	ENBS0029	0-2	Nickel	17.8	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	41.40	233.5	128	0.9166	37.94	64.2	0.00
Boeing RFI Subarea 1B North	R1BS03	0-2	Nickel	17	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	39.53	233.5	128	0.9166	36.24	64.2	0.00
Boeing RFI Subarea 1B North	R1BS1040	0-2	Nickel	16.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	38.84	233.5	128	0.9166	35.60	64.2	0.00
Boeing RFI Subarea 1B North	R1BS1028	0-2	Nickel	16.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	38.60	233.5	128	0.9166	35.39	64.2	0.00
Boeing RFI Subarea 1B North	A2BS04	0-2	Nickel	16	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	37.21	233.5	128	0.9166	34.11	64.2	0.00
Boeing RFI Subarea 1B North	BABS1079	0-2	Nickel	15.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	36.28	233.5	128	0.9166	33.25	64.2	0.00
Boeing RFI Subarea 1B North	A2TS38S01	0-2	Nickel	15	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	34.88	233.5	128	0.9166	31.98	64.2	0.00
Boeing RFI Subarea 1B North	R1BS1041	0-2	Nickel	14.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	34.42	233.5	128	0.9166	31.55	64.2	0.00
Boeing RFI Subarea 1B North	R1BS1002	0-2	Nickel	14.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	33.72	233.5	128	0.9166	30.91	64.2	0.00
Boeing RFI Subarea 1B North	BABS1017	0-2	Nickel	14	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.56	233.5	128	0.9166	29.84	64.2	0.00
Boeing RFI Subarea 1B North	BABS1105	0-2	Nickel	13.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.09	233.5	128	0.9166	29.42	64.2	0.00
Boeing RFI Subarea 1B North	A2TS22S01	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	233.5	128	0.9166	27.71	64.2	0.00
Boeing RFI Subarea 1B North	R1BS14	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	233.5	128	0.9166	27.71	64.2	0.00
Boeing RFI Subarea 1B North	BABS1081	0-2	Nickel	12.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	29.77	233.5	128	0.9166	27.29	64.2	0.00
Boeing RFI Subarea 1B North	BABS1015	0-2	Nickel	12.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	29.53	233.5	128	0.9166	27.07	64.2	0.00
Boeing RFI Subarea 1B North	BABS51	0-2	Nickel	12.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	28.60	233.5	128	0.9166	26.22	64.2	0.00
Boeing RFI Subarea 1B North	BABS1052	0-2	Nickel	12.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	28.14	233.5	128	0.9166	25.79	64.2	0.00
Boeing RFI Subarea 1B North	BABS1062	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	233.5	128	0.9166	25.58	64.2	0.00
Boeing RFI Subarea 1B North	A2TS11S01	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	233.5	128	0.9166	25.58	64.2	0.00
Boeing RFI Subarea 1B North	A2TS15S01	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	233.5	128	0.9166	25.58	64.2	0.00
Boeing RFI Subarea 1B North	BABS1106	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	233.5	128	0.9166	25.58	64.2	0.00
Boeing RFI Subarea 1B North	BABS1014	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	233.5	128	0.9166	25.58	64.2	0.00
Boeing RFI Subarea 1B North	BABS1032	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	233.5	128	0.9166	25.58	64.2	0.00
Boeing RFI Subarea 1B North	R1BS1059	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	233.5	128	0.9166	25.58	64.2	0.00
Boeing RFI Subarea 1B North	BABS1166	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	233.5	128	0.9166	25.58	64.2	0.00
Boeing RFI Subarea 1B North	BABS1102	0-2	Nickel	11.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	26.51	233.5	128	0.9166	24.30	64.2	0.00
Boeing RFI Subarea 1B North	BABS1087	0-2	Nickel	11.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	26.51	233.5	128	0.9166	24.30	64.2	0.00
Boeing RFI Subarea 1B North	BASS02	0-2	Nickel	11.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	26.51	233.5	128	0.9166	24.30	64.2	0.00
Boeing RFI Subarea 1B North	BABS1019	0-2	Nickel	11.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	26.28	233.5	128	0.9166	24.09	64.2	0.00
Boeing RFI Subarea 1B North	BABS1101	0-2	Nickel	11.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	26.28	233.5	128	0.9166	24.09	64.2	0.00
Boeing RFI Subarea 1B North	BABS1003	0-2	Nickel	11.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	26.28	233.5	128	0.9166	24.09	64.2	0.00
Boeing RFI Subarea 1B North	TTBS1218	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	233.5	128	0.9166	23.45	64.2	0.00
Boeing RFI Subarea 1B North	BABS1001	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	233.5	128	0.9166	23.45	64.2	0.00
Boeing RFI Subarea 1B North	R1BS1000	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	233.5	128	0.9166	23.45	64.2	0.00
Boeing RFI Subarea 1B North	BABS1086	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	233.5	128	0.9166	23.45	64.2	0.00
Boeing RFI Subarea 1B North	A2TS10S01	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	233.5	128	0.9166	23.45	64.2	0.00
Boeing RFI Subarea 1B North	A2TS12S02	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	233.5	128	0.9166	23.45	64.2	0.00
Boeing RFI Subarea 1B North	BABS1074	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	233.5	128	0.9166	23.45	64.2	0.00
Boeing RFI Subarea 1B North	BABS1080	0-2	Nickel	10.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.35	233.5	128	0.9166	23.24	64.2	0.00
Boeing RFI Subarea 1B North	BABS1030	0-2	Nickel	10.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	24.88	233.5	128	0.9166	22.81	64.2	0.00
Boeing RFI Subarea 1B North	BABS1000	0-2	Nickel	10.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	24.88	233.5	128	0.9166	22.81	64.2	0.00
Boeing RFI Subarea 1B North	BABS1012	0-2	Nickel	10.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	24.65	233.5	128	0.9166	22.60	64.2	0.00

Boeing RFI Subarea 1B North	BABS1038	0-2	Nickel	10.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	24.65	233.5	128	0.9166	22.60	64.2	0.00
Boeing RFI Subarea 1B North	BGSS06	0-2	Nickel	10.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	24.19	233.5	128	0.9166	22.17	64.2	0.00
Boeing RFI Subarea 1B North	BABS1100	0-2	Nickel	10.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.72	233.5	128	0.9166	21.74	64.2	0.00
Boeing RFI Subarea 1B North	R1BS1043	0-2	Nickel	10.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.49	233.5	128	0.9166	21.53	64.2	0.00
Boeing RFI Subarea 1B North	R1BS1007	0-2	Nickel	10.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.49	233.5	128	0.9166	21.53	64.2	0.00
Boeing RFI Subarea 1B North	BABS1029	0-2	Nickel	10.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.49	233.5	128	0.9166	21.53	64.2	0.00
Boeing RFI Subarea 1B North	R1BS1006	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	233.5	128	0.9166	21.32	64.2	0.00
Boeing RFI Subarea 1B North	BABS1009	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	233.5	128	0.9166	21.32	64.2	0.00
Boeing RFI Subarea 1B North	BABS1083	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	233.5	128	0.9166	21.32	64.2	0.00
Boeing RFI Subarea 1B North	BABS1088	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	233.5	128	0.9166	21.32	64.2	0.00
Boeing RFI Subarea 1B North	BABS1018	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	233.5	128	0.9166	21.32	64.2	0.00
Boeing RFI Subarea 1B North	BABS1175	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	233.5	128	0.9166	21.32	64.2	0.00
Boeing RFI Subarea 1B North	A2TS08S01	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	233.5	128	0.9166	21.32	64.2	0.00
Boeing RFI Subarea 1B North	A2TS16S01	0-2	Nickel	9.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.02	233.5	128	0.9166	21.10	64.2	0.00
Boeing RFI Subarea 1B North	BABS1010	0-2	Nickel	9.9	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	23.02	233.5	128	0.9166	21.10	64.2	0.00
Boeing RFI Subarea 1B North	BABS1027	0-2	Nickel	9.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.79	233.5	128	0.9166	20.89	64.2	0.00
Boeing RFI Subarea 1B North	R1BS1044	0-2	Nickel	9.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.79	233.5	128	0.9166	20.89	64.2	0.00
Boeing RFI Subarea 1B North	BABS1077	0-2	Nickel	9.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.79	233.5	128	0.9166	20.89	64.2	0.00
Boeing RFI Subarea 1B North	R1BS1030	0-2	Nickel	9.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.79	233.5	128	0.9166	20.89	64.2	0.00
Boeing RFI Subarea 1B North	BABS1051	0-2	Nickel	9.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.56	233.5	128	0.9166	20.68	64.2	0.00
Boeing RFI Subarea 1B North	BABS1103	0-2	Nickel	9.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.56	233.5	128	0.9166	20.68	64.2	0.00
Boeing RFI Subarea 1B North	R1BS1060	0-2	Nickel	9.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.56	233.5	128	0.9166	20.68	64.2	0.00
Boeing RFI Subarea 1B North	R1BS1011	0-2	Nickel	9.6	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	22.33	233.5	128	0.9166	20.46	64.2	0.00
Boeing RFI Subarea 1B North	BATS1004	0-2	Nickel	9.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.86	233.5	128	0.9166	20.04	64.2	0.00
Boeing RFI Subarea 1B North	A2TS13S01	0-2	Nickel	9.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.86	233.5	128	0.9166	20.04	64.2	0.00
Boeing RFI Subarea 1B North	R1BS1030	0-2	Nickel	9.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.86	233.5	128	0.9166	20.04	64.2	0.00
Boeing RFI Subarea 1B North	R1BS1023	0-2	Nickel	9.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.63	233.5	128	0.9166	19.83	64.2	0.00
Boeing RFI Subarea 1B North	R1BS1009	0-2	Nickel	9.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.40	233.5	128	0.9166	19.61	64.2	0.00
Boeing RFI Subarea 1B North	BABS1075	0-2	Nickel	9.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.16	233.5	128	0.9166	19.40	64.2	0.00
Boeing RFI Subarea 1B North	BABS1024	0-2	Nickel	8.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.70	233.5	128	0.9166	18.97	64.2	0.00
Boeing RFI Subarea 1B North	B-4-08	0-2	Nickel	8.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.70	233.5	128	0.9166	18.97	64.2	0.00
Boeing RFI Subarea 1B North	BABS1090	0-2	Nickel	8.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.23	233.5	128	0.9166	18.55	64.2	0.00
Boeing RFI Subarea 1B North	BABS1085	0-2	Nickel	8.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.00	233.5	128	0.9166	18.33	64.2	0.00
Boeing RFI Subarea 1B North	A2BS22	0-2	Nickel	8.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.00	233.5	128	0.9166	18.33	64.2	0.00
Boeing RFI Subarea 1B North	BABS1033	0-2	Nickel	8.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	19.53	233.5	128	0.9166	17.91	64.2	0.00
Boeing RFI Subarea 1B North	R1BS1035	0-2	Nickel	8.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	19.30	233.5	128	0.9166	17.69	64.2	0.00
Boeing RFI Subarea 1B North	A2TS09S02	0-2	Nickel	8.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	19.30	233.5	128	0.9166	17.69	64.2	0.00
Boeing RFI Subarea 1B North	BABS1011	0-2	Nickel	8.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	19.07	233.5	128	0.9166	17.48	64.2	0.00
Boeing RFI Subarea 1B North	BABS1025	0-2	Nickel	8.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	19.07	233.5	128	0.9166	17.48	64.2	0.00
Boeing RFI Subarea 1B North	R1BS04	0-2	Nickel	8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	18.60	233.5	128	0.9166	17.05	64.2	0.00
Boeing RFI Subarea 1B North	BABS1104	0-2	Nickel	7.9	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	18.37	233.5	128	0.9166	16.84	64.2	0.00
Boeing RFI Subarea 1B North	BABS1068	0-2	Nickel	7.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	17.67	233.5	128	0.9166	16.20	64.2	0.00
Boeing RFI Subarea 1B North	BABS1007	0-2	Nickel	7.54	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	17.53	233.5	128	0.9166	16.07	64.2	0.00
Boeing RFI Subarea 1B North	BABS1091	0-2	Nickel	7.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	17.44	233.5	128	0.9166	15.99	64.2	0.00
Boeing RFI Subarea 1B North	R1BS1047	0-2	Nickel	7.34	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	17.07	233.5	128	0.9166	15.65	64.2	0.00
Boeing RFI Subarea 1B North	A2BS21	0-2	Nickel	7.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	16.51	233.5	128	0.9166	15.14	64.2	0.00
Boeing RFI Subarea 1B North	BABS49	0-2	Nickel	7.04	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	16.37	233.5	128	0.9166	15.01	64.2	0.00
Boeing RFI Subarea 1B North	ENBS0030	0-2	Nickel	6.9	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	16.05	233.5	128	0.9166	14.71	64.2	0.00
Boeing RFI Subarea 1B North	BABS1123	0-2	Nickel	6.1	mg/kg	U	Mule Deer	Low TRV-Based RBSL	0.43	14.19	233.5	128	0.9166	13.00	64.2	0.00
Boeing RFI Subarea 1B North	R1BS1018	0-2	Nickel	5.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	13.72	233.5	128	0.9166	12.58	64.2	0.00
Boeing RFI Subarea 1B North	R1BS07	0-2	Nickel	5.03	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	11.70	233.5	128	0.9166	10.72	64.2	0.00
Boeing RFI Subarea 1B North	B-4-05	0-2	Nickel	4.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	9.53	233.5	128	0.9166	8.74	64.2	0.00
Boeing RFI Subarea 1B North	R1BS02	0-2	Nickel	3.5	mg/kg	U	Mule Deer	Low TRV-Based RBSL	0.43	8.14	233.5	128	0.9166	7.46	64.2	0.00
Boeing RFI Subarea 1B North	B-4-04	0-2	Nickel	2.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	4.88	233.5	128	0.9166	4.48	64.2	0.00
Boeing RFI Subarea 1B North	B-4-06	0-2	Nickel	1.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	4.19	233.5	128	0.9166	3.84	64.2	0.00

Boeing RFI Subarea 1B North	B-4-07	0-2	Nickel	1.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	3.49	233.5	128	0.9166	3.20	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS19	0-2	Nickel	96	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	223.26	101.7	128	0.5876	131.18	64.2	43.45
Boeing RFI Subarea 1B Southeast	CLBS1026	0-2	Nickel	59.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	138.84	101.7	128	0.5876	81.58	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1045	0-2	Nickel	33.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	77.67	101.7	128	0.5876	45.64	64.2	0.00
Boeing RFI Subarea 1B Southeast	TTBS1217	0-2	Nickel	33.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	76.98	101.7	128	0.5876	45.23	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS09	0-2	Nickel	32	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	74.42	101.7	128	0.5876	43.73	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1057	0-2	Nickel	31	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	72.09	101.7	128	0.5876	42.36	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS35	0-2	Nickel	27	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	62.79	101.7	128	0.5876	36.89	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1191	0-2	Nickel	26.8	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	62.33	101.7	128	0.5876	36.62	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1022	0-2	Nickel	25	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	58.14	101.7	128	0.5876	34.16	64.2	0.00
Boeing RFI Subarea 1B Southeast	PPSS01	0-2	Nickel	24.7	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	57.44	101.7	128	0.5876	33.75	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1213	0-2	Nickel	24	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	55.81	101.7	128	0.5876	32.79	64.2	0.00
Boeing RFI Subarea 1B Southeast	TTBS1187	0-2	Nickel	23.2	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	53.95	101.7	128	0.5876	31.70	64.2	0.00
Boeing RFI Subarea 1B Southeast	PPBS1037	0-2	Nickel	22.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	52.79	101.7	128	0.5876	31.02	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS62	0-2	Nickel	22.5	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	52.33	101.7	128	0.5876	30.74	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1038	0-2	Nickel	22	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	51.16	101.7	128	0.5876	30.06	64.2	0.00
Boeing RFI Subarea 1B Southeast	PPBS1038	0-2	Nickel	22	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	51.16	101.7	128	0.5876	30.06	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1218	0-2	Nickel	22	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	51.16	101.7	128	0.5876	30.06	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1150	0-2	Nickel	22	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	51.16	101.7	128	0.5876	30.06	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS49	0-2	Nickel	21	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	48.84	101.7	128	0.5876	28.70	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1053	0-2	Nickel	21	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	48.84	101.7	128	0.5876	28.70	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1006	0-2	Nickel	21	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	48.84	101.7	128	0.5876	28.70	64.2	0.00
Boeing RFI Subarea 1B Southeast	PPBS1033	0-2	Nickel	21	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	48.84	101.7	128	0.5876	28.70	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1215	0-2	Nickel	20	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	46.51	101.7	128	0.5876	27.33	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1042	0-2	Nickel	20	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	46.51	101.7	128	0.5876	27.33	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1032	0-2	Nickel	20	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	46.51	101.7	128	0.5876	27.33	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1017	0-2	Nickel	20	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	46.51	101.7	128	0.5876	27.33	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1024	0-2	Nickel	20	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	46.51	101.7	128	0.5876	27.33	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1048	0-2	Nickel	19	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	44.19	101.7	128	0.5876	25.96	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1217	0-2	Nickel	19	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	44.19	101.7	128	0.5876	25.96	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1046	0-2	Nickel	18.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	42.33	101.7	128	0.5876	24.87	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1033	0-2	Nickel	18	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	41.86	101.7	128	0.5876	24.60	64.2	0.00
Boeing RFI Subarea 1B Southeast	TTBS1264	0-2	Nickel	18	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	41.86	101.7	128	0.5876	24.60	64.2	0.00
Boeing RFI Subarea 1B Southeast	PPBS1009	0-2	Nickel	17.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	41.16	101.7	128	0.5876	24.19	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1029	0-2	Nickel	17.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	40.47	101.7	128	0.5876	23.78	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS22	0-2	Nickel	17.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	40.00	101.7	128	0.5876	23.50	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1020	0-2	Nickel	17.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	39.77	101.7	128	0.5876	23.37	64.2	0.00
Boeing RFI Subarea 1B Southeast	PPBS1004	0-2	Nickel	17	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	39.53	101.7	128	0.5876	23.23	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1194	0-2	Nickel	16.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	39.07	101.7	128	0.5876	22.96	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1013	0-2	Nickel	16.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	39.07	101.7	128	0.5876	22.96	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1054	0-2	Nickel	16	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	37.21	101.7	128	0.5876	21.86	64.2	0.00
Boeing RFI Subarea 1B Southeast	TTBS1176	0-2	Nickel	15.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	36.51	101.7	128	0.5876	21.45	64.2	0.00
Boeing RFI Subarea 1B Southeast	PPBS1025	0-2	Nickel	15.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	36.28	101.7	128	0.5876	21.32	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1039	0-2	Nickel	15.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	36.05	101.7	128	0.5876	21.18	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1027	0-2	Nickel	15.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	35.81	101.7	128	0.5876	21.04	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1019	0-2	Nickel	15	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	34.88	101.7	128	0.5876	20.50	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1113	0-2	Nickel	15	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	34.88	101.7	128	0.5876	20.50	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLTS1101	0-2	Nickel	15	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	34.88	101.7	128	0.5876	20.50	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1014	0-2	Nickel	15	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	34.88	101.7	128	0.5876	20.50	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1220	0-2	Nickel	15	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	34.88	101.7	128	0.5876	20.50	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1031	0-2	Nickel	15	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	34.88	101.7	128	0.5876	20.50	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1015	0-2	Nickel	15	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	34.88	101.7	128	0.5876	20.50	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1219	0-2	Nickel	15	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	34.88	101.7	128	0.5876	20.50	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS17	0-2	Nickel	15	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	34.88	101.7	128	0.5876	20.50	64.2	0.00
Boeing RFI Subarea 1B Southeast	TTBS1173	0-2	Nickel	14.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	34.42	101.7	128	0.5876	20.22	64.2	0.00

Boeing RFI Subarea 1B Southeast	CLBS1192	0-2	Nickel	14.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	33.95	101.7	128	0.5876	19.95	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1056	0-2	Nickel	14.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	33.02	101.7	128	0.5876	19.40	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1148	0-2	Nickel	14.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.79	101.7	128	0.5876	19.27	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS07	0-2	Nickel	14	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	32.56	101.7	128	0.5876	19.13	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1050	0-2	Nickel	14	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.56	101.7	128	0.5876	19.13	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS26	0-2	Nickel	14	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.56	101.7	128	0.5876	19.13	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1113	0-2	Nickel	14	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.56	101.7	128	0.5876	19.13	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1059	0-2	Nickel	14	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.56	101.7	128	0.5876	19.13	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1018	0-2	Nickel	14	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.56	101.7	128	0.5876	19.13	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1007	0-2	Nickel	14	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.56	101.7	128	0.5876	19.13	64.2	0.00
Boeing RFI Subarea 1B Southeast	PPSS03	0-2	Nickel	13.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.09	101.7	128	0.5876	18.86	64.2	0.00
Boeing RFI Subarea 1B Southeast	TTBS1219	0-2	Nickel	13.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	31.63	101.7	128	0.5876	18.58	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1043	0-2	Nickel	13.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.47	101.7	128	0.5876	17.90	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1003	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	101.7	128	0.5876	17.76	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1104	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	101.7	128	0.5876	17.76	64.2	0.00
Boeing RFI Subarea 1B Southeast	PPBS1024	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	101.7	128	0.5876	17.76	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1040	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	101.7	128	0.5876	17.76	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1002	0-2	Nickel	12.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	29.30	101.7	128	0.5876	17.22	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1193	0-2	Nickel	12.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	28.84	101.7	128	0.5876	16.94	64.2	0.00
Boeing RFI Subarea 1B Southeast	TTBS1220	0-2	Nickel	12.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	28.37	101.7	128	0.5876	16.67	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1049	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	101.7	128	0.5876	16.40	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1047	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	101.7	128	0.5876	16.40	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1005	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	101.7	128	0.5876	16.40	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1041	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	101.7	128	0.5876	16.40	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1052	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	101.7	128	0.5876	16.40	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1009	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	101.7	128	0.5876	16.40	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS03	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	101.7	128	0.5876	16.40	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1209	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	101.7	128	0.5876	16.40	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1100	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	101.7	128	0.5876	16.40	64.2	0.00
Boeing RFI Subarea 1B Southeast	PPBS1034	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	101.7	128	0.5876	16.40	64.2	0.00
Boeing RFI Subarea 1B Southeast	PPBS1012	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	101.7	128	0.5876	16.40	64.2	0.00
Boeing RFI Subarea 1B Southeast	PPBS1026	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	101.7	128	0.5876	16.40	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1058	0-2	Nickel	11.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	26.98	101.7	128	0.5876	15.85	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1188	0-2	Nickel	11.5	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	26.74	101.7	128	0.5876	15.71	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS32	0-2	Nickel	11.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	26.74	101.7	128	0.5876	15.71	64.2	0.00
Boeing RFI Subarea 1B Southeast	PPBS1035	0-2	Nickel	11.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	26.51	101.7	128	0.5876	15.58	64.2	0.00
Boeing RFI Subarea 1B Southeast	TTBS1177	0-2	Nickel	11.4	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	26.51	101.7	128	0.5876	15.58	64.2	0.00
Boeing RFI Subarea 1B Southeast	PPBS1014	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	101.7	128	0.5876	15.03	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1008	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	101.7	128	0.5876	15.03	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1011	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	101.7	128	0.5876	15.03	64.2	0.00
Boeing RFI Subarea 1B Southeast	PPBS1023	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	101.7	128	0.5876	15.03	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1102	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	101.7	128	0.5876	15.03	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1034	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	101.7	128	0.5876	15.03	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1044	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	101.7	128	0.5876	15.03	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1012	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	101.7	128	0.5876	15.03	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1028	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	101.7	128	0.5876	15.03	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS28	0-2	Nickel	10.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	24.65	101.7	128	0.5876	14.48	64.2	0.00
Boeing RFI Subarea 1B Southeast	TTBS1221	0-2	Nickel	10.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	24.65	101.7	128	0.5876	14.48	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1010	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	101.7	128	0.5876	13.66	64.2	0.00
Boeing RFI Subarea 1B Southeast	TTBS1192	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	101.7	128	0.5876	13.66	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1101	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	101.7	128	0.5876	13.66	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1212	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	101.7	128	0.5876	13.66	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1051	0-2	Nickel	9.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.56	101.7	128	0.5876	13.25	64.2	0.00
Boeing RFI Subarea 1B Southeast	TTBS1178	0-2	Nickel	9.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.33	101.7	128	0.5876	13.12	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1016	0-2	Nickel	9.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.09	101.7	128	0.5876	12.98	64.2	0.00

Boeing RFI Subarea 1B Southeast	CLBS1023	0-2	Nickel	9.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.86	101.7	128	0.5876	12.84	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1103	0-2	Nickel	9.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.40	101.7	128	0.5876	12.57	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS20	0-2	Nickel	9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.93	101.7	128	0.5876	12.30	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1035	0-2	Nickel	8.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.70	101.7	128	0.5876	12.16	64.2	0.00
Boeing RFI Subarea 1B Southeast	SWBS1008	0-2	Nickel	8.85	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.58	101.7	128	0.5876	12.09	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1144	0-2	Nickel	8.6	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	20.00	101.7	128	0.5876	11.75	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1004	0-2	Nickel	8.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	19.77	101.7	128	0.5876	11.61	64.2	0.00
Boeing RFI Subarea 1B Southeast	TTBS1210	0-2	Nickel	8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	18.60	101.7	128	0.5876	10.93	64.2	0.00
Boeing RFI Subarea 1B Southeast	PPSS02	0-2	Nickel	6.8	mg/kg	B	Mule Deer	Low TRV-Based RBSL	0.43	15.81	101.7	128	0.5876	9.29	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1021	0-2	Nickel	6.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	15.12	101.7	128	0.5876	8.88	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1037	0-2	Nickel	6.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	14.19	101.7	128	0.5876	8.34	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS0088	0-2	Nickel	3.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	8.84	101.7	128	0.5876	5.19	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1044	0-2	Nickel	1630	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	3790.70	83.1	128	0.2427	919.83	64.2	883.60
Boeing RFI Subarea 1B Southwest	SB_TTF-26	0-2	Nickel	1300	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	3023.26	83.1	128	0.2427	733.61	64.2	697.38
Boeing RFI Subarea 1B Southwest	TTBS17	0-2	Nickel	660	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	1534.88	83.1	128	0.2427	372.45	64.2	336.22
Boeing RFI Subarea 1B Southwest	SB_TTF-24	0-2	Nickel	350	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	813.95	83.1	128	0.2427	197.51	64.2	161.28
Boeing RFI Subarea 1B Southwest	TTBS1098	0-2	Nickel	234	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	544.19	83.1	128	0.2427	132.05	64.2	95.82
Boeing RFI Subarea 1B Southwest	TTTS1010	0-2	Nickel	217	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	504.65	83.1	128	0.2427	122.46	64.2	86.23
Boeing RFI Subarea 1B Southwest	TTBS1262	0-2	Nickel	170	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	395.35	83.1	128	0.2427	95.93	64.2	59.70
Boeing RFI Subarea 1B Southwest	TTBS1193	0-2	Nickel	160	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	372.09	83.1	128	0.2427	90.29	64.2	54.06
Boeing RFI Subarea 1B Southwest	TTBS1262	0-2	Nickel	150	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	348.84	83.1	128	0.2427	84.65	64.2	48.42
Boeing RFI Subarea 1B Southwest	SB_TTF-27	0-2	Nickel	144	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	334.88	83.1	128	0.2427	81.26	64.2	45.03
Boeing RFI Subarea 1B Southwest	TTBS1261	0-2	Nickel	140	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	325.58	83.1	128	0.2427	79.00	64.2	42.77
Boeing RFI Subarea 1B Southwest	TTBS1261	0-2	Nickel	130	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	302.33	83.1	128	0.2427	73.36	64.2	37.13
Boeing RFI Subarea 1B Southwest	SB_TTF-25	0-2	Nickel	120	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	279.07	83.1	128	0.2427	67.72	64.2	31.49
Boeing RFI Subarea 1B Southwest	TTBS1101	0-2	Nickel	110	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	255.81	83.1	128	0.2427	62.07	64.2	25.85
Boeing RFI Subarea 1B Southwest	TTTS1011	0-2	Nickel	102	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	237.21	83.1	128	0.2427	57.56	64.2	21.33
Boeing RFI Subarea 1B Southwest	TTBS1095	0-2	Nickel	84	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	195.35	83.1	128	0.2427	47.40	64.2	11.17
Boeing RFI Subarea 1B Southwest	TTBS53	0-2	Nickel	69	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	160.47	83.1	128	0.2427	38.94	64.2	2.71
Boeing RFI Subarea 1B Southwest	TTBS15	0-2	Nickel	62	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	144.19	83.1	128	0.2427	34.99	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1013	0-2	Nickel	61.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	142.56	83.1	128	0.2427	34.59	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-37	0-2	Nickel	61	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	141.86	83.1	128	0.2427	34.42	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1070	0-2	Nickel	60.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	140.00	83.1	128	0.2427	33.97	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS08	0-2	Nickel	58.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	136.05	83.1	128	0.2427	33.01	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS54	0-2	Nickel	58	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	134.88	83.1	128	0.2427	32.73	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS19	0-2	Nickel	56	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	130.23	83.1	128	0.2427	31.60	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS66	0-2	Nickel	56	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	130.23	83.1	128	0.2427	31.60	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1057	0-2	Nickel	54	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	125.58	83.1	128	0.2427	30.47	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS22	0-2	Nickel	49	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	113.95	83.1	128	0.2427	27.65	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1004	0-2	Nickel	46	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	106.98	83.1	128	0.2427	25.96	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1094	0-2	Nickel	46	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	106.98	83.1	128	0.2427	25.96	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1157	0-2	Nickel	44.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	104.19	83.1	128	0.2427	25.28	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS67	0-2	Nickel	43	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	100.00	83.1	128	0.2427	24.27	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1222	0-2	Nickel	42.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	99.30	83.1	128	0.2427	24.10	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1091	0-2	Nickel	42	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	97.67	83.1	128	0.2427	23.70	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1040	0-2	Nickel	41.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	96.05	83.1	128	0.2427	23.31	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1068	0-2	Nickel	41.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	95.58	83.1	128	0.2427	23.19	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1016	0-2	Nickel	40	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	93.02	83.1	128	0.2427	22.57	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1096	0-2	Nickel	39.2	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	91.16	83.1	128	0.2427	22.12	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1017	0-2	Nickel	37.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	86.51	83.1	128	0.2427	20.99	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-44	0-2	Nickel	37	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	86.05	83.1	128	0.2427	20.88	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1175	0-2	Nickel	36	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	83.72	83.1	128	0.2427	20.32	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1043	0-2	Nickel	35	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	81.40	83.1	128	0.2427	19.75	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF_RR-8	0-2	Nickel	34	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	79.07	83.1	128	0.2427	19.19	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS57	0-2	Nickel	34	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	79.07	83.1	128	0.2427	19.19	64.2	0.00

Boeing RFI Subarea 1B Southwest	TTBS18	0-2	Nickel	34	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	79.07	83.1	128	0.2427	19.19	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1015	0-2	Nickel	34	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	79.07	83.1	128	0.2427	19.19	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS63	0-2	Nickel	33	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	76.74	83.1	128	0.2427	18.62	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1102	0-2	Nickel	33	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	76.74	83.1	128	0.2427	18.62	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1089	0-2	Nickel	32	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	74.42	83.1	128	0.2427	18.06	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1087	0-2	Nickel	30	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	69.77	83.1	128	0.2427	16.93	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1155	0-2	Nickel	30	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	69.77	83.1	128	0.2427	16.93	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-22	0-2	Nickel	29	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	67.44	83.1	128	0.2427	16.37	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1150	0-2	Nickel	29	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	67.44	83.1	128	0.2427	16.37	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1051	0-2	Nickel	28	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	65.12	83.1	128	0.2427	15.80	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1030	0-2	Nickel	27.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	64.19	83.1	128	0.2427	15.58	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1083	0-2	Nickel	27.4	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	63.72	83.1	128	0.2427	15.46	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1092	0-2	Nickel	27.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	63.02	83.1	128	0.2427	15.29	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1093	0-2	Nickel	27	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	62.79	83.1	128	0.2427	15.24	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS71	0-2	Nickel	27	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	62.79	83.1	128	0.2427	15.24	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1045	0-2	Nickel	27	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	62.79	83.1	128	0.2427	15.24	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1086	0-2	Nickel	26.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	61.63	83.1	128	0.2427	14.95	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-17	0-2	Nickel	26	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	60.47	83.1	128	0.2427	14.67	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1150	0-2	Nickel	26	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	60.47	83.1	128	0.2427	14.67	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1066	0-2	Nickel	26	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	60.47	83.1	128	0.2427	14.67	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS35	0-2	Nickel	26	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	60.47	83.1	128	0.2427	14.67	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS70	0-2	Nickel	25	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	58.14	83.1	128	0.2427	14.11	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1225	0-2	Nickel	24.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	57.91	83.1	128	0.2427	14.05	64.2	0.00
Boeing RFI Subarea 1B Southwest	SWBS1007	0-2	Nickel	24.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	56.98	83.1	128	0.2427	13.83	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-42	0-2	Nickel	24	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	55.81	83.1	128	0.2427	13.54	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1084	0-2	Nickel	24	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	55.81	83.1	128	0.2427	13.54	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-21	0-2	Nickel	24	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	55.81	83.1	128	0.2427	13.54	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1150	0-2	Nickel	24	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	55.81	83.1	128	0.2427	13.54	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1097	0-2	Nickel	24	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	55.81	83.1	128	0.2427	13.54	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-10	0-2	Nickel	23	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	53.49	83.1	128	0.2427	12.98	64.2	0.00
Boeing RFI Subarea 1B Southwest	PPBS1039	0-2	Nickel	23	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	53.49	83.1	128	0.2427	12.98	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-32	0-2	Nickel	23	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	53.49	83.1	128	0.2427	12.98	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1090	0-2	Nickel	22	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	51.16	83.1	128	0.2427	12.41	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1014	0-2	Nickel	22	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	51.16	83.1	128	0.2427	12.41	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1153	0-2	Nickel	22	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	51.16	83.1	128	0.2427	12.41	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS68	0-2	Nickel	22	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	51.16	83.1	128	0.2427	12.41	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1263	0-2	Nickel	22	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	51.16	83.1	128	0.2427	12.41	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS36	0-2	Nickel	22	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	51.16	83.1	128	0.2427	12.41	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS49	0-2	Nickel	21.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	50.23	83.1	128	0.2427	12.19	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1179	0-2	Nickel	21.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	49.30	83.1	128	0.2427	11.96	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1031	0-2	Nickel	21.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	49.07	83.1	128	0.2427	11.91	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1152	0-2	Nickel	21	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	48.84	83.1	128	0.2427	11.85	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1031	0-2	Nickel	21	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	48.84	83.1	128	0.2427	11.85	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1174	0-2	Nickel	21	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	48.84	83.1	128	0.2427	11.85	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1041	0-2	Nickel	21	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	48.84	83.1	128	0.2427	11.85	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1104	0-2	Nickel	21	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	48.84	83.1	128	0.2427	11.85	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS69	0-2	Nickel	21	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	48.84	83.1	128	0.2427	11.85	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1099	0-2	Nickel	20.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	47.44	83.1	128	0.2427	11.51	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1163	0-2	Nickel	20.2	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	46.98	83.1	128	0.2427	11.40	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-19	0-2	Nickel	20	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	46.51	83.1	128	0.2427	11.29	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1154	0-2	Nickel	20	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	46.51	83.1	128	0.2427	11.29	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1052	0-2	Nickel	20	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	46.51	83.1	128	0.2427	11.29	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-30	0-2	Nickel	20	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	46.51	83.1	128	0.2427	11.29	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1111	0-2	Nickel	20	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	46.51	83.1	128	0.2427	11.29	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1110	0-2	Nickel	20	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	46.51	83.1	128	0.2427	11.29	64.2	0.00

Boeing RFI Subarea 1B Southwest	SB_TTF-20	0-2	Nickel	20	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	46.51	83.1	128	0.2427	11.29	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1028	0-2	Nickel	19.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	44.65	83.1	128	0.2427	10.83	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1032	0-2	Nickel	19	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	44.19	83.1	128	0.2427	10.72	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS23	0-2	Nickel	19	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	44.19	83.1	128	0.2427	10.72	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1012	0-2	Nickel	18.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	43.02	83.1	128	0.2427	10.44	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1183	0-2	Nickel	18.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	42.79	83.1	128	0.2427	10.38	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1085	0-2	Nickel	18.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	42.56	83.1	128	0.2427	10.33	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1037	0-2	Nickel	18.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	42.56	83.1	128	0.2427	10.33	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1148	0-2	Nickel	18.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	42.09	83.1	128	0.2427	10.21	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS52	0-2	Nickel	18	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	41.86	83.1	128	0.2427	10.16	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1159	0-2	Nickel	18	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	41.86	83.1	128	0.2427	10.16	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1133	0-2	Nickel	17.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	41.40	83.1	128	0.2427	10.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1016	0-2	Nickel	17.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	41.16	83.1	128	0.2427	9.99	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1149	0-2	Nickel	17.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	40.70	83.1	128	0.2427	9.88	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1027	0-2	Nickel	17.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	40.23	83.1	128	0.2427	9.76	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-9	0-2	Nickel	17	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	39.53	83.1	128	0.2427	9.59	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-41	0-2	Nickel	17	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	39.53	83.1	128	0.2427	9.59	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1082	0-2	Nickel	17	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	39.53	83.1	128	0.2427	9.59	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1156	0-2	Nickel	17	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	39.53	83.1	128	0.2427	9.59	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1109	0-2	Nickel	17	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	39.53	83.1	128	0.2427	9.59	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1014	0-2	Nickel	17	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	39.53	83.1	128	0.2427	9.59	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1086	0-2	Nickel	17	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	39.53	83.1	128	0.2427	9.59	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1038	0-2	Nickel	17	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	39.53	83.1	128	0.2427	9.59	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1186	0-2	Nickel	17	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	39.53	83.1	128	0.2427	9.59	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1032	0-2	Nickel	17	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	39.53	83.1	128	0.2427	9.59	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1011	0-2	Nickel	17	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	39.53	83.1	128	0.2427	9.59	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-12	0-2	Nickel	17	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	39.53	83.1	128	0.2427	9.59	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1020	0-2	Nickel	17	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	39.53	83.1	128	0.2427	9.59	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS62	0-2	Nickel	17	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	39.53	83.1	128	0.2427	9.59	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-38	0-2	Nickel	17	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	39.53	83.1	128	0.2427	9.59	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1043	0-2	Nickel	16.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	39.07	83.1	128	0.2427	9.48	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1042	0-2	Nickel	16.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	38.84	83.1	128	0.2427	9.42	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1029	0-2	Nickel	16.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	37.91	83.1	128	0.2427	9.20	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1130	0-2	Nickel	16.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	37.67	83.1	128	0.2427	9.14	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1108	0-2	Nickel	16.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	37.67	83.1	128	0.2427	9.14	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1035	0-2	Nickel	16	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	37.21	83.1	128	0.2427	9.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1081	0-2	Nickel	16	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	37.21	83.1	128	0.2427	9.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1039	0-2	Nickel	16	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	37.21	83.1	128	0.2427	9.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1034	0-2	Nickel	16	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	37.21	83.1	128	0.2427	9.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1151	0-2	Nickel	16	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	37.21	83.1	128	0.2427	9.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1077	0-2	Nickel	16	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	37.21	83.1	128	0.2427	9.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1129	0-2	Nickel	16	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	37.21	83.1	128	0.2427	9.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1194	0-2	Nickel	16	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	37.21	83.1	128	0.2427	9.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1002	0-2	Nickel	15.8	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	36.74	83.1	128	0.2427	8.92	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1121	0-2	Nickel	15.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	36.05	83.1	128	0.2427	8.75	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1033	0-2	Nickel	15.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	35.58	83.1	128	0.2427	8.63	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1144	0-2	Nickel	15.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	35.12	83.1	128	0.2427	8.52	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1055	0-2	Nickel	15	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	34.88	83.1	128	0.2427	8.46	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1111	0-2	Nickel	15	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	34.88	83.1	128	0.2427	8.46	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-6	0-2	Nickel	15	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	34.88	83.1	128	0.2427	8.46	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1124	0-2	Nickel	15	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	34.88	83.1	128	0.2427	8.46	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1118	0-2	Nickel	15	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	34.88	83.1	128	0.2427	8.46	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1125	0-2	Nickel	15	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	34.88	83.1	128	0.2427	8.46	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-18	0-2	Nickel	15	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	34.88	83.1	128	0.2427	8.46	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1141	0-2	Nickel	15	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	34.88	83.1	128	0.2427	8.46	64.2	0.00

Boeing RFI Subarea 1B Southwest	TTBS1039	0-2	Nickel	15	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	34.88	83.1	128	0.2427	8.46	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1030	0-2	Nickel	14.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	34.65	83.1	128	0.2427	8.41	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1079	0-2	Nickel	14.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	34.65	83.1	128	0.2427	8.41	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1037	0-2	Nickel	14.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	33.95	83.1	128	0.2427	8.24	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1135	0-2	Nickel	14.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	33.95	83.1	128	0.2427	8.24	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1017	0-2	Nickel	14.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	33.95	83.1	128	0.2427	8.24	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1062	0-2	Nickel	14.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	33.72	83.1	128	0.2427	8.18	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1018	0-2	Nickel	14.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	33.72	83.1	128	0.2427	8.18	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1008	0-2	Nickel	14.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	33.49	83.1	128	0.2427	8.13	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1147	0-2	Nickel	14.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	33.26	83.1	128	0.2427	8.07	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1009	0-2	Nickel	14.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	33.02	83.1	128	0.2427	8.01	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1136	0-2	Nickel	14.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.79	83.1	128	0.2427	7.96	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1036	0-2	Nickel	14.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.79	83.1	128	0.2427	7.96	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1006	0-2	Nickel	14	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.56	83.1	128	0.2427	7.90	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1029	0-2	Nickel	14	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.56	83.1	128	0.2427	7.90	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1186	0-2	Nickel	14	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.56	83.1	128	0.2427	7.90	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS45	0-2	Nickel	14	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.56	83.1	128	0.2427	7.90	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1074	0-2	Nickel	14	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.56	83.1	128	0.2427	7.90	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1007	0-2	Nickel	14	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.56	83.1	128	0.2427	7.90	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1001	0-2	Nickel	14	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.56	83.1	128	0.2427	7.90	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1161	0-2	Nickel	14	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.56	83.1	128	0.2427	7.90	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1023	0-2	Nickel	14	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.56	83.1	128	0.2427	7.90	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1142	0-2	Nickel	14	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.56	83.1	128	0.2427	7.90	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1038	0-2	Nickel	14	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.56	83.1	128	0.2427	7.90	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-13	0-2	Nickel	14	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.56	83.1	128	0.2427	7.90	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1008	0-2	Nickel	14	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.56	83.1	128	0.2427	7.90	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-16	0-2	Nickel	14	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.56	83.1	128	0.2427	7.90	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1041	0-2	Nickel	14	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.56	83.1	128	0.2427	7.90	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1027	0-2	Nickel	14	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.56	83.1	128	0.2427	7.90	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1158	0-2	Nickel	13.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	31.63	83.1	128	0.2427	7.67	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1028	0-2	Nickel	13.4	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	31.16	83.1	128	0.2427	7.56	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1067	0-2	Nickel	13.2	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	30.70	83.1	128	0.2427	7.45	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1034	0-2	Nickel	13.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.70	83.1	128	0.2427	7.45	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1005	0-2	Nickel	13.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.70	83.1	128	0.2427	7.45	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1134	0-2	Nickel	13.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.47	83.1	128	0.2427	7.39	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1003	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	83.1	128	0.2427	7.34	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1024	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	83.1	128	0.2427	7.34	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1103	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	83.1	128	0.2427	7.34	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1080	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	83.1	128	0.2427	7.34	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1042	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	83.1	128	0.2427	7.34	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1128	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	83.1	128	0.2427	7.34	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-36	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	83.1	128	0.2427	7.34	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1040	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	83.1	128	0.2427	7.34	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1131	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	83.1	128	0.2427	7.34	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1007	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	83.1	128	0.2427	7.34	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1000	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	83.1	128	0.2427	7.34	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1033	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	83.1	128	0.2427	7.34	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1017	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	83.1	128	0.2427	7.34	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1036	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	83.1	128	0.2427	7.34	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1180	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	83.1	128	0.2427	7.34	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1039	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	83.1	128	0.2427	7.34	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1088	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	83.1	128	0.2427	7.34	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1194	0-2	Nickel	12.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	29.77	83.1	128	0.2427	7.22	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1099	0-2	Nickel	12.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	29.77	83.1	128	0.2427	7.22	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1184	0-2	Nickel	12.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	29.77	83.1	128	0.2427	7.22	64.2	0.00

Boeing RFI Subarea 1B Southwest	CTBS1000	0-2	Nickel	12.7	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	29.53	83.1	128	0.2427	7.17	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1169	0-2	Nickel	12.7	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	29.53	83.1	128	0.2427	7.17	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1123	0-2	Nickel	12.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	29.53	83.1	128	0.2427	7.17	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1100	0-2	Nickel	12.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	29.53	83.1	128	0.2427	7.17	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1020	0-2	Nickel	12.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	29.53	83.1	128	0.2427	7.17	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1026	0-2	Nickel	12.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	29.30	83.1	128	0.2427	7.11	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1103	0-2	Nickel	12.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	29.07	83.1	128	0.2427	7.05	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1069	0-2	Nickel	12.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	28.37	83.1	128	0.2427	6.88	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1030	0-2	Nickel	12.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	28.14	83.1	128	0.2427	6.83	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1257	0-2	Nickel	12.1	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	28.14	83.1	128	0.2427	6.83	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1106	0-2	Nickel	12.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	28.14	83.1	128	0.2427	6.83	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1038	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	83.1	128	0.2427	6.77	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1006	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	83.1	128	0.2427	6.77	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1196	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	83.1	128	0.2427	6.77	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1005	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	83.1	128	0.2427	6.77	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1172	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	83.1	128	0.2427	6.77	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1024	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	83.1	128	0.2427	6.77	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1182	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	83.1	128	0.2427	6.77	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1025	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	83.1	128	0.2427	6.77	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1204	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	83.1	128	0.2427	6.77	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS65	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	83.1	128	0.2427	6.77	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1199	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	83.1	128	0.2427	6.77	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1130	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	83.1	128	0.2427	6.77	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS04	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	83.1	128	0.2427	6.77	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-43	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	83.1	128	0.2427	6.77	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1010	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	83.1	128	0.2427	6.77	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-31	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	83.1	128	0.2427	6.77	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-39	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	83.1	128	0.2427	6.77	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1101	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	83.1	128	0.2427	6.77	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1037	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	83.1	128	0.2427	6.77	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1063	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	83.1	128	0.2427	6.77	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1025	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	83.1	128	0.2427	6.77	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-34	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	83.1	128	0.2427	6.77	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1035	0-2	Nickel	11.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.67	83.1	128	0.2427	6.72	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1003	0-2	Nickel	11.8	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	27.44	83.1	128	0.2427	6.66	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1164	0-2	Nickel	11.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.21	83.1	128	0.2427	6.60	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1137	0-2	Nickel	11.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.21	83.1	128	0.2427	6.60	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1021	0-2	Nickel	11.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	26.98	83.1	128	0.2427	6.55	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1119	0-2	Nickel	11.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	26.98	83.1	128	0.2427	6.55	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1001	0-2	Nickel	11.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	26.98	83.1	128	0.2427	6.55	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1145	0-2	Nickel	11.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	26.98	83.1	128	0.2427	6.55	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1137	0-2	Nickel	11.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	26.98	83.1	128	0.2427	6.55	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1134	0-2	Nickel	11.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	26.28	83.1	128	0.2427	6.38	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1122	0-2	Nickel	11.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	26.28	83.1	128	0.2427	6.38	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1119	0-2	Nickel	11.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	26.05	83.1	128	0.2427	6.32	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1164	0-2	Nickel	11.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	26.05	83.1	128	0.2427	6.32	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1021	0-2	Nickel	11.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.81	83.1	128	0.2427	6.26	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1075	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	83.1	128	0.2427	6.21	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1076	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	83.1	128	0.2427	6.21	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1199	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	83.1	128	0.2427	6.21	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS11	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	83.1	128	0.2427	6.21	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1011	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	83.1	128	0.2427	6.21	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1188	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	83.1	128	0.2427	6.21	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS10	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	83.1	128	0.2427	6.21	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1132	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	83.1	128	0.2427	6.21	64.2	0.00

Boeing RFI Subarea 1B Southwest	TTBS1113	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	83.1	128	0.2427	6.21	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS30	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	83.1	128	0.2427	6.21	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS42	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	83.1	128	0.2427	6.21	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS44	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	83.1	128	0.2427	6.21	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-2	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	83.1	128	0.2427	6.21	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1047	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	83.1	128	0.2427	6.21	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1106	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	83.1	128	0.2427	6.21	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1032	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	83.1	128	0.2427	6.21	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-11	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	83.1	128	0.2427	6.21	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1001	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	83.1	128	0.2427	6.21	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1060	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	83.1	128	0.2427	6.21	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1024	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	83.1	128	0.2427	6.21	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-40	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	83.1	128	0.2427	6.21	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1206	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	83.1	128	0.2427	6.21	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1049	0-2	Nickel	10.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.35	83.1	128	0.2427	6.15	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1158	0-2	Nickel	10.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.35	83.1	128	0.2427	6.15	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1224	0-2	Nickel	10.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.12	83.1	128	0.2427	6.09	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1036	0-2	Nickel	10.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.12	83.1	128	0.2427	6.09	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1105	0-2	Nickel	10.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	24.88	83.1	128	0.2427	6.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1009	0-2	Nickel	10.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	24.88	83.1	128	0.2427	6.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1127	0-2	Nickel	10.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	24.88	83.1	128	0.2427	6.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1143	0-2	Nickel	10.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	24.65	83.1	128	0.2427	5.98	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1033	0-2	Nickel	10.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	24.65	83.1	128	0.2427	5.98	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1010	0-2	Nickel	10.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	24.65	83.1	128	0.2427	5.98	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1004	0-2	Nickel	10.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	24.42	83.1	128	0.2427	5.93	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1061	0-2	Nickel	10.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	24.42	83.1	128	0.2427	5.93	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1020	0-2	Nickel	10.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	24.19	83.1	128	0.2427	5.87	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1072	0-2	Nickel	10.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	24.19	83.1	128	0.2427	5.87	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1019	0-2	Nickel	10.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.95	83.1	128	0.2427	5.81	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1048	0-2	Nickel	10.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.95	83.1	128	0.2427	5.81	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1203	0-2	Nickel	10.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.72	83.1	128	0.2427	5.76	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1139	0-2	Nickel	10.2	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	23.72	83.1	128	0.2427	5.76	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1002	0-2	Nickel	10.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.49	83.1	128	0.2427	5.70	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1201	0-2	Nickel	10.1	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	23.49	83.1	128	0.2427	5.70	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1040	0-2	Nickel	10.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.49	83.1	128	0.2427	5.70	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1046	0-2	Nickel	10.1	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	23.49	83.1	128	0.2427	5.70	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1216	0-2	Nickel	10.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.49	83.1	128	0.2427	5.70	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1169	0-2	Nickel	10.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.49	83.1	128	0.2427	5.70	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1167	0-2	Nickel	10.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.49	83.1	128	0.2427	5.70	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1026	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	83.1	128	0.2427	5.64	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1073	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	83.1	128	0.2427	5.64	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1011	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	83.1	128	0.2427	5.64	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1195	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	83.1	128	0.2427	5.64	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1026	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	83.1	128	0.2427	5.64	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1126	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	83.1	128	0.2427	5.64	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS46	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	83.1	128	0.2427	5.64	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1060	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	83.1	128	0.2427	5.64	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1162	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	83.1	128	0.2427	5.64	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1056	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	83.1	128	0.2427	5.64	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1139	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	83.1	128	0.2427	5.64	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1035	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	83.1	128	0.2427	5.64	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS33	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	83.1	128	0.2427	5.64	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS29	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	83.1	128	0.2427	5.64	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1029	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	83.1	128	0.2427	5.64	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1112	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	83.1	128	0.2427	5.64	64.2	0.00

Boeing RFI Subarea 1B Southwest	TTBS1107	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	83.1	128	0.2427	5.64	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS43	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	83.1	128	0.2427	5.64	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1059	0-2	Nickel	9.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.02	83.1	128	0.2427	5.59	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1117	0-2	Nickel	9.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.02	83.1	128	0.2427	5.59	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1053	0-2	Nickel	9.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.02	83.1	128	0.2427	5.59	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1156	0-2	Nickel	9.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.79	83.1	128	0.2427	5.53	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1074	0-2	Nickel	9.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.79	83.1	128	0.2427	5.53	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1181	0-2	Nickel	9.8	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	22.79	83.1	128	0.2427	5.53	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1107	0-2	Nickel	9.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.56	83.1	128	0.2427	5.47	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1121	0-2	Nickel	9.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.56	83.1	128	0.2427	5.47	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1205	0-2	Nickel	9.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.56	83.1	128	0.2427	5.47	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1050	0-2	Nickel	9.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.56	83.1	128	0.2427	5.47	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1108	0-2	Nickel	9.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.56	83.1	128	0.2427	5.47	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1202	0-2	Nickel	9.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.56	83.1	128	0.2427	5.47	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1013	0-2	Nickel	9.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.56	83.1	128	0.2427	5.47	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1004	0-2	Nickel	9.69	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.53	83.1	128	0.2427	5.47	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1006	0-2	Nickel	9.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.33	83.1	128	0.2427	5.42	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1146	0-2	Nickel	9.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.09	83.1	128	0.2427	5.36	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1104	0-2	Nickel	9.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.09	83.1	128	0.2427	5.36	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1002	0-2	Nickel	9.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.09	83.1	128	0.2427	5.36	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1025	0-2	Nickel	9.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.86	83.1	128	0.2427	5.30	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1160	0-2	Nickel	9.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.86	83.1	128	0.2427	5.30	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1071	0-2	Nickel	9.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.86	83.1	128	0.2427	5.30	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1022	0-2	Nickel	9.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.86	83.1	128	0.2427	5.30	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1189	0-2	Nickel	9.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.86	83.1	128	0.2427	5.30	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1022	0-2	Nickel	9.33	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.70	83.1	128	0.2427	5.27	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1078	0-2	Nickel	9.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.63	83.1	128	0.2427	5.25	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1202	0-2	Nickel	9.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.63	83.1	128	0.2427	5.25	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1168	0-2	Nickel	9.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.40	83.1	128	0.2427	5.19	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1054	0-2	Nickel	9.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.40	83.1	128	0.2427	5.19	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1171	0-2	Nickel	9.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.40	83.1	128	0.2427	5.19	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS08	0-2	Nickel	9.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.40	83.1	128	0.2427	5.19	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1042	0-2	Nickel	9.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.40	83.1	128	0.2427	5.19	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1170	0-2	Nickel	9.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.16	83.1	128	0.2427	5.14	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-33	0-2	Nickel	9.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.16	83.1	128	0.2427	5.14	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1105	0-2	Nickel	9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.93	83.1	128	0.2427	5.08	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-14	0-2	Nickel	9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.93	83.1	128	0.2427	5.08	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1123	0-2	Nickel	9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.93	83.1	128	0.2427	5.08	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS09	0-2	Nickel	9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.93	83.1	128	0.2427	5.08	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-23	0-2	Nickel	9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.93	83.1	128	0.2427	5.08	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1018	0-2	Nickel	9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.93	83.1	128	0.2427	5.08	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS48	0-2	Nickel	8.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.70	83.1	128	0.2427	5.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1203	0-2	Nickel	8.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.47	83.1	128	0.2427	4.97	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-5	0-2	Nickel	8.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.47	83.1	128	0.2427	4.97	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1012	0-2	Nickel	8.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.47	83.1	128	0.2427	4.97	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1044	0-2	Nickel	8.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.47	83.1	128	0.2427	4.97	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1116	0-2	Nickel	8.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.47	83.1	128	0.2427	4.97	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1021	0-2	Nickel	8.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.23	83.1	128	0.2427	4.91	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1019	0-2	Nickel	8.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.00	83.1	128	0.2427	4.85	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1102	0-2	Nickel	8.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.00	83.1	128	0.2427	4.85	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1018	0-2	Nickel	8.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	19.77	83.1	128	0.2427	4.80	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1152	0-2	Nickel	8.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	19.53	83.1	128	0.2427	4.74	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1027	0-2	Nickel	8.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	19.53	83.1	128	0.2427	4.74	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1166	0-2	Nickel	8.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	19.30	83.1	128	0.2427	4.68	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1019	0-2	Nickel	8.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	19.30	83.1	128	0.2427	4.68	64.2	0.00

Boeing RFI Subarea 1B Southwest	TTBS13	0-2	Nickel	8.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	19.30	83.1	128	0.2427	4.68	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1140	0-2	Nickel	8.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	19.07	83.1	128	0.2427	4.63	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1201	0-2	Nickel	8.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	19.07	83.1	128	0.2427	4.63	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1200	0-2	Nickel	8.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	19.07	83.1	128	0.2427	4.63	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS24	0-2	Nickel	8.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	19.07	83.1	128	0.2427	4.63	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1122	0-2	Nickel	8.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	18.84	83.1	128	0.2427	4.57	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1159	0-2	Nickel	8.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	18.84	83.1	128	0.2427	4.57	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1061	0-2	Nickel	8.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	18.84	83.1	128	0.2427	4.57	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-1	0-2	Nickel	8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	18.60	83.1	128	0.2427	4.51	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1064	0-2	Nickel	7.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	18.37	83.1	128	0.2427	4.46	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS80	0-2	Nickel	7.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	18.37	83.1	128	0.2427	4.46	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1005	0-2	Nickel	7.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	18.14	83.1	128	0.2427	4.40	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-8	0-2	Nickel	7.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	17.91	83.1	128	0.2427	4.35	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1120	0-2	Nickel	7.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	17.91	83.1	128	0.2427	4.35	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS28	0-2	Nickel	7.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	17.67	83.1	128	0.2427	4.29	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1138	0-2	Nickel	7.6	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	17.67	83.1	128	0.2427	4.29	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1003	0-2	Nickel	7.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	17.44	83.1	128	0.2427	4.23	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1068	0-2	Nickel	7.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	17.21	83.1	128	0.2427	4.18	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1058	0-2	Nickel	7.33	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	17.05	83.1	128	0.2427	4.14	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1185	0-2	Nickel	7.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	16.98	83.1	128	0.2427	4.12	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1160	0-2	Nickel	7.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	16.98	83.1	128	0.2427	4.12	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1015	0-2	Nickel	7.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	16.98	83.1	128	0.2427	4.12	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-15	0-2	Nickel	7.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	16.74	83.1	128	0.2427	4.06	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1120	0-2	Nickel	7.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	16.74	83.1	128	0.2427	4.06	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-35	0-2	Nickel	7.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	16.51	83.1	128	0.2427	4.01	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS27	0-2	Nickel	6.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	16.05	83.1	128	0.2427	3.89	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1071	0-2	Nickel	6.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	15.58	83.1	128	0.2427	3.78	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1004	0-2	Nickel	6.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	15.58	83.1	128	0.2427	3.78	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1009	0-2	Nickel	6.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	15.58	83.1	128	0.2427	3.78	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1185	0-2	Nickel	6.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	15.58	83.1	128	0.2427	3.78	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1022	0-2	Nickel	6.52	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	15.16	83.1	128	0.2427	3.68	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1003	0-2	Nickel	6.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	14.42	83.1	128	0.2427	3.50	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1065	0-2	Nickel	5.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	13.02	83.1	128	0.2427	3.16	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1023	0-2	Nickel	5.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	12.56	83.1	128	0.2427	3.05	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1000	0-2	Nickel	5.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	12.33	83.1	128	0.2427	2.99	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-3	0-2	Nickel	4.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	11.40	83.1	128	0.2427	2.77	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1014	0-2	Nickel	4.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	10.47	83.1	128	0.2427	2.54	64.2	0.00
Boeing RFI Subarea 1B Southwest	R_TTF_0229-1	0-2	Nickel	4.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	9.77	83.1	128	0.2427	2.37	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-4	0-2	Nickel	3.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	8.60	83.1	128	0.2427	2.09	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-7	0-2	Nickel	3.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	8.60	83.1	128	0.2427	2.09	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS47	0-2	Nickel	1.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	3.49	83.1	128	0.2427	0.85	64.2	0.00
Boeing RFI Subarea 1B Southwest	R_TTF_0229-2	0-2	Nickel	1.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	2.56	83.1	128	0.2427	0.62	64.2	0.00
Boeing RFI Subarea 1B Southwest	R_TTF_0229-1	0-2	Nickel	0.86	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	2.00	83.1	128	0.2427	0.49	64.2	0.00
Boeing RFI Subarea 1B Southwest	R_TTF_0229-	0-2	Nickel	0.12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	0.28	83.1	128	0.2427	0.07	64.2	0.00
Boeing RFI Subarea 1B Southwest	R_TTF_0229-	0-2	Nickel	0.02	mg/kg	U	Mule Deer	Low TRV-Based RBSL	0.43	0.05	83.1	128	0.2427	0.01	64.2	0.00
Boeing RFI Subarea 1B Southwest	R_TTF_0229-	0-2	Nickel	0.02	mg/kg	U	Mule Deer	Low TRV-Based RBSL	0.43	0.05	83.1	128	0.2427	0.01	64.2	0.00
Boeing RFI Subarea 1B Southwest	R_TTF_0229-	0-2	Nickel	0.02	mg/kg	U	Mule Deer	Low TRV-Based RBSL	0.43	0.05	83.1	128	0.2427	0.01	64.2	0.00
Boeing RFI Subarea 1B Southwest	R_TTF_0229-	0-2	Nickel	0.005	mg/kg	U	Mule Deer	Low TRV-Based RBSL	0.43	0.01	83.1	128	0.2427	0.00	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1035	0-2	Nickel	55	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	127.91	58.3	128	0.2244	28.71	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1035	0-2	Nickel	46.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	108.14	58.3	128	0.2244	24.27	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1406	0-2	Nickel	37	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	86.05	58.3	128	0.2244	19.31	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS09	0-2	Nickel	31	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	72.09	58.3	128	0.2244	16.18	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1020	0-2	Nickel	29.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	68.37	58.3	128	0.2244	15.35	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1032	0-2	Nickel	28.7	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	66.74	58.3	128	0.2244	14.98	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1407	0-2	Nickel	28	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	65.12	58.3	128	0.2244	14.61	64.2	0.00

Boeing RFI Subarea 5/9 North	SNBS1032	0-2	Nickel	27.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	64.88	58.3	128	0.2244	14.56	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS1025	0-2	Nickel	26.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	62.56	58.3	128	0.2244	14.04	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1008	0-2	Nickel	26.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	62.09	58.3	128	0.2244	13.94	64.2	0.00
Boeing RFI Subarea 5/9 North	ECSS02	0-2	Nickel	26.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	60.93	58.3	128	0.2244	13.68	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1023	0-2	Nickel	25.4	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	59.07	58.3	128	0.2244	13.26	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS10	0-2	Nickel	25	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	58.14	58.3	128	0.2244	13.05	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS1031	0-2	Nickel	23.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	54.42	58.3	128	0.2244	12.21	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS14	0-2	Nickel	23	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	53.49	58.3	128	0.2244	12.01	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS1016	0-2	Nickel	22.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	52.33	58.3	128	0.2244	11.74	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS1024	0-2	Nickel	22.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	52.09	58.3	128	0.2244	11.69	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1033	0-2	Nickel	22.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	51.40	58.3	128	0.2244	11.54	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1006	0-2	Nickel	22	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	51.16	58.3	128	0.2244	11.48	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS1017	0-2	Nickel	22	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	51.16	58.3	128	0.2244	11.48	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1013	0-2	Nickel	21.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	50.47	58.3	128	0.2244	11.33	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS1027	0-2	Nickel	21.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	49.53	58.3	128	0.2244	11.12	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1009	0-2	Nickel	20.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	48.37	58.3	128	0.2244	10.86	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS1033	0-2	Nickel	20.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	47.21	58.3	128	0.2244	10.60	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1017	0-2	Nickel	20	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	46.51	58.3	128	0.2244	10.44	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1037	0-2	Nickel	20	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	46.51	58.3	128	0.2244	10.44	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1031	0-2	Nickel	20	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	46.51	58.3	128	0.2244	10.44	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS1035	0-2	Nickel	19.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	45.12	58.3	128	0.2244	10.13	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1016	0-2	Nickel	19.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	44.65	58.3	128	0.2244	10.02	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS22	0-2	Nickel	19	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	44.19	58.3	128	0.2244	9.92	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS1018	0-2	Nickel	18.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	43.02	58.3	128	0.2244	9.66	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS1036	0-2	Nickel	18.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	42.79	58.3	128	0.2244	9.60	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS1019	0-2	Nickel	18.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	42.56	58.3	128	0.2244	9.55	64.2	0.00
Boeing RFI Subarea 5/9 North	D-5-02	0-2	Nickel	18	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	41.86	58.3	128	0.2244	9.40	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1021	0-2	Nickel	18	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	41.86	58.3	128	0.2244	9.40	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS1015	0-2	Nickel	17.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	40.23	58.3	128	0.2244	9.03	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS1018	0-2	Nickel	16.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	39.30	58.3	128	0.2244	8.82	64.2	0.00
Boeing RFI Subarea 5/9 North	ECSS01	0-2	Nickel	16.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	39.30	58.3	128	0.2244	8.82	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1025	0-2	Nickel	16.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	39.07	58.3	128	0.2244	8.77	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1034	0-2	Nickel	16.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	38.60	58.3	128	0.2244	8.66	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS1040	0-2	Nickel	16.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	37.67	58.3	128	0.2244	8.46	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS1022	0-2	Nickel	16	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	37.21	58.3	128	0.2244	8.35	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS1030	0-2	Nickel	15.9	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	36.98	58.3	128	0.2244	8.30	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS1020	0-2	Nickel	15.7	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	36.51	58.3	128	0.2244	8.19	64.2	0.00
Boeing RFI Subarea 5/9 North	SPBS1045	0-2	Nickel	15.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	35.81	58.3	128	0.2244	8.04	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS11	0-2	Nickel	15	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	34.88	58.3	128	0.2244	7.83	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS03	0-2	Nickel	15	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	34.88	58.3	128	0.2244	7.83	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS02	0-2	Nickel	15	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	34.88	58.3	128	0.2244	7.83	64.2	0.00
Boeing RFI Subarea 5/9 North	BUBS07	0-2	Nickel	14	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.56	58.3	128	0.2244	7.31	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS04	0-2	Nickel	14	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.56	58.3	128	0.2244	7.31	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1005	0-2	Nickel	14	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.56	58.3	128	0.2244	7.31	64.2	0.00
Boeing RFI Subarea 5/9 North	D-5-03	0-2	Nickel	14	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.56	58.3	128	0.2244	7.31	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1007	0-2	Nickel	13.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	31.86	58.3	128	0.2244	7.15	64.2	0.00
Boeing RFI Subarea 5/9 North	ECTS06S01	0-2	Nickel	13.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	31.86	58.3	128	0.2244	7.15	64.2	0.00
Boeing RFI Subarea 5/9 North	SPBS1044	0-2	Nickel	13.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	31.63	58.3	128	0.2244	7.10	64.2	0.00
Boeing RFI Subarea 5/9 North	SPBS1046	0-2	Nickel	13.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	31.63	58.3	128	0.2244	7.10	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS1039	0-2	Nickel	13.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.70	58.3	128	0.2244	6.89	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS1021	0-2	Nickel	13.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.47	58.3	128	0.2244	6.84	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS12	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	58.3	128	0.2244	6.79	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS21	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	58.3	128	0.2244	6.79	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1036	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	58.3	128	0.2244	6.79	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1030	0-2	Nickel	12.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	29.53	58.3	128	0.2244	6.63	64.2	0.00

Boeing RFI Subarea 5/9 North	ECTS02S01	0-2	Nickel	12.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	29.53	58.3	128	0.2244	6.63	64.2	0.00
Boeing RFI Subarea 5/9 North	BGSS03	0-2	Nickel	12.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	28.14	58.3	128	0.2244	6.32	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1001	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	58.3	128	0.2244	6.26	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS1014	0-2	Nickel	11.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.81	58.3	128	0.2244	5.79	64.2	0.00
Boeing RFI Subarea 5/9 North	BUBS0020	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	58.3	128	0.2244	5.74	64.2	0.00
Boeing RFI Subarea 5/9 North	NCBS1017	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	58.3	128	0.2244	5.74	64.2	0.00
Boeing RFI Subarea 5/9 North	NCBS1018	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	58.3	128	0.2244	5.74	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS16	0-2	Nickel	10.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	24.42	58.3	128	0.2244	5.48	64.2	0.00
Boeing RFI Subarea 5/9 North	NCBS1019	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	58.3	128	0.2244	5.22	64.2	0.00
Boeing RFI Subarea 5/9 North	D-5-04	0-2	Nickel	9.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.79	58.3	128	0.2244	5.12	64.2	0.00
Boeing RFI Subarea 5/9 North	D-5-05	0-2	Nickel	9.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.63	58.3	128	0.2244	4.85	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS13	0-2	Nickel	9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.93	58.3	128	0.2244	4.70	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1014	0-2	Nickel	8.6	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	20.00	58.3	128	0.2244	4.49	64.2	0.00
Boeing RFI Subarea 5/9 North	CDBS1032	0-2	Nickel	8.36	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	19.44	58.3	128	0.2244	4.36	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1011	0-2	Nickel	8.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	19.07	58.3	128	0.2244	4.28	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS1034	0-2	Nickel	8.13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	18.91	58.3	128	0.2244	4.24	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS16	0-2	Nickel	8	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	18.60	58.3	128	0.2244	4.18	64.2	0.00
Boeing RFI Subarea 5/9 North	SPBS0028	0-2	Nickel	7.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	18.14	58.3	128	0.2244	4.07	64.2	0.00
Boeing RFI Subarea 5/9 North	BUBS0021	0-2	Nickel	7.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	17.91	58.3	128	0.2244	4.02	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS18	0-2	Nickel	6.65	mg/kg	UJ	Mule Deer	Low TRV-Based RBSL	0.43	15.47	58.3	128	0.2244	3.47	64.2	0.00
Boeing RFI Subarea 5/9 North	BUBS1082	0-2	Nickel	5.48	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	12.74	58.3	128	0.2244	2.86	64.2	0.00
Boeing RFI Subarea 5/9 North	SNSS01	0-2	Nickel	4.7	mg/kg	B	Mule Deer	Low TRV-Based RBSL	0.43	10.93	58.3	128	0.2244	2.45	64.2	0.00
Boeing RFI Subarea 5/9 North	D-5-01	0-2	Nickel	2.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	4.88	58.3	128	0.2244	1.10	64.2	0.00
Boeing RFI Subarea 5/9 North	P2TS45	0-2	Nickel	0.28	mg/kg	U	Mule Deer	Low TRV-Based RBSL	0.43	0.65	58.3	128	0.2244	0.15	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS10	0-2	Nickel	210	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	488.37	168.0	128	0.8060	393.61	64.2	273.28
Boeing RFI Subarea 5/9 South	STBS02	0-2	Nickel	150	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	348.84	168.0	128	0.8060	281.15	64.2	160.82
Boeing RFI Subarea 5/9 South	CFTS01	0-2	Nickel	118	mg/kg	QC	Mule Deer	Low TRV-Based RBSL	0.43	274.42	168.0	128	0.8060	221.17	64.2	100.84
Boeing RFI Subarea 5/9 South	P2TS09	0-2	Nickel	108	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	251.16	168.0	128	0.8060	202.43	64.2	82.10
Boeing RFI Subarea 5/9 South	CFBS11	0-2	Nickel	99	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	230.23	168.0	128	0.8060	185.56	64.2	65.23
Boeing RFI Subarea 5/9 South	STBS1002	0-2	Nickel	87	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	202.33	168.0	128	0.8060	163.07	64.2	42.74
Boeing RFI Subarea 5/9 South	STBS1007	0-2	Nickel	85	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	197.67	168.0	128	0.8060	159.32	64.2	38.99
Boeing RFI Subarea 5/9 South	STBS1014	0-2	Nickel	68.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	158.60	168.0	128	0.8060	127.83	64.2	7.50
Boeing RFI Subarea 5/9 South	SLBS1054	0-2	Nickel	66.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	154.42	168.0	128	0.8060	124.46	64.2	4.12
Boeing RFI Subarea 5/9 South	STBS1006	0-2	Nickel	62	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	144.19	168.0	128	0.8060	116.21	64.2	0.00
Boeing RFI Subarea 5/9 South	STBS1404	0-2	Nickel	56.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	130.93	168.0	128	0.8060	105.53	64.2	0.00
Boeing RFI Subarea 5/9 South	STBS1010	0-2	Nickel	55	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	127.91	168.0	128	0.8060	103.09	64.2	0.00
Boeing RFI Subarea 5/9 South	STBS1012	0-2	Nickel	49.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	114.88	168.0	128	0.8060	92.59	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1411	0-2	Nickel	48.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	113.49	168.0	128	0.8060	91.47	64.2	0.00
Boeing RFI Subarea 5/9 South	STTS01	0-2	Nickel	48.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	112.33	168.0	128	0.8060	90.53	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1403	0-2	Nickel	43.4	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	100.93	168.0	128	0.8060	81.35	64.2	0.00
Boeing RFI Subarea 5/9 South	STBS1401	0-2	Nickel	42.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	99.53	168.0	128	0.8060	80.22	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1400	0-2	Nickel	42.7	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	99.30	168.0	128	0.8060	80.04	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1412	0-2	Nickel	41	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	95.35	168.0	128	0.8060	76.85	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1046	0-2	Nickel	39.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	91.86	168.0	128	0.8060	74.04	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1402	0-2	Nickel	38.9	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	90.47	168.0	128	0.8060	72.91	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS06	0-2	Nickel	38	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	88.37	168.0	128	0.8060	71.23	64.2	0.00
Boeing RFI Subarea 5/9 South	STBS04	0-2	Nickel	35	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	81.40	168.0	128	0.8060	65.60	64.2	0.00
Boeing RFI Subarea 5/9 South	STBS1013	0-2	Nickel	34.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	80.70	168.0	128	0.8060	65.04	64.2	0.00
Boeing RFI Subarea 5/9 South	STBS01	0-2	Nickel	34	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	79.07	168.0	128	0.8060	63.73	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1034	0-2	Nickel	33	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	76.74	168.0	128	0.8060	61.85	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1004	0-2	Nickel	32.9	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	76.51	168.0	128	0.8060	61.67	64.2	0.00
Boeing RFI Subarea 5/9 South	STBS1001	0-2	Nickel	32.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	75.81	168.0	128	0.8060	61.10	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1015	0-2	Nickel	32	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	74.42	168.0	128	0.8060	59.98	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1410	0-2	Nickel	31	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	72.09	168.0	128	0.8060	58.11	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS24	0-2	Nickel	30.7	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	71.40	168.0	128	0.8060	57.54	64.2	0.00

Boeing RFI Subarea 5/9 South	CFBS1404	0-2	Nickel	30.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	70.47	168.0	128	0.8060	56.79	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1003	0-2	Nickel	30	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	69.77	168.0	128	0.8060	56.23	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1401	0-2	Nickel	29.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	68.60	168.0	128	0.8060	55.29	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1405	0-2	Nickel	29.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	68.14	168.0	128	0.8060	54.92	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1028	0-2	Nickel	28.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	66.51	168.0	128	0.8060	53.61	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS12	0-2	Nickel	28	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	65.12	168.0	128	0.8060	52.48	64.2	0.00
Boeing RFI Subarea 5/9 South	STBS1400	0-2	Nickel	28	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	65.12	168.0	128	0.8060	52.48	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1001	0-2	Nickel	27.7	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	64.42	168.0	128	0.8060	51.92	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1016	0-2	Nickel	27	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	62.79	168.0	128	0.8060	50.61	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1025	0-2	Nickel	26.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	62.56	168.0	128	0.8060	50.42	64.2	0.00
Boeing RFI Subarea 5/9 South	STBS1009	0-2	Nickel	26	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	60.47	168.0	128	0.8060	48.73	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1024	0-2	Nickel	25.4	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	59.07	168.0	128	0.8060	47.61	64.2	0.00
Boeing RFI Subarea 5/9 South	CFSS01	0-2	Nickel	25.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	58.60	168.0	128	0.8060	47.23	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1016	0-2	Nickel	23.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	55.35	168.0	128	0.8060	44.61	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1035	0-2	Nickel	23.2	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	53.95	168.0	128	0.8060	43.49	64.2	0.00
Boeing RFI Subarea 5/9 South	STBS1403	0-2	Nickel	23.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	53.95	168.0	128	0.8060	43.49	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1021	0-2	Nickel	23.1	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	53.72	168.0	128	0.8060	43.30	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1020	0-2	Nickel	22.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	53.02	168.0	128	0.8060	42.74	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1023	0-2	Nickel	22.7	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	52.79	168.0	128	0.8060	42.55	64.2	0.00
Boeing RFI Subarea 5/9 South	STBS1000	0-2	Nickel	22.5	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	52.33	168.0	128	0.8060	42.17	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1002	0-2	Nickel	22.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	51.86	168.0	128	0.8060	41.80	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1060	0-2	Nickel	22.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	51.40	168.0	128	0.8060	41.42	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1413	0-2	Nickel	22	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	51.16	168.0	128	0.8060	41.24	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1012	0-2	Nickel	21.8	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	50.70	168.0	128	0.8060	40.86	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1059	0-2	Nickel	21.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	49.53	168.0	128	0.8060	39.92	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1061	0-2	Nickel	21.1	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	49.07	168.0	128	0.8060	39.55	64.2	0.00
Boeing RFI Subarea 5/9 South	STBS1005	0-2	Nickel	21	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	48.84	168.0	128	0.8060	39.36	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1400	0-2	Nickel	20.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	48.60	168.0	128	0.8060	39.17	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1414	0-2	Nickel	20.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	48.14	168.0	128	0.8060	38.80	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1011	0-2	Nickel	20.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	48.14	168.0	128	0.8060	38.80	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1033	0-2	Nickel	19.2	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	44.65	168.0	128	0.8060	35.99	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS02	0-2	Nickel	19	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	44.19	168.0	128	0.8060	35.61	64.2	0.00
Boeing RFI Subarea 5/9 South	STBS1011	0-2	Nickel	19	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	44.19	168.0	128	0.8060	35.61	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1018	0-2	Nickel	18.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	43.02	168.0	128	0.8060	34.68	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1405	0-2	Nickel	18.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	43.02	168.0	128	0.8060	34.68	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1401	0-2	Nickel	18	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	41.86	168.0	128	0.8060	33.74	64.2	0.00
Boeing RFI Subarea 5/9 South	SLTS1507	0-2	Nickel	17.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	41.63	168.0	128	0.8060	33.55	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1012	0-2	Nickel	17.9	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	41.63	168.0	128	0.8060	33.55	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1053	0-2	Nickel	17.9	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	41.63	168.0	128	0.8060	33.55	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1406	0-2	Nickel	17.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	41.16	168.0	128	0.8060	33.18	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1038	0-2	Nickel	17.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	40.93	168.0	128	0.8060	32.99	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1034	0-2	Nickel	16.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	39.30	168.0	128	0.8060	31.68	64.2	0.00
Boeing RFI Subarea 5/9 South	SLTS1500	0-2	Nickel	16.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	39.30	168.0	128	0.8060	31.68	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1404	0-2	Nickel	16.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	38.60	168.0	128	0.8060	31.11	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1064	0-2	Nickel	16.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	38.60	168.0	128	0.8060	31.11	64.2	0.00
Boeing RFI Subarea 5/9 South	SLTS1506	0-2	Nickel	16.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	38.14	168.0	128	0.8060	30.74	64.2	0.00
Boeing RFI Subarea 5/9 South	ELBS1021	0-2	Nickel	16	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	37.21	168.0	128	0.8060	29.99	64.2	0.00
Boeing RFI Subarea 5/9 South	SLTS1501	0-2	Nickel	16	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	37.21	168.0	128	0.8060	29.99	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1412	0-2	Nickel	16	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	37.21	168.0	128	0.8060	29.99	64.2	0.00
Boeing RFI Subarea 5/9 South	SLSS08	0-2	Nickel	16	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	37.21	168.0	128	0.8060	29.99	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1014	0-2	Nickel	15.7	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	36.51	168.0	128	0.8060	29.43	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1037	0-2	Nickel	15.6	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	36.28	168.0	128	0.8060	29.24	64.2	0.00
Boeing RFI Subarea 5/9 South	BKND-7	0-2	Nickel	15.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	35.81	168.0	128	0.8060	28.87	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1032	0-2	Nickel	15.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	35.81	168.0	128	0.8060	28.87	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1033	0-2	Nickel	15.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	35.81	168.0	128	0.8060	28.87	64.2	0.00

Boeing RFI Subarea 5/9 South	ELBS1028	0-2	Nickel	15.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	35.58	168.0	128	0.8060	28.68	64.2	0.00
Boeing RFI Subarea 5/9 South	ELBS1029	0-2	Nickel	15.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	35.12	168.0	128	0.8060	28.30	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1413	0-2	Nickel	15	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	34.88	168.0	128	0.8060	28.12	64.2	0.00
Boeing RFI Subarea 5/9 South	ELBS1024	0-2	Nickel	14.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	33.95	168.0	128	0.8060	27.37	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1062	0-2	Nickel	14.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	33.72	168.0	128	0.8060	27.18	64.2	0.00
Boeing RFI Subarea 5/9 South	ELBS1027	0-2	Nickel	14	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	32.56	168.0	128	0.8060	26.24	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS25	0-2	Nickel	14	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	32.56	168.0	128	0.8060	26.24	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1021	0-2	Nickel	14	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.56	168.0	128	0.8060	26.24	64.2	0.00
Boeing RFI Subarea 5/9 South	ELBS1013	0-2	Nickel	14	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	32.56	168.0	128	0.8060	26.24	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1067	0-2	Nickel	14	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.56	168.0	128	0.8060	26.24	64.2	0.00
Boeing RFI Subarea 5/9 South	ELBS10	0-2	Nickel	14	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	32.56	168.0	128	0.8060	26.24	64.2	0.00
Boeing RFI Subarea 5/9 South	CABS0515	0-2	Nickel	13.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	31.86	168.0	128	0.8060	25.68	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1027	0-2	Nickel	13.4	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	31.16	168.0	128	0.8060	25.12	64.2	0.00
Boeing RFI Subarea 5/9 South	SLTS1502	0-2	Nickel	13.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.47	168.0	128	0.8060	24.55	64.2	0.00
Boeing RFI Subarea 5/9 South	ELSS01	0-2	Nickel	13.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.47	168.0	128	0.8060	24.55	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1031	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	168.0	128	0.8060	24.37	64.2	0.00
Boeing RFI Subarea 5/9 South	ELBS1026	0-2	Nickel	13	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.23	168.0	128	0.8060	24.37	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1019	0-2	Nickel	13	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	30.23	168.0	128	0.8060	24.37	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1052	0-2	Nickel	12.8	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	29.77	168.0	128	0.8060	23.99	64.2	0.00
Boeing RFI Subarea 5/9 South	P2TS11	0-2	Nickel	12.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	29.30	168.0	128	0.8060	23.62	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1045	0-2	Nickel	12.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	29.30	168.0	128	0.8060	23.62	64.2	0.00
Boeing RFI Subarea 5/9 South	ELBS1020	0-2	Nickel	12.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	28.84	168.0	128	0.8060	23.24	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1501	0-2	Nickel	12.2	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	28.37	168.0	128	0.8060	22.87	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1017	0-2	Nickel	12	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	27.91	168.0	128	0.8060	22.49	64.2	0.00
Boeing RFI Subarea 5/9 South	D-1-01	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	168.0	128	0.8060	22.49	64.2	0.00
Boeing RFI Subarea 5/9 South	D-1-02	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	168.0	128	0.8060	22.49	64.2	0.00
Boeing RFI Subarea 5/9 South	ELBS1014	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	168.0	128	0.8060	22.49	64.2	0.00
Boeing RFI Subarea 5/9 South	ELBS1018	0-2	Nickel	12	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	27.91	168.0	128	0.8060	22.49	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1601	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	168.0	128	0.8060	22.49	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1063	0-2	Nickel	11.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.44	168.0	128	0.8060	22.12	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1047	0-2	Nickel	11.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.21	168.0	128	0.8060	21.93	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1032	0-2	Nickel	11.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	26.98	168.0	128	0.8060	21.74	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1040	0-2	Nickel	11.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	26.98	168.0	128	0.8060	21.74	64.2	0.00
Boeing RFI Subarea 5/9 South	ELBS1015	0-2	Nickel	11.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	26.51	168.0	128	0.8060	21.37	64.2	0.00
Boeing RFI Subarea 5/9 South	ELBS1019	0-2	Nickel	11.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	26.51	168.0	128	0.8060	21.37	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1039	0-2	Nickel	11.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	26.28	168.0	128	0.8060	21.18	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1001	0-2	Nickel	11.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	26.28	168.0	128	0.8060	21.18	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1043	0-2	Nickel	11.2	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	26.05	168.0	128	0.8060	20.99	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS27	0-2	Nickel	11.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	26.05	168.0	128	0.8060	20.99	64.2	0.00
Boeing RFI Subarea 5/9 South	P2TS07	0-2	Nickel	11.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.81	168.0	128	0.8060	20.81	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1006	0-2	Nickel	11	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	25.58	168.0	128	0.8060	20.62	64.2	0.00
Boeing RFI Subarea 5/9 South	ELBS1016	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	168.0	128	0.8060	20.62	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS09	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	168.0	128	0.8060	20.62	64.2	0.00
Boeing RFI Subarea 5/9 South	SLTS1504	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	168.0	128	0.8060	20.62	64.2	0.00
Boeing RFI Subarea 5/9 South	SLTS1503	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	168.0	128	0.8060	20.62	64.2	0.00
Boeing RFI Subarea 5/9 South	BKND-6	0-2	Nickel	10.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.35	168.0	128	0.8060	20.43	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1008	0-2	Nickel	10.7	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	24.88	168.0	128	0.8060	20.06	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1500	0-2	Nickel	10.7	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	24.88	168.0	128	0.8060	20.06	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1002	0-2	Nickel	10.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	24.65	168.0	128	0.8060	19.87	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1049	0-2	Nickel	10.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	24.65	168.0	128	0.8060	19.87	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1022	0-2	Nickel	10.6	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	24.65	168.0	128	0.8060	19.87	64.2	0.00
Boeing RFI Subarea 5/9 South	P2TS04	0-2	Nickel	10.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	24.19	168.0	128	0.8060	19.49	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1013	0-2	Nickel	10.2	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	23.72	168.0	128	0.8060	19.12	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1402	0-2	Nickel	10.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.72	168.0	128	0.8060	19.12	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1015	0-2	Nickel	10.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.49	168.0	128	0.8060	18.93	64.2	0.00

Boeing RFI Subarea 5/9 South	CFBS04	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	168.0	128	0.8060	18.74	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1036	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	168.0	128	0.8060	18.74	64.2	0.00
Boeing RFI Subarea 5/9 South	SLTS1505	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	168.0	128	0.8060	18.74	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1013	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	168.0	128	0.8060	18.74	64.2	0.00
Boeing RFI Subarea 5/9 South	P2TS26	0-2	Nickel	9.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.02	168.0	128	0.8060	18.56	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1065	0-2	Nickel	9.8	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	22.79	168.0	128	0.8060	18.37	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1005	0-2	Nickel	9.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.79	168.0	128	0.8060	18.37	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1050	0-2	Nickel	9.6	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	22.33	168.0	128	0.8060	17.99	64.2	0.00
Boeing RFI Subarea 5/9 South	CABS0514	0-2	Nickel	9.54	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.19	168.0	128	0.8060	17.88	64.2	0.00
Boeing RFI Subarea 5/9 South	STBS1402	0-2	Nickel	9.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.09	168.0	128	0.8060	17.81	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1048	0-2	Nickel	9.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.86	168.0	128	0.8060	17.62	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1019	0-2	Nickel	9.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.40	168.0	128	0.8060	17.24	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1008	0-2	Nickel	9.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.16	168.0	128	0.8060	17.06	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1044	0-2	Nickel	9.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.16	168.0	128	0.8060	17.06	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS08	0-2	Nickel	9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.93	168.0	128	0.8060	16.87	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1005	0-2	Nickel	8.9	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	20.70	168.0	128	0.8060	16.68	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1058	0-2	Nickel	8.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.70	168.0	128	0.8060	16.68	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1003	0-2	Nickel	8.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.47	168.0	128	0.8060	16.49	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1023	0-2	Nickel	8.7	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	20.23	168.0	128	0.8060	16.31	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1600	0-2	Nickel	8.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.00	168.0	128	0.8060	16.12	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1007	0-2	Nickel	8.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	19.30	168.0	128	0.8060	15.56	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1007	0-2	Nickel	7.4	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	17.21	168.0	128	0.8060	13.87	64.2	0.00
Boeing RFI Subarea 5/9 South	D-1-03	0-2	Nickel	7.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	16.98	168.0	128	0.8060	13.68	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS07	0-2	Nickel	7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	16.28	168.0	128	0.8060	13.12	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1041	0-2	Nickel	6.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	15.81	168.0	128	0.8060	12.75	64.2	0.00
Boeing RFI Subarea 5/9 South	ELBS1011	0-2	Nickel	6.7	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	15.58	168.0	128	0.8060	12.56	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1026	0-2	Nickel	6.7	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	15.58	168.0	128	0.8060	12.56	64.2	0.00
Boeing RFI Subarea 5/9 South	ELBS1017	0-2	Nickel	6.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	15.35	168.0	128	0.8060	12.37	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1004	0-2	Nickel	6.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	14.88	168.0	128	0.8060	12.00	64.2	0.00
Boeing RFI Subarea 5/9 South	D-3-02	0-2	Nickel	5.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	13.49	168.0	128	0.8060	10.87	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1006	0-2	Nickel	5.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	12.79	168.0	128	0.8060	10.31	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1010	0-2	Nickel	5.4	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	12.56	168.0	128	0.8060	10.12	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS05	0-2	Nickel	4.5	mg/kg	U	Mule Deer	Low TRV-Based RBSL	0.43	10.47	168.0	128	0.8060	8.43	64.2	0.00
Boeing RFI Subarea 5/9 South	ELBS1012	0-2	Nickel	4.5	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	10.47	168.0	128	0.8060	8.43	64.2	0.00
Boeing RFI Subarea 5/9 South	BCSS10	0-2	Nickel	3	mg/kg	U	Mule Deer	Low TRV-Based RBSL	0.43	6.98	168.0	128	0.8060	5.62	64.2	0.00
Boeing RFI Subarea 5/9 South	D-3-03	0-2	Nickel	3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	6.98	168.0	128	0.8060	5.62	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1066	0-2	Nickel	2.4	mg/kg	U	Mule Deer	Low TRV-Based RBSL	0.43	5.58	168.0	128	0.8060	4.50	64.2	0.00
Boeing RFI Subarea 10	U0SS1022	0-2	Nickel	56.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	131.16	794.8	128	1.0000	131.16	64.2	0.00
Boeing RFI Subarea 10	U0SS1023	0-2	Nickel	35.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	83.49	794.8	128	1.0000	83.49	64.2	0.00
Boeing RFI Subarea 10	U0SS1038	0-2	Nickel	28.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	65.58	794.8	128	1.0000	65.58	64.2	0.00
Boeing RFI Subarea 10	U0SS1016	0-2	Nickel	27.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	63.72	794.8	128	1.0000	63.72	64.2	0.00
Boeing RFI Subarea 10	U0SS1042	0-2	Nickel	27.2	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	63.26	794.8	128	1.0000	63.26	64.2	0.00
Boeing RFI Subarea 10	U0SS1017	0-2	Nickel	26.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	61.86	794.8	128	1.0000	61.86	64.2	0.00
Boeing RFI Subarea 10	U0SS1013	0-2	Nickel	26.2	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	60.93	794.8	128	1.0000	60.93	64.2	0.00
Boeing RFI Subarea 10	U0BS1000	0-2	Nickel	25.1	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	58.37	794.8	128	1.0000	58.37	64.2	0.00
Boeing RFI Subarea 10	BCSS14	0-2	Nickel	23	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	53.49	794.8	128	1.0000	53.49	64.2	0.00
Boeing RFI Subarea 10	U0SS1041	0-2	Nickel	19.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	45.81	794.8	128	1.0000	45.81	64.2	0.00
Boeing RFI Subarea 10	U0SS1030	0-2	Nickel	18.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	42.09	794.8	128	1.0000	42.09	64.2	0.00
Boeing RFI Subarea 10	U0SS1008	0-2	Nickel	18	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	41.86	794.8	128	1.0000	41.86	64.2	0.00
Boeing RFI Subarea 10	BZSS03	0-2	Nickel	17.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	40.47	794.8	128	1.0000	40.47	64.2	0.00
Boeing RFI Subarea 10	U0SS1043	0-2	Nickel	17	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	39.53	794.8	128	1.0000	39.53	64.2	0.00
Boeing RFI Subarea 10	TTBS1223	0-2	Nickel	16	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	37.21	794.8	128	1.0000	37.21	64.2	0.00
Boeing RFI Subarea 10	BGSS07	0-2	Nickel	15.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	36.28	794.8	128	1.0000	36.28	64.2	0.00
Boeing RFI Subarea 10	U0SS1037	0-2	Nickel	15.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	35.58	794.8	128	1.0000	35.58	64.2	0.00
Boeing RFI Subarea 10	Upstream 002	0-2	Nickel	15	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	34.88	794.8	128	1.0000	34.88	64.2	0.00

Boeing RFI Subarea 10	TTBS1223	0-2	Nickel	14.7	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	34.19	794.8	128	1.0000	34.19	64.2	0.00
Boeing RFI Subarea 10	U0SS1018	0-2	Nickel	14.5	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	33.72	794.8	128	1.0000	33.72	64.2	0.00
Boeing RFI Subarea 10	U0SS1001	0-2	Nickel	14.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	33.49	794.8	128	1.0000	33.49	64.2	0.00
Boeing RFI Subarea 10	U0SS1002	0-2	Nickel	14.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	33.26	794.8	128	1.0000	33.26	64.2	0.00
Boeing RFI Subarea 10	U0SS1012	0-2	Nickel	13.9	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	32.33	794.8	128	1.0000	32.33	64.2	0.00
Boeing RFI Subarea 10	U0FS1005	0-2	Nickel	13.9	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	32.33	794.8	128	1.0000	32.33	64.2	0.00
Boeing RFI Subarea 10	U0BS1008	0-2	Nickel	13.9	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	32.33	794.8	128	1.0000	32.33	64.2	0.00
Boeing RFI Subarea 10	BZSS01	0-2	Nickel	13.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.09	794.8	128	1.0000	32.09	64.2	0.00
Boeing RFI Subarea 10	U0SS1000	0-2	Nickel	13.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	32.09	794.8	128	1.0000	32.09	64.2	0.00
Boeing RFI Subarea 10	U0FS1003	0-2	Nickel	13.6	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	31.63	794.8	128	1.0000	31.63	64.2	0.00
Boeing RFI Subarea 10	U0SS1027	0-2	Nickel	13.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	31.16	794.8	128	1.0000	31.16	64.2	0.00
Boeing RFI Subarea 10	U0SS1028	0-2	Nickel	13.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.70	794.8	128	1.0000	30.70	64.2	0.00
Boeing RFI Subarea 10	U0SS1032	0-2	Nickel	13.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.70	794.8	128	1.0000	30.70	64.2	0.00
Boeing RFI Subarea 10	U0SS1015	0-2	Nickel	12.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	30.00	794.8	128	1.0000	30.00	64.2	0.00
Boeing RFI Subarea 10	U0SS1020	0-2	Nickel	12.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	29.53	794.8	128	1.0000	29.53	64.2	0.00
Boeing RFI Subarea 10	U0SS1011	0-2	Nickel	12.7	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	29.53	794.8	128	1.0000	29.53	64.2	0.00
Boeing RFI Subarea 10	U0BS1002	0-2	Nickel	12.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	28.60	794.8	128	1.0000	28.60	64.2	0.00
Boeing RFI Subarea 10	U0SS1024	0-2	Nickel	12.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	28.37	794.8	128	1.0000	28.37	64.2	0.00
Boeing RFI Subarea 10	U0SS1004	0-2	Nickel	12.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	28.37	794.8	128	1.0000	28.37	64.2	0.00
Boeing RFI Subarea 10	U0BS1004	0-2	Nickel	12.1	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	28.14	794.8	128	1.0000	28.14	64.2	0.00
Boeing RFI Subarea 10	U0SS1031	0-2	Nickel	12.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	28.14	794.8	128	1.0000	28.14	64.2	0.00
Boeing RFI Subarea 10	BCSS12	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	794.8	128	1.0000	27.91	64.2	0.00
Boeing RFI Subarea 10	U0SS1039	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	794.8	128	1.0000	27.91	64.2	0.00
Boeing RFI Subarea 10	BZSS02	0-2	Nickel	12	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.91	794.8	128	1.0000	27.91	64.2	0.00
Boeing RFI Subarea 10	BZSS04	0-2	Nickel	11.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	27.67	794.8	128	1.0000	27.67	64.2	0.00
Boeing RFI Subarea 10	U0BS1003	0-2	Nickel	11.8	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	27.44	794.8	128	1.0000	27.44	64.2	0.00
Boeing RFI Subarea 10	U0SS1040	0-2	Nickel	11.4	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	26.51	794.8	128	1.0000	26.51	64.2	0.00
Boeing RFI Subarea 10	U0BS1012	0-2	Nickel	11.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	26.05	794.8	128	1.0000	26.05	64.2	0.00
Boeing RFI Subarea 10	BCSS09	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	794.8	128	1.0000	25.58	64.2	0.00
Boeing RFI Subarea 10	SB_TTF_BG-1	0-2	Nickel	11	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	25.58	794.8	128	1.0000	25.58	64.2	0.00
Boeing RFI Subarea 10	BKND-5	0-2	Nickel	11	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	25.58	794.8	128	1.0000	25.58	64.2	0.00
Boeing RFI Subarea 10	U0BS1006	0-2	Nickel	10.9	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	25.35	794.8	128	1.0000	25.35	64.2	0.00
Boeing RFI Subarea 10	U0SS1036	0-2	Nickel	10.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	24.65	794.8	128	1.0000	24.65	64.2	0.00
Boeing RFI Subarea 10	U0SS1021	0-2	Nickel	10.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	24.65	794.8	128	1.0000	24.65	64.2	0.00
Boeing RFI Subarea 10	U0SS1019	0-2	Nickel	10.6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	24.65	794.8	128	1.0000	24.65	64.2	0.00
Boeing RFI Subarea 10	U0SS1007	0-2	Nickel	10.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	24.42	794.8	128	1.0000	24.42	64.2	0.00
Boeing RFI Subarea 10	U0SS1033	0-2	Nickel	10.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	24.42	794.8	128	1.0000	24.42	64.2	0.00
Boeing RFI Subarea 10	U0FS1011	0-2	Nickel	10.5	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	24.42	794.8	128	1.0000	24.42	64.2	0.00
Boeing RFI Subarea 10	U0SS1034	0-2	Nickel	10.4	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	24.19	794.8	128	1.0000	24.19	64.2	0.00
Boeing RFI Subarea 10	U0SS1010	0-2	Nickel	10.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.95	794.8	128	1.0000	23.95	64.2	0.00
Boeing RFI Subarea 10	U0SS1009	0-2	Nickel	10.1	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.49	794.8	128	1.0000	23.49	64.2	0.00
Boeing RFI Subarea 10	U0ST1007	0-2	Nickel	10	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	23.26	794.8	128	1.0000	23.26	64.2	0.00
Boeing RFI Subarea 10	SB_TTF_BG-2	0-2	Nickel	10	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.26	794.8	128	1.0000	23.26	64.2	0.00
Boeing RFI Subarea 10	BKND-3	0-2	Nickel	9.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.02	794.8	128	1.0000	23.02	64.2	0.00
Boeing RFI Subarea 10	BKND-5	0-2	Nickel	9.9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	23.02	794.8	128	1.0000	23.02	64.2	0.00
Boeing RFI Subarea 10	U0SS1026	0-2	Nickel	9.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.79	794.8	128	1.0000	22.79	64.2	0.00
Boeing RFI Subarea 10	BKND-4	0-2	Nickel	9.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	22.79	794.8	128	1.0000	22.79	64.2	0.00
Boeing RFI Subarea 10	U0BS1005	0-2	Nickel	9.8	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	22.79	794.8	128	1.0000	22.79	64.2	0.00
Boeing RFI Subarea 10	U0SS1005	0-2	Nickel	9.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.63	794.8	128	1.0000	21.63	64.2	0.00
Boeing RFI Subarea 10	U0SS1014	0-2	Nickel	9.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	21.40	794.8	128	1.0000	21.40	64.2	0.00
Boeing RFI Subarea 10	BCBS07	0-2	Nickel	9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.93	794.8	128	1.0000	20.93	64.2	0.00
Boeing RFI Subarea 10	U0FS1010	0-2	Nickel	9	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.93	794.8	128	1.0000	20.93	64.2	0.00
Boeing RFI Subarea 10	U0SS1025	0-2	Nickel	8.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	20.47	794.8	128	1.0000	20.47	64.2	0.00
Boeing RFI Subarea 10	U0SS1035	0-2	Nickel	8.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	19.07	794.8	128	1.0000	19.07	64.2	0.00
Boeing RFI Subarea 10	U0SS1003	0-2	Nickel	7.8	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	18.14	794.8	128	1.0000	18.14	64.2	0.00

Boeing RFI Subarea 10	U0FS1004	0-2	Nickel	7.6	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	17.67	794.8	128	1.0000	17.67	64.2	0.00
Boeing RFI Subarea 10	U0FS1020	0-2	Nickel	7.5	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	17.44	794.8	128	1.0000	17.44	64.2	0.00
Boeing RFI Subarea 10	U0FS1019	0-2	Nickel	7.42	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	17.26	794.8	128	1.0000	17.26	64.2	0.00
Boeing RFI Subarea 10	U0FS1013	0-2	Nickel	7.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	16.98	794.8	128	1.0000	16.98	64.2	0.00
Boeing RFI Subarea 10	U0SS1029	0-2	Nickel	7.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	16.74	794.8	128	1.0000	16.74	64.2	0.00
Boeing RFI Subarea 10	U0FS1000	0-2	Nickel	7	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	16.28	794.8	128	1.0000	16.28	64.2	0.00
Boeing RFI Subarea 10	BCSS09	0-2	Nickel	7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	16.28	794.8	128	1.0000	16.28	64.2	0.00
Boeing RFI Subarea 10	U0FS1022	0-2	Nickel	6.9	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	16.05	794.8	128	1.0000	16.05	64.2	0.00
Boeing RFI Subarea 10	U0FS1006	0-2	Nickel	6.8	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	15.81	794.8	128	1.0000	15.81	64.2	0.00
Boeing RFI Subarea 10	U0FS1012	0-2	Nickel	6.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	15.58	794.8	128	1.0000	15.58	64.2	0.00
Boeing RFI Subarea 10	U0BS1001	0-2	Nickel	6.7	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	15.58	794.8	128	1.0000	15.58	64.2	0.00
Boeing RFI Subarea 10	U0FS1021	0-2	Nickel	6.3	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	14.65	794.8	128	1.0000	14.65	64.2	0.00
Boeing RFI Subarea 10	U0SS1006	0-2	Nickel	6.2	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	14.42	794.8	128	1.0000	14.42	64.2	0.00
Boeing RFI Subarea 10	U0FS1018	0-2	Nickel	6.2	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	14.42	794.8	128	1.0000	14.42	64.2	0.00
Boeing RFI Subarea 10	U0FS1009	0-2	Nickel	6.1	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	14.19	794.8	128	1.0000	14.19	64.2	0.00
Boeing RFI Subarea 10	U0FS1001	0-2	Nickel	6.1	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	14.19	794.8	128	1.0000	14.19	64.2	0.00
Boeing RFI Subarea 10	BCSS08	0-2	Nickel	6	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	13.95	794.8	128	1.0000	13.95	64.2	0.00
Boeing RFI Subarea 10	U0FS1014	0-2	Nickel	5.7	mg/kg		Mule Deer	Low TRV-Based RBSL	0.43	13.26	794.8	128	1.0000	13.26	64.2	0.00
Boeing RFI Subarea 10	U0FS1019	0-2	Nickel	5.6	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	13.02	794.8	128	1.0000	13.02	64.2	0.00
Boeing RFI Subarea 10	U0FS1002	0-2	Nickel	5.4	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	12.56	794.8	128	1.0000	12.56	64.2	0.00
Boeing RFI Subarea 10	U0FS1015	0-2	Nickel	5.4	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	12.56	794.8	128	1.0000	12.56	64.2	0.00
Boeing RFI Subarea 10	U0FS1017	0-2	Nickel	5.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	12.33	794.8	128	1.0000	12.33	64.2	0.00
Boeing RFI Subarea 10	U0FS1016	0-2	Nickel	5.3	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	12.33	794.8	128	1.0000	12.33	64.2	0.00
Boeing RFI Subarea 10	U0FS1007	0-2	Nickel	5.11	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	11.88	794.8	128	1.0000	11.88	64.2	0.00
Boeing RFI Subarea 10	U0FS1008	0-2	Nickel	4.7	mg/kg	J	Mule Deer	Low TRV-Based RBSL	0.43	10.93	794.8	128	1.0000	10.93	64.2	0.00
Boeing RFI Subarea 10	BCBS08	0-2	Nickel	3	mg/kg	U	Mule Deer	Low TRV-Based RBSL	0.43	6.98	794.8	128	1.0000	6.98	64.2	0.00
Boeing RFI Subarea 10	Upstream 001	0-2	Nickel	2.7	mg/kg	UJ	Mule Deer	Low TRV-Based RBSL	0.43	6.28	794.8	128	1.0000	6.28	64.2	0.00
Boeing RFI Subarea 1A Central	BSBK04	0-2	Nickel	74	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.74	21.9	128	0.0954	0.07	64.2	0.01
Boeing RFI Subarea 1A Central	AFBS0085	0-2	Nickel	51.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.52	21.9	128	0.0954	0.05	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0111	0-2	Nickel	38.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.38	21.9	128	0.0954	0.04	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0084	0-2	Nickel	32.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.32	21.9	128	0.0954	0.03	64.2	0.00
Boeing RFI Subarea 1A Central	BSBK05	0-2	Nickel	26	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.26	21.9	128	0.0954	0.02	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0144	0-2	Nickel	24.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.25	21.9	128	0.0954	0.02	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0093	0-2	Nickel	23.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.24	21.9	128	0.0954	0.02	64.2	0.00
Boeing RFI Subarea 1A Central	BSBK03	0-2	Nickel	23	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.23	21.9	128	0.0954	0.02	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS05	0-2	Nickel	23	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.23	21.9	128	0.0954	0.02	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0095	0-2	Nickel	22.1	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.22	21.9	128	0.0954	0.02	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0093	0-2	Nickel	21.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.22	21.9	128	0.0954	0.02	64.2	0.00
Boeing RFI Subarea 1A Central	BSTS07S01	0-2	Nickel	21	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.21	21.9	128	0.0954	0.02	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0094	0-2	Nickel	20.8	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.21	21.9	128	0.0954	0.02	64.2	0.00
Boeing RFI Subarea 1A Central	BSBK02	0-2	Nickel	20	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.20	21.9	128	0.0954	0.02	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0072	0-2	Nickel	19.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.20	21.9	128	0.0954	0.02	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0115	0-2	Nickel	16.5	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.17	21.9	128	0.0954	0.02	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS37	0-2	Nickel	16	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.16	21.9	128	0.0954	0.02	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0113	0-2	Nickel	14.7	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.15	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	HVBS13	0-2	Nickel	14.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS39	0-2	Nickel	14	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.14	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	HVBS30	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS06	0-2	Nickel	12.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	HVBS12	0-2	Nickel	12.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	HVBS03	0-2	Nickel	12.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0151	0-2	Nickel	12	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.12	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS0139	0-2	Nickel	12	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.12	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS35	0-2	Nickel	12	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.12	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSBK51	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	21.9	128	0.0954	0.01	64.2	0.00

Boeing RFI Subarea 1A Central	HNBS0015	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	HNBS0016	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0073	0-2	Nickel	11.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0083	0-2	Nickel	11.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSTC30S02	0-2	Nickel	11.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSTS23	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSBK12	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSBK53	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	HNBS0018	0-2	Nickel	11	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.11	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSBK48	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	HNBS0007	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS0153	0-2	Nickel	10.8	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.11	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS0137	0-2	Nickel	10.6	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.11	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS0160	0-2	Nickel	10.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0105	0-2	Nickel	10.4	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS15	0-2	Nickel	10.4	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS0121	0-2	Nickel	10.4	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0114	0-2	Nickel	10.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0107	0-2	Nickel	10.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS0153	0-2	Nickel	10.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSBK13	0-2	Nickel	10.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0145	0-2	Nickel	10.1	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	HVBF42	0-2	Nickel	10	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSBK11	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS26	0-2	Nickel	10	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSBK0057	0-2	Nickel	10	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSBK0054	0-2	Nickel	10	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSBK0058	0-2	Nickel	10	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS0133	0-2	Nickel	9.9	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS0154	0-2	Nickel	9.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS0136	0-2	Nickel	9.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	HNBS0011	0-2	Nickel	9.9	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	HNBS0006	0-2	Nickel	9.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0080	0-2	Nickel	9.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS26	0-2	Nickel	9.6	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0129	0-2	Nickel	9.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0153	0-2	Nickel	9.6	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS0158	0-2	Nickel	9.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSBK50	0-2	Nickel	9.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	HVBS11	0-2	Nickel	9.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	HVBS0108	0-2	Nickel	9.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	HNBS0004	0-2	Nickel	9.4	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.09	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS23	0-2	Nickel	9.4	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.09	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0161	0-2	Nickel	9.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSTS29S02	0-2	Nickel	9.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSBK0055	0-2	Nickel	9.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.09	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0152	0-2	Nickel	9.27	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.09	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0070	0-2	Nickel	9.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS33	0-2	Nickel	9.1	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.09	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSTS29S01	0-2	Nickel	9.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0116	0-2	Nickel	9.1	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.09	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0124	0-2	Nickel	9.1	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.09	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	HVBS19	0-2	Nickel	9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS24	0-2	Nickel	9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS25	0-2	Nickel	9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	21.9	128	0.0954	0.01	64.2	0.00

Boeing RFI Subarea 1A Central	HVBF17	0-2	Nickel	9	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.09	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSBK0056	0-2	Nickel	9	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.09	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	HNBS0003	0-2	Nickel	9	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.09	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	HVBF19	0-2	Nickel	8.9	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.09	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	HNBS0005	0-2	Nickel	8.9	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.09	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSBK49	0-2	Nickel	8.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0103	0-2	Nickel	8.8	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.09	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS0133	0-2	Nickel	8.8	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.09	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS0164	0-2	Nickel	8.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0106	0-2	Nickel	8.7	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.09	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	HNBS0002	0-2	Nickel	8.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	HNBS0017	0-2	Nickel	8.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0130	0-2	Nickel	8.5	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.09	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS0139	0-2	Nickel	8.5	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.09	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0128	0-2	Nickel	8.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS0159	0-2	Nickel	8.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0121	0-2	Nickel	8.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.08	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSBK01	0-2	Nickel	8.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	HNBS0001	0-2	Nickel	8.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	HNBS0002	0-2	Nickel	8.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	LFBS0108	0-2	Nickel	8.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS43	0-2	Nickel	8.2	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.08	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0104	0-2	Nickel	8.1	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.08	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0079	0-2	Nickel	8.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0122	0-2	Nickel	8	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.08	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS36	0-2	Nickel	8	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.08	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	HVBS42	0-2	Nickel	8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	HVBS41	0-2	Nickel	8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	HVBF15	0-2	Nickel	7.9	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.08	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	HVBF18	0-2	Nickel	7.8	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.08	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	HVBF14	0-2	Nickel	7.7	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.08	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	HVBF20	0-2	Nickel	7.6	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.08	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	HNBS0013	0-2	Nickel	7.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0123	0-2	Nickel	7.5	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.08	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS22	0-2	Nickel	7.5	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.08	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0090	0-2	Nickel	7.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0076	0-2	Nickel	7.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	HNBS0009	0-2	Nickel	7.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.07	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS21	0-2	Nickel	7.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.07	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0116	0-2	Nickel	7.2	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.07	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSTS10	0-2	Nickel	7.2	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.07	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSBK17	0-2	Nickel	7.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	HNBS0027	0-2	Nickel	7.1	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.07	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	HVBS39	0-2	Nickel	7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS22	0-2	Nickel	7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	HVBS38	0-2	Nickel	7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSTS24	0-2	Nickel	6.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSTS22	0-2	Nickel	6.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	HVBS18	0-2	Nickel	6.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS0163	0-2	Nickel	6.71	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS0162	0-2	Nickel	6.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS62	0-2	Nickel	6.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS34	0-2	Nickel	6.6	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.07	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSTC25S06	0-2	Nickel	6.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.06	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS0134	0-2	Nickel	6.2	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.06	21.9	128	0.0954	0.01	64.2	0.00

Boeing RFI Subarea 1A Central	AFBS38	0-2	Nickel	6.1	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.06	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSTS20	0-2	Nickel	6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.06	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSTS09	0-2	Nickel	6	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.06	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	HNBS0010	0-2	Nickel	5.8	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.06	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS42	0-2	Nickel	5.8	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.06	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSTS21	0-2	Nickel	5.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.06	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	BSBK52	0-2	Nickel	5.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.05	21.9	128	0.0954	0.01	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS40	0-2	Nickel	5.2	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.05	21.9	128	0.0954	0.00	64.2	0.00
Boeing RFI Subarea 1A Central	HZBS0005	0-2	Nickel	4.8	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.05	21.9	128	0.0954	0.00	64.2	0.00
Boeing RFI Subarea 1A Central	HZBS0005	0-2	Nickel	4.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.04	21.9	128	0.0954	0.00	64.2	0.00
Boeing RFI Subarea 1A Central	BSBS0163	0-2	Nickel	4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.04	21.9	128	0.0954	0.00	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0078	0-2	Nickel	4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.04	21.9	128	0.0954	0.00	64.2	0.00
Boeing RFI Subarea 1A Central	AFBS0147	0-2	Nickel	2.79	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.03	21.9	128	0.0954	0.00	64.2	0.00
Boeing RFI Subarea 1A North	A1BS01	0-2	Nickel	133	mg/kg		Mule Deer	High TRV-Based RBSL	100	1.33	122.7	128	0.6782	0.90	64.2	0.47
Boeing RFI Subarea 1A North	A1BS0068	0-2	Nickel	85.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.85	122.7	128	0.6782	0.58	64.2	0.14
Boeing RFI Subarea 1A North	A1BS0102	0-2	Nickel	29.6	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.30	122.7	128	0.6782	0.20	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0101	0-2	Nickel	29.4	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.29	122.7	128	0.6782	0.20	64.2	0.00
Boeing RFI Subarea 1A North	A1BS03	0-2	Nickel	28.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.28	122.7	128	0.6782	0.19	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0087	0-2	Nickel	26.5	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.27	122.7	128	0.6782	0.18	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0232	0-2	Nickel	25.4	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.25	122.7	128	0.6782	0.17	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0248	0-2	Nickel	24.5	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.25	122.7	128	0.6782	0.17	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0108	0-2	Nickel	24	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.24	122.7	128	0.6782	0.16	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0097	0-2	Nickel	23.9	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.24	122.7	128	0.6782	0.16	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0349	0-2	Nickel	23.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.24	122.7	128	0.6782	0.16	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0373	0-2	Nickel	21.8	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.22	122.7	128	0.6782	0.15	64.2	0.00
Boeing RFI Subarea 1A North	ILBS40	0-2	Nickel	21	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.21	122.7	128	0.6782	0.14	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0370	0-2	Nickel	20.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.21	122.7	128	0.6782	0.14	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0086	0-2	Nickel	20.1	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.20	122.7	128	0.6782	0.14	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0118	0-2	Nickel	19.2	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.19	122.7	128	0.6782	0.13	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0371	0-2	Nickel	18.9	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.19	122.7	128	0.6782	0.13	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0211	0-2	Nickel	18	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.18	122.7	128	0.6782	0.12	64.2	0.00
Boeing RFI Subarea 1A North	NDET5026	0-2	Nickel	18	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.18	122.7	128	0.6782	0.12	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0091	0-2	Nickel	17.8	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.18	122.7	128	0.6782	0.12	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0075	0-2	Nickel	17.7	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.18	122.7	128	0.6782	0.12	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0089	0-2	Nickel	17.4	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.17	122.7	128	0.6782	0.12	64.2	0.00
Boeing RFI Subarea 1A North	ENBS0043	0-2	Nickel	17.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.17	122.7	128	0.6782	0.12	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0164	0-2	Nickel	17	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.17	122.7	128	0.6782	0.12	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0114	0-2	Nickel	16.9	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.17	122.7	128	0.6782	0.11	64.2	0.00
Boeing RFI Subarea 1A North	ILTS05	0-2	Nickel	16.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.16	122.7	128	0.6782	0.11	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0074	0-2	Nickel	16.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.16	122.7	128	0.6782	0.11	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0223	0-2	Nickel	16	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.16	122.7	128	0.6782	0.11	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0212	0-2	Nickel	16	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.16	122.7	128	0.6782	0.11	64.2	0.00
Boeing RFI Subarea 1A North	ENBS0056	0-2	Nickel	16	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.16	122.7	128	0.6782	0.11	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0375	0-2	Nickel	15.9	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.16	122.7	128	0.6782	0.11	64.2	0.00
Boeing RFI Subarea 1A North	ENBS0044	0-2	Nickel	15.8	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.16	122.7	128	0.6782	0.11	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0365	0-2	Nickel	15.8	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.16	122.7	128	0.6782	0.11	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0372	0-2	Nickel	15.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.15	122.7	128	0.6782	0.10	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0373	0-2	Nickel	15.1	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.15	122.7	128	0.6782	0.10	64.2	0.00
Boeing RFI Subarea 1A North	ILBS44	0-2	Nickel	15	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	122.7	128	0.6782	0.10	64.2	0.00
Boeing RFI Subarea 1A North	ILBS25	0-2	Nickel	15	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	122.7	128	0.6782	0.10	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0224	0-2	Nickel	15	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	122.7	128	0.6782	0.10	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0137	0-2	Nickel	15	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.15	122.7	128	0.6782	0.10	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0213	0-2	Nickel	15	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	122.7	128	0.6782	0.10	64.2	0.00
Boeing RFI Subarea 1A North	ILBS93	0-2	Nickel	15	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.15	122.7	128	0.6782	0.10	64.2	0.00
Boeing RFI Subarea 1A North	A1BS10	0-2	Nickel	15	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	122.7	128	0.6782	0.10	64.2	0.00

Boeing RFI Subarea 1A North	ENBS0044	0-2	Nickel	14.9	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.15	122.7	128	0.6782	0.10	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0367	0-2	Nickel	14.9	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.15	122.7	128	0.6782	0.10	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0366	0-2	Nickel	14.8	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.15	122.7	128	0.6782	0.10	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0079	0-2	Nickel	14.8	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.15	122.7	128	0.6782	0.10	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0111	0-2	Nickel	14.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	122.7	128	0.6782	0.10	64.2	0.00
Boeing RFI Subarea 1A North	ENBS0066	0-2	Nickel	14.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	122.7	128	0.6782	0.10	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0093	0-2	Nickel	14.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.14	122.7	128	0.6782	0.10	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0374	0-2	Nickel	14.2	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.14	122.7	128	0.6782	0.10	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0144	0-2	Nickel	14	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	122.7	128	0.6782	0.09	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0212	0-2	Nickel	14	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	122.7	128	0.6782	0.09	64.2	0.00
Boeing RFI Subarea 1A North	B1BS0073	0-2	Nickel	14	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	122.7	128	0.6782	0.09	64.2	0.00
Boeing RFI Subarea 1A North	B1BS0065	0-2	Nickel	14	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.14	122.7	128	0.6782	0.09	64.2	0.00
Boeing RFI Subarea 1A North	B1BS0063	0-2	Nickel	14	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.14	122.7	128	0.6782	0.09	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0179	0-2	Nickel	14	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.14	122.7	128	0.6782	0.09	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0182	0-2	Nickel	14	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	122.7	128	0.6782	0.09	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0193	0-2	Nickel	14	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	122.7	128	0.6782	0.09	64.2	0.00
Boeing RFI Subarea 1A North	ILBS14	0-2	Nickel	14	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	122.7	128	0.6782	0.09	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0369	0-2	Nickel	13.9	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.14	122.7	128	0.6782	0.09	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0122	0-2	Nickel	13.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	122.7	128	0.6782	0.09	64.2	0.00
Boeing RFI Subarea 1A North	BGSS01	0-2	Nickel	13.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	122.7	128	0.6782	0.09	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0073	0-2	Nickel	13.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	122.7	128	0.6782	0.09	64.2	0.00
Boeing RFI Subarea 1A North	A1TS48	0-2	Nickel	13.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	122.7	128	0.6782	0.09	64.2	0.00
Boeing RFI Subarea 1A North	A1BS04	0-2	Nickel	13.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	122.7	128	0.6782	0.09	64.2	0.00
Boeing RFI Subarea 1A North	ENBS0068	0-2	Nickel	13.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	122.7	128	0.6782	0.09	64.2	0.00
Boeing RFI Subarea 1A North	ENBS0037	0-2	Nickel	13.1	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.13	122.7	128	0.6782	0.09	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0158	0-2	Nickel	13.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	122.7	128	0.6782	0.09	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0083	0-2	Nickel	13.1	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.13	122.7	128	0.6782	0.09	64.2	0.00
Boeing RFI Subarea 1A North	B1BS23	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	122.7	128	0.6782	0.09	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0166	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	122.7	128	0.6782	0.09	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0156	0-2	Nickel	13	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.13	122.7	128	0.6782	0.09	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0201	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	122.7	128	0.6782	0.09	64.2	0.00
Boeing RFI Subarea 1A North	NDET5028	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	122.7	128	0.6782	0.09	64.2	0.00
Boeing RFI Subarea 1A North	B1BS0066	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	122.7	128	0.6782	0.09	64.2	0.00
Boeing RFI Subarea 1A North	ILBS38	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	122.7	128	0.6782	0.09	64.2	0.00
Boeing RFI Subarea 1A North	B1BS0060	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	122.7	128	0.6782	0.09	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0194	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	122.7	128	0.6782	0.09	64.2	0.00
Boeing RFI Subarea 1A North	B1BS0061	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	122.7	128	0.6782	0.09	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0239	0-2	Nickel	12.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	122.7	128	0.6782	0.09	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0077	0-2	Nickel	12.7	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.13	122.7	128	0.6782	0.09	64.2	0.00
Boeing RFI Subarea 1A North	B1BS0156	0-2	Nickel	12.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	122.7	128	0.6782	0.09	64.2	0.00
Boeing RFI Subarea 1A North	ENBS0068	0-2	Nickel	12.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	122.7	128	0.6782	0.08	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0368	0-2	Nickel	12.4	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.12	122.7	128	0.6782	0.08	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0092	0-2	Nickel	12.2	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.12	122.7	128	0.6782	0.08	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0206	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	122.7	128	0.6782	0.08	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0173	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	122.7	128	0.6782	0.08	64.2	0.00
Boeing RFI Subarea 1A North	NDET5027	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	122.7	128	0.6782	0.08	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0180	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	122.7	128	0.6782	0.08	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0166	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	122.7	128	0.6782	0.08	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0374	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	122.7	128	0.6782	0.08	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0157	0-2	Nickel	12	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.12	122.7	128	0.6782	0.08	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0191	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	122.7	128	0.6782	0.08	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0195	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	122.7	128	0.6782	0.08	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0119	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	122.7	128	0.6782	0.08	64.2	0.00
Boeing RFI Subarea 1A North	ENBS0047	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	122.7	128	0.6782	0.08	64.2	0.00
Boeing RFI Subarea 1A North	B1BS0053	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	122.7	128	0.6782	0.08	64.2	0.00

Boeing RFI Subarea 1A North	B1BS29	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	122.7	128	0.6782	0.08	64.2	0.00
Boeing RFI Subarea 1A North	A1TS0058A	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	122.7	128	0.6782	0.08	64.2	0.00
Boeing RFI Subarea 1A North	B1BS0224	0-2	Nickel	11.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	122.7	128	0.6782	0.08	64.2	0.00
Boeing RFI Subarea 1A North	ENBS0038	0-2	Nickel	11.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	122.7	128	0.6782	0.08	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0067	0-2	Nickel	11.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	122.7	128	0.6782	0.08	64.2	0.00
Boeing RFI Subarea 1A North	A1TS49	0-2	Nickel	11.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	122.7	128	0.6782	0.08	64.2	0.00
Boeing RFI Subarea 1A North	A1BS11	0-2	Nickel	11.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	122.7	128	0.6782	0.08	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0120	0-2	Nickel	11.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	122.7	128	0.6782	0.08	64.2	0.00
Boeing RFI Subarea 1A North	ILTS02	0-2	Nickel	11.4	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.11	122.7	128	0.6782	0.08	64.2	0.00
Boeing RFI Subarea 1A North	ENBS0072	0-2	Nickel	11.4	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.11	122.7	128	0.6782	0.08	64.2	0.00
Boeing RFI Subarea 1A North	B1BS0222	0-2	Nickel	11.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	122.7	128	0.6782	0.08	64.2	0.00
Boeing RFI Subarea 1A North	ENBS0063	0-2	Nickel	11.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	122.7	128	0.6782	0.08	64.2	0.00
Boeing RFI Subarea 1A North	A1BS07	0-2	Nickel	11.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	122.7	128	0.6782	0.08	64.2	0.00
Boeing RFI Subarea 1A North	B1BS0225	0-2	Nickel	11.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	122.7	128	0.6782	0.08	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0205	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0202	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0187	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0209	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0141	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	B1BS22	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS01	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0185	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0176	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0170	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0160	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0148	0-2	Nickel	11	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.11	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0136	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0140	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0143	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0134	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0142	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0186	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	A1TS03	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ENBS0069	0-2	Nickel	11	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.11	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0241	0-2	Nickel	11	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.11	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0034	0-2	Nickel	11	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.11	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	B1BS0223	0-2	Nickel	10.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	B1BS0231	0-2	Nickel	10.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0123	0-2	Nickel	10.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	A1BS08	0-2	Nickel	10.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	A1TS11	0-2	Nickel	10.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	A1TS45	0-2	Nickel	10.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	A1TS31	0-2	Nickel	10.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ENBS0042	0-2	Nickel	10.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	A1TS19	0-2	Nickel	10.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ENBS0045	0-2	Nickel	10.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ENBS0041	0-2	Nickel	10.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	A1TS07	0-2	Nickel	10.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0207	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0171	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	B1BS27	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0180	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	B1BS0052	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0208	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0159	0-2	Nickel	10	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	122.7	128	0.6782	0.07	64.2	0.00

Boeing RFI Subarea 1A North	ILBS0174	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0133	0-2	Nickel	10	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	B1BS0070	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0222	0-2	Nickel	10	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0125	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0146	0-2	Nickel	10	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	A1BS09	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0175	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0053	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0283	0-2	Nickel	9.92	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0172	0-2	Nickel	9.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0149	0-2	Nickel	9.9	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0210	0-2	Nickel	9.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0177	0-2	Nickel	9.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0138	0-2	Nickel	9.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0112	0-2	Nickel	9.9	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0080	0-2	Nickel	9.9	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0238	0-2	Nickel	9.7	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0140	0-2	Nickel	9.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	B1BS21	0-2	Nickel	9.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0235	0-2	Nickel	9.6	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0203	0-2	Nickel	9.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0147	0-2	Nickel	9.6	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0190	0-2	Nickel	9.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0277	0-2	Nickel	9.59	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	122.7	128	0.6782	0.07	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0135	0-2	Nickel	9.5	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	122.7	128	0.6782	0.06	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0233	0-2	Nickel	9.5	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	122.7	128	0.6782	0.06	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0189	0-2	Nickel	9.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	122.7	128	0.6782	0.06	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0099	0-2	Nickel	9.41	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.09	122.7	128	0.6782	0.06	64.2	0.00
Boeing RFI Subarea 1A North	A1BS05	0-2	Nickel	9.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	122.7	128	0.6782	0.06	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0275	0-2	Nickel	9.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.09	122.7	128	0.6782	0.06	64.2	0.00
Boeing RFI Subarea 1A North	B1BS0074	0-2	Nickel	9.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	122.7	128	0.6782	0.06	64.2	0.00
Boeing RFI Subarea 1A North	B1BS0064	0-2	Nickel	9.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.09	122.7	128	0.6782	0.06	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0242	0-2	Nickel	9.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.09	122.7	128	0.6782	0.06	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0139	0-2	Nickel	9.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	122.7	128	0.6782	0.06	64.2	0.00
Boeing RFI Subarea 1A North	A1BS14	0-2	Nickel	9.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	122.7	128	0.6782	0.06	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0124	0-2	Nickel	9.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	122.7	128	0.6782	0.06	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0260	0-2	Nickel	9.1	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.09	122.7	128	0.6782	0.06	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0242	0-2	Nickel	9.1	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.09	122.7	128	0.6782	0.06	64.2	0.00
Boeing RFI Subarea 1A North	A1BS06	0-2	Nickel	9.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	122.7	128	0.6782	0.06	64.2	0.00
Boeing RFI Subarea 1A North	B1BS0221	0-2	Nickel	9.09	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	122.7	128	0.6782	0.06	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0098	0-2	Nickel	9.04	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	122.7	128	0.6782	0.06	64.2	0.00
Boeing RFI Subarea 1A North	ILBS18	0-2	Nickel	9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	122.7	128	0.6782	0.06	64.2	0.00
Boeing RFI Subarea 1A North	B1BS28	0-2	Nickel	9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	122.7	128	0.6782	0.06	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0110	0-2	Nickel	9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	122.7	128	0.6782	0.06	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0230	0-2	Nickel	9	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.09	122.7	128	0.6782	0.06	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0167	0-2	Nickel	8.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	122.7	128	0.6782	0.06	64.2	0.00
Boeing RFI Subarea 1A North	A1SS02	0-2	Nickel	8.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	122.7	128	0.6782	0.06	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0117	0-2	Nickel	8.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	122.7	128	0.6782	0.06	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0204	0-2	Nickel	8.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	122.7	128	0.6782	0.06	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0168	0-2	Nickel	8.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	122.7	128	0.6782	0.06	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0231	0-2	Nickel	8.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.08	122.7	128	0.6782	0.06	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0261	0-2	Nickel	8.26	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	122.7	128	0.6782	0.06	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0192	0-2	Nickel	8.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	122.7	128	0.6782	0.05	64.2	0.00
Boeing RFI Subarea 1A North	B1BS0070	0-2	Nickel	8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	122.7	128	0.6782	0.05	64.2	0.00

Boeing RFI Subarea 1A North	ILBS0381	0-2	Nickel	7.9	mg/kg	UJ	Mule Deer	High TRV-Based RBSL	100	0.08	122.7	128	0.6782	0.05	64.2	0.00
Boeing RFI Subarea 1A North	A1TS47	0-2	Nickel	7.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	122.7	128	0.6782	0.05	64.2	0.00
Boeing RFI Subarea 1A North	ILBS92	0-2	Nickel	7.7	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.08	122.7	128	0.6782	0.05	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0165	0-2	Nickel	7.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	122.7	128	0.6782	0.05	64.2	0.00
Boeing RFI Subarea 1A North	A1TS12	0-2	Nickel	7.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	122.7	128	0.6782	0.05	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0276	0-2	Nickel	7.26	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.07	122.7	128	0.6782	0.05	64.2	0.00
Boeing RFI Subarea 1A North	ILBS94	0-2	Nickel	6.8	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.07	122.7	128	0.6782	0.05	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0121	0-2	Nickel	6.6	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.07	122.7	128	0.6782	0.04	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0231	0-2	Nickel	6.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.06	122.7	128	0.6782	0.04	64.2	0.00
Boeing RFI Subarea 1A North	B-1-01	0-2	Nickel	6.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.06	122.7	128	0.6782	0.04	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0278	0-2	Nickel	6.08	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.06	122.7	128	0.6782	0.04	64.2	0.00
Boeing RFI Subarea 1A North	B-1-02	0-2	Nickel	6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.06	122.7	128	0.6782	0.04	64.2	0.00
Boeing RFI Subarea 1A North	B-1-03	0-2	Nickel	5.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.06	122.7	128	0.6782	0.04	64.2	0.00
Boeing RFI Subarea 1A North	ILBS0243	0-2	Nickel	5.5	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.06	122.7	128	0.6782	0.04	64.2	0.00
Boeing RFI Subarea 1A North	A1BS0085	0-2	Nickel	5.45	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.05	122.7	128	0.6782	0.04	64.2	0.00
Boeing RFI Subarea 1A North	A1TS30	0-2	Nickel	2.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.02	122.7	128	0.6782	0.01	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0102	0-2	Nickel	199	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	1.99	346.5	128	1.0000	1.99	64.2	1.35
Boeing RFI Subarea 1A South	LFBS43	0-2	Nickel	128	mg/kg		Mule Deer	High TRV-Based RBSL	100	1.28	346.5	128	1.0000	1.28	64.2	0.64
Boeing RFI Subarea 1A South	LFBS44	0-2	Nickel	94.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.95	346.5	128	1.0000	0.95	64.2	0.30
Boeing RFI Subarea 1A South	CNBS0085	0-2	Nickel	61.7	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.62	346.5	128	1.0000	0.62	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0002	0-2	Nickel	45.2	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.45	346.5	128	1.0000	0.45	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0001	0-2	Nickel	31.4	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.31	346.5	128	1.0000	0.31	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0003	0-2	Nickel	28.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.28	346.5	128	1.0000	0.28	64.2	0.00
Boeing RFI Subarea 1A South	LFSS08	0-2	Nickel	28	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.28	346.5	128	1.0000	0.28	64.2	0.00
Boeing RFI Subarea 1A South	LFR-2	0-2	Nickel	27	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.27	346.5	128	1.0000	0.27	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0032	0-2	Nickel	26.7	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.27	346.5	128	1.0000	0.27	64.2	0.00
Boeing RFI Subarea 1A South	LFBS31	0-2	Nickel	24	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.24	346.5	128	1.0000	0.24	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0144	0-2	Nickel	22.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.22	346.5	128	1.0000	0.22	64.2	0.00
Boeing RFI Subarea 1A South	LFBS45	0-2	Nickel	21.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.21	346.5	128	1.0000	0.21	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0155	0-2	Nickel	21	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.21	346.5	128	1.0000	0.21	64.2	0.00
Boeing RFI Subarea 1A South	CNBS33	0-2	Nickel	21	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.21	346.5	128	1.0000	0.21	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0336	0-2	Nickel	20.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.21	346.5	128	1.0000	0.21	64.2	0.00
Boeing RFI Subarea 1A South	LFBS86	0-2	Nickel	20	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.20	346.5	128	1.0000	0.20	64.2	0.00
Boeing RFI Subarea 1A South	HVBS54	0-2	Nickel	20	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.20	346.5	128	1.0000	0.20	64.2	0.00
Boeing RFI Subarea 1A South	HZET0507	0-2	Nickel	19.9	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.20	346.5	128	1.0000	0.20	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0256	0-2	Nickel	19.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.19	346.5	128	1.0000	0.19	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0013	0-2	Nickel	19.1	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.19	346.5	128	1.0000	0.19	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0130	0-2	Nickel	18.7	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.19	346.5	128	1.0000	0.19	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0337	0-2	Nickel	18.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.19	346.5	128	1.0000	0.19	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0332	0-2	Nickel	18.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.18	346.5	128	1.0000	0.18	64.2	0.00
Boeing RFI Subarea 1A South	CNBS55	0-2	Nickel	18	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.18	346.5	128	1.0000	0.18	64.2	0.00
Boeing RFI Subarea 1A South	HVBF35	0-2	Nickel	18	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.18	346.5	128	1.0000	0.18	64.2	0.00
Boeing RFI Subarea 1A South	ENBS0052	0-2	Nickel	17.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.18	346.5	128	1.0000	0.18	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0125	0-2	Nickel	17.4	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.17	346.5	128	1.0000	0.17	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0045	0-2	Nickel	17.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.17	346.5	128	1.0000	0.17	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0264	0-2	Nickel	17.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.17	346.5	128	1.0000	0.17	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0124	0-2	Nickel	17.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.17	346.5	128	1.0000	0.17	64.2	0.00
Boeing RFI Subarea 1A South	CNBS58	0-2	Nickel	17	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.17	346.5	128	1.0000	0.17	64.2	0.00
Boeing RFI Subarea 1A South	HVTC19S21	0-2	Nickel	17	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.17	346.5	128	1.0000	0.17	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0335	0-2	Nickel	16.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.17	346.5	128	1.0000	0.17	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0334	0-2	Nickel	16.6	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.17	346.5	128	1.0000	0.17	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0165	0-2	Nickel	16	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.16	346.5	128	1.0000	0.16	64.2	0.00
Boeing RFI Subarea 1A South	ENBS0036	0-2	Nickel	16	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.16	346.5	128	1.0000	0.16	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0166	0-2	Nickel	16	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.16	346.5	128	1.0000	0.16	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0327	0-2	Nickel	16	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.16	346.5	128	1.0000	0.16	64.2	0.00

Boeing RFI Subarea 1A South	LFBS69	0-2	Nickel	16	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.16	346.5	128	1.0000	0.16	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0326	0-2	Nickel	15.9	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.16	346.5	128	1.0000	0.16	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0333	0-2	Nickel	15.9	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.16	346.5	128	1.0000	0.16	64.2	0.00
Boeing RFI Subarea 1A South	ENBS0146	0-2	Nickel	15.6	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.16	346.5	128	1.0000	0.16	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0254	0-2	Nickel	15.4	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.15	346.5	128	1.0000	0.15	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0307	0-2	Nickel	15.4	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.15	346.5	128	1.0000	0.15	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0145	0-2	Nickel	15.2	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.15	346.5	128	1.0000	0.15	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0081	0-2	Nickel	15.1	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.15	346.5	128	1.0000	0.15	64.2	0.00
Boeing RFI Subarea 1A South	HVTC12S06	0-2	Nickel	15	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	346.5	128	1.0000	0.15	64.2	0.00
Boeing RFI Subarea 1A South	LFBS70	0-2	Nickel	15	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	346.5	128	1.0000	0.15	64.2	0.00
Boeing RFI Subarea 1A South	LFBS59	0-2	Nickel	15	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	346.5	128	1.0000	0.15	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0270	0-2	Nickel	15	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.15	346.5	128	1.0000	0.15	64.2	0.00
Boeing RFI Subarea 1A South	HVBK19	0-2	Nickel	15	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	346.5	128	1.0000	0.15	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0212	0-2	Nickel	15	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.15	346.5	128	1.0000	0.15	64.2	0.00
Boeing RFI Subarea 1A South	HVBD95	0-2	Nickel	15	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	346.5	128	1.0000	0.15	64.2	0.00
Boeing RFI Subarea 1A South	LFBS89	0-2	Nickel	15	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	346.5	128	1.0000	0.15	64.2	0.00
Boeing RFI Subarea 1A South	ENBS0144	0-2	Nickel	14.9	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.15	346.5	128	1.0000	0.15	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0211	0-2	Nickel	14.8	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.15	346.5	128	1.0000	0.15	64.2	0.00
Boeing RFI Subarea 1A South	AFBS0112	0-2	Nickel	14.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	346.5	128	1.0000	0.15	64.2	0.00
Boeing RFI Subarea 1A South	ENBS0143	0-2	Nickel	14.4	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.14	346.5	128	1.0000	0.14	64.2	0.00
Boeing RFI Subarea 1A South	ENBS0053	0-2	Nickel	14.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	346.5	128	1.0000	0.14	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0029	0-2	Nickel	14.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.14	346.5	128	1.0000	0.14	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0006	0-2	Nickel	14.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.14	346.5	128	1.0000	0.14	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0104	0-2	Nickel	14.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	346.5	128	1.0000	0.14	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S02	0-2	Nickel	14.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	346.5	128	1.0000	0.14	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S36	0-2	Nickel	14	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	346.5	128	1.0000	0.14	64.2	0.00
Boeing RFI Subarea 1A South	HVBF0045	0-2	Nickel	14	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	346.5	128	1.0000	0.14	64.2	0.00
Boeing RFI Subarea 1A South	LFBS15	0-2	Nickel	14	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	346.5	128	1.0000	0.14	64.2	0.00
Boeing RFI Subarea 1A South	LFBS58	0-2	Nickel	14	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	346.5	128	1.0000	0.14	64.2	0.00
Boeing RFI Subarea 1A South	LFBS85	0-2	Nickel	14	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	346.5	128	1.0000	0.14	64.2	0.00
Boeing RFI Subarea 1A South	CNBS74	0-2	Nickel	14	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	346.5	128	1.0000	0.14	64.2	0.00
Boeing RFI Subarea 1A South	HVBK21	0-2	Nickel	14	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	346.5	128	1.0000	0.14	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0268	0-2	Nickel	13.9	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.14	346.5	128	1.0000	0.14	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0126	0-2	Nickel	13.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	346.5	128	1.0000	0.14	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0080	0-2	Nickel	13.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	346.5	128	1.0000	0.14	64.2	0.00
Boeing RFI Subarea 1A South	ENBS0051	0-2	Nickel	13.6	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.14	346.5	128	1.0000	0.14	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0134	0-2	Nickel	13.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	346.5	128	1.0000	0.14	64.2	0.00
Boeing RFI Subarea 1A South	ENBS0054	0-2	Nickel	13.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	346.5	128	1.0000	0.14	64.2	0.00
Boeing RFI Subarea 1A South	ENBS0050	0-2	Nickel	13.5	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.14	346.5	128	1.0000	0.14	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0324	0-2	Nickel	13.4	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.13	346.5	128	1.0000	0.13	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0240	0-2	Nickel	13.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.13	346.5	128	1.0000	0.13	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0123	0-2	Nickel	13.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	346.5	128	1.0000	0.13	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0174	0-2	Nickel	13.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	346.5	128	1.0000	0.13	64.2	0.00
Boeing RFI Subarea 1A South	LFBS87	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	346.5	128	1.0000	0.13	64.2	0.00
Boeing RFI Subarea 1A South	HVBS49	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	346.5	128	1.0000	0.13	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0135	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	346.5	128	1.0000	0.13	64.2	0.00
Boeing RFI Subarea 1A South	HZET0508	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	346.5	128	1.0000	0.13	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0153	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	346.5	128	1.0000	0.13	64.2	0.00
Boeing RFI Subarea 1A South	HVBF0044	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	346.5	128	1.0000	0.13	64.2	0.00
Boeing RFI Subarea 1A South	CNBS38	0-2	Nickel	13	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.13	346.5	128	1.0000	0.13	64.2	0.00
Boeing RFI Subarea 1A South	HVBD96	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	346.5	128	1.0000	0.13	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0287	0-2	Nickel	13	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.13	346.5	128	1.0000	0.13	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0171	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	346.5	128	1.0000	0.13	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S03	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	346.5	128	1.0000	0.13	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0047	0-2	Nickel	12.7	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.13	346.5	128	1.0000	0.13	64.2	0.00

Boeing RFI Subarea 1A South	LFBS0195	0-2	Nickel	12.7	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.13	346.5	128	1.0000	0.13	64.2	0.00
Boeing RFI Subarea 1A South	HVBK20	0-2	Nickel	12.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	346.5	128	1.0000	0.13	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0040	0-2	Nickel	12.6	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.13	346.5	128	1.0000	0.13	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0305	0-2	Nickel	12.5	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.13	346.5	128	1.0000	0.13	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0083	0-2	Nickel	12.5	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.13	346.5	128	1.0000	0.13	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0034	0-2	Nickel	12.4	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.12	346.5	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0191	0-2	Nickel	12.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.12	346.5	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0031	0-2	Nickel	12.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	346.5	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0241	0-2	Nickel	12.1	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.12	346.5	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0295	0-2	Nickel	12.1	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.12	346.5	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 1A South	HVTC16S05	0-2	Nickel	12.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	346.5	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0194	0-2	Nickel	12.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	346.5	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 1A South	HVTC12S01	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	346.5	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S08	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	346.5	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S14	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	346.5	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0140	0-2	Nickel	12	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.12	346.5	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 1A South	BZSS05	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	346.5	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 1A South	HVTC16S06	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	346.5	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S09	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	346.5	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 1A South	HVBS33	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	346.5	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0124	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	346.5	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 1A South	HVBS59	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	346.5	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S31	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	346.5	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0152	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	346.5	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 1A South	CNBS73	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	346.5	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S44	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	346.5	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 1A South	LFR-3	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	346.5	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 1A South	HVBS61	0-2	Nickel	11.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	346.5	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0338	0-2	Nickel	11.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	346.5	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0277	0-2	Nickel	11.8	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.12	346.5	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 1A South	HVBS67	0-2	Nickel	11.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	346.5	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0242	0-2	Nickel	11.8	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.12	346.5	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 1A South	HVBS64	0-2	Nickel	11.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	346.5	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S06	0-2	Nickel	11.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	346.5	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0122	0-2	Nickel	11.7	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.12	346.5	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 1A South	ENBS0035	0-2	Nickel	11.6	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.12	346.5	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0152	0-2	Nickel	11.5	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.12	346.5	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0007	0-2	Nickel	11.5	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.12	346.5	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0323	0-2	Nickel	11.5	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.12	346.5	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0141	0-2	Nickel	11.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	346.5	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 1A South	HVTC11S53	0-2	Nickel	11.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	346.5	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S18	0-2	Nickel	11.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	346.5	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 1A South	HVBS65	0-2	Nickel	11.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	346.5	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0148	0-2	Nickel	11.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	346.5	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 1A South	HVBS88	0-2	Nickel	11.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	346.5	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0030	0-2	Nickel	11.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.11	346.5	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0253	0-2	Nickel	11.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	346.5	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0011	0-2	Nickel	11.2	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.11	346.5	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0109	0-2	Nickel	11.2	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.11	346.5	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0100	0-2	Nickel	11.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	346.5	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0266	0-2	Nickel	11.1	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.11	346.5	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S13	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	346.5	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S12	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	346.5	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 1A South	HVTC11S04	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	346.5	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 1A South	BZSS05	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	346.5	128	1.0000	0.11	64.2	0.00

Boeing RFI Subarea 1A South	HVTC13S11	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	346.5	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S07	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	346.5	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 1A South	HVTC11S10	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	346.5	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S05	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	346.5	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0193	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	346.5	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S15	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	346.5	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 1A South	CNBS44	0-2	Nickel	11	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.11	346.5	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 1A South	HVBK17	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	346.5	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 1A South	LFBS04	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	346.5	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 1A South	LFBS14	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	346.5	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 1A South	LFBS42	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	346.5	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 1A South	LFBS57	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	346.5	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 1A South	LFBS70	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	346.5	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S25	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	346.5	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 1A South	HVTC10S11	0-2	Nickel	10.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	346.5	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0102	0-2	Nickel	10.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	346.5	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0112	0-2	Nickel	10.8	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.11	346.5	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0082	0-2	Nickel	10.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	346.5	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0022	0-2	Nickel	10.7	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.11	346.5	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 1A South	HVBS63	0-2	Nickel	10.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	346.5	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0103	0-2	Nickel	10.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	346.5	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0124	0-2	Nickel	10.6	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.11	346.5	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0162	0-2	Nickel	10.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	346.5	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0227	0-2	Nickel	10.6	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.11	346.5	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0146	0-2	Nickel	10.5	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.11	346.5	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0008	0-2	Nickel	10.5	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.11	346.5	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 1A South	LFBS38	0-2	Nickel	10.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	346.5	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0027	0-2	Nickel	10.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	346.5	128	1.0000	0.10	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0220	0-2	Nickel	10.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	346.5	128	1.0000	0.10	64.2	0.00
Boeing RFI Subarea 1A South	HVBS89	0-2	Nickel	10.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	346.5	128	1.0000	0.10	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0107	0-2	Nickel	10.2	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	346.5	128	1.0000	0.10	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0129	0-2	Nickel	10.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	346.5	128	1.0000	0.10	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0142	0-2	Nickel	10.1	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	346.5	128	1.0000	0.10	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0306	0-2	Nickel	10.1	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	346.5	128	1.0000	0.10	64.2	0.00
Boeing RFI Subarea 1A South	CNBS72	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	346.5	128	1.0000	0.10	64.2	0.00
Boeing RFI Subarea 1A South	HVTC11S12	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	346.5	128	1.0000	0.10	64.2	0.00
Boeing RFI Subarea 1A South	HVTC11S05	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	346.5	128	1.0000	0.10	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S39	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	346.5	128	1.0000	0.10	64.2	0.00
Boeing RFI Subarea 1A South	LFBS23	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	346.5	128	1.0000	0.10	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0172	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	346.5	128	1.0000	0.10	64.2	0.00
Boeing RFI Subarea 1A South	HVBS51	0-2	Nickel	9.96	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	346.5	128	1.0000	0.10	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0157	0-2	Nickel	9.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	346.5	128	1.0000	0.10	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0186	0-2	Nickel	9.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	346.5	128	1.0000	0.10	64.2	0.00
Boeing RFI Subarea 1A South	HVBF33	0-2	Nickel	9.8	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	346.5	128	1.0000	0.10	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S10	0-2	Nickel	9.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	346.5	128	1.0000	0.10	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0128	0-2	Nickel	9.7	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	346.5	128	1.0000	0.10	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0136	0-2	Nickel	9.7	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	346.5	128	1.0000	0.10	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0192	0-2	Nickel	9.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	346.5	128	1.0000	0.10	64.2	0.00
Boeing RFI Subarea 1A South	HZET0501	0-2	Nickel	9.7	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	346.5	128	1.0000	0.10	64.2	0.00
Boeing RFI Subarea 1A South	HVTC10S12	0-2	Nickel	9.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	346.5	128	1.0000	0.10	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0206	0-2	Nickel	9.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	346.5	128	1.0000	0.10	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0127	0-2	Nickel	9.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	346.5	128	1.0000	0.10	64.2	0.00
Boeing RFI Subarea 1A South	CNBS35	0-2	Nickel	9.5	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	346.5	128	1.0000	0.10	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0174	0-2	Nickel	9.5	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	346.5	128	1.0000	0.10	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0293	0-2	Nickel	9.42	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.09	346.5	128	1.0000	0.09	64.2	0.00

Boeing RFI Subarea 1A South	HZBS0180	0-2	Nickel	9.42	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	346.5	128	1.0000	0.09	64.2	0.00
Boeing RFI Subarea 1A South	ENBS0049	0-2	Nickel	9.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	346.5	128	1.0000	0.09	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0173	0-2	Nickel	9.4	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.09	346.5	128	1.0000	0.09	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0184	0-2	Nickel	9.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	346.5	128	1.0000	0.09	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0110	0-2	Nickel	9.4	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.09	346.5	128	1.0000	0.09	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0158	0-2	Nickel	9.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	346.5	128	1.0000	0.09	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0159	0-2	Nickel	9.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	346.5	128	1.0000	0.09	64.2	0.00
Boeing RFI Subarea 1A South	CNBS66	0-2	Nickel	9.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	346.5	128	1.0000	0.09	64.2	0.00
Boeing RFI Subarea 1A South	CNBS43	0-2	Nickel	9.2	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.09	346.5	128	1.0000	0.09	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0009	0-2	Nickel	9.2	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.09	346.5	128	1.0000	0.09	64.2	0.00
Boeing RFI Subarea 1A South	LFTS12	0-2	Nickel	9.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	346.5	128	1.0000	0.09	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0126	0-2	Nickel	9.2	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.09	346.5	128	1.0000	0.09	64.2	0.00
Boeing RFI Subarea 1A South	HVBS72	0-2	Nickel	9.1	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.09	346.5	128	1.0000	0.09	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0010	0-2	Nickel	9.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	346.5	128	1.0000	0.09	64.2	0.00
Boeing RFI Subarea 1A South	HVBD94	0-2	Nickel	9.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	346.5	128	1.0000	0.09	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0039	0-2	Nickel	9.1	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.09	346.5	128	1.0000	0.09	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0117	0-2	Nickel	9.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	346.5	128	1.0000	0.09	64.2	0.00
Boeing RFI Subarea 1A South	CNBS57	0-2	Nickel	9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	346.5	128	1.0000	0.09	64.2	0.00
Boeing RFI Subarea 1A South	LFBS20	0-2	Nickel	9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	346.5	128	1.0000	0.09	64.2	0.00
Boeing RFI Subarea 1A South	LFBS06	0-2	Nickel	9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	346.5	128	1.0000	0.09	64.2	0.00
Boeing RFI Subarea 1A South	HVBS97	0-2	Nickel	9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	346.5	128	1.0000	0.09	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0170	0-2	Nickel	9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	346.5	128	1.0000	0.09	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0220	0-2	Nickel	9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	346.5	128	1.0000	0.09	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0151	0-2	Nickel	9	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.09	346.5	128	1.0000	0.09	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0185	0-2	Nickel	8.98	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	346.5	128	1.0000	0.09	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S41	0-2	Nickel	8.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	346.5	128	1.0000	0.09	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0221	0-2	Nickel	8.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	346.5	128	1.0000	0.09	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S45	0-2	Nickel	8.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	346.5	128	1.0000	0.09	64.2	0.00
Boeing RFI Subarea 1A South	LFBS88	0-2	Nickel	8.7	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.09	346.5	128	1.0000	0.09	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0023	0-2	Nickel	8.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	346.5	128	1.0000	0.09	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0147	0-2	Nickel	8.7	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.09	346.5	128	1.0000	0.09	64.2	0.00
Boeing RFI Subarea 1A South	HVBS98	0-2	Nickel	8.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	346.5	128	1.0000	0.09	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0121	0-2	Nickel	8.5	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.09	346.5	128	1.0000	0.09	64.2	0.00
Boeing RFI Subarea 1A South	LFBS81	0-2	Nickel	8.5	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.09	346.5	128	1.0000	0.09	64.2	0.00
Boeing RFI Subarea 1A South	HVBK22	0-2	Nickel	8.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	346.5	128	1.0000	0.09	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0101	0-2	Nickel	8.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	346.5	128	1.0000	0.09	64.2	0.00
Boeing RFI Subarea 1A South	LFTS08	0-2	Nickel	8.4	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.08	346.5	128	1.0000	0.08	64.2	0.00
Boeing RFI Subarea 1A South	HVBF0043	0-2	Nickel	8.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	346.5	128	1.0000	0.08	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0187	0-2	Nickel	8.4	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.08	346.5	128	1.0000	0.08	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0108	0-2	Nickel	8.4	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.08	346.5	128	1.0000	0.08	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0125	0-2	Nickel	8.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	346.5	128	1.0000	0.08	64.2	0.00
Boeing RFI Subarea 1A South	LFBS79	0-2	Nickel	8.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.08	346.5	128	1.0000	0.08	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0154	0-2	Nickel	8.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	346.5	128	1.0000	0.08	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0145	0-2	Nickel	8.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.08	346.5	128	1.0000	0.08	64.2	0.00
Boeing RFI Subarea 1A South	HVBD93	0-2	Nickel	8.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	346.5	128	1.0000	0.08	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0164	0-2	Nickel	8.22	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	346.5	128	1.0000	0.08	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0084	0-2	Nickel	8.22	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	346.5	128	1.0000	0.08	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0172	0-2	Nickel	8.2	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.08	346.5	128	1.0000	0.08	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0038	0-2	Nickel	8.2	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.08	346.5	128	1.0000	0.08	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0125	0-2	Nickel	8.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	346.5	128	1.0000	0.08	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0156	0-2	Nickel	8.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	346.5	128	1.0000	0.08	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0163	0-2	Nickel	8.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	346.5	128	1.0000	0.08	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0104	0-2	Nickel	8.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	346.5	128	1.0000	0.08	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0087	0-2	Nickel	8.1	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.08	346.5	128	1.0000	0.08	64.2	0.00
Boeing RFI Subarea 1A South	LFSS02	0-2	Nickel	8.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	346.5	128	1.0000	0.08	64.2	0.00

Boeing RFI Subarea 1A South	HVBD98	0-2	Nickel	8.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	346.5	128	1.0000	0.08	64.2	0.00
Boeing RFI Subarea 1A South	LFBS29	0-2	Nickel	8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	346.5	128	1.0000	0.08	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0162	0-2	Nickel	7.99	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	346.5	128	1.0000	0.08	64.2	0.00
Boeing RFI Subarea 1A South	CNBS65	0-2	Nickel	7.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	346.5	128	1.0000	0.08	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0162	0-2	Nickel	7.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	346.5	128	1.0000	0.08	64.2	0.00
Boeing RFI Subarea 1A South	HVBF02	0-2	Nickel	7.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	346.5	128	1.0000	0.08	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0179	0-2	Nickel	7.74	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.08	346.5	128	1.0000	0.08	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0121	0-2	Nickel	7.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	346.5	128	1.0000	0.08	64.2	0.00
Boeing RFI Subarea 1A South	HVBS66	0-2	Nickel	7.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	346.5	128	1.0000	0.08	64.2	0.00
Boeing RFI Subarea 1A South	HVBF34	0-2	Nickel	7.6	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.08	346.5	128	1.0000	0.08	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0088	0-2	Nickel	7.6	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.08	346.5	128	1.0000	0.08	64.2	0.00
Boeing RFI Subarea 1A South	CNBS34	0-2	Nickel	7.5	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.08	346.5	128	1.0000	0.08	64.2	0.00
Boeing RFI Subarea 1A South	CNBS36	0-2	Nickel	7.5	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.08	346.5	128	1.0000	0.08	64.2	0.00
Boeing RFI Subarea 1A South	ENBS0048	0-2	Nickel	7.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	346.5	128	1.0000	0.08	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0025	0-2	Nickel	7.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	346.5	128	1.0000	0.08	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0075	0-2	Nickel	7.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	346.5	128	1.0000	0.08	64.2	0.00
Boeing RFI Subarea 1A South	HVTC13S22	0-2	Nickel	7.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	346.5	128	1.0000	0.08	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0024	0-2	Nickel	7.39	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	346.5	128	1.0000	0.07	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0026	0-2	Nickel	7.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.07	346.5	128	1.0000	0.07	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0178	0-2	Nickel	7.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.07	346.5	128	1.0000	0.07	64.2	0.00
Boeing RFI Subarea 1A South	CNBS41	0-2	Nickel	7.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.07	346.5	128	1.0000	0.07	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0106	0-2	Nickel	7.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	346.5	128	1.0000	0.07	64.2	0.00
Boeing RFI Subarea 1A South	LFTS07	0-2	Nickel	7.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	346.5	128	1.0000	0.07	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0139	0-2	Nickel	7.16	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.07	346.5	128	1.0000	0.07	64.2	0.00
Boeing RFI Subarea 1A South	LFBS30	0-2	Nickel	7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	346.5	128	1.0000	0.07	64.2	0.00
Boeing RFI Subarea 1A South	LFBS35	0-2	Nickel	7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	346.5	128	1.0000	0.07	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0189	0-2	Nickel	7	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.07	346.5	128	1.0000	0.07	64.2	0.00
Boeing RFI Subarea 1A South	HVBS96	0-2	Nickel	7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	346.5	128	1.0000	0.07	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0033	0-2	Nickel	7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	346.5	128	1.0000	0.07	64.2	0.00
Boeing RFI Subarea 1A South	LFBS48	0-2	Nickel	6.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	346.5	128	1.0000	0.07	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0218	0-2	Nickel	6.8	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.07	346.5	128	1.0000	0.07	64.2	0.00
Boeing RFI Subarea 1A South	LFSS01	0-2	Nickel	6.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	346.5	128	1.0000	0.07	64.2	0.00
Boeing RFI Subarea 1A South	LFBS47	0-2	Nickel	6.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	346.5	128	1.0000	0.07	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0296	0-2	Nickel	6.77	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	346.5	128	1.0000	0.07	64.2	0.00
Boeing RFI Subarea 1A South	LFBS67	0-2	Nickel	6.6	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.07	346.5	128	1.0000	0.07	64.2	0.00
Boeing RFI Subarea 1A South	HVBF01	0-2	Nickel	6.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	346.5	128	1.0000	0.07	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0086	0-2	Nickel	6.6	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.07	346.5	128	1.0000	0.07	64.2	0.00
Boeing RFI Subarea 1A South	CNBS32	0-2	Nickel	6.5	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.07	346.5	128	1.0000	0.07	64.2	0.00
Boeing RFI Subarea 1A South	LFBS0190	0-2	Nickel	6.4	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.06	346.5	128	1.0000	0.06	64.2	0.00
Boeing RFI Subarea 1A South	HVBD97	0-2	Nickel	6.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.06	346.5	128	1.0000	0.06	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0118	0-2	Nickel	6.4	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.06	346.5	128	1.0000	0.06	64.2	0.00
Boeing RFI Subarea 1A South	LFBS39	0-2	Nickel	6.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.06	346.5	128	1.0000	0.06	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0044	0-2	Nickel	6.4	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.06	346.5	128	1.0000	0.06	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0161	0-2	Nickel	6.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.06	346.5	128	1.0000	0.06	64.2	0.00
Boeing RFI Subarea 1A South	CNBS56	0-2	Nickel	6.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.06	346.5	128	1.0000	0.06	64.2	0.00
Boeing RFI Subarea 1A South	LFBS46	0-2	Nickel	6.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.06	346.5	128	1.0000	0.06	64.2	0.00
Boeing RFI Subarea 1A South	BGSS02	0-2	Nickel	5.9	mg/kg	B	Mule Deer	High TRV-Based RBSL	100	0.06	346.5	128	1.0000	0.06	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0004	0-2	Nickel	5.9	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.06	346.5	128	1.0000	0.06	64.2	0.00
Boeing RFI Subarea 1A South	CNBS42	0-2	Nickel	5.6	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.06	346.5	128	1.0000	0.06	64.2	0.00
Boeing RFI Subarea 1A South	CNBS37	0-2	Nickel	5.6	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.06	346.5	128	1.0000	0.06	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0043	0-2	Nickel	5.6	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.06	346.5	128	1.0000	0.06	64.2	0.00
Boeing RFI Subarea 1A South	CNBS0105	0-2	Nickel	5.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.05	346.5	128	1.0000	0.05	64.2	0.00
Boeing RFI Subarea 1A South	HVBF03	0-2	Nickel	5.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.05	346.5	128	1.0000	0.05	64.2	0.00
Boeing RFI Subarea 1A South	CNBS46	0-2	Nickel	5.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.05	346.5	128	1.0000	0.05	64.2	0.00
Boeing RFI Subarea 1A South	HZBS0042	0-2	Nickel	5	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.05	346.5	128	1.0000	0.05	64.2	0.00

Boeing RFI Subarea 1A South	LFBS0149	0-2	Nickel	4.4	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.04	346.5	128	1.0000	0.04	64.2	0.00
Boeing RFI Subarea 1A South	B-12-03	0-2	Nickel	2.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.03	346.5	128	1.0000	0.03	64.2	0.00
Boeing RFI Subarea 1A South	B-12-02	0-2	Nickel	2.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.03	346.5	128	1.0000	0.03	64.2	0.00
Boeing RFI Subarea 1A South	HVBS69	0-2	Nickel	2.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.03	346.5	128	1.0000	0.03	64.2	0.00
Boeing RFI Subarea 1A South	LFBS19	0-2	Nickel	2.5	mg/kg	U	Mule Deer	High TRV-Based RBSL	100	0.03	346.5	128	1.0000	0.03	64.2	0.00
Boeing RFI Subarea 1A South	B-12-01	0-2	Nickel	0.75	mg/kg	U	Mule Deer	High TRV-Based RBSL	100	0.01	346.5	128	1.0000	0.01	64.2	0.00
Boeing RFI Subarea 1B North	R1BS09	0-2	Nickel	340	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	3.40	233.5	128	0.9166	3.12	64.2	2.53
Boeing RFI Subarea 1B North	BABS1054	0-2	Nickel	100	mg/kg		Mule Deer	High TRV-Based RBSL	100	1.00	233.5	128	0.9166	0.92	64.2	0.33
Boeing RFI Subarea 1B North	AABS1103	0-2	Nickel	58.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.59	233.5	128	0.9166	0.54	64.2	0.00
Boeing RFI Subarea 1B North	AABS1104	0-2	Nickel	55.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.56	233.5	128	0.9166	0.51	64.2	0.00
Boeing RFI Subarea 1B North	BABS1163	0-2	Nickel	53	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.53	233.5	128	0.9166	0.49	64.2	0.00
Boeing RFI Subarea 1B North	R1BS1031	0-2	Nickel	46	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.46	233.5	128	0.9166	0.42	64.2	0.00
Boeing RFI Subarea 1B North	BABS1140	0-2	Nickel	44	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.44	233.5	128	0.9166	0.40	64.2	0.00
Boeing RFI Subarea 1B North	BABS1055	0-2	Nickel	43	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.43	233.5	128	0.9166	0.39	64.2	0.00
Boeing RFI Subarea 1B North	ENBS0023	0-2	Nickel	40.5	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.41	233.5	128	0.9166	0.37	64.2	0.00
Boeing RFI Subarea 1B North	BABS1139	0-2	Nickel	28	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.28	233.5	128	0.9166	0.26	64.2	0.00
Boeing RFI Subarea 1B North	LXTS0008	0-2	Nickel	26	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.26	233.5	128	0.9166	0.24	64.2	0.00
Boeing RFI Subarea 1B North	BABS1023	0-2	Nickel	25.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.26	233.5	128	0.9166	0.23	64.2	0.00
Boeing RFI Subarea 1B North	A2BS1142	0-2	Nickel	24.2	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.24	233.5	128	0.9166	0.22	64.2	0.00
Boeing RFI Subarea 1B North	BABS1137	0-2	Nickel	23	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.23	233.5	128	0.9166	0.21	64.2	0.00
Boeing RFI Subarea 1B North	ENBS0025	0-2	Nickel	22	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.22	233.5	128	0.9166	0.20	64.2	0.00
Boeing RFI Subarea 1B North	R1BS01	0-2	Nickel	22	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.22	233.5	128	0.9166	0.20	64.2	0.00
Boeing RFI Subarea 1B North	R1BS0021	0-2	Nickel	21.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.21	233.5	128	0.9166	0.20	64.2	0.00
Boeing RFI Subarea 1B North	A2TS06S01	0-2	Nickel	20	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.20	233.5	128	0.9166	0.18	64.2	0.00
Boeing RFI Subarea 1B North	BABS1031	0-2	Nickel	20	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.20	233.5	128	0.9166	0.18	64.2	0.00
Boeing RFI Subarea 1B North	BABS1138	0-2	Nickel	19	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.19	233.5	128	0.9166	0.17	64.2	0.00
Boeing RFI Subarea 1B North	A2BS02	0-2	Nickel	19	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.19	233.5	128	0.9166	0.17	64.2	0.00
Boeing RFI Subarea 1B North	ENBS0055	0-2	Nickel	18.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.19	233.5	128	0.9166	0.17	64.2	0.00
Boeing RFI Subarea 1B North	ENBS0022	0-2	Nickel	18.6	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.19	233.5	128	0.9166	0.17	64.2	0.00
Boeing RFI Subarea 1B North	A2BS01	0-2	Nickel	18	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.18	233.5	128	0.9166	0.16	64.2	0.00
Boeing RFI Subarea 1B North	A2BS03	0-2	Nickel	18	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.18	233.5	128	0.9166	0.16	64.2	0.00
Boeing RFI Subarea 1B North	BATS27	0-2	Nickel	17.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.18	233.5	128	0.9166	0.16	64.2	0.00
Boeing RFI Subarea 1B North	ENBS0029	0-2	Nickel	17.8	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.18	233.5	128	0.9166	0.16	64.2	0.00
Boeing RFI Subarea 1B North	R1BS03	0-2	Nickel	17	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.17	233.5	128	0.9166	0.16	64.2	0.00
Boeing RFI Subarea 1B North	R1BS1040	0-2	Nickel	16.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.17	233.5	128	0.9166	0.15	64.2	0.00
Boeing RFI Subarea 1B North	R1BS1028	0-2	Nickel	16.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.17	233.5	128	0.9166	0.15	64.2	0.00
Boeing RFI Subarea 1B North	A2BS04	0-2	Nickel	16	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.16	233.5	128	0.9166	0.15	64.2	0.00
Boeing RFI Subarea 1B North	BABS1079	0-2	Nickel	15.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.16	233.5	128	0.9166	0.14	64.2	0.00
Boeing RFI Subarea 1B North	A2TS38S01	0-2	Nickel	15	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	233.5	128	0.9166	0.14	64.2	0.00
Boeing RFI Subarea 1B North	R1BS1041	0-2	Nickel	14.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	233.5	128	0.9166	0.14	64.2	0.00
Boeing RFI Subarea 1B North	R1BS1002	0-2	Nickel	14.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	233.5	128	0.9166	0.13	64.2	0.00
Boeing RFI Subarea 1B North	BABS1017	0-2	Nickel	14	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	233.5	128	0.9166	0.13	64.2	0.00
Boeing RFI Subarea 1B North	BABS1105	0-2	Nickel	13.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	233.5	128	0.9166	0.13	64.2	0.00
Boeing RFI Subarea 1B North	A2TS22S01	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	233.5	128	0.9166	0.12	64.2	0.00
Boeing RFI Subarea 1B North	R1BS14	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	233.5	128	0.9166	0.12	64.2	0.00
Boeing RFI Subarea 1B North	BABS1081	0-2	Nickel	12.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	233.5	128	0.9166	0.12	64.2	0.00
Boeing RFI Subarea 1B North	BABS1015	0-2	Nickel	12.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	233.5	128	0.9166	0.12	64.2	0.00
Boeing RFI Subarea 1B North	BABS51	0-2	Nickel	12.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	233.5	128	0.9166	0.11	64.2	0.00
Boeing RFI Subarea 1B North	BABS1052	0-2	Nickel	12.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	233.5	128	0.9166	0.11	64.2	0.00
Boeing RFI Subarea 1B North	BABS1014	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	233.5	128	0.9166	0.11	64.2	0.00
Boeing RFI Subarea 1B North	BABS1062	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	233.5	128	0.9166	0.11	64.2	0.00
Boeing RFI Subarea 1B North	R1BS1059	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	233.5	128	0.9166	0.11	64.2	0.00
Boeing RFI Subarea 1B North	A2TS11S01	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	233.5	128	0.9166	0.11	64.2	0.00
Boeing RFI Subarea 1B North	A2TS15S01	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	233.5	128	0.9166	0.11	64.2	0.00
Boeing RFI Subarea 1B North	BABS1106	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	233.5	128	0.9166	0.11	64.2	0.00

Boeing RFI Subarea 1B North	BABS1166	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	233.5	128	0.9166	0.11	64.2	0.00
Boeing RFI Subarea 1B North	BABS1032	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	233.5	128	0.9166	0.11	64.2	0.00
Boeing RFI Subarea 1B North	BASS02	0-2	Nickel	11.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	233.5	128	0.9166	0.10	64.2	0.00
Boeing RFI Subarea 1B North	BABS1087	0-2	Nickel	11.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	233.5	128	0.9166	0.10	64.2	0.00
Boeing RFI Subarea 1B North	BABS1102	0-2	Nickel	11.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	233.5	128	0.9166	0.10	64.2	0.00
Boeing RFI Subarea 1B North	BABS1003	0-2	Nickel	11.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	233.5	128	0.9166	0.10	64.2	0.00
Boeing RFI Subarea 1B North	BABS1019	0-2	Nickel	11.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	233.5	128	0.9166	0.10	64.2	0.00
Boeing RFI Subarea 1B North	BABS1101	0-2	Nickel	11.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	233.5	128	0.9166	0.10	64.2	0.00
Boeing RFI Subarea 1B North	R1BS1000	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	233.5	128	0.9166	0.10	64.2	0.00
Boeing RFI Subarea 1B North	BABS1001	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	233.5	128	0.9166	0.10	64.2	0.00
Boeing RFI Subarea 1B North	BABS1074	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	233.5	128	0.9166	0.10	64.2	0.00
Boeing RFI Subarea 1B North	BABS1086	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	233.5	128	0.9166	0.10	64.2	0.00
Boeing RFI Subarea 1B North	TTBS1218	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	233.5	128	0.9166	0.10	64.2	0.00
Boeing RFI Subarea 1B North	A2TS12S02	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	233.5	128	0.9166	0.10	64.2	0.00
Boeing RFI Subarea 1B North	A2TS10S01	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	233.5	128	0.9166	0.10	64.2	0.00
Boeing RFI Subarea 1B North	BABS1080	0-2	Nickel	10.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	233.5	128	0.9166	0.10	64.2	0.00
Boeing RFI Subarea 1B North	BABS1000	0-2	Nickel	10.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	233.5	128	0.9166	0.10	64.2	0.00
Boeing RFI Subarea 1B North	BABS1030	0-2	Nickel	10.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	233.5	128	0.9166	0.10	64.2	0.00
Boeing RFI Subarea 1B North	BABS1038	0-2	Nickel	10.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	233.5	128	0.9166	0.10	64.2	0.00
Boeing RFI Subarea 1B North	BABS1012	0-2	Nickel	10.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	233.5	128	0.9166	0.10	64.2	0.00
Boeing RFI Subarea 1B North	BGSS06	0-2	Nickel	10.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	233.5	128	0.9166	0.10	64.2	0.00
Boeing RFI Subarea 1B North	BABS1100	0-2	Nickel	10.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	233.5	128	0.9166	0.09	64.2	0.00
Boeing RFI Subarea 1B North	R1BS1007	0-2	Nickel	10.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	233.5	128	0.9166	0.09	64.2	0.00
Boeing RFI Subarea 1B North	R1BS1043	0-2	Nickel	10.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	233.5	128	0.9166	0.09	64.2	0.00
Boeing RFI Subarea 1B North	BABS1029	0-2	Nickel	10.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	233.5	128	0.9166	0.09	64.2	0.00
Boeing RFI Subarea 1B North	BABS1009	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	233.5	128	0.9166	0.09	64.2	0.00
Boeing RFI Subarea 1B North	BABS1175	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	233.5	128	0.9166	0.09	64.2	0.00
Boeing RFI Subarea 1B North	R1BS1006	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	233.5	128	0.9166	0.09	64.2	0.00
Boeing RFI Subarea 1B North	BABS1083	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	233.5	128	0.9166	0.09	64.2	0.00
Boeing RFI Subarea 1B North	BABS1088	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	233.5	128	0.9166	0.09	64.2	0.00
Boeing RFI Subarea 1B North	BABS1018	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	233.5	128	0.9166	0.09	64.2	0.00
Boeing RFI Subarea 1B North	A2TS08S01	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	233.5	128	0.9166	0.09	64.2	0.00
Boeing RFI Subarea 1B North	A2TS16S01	0-2	Nickel	9.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	233.5	128	0.9166	0.09	64.2	0.00
Boeing RFI Subarea 1B North	BABS1010	0-2	Nickel	9.9	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	233.5	128	0.9166	0.09	64.2	0.00
Boeing RFI Subarea 1B North	R1BS1030	0-2	Nickel	9.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	233.5	128	0.9166	0.09	64.2	0.00
Boeing RFI Subarea 1B North	BABS1027	0-2	Nickel	9.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	233.5	128	0.9166	0.09	64.2	0.00
Boeing RFI Subarea 1B North	BABS1077	0-2	Nickel	9.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	233.5	128	0.9166	0.09	64.2	0.00
Boeing RFI Subarea 1B North	R1BS1044	0-2	Nickel	9.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	233.5	128	0.9166	0.09	64.2	0.00
Boeing RFI Subarea 1B North	BABS1103	0-2	Nickel	9.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	233.5	128	0.9166	0.09	64.2	0.00
Boeing RFI Subarea 1B North	R1BS1060	0-2	Nickel	9.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	233.5	128	0.9166	0.09	64.2	0.00
Boeing RFI Subarea 1B North	BABS1051	0-2	Nickel	9.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	233.5	128	0.9166	0.09	64.2	0.00
Boeing RFI Subarea 1B North	R1BS1011	0-2	Nickel	9.6	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	233.5	128	0.9166	0.09	64.2	0.00
Boeing RFI Subarea 1B North	R1BS1030	0-2	Nickel	9.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	233.5	128	0.9166	0.09	64.2	0.00
Boeing RFI Subarea 1B North	BATS1004	0-2	Nickel	9.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	233.5	128	0.9166	0.09	64.2	0.00
Boeing RFI Subarea 1B North	A2TS13S01	0-2	Nickel	9.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	233.5	128	0.9166	0.09	64.2	0.00
Boeing RFI Subarea 1B North	R1BS1023	0-2	Nickel	9.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	233.5	128	0.9166	0.09	64.2	0.00
Boeing RFI Subarea 1B North	R1BS1009	0-2	Nickel	9.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	233.5	128	0.9166	0.08	64.2	0.00
Boeing RFI Subarea 1B North	BABS1075	0-2	Nickel	9.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	233.5	128	0.9166	0.08	64.2	0.00
Boeing RFI Subarea 1B North	B-4-08	0-2	Nickel	8.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	233.5	128	0.9166	0.08	64.2	0.00
Boeing RFI Subarea 1B North	BABS1024	0-2	Nickel	8.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	233.5	128	0.9166	0.08	64.2	0.00
Boeing RFI Subarea 1B North	BABS1090	0-2	Nickel	8.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	233.5	128	0.9166	0.08	64.2	0.00
Boeing RFI Subarea 1B North	BABS1085	0-2	Nickel	8.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	233.5	128	0.9166	0.08	64.2	0.00
Boeing RFI Subarea 1B North	A2BS22	0-2	Nickel	8.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	233.5	128	0.9166	0.08	64.2	0.00
Boeing RFI Subarea 1B North	BABS1033	0-2	Nickel	8.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	233.5	128	0.9166	0.08	64.2	0.00
Boeing RFI Subarea 1B North	R1BS1035	0-2	Nickel	8.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.08	233.5	128	0.9166	0.08	64.2	0.00

Boeing RFI Subarea 1B North	A2TS09S02	0-2	Nickel	8.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	233.5	128	0.9166	0.08	64.2	0.00
Boeing RFI Subarea 1B North	BABS1011	0-2	Nickel	8.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	233.5	128	0.9166	0.08	64.2	0.00
Boeing RFI Subarea 1B North	BABS1025	0-2	Nickel	8.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	233.5	128	0.9166	0.08	64.2	0.00
Boeing RFI Subarea 1B North	R1BS04	0-2	Nickel	8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	233.5	128	0.9166	0.07	64.2	0.00
Boeing RFI Subarea 1B North	BABS1104	0-2	Nickel	7.9	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.08	233.5	128	0.9166	0.07	64.2	0.00
Boeing RFI Subarea 1B North	BABS1068	0-2	Nickel	7.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	233.5	128	0.9166	0.07	64.2	0.00
Boeing RFI Subarea 1B North	BABS1007	0-2	Nickel	7.54	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	233.5	128	0.9166	0.07	64.2	0.00
Boeing RFI Subarea 1B North	BABS1091	0-2	Nickel	7.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	233.5	128	0.9166	0.07	64.2	0.00
Boeing RFI Subarea 1B North	R1BS1047	0-2	Nickel	7.34	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	233.5	128	0.9166	0.07	64.2	0.00
Boeing RFI Subarea 1B North	A2BS21	0-2	Nickel	7.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	233.5	128	0.9166	0.07	64.2	0.00
Boeing RFI Subarea 1B North	BABS49	0-2	Nickel	7.04	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	233.5	128	0.9166	0.06	64.2	0.00
Boeing RFI Subarea 1B North	ENBS0030	0-2	Nickel	6.9	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.07	233.5	128	0.9166	0.06	64.2	0.00
Boeing RFI Subarea 1B North	BABS1123	0-2	Nickel	6.1	mg/kg	U	Mule Deer	High TRV-Based RBSL	100	0.06	233.5	128	0.9166	0.06	64.2	0.00
Boeing RFI Subarea 1B North	R1BS1018	0-2	Nickel	5.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.06	233.5	128	0.9166	0.05	64.2	0.00
Boeing RFI Subarea 1B North	R1BS07	0-2	Nickel	5.03	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.05	233.5	128	0.9166	0.05	64.2	0.00
Boeing RFI Subarea 1B North	B-4-05	0-2	Nickel	4.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.04	233.5	128	0.9166	0.04	64.2	0.00
Boeing RFI Subarea 1B North	R1BS02	0-2	Nickel	3.5	mg/kg	U	Mule Deer	High TRV-Based RBSL	100	0.04	233.5	128	0.9166	0.03	64.2	0.00
Boeing RFI Subarea 1B North	B-4-04	0-2	Nickel	2.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.02	233.5	128	0.9166	0.02	64.2	0.00
Boeing RFI Subarea 1B North	B-4-06	0-2	Nickel	1.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.02	233.5	128	0.9166	0.02	64.2	0.00
Boeing RFI Subarea 1B North	B-4-07	0-2	Nickel	1.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.02	233.5	128	0.9166	0.01	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS19	0-2	Nickel	96	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.96	101.7	128	0.5876	0.56	64.2	0.19
Boeing RFI Subarea 1B Southeast	CLBS1026	0-2	Nickel	59.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.60	101.7	128	0.5876	0.35	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1045	0-2	Nickel	33.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.33	101.7	128	0.5876	0.20	64.2	0.00
Boeing RFI Subarea 1B Southeast	TTBS1217	0-2	Nickel	33.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.33	101.7	128	0.5876	0.19	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS09	0-2	Nickel	32	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.32	101.7	128	0.5876	0.19	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1057	0-2	Nickel	31	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.31	101.7	128	0.5876	0.18	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS35	0-2	Nickel	27	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.27	101.7	128	0.5876	0.16	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1191	0-2	Nickel	26.8	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.27	101.7	128	0.5876	0.16	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1022	0-2	Nickel	25	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.25	101.7	128	0.5876	0.15	64.2	0.00
Boeing RFI Subarea 1B Southeast	PPSS01	0-2	Nickel	24.7	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.25	101.7	128	0.5876	0.15	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1213	0-2	Nickel	24	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.24	101.7	128	0.5876	0.14	64.2	0.00
Boeing RFI Subarea 1B Southeast	TTBS1187	0-2	Nickel	23.2	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.23	101.7	128	0.5876	0.14	64.2	0.00
Boeing RFI Subarea 1B Southeast	PPBS1037	0-2	Nickel	22.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.23	101.7	128	0.5876	0.13	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS62	0-2	Nickel	22.5	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.23	101.7	128	0.5876	0.13	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1038	0-2	Nickel	22	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.22	101.7	128	0.5876	0.13	64.2	0.00
Boeing RFI Subarea 1B Southeast	PPBS1038	0-2	Nickel	22	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.22	101.7	128	0.5876	0.13	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1150	0-2	Nickel	22	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.22	101.7	128	0.5876	0.13	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1218	0-2	Nickel	22	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.22	101.7	128	0.5876	0.13	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1006	0-2	Nickel	21	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.21	101.7	128	0.5876	0.12	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1053	0-2	Nickel	21	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.21	101.7	128	0.5876	0.12	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS49	0-2	Nickel	21	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.21	101.7	128	0.5876	0.12	64.2	0.00
Boeing RFI Subarea 1B Southeast	PPBS1033	0-2	Nickel	21	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.21	101.7	128	0.5876	0.12	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1032	0-2	Nickel	20	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.20	101.7	128	0.5876	0.12	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1215	0-2	Nickel	20	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.20	101.7	128	0.5876	0.12	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1017	0-2	Nickel	20	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.20	101.7	128	0.5876	0.12	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1042	0-2	Nickel	20	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.20	101.7	128	0.5876	0.12	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1024	0-2	Nickel	20	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.20	101.7	128	0.5876	0.12	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1048	0-2	Nickel	19	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.19	101.7	128	0.5876	0.11	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1217	0-2	Nickel	19	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.19	101.7	128	0.5876	0.11	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1046	0-2	Nickel	18.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.18	101.7	128	0.5876	0.11	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1033	0-2	Nickel	18	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.18	101.7	128	0.5876	0.11	64.2	0.00
Boeing RFI Subarea 1B Southeast	TTBS1264	0-2	Nickel	18	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.18	101.7	128	0.5876	0.11	64.2	0.00
Boeing RFI Subarea 1B Southeast	PPBS1009	0-2	Nickel	17.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.18	101.7	128	0.5876	0.10	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1029	0-2	Nickel	17.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.17	101.7	128	0.5876	0.10	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS22	0-2	Nickel	17.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.17	101.7	128	0.5876	0.10	64.2	0.00

Boeing RFI Subarea 1B Southeast	CLBS1020	0-2	Nickel	17.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.17	101.7	128	0.5876	0.10	64.2	0.00
Boeing RFI Subarea 1B Southeast	PPBS1004	0-2	Nickel	17	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.17	101.7	128	0.5876	0.10	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1194	0-2	Nickel	16.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.17	101.7	128	0.5876	0.10	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1013	0-2	Nickel	16.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.17	101.7	128	0.5876	0.10	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1054	0-2	Nickel	16	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.16	101.7	128	0.5876	0.09	64.2	0.00
Boeing RFI Subarea 1B Southeast	TTBS1176	0-2	Nickel	15.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.16	101.7	128	0.5876	0.09	64.2	0.00
Boeing RFI Subarea 1B Southeast	PPBS1025	0-2	Nickel	15.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.16	101.7	128	0.5876	0.09	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1039	0-2	Nickel	15.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.16	101.7	128	0.5876	0.09	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1027	0-2	Nickel	15.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	101.7	128	0.5876	0.09	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS17	0-2	Nickel	15	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	101.7	128	0.5876	0.09	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1014	0-2	Nickel	15	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	101.7	128	0.5876	0.09	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1113	0-2	Nickel	15	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	101.7	128	0.5876	0.09	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1220	0-2	Nickel	15	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	101.7	128	0.5876	0.09	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLTS1101	0-2	Nickel	15	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	101.7	128	0.5876	0.09	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1031	0-2	Nickel	15	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	101.7	128	0.5876	0.09	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1019	0-2	Nickel	15	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	101.7	128	0.5876	0.09	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1015	0-2	Nickel	15	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	101.7	128	0.5876	0.09	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1219	0-2	Nickel	15	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	101.7	128	0.5876	0.09	64.2	0.00
Boeing RFI Subarea 1B Southeast	TTBS1173	0-2	Nickel	14.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	101.7	128	0.5876	0.09	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1192	0-2	Nickel	14.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	101.7	128	0.5876	0.09	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1056	0-2	Nickel	14.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	101.7	128	0.5876	0.08	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1148	0-2	Nickel	14.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	101.7	128	0.5876	0.08	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS26	0-2	Nickel	14	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	101.7	128	0.5876	0.08	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1113	0-2	Nickel	14	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	101.7	128	0.5876	0.08	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS07	0-2	Nickel	14	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.14	101.7	128	0.5876	0.08	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1059	0-2	Nickel	14	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	101.7	128	0.5876	0.08	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1007	0-2	Nickel	14	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	101.7	128	0.5876	0.08	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1050	0-2	Nickel	14	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	101.7	128	0.5876	0.08	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1018	0-2	Nickel	14	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	101.7	128	0.5876	0.08	64.2	0.00
Boeing RFI Subarea 1B Southeast	PPSS03	0-2	Nickel	13.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	101.7	128	0.5876	0.08	64.2	0.00
Boeing RFI Subarea 1B Southeast	TTBS1219	0-2	Nickel	13.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	101.7	128	0.5876	0.08	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1043	0-2	Nickel	13.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	101.7	128	0.5876	0.08	64.2	0.00
Boeing RFI Subarea 1B Southeast	PPBS1024	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	101.7	128	0.5876	0.08	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1104	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	101.7	128	0.5876	0.08	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1040	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	101.7	128	0.5876	0.08	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1003	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	101.7	128	0.5876	0.08	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1002	0-2	Nickel	12.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	101.7	128	0.5876	0.07	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1193	0-2	Nickel	12.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	101.7	128	0.5876	0.07	64.2	0.00
Boeing RFI Subarea 1B Southeast	TTBS1220	0-2	Nickel	12.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	101.7	128	0.5876	0.07	64.2	0.00
Boeing RFI Subarea 1B Southeast	PPBS1026	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	101.7	128	0.5876	0.07	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1041	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	101.7	128	0.5876	0.07	64.2	0.00
Boeing RFI Subarea 1B Southeast	PPBS1012	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	101.7	128	0.5876	0.07	64.2	0.00
Boeing RFI Subarea 1B Southeast	PPBS1034	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	101.7	128	0.5876	0.07	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1100	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	101.7	128	0.5876	0.07	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1209	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	101.7	128	0.5876	0.07	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1052	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	101.7	128	0.5876	0.07	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1049	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	101.7	128	0.5876	0.07	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1047	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	101.7	128	0.5876	0.07	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1009	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	101.7	128	0.5876	0.07	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS03	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	101.7	128	0.5876	0.07	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1005	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	101.7	128	0.5876	0.07	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1058	0-2	Nickel	11.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	101.7	128	0.5876	0.07	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS32	0-2	Nickel	11.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	101.7	128	0.5876	0.07	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1188	0-2	Nickel	11.5	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.12	101.7	128	0.5876	0.07	64.2	0.00
Boeing RFI Subarea 1B Southeast	TTBS1177	0-2	Nickel	11.4	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.11	101.7	128	0.5876	0.07	64.2	0.00

Boeing RFI Subarea 1B Southeast	PPBS1035	0-2	Nickel	11.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	101.7	128	0.5876	0.07	64.2	0.00
Boeing RFI Subarea 1B Southeast	PPBS1014	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	101.7	128	0.5876	0.06	64.2	0.00
Boeing RFI Subarea 1B Southeast	PPBS1023	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	101.7	128	0.5876	0.06	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1102	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	101.7	128	0.5876	0.06	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1044	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	101.7	128	0.5876	0.06	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1034	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	101.7	128	0.5876	0.06	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1028	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	101.7	128	0.5876	0.06	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1011	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	101.7	128	0.5876	0.06	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1012	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	101.7	128	0.5876	0.06	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1008	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	101.7	128	0.5876	0.06	64.2	0.00
Boeing RFI Subarea 1B Southeast	TTBS1221	0-2	Nickel	10.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	101.7	128	0.5876	0.06	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS28	0-2	Nickel	10.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	101.7	128	0.5876	0.06	64.2	0.00
Boeing RFI Subarea 1B Southeast	TTBS1192	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	101.7	128	0.5876	0.06	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1101	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	101.7	128	0.5876	0.06	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1212	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	101.7	128	0.5876	0.06	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1010	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	101.7	128	0.5876	0.06	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1051	0-2	Nickel	9.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	101.7	128	0.5876	0.06	64.2	0.00
Boeing RFI Subarea 1B Southeast	TTBS1178	0-2	Nickel	9.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	101.7	128	0.5876	0.06	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1016	0-2	Nickel	9.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	101.7	128	0.5876	0.06	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1023	0-2	Nickel	9.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	101.7	128	0.5876	0.06	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1103	0-2	Nickel	9.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	101.7	128	0.5876	0.05	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS20	0-2	Nickel	9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	101.7	128	0.5876	0.05	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1035	0-2	Nickel	8.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	101.7	128	0.5876	0.05	64.2	0.00
Boeing RFI Subarea 1B Southeast	SWBS1008	0-2	Nickel	8.85	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	101.7	128	0.5876	0.05	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1144	0-2	Nickel	8.6	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.09	101.7	128	0.5876	0.05	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1004	0-2	Nickel	8.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	101.7	128	0.5876	0.05	64.2	0.00
Boeing RFI Subarea 1B Southeast	TTBS1210	0-2	Nickel	8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	101.7	128	0.5876	0.05	64.2	0.00
Boeing RFI Subarea 1B Southeast	PPSS02	0-2	Nickel	6.8	mg/kg	B	Mule Deer	High TRV-Based RBSL	100	0.07	101.7	128	0.5876	0.04	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1021	0-2	Nickel	6.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	101.7	128	0.5876	0.04	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS1037	0-2	Nickel	6.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.06	101.7	128	0.5876	0.04	64.2	0.00
Boeing RFI Subarea 1B Southeast	CLBS0088	0-2	Nickel	3.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.04	101.7	128	0.5876	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1044	0-2	Nickel	1630	mg/kg		Mule Deer	High TRV-Based RBSL	100	16.30	83.1	128	0.2427	3.96	64.2	3.80
Boeing RFI Subarea 1B Southwest	SB_TTF-26	0-2	Nickel	1300	mg/kg		Mule Deer	High TRV-Based RBSL	100	13.00	83.1	128	0.2427	3.15	64.2	3.00
Boeing RFI Subarea 1B Southwest	TTBS17	0-2	Nickel	660	mg/kg		Mule Deer	High TRV-Based RBSL	100	6.60	83.1	128	0.2427	1.60	64.2	1.45
Boeing RFI Subarea 1B Southwest	SB_TTF-24	0-2	Nickel	350	mg/kg		Mule Deer	High TRV-Based RBSL	100	3.50	83.1	128	0.2427	0.85	64.2	0.69
Boeing RFI Subarea 1B Southwest	TTBS1098	0-2	Nickel	234	mg/kg		Mule Deer	High TRV-Based RBSL	100	2.34	83.1	128	0.2427	0.57	64.2	0.41
Boeing RFI Subarea 1B Southwest	TTTS1010	0-2	Nickel	217	mg/kg		Mule Deer	High TRV-Based RBSL	100	2.17	83.1	128	0.2427	0.53	64.2	0.37
Boeing RFI Subarea 1B Southwest	TTBS1262	0-2	Nickel	170	mg/kg		Mule Deer	High TRV-Based RBSL	100	1.70	83.1	128	0.2427	0.41	64.2	0.26
Boeing RFI Subarea 1B Southwest	TTBS1193	0-2	Nickel	160	mg/kg		Mule Deer	High TRV-Based RBSL	100	1.60	83.1	128	0.2427	0.39	64.2	0.23
Boeing RFI Subarea 1B Southwest	TTBS1262	0-2	Nickel	150	mg/kg		Mule Deer	High TRV-Based RBSL	100	1.50	83.1	128	0.2427	0.36	64.2	0.21
Boeing RFI Subarea 1B Southwest	SB_TTF-27	0-2	Nickel	144	mg/kg		Mule Deer	High TRV-Based RBSL	100	1.44	83.1	128	0.2427	0.35	64.2	0.19
Boeing RFI Subarea 1B Southwest	TTBS1261	0-2	Nickel	140	mg/kg		Mule Deer	High TRV-Based RBSL	100	1.40	83.1	128	0.2427	0.34	64.2	0.18
Boeing RFI Subarea 1B Southwest	TTBS1261	0-2	Nickel	130	mg/kg		Mule Deer	High TRV-Based RBSL	100	1.30	83.1	128	0.2427	0.32	64.2	0.16
Boeing RFI Subarea 1B Southwest	SB_TTF-25	0-2	Nickel	120	mg/kg		Mule Deer	High TRV-Based RBSL	100	1.20	83.1	128	0.2427	0.29	64.2	0.14
Boeing RFI Subarea 1B Southwest	TTBS1101	0-2	Nickel	110	mg/kg		Mule Deer	High TRV-Based RBSL	100	1.10	83.1	128	0.2427	0.27	64.2	0.11
Boeing RFI Subarea 1B Southwest	TTTS1011	0-2	Nickel	102	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	1.02	83.1	128	0.2427	0.25	64.2	0.09
Boeing RFI Subarea 1B Southwest	TTBS1095	0-2	Nickel	84	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.84	83.1	128	0.2427	0.20	64.2	0.05
Boeing RFI Subarea 1B Southwest	TTBS53	0-2	Nickel	69	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.69	83.1	128	0.2427	0.17	64.2	0.01
Boeing RFI Subarea 1B Southwest	TTBS15	0-2	Nickel	62	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.62	83.1	128	0.2427	0.15	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1013	0-2	Nickel	61.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.61	83.1	128	0.2427	0.15	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-37	0-2	Nickel	61	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.61	83.1	128	0.2427	0.15	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1070	0-2	Nickel	60.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.60	83.1	128	0.2427	0.15	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS08	0-2	Nickel	58.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.59	83.1	128	0.2427	0.14	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS54	0-2	Nickel	58	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.58	83.1	128	0.2427	0.14	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS19	0-2	Nickel	56	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.56	83.1	128	0.2427	0.14	64.2	0.00

Boeing RFI Subarea 1B Southwest	TTBS66	0-2	Nickel	56	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.56	83.1	128	0.2427	0.14	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1057	0-2	Nickel	54	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.54	83.1	128	0.2427	0.13	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS22	0-2	Nickel	49	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.49	83.1	128	0.2427	0.12	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1004	0-2	Nickel	46	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.46	83.1	128	0.2427	0.11	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1094	0-2	Nickel	46	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.46	83.1	128	0.2427	0.11	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1157	0-2	Nickel	44.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.45	83.1	128	0.2427	0.11	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS67	0-2	Nickel	43	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.43	83.1	128	0.2427	0.10	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1222	0-2	Nickel	42.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.43	83.1	128	0.2427	0.10	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1091	0-2	Nickel	42	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.42	83.1	128	0.2427	0.10	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1040	0-2	Nickel	41.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.41	83.1	128	0.2427	0.10	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1068	0-2	Nickel	41.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.41	83.1	128	0.2427	0.10	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1016	0-2	Nickel	40	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.40	83.1	128	0.2427	0.10	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1096	0-2	Nickel	39.2	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.39	83.1	128	0.2427	0.10	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1017	0-2	Nickel	37.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.37	83.1	128	0.2427	0.09	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-44	0-2	Nickel	37	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.37	83.1	128	0.2427	0.09	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1175	0-2	Nickel	36	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.36	83.1	128	0.2427	0.09	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1043	0-2	Nickel	35	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.35	83.1	128	0.2427	0.08	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS18	0-2	Nickel	34	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.34	83.1	128	0.2427	0.08	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF_RR-8	0-2	Nickel	34	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.34	83.1	128	0.2427	0.08	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1015	0-2	Nickel	34	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.34	83.1	128	0.2427	0.08	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS57	0-2	Nickel	34	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.34	83.1	128	0.2427	0.08	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS63	0-2	Nickel	33	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.33	83.1	128	0.2427	0.08	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1102	0-2	Nickel	33	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.33	83.1	128	0.2427	0.08	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1089	0-2	Nickel	32	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.32	83.1	128	0.2427	0.08	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1087	0-2	Nickel	30	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.30	83.1	128	0.2427	0.07	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1155	0-2	Nickel	30	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.30	83.1	128	0.2427	0.07	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-22	0-2	Nickel	29	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.29	83.1	128	0.2427	0.07	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1150	0-2	Nickel	29	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.29	83.1	128	0.2427	0.07	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1051	0-2	Nickel	28	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.28	83.1	128	0.2427	0.07	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1030	0-2	Nickel	27.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.28	83.1	128	0.2427	0.07	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1083	0-2	Nickel	27.4	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.27	83.1	128	0.2427	0.07	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1092	0-2	Nickel	27.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.27	83.1	128	0.2427	0.07	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS71	0-2	Nickel	27	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.27	83.1	128	0.2427	0.07	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1093	0-2	Nickel	27	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.27	83.1	128	0.2427	0.07	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1045	0-2	Nickel	27	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.27	83.1	128	0.2427	0.07	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1086	0-2	Nickel	26.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.27	83.1	128	0.2427	0.06	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS35	0-2	Nickel	26	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.26	83.1	128	0.2427	0.06	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1066	0-2	Nickel	26	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.26	83.1	128	0.2427	0.06	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-17	0-2	Nickel	26	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.26	83.1	128	0.2427	0.06	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1150	0-2	Nickel	26	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.26	83.1	128	0.2427	0.06	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS70	0-2	Nickel	25	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.25	83.1	128	0.2427	0.06	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1225	0-2	Nickel	24.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.25	83.1	128	0.2427	0.06	64.2	0.00
Boeing RFI Subarea 1B Southwest	SWBS1007	0-2	Nickel	24.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.25	83.1	128	0.2427	0.06	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1097	0-2	Nickel	24	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.24	83.1	128	0.2427	0.06	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1150	0-2	Nickel	24	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.24	83.1	128	0.2427	0.06	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1084	0-2	Nickel	24	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.24	83.1	128	0.2427	0.06	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-21	0-2	Nickel	24	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.24	83.1	128	0.2427	0.06	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-42	0-2	Nickel	24	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.24	83.1	128	0.2427	0.06	64.2	0.00
Boeing RFI Subarea 1B Southwest	PPBS1039	0-2	Nickel	23	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.23	83.1	128	0.2427	0.06	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-10	0-2	Nickel	23	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.23	83.1	128	0.2427	0.06	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-32	0-2	Nickel	23	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.23	83.1	128	0.2427	0.06	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS36	0-2	Nickel	22	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.22	83.1	128	0.2427	0.05	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1014	0-2	Nickel	22	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.22	83.1	128	0.2427	0.05	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1153	0-2	Nickel	22	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.22	83.1	128	0.2427	0.05	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1090	0-2	Nickel	22	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.22	83.1	128	0.2427	0.05	64.2	0.00

Boeing RFI Subarea 1B Southwest	TTBS1263	0-2	Nickel	22	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.22	83.1	128	0.2427	0.05	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS68	0-2	Nickel	22	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.22	83.1	128	0.2427	0.05	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS49	0-2	Nickel	21.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.22	83.1	128	0.2427	0.05	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1179	0-2	Nickel	21.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.21	83.1	128	0.2427	0.05	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1031	0-2	Nickel	21.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.21	83.1	128	0.2427	0.05	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1174	0-2	Nickel	21	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.21	83.1	128	0.2427	0.05	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1041	0-2	Nickel	21	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.21	83.1	128	0.2427	0.05	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1031	0-2	Nickel	21	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.21	83.1	128	0.2427	0.05	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1104	0-2	Nickel	21	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.21	83.1	128	0.2427	0.05	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1152	0-2	Nickel	21	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.21	83.1	128	0.2427	0.05	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS69	0-2	Nickel	21	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.21	83.1	128	0.2427	0.05	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1099	0-2	Nickel	20.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.20	83.1	128	0.2427	0.05	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1163	0-2	Nickel	20.2	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.20	83.1	128	0.2427	0.05	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1111	0-2	Nickel	20	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.20	83.1	128	0.2427	0.05	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-19	0-2	Nickel	20	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.20	83.1	128	0.2427	0.05	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-20	0-2	Nickel	20	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.20	83.1	128	0.2427	0.05	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1052	0-2	Nickel	20	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.20	83.1	128	0.2427	0.05	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-30	0-2	Nickel	20	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.20	83.1	128	0.2427	0.05	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1154	0-2	Nickel	20	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.20	83.1	128	0.2427	0.05	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1110	0-2	Nickel	20	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.20	83.1	128	0.2427	0.05	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1028	0-2	Nickel	19.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.19	83.1	128	0.2427	0.05	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1032	0-2	Nickel	19	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.19	83.1	128	0.2427	0.05	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS23	0-2	Nickel	19	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.19	83.1	128	0.2427	0.05	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1012	0-2	Nickel	18.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.19	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1183	0-2	Nickel	18.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.18	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1085	0-2	Nickel	18.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.18	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1037	0-2	Nickel	18.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.18	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1148	0-2	Nickel	18.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.18	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS52	0-2	Nickel	18	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.18	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1159	0-2	Nickel	18	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.18	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1133	0-2	Nickel	17.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.18	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1016	0-2	Nickel	17.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.18	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1149	0-2	Nickel	17.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.18	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1027	0-2	Nickel	17.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.17	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1086	0-2	Nickel	17	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.17	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-41	0-2	Nickel	17	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.17	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS62	0-2	Nickel	17	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.17	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-38	0-2	Nickel	17	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.17	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1156	0-2	Nickel	17	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.17	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1020	0-2	Nickel	17	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.17	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1032	0-2	Nickel	17	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.17	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1014	0-2	Nickel	17	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.17	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1082	0-2	Nickel	17	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.17	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1186	0-2	Nickel	17	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.17	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-9	0-2	Nickel	17	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.17	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-12	0-2	Nickel	17	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.17	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1011	0-2	Nickel	17	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.17	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1109	0-2	Nickel	17	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.17	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1038	0-2	Nickel	17	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.17	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1043	0-2	Nickel	16.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.17	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1042	0-2	Nickel	16.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.17	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1029	0-2	Nickel	16.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.16	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1130	0-2	Nickel	16.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.16	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1108	0-2	Nickel	16.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.16	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1039	0-2	Nickel	16	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.16	83.1	128	0.2427	0.04	64.2	0.00

Boeing RFI Subarea 1B Southwest	TTBS1035	0-2	Nickel	16	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.16	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1151	0-2	Nickel	16	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.16	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1034	0-2	Nickel	16	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.16	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1077	0-2	Nickel	16	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.16	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1081	0-2	Nickel	16	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.16	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1129	0-2	Nickel	16	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.16	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1194	0-2	Nickel	16	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.16	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1002	0-2	Nickel	15.8	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.16	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1121	0-2	Nickel	15.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.16	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1033	0-2	Nickel	15.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1144	0-2	Nickel	15.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1111	0-2	Nickel	15	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1118	0-2	Nickel	15	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-18	0-2	Nickel	15	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1124	0-2	Nickel	15	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1055	0-2	Nickel	15	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.15	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1125	0-2	Nickel	15	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1039	0-2	Nickel	15	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1141	0-2	Nickel	15	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-6	0-2	Nickel	15	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1079	0-2	Nickel	14.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1030	0-2	Nickel	14.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1037	0-2	Nickel	14.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1135	0-2	Nickel	14.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1017	0-2	Nickel	14.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1062	0-2	Nickel	14.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1018	0-2	Nickel	14.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	83.1	128	0.2427	0.04	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1008	0-2	Nickel	14.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1147	0-2	Nickel	14.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1009	0-2	Nickel	14.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1036	0-2	Nickel	14.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1136	0-2	Nickel	14.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1006	0-2	Nickel	14	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1001	0-2	Nickel	14	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-13	0-2	Nickel	14	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1027	0-2	Nickel	14	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-16	0-2	Nickel	14	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1023	0-2	Nickel	14	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1029	0-2	Nickel	14	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1038	0-2	Nickel	14	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1008	0-2	Nickel	14	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1007	0-2	Nickel	14	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1142	0-2	Nickel	14	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS45	0-2	Nickel	14	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1041	0-2	Nickel	14	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1074	0-2	Nickel	14	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1186	0-2	Nickel	14	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1161	0-2	Nickel	14	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1158	0-2	Nickel	13.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1028	0-2	Nickel	13.4	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.13	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1034	0-2	Nickel	13.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1005	0-2	Nickel	13.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1067	0-2	Nickel	13.2	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.13	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1134	0-2	Nickel	13.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1080	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	83.1	128	0.2427	0.03	64.2	0.00

Boeing RFI Subarea 1B Southwest	TTTS1040	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1042	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1003	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1128	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1024	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1033	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1036	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1131	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1180	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-36	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1000	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1007	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1017	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1103	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1039	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1088	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1184	0-2	Nickel	12.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1194	0-2	Nickel	12.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1099	0-2	Nickel	12.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1169	0-2	Nickel	12.7	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.13	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1100	0-2	Nickel	12.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1123	0-2	Nickel	12.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1020	0-2	Nickel	12.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1000	0-2	Nickel	12.7	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.13	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1026	0-2	Nickel	12.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1103	0-2	Nickel	12.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1069	0-2	Nickel	12.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1106	0-2	Nickel	12.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1030	0-2	Nickel	12.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1257	0-2	Nickel	12.1	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.12	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1199	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1010	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1025	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-43	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1204	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1130	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1063	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-39	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1196	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1182	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1172	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-34	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-31	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1101	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1037	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1038	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1025	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1024	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS65	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS04	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1005	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1006	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1035	0-2	Nickel	11.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1003	0-2	Nickel	11.8	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.12	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1164	0-2	Nickel	11.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	83.1	128	0.2427	0.03	64.2	0.00

Boeing RFI Subarea 1B Southwest	TTBS1137	0-2	Nickel	11.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1001	0-2	Nickel	11.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1119	0-2	Nickel	11.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1021	0-2	Nickel	11.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1137	0-2	Nickel	11.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1145	0-2	Nickel	11.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1134	0-2	Nickel	11.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1122	0-2	Nickel	11.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1164	0-2	Nickel	11.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1119	0-2	Nickel	11.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1021	0-2	Nickel	11.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1060	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1011	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1075	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1076	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1047	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS11	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-40	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1113	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-2	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1132	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1032	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1024	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS10	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1106	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS30	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS44	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1001	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-11	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS42	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1188	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1199	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1206	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1049	0-2	Nickel	10.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1158	0-2	Nickel	10.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1224	0-2	Nickel	10.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1036	0-2	Nickel	10.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1009	0-2	Nickel	10.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1105	0-2	Nickel	10.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1127	0-2	Nickel	10.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1010	0-2	Nickel	10.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1033	0-2	Nickel	10.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1143	0-2	Nickel	10.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1061	0-2	Nickel	10.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1004	0-2	Nickel	10.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1020	0-2	Nickel	10.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1072	0-2	Nickel	10.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.03	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1019	0-2	Nickel	10.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1048	0-2	Nickel	10.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1203	0-2	Nickel	10.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1139	0-2	Nickel	10.2	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1002	0-2	Nickel	10.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1046	0-2	Nickel	10.1	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1169	0-2	Nickel	10.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1040	0-2	Nickel	10.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00

Boeing RFI Subarea 1B Southwest	TTBS1201	0-2	Nickel	10.1	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1216	0-2	Nickel	10.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1167	0-2	Nickel	10.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS33	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS46	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1026	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1011	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1060	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1026	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS29	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS43	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1107	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1073	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1162	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1195	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1112	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1126	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1056	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1139	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1035	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1029	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1053	0-2	Nickel	9.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1059	0-2	Nickel	9.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1117	0-2	Nickel	9.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1074	0-2	Nickel	9.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1156	0-2	Nickel	9.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1181	0-2	Nickel	9.8	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1050	0-2	Nickel	9.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1121	0-2	Nickel	9.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1108	0-2	Nickel	9.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1107	0-2	Nickel	9.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1013	0-2	Nickel	9.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1205	0-2	Nickel	9.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1202	0-2	Nickel	9.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1004	0-2	Nickel	9.69	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1006	0-2	Nickel	9.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1104	0-2	Nickel	9.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1002	0-2	Nickel	9.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1146	0-2	Nickel	9.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1071	0-2	Nickel	9.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1022	0-2	Nickel	9.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1160	0-2	Nickel	9.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1025	0-2	Nickel	9.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1189	0-2	Nickel	9.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1022	0-2	Nickel	9.33	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1202	0-2	Nickel	9.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1078	0-2	Nickel	9.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1054	0-2	Nickel	9.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS08	0-2	Nickel	9.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1168	0-2	Nickel	9.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1171	0-2	Nickel	9.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1042	0-2	Nickel	9.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-33	0-2	Nickel	9.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1170	0-2	Nickel	9.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS09	0-2	Nickel	9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	83.1	128	0.2427	0.02	64.2	0.00

Boeing RFI Subarea 1B Southwest	CTBS1018	0-2	Nickel	9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-14	0-2	Nickel	9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1105	0-2	Nickel	9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-23	0-2	Nickel	9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1123	0-2	Nickel	9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS48	0-2	Nickel	8.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-5	0-2	Nickel	8.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1044	0-2	Nickel	8.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1012	0-2	Nickel	8.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1203	0-2	Nickel	8.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1116	0-2	Nickel	8.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1021	0-2	Nickel	8.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	CTBS1102	0-2	Nickel	8.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1019	0-2	Nickel	8.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1018	0-2	Nickel	8.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1027	0-2	Nickel	8.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1152	0-2	Nickel	8.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1019	0-2	Nickel	8.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS13	0-2	Nickel	8.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1166	0-2	Nickel	8.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1140	0-2	Nickel	8.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1200	0-2	Nickel	8.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS24	0-2	Nickel	8.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1201	0-2	Nickel	8.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1159	0-2	Nickel	8.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1122	0-2	Nickel	8.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1061	0-2	Nickel	8.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-1	0-2	Nickel	8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1064	0-2	Nickel	7.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS80	0-2	Nickel	7.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1005	0-2	Nickel	7.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-8	0-2	Nickel	7.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1120	0-2	Nickel	7.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS28	0-2	Nickel	7.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1138	0-2	Nickel	7.6	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.08	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1003	0-2	Nickel	7.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1068	0-2	Nickel	7.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1058	0-2	Nickel	7.33	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1015	0-2	Nickel	7.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1185	0-2	Nickel	7.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1160	0-2	Nickel	7.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1120	0-2	Nickel	7.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-15	0-2	Nickel	7.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-35	0-2	Nickel	7.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS27	0-2	Nickel	6.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1071	0-2	Nickel	6.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1004	0-2	Nickel	6.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1185	0-2	Nickel	6.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1009	0-2	Nickel	6.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1022	0-2	Nickel	6.52	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1003	0-2	Nickel	6.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.06	83.1	128	0.2427	0.02	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1065	0-2	Nickel	5.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.06	83.1	128	0.2427	0.01	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS1023	0-2	Nickel	5.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.05	83.1	128	0.2427	0.01	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTTS1000	0-2	Nickel	5.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.05	83.1	128	0.2427	0.01	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-3	0-2	Nickel	4.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.05	83.1	128	0.2427	0.01	64.2	0.00

Boeing RFI Subarea 1B Southwest	TTBS1014	0-2	Nickel	4.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.05	83.1	128	0.2427	0.01	64.2	0.00
Boeing RFI Subarea 1B Southwest	R_TTF_0229-1	0-2	Nickel	4.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.04	83.1	128	0.2427	0.01	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-4	0-2	Nickel	3.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.04	83.1	128	0.2427	0.01	64.2	0.00
Boeing RFI Subarea 1B Southwest	SB_TTF-7	0-2	Nickel	3.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.04	83.1	128	0.2427	0.01	64.2	0.00
Boeing RFI Subarea 1B Southwest	TTBS47	0-2	Nickel	1.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.02	83.1	128	0.2427	0.00	64.2	0.00
Boeing RFI Subarea 1B Southwest	R_TTF_0229-2	0-2	Nickel	1.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.01	83.1	128	0.2427	0.00	64.2	0.00
Boeing RFI Subarea 1B Southwest	R_TTF_0229-1	0-2	Nickel	0.86	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.01	83.1	128	0.2427	0.00	64.2	0.00
Boeing RFI Subarea 1B Southwest	R_TTF_0229-	0-2	Nickel	0.12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.00	83.1	128	0.2427	0.00	64.2	0.00
Boeing RFI Subarea 1B Southwest	R_TTF_0229-	0-2	Nickel	0.02	mg/kg	U	Mule Deer	High TRV-Based RBSL	100	0.00	83.1	128	0.2427	0.00	64.2	0.00
Boeing RFI Subarea 1B Southwest	R_TTF_0229-	0-2	Nickel	0.02	mg/kg	U	Mule Deer	High TRV-Based RBSL	100	0.00	83.1	128	0.2427	0.00	64.2	0.00
Boeing RFI Subarea 1B Southwest	R_TTF_0229-	0-2	Nickel	0.02	mg/kg	U	Mule Deer	High TRV-Based RBSL	100	0.00	83.1	128	0.2427	0.00	64.2	0.00
Boeing RFI Subarea 1B Southwest	R_TTF_0229-	0-2	Nickel	0.005	mg/kg	U	Mule Deer	High TRV-Based RBSL	100	0.00	83.1	128	0.2427	0.00	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1035	0-2	Nickel	55	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.55	58.3	128	0.2244	0.12	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1035	0-2	Nickel	46.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.47	58.3	128	0.2244	0.10	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1406	0-2	Nickel	37	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.37	58.3	128	0.2244	0.08	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS09	0-2	Nickel	31	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.31	58.3	128	0.2244	0.07	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1020	0-2	Nickel	29.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.29	58.3	128	0.2244	0.07	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1032	0-2	Nickel	28.7	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.29	58.3	128	0.2244	0.06	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1407	0-2	Nickel	28	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.28	58.3	128	0.2244	0.06	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS1032	0-2	Nickel	27.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.28	58.3	128	0.2244	0.06	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS1025	0-2	Nickel	26.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.27	58.3	128	0.2244	0.06	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1008	0-2	Nickel	26.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.27	58.3	128	0.2244	0.06	64.2	0.00
Boeing RFI Subarea 5/9 North	ECSS02	0-2	Nickel	26.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.26	58.3	128	0.2244	0.06	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1023	0-2	Nickel	25.4	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.25	58.3	128	0.2244	0.06	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS10	0-2	Nickel	25	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.25	58.3	128	0.2244	0.06	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS1031	0-2	Nickel	23.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.23	58.3	128	0.2244	0.05	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS14	0-2	Nickel	23	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.23	58.3	128	0.2244	0.05	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS1016	0-2	Nickel	22.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.23	58.3	128	0.2244	0.05	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS1024	0-2	Nickel	22.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.22	58.3	128	0.2244	0.05	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1033	0-2	Nickel	22.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.22	58.3	128	0.2244	0.05	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS1017	0-2	Nickel	22	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.22	58.3	128	0.2244	0.05	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1006	0-2	Nickel	22	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.22	58.3	128	0.2244	0.05	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1013	0-2	Nickel	21.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.22	58.3	128	0.2244	0.05	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS1027	0-2	Nickel	21.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.21	58.3	128	0.2244	0.05	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1009	0-2	Nickel	20.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.21	58.3	128	0.2244	0.05	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS1033	0-2	Nickel	20.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.20	58.3	128	0.2244	0.05	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1037	0-2	Nickel	20	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.20	58.3	128	0.2244	0.04	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1017	0-2	Nickel	20	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.20	58.3	128	0.2244	0.04	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1031	0-2	Nickel	20	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.20	58.3	128	0.2244	0.04	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS1035	0-2	Nickel	19.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.19	58.3	128	0.2244	0.04	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1016	0-2	Nickel	19.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.19	58.3	128	0.2244	0.04	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS22	0-2	Nickel	19	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.19	58.3	128	0.2244	0.04	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS1018	0-2	Nickel	18.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.19	58.3	128	0.2244	0.04	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS1036	0-2	Nickel	18.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.18	58.3	128	0.2244	0.04	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS1019	0-2	Nickel	18.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.18	58.3	128	0.2244	0.04	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1021	0-2	Nickel	18	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.18	58.3	128	0.2244	0.04	64.2	0.00
Boeing RFI Subarea 5/9 North	D-5-02	0-2	Nickel	18	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.18	58.3	128	0.2244	0.04	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS1015	0-2	Nickel	17.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.17	58.3	128	0.2244	0.04	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS1018	0-2	Nickel	16.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.17	58.3	128	0.2244	0.04	64.2	0.00
Boeing RFI Subarea 5/9 North	ECSS01	0-2	Nickel	16.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.17	58.3	128	0.2244	0.04	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1025	0-2	Nickel	16.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.17	58.3	128	0.2244	0.04	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1034	0-2	Nickel	16.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.17	58.3	128	0.2244	0.04	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS1040	0-2	Nickel	16.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.16	58.3	128	0.2244	0.04	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS1022	0-2	Nickel	16	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.16	58.3	128	0.2244	0.04	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS1030	0-2	Nickel	15.9	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.16	58.3	128	0.2244	0.04	64.2	0.00

Boeing RFI Subarea 5/9 North	SNBS1020	0-2	Nickel	15.7	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.16	58.3	128	0.2244	0.04	64.2	0.00
Boeing RFI Subarea 5/9 North	SPBS1045	0-2	Nickel	15.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	58.3	128	0.2244	0.03	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS11	0-2	Nickel	15	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	58.3	128	0.2244	0.03	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS02	0-2	Nickel	15	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	58.3	128	0.2244	0.03	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS03	0-2	Nickel	15	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	58.3	128	0.2244	0.03	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS04	0-2	Nickel	14	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	58.3	128	0.2244	0.03	64.2	0.00
Boeing RFI Subarea 5/9 North	BUBS07	0-2	Nickel	14	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	58.3	128	0.2244	0.03	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1005	0-2	Nickel	14	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	58.3	128	0.2244	0.03	64.2	0.00
Boeing RFI Subarea 5/9 North	D-5-03	0-2	Nickel	14	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	58.3	128	0.2244	0.03	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1007	0-2	Nickel	13.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	58.3	128	0.2244	0.03	64.2	0.00
Boeing RFI Subarea 5/9 North	ECTS06S01	0-2	Nickel	13.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	58.3	128	0.2244	0.03	64.2	0.00
Boeing RFI Subarea 5/9 North	SPBS1046	0-2	Nickel	13.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	58.3	128	0.2244	0.03	64.2	0.00
Boeing RFI Subarea 5/9 North	SPBS1044	0-2	Nickel	13.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	58.3	128	0.2244	0.03	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS1039	0-2	Nickel	13.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	58.3	128	0.2244	0.03	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS1021	0-2	Nickel	13.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	58.3	128	0.2244	0.03	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS12	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	58.3	128	0.2244	0.03	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS21	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	58.3	128	0.2244	0.03	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1036	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	58.3	128	0.2244	0.03	64.2	0.00
Boeing RFI Subarea 5/9 North	ECTS02S01	0-2	Nickel	12.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	58.3	128	0.2244	0.03	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1030	0-2	Nickel	12.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	58.3	128	0.2244	0.03	64.2	0.00
Boeing RFI Subarea 5/9 North	BGSS03	0-2	Nickel	12.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	58.3	128	0.2244	0.03	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1001	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	58.3	128	0.2244	0.03	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS1014	0-2	Nickel	11.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	58.3	128	0.2244	0.02	64.2	0.00
Boeing RFI Subarea 5/9 North	NCBS1017	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	58.3	128	0.2244	0.02	64.2	0.00
Boeing RFI Subarea 5/9 North	BUBS0020	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	58.3	128	0.2244	0.02	64.2	0.00
Boeing RFI Subarea 5/9 North	NCBS1018	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	58.3	128	0.2244	0.02	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS16	0-2	Nickel	10.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	58.3	128	0.2244	0.02	64.2	0.00
Boeing RFI Subarea 5/9 North	NCBS1019	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	58.3	128	0.2244	0.02	64.2	0.00
Boeing RFI Subarea 5/9 North	D-5-04	0-2	Nickel	9.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	58.3	128	0.2244	0.02	64.2	0.00
Boeing RFI Subarea 5/9 North	D-5-05	0-2	Nickel	9.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	58.3	128	0.2244	0.02	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS13	0-2	Nickel	9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	58.3	128	0.2244	0.02	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1014	0-2	Nickel	8.6	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.09	58.3	128	0.2244	0.02	64.2	0.00
Boeing RFI Subarea 5/9 North	CDBS1032	0-2	Nickel	8.36	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.08	58.3	128	0.2244	0.02	64.2	0.00
Boeing RFI Subarea 5/9 North	ECBS1011	0-2	Nickel	8.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	58.3	128	0.2244	0.02	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS1034	0-2	Nickel	8.13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	58.3	128	0.2244	0.02	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS16	0-2	Nickel	8	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.08	58.3	128	0.2244	0.02	64.2	0.00
Boeing RFI Subarea 5/9 North	SPBS0028	0-2	Nickel	7.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	58.3	128	0.2244	0.02	64.2	0.00
Boeing RFI Subarea 5/9 North	BUBS0021	0-2	Nickel	7.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	58.3	128	0.2244	0.02	64.2	0.00
Boeing RFI Subarea 5/9 North	SNBS18	0-2	Nickel	6.65	mg/kg	UJ	Mule Deer	High TRV-Based RBSL	100	0.07	58.3	128	0.2244	0.01	64.2	0.00
Boeing RFI Subarea 5/9 North	BUBS1082	0-2	Nickel	5.48	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.05	58.3	128	0.2244	0.01	64.2	0.00
Boeing RFI Subarea 5/9 North	SNSS01	0-2	Nickel	4.7	mg/kg	B	Mule Deer	High TRV-Based RBSL	100	0.05	58.3	128	0.2244	0.01	64.2	0.00
Boeing RFI Subarea 5/9 North	D-5-01	0-2	Nickel	2.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.02	58.3	128	0.2244	0.00	64.2	0.00
Boeing RFI Subarea 5/9 North	P2TS45	0-2	Nickel	0.28	mg/kg	U	Mule Deer	High TRV-Based RBSL	100	0.00	58.3	128	0.2244	0.00	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS10	0-2	Nickel	210	mg/kg		Mule Deer	High TRV-Based RBSL	100	2.10	168.0	128	0.8060	1.69	64.2	1.18
Boeing RFI Subarea 5/9 South	STBS02	0-2	Nickel	150	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	1.50	168.0	128	0.8060	1.21	64.2	0.69
Boeing RFI Subarea 5/9 South	CFTS01	0-2	Nickel	118	mg/kg	QC	Mule Deer	High TRV-Based RBSL	100	1.18	168.0	128	0.8060	0.95	64.2	0.43
Boeing RFI Subarea 5/9 South	P2TS09	0-2	Nickel	108	mg/kg		Mule Deer	High TRV-Based RBSL	100	1.08	168.0	128	0.8060	0.87	64.2	0.35
Boeing RFI Subarea 5/9 South	CFBS11	0-2	Nickel	99	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.99	168.0	128	0.8060	0.80	64.2	0.28
Boeing RFI Subarea 5/9 South	STBS1002	0-2	Nickel	87	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.87	168.0	128	0.8060	0.70	64.2	0.18
Boeing RFI Subarea 5/9 South	STBS1007	0-2	Nickel	85	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.85	168.0	128	0.8060	0.69	64.2	0.17
Boeing RFI Subarea 5/9 South	STBS1014	0-2	Nickel	68.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.68	168.0	128	0.8060	0.55	64.2	0.03
Boeing RFI Subarea 5/9 South	SLBS1054	0-2	Nickel	66.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.66	168.0	128	0.8060	0.54	64.2	0.02
Boeing RFI Subarea 5/9 South	STBS1006	0-2	Nickel	62	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.62	168.0	128	0.8060	0.50	64.2	0.00
Boeing RFI Subarea 5/9 South	STBS1404	0-2	Nickel	56.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.56	168.0	128	0.8060	0.45	64.2	0.00
Boeing RFI Subarea 5/9 South	STBS1010	0-2	Nickel	55	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.55	168.0	128	0.8060	0.44	64.2	0.00

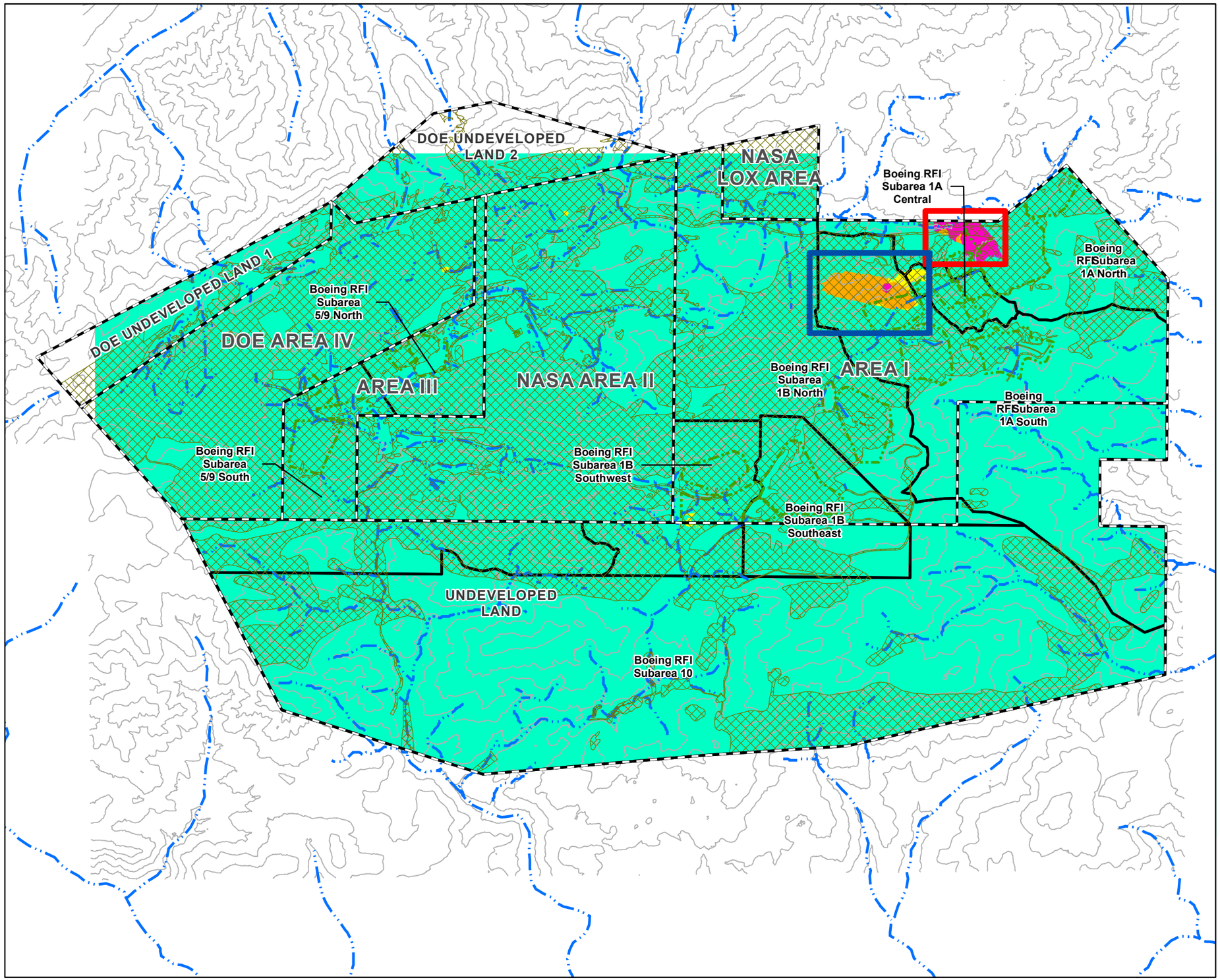
Boeing RFI Subarea 5/9 South	STBS1012	0-2	Nickel	49.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.49	168.0	128	0.8060	0.40	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1411	0-2	Nickel	48.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.49	168.0	128	0.8060	0.39	64.2	0.00
Boeing RFI Subarea 5/9 South	STTS01	0-2	Nickel	48.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.48	168.0	128	0.8060	0.39	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1403	0-2	Nickel	43.4	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.43	168.0	128	0.8060	0.35	64.2	0.00
Boeing RFI Subarea 5/9 South	STBS1401	0-2	Nickel	42.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.43	168.0	128	0.8060	0.34	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1400	0-2	Nickel	42.7	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.43	168.0	128	0.8060	0.34	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1412	0-2	Nickel	41	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.41	168.0	128	0.8060	0.33	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1046	0-2	Nickel	39.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.40	168.0	128	0.8060	0.32	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1402	0-2	Nickel	38.9	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.39	168.0	128	0.8060	0.31	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS06	0-2	Nickel	38	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.38	168.0	128	0.8060	0.31	64.2	0.00
Boeing RFI Subarea 5/9 South	STBS04	0-2	Nickel	35	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.35	168.0	128	0.8060	0.28	64.2	0.00
Boeing RFI Subarea 5/9 South	STBS1013	0-2	Nickel	34.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.35	168.0	128	0.8060	0.28	64.2	0.00
Boeing RFI Subarea 5/9 South	STBS01	0-2	Nickel	34	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.34	168.0	128	0.8060	0.27	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1034	0-2	Nickel	33	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.33	168.0	128	0.8060	0.27	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1004	0-2	Nickel	32.9	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.33	168.0	128	0.8060	0.27	64.2	0.00
Boeing RFI Subarea 5/9 South	STBS1001	0-2	Nickel	32.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.33	168.0	128	0.8060	0.26	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1015	0-2	Nickel	32	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.32	168.0	128	0.8060	0.26	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1410	0-2	Nickel	31	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.31	168.0	128	0.8060	0.25	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS24	0-2	Nickel	30.7	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.31	168.0	128	0.8060	0.25	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1404	0-2	Nickel	30.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.30	168.0	128	0.8060	0.24	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1003	0-2	Nickel	30	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.30	168.0	128	0.8060	0.24	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1401	0-2	Nickel	29.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.30	168.0	128	0.8060	0.24	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1405	0-2	Nickel	29.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.29	168.0	128	0.8060	0.24	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1028	0-2	Nickel	28.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.29	168.0	128	0.8060	0.23	64.2	0.00
Boeing RFI Subarea 5/9 South	STBS1400	0-2	Nickel	28	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.28	168.0	128	0.8060	0.23	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS12	0-2	Nickel	28	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.28	168.0	128	0.8060	0.23	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1001	0-2	Nickel	27.7	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.28	168.0	128	0.8060	0.22	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1016	0-2	Nickel	27	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.27	168.0	128	0.8060	0.22	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1025	0-2	Nickel	26.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.27	168.0	128	0.8060	0.22	64.2	0.00
Boeing RFI Subarea 5/9 South	STBS1009	0-2	Nickel	26	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.26	168.0	128	0.8060	0.21	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1024	0-2	Nickel	25.4	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.25	168.0	128	0.8060	0.20	64.2	0.00
Boeing RFI Subarea 5/9 South	CFSS01	0-2	Nickel	25.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.25	168.0	128	0.8060	0.20	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1016	0-2	Nickel	23.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.24	168.0	128	0.8060	0.19	64.2	0.00
Boeing RFI Subarea 5/9 South	STBS1403	0-2	Nickel	23.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.23	168.0	128	0.8060	0.19	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1035	0-2	Nickel	23.2	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.23	168.0	128	0.8060	0.19	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1021	0-2	Nickel	23.1	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.23	168.0	128	0.8060	0.19	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1020	0-2	Nickel	22.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.23	168.0	128	0.8060	0.18	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1023	0-2	Nickel	22.7	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.23	168.0	128	0.8060	0.18	64.2	0.00
Boeing RFI Subarea 5/9 South	STBS1000	0-2	Nickel	22.5	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.23	168.0	128	0.8060	0.18	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1002	0-2	Nickel	22.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.22	168.0	128	0.8060	0.18	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1060	0-2	Nickel	22.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.22	168.0	128	0.8060	0.18	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1413	0-2	Nickel	22	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.22	168.0	128	0.8060	0.18	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1012	0-2	Nickel	21.8	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.22	168.0	128	0.8060	0.18	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1059	0-2	Nickel	21.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.21	168.0	128	0.8060	0.17	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1061	0-2	Nickel	21.1	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.21	168.0	128	0.8060	0.17	64.2	0.00
Boeing RFI Subarea 5/9 South	STBS1005	0-2	Nickel	21	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.21	168.0	128	0.8060	0.17	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1400	0-2	Nickel	20.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.21	168.0	128	0.8060	0.17	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1011	0-2	Nickel	20.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.21	168.0	128	0.8060	0.17	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1414	0-2	Nickel	20.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.21	168.0	128	0.8060	0.17	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1033	0-2	Nickel	19.2	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.19	168.0	128	0.8060	0.15	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS02	0-2	Nickel	19	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.19	168.0	128	0.8060	0.15	64.2	0.00
Boeing RFI Subarea 5/9 South	STBS1011	0-2	Nickel	19	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.19	168.0	128	0.8060	0.15	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1018	0-2	Nickel	18.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.19	168.0	128	0.8060	0.15	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1405	0-2	Nickel	18.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.19	168.0	128	0.8060	0.15	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1401	0-2	Nickel	18	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.18	168.0	128	0.8060	0.15	64.2	0.00

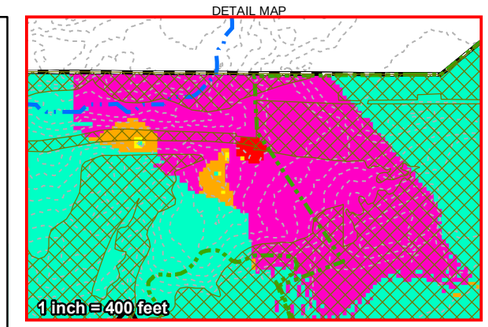
Boeing RFI Subarea 5/9 South	SLTS1507	0-2	Nickel	17.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.18	168.0	128	0.8060	0.14	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1053	0-2	Nickel	17.9	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.18	168.0	128	0.8060	0.14	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1012	0-2	Nickel	17.9	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.18	168.0	128	0.8060	0.14	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1406	0-2	Nickel	17.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.18	168.0	128	0.8060	0.14	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1038	0-2	Nickel	17.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.18	168.0	128	0.8060	0.14	64.2	0.00
Boeing RFI Subarea 5/9 South	SLTS1500	0-2	Nickel	16.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.17	168.0	128	0.8060	0.14	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1034	0-2	Nickel	16.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.17	168.0	128	0.8060	0.14	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1404	0-2	Nickel	16.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.17	168.0	128	0.8060	0.13	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1064	0-2	Nickel	16.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.17	168.0	128	0.8060	0.13	64.2	0.00
Boeing RFI Subarea 5/9 South	SLTS1506	0-2	Nickel	16.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.16	168.0	128	0.8060	0.13	64.2	0.00
Boeing RFI Subarea 5/9 South	ELBS1021	0-2	Nickel	16	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.16	168.0	128	0.8060	0.13	64.2	0.00
Boeing RFI Subarea 5/9 South	SLTS1501	0-2	Nickel	16	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.16	168.0	128	0.8060	0.13	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1412	0-2	Nickel	16	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.16	168.0	128	0.8060	0.13	64.2	0.00
Boeing RFI Subarea 5/9 South	SLSS08	0-2	Nickel	16	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.16	168.0	128	0.8060	0.13	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1014	0-2	Nickel	15.7	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.16	168.0	128	0.8060	0.13	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1037	0-2	Nickel	15.6	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.16	168.0	128	0.8060	0.13	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1033	0-2	Nickel	15.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	168.0	128	0.8060	0.12	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1032	0-2	Nickel	15.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	168.0	128	0.8060	0.12	64.2	0.00
Boeing RFI Subarea 5/9 South	BKND-7	0-2	Nickel	15.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	168.0	128	0.8060	0.12	64.2	0.00
Boeing RFI Subarea 5/9 South	ELBS1028	0-2	Nickel	15.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	168.0	128	0.8060	0.12	64.2	0.00
Boeing RFI Subarea 5/9 South	ELBS1029	0-2	Nickel	15.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	168.0	128	0.8060	0.12	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1413	0-2	Nickel	15	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	168.0	128	0.8060	0.12	64.2	0.00
Boeing RFI Subarea 5/9 South	ELBS1024	0-2	Nickel	14.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	168.0	128	0.8060	0.12	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1062	0-2	Nickel	14.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	168.0	128	0.8060	0.12	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1021	0-2	Nickel	14	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	168.0	128	0.8060	0.11	64.2	0.00
Boeing RFI Subarea 5/9 South	ELBS1013	0-2	Nickel	14	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.14	168.0	128	0.8060	0.11	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS25	0-2	Nickel	14	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.14	168.0	128	0.8060	0.11	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1067	0-2	Nickel	14	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	168.0	128	0.8060	0.11	64.2	0.00
Boeing RFI Subarea 5/9 South	ELBS10	0-2	Nickel	14	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.14	168.0	128	0.8060	0.11	64.2	0.00
Boeing RFI Subarea 5/9 South	ELBS1027	0-2	Nickel	14	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.14	168.0	128	0.8060	0.11	64.2	0.00
Boeing RFI Subarea 5/9 South	CABS0515	0-2	Nickel	13.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	168.0	128	0.8060	0.11	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1027	0-2	Nickel	13.4	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.13	168.0	128	0.8060	0.11	64.2	0.00
Boeing RFI Subarea 5/9 South	ELSS01	0-2	Nickel	13.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	168.0	128	0.8060	0.11	64.2	0.00
Boeing RFI Subarea 5/9 South	SLTS1502	0-2	Nickel	13.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	168.0	128	0.8060	0.11	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1019	0-2	Nickel	13	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.13	168.0	128	0.8060	0.10	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1031	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	168.0	128	0.8060	0.10	64.2	0.00
Boeing RFI Subarea 5/9 South	ELBS1026	0-2	Nickel	13	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	168.0	128	0.8060	0.10	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1052	0-2	Nickel	12.8	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.13	168.0	128	0.8060	0.10	64.2	0.00
Boeing RFI Subarea 5/9 South	P2TS11	0-2	Nickel	12.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	168.0	128	0.8060	0.10	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1045	0-2	Nickel	12.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	168.0	128	0.8060	0.10	64.2	0.00
Boeing RFI Subarea 5/9 South	ELBS1020	0-2	Nickel	12.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	168.0	128	0.8060	0.10	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1501	0-2	Nickel	12.2	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.12	168.0	128	0.8060	0.10	64.2	0.00
Boeing RFI Subarea 5/9 South	ELBS1018	0-2	Nickel	12	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.12	168.0	128	0.8060	0.10	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1601	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	168.0	128	0.8060	0.10	64.2	0.00
Boeing RFI Subarea 5/9 South	ELBS1014	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	168.0	128	0.8060	0.10	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1017	0-2	Nickel	12	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.12	168.0	128	0.8060	0.10	64.2	0.00
Boeing RFI Subarea 5/9 South	D-1-02	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	168.0	128	0.8060	0.10	64.2	0.00
Boeing RFI Subarea 5/9 South	D-1-01	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	168.0	128	0.8060	0.10	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1063	0-2	Nickel	11.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	168.0	128	0.8060	0.10	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1047	0-2	Nickel	11.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	168.0	128	0.8060	0.09	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1032	0-2	Nickel	11.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	168.0	128	0.8060	0.09	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1040	0-2	Nickel	11.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	168.0	128	0.8060	0.09	64.2	0.00
Boeing RFI Subarea 5/9 South	ELBS1019	0-2	Nickel	11.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	168.0	128	0.8060	0.09	64.2	0.00
Boeing RFI Subarea 5/9 South	ELBS1015	0-2	Nickel	11.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	168.0	128	0.8060	0.09	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1039	0-2	Nickel	11.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	168.0	128	0.8060	0.09	64.2	0.00

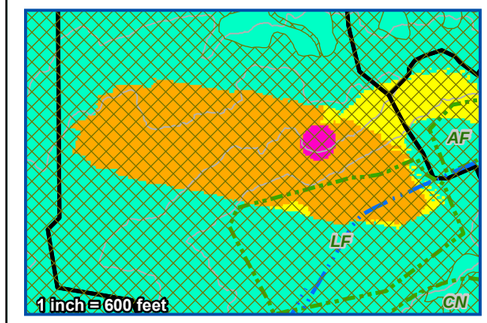
Boeing RFI Subarea 5/9 South	SLBS1001	0-2	Nickel	11.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.11	168.0	128	0.8060	0.09	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1043	0-2	Nickel	11.2	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.11	168.0	128	0.8060	0.09	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS27	0-2	Nickel	11.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	168.0	128	0.8060	0.09	64.2	0.00
Boeing RFI Subarea 5/9 South	P2TS07	0-2	Nickel	11.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	168.0	128	0.8060	0.09	64.2	0.00
Boeing RFI Subarea 5/9 South	SLTS1504	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	168.0	128	0.8060	0.09	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1006	0-2	Nickel	11	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.11	168.0	128	0.8060	0.09	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS09	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	168.0	128	0.8060	0.09	64.2	0.00
Boeing RFI Subarea 5/9 South	SLTS1503	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	168.0	128	0.8060	0.09	64.2	0.00
Boeing RFI Subarea 5/9 South	ELBS1016	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	168.0	128	0.8060	0.09	64.2	0.00
Boeing RFI Subarea 5/9 South	BKND-6	0-2	Nickel	10.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	168.0	128	0.8060	0.09	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1008	0-2	Nickel	10.7	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.11	168.0	128	0.8060	0.09	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1500	0-2	Nickel	10.7	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.11	168.0	128	0.8060	0.09	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1022	0-2	Nickel	10.6	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.11	168.0	128	0.8060	0.09	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1002	0-2	Nickel	10.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	168.0	128	0.8060	0.09	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1049	0-2	Nickel	10.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	168.0	128	0.8060	0.09	64.2	0.00
Boeing RFI Subarea 5/9 South	P2TS04	0-2	Nickel	10.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	168.0	128	0.8060	0.08	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1013	0-2	Nickel	10.2	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	168.0	128	0.8060	0.08	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1402	0-2	Nickel	10.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	168.0	128	0.8060	0.08	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1015	0-2	Nickel	10.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	168.0	128	0.8060	0.08	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1036	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	168.0	128	0.8060	0.08	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS04	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	168.0	128	0.8060	0.08	64.2	0.00
Boeing RFI Subarea 5/9 South	SLTS1505	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	168.0	128	0.8060	0.08	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1013	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	168.0	128	0.8060	0.08	64.2	0.00
Boeing RFI Subarea 5/9 South	P2TS26	0-2	Nickel	9.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	168.0	128	0.8060	0.08	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1065	0-2	Nickel	9.8	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	168.0	128	0.8060	0.08	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1005	0-2	Nickel	9.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	168.0	128	0.8060	0.08	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1050	0-2	Nickel	9.6	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	168.0	128	0.8060	0.08	64.2	0.00
Boeing RFI Subarea 5/9 South	CABS0514	0-2	Nickel	9.54	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	168.0	128	0.8060	0.08	64.2	0.00
Boeing RFI Subarea 5/9 South	STBS1402	0-2	Nickel	9.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	168.0	128	0.8060	0.08	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1048	0-2	Nickel	9.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	168.0	128	0.8060	0.08	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1019	0-2	Nickel	9.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	168.0	128	0.8060	0.07	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1008	0-2	Nickel	9.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	168.0	128	0.8060	0.07	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1044	0-2	Nickel	9.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	168.0	128	0.8060	0.07	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS08	0-2	Nickel	9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	168.0	128	0.8060	0.07	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1058	0-2	Nickel	8.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	168.0	128	0.8060	0.07	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1005	0-2	Nickel	8.9	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.09	168.0	128	0.8060	0.07	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1003	0-2	Nickel	8.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	168.0	128	0.8060	0.07	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1023	0-2	Nickel	8.7	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.09	168.0	128	0.8060	0.07	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1600	0-2	Nickel	8.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	168.0	128	0.8060	0.07	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1007	0-2	Nickel	8.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	168.0	128	0.8060	0.07	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1007	0-2	Nickel	7.4	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.07	168.0	128	0.8060	0.06	64.2	0.00
Boeing RFI Subarea 5/9 South	D-1-03	0-2	Nickel	7.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	168.0	128	0.8060	0.06	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS07	0-2	Nickel	7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	168.0	128	0.8060	0.06	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1041	0-2	Nickel	6.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	168.0	128	0.8060	0.05	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1026	0-2	Nickel	6.7	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.07	168.0	128	0.8060	0.05	64.2	0.00
Boeing RFI Subarea 5/9 South	ELBS1011	0-2	Nickel	6.7	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.07	168.0	128	0.8060	0.05	64.2	0.00
Boeing RFI Subarea 5/9 South	ELBS1017	0-2	Nickel	6.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	168.0	128	0.8060	0.05	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1004	0-2	Nickel	6.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.06	168.0	128	0.8060	0.05	64.2	0.00
Boeing RFI Subarea 5/9 South	D-3-02	0-2	Nickel	5.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.06	168.0	128	0.8060	0.05	64.2	0.00
Boeing RFI Subarea 5/9 South	SLBS1006	0-2	Nickel	5.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.06	168.0	128	0.8060	0.04	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS1010	0-2	Nickel	5.4	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.05	168.0	128	0.8060	0.04	64.2	0.00
Boeing RFI Subarea 5/9 South	ELBS1012	0-2	Nickel	4.5	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.05	168.0	128	0.8060	0.04	64.2	0.00
Boeing RFI Subarea 5/9 South	CFBS05	0-2	Nickel	4.5	mg/kg	U	Mule Deer	High TRV-Based RBSL	100	0.05	168.0	128	0.8060	0.04	64.2	0.00
Boeing RFI Subarea 5/9 South	BCSS10	0-2	Nickel	3	mg/kg	U	Mule Deer	High TRV-Based RBSL	100	0.03	168.0	128	0.8060	0.02	64.2	0.00
Boeing RFI Subarea 5/9 South	D-3-03	0-2	Nickel	3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.03	168.0	128	0.8060	0.02	64.2	0.00

Boeing RFI Subarea 5/9 South	SLBS1066	0-2	Nickel	2.4	mg/kg	U	Mule Deer	High TRV-Based RBSL	100	0.02	168.0	128	0.8060	0.02	64.2	0.00
Boeing RFI Subarea 10	U0SS1022	0-2	Nickel	56.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.56	794.8	128	1.0000	0.56	64.2	0.00
Boeing RFI Subarea 10	U0SS1023	0-2	Nickel	35.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.36	794.8	128	1.0000	0.36	64.2	0.00
Boeing RFI Subarea 10	U0SS1038	0-2	Nickel	28.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.28	794.8	128	1.0000	0.28	64.2	0.00
Boeing RFI Subarea 10	U0SS1016	0-2	Nickel	27.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.27	794.8	128	1.0000	0.27	64.2	0.00
Boeing RFI Subarea 10	U0SS1042	0-2	Nickel	27.2	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.27	794.8	128	1.0000	0.27	64.2	0.00
Boeing RFI Subarea 10	U0SS1017	0-2	Nickel	26.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.27	794.8	128	1.0000	0.27	64.2	0.00
Boeing RFI Subarea 10	U0SS1013	0-2	Nickel	26.2	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.26	794.8	128	1.0000	0.26	64.2	0.00
Boeing RFI Subarea 10	U0BS1000	0-2	Nickel	25.1	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.25	794.8	128	1.0000	0.25	64.2	0.00
Boeing RFI Subarea 10	BCSS14	0-2	Nickel	23	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.23	794.8	128	1.0000	0.23	64.2	0.00
Boeing RFI Subarea 10	U0SS1041	0-2	Nickel	19.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.20	794.8	128	1.0000	0.20	64.2	0.00
Boeing RFI Subarea 10	U0SS1030	0-2	Nickel	18.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.18	794.8	128	1.0000	0.18	64.2	0.00
Boeing RFI Subarea 10	U0SS1008	0-2	Nickel	18	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.18	794.8	128	1.0000	0.18	64.2	0.00
Boeing RFI Subarea 10	BZSS03	0-2	Nickel	17.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.17	794.8	128	1.0000	0.17	64.2	0.00
Boeing RFI Subarea 10	U0SS1043	0-2	Nickel	17	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.17	794.8	128	1.0000	0.17	64.2	0.00
Boeing RFI Subarea 10	TTBS1223	0-2	Nickel	16	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.16	794.8	128	1.0000	0.16	64.2	0.00
Boeing RFI Subarea 10	BGSS07	0-2	Nickel	15.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.16	794.8	128	1.0000	0.16	64.2	0.00
Boeing RFI Subarea 10	U0SS1037	0-2	Nickel	15.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	794.8	128	1.0000	0.15	64.2	0.00
Boeing RFI Subarea 10	Upstream 002	0-2	Nickel	15	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.15	794.8	128	1.0000	0.15	64.2	0.00
Boeing RFI Subarea 10	TTBS1223	0-2	Nickel	14.7	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.15	794.8	128	1.0000	0.15	64.2	0.00
Boeing RFI Subarea 10	U0SS1018	0-2	Nickel	14.5	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.15	794.8	128	1.0000	0.15	64.2	0.00
Boeing RFI Subarea 10	U0SS1001	0-2	Nickel	14.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	794.8	128	1.0000	0.14	64.2	0.00
Boeing RFI Subarea 10	U0SS1002	0-2	Nickel	14.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	794.8	128	1.0000	0.14	64.2	0.00
Boeing RFI Subarea 10	U0BS1008	0-2	Nickel	13.9	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.14	794.8	128	1.0000	0.14	64.2	0.00
Boeing RFI Subarea 10	U0FS1005	0-2	Nickel	13.9	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.14	794.8	128	1.0000	0.14	64.2	0.00
Boeing RFI Subarea 10	U0SS1012	0-2	Nickel	13.9	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.14	794.8	128	1.0000	0.14	64.2	0.00
Boeing RFI Subarea 10	BZSS01	0-2	Nickel	13.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	794.8	128	1.0000	0.14	64.2	0.00
Boeing RFI Subarea 10	U0SS1000	0-2	Nickel	13.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.14	794.8	128	1.0000	0.14	64.2	0.00
Boeing RFI Subarea 10	U0FS1003	0-2	Nickel	13.6	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.14	794.8	128	1.0000	0.14	64.2	0.00
Boeing RFI Subarea 10	U0SS1027	0-2	Nickel	13.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	794.8	128	1.0000	0.13	64.2	0.00
Boeing RFI Subarea 10	U0SS1028	0-2	Nickel	13.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	794.8	128	1.0000	0.13	64.2	0.00
Boeing RFI Subarea 10	U0SS1032	0-2	Nickel	13.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	794.8	128	1.0000	0.13	64.2	0.00
Boeing RFI Subarea 10	U0SS1015	0-2	Nickel	12.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	794.8	128	1.0000	0.13	64.2	0.00
Boeing RFI Subarea 10	U0SS1011	0-2	Nickel	12.7	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.13	794.8	128	1.0000	0.13	64.2	0.00
Boeing RFI Subarea 10	U0SS1020	0-2	Nickel	12.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.13	794.8	128	1.0000	0.13	64.2	0.00
Boeing RFI Subarea 10	U0BS1002	0-2	Nickel	12.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.12	794.8	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 10	U0SS1024	0-2	Nickel	12.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	794.8	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 10	U0SS1004	0-2	Nickel	12.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	794.8	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 10	U0SS1031	0-2	Nickel	12.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	794.8	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 10	U0BS1004	0-2	Nickel	12.1	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.12	794.8	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 10	BZSS02	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	794.8	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 10	U0SS1039	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	794.8	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 10	BCSS12	0-2	Nickel	12	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	794.8	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 10	BZSS04	0-2	Nickel	11.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.12	794.8	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 10	U0BS1003	0-2	Nickel	11.8	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.12	794.8	128	1.0000	0.12	64.2	0.00
Boeing RFI Subarea 10	U0SS1040	0-2	Nickel	11.4	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.11	794.8	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 10	U0BS1012	0-2	Nickel	11.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	794.8	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 10	SB_TTF_BG-1	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	794.8	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 10	BCSS09	0-2	Nickel	11	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	794.8	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 10	BKND-5	0-2	Nickel	11	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.11	794.8	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 10	U0BS1006	0-2	Nickel	10.9	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.11	794.8	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 10	U0SS1021	0-2	Nickel	10.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	794.8	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 10	U0SS1019	0-2	Nickel	10.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	794.8	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 10	U0SS1036	0-2	Nickel	10.6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	794.8	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 10	U0SS1007	0-2	Nickel	10.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	794.8	128	1.0000	0.11	64.2	0.00

Boeing RFI Subarea 10	U0SS1033	0-2	Nickel	10.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	794.8	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 10	U0FS1011	0-2	Nickel	10.5	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.11	794.8	128	1.0000	0.11	64.2	0.00
Boeing RFI Subarea 10	U0SS1034	0-2	Nickel	10.4	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	794.8	128	1.0000	0.10	64.2	0.00
Boeing RFI Subarea 10	U0SS1010	0-2	Nickel	10.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	794.8	128	1.0000	0.10	64.2	0.00
Boeing RFI Subarea 10	U0SS1009	0-2	Nickel	10.1	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	794.8	128	1.0000	0.10	64.2	0.00
Boeing RFI Subarea 10	U0ST1007	0-2	Nickel	10	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	794.8	128	1.0000	0.10	64.2	0.00
Boeing RFI Subarea 10	SB_TTF_BG-2	0-2	Nickel	10	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	794.8	128	1.0000	0.10	64.2	0.00
Boeing RFI Subarea 10	BKND-5	0-2	Nickel	9.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	794.8	128	1.0000	0.10	64.2	0.00
Boeing RFI Subarea 10	BKND-3	0-2	Nickel	9.9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	794.8	128	1.0000	0.10	64.2	0.00
Boeing RFI Subarea 10	U0SS1026	0-2	Nickel	9.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	794.8	128	1.0000	0.10	64.2	0.00
Boeing RFI Subarea 10	BKND-4	0-2	Nickel	9.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.10	794.8	128	1.0000	0.10	64.2	0.00
Boeing RFI Subarea 10	U0BS1005	0-2	Nickel	9.8	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.10	794.8	128	1.0000	0.10	64.2	0.00
Boeing RFI Subarea 10	U0SS1005	0-2	Nickel	9.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	794.8	128	1.0000	0.09	64.2	0.00
Boeing RFI Subarea 10	U0SS1014	0-2	Nickel	9.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	794.8	128	1.0000	0.09	64.2	0.00
Boeing RFI Subarea 10	BCBS07	0-2	Nickel	9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	794.8	128	1.0000	0.09	64.2	0.00
Boeing RFI Subarea 10	U0FS1010	0-2	Nickel	9	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	794.8	128	1.0000	0.09	64.2	0.00
Boeing RFI Subarea 10	U0SS1025	0-2	Nickel	8.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.09	794.8	128	1.0000	0.09	64.2	0.00
Boeing RFI Subarea 10	U0SS1035	0-2	Nickel	8.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	794.8	128	1.0000	0.08	64.2	0.00
Boeing RFI Subarea 10	U0SS1003	0-2	Nickel	7.8	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.08	794.8	128	1.0000	0.08	64.2	0.00
Boeing RFI Subarea 10	U0FS1004	0-2	Nickel	7.6	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.08	794.8	128	1.0000	0.08	64.2	0.00
Boeing RFI Subarea 10	U0FS1020	0-2	Nickel	7.5	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.08	794.8	128	1.0000	0.08	64.2	0.00
Boeing RFI Subarea 10	U0FS1019	0-2	Nickel	7.42	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.07	794.8	128	1.0000	0.07	64.2	0.00
Boeing RFI Subarea 10	U0FS1013	0-2	Nickel	7.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.07	794.8	128	1.0000	0.07	64.2	0.00
Boeing RFI Subarea 10	U0SS1029	0-2	Nickel	7.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	794.8	128	1.0000	0.07	64.2	0.00
Boeing RFI Subarea 10	BCSS09	0-2	Nickel	7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	794.8	128	1.0000	0.07	64.2	0.00
Boeing RFI Subarea 10	U0FS1000	0-2	Nickel	7	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.07	794.8	128	1.0000	0.07	64.2	0.00
Boeing RFI Subarea 10	U0FS1022	0-2	Nickel	6.9	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.07	794.8	128	1.0000	0.07	64.2	0.00
Boeing RFI Subarea 10	U0FS1006	0-2	Nickel	6.8	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.07	794.8	128	1.0000	0.07	64.2	0.00
Boeing RFI Subarea 10	U0FS1012	0-2	Nickel	6.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.07	794.8	128	1.0000	0.07	64.2	0.00
Boeing RFI Subarea 10	U0BS1001	0-2	Nickel	6.7	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.07	794.8	128	1.0000	0.07	64.2	0.00
Boeing RFI Subarea 10	U0FS1021	0-2	Nickel	6.3	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.06	794.8	128	1.0000	0.06	64.2	0.00
Boeing RFI Subarea 10	U0SS1006	0-2	Nickel	6.2	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.06	794.8	128	1.0000	0.06	64.2	0.00
Boeing RFI Subarea 10	U0FS1018	0-2	Nickel	6.2	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.06	794.8	128	1.0000	0.06	64.2	0.00
Boeing RFI Subarea 10	U0FS1001	0-2	Nickel	6.1	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.06	794.8	128	1.0000	0.06	64.2	0.00
Boeing RFI Subarea 10	U0FS1009	0-2	Nickel	6.1	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.06	794.8	128	1.0000	0.06	64.2	0.00
Boeing RFI Subarea 10	BCSS08	0-2	Nickel	6	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.06	794.8	128	1.0000	0.06	64.2	0.00
Boeing RFI Subarea 10	U0FS1014	0-2	Nickel	5.7	mg/kg		Mule Deer	High TRV-Based RBSL	100	0.06	794.8	128	1.0000	0.06	64.2	0.00
Boeing RFI Subarea 10	U0FS1019	0-2	Nickel	5.6	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.06	794.8	128	1.0000	0.06	64.2	0.00
Boeing RFI Subarea 10	U0FS1002	0-2	Nickel	5.4	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.05	794.8	128	1.0000	0.05	64.2	0.00
Boeing RFI Subarea 10	U0FS1015	0-2	Nickel	5.4	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.05	794.8	128	1.0000	0.05	64.2	0.00
Boeing RFI Subarea 10	U0FS1016	0-2	Nickel	5.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.05	794.8	128	1.0000	0.05	64.2	0.00
Boeing RFI Subarea 10	U0FS1017	0-2	Nickel	5.3	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.05	794.8	128	1.0000	0.05	64.2	0.00
Boeing RFI Subarea 10	U0FS1007	0-2	Nickel	5.11	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.05	794.8	128	1.0000	0.05	64.2	0.00
Boeing RFI Subarea 10	U0FS1008	0-2	Nickel	4.7	mg/kg	J	Mule Deer	High TRV-Based RBSL	100	0.05	794.8	128	1.0000	0.05	64.2	0.00
Boeing RFI Subarea 10	BCBS08	0-2	Nickel	3	mg/kg	U	Mule Deer	High TRV-Based RBSL	100	0.03	794.8	128	1.0000	0.03	64.2	0.00
Boeing RFI Subarea 10	Upstream 001	0-2	Nickel	2.7	mg/kg	UJ	Mule Deer	High TRV-Based RBSL	100	0.03	794.8	128	1.0000	0.03	64.2	0.00







LEGEND

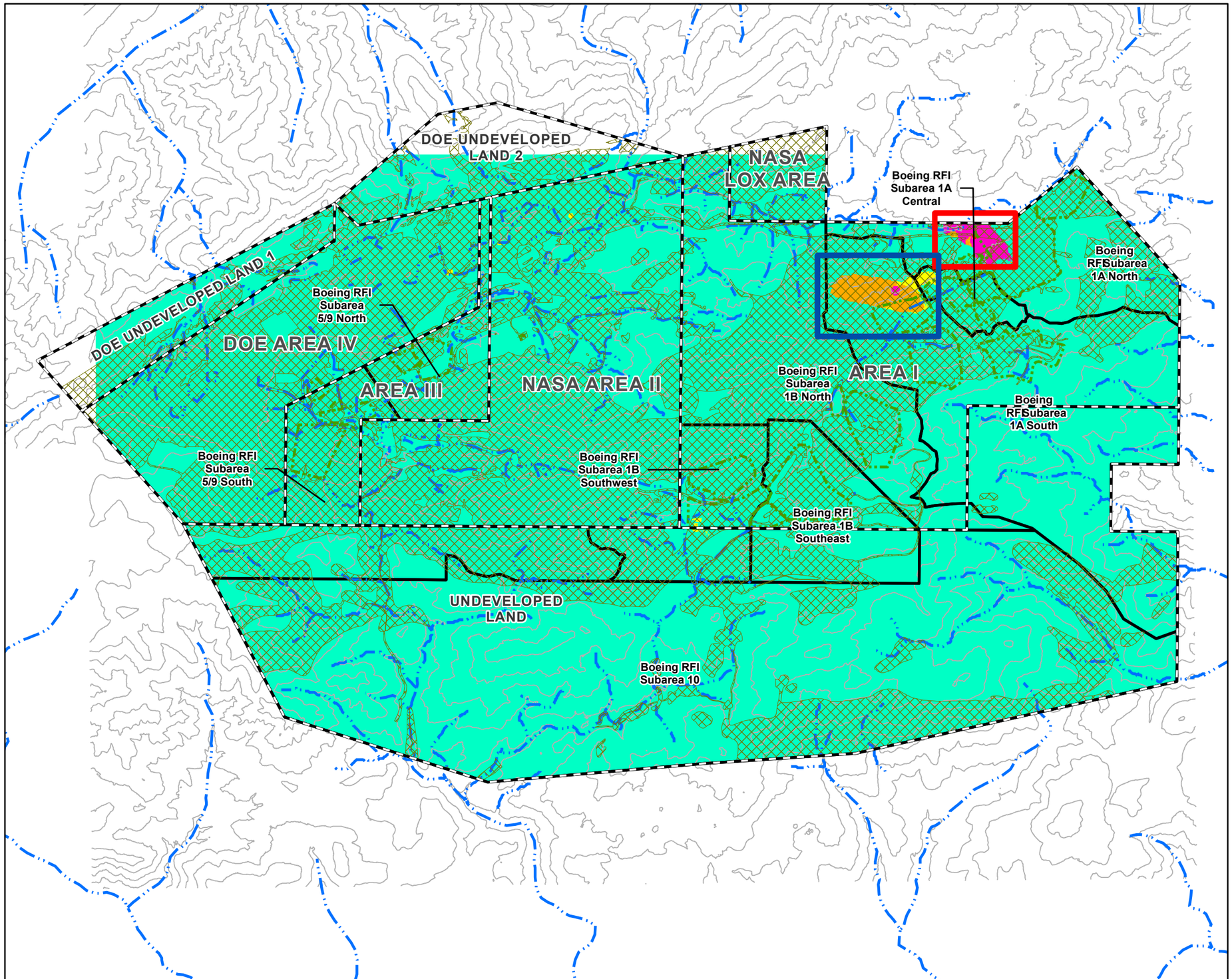
- HQ < 1
- HQ 1-10
- HQ 10-100
- HQ 100-1000
- HQ > 1000
- No Data Available
- Suitable Habitat
- Boeing RFI SIte
- Boeing RFI Subarea Boundary
- Administrative Boundary
- Drainage Channel
- 100 ft Topo Contour
- 10 ft Topo Contour

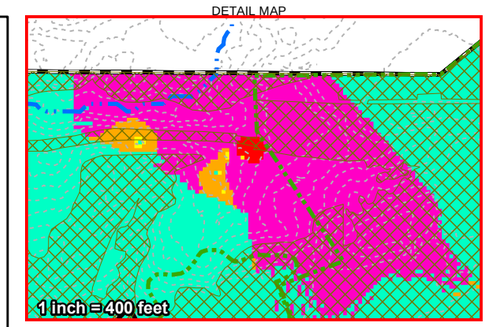
Note:
1. Estimated risks are based on single chemical toxicity data and do not account for ambient (background) concentrations. Risk due to background may be considerable and will be discussed in the risk assessment.

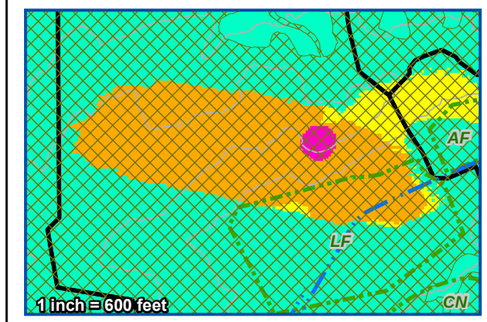
N

0 750 1,500
Feet
1 in = 1,500 ft

FIGURE EX-1
Spatially Interpolated Risk Estimates for the Red-tailed Hawk at the Subarea Level using the Low EcoRBSL – Baseline (Dioxin/Furan)
Large Home Range Receptor Ecological Risk Assessment Methodology Technical Memorandum
Santa Susana Field Laboratory, Ventura County, California







LEGEND

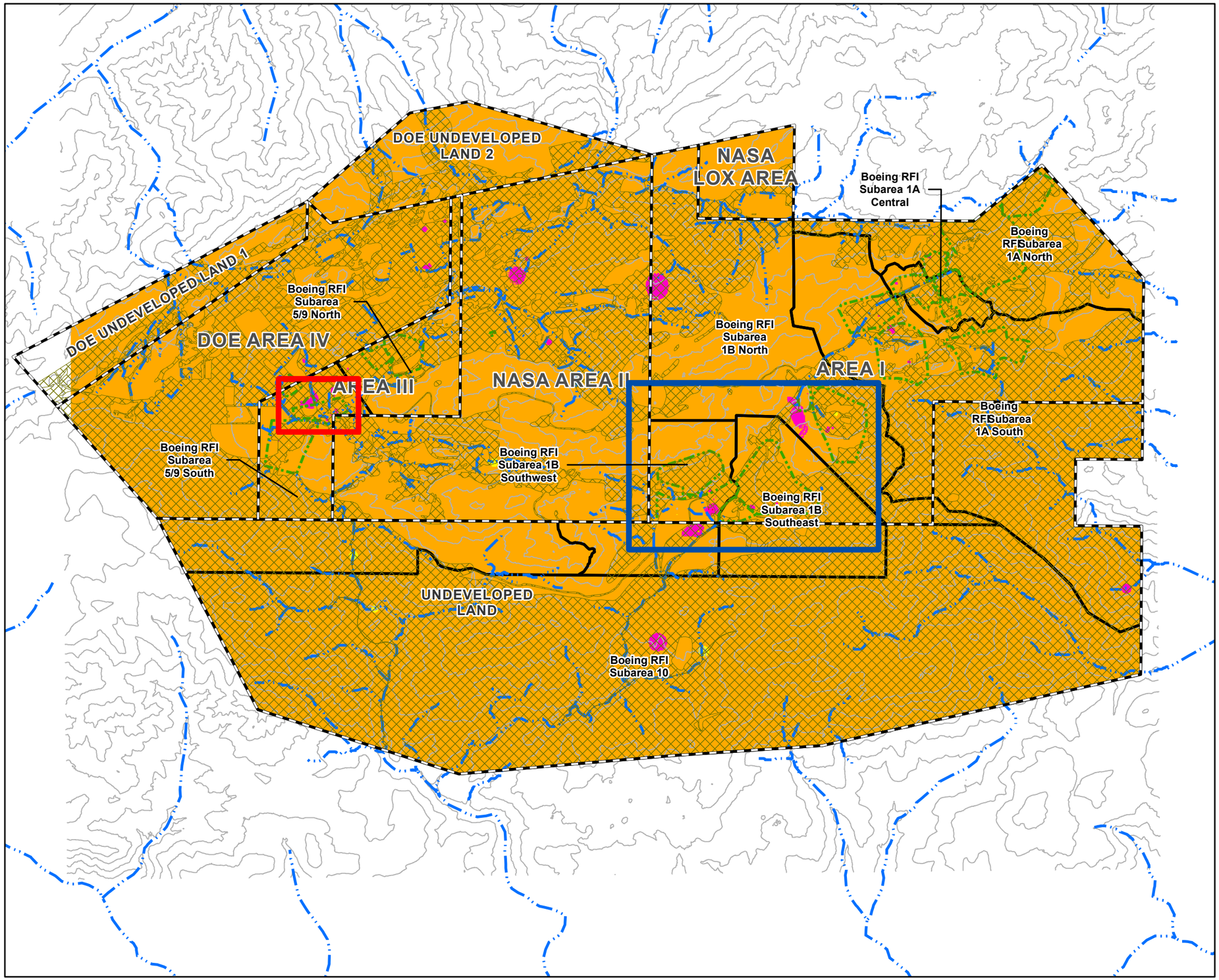
- HQ < 1
- HQ 1-10
- HQ 10-100
- HQ 100-1000
- HQ > 1000
- No Data Available
- Suitable Habitat
- Boeing RFI SIte
- Boeing RFI Subarea Boundary
- Administrative Boundary
- Drainage Channel
- 100 ft Topo Contour
- 10 ft Topo Contour

Note:
1. Estimated risks are based on single chemical toxicity data and do not account for ambient (background) concentrations. Risk due to background may be considerable and will be discussed in the risk assessment.

N

0 750 1,500
Feet
1 in = 1,500 ft

FIGURE EX-2
Spatially Interpolated Risk Estimates for the Red-tailed Hawk at the Subarea Level using the Low EcoRBSL – AUF-adjusted (Dioxin/Furan)
Large Home Range Receptor Ecological Risk Assessment Methodology Technical Memorandum
Santa Susana Field Laboratory, Ventura County, California



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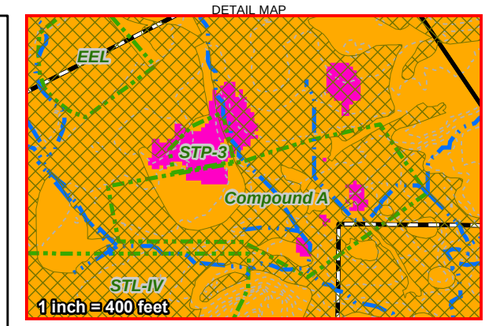

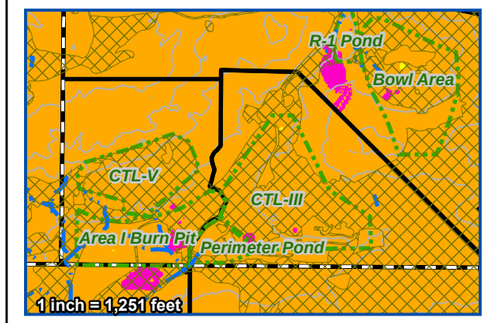

LEGEND

- HQ < 1
- HQ 1-10
- HQ 10-100
- HQ 100-1000
- HQ > 1000
- No Data Available
- Suitable Habitat
- Boeing RFI SIte
- Boeing RFI Subarea Boundary
- Administrative Boundary
- Drainage Channel
- 100 ft Topo Contour
- 10 ft Topo Contour

Notes:
1. BTV: 64.2
2. Estimated risks are based on single chemical toxicity data and do not account for ambient (background) concentrations. Risk due to background may be considerable and will be discussed in the risk assessment.

N

0 750 1,500
Feet
1 in = 1,500 ft

FIGURE EX-3
Spatially Interpolated Risk Estimates for the Mule Deer at the Subarea Level using the Low EcoRBSL – Baseline (Nickel)

Large Home Range Receptor Ecological Risk Assessment Methodology Technical Memorandum
Santa Susana Field Laboratory, Ventura County, California

CH2MHILL

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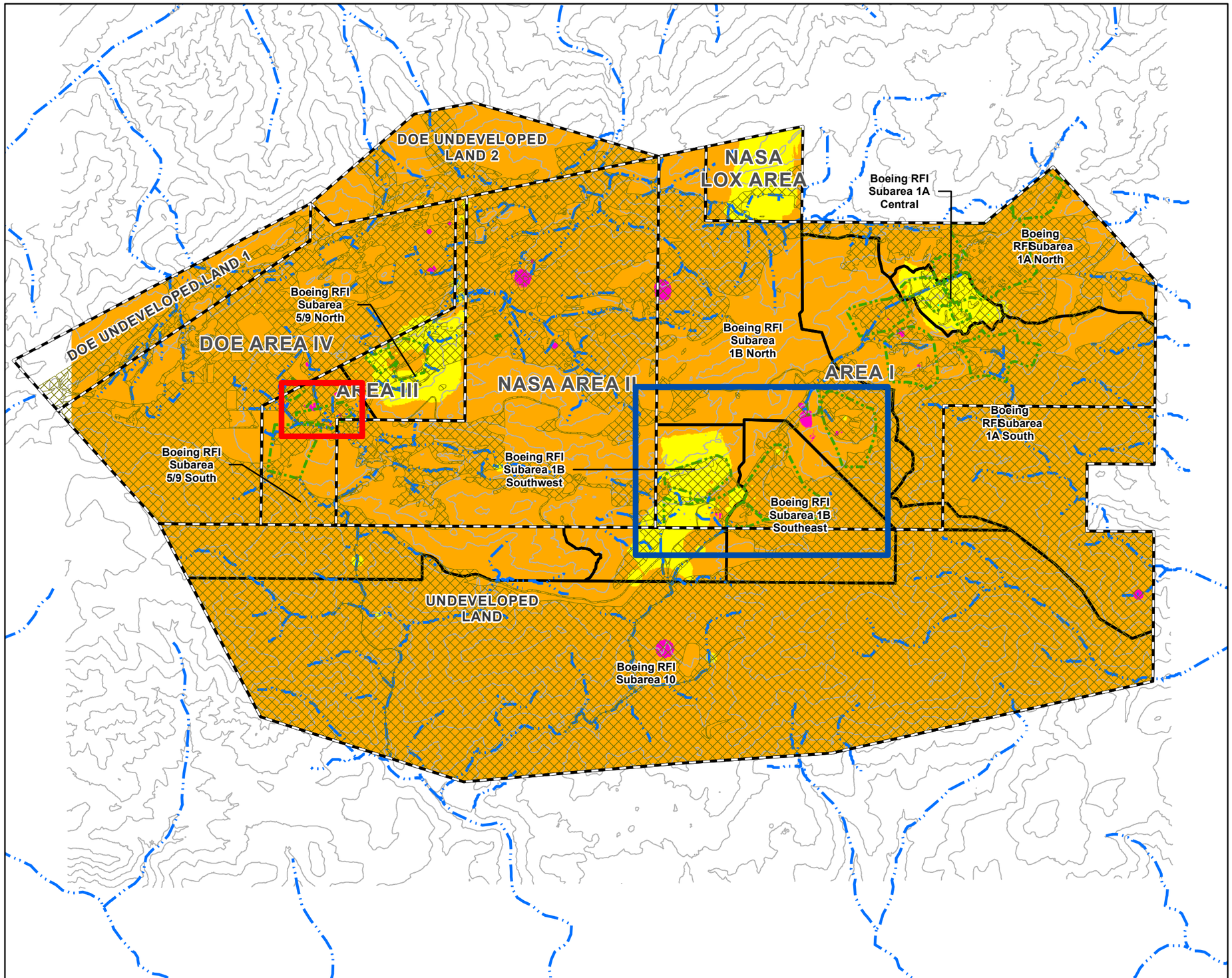
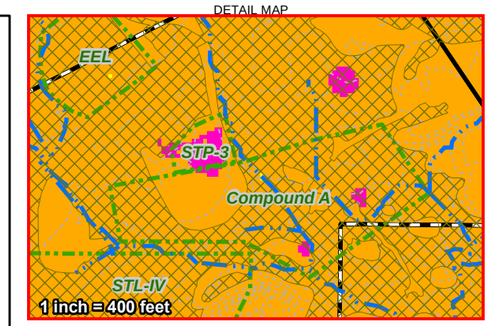
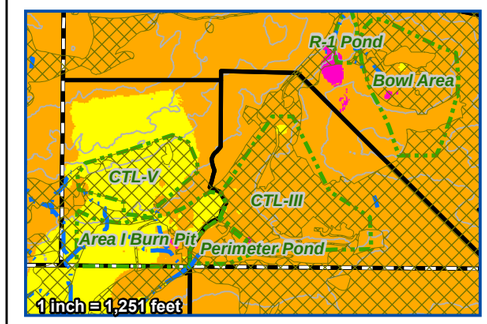


DETAIL MAP





LEGEND

- HQ < 1
- HQ 1-10
- HQ 10-100
- HQ 100-1000
- HQ > 1000
- No Data Available
- Suitable Habitat
- Boeing RFI SIte
- Boeing RFI Subarea Boundary
- Administrative Boundary
- Drainage Channel
- 100 ft Topo Contour
- 10 ft Topo Contour

Notes:
1. BTV: 64.2
2. Estimated risks are based on single chemical toxicity data and do not account for ambient (background) concentrations. Risk due to background may be considerable and will be discussed in the risk assessment.

N

0 750 1,500
Feet
1 in = 1,500 ft

FIGURE EX-4
Spatially Interpolated Risk Estimates for the Mule Deer at the Subarea Level using the Low EcoRBSL – AUF-adjusted (Nickel)

Large Home Range Receptor Ecological Risk Assessment Methodology Technical Memorandum
Santa Susana Field Laboratory, Ventura County, California

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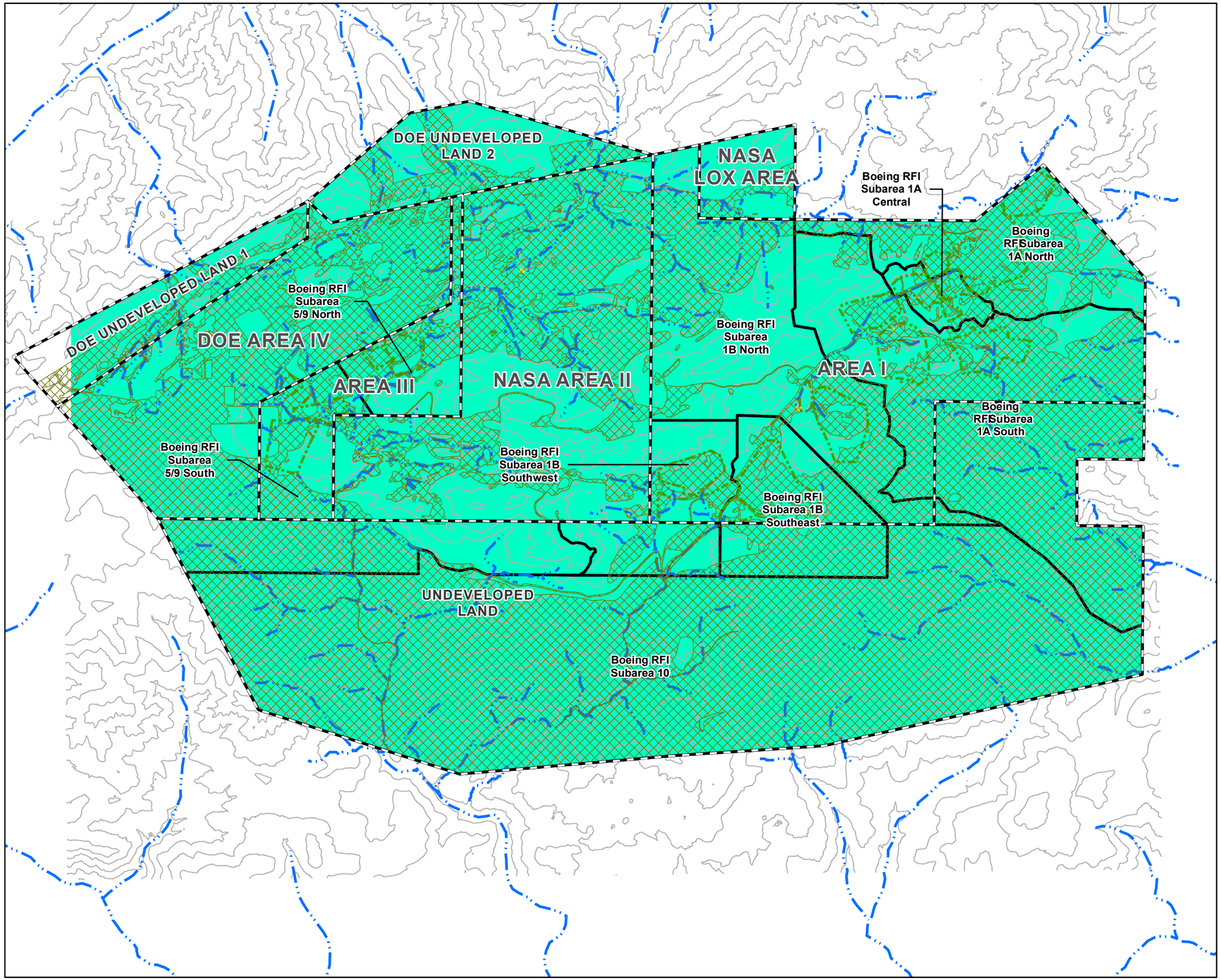

LEGEND

- HQ < 1
- HQ 1-10
- HQ 10-100
- HQ 100-1000
- HQ > 1000
- No Data Available
- Suitable Habitat
- Boeing RFI SIte
- Boeing RFI Subarea Boundary
- Administrative Boundary
- Drainage Channel
- 100 ft Topo Contour
- 10 ft Topo Contour

Notes:
1. BTV: 64.2
2. Estimated risks are based on single chemical toxicity data and do not account for ambient (background) concentrations. Risk due to background may be considerable and will be discussed in the risk assessment.

N

0 750 1,500
Feet
1 in = 1,500 ft

FIGURE EX-5
Spatially Interpolated Risk Estimates for the Mule Deer at the Subarea Level using the High EcoRBSL – AUF-adjusted (Nickel)
Large Home Range Receptor Ecological Risk Assessment Methodology Technical Memorandum
Santa Susana Field Laboratory, Ventura County, California

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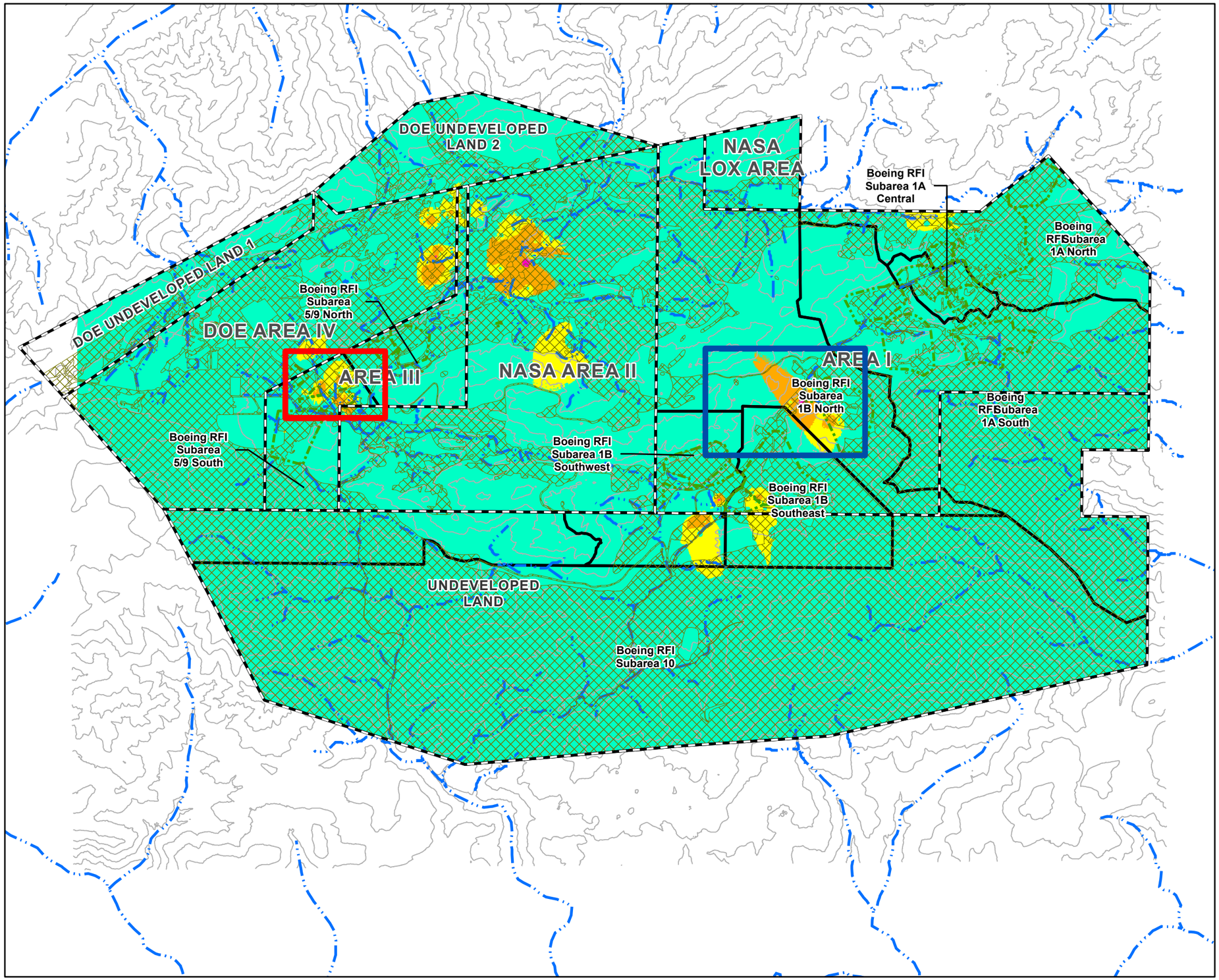

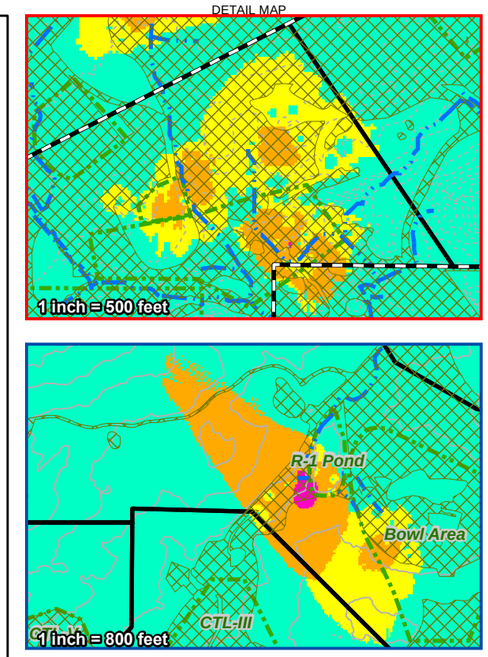

LEGEND

- HQ < 1
- HQ 1-10
- HQ 10-100
- HQ 100-1000
- HQ > 1000
- No Data Available/Outside Facility Boundary
- Suitable Habitat
- Boeing RFI SIte
- Boeing RFI Subarea Boundary
- Administrative Boundary
- Drainage Channel
- 100 ft Topo Contour
- 10 ft Topo Contour

N

0 750 1,500
Feet
1 in = 1,500 ft

FIGURE EX-6
Spatially Interpolated Incremental Risk Estimates for the Mule Deer at the Subarea-level using the Low EcoRBSL – AUF-adjusted (Nickel)
Large Home Range Receptor Ecological Risk Assessment Methodology Technical Memorandum
Santa Susana Field Laboratory, Ventura County, California

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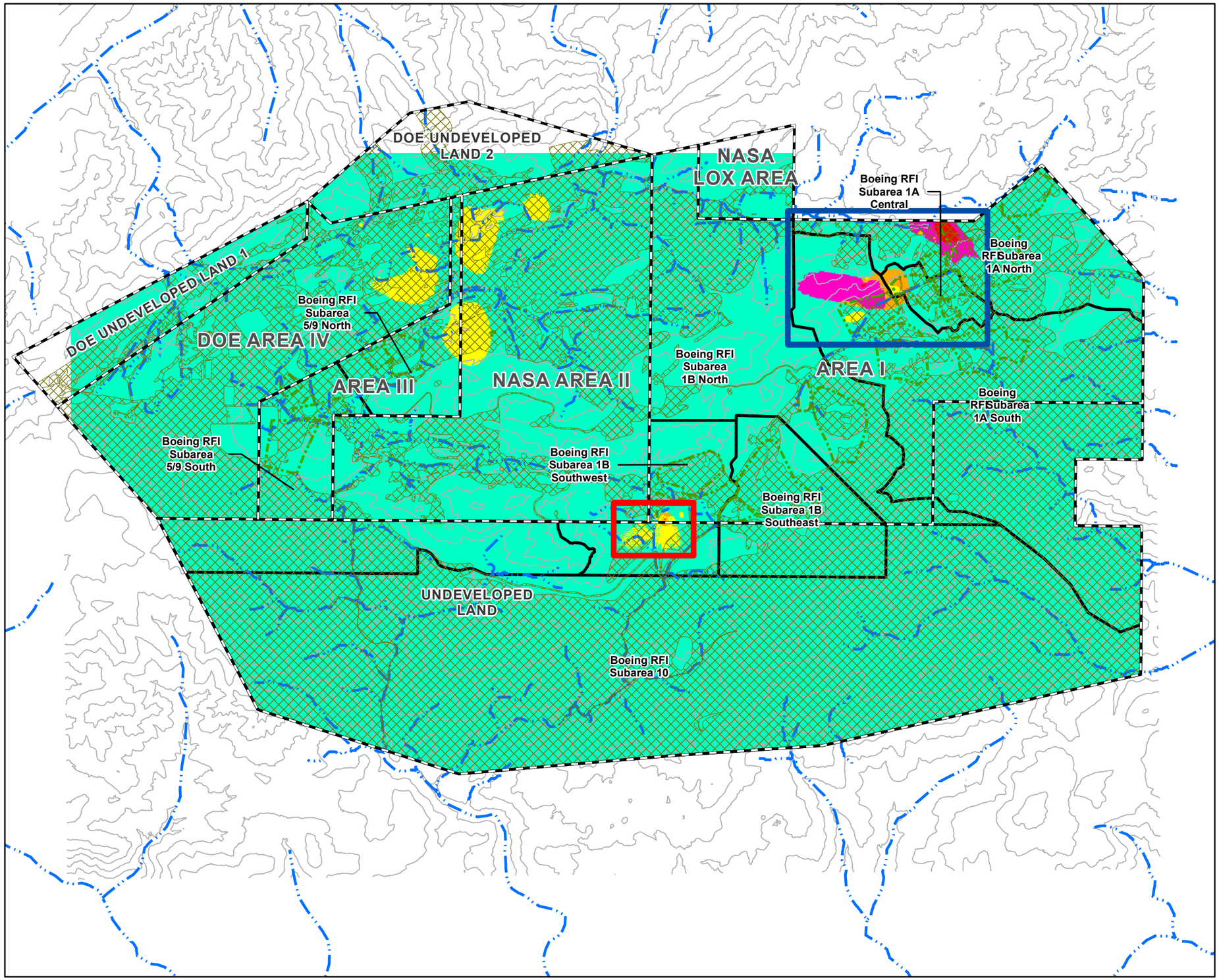

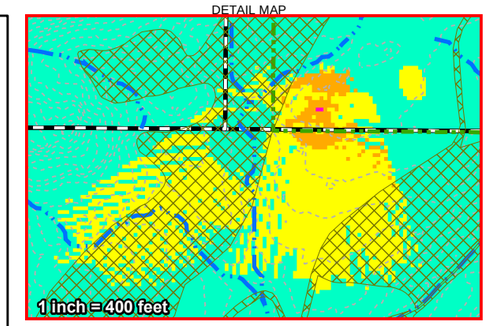

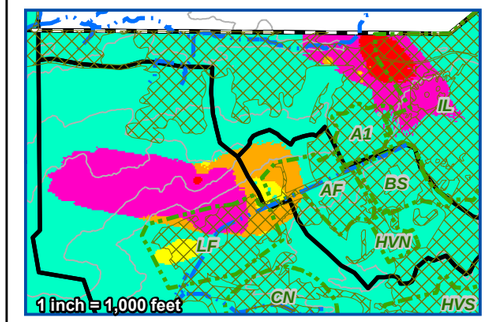

LEGEND

- HQ < 1
- HQ 1-10
- HQ 10-100
- HQ 100-1000
- HQ > 1000
- No Data Available
- Suitable Habitat
- Boeing RFI SIte
- Administrative Boundary
- Drainage Channel
- 100 ft Topo Contour
- 10 ft Topo Contour

Note:
1. Estimated risks are based on single chemical toxicity data and do not account for ambient (background) concentrations. Risk due to background may be considerable and will be discussed in the risk assessment.

N

0 750 1,500
Feet
1 in = 1,500 ft

FIGURE EX-7
Spatially Interpolated Risk Estimates for the Mule Deer at the Subarea Level using the Low EcoRBSL – Baseline (Dioxin/Furan)

Large Home Range Receptor Ecological Risk Assessment Methodology Technical Memorandum
Santa Susana Field Laboratory, Ventura County, California

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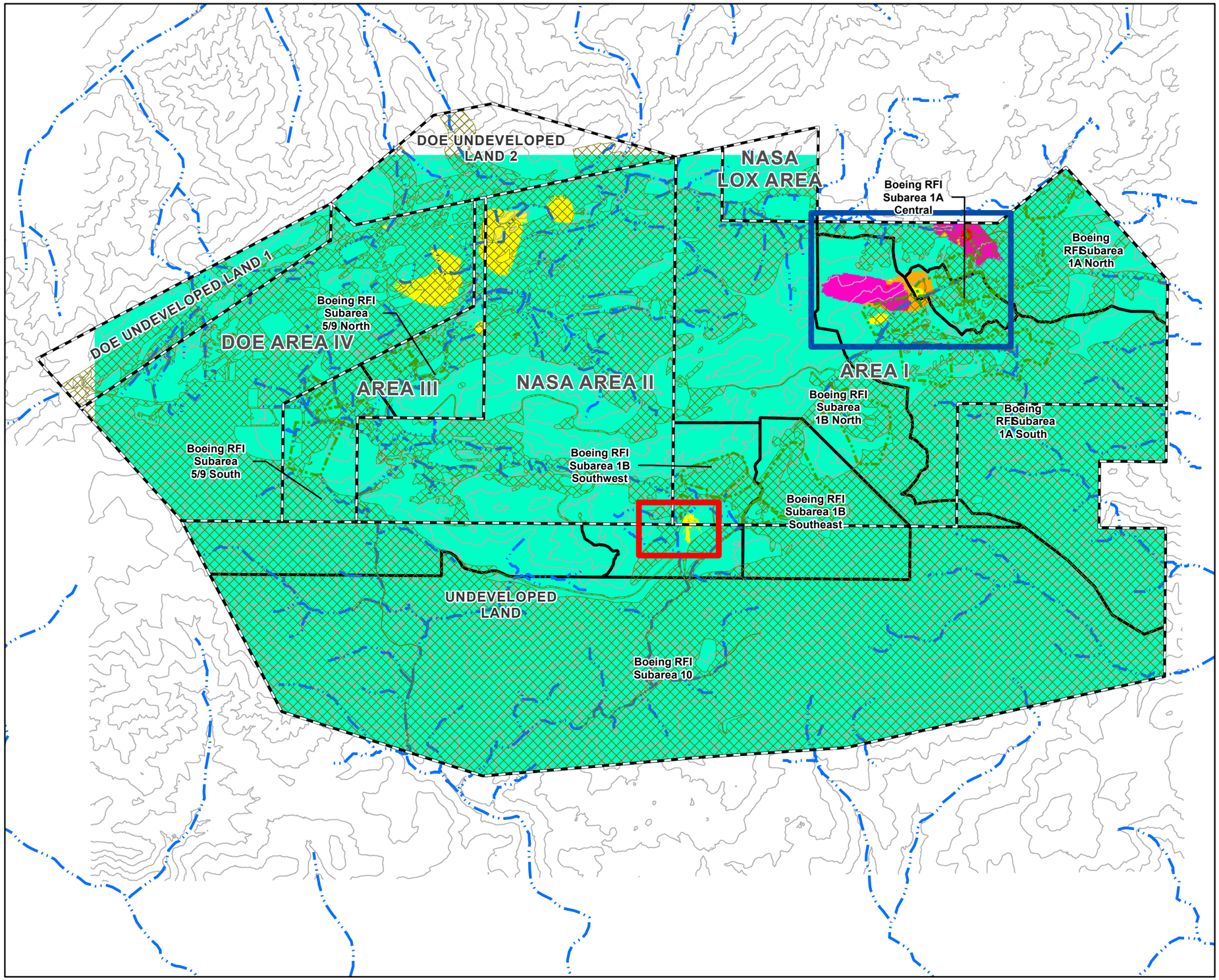
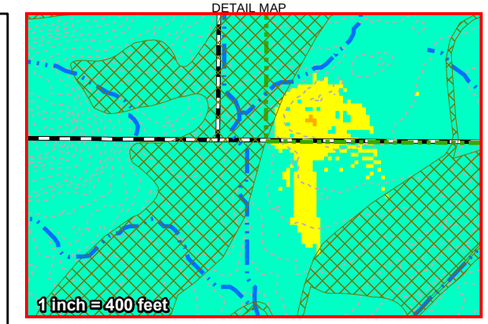
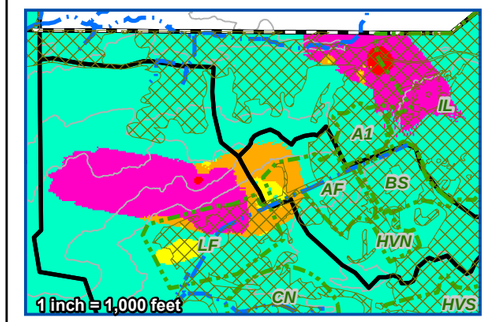






LEGEND

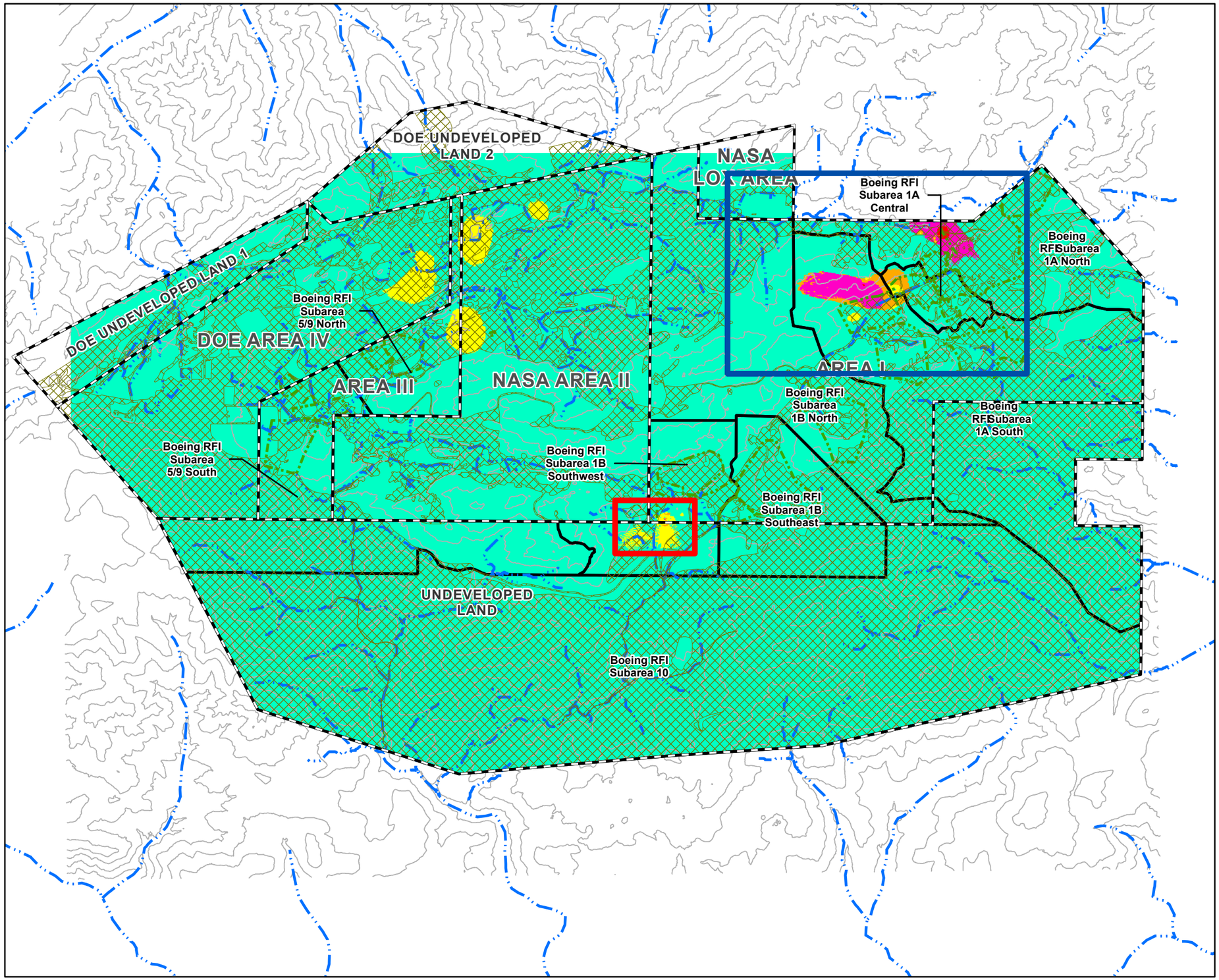
- HQ < 1
- HQ 1-10
- HQ 10-100
- HQ 100-1000
- HQ > 1000
- No Data Available
- Suitable Habitat
- Boeing RFI SIte
- Boeing RFI Subarea Boundary
- Administrative Boundary
- Drainage Channel
- 100 ft Topo Contour
- 10 ft Topo Contour

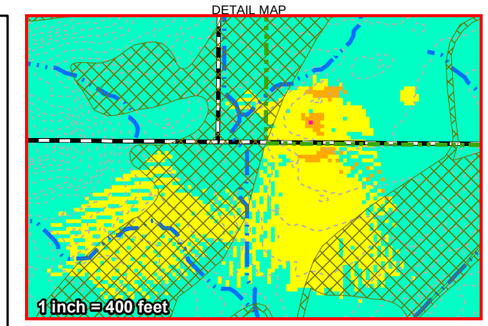
Note:
1. Estimated risks are based on single chemical toxicity data and do not account for ambient (background) concentrations. Risk due to background may be considerable and will be discussed in the risk assessment.

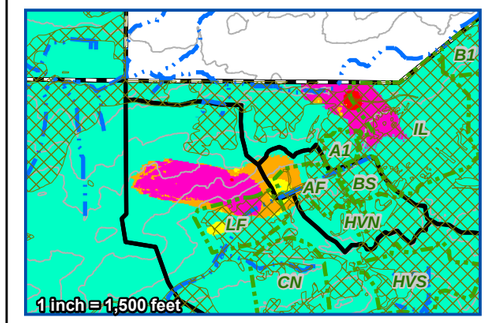
N

0 750 1,500
Feet
1 in = 1,500 ft

FIGURE EX-8
Spatially Interpolated Risk Estimates for the Mule Deer at the Subarea Level using the Low EcoRBSL – AUF-adjusted (Dioxin/Furan)
Large Home Range Receptor Ecological Risk Assessment Methodology Technical Memorandum
Santa Susana Field Laboratory, Ventura County, California







LEGEND

- HQ < 1
- HQ 1-10
- HQ 10-100
- HQ 100-1000
- HQ > 1000
- No Data Available/Outside Facility Boundary
- Suitable Habitat
- Boeing RFI SIte
- Boeing RFI Subarea Boundary
- Administrative Boundary
- Drainage Channel
- 100 ft Topo Contour
- 10 ft Topo Contour

Note:
1. Estimated risks are based on single chemical toxicity data and do not account for ambient (background) concentrations. Risk due to background may be considerable and will be discussed in the risk assessment.

N

0 750 1,500
Feet
1 in = 1,500 ft

FIGURE EX-9
Spatially Interpolated Risk Estimates for the Mule Deer at the Facility-wide Level using the Low EcoRBSL – AUF-adjusted (Dioxin/Furan)

Large Home Range Receptor Ecological Risk Assessment Methodology Technical Memorandum
Santa Susana Field Laboratory, Ventura County, California

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APPENDIX H

Method for Documenting the Use of Extrapolated Data in Risk Assessments Prepared for the Santa Susana Field Laboratory, Ventura County, California – Technical Memorandum

METHOD FOR DOCUMENTING THE USE OF EXTRAPOLATED DATA IN RISK ASSESSMENTS PREPARED FOR THE SANTA SUSANA FIELD LABORATORY, VENTURA COUNTY, CALIFORNIA - TECHNICAL MEMORANDUM

Prepared For:

THE BOEING COMPANY

Prepared By:

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Risk Assessment Project Director

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August 2014

TABLE OF CONTENTS

ATTACHMENTS

Attachment No.

1 Example COPC/EPC and Risk Calculation Tables

This technical memorandum describes the proposed approach for documenting the use of extrapolated data in future human health and ecological risk assessments (HHERAs) at the Santa Susana Field Laboratory (SSFL) during RCRA Facility Investigation and/or Remedial Investigation (RFI/RI) activities. This document has been prepared for the California Environmental Protection Agency (Cal-EPA) Department of Toxic Substance Control (DTSC) on behalf of the Boeing Company (Boeing) in response to DTSC comments on the Group 6 RFI report and a request by DTSC made during a meeting held on February 17, 2010.

Data extrapolations are performed during the preparation of HHERAs for the SSFL when analytical results for a specific analyte are not available but analytical results for a mixture of chemicals suggest that the analyte could potentially be present. For example, data for arochlors are generally available for many RFI/RI sites, while analytical results for individual polychlorinated biphenyl (PCB) congeners are not always available. In such cases, concentrations of individual PCB congeners are extrapolated from arochlor results using extrapolation factors. The specific methods used in data extrapolations for PCBs and other chemicals are presented in Section 2.7 of the Standardized Risk Assessment Methodology (SRAM), Revision 2 (Rev. 2; MWH, 2005). Up to this point, a standard method for documenting extrapolated concentrations of chemicals was not available. This technical memorandum was prepared to document the proposed approach for presenting extrapolated concentrations in HHERAs prepared for the SSFL.

As requested by DTSC, the proposed approach for documenting the use of extrapolated data in risk assessment tables is to present names of chemicals with exposure point concentrations (EPCs) and risk estimates based all, or in part, on extrapolated data in italicized font on the following types of HHERA tables:

- tables presenting the selection of chemicals of potential concern (COPCs) and EPCs for soil and soil vapor;
- tables presenting the selection of chemicals of potential ecological concern (CPECs) and EPCs for soil and soil vapor;
- tables presenting the migration of volatile COPCs from soils to residential building indoor air;
- tables presenting human health total site media cumulative cancer risk and noncancer hazard estimates for each COPC;
- tables presenting human health risk estimate summary information for each receptor and medium; and
- tables presenting ecological hazard estimate summary information for each receptor

As indicated above, the proposed approach for documenting extrapolated data includes showing names of chemicals with risk estimates based all, or in part, on extrapolated data in italicized font in risk estimate summary tables only, not in all individual risk calculation tables. Example COPC/EPC, human health total site media cumulative cancer risk/noncancer hazard, human health risk estimate summary, and ecological hazard estimate summary tables showing the proposed method for documenting the use of extrapolated data in the HHERAs are attached. These example tables were created by adding the appropriate formatting to tables from the Group 7 RFI Report. Future risk estimate summary tables using the proposed sum-of-fractions approach will be different from the attached examples. However, names of chemicals with EPCs and risk estimates based all, or in part, on extrapolated data will still be shown in italicized font.

In addition to the above-mentioned tabular call-outs to extrapolated data, text will be added to future HHERAs describing when extrapolations were performed and for which media and chemicals.

REFERENCES

MWH Americas, Inc. (MWH), 2005. Standardized Risk Assessment Methodology (SRAM) Work Plan, Santa Susana Field Laboratory, Ventura County, California. Revision 2 – Final. September. HDMSE00198.

ATTACHMENT 1

Example COPC/EPC and Risk Calculation Tables

Spreadsheet E.3-2

Selection of Chemicals of Potential Concern and Exposure Point Concentrations for Soil (0-10 feet bgs)
Radioactive Materials Handling Facility RFI Site

Chemical[a, b]	Number of Samples	Number of Detects	Percent Frequency of Detection	Maximum Detected Concentration (mg/kg)	Potentially Site Related	Chemical Detected in Laboratory Blanks [c]	RFI Site Exceeds Background [d]	COPC	ProUCL Distribution	EPC CTE[e] (mg/kg)	EPC RME[f] (mg/kg)
Inorganic Compounds											
Aluminum	137	137	100	2.0E+04	Yes	No	No	No [g]	NT	NC	NC
Antimony	137	17	12	5.3E+00	Yes	No	No	No [g]	NT	NC	NC
Arsenic	137	137	100	1.0E+01	Yes	No	No	No [g]	NT	NC	NC
Barium	137	137	100	1.3E+02	Yes	No	No	No [g]	NT	NC	NC
Beryllium	137	137	100	1.1E+00	Yes	No	No	No [g]	NT	NC	NC
Boron	140	75	54	1.8E+01	Yes	No	No	No [g]	NT	NC	NC
Cadmium	137	130	95	4.8E+00	Yes	No	Yes	**Yes** [h]	NP	1.8E-01	2.5E-01
Chromium	137	137	100	3.8E+01	Yes	No	No	No [g]	NT	NC	NC
Cobalt	138	138	100	4.8E+01	Yes	No	Yes	**Yes** [h]	NP	5.1E+00	5.9E+00
Copper	140	140	100	6.3E+01	Yes	No	Yes	**Yes** [h]	NP	7.2E+00	8.1E+00
Cyanide	5	2	40	6.9E-01	Yes	No	Yes	**Yes**	NP	6.1E-01	6.6E-01
Fluoride	18	18	100	7.5E+00	Yes	No	No	No [g]	NT	NC	NC
Hexavalent chromium	55	12	22	6.9E-01	Yes	No	Yes	**Yes**	NP	6.3E-02	9.0E-02
Lead	137	137	100	4.4E+01	Yes	No	No	No [g]	NT	NC	NC
Lithium	137	137	100	3.3E+01	Yes	No	No	No [g]	NT	NC	NC
Mercury	137	112	82	1.2E-01	Yes	No	No	No [g]	NT	NC	NC
Molybdenum	137	106	77	9.2E-01	Yes	No	No	No [g]	NT	NC	NC
Nickel	137	137	100	2.1E+01	Yes	No	No	No [g]	NT	NC	NC
Perchlorate	22	0	0	-	Yes	No	No	No	NT	NC	NC
Selenium	138	10	7	2.7E+00	Yes	No	Yes	**Yes** [h]	NP	3.1E-01	3.8E-01
Silver	137	29	21	2.1E-01	Yes	No	No	No [g]	NT	NC	NC
Thallium	140	45	32	5.1E-01	Yes	No	No	No [g]	NT	NC	NC
Vanadium	140	140	100	7.5E+01	Yes	No	No	No [g]	NT	NC	NC
Zinc	140	140	100	1.2E+03	Yes	No	Yes	**Yes** [h]	NP	7.4E+01	9.1E+01
Zirconium	140	126	90	1.4E+01	Yes	No	No	No [g]	NT	NC	NC
VOCs											
1,1,1,2-Tetrachloroethane	93	0	0	-	No	No	-	No	NT	NC	NC
1,1,1-Trichloroethane	93	0	0	-	Yes	No	-	No	NT	NC	NC
1,1,2,2-Tetrachloroethane	93	0	0	-	No	No	-	No	NT	NC	NC
1,1,2-Trichloro-1,2,2-trifluoroethane	93	0	0	-	Yes	No	-	No	NT	NC	NC
1,1,2-Trichloroethane	93	0	0	-	No	No	-	No	NT	NC	NC
1,1-Dichloroethane	93	0	0	-	No	No	-	No	NT	NC	NC
1,1-Dichloroethene	93	0	0	-	No	No	-	No	NT	NC	NC

Spreadsheet E.3-2

Selection of Chemicals of Potential Concern and Exposure Point Concentrations for Soil (0-10 feet bgs)
Radioactive Materials Handling Facility RFI Site

Chemical[a, b]	Number of Samples	Number of Detects	Percent Frequency of Detection	Maximum Detected Concentration (mg/kg)	Potentially Site Related	Chemical Detected in Laboratory Blanks [c]	RFI Site Exceeds Background [d]	COPC	ProUCL Distribution	EPC CTE[e] (mg/kg)	EPC RME[f] (mg/kg)
1,1-Dichloropropene	93	0	0	-	No	No	-	No	NT	NC	NC
1,2,3-Trichlorobenzene	92	0	0	-	No	No	-	No	NT	NC	NC
1,2,3-Trichloropropane	93	0	0	-	No	No	-	No	NT	NC	NC
1,2,4-Trichlorobenzene	104	0	0	-	No	No	-	No	NT	NC	NC
1,2,4-Trimethylbenzene	92	0	0	-	No	No	-	No	NT	NC	NC
1,2-Dibromo-3-chloropropane	93	0	0	-	No	No	-	No	NT	NC	NC
1,2-Dibromoethane	93	0	0	-	No	No	-	No	NT	NC	NC
1,2-Dichlorobenzene	105	0	0	-	No	No	-	No	NT	NC	NC
1,2-Dichloroethane	93	0	0	-	No	No	-	No	NT	NC	NC
1,2-Dichloropropane	93	0	0	-	No	No	-	No	NT	NC	NC
1,3,5-Trimethylbenzene	92	0	0	-	No	No	-	No	NT	NC	NC
1,3-Dichlorobenzene	104	0	0	-	No	No	-	No	NT	NC	NC
1,3-Dichloropropane	93	0	0	-	No	No	-	No	NT	NC	NC
1,4-Dichlorobenzene	104	0	0	-	No	No	-	No	NT	NC	NC
2-Butanone	93	1	1	1.8E-03	Yes	No	-	**Yes**	NT	1.8E-03	1.8E-03
2-Chloro-1,1,1-trifluoroethane	24	0	0	-	No	No	-	No	NT	NC	NC
2-Chloroethylvinylether	93	0	0	-	No	No	-	No	NT	NC	NC
2-Chlorotoluene	92	0	0	-	No	No	-	No	NT	NC	NC
2-Hexanone	93	0	0	-	No	No	-	No	NT	NC	NC
4-Chlorotoluene	92	0	0	-	No	No	-	No	NT	NC	NC
4-Methyl-2-pentanone	93	0	0	-	No	No	-	No	NT	NC	NC
Acetone	93	0	0	-	Yes	No	-	No	NT	NC	NC
Benzene	93	0	0	-	Yes	No	-	No	NT	NC	NC
Bromobenzene	93	0	0	-	No	No	-	No	NT	NC	NC
Bromochloromethane	93	0	0	-	No	No	-	No	NT	NC	NC
Bromodichloromethane	93	0	0	-	No	No	-	No	NT	NC	NC
Bromoform	93	0	0	-	No	No	-	No	NT	NC	NC
Bromomethane	93	0	0	-	No	No	-	No	NT	NC	NC
Carbon tetrachloride	93	0	0	-	Yes	No	-	No	NT	NC	NC
Chlorobenzene	93	0	0	-	No	No	-	No	NT	NC	NC
Chloroethane	93	0	0	-	No	No	-	No	NT	NC	NC
Chloroform	93	0	0	-	Yes	No	-	No	NT	NC	NC
Chloromethane	94	0	0	-	No	No	-	No	NT	NC	NC
Chlorotrifluoroethene	24	0	0	-	No	No	-	No	NT	NC	NC
cis-1,2-Dichloroethene	93	0	0	-	No	No	-	No	NT	NC	NC

Spreadsheet E.3-2

Selection of Chemicals of Potential Concern and Exposure Point Concentrations for Soil (0-10 feet bgs)
Radioactive Materials Handling Facility RFI Site

Chemical[a, b]	Number of Samples	Number of Detects	Percent Frequency of Detection	Maximum Detected Concentration (mg/kg)	Potentially Site Related	Chemical Detected in Laboratory Blanks [c]	RFI Site Exceeds Background [d]	COPC	ProUCL Distribution	EPC CTE[e] (mg/kg)	EPC RME[f] (mg/kg)
cis-1,3-Dichloropropene	93	0	0	-	No	No	-	No	NT	NC	NC
Dibromochloromethane	93	0	0	-	No	No	-	No	NT	NC	NC
Dibromomethane	93	0	0	-	No	No	-	No	NT	NC	NC
Dichlorodifluoromethane	93	0	0	-	Yes	No	-	No	NT	NC	NC
Ethylbenzene	93	1	1	3.2E-04	No	No	-	No	NT	NC	NC
Isopropylbenzene	92	0	0	-	No	No	-	No	NT	NC	NC
m,p-Xylene	93	10	11	6.8E-04	Yes	No	-	**Yes**	NP	4.6E-04	5.3E-04
Methyl tert-butyl ether	93	0	0	-	No	No	-	No	NT	NC	NC
Methylene chloride	93	22	24	8.6E-03	Yes	No	-	**Yes**	NP	3.2E-03	3.5E-03
n-Butylbenzene	92	0	0	-	No	No	-	No	NT	NC	NC
n-Propylbenzene	92	0	0	-	No	No	-	No	NT	NC	NC
o-Xylene	93	0	0	-	Yes	No	-	No	NT	NC	NC
p-Isopropyltoluene	92	0	0	-	No	No	-	No	NT	NC	NC
sec-Butylbenzene	92	0	0	-	No	No	-	No	NT	NC	NC
Styrene	93	25	27	5.5E-04	No	No	-	**Yes**	NP	2.9E-04	3.1E-04
tert-Butylbenzene	92	0	0	-	No	No	-	No	NT	NC	NC
Tetrachloroethene	93	2	2	4.7E-04	Yes	No	-	**Yes**	NP	3.5E-04	4.7E-04
Toluene	93	3	3	4.5E-04	Yes	No	-	**Yes**	NP	3.8E-04	4.5E-04
trans-1,2-Dichloroethene	93	0	0	-	No	No	-	No	NT	NC	NC
trans-1,3-Dichloropropene	93	0	0	-	No	No	-	No	NT	NC	NC
Trichloroethene	93	0	0	-	Yes	No	-	No	NT	NC	NC
Trichlorofluoromethane	93	0	0	-	No	No	-	No	NT	NC	NC
Vinyl chloride	93	0	0	-	No	No	-	No	NT	NC	NC
SVOCs											
1,2-Diphenylhydrazine	29	0	0	-	No	No	-	No	NT	NC	NC
1-Methylnaphthalene	105	1	1	7.0E-04	Yes	No	-	**Yes**	NT	7.0E-04	7.0E-04
2,4,5-Trichlorophenol	29	0	0	-	No	No	-	No	NT	NC	NC
2,4,6-Trichlorophenol	29	0	0	-	No	No	-	No	NT	NC	NC
2,4-Dichlorophenol	29	0	0	-	No	No	-	No	NT	NC	NC
2,4-Dimethylphenol	29	0	0	-	No	No	-	No	NT	NC	NC
2,4-Dinitrophenol	29	0	0	-	No	No	-	No	NT	NC	NC
2-Chloronaphthalene	29	0	0	-	No	No	-	No	NT	NC	NC
2-Chlorophenol	29	0	0	-	No	No	-	No	NT	NC	NC
2-Methylnaphthalene	105	1	1	8.0E-04	Yes	No	-	**Yes**	NT	8.0E-04	8.0E-04

Spreadsheet E.3-2

Selection of Chemicals of Potential Concern and Exposure Point Concentrations for Soil (0-10 feet bgs)
Radioactive Materials Handling Facility RFI Site

Chemical[a, b]	Number of Samples	Number of Detects	Percent Frequency of Detection	Maximum Detected Concentration (mg/kg)	Potentially Site Related	Chemical Detected in Laboratory Blanks [c]	RFI Site Exceeds Background [d]	COPC	ProUCL Distribution	EPC CTE[e] (mg/kg)	EPC RME[f] (mg/kg)
2-Methylphenol	29	0	0	-	No	No	-	No	NT	NC	NC
2-Nitroaniline	29	0	0	-	No	No	-	No	NT	NC	NC
2-Nitrophenol	29	0	0	-	No	No	-	No	NT	NC	NC
3,3'-Dichlorobenzidine	29	0	0	-	No	No	-	No	NT	NC	NC
3-Nitroaniline	29	0	0	-	No	No	-	No	NT	NC	NC
4,6-Dinitro-2-methylphenol	29	0	0	-	No	No	-	No	NT	NC	NC
4-Bromophenyl phenyl ether	29	0	0	-	No	No	-	No	NT	NC	NC
4-Chloro-3-methylphenol	29	0	0	-	No	No	-	No	NT	NC	NC
4-Chloroaniline	29	0	0	-	No	No	-	No	NT	NC	NC
4-Chlorophenyl phenyl ether	29	0	0	-	No	No	-	No	NT	NC	NC
4-Methylphenol	29	0	0	-	No	No	-	No	NT	NC	NC
4-Nitroaniline	29	0	0	-	No	No	-	No	NT	NC	NC
4-Nitrophenol	29	0	0	-	No	No	-	No	NT	NC	NC
Acenaphthene	105	3	3	1.0E-02	Yes	No	-	**Yes**	NP	1.3E-02	1.9E-02
Acenaphthylene	105	0	0	-	Yes	No	-	**Yes** [i]	NP	2.4E-03	3.4E-03
Aniline	29	0	0	-	No	No	-	No	NT	NC	NC
Anthracene	105	7	7	1.4E-02	Yes	No	-	**Yes**	NP	8.8E-03	1.2E-02
Benzidine	29	0	0	-	No	No	-	No	NT	NC	NC
Benzo(a)anthracene	105	14	13	7.0E-02	Yes	No	-	**Yes**	NP	3.4E-03	6.7E-03
Benzo(a)pyrene	105	15	14	7.1E-02	Yes	No	-	**Yes**	NP	3.5E-03	6.9E-03
Benzo(b)fluoranthene	105	22	21	1.4E-01	Yes	No	-	**Yes**	NP	6.7E-03	1.3E-02
Benzo(e)pyrene	-	-	-	-	Yes	No	-	**Yes** [j]	NP	1.5E-02	3.0E-02
Benzo(g,h,i)perylene	105	12	11	3.1E-02	Yes	No	-	**Yes**	NP	6.3E-03	8.5E-03
Benzo(k)fluoranthene	104	1	1	1.8E-04	Yes	No	-	**Yes**	NP	8.9E-04	1.7E-03
Benzoic acid	29	0	0	-	No	No	-	No	NT	NC	NC
Benzyl alcohol	28	0	0	-	No	No	-	No	NT	NC	NC
bis(2-Chloroethoxy)methane	29	0	0	-	No	No	-	No	NT	NC	NC
bis(2-Chloroethyl)ether	29	0	0	-	No	No	-	No	NT	NC	NC
bis(2-Chloroisopropyl) ether	29	0	0	-	No	No	-	No	NT	NC	NC
bis(2-Ethylhexyl)phthalate	105	13	12	3.7E+00	No	No	-	**Yes**	NP	4.7E-02	2.1E-01
Butyl benzyl phthalate	105	8	8	2.1E-02	No	No	-	**Yes**	NP	8.5E-03	1.0E-02
Chrysene	105	17	16	1.0E-01	No	No	-	**Yes**	NP	5.2E-03	1.0E-02
Dibenz(a,h)anthracene	105	2	2	2.0E-03	Yes	No	-	**Yes**	NP	6.1E-04	1.1E-03
Dibenzofuran	29	0	0	-	No	No	-	No	NT	NC	NC
Diethylphthalate	105	1	1	1.2E-02	No	No	-	No	NT	NC	NC

Spreadsheet E.3-2

Selection of Chemicals of Potential Concern and Exposure Point Concentrations for Soil (0-10 feet bgs)
Radioactive Materials Handling Facility RFI Site

Chemical[a, b]	Number of Samples	Number of Detects	Percent Frequency of Detection	Maximum Detected Concentration (mg/kg)	Potentially Site Related	Chemical Detected in Laboratory Blanks [c]	RFI Site Exceeds Background [d]	COPC	ProUCL Distribution	EPC CTE[e] (mg/kg)	EPC RME[f] (mg/kg)
Dimethyl phthalate	105	0	0	-	No	No	-	No	NT	NC	NC
Di-n-butylphthalate	105	21	20	7.6E-02	No	No	-	**Yes**	NP	8.4E-03	1.0E-02
Di-n-octyl phthalate	105	1	1	8.7E-03	No	No	-	No	NT	NC	NC
Diphenylamine	29	0	0	-	No	No	-	No	NT	NC	NC
Fluoranthene	105	22	21	1.8E-01	Yes	No	-	**Yes**	NP	8.0E-03	1.6E-02
Fluorene	104	2	2	9.2E-04	Yes	No	-	**Yes**	NP	1.4E-02	2.8E-02
Hexachlorobenzene	29	0	0	-	No	No	-	No	NT	NC	NC
Hexachlorobutadiene	103	0	0	-	No	No	-	No	NT	NC	NC
Hexachlorocyclopentadiene	29	0	0	-	No	No	-	No	NT	NC	NC
Hexachloroethane	29	0	0	-	No	No	-	No	NT	NC	NC
Indeno(1,2,3-cd)pyrene	105	9	9	2.9E-02	Yes	No	-	**Yes**	NP	1.9E-03	3.6E-03
Isophorone	29	0	0	-	No	No	-	No	NT	NC	NC
m-Terphenyl	23	0	0	-	No	No	-	No	NT	NC	NC
Naphthalene	124	3	2	7.6E-04	Yes	No	-	**Yes**	NP	4.6E-04	7.2E-04
N-Nitrosodimethylamine	105	1	1	5.7E-03	No	No	-	No	NT	NC	NC
N-Nitrosodi-n-propylamine	29	0	0	-	No	No	-	No	NT	NC	NC
o-Terphenyl	23	0	0	-	No	No	-	No	NT	NC	NC
Pentachlorophenol	29	0	0	-	No	No	-	No	NT	NC	NC
Perylene	-	-	-	-	No	No	-	**Yes** [i]	NP	8.5E-03	1.7E-02
Phenanthrene	105	17	16	8.7E-02	Yes	No	-	**Yes**	NP	3.2E-02	4.7E-02
Phenol	29	0	0	-	No	No	-	No	NT	NC	NC
p-Terphenyl	23	0	0	-	No	No	-	No	NT	NC	NC
Pyrene	105	24	23	1.6E-01	Yes	No	-	**Yes**	NP	9.0E-03	1.7E-02
Glycols											
Diethylene glycol	8	0	0	-	Yes	No	-	No	NT	NC	NC
Ethylene glycol	8	0	0	-	Yes	No	-	No	NT	NC	NC
Propylene glycol	8	0	0	-	Yes	No	-	No	NT	NC	NC
Triethylene glycol	8	0	0	-	Yes	No	-	No	NT	NC	NC
Energetic Constituents											
2,4-Dinitrotoluene	29	0	0	-	No	No	-	No	NT	NC	NC
2,6-Dinitrotoluene	29	0	0	-	No	No	-	No	NT	NC	NC
Nitrobenzene	29	0	0	-	No	No	-	No	NT	NC	NC

Spreadsheet E.3-2

Selection of Chemicals of Potential Concern and Exposure Point Concentrations for Soil (0-10 feet bgs)
Radioactive Materials Handling Facility RFI Site

Chemical[a, b]	Number of Samples	Number of Detects	Percent Frequency of Detection	Maximum Detected Concentration (mg/kg)	Potentially Site Related	Chemical Detected in Laboratory Blanks [c]	RFI Site Exceeds Background [d]	COPC	ProUCL Distribution	EPC CTE[e] (mg/kg)	EPC RME[f] (mg/kg)
Pesticides											
4,4'-DDD	5	0	0	-	No	No	-	No	NT	NC	NC
4,4'-DDE	5	1	20	4.9E-03	No	No	-	**Yes**	NT	2.7E-03	4.9E-03
4,4'-DDT	5	1	20	5.3E-03	No	No	-	**Yes**	NT	2.8E-03	5.3E-03
Aldrin	5	0	0	-	No	No	-	No	NT	NC	NC
alpha-BHC	5	0	0	-	No	No	-	No	NT	NC	NC
alpha-Chlordane	5	0	0	-	No	No	-	No	NT	NC	NC
beta-BHC	5	0	0	-	No	No	-	No	NT	NC	NC
delta-BHC	5	0	0	-	No	No	-	No	NT	NC	NC
Dieldrin	5	0	0	-	No	No	-	No	NT	NC	NC
Endosulfan I	5	0	0	-	No	No	-	No	NT	NC	NC
Endosulfan II	5	0	0	-	No	No	-	No	NT	NC	NC
Endosulfan sulfate	5	0	0	-	No	No	-	No	NT	NC	NC
Endrin	5	0	0	-	No	No	-	No	NT	NC	NC
Endrin aldehyde	5	0	0	-	No	No	-	No	NT	NC	NC
Endrin ketone	5	0	0	-	No	No	-	No	NT	NC	NC
gamma-BHC	5	0	0	-	No	No	-	No	NT	NC	NC
gamma-Chlordane	5	0	0	-	No	No	-	No	NT	NC	NC
Heptachlor	5	0	0	-	No	No	-	No	NT	NC	NC
Heptachlor epoxide	5	0	0	-	No	No	-	No	NT	NC	NC
Methoxychlor	5	0	0	-	No	No	-	No	NT	NC	NC
Toxaphene	5	0	0	-	No	No	-	No	NT	NC	NC
Herbicides											
2,4,5-T	5	0	0	-	No	No	-	No	NT	NC	NC
2,4,5-TP	5	0	0	-	No	No	-	No	NT	NC	NC
2,4-D	5	0	0	-	No	No	-	No	NT	NC	NC
Total Petroleum Hydrocarbons											
C08-C11(Gasoline Range)	137	1	1	1.5E+00	No	No	-	No	NT	NC	NC
C11-C14(Kerosene Range)	137	3	2	3.6E+00	Yes	No	-	**Yes**	NP	1.6E+00	1.9E+00
C14-C20(Diesel Range)	136	17	13	2.6E+02	Yes	No	-	**Yes**	NP	4.2E+00	8.0E+00
C20-C30(Lubricant Oil Range)	138	131	95	1.0E+03	Yes	No	-	**Yes**	NP	5.5E+01	1.1E+02

Spreadsheet E.3-2

Selection of Chemicals of Potential Concern and Exposure Point Concentrations for Soil (0-10 feet bgs)
Radioactive Materials Handling Facility RFI Site

Chemical[a, b]	Number of Samples	Number of Detects	Percent Frequency of Detection	Maximum Detected Concentration (mg/kg)	Potentially Site Related	Chemical Detected in Laboratory Blanks [c]	RFI Site Exceeds Background [d]	COPC	ProUCL Distribution	EPC CTE[e] (mg/kg)	EPC RME[f] (mg/kg)
PCDD/PCDFs											
2,3,7,8-TCDD	8	0	0	-	No	No	-	**Yes** [j]	NT	1.1E-07	3.3E-07
1,2,3,7,8-PeCDD	8	3	38	1.6E-07	No	No	-	**Yes** [j]	NP	1.4E-07	1.5E-07
1,2,3,4,7,8-HxCDD	8	2	25	1.7E-07	No	No	-	**Yes** [j]	NP	1.5E-07	1.6E-07
1,2,3,6,7,8-HxCDD	8	4	50	8.8E-07	No	No	-	**Yes** [j]	NP	5.1E-07	6.2E-07
1,2,3,7,8,9-HxCDD	8	4	50	5.8E-07	No	No	-	**Yes** [j]	NP	3.8E-07	4.6E-07
1,2,3,4,6,7,8-HpCDD	8	7	88	2.4E-05	No	No	-	**Yes** [j]	NP	8.8E-06	1.4E-05
OCDD	8	8	100	3.9E-04	No	No	-	**Yes** [j]	NP	1.2E-04	2.1E-04
2,3,7,8-TCDF	8	0	0	-	No	No	-	**Yes** [j]	NT	2.9E-07	4.4E-07
1,2,3,7,8-PeCDF	8	0	0	-	No	No	-	**Yes** [j]	NT	6.0E-07	2.2E-06
2,3,4,7,8-PeCDF	8	2	25	4.4E-07	No	No	-	**Yes** [j]	NP	2.1E-07	3.5E-07
1,2,3,4,7,8-HxCDF	8	3	38	1.0E-06	No	No	-	**Yes** [j]	NP	5.6E-07	7.1E-07
1,2,3,6,7,8-HxCDF	8	3	38	3.2E-07	No	No	-	**Yes** [j]	NP	2.1E-07	2.8E-07
2,3,4,6,7,8-HxCDF	8	3	38	4.3E-07	No	No	-	**Yes** [j]	NP	2.5E-07	3.3E-07
1,2,3,7,8,9-HxCDF	8	3	38	1.7E-07	No	No	-	**Yes** [j]	NP	1.4E-07	1.6E-07
1,2,3,4,6,7,8-HpCDF	8	6	75	5.9E-06	No	No	-	**Yes** [j]	NP	2.2E-06	3.6E-06
1,2,3,4,7,8,9-HpCDF	8	2	25	4.3E-07	No	No	-	**Yes** [j]	NP	3.0E-07	3.7E-07
OCDF	8	5	63	1.2E-05	No	No	-	**Yes** [j]	NP	4.4E-06	7.5E-06
Total Tetra	-	-	-	-	-	-	No	-	NT	NC	NC
Total Penta	-	-	-	-	-	-	No	-	NT	NC	NC
Total Hexa	-	-	-	-	-	-	No	-	NT	NC	NC
Total Hepta	-	-	-	-	-	-	No	-	NT	NC	NC
Total Octa	-	-	-	-	-	-	Yes	-	NT	NC	NC
PCBs and PCTs											
Aroclor 1016	79	0	0	-	Yes	No	-	No	NT	NC	NC
Aroclor 1221	79	0	0	-	Yes	No	-	No	NT	NC	NC
Aroclor 1232	79	0	0	-	Yes	No	-	No	NT	NC	NC
Aroclor 1242	79	4	5	1.1E-02	Yes	No	-	**Yes**	NP	3.5E-03	3.8E-03
Aroclor 1248	79	1	1	7.9E-03	Yes	No	-	**Yes**	NT	7.5E-03	7.9E-03
Aroclor 1254	79	17	22	4.1E-02	Yes	No	-	**Yes**	NP	4.8E-03	6.4E-03
Aroclor 1260	79	20	25	6.7E+00	Yes	No	-	**Yes**	NP	8.9E-02	4.7E-01
Aroclor 5442	5	0	0	-	Yes	No	-	No	NT	NC	NC
PCB-105	-	-	-	-	No	No	-	**Yes** [k]	NP	7.7E-06	3.8E-05
PCB-114	-	-	-	-	No	No	-	**Yes** [k]	NP	1.5E-07	6.9E-07

Spreadsheet E.3-2

Selection of Chemicals of Potential Concern and Exposure Point Concentrations for Soil (0-10 feet bgs)
Radioactive Materials Handling Facility RFI Site

Chemical[a, b]	Number of Samples	Number of Detects	Percent Frequency of Detection	Maximum Detected Concentration (mg/kg)	Potentially Site Related	Chemical Detected in Laboratory Blanks [c]	RFI Site Exceeds Background [d]	COPC	ProUCL Distribution	EPC CTE[e] (mg/kg)	EPC RME[f] (mg/kg)
PCB-118	-	-	-	-	No	No	-	**Yes** [k]	NP	1.5E-05	7.6E-05
PCB-123	-	-	-	-	No	No	-	**Yes** [k]	NP	2.1E-07	1.1E-06
PCB-126	-	-	-	-	No	No	-	**Yes** [k]	NP	5.9E-07	2.9E-06
PCB-156	-	-	-	-	No	No	-	**Yes** [k]	NP	5.0E-06	2.5E-05
PCB-157	-	-	-	-	No	No	-	**Yes** [k]	NP	2.2E-06	1.1E-05
PCB-167	-	-	-	-	No	No	-	**Yes** [k]	NP	3.8E-06	2.0E-05
PCB-169	-	-	-	-	No	No	-	**Yes** [k]	NP	5.7E-08	2.9E-07
PCB-189	-	-	-	-	No	No	-	**Yes** [k]	NP	5.7E-07	2.9E-06
PCB-77	-	-	-	-	No	No	-	**Yes** [k]	NP	1.2E-06	5.9E-06
PCB-81	-	-	-	-	No	No	-	**Yes** [k]	NP	2.1E-07	1.0E-06
Polychlorinated Terphenyls	4	0	0	-	No	No	-	No	NT	NC	NC

Notes:

a. **Bold** - Chemicals in bold font were selected as COPCs.
b. *Italics* - For chemicals in italicized font, EPCs are based all, or in part, on extrapolated data.
c. Any chemical eliminated as COPC due to laboratory blank contamination is discussed in Section 3.0.
d. Background comparison for inorganic compounds presented in Spreadsheet E.3-7.
e. Either the mean concentration for two or more samples, the reported concentration for a single sample, or the maximum detected concentration in cases where the mean concentration exceeds the maximum detected concentration.
f. Either the 95% upper confidence limit (95% UCL) on the mean for three or more samples, or the maximum detected concentration for less than three samples, or the maximum detected concentration in cases where the 95% UCL exceeds the maximum detected concentration.
g. Not selected as COPC since the RFI site sample population for soils at 0 to 10 feet bgs was found to be no different than the background sample population based on the Wilcoxon Rank Sum Test.
h. Although Wilcoxon Rank Sum Test indicates comparable to background, metal is present at maximum concentrations significantly greater than maximum background concentrations. It is subsequently selected as a COPC.
i. Selected as a COPC since either petroleum hydrocarbon fraction C11-C14, C14-C20, or C20-C30 was selected as a COPC.
j. If the PCDD/PCDFs are greater than background the entire group is selected as a COPC including individual constituents that were not detected.
k. Selected as a soil COPC since Aroclor-1254 and Aroclor-1260 were selected as COPCs.

"-" not applicable
bgs - below ground surface
COPC - chemical of potential concern
CTE - Central Tendency Exposure
EPC - exposure point concentration
mg/kg - milligrams per kilogram
NC - not calculated
NP - nonparametric distribution

Spreadsheet E.3-2

Selection of Chemicals of Potential Concern and Exposure Point Concentrations for Soil (0-10 feet bgs)
Radioactive Materials Handling Facility RFI Site

Chemical[a, b]	Number of Samples	Number of Detects	Percent Frequency of Detection	Maximum Detected Concentration (mg/kg)	Potentially Site Related	Chemical Detected in Laboratory Blanks [c]	RFI Site Exceeds Background [d]	COPC	ProUCL Distribution	EPC	
										CTE[e] (mg/kg)	RME[f] (mg/kg)

NT - data not tested for distribution due to sample size
PCBs - polychlorinated biphenyls
PCDD/PDDFs - polychlorinated dibenzo-p-dioxins and dibenzofurans
RME - Reasonable Maximum Exposure
SVOC - semivolatile organic chemicals
Total Tetra - sum of the 2,3,7,8-substituted tetrachlorinated dibenzo-p-dioxin and dibenzofuran congener concentrations
Total Penta - sum of the 2,3,7,8-substituted pentachlorinated dibenzo-p-dioxin and dibenzofuran congener concentrations
Total Hexa - sum of the 2,3,7,8-substituted hexachlorinated dibenzo-p-dioxin and dibenzofuran congener concentrations
Total Hepta - sum of the 2,3,7,8-substituted heptachlorinated dibenzo-p-dioxin and dibenzofuran congener concentrations
Total Octa - sum of the octachlorinated dibenzo-p-dioxin and dibenzofuran congener concentrations concentrations
VOC - volatile organic chemicals

Table E.3-3

Human Health Risk Estimate Summary[a]
Radioactive Materials Handling Facility RFI Site

Receptor	Soil Media[b]				Groundwater[c]				Total for Site Media			
	HI Range	CD[d, e]	Risk Range	CD[d, e]	HI Range	CD[d, e]	Risk Range	CD[d, e]	HI Range	CD[d, e]	Risk Range	CD[d, e]
Future Adult Recreator	<0.001 - 0.007	None	5E-09 - 2E-06	Aroclor 1260	<0.001 - <0.001	None	1E-11 - 1E-10	None	<0.001 - 0.007	None	5E-09 - 2E-06	Aroclor 1260
Future Child Recreator	0.02 - 0.08	None	7E-08 - 1E-06	None	<0.001 - <0.001	None	6E-11 - 2E-10	None	0.02 - 0.08	None	7E-08 - 1E-06	None
Future Adult Resident	0.01 - 0.03	None	1E-07 - 2E-06	Aroclor 1260	0.01 - 0.02	None	2E-06 - 7E-06	Trichloroethene, Tetrachloroethene	0.02 - 0.05	None	2E-06 - 1E-05	Aroclor 1260, Trichloroethene, Tetrachloroethene
without domestic use of groundwater[f]	0.01 - 0.03	None	1E-07 - 2E-06	Aroclor 1260	<0.001 - 0.001	None	2E-08 - 1E-07	None	0.01 - 0.03	None	1E-07 - 2E-06	Aroclor 1260
Future Child Resident	0.1 - 0.3	None	6E-07 - 5E-06	Aroclor 1260	0.04 - 0.06	None	4E-06 - 7E-06	Trichloroethene, Tetrachloroethene	0.2 - 0.4	None	5E-06 - 1E-05	Aroclor 1260, Trichloroethene, Tetrachloroethene
without domestic use of groundwater[f]	0.1 - 0.3	None	6E-07 - 5E-06	Aroclor 1260	0.002 - 0.003	None	7E-08 - 1E-07	None	0.1 - 0.3	None	6E-07 - 5E-06	Aroclor 1260

Notes:

a. Risk estimates shown are a sum of all exposure pathways per media; the range reported is for the central tendency and reasonable maximum exposures, respectively.
b. Soil media risk estimates are a sum of all direct and indirect exposure, so site soil and soil vapor.
c. Groundwater media risk estimates are a sum of indirect and direct exposure to site groundwater, except where indicated that direct exposure due to domestic groundwater use is excluded..
d. Chemical risk drivers are those COPCs detected onsite with an HI > 1, risk > $1x10^{-6}$, or blood lead concentration > 10 µg/dl. Only major risk contributors listed if cumulative HI >> 1 or cancer risk >> $1x10^{-6}$.
e. For chemical risk drivers in italicized font, risk estimates are based all, or in part, on extrapolated data.
f. Groundwater media risk estimates are for indirect exposure only and assume no domestic use of groundwater.

CD = Chemical risk driver
COPC = Chemical of potential concern
HI = Hazard index
NA = Not Applicable
µg/dl - micrograms per deciliter

Table E.3-5
Reasonable Maximum Exposure Cumulative Risk Estimates
Radioactive Materials Handling Facility RFI Site

Chemical[a]	Total Site Media Cancer Risk/HI[b]					
					W/O Domestic Groundwater Use	
	Adult Recreator	Child Recreator	Adult Resident	Child Resident	Adult Resident	Child Resident
CANCER RISK						
Inorganic Compounds						
Cadmium	7E-12	1E-11	5E-11	4E-11	5E-11	4E-11
Cobalt	3E-10	7E-10	2E-09	2E-09	2E-09	2E-09
Hexavalent chromium	9E-11	2E-10	6E-10	5E-10	6E-10	5E-10
VOCs						
1,1-Dichloroethane	7E-13	1E-12	9E-09	8E-09	8E-10	6E-10
Benzene	3E-10	6E-10	2E-07	1E-07	2E-07	1E-07
Chloroform	7E-13	1E-12	4E-08	4E-08	8E-10	6E-10
Methylene chloride	2E-11	3E-11	3E-09	2E-09	3E-09	2E-09
Tetrachloroethene	1E-10	2E-10	5E-06	5E-06	3E-08	2E-08
Trichloroethene	9E-11	2E-10	2E-06	2E-06	1E-07	8E-08
SVOCs						
1-Methylnaphthalene	1E-11	8E-12	1E-11	3E-11	1E-11	3E-11
Benzo(a)anthracene	5E-09	4E-09	6E-09	1E-08	6E-09	1E-08
Benzo(a)pyrene	5E-08	4E-08	7E-08	1E-07	7E-08	1E-07
Benzo(b)fluoranthene	1E-08	8E-09	1E-08	3E-08	1E-08	3E-08
Benzo(k)fluoranthene	1E-09	1E-09	2E-09	3E-09	2E-09	3E-09
bis(2-Ethylhexyl)phthalate	3E-10	3E-10	5E-10	1E-09	5E-10	1E-09
Butyl benzyl phthalate	8E-12	7E-12	1E-11	3E-11	1E-11	3E-11
Chrysene	7E-10	6E-10	1E-09	2E-09	1E-09	2E-09
Dibenz(a,h)anthracene	3E-09	2E-09	4E-09	8E-09	4E-09	8E-09
Indeno(1,2,3-cd)pyrene	3E-09	2E-09	3E-09	7E-09	3E-09	7E-09
Naphthalene	2E-16	3E-16	1E-15	8E-16	1E-15	8E-16
Pesticides						
4,4'-DDE	4E-10	6E-10	9E-10	2E-09	9E-10	2E-09
4,4'-DDT	4E-10	6E-10	9E-10	2E-09	9E-10	2E-09
PCDD/PCDFs						
2,3,7,8-TCDD	7E-09	1E-08	2E-08	5E-08	2E-08	5E-08
1,2,3,7,8-PeCDD	3E-09	6E-09	1E-08	2E-08	1E-08	2E-08
1,2,3,4,7,8-HxCDD	3E-10	7E-10	1E-09	2E-09	1E-09	2E-09
1,2,3,6,7,8-HxCDD	1E-09	3E-09	4E-09	9E-09	4E-09	9E-09
1,2,3,7,8,9-HxCDD	1E-09	2E-09	3E-09	7E-09	3E-09	7E-09
1,2,3,4,6,7,8-HpCDD	3E-09	6E-09	9E-09	2E-08	9E-09	2E-08
OCDD	1E-09	3E-09	4E-09	9E-09	4E-09	9E-09
2,3,7,8-TCDF	9E-10	2E-09	3E-09	6E-09	3E-09	6E-09
1,2,3,7,8-PeCDF	1E-09	3E-09	4E-09	9E-09	4E-09	9E-09
2,3,4,7,8-PeCDF	2E-09	4E-09	7E-09	1E-08	7E-09	1E-08
1,2,3,4,7,8-HxCDF	1E-09	3E-09	5E-09	1E-08	5E-09	1E-08
1,2,3,6,7,8-HxCDF	6E-10	1E-09	2E-09	4E-09	2E-09	4E-09
2,3,4,6,7,8-HxCDF	7E-10	1E-09	2E-09	5E-09	2E-09	5E-09
1,2,3,7,8,9-HxCDF	3E-10	7E-10	1E-09	2E-09	1E-09	2E-09
1,2,3,4,6,7,8-HpCDF	8E-10	1E-09	2E-09	5E-09	2E-09	5E-09
1,2,3,4,7,8,9-HpCDF	8E-11	2E-10	2E-10	5E-10	2E-10	5E-10
OCDF	5E-11	9E-11	1E-10	3E-10	1E-10	3E-10
PCBs						
Aroclor 1242	1E-08	8E-09	1E-08	3E-08	1E-08	3E-08
Aroclor 1248	2E-08	2E-08	3E-08	6E-08	3E-08	6E-08
Aroclor 1254	2E-08	1E-08	3E-08	5E-08	3E-08	5E-08
Aroclor 1260	1E-06	1E-06	2E-06	4E-06	2E-06	4E-06
PCB-105	3E-11	5E-11	8E-11	2E-10	8E-11	2E-10
PCB-114	5E-13	1E-12	2E-12	3E-12	2E-12	3E-12
PCB-118	5E-11	1E-10	2E-10	4E-10	2E-10	4E-10
PCB-123	8E-13	2E-12	2E-12	5E-12	2E-12	5E-12
PCB-126	7E-09	1E-08	2E-08	5E-08	2E-08	5E-08
PCB-156	2E-11	4E-11	6E-11	1E-10	6E-11	1E-10
PCB-157	8E-12	2E-11	3E-11	6E-11	3E-11	6E-11

Table E.3-5
Reasonable Maximum Exposure Cumulative Risk Estimates
Radioactive Materials Handling Facility RFI Site

Chemical[a]	Total Site Media Cancer Risk/HI[b]					
					W/O Domestic Groundwater Use	
	Adult Recreator	Child Recreator	Adult Resident	Child Resident	Adult Resident	Child Resident
PCB-167	1E-11	3E-11	4E-11	1E-10	4E-11	1E-10
PCB-169	2E-10	4E-10	7E-10	1E-09	7E-10	1E-09
PCB-189	2E-12	4E-12	7E-12	1E-11	7E-12	1E-11
PCB-77	1E-11	3E-11	4E-11	1E-10	4E-11	1E-10
PCB-81	7E-12	1E-11	2E-11	5E-11	2E-11	5E-11
Total PCB Congeners	**7E-09**	**1E-08**	**2E-08**	**5E-08**	**2E-08**	**5E-08**
Total Cancer Risk	**2E-06**	**1E-06**	**1E-05**	**1E-05**	**2E-06**	**5E-06**

Table E.3-5
Reasonable Maximum Exposure Cumulative Risk Estimates
Radioactive Materials Handling Facility RFI Site

Chemical[a]	Total Site Media Cancer Risk/HI[b]					
					W/O Domestic Groundwater Use	
	Adult Recreator	Child Recreator	Adult Resident	Child Resident	Adult Resident	Child Resident
HAZARD INDEX						
Inorganic Compounds						
Beryllium	-	-	9E-03	3E-02	-	-
Cadmium	6E-05	1E-03	4E-04	3E-03	4E-04	3E-03
Cobalt	6E-03	8E-02	3E-02	3E-01	3E-02	3E-01
Copper	6E-05	8E-04	3E-04	3E-03	3E-04	3E-03
Cyanide	1E-05	1E-04	5E-05	5E-04	5E-05	5E-04
Hexavalent chromium	7E-06	1E-04	5E-05	4E-04	5E-05	4E-04
Selenium	2E-05	3E-04	1E-04	1E-03	1E-04	1E-03
Zinc	1E-04	2E-03	6E-04	5E-03	6E-04	5E-03
VOCs						
1,1,2-Trichloro-1,2,2-trifluoroethane	6E-08	5E-07	4E-05	1E-04	4E-05	1E-04
1,1-Dichloroethane	2E-09	2E-08	2E-05	9E-05	2E-06	7E-06
1,1-Dichloroethene	2E-07	2E-06	4E-04	1E-03	2E-04	7E-04
2-Butanone	9E-11	7E-10	1E-07	3E-07	1E-07	3E-07
Benzene	1E-06	9E-06	7E-04	2E-03	7E-04	2E-03
Chloroform	4E-09	3E-08	4E-04	2E-03	5E-06	1E-05
cis-1,2-Dichloroethene	1E-07	8E-07	3E-03	1E-02	1E-04	4E-04
m,p-Xylene	5E-09	3E-08	1E-06	3E-06	1E-06	3E-06
Methylene chloride	1E-07	5E-07	2E-05	6E-05	2E-05	6E-05
Styrene	2E-09	8E-09	2E-08	6E-08	2E-08	6E-08
Tetrachloroethene	5E-07	4E-06	3E-03	1E-02	4E-04	1E-03
Toluene	3E-08	2E-07	2E-05	4E-05	2E-05	4E-05
Trichloroethene	2E-07	2E-06	3E-04	8E-04	3E-04	8E-04
SVOCs						
1-Methylnaphthalene	-	-	-	-	-	-
2-Methylnaphthalene	3E-07	1E-06	4E-07	4E-06	4E-07	4E-06
Acenaphthene	8E-07	3E-06	1E-06	9E-06	1E-06	9E-06
Acenaphthylene	2E-07	5E-07	2E-07	2E-06	2E-07	2E-06
Anthracene	8E-08	2E-07	1E-07	8E-07	1E-07	8E-07
Benzo(a)anthracene	-	-	-	-	-	-
Benzo(a)pyrene	-	-	-	-	-	-
Benzo(b)fluoranthene	-	-	-	-	-	-
Benzo(e)pyrene	2E-06	6E-06	2E-06	2E-05	2E-06	2E-05
Benzo(g,h,i)perylene	-	-	-	-	-	-
Benzo(k)fluoranthene	-	-	-	-	-	-
bis(2-Ethylhexyl)phthalate	1E-05	6E-05	2E-05	2E-04	2E-05	2E-04
Butyl benzyl phthalate	6E-08	2E-07	1E-07	9E-07	1E-07	9E-07
Chrysene	-	-	-	-	-	-
Dibenz(a,h)anthracene	-	-	-	-	-	-
Di-n-butylphthalate	1E-07	5E-07	2E-07	2E-06	2E-07	2E-06
Fluoranthene	8E-07	2E-06	1E-06	8E-06	1E-06	8E-06
Fluorene	1E-06	4E-06	2E-06	1E-05	2E-06	1E-05
Indeno(1,2,3-cd)pyrene	-	-	-	-	-	-
Naphthalene	6E-08	2E-07	8E-08	7E-07	8E-08	7E-07
Perylene	1E-06	3E-06	1E-06	1E-05	1E-06	1E-05
Phenanthrene	3E-07	9E-07	4E-07	3E-06	4E-07	3E-06
Pyrene	1E-06	3E-06	1E-06	1E-05	1E-06	1E-05
Pesticides						
4,4'-DDE	-	-	-	-	-	-
4,4'-DDT	7E-06	4E-05	2E-05	2E-04	2E-05	2E-04
Total Petroleum Hydrocarbons						
C11-C14(Kerosene Range)	-	-	-	-	-	-
C14-C20(Diesel Range)	-	-	-	-	-	-
C20-C30(Lubricant Oil Range)	-	-	-	-	-	-

Table E.3-5
Reasonable Maximum Exposure Cumulative Risk Estimates
Radioactive Materials Handling Facility RFI Site

Chemical[a]	Total Site Media Cancer Risk/HI[b]					
					W/O Domestic Groundwater Use	
	Adult Recreator	Child Recreator	Adult Resident	Child Resident	Adult Resident	Child Resident
PCDD/PCDFs						
2,3,7,8-TCDD	6E-05	1E-03	5E-04	4E-03	5E-04	4E-03
1,2,3,7,8-PeCDD	-	-	-	-	-	-
1,2,3,4,7,8-HxCDD	-	-	-	-	-	-
1,2,3,6,7,8-HxCDD	-	-	-	-	-	-
1,2,3,7,8,9-HxCDD	-	-	-	-	-	-
1,2,3,4,6,7,8-HpCDD	-	-	-	-	-	-
OCDD	-	-	-	-	-	-
2,3,7,8-TCDF	-	-	-	-	-	-
1,2,3,7,8-PeCDF	-	-	-	-	-	-
2,3,4,7,8-PeCDF	-	-	-	-	-	-
1,2,3,4,7,8-HxCDF	-	-	-	-	-	-
1,2,3,6,7,8-HxCDF	-	-	-	-	-	-
2,3,4,6,7,8-HxCDF	-	-	-	-	-	-
1,2,3,7,8,9-HxCDF	-	-	-	-	-	-
1,2,3,4,6,7,8-HpCDF	-	-	-	-	-	-
1,2,3,4,7,8,9-HpCDF	-	-	-	-	-	-
OCDF	-	-	-	-	-	-
PCBs						
Aroclor 1242	-	-	-	-	-	-
Aroclor 1248	-	-	-	-	-	-
Aroclor 1254	6E-04	2E-03	8E-04	7E-03	8E-04	7E-03
Aroclor 1260	-	-	-	-	-	-
PCB-105	-	-	-	-	-	-
PCB-114	-	-	-	-	-	-
PCB-118	-	-	-	-	-	-
PCB-123	-	-	-	-	-	-
PCB-126	-	-	-	-	-	-
PCB-156	-	-	-	-	-	-
PCB-157	-	-	-	-	-	-
PCB-167	-	-	-	-	-	-
PCB-169	-	-	-	-	-	-
PCB-189	-	-	-	-	-	-
PCB-77	-	-	-	-	-	-
PCB-81	-	-	-	-	-	-
Total PCB Congeners	-	-	-	-	-	-
Total Hazard Index	**7E-03**	**8E-02**	**5E-02**	**4E-01**	**3E-02**	**3E-01**

Notes:

a. For chemicals in italicized font, risk estimates are based all, or in part, on extrapolated data.

b. Total Site Media risk estimates are a sum of all exposure pathways for both soil and groundwater, except the plant consumption pathway, which is evaluated separately per the SRAM (MWH 2005). Total Site Media risk estimates include the maximum risk associated with indoor air and ambient air concentrations o COPCs modeled from soil vapor, soil, or groundwater.

"-" indicates that either adequate toxicity data were not available for a chemical or the exposure pathway was not applicable to that chemical.

HI - hazard index

PCB - polychlorinated biphenyls

PCDD/PCDF - Polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans.

SVOC - semi-volatile organic compound

VOC - volatile organic compound

W/O - without

HIs and cancer risks for PCB congeners. These results not included in cumulative risk estimates per the SRAM (MW

Table E.3-26

Ecological Hazard Estimate Summary
Radioactive Materials Handling Facility RFI Site

Receptor	Chemical Risk Driver[a, b]
Deer Mouse	Total Aroclors (7), Cadmium(10), Copper (4), Selenium (2), Zinc (6)
without inhalation pathway	Total Aroclors (7), Cadmium(10), Copper (4), Selenium (2), Zinc (6)
Hermit Thrush	Total Aroclors (7), Copper (8), Zinc (5)
Red-Tailed Hawk	Total Aroclors (2), Zinc (2)
Using Large Home Range Factor[c]	None
Bobcat	None
Using Large Home Range Factor[c]	None
Mule Deer	Cadmium (2)
Using Large Home Range Factor[c]	None

Notes:

a. Chemical risk drivers are those CPECs detected onsite with an HQ > 1, the RME HQ is provided after the chemical name. "None" indicates that no chemical's HQs > 1.

b. For chemical risk drivers in italicized font, hazard estimates are based all, or in part, on extrapolated data.

c. The hazard estimates for hawk, mule deer, and bobcat assume that their home ranges are equal to the RFI site acreage. This is an extremely conservative assumption; RFI site acreage is typically only a small fraction of a large animal's home range. The estimated hazard estimates decrease to the values indicated above if an adjustment is made to reflect a more realistic home range for these receptors.

CPEC = chemical of potential ecological concern
HQ = hazard quotient
RME - reasonable maximum exposure

APPENDIX I

Incremental Risk Calculation Methodology for Human and Ecological Risk Assessments
Technical Memorandum, Santa Susana Field Laboratory, Ventura County, California

INCREMENTAL RISK CALCULATION METHODOLOGY FOR HUMAN AND ECOLOGICAL RISK ASSESSMENTS
TECHNICAL MEMORANDUM
SANTA SUSANA FIELD LABORATORY
VENTURA COUNTY, CALIFORNIA

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2 Incremental Noncancer Hazard Estimates for Soil

3 Ecological Incremental Hazard Estimates for Chemicals in Soil

4 Ecological Incremental Hazard Estimates for Radionuclides in Soil

This technical memorandum describes the procedures to be used in the calculation of incremental risks for chemicals and radionuclides in human health and ecological risk assessments (HHERAs) prepared for the Santa Susana Field Laboratory (SSFL) during Resource Conservation and Recovery Act (RCRA) Facility Investigation and/or Remedial Investigation (RFI/RI) activities. In this technical memorandum, the term "risk" is used to refer to both carcinogenic risk and non-carcinogenic hazard estimates for chemicals and radionuclides in soil during human health risk assessments (HHRAs); and hazard estimates for chemicals in soil during ecological risk assessments (ERAs). Background comparisons are not currently performed for media other than soil; therefore, incremental risk estimates are specific to soil. This document was prepared for the California Environmental Protection Agency (Cal-EPA) Department of Toxic Substances Control (DTSC) on behalf of the Boeing Company (Boeing), National Aeronautics and Space Administration (NASA), and U.S. Department of Energy (DOE) in response to a request made by DTSC during a meeting held on February 17, 2010. This document is intended to supplement the Standardized Risk Assessment Methodology Work Plan, Santa Susana Field Laboratory, Ventura County, California Revision 2 – Final (SRAM Rev. 2) (MWH, 2005).

INTRODUCTION

"Incremental" risk is the additional risk that a receptor may incur from site-related exposure to chemicals or radionuclides above and beyond the risk that may result from exposure to background concentrations of chemicals or radionuclides. Because incremental risk estimates identify that portion of a receptor's risk that is attributable to site-related chemicals and/or radionuclides, such estimates allow risk managers to make more informed decisions regarding the need to remediate a site, and the scope of remediation, than do total risk estimates that are inclusive of background risks (USEPA, 2003). Human health incremental risk estimates for RFI/RI sites at the SSFL will be compared to the U.S. Environmental Protection Agency (USEPA) risk management range of 1E-06 to 1E-04 for carcinogenic risk and a hazard index (HI) of 1 for non-carcinogenic hazard (USEPA, 1991). For ecological receptors, incremental risk estimates for RFI/RI sites at the SSFL will be compared to the USEPA risk management value of 1 for hazard estimates. It will also be acknowledged in HHRAs prepared for the SSFL that an incremental carcinogenic risk of 1E-06 is the USEPA's and Cal-EPA's point-of-departure when making risk management decisions regarding remediation of a site.

The proposed procedures for calculating incremental risks attributable to exposures to RFI/RI site-related chemicals and radionuclides in HHERAs prepared for the SSFL are described below.

HUMAN HEALTH INCREMENTAL RISK METHODOLOGY

Incremental risk evaluations in support of future HHRAs prepared for the SSFL will include the following procedures:

- Screen chemical and radionuclide concentrations in samples collected at the SSFL to background concentrations of chemicals/radionuclides to identify chemicals of potential concern (COPCs) and/or radionuclides of potential concern (ROPCs) for each site;
- Calculate total (i.e., site-related and background) risk estimates for COPCs/ROPCs identified for a site;
- Calculate background risk estimates for COPCs/ROPCs identified for a site for which background concentrations have been established; and
- Calculate incremental risk estimates for site COPCs/ROPCs, based on the difference between total site risk estimates and background risk estimates.

Details of these procedures and examples of how incremental risk estimates will be presented in HHRAs prepared for the SSFL are described in the following subsections.

Comparison of Site Data to Background Data to Identify COPCs and ROPCs

Analytical results for chemicals and radionuclides in samples collected from RFI/RI sites will be screened against Agency-approved background concentrations using the methodology described for metals and dioxins in soil in SRAM Rev. 2 (MWH, 2005), or an alternative statistical method to be determined after completion of the SSFL supplemental background study. Chemicals and radionuclides with site concentrations higher than background concentrations, as determined through methods specified in SRAM Rev. 2 (MWH, 2005), or an alternative method approved by DTSC, will be retained as COPCs and ROPCs for quantitative evaluation in RFI/RI site HHRAs. Chemicals and radionuclides having site concentrations within the range of background concentrations will not be selected as COPCs or ROPCs, and will not be quantitatively evaluated in HHRAs prepared for RFI/RI sites.

Chemicals and radionuclides for which background data are available will be screened during the COPC/ROPC selection process of the HHRA. Background data for metals and dioxins/furans in soil were approved by DTSC in 2005, but additional soil background studies for chemicals (i.e., inorganics, dioxins/furans and polynuclear aromatic hydrocarbons [PAHs]) and radionuclides are were conducted by the DTSC and USEPA, respectively. The final, agency-approved background concentration data sets for chemicals and radionuclides defined by these studies will be used in the HHRA COPC/ROPC selection process.

Calculation of Total Risk Estimates

Total (i.e., site-related and background) risk estimates for RFI/RI sites will be calculated for human receptors exposed to COPCs based on applicable risk-based screening levels (RBSLs) and exposure point concentrations (EPCs), as described in Appendix B of the Standardized Risk

Assessment Methodology Addendum (SRAM Rev. 2 Addendum). Total risk estimates will be calculated based on the methodology described in SRAM Rev. 2 (MWH, 2005) and the SRAM Rev. 2 Addendum. Risk estimates for all exposure pathways and media will be combined to estimate total, cumulative site risk estimates for each combination of receptors and COPCs/ROPCs.

Total risk estimates for carcinogenic COPCs/ROPCs and non-carcinogenic COPCs will be presented separately, as shown in Tables 1 and 2. [Note: Total risk estimates presented in Tables 1 and 2 are 'fictional,' and do not represent actual risk estimates for any SSFL site. These risk estimates are presented for purposes of example, only.]

Calculation of Background Risk Estimates

Agency-approved background concentrations of chemicals or radionuclides retained as COPCs or ROPCs for a given RFI/RI site will be used as EPCs in the calculation of background risk estimates for each receptor. Background risk estimates will be calculated using the same procedures and assumptions that were used to calculate total RFI/RI site risk estimates.

Background risk estimates for carcinogenic COPCs/ROPCs and non-carcinogenic COPCs will be presented separately, as shown in Tables 1 and 2. [Note: Background risk estimates presented in Tables 1 and 2 are 'fictional', and do not represent actual risk estimates for any SSFL site; they are presented for purposes of example, only.]

Calculation of Incremental Risk Estimates

Incremental risk estimates will be calculated for each RFI/RI site by subtracting background risk estimates from total risk estimates for each receptor and COPC/ROPC combination. Incremental risk estimates for carcinogenic COPCs/ROPCs and non-carcinogenic COPCs will be presented separately, as shown in Tables 1 and 2. [Note: Incremental risk estimates presented in Tables 1 and 2 are 'fictional', and do not represent actual risk estimates for any SSFL site; they are presented for purposes of example, only.]Incremental risk estimates for all carcinogenic COPCs and ROPCs will be summed to calculate the cumulative, incremental carcinogenic risk for each receptor. Cumulative, incremental carcinogenic risk estimates for RFI/RI sites at the SSFL will be compared to USEPA's risk management range of 1E-06 to 1E-04 for carcinogenic risk (USEPA, 1991), and point-of-departure cancer risk criterion of 1E-06, when making risk management recommendations for a RFI/RI site. Sites with a cumulative, incremental carcinogenic risk estimate above these criteria will be proposed for evaluation of remedial alternatives in the feasibility study (FS).

Incremental risk estimates for all non-carcinogenic COPCs will be summed to calculate the cumulative, incremental non-cancer HI for each receptor. Cumulative, incremental non-cancer HI estimates will be compared to USEPA's non-cancer HI criterion of 1. In the event that the

total cumulative, incremental non-cancer HI estimate summed across all non-carcinogenic COPCs exceeds 1, target organ-specific incremental HI estimates will be calculated. Target organ-specific incremental HI estimates for each receptor will be compared to USEPA's non-cancer HI criterion of 1. Sites with a cumulative, target organ-specific incremental non-cancer HI estimate greater than 1 will be proposed for evaluation of remedial alternatives in the FS.

ECOLOGICAL INCREMENTAL RISK METHODOLOGY

Incremental risk evaluations in support of future ERAs prepared for the SSFL will follow methods similar to those used in calculating incremental risk for HHRAs, as discussed above. The procedures used to calculate incremental risk for ERAs include:

- Screen chemical and radionuclide concentrations detected in samples collected at the SSFL against background concentrations of chemicals/radionuclides to identify chemicals of potential ecological concern (CPECs) and/or radionuclides of potential ecological concern (RPECs) for each site

- Screen chemical sample quantitation limits (SQLs) against chemical-specific ecological risk-based screening levels (EcoRBSLs) to also identify CPECs;

- Calculate the total (i.e., site-related and background) risk estimates for CPECs/RPECs identified for a site;

- Calculate background risk estimates for CPECs/RPECs identified for a site for which background concentrations have been established; and

- Calculate incremental risk estimates for CPECs/RPECs at a site, based on the difference between total site risk estimates and background risk estimates.

These procedures and examples of how incremental risk estimates will be presented in ERAs prepared for the SSFL are described in the following subsections.

Comparison of Site Data to Background Data to Identify CPECs and RPECs

Chemicals and radionuclides for which background data are or will be available, including inorganics, dioxins/furans, PAHs, and radionuclides, will be used in the CPEC/RPEC selection process of the ERA. In conjunction with other screening criteria described in SRAM Rev. 2 (MWH, 2005), chemicals and radionuclides having site concentrations within the range of background concentrations will not be selected as CPECs or RPECs, and will not be quantitatively evaluated in ERAs. Chemicals and radionuclides with site concentrations higher than background concentrations will be retained as CPECs and RPECs for quantitative evaluation in RFI/RI site ERAs.

Calculation of Total Risk Estimates

Total (i.e., site-related and background) risk estimates for RFI/RI sites will be calculated for ecological receptors exposed to CPECs based on the EcoRBSLs and EPCs described in Appendix F of the SRAM Rev. 2 Addendum. Total risk estimates will be calculated based on the methodology described in SRAM Rev. 2 (MWH, 2005) and the SRAM Rev. Addendum. Ecological risk estimates (hazard quotients [HQs and HIs) for radionuclides are calculated based on different methodologies than ecological risk estimates for chemicals. These differences in methodology include the use of generic biota concentration guides (BCGs) during the calculation of ecological HQs and HIs for radionuclides, while receptor-specific HQs and HIs are calculated for chemicals. As a result, it is inappropriate to sum ecological hazards for radionuclides and chemicals to a total cumulative HI (MWH, 2009). Therefore, risk estimates for each ecological receptor across all applicable exposure pathways and media will be combined by chemical class to estimate total, cumulative site risk estimates for each ecological receptor and CPECs or RPECs.

Total risk estimates for CPECs and RPECs will be presented separately, as shown in Tables 3 and 4. [Note: Total risk estimates presented in Tables 3 and 4 are 'fictional', and do not represent actual risk estimates for any SSFL site; they are presented for purposes of example, only.]

Calculation of Background Risk Estimates

Agency-approved background concentrations of chemicals or radionuclides retained as CPECs or RPECs for a given RFI/RI site will be used as EPCs in the calculations of local background risk estimates for each receptor. Background risk estimates will be calculated using the same procedures and assumptions that were used to calculate total RFI/RI site risk estimates.

Background risk estimates for CPECs and RPECs will be presented separately, as shown in Tables 3 and 4. [Note: Background risk estimates presented in Tables 3 and 4 are 'fictional', and do not represent actual risk estimates for any SSFL site; they are presented for purposes of example, only.]

Calculation of Incremental Risk Estimates

Incremental risk estimates will be calculated for each RFI/RI site by subtracting background risk estimates from total risk estimates for each ecological receptor and for each CPEC or RPEC. Incremental risk estimates for CPECs and RPECs will be presented separately, as shown in Tables 3 and 4. [Note: Incremental risk estimates presented in Tables 3 and 4 are 'fictional', and do not represent actual risk estimates for any SSFL site; they are presented for purposes of example, only.]

Incremental risk estimates for CPECs with similar target organ effects (i.e., organochlorine pesticides, dioxins/furans, polychlorinated biphenyls, PAHs, etc.) and for RPECs will be summed to calculate chemical class-specific and radionuclide cumulative, incremental HIs for each receptor. Class-specific cumulative, incremental HI estimates will be compared to USEPA's HI criterion of 1. Sites with a chemical class-specific or radionuclide cumulative incremental HI estimate greater than 1 will be proposed for evaluation of remedial alternatives in the FS.

REFERENCES

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United States Environmental Protection Agency (USEPA), 1991. Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions. OSWER Directive 9355.0-30. April 22.

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USEPA, 2003. Exposure and Human Health Reassessment of 2,3,7,8-Tetrachlorodibenzo-*p*-Dioxin (TCDD) and Related Compounds National Academy Sciences (NAS) Review Draft. Vol. 3 Site-Specific Procedures.

TABLES

Table 1
RME Incremental Cancer Risk Estimates for Soil
Santa Susana Field Laboratory, Ventura County, California

Chemical	Total Site Risk Estimates		Background Risk Estimates		Incremental Cancer Risk Estimates	
	Resident	Recreator	Resident	Recreator	Resident	Recreator
Inorganic Compounds						
Arsenic	2.0E-05	6.5E-06	1.5E-05	5.0E-06	5E-06	2E-06
Barium	-	-	-	-	-	-
Beryllium	3.6E-12	1.2E-12	2.4E-12	8.0E-13	1E-12	4E-13
Cadmium	4.8E-11	1.6E-11	3.2E-11	1.1E-11	2E-11	5E-12
Cobalt	2.3E-09	7.6E-10	1.5E-09	5.1E-10	8E-10	3E-10
Copper	-	-	-	-	-	-
Hexavalent chromium	6.1E-10	9.2E-11	-	-	6E-10	9E-11
Manganese	-	-	-	-	-	-
Nickel	4.2E-12	1.4E-12	2.8E-12	9.3E-13	1E-12	5E-13
Zinc	-	-	-	-	-	-
Total Risk Estimates - Inorganic Compounds	**2E-05**	**7E-06**	**2E-05**	**5E-06**	**5E-06**	**2E-06**
VOCs					-	
Benzene	1.9E-07	3.0E-10	-	-	2E-07	3E-10
Methylene chloride	2.6E-09	2.2E-11	-	-	3E-09	2E-11
Tetrachloroethene	2.1E-08	1.3E-10	-	-	2E-08	1E-10
Vinyl chloride	1.7E-05	5.5E-06	-	-	2E-05	6E-06
Total Risk Estimates - VOCs	**2E-05**	**6E-06**	-	-	**2E-05**	**6E-06**
					-	
PAH TEQs					-	
Acenaphthene	NA	NA	-	-	NC	NC
Acenaphthylene	NA	NA	-	-	NC	NC
Anthracene	NA	NA	-	-	NC	NC
Benzo(a)anthracene	NA	NA	-	-	NC	NC
Benzo(a)pyrene	1.2E-05	4.3E-06	9.0E-06	3.0E-06	3.0E-06	1.3E-06
Benzo(b)fluoranthene	NA	NA	-	-	NC	NC
Benzo(g,h,i)perylene	NA	NA	-	-	NC	NC
Benzo(k)fluoranthene	NA	NA	-	-	NC	NC
Chrysene	NA	NA	-	-	NC	NC
Dibenz(a,h)anthracene	NA	NA	-	-	NC	NC
Fluoranthene	NA	NA	-	-	NC	NC
Fluorene	NA	NA	-	-	NC	NC

Table 1
RME Incremental Cancer Risk Estimates for Soil
Santa Susana Field Laboratory, Ventura County, California

Chemical	Total Site Risk Estimates		Background Risk Estimates		Incremental Cancer Risk Estimates	
	Resident	**Recreator**	**Resident**	**Recreator**	**Resident**	**Recreator**
Indeno(1,2,3-cd)pyrene	NA	NA	-	-	NC	NC
Naphthalene	2.8E-07	9.3E-08	8.3E-08	0.0000	2.0E-07	6.5E-08
Phenanthrene	NA	NA	-	-	NC	NC
Pyrene	NA	NA	-	-	NC	NC
Total Risk Estimates - PAH	**1E-05**	**4E-06**	**9E-06**	**3E-06**	**3E-06**	**1E-06**
Dioxin TEQ						
2,3,7,8-TCDD	6.4E-08	1.6E-08	3.2E-08	1.0E-08	3.2E-08	5.2E-09
Total Risk Estimates - Dioxin TEQ	**6E-08**	**2E-08**	**3E-08**	**1E-08**	**3E-08**	**5E-09**
Radionuclides						
Americium-241	1.9E-08	6.2E-09	1.2E-08	4.2E-09	6.7E-09	2.0E-09
Cobalt-60	3.6E-10	1.2E-10	2.4E-10	8.0E-11	1.2E-10	4.0E-11
Cesium-134	1.6E-09	5.2E-10	1.0E-09	3.5E-10	5.7E-10	1.7E-10
Cesium-137	3.9E-08	1.3E-08	2.6E-08	8.6E-09	1.3E-08	4.4E-09
Europium-152	4.2E-10	1.4E-10	2.8E-10	9.2E-11	1.4E-10	4.8E-11
Europium-154	5.0E-10	1.7E-10	3.3E-10	1.1E-10	1.7E-10	6.0E-11
Hydrogen-3	2.3E-08	7.6E-09	1.5E-08	5.1E-09	7.9E-09	2.5E-09
Iron-55	7.5E-07	3.2E-07	4.5E-07	1.5E-07	3.0E-07	1.7E-07
Manganese-54	1.1E-09	3.6E-10	7.2E-10	2.4E-10	3.6E-10	1.2E-10
Nickel-59	1.0E-06	3.5E-07	7.0E-07	2.5E-07	3.0E-07	1.0E-07
Nickel-63	9.5E-07	3.2E-07	6.3E-07	2.1E-07	3.2E-07	1.1E-07
Potassium-40	6.9E-09	2.3E-09	4.6E-09	1.5E-09	2.3E-09	8.0E-10
Plutonium-238	3.0E-08	9.9E-09	2.0E-08	6.6E-09	9.7E-09	3.3E-09
Plutonium-239	2.6E-08	8.6E-09	1.7E-08	5.8E-09	8.9E-09	2.8E-09
Plutonium-240	2.6E-08	8.7E-09	1.7E-08	5.8E-09	9.0E-09	2.9E-09
Plutonium-241	2.0E-06	6.9E-07	1.3E-06	4.2E-07	7.0E-07	2.7E-07
Plutonium-242	2.7E-08	9.1E-09	1.8E-08	6.1E-09	9.3E-09	3.0E-09
Radium-226	1.9E-09	6.4E-10	1.3E-09	4.3E-10	6.3E-10	2.1E-10
Radium-228	2.6E-09	8.7E-10	1.7E-09	5.8E-10	9.0E-10	2.9E-10
Sodium-22	8.6E-10	2.9E-10	5.8E-10	1.9E-10	2.8E-10	1.0E-10
Strontium-90	3.3E-09	1.1E-09	2.2E-09	7.4E-10	1.1E-09	3.6E-10
Thorium-228	2.4E-07	8.0E-08	1.6E-09	5.4E-08	2.4E-07	2.6E-08
Thorium-230	3.5E-08	1.2E-08	2.3E-08	7.8E-09	1.2E-08	4.2E-09

Table 1
RME Incremental Cancer Risk Estimates for Soil
Santa Susana Field Laboratory, Ventura County, California

Chemical	Total Site Risk Estimates		Background Risk Estimates		Incremental Cancer Risk Estimates	
	Resident	**Recreator**	**Resident**	**Recreator**	**Resident**	**Recreator**
Thorium-232	3.1E-08	1.0E-08	2.1E-08	6.9E-09	1.0E-08	3.1E-09
Uranium-233	3.9E-08	1.3E-08	2.6E-08	8.6E-09	1.3E-08	4.4E-09
Uranium-234	4.0E-08	1.3E-08	2.7E-08	8.9E-09	1.3E-08	4.1E-09
Uranium-235	2.0E-09	6.8E-10	1.4E-09	4.5E-10	6.4E-10	2.3E-10
Uranium-238	4.5E-08	1.5E-08	3.0E-08	9.9E-09	1.5E-08	5.1E-09
Total Risk Estimates - Radionuclides	**5E-06**	**2E-06**	**3E-06**	**1E-06**	**2E-06**	**7E-07**
Total Cancer Risk	**5E-05**	**2E-05**	**3E-05**	**9E-06**	**3E-05**	**9E-06**

Notes:

Total risk, background risk and incremental risk estimates presented in this table are ‘fictional’ and do not represent actual risk estimates for any SSFL site; they are presented for purposes of example, only.

"-" indicates that either adequate toxicity data were not available for a chemical or the exposure pathway was not applicable to that chemical.
NA - not applicable
NC - not calculated
PAH - polycyclic aromatic hydrocarbon
TEQ - toxic equivalency
VOC - volatile organic compound

Table 2
RME Incremental Noncancer Hazard Estimates for Soil
Santa Susana Field Laboratory, Ventura County, California

Chemical	Total Site Hazard Estimates		Background Hazard Estimates		Incremental Hazard Risk Estimates	
	Resident	Recreator	Resident	Recreator	Resident	Recreator
Inorganic Compounds						
Arsenic	0.47	0.17	0.32	0.11	0.16	0.065
Barium	0.0037	0.0012	0.0025	0.00082	0.0012	0.00041
Beryllium	0.37	0.12	0.24	0.081	0.12	0.041
Cadmium	0.69	0.23	0.46	0.15	0.23	0.077
Cobalt	0.15	0.049	0.097	0.032	0.049	0.016
Copper	0.019	0.0065	0.013	0.0043	0.0065	0.0022
Hexavalent chromium	0.24	0.079	0.16	0.053	0.079	0.026
Manganese	0.0064	0.0021	0.0043	0.0014	0.0021	0.00071
Nickel	0.037	0.012	0.025	0.0082	0.012	0.0041
Zinc	0.0053	0.0018	0.0035	0.0012	0.0018	0.00059
Total Hazard Estimates - Inorganic Compounds	**2**	**0.7**	**1**	**0.4**	**0.7**	**0.2**
VOCs						
Benzene	0.24	0.15	-	-	0.24	0.15
Methylene chloride	0.016	0.01	-	-	0.016	0.010
Tetrachloroethene	0.097	0.060	-	-	0.097	0.060
Vinyl chloride	0.32	0.11	-	-	0.32	0.20
Total Hazard Estimates - VOCs	**0.7**	**0.3**	**-**	**-**	**0.7**	**0.4**
SVOCs						
Acenaphthene	0.018	0.014	0.012	0.0041	0.0061	0.010
Acenaphthylene	0.018	0.014	0.012	0.0041	0.0061	0.010
Anthracene	0.004	0.003	0.0024	0.00081	0.0012	0.0020
Benzo(a)anthracene			-	-	NC	NC
Benzo(a)pyrene			-	-	NC	NC
Benzo(b)fluoranthene			-	-	NC	NC
Benzo(g,h,i)perylene			-	-	NC	NC
Benzo(k)fluoranthene			-	-	NC	NC
Chrysene			-	-	NC	NC
Dibenz(a,h)anthracene			-	-	NC	NC
Fluoranthene	0.027	0.021	0.018	0.0061	0.0091	0.015
Fluorene	0.027	0.021	0.018	0.0061	0.0091	0.015
Indeno(1,2,3-cd)pyrene			-	-	NC	NC
Naphthalene	0.055	0.043	0.037	0.012	0.018	0.030

Table 2
RME Incremental Noncancer Hazard Estimates for Soil
Santa Susana Field Laboratory, Ventura County, California

Chemical	Total Site Hazard Estimates		Background Hazard Estimates		Incremental Hazard Risk Estimates	
	Resident	**Recreator**	**Resident**	**Recreator**	**Resident**	**Recreator**
Phenanthrene	0.0037	0.0028	0.0024	0.00081	0.0012	0.0020
Pyrene	0.037	0.028	0.024	0.0081	0.012	0.020
Total Hazard Estimates - PAH	**0.09**	**0.07**	**0.1**	**0.04**	**0.06**	**0.1**
Dioxin TEQ						
2,3,7,8-TCDD	0.0023	0.00032	0.0011	0.00057	0.00045	0.000065
Total Hazard Estimates - Dioxin TEQ	**0.002**	**0.0003**	**0.001**	**0.0006**	**0.0005**	**0.00006**
Total Hazard Index	**3**	**1**	**1**	**0.5**	**1**	**0.8**

Notes:
Total risk, background risk and incremental risk estimates presented in this table are ‘fictional’ and do not represent actual risk estimates for any SSFL site; they are presented for purposes of example, only.

"-" indicates that either adequate toxicity data were not available for a chemical or the exposure pathway was not applicable to that chemical.
NA - not applicable
NC - not calculated
PAH - polycyclic aromatic hydrocarbon
TEQ - toxic equivalency
VOC - volatile organic compound

Table 3
Ecological Incremental Hazard Estimates for Chemicals in Soil
Santa Susana Field Laboratory, Ventura County, California

Chemical	Total Site Hazard Estimates			Background Hazard Estimates			Incremental Hazard Estimates		
	Soil Invertebrate	Deer Mouse	Hermit Thrush	Soil Invertebrate	Deer Mouse	Hermit Thrush	Soil Invertebrate	Deer Mouse	Hermit Thrush
Inorganic Compounds									
Arsenic	0.020	0.093	0.12	-	0.025	0.033	0.020	0.068	0.09
Barium	0.0013	0.16	0.19	0.00015	0.018	0.022	0.0012	0.14	0.17
Beryllium	0.019	0.13	-	0.0033	0.023	-	0.015	0.11	-
Cadmium	0.0020	0.066	0.24	0.00060	0.020	0.074	0.0014	0.046	0.17
Cobalt	0.0024	0.15	0.065	0.00063	0.040	0.017	0.0018	0.11	0.048
Copper	0.24	0.30	0.13	0.11	0.14	0.061	0.13	0.16	0.07
Hexavalent chromium	0.080	0.049	-	0.0045	0.0027	-	0.076	0.046	-
Manganese	0.19	0.045	0.11	-	0.0091	0.023	0.19	0.035	0.089
Nickel	0.021	0.16	0.22	0.0044	0.035	0.047	0.017	0.13	0.18
Zinc	0.22	0.10	0.013	0.014	0.0063	0.00081	0.21	0.095	0.012
Volatile Organic Compounds VOCs									
Benzene	0.00018	0.076	-	-	-	-	0.00018	0.076	-
Methylene chloride	-	0.00016	-	-	-	-	-	0.00016	-
Tetrachloroethene	0.00024	0.067	-	-	-	-	0.00024	0.067	-
Vinyl chloride	0.084	0.00060	-	-	-	-	0.084	0.00060	-
Semi-Volatile Organic Compounds (SVOCs)									
Acenaphthene	0.00031	0.000047	0.0055	0.000037	0.0000057	0.00066	0.00027	0.000042	0.0048
Acenaphthylene	0.00019	0.000061	0.0045	0.000030	0.000010	0.00071	0.00016	0.000051	0.0038
Anthracene	0.00019	0.000010	0.0067	0.000053	0.0000027	0.0019	0.00014	0.0000070	0.0049
Benzo(a)pyrene	0.00219	0.0091	0.014	0.00078	0.0032	0.0051	0.0014	0.0058	0.0091
Fluoranthene	0.00297	0.00088	0.0059	0.00025	0.000075	0.00050	0.0027	0.00080	0.0054
Fluorene	0.00092	0.00016	0.015	0.00014	0.000025	0.0024	0.00077	0.00014	0.013
Naphthalene	0.00042	0.000060	0.00084	0.000021	0.0000030	0.000042	0.00040	0.000057	0.00080
Phenanthrene	0.00312	0.0034	0.041	0.00026	0.00029	0.0034	0.0029	0.0031	0.037
Pyrene	0.00552	0.0032	0.011	0.00064	0.00037	0.0013	0.0049	0.0028	0.0097
PCDDs/PCDFs									
DioxinFuran TEQ[a]	NA	0.13	0.6	NA	0.065	0.43	NA	0.065	0.13
Total Hazard Estimate - PCDDs/PCDFs	**NA**	**0.1**	**0.6**	**NA**	**0.07**	**0.4**	**NA**	**0.07**	**0.1**
Coplanar Polychlorinated Biphenyls (Coplanar PCBs)[b]									
PCB TEQ [c]	NA	0.15	1.9	NA	0.075	1.1	NA	0.075	0.82
Total Hazard Estimate - Coplanar PCBs	**NA**	**0.2**	**2**	**NA**	**0.08**	**1**	**NA**	**0.08**	**0.8**
Total Hazard Estimate - PCDDs/PCDFs/Coplanar PCBs[d]	**NA**	**0.3**	**2**	**NA**	**0.1**	**2**	**NA**	**0.1**	**0.9**

Table 3
Ecological Incremental Hazard Estimates for Chemicals in Soil
Santa Susana Field Laboratory, Ventura County, California

Chemical	Total Site Hazard Estimates			Background Hazard Estimates			Incremental Hazard Estimates		
	Soil Invertebrate	Deer Mouse	Hermit Thrush	Soil Invertebrate	Deer Mouse	Hermit Thrush	Soil Invertebrate	Deer Mouse	Hermit Thrush
PCBs - Aroclors									
Aroclor-1248	0.000049	0.74	0.32	-	-	-	0.000049	0.74	0.32
Aroclor-1254	0.000068	0.12	0.21	-	-	-	0.000068	0.12	0.21
Aroclor-1260	0.00055	0.074	0.16	-	-	-	0.00055	0.074	0.16
Total Hazard Estimate - PCBs - Aroclors	**0.0007**	**0.9**	**0.7**	-	-	-	**0.0007**	**0.9**	**0.7**

Notes:

Total risk, background risk and incremental risk estimates presented in this table are ‘fictional’ and do not represent actual risk estimates for any SSFL site; they are presented for purposes of example, only.

[a] PCDDs/PCDFs toxicity equivalency for either mammals or birds.

[b] Represents the PCBs which are dioxin-like and for which hazards are calculated using the 2,3,7,8-TCDD toxicity value for each ecological receptor.

[c] Coplanar PCB toxicity equivalency for either mammals or birds.

[d] The total hazard estimate as a result of dioxin-like PCBs and PCDDs/PCDFs.

"-" indicates that either adequate toxicity data were not available for a chemical or the exposure pathway was not applicable to that chemical.
NA - not applicable
PCDD/PCDF - polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans.
TEQ - toxic equivalency

Table 4
Ecological Incremental Hazard Estimates for Radionuclides in Soil
Santa Susana Field Laboratory, Ventura County, California

Radionuclide	Total Site Hazard Estimates [a]	Background Hazard Estimates	Incremental Hazard Estimates
Americium-241	5.8E-06	6.3E-07	5.2E-06
Cesium-134	2.1E-03	3.0E-04	1.8E-03
Cesium-137	1.1E-02	3.4E-03	7.4E-03
Cobalt-60	4.1E-05	4.0E-06	3.7E-05
Europium-152	4.4E-05	7.6E-06	3.7E-05
Europium-154	2.1E-01	3.5E-02	1.7E-01
Hydrogen-3	5.0E-05	1.6E-05	3.3E-05
Iron-55	NC	NC	NC
Manganese-54	NC	NC	NC
Nickel-59	NC	NC	NC
Nickel-63	NC	NC	NC
Potassium-40	1.7E-04	3.1E-05	1.3E-04
Plutonium-238	2.0E-03	4.9E-04	1.5E-03
Plutonium-239	1.6E-06	4.0E-07	1.2E-06
Plutonium-240	NC	NC	NC
Plutonium-241	NC	NC	NC
Plutonium-242	NC	NC	NC
Radium-226	2.3E-03	1.5E-04	2.2E-03
Radium-228	2.8E-04	4.4E-05	2.4E-04
Sodium-22	NC	NC	NC
Strontium-90	4.9E-02	1.0E-02	3.9E-02
Thorium-228	2.4E-03	1.6E-04	2.2E-03
Thorium-230	1.1E-04	2.5E-05	8.0E-05
Thorium-232	7.7E-04	1.4E-04	6.3E-04
Uranium-233	1.6E-04	1.2E-05	1.5E-04
Uranium-234	1.7E-04	2.2E-05	1.5E-04
Uranium-235	2.7E-05	8.0E-06	1.9E-05
Uranium-238	5.4E-04	5.5E-05	4.8E-04
Total Hazard Estimate - Radionuclides	**3E-01**	**5E-02**	**2E-01**

Notes:

Total risk, background risk and incremental risk estimates presented in this table are ‘fictional’ and do not represent actual risk estimates for any SSFL site; they are presented for purposes of example, only.

[a] Total site hazard estimates are calculated for radionuclides which have biota concentration guides (BCGs) available. BCGs are based upon terrestrial animals, which are the limiting organism.

"-" indicates that either adequate toxicity data were not available for a chemical or the exposure pathway was not applicable to that chemical.

NC - not calculated

APPENDIX J

Hot Spot Evaluation Technical Memorandum, Santa Susana Field Laboratory, Ventura County, California

HOT SPOT EVALUATION
TECHNICAL MEMORANDUM
SANTA SUSANA FIELD LABORATORY
VENTURA COUNTY, CALIFORNIA

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This technical memorandum describes methods for identifying and evaluating potential soil concentration hot spots at the Santa Susana Field Laboratory (SSFL) during RCRA Facility Investigation (RFI) activities. This document has been prepared for the California Environmental Protection Agency (Cal-EPA) Department of Toxic Substances Control (DTSC) on behalf of the Boeing Company (Boeing) in response to DTSC comments on the Groups 4 and 6 RFI reports and a request by DTSC made during a meeting held on February 17, 2010. This document is intended to supplement the DTSC-approved *Standardized Risk Assessment Methodology (SRAM) Work Plan, Revision 2 - Final* (SRAM) (MWH, 2005).

INTRODUCTION

The current practice in risk assessments prepared for the SSFL is to calculate exposure point concentrations (EPCs) and risk estimates based on RFI site-wide area averaging. RFI site-wide area averaging is considered to be an appropriate method for calculating EPCs and resulting risks for the SSFL because of the intentionally biased nature of the sampling performed at such sites (i.e., samples are collected from known and suspected chemical use/release areas where concentrations are anticipated to be the highest, and then from step-out locations where concentrations are expected to be lower). However, DTSC has questioned whether this method may result in underestimation of risk for areas within an RFI site that may have higher constituent concentrations (i.e., potential hot spots) than other sampled locations within the RFI site. This technical memorandum describes procedures that will be used to evaluate contamination hot spots within an RFI site as part of the human health and ecological risk assessments (HHERAs) prepared for the SSFL.

The term “hot spot” is typically used to denote an investigation area that contains concentrations of a contaminant that are substantially elevated relative to a criterion, such as background concentrations or a screening level (ITRC, 2008). However, there is no standard definition of a hot spot, or what constitutes a “substantially” elevated concentration. In this technical memorandum, the term “hot spot” refers to a sample, or cluster of samples, with concentrations of one or more contaminants that are greater than 2 times the maximum background concentration, as available, and 10 times the most conservative human health risk-based screening level (RBSL) or high TRV-based ecological RBSL (EcoRBSL; i.e., ecological RBSL, based on the lowest observed adverse effect level [LOAEL]), as defined further below. Hot spot evaluation procedures will occur at two different steps in the risk assessment process: 1) during selection of chemicals of potential concern (COPCs) and chemicals of potential ecological concern

(CPECs), and 2) after preliminary risk estimates are calculated. Proposed procedures for identifying and evaluating potential hot spots are described below.

HOT SPOT EVALUATION PROCEDURES DURING COPC AND CPEC SELECTION

COPCs and CPECs will be selected as described in Section 3 of the SRAM (MWH, 2005) and the Standardized Risk Assessment Methodology Addendum (SRAM Rev. 2 Addendum). The COPC and CPEC selection process includes the following procedures:

- comparison of RFI site-specific data to background data; and
- evaluation of frequency of detection.

The hot spot evaluation components included in the COPC and CPEC selection procedures are described below.

Comparison of RFI Site-specific Data to Background Data

Analytical results for chemicals (i.e., metals, dioxins/furans, and polynuclear aromatic hydrocarbons [PAHs]) in samples collected at RFI sites will be screened against DTSC-approved background concentrations using the methodology described for metals and dioxin/furans in soil in Section 3.3 of the SRAM (MWH, 2005), or an alternative statistical method to be determined after completion of the SSFL new background study being conducted by DTSC. Chemicals determined to be above background will be retained as COPCs and CPECs for quantitative evaluation in RFI site HHERAs. Chemicals having RFI site concentrations consistent with background concentrations will not be selected as COPCs or CPECs, and will not be quantitatively evaluated in HHERAs prepared for RFI sites.

Background comparison tests that are currently performed in HHERAs prepared for the SSFL cannot guarantee that a chemical with concentrations within a small portion of the RFI site, or at an individual sample location, above background are retained as COPCs or CPECs due to the inherent nature of area averaging and statistical testing. For example, an RFI data set with one or several results higher than the range of background concentrations could be statistically indistinguishable from the background data set because it contains results below the minimum concentration in the background data set or because it contains a higher proportion of results below the mean of the background data set. As a result, chemicals may appear to be present at concentrations consistent with background through statistical comparison, yet still include a small portion of data that are inconsistent with background. In order to ensure that such analytes are not inappropriately eliminated from the HHERA, chemicals that have maximum detected

concentrations greater than 2 times maximum background concentrations, and are in areas of known or suspected chemical impacts, will be retained as COPCs and CPECs for further evaluation in RFI site HHERAs.

Evaluation of Frequency of Detection

As described in Section 3.1.2.2 of the SRAM (MWH, 2005), chemicals may be eliminated as COPCs and CPECs based on low frequency of detection (i.e., between zero and five percent frequency of detection for data sets with at least 20 samples). However, even chemicals detected infrequently may pose a potential risk to human health or the environment if their concentrations are high relative to applicable risk-based concentrations. As a result, frequency of detection will no longer be used as a selection criterion during the identification of COPCs and CPECs.

HOT SPOT EVALUATION PROCEDURES FOLLOWING CALCULATION OF PRELIMINARY RISK ESTIMATES

Total, background, and incremental human health and ecological risk estimates will be calculated on a RFI site-wide basis, as described in the *Incremental Risk Calculation Methodology for Human Health and Ecological Risk Assessments Technical Memorandum* (Appendix I or SRAM Rev. 2). Following calculation of human health and ecological risk estimates, Corrective Measures Study (CMS) or no further action (NFA) site recommendations for RFI sites will be made by the RFI site characterization and HHERA teams based on the 6-step process described below:

1. **Evaluation Step 1.** Risk assessment results for current or potential future human and ecological receptors for each RFI site will be compared to the DTSC points of departure as follows:
    - Human Health – carcinogenic risk criterion of 1×10^{-6} or non-carcinogenic hazard index (HI) of 1.
    - Ecological – chemical-specific hazard quotient (HQ) of 1 or target organ-specific chemical group HIs (dioxin/furans, LMW PAHs, HMW PAHs, PCBs, Aroclors, and organochlorine pesticides) of 1.
2. **Evaluation Step 2.** When estimated incremental risks are greater than the points of departure (as described in Evaluation Step 1) for an RFI site, they will be reviewed on a chemical-by-chemical basis to identify risk drivers and/or significant contributors to site incremental risk for each evaluated receptor, as follows:
    - Human Health – Risk drivers will be those chemicals with associated total site incremental risks for chemicals with background values (i.e., metals, dioxin/furans, and PAHs) and/or total site risks for chemicals lacking background values that are greater than the points of departure (as described in Evaluation Step 1). Risk contributors will be those chemicals that contribute to total incremental risk, but whose individual chemical-

associated incremental risk is between 2×10^{-7} and 1×10^{-6} or individual HQ values are between 0.2 and 1. The identification of risk contributors will be based on best professional judgment; these risk contribution departure points are approximate and may vary based on the chemical type detected and the estimated incremental risk or hazard for the individual chemical.

- Ecological – Detected chemicals with incremental chemical-specific HQs greater than 1 or incremental target organ-specific chemical group HIs (cadmium plus lead, dioxin/furans, PAHs, PCBs, and organochlorine pesticides) greater than 1 will be considered risk drivers.

3. **Evaluation Step 3.** Based upon the results of Evaluation Steps 1 and 2, RFI site areas will be recommended for either NFA or CMS by the RFI site characterization and HHERA teams. For RFI site areas that are recommended for CMS, risk drivers and risk contributors (where applicable) will be described in the "Results" section of the HHERA.
4. **Evaluation Step 4.** All RFI site areas (whether they are recommended for NFA or CMS) will undergo an additional hot spot analysis to determine whether any chemicals were inadvertently omitted as risk drivers or risk contributors (where applicable) due to area-averaging. Site characterization results for non-risk drivers and non-risk contributors over the entire RFI site will be reviewed on a point-by-point basis so that any potential chemical concentrations that may represent a potential hot spot are not overlooked. Specifically, this point-by-point hot spot evaluation will be performed by comparing sample-specific concentrations of non-risk drivers and non-risk contributors detected over the entire RFI site to 10 times the most conservative human health RBSL or high TRV-based EcoRBSL. The use of 10 times the most conservative human health RBSL will identify any portion of an RFI site that is within USEPA's risk management range of 10^{-6} to 10^{-4} for carcinogens, and at a level typically associated with a LOAEL for non-carcinogens. The use of 10 times the most conservative high TRV-based EcoRBSL is consistent with Menzie et al. (1992) which states that a limited potential for adverse effects on representative ecological species is assumed when individual HQs are between 1 and 10.
5. **Evaluation Step 5.** Sample locations with chemical concentrations greater than 10 times the most conservative human health RBSL or high TRV-based EcoRBSL will be evaluated spatially to identify potential hot spots (i.e., single sample locations or clusters of sample locations with elevated concentrations of contaminants).
6. **Evaluation Step 6.** Uncertainties identified in RFI site characterization and risk assessment results that affect site recommendations will be discussed in the HHERA Uncertainty Analysis section. In some cases, spatial areas containing chemicals within an RFI site that otherwise would have been recommended for NFA based on area averaging, will be evaluated in the CMS as a result of these uncertainties.

If a hot spot is identified using the evaluation procedures described above, further evaluation will be performed to determine if the hot spot presents significant risks. If significant risks are identified, the hot spot will be recommended for CMS. This additional evaluation and basis for the recommendation for the hot spot action will be presented in the RFI report.

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