Master

Work Plan/Field Sampling and Analysis Plan

Co-Located Chemical Sampling at Area IV

Santa Susana Field Laboratory

Ventura County, California

Prepared for:

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Energy Technology and Engineering Center
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Acronyms and Abbreviations

°C	degrees Celsius
%	percent
AOC	Area of Concern
bgs	below ground surface
Boeing	The Boeing Company
CAR	corrective action request
CDM	CDM Federal Programs Corporation
CMI	Corrective Measures Implementation
CMS	Corrective Measures Study
COC	contaminants of concern
D&D	decontamination and decommissioning
DL	detection limit
DOE	Department of Energy
DPT	direct push technology
DQO	data quality objective
DTSC	Department of Toxic Substances Control
EDD	electronic data deliverable
ELAP	Environmental Laboratory Accreditation Program
EPA	United States Environmental Protection Agency
ETEC	Energy Technology Engineering Center
FSAP	Field Sampling and Analysis Plan
g	gram
GIS	geographical information system
HAZWOPER	Hazardous Waste Operations and Emergency Response
HGL	HydroGeoLogic, Inc.
IDW	investigative derived waste
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
MS	matrix spike
MSD	matrix spike duplicate
NASA	National Aeronautics and Space Administration
NBZ	Northern Buffer Zone
NELAP	National Environmental Laboratory Accreditation Program
oz	ounce
PAH	polycyclic aromatic hydrocarbon
PARCCS	precision, accuracy, representativeness, completeness, comparability, and sensitivity
PCB	polychlorinated biphenyl
PID	photoionization detector
ppm	parts per million

PRG	preliminary remediation goal
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
%R	percent recovery
RBSL	risk-based screening level
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RPD	relative percent difference
SHASP	site health and safety plan
SIM	selective ion monitoring
SSFL	Santa Susana Field Laboratory
SVOC	semi-volatile organic compound
SWMU	solid waste management unit
TPH	total petroleum hydrocarbon
VOC	volatile organic compound
WP	Work Plan

Section 1
Introduction

1.1 Overview of the Work Plan/Field Sampling and Analysis Plan

This combined Work Plan (WP)/Field Sampling and Analysis Plan (FSAP) addresses the field sampling, analytical, quality control, and data review procedures for the collection and chemical analysis of soil samples within Area IV of the Santa Susana Field Laboratory (SSFL) and the Northern Buffer Zone (NBZ), collectively termed the Area IV study area. As part of a radiological characterization study, the United States Environmental Protection Agency (EPA) will be collecting surface and subsurface soil samples throughout Area IV of SSFL and the NBZ. The California Department of Toxic Substances Control (DTSC) and Department of Energy (DOE) suggested that soil collected by EPA also be analyzed for chemical analytes. EPA’s scope is only for radionuclide characterization of soil; therefore, DTSC and DOE agreed that the initial chemical sampling be done by DOE’s contractor, CDM Federal Programs Corporation (CDM).

To be consistent with EPA’s approach to radionuclide sampling that is governed by a master sampling plan with sampling specifics provided in addenda documents, this WP/FSAP reflects a “master” plan for co-located chemical sampling. This WP/FSAP represents a modified version of the DTSC-approved *Work Plan/Field Sampling and Analysis Plan , Co-Located Chemical Sampling at Area IV, SSFL* (CDM 2010). The WP/FSAP initially addressed the first subarea to be sampled (Subarea 5C), and the revised master WP/FSAP will address the Phase I co-located soil chemical sampling throughout Area IV and the NBZ. EPA has subdivided Area IV into 10 subareas (see Figure 1-1) for purposes of its radiological characterization study and will develop separate radionuclide FSAP addenda for each of the subareas. Addenda consistent with EPA’s addenda will be developed to address where the soil samples will be collected and the chemical analytical suite for each sample. The Co-located Chemical WP/FSAP addenda will also include modifications to EPA’s sampling procedures that would affect soil sampling for chemicals.

To ensure that chemical samples are obtained at the same time EPA collects their samples, EPA will obtain a sufficient volume of soil to allow for collection of samples to be subjected to chemical analyses from co-located locations with the radiological sampling. EPA will collect the soil for placement in sample containers provided by CDM. EPA will perform this sampling using the *Field Sampling Plan for Soil Sampling, Area IV Radiological Study* (HydroGeoLogic, Inc [HGL] 2010a) and with sampling specifics provided in addenda plans such as the *Subarea 5C Addendum to Field Sampling Plan for Soil Sampling* (HGL, 2010b). CDM will be responsible for shipment of the soil samples to a DTSC-approved laboratory.

This work effort adopts the Quality Assurance Project Plan (QAPP) that has been developed for the SSFL Resource Conservation and Recovery Act (RCRA) Field Investigation (RFI) program being administered by DTSC (MEC^X 2009). Therefore a separate QAPP will not be developed for the co-located sampling effort.

This WP/FSAP also represents a "bridge" plan for the co-located sampling effort being implemented by CDM under contract to DOE. In the future, this WP/FSAP may be amended to reflect a separate management approach, as directed by DTSC.

This WP/FSAP is a bridge document for a second reason. The chemical cleanup strategy for area investigated under this WP/FSAP is cleanup to background or cleanup to detection limits (DLs), whichever is greater. However, the chemical background values for SSFL are currently being developed as well as the chemical one-in-a-million risk-based screening levels (RBSLs) for the rural residential scenario. DLs should be based on both considerations. Because background values and rural residential RBSLs are not currently available, analytical DLs used in this study will be based on reporting limits previously provided by DTSC that approximated the order of magnitude of the suburban RBSLs (MWH Americas, Inc. 2005) lowered by two orders of magnitude. Once the background values and rural residential RBSLs are available, the DLs stated in this plan may need to be adjusted to reflect the background and rural residential RBSL values.

1.2 Site Location and Description

The SSFL is located in southeastern Ventura County, California, and has an area of approximately 1,153 hectares (2,850 acres) south of Simi Valley (Figure 1-2). The SSFL is separated into four administrative areas (Figure 1-3). The Boeing Company (Boeing) owns most of Area I, except for 42 acres that are owned by the federal government and administered by the National Aeronautics and Space Administration (NASA). Area II is also owned by the federal government and administered by NASA. The NASA portions are operated by Boeing. Boeing owns and operates Areas III and IV. The SSFL facility includes, within Area IV, a specific operational area that was dedicated to the development and testing of components used in metallic sodium systems that was a part of the federal government's Energy Technology Engineering Center (ETEC). Areas I, II, and III were used by predecessors of Boeing, NASA, and the Department of Defense for rocket engine and laser testing. Environmental contamination resulting from activities in Areas I, II, and III is the responsibility of Boeing and NASA and is not part of the scope of the sampling effort that is guided by this WP/FSAP. Table 2-1 presents the specific RFI areas in Area IV covered by this sampling effort. DOE was and remains responsible for operation of the ETEC located in Area IV.

From the mid-1950s until the mid-1990s, DOE and its predecessor agencies were engaged in or sponsored nuclear operations including the development, fabrication, disassembly, and examination of nuclear reactors, reactor fuel, and other radioactive materials. Associated experiments included large-scale liquid sodium metal testing for fast breeder reactor components. Nuclear operations at ETEC included 10 nuclear research reactors, seven critical facilities, the Hot Laboratory, the Nuclear Materials Development Facility, the Radioactive Materials Handling Facility, and various test and radioactive material storage areas. In addition to the handling and processing of radioactive materials, these DOE facilities also used non-radioactive chemicals, a variety of specialty metals, and other hazardous materials (e.g., polychlorinated biphenyls [PCBs], solvents, and lead-based paints) in their operations.

All nuclear research in Area IV was terminated in 1988 when DOE shifted its focus at SSFL from research to decontamination and decommissioning (D&D) activities. D&D of the sodium test facilities started in 1996, when DOE determined that the entire ETEC facility was surplus to its mission. At that time, DOE began formal closure of its facilities in Area IV and began cleanup activities in preparation for return of the property to Boeing. DOE discontinued D&D and demolition of the remaining facilities in 2008, but has continued surveillance, maintenance, monitoring and investigation activities. This includes investigation of soil and groundwater, as required under the DTSC RFI and the EPA radiological investigation.

1.3 Purpose of Co-Located Sampling

The purpose of collecting chemical data co-located with the radionuclide data is to assist decision makers in identifying key chemical and radionuclide contaminants of concern (COCs) that may drive cleanup decisions. This co-located sampling plan presents an efficient and effective means for supporting future cleanup decisions. First, the planned approach is efficient because EPA has already planned and mobilized crews to collect soil samples throughout the Area IV study area(for radionuclide analyses only), the analyses of the samples for chemicals takes advantage of EPA's overall sampling efforts. Second, the planned co-located analyses are effective because it will provide radionuclide and chemical data at the same location and facilitate evaluations of the overlap of radionuclide and chemical presence at the same locations throughout Area IV study area. Evaluating both radionuclide and chemical data supports the purpose or goal of making informed cleanup decisions. Future chemical sampling may include step-outs and would involve amending this WP/FSAP or preparation of new planning documents.

1.4 Technical or Regulatory Standards

This WP/FSAP does not establish the final cleanup levels for SSFL. The cleanup levels are being developed through EPA and DTSC background studies, development of RBSLs, and evaluation of laboratory DLs, all of which is an ongoing process separate from the collocated chemical sampling effort. In the interim, DOE and DTSC have agreed to an approach that is the subject of a legally binding consent order signed by DTSC and the DOE in December 2010. The consent order specifies the goal for the environmental cleanup of Area IV of SSFL to achieve chemical specific remedial objectives with chemical concentrations equivalent to background or detection limits for chemicals. EPA is currently determining the radionuclide background levels and EPA preliminary remediation goals (PRGs) exist for an agricultural (rural residential) land use scenario. DTSC has leadership over a study to determine chemical background and is directing development of the rural residential RBSLs.

Background and rural residential RBSLs will form the "regulatory" standards for the co-located soil sampling study. The ability of laboratories to analyze chemicals at a level approximate to the RBSLs is currently being researched through contact with laboratories throughout the United States. The results of that research will be shared with the stakeholders. If the laboratories can analyze samples and report results at background or the RBSL values, then the DLs will be the same as the "regulatory" limit. If the laboratories cannot achieve DLs equivalent to the RBSL, then the achievable DLs will become "technical" targets for the soil investigation. This process is the same as that being used by EPA in the demonstration of the ability of laboratories to achieve EPA radionuclide PRGs for the rural residential scenario.

1.5 Work Plan/Field Sampling and Analysis Plan Organization

This WP/FSAP includes the following sections:

Section 1	Introduction – Summarizes the basis and objectives of the co-located sampling;
Section 2	Project Background – Provides details regarding the RFI studies of Area IV and EPA's radionuclide characterization study of Area IV;
Section 3	Project Organization – Identifies the individuals responsible for implementing the FSAP, their specific responsibilities, and their organizations;
Section 4	Quality Objectives and Rationale – Provides the data quality objectives and their criteria;
Section 5	Sample Design and Rationale – Describes the rationale for EPA's sample locations, EPA's soil sampling procedures and intervals, the hand-off of sample material to the chemical sampling team, rationale for chemical sample intervals, and volatile organic compound (VOC) sample collection;
Section 6	Project Task Descriptions – Provides the procedures for preparing for sampling hand-off, sample containers, labeling, paperwork, sample management, preservation, sample custody, and shipment to the analytical laboratories;
Section 7	Quality Control Criteria – Describes the analytical methods, and provides a summary of analytical quality control procedures, analytical DLs, field quality control (QC) limits, and analytical QC limits;

Section 8	Instrument/Equipment and Supplies – Describes all equipment and materials necessary to collect, preserve, package, record, and ship samples;
Section 9	Special Training and Certification – Describes training requirements for field staff, data reviewers and validators, and certifications of analytical laboratories;
Section 10	Documentation and Records – Describes requirements and procedures for documenting all aspects of sample collection, custody, and analytical reporting;
Section 11	Assessment and Oversight – Describes the field and laboratory assessments/audits that will be performed to ensure that all procedures are adhered to, corrective measures are identified, and corrective actions completed;
Section 12	Data Review – Describes the procedures for reviewing field records for accuracy and completeness, verification of analytical records, data validation, and the overall assessment of data quality relative to project objectives and criteria; and
Section 13	References.

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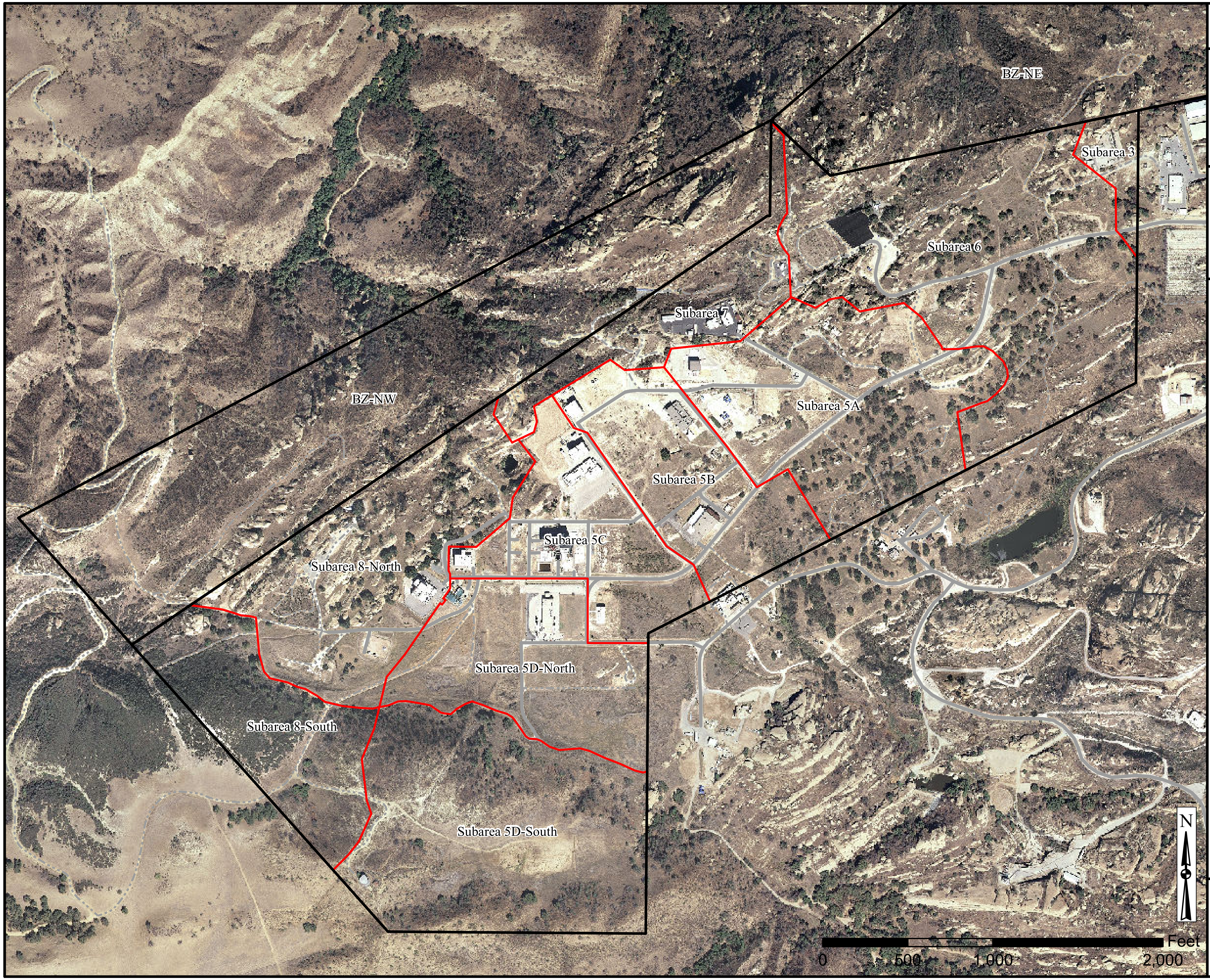
HGL—Gamma Scanning, Santa Susana
Field Laboratory Site Ventura County, California

Figure 1-1
Subarea Designation
Santa Susana Field Laboratory

U.S. EPA Region 9



Legend

🟥 Subarea

▭ Area IV & Northern Buffer Zones

Centerline Roads

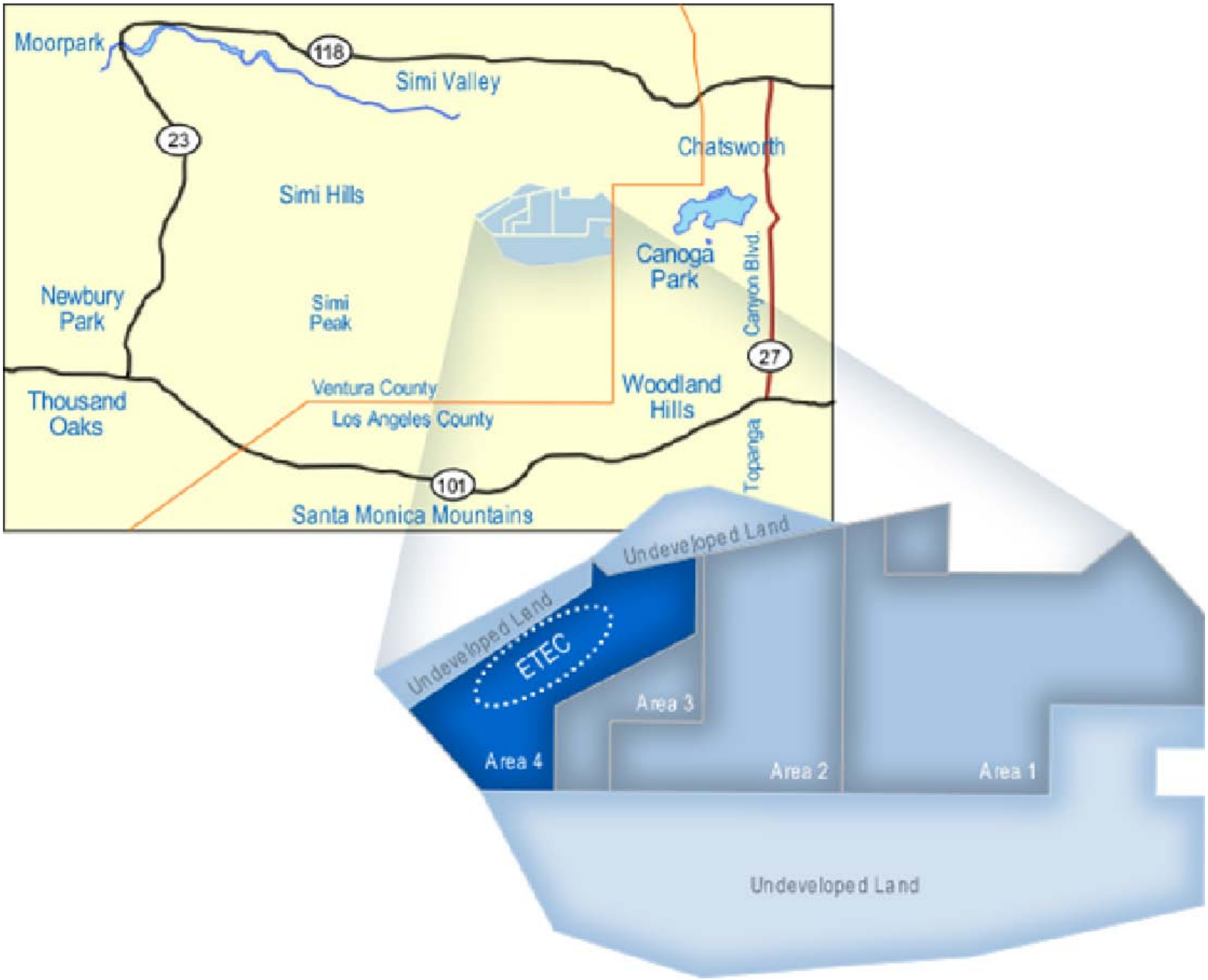
— Primary

— Secondary

- - - Tertiary

Filepath: Y:/Santa_Susana/EP9038/SubArea_SurveySection/Overall/Subarea_Designation_20101221.mxd
Project: EP9038
Edited By: PL 20101221
Source: CIRGIS 2007, HGL 2010

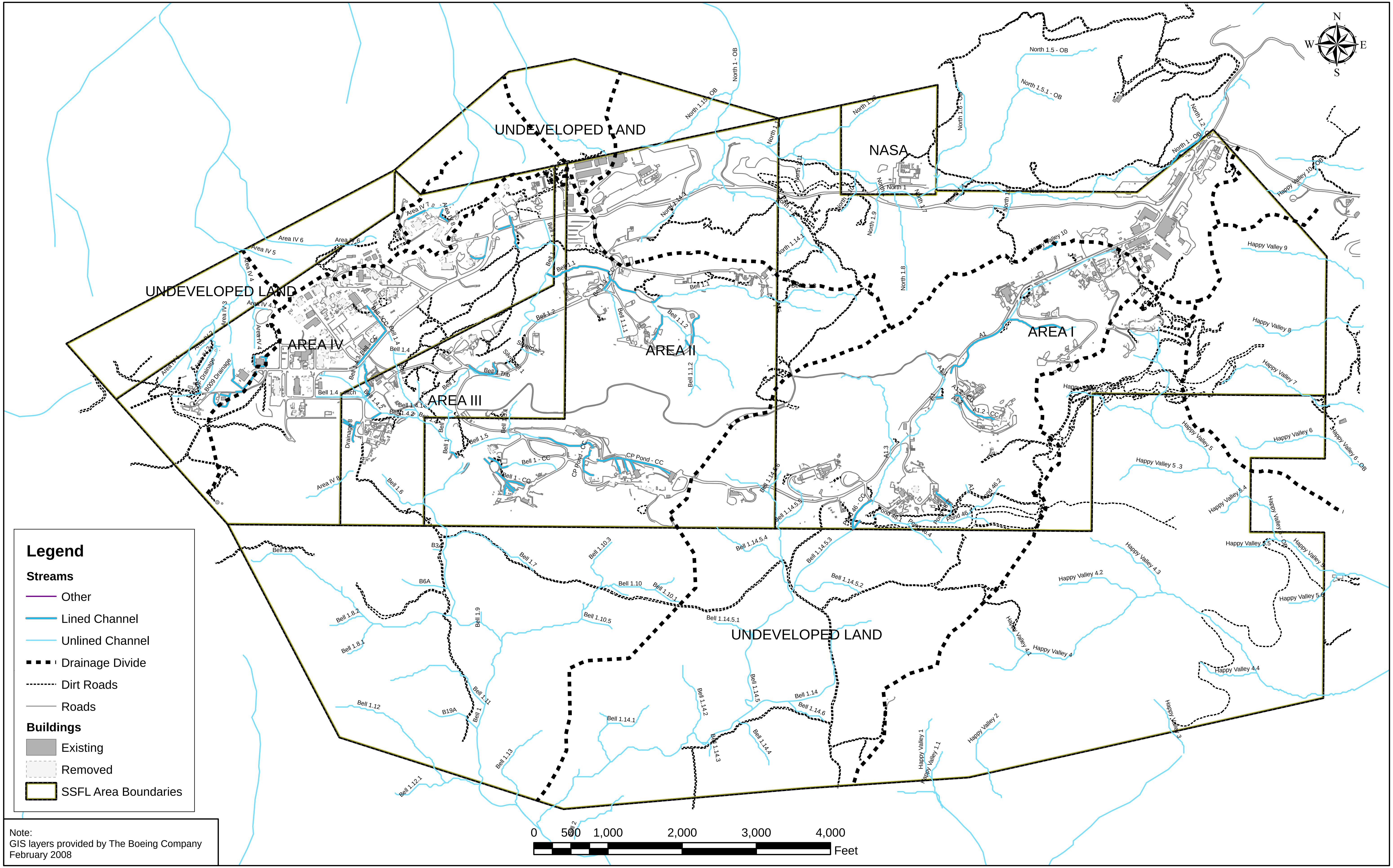
HGL HydroGeoLogic, Inc



CDM

Santa Susana Field Laboratory Area IV
Ventura County, California

Figure 1-2
SSFL Location



Legend

Streams

- Other
- Lined Channel
- Unlined Channel
- Drainage Divide
- Dirt Roads
- Roads

Buildings

- Existing
- Removed
- SSFL Area Boundaries

Note:
GIS layers provided by The Boeing Company
February 2008

CDM

Santa Susana Field Laboratory Area IV
Ventura County, California

Figure 1-3
Santa Susana Field Laboratory Layout

Section 2
Project Background

2.1 Area IV RCRA Field Investigation

The information in this section was taken from the *Group 5 – Central Portion of Areas III and IV RCRA Facility Investigation Report Santa Susana Laboratory, Ventura County, California* (CH2M Hill 2008).

The RCRA-related activities at the SSFL include four major environmental programs being conducted by Boeing 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, and (4) Interim Measures. In some instances these programs overlap (such as closed RCRA units within RFI sites that 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. The RCRA Corrective Action Program is described below.

The RCRA Corrective Action process includes four phases to achieve site cleanup and closure. These are the RCRA Facility Assessment (RFA), RFI, Corrective Measures Study (CMS), and Corrective Measures Implementation (CMI) phases. The RFA was completed in 1994 and resulted in the identification of Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs), where various hazardous materials were used, stored, or handled.

The SSFL RCRA Corrective Action program is currently in the RFI phase. During the RFI, additional AOCs (beyond those listed in the RFA) have been identified and investigated. Those identified within Area IV are presented in Table 2-1. The AOCs and SWMUs have been grouped by location for purposes of investigation and are called “RFI sites.” The RFI sites have been divided into 11 Group Reporting Areas across SSFL and four of those groups (Groups 5, 6, 7, and 8) are wholly or in part associated with Area IV.

The RFI includes chemical characterization of all relevant environmental media present at SSFL. Investigations of environmental media (soil, soil gas, sediment, groundwater, and surface water) have been conducted following DTSC-approved work plans. The objectives of the RFI are to characterize the nature and extent of chemical contamination in environmental media, evaluate risks to potential receptors, gather data for the CMS, and identify areas for additional work.

The chemical data collected under this WP/FSAP will be added to the RFI data previously collected to aid in completion of the overall characterization of the RFI groups wholly or partially located in Area IV.

Table 2-1
RFI Groups and Sites Within Area IV of SSFL

GROUP NO.	RFI SITES	AOCs OR SWMUs INCLUDED IN RFI SITE
5	Boeing Area IV Leach Field	Building 4011 Leach Field AOC
		Building 4008 Warehouse AOC
	Environmental Effects Laboratory (EEL)	SWMU 6.9 (located in both Areas III and IV)
	Pond Dredge Area	Pond Dredge Area AOC
	Process Development Unit (PDU)	SWMU 7.10 (Building 4005)
	Southeast Drum Storage Yard (SE Drum Yard)	SE Drum Yard AOC
	Building 65 Metals Laboratory Clarifier	Building 65 Metals Laboratory Clarifier AOC
	Building 100 Trench	SWMU 7.5 (Building 100 Trench Area)
	DOE Leach Field 1 (DOE LF1)	Building 4030 Leach Field AOC
		Building 4093 Leach Field AOC
	DOE Leach Field 2 (DOE LF2)	Building 4010 Leach Field AOC
	DOE Leach Field 3 (DOE LF3)	Building 4373 Leach Field AOC
		Building 4383 Leach Field AOC
		Building 4393 Leach Field AOC
	Hazardous Material Storage Area (HMSA)	SWMU 5.7 (Building 4457)
	Rockwell International Hot Laboratory (RIHL)	SWMU 7.7 (Building 4020)
	Systems for Nuclear Auxiliary Power Facility (SNAP)	Building 4059 AOC

Table 2-1 (continued)
RFI Groups and Sites Within Area IV of SSFL

GROUP NO.	RFI SITES	AOCs OR SMWUs INCLUDED IN RFI SITE
6	Old Conservation Yard	SWMU 7.4
	New Conservation Yard	SWMU 7.8
	Sodium Reactor Experiment	SRE Complex Area AOC
		Building 003 Leach Field AOC
	Building 064 Leachfield	Building 064 Leachfield AOC
7	Building 4029	SWMU 7.11 (Reactive Metals Storage Yard)
	Building 4133	SWMU 7.2 (Sodium Burn Facility)
	Radioactive Materials Handling Facility	SWMU 7.6 (operational area of RMHF & former Catch Basin)
		Building 4021 Leach Field AOC
8	Building 009 Leach Field	Building 009 Leach Field AOC
	Building B056 Landfill	SWMU 7.1
	Empire State Atomic Development Authority (ESADA)	SMWU 7.9 (ESADA Chemical Storage Yard)
	Former Sodium Disposal Facility (FSDF)	SWMU 7.3 (Building 886 FSDF)

Notes:

AOC = area of concern
No. = number
RCRA = Resource Conservation and Recovery Act
RFI = RCRA Facility Investigation
SSFL = Santa Susana Field Laboratory
SWMU = solid waste management unit

2.2 Administrative Order on Consent

The *Administrative Order on Consent for Remedial Action,* signed on December 6, 2010 by DTSC and DOE, is a legally binding order that describes the characterization of Area IV and NBZ soils and the process for their cleanup. Included in this order is the stipulation that where EPA collects samples for radiologic contaminants, DOE will take a similar sample from the same or proximate locations and submit the samples for necessary chemical analyses. See Section 5.1 of this WP/FSAP for the process that DTSC and DOE have agreed upon to make informed decisions as to where to collect chemical samples.

2.3 EPA Radionuclide Characterization Study of Area IV

The primary objective of the EPA soil sampling effort is to evaluate the nature of potential radionuclide contamination in soil within the Area IV Study Area that may have resulted from past nuclear research activities within SSFL Area IV. This objective will be achieved through the collection and analysis of surface and subsurface soil samples. The basic objectives of EPA's soil sampling effort are described in *Field Sampling Plan for Soil Sampling, Area IV Radiological Study, Santa Susana Field Laboratory* (HGL 2010a). The reader is referred to that document for a greater understanding of the EPA-directed radionuclide characterization study.

Section 3
Project Organization

The roles of all entities engaged in this effort are summarized below.

3.1 Department of Energy

DOE is the lead federal agency with ultimate responsibility for the investigation and cleanup of Area IV. DOE is funding the co-located sampling effort.

3.2 Department of Toxic Substances Control

DTSC is the agency with overall responsibility for ensuring that investigation and cleanup is performed to state regulations. DTSC will have responsibility for oversight of field work, analytical laboratory acceptance, review of analytical results, and decisions related to cleanup of all of SSFL, including Area IV.

3.3 United States Environmental Protection Agency

Under an agreement with DOE, EPA is conducting the radiological background and Area IV/NBZ radionuclide characterization studies. Soil samples for chemical analyses identified in this WP/FSAP will be collected by EPA at the same locations where EPA will collect soil samples for radionuclide analyses. Portions of EPA's radionuclide FSAP describing sampling procedures and locations are incorporated directly into this WP/FSAP.

3.4 CDM

CDM is the DOE contractor responsible for obtaining soil material collected by EPA, ensuring that the sample labels are correct, chain-of-custody paperwork complete, procurement of analytical services, preparation and shipment of samples to the laboratories, oversight of laboratory performance, review of laboratory data reports for completeness, and independent data validation of the results. CDM will also prepare the data report presenting the results of analysis of the chemical samples.

3.5 Subcontractors

CDM has procured Lancaster Laboratories for chemical analysis of samples and is in the process of procuring independent data reviewers. CDM will perform 10 percent of the data review and the independent data reviewer will review the remaining 90 percent of the data. The name of the independent data reviewer is not known at the time of drafting this version of the co-located sampling WP/FSAP.

3.6 Community

The community has had the opportunity to review EPA's sampling procedures, EPA's sampling locations, this WP/FSAP, and the analytical DLs stated by the chemical laboratories. They will also be given the opportunity to review the results of this sampling effort.

Section 4
Quality Objectives and Rationale

The data quality objective (DQO) process is a series of seven planning steps (based on the scientific method) designed to specify the type, quantity, and quality of environmental data needed to support defensible decisions based on current conditions and proposed activities at an environmental site (EPA 2006). The EPA seven-step DQO process was used as general guidance during the development of these DQOs.

DQOs are qualitative and quantitative statements derived from the outputs of each step of the DQO process that:

- Clarify study objectives;
- Define data needs (type, quality, etc.); and
- Specify acceptable levels of decision errors that will be used as the basis for establishing the quantity and quality of data needed to support the decision.

The derived statements are then used to develop scientific, resource-effective, and defensible sampling designs. The DQO summary table is provided in Table 4-1.

Table 4-1
Data Quality Objectives

PROCESS	RESPONSE
STEP 1 State the problem.	Historical operations at SSFL have released chemicals into the soil. Soil chemical concentration data for Area IV and the NBZ are needed to complete the process of identifying potential COCs and determine if site soil chemical concentrations exceed background values and detection limits. Soil chemical concentrations will be used to determine locations of areas with chemical contamination at the site.
STEP 2 Identify the Goal of the Study.	The COCs (those exceeding background values and detection limit values) and areas of contamination at Area IV need to be determined to allow for cleanup decisions. The specific goal of this soil sampling is to answer the following questions: ▪ Do the soil chemical concentrations exceed background values and detection limit values? ▪ What is the vertical and lateral extent of soil chemical concentrations? ▪ What is the location and volume of contaminated soil that needs to be removed?
STEP 3 Identify Information Inputs.	▪ Field screening of the soil core with a PID will be performed to determine if VOCs or fuels are present in the soil. If the PID indicates the presence of VOCs in the sample core, a sample will be collected and analyzed for VOCs and fuels. ▪ Visual observations of the soil core will be used to look for indicators of contamination (sheen, discoloration, foreign matter, distinct stratigraphic changes, and odor). If any of these indicators are observed, the subsurface sample will be taken from the depth where potential contamination is observed. ▪ Elevated alpha, beta, or gamma readings. ▪ Soil samples will be analyzed for the chemical analytes stated in Step 7.
STEP 4 Define the Boundaries of the Study.	The lateral boundaries are shown on Figure 1-2 as the boundaries of Area IV and the NBZ. The vertical boundary is 10 feet bgs or refusal at locations where no prior soil excavation is known; and to the depth of former excavations, or to groundwater, where building excavations have involved replacement of excavated materials. The temporal boundary includes data collected from prior SSFL investigations and to the data collected during this soil sampling and any concurrent or additional investigations at the site (soil vapor sampling, radiological sampling, additional soil sampling, etc.).
STEP 5 Develop the Analytic Approach.	The background values and detection limit values for use at SSFL are currently in development. The target DLs (Table 7-1) will be used in this WP/FSAP as discussed in Section 7 until the background values and detection limit values have been finalized. The soil chemical concentrations will be compared to the approved background values and detection limit values. Determine whether there has been a release of hazardous substances at Area IV. ▪ **If** chemical concentrations in soils exceed background values or detection limit values (whichever applies), **then** additional sampling may be recommended to further delineate the site and/or a remediation strategy will be developed that will reduce chemical concentrations to background values or detection limit values. **If** chemical concentrations in soils do not exceed background values or detection limit values, **then** no further action will be recommended at the location where background and detection limits are met.
STEP 6 Specify Performance or Acceptance Criteria.	Analytical data reported by the laboratory will be validated by a third party. Validated data will be assessed for usability as described in Section 12.4 to ensure that the PARCCS data quality indicators are met. Data assessment and validation will determine if collected data can be used for comparison. In general, it will ensure that: ▪ Appropriate field procedures were followed; ▪ Deviations were documented and assessed; ▪ Data met applicable criteria; and ▪ Data are usable for the stated project needs. All samples submitted to the analytical laboratory will be analyzed by an accepted EPA method or DTSC approved method. Laboratory achievable DLs for analytical methods are listed in Table 7-1. Measurement performance criteria for the data are presented in Sections 7.2 and 7.3.

Table 4-1 (continued)
Data Quality Objectives

PROCESS	RESPONSE
STEP 7 Develop the Plan for Obtaining Data.	Soil samples (and QC samples; see Section 7.2) will be collected at surface soil and boring locations identified for the radiological study. The surface samples will be collected from the 0 to 0.5 foot bgs interval. Samples for VOC analyses will be collected in an En Core ® Sampler. Surface soil samples for SVOC, PAH, and PCB analyses will be collected in a stainless steel metal sleeve. All other surface soil samples will be a grab sample placed into a glass container. EPA will collect subsurface soil samples using a 5-foot long, 1.8-inch inner diameter DPT acetate sleeve. Two sleeves produce adequate volume for the number of chemical analyses, thus two borings will be required. The subsurface chemical samples will be co-located with the radiological sample when either: (1) elevated alpha/beta/gamma readings are detected; (2) a specific feature (pipeline, drain, UST, etc.) is targeted by EPA, (3) there are elevated PID readings (greater than background) indicating potential solvents or fuels, or (4) there is visual evidence of contamination. If the previous conditions are not met (that is there is no elevated gamma reading, no targeted feature, or no evidence of contamination), then the default subsurface sample will be collected from 4- to 5-feet bgs to be consistent with the 5-foot bgs target interval for prior RFI chemical data. The sample interval for subsurface soil samples will be 1 foot to remain consistent with the RFI. To obtain the sample from the first boring, the acetate sleeve will be split open, and the entire sample interval placed into a 16-oz glass jar. The SVOC sample will be handled to minimize disturbance (placed in the jar intact) and the jar lid cleaned to ensure an air-tight seal. A second boring will be used to fill a second 16-ounce jar at the same depth interval. A deeper subsurface sample for chemical analyses will be targeted for collection at 9 feet (9 to 10 feet bgs, assuming no refusal at or above 7.5 feet bgs). For refusal between 10 and 7.5 feet bgs, the sample will be the interval 1 foot above the point of refusal. For sample depth refusal above 4 feet bgs (0 to 4 feet bgs), the interval between 4 feet and 2.5 feet will be considered as a subsurface sample. 2.5 feet bgs will be the shallowest depth considered for a subsurface sample. Primary Analytes (i.e., meaning the analytical suite for soil samples collected at all locations) for analyses by an offsite laboratory are: ▪ Metals using EPA Methods 6010B/6020, 7471A (mercury), and 7199 (chromium VI); ▪ Soil pH using EPA Method 9045C; ▪ Fluoride using EPA Method 300.0; ▪ SVOCs using EPA Method 8270C and PAHs using 8270 SIM; ▪ PCBs using EPA Method 8082; ▪ Dioxins/Furans using EPA Method 1613B; and ▪ Perchlorate using EPA Method 314.0 (and EPA Method 6850 for verification of non-detects at a rate of 10 percent of the samples submitted). For surface soil samples primary analyses also include: ▪ Pesticides using EPA Method 8081A. ▪ Herbicides using EPA Method 8151. Analysis of soil samples for VOCs using EPA Method 8260B will be performed on samples collected at locations exhibiting staining, a elevated PID reading (greater than background), any indication of waste, and/or or where RFI results indicate a VOC source near the sample location. ▪ 1,4-Dioxane using EPA Method 8260B SIM (with any VOC sample). Secondary Analytes (meaning analyses of soil samples collected at locations with a process history of the specific chemical usage, sample sites with elevated instrument readings, of soil fill, waste, or visually contaminated materials) are: ▪ Nitrates using EPA Method 300.0 (waste sample and any sample near a monitoring well exhibiting nitrates); ▪ Formaldehyde using EPA Method 8315A; ▪ n-Nitrosodimethylamine using EPA Method 1625C; ▪ Energetics using EPA Method 8330A;

Table 4-1 (continued)
Data Quality Objectives

PROCESS	RESPONSE
STEP 7 Develop the Plan for Obtaining Data.	▪ Cyanide using EPA Method 9012B; and ▪ Alcohols/Terphenyls/Glycols using EPA Method 8015B. If there is visual or historic evidence for gasoline/oil/diesel usage soil samples will be analyzed for: ▪ TPH (gas/oil/diesel) using EPA Method 8015B (visual or historic evidence for gasoline/diesel usage).

Acronyms and Abbreviations:

bgs = below ground surface
COC = contaminant of concern
DL = detection limit
DPT = direct push technology
EPA = United States Environmental Protection Agency
FSAP = Field sampling and Analysis Plan
PAH = polycyclic aromatic hydrocarbon
PARCCS = precision, accuracy, representativeness, completeness, comparability, and sensitivity
PCB = polychlorinated biphenyl
PID = photoionization detector
QC = quality control
RFI = Resource Conservation and Recovery Act (RCRA) Facility Investigation
SIM = selected ion monitoring
SSFL = Santa Susana Field Laboratory
SVOC = semi-volatile organic compound
TPH = total petroleum hydrocarbon
UST = underground storage tank
VOC = volatile organic compound
WP = Work Plan

Section 5
Sample Design and Rationale

This section describes the sampling location rationale and field sampling program to be followed during the performance of the soil sampling for chemical analyses. Samples will be collected as described in this section and in accordance with the quality control (QC) criteria in Section 12. The field procedures are designed so that:

- Samples collected are consistent with project objectives; and
- Samples are collected in a manner so that data represent actual site conditions.

5.1 Sampling Location Rationale

The sample locations are those stipulated in EPA's radiological study sampling plan addenda. The soil sampling for chemicals is being conducted concurrently with the radiological soil sampling in order to expedite sampling and provide co-located chemical and radiological data. The soil samples for chemical analysis will be collected as described for the radiological samples in Sections 5.2.2 and Section 5.2.3. Per the EPA field sampling plan (HGL 2010a) the selection of targeted sampling locations are based on a combination of review of existing data, historical records sources, and current gamma and geophysical surveys.

However, soil samples for chemical analyses may not need to be collected from all locations identified in Area IV by EPA for radionuclide analyses. Area IV has been subject to prior investigations under the RFI and some locations have adequate data for use in determining the need for a soil cleanup action. DTSC/DOE will jointly review EPA's sample locations relative to adjacent RFI sample locations, chemical analytical results and professional judgment in order to use discretion in limiting (i.e, de-selecting) some EPA locations from being sampled for chemical analyses. This de-selection process will be performed following three decision scenarios:

SCENARIO 1. CLEARLY CONTAMINATED AREAS THAT WILL REQUIRE CLEANUP

a. Clearly contaminated areas are those where a high frequency of occurrence and/or number of chemical analyte concentrations detected in RFI samples obviously exceed current background and/or method reporting limits. The magnitude of exceedance to be considered may vary on a case by case basis (e.g., two to ten times exceedance of background or method reporting limits will be considered on a case by case basis).

b. DOE agrees to cleanup of the area in question.

A potential discretionary decision may be made to not collect chemical samples at some EPA locations where sufficient chemical data already exist, however co-located sampling will still be conducted near such an area, as needed, to adequately define the extent of contamination.

SCENARIO 2. HIGH DENSITY RADIOLOGICAL SAMPLING IN AREAS WITH ELEVATED GAMMA SURVEY RESULTS

a. There are no known and/or identified chemical operational areas and/or releases (subject to field observations).

b. There is a non-point source, no preferential pathways have been identified, and the locations are in an open/flat area.

c. The area is sufficiently distant from known potential chemical sources.

A potential discretionary decision may be made to not collect chemical samples at some EPA locations so that sample spacing is consistent with the RFI approach of approximately 50 to 100 feet for spacing. Terrain and structures will be taken into consideration.

SCENARIO 3. HIGH DENSITY RADIOLOGIC SAMPLING OF HISTORIC FEATURES

a. The feature has known chemical and/or radiologic impacts and/or identified data gaps

b. Targeted sampling density should be based on feature characteristics and historical use (e.g., hold up tanks, septic tanks, sumps, test areas, etc.).

A potential discretionary decision, using professional judgment, may be made to not collect chemical samples at some EPA locations so that sample spacing is consistent with the RFI approach.

In addition, future additional scenarios will be evaluated using existing RFI data and recent co-located sampling results:

- Discretionary depth selection for certain analytes (e.g., dioxins) based on known distribution, and
- Discretionary reduction of analyte list based on known historical chemical usage and chemical breakdown rate.

These scenarios identified for potential discretionary chemical sampling were communicated to stakeholders during the Public Stakeholder Meeting held on February 2, 2011. As EPA submits their Sampling Addendums for each of the Subareas within Area IV, DOE/DTSC will evaluate EPA's proposed sampling locations using the above decision criteria to exclude some locations from DOE/DTSC co-located chemical soil sampling and/or analyses. DOE will then submit an Addendum to this Master WP/FSAP indicating those locations (and supporting rationale) that were either deselected for sampling and/or were subject to a reduction in list of analytes.

5.2 Field Sampling Program

The field sampling activities will include surface soil sampling and subsurface soil sampling from a DPT borehole drilled by HGL (HGL 2010a). CDM technicians will collect the subsurface soils from the opened acetate sleeves and place the materials into glass jars. VOC samples will be collected using En Core® samplers. HGL will collect the surface soil samples and after the soil samples are collected into appropriate containers, HGL will transfer the samples to CDM. Land surveying of all borehole locations will be conducted by HGL upon completion of all sampling activities (HGL 2010a). Investigative derived waste (IDW) disposal activities will be performed by HGL (see Section 6.9).

5.2.1 EPA Soil Sampling Procedure

Surface soil samples will be collected from the 0 to 0.5 feet bgs interval. The surface of the sample area will be prepared by HGL's sampler by removing leaves, grass, and surface debris. For radionuclide sampling, the soil will be collected from a circle approximately 12-inches in diameter to a depth of 6 inches bgs ensuring the edges are vertical to provide a representative sample. The removed soil will be placed in a stainless steel bowl for homogenization removing any debris, wood, or materials greater than 0.25 inches in size.

For chemical sampling, any stained surface soil will be sampled first using an En Core® Sampler, as appropriate. Soil collected for SVOC, PAH, and PCB analyses will be collected from undisturbed surface soil using a 6-inch stainless steel sleeve. Both ends of the sleeve will be covered with Teflon squares and sealed with a plastic end cap to reduce loss of SVOCs. Soil for the remaining chemical analyses will be collected as grab samples using a stainless steel trowel, and placed directly into the appropriate glass sample containers consistent with current RFI sampling practice.

Subsurface soil sampling activities will be performed by HGL using DPT . Gamma readings will be taken by HGL along the length of the boring. The DPT operations will be conducted by a California-licensed DPT subcontractor with HGL oversight. In most cases, DPT borings will be advanced to a targeted depth of approximately 10 feet bgs or refusal. The definition of refusal for this study will be when the DPT soil sampler cannot be advanced any further below the ground surface.

Soil cores will be collected using the Geoprobe dual-tube sampling method, which consists of an outer drive casing and an inner soil sampling sleeve barrel. A Geoprobe Macro-Core sampler will be used as the inner soil sampling barrel to collect continuous 5-foot soil cores from inside the outer drive casing. After the system is advanced the length of the Macro-Core sampler, the sampler will be retrieved while the drive casing is left in place to prevent the borehole from collapsing. The Macro-Core sampler provides a 5-foot long soil core contained in an acetate sleeve.

The general sampling procedure is:

- Drive the outer drive casing and Macro-Core sampler into the sample material the length of the sampler.
- Retract and disassemble the Macro-Core sampler.
- Remove the acetate liner.
- Open the acetate liner with a cutting tool.
- Screen the soil core using Micro R (gamma) and Pancake (alpha, beta) probes.
- Screen the soil core using a photoionization detector (PID).
- Determine the depth interval to be sampled (based on instrument readings, visual evidence, or default depths).
- Collect the sample using a clean utensil.
- Place the sample in appropriate container(s).
- Decontaminate sampler and inner rods.
- Insert new acetate liner.
- Insert the Macro-Core sampler back inside the outer drive casing.
- Drive the outer drive casing and Macro-Core sampler into the sample material the length of the sampler.
- Repeat until the desired depth is reached.

HGL will screen the length of the core using alpha/beta detectors for evidence of non gamma-emitting radionuclides. HGL will also use a PID to measure for VOCs as the sleeve is cut open lengthwise. The PID readings will be used to determine the subsurface sample location for volatile compound (solvents and fuels) analyses (see Sections 5.2.2 and 5.2.3).

Once the sample depth intervals have been determined following the borehole gamma logging and PID measurements, a second boring will be pushed by HGL. Subsurface soil samples will be collected over a 1 foot distance (e.g., 4 feet to 5 feet) and submitted for chemical analyses. Soil samples for VOCs, 1,4-dioxane, and/or TPH gasoline analyses will first be collected in En Core® Samplers directly from the open polyethylene sleeve. If additional sample material is required, a second borehole will be advanced and additional soil will be collected from the same depth interval. Soil for SVOC, PAH, and PCB analyses will be placed directly into the appropriate glass containers with minimal soil disturbance. Soil for all other analyses will also be removed from the acetate sleeves and placed into appropriate glass containers.

The subsurface chemical samples will be co-located with the radiological sample when either: (1) elevated alpha/beta/gamma readings are detected; (2) a specific feature (pipeline, drain, UST, etc.) is targeted by EPA, (3) where there are elevated PID readings (greater than background) indicating potential solvents or fuels; or (4) where there is visual evidence of contamination. If the previous conditions are not met (that is there is no elevated gamma reading, no targeted feature, or no evidence of contamination), then the default subsurface sample will be collected from 4 to 5 feet bgs to be consistent with the 5-foot bgs target interval for prior RFI chemical data. A second subsurface sample for chemical analyses will be collected below 9 feet (9 to 10 feet bgs, assuming no refusal until 10 feet bgs). No second subsurface sample will be collected if refusal occurs at 7.5 feet bgs or shallower.

The reader of this WP/FSAP is referred to the EPA's field sampling plan (HGL 2010a,b) for additional details on the DPT drilling, gamma reading equipment and procedures, radiological soil sampling procedures, and standard operating procedures.

5.2.2 Chemical Sample Interval Selection

The surface chemical sample interval is from the surface to 0.5 feet bgs. With the exception of soil to be analyzed for SVOCs, PAHs, and PCBs, HGL will place the soil in the required sample containers and pass the filled sample containers to CDM for shipment to the appropriate analytical laboratory. SVOC, PAH, and PCB samples will be collected in a 6-inch stainless steel sleeve using an impact hammer. Surface samples will be analyzed for all primary analytes as described in Table 4-1, Step 7.

The subsurface chemical sample intervals will be determined in the field based on field observations. The protocol for making this determination is detailed in Figures 5-1 and 5-2. It is assumed that based on prior investigations that subsurface refusal may be encountered between 5 and 10 feet bgs except in areas of backfilled excavations.

5.2.3 Volatile Organic Compound Sampling

Surface soil samples will not be collected for VOCs and TPH as gasoline unless PID readings above background, odor, are stained soils are observed. Subsurface soil samples will be collected for VOCs analysis where PID readings indicate the presence of fuels or solvents or at the 4.5-ft bgs interval when there is no indication of possible presence of fuels or solvents.

5.2.3.1 Identification of Sample Interval

As the sleeve holding the core is cut open, PID readings will be taken. If there are elevated PID readings (above background), a subsurface soil sample will be taken at the midpoint of the elevated PID reading. For those borings where no PID readings are encountered, a subsurface soil sample will be collected at the 4.5 foot bgs interval.

5.2.3.2 VOC/Petroleum Hydrocarbon Sampling Procedure

En Core® Samplers and a T-handle will be used to collect samples for VOCs, 1,4-Dioxane, and TPH as gasoline analyses. Four 5 gram (g) samplers are required for VOCs and 1,4-Dioxane and a fifth En Core® Sampler will be needed for TPH as gasoline for sufficient soil volume. Moisture analysis will be performed on the soil placed into a 16-ounce (oz) wide-mouth glass jar that will be collected from the same interval for the remaining soil analyses.

The procedures for collecting soil for analysis by the En Core® Sampler Method are:

1. Wear clean gloves during handling of all sample containers and sampling devices.

2. Remove sampler and cap from package and attach T-handle to sampler body.

3. Quickly push the sampler into a freshly exposed surface of soil until the sampler is full. The O-ring will be visible within the hole on the side of the T-handle. If the O-ring is not visible within this window, then the sampler is not full.

4. Extract sampler and wipe the sampler head with a clean paper towel so that the cap can be tightly attached.

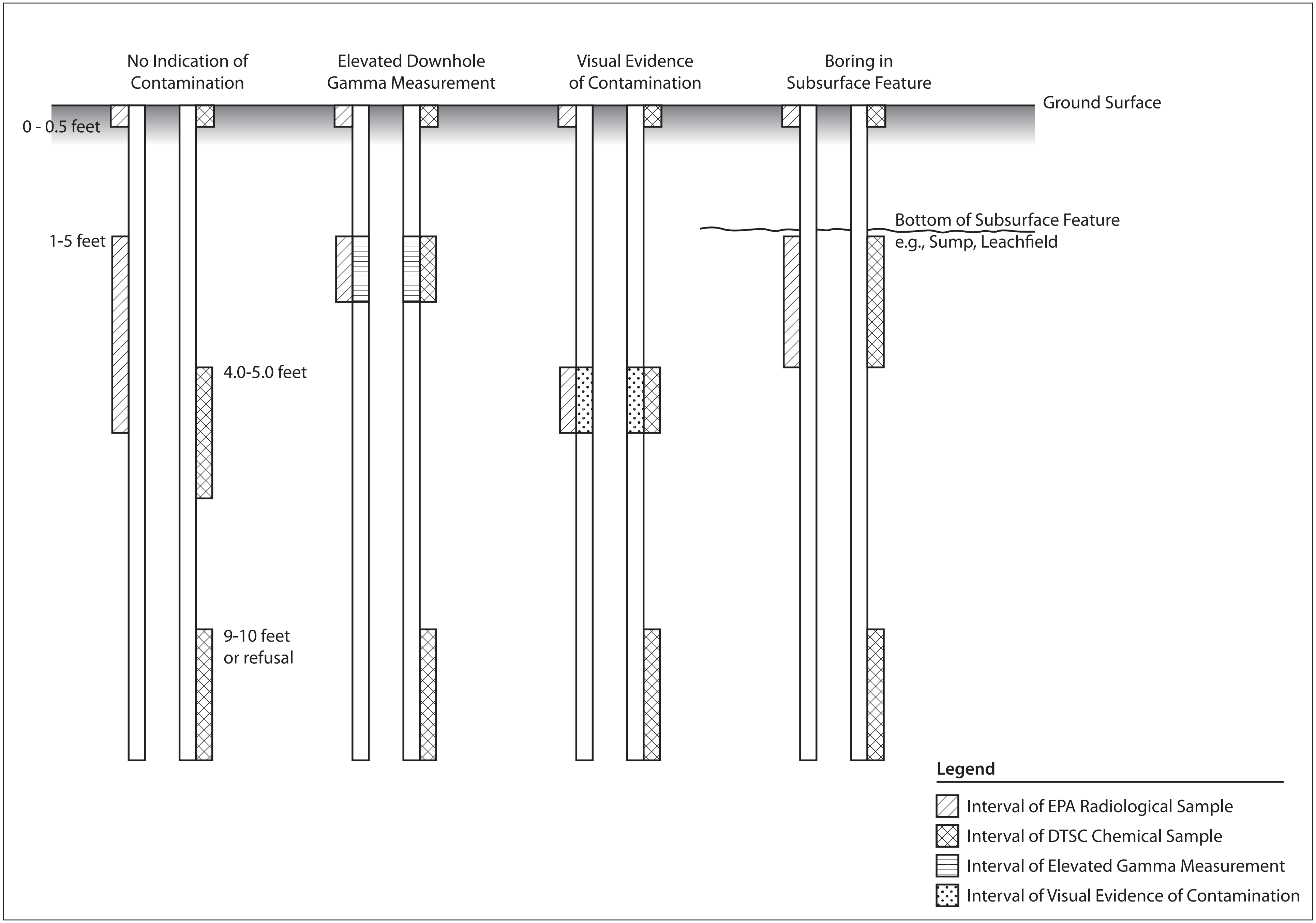
5. Push cap on with a twisting motion to secure it to the sampler body.

6. Rotate the sampler stem counterclockwise until stem locks in place to retain sample within the sampler body.

7. Fill out sample label and attach to sampler.

8. Repeat procedure for the remaining samplers.

9. Store samplers at 4 degrees Celsius (°C) ±2°C. Samples must be shipped and delivered to the analytical laboratory for extraction within 48 hours.

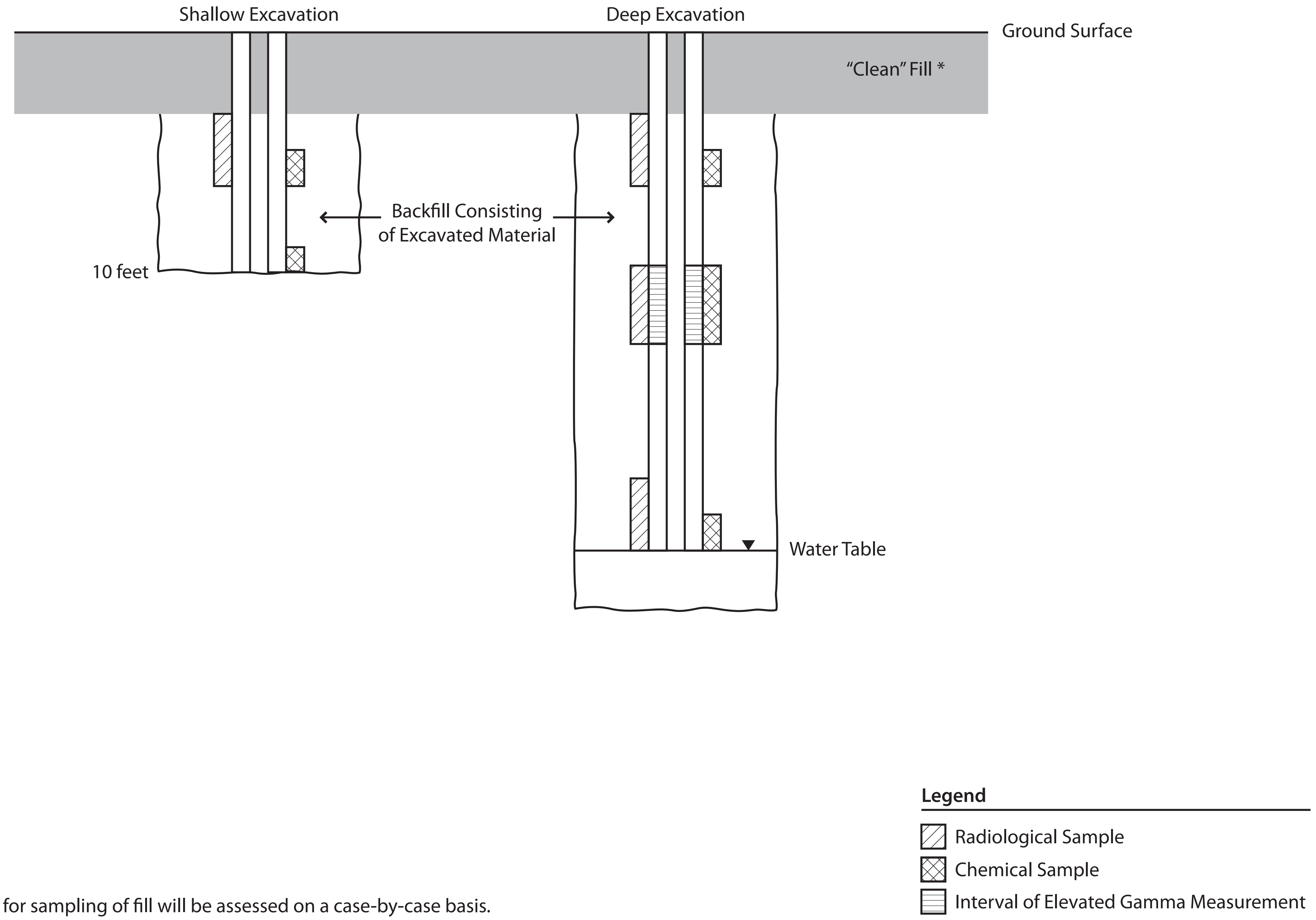


W:\REPORTS\Santa Susana Field Laboratory_May10\Graphics\Figure5-1_Sampling Strategy for EPA DTSC.ai 11/12/10 JJT

CDM

Figure 5-1

Sampling Strategy for EPA/DTSC Co-Located Borings
Borings Not Located in Areas Previously Excavated



* The need for sampling of fill will be assessed on a case-by-case basis.

W:\REPORTS\Santa Susana Field Laboratory_May10\Graphics\Figure5-2_Sampling Strategy for EPA DTSC.ai 11/12/10 JJT

Figure 5-2

Sampling Strategy for EPA/DTSC Co-Located Borings
Borings Located in Former Excavation and Fill Areas

Section 6
Project Task Descriptions

The following project tasks will be performed during soil sampling for chemical analyses.

6.1 Field Work Preparation

The CDM field team leader has obtained sample containers (pre-preserved as required) and coolers from the subcontracted analytical laboratory. The number and type of containers needed for samples are presented in Table 6-1. This table also lists preservatives and holding times for each analytical method. Holding time is the maximum time allowed between sample collection and extraction (if applicable) and sample analysis, during which the designated preservation and storage techniques are employed. All samples will be shipped to the laboratory via Federal Express to meet required holding times. The field team leader will coordinate with HGL throughout the duration of field work to verify drilling locations and schedules. HGL performed initial site setup that consisted of procuring the drilling subcontractor, field vehicles, personnel, and equipment, and geophysically clearing the proposed sampling locations.

6.2 Sample Container Labeling

Field crews collecting the chemical samples will use similar sample identification as EPA to allow for correlation with the radiological samples. To distinguish chemical soil samples collected from discrete depths from radiological soil samples homogenized over a 4 foot interval in the same soil boring, the sample identification will identify a common boring location, but distinguish between the depth intervals.

A unique number code to indicate the sampling location will identify each sample based on the location numbering assigned by HGL. The sample identification will include:

- Sample Location: SL-001 to SL-999
- Subarea: SA5C (for example)
- Sample Type: SS for surface soil; SB for subsurface soil
- Beginning depth-End Depth: listed in feet
- QA/QC samples: EB for equipment rinsate; FB for source water blank; DUP for field duplicate; and MS for matrix spike

An example surface soil sample identification is:

SL-004-SA5C-SS-0.0-0.5 (surface soil sample collected in Subarea 5C at sample location 4 at a depth of 0.0 to 0.5 feet)

An example subsurface soil sample identification is:

SL-056-SA5C -SB-4.0-5.0 (subsurface soil sample collected in Subarea 5C at sample location 56 at a depth of 4.0 to 5.0 feet)

An example aqueous QC sample identification is:

EB03-SA5C-112510 (third equipment rinsate blank collected in Subarea 5C on November 25, 2010)

An example field duplicate sample identification is:

DUP25-SA5C-QC-112510 (25th field duplicate sample collected in Subarea 5C on November 25, 2010)

For samples to be used by the laboratory for their matrix spike (MS) and matrix spike duplicate (MSD) samples, "MS" will be added at the end of the sample identification number. For example, if the surface sample indicated above is to be used as the MS/MSD sample, it will be labeled as SL-004-SA5C-SS-0.0-0.5MS.

Sample labels will be affixed to all samples collected for this project. One label will be completed with the following information for each sample container collected.

- sample number
- date to indicate the month, day, and year of sample collection
- time (military) of sample collection
- indicate composite or grab sample
- sampler's initials
- preservative (other than ice)
- analyses for which the sample is to be analyzed
- any additional relevant information

The adhesive sample labels will be placed directly on the sample containers and secured with clear tape over the label to protect from moisture. CDM will verify that the information recorded on the sample label is consistent with the information recorded on the chain-of-custody record.

6.3 Sample Container Filling

Soil collected for VOCs, 1,4-Dioxane, and TPH gasoline analyses will be collected in En Core® Samplers (see Section 5.2.3.2 for VOC sample handling procedures) in all instances. Surface soil collected for SVOC, PAH, and PCB analyses will be collected in stainless steel sleeves. Surface soil for all other analyses will be collected with a stainless steel trowel and placed into a 16-oz glass jar.

All subsurface soil will be initially collected in acetate sleeves. Soil for VOCs, 1,4-Dioxane, and TPH gasoline analyses will be collected from the sleeve using an EnCore® Sampler. Subsurface soil for SVOC, PAH, and PCB analyses will be removed from the acetate sleeve in a manner causing minimal soil disturbance and placed into 16 oz glass jars. Soil for all other analyses will also be placed into 16-oz glass jars. All sample volumes will be based on the analytical laboratories requirements to address the detection limit requirements of this investigation. The number and type of containers needed for samples are presented in Table 6-1. The containers will be labeled immediately after filling (see Section 6.2 for sample labeling procedures). The exteriors of sample containers will be wiped with a clean paper towel to remove residual soil from the exterior of the containers prior to labeling. Each labeled container will be placed in a zip-top plastic bag. After each zip-top plastic bag is sealed, it will be placed in a cooler containing ice.

6.4 Sample Handling

The following steps will be followed when packing sample bottles and jars for shipment:

1. Verify the samples undergoing shipment meet the definition of "environmental sample" and are not a hazardous material defined by the Department of Transportation. During the collection of soil samples, a Geiger-Mueller (Pancake) probe will be used to screen each soil core to identify potential radiological activity. Professional judgment and/or consultation with qualified persons such as the appropriate health and safety coordinator or the health and safety manager shall be observed.

2. Only sturdy coolers in good repair will be used. Tape any interior opening in the cooler (i.e., the drain plug) from the inside to ensure control of interior contents. Also tape the drain plug from the outside of the cooler. Line the cooler with a large heavy duty plastic bag.

3. Be sure the caps on all bottles are tight (will not leak); check to see that labels and chain-of-custody records are completed properly.

4. Place all bottles and jars in separate and appropriately sized plastic zip-top bags and close the bags. The volatile organic analysis vials (collected as QC samples) may be packed in one bag. Binding the vials together with a rubber band on the outside of the bag, separating them so that they do not contact each other, will

reduce the risk of breakage. Bottles may be wrapped in bubble wrap or placed into foam vial holders.

5. Place 2 to 4 inches of packing material into a cooler that has been lined with a large plastic bag, and place the sample containers in the bag with sufficient space to allow for the addition of packing material between any glass containers. It is preferable to place glass sample bottles and jars into the cooler vertically as they are less likely to break when packed vertically rather than horizontally. The containers may alternatively be placed into cardboard dividers that fit into the coolers.

6. While placing sample containers into the cooler, conduct an inventory of the contents of the shipping cooler against the chain-of-custody record.

7. Make and retain an electronic copy of the chain-of-custody form. Place the completed chain-of-custody record for the laboratory into a plastic zip-top bag, seal the bag, and tape it to the inner side of the cooler lid. The original chain-of-custody form will be placed in one cooler and copies will be placed in the remaining coolers shipped under the same chain-of-custody.

8. Put ice in large plastic zip-top bags (double bagging the zip-tops is preferred) and properly seal. Place the ice bags on top of and/or between the samples. Several bags of ice may be required (dependant on outdoor temperature, staging time, etc.) to maintain the cooler temperature at approximately 4°C. Fill all remaining space between the bottles or jars with packing material. Securely fasten the top of the large garbage bag with fiber or duct tape, or a plastic cable tie. Close the cooler lid.

9. Attach a completed custody seal across the opening of the cooler on opposite sides. The cooler lid shall be secured with nylon reinforced strapping tape by wrapping each end of the cooler a minimum of two times over the custody seals so that the cooler cannot be opened without breaking the seal. Complete two more wraps around the cooler with fiber tape.

10. The shipping container lid must be marked **"THIS END UP"** and arrow labels indicating the proper upward position of the container affixed to the cooler. A label containing the name and address of the shipper (CDM) shall be placed on the outside of the container. Labels used in the shipment of hazardous materials (such as Cargo Only Air Craft, Flammable Solids, etc.) are not permitted on the outside of containers used to transport environmental samples and shall not be used. The name and address of the laboratory shall be placed on the container, or when shipping by common courier, the bill of lading shall be completed and attached to the shipping container.

6.5 Sample Preservation

6.5.1 Soil

Soil samples will be maintained at a temperature of 4°C ±2°C. Soil samples for volatiles analyses collected using an En Core® Sampler are required to be preserved by the laboratory within 48 hours of collection.

6.5.2 Water

Aqueous samples will be collected for QC purposes (see Section 7.2). The analytical laboratory will provide pre-preserved sample containers. The preservative required for each method is included in Table 6-1. Aqueous samples will also be maintained at a temperature of 4°C ±2°C.

6.6 Sample Documentation

Sample documentation will be tracked on chain-of-custody forms and shipping documents. Copies of these documents will be maintained in the project files, as well as annotated in the field logbook. The field logbook provides a means of recording all data collection activities performed at the site. As such, entries should be as descriptive and detailed as possible so that a sample's history can be reconstructed without relying on the collector’s memory. The field logbook will be completed, tracked, and maintained in accordance with Section 10.1. Any deviations from these procedures will be noted in the field logbook.

6.7 Sample Custody

This section establishes a method for maintaining custody of samples through use of a chain-of-custody record. These procedures will be followed for all samples collected or split samples accepted.

The following steps describe the procedures required to maintain field custody:

1. As few people as possible shall handle samples.

2. Complete sample labels or tags for each sample using waterproof ink.

3. Maintain personal custody of the samples (in your possession) at all times until custody is transferred for sample shipment or directly to the analytical laboratory.

A chain-of-custody record will be completed for all samples. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents sample custody transfer from the sampler, often through another person, to the sample custodian in the appropriate laboratory. The date/time will be the same for both signatures when custody is transferred directly to another person. When samples are shipped via common carrier (e.g., Federal Express), the date/time will not be the same for both signatures. Common carriers are not required to sign the chain-of-custody record. In all cases, it must be readily apparent that the person who received custody is the same person who relinquished custody to the next custodian. If samples are left unattended or a person refuses to sign, this must be documented and explained on the chain-of-custody record. If a field sample custodian has been designated, he/she may initiate the chain-of-custody record, sign, and date as the relinquisher. The individual sampler(s) must sign in the appropriate block, but does (do) not need to sign and date as a relinquisher.

The samples will be packaged properly for shipment and dispatched to the appropriate laboratory for analysis. Each shipment of coolers must be accompanied by a chain-of-custody record.

A signed copy of the chain-of-custody record will accompany the shipment. Freight bills will also be retained by CDM as part of the permanent documentation. The shipping number from the freight bill shall be recorded on the applicable chain-of custody record and field logbook.

The following procedure is to be used to fill out the chain-of-custody record. The chain-of-custody record shall be filled out in its entirety.

1. Record project number.
2. Record the field team leader for the project (if a field sample custodian has been designated, also record this name in the “Remarks” or “Notes” box).
3. Record the name of the laboratory to which samples are being shipped.
4. Enter the project name/location or code number.
5. Record overnight courier’s airbill number.
6. Record sample number.
7. Note preservatives added to the sample (or pre-preserved in the sample container).
8. Note media type (matrix) of the sample.
9. Enter date of sample collection.
10. Enter time of sample collection in military time.
11. List parameters for analysis and the number of containers submitted for each analysis.
12. Enter appropriate designation for laboratory quality control (e.g., MS/MSD, or other remarks (e.g., sample depth).

13. Sign the chain-of-custody record(s) in the space provided. All samplers must sign each record.

14. The originator checks information entered on the chain-of-custody and then signs the "Relinquished by" box, prints his/her name, and enters the current date and time (military).

15. Send the signed chain-of-custody with the samples to the laboratory.

16. The laboratory sample custodian receiving the sample shipment checks the sample label information against the chain-of-custody record. Sample condition is checked and anything unusual is noted under "Remarks" or "Notes" on the chain-of-custody record. The laboratory custodian receiving custody signs in the adjacent "Received by" box and keeps the copy. A copy of the annotated COC will be returned to CDM in the sample delivery group results package.

6.8 Equipment Decontamination

Equipment decontamination minimizes the risk of cross-contamination of samples and ensures the collection of representative samples. All equipment decontamination will be conducted by HGL. Any deviations will be noted in the CDM and HGL field logbooks.

6.9 Investigative Derived Waste Management

HGL will generate and dispose of the IDW during the field activities, except CDM's personal protective equipment IDW. CDM will dispose of personal protective equipment as solid waste off site.

Table 6-1
Analytical Methods, Containers, Preservatives, and Holding Times

Parameter	EPA Analytical Method	Matrix	Sample Container Size[(a)]/ Minimum Sample Volume	Preservation	Maximum Holding Times[(b)]	
					Extraction	Analysis
Primary Analyses						
Fluoride	EPA 300.0	Soil	4 oz jar/5 grams (g)	Ice to 2 to 6ºC	--	28 days
Dioxins/Furans	EPA 1613B	Soil	4 oz jar/10 g	Ice to 2 to 6ºC	30 days	45 days
Total Petroleum Hydrocarbons	EPA 8015M	Soil	1 x 5 g En Core® Sampler /5 g for gasoline	Ice to 2 to 6ºC	48 hours	7 days
			4 oz jar/50 g for oil and diesel	Ice to 2 to 6ºC	14 days	40 days
SVOCs	EPA 8270C	Soil	Stainless steel sleeve for surface soil, 4 oz jar for subsurface soil/30 g	Ice to 2 to 6ºC	14 days	40 days
PAHs	EPA 8270 SIM	Soil	Stainless steel sleeve for surface soil, 4 oz jar for subsurface soil/30 g	Ice to 2 to 6ºC	14 days	40 days
PCBs	EPA 8082	Soil	Stainless steel sleeve for surface soil, 4 oz jar for subsurface soil/90 g	Ice to 2 to 6ºC	14 days	40 days
Hexavalent Chromium	EPA 7199	Soil	4 oz jar/40 g	Ice to 2 to 6ºC	30 days	7 days
Metals	EPA 6010B/6020/7471	Soil	4 oz jar/5 g	Ice to 2 to 6ºC	--	6 months (28 days for Hg)
VOCs	EPA 8260B	Soil	3 x 5 g En Core® Sampler/5 g	Ice to 2 to 6ºC	48 hours	7 days
1,4-Dioxane	EPA 8260B SIM	Soil	1 x 5 g En Core® Sampler/5 g	Ice to 2 to 6ºC	48 hours	7 days
Perchlorate	EPA314.0/6850	Soil	4 oz jar/ 10 g	Ice to 2 to 6ºC	--	28 days

Table 6-1 (continued)
Analytical Methods, Containers, Preservatives, and Holding Times

Parameter	EPA Analytical Method	Matrix	Sample Container Size[(a)]/ Minimum Sample Volume	Preservation	Maximum Holding Times[(b)]	
					Extraction	**Analysis**
Primary Analyses (continued)						
Pesticides[(c)]	EPA 8081A	Soil	4 oz jar/60 g	Ice to 2 to 6ºC	14 days	40 days
Herbicides[(c)]	EPA 8151	Soil	4 oz jar/60 g	Ice to 2 to 6ºC	14 days	40 days
Secondary Analyses						
Formaldehyde	EPA 8315A	Soil	4 oz jar/ 10 g	Ice to 2 to 6ºC	7 days	3 days
n-Nitrosodimethylamine	EPA 1625C	Soil	4 oz jar/ 10 g	Ice to 2 to 6ºC	14 days	40 days
Energetics	EPA 8330A	Soil	4 oz jar/ 10 g	Ice to 2 to 6ºC	14 days	40 days
Nitrates	EPA 300.0	Soil	4 oz jar/5 g	Ice to 2 to 6ºC	--	28 days
pH	EPA9045C	Soil	4 oz jar/5 g	Ice to 2 to 6ºC	--	ASAP
Cyanide	EPA 9012B	Soil	4 oz jar/ 5 g	Ice to 2 to 6ºC	--	14 days
Alcohols	EPA 8015B	Soil	3 x 5 g En Core® Sampler/5 g	Ice to 2 to 6ºC	--	7 days
Terphenyls	EPA 8015B	Soil	4 oz jar/10 g	Ice to 2 to 6ºC	14 days	40 days
Glycols	EPA 8015B	Soil	3 x 5 g En Core® Sampler/5 g	Ice to 2 to 6ºC	--	7 days

Table 6-1 (continued)
Analytical Methods, Containers, Preservatives, and Holding Times

Parameter	EPA Analytical Method	Matrix	Sample Container Size(a)/ Minimum Sample Volume	Preservation	Maximum Holding Times(b)	
					Extraction	Analysis
Primary Analyses						
Fluoride	EPA 300.0	Water	1 x 500 ml polyethylene/100 ml	Ice to 2 to 6ºC	--	28 days
Dioxins/Furans	EPA 1613B	Water	1 x 1 L amber glass/1 L	Ice to 2-6ºC	30 days	45 days
Total Petroleum Hydrocarbons	EPA 8015M	Water	3 x 40 ml VOA vials/40 ml for gas	Ice to 2-6ºC, HCl	--	14 days
			1 x 1 L amber glass/ 1 L for oil and diesel	Ice to 2-6ºC	7 days	40 days
SVOCs	EPA 8270C	Water	1 x 1 L amber glass/1 L	Ice to 2-6ºC	7 days	40 days
PAHs	EPA 8270 SIM	Water	1 x 1 L amber glass/1 L	Ice to 2-6ºC	7 days	40 days
PCBs	EPA 8082	Water	1 x 1 L amber glass/1 L	Ice to 2-6ºC	7 days	40 days
Hexavalent Chrome	EPA 7199	Water	1 X 500 ml polyethylene/100 ml	Ice to 2-6ºC	--	24 hours
Metals	EPA 6010B/6020/7471	Water	1 X 500 ml polyethylene/100 ml	Ice to 2-6ºC, HNO3	--	6 months (28 days for Hg)
VOCs	EPA 8260B	Water	3 x 40 ml VOA vials/40 ml	Ice to 2-6ºC, HCl	--	14 days
1,4-Dioxane	EPA 8260B SIM	Water			--	14 days
Perchlorate	EPA 314.0	Water	1 x 500 ml polyethylene/10 ml	Ice to 2 to 6ºC	--	28 days

Table 6-1 (continued)
Analytical Methods, Containers, Preservatives, and Holding Times

Parameter	EPA Analytical Method	Matrix	Sample Container Size$^{(a)}$/ Minimum Sample Volume	Preservation	Maximum Holding Times$^{(b)}$	
					Extraction	**Analysis**
Primary Analyses (continued)						
Pesticides	EPA 8081A	Water	1 x 1 L amber glass/1 L	Ice to 2 to 6ºC	7 days	40 days
Herbicides	EPA 8151	Water	1 x 1 L amber glass/1 L	Ice to 2 to 6ºC	7 days	40 days
Secondary Analyses						
Formaldehyde	EPA 8315A	Water	1 x 250 ml round glass/100 ml	Ice to 2 to 6ºC	3 days	3 days
n-Nitrosodimethylamine	EPA 1625C	Water	1 x 1 L amber glass/1 L	Ice to 2 to 6ºC,H_2SO_4	7 days	40 days
Nitrates	EPA 300.0	Water	2 x 40 ml glass vials/5 ml	Ice to 2 to 6ºC	--	28 days
Energetics	EPA 8330A	Water	1 x 1 L amber glass/1 L	Ice to 2 to 6ºC	7 days	40 days
Cyanide	EPA 9012B	Water	1 x 500 ml poly/100 ml	Ice to 2 to 6ºC, NaOH to pH >12	--	14 days
pH	EPA 9040C	Water	1 x 500 ml poly/ 40 ml	Ice to 2 to 6ºC	--	24 hours
Alcohols	EPA 8015B	Water	2 x 40 ml VOA vials/80 ml	Ice to 2 to 6ºC, HCl	--	7 days
Terphenyls	EPA 8015B	Water	1 x 1 L amber glass/1 L	Ice to 2 to 6ºC, HCl	7 days	40 days
Glycols	EPA 8015B	Water	2 x 40 ml VOA vials/80 ml	Ice to 2 to 6ºC	--	7 days

Table 6-1 (continued)
Analytical Methods, Containers, Preservatives, and Holding Times

(a) Multiple analyses for subsurface soil samples (other than those collected in En Core® Samplers) will be performed from 2-16 oz glass jars. For surface soils, one stainless steel sleeve will be submitted for SVOC, PAH, and PCB analyses.

(b) Source is from MEC^x, 2009.

(c) Only surface samples will be analyzed for pesticides and herbicides.

Acronyms and Abbreviations:

ºC = degrees Celsius
EPA = United States Environmental Protection Agency
g = gram
HCl = hydrochloric acid
HNO_3 = nitric acid
H_2SO_4 = sulfuric acid
L = liter
ml = milliliter
NaOH = sodium hydroxide
NOAA = National Oceanic and Atmospheric Association
oz = ounce
PAH = polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyl
SIM = selected ion monitoring
SVOCs = semi-volatile organic compounds
VOA = volatile organic analyte
VOCs = volatile organic compounds
-- = extraction not required

Section 7
Quality Control Criteria

The field quality assurance (QA) program has been designed in accordance with CDM's *Quality Assurance Manual, Revision 11* (CDM 2007), *Guidance for the Data Quality Objectives Process* (EPA 2006), and *EPA Requirements for Quality Assurance Project Plans* (EPA 2001).

All project deliverables will receive technical and QA reviews prior to being issued to the client; completed review forms will be maintained in the project file. Corrective action of any deficiencies will be the responsibility of the project manager, with assistance from the QA staff.

This section describes the QC criteria used to ensure that the data collected during this sampling effort will be used appropriately to meet the project objectives.

7.1 Analytical Methods and Detection Limits

All samples will be submitted to a fixed-base laboratory certified by the California Department of Health Services through Environmental Laboratory Accreditation Program (ELAP) or National Environmental Laboratory Accreditation Program (NELAP). The samples collected during this investigation will be analyzed using the methods provided below. These methods are described in detail in *Test Methods For Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition* as updated by revisions I, II, IIA, IIB, III, IIIA, IIIB, IVA, and IVB (EPA 1997).

The background values for SSFL are currently being developed as well as the one-in-a-million RBSLs for the rural residential scenario. These two values will be used as decision criteria for Area IV as described in Section 1.4. Analytical DLs should also be based on both considerations. Because these values are not currently available, analytical protocols used in this study will be based on reporting limits previously provided by DTSC that approximated the suburban RBSLs lowered by two orders of magnitude for soil (Table 7-1). Once the background values and RBSLs are available, the DL goals stated in this plan may need to be adjusted to reflect the background and RBSL values.

When a positive detection is greater than the laboratory DL, but less than the method reporting limit, the value will be reported and qualified (J flagged) as an estimated concentration. DLs are attained contingent upon instrument sensitivity and sample matrix effects. It is important to monitor the sensitivity of data-gathering instruments to ensure data quality through constant checks of instrument performance.

7.1.1 Volatile Organic Compounds

Soil samples will be analyzed for VOCs using EPA Method 8260B.

7.1.2 Metals

Soil samples will be analyzed for metals, using EPA Methods 6010B/6020, 7471A (for mercury), and EPA Method 7199 for chromium VI.

7.1.3 Fluoride

Soil samples will be analyzed for fluoride using EPA Method 300.0.

7.1.4 Semi-Volatile Organic Compounds

Soil samples will be analyzed for semi-volatile organic compounds (SVOCs) using EPA Method 8270C.

7.1.5 Polycyclic Aromatic Hydrocarbons

Soil samples will be analyzed for polycyclic aromatic hydrocarbons (PAHs) using EPA Method 8270 modified for selected ion monitoring (SIM).

7.1.6 Polychlorinated Biphenyls and Triphenyls

Soil samples will be analyzed for PCBs and TCPs using EPA Method 8082.

7.1.7 Dioxins/Furans

Soil samples will be analyzed for dioxins/furans using EPA Method 1613B.

7.1.8 Perchlorate

Soil samples will be analyzed for perchlorate using EPA Method 314.0 with confirmation by EPA Method 6850.

7.1.9 Nitrate

Secondary soil samples will be analyzed for nitrates using EPA Method 300.0.

7.1.10 Total Petroleum Hydrocarbons

Soil samples exhibiting staining will be analyzed for total petroleum hydrocarbons (TPH) (gas/oil/diesel) using EPA Method 8015B.

7.1.11 Formaldehyde

Secondary sediment samples (i.e., exhibiting staining or other evidence of contamination) will be analyzed for formaldehyde using EPA Method 8315A.

7.1.12 Cyanide

Secondary sediment samples (i.e., exhibiting staining or other evidence of contamination) will be analyzed for cyanide using EPA Method 8012B.

7.1.13 N-Nitrosodimethylamine and Energetics

Secondary sediment samples (i.e., exhibiting staining or other evidence of contamination) will be analyzed for N-Nitrosodimethylamine by EPA Method 1625C and Energetics by EPA Method 8330A.

7.1.14 Methyl Mercury

Sediment samples from ponds will be analyzed for methyl mercury using EPA Method 1630.

7.1.15 Organotin

Selected sediment samples from ponds will be analyzed for organotin using National Oceanic and Atmospheric Administration (NOAA) Status and Trends.

7.2 Field QC Samples and Frequencies

The following types of field QC samples will be required during sampling. All QC samples will be analyzed for the same parameters as the primary samples except trip blanks which will only be analyzed for VOCs, 1,4-Dioxane, and TPH gasoline. Table 7-2 presents the measurement performance criteria for the required field QC samples.

7.2.1 Field Duplicate

Soil duplicates will be collected in separate containers, but from the same location of the original primary samples. The duplicate samples will be analyzed as a separate sample from the primary samples. This type of field duplicate measures the total system variability (field and laboratory variance), including the variability component resulting from the inherent heterogeneity of the soil. Field duplicates will be collected at a frequency of one per twenty primary soil samples.

7.2.2 Equipment Rinsate Blank

An equipment rinsate blank will be prepared and submitted for analysis at a minimum frequency of one per 20 primary soil samples (i.e., duplicate samples are not included) collected per sampling technique and additionally whenever there are changes in the sample collection procedures, sampling decontamination procedures, or sampling equipment. The equipment rinsate blank will consist of analyte-free water used to rinse sampling equipment as the last step in the decontamination process. This QC sample serves as a check for effectiveness of the decontamination process.

7.2.3 Trip Blank

A trip blank consists of target analyte-free water provided by the laboratory. The trip blank is a sealed container that accompanies the samples from collection at the site through shipment. This QC sample serves as a check for cross-contamination of VOCs. Trip blanks will be submitted to the laboratory at a frequency of one per cooler (for VOC, 1,4-Dioxane, and TPH gasoline analyses only) for those coolers containing samples to be analyzed for VOCs.

7.2.4 Source Blank

A source blank consists of American Society for Testing and Materials (ASTM) Type II water used by sampling personnel for equipment decontamination. The sample is used to determine chemical characteristics of the decontamination water. The ASTM Type II water is placed into the sampling container, preserved as shown on Table 6-1, and analyzed for the same parameters as the soil samples. This QC sample serves as a check on reagents (preservatives) and the cleanliness of the water used for decontamination. One source blank will be prepared and submitted for each lot number of ASTM Type II water used for decontamination during the sampling event.

7.2.5 Temperature Blank

A temperature blank will be used to notify the receiving laboratory if samples exceeded the acceptable temperature (4°C ± 2°C) at the time of receipt. This QC measure serves as a check of adequate cooling of samples to be analyzed. Temperature blanks will be submitted to the laboratory at a frequency of one per cooler.

7.3 Laboratory QC Samples

Laboratory QC data are necessary to determine precision and accuracy and to demonstrate the absence of interference by and/or contamination of laboratory glassware and reagents. Table 7-2 presents a summary of the laboratory QC samples for this project, their frequency, and the measurement performance criteria. Laboratory QC results will be included in the data package.

The types of QC spike samples the laboratory will use include laboratory control samples (LCSs) (or method blank spikes), matrix spike (MS) matrix spike duplicate (MS/D, and surrogates. An LCS is a clean matrix (i.e., the same used for a method blank) spiked with known concentration(s) of target analyte(s). The LCS will be carried through the entire analytical procedure to assess the overall accuracy of the method. An MS is an aliquot of a parent sample spiked with target analyte(s) of known concentration(s) prior to sample preparation. The impact of the sample matrix on target analyte recovery (i.e., accuracy) and precision will be assessed by QC sampling MSs and MSDs. A surrogate is a non-target analyte spiked at a known concentration prior to sample preparation. Surrogate analytes will be used to monitor method performance on a matrix-specific/sample-specific basis.

For this project, acceptance limits for precision and accuracy for MSs and surrogate percent recovery are presented in Table 7-2. Each analytical preparation batch must contain an MS/MSD pair.

Matrix QC samples will be analyzed with each batch of 20 samples or fewer analyzed by the laboratory.

A calibration standard is prepared in the laboratory by dissolving a known amount of a pure compound in an appropriate matrix or dilution of commercially obtained solution. The final concentration calculated from the known quantities is the true value of the standard. Where applicable, reference standard solutions will be traceable to National Institute of Standards and Technology or another nationally recognized reference standard source. The analytical results obtained for these standards are used to prepare a standard curve and thereby quantify the compounds found in the environmental samples. The number of calibration standards is prescribed by each analytical method procedure.

Table 7-1
Co-Located Soil Chemical Target Detection Limits

Method/Analyte	**Targeted Method Detection Limits Soil**	**Method Detection Limits Aqueous**
Volatile Organic Compounds by EPA 8260B	**ng/kg**	**µg/L**
1,3-Dichlorobenzene	20	2
1,3-Dichloropropane	20	2
1,4-Dichlorobenzene	20	2
2-Chloroethyl vinyl ether	50	5
2-Chloro-1,1,1-trifluoroethane	50	5
2-Chlorotoluene	50	5
2-Butanone (MEK)	100	10
2-Hexanone	100	10
2,2-Dichloropropane	10	1
4-Chlorotoluene	50	5
4-Methyl-2-pentanone (MIBK)	50	5
Acetone	100	10
Benzene	20	2
Bromobenzene	50	5
Bromochloromethane	50	5
Bromodichloromethane	20	2
Bromoform	50	5
Bromomethane	50	5
n-Propylbenzene	20	2
p-Isopropyltoluene	20	2
sec-Butylbenzene	50	5
tert—Butylbenzene	50	5
Styrene	20	2
Tetrachloroethene	20	2
Toluene	20	2
trans-1,2-Dichloroethene	20	2
trans-1,3-Dichloropropene	20	2
Trichloroethene	20	2
Trichlorofluoromethane	50	5
o-Xylene	20	2
m, p-Xylene	50	2
Vinyl chloride	20	2
1,1,2-Trichloro-1,2,2-trifluoroethane	50	5

Table 7-1 (continued)
Co-Located Soil Chemical Target Detection Limits

Method/Analyte	Targeted Method Detection Limits Soil	Method Detection Limits Aqueous
Volatile Organic Compounds by EPA 8260B (continued)	**ng/kg**	**µg/L**
1,1,1-Trichloroethane	20	2
1,1,2,2-Tetrachloroethane	20	2
1,1,2-Trichloroethane	20	2
1,1-Dichloroethane	20	2
1,1-Dichloroethene	50	5
1,1-Dichloropropene	20	1
1,2,3-Trichlorobenzene	50	2
1,2,3-Trichloropropane	10	5
1,2,4-Trichlorobenzene	50	1
1,2,4-Trimethylbenzene	20	5
1,2-Dibromo-3-chloropropane	50	2
1,2-Dibromoethane (EDB)	20	5
1,2-Dichlorobenzene	20	2
1,2-Dichloroethane	10	2
1,2-Dichloropropane	20	1
1,3,5-Trimethylbenzene	20	2
Carbon tetrachloride	10	1
Chlorobenzene	20	2
Chloroethane	50	5
Chloroform	20	5
Chloromethane	50	2
Chlorotrifluoroethylene	50	5
cis-1,2-Dichloroethene	20	2
cis-1,3-Dichloropropene	20	2
Dibromochloromethane	20	2
Dibromomethane	10	1
Dichlorodifluoromethane	50	5
Ethylbenzene	20	2
Hexachlorobutadiene	50	5
Isopropylbenzene	20	2
Methyl-tert-butyl- Ether (MTBE)	50	5
Methylene chloride	50	5
n-butylbenzene	50	5

Table 7-1 (continued)
Co-Located Soil Chemical Target Detection Limits

Method/Analyte	Targeted Method Detection Limits Soil	Method Detection Limits Aqueous
1,4-Dioxane by EPA 8260B SIM	**ng/kg**	**µg/L**
1,4-Dioxane	50	5
Metals by EPA 6010B/6020	**µg/kg**	**µg/L**
Aluminum	100	200
Antimony	10	10
Arsenic	5	5
Barium	5	2
Beryllium	3	0.5
Boron	50	50
Cadmium	2	1
Calcium	100	50
Chromium	10	3
Cobalt	5	1
Copper	2	1
Iron	50	20
Lead	4	2
Lithium	63	5
Magnesium	1000	10
Manganese	10	1
Molybdenum	1	0.5
Nickel	4	2
Phosphorus	500	50
Potassium	500	50
Selenium	10	5
Silver	2	1
Sodium	500	50
Strontium	50	5
Thallium	2	1
Tin	100	10
Titanium	20	2
Vanadium	10	10
Zinc	50	10
Zirconium	250	50

Table 7-1 (continued)
Co-Located Soil Chemical Target Detection Limits

Method/Analyte	Targeted Method Detection Limits Soil	Method Detection Limits Aqueous
Mercury by EPA 7471A	**µg/kg**	**µg/L**
Mercury	0.1	0.2
Chromium VI by EPA 7199	**µg/kg**	**µg/L**
Chromium VI	2	10
Select SVOCs (PAHs) by EPA 8270C(SIM)*	**ng/kg**	**µg/L**
1-Methyl naphthalene	200	10
2-Methylnaphthalene	200	10
Acenaphthene	200	10
Acenaphthylene	200	10
Anthracene	200	10
Benzo(a)anthracene	200	10
Benzo(a)pyrene	200	10
Benzo(b)fluoranthene	200	10
Benzo(ghi)perylene	200	10
Benzo(k)fluoranthene	200	10
bis(2-Ethylhexyl) phthalate	200	10
Butyl benzyl phthalate	200	10
Chrysene	200	10
Dibenzo(a,h)anthracene	200	10
Diethyl phthalate	200	10
Dimethyl phthalate	200	10
Di-n-butyl phthalate	200	10
Di-n-octyl phthalate	200	10
Fluoranthene	200	10
Fluorene	200	10
Indeno(1,2,3-cd)pyrene	200	10
Naphthalene	200	10
n-Nitrosodimethylamine	200	10
Phenanthrene	200	10
Pyrene	200	10

Table 7-1 (continued)
Co-Located Soil Chemical Target Detection Limits

Method/Analyte	Targeted Method Detection Limits Soil	Method Detection Limits Aqueous
Semivolatile Organic Compounds by EPA 8270C	**µg/kg**	**µg/L**
1-Methylnaphthalene	3.3	10
1,2-Dichlorobenzene	3.3	10
1,2-Diphenylhydrazine/Azobenzene	3.3	20
1,3-Dichlorobenzene	3.3	10
1,4-Dichlorobenzene	3.3	10
1,2,4-Trichlorobenzene	3.3	10
2,4,5-Trichlorophenol	3.3	20
2,4,6-Trichlorophenol	3.3	20
2,4-Dichlorophenol	3.3	10
2,4-Dimethylphenol	3.3	20
2,4-Dinitrophenol	6.6	20
2,4-Dinitrotoluene	3.3	10
2,6-Dinitrotoluene	3.3	10
3,3-Dichlorobenzidine	8.3	20
2-Chloronaphthalene	3.3	20
2-Chlorophenol	3.3	10
2-Methylnaphthalene	3.3	10
2-Methylphenol	3.3	10
2-Nitroaniline	3.3	10
2-Nitrophenol	3.3	10
3-Nitroaniline	3.3	20
3,5-Dimethylphenol	3.3	20
4,6-Dinitro-2-methylphenol	4.2	20
4-Bromophenyl-phenylether	3.3	10
4-Chloroaniline	3.3	10
4-Chloro-3-methylphenol	3.3	20
4-Chlorophenyl-phenylether	3.3	10
4-Methylphenol	3.3	10
4-Nitroaniline	8.3	20
4-Nitrophenol	8.3	20
Acenaphthene	3.3	10
Acenaphthylene	3.3	10
Aniline	4.2	10

Table 7-1 (continued)
Co-Located Soil Chemical Target Detection Limits

Method/Analyte	Targeted Method Detection Limits Soil	Method Detection Limits Aqueous
Semivolatile Organic Compounds by EPA 8270C (continued)	**µg/kg**	**µg/L**
Anthracene	3.3	10
Benzidine	16	20
Benzoic acid	8.3	20
Benzo(a)anthracene	3.3	10
Benzo(a)pyrene	3.3	10
Benzo(b)fluoranthene	3.3	10
Benzo(g,h,i)perylene	3.3	10
Benzo(k)fluoranthene	3.3	10
Benzyl alcohol	3.3	20
bis(2-Chloroethoxy)methane	3.3	10
Bis(2-chloroethyl)ether	3.3	10
Bis(2-chloroisopropyl)ether	3.3	10
Bis(2-ethylhexyl)phthalate	3.3	50
Butylbenzylphthalate	3.3	20
Carbazole	3.3	20
Chrysene	3.3	10
Dibenzo(a,h)anthracene	3.3	20
Dibenzofuran	3.3	10
Diethylphthalate	3.3	10
Dimethylphthalate	3.3	10
Di-n-butylphthalate	3.3	20
Di-n-octyl-phthalate	3.3	20
Fluoranthene	3.3	10
Fluorene	3.3	10
Hexachlorobenzene	3.3	10
Hexachlorobutadiene	3.3	10
Hexachlorocyclopentadiene	8.3	20
Hexachloroethane	3.3	10
Indeno(1,2,3-cd)pyrene	3.3	20
Isophorone	3.3	10
Naphthalene	3.3	10
Nitrobenzene	3.3	20
n-Nitroso-di-n-propylamine	3.3	10
n-Nitrosodimethylamine	3.3	20

Table 7-1 (continued)
Co-Located Soil Chemical Target Detection Limits

Method/Analyte	Targeted Method Detection Limits Soil	Method Detection Limits Aqueous
Semivolatile Organic Compounds by EPA 8270C (continued)	**µg/kg**	**µg/L**
n-Nitrosodiphenylamine	3.3	10
Phenanthrene	3.3	10
Pentachlorophenol	8.3	20
Phenol	3.3	10
Pyrene	3.3	10
Formaldehyde by EPA 8315A	**µg/kg**	**µg/L**
Formaldehyde	10	50
Perchlorate	**ng/kg**	**µg/L**
EPA 6850	20	2
EPA 314.0	40	4
PCB and PCT by EPA 8082	**ng/kg**	**µg/L**
Aroclor 1016	150	0.1
Aroclor 1221	150	0.2
Aroclor 1232	150	0.1
Aroclor 1242	150	0.1
Aroclor 1248	150	0.1
Aroclor 1254	150	0.1
Aroclor 1260	150	0.1
Aroclor 1262	500	0.5
Aroclor 1268	500	0.5
Aroclor 5432	500	0.5
Aroclor 5442	500	0.5
Aroclor 5460	500	0.5
NDMA by EPA 1625C	**ng/kg**	**µg/L**
n-Nitrosodimethylamine	30	0.01

Table 7-1 (continued)
Co-Located Soil Chemical Target Detection Limits

Method/Analyte	Targeted Method Detection Limits Soil	Method Detection Limits Aqueous
Energetics by EPA 8330A	**µg/kg**	**µg/L**
HMX	2.5	0.5
Nitrobenzene	2.5	0.5
Nitroglycerin	50	2
PETN	40	2
RDX	2.5	0.5
Tetryl	5	1.5
1,3-Dinitrobenzene	2.5	0.5
1,3,5-Trinitrobenzene	2.5	0.5
2-Amino-4,6-dinitrotoluene	2.5	0.5
2-Nitrotoluene	2.5	0.5
2,4-diamino-6-nitrotoluene	10	5
2,4-Dinitrotoluene	2.5	0.5
2,4,6-Trinitrotoluene	2.5	0.5
2,6-diamino-4-nitrotoluene	10	5
2,6-Dinitrotoluene	2.5	0.5
3-Nitrotoluene	2.5	0.5
4-Amino-2,6-dinitrotoluene	2.5	0.5
4-Nitrotoluene	4	0.5
Anions by EPA 300.0	**µg/kg**	**mg/L**
Fluoride	50	0.1
Nitrates	50	0.1
Cyanide by EPA 9012B	**µg/kg**	**µg/L**
Cyanide	5	5
pH by EPA 9045C	**pH**	**pH**
pH	0.1 pH units	0.1 pH units

Table 7-1 (continued)
Co-Located Soil Chemical Target Detection Limits

Method/Analyte	Targeted Method Detection Limits Soil	Method Detection Limits Aqueous
TPH by EPA 8015B	**µg/kg**	**µg/L**
Total Petroleum Hydrocarbons as Gasoline (C4-C12)	50	50
Total Petroleum Hydrocarbons as Diesel – Specific Carbon Ranges		
EFH(C8-C11)	50	100
EFH(C12-C14)	50	100
EFH(C15-C20)	50	100
EFH(C21-C30)	50	100
Total Petroleum Hydrocarbons as Oil (C30-C40)	250	100
Alcohols by EPA 8015B	**mg/kg**	**mg/L**
Ethanol	1	20
Isopropanol	1	20
Methanol	1	20
Terphenyls by EPA 8015B	**µg/kg**	**mg/L**
o-Terphenyls	1.7	0.005
m-Terphenyls	1.7	0.005
p-Terphenyls	1.7	0.005
Glycols by EPA 8015B	**µg/kg**	**µg/L**
Diethylene Glycol	500	10
Ethylene Glycol	500	10
Propylene Glycol	500	10
Methyl Mercury by 1630 (Mod)	**pg/g**	**ng/L**
Methyl mercury	0.5	0.06
Organic Tin by NOAA Status and Trends	**ng/kg**	**µg/L**
Monobutyl tin	50	0.5
Tetrabutyl tin	17	0.05
Tributyl tin	18	0.045
Dibutyl tin	13	0.039

Table 7-1 (continued)
Co-Located Soil Chemical Target Detection Limits

Method/Analyte	**Targeted Method Detection Limits Soil**	**Method Detection Limits Aqueous**
Pesticides by EPA 8081A	**ng/kg**	**µg/L**
4,4'-DDD	50	0.04
4,4'-DDE	50	0.04
4,4'-DDT	50	0.04
Aldrin	50	0.02
alpha-BHC	50	0.02
beta-BHC	50	0.02
Chlordane (Technical)	100	0.25
delta-BHC	100	0.02
Dieldrin	50	0.04
Endosulfan I	50	0.02
Endosulfan II	50	0.04
Endosulfan sulfate	100	0.04
Endrin	50	0.04
Endrin aldehyde	50	0.04
Endrin ketone	50	0.04
gamma-BHC	50	0.02
Heptachlor	50	0.02
Heptachlor epoxide	50	0.02
Mirex	50	0.05
p,p'-Methoxychlor	50	0.2
Toxaphene	500	2
Herbicides by EPA Method 8151	**ng/kg**	**µg/L**
2,4,5-T	200	1.0
2,4,5-Trichlorophenoxypropionic acid	800	1.0
2,4-Dichlorophenoxyacetic Acid (2,4-D)	200	4.0
2,4-Dichlorophenoxybutyric acid	800	4.0
Dalapon	500	2
Dicamba	400	2.0
Dichlorprop	800	4.0
Dinoseb	120	1.0
MCPA	80000	500
MCPP	80000	500

Table 7-1 (continued)
Co-Located Soil Chemical Target Detection Limits

Method/Analyte	Targeted Method Detection Limits Soil	Method Detection Limits Aqueous
Dioxin/Furan by EPA Method 1613B	**pg/g**	**ng/L**
1,2,3,4,6,7,8-HpCDF	0.05	0.01
1,2,3,4,6,7,8-HpCDD	0.05	0.01
1,2,3,4,7,8,9-HpCDF	0.05	0.01
1,2,3,4,7,8-HxCDF	0.05	0.01
1,2,3,4,7,8-HxCDD	0.05	0.01
1,2,3,6,7,8-HxCDF	0.05	0.01
1,2,3,6,7,8-HxCDD	0.05	0.01
1,2,3,7,8,9-HxCDF	0.05	0.01
1,2,3,7,8,9-HxCDD	0.05	0.01
1,2,3,7,8-PeCDF	0.05	0.01
1,2,3,7,8-PeCDD	0.05	0.01
2,3,4,6,7,8-HxCDF	0.05	0.01
2,3,4,7,8-PeCDF	0.05	0.01
2,3,7,8-TCDD	0.01	0.005
2,3,7,8-TCDF	0.01	0.005
OCDF	0.1	0.05
OCDD	0.1	0.05

Notes:

EPA = United States Environmental Protection Agency
mg/kg = milligrams per kilogram
mg/L = milligrams per liter
ng/L = nanograms per liter
PAH = polycyclic aromatic hydrocarbons
pg/g = picograms per gram
SIM = selected ion monitoring
µg/kg = micrograms per kilogram
µg/L = micrograms per liter

Table 7-2
Quality Control Objectives for Analytical Methods

Analytical Category	**Method Number and Reference**	**MS/MSD or Surrogate Accuracy Criterion (% Recovery)**	**BS/LCS Accuracy Criterion (% Recovery)**	**Precision Criterion (Maximum RPD)**
		Soil/Water	**Soil/Water**	**Soil/Water**
Volatile Organic Compounds	**EPA Method 8260B**			
<u>Spike</u>				
1,3-Dichlorobenzene				
1,4-Dichlorobenzene		--	--	--
2-Butanone (MEK)		--	--	--
2-Hexanone		--	--	--
4-Methyl-2-pentanone (MIBK)		--	--	--
Acetone		--	--	--
Benzene		--	--	--
Bromodichloromethane		--	--	--
Bromoform		--	--	--
Bromomethane		--	--	--
Carbon Tetrachloride		--	--	--
Cyclohexane		--	--	--
Methyl acetate		--	--	--
Methylcyclohexane		--	--	--
Styrene		--	--	--
Tetrachloroethene		--	--	--
Toluene		--	--	--
Trans-1,2-Dichloroethene		--	--	--
Trans-1,3-Dichloropropene		--	--	--
Trichloroethene		--	--	--
Trichlorofluoromethane		--	--	--
Vinyl chloride		--	--	--
1,1,2-Trichloro-1,2,2-trifluorethane		--	--	--
1,1,1-Trichloroethane		--	--	--
1,1,2,2-Tetrachloroethane		--	--	--
1,1,2-Trichloroethane		--	--	--
1,1-Dichloroethane		--	--	--
1,1-Dichloroethene		--	--	--

Table 7-2 (continued)
Quality Control Objectives for Analytical Methods

Analytical Category	Method Number and Reference	MS/MSD or Surrogate Accuracy Criterion (% Recovery)	BS/LCS Accuracy Criterion (% Recovery)	Precision Criterion (Maximum RPD)
		Soil/Water	Soil/Water	Soil/Water
Volatile Organic Compounds	**EPA Method 8260B**			
Spike				
1,2-Dichlorobenzene		--	--	--
1,2-Dichloropropane		--	--	--
Chlorobenzene		--	--	--
Chloroethane		--	--	--
Chloroform		--	--	--
Chloromethane		--	--	--
Cis-1,2-Dichloroethene		--	--	--
Cis-1,3-Dichloropropene		--	--	--
Dibromochloromethane		--	--	--
Dichlorodifluoromethane		--	--	--
Ethylbenzene		--	--	--
Isopropylbenzene		--	--	--
Methylene chloride		--	--	--
o-Xylene		--	--	--
m,p-Xylenes		--	--	--
1,2-Dichlorobenzene		--	--	--
1,2-Dichloropropane		--	--	--
Chlorobenzene		--	--	--
Surrogate				
4-Bromofluorobenzene		74-121/86-115	74-121/86-115	NA
Dibromofluoromethane		80-120/86-118	80-120/86-118	NA
1,2-Dichloroethane- d_4		80-120/80-120	80-120/80-120	NA
Toluene-d_8		81-117/88-110	81-117/88-110	NA
1,4-Dioxane	**EPA Method 8260B SIM**			
Spike				
1,4-Dioxane		--	--	--

Table 7-2 (continued)
Quality Control Objectives for Analytical Methods

Analytical Category	**Method Number and Reference**	**MS/MSD or Surrogate Accuracy Criterion (% Recovery)**	**BS/LCS Accuracy Criterion (% Recovery)**	**Precision Criterion (Maximum RPD)**
		Soil/Water	**Soil/Water**	**Soil/Water**
pH	**EPA Method 9045C**			
Spike				
pH		NA/NA	95-105/90-110	5
Total Petroleum Hydrocarbons (TPH)	**EPA Method 8015B**			
Spike				
TPH as gasoline		--	--	--
TPH as diesel		--	--	--
TPH as oil		--	--	--
Semivolatile Organic Compounds	**EPA Method 8270C**			
Spike				
Acenaphthene		--	--	--
Acenaphthylene		--	--	--
Acetophenone		--	--	--
Anthracene		--	--	--
Benzo(a)anthracene		--	--	--
Benzo(b)fluoranthene		--	--	--
Benzo(k)fluoranthene		--	--	--
Benzo(g,h,i)perylene		--	--	--
Benzo(a)pyrene		--	--	--
Benzylaldehyde		--	--	--
Bis(2-ethylhexyl)methane		--	--	--
Bis(2-chloroethyl)phthalate		--	--	--
4-Bromophenyl phenyl ether		--	--	--
Butyl benzyl phthalate		--	--	--

Table 7-2 (continued)
Quality Control Objectives for Analytical Methods

Analytical Category	Method Number and Reference	MS/MSD or Surrogate Accuracy Criterion (% Recovery)	BS/LCS Accuracy Criterion (% Recovery)	Precision Criterion (Maximum RPD)
		Soil/Water	Soil/Water	Soil/Water
Semivolatile Organic Compounds	**EPA Method 8270C**			
<u>Spike</u>				
4-Chloraniline		--	--	--
2-Chloronaphthalene		--	--	--
4-Chloro-3-methylphenol		--	--	--
2-Chlorophenol		--	--	--
4-Chlorophenyl phenyl ether		--	--	--
Chrysene		--	--	--
Dibenz(a,h)anthracene		--	--	--
Dibenzofuran		--	--	--
Di-n-butyl phthalate		--	--	--
Carbazole		--	--	--
3,3-Dichlorobenzidine		--	--	--
2,4-Dichlorophenol		--	--	--
Diethyl phthalate		--	--	--
2,4-Dimethylphenol		--	--	--
Dimethyl phthalate		--	--	--
4,6-Dinitro-2-methylphenol		--	--	--
2,4-Dinitrophenol		--	--	--
2,4-Dinitrotoluene		--	--	--
2,6-Dinitrotoluene		--	--	--
Di-n-octyl phthalate		--	--	--
Fluoranthene		--	--	--
Fluorene		--	--	--
Hexachlorobenzene		--	--	--
Hexachlorobutadiene		--	--	--
Hexachlorocyclopentadiene		--	--	--
Hexachloroethane		--	--	--
Indeno(1,2,3-cd)pyrene		--	--	--
Isophorone		--	--	--

Table 7-2 (continued)
Quality Control Objectives for Analytical Methods

Analytical Category	Method Number and Reference	MS/MSD or Surrogate Accuracy Criterion (% Recovery)	BS/LCS Accuracy Criterion (% Recovery)	Precision Criterion (Maximum RPD)
		Soil/Water	Soil/Water	Soil/Water
Semivolatile Organic Compounds	**EPA Method 8270C**			
Spike				
2-Methylnaphthalene		--	--	--
2-Methylphenol		--	--	--
4-Methylphenol		--	--	--
Naphthalene		--	--	--
2-Nitroaniline		--	--	--
3-Nitroaniline		--	--	--
4-Nitroaniline		--	--	--
Nitrobenzene		--	--	--
2-Nitrophenol		--	--	--
4-Nitrophenol		--	--	--
N-Nitrosodiphenylamine		--	--	--
N-Nitroso-di-n-propylamine		--	--	--
Pentachlorophenol		--	--	--
Phenanthrene		--	--	--
Phenol		--	--	--
Pyrene		--	--	--
2,4,5-Trichlorophenol		--	--	--
2,4,6-Trichlorophenol		--	--	--
Surrogate				
2-Fluorobiphenyl		45-130/45-130	45-130/45-130	NA
2-Fluorophenol		25-130/20-130	25-130/20-110	NA
Nitrobenzene-d_5		40-130/40-130	40-130/40-130	NA
Phenol-d_5		25-120/20-120	25-120/20-110	NA
Terphenyl- d_{14}		45-135/45-135	45-130/45-130	NA
2,4,6-Tribromophenol		35-130/30-130	35-130/30-110	NA

Table 7-2 (continued)
Quality Control Objectives for Analytical Methods

Analytical Category	Method Number and Reference	MS/MSD or Surrogate Accuracy Criterion (% Recovery)	BS/LCS Accuracy Criterion (% Recovery)	Precision Criterion (Maximum RPD)
		Soil/Water	Soil/Water	Soil/Water
Polychlorinated biphenyl	**EPA Method 8082**			
Spike				
Aroclor-1016		--	--	--
Arochlor-1260		--	--	--
Arochlor-5432		--	--	--
Arochlor-5442		--	--	--
Arochlor-5460		--	--	--
Surrogate				
Decachlorobiphenyl		45-120/45-120	45-120/45-120	NA
Anions	**EPA Method 300**			
Spike				
Fluoride		80-120/80-120	90-110/90-110	20
Nitrates		80-120/80-120	90-110/90-110	20
Metals	**EPA Method 6010B/6020**			
Spikes				
Aluminum		75-125/75-125	80-120/80-120	20
Antimony		75-125/75-125	80-120/80-120	20
Arsenic		75-125 /75-125	-- /80-120	--
Barium		75-125/75-125	-- /80-120	--
Beryllium		75-125 /75-125	-- /80-120	--
Cadmium		75-125/75-125	-- /80-120	--
Calcium		75-125/75-125	-- /80-120	--
Chromium		75-125/75-125	-- /80-120	--
Cobalt		75-125/75-125	-- /80-120	--
Copper		75-125/75-125	-- /80-120	--
Iron		75-125/75-125	-- /80-120	--

Table 7-2 (continued)
Quality Control Objectives for Analytical Methods

Analytical Category	Method Number and Reference	MS/MSD or Surrogate Accuracy Criterion (% Recovery)	BS/LCS Accuracy Criterion (% Recovery)	Precision Criterion (Maximum RPD)
		Soil/Water	**Soil/Water**	**Soil/Water**
Metals	**EPA Method 6010B/6020**			
Spikes				
Lead		75-125/75-125	-- /80-120	--
Magnesium		75-125/75-125	-- /80-120	--
Manganese		75-125/75-125	-- /80-120	--
Nickel		75-125/75-125	-- /80-120	--
Potassium		75-125/75-125	-- /80-120	--
Selenium		75-125/75-125	-- /80-120	--
Silver		75-125/75-125	-- /80-120	--
Sodium		75-125/75-125	-- /80-120	--
Thallium		75-125/75-125	-- /80-120	--
Vanadium		75-125/75-125	-- /80-120	--
Zinc		75-125/75-125	-- /80-120	--
Dioxins/Furans	**EPA Method 1613B**			
Spikes				
2,3,7,8-TCDD		40-135/40-125	67-158/60-150	20
1,2,3,7,8-PeCDD		40-135/40-125	70-142/60-150	20
1,2,3,4,7,8-HxCDD		40-135/40-125	70-142/60-150	20
1,2,3,6,7,8-HxCDD		40-135/40-125	76-134/60-150	20
1,2,3,7,8,9-HxCDD		40-135/40-125	64-162/60-150	20
1,2,3,4,6,7,8-HpCDD		40-135/40-125	70-140/60-150	20
OCDD		40-135/40-125	78-144/60-150	20
2,3,7,8-TCDF		40-135/40-125	75-158/60-150	20
1,2,3,7,8-PeCDF		40-135/40-125	80-134/60-150	20
2,3,4,7,8-PeCDF		40-135/40-125	68-160/60-150	20
1,2,3,4,7,8-HxCDF		40-135/40-125	72-134/60-150	20
1,2,3,6,7,8-HxCDF		40-135/40-125	84-130/60-150	20
2,3,4,6,7,8-HxCDF		40-135/40-125	70-156/60-150	20
1,2,3,7,8,9-HxCDF		40-135/40-125	78-130/60-150	20
1,2,3,4,6,7,8-HpCDF		40-135/40-125	82-122/60-150	20

Table 7-2 (continued)
Quality Control Objectives for Analytical Methods

Analytical Category	Method Number and Reference	MS/MSD or Surrogate Accuracy Criterion (% Recovery)	BS/LCS Accuracy Criterion (% Recovery)	Precision Criterion (Maximum RPD)
		Soil/Water	**Soil/Water**	**Soil/Water**
Dioxins/Furans	**EPA Method 1613B**			
Spikes				
1,2,3,4,7,8,9-HpCDF		40-135/40-125	78-138/60-150	20
OCDF		40-135/40-125	63-170/60-150	20
Mercury	**EPA Method 7471A**			
Spike				
Mercury		65-135/75-120	85-120/90-115	20
Methyl Mercury	**EPA Method 1630**			
Spike				
Methyl mercury		70-130/75-125	70-130/77-123	30/25
Chromium VI	**EPA Method 7199**			
Spike				
Chromium VI		75-125/85-115	80-120/90-110	20
Cyanide	**EPA Method 9012B**			
Spike				
Cyanide		75-125/70-115	80-120/90-110	20/15
Perchlorate	**EPA Method 314/ 6850**			
Spike				
Perchlorate		80-120/80-120	85-115/85-115	20
N-Nitrosodimethylamine	**EPA Method 1625C**			
Spike				
n-Nitrosodimethylamine		--	--	--
Organotin	**NOAA Status and Trends**			
Monbutyltin		--	--	--
Tetrabutyltin		--	--	--
Tributyltin		--	--	--
Dibutyltin		--	--	--

Table 7-2 (continued)
Quality Control Objectives for Analytical Methods

Analytical Category	Method Number and Reference	MS/MSD or Surrogate Accuracy Criterion (% Recovery)	BS/LCS Accuracy Criterion (% Recovery)	Precision Criterion (Maximum RPD)
		Soil/Water	**Soil/Water**	**Soil/Water**
Pesticides	**EPA Method 8081A**			
<u>Spikes</u>				
4,4’-DDD		--	--	--
4,4’-DDE		--	--	--
4,4’DDT		--	--	--
Aldrin		--	--	--
Alpha-BHC		--	--	--
Alpha-Chlordane		NA	NA	NA
beta-BHC		--	--	--
delta-BHC		--	--	--
Dieldrin		--	--	--
Endosulfan I		--	--	--
Endosulfan II		--	--	--
Endosulfan Sulfate		--	--	--
Endosulfan II		--	--	--
Endosulfan Sulfate		--	--	--
Endrin		--	--	--
Endrin Aldehyde		--	--	--
Endrin Ketone		--	--	--
gamma-BHC		--	--	--
Heptachlor		--	--	--
Heptachlor Epoxide		--	--	--
Methoxychlor		--	--	--
Mirex		--	--	--
<u>Surrogate</u>				
Decachlorobiphenyl		20-120/40-150	20-120/40-150	NA
Tetrachloro-m-xylene		50-130/30-140	50-130/30-140	NA

Table 7-2 (continued)
Quality Control Objectives for Analytical Methods

Analytical Category	**Method Number and Reference**	**MS/MSD or Surrogate Accuracy Criterion (% Recovery)**	**BS/LCS Accuracy Criterion (% Recovery)**	**Precision Criterion (Maximum RPD)**
		Soil/Water	**Soil/Water**	**Soil/Water**
Energetics	**EPA Method 8330A**			
<u>Spike</u>				
HMX		--	--	--
Nitrobenzene		--	--	--
Nitroglycerin		--	--	--
PETN		--	--	--
RDX		--	--	--
Tetryl		--	--	--
1,3-Dinitrobenzene		--	--	--
1,3,5-Trinitrobenzene		--	--	--
2-Amino-4,6-dinitrotoluene		--	--	--
2-Nitrotoluene		--	--	--
2,4-diamino-6-nitrotoluene		--	--	--
2,4-Dintrotoluene		--	--	--
2,4,6-Trinitrotoluene		--	--	--
2,6-diamino-4-nitrotoluene		--	--	--
2,6-Dinitrotoluene		--	--	--
3-Nitrotoluene		--	--	--
4-Amino-2,6-dinitrotoluene		--	--	--
4-Nitrotoluene		--	--	--
<u>Surrogate</u>				
2-Nitro-m-xylene		80-146/80-146	80-146/80-146	NA

Table 7-2 (continued)
Quality Control Objectives for Analytical Methods

Analytical Category	Method Number and Reference	MS/MSD or Surrogate Accuracy Criterion (% Recovery)	BS/LCS Accuracy Criterion (% Recovery)	Precision Criterion (Maximum RPD)
		Soil/Water	**Soil/Water**	**Soil/Water**
Herbicides	**EPA Method 8151A**			
<u>Spikes</u>				
2,4-D		--	--	--
2,4-DB		--	--	--
2,4,5-T		--	--	--
Silvex		--	--	--
Dalapon		--	--	--
Dicambra		--	--	--
Dichloroprop		--	--	--
Dinoseb		--	--	--
MCPA		--	--	--
MCPP		--	--	--
PAH	**EPA Method 8270SIM**			
<u>Spikes</u>				
Acenaphthene		--	--	--
Acenaphthylene		--	--	--
Anthracene		--	--	--
Benzo(a)anthracene		--	--	--
Benzo(a)pyrene		--	--	--
Benzo(b)fluoranthene		--	--	--
Benzo(g,h,i)perylene		--	--	--
Benzo(k)fluoranthene		--	--	--
Bis(2-ethylhexyl)phthalate		--	--	--
Chrysene		--	--	--
Di-n-butyl phthalate		--	--	--
Di-n-octyl phthalate		--	--	--
Dibenzo(a,h)anthracene		--	--	--

Table 7-2 (continued)
Quality Control Objectives for Analytical Methods

Analytical Category	Method Number and Reference	MS/MSD or Surrogate Accuracy Criterion (% Recovery)	BS/LCS Accuracy Criterion (% Recovery)	Precision Criterion (Maximum RPD)
		Soil/Water	Soil/Water	Soil/Water
PAH	**EPA Method 8270SIM**			
Spikes				
Diethyl phthalate		--	--	--
Dimethyl phthalate		--	--	--
Fluoranthene		--	--	--
Fluorene		--	--	--
Indeno(1,2,3-cd)pyrene		--	--	--
n-Nitrosodiphenylamine		--	--	--
Naphthalene		--	--	--
Phenanthrene		--	--	--
Pyrene		--	--	--
1-Methylnaphthalene		--	--	--
2-Methylnaphthalene		--	--	--
Surrogate				
Phenol-d5		25-120/20-120	25-120/20-110	NA
2-Fluorophenol		25-130/20-130	25-130/20-110	NA
2,4,6-Tribromophenol		35-130/30-130	35-130/30-110	NA
Nitrobenzene-d5		40-130/40-130	40-130/40-130	NA
2-Fluorbiphenyl		45-130/45-130	45-130/45-130	NA
Terphenyl-d14		45-135/45-135	45-130/45-130	NA

Source of information in Table 7-2 is from MEC^{x}, 2009.

Acronyms and Abbreviations:

BFB = Bromofluorobenzene
BS/LCS = Blank Spike/Laboratory Control Sample
EPA = U.S. Environmental Protection Agency
MS/MSD = Matrix Spike/Matrix Spike Duplicate
NA = not applicable
RPD = Relative Percent Difference
“—“ = Laboratory specific lower control limit-upper control limit or laboratory specific maximum RPD

Section 8
Instruments/Equipment and Supplies

8.1 Field Instruments/Equipment

All field instruments/equipment will be calibrated and tested in accordance with laboratory standard operating procedures or manufacturer's specifications, as applicable. HGL will maintain all field instruments and equipment on site and specific details can be found in EPA's field sampling plan (HGL 2010a). HGL will maintain documentation of its calibration and maintenance activities.

8.2 Laboratory Instruments/Equipment

Calibration of laboratory equipment will be based on written procedures approved by laboratory management. Instruments and equipment will be initially and continuously calibrated at approved intervals as specified by either the manufacturer or other requirements (e.g., methodology requirements). The laboratory will provide their respective SOPs.

8.3 Inspection/Acceptance of Supplies and Consumables

Prior to acceptance, supplies and consumables will be inspected to ensure that they are in satisfactory condition and free of defects.

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Section 9
Special Training and Certification

All CDM field personnel will be required to demonstrate successful completion of health and safety training prescribed by 29 Code of Federal Regulations 1910.120 also known as Hazardous Waste Operations and Emergency Response (HAZWOPER) regulations. All employees and subcontractor personnel will have completed 40-hours of HAZWOPER instruction in addition to receiving 8-hours of refresher training on a yearly basis. Minimum course requirements included in the HAZWOPER training is described in the Site Health and Safety Plan (SHASP).

All field personnel will be required to read and understand the procedures described in this WP/FSAP and HGL's field sampling plan (HGL 2010a, 2010b) before beginning field work. The CDM Field Team Leader will conduct a field planning meeting with CDM field personnel prior to commencement of field work to discuss their understanding of the WP/FSAP.

All samples will be submitted to Lancaster Laboratories, Inc., which has been certified by the State of California through the ELAP or NELAP, for the methods that California certifies.

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Section 10
Documentation and Records

Table 10-1 provides a summary of the documents to be maintained for this project. CDM's local administrative staff has the responsibility for maintenance of the document control system for the project. This system includes a document inventory procedure and a filing system. Project personnel will be responsible for project documents in their possession while working on a particular task.

Electronic copies of project deliverables, including graphics, will be routinely backed up and archived. Final reports will be submitted to DOE on compact disks in Microsoft Word, Microsoft Excel for certain tables, and geographical information system (GIS) for figures.

10.1 Field Logbook and Records

Permanently bound and consecutively paginated field logbooks will be maintained daily by the CDM field team in accordance with the procedures below. Documentation modification requirements are also described below. In general, a single strikeout, initialed and dated, is required for each documentation change. HGL will maintain their own field logbooks in accordance with the HGL field sampling plan (HGL 2010).

The CDM field team leader is responsible for ensuring that the format and content of data entries are in accordance with this procedure. The field team leader will provide field logbooks to site personnel who will be responsible for their care and maintenance while in their possession. Site personnel will return field logbooks to the field team leader at the end of their assignment.

All markings and notes will be made with indelible black or blue ink pen. All pages must be numbered before initial use of the logbook. Before use in the field, each logbook will be sequentially numbered by the CDM field team leader . The following information shall be recorded on the cover of each logbook:

- Field logbook number.
- Start date of entries.
- Activity, site name, and location.
- Name of CDM contact and phone number(s) (typically the project manager).
- End date of entries.

The first few (approximately five) pages of the logbook will be reserved for a table of contents. Mark the first page with the heading (Table of Contents) and enter the following:

- Date/Description Pages
- (Start Date)/Reserved for Table of Contents 1-5

The remaining pages of the table of contents will be designated as such with “Table of Contents” written on the top center of each page. The table of contents should be completed as activities are completed and before placing the logbook in the records file.

The requirements that must be followed when using a logbook are:

- Record work, observations, quantities of materials, calculations, drawings, and related information directly in the logbook. If data collection forms are specified by an activity-specific plan, this information does not need to be duplicated in the logbook. However, any forms used to record site information must be referenced in the logbook.
- Do not start a new page until the previous one is full or has been marked with a single diagonal line so that additional entries cannot be made. Use both sides of each page.
- Do not erase or blot out any entry at any time. Indicate any deletion by a single line through the material to be deleted. Initial and date each deletion. Take care to not obliterate what was written previously.
- Do not remove any pages from the book.

Specific requirements for field logbook entries include:

- Initial and date each page.
- Sign and date the final page of entries for each day.
- Initial and date all changes.
- If authors change within the course of a day, the original author must insert the following:

  Above notes authored by:

  - (Sign name)
  - (Print name)
  - (Date)
- The new author must sign and print his/her name before additional entries are made.

- Draw a diagonal line through the remainder of the final page at the end of the day.
- Record the following information on a daily basis:
  - Date and time
  - Name of individual making entry
  - Names of field team and other persons onsite
  - Description of activity being conducted including sampling location numbers
  - Weather conditions (i.e., temperature, cloud cover, precipitation, wind direction, and speed) and other pertinent data
  - Level of personal protection used
  - Serial numbers of instruments
  - Equipment calibration information

Entries into the field logbooks shall be preceded with the time (written in military units) of the observation. The time should be recorded frequently and at the point of events or measurements that are critical to the activity being logged. All measurements made and samples collected must be recorded.

Other events and observations that should be recorded include:

- Changes in weather that impact field activities.
- Deviations from procedures outlined in any governing documents. Also record the reason for any noted deviation.
- Problems, downtime, or delays.
- Upgrade or downgrade of personal protection equipment.
- Visitors to the site.

To guard against loss of data as a result of damage or disappearance of logbooks, completed pages shall be periodically scanned (weekly, at a minimum) and forwarded to the field or project office. Other field records shall be photocopied and submitted regularly and as promptly as possible to the office. When possible, electronic media such as disks and tapes should be copied and forwarded to the project office.

At the conclusion of each day, the individual responsible for the logbook will ensure that all entries have been appropriately signed and dated and that corrections were made properly (single lines drawn through incorrect information, then initialed and dated). Completed logbooks will be returned to the field team leader.

The onsite HGL geologist will prepare detailed boring logs in accordance with the HGL field sampling plan (HGL 2010a).

10.2 Photographs

Photographs may be taken at the site as needed to visually document field activities and site features. Digital photographs will be submitted to the electronic project files.

All digital photographs should have a caption added after the photographs are downloaded. This information should also be recorded in the field logbook as the photographs are taken. The caption should contain the following information:

- Photograph sequence number
- Description of activity/item shown (e.g., name of facility/site, specific project name, project number)
- Date and time
- Direction (if applicable)
- Photographer

10.3 Laboratory Data

The laboratory will submit an analytical data report to CDM. The data report will contain a case narrative that briefly describes the numbers of samples, the analyses, and noteworthy analytical difficulties or QA/QC issues associated with the submitted samples. The data report will include signed COC forms, cooler receipt forms, analytical data, a QC package, raw data, and an electronic copy of the data in a format compatible with the established SSFL data management system. The data package will also include all QC sample results and associated calculations (i.e., percent recovery [%R] and relative percent difference [RPD]).

Hard copies and electronic copies of the data report on compact disks will be archived by CDM at offsite storage for a minimum of five years and will be made available to the regulatory agencies upon request by DOE. DOE will maintain hard copies and electronic files per federal requirements. The analytical results and environmental data will be submitted to the established SSFL data management system using the semi-colon delimited text file submittal requirements specified in the extended electronic data deliverable (EDD) specification within 30 days of receiving all data validation reports.

Section 11
Assessment and Oversight

11.1 Planned Project Assessments

Prior to initiating field work, a Field Planning Meeting will be held with HGL to assess the readiness for field work start up. The Field Planning Meeting will be documented using the form presented in Figure 11-1. The project manager is responsible for holding the Field Planning Meeting and is responsible for responding to or correcting any deficiencies identified during the meeting prior to the initiation of field work.

System assessments are qualitative reviews of different aspects of project work (e.g., field audits and office audits) to check on the use of appropriate QC measures and the functioning of the QA system. Determinations for project assessments will be performed under the direction of the CDM QA director, who reports directly to the CDM president. Quality Procedure 6.2, as defined in the CDM Quality Assurance Manual, Part Two (CDM 2007), defines CDM's corporate assessments procedures and requirements.

11.1.1 Field Assessments

At the start of field work, the project manager or field team leader will conduct a Field Sampling Technical Systems Assessment. This qualitative audit will assess the equipment, facilities, personnel, training, procedures, record-keeping, and data management aspects of the field work to ensure conformance with the WP/FSAP. The project manager or field team leader is responsible for conducting the Field Sampling Technical Systems Assessment, reporting the results of the assessment in the field logbook, and responding to or correcting any deficiencies identified during the assessment prior to the start of field work.

A minimum of one field audit will be conducted on CDM work and subcontractor work activities by an authorized CDM technical staff independent of the activities audited. Auditors for field activities and laboratory operations require technical expertise specific to the activity audited and must be authorized by the CDM QA Director. The project manager and/or field team leader are responsible for responding to and correcting any identified field audit findings. The QA coordinator is responsible for monitoring the effectiveness of the implemented corrective action. The responsibilities and procedures for planning, conducting, and closing-out audits are further specified in CDM's QA Manual (CDM 2007).

DOE and EPA staff will have the opportunity to review site activities and verify that the procedures described in planning documents such as the WP/FSAP are being followed.

11.1.2 Laboratory Assessments

Performance assessments are quantitative checks on the quality of a measurement system (e.g., proficiency testing) and will be scheduled for this project.

CDM chemists will perform an formal review of laboratory activities sample logging, recording, handling, preparation, and analysis procedures the first week of sampling to verify that the procedures described in planning documents such as the WP/FSAP are being followed. If the CDM chemist(s) observe deviations from the planning documents, a formal performance assessment will be performed within one week.

11.2 Assessments Findings and Response Actions

Any conditions or problems identified during routine activities or through assessments that may impair the quality of work will be addressed through either rapid corrective response actions or formal corrective action processes. All response actions will be implemented on a case by case basis to correct quality problems.

Field audit findings are provided by the auditor to the project manager and/or field team leader on the day of the audit through a post-audit debrief. Field audits are further documented via an audit report. Within 15 working days of the audit, the auditor will prepare a draft audit report for review by the QA Director. The QA Director will approve and distribute the audit report within 30 working days of the audit. If there are any unresolved deficiencies, the auditor, through a corrective action request (Figure 11-2), will request the audited party to take corrective action. Specific procedures for issuing and following up on corrective actions are presented in CDM's QA Manual (CDM 2007). The timeframe for response to the corrective action request is typically 15 to 30 days from the date of the corrective action notice. The QA Director is the individual responsible for receiving and approving the corrective action response.

Minor rapid response actions taken in the field immediately (within 24 hours) to correct a quality problem will be documented in the field logbook and verbally reported to the CDM project manager.

Major rapid response actions taken in the field will require notification (within 24 hours) and approval by the DOE project manager, EPA project manager, CDM QA Coordinator, and CDM project manager prior to implementation. Such actions may include revising procedures in the field or retesting.

Minor or major quality problems that cannot be corrected quickly through rapid routine procedures require implementation of a corrective action request (CAR) form (see Figure 11-2). The CAR will be initiated by the person identifying the problem and forwarded to the CDM QA Coordinator within 48 hours of identifying the problem. In consultation with the CDM QA Director, the CDM QA Coordinator will be responsible for investigating and following up on the quality problem; the timeframe for response will be determined by the CDM QA Coordinator based on the specific quality problem.

The DOE project manager will approve any major response actions in writing.

11.3 Reports to Management

During active months of the project, CDM will schedule, at a minimum, monthly phone calls with the DOE and EPA project managers to provide a verbal status report identifying activities performed, significant conversations, planned activities, and an updated schedule.

QA reports will be provided to management when significant quality problems are encountered. Field staff will note quality problems in the field logbooks. The CDM project manager will inform the CDM QA coordinator upon encountering quality issues that cannot be immediately corrected. Monthly QA reports will be submitted to CDM's QA director by the CDM QA coordinator. These reports will be provided upon request of the DOE project manager.

The measurement report (to be prepared by CDM) will contain a QA section that will discuss adherence to governing documents, extent to which DQOs were met, deviations from the WP/FSAP, data precision and accuracy goals met, and changes, if any, to the governing documents. It will also provide a summary of QA activities performed as well as a description of quality problems encountered and corrective actions implemented. QA reports and CARs will be included in the measurement report as appropriate.

Figure 11-1
Field Planning Meeting Form

CDM FIELD PLANNING MEETING FORM

Assignment No./Name:______________________________

Date of Meeting:____________________________________

ATTENDEES

Project Manager:____

Field Team Leader: ____

Site Health and Safety Officer: _____________________________________

Additional Sampling Personnel:_____________________________________

QA Coordinator:____

AGENDA

I. PERSONNEL, FIELD SCHEDULES, TASKS

A. Who is doing the sample collection? List personnel and responsibilities.

B. What media are being sampled? List here.

C. Identify sample locations and requested analytical parameters here. Attach map if needed.

D. How long will personnel be in the field?

Figure 11-1 (continued)
Field Planning Meeting Form

II. PRE-PLANNING

A. Are site-specific Work Plan, SAP and H&SP ready?

B. Have other necessary documents been assembled (Client SOPs, CDM SOPs, other applicable client documents)?

C. Review status of procurement of field supplies, equipment and subcontracts

D. Reservation of Laboratory Space

E. Arrangement for QC Samples (Spikes, trip blanks, rinsates, temperature blank, duplicates, MS/MSD, others if necessary)

F. Coordination with client project manager and subcontractors

G. Have chain-of-custody forms and sample labels been prepared?

H. Are field equipment calibration logs prepared/available for all the field equipment to be used?

III. TRAINING

A. Are sampling personnel familiar with sample collection procedures and requirements, CDM SOP requirements, or other applicable client requirements?

B. Review sampling procedures as needed (logbook entries, non-CLP tracking form, spike submittal, etc)

Figure 11-1 (continued)
Field Planning Meeting Form

IV. CHAIN-OF-COMMAND

A. Who will talk to client project manager?

B. Have back-ups been established for the client project manager and the CDM project manager?

C. If applicable, has a client contract specialist or client technical/field procedure contact been established?

Figure 11-2
Corrective Action Request Form

CAR No. ____________

CDM CORRECTIVE ACTION REQUEST

Project: ____

Contract/Project No: ______________ Project Manager: ________________

Description of problem and date identified: ________________________________

Requested by: ____________________ Date: ____________________________

Submit this form to the QA Director promptly.

Significant Condition Adverse to Quality? Yes / No

Responsible for Action: ___________ Response Due: __________________

Submit completed response to: ____

[To be completed by the responsible person. Attach additional pages as required. **Include evidence that corrective action has been implemented.**]

State cause of problem (if known or suspected): ___________________________

____

____

Corrective Action(s) Taken to Correct Problem and Prevent Recurrence: ______

____

____

Signature: _______________________ Date: ____________________________

Corrective Action Plan Accepted: _____________________ Date: ___________

Corrective Action Verified By: _______________________ Date: ___________

Corrective Action Accepted: _________________________ Date: ___________

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Section 12
Data Review

The data review process includes four distinctive steps to evaluate and ensure that project data quality will meet the project needs and requirements. The data review process is comprised of verification, validation and usability assessments. Each of these is conducted to ensure that project data are of known and documented quality. The following sections provide details associated with each step in the data review process.

12.1 Field Record Verification

Data verification consists of a completeness review that is performed in order to ensure that required information is available. This step provides examination of objective evidence to ensure that sampling and analytical requirements have been completed. Several inputs will be examined. Table 12-1 provides a summary of the verification steps for this project.

12.2 Laboratory Data Verification

Data verification consists of a completeness review that is performed in order to ensure that required information is available. This step provides examination of objective evidence to ensure that sampling and analytical requirements have been completed. Several inputs will be examined. Table 12-1 provides a summary of the verification steps for this project.

12.3 Data Validation

The data validation process consists of two steps to be completed. The first step consists of determining compliance with methods, procedures, and contracts for sampling and analysis. The second step of the data validation process consists of comparing information collected with measurement performance criteria presented in the WP/FSAP and data validation guidance. Several validation inputs will be examined.

All data validation will be conducted in accordance with *EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA 2004), *EPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review* (EPA 2008), and *EPA Contract Laboratory Program National Functional Guidelines for Chlorinated Dioxin/Furan Data Review* (EPA 2005).

The data validation strategy to be employed during the field sampling is to validate 10% of the data according to EPA Level IV protocols and the remaining 90% according to EPA Level III protocols. Data validation will be conducted by an independent data validation subcontractor.

12.4 Data Usability Assessment

The data usability assessment will be performed on the validated data by a team of personnel at CDM under the responsibility of the project manager. The results of the data usability assessment will be presented in the measurement report and data deemed appropriate for use will be used in the project decision making process. Data qualified as rejected are considered unusable. All other data are considered to be valid and acceptable including those analytes that have been qualified as estimated or non-detect.

The following sections describe the precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCCS) goals for this project and describe how they will be used to conduct the data usability assessment.

12.4.1 Precision

The precision of a measurement is an expression of mutual agreement among individual measurements of the same property taken under prescribed similar conditions. Precision is quantitative and most often expressed in terms of RPD. Precision of reported results is a function of inherent field-related variability plus laboratory analytical variability. Various measures of precision exist, depending upon "prescribed similar conditions." Field duplicate samples will be collected to provide a measure of the contribution to overall variability of field-related sources. Contribution of laboratory-related sources to overall variability is measured through various laboratory QC samples. The acceptable RPD limits for field duplicates are less than 50% for soil. Chemical analytical data will be validated for precision using field duplicates, laboratory duplicates, MS/MSDs, and LCS/laboratory control sample duplicates (LCSDs), as applicable.

Precision of the laboratory analysis will be assessed by comparing the analytical results and the laboratory duplicate results. The RPD will be calculated for each pair of duplicate analyses using the following equation:

$$RPD = \left(\left|S - D\right| / (S + D) / 2\right) \times 100$$

Where S = First sample value (original value); and
D = Second sample value (duplicate value).

A discussion summarizing the results of laboratory and field precision and any limitations on the use of the data will be described in the measurement report.

12.4.2 Accuracy

Accuracy is the degree of agreement of a measurement with an accepted reference or true value, and is a measure of the bias in a system. Accuracy is quantitative and usually expressed as the %R of a sample result. Ideally, it is desirable that the reported concentration equals the actual concentration present in the sample. Acceptable QC limits for %R are 70% to 130% for water and soil LCS/LCSDs; 70% to

130% for soil LCS/LCSDs; 70% to 130% for surrogates; and 70% to 130% for MS/MSDs. Chemical analytical data will be validated for accuracy using surrogates, MS/MSDs, and LCS/LCSDs, as applicable.

The %R of spiked samples will be calculated using the following equation:

$$\%R = \left(\left(A - B\right) / C\right) \times 100$$

Where A = Analyte concentration determined experimentally from the spiked sample;
B = Background level determined by a separate analysis of the unspiked sample; and
C = Amount of the spike added.

A discussion summarizing the results of laboratory accuracy and any limitation on the use of the data will be described.

12.4.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent: (a) a characteristic of a population, (b) parameter variations at a sampling point, and/or (c) an environmental condition. Representativeness is a qualitative and quantitative parameter that is most concerned with the proper design of the sampling plan and the absence of cross-contamination. Good representativeness will be achieved through:

- Careful, informed selection of sampling sites;
- Selection of testing parameters and methods that adequately define and characterize the extent of possible contamination and meet the required parameter DLs;
- Proper gathering and handling of samples to avoid interference and prevent contamination and loss; and
- Collection of a sufficient number of samples to allow characterization.

Representativeness is a consideration that will be employed during sample location and collection efforts and will be assessed qualitatively by reviewing field procedures and reviewing actual sampling locations versus planned locations. Representativeness will be reviewed quantitatively using blank samples. If a concentration in a sample is less than five times the concentration in an associated blank, the sample concentration is considered non-detect. Conclusions drawn based on these reviews will be presented and any impacts discussed in the measurement report.

12.4.4 Completeness

Completeness is a measure of the amount of usable data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. Usability will be assessed by evaluating the PARCCS parameters. Those data that are validated and need no qualification, or are qualified as estimated data, are considered usable. Rejected data are not considered usable. Completeness will be calculated following data evaluation. For this work, a completeness goal of 90% is projected for each analytical test. If this goal is not met, additional sampling may be necessary to adequately achieve project objectives. An evaluation of the impact of missing information and any project limitations with respect to completeness will be discussed in the measurement report.

12.4.5 Comparability

Consistency in the acquisition, handling, and analysis of samples is necessary for comparing results. Where appropriate, the results of analyses obtained will be compared with the results obtained in previous studies. Standard EPA analytical and QC methods will be used to ensure comparability of results with other analyses performed in a similar manner. Comparability is a qualitative parameter and cannot be assessed using QC samples. Any comparability limitations will be presented and discussed in the measurement report.

12.4.6 Sensitivity

Sensitivity is the ability of the method or instrument to detect target analytes at the level of interest. Examples of QC measures for determining sensitivity include method detection limit studies, and low initial calibration standards at the quantitation/detection limit. A review of initial calibration data (specifically low standards at the detection limit) will be completed to determine if project required sensitivities (detection limits) were achieved. The measurement report will discuss sensitivity and any impacts and limitations on the use of project data.

Table 12-1
Verification Process

Verification Input	Description	Internal/ External	Responsible for Verification
Chain-of-custody forms	Chain-of-custody forms will be reviewed internally upon their completion and verified against the packed sample coolers prior to shipment to the laboratory. Copies of the chain-of-custody forms will be reviewed again and verified against field logs, analytical laboratory reports, and the Work Plan/Field Sampling and Analysis Plan (FSAP) prior to completion of the measurement report.	Internal	Field team leader
Audit reports	Upon report completion, a copy of all audit reports will be placed in the project file. If corrective actions are required, a copy of the documented corrective action taken will be attached to the appropriate audit report in the project file. Project file audit reports will be reviewed internally to ensure that all appropriate corrective actions have been taken and that corrective action reports are attached. If corrective actions have not been taken, the project manager will be notified to ensure action is taken.	Internal	Project manager
Field logbooks and field forms	Field logbooks and field forms will be reviewed to ensure accuracy and completeness. The field logbook will be maintained in the project file and field forms will be included in the measurement report.	Internal	Field team leader
Laboratory Data Reports	Data validation reports will be reviewed to ensure they represent the data collected during the project. The laboratory data will be evaluated against the project data quality objectives and measurement performance criteria established in the WP/FSAP.	Internal	Project manager and/or database coordinator
Sampling Procedures	The implementation of sampling procedures will be reviewed and evaluated through the use of audit reports, sampling reports, field change request forms, the WP/FSAP, and/or field logbooks to determine proper equipment use and sampling processes.	Internal	Field team leader
Electronic Data Deliverables (EDD)	The electronic data deliverable will be compared to the EDD guidance for compliance with required fields and format. The results will be reviewed to ensure that they have been transferred correctly from laboratory data printouts to the laboratory report and to the EDD.	Internal	Database coordinator
WP/FSAP	All planning documents (including the WP/FSAP) will be reviewed to evaluate whether planned activities and objectives were actually implemented and to document deviations to the plans as necessary.	Internal and External	All data users
Laboratory data	All laboratory data packages will be verified internally by the laboratory performing the work and by the data validators for completeness and technical accuracy prior to submittal to CDM.	Internal and External	Subcontracted analytical laboratory and data validators

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Section 13
References

CDM Federal Programs Corporation (CDM). 2007. *Quality Assurance Manual, Revision 11.* March.

CH2M Hill. 2008. *Group 5 – Central Portion of Areas III and IV RCRA Facility Investigation Report Santa Susana Field Laboratory, Ventura County, California*. November.

HydroGeoLogic, Inc. 2010a. *Field Sampling Plan for Soil Sampling, Area IV Radiological Study, Santa Susana Field Laboratory.* October.

HydroGeoLogic, Inc. 2010b. *Subarea 5C Addendum to Field Sampling Plan for Soil Sampling, Area IV Radiological Study, Santa Susana Field Laboratory.* October.

MEC^X. 2009. *Quality Assurance Project Plan, Santa Susana Field Laboratory, RCRA Facility Investigation, Surficial Media Operable Unit*. March.

MWH Americas, Inc. 2005. *Standardized Risk Assessment Methodology (SRAM) Work Plan, Santa Susana Field Laboratory.* Revision 2. September.

United States Environmental Protection Agency (EPA). 2008. *EPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review*. EPA-540-R-08-01. June.

________. 2006. *Guidance for the Data Quality Objectives Process, EPA QA/G-4.* Final. EPA/600/R-96/055. August

________. 2005. *EPA Contract Laboratory Program National Functional Guidelines for Chlorinated Dioxin/Furan Data Review*. EPA-540-R-05-001. September.

________. 2004. *EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*. EPA 540-R-04-004. October.

________. 2001. *U.S. EPA Requirements for Quality Assurance Project Plans, EPAQA/R-5.* Final. EPA/240/B-01/003. March.

________. 1997. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods,* SW-846, Third Edition (as updated by revisions I, II, IIA, IIB, III, IIIA, IIIB, IVA, and IVB). July.

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