Technical Memorandum

Co-Located Chemical Sampling Results for Sediment Samples at Area IV, Santa Susana Field Laboratory Ventura County, California

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Contract DE-AM09-05SR22404
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I certify that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted.
Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete.

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Acronyms

°C	degrees Celsius
%	percent
AOC	Area of Concern
AOC	Administrative Order on Consent
ASTM	American Society of Testing and Materials
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
DUAR	Data Usability and Assessment Report
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
FTL	Field Team Leader
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
LLI	Lancaster Laboratories Inc.
mL	milliliter
MS	matrix spike
MSD	matrix spike duplicate
NASA	National Aeronautics and Space Administration
NBZ	Northern Buffer Zone
NELAP	National Environmental Laboratory Accreditation Program
NOAA	National Oceanic and Atmospheric Administration
PAH	polycyclic aromatic hydrocarbon
PARCCS	precision, accuracy, representativeness, completeness, comparability, and sensitivity

PCB	polychlorinated biphenyl
pg/L	picograms per liter
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
RL	reporting limit
RPD	relative percent difference
SDG	sample delivery group
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
WP	Work Plan

Section 1
Introduction

This Technical Memorandum (TM) presents the results of chemical analysis of sediment samples collected under the *Work Plan/ Field Sampling and Analysis Plan, Co-Located Chemical Sediment Sampling at Area IV, Santa Susana Field Laboratory* (CDM Federal Programs Corporation [CDM] 2010). Sediment samples were collected from drainages within Area IV and in the Northern Buffer Zone (NBZ). A sample of the sediment in the bottom of the Building 4056 excavation was also collected.

This TM provides a description of the sampling activities, a discussion of the analytical data review findings, and the analytical results. The TM does not provide detailed interpretation of the results. The data provided in this TM are intended to be combined with data collected under the prior Resource Conversation and Recovery Act (RCRA) Facility Investigation (RFI) efforts into the Area IV soil chemical database. A data gap analysis will be performed to assess the adequacy of Area IV data as a whole in defining nature and extent of chemicals in soil for purposes of remedy determination.

1.1 Co-Located Sediment Chemical Sampling Objectives

The radiological characterization study being performed by the United States Environmental Protection Agency (EPA) includes collection of surface and subsurface soil, and drainage sediment samples throughout Area IV of Santa Susana Field Laboratory (SSFL) and the NBZ for analysis of radionuclides. The California Department of Toxic Substances Control (DTSC) and Department of Energy (DOE) suggested that soil/sediment samples collected by EPA also be analyzed for chemical analytes. DTSC and DOE agreed that the chemical sampling would be done by DOE's contractor, CDM. EPA's contractor, Hydrogeologic, Inc. (HGL) collected all EPA-proposed drainage sediment samples. CDM was responsible for the management, shipment, and laboratory analyses of the samples.

The *Administrative Order on Consent for Remedial Action* Docket Number HSA-CO 10/11-037 between DTSC and DOE was signed on December 6, 2010. The *Administrative Order on Consent* (AOC) is a legally binding order that describes the characterization of Area IV and NBZ soils/sediments and further defines DOE's obligations in relation to radiologic and chemical cleanup of soils within these areas. It also stipulates that during Phase 1 of the chemical investigation activities, DOE is to analyze a soil sample for chemical constituents at each location where EPA collects a sample for radiological analyses.

1.2 Basis for the Area IV and Northern Buffer Zone Drainage Sediment Sampling

HGL's *Final Phase I Field Sampling Plan for Groundwater, Surface Water, and Sediment, Area IV Radiological Study, Santa Susana Field Laboratory* (HGL 2010a) includes a description of the project objectives, the scope of work, laboratory analytical suites, and sample collection and other standard field operation methods. Table 3.4 of HGL's sampling plan includes proposed sediment sample locations EPASED01 through EPASED35.

The *Surface Water and Sediment Addendum to the Phase I Field Sampling Plan for Groundwater, Surface Water, and Sediment, Santa Susana Field Laboratory, Area IV Radiological Study* (HGL 2010b) was prepared by HGL to support the field implementation of their surface water and sediment sampling program in Area IV. The addendum documented the technical justification for deleting one alternate sediment sample location (EPASED15A), relocating two locations (EPASED15 and EPASED34), and adding locations (EPASED36 through EPASED40), based on stakeholder comments received during the Technical Breakout Session held on November 18, 2010. CDM obtained sediment samples for chemical analysis at each location where HGL collected sediment samples for radionuclides analysis.

1.3 Geology

The drainage sediment locations are all within the Chatsworth Formation, which is composed predominantly of sandstone interbedded with siltstone and shale. The soils at the majority of the drainage locations sampled are predominately fine to medium or coarse grained sand and silt with no clay. Locations EPASED04, EPASED05, EPASED16, EPASED19, EPASED26, and EPASED 36 contained as much as 20 percent clay.

Additional information regarding the geology in Area IV can be found in Volume I of *Group 5 – Central Portion of Areas III and IV RCRA Facility Investigation Report Santa Susana Field Laboratory, Ventura County, California* (CH2M Hill 2008).

1.4 Report Organization

This TM includes the following sections:

- **Section 1 - Introduction** – Summarizes the basis and objectives of the co-located drainage sediment sampling

- **Section 2 - Field Sampling and Analytical Methods** – Provides details regarding field sampling procedures and laboratory analytical methods

- **Section 3 - Drainage Sediment Sample Results** – Provides a summary of analytical results for each chemical; the appendices provide the overall results

- **Section 4 - Data Usability Assessment** – Discusses the outcome of the data review and validation processes
- **Section 5 - References**

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Section 2
Field Sampling and Analytical Methods

The Area IV and NBZ drainage locations were sampled during December 13, 2010 through December 22, 2010 and on January 13, 2011. The sediment sample from the Building 4056 excavation was collected on May 23, 2011. All sediment sample locations are shown on Figure 2-1.

Table 2-1 includes sample number and date of collection for the drainage sediment samples; location descriptions; sediment sample description including percentage of clay, silt, sand, and gravel; and any other pertinent information.

2.1 Drainage Sediment Sampling

The drainage sediment samples were collected from the surface to 6-inches below ground surface (bgs). The surface of the sample area was prepared by HGL's sampling personnel by removing leaves, grass, and any other surface debris. Samples to be analyzed for semi-volatile organic compounds (SVOCs) and polyaromatic hydrocarbons (PAHs) were collected first using a slide hammer equipped with a 2-inch diameter and 6-inch long stainless steel sample liner. The sampler was pounded into the soil until its top was flush with the surface and then removed from the soil. The sample sleeve was removed from the sampler and capped with a Teflon liner and a plastic cap on both ends of the sleeve.

The sediment for the remaining sample analytes was collected from a circular hole, approximately 12-inches in diameter to a depth of 6-inches bgs, using a stainless steel trowel and transferred to a stainless steel bowl and homogenized. Wood, debris, and any other materials larger than 0.25 inches were removed prior to homogenization. After homogenization, the sample was placed into one or more 16-ounce glass jars. Adhesive sample labels, completed with all sampling information, were affixed to both the sample sleeves and jars. All sleeves and jars were placed into plastic baggies. All samples were analyzed for primary sample analytes only (i.e., SVOCs, PAHs, metals, hexavalent chromium, fluoride, polychlorinated biphenyls (PCBs), and polychlorinated triphenyls (PCTs), dioxins, perchlorate, pesticides, and herbicides), with the exception of the sample collected from the Building 4056 excavation, which was also analyzed for pH, methyl mercury, and organotins.

The sediment sample from the Building 4056 excavation was collected using an Ekman sampler; a box-style sediment sampler with a spring-loaded clam-shell bottom. The sampler was dropped with the clam-shell open downward into the water until the it made contact with the bottom of the water body. A weight dropped along the line attached to the top of the sampler serves as a "messenger" that (closes the clam shell-operated release device. The closing of the clam-shell doors scoops sample material into the sampling box. The sampler has overlapping cover plates, loosely hinged at the top of the box, that permits an outflow of water during descent of the device as it is dropped to the bottom, and closes tightly to prevent wash-out of sediment during ascent. After the sampler was retrieved from the excavation, sediment was transferred directly from the sampler into the proper sampling jars using a disposable plastic scoop.

2.2 Sample Handling

All soil samples collected were transferred by the field sampler to CDM's Field Team Leader (FTL). The FTL ensured that the sample labels were complete and legible. Any discrepancies were discussed with the field sampler and corrections to the sample labels made as needed. All sample labels were covered with clear tape, the sleeves and jars placed back into their plastic baggie, and refrigerated.

All sampling information was placed onto a chain of custody (COC) form. The sampler reviewed the COC and any discrepancies were corrected by the FTL. Each completed COC was signed by the sampler and the FTL as relinquisher. All samples were packed into coolers in accordance with Section 6.4 of the *Work Plan/ Field Sampling and Analysis Plan, Co-Located Chemical Sediment Sampling at Area IV, Santa Susana Field Laboratory* (CDM 2010).

2.3 Field Quality Control Procedures

Quality control samples collected in the field included field duplicates, matrix spike (MS)/matrix spike duplicate (MSD) samples, equipment rinsate blanks, and field blanks.

2.3.1 Field Duplicates and MS/MSD Samples

Both field duplicates and MS/MSD samples were collected at a frequency of 1 per 20 "parent" sediment samples collected; thus, both the field duplicate and MS/MSD samples were collected from the same location. The duplicate samples were submitted to the laboratory as a separate (and blind) sample from the parent sample. The MS/MSD samples are additional volume of the parent samples.

Two duplicates and MS/MSD samples were collected for the sediment samples and analyzed for primary analytes only. A third duplicate and MS/MSD sample was collected for methyl mercury and organotins analyses only.

2.3.2 Equipment Rinsate Blank Samples

Equipment rinsate blanks were to be prepared and submitted for analysis at a minimum frequency of 1 per 20 primary samples collected. Only one equipment rinsate blank sample was collected in association with the drainage sediment sampling. No equipment rinsate blanks were collected for methyl mercury and organotins because only one sample was collected using a disposable scoop.

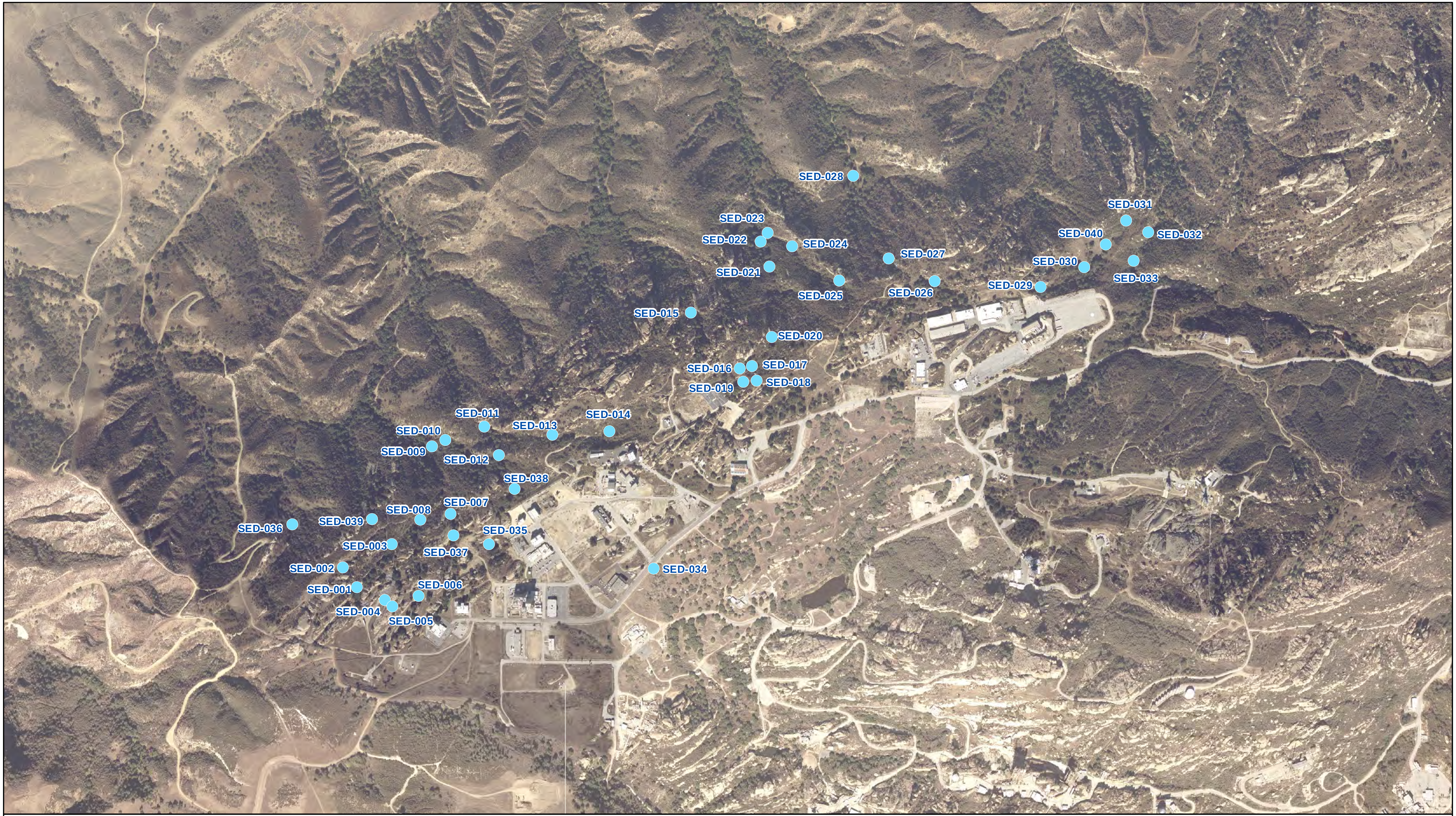
2.3.3 Field Blank Samples

Initially, to match the collection of field blank samples associated with the radionuclide sampling, field blanks for chemical analyses were collected on a daily

Table 2-1
Drainage Sediment Samples Collected from Area IV and Northern Buffer Zone

Location ID	Drainage Designation	EPA Sampling Rationale and Location Description	Sample Date	Sample Time	Analyses	Sample Number	EPA Sample Description	Percent Clay	Percent Silt	Percent Sand	Percent Gravel	Other Notes
EPASED 01	Area IV 1	Downgradient of Outfall 5	12.17.10	1241	Primary	SED-001-SIV-SD-0.0-0.5	Fine (F) to Medium (M) SAND, non-plastic, loose, moist, plant debris	0	35	65	0	
EPASED 02	Not Applicable	Associated with surface water sampling location EPASW02	12.21.10	0950	Primary	SED-002-SIV-SD-0.0-0.5MS	F to M SAND, non-plastic, loose, moist, plant debris	0	35	65	0	
EPASED 03	Area IV 2	Downgradient of Outfalls 5 and 6	12.20.10	0946	Primary	SED-003-SIV-SD-0.0-0.5	F to M SAND, subangular to subrounded GRAVEL, non-plastic, very loose	0	15	85	Trace	Location underwater from rain run-off
EPASED 04	Area IV 2	Characterize the sediment within the drainage	12.17.10	1142	Primary	SED-004-SIV-SD-0.0-0.5	F SAND, medium-plasticity, soft, moist, plant material	20	35	45	0	Below ground surface=groundwater
EPASED 05	FSDF Drainage	Characterize the sediment within the drainage	12.20.10	0830	Primary	SED-005-SIV-SD-0.0-0.5MS	F to Coarse (C) SAND, subangular to subrounded GRAVEL, low plasticity, soft, moist, plant material	10	30	60	Trace	
EPASED 06	B009 Drainage	Characterize the sediment within the drainage	12.17.10	1525	Primary	SED-006-SIV-SD-0.0-0.5	F SAND, low plasticity, soft, moist, plant material	0	60	40	0	
EPASED 07	Area IV 4	Downgradient of Outfall 7	12.20.10	1330	Primary	SED-007-SIV-SD-0.0-0.5	F to C SAND, subangular to subrounded GRAVEL, low plasticity, soft, moist, plant material, broken pieces of asphalt, burnt wood	0	20	80	Trace	Raining heavily, location wet. Debris in drainage near sample location
EPASED 08	Area IV 3	Characterize the sediment within the drainage	12.20.10	1039	Primary	SED-008-SIV-SD-0.0-0.5	F to C SAND, subangular to subrounded GRAVEL, low plasticity, very loose, moist, plant material	0	20	80	Trace	Location underwater from rain run-off
EPASED 09	Area IV 4	Downgradient of Outfall 7, and on the boundary of the Northern Buffer Zone (NBZ)	01.13.11	0945	Primary	SED-009-SIV-SD-0.0-0.5	F to C SAND, non-plastic, loose, moist, plant material	0	30	70	0	Drainage contained primarily SS and is on an ~ 70 degree slope
EPASED 10	Area IV 5	Characterize sediment within drainage at boundary of the NBZ	12.22.10	1010	Primary	SED-010-SIV-SD-0.0-0.5	F to C SAND, subangular to subrounded GRAVEL, non-plastic, very loose, wet, plant material	0	15	80	5	
EPASED 11	Area IV 6	Downgradient of Outfall 3	12.16.10	1418	Primary	SED-011-SIV-SD-0.0-0.5	F to M SAND, low plasticity, very soft, loose, moist, plant material	0	40	60	0	
EPASED 12	Area IV 5	Characterize the sediment within the drainage	12.17.10	1024	Primary	SED-012-SIV-SD-0.0-0.5	F to C SAND, subangular to subrounded GRAVEL, low plasticity, loose, moist, plant material	0	15	80	5	SS boulders throughout drainage/ravine
EPASED 13	Area IV 6	Downgradient of Outfall 3	12.16.10	1526	Primary	SED-013-SIV-SD-0.0-0.5	F to C SAND, low plasticity,very soft, loose, moist, plant material	0	40	60	0	
EPASED 14	Area IV 6	Upgradient of Outfall 3 and downgradient of RMHF building	12.17.10	0844	Primary	SED-014-SIV-SD-0.0-0.5	F to C SAND, non-plastic,loose, moist, plant material	0	25	75	0	Raining during sampling
EPASED 15	Not Applicable	Characterize sediment within drainage at border of the NBZ	12.21.10	1305	Primary	SED-015-SIV-SD-0.0-0.5	F to C SAND, low plasticity,very soft, loose, moist, plant material	0	30	70	0	
EPASED 16	Area IV 7	Associated with surface water sampling location EPASW05	12.15.10	1341	Primary	SED-016-SIV-SD-0.0-0.5	F to M SAND, low plasticity, very soft, loose, moist, plant material	10	35	55	0	Sandstone at 6 inches
EPASED 17	Area IV 7	Characterize the sediment below fill material at surface water sampling location EPASW09	12.16.10	1045	Primary	SED-017-SIV-SD-0.0-0.5	F to C SAND, sub angular GRAVEL, low plasticity, very soft, loose, moist	0	40	60	Trace	Drainage contained considerable amt. of debris (concrete, wire)
EPASED 18	Area IV 7	Characterize the sediment below surface water sampling location EPASW08	12.15.10	1231	Primary	SED-018-SIV-SD-0.0-0.5	F to M SAND, low plasticity, very soft, moist, plant material	0	45	55	0	
EPASED 19	Area IV 7	Downgradient of Outfall 4; sediment from pond	12.16.10	0930	Primary	SED-019-SIV-SD-0.0-0.5	F to M SAND, trace C SAND, low plasticity, very soft, moist, plant material	10	35	55	0	
EPASED 20	Area IV 7	Downgradient of Outfall 4 and accessible from Area IV	12.16.10	1140	Primary	SED-020-SIV-SD-0.0-0.5	F to C SAND, trace C SAND, low plasticity, very soft, moist, plant material	0	30	70	0	
EPASED 21	Area IV 7	Downgradient of Outfall 4; mid-way down drainage, accessible from Area IV	12.15.10	0921	Primary	SED-021-SIV-SD-0.0-0.5	F to C SAND, loose, moist, plant material	0	10	90	0	Drainage/ravine contained numerous sandstone boulders and heavy brush
EPASED 22	Area IV 7	Downgradient of Outfall 4 and at the boundary of the NBZ	12.14.10	1008	Primary	SED-022-SIV-SD-0.0-0.5	F to C SAND, non-plastic, loose, moist, plant material	0	30	70	0	Drainage contained numerous SS boulders
EPASED 23	Not Applicable	Characterize sediment within drainage at boundary of the NBZ	12.14.10	0919	Primary	SED-023-SIV-SD-0.0-0.5	F to C SAND, subangular to subrounded GRAVEL, non-plastic, loose, moist, plant material	0	35	65	Trace	
EPASED 24	Not Applicable	Characterize the sediment within the drainage	12.14.10	1116	Primary	SED-024-SIV-SD-0.0-0.5	F to C SAND, non-plastic, loose, moist, plant material	0	30	70	0	
EPASED 25	Not Applicable	Characterize the sediment within the drainage	12.14.10	1244	Primary	SED-025-SIV-SD-0.0-0.5	F to C SAND, non-plastic, loose, moist, plant material	0	30	70	0	
EPASED 26	Not Applicable	Downgradient of Outfall 4; characterize sediment within drainage	12.14.10	1522	Primary	SED-026-SIV-SD-0.0-0.5	F to M SAND, low plasticity, soft, moist, plant material	10	50	40	0	
EPASED 27	Not Applicable	Downgradient of Outfall 4; characterize sediment within drainage	12.14.10	1559	Primary	SED-027-SIV-SD-0.0-0.5	F to M SAND, non-plastic, loose, moist, plant debris	0	30	70	0	
EPASED 28	Not Applicable	Downgradient of Outfall 4 at the border of the NBZ	01.13.11	1115	Primary	SED-028-SIV-SD-0.0-0.5	F to C SAND; subangular to subrounded GRAVEL, non-plastic, very loose, wet, plant material	0	30	70	Trace	Pooled water still in drainage from rains, drainage primarily sandstone
EPASED 29	North 1.15 – OB	Characterize the sediment within the drainage	12.13.10	1152	Primary	SED-029-SIV-SD-0.0-0.5	F to C SAND; subangular to subrounded GRAVEL, non-plastic, very loose, plant material	0	25	70	5	
EPASED 30	North 1.15 – OB	Characterize the sediment within the drainage	12.13.10	1113	Primary	SED-030-SIV-SD-0.0-0.5	F to M SAND, low plasticity, very soft, moist, plant material	0	30	70	0	
EPASED 31	North 1.15 – OB	Characterize sediment within drainage at border of the NBZ	12.13.10	0920	Primary	SED-031-SIV-SD-0.0-0.5	F to C SAND, subangular to subrounded GRAVEL, non-plastic, loose, moist, plant material	0	30	70	Trace	
EPASED 32	North 1 – OB	Characterize sediment within drainage at border of the NBZ	12.13.10	1457	Primary	SED-032-SIV-SD-0.0-0.5	F to C SAND, subangular to subrounded GRAVEL, non-plastic, loose, moist, plant material	0	25	75	Trace	
EPASED 33	North 1 – OB	Characterize sediment downgradient of Outfall 9 at northern boundary of the NBZ	12.13.10	1540	Primary	SED-033-SIV-SD-0.0-0.5	F to C SAND, subangular to subrounded GRAVEL, very loose, moist	0	10	85	5	
EPASED 34		Characterize sediment within a potential drainage leading westward from the western boundary of the NBZ.	12.20.10	1530	Primary	SED-034-SIV-SD-0.0-0.5	F to C SAND, subangular to subrounded GRAVEL, non-plastic, loose, moist, plant material	0	20	80	Trace	Location under water
EPASED 35	Building 4056	Characterize sediment in pond in Building 4056 excavation	05.23.11	1500	Primary, Methyl Hg & organotins	SED-035-SIV-SD SED-035-SIV-SDMS	Fine grained silt, wet, swampy odor, very black, containing organic matter such as leaves and twigs.	-	-	-	-	
EPASED 36		Characterize sediment that may have originated in sodium burn pit area or from Arness fire road in northwest corner of NBZ	12.21.10	1145	Primary	SED-036-SIV-SD-0.0-0.5	F SAND, low plasticity, soft, moist, plant material	15	40	45	0	
EPASED 37		Characterize sediment potentially originating from Building 56 Landfill, northwest of Building 56 excavation.	12.20.10	1430	Primary	SED-037-SIV-SD-0.0-0.5	F to C SAND, subangular to subrounded GRAVEL, non-plastic, loose, wet, plant material	0	25	75	Trace	Considerable amount of debris (barbed wire, tin cans, concrete & asphalt in drainage near sample location
EPASED 38		Characterize sediment transported downgradient from SNAP area.	12.21.10	1515	Primary	SED-038-SIV-SD-0.0-0.5	F to C SAND, non-plastic, loose, moist, plant material	0	25	75	0	
EPASED 39		Characterize sediment transported downgradient from roads potentially used to facilitate releases from discarded wastes.	12.21.10	1055	Primary	SED-039-SIV-SD-0.0-0.5	F to C SAND, non-plastic, loose, moist, plant material	0	15	85	0	
EPASED 40		Further evaluate plutonium result reported in Boeing's paper "Plutonium-238 at Brandeis-Bardin"	12.13.10	1019	Primary	SED-040-SIV-SD-0.0-0.5	F to C SAND, non-plastic, loose, moist, plant material	0	30	70	0	

Abbreviations:
FSDF - Former Sodium Diposal Facility
RMHF - Radioactive Materials Handling Facility
SNAP - Systems Nuclear Auxiliary Power
Primary analyses include: metals, fluoride, hexavalent chromium, SVOCs/PAHs, PCBs/PCTs, dioxins/furans, perchlorate, pesticides, and herbicides. pH was also included as a primary analyte for sample EPASED 35.



Sediment Sample Locations

Santa Susana
Ventura County, California
Figure 2-1

CDM

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basis. However, DTSC agreed to reduce the frequency of collection of field blank samples to once per lot number of the American Society for Testing and Materials (ASTM) Type II water that HGL used for equipment decontamination. The field blanks are now collected once for each lot number of ASTM water that HGL uses. Field blanks were collected for primary analyses in conjunction with the surface soil samples. Field blank FB08-SIV-052311 was collected on May 23, 2011 and submitted for organotins and methyl mercury analyses only.

2.3.4 Decontamination of Sampling Equipment

Because sampling was performed in remote drainages, enough equipment needed to complete a full day of sampling was carried by the field crew. Therefore, all reusable sampling equipment needed for a day of sediment sampling was cleaned the day before sampling. This included the trowels, bowls, and the portion of the hand auger that comes into contact with the soil and into which the stainless steel sleeves are inserted.

Hand sampling equipment was decontaminated as follows:

- Washed with a solution of potable water and Liquinox, or equivalent laboratory-grade detergent
- Rinsed thoroughly with copious quantities of potable water
- Given a final rinse with analyte-free water

Each piece of sampling equipment was then wrapped in oil-free aluminum foil, or placed in a closed plastic, stainless steel, glass, or Teflon container.

2.4 Analytical Laboratory Methods and Procedures

2.4.1 Analytical Methods

The analytical methods for the drainage sediment sampling consist of one primary "suite." This primary suite of analyses is to be performed on all samples and includes:

- Metals using EPA Methods 6010B/6020, 7471A (mercury), and 7199 (chromium VI)
- Fluoride using EPA Method 300.0
- SVOCs using EPA Method 8270C and PAHs using Method 8270 selective ion monitoring (SIM)
- PCBs and PCTs using EPA Method 8082
- Dioxins/furans using EPA Method 1613B
- Perchlorate using EPA Method 314.0 (and EPA Method 6850 for verification of nondetects at a rate of 10 percent of the samples submitted)

- Pesticides using EPA Method 8081A
- Herbicides using EPA Method 8151A

In addition, the Building 4056 excavation sediment sample was requested for analysis using:

- pH using EPA Method 9045C
- Methyl mercury using EPA Method 1630M
- Organotins using National Oceanic and Atmospheric Administration (NOAA) status and trends method

2.4.2 Analytical Procedures

The analytical laboratory used for the drainage sediment sampling effort was Lancaster Laboratories, Inc. of Lancaster, Pennsylvania. Lancaster was selected from five laboratories that submitted proposals. Lancaster's selection was based on their proposed method detection limits. Selection of Lancaster as the co-located soil analytical laboratory was discussed with the community on October 10, 2010.

The analytical methods identified for the co-located soil sampling were selected to be consistent with the methods used for the RFI. These analytical methods are presented in the *Quality Assurance Project Plan, Santa Susanna Field Laboratory RCRA Facility Investigation, Surficial Media Operable Unit* (RFI Quality Assurance Project Plan [QAPP]) (MECx 2009) and are listed in Table 2-2. CDM was requested to evaluate the RFI QAPP detection limits relative to risk-based soil criteria. There were several instances where risk-based soil values were lower than the RFI QAPP limits. To determine whether the analytical method detection limit could be lowered, method modifications were discussed with DTSC chemists and Lancaster at the time of implementation. The ability of the laboratory to achieve project reporting limits and quality control criteria using these method modifications remains under evaluation by the project chemists. Table 2-2 identifies methods that have been modified as a result of these discussions in an effort to lower respective detection and reporting limits (RLs).

Table 2-2 Analytical Methods and Method Modifications

Parameter Group	Analytical Method	Method Modification?
Select SVOCs	EPA 8270C SIM	No
Semivolatile Organics	EPA 8270C	No
PCBs/PCTs	EPA 8082	Yes
Pesticides	EPA 8081A	Yes
Herbicides	EPA 8151A	Yes
Perchlorate	EPA 6850	No
Perchlorate[1]	EPA 314	No
Organotins	NOAA Status and Trends	No
Dioxin/Furan	EPA 1613B	No
Metals	EPA 6010B/6020/7471A	No
Chromium VI	EPA 7199	No
Anions (Nitrate and Fluoride)	EPA 300	No
Methyl Mercury	EPA 1630M	No
pH	EPA 9045C	No

[1] Perchlorate analyzed on 10 percent of all samples

A description of the method modifications are listed below. The modifications primarily involved increasing the prescribed sample volume (soil mass extracted) and concentrating the resulting extract to a smaller final volume.

- Method 8082 (PCBs and PCTs) – 60 grams of sample is prepared and concentrated 5-fold to a final volume of 2 milliliter (mL)

- Method 8081A (Pesticides) – 60 grams of sample is prepared and taken to a final volume of 4 mL (due to extract cleanup techniques)

- Method 8151A (Herbicides) – 60 grams of sample is prepared and taken to a final volume of 2 mL

The methyl mercury method, EPA 1630M was not modified by CDM/DTSC but is a modified method from EPA.

2.5 Data Review Processes

Analytical data produced by Lancaster was subject to multiple review steps to coincide with the start of distinct tasks. These steps were performed in a timely manner to ensure appropriate feedback and correction of errors. These steps included:

- Cross-reference check of sample COC documents against the laboratory acknowledgement of sample receipt form. The laboratory acknowledgement of sample receipt was typically transmitted to the data manager through e-mail two to three days after sample receipt and login and includes a summary of the requested analyses to be performed per sample. Sample log-in errors were identified and corrected at this step.

- Tracking of sample collection, receipt, and laboratory sample delivery group (SDG) numbers on a sample tracking spreadsheet. This spreadsheet also includes field quality control (QC) sample information, sample location coordinates, and laboratory deliverables required including reports, electronic data deliverables, raw data, and the status of validation.

Upon receipt of the laboratory report (delivered via e-mail), a preliminary review of the data is performed. This review consists of:

- Reconciliation of the reported analyses against the analyses that were requested on the COCs.

- Review of the laboratory case narratives. The case narrative identifies and explains quality issues encountered during the analysis of the samples. Quality issues may include (but are not limited to) missed holding times, poor spike recoveries in matrix or batch-specific QC samples, instrument calibration exceedences, and blank contamination. The laboratory normally consults with the project chemists on these issues and receives instruction on how to proceed before reporting the sample results.

- Review of the laboratory-specific QC data. These data are provided by the laboratory in summary form. Any unanticipated deviations from the project or method-specific criteria are reconciled with the laboratory at this stage.

2.6 Deviations from the Work Plan

Only one equipment rinsate blank was collected in association with the sediment samples. Two equipment rinsate blanks should have been collected for the number of sediment samples collected.

Most of the samples collected from the NBZ were in locations accessible only by foot, thus the sampling team was in the field all day. It was not feasible or safe to carry a cooler with ice to and from these locations, so a field decision was made that all sediment samples would be placed on ice at the end of the work day. This was done so that all of the sediment samples were handled in the same manner, and some would not be refrigerated for a longer time than others prior to being shipped to the laboratory.

Section 3
Drainage Sediment Sampling Results

Because this report only provides a presentation of the results, data in this section are presented in a summary fashion. Table 3-1 provides a summary of the drainage sediment data. The table shows the chemicals analyzed for, frequency of detections, the minimum and maximum detected concentrations, the range of observed detections and RLs, and the location where the maximum concentration was observed. When screening criteria are developed to assess where contamination exists above the applicable criteria, the drainage sediment data will be combined with RFI data to develop a better understanding of the extent of surface soil contamination throughout the various drainages.

Appendix A provides the data tables for all validated data by analytical method and sample location. Appendix B provides the summary analytical data reports as received from Lancaster. Appendix C presents the data usability and assessment report (DUAR) along with all validation reports. Appendix D is the master database of all sample results presenting the data validation "flags" (qualifiers) for the results.

Table 3-1
Summary of Analytical Results for Chemicals - Validated Data
Drainage Sediments

Group	Chemical	CAS No	Analytic Method	Detection Frequency	Minimum Concentration	Maximum Concentration	Range of Method Detection Limit	Range of Method Reporting Limit	Unit	Location of Maximum Concentration	Depth of Maximum Concentration (mg/kg)
Inorganic	Fluoride	16984-48-8	300	34 / 40	0.90 J	2.9 J	0.84 - 1.2	1.1 - 1.5	mg/kg	SED-003-SIV	0 - 0.5
Inorganic	Aluminum	7429-90-5	6010B	40 / 40	7300	30200	5.13 - 7.12	20.4 - 28.3	mg/kg	SED-006-SIV	0 - 0.5
Inorganic	Iron	7439-89-6	6010B	40 / 40	10300	32800	4.81 - 6.67	20.4 - 28.3	mg/kg	SED-004-SIV	0 - 0.5
Inorganic	Lead	7439-92-1	6020	40 / 40	5.31 J	54.2 J	0.0105 - 0.0292	0.202 - 0.561	mg/kg	SED-019-SIV	0 - 0.5
Inorganic	Lithium	7439-93-2	6010B	40 / 40	11.1	42.9	0.22 - 0.31	2 - 2.8	mg/kg	SED-036-SIV	0 - 0.5
Inorganic	Magnesium	7439-95-4	6010B	40 / 40	2250	9100	2.59 - 3.59	10.2 - 14.2	mg/kg	SED-004-SIV	0 - 0.5
Inorganic	Manganese	7439-96-5	6010B	40 / 40	162	524	0.0796 - 0.11	0.51 - 0.708	mg/kg	SED-013-SIV	0 - 0.5
Inorganic	Mercury	7439-97-6	7471A	34 / 40	0.0039 J	0.927	0.0029 - 0.008	0.0998 - 0.28	mg/kg	SED-001-SIV	0 - 0.5
Inorganic	Methyl Mercury	22967-92-6	1630M	1 / 1	0.452	0.452	0.05 - 0.05	0.133 - 0.133	ug/kg	SED-035-SIV	0 - 0.5
Inorganic	Molybdenum	7439-98-7	6020	40 / 40	0.222	3.69 J	0.0506 - 0.0743	0.101 - 0.149	mg/kg	SED-019-SIV	0 - 0.5
Inorganic	Nickel	7440-02-0	6020	40 / 40	6.99 J	28 J	0.101 - 0.149	0.404 - 0.594	mg/kg	SED-036-SIV	0 - 0.5
Inorganic	Potassium	7440-09-7	6010B	40 / 40	1580 J	6980	18.4 - 25.5	51 - 70.8	mg/kg	SED-004-SIV	0 - 0.5
Inorganic	Silver	7440-22-4	6020	40 / 40	0.017 J	1.39 J	0.0121 - 0.0178	0.101 - 0.149	mg/kg	SED-032-SIV	0 - 0.5
Inorganic	Sodium	7440-23-5	6010B	40 / 40	54.3 J	155	38.1 - 52.8	102 - 142	mg/kg	SED-004-SIV	0 - 0.5
Inorganic	Strontium	7440-24-6	6010B	40 / 40	7.16 J	67.1	0.0633 - 0.0877	0.51 - 0.708	mg/kg	SED-004-SIV	0 - 0.5
Inorganic	Thallium	7440-28-0	6020	40 / 40	0.156	0.585	0.0303 - 0.0446	0.101 - 0.149	mg/kg	SED-036-SIV	0 - 0.5
Inorganic	Tin	7440-31-5	6010B	3 / 40	2.40 J	2.74 J	1.02 - 1.42	10.2 - 14.2	mg/kg	SED-009-SIV	0 - 0.5
Inorganic	Titanium	7440-32-6	6010B	40 / 40	637	1550	0.388 - 0.853	1.02 - 2.24	mg/kg	SED-013-SIV SED-004-SIV	0 - 0.5 0 0.5
Inorganic	Antimony	7440-36-0	6020	17 / 40	0.0859 J	0.931 J	0.0607 - 0.0892	0.202 - 0.297	mg/kg	SED-019-SIV	0 - 0.5
Inorganic	Arsenic	7440-38-2	6020	40 / 40	2.43 J	37.9	0.0607 - 0.111	0.404 - 0.594	mg/kg	SED-009-SIV	0 - 0.5
Inorganic	Beryllium	7440-41-7	6020	40 / 40	0.274	1.07 J	0.0162 - 0.0238	0.101 - 0.149	mg/kg	SED-019-SIV SED-036-SIV	0 - 0.5 0 0.5
Inorganic	Barium	7440-39-3	6020	40 / 40	62.3 J	202 J	0.109 - 0.16	0.404 - 0.594	mg/kg	SED-030-SIV	0 - 0.5
Inorganic	Boron	7440-42-8	6010B	37 / 40	3.23 J	15.7	0.908 - 1.26	5.1 - 7.08	mg/kg	SED-004-SIV	0 - 0.5
Inorganic	Cadmium	7440-43-9	6020	35 / 40	0.0800 J	2.23 J	0.0364 - 0.0555	0.101 - 0.149	mg/kg	SED-019-SIV	0 - 0.5
Inorganic	Chromium	7440-47-3	6020	40 / 40	10.8 J	43.6 J	0.121 - 0.178	0.404 - 0.594	mg/kg	SED-004-SIV	0 - 0.5
Inorganic	Cobalt	7440-48-4	6020	40 / 40	2.74 J	13.1 J	0.0202 - 0.0297	0.101 - 0.149	mg/kg	SED-036-SIV	0 - 0.5
Inorganic	Copper	7440-50-8	6020	40 / 40	4.44	50.5 J	0.0667 - 0.0981	0.404 - 0.594	mg/kg	SED-019-SIV	0 - 0.5
Inorganic	Vanadium	7440-62-2	6020	40 / 40	23.9 J	83.9 J	0.0222 - 0.0327	0.101 - 0.149	mg/kg	SED-004-SIV	0 - 0.5
Inorganic	Zinc	7440-66-6	6020	40 / 40	42.6 J	308 J	0.566 - 1.83	3.03 - 9.81	mg/kg	SED-019-SIV	0 - 0.5
Inorganic	Zirconium	7440-67-7	6010B	29 / 40	0.900 J	6.96	0.857 - 1.19	5.1 - 7.08	mg/kg	SED-004-SIV	0 - 0.5
Inorganic	Calcium	7440-70-2	6010B	40 / 40	1710	31400	6.26 - 8.67	20.4 - 28.3	mg/kg	SED-004-SIV	0 - 0.5
Inorganic	Phosphorus	7723-14-0	6010B	40 / 40	267 J	707 J	0.572 - 0.792	10.2 - 14.2	mg/kg	SED-019-SIV	0 - 0.5
Inorganic	Selenium	7782-49-2	6020	39 / 40	0.0829 J	0.517	0.0404 - 0.0594	0.404 - 0.594	mg/kg	SED-004-SIV	0 - 0.5
Inorganic	Chromium VI	18540-29-9	7199	17 / 40	0.25 J	0.95 J	0.21 - 0.3	1.1 - 1.5	mg/kg	SED-013-SIV	0 - 0.5
Inorganic	Perchlorate	14797-73-0	314	1 / 40	29.4 J	29.4 J	9.5 - 13.4	31.6 - 44.6	ug/kg	SED-008-SIV	0 - 0.5
Inorganic	Perchlorate	14797-73-0	6850	0 / 4	-	-	2.3 - 2.4	5.4 - 5.7	ug/kg		
Inorganic	Percent Moisture	MOIST	160.3M	44 / 45	5.1	32.7	0.5 - 0.5	0.5 - 0.5	%	SED-008-SIV	0 - 0.5
Inorganic	pH	pH	9045M	40 / 40	4.76	8.48			pH unit	SED-032-SIV	0 - 0.5
Organic Tin	Tetrabutyltin	1461-25-2	NOAA S&T	0 / 1	3.2 U	3.2 U	0.84 - 0.84	3.2 - 3.2	ug/kg		
Organic Tin	Tributyltin	688-73-3	NOAA S&T	0 / 1	2.9 U	2.9 U	1.3 - 1.3	2.9 - 2.9	ug/kg		
Organic Tin	Dibutyltin	77-58-7	NOAA S&T	0 / 1	2.5 U	2.5 U	0.76 - 0.76	2.5 - 2.5	ug/kg		
Organic Tin	Monobutyltin	78763-54-9	NOAA S&T	0 / 1	9.5 UJ	9.5 UJ	9.5 - 9.5	9.5 - 9.5	ug/kg		
Dioxins and Furans	2,3,7,8-TCDD	1746-01-6	1613B	22 / 40	0.0302 J	2.18	0.0133 - 0.208	1.05 - 1.49	ng/kg	SED-019-SIV	0 - 0.5
Dioxins and Furans	1,2,3,7,8,9-HxCDD	19408-74-3	1613B	32 / 40	0.156 J	26.7	0.0213 - 0.284	5.27 - 7.43	ng/kg	SED-019-SIV	0 - 0.5
Dioxins and Furans	OCDD	3268-87-9	1613B	40 / 40	6.76 J	49800 J	0.0323 - 0.593	10.5 - 14.9	ng/kg	SED-014-SIV	0 - 0.5
Dioxins and Furans	1,2,3,4,6,7,8-HpCDD	35822-46-9	1613B	40 / 40	1.22 J	4430 J	0.0324 - 0.713	5.27 - 7.43	ng/kg	SED-014-SIV	0 - 0.5
Dioxins and Furans	OCDF	39001-02-0	1613B	32 / 40	1.72 J	2920	0.0202 - 0.446	10.5 - 14.9	ng/kg	SED-014-SIV	0 - 0.5
Dioxins and Furans	1,2,3,4,7,8-HxCDD	39227-28-6	1613B	23 / 40	0.114 J	16.0	0.0213 - 0.274	5.27 - 7.43	ng/kg	SED-019-SIV	0 - 0.5
Dioxins and Furans	1,2,3,7,8-PeCDD	40321-76-4	1613B	23 / 40	0.170 J	4.86 J	0.0296 - 0.254	5.27 - 7.43	ng/kg	SED-019-SIV	0 - 0.5
Dioxins and Furans	2,3,7,8-TCDF	51207-31-9	1613B	31 / 40	0.0902 J	9.59	0.0267 - 0.318	1.05 - 1.49	ng/kg	SED-019-SIV	0 - 0.5
Dioxins and Furans	1,2,3,4,7,8,9-HpCDF	55673-89-7	1613B	18 / 40	0.314 J	85.3	0.0233 - 0.518	5.27 - 7.43	ng/kg	SED-014-SIV	0 - 0.5
Dioxins and Furans	2,3,4,7,8-PeCDF	57117-31-4	1613B	26 / 40	0.266 J	9.60	0.0147 - 0.172	5.27 - 7.43	ng/kg	SED-019-SIV	0 - 0.5
Dioxins and Furans	1,2,3,7,8-PeCDF	57117-41-6	1613B	29 / 40	0.192 J	18.1	0.0142 - 0.17	5.27 - 7.43	ng/kg	SED-019-SIV	0 - 0.5

Table 3-1

Summary of Analytical Results for Chemicals - Validated Data

Drainage Sediments

Group	Chemical	CAS No	Analytic Method	Detection Frequency	Minimum Concentration	Maximum Concentration	Range of Method Detection Limit	Range of Method Reporting Limit	Unit	Location of Maximum Concentration	Depth of Maximum Concentration (mg/kg)
Dioxins and Furans	1,2,3,6,7,8-HxCDF	57117-44-9	1613B	19 / 40	0.196 J	12.4	0.0143 - 0.191	5.27 - 7.43	ng/kg	SED-014-SIV	0 - 0.5
Dioxins and Furans	1,2,3,6,7,8-HxCDD	57653-85-7	1613B	35 / 40	0.149 J	83.8	0.0225 - 0.286	5.27 - 7.43	ng/kg	SED-014-SIV	0 - 0.5
Dioxins and Furans	2,3,4,6,7,8-HxCDF	60851-34-5	1613B	18 / 40	0.510 J	13.7	0.0158 - 0.223	5.27 - 7.43	ng/kg	SED-019-SIV	0 - 0.5
Dioxins and Furans	1,2,3,4,6,7,8-HpCDF	67562-39-4	1613B	29 / 40	0.459 J	455	0.0165 - 0.297	5.27 - 7.43	ng/kg	SED-014-SIV	0 - 0.5
Dioxins and Furans	1,2,3,4,7,8-HxCDF	70648-26-9	1613B	19 / 40	0.287 J	18.1	0.017 - 0.234	5.27 - 7.43	ng/kg	SED-014-SIV	0 - 0.5
Dioxins and Furans	1,2,3,7,8,9-HxCDF	72918-21-9	1613B	11 / 40	0.217	2.86 J	0.0192 - 0.287	5.27 - 7.43	ng/kg	SED-014-SIV	0 - 0.5
PCBs	Aroclor 1260	11096-82-5	8082	31 / 40	0.65 J	180	0.36 - 7.1	1.8 - 37	ug/kg	SED-019-SIV	0 - 0.5
PCBs	Aroclor 1254	11097-69-1	8082	32 / 40	1.1 J	300	0.36 - 7.1	1.8 - 37	ug/kg	SED-008-SIV	0 - 0.5
PCBs	Aroclor 1268	11100-14-4	8082	0 / 40	-	-	0.35 - 7.1	1.8 - 37	ug/kg		
PCBs	Aroclor 1221	11104-28-2	8082	0 / 40	-	-	0.38 - 11	1.8 - 37	ug/kg		
PCBs	Aroclor 5460	11126-42-4	8082	28 / 40	1.3 J	170 J	1.1 - 22	3.5 - 71	ug/kg	SED-029-SIV	0 - 0.5
PCBs	Aroclor 1232	11141-16-5	8082	0 / 40	-	-	0.38 - 11	1.8 - 37	ug/kg		
PCBs	Aroclor 5442	12642-23-8	8082	0 / 40	-	-	1.1 - 22	3.5 - 71	ug/kg		
PCBs	Aroclor 1248	12672-29-6	8082	2 / 40	4.8	17 J	0.35 - 7.1	1.8 - 37	ug/kg	SED-026-SIV	0 - 0.5
PCBs	Aroclor 1016	12674-11-2	8082	0 / 40	-	-	0.35 - 7.1	1.8 - 37	ug/kg		
PCBs	Aroclor 1262	37324-23-5	8082	0 / 40	-	-	0.35 - 7.1	1.8 - 37	ug/kg		
PCBs	Aroclor 1242	53469-21-9	8082	0 / 40	-	-	0.38 - 11	1.8 - 37	ug/kg		
PCBs	Aroclor 5432	63496-31-1	8082	0 / 40	-	-	1.1 - 22	3.5 - 71	ug/kg		
Pesticides	Dichlorprop	120-36-5	8151A	1 / 40	2.0 J	2.0 J	0.84 - 9.2	1.8 - 20	ug/kg	SED-006-SIV	0 - 0.5
Pesticides	Dicamba	1918-00-9	8151A	14 / 40	0.49 J	1.9	0.42 - 4.6	0.74 - 14	ug/kg	SED-001-SIV	0 - 0.5
Pesticides	2,2-Dichlor-Propionic Acid	75-99-0	8151A	0 / 40	-	-	4.6 - 51	9.5 - 100	ug/kg		
Pesticides	Dinitrobutyl Phenol	88-85-7	8151A	0 / 40	-	-	0.84 - 9.2	2.5 - 28	ug/kg		
Pesticides	MCPP	93-65-2	8151A	9 / 40	200 J	430	79 - 11000	260 - 11000	ug/kg	SED-016-SIV	0 - 0.5
Pesticides	2,4,5-TP	93-72-1	8151A	5 / 40	0.20	1.4 J	0.079 - 0.86	0.18 - 2	ug/kg	SED-035-SIV	0 - 0.5
Pesticides	2,4,5-T	93-76-5	8151A	2 / 40	0.33 J	0.38 J	0.087 - 1	0.18 - 2	ug/kg	SED-022-SIV	0 - 0.5
Pesticides	MCPA	94-74-6	8151A	11 / 40	310	1800 J	81 - 1700	270 - 2900	ug/kg	SED-022-SIV	0 - 0.5
Pesticides	2,4-D	94-75-7	8151A	5 / 40	1.4 J	3.0 J	1.3 - 14	3.8 - 41	ug/kg	SED-038-SIV SED-030-SIV	0 - 0.5 0 0.5
Pesticides	2,4 DB	94-82-6	8151A	4 / 40	2.3 J	14	0.66 - 30	1.8 - 30	ug/kg	SED-023-SIV	0 - 0.5
Pesticides	Toxaphene	8001-35-2	8081A	0 / 40	-	-	2.3 - 24	7 - 71	ug/kg		
Pesticides	Heptachlor Epoxide	1024-57-3	8081A	0 / 40	-	-	0.036 - 1.2	0.17 - 1.8	ug/kg		
Pesticides	Endosulfan Sulfate	1031-07-8	8081A	1 / 40	0.49 J	0.49 J	0.07 - 0.94	0.36 - 3.7	ug/kg	SED-027-SIV	0 - 0.5
Pesticides	Mirex	2385-85-5	8081A	0 / 40	-	-	0.07 - 2.5	0.36 - 3.7	ug/kg		
Pesticides	Aldrin	309-00-2	8081A	1 / 40	0.13 J	0.13 J	0.07 - 0.71	0.17 - 1.8	ug/kg	SED-039-SIV	0 - 0.5
Pesticides	Alpha-BHC	319-84-6	8081A	4 / 40	0.066 J	1.2 J	0.036 - 0.39	0.17 - 1.9	ug/kg	SED-011-SIV	0 - 0.5
Pesticides	Beta-BHC	319-85-7	8081A	2 / 40	0.35 J	0.54	0.064 - 0.69	0.17 - 1.9	ug/kg	SED-030-SIV	0 - 0.5
Pesticides	Delta-BHC	319-86-8	8081A	17 / 40	0.071 J	2.6 J	0.038 - 2.4	0.17 - 2.4	ug/kg	SED-022-SIV	0 - 0.5
Pesticides	Endosulfan II	33213-65-9	8081A	0 / 40	-	-	0.07 - 2.1	0.36 - 3.7	ug/kg		
Pesticides	4,4'-DDT	50-29-3	8081A	10 / 40	0.37 J	11	0.07 - 32	0.36 - 32	ug/kg	SED-003-SIV	0 - 0.5
Pesticides	Endrin Ketone	53494-70-5	8081A	0 / 40	-	-	0.07 - 0.71	0.36 - 3.7	ug/kg		
Pesticides	Chlordane	57-74-9	8081A	0 / 40	-	-	0.84 - 22	3.6 - 37	ug/kg		
Pesticides	Gamma-BHC (Lindane)	58-89-9	8081A	5 / 40	0.058 J	2.7 J	0.036 - 2.3	0.17 - 2.3	ug/kg	SED-022-SIV	0 - 0.5
Pesticides	Dieldrin	60-57-1	8081A	1 / 40	0.12 J	0.12 J	0.07 - 1.6	0.33 - 3.7	ug/kg	SED-012-SIV	0 - 0.5
Pesticides	Endrin	72-20-8	8081A	1 / 40	1.2 J	1.2 J	0.07 - 0.98	0.36 - 3.7	ug/kg	SED-003-SIV	0 - 0.5
Pesticides	Methoxychlor	72-43-5	8081A	0 / 40	-	-	0.36 - 8.6	1.7 - 18	ug/kg		
Pesticides	4,4'-DDD	72-54-8	8081A	1 / 40	0.35 J	0.35 J	0.07 - 19	0.36 - 19	ug/kg	SED-012-SIV	0 - 0.5
Pesticides	4,4'-DDE	72-55-9	8081A	6 / 40	0.18 J	2.7 J	0.07 - 2.8	0.36 - 3.7	ug/kg	SED-037-SIV	0 - 0.5
Pesticides	Endrin Aldehyde	7421-93-4	8081A	2 / 40	0.40	1.8 J	0.07 - 5.9	0.36 - 5.9	ug/kg	SED-022-SIV	0 - 0.5
Pesticides	Heptachlor	76-44-8	8081A	5 / 40	0.11 J	0.56 J	0.063 - 0.65	0.17 - 1.8	ug/kg	SED-023-SIV	0 - 0.5
Pesticides	Endosulfan I	959-98-8	8081A	1 / 40	0.13 J	0.13 J	0.046 - 0.48	0.17 - 1.8	ug/kg	SED-011-SIV	0 - 0.5
Semivolatiles	N-Nitrosodimethylamine	62-75-9	8270C SIM	0 / 40	-		0.7 - 7.4	1.8 - 18	ug/kg		
Semivolatiles	2,4-Dinitrotoluene	121-14-2	8270C	0 / 40	-	-	35 - 50	180 - 250	ug/kg		
Semivolatiles	Nitrobenzene	98-95-3	8270C	0 / 40	-	-	18 - 25	180 - 250	ug/kg		
Semivolatiles	1,4-Dichlorobenzene	106-46-7	8270C	0 / 40	-	-	18 - 25	180 - 250	ug/kg		
Semivolatiles	1,2,4-Trichlorobenzene	120-82-1	8270C	0 / 40	-	-	18 - 25	180 - 250	ug/kg		

Table 3-1
Summary of Analytical Results for Chemicals - Validated Data
Drainage Sediments

Group	Chemical	CAS No	Analytic Method	Detection Frequency	Minimum Concentration	Maximum Concentration	Range of Method Detection Limit	Range of Method Reporting Limit	Unit	Location of Maximum Concentration	Depth of Maximum Concentration (mg/kg)
Semivolatiles	1,3-Dichlorobenzene	541-73-1	8270C	0 / 40	-	-	18 - 25	180 - 250	ug/kg		
Semivolatiles	Hexachlorobutadiene	87-68-3	8270C	0 / 40	-	-	70 - 99	180 - 250	ug/kg		
Semivolatiles	1,2-Dichlorobenzene	95-50-1	8270C	0 / 40	-	-	18 - 25	180 - 250	ug/kg		
Semivolatiles	4-Nitroaniline	100-01-6	8270C	0 / 40	-	-	70 - 99	180 - 250	ug/kg		
Semivolatiles	4-Nitrophenol	100-02-7	8270C	0 / 40	-	-	180 - 250	530 - 740	ug/kg		
Semivolatiles	4-Bromophenyl Phenyl Ether	101-55-3	8270C	0 / 40	-	-	18 - 25	180 - 250	ug/kg		
Semivolatiles	2,4-Dimethylphenol	105-67-9	8270C	0 / 40	-	-	35 - 50	180 - 250	ug/kg		
Semivolatiles	4-Methylphenol	106-44-5	8270C	0 / 40	-	-	35 - 50	180 - 250	ug/kg		
Semivolatiles	4-Chloroaniline	106-47-8	8270C	0 / 40	-	-	70 - 99	180 - 250	ug/kg		
Semivolatiles	3,5-Dimethylphenol	108-68-9	8270C	0 / 40	-	-	35 - 50	180 - 250	ug/kg		
Semivolatiles	Phenol	108-95-2	8270C	0 / 40	-	-	18 - 25	180 - 250	ug/kg		
Semivolatiles	Bis(2-Chloroethyl) ether	111-44-4	8270C	0 / 40	-	-	18 - 25	180 - 250	ug/kg		
Semivolatiles	Bis(2-Chloroethoxy) methane	111-91-1	8270C	0 / 40	-		18 - 25	180 - 250	ug/kg		
Semivolatiles	Bis(2-Ethylhexyl) phthalate	117-81-7	8270C	19 / 24	19 J	130 J	18 - 24	350 - 470	ug/kg	SED-010-SIV	0 - 0.5
Semivolatiles	Bis(2-Ethylhexyl) phthalate	117-81-7	8270C SIM	13 / 16	8.2 J	69	6.4 - 8.9	19 - 27	ug/kg	SED-008-SIV	0 - 0.5
Semivolatiles	Di-N-Octyl Phthalate	117-84-0	8270C	0 / 2	-	-	19 - 22	190 - 220	ug/kg		
Semivolatiles	Di-N-Octyl Phthalate	117-84-0	8270C SIM	3 / 38	8.6 J	97 J	6.3 - 66	19 - 200	ug/kg	SED-029-SIV	0 - 0.5
Semivolatiles	Hexachlorobenzene	118-74-1	8270C	0 / 40	-	-	18 - 25	180 - 250	ug/kg		
Semivolatiles	Anthracene	120-12-7	8270C	1 / 1	37 J	37 J	19 - 19	190 - 190	ug/kg	SED-032-SIV	0 - 0.5
Semivolatiles	Anthracene	120-12-7	8270C SIM	16 / 39	0.38 J	6.0 J	0.35 - 3.7	1.8 - 18	ug/kg	SED-019-SIV	0 - 0.5
Semivolatiles	2,4-Dichlorophenol	120-83-2	8270C	0 / 40	-	-	18 - 25	180 - 250	ug/kg		
Semivolatiles	1,2-Diphenylhydrazine	122-66-7	8270C	0 / 40	-	-	18 - 25	180 - 250	ug/kg		
Semivolatiles	Pyrene	129-00-0	8270C	3 / 3	34 J	540	19 - 22	190 - 220	ug/kg	SED-032-SIV	0 - 0.5
Semivolatiles	Pyrene	129-00-0	8270C SIM	31 / 37	0.95 J	32	0.7 - 7.4	1.8 - 18	ug/kg	SED-029-SIV	0 - 0.5
Semivolatiles	Dimethylphthalate	131-11-3	8270C	0 / 3	-	-	18 - 22	180 - 220	ug/kg		
Semivolatiles	Dimethylphthalate	131-11-3	8270C SIM	0 / 37	-	-	6.3 - 8.9	19 - 27	ug/kg		
Semivolatiles	Dibenzofuran	132-64-9	8270C	0 / 40	-	-	18 - 25	180 - 250	ug/kg		
Semivolatiles	Benzo(g,h,i)perylene	191-24-2	8270C	2 / 2	22 J	500	19 - 20	190 - 200	ug/kg	SED-032-SIV	0 - 0.5
Semivolatiles	Benzo(g,h,i)perylene	191-24-2	8270C SIM	20 / 38	0.77 J	12	0.7 - 7.4	1.8 - 18	ug/kg	SED-019-SIV	0 - 0.5
Semivolatiles	Indeno(1,2,3-Cd)Pyrene	193-39-5	8270C	1 / 1	420	420	19 - 19	190 - 190	ug/kg	SED-032-SIV	0 - 0.5
Semivolatiles	Indeno(1,2,3-Cd)Pyrene	193-39-5	8270C SIM	17 / 39	0.91 J	10	0.7 - 7.4	1.8 - 18	ug/kg	SED-033-SIV	0 - 0.5
Semivolatiles	Benzo(b)fluoranthene	205-99-2	8270C	1 / 1	680	680	19 - 19	190 - 190	ug/kg	SED-032-SIV	0 - 0.5
Semivolatiles	Benzo(b)fluoranthene	205-99-2	8270C SIM	35 / 39	0.94 J	49	0.7 - 7.4	1.8 - 18	ug/kg	SED-009-SIV	0 - 0.5
Semivolatiles	Fluoranthene	206-44-0	8270C	3 / 3	37 J	420	19 - 22	190 - 220	ug/kg	SED-032-SIV	0 - 0.5
Semivolatiles	Fluoranthene	206-44-0	8270C SIM	33 / 37	0.94 J	47	0.7 - 7.4	1.8 - 18	ug/kg	SED-029-SIV	0 - 0.5
Semivolatiles	Benzo(k)fluoranthene	207-08-9	8270C	1 / 1	280	280	19 - 19	190 - 190	ug/kg	SED-032-SIV	0 - 0.5
Semivolatiles	Benzo(k)fluoranthene	207-08-9	8270C SIM	23 / 39	0.73 J	14	0.7 - 7.4	1.8 - 18	ug/kg	SED-033-SIV	0 - 0.5
Semivolatiles	Acenaphthylene	208-96-8	8270C SIM	6 / 40	0.46 J	0.72 J	0.35 - 3.7	1.8 - 18	ug/kg	SED-022-SIV	0 - 0.5
Semivolatiles	Chrysene	218-01-9	8270C	2 / 2	37 J	490	19 - 22	190 - 220	ug/kg	SED-032-SIV	0 - 0.5
Semivolatiles	Chrysene	218-01-9	8270C SIM	36 / 38	0.62 J	29	0.35 - 3.7	1.8 - 18	ug/kg	SED-007-SIV	0 - 0.6
Semivolatiles	bis(2-Chloroisopropyl) ether	39638-32-9	8270C	0 / 40	-	-	18 - 25	180 - 250	ug/kg		
Semivolatiles	Benzo(a)pyrene	50-32-8	8270C	1 / 1	650	650	19 - 19	190 - 190	ug/kg	SED-032-SIV	0 - 0.5
Semivolatiles	Benzo(a)pyrene	50-32-8	8270C SIM	26 / 39	0.79 J	25	0.7 - 7.4	1.8 - 18	ug/kg	SED-033-SIV	0 - 0.5
Semivolatiles	2,4-Dinitrophenol	51-28-5	8270C	0 / 40	-	-	380 - 990	1200 - 3000	ug/kg		
Semivolatiles	4,6-Dinitro-2-Methylphenol	534-52-1	8270C	0 / 40	-	-	180 - 250	530 - 740	ug/kg		
Semivolatiles	Dibenzo(a,h)anthracene	53-70-3	8270C	1 / 1	120 J	120 J	19 - 19	190 - 190	ug/kg	SED-032-SIV	0 - 0.5
Semivolatiles	Dibenzo(a,h)anthracene	53-70-3	8270C SIM	2 / 39	3.2	5.7 J	0.7 - 7.4	1.8 - 18	ug/kg	SED-007-SIV	0 - 0.6
Semivolatiles	Benzo(a)anthracene	56-55-3	8270C	2 / 2	24 J	400	19 - 22	190 - 220	ug/kg	SED-032-SIV	0 - 0.5
Semivolatiles	Benzo(a)anthracene	56-55-3	8270C SIM	20 / 38	0.84 J	15	0.7 - 7.4	1.8 - 18	ug/kg	SED-033-SIV	0 - 0.5
Semivolatiles	4-Chloro-3-Methylphenol	59-50-7	8270C	0 / 40	-	-	35 - 50	180 - 250	ug/kg		
Semivolatiles	N-Nitroso-Di-N-Propylamine	621-64-7	8270C	0 / 40	-	-	18 - 25	180 - 250	ug/kg		
Semivolatiles	Aniline	62-53-3	8270C	0 / 40	-	-	180 - 250	530 - 740	ug/kg		
Semivolatiles	Benzoic Acid	65-85-0	8270C	0 / 40	-	-	180 - 250	530 - 740	ug/kg		
Semivolatiles	Hexachloroethane	67-72-1	8270C	0 / 40	-	-	18 - 25	180 - 250	ug/kg		
Semivolatiles	4-Chlorophenyl Phenylether	7005-72-3	8270C	0 / 40	-	-	35 - 50	180 - 250	ug/kg		

Table 3-1
Summary of Analytical Results for Chemicals - Validated Data
Drainage Sediments

Group	Chemical	CAS No	Analytic Method	Detection Frequency	Minimum Concentration	Maximum Concentration	Range of Method Detection Limit	Range of Method Reporting Limit	Unit	Location of Maximum Concentration	Depth of Maximum Concentration (mg/kg)
Semivolatiles	Hexachlorocyclopentadiene	77-47-4	8270C	0 / 40	-	-	180 - 250	530 - 740	ug/kg		
Semivolatiles	Isophorone	78-59-1	8270C	0 / 40	-	-	18 - 25	180 - 250	ug/kg		
Semivolatiles	Acenaphthene	83-32-9	8270C	1 / 1	43 J	43 J	19 - 19	190 - 190	ug/kg	SED-032-SIV	0 - 0.5
Semivolatiles	Acenaphthene	83-32-9	8270C SIM	0 / 39	-	-	0.7 - 7.4	1.8 - 18	ug/kg		
Semivolatiles	Diethylphthalate	84-66-2	8270C	0 / 3	-	-	18 - 22	180 - 220	ug/kg		
Semivolatiles	Diethylphthalate	84-66-2	8270C SIM	0 / 37	-	-	6.3 - 8.9	19 - 27	ug/kg		
Semivolatiles	Di-n-Butylphthalate	84-74-2	8270C	1 / 3	26 J	26 J	18 - 22	180 - 220	ug/kg	SED-019-SIV	0 - 0.5
Semivolatiles	Di-n-Butylphthalate	84-74-2	8270C SIM	4 / 37	7.3 J	15 J	6.3 - 8.9	19 - 27	ug/kg	SED-038-SIV	0 - 0.5
Semivolatiles	Phenanthrene	85-01-8	8270C	2 / 2	25 J	110 J	19 - 19	190 - 190	ug/kg	SED-032-SIV	0 - 0.5
Semivolatiles	Phenanthrene	85-01-8	8270C SIM	34 / 38	0.89 J	22	0.7 - 7.4	1.8 - 18	ug/kg	SED-019-SIV SED-029-SIV	0 - 0.5 0 0.5
Semivolatiles	Butylbenzylphthalate	85-68-7	8270C	4 / 5	31 J	56 J	18 - 22	180 - 220	ug/kg	SED-036-SIV	0 - 0.5
Semivolatiles	Butylbenzylphthalate	85-68-7	8270C SIM	12 / 35	7.1 J	17 J	6.3 - 8.9	19 - 27	ug/kg	SED-003-SIV SED-039-SIV	0 - 0.5 0 0.5
Semivolatiles	N-Nitrosodiphenylamine	86-30-6	8270C	0 / 40	-	-	18 - 25	180 - 250	ug/kg		
Semivolatiles	Fluorene	86-73-7	8270C SIM	11 / 40	1.9 J	11	0.7 - 7.4	1.8 - 18	ug/kg	SED-012-SIV	0 - 0.5
Semivolatiles	Carbazole	86-74-8	8270C	1 / 40	24 J	24 J	18 - 25	180 - 250	ug/kg	SED-032-SIV	0 - 0.5
Semivolatiles	Pentachlorophenol	87-86-5	8270C	0 / 40	-	-	180 - 250	530 - 740	ug/kg		
Semivolatiles	2,4,6-Trichlorophenol	88-06-2	8270C	0 / 40	-	-	35 - 50	180 - 250	ug/kg		
Semivolatiles	2-Nitroaniline	88-74-4	8270C	0 / 40	-	-	18 - 25	180 - 250	ug/kg		
Semivolatiles	2-Nitrophenol	88-75-5	8270C	0 / 40	-	-	18 - 25	180 - 250	ug/kg		
Semivolatiles	1-Methylnaphthalene	90-12-0	8270C SIM	8 / 40	J	2.6	0.7 - 7.4	1.8 - 18	ug/kg	SED-037-SIV	0 - 0.5
Semivolatiles	Naphthalene	91-20-3	8270C SIM	27 / 40	0.83 J	9.0 J	0.7 - 7.4	1.8 - 18	ug/kg	SED-019-SIV	0 - 0.5
Semivolatiles	2-Methylnaphthalene	91-57-6	8270C SIM	8 / 40	0.96 J	3.1	0.7 - 7.4	1.8 - 18	ug/kg	SED-037-SIV	0 - 0.5
Semivolatiles	2-Chloronaphthalene	91-58-7	8270C	0 / 40	-	-	18 - 25	180 - 250	ug/kg		
Semivolatiles	3,3`-Dichlorobenzidine	91-94-1	8270C	0 / 40	-	-	110 - 150	350 - 500	ug/kg		
Semivolatiles	Benzidine	92-87-5	8270C	0 / 40	-	-	1200 - 1700	3500 - 5000	ug/kg		
Semivolatiles	2-Methylphenol	95-48-7	8270C	0 / 40	-	-	35 - 50	180 - 250	ug/kg		
Semivolatiles	2-Chlorophenol	95-57-8	8270C	0 / 40	-	-	18 - 25	180 - 250	ug/kg		
Semivolatiles	2,4,5-Trichlorophenol	95-95-4	8270C	0 / 40	-	-	35 - 50	180 - 250	ug/kg		
Semivolatiles	3-Nitroaniline	99-09-2	8270C	0 / 40	-	-	35 - 50	180 - 250	ug/kg		
Semivolatiles	Benzyl Alcohol	100-51-6	8270C	0 / 40	-	-	180 - 250	530 - 740	ug/kg		
Semivolatiles	2,6-Dinitrotoluene	606-20-2	8270C	0 / 40	-	-	18 - 25	180 - 250	ug/kg		

Notes:
J = The associated value is an estimated quantity

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Section 4
Data Usability Assessment

The purposes of the DUAR provided in Appendix C and summarized here are to: 1) describe the data validation processes performed on the data sets, and 2) determine whether the sample results meet the data quality objectives (DQOs) outlined in the *Draft Work Plan/Field Sampling and Analysis Plan Co-Located Chemical Sediment Sampling at Area IV Santa Susana Field Laboratory, Ventura County, California* (CDM 2010).

4.1 Usability Summary

For this drainage sediment data usability assessment, 23 data sets were reviewed. A data set consists of 20 or fewer samples grouped together by analytical method for analyses depending on the time and date the samples were received by the laboratory. A data set is called a sample delivery group or SDG. The analyses performed are discussed in Section 2.4.2.

Samples were collected and analyzed in accordance with the field sampling and analysis plan (CDM 2010). Deviations from what was prescribed during the field investigation are discussed in Section 2.6.

The data generated for the drainage sediment samples together with the data validation qualifiers added are usable as reported, with the exception of 117 individual analyte results (1.73 percent of all analytes) that were rejected (2 individual metal results, 79 individual pesticide results, and 36 individual herbicide results). These rejected data do not impact project objectives and goals. Specific details are provided in the validation reports in Appendix C and in Section 4.9.

4.2 Data Validation Procedures

Data were validated by the independent data validation firm Laboratory Data Consultants, Inc. All data validation was 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 was to validate 10 percent of the data according to EPA Level IV protocols (all QC parameters and raw data) and the remaining 90 percent according to EPA Level III protocols (all QC parameters except calibrations and raw data).

Table 4-1 shows the SDGs that include the drainage sediment samples and which of these SDGs were validated as Level III or Level IV. Some SDGs contain samples from other subareas[1] but all samples in an SDG were validated together.

In order to evaluate the quality of the laboratory and the validation firm, CDM chemists reviewed 10 percent of the drainage sediment sample SDGs. The purpose of the review was to identify any QC issues with the laboratory not identified by the validation firm or any discrepancies in validation procedures by the validation firm. No additional qualifiers were applied to the data based on CDM's review. The results of this review are provided in Section 4.8.

4.3 Quality Assurance Objectives

Quality assurance (QA) objectives for measurement data are expressed in terms of precision, accuracy, representativeness, comparability, completeness, and sensitivity (PARCCS). The QA objectives provide a mechanism for ongoing QC and evaluating and measuring data quality throughout the project.

A review of the collected data is necessary to determine if data measurement objectives established in the field sampling and analysis plan (CDM 2010) have been met. The following data measurement objectives were considered:

- Specification and adherence to analytical method and reporting detection limit requirements
- Identification of the appropriate laboratory analytical QC requirements and verification of whether these QC requirements were met
- Verification that measurement performance criteria (representativeness and completeness) for the data have been met
- Verification that field procedures were followed, deviations were documented, and determination of impact on data quality as a result of these deviations

The data validation review of the QA objectives determines if the collected data are of sufficient quality (except for the rejected results) to support their intended use.

4.4 Summary of Field and Laboratory QA Activities

CDM completed sampling activities in accordance with the approved work plan (CDM 2010). A total of 40 drainage sediment samples were collected and 42 samples were analyzed (includes field duplicates). Table 2-1 provides a summary of the samples collected and the laboratory analyses requested.

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[1] During the course of sampling for drainage sediment samples, EPA transitioned sampling into subarea 5B. Therefore some sample delivery groups contain results for both 5C, 5B, and drainage sediment samples.

An index of samples associated with each SDG is presented at the beginning of Appendix C. The work plan (CDM 2010) defined the procedures to be followed and the data quality requirements for the field sampling.

Table 4-1 Sample Delivery Groups and Validation Levels

Sample Delivery Group	Level of Validation Performed	CDM Review
DE036	Level III	
DE037	Level III	
DE038	Level III	YES
DE039	Level III	
DE040	Level III	
DE042	Level IV	
DE045	Level III	
DE046	Level IV	YES
DE050	Level III	
DE051	Level III	
DE060	Level III	
DE159	Level III	
DX020	Level III	YES
DX021	Level III	
DX022	Level III	
DX023	Level III	
DX024	Level III	
DX026	Level III	
DX029	Level IV	YES
DX033	Level IV	
DX034	Level III	
DX038	Level III	
DX087	Level III	
1105316	Level IV	Completed by CDM
5311	Level IV	Completed by CDM

4.5 Field Quality QA/QC

The field QC samples were collected at a frequency of 1 per 20 samples (5 percent) for MS/MSDs and field duplicates. Two MS/MSD samples and two field duplicate samples were collected by CDM and analyzed by Lancaster. MS/MSD and field duplicate samples met the frequency requirements detailed in the field sampling and analysis plan (CDM 2010). A third field duplicate and MS/MSD sample was collected for methyl mercury and organotin analyses only.

As discussed in Section 2.3.2, one equipment rinsate blank sample was collected. The equipment rinsate blank results are presented in Appendix C and a summary of the detected results is presented in Table 4-2. One field blank sample was collected for organotins and methyl mercury analyses only. The results for this sample (presented in Appendix C) are nondetect. .

Temperature blanks were included with each shipment of samples.

Table 4-2. Equipment Blank for Drainage Sediment Samples - Detected Results Only

EB01-SIV-121710 12/17/2010 Equipment Blank			
Analyte	**Units**	**Concentration**	**Final Qualifier**
Diethylphthalate	µg/L	0.054	J
Naphthalene	µg/L	0.051	J
OCDD	pg/L	13.7	J

Notes:
µg/L - micrograms per liter
pg/L - picograms per liter
OCDD - Octachlorodibenzodioxin

The number of field quality control samples collected satisfies the minimum requirements for the drainage sediment sampling event except for the equipment blanks. This deviation is discussed in Section 2.6.

Field QA/QC objectives were attained through the use of appropriate sampling techniques and collection of the required QC samples at the required frequencies.

4.6 Laboratory Quality QA/QC

Analytical QA/QC was assessed by laboratory QC checks, method blanks, sample custody tracking, sample preservation, adherence to holding times, laboratory control samples (LCSs), MSs, calibration recoveries, surrogates, tuning criteria, second column confirmations, internal standards, serial dilutions, laboratory duplicates, and interference check standards. The majority of the laboratory QC sample criteria met project requirements as indicated in the data validation reports in Appendix C with the appropriate qualifiers applied. One hundred and seventeen individual analyte results (1.73 percent of all the analytes) were rejected and are discussed in detail below and in Appendix C.

4.7 Data Quality Indicators

This section summarizes the validation performed. Individual SDG validation reports with specific sample detail are provided in Appendix C.

Achievement of the DQOs was determined in part by the use of data quality indicators (DQIs) described in the DUAR in Appendix C. These DQIs for measurement data are expressed in terms of PARCCS. The DQIs provide a mechanism for ongoing control to evaluate and measure data quality throughout the project. These criteria are defined in the sections below.

4.7.1 Precision

Precision is the measurement of the ability to obtain the same value on re-analysis of a sample. The closer the results of the measurements are together, the greater is the precision. Precision has nothing to do with accuracy or true values in the sample. Instead it is focused upon the random errors inherent in the analysis that stem from the measurement process and are compounded by the sample vagaries. Precision is measured by analyzing two portions of the sample (sample and duplicate) and then comparing the results. This comparison is expressed in terms of relative percent difference (RPD). RPD is calculated as the difference between the two measurements divided by the average of the two measurements.

$$\mathbf{RPD = 2(A-B)/A+B \times 100}$$

The problem with this formula is that it depends on the average of the two measurements and the magnitude of the calculated RPD is intimately linked to the magnitude of the results. When sample results are close to the RL, the RPD is greater but does not necessarily indicate that the precision is out of control limits, just that the sample concentrations are low.

RPD as a measure of precision works very well in those cases where the same level of analyte is present in all samples; however, it does not work well as a quantitative tool when varying levels are present. Analysis of sample duplicates is valuable as a quantitative measure of precision but is not useful as a quantitative measure in environmental sample analyses. Another option that is used for evaluating the differences between sample results that are close to the RL is by evaluating the absolute difference between the results. In this situation the difference between the sample results is compared to the RL (2 times the RL for soils) and if the difference is greater the sample results are estimated.

Because of these problems, precision is normally calculated on spike samples, either on an MS and MSD or on a LCS and laboratory control sample duplicate (LCSD). In this case, a constant level of analyte has been created in each sample and long and short term evaluations of RPD can be made that are applicable to the reality of the measurement. The drawback is that the precision measurement is only applicable to the particular spike level used.

For the drainage sediment data set, precision was evaluated by reviewing RPD results for QC parameters consisting of MS/MSDs, LCS/LCSDs, laboratory duplicates, and field duplicates.

Laboratory RPD control limits are presented in the work plan/SAP (CDM 2010) or are laboratory specific. For laboratory duplicates, if one or both of the sample results are less than 2 times the RL, a control limit of the RL absolute value is used for comparison.

The field duplicate RPD criterion is 50 percent. Field duplicates for this project are validated following the criteria where if one result is non-detect and the other result is above the reporting limit, the RPD result is reported at 200 percent and the field duplicate sample and parent sample results are qualified as estimated "J" or "UJ." If the field duplicate RPD is above the 50 percent criteria (and both sample results were above the RL), the field duplicate and parent sample results for that analyte are qualified as estimated "J."

Qualifiers are applied to applicable sample analyte results during the validation process based on laboratory and field RPD results. Details of the validation and the number of analytes qualified are discussed in the DUAR and laboratory validation reports in Appendix C.

The following individual analyte results were qualified as estimated "J/UJ" based on precision criteria:

- Some of the fluoride results and various metal analyte results due to laboratory precision criteria.

- Some of the pesticide, PCBs, and herbicide analyte results due to the RPD results between the two columns being outside of criteria.

Field duplicate precision criteria required the qualification of some fluoride results, various metal analyte results, SVOCs and PAH results, pesticide results, herbicide results, dioxin results, and PCB results. The associated results were qualified as estimated "J/UJ" due to field duplicate precision criteria. No results were rejected based on field duplicate precision criteria. All field duplicate RPD results are presented in Appendix C.

RPD objectives are analyte dependent. There is no discernable pattern or reason for the exceedances. No field sampling issues were identified from the RPD results that were outside of criteria and the exceedances are reasonable for this type of sampling activity. Sample results that have been qualified as estimated "J/UJ" due to precision criteria are usable for project decisions. Results that have been rejected are not usable.

4.7.2 Accuracy

Accuracy is a concept from quantitative analysis that attempts to address the question of how close the analytical result is to the true value of the analyte in the sample. Accuracy is determined through a spike procedure, where a known amount of the target analyte is added to a portion of the sample, then the sample and the spiked sample are analyzed. The quantitative measure of accuracy is percent recovery (%R) calculated as follows:

$$\textbf{Percent Recovery} = \frac{(\textbf{Total Analyte Found} - \textbf{Analyte Originally Present})}{\textbf{Analyte Added}} \times \textbf{100}$$

Each measurement performed on a sample is subject to random and systematic error. Accuracy is related to the systematic error. Attempts to assess systematic error are always complicated by the inherent random error of the measurement.

A single detection of accuracy on a sample is not significant statistically, although many people will treat it as if it is. Statistics is the science of prediction of reality based on a limited number of observations. The more limited the number of observations, the worse the prediction is going to be. The following QC samples are used to help assess laboratory accuracy:

> Matrix Spikes: Matrix spikes are a known amount of a target analyte added to a sample. Analysis of the sample that has been spiked and comparison with the results from the unspiked sample (background) gives information about the ability of the test procedure to generate a correct result from the sample.
>
> Post Digestion Spikes: Post digestion spikes are performed after the sample has been prepared and are ready for analysis. These are also termed "analytical spikes." The technique is used in conjunction with a matrix spike to provide data that can separate interferences produced as part of the sample preparation from interferences that are innate qualities of the sample.
>
> Laboratory Control Samples: Laboratory control samples consist of a portion of analyte-free water or solid phase sample that is spiked with target analytes at a known concentration.
>
> Surrogates: Surrogate recovery is a quality control measure limited to use in organics analysis. Surrogates are compounds added to every sample at the beginning of the sample preparation to monitor the success of the sample preparation on an individual sample basis. Individual compounds used as surrogates are selected based on their ability to mimic the behavior of specific target analytes held to be particularly sensitive to the sample preparation manipulations.
>
> Interference Check Samples: Interference check sample analysis is a quality control unique to metals analysis using inductively coupled plasma atomic emission spectrometry. Each element, when it is excited, emits light of set wavelengths. The wavelengths of light emitted from a sample can be measured to provide a qualitative and a quantitative evaluation of the elemental composition of the sample.
>
> Calibrations and Internal Standards: Calibration/internal standards determine the establishment of a quantitative relationship between the response of the analytical procedure and the concentration of the target analyte. Calibration is the technique that performs the quantitative analysis on the sample. A necessary prerequisite is that a confident identification of the target analyte has already been established.
>
> Serial Dilution: Serial dilutions are performed on at least one sample from every batch of analyses for metals to determine if physical or chemical interferences exist in the analyte determinations.

For the drainage sediment data set, accuracy was evaluated by reviewing the %R values of initial and continuing calibration (percent difference or percent drift [%D] for organic analyses), internal standards, surrogate spikes (organic analyses only), MS/MSD, LCS/LCSD, inductively coupled plasma (ICP) interferences, and by performing serial dilution checks during metals analyses, in conjunction with method blank, calibration blank, equipment rinsate blank, and trip blank results. These QC results assist in identifying the type and magnitude of effects that contributed to the system error introduced via field and/or laboratory procedures.

Analytical accuracy for the entire data collection activity is difficult to assess because several sources of error exist. Errors can be introduced by any of the following:

- Sampling procedure
- Field contamination
- Sample preservation and handling
- Sample matrix
- Sample preparation
- Analytical techniques

Accuracy is maintained to the extent possible by adhering to the EPA method and approved field and analytical standard operating procedures.

Qualifiers are applied to applicable sample analyte results during the validation process based on laboratory accuracy results. Details of the validation and the number of analytes qualified are discussed in detail in the data usability assessment report and laboratory validation reports in Appendix C.

The following individual analyte results were qualified as estimated "J/UJ" based on accuracy criteria:

- Some of the various metal analyte results, SVOC results, PAH results, herbicide results, and PCB results due to matrix spike accuracy criteria.

- Some of the perchlorate results, SVOC results, PAH results, pesticide results, herbicide results, monobutyltin results, and PCB results due to laboratory control sample accuracy criteria.

- Some of the pesticide results, herbicide results, and PCB results due to surrogate criteria.

- Some of the PAH results, pesticide results, and herbicide results due to calibration criteria.

- Some of the PAH analyte results due to internal standard recovery results.

- Some of the metal analyte results due to serial dilution criteria.

- Some of the dioxin analyte results based on sample concentrations being greater than the calibration range.

The following individual analyte results were rejected "R" based on accuracy criteria:

- Two antimony results based on matrix spike accuracy criteria.
- Thirty-six individual herbicide analyte results based on laboratory control sample accuracy criteria.
- Seventy-nine individual pesticide analyte results based on surrogate recovery accuracy criteria.

Sample preservation, handling, and holding times are additional measures of accuracy of the data. Holding times are defined as the amount of time that elapses between the collection of the sample from the source in the field and the beginning of the analysis procedure. Preservation is defined as techniques used to maintain the target analytes at concentrations representative of those in the source sampled, until the sample is analyzed in the laboratory. Published holding times are viewed as valid as long as the associated preservation and container requirements have been met. All sample preservation and handling criteria were met or performed in a manner that addressed field conditions during sampling as discussed in Section 2.6.

Sample results that have been qualified as estimated "J/UJ" due to accuracy criteria are usable for project decisions. Results that have been rejected are not usable.

4.7.3 Blank Contamination

Blanks are used to determine the level of laboratory and field contamination introduced into the samples, independent of the level of target analytes found in the sample source. Sources of sample contamination can include the containers and equipment used to collect the sample, preservatives added to the sample, other samples in transport coolers and laboratory sample storage refrigerators, standards and solutions used to calibrate instruments, glassware and reagents used to process samples and the analytical instrument sample introduction equipment. Each area of analysis has its own particular suite of common laboratory contaminants. Active measures must be performed to continually measure the ambient contamination level and steps taken to discover the source of the contamination to eliminate or minimize the levels. Random spot contamination can also occur from analytes that are not common laboratory problems but that can arise as a problem for a specific project or over a short period of time. Field blanks, equipment blanks, trip blanks and laboratory method blanks are analyzed to identify possible sources of contamination. The data assessment summary report and laboratory validation reports in Appendix C discuss the results qualified based on field and laboratory blank contamination.

In summary, some metal results, SVOC results, PAH results, one herbicide result and dioxin results were qualified as non-detect due to blank contamination criteria. Table 4-2 provides a summary of chemicals observed in equipment blank samples.

4.7.4 Representativeness, Comparability, and Sensitivity

Representativeness, comparability, and sensitivity are achieved by using EPA-approved sampling procedures and analytical methodologies. By following the procedures described in the field sampling and analysis plan for this sampling event and future sampling events, sample analysis should yield results representative of environmental conditions at the time of sampling. Similarly, reasonable comparability of analytical results for this and future sampling events can be achieved if approved EPA analytical methods and standardized reporting units are employed.

4.7.4.1 Representativeness

Representativeness is a qualitative term that expresses the degree to which the sample data accurately and precisely represent the environmental conditions corresponding to the location and depth interval of sample collection. Requirements and procedures for sample collection are designed to maximize sample representativeness.

Representativeness also can be monitored by reviewing field documentation and/or performing field audits. For this report, a detailed review was performed on the COC forms, laboratory sample confirmation logs, and data validation packages. Laboratory QA/QC requirements were included in the field sampling and analysis plan (CDM 2010) and laboratory statements of work (SOWs) to ensure that the laboratory analytical results were representative of true field conditions.

Field sampling accuracy was attained through strict adherence to the approved field sampling and analysis plan and by using approved standard operating procedures for field data collection. Based on this, the data should represent as near as possible the actual field conditions at the time of sampling.

Representativeness has been achieved by the performed field work and laboratory analyses. The analytical data generated, that have not been rejected, are viewed to be a representative characterization of the project area.

4.7.4.2 Comparability

Comparability is a qualitative term that expresses the confidence with which a data set can be compared with another. Strict adherence to standard sample collection procedures, analytical detection limits, and analytical methods assures that data from like samples and sample conditions are comparable. This comparability is independent of laboratory personnel, data reviewers, or sampling personnel. Comparability criteria are met for the project if, based on data review, the sample collection and analytical procedures are determined to have been followed, or defined to show that variations did not affect the values reported.

To ensure comparability of data generated for the site, standard sample collection procedures and DTSC-approved analytical methods were utilized by CDM. The sample analyses were performed by LLI in Lancaster, Pennsylvania. Utilizing such procedures and methods enables the current data to be comparable with previous and future data sets generated using similar methods.

4.7.4.3 Sensitivity

Sensitivity is related to the ability to compare analytical results with project-specific levels of interest, such as risk-based screening levels or action levels. Analytical detection limits for the various sample analytes should be below the level of interest to allow an effective comparison.

Detection Limits

The method detection limit attempts to answer the question, "What is the lowest level of analyte in a sample that will result in a signal different than zero"? The study is based upon repetitive analysis of an interference-free sample spiked with a known amount of the target analyte. The MDL is a measure of the ability of the test procedure to generate a positive response for the target analyte in the absence of any other interferences from the sample.

The RL is generally defined as the lowest concentration at which an analyte can be detected in a sample and its concentration reported with a reasonable degree of accuracy and precision. For samples that do not pose a particular matrix problem, the RL is typically about three to five times higher than the MDL.

Laboratory results are reported according to rules that provide established certainty of detection and RLs. The result for an analyte is flagged with a "U" if that analyte was not detected, or qualified with a "J" flag if blank or other QC results fall outside the appropriate tolerance limits.

If an analyte is present at a concentration between the MDL and the RL, the analytical result is flagged with a "J," indicating an estimated quantity. Qualifying the result as an estimated concentration reflects increased uncertainty in the reported value.

Qualifiers were applied to applicable sample analyte results during the validation process based on sample results being reported as detected and below the reporting limit/MDL. Details of the validation and the number of analytes qualified are discussed in detail in the data usability assessment report and laboratory validation reports in Appendix C.

In summary, for all methods analyzed some of the analytes for were qualified as estimated due to reporting limit criteria.

In general, for the data validated in this report, detection limits for the sample results were low enough to compare to the action levels stated in the work plan (CDM 2010). The detection limits for this project are lower than "normal" environmental data analyses. Analytical laboratory methods are being modified in order to achieve these lower reporting limits. Current laboratory instrumentation technology cannot achieve all of these low reporting limits, and thus some of the RLs are above project criteria. These results are still considered usable for project decisions.

The data validation process also determines the most valid analyte result to use for samples that are re-analyzed or diluted. These validated results are entered into the project database and used for decision-making.

4.8 Review of Selected Validation Reports

CDM performed a review of the validation reports identified in Table 4-1. This review involved comparing the validation report results against the laboratory data packages as well as the validation guidance documents. All validation report results were verified against the laboratory data packages and validation documents were followed as required.

4.9 Data Completeness

Completeness of the data collection program is defined as the percentage of samples planned for collection as listed in the final work plan versus the actual number of samples collected during the field program (see equation A).

Completeness for acceptable data is defined as the percentage of acceptable data obtained judged to be valid versus the total quantity of data generated (see equation B). Acceptable data include both data that pass all the QC criteria (unqualified data) and data that may not pass all the QC criteria but had appropriate corrective actions taken (qualified but usable data).

Equation A. $$\%\mathbf{Completeness} = \mathbf{Cx}\frac{\mathbf{100}}{\mathbf{n}}$$

Where:

C = actual number of samples collected
n = total number of samples planned

Equation B. $$\%\mathbf{Completeness} = \mathbf{Vx}\frac{\mathbf{100}}{\mathbf{n'}}$$

Where:

V = number of measurements judged valid
n' = total number of measurements made

The overall completeness goal for this sampling event was 90 percent for all project data.

A total of 42 drainage sediment samples including the field duplicates were collected and analyzed. As discussed in Section 2.6, one equipment rinsate blank sample was not collected based on field conditions and locations. This is not considered a data gap for this sampling event. Ninety-eight percent of the samples identified in the work plan were collected meeting the completeness goal for the number of samples collected versus number of samples planned.

The completeness goal achieved for acceptable data was 98.3 percent of the number of measurements judged to be valid versus the total number of measurements made for all drainage sediment samples analyzed. Table 4-3, shows a summary of all results that were estimated or rejected.

The following individual analyte results were rejected per analyses:

- Method 6020
  - 2 individual metal analyte results out of 640 results (0.31%)
- Method 8081A
  - 79 individual pesticide analyte results out of 840 results (9.49%)
- Method 8151A
  - 36 individual herbicide analyte results out of 400 results (9%)

Table 4-3 Summary of Data Completeness Following Data Validation

	Number of Analyte Detections Without Qualifiers	**Number of Estimated Results**	**Number of Rejected Results**	**Number of Non-Detect Results**	**Number of Estimated Non-Detect Results**	**Total Analytes Detect and Non-Detect**	**Percent of Analyte Results Judged Valid Versus Total Analyte Results Collected**
Inorganics	489	717	2	135	21	1364	99.85%
Dioxins	142	309	0	232	1	684	100%
PCBs	31	62	0	312	75	480	100%
Pesticides	11	46	79	571	133	840	90.6%
Herbicides	21	30	36	295	18	400	91%
Semivolatiles	9	37	0	1885	10	1941	100%
PAHs	162	223	0	526	28	939	100%
Completeness Total for All Drainage Sediment Samples Collected and Judged Valid							**98.27%**

The completeness goals for both the number of samples collected for sampling events and the number of measurements judged to be valid were met.

Sampling deviations from that described in the Field Sampling Plan are discussed in Section 2.6 of this report. Deviations did not impact DQOs for this sampling event. The data reported and not rejected, are suitable for their intended use for characterization of Area IV of SSFL. The DQIs identified in the field sampling and analytical plan (CDM 2010) met appropriate criteria. The achievement of the completeness goals for the data provides sufficient quality data for project decisions.

4.10 Assessment of Data Usability and Reconciliation with Work Plan Goals

Ninety-eight percent of the data validated and reported in this TM are suitable for their intended use for site characterization. Sample results that were rejected are not suitable for project use. The rejected analyte results do not impact overall project objectives. The detection limits reported generally met the expected limits proposed by the analytical laboratory in their contract agreement with CDM.

Sample results that were qualified as estimated are usable for project decisions. Numerous dioxin results were qualified as estimated and/or nondetect due to the low detection limits. This data is considered usable for project decisions.

The achievement of the completeness goals for number of samples collected, and the number of sample results acceptable for use provides sufficient quality data to support project decisions. Field duplicate precision also met criteria a majority of the time. RPDs were outside criteria predominantly when the sample results were close to the RL and/or below the project required action limits. Decisions based on results close to the RL should be made with a degree of caution.

Section 5
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