Master Field Sampling Plan for Chemical Data Gap Investigation Phase 3 Soil Chemical Sampling at Area IV, Santa Susana Field Laboratory
Ventura County, California

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Prepared under:

U.S. Department of Energy
EM Consolidated Business Center
Contract DE-AM09-05SR22404
CDM Smith Task Order
DE-AT30-08CC60021/ET17

April 2012

Master Field Sampling Plan for Chemical Data Gap Investigation Phase 3 Soil Chemical Sampling at Area IV Santa Susana Field Laboratory Ventura County, California

Contract DE-AM09-05SR22404
CDM Smith Task Order DE-AT30-08CC60021/ET17

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 and Abbreviations

AHA	Activity Hazard Analysis
AOC	Administrative Order on Consent
ASTM	American Standards for Testing and Measurement
bgs	below ground surface
Boeing	The Boeing Company
°C	degrees Celsius
CAR	corrective action request
CDM Smith	CDM Federal Programs Corporation
CFR	Code of Federal Regulations
CMS	Corrective Measure Study
CoC	chain-of-custody
D&D	decontamination and decommissioning
DL	detection limit
DOE	U.S. Department of Energy
DPT	direct push technology
DQO	data quality objective
DTSC	California Department of Toxic Substances Control
EFH	extractable fuel hydrocarbon
ELAP	Environmental Laboratory Accreditation Program
EPA	United States Environmental Protection Agency
ETEC	Energy Technology Engineering Center
FSAP	Field Sampling and Analysis Plan
FSP	Field Sampling Plan
FTL	field team leader
g	gram
GIS	geographic information system
GPS	global positioning system
GRO	Gasoline Range Organics
H&S	Health and Safety
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HCl	hydrochloric acid
HNO_3	nitric acid
HSA	Historic Site Assessment
H_2SO_4	sulfuric acid
IDW	investigation derived waste
ISL	interim screening level
L	liter
LDC, Inc.	Laboratory Data Consultants, Inc.
Master FSP	Master Field Sampling Plan
MDL	method detection limit
mL	milliliter
MS	matrix spike
MSD	matrix spike duplicate
NaOH	sodium hydroxide
NASA	National Aeronautics and Space Administration
NBZ	Northern Buffer Zone
NOAA	National Oceanic and Atmospheric Association
NPDES	National Pollution Discharge Elimination Sysytem
oz	ounce
PAH	Polycyclic Aromatic Hydrocarbon

PARCCS	precision, accuracy, representativeness, completeness, comparability, and sensitivity
PCB	Polychlorinated Biphenyl
PCT	Polychlorinated Triphenyl
PID	photoionization detector
PM	project manager
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
%R	percent recovery
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RL	reporting limit
RPD	relative percent difference
SIM	selective ion monitoring
SOP	standard operating procedure
SRAIP	Soil Remedial Action Implementation Plan
SSFL	Santa Susana Field Laboratory
SVOC	Semi-volatile Organic Compound
TIC	tentatively identified compounds
TPH	Total Petroleum Hydrocarbon
VOA	Volatile Organic Analyte
VOC	Volatile Organic Compound
WSHP	Worker Safety and Health Program

Section 1

Introduction

1.1 Overview of the Field Sampling Plan

This Master Field Sampling Plan (Master FSP) addresses field sampling procedures and methods and quality assurance (QA) and quality control (QC) requirements 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. This Master FSP is one component of the Work Plan for Soil Investigation that addresses the requirements of the Administrative Order on Consent (AOC - Docket HSA-CO-10/11-037) signed by the California Department of Toxic Substances Control (DTSC) and U.S. Department of Energy (DOE) for the completion of Phase 3 Chemical Data Gap Investigation. The other two components of the Work Plan are the Quality Assurance Project Plan (QAPP) and Health and Safety Plan (HASP), which collectively will be implemented with the Master FSP. In addition, this Master FSP will be supplemented by FSP addenda that will describe the rationale for where and why soil samples will be collected for chemical analysis.

The AOC addresses three phases of sampling. Phase 1 was co-located soil sampling with the United States Environmental Protection Agency (EPA). Phase 1 sampling was started on October 18, 2010, and was essentially completed with EPA on January 27, 2012. Phase 2 per the AOC will be random sampling with EPA. The sampling and analytical requirements for Phase 2 will be addressed in a separate FSP.

This Master FSP provides the background and protocols for Phase 3 soil sampling under the Chemical Data Gap Investigation of the AOC. Sampling covered by this Master FSP is based on a data gap analysis of all valid chemical data for Area IV. The specific objective of the data gap analysis is to determine data necessary to identify areal extent of contamination for cleanup remedy evaluation. To support development of the Soil Remedial Action Implementation Plan (SRAIP), all environmental data collected for Area IV (including prior Resource Conservation and Recovery Act [RCRA] Facility Investigation [RFI], and AOC Phase 1, 2, and 3 data) will be incorporated into a single database for a final data gap analysis review. Should the final data gap analysis indicate additional sampling is needed to support SRAIP decisions, those samples will be collected at that time. The results of the data gap analyses and the rationale for additional sampling will be provided in separate FSP addenda that will tier from the sampling and analytical protocols as specified in this document.

A QAPP has been developed to describe the quality assurance/quality control (QA/QC) requirements and analytical limits and criteria for the soil chemical sampling. The QAPP also contains the chemical analytical methods, data review and validation, reporting, and QA/QC requirements for Chemical Data Gap Investigation.

The Worker Safety and Health Program (WSHP) applies to work performed by CDM Federal Programs Corporation (CDM Smith), and subcontractors on behalf of CDM Smith, under contract with DOE. The WSHP describes CDM Smith's methods to comply with the requirements in 10 Code of Federal Regulations (CFR) Part 851 (the Rule), Worker Safety and Health Program, Subpart C, Specific Program Requirements. The WSHP includes the regulations and standards specifically required by 10 CFR 851, and is to be used in conjunction with CDM Smith's Corporate Health and Safety (H&S)

Program and Integrated Safety Management System description as an overall H&S management approach to SSFL activities. When hazards are identified and analyzed, controls are developed to mitigate hazards. The controls will be documented in a task-level HASP or Activity Hazard Analysis (AHA) for work at SSFL. If during implementation of the work new hazards are identified, the HASP or AHA will be modified to address the new hazards.

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 1-1). The SSFL is separated into four administrative areas (Figure 1-2) and subareas (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 I, 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 Master FSP. Table 2-1 presents the specific RFI program 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 nonradioactive 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, Phase 1 co-located sampling under the AOC, and the EPA radiological investigation.

1.3 Purpose of Phase 3 Chemical Data Gap Investigation Soil Sampling

Per the AOC, DOE is to conduct a data gap analysis using data collected under the RFI program and the Phase 1 co-located and the Phase 2 random soil sampling event. The purpose of the data gap analysis is to identify any additional soil chemical data needed to support the SRAIP per the AOC. This additional sampling will be conducted in Phase 3. The SRAIP will serve as the soil cleanup remedy evaluation document that will describe where and how much soil will require cleanup.

1.4 Technical or Regulatory Standards

This Master FSP does not establish the final cleanup levels for Area IV of SSFL. The cleanup levels are being developed by DTSC per AOC requirements and will include the results of EPA and DTSC background studies, and evaluation of laboratory reporting limits (RLs) and analytical chemistry methods that address the AOC. At the time of development of this Master FSP, the soil cleanup levels were still under DTSC evaluation. In the interim, DTSC has accepted for use of interim screening levels (ISLs) for the data gap analysis and planning for Chemical Data Gap Investigation sampling. The ISLs reflect results from a prior background study for metals and dioxins (MWH 2005), and demonstrated analytical RLs for chemical analytes without background values (DOE 2011). Once the new background study results are available and the evaluation of laboratory methods and RLs is completed, DTSC will issue a soil "Lookup Table" that will include the soil cleanup values for Area IV. The "Lookup Table" process is not expected to be completed until mid-2012 and, until then, the ISL values will be used to evaluate site characterization results.

Following the receipt of DTSC Lookup Table values, a data gap analysis of all prior data will be conducted. The purpose of this last and final data gap analysis is to compare each ISL value to the Lookup Table value. In cases where ISLs are greater than Lookup Table values (ISL > Lookup Table) a data gap analysis will provide additional data needs (sample location, targeted interval, and analysis). These data gaps will be addressed by a final Phase 3 investigation event. Data collected during this final field investigation will be used to support the SRAIP.

1.5 Field Sampling Plan Organization

This Master FSP includes the following sections:

- **Section 1 Introduction** – Summarizes the basis and objectives of Chemical Data Gap Investigation sampling and relationship of the Master FSP with the Chemical Data Gap Investigation Work Plan

- **Section 2 Project Background** – Provides details regarding the RFI studies of Area IV and EPA's radionuclide characterization study of Area IV

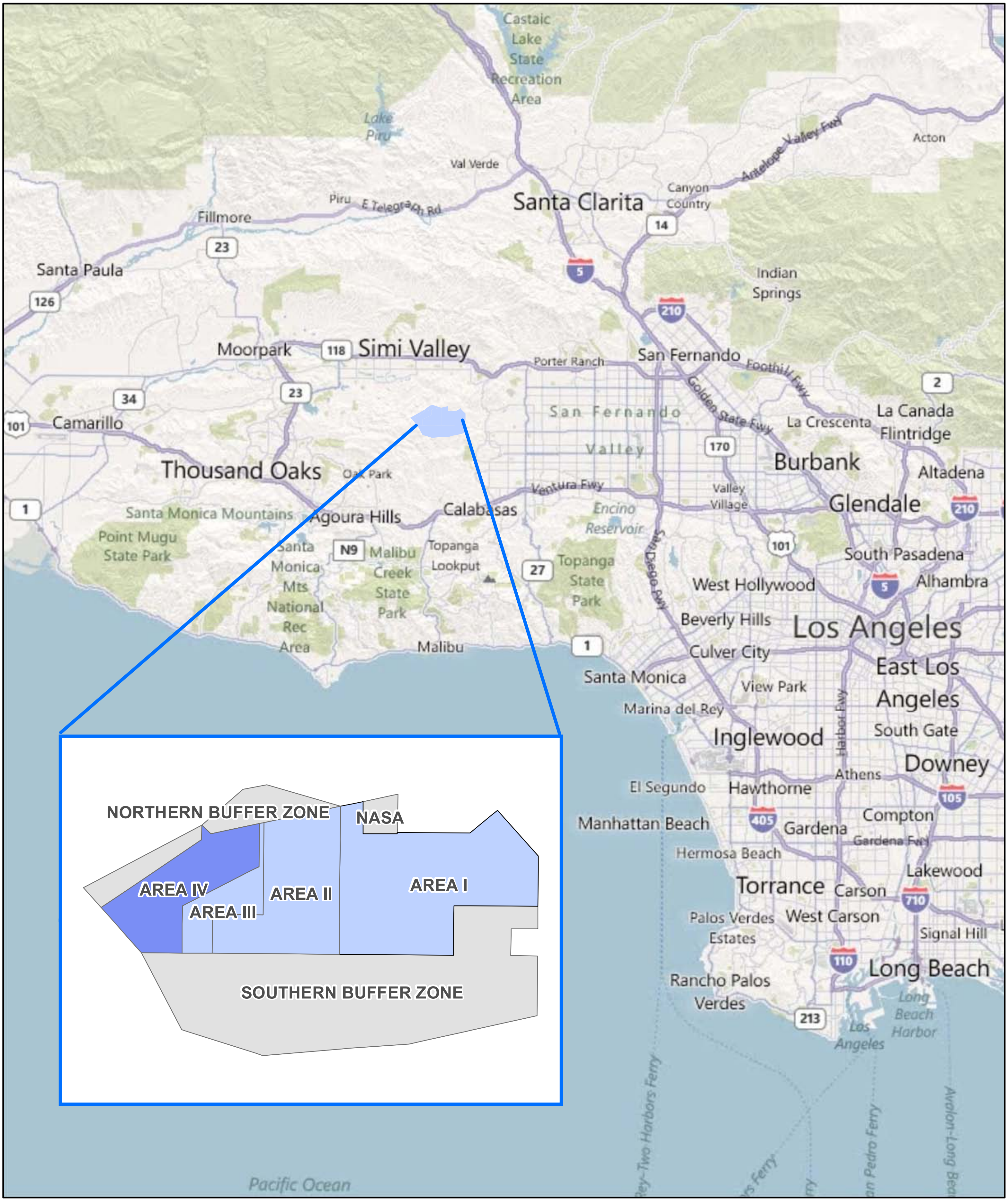
- **Section 3 Project Organization** – Identifies the individuals responsible for implementing the Master FSP, their specific responsibilities, and their organizations

- **Section 4 Quality Objectives and Rationale** – Provides the data quality objectives (DQOs) and their criteria

- **Section 5 Sample Design and Rationale** – Describes the soil sampling procedures and intervals, sample material management, rationale for chemical sample intervals, and sample collection

- **Section 6 Project Task Descriptions** – Provides the procedures for sample management, sample containers, labeling, paperwork, sample management, preservation, sample custody, and shipment to the analytical laboratories

- **Section 7 Quality Control Criteria** – Lists the analytical methods, and provides a summary of analytical quality control procedures, analytical method detection limits (MDLs), and both field 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 data review process and four distinctive steps to evaluate and ensure that project data quality will meet the project needs and requirements
- **Section 13 References**



Santa Susana
Ventura County, California

Figure 1-1

Santa Susana Field Laboratory Location

N

Miles
0 1 2 4 6 8

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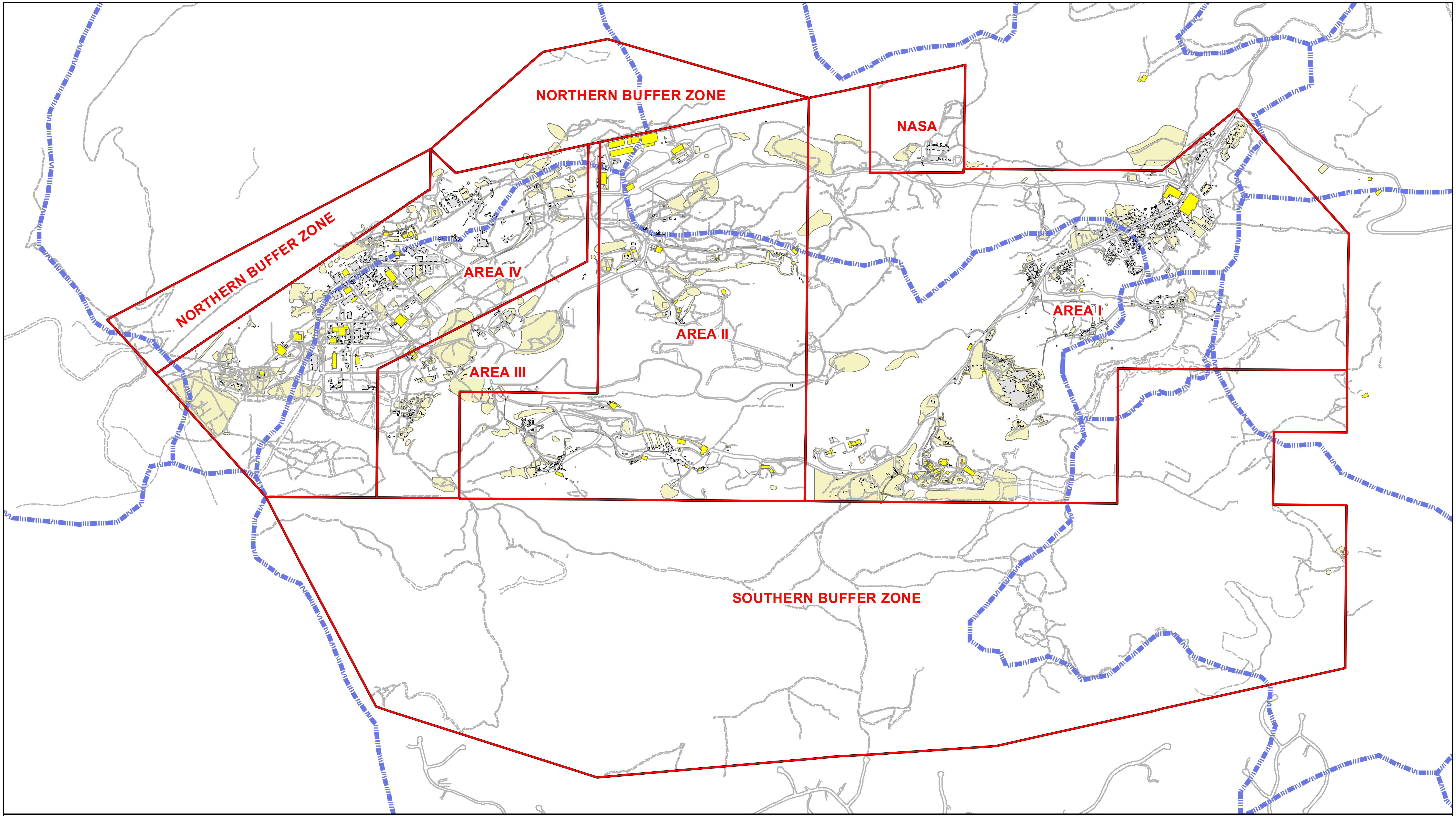

Note: GIS Layers provided by Boeing.

Santa Susana Field Laboratory Layout

Santa Susana
Ventura County, California
Figure 1-2

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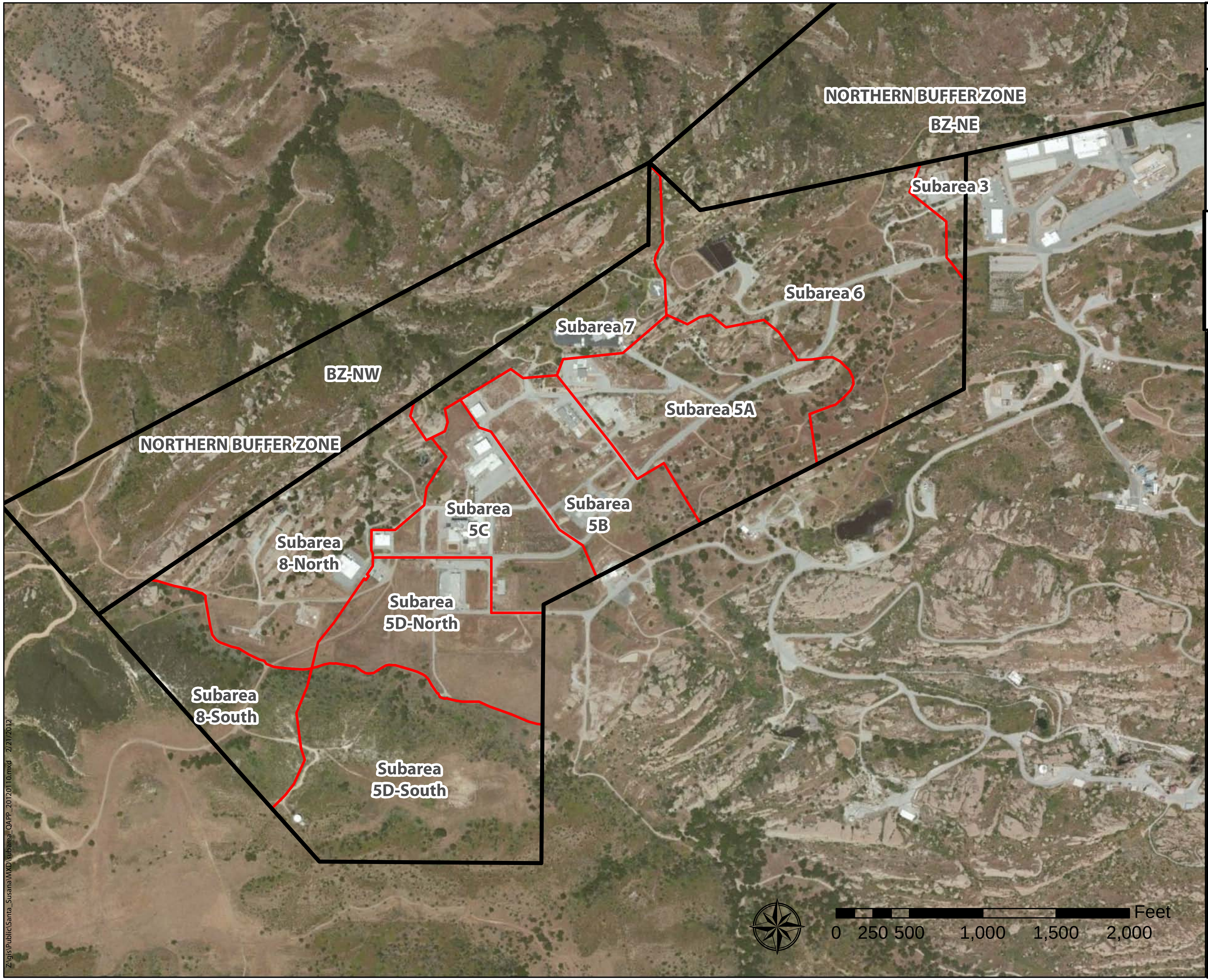
Santa Susana Field Laboratory Site
Ventura County, California

Figure 1-3
Area IV and Northern Buffer Zone Subarea Designation Santa Susana Field Laboratory

EPA Region 9



Legend

▭ Subarea
▭ Area IV & Northern Buffer Zones

Aerial Source: Bing Maps, (c) 2010 Microsoft Corporation and its data suppliers

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Section 2

Project Background

2.1 Area IV RCRA Facility Investigation

Some of the data used in the Phase 3 Data Gap Investigation were obtained from the SSFL RCRA Corrective Action program RFI phase.

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 Corrective Measure Study (CMS), and identify areas for additional work.

The chemical data collected under this Master FSP will be added to the RFI. Phase 1 is completed and the data are included in the RFI database. Phase 2 data, being implemented concurrently with Phase 3, will also be included in the RFI database.

2.2 Phase 1 Co-Located Soil Sampling with EPA

During the Phase 1 co-located soil sampling, EPA had the lead on identification of sample points and the collection of soil samples. DOE, per agreement with DTSC, obtained soil samples at the EPA sample locations and submitted the samples for chemical analysis. The handling and processing of soil samples and procurement of a subcontract analytical laboratory was performed by DOE's contractor CDM Smith.

EPA identified its sample locations through several lines of evidence that included reviews of historical documents and records, review of aerial photographs, performance of gamma scanning, geophysical and magnetometer surveys, and via interview of former workers. EPA reported its reviews and site survey findings in historical site assessment documents that provided the basis and rationale for its proposed soil sampling. DOE reviewed the EPA rationale for sampling as part of the Phase 1 chemical soil sampling planning.

EPA divided Area IV into 10 subareas to facilitate their planning, investigation, and sampling purposes (Figure 1-3). The subareas were divided based on the Area IV groups delineated under the RFI program. Implementation of the co-located sampling program started in Subarea 5C and progressed through Subareas 5B, 5A, 5D North, 8 North, 6, 7, 3, 5D South, and 8 South. EPA also sampled drainages leading into and within the NBZ of SSFL. EPA plans on sampling soil within NBZ, but it has not yet been scheduled. Because of the sequencing of chemical analyses and data validation following sample collection within the subareas, it is expected that Chemical Data Gap Investigation sampling will follow a similar sequence of subareas, both for the data gap analysis and the development of FSP addenda.

2.3 Clearly Contaminated Areas within Area IV

As part of the planning process for the identification of sampling locations and chemical analytes for soil samples collected under Phase 1 of the co-located sampling program, clearly contaminated areas were identified. Clearly contaminated areas are defined as locations where chemical data collected under the RFI or Phase 1 demonstrate contamination significantly above an ISL. Typically the chemical exceedance is greater than an order of magnitude higher than the ISL and there are multiple chemical contaminants present. Decisions were made that further investigation within the clearly contaminated areas may not be necessary, but lateral definition and some vertical definition may be necessary to determine soil volumes for the SRAIP. This Master FSP considers the clearly contaminated area definition as part of the planning requirements for future sampling identified through February 20, 2012.

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 Chemical Data Gap Investigation soil 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 and complies with AOC (Docket HSA-CO-10/11-037). 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 CDM Smith

CDM Smith is the DOE contractor responsible for procuring services needed to implement this investigation including: cultural resources and Native American monitor, utility locator, geophysics survey, excavator, driller, laboratories, and data validation subcontractors. The drilling contractor shall be licensed in the State of California. CDM Smith will perform soil sampling under this Master FSP, and ensuring that the sample labels are correct and chain-of-custody (CoC) paperwork is complete, procuring analytical services, preparing and shipping samples to the laboratories, as well as overseeing laboratory performance, reviewing laboratory data reports for completeness, and independently validating selected analytical results. CDM Smith will obtain sample location information and prepare the data report presenting the results of analysis of the chemical samples.

3.4 Subcontractors

CDM Smith will procure laboratories for chemical analysis of samples that have Environmental Laboratory Accreditation Program (ELAP) certification and approvals from California DTSC for performing the specific analyses. Laboratories under contract to CDM Smith include:

Lancaster Laboratories, Inc.
Nicole Maljovec - Senior Project Manager/Group Leader, Environmental Client Services
2425 New Holland Pike
Lancaster, PA 17601 USA
Phone: 717-556-7259
Fax: 717-656-6766
ELAP Certification No.: 2501
NELAC/NELAP Certification No.: 10276CA

EMAX
Jim Carter - Business Development Manager
EMAX Laboratories, Inc.
1835 W. 205th Street
Torrance, CA 90501
Phone: 310-618-8889 x105
ELAP Certification No.: 2672
NELAP Certification No.:02116CA

Additional laboratory subcontracts have yet to be procured, but when known, an FSP will be amended to include this information.

CDM Smith has subcontracted with Laboratory Data Consultants, Inc. (LDC, Inc.) to perform the data validation. LDC, Inc. contact information is provided below.

Laboratory Data Consultants, Inc.
7750 El Camino Real, Ste 2L
Carlsbad, CA 92009
Phone: 760-634-0437

A Native American monitor, utility locator, geophysical surveyor, excavator, and drilling subcontractor have yet to be procured, but when known, an FSP will be amended to include this information.

3.5 Community

The community has had the opportunity to review DOE's sampling procedures, the proposed Chemical Data Gap Investigation sampling locations, this Master FSP, and the analytical method RLs 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 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.)
- 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 Chemical Data Gap Investigation Soil Sampling Data Quality Objectives

Process	Response
STEP 1 State the problem.	Historical operations at SSFL have released chemicals into the soil requiring characterization to support remedial planning. Existing soil chemical concentration data and other information sources for Area IV and the NBZ need to be evaluated for completeness and supplemented as necessary.
STEP 2 Identify the Goal of the Study.	Specific goal of the Area IV Chemical Data Gap Investigation soil sampling program is to answer the following questions: • Are there sufficient chemical soil sampling data to assess potential release areas for remedial planning according to the AOC? • Where do soil chemical concentrations exceed ISL values? • What is the vertical and lateral extent of soil concentrations exceeding ISL values and resulting volumes? • Are there potential chemical release areas where soil has not been adequately characterized?
STEP 3 Identify Information Inputs.	• Phase 1 co-located and RFI soil sampling results (all media) • Phase 1 co-located and RFI field sampling observations – stained soil, debris, etc. • Identified potential chemical release locations based on RFI historical document and aerial photographic review • Historical operational information from EPA HSA documents and field surveys • DTSC comments regarding previous RFI sampling adequacy • ISLs for chemicals • EPA radiological sampling data • Site conditions (e.g., bedrock outcrops, drainage pathways) • Field sampling Standard Operating Procedures (SOPs) – soil boring installation, trenching, etc. • Laboratory method Information (including DTSC input regarding site-specific requirements) A Geographic Information System (GIS) will be used to evaluate information sources to complete chemical data gap analysis and sample planning.

Table 4-1 Chemical Data Gap Investigation Soil Sampling Data Quality Objectives (cont.)

Process	Response
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 depth contamination to weathered bedrock; 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 (e.g., RFI and Phase 1 co-located soil sampling) and any concurrent or additional investigations at the site (e.g., soil vapor sampling, radiological sampling).
STEP 5 Develop the Analytic Approach.	The criteria used to identify Chemical Data Gap Investigation chemical sampling are as follows: • ISLs accepted by DTSC will be used to screen previously collected sampling results to identify additional sample locations and depths, and to identify the analytical suites needed to fill chemical data gaps. ISLs are presented on Table 4-2. • As part of the review of existing data completeness if it can be demonstrated that soil characterization above ISLs allows for adequate remedial planning (e.g., soil volume determination), then no additional sampling will be required. • If review of existing data shows that soil characterization is incomplete for remedial planning, then additional soil sampling will be required. • If soil concentrations above ISL values occur immediately above bedrock refusal, then the threat of the contaminant to groundwater will be assessed (e.g., contaminant gradients, geologic information, mobility of chemical, proximity to water table). This step will be conducted in consultation with DTSC and the SSFL groundwater team and if additional investigation is warranted using more powerful drilling techniques and how it is to be conducted. • If a new potential chemical release area is identified and has not been adequately characterized and delineated, then additional soil sampling will be assessed. • If additional sampling is proposed, then select sampling locations based on evaluation of multiple lines of evidence from the information inputs listed in Step 3. • If all data reviewed indicate that the potential chemical release area has been characterized and adequately delineated, and the results are below the ISLs, then additional sampling will not be required.
STEP 6 Specify Performance or Acceptance Criteria.	DTSC approval of the Chemical Data Gap Investigation Work Plan and subsequent FSP addenda will be obtained prior to field work. Samples will be analyzed following EPA-approved methods and procedures, and/or those approved by DTSC. Laboratory methods and analytical RLs are provided in the QAPP and Table 6-1 of this Master FSP. Analytical accuracy and precision performance criteria are listed in the QAPP, Table 8-3. Analytical data will be validated by a third party following EPA guidelines as described in the QAPP. Validated data will be evaluated for PARCCS data quality indicators for usability to meet project goals. Data assessment and validation will determine if collected data can be used for remedial planning. In general, the assessment process will be used to demonstrate that: • Appropriate field procedures were followed • Deviations were documented and assessed • The chemistry data met applicable criteria • All data and field measurements are usable for the stated project needs Lateral and vertical extent of chemicals above ISL values will be defined sufficiently for remedial planning so that soil contamination volumes can be generally estimated within -30 percent to +50 percent (e.g., between 70 and 150 cubic yards, between 700 and 1,500 cubic yards, and between 7,000 and 15,000 cubic yards, etc.). Soil samples will be collected at surface and subsurface locations to delineate the extent of chemical contamination above ISL values and to assess newly identified potential chemical release areas. For the purpose of the Chemical Data Gap investigation sampling, "weathered bedrock" means the upper portion of oxidized bedrock immediately below the soil interface, penetrable by direct push drilling (typically 1 foot), or by other excavation or drilling methods (typically 1 to 5 feet based on previous

Table 4-1 Chemical Data Gap Investigation Soil Sampling Data Quality Objectives (cont.)

Process	Response
	site investigation or remediation excavation efforts using backhoes, excavators, rippers, and/or auger and sonic drilling method). • Sample Collection. Subsurface soil samples will be collected using direct push technology (DPT) soil borings, at trenching locations, or by augering at locations inaccessible to larger equipment. All sample collection will be performed using DTSC-approved sampling procedures. • Analytical Suites. Soil samples will be analyzed for chemicals to address concentrations above ISL values or to address new potential release areas. − Analyses requested for soil samples proposed as step-outs to existing data will be based on soil concentrations above the ISL value and consideration of chemical release factors (e.g., site conditions, nearby sampling results, chemical gradients). − To assess recently identified potential chemical release areas, analyses requested for proposed soil samples will be based on the type of operations and/or existing soil sampling results in the area greater than ISL values. • Elevated RLs. Evaluation of outstanding characterization requirements in cases where elevated RLs exist will consider multiple lines of evidence (e.g., type of chemical, type and scale of potential release, chemical gradients and surrounding sampling results, and historical operations) to determine a sampling strategy to complete characterization. Sampling frequency, including representative sampling approaches, will be determined on a case-by-case basis. • Lateral Sample. Proposed lateral sample spacing will depend on multiple lines of evidence such as type and scale of chemical release, previous sampling density, chemical gradients, chemical type, and site conditions such as drainage morphology and bedrock outcrops). − Horizontal spacing for potential non-point source chemical release areas that are generally flat with no preferential drainage pathways will be approximately 25 to 100 feet. − Step-out sample spacing will depend on chemical gradients, potential sources and site conditions, generally using a 25- to 50-foot spacing. − Drainage samples will target fine-grained accumulation areas within the channel and over-bank deposits along the channel, generally using a 50-foot spacing within channels and a 5- to 10-foot transect spacing in over-bank deposits. • Vertical Sampling. Proposed vertical sampling intervals will be designed to collect data to identify and delineate soil concentrations above ISL values and will be based on multiple lines of evidence such as the type of targeted feature, type and scale of chemical release, magnitude/gradient of detected concentrations, and site conditions (drainage morphology, depth to bedrock). Vertical sampling will generally following these guidelines: − Surface samples will generally be collected between 0 and 0.5 feet below ground surface (bgs), unless there is evidence to indicate that surface soils may not represent in situ shallow/surficial soils during site operations. If such evidence exists then soil samples will be targeted at appropriate depths to characterize the potential release. Soil samples collected below 2 feet bgs will not be designated as surface soil samples in the database. − Subsurface soil samples collected at intervals based on the sample and analytical requirements for each location as dictated by data gap analysis and general lines of evidence. For example, at locations where data show contamination at the surface and the same contaminants below the ISLs at 5 feet bgs, sampling intervals between the two depths will be identified. For locations with an unknown sampling depth lines of evidence will be used, with a default sampling at 5-foot intervals where no lines of evidence are known. The depth of bedrock refusal and/or type of chemical may require a different vertical sampling interval, and, in general, sampling will be targeted immediately above the bedrock interface if soil concentrations still exceed ISLs at depth. − Proposed sampling depths to delineate surficial release of organic chemicals such as PCBs/PCTs, dioxins, and terphenyls may be shallower than 5 feet, due to limited mobility of

Table 4-1 Chemical Data Gap Investigation Soil Sampling Data Quality Objectives (cont.)

Process	Response
	these chemicals under normal onsite soil conditions. Sampling depths will be proposed based on site conditions, depth to bedrock, and/or other chemicals present in the area. Waste pond, leach field, and landfill conditions are not considered 'normal' soil conditions on site and deeper sampling for PCBs/PCTs, dioxins, and terphenyls will be performed as warranted to delineate impacts in these areas. – The soil sample interval will be 0.5 to 1 foot thick. Closely spaced multiple borings may be needed to obtain sufficient sample volume for proposed chemical analyses. The vertical extent of a single interval sample depth will not be greater than 1 foot. Sample depth will be assigned to the deepest depth, consistent with RFI sampling conventions. – Additional sampling depths and chemical analyses may be proposed based on observed field sampling conditions that suggest a release (e.g., staining, odors, PID readings, unexpected debris noted); rationale for additional samples/ analyses will be documented and reported in the Data Gap Report, and discussed with DTSC as these are situations are encountered. • Migration Pathways. Migration pathways will be evaluated and sampled to assess potential chemical releases from onsite sources. Surface water, groundwater, and aerial dispersion migration pathways will be evaluated based on the type of release to delineate the extent of chemical contamination on site or in areas contiguous to Area IV and the NBZ. – Migration by surface water – since most surface water is present for only short periods of time during the winter rainy season, the surface water migration pathway will be assessed using sediment data from drainage pathways. National Pollution Discharge Elimination System (NPDES) surface water data will be evaluated if the monitoring point is upgradient and proximate to the area being evaluated. Existing surface water sampling results from permanent surface water bodies will also be evaluated in determining soil characterization completeness. – Migration to groundwater – soil sampling for potentially mobile compounds will be performed to top of weathered bedrock in recharge features (e.g., ponds, leach fields) with chemical releases. In cases where soil concentrations still exceed ISLs in soil immediately above weathered bedrock, lines of evidence regarding migration to groundwater will be evaluated and discussed with DTSC and the SSFL groundwater team as indicated above in Step 5. Lines of evidence used for the data gap analysis are discussed in detail in the CDM Smith Work Plan. If warranted for deeper investigation, sampling areas and results will be provided to the SSFL groundwater team for further assessment under the groundwater program as a threat to groundwater and/or any additional sampling requirements. – Migration by aerial dispersion – soil sampling for airborne chemicals will be performed along predominant wind directions and in adjacent drainages to assess secondary migration areas.

Acronyms and Abbreviations:

bgs = below ground surface
DL = detection limit
DPT = direct push technology
EPA = United States Environmental Protection Agency
FSP = Field sampling Plan
HSA = Historic Site Assessment
PAH = polycyclic aromatic hydrocarbon
PARCCS = precision, accuracy, representativeness, completeness, comparability, and sensitivity
PCB/PCT = polychlorinated biphenyl/polychlorinated triphenyl
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
VOC = volatile organic compound

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 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 will be presented in addenda to this Master FSP. The addenda will include the rationale for each sample along with the chemical methods that will be used to analyze each sample. The sample locations and chemical analyses will be discussed with DTSC and the community as part of the process of developing and obtaining DTSC approval of the addenda. The soil samples for chemical analysis will be collected as described in Sections 5.2.1, 5.2.2, and 5.2.3.

5.2 Field Sampling Program

SOPs will govern collection, management and recording of field samples, and the management and maintenance of field instruments. The SOPs identified for this investigation include:

- SSFL SOP 1 – Procedures for Locating and Clearing Phase 3 Samples
- SSFL SOP 2 – Surface Soil Sampling
- SSFL SOP 3 – Subsurface Soil Sampling with Hand Auger
- SSFL SOP 4 – Direct Push Technology Sampling
- SSFL SOP 5 – Backhoe Trenching/Test Pit for Sample Collection
- SSFL SOP 6 – Field Measurement of Total Organic Vapors
- SSFL SOP 7 – Field Measurement for Residual Radiation
- SSFL SOP 8 – Field Logbook Content and Control
- SSFL SOP 9 – Lithologic Logging
- SSFL SOP 10 – Sample Custody
- SSFL SOP 11 – Packaging and Shipping of Environmental Samples
- SSFL SOP 12 – Field Equipment Decontamination
- SSFL SOP 13 – Guide to Handling Investigation-Derived Waste
- SSFL SOP 14 – Geophysical Survey
- SSFL SOP 15 – Photographic Documentation of Field Activities
- SSFL SOP 16 – Control of Measurement and Test Equipment
- SSFL SOP 17 – Laboratory Homogenization of Phase 3 Soil Samples
- SSFL SOP 18 – Clean Sample Method Procedure for Methyl Mercury and Organotin Analyses

This Master FSP has been developed to be a single, encompassing project plan. However, because of complexities of the investigations and evaluation of the data by others, a single Master FSP containing all SOPs is not possible. As such, additional SOPs may be needed and will be included in FSP addenda when the new SOPs are identified.

The field sampling activities will include surface soil sampling and subsurface soil sampling from DPT boreholes drilled by a California-licensed drilling company subcontracted by CDM Smith. When the DPT rig cannot access a location, a hand auger and slide hammer will be used to collect the soil samples. A backhoe will be used to dig trenches and test pits in selected areas identified in the data gap analysis. Target depth for samples collected from both DPT boreholes and test pits will be provided in the data gap analysis. Sampled intervals will be adjusted based on site conditions, field instrument readings, and direct visual observations of the soil (staining, odor, etc.) as described in Section 5.2.3.

A CDM Smith geologist working under the supervision of a California registered geologist will log the sample using Unified Soil Classification System. Lithologic logging will be performed according to SOP 9 (Appendix D). CDM Smith will collect, package, and ship the samples to the laboratory according to SOP 11 (Appendix D). Surveying of all sample locations will be conducted by CDM Smith using global positioning system (GPS) coordinates according to SOP 1 (Appendix D). Investigation-derived waste (IDW) disposal activities will be performed by CDM Smith (see Section 6.9) in accordance with SOP 13 (Appendix D).

5.2.1 Surface Soil Sampling Procedure

Surface soil samples will be collected according to SOP 2 (Appendix D). Surface soil samples will be collected from the 0- to 0.5- foot bgs interval using a slide hammer and stainless steel sleeves. The surface of the sample area, approximately 6 to 8 inches in diameter, will be prepared by field samplers by removing leaves, grass, and surface debris. Surface soil samples will be collected from within the 12-inch diameter sampling area to a depth of 6 inches bgs. If volatile organic compounds (VOCs) and 1,4-dioxane and/or total petroleum hydrocarbon (TPH) - gasoline range organics (GRO) are to be analyzed, the required number of EnCore® samplers will be filled with soil from the bottom of the sleeve. Both ends of the sleeve will then be covered with Teflon squares and sealed with a plastic end cap to reduce loss of semi-volatile organics (SVOCs) and polycyclic aromatic hydrocarbons (PAHs). The plastic end caps will be marked to indicate "top" and "bottom." If additional soil is needed, more sleeves will be filled following the same procedure.

5.2.2 Subsurface Soil Sampling Procedures

For those subsurface samples collected in multiple volumes for purposes of matrix spike (MS)/matrix spike duplicates (MSD) and/or field duplicates, all soil cores that are retrieved at one sample location will be visually assessed by the field geologist to determine the degree of heterogeneity in the interval to be sampled. If the soil cores show obvious heterogeneity, the MS/MSD and/or field duplicate samples will be collected from another location where the soil exhibits greater homogeneity. MS/MSD and field duplicate samples will be collected only from locations with visually homogenous soil.

5.2.2.1 Direct Push Technology Sampling

Subsurface soil samples will be collected according to SOP 4 (Appendix D), if accessible by DPT (see Section 5.2.2.2). Subsurface soil sampling activities will be performed by CDM Smith using DPT. The DPT operations will be conducted by a California-licensed DPT subcontractor with CDM Smith oversight. In most cases, DPT borings will be advanced to a targeted depth 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. The CDM Smith geologist will distinguish and denote on the boring log if refusal was caused either by bedrock or DPT equipment.

Soil cores will be collected using a dual-tube sampling method, which consists of an outer drive casing and an inner soil sampling sleeve barrel. A DPT split-barrel sampler will be used as the inner soil sampling barrel to collect continuous 5-foot soil cores contained in an acetate sleeve. After the system is advanced 5 feet, the inner sampler containing the 5-foot soil core are removed from the boring. The polyethylene sleeve within the sampler is removed with the soil intact and the outer drive casing refilled with a sample barrel. The system is advanced again until total depth or refusal is reached.

CDM Smith will screen the length of the core using alpha/beta detectors for evidence of non gamma-emitting radionuclides. CDM Smith will also use a photoionization detector (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 VOCs and 1,4 dioxane and/or TPH-GRO analyses.

Soil samples for VOCs and/or TPH-GRO analyses will first be collected in an EnCore® sampler directly from the open acetate sleeve. If additional sample material is required, additional boreholes will be advanced and additional soil will be collected from the same depth interval. Soil for SVOC, PAH, and PCB/polychlorinated triphenyl (PCT) 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. DPT borings will be backfilled according to SOP 4 (Appendix D).

5.2.2.2 Hand Auger Sampling

Hand auger samples will be collected according to SOP 3 (Appendix D). Some locations may not be accessible by the DPT rig because of excessive slope or other accessibility issues. For these locations, the subsurface soil samples will be collected using a hand auger and slide hammer. A decontaminated hand auger will be used to remove soil to the desired sample depth. The soil brought up in each auger will be placed into plastic bags and the soil screened using the PID and/or pancake meter. Once the default depth of 4 feet bgs is reached, if needed, a soil sample will be collected using the slide hammer in accordance with the procedure in Section 5.2.1 above, for analysis of PAHs, PCBs/PCTs, and SVOCs. If samples are needed for VOCs, 1,4-dioxane, and/or TPH-GRO, the EnCore® samplers will be filled from the bottom of the filled sleeve just collected using the slide hammer. Both ends of the sleeve will be covered with Teflon squares and sealed with a plastic end cap to reduce loss of SVOCs and PAHs. The plastic end caps will be marked to indicate "top" and "bottom." Another auger-full of soil will be removed from the hole and the required number of sampling jars will be filled for all other analyses. Augering will continue until the next targeted or default depth is reached or the limit of hand augering is reached. In the event that an above-background measurement is observed with the PID or pancake meter, at depths other than default, a second hole will be hand augered and samples will be collected from intervals with above-background measurements. The sampler will be decontaminated between sample intervals. Hand auger borings will be backfilled according to SOP 3 (Appendix D).

For the Chemical Data Gap Investigation sampling, sample depth will be targeted based on contamination depth delineation requirements as determined through a data gap analysis. The rationale for sample depth will be clearly defined in the related FSP addenda.

5.2.2.3 Backhoe Subsurface Investigations

Samples collected from trenches and test pits will be collected according to SOP 5 (Appendix D). To provide access to subsurface materials, including building debris and rubble, a backhoe will be used to dig test pits. The test pits will be used to both characterize the type of debris remaining and for the collection of soil samples for chemical analyses. Entry into the trench and test pits by the CDM Smith technicians will not be allowed. Soil samples collected from the test pit from 0.5 feet to a depth of 5 feet will be collected from the side walls of the test pit using a slide hammer as described above. Soil samples collected below 5 feet will be collected directly from the bucket of the backhoe using the slide hammer and stainless steel sleeves. Samples for VOC analyses will be collected directly from the bottom of the stainless steel sleeve using the EnCore® sampler. The FSP addenda developed under this Master FSP will provide specific details on the rationale, analytes, and sampling protocols for backhoe-related sampling. Trenches and test pits will be backfilled according to SOP 5 (Appendix D).

5.2.3 Sediment Sampling Procedures

Sediment samples will be collected according to SOP 18 (Appendix D). Due to the potential variety of conditions under which sediment samples may be collected such as not submerged, partially submerged, and submerged, specific sampling equipment is not determined until locations are selected. Potential sample equipment may consist of scoops, dredges and cores. Sediment samples will be analyzed for methyl mercury and organtin analyses. For these analyses, a stringent sample collection method must be followed which is detailed in SOP 18. The surface of the sample area will be prepared by field samplers by removing vegetation, stones, and debris from the sediment surface (including below water level). If possible, samplers will also stand downstream of the sample location to minimize cross contamination and disturbing the area to be sampled. Specific sample collection equipment will be addressed in the subsequent FSP addenda.

5.2.4 Chemical Sample Interval Selection

The surface chemical sample interval is from the surface to 0.5 feet bgs. Subsurface soil samples will be collected at intervals based on the sample and analytical requirements for each location as dictated by the data gap analysis and general lines of evidence. For example, at locations where data show contaminants at the surface above ISL values and the same contaminants below the ISLs at 5 feet bgs, sampling intervals between the two depths will be identified. For locations with an unknown sampling depth, lines of evidence will be used, with default sampling at 5-foot intervals where no lines of evidence are known. The depth of bedrock refusal and/or type of chemical may require a different vertical sampling interval, and in general, sampling will be targeted immediately above the bedrock interface if soil concentrations still exceed ISL values at depth.

5.2.5 Volatile Organic Compound Sampling Procedures

Samples collected with the EnCore® sampler will be collected according to SOP 2, 3, 4, and 5 (Appendix D). EnCore® samplers and a T-handle will be used to collect samples for VOCs, 1,4-dioxane, and TPH-GRO analyses. Four 5-gram (g) samplers are required for VOCs and 1,4-dioxane and a fifth EnCore® sampler will be needed for TPH-GRO for sufficient soil volume. Moisture analysis will be performed on the soil placed into an appropriately sized wide-mouth glass jar or 6-inch long stainless steel sleeve that will be collected from the same interval for the remaining soil analyses. If no other analyses will be performed, an appropriately sized jar of soil will be collected from the same depth as the EnCore® samplers.

5.3 Geophysical Investigation

Information obtained from the chemical data gap analysis will be used to identify areas suspected of being used for disposal of debris or where landfill operations may have been conducted. CDM Smith will perform noninvasive geophysical investigations in areas using methods that have been successfully implemented at SSFL by EPA. Geophysical data collection will be preformed according to SOP 14 (Appendix D).

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 Smith field team leader (FTL) obtains sample containers (pre-preserved as required) and coolers from the subcontracted analytical laboratory. The estimated number and type of containers needed for samples are presented in Table 6-1. The actual number and container volume is laboratory-dependant and will be provided in the FSP addenda. 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 overnight delivery service or delivered directly to meet required holding times.

Area IV contains many underground utilities. Prior to the start of soil sampling under this Master FSP, CDM Smith will coordinate with Boeing to obtain information regarding subsurface utilities in the vicinity of each proposed subsurface drilling location. CDM Smith will also procure a licensed underground utility clearance surveyor to clear the subsurface at all proposed boring locations. Prior to performing the underground utilities survey, CDM Smith shall locate all proposed sampling locations in the field using pin flags, wooden stakes with flagging tape, and/or neon paint. Each location will be clearly marked by the surveyor so that the utilities are clearly marked and unambiguous. CDM Smith's locating and clearing sample locations is detailed in SOP 1 (Appendix D).

All locations shall be surveyed using GPS equipment according to SOP 1 (Appendix D). Each surveyed location will also be marked with a survey nail. Survey data will be recorded using the appropriate coordinate system.

6.2 Sample Container Labeling

Field crews collecting the chemical samples will use a sample identification scheme similar to the one used during the Phase 1 co-located soil sampling program. A unique number code to indicate the sampling location will identify each sample. The sample identification will include:

- Sample Location: SL-500 to SL-999 (sample location numbers will be detailed in the addendum FSP for each subarea)
- Subarea: SA5A, SA5B, SA5C, SA6, etc.
- Sample Type: SB for soil boring; CU for contained unit (i.e., ditch, sump)
- Beginning Depth-End Depth: listed in feet

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

Parameter	EPA Analytical Method	Nominal Sample Container Size(a)/ Minimum Sample Volume	Preservation	Maximum Holding Times(b)	
				Extraction	Analysis
SOIL SAMPLES					
Fluoride	EPA 300.0/9056A	4 oz jar / 5 g	Ice to 2 to 6ºC	--	28 days
Dioxins/Furans	EPA 1613B	4 oz jar / 10 g	Ice to 2 to 6ºC	30 days	45 days
Total Petroleum Hydrocarbons	EPA 8015B, C, D	3x 5 g En Core® sampler / 5 g for gasoline	Ice to 2 to 6ºC	48 hours	48 hours
		8 oz jar / 50 g for oil and diesel	Ice to 2 to 6ºC	14 days	40 days
SVOCs	EPA 8270C/D	Stainless steel sleeve for surface soil, 8 oz jar for subsurface soil / 30 g	Ice to 2 to 6ºC	14 days	40 days
PAHs	EPA 8270C/D SIM	Stainless steel sleeve for surface soil, 8 oz jar for subsurface soil / 30 g	Ice to 2 to 6ºC	14 days	40 days
PCB/PCTs	EPA 8082A	Stainless steel sleeve for surface soil, 16 oz jar for subsurface soil / 90 g	Ice to 2 to 6ºC	14 days	40 days
Hexavalent Chromium	EPA 7196A/7199	8 oz jar / 40 g	Ice to 2 to 6ºC	30 days	7 days
Metals	EPA 6010B/C, 6020A, 7471B	4 oz jar / 5 g	Ice to 2 to 6ºC	--	6 months (28 days for Hg)
VOCs	EPA 8260B/C	3 x 5 g En Core® sampler / 5 g	Ice to 2 to 6ºC	48 hours	48 hours
1,4-Dioxane	EPA 8260B/C SIM, 8270C/D SIM	3x 5 g En Core® Sampler / 5 g (8260 SIM) 8 oz jar/ 30 g (8270 SIM)	Ice to 2 to 6ºC	48 hours (8260 SIM)/ 14 days (8270 SIM)	48 hours (8260 SIM)/40 days (8270 SIM)
Perchlorate	EPA314.0/331.0/6850/6860	4 oz jar / 10 g	Ice to 2 to 6ºC	--	28 days
Pesticides	EPA 8081B	16 oz jar / 60 g	Ice to 2 to 6ºC	14 days	40 days
Herbicides	EPA 8151A	16 oz jar / 60 g	Ice to 2 to 6ºC	14 days	40 days
Formaldehyde	EPA 8315A	4 oz jar / 10 g	Ice to 2 to 6ºC	30 days	3 days
Energetics	EPA 8330A	4 oz jar / 10 g	Ice to 2 to 6ºC	14 days	40 days
Nitrates	EPA 300.0/9056A	4 oz jar / 5 g	Ice to 2 to 6ºC	--	48-hours
pH	EPA 9045D	4 oz jar / 5 g	Ice to 2 to 6ºC	--	ASAP
Cyanide	EPA 9012B	4 oz jar / 5 g	Ice to 2 to 6ºC	--	14 days
Alcohols	EPA 8015B,C,D	3 x 5 g En Core® sampler / 5 g	Ice to 2 to 6ºC	--	7 days
Terphenyls	EPA 8015B,C,D	4 oz jar / 10 g	Ice to 2 to 6ºC	14 days	40 days
Glycols	EPA 8015B,C,D	3 x 5 g En Core® sampler / 5 g	Ice to 2 to 6ºC	--	7 days
Methyl Mercury	EPA 1630M	4 oz HDPE jar / 25 g	Ice to 2 to 6ºC Frozen in one week if not analyzed before then	--	28 days
Organotins	NOAA Status & Trends	4 oz jar / 10 g	Ice to 2 to 6ºC	--	--

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

Parameter	EPA Analytical Method	Nominal Sample Container Size(a)/ Minimum Sample Volume	Preservation	Maximum Holding Times(b)	
				Extraction	Analysis
WATER SAMPLES					
Fluoride	EPA 300.0/9056A	1 x 500 mL polyethylene / 100 mL	Ice to 2 to 6ºC	--	28 days
Dioxins/Furans	EPA 1613B	2 x 1 L amber glass / 1 L	Ice to 2 to 6ºC	30 days	45 days
Total Petroleum Hydrocarbons	EPA 8015B, C, D	3 x 40 ml VOA vials / 40 mL for gas	Ice to 2 to 6ºC, HCl	--	14 days
		2 x 1 L amber glass / 1 L for oil and diesel	Ice to 2-6ºC	7 days	40 days
SVOCs	EPA 8270C/D	2 x 1 L amber glass / 1 L	Ice to 2-6ºC	7 days	40 days
PAHs	EPA 8270C,D SIM	2 x 1 L amber glass / 1 L	Ice to 2-6ºC	7 days	40 days
PCBs/PCTs	EPA 8082A	2 x 1 L amber glass / 1 L	Ice to 2-6ºC	30 days	40 days
Hexavalent Chrome	EPA 7196A/7199	1 X 500 mL polyethylene / 100 mL	Ice to 2-6ºC	--	24 hours
Metals	EPA 6010B,C/6020A/7470A	1 X 500 mL polyethylene / 100 mL	Ice to 2 to 6ºC, HNO3	--	6 months (28 days for Hg)
VOCs	EPA 8260B/C	3 x 40 mL VOA vials / 40 mL	Ice to 2 to 6ºC, HCl	--	14 days
1,4-Dioxane	EPA 8260B, C SIM, 8270C, D SIM	3 x 40 mL VOA vials / 40 mL (8260 SIM) 2 X 1 L amber glass / 1 L (8270 SIM)	Ice to 2 to 6ºC, HCl (8260 SIM)/Ice to 2 to 6°C (8270 SIM)	14 Days (8260 SIM)/7 days (8270 SIM)	14 days (8260 SIM)/ 40 days (8270 SIM)
Perchlorate	EPA 314.0, 331.0, 6850, 6860	1 x 500 mL polyethylene / 100 mL	Ice to 2 to 6ºC	--	28 days
Pesticides	EPA 8081B	2 x 1 L amber glass / 1 L	Ice to 2 to 6ºC	7 days	40 days
Herbicides	EPA 8151A	2x 1 L amber glass / 1 L	Ice to 2 to 6ºC	7 days	40 days
Formaldehyde	EPA 8315A	1 x 250 mL round glass / 100 mL	Ice to 2 to 6ºC	3 days	3 days
Nitrates	EPA 300.0/9056A	2 x 40 mL glass vials / 5 mL	Ice to 2 to 6ºC	--	48 hours
Energetics	EPA 8330A	2 x 1 L amber glass / 1 L	Ice to 2 to 6ºC	7 days	40 days
Cyanide	EPA 9012B	1 x 500 mL poly / 100 mL	Ice to 2 to 6ºC, NaOH to pH >12	--	14 days
pH	EPA 9040C	1 x 500 mL poly / 40 mL	Ice to 2 to 6ºC	--	as soon as possible
Alcohols	EPA 8015B, C, D	2 x 40 mL VOA vials / 80 mL	Ice to 2 to 6ºC,	--	7 days
Terphenyls	EPA 8015B, C, D	2 x 1 L amber glass / 1 L	Ice to 2 to 6ºC, HCl	7 days	40 days
Glycols	EPA 8015B, C, D	2 x 40 mL VOA vials / 80 mL	Ice to 2 to 6ºC	--	7 days
Methyl Mercury	EPA 1630	250 mL in a borosilicate glass bottle	Ice to 2 to 6ºC Preserve upon receipt within 48 hours with 0.4% HCl – or preserved in field with pretreated bottles from the laboratory	--	28 days
Organotins	NOAA Status & Trends	2 x 1 L amber glass / 1 L	Ice to 2 to 6ºC	7 days	40 days

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

Parameter	EPA Analytical Method	Nominal Sample Container Size(a)/ Minimum Sample Volume	Preservation	Maximum Holding Times(b)	
				Extraction	Analysis

(a) Nominal sample containers and volume have been provided. Laboratory required containers and volume will be included in the Addenda FSP. For this table, multiple analyses for subsurface soil samples (other than those collected in En Core® samplers) will be performed from two 16-oz glass jars. Surface soil samples will be submitted in stainless steel sleeves.

(b) Source is from MEC^{X}, 2009.

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/PCT = polychlorinated biphenyl / polychlorinated triphenyl
SIM = selected ion monitoring
SVOCs = semi-volatile organic compounds
VOA = volatile organic analyte
VOCs = volatile organic compounds
-- = extraction not required

Example soil sample identifications follow:

- SL-504-SA5C-SB-0.0-0.5 (soil sample collected in Subarea 5C at sample location 504 from a depth of 0.0 to 0.5 feet)
- SL-556-SA5C-SB-4.0-5.0 (soil sample collected in Subarea 5C at sample location 556 from a depth of 4.0 to 5.0 feet)

QA/QC samples include equipment rinsate blanks, field (or source water) blanks, field duplicates, and MSs.

- An example of EB sample identification is: EB-042512 (equipment rinsate blank collected on April 25, 2012)
- An example FB sample identification is: FB-051212 (field blank collected on May 12, 2012)

During Phase 1 sampling, duplicate samples were collected at the same location as the MS samples. This practice will be continued during the Phase 3 sampling. For samples to be used by the laboratory for their MS and MSD samples, "MS" will be added at the end of the sample identification number. If sample SL-556-SA5C-SB-4.0-5.0 indicated above is to be used as the MS/MSD sample, it will be labeled as SL-556-SA5C-SB-4.0-5.0MS. The duplicate sample collected in conjunction with this MS sample will have 300 added to the sample location number and the duplicate sample number will be SL-856-SA5C-SB-4.5-5.0.

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 indicating the month, day, and year of sample collection
- Time (military) of sample collection
- Sampler's initials
- Any 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 to protect from moisture. The CDM Smith field geologist will verify that the information recorded on the sample label is consistent with the information recorded on the CoC record. An example CoC is shown on Figure 6-1.

6.3 Sample Container Filling

Sample container filling will be performed according to SOP 2, 3, 4, and 5 (Appendix D). Soil collected for VOCs, 1,4-dioxane, and TPH-GRO will be collected in EnCore® samplers (see Section 5.2.3 for VOC sample handling procedures) in all instances. Surface soil collected for all analyses will be collected in stainless steel sleeves.

All subsurface soil will be initially collected in acetate sleeves. Soil for VOCs, 1,4-dioxane, and TPH-GRO analyses will be collected from the sleeve using an EnCore® sampler. Subsurface soil for SVOC, PAH, and PCB/PCT analyses will be removed from the acetate sleeve in a manner causing minimal soil disturbance and placed into the appropriately sized glass jars. Soil for all other analyses will also be placed into appropriately sized glass jars. All sample volumes will be based on the analytical laboratories needs to address the detection limit requirements of this investigation. The nominal number and type of containers needed for samples are presented in Table 6-1. The number and volume (size) of containers is laboratory dependent and will be provided in the FSP addenda.

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, sealed, and placed in a cooler containing ice. Laboratory homogenization of Phase 3 soil samples is described in SOP 17 (Appendix D).

6.4 Sample Handling

Sample handling is described in SOPs 10 and 11. To verify that samples undergoing shipment meet the definition of "environmental sample" and are not a hazardous material defined by the Department of Transportation, a Ludlum Model 2360 Radiation Monitor with a 43-89 Dual Phosphor Alpha/Beta Scintillation Detector (or equivalent) and a gamma radiation monitor (e.g., Ludlum Model 19 or Model 192 Micro R meter – or equivalent) will be used to screen each soil core at collection and prior to shipping to identify potential radiological activity. Professional judgment and/or consultation with qualified persons such as the appropriate H&S coordinator or the H&S manager shall be observed.

6.5 Sample Preservation

6.5.1 Soil

Soil samples will be maintained at a temperature of 4 degrees Celsuis (°C) with an acceptable range between 2 and 6°C. Soil samples for VOC analyses collected using an EnCore® sampler are required to be preserved by the laboratory within 48 hours of collection.

6.5.2 Water

Aqueous samples (equipment rinsate and trip blanks) 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 with an acceptable range between 2 and 6°C.

6.6 Sample Documentation

Sample documentation will be performed according to SOP 8, 9, and 10 (Appendix D). Sample documentation will be tracked on CoC 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

Sample custody establishes a method for maintaining custody of samples through use of a CoC record. Procedures detailed in SOP 10 will be followed for all samples collected or split samples accepted.

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 CDM Smith and managed in accordance to Section 6.9. Equipment decontamination will be performed according to SOP 12 (Appendix D).

Any deviations to the SOP will be noted in the CDM Smith field logbooks.

6.9 Investigation-Derived Waste Management

CDM Smith will generate IDW consisting predominately of personal protective equipment (i.e., nitrile gloves), paper towels, polyethylene sheeting, and used decontamination fluids. Soil IDW is not anticipated as the void space in each borehole will be filled with the drill cuttings and covered with hydrated bentonite chips prior to moving to the next sampling location. CDM Smith will dispose of personal protective equipment as solid waste off site. Used decontamination fluids will be stored in appropriate containers (e.g., 55-gallon drums) at a pre-designated staging area at SSFL. The fluids will be analyzed by the laboratory prior to being disposed off site by a disposal vendor. IDW handling will be performed according to SOP 13 (Appendix D).

6.10 Field Measurements of Soil Samples

Field measurements associated with soil sampling activities include gamma scanning of soils to identify potential gamma radiation hazards, and PID measurements of soils to identify potential hazards from VOCs.

6.10.1 Gamma Scanning of Soil Samples

Radiological scanning of soil samples will be performed according to SOP 7 (Appendix D). During the collection of surface soil samples a Ludlum MicroR Detector will be used to monitor for potential gamma radiation. The monitoring will mainly be conducted for health and safety of field workers.

During the collection of subsurface soil samples, a Ludlum 2360 Radiation Monitor with a 43-89 Dual Phosphor Alpha/Beta Scintillation Detector (or equivalent) and a gamma radiation monitor (e.g., Ludlum Model 19 or Model 192 Micro R meter – or equivalent) will be used to screen each soil core to identify potential radiological activity. Readings will be recorded in the field logbook and will be evaluated in the field to determine if there is a hazardous condition for field or laboratory workers.

6.10.2 Photoionization Detector Measurements

VOC vapor measurements will be performed according to SOP 6 (Appendix D). A PID will be used to perform measurement of VOC vapors in surface soil and subsurface soil cores. Measurements of the soil cores will be made every 6 inches. PID concentrations will be recorded in the field logbooks. Positive PID readings will be evaluated in the field to determine if there is a hazardous condition for field or laboratory workers, or an indication of potential subsurface chemical contamination.

CDM Smith (LAB COPY) **Chain of Custody** **No:**

DateShipped:
CarrierName:
AirbillNo:

Site #:
Project Code:
Cooler #:

Lab:
Lab Contact:
Lab Phone:

Sample #	Matrix/Sampler	Coll. Method	Analysis/Turnaround	Tag/Preservative/Bottles	Station Location	Collected		For Lab Use Only

Special Instructions:	**Shipment for Case Complete? N**
	Samples Transferred From Chain of Custody #

Items/Reason	Relinquished by	Date	Received by	Date	Time		Items/Reason	Relinquished By	Date	Received by	Date	Tim

Figure 6-1

Section 7

Quality Control Criteria

The field QA program has been designed in accordance with *CDM's Quality Assurance Manual, Revision 11* (CDM Smith 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 CDM Smith project manager (PM), 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 ELAP. The samples collected during this investigation may be analyzed using any of 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).

Analytical method reporting limits will be based on the ISLs. Analytical method reporting limits are provided in the QAPP. In addition to the standard analyte list of the methods described below, three tentatively identified compounds (TICs) will be requested of the laboratory under the SVOC analyses (EPA Method 8270 C) (see Section 7.1.4).

7.1.1 Volatile Organic Compounds

Soil samples may be analyzed for VOCs and 1,4-dioxane using EPA Method 8260B and 8260B Selective Ion Monitoring (SIM), respectively.

7.1.2 Metals

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

7.1.3 Fluoride and Nitrate

Soil samples may be analyzed for fluoride and/or nitrate using EPA Method 300.0.

7.1.4 Semi-Volatile Organic Compounds

Soil samples may be analyzed for SVOCs (including N-Nitrosodimethylamine) using EPA Method 8270C. In addition to the standard analyte list, three TICs will be requested: tetralin, 2-phenoxyethanol, and 2-butoxyethanol.

7.1.5 Polycyclic Aromatic Hydrocarbons

Soil samples may be analyzed for PAHs using EPA Method 8270 modified for SIM.

7.1.6 Polychlorinated Biphenyls and Triphenyls

Soil samples may be analyzed for PCBs and PCTs using EPA Method 8082.

7.1.7 Dioxins/Furans

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

7.1.8 Perchlorate

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

7.1.9 Total Petroleum Hydrocarbons

Soil samples may be analyzed for TPH-GRO and TPH as extractable fuel hydrocarbons (TPH-EFH) using EPA Method 8015B.

7.1.10 Formaldehyde

Soil samples may be analyzed for formaldehyde using EPA Method 8315A.

7.1.11 Cyanide

Soil samples may be analyzed for cyanide using EPA Method 8012B.

7.1.12 Energetics

Soil samples may be analyzed for energetics by EPA Method 8330A.

7.1.13 Methyl Mercury

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

7.1.14 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/or TPH-GRO. These field QC samples are also discussed in the QAPP.

7.2.1 Field Duplicate

Soil duplicates will be collected in separate containers, but from the same location as the original parent samples. The duplicate samples will be analyzed as a separate sample from the parent 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 20 primary soil samples.

7.2.2 Equipment Rinsate Blank

An equipment rinsate blank will be prepared and submitted for analysis on a weekly basis 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 the American Standards for Testing and Measurement (ASTM) Type II 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 is a sealed container that contains target analyte-free water shipped by the laboratory to the site. One trip blank will be submitted in each cooler that contains soil samples to be analyzed for VOCs, 1,4-dioxane, and/or TPH-GRO. This QC sample serves as a check for cross-contamination of VOCs.

7.2.4 Source Blank

A source blank consists of the 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 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 (2 to 6°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. Laboratory QC results will be included in the data package.

The types of QC spike samples the laboratory will use include laboratory control samples (or method blank spikes), MS/MSD, and surrogates. 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.

Detailed information pertaining to laboratory QC can be found the QAPP.

Section 8

Instruments/Equipment and Supplies

8.1 Field Instruments/Equipment

All field instruments/equipment will be calibrated and tested in accordance with SOPs or manufacturer's specifications, as applicable. CDM Smith will maintain all field instruments and equipment on site. CDM Smith will maintain documentation of its calibration and maintenance activities. Control of measurement and test equipment will be performed according to SOP 16 (Appendix D).

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.

Section 9

Special Training and Certification

All CDM Smith field personnel who enter the exclusion zone to observe or handle samples will be required to demonstrate successful completion of H&S training prescribed by 29 CFR 1910.120, also known as Hazardous Waste Operations and Emergency Response (HAZWOPER) regulations. All employees and subcontractor personnel who have a need to enter the exclusion zone will have completed 40 hours of HAZWOPER instruction in addition to 8 hours of refresher training on a yearly basis. Minimum course requirements included in the HAZWOPER training is described in the WSHP. All site personnel engaged in non-intrusive activities (e.g., archaeological or biological monitors) will have at least 16 hours of site-specific orientation and safety training.

All field personnel regardless of activity will be required to read and understand the procedures described in this Master FSP before beginning field work. The CDM Smith FTL will conduct a project quality management meeting with the entire project team and a field planning meeting with all field personnel prior to commencement of field work to discuss the understanding of the Master FSP.

All samples will be submitted to DTSC-approved laboratories that have been certified by the State of California through the ELAP for the methods that California certifies.

Section 10

Documentation and Records

FSP addenda, Technical Memoranda (Chemical Sampling Results), and Data Usability Assessment Reports will be developed and maintained for this project. CDM Smith'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 PDF format; however, Microsoft Word, Microsoft Excel for certain tables, and GIS format figures are available upon request from DOE.

10.1 Field Logbook and Records

Field logbooks will be controlled according to SOP 8 (Appendix D). A permanently bound and consecutively paginated field logbook will be maintained daily by the CDM Smith 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.

The CDM Smith FTL is responsible for ensuring that the format and content of data entries are in accordance with this procedure. The FTL 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 FTL 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 Smith FTL.

Entries into the field logbook 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.

To guard against loss of data as a result of damage or disappearance of logbooks, completed pages shall be photocopied daily and forwarded to the field or project office. Other field records (e.g., soil boring logs) shall be photocopied and submitted weekly, as requested.

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 FTL.

The onsite field geologist working under the supervision of a California registered geologist will prepare detailed boring logs in accordance with CDM Smith's SOPs (Appendix D).

10.2 Photographs

Photographs will be collected according to SOP 15 (Appendix D). Photographs may be taken at the site to visually document field activities and site features, as needed. 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 Smith. 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 Smith at offsite storage for a minimum of 10 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 semicolon-delimited text file submittal requirements specified in the extended electronic data deliverable specification within 30 days of receiving all data validation reports.

Section 11

Assessment and Oversight

11.1 All Planned Project Assessments

Prior to initiating field work, a Field Planning Meeting will be held 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 PM 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 Smith QA Director, who reports directly to the CDM Smith president. Quality Procedure 6.2, as defined in the CDM Smith Quality Assurance Manual, defines CDM Smith's corporate assessments procedures and requirements.

11.1.1 Field Assessments

At the start of field work, the PM or FTL 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 Master FSP. The PM or FTL 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 Smith field work and subcontractor work activities by an authorized CDM Smith 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 Smith QA Director. The PM and/or FTL 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 Smith’s QA Manual (CDM 2007).

DOE and DTSC staff will have the opportunity to review site activities and verify that the procedures described in planning documents such as the Master FSP 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, as described in the QAPP Section 11.3.

CDM Smith chemists will perform a 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 this Master FSP are being followed. If the CDM

Smith 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 PM and/or FTL 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 (CAR) (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 Smith'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 Smith PM.

Major rapid response actions taken in the field will require notification (within 24 hours) and approval by the DOE PM, DTSC PM, CDM Smith QA/Coordinator, and CDM Smith PM 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 CAR form (see Figure 11-2). The CAR will be initiated by the person identifying the problem and forwarded to the CDM Smith QA/Coordinator within 48 hours of identifying the problem. In consultation with the CDM Smith QA Director, the CDM Smith QA/ Coordinator will be responsible for investigating and following up on the quality problem; the timeframe for response will be determined by the CDM Smith QA/Coordinator based on the specific quality problem.

The DOE PM will approve any major response actions in writing.

11.3 Reports to Management

During active months of the project, CDM Smith will schedule, at a minimum, monthly phone calls with the DOE and DTSC PMs 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 on field data sheets. The CDM Smith PM will inform the CDM Smith QA/ Coordinator upon encountering quality issues that cannot be immediately corrected. Monthly QA reports will be submitted to CDM Smith's QA Director by the CDM Smith QA/Coordinator. These reports will be provided upon request of the DOE PM.

The measurement report (to be prepared by CDM Smith) will contain a QA section that will discuss adherence to governing documents, extent to which DQOs were met, deviations from the Master FSP, 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 SMITH 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?

II. PRE-PLANNING

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

B. Have other necessary documents been assembled (Client SOPs, CDM Smith 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 Smith SOP requirements, or other applicable client requirements?

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

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 Smith project manager?

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

Figure 11-2 Corrective Action Request From

CAR No. ______________

CDM SMITH 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: ______________

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 details associated with data review process are presented in the QAPP.

12.1 Field Record Verification

Data verification consists of a completeness review that is performed to ensure that required information is available. This information is the presented in QAPP Section 13.

12.2 Laboratory Data Verification

Data verification consists of a completeness review that is performed to ensure that required information is available. This information is the presented in QAPP Section 13.

12.3 Data Validation

The data validation process consists of two steps. 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 Master FSP and data validation guidance. Several validation inputs will be examined. This information is the presented in QAPP Section 13.

12.4 Data Usability Assessment

The data usability assessment will be performed on the validated data by a team of personnel at CDM Smith under the responsibility of the PM. 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. This information is the presented in QAPP Section 13.

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. This information is the presented in QAPP Section 13.

12.4.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent:

- A characteristic of a population
- Parameter variations at a sampling point
- 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. This information is the presented in QAPP Section 13.

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. 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 percent 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. This information is the presented in QAPP Section 13.

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. This information is the presented in QAPP Section 13.

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 MDL 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. This information is the presented in QAPP Section 13.

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 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 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
FSAP	All planning documents (including the 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 Smith.	Internal and External	Subcontracted analytical laboratory and data validators

Section 13

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