Appendix D

Technical Standard Operating Procedures (SOPs) for the SSFL Phase 3 Sampling

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# Procedures for Locating and Clearing Phase 3 Samples

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<td>QA Review: J. Oxford</td>
<td>Approved and issued: Signature/Date</td>
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## 1.0 Objective

The objective of this technical standard operating procedure (SOP) is to describe the sample location and utility clearance protocols for the Phase 3 - Chemical Data Gap Investigation at the Santa Susana Field Laboratory (SSFL) site. Because this phase of investigation is targeted at minimizing data gaps in the understanding of the nature and extent of chemical contaminants in surface (0 to 0.5 foot) and subsurface (0.5 to 20 feet) soil, the precise location of each soil sample location is very important.

## 2.0 Background

### 2.1 Definitions

**Data Gap Analysis**—An analysis that identifies specific soil sample locations and depths for which insufficient data exists. The analysis is to minimize the data gap and ensure that collected data are representative of the study area. MWH, Inc. (MWH; under a separate agreement with Department of Energy [DOE]) is performing this effort.

**Staked Location**—Proposed sample location marked on the ground surface either with fluorescent paint (on concrete or asphalt), metal pins with fluorescent nylon whiskers, or wooden stakes marked with the sample location identifier installed at the exact sample locations identified through the MWH data gap analysis.

**GPS**—Global Positioning System that measures east-west and north-south coordinates of sample locations.

**GeoExplorer 6000 Series Handheld Unit**—GPS field unit used to survey proposed and actual sample locations.

**Utility Locate**—A survey of all proposed sample locations for underground utilities, including, but not limited to, water lines, sewer lines, storm sewer lines, gas lines, electric lines, and telecommunication lines. Performed by subcontractor.

**Fisher TW-6-M-Scope Pipe and Cable Locator (or equivalent)**—A field unit used to identify detectable electrically conductive conduits or piping which may have no surface expression.

**Radiodetection RD4000 Utility Locator (or equivalent)**—A field unit used to locate the surface trace of a variety of buried utilities.

**Metrotech 50/60 Power Line Locator (or equivalent)**—A field unit used to detect conduits that carry 60-cycle current.

**3M Dynatel 2250 Cable Locator (or equivalent)**—A field unit used to detect the surface trace of telephone and other narrow gauge wiring.

### 2.2 Associated Procedures

- SSFL SOP 2, *Surface Soil Sampling*
- SSFL SOP 3, *Subsurface Soil Sampling with Hand Auger*
- SSFL SOP 4, *Direct Push Technology (DPT) Sampling*
- SSFL SOP 5, *Backhoe Trenching/Test Pits for Sample Collection*
- SSFL SOP 6, *Field Measurement of Total Organic Vapor*
- SSFL SOP 7, *Field Measurement of Residual Radiation*
- SSFL SOP 8, *Field Data Collection Documents, Content, and Control*
- SSFL SOP 14, *Geophysical Survey*
2.3 Discussion
Geographic Information System (GIS) sample location files will be received from MWH for field verification and those locations staked using global GPS location identification procedures. Office and field verification of GPS coordinates is necessary for determining the precise location of each sample point and to ensure the adequacy of signal strength of the GPS equipment. Inaccessible locations due to underground utilities, site geology, or that do not target the identified site will be assigned alternate locations by CDM Smith. Using GPS, site coordinate data will be collected at the alternative location and the updated surveyed location data will be electronically provided to MWH for updating the Area IV GIS. All proposed sample locations will be marked in the field using fluorescent paint, metal pins, or wooden stakes. Following MWH review of the relocated marked sample locations, CDM Smith will complete any additional required utility/geophysics clearances of the sample location and initiate sampling. In addition, protection of cultural and natural resources is an integral portion of locating sample points. Cultural, biological, and Native American monitors will be engaged throughout the process. Quality control measures will be implemented during GPS field collection and during post processing of confirmed or relocated sample locations.

3.0 General Responsibilities
Field Team Leader - The field team leader (FTL) is responsible for ensuring that field personnel collect soil and sediment samples in accordance with this SOP and other relevant procedures.

Site Health and Safety Technician – The person who will use field screening instruments to monitor all field activities for VOCs and radiological contaminants and pre-shipment sample coolers. This person is a trained radiological technician who works under the guidance of Science Application International Corporation’s (SAIC’s) Certified Health Physicist (CHP).

Site Geologist – The person responsible for attending sample location efforts and collecting and logging the soil sample.

Utility Locator Subcontractor – The subcontractor is responsible for identifying all buried utilities in the vicinity of soil borings, trenches, and test pits.

4.0 Required Equipment
4.1 General
- Site-specific plans (e.g., Field Sampling Plan [FSP] Addendum, health and safety)
- Mapping of proposed sample locations
- Mapping of known utilities
- Fluorescent paint and metal pins or wooden stakes
- Field logbook
- 2-way radios
- Monitoring and screening instruments per the health and safety plan

- 3M Dynatel 2250 Cable Locator (or equivalent) to detect the surface trace of telephone and other narrow gauge wiring
- Fisher TW-6-M-Scope Pipe and Cable Locator (or equivalent)
- Radiodetection RD4000 Utility Locator (or equivalent)
- Metrotech 50/60 Power Line Locator (or equivalent) to detect conduits that carry 60-cycle current
- GeoExplorer 6000 Series Handheld GPS Unit
- Sample rationale table (Table 1 of FSP Addendum)

5.0 Procedures
5.1 Field Staking
1. MWH provides specific data gap sample location information (i.e., GIS coordinates, map, and table) to CDM Smith for field use. The sample information includes:
   - Sample rationale (sampling objective)
   - Sample location
   - Depth interval
   - Analytical suite
2. The figures showing proposed sample locations are provided to the cultural, biological, and Native American monitors in advance of field verification so they can review their records for any cultural or biological resources in the vicinity of the sampling areas.

3. A minimum of four working days advanced notice of field work is required for the cultural and biological resource reviews. CDM Smith will meet with the monitors to discuss concerns. Sample locations in areas of resource concern are reported back to CDM Smith and revised sample locations are discussed with DOE, the California Department of Toxic Substances Control (DTSC) and MWH.

4. Once all locations have been reviewed, the GIS sample location coordinates are loaded into the GPS (See Section 5.2) for field staking.

5. CDM Smith’s Sample Location Team mobilizes to each proposed sampling location. This Team consists of:
   - CDM Smith’s FTL/Geologist
   - CDM Smith Site Health and Safety Technician
   - Utility Location Technician
   - Science Applications International Corporation’s (SAIC’s) Archaeological/Cultural Resource Compliance representative
   - SAIC’s Natural Resource Compliance representative
   - Native American monitor

6. The FTL locates each sample station using the GPS. The FTL verifies that the location addresses the sampling rationale stated for the location in the FSP Addendum (Table 1). If it does, the location is marked with fluorescent paint and metal pins with fluorescent nylon whiskers or wooden stakes at the precise GIS/GPS coordinates.

7. If the location is identified by the cultural, natural resource, or Native American monitor as a location of concern, they will demarcate restricted areas as necessary and determine the degree of support necessary for each sample location during the intrusive investigation (soil boring or excavation). Each proposed sample location is also preliminarily screened for radiation.

8. Once staked, the FTL will escort the subcontract utility locator (See Section 5.3) to clear all proposed sample locations for underground utilities. Samples locations affected by underground utilities will be noted, and an alternative location staked to avoid the utility. All adjusted sample locations will be reviewed with DOE, DTSC, and MWH; and the cultural and natural resource, and Native American monitors.

9. Proposed locations may be adjusted based on the following considerations:
   - sample locations that are impacted by overhead/underground utilities
   - sample locations that are impacted by steep or non-accessible terrain or exposed bedrock
   - sample locations that are impacted by archaeological/cultural resources
   - sample locations that are impacted by biological resources
   - sample locations that did not meet the intent of the MWH sample rationale

10. Using the final GPS coordinates, CDM Smith will provide the updated the sample location data to MWH for updating the Area IV GIS. A revised sample location map will be incorporated into the FSP Addendum and provided to DOE and DTSC.

11. DOE, DTSC, and MWH will have the opportunity to review all sample locations in the field and approve/accept the locations. Locations noted to be impacted or not meeting the intent of the sample collection rationale will be reviewed and direction will be provided to the FTL. Coordinates for adjusted samples locations will be immediately collected using the GPS unit and marked in the field as described above. Markers/paint of samples locations that will not be used will be destroyed at that time.

12. At each location, additional field-check of the sample location (coordinates) will be performed using the GPS unit at the time of sample collection.
5.2 GPS Survey

5.2.1 General
The following equipment is required to load and use GPS waypoint data for field surveys.
- ESRI ArcGIS Software
- Trimble Pathfinder Office Software
- TerraSync Software
- GeoExplorer 6000 Series Handheld Unit

The procedure to load and use GPS data consists of:

1. Load 2009 U.S. Department of Agriculture (USDA) National Agricultural Imagery Program (NAIP) color imagery onto GPS with the Pathfinder Office data transfer utility

2. Prepare GPS unit for data logging based on Chapter 9 (Setup Section) in “TerraSync Software Getting Started Guide”, which are as follows:
   a. 2.0 meter antenna height
   b. 30 positions logged and averaged for each collected sample location
   c. Required accuracy < 1.0 meter
   d. Quality of Global Navigation Satellite Systems (GNSS) positions logged will be controlled by the Trimble default “Smart Settings” referenced on page 181 of Chapter 9 of the Software Guide.

5.2.1 Method for Importing Sample Point Location Data
The following steps are used to load the data to the TerraSync software and should be done prior to navigating to a point (Chapters 5 and 6 of “TerraSync Software Getting Started Guide” can be referenced for further help):

1. Open TerraSync software on GPS unit and select ‘Data’ in the section list button
2. Tap ‘Manager – Existing File’
3. Select ‘MWH_SampleLoc.ssf’
4. Select ‘Map’ in the section list button
5. Tap ‘Layers – Background Files’
6. Check the box next to ‘SSFL_Aerial.sid’ and return to map view
7. Current location is denoted by a red x and the points on the map represent the MWH chosen sample locations.

The following steps must be taken to navigate to a given point (Chapter 7 of “TerraSync Software Getting Started Guide” can be referenced for further help):

1. Walk toward the nearest sample location with the FSP Addendum mapping and aerial photo as a reference
2. Select the point with the ‘select’ tool from the map tool dropdown list
3. Tap ‘Options – Set Nav Target’
4. Determine distance and bearing to target through the direction dial screen
5. A close-up screen will appear once target is within close proximity
6. Move toward the target and stop when the red x is within the center of the circle
Procedures for Locating and Clearing Phase 3 Samples

7. Place the sample location pin or wooden stake at the base of the antenna

5.2.2 Coordinate Collection for Revised Sample Locations

The following steps will be taken to survey revised sample locations where the proposed location was deemed inaccessible due to underground utilities or the presence of archaeological/cultural, natural resource, or Native American considerations. CDM Smith will determine an alternate location for the sample and the coordinate data set will be updated using the GPS unit (Chapter 6 of ‘TerraSync Software Getting Started Guide’ can be reference for further help):

1. Select ‘Data’ in the section list button
2. Select ‘Update’ from the sub-section list button
3. Tap ‘Options – Logging Options’ and confirm it is set to ‘Update Feature (Replace)’
4. Return to the update features screen and select the sample location you intend to modify from the ‘Choose Feature’ list

5.2.3 Quality Assurance/Quality Control

Proper operation of the GPS unit will be demonstrated prior to and at the conclusion of each day’s field activity. The following two permanent survey control points located within the SSFL Area IV will used to confirm the accuracy of the GPS unit:

<table>
<thead>
<tr>
<th>Permanent Survey Control Point</th>
<th>Northing</th>
<th>Easting</th>
<th>Elevation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set 2x2 w/ MG Tag #1</td>
<td>1907959.668000</td>
<td>6346660.571000</td>
<td>1825.270</td>
</tr>
<tr>
<td>Set 2x2 w/ MG Tag #2</td>
<td>1909915.202000</td>
<td>6350452.377000</td>
<td>1854.230</td>
</tr>
<tr>
<td>Set 1-in Pipe w/ MG Plastic Cap #3</td>
<td>1906485.748000</td>
<td>6344437.803000</td>
<td>1870.060</td>
</tr>
<tr>
<td>Set 1-in Pipe w/ MG Plastic Cap #4</td>
<td>1905107.447000</td>
<td>6344791.648000</td>
<td>2134.570</td>
</tr>
<tr>
<td>Set 1-in Pipe w/ MG Plastic Cap #5</td>
<td>1908215.335000</td>
<td>6348977.693000</td>
<td>1816.780</td>
</tr>
</tbody>
</table>

At the beginning and end of day, the GPS unit will be positioned directly over the Control Point and the coordinates recorded in the GPS unit. The GPS coordinates will be compared to the above stated survey control point coordinates. If comparison of the coordinates is within the acceptable required accuracy (< 1.0 meter) of the instrument, the GPS unit is locating properly and this information will be recorded in the logbook. If the coordinates are outside of the acceptable required accuracy (< 1.0 meter), then the SSFL SOP 16 should be consulted. Generally, if any field equipment fails to operate properly or provides inaccurate results, the field work will be temporarily suspended and the concern will be entered on the calibration log form and field logbook (SSFL SOP 8). Work will not resume until proper calibration is achieved or replacement equipment is received.

5.3 Utility Location and Clearance

Prior to survey activities, all subcontractor equipment will be inspected by the FTL to ensure that the equipment meets Occupational Safety and Health Act (OSHA) or other contract or SSFL health and safety requirements. Following inspection, the utility locate survey will be conducted by the utility locator subcontractor:

1. Review GIS mapping of known utilities for utility types in vicinity of each proposed sampling location.
2. Using the geophysical instrumentation, search and mark on the ground the identified underground utilities, including, but not limited to, water lines, sewer lines, storm sewer lines, gas lines, electric lines, and telecommunication lines within a 10-foot radius of the sample location. Verify the proximity of any buried natural gas lines within 25-feet of the sampling point.
3. Search and mark, if identified, any anomalies representing potential subsurface structures or obstructions (such as, but not limited to, boulders, rebar, underground storage tanks, sinkholes, voids, buried artifacts, concrete pipes, etc.).
Where possible, the concrete slab thickness shall also be estimated.

4. Additional soil boring/test pit utility clearing of all locations within a 10-foot radius of an identified utility or anomaly. Any identified utilities and anomalies shall be marked on the ground surface, on a hand-drawn sketch, and on a scaled site map. **Note:** All test pit excavations require coordination and onsite oversight of the cultural, natural resource, and Native American monitors.

5. Provide field notes, hand-drawn sketches and scaled maps of each survey location to the FTL at the conclusion of each day. CDM Smith will make available to the subcontractor scaled base maps for the site.

All known surface and subsurface utilities located within the Area IV GIS will be used, in part, to determine the level of effort for clearing individual boring/test pit locations in (a) non-developed areas and (b) developed or previously developed areas or areas with known utilities. These areas and effort are discussed below.

### 5.3.1 Non-Developed Areas

The utility subcontractor will perform a reconnaissance survey of all areas that have no historic record of development and are absent of known utilities (as illustrated by the Area IV GIS). The subcontractor will physically inspect all or a portion of the area as necessary to provide assurance that the area does not contain utilities. The subcontractor will determine the identification method and effort necessary and communicate this information to the FTL prior to commencing sampling activities in those areas. Following approval from the FTL or geologist, the utility subcontractor will clear soil boring/test pit locations. The utility subcontractor will mark utilities/features on the ground within the designated areas using a color code established by the American Public Works Association (and provided by the subcontractor).

### 5.3.2 Developed Areas and Areas with Known Utilities

In developed areas, the exteriors of the buildings, curbsides, streets, and/or land where building demolishing and dismantling activities have taken place, the utility subcontractor will visually inspect proposed sample/test pit locations for evidence of utilities. Exposed tracer wire or portions of metallic conduits and pipe will be used to conduct a signal with the instrument appropriate for a given type of utility. All utilities/features identified using conductive signals will be marked on the ground within the designated areas using a color code established by the American Public Works Association (and provided by the subcontractor).

The utility subcontractor will physically inspect all or a portion of the proposed sampling/test pit area as necessary to provide assurance that the area does not contain utilities and to identify any surface features (depressions, pits, trenches, etc.) or anomaly representing potential subsurface structures or obstructions (such as, but not limited to, boulders, rebar, underground storage tanks, voids, buried artifacts, concrete pipes, etc.).

For areas where soil borings are located within 10 feet, and test pits are within 50 feet, of an identified utility or identified subsurface features or anomaly, additional clearing of the soil boring/test pit location will be required. The utility subcontractor will provide additional clearing activities at these locations as described below.

Equipment/instruments that do not use an induced current via pipe/conduit/wire will be swept over the ground surface within the designated clearance area. The signals will be traced at the surface and the underground utility or features will be delineated.

At a minimum, two 20-foot transects that are perpendicular to each other will be run within the diameter of each survey area. The transects will be centered on the boring/test pit location. Any surface features and anomaly representing potential subsurface structures or obstructions shall be identified and marked as appropriate. Where possible, the concrete slab thickness shall also be estimated.

### 5.4 Onsite Equipment and Vehicle Requirements

All equipment will be cleaned prior to entering and leaving SSFL. Vehicles are restricted to asphalt roads and parking lots and will be free of leaks. If vehicles or any equipment is leaking it will be taken out of service immediately and the fluids will be contained. Under CDM Smith’s direction, the subcontractor will immediately clean up any petroleum or hydrocarbon fluid spills. Boeing, DOE, and DTSC will be immediately notified of any spills at the site.
6.0 Restrictions/Limitations

6.1 GPS Survey Instruments

External factors with the potential to degrade the quality of GPS data and the locating capabilities of the GPS are inherent within the GPS environment. A low signal to noise ratio (SNR), a high Position Dilution of Precision (PDOP), a multipath (GPS signal hits a physical barrier, thus reducing reflectivity), and a changing satellite constellation can all impact the quality of the GPS data. Because the equipment and logging settings are pre-determined for this project, inaccurate data due to the aforementioned external factors and potential human input errors should be minimized. The quality control procedures outlined in Section 5.2.3 will be followed to reduce GPS data quality issues/concerns.

7.0 References


1.0 Objective
The purpose of this technical standard operating procedure (SOP) is to define the general techniques and requirements for the collection of surface soil samples at the Santa Susana Field Laboratory (SSFL) site.

2.0 Background
2.1 Definitions
Grab Sample - A discrete portion of soil or an aliquot taken from a specific sample location at a given point in time.

Slide Hammer- A sampling tool used to drive and retract a 6-inch long thin-walled stainless steel sample collection sleeve (approximately 2-inches in diameter).

Surface Soil- Soil that occurs at 0 to 6 inches below ground surface (bgs).

EnCore® Sampler- A single-use plastic sampling device, typically with a capacity of 5 grams, used to obtain undisturbed, unconsolidated material samples (e.g., soil) for laboratory analyses. The sampler is inserted into a metal T-handle and the open end of the sampler pushed directly into the soil.

2.2 Associated Procedures
- SSFL SOP 1, Procedures for Locating and Clearing Phase 3 Samples
- SSFL SOP 6, Field Measurement of Total Organic Vapors
- SSFL SOP 7, Field Measurement of Residual Radiation
- SSFL SOP 8, Field Data Collection Documents, Content, and Control
- SSFL SOP 9, Lithologic Logging
- SSFL SOP 10, Sample Custody
- SSFL SOP 11, Packaging and Shipping Environmental Samples
- SSFL SOP 12, Field Equipment Decontamination
- SSFL SOP 13, Guide to Handling Investigation Derived Waste
- SSFL SOP 15, Photographic Documentation of Field Activities
- SSFL SOP 16, Control of Measurement and Test Equipment

2.3 Discussion
Soil samples will be collected to determine the type(s) and level(s) of contamination in surface soil. All SOPs will be on hand with the field sampling team.

3.0 General Responsibilities
Field Team Leader - The field team leader (FTL) is responsible for ensuring that field personnel collect surface soil samples in accordance with this SOP.

Site Geologist – The person responsible for collecting and logging the soil sample.

Site Health and Safety Technician– The person who will use field screening instruments to monitor all field activities for VOCs and radiological contaminants and pre-shipment sample coolers. This person is a trained radiological technician who works under the guidance of Science Application International Corporation’s (SAIC’s) Certified Health Physicist (CHP).
4.0 Required Equipment

- Site-specific plans (including Field Sampling Plan [FSP] Addendum and health and safety plan)
- Insulated cooler
- Plastic zip-top bags
- Personal protective clothing and equipment
- Slide hammer with stainless steel sleeves
- EnCore samplers and T-handle
- Clear, waterproof tape
- Securely-sealed bags of ice
- Plastic sheeting
- Appropriate sample containers
- Global Positioning System (GPS) unit
- Trash Bags
- Monitoring/screening instruments required by health and safety plan
- Nitrile or other appropriate protective gloves
- Field logbook
- Indelible blue or black ink pen and/or marker
- Decontamination supplies
- Paper towels or Kim wipes
- Custody seals
- Chain of custody forms
- Sample labels
- Teflon squares and sleeve end caps
- 2-way radios
- Disposable plastic spoons and knives

5.0 Procedures

5.1 Preparation

The following steps must be followed when preparing for sample collection:

1. Review site-specific health and safety plan and project plans (FSP Addendum) before initiating sampling activity.
2. Don the appropriate personal protective clothing as specified in the site-specific health and safety plan.
3. Locate sampling location(s) in accordance with FSP Addendum and document pertinent information in the field logbook (SSFL SOP 8). Confirm GPS coordinates of each location (SSFL SOP 1).
4. Use clean (decontaminated) sampling tools to obtain sample material from each specified sample location.
5. Carefully remove stones, vegetation, debris, etc. from the ground surface in the sampling location area. Clear the sample location using a new and/or appropriately decontaminated tool as described to expose a fresh sampling surface.
6. The Site Health and Safety Technician will perform contaminant screening using hand-held instruments at each sample location before sampling and for each sample collected (SSFL SOPs 6 and 7). The most recent spoils materials will be segregated to minimize cross-contamination. The breathing zone and excavated materials will be monitored continuously. If levels are detected above health and safety plan action levels (HASP page 8), work will be temporarily discontinued. If radiation levels, exceed two times (2X) background levels (HASP page 8), the Department of Energy (DOE), The Boeing Company (Boeing), and the California Department of Toxic Substances Control (DTSC) will be contacted. Site work will not resume at that location until further guidance is provided by DOE or Boeing. Contact information is in the health and safety plan.

The following steps must be taken to prepare the slide hammer for sampling.

1. Obtain the slide hammer, sample tube with the shoe, and stainless steel liners.
2. Remove the sample tube shoe and insert a clean liner. Screw the shoe back onto the sample tube.
3. Screw the assembled sample tube onto the slide hammer.
4. After sampling, remove the sampling liner from the sample tube for sample collection.
5. Decontaminate the sample tube and shoe.

5.2 Sample Collection
The following general steps must be followed when collecting surface soil samples.

1. Wear new, clean gloves during handling of all sample containers and sampling devices. Change out gloves at each sampling location, or each time a new sample is to be collected, to avoid cross-contamination.

2. Document the sampling process by recording applicable information in the designated field logbook. Document any and all deviations from the SOPs and the sampling plan in the field logbook and include rationale for changes. See SSFL SOP 8 for guidance on entering information into field log books.

3. Because sampling for volatile organic compounds (VOCs) is not anticipated for most surface soil locations, the procedure for non-VOC sample collection is described first (Section 5.2.1). When sampling of VOCs is required (i.e., identified in Table 1 of FSP Addendum, observed stained soil, petroleum odor, or elevated photoionization detector [PID] reading) at any location, collect the required sample aliquot for volatile analyses (Section 5.2.2) first, as well as any other samples that may be degraded by aeration, followed by the collection of samples for other analyses.

5.2.1 Method for Collecting Samples for Nonvolatile Organic or Inorganic Compound Analyses
The requirements for collecting samples of surface soil for nonvolatile organic or inorganic analyses are as follows:

1. Use a clean slide hammer and decontaminated stainless steel sleeves to drive a sample from 0 to 6-inches bgs. Several sleeves may be required from this interval to collect the amount of surface soil to satisfy the analytical protocol (refer to Table 1 in the FSP Addendum). Quickly screen the open end of the sleeve and the sample borehole for VOCs and radioactivity (SSFL SOPs 6 and 7).

2. Collect subsamples for chromium (Cr\(^{3+}\)) and/or hexavalent chrome (Cr\(^{6+}\)) and/or pH from the center of the stainless steel sleeve into a glass jar using a disposable plastic spoon or knife. Ensure that the soil that was in contact with the sleeve is not collected in the jar.

3. Prior to capping the sleeve for the remaining non-volatile parameters, place a Teflon® cover sheets over each end of the sample. Secure the respective cap on each sample container immediately after collection. Label the sample sleeve with “top” and “bottom” designations.

4. Wipe the sample containers with a clean paper towel or Kimwipe to remove any residual soil from the sample container surface.

5. Fill out the sample label with the appropriate sample information (e.g., sample identification, date/time of sample collection, requested analyses) per FSP Addendum Table 1 and attach to sample sleeve.

6. Place sample containers in individual zip-top plastic bags and seal the bags. Place baggies onto ice in an insulated cooler to maintain at 4°C (±2°C).

7. Decontaminate all non-disposable sampling equipment in accordance with SSFL SOP 12.

5.2.2 Method for Collecting Soil Samples for Volatile Organic Compound Analysis
The following text contains the recommended SW-846 Test Method 5035 procedure for sampling and field preservation of soil samples for VOC analysis, which includes the EnCore™ Sampler Method for low-level VOC analyses.

1. When collecting grab sampling for VOC analysis, it is necessary to minimize sample disturbance and consequently minimize analyte loss.

2. Wear new, clean gloves during handling of all sample containers and sampling devices. Change out gloves at each
3. VOC samples shall be collected first as grab samples. After clearing sample site, use a clean slide hammer and decontaminated stainless steel sleeves to drive a sample from 0 to 6-inches bgs. EnCore samplers will be used to collect subsamples for the required analytical protocol (e.g., VOCs, 1,4-dioxane, and total petroleum hydrocarbons-gasoline range organics [TPH-GRO]). The VOC sample will be collected from the bottom of the 6-inch stainless steel sleeve. Several slide hammer samples (stainless steel liners) may be required at the location to obtain the required sample volume for all VOC samples.

4. Once the sleeve is retrieved, quickly screen the open end of the sleeve and the sample borehole for VOCs and radioactivity (SSFL SOPs 6 and 7).

5. Remove the EnCore sampler and cap from package and attach T-handle to sampler body. Ensure that the sampler is locked into the T-Handle before sampling.

6. Push the sampler into the freshly-exposed soil in the bottom of the sampler sleeve until the O-ring is visible within the hole on the side of the T-handle. If the O-ring is not visible within this window, then the sampler is not full.

7. Extract the sampler and wipe the sampler sides with a clean paper towel or Kimwipe so that the sampler cap can be tightly attached.

8. While still locked into the T-handle, push the sampler cap on the head of the sampler with a twisting motion to secure it to the sampler body.

9. Remove the sampler from the T-handle and rotate the sampler stem counterclockwise until the stem locks in place to retain the sample within the sampler body.

10. Repeat procedure for each of the remaining samplers.

11. When collecting soil samples using the EnCore Sampler Method, collection of soil for moisture content analysis is required. Results of the moisture analysis are used to adjust “wet” concentration results to “dry” concentrations to meet analytical method requirements. The moisture sample will be collected in a separate 4 oz. glass jar. Following EnCore sample collection (typically five samplers), fill one 4 oz. jar with soil from bottom of a stainless steel sleeve for moisture analysis using a disposable plastic spoon or knife.

12. After VOC and moisture sampling, discard the remaining soil within the stainless steel sleeves back into the borehole.

13. Complete the sample labels by filling in the appropriate information (e.g., sample identification, date and time of sample collection, and requested analyses [per FSP Addendum]) and secure the label to the container.

14. Store samples at 4°C (±2°C) until samples are delivered to the designated analytical laboratory. Determine sample holding times with the appropriate analytical laboratory. Samples must be shipped and delivered to the analytical laboratory for extraction within 48 hours.

15. Pack all samples per SSFL SOP 11 and/or laboratory requirements. Include properly completed documentation and affix signed and dated custody seals to the cooler lid. See SSFL SOP 10 for guidance on sample custody procedures.

16. Decontaminate all non-disposable sampling equipment in accordance with SSFL SOP 12.

**Note**: A water trip blank will be included with sample coolers containing VOC samples.

### 5.2.3 Sample Packing and Shipment

1. Store samples at 4°C (±2°C) until samples are delivered to the designated analytical laboratory.
2. Pack all samples per SSFL SOP 11 and/or laboratory requirements. Include properly completed documentation and affix signed and dated custody seals to the cooler lid. See SSFL SOP 10 for guidance on sample custody procedures.

6.0 Restrictions/Limitations
Before conducting the soil sampling at each location, underground utilities and structures must be demarcated on the ground surface. In addition, archaeological and cultural resources as well as Native American cultural concerns must be cleared. A subcontractor will be used to locate and mark the utility lines. The selected sampling location shall be a safe distance from the demarcated utility. In some cases, records regarding utility locations may not exist.

Also, as presented in Section 5.2.2 of this SOP, when grab sampling for VOC analysis or other compound(s) that may be compromised by aeration, it is necessary to minimize sample disturbance and consequently minimize analyte loss. The representativeness of a VOC grab sample is difficult to determine because the collected sample represents a single point, is not homogenized, and has been disturbed.

7.0 References


1.0 Objective
The objective of this technical standard operating procedure (SOP) is to define the techniques and requirements for collecting shallow subsurface soil samples for environmental characterization purposes from the unconsolidated subsurface zone. The sampling techniques discussed in this SOP involve use of hand augers at the Santa Susana Field Laboratory (SSFL) site.

2.0 Background
2.1 Definitions
Slide Hammer- A drive tool is used to drive and retract a 6-inch long (and approximately 2 inches in diameter), thin-walled stainless steel sleeve.

Hand Auger - A stainless steel cylinder (bucket) approximately 3 to 4 inches (in) in diameter and 1 foot (ft) in length, open at both ends with the bottom edge designed to advance perpendicular to the ground surface with a twisting motion into unconsolidated subsurface material to obtain a soil sample. The auger has a T-shaped handle (fixed or ratchet used for manual operation) attached to the top of the bucket by extendable stainless steel rods.

EnCore® Sampler- A disposable plastic sampling device, typically with a capacity of 5 grams, used to obtain undisturbed, unconsolidated material samples (e.g., soil) for laboratory analyses. The sampler is inserted into a metal T-handle and the open end of the sampler pushed directly into the soil.

Subsurface Soil - The unconsolidated, or non-lithified, material that exists deeper than approximately 6 inches below the ground surface (bgs).

Unconsolidated Zone - A layer of non-lithified earth material (soil) that has no mineral cement or matrix binding its grains.

2.2 Associated Procedures
- SSFL SOP 1, Procedures for Locating and Clearing Phase 3 Samples
- SSFL SOP 6, Field Measurement of Total Organic Vapors
- SSFL SOP 7, Field Measurement of Residual Radiation
- SSFL SOP 8, Field Data Collection Documents, Content, and Control
- SFSL SOP 9, Lithologic Logging
- SSFL SOP 10, Sample Custody
- SSFL SOP 11, Packaging and Shipping Environmental Samples
- SSFL SOP 12, Field Equipment Decontamination
- SSFL SOP 13, Guide to Handling Investigation Derived Waste
- SSFL SOP 15, Photographic Documentation of Field Activities
- SSFL SOP 16, Control of Measurement and Test Equipment

2.3 Discussion
Subsurface soil samples, or those taken from depths below 6 inches, are collected using a hand auger to depths up to 10 ft bgs or bedrock refusal. Subsurface samples in locations inaccessible to a DPT rig will be collected by drilling using hand augers to the sample depth, and then sample collection from the auger hole using a slide hammer and stainless steel sleeves. The maximum depth of hand auger samples is typically 10 feet bgs. All sample locations and sample materials will be screened by the Site Health and Safety Technician using hand-help instruments. In addition, all SOPs will be on
3.0 General Responsibilities

Field Team Leader - The field team leader is responsible for ensuring that field personnel collect subsurface soil samples in accordance with this SOP.

Site Geologist – The person responsible for collecting and logging the soil sample.

Site Health and Safety Technician – The person who will use field screening instruments to monitor all field activities for VOCs and radiological contaminants and pre-shipment sample coolers. This person is a trained radiological technician who works under the guidance of Science Application International Corporation’s (SAIC’s) Certified Health Physicist (CHP).

4.0 Required Equipment

4.1 General

- Site-specific plans (e.g., Field Sampling Plan [FSP] Addendum, health and safety)
- Field logbook
- Appropriate sample containers
- EnCore samplers and T-handle
- Insulated cooler(s)
- Bags of ice
- Nitrile or appropriate gloves
- Clear, waterproof tape
- Indelible black ink pens and markers
- Slide hammer with stainless steel sleeves
- Global Positioning System (GPS) unit
- 2-way radios
- Monitoring/screening equipment per health and safety plan
- Personal protective clothing and equipment
- Plastic sheeting
- Plastic zip-top bags
- Chain-of-custody forms
- Custody seals
- Sample labels
- Decontamination supplies
- Kimwipes or paper towels
- Teflon squares and sleeve end caps
- Trash bags
- Disposable plastic spoons or knives

4.2 Manual (Hand) Auger Sampling

- T-handle
- Hand auger: extensions, bucket-, or tube-type auger as required by the site-specific plans
- Extension rods
- Wrench(es), pliers

5.0 Procedures

5.1 Preparation

1. Review site-specific health and safety plan and FSP Addendum before initiating sampling activity.

2. Don the appropriate personal protective clothing as indicated in the site-specific health and safety plan.

3. Locate sampling location(s) in accordance with FSP Addendum and document pertinent information in the appropriate field logbook (SSFL SOP 8). Confirm GPS coordinates of each location (SSFL SOP 1).

4. Use clean, (decontaminated) sampling tools to obtain sample material from each specified sample location.

5. Carefully remove stones, vegetation, debris, etc. from the ground surface in the sampling location area. Clear the sample location using a new and/or appropriately decontaminated tool as described to expose a fresh sampling surface.

6. The Site Health and Safety Technician will perform contaminant screening using hand-held instruments at each sample location before sampling and for each sample collected (SSFL SOPs 6 and 7). The most recent spoils materials will be segregated to minimize cross-contamination. The breathing zone and excavated materials will be monitored continuously. If levels are detected above health and safety plan action levels (HASP page 8), work will be temporarily discontinued. If radiation levels exceed two-times (2X) background levels (HASP page 8), the Department of Energy...
Subsurface Soil Sampling With Hand Auger

( DOE), The Boeing Company (Boeing), and the California Department of Toxic Substances Control (DTSC) will be contacted. Site work will not resume at that location until further guidance is provided by DOE or Boeing. Contact information is in the health and safety plan.

The following steps must be taken to prepare the slide hammer for sampling.

1. Obtain the slide hammer, sample tube with the shoe and stainless steel liners.
2. Remove the sample tube shoe and insert a clean liner. Screw the shoe back onto the sample tube.
3. Screw the assembled sample tube onto the slide hammer.
4. After sampling remove the sampling liner from the sample tube for sample collection.
5. Decontaminate the sample tube and shoe.

5.2 Sample Collection
The following general steps must be followed when collecting all subsurface soil samples. Soil samples will be preserved by placing the samples on ice.

1. Wear clean gloves during handling of sample containers and sampling devices. Change out gloves at each sampling location, or each time a new sample is to be collected, to avoid cross-contamination.
2. VOC samples or samples that may be degraded by aeration will be collected first and with the least disturbance possible to minimize sample disturbance and consequently minimize analyte loss.
3. While advancing the hand auger, the subsurface lithology shall be described according to SSFL SOP 9.
4. Specific sampling devices are identified in the FSP Addendum and will be recorded in the field logbook. Document any and all deviations from the SOPs and the sampling plan in the field logbook and include rationale for changes. See SSFL SOP 8 for guidance on entering information into field log books.
5. Care must be taken to prevent cross-contamination and misidentification of samples as described in subsequent subsections of this SOP.

5.2.1 Manual (Hand) Auger Sampling Using a Slide Hammer
The following steps must be followed when collecting environmental soil samples using a hand-auger and slide hammer:

1. Auger to the depth required for sampling, per the FSP Addendum. Place cuttings on plastic sheeting. If possible, lay out the cuttings in stratigraphic order.
2. During auger advancement and sample collection, record observations made of the geologic features of the soil or sediments per SSFL SOP 9.
3. Stop advancing the auger when the top of the specified sampling depth has been reached. Remove the auger from the hole and set aside for future decontamination (see line item 11 below).
4. Obtain the subsurface soil sample by driving the sample sleeve through the specified sample interval with the slide hammer. Remove the stainless steel liner from the slide hammer and quickly screen the sleeve for VOCs and radiation (SSFL SOPs 6 and 7).
5. Immediately subsample for VOCs (if required) by FSP Addendum Table 1, observe stained soil, petroleum odor, or elevated PID reading) by pushing the EnCore sampler into the soil in the bottom end of the sampling sleeve. See Section 5.2.2 and 5.2.3.
6. Proceed with additional sample depth collection as required by the FSP Addendum.

7. When sampling is complete, place cuttings back into the borehole and top off with bentonite pellets, as necessary, to bring former borehole to ground surface. Place plastic sheeting and gloves in garbage bag and transfer decontamination water to storage container as specified SSFL SOP 13.

8. Decontaminate all equipment between each sample according to SSFL SOP 12.

9. Complete the field logbook entry and other forms, being sure to record all relevant information before leaving the sample location.

10. Properly package all samples for shipment and complete all necessary sample shipment documentation. Remand custody of samples to the appropriate personnel. See SSFL SOPs 10 and 11.

5.2.2 Method for Collecting Soil Samples for Volatile Organic Compound Analysis

The following text contains the recommended SW-846 Test Method 5035 procedure for sampling and field preservation of soil samples for volatile organic compound (VOC) analysis, which includes the EnCore® Sampler Method for low-level VOC analyses.

1. When collecting grab sampling for VOC analysis, it is necessary to minimize sample disturbance and consequently minimize analyte loss.

2. Wear new, clean gloves during handling of sample containers and sampling devices. Change out gloves at each sampling location, or each time a new sample is to be collected, to avoid cross-contamination.

3. VOC samples shall be collected first as grab samples. EnCore samplers will be used to collect subsamples for the required analytical protocol (e.g., VOCs, 1,4-dioxane, and total petroleum hydrocarbon-gasoline range organics [TPH-GRO]) from sample sleeves collected at depth. The VOC sample will be collected from the bottom of the 6-inch stainless steel sleeve. Several slide hammer samples (stainless steel liners) may be required to obtain the required sample volume for all VOC analyses.

4. Once the sleeve is retrieved, quickly screen the open end of the sleeve and the sample borehole for VOCs and radioactivity (SSFL SOPs 6 and 7).

5. Remove EnCore sampler and cap from package and attach T-handle to sampler body. Ensure that the sampler is locked into the T-handle before sampling.

6. Push the sampler into the freshly-exposed soil in the bottom of the sampler sleeve until the O-ring is visible within the hole on the side of the T-handle. If the O-ring is not visible within this window, then the sampler is not full.

7. Extract the sampler and wipe the sampler sides with a clean paper towel or Kimwipe so that the sampler cap can be tightly attached.

8. While still locked into the T-handle, push the sampler cap on the head of the sampler with a twisting motion to secure it to the sampler body.

9. Remove the sampler from the T-handle and rotate the sampler stem counterclockwise until the stem locks in place to retain the sample within the sampler body.

10. Repeat procedure for each of the remaining samplers.

11. When collecting soil samples using the EnCore Sampler Method, collection of soil for moisture content analysis is required. Results of the moisture analysis are used to adjust “wet” concentration results to “dry” concentrations to meet analytical
method requirements. The moisture sample will be collected in a separate 4 oz. glass jar. After collecting the required number of EnCore samples (typically five), fill one 4 oz. jar with soil from bottom of stainless steel sleeve for moisture analysis using a disposable plastic spoon or knife.

12. After VOC and moisture sampling, discard the remaining soil within the stainless steel sleeves back into the borehole.

13. Complete the sample labels by filling in the appropriate information (e.g., sample identification, date and time of sample collection, and requested analyses [per FSP Addendum]) and securing the label to the container.

14. Store samples at 4°C (±2°C) until samples are delivered to the designated analytical laboratory. Determine sample holding times with the appropriate analytical laboratory. Samples must be shipped and delivered to the analytical laboratory for extraction within 48 hours.

15. Pack all samples per SSFL SOP 11 and/or laboratory requirements. Include properly completed documentation and affix signed and dated custody seals to the cooler lid. See SSFL SOP 10 for guidance on sample custody procedures.

16. Decontaminate all non-disposable sampling equipment in accordance with SSFL SOP 12.

**Note:** A water trip blank will be included with sample coolers containing VOC samples.

### 5.2.3 Method for Collecting Samples for Nonvolatile Organic or Inorganic Compound Analyses

The requirements for collecting samples of subsurface soil for nonvolatile organic or inorganic analyses are as follows:

1. Use a clean slide hammer and decontaminated stainless steel sleeves to drive a sample through a 6-inch interval at the prescribed depth. Several sleeves may be required from this interval to collect the necessary amount of subsurface soil to satisfy the analytical protocol (refer to sampling rationale Table 1 in the FSP Addendum). Quickly screen the open end of the sleeve and the sample borehole for VOCs and radioactivity (SSFL SOPs 6 and 7).

2. Collect sub samples for chromium (Cr\textsuperscript{3+}) and/or hexavalent chrome (Cr\textsuperscript{6+}) and or pH from the center of the stainless steel sleeve into a glass jar using a disposable plastic spoon or knife. Ensure that the soil that was in contact with the sleeve is not collected in the jar.

3. Prior to capping the sleeve for the remaining non-volatile parameters, place a Teflon® cover sheets over each end of the sample. Secure the respective cap on each sample container immediately after collection.

4. Label the sample sleeve with “top” and “bottom” designations.

5. Wipe the sample containers with a clean paper towel or Kimwipe to remove any residual soil from the sample container surface.

6. Fill out the sample label with the appropriate sample information (e.g., sample identification, date/time of sample collection, requested analyses) per FSP Addendum Table 1 and attach to sample sleeve.

7. Place sample containers in individual zip-top plastic bags and seal the bags. Place baggies onto ice in an insulated cooler to maintain at 4°C (±2°C).

8. Decontaminate all non-disposable sampling equipment in accordance with SSFL SOP 12.

### 5.2.4 Sample Packing and Shipment

1. Store samples at 4°C (±2°C) until samples are delivered to the designated analytical laboratory.

2. Pack all samples per SSFL SOP 11 and/or laboratory requirements. Include properly completed documentation and affix signed and dated custody seals to the cooler lid. See SSFL SOP 10 for guidance on sample custody procedures.
6.0 Restrictions/Limitations
Before conducting the soil sampling at each location, underground utilities and structures must be demarcated on the ground surface. In addition, archeological and cultural resources as well as Native American cultural concerns must be cleared. A subcontractor will be used to locate and mark the utility lines. The selected sampling location shall be a safe distance from the demarcated utility. In some cases, records regarding utility locations may not exist.

Also, when grab sampling for VOC analysis or for analysis of any other compound(s) that may be degraded by aeration, it is necessary to minimize sample disturbance and analyte loss. The representativeness of a VOC grab sample is difficult to determine because the collected sample represents a single point, is not homogenized, and has been disturbed.

7.0 References


1.0 Objective
The objective of this technical standard operating procedure (SOP) is to define the requirements for collecting subsurface soil using direct push technology (DPT) sampling techniques at the Santa Susana Field Laboratory (SSFL) site.

2.0 Background

2.1 Definitions
DPT rig - A hydraulically-operated hammer device installed on the back of a van, pickup truck, or skid used to advance a hollow-stem rod and sampler into the subsurface soil (up to bedrock refusal) to collect subsurface soil samples.

Probe-Driven Sampler - A sampling device, similar to a split-spoon sampler, used to collect soil samples with a DPT rig. The sampler is 5-foot steel core barrel with an acetate liner to contain the sample.

Extension Rod - Stainless steel rod used to remove stop-pin and drive-point assembly.

Drive Point - Solid steel retractable point used to advance sample collection device to the required sample depth.

Probe Rod - Hollow, flush-threaded, steel rod similar to a drill rod.

Stop-Pin - Steel plug that threads into the top of the drive cap to hold the drive point in place during advancement of the probe rods.

Drive Cap - Threaded, hardened-steel top cap that attaches to the top of the probe rod; used when advancing the probe rods with the hydraulic hammer.

Pull Cap - Threaded, hardened-steel top cap that attaches to the top of the probe rod; used when retracting the probe rods.

2.2 Associated Procedures
- SSFL SOP 1, Procedures for Locating and Clearing Phase 3 Samples
- SSFL SOP 6, Field Measurement of Total Organic Vapors
- SSFL SOP 7, Field Measurement of Residual Radiation
- SSFL SOP 8, Field Data Collection Documents, Content, and Control
- SSFL SOP 9, Lithologic Logging
- SSFL SOP 10, Sample Custody
- SSFL SOP 11, Packaging and Shipping Environmental Samples
- SSFL SOP 12, Field Equipment Decontamination
- SSFL SOP 13, Guide to Handling Investigation Derived Waste
- SSFL SOP 15, Photographic Documentation of Field Activities
- SSFL SOP 16, Control of Measurement and Test Equipment

2.3 Discussion
The DPT rig consists of a hydraulically-operated hammer device mounted on the back of a van, a pickup truck or a skid. The DPT system hydraulically advances small-diameter, hollow rods and sampler to the desired sampling depth. The specific type of DPT sampling equipment for soil sample collection is then deployed. This work will be performed by a subcontractor with
The use of DPT technology is a cost-effective alternative to using conventional drilling techniques for collecting subsurface soil samples given the site-specific geologic and hydrogeologic conditions and sample requirements.

Advantages of using the DPT system include:

- Areas usually considered inaccessible by drill rigs because of terrain and vegetation, overhead wires, size constraints, etc., may be accessed with a van- or pickup truck-mounted DPT rig.
- Investigation-derived wastes such as soil cuttings and purge water are minimized due to its small diameter rods and its displacement of soil horizontally, not vertically.

In addition, all SOPs will be on hand with the field sampling team.

### 3.0 General Responsibilities

**DPT Subcontractor**–Subcontractor retained to perform all DPT drilling activities.

**Field Team Leader (FTL)**-The FTL is responsible for ensuring that sampling efforts are conducted in accordance with this procedure and the Field Sampling Plan (FSP) Addendum.

**Site Health and Safety Technician**–The person who will use field screening instruments to monitor all field activities for VOCs and radiological contaminants and pre-shipment sample coolers. This person is a trained radiological technician who works under the guidance of Science Application International Corporation’s (SAIC’s) Certified Health Physicist (CHP).

**Site Geologist**–The person responsible for overseeing sample collecting, recording sampling information and for logging the soil sample.

### 4.0 Required Equipment

#### General

- Site-specific plans (e.g., Field Sampling Plan [FSP] Addendum, health and safety plan)
- Field logbook
- Appropriate sample containers
- Insulated coolers
- Bags of ice
- Indelible black or blue ink pens and markers
- Plastic zip-top bags
- Clear, waterproof sealing tape
- Personal protective equipment
- Global Positioning System (GPS)
- 2-way radios
- Nitrile or appropriate gloves
- Monitoring/screening instruments required by the health and safety plan
- Plastic sheeting
- Decontamination supplies
- Chain of custody forms
- Sample labels
- Custody seals
- Stainless steel trowel
- EnCore samplers and T-handle
- Kimwipes or paper towels
- Trash bags
- Plastic spoons or knives

#### DPT Soil Sampling Equipment

- DPT rig (van or truck-mounted) with the following:
  - Probe rods 5-foot (ft) lengths
  - Extension rods (5-ft) lengths, couplers, and handle
  - Piston stop-pins (two each per rig, minimum)
  - Drive caps and pull caps (two each per rig, minimum)
  - Carbide-tipped drill bit for working in concrete- or asphalt-covered areas
  - O-rings
5.0 Procedures

Subsurface soil sampling procedures are discussed below. CDM Smith will oversee DPT operations and handle the samples. It is the DPT subcontractor’s responsibility to operate the DPT equipment.

1. Review site-specific health and safety plan and FSP Addendum before initiating sampling activity.

2. Don the appropriate personal protective clothing as indicated in the site-specific health and safety plan.

3. Locate sampling location(s) in accordance with FSP Addendum and document pertinent information in the appropriate field logbook (SSFL SOP 8). Confirm GPS coordinates of each location (SSFL SOP 1).

4. Use clean, (decontaminated) sampling tools to obtain sample material from each specified sample location.

5. Carefully remove stones, vegetation, debris, etc. from the ground surface in the sampling location area. Clear the sample location using a new and/or appropriately decontaminated tool as described to expose a fresh sampling surface.

6. The Site Health and Safety Technician will perform contaminant screening using hand-held instruments at each sample location before sampling and for each sample collected (SSFL SOPs 6 and 7). The most recent spoils materials will be segregated to minimize cross-contamination. The breathing zone and excavated materials will be monitored continuously. If levels are detected above health and safety plan action levels (HASP page 8), work will be temporarily discontinued. If radiation levels exceed two-times (2X) background levels (HASP page 8), the Department of Energy (DOE), The Boeing Company (Boeing), and the California Department of Toxic Substances Control (DTSC) will be contacted. Site work will not resume at that location until further guidance is provided by DOE or Boeing. Contact information is in the health and safety plan.

7. If the sampling site is in a concrete- or asphalt-covered area, drill a hole using the rotary function and a specially designed (1.5-inch or 2.0-inch diameter) carbide-tipped drill bit. Otherwise, the area needs to be cleared of heavy underbrush and immediate overhead obstructions.

5.1 Soil Sampling

Assembly

1. Assemble the sampling device as follows:
   - Screw the cutting shoe to the bottom end of the sample tube, unless using standard probe drive sampler which has a built-in cutting edge.
   - Screw the piston tip onto the piston rod.
   - Screw the drive head onto the top end of the sample tube.
   - Insert the acetate liner into sample tube.
   - Slide the piston rod into the sample tube, leaving the piston tip sticking out of the bottom end of the sample tube.
   - Screw the piston stop-pin onto the top end of the piston rod in a counter-clockwise direction.

2. Attach the assembled sampler onto the leading probe rod.

Probing

3. Thread the drive cap onto the top of the probe rod and advance the sampler.

4. Advance the sampler using the hydraulic hammer. Add additional probe rods as necessary to reach the specified sampling depth (see Table 1 in Field Sampling Plan Addendum).

Stop-Pin Removal

5. Move the probe unit back from the top of the probe rods and remove the drive cap.
6. Lower the extension rods into the inside diameter of the probe rods using extension rod couplers to join the extension rods.

7. Attach the extension rod handle to the top extension rod and rotate the handle clockwise until the leading extension rod is screwed into the piston stop-pin. Continue to rotate the handle clockwise until the stop-pin disengages from the drive head.

8. Remove the extension rods and attached piston stop-pin from the probe rods.

**Continuous Sampling**

Direct push sampling will be performed with a dual–tube sampling method using a specialty continuous coring sampler (5-ft with inner acetate sleeve.) The sampler is driven in 5-ft intervals slightly ahead of stainless steel casing, and retrieved after each interval push as described above.

9. Replace the drive cap,

10. Advance the probe rods using the hydraulic hammer the length of the sample tube (5 ft).

11. Replace the drive cap with the pull cap and retract the probe rod(s). Secure the rod(s) with a clamp or by hand during removal so they do not fall back down the resulting borehole.

12. Detach the sampler from the lead probe rod, verifying that sufficient sample volume was recovered (Note: The length of sample contained within the tube is approximately equal to the length of exposed piston rod).

13. Disassemble the sampler. Remove the acetate liner. Use cutting tool to cut length of liner (2 times) to remove an approximate 1-inch strip to access the sample material.

14. Screen with field instruments, note readings, and collect samples where appropriate (SSFL SOPs 6 and 7).

15. The Site Health and Safety Technician will perform contaminant screening using hand-held instruments at each sample location before sampling and for each sample collected (SSFL SOPs 6 and 7). The most recent spoils materials will be segregated to minimize cross-contamination. The breathing zone and excavated materials will be monitored continuously. If levels are detected above health and safety plan action levels (HASP page 8), work will be temporarily discontinued. If radiation levels exceed two-times (2X) background levels (HASP page 8), the DOE, Boeing, and DTSC will be contacted. Site work will not resume at that location until further guidance is provided by DOE or Boeing. Contact information is in the health and safety plan.

16. If the PID indicates elevated VOCs, immediately collect a VOC sample using the EnCore sampler per Section 5.2.

17. If the core indicates staining, discoloration, or debris, cut 6-inch soil interval from core and save for VOC sampling (Section 5.2) and or non-VOC sampling (Section 5.3). If there is no indication of contamination, cut 6-inch soil interval from the target interval stated in FSP Addendum for sampling.

18. Transfer sample material for non-volatile analytical protocol to glass jars using disposable plastic spoons or knives.

19. Wipe sealed jars with a clean Kimwipe or paper towel.

20. Fill out the sample label with the appropriate sample information (e.g., sample identification, date/time of sample collection, requested analyses per Table 1 of FSP Addendum) and attach to sample container.

21. Place sample containers in zip-top plastic bags and seal the bags. Pack samples in a cooler with ice to maintain a temperature of 4°C (+2°C).

22. Proceed with additional sample depth collection as required by the FSP Addendum.
23. When sampling is complete, place cuttings back into the borehole and top off with bentonite pellets, as necessary, to bring former borehole to ground surface. Place plastic sheeting and gloves in garbage bag and transfer decontamination water to storage container as specified in SSFL SOP 13.

24. Decontaminate the sampling equipment according to SSFL SOP 12.

25. Complete the field logbook entry (SSFL SOP 8) and lithologic forms (SSFL SOP 9), being sure to record all relevant information before leaving the sample location.

26. Demobilize from sample location.

5.2 Method for Collecting Soil Samples for Volatile Organic Compound Analysis

The following text contains the recommended SW-846 Test Method 5035 procedure for sampling and field preservation of soil samples for volatile organic compound (VOC) analysis, which includes the EnCore™ Sampler Method for low-level VOC analyses.

1. When collecting grab samples for VOC analysis, it is necessary to minimize sample disturbance and minimize analyte loss.

2. Wear new, clean gloves while handling sample containers and sampling devices. Change out gloves at each sampling location, or each time a new sample is to be collected to avoid cross-contamination.

3. The VOC samples shall be collected first as grab samples. EnCore samplers will be used to collect subsamples for the required analytical protocol (e.g., VOCs, 1,4-dioxane, and total petroleum hydrocarbons-gasoline range organics [TPH-GRO]). The VOC sample will be collected from the appropriate interval within the acetate sleeve – in a section of staining, odor, or PID response, or at the target depth. Additional DPT cores may be necessary for all analyses.

4. Once the sleeve is retrieved, quickly screen the open end of the sleeve and the sample borehole for VOCs and radioactivity (SSFL SOPs 6 and 7).

5. Remove EnCore sampler and cap from package and attach T-handle to sampler body. Ensure the sampler is locked into the T-handle before sampling.

6. Push the sampler into the freshly-exposed sample in the acetate liner until the O-ring is visible within the hole on the side of the T-handle. If the O-ring is not visible within this window, then the sampler is not full.

7. Extract the sampler and wipe the sampler sides with a clean paper towel or Kimwipe so that the sampler cap can be tightly attached.

8. While locked into the T-handle, push the sampler cap on the head of the sampler with a twisting motion to secure it to the sampler body.

9. Remove the sampler from the T-handle and, rotate the sampler stem counterclockwise until the stem locks in place to retain the sample within the sampler body.

10. Repeat procedure for each of the remaining samplers.

11. When collecting soil samples using the EnCore Sampler Method, collection of soil for moisture content analysis is required. Results of the moisture analysis are used to adjust “wet” concentration results to “dry” concentrations to meet analytical method requirements. The moisture sample will be collected in a separate 4 ounce (oz.) glass jar. After collecting the required number of EnCore samples (typically five), fill one 4 oz. jar with soil from the liner in close proximity to the VOC samples for moisture analysis using a disposable plastic spoon or knife.
12. After VOC and moisture sampling, discard the remaining soil within the liner to the plastic sheet or back into the borehole, if complete.

13. Complete the sample labels by filling in the appropriate information (e.g., sample identification, date and time of sample collection, and requested analyses [per Table 1 of FSP Addendum]) and securing the label to the container.

14. Store samples at 4°C (±2°C) until samples are delivered to the designated analytical laboratory. Determine sample holding times with the appropriate analytical laboratory. Samples must be shipped and delivered to the analytical laboratory for extraction within 48 hours.

15. Pack all samples per SSFL SOP 11 and/or laboratory requirements. Include properly completed documentation and affix signed and dated custody seals to the cooler lid. See SSFL SOP 10 for guidance on sample custody procedures.

16. Decontaminate all non-disposable sampling equipment in accordance with SSFL SOP 12.

**Note:** A water trip blank will be included with sample coolers containing VOC samples.

### 5.3 Method for Collecting Samples for Nonvolatile Organic or Inorganic Compound Analyses

The requirements for collecting samples of subsurface soil for nonvolatile organic or inorganic analyses are as follows:

1. Wear new, clean gloves while handling sample containers and sampling devices. Change out gloves at each sampling location, or each time a new sample is to be collected to avoid cross-contamination.

2. The non-VOC samples will be collected after VOCs; a separate sampler with acetate liner will likely be needed. Collect the sample from a 6-inch section from at the appropriate interval within the acetate sleeve – in a section of staining, odor, or PID response, or at the target depth. Before sampling, quickly screen the length of the acetate liner for VOCs and radioactivity (SSFL SOPs 6 and 7).

3. Using a decontaminated stainless steel or plastic spoon or trowel, scoop soil from the acetate liner (from the 6-inch target interval) into the required glass sample jars.

4. Wipe the sample containers with a clean paper towel or Kimwipe to remove any residual soil from the sample container surface.

5. Fill out the sample label with the appropriate sample information (e.g., sample identification, date/time of sample collection, requested analyses) and attach to sample jar(s).

6. Place sample containers in individual zip-top plastic bags and seal the bags. Place baggies onto ice in an insulated cooler to maintain at 4°C (±2°C).

7. Decontaminate all non-disposable sampling equipment in accordance with SSFL SOP 12.

### 5.4 Sample Packing and Shipment

1. Store samples at 4°C (±2°C) until samples are delivered to the designated analytical laboratory.

2. Pack all samples per SSFL SOP 11 and/or laboratory requirements. Include properly completed documentation and affix signed and dated custody seals to the cooler lid. See SSFL SOPs 10 for guidance on sample custody procedures.

### 6.0 Restrictions/Limitations

Before conducting the DPT sampling event, underground utilities and structures must be demarcated on the ground surface. In addition, archeological and cultural resources as well as Native American cultural concerns must be cleared.
subcontractor will be used to locate and mark the utility lines. The selected sampling location shall be a safe distance from the demarcated utility. In some cases, records regarding utility locations may not exist. In any event, a good practice is to slowly push the probe rods the first few feet (rather than hammering) to ensure that no utilities, underground storage tanks, or other subsurface structures are present.

Also, when grab sampling for VOC analysis or for analysis of any other compound(s) that may be degraded by aeration, it is necessary to minimize sample disturbance and analyte loss. The representativeness of a VOC grab sample is difficult to determine because the collected sample represents a single point, is not homogenized, and has been disturbed.

7.0 References
1.0 Objective
The objective of this technical standard operating procedure (SOP) is to define the techniques and requirements for collecting soil samples and for characterizing the type of soil and debris from the unconsolidated subsurface zone using a backhoe at the Santa Susana Field Laboratory (SSFL) site. Two types of trenching activities will be conducted (1) trenching to observe debris and collect samples and (2) test pits to characterize subsurface soil, identify geophysical anomalies, and to determine if debris is present or not. In most cases, test pits are not expected to be sampled. General sampling techniques discussed in this SOP include use of sampling with a slide hammer and stainless steel sleeves from the side walls of the trench or from the backhoe bucket. Samples for will be contained in the EnCore® sampler or in the sleeves.

2.0 Background
2.1 Definitions
Backhoe - An excavator to which a shovel bucket is attached to a hinged boom and is drawn backward to excavate materials.

EnCore® Sampler- A single use plastic sampling device, typically with a capacity of 5 grams, used to obtain undisturbed, unconsolidated material samples (e.g., soil) for laboratory analyses. The sampler is inserted into a metal T-handle and open end of the sampler is pushed directly into the soil.

Grab Sample - A discrete portion or aliquot of material taken from a specific location at a given point in time.

Slide Hammer- A drive tool is used to drive and retract a 6-inch long thin-walled stainless steel sampler.

Subsurface Soil - The unconsolidated, or non-lithified, material that exists deeper than 6 inches below the ground surface (bgs).

Unconsolidated Zone - A layer of non-lithified earth material (soil) that has no mineral cement or matrix binding its grains.

2.2 Associated Procedures
- SSFL SOP 1, Procedures for Locating and Clearing Phase 3 Samples
- SSFL SOP 6, Field Measurement of Total Organic Vapors
- SSFL SOP 7, Field Measurement of Residual Radiation
- SSFL SOP 8, Field Data Collection Documents, Content, and Control
- SSFL SOP 9, Lithologic Logging
- SSFL SOP 10, Sample Custody
- SSFL SOP 11, Packaging and Shipping 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

2.3 Discussion
Trenches and test pits will be excavated using a backhoe for visual observations of buried debris material (particularly that observed through geophysics) and to access the subsurface for soil sampling. A backhoe will also be used to provide
access to subsurface materials, including building debris and rubble that a DPT rig cannot penetrate, or where test pits are required to observe geophysical anomalies. Soil samples will be collected from trenches (and possibly test pits) either at depths specified in Field Sampling Plan (FSP) Addendum or at locations with observed discoloration, staining, petroleum odors, or elevated photoionization detector (PID) readings.

3.0 General Responsibilities

**Excavation Subcontractor** – All backhoe trenching and test pits will be performed by a subcontractor.

**Field Team Leader** - The field team leader (FTL) is responsible for ensuring that field personnel collect trenching and test pit subsurface soil samples in accordance with this SOP and the FSP Addendum.

**Site Geologist** – The person responsible for overseeing sample collecting, recording sampling information and for logging the soil sample.

**Site Health and Safety Technician** – The person who will use field screening instruments to monitor all field activities for VOCs and radiological contaminants and pre-shipment sample coolers. This person is a trained radiological technician who works under the guidance of Science Application International Corporation’s (SAIC’s) Certified Health Physicist (CHP).

4.0 Required Equipment

4.1 General

- Site-specific plans (e.g., FSP Addendum, health and safety)
- Field logbook
- Indelible black ink pens and markers
- Clear, waterproof tape
- Appropriate sample containers
- Bags of ice
- Sample labels
- Chain of custody forms
- Insulated cooler(s)
- Global Positioning System (GPS) unit
- 2-way radios
- Trash Bags
- Monitoring/screening instruments as required by the health and safety plan
- Plastic zip-top bags
- Personal protective clothing
- Plastic sheeting
- Nitrile or appropriate gloves
- Slide hammer and stainless steel sleeves
- EnCore sampler and T-handle
- Decontamination supplies
- Kimwipes or paper towels
- Custody seals
- Teflon squares and sleeve end caps
- 300-ft tape measure
- Disposable plastic spoons and knives

4.2 Backhoe Sampling

- Backhoe with a sufficient length boom to extend to 10+ft bgs
- Samples collected to a depth of 5 feet (ft) will be collected from the side walls of the trench/test pit using a slide hammer and stainless steel sleeves, as long as the side wall can be safely accessed at that depth. In some instances, safely reaching the sidewall at 5 ft bgs may not be possible and the bucket of the backhoe will be used to access soil material.
- Samples collected deeper than 5 ft bgs will be collected directly from the backhoe bucket using a slide hammer and stainless steel sleeves of soil material contained in the bucket that is not in contact with the bucket walls.
- VOC samples will be subsampled from the stainless steel sleeve using an EnCore sampling device.

*Note: Personnel will not enter an excavation of any depth.*

5.0 Procedures

5.1 Preparation

1. Review site-specific health and safety plan and FSP Addendum before initiating sampling activity.
Backhoe Trenching/Test Pits for Sample Collection

2. Don the appropriate personal protective clothing as indicated in the site-specific health and safety plan.

3. Locate sampling point(s) in accordance with project documents (e.g., FSP Addendum) and document pertinent information in the appropriate field logbook (SSFL SOP 8). Confirm GPS coordinates of each location (SSFL SOP 1).

4. The depth of sampling will be verified with a tape measure.

5. Use clean (decontaminated) sampling tools to obtain sample material from each specified sample location.

6. The Site Health and Safety Technician will perform contaminant screening using hand-held instruments at each sample location before sampling and for each sample collected (SSFL SOPs 6 and 7). The most recent spoils materials will be segregated to minimize cross-contamination. The breathing zone and excavated materials will be monitored continuously. If levels are detected above health and safety plan action levels (HASP page 8), work will be temporarily discontinued. If radiation levels exceed two-times (2X) background levels (HASP page 8), the Department of Energy (DOE), The Boeing Company (Boeing), and the California Department of Toxic Substances Control (DTSC) will be contacted. Site work will not resume at that location until further guidance is provided by DOE or Boeing. Contact information is in the health and safety plan.

The following steps must be taken to prepare the slide hammer for sampling.

1. Obtain the slide hammer, sample tube with the shoe and stainless steel liners.

2. Remove the sample tube shoe and insert a clean liner. Screw the shoe back onto the sample tube.

3. Screw the assembled sample tube onto the slide hammer.

4. After sampling remove the sampling liner from the sample tube for sample collection.

5. Decontaminate the sample tube and shoe (SSFL SOP 12).

5.2 Sample Collection

The following general steps must be followed when collecting all subsurface soil samples. Refer to Section 5.3 of this SOP for additional guidance on field sampling and preservation methods.

1. Wear clean gloves during handling of all sample containers and sampling devices. Change out gloves at each sampling location, or each time a new sample is to be collected, to avoid cross-contamination.

2. VOC samples or samples that may be degraded by aeration shall be collected first and with the least disturbance possible and consequently minimize analyte loss.

3. Record all sampling information, including environmental and/or soil and debris characterization, and sample depth in the field logbook (SSFL SOP 8) and on lithologic log forms as specified in the FSP Addendum. Describe sample lithology according to SSFL SOP 9. Document with photographs, as appropriate, per SSFL SOP 15.

4. Record specific sampling devices identified in the FSP Addendum in the field logbook. Document any and all deviations from the SOPs and the sampling plan in the field logbook and include rationale for changes. See SSFL SOP 8 for guidance on entering information into field log books.

5. Care must be taken to prevent cross-contamination and misidentification of samples as described in subsequent subsections of this SOP.

5.2.1 Backhoe Sampling

*Note:* Steps 2, 7, and 8 describe activities to be performed by a licensed heavy equipment operator, not CDM Smith personnel.
The following steps must be followed when collecting environmental samples using a backhoe:

1. Verify that the parts of the backhoe that will come in contact with the soil to be sampled have been decontaminated per SSFL SOP 12 before excavation begins.
2. Excavate to the depth specified in the FSP Addendum.
3. Visually inspect and log the soil profile in accordance with SSFL SOP 9, and record the types of debris (if present) within the trench. Screen for VOCs and radiation in accordance with SSFL SOPs 6 and 7.
4. If it can be performed safely, collect soil samples from the sidewalls of backhoe trench/test pit at the specified depth using a slide hammer sampler and stainless steel sleeves. If the sample will be deeper than 5 feet bgs, the sample will be collected from the backhoe bucket (from the middle of the bucket and untouched by the bucket) using a slide hammer and stainless steel sleeves. Personnel will not enter excavations under any circumstances.
5. Soil sample depths and sample volumes to address required analyses are presented in Table 1 of FSP Addendum.
6. When sample collection has been completed in the trench, backfill the trench with the excavated material. Compact the surface of the former excavation/test pit with backhoe bucket and/or tires. Spread any extra excavation spoils on the ground surface in the vicinity of the trench and test pit.
7. Once the trench has been backfilled, decontaminate backhoe in accordance to SSFL SOP 12.
8. Place sampling PPE in a plastic trash bag and transfer decontamination fluids to a storage container per SSFL SOP 13.
9. Complete the field logbook entries (SSFL SOP 8), being sure to record all relevant information before leaving the site.

### 5.2.2 Sampling With a Slide Hammer

Follow the steps below when collecting environmental soil samples using a slide hammer:

1. Obtain the sample by driving the slide hammer into side wall of test pit (depths above 5 ft bgs) or into sample material in backhoe bucket (depths below 5 ft). Retract hammer and remove the stainless steel liner from the tube. Collect and handle the sample in accordance with 5.2.3 and 5.2.4.
2. Proceed with additional sample collection as identified for the sampling location in Table 1 of FSP Addendum.
3. Decontaminate all equipment according to SSFL SOP 12 between each sample.
4. Complete the field logbook (SSFL SOP 8) entry and lithologic log form (SSFL SOP 9), being sure to record all relevant information before leaving the site.

### 5.2.3 Method for Collecting Soil Samples for Volatile Organic Compound Analysis

The following text contains the recommended SW-846 Test Methods 5035 procedure for sampling and field preservation of soil samples for volatile organic compound (VOC) analysis, which includes the EnCore® Sampler Method for low-level VOC analyses. Equipment requirements in addition to the equipment specified in Section 4.0 of this SOP for each method are indicated at the beginning of each subsection.

1. When collecting grab sampling for VOC analysis, it is necessary to minimize sample disturbance and consequently minimize analyte loss.
2. Wear new, clean gloves during handling of all sample containers and sampling devices. Change out gloves at each sampling location, or each time a new sample is to be collected, to avoid cross-contamination.
3. VOC samples shall be collected first as grab samples. After clearing sample site, use a clean slide hammer and decontaminated stainless steel sleeves to drive and retract the sample sleeve into and from the trench wall. EnCore samplers will be used to collect subsamples for the required analytical protocol (e.g., VOCs, 1,4-dioxane, and total...
4. Once the sleeve is retrieved, quickly screen the open end of the sleeve and the sample borehole for VOCs and radioactivity (SSFL SOPs 6 and 7).

5. Remove EnCore sampler and cap from package and attach T-handle to sampler body. Ensure that the sampler is locked into the T-handle before sampling.

6. Push the sampler into the freshly-exposed sampling from the bottom of the sampler sleeve until the O-ring is visible within the hole on the side of the T-handle. If the O-ring is not visible within this window, then the sampler is not full.

7. Extract the sampler and wipe the sampler sides with a clean paper towel or Kimwipe so that the sampler cap can be tightly attached.

8. While still locked into the T-handle, push the sampler cap on the head of the sampler with a twisting motion to secure it to the sampler body.

9. Remove the sampler from the T-handle and rotate the sampler stem counterclockwise until the stem locks in place to retain the sample within the sampler body.

10. Repeat procedure for each of the remaining samplers.

11. When collecting soil samples using the EnCore Sampler Method, collection of soil for moisture content analysis is required. Results of the moisture analysis are used to adjust "wet" concentration results to "dry" concentrations to meet analytical method requirements. The moisture sample will be collected in a separate 4 ounce (oz.) glass jar. After collecting the required number of EnCore samples (typically five), fill one 4 oz. jar with soil from bottom of stainless steel sleeve for moisture analysis using a disposable plastic spoon or knife.

12. After VOC and moisture sampling, discard the remaining soil within the stainless steel sleeves to the plastic sheets or back to the borehole, if completed.

13. Complete the sample labels by filling in the appropriate information (e.g., sample identification, date and time of sample collection, and requested analyses [per Table 1 of FSP Addendum]) and securing the label to the container.

14. Store samples at 4°C (±2°C) until samples are delivered to the designated analytical laboratory. Determine sample holding times with the appropriate analytical laboratory. Samples must be shipped and delivered to the analytical laboratory for extraction within 48 hours.

15. Pack all samples per SSFL SOP 11 and/or laboratory requirements. Include properly completed documentation and affix signed and dated custody seals to the cooler lid. See SSFL SOP 10 for guidance on sample custody procedures.

16. Decontaminate all non-disposable sampling equipment in accordance with SSFL SOP 12.

**Note:** A water trip blank will be included with sample coolers containing VOC samples.

### 5.2.3 Method for Collecting Samples for Nonvolatile Organic or Inorganic Compound Analyses

The requirements for collecting samples of subsurface soil for nonvolatile organic or inorganic analyses are as follows:

1. Use a clean slide hammer and decontaminated stainless steel sleeves to drive the sampler into the trench wall (above 5 ft. bgs) or soil in the backhoe bucket (depths below 5 ft bgs). Several sleeves may be required from this interval to collect the necessary amount of subsurface soil to satisfy the analytical protocol (refer to sampling rationale table in Table 1 of FSP Addendum). Quickly screen the open end of the sleeve and the sample borehole for VOCs and radioactivity (SSFL SOPs 6 and 7).
Backhoe Trenching/Test Pits for Sample Collection

2. Collect sub samples for chromium (Cr\(^{3+}\)) and/or hexavalent chrome (Cr\(^{6+}\)) and/or pH from the center of the stainless steel sleeve into a glass jar using a disposable plastic spoon or knife. Ensure that the soil that was in contact with the sleeve is not collected in the jar.

3. Prior to capping the sleeve for the remaining non-volatile parameters, place a Teflon® cover sheets over each end of the sample. Secure the respective cap on each sample container immediately after collection.

4. Label the sample sleeve with “top” and “bottom” designations.

5. Wipe the sample containers with a clean paper towel or Kimwipe to remove any residual soil from the sample container surface.

6. Fill out the sample label with the appropriate sample information (e.g., sample identification, date/time of sample collection, requested analyses per FSP Addendum Table 1) and attach to sample sleeve.

7. Place sample containers in individual zip-top plastic bags and seal the bags. Place baggies onto ice in an insulated cooler to maintain at 4°C (±2°C).

8. Decontaminate all non-disposable sampling equipment in accordance with SSFL SOP 12.

5.3 Sample Packing and Shipment
1. Store samples at 4°C (±2°C) until samples are delivered to the designated analytical laboratory.

2. Pack all samples per SSFL SOP 11 and/or laboratory requirements. Include properly completed documentation and affix signed and dated custody seals to the cooler lid. See SSFL SOP 10 for guidance on sample custody procedures.

6.0 Restrictions/Limitations
Extreme care must be taken when working around open excavations. Maintain safe distances from trench sidewalls to avoid injury should a sidewall of the trench sloughing back into the excavation. Personnel will not enter any trenches/test pits at any time.

Also, when grab sampling for VOC analysis or for analysis of any other compound(s) that may be degraded by aeration, it is necessary to minimize sample disturbance and consequently minimize analyte loss. The representativeness of a VOC grab sample is difficult to determine because the collected sample represents a single point, is not homogenized, and has been disturbed.

7.0 References


1.0 Objective
The objective of this technical standard operating procedure (SOP) is to define the techniques and the requirements for the measurement of total organic vapors in the breathing zone and in field samples at the Santa Susana Field Laboratory (SSFL) site.

2.0 Background

2.1 Definitions
Photoionization detector (PID) – A portable, hand-held instrument that measures the concentration of gaseous organic compounds through the photoionization of organic vapors.

2.2 Associated Procedures
- 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 (DPT) Sampling
- SSFL SOP 5, Backhoe Trenching/Test Pits for Sample Collection
- SSFL SOP 9, Lithologic Logging

2.3 Discussion
The measurement of organic vapors is a required step during numerous field activities. The measurement of organic vapors is being performed for two purposes. The first objective is to address health and safety concerns to determine if the breathing zone in a work area is acceptable or if personal protective equipment such as a respirator or a supplied air device is necessary for field personnel. The second objective is to assist in the identification of contamination and possible sample intervals for field judgment decisions on where samples for volatile organic compounds (VOCs) should be collected.

Samples to be screened include excavation spoils, hand auger cuttings, sample material from an acetate liner or stainless steel sleeve, as well as in situ screening. All sample material will be screened for the presence of volatile organic chemicals.

2.3.1 PID Operation
The PID is preferred when the compounds of interest are aromatics or halogenated VOCs. The PID ionizes the sampled vapors using an ultraviolet lamp that emits light energy at a specific electron voltage (eV - labeled on the lamp). Every organic compound has a specific ionization potential (measured in electron volts). The energy emitted by the lamp must be higher than the ionization potential of the compound for the compound to become ionized and emit an electron. If the ionization potential of the compound is higher than the eV of the lamp, there will be no response on the instrument. Therefore, the ionization potential of the known or suspected compounds shall be checked against the energy of the ultraviolet lamp (i.e., typically 10.2 eV, 10.7 eV, or 11.7 eV) to verify that the energy provided by the lamp is greater.

Consult the manufacturer’s manual to determine the appropriate ultraviolet lamp to be used and obtain the appropriate correction factors for known or suspected contaminants.

Water vapor associated with samples can interfere with the PID detector and cause the instrument to stop responding. This can be caused by using the PID on a rainy day or when sampling headspace samples that have been in the sun. If moisture is suspected, use the calibration gas to check the instrument response by inserting the gas as a check sample, not by recalibrating. If the response is lower than the gas level, then dry out the probe and the ionization chamber before...
reusing the instrument.

Do not insert the sampling probe directly into soil samples or dusty areas, as the instrument vacuum will pull dirt into the ionization chamber. Under particularly dirty or dusty conditions, the lamp may become covered with a layer of dust. If dirty conditions are encountered, or if the instrument response seems to have decreased, then clean the lamp. The instrument manual provides instructions on removing the instrument cover to access the lamp, and cleaning the screen in the ionization chamber as well as the surface of the lamp. In addition, the ultraviolet lamp in the PID is sensitive to shock, especially when using the higher eV lamps. Therefore, handle and transport the equipment carefully.

Finally, make sure the battery is fully charged before use. The average battery life is on the order of 8 to 12 hours of continuous use. Also, make sure the unit is allowed to equilibrate to ambient outdoor temperatures.

3.0 Responsibilities

Field Team Leader– The field team leader (FTL) is responsible for ensuring that field personnel conduct field activities in accordance with this SOP and the Field Sampling Plan (FSP) Addendum.

Site Geologist – The person responsible for overseeing soil sample collection, documentation, and lithologic logging.

Sampling Personnel – Field team members responsible for physically collecting samples and decontamination of equipment.

Site Health and Safety Technician – The person who will use field screening instruments to monitor all field activities for VOCs and radiological contaminants and pre-shipment sample coolers.

4.0 Required Equipment

- Site-specific plans (i.e., FSP Addendum)
- Health and safety plan
- Field logbook
- Photoionization detector with appropriate lamp rating
- Calibration gases in a range appropriate for the expected use
- Pint-to-quart-sized zip-top plastic bags
- Waterproof black ink pen
- Personal protective clothing and equipment

5.0 Procedures

5.1 Direct Reading Measurement

1. Charge the instrument overnight.

2. Connect the measurement probe to the instrument (if necessary), turn on the probe, and make necessary operational checks (e.g., battery check) as outlined in the manufacturer’s manual.

3. Calibrate the instrument using appropriate calibration gas and following the applicable manufacturer’s manual.

4. Make sure the instrument is reading zero and all function and range switches are set appropriately.

5. Insert the end of the probe directly into the atmosphere to be measured (e.g., breathing zone, soil sampler liner) and read the total organic vapor concentration in parts per million (ppm) from the instrument display. Apply the appropriate correction factor if necessary. Record the highest instrument response.

6. Immediately document the reading in the field logbook or on the appropriate field form.

5.2 Headspace Measurement

1. Once on and operational, calibrate the instrument (as needed) following the appropriate manufacturer’s manual.

2. Make sure the instrument is reading zero and all function and range switches are set appropriately.
3. Fill one zip-top plastic bag approximately one-half full of the sample to be measured. Quickly seal the bag minimizing volume of air in bag.

4. Allow headspace to develop for approximately 10 minutes. It is generally preferable to knead the bag for 10 to 15 seconds to break apart the sample and maximize sample surface area.

*Note:* When the ambient temperature is below 0 degrees Celsius (32 degrees Fahrenheit), perform the headspace development and subsequent measurement within a heated vehicle or building.

5. Quickly puncture the bag wall and insert the probe, wrapping the bag wall around the probe stem to minimize loss of vapors. Insert the instrument probe to a point approximately one-half of the headspace depth. Do not let the probe contact the soil, and ensure the probe does not get plugged by the plastic during puncturing. If using a PID and there is condensation on the inside of the bag, only leave the probe in the jar or bag long enough to obtain a reading. Remove the probe and allow fresh air to flow through the instrument to avoid excess water vapor build-up.

6. Read the total organic vapor concentration in ppm from the instrument display. Apply the appropriate correction factor if necessary. Record the highest instrument response.

7. Immediately record the reading in the field logbook or on the appropriate field form.

### 6.0 Restrictions/Limitations

The PID provides quantitative measurement of total organic vapors, but generally is not compound-specific. The typical measurement range of the PID is 0 to 2,000 ppm. In addition, the instrument will not detect/measure VOCs with an associated ionization potential (in eVs) above the rating of the lamp, so lamp rating is critical to monitoring for selected VOCs.

*Note:* The presence of methane will cause erratic PID measurements.

### 7.0 References

No references were used in development of this SOP.
1.0 Objective
The objective of this technical standard operating procedure (SOP) is to define the techniques and the requirements for the detection of residual radiation in the breathing zone and in soil at the Santa Susana Field Laboratory (SSFL). The Department of Energy (DOE) surface contamination criteria are also defined herein with footnotes which reflect acceptable approaches for demonstrating achievement of such criteria.

2.0 Background
2.1 Definitions
MicroR detector—A portable, hand-held scintillation counter that measures gamma radiation in air. Although measurements are typically made about one meter above the ground surface, such sodium iodide scintillation detectors can also be used qualitatively measure radiation emitted from soil samples and soil cores. In this instance the detectors will be held about 0.5 to 1 inch above the samples. When used to evaluate soil sample activity, measurements will be compared against background count rates for the same material taken in a consistent manner (i.e., 0.5 to 1 inch above soil material). Background is established by taking measurements in an area that produced count rates that are relatively low and uniform.

Dual Phosphor Alpha Beta Scintillator—A portable, hand-held field radiation survey instrument that may detect alpha, beta, and gamma radiation emissions and, with proper calibration, can measure gamma emissions.

2.2 Associated Procedures
- 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 (DPT) Sampling
- SSFL SOP 5, Backhoe Trenching/Test Pits for Sample Collection
- SSFL SOP 9, Lithologic Logging

2.3 Discussion
Radiation screening of soil samples and ambient air is necessary because of the prior use of Area IV for nuclear research. Radiation measurement data will be used pursuant to health and safety monitoring to determine if radiation exposure rates for field personnel in a work area is acceptable or if additional personal protective equipment or exposure limitations are necessary for field personnel. In addition to health and safety monitoring, radiation monitoring will be used to screen surface and subsurface soil and sediment samples for levels above background. Background readings are important because they provide a point of departure for elevated readings.

Two types of instruments will be used to measure residual radiation: the MicroR gamma detector and Dual Phosphor alpha/beta detector.

2.3.1 MicroR Operation
The MicroR detector is a scintillation meter used to measure low levels of gamma radiation. Although sodium iodide detectors can be set up to operate as a single channel analyzer, thereby reporting a specific radionuclide, the instruments for this project will be set up to report all gamma emissions, irrespective of radionuclide. The instrument has a speaker which provides an audible measure of the radiation emitted, as an audible click. The rate at which the clicks occur allows real-time monitoring of the strength of the radiation sources. Readout is generally in terms of microroentgens per hour.
2.3.2 Dual Phosphor Alpha Beta Scintillation Operation

For this project a Model 4389 Dual Phosphor alpha/beta scintillation detector will be primarily used to detect alpha/beta emissions.

Although these detectors can also detect alpha emissions, alpha particles generally have a range of about an inch or less in air with relatively few able to penetrate the detector window such that they are counted. Alpha/beta detectors are generally calibrated to the gamma emissions of cesium-137 with instrument response being energy dependent. Beta efficiency also varies with energy such that 4 pi efficiency ranges from about 13 percent to 50 percent for beta particles with average energies of 50 and 550 kiloelectron volts (keV), respectively. If the instrument has a speaker, the pulses also give an audible click. The readout can be displayed in multiple different units (e.g., roentgens per hour (R/hr), milliroentgens per hour (mR/hr), millirem per hour (mrem/hr), and counts per minute (cpm)) when the control switch is in the “Ratemeter” position. Alpha/beta probes including, the pancake type, are commonly used with a variety of different hand held scalers/ratemeters for contamination measurements. Given the energy dependence of the instruments and their variable response to different types of radiation, radiation control/health physics personnel should be consulted if any activity exceeding instrument background is detected.

3.0 Responsibilities

Field Team Leader—The field team leader (FTL) is responsible for ensuring that field personnel conduct field activities in accordance with this SOP and the Field Sampling Plan [FSP] Addendum.

Site Health and Safety Technician—The person who will use field screening instruments to monitor all field activities for VOCs and radiological contaminants and pre-shipment sample coolers. This person is a trained radiological technician who works under the guidance of Science Application International Corporation’s (SAIC’s) Certified Health Physicist (CHP).

Certified Health Physicist—The person who oversee radiation survey activities, confirm background levels, and provide field direction when background levels are exceeded per the Health and Safety Plan.

4.0 Required Equipment

- Model 19 Micro R Detector
- Model 4389 Dual Phosphor Alpha/Beta Scintillation Detector
- Site-specific plans (i.e., FSP Addendum)
- Health and safety plan (HSAP)
- Field logbook
- Waterproof black ink pen
- Personal protective clothing and equipment

5.0 Determination of Radiation Background

As set forth in the HASP (health and safety plan monitoring and action levels) and for the selection of soil sample intervals (SSFL SOP 2, 3, 4, and 5), background radiation levels for various media will be established prior to soil sampling. Because radiation levels vary based on composition of the media and multimedia that will effect radiation measurements at the site, the following background radiation levels will be developed initially at the site.

- Unconsolidated soil
- Bedrock
- Concrete slab/rubble
**Field Measurement of Residual Radiation**

**Asphalt**

Additional media may be added as it is encountered in the field. Background of these media will be established using the following procedure.

1. Ensure instrument is functioning properly and check source readings are acceptable per requirements of this SOP.

2. Demarcate background radiation SAMPLE AREA for each media with wooden Stakes. The Area IV background survey location established by EPA will serve as a starting point. Minimum requirements for the background SAMPLE AREA is as follows:
   - a. 20 square feet of surface area
   - b. made up of 80% intended media
   - c. area does not consist of imported fill or debris
   - d. area is absent of contamination (identified by visually inspection, and from EPA HSA, EPA gamma surveys, EPA soil sample results, RFI and Co-located Chemical data)

3. Obtain and Record GPS coordinates of SAMPLE AREA

4. Using appropriate radiation instrument (Micro R Meter Model 19, Dual Phosphor Alpha/Beta Detector Model 4389) collect 10 gamma, alpha, and beta measurement about 0.5 to 1 inch above the media, equally distribute throughout the SAMPLE AREA. Each measurement will be at least 1 minute in duration.

5. Record the ten radiation measurements in log book.

6. Following collection of background measurements, ensure instrument is functioning properly and check source readings are acceptable per this SOP.

7. Discuss readings with site Certified Health Physicist for review and receive approval of background radiation level.

8. The Certified Health Physicist will provide approved background radiation level for the media to DOE and CDM Smith. This will include background level, mean, and standard deviation will be provided.

9. CDM Smith FTL will record the Certified Health Physicist’s recommendations and discuss the background action level with all field personnel as part of safety briefings.

10. Following establishment of, and periodical renewal of background readings throughout project, background radiation levels will be discussed during project meetings and daily tailgate safety meetings.

**6.0 Procedures**

**6.1 MicroR Detector**

**Background Gamma Scan**

1. Prepare the instrument and check batteries. The meter needle should move to area on scale marked battery, indicating the batteries are good.

2. Measure background radiation level away from sample and source area. Measure the background radiation for approximately 60 seconds to allow determination of the range and relative mean background exposure rates and write down the readings. Note that background commonly ranges from about 5 to 20 µR/h, but can be higher as a result of increased elevation or higher concentrations of naturally occurring radioactive materials. In addition, it is often necessary to reevaluate background for different areas within the site. Upon completion of background determination,
Field Measurement of Residual Radiation

verify proper instrument operation using a National Institute of Standards and Technology (NIST) traceable check source to confirm proper instrument operation.

Surface Soil Gamma Scan

1. Beginning at the highest scale, proceed to lower scales until a reading is encountered. Set the instrument selector switch to the most sensitive range of the instrument. Holding the probe approximately 0.5 to 1 inch from the surface soil sample, move the detector slowly (about 1 inch per second) over the core and/or sample being evaluated with the detector parallel to the length of the core.

2. Do not let the probe touch anything and try to maintain a constant distance.

3. Areas that register more than background levels may be considered contaminated and a health physicist should be consulted.

6.2 Dual Phosphor Alpha/Beta Scintillation Detector

Background Alpha/Beta Scan

1. Prepare the instrument and check batteries. The meter needle should move to area on scale marked battery, indicating the batteries are good. Measure background radiation level away from source area.

2. Measure the background radiation at 0.5 to 1 inch above the media for ten 2-minute counting periods and record each of the readings. Background commonly ranges from about 5 to 20 µR/h but can be higher as a result of increased elevation or higher concentrations of naturally occurring radioactive materials.

3. Obtain ten 1-minute source activity measurements using a NIST traceable source of the appropriate beta energy.

4. Upon completion of the background and source efficiency counts, input the associated data into the spreadsheet provided to determine parameter limits (e.g., background and source efficiency within 20 percent of the mean). Subsequent counts of both background and source efficiency should be performed daily before instrument use, at the end of each duty day, and any time that instrument operation is questionable.

Soil Sample Beta Scan

1. Set the instrument selector switch to the most sensitive range of the instrument.

2. Holding the probe approximately 0.5 to 1 inch from the sample and move the probe slowly (about 1 inch per second). *(Note: Alpha emissions are reliably detectable only with the detector as close as practicable to the item being surveyed. In addition, it should be noted that variation in beta background can preclude the ability to detect alpha emissions at levels prescribed in 10 CFR 835, Appendix D.)*

3. Do not let the probe touch anything and try to maintain a constant distance.

4. Areas that register more than background level may be considered contaminated and a health physicist should be consulted.

Surface Contamination Scanning

In addition, every sample, piece of equipment, and container of material used at the site and/or that leaves the site will be surveyed and results will be used to document that residual total and removable surface contamination are compliant with criteria contained in Appendix D, 10 CFR 835. I

<table>
<thead>
<tr>
<th>Radionuclide</th>
<th>Removable</th>
<th>Total (Fixed + Removable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface Contamination Values¹ in dpm/100 cm²</td>
<td>², ³</td>
<td>², ³</td>
</tr>
</tbody>
</table>

1, 2, 3, 4
## Field Measurement of Residual Radiation

<table>
<thead>
<tr>
<th>Category</th>
<th>Lower Limit</th>
<th>Upper Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>U-nat, U-235, U-238, and associated decay products</td>
<td>1,000&quot;</td>
<td>5,000&quot;</td>
</tr>
<tr>
<td>Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129</td>
<td>20</td>
<td>500</td>
</tr>
<tr>
<td>Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133</td>
<td>200</td>
<td>1,000</td>
</tr>
<tr>
<td>Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above</td>
<td>1,000</td>
<td>5,000</td>
</tr>
<tr>
<td>Tritium and STCs 6</td>
<td>10,000</td>
<td>See Footnote 6</td>
</tr>
</tbody>
</table>

1. The values in this appendix, with the exception noted in footnote 6 below, apply to radioactive contamination deposited on, but not incorporated into the interior or matrix of, the contaminated item. Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides apply independently.

2. As used in this table, disintegrations per minute (dpm) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

3. The levels may be averaged over one square meter provided the maximum surface activity in any area of 100 cm² is less than three times the value specified. For purposes of averaging, any square meter of surface shall be considered to be above the surface contamination value if: (1) from measurements of a representative number of sections it is determined that the average contamination level exceeds the applicable value; or (2) it is determined that the sum of the activity of all isolated spots or particles in any 100 cm² area exceeds three times the applicable value.

4. The amount of removable radioactive material per 100 cm² of surface area should be determined by swiping the area with dry filter or soft absorbent paper, applying moderate pressure, and then assessing the amount of radioactive material on the swipe with an appropriate instrument of known efficiency. (Note—The use of dry material may not be appropriate for tritium.) When removable contamination on objects of surface area less than 100 cm² is determined, the activity per unit area shall be based on the actual area and the entire surface shall be wiped. It is not necessary to use swiping techniques to measure removable contamination levels if direct scan surveys indicate that the total residual surface contamination levels are within the limits for removable contamination.

5. This category of radionuclides includes mixed fission products, including the Sr-90 which is present in them. It does not apply to Sr-90 which has been separated from the other fission products or mixtures where the Sr-90 has been enriched.

6. Tritium contamination may diffuse into the volume or matrix of materials. Evaluation of surface contamination shall consider the extent to which such contamination may migrate to the surface in order to ensure the surface contamination value provided in this appendix is not exceeded. Once this contamination migrates to the surface, it may be removable, not fixed; therefore, a “Total” value does not apply. In certain cases, a “Total” value of 10,000 dpm/100 cm² may be applicable either to metals, of the types which form insoluble special tritium compounds that have been exposed to tritium; or to bulk materials to which particles of insoluble special tritium compound are fixed to a surface.

7. These limits only apply to the alpha emitters within the respective decay series.

7.0 Restrictions/Limitations
Micro R and Dual Phosphor detectors are principally used for the detection of presence of radionuclides above background, not measurement devices. They are prone to breaking if the thin entrance window (found on pancake and end-window designs) is punctured. This can easily occur if the window comes in contact with a variety of objects (such as a blade of grass, paper clip, nail, and paint flecks). Once the window is broken the instrument ceases to operate and must, therefore, be returned for repair and calibration.

8.0 References


Title 10, Code of Federal Regulations, Part 835, Occupational Radiation Protection

DOE Standard Radiological Control, DOE-STD-1098-2008 with change 1 dated May 2009

DOE Order 426.2, Personnel Selection, Training, Qualification, and Certification Requirements for DOE Nuclear Facilities, 21 April 2010

DOE Standard 1107-97 with Change 1 dated November 2007, Knowledge, Skills, and Abilities for Key Radiation Protection Positions

Ludlum Measurements, Inc. Operators Manuals for Model 2241 Survey Meter with Model 19 Detector
1.0 Objective
The objective of this technical standard operating procedure (SOP) is to set criteria for content entry and form of field logbooks and SSFL Field Sample Data Sheets used for field work at the Santa Susana Field Laboratory (SSFL) site, and data entry into the Scribe database.

2.0 Background
A permanently bound and consecutively paginated field logbook will be maintained daily by the CDM Smith field team in accordance with the procedures below.

2.1 Discussion
Information recorded in field logbooks includes field team names, visitors, observations, data, calculations made onsite, date/time, weather, and description of the data collection activity, methods, instruments, and results. Additionally, the logbook must contain deviations from plans, observations of fill, and site features including sketches, maps, or drawings as appropriate. In addition, all SOPs will be on hand with the field sampling team.

2.2 Associated Procedures
- 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 Pits for Sample Collection
- SSFL SOP 9, Lithologic Logging
- SSFL SOP 14, Geophysical Survey
- SSFL SOP 15, Photographic Documentation of Field Activities
- SSFL SOP 16, Control of Measurement and Test Equipment

3.0 General Responsibilities
Field Team Leader (FTL) – The 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 and field data sheets to site personnel who will be responsible for their care and maintenance while in their possession.

Site Geologist – The site geologist is responsible documenting site activities into the logbooks and sample data sheets as well as all sample description details.

Other Site Personnel – All CDM Smith employees who make entries in field logbooks during onsite activities are required to read this procedure before engaging in this activity. Site personnel will return field logbooks to the FTL at the end of the assignment.

4.0 Required Equipment
- Site-specific plans (Field Sampling Plan [FSP] Addendum, health and safety plan)
- Field logbook
- Scribe Version 3.8 (or later)
- Indelible black or blue ink pen
- SSFL Field Sample Data Sheet (FSDS)
5.0 Procedures

5.1 Preparation
In addition to this SOP, site personnel responsible for maintaining logbooks must be familiar with all procedures applicable to the field activity being performed. These procedures should be consulted as necessary to obtain specific information about equipment and supplies, health and safety, sample collection, packaging, decontamination, and documentation. These procedures should be located at the field office or vehicle for easy reference.

Field logbooks are bound, with lined and consecutively numbered pages. 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, the FTL will title and sequentially number each logbook, and ensure the pages are sequentially numbered and the table of contents (TOC) is set up. Record the following information on the cover of the logbook:

- Field logbook number (if applicable).
- Site name and location.
- Activity (if the logbook is to be activity-specific).
- Start date of entries.
- End date of entries.
- Name of CDM Smith contact and phone number(s) (typically the project manager).

The first few (approximately two) pages of the logbook will be reserved for a TOC. Mark the first page with the heading “Table of Contents” and enter the following:

<table>
<thead>
<tr>
<th>Date/Description</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Start Date)/Reserved for TOC</td>
<td>1-2</td>
</tr>
</tbody>
</table>

The remaining pages of the TOC will also be designated as such with “Table of Contents” written on the top center of each page. The TOC should be completed as activities are completed and before returning the logbook back to the FTL.

5.2 Log Book Requirements
Documentation requirements for logbooks are:

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

Specific requirements for field logbook entries include:

- Initial and date each page.
- Sign and date the final page of entries for each day.
- Initial and date all changes.
- If authors change within the course of the day, the original author must insert the following:
  Above notes authored by:
  - (Sign name)
  - (Print name)
  - (Date)
- The new author must sign and print his/her name before additional entries are made.
- Draw a diagonal line through the remainder of the final page at the end of the day.
Record the following information on a daily basis:
- Date and time
- Name of individual making entry
- Names of field team and other persons onsite
- Description of activity being conducted including station or location (i.e., boring, sampling location number) if appropriate
- Weather conditions (i.e., temperature, cloud cover, precipitation, wind direction and speed) and other pertinent data
- Level of personal protection used
- Serial numbers of instruments
- Equipment calibration information (initial and ongoing date and time activity)
- Serial/tracking numbers on documentation (e.g., carrier air bills)

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.

A sketch of station location may be warranted. All maps or sketches made in the logbook should have descriptions of the features shown and a direction indicator.

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

5.3 Field Sample Data Sheets
- An example Field Sample Data Sheet (FSDS) that will be used to record the sample details and subsurface conditions is included as Attachment 1 to SOP 8.
- The FSDS will be completed by the Site Geologist from observations of the soil core, cuttings, and sidewalls of trenches and test pits.
- The FSDS is a single page, double-sided form that will be completed in indelible ink.
- All portions of the form will be completed. If any portion is not applicable to the activity being recorded, that portion will be crossed out with a single line and initialed by the Site Geologist.
- The FSDS must be reviewed and signed by another field team member before being copied into a pdf file.
- The pdf file will be transferred to CDM’s main database weekly by the Site Geologist. The original of the FSDS will be maintained in a binder at the site office until completion of all field activities.
- Sample description information (sample characteristics, presence of fill, staining, odor, etc.) will be transferred to the electronic database on a weekly basis by the Site Geologist or his/her designee.
- Copies of the FSDS documents will be included in the data report presenting the findings of the investigation.
- This form will be kept as a quality record in the project file for period stated in the Administrative Order on Consent.

5.4 Scribe Database Requirements
The Scribe will be used to capture the data from the FSDS and performs the following tasks at a minimum:
- Document Field Sample Collection
- Generate Chain of Custody Forms
- Track Field Samples to Laboratories
- Query Database and Produce Reports

The FSDS information is entered into the field database, Scribe.
The Scribe data entry is reviewed by another staff.
The Scribe database is backed up daily off-site to CDM Smith servers. In the event of internet outages, the backups will be made to an external device such as an external hard-drive, thumb drive or CD/DVD. Once internet service is re-established, the backups will be transferred to the main CDM servers.
Field Data Collection Documents, Content, and Control

restored the most current backup will be used and placed on the CDM Smith servers.
- Changes to the finalized FSDS are documented on the FSDS and Scribe.

5.5 Photographs
Photography is restricted at SSFL. All cameras require permits from The Boeing Company (Boeing) to be onsite. Photographs may be taken at the site to visually document field activities and site features, as needed and in accordance with SSFL SOP 15. Digital photographs will be submitted to the electronic project files.

All digital photographs will be documented on a photographic log in the logbook or on a separate form (reference in the logbook). Captions must be added to the file name after the photographs are downloaded. The caption should be a unique identifier – number or date and short description. The photographic log should contain the following information:

- Photograph sequence number
- Description of activity/item shown (e.g., SSFL and sampling activity)
- Date and time
- Direction (if applicable)
- Name of photographer

5.6 Post-Operation
To guard against loss of data as a result of damage or disappearance of logbooks, photocopy completed pages daily and forward to the field or project office weekly (at a minimum). Photocopy other field records (e.g., Field Sample Data Sheets, photographic logs) weekly and submit to the field or project office weekly (at a minimum), or 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.

6.0 Restrictions/Limitations
Field logbooks constitute the official record of onsite technical work, investigations, and data collection activities. Their use, control, and ownership are restricted to activities pertaining to specific field operations carried out by CDM Smith personnel and their subcontractors. They may be used in court to indicate dates, personnel, procedures, and techniques employed during site activities. Entries made in these logbooks should be factual, clear, precise, and non-subjective. Field logbooks, and entries within, are not to be used for personal use.

7.0 References
No references used.
SSFL Phase 3 – Field Sample Data Sheet

Sample ID ................................................................. Date/Time .................................................................

Matrix (circle one)   Start Depth ................................................................. Depth Units (circle one) .................................................................
Soil               Water

End Depth .................................................................

Check if Composite [ ] Collection Method (circle one) .................................................................

QC Type (circle one) ................................................................. Parent Sample ID .................................................................
N     FD     R     FB     TB

Geologist ................................................................. Geologist Registration # .................................................................

Sampler ................................................................. Organization .................................................................

CDM Smith

Analysis

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Method</th>
<th>Analyze?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metals</td>
<td>EPA 6010</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EPA 6020</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EPA 7471 (Soil)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EPA 7470 (Water)</td>
<td></td>
</tr>
</tbody>
</table>

Flouride: EPA 300.0/9056
SVOCs: EPA 8270
TIC: EPA 8270
PAHs: EPA 8270 SIM
1,4 Dioxane: EPA 8270 SIM
Dioxins: EPA 1613
PCBs/PCTs: EPA 8082

Perchlorate: EPA 314.0/331
Perchlorate Confirmation: EPA 6850/6860
pH: EPA 9045 (Soil)
Hexavalent Chromium: EPA 7196/7199
Herbicides: EPA 8151
Pesticides: EPA 8081

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Method</th>
<th>Analyze?</th>
</tr>
</thead>
<tbody>
<tr>
<td>VOCs</td>
<td>EPA 8260</td>
<td></td>
</tr>
<tr>
<td>1,4 Dioxane</td>
<td>EPA 8260 SIM</td>
<td></td>
</tr>
<tr>
<td>TPH-GRO</td>
<td>EPA 8015</td>
<td></td>
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<tr>
<td>TPH-EFH</td>
<td>EPA 8015</td>
<td></td>
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<tr>
<td>Glycols</td>
<td>EPA 8015</td>
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<tr>
<td>Alcohols</td>
<td>EPA 8015</td>
<td></td>
</tr>
<tr>
<td>Terphenyls</td>
<td>EPA 8015</td>
<td></td>
</tr>
<tr>
<td>Nitrates</td>
<td>EPA 300.0/9056</td>
<td></td>
</tr>
<tr>
<td>Energetics</td>
<td>EPA 8330</td>
<td></td>
</tr>
<tr>
<td>Cyanide</td>
<td>EPA 9012</td>
<td></td>
</tr>
<tr>
<td>Formaldehyde</td>
<td>EPA 8315</td>
<td></td>
</tr>
<tr>
<td>NDMA</td>
<td>EPA 1625</td>
<td></td>
</tr>
</tbody>
</table>

Encores

Organotin: NOAA Status and Trends, Krone et al
Methyl Mercury: EPA 1630

FSDS Revision 1.0
### Soil Classification (circle one)

<table>
<thead>
<tr>
<th>MAJOR DIVISION</th>
<th>GROUP SYMBOL</th>
<th>LETTER SYMBOL</th>
<th>GROUP NAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE</td>
<td>GW</td>
<td>W</td>
<td>Well-graded GRAVEL</td>
</tr>
<tr>
<td></td>
<td>GM</td>
<td>G</td>
<td>Poorly graded GRAVEL</td>
</tr>
<tr>
<td></td>
<td>GC</td>
<td>G</td>
<td>Well-graded GRAVE WITH silt</td>
</tr>
<tr>
<td></td>
<td>GC</td>
<td>G</td>
<td>Wetgraded GRAVE WITH clay</td>
</tr>
<tr>
<td></td>
<td>GM</td>
<td>G</td>
<td>Poorly graded GRAVE WITH silt</td>
</tr>
<tr>
<td></td>
<td>SC</td>
<td>G</td>
<td>Poorly graded GRAVE WITH clay</td>
</tr>
<tr>
<td>SAND AND SANITY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE</td>
<td>SM</td>
<td>S</td>
<td>Silty SAND</td>
</tr>
<tr>
<td></td>
<td>SW</td>
<td>S</td>
<td>Clayey SAND</td>
</tr>
<tr>
<td></td>
<td>SC</td>
<td>S</td>
<td>Wetgraded SAND</td>
</tr>
<tr>
<td></td>
<td>WC</td>
<td>S</td>
<td>Wetgraded SAND WITH clay</td>
</tr>
<tr>
<td></td>
<td>WM</td>
<td>S</td>
<td>Poorly graded SAND WITH silt</td>
</tr>
<tr>
<td></td>
<td>WS</td>
<td>S</td>
<td>Poorly graded SAND WITH clay</td>
</tr>
<tr>
<td>FINE GRAINED SOILS CONTAINING MORE THAN 50% FINE</td>
<td>SILT AND CLAY</td>
<td>ML</td>
<td>Inorganic Silt WITH low plasticity</td>
</tr>
<tr>
<td></td>
<td>CL</td>
<td>L</td>
<td>Lean inorganic CLAY WITH low plasticity</td>
</tr>
<tr>
<td></td>
<td>OL</td>
<td>L</td>
<td>Organic Silt WITH low plasticity</td>
</tr>
<tr>
<td></td>
<td>MHL</td>
<td>L</td>
<td>Elastic inorganic Silt WITH moderate to high plasticity</td>
</tr>
<tr>
<td></td>
<td>CH</td>
<td>MB</td>
<td>Fat inorganic CLAY WITH moderate to high plasticity</td>
</tr>
<tr>
<td></td>
<td>PT</td>
<td>MB</td>
<td>Organic Silt OR CLAY WITH moderate to high plasticity</td>
</tr>
</tbody>
</table>

### Additional Comments

- Soil Classification (circle one)
- Check if Fill Material Present
- Percentage Fill (%)
- Fill Description (circle one)
- Odor (circle one)
- Color
- Odor Description (circle one)
- Moisture Condition (circle one)
- Additional Comments
# Lithologic Logging

## 1.0 Objective
This technical standard operating procedure (SOP) governs basic lithologic logging of surface and subsurface soil samples collected during field operations at the Santa Susana Field Laboratory (SSFL) site. The purpose of this SOP is to present a protocol and standardized documentation format for lithologic observations. Protocols for recording basic lithologic data including, but not limited to, soil types (per the Unified Soil Classification System [USCS] classification), presence of fill (and associated deleterious materials), lithologic names, color, moisture, density, contacts, and secondary features such as organic material and fractures.

The goal of this SOP is to have consistent descriptions of the subsurface materials.

## 2.0 Background
Thousands of boreholes and associated descriptions of the surface and subsurface soil and rock have been completed at the SSFL site. Lithologic information about soil, rock, and fill assists in the understanding of subsurface conditions, moisture infiltration, groundwater flow, and potential contaminant migration pathways.

## 2.1 Definitions
The following list corresponds to the description sequences outlined in Section 5.2.1. An example lithologic log is included in Attachment A.

### Name of Sediment or Rock
In naming unconsolidated sediments, the logger shall describe the grain size, distribution, color, and moisture content, and determine the presence of fill materials. In naming sedimentary rocks (only type of bedrock anticipated at SSFL), the logger shall examine the specimen for mineralogy and use the appropriate rock description.

### Color
Color may be determined using the appropriate Munsell color chart (soil or rock) and listing the Munsell number that corresponds to the color. If an unconsolidated material is mottled in color, the ranges in color shall be described. When describing core samples with several individual colors, individual color names shall be listed and an overall best color name shall be given.

### Degree of Consolidation
The degree of consolidation refers to how well the material has been indurated. Unconsolidated sediments may be compacted somewhat and should be described as loose, moderately compacted, or strongly compacted. In some cases they may be slightly cemented by caliche and should be described as slightly cemented, moderately cemented, or strongly cemented. Sedimentary rocks are typically indurated, but may vary in the degree of cementation. These rocks should be described as friable, moderately friable, or well indurated. If the logger believes he/she can identify the cementing material, then it shall be included in the description.

### Moisture Content
Moisture content refers to the amount of water within the sediment or the matrix. Sedimentary rocks and unconsolidated sediments may have associated moisture within and should be described as dry, slightly moist, medium moist, moist, wet (not flowing), or saturated (flowing water).

### Evidence of Contamination
The logger should examine the sample/core and note any obvious signs of contamination such as streaking, free product, odor, or discoloration. These observations will be noted in the field book and on the lithologic log, as well as screening measurements from the photoionization detector (PID) and radiation (alpha, beta) probes.

### Description of Contacts
The logger will note changes in lithology. These changes may be gradational contacts within sediments or may be sharp contacts such as sediments over rocks. The logger should describe whether the contacts are...
### Lithologic Logging

**Composition** – The composition of the rock refers to the mineralogy of the material encountered. The logger should describe the mineralogy, if it can be determined.

### 2.2 Associated Procedures

- 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 Pits for Sample Collection*
- SSFL SOP 8, *Field Data Collection Documents, Content, and Control*

### 2.3 Discussion

The subsurface sampling techniques used at SSFL (i.e., slide hammer, hand auger, DPT rigs, and trenching) all result in soil/rock being brought to the surface for description and logging. The soil boring, core retrieval, and lithologic logging will be conducted under the guidance of a California professional geologist, or other earth scientist under a geologist’s supervision. An important aspect of soil sampling is the identification and differentiation of native soil/rock from fill material. To help in this task, it is important to use the USCS classification scheme, and uniform and consistent descriptions. This SOP also provides a sequence for recording information on a standardized log form to make descriptions as uniform and consistent as possible.

The local geology of SSFL is well characterized; thousands of shallow boreholes and excavations have been completed. Local soil and rock are well documented. As such, detailed lithologic logs are not necessary. The primary goal of lithologic logging is to document the stratigraphic sequence, the presence of fill or native soil, occurrence and type of debris and/or staining, associated PID and radiological screening values, and deviations from the normal or anticipated stratigraphic section.

In addition, all SOPS will be on hand with the field sampling crew.

### 3.0 General Responsibilities

**Field Team Leader (FTL)** – The FTL is responsible for maintaining logbooks and qualified field staff.

**Site Geologist** – Individual responsible for describing and logging of all soil cuttings/samples and all rock per this SOP. A California professional geologist is required to lead this project work.

### 4.0 Required Equipment

The description of subsurface lithologies requires a minor amount of field equipment for the geologist. This section provides a list of equipment to be used by the lithologic logger but does not include equipment such as drill rigs, PID, sampling equipment, and personal protection equipment. The following is a general list of equipment that may be used:

- Field logbook and lithologic log form
- Clipboard
- Munsell color chart for soil
- Munsell color chart for rock
- Dilute (10 percent) hydrochloric acid, as desired
- Waterproof pens
- 10x magnifying hand lens
- Knife or cutting tool
- Zip-top baggies
- Reference field charts, as desired

### 5.0 Procedures

#### 5.1 Office

- Obtain field logbook and lithologic log forms
- Coordinate schedules/actions with FTL
- Obtain necessary field equipment (see above)
- Review field support documents (i.e., Field Sampling Plan [FSP] Addendum, health and safety plan)
- Review applicable geologic references such as historic lithologic logs from the site and/or geologic maps, as needed
5.1.1 Documentation
Record observations in a bound field logbook (SSFL SOP 8) and/or on individual lithologic log forms. Site geologists (i.e., lithologic loggers) will follow the general procedures for keeping a field logbook. If using a bound field logbook, record the same data required on the lithologic log form. Data from the field logbook must be transcribed to the lithologic log form if filling in the form in the field is not feasible. In this case, the data must be the identical to those recorded in the field logbook. Post-logging editing of field logbook data is not allowed. In addition, if data are transcribed to the lithologic log form, it must be completed within 24 hours of the original data recording. All blanks in the lithologic log form must be filled out; if an item is not applicable, an “NA” shall be entered.

The Lithologic Log Form shall be filled out according to the following instructions. The front page of the form contains general information:

- The project name, sample location, subarea, and sample type
- Date that the drilling activity was started and completed
- Name of the person logging along with the beginning depth-end depth (in feet)
- Borehole diameter(s) and drilling methods
- Name and company of the driller and the type of sampling tool used

A map showing the soil sampling location may be attached.

The continuation page(s) of the log form should be completed according to the instructions provided within this section and according to the sequence provided in Section 5.2.1. The depth column refers to the depth below ground surface (bgs) in feet. The tick marks can be arbitrarily set to any depth interval depending on the scale needed except where client requirements dictate the spacing. The lithology column shall contain the USCS soil type/rock type; schematic symbols are not required. Use a single X to mark the area where no core was recovered, and notes shall be recorded as to why the section was not recovered. Sharp or abrupt contacts between lithologies will be indicated by a solid horizontal line. Gradational changes in lithologic composition should be noted. PID and radiation measurements will be recorded within the PID column at the appropriate depth. The description column, where the lithology is described, is the most important part of the lithologic log. In completing this section, use the applicable reference charts and complete according to the sequence in Section 5.2.1. The sample interval column is reserved for noting any samples taken and processed for the laboratory. The sample number shall be filled in at the appropriate depth. The last column refers to the percent core recovery. The geologist will estimate the amount recovered and record the percentage at the appropriate depth.

In addition to the information on the log form, the geologist will record the appropriate information into the logbook when there is a rig shutdown, rig problems, failures to recover cores, or other issues.

5.2 General Guidelines for Using and Supplementing Lithologic Descriptive Protocols
This SOP is intended to serve as a guide for recording basic lithologic information. The descriptive protocol presented here must be followed in making basic observations. Selected information charts may be used for classification and naming of rock, sediment, and soil. Some observations will be common to all rock and soil descriptions. All descriptions shall include as appropriate: name of sediment or rock, color (using the Munsell color charts), moisture content, composition, significant inclusions, and degree of consolidation or induration, and the presence and type of fill materials, if identified. The description of each category shall be separated by a semicolon. Any interpretive comments will be segregated from lithologic descriptions and recorded in the remarks column.

Describe all unconsolidated sediment and soil according to the USCS. It is often more practical to use abbreviations for often-repeated terminology when recording lithologic descriptions. Abbreviations are allowed; however, the abbreviation and its meaning must be recorded on the lithologic log the first time it is used, or listed at the bottom the log. Loggers are cautioned to limit the use of abbreviations to avoid a lithologic log that is cryptic.

5.2.1 Protocols for Lithologic Description of Discrete Soil or Rock Cores
This section describes the protocols for completing a lithologic description based on discrete soil or rock core samples. For
instance, in a 5-foot soil core, the dominant lithology may be siltstone that is interrupted by several thin beds of another lithology such as gravel. This section description can be simplified by writing: 5-10 bgs = siltstone (with other descriptors) except as noted; 7-8 foot gravel zone (with descriptors); 8-9 foot pebble zone (with descriptors); etc. This also aids in “seeing” the thickest unit designations possible for use in modeling.

**Description of Unconsolidated Material**

Unconsolidated material comprises the majority of the subsurface interval for the Phase 3 investigation. The shallow subsurface is very important to the chemical characterization because of infiltration and migration. Soils are to be described as unconsolidated material and will include:

- Name of sediment (sand, silt, clay, etc.)
- Degree of consolidation and cementation
- Grain size and distribution
- Moisture content
- Composition of larger-grained sediments
- Density
- Color (per Munsell color chart)
- Description of contacts
- Composition of larger-grained sediments
- Description of contacts

In accordance with the USCS on naming unconsolidated sediment, the particle size with the highest percentage is the root name. When additional grains are present in excess of 15 percent, the root name is modified by adding a term in front of the root name. For instance, if a material is 80 percent sand and 20 percent gravel, then it is gravelly sand. If the subordinate grains comprise less than 15 percent but greater than 5 percent, the name is written: ____________________(dominant grain) with ________________(subordinate grain). For example, a soil with 90 percent sand and 10 percent silt would be named a sand with silt. If a soil contains greater than 15 percent of four particle sizes, then the name is comprised of the dominant grain size as the root name and modifiers as added before. For example, if a material is 60 percent sand, 20 percent silt, and 20 percent clay the name would be a silty clayey sand. If a material is 70 percent sand, 20 percent silt, and 10 percent clay, it would be a silty sand with clay. When large cobbles or boulders are present, their percentage shall be estimated and their mineralogy recorded.

**6.0 Restrictions/Limitations**

Only geologists, or similarly qualified persons trained in lithologic description, are qualified to perform the duties described in this SOP. The FTL for a project will have the authority to decide whether or not an individual is qualified.

**7.0 References**


**8.0 Attachments**

*Note:* These Attachments are for informational purposes. Other equivalent charts such as USCS or logs may be used.

- Attachment A - Lithologic Logs
- Attachment B - Common Abbreviations for Lithologic Logging
- Attachment C - Naming of Unconsolidated Materials
- Attachment D - Example of Unified Soil Classification System (USCS)
# Lithologic Logging

**Attachment A**  
**Lithologic Log**

<table>
<thead>
<tr>
<th>DRILLING LOG</th>
<th>Client</th>
<th>Boring Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company Name</td>
<td>CDM Smith</td>
<td></td>
</tr>
<tr>
<td>Project</td>
<td>Location</td>
<td></td>
</tr>
<tr>
<td>Name of Driller</td>
<td>Drill Rig(s)</td>
<td></td>
</tr>
<tr>
<td>Sizes and Types of Drilling and Sampling Equipment</td>
<td>Nothing</td>
<td>Bailing</td>
</tr>
<tr>
<td>Surface Elevation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date Started</td>
<td>Date Completed</td>
<td></td>
</tr>
<tr>
<td>Overburden Thickness</td>
<td>Depth Groundwater Encountered</td>
<td></td>
</tr>
<tr>
<td>Depth Drilled into Rock</td>
<td>Depth to Water and Elapsed Time After Drilling Completed</td>
<td></td>
</tr>
<tr>
<td>Total Depth of Hole</td>
<td>Other Water Level Measurements (Specify)</td>
<td></td>
</tr>
<tr>
<td>Drilling Method</td>
<td>Borehole Diameter(s)</td>
<td>Depth of Surface Casing</td>
</tr>
</tbody>
</table>

**Location Map**
Lithologic Logging

| Date: March 2012 |

<table>
<thead>
<tr>
<th>DRILLING LOG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field</td>
</tr>
<tr>
<td>-------</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Wells</th>
<th>Test Flies</th>
<th>Examinations of Materials</th>
<th>(Ft)</th>
<th>(mm)</th>
<th>(Ft)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Project</th>
<th>Field Screening</th>
<th>Sample Ref</th>
<th>Recovery</th>
<th>Reference</th>
</tr>
</thead>
</table>

|  |  |  |  |  |  |
| | | | | | |
Attachment B
Common Abbreviations

<table>
<thead>
<tr>
<th>Common Abbreviations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abundant – abnt</td>
</tr>
<tr>
<td>Amount – amt</td>
</tr>
<tr>
<td>Approximate – approx</td>
</tr>
<tr>
<td>Arenaceous – aren</td>
</tr>
<tr>
<td>Argillaceous – arg</td>
</tr>
<tr>
<td>Average – ave</td>
</tr>
<tr>
<td>Bedded – bdd</td>
</tr>
<tr>
<td>Bedding – bdg</td>
</tr>
<tr>
<td>Calcareous – calc</td>
</tr>
<tr>
<td>Cemented – cmt</td>
</tr>
<tr>
<td>Cobble – cbl</td>
</tr>
<tr>
<td>Contact – ctc</td>
</tr>
<tr>
<td>Cross-bedded – xbdd</td>
</tr>
<tr>
<td>Cross-bedding – xbdg</td>
</tr>
<tr>
<td>Cross-laminated – xlam</td>
</tr>
<tr>
<td>Crystal – xl</td>
</tr>
<tr>
<td>Crystalline – xln</td>
</tr>
<tr>
<td>Grain Size – gn</td>
</tr>
<tr>
<td>fine – f</td>
</tr>
<tr>
<td>very fine – vf</td>
</tr>
<tr>
<td>medium – med</td>
</tr>
<tr>
<td>coarse – crs</td>
</tr>
<tr>
<td>large – lg</td>
</tr>
<tr>
<td>very large – vlg</td>
</tr>
<tr>
<td>small – sm</td>
</tr>
<tr>
<td>Contacts – gradational – grad</td>
</tr>
<tr>
<td>erosional – er</td>
</tr>
<tr>
<td>abrupt – ab</td>
</tr>
<tr>
<td>Grain supported – gs</td>
</tr>
<tr>
<td>matrix supported – ms</td>
</tr>
<tr>
<td>imbricate – im</td>
</tr>
<tr>
<td>Sorting – poor – pr</td>
</tr>
<tr>
<td>moderate – mod</td>
</tr>
<tr>
<td>well – well</td>
</tr>
<tr>
<td>Unconformity – uncnf</td>
</tr>
<tr>
<td>Variegated – vrgt</td>
</tr>
<tr>
<td>Vein – vn</td>
</tr>
</tbody>
</table>
### Attachment C
#### Naming of Unconsolidated Materials

<table>
<thead>
<tr>
<th>Main Particle</th>
<th>Gravel</th>
<th>Sand</th>
<th>Silt</th>
<th>Clay</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 15% gravel</td>
<td>Gravel</td>
<td>Gravelly sand</td>
<td>Gravelly silt</td>
<td>Gravelly clay</td>
</tr>
<tr>
<td>&gt; 15% sand</td>
<td>Sandy gravel</td>
<td>Sand</td>
<td>Sandy silt</td>
<td>Sandy clay</td>
</tr>
<tr>
<td>&gt; 15% silt</td>
<td>Silty gravel</td>
<td>Silty sand</td>
<td>Silt</td>
<td>Silty clay</td>
</tr>
<tr>
<td>&gt; 15% clay</td>
<td>Clayey gravel</td>
<td>Clayey sand</td>
<td>Clayey silt</td>
<td>Clay</td>
</tr>
<tr>
<td>5-15% gravel</td>
<td>Not applicable</td>
<td>Sand with gravel</td>
<td>Silt with gravel</td>
<td>Clay with gravel</td>
</tr>
<tr>
<td>5-15% sand</td>
<td>Gravel with sand</td>
<td>Not applicable</td>
<td>Silt with sand</td>
<td>Clay with sand</td>
</tr>
<tr>
<td>5-15% silt</td>
<td>Gravel with silt</td>
<td>Sand with silt</td>
<td>Not applicable</td>
<td>Clay with silt</td>
</tr>
<tr>
<td>5-15% clay</td>
<td>Gravel with silt</td>
<td>Sand with clay</td>
<td>Silt with clay</td>
<td>Not applicable</td>
</tr>
<tr>
<td>&gt; 15% gravel plus 15% sand</td>
<td>Sandy gravel</td>
<td>Gravelly sand</td>
<td>Gravelly sandy silt</td>
<td>Gravelly sandy clay</td>
</tr>
<tr>
<td>&gt; 15% gravel plus 15% silt</td>
<td>Silty gravel</td>
<td>Gravelly silty sand</td>
<td>Gravelly silt</td>
<td>Gravelly silty clay</td>
</tr>
<tr>
<td>&gt; 15% gravel plus 15% clay</td>
<td>Clayey gravel</td>
<td>Gravelly clayey sand</td>
<td>Gravelly sandy silt</td>
<td>Gravelly clay</td>
</tr>
<tr>
<td>&gt; 15% sand plus 15% silt</td>
<td>Silty sandy gravel</td>
<td>Silty sand</td>
<td>Sandy silt</td>
<td>Sandy silty clay</td>
</tr>
<tr>
<td>&gt; 15% sand plus 15% clay</td>
<td>Sandy clayey gravel</td>
<td>Clayey sand</td>
<td>Sandy clayey silt</td>
<td>Sandy clay</td>
</tr>
<tr>
<td>&gt; 15% silt plus 15% clay</td>
<td>Silty clayey gravel</td>
<td>Silty clayey sand</td>
<td>Clayey silt</td>
<td>Silty clay</td>
</tr>
</tbody>
</table>

**Note:** Other combinations are possible when all particle sizes are present in greater than 15%. For example, a silty clayey gravelly sand. Other possible combinations exist such as a gravelly sand with silt.

# Attachment D

Example of Unified Soil Classification System (USCS)

<table>
<thead>
<tr>
<th>Summary of USCS Field Identification Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Coarse-Grained Soils</strong></td>
</tr>
<tr>
<td>More than half the material (by weight) is individual grains visible to the naked eye.</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Sandy Soils</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Fine-Grained Soils</strong></td>
</tr>
<tr>
<td>More than half the material (by weight) is individual grains not visible to the naked eye. (&lt;0.074 mm)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Highly Organic Soils</strong></td>
</tr>
<tr>
<td>Readily identified by color, odor, spongy feel, and frequently by fibrous texture</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
### Example of Unified Soil Classification System (USCS)

#### Summary of USCS Field Identification Tests

<table>
<thead>
<tr>
<th>Coarse-Grained Soils</th>
<th>Gravelly Soils</th>
<th>Clean Gravels</th>
<th>Substantial amounts of all grain particle sizes</th>
<th>GW</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>More than half of coarse fraction is larger than 4.75 mm.</td>
<td>Will not leave a stain on a wet palm</td>
<td>Predominantly one size or range of sizes with some intermediate sizes missing</td>
<td>GP</td>
</tr>
<tr>
<td></td>
<td>Dirty Gravels</td>
<td>Will leave a stain on a wet palm</td>
<td>Non-plastic fines (to identify, see ML below)</td>
<td>GM</td>
</tr>
<tr>
<td></td>
<td>Predominantly one size or range of sizes with some intermediate sizes missing</td>
<td>Plastic fines (to identify, see CL below)</td>
<td>GC</td>
<td></td>
</tr>
<tr>
<td>Sandy Soils</td>
<td>Gravelly Soils</td>
<td>Clean Sands</td>
<td>Wide range in grain size and substantial amounts of all grain particle sizes</td>
<td>SW</td>
</tr>
<tr>
<td>More than half of coarse fraction is smaller than 4.75 mm.</td>
<td>Will not leave a stain on a wet palm</td>
<td>Predominantly one size or a range of sizes with some intermediate sizes missing</td>
<td>SP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dirty Sands</td>
<td>Will leave a stain on a wet palm</td>
<td>Non-plastic fines (to identify, see ML below)</td>
<td>SM</td>
</tr>
<tr>
<td></td>
<td>Plastic fines (to identify, see CL below)</td>
<td>GC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fine-Grained Soils</td>
<td>Ribbons</td>
<td>Liquid Limit</td>
<td>Dry Crushing Strength</td>
<td>Dilatancy Reaction</td>
</tr>
<tr>
<td>More than half the material (by weight) is individual grains not visible to the naked eye. (&lt;0.074 mm)</td>
<td>None</td>
<td>&lt;50</td>
<td>None to Slight</td>
<td>Rapid</td>
</tr>
<tr>
<td>Weak</td>
<td>Medium to High</td>
<td>Medium to High</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Strong</td>
<td>Slight to Medium</td>
<td>Slow to None</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>Very Strong</td>
<td>High to Very High</td>
<td>None</td>
<td>High</td>
<td>Very High</td>
</tr>
</tbody>
</table>

#### Highly Organic Soils

- Readily identified by color, odor, spongy feel, and frequently by fibrous texture
- OL
- OH
- Pt
1.0 Objective
Because of the evidentiary nature of samples collected during environmental investigations, possession must be traceable from the time the samples are collected until their derived data are used to support remedial or other decisions. To maintain and document sample possession, sample custody procedures, as described in this technical standard operating procedure (SOP) are followed. All paperwork associated with the sample custody procedures at the Santa Susana Field Laboratory (SSFL) site will be retained in CDM Smith files unless Department of Energy (DOE) requests that it be transferred to them.

2.0 Background

2.1 Definitions

Sample – A sample is material to be analyzed that is contained in single or multiple containers representing a unique sample identification number.

Sample Custody – A sample is under custody if:
1. It is in your possession
2. It is in your view, after being in your possession
3. It was in your possession and you locked it up
4. It is in a designated secure area
5. It is in transit by a delivery or courier service

Chain-of-Custody Record – A chain-of-custody record is a form used to document the transfer of custody of samples from one individual to another. The forms are electronic and managed in the Scribe software. An example form is included in the Field Sampling Plan (FSP) Addendum and attached to this SOP.

Custody Seal – A custody seal is a tape-like seal that is part of the chain-of-custody process and is used to detect tampering with samples after they have been packed for shipping. Custody seals are placed on coolers not individual samples.

Sample Label – A sample label is an adhesive label placed on sample containers to designate a sample identification number and other sampling information.

2.2 Associated Procedures
- 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 Pits for Sample Collection
- SSFL SOP 8, Field Data Collection Documents, Content, and Control

3.0 General Responsibilities

Field Team Leader – The field team leader (FTL) is responsible for ensuring that strict chain-of-custody procedures are maintained during all sampling events. The FTL is also responsible for coordinating with the subcontract laboratory to ensure that adequate information is recorded on custody records. The FTL determines whether proper custody procedures were followed during the fieldwork.

Field Sample Custodian – The field sample custodian, designated by the FTL, is responsible for accepting custody of
samples from the sampler(s) and properly packing and shipping the samples to the laboratory assigned to do the analyses.

Sampler—The sampler is personally responsible for the care and custody of the samples collected until they are properly transferred or dispatched.

Site Health and Safety Technician—The person who will use field screening instruments to monitor all field activities for VOCs and radiological contaminants and pre-shipment sample coolers. This person is a trained radiological technician who works under the guidance of Science Application International Corporation’s (SAIC’s) Certified Health Physicist (CHP).

4.0 Required Supplies
- Chain-of-custody record forms
- Custody seals
- Sample labels
- Clear tape
- Computer
- Printer and paper
- Waterproof pen
- Ball point ink pen

5.0 Procedures
5.1 Chain-of-Custody Record
This procedure establishes a method for maintaining custody of samples through use of a chain-of-custody record. This procedure will be followed for all samples collected.

Field Custody
1. The quantity and types of samples to be collected and the proposed sample locations are documented in the FSP Addendum.
2. Complete sample labels for each sample using waterproof ink.
3. Maintain personal custody of the samples (in your possession) at all times until custody is transferred to the sample custodian for sample shipment.

Transfer of Custody and Shipment
1. Complete a chain-of-custody record for all samples (see FSP Addendum for the chain-of-custody record). To transfer the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents sample custody transfer from the sampler, often through another person, to the laboratory sample manager in the appropriate laboratory.
   - The date/time will be the same for both signatures when custody is transferred directly to another person. When samples are shipped via common carrier (e.g., Federal Express), the date/time will not be the same for both signatures. In all cases, it must be readily apparent that the person who received custody is the same person who relinquished custody to the next custodian.
   - If samples are left unattended or a person refuses to sign, this must be documented and explained on the chain-of-custody record.

   Note: If a field sample custodian is designated, he/she may initiate the chain-of-custody record, sign, and date as the relinquisher. The individual sampler(s) must sign in the appropriate block, but does (do) not need to sign and date as a relinquisher.
2. Package samples properly for shipment and dispatch to the appropriate laboratory for analysis. Each shipment must be accompanied by a separate chain-of-custody record. If a shipment consists of multiple coolers, a chain-of-custody record shall be filled out for each cooler documenting only samples contained in that particular cooler.
3. The original record will accompany the shipment. Copies are retained by the FTL and distributed to the appropriate sample coordinator(s). Freight bills will also be retained by the FTL as part of the permanent documentation. The shipping number
Sample Custody

from the freight bill shall be recorded on the applicable chain-of-custody record and field logbook in accordance with SSFL SOP 8).

Procedure for Completing Chain-of-Custody Record

The following procedure is used to fill out the SSFL chain-of-custody record. The custody record must be filled out in its entirety. Chain-of-custody forms will be computer-generated. Review the form to ensure all information boxes are completed. Example custody record information includes:

Chain of Custody Title Information
1. Record site, project code, and cooler number.
2. Record the name and address of the laboratory where the samples are being shipped, and the lab contact’s name.
3. Record the date shipped, overnight courier’s name, and airbill number.

Sample Record Information
1. Record the sample number.
2. Record the matrix and sample personnel names.
3. Record the sample collection method.
4. Record the analysis and turnaround time.
5. Record the preservative and number and type of bottles; the “tag” field will not be used.
6. Record the station location.
7. Enter time of sample collection in military time.
8. List any special instructions. Also, note which samples may have high concentrations as advanced notice for the laboratory.
9. Record if the shipment case is complete.
10. Sign the chain-of-custody record(s) in the space provided. List the title and company of the Relinquisher. All samplers must sign each record.

5.2 Sample Labels

Sample labels will be used for all samples collected at the SSFL site.

1. Complete one label with the following information for each sample container collected:
   - Project code (i.e., project or task number).
   - Station number (sample identification number).
   - Date (i.e., month, day, and year of collection).
   - Time (i.e., military) of sample collection.
   - Mark to indicate soil or water sample.
   - Sampler will place their initial in the space provided.
   - List preservative type.
   - List or mark the “Analyses” for which the sample is to be analyzed. If the desired analysis is not listed, write it in the empty slot. Note: Do not write in the box for “laboratory sample number.”
   - Place or write additional relevant information under “Remarks.”

2. Place adhesive labels directly on the sample containers so that the label is completely below the lid of the container. Place clear tape over the label to protect from moisture.

Note: The EnCore sampler is very small; therefore, the sample label is placed on the zip-top bag that contains the samplers.

3. Double-check that the information recorded on the sample label is consistent with the information recorded on the chain-of-custody record.

5.3 Custody Seals

Two custody seals must be placed on opposite corners of all shipping containers (e.g., cooler) before shipment. The seals
shall be signed and dated by the shipper.

5.4 Sample Shipping
SSFL SOP 11 defines the requirements for packaging and shipping environmental samples. Following packing, all coolers must be screened for radiation by the Site Health and Safety Technician (SSFL SOP 7).

6.0 Restrictions/Limitations
There are no identified restrictions/limitations.

7.0 References


## Attachment A

### Example Chain of Custody Form

<table>
<thead>
<tr>
<th>Sample #</th>
<th>Matrix/Sampler</th>
<th>Col. Method</th>
<th>Analysis/Turnaround</th>
<th>Tag/Preservative/Bottle</th>
<th>Station Location</th>
<th>Collected</th>
<th>For Lab Use Only</th>
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</thead>
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**Special Instructions:**

**Shipment for Case Completion?** N

**Sample Transferred From Chain of Custody #**

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<tr>
<th>Items/Reason</th>
<th>Reinquished by</th>
<th>Date</th>
<th>Received by</th>
<th>Date</th>
<th>Time</th>
<th>Items/Reason</th>
<th>Reinquished By</th>
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<th>Received by</th>
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<th>Time</th>
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</table>

__(CDM Smith (LAB COPY)__

**Date Shipped:**

**Container Name:**

**Ark/-in-Lo:**

**Chain of Custody No.:**

**Site #:**

**Lab:**

**Project Code:**

**Lab Contact:**

**Cooler #:**

**Lab Phone:**

---

SSFL Use Only

Sample Custody

SSFL SOP 10
Revision: 0
Date: March 2012

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1.0 Objective
The objective of this technical standard operating procedure (SOP) is to outline the requirements for the packaging and shipment of environmental samples for the Santa Susana Field Laboratory (SSFL) site. Additionally, Sections 2.0 and 3.0 outline requirements for the packaging and shipping of regulated environmental samples under the Department of Transportation (DOT) Hazardous Materials Regulations, the International Air Transportation Association (IATA), and International Civil Aviation Organization (ICAO) Dangerous Goods Regulations for shipment by air and apply only to domestic shipments. This SOP does not cover the requirements for packaging and shipment of equipment (including data or bulk chemicals) that are regulated under the DOT, IATA, and ICAO. However, packaging and shipment of hazardous material and radioactive samples is not expected.

1.1 Packaging and Shipping of All Samples
This SOP applies to the packaging and shipping of all environmental samples. Samples displaying radioactivity above background concentrations will not be collected or shipped.

Note: This SOP does not address shipment of hazardous or radioactive materials. Do not ship a hazardous or radioactive material unless you have received training that meets the requirements of the Department of Energy (DOE), The Boeing Company (Boeing), CDM Smith, and the DOT.

2.0 Background
2.1 Definitions
Environmental Sample - An aliquot of sample representative of the site. This definition applies only to environmental samples that contain less than reportable quantities for any foreseeable hazardous constituents according to DOT regulations promulgated in 49 CFR - Part 172.101 Appendix A.

Custody Seal - A custody seal is a narrow adhesive-backed seal that is applied to individual sample containers and/or the container (i.e., cooler) before offsite shipment. Custody seals are used to demonstrate that sample integrity has not been compromised during transportation from the field to the analytical laboratory.

Inside Container - The container, normally made of glass or plastic, that actually contacts the shipped material. Its purpose is to keep the sample from mixing with the ambient environment.

Outside Container - The container, normally made of metal or plastic, that the transporter contacts. Its purpose is to protect the inside container.

Secondary Containment - The outside container provides secondary containment if the inside container breaks (i.e., plastic overpackaging if liquid sample is collected in glass).

Excepted Quantity - Excepted quantities are limits to the mass or volume of a hazardous material below which DOT, IATA, ICAO regulations do not apply. The excepted quantity limits are very low. Most regulated shipments will be made under limited quantity.

Limited Quantity - Limited quantity is the amount of a hazardous material exempted from DOT labeling or packaging requirements in 49 CFR. Authorized exemptions are noted under column 8A in the Hazardous Materials Table in 49 CFR 172.101.
Packaging and Shipping Environmental Samples

Qualified Shipper - A qualified shipper is a person who has been adequately trained to perform the functions of shipping hazardous materials.

2.2 Associated Procedures
- SSFL SOP 10, Sample Custody

2.3 Discussion
Proper packaging and shipping is necessary to ensure the protection of the integrity of environmental samples shipped for analysis. These shipments are potentially subject to regulations published by DOT. Failure to abide by these rules places both CDM Smith and the individual employee at risk of serious fines. The analytical holding times for the samples must not be exceeded. If necessary, the samples shall be packed in time to be shipped for overnight delivery or for pick-up by the laboratory courier. Make arrangements with the laboratory before sending samples for weekend delivery.

3.0 General Responsibilities
Field Team Leader–The field team leader (FTL) is responsible for:
- Ensuring that field personnel package and ship samples in accordance with this SOP.
- Ensuring samples are shipped such that holding times can be met by the laboratory.
- Ensuring normal samples collected and QC samples are documented on the Chain of Custody (CoC).

Site Health and Safety Technician–The person who will use field screening instruments to monitor all field activities for VOCs and radiological contaminants and pre-shipment sample coolers. This person is a trained radiological technician who works under the guidance of Science Application International Corporation’s (SAIC’s) Certified Health Physicist (CHP).

4.0 Required Equipment
The following equipment will be needed in the field trailer to conduct sample packing and shipping:

- Site-specific plans (e.g., Field Sampling Plan [FSP] Addendum, health and safety plan
- Insulated coolers with return address to the SSFL site
- Heavy-duty plastic garbage bags
- Plastic zip-top bags, small and large
- Clear tape
- Duct tape
- Nylon reinforced strapping tape
- Rubber bands (optional)
- Bubble wrap (optional)
- Ice in bags
- Custody seals
- Chain-of-custody record
- This End Up and directional arrow labels
- Overnight courier airbills

5.0 Procedures
5.1 Packaging Environmental Samples
Preservatives in samples are not anticipated to meet threshold criteria to be classified as hazardous materials for shipping purposes. The following steps must be followed when packing sample bottles and jars for shipment:

1. Verify the samples undergoing shipment meet the definition of “environmental sample” and are not a hazardous material as defined by DOT. Professional judgment and/or consultation with qualified persons such as the appropriate health and safety coordinator or the health and safety manager shall be observed.

2. Select a sturdy cooler in good repair. Tape any interior opening in the cooler (drain plug) from the inside to ensure control of interior contents. Also, tape the drain plug from the outside of the cooler. Line the cooler with a large heavy-duty plastic garbage bag.

3. Be sure the caps on all bottles are tight (will not leak); check to see that labels and chain-of-custody records are completed properly (SSFL SOP 10).
Packaging and Shipping Environmental Samples

4. Place all bottles in separate and appropriately sized plastic zip-top bags and close the bags. Up to three VOA vials may be packed in one bag. Binding the vials together with a rubber band on the outside of the bag, or separating them so that they do not contact each other, will reduce the risk of breakage. Bottles may be wrapped in bubble wrap or placed into foam bottle holders.

*Note:* Trip blanks must be included in coolers containing VOA samples.

5. Place bubble wrap in the bottom of an empty cooler followed by a large plastic bag, and place the sample containers in the bag with sufficient space to allow for the addition of packing material between any glass containers. It is preferable to place glass sample bottles and jars into the cooler vertically. Glass containers are less likely to break when packed vertically rather than horizontally. The containers may alternatively be placed into foam holders that fit within the coolers.

6. While placing sample containers into the cooler, conduct an inventory of the contents of the shipping cooler against the chain-of-custody record. The chain-of-custody with the cooler shall reflect only those samples within the cooler.

7. Put ice in large plastic zip-top bags (double bagging the zip-tops is preferred) and properly seal. Place the ice bags on top of and/or between the samples. Several bags of ice are required (dependant on outdoor temperature, staging time, etc.) to maintain the cooler temperature at approximately 4° Celsius (C) if the analytical method requires cooling. Fill all remaining space between the bottles or cans with packing material. Securely fasten the top of the large garbage bag with fiber or duct tape.

8. The samples in the cooler must match the CoC record. Print copies of the electronic CoC form. Place one copy of the completed CoC record for the laboratory into a plastic zip-top bag, seal the bag, tape the bag to the inner side of the cooler lid. Retain a second copy of the CoC for sample management records. Close the cooler lid.

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

10. The shipping container lid must be marked “THIS END UP” and arrow labels that indicate the proper upward position of the container shall be affixed to the cooler. A label containing the name and address of the shipper (CDM Smith) shall be placed on the outside of the container. Labels used in the shipment of hazardous materials (such as Cargo Only Air Craft, Flammable Solids, etc.) are not permitted on the outside of containers used to transport environmental samples and shall not be used. The name and address of the laboratory is included on the shipping label (i.e., overnight delivery service label).

11. Screen the cooler with the radiation meter before shipment and document that a background levels (at most) exist. The cooler will be surveyed by the RAD Technician to ensure that radiation flux on exterior surfaces does not exceed 0.5 mrem/hr on all sides. This survey will be documented and the results reviewed by the qualified shipper, as needed.

### 5.2 Packaging of Limited-Quantity Radioactive Samples

Samples containing radioactivity above background will not be collected and therefore, will not be shipped. Any exceedence of radiological screening levels (per the health and safety plan or SSFL SOP 7) will be set aside and the DOE and Boeing will be contacted.

### 6.0 Restrictions/Limitations

This SOP addresses the packing and shipping of non-radioactive environmental samples. Being a site that has a history of radioactive occurrences, the sample locations, samples, and coolers will be screened for radioactivity. However, CDM Smith will not handle, package, or ship samples with radioactivity. If radioactivity above background is detected, packing and shipping work will be temporarily suspended and DOE, Boeing, and the California Department of Toxic Substance Control (DTSC) will be contacted for further direction. The cooler or samples will be set aside, and work with those samples will not resume until approved by DOE or Boeing. Any effort beyond stop work will require modified SOPs.
7.0 References


# Field Equipment Decontamination

## 1.0 Objective

The objective of this technical standard operating procedure (SOP) is to describe the general procedures required for decontamination of non-disposable field equipment for the Santa Susana Field laboratory (SSFL) site. Given the history of radioactive material usage at SSFL, screening for radioactive materials will occur with all field operations. Decontamination of field equipment is necessary to ensure acceptable quality of samples by preventing cross-contamination. Further, decontamination reduces health hazards and prevents the spread of contaminants off site.

## 2.0 Background

Decontamination of equipment will occur before sampling begins and between each sample collection (for sampling equipment). All decontamination water will be collected for future disposal.

## 2.1 Definitions

- **ASTM Type II Water** – Reagent grade water defined by American Standards for Testing and Measurements (ASTM) that is used in the final rinse of surfaces of contaminated equipment.

- **Clean** – Free of contamination and when decontamination has been completed in accordance with this SOP.

- **Cross-Contamination** – The transfer of contaminants through equipment or personnel from the contamination source to less contaminated or non-contaminated samples or areas.

- **Decontamination** – The process of rinsing or otherwise cleaning the surfaces of equipment to rid them of contaminants and to minimize the potential for cross-contamination of samples or exposure of personnel.

- **Material Safety Data Sheets** – These documents discuss the proper storage and physical and toxicological characteristics of a particular substance used during decontamination. These documents, generally included in site health and safety plans, shall be kept on site at all times during field operations.

- **Potable Water** – Potable water is provided by local city sources and is safe for consumption. Chemical analysis of the water source will not be required before it is used.

- **Site Health and Safety Technician** – The person who will use field screening instruments to monitor all field activities for VOCs and radiological contaminants and pre-shipment sample coolers. This person is a trained radiological technician who works under the guidance of Science Application International Corporation’s (SAIC’s) Certified Health Physicist (CHP).

- **Sampling Equipment** – Equipment that comes into direct contact with the sample media.

- **Soap** – Low-sudsing, non-phosphate detergent such as Liquinox™.

## 2.2 Associated Procedures

- 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 Pits for Sample Collection*

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
# Field Equipment Decontamination

| SSFL SOP 6, *Field Measurement of Total Organic Vapors* |
| SSFL SOP 7, *Field Measurement of Residual Radiation* |
| SSFL SOP 13, *Guide to Handling Investigation-Derived Waste* |

## 3.0 Responsibilities

**Field Team Leader (FTL)** - ensures that field personnel are trained in the performance of this procedure and that decontamination is conducted in accordance with this SOP. The FTL may also be required to collect and document rinseate samples (also known as equipment blanks) to provide quantitative verification that these procedures have been correctly implemented.

**Field Team Member** - performs decontamination of field sampling equipment and/or oversees subcontractors performing decontamination activities. Ensures the procedures are followed, equipment is clean, and collects field equipment rinseate blanks.

## 4.0 Required Equipment

- Stiff-bristle scrub brushes
- Plastic buckets and troughs
- Portable hot-water/steam, high pressure spray cleaners
- Soap
- Nalgene or Teflon sprayers or wash bottles or 2- to 5-gallon, manual-pump sprayer (pump sprayer material must be compatible with the solution used)
- Plastic sheeting, plastic bags, and/or aluminum foil to keep decontaminated equipment clean between uses
- Disposable wipes, rags, or paper towels
- Potable water
- ASTM Type II water
- Trough or collection pool to contain wash waters duration decontamination
- Sheet plastic to place beneath trough to contain any splash water
- Gloves, safety glasses, and other protective clothing as specified in the health and safety plan
- Tools for equipment assembly and disassembly (as required)
- 55-gallon drums for temporary storage of decontamination water
- Drum labels
- Pallets for drums holding decontamination water
- Pump to transfer water to drums (as needed)

## 5.0 Procedures

Decontaminate all reusable equipment (non-dedicated) used to collect, handle, or measure samples before coming into contact with any sampled media or personnel using the equipment. Screen all used equipment for radioactivity before transport to the decontamination area (SSFL SOP 7). Decontaminate equipment at portable decontamination stations set up at the sampling location. Transport equipment to and from the decontamination station in a manner to prevent cross-contamination of equipment and/or area. Take precautions such as enclosing large equipment (rods) in plastic wrap while being transporting.

Construct the decontamination area so that contaminated water is either collected directly into appropriate containers (5-gallon buckets or steel wash tubs) suitable for collecting the decontamination water. If needed construct small soil berm or depression lined with plastic to collect any overspray or splash. Transfer water from the collection pool and containment area into 55-gallon drums for temporary storage. Stage decontamination water until sampling results or waste characterization results are obtained and evaluated and the proper disposition of the waste is determined (SSFL SOP 13).

Decontaminate all items that come into contact with potentially contaminated media before use and between sampling and/or drilling locations. If decontaminated items are not immediately used, cover them with either clean plastic or aluminum foil depending on the size of the item. Decontamination procedures for equipment are as follows:
Field Equipment Decontamination

General Guidelines
- Potable and ASTM Type II water will be free of all contaminants of concern.
- Decontaminated equipment will be allowed to air dry before being used.
- Equipment type, date, time, and method of decontamination along with associated field quality assurance sampling shall be recorded in the appropriate logbook.
- Gloves, boots, safety vest, safety glasses, and any other personnel protective clothing and equipment shall be used as specified in the health and safety plan.

5.1 Heavy Equipment Decontamination
The following steps will be used when decontaminating heavy equipment (i.e., backhoes):

1. Establish a decontamination area (e.g., large troughs or plastic sheeting with temporary wood bermed sides) that is large enough to fully contain the equipment to be cleaned. All decontamination areas must be upwind of the area under investigation.

2. Screen the backhoe bucket and arm for radioactivity. If measured above background, take measures to contain decontamination water separately from non-radioactive-impacted water.

3. With the heavy equipment in place, spray areas (bucket of the backhoe) exposed to contaminated media using a hand-handle sprayer. Be sure to spray down all surfaces that contact soil.

4. Use brushes, soap, and potable water to remove dirt whenever necessary.

5. Remove equipment from the decontamination pool and allow it to air dry before returning it to the work site.

6. After decontamination activities are completed, collect all contaminated wastewater, plastic sheeting, and disposable gloves, boots, and clothing in separate containers or receptacles (i.e., solids and liquids). A decontamination area may be used for multiple day/weeks provided the containment integrity is maintained. All receptacles containing contaminated items must be properly labeled for disposal. Liquids must be separated from solids and drummed.

5.2 Downhole Equipment Decontamination
Downhole equipment includes rods, stems, etc. Follow these steps when decontaminating this equipment:

1. Set up a centralized decontamination area (e.g., large trough of plastic bermed area), if possible. This area shall be set up to collect contaminated rinse waters and to minimize the spread of airborne spray.

2. Set up a "clean" area upwind of the decontamination area to receive cleaned equipment for air-drying. At a minimum, clean plastic sheeting must be used to cover tables or other surfaces on which decontaminated equipment is to be placed. All decontamination areas shall be upwind of any areas under investigation.

3. Screen all equipment for radioactivity before decontamination. If measured above background, take measures to contain decontamination water separately from non-radioactive-impacted water.

4. Place the object in a 5-gallon bucket or tub for detergent wash. If needed, longer equipment may be placed on aluminum foil or plastic-covered wooden sawhorses or other supports. The objects to be cleaned shall be at least 2 feet above the ground to avoid splash back when decontaminating.

5. Using soap and potable water wash the contaminated equipment. When using hand-handle sprayers aim nozzle downward to avoid spraying outside the decontamination area. Be sure to spray inside corners and gaps especially well. Use a brush, if necessary, to dislodge dirt.

6. Move the equipment to a second bucket and rinse the equipment using clean, potable water.
Field Equipment Decontamination

SSFL SOP 12
Revision: 0
Date: March 2012

7. Using a suitable sprayer, conduct a final rinse of the equipment thoroughly with ASTM Type II water.

8. Remove the equipment from the decontamination area and place in a clean area upwind to air dry.

9. After decontamination activities are completed, collect all contaminated wastewaters, plastic sheeting, and disposable gloves, boots, and clothing in separate containers or receptacles. All receptacles containing contaminated items must be properly labeled for disposal. Liquids must be separated from solids and drummed. Any radioactive decontamination water must be contained in separate drums.

5.3 Sampling Equipment Decontamination

Follow these steps when decontaminating sampling equipment:

1. Set up a decontamination line (e.g., buckets or trough). The decontamination line shall progress from "dirty" to "clean." A clean area shall be established upwind of the decontamination wash/rinse activities to dry the equipment. At a minimum, clean plastic sheeting must be used to cover the tables or other surfaces that the decontaminated equipment is placed for drying.

2. Disassemble any items that may trap contaminants internally. Do not reassemble the items until decontamination and air drying are complete.

3. Wash the items with potable water and soap using a stiff brush as necessary to remove particulate matter and surface films.

4. Thoroughly rinse the items with potable water.

5. Rinse the items thoroughly using ASTM Type II water.

6. Allow the items to air dry completely.

7. After drying, reassemble the parts as necessary and wrap the items in clean plastic wrap or in aluminum foil.

8. After decontamination activities are completed, collect all contaminated waters, plastic sheeting, and disposable personal protective equipment. Separate solid waste from liquid investigation-derived waste. Place solid water items in trash bags for municipal disposal. Liquids must be separated from solids and drummed. Any radioactive decontamination water must be contained in separate drums. Refer to site-specific plans for labeling and waste management requirements.

5.4 Waste Disposal

Refer to site-specific plans and SSFL SOP 13 for waste disposal requirements. The following are guidelines for disposing of wastes:

- All wash water, rinse water, and decontamination solutions that have come in contact with contaminated equipment are to be handled, packaged (55-gallon drums), labeled, marked, stored, and disposed of as investigation-derived waste.
- Small quantities of decontamination solutions may be allowed to evaporate to dryness.
- Unless otherwise required, plastic sheeting and disposable protective clothing may be treated as solid, nonhazardous waste and placed in trash bags for disposal.
- Waste liquids shall be sampled, analyzed for contaminants of concern in accordance with disposal regulations, and disposed of accordingly.

6.0 Restrictions/Limitations

If the field equipment is not thoroughly rinsed and allowed to completely air dry before use, volatile organic residue, which interferes with the analysis, may be detected in the samples. The occurrence of residual organic solvents is often
dependent on the time of year sampling is conducted. In the summer, volatilization is rapid, and in the winter, volatilization is slow.

7.0 References

1.0 Objective
This technical standard operating procedure (SOP) presents guidance for the management of investigation-derived waste (IDW) generated at the Santa Susana Field Laboratory (SSFL) site during soil sampling, trenching, and equipment decontamination activities. The primary objectives for managing IDW during field activities include:

- Leaving the site in no worse condition than existed before field activities
- Removing wastes that pose an immediate threat to human health or the environment
- Segregating radiological wastes above background or "permissible" concentrations
- Complying with federal, state, local, regulations
- Minimizing the quantity of IDW

2.0 Background
2.1 Definitions
Hazardous Waste - Discarded material that is regulated listed waste, or waste that exhibits ignitability, corrosivity, reactivity, or toxicity as defined in 40 CFR 261.3 or state regulations.

Investigation-Derived Wastes - Discarded materials resulting from field activities such as sampling, surveying, drilling, excavation, and decontamination processes that, in present form, possess no inherent value or additional usefulness without treatment. Wastes will be personal protective equipment, (e.g., nitrile gloves, paper towels, polyethylene sheeting) and decontamination fluids that may be classified as hazardous or nonhazardous.

Mixed Waste - Any material that has been classified as both hazardous and radioactive.

Radioactive Wastes - Discarded materials that are contaminated with radioactive constituents with specific activities in concentrations greater than the latest regulatory criteria (i.e., 10 CFR 20).

Treatment, Storage, and Disposal Facility (TSDF) - Permitted facilities that accept hazardous waste shipments for further treatment, storage, and/or disposal. These facilities must be permitted by the U.S. Environmental Protection Agency (EPA) and appropriate state and local agencies.

2.2 Discussion
Field investigation activities result in the generation of waste materials that may be characterized as hazardous or radioactive. IDWs may include solutions from decontaminating sampling equipment; and other wastes or supplies used in sampling and testing potentially hazardous or radiologically contaminated material. Personal protective equipment (PPE) and other solid waste (paper towels, plastic sheeting, etc) are not considered IDW. DPT cuttings, excess sample spoils, and excavated soil will be returned to the borehole/excavation and are not considered IDW.

3.0 General Responsibilities
Field Team Leader - The field team leader (FTL) is responsible for ensuring that field personnel conduct field activities in accordance with this SOP and the Field Sampling Plan (FSP) Addendum.

Field Team Members - Field team members are responsible for implementing this SOP and communicating any unusual or unplanned condition to the FTL’s attention.
SSFL Use Only

Guide to Handling Investigation-Derived Waste
SSFL SOP 13
Revision: 0
Date: March 2012

Site Health and Safety Technician—The person who will use field screening instruments to monitor all field activities for VOCs and radiological contaminants and pre-shipment sample coolers. This person is a trained radiological technician who works under the guidance of Science Application International Corporation’s (SAIC’s) Certified Health Physicist (CHP).

4.0 Required Equipment and Handling

4.1 IDW Containment Devices
Currently, the anticipated IDW containment device is:

- Department of Transportation (DOT)-approved 55-gallon steel containers (drums)

4.2 IDW Container Labeling
An “IDW Container” label shall be applied to each drum using indelible marking. Labeling or marking requirements for IDW are as detailed below.

- The Site Health and Safety Technician will screen all containers for radioactivity using hand-held field instruments.
- Include the following information on labels and markings: project name, generation date, location of waste origin, container identification number, sample number (if applicable), and contents (i.e., decontamination water).
- Apply each label or marking to the upper one-third of the container at least twice, on opposite sides.
- Position labels or markings on a smooth part of the container. The label must not be affixed across container bungs, seams, ridges, or dents.
- Use weather-resistant material for labels and markings and permanent markers or paint pens capable of enduring the expected weather conditions. If markings are used, the color must be easily distinguishable from the container color.
- Secure labels in a manner to ensure that they remain affixed to the container.

Labeling or marking requirements for hazardous (or radioactive) IDW expected to be transported offsite must be in accordance with the requirements of 49 CFR 172 (not anticipated for this work). Wastes determined to be hazardous or radioactive will be staged onsite until disposal options are determined by Department of Energy (DOE) or The Boeing Company (Boeing). Upon generation and containment and prior to transport, DOE, Boeing, and the California Department of Toxic Substance Control (DTSC) will be immediately notified of the occurrence. Contact information is provided in the health and safety plan.

4.3 IDW Container Movement
Predetermine staging areas for IDW containers in accordance with SSFL requirements. Determine the methods and personnel required to safely transport IDW containers to the staging area before field mobilization. Handling and transport equipment will be consistent with the associated weight for both lifting and transporting. Transportation of IDW containers offsite via a public roadway is prohibited unless 49 CFR 172 requirements are met.

Wastes determined to be hazardous or radioactive will be handled as directed by DOE or Boeing and segregated from standard IDW and solid wastes.

4.4 IDW Container Storage
Stage containerized IDW awaiting results of chemical analysis at a pre-determined location on the SSFL site. Store containers such that the labels can be easily read. Provide a secondary/spill container for liquid IDW storage (e.g., steel drums shall not be stored in direct contact with the ground).

5.0 Procedures
All liquid IDW generated at the site will be disposed offsite. The field screening and chemical analyses will determine the ultimate disposition of the waste. Formal plans for the management of IDW will be determined by CDM Smith and submitted to DOE, Boeing, and DTSC for approval. Interim management of IDW is discussed below.

5.1 Collection for Offsite Disposal
Radiological screening and laboratory analysis are required before sending any IDW to an offsite TSDF or to a publicly
owned treatment works (POTW). Manifests are required to accompany any IDW determined to be hazardous, and DOE will direct the handling of this material. Arrange with DOE and/or Boeing who are responsible for the site and signing as generator on any waste profile and all manifests or bill of ladings; it is CDM Smith’s policy not to take ownership of the waste, but may sign waste profiles or manifests on behalf of DOE or Boeing, as an authorized contractor. Use permitted TSDFs and transporters for the respective wastes. Non-bulk containers (e.g., drums) must have a DOT-approved label affixed to the container and all required associated placard stickers before leaving SSFL for an offsite TSDF. Include information as required in 49 CFR 172.

5.1.1 Aqueous Liquids
Store used decontamination fluids in appropriate containers (e.g., 55-gallon drums) at a pre-designated staging area at SSFL. Prior to being disposed offsite by a disposal vendor, ship a sample of the fluids for laboratory analysis.

5.2.2 Disposable PPE and Other Solid Waste
Dispose of personal protective equipment and other solid waste (paper towels, plastic, etc.) offsite as solid waste. After screening for radioactivity, these wastes may be contained in standard plastic trash bags and placed in trash cans.

6.0 Restrictions/Limitations
The project managers will determine the most appropriate disposal option for solid waste and used decontamination fluids. Parameters to consider, especially when determining the level of protection, include the volume of IDW and the level of contaminants present in the surface and subsurface soils. Under no circumstances will IDW materials be stored in a siteoffice or warehouse.

7.0 References


1.0 Objective

The purpose of this technical standard operating procedure (SOP) is to introduce the procedures for non-invasive geophysical investigations in areas suspected of being used for disposal of debris or where landfill operations may have been conducted. Specifics of the geophysical surveys will be discussed in the Geophysical Survey Field Sampling Plan Addendum. Geophysical methods that will be used to accurately locate and record buried geophysical anomalies are:

- Total Field Magnetometry (TFM)
- Frequency Domain Electromagnetic Method (FDEM)
- Ground Penetrating Radar (GPR)

TFM and FDEM will be applied to all areas of interest while GPR will be applied only to areas of interest that require further and/or higher resolution of geophysical anomaly. The geophysical investigation (survey) will be conducted by geophysical subcontractor personnel trained, experienced, and qualified in shallow subsurface geophysics necessary to successfully perform any of the above geophysical methods. CDM Smith will provide oversight of the geophysical contractor.

2.0 Background

2.1 Discussion

This SOP is based on geophysical methods employed by US Environmental Protection Agency’s (EPA) subcontractor Hydrogeologic Inc. (HGL) while conducted geophysical surveys of portions of Area IV during 2010 and 2011. The Data Gap Investigation conducted as part of Phase 3 identified additional locations of suspected buried materials not surveyed by HGL. To be consistent with the recently collected subsurface information, HGL procedures are being adopted.

The areas of interest and survey limits will be determined prior to field mobilization. The rationale for selecting the specific geophysical instrument, investigation method, and area of interest is detailed in the Field Sampling Plan (FSP) Addendum. In addition, all SOPs will be on hand with the field sampling team.

2.2 Associated Procedures

- SSFL SOP 5, Backhoe Trenching/Test Pits for Sample Collection
- SSFL SOP 6, Field Measurement of Total Organic Vapor
- SSFL SOP 7, Field Measurement of Residual Radiation
- SSFL SOP 8, Field Data Collection Documents, Content, and Control

3.0 General Responsibilities

Field Team Leader-The field team leader (FTL) is responsible for oversight of the geophysical subcontractor and ensuring that survey work is conducted in accordance with this SOP.

Site Health and Safety Technician—The person who will use field screening instruments to monitor all field activities for VOCs and radiological contaminants and pre-shipment sample coolers. This person is a trained radiological technician who works under the guidance of Science Application International Corporation’s (SAIC’s) Certified Health Physicist (CHP).

4.0 Required Equipment

- Appropriate project documents (including FSP Addendum and health and safety plan)
- Personal protective clothing and equipment (there may be limitations for steel-toed boots and geophysical equipment)
5.0 Procedures

5.1 Site Reconnaissance

The FTL will perform a site reconnaissance of the area of interest to identify features that would suggest ground disturbance and further define the geophysical survey boundaries. Mounding or hummocky ground surface and the presence of surface debris and ferrous material will be noted. These features will be marked with a wooden stake, surveyor’s flag, or nail and whisker, and their location recorded with a GPS unit. All surface metal such as scrap metal, fences, above ground pipes and tanks, manholes, and signposts, will be mapped and recorded using a GPS unit. Radiological screening will occur at each area of interest scheduled for a geophysical survey.

5.2 Grid Layout

Areas of interest will be divided into 100-foot by 100-foot grids. A wooden stake placed at the southwest corner of each grid will be used to uniquely identify each grid. A 300-foot measuring tape will be used to measure the north and south sides of each grid. North to south oriented traverse lines will be marked starting from the southwest corner of each grid. Geophysical data will be collected along these traverse lines.

5.3 Data Acquisition

5.3.1 Total Field Magnetometry (TFM)

The TFM system consists of two instruments, the Geometrics G858 cesium vapor magnetometer (CVM) used for area of interest measurements and the G856 proton procession magnetometer (PPM) for base station correction. TFM is useful for identifying ferrous metal objects at shallow to moderately deep depths as well as mapping subtle changes in magnetic properties of soil.

To monitor the earth’s magnetic field, which varies in time, PPM base station data will be collected in automatic mode with a total magnetic field reading made every 10 seconds. The PPM base station will be set up near the SSFL quality assurance/quality control (QA/QC) area (described in Section 5.5). The sensor will be attached to a pole at a height of 6 feet above ground surface and oriented due north. Base station readings will be recorded prior to field data collection, in the middle of the day and at the end of the day to ensure that the PPM is working properly. The entire day’s data will be recorded and stored in the G856 internal logger. Data will be downloaded from the internal logger at the end of each day.

Total magnetic field at each area of interest will be measured using the CVM. Because the size of the area of interest will vary by location, the Geophysical Survey Field Sampling Plan Addendum will describe the spacing of transects and grids. Nominally selected areas may be surveyed using 100-foot by 100-foot grids divided into 10-foot spaced transects and marked in the field using traffic cones. Each transect will be traversed until the grid is completely surveyed. Tie lines will be used as appropriate to adjust levels from one survey line to the next.

The CVM will be set to record 10 cycles per second and an AG-132 GPS unit will be attached to the CVM. Data will be stored in the G858 internal data logger. The CVM will carry two sensors (gradiometer mode) mounted in parallel recording data simultaneously and perpendicular to the ground at a height of about 3 feet. The operator will remove all metal from his person prior to performing the survey and will ensure the proper orientation of the sensors. The operator will check battery level and the GPS and the sensor signal strength. The operator will monitor the GPS and signal data stream during the survey using the G858 liquid crystal display. Data will be downloaded from the data logger at the end of each day.

The CVM survey total magnetic field data will be corrected for temporal changes in Earth’s magnetic field (diurnal drift) during the period of the survey. The diurnal drift correction will be made by subtraction of the variations measured by the PPM at the base station from the CVM survey total magnetic field data. The CVM gradiometer data requires no diurnal corrections because the diurnal changes affect both sensors equally.

A diurnal drift correction will be made to the TFM data. The gradiometer data automatically removes regional magnetic
gradient and increases resolution of anomalies. The need for additional filtering of the TFM and gradiometer data will be
determined by the geophysicist interpreting the data and cannot be specified at this time. The data processing and
assumptions will be provided by the CDM subcontractor performing the geophysical subcontractor and will be described in
greater detail in the Geophysical Survey Field Sampling Plan Addendum.

5.3.2 Frequency Domain Electromagnetic Method (FDEM)
Mapping of shallow disposal pits, fill areas, utility lines, and larger metallic objects using conductivity measurements will be
accomplished using the FDEM system, the Geonics EM-31 standard and EM-31 short. The EM-31 short will be used on
steep, hilly terrain. The EM-31 will be set to record terrain conductivity at an interval of five cycles per second. Location
information will be obtained using an AG-114 GPS unit; conductivity and GPS data will be recorded on an Allegro handheld
personal computer. Data will be downloaded at the end of each day.

Terrain conductivity at each area of interest will be measured using the EM-31. Nominally, 100-foot by 100-foot grid will be
divided into 5-foot spaced transects and marked in the field using traffic cones. However, spacing may vary based on the
size of the area and objectives stated in the Geophysical Survey Field Sampling Plan Addendum. Each transect will be
traversed until the grid is completely surveyed.

The operator will remove all metal from his body prior to conducting the survey. The Operator will check the GPS data
stream and perform an EM-31 function test, and ensure that the coils are approximately 3 feet above the ground and
oriented parallel with the ground. The operator will ensure proper function of the EM-31 and GPS by monitoring the liquid
crystal display of the Allegro handheld personal computer.

5.3.3 Ground Penetrating Radar (GPR)
GPR will be used to locate utilities, USTs, metallic and non-metallic containers, and boundaries of burial trenches to a
higher resolution that that obtained using the TFM or FDEM systems. GPR uses pulsed, high frequency signals (i.e., radio
waves) transmitted into the ground using an antenna. The sample antenna receives the electromagnetic waves reflected
from materials with differing dielectric properties. The data is recorded by the Noggin 250 Smart Cart instruments digital
video logger (DVL).

An odometer will be attached to the Noggin 250 Smart Cart and data will be recorded at a rate of 1 cycle per 2 inches.
Data will be recorded using the DVL and will be downloaded at the end of each day.

When higher resolution is required, the GPR will be used at areas of interest or an anomaly. The 100-foot by 100-foot grid
will be divided into nominally 2-foot spaced transects and marked in the field using traffic cones. The specific spacing may
vary depending on the size of the study unit and the objectives stated in the Geophysical Survey Field Sampling Plan
Addendum. Each transect will be traversed until the grid is completely surveyed.

To ensure proper operation of the GPR system, the operation will monitor the line length and cross-section on the DVL.

5.4 Navigation and Global Positioning System (GPS)
To properly locate and record geophysical investigations positions and anomalies, four different global positioning system
(GPS) devices will be used:

- Trimble AG-114 and AG-132 – used with EM-31 and CVM
- Trimble Handheld GeoXH and Real Time Kinematic – used for grid setup, surface material identification, and
  ground truthing.

The geodetic datum will be the California State Plane Coordinate System, North American Datum 1983 Zone 5, converted
from the World Geodetic System 84 geographic (north latitude, west longitude) datum.

5.5 Quality Assurance/Quality Control

5.5.1 Control Evaluation Area
The effectiveness of the use of the CVM, EM-31, and GPR to detect buried metallic objects under actual site conditions will be demonstrated using a performance test plot established by HGL. The test plot includes specific locations of buried debris that was used by HGL as part of its Area IV geophysical surveys. Instruments used to conduct the Phase 3 surveys will be used over the test plot to check instrument responses. The data will be compared with that collected by HGL to demonstrate instrument performance. Corrections will be made to instrument performance where the readings do not match.

In addition, the QA/QC control evaluation area constructed by HGL in Subarea 5D-North in an undisturbed area free of buried metal and cultural interferences will be used to obtain background readings. The area consists of an instrument check base station and two evaluation test strips (a baseline and seeded line). Information pertaining to the control evaluation area is included in the EPA Santa Susana Field Laboratory Geophysical Report (HGL 2011).

The EM-31 and CVM will be evaluated each morning in the QA/QC control evaluation area as follows:

- **Static Test** – three minute stationary test conducted in the instrument check base station with EM-31 or CVM recording data. The operator will shake and pull the cables to simulate field conditions.
- **Baseline Test** – motion test conducted over the baseline evaluation test strip using EM-31 or CVM recording data.
- **Seeded Line Test** – motion test conducted over the seeded line evaluation test strip using EM-31 or CVM recording data.

The test data will be reviewed during data collection and following data collection. CDM Smith and the subcontractor will evaluate the test data to determine if the equipment was functioning properly and that the target detection capabilities of the instruments were consistent with the objectives/standards of the investigation.

### 5.5.2 Daily Instrument Checks

All geophysical instruments are calibrated at the factory and no field calibration will be necessary. Daily instrument field checks will be performed as recommended by the manufacturer. The functional and quality checks for each instrument are described below. Refer to the manufacturer’s operation manual for specific procedures for each instrument.

**CVM** – Following setup of the instrument and before operating the CVM the following functions will be checked to ensure proper operation:

- Battery – batteries will be checked to ensure that they are fully charged.
- Signal Strength – Prior to operating the CVM, the sensors signal strength will be operating at 25 percent or greater full signal strength.
- GPS Acquisition – Prior to operating the CVM, the GPS chat mode will be checked to ensure that unit is functioning properly and receiving a signal.

**PPM** – The following functional tests will be performed:

- Synchronization of instrument time clocks – CVM and PPM clocks will be synchronized to the second. Record day and time.
- Reading Check – Record ambient magnetic field.
- Tuning – Tune instrument to 47,500 nanoTesla ambient field and maintain between 4.0 and 8.0 signal strength.
- Time – Record real time and the time on the PPM.

**EM-31 Standard and EM-31 Short** – Prior to each day of testing, during the midday function test, and at the completion of each day’s geophysical activities, several functional tests and nulling of the I component (measure of the “quality” of the conductive materials within the volume investigated) will be conducted at the instrument check base station. The following information will be recorded daily:

- Battery Check – record at beginning of day and prior to connecting to receiver. Batteries should read above 4.7 volts.
Geophysical Survey

- **Zero in Test** – record at beginning of day and prior to connecting to receiver. The Q interval (measure of the average bulk terrain conductivity sampled over a volume of earth to a maximum depth proportional to the coil spacing and transmission frequency of the instrument) is required to be between -1.000 and 1.000. Adjust instrument as necessary.
- **Nulling** – record at beginning and end of each day. The I component should be adjusted to 0.000 and within -0.003 and 0.003. Check and adjust frequently throughout the day.
- **Phase Test** – record at the beginning of the day and during the midday function test. The Q value is required to be 0.100 between two course adjustment settings.
- **Sensitivity Test** – record at the beginning of the day and during midday function test.
- **Q and I Values** – record at the beginning of the day and end of the day. The Q and I values will be recorded while EM-31 is in North-South orientation and in East-West orientation.
- **GPS Acquisition** – before performing geophysical operations, check GPS signal and data acquisition system.

Geophysical and GPS data will be downloaded from the recording unit to an external computer at the end of each day. The data will be reviewed for quality and accuracy. Issues with geophysical or GPS data will be noted and corrective actions will be developed if necessary.

### 5.5.3 Ground Truthing

Grounding truthing will be performed to verify or eliminate an instrument response anomaly. Ground truthing may include additional site reconnaissance, additional magnetic locator(s), and other line of evidence observations used to support or eliminate the anomaly and further investigation action(s). If an anomaly is verified, its boundaries, type, and location will be incorporated into the SSFL geographic information system.

### 5.6 Reporting

Geophysical investigation will include:

- Record of instrument calibration in accordance with manufacturer’s instructions.
- Conduct and document replicate measurements so that measurement precision can be established.
- Review of graphical data during field activities to determine that the quality is adequate, and whether the survey results appear to be consistent with geological concepts of the area of interest.
- Conduct interim, real-time scrutiny of the data to identify any technical difficulties, and notify CDM Smith of any quality problems and corrective actions taken.
- Identification of utilities and subsurface features will be marked by the subcontractor at the surface using field markings (paint), flags, or wooden stakes. A copy of the field-marked map will be provided to CDM Smith at the end of the day that the surveys are completed.
- Site sketches will reference permanent landmarks so that locations can be determined at a later date in the event that field markings, flags, or stakes have been obliterated or removed.
- Iso-intensity contour maps of the TFM and FDEM data will be prepared and included in the report.
- Field notes and maps will be provided to CDM Smith at the end of the day that the surveys are completed (operator, line and trace designation, equipment reference, antenna frequency, and profile image in hardcopy format).
- Electronic record of all geophysical survey and GPS data.
- Letter format report(s) providing a project narrative and summarizing the area(s) surveyed, technology used, and the findings. Attachments to the letter report will include copies of the field logbook notes, hand-drawn site sketches, electronic survey records, and quality control data and level of quality of the data.

### 6.0 Restrictions/Limitations

All geophysical methods have limitations. The FTL and technical staff must work with the subcontractor to understand the limitations of various data collection techniques. Limitations typically are associated with interferences (both surface and underground) that result in anomalous reading/results.
### 7.0 References


# Photographic Documentation of Field Activities

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## 1.0 Objective

The purpose of this technical standard operating procedure (SOP) is to provide standard guidelines and methods for photographic documentation. All photography should be digital – camera and/or video – and document field activities and site features (geologic formations, core sections, lithologic samples, general site layout, etc.). This SOP is intended for circumstances when formal photographic documentation is required.

All photography at SSFL is highly restricted. The use of cameras or video equipment at the SSFL site requires a permit secured through the primary site manager – The Boeing Company (Boeing). Unpermitted photography is strictly prohibited.

## 2.0 Background

### 2.1 Definitions

**Standard Reference Marker** - A standard reference marker is a reference marker that is used to indicate a feature size in the photograph and is a standard length of measure, such as a ruler, meter stick, etc. In limited instances, if a ruled marker is not available or its use is not feasible, it can be a common object of known size placed within the visual field and used for scale.

### 2.2 Associated Procedures

- 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 Pits for Sample Collection*
- SSFL SOP 8, *Field Data Collection Documents, Content, and Control*
- SSFL SOP 14, *Geophysical Survey*

### 2.3 Discussion

Photographs taken during field investigations are used as an aid in documenting and describing site features, sample collection activities, equipment used, and possible lithologic interpretation. This SOP provides basic details for taking photographs during fieldwork. The use of a photographic logbook or log form and standardized entry procedures are also outlined. In addition, all SOPS will be on hand with the field sampling team.

## 3.0 General Responsibilities

### Field Team Leader-
The field team leader (FTL) is responsible for ensuring that the format and content of photographic documentation are in accordance with this procedure. The FTL is also responsible for supporting decisions of items to be photographed - specific situations, site features, or operations that the photographer will be responsible for documenting.

### Photographer-
The photographer is one of the field crew. The photographer is responsible for maintaining a logbook or photographic log form per Sections 5.1 and 5.2 of this SOP.

## 4.0 Required Equipment

A general list of equipment that may be used:

- 35mm digital camera
- Standard reference markers
### Photographic Documentation of Field Activities

| Logbook | Extra batteries for 35mm camera |
| Indelible black or blue ink pen | Storage medium (disks or cards) for digital camera |

## 5.0 Procedures

### 5.1 Documentation

Use a photographic log form and/or project specific logbook to log and document photographic activities. Review SSFL SOP 8.

### 5.2 Operation

#### 5.2.1 General Photographic Activities in the Field

The following sections provide general guidelines that should be followed to visually document field activities and site features using digital cameras and video equipment. Listed below are general suggestions that the photographer should consider when performing activities under this SOP:

- The photographer should be prepared to make a variety of shots, from close-up to wide-angle. Many shots will be repetitive in nature or format, especially close-up site feature photographs.
- The lighting for sample and feature photography should be oriented toward a flat condition with little or no shadow. Or, a flash may be used.
- Digital cameras have multiple photographic quality settings. A camera that obtains a higher resolution (quality) has a higher number of pixels and will store less photographs per digital storage medium.

#### 5.2.2 General Guidelines for Still Photography

**Caption Information**

All photographs will have a full caption on a photo log sheet. The caption should contain the following information (digital photographs should have a caption added after the photographs are downloaded):

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

When possible, a standard reference marker should be used in all documentary visual media. While the standard reference marker will be predominantly used in close-up feature documentation, inclusion in all scenes should be considered. Digital media should be downloaded at least once each day to a personal computer; the files should be in either “JPEG” or “TIFF” format. Files should be renamed at the time of download to correspond to the logbook. It is recommended that electronic files be copied to a compact disc for backup.

**Close-Up and Feature Photography**

Any close-up photographs should include a standard reference marker of appropriate size as an indication of the feature size. Feature samples, core pieces, and other lithologic media should be photographed as soon as possible after they have been removed from their *in situ* locations. This enables a more accurate record of their initial condition and color.

**Site Area Photography**

Site area and background photography is not allowed without prior permission of Boeing.

**Panoramic**

Panoramic photography is not allowed without prior permission of Boeing.

#### 5.2.3 Photographic Documentation

Photographic activities must be documented in a photographic log or in a section of the field logbook. The photographer will be responsible for making proper entries.
In addition to following the technical standards for logbook entry as referenced in SSFL SOP 8, the following information should be maintained in the appropriate logbook:

- Photographer name
- If required, an entry shall be made for each new roll control number assigned
- Sequential tracking number for each photograph taken (the camera-generated number may be used)
- Date and time (military time)
- Location
- A description of the activity/item photographed
- Record as much other information as possible to assist in the identification of the photographic document

5.3 Post Operation

5.3.1 Documentation
At the end of each day’s photographic session, the photographer(s) will ensure that the field logbook (in accordance with SSFL SOP 8) and/or photographic log is complete.

5.3.2 Archive Procedures
- Photographs and the associated digital media will be submitted to the project files and handled according to contract records requirements. The project manager will ensure their proper distribution.
- Completed pages of the appropriate logbook will be copied weekly and submitted to the project files.

6.0 Restrictions/Limitations
This document is designed to provide a set of guidelines for the field amateur photographer to ensure that an effective and standardized program of visual documentation is maintained.

Note: Photography is restricted at SSFL; a camera permit from Boeing is required.

7.0 References
No references were used to develop this SOP.
**1.0 Objective**
The objective of this technical standard operating procedure (SOP) is to establish the baseline requirements, procedures, and responsibilities inherent to the control and use of all measurement and test equipment (M&TE; e.g., hand-held field monitoring equipment, global positioning system (GPS) unit) for the Santa Susana Field Laboratory (SSFL) site.

**2.0 Background**

**2.1 Definitions**
- **Requisitioner** – The person responsible for ordering the leased or purchased equipment.
- **Traceability** – The ability to trace the history, application, or location of an item and like items or activities by means of recorded identification.

**2.2 Associated Procedures**
- SSFL SOP 6, *Field Measurement of Total Organic Vapors*
- SSFL SOP 7, *Field Measurement of Residual Radiation*
- SSFL SOP 8, *Field Data Collection Documents, Content, and Control*
- Manufacturer’s operating and maintenance and calibration procedures

**2.3 Discussion**
All M&TE used will be rented or leased from an outside vendor, or purchased. It is essential that measurements and tests resulting from the use of equipment be of the highest accountability and integrity. The equipment user should completely understand the operational instructions and comply with the specifications in the manufacturer’s operations and maintenance manual and follow calibration procedures and in accordance with the Field Sampling Plan (FSP) Addendum.

**3.0 Responsibilities**
All staff with direct control and/or use of M&TE are responsible for being knowledgeable of and understanding and implementing the requirements contained herein. In addition, all field staff will be required to review the FSP Addendum, particularly as where the Addendum affects this SOP. It is possible that a variance from this SOP be identified as part of the Data Gap Investigation which would be described in the FSP Addendum.

The field team leader (FTL) or designee (equipment coordinator, quality assurance coordinator, etc.) is responsible for initiating and tracking the requirements contained herein.

**4.0 Requirements for M&TE**
- Determine and implement M&TE-related project-specific requirements.
- Follow the maintenance and calibration procedures when using M&TE.
- Obtain the maintenance and calibration procedures if they are missing or incomplete.
- Attach or include the maintenance and calibration procedures with the M&TE.
- Prepare and record maintenance and calibration in an equipment log or a field log as appropriate (Figure 1).
- Maintain M&TE records.
- Label M&TE requiring routine or scheduled calibration (when required).
- Perform calibration using the appropriate procedure and calibration standards; maintenance will be discussed with the supplier before conduct.
5.0 Procedures

5.1 Obtain the Operating and Maintenance and Calibration Documents
For leased equipment, the requisitioner will request the maintenance and calibration procedures, the latest calibration record, and the calibration standards certification be provided to CDM Smith. If this information is not delivered with the M&TE, ask the procurement division to request it from the vendor.

5.2 Prepare and Record Maintenance and Calibration Records
The FTL or designee will record the initial daily maintenance and calibration events in a field logbook. Subsequent maintenance and calibration events will be reported to the FTL and recorded at the end of the each day.

5.3 Operating, Maintaining, or Calibrating an M&TE Item
The FTL or designee and user must operate, maintain, and calibrate M&TE in accordance with the maintenance and calibration procedures. Record maintenance and calibration actions in the equipment log or field log.

5.4 Shipment
The rental equipment supplier must inspect the item to ensure that the maintenance and calibration procedures and latest calibration and standards certification records are included before shipment. If any documentation is missing or incomplete, the item should not be shipped.

The receiver (FTL or field requisitioner) will communicate all documentation requirements to the shipper. They must also inspect and confirm the requested equipment and records were provided upon receipt. If documentation is missing, immediately contact the procurement division and request that they obtain the documentation from the vendor.

5.5 Records Maintenance
The receiver must also forward the packing slip to the procurement division.

The user must:
- Forward the completed field log to the FTL and SSFL project manager for inclusion in the project files.
- Retain the most current maintenance and calibration record and calibration standards certifications with the M&TE item and forward previous versions to the FTL and project manager for inclusion in the project files.

5.6 Traceability of Calibration Standards
The FTL or designee and user must:
- Order calibration standards designated by the supplier.
- Request and obtain certifications for standards that clearly state the traceability.
- Request and obtain material safety data sheets for the standards.
- Monitor standards that are perishable and consume or dispose of them on or before the expiration date.

5.7 M&TE That Fails Calibration
The FTL or designee must:
- Immediately discontinue use of the equipment and segregate the item from other equipment. Notify the FTL and take immediate action to replace the item.
- Review the current and previous maintenance and calibration records to determine if the validity of current or previous measurement and test results could have been affected and notify the FTL of the results of the review.

5.8 Determine if Other Related Project Requirements Apply
In the event a different or unique piece of equipment is needed on short notice for site-specific activity, the FTL or designee...
will determine if other M&TE project-related requirements could apply. If M&TE-related requirements apply, obtain a copy of them and review and implement as appropriate.

6.0 Restrictions/Limitations
Calibration and maintenance for field instruments are critical to collecting reputable data. If field monitoring equipment is not working properly, it should not be used. Work will be suspended until functional monitoring equipment is available.

7.0 References
No References used to develop this SOP.
## Control of Measurement and Test Equipment

**SSFL SOP 16**

**Revision: 0**

**Date: March 2012**

### Maintenance and Calibration

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### Maintenance

**Maintenance Performed:**

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**Comments:**

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**Signature:** ______________________  **Date:** ______________________

### Calibration/Field Check

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**Calibration:**  □ Passed  □ Failed

**Comments:**

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**Signature:** ______________________  **Date:** ______________________
1.0 Objective
The objective of this standard operating procedure (SOP) is to define the requirements and responsibilities for homogenizing multiple sample containers into one discrete surface or subsurface soil for all non-volatile/semi-volatile analyses (and select other) analyses for samples collected from the Santa Susana Field Laboratory (SSFL) site. Physical homogenization of soil material will be performed by subcontract laboratories. Homogenization of the depth-discrete samples by CDM Smith will not be performed in the field or in the field trailer. This SOP is intended to identify the minimum requirements required of the subcontract laboratories and is not intended to replace or supersede existing laboratory specific SOP.

2.0 Background
Soil sample homogenization prior to laboratory analysis has been requested by the California Department of Toxic Substances Control (DTSC) for the SSFL Phase 3 non-volatile chemical analyses. Homogenization was previously performed for selected SSFL Chemical Soil Background Study samples collected in the summer and fall 2011. During the background study, DTSC homogenized soil samples for chemical analyses for semi-volatile organic compounds (SVOCs), dioxins, pesticides/herbicides, and metals, not including hexavalent chromium. The DTSC has determined that homogenizing future soil samples for all inorganic and non-volatile analyses (refer to the Field Sampling Plan [FSP] Addendum) will provide greater consistency and comparability of the analytical results from future studies throughout SSFL sampling programs.

During Phase 3 sampling, surface and subsurface soil samples will be collected following SSFL SOPs 2, 3, 4, and 5 through the use of stainless steel sleeves or placement in glass sample jars. Because of the volume needed for multiple chemical analyses, multiple sleeves or glass jars may be required from each sampling location. Soil samples to be analyzed for metals (not including hexavalent chromium), PCBs, dioxins/furans, pesticides, herbicides, SVOCs, and perchlorate will be subject to homogenization. Soil samples for VOC, TPH, alcohols, glycols, and similar volatiles analyses will not be homogenized.

Homogenization of soil samples will be requested to be performed by each laboratory before analytical testing begins.

2.1 Definitions
Grab Sample - A discrete portion of sample material or an aliquot taken from a specific sample location at a given point in time.

Spoon/Scoop/Trowel - A small stainless steel, Teflon®, Teflon®-lined, or plastic utensil measuring approximately 6 inches in length with a stem-like handle (for manual operation). Samples are handled and combined collected using a scooping action.

Stainless Steel or Glass Trays, Bowls or Pans – Appropriately-sized mixing containers used in the homogenization process.

2.2 Associated Procedures
- 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 Pits for Sample Collection
- SSFL SOP 10, Sample Custody
Laboratory Homogenization For Phase 3 Soil Samples

3.0 General Responsibilities

Field Team Leader - The field team leader (FTL) is responsible for ensuring that the Field Sample Coordinator is properly trained to manage the Phase 3 samples – identifying those sample sleeves and jars that do not require homogenization and those sample sleeves and jars that do require homogenization by the subcontract laboratory. The FTL also need to confirm that the sampling team is collecting sufficient sample volume for the homogenization measures.

Field Sample Coordinator – The sample coordinator is responsible for ensuring that all contracted laboratories follow this guidance in accordance with this procedure. In addition, all subcontract laboratories are required to have an SOP in place that describes in detail the specific laboratory procedures utilized to comply with this SOP.

Field Sampling Team – The field sampling team is responsible for collecting the proper volume of sample (refer to Table 1 in the FSP Addendum).

Laboratory Project Manager (PM) – The laboratory project manager is responsible for ensuring that all instructions regarding soil sample homogenization are followed by laboratory staff.

4.0 Required Equipment

Because homogenization of samples will occur at the subcontract laboratory, the laboratory supplies at a minimum should include:

- Laboratory logbook, bench sheet forms, other forms for documenting sample homogenization
- Indelible black or blue ink pens and markers
- Appropriate size sample containers (glass and plastic) with labels
- Stainless steel or glass trays, bowls, or pans
- Stainless steel or Teflon lined scoops/spoons/trowels
- Decontamination supplies
- Latex, nitrile or appropriate gloves

5.0 Procedures

5.1 Laboratory Soil Homogenization/Compositing (Cone and Quarter Method)

The following steps will be performed by the analytical laboratory to create a composite soil sample for the non-volatile analyses. The laboratory will use sample quantities submitted in stainless steel sleeves or glass jars to perform this procedure.

1. Decontaminate all laboratory compositing equipment according to appropriate Laboratory SOPs.

2. Don appropriate PPE and gloves. Clean gloves must be worn for each sample composited.

3. With the top 1/3 and bottom 1/3 of sample material in the homogenization tray/bowl/pan, chop-up the sample into small chunks using a clean, stainless steel wallboard knife or other suitable implement.

4. Remove non-soil debris, including sticks and vegetation, as much as possible.

5. Scooping from the edge, form a mound in the center of the tray/bowl/pan.

6. Divide the mound into two equal piles and form each pile into a mound.

7. Divide each into two piles. (At this point there should be four piles in the tray/bowl/pan).
8. Mix the piles together that are opposite from each other into a single mound.

9. Repeat steps 7, 8 and 9 until the sample is thoroughly homogenized (a minimum of 3 times).

10. Transfer the thoroughly mixed sample to appropriately labeled sample containers for the required analyses.

11. Analyze the samples.

5.2 Contracted Laboratory Compositing Equipment Decontamination
To clean laboratory equipment used in homogenization, remove all gross materials/stains/hardened material using a scrubbing pad or brush and rinsing the equipment with water. After scrubbing and rinsing, the laboratory should implement internal laboratory procedures/SOPs to complete cleaning and decontamination process to ensure the compositing equipment is free of potential cross contamination. At a minimum, the laboratory decontamination process must comply with the requirements of SSFL SOP 12.

6.0 Documentation
Document all compositing activities including decontamination in an appropriate logbook and/or bench sheet.

7.0 References
Lancaster Laboratories Inc. 2011 SOP-SS-009 Homogenization and Subsampling of Solid Waste Samples from Environmental Sources. July.