Energy Technology Engineering Center
4100 Guardian Street, Suite 160
Simi Valley, CA 93063

November 12, 2013

Ms. Laura Rainey, P.G.
DOE SSFL Project Manager
Department of Toxic Substances Control
5796 Corporate Avenue
Cypress, CA 90630

Subject: Addendum No. 9 to Master Field Sampling Plan for Chemical Data Gap Investigation Phase 3 Soil Chemical Sampling at Area IV Santa Susana Field Laboratory

Dear Laura:

Attached to this email is Addendum No. 9 to the Chemical Data Gap Investigation Work Plan, Phase 3 Soil Chemical Sampling at Area IV for the Northern Buffer Zone. (Addendum No. 5; CDM Federal Programs Corporation, October 2012). The Chemical Data Gap Investigation Work Plan, Phase 3 Soil Chemical Sampling at Area IV (Phase 3 Work Plan; CDM Programs Corporation, April 2012) was approved by DTSC on April 11, 2012.

This addendum includes the data gap analysis and the proposed sampling locations and objectives for each sample. This version reflects the incorporation of all DTSC comments and the stakeholder input we received at the technical stakeholder meeting we had on October 29, 2013.

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

DOE requests approval of the sampling plan for the Northern Buffer Zone.

Sincerely,

Stephie Jennings
Deputy Federal Project Director
U.S. Department of Energy

cc: Mr. John Jones, DOE
Mr. Buck King, DTSC
Mr. Richard Hume, DTSC
Mr. Mark Malinowski, DTSC
Mr. David Dassler, Boeing
Mr. John Wondolleck, CDM Smith
Ms. Dixie Hambrick, MWH

Addendum No. 9 to
Master Field Sampling Plan for Chemical Data Gap Investigation
Phase 3 Soil Chemical Sampling at Area IV
Santa Susana Field Laboratory
Ventura County, California

Northern Buffer Zone

Prepared for:

Department of Energy
Energy Technology and Engineering Center
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Prepared by:

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Prepared under:

US Department of Energy
EM Consolidated Business Center
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CDM Smith Task Order DE-DT0003515

November 2013
Revision 0

Addendum No. 9 to
Master Field Sampling Plan for Chemical Data Gap Investigation
Phase 3 Soil Chemical Sampling at Area IV
Santa Susana Field Laboratory
Ventura County, California

Northern Buffer Zone

Contract DE-EM0001128
CDM Smith Task Order DE-DT0003515

Prepared by: _____ **November 7, 2013**
Michael Hoffman, P.G. **Date**
CDM Smith Geologist

Approved by: _____ **November 7, 2013**
John Wondolleck **Date**
CDM Smith Project Manager

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Introduction

This document supports implementation of the soil sampling program described in the *Work Plan for Chemical Data Gap Investigation, Phase 3 Soil Chemical Sampling at Area IV, Santa Susana Field Laboratory, Ventura County, California* (Phase 3 Work Plan, CDM Smith 2012a). The Phase 3 Work Plan contains four appendices. Appendix A is the *Master Field Sampling Plan for Chemical Data Gap Investigation, Phase 3 Soil Chemical Sampling at Area IV, Santa Susana Field Laboratory, Ventura County, California* (Master FSP, CDM Smith 2012b). Appendix B is the *Quality Assurance Project Plan, Chemical Sampling at Area IV, Santa Susana Field Laboratory, Ventura County, California* (Phase 3 QAPP, CDM Smith 2012c). Appendix C is the *Worker Health and Safety Plan for Chemical Data Gap Investigation, Phase 3 Soil Chemical Sampling at Area IV, Santa Susana Field Laboratory, Ventura County, California* (Safety Plan, CDM Smith 2012d). And Appendix D of the Phase 3 Work Plan provides the Standard Operating Procedures (SOPs) (Phase 3 SOPs, CDM Smith 2012e) describing the details of sampling activities and sample management at SSFL.

The Master FSP addresses soil sampling within Area IV and the Northern Buffer Zone of the Santa Susana Field Laboratory (SSFL) as required under the *Administrative Order on Consent for Remedial Action* (Docket Number HSA-CO 10/11-037) (AOC) signed by the California Department of Toxic Substances Control (DTSC) and the Department of Energy (DOE). For all samples collected at locations within the Northern Buffer Zone, the Master FSP and the SSFL SOPs dictate the procedures pertaining to:

- locating and verifying sampling points
- surface soil sampling techniques
- subsurface soil sampling techniques using a direct push technology (DPT) rig and a hand auger and slide hammer for those locations not accessible by the DPT rig
- sample handling and shipping
- analytical, quality control, and data review
- instrument calibration and maintenance

The AOC between DTSC and DOE was signed on December 6, 2010. The AOC is a legally binding order that describes the characterization of Area IV and Northern Buffer Zone (NBZ) soils/sediments and further defines DOE's obligations in relation to radiologic and chemical cleanup of soils within these areas. It stipulates that during phases 1 and 2 of the chemical investigation activities, DOE was to analyze a soil sample for chemical constituents at locations where EPA collected a sample for radiological analysis. The prior sampling with EPA in the NBZ was conduct under two concurrent EPA sampling phases: Phase 1 Co-Located Soil Sampling and Phase 2

Random Soil Sampling. In addition, co-located sampling occurred with EPA as part of its drainage sampling efforts within the NBZ. Phase 1 and 2 soil sampling with EPA occurred in March and April 2012. Sediment sampling occurred during December 2010 and January 2011.

Phase 3 of the AOC is the data gap analysis, which includes an assessment of data adequacy using the data collected under the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) program, the results of co-located soil samples collected during phases 1 and 2 of the AOC, and multiple lines of evidence as described in the Phase 3 Work Plan (CDM 2012a). The purpose of the data gap analysis is to identify additional soil chemical data needed to support the Soil Remedial Action Implementation Plan for Area IV. The sampling that will be performed under this FSP Addendum is based on the results of the data gap analysis.

The Phase 3 sampling within the NBZ is governed by the Phase 3 Work Plan and its elements including the Master FSP, the QAPP, Safety Plan, and the Phase 3 SSFL SOPs. These documents are incorporated into this FSP Addendum by reference.

Purpose of FSP Addendum

This FSP Addendum addresses Phase 3 sampling in the NBZ. Figure 1 of this document illustrates the location of the NBZ. The western portion of the NBZ is immediately north of Area IV of SSF; the eastern portion is north of SSFL Areas 2 and 3. The rationale for sample location and chemical analytes is provided in the document *Northern Buffer Zone Phase 3 Data Gap Analysis Technical Memorandum, Santa Susana Field Laboratory, Ventura County, California* (MWH 2013[1]) (*NBZ Data Gap TM*). The *NBZ Data Gap TM* is included as Attachment 1 to this FSP Addendum. It illustrates the proposed sample locations and includes Table 1, which provides the sampling rationale for each location. Figures 1 and 2 of the *NBZ Data Gap TM* (MWH 2013) provide the proposed soil sample locations in the western NBZ and eastern NBZ areas, respectively. Soil sample locations were identified during data gap analysis as well as from public comments received during the recent NBZ Data Gap Investigation public meeting. Attachment 3 (Table F NBZ Field Tracker) to this NBZ FSP Addendum provides additional information beyond the rationale in Table 1 of the *NBZ Data Gap TM* for sample locations that target specific field conditions. These include natural drainage pathways, edge of fill material, addressing subsurface anomalies (potential buried materials), and potential releases from lined man-made drainages. Information on specific field conditions and sample locations will be necessary as part of sample point staking and soil collection.

For the NBZ, surface and subsurface samples will be collected. For surface soil samples, only the top 6-inches of soil (surface soil) will be collected. Many of the

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[1] MWH prepared this Technical Memorandum under contract with The Boeing Company, which is under direct contract with DOE. Through this contractual relationship and under the regulatory oversight of DTSC, MWH has represented DOE in conducting the Chemical Data Gap Analysis and in the preparation of this Technical Memorandum.

sample locations will involve collection of subsurface samples. A direct push technology (DPT) rig will be used to sample subsurface soil at all locations except those inaccessible due to terrain constraints. Borings located in areas inaccessible to the DPT rig will be sampled using a hand auger and slide hammer as described in Phase 3 SSFL SOP 3. All borings will be drilled to the target depth specified in Table 1 of the *NBZ Data Gap TM*. The cores will be visually inspected and monitored with field instruments for the presence of contamination, including discoloration, debris, and fill. Soil samples will be targeted where contamination is evident.

CDM Smith will be responsible for the physical collection of all samples per the procedures and controls specified in the Master FSP. CDM Smith will be responsible for the hand auger and DPT rig sampling aspects of the field sampling program under Phase 3 of the AOC. This includes locating in the field the sample locations selected during the data gap investigation and that were initially generated and displayed electronically using Geographic Information System (GIS) coordinates. The GIS coordinates are downloaded into a Geographic Positioning System (GPS) unit for physically locating the samples in the field. SSFL SOP 1 provides the process for verifying that the sample locations initially identified by GIS review reflect the targeted feature described in Table 1 and are consistent with the GPS coordinates generated in the field. If necessary the sample location will be adjusted in the field so that the targeted feature is sampled. Adjusted and all final sample location coordinates will be provided back to the GIS managers so that the GIS database can be updated.

CDM Smith personnel will be responsible for the sample container preparation, sample handling and documentation, sample shipment, laboratory coordination, chemical analyses of the samples, and chemical data review. A CDM Smith sample coordinator will be responsible for sample preparation and shipment to an analytical laboratory under contract with CDM Smith. Soil samples collected by CDM Smith will be analyzed for chemical analytes identified in Table 1 of the *NBZ Data Gap TM* (MWH 2013). Analytical methods and quality control criteria to be used are stipulated in Table 8-3 (Quality Control Objectives for Analytical Methods) of the QAPP (CDM Smith 2012c) and Table 6-1 (Analytical Methods, Containers, Preservatives, and Holding Times) of the Master FSP (CDM Smith 2012b).

Table 1 of the *NBZ Data Gap TM* also identifies proposed target depths for sample collection. Samples will also be collected from depth intervals (until refusal) that exhibit evidence of staining, odor, debris, or photoionization detector (PID) readings above background.

Sample Analytes

Table 1 of the *NBZ Data Gap TM* (MWH 2013) provides the chemical analyses (analytes) for each sample proposed for collection under this FSP Addendum and the respective rationale for sample location and chemical analyses. The chemical analyses by location were identified through the data gap investigation process.

Field Locating Soil Sample Locations

CDM Smith will be responsible for determining the precise position of soil sample locations in the field in accordance with SSFL SOP 1. At the same time, each sample location will also be cleared for buried utilities, and assessing the presence of cultural and biological resources for their protection.

Surface Soil Sampling

Surface soil samples will be collected at each location as proposed in Table 1. Surface soil samples will be collected in accordance with SSFL SOP 2. A slide hammer with stainless steel sleeve will be used to collect the soil sample to be analyzed for semi-volatile organic compounds and polychlorinated biphenyls. Volatile organic compounds and total petroleum hydrocarbon samples will be collected using Encore samplers. Soil for all other sample analytes will be place in one or more glass jars.

Subsurface Soil Sampling

Subsurface soil samples will be collected primarily through the use of a DPT rig. SSFL SOP 4 describes the DPT sampling procedures. Sampling will be conducted through the use of 5-foot long acetate sleeves placed within the DPT sampling tool. All cores will be screened using a PID instrument for volatiles and a Micro R gamma detection instrument and a dual phosphor alpha/beta detection instrument (SSFL SOPs 6 and 7, respectively). Soil samples will be collected at the depths specified in Table 1 of the *Subarea NBZ Data Gap TM* (MWH 2013) and/or at locations where instrument readings, soil staining, or evidence of debris is observed.

To determine depth of contamination at locations where prior data indicates contamination at the surface but depth has not been defined, the core will be divided into one-foot long samples and with the sample depth intervals identified in Table 1 prepared for shipment to the laboratory. Table 1 also identifies the chemical analyses proposed for each depth interval.

There will be proposed sampling locations that the DPT rig will not be able to access. At those locations, subsurface samples will be collected using a hand auger to access the sample depth and a slide hammer sampler with stainless steel sleeves will be used to collect the actual sample. SSFL SOP 3 describes the hand auger sampling procedure.

The soil logging of all surface and subsurface samples will be conducted following SSFL SOP 9.

Sampling of Locations with Sustained Instrument Readings, Odor, or Staining

For any locations where PID instrument readings remain above measured background readings, there is an odor, or the soil appears to be stained with hydrocarbons, samples will be collected at the sample depth interval and analyzed

for VOCs, 1,4-dioxane, and total petroleum hydrocarbons-gasoline range organics (TPH-GRO) using Encore samplers, in addition to the target analytes specified in Table 1 of the *NBZ Data Gap TM*. Any sustained instrument readings above background (PID, Micro R gamma detection, and dual phosphor alpha/beta detection instruments) will be immediately reported to DOE by the CDM Smith Field Team Leader and DOE will contact Boeing with this information in accordance with the Worker Health and Safety Plan requirements. The monitoring instruments will be operated per SSFL SOPs 6 (volatile organics) and 7 (radiation).

Decontamination of Sampling Equipment

Equipment that comes in contact with sample material will be decontaminated per SSFL SOP 12. Investigation derived waste will be handled per SSFL SOP 13.

Sample Handling, Recording, and Shipment

SSFL SOPs 10 and 11 describe the sample custody, handling, information recording, preservation, and shipping procedures. Any photographic documentation of sampling activities will be performed per SSFL SOP 15.

Instrument Calibration and Maintenance

All instruments used to screen samples for volatile organics and radioactivity will be calibrated and maintained per SSFL SOP 16.

Laboratory Sample Preparation (Homogenization)

Soil samples intended for chemical analyses of non-volatile and non-semivolatile constituents (e.g. metals, PCBs, and dioxins) will be homogenized by the analytical laboratory in the laboratory in accordance with SSFL SOP 17.

Schedule

Soil sampling activities under this FSP Addendum will most likely start the week of November 18, 2013, following DTSC approval of this NBZ FSP Addendum. Due to the remoteness of many of the NBZ sample locations, the locations will be identified in the field just prior to soil sampling. Locations will not be marked in advance of sampling. Also due to the remoteness of locations and the need to hike to their location, it is anticipated that only 20 locations will be sampled during each sampling week.

References

CDM Smith. 2012a. *Work Plan for Chemical Data Gap Investigation, Phase 3 Soil Chemical Sampling at Area IV, Santa Susana Field Laboratory, Ventura County, California.* April.

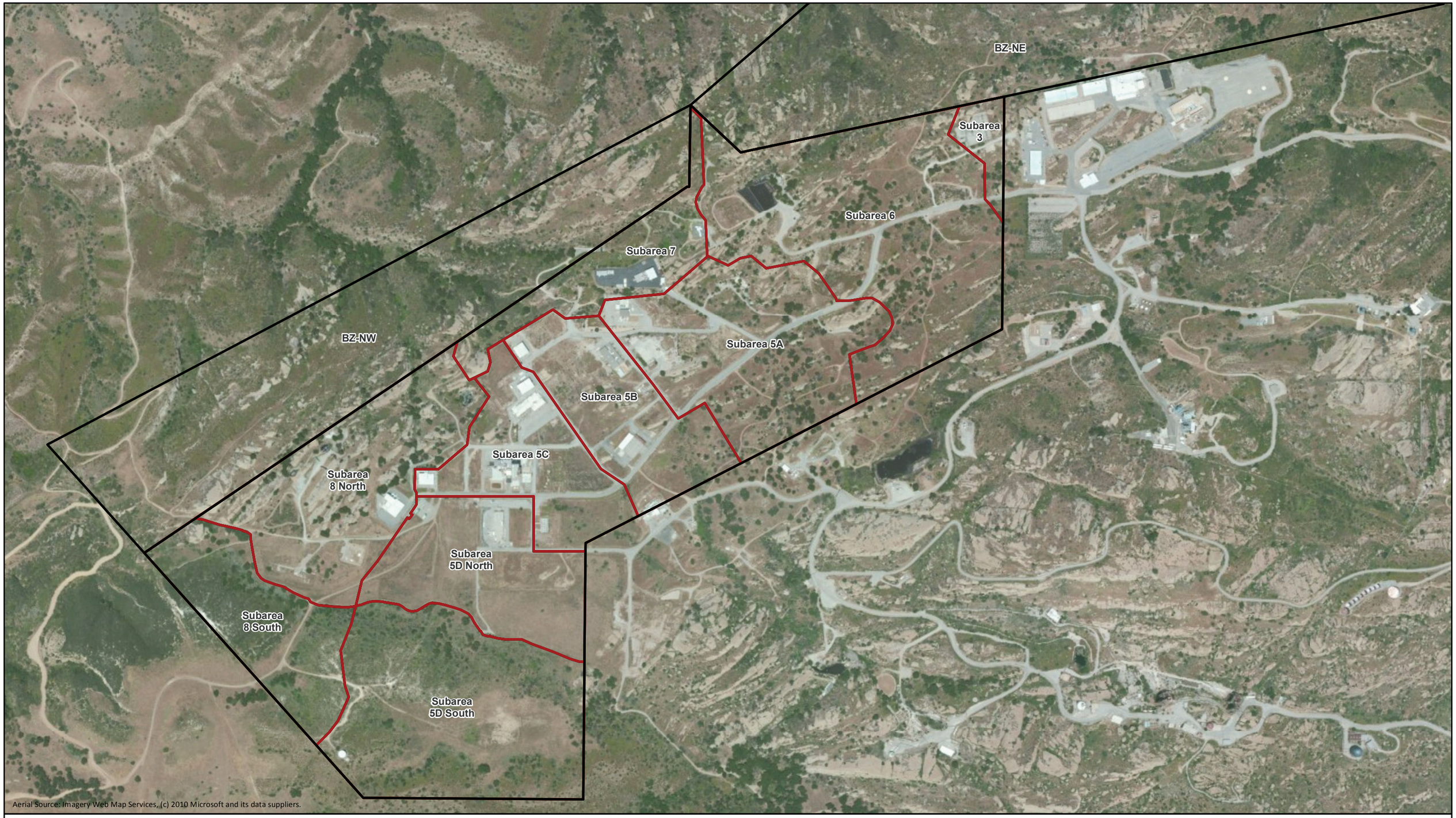
CDM Smith. 2012b. *Master Field Sampling Plan for Chemical Data Gap Investigation, Phase 3 Soil Chemical Sampling at Area IV, Santa Susana Field Laboratory, Ventura County, California.* April.

CDM Smith. 2012c. *Quality Assurance Project Plan for Chemical Data Gap Investigation, Phase 3 Soil Chemical Sampling at Area IV, Santa Susana Field Laboratory, Ventura County, California.* April.

CDM Smith. 2012d. *Worker Health and Safety Plan for Chemical Data Gap Investigation, Phase 3 Soil Chemical Sampling at Area IV, Santa Susana Field Laboratory, Ventura County, California.* April.

CDM Smith. 2012e. *Standard Operating Procedures*.

MWH 2013. *Northern Buffer Zone Phase 3 Data Gap Analysis Technical Memorandum Santa Susana Field Laboratory, Ventura County, California.* November.



Aerial Source: Imagery Web Map Services, (c) 2010 Microsoft and its data suppliers.

Legend

Area IV & Northern Buffer Zone

Area IV Subarea

Subarea Designations
Area IV

0 300 600 1,200 Feet

Santa Susana Field Laboratory
Ventura County, California
Figure 1

CDM Smith

FarmerRA C:_projects\SantaSusana\GIS\MXD\SSFL_Subarea_Designations_AreaIV_11x17.mxd 8/16/2013

Attachment 1

Northern Buffer Zone Phase 3 Data Gap Analysis
Technical Memorandum, Santa Susana Field Laboratory, Ventura County,
(MWH 2013)

NORTHERN BUFFER ZONE PHASE 3 DATA GAP ANALYSIS
TECHNICAL MEMORANDUM
SANTA SUSANA FIELD LABORATORY
VENTURA COUNTY, CALIFORNIA

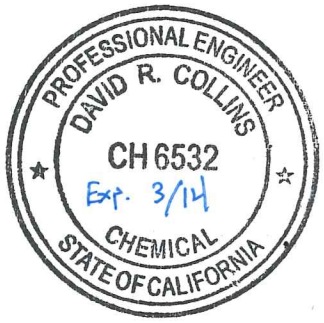
Prepared For:

THE UNITED STATES DEPARTMENT OF ENERGY

Prepared By:

MWH Americas, Inc.
618 Michillinda Ave, Suite 200
Arcadia, CA 91007

November 2013



Jose Toledo
Subarea Data Gap Manager

David Collins, P.E. CH6532
Project Manager

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ACRONYMS AND ABBREVIATIONS

AOC	Administrative Order on Consent
BTV	background threshold value
DOE	Department of Energy
DQO	Data Quality Objective
DTSC	Department of Toxic Substances Control
EPA	Environmental Protection Agency
FSDF	Former Sodium Disposal Facility
GIS	geographic information system
HGL	Hydrogeologic, Inc.
HSA	historical site assessment
ISL	interim screening level
LUT	Look-Up Table
MFSP	Master Field Sampling Plan
MRL	method reporting limit
MWH	MWH Americas, Inc.
NASA	National Aeronautics and Space Administration
NBZ	Northern Buffer Zone
NDMA	n-nitrosodimethylamine
PAH	polyaromatic hydrocarbon
PCB	polycyclic biphenyls
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
SSFL	Santa Susana Field Laboratory
TM	technical memorandum
TPH	total petroleum hydrocarbon
VOC	volatile organic compound

1.0 INTRODUCTION

This technical memorandum (TM) has been prepared to describe the chemical data gap analysis performed by MWH Americas, Inc. (MWH) for the U.S. Department of Energy (DOE) for the Northern Buffer Zone (NBZ) at the Santa Susana Field Laboratory (SSFL). The chemical data gap analysis was performed in compliance with the Administrative Order on Consent (AOC) for Remedial Action (AOC; Docket No. HSA-CO 10/11 - 037), and serves as the basis for the Phase 3 data gap investigation being performed in the NBZ located north of Area IV by DOE and implemented by CDM Smith, a contractor to DOE. This Data Gap TM is included as an appendix to the Master Field Sampling Plan (MFSP) Addendum for the NBZ prepared by CDM Smith for review and approval by the California Environmental Protection Agency Department of Toxic Substances Control (DTSC).

Information provided in this data gap TM describes the overall background and approach for the chemical data gap analysis and investigation, followed by a description of specific application of the data gap analysis approach or unique circumstances within the NBZ.

2.0 DATA GAP ANALYSIS PROCESS

The AOC requires a chemical data gap investigation to identify locations within the NBZ or contiguous areas where additional chemical investigation is necessary. Per the AOC (Section 2.5.3.2):

> "In determining the scope, DOE and DTSC shall evaluate the results from the Phase 1 Co-Located sampling effort, the results from the Phase 2 Co-Located sampling effort[1], the results of the U.S. EPA's radiological survey and characterization efforts, the data and information presented in the previous RFI reports and RFI work plans, and any available historical Site data. This scoping effort shall be used to determine the locations at the Site where insufficient chemical data exists and additional chemical investigation is necessary."

This TM describes the data evaluation process that has been used to identify chemical data gaps. Data gaps exist where more information is needed for DTSC and DOE to make remedial planning decisions, (i.e., whether soil contamination exists, and if so, to what extent). The data gap analysis approach was developed using the U.S. Environmental Protection Agency's (EPA's) seven-step Data Quality Objective (DQO) process that presents a systematic approach to identify chemical sampling needs, address existing data gaps, and obtain environmental data and information required for future remedial planning. The Phase 3 chemical data gap investigation

[1] According to the AOC, the Phase 2 random sampling is to be conducted with EPA. EPA has completed random sampling within the NBZ. The data gap analysis will use the results from Phase 2 sampling within the NBZ to assess additional sampling for that area.

DQOs are the framework for the analysis described in this TM and are presented in Section 4.0 of the MFSP (CDM Smith, 2012b).

The Phase 3 data gap analysis is an iterative process. In data gap evaluations for prior Subareas (5C, 5B, 5A, 6/3, and 7), data were compared with the interim screening levels (ISLs) developed for evaluation of available data (see Master Phase 3 Work Plan Table 2-1, CDM Smith, 2012a) since DTSC had not yet established Chemical Look-Up Table (LUT) values. The ISLs were developed jointly by DTSC and DOE, and reflect the 2005 background soil concentrations for metals and dioxins, and analytical reporting limits for chemicals not having a background value.

In June 2013, DTSC issued the revised Chemical LUT values for the chemicals most frequently detected within Area IV, including all background constituents and additional chemicals of interest to DTSC. The second part of the Chemical LUT is currently being developed by DTSC, and when issued in the near future will reflect required Method Reporting Limits (MRLs) for the remaining chemicals being investigated at the site. Since the DTSC Chemical LUT values are now available for the most frequently detected chemicals in Area IV, and because these values provide the AOC standard for remediation, the newly issued LUT values are being used for Phase 3 data gap analysis, including the NBZ presented in this TM. Since the second part of the Look-Up Table has not yet been issued by DTSC, MRLs achievable by several analytical laboratories, similar to or lower than the ISL MRLs, were used in the NBZ data gap analysis as the comparison values for the remaining chemicals. The remaining LUT values based on MRLs will be used in future subarea data gap analyses after they are issued by DTSC.

At the completion of the first round of Phase 3 data gap analysis of all Area IV subareas and the NBZ, DTSC's Chemical Look-Up Table values and EPA's final radionuclide sampling results will be used for data screening and identification of any remaining chemical data gaps. Ultimately, all available previous chemical data, including prior Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) results and Phase 1, 2, and 3 chemical data, will be evaluated using DTSC's Look-Up Table values per the AOC and summarized in the Final Chemical Data Summary Report.

This data gap analysis is based on prior RFI data, the Phase 1 co-located sample results, and historical information on activities within Area IV, and considers results from EPA's radiological investigation activities (e.g., radionuclide sampling results, gamma surveys, geophysical surveys, aerial photograph interpretations).

The data gap analysis identifies where additional information is needed for remedial planning by:

- Comparing existing soil sampling results to LUT criteria to identify additional sample locations needed to define the extent of contamination (based on criteria exceedance) and/or gradients in chemical concentrations away from a potential source;

- Evaluating migration pathways to ensure that samples are collected where contamination may have migrated via natural or anthropogenic processes; and
- Evaluating historical documents and site survey information to identify potential release areas that may not have been adequately characterized.

Each of these evaluation steps are described below.

2.1 COMPARISON OF PREVIOUS SAMPLING DATA TO SCREENING CRITERIA

To determine future chemical sampling needs (to be implemented under the Master Phase 3 Work Plan and MFSP), validated soil chemistry results are compared with LUT values. The LUT values are based on either 2012 soil background threshold values (BTVs) or analytical MRLs for chemicals that do not have established BTVs. The LUT values currently being used for the data gap analysis are dated June 2013, and are posted on DTSC's SSFL web site and provided herein as Attachment A.

This data comparison is conducted to answer several questions:

- Are the data adequate to define the extent of soil contamination? (i.e., what is the areal extent? How deep does contamination go?)
- Where are additional data needed to address areal and depth extent?
- What types of chemical data are needed at each location?

The soil chemical results within the analytical database are "filterable," meaning each individual soil chemical result can be selectively evaluated or results can be collectively reviewed for each prior sample point. The analytical database incorporates data files for soil chemical data collected under the RFI and co-located sampling programs. A geographic information system (GIS) is used to spatially display the sampling results. To display the data, the sampling results are compared with the LUT values for all chemicals analyzed at each sample location using a computer algorithm. The algorithm calculates the ratio of the soil concentration to the LUT value. The GIS is then used to display the maximum comparison value (i.e., 'ratio') at a sampling location, so that the highest result relative to the LUT is displayed. The GIS uses a color-coded system to display the soil concentration relative to the LUT value. For example, soil concentrations that are at or below the LUT value are displayed as a green symbol. Locations where the soil concentration exceeds the LUT are displayed as yellow, orange, magenta, or red, depending on the degree of exceedance of the LUT value. Maps displaying the sampling results as color-coded symbols are included in this Data Gap Analysis TM (Figures 1 and 2) to help display this evaluation step in the context of proposed sampling locations.

The data gap analysis includes review of sampling results for combined chemicals, individual chemical groups (e.g. volatile organic compounds [VOCs], polyaromatic hydrocarbons [PAHs], polycyclic biphenyls [PCBs], etc.), and individual chemicals (e.g., barium, perchlorate). Sampling results in the database are 'filtered' to determine which chemicals are above LUT values, their depth of occurrence, and which chemicals are co-located. This allows for effective evaluation and selection of step-out sample locations and analytical suites for assessing the extent and/or distribution of chemicals that exceed their respective LUT values. In some cases, sampling to address elevated reporting limits in historical data is not proposed in all areas of the NBZ. In areas where other data gaps have been identified, sampling for elevated reporting limits is also proposed as needed. In other areas, data gap evaluation for elevated reporting limits in historical data will be addressed in the context of all recent sampling results after collection of the samples as proposed in this TM.

The GIS display of the LUT-compared sampling results is used to evaluate potential sampling locations. In areas where detected concentrations exceed LUT values, previous sampling data are evaluated to determine if the lateral or vertical extent of the exceedance is limited by other sampling results below LUT values or other features at the site (e.g., bedrock). If not, then additional sampling is proposed in that area. Conversely, in some areas existing sampling results are adequate to support remedial planning. A review of the distribution of results along with other lines of evidence (described below) is used to identify where additional sampling is needed.

Some locations with elevated concentrations (now recognized as significant exceedances of LUT values) have been identified by DOE and DTSC as soil "clearly contaminated areas." These are areas most likely requiring remediation based on the existing elevated sampling results, and are displayed in GIS and on maps in this TM with pink shading. The data gap analysis for these areas considers whether sufficient information is available to determine the lateral and vertical extent of contamination. In many cases, more data are needed to determine a volume of soil to be remediated for use in remedial planning, and additional sampling is proposed in these areas.

2.2 EVALUATION OF MIGRATION PATHWAYS

Migration pathways are the means by which chemicals can move in the environment, including surface water transport, downward movement to subsurface soil, or air/wind dispersion. Migration pathways are evaluated to answer several questions:

- Where could potentially contaminated soil migrate via surface water flow?
- Where could contaminants migrate in subsurface soils? Could groundwater be affected by the soil contamination?

- Were chemicals potentially released into the air, dispersed by wind and deposited in surrounding areas at concentrations exceeding LUT values?

The topographic and surface water flow data in the GIS is used to identify surface water pathways from potential contamination sources. Prior data for those pathways will be evaluated as to the adequacy for addressing contaminant migration. If additional data are needed to define the extent of chemicals moved by surface water, downward migration in the subsurface, or to assess air dispersion, sampling locations are proposed for the migration pathways.

This data gap analysis identifies previous soil sampling locations or features where there may be outstanding groundwater investigation program data needs. At these features, the data gap analysis is evaluating the adequacy of existing soil sampling results to assess potential migration of contaminants to groundwater, and proposing additional soil sampling to the top of bedrock if gaps are identified.

2.3 HISTORIC AND SITE SURVEY INFORMATION REVIEWS

The data gap analysis also addresses potential sources of contamination not covered by prior sampling events. Historical survey and site operational information for Area IV is represented in GIS and viewed in context of previous sampling results. Historical and site survey information will be used to answer two questions:

- Are there any potential chemical use/release features that have not been sampled?
- If a potential chemical use area has already been sampled (but not for all chemicals potentially used), are additional samples/analyses needed to complete characterization?

A checklist has been developed that is reviewed along with the chemical data to ensure that features not covered by RFI or Phase 1 co-located sampling are addressed. The checklist includes the results of the historical site assessment (HSA) conducted by Sapere (2005), site operational and aerial photographic information recently compiled for the RFI, and the recent HSA completed by EPA (Hydrogeologic, Inc. [HGL], 2012). The “lines of evidence” reviewed as part of the checklist are published in the Master Phase 3 Work Plan Table 2-2, and provided herein (Table 2) for how they were applied in the NBZ.

Site information includes various site features or survey information that is displayed in GIS using a common coordinate system (similar to latitude and longitude). Tanks, buildings, leach fields, geophysical survey results, historical aerial photos, storage areas, debris/disposal areas, identified chemical use areas, and surface water flow paths are examples of site information/features used to identify potential data gaps and proposed sampling locations. Site information is shown as layers in GIS that can be displayed individually or combined with sampling results. The site information features, compiled from historical documents, aerial

photo review, and site surveys are evaluated using existing data to assess the completeness of characterization. If gaps are identified (e.g., a storage area not previously sampled), sampling is proposed with the analytical suites developed based on surrounding site operational uses and existing sample result exceedances.

In addition to site historical use or survey information, soil borings and trench logs are reviewed to identify relevant soil conditions (e.g., debris, staining, bedrock depth) since unique soil characteristics may also guide proposed sampling intervals. For example, sampling may be proposed both within and below stained horizons, or in another case, both within fill materials and below fill materials in underlying native soils. In both of these cases, sampling is needed below a potential contamination zone to identify how far contamination has migrated downward.

Data gaps associated with some historical operational use features are not addressed in this TM but will be included in future documents. Historical operational use features not addressed in this plan include the Area IV sewer system, the natural gas pipelines within Area IV, and features within existing Area IV buildings. Data gaps associated with the sewer system and natural gas pipelines are being evaluated for these systems as a whole, and will be addressed in a separate technical memorandum. Where applicable, sampling is proposed in this TM where sewer pipelines leave former or existing buildings since these are considered site-specific sampling features. Data gaps associated with existing buildings are being evaluated as part of this process, but sampling requirements within or below existing buildings will be detailed in forthcoming demolition plans since that work will proceed under a different schedule and process.

2.4 DATA GAP ANALYSIS PROCESS SUMMARY

A systematic process that incorporates the evaluation components discussed in Sections 2.1 through 2.3 is being used during data gap analysis to ensure available information from multiple sources is considered during data gap review. Thus, combining data gap recommendations from the three evaluation components (data screening evaluations, migration pathway evaluations, and historical document/site survey reviews), sampling is proposed for the evaluated subarea.

The outcome of the data gap analysis process is the identification of soil sampling requirements for Phase 3, including rationale for Phase 3 samples, their locations, depths, and proposed analytical suites. Soil sampling for chemicals in Phase 3 are proposed in this TM ('soil' sampling is often referred to as 'soil matrix' sampling to distinguish it from soil vapor sampling). Soil matrix and soil vapor media provide different types of chemical data for remedial planning purposes. Soil vapor sampling is preferred to assess the potential release of solvents, which contain VOCs. Since VOCs are highly volatile, they are generally best evaluated in soil vapor samples, not soil matrix. However, soil vapor sampling is not proposed in this TM since there is no known solvent uses within the NBZ, VOC groundwater plumes only occur within the NBZ

immediately adjacent to operational areas within Area IV, and the NBZ is dominanted by rock outcrops and limited extents of thin soil.

The analytical parameters proposed for step-out or step-down sampling locations are based both on what the prior data indicate are chemicals of potential concern for the location, in conjunction with data needs identified based on review of migration pathways and other lines of evidence. Proposed sample spacing is based on the types of operations and releases, the magnitude and gradients of nearby sampling results, and site conditions (e.g., depth of soil, proximity of bedrock outcrops). Generally, samples are located with a 25 to 100 foot spacing laterally, and at 0.5- and 5--foot depth intervals vertically (no 10-foot samples are proposed in the NBZ since soils are very thin). In many cases the deepest samples will be placed on 'hold' by the laboratory, and analyzed if elevated results are detected in the shallower samples. In special cases, sampling is proposed at shallower depths (e.g., 2 feet) to assess potentially more limited downward migration of large organic molecules like PCBs, dioxins, or PAHs.

The data gap analysis also identifies additional investigation techniques for some areas to aid in selection of sampling locations. The additional investigation techniques can include trenching or test pit excavation to observe soil conditions prior to sampling, or geophysical surveying of areas to identify targeted features, such as pipelines, underground storage tanks, or fill areas. In some cases, field reconnaissance or mapping is needed to refine proposed sampling locations, such as along drainages. The sampling rationales included in this TM specify these additional investigative techniques where applicable.

The data gap analysis can identify future sampling locations outside of the subarea being evaluated. In data gap evaluations for prior Subareas (5A, 5B, 5C, 5D, 6/3, 7, and 8), these future locations were displayed with pink '+' symbols on the sample location figures associated with the TM. In some cases, the samples were located outside of Area IV and required additional surveys and coordination prior to sampling. In other cases, the proposed samples were within another subarea, and were included in the subsequent corresponding Subarea Data Gap Analysis TM. For this TM, proposed sampling at locations outside the NBZ is planned to be performed concurrent with proposed sampling within the NBZ. Therefore, no 'future' sampling locations are identified in this TM.

The information presented in this TM, along with supporting GIS and analytical information, is reviewed with DTSC during the data gap process and with interested stakeholders at the end of the data gap process. Input received from DTSC during review and from the public during meetings is incorporated into the proposed sampling included in this TM.

3.0 NBZ DATA GAP ANALYSIS

The data gap analysis for the NBZ was performed following the process outlined above and using the DQOs presented in Section 4 of the MFSP (CDM Smith, 2012b). The proposed soil matrix sampling for the NBZ is presented in Table 1, and Figures 1 and 2 for the northwestern and northeastern portions of the NBZ, respectively. As described above, soil vapor sampling is not proposed within the NBZ since there is no documented historical solvent use, groundwater plumes are immediately adjacent to operational areas within Area IV, and soils are thin within a very rocky terrain. For similar reasons, no potential groundwater input areas are identified in this TM for targeted sampling. Table 2 presents the lines of evidence evaluation summary for the NBZ, with checkmarks indicating what information resulted in proposed data gap samples.

As part of the NBZ data gap analysis, some areas were identified where the DQOs were uniquely applied, or where specific sampling approaches have been recommended. These are briefly described below. More detailed, sample-specific rationales for these (and all) areas are provided in Table 1.

- Sporadic low-level exceedances of LUT values were identified at several previously sampled locations (e.g., BZSS06, SL-078-NBZ, SL-124-NBZ, SL-157-NBZ, SL-173-NBZ, and SED-002-SIV) outside of surface water pathways in the NBZ. Additional step-out sampling is not proposed in this TM for those locations since there is no pattern of the detected results and the exceedances are just slightly above the LUT values. The extent of these exceedances are sufficiently defined for remediation planning since they are typically found on hillsides with limited soil extent.
- At or adjacent to roads in the western portion of the NBZ, sampling is proposed as step-out locations to exceedances at existing locations and to target potential releases along the western roadway (e.g., onsite locations NBZ_DG-502 through NBZ_DG-504, NBZ_DG-509, and NBZ_DG-510, and offsite locations NBZ_DG-506 through NBZ_DG-508).
- Potential air dispersion impacts related to burning and treatment activities at the former FSDF Ponds is addressed by sampling undeveloped hillsides and downgradient drainages away from the former ponds in the prevailing wind direction to the northwest (the southeastern direction already has been sampled with high density of locations) and toward the southwest due to periodic 'Santa Ana' wind conditions. Nine soil sample locations within the NBZ are proposed to assess this migration pathway (NBZ_DG-505, NBZ_DG-511, NBZ_DG-512, and NBZ_DG-516 through NBZ_DG-521).
- No sampling is proposed in drainages in the eastern portion of the NBZ or near Building 2203 (located in Area II) since recent data in these areas collected by National Aeronautics and Space Administration (NASA) is pending evaluation by DOE. Upon

completion of this data review and discussion with DTSC and NASA, DOE may propose additional sampling for these areas in a future data gap SAP.

- Downdrainage step-out sampling is proposed at offsite drainages and surface water pathways north of the NBZ to address onsite LUT exceedances.
    - In well defined drainages, three step-out locations are proposed downdrainage of each of the nearest LUT exceedances (e.g., NBZ_DG-527 through NBZ_DG-529, NBZ_DG-540 through NBZ_DG-542, NBZ_DG-553 through NBZ_DG-555, and NBZ_DG-557).
    - In less defined surface water pathways, two step-out sampling locations are proposed downdrainage of each of the nearest LUT exceedances (e.g., NBZ_DG-514 and NBZ_DG-515, NBZ_DG-523 and NBZ_DG-524, NBZ_DG-535 and NBZ_DG-536, NBZ_DG-538 and NBZ_DG-539, and NBZ_DG-551 and NBZ_DG-552).
    - Proposed sampling locations will be selected and/or further refined in the field to target topographic low spots and sediment collection areas along the drainage.

4.0 REFERENCES

CDM Smith. 2012a. Work Plan for Chemical Data Gap Investigation, Phase 3 Chemical Sampling at Area IV, Santa Susana Field Laboratory, Ventura County, California. April.

CDM Smith. 2012b. Master Field Sampling Plan for Chemical Data Gap Investigation Sampling at Area IV, Santa Susana Field Laboratory, Ventura County, California. April.

Hydrogeologic, Inc. (HGL) 2012. Draft Final Historic Site Assessment Santa Susana Field Laboratory Site Area IV Radiological Study, Ventura County, California.

TABLES

Table 1
Northern Buffer Zone Phase 3 Proposed Soil Sample Locations
(1 of 5)

Location ID[1]	Area	Location Description	Sample Type	Depth (feet bgs)	Analytical Method														Data Gap Checklist[3]	Rationale / Comments[4]
					PAHs, , phthalates, NDMA (EPA Method 8270C [SIM])	PCBs / PCTs (EPA Method 8082)	Dioxins/Furans (EPA Method 1613)	Metals[2] (EPA Methods 6010B/6010C /6020/6020A/7471A/7471B)	Cadmium (EPA Method 6020A)	Silver (EPA Method 6020A)	Perchlorate (EPA Method 6850/6860)	TPH (EPA Method 8015B)	Pesticides (EPA Method 8081)	Herbicides (EPA Method 8151A)	Nitrate (EPA Method 300.0)	Cyanide (EPA Method 9014)	pH (EPA Method 9045C)	Soil Moisture (ASTM D2216/ EPA Method 160.3)		
NBZ_DG-501	NBZ-NW	Southwestern Portion of NBZ-NW	Soil Boring	0.5				X									X	X		Resample for cadmium at 92-886-1A-1 and 93--886-25A to confirm detects that were above LUT value. Also addresses elevated RLs for antimony and silver results. Bedrock anticipated <5 feet bgs. If deeper soils encountered, sample and place on hold pending shallow results.
				5				X									X	X		
NBZ_DG-502	NBZ-NW	Southwestern Portion of NBZ-NW	Soil Boring	0.5								X	X					X	√	Stepout for pesticides and TPH at SL-002-NBZ. Also targets historic dirt road. Bedrock anticipated <5 feet bgs. If deep soils encountered, sample and place on hold pending shallow results.
				5								X	X					X		
NBZ_DG-503	NBZ-NW	Southwestern Portion of NBZ-NW	Soil Boring	0.5								X	X					X	√	Same as NBZ_DG-502.
				5								X	X					X		
NBZ_DG-504	NBZ-NW	Southwestern Portion of NBZ-NW	Soil Boring	0.5								X	X					X	√	Same as NBZ_DG-502.
				5								X	X					X		
NBZ_DG-505	NBZ-NW	Western Portion of NBZ-NW	Soil Boring	0.5	X		X	X				X					X	X	√	Assesses potential air dispersion impacts related to burning and treatment activities at the former FSDF ponds and is located northwest of FSDF in the prevailing wind direction. Location is in a blind drainage and is one of nine locations proposed (e.g., NBZ_DG-505 -511, -512, -516, -517, -518, -519, -520, -521) that will assess this migration pathway. Additional sampling to address this pathway was also proposed in Subarea 8. Bedrock anticipated <5 feet bgs. If deep soils encountered, sample and place on hold pending shallow results.
				5	X		X	X				X					X	X		
NBZ_DG-506	NBZ-NW	Southwest of NBZ-NW	Soil Boring	0.5								X	X					X	√	Stepout for pesticides and TPH at SL-001-NBZ. Also targets an offsite historic dirt road. Bedrock anticipated <5 feet bgs. If deep soils encountered, sample and place on hold pending shallow results.
				5								X	X					X		
NBZ_DG-507	NBZ-NW	Southwest of NBZ-NW	Soil Boring	0.5								X	X					X	√	Same as NBZ_DG-506.
				5								X	X					X		
NBZ_DG-508	NBZ-NW	North of NBZ-NW	Soil Boring	0.5	X	X	X					X	X				X	X	√	Stepout for benzyl butyl phthalate at SL-148-NBZ to the south. Also targets an historic dirt road. Bedrock anticipated <5 feet bgs. If deep soils encountered, sample and place on hold pending shallow results.
				5	X	X	X					X	X				X	X		
NBZ_DG-509	NBZ-NW	Northwestern Portion of NBZ-NW	Soil Boring	0.5	X	X	X					X	X				X	X	√	Location targets historic dirt road upslope and downslope of pesticide and TPH detections. Bedrock anticipated <5 feet bgs; if deep soils encountered, sample and place on hold pending shallow results.
				5	X	X	X					X	X				X	X		
NBZ_DG-510	NBZ-NW	Northwestern Portion of NBZ-NW	Soil Boring	0.5	X	X	X					X	X				X	X	√	Same as NBZ_DG-509.
				5	X	X	X					X	X				X	X		
NBZ_DG-511	NBZ-NW	Western Portion of NBZ-NW	Soil Boring	0.5	X		X	X				X					X	X	√	Assesses potential air dispersion impacts related to burning and treatment activities at the former FSDF ponds, located northwest of FSDF in the prevailing wind direction. Location is one of nine locations (e.g., NBZ_DG-505 511, -512, -516, -517, -518, -519, -520, -521) proposed to assess this migration pathway. Additional sampling to address this pathway was also proposed in Subarea 8. Bedrock anticipated <5 feet bgs; if deep soils encountered, sample and place on hold pending shallow results.
				5	X		X	X				X					X	X		
NBZ_DG-512	NBZ-NW	Southwestern Portion of NBZ-NW	Soil Boring	0.5	X		X		X			X						X	√	Assesses potential air dispersion impacts related to burning and treatment activities at the former FSDF ponds, located northwest of FSDF in the prevailing wind direction. Location is one of nine locations (e.g., NBZ_DG-505 511, -512, -516, -517, -518, -519, -520, -521) proposed to assess this migration pathway. Additional sampling to address this pathway was also proposed in Subarea 8. Previous analysis at this location was performed at the surface for metals only. Resample at 0.5 ft bgs for cadmium at 92-886-1B-1 to confirm detects above the LUT value. Bedrock anticipated <5 feet bgs; if deep soils encountered, sample and place on hold pending shallow results.
				5	X		X	X				X					X	X		

Table 1
Northern Buffer Zone Phase 3 Proposed Soil Sample Locations
(2 of 5)

Location ID[1]	Area	Location Description	Sample Type	Depth (feet bgs)	Analytical Method														Data Gap Checklist[3]	Rationale / Comments[4]
					PAHs, , phthalates, NDMA (EPA Method 8270C [SIM])	PCBs / PCTs (EPA Method 8082)	Dioxins/Furans (EPA Method 1613)	Metals[2] (EPA Methods 6010B/6010C /6020/6020A/7471A/7471B)	Cadmium (EPA Method 6020A)	Silver (EPA Method 6020A)	Perchlorate (EPA Method 6850/6860)	TPH (EPA Method 8015B)	Pesticides (EPA Method 8081)	Herbicides (EPA Method 8151A)	Nitrate (EPA Method 300.0)	Cyanide (EPA Method 9014)	pH (EPA Method 9045C)	Soil Moisture (ASTM D2216/ EPA Method 160.3)		
NBZ_DG-513	NBZ-NW	Western Portion of NBZ-NW	Soil Boring	0.5								X						X	√	Location targets surface water flow pathway downgradient from TPH exceedance at SL-011-NBZ. Bedrock anticipated <5 feet bgs; if deep soils encountered, sample and place on hold pending shallow results.
				5								X						X		
NBZ_DG-514	NBZ-NW	North of NBZ-NW	Soil Boring	0.5									X					X	√	Location targets surface water pathway downgradient from pesticide exceedance at SED-036-SIV. Bedrock anticipated <5 feet bgs; if deep soils encountered, sample and place on hold pending shallow results.
				5									X					X		
NBZ_DG-515	NBZ-NW	North of NBZ-NW	Soil Boring	0.5									X					X	√	Same as NBZ_DG-514.
				5									X					X		
NBZ_DG-516	NBZ-NW	North of NBZ-NW	Soil Boring	0.5	X		X	X				X					X	X	√	Assesses potential air dispersion impacts related to burning and treatment activities at the former FSDF ponds, located on the hillslope north of the Northeast Northern Buffer Zone and northwest of FSDF in the prevailing wind direction. Location is one of nine locations (e.g., NBZ_DG-505 -511, -512, -516, -517, -518, -519, -520, -521) proposed to assess this migration pathway. Additional sampling to address this pathway was also proposed in Subarea 8. Bedrock anticipated <5 feet bgs. If deep soils encountered, sample and place on hold pending shallow results.
				5	X		X	X				X					X	X		
NBZ_DG-517	NBZ-NW	North of NBZ-NW	Soil Boring	0.5	X		X	X				X					X	X	√	Same as NBZ_DG-516.
				5	X		X	X				X					X	X		
NBZ_DG-518	NBZ-NW	North of NBZ-NW	Soil Boring	0.5	X		X	X				X					X	X	√	Location targets the bottom of a blind surface water pathway/drainage northwest of FSDF in the prevailing wind direction. Assesses potential air dispersion impacts related to burning and treatment activities at the former FSDF ponds and is one of nine locations (e.g., NBZ_DG-505 -511, -512, -516, -517, -518, -519, -520, -521) proposed to assess this migration pathway. Additional sampling to address this pathway was also proposed in Subarea 8. Bedrock anticipated <5 feet bgs. If deep soils encountered, sample and place on hold pending shallow results.
				5	X		X	X				X					X	X		
NBZ_DG-519	NBZ-NW	North of NBZ-NW	Soil Boring	0.5	X		X	X				X					X	X	√	Location targets area further downdrainage from NBZ-DG-518. Assesses potential air dispersion impacts related to burning and treatment activities at the former FSDF ponds and is one of nine locations (e.g., NBZ_DG-505 -511, -512, -516, -517, -518, -519, -520, -521) proposed to assess this migration pathway. Additional sampling to address this pathway was also proposed in Subarea 8. Bedrock anticipated <5 feet bgs. If deep soils encountered, sample and place on hold pending shallow results.
				5	X		X	X				X					X	X		
NBZ_DG-520	NBZ-NW	North of NBZ-NW	Soil Boring	0.5	X		X	X				X					X	X	√	Location targets blind surface water pathway/drainage northwest of FSDF in the prevailing wind direction. Assesses potential air dispersion impacts related to burning and treatment activities at the former FSDF ponds and is one of nine locations (e.g., NBZ_DG-505 -511, -512, -516, -517, -518, -519, -520, -521) proposed to assess this migration pathway. Additional sampling to address this pathway was also proposed in Subarea 8. Bedrock anticipated <5 feet bgs. If deep soils encountered, sample and place on hold pending shallow results.
				5	X		X	X				X					X	X		
NBZ_DG-521	NBZ-NW	North of NBZ-NW	Soil Boring	0.5	X		X	X				X					X	X	√	Assesses potential air dispersion impacts related to burning and treatment activities at the former FSDF ponds, located on the hillslope north of the Northeast Northern Buffer Zone and northwest of FSDF in the prevailing wind direction. Location is one of nine locations (e.g., NBZ_DG-505 -511, -512, -516, -517, -518, -519, -520, -521) proposed to assess this migration pathway. Additional sampling to address this pathway was also proposed in Subarea 8. Bedrock anticipated <5 feet bgs. If deep soils encountered, sample and place on hold pending shallow results.
				5	X		X	X				X					X	X		
NBZ_DG-522	NBZ-NW	Central Portion of NBZ-NW	Soil Boring	0.5	X							X			X			X	√	Location targets surface water pathway upgradient from exceedances of PAHs, TPH, and nitrate at SL-081-NBZ. Bedrock anticipated <5 feet bgs. If deep soils encountered, sample and place on hold pending shallow results.
				5	X							X			X			X		
NBZ_DG-523	NBZ-NW	North of NBZ-NW	Soil Boring	0.5	X							X			X			X	√	Location targets surface water pathway downgradient from exceedances of PAHs, TPH, and nitrate at SL-081-NBZ. Bedrock anticipated <5 feet bgs. If deep soils encountered, sample and place on hold pending shallow results.
				5	X							X			X			X		

Table 1
Northern Buffer Zone Phase 3 Proposed Soil Sample Locations
(3 of 5)

Location ID[1]	Area	Location Description	Sample Type	Depth (feet bgs)	Analytical Method														Data Gap Checklist[3]	Rationale / Comments[4]
					PAHs, , phthalates, NDMA (EPA Method 8270C [SIM])	PCBs / PCTs (EPA Method 8082)	Dioxins/Furans (EPA Method 1613)	Metals[2] (EPA Methods 6010B/6010C /6020/6020A/7471A/7471B)	Cadmium (EPA Method 6020A)	Silver (EPA Method 6020A)	Perchlorate (EPA Method 6850/6860)	TPH (EPA Method 8015B)	Pesticides (EPA Method 8081)	Herbicides (EPA Method 8151A)	Nitrate (EPA Method 300.0)	Cyanide (EPA Method 9014)	pH (EPA Method 9045C)	Soil Moisture (ASTM D2216/ EPA Method 160.3)		
NBZ_DG-524	NBZ-NW	North of NBZ-NW	Soil Boring	0.5	X							X			X			X	√	Same as NBZ_DG-523.
				5	X							X			X			X		
NBZ_DG-525	NBZ-NW	Central Portion of NBZ-NW	Soil Boring	0.5								X		X				X	√	Stepout for TPH and herbicides at SL-021-NBZ. Bedrock anticipated <5 feet bgs. If deep soils encountered, sample and place on hold pending shallow results.
				5								X		X				X		
NBZ_DG-526	NBZ-NW	Central Portion of NBZ-NW	Soil Boring	0.5								X	X	X				X	√	Stepout for TPH and herbicdes at SL-021-NBZ, and pesticides at SL-023-NBZ. Bedrock anticipated <5 feet bgs. If deep soils encountered, sample and place on hold pending shallow results.
				5								X	X	X				X		
NBZ_DG-527	NBZ-NW	North of NBZ-NW	Soil Boring	0.5	X	X	X						X					X	√	One of three locations downdrainage from exceedances of dioxins, pesticides, and bis(2-ethylhexyl)phthalate at SED-011-SIV. Analyze for PCBs to support evaluation in FSDF drainage to the west and downstream of confluence. Bedrock anticipated <5 feet bgs. If deep soils encountered, sample and place on hold pending shallow results.
				5	X	X	X						X					X		
NBZ_DG-528	NBZ-NW	North of NBZ-NW	Soil Boring	0.5	X	X	X						X					X	√	Same as NBZ_DG-527.
				5	X	X	X						X					X		
NBZ_DG-529	NBZ-NW	North of NBZ-NW	Soil Boring	0.5	X	X	X						X					X	√	Same as NBZ_DG-527.
				5	X	X	X						X					X		
NBZ_DG-530	NBZ-NW	Eastern Portion of NBZ-NW	Soil Boring	0.5								X	X					X	√	Stepout for pesticides and TPH at SL-025-NBZ. Bedrock anticipated <5 feet bgs. If deep soils encountered, sample and place on hold pending shallow results.
				5								X	X					X		
NBZ_DG-531	NBZ-NW	Eastern Portion of NBZ-NW	Soil Boring	0.5								X	X					X	√	Stepout for pesticides and TPH at SL-025-NBZ and TPH at SL-026-NBZ. Bedrock anticipated <5 feet bgs. If deep soils encountered, sample and place on hold pending shallow results.
				5								X	X					X		
NBZ_DG-532	NBZ-NW	Eastern Portion of NBZ-NW	Soil Boring	0.5								X	X					X	√	Stepout for pesticides and TPH at SL-025-NBZ and TPH at SL-026-NBZ. Bedrock anticipated <5 feet bgs. If deep soils encountered, sample and place on hold pending shallow results.
				5								X	X					X		
NBZ_DG-533	NBZ-NW	Eastern Portion of NBZ-NW	Soil Boring	0.5								X		X				X	√	Stepout for TPH at SL-026-NBZ, HFBS0065, SL-019-SA7, and herbicides at SL-019-SA7. Bedrock anticipated <5 feet bgs. If deep soils encountered, sample and place on hold pending shallow results.
				5								X		X				X		
NBZ_DG-534	NBZ-NW	Northeastern Portion of NBZ-NW	Soil Boring	0.5								X						X	√	Stepout in upslope surface water pathway from TPH exceedance at SRBS1099. Bedrock anticipated <5 feet bgs. If deep soils encountered, sample and place on hold pending shallow results.
				5								X						X		
NBZ_DG-535	NBZ-NW	North of NBZ-NW	Soil Boring	0.5								X						X	√	Location targets surface water pathway downslope from TPH exceedances at SL-032-NBZ and SRBS1099. Bedrock anticipated <5 feet bgs. If deep soils encountered, sample and place on hold pending shallow results.
				5								X						X		
NBZ_DG-536	NBZ-NW	North of NBZ-NW	Soil Boring	0.5								X						X	√	Location targets surface water pathway downslope from TPH exceedances at SL-032-NBZ, SL-033-NBZ, and SRBS1099. Bedrock anticipated <5 feet bgs. If deep soils encountered, sample and place on hold pending shallow results.
				5								X						X		
NBZ_DG-537	NBZ-NE	Northwestern Portion of NBZ-NE	Soil Boring	0.5			X					X	X					X	√	Location targets surface water pathway downdrainage from exceedances of TPH and pesticides at SL-034-NBZ. Bedrock anticipated <5 feet bgs. If deep soils encountered, sample and place on hold pending shallow results.
				5			X					X	X					X		
NBZ_DG-538	NBZ-NE	North of NBZ-NE	Soil Boring	0.5	X		X					X						X	√	Location targets surface water pathway downdrainage from exceedances of TPH and pesticides at SL-034-NBZ, and bis-(2-ethylhexyl)phthalate, dioxins, and PAHs at SED-015-SIV. Bedrock anticipated <5 feet bgs. If deep soils encountered, sample and place on hold pending shallow results.
				5	X		X					X						X		

Table 1
Northern Buffer Zone Phase 3 Proposed Soil Sample Locations
(4 of 5)

Location ID[1]	Area	Location Description	Sample Type	Depth (feet bgs)	Analytical Method														Data Gap Checklist[3]	Rationale / Comments[4]
					PAHs, , phthalates, NDMA (EPA Method 8270C [SIM])	PCBs / PCTs (EPA Method 8082)	Dioxins/Furans (EPA Method 1613)	Metals[2] (EPA Methods 6010B/6010C /6020/6020A/7471A/7471B)	Cadmium (EPA Method 6020A)	Silver (EPA Method 6020A)	Perchlorate (EPA Method 6850/6860)	TPH (EPA Method 8015B)	Pesticides (EPA Method 8081)	Herbicides (EPA Method 8151A)	Nitrate (EPA Method 300.0)	Cyanide (EPA Method 9014)	pH (EPA Method 9045C)	Soil Moisture (ASTM D2216/ EPA Method 160.3)		
NBZ_DG-539	NBZ-NE	North of NBZ-NE	Soil Boring	0.5	X		X											X	√	Same as NBZ_DG-538.
				5	X		X											X		
NBZ_DG-540	NBZ-NE	North of NBZ-NE	Soil Boring	0.5	X		X						X	X				X	√	One of three stepout locations (NBZ_DG-540, -541, -542) downdrainage from exceedances of PAHs, dioxins, pesticides, and herbicides at SED-022-SIV and pesticides/herbicides at SED-023-SIV. Bedrock anticipated <5 feet bgs. If deep soils encountered, sample and place on hold pending shallow results.
				5	X		X						X	X				X		
NBZ_DG-541	NBZ-NE	North of NBZ-NE	Soil Boring	0.5	X		X						X	X				X	√	Same as NBZ_DG-540.
				5	X		X						X	X				X		
NBZ_DG-542	NBZ-NE	North of NBZ-NE	Soil Boring	0.5	X		X						X	X				X	√	Same as NBZ_DG-540.
				5	X		X						X	X				X		
NBZ_DG-543	NBZ-NE	Western Portion of NBZ-NE	Soil Boring	0.5	X							X						X	√	Stepout upslope from exceedances of PAHs and TPH at SL-080-NBZ. Bedrock anticipated <5 feet bgs. If deep soils encountered, sample and place on hold pending shallow results.
				5	X							X						X		
NBZ_DG-544	NBZ-NE	Western Portion of NBZ-NE	Soil Boring	0.5	X		X	X				X	X				X	X	√	Location targets potential surface water pathway downslope from exceedances of pesticides at SL-095-NBZ, TPH at SL-043-NBZ, and PAHs, metals, and TPH at OCBS92. Aerial photographs show bedrock outcrop in the area; field place sample in area of soil if possible. Bedrock anticipated <5 feet bgs; if deep soils encountered, sample and place on hold pending shallow results.
				5	X		X	X				X	X				X	X		
NBZ_DG-545	NBZ-NE	Western Portion of NBZ-NE	Soil Boring	0.5	X	X	X	X				X				X	X	X	√	Stepout downslope from exceedances of PCBs at SL-047-NBZ, cyanide, dioxins, PAHs, and TPH at SL-048-NBZ, and TPH at SL-049-NBZ. Bedrock anticipated <5 feet bgs. If deep soils encountered, sample and place on hold pending shallow results.
				5	X	X	X	X				X				X	X	X		
NBZ_DG-546	NBZ-NE	Western Portion of NBZ-NE	Soil Boring	0.5								X						X	√	Location targets surface water pathway upslope from exceedance of TPH at OCBS88. Bedrock anticipated <5 feet bgs. If deep soils encountered, sample and place on hold pending shallow results.
				5								X						X		
NBZ_DG-547	NBZ-NE	Western Portion of NBZ-NE	Soil Boring	0.5								X						X	√	Location targets surface water pathway downslope from exceedance of TPH at OCBS88. Bedrock anticipated <5 feet bgs. If deep soils encountered, sample and place on hold pending shallow results.
				5								X						X		
NBZ_DG-548	NBZ-NE	Western Portion of NBZ-NE	Soil Boring	0.5		X	X					X						X	√	Stepout for PCBs, dioxins, and TPH at SL-062-NBZ. Also targets historical dirt road. Bedrock anticipated <5 feet bgs; if deep soils encountered, sample and place on hold pending shallow results.
				5		X	X					X						X		
NBZ_DG-549	NBZ-NE	Western Portion of NBZ-NE	Soil Boring	0.5								X						X	√	Location targets surface water pathway downslope from exceedance of TPH at SL-065-NBZ. Bedrock anticipated <5 feet bgs. If deep soils encountered, sample and place on hold pending shallow results.
				5								X						X		
NBZ_DG-551	NBZ-NE	Northeast of NBZ-NE	Soil Boring	0.5	X													X	√	One of two locations (NBZ_DG-551, -552) targeting surface water pathway downslope from exceedance of PAHs at SL-101-NBZ. Bedrock anticipated <5 feet bgs; if deep soils encountered, sample and place on hold pending shallow results.
				5	X													X		
NBZ_DG-552	NBZ-NE	Northeast of NBZ-NE	Soil Boring	0.5	X													X	√	Same as NBZ_DG-551.
				5	X													X		
NBZ_DG-553	NBZ-NW	North of NBZ-NE	Soil Boring	0.5		X												X	√	Down-drainage stepout for PCBs at 428480. Bedrock anticipated <5 feet bgs. If deep soils encountered, sample and place on hold pending shallow results.
				5		X												X		
NBZ_DG-554	NBZ-NW	North of NBZ-NE	Soil Boring	0.5		X												X	√	Same as NBZ_DG-553.
				5		X												X		

Table 1
Northern Buffer Zone Phase 3 Proposed Soil Sample Locations
(5 of 5)

Location ID[1]	Area	Location Description	Sample Type	Depth (feet bgs)	Analytical Method															Data Gap Checklist[3]	Rationale / Comments[4]
					PAHs, , phthalates, NDMA (EPA Method 8270C [SIM])	PCBs / PCTs (EPA Method 8082)	Dioxins/Furans (EPA Method 1613)	Metals[2] (EPA Methods 6010B/6010C /6020/6020A/7471A/7471B)	Cadmium (EPA Method 6020A)	Silver (EPA Method 6020A)	Perchlorate (EPA Method 6850/6860)	TPH (EPA Method 8015B)	Pesticides (EPA Method 8081)	Herbicides (EPA Method 8151A)	Nitrate (EPA Method 300.0)	Cyanide (EPA Method 9014)	pH (EPA Method 9045C)	Soil Moisture (ASTM D2216/ EPA Method 160.3)		
NBZ_DG-555	NBZ-NW	North of NBZ-NE	Soil Boring	0.5		X												X	√	Same as NBZ_DG-554.
				5		X												X		
NBZ_DG-556	NBZ-NW	Central Portion of NBZ-NW	Soil Boring	0.5								X		X				X	√	Stepout upslope from TPH exceedance at U7BS0006. Bedrock anticipated <5 feet bgs. If deep soils encountered, sample and place on hold pending shallow results.
				5								X		X				X		
NBZ_DG-557	NBZ-NW	North of NBZ-NW	Soil Boring	0.5		X												X	√	Stepout downdrainage from PCB exceedance at Brandeis-2. Bedrock anticipated <5 feet bgs. If deep soils encountered, sample and place on hold pending shallow results.
				5		X												X		

Footnotes

1. Sampling will generally be at 5 foot intervals to bedrock. In areas where fill is encountered or anticipated, samples will be collected from the top of native soil (beneath fill) and soil just above bedrock. Samples collected at 0.5 feet and 5 feet will be analyzed with deeper samples placed on hold pending shallower results, unless otherwise stated. If deeper soils are encountered, additional sampling will be added as needed. Sample intervals may be added or adjusted based on field conditions.

2. Standard metals analysis includes silver and mercury, but does not include hexavalent chromium.

3. Checkmark in column indicates sample was proposed based on review of information source indicated in Table 2 (Data Gap Checklist) for the area listed in "Location Description" (GIS or aerial photo review layers).

Acronyms

bgs = below ground surface
EPA = Environmental Protection Agency
FSDF = Former Sodium Disposal Facility
ft = foot or feet
GIS = geographic information system
LUT = Look-Up Table
PAH = polyaromatic hydrocarbon
NBZ = Northern Buffer Zone
OCY = Old Conservation Yard
PCB = polychlorinated biphenyl
RMHF - Radioactive Materials Handling Facility
TPH = total petroleum hydrocarbons
UST = underground storage tank

Table 2
Northern Buffer Zone
Data Gap Checklist
(Page 1 of 2)

INFORMATION SOURCE	Northern Buffer Zone (NBZ) Data Gap Evaluation Areas [1]	
	NBZ-NW	NBZ-NE
GIS Base Map Layers		
Tanks (and Sitewide Tank Inventory Table)	√	√
Transformers	√	√
Structures	√	√
Sumps	√	√
Vaults	√	√
Pipes	√	√
Undefined features	√	√
Chemical Use Areas (RFI)	√	√
Streams/ditches	√	√
Leachfields	√	√
Storage Yard Areas	√	√
Roads	√	√
Soil Disturbance (Veg clearance, excavation, grading, etc)	√	√
Migration Pathways		
Surface Water	√	√
Aerial Dispersion [2]	√	√
Subsurface Soil	√	√
Site-wide Infrastructure		
IWW - spray fields	√	√
Natural Gas Pipelines (site-wide approach also in progress)	√	√
Sewer (site-wide approach also in progress)	√	√
Aerial Photo Review		
Historical aerial photographs from 17 years (1953 - 2005)	√	√
EPA Layers		
Gamma Scan	√	√
Potential Gamma Anomalies (PGRAY)	√	√
Tank Points	N/A	N/A
HSA Line Layer (HSA linear features)	N/A	N/A
HSA Photo Layer (HSA aerial photo review features)	√	√
Historical Use Data (chem use, storage, leach fields, releases, interviews, etc.)	√	√
Area IV Conduit (pipelines)	√	√
Geophysical Survey (EM, GPR, TC)	√	√
Other [3]		
Existing Building Feature Documentation - process info reviewed	N/A	N/A
Historical Facility Diagrams - deep feature info reviewed	N/A	N/A

Table 2
Northern Buffer Zone
Data Gap Checklist

INFORMATION SOURCE	Northern Buffer Zone (NBZ) Data Gap Evaluation Areas [1]	
	NBZ-NW	**NBZ-NE**
Groundwater Impacts / Potential Inputs to Groundwater Evaluated [4]	N/A	N/A
Site-wide Tank Inventory Table for unlocated tanks (viewed with Tanks Base Map layer)	√	√
EPA Area IV radiological sampling results [5]	√	√
Uncollected EPA Phase 1 sample locations [6]	√	√

√	Feature reviewed during data gaps evaluation
√	Indicates sampling proposed based on reviewed feature
--	No buildings present for inspection
N/A	Information source not available for this subarea

Notes

1. Data gap evaluations were performed over smaller footprints within each subarea. The NBZ-NW area includes the area northwest and west of Area IV that is located within the SSFL administrative area. The NBZ-NE area includes the area north of Areas II, III, and IV that is located within the SSFL administrative boundary.

2. Evaluation of air dispersion migration pathways was performed using existing sampling results, or proposing additional sampling as warranted along predominant wind directions (NW), and/or in adjacent drainages. For the NBZ, air dispersion sources evaluated included the former ponds at FSDF.

3. Other notes and resources used in the data gap process included data dotmaps, a co-located sampling boring log summary table (including analytical and sample depth info), boring and trench logs from the RFI, EPA boring logs from co-located sampling, filterable dataset, and the EPA HSA document. Previous RFI Group reports were used as a reference on an as-needed basis in evaluation of selected features (e.g. building use descriptions).

4. Feature/area identified that may warrant further consideration of groundwater input sources and threat to groundwater sampling requirements by DTSC and SSFL groundwater teams. Identification based on type of feature (typically, a liquid waste disposal or storage feature), and soil detections of mobile chemicals (e.g., VOCs, NDMA, perchlorate, 1,4-dioxane), and/or multiple chemical detections significantly above LUTs. Since solvent use was not documented within the NBZ, VOC groundwater plumes occur only within the NBZ immediately adjacent to operational areas within Area IV, and the NBZ is dominanted by rock outcrops and limited extents of thin soil, no potential groundwater input areas were identified at the NBZ for targeted sampling.

5. EPA radiological sampling results summaries included as part of chemical data gap evaluation process. For the NBZ, no chemical data gaps identified based only on radiological sampling results.

6. Proposed Phase 1 sampling locations where no radiological sample was collected by EPA (due to refusal, safety concerns, etc.) were evaluated to determine if a chemical data gap still existed, with additional sampling proposed in Phase 3 if a gap was identified.

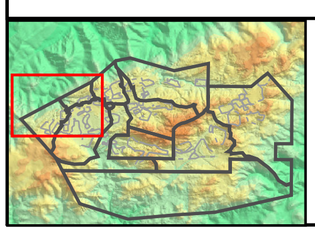
FIGURES

Notes:
1. Drainage courses are approximate based on topography, sample locations and aerial photograph review. Actual locations will be refined based on field reconnaissance during sampling.

NBZ_DG-553
NBZ_DG-554
NBZ_DG-555
NBZ_DG-529
NBZ_DG-528
NBZ_DG-557
NBZ_DG-527
NBZ_DG-521
NBZ_DG-519
NBZ_DG-518
NBZ_DG-520
NBZ_DG-516
NBZ_DG-515
NBZ_DG-517
NBZ_DG-514
NBZ_DG-510
NBZ_DG-508
NBZ_DG-505
NBZ_DG-509
NBZ_DG-511
NBZ_DG-512
NBZ_DG-504
NBZ_DG-507
NBZ_DG-506
NBZ_DG-502
NBZ_DG-503
NBZ_DG-501
NBZ_DG-524
NBZ_DG-523
NBZ_DG-522
NBZ_DG-513
NBZ_DG-539
NBZ_DG-538
NBZ_DG-536
NBZ_DG-537
NBZ_DG-535
NBZ_DG-534
NBZ_DG-533
NBZ_DG-531
NBZ_DG-532
NBZ_DG-530
NBZ_DG-526
NBZ_DG-525
NBZ_DG-556

BZ-NE
BZ-NW
Subarea 6
Subarea 7
Subarea 5A
Subarea 5B
Subarea 5C
Subarea 5D North
Subarea 8 North
Subarea 8 South
Northern Buffer Zone
Area IV
Area II
Area III
Area IV

Please Note: The original version of this figure includes colorized features and shading. A black and white copy of the figure should not be used because it may not accurately represent the information presented.



Base Map Legend
- Administrative Area Boundary
- HSA Subareas
- Clearly Contaminated Areas
- Existing Building or Structure
- Removed Building or Structure
- Ponds
- Excavated Area
- Backfilled Excavation Area
- Pipe
- Leach Field
- Drainage
- Concrete Lined Drainage
- Rock Outcrop
- Dirt Road
- A/C Paving

Groundwater Wells
- Near Surface
- Chatsworth

Trenches
- Previous
- Proposed

The "Combined Analyte" Data Summary includes all chemicals listed in the DTSC Look-up Table (LUT) as well as other chemicals analyzed at the site. The maximum ratio to LUT value was used to color code symbols at each location as shown in the legend. For locations where at least one chemical was detected, the maximum ratio of detected concentration/LUT value was used; otherwise the maximum ratio of MRL/LUT value was used and the location was symbolized as ND. VOCs and TPH are not included in the "combined analyte" comparison since they are typically evaluated separately for characterization and remedial planning.

DataGap Area IV Proposed Samples
- Future Sample Location
- Add to Analytical Suite at Sample Location
- Re-analysis Sample Location (RLs)
- Other Targeted Sample Location
- Tank Sample location
- Stepout/Stepdown Sample location
- Test Pit Location
- Post Demolition Sampling Area

Combined Detect / LUT Values	Combined ND / LUT Values
<= 1x LUT Values	<= 1x LUT Values
1x - 2x LUT Values	1x - 2x LUT Values
2x - 10x LUT Values	2x - 10x LUT Values
10x - 100x LUT Values	10x - 100x LUT Values
> 100x LUT Values	> 100x LUT Values

Northern Buffer Zone - Northwest
Phase 3 Proposed Soil Matrix Sampling Locations and Previous Data Summary
SANTA SUSANA FIELD LABORATORY

Path: T:\projects\rock3\HSA\Working\Subarea NBZ\HSA_NBZW_Summary.mxd
Date: 10/2/2013

1 inch = 269 feet

0 275 550 Feet

FIGURE 1

Notes:
1. Drainage courses are approximate based on topography, sample locations and aerial photograph review. Actual locations will be refined based on field reconnaissance during sampling.
2. No additional stepout sampling is proposed at this time within the Northeast Northern Buffer Zone for locations adjacent to NASA's estimated soil cleanup boundaries for proposed actions. Recent data in these areas collected by NASA is pending evaluation by DOE.

NBZ_DG-540
NBZ_DG-541
NBZ_DG-542
NBZ_DG-539
NBZ_DG-538
NBZ_DG-537
NBZ_DG-551
NBZ_DG-552
NBZ_DG-549
NBZ_DG-547
NBZ_DG-546
NBZ_DG-548
NBZ_DG-543
NBZ_DG-545
NBZ_DG-544

BZ-NE
Northern Buffer Zone
Area II
Subarea 3
Subarea 6
HSA 6 North
Area IV
Area III
Area II

Please Note: The original version of this figure includes colorized features and shading. A black and white copy of the figure should not be used because it may not accurately represent the information presented.

Base Map Legend
- Administrative Area Boundary
- HSA Subareas
- Clearly Contaminated Areas
- Existing Building or Structure
- Removed Building or Structure
- Ponds
- Excavated Area
- Backfilled Excavation Area
- Pipe
- Leach Field
- Drainage
- Concrete Lined Drainage
- Rock Outcrop
- Dirt Road
- A/C Paving

Groundwater Wells
- Near Surface
- Chatsworth

Trenches
- Previous
- Proposed

The "Combined Analyte" Data Summary includes all chemicals listed in the DTSC Look-up Table (LUT) as well as other chemicals analyzed at the site. The maximum ratio to LUT value was used to color code symbols at each location as shown in the legend. For locations where at least one chemical was detected, the maximum ratio of detected concentration/LUT value was used; otherwise the maximum ratio of MRL/LUT value was used and the location was symbolized as ND. VOCs and TPH are not included in the "combined analyte" comparison since they are typically evaluated separately for characterization and remedial planning.

DataGap Area IV Proposed Samples
- Future Sample Location
- Add to Analytical Suite at Sample Location
- Re-analysis Sample Location (RLs)
- Other Targeted Sample Location
- Tank Sample location
- Stepout/Stepdown Sample location
- Test Pit Location
- Post Demolition Sampling Area

Combined Detect / LUT Values	Combined ND / LUT Values
<= 1x LUT Values	<= 1x LUT Values
1x - 2x LUT Values	1x - 2x LUT Values
2x - 10x LUT Values	2x - 10x LUT Values
10x - 100x LUT Values	10x - 100x LUT Values
> 100x LUT Values	> 100x LUT Values

Northern Buffer Zone - Northeast
Phase 3 Proposed Soil Matrix Sampling Locations and Previous Data Summary
SANTA SUSANA FIELD LABORATORY

Path: T:\projects\rock3\HSA\Working\Subarea NBZ\HSA_NBZE_Summary.mxd
Date: 10/2/2013

1 inch = 250 feet
0 250 500 Feet

FIGURE 2

ATTACHMENT 2
Chemical Look-Up Table

Att 2 Chemical Look-Up Table for DOE and NASA at SSFL
June 2013

Chemical Constituent	Units	Look-Up Table Value	Basis
Alcohols - EPA Method 8015B			
Ethanol	mg/kg	0.7	BG MRL
Methanol	mg/kg	0.7	BG MRL
Anions - EPA Methods 300.0 / 9056A			
Fluoride	mg/kg	10.2	BTV
Nitrate	mg/kg	22.3	BTV
Cyanide - EPA Method 9012A			
Cyanide	mg/kg	0.6	BG MRL
Dioxin-Furans - EPA Method 1613B			
1,2,3,4,6,7,8-HpCDD	pg/g	see note[1]	---
1,2,3,4,6,7,8-HpCDF	pg/g	see note[1]	---
1,2,3,4,7,8,9-HpCDF	pg/g	see note[1]	---
1,2,3,4,7,8-HxCDD	pg/g	see note[1]	---
1,2,3,4,7,8-HxCDF	pg/g	see note[1]	---
1,2,3,6,7,8-HxCDD	pg/g	see note[1]	---
1,2,3,6,7,8-HxCDF	pg/g	see note[1]	---
1,2,3,7,8,9-HxCDD	pg/g	see note[1]	---
1,2,3,7,8,9-HxCDF	pg/g	see note[1]	---
1,2,3,7,8-PeCDD	pg/g	see note[1]	---
1,2,3,7,8-PeCDF	pg/g	see note[1]	---
2,3,4,6,7,8-HxCDF	pg/g	see note[1]	---
2,3,4,7,8-PeCDF	pg/g	see note[1]	---
2,3,7,8-TCDD	pg/g	see note[1]	---
2,3,7,8-TCDF	pg/g	see note[1]	---
OCDD	pg/g	see note[1]	---
OCDF	pg/g	see note[1]	---
2,3,7,8-TCDD TEQ			
2,3,7,8-TCDD TEQ[1]	pg/g	0.912 (see note[1])	BTV-TEQ
Energetics - EPA Method 8330			
RDX	µg/kg	300	M-L MRL
Formaldehyde - EPA Method 8315A			
Formaldehyde	µg/kg	1,870	BG MRL

DTSC Chemical Look-Up Table for DOE NASA at SSFL

June 2013

Chemical Constituent	Units	Look-Up Table Value	Basis
Herbicides - EPA Method 8151A			
2,4,5-T	µg/kg	1.2	BTV
2,4,5-TP	µg/kg	0.63	BTV
2,4-D	µg/kg	5.8	BTV
2,4-DB	µg/kg	2.4	BG MRL
2,4-DP (Dichloroprop)	µg/kg	2.4	BTV
Dalapon	µg/kg	12.5	BG MRL
Dicamba	µg/kg	1.3	BTV
Dinoseb	µg/kg	3.3	BG MRL
MCPA	µg/kg	761	BTV
MCPP (Mecoprop)	µg/kg	377	BTV
Pentachlorophenol	µg/kg	170	M-L MRL
Metals - EPA Methods 6010B/6020A			
Aluminum	mg/kg	58,600	BTV
Antimony	mg/kg	0.86	BTV
Arsenic	mg/kg	46	BTV
Barium	mg/kg	371	BTV
Beryllium	mg/kg	2.2	BTV
Boron	mg/kg	34	BTV
Cadmium	mg/kg	0.7	BTV
Chromium	mg/kg	94	BTV
Cobalt	mg/kg	44	BTV
Copper	mg/kg	119	BTV
Lead	mg/kg	49	BTV
Lithium	mg/kg	91	BTV
Manganese	mg/kg	1,120	BTV
Molybdenum	mg/kg	3.2	BTV
Nickel	mg/kg	132	BTV
Potassium	mg/kg	14,400	BTV
Selenium	mg/kg	1	BTV
Silver	mg/kg	0.2	BTV
Sodium	mg/kg	1,780	BTV
Strontium	mg/kg	163	BTV
Thallium	mg/kg	1.2	BTV
Vanadium	mg/kg	175	BTV
Zinc	mg/kg	215	BTV
Zirconium	mg/kg	19	BTV
Hexavalent Chromium - EPA Methods 7199/7196A			
Hexavalent Chromium	mg/kg	2	BTV
Mercury - EPA Methods 7471A/7470A			
Mercury	mg/kg	0.13	BG MRL
Methyl Mercury - EPA Method 1630 (Mod)			
Methyl Mercury	µg/kg	0.05	M-L MRL

DTSC Chemical Look-Up Table for DOE NASA at SSFL

June 2013

Chemical Constituent	Units	Look-Up Table Value	Basis
PCBs / PCTs - EPA Method 8082			
Aroclor 1016	µg/kg	17	M-L MRL
Aroclor 1221	µg/kg	33	M-L MRL
Aroclor 1232	µg/kg	17	M-L MRL
Aroclor 1262	µg/kg	33	M-L MRL
Aroclor 1254	µg/kg	17	M-L MRL
Aroclor 1260	µg/kg	17	M-L MRL
Aroclor 1268	µg/kg	33	M-L MRL
Aroclor 1242	µg/kg	17	M-L MRL
Aroclor 1248	µg/kg	17	M-L MRL
Aroclor 5432	µg/kg	50	M-L MRL
Aroclor 5442	µg/kg	50	M-L MRL
Aroclor 5460	µg/kg	50	M-L MRL
Perchlorate - EPA Methods 6850/6860			
Perchlorate	µg/kg	1.63	BTV
Pesticides - EPA Method 8081A			
Aldrin	µg/kg	0.24	BG MRL
Alpha-BHC	µg/kg	0.24	BG MRL
Beta-BHC	µg/kg	0.23	BTV
Chlordane	µg/kg	7	BTV
Delta-BHC	µg/kg	0.22	BTV
Dieldrin	µg/kg	0.48	BG MRL
Endosulfan I	µg/kg	0.24	BG MRL
Endosulfan II	µg/kg	0.48	BG MRL
Endosulfan Sulfate	µg/kg	0.48	BG MRL
Endrin	µg/kg	0.48	BG MRL
Endrin Aldehyde	µg/kg	0.7	BTV
Endrin Ketone	µg/kg	0.7	BTV
Gamma-BHC - Lindane	µg/kg	0.24	BG MRL
Heptachlor	µg/kg	0.24	BG MRL
Heptachlor Epoxide	µg/kg	0.24	BG MRL
Methoxychlor	µg/kg	2.4	BG MRL
Mirex	µg/kg	0.5	BTV
p,p-DDD	µg/kg	0.48	BG MRL
p,p-DDE	µg/kg	8.6	BTV
p,p-DDT	µg/kg	13	BTV
Toxaphene	µg/kg	8.8	BG MRL

DTSC Chemical Look-Up Table for DOE NASA at SSFL

June 2013

Chemical Constituent	Units	Look-Up Table Value	Basis
Semi-Volatiles (SVOCs)/PAHs - EPA Method 8270C(SIM)			
Acenaphthylene	µg/kg	2.5	BG MRL
Anthracene	µg/kg	2.5	BG MRL
Benzo(a)anthracene	µg/kg	see note [2]	---
Benzo(a)pyrene	µg/kg	see note [2]	---
Benzo(b)fluoranthene	µg/kg	see note [2]	---
Benzo(g,h,i)perylene	µg/kg	2.5	BG MRL
Benzo(k)fluoranthene	µg/kg	see note [2]	---
Bis(2-Ethylhexyl)phthalate	µg/kg	61	BTV
Butylbenzylphthalate	µg/kg	100	BTV
Chrysene	µg/kg	see note [2]	---
Dibenz(a,h)anthracene	µg/kg	see note [2]	---
Diethyl phthalate	µg/kg	27	BG MRL
Dimethyl phthalate	µg/kg	27	BG MRL
Di-n-butylphthalate	µg/kg	27	BG MRL
Di-n-octylphthalate	µg/kg	27	BG MRL
Fluoranthene	µg/kg	5.2	BTV
Fluorene	µg/kg	3.8	BTV
Indeno(1,2,3-cd)pyrene	µg/kg	see note [2]	---
Naphthalene	µg/kg	3.6	BTV
Phenanthrene	µg/kg	3.9	BTV
Pyrene	µg/kg	5.6	BTV
1-Methyl naphthalene	µg/kg	2.5	BG MRL
2-Methylnaphthalene	µg/kg	2.5	BG MRL
Acenaphthene	µg/kg	2.5	BG MRL
Benzo(a)pyrene Equivalent			
Benzo(a)pyrene TEQ[2]	µg/kg	4.47 (see note[2])	BTV-TEQ
Other SVOCs			
Benzoic Acid - EPA 8270	µg/kg	660	M-L MRL
N-Nitrosodimethylamine - 8270C(SIM)	µg/kg	10	M-L MRL
Phenol - EPA 8270	µg/kg	170	M-L MRL
TPH - EPA Method 8015			
TPH EFH (C15-C20)[3]	mg/kg	5 (see note[3])	M-L MRL
Terphenyls - EPA Method 8015			
o-Terphenyl	mg/kg	7	M-L MRL

DTSC Chemical Look-Up Table for DOE NASA at SSFL

June 2013

Chemical Constituent	Units	Look-Up Table Value	Basis
VOCs - EPA Method 8260			
1,1-Dichloroethene	µg/kg	5	M-L MRL
1,4-Dioxane - EPA 8260 (SIM)	µg/kg	10	M-L MRL
2-Hexanone	µg/kg	10	M-L MRL
Acetone	µg/kg	20	M-L MRL
Benzene	µg/kg	5	M-L MRL
cis-1,2-Dichloroethene	µg/kg	5	M-L MRL
Ethylbenzene	µg/kg	5	M-L MRL
Hexachlorobutadiene	µg/kg	5	M-L MRL
Methylene chloride	µg/kg	10	M-L MRL
Tetrachloroethene	µg/kg	5	M-L MRL
Toluene	µg/kg	5	M-L MRL
Trichloroethene	µg/kg	5	M-L MRL
Vinyl chloride	µg/kg	5	M-L MRL

Notes:

mg/kg: milligrams per kilogram (parts per million)
µg/kg: micrograms per kilogram (parts per billion)
pg/g: picograms per gram (parts per trillion)
BTV: Background threshold value
BG-MRL: Background method reporting limit
M-L MRL: Multi-Lab method reporting limit
PAH: Polyaromatic hydrocarbon
PCB: Polychlorinated biphenyl
PCT: Polychlorinated terphenyl
RDX: Research Department Explosive
SIM: Selective ion monitoring
SVOC: Semi-volatile organic compound
TEQ: Toxicity equivalency
TPH EFH: Total petroleum hydrocarbon - extractable fuel hydrocarbon
VOC: Volatile organic compound

[1] DTSC applied the World Health Organization's 2,3,7,8-TCDD toxicity equivalence approach for dixoin-furans. To evaluate 2,3,7,8-TCDD equivalence, dixoin-furans need to meet respective background study MRLs.

[2] Benzo(a)pyrene equivalence developed based on sum of carcinogenic PAHs. In order to evaluate Benzo(a)pyrene equivalence, carcinogenic PAHs need to meet respective background study MRLs.

[3] For locations where TPH is the sole contaminant, a cleanup strategy will be considered based on the findings of soil treatability study.

Attachment 3
Table F
Field Tracker
Northern Buffer Zone

Table F
Field Tracker
Northern Buffer Zone
Draft for Review

Location Description	Location ID(s)	Explanation and Notes
Samples targeting offsite surface water pathways	NBZ_DG-513 NBZ_DG-514 NBZ_DG-515 NBZ_DG-522 NBZ_DG-523 NBZ_DG-524 NBZ_DG-534 NBZ_DG-535 NBZ_DG-536 NBZ_DG-537 NBZ_DG-538 NBZ_DG-539 NBZ_DG-543 NBZ_DG-544 NBZ_DG-545 NBZ_DG-546 NBZ_DG-547 NBZ_DG-549 NBZ_DG-551 NBZ_DG-552	Locations target surface water pathways (not defined drainages). Observe topography in field and look for rilling, topographic lows, or other surface features indicative of a surface water pathway. Collect samples in center of pathway and low point where surface water would flow during precipitation or surface release. If actual drainage is observed, collect GPS coordinates and map in GIS.
Drainages in western portion of the NBZ	NBZ_DG-527 NBZ_DG-528 NBZ_DG-529 NBZ_DG-540 NBZ_DG-541 NBZ_DG-542 NBZ_DG-553 NBZ_DG-554 NBZ_DG-555 NBZ_DG-557	Perform field check to identify depositional areas within the drainage and target fine-grained sediment deposits within these areas, where identified. Collect sample to bedrock and analyze all depths to characterize historical deposition over time.
Surface water pathways north/ northwest of the OCY North Slope Storage Area	NBZ_DG-543 NBZ_DG-544 NBZ_DG-545 NBZ_DG-546 NBZ_DG-547	Locations NBZ_DG-543, -544, and -545 assess potential migration from OCY locations via surface water pathways, and NBZ-DG-546 and -547 target upslope and downslope areas from OCBS88. Assess topography (rills, topographic lows, or other features indicative of surface water flow) and identify locations downslope from Phase 1 samples to select stepout locations.
Air dispersion impacts related to burning and treatment activities at the former FSDF ponds	NBZ_DG-505 NBZ_DG-511 NBZ_DG-512 NBZ_DG-516 NBZ_DG-517 NBZ_DG-518 NBZ_DG-519 NBZ_DG-520 NBZ_DG-521	Sample on undeveloped hillsides and downgradient drainages away from the former ponds in the prevailing wind direction to the northwest and the periodic 'Santa Ana' wind direction to the southwest. Locations NBZ_DG-505 and -518 through -521 target blind surface water pathways/drainages. Perform field check to evaluate surface water pathway and confirm that the area is a blind drainage. If actual drainage is observed, collect GPS coordinates and map in GIS. Identify depositional areas within the drainage and target fine-grained sediment deposits within these areas, where identified. Collect sample to bedrock and analyze all depths to characterize historical deposition over time. Locations NBZ-DG-511, -512, -516, and -517 target undeveloped hillslopes.

Table F
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Northern Buffer Zone
Draft for Review

Location Description	Location ID(s)	Explanation and Notes
Surface water pathways north/northwest of RMHF	NBZ_DG-526 NBZ_DG-556 NBZ_DG-530 NBZ_DG-531 NBZ_DG-532 NBZ_DG-533	Locations are stepouts from sample results on the roads west and downslope from RMHF (SL-021-NBZ, SL-022-NBZ, SL-023-NBZ, 7_DG-553). Select actual proposed data gap locations in the field to target areas downslope from the roads, specifically targeting surface water pathways (rills, topographic lows, etc.) if present.
Depth to bedrock verification of previous locations	SED-039-SIV SL-004-NBZ SL-157-NBZ SL-173-NBZ SL-182-NBZ	Re-occupy previously sampled locations where detected results were greater than the LUT value and depth to bedrock refusal information was not collected at or near the location. Do not sample, but complete boring logs to bedrock refusal. Previous logging was performed only to deepest sample depth.
Proposed locations along western roads near FSDF	NBZ_DG-502 NBZ_DG-503 NBZ_DG-504 NBZ_DG-506 NBZ_DG-507 NBZ_DG-508 NBZ_DG-509 NBZ_DG-510	Perform field check and look for turnouts, soil piles, or other features that could be related to dumping and place samples to target features if identified.
Surface water pathway north of SRE	NBZ_DG-534 NBZ_DG-535 NBZ_DG-536 NBZ_DG-537 NBZ_DG-538 NBZ_DG-539	Locations assess potential migration from SL-032-NBZ, SL-033-NBZ, SL-034-NBZ, and SL-040-NBZ via surface water pathways. Assess topography (rills, topographic lows, or other features indicative of surface water flow) and identify locations downslope from Phase 1 samples to select stepout locations.