U.S. Department of Energy

Oakland Operations Office, Oakland, California

FINAL
DOMESTIC SEPTIC SYSTEMS 3 AND 6
REMOVAL ACTIONS CONFIRMATION REPORT

for the

LABORATORY FOR ENERGY-RELATED HEALTH RESEARCH
UNIVERSITY OF CALIFORNIA, DAVIS

Prepared for:

United States Department of Energy, National Nuclear Security Agency
Oakland Operations Office
1301 Clay Street
Oakland, California 94612-5208

Prepared by:

Weiss Associates
5801 Christie Avenue, Suite 600
Emeryville, California 94608-1827

March 28, 2003
Rev. 0

DOE Oakland Operations Contract DE-AC03-96SF20686

Weiss Associates
Environmental Science, Engineering and Management

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Approved by: _____ Date: _____
Dolores Loll, P.E.
Project Quality Assurance Manager
Weiss Associates

Approved by: _____ Date: _____
Robert O. Devany, C.E.G., C.H.G.
Project Manager
Weiss Associates

Approved by: _____ Date: _____
Michael D. Dresen, C.E.G., C.H.G.
Program Manager
Weiss Associates

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ACRONYMS AND ABBREVIATIONS

°F	degrees Fahrenheit
AHA	activity hazard analysis
ALARA	as-low-as-reasonably-achievable
ASTM	American Society for Testing and Materials
bgs	below ground surface
BHC	hexachlorocyclohexane
CFR	Code of Federal Regulations
Co-60	cobalt-60
COCs	constituents of concern
cpm	counts per minute
Cs-137	cesium-137
cu yd	cubic yard(s)
DACs	derived air concentrations
DB	distribution box
DCG	derived concentration guide
$DCGL_{EMC}$	Derived Concentration Guideline Level Elevated Measurement Comparison
DI WET	deionized water waste extraction test
DL	designated-level
DL	diluted sample (after sample identification numbers)
DOE	United States Department of Energy
DSS	domestic septic system
DSSI	Domestic Septic Systems investigation
DST	domestic septic tank
EDPs	Eastern Dog Pens
ft	foot/feet
g	grams

G-M	Geiger-Mueller
H&S	health and safety
Hg	mercury
HQ	hazard quotient
HSP	Health and Safety Procedure
IC	initial concentration
LEHR	Laboratory for Energy-Related Health Research
LF	lateral ground water factor
MCL	maximum contaminant level
MEK	methyl ethyl ketone
mg/kg	milligram per kilogram
mg/l	milligram per liter
NaI	sodium iodide
Pb-210	lead-210
PCB	polychlorinated biphenyl
pCi/g	picoCuries per gram
PHSP	Project Health and Safety Plan
PM_{10}	particulate matter less than 10 microns in aerodynamic diameter
PPE	personal protective equipment
PRG	preliminary remediation goal
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RA	removal action
Ra-226	radium-226
RAO	removal action objective
RCT	radiological control technician
RME	reasonable maximum exposure
RPM	Remedial Project Manager
RPP	Radiological Protection Plan
RSO	Radiation Safety Officer

SC	screening criteria
SHSO	Site Health and Safety Officer
SOP	Standard Operating Procedure
Sr-90	strontium-90
STLC	soluble threshold limit concentration
SVOC	semi-volatile organic compound
TCLP	toxicity characteristic leaching procedure
TF	total conversion factor
TSM	tailgate safety meeting
UC Davis	University of California, Davis
UCL	upper confidence limit
US EPA	United States Environmental Protection Agency
VCP	vitrified clay pipe
VOC	volatile organic compound
WA	Weiss Associates
WDPs	Western Dog Pens
WET	waste extraction test
WP	Work Plan
WRS	Wilcoxon Rank Sum
µg/kg	micrograms per kilogram
µg/l	micrograms per liter
µCi/ml	microCuries per milliliter

EXECUTIVE SUMMARY

Non-time-critical removal actions (RAs) were conducted at the Domestic Septic System (DSS) 3 and DSS 6 Areas (Figure 1-2) located at the Laboratory for Energy-Related Health Research (LEHR or the Site), University of California, Davis (UC Davis), California. The RAs were implemented according to the National Contingency Plan, 40 Code of Federal Regulations Part 300.415. This report was prepared according to "Superfund Removal Procedures, Removal Response Reporting: POLREPS and OSC Reports," United States Environmental Protection Agency (US EPA) Publication 9360.3-03 (US EPA, 1994).

The objectives of the RA were defined in the *Domestic Septic Systems 3 and 6 Removal Actions Work Plan* (Work Plan) (WA, 2002) as follows:

1. Lower the excess cumulative cancer risk to an individual from exposure to site contaminants to a nominal range of 10^{-4} to 10^{-6}, using 10^{-6} as the point of departure;
2. Reduce the non-cancer hazard indices below 1.0;
3. Mitigate potential future impact to ground water;
4. Mitigate potential ecological risks during and after the RA;
5. Mitigate hazardous waste; and,
6. Minimize impact to on-site university research.

The DSSs 3 and 6 RAs were conducted from April to July 2002 according to the Work Plan (WA, 2002).

The DSS 3 RA began with demolition and removal of the distribution box (DB). All of the DB effluent lines were removed along with concrete, perforated Orangeburg pipe and leach trench gravel. Approximately one foot of additional soil from the trench floor and sidewalls was also removed. The DSS 3 leach trench excavation depth ranged from 11 to 12.5 feet (ft) below ground surface (bgs), and was up to 8 ft wide and 50 ft long. Approximately 170 cubic yards (cu yd) of removed piping, concrete, gravel and underlying soil are being managed as potentially mixed waste.

The DSS 6 RA consisted of removal of all the effluent lines, perforated Orangeburg pipe and leach trench gravels. Approximately one ft of additional soil from the trench floor and sidewalls was also removed. The excavation depth ranged from 6 ft bgs to 7 ft bgs and was 11 ft wide by 105 ft long. Approximately 215 cu yd of removed piping, gravel and underlying soil are being managed as potentially hazardous waste.

Following removal of these subsurface structures and the surrounding contaminated soil, confirmation samples were collected, and the excavations were backfilled and compacted according

to work plan requirements. Approximately 300 cu yd of additional soil were required for backfilling. An off-site source of clean backfill soil was identified, tested and deemed appropriate for on-site use.

Two phases of data evaluation were used to determine if the removal action objectives (RAOs) were achieved during the DSSs 3 and 6 RAs. The Phase I Data Evaluation occurred immediately following the RA while the excavations were open, and was based on analyses of screening samples collected during the RAs and analyzed only for "driver constituents of concern (COCs)." The driver COCs for the DSS 3 RA were Ra-226 and Hg, and the sole driver for the DSS 6 RA was Hg. Prior to backfilling the excavations, screening analytical results were discussed with the LEHR Remedial Project Managers (RPMs) at a teleconference on June 18, 2002. This teleconference satisfied the Phase I Data Evaluation objectives described in the Work Plan (WA, 2002). During the teleconference, a decision was reached to collect confirmation samples, backfill the excavations and restore the Site.

The Phase II Data Evaluation is included in this report and was completed after all analytical results from the RA confirmation sampling were received. The objective of the confirmation sampling was to ensure the attainment of cleanup goals using a statistically-based sampling design. The statistical approach used US EPA guidance (US EPA, 1994) to determine the required number of confirmation samples and the grid size.

The confirmation samples were collected from the excavation sidewalls and floor to verify whether the cleanup criteria for all COCs were met. At DSS 3, a total of 37 confirmation samples and 5 field duplicates were collected between 3.6 and 12.5 ft bgs. At DSS 6, a total of 30 confirmation samples and 3 field duplicates were collected between 3.7 and 7 ft bgs. The excavation confirmation samples were packaged and shipped to an off-site laboratory for analysis. The DSS 3 samples were analyzed for cadmium, copper, lead, mercury (Hg), chromium, silver, cesium-137, lead-210, radium-226 (Ra-226), strontium-90, formaldehyde, alpha and gamma chlordane, heptachlor epoxide, hexavalent chromium, and nitrate. At the request of the RPMs, seven discretionary samples (including one field duplicate) were collected from the DSS 3 excavation and analyzed for semi-volatile organic compounds (SVOCs) and volatile organic compounds (VOCs). The DSS 6 samples were analyzed for barium, copper, Hg and hexavalent chromium. Seven discretionary samples were collected from the DSS 6 excavation: three were analyzed for SVOCs, VOCs and Hg; three were analyzed for SVOCs and VOCs only; and one was analyzed for Hg only.

The Phase II Data Evaluation consisted of conducting a risk analysis, refined designated-level (DL) analysis using vadose zone modeling, and RA completion analysis. The risk analysis assessed whether the first and second RAOs for the DSSs 3 and 6 RAs were attained. The risk analysis consisted of:

- Calculating the reasonable maximum exposure (RME) concentration for each COC;
- Completing a background comparison for COCs with risk-based action standard (RBAS) values less than background;
- Performing a risk analysis for carcinogens and non-carcinogens using the RBAS;

- Comparing RMEs to US EPA preliminary remediation goals; and,
- Completing a hot measurement analysis.

Results of the risk analysis are discussed in the RA completion analysis at the end of this section and in greater detail in Section 6.2.

The third RAO was to mitigate any potential future impacts to ground water by reducing COC concentrations in soil. To determine whether this objective has been attained, a DL analysis was conducted.

The DL analysis consisted of:

- Preliminary DL Analysis: Evaluation of investigation sampling results and identifying DL COCs and hot spot areas;
- Data Gaps Investigation: Collecting additional vertical profile data, if needed, for each DL COC at the hot spot area; and,
- Refined DL Analysis: Modeling and calculating the DL values that protect ground water using the vertical profile of DL COCs.

The Preliminary DL Analysis was conducted on the DSSs 3 and 6 investigation data. The preliminary DL analysis is typically conducted on the confirmation sample data. However, to meet the Federal Facility Agreement September 30 milestone for submittal of the Draft Domestic Septic Systems 3 and 6 Removal Actions Confirmation Report, DL samples were collected prior to RA activities. Conducting the preliminary DL analysis using the investigation data is conservative because the investigation samples were collected beneath the sources of contamination. Review of the confirmation data set indicated the DL boring locations selected prior to the RAs were near contaminant sources and therefore were reasonable locations for determining the vertical profile of the DL COCs. Data Gaps Investigation (DL sampling) was conducted prior to the DSSs 3 and 6 RA to collect additional vertical profile data for each DL COC. The DL results were used in the refined DL analysis which was conducted for this report and is discussed below.

The DSS 3 preliminary DL analysis (WA, 2002) identified thirteen COCs that required additional evaluation: formaldehyde, hexavalent chromium, carbazole, arsenic, cadmium, chromium, lead, Hg, molybdenum, nitrate, selenium, silver and Ra-226. The DSS 6 preliminary DL analysis (WA, 2002) identified three COCs that require additional evaluation: hexavalent chromium, copper and Hg. One DL boring was drilled at the first point of perforation on the eastern DSS 3 leach line. One boring each was drilled at the first points of perforation on the southeastern and northeastern DSS 6 leach lines.

The analytical results from DL boring samples were used to refine the DL analysis. The post-RA confirmation sampling and DL sampling data indicated that six of the thirteen DSS 3 DL COCs did not require modeling. Arsenic, cadmium, Ra-226, selenium and lead were not detected above background in any DSS 3 confirmation or DL sample, and carbazole was not measured above

the detection limit in any sample. At DSS 6, all of the copper results from the confirmation and DL sampling were below background. Therefore modeling was not justified for these constituents.

Based on the DSS 3 DL analysis, hexavalent chromium in the DSS 3 area presents no threat to ground water. Any ground water impact resulting from silver in the DSS 3 soil would likely be very localized and below maximum contaminant levels (MCLs). Localized ground water impacts from molybdenum above background are possible and peak impact has likely already occurred. Localized ground water impact above background and the MCL is possible for Hg, chromium, formaldehyde and nitrate. The peak times for Hg and chromium ground water impacts are 3,300 and 1,200 years, respectively.

Based on the DSS 6 DL analysis, hexavalent chromium in the DSS 3 area presents no threat to ground water. Localized ground water impact above background and the MCL is possible for Hg. The peak time for Hg ground water impacts is 1,700 years.

Lastly, RA completion analysis was performed to determine whether RAOs had been met, as discussed below.

Removal Action Objective 1—Reduce Cancer Risk

The first RAO is to reduce the excess cumulative cancer risk from the DSSs 3 and 6 areas to the nominal range of 10^{-4} to 10^{-6} using 10^{-6} as the point of departure. As discussed in Section 6.2.5.1, the cancer risk for all three scenarios is below 10^{-6}. Therefore, this objective has been attained at both the DSSs 3 and 6 areas.

Removal Action Objective 2—Reduce Non-Cancer Hazard Indices

The second RAO is to reduce the cumulative non-cancer hazard quotient (HQ) below 1.0. As discussed in Section 6.2.5.2, this RAO has been attained for RBAS Scenarios 1 (On-Site Researcher) and 3 (South Side Residential Farmer), but not at DSS 3 or 6 for RBAS Scenario 2 (East Side Residential Farmer). The cumulative non-cancer HQs for DSSs 3 and 6 were 3.22 and 2.5, respectively. Hg was the most significant contributor in both areas. However, the EPA Region 9 PRG HQ is less than 1. Attainment of this RAO will be determined during the planned Site-Wide Risk Assessment.

Removal Action Objective 3—Mitigate Ground Water Impact

The third RAO is to mitigate potential future impacts to ground water associated with residual COC concentrations in soil. All sources and structures with the potential to create an environmental release in the DSSs 3 and 6 areas were removed during the RA, thereby mitigating future potential impacts to ground water. The DL analysis (Section 6.3) indicates that some residual

silver, nitrate, Hg, molybdenum, formaldehyde and chromium in DSS 3 area soil may result in future localized impacts above background and/or MCLs. The DSS 6 DL analysis indicates that some residual Hg in DSS 6 area soil may result in future localized impacts above background and MCLs. However, the residual Hg is not widespread and needs to be confirmed due to data quality issues.. Evaluation of the possible need for future remedial action to address these residual COCs will be in the United States Department of Energy Areas Feasibility Study.

Removal Action Objective 4—Mitigate Ecological Risk

The fourth RAO is to mitigate potential ecological risks during and after the RA. During the RA, mitigation measures including fencing and storm water sediment control were implemented to protect sensitive habitats on site. No impact to ecological receptors was observed during the RA. Since no ecological risk screening has been performed at the Site, no ecological risk-based screening standards are available for comparison and evaluation of this RAO. Attainment of this RAO will be determined during the planned Site-Wide Risk Assessment.

Removal Action Objective 5–Mitigate Hazardous Waste

The fifth RAO is to mitigate hazardous waste. All of the confirmation samples with total mercury concentrations exceeding 10 times the soluble threshold limit concentration value or 20 times the toxicity characteristic leaching procedure (TCLP) were analyzed for mercury by the waste extraction test and/or TCLP analytical procedures. The analytical results indicated that all residual mercury was below the hazardous waste limits. Therefore, this RAO has been attained.

Removal Action Objective 6–Minimize Disruption to University Research

The sixth RAO is to minimize disruption to university research activities while conducting the RA. The RA implemented at the DSSs 3 and 6 areas during the summer of 2002 did not significantly disrupt university research. Therefore this objective has been attained.

1. INTRODUCTION

This report presents the results of the non-time-critical removal actions (RAs) conducted at former Domestic Septic Systems (DSSs) 3 and 6 located at the Laboratory for Energy-Related Health Research (LEHR or the Site), University of California, Davis (UC Davis) (Figure 1-1). This report includes the Phase II Data Evaluation described in the DSSs 3 and 6 Removal Actions Work Plan (Work Plan) (WA, 2002), documents the RA activities performed, presents the analytical results of the confirmation sampling, and evaluates whether removal action objectives (RAOs) for the DSSs 3 and 6 RAs have been achieved. The RA was implemented in accordance with the National Contingency Plan, 40 Code of Federal Regulations (CFR) Part 300.415.

This report was prepared according to "Superfund Removal Procedures, Removal Response Reporting: POLREPS and OSC Reports" (US EPA, 1994). This report was prepared by Weiss Associates (WA) under United States Department of Energy (DOE) Environmental Restoration/Waste Management Contract No. DE-AC03-96SF20686.

1.1 Site Background

The Atomic Energy Commission (now DOE) began conducting radiological studies on laboratory animals at LEHR in the early 1950s. Initial studies were carried out on the main UC Davis campus and involved irradiation of beagles. The Site began operating in its present location in 1958 when full-scale experimental use of radioactive materials began. Research at LEHR through the mid-1980s focused on the health effects from chronic exposure to radionuclides, primarily strontium-90 (Sr-90) and radium-226 (Ra-226).

Beginning in 1958, the DSSs served LEHR offices and laboratories. A plan dated December 12, 1958 shows DSS 6, the oldest DSS at LEHR, connected to the "Animal Holding Building." DSS 3 was apparently installed during construction of the Reproductive Biology Laboratory (Building H-215) and the Specimen Storage Building (Building H-216) between 1962 and 1964, when the capacity of the tank serving the Inter-Regional Project No. 4 Building (Building H-217) may have become insufficient (WA, 2002). The locations of DSSs 3 and 6 are shown on Figure 1-2.

Liquid wastes and sewage were discharged to DSSs 3 and 6 prior to the Site's connection to the UC Davis Wastewater Treatment Plant in 1971. At that time, Domestic Septic Tanks (DSTs) 3 and 6 were abandoned and no longer used. DSTs 3 and 6 were backfilled with sand and the influent/effluent lines for each tank were reportedly cut and capped (IT Corp., 1996). No formal closure reports for these DSTs are known to exist (D&M, 1994).

In 2001, the Domestic Septic Systems investigation (DSSI) was conducted to characterize the occurrence, if any, of constituents of concern (COCs) at the existing DSSs. Soil samples were collected adjacent to the most likely sources of contamination. The DSSI analytical results collected from the DSSs 3 and 6 areas, along with data from previous investigations, indicated that several COCs, particularly mercury (Hg), were present in concentrations that exceeded site background and risk-based action standard (RBAS) values.

1.2 Constituents of Concern

The COCs for each RA area were identified using the data collected during the previous investigations. In general, compounds detected above background and the lowest RBAS or residential preliminary remediation goal (PRG) were considered COCs. At DSS 3, formaldehyde, hexavalent chromium, cadmium, chromium, lead, manganese, Hg, molybdenum, nickel, silver, alpha-chlordane, gamma-chlordane, heptachlor epoxide, Sr-90 and Ra-226 were identified as COCs. At DSS 6, hexavalent chromium, antimony, barium, copper, lead, Hg and nickel were identified as COCs.

Only a few COCs were consistently detected throughout each area and are associated with past operations. The COCs detected consistently in each area that are known to have been released to the environment are considered “driver COCs”. The driver COCs for the DSS 3 RA are Hg and Ra-226, and the sole driver COC for the DSS 6 area is Hg. A previous evaluation of metals and semi-volatile organic compound (SVOC) mobility and distribution indicates that Hg is a reasonable indicator of attaining cleanup in the DSS areas (WA, 2002).

1.3 Removal Action Objectives

The objectives of the DSSs 3 and 6 non-time-critical RAs are:

- Mitigate potential excess cumulative cancer risk to an individual from exposure to site contaminants to a level within a nominal range of 10^{-4} to 10^{-6}, using 10^{-6} as the point of departure;
- Reduce potential non-cancer hazard indices to levels below 1;
- Mitigate potential future impact to ground water;
- Minimize ecological risks during and after the RAs;
- Mitigate hazardous waste; and,
- Minimize impact to site university research.

To achieve these objectives, RAs consisting of excavation and off-site disposal were conducted at DSSs 3 and 6.

1.4 Report Organization

Section 2 of this report describes the RA activities including site preparation, material/waste removal and sorting, backfilling, and final site restoration. Section 3 presents the waste management activities from generation through packaging, storage and disposal. Section 4 summarizes the health and safety (H&S) activities performed during the RAs. Section 5 presents the sampling activities and analytical results. Section 6 contains the Phase II Data Evaluation, including statistical evaluation, risk analysis and designated-level (DL) analysis. Section 7 evaluates whether the RAOs were attained by the RAs.

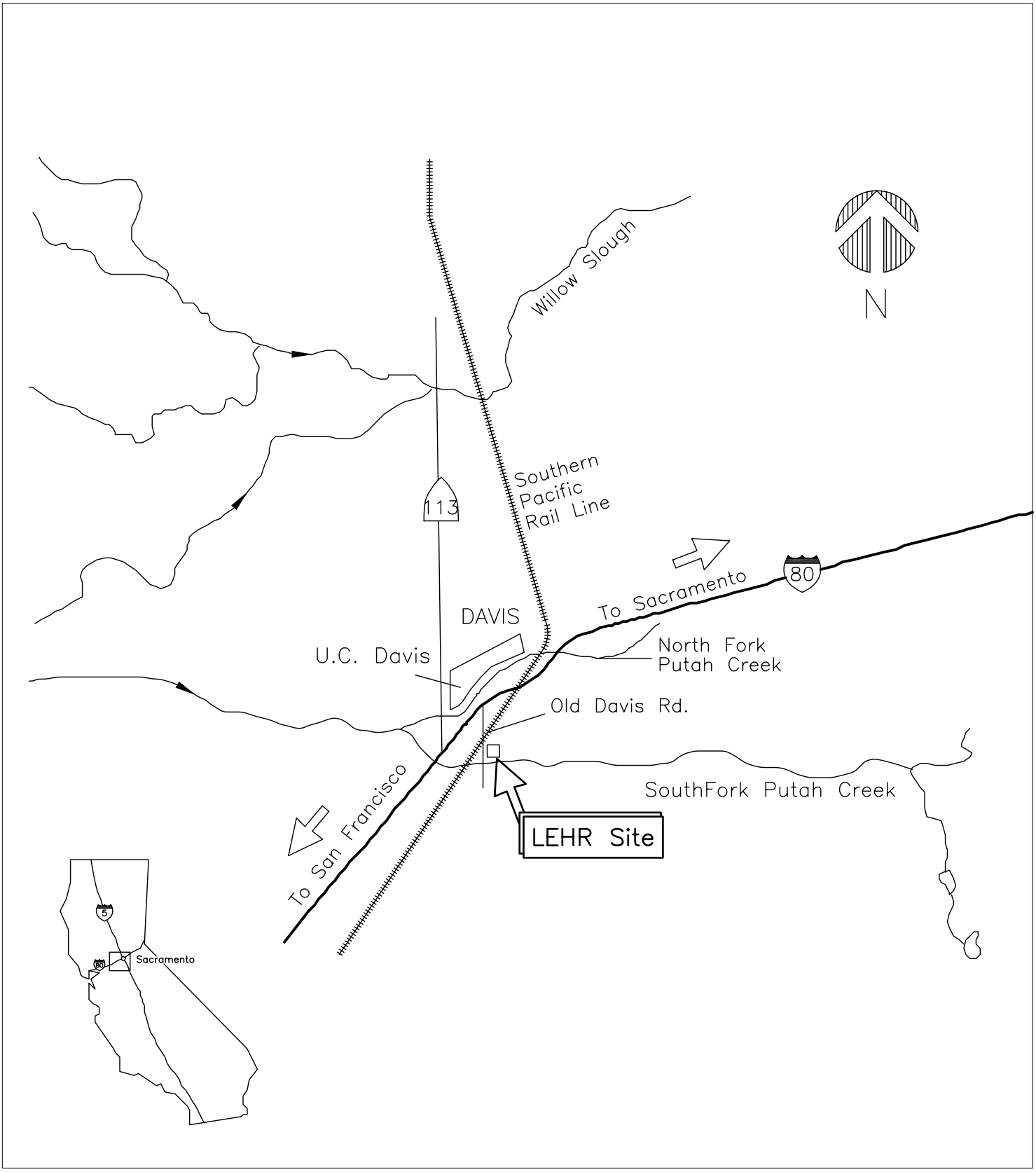

Figure 1-1. LEHR Site and Vicinity

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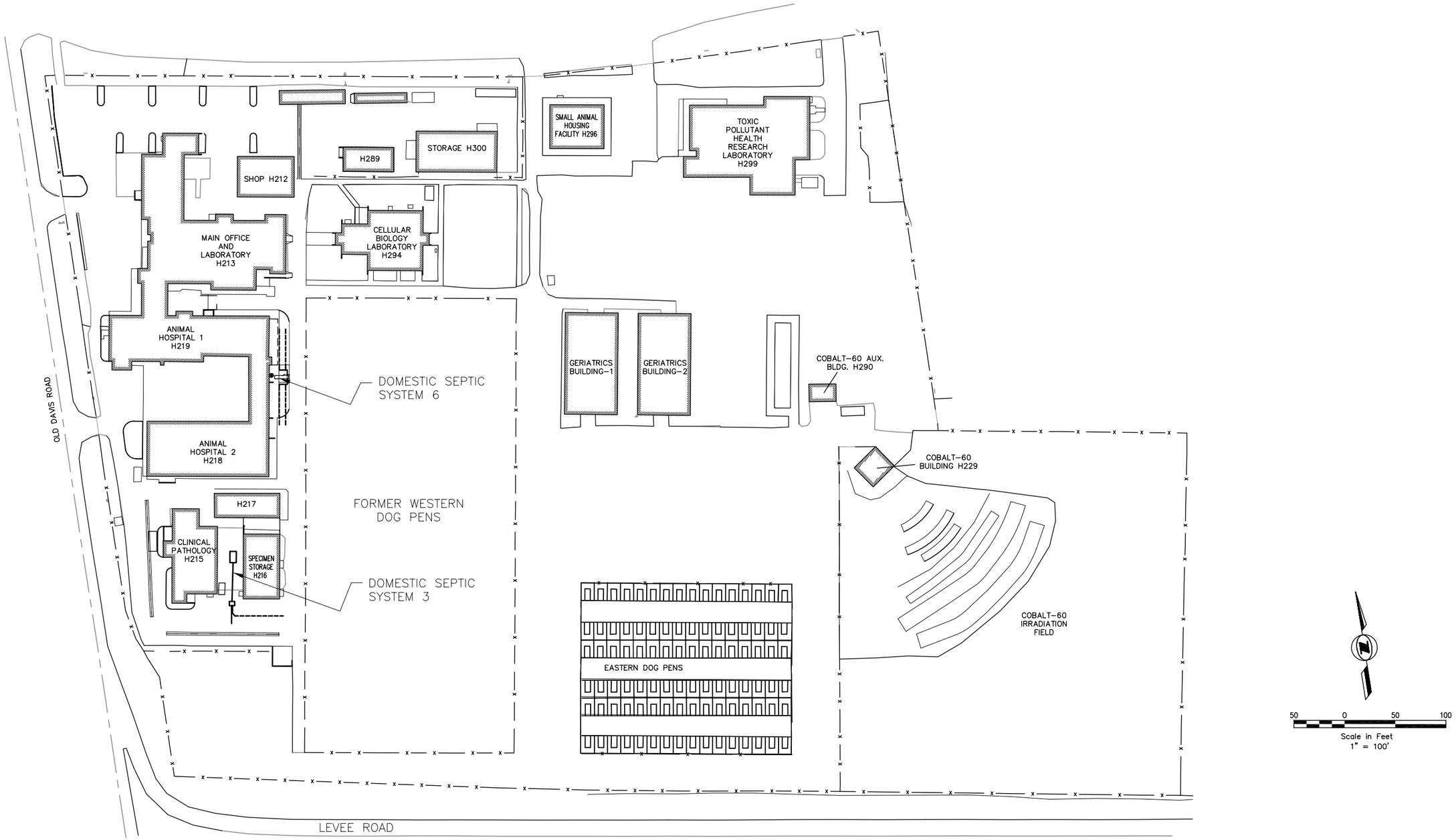

Figure 1-2. Locations of Domestic Septic Systems 3 and 6 and LEHR Facility Buildings

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2. REMOVAL ACTION ACTIVITIES

The DSSs 3 and 6 RAs were conducted from April to July 2002 in accordance with the Work Plan (WA, 2002). The following sections describe the RA activities, including pre-job planning, mobilization, site setup, material/waste removal and staging, backfill and compaction, site restoration and demobilization.

2.1 Pre-Job Activities/Planning

Tasks completed prior to the start of the RA to facilitate field operations included:

- Coordinating with UC Davis facility personnel; and,
- Locating utilities and conducting a geophysical survey of the work area.

Removal activities were conducted to minimize disturbance (i.e., noise and vibration) to research activities at the adjacent UC Davis Center for Health and the Environment. Meetings were held with UC Davis prior to starting each RA to discuss planned field activities and any measures needed to mitigate impacts to UC Davis operations. Schedule, work scope, construction area boundaries, site access, haul routes, and UC Davis facility support were discussed during these meetings.

A geophysical survey was conducted in the DSSs 3 and 6 RA areas to locate underground utilities. A private contractor located underground utilities within the RA area and marked their locations on the ground surface. UC Davis also provided line locating services and reviewed site drawings. Underground Services Alert was contacted prior to excavation activities to help ensure all underground utilities were identified prior to beginning work.

2.2 Mobilization and Site Setup

Weiss Associates and its subcontractor, Shaw Environmental and Infrastructure, arrived on site in late April 2002 to begin preparation for the RA. Activities conducted prior to the start of RA included:

- Mobilizing personnel and equipment to the Site;
- Training workers;
- Installing a temporary perimeter fence around the DSSs areas;

- Preparing material waste storage areas in the Eastern Dog Pens (EDPs) and the former Cobalt-60 (Co-60) Field;
- Establishing haul routes;
- Installing and testing scales for weighing soft-sided waste containers;
- Removing surface asphalt and sidewalk;
- Establishing grid-coordinate systems over the excavation areas; and,
- Setting up the on-site laboratory.

Approximately 700 linear feet (ft) of temporary fence were installed to control access to the RA areas (Figure 2-1). Weed abatement was performed in portions of the Western Dog Pens (WDPs), EDPs and the former Co-60 Field to facilitate removal activities and material/waste storage. The RA areas were controlled and posted according to Section 7 of the Project Health and Safety Plan (PHSP) (WA, 2001a) and Standard Operating Procedure (SOP) 24.1, Radiological Areas and Postings (WA, 2001b).

All RA activities were performed to mitigate the spread of contamination to surface and ground waters. Storm drain covers were installed in the construction area, and tarps and sand bags were available to cover exposed areas in the event of significant precipitation.

An on-site laboratory was used to screen excavation samples for potential radiological impacts at DSS 3. A gamma spectrometer was used for Ra-226 analyses. Laboratory setup consisted of cleaning and covering all surfaces with plastic sheeting, configuring and calibrating instruments, and acquiring liquid nitrogen for cooling down the gamma spectrometer diode.

All site workers performing RA and support activities completed all required training defined in Section 3.1.4 of the Work Plan (WA, 2002). Training provided at the Site was documented by the Site Health and Safety Officer (SHSO). Training records and certification for courses completed off site were submitted to the SHSO for review and approval. All training records were filed in the project record in accordance with the Quality Assurance Project Plan (QAPP) (WA, 2000a).

In addition to the formal training required by the Work Plan and other LEHR project documents, the SHSO, Site Coordinator and Radiation Safety Officer (RSO) provided supplemental safety training throughout the project at daily tailgate safety meetings (TSMs). Meeting content and attendance are documented on the TSM forms. When additional safety precautions were required, pre-task meetings were held to discuss the hazards and their controls.

Meetings were held with project management personnel prior to the start and during the RAs to discuss work scope, review preparatory tasks and address logistical concerns. Weekly meetings were held with all project staff to discuss operational, safety and training needs; obtain staff input on project safety; and provide formal recognition of suggestions for improving project and site safety.

2.3 Material/Waste Removal and Staging

All excavated material/waste was removed following preparation of the staging and storage areas within the RA areas, EDPs and Co-60 Field (Figure 2-1).

2.3.1 Surface Material and Overburden Removal

Surface asphalt and concrete in the DSSs 3 and 6 excavation areas were saw-cut in place and removed with a backhoe. This material was transported from the RA area and temporarily stockpiled in the Co-60 Field (Figure 2-1). The aggregate road base material and soil above leach line structures were excavated using a backhoe and placed in stockpiles within the construction areas for reuse. The overburden soil was returned to the excavation following removal of the DSSs 3 and 6 leach lines, and the aggregate road base was returned to the upper foot of the excavation.

2.3.2 Domestic Septic System 3

DSS 3 consisted of a septic tank with an effluent line leading to a distribution box (DB) and eventually to a leach field (Figure 2-2). As discussed in Section 1.2.1 of the Work Plan, there were no indications of sludge at the bottom of DST 3 or releases of COCs outside the tank and associated piping. Therefore, DST 3 was not removed and excavation activities started with the DB and one four-ft section of the influent line.

The DB was constructed of eight-inch thick concrete and measured 4.75 ft long, 4.5 ft wide and 2.33 ft deep. Located on the southern end of the DB were two, six-inch diameter vitrified clay pipe (VCP) effluent lines. The western effluent line terminated 15 ft to the south. The eastern effluent was joined to an east-west oriented, perforated Orangeburg leach line that was bedded in one- to two-inch rounded gravel (Figure 2-2). The gravel trench and leach line extended east 45 ft, was approximately 3 ft wide and was approximately 4 to 9 ft below ground surface (bgs).

A backhoe was used to excavate and direct-load the material into soft-sided containers. Once the soft-sided containers were filled and sampled, a large capacity forklift removed them from the construction area to be weighed and stored in the EDPs (Figure 2-1). A hydraulic breaker bit attachment for the backhoe was used to break up the concrete DB into manageable pieces. Residual sediment was removed from the DB prior to demolition. Following DB demolition, the concrete and one ft of underlying soil was loaded into soft-sided containers.

All of the effluent lines were removed along with concrete, perforated Orangeburg pipe and leach trench gravels. Approximately one ft of additional soil from the trench floor and sidewalls was removed. The leach trench excavation depth ranged from 11 to 12.5 ft bgs, and was up to 8 ft wide and 50 ft long (Figure 2-2). The removed piping, concrete, gravel and underlying soil are being managed as potentially mixed waste because investigation data suggest that these materials may contain radioactive and hazardous constituents.

2.3.3 Domestic Septic System 6

DSS 6 consisted of a septic tank attached to a DB with two VCP effluent lines leading north and south to perforated Orangeburg pipes set in gravel (Figure 2-3). DST 6 is constructed of six-inch thick reinforced concrete and is approximately ten ft long, four ft wide and five ft deep. The majority of the tank's top and bottom are no longer present as it appears that they were destroyed during the installation of the existing sewer line (Figure 2-3). DST 6 and the attached DB were not removed during the RA because the concrete sample collected from the bottom of DST 6 showed no significant signs of contamination (WA, 2002).

Effluent from DST 6 flowed through the VCP effluent lines into two parallel perforated Orangeburg pipes bedded in one- to two-inch rounded gravel (Figure 2-3). Each effluent line fed two perforated pipes set in gravel that were separated laterally by 4.5 ft. The leach line gravel trenches were approximately 1.5 ft wide and ranged in depth from 2 ft deep to 5 ft deep. Each of the 4 leach trenches was approximately 40 ft long.

Excavation at DSS 6 began at the north end and proceeded south. Following overburden soil removal and stockpiling, the leach lines were exposed and the excavation followed the leach lines laterally and vertically until native soil was encountered. A backhoe was used to excavate the waste and direct-load the material into soft-sided containers for storage and transport. Approximately one ft of additional soil was removed from the trench floor and sidewalls.

All of the effluent lines were removed along with the perforated Orangeburg pipe and leach trench gravels. Approximately one ft of additional soil from the trench floor and sidewalls was also removed. The excavation depth ranged from 6 ft to 7 ft bgs and was 11 ft wide by 105 ft long. The removed piping, gravel and underlying soil are being managed as potentially hazardous waste because investigation data suggest that these materials may contain radioactive and hazardous constituents.

2.4 Excavation Sampling

Following removal of material/waste described Section 2.3, soil samples were collected from the DSSs excavation areas and analyzed to confirm that concentrations in the soil were below the screening criteria (SC) for the driver COCs (Section 5.1). The excavation screening samples were collected concurrently with excavation activities and analyzed on site for real-time results. Upon review of the screening sample results, either additional excavation and sample collection would occur at that location or the excavation activities would continue elsewhere in the DSS area.

As discussed in Section 5.1.2, one sample exceeded the Hg screening criterion at DSS 3 and five samples exceeded the screening criterion at DSS 6. Additional excavation at DSSs 3 and 6 was conducted where the sample concentrations exceeded their SC. Additional sampling in these areas confirmed that Hg concentrations were below the SC.

The excavation screening sample data for DSSs 3 and 6 were presented to the Remedial Project Managers (RPMs) on June 18, 2002 as part of the Phase I Data Evaluation. Based on the screening sample data, the RPMs approved collection of the recommended confirmation samples to ensure attainment of RA goals. The excavation confirmation samples were collected prior to backfilling.

2.5 Surveys and Backfilling

Following excavation and sampling, a radiological surface scan of the DSS 3 excavation area was conducted between June 17 and June 25, 2002 at the request of the California Department of Health Services. The objective of the survey was to supplement soil sampling activities by searching for any localized areas of elevated radioactivity. This was achieved by performing a 100% surface scan with appropriate field instrumentation (Appendix A). No elevated levels of radioactivity were detected during the surface scan.

A land survey crew surveyed the lateral and vertical extents of the removal areas to accurately document their dimensions and position relative to at least three permanent benchmarks. Confirmation sample locations were also surveyed prior to backfilling the area. Upon completion, the land survey subcontractors provided hard and electronic copies of survey maps and survey data for the project file.

Approximately 300 cubic yards (cu yd) of additional soil were acquired for backfilling portions of the DSSs 3 and 6 excavation areas. An off-site source of clean backfill soil was identified in Esparto, California by a soil vendor (CL Smith Trucking, Inc. of Woodland, California). Samples were collected from the imported soil stockpile and analyzed for chemicals and radioactive constituents using United States Environmental Protection Agency (US EPA) methods and laboratory SOPs. In addition to the chemical and radiochemical analyses, geotechnical tests were performed on the imported fill, including a hydraulic conductivity (permeability) test using American Society for Testing and Materials (ASTM) Method D-5084, and a compaction (moisture-density relationship) test using ASTM Method D-1557.

Based on the analytical results, the imported fill did not contain chemicals or radionuclides at concentrations significantly above background or RBAS/residential PRGs (10^{-6} risk), and was therefore deemed suitable for use as backfill within the DSSs 3 and 6 areas (Appendix E). The material exhibited an average permeability of 2×10^{-6} centimeters per second as measured by ASTM Method D-5084, at 90% of optimum compaction.

Each 8-inch lift of loose backfill was compacted using a vibra-plate and a vibratory roller to the required minimum of 95% compaction at DSS 3, which is subject to vehicular traffic and 90% compaction at DSS 6. Backfill and compaction activities conformed to Specification 02200, Earthwork, of the UC Davis Campus Standards and Design (UC Davis, 1994). The in-place dry density (ASTM D-2922) and moisture content (ASTM D-3017) of the backfill were tested with a nuclear density gauge once for every 2,000 square ft of compacted soil.

2.6 Site Restoration

After the excavations were backfilled and compacted, the fence was removed, and removal areas were graded and cleaned. Tools, equipment and unused material were stored and secured according to LEHR property management practices.

2.7 Demobilization

The DSSs RAs were conducted in parallel with other site activities including off-site shipment of low-level waste. A gradual downsizing of personnel and equipment started on July 9, 2002 and all equipment and personnel associated with the RAs were demobilized from the Site on July 15, 2002.

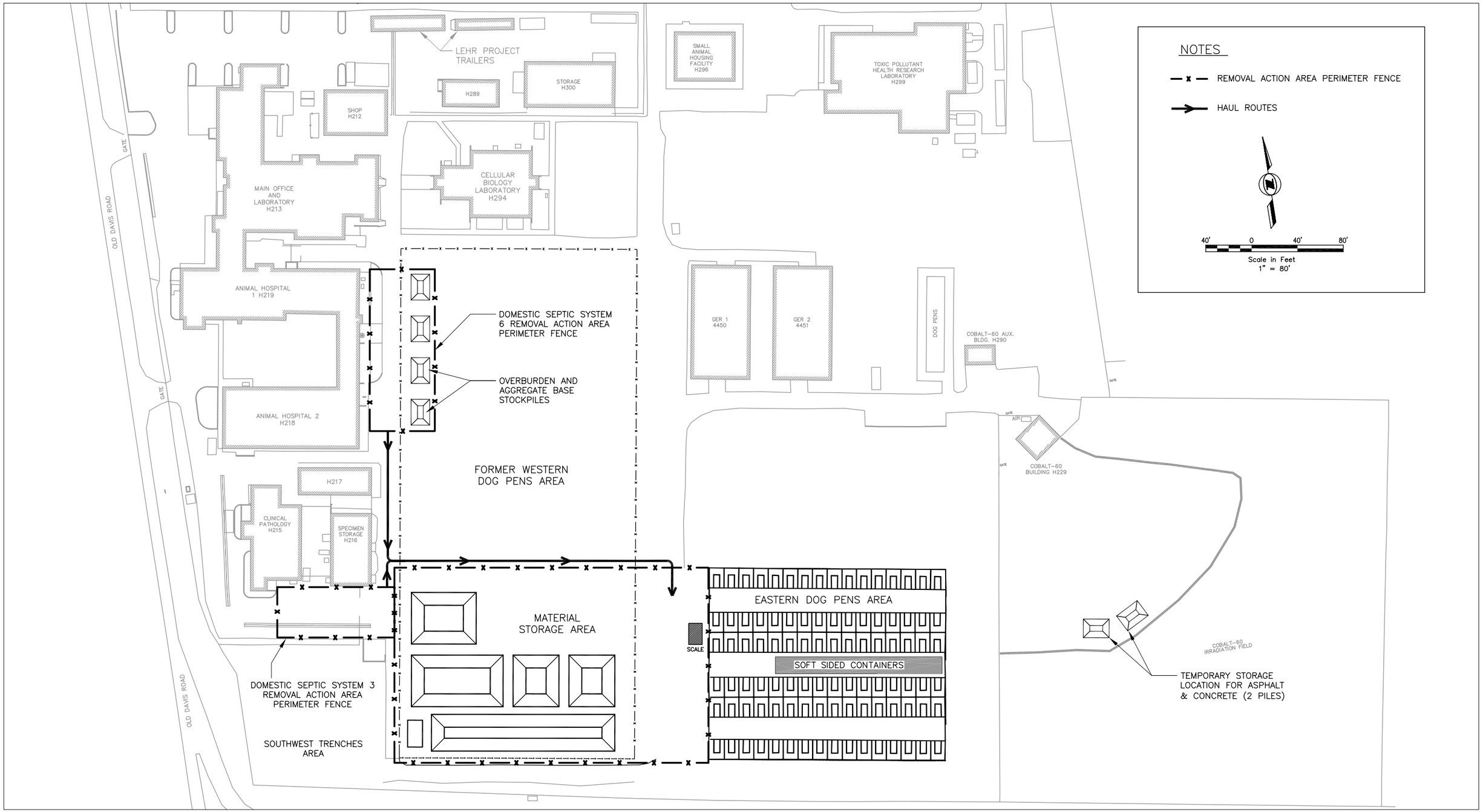

Figure 2-1. Domestic Septic Systems 3 and 6 Removal Actions Activity Locations

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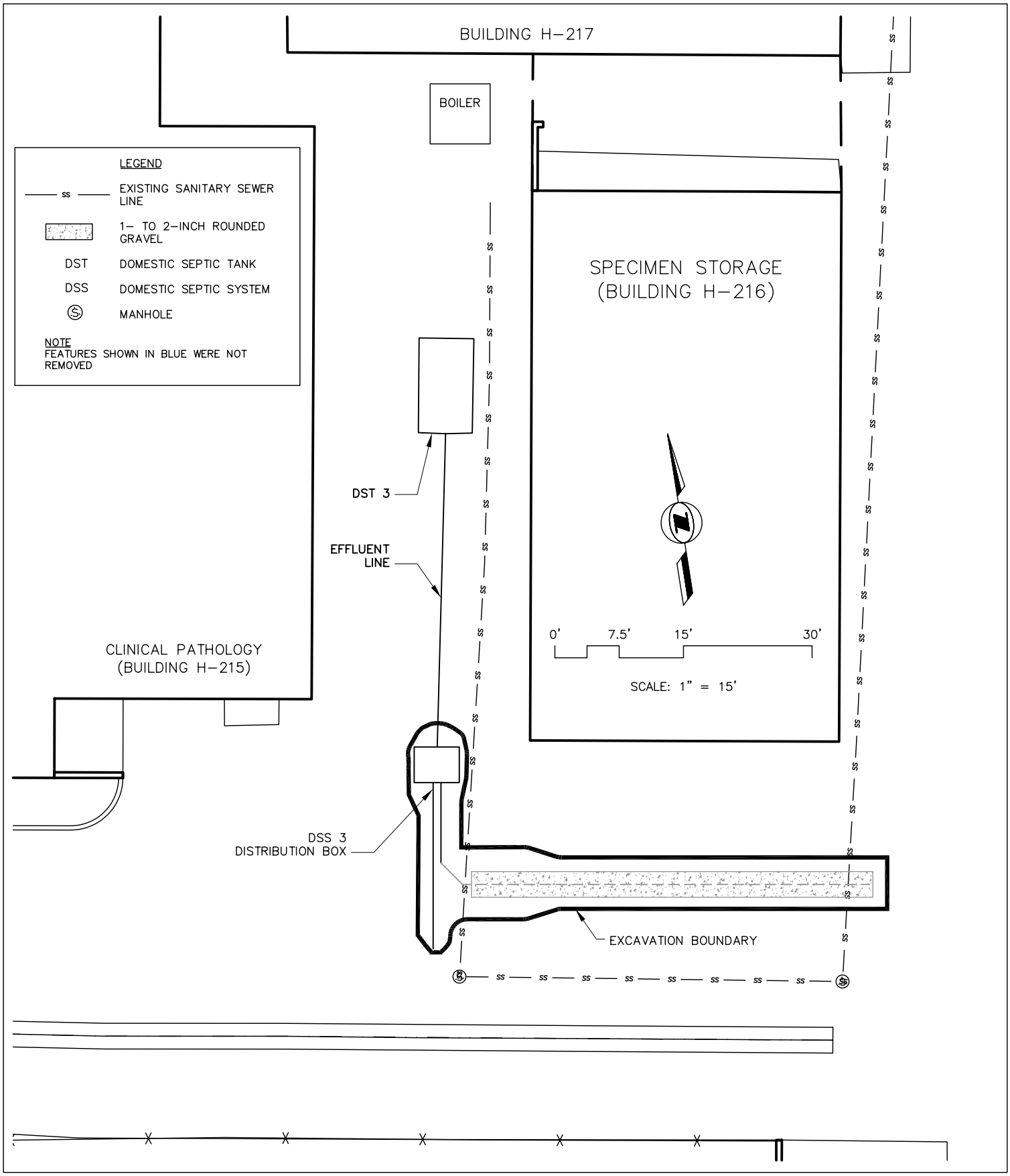

Figure 2-2. Domestic Septic System 3 Removal Action Area and Excavation Boundary

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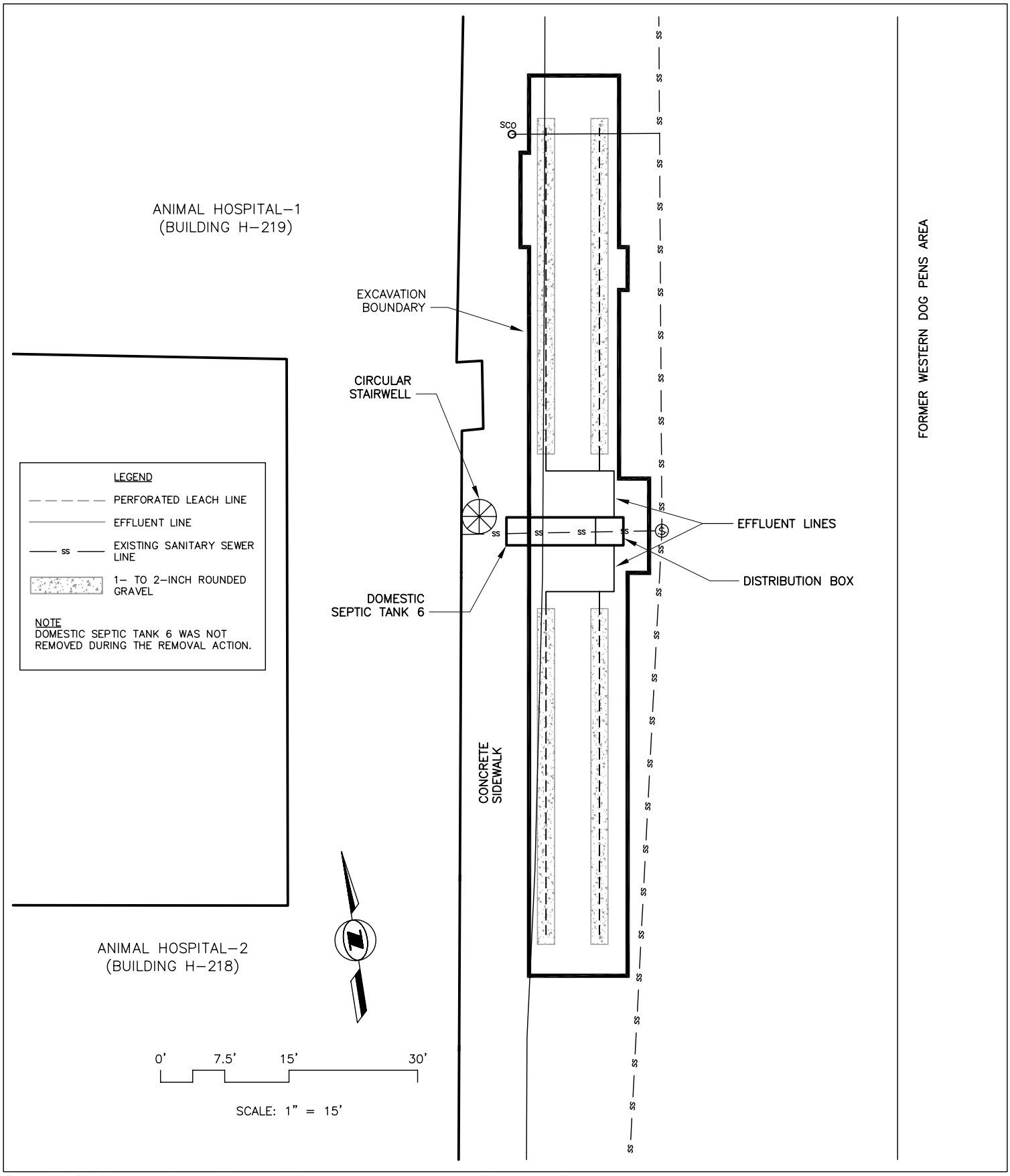

Figure 2-3. Domestic Septic System 6 Removal Action Area and Excavation Boundary

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3. WASTE MANAGEMENT ACTIVITIES

3.1 Domestic Septic System 3 Waste Generation

Material/waste generated during the DSS 3 RA consisted of surface overburden soil and road base, asphalt, concrete, DB sediment, soil, gravel, cobbles and other miscellaneous debris/material. The waste generation process is described below and summarized in Table 3-1.

3.1.1 Surface Overburden

The overburden soil and road base material above the DSS 3 leach lines and structures were excavated and transferred to lined stockpiles in the WDPs for storage. Process knowledge and site operations history were utilized to classify this material as containing no added hazardous or radioactive constituents. The overburden soil was returned to the excavation and used as backfill following completion of the DSS 3 RA.

3.1.2 Surface Asphalt

During the DSS 3 RA, approximately 7.5 cu yd of surface asphalt were removed and stockpiled in the former Co-60 Field storage area. Based on process and site operations knowledge, the asphalt was classified as containing no hazardous constituents or added radioactivity and was therefore not sampled for characterization. The surface asphalt was disposed at the UC Davis Landfill.

3.1.3 Distribution Box Sediment

During the DSSI, residual sediment was identified in the DSS 3 DB. The volume of sediment in the DSS 3 DB was less than one cubic foot. This sediment was removed, sampled and consumed at the off-site laboratory during characterization; no sediment remains on site.

3.1.4 Concrete, Soil, Gravel and Cobbles

Approximately ten cu yd of concrete and rebar from the DSS 3 DB were processed into manageable pieces and packaged into Lift Liners®. Adjacent native soil one foot below and from each side of the structure was over-excavated and loaded into Lift Liners® with the concrete.

Approximately 170 cu yd of leach line waste were removed from the DSS 3 leach field. This material consisted of soil, one-inch to two-inch rounded gravel and five-inch to ten-inch cobbles. An additional one foot of native soil was excavated from the excavation floor and sidewalls and packaged in the Lift Liners® with the leach line waste.

As described in Section 5.1, screening sample analysis identified one area with elevated Hg concentrations at DSS 3. This area was located on the western edge of the leach field excavation floor, approximately ten ft bgs. The material in this area was over-excavated, packaged into a Lift Liner® and transferred to the EDPs for storage. The over-excavated material was discretely sampled and analyzed for soluble threshold limit concentration (STLC) Hg and toxicity characteristic leaching procedure (TCLP) Hg.

3.1.5 Other Miscellaneous Debris/Waste

Personal protective equipment (PPE) worn during sampling activities was bagged and added to the Lift Liners®. Equipment decontamination water generated during excavation and sampling activities was added as a dust suppressant to the DSS 3 waste as it was being packaged. No decontamination water remains on site.

VCP and Orangeburg pipes were excavated as part of the leach field and were packaged into Lift Liners® with other leach field waste.

3.2 Domestic Septic System 6 Waste Generation

Material/waste generated during the DSS 6 RA consisted of surface overburden soil, surface gravel, concrete, asphalt, soil, leach line gravel and other miscellaneous debris/material. The waste generation process is described below and summarized in Table 3-1.

3.2.1 Surface Overburden Soil and Gravel

The overburden soil and gravel above the leach fields and structures were excavated and transferred to lined stockpiles in the WDPs. Process knowledge and site operations history were utilized to classify this material as containing no added hazardous or radioactive constituents. At the conclusion of RA activities, the material was returned to the excavation and used as backfill material.

3.2.2 Surface Concrete

Approximately 15 cu yd of concrete were removed and stockpiled in the former Co-60 Field during the DSSI and the DSS 6 RA. This material consisted of the curbing and the sidewalks above the excavated areas. Process knowledge and site operations history were utilized to classify this material as containing no added hazardous or radioactive constituents. This concrete is managed as non-hazardous waste with no added radioactivity and is scheduled for off-site disposal at a local sanitary landfill, presumably the Yolo County Landfill.

3.2.3 Surface Asphalt

Approximately one cu yd of asphalt was removed during the DSS 6 RA. Based on process knowledge and site operations history, this asphalt was classified as containing no hazardous constituents or added radioactivity. This asphalt was combined with DSS 3 RA surface asphalt waste and was sent to the UC Davis Landfill.

3.2.4 Soil and Gravel

Approximately 215 cu yd of waste were removed during the DSS 6 RA. This material consisted of soil and one-inch to two-inch rounded gravel. An additional one foot of native soil was removed from the excavation floor and sidewalls and was packaged in Lift Liners® with the leach line waste.

Screening sample analysis identified three areas with elevated Hg concentrations at DSS 6. These areas were located on both the western and eastern sidewalls, approximately four ft bgs, in the northern leach field (Figure 5-2). These spots were over-excavated, packaged into SuperSacks® and transported to the former Co-60 Field for storage. The over-excavated soil was discretely sampled and analyzed for STLC Hg and TCLP Hg.

3.2.5 Other Miscellaneous Debris/Waste

PPE worn during sampling activities was bagged and added to Lift Liners®. Equipment decontamination water generated during excavation and sampling activities was added as a dust suppressant to the DSS 6 waste as it was being packaged. No decontamination water remains on site.

VCP and Orangeburg pipes were excavated and packaged into Lift Liners® with other leach field waste.

3.3 Waste Sampling

3.3.1 General

Waste characterization sampling was conducted concurrently with waste/material excavation and loading activities. Sampling staff collected one eight-ounce sample in a glass jar from each Lift Liner® prior to package closure. In addition, screening samples were also collected from each package for on-site Ra-226 and Hg analyses.

Composite samples were labeled, transported and stored in the LEHR on-site laboratory for off-site chemical and radiological analyses. Sampling staff collected composite samples on site to represent 100-cu yd increments of waste.

At a minimum, one sample and one field duplicate were collected from each of the DSSs 3 and 6 structures per 100 cu yd of waste to fulfill the 10% quality assurance/quality control (QA/QC) requirement. Sampling frequencies and parameters were selected to obtain data required to meet the waste acceptance criteria for Envirocare and the Nevada Test Site disposal facilities.

All samples were analyzed for the radiological, chemical and disposal suites shown in Table 3-2, including STLC and TCLP for Hg. Samples collected from DSS 3 began with sample CWD3C001 and samples collected from DSS 6 began with sample CWD6C003.

3.3.2 Volatile Organic Compounds

Ten percent of the waste packages were sampled for volatile organic compound (VOC) analysis by US EPA Method 5035. Waste packages sampled for VOC analysis were those exhibiting odors, staining or other signs of chemical release. Lacking these characteristics, VOC samples were collected in waste associated with the highest Hg concentrations based on screening data. Discrete VOC samples were collected using plug-core samplers, provided by the off-site laboratory, according to US EPA Method 5035. The sample containers were labeled and shipped to the laboratory under chain-of-custody.

3.3.3 Referenced Procedures and Documents

Sample collection, handling, packaging, storage and shipping were conducted according to procedures described in the following documents and LEHR SOPs (WA, 2001b):

- Work Plan (WA, 2002);
- Radiological Protection Plan (RPP) (WA, 1999);
- QAPP (WA, 2000a);
- SOP 1.1, Chain-of-Custody;
- SOP 2.1, Sample Handling, Packaging and Shipping;

- SOP 6.1, Sampling Equipment and Well Material Decontamination;
- SOP 17.1, Sample Labeling;
- SOP 17.2, Sample Numbering;
- SOP 18.1, Field QC Sampling;
- SOP 19.1, On-Site Sample Storage; and,
- SOP 20.1, Sample Containers, Preservation and Holding Times.

Samples for VOC analysis were collected using separate containers supplied by the off-site laboratory. The sample containers were labeled and shipped to the laboratory for VOC analysis according to US EPA Method 5035 (Table 3-2).

3.3.4 Quality Assurance/Quality Control Samples

Duplicate (split) samples were collected at a rate of 10%, with at least one duplicate sample collected per structure (Table 3-1). Sampling frequencies and parameters are in accordance with existing agreements with disposal facilities. Duplicate sample locations are listed in Table 3-1.

One equipment rinseate sample was collected following completion of the sampling campaign to validate that the equipment was properly decontaminated and not cross-contaminating samples. The rinseate sample is identified in Table 3-1.

One soil QC blank was collected for each DSS area to determine if the soil matrix was contaminated with VOCs during sample collection or shipment**.** The soil QC blank preparation procedure is described in SOP 3.1, Surface and Shallow Subsurface Soil Sampling (WA, 2001b). The soil QC blank is identified in Table 3-1.

Three trip blanks prepared by the outside analytic laboratory were sent with each cooler containing samples for VOC analysis to evaluate whether VOCs were not introduced into the sample matrix during transportation and handling. The trip blanks are identified in Table 3-1.

Table 3-1. Domestic Septic Systems 3 and 6 Removal Actions Material/Waste Sampling and Analysis Protocols

Item	LEHR Package	Package Type	Area	Description	Volume (cu yd)	Storage Location	Sample ID	Sample Strategy	Completed Analysis	Preliminary Designation
1	N/A	N/A	DSS 3	DB Sediment	0.04	N/A	CWD3C001	Discrete	RS, CS	N/A
2	N/A	N/A	DSS 3	DB Sediment	0.04	N/A	CWD3C002	Discrete	RS, CS	N/A
3	LEHR1694	Lift Liner®	DSS 3	DB Concrete QC Soil Blank	8.5	EDPs	CWD3C003[4] CWD3C004[3]	Composite	RS, CS STLC Hg, TCLP Hg, TCLP Zn	HW
4	LEHR1695	Lift Liner®	DSS 3	Leach Line	8.5	EDPs	CWD3C010	Composite	DS	HW
5	LEHR1696	Lift Liner®	DSS 3	Leach Line	8.5	EDPs	CWD3C010	Composite	DS	HW
6	LEHR1697	Lift Liner®	DSS 3	Leach Line	8.5	EDPs	CWD3C009 CWD3C010	Composite Composite	STLC Hg, TCLP Hg DS	HW
7	LEHR1698	Lift Liner®	DSS 3	Leach Line	8.5	EDPs	CWD3C009 CWD3C010	Composite Composite	STLC Hg, TCLP Hg DS	HW
8	LEHR1699	Lift Liner®	DSS 3	Leach Line	8.5	EDPs	CWD3C005 CWD3C010	Discrete Composite	VOCs DS	HW
9	LEHR1700	Lift Liner®	DSS 3	Leach Line	8.5	EDPs	CWD3C010	Composite	DS	HW
10	LEHR1701	Lift Liner®	DSS 3	Hot Spot	8.5	EDPs	CWD3C008 CWD3C010	Discrete Composite	STLC Hg, TCLP Hg DS	MW
11	LEHR1702	Lift Liner®	DSS 3	Leach Line	8.5	EDPs	CWD3C010	Composite	DS	HW
12	LEHR1703	Lift Liner®	DSS 3	Leach Line	8.5	EDPs	CWD3C006 CWD3C010	Discrete Composite	DS Hg DS	HW
13	LEHR1704	Lift Liner®	DSS 3	Leach Line	8.5	EDPs	CWD3C010	Composite	DS	HW
14	LEHR1705	Lift Liner®	DSS 3	Leach Line	8.5	EDPs	CWD3C007 CWD3C009 CWD3C010	Discrete Discrete Composite	VOCs STLC Hg, TCLP Hg DS	HW
15	LEHR1706	Lift Liner®	DSS 3	Leach Line	8.5	EDPs	CWD3C010	Composite	DS	HW
16	LEHR1707	Lift Liner®	DSS 3	Leach Line	8.5	EDPs	CWD3C010	Composite	DS	HW

Table 3-1. Domestic Septic Systems 3 and 6 Removal Actions Material/Waste Sampling and Analysis Protocols (continued)

Item	LEHR Package	Package Type	Area	Description	Volume (cu yd)	Storage Location	Sample ID	Sample Strategy	Completed Analysis	Preliminary Designation
17	LEHR1708	Lift Liner®	DSS 3	Leach Line	8.5	EDPs	CWD3C009	Composite	STLC Hg, TCLP Hg DS	HW
							CWD3C010	Composite		
18	LEHR1709	Lift Liner®	DSS 3	Leach Line	8.5	EDPs	CWD3C010	Composite	DS	HW
19	LEHR1710	Lift Liner®	DSS 3	Leach Line	8.5	EDPs	CWD3C010	Composite	DS	HW
20	LEHR1711	Lift Liner®	DSS 3	Leach Line	8.5	EDPs	CWD3C010	Composite	DS	HW
21	LEHR1712	Lift Liner®	DSS 6	Leach Line	8.5	EDPs	CWD6C003	Composite	RS, CS, DS	HW
							CWD6C004	Composite	RS, CS, DS	
							CWD6C005[4]	Discrete	VOCs	
							CWD6C006[a]	Discrete	VOCs	
				QC Soil Blank			CWD6C007[3]	Discrete	VOCs	
22	LEHR1713	Lift Liner®	DSS 6	Leach Line	8.5	EDPs	CWD6C003	Composite	RS, CS, DS	HW
							CWD6C004	Composite	RS, CS, DS	
							CWD6C005[4]	Discrete	VOCs	
							CWD6C006[a]	Discrete	VOCs	
				QC Soil Blank			CWD6C007[3]	Discrete	VOCs	
23	LEHR1714	Lift Liner®	DSS 6	Leach Line	8.5	EDPs	CWD6C003	Composite	RS, CS, DS	HW
							CWD6C004	Composite	RS, CS, DS	
							CWD6C005[4]	Discrete	VOCs	
							CWD6C006[a]	Discrete	VOCs	
				QC Soil Blank			CWD6C007[3]	Discrete	VOCs	
24	LEHR1715	Lift Liner®	DSS 6	Leach Line	8.5	EDPs	CWD6C003	Composite	RS, CS, DS	HW
							CWD6C004	Composite	RS, CS, DS	
							CWD6C005[4]	Discrete	VOCs	
							CWD6C006[a]	Discrete	VOCs	
				QC Soil Blank			CWD6C007[3]	Discrete	VOCs	
25	LEHR1716	SuperSack®	DSS 6	Hot Spot	1	Co-60 Field	CWD6C008	Composite	STLC Hg, TCLP Hg	MW
26	LEHR1717	SuperSack®	DSS 6	Hot Spot	1	Co-60 Field	CWD6C008	Composite	STLC Hg, TCLP Hg	MW

Table 3-1. Domestic Septic Systems 3 and 6 Removal Actions Material/Waste Sampling and Analysis Protocols (continued)

Item	LEHR Package	Package Type	Area	Description	Volume (cu yd)	Storage Location	Sample ID	Sample Strategy	Completed Analysis	Preliminary Designation
27	LEHR1718	Lift Liner®	DSS 6	Leach Line	8.5	EDPs	CWD6C003	Composite	RS, CS, DS	HW
							CWD6C004	Composite	RS, CS, DS	
							CWD6C005[4]	Discrete	VOCs	
							CWD6C006[a]	Discrete	VOCs	
				QC Soil Blank			CWD6C007[3]	Discrete	VOCs	
28	LEHR1719	Lift Liner®	DSS 6	Leach Line	8.5	EDPs	CWD6C003	Composite	RS, CS, DS	HW
							CWD6C004	Composite	RS, CS, DS	
							CWD6C005[4]	Discrete	VOCs	
							CWD6C006[a]	Discrete	VOCs	
				QC Soil Blank			CWD6C007[3]	Discrete	VOCs	
29	LEHR1720	Lift Liner®	DSS 6	Leach Line	8.5	EDPs	CWD6C003	Composite	RS, CS, DS	HW
							CWD6C004	Composite	RS, CS, DS	
							CWD6C005[4]	Discrete	VOCs	
							CWD6C006[a]	Discrete	VOCs	
				QC Soil Blank			CWD6C007[3]	Discrete	VOCs	
30	LEHR1721	Lift Liner®	DSS 6	Leach Line	8.5	EDPs	CWD6C003	Composite	RS, CS, DS	HW
							CWD6C004	Composite	RS, CS, DS	
							CWD6C005[4]	Discrete	VOCs	
							CWD6C006[a]	Discrete	VOCs	
				QC Soil Blank			CWD6C007[3]	Discrete	VOCs	
31	LEHR1722	SuperSack®	DSS 6	Hot Spot	1	Co-60 Field	CWD6C008	Composite	STLC Hg, TCLP Hg	MW
32	LEHR1723	Lift Liner®	DSS 6	Leach Line	8.5	EDPs	CWD6C003	Composite	RS, CS, DS	HW
							CWD6C004	Composite	RS, CS, DS	
							CWD6C005[4]	Discrete	VOCs	
							CWD6C006[a]	Discrete	VOCs	
				QC Soil Blank			CWD6C007[3]	Discrete	VOCs	

Table 3-1. Domestic Septic Systems 3 and 6 Removal Actions Material/Waste Sampling and Analysis Protocols (continued)

Item	LEHR Package	Package Type	Area	Description	Volume (cu yd)	Storage Location	Sample ID	Sample Strategy	Completed Analysis	Preliminary Designation
33	LEHR1724	Lift Liner®	DSS 6	Leach Line	8.5	EDPs	CWD6C003	Composite	RS, CS, DS	HW
							CWD6C004	Composite	RS, CS, DS	
							CWD6C005[4]	Discrete	VOCs	
							CWD6C006 [a]	Discrete	VOCs	
				QC Soil Blank			CWD6C007[3]	Discrete	VOCs	
34	LEHR1725	Lift Liner®	DSS 6	Leach Line	8.5	EDPs	CWD6C003	Composite	RS, CS, DS	HW
							CWD6C004	Composite	RS, CS, DS	
							CWD6C005[4]	Discrete	VOCs	
							CWD6C006 [a]	Discrete	VOCs	
				QC Soil Blank			CWD6C007[3]	Discrete	VOCs	
35	LEHR1726	Lift Liner®	DSS 6	Leach Line	8.5	EDPs	CWD6C003	Composite	RS, CS, DS	HW
							CWD6C004	Composite	RS, CS, DS	
							CWD6C005[4]	Discrete	VOCs	
							CWD6C006 [a]	Discrete	VOCs	
				QC Soil Blank			CWD6C007[3]	Discrete	VOCs	
36	LEHR1727	Lift Liner®	DSS 6	Leach Line	8.5	EDPs	CWD6C003	Composite	RS, CS, DS	HW
							CWD6C004	Composite	RS, CS, DS	
							CWD6C005[4]	Discrete	VOCs	
							CWD6C006 [a]	Discrete	VOCs	
				QC Soil Blank			CWD6C007[3]	Discrete	VOCs	
37	LEHR1728	Lift Liner®	DSS 6	Leach Line	8.5	EDPs	CWD6C003	Composite	RS, CS, DS	HW
							CWD6C004	Composite	RS, CS, DS	
							CWD6C005[4]	Discrete	VOCs	
							CWD6C006 [a]	Discrete	VOCs	
				QC Soil Blank			CWD6C007[3]	Discrete	VOCs	

Table 3-1. Domestic Septic Systems 3 and 6 Removal Actions Material/Waste Sampling and Analysis Protocols (continued)

Item	LEHR Package	Package Type	Area	Description	Volume (cu yd)	Storage Location	Sample ID	Sample Strategy	Completed Analysis	Preliminary Designation
38	LEHR1729	Lift Liner®	DSS 6	Leach Line	8.5	EDPs	CWD6C003	Composite	RS, CS, DS	HW
							CWD6C004	Composite	RS, CS, DS	
							CWD6C005[4]	Discrete	VOCs	
							CWD6C006[a]	Discrete	VOCs	
				QC Soil Blank			CWD6C007[3]	Discrete	VOCs	
39	LEHR1730	Lift Liner®	DSS 6	Leach Line	8.5	EDPs	CWD6C003	Composite	RS, CS, DS	HW
							CWD6C004	Composite	RS, CS, DS	
							CWD6C005[4]	Discrete	VOCs	
							CWD6C006[a]	Discrete	VOCs	
				QC Soil Blank			CWD6C007[3]	Discrete	VOCs	
40	LEHR1731	Lift Liner®	DSS 6	Leach Line	8.5	EDPs	CWD6C003	Composite	RS, CS, DS	HW
							CWD6C004	Composite	RS, CS, DS	
							CWD6C005[4]	Discrete	VOCs	
							CWD6C006[a]	Discrete	VOCs	
				QC Soil Blank			CWD6C007[3]	Discrete	VOCs	
41	LEHR1732	Lift Liner®	DSS 6	Leach Line	8.5	EDPs	CWD6C003	Composite	RS, CS, DS	HW
							CWD6C004	Composite	RS, CS, DS	
							CWD6C005[4]	Discrete	VOCs	
							CWD6C006[a]	Discrete	VOCs	
				QC Soil Blank			CWD6C007[3]	Discrete	VOCs	
42	LEHR1733	Lift Liner®	DSS 6	Leach Line	8.5	EDPs	CWD6C003	Composite	RS, CS, DS	HW
							CWD6C004	Composite	RS, CS, DS	
							CWD6C005[4]	Discrete	VOCs	
							CWD6C006[a]	Discrete	VOCs	
				QC Soil Blank			CWD6C007[3]	Discrete	VOCs	

Table 3-1. Domestic Septic Systems 3 and 6 Removal Actions Material/Waste Sampling and Analysis Protocols (continued)

Item	LEHR Package	Package Type	Area	Description	Volume (cu yd)	Storage Location	Sample ID	Sample Strategy	Completed Analysis	Preliminary Designation
43	LEHR1734	Lift Liner®	DSS 6	Leach Line	8.5	EDPs	CWD6C003	Composite	RS, CS, DS	HW
							CWD6C004	Composite	RS, CS, DS	
							CWD6C005[4]	Discrete	VOCs	
							CWD6C006 [a]	Discrete	VOCs	
				QC Soil Blank			CWD6C007[3]	Discrete	VOCs	
44	LEHR1735	Lift Liner®	DSS 6	Leach Line	8.5	EDPs	CWD6C003	Composite	RS, CS, DS	HW
							CWD6C004	Composite	RS, CS, DS	
							CWD6C005[4]	Discrete	VOCs	
							CWD6C006 [a]	Discrete	VOCs	
				QC Soil Blank			CWD6C007[3]	Discrete	VOCs	
45	LEHR1736	Lift Liner®	DSS 6	Leach Line	8.5	EDPs	CWD6C003	Composite	RS, CS, DS	HW
							CWD6C004	Composite	RS, CS, DS	
							CWD6C005[4]	Discrete	VOCs	
							CWD6C006 [a]	Discrete	VOCs	
				QC Soil Blank			CWD6C007[3]	Discrete	VOCs	
46	LEHR1737	Lift Liner®	DSS 6	Leach Line	8.5	EDPs	CWD6C003	Composite	RS, CS, DS	HW
							CWD6C004	Composite	RS, CS, DS	
							CWD6C005[4]	Discrete	VOCs	
							CWD6C006 [a]	Discrete	VOCs	
				QC Soil Blank			CWD6C007[3]	Discrete	VOCs	
47	N/A	N/A	DSS 6	Sampling Equipment Rinseate	N/A	N/A	WSD3C002[1]	Discrete	RS, CS	NH
48	N/A	N/A	DSS 6	VOC Trip Blank	N/A	N/A	Trip Blank[2]	Discrete	VOCs	NH

Table 3-1. Domestic Septic Systems 3 and 6 Removal Actions Material/Waste Sampling and Analysis Protocols (continued)

Notes

[a] duplicate samples

[1] Sample equipment was decontaminated between 200-cu yd segments. One equipment rinseate sample was collected following the completion of the sampling campaign to validate that the equipment was properly decontaminated and not cross-contaminating samples. The rinseate sample is identified in Table 3-1. No waste is associated with this sample ID.

[2] Three trip blanks prepared by General Engineering Laboratories were sent with each sample cooler to confirm that VOCs were not introduced into the sample matrix during transportation and handling. The trip blanks associated with each cooler were assigned unique identification numbers and entered as samples in the log book.

[3] One soil QC blank was collected to determine if the soil matrix was contaminated during sample collection or shipment. The soil QC blank preparation procedure is described in Standard Operating Procedure 3.1, Surface and Shallow Subsurface Soil Sampling.

[4] Matrix spike and a duplicate were collected as part of the VOC analysis.

Abbreviations

Co-60	former Cobalt-60 Field
CS	chemical disposal suite (Table 3-2)
cu yd	cubic yard(s)
DB	distribution box
DS	disposal suite (Table 3-2)
DSS	domestic septic system
EDPs	Eastern Dog Pens
HDPE	high-density polyethylene
Hg	mercury
HW	hazardous waste
ID	identification (number)
L	liter
LLW	low-level waste
MW	mixed waste
N/A	not applicable
NH	non-hazardous waste
pt	point
QC	quality control
RS	radiological suite (Table 3-2)
STLC	soluble threshold limit concentration
TCLP	toxicity characteristic leaching procedure
VOC	volatile organic compound
Zn	zinc

Table 3-2. Analytical Methods and Detection Limits for Domestic Septic Systems 3 and 6 Removal Actions Material/Waste

Sample Suite	Analysis	Required Detection Limit (pCi/g for radionuclides, mg/kg for metals/general chemistry, µg/kg for organics)
Radiological	Gross Alpha/Beta (EPA 900.0)	1
	Gamma Emitters (Lab SOP)	
	Actinium-228 (Lab SOP)	0.1
	Bismuth-212 (Lab SOP)	0.1
	Bismuth-214 (Lab SOP)	0.1
	Cesium-137 (Lab SOP)	0.01
	Cobalt-60 (Lab SOP)	0.005
	Lead-210 (Lab SOP)	0.5
	Lead-212 (Lab SOP)	0.1
	Lead-214 (Lab SOP)	0.1
	Potasium-40 (Lab SOP)	1
	Radium-223 (Lab SOP)	2
	Radium-228 (Lab SOP)	0.1
	Thalium-208 (Lab SOP)	0.05
	Thorium-234 (Lab SOP)	0.5
	Radium-226 (Lab SOP)	0.1
	Strontium-90 (EPA 905.0)	0.05
	Americium-241 (Lab SOP)	0.01
	Plutonium-241 (Lab SOP)	0.5
	Uranium-233/234, 235, 238 (Lab SOP)	0.025, 0.01, 0.025, respectively
	Thorium-228, 230, 232 (Lab SOP)	0.1, 0.05, 0.05, respectively
	Tritium (EPA 906.0)	1
	Carbon-14 (Lab SOP)	0.1
Chemical	VOCs (SW-846 8260)	As specified in method
	SVOCs (SW-846 8270)	As specified in method
	Pest/PCBs (SW-846 8081)	As specified in method
	Title 22 Metals (SW-846 6010/7471)	
	Antimony	0.5
	Arsenic	2
	Barium	40
	Beryllium	1
	Cadmium	0.25
	Chromium (Total)	1
	Cobalt	10
	Copper	0.25
	Iron	20
	Lead	0.3
	Manganese	3
	Mercury	0.1
	Molybdenum	0.1

Table 3-2. Analytical Methods and Detection Limits for Domestic Septic Systems 3 and 6 Removal Actions Material/Waste (continued)

Sample Suite	Analysis	Required Detection Limit (pCi/g for radionuclides, mg/kg for metals/general chemistry, µg/kg for organics)
Chemicals (continued)	Nickel	1
	Selenium	1
	Silver	0.1
	Thallium	0.5
	Vanadium	1
	Zinc	4
	Chromium (VI) (SW-846 3060A/7196)	0.05
	Nitrate (SW-846 300.0)	1
	VOC TCLP (SW-846 8260/1311)	As specified in method
	Chromium and Nickel (SW-846 6010/1311)	10
	Chromium and Nickel (SW-846 6010/CA STLC)	10
Disposal	Reactive Cyanide (SW-846 7.3.3.2)	0.02
	Reactive Sulfide (SW-846 7.3.4.2)	0.02
	Paint Filter Test (SW-846 9095)	Not applicable
	pH (SW-846 9045)	0.01 (pH unit)
	Herbicides (SW-846 8151)	2.0
	Ignitability (SW-846 1020A or 1010)	Not applicable

Abbreviations

CA	California
CS	chemical suite
DS	disposal suite
Ed.	edition
EPA	United States Environmental Protection Agency
mg/kg	milligrams per kilogram
PCBs	polychlorinated biphenyls
pCi/g	picoCuries per gram
Pest	pesticides
RS	radiological suite
SOP	standard operating procedure
SVOC	semi-volatile organic compound
STLC	Soluble Threshold Limit Concentration
TCLP	Toxicity Characteristic Leaching Procedure
VOC	volatile organic compound
µg/kg	micrograms per kilogram

4. HEALTH AND SAFETY ACTIVITIES

Health and safety activities for the DSSs 3 and 6 RAs were addressed in the Work Plan (WA, 2002). The Work Plan incorporated the following LEHR H&S documents:

- Integrated Safety Management System Description (WA, 2000b);
- PHSP (WA, 2001a);
- Health and Safety Procedures (HSPs) (WA, 2000c);
- SOPs (WA, 2001b);
- Contingency Plan and General Emergency Response Procedures (WA, 2000d);
- As-Low-As-Reasonably-Achievable (ALARA) Program (WA, 2001c); and,
- RPP (WA, 1999).

The H&S program implemented during the DSSs 3 and 6 RAs met the requirements of 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response and 10 CFR 835, Occupational Radiation Protection.

4.1 Hazard Analysis

Hazards associated with field activities were identified and evaluated using the activity hazard analysis (AHA) process. The hazard identification and evaluation were documented for each task in Appendix D of the Work Plan (WA, 2002). The tasks analyzed included:

- Waste Container Loading and Transport;
- Soil Excavation in Areas with Underground Utilities;
- Equipment Operation under Overhead Lines;
- Equipment Fueling Operations;
- Fence Installation;
- Asphalt Removal;
- Waste/Soil Excavation;
- Heavy Equipment Operation;
- Demolition of the DSS 3 Concrete DB;

- Piping Removal;
- Sampling;
- Stockpile Management;
- Backfill and Compaction; and,
- Site Restoration.

The controls developed in the Work Plan were followed during the RA. An additional AHA was developed for sampling soil from the excavations using a manlift, as this activity was not anticipated in the Work Plan.

4.1.1 Identified Potential Chemical and Particulate Exposure

The following DSSs 3 and 6 RA activities presented potential for chemical and particulate exposure to workers through contact, ingestion and inhalation:

- Soil, gravel, piping and concrete removal;
- Concrete demolition; and,
- Soil sampling.

Low levels of Hg were present in the DSSs 3 and 6 areas. Airborne Hg concentrations were obtained during the previous RAs and indicated that the exposure levels were significantly below Occupational Safety and Health Administration (OSHA) permissible exposure limits (PELs). Therefore, no respiratory protection was required. Respirable dust was identified as a potential hazard during all soil handling, concrete demolition, waste removal, packaging and sampling activities.

4.1.2 Identified Potential Radiological Exposure

Radionuclides at DSS 6 were present at concentrations equivalent to the site background and were therefore not considered of occupational concern. At DSS 3, Ra-226 and Sr-90 were present at concentrations above site background; however, based on air monitoring conducted during soil sampling activities in 2001, radiation exposure was not considered to be of concern (WA, 2002). Any potential exposure through contact, ingestion and inhalation was associated with soil, gravel, piping and concrete removal/demolition, waste removal, packaging and sampling activities.

4.2 Hazard Monitoring

4.2.1 Air Monitoring

Radiological air monitoring was conducted according to HSP 14.1, Airborne Radioactivity Monitoring. All air monitoring equipment was maintained and calibrated according to manufacturer's recommendations; SOP 25.1, Radiological Surveys and Instrumentation; and HSP 14, Airborne Radioactivity Monitoring. Air monitoring for nuisance dust exposure was conducted daily until collected data were sufficient to predict exposures to airborne contaminants during the activity being monitored. Any time activities were modified, dust monitoring was resumed and continued until sufficient data were collected to characterize the new activity. The results never exceeded the action limit, which was half of the OSHA PEL.

4.2.1.1 Nuisance Dust

During excavation and sampling activities, real-time continuous airborne dust monitoring was conducted using a hand-held monitoring device (e.g., DataRAM). Air monitoring for nuisance dust exposure was conducted during earth-moving activities and on truck routes. The monitoring was conducted daily during the month of May during excavation activities and on haul routes. The monitoring continued until sufficient data were collected to characterize potential dust exposure and was discontinued at the beginning of June. Monitoring was resumed when a change in activities created potentially different conditions than those previously monitored, such as loading of material into containers. During the entire RA, the airborne dust levels remained below the action limits set in Section 6 of the PHSP and never required PPE modifications.

4.2.1.2 Airborne Radioactivity

General area radiological air monitoring was performed during DSS 3 RA activities on May 14 and May 22 to confirm that there was no potential exposure to airborne radioactive contaminants above 10% of the derived air concentrations (DACs) listed in 10 CFR 835, Appendix A. The air monitoring locations were established in areas having the highest potential for generating airborne radioactive contaminants. The air samples indicated that all airborne radionuclide concentrations were well below 10% of the respective DACs.

4.3 Radiological Monitoring

During the DSS 3 RA, exposure to radionuclides was evaluated and controlled by the radiological control technicians (RCTs) according to LEHR SOPs and HSPs established as part of the RPP. Gross alpha, gross beta, and gross gamma readings were collected by RCTs using field procedures/analyses (e.g., Geiger-Mueller probe, scintillation detector) and utilized as indicators of radionuclides above background levels that may pose an occupational hazard. The dosage limits for radiation exposure listed in Table 1 of HSP 15.1, External Radiation Exposure Control, were not exceeded at any time during the RA.

The applicable ALARA procedures and principles presented in the ALARA Program were followed while conducting the RA.

4.3.1 Physiological Monitoring

The RA was conducted during May, June and July 2002 when maximum temperatures in Davis are typically between 90 and 110 degrees Fahrenheit (°F). Wearing PPE in this elevated temperature range can put workers at risk of heat stress. All workers had medical clearance prior to working on site and there was an acclimation period of one to three days for most workers. Daily measurements of weather conditions using a Wet-Bulb-Globe-Temperature instrument were collected, and working conditions were evaluated to minimize heat stress. Based on weather conditions and the PPE used, a work regime was established each day in accordance with Section 5 of the PHSP and HSP 3.1, Working in Hot Environments.

Heat stress prevention included the following mitigation measures: review of signs and symptoms of heat stress in daily TSMs, required proper rest prior to work, scheduled breaks, provision of sports drinks and water for field staff to ensure appropriate fluid intake, use of a shaded rest area for short breaks while wearing PPE, use of portable shade tarps, and rotation of heavy work tasks. The physiological monitoring included body temperature and heart rate measurements, and visual observations of workers as discussed in Section 5 of the PHSP and HSP 3.1, Working in Hot Environments. During extremely hot days (i.e., temperatures in excess of 100°F), work hours were adjusted to start at 5 A.M. to minimize work during the hottest hours.

4.3.2 Noise Monitoring

Based on noise monitoring conducted during prior RAs for the same activity, hearing protection was required and worn by all field staff in the vicinity of drilling and concrete demolition activities. Noise levels above 85 decibels were not encountered during any other RA activities, and consequently hearing protection was not required. Hearing protection was available to workers who chose to use it.

4.4 Hazard Controls

The following control measures were implemented during the DSSs 3 and 6 RAs, as discussed in the RA Work Plan (WA, 2002):

- PPE;
- Hazardous Work Permit;
- Boundaries, including temporary fencing;
- Decontamination Procedures;
- Training;
- Buddy System;

- Engineering Controls;
- Safety Equipment; and,
- Spill Containment.

4.4.1 Engineering Controls

Engineering controls were the preferred method to reduce potential airborne radioactivity and chemical exposure, and were utilized in lieu of respiratory protection. Dust suppression with water spray was used to reduce potential exposure to respirable dust and other soil contaminants. Water spray was applied during excavation activities and used to wet traffic routes.

Extension tools and mechanical equipment were used wherever possible to reduce the potential for internal and external radiological exposure to ALARA levels. Applicable ALARA principles were discussed with workers during on-the-job training.

During the DSSs 3 and 6 RAs, engineering controls were implemented to eliminate the need for PPE. The backhoe was positioned outside of the contamination zone, allowing the backhoe operator and sample technicians to work without the use of PPE, minimizing potential for heat stress-related injuries.

4.4.2 Personal Protective Equipment

At the beginning of the DSSs 3 and 6 RAs, contact with chemical and radioactive contamination was controlled by the use of modified level D PPE (Tyvek coveralls, gloves, booties, safety glasses and hard hats). This PPE ensemble was used between May 6 and June 11, 2002.

On June 12, 2002, in response to a suggestion from an equipment operator, the cab of the backhoe excavating contaminated soil from the DSS 3 was placed outside of the controlled contamination area, such that only the arm and bucket of the backhoe entered the controlled contamination area. This placed the operator in a clean area outside the contamination zone, eliminating potential contact with contamination and allowing a downgrade of the PPE to unmodified level D (work clothes).

The elimination of Tyvek coveralls, gloves and booties minimized the potential for heat stress-related injuries, resulted in increased productivity and minimized the amount of waste generated by discarded PPE. Proper personal hygiene (e.g., washing hands and face) continued to be implemented.

4.4.3 Communication

To ensure good communication during operation of construction equipment, two-way radios were provided for use between equipment operators and spotters. All ground-based workers in the vicinity of heavy equipment wore high-visibility vests to help the operator locate them quickly. The equipment was checked daily to ensure the proper operation of back-up warning alarms that could be heard by all nearby workers.

4.4.4 Injuries

During the RA, no significant or recordable injuries occurred and no reportable DOE incidents took place.

4.5 Conclusion

Based on the H&S controls and engineering modifications implemented during the RAs, PPE upgrades were not required. In fact, a PPE downgrade occurred during the DSS 3 RA. General area dust and radiological monitoring indicated that workers were not exposed to any form of chemical or radiological contamination. By extrapolation, other on-site personnel, off-site neighbors, and off-site receptors were not exposed to any contaminants during the DSSs 3 and 6 RAs.

5. SAMPLING ACTIVITIES AND ANALYTICAL RESULTS

This section describes sampling activities and presents the analytical results for the DSSs 3 and 6 RAs. DSSs 3 and 6 sampling activities began on May 2, 2002 and were completed on June 24, 2002. Sampling was conducted according to the Work Plan and applicable project documents. Deviations from or modifications to the Work Plan that resulted from field conditions are discussed with the related sampling activities and analytical results.

A grid coordinate system was established in each RA area as the horizontal coordinate reference system for marking and locating samples in the field (Figures 5-1 and 5-2). The origin of the grid system was located at the southwest corner of each DSS area. The north-south gridlines were labeled with an "N" and numerically increased from "0" to "30" ft and "0" to "105" ft for DSSs 3 and 6, respectively. Similarly, the east-west gridlines were labeled with an "E" and increased from west to east from "0" to "60" and "0" to "15" for DSSs 3 and 6, respectively. For example, E10N25 identified a location that was 10 ft east and 25 ft north of the origin.

5.1 Excavation Screening Sampling

Following the waste removal described in Section 2, soil samples were collected from the DSSs 3 and 6 excavations and analyzed to help guide removal activities and determine whether the SC for the driver COCs were attained. SC represent the higher value of background or the RBAS for each COC. Samples were collected from the sidewalls and bottoms of the excavation and analyzed for the driver COCs. The driver COCs for the DSS 3 RA were Ra-226 and Hg, and the sole driver for the DSS 6 RA was Hg. DSSs 3 and 6 screening samples were analyzed for Hg by cold-vapor atomic absorption according to US EPA SW-846 (Method 7471). DSS 3 screening samples were also analyzed for Ra-226 according to SOP 10.4, Radium-226 Analysis by Gamma Spectrometer (WA, 2001b).

The screening analytical results were compared to the SC defined in the Work Plan:

- 0.75 picoCuries per gram (pCi/g) for Ra-226 at DSS 3 (background);
- 6.8 milligrams per kilogram (mg/kg) for Hg at DSS 3 (area-specific RBAS for 10^{-6} risk); and,
- 8.3 mg/kg for Hg at DSS 6 (area-specific RBAS for 10^{-6} risk).

5.1.1 Sampling

The sources of contamination at DSSs 3 and 6 are known. Consequently, the excavation screening sample design was conservatively biased to identify residual contamination. The excavation screening samples were collected at five-ft lateral intervals from the excavation floors beneath the former locations of the leach trenches and effluent lines. Screening samples were also collected at five-ft intervals along trench excavation sidewalls at depths that exceeded the bottoms of the perforated leach lines. Figures 5-1 and 5-2 show the excavation areas and screening sample locations for DSSs 3 and 6, respectively.

5.1.2 Analytical Results

A total of 48 screening samples (including six field duplicates) were collected from the DSS 3 area and analyzed for Ra-226. Sixty-three samples (including nine field duplicates) were collected and analyzed for Hg. A total of 111 samples (including 10 field duplicates) were collected from the DSS 6 excavation and analyzed for Hg (Figure 5-2). At DSS 3, none of the results were above the Ra-226 SC (0.75 pCi/g) and one was above the Hg SC (6.8 mg/kg) (Table 5-1). At DSS 6, five samples at three locations exceeded the Hg SC (8.3 mg/kg) (Table 5-2).

Additional excavation was conducted in the DSSs 3 and 6 areas where the Hg concentrations exceeded their area-specific RBAS. Subsequent sampling in these areas confirmed that Hg concentrations were below the SC (Tables 5-1 and 5-2).

5.2 Confirmation Sampling

The excavation screening sample data for DSSs 3 and 6 were presented to the RPMs on June 18, 2002 as part of the Phase I Data Evaluation. Based on the screening sample data, the RPMs concurred with collection of the recommended confirmation samples. Both random-based and discretionary hot-spot confirmation samples were collected to ensure attainment of RA goals using a statistically-based sampling design. The statistical approach used to determine the required number of confirmation samples and the sampling grid size was selected according to US EPA guidance (US EPA, 1994). The DSSs 3 and 6 confirmation samples were collected between June 19 and June 24, 2002.

5.2.1 Sampling

At DSS 3, a total of 37 confirmation samples and 5 field duplicates, SSD3C024 through SSD3C066 (excluding SSD3C027, SSD3C035 and SSD3C037, [see below]), were collected between 3.6 and 12.5 ft bgs. The DSS 3 confirmation sampling consisted of 30 soil samples (including three field duplicates) that were collected at grid locations determined by the Noether calculation (a random-start grid sampling approach). DSSs 3 and 6 COCs comprising the confirmation sampling

suite were determined by the COC screening process presented as Appendix E in the Work Plan. The DSS 3 random-start grid samples were analyzed for cadmium, copper, lead, Hg, chromium, silver, cesium-137 (Cs-137), lead-210 (Pb-210), Ra-226, Sr-90, formaldehyde, alpha and gamma chlordane, heptachlor epoxide, hexavalent chromium, and nitrate. At the request of the RPMs, six discretionary samples and one field duplicate sample (SSD3C028 to SSD3C034) were collected from the DSS 3 excavation and analyzed for SVOCs and VOCs. The DSS 3 confirmation sample locations are shown on Figure 5-3.

Three tank contents samples (including one field duplicate), SSD3C024 through SSD3C026, were also collected from the bottom of DST 3. The samples were collected from the northern and southern ends of the tank through the tank hatches. A concrete sample was collected from the DST 3 tank bottom using a concrete coring device. At the request of the RPMs, an additional sample was collected beneath the effluent line leading from DST 3 to the DSS 3 DB. This sample, sample SSD3C036, was collected beneath the first pipe joint encountered north of the DSS 3 DB (Figure 5-3). All of these samples were analyzed for a full suite of constituents including radionuclides, SVOCs, VOCs, pesticides, polychlorinated biphenyls (PCBs), metals, nitrate, hexavalent chromium, and the waste extraction test (WET) and TCLP analyses for Hg. Samples SSD3C027 and SSD3C035 were VOC trip blanks. Sample SSD3C037 was not collected. Therefore, these three samples were not discussed within the text or included in Appendix B.

At DSS 6, a total of 30 confirmation samples and three field duplicates, samples SSD6C017 through SSD6C049, were collected between 3.7 and 7 ft bgs. The DSS 6 confirmation sampling consisted of 26 soil samples (including 3 field duplicates) that were collected at grid locations determined by the Noether calculation. The DSS 6 random-start grid samples were analyzed for barium, copper, Hg and hexavalent chromium. At the request of the RPMs, seven discretionary samples were also collected from the DSS 6 excavation. Three of the discretionary samples, SSD6C044, SSD6C047 and SSD6C048 were analyzed for SVOCs, VOCs and Hg; three samples, SSD6C043, SSD6C045, and SSD6C046 were analyzed for SVOCs and VOCs only; and one sample SSD6C049 was analyzed for Hg only. The DSS 6 confirmation sample locations are shown on Figure 5-4.

At DSS 6, confirmation samples SSD6C022 and SSD6C035 were collected at locations differing from those specified in the Work Plan, which assumed that the soil directly north and south of DST 6 would remain in place. However, this soil was removed during the RA. Therefore, samples SSD6C022 and SS6C035 were collected from the trench floor, not the excavation sidewalls. Two additional samples, SSD6C028 and SSD6C042 (Figure 5-4), were collected from the northern portion of the excavation because the excavation extended beyond the boundaries originally estimated in the Work Plan.

At the request of the RPMs, all of the confirmation sample with total Hg concentrations exceeding 10 times the STLC value or 20 times the TCLP were analyzed for Hg by WET and/or TCLP analytical procedures. The Hg WET and TCLP results are summarized in Table 5-4 and are discussed below in Sections 5.2.2.2 and 5.2.3.

5.2.2 Domestic Septic System 3 Analytical Results

Table 5-3 summarizes the detected analytes for the DSS 3 confirmation sampling. The complete set of confirmation sample analytical results are presented in Appendix B. All of the SVOC and VOC soil sample results were below the detection limits. The analytical results for the DSS 3 RA confirmation soil samples are discussed below in Sections 5.2.2.1 through 5.2.2.4, and those for the DST 3 sediment and concrete samples are discussed in Sections 5.2.2.5.

5.2.2.1 General Chemistry

Notable results of the DSS 3 RA confirmation soil sample general chemistry analyses include:

- The maximum reported nitrate concentration, 106 mg/kg, was detected in sample SSD3C049, which was collected 12.5 ft bgs beneath the first points of perforation on the DSS 3 leach line. The six samples with the highest nitrate concentrations (45.2 to 106 mg/kg) were collected from the trench floor beneath the former location of the leach line at depths ranging from 11 to 13 ft bgs.
- The maximum reported hexavalent chromium concentration was detected in sample SSD3C046, collected 6 ft bgs from the leach trench's northern sidewall. Three of the four highest concentrations were detected in soil samples collected from the leach trench's northern sidewall.
- The maximum reported formaldehyde concentration, 2.2 mg/kg, was detected in sample SSD3C055, which was collected 12 ft bgs on the leach trench floor. Six of the seven maximum reported formaldehyde concentrations (1.1 to 2.2 mg/kg) were detected in soil samples collected 10 to 13 ft bgs.

5.2.2.2 Metals

Notable results of the DSS 3 RA confirmation soil sample metals analyses include:

- The maximum reported cadmium concentration, 0.15 mg/kg, was detected in samples SSD3C058 and SSD3C059. Both samples were collected from the western end of the leach trench's southern sidewall.
- The maximum detected total chromium concentration, 174 mg/kg, was detected in sample SSD3C047. Sample SSD3C047 was collected 5.9 ft bgs, from the northern sidewall of the leach trench. The ten highest chromium concentrations (131 to 174 mg/kg) were detected in soil samples collected from the excavation sidewalls at depths ranging from 5 to 6 ft bgs.
- The maximum reported copper concentration, 48.9 mg/kg, was detected in sample SSD3C040, collected 6 ft bgs beneath the former location of the DB effluent lines. No copper concentration trend with depth was observed.
- The maximum reported lead concentration, 7.8 mg/kg, was detected in sample SSD3C050. This sample was collected 12.5 ft bgs, from the DSS 3

leach trench floor. Five of the six maximum reported lead concentrations (7.1 to 7.8 mg/kg) were detected in soil samples collected nine ft bgs or greater.

- The maximum reported Hg concentration, 4.4 mg/kg, was detected in sample SSD3C066, collected 5.2 ft bgs on the leach trench's south sidewall. The seven highest Hg concentrations (2.4 to 4.4 mg/kg) were detected in soil samples collected 5 to 6 ft bgs. All of the Hg WET and TCLP results (Table 5-4) were well below the hazardous waste limit of 0.2 milligrams per liter (mg/l).
- Silver was reported above the detection limit in only 5 of 27 samples. The maximum reported silver concentration, 2.4 mg/kg, was detected in sample SSD3C053, collected 10.5 ft bgs from the leach trench floor.

5.2.2.3 Pesticides

Notable results of the DSS 3 RA confirmation soil sample pesticide analyses include:

- The maximum reported alpha- and gamma-chlordane concentrations, 161 and 294 micrograms per kilogram (µg/kg), respectively, were detected in sample SSD3C047DL. This sample was collected 5.9 ft bgs from the leach trench's northern sidewall. The nine highest alpha and gamma chlordane concentrations were detected in samples collected between five and six ft bgs.
- Heptachlor epoxide was detected in only 1 of 27 soil samples. The maximum reported heptachlor epoxide concentration, 4 µg/kg, was detected in sample SSD3C061, collected 5.2 ft bgs, from the leach trench's southern sidewall.

5.2.2.4 Radionuclides

Notable results of the DSS 3 RA confirmation soil sample radionuclide analyses include:

- Cs-137 was measured above the detection limit in only 2 of 27 samples. The maximum reported Cs-137 concentration, 0.0139 pCi/g, was detected in sample SSD3C036. This sample was a discretionary sample collected 5.5 ft bgs, beneath the effluent line between DST 3 and the DSS 3 DB. Sample SSD3C036 was collected under the first pipe joint north of the DB.
- Pb-210 was detected in only 5 of 27 soil samples. The maximum reported Pb-210 concentration, 0.961 pCi/g, was detected in sample SSD3C038. This sample was collected beneath the former locations of the DB effluent lines.
- Ra-226 was detected within the site background range in all 27 confirmation soil samples. The maximum reported Ra-226 concentration, 0.598 pCi/g, was detected in sample SSD3C050. This sample was collected 12 ft bgs from the leach trench floor. There was little variation in the Ra-226 concentrations detected in soil at DSS 3, which ranged from 0.37 to 0.598 pCi/g. There was no Ra-226 concentration trend with depth.

- Sr-90 was detected in 19 of 27 samples. The maximum reported Sr-90 concentration, 1.6 pCi/g, was detected in sample SSD3C056. Sample SSD3C056 was collected 13 ft bgs from the leach trench floor. The five highest Sr-90 concentrations (0.597 to 1.6 pCi/g) were detected in samples collected between 10 and 13 ft bgs.

5.2.2.5 Domestic Septic Tank 3

As discussed in Section 5.2.1, two tank contents samples and one field duplicate, SSD3C024 through SSD3C026, were collected from the bottom of DST 3. Notable results of the analyses of these samples include:

- All of the SVOC and VOC results were below their respective detection limits.
- Hg, molybdenum, hexavalent chromium, silver and Cs-137 were the only analytes detected above the lowest site soil background values.
- The 3.2 and 1.1 mg/kg Hg concentrations reported in the tank contents exceeded the lowest site soil background value of 0.248 mg/kg and the DSS 3 area-specific Hg RBAS of 1.13 mg/kg.
- The Cs-137 sediment concentrations, 0.0195 and 0.0108 pCi/g, were above the lowest site soil background value of 0.00695 pCi/g, but below the lowest RBAS of 0.1 pCi/g.
- Silver was detected above the site soil background of 0.55 mg/kg in one sediment sample at a concentration of 1.9 mg/kg.
- Molybdenum tank contents concentrations, 0.74 and 0.63 mg/kg, exceeded the site soil background concentration of 0.26 mg/kg.
- Hexavalent chromium was detected at 0.124 mg/kg, above the site's soil background of 0.054 mg/kg, but below the lowest RBAS of 3.8 mg/kg.
- Gamma-chlordane was detected above the detection limit, but below the lowest RBAS, in one sediment sample at 47.8 µg/kg.
- Arochlor-1254, at 225 µg/kg, was the only PCB detected.

A concrete sample was collected from the bottom of DST 3. Notable results from this sample include:

- All SVOCs and pesticides results were below their respective detection limits.
- Molybdenum and thallium were the only analytes detected above the lowest site soil background values.
- Molybdenum was detected at 0.52 mg/kg above the soil background of 0.26 mg/kg.
- Thallium was detected at 2.8 mg/kg above the soil background of 1.6 mg/kg.

- Acetone at 30.9 µg/kg was the only VOC detected in DST 3 concrete. The acetone concentration detected in the concrete was well below the RBAS value of 1,700 µg/kg.

5.2.3 Domestic Septic System 6 Analytical Results

Table 5-5 summarizes the DSS 6 confirmation sampling analytical results. The complete set of confirmation sample analytical results are presented in Appendix B. Notable results of these analyses include:

- All SVOC and VOC results were below detection limits.
- The maximum reported hexavalent chromium concentration was detected in sample SSD6C023, collected 4.4 ft bgs from the excavation sidewall east of the northeastern leach line's former location. Five of six hexavalent chromium detections were collected from the excavation's eastern sidewall.
- The maximum reported copper and barium concentrations, 52.2 mg/kg and 290 mg/kg, respectively, were detected in soil sample SSD6C041. This sample was collected 7 ft bgs, beneath the former location of the DSS 6 northeastern leach line (Figure 5-4). In general, the trench floor samples had the highest copper and barium concentrations.
- The maximum reported Hg concentration, 8 mg/kg, was detected in soil sample SSD6C038, collected 7 ft bgs beneath the former location of the DSS 6 northeastern leach line. The second highest Hg concentration, 7 mg/kg, was detected in soil sample SSD6C025. This sample was collected 4.4 ft bgs, approximately 7 ft west of sample SSD6C038 (Figure 5-4). The Hg concentrations for discretionary samples SSD6C047 through SSD6C049 ranged from 0.46 to 1.9 mg/kg. All of the Hg WET and TCLP results (Table 5-4) were well below the hazardous waste limit of 0.2 mg/l.

5.3 Designated-Level Analysis—Data Gap Investigation

LEHR site preliminary DL analysis is typically conducted using the confirmation sample data. However, to meet the Federal Facility Agreement September 30 milestone for submittal of this report, DL samples were collected prior to RA activities. Conducting the preliminary DL analysis on the investigation data rather than the confirmation sampling data is conservative because the investigation samples were collected beneath the sources of contamination. Based on review of the confirmation data, the DL boring locations selected prior to the RAs were near contaminant sources and therefore were reasonable for determining the vertical profile of the DL COCs. The post-RA confirmation sampling and DL sampling data were used to determine if vadose zone modeling was warranted. Modeling was conducted for any constituent that was detected above background in the confirmation and DL sample data sets. The confirmation and DL sample data sets were used to

determine the appropriate contamination interval for modeling the distribution of constituents in the subsurface.

The DSS 3 preliminary DL analysis (WA, 2002) identified thirteen COCs that require additional evaluation: formaldehyde, hexavalent chromium, carbazole, arsenic, cadmium, chromium, lead, Hg, molybdenum, nitrate, selenium, silver and Ra-226. The DSS 6 preliminary DL analysis (WA, 2002) identified three COCs that require additional evaluation: hexavalent chromium, copper and Hg. DL sampling was conducted prior to the RAs to collect additional vertical profile data for each DL COC. The primary objective of the DL sampling and subsequent data evaluation was to determine whether residual concentrations of specific constituents in soil could potentially impact ground water. Therefore, samples were collected from depths anticipated to represent post-RA residual concentrations. The DSSs 3 and 6 DL sampling depths were based on information collected during the 2001 DSSI.

5.3.1 Sampling

One DL boring was drilled at the first point of perforation on the eastern DSS 3 leach line (Figure 5-5). DL samples were collected at 1-ft vertical intervals between 13 and 17 ft bgs and analyzed for Hg. DL samples were collected at 5-ft vertical intervals between 15 and 40 ft bgs and analyzed for Ra-226, hexavalent chromium, nitrate, SVOCs and metals.

Borings were also drilled at the first points of perforation on the southeastern and northeastern DSS 6 leach lines (Figure 5-6). At each boring, DL samples were collected at 1-ft vertical intervals from 6 to 10 ft bgs and at 5-ft vertical intervals from 10 to 40 ft bgs and analyzed for Hg. Samples were also collected at 5-ft vertical intervals from 6 to 41 ft bgs and analyzed for nitrate, total nitrogen, ammonia, copper, and hexavalent chromium.

The analytical suite for the first two soil samples collected at the five-ft intervals from each boring also included the deionized water waste extraction test (DI WET) for metals, SVOCs and nitrate. All DL samples were analyzed by an off-site laboratory. The samples collected between 13 and 17 ft at DSS 3 and between 6 and 10 ft at DSS 6, were also analyzed for Hg. DL soil borings were drilled to the top of the seasonal water table at 40 ft. Ground water samples were collected from each boring and analyzed for metals, radionuclides, SVOCs, VOCs, pesticides, nitrate and hexavalent chromium. The ground water samples were collected using a disposable bailer that was lowered into the boring and down to the water table, and samples were decanted directly into the appropriate sample containers. The complete set of DL sampling analytical results are presented in Appendix B.

5.3.2 Domestic Septic System 3 Analytical Results

The DSS 3 DL analytical results are shown in Table 5-6. All of the arsenic results are below the 10.9 mg/kg site background (for greater than 4 ft bgs) with no obvious concentration trend with

depth. All of the cadmium results are below the site background of 0.51 mg/kg. The four maximum detected cadmium concentrations were collected between 25 and 40 ft bgs. All carbazole results are below the detection limit. All of the chromium results are below the 125 mg/kg site background (for greater than 4 ft bgs), with no obvious concentration trend with depth. Formaldehyde concentrations ranged from 0.19 mg/kg to 0.92 mg/kg, which are below the RBAS of 1.7 mg/kg. Hexavalent chromium concentrations were detected above background (0.054 mg/kg) in five of the six samples, but below the 3.8 mg/kg RBAS. The three maximum detected hexavalent chromium concentrations (0.322 to 0.387 mg/kg) were collected between 15 and 25 ft bgs. All of the lead results are below the 9.5 mg/kg site background (for greater than 4 ft bgs), with no obvious concentration trend with depth. Hg was detected above the 0.248 mg/kg background concentration (for greater than 4 ft bgs) in one of ten samples. The highest Hg concentration is 0.28 mg/kg, collected at 14 ft bgs. Molybdenum concentrations ranged from not non-detectable to 0.66 mg/kg. Four of six molybdenum samples are above the 0.26 mg/kg background concentrations, but below the PRG. All of the nitrate results are below the 36 mg/kg site background, with no obvious concentration trend with depth. Selenium was detected in only one of six samples at 0.86 mg/kg, which is below the 1.2 mg/kg site background concentration. All of the silver results are below the 0.56 mg/kg site background, with no obvious concentration trend with depth.

The hexavalent chromium, formaldehyde, molybdenum and Hg DL sampling analytical results were used to set the COC impact intervals for the refined DL modeling described in Section 6.3.1. A typical soil profile for the DSSs 3 and 6 areas, based on the lithologies encountered in the DL borings as well as the RA excavations, is presented in Table 5-7. This soil profile was also used in the refined DL modeling described in Section 6.3.1.

5.3.2.1 Deionized Water Waste Extraction Test Results

To assess whether residual COC concentrations at DSS 3 could potentially impact ground water, DL soil samples were collected at 13 and 17 ft bgs and analyzed using DI WET procedures for metals, SVOCs and nitrate. The goal in calculating designated levels for solid waste is to determine concentrations of soluble constituents in the waste above which leachate would be able to carry them to ground or surface waters in amounts that would cause water quality goals to be exceeded in those waters (CRWQCB, 1989). DSS 3 DI WET results are shown in Table 5-8. The DI WET results were directly compared to three water quality goals (background, maximum contaminant levels [MCLs] and tap water PRGs to determine the soil's potential to degrade water quality. Direct comparison between the DI WET results and the water quality goals assumes an environmental attenuation factor of ten because the WET procedure requires the use of ten parts of water per every part of waste (e.g., soil).

The DI WET results were first compared to background. The maximum detected concentration of each constituent detected in HSU 1 ground water well UCD1-18, located upgradient of the LEHR site, was used as the background concentration. If the DI WET results exceeded background, they were compared to the MCLs. Only two constituents, arsenic and chromium, were detected above their respective backgrounds and MCLs. Iron was detected above background and its PRG. Several constituents did not have background or MCL values. Therefore, the DI WET results were also compared to their respective US EPA PRG for tap water. Lead, manganese and vanadium

were detected above their MCL or PRG. Assuming a 100-fold attenuation factor, all constituents, with the exception of one iron sample, were below their respective backgrounds, MCLs, or PRGs. The "Final Statement of Reasons for Proposed Regulations: Criteria for Identification of Hazardous and Extremely Hazardous Wastes" (DHS, 1984) justifies the use of a 100-fold attenuation factor, based on studies conducted by Batelle Laboratories and the US EPA (CRWQCB, 1989).

5.3.2.2 Ground Water Samples

A ground water sample was collected from DL boring D3-DL1 (Figure 5-5). Table 5-9 presents the analytical results for this sample that were above detection limits. The ground water samples were compared to background, MCLs and PRGs. Three of thirteen DL COCs, hexavalent chromium, carbazole and cadmium, were not measured above the detection limit. Arsenic and chromium were detected above their respective backgrounds and MCLs, but below PRGs. Total Hg was detected above its MCL, but below the PRG. Iron, lead, nickel and potassium-40 were detected above their respective PRG or MCL.

The ground water sample at DSS 3 was collected from a borehole, not from a properly completed ground water well. The sample contained sediment soil particles and was not filtered in the field or in the laboratory. Therefore, the ground water sample collected from the DSS 3 DL borings is not representative of actual ground water concentrations for all constituents particularly metals in this area.

5.3.3 Domestic Septic System 6 Analytical Results

The DSS 6 DL soil analytical results are shown in Table 5-10. All of the copper results are below the 61.8 mg/kg background concentration (for greater than 4 ft bgs), with no obvious concentration trend with depth. Hexavalent chromium was detected above background in 15 of 16 DL soil samples. No obvious concentration trend with depth was observed. Hg was detected above the 0.248 mg/kg background concentration (for greater than 4 ft bgs) in six of the 21 samples (not including field duplicates). Five of six samples that had Hg concentrations above the background had high matrix spike recovery (see Section 6.1.2). The DSS 6 DL mercury samples will be re-collected to confirm these results. The highest Hg concentrations were observed between 10 and 20 ft bgs. All nitrate concentrations were well below the background concentration of 36 mg/kg. Ammonia concentrations ranged from not detectable to 6.81 mg/kg. Total nitrogen concentrations ranged from 137 to 789 mg/kg.

The hexavalent chromium and Hg analytical results were used to set the COC impact intervals for the refined DL modeling described in Section 6.3.1. A typical soil profile for the DSSs 3 and 6 areas, based on the lithologies encountered in the DL borings and the RA excavations, is presented in Table 5-7. This soil profile was also used in the refined DL modeling described in Section 6.3.1.

5.3.3.1 Deionized Water Waste Extraction Test Results

All of the samples with detected DI WET results at DSS 6 are shown in Table 5-11. DSS 6 DI WET results were evaluated following the methods described in Section 5.3.2.1. Only three constituents, arsenic, hexavalent chromium and total chromium, were detected above their respective backgrounds and MCLs. Lead was detected above its MCL in one sample. Assuming a 100-fold attenuation factor, arsenic, lead and chromium were below their respective backgrounds and MCLs.

Several constituents do not have background or MCL values. Therefore, the DI WET results for these constituents were compared to their respective US EPA PRG for tap water. Aluminum, hexavalent chromium and iron were detected above their respective tap water PRG. Assuming a 100-fold attenuation factor, all of these constituents were below their respective PRG.

5.3.3.2 Ground Water Samples

Two ground water samples and one field duplicate were collected from the DL borings at DSS 6 using the same techniques described in Section 5.3.1. Table 5-12 presents the analytical results that were above detection limits. All of the Hg concentrations were below the MCL. Hexavalent chromium was detected in one sample at 0.051 mg/l, which is slightly above the 0.05 mg/l MCL. Copper was detected in two samples. The maximum detected copper concentration, 2.6 mg/l, is twice the MCL of 1.3 mg/l. Two nitrate samples were above the MCL, but below background.

Arsenic, barium, chromium, and selenium were detected above their respective backgrounds and MCLs. Iron, beryllium, chromium, cadmium, lead, nickel, potassium-40 were detected above their respective MCL and/or PRG.

The ground water samples at DSS 6 were collected from a borehole, not from a properly completed monitoring well. These samples contained sediment/soil particles and were not filtered in the field or in the laboratory. Therefore, ground water samples collected from the DL borings at DSS 6 are not representative of actual ground water concentrations for all constituents particularly metals in this area.

5.4 Air Sampling

Air samples were collected during the RA from three stations around the perimeter of the site and one background station. These ambient air stations were strategically placed to monitor every area of the site. The locations of the air monitoring stations are listed below and shown on Figure 5-7.

- AM-2 is north of the Toxic Pollutant Health Research Laboratory in the northeast corner of the Site;
- AM-7, a mobile monitoring station, was placed near the Cellular Biology Laboratory;

- AM-3, the current background station, is located east of the LEHR site; and,
- AM-5 is situated in the southwest trenches area near DSS 3.

Analytical results from the air sampling are presented in Table 5-13, which compares the average and maximum air concentrations with PELs, PRGs for ambient air, and the derived concentration guide (DCG) for all constituents with concentrations greater than their detection limits.

5.4.1 Sampling Schedule

Based on the COCs detected in soil at the DSS areas prior to the 2002 RA, the following RA air monitoring program was established. Air sampling was conducted once during RA activities to monitor for potential releases of barium, cadmium, Cs-137, chlordane, chromium, copper, heptachlor epoxide, lead, Pb-210, Hg, Ra-226, silver, Sr-90, and particulate matter less than 10 microns in aerodynamic diameter (PM_{10}) into ambient air. All LEHR air samples were analyzed by either California State-certified or Contract Laboratory Program laboratories.

5.4.2 Analytical Results

Since there was only one sampling event, there were not adequate data to perform statistical tests. The average air concentrations from the three air monitoring stations on site were calculated and compared to the concentrations detected at background station AM-3 (Figure 5-7). Chlordane, silver and heptachlor epoxide were not reported at concentrations greater than their detection limits and therefore were not included in this evaluation. All of the average air concentrations, with the exception of Cs-137 and chromium, were above background (Table 5-13). All of the maximum detected air concentrations were then compared to the appropriate regulatory limits. All radionuclide air concentrations were below their respective DCGs. All metals air concentrations were below their respective PRGs and PELs, with the exception of chromium. Chromium exceeded its PRG for ambient air, but was well below the OSHA PEL.

The US EPA specifies a size-specific air quality standard for ambient air particulates that applies to PM_{10} concentrations (Federal Register, 1987). PM_{10} concentrations did not exceed the 150 micrograms per cubic meter standard for a 24-hour period. The highest recorded PM_{10} concentration for the DSS RA was 20.6 $\mu g/m^3$ for a 24-hour period.

On-site air monitoring data collected during the DSSs 3 and 6 RAs indicated that ambient air concentrations did not pose any health risks to site workers or laboratory personnel at LEHR.

Table 5-1. Excavation Screening Sample Results, Domestic Septic System 3

Sample ID	Grid Location (East/North)	Structure	Depth (ft bgs)	Mercury Conc. [1] (mg/kg)	Radium-226 Conc. [2] (pCi/g)
SSD3F001	5/25	DB - Trench Floor	6	0.15	0.351
SSD3F002 [3]	5/25	DB - Trench Floor	6	0.24	0.363
SSD3F003	5/20	EP/Trench Floor	6.5	0.16	0.385
SSD3F004 [4]	5/26	DB - Northern Sidewall	5.5	0.2	0.34
SSD3F005	8/25	DB- Eastern Sidewall	5	0.18	0.328
SSD3F006	2/25	DB- Western Sidewall	5	0.13	0.348
SSD3F007 [4]	5/28	DB - IP Sidewall	5.5	0.3	0.328
SSD3F008	5/30	DB - IP Sidewall	5.5	0.27	0.348
SSD3F009	5/15	EP - Trench Floor	6.5	0.15	0.415
SSD3F010	5/10	EP - Trench Floor	7	0.11	0.389
SSD3F011	5/5	EP - Trench Floor	7	0.2	0.365
SSD3F012 [3]	5/5	EP - Trench Floor	7	0.12	0.376
SSD3F013	5/2	EP- South Sidewall	6	0.45	0.326
SSD3F014 [4]	**10/10**	**Leach line, Trench floor**	**10**	**19**	0.551
SSD3F015	15/10	Leach line, Trench floor	11	0.72	0.52
SSD3F016	10/14	Leach Line, North Sidewall	8	0.52	0.375
SSD3F017 [3]	10/14	Leach Line, North Sidewall	8	0.58	0.379
SSD3F018	15/14	Leach Line, North Sidewall	9	0.26	0.411
SSD3F019	10/6.5	Leach line, South Sidewall	8	0.57	0.333
SSD3F020	15/6.5	Leach line, South Sidewall	9	0.28	0.381
SSD3F021 [4, 5]	7/13	Leach line, Trench floor	10	0.74	NC
SSD3F022 [4, 5]	10/7	Leach line, Trench floor	10	<0.1	NC
SSD3F023 [4, 5]	10/13	Leach line, Trench floor	10	<0.1	NC
SSD3F024 [4, 5]	7/7	Leach line, Trench floor	10	0.94	NC
SSD3F025 [4, 5]	7/10	Leach line, Trench floor	10	0.93	NC
SSD3F026 [4, 5]	13/7	Leach line, Trench floor	10	0.95	NC
SSD3F027 [4, 5]	13/13	Leach line, Trench floor	10	<0.1	NC
SSD3F028 [5]	10/12.5	Leach line, North Sidewall	11.5	<0.1	NC
SSD3F029 [5]	12.5/10	Leach line, Trench floor	12.5	<0.1	NC
SSD3F030 [5]	7.5/10	Trench Floor - West Sidewall	11	0.1	NC
SSD3F031 [6]	10/10	Leach line, Trench floor	12.5	<0.1	NC
SSD3F032 [3, 6]	10/10	Leach line, Trench floor	12.5	<0.1	NC
SSD3F033 [5]	10/7.5	Leach line, South Sidewall	11.5	0.11	NC
SSD3F034	20/7	Leach line, South Sidewall	10.5	<0.1	0.406
SSD3F035	25/7	Leach line, South Sidewall	9	<0.1	0.377
SSD3F036	20/13	Leach line, North Sidewall	10.5	<0.1	0.411
SSD3F037	25/13	Leach line, North Sidewall	9.5	0.34	0.421

Table 5-1. Excavation Screening Sample Results, Domestic Septic System 3 (continued)

Sample ID	Grid Location (East/North)	Structure	Depth (ft bgs)	Mercury Conc. [1] (mg/kg)	Radium-226 Conc. [2] (pCi/g)
SSD3F038	20/10	Leach line, Trench floor	12.5	0.18	0.504
SSD3F039	25/10	Leach line, Trench floor	11.5	0.58	0.447
SSD3F040	30/10	Leach line, Trench floor	11	0.98	0.503
SSD3F041 [3]	30/10	Leach line, Trench floor	11	0.8	0.504
SSD3F042	30/7	Leach line, South Sidewall	9	<0.1	0.423
SSD3F043	30/13	Leach line, North Sidewall	9	0.28	0.474
SSD3F044	35/10	Leach line, Trench floor	11.5	3.3/7 [7]	0.428
SSD3F045	35/13	Leach line, North Sidewall	9.5	0.42	0.441
SSD3F046	35/7	Leach line, South Sidewall	9.5	0.21	0.478
SSD3F047 [3]	35/7	Leach line, South Sidewall	9.5	0.19	NC
SSD3F048	40/10	Leach line, Trench floor	11.5	0.67	0.37
SSD3F049	40/13	Leach line, North Sidewall	9.5	0.12	0.402
SSD3F050	40/7	Leach line, South Sidewall	9.5	0.18	0.366
SSD3F051	45/10	Leach line, Trench floor	11	0.33	0.471
SSD3F052	50/13	Leach line, North Sidewall	9	0.41	0.404
SSD3F053	45/7	Leach line, South Sidewall	9	0.1	0.415
SSD3F054	50/7	Leach line, South Sidewall	9	0.19	0.389
SSD3F055 [3]	50/7	Leach line, South Sidewall	9	0.16	0.401
SSD3F056	50/10	Leach line, Trench floor	11	1.6	0.411
SSD3F057 [3]	50/10	Leach line, Trench floor	11	1.5	0.373
SSD3F058	45/13	Leach line, North Sidewall	9	0.1	0.459
SSD3F059	55/10	Leach line, Trench floor	11	0.23	0.397
SSD3F060	55/13	Leach line, North Sidewall	9	0.1	0.426
SSD3F061	55/7	Leach line, South Sidewall	9	0.1	0.407
SSD3F062	58/10	Leach line, East Sidewall	9	0.1	0.557
SSD3F063 [3]	58/10	Leach line, East Sidewall	9	0.1	NC

Notes

[1] Analyzed on site by cold-vapor atomic absorption (United States Environmental Protection Agency SW 846 Method 7471) with a reporting limit of 0.10 mg/kg.

[2] Analyzed on site by a high-purity germanium gamma spectrometer.

[3] This sample is a field duplicate of the prior sample.

[4] This sample location was removed during the removal action.

[5] This sample was collected to further define the occurrence of mercury above the screening criteria. Therefore, no radium-226 sample was collected.

[6] This sample was collected to confirm that mercury detected in sample SSD3F014 had been removed as a result of the additional excavation at this location.

[7] This sample was reanalyzed.

Bold text indicates that the mercury concentration exceeds the area-specific screening criterion of 6.8 mg/kg.

Table 5-1. Excavation Screening Sample Results, Domestic Septic System 3 (continued)

Abbreviations

bgs	below ground surface
Conc.	concentration
DB	distribution box
EP	effluent pipe
ft	feet
ID	identification (number)
IP	influent pipe
mg/kg	milligrams per kilogram
NC	not collected
pCi/g	picoCuries per gram

Table 5-2. Excavation Screening Sample Results, Domestic Septic System 6

Sample ID	Grid Location (East/ North)	Structure	Depth (ft)	Mercury Concentration [1] (mg/kg)
SSD6F001	3/100	N LL, West Sidewall	4	0.6
SSD6F002	11/100	N LL, East Sidewall	4	<0.1
SSD6F003	5/103	N LL, North Sidewall - West	4	0.22
SSD6F004	11/103	N LL, North Sidewall - East	4	0.2
SSD6F005 [2]	11/103	N LL, North Sidewall - East	4	0.21
SSD6F006	3/95	N LL, West Sidewall	4	0.72
SSD6F007	11/95	N LL, East Sidewall	4	0.43
SSD6F008 [3]	**3/90**	**N LL, West Sidewall**	**4**	**49**
SSD6F009	11/90	N LL, East Sidewall	4	<0.1
SSD6F010	10/100	N LL, Trench Floor	6	0.10 J
SSD6F011 [2]	10/100	N LL, Trench Floor	6	0.11
SSD6F012	5/100	N LL, Trench Floor	6	1.6
SSD6F013	5/95	N LL, Trench Floor	6	1.2
SSD6F014	10/95	N LL, Trench Floor	6	0.17
SSD6F015 [3]	**3/85**	**N LL, West Sidewall**	**3.5**	**20**
SSD6F016	5/90	N LL, Trench Floor	4.5	0.094 J
SSD6F017	10/90	N LL, Trench Floor	6	<0.1
SSD6F018	11/85	N LL, East Sidewall	4	0.51
SSD6F019	3/80	N LL, West Sidewall	4	0.45
SSD6F020 [3]	**11/80**	**N LL, East Sidewall**	**4**	**35**
SSD6F021	10/85	N LL, Trench Floor	6	0.3
SSD6F022	5/85	N LL, Trench Floor	6	0.29
SSD6F023 [3]	**3/90**	**N LL, West Sidewall**	**4**	**8.9**
SSD6F024 [3, 4]	3/92	N LL, West Sidewall	4	1.8
SSD6F025 [3, 4]	**3/88**	**N LL, West Sidewall**	**4**	**13**
SSD6F026 [3, 4, 5]	2/90	N LL, West Sidewall	2	0.35
SSD6F027 [3, 4]	2/92.5	N LL, West Sidewall	4	0.32
SSD6F028 [5]	2/90	N LL, West Sidewall	4	0.26
SSD6F029 [2, 5]	2/90	N LL, West Sidewall	4	0.15
SSD6F030 [3, 4, 5]	2/90	N LL, West Sidewall	6.5	<0.1

Table 5-2. Excavation Screening Sample Results, Domestic Septic System 6 (continued)

Sample ID	Grid Location (East/ North)	Structure	Depth (ft)	Mercury Concentration [1] (mg/kg)
SSD6F031 [3, 4, 5]	2/87.5	N LL, West Sidewall	4	0.43
SSD6F032	5/80	N LL, Trench Floor	6	0.65
SSD6F033	10/80	N LL, Trench Floor	6	0.11
SSD6F034	11/75	N LL, East Sidewall	4	0.13
SSD6F035	3/75	N LL, West Sidewall	4	0.13
SSD6F036 [4, 5]	2/85	N LL, West Sidewall	4	0.25
SSD6F037 [4, 5]	2/87.5	N LL, West Sidewall	4	0.31
SSD6F038 [4, 5]	2/85	N LL, West Sidewall	6.5	1.2
SSD6F039 [4, 5]	2/85	N LL, West Sidewall	2	0.53
SSD6F040 [4]	2/82.5	N LL, West Sidewall	4	0.35
SSD6F041	5/75	N LL, Trench Floor	6.5	0.28
SSD6F042	10/75	N LL, Trench Floor	6.5	0.22
SSD6F043	2.5/70	N LL, West Sidewall	4	0.24
SSD6F044	2.5/65	N LL, West Sidewall	4	0.44
SSD6F045	11/70	N LL, East Sidewall	4	0.37
SSD6F046 [2]	11/70	N LL, East Sidewall	4	0.34
SSD6F047 [5]	12/80	N LL, East Sidewall	4	0.13
SSD6F048 [4]	12/82.5	N LL, East Sidewall	4	<0.1
SSD6F049 [4]	12/77.5	N LL, East Sidewall	4	<0.1
SSD6F050 [4, 5]	12/80	N LL, East Sidewall	6.5	<0.1
SSD6F051 [4, 5]	12/80	N LL, East Sidewall	2	0.32
SSD6F052	4/70	N LL, Trench Floor	6.5	<0.1
SSD6F053	10/70	N LL, Trench Floor	6.5	<0.1
SSD6F054	11/65	N LL, West Sidewall	4	<0.1
SSD6F055	2/60	N LL, West Sidewall	4	0.28
SSD6F056	5/65	N LL, Trench Floor	6.5	0.49
SSD6F057	5/60	N LL, Trench Floor	6.5	<0.1
SSD6F058	11/60	N LL, East Sidewall	4	0.11
SSD6F059 [2]	11/60	N LL, East Sidewall	4	0.13
SSD6F060	10/65	N LL, Trench Floor	6.5	<0.1

Table 5-2. Excavation Screening Sample Results, Domestic Septic System 6 (continued)

Sample ID	Grid Location (East/ North)	Structure	Depth (ft)	Mercury Concentration [1] (mg/kg)
SSD6F061	10/60	N LL, Trench Floor	6.5	<0.1
SSD6F062	15/55	N LL, East Sidewall	4	0.1
SSD6F063 [2]	15/55	N LL, East Sidewall	4	<0.1
SSD6F064	10/55	N LL, Trench Floor	6	0.1
SSD6F065	5/45	N LL, Trench Floor	6.5	<0.1
SSD6F066	10/45	N LL, Trench Floor	6.5	<0.1
SSD6F067	12/45	N LL, East Sidewall	4	0.13
SSD6F068	3/40	N LL, West Sidewall	4	0.46
SSD6F069	5/40	N LL, Trench Floor	6.5	0.2
SSD6F070	10/40	N LL, Trench Floor	6.5	1.3
SSD6F071	12/40	N LL, East Sidewall	4	0.13
SSD6F072	3/35	N LL, West Sidewall	4	0.17
SSD6F073 [2]	3/35	N LL, West Sidewall	4	0.16
SSD6F074	12/35	N LL, East Sidewall	4	1.7
SSD6F075	5/55	N LL, Trench Floor	6	1.4
SSD6F076	5/35	N LL, Trench Floor	6.5	<0.1
SSD6F077	10/35	N LL, Trench Floor	6.5	<0.1
SSD6F078	10/30	N LL, Trench Floor	6.5	<0.1
SSD6F079 [2]	10/30	N LL, Trench Floor	6.5	0.12
SSD6F080	5/30	N LL, Trench Floor	6	0.18
SSD6F081	3/30	N LL, West Sidewall	4	<0.1
SSD6F082	12/30	N LL, East Sidewall	4	<0.1
SSD6F083	10/25	N LL, Trench Floor	6.5	<0.1
SSD6F084	12/25	N LL, East Sidewall	4.5	<0.1
SSD6F085	5/25	N LL, West Sidewall	6.5	<0.1
SSD6F086	3/25	N LL, Trench Floor	4	0.27
SSD6F087 [2]	3/25	N LL, Trench Floor	4	0.31
SSD6F088	5/20	S LL, Trench Floor	7	<0.1
SSD6F089	10/20	S LL, Trench Floor	7	<0.1
SSD6F090	3/20	S LL, West Sidewall	4.5	0.13

Table 5-2. Excavation Screening Sample Results, Domestic Septic System 6 (continued)

Sample ID	Grid Location (East/ North)	Structure	Depth (ft)	Mercury Concentration [1] (mg/kg)
SSD6F091	3/15	S LL, West Sidewall	4.5	0.3
SSD6F092	12/20	S LL, East Sidewall	4.5	<0.1
SSD6F093 [2]	12/20	S LL, East Sidewall	4.5	<0.1
SSD6F094	12/15	S LL, East Sidewall	4.5	0.12
SSD6F095	5/15	S LL, Trench Floor	7	<0.1
SSD6F096	10/15	S LL, Trench Floor	7	<0.1
SSD6F097	5/10	S LL, Trench Floor	7	<0.1
SSD6F098	10/10	S LL, Trench Floor	7	0.1
SSD6F099	3/10	S LL, West Sidewall	4.5	0.62
SSD6F100	3/5	S LL, West Sidewall	4.5	0.32
SSD6F101	3/0	S LL, West Sidewall	4.5	0.53
SSD6F102	5/-2	S LL, South Sidewall	4.5	0.4
SSD6F103	12/10	S LL, East Sidewall	4.5	0.15
SSD6F104	12/5	S LL, East Sidewall	4.5	0.4
SSD6F105	5/5	S LL, Trench Floor	7	0.56
SSD6F106	10/5	S LL, Trench Floor	7	<0.1
SSD6F107	5/0	S LL, Trench Floor	7	0.12
SSD6F108	10/0	S LL, Trench Floor	7	0.25
SSD6F109	10/10	S LL, Trench Floor	7	0.37
SSD6F110	10/0	S LL, South Sidewall	4.5	1.3
SSD6F111	12/0	S LL, East Sidewall	4.5	0.25

Notes

[1] Analysis was conducted on site by cold-vapor atomic absorption (United States Environmental Protection Agency SW 846 Method 7471) with a reporting limit of 0.10 mg/kg.

[2] This sample is a field duplicate of the prior sample.

[3] This sample location was removed during the removal action.

[4] Hot spot characterization sample not shown in Figure 5-2.

[5] This sample was collected to confirm that mercury detected above the screening criterion on a prior sample was removed as a result of the additional excavation at this location.

Bold text indicates that the mercury concentration exceeds the area-specific screening criterion of 8.3 mg/kg.

Table 5-2. Excavation Screening Sample Results, Domestic Septic System 6 (continued)

Abbreviations

ft	feet
ID	identification (number)
J	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
LL	leach line
mg/kg	milligrams per kilogram
N	northern
S	southern

Table 5-3. Confirmation Sampling Analytical Results Summary, Domestic Septic System 3

Constituent	Number of Samples	Number of Samples > Detection Limit	Range of Detections	Sample ID with Maximum Concentration	Depth (ft bgs)	Structure Near Maximum Location
General Chemistry			**mg/kg**			
Formaldehyde	27	27	0.21- 2.2	SSD3C055	12	Leach Trench Floor
Hexavalent Chromium	27	23	0.0513- 0.384	SSD3C046	5.9	Leach Trench North Sidewall
Nitrate	27	26	1.15-106	SSD3C049	12.5	Leach Trench Floor
Metals			**mg/kg**			
Arsenic	1	1	7	SSD3C036	5.5	Beneath the DST 3 Effluent Line
Barium	1	1	195	SSD3C036	5.5	Beneath the DST 3 Effluent Line
Beryllium	1	1	0.41	SSD3C036	5.5	Beneath the DST 3 Effluent Line
Cadmium	27	14	0.07-0.15	SSD3C058 and -059	5.2	Leach Trench South Sidewall
Chromium	27	27	76.9-174	SSD3C047	5.9	Leach Trench North Sidewall
Cobalt	1	1	21.8	SSD3C036	5.5	Beneath the DST 3 Effluent Line
Copper	27	27	28.5-48.9	SSD3C040	6	Beneath DB Effluent Lines
Iron	1	1	33,200	SSD3C036	5.5	Beneath the DST 3 Effluent Line
Lead	27	27	6-7.8	SSD3C050	12.5	Leach Trench Floor
Manganese	1	1	646	SSD3C036	5.5	Beneath the DST 3 Effluent Line
Mercury	27	27	0.24-4.4	SSD3C066	5.2	Leach Trench South Sidewall
Nickel	1	1	245	SSD3C036	5.5	Beneath the DST 3 Effluent Line
Selenium	1	1	1.1	SSD3C036	5.5	Beneath the DST 3 Effluent Line
Silver	27	5	0.29-2.4	SSD3C053	10.5	Leach Trench Floor
Vanadium	1	1	59.3	SSD3C036	5.5	Beneath the DST 3 Effluent Line
Zinc	1	1	70	SSD3C036	5.5	Beneath the DST 3 Effluent Line
Radionuclides			**pCi/g**			
Actinium-228	1	1	0.442	SSD3C036	5.5	Beneath the DST 3 Effluent Line
Americium-241	1	1	0.0136	SSD3C036	5.5	Beneath the DST 3 Effluent Line
Bismuth-212	1	1	0.298	SSD3C036	5.5	Beneath the DST 3 Effluent Line
Bismuth-214	1	1	0.4	SSD3C036	5.5	Beneath the DST 3 Effluent Line
Cesium-137	27	2	0.0049-0.0139	SSD3C036	5.5	Beneath the DST 3 Effluent Line
Lead-210	27	5	0.433-0.961	SSD3C038	3.6	DB Effluent Line
Lead-212	1	1	0.481	SSD3C036	5.5	Beneath the DST 3 Effluent Line
Lead-214	1	1	0.446	SSD3C036	5.5	Beneath the DST 3 Effluent Line
Potassium-40	1	1	10.5	SSD3C036	5.5	Beneath the DST 3 Effluent Line
Radium-226	27	27	0.37-0.598	SSD3C050	12.5	Leach Trench Floor
Radium-228	1	1	0.442	SSD3C036	5.5	Beneath the DST 3 Effluent Line
Strontium-90	27	19	0.0983-1.6	SSD3C056	13	Leach Trench Floor
Thallium-208	1	1	0.157	SSD3C036	5.5	Beneath the DST 3 Effluent Line
Thorium-228	1	1	0.468	SSD3C036	5.5	Beneath the DST 3 Effluent Line
Thorium-230	1	1	0.516	SSD3C036	5.5	Beneath the DST 3 Effluent Line
Thorium-232	1	1	0.45	SSD3C036	5.5	Beneath the DST 3 Effluent Line
Thorium-234	1	1	0.524	SSD3C036	5.5	Beneath the DST 3 Effluent Line
Uranium-233/234	1	1	0.365	SSD3C036	5.5	Beneath the DST 3 Effluent Line

Table 5-3. Confirmation Sampling Analytical Results Summary, Domestic Septic System 3 (continued)

Constituent	Number of Samples	Number of Samples > Detection Limit	Range of Detections	Sample ID with Maximum Concentration	Depth (ft bgs)	Structure Near Maximum Location
Radionuclides (continued)			**pCi/g**			
Uranium-235/236	1	1	0.0295	SSD3C036	5.5	Beneath the DST 3 Effluent Line
Uranium-238	1	1	0.391	SSD3C036	5.5	Beneath the DST 3 Effluent Line
Pesticides			**µg/kg**			
Alpha chlordane	27	19	2-161	SSD3C047DL	5.9	Leach Trench North Sidewall
Gamma chlordane	27	19	2.2-294	SSD3C047DL	5.9	Leach Trench North Sidewall
Heptachlor epoxide	27	1	4	SSD3C061	5.2	Leach Trench South Sidewall

Note

All semi-volatile and volatile organic compound results were below their respective detection limits.

Abbreviations

µg/kg	micrograms per kilogram
DB	distribution box
DL	diluted sample
DST	domestic septic tank
ID	identification (number)
ft bgs	feet below ground surface
mg/kg	milligrams per kilogram
pCi/g	picoCuries per gram

Table 5-4. Domestic Septic Systems 3 and 6 Confirmation Sample Waste Extraction Test and Toxicity Characteristic Leaching Procedure Analytical Results

Sample ID	Analytic Method	Concentration (mg/l)
Domestic Septic System 3		
SSD3C024(s)	WET for Hg	<0.0006
SSD3C024(t)	TCLP for Hg	<0.001
SSD3C025(s)	WET for Hg	<0.0004
SSD3C025(t)	TCLP for Hg	<0.001
SSD3C036(s)	WET for Hg	0.00713
SSD3C036(t)	TCLP for Hg	<0.001
SSD3C039(s)	WET for Hg	0.001
SSD3C042(s)	WET for Hg	<0.0004
SSD3C048(s)	WET for Hg	0.0004
SSD3C052(s)	WET for Hg	0.001
SSD3C055(s)	WET for Hg	0.001
SSD3C060(s)	WET for Hg	0.002
SSD3C064(s)	WET for Hg	0.001
SSD3C066(s)	WET for Hg	<0.0004
SSD3C066(t)	TCLP for Hg	<0.0004
Domestic Septic System 6		
SSD6C021(s)	WET for Hg	0.001
SSD6C025(s)	WET for Hg	0.001
SSD6C038(s)	WET for Hg	0.001
SSD6C025(t)	TCLP for Hg	<0.0004
SSD6C038(t)	TCLP for Hg	<0.0004

Note

The hazardous waste limit for mercury is 0.2 mg/l.

Abbreviations

Hg mercury
ID identification
mg/L milligram per kilogram
TCLP toxicity characteristic leaching procedure
WET waste extraction test

Table 5-5. Confirmation Sampling Analytical Results Summary, Domestic Septic System 6

Constituent	Number of Samples	Number of Samples > Detection Limit	Range of Detections	Sample ID with Maximum Concentration	Depth (ft bgs)	Structure Near Maximum Location
General Chemistry			**mg/kg**			
Hexavalent Chromium	23	6	0.0435- 0.362	SSD6C023	4.4	Northwestern Leach Line, Sidewall
Metals			**mg/kg**			
Barium	23	23	138- 290	SSD6C041	7	Northeastern Leach Line, Trench Floor
Copper	23	23	30.4- 52.2	SSD6C041	7	Northeastern Leach Line, Trench Floor
Mercury	27	27	0.01- 8	SSD6C038	7	Northeastern Leach Line, Trench Floor

Note

All semi-volatile and volatile organic compound results were below their respective detection limits.

Abbreviations

ft bgs feet below ground surface
ID identification (number)
mg/kg milligrams per kilogram

Table 5-6. Designated-Level Sampling Analytical Results, Domestic Septic System 3

Arsenic		
Sample ID	Concentration (mg/kg)	Depth (ft)
SSD3DL04	7.5	15
SSD3DL07	6.7	20
SSD3DL09	7.5	25
SSD3DL10	8.2	30
SSD3DL11	7.2	35
SSD3DL12	5.6	40
Cadmium		
Sample ID	Concentration (mg/kg)	Depth (ft)
SSD3DL04	0.18	15
SSD3DL07	0.16	20
SSD3DL09	0.26	25
SSD3DL10	0.22	30
SSD3DL11	0.26	35
SSD3DL12	0.26	40
Chromium		
Sample ID	Concentration (mg/kg)	Depth (ft)
SSD3DL04	70.5	15
SSD3DL08	40.8	20
SSD3DL09	85.8	25
SSD3DL10	84.7	30
SSD3DL11	75.7	35
SSD3DL12	92	40
Formaldehyde		
Sample ID	Concentration (mg/kg)	Depth (ft)
SSD3DL04	0.92	15
SSD3DL07	0.82	20
SSD3DL09	0.88	25
SSD3DL10	0.49	30
SSD3DL11	0.22	35
SSD3DL12	0.19	40
Hexavalent Chromium		
Sample ID	Concentration (mg/kg)	Depth (ft)
SSD3DL04	0.387	15
SSD3DL07	0.245	20
SSD3DL09	0.322	25
SSD3DL10	0.112	30
SSD3DL11	<0.058	35
SSD3DL12	0.0558	40

Table 5-6. Designated-Level Sampling Analytical Results, Domestic Septic System 3 (continued)

Lead		
Sample ID	Concentration (mg/kg)	Depth (ft)
SSD3DL04	7.9	15
SSD3DL08	8.4	20
SSD3DL09	9.1	25
SSD3DL10	7.3	30
SSD3DL11	7.2	35
SSD3DL12	4.7	40
Mercury		
Sample ID	Concentration (mg/kg)	Depth (ft)
SSD3DL01	0.23	13
SSD3DL02	0.28	14
SSD3DL04	0.07	15
SSD3DL05	0.08	16
SSD3DL06	0.12	17
SSD3DL07	0.04	20
SSD3DL09	0.1	25
SSD3DL10	0.1	30
SSD3DL11	0.11	35
SSD3DL12	0.2	40
Molybdenum		
Sample ID	Concentration (mg/kg)	Depth (ft)
SSD3DL04	0.44	15
SSD3DL07	0.66	20
SSD3DL09	0.27	25
SSD3DL10	<0.26	30
SSD3DL11	2.5	35
SSD3DL12	<0.26	40
Nitrate		
Sample ID	Concentration (mg/kg)	Depth (ft)
SSD3DL04	33.2	15
SSD3DL07	9.57	20
SSD3DL09	9.48	25
SSD3DL10	10.6	30
SSD3DL11	9.11	35
SSD3DL12	9.06	40

Table 5-6. Designated-Level Sampling Analytical Results, Domestic Septic System 3 (continued)

Selenium		
Sample ID	Concentration (mg/kg)	Depth (ft)
SSD3DL04	ND	15
SSD3DL07	0.86	20
SSD3DL09	ND	25
SSD3DL10	ND	30
SSD3DL11	ND	35
SSD3DL12	ND	40
Silver		
Sample ID	Concentration (mg/kg)	Depth (ft)
SSD3DL04	0.34	15
SSD3DL07	0.34	20
SSD3DL09	ND	25
SSD3DL10	0.37	30
SSD3DL11	0.3	35
SSD3DL12	ND	40
Radium-226		
Sample ID	Concentration (pCi/g)	Depth (ft)
SSD3DL04	0.534	15
SSD3DL07	0.531	20
SSD3DL09	0.564	25
SSD3DL10	0.49	30
SSD3DL11	0.576	35
SSD3DL12	0.383	40

Abbreviations

ft	feet
ID	identification (number)
mg/kg	milligrams per kilograms
ND	not detected
pCi/g	picoCuries per gram

Table 5-7. Generalized Lithology for the Domestic Septic Systems 3 and 6 Areas

Approximate Depths (ft bgs)	Dominant Lithology	Physical Characteristics	Estimated Relative Permeability
0.0 – 14.0	Clayey Silt	Medium Stiff, Low Plasticity	Low
14.0 – 29.5	Silty Clay	Stiff, Low Plasticity – Medium Plasticity	Very Low
29.5. – 32.5	Silty Sand	Medium Dense, Non-Plastic, Well-Sorted	Moderate-High
32.5 – 45.0	Silty Clay	Stiff, Low to Medium Plasticity	Very Low

Abbreviation
ft bgs feet below ground surface

Table 5-8. Analysis of Deionized Water Waste Extraction Test Results, Domestic Septic System 3

Sample ID	Constituent	Concentration (mg/l)	Background (mg/l)	MCLs (mg/l)	Tap Water PRGs (mg/l)	Concentration < Background	Concentration < MCLs	Concentration < PRG	1/10 Concentration vs. MCL or PRG[a]	Overall Comparison
SSD3DL04(diwet)	Aluminum	112	NE	NE	36	NA	NA	Fail	**Pass**	**Pass**
SSD3DL08(diwet)	Aluminum	55.8	NE	NE	36	NA	NA	Fail	**Pass**	**Pass**
SSD3DL04(diwet)	Arsenic	0.0421	0.008	0.01	0.000045	Fail	Fail	Fail	**Pass**	**Pass**
SSD3DL08(diwet)	Arsenic	0.0311	0.008	0.01	0.000045	Fail	Fail	Fail	**Pass**	**Pass**
SSD3DL04(diwet)	Barium	0.829	0.187[b]	2	2.6	Fail	**Pass**			**Pass**
SSD3DL07(diwet)	Barium	0.507	0.187[b]	2	2.6	Fail	**Pass**			**Pass**
SSD3DL04(diwet)	Beryllium	0.0021	ND	0.004	0.073	NA	**Pass**			**Pass**
SSD3DL07(diwet)	Beryllium	0.0016	ND	0.004	0.073	NA	**Pass**			**Pass**
SSD3DL04(diwet)	Chromium	0.424	0.025[b]	0.1	55	Fail	Fail	**Pass**		**Pass**
SSD3DL08(diwet)	Chromium	0.154	0.025[b]	0.1	55	Fail	Fail	**Pass**		**Pass**
SSD3DL04(diwet)	Cobalt	0.0461	0.002[c]	NE	2.2	Fail	NA	**Pass**		**Pass**
SSD3DL07(diwet)	Cobalt	0.0267	0.002[c]	NE	2.2	Fail	NA	**Pass**		**Pass**
SSD3DL04(diwet)	Copper	0.202	0.002[c]	1.3	1.4	Fail	**Pass**			**Pass**
SSD3DL08(diwet)	Copper	0.0972	0.002[c]	1.3	1.4	Fail	**Pass**			**Pass**
SSD3DL04(diwet)	Iron	180	0.5[c]	NE	11	Fail	NA	Fail	Fail	Fail
SSD3DL08(diwet)	Iron	94.9	0.5[c]	NE	11	Fail	NA	Fail	**Pass**	**Pass**
SSD3DL04(diwet)	Lead	0.038	0.001[c]	0.015	NE	Fail	Fail		**Pass**	**Pass**
SSD3DL08(diwet)	Lead	0.0284	0.001[c]	0.015	NE	Fail	Fail		**Pass**	**Pass**
SSD3DL04(diwet)	Magnesium	75.1	112[b]	NE	NE	**Pass**				**Pass**
SSD3DL07(diwet)	Magnesium	26	112[b]	NE	NE	**Pass**				**Pass**
SSD3DL04(diwet)	Manganese	1.94	0.009[c]	NE	0.88	**Pass**				**Pass**
SSD3DL07(diwet)	Manganese	1.36	0.009[c]	NE	0.88	**Pass**				**Pass**
SSD3DL04(diwet)	Mercury	0.0017	0.0001[d]	0.002	0.011	Fail	**Pass**			**Pass**
SSD3DL07(diwet)	Mercury	0.0011	0.0001[d]	0.002	0.011	Fail	**Pass**			**Pass**
SSD3DL04(diwet)	Molybdenum	0.0034	0.015[b]	NE	0.18	**Pass**				**Pass**

Table 5-8. Analysis of Deionized Water Waste Extraction Test Results, Domestic Septic System 3 (continued)

Sample ID	Constituent	Concentration (mg/l)	Background (mg/l)	MCLs (mg/l)	Tap Water PRGs (mg/l)	Concentration < Background	Concentration < MCLs	Concentration < PRG	1/10 Concentration vs. MCL or PRG[a]	Overall Comparison
SSD3DL07(diwet)	Molybdenum	0.0025	0.015[b]	NE	0.18	**Pass**				**Pass**
SSD3DL04(diwet)	Nickel	0.706	0.078[b]	NE	0.73	Fail	**Pass**			**Pass**
SSD3DL07(diwet)	Nickel	0.209	0.078[b]	NE	0.73	Fail	**Pass**			**Pass**
SSD3DL04(diwet)	Nitrate	2.31	25.1[b]	10	10	**Pass**				**Pass**
SSD3DL08(diwet)	Nitrate	0.489	25.1[b]	10	10	**Pass**				**Pass**
SSD3DL04(diwet)	Selenium	0.0065	0.0056	0.05	0.18	Fail	**Pass**			**Pass**
SSD3DL08(diwet)	Selenium	0.0033	0.0056	0.05	0.18	**Pass**				**Pass**
SSD3DL04(diwet)	Vanadium	0.33	0.02[b]	NE	0.26	Fail	NA	Fail	**Pass**	**Pass**
SSD3DL08(diwet)	Vanadium	0.191	0.02[b]	NE	0.26	Fail	NA	**Pass**		**Pass**
SSD3DL04(diwet)	Zinc	0.361	0.03[b]	NE	11	Fail	NA	**Pass**		**Pass**
SSD3DL07(diwet)	Zinc	0.187	0.03[b]	NE	11	Fail	NA	**Pass**		**Pass**

Notes

[a] This represents a 100-fold environmental attenuation factor.
[b] The background concentration represents the 80% lower confidence limit on 95th percentile of the ground water concentrations detected in well UCD-18.
[c] The background concentration represents the maximum detected concentration in well UCD-18 samples. There was insufficient detected data to calculate 80% lower confidence limit on the 95th percentile.
[d] The background concentration represents one half of the lowest reported detection limit for well UCD1-18 samples. Applies to COCs whose UCD1-18 results were all ND.

Abbreviations

DI WET	deionized water waste extraction test
ID	identification (number)
MCL	maximum contaminant level
mg/l	milligrams per liter
NA	not applicable
ND	not detected
NE	not established
PRG	preliminary remediation goal

Table 5-9. Evaluation of Ground Water Results[a], Domestic Septic System 3

Constituent	Concentration	Background	MCL	Tap Water PRG	Concentration < Background	Concentration < MCL	Concentration < PRG
Metals	**mg/L**	**mg/L**	**mg/L**	**mg/L**			
Aluminum	85.6	NE	NE	36	NA	NA	Fail
Arsenic	0.026	0.008	0.01	0.000045	Fail	Fail	Fail
Barium	1.09	0.187[b]	2	2.6	Fail	**Pass**	
Beryllium	0.0017	0.002[c]	0.004	0.004	**Pass**		
Chromium	0.906	0.025[b]	0.1	55	Fail	Fail	**Pass**
Cobalt	0.113	0.002[c]	NE	2.2	Fail	NA	**Pass**
Copper	0.211	0.002[c]	1.3	1.4	Fail	**Pass**	
Iron	205	0.502[c]	NE	11	Fail	NA	Fail
Lead	0.0324	0.001[c]	0.015	NE	Fail	Fail	
Magnesium	263	112[b]	NE	NE	Fail	NA	**Pass**
Manganese	3.26	0.0099[b]	NE	NE	Fail	NA	**Pass**
Mercury	0.0061	0.0001[d]	0.002	0.011	Fail	Fail	**Pass**
Molybdenum	0.0167	0.015[b]	NE	0.18	Fail	NA	**Pass**
Nickel	1.36	0.078[b]	NE	0.73	Fail	NA	Fail
Nitrate	15.3	25.1[b]	10	10	**Pass**		
Selenium	0.0073	0.0057[b]	0.05	0.18	Fail	**Pass**	
Silver	0.0024	0.005[d]	NE	0.18	**Pass**		
Vanadium	0.334	0.02[b]	NE	0.663/0.674	Fail	NA	**Pass**
Zinc	1.12	0.03[b]	NE	11	Fail	NA	**Pass**

Table 5-9. Evaluation of Ground Water Results[a], Domestic Septic System 3 (continued)

Constituent	Concentration	Background	MCL	Tap Water PRG	Concentration < Background	Concentration < MCL	Concentration < PRG
Radionuclides	**pCi/L**	**pCi/L**	**PCi/L**	**pCi/L**			
Potassium-40	68.6	22[d]	NE	1.93	Fail	NA	Fail
Radium-226	0.417	1.14[b]	5	0.0008	**Pass**		
Thorium-230	0.312	NE	NE	0.52	NA	**Pass**	
Uranium-233/234	1.28	NE	27[e]	0.26	NA	**Pass**	
Uranium-238	1.02	NE	27[e]	0.26	NA	**Pass**	

Notes

[a] All of these analytical results are from ground water sample WSD3DL01, which was collected from the drill stem using a bailer.
[b] The background concentration represents the 80% lower confidence limit on 95th percentile of the ground water concentrations detected in well UCD-18.
[c] The background concentration represents the maximum detected concentration in well UCD-18 samples. There was insufficient detected data to calculate 80% lower confidence limit on the 95th percentile.
[d] The background concentration represents one half of the lowest reported detection limit for well UCD1-18 samples. Applies to COCs whose UCD1-18 results were all ND.
[e] Uranium as a mixture.

Abbreviations

ID	identification (number)
MCL	maximum contaminant level
mg/l	milligrams per liter
NA	not applicable
ND	not detected
NE	not established
pCi/l	picoCuries per liter
PRG	preliminary remediation goal

Table 5-10. Designated-Level Sampling Analytical Results, Domestic Septic System 6

Copper			
Sample ID	Concentration (mg/kg)	Boring ID	Depth (ft)
SSD6DL01	43.1	D6-DL1	6
SSD6DL06	43.8	D6-DL1	11
SSD6DL08	31.2	D6-DL1	16
SSD6DL10	27.1	D6-DL1	21
SSD6DL12	33.6	D6-DL1	26
SSD6DL14	50	D6-DL1	31
SSD6DL16	50.2	D6-DL1	36
SSD6DL18	50.5	D6-DL1	41
SSD6DL21	43	D6-DL2	6
SSD6DL26	38.7	D6-DL2	11
SSD6DL28	41.2	D6-DL2	16
SSD6DL30	22.5	D6-DL2	21
SSD6DL32	49.9	D6-DL2	26
SSD6DL34	45.6	D6-DL2	31
SSD6DL36	46.4	D6-DL2	36
SSD6DL38	57.5	D6-DL2	41
Hexavalent Chromium			
Sample ID	Concentration (mg/kg)	Boring ID	Depth (ft)
SSD6DL01	<0.0415	D6-DL1	6
SSD6DL06	0.349	D6-DL1	11
SSD6DL08	0.271	D6-DL1	16
SSD6DL10	0.157	D6-DL1	21
SSD6DL12	0.0852	D6-DL1	26
SSD6DL14	0.232	D6-DL1	31
SSD6DL16	0.202	D6-DL1	36
SSD6DL18	0.287	D6-DL1	41
SSD6DL21	0.467	D6-DL2	6
SSD6DL26	0.268	D6-DL2	11
SSD6DL28	0.319	D6-DL2	16
SSD6DL30	0.233	D6-DL2	21
SSD6DL32	0.215	D6-DL2	26
SSD6DL34	0.238	D6-DL2	31
SSD6DL36	0.262	D6-DL2	36
SSD6DL38	0.204	D6-DL2	41

Table 5-10. Designated-Level Sampling Analytical Results, Domestic Septic System 6 (continued)

Mercury			
Sample ID	Concentration (mg/kg)	Boring ID	Depth (ft)
SSD6DL01	0.22[a]	D6-DL1	6
SSD6DL02	0.23[a]	D6-DL1	7
SSD6DL03	0.093[a]	D6-DL1	8
SSD6DL04	0.17[a]	D6-DL1	9
SSD6DL05	4.3[a]	D6-DL1	10
SSD6DL07	3.6[a]	D6-DL1	15
SSD6DL09	6.7[a]	D6-DL1	20
SSD6DL11	0.23[a]	D6-DL1	25
SSD6DL13	0.94[a]	D6-DL1	30
SSD6DL15	0.53[a]	D6-DL1	35
SSD6DL17	0.17[a]	D6-DL1	40
SSD6DL19 (FD)	0.13[a]	D6-DL1	40
SSD6DL21	0.093[a]	D6-DL2	6
SSD6DL22	0.076[a]	D6-DL2	7
SSD6DL23	0.069[a]	D6-DL2	8
SSD6DL24	0.073[a]	D6-DL2	9
SSD6DL25	0.11[a]	D6-DL2	10
SSD6DL27	0.16[a]	D6-DL2	15
SSD6DL29	0.03[a]	D6-DL2	20
SSD6DL31	0.13[a]	D6-DL2	25
SSD6DL33	0.136	D6-DL2	30
SSD6DL35	0.453	D6-DL2	35
SSD6DL37	0.128	D6-DL2	40
SSD6DL39 (FD)	0.0758	D6-DL2	40
Nitrate			
Sample ID	Concentration (mg/kg)	Boring ID	Depth (ft)
SSD6DL01	4.74	D6-DL1	6
SSD6DL06	2.39	D6-DL1	11
SSD6DL08	3.73	D6-DL1	16
SSD6DL10	3.45	D6-DL1	21
SSD6DL12	3.65	D6-DL1	26
SSD6DL14	2.4	D6-DL1	31
SSD6DL16	3.05	D6-DL1	36
SSD6DL18	2.12	D6-DL1	41
SSD6DL21	5.14	D6-DL2	6
SSD6DL26	2.74	D6-DL2	11
SSD6DL28	1.41	D6-DL2	16
SSD6DL30	1.11	D6-DL2	21

Table 5-10. Designated-Level Sampling Analytical Results, Domestic Septic System 6 (continued)

Nitrate (continued)

Sample ID	Concentration (mg/kg)	Boring ID	Depth (ft)
SSD6DL32	1.63	D6-DL2	26
SSD6DL34	1.93	D6-DL2	31
SSD6DL36	1.67	D6-DL2	36
SSD6DL38	2.27	D6-DL2	41

Nitrogen, Ammonia

Sample ID	Concentration (mg/kg)	Boring ID	Depth (ft)
SSD6DL01	6.81	D6-DL1	6
SSD6DL06	1.42	D6-DL1	11
SSD6DL08	1.67	D6-DL1	16
SSD6DL10	1.65	D6-DL1	21
SSD6DL12	3.17	D6-DL1	26
SSD6DL14	<1.22	D6-DL1	31
SSD6DL16	3.39	D6-DL1	36
SSD6DL18	<1.2	D6-DL1	41
SSD6DL21	4.52	D6-DL2	6
SSD6DL26	0.971	D6-DL2	11
SSD6DL28	1.91	D6-DL2	16
SSD6DL30	1.6	D6-DL2	21
SSD6DL32	<1.25	D6-DL2	26
SSD6DL34	<1.23	D6-DL2	31
SSD6DL36	<1.22	D6-DL2	36
SSD6DL38	<1.24	D6-DL2	41

Total Nitrogen

Sample ID	Concentration (mg/kg)	Boring ID	Depth (ft)
SSD6DL01	789	D6-DL1	6
SSD6DL06	228	D6-DL1	11
SSD6DL08	259	D6-DL1	16
SSD6DL10	189	D6-DL1	21
SSD6DL12	209	D6-DL1	26
SSD6DL14	208	D6-DL1	31
SSD6DL16	308	D6-DL1	36
SSD6DL18	277	D6-DL1	41
SSD6DL21	430	D6-DL2	6
SSD6DL26	218	D6-DL2	11
SSD6DL28	261	D6-DL2	16
SSD6DL30	137	D6-DL2	21
SSD6DL32	249	D6-DL2	26
SSD6DL34	196	D6-DL2	31

Table 5-10. Designated-Level Sampling Analytical Results, Domestic Septic System 6 (continued)

Total Nitrogen (continued)			
Sample ID	Concentration (mg/kg)	Boring ID	Depth (ft)
SSD6DL36	227	D6-DL2	36
SSD6DL38	254	D6-DL2	41

Notes:

[a]This sample had a high matrix spike recovery.

Abbreviations

ft feet
ID identification (number)
mg/kg milligrams per kilograms

Table 5-11. Analysis of Deionized Water Waste Extraction Test Results, Domestic Septic System 6

Sample ID	Constituent	Concentration (mg/L)	Background (mg/L)	MCLs (mg/L)	Tap Water PRGs (mg/L)	Concentration < Background	Concentration < MCLs	Concentration < PRG	1/10 Concentration vs. MCL or PRG[a]	Overall Comparison
SSD6DL06(diwet)	Hexavalent Chromium	0.028	0.039[b]	0.1[d]	0.00016	**Pass**				**Pass**
SSD6DL21(diwet)	Hexavalent Chromium	0.055	0.039[b]	0.1[d]	0.00016	Fail	**Pass**			**Pass**
SSD6DL21(diwet)	Aluminum	52.1	NE	NE	36	NA	NA	Fail	**Pass**	**Pass**
SSD6DL01(diwet)	Aluminum	38	NE	NE	36	NA	NA	Fail	**Pass**	**Pass**
SSD6DL26(diwet)	Aluminum	9.08	NE	NE	36	NA	NA	**Pass**		**Pass**
SSD6DL06(diwet)	Aluminum	2.87	NE	NE	36	NA	NA	**Pass**		**Pass**
SSD6DL21(diwet)	Arsenic	0.0191	0.008	0.01	0.000045	Fail	Fail	Fail	**Pass**	**Pass**
SSD6DL01(diwet)	Arsenic	0.0145	0.008	0.01	0.000045	Fail	Fail	Fail	**Pass**	**Pass**
SSD6DL06(diwet)	Arsenic	0.009	0.008	0.01	0.000045	Fail	**Pass**			**Pass**
SSD6DL26(diwet)	Arsenic	0.0082	0.008	0.01	0.000045	Fail	**Pass**			**Pass**
SSD6DL21(diwet)	Barium	0.43	0.187[b]	2	2.6	Fail	**Pass**			**Pass**
SSD6DL01(diwet)	Barium	0.403	0.187[b]	2	2.6	Fail	**Pass**			**Pass**
SSD6DL26(diwet)	Barium	0.0965	0.187[b]	2	2.6	**Pass**				**Pass**
SSD6DL06(diwet)	Barium	0.0387	0.187[b]	2	2.6	**Pass**				**Pass**
SSD6DL21(diwet)	Beryllium	0.00094	0.002[c]	0.004	0.073	**Pass**				**Pass**
SSD6DL01(diwet)	Beryllium	0.00076	0.002[c]	0.004	0.073	**Pass**				**Pass**
SSD6DL21(diwet)	Cadmium	0.00067	0.001[d]	0.005	0.018[c]	**Pass**				**Pass**
SSD6DL01(diwet)	Cadmium	0.00053	0.001[d]	0.005	0.018[c]	**Pass**				**Pass**
SSD6DL26(diwet)	Cadmium	0.00028	0.001[d]	0.005	0.018[c]	**Pass**				**Pass**
SSD6DL06(diwet)	Cadmium	0.00024	0.001[d]	0.005	0.018[c]	**Pass**				**Pass**
SSD6DL21(diwet)	Chromium	0.264	0.025[b]	0.1	55	Fail	Fail	**Pass**	**Pass**	**Pass**
SSD6DL01(diwet)	Chromium	0.207	0.025[b]	0.1	55	Fail	Fail	**Pass**	**Pass**	**Pass**
SSD6DL26(diwet)	Chromium	0.0492	0.025[b]	0.1	55	Fail	**Pass**			**Pass**
SSD6DL06(diwet)	Chromium	0.0156	0.025[b]	0.1	55	**Pass**				**Pass**
SSD6DL21(diwet)	Cobalt	0.0176	0.002[c]	NE	2.2	NA	NA	**Pass**		**Pass**

Table 5-11. Analysis of Deionized Water Waste Extraction Test Results, Domestic Septic System 6 (continued)

Sample ID	Constituent	Concentration (mg/L)	Background (mg/L)	MCLs (mg/L)	Tap Water PRGs (mg/L)	Concentration < Background	Concentration < MCLs	Concentration < PRG	1/10 Concentration vs. MCL or PRG[a]	Overall Comparison
SSD6DL01(diwet)	Cobalt	0.0169	0.002[c]	NE	2.2	Fail	NA	**Pass**		**Pass**
SSD6DL26(diwet)	Cobalt	0.0035	0.002[c]	NE	2.2	Fail	NA	**Pass**		**Pass**
SSD6DL06(diwet)	Cobalt	0.00071	0.002[c]	NE	2.2	**Pass**				**Pass**
SSD6DL21(diwet)	Copper	0.0871	0.002[c]	1.3	1.4	Fail	**Pass**			**Pass**
SSD6DL01(diwet)	Copper	0.0682	0.002[c]	1.3	1.4	Fail	**Pass**			**Pass**
SSD6DL26(diwet)	Copper	0.0217	0.002[c]	1.3	1.4	Fail	**Pass**			**Pass**
SSD6DL06(diwet)	Copper	0.008	0.002[c]	1.3	1.4	Fail	**Pass**			**Pass**
SSD6DL21(diwet)	Hexavalent Chromium	0.055	0.039[b]	0.05	0.00016[c]	Fail	Fail	Fail	**Pass**	**Pass**
SSD6DL06(diwet)	Hexavalent Chromium	0.028	0.039[b]	0.05	0.00016[c]	**Pass**				**Pass**
SSD6DL21(diwet)	Iron	85.8	0.5[c]	NE	11	Fail	NA	Fail	**Pass**	**Pass**
SSD6DL01(diwet)	Iron	66.9	0.5[c]	NE	11	Fail	NA	Fail	**Pass**	**Pass**
SSD6DL26(diwet)	Iron	17.4	0.5[c]	NE	11	Fail	NA	Fail	**Pass**	**Pass**
SSD6DL06(diwet)	Iron	5.55	0.5[c]	NE	11	Fail	NA	Fail	**Pass**	**Pass**
SSD6DL21(diwet)	Lead	0.0152	0.001[c]	0.015	NE	Fail	Fail		**Pass**	**Pass**
SSD6DL01(diwet)	Lead	0.0124	0.001[c]	0.015	NE	Fail	**Pass**			**Pass**
SSD6DL26(diwet)	Lead	0.0039	0.001[c]	0.015	NE	Fail	**Pass**			**Pass**
SSD6DL06(diwet)	Lead	0.002	0.001[c]	0.015	NE	Fail	**Pass**			**Pass**
SSD6DL21(diwet)	Magnesium	31.9	112[b]	NE	NE	**Pass**				**Pass**
SSD6DL01(diwet)	Magnesium	27.3	112[b]	NE	NE	**Pass**				**Pass**
SSD6DL26(diwet)	Magnesium	13.3	112[b]	NE	NE	**Pass**				**Pass**
SSD6DL06(diwet)	Magnesium	8.29	112[b]	NE	NE	**Pass**				**Pass**
SSD6DL21(diwet)	Manganese	0.568	0.01[c]	NE	0.88	Fail	NA	**Pass**		**Pass**
SSD6DL01(diwet)	Manganese	0.492	0.01[c]	NE	0.88	Fail	NA	**Pass**		**Pass**
SSD6DL26(diwet)	Manganese	0.127	0.01[c]	NE	0.88	Fail	NA	**Pass**		**Pass**
SSD6DL06(diwet)	Manganese	0.0373	0.01[c]	NE	0.88	Fail	NA	**Pass**		**Pass**

Table 5-11. Analysis of Deionized Water Waste Extraction Test Results, Domestic Septic System 6 (continued)

Sample ID	Constituent	Concentration (mg/L)	Background (mg/L)	MCLs (mg/L)	Tap Water PRGs (mg/L)	Concentration < Background	Concentration < MCLs	Concentration < PRG	1/10 Concentration vs. MCL or PRG[a]	Overall Comparison
SSD6DL21(diwet)	Mercury	0.00033	0.0001[c]	0.002	0.011	Fail	**Pass**			**Pass**
SSD6DL01(diwet)	Mercury	0.00019	0.0001[c]	0.002	0.011	Fail	**Pass**			**Pass**
SSD6DL26(diwet)	Mercury	0.000066	0.0001[c]	0.002	0.011	**Pass**				**Pass**
SSD6DL01(diwet)	Molybdenum	0.0013	0.015[b]	NE	0.18	**Pass**				**Pass**
SSD6DL21(diwet)	Molybdenum	0.0013	0.015[b]	NE	0.18	**Pass**				**Pass**
SSD6DL21(diwet)	Nickel	0.427	0.078[b]	NE	0.73	Fail	**Pass**			**Pass**
SSD6DL01(diwet)	Nickel	0.364	0.078[b]	NE	0.73	Fail	**Pass**			**Pass**
SSD6DL26(diwet)	Nickel	0.0925	0.078[b]	NE	0.73	Fail	**Pass**			**Pass**
SSD6DL06(diwet)	Nickel	0.0298	0.078[b]	NE	0.73	**Pass**				**Pass**
SSD6DL01(diwet)	Nitrate	0.152	25.1[b]	10	10	**Pass**				**Pass**
SSD6DL21(diwet)	Vanadium	0.165	0.02[b]	NE	0.26	Fail	NA	**Pass**		**Pass**
SSD6DL01(diwet)	Vanadium	0.126	0.02[b]	NE	0.26	Fail	NA	**Pass**		**Pass**
SSD6DL26(diwet)	Vanadium	0.0466	0.02[b]	NE	0.26	Fail	NA	**Pass**		**Pass**
SSD6DL06(diwet)	Vanadium	0.0243	0.02[b]	NE	0.26	Fail	NA	**Pass**		**Pass**
SSD6DL21(diwet)	Zinc	0.22	0.03[b]	NE	11	Fail	NA	**Pass**		**Pass**
SSD6DL01(diwet)	Zinc	0.167	0.03[b]	NE	11	Fail	NA	**Pass**		**Pass**
SSD6DL06(diwet)	Zinc	0.0186	0.03[b]	NE	11	**Pass**				**Pass**
SSD6DL26(diwet)	Zinc	0.016	0.03[b]	NE	11	**Pass**				**Pass**

Notes

[a] This represents a 100-fold environmental attenuation factor.
[b] The background concentration represents the 80% lower confidence limit on 95th percentile of the ground water concentrations detected in well UCD-18.
[c] The background concentration represents the maximum detected concentration in well UCD-18 samples. There was insufficient detected data to calculate 80% lower confidence limit on the 95th percentile.
[d] The background concentration represents one half of the lowest reported detection limit for well UCD1-18 samples. Applies to COCs whose UCD1-18 results were all ND.

Table 5-11. Analysis of Deionized Water Waste Extraction Test Results, Domestic Septic System 6 (continued)

Abbreviations

DI WET	deionized water waste extraction test
ID	identification (number)
MCL	maximum contaminant level
mg/L	milligrams per liter
NA	not applicable
ND	not detected
NE	not established
PRG	preliminary remediation goal

Table 5-12. Evaluation of Ground Water Results, Domestic Septic System 6

Sample ID	Constituent	Concentration	Background (mg/l or pCi/l)	MCLs (mg/l or pCi/l)	Tap Water PRGs (mg/l or pCi/l)	Concentration < Background	Concentration < MCLs	Concentration < PRG
Pesticides		**mg/l**			**mg/l**			
WSD6DL01	4,4'-DDT	0.00011	ND	NE	200	NA	NA	**Pass**
WSD6DL01	Endrin aldehyde	0.00016	ND	NE	NE	NA	NA	NA
General Chemistry		**mg/l**	**mg/l**	**mg/l**	**mg/l**			
WSD6DL05	Hexavalent Chromium	0.051	0.039[a]	0.05	0.00016[b]	Fail	Fail	Pass
Metals		**mg/l**	**mg/l**	**mg/l**	**mg/l**			
WSD6DL03	Aluminum	1220	NE	NE	36	NA	NA	Fail
WSD6DL01	Aluminum	596	NE	NE	36	NA	NA	Fail
WSD6DL05	Aluminum	0.0326	NE	NE	36	NA	NA	**Pass**
WSD6DL01	Arsenic	0.0546	0.008	0.01	0.000045	Fail	Fail	Fail
WSD6DL03	Arsenic	0.0429	0.008	0.01	0.000045	Fail	Fail	Fail
WSD6DL03	Barium	24.6	0.187[a]	2	2.6	Fail	Fail	Fail
WSD6DL01	Barium	8.36	0.187[a]	2	2.6	Fail	Fail	Fail
WSD6DL03	Beryllium	0.0348	0.002[b]	0.004	0.004	Fail	Fail	Fail
WSD6DL01	Beryllium	0.0129	0.002[b]	0.004	0.004	Fail	Fail	Fail
WSD6DL03	Cadmium	0.0052	0.002[c]	0.005	0.018	Fail	Fail	**Pass**
WSD6DL03	Chromium	5.38	0.025[a]	0.1	55	Fail	Fail	**Pass**
WSD6DL01	Chromium	3.22	0.025[a]	0.1	55	Fail	Fail	**Pass**
WSD6DL03	Cobalt	2.63	0.002[b]	NE	2.2	Fail	NA	Fail
WSD6DL01	Cobalt	0.974	0.002[b]	NE	2.2	Fail	NA	**Pass**
WSD6DL03	Copper	2.6	0.002[b]	1.3	1.4	Fail	Fail	Fail
WSD6DL01	Copper	1.1	0.002[b]	1.3	1.4	Fail	**Pass**	
WSD6DL03	Iron	1950	0.502[b]	NE	11	Fail	NA	Fail
WSD6DL01	Iron	1160	0.502[b]	NE	11	Fail	NA	Fail
WSD6DL05	Iron	0.0303	0.502[b]	NE	11	**Pass**		
WSD6DL03	Lead	0.737	0.001[b]	0.015	NE	Fail	Fail	**Pass**
WSD6DL01	Lead	0.231	0.001[b]	0.015	NE	Fail	Fail	**Pass**
WSD6DL03	Magnesium	2110	112[a]	NE	NE	Fail	NA	
WSD6DL01	Magnesium	997	112[a]	NE	NE	Fail	NA	

Table 5-12. Evaluation of Ground Water Results, Domestic Septic System 6 (continued)

Sample ID	Constituent	Concentration	Background (mg/l or pCi/l)	MCLs (mg/l or pCi/l)	Tap Water PRGs (mg/l or pCi/l)	Concentration < Background	Concentration < MCLs	Concentration < PRG
Metals (continued)		**mg/l**	**mg/l**	**mg/l**	**mg/l**			
WSD6DL05	Magnesium	0.0103	112[a]	NE	NE	**Pass**		
WSD6DL03	Manganese	112	0.01[b]	NE	NE	Fail	NA	
WSD6DL01	Manganese	42.6	0.01[b]	NE	NE	Fail	NA	
WSD6DL05	Manganese	0.0012	0.01[b]	NE	NE	**Pass**		
WSD6DL01	Mercury	0.0012	0.0001[c]	0.002	0.011	Fail	**Pass**	
WSD6DL03	Mercury	0.0011	0.0001[c]	0.002	0.011	Fail	**Pass**	
WSD6DL03	Nickel	15.2	0.078[a]	NE	0.73	Fail	NA	Fail
WSD6DL01	Nickel	7.65	0.078[a]	NE	0.73	Fail	NA	Fail
WSD6DL03	Nitrate	24.2	25.1[a]	10	10	**Pass**		
WSD6DL01	Nitrate	16.8	25.1[a]	10	10	**Pass**		
WSD6DL01	Selenium	0.0773	0.006[c]	0.05	0.18	Fail	Fail	**Pass**
WSD6DL03	Silver	0.0036	5[c]	NE	0.18	Fail	NA	**Pass**
WSD6DL03	Vanadium	1.79	0.02[a]	NE	0.26	Fail	**Pass**	
WSD6DL01	Vanadium	1.51	0.02[a]	NE	0.26	Fail	**Pass**	
WSD6DL03	Zinc	4.92	0.03[a]	NE	11	Fail	NA	**Pass**
WSD6DL01	Zinc	2.45	0.03[a]	NE	11	Fail	NA	**Pass**
WSD6DL05	Zinc	0.0025	0.03[a]	NE	11	**Pass**	NA	**Pass**
Radionuclides		**pCi/l**	**pCi/l**	**pCi/l**	**pCi/l**			
WSD6DL01	Bismuth-214	20.9	35[b]	NE	248	**Pass**		
WSD6DL03	Bismuth-214	13.3	35[b]	NE	248	**Pass**		
WSD6DL01	Lead-212	19	3.6[b]	NE	1.90	Fail	NA	Fail
WSD6DL01	Lead-214	13.1	31.3[b]	NE	138	**Pass**		
WSD6DL01	Potassium-40	320	22[c]	NE	1.93	Fail	NA	Fail
WSD6DL03	Potassium-40	72	22[c]	NE	1.93	Fail	NA	Fail
WSD6DL03	Radium-226	2.85	1.14[a]	5	0.0008	Fail	**Pass**	
WSD6DL01	Radium-226	1.51	1.14[a]	5	0.0008	Fail	**Pass**	
WSD6DL05	Radium-226	0.642	1.14[a]	5	0.0008	**Pass**		
WSD6DL01	Thallium-208	6.82	2.15[c]	NE	NE	Fail	NA	

Table 5-12. Evaluation of Ground Water Results, Domestic Septic System 6 (continued)

Sample ID	Constituent	Concentration	Background (mg/l or pCi/l)	MCLs (mg/l or pCi/l)	Tap Water PRGs (mg/l or pCi/l)	Concentration < Background	Concentration < MCLs	Concentration < PRG
Radionuclides (continued)		**pCi/l**	**pCi/l**	**pCi/l**	**pCi/l**			
WSD6DL03	Thorium-230	0.522	NE	NE	0.52	NA	NA	**Pass**
WSD6DL05	Thorium-230	0.255	NE	NE	0.52	NA	NA	**Pass**
WSD6DL01	Thorium-232	0.151	NE	NE	0.47	NA	NA	**Pass**
WSD6DL01	Uranium-233/234	0.554	NE	27	0.663/0.674	NA	**Pass**	
WSD6DL05	Uranium-233/234	0.551	NE	27	0.663/0.674	NA	**Pass**	
WSD6DL03	Uranium-233/234	0.391	NE	27	0.663/0.674	NA	**Pass**	
WSD6DL05	Uranium-235/236	0.122	ND	27	0.684/0.711	NA	**Pass**	
WSD6DL01	Uranium-238	0.304	NE	27	0.74	NA	**Pass**	

Notes

[a] The background concentration represents the 80% lower confidence limit on 95th percentile of the ground water concentrations detected in well UCD-18.
[b] The background concentration represents the maximum detected concentration in well UCD-18 samples. There was insufficient detected data to calculate 80% lower confidence limit on the 95th percentile.
[c] The background concentration represents one half of the lowest reported detection limit for well UCD1-18 samples. Applies to COCs whose UCD1-18 results were all ND.

Abbreviations

DDT	dichlordiphenyl trichlor
ID	identification (number)
MCL	maximum contaminant level
mg/l	milligrams per liter
NA	not applicable
ND	not detected
NE	not established
pCi/l	picoCuries per liter
PRGs	preliminary remediation goal

Table 5-13. Domestic Septic Systems 3 and 6 Removal Actions Air Monitoring Data Summary

Contaminant of Concern	Units	Average Concentration	Maximum Concentration	Background Concentration[1]	DCG	PRG	PEL	Average Concentration > Background	Maximum Concentration > Regulatory Limit[2]
Barium	$\mu g/m^3$	0.0034	0.004	0.0016	N/A	0.52	500	Yes	No/No[3]
Cadmium	$\mu g/m^3$	0.0002	0.0002	0.0001	N/A	0.0011	5	Yes	No/No[3]
Cesium-137	µCi/ml	2.05E-18	4.5E-17	5.19E-17	4E-10	N/A	N/A	No	No
Chromium	$\mu g/m^3$	0.0015	0.0017	0.0016	N/A	0.000023	500	No	Yes/No[3]
Copper	$\mu g/m^3$	0.0203	0.0331	0.0061	N/A	N/A	1,000	Yes	No
Lead	$\mu g/m^3$	0.0014	0.0019	0.0007	N/A	N/A	0.05	Yes	No
Lead-210	µCi/ml	2.16E-14	3.53E-14	4.37E-15	9E-13[4]	N/A	N/A	Yes	No
Mercury	$\mu g/m^3$	5.73E-05	6.76E-05	2.47E-05	N/A	0.31[5]	10[6]	Yes	No/No[3]
Radium-226	µCi/ml	3.56E-16	5.84E-16	5.56E-16	1E-12[7]	N/A	N/A	Yes	No
Strontium-90	µCi/ml	3.62E-17	4.94E-17	ND	9E-12	N/A	N/A	Yes	No

Notes

[1] The background concentration is the air concentration detected at the background air monitoring station, AM-3, during the Domestic Septic Systems 3 and 6 removal actions.
[2] Regulatory limit refers to derived concentration guides for radionuclides and preliminary remediation goals/ permissible exposure limits for metals.
[3] The left side states whether the maximum concentration is greater than the preliminary remediation goal. The right side states whether the maximum concentration is greater than the permissible exposure limit.
[4] Derived concentration guide value for lung retention class "D"
[5] Preliminary remediation goal for elemental mercury
[6] Mercury (aryl and inorganic compounds)
[7] Derived concentration guide value for lung retention class "W"

Abbreviations

DCG	derived concentration guide
N/A	not applicable
ND	not detected
PEL	permissible exposure limit
PRG	preliminary remediation goal for ambient air
$\mu g/m^3$	microgram per cubic meter
µCi/ml	microCurie per milliliter

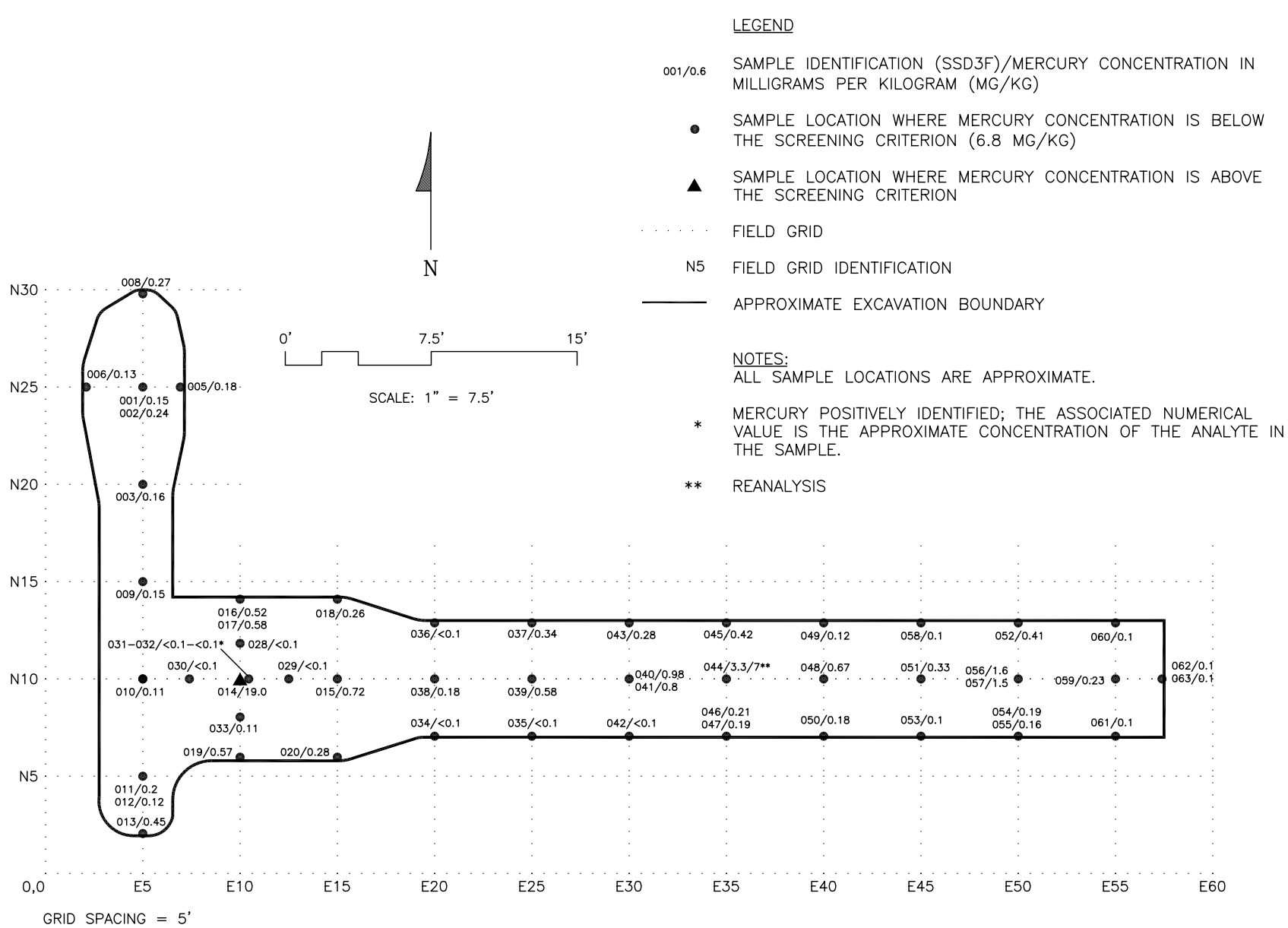

Figure 5-1. Excavation Screening Sample Locations and Mercury Concentrations, Domestic Septic System 3 Removal Action

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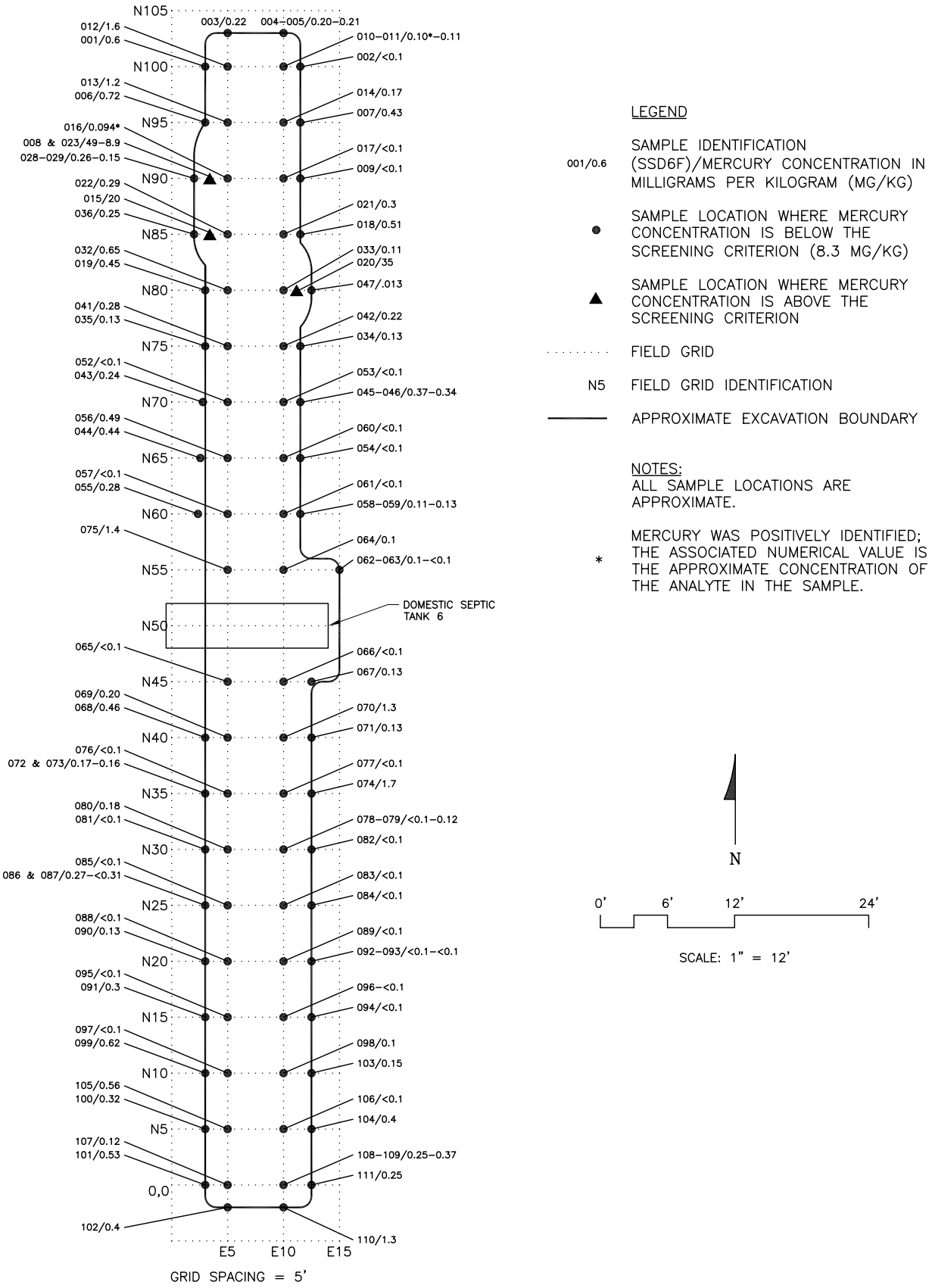

Figure 5-2 Screening Sample Locations and Mercury Concentrations, Domestic Septic System 6 Removal Action

WEISS ASSOCIATES

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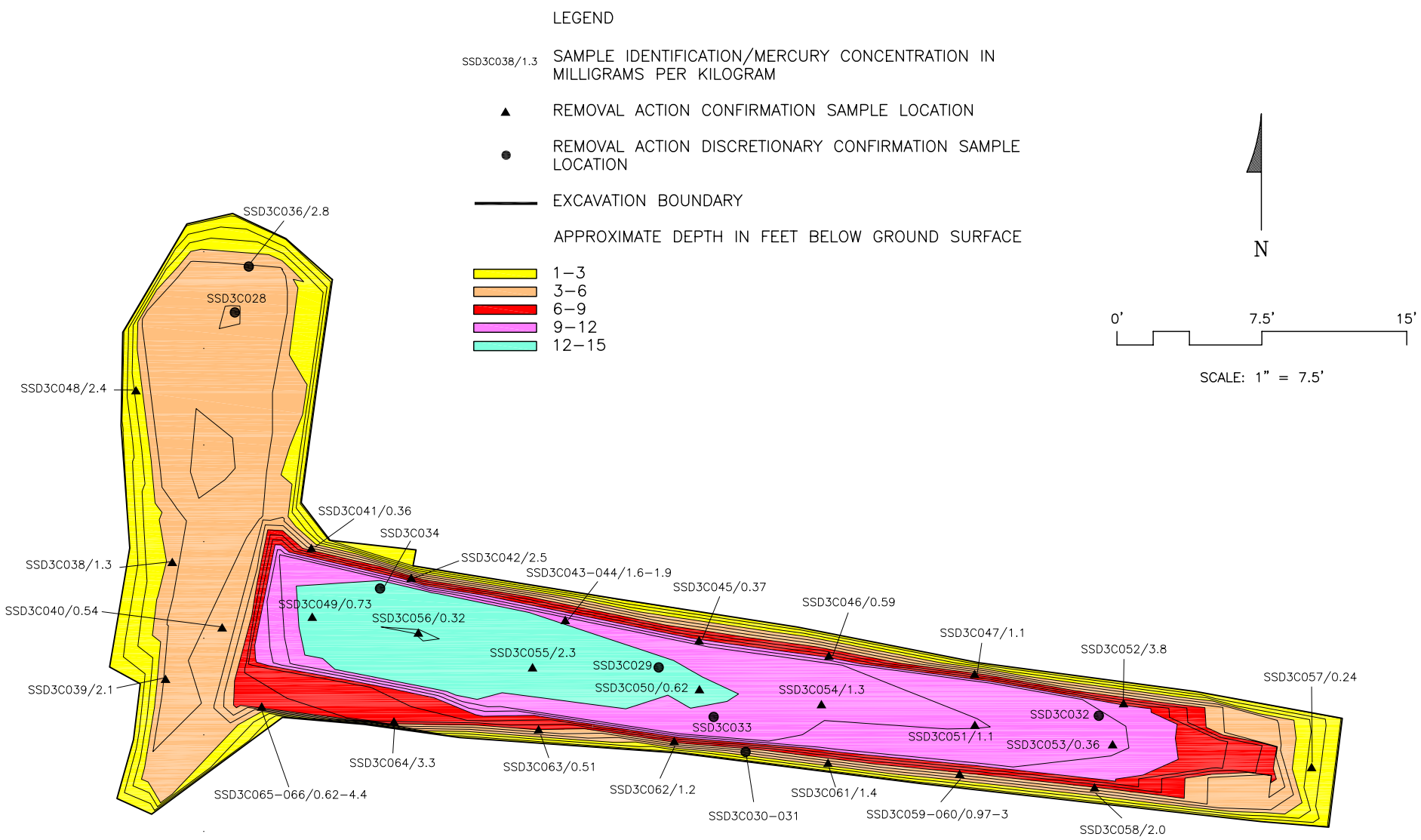

Figure 5–3. Confirmation Sample Locations and Mercury Concentration, Domestic Septic System 3 Removal Action

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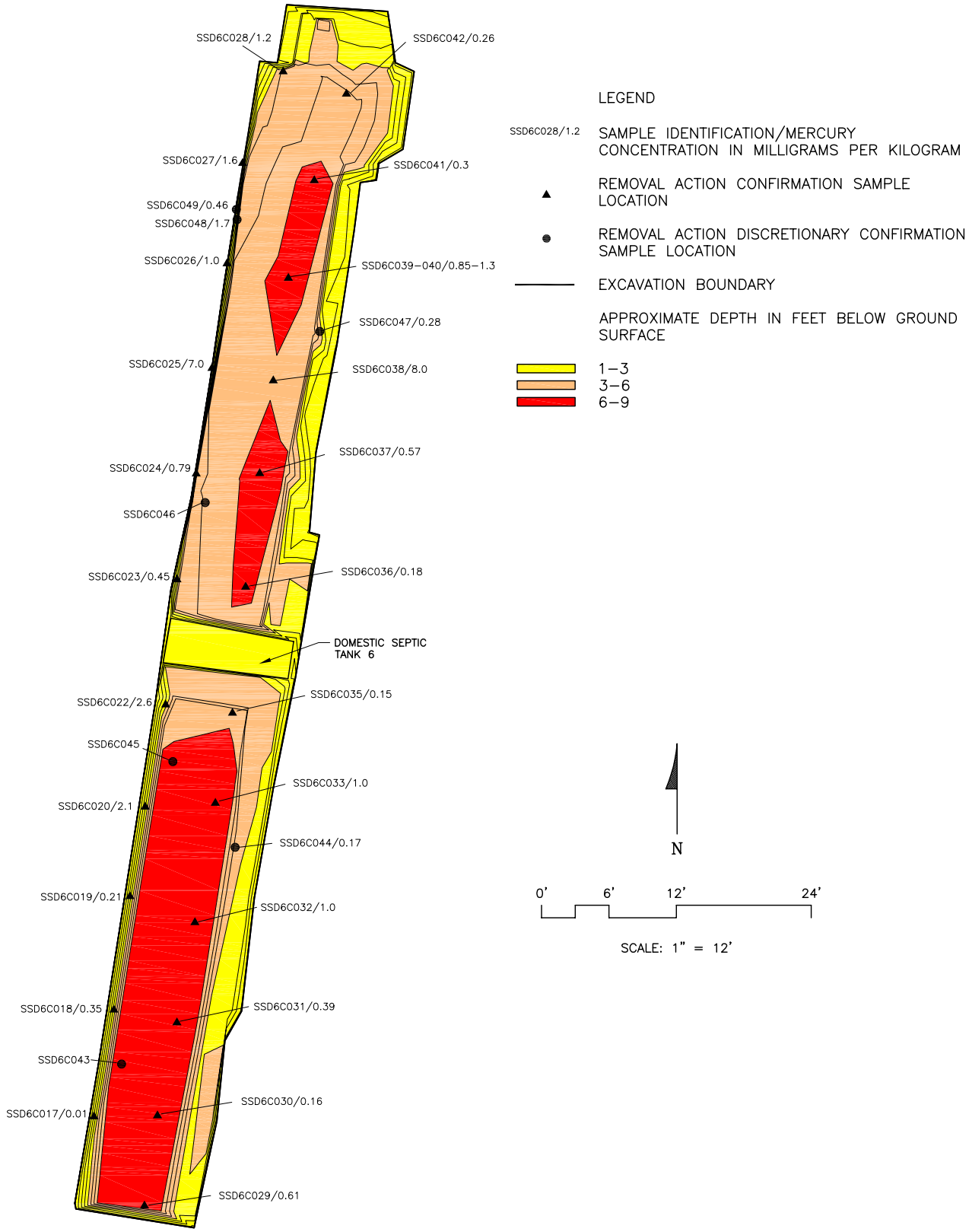

Figure 5-4 Confirmation Sample Locations, Domestic Septic System 6 Removal Action

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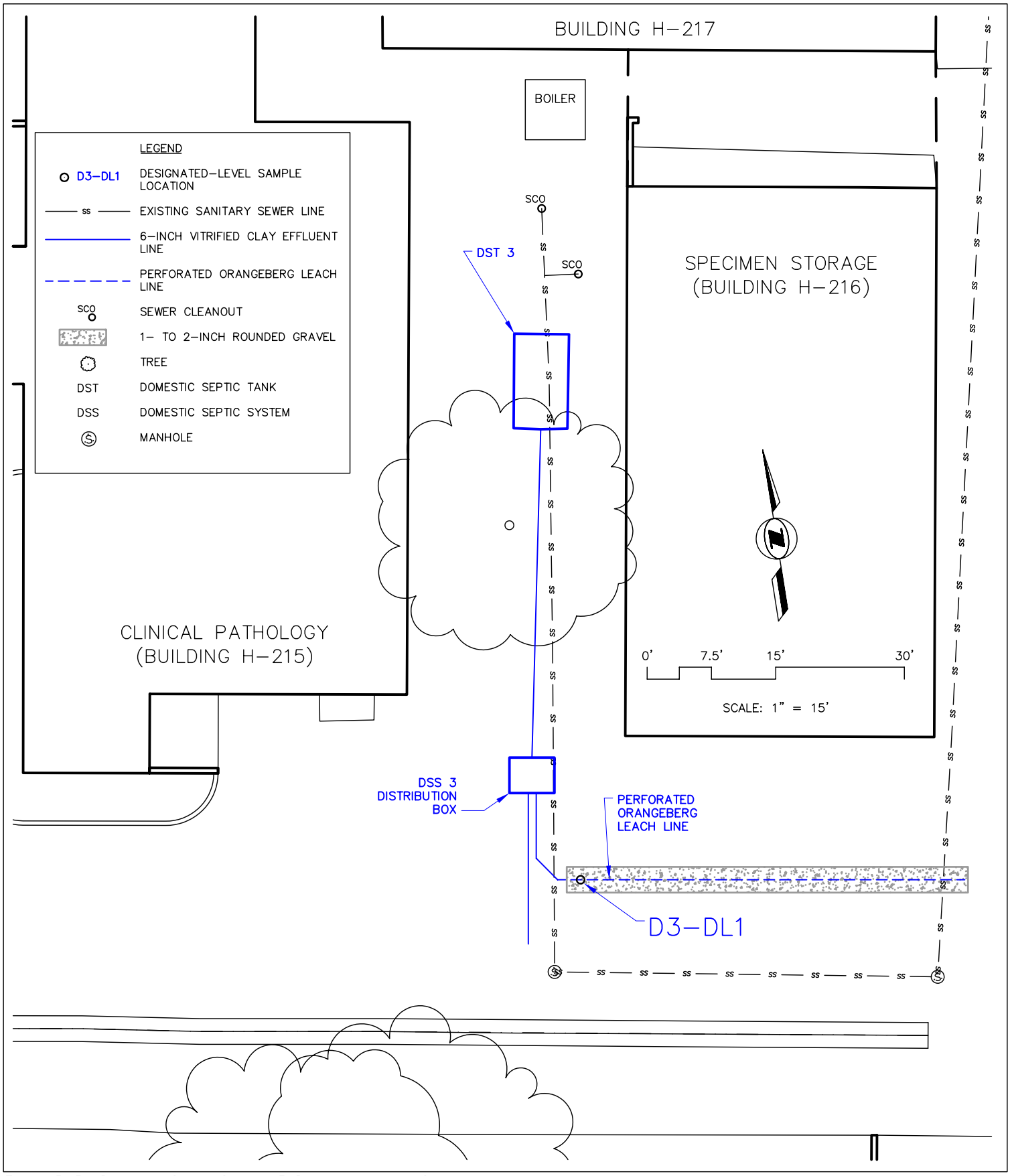

Figure 5-5. Domestic Septic System 3 Designated-Level Sample Location

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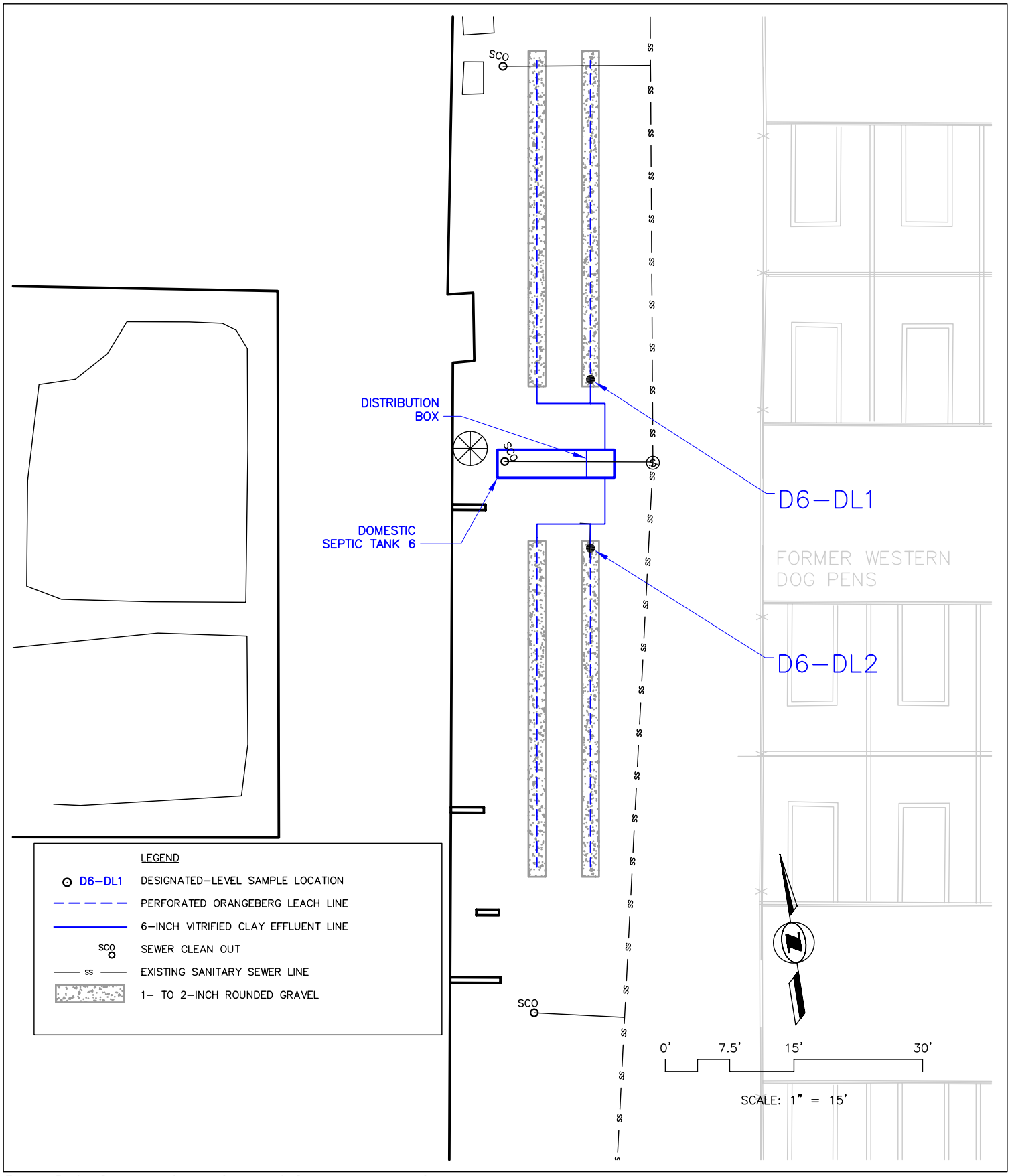

Figure 5-6. Domestic Septic System 6 Designated-Level Sample Locations

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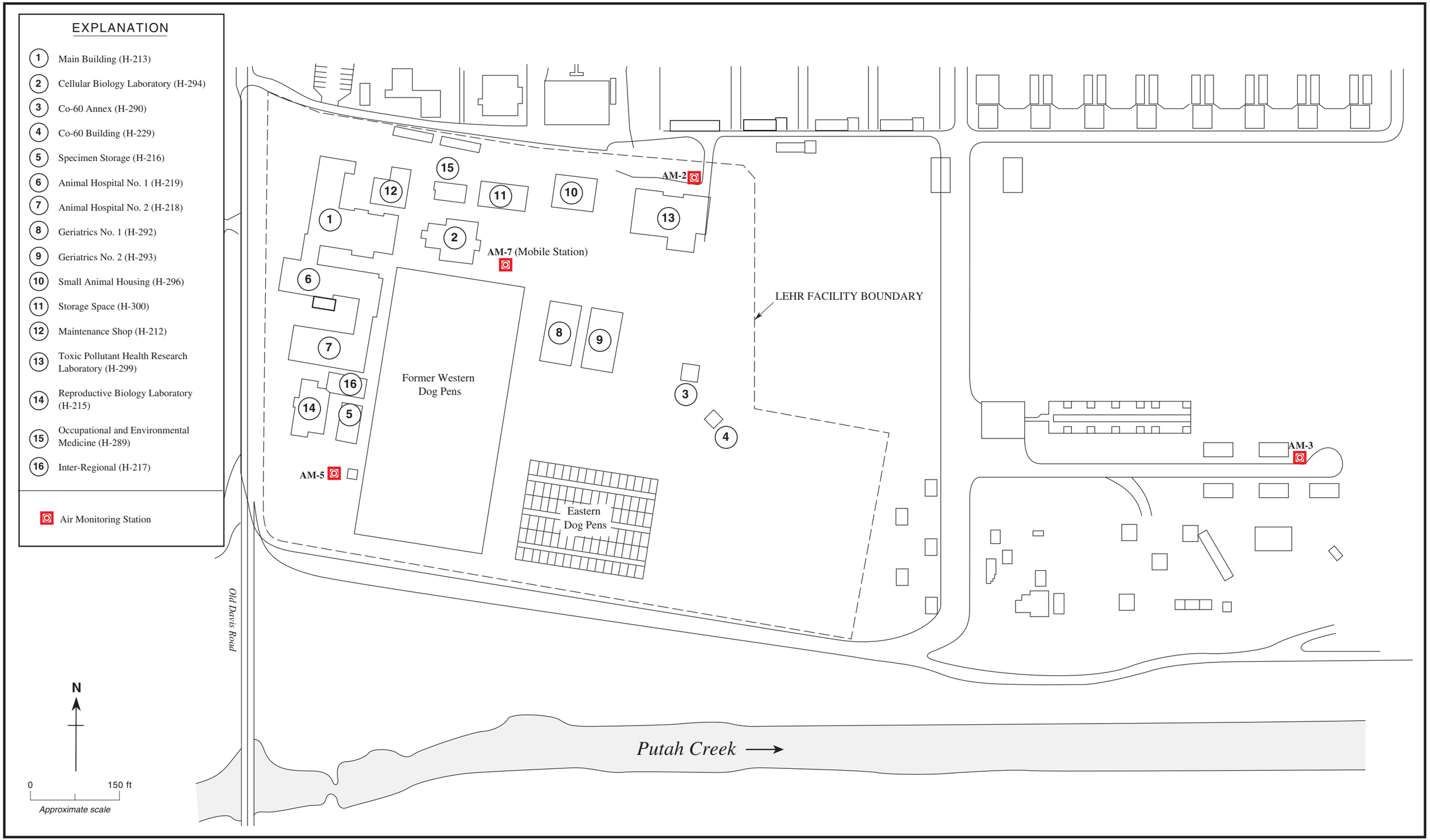

Figure 5-7. LEHR Air Monitoring Station Locations

Weiss Associates

6. PHASE II DATA EVALUATION

The data from the DSSs 3 and 6 RAs were evaluated in two phases:

- The Phase I Data Evaluation, presented to the RPMs on June 18, 2002, was based on field sampling and screening methods summarized in Section 5; and,
- The Phase II Data Evaluation, contained in this section, was based on analytical laboratory results from confirmation and DL samples. Figure 6-1 is a decision flow diagram for the Phase II Data Evaluation.

The Phase I Data Evaluation occurred immediately following waste removal while the excavations were open. The Phase I data were used to guide the excavation activities and was based on screening sample analyses conducted during the RAs. The Phase I Data Evaluation was presented to the RPMs on June 18, 2002 to reach consensus on whether cleanup goals were attained for driver COCs. During the June 18 meeting, decisions were reached to proceed with collecting confirmation samples, backfilling the excavations, and restoring the site. The June 18 meeting satisfied the Phase I Data Evaluation objectives described in the Work Plan.

The Phase II Data Evaluation was completed after all analytical results from the confirmation and DL sampling were received. Figure 6-2 presents the data evaluation process. During the Phase II Data Evaluation, confirmation and DL sampling results were tabulated according to chemical group, and then risk and DL analyses were conducted. These analyses were used to determine whether the RAOs presented in Section 1.3 were attained and, if not, make recommendations regarding any additional required actions. The first step in the Phase II Data Evaluation was data management and validation, as described below.

6.1 Data Reduction/Verification/Reporting and Records Management

Obtaining valid and comparable data requires adequate QA/QC procedures and documentation. The QA requirements applicable to the RA activities are provided in the Final QAPP (WA, 2000a). The QAPP was based upon the requirements of DOE Order 5700.6c "Quality Assurance" and QAMS-005/80 (US EPA, 1980) "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans" as they are applicable to the RA scope of work.

Per the QAPP and Work Plan, the following activities were conducted to ensure data usability:

- Sample collection QA/QC;
- Data reduction, verification, reporting, and validation; and,
- Data management.

6.1.1 Sample Collection Quality Assurance/Quality Control

Field QA/QC samples were collected to ensure reliability of field sampling procedures and materials. Eight field duplicates greater than 10% of the 67 confirmation samples, and 1 equipment rinsate blank were collected following the RA, as required in the QAPP and Work Plan. The relative percent difference between Hg results was greater than 100% in two of three field duplicate pairs from the DSS 3 confirmation samples and one of three field duplicate pairs from the DSS 6 confirmation samples. Relative percent difference values were high despite measures taken to homogenize the samples before Hg analysis. All field duplicate samples were homogenized in the field before being split into field duplicate pairs. In addition, all samples were dried, pulverized and thoroughly mixed in the laboratory before Hg sample preparation. Because the Hg samples were pulverized and homogenized to a maximum particle size of 0.01 grams (g), Hg may be present in extremely small particles (<0.01 g) of high concentration.

6.1.2 Data Reduction, Verification, Reporting, and Validation

Accurate data reduction, validation, and reporting protocols are necessary to interpret data and make sound decisions. After the RA confirmation sampling was completed, data reduction, verification, reporting, and validation were performed, as required by the QAPP and RA Work Plan.

Independent of the laboratory review, WA performed data validation and verification on the analyzed samples using the "US EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review" (US EPA, 1988a) and "US EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review" (US EPA, 1988b). Analytical results were qualified as a result of the data validation process in accordance with the flagging convention described in the QAPP.

Sample results and associated QA/QC results that were reviewed included (as applicable): holding times, field and laboratory blank results, laboratory control sample spike results, matrix spike/matrix spike duplicate recovery failure (m qualifier), laboratory matrix duplicate results, surrogate recoveries and internal standard performance. All sample results were identified as usable (no qualifier), estimated and usable (with J or UJ qualifier), or rejected and unusable (with R qualifier). Rejected data and data containing substantial untraceable omissions or errors were removed from the database before determining the COC concentration terms. Twenty of the 33 DSS 3 confirmation samples were re-collected and reanalyzed for hexavalent chromium because the contract-required detection limit was not achieved for the original samples. Similarly, 24 of 26 DSS 6 confirmation samples were re-collected and reanalyzed for hexavalent chromium because the contract-required detection limit was not met for the original samples. It is important to note that the original hexavalent chromium data were not R-qualified (rejected) during data validation. However, the original data were not used because they were of lower quality than the re-collected and reanalyzed samples that achieved the contract-required detection limit. Eighteen DSS 6 DL Hg samples were Jm-qualified due to a batch matrix spike recovery of 377%. These results were qualified during data validation to indicate the matrix spike recovery was outside of control limits (75% to 125%). Because the matrix spike recovery was well above the control limit, the reported

mercury concentrations may have a large positive bias. These samples should be re-analyzed to obtain higher quality results. However, the original samples have significantly exceeded the holding time requirement of 28 days. The DSS 6 DL mercury samples will be re-collected to confirm these results.

Only 0.5% of DSS 3 confirmation data were qualified with an R qualifier (rejected and unusable) during data validation. None of the DSS 6 confirmation data were rejected with an R qualifier.

6.1.3 Data Management

All electronic records were compared with the laboratory hard copy results to assure electronic database quality. Differences between electronic records and hard copy results were documented and resolved by investigating the validated data packages. Electronic records that contained errors were corrected and the corrections were documented and stored with the data validation records and detailed data packages. No errors were found on the hard copy results. The constituents that were detected in at least one DSS 3 confirmation sample, but were not included in the risk analysis because they do not have RBAS values are: actinium-228, arsenic, beryllium, cobalt, iron, lead-212, nickel, nitrate, potassium-40, Ra-228, thallium-208, thorium-230, uranium-233/234 and uranium-238 and vanadium. The upcoming Site-Wide Risk Assessment will address all positive detections from the confirmation data set.

Some COCs were reported below laboratory detection limits for the confirmation samples. Per the Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance (DOE, 1991) and Statistical Methods for Environmental Pollution Monitoring (Gilbert, 1987), the data were managed as follows:

- All radionuclide results were used in statistical tests and sample statistic determinations including negative values, zero values and results below the minimum detectable activity. All radiological data were used to avoid bias in the statistical tests, concentration term calculations used in the risk screening, and sample statistics (Gilbert, 1987; DOE, 1991).
- For non-radionuclides, only values above the laboratory/contract-required detection limit or analytical method detection limit were used to calculate the concentration terms for the risk screening (Gilbert, 1987).

6.1.4 Data Summary

Analytical results are compared to RBAS values in Section 6.2.2. Notable findings based on review of the DSSs 3 and 6 confirmation data are discussed below.

6.1.4.1 Domestic Septic System 3

Notable findings based on review of the DSS 3 confirmation data include:

- All SVOC and VOC confirmation sample analytical results were below the detection limits.
- All of the cadmium, copper and lead results were below their respective background concentrations.
- All of the metals confirmation results were below their respective PRGs.
- All of the radionuclide confirmation sample analytical results were below background with the exception of Cs-137 and Sr-90.
- All alpha and gamma chlordane and heptachlor epoxide confirmation sample analytical results were below their respective PRGs.

6.1.4.2 Domestic Septic System 6

Notable findings based on review of the DSS 6 confirmation data include:

- All SVOC and VOC confirmation sample analytical results were below their detection limits.
- All copper and barium confirmation results were below their respective background concentrations.
- All Hg confirmation results were below the PRG.

6.2 Risk Screening

The risk screening conducted for this report evaluated potential impacts to human health at the three receptor locations shown in Figure 6-3. A risk-screening evaluation was conducted using RBAS values developed for the Site (Section 6.2.2). The purpose of the risk screening was to determine if excess cancer risk was within the US EPA acceptable range of 10^{-4} to 10^{-6} and if non-carcinogenic effects were less than the cumulative hazard quotient (HQ) of 1.0. All of the constituents that were measured above the detection limit and had established RBAS values were included in the risk screening. All positive detections from the confirmation data set will be addressed in the Site-Wide Risk Assessment.

6.2.1 Background Concentrations

Background concentrations of COCs in LEHR-area soil (Tables 6-1 and 6-2) were calculated using analytical results of off-site soil samples and US EPA-approved statistical methods. This evaluation used background concentrations presented in Appendix C of the Radium/Strontium Treatment Systems Work Plan (WA, 2000e). Specifically, the 80% lower confidence limit of the

95th quantile for the available off-site soil data was selected to represent the background value for each COC.

All of the DSS 6 RA confirmation samples were collected at depths greater than four ft bgs. All of the DSS 3 RA confirmation samples were collected at depths greater than 4 ft bgs with the exception of two samples collected at 3.6 ft bgs. Therefore, the background concentrations calculated for soil greater than four ft deep were used for the background comparisons during the DSSs 3 and 6 Phase II Data Evaluation.

6.2.2 Risk-Based Action Standards

RBASs for the DOE areas at the LEHR site were developed and presented in the *Draft Final Determination of Risk-Based Action Standards Report* (WA, 1997a). The RBAS values are site-specific concentrations that yielded the target incremental cancer risk or non-cancer risk for each COC. DOE and the regulatory agencies use the RBAS values as cleanup guidelines during RAs.

The RBAS values are single COC concentrations which, if present in soil at DOE areas of the LEHR site, might result in the specified maximum individual excess cancer risk level (or HQ) to an exposed individual. RBAS values were developed using US EPA guidance for developing risk-based PRGs using a back-calculation approach for both carcinogenic and non-carcinogenic COCs.

Calculating the RBAS values included the following steps (WA, 1997a):

- Identifying the COCs present in soil media at DOE areas of the LEHR site. Seventy-four chemicals and radionuclides were identified as LEHR site COCs. Of these 74 COCs, only barium, copper, Hg and hexavalent chromium were identified as COCs at DSS 6 (WA, 2002). Cadmium, copper, lead, Hg, chromium, silver, Cs-137, Pb-210, Ra-226, Sr-90, formaldehyde, alpha and gamma chlordane, heptachlor epoxide, hexavalent chromium and nitrate were identified as COCs at DSS 3. At the request of the RPMs, SVOC and VOC samples were also collected from the DSSs 3 and 6 areas and one soil sample was also collected beneath the effluent line between DST 3 and the DSS 3 DB and analyzed for a full suite of constituents including metals, SVOCs, VOCs, radionuclides, and pesticides/PCBs. All of the COCs that had analytical results above the detection limit and an established RBAS were included in the risk screening.
- Identifying possible exposure pathways and scenarios;
- Conducting fate and transport modeling to relate on-site concentrations of the COCs to concentrations in exposure media;
- Calculating the chemical dose or intake for each COC; and,
- Performing iterative back-calculations to determine the source soil concentration or RBAS that yielded the acceptable incremental cancer or non-cancer risk.

For carcinogenic compounds, the RBAS values used in this risk screening are based upon a level of protection equal to the excess upper bound lifetime cancer risk of 10^{-6}. For systemic non-carcinogenic compounds, the RBAS values are equivalent to an HQ of 1.0, representing no significant adverse effect during a lifetime. The non-carcinogenic Scenario 2 RBASs (see below) for Hg at DSSs 3 and 6 were recalculated using new contamination intervals based on confirmation and DL data (Appendix C). The carcinogenic Scenario 2 RBAS for heptachlor epoxide at DSS 3 was recalculated because this compound was only detected in one of 27 confirmation samples. The original RBAS calculation for heptachlor epoxide used a contamination interval of zero to 15 ft bgs. The DSS 6 confirmation sample with the heptachlor epoxide detection was collected 5.2 ft bgs. The heptachlor epoxide RBAS for the DSS 6 area was recalculated using a contamination interval of 5 to 6 ft bgs to more accurately represent the contaminant distribution in this area (Appendix C). The 2000 PRGs included a non-cancer slope factor for heptachlor epoxide, therefore, an RBAS with a non-cancer end-point was also calculated.

Risk assessments evaluate excess or incremental risk due to the presence of contaminants above background or naturally occurring contaminant levels. Background is typically identified as contributing zero excess or incremental risk since the contaminants are present regionally and are often naturally occurring. For some of the COCs, the RBAS values are less than their background concentrations. In these cases, the action standard is set at background. Additionally, if a COC is detected at or below background levels, it was assumed that it does not contribute to excess or incremental risk and was removed prior to the risk screening.

Three risk exposure scenarios have been developed (WA, 1997a) and RBAS values were calculated for each scenario. The RBAS values for the 10^{-6} excess cancer risk level and HQ equal to 1.0 for the DSSs 3 and 6 COCs under each risk scenario are presented in Tables 6-1 and 6-2. Figure 6-3 shows the locations of the receptors. Each scenario is described below.

- Scenario 1: On-Site Researcher—Represents potential on-site workers that may be exposed to source area soil through external radiation from radionuclides at or near the ground surface (for radionuclides only), ingestion, inhalation and dermal exposure.
- Scenario 2: East Side Residential Farmer—Represents potential off-site residential farmers that may be exposed to potentially impacted ground water, potentially impacted surface water (via recreational use), and via external radiation from radionuclides at or near the ground surface (for radionuclides only). Exposure is through inhalation of fugitive dust, soil ingestion, and consumption of agricultural foods that are potentially impacted by fugitive dust migration from the on-site source areas.
- Scenario 3: South Side Residential Farmer—Identical to Scenario 2 except that exposure to impacted ground water is not included, since ground water flow from potential on-site LEHR sources is away from this receptor location. It is assumed that ground water contamination does not impact Putah Creek.

6.2.3 Reasonable Maximum Exposure

US EPA guidance (US EPA, 1994) recommends using a reasonable maximum exposure (RME) for Superfund risk assessments. The RME is a conservative estimate of intake and is defined as the highest exposure that could reasonably be expected to occur for a given exposure pathway at a site. The RME accounts for inherent environmental media sampling uncertainty in the contaminant concentration.

Per US EPA (1994), statistical calculations were performed for each COC to determine the concentration terms. The statistical calculations included determining the mean, standard deviation, and the 95% upper confidence limit (UCL) on the mean of data. The 95% UCL is a statistical value that is often calculated for Superfund sites to conservatively compare the cleanup area or remediation unit data to a pre-determined level such as the RBAS.

The US EPA recommends that the 95% UCL be used as the concentration term, or RME, in Superfund assessments because of the uncertainty associated with the true average concentration at a site. Though sampling plans are developed to collect an adequate number of samples to characterize the contamination at a site, the true mean of the contamination data set is rarely known or available.

The 95% UCL provides reasonable confidence that the true site average concentration will not be underestimated. The 95% UCL is defined as a value that, when calculated repeatedly for randomly drawn subsets of a site's data, equals or exceeds the true mean for the Site's concentration 95% of the time. Therefore, the 95% UCL is used as the average concentration because it is an available statistical value as opposed to the true mean of the population which typically is not available.

The 95% UCL varies depending on the distribution of the data and the mean for the data set and is calculated for a normally distributed data set, using the following formula:

$$95\%\ UCL = \bar{x} + t_{.05}(S/(N)^{1/2})$$

Where,

$\bar{x}$	=	Mean of the data set
$t_{.05}$	=	Student t value for a one-tailed 95% confidence interval and the representative number of degrees of freedom
S	=	Standard deviation of the data set
N	=	Number of samples

Three COCs (barium, chromium and copper) have log-normally distributed confirmation data sets based on the background data sets. It is assumed, therefore, that the confirmation data sets for these three COCs are also log-normally distributed. The following log-normal formula is used to calculate the 95% UCL on the mean for these data sets:

$$95\%\ UCL = e^{\bar{x}+0.5s^2+sH/(n-1)^{0.5}}$$

Where,

e	=	Constant (base of the natural log, equal to 2.718)
$\bar{x}$	=	Mean of the transformed data set
s	=	Standard deviation of the transformed data
H	=	H-statistic (from the table published in Gilbert, 1987)
N	=	Number of samples

If less than ten samples[1] contain detectable concentrations, the maximum detected concentration was selected as the concentration term or RME for the risk screening. At DSS 3, this was the case for 19 of the 30 COCs. At DSS 6, one of four COCs had less than ten detectable concentrations. Otherwise, the 95% UCL on the mean was calculated to determine the concentration term or RME for the COC, using US EPA procedures (US EPA, 1992). Tables 6-4 and 6-5 present the RMEs for all detected COCs at DSSs 3 and 6, respectively.

6.2.4 Background Comparison

Background comparisons were performed for COCs with an RBAS less than the background value (Table 6-3). Background comparisons were performed for the DSS 3 cadmium, copper, lead, Hg and Ra-226. Background comparisons were performed for the DSS 6 barium, copper and Hg confirmation data. Per US EPA (1994), these were performed by comparing the data set for the background off-site soil data to the confirmation sampling data set for each applicable COC. For VOCs, SVOCs, and pesticides/PCBs, where no background data exist, the reported detection limit was used for the comparison.

US EPA guidance recommends the Wilcoxon Rank Sum (WRS) and the Quantile tests to perform the background comparison. These tests are outlined in the Statistical Method for Evaluating the Attainment of Cleanup Standards, Vol. 3 (US EPA, 1994). The WRS test is used to determine whether the RA has uniformly attained the cleanup goal for a particular COC throughout the cleanup unit, whereas the Quantile Test is more appropriate to detect when an RA has failed in only a few areas within the cleanup unit.

The results of the WRS and Quantile tests from the background comparisons are summarized in Table 6-3. The DSS 3 cadmium, copper, lead and Ra-226 data sets passed the WRS and Quantile tests. The DSS 6 barium and copper data sets passed the WRS and Quantile tests. All of these COCs were eliminated from their respective risk screenings, since their confirmation data sets were similar to background and were therefore assumed not to contribute to excess or incremental risk at the site.

[1] Sampling data from Superfund sites have shown that data sets with fewer than 10 samples per exposure area provide poor estimates of the mean concentration (US EPA, 1992). Thus, the maximum concentration is selected to represent the data set.

The DSSs 3 and 6 Hg data sets both failed the WRS and Quantile tests and histogram comparisons. The data suggests that Hg is present in concentrations above background for the Site. Accordingly, Hg was not removed from the risk screening.

6.2.5 Risk Calculation

The risk screening assessed whether the first and second RAOs for the DSSs 3 and 6 RAs were attained. The risk screening decision process is illustrated in Figure 6-4. For each carcinogenic COC with an RBAS above the background concentration, the RME is divided by the RBAS at specified risk levels (10^{-6}, 10^{-5}, and 10^{-4}). The sum of the RME/RBAS ratios for all COCs with an RBAS above the background concentration are then computed for each of the three risk scenarios. If the cumulative sum of the ratios is less than 1.0, the screening level evaluation concludes that the first RAO has been met.

A similar ratio is calculated for the cumulative HQ for non-carcinogenic COCs. If the sum of the RME/RBAS ratios for the non-carcinogens is less than 1.0, the risk screening concludes the second RAO has been attained.

Below is an example of the calculation method used for the RME to RBAS comparisons.

Individual COC

$$\frac{RME_1}{RBAS_{1Scenario_n}} = \text{ratio of RME to the RBAS for each scenario (n = Scenario 1, 2 or 3)}$$

where:

RME_1 = RME for COC_1

$RBAS_1$ = RBAS for COC_1, in Scenario n

Cumulative Carcinogenic COCs

$$\text{cumulative ratio} = \sum \frac{RME_1}{RBAS_{1Scenario_n}} + \frac{RME_2}{RBAS_{2Scenario_n}} + \frac{RME_3}{RBAS_{3Scenario_n}} \cdots + \frac{RME_m}{RBAS_{mScenario_n}}$$

Cumulative Non-Carcinogenic COCs

$$\text{cumulative ratio} = \sum \frac{RME_1}{RBAS_{1Scenario_n}} + \frac{RME_2}{RBAS_{2Scenario_n}} + \frac{RME_3}{RBAS_{3Scenario_n}} \cdots + \frac{RME_m}{RBAS_{mScenario_n}}$$

Tables 6-6 and 6-7 show the RME/RBAS ratios for each COC and each scenario at the 10^{-6} excess cancer risk level, and HQ = 1.0 non-carcinogenic risk level for DSSs 3 and 6 confirmation data, respectively. Tables 6-8 and 6-9 show the cumulative RME/RBAS ratios for each scenario at the 10^{-6}, 10^{-5}, and 10^{-4} excess cancer risk levels and HQ = 1.0 non-carcinogenic risk level for DSSs 3 and 6, respectively.

6.2.5.1 Cancer Risk Calculations

Comparison of the RBAS values to the measured soil concentrations indicates that none of the individual COCs exceed the carcinogenic RBAS values in the DSS 3 or 6 areas for the 10^{-6}, 10^{-5}, or 10^{-4} target risk levels after the RA. At 10^{-6}, 10^{-5} and 10^{-4} target incremental carcinogenic risk levels, none of the cumulative RME/RBAS ratio exceed 1.0 for the DSSs 3 and 6 data sets.

Tables 6-6 and 6-7 show the DSS 3 individual carcinogenic COC RME/RBAS ratios and the cumulative carcinogen RME/RBAS ratios, respectively. Tables 6-8 and 6-9 show the DSS 6 individual carcinogenic COC RME/RBAS ratios and the cumulative carcinogen RME/RBAS ratios, respectively.

These data demonstrate that the cumulative residual risk for carcinogens falls within the US EPA Comprehensive Environmental Response, Compensation and Liability Act risk range of 10^{-4} to 10^{-6}. Thus, the DSSs 3 and 6 RAs achieved RAO No. 1 by reducing the cumulative cancer risk to a nominal range of 10^{-4} to 10^{-6}.

6.2.5.2 Non-Cancer Risk Calculations

6.2.5.2.1 Domestic Septic System 3

Comparison of the RBAS values to the measured site soil concentrations indicates that only one COC, Hg, exceeds its non-carcinogenic RBAS value based on an HQ of 1.0 after the DSS 3 RA. Tables 6-6 and 6-8 show individual non-carcinogenic COC RME/RBAS ratios and the cumulative non-carcinogen RME/RBAS ratio, respectively.

Scenario 2 (East Side Residential Farmer) is the only scenario that had a cumulative HQ that exceeded 1.0. At DSS 3, the cumulative HQ for Scenario 2 is 3.22. Hg is the most significant contributor to the cumulative HQ with a ratio of 1.73. These data indicate that the DSS 3 RA has not achieved the second RAO by reducing the cumulative non-cancer HQ to below 1.0.

6.2.5.2.2 Domestic Septic System 6

Comparison of the RBAS values to the measured site soil concentrations indicates that only one COC, Hg, exceeds its non-carcinogenic RBAS value based on an HQ of 1.0 after the DSS 6 RA. Tables 6-7 and 6-9 show individual non-carcinogenic COC RME/RBAS ratios and the cumulative non-carcinogen RME/RBAS ratio, respectively.

Scenario 2 is the only scenario that had a cumulative HQ that exceeded 1.0. Scenario 2 conservatively assumes that ground water being ingested from an off-site residential well contains a soluble form of Hg and that the receptor is ingesting the peak Hg concentration. At DSS 6, the

cumulative HQ for Scenario 2 is 2.50. Hg is the most significant contributor to the cumulative HQ with a ratio of 2.40.

The Hg HQ was also above 1.0 at the DSS 3, Southwest Trenches and Radium and Strontium Treatment Systems Areas. Hg above an HQ of 1.0 at many areas of the LEHR site could be due to the conservative assumptions that ground water would be ingested under Scenario 2.

6.2.5.3 Comparisons of Preliminary Remediation Goals to Reasonable Maximum Exposure Values

The RME values for each COC were compared to the following action standards:

- Chemical Constituents—Residential PRGs established by US EPA Region 9 in November 2000; and,
- Radionuclides—Radionuclide PRGs established by US EPA Region 9 in January 2001.

6.2.5.3.1 Domestic Septic System 3

The Sr-90 RME, 0.53 pCi/g, exceeded the PRG for residential soil of 0.231 pCi/g. All other COC RME values were at or below their respective residential soil PRGs.

6.2.5.3.2 Domestic Septic System 6

The hexavalent chromium RME, 0.362 mg/kg, marginally exceeded the California-modified PRG for residential soil of 0.2 mg/kg. All other COC RME values were below their respective residential soil PRGs.

6.2.6 Hot Measurement Analysis

A hot measurement analysis (US EPA, 1994) was also performed to determine if any COC exceeded its respective upper limit concentration value. If so, then further evaluation or additional remedial action may be required, at least locally, for the areas with hot measurements, regardless of the outcome of the background comparisons using the WRS and Quantile tests or the risk screening analysis.

The hot measurement analysis is typically used in background comparisons in conjunction with the WRS and Quantile tests to help ensure that unusually large sampling data measurements receive proper attention regardless of the outcome of the WRS and Quantile tests. Due to the de-emphasis of high concentrations when grouped with the entire data set, the WRS and Quantile tests may indicate that the remedial action is complete even if a few very high concentrations are detected in the remediation area.

For this Phase II Data Evaluation, a hot measurement analysis was performed on all COCs regardless of whether they were included in the background comparison to determine if COC

measurements exceeded a value equal to ten times their respective 10^{-6} RBAS values for the carcinogenic COCs, and the RBAS for the non-carcinogenic COCs. A factor of ten times the 10^{-6} RBAS was selected since it would correspond to a 10^{-5} excess cancer risk level, or the middle of the US EPA target risk range. The non-carcinogenic RBAS values were treated differently because, in contrast to carcinogens which have risk levels from 10^{-6} to 10^{-4}, risk assessments typically use only one risk level for non-carcinogens: HQ = 1.0. The results of the hot measurement analyses for DSSs 3 and 6 are presented in Tables 6-10 and 6-11, respectively.

6.2.6.1 Domestic Septic System 3

Mercury and formaldehyde were the only COCs that failed the hot measurement analysis. Two formaldehyde results were above the lowest non-carcinogenic RBAS, 1.7 mg/kg. Sixteen Hg results were above the lowest non-carcinogenic RBAS, 1.13 mg/kg. The maximum sample detection locations and histograms for the Hg and formaldehyde data sets were evaluated. The need for additional remedial action will be determined in the Feasibility Study.

Derived Concentration Guideline Level Elevated Measurement Comparison ($DCGL_{EMC}$) values were derived for Ra-226 and Sr-90 (Appendix A). The $DCGL_{EMC}$ for Ra-226 and Sr-90 are 7.34 pCi/g and 3,740 pCi/g, respectively. All Ra-226 and Sr-90 data were well below their respective $DCGL_{EMC}$.

6.2.6.2 Domestic Septic System 6

Mercury was the only COC that failed the hot measurement analysis. Twelve Hg results were above the lowest non-carcinogenic RBAS, 0.77 mg/kg. The maximum sample detection locations and histograms for the Hg data set were evaluated. The need for additional remedial action will be determined in the Feasibility Study.

6.3 Designated-Level Analysis

The third RAO is to mitigate any potential future impacts to ground water by reducing COC concentrations in soil. *The Designated Level Methodology for Waste Classification and Cleanup Level Determination* (Marshack, 1989) is a guidance document developed by the California Regional Water Quality Control Board, Central Valley Region staff for determining a soil constituent's potential to impact ground water.

The DL approach consists of three phases:

- Preliminary DL Analysis: Evaluate investigation sampling results and identify DL COCs and hot spot areas;
- Data Gaps Investigation: Collect additional vertical profile data if needed for each DL COC at the hot spot area; and,
- Refined DL Analysis: Model and calculate the DL values that protect ground water using the vertical profile of DL COCs.

Preliminary DL Analysis was conducted on the DSSs 3 and 6 investigation data. The preliminary DL analysis is typically conducted on the confirmation sample data. However, to meet the Federal Facility Agreement September 30 milestone for submittal of the Draft DSSs 3 and 6 Removal Actions Confirmation Report, DL samples were collected prior to RA activities. Conducting the preliminary DL analysis on the investigation data is more conservative because the investigation samples were collected beneath the sources of contamination based on 2001 DSSI data. Review of the confirmation data, the DL boring locations selected prior to the RAs were near contaminant sources and therefore were reasonable for determining the vertical profile of the DL COCs. The DSSs 3 and 6 DL sampling depths were also based on information collected during the 2001 DSSI.

The DSS 3 preliminary DL analysis (WA, 2002) identified 13 COCs that require additional evaluation: formaldehyde, hexavalent chromium, carbazole, arsenic, cadmium, chromium, lead, Hg, molybdenum, nitrate, selenium, silver and Ra-226. The DSS 6 preliminary DL analysis (WA, 2002) identified three COCs that require additional evaluation: hexavalent chromium, copper and Hg. Data Gaps Investigation DL sampling was conducted prior to the DSSs 3 and 6 RAs to collect additional vertical profile data for each DL COC. The objective of the DL sampling and subsequent data evaluation was to determine whether residual concentrations of specific constituents in soil would potentially impact ground water. Therefore, samples were collected from depths that represented estimated post-RA residual concentrations. A detailed discussion of the preliminary DL Analysis process and the results are presented *Domestic Septic Systems 3 and 6 Removal Actions Work Plan* (WA, 2002).

The DL sampling and analytical results are discussed in detail in Section 5.3. The DL results were used in the refined DL analysis (Phase C).

6.3.1 Refined Designated-Level Analysis

This section summarizes the methodologies, assumptions, and rationale used to conduct the refined DL analysis. The refined DL analysis consisted of performing vadose zone modeling to determine the potential adverse impacts to ground water from specific COCs. The model used consists of a computer program written to interface with the multiphase fate and transport modeling code NUFT (Nitao, 1996). Details of the model, including the selection of input parameter values and model setup, are the same as those presented in previous reports (WA, 1997d and WA, 2000). Parameters are only discussed below if changes were made for this modeling effort. The iterative calculation approach as it applies to this tool is described in WA, 2000. Modeling input and results are presented in Appendix D.

The scope of this modeling was limited to developing a soil profile model that was representative of the post-RA conditions in the DSSs 3 and 6 areas. One conservative infiltration rate was used, as described further below.

6.3.2 Indicator Constituents and Distribution

The modeled contamination depth intervals were selected based on the actual distribution of COCs as established by the post-RA confirmation sampling and DL sampling. To be conservative, it was assumed that each COC was homogeneously distributed within the established contamination interval.

6.3.2.1 Domestic Septic System 3

The DSS 3 DL sampling results are presented in Table 5-6. The post-RA confirmation sampling and DL sampling data indicated that 7 of the 13 DSS 3 DL COCs did not require modeling. Arsenic, cadmium, Ra-226, selenium and lead were not detected above background in any sample, and carbazole was not measured above the detection limit in any sample. Therefore, modeling was not warranted for these constituents.

Natural chromium in LEHR soil is stratified with depth, having higher concentrations in shallow soil (0 to 4 ft bgs) than deeper soil (>4 to 40 ft bgs). The background values determined previously (WA, 2000e) for shallow and deep soil were 199 mg/kg and 125 mg/kg, respectively. The depth intervals used to determine shallow and deep background values are poorly correlated with the DSS 3 confirmation sample depths. DSS 3 confirmation samples were collected at depths ranging from 3.6 to 13 ft bgs, which begins at the bottom of the shallow background depth range (0 to 4 ft) and ends in the upper third of the deep range (>4 to 40 ft). In order to provide a more accurate comparison between the DSS 3 confirmation data and stratified natural background, a chromium background value was determined from background samples collected within the 3.5 to 13 ft depth range. The new chromium background value for the DSS 3 confirmation sample depth range is 197 mg/kg. Chromium was not detected above 197 mg/kg in any DSS 3 confirmation or DL sample. Therefore, modeling was not warranted for chromium.

The hexavalent chromium and formaldehyde contamination intervals were conservatively assumed to extend throughout the entire soil column. Hg was detected above background in confirmation samples collected between 4 and 12 ft bgs; therefore, this interval was used to model the Hg distribution in the subsurface at DSS 3. The contamination interval selected for modeling molybdenum was 15 to 35 ft since it was detected above background in the DL samples collected over this depth interval. The confirmation sampling data indicated that the nitrate and silver contamination intervals are 6 to 13 ft bgs and 8 to 11 ft bgs, respectively, based on above background detections at these depths.

6.3.2.2 Domestic Septic System 6

The DSS 6 DL sampling analytical results are presented in Table 5-10. All of the copper and nitrate results were below background. Therefore modeling for these constituents was not warranted.

The post-RA confirmation sampling and DL sampling indicated that Hg and hexavalent chromium were present in the DSS 6 area soil at concentrations exceeding background. Therefore, modeling was conducted to assess potential impacts to ground water. The interval selected for modeling the distribution of Hg in the subsurface at DSS 6 is 4 to 20 ft bgs. The confirmation

samples collected between four and seven ft bgs contained Hg concentrations that exceeded background. Hg results from boring D6-DL1 indicated that the maximum Hg concentrations are present between 10 and 20 ft bgs. However, as previously discussed in Section 6.1.2, the DSS-DL mercury results are suspect due to high matrix spike recoveries and resampling is required. However, the contamination interval for Hg at DSS 6 was conservatively set at 4 to 20 ft bgs for the purposes of this report. The vadose zone was conservatively assumed to extend to 20 ft bgs because this is the shallowest depth at which the ground water table has been observed. DL boring samples were collected down to approximately 40 ft because this is the maximum depth at which the ground water table has been observed.

The hexavalent chromium contamination interval was conservatively assumed to extended throughout the entire vadose zone soil column because it was detected above background in confirmation and DL samples collected between 4.4 and 41 ft bgs.

6.3.3 Soil Profile

A soil profile representing typical lithologies encountered in the post-RA DSSs 3 and 6 Areas was developed based on the DL boreholes and RA excavations. As shown in Table 5-7, the subsurface lithology to 45 ft bgs in the DSSs 3 and 6 areas is dominated by clayey silt and silty clay, with a relatively small zone of more permeable silty sand from 29.5 to 32.5 ft bgs. For the DL model, the entire vadose zone (0 to 20 ft bgs) was assumed to be very low estimated permeability silty clay.

6.3.4 Ground Water Goals

The California and/or US EPA MCLs were used as the primary ground water goals in the DL modeling. In addition, estimated background concentrations were used as ground water goals. These background concentrations were based on COC concentrations detected in ground water from well UCD1-18, located approximately 500 ft upgradient of the LEHR site. For Hg and silver, one-half of the lowest detection limits were used because these COCs have never been detected in well UCD1-18. For nitrate and hexavalent chromium, the 80% lower confidence limit on the 95th quantile of concentrations detected in well UCD1-18 was used. The background nitrate and hexavalent chromium concentrations were 25 mg/l and 0.0394 mg/l, respectively. The 25 mg/l nitrate background value is higher than the 10 mg/l MCL.

6.3.5 Parameter Value Estimation

The assumptions and data used to develop the input parameters for modeling calculations are described in detail in WA, 1997b. In general, the same soil physical and hydraulic properties that were used previously to model the Ra/Sr Area were also used for this modeling effort. The physical,

chemical and hydraulic input parameter values are summarized in Appendix D. Conservative assumptions regarding the selected parameters are described below:

- Depth to ground water: A depth to the water table (20 ft) observed at the site was used in the model;
- Infiltration: An infiltration rate of 10.8 cm/year, corresponding to 25% of the mean annual precipitation rate (Dames and Moore, 1994), was selected. The infiltration was assigned to the model at constant rates resulting in continuous vertical flux toward the water table. This is a very conservative assumption since there are periods when the direction of flux is reversed due to evapotranspiration;
- Permeability and porosity: The highest measured values for each soil type are used in the model;
- Volatility: No volatilization was used for any of the COCs;
- Dispersion: No dispersion was used for any of the COCs;
- Partitioning coefficients: The smallest measured or reported partitioning coefficients were used for each soil type to minimize attenuation due to adsorption. The partitioning coefficient for all Hg species was assumed to be 52 milliliters per gram, which is the lowest value found in the literature for Hg. This Hg K_d was from the Superfund Chemical Data Matrix (US EPA, 1996);
- Initial concentration (IC) distribution: ICs are assumed to be uniformly distributed throughout the entire extent of the selected interval thereby significantly overestimating the total mass for that interval; and,
- Dilution: A thin aquifer thickness at the bottom of the model was used to represent the top of the water table as a receptor. Dilution is therefore negligible and this assumption overestimates the concentrations of ICs that may reach the water table.

6.3.6 Model Setup, Initialization, and Parameter Sensitivity Analysis

The details of the conceptual model, boundary conditions and the initial flow conditions are described in *One-Dimensional Vadose Zone Modeling (*WA, 1997d).

The sensitivity of the model to infiltration rate, lithology, dispersion, grid-cell spacing, initial contaminant mass inventory and distribution, and ground water goal was also discussed in detail in *One-Dimensional Vadose Zone Modeling* (WA, 1997d). Although no formal sensitivity analysis was performed on retardation factor and vadose zone thickness, increasing these parameters would be expected to increase peak time and decrease peak concentration.

In summary, the sensitivity analyses suggest that the DL modeling performed for the DSSs 3 and 6 areas produces conservatively low allowable soil concentrations for a given ground water goal

because: 1) no vadose zone dispersion was included; 2) contaminant mass was estimated conservatively high; 3) retardation factors were estimated conservatively low; and, 4) the vadose zone thickness used was the minimum recorded. The infiltration rate and lithologies used to represent the DSSs 3 and 6 areas are considered representative, and using the reasonable yet conservative representation of these parameters would not significantly change the modeling results. Therefore, the DL modeling results overestimate actual impacts to ground water.

6.3.7 Refined Designated-Level Analysis Results and Conclusions

The results of the modeling performed during refined DSSs 3 and 6 DL analysis are presented in Appendix D and summarized in Table 6-12. The results are discussed for each DSS below.

6.3.7.1 Domestic Septic System 3

Mercury

The Hg DL modeling results are shown in Table 6-12 and in Appendix D. The modeling results indicate a soil Hg concentration of 0.76 mg/kg could result in a peak ground water impact equal to the State of California MCL of 11 µg/l in approximately 3,400 years. The maximum Hg concentration detected in DSS 3 Area confirmation samples was 4.4 mg/kg, which exceeds this model result.

Table 6-12 also presents DL modeling results using background as an Hg ground water goal. Data from upgradient well UCD1-18 were used to represent the background concentration. Because Hg has not been detected in this well, one-half of the detection limit for Hg analyses (0.5 µg/l) was used as the ground water goal. As shown on Table 6-12, this ground water goal results in a modeled soil concentration of 0.00759 mg/kg. This concentration is more than an order of magnitude lower than the background soil Hg concentration (which is 0.248 mg/kg in soil deeper than 4 ft bgs).

Based on these DL modeling results, the residual Hg concentration in soil at DSS 3 might result in some measurable impact to ground water above the MCL and current background in more than 3,300 years.

Formaldehyde

The DL modeling results for formaldehyde indicate that a soil concentration of 0.0151 mg/kg distributed throughout the vadose zone may result in ground water impact at the 100 micrograms per liter (µg/l) California Department of Health Services State Action Level. Based on the DL modeling, a soil concentration of 0.167 mg/kg distributed throughout the vadose zone might result in ground water impact at the estimated 1,140 µg/l background level.

The maximum formaldehyde concentration detected in DSS 3 confirmation soil samples was 2.2 mg/kg, and the RME concentration was 0.99 mg/kg. The DL sampling maximum result was 0.92

mg/kg. Based on the DL modeling, localized impact on ground water may exceed the MCL and background from these concentrations of formaldehyde in DSS 3 soil. The peak impact is predicted to occur in approximately 10 years.

Hexavalent Chromium

The DL modeling results for hexavalent chromium indicate that a soil concentration of 0.809 mg/kg distributed throughout the vadose zone may result in ground water impact at the 50 µg/l MCL. Based on the DL modeling, a soil concentration of 0.638 mg/kg distributed throughout the vadose zone might result in ground water impact at the estimated 39 µg/l background level. The hexavalent chromium background concentration for soil is 0.054 mg/kg.

The maximum hexavalent chromium concentration detected in DSS 3 confirmation soil samples was 0.384 mg/kg, and the RME concentration was 0.2 mg/kg. The DL sampling maximum result was 0.387 mg/kg. Based on the DL modeling, any impact on ground water from these concentrations of hexavalent chromium in DSS 3 soil would be below the MCL and background.

Molybdenum

The DL results indicate that molybdenum levels of 3.11 mg/kg may result in ground water impact equal to the 183 µg/l Region 9 Environmental Protection Agency PRG for drinking water. The DL modeling results also indicate that a molybdenum concentration of 0.253 mg/kg might result in ground water impact at the estimated 15 µg/l background level. The molybdenum background concentration for soil is non-detect at a detection limit of 0.26 mg/kg.

The maximum molybdenum concentration detected in DSS 3 Area DL samples was 2.5 mg/kg. Based on the DL modeling, any impact on ground water from these concentrations of molybdenum in DSS 3 soil will be below the drinking water PRG. The DL modeling indicated that localized impact on ground water may exceed current ground water background and that the peak concentration in ground water is occurring or has already passed. However, the concentration of molybdenum in the DL borehole ground water sample (16.7 µg/l) was within the range of background concentrations detected in upgradient well UCD1-18 (1.2 µg/l to 90 µg/l).

Nitrate

The DL results indicate that 2.6 mg/kg nitrate may result in ground water impact equal to the 10 mg/l nitrate (as nitrogen) MCL (Table 6-12). These results are lower than the preliminary DL analysis value of 10 mg/kg, primarily because the minimum depth-to-water was raised to 20 ft bgs for the refined modeling, resulting in a higher peak ground water concentration in a shorter time.

There are known regional nitrate impacts to ground water in the LEHR area from agricultural activities. For example, ground water from well UCD1-18, located approximately 500 ft upgradient of the LEHR site, has a nitrate concentration of 25 mg/l (80% LCL on 95th quantile of available data). Using this concentration as a ground water goal for the DL modeling results in an allowable soil concentration of 6.22 mg/kg. The nitrate background concentration for soil (36 mg/kg) is more than five times greater than the modeled DL concentrations.

The maximum nitrate concentration detected in DSS 3 confirmation soil samples was 106 mg/kg, and the RME concentration was 33.5 mg/kg. The DL sampling maximum result was 33.2 mg/kg, indicating that the soil column is not currently contaminated above soil background. Based on the DL modeling, localized impact on ground water may exceed the MCL and background from these concentrations of nitrate in DSS 3 soil. The peak impact is predicted to occur in approximately 13 years.

Silver

Using the 100 µg/l MCL as the ground water goal, the DL modeling result for silver is 2.68 mg/kg in soil, with a peak ground water concentration equivalent to the MCL in 500 years. Using the 5 µg/l estimated background ground water concentration as a goal, the resulting DL soil limit is 0.143 mg/kg. The LEHR background soil concentration is 0.55 mg/kg.

The maximum silver concentrations detected in confirmation and DL samples were 2.4 mg/kg, and 0.37 mg/kg, respectively. Based on the DL modeling, silver in DSS 3 soil may locally impact ground water, but the impact would be expected to be below the MCL.

6.3.7.2 Domestic Septic System 6

Hexavalent Chromium

The DL modeling results for hexavalent chromium indicate that a soil concentration of 0.809 mg/kg distributed throughout the vadose zone may result in ground water impact at the 50 µg/l MCL. In addition, the modeling results indicated that a soil concentration of 0.638 mg/kg might impact ground water at the estimated 39 µg/l background level. The maximum hexavalent chromium concentrations detected in confirmation and DL samples were 0.362 mg/kg, and 0.467 mg/kg, respectively. Based on the DL modeling, any impact on ground water from these concentrations of hexavalent chromium in DSS 6 soil will be below the MCL and background.

Mercury

Using the 11 µg/l MCL as the ground water goal, the DL modeling result for Hg is 0.522 mg/kg in soil, with a peak ground water concentration equivalent to the MCL in 1,860 years. Using the 0.10 µg/l estimated background ground water concentration as a goal, the resulting DL soil limit is 0.00475 mg/kg.

The maximum Hg concentrations detected in confirmation and DL samples were 8.0 mg/kg, and 6.7 mg/kg, respectively. The RME concentration was 1.85 mg/kg. Based on the DL modeling, localized impact on ground water may exceed the MCL and background from these concentrations of Hg in DSS 6 soil.

Table 6-1. Summary of Risk-Based Action Standards for Carcinogenic Compounds in Surface Soil at the 10^{-6} Risk Level

	Risk-Based Action Standards				
Analyte	**Background Concentration (mg/kg)**	**Scenario 1 10^{-6} Risk (mg/kg)**	**Scenario 2 10^{-6} Risk (mg/kg)**	**Scenario 3 10^{-6} Risk (mg/kg)**	**2000 PRG Residential 10^{-6} Risk (mg/kg)**
4,4'-DDD	None	7.9	9.4	70,000	2.4
4,4'-DDE	None	5.6	9.0	61,000	1.7
4,4'-DDT	None	5.6	30	23,000	1.7
Alpha-BHC	None	0.30	0.0075	8,400	0.09
Alpha-Chlordane	None	1.5	0.80	5.9	1.6 total
Arochlor-1260	None	0.25	4.9	120	0.22
Benzene	None	0.23	0.015	NC	0.65
Benzo(a)anthracene	None	2.6	1.2	30,000	0.65
Benzo(a)pyrene	None	0.26	0.24	1,300	0.062
Benzo(b)fluoranthene	None	2.6	3.3	12,000	0.62
Benzo(k)fluoranthene	None	26	27	100,000[1]	0.61
Bis(2-Ethylhexyl)phthalate	None	136	7.7	8.6	35
Cadmium (Cd)	0.51	4,800	100,000[1]	100,000[1]	9.0
Carbazole	None	95	2.2	100,000[1]	24
Carbon Tetrachloride	None	0.22	0.055	NC	0.24
Chlordane	None	1.5	0.78	5.9	1.6 total
Chromium (Cr)	199/125[2]	720	100,000[1]	100,000[1]	210
Chromium, Hexavalent (Cr+6)	0.054	100	100,000[1]	23,000	0.2
Chrysene	None	260	20	100,000[1]	6.2
Delta-BHC	None	0.30	0.013	0.21	0.32
Dibenzo(a,h)anthracene	None	0.26	0.54	260	0.062
Dieldrin	None	0.12	0.015	4,100	0.030
Formaldehyde	None	220	NC	NC	N/A
Gamma-BHC	None	1.5	0.030	35,000	0.44
Gamma-Chlordane	None	1.5	0.81	6.4	1.6 total
Heptachlor	None	0.42	0.17	14,000	0.11
Heptachlor Epoxide	None	0.21	0.0689/ 0.00057[3]	1,800	0.053
Indeno(1,2,3-cd)pyrene	None	2.6	4.9	4,600	0.62
Lead (Pb)	9.5	3.0	0.044	19	400
Methylene Chloride	None	7.2	0.13	NC	8.4
Pentachlorophenol	None	16	13	100,000[1]	3

Table 6-1. Summary of Risk-Based Action Standards for Carcinogenic Compounds in Surface Soil at the 10^{-6} Risk Level (continued)

	Risk-Based Action Standards				
Analyte	**Background Concentration (pCi/g)**	**Scenario 1 10^{-6} Risk (pCi/g)**	**Scenario 2 10^{-6} Risk (pCi/g)**	**Scenario 3 10^{-6} Risk (pCi/g)**	**2001 PRG Residential 10^{-6} risk (pCi/g)**
Radionuclides					
Americium-241	<0.014	17	0.092	16,000	1.87
Bismuth-212 (Th-228 Daughter)	0.43	DP	DP	DP	22,600
Bismuth-214 (Ra-226 Daughter)	0.54	DP	DP	DP	8,190
Carbon-14	<0.13	4,200	9,500	7,000	0.46
Cesium-137+D	0.102/0.00695[2]	0.10	200,000	25,000	3.88
Cobalt-60	<0.006	0.022	32,000	5,800	0.0361
Lead-210+D	1.6	9.6	40	40	0.15
Lead-214 (Ra-226 Daughter)	0.58	DP	DP	DP	46,300
Plutonium-241 +D	<0.50	600	3.2	2,200,000	406
Radium-223 (U-235 Daughter)	DP	DP	DP	DP	89.9
Radium-226+D	**0.75**	**0.0042**	**1,100**	**1,100**	**0.0124**
Strontium-90+D	0.056	10	290,000	34,000	0.231
Thorium-228+D	0.74	0.032	2,000	1,600	24.2
Thorium-232	0.75	0.022	3,800	2,200	3.1
Thorium-234 (U-238+D)	0.78	3.2	88,000	63,000	1,330
Tritium	<1.2	130,000	5.4	2,500,000	2.28
Uranium-235+D	0.039	0.79	0.15	32,000	0.195

Notes

Scenario 1 - On-Site Researcher, Scenario 2—East-Side Residential Farmer, and Scenario 3—South-Side Residential Farmer

Highlighted compounds are the removal action "driver" compounds.

[1]Risk not exceeded for free-phase interstitial compound. Assumes 10% by weight (i.e., 100,000 mg/kg) as the maximum soil concentration.

[2]The first number is the background concentration for less than four feet below ground surface. The second number is the background concentration for greater than four feet below ground surface.

[3]The first number is the risk-based action standard (RBAS) for the Domestic Septic System 3 area. The second number is the site-wide RBAS.

Abbreviations

BHC hexachlorocyclohexane
DDD dichlordiphenyl dichlor
DDE dichlordiphenyl dichloroethylene
DDT dichlordiphenyl trichlor
DP Daughter product; standard driven by parent isotope
mg/kg milligrams per kilogram
NC Exposure pathway incomplete for compound
None Analyte is not present in background soil samples.
pCi/g picoCuries per gram
PRG preliminary remediation goal for U.S. Environmental Protection Agency
+D plus Daughters

Table 6-2. Summary of Risk-Based Action Standards for Non-Carcinogenic Compounds in Surface Soil at a Hazard Quotient of 1.0

		Risk-Based Action Standards			
Analyte	**Background Concentration (mg/kg)**	**Scenario 1 (mg/kg)**	**Scenario 2 (mg/kg)**	**Scenario 3 (mg/kg)**	**2000 PRG Residential HQ = 1.0 risk (mg/kg)**
2-Butanone (MEK)	None	710	12	NC	7,300
Acenaphthene	None	41,000	250	100,000[1]	3,700
Acetone	None	830	1.7	1,900	1,600
Anthracene	None	200,000	1,400	100,000[1]	22,000
Antimony (Sb)	1.4	680	0.30	100,000[1]	31
Barium (Ba)	211/294[2]	100,000[1]	53	100,000[1]	5,400
Benzo(g,h,i)perylene	None	20,000	9,100	100,000[1]	N/A
Cadmium (Cd)	0.51	850	0.38	100,000[1]	37
Chromium (Cr)	199/125[2]	100,000[1]	760	100,000[1]	N/A
Chromium, Hexavalent (Cr+6)	0.054	8,500	3.8	740	N/A
Copper (Cu)	48.8/61.8[2]	63,000	28	100,000[1]	2,900
Dibenzofuran	None	2,700	14	100,000[1]	290
Diethyl Phthalate	None	100,000[1]	220	100,000[1]	49,000
Di-n-Butylphthalate	None	68,000	890	3,300	6,100
Di-n-Octylphthalate	None	14,000	28,000	4,900	1,200
Endosulfan I	None	4,100	29	100,000[1]	370
Endosulfan Sulfate	None	4,100	26	100,000[1]	2,600
Ethyl Benzene	None	2,400	10	NC	230
Fluoranthene	None	27,000	1,800	100,000[1]	2,300
Fluorene	None	27,000	170	100,000[1]	2,000
Formaldehyde	None	100,000[1]	1.7	10,000	9,200
Heptachlor Epoxide	None	NC	1.33[3]	NC	
Manganese (Mn)	750	52,000	36	100,000[1]	1,800
Mercury (Hg)	**0.63/0.248[2]**	**510**	**1.13/0.77[4]**	**6.4**	**23**
Methoxychlor	None	3,400	100	100,000[1]	310
Naphthalene	None	27,000	39	100,000[1]	56
Phenanthrene	None	20,000	1,200	100,000[1]	N/A
Pyrene	None	20,000	490	100,000[1]	2,300
Selenium (Se)	1.2	8,500	58	100,000[1]	390
Silver (Ag)	0.55	8,500	3.8	100,000[1]	390
Styrene	None	710	76	NC	1,700
Toluene	None	920	19	NC	520
Xylenes (Total)	None	1,700	700	NC	210
Zinc (Zn)	42.4/93.1[2]	100,000[1]	3,400	100,000[1]	23,000

Table 6-2. Summary of Risk-Based Action Standards for Non-Carcinogenic Compounds in Surface Soil at a Hazard Quotient of 1.0 (continued)

Notes

Scenario 1 - On-Site Researcher, Scenario 2—East-Side Residential Farmer, and Scenario 3—South-Side Residential Farmer

Highlighted compound is the removal action "driver" compounds.

[1]Risk not exceeded for free-phase interstitial compound. Assumes 10% by weight (i.e., 100,000 mg/kg) as the maximum soil concentration.

[2]The first number is the background concentration for less than four feet below ground surface. The second number is the background concentration for greater than four feet below ground surface.

[3]This number is the RBAS for the Domestic Septic System 3 area.

[4]The first concentration is the RBAS for the Domestic Septic System 3 area. The second concentration is the RBAS for the Domestic Septic System 6 area.

Abbreviations

MEK	methyl ethyl ketone
mg/kg	milligrams per kilogram
N/A	Not Applicable
NC	Exposure pathway incomplete for compound.
None	Analyte is not present in background soil samples.
PRG	preliminary remediation goal for U.S. Environmental Protection Agency Region 9

Table 6-3. Background Comparison for Constituents of Concern with Risk-Based Action Standards Less than Background, Domestic Septic Systems 3 and 6

Constituent of Concern	Background Concentration (>4 ft bgs)	WRS Test [1, 2]	Quantile Test [2]	Requires Histogram Comparison?	Histogram Comparison	Conclusion
Domestic Septic System 3						
Cadmium	0.51	P	P	N		COC is at or below background [3]
Copper[4]	61.8	P	P	N		COC is at or below background [3]
Lead	9.5	P	P	N		COC is at or below background [3]
Mercury[4]	**0.248**	**F (Q)**	**F**	**Y**	**F**	COC exceeds background [6]
Radium-226	0.752	P	P	N		COC is at or below background [3]
Domestic Septic System 6						
Barium[5]	294	P	P	N		COC is at or below background [3]
Copper[5]	61.8	P	P	N		COC is at or below background [3]
Mercury[5] (>4 ft bgs stratified)	**0.248**	**F (Q)**	**F**	**Y**	**F**	COC exceeds background [6]

Notes

[1]US EPA guidance recommends using the Wilcoxon Rank Sum test (WRS test) and the Quantile test to perform the background comparisons. These tests are outlined in *Statistical Method for Evaluating the Attainment of Cleanup Standards*, Vol. 3 (US EPA, 1994). The WRS test is used to determine whether the removal action has uniformly attained the cleanup goal for a particular constituent of concern (COC) throughout the cleanup unit, whereas the Quantile test is more appropriate to detect when removal action has failed in only a few areas within the cleanup unit. Barium and copper have log-normally distributed background data sets and are therefore assumed to have log-normal confirmation data sets. The background comparisons for barium and copper used log-transformed data.

[2]The COC passed the statistical test if "P" is indicated. The COC failed the test if "F" is indicated. A "P" or "F" with "(Q)" indicates the pass or fail was qualified due to a limited number of background or confirmation samples, or a limited number of samples above the detection limit.

[3]This COC is present on site at or below background concentrations. If a COC is detected at or below background levels, it is assumed that it does not contribute to excess or incremental risk and is therefore removed from the risk analysis for the Domestic Septic System (DSS) 3 and 6 confirmation sample results.

[4]The DSS 3 copper and mercury confirmation data were compared with the background data collected greater than four feet below ground surface because all of the DSS 3 confirmation data was collected greater than four feet below ground surface with exception of samples SSD3C038 and SSD3C039. These samples were collected 3.6 feet below ground surface.

[5]All of the DSS 6 confirmation samples were collected greater than four feet below ground surface. Therefore, the confirmation data sets were compared with background data collected greater than four feet below ground surface.

[6]Mercury was detected above background and was therefore included in the DSSs 3 and 6 risk analyses.

Table 6-4. Sample Statistics, Background, 95% Upper Confidence Limit, Reasonable Maximum Exposure, and Risk-Based Action Standard Values for Domestic Septic System 3

COCs	Units	No. of Samples Analyzed	No. of Samples > Detection Limit	Background Concentration (>4 ft bgs)	Concentration Range	95% UCL	RME	Carc. RBAS Scenario 1	Carc. RBAS Scenario 2	Carc. RBAS Scenario 3	Non-Carc. RBAS Scenario 1	Non-Carc. RBAS Scenario 2	Non-Carc. RBAS Scenario 3	Carc. 2000/2001 PRG Residential	Non-Carc. 2000 PRG Residential
General Chemistry															
Formaldehyde	mg/kg	27	27	N/A	0.21 – 2.2	0.99	0.99	220	NC	NC	100,000	1.7	10,000	n/a	9,200
Hexavalent Chromium	mg/kg	27	23	0.054	0.0513 – 0.384	0.2	0.2	100	100,000	23,000	8,500	3.8	740	0.2	n/a
Metals															
Barium	mg/kg	1	1	294	195	N/A	195	N/a	n/a	N/a	110,000	53	100,000	n/a	5,400
Cadmium	mg/kg	27	14	0.51	0.07 – 0.15	0.11	0.11	4,800	n/a	N/a	850	0.380	100,000	9	37
Chromium	mg/kg	27	27	125	76.9 – 174	136.95	136.95	720	840,000	160,000	100,000	760	100,000	210	n/a
Copper	mg/kg	27	27	61.8	28.5 – 48.9	37.6	37.6	N/a	n/a	N/a	63,000	28	610,000	n/a	2,900
Lead	mg/kg	27	27	9.5	6 – 7.8	6.95	6.95	3	0.044	19	n/a	n/a	n/a	400	n/a
Manganese	mg/kg	1	1	750	646	N/A	646	N/a	n/a	N/a	52,000	36	100,000	n/a	1,800
Mercury	**mg/kg**	**27**	**27**	**0.248**	**0.24 – 4.4**	**1.96**	**1.96**	**N/a**	**n/a**	**N/a**	**510**	**1.13 [a]**	**6.400**	**n/a**	**23**
Selenium	mg/kg	1	1	1.2	1.1	N/A	1.1	N/a	n/a	N/a	8,500	58	100,000	n/a	390
Silver	mg/kg	27	5	0.55	0.29 – 2.4	N/A	2.4	N/a	n/a	N/a	8,500	3.8	100,000	n/a	390
Zinc	mg/kg	1	1	93.1	70	N/A	70	N/a	n/a	N/a	510,000	3,400	150,000	n/a	23,000
Radionuclides															
Americium-241	pCi/g	1	1	0.014	0.0136	N/A	0.0136	17	0.092	16,000	n/a	n/a	n/a	1.87	n/a
Bismuth-212	pCi/g	1	1	0.434	0.298	N/A	0.298	N/a	n/a	N/a	n/a	n/a	n/a	22,600	n/a
Bismuth-214	pCi/g	1	1	0.54	0.4	N/A	0.4	N/a	n/a	N/a	n/a	n/a	n/a	8,190	n/a
Cesium-137	pCi/g	27	2	0.00695	0.0049 – 0.0139	N/A	0.0139	4,200	9,500	7,000	n/a	n/a	n/a	0.46	n/a
Lead-210	pCi/g	27	5	1.6	0.433 – 0.961	N/A	0.961	0.1	200,000	25,000	n/a	n/a	n/a	3.88	n/a
Lead-214	pCi/g	1	1	0.581	0.446	N/A	0.446	N/a	n/a	N/a	n/a	n/a	n/a	46,300	n/a
Radium-226	**pCi/g**	**27**	**27**	**0.752**	**0.37 – 0.598**	**0.5**	**0.5**	**0.004**	**1,100**	**1,100**	**n/a**	**n/a**	**n/a**	**0.0124**	**n/a**
Strontium-90	pCi/g	27	19	0.056	0.0983 – 1.6	0.53	0.53	10	280,000	34,000	n/a	n/a	n/a	0.231	n/a
Thorium-228	pCi/g	1	1	0.771	0.468	N/A	0.468	0.032	2,000	1,600	n/a	n/a	n/a	24.2	n/a
Thorium-232	pCi/g	1	1	0.8	0.45	N/A	0.45	0.022	3,800	2,200	n/a	n/a	n/a	3.1	n/a
Thorium-234	pCi/g	1	1	0.78	0.524	N/A	0.524	3.2	88,000	63,000	n/a	n/a	n/a	1,330	n/a
Uranium-235	pCi/g	1	1	0.038	0.0295	N/A	0.0295	0.790	0.150	32,000	n/a	n/a	n/a	0.195	n/a
Pesticides															
alpha-Chlordane	µg/kg	27	19	N/A	2 – 161	70.53	70.53	1,500	800	5,900	n/a	n/a	n/a	NE	n/a
gamma-Chlordane	µg/kg	27	19	N/A	2.2 – 294	93.85	93.85	1,500	810	6,400	n/a	n/a	n/a	NE	n/a

Table 6-4. Sample Statistics, Background, 95% Upper Confidence Limit, Reasonable Maximum Exposure, and Risk-Based Action Standard Values for Domestic Septic System 3 (continued)

COCs	Units	No. of Samples Analyzed	No. of Samples > Detection Limit	Background Concentration (>4 ft bgs)	Concentration Range	95% UCL	RME	Carc. RBAS Scenario 1	Carc. RBAS Scenario 2	Carc. RBAS Scenario 3	Non-Carc. RBAS Scenario 1	Non-Carc. RBAS Scenario 2	Non-Carc. RBAS Scenario 3	Carc. 2000/2001 PRG Residential	Non-Carc. 2000 PRG Residential
Pesticides (continued)															
alpha+gamma-Chlordane	µg/kg	27	19	N/A	4.2 – 455	163.88	163.88	1,500	780	5,900	n/a	n/a	n/a	1,600[b]	n/a
Heptachlor epoxide	µg/kg	27	1	N/A	4	N/A	4	210	68.9[a]	1,800,000	n/a	1,330	n/a	53	n/a

Notes

The driver constituents of concern are in **bold** text.

This table includes only the COCs that had analytical results above the detection limit and an established RBAS. All positive detections from the confirmation data set will be addressed in the Site-Wide Risk Assessment.

[a] Scenario 2 RBAS is specific to potential source soil in the Domestic Septic System 6 area.

[b] PRG for total chlordane.

Background Concentration = 80% lower confidence limit on 95th percentile of background data

> 4 ft bgs = Background statistic was determined from samples collected at depths greater than 4 feet below ground surface when constituent concentration was known to vary with depth.

Abbreviations

95% UCL	95% upper confidence limit on the mean concentration
bgs	below ground surface
Carc.	based on carcinogenic toxicity
COCs	constituents of concern
ft	feet
mg/kg	milligrams per kilogram
N/A	not applicable
NC	not calculated
No.	number
Non-Carc.	Based on non-carcinogenic toxicity
PRG	Preliminary remediation goals for non-radionuclides (US EPA Region 9, 2000) and radionuclides (US EPA, 2001).
RBAS	Risk Based Action Standard. 10^{-6} risk for carcinogenic effects and a hazard quotient of 1.0 for non-carcinogenic effects (WA, 1997).
RME	Reasonable maximum exposure concentration. The 95% UCL was used as the RME for all Domestic Septic System COCs.
µg/kg	micrograms per kilogram

Table 6-5. Sample Statistics, Background, 95% Upper Confidence Limit, Reasonable Maximum Exposure, and Risk-Based Action Standard Values for Domestic Septic System 6

COCs	Units	No. of Samples Analyzed	No. of Samples > Detection Limit	Background Concentration (>4 ft bgs)	Concentration Range	95% UCL	RME	Carc. RBAS Scenario 1	Carc. RBAS Scenario 2	Carc. RBAS Scenario 3	Non-Carc. RBAS Scenario 1	Non-Carc. RBAS Scenario 2	Non-Carc. RBAS Scenario 3	Carc. 2000PRG Residential	Non-Carc. 2000 PRG Residential
Hexavalent Chromium	mg/kg	23	6	0.054	0.0435- 0.362	N/A	0.362	100	100,000	23,000	8,500	3.8	740	0.2	n/a
Mercury	mg/kg	27	27	21	0.01- 8	1.85	1.85	n/a	n/a	n/a	510	0.77[a]	6.40	n/a	23
Barium	mg/kg	23	23	0	138- 290	221.16	221.16	n/a	n/a	n/a	110,000	53	100,000	n/a	5,400
Copper	mg/kg	23	23	0	30.4- 52.2	46.48	46.45	n/a	n/a	n/a	63,000	28	610,000	n/a	2,900

Notes

This table includes only the COCs that had analytical results above the detection limit and an established RBAS. All positive detections from the confirmation data set will be addressed in the Site-Wide Risk Assessment.

[a] Scenario 2 mercury RBAS is specific to potential source soil in the Domestic Septic System 6 area.

Background Concentration = 80% lower confidence limit on 95th percentile of background data

> 4 ft bgs = Background statistic was determined from samples collected at depths greater than four feet below ground surface when constituent concentration was known to vary with depth.

Abbreviations

95% UCL	95% upper confidence limit on the mean concentration
Carc.	based on carcinogenic toxicity
COCs	constituents of concern
mg/kg	milligrams per kilogram
n/a	not applicable
No.	number
Non-Carc.	based on non-carcinogenic toxicity
PRG	preliminary remediation goals (EPA Region 9, 2000)
RBAS	Risk-based action standard. 10^{-6} risk for carcinogenic effects and a hazard quotient of 1.0 for non-carcinogenic effects (WA, 1997).
RME	Reasonable maximum exposure concentration. The 95% UCL was used as the RME for all domestic septic system COCs.

Table 6-6. Screening Analysis for Risk Constituents of Concern, Domestic Septic System 3

Constituent	Carc. Scen. 1 RME/RBAS Ratio	Carc. Scen. 2 RME/RBAS Ratio	Carc. Scen. 3 RME/RBAS Ratio	Non-Carc. Scen. 1 RME/RBAS Ratio	Non-Carc. Scen. 2 RME/RBAS Ratio	Non-Carc. Scen. 3 RME/RBAS Ratio	Carc. RME/ Residential PRG Ratio	Non-Carc. RME/ Residential PRG Ratio
General Chemistry								
Formaldehyde	0.00	N/A	N/A	0.00	0.58	0.00	N/A	0.00
Hexavalent Chromium	0.00	0.00	0.00	0.00	0.05	0.00	1.00	N/A
Metals								
Barium	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1
Cadmium	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1
Chromium	0.19	0.00	0.00	0.00	0.18	0.00	0.65	N/A
Copper	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1
Lead	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1
Manganese	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1
Mercury	N/A	N/A	N/A	0.00	1.73	0.31	N/A	0.09
Selenium	N/A	N/A	N/A	0.00	0.02	0.00	N/A	0.00
Silver	N/A	N/A	N/A	0.00	0.63	0.00	N/A	0.01
Zinc	N/A	N/A	N/A	0.00	0.02	0.00	N/A	0.00
Radionuclides								
Americium-241	0.00	0.15	0.00	N/A	N/A	N/A	0.01	N/A
Bismuth-212	N/A	N/A	N/A	N/A	N/A	N/A	0.00	N/A
Bismuth-214	N/A	N/A	N/A	N/A	N/A	N/A	0.00	N/A
Cesium-137	0.00	0.00	0.00	N/A	N/A	N/A	0.03	N/A
Lead-210	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1
Lead-214	N/A	N/A	N/A	N/A	N/A	N/A	0.00	N/A
Radium-226	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1
Radionuclides (continued)								
Strontium-90	0.05	0.00	0.00	N/A	N/A	N/A	2.29	N/A

Table 6-6. Screening Analysis for Risk Constituents of Concern, Domestic Septic System 3 (continued)

Constituent	Carc. Scen. 1 RME/RBAS Ratio	Carc. Scen. 2 RME/RBAS Ratio	Carc. Scen. 3 RME/RBAS Ratio	Non-Carc. Scen. 1 RME/RBAS Ratio	Non-Carc. Scen. 2 RME/RBAS Ratio	Non-Carc. Scen. 3 RME/RBAS Ratio	Carc. RME/ Residential PRG Ratio	Non-Carc. RME/ Residential PRG Ratio
Thorium-228	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1
Thorium-232	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1
Thorium-234	0.16	0.00	0.00	N/A	N/A	N/A	0.00	N/A
Uranium-235	0.04	0.20	0.00	N/A	N/A	N/A	0.15	N/A
Pesticides								
alpha-Chlordane	0.05	0.09	0.01	N/A	N/A	N/A	0.04	N/A
gamma-Chlordane	0.06	0.12	0.01	N/A	N/A	N/A	0.06	N/A
alpha+gamma-chlordane	0.11	0.21	0.03	N/A	N/A	N/A	0.1	N/A
Heptachlor epoxide	0.02	0.06	0.00	N/A	0.00	N/A	0.08	N/A
SUM OF RME/RBAS RATIO:	0.69	0.73	0.06	0.01	3.22	0.31	4.41	0.1

Note

This table includes only the COCs that had analytical results above the detection limit and an established RBAS. All positive detections from the confirmation data set will be addressed in the Site-Wide Risk Assessment.

[1] The RBAS for this COC was less than the background value. Per the Work Plan, a background comparison was conducted. The sample data set was not above the background data set. Therefore, the COC was not considered a contributor to excess risk from the site, and a RME/RBAS ratio was not calculated for inclusion in the cumulative summation. The COC was removed from further risk screening.

Abbreviations

95% UCL	95% upper confidence limit on the mean concentration
Carc.	carcinogen
COC	constituent of concern
N/A	not applicable
PRG	preliminary remediation goal concentration (California specific PRG in brackets)
RBAS	risk-based action standard determined specifically for the LEHR site
RME	Reasonable maximum exposure concentration. The 95% UCL was used as the RME.
Scen.	scenario

Table 6-7. Screening Analysis for Risk Constituents of Concern, Domestic Septic System 6

Constituent	Carc. Scen. 1 RME/RBAS Ratio	Carc. Scen. 2 RME/RBAS Ratio	Carc. Scen. 3 RME/RBAS Ratio	Non-Carc. Scen. 1 RME/RBAS Ratio	Non-Carc. Scen. 2 RME/RBAS Ratio	Non-Carc. Scen. 3 RME/RBAS Ratio	Carc. RME/ Residential PRG Ratio	Non-Carc. RME/ Residential PRG Ratio
Hexavalent Chromium	0.00	0.00	0.00	0.00	0.10	0.00	1.84	n/a
Mercury	n/a	n/a	n/a	0.00	2.40	0.29	n/a	0.08
Barium	n/a	n/a	n/a	Note 1	Note 1	Note 1	Note 1	Note 1
Copper	n/a	n/a	n/a	Note 1	Note 1	Note 1	Note 1	Note 1
Sum of RME/RBAS Ratio	0.00	0.00	0.00	0.00	2.50	0.29	1.84	0.08

Notes

This table includes only the COCs that had analytical results above the detection limit and an established RBAS. All positive detections from the confirmation data set will be addressed in the Site-Wide Risk Assessment.

Note 1 The RBAS for this COC was less than the background value. Per the Work Plan, a background comparison was conducted. The sample data set was not above the background data set. Therefore, the COC was not considered a contributor to excess risk from the site, and a RME/RBAS ratio was not calculated for inclusion in the cumulative summation. The COC was removed from further risk screening.

Abbreviations

95% UCL 95% upper confidence limit on the mean concentration
COC constituent of concern
n/a not applicable
PRG preliminary remediation goal concentration (California-specific PRG in brackets)
RBAS risk-based action standard determined specifically for the LEHR site
RME Reasonable maximum exposure concentration. The 95% UCL was used as the RME.

Table 6-8. Risk Screening Summary, Reasonable Maximum Exposure/Risk-Based Standard Sums for Domestic Septic System 3

Excess Risk	Carc. Scen. 1 RME/RBAS Ratio	Carc. Scen. 2 RME/RBAS Ratio	Carc. Scen. 3 RME/RBAS Ratio	Non-Carc. Scen. 1 RME/RBAS Ratio	Non-Carc. Scen. 2 RME/RBAS Ratio	Non-Carc. Scen. 3 RME/RBAS Ratio
10^{-6}	0.69	0.73	0.06	N/A	N/A	N/A
10^{-5}	0.069	0.073	0.006	N/A	N/A	N/A
10^{-4}	0.007	0.0073	0.001	N/A	N/A	N/A
HQ =1	N/A	N/A	N/A	0.01	3.22	0.31

Non-Carcinogen Scenario 2 Contributors to 3.22 total RME/RBAS ratio	RME/RBAS
mercury	1.73
silver	0.63
formaldehyde	0.58
remaining risk COCs	0.27

Notes
RME = Reasonable Maximum Exposure = 95% UCL or maximum value (if a 95% UCL was not available)

Abbreviations
Carc. carcinogenic
COC constituent of concern
HQ hazard quotient
N/A not available
RBAS risk-based action standard
RME reasonable maximum exposure concentration
Scen. scenario
UCL upper confidence limit

Table 6-9. Risk Screening Summary, Reasonable Maximum Exposure/Risk-Based Standard Sums for Domestic Septic System 6

Excess Risk	Carc. Scen. 1 RME/RBAS Ratio	Carc. Scen. 2 RME/RBAS Ratio	Carc. Scen. 3 RME/RBAS Ratio	Non-Carc. Scen. 1 RME/RBAS Ratio	Non-Carc. Scen. 2 RME/RBAS Ratio	Non-Carc. Scen. 3 RME/RBAS Ratio
10^{-6}	0.00	0.12	0.00	N/A	N/A	N/A
10^{-5}	0.00	0.012	0.000	N/A	N/A	N/A
10^{-4}	0.00	0.001	0.000	N/A	N/A	N/A
HQ =1	N/A	N/A	N/A	0.00	2.50	0.29

Non-Carcinogen Scenario 2 Contributors to 2.5 RME/RBAS Ratio	RME/RBAS
mercury	2.40
hexavalent chromium	0.10

Abbreviations
Carc. carcinogenic
HQ hazard quotient
N/A not available
RBAS risk based action standard
RME Reasonable maximum exposure = 95% UCL or maximum value (if a 95% UCL was not available).
Scen. scenario
UCL upper control limit

Table 6-10. Hot Measurement Analysis for the Domestic Septic System 3 Removal Action

Constituent	Units	Maximum Concentration	Sample ID of Maximum Concentration	Background Concentration (> 4 ft bgs)	Lowest Carcinogenic 10^{-5} RBAS	Lowest Non-Carcinogenic RBAS
General Chemistry						
Formaldehyde	**mg/kg**	**2.2**	**SSD3C055**	**N/A**	**2,200**	**1.7**
Hexavalent Chromium	mg/kg	0.384	SSD3C046	0.054	1,000	3.8
Metals						
Barium	mg/kg	195	SSD3C036	294	N/A	53
Cadmium	mg/kg	0.15	SSD3C058	0.51	48,000	0.38
Chromium	mg/kg	174	SSD3C047	125	7,200	760
Copper	mg/kg	48.9	SSD3C040	61.8	N/A	28
Lead	mg/kg	7.8	SSD3C050	9.5	0.44	N/A
Manganese	mg/kg	646	SSD3C036	750	N/A	36
Mercury	**mg/kg**	**4.4**	**SSD3C066**	**0.248**	**150**	**1.13**
Selenium	mg/kg	1.1	SSD3C036	1.2	N/A	58
Silver	mg/kg	2.4	SSD3C053	0.55	N/A	3.8
Zinc	mg/kg	70	SSD3C036	93.1	N/A	3,400
Radionuclides						
Americium-241	pCi/g	0.0136	SSD3C036	0.014	0.92	N/A
Bismuth-212	pCi/g	0.298	SSD3C036	0.434	N/A	N/A
Bismuth-214	pCi/g	0.4	SSD3C036	0.54	N/A	N/A
Cesium-137	pCi/g	0.0139	SSD3C036	0.00695	42,000	N/A
Lead-210	pCi/g	0.961	SSD3C038	1.6	1	N/A
Lead-214	pCi/g	0.446	SSD3C036	0.581	N/A	N/A
Radium-226	pCi/g	0.598	SSD3C050	0.752	0.04	N/A
Strontium-90	pCi/g	1.6	SSD3C056	0.056	100	N/A
Thorium-228	pCi/g	0.468	SSD3C036	0.771	0.32	N/A
Thorium-232	pCi/g	0.45	SSD3C036	0.8	0.22	N/A
Thorium-234	pCi/g	0.524	SSD3C036	0.78	32	N/A
Uranium-235	pCi/g	0.0295	SSD3C036	0.038	1.5	N/A

Table 6-10. Hot Measurement Analysis for the Domestic Septic System 3 Removal Action (continued)

Constituent	Units	Maximum Concentration	Sample ID of Maximum Concentration	Background Concentration (> 4 ft bgs)	Lowest Carcinogenic 10^{-5} RBAS	Lowest Non-Carcinogenic RBAS
Pesticides						
alpha-Chlordane	ug/kg	161	SSD3C047DL	N/A	800	N/A
gamma-Chlordane	ug/kg	294	SSD3C047DL	N/A	810	N/A
Heptachlor epoxide	ug/kg	4	SSD3C061	N/A	5.7	N/A

Notes

Constituents in **bold** text failed the Hot Measurement Analysis.

Abbreviations

bgs below ground surface
ft feet
ID identification (number)
mg/kg milligram per kilogram
N/A not available
pCi/g picoCuries per gram
RBAS risk-based action standard
µg/kg micrograms per kilogram

Table 6-11. Hot Measurement Analysis for the Domestic Septic System 6 Removal Action

Constituent	Units	Maximum Concentration	Sample ID of Maximum Concentration	Background Concentration (> 4 ft bgs)	Lowest Carcinogenic 10^{-5} RBAS	Lowest Non-Carcinogenic RBAS
General Chemistry						
Hexavalent Chromium	mg/kg	0.362	SSD6C023	0.054	1000	3.8
Metals						
Barium	mg/kg	290	SSD6C041	294	N/A	53
Copper	mg/kg	52.2	SSD6C041	61.8	N/A	28
Mercury	**mg/kg**	**8**	**SSD6C038**	**0.248**	**150**	**0.77**

Notes

Constituents in **bold** text failed the Hot Measurement Analysis.

Abbreviations

bgs below ground surface
ft feet
ID identification (number)
mg/kg milligrams per kilogram
N/A not available
pCi/g picoCuries per gram
RBAS risk-based action standard
µg/kg micrograms per kilogram

Table 6-12. Summary Evaluation of Potential Impact of Designated-Level Constituents of Concern in the Domestic Septic Systems 3 and 6 Areas

COC	Confirmation Sampling		Confirmation	DL Sampling		Soil Background Value	NUFT Soil Result	NUFT Soil Result	Summary of Ground Water Impact Potential
	Maximum (mg/kg)	Depth of Maximum (ft)	95% UCL (mg/kg)	Maximum (mg/kg)	Depth of Maximum (ft)	(mg/kg)	(BG goal) (mg/kg)	(MCL goal) (mg/kg)	
Domestic Septic System 3									
Mercury[1]	4.4	5.2	1.96	0.28	14	0.248	0.00759	0.760	Localized impact above background and MCL possible; note peak time for ground water impact is more than 3,300 years.
Formaldehyde	2.2	12.5	0.99	0.92	15	NA	0.167	0.0151	Localized impact above background and MCL possible; peak ground water impact in approximately ten years.
Hexavalent Chromium	0.384	5.9	0.2	0.387	15	0.054	0.638	0.809	No impact above background or MCL expected.
Molybdenum	NA	NA	NA	2.5	35	<0.26	0.253	3.11[4]	Localized impact above background possible; no impact above PRG[4] expected; peak ground water impact has likely already occurred.[3]
Nitrate (as Nitrogen)	106	12.5	33.5	33.2	15	36	6.22	2.60	Localized impact above background and MCL possible; peak ground water impact in approximately 13 years.

Table 6-12. Summary Evaluation of Potential Impact of Designated-Level Constituents of Concern in the Domestic Septic Systems 3 and 6 Areas (continued)

COC	Confirmation Sampling		Confirmation	DL Sampling		Soil Background Value	NUFT Soil Result	NUFT Soil Result	Summary of Ground Water Impact Potential
	Maximum (mg/kg)	Depth of Maximum (ft)	95% UCL (mg/kg)	Maximum (mg/kg)	Depth of Maximum (ft)	(mg/kg)	(BG goal) (mg/kg)	(MCL goal) (mg/kg)	
Domestic Septic System 3 (continued)									
Silver	2.4[5]	10.5	N/A	0.37	30	0.55	0.143	2.68	No impact above MCL expected; localized impact above background possible; peak ground water impact in approximately 500 years.
Domestic Septic System 6									
Hexavalent Chromium	0.362	4.4	N/A	0.467	6	0.054	0.638	0.809	Designated Level modeling indicates no impact above background or MCL.
Mercury[1]	8.0	7	1.85	6.7	20	0.248	0.00475	0.522	Localized impact above background and MCL possible; note peak time for ground water impact is more than 1,700 years.

Notes

1 Assumed to be mercuric chloride.
2 The background concentration is for >four ft bgs.
3 Molybdenum concentration in designated level grab ground water sample from a borehole was consistent with background in upgradient well UCD1-18. The peak concentration was likely already passed through the water table.
4 Region 9 Environmental Protection Agency PRG
5 Maximum silver concentration may be due to laboratory contamination. Silver detected in laboratory method blank. Sample is undergoing re-analysis.

Table 6-12. Summary Evaluation of Potential Impact of Designated-Level Constituents of Concern in the Domestic Septic Systems 3 and 6 Areas (continued)

Abbreviations

BG	background, based on concentrations in ground water from upgradient well UCD1-18
COC	constituent of concern
DL	designated-level
ft	feet
mg/kg	milligrams per kilogram
MCL	primary maximum contaminant level for ground water
N	nitrogen
NA	not applicable or not available
NUFT	non-isothermal, unsaturated flow and transport model
pCi/g	picoCuries per gram
PRG	preliminary remediation goal
UCL	upper confidence limit on the true mean based on sample data

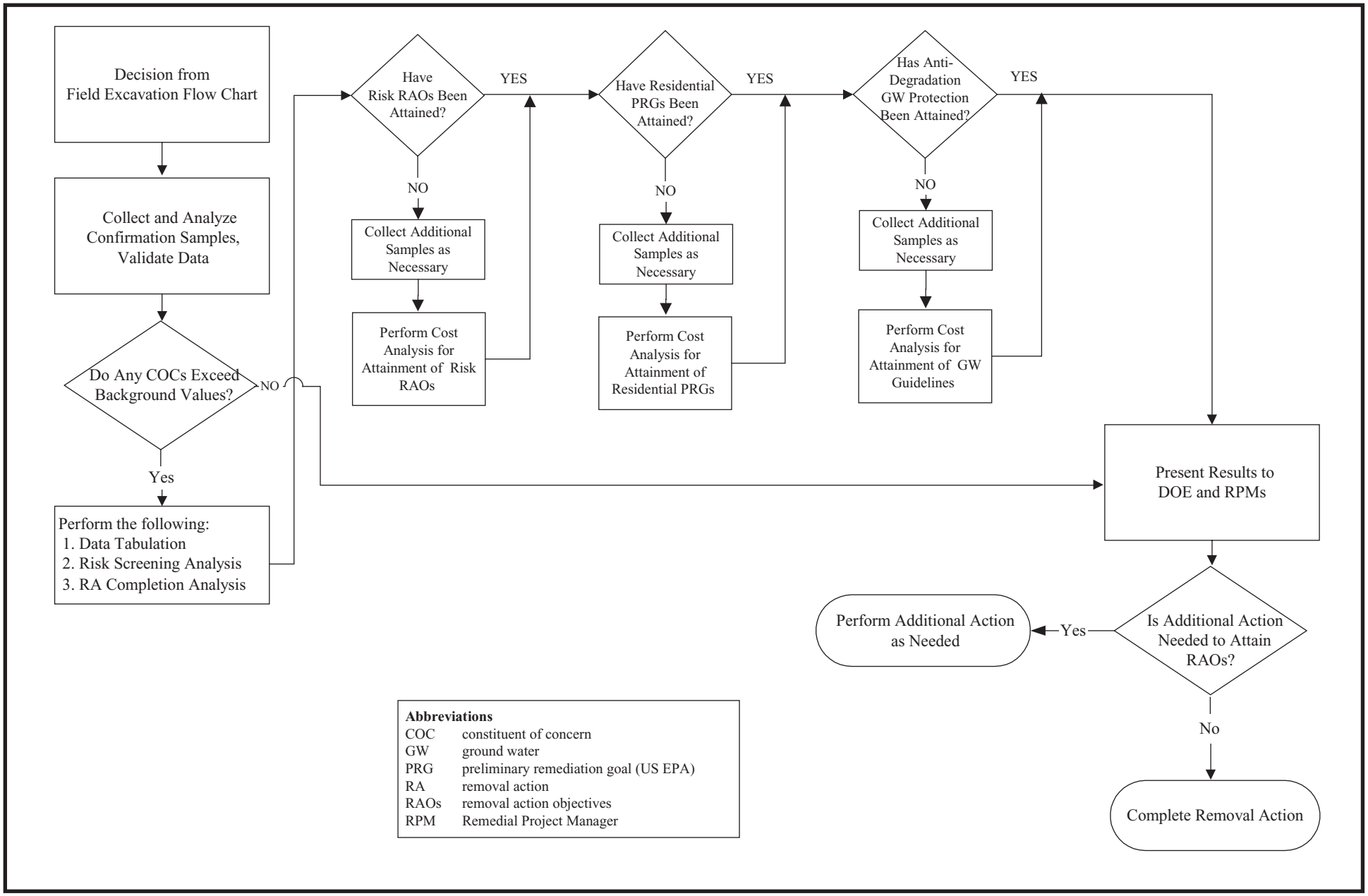

Figure 6-1. Domestic Septic Systems 3 and 6 Removal Actions Phase II Data Evaluation Decision Flow Diagram

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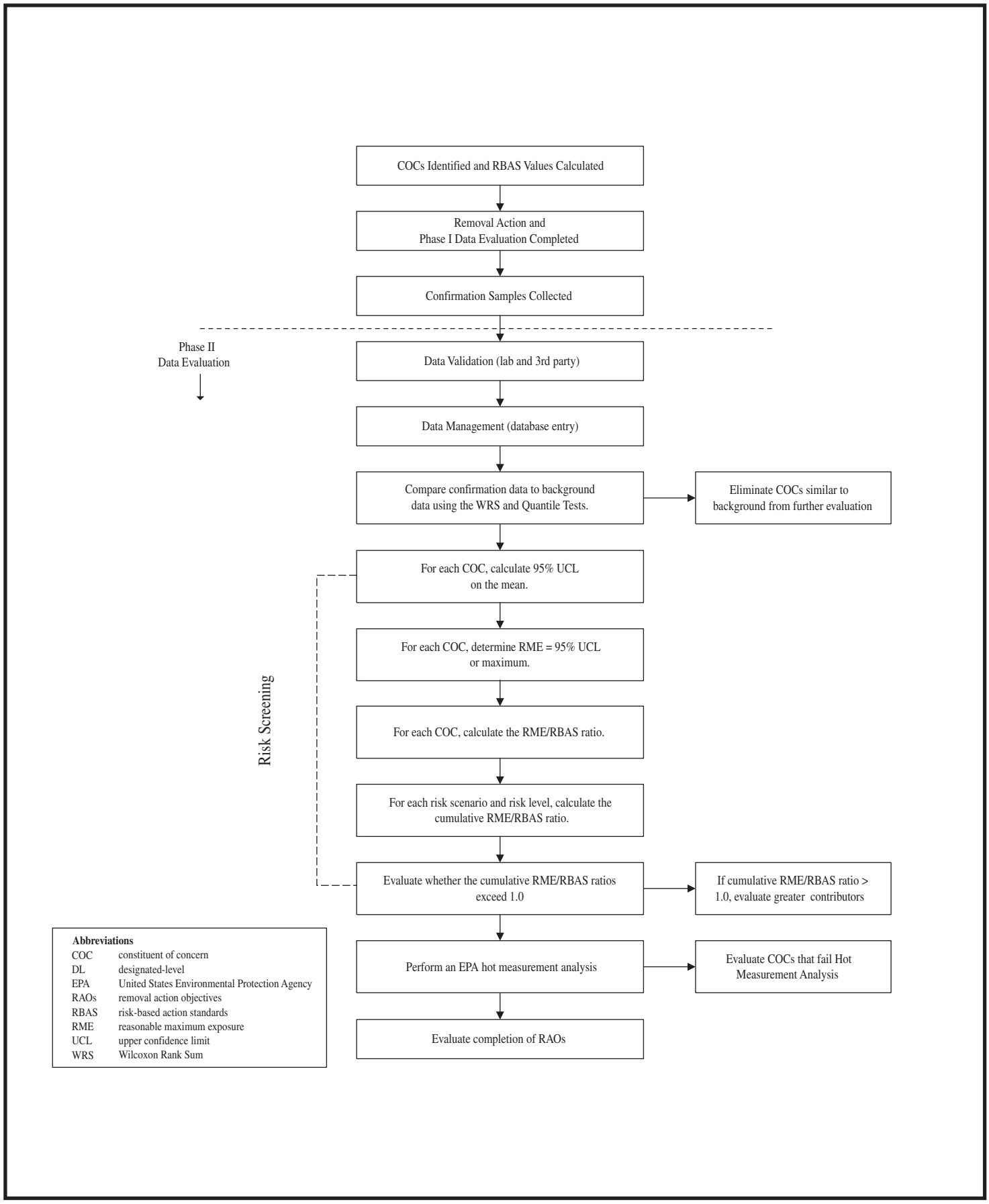

Figure 6-2. Domestic Septic Systems 3 and 6 Data Evaluation Process

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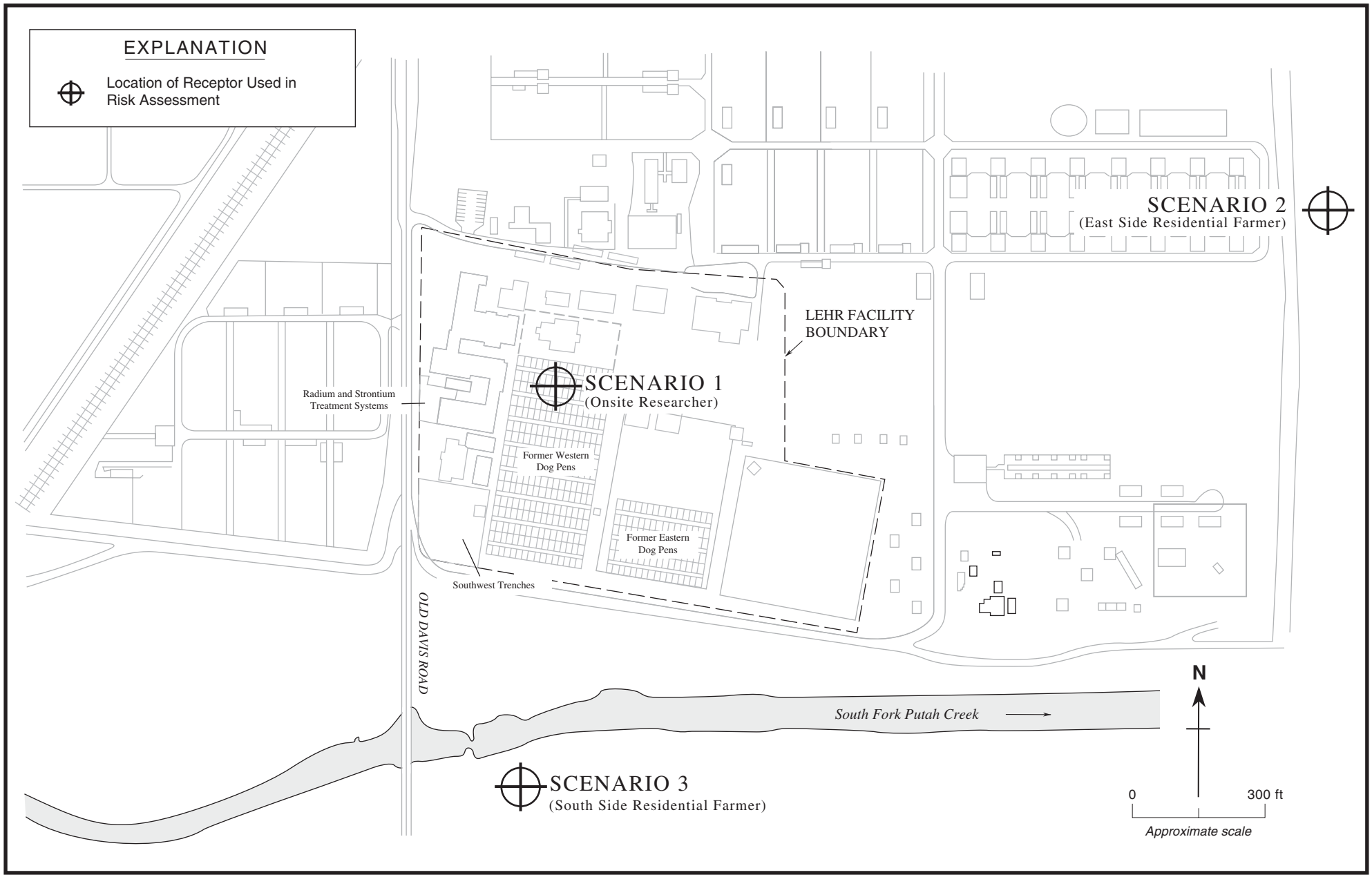

Figure 6-3. Receptor Locations for Risk Scenarios 1,2, and 3

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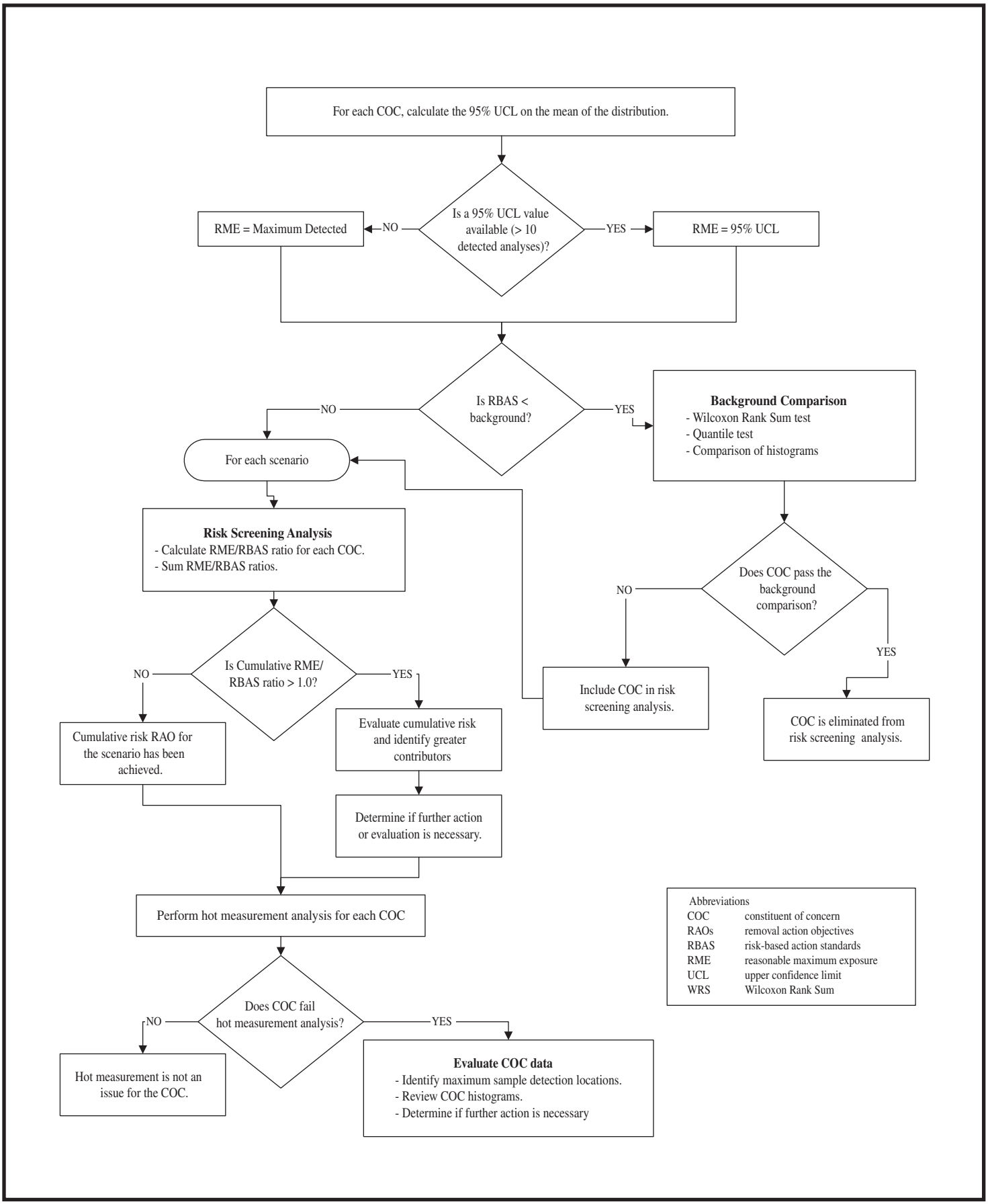

Figure 6-4. Risk Screening Decision Flow Chart

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7. REMOVAL ACTION COMPLETION ANALYSIS

In the DSSs 3 and 6 RAs work plan, (WA, 2002), six objectives were defined for the RAs. Attainment of each is discussed below.

7.1 Removal Action Objective 1—Reduce Cancer Risk

The first RAO is to reduce the excess cumulative cancer risk from the DSSs 3 and 6 areas to the nominal range of 10^{-4} to 10^{-6} using 10^{-6} as the point of departure. As discussed in Section 6.2.5.1, the cancer risk for all three scenarios is below 10^{-6}. Therefore, this objective has been attained at both the DSSs 3 and 6 areas.

7.2 Removal Action Objective 2—Reduce Non-Cancer Hazard Quotient

The second RAO is to reduce the non-cancer HQ below 1.0. As discussed in Section 6.2.5.2, this RAO has been attained for RBAS Scenarios 1 and 3. However, this RAO was not attained at DSS 3 or 6 for RBAS Scenario 2. The cumulative non-cancer RBAS HQs for DSSs 3 and 6 were 3.22 and 2.5, respectively. Hg was the most significant contributor in both areas. However, the EPA Region 9 PRG HQ is less than 1. Attainment of this RAO will be determined during the planned Site-Wide Risk Assessment.

7.3 Removal Action Objective 3—Mitigate Ground Water Impact

The third RAO is to mitigate potential future impacts to ground water associated with residual COC concentrations in soil. The RA mitigated the ground water impacts by removing contaminated structures and soil. The DL analysis (Section 6.3) indicates that residual silver, nitrate, Hg, molybdenum, formaldehyde and chromium in DSS 3 Area soil may result in future localized impacts above background and/or MCLs. The DSS 6 DL analysis indicates that residual Hg in DSS 6 area soil may result in future localized impacts above background and MCLs. However, the residual Hg is not widespread and its extent needs to be confirmed due to analytical data quality issues.. The evaluation of the possible need for future remedial action to address these residual COCs will be addressed in the Draft Final U.S. Department of Energy Areas Feasibility Study.

7.4 Removal Action Objective 4—Mitigate Ecological Risk

The fourth RAO is to mitigate potential ecological risks during and after the RA. During the RA, mitigation measures including fencing and storm water sediment control were implemented to protect sensitive habitat on site. No impact to ecological receptors was observed during the RA. Since no ecological risk screening has been performed at the Site, no ecological risk-based screening standards are available for comparison and evaluation of this RAO. Attainment of this RAO will be determined during the planned Site-Wide Risk Assessment.

7.5 Removal Action Objective 5—Mitigate Hazardous Waste

The fifth RAO is to mitigate hazardous waste. All of the confirmation samples with total Hg concentrations exceeding 10 times the STLC value or 20 times the TCLP were analyzed for Hg by the WET and/or TCLP analytical procedures. The analytical results indicated that all residual Hg was below the hazardous waste limits. Therefore, this RAO has been attained.

7.6 Removal Action Objective 6—Minimize Disruption to University Research

The sixth RAO is to minimize disruption to University research activities while conducting the RA. The RA implemented at the DSSs 3 and 6 areas during the summer of 2002 did not significantly disrupt University research. Therefore this objective has been attained.

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APPENDIX A

DOMESTIC SEPTIC SYSTEM 3 RADIOLOGICAL FIELD SURVEY

A. DOMESTIC SEPTIC SYSTEM 3 RADIOLOGICAL FIELD SURVEY

Between June 20 and June 25, 2002, The Shaw Group Inc (Shaw) conducted a 100% surface scan of the Domestic Septic System 3 (DSS 3) area excavation. The radiological field survey was conducted at the request of the California Department of Health Services to evaluate whether any localized areas of radium-226 (Ra-226) or strontium-90 (Sr-90) activity existed above the derived concentration guideline for elevated measurement comparison ($DCGL_{EMC}$) values. The $DCGL_{EMC}$ values for Ra-226 and Sr-90 in DSS 3 soil are 7.3 picoCuries per gram (pCi/g) and 3,740 pCi/g, respectively. These $DCGL_{EMC}$ values were derived following Section 5.5.2.4 of the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) (NRC, 1997). On June 14, 2002, the California Department of Health Services (DHS) concurred with the DSS 3 surface scan work plan that presented the $DCGL_{EMC}$ values.

A.1 Surface Scan Procedure

A two-inch by two-inch sodium iodide (NaI) detector was used to scan for elevated Ra-226 activity. A Geiger-Mueller (G-M) detector was used to scan for elevated Sr-90 activity. Both detectors were used with Ludlum rate-meters, containing audio as well as meter response.

Field instrumentation setup consisted of establishing site background count rates and determining the scan minimum detectable concentration (MDC) for each instrument. The NaI detector background was 6461 counts per minute (cpm) and the G-M detector background was 48 cpm. The NaI detector scan MDC was 2000 counts per minute, which corresponds to a Ra-226 activity of 3.7 pCi/g. The G-M detector scan MDC was 60 cpm (644 pCi/g). On June 14, 2002, the California DHS concurred with the DSS 3 surface scan workplan containing these scan MDC values.

Upon setup, standard operation of the instrumentation was conducted in accordance with manufacturer operating instructions. A Shaw radiological control technician scanned the entire surface of the excavation at a speed no greater than two inches per second with the G-M detector. The excavation was also surveyed at a speed no greater than 0.5 meters per second with the NaI detector. The distance between the detector and the excavation surfaces was 0.25 to 0.50 inches (in.) for the G-M detector and approximately 2.5 in. for the NaI detector. This survey utilized the same 5 foot (ft) by 5 ft grid system that was established throughout the RA area as the reference coordinate system for marking and determining sample locations in the field. The 5 ft by 5 ft squares were physically marked over the entire excavation area. The surveyor documented the observed average count at the center of each grid square.

A.2 Surface Scan Results

The surface scan data are shown in Table A-1. The highest NaI detector (gamma scan) and G-M detector (beta scan) count rates were 10,183 cpm and 69 cpm, respectively. Soil samples were collected at the two locations of highest activity identified during the gamma and beta scans (four samples total) and analyzed for Ra-226 and Sr-90 by the onsite analytical laboratory. Ra-226 activities in the soil samples were 0.414 pCi/g and 0.481 pCi/g. The Sr-90 activities were 1.95 pCi/g and 2.34 pCi/g.

Although the maximum gamma scan count rate was 3,722 cpm above background, the soil sample results indicated that Ra-226 was less than 0.5 pCi/g at the maximum gamma location. Because the background value for Ra-226 in LEHR soil is 0.75 pCi/g, it appears that the scan counts above background are not due to excess Ra-226 activity. The count rate was anticipated to be artificially high due to the trench geometry in the DSS 3 excavation. Thus, the apparent 3,722 cpm activity above background, which could be roughly correlated to 6.9 pCi/g for the NaI field detector, is actually well below the 7.3 pCi/g $DCGL_{EMC}$ for Ra-226.

The maximum beta scan count rate was 21 cpm above background, which is roughly 225 pCi/g for the G-M field detector. The Sr-90 activity appears to be well below $DCGL_{EMC}$ of 3,740 pCi/g based on the beta scan data and the results of soil samples collected at the locations of maximum beta scan activity (1.95 pCi/g and 2.34 pCi/g).

Table A-1. Radiological Surface Scan Data, Domestic Septic System 3

NorthWall		South Wall		Trench Floor	
Gamma Scan Average cpm	Beta Scan Average cpm	Gamma Scan Average cpm	Beta Scan Average cpm	Gamma Scan Average cpm	Beta Scan Average cpm
10033	49	9613	52	9701	69
10149	53	9792	57	9631	54
10183	47	9965	49	9946	59
9886	52	9879	54	10073	63
9834	56	9810	47	10033	58
9814	59	9503	47	9947	53
9607	49	9606	52	9847	66
9677	52	9702	45	9924	60
9567	47	9356	49	10024	47
9230	42	10021	55	9812	63
9019	48	8893	46	9785	55

West Wall		East Wall		Trench Floor	
Gamma Scan Average cpm	Beta Scan Average cpm	Gamma Scan Average cpm	Beta Scan Average cpm	Gamma Scan Average cpm	Beta Scan Average cpm
8075	49	7845	42	7917	53
7687	51	N/A	N/A	7717	48
7491	45	N/A	N/A	7919	58
7721	46	7469	48	7443	54
8125	48	7844	48	7948	60
7354	53	7599	41	8008	52

Abbreviation

cpm counts per minute

APPENDIX B

CONFIRMATION AND DESIGNATED-LEVEL SAMPLE ANALYTICAL RESULTS

Appendix B is a compact disk attached to the inside back cover of this binder.

APPENDIX C

RISK-BASED ACTION STANDARD RE-CALCULATIONS

C. RISK-BASED ACTION STANDARD RECALCULATIONS

Area-specific risk-based action standard (RBAS) values for mercury and heptachlor epoxide were recalculated for Domestic Septic System (DSS) 3 based on designated-level (DL) and confirmation data gathered in 2002. In addition, the DSS 6 mercury RBAS value was recalculated using the 2002 data. The 2002 DL and confirmation data provided more detailed characterization information for these compounds, providing the opportunity to calculate more realistic, yet conservative, RBAS values. The new RBAS values were calculated using new contamination intervals determined from the 2002 data and used in the vadose zone model.

C.1 Approach

The DSSs 3 and 6 RBAS values were recalculated using the same approach used in Draft Determination for Risk-Based Action Standards for DOE Areas (WA, 1997a). The calculations were performed for the non-carcinogenic effects related to mercury and both carcinogenic and non-carcinogenic effects related to heptachlor epoxide. RBAS calculations were performed for Risk Scenario 2 (East Residential Farmer) only. Risk Scenarios 1 (On-Site Researcher) and 3 (South Residential Farmer) were not included in RBAS calculations because all contaminant migration pathways under these scenarios were closed due to removal action (RA) activities at DSSs 3 and 6.

C.1.1 Exposure Pathways

Contaminant migration from vadose zone soil to ground water is the only open pathway at DSSs 3 and 6 after the 2002 RA because any residual contamination is covered with clean fill and located at least 4 feet (ft) below ground surface (bgs). The only open exposure routes are ingestion of ground water and dermal contact with ground water while showering under Risk Scenario 2. Risk Scenarios 1 and 3 don't include ground water ingestion or dermal contact with ground water as explained in the Draft Determination for Risk-Based Action Standards for DOE Areas (WA, 1997a). The remaining pathways, which are direct soil contact, atmospheric dispersion, and surface water runoff, are closed for all three Scenarios due to the clean fill that overlies any residual contamination. The exposure pathway analysis is shown in Table C-1 with a comparison of open and closed pathways before and after the 2002 RA. Based on the exposure pathway analysis, the DSSs 3 and 6 RBAS re-calculations include:

- A determination of ground water impact from vadose zone contamination;
- Health risk calculations for ground water ingestion; and,
- Health risk calculations for dermal contact with ground water.

The ground water impact determination and risk calculations are described below.

C.1.2 Determination of Ground Water Impact

A vadose zone model was used to determine the peak impact that vadose zone contamination could have on ground water. The vadose zone model is described in detail in Draft Determination for Risk-Based Action Standards for DOE Areas (WA, 1997a). DSSs 3 and 6 vadose zone contamination interval data, soil property data, and chemical-specific parameters were used in the vadose zone model to determine ground water impact.

C.1.2.1 Vadose Zone Contamination Intervals

Vadose zone contamination intervals were determined for mercury and heptachlor epoxide at DSS 3 and mercury at DSS 6 using 2002 data.

Year 2002 confirmation samples collected from the DSS 3 RA excavation indicated that mercury concentrations were above background in the sidewalls and floor of the excavation. However, the DSS 3 DL samples indicated mercury did not extend below the excavation base. To be conservative, we assumed the elevated sidewall and excavation floor concentrations were arranged in the same contamination interval extended continuously from 4 to 12 ft bgs.

Heptachlor epoxide was detected 5.5 ft bgs in only one of 27 confirmation samples collected at DSS 3. Because heptachlor epoxide was detected in only 1 of the 27 confirmation samples, the extent of contamination is likely very limited. A contamination interval of 5 to 6 ft bgs was chosen to represent the limited presence of heptachlor epoxide at DSS 3.

Mercury concentrations were above background in DSS 6 DL samples between 10 and 20 feet bgs and DSS 6 confirmation samples indicated mercury was above background from 4 ft bgs to the base of the excavation. To be conservative, the mercury contamination interval was assumed to extend from 4 to 20 feet bgs.

C.1.2.2 Soil Lithology, Soil Physical Parameters, and Chemical Specific Parameters

Native soil types encountered in the DL soil borings at DSSs 3 and 6 consisted of low permeability sandy clay and sandy silt to 29 feet bgs (Table 5-6). The backfill soil placed in the excavations at DSSs 3 and 6 was characterized by the field geologist as low permeability sandy silt. Cooper Testing Lab, Inc. of Mountain View, California View tested the fill material for hydraulic permeability using American Society for Testing and Materials Method D5084 (falling head/rising tailwater procedure). The hydraulic permeability of the fill material was determined to be 2×10^{-6} centimeters per second, consistent with the field geologist's characterization. Based on the soil classification and hydraulic permeability of the backfill and the lithology of the underlying native soil, the soil columns at DSSs 3 and 6 were assumed to consist of clayey sandy silt from ground surface to the base of the models 25 feet bgs. The soil columns used in the DSS 3 and DSS 6 models are shown in Tables C-2 and C-3, respectively.

The soil physical parameters used in the vadose zone model are from the LEHR soil data presented in the Draft Final One-Dimensional Vadose Zone Modeling (WA, 1997b) report and shown in Table C-4. Chemical-specific modeling parameters for mercury and heptachlor epoxide are shown in Table C-5. Mercury and heptachlor epoxide K_d values were obtained from the literature sources listed in the reference section of Table C-5. Each K_d value selected for use in modeling is the most conservative (lowest) value found among the literature values.

C.1.2.3 Modeling Results

A one-dimensional model was used to simulate contaminant migration from the vadose zone to ground water. Application of the Nonisothermal Unsaturated-Saturated Flow and Transport (NUFT) code to RBAS value determinations is described in detail in the Draft Determination for Risk-Based Action Standards for DOE Areas (WA, 1997a).

In summary, an arbitrary initial contaminant concentration of 100 mg/kg was applied to the vadose zone contamination interval and the NUFT model was run to determine the resulting contaminant concentration in ground water at the water table over time. The vadose zone model outputs for mercury at DSS3, heptachlor epoxide at DSS 3, and mercury at DSS 6 are shown in Tables C-6, C-7, and C-8, respectively. The peak concentrations in ground water were selected from the model outputs and used to determine vadose zone factors, which are the peak ground water concentrations divided by the initial contaminated interval soil concentrations.

The vadoze zone factors were multiplied by a previously determined lateral ground water factor (LF) to get the total conversion factors (TFs) from on-site vadose zone soil to the offsite ground water used in Scenario 2. The LF represents the concentration in ground water at the offsite receptor divided by the concentration in ground water at the onsite source. The LF is not chemical-specific and its determination is described in the Draft Determination for Risk-Based Action Standards for DOE Areas (WA, 1997A). TFs for mercury at DSS 3, heptachlor epoxide at DSS 3, and mercury at DSS6 are shown in Tables C-6, C-7, and C-8, respectively. The RBAS concentration in soil is multiplied by the TF to obtain the concentration in ground water that the Scenario 2 receptor would use for ingestion and showering.

C.1.3 Toxicity

Similar to previous RBAS calculations, toxicity parameters for mercury and heptachlor epoxide were taken from the Environmental Protection Agency Integrated Risk Information System (IRIS) online (http://www.epa.gov/iris/index.html). Based on the historical use of mercuric chloride as a tissue preservative, mercury was assumed to be deposited in DSS 3 and DSS 6 soil in the form of mercuric chloride from laboratory sink waste. Non-carcinogenic effects from oral dosage characterize mercuric chloride toxicity. Inhalation dosage applies only to the elemental form of mercury, which is not present in DSS 3 and DSS 6 soil based on mercury speciation analyses.

Toxicity parameters shown in Table C-5 were obtained from IRIS for the carcinogenic and non-carcinogenic effects of heptachlor epoxide.

C.1.4 RBAS Recalculation Results

The RBAS recalculations are shown in Tables C-9 through C-12. Tables C-9 and C-12 contain the mercury RBAS recalculations for DSS 3 and DSS 6, respectively. Tables C-10 and C-11 contain the heptachlor epoxide RBAS recalculations for carcinogenic and non-carcinogenic effects, respectively, for DSS 3. The RBAS recalculation results are summarized in Table C-13.

Table C-1. Revised Residential Farmer Exposure Pathway Analysis, Domestic Septic Systems 3 and 6, Post-Removal Action

Source	Transport Mechanism	Exposure Route	Pathway Open?		Rationale
			Before 2002 Removal Action	After 2002 Removal Action	
DSS 3 and 6 Post-Removal Action Soil Contamination	Direct contact	Dermal exposure	No	No	No direct access to on-site soil.
		Direct ingestion	No	No	Residents would not cross fenced LEHR Site boundary.
	Migration in saturated/unsaturated zone via diffusion, advection, etc.	Ground water ingestion	Yes	Yes	Ground water ingestion from residential well assumed. Receptor is assumed to be downgradient of contamination source.
	Subsurface diffusion/volatilization	Inhalation	No	No	Mercury and heptachlor epoxide are not volatile.
	Dispersion and deposition of particulates in air	Inhalation of particulates	Yes	No	No contact between subsurface soil and atmosphere for dispersion.
		Deposition with dermal exposure/Direct ingestion	Yes	No	
		Deposition with impacted food ingestion	Yes	No	
	Precipitation and surface water runoff	Incidental ingestion of surface water	Yes	No	No contact between subsurface soil and surface water.
		Dermal exposure to surface water	Yes	No	
		Aquatic food ingestion	Yes	No	
	Direct exposure	External radiation	No	No	Mercury and heptachlor epoxide are not radiological constituents.

Table C-2. Representative Soil Profile, Domestic Septic System 3

Element	dz(m)	depth (m)	dz (ft)	depth (ft)	Material	Boundary Condition
30	1.00	0.00	3.28	0.00	ATM	atmospheric element
29	1.00	0.00	3.28	0.00	ATM	recharge element
28	0.15	0.15	0.50	0.50	non-clayey silt	
27	0.15	0.31	0.50	1.00	non-clayey silt	
26	0.31	0.61	1.00	2.00	non-clayey silt	
25	0.31	0.92	1.00	3.00	non-clayey silt	
24	0.15	1.07	0.50	3.50	non-clayey silt	
23	0.15	1.22	0.50	4.00	non-clayey silt	
22	0.15	1.37	0.50	4.50	non-clayey silt	
21	0.15	1.53	0.50	5.00	non-clayey silt	backfill soil
20	0.31	1.83	1.00	6.00	non-clayey silt	
19	0.31	2.14	1.00	7.00	non-clayey silt	
18	0.31	2.44	1.00	8.01	non-clayey silt	
17	0.31	2.75	1.00	9.01	non-clayey silt	
16	0.31	3.05	1.00	10.01	non-clayey silt	
15	0.31	3.36	1.00	11.01	non-clayey silt	base of excavation
14	0.31	3.66	1.00	12.01	non-clayey silt	no soil type change
13	0.31	3.97	1.00	13.01	non-clayey silt	
12	0.31	4.27	1.00	14.01	non-clayey silt	
11	0.31	4.58	1.00	15.01	non-clayey silt	
10	0.31	4.88	1.00	16.01	non-clayey silt	native soil
9	0.31	5.19	1.00	17.01	non-clayey silt	
8	0.31	5.49	1.00	18.01	non-clayey silt	
7	0.31	5.80	1.00	19.01	non-clayey silt	
6	0.31	6.10	1.00	20.01	non-clayey silt	water table 20 feet below ground surface
5	0.31	6.41	1.00	21.01	non-clayey silt	
4	0.31	6.71	1.00	22.01	non-clayey silt	
3	0.31	7.02	1.00	23.02	non-clayey silt	
2	0.31	7.32	1.00	24.02	non-clayey silt	
1	0.31	7.63	1.00	25.02	non-clayey silt	1.98 m of water. Aquifer receiving all of contamination assumed to be 1.98 meters (6 feet) thick.

Note: Thirty elements are contained in the model column.

Abbreviations

ATM atmospheric element (ambient air above the soil column)
dz (ft) element thickness in feet
dz (m) element thickness in meters
ft foot/feet
m meter

Table C-3. Representative Soil Profile, Domestic Septic System 6

Element	dz(m)	depth (m)	dz (ft)	depth (ft)	Material	Boundary Condition
30	1.00	0.00	3.28	0.00	ATM	atmospheric element
29	1.00	0.00	3.28	0.00	ATM	recharge element
28	0.15	0.15	0.50	0.50	non-clayey silt	
27	0.15	0.31	0.50	1.00	non-clayey silt	
26	0.31	0.61	1.00	2.00	non-clayey silt	
25	0.31	0.92	1.00	3.00	non-clayey silt	
24	0.15	1.07	0.50	3.50	non-clayey silt	Backfill Soil
23	0.15	1.22	0.50	4.00	non-clayey silt	
22	0.15	1.37	0.50	4.50	non-clayey silt	
21	0.15	1.53	0.50	5.00	non-clayey silt	
20	0.31	1.83	1.00	6.00	non-clayey silt	
19	0.31	2.14	1.00	7.00	non-clayey silt	Base of Excavation
18	0.31	2.44	1.00	8.01	non-clayey silt	No Soil Type Change
17	0.31	2.75	1.00	9.01	non-clayey silt	
16	0.31	3.05	1.00	10.01	non-clayey silt	
15	0.31	3.36	1.00	11.01	non-clayey silt	
14	0.31	3.66	1.00	12.01	non-clayey silt	
13	0.31	3.97	1.00	13.01	non-clayey silt	Native Soil
12	0.31	4.27	1.00	14.01	non-clayey silt	
11	0.31	4.58	1.00	15.01	non-clayey silt	
10	0.31	4.88	1.00	16.01	non-clayey silt	
9	0.31	5.19	1.00	17.01	non-clayey silt	
8	0.31	5.49	1.00	18.01	non-clayey silt	
7	0.31	5.80	1.00	19.01	non-clayey silt	
6	0.31	6.10	1.00	20.01	non-clayey silt	water table 20 feet below ground surface
5	0.31	6.41	1.00	21.01	non-clayey silt	
4	0.31	6.71	1.00	22.01	non-clayey silt	
3	0.31	7.02	1.00	23.02	non-clayey silt	
2	0.31	7.32	1.00	24.02	non-clayey silt	
1	0.31	7.63	1.00	25.02	non-clayey silt	1.98 m of water. Aquifer receiving all of contamination assumed to be 1.98 meters (6 feet) thick.

Note: Thirty elements are contained in the model column.

Abbreviations

ATM atmospheric element (ambient air above the soil column)
dz (ft) element thickness in feet
dz (m) element thickness in meters
ft foot/feet
m meter

Table C-4. One-Dimensional Vadose Zone Modeling Physical Parameters for Domestic Septic Systems 3 and 6 Risk-Based Action Standard Re-Calculation

Soil Type Parameter	Unit	Clayey Sandy Silt
Solid density (ρs)	kg/m^3	2,570
Bulk density (ρB)	kg/m^3	1,700
Vertical hydraulic conductivity (Kz)	cm/sec	7.08E-05
Intrinsic permeability	m^2	7.22E-14
Porosity (f)	%	0.354

Abbreviations

%	percent
cm/sec	centimeters per second
kg/m^3	kilograms per cubic meter
m^2	square meters

Table C-5. Chemical-Specific and Toxicological Parameters

Parameter	Unit	Mercuric Chloride	Heptachlor Epoxide
Mol. Wt.	g/mole	232.68[f]	389.3[f]
RfDo	mg/kg-day	0.0003[g]	0.000013[g]
RfDi	mg/kg-day	none	0.000013[g]
Sfo	1/(mg/kg-day)	none	9.1[g]
Sfi	1/(mg/kg-day)	none	9.1[g]
K_d[(1)]	ml/g	52[f]	160[f]

Abbreviations

g/mole	grams per mole
K_d	adsorption coefficient
mg/kg-day	milligrams per kilogram per day
ml/g	milliliters per gram
Mol.	molecular
None	Toxicity threshold or slope factor not currently published in toxicology literature for inorganic mercury, including mercuric chloride.
RfD_0	reference dose
RfDi	reference dose inhalation
Sf_i	slope factor, inhalation
Sf_o	slope factor, oral
Wt.	weight

Note

(1) K_d values for each constituent were obtained from the literature sources listed below. Each K_d value selected for use in modeling is the most conservative (lowest) value found in the literature.

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e US Department of Energy, 1996 RESRAD-BASELINE for Windows, Version 2.20, Radiological Health Risk Section, Environmental Assessments Division, Argone National Laboratory.

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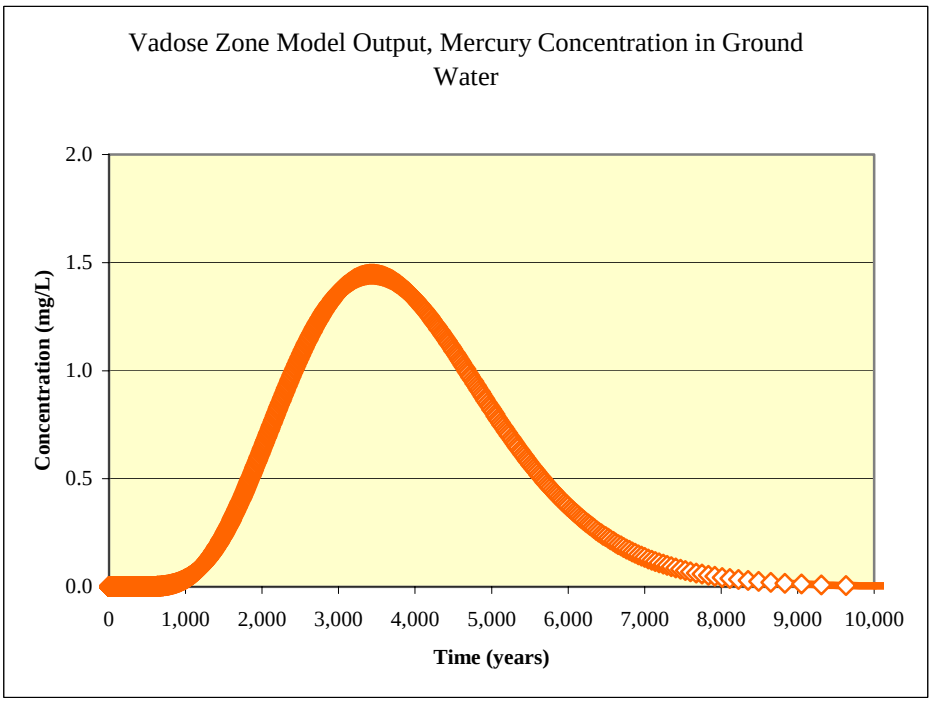
Table C-6. Model Results, Mercury Risk-Based Action Standard, 4- to 12-Foot Contaminated Depth, Domestic Septic System 3, Laboratory for Energy-Related Health Research

Soil to Offsite Ground Water Conversion Factor		
Arbitrary initial concentration in soil	100	mg/kg
Peak ground water concentration	1.446	mg/L
Vadose zone factor	0.01446	(mg/L)/(mg/kg)
Lateral ground water factor	0.2	(mg/L)/(mg/L)
Total conversion factor	**0.002892**	(mg/L)/(mg/kg)

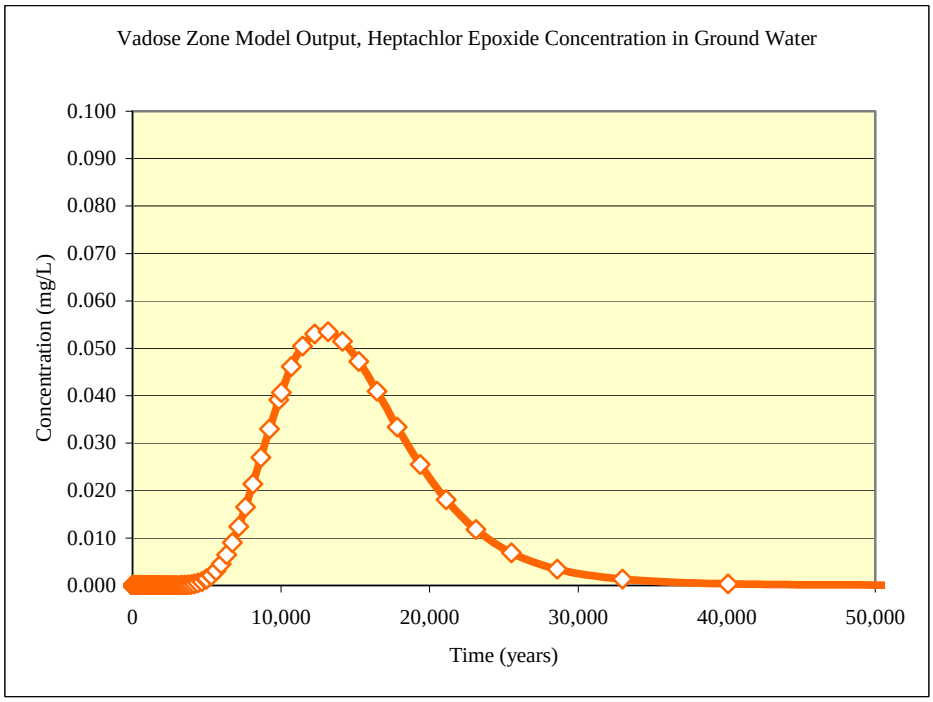


Abbreviations

mg/kg milligrams per kilogram
mg/L milligrams per liter

Table C-7. Model Results for Heptachlor Epoxide Risk-Based Action Standard, 5- to 6-Foot Contaminated Depth, Domestic Septic System 3, Laboratory for Energy-Related Health Research

Soil to Offsite Ground Water Conversion Factor		
Arbitrary initial concentration in soil	100	mg/kg
Peak ground water concentration	0.0535	mg/L
Vadose zone factor	0.0005349	(mg/L)/(mg/kg)
Lateral ground water factor	0.2	(mg/L)/(mg/L)
Total conversion factor	**0.000107**	(mg/L)/(mg/kg)

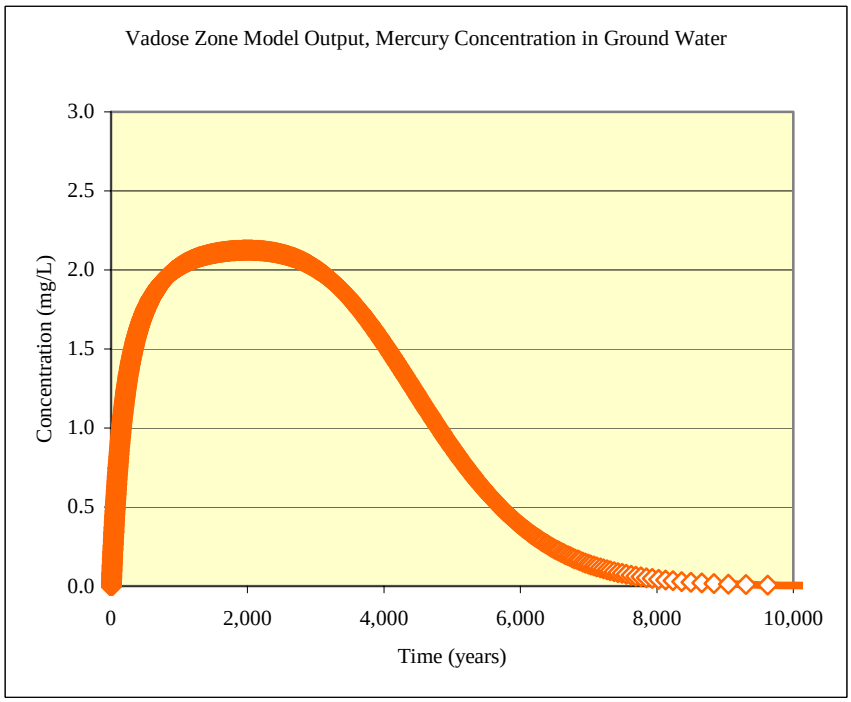


Abbreviations

mg/kg milligrams per kilogram
mg/L milligrams per liter

Table C-8. Model Results for Mercury Risk-Based Action Standard, 4- to 12-Foot Contaminated Depth, Domestic Septic System 6

Soil to Offsite Ground Water Conversion Factor		
Arbitrary initial concentration in soil	100	mg/kg
Peak ground water concentration	2.125	mg/L
Vadose zone factor	0.02125	(mg/L)/(mg/kg)
Lateral ground water factor	0.2	(mg/L)/(mg/L)
Total conversion factor	**0.00425**	(mg/L)/(mg/kg)



Abbreviations

mg/kg milligrams per kilogram
mg/L milligrams per liter

Table C-9. Domestic Septic System 3 Mercury Risk-Based Action Standard Re-Calculation

Scenario 2, RBAS value and Hazard Quotients for mercury, 4-12 ft deep contaminated interval, Domestic Septic System 3

Target HQ 1.00E+00

Analyte	Soil Conc. (mg/kg)	Ground Water Ingestion HQ	Swimming Ingestion HQ	Dermal Swimming HQ	Dermal Showering HQ	Soil Ingestion HQ	Dermal Soil HQ	Inhalation HQ	Fish Ingestion HQ	Plant Ingestion HQ	Meat Ingestion HQ	Milk Ingestion HQ	HQ Across Pathways
mercury (hg)	1.13	9.95E-01	0.00E+00	0.00E+00	4.86E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.000E+00

Ground Water Ingestion Pathway

Scenario 2, HQ Back Calculation - Non-Carcinogens, Ground Water Concentration Conversion Factors

Analyte	Soil Concentration (4-12 ft bgs) (mg/kg)	Vadose Zone Modeling Result[1] Ground Water/Soil Ratio (mg/L)/(mg/kg)	Ground Water Concentration (mg/L)
mercury (hg)	1.13	2.89E-03	3.27E-03

[1] Vadose zone modeling result is the ground water concentration at the receptor divided by the concentration in soil at the source.

Summary Table

Scenario 2, HQ Back Calculation - Ingestion of chemicals in drinking water.

Chemical	CW (mg/L)	Child IR (L/d)	Adult IR (L/d)	EF (d/yr)	Child ED (yr)	Adult ED (yr)	Child BW (Kg)	Adult BW (Kg)	Child AT (days)	Adult AT (days)	I (mg/kg-day)	RfDo (mg/kg-day)	HQ (unitless)
mercury (hg)	3.27E-03	1.0	2	350	6	24	15	70	2190	8760	2.99E-04	**0.0003**	9.95E-01

CW = Chemical Concentration in Water (mg/L)
IR = Ingestion Rate (L/d)
EF = Exposure Frequency (d/yr)
ED = Exposure Duration (yr)
BW = Body Weight (Kg)
AT = Averaging Time (days)
I = Intake (mg/kg-day) = CW x IR_{child} x EF x ED_{child} / BW_{child} / AT_{child} + CW x IR_{adult} x EF x ED_{adult} / BW_{adult} / AT_{adult}
RfDo = Oral Reference Dose (mg/kg-d)
HQ = Calculated Hazard Quotient (unitless) = I / RfDo

Showering - Dermal Pathway

Scenario 2, HQ Back Calculation - Dermal Contact With Chemicals in Water While Showering.

From GW ingestion

Summary Table

Chemical	CW (mg/L)	SA (cm^2)	PC (cm/hr)	ET (hr/d)	EF (d/yr)	Child ED (yr)	Adult ED (yr)	CF ($1L/1000cm^3$)	Child BW (Kg)	Adult BW (Kg)	Child AT (days)	Adult AT (days)	AD (mg/kg-day)	RfDo (mg/kg-day)	HQ (unitless)
mercury (hg)	3.27E-03	23,000	0.001	0.25	350	6	24	0.001	15	70	2190	8760	1.46E-06	0.0003	4.86E-03

CW = Chemical Concentration in Water (mg/L)
SA = Skin Surface Area Available for Contact (cm^2)
PC = Dermal Permeability Constant (cm/hr) - chemical specific. Values from Table I-1.
ET = Exposure Time (hr/d)
EF = Exposure Frequency (d/yr)
ED = Exposure Duration (yr)
CF = Volumetric Conversion Factor for Water ($1L/1000cm^3$)
BW = Body Weight (Kg)
AT = Averaging Time (days)
AD = Absorbed Dose (mg/kg-day) = CW x SA x PC x ET x EF x ED_{child} x CF / BW_{child} / AT_{child} + CW x SA x PC x ET x EF x ED_{adult} x CF / BW_{adult} / AT_{adult}
RfDo = Oral Reference Dose (mg/kg-d)
HQ = Calculated Hazard Quotient (unitless) = AD / RfDo

End of Calculations

Table C-10. Domestic Septic System 3 Carcinogenic Heptachlor Epoxide Risk-Based Action Standard Re-Calculation

Scenario 2, RBAS value and carcinogenic risk for heptachlor epoxide, 5-6 ft deep contaminated interval, Domestic Septic System 3

Target HQ 1.00E+00

Analyte	Soil Conc. (mg/kg)	Ground Water Ingestion Risk	Swimming Ingestion Risk	Dermal Swimming Risk	Dermal Showering Risk	Soil Ingestion Risk	Dermal Soil Risk	Inhalation Risk	Fish Ingestion Risk	Plant Ingestion Risk	Meat Ingestion Risk	Milk Ingestion Risk	Risk Across Pathways
Heptachlor epoxide	0.0689	9.97E-07	0.00E+00	0.00E+00	2.64E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.000E-06

Ground Water Ingestion Pathway

Scenario 2, Back Calculation - Ground Water Concentration Conversion Factor

Analyte	Soil Concentration (5-6 ft bgs) (mg/kg)	Vadose Zone Modeling Result[1] Ground Water/Soil Ratio (mg/L)/(mg/kg)	Ground Water Concentration (mg/L)
Heptachlor epoxide	0.0689	1.07E-04	7.37E-06

[1] Vadose zone modeling result is the ground water concentration at the receptor divided by the concentration in soil at the source.

Summary Table

Scenario 2, Risk Back Calculation - Ingestion of chemicals in drinking water.

Chemical	CW (mg/L)	Child IR (L/d)	Adult IR (L/d)	EF (d/yr)	Child ED (yr)	Adult ED (yr)	Child BW (Kg)	Adult BW (Kg)	AT (days)	I (mg/kg-day)	SFo (kg-d/mg)	Risk (unitless)
Heptachlor epoxide	7.37E-06	1.0	2	350	6	24	15	70	25550	1.10E-07	9.1	9.97E-07

CW = Chemical Concentration in Water (mg/L)
IR = Ingestion Rate (L/d)
EF = Exposure Frequency (d/yr)
ED = Exposure Duration (yr)
BW = Body Weight (Kg)
AT = Averaging Time (days)
I = Intake (mg/kg-day) = CW x IRchild x EF x EDchild / BWchild / AT + CW x IRadult x EF x EDadult / BWadult / AT
Sfo = Cancer Slope Factor (kg-d/mg)
Risk = Calculated Risk (positives/population) = I x SFo

Showering - Dermal Pathway

Scenario 2, Risk Back Calculation - Dermal Contact With Chemicals in Water While Showering.

From GW ingestion

Summary Table

Chemical	CW (mg/L)	SA (cm2)	PC (cm/hr)	ET (hr/d)	EF (d/yr)	Child ED (yr)	Adult ED (yr)	CF (1L/1000cm3)	Child BW (Kg)	Adult BW (Kg)	AT (days)	AD (mg/kg-day)	SFo (kg-d/mg)	Risk (unitless)
Heptachlor epoxide	7.37E-06	23,000	0.00067	0.25	350	6	24	0.001	15	70	25550	2.9035E-10	9.1	2.64E-09

CW = Chemical Concentration in Water (mg/L)
SA = Skin Surface Area Available for Contact (cm^2)
PC = Dermal Permeability Constant (cm/hr) - chemical specific. Values from Table I-1.
ET = Exposure Time (hr/d)
EF = Exposure Frequency (d/yr)
ED = Exposure Duration (yr)
CF = Volumetric Conversion Factor for Water (1L/1000cm^3)
BW = Body Weight (Kg)
AT = Averaging Time (days)
AD = Absorbed Dose (mg/kg-day) = CW x SA x PC x ET x EF x ED_{child} x CF / BW_{child} / AT + CW x SA x PC x ET x EF x ED_{adult} x CF / BW_{adult} / AT
Sfo = Cancer Slope Factor (kg-d/mg)
Risk = Calculated Risk (positives/population) =AD x SFo

End of Calculations

Table C-11. Domestic Septic System 3 Non-Carcinogenic Heptachlor Epoxide Risk-Based Action Standard Re-Calculation

Scenario 2, RBAS value and Hazard Quotients for heptachlor epoxide, 5-6 ft deep contaminated interval, Domestic Septic System 3

Target HQ 1.00E+00

Analyte	Soil Conc. (mg/kg)	Ground Water Ingestion HQ	Swimming Ingestion HQ	Dermal Swimming HQ	Dermal Showering HQ	Soil Ingestion HQ	Dermal Soil HQ	Inhalation HQ	Fish Ingestion HQ	Plant Ingestion HQ	Meat Ingestion HQ	Milk Ingestion HQ	HQ Across Pathways
Heptachlor epoxide	1.33	9.97E-01	0.00E+00	0.00E+00	3.26E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.000E+00

Ground Water Ingestion Pathway

Scenario 2, Back Calculation - Ground Water Concentration Conversion Factor

Analyte	Soil Concentration (5-6 ft bgs) (mg/kg)	Vadose Zone Modeling Result[1] Ground Water/Soil Ratio (mg/L)/(mg/kg)	Ground Water Concentration (mg/L)
Heptachlor epoxide	1.33	1.07E-04	1.42E-04

[1] Vadose zone modeling result is the ground water concentration at the receptor divided by the concentration in soil at the source.

Summary Table

Scenario 2, HQ Back Calculation - Ingestion of chemicals in drinking water.

Chemical	CW (mg/L)	Child IR (L/d)	Adult IR (L/d)	EF (d/yr)	Child ED (yr)	Adult ED (yr)	Child BW (Kg)	Adult BW (Kg)	Child AT (days)	Adult AT (days)	I (mg/kg-day)	RfDo (mg/kg-day)	HQ (unitless)
Heptachlor epoxide	1.42E-04	1.0	2	350	6	24	15	70	2190	8760	1.30E-05	**0.000013**	9.97E-01

CW = Chemical Concentration in Water (mg/L)
IR = Ingestion Rate (L/d)
EF = Exposure Frequency (d/yr)
ED = Exposure Duration (yr)
BW = Body Weight (Kg)
AT = Averaging Time (days)
I = Intake (mg/kg-day) = CW x IR_{child} x EF x ED_{child} / BW_{child} / AT_{child} + CW x IR_{adult} x EF x ED_{adult} / BW_{adult} / AT_{adult}
RfDo = Oral Reference Dose (mg/kg-d)
HQ = Calculated Hazard Quotient (unitless) = I / RfDo

Showering - Dermal Pathway

Scenario 2, HQ Back Calculation - Dermal Contact With Chemicals in Water While Showering.

From GW ingestion

Summary Table

Chemical	CW (mg/L)	SA (cm^2)	PC (cm/hr)	ET (hr/d)	EF (d/yr)	Child ED (yr)	Adult ED (yr)	CF ($1L/1000cm^3$)	Child BW (Kg)	Adult BW (Kg)	Child AT (days)	Adult AT (days)	AD (mg/kg-day)	RfDo (mg/kg-day)	HQ (unitless)
Heptachlor epoxide	1.42E-04	23,000	0.00067	0.25	350	6	24	0.001	15	70	2190	8760	4.24E-08	0.000013	3.26E-03

CW = Chemical Concentration in Water (mg/L)
SA = Skin Surface Area Available for Contact (cm^2)
PC = Dermal Permeability Constant (cm/hr) - chemical specific. Values from Table I-1.
ET = Exposure Time (hr/d)
EF = Exposure Frequency (d/yr)
ED = Exposure Duration (yr)
CF = Volumetric Conversion Factor for Water ($1L/1000cm^3$)
BW = Body Weight (Kg)
AT = Averaging Time (days)
AD = Absorbed Dose (mg/kg-day) = CW x SA x PC x ET x EF x ED_{child} x CF / BW_{child} / AT_{child} + CW x SA x PC x ET x EF x ED_{adult} x CF / BW_{adult} / AT_{adult}
RfDo = Oral Reference Dose (mg/kg-d)
HQ = Calculated Hazard Quotient (unitless) = AD / RfDo

End of Calculations

Table C-12. Domestic Septic System 3 Mercury Risk-Based Action Standard Calculation

Scenario 2, RBAS value and Hazard Quotients for mercury, 4-20 ft deep contaminated interval, Domestic Septic System 6

Target HQ 1.00E+00

Analyte	Soil Conc. (mg/kg)	Ground Water Ingestion HQ	Swimming Ingestion HQ	Dermal Swimming HQ	Dermal Showering HQ	Soil Ingestion HQ	Dermal Soil HQ	Inhalation HQ	Fish Ingestion HQ	Plant Ingestion HQ	Meat Ingestion HQ	Milk Ingestion HQ	HQ Across Pathways
mercury (hg)	0.77	9.95E-01	0.00E+00	0.00E+00	4.86E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.000E+00

Ground Water Ingestion Pathway

Scenario 2, HQ Back Calculation - Non-Carcinogens, Ground Water Concentration Conversion Factors

Analyte	Soil Concentration (4-20 ft bgs) (mg/kg)	Vadose Zone Modeling Result[1] Ground Water/Soil Ratio (mg/L)/(mg/kg)	Ground Water Concentration (mg/L)
mercury (hg)	0.77	4.25E-03	3.27E-03

[1] Vadose zone modeling result is the ground water concentration at the receptor divided by the concentration in soil at the source.

Summary Table

Scenario 2, HQ Back Calculation - Ingestion of chemicals in drinking water.

Chemical	CW (mg/L)	Child IR (L/d)	Adult IR (L/d)	EF (d/yr)	Child ED (yr)	Adult ED (yr)	Child BW (Kg)	Adult BW (Kg)	Child AT (days)	Adult AT (days)	I (mg/kg-day)	RfDo (mg/kg-day)	HQ (unitless)
mercury (hg)	3.27E-03	1.0	2	350	6	24	15	70	2190	8760	2.99E-04	**0.0003**	9.95E-01

CW = Chemical Concentration in Water (mg/L)
IR = Ingestion Rate (L/d)
EF = Exposure Frequency (d/yr)
ED = Exposure Duration (yr)
BW = Body Weight (Kg)
AT = Averaging Time (days)
I = Intake (mg/kg-day) = CW x IR_{child} x EF x ED_{child} / BW_{child} / AT_{child} + CW x IR_{adult} x EF x ED_{adult} / BW_{adult} / AT_{adult}
RfDo = Oral Reference Dose (mg/kg-d)
HQ = Calculated Hazard Quotient (unitless) = I / RfDo

Showering - Dermal Pathway

Scenario 2, HQ Back Calculation - Dermal Contact With Chemicals in Water While Showering.

From GW ingestion

Summary Table

Chemical	CW (mg/L)	SA (cm^2)	PC (cm/hr)	ET (hr/d)	EF (d/yr)	Child ED (yr)	Adult ED (yr)	CF ($1L/1000cm^3$)	Child BW (Kg)	Adult BW (Kg)	Child AT (days)	Adult AT (days)	AD (mg/kg-day)	RfDo (mg/kg-day)	HQ (unitless)
mercury (hg)	3.27E-03	23,000	0.001	0.25	350	6	24	0.001	15	70	2190	8760	1.46E-06	0.0003	4.86E-03

CW = Chemical Concentration in Water (mg/L)
SA = Skin Surface Area Available for Contact (cm^2)
PC = Dermal Permeability Constant (cm/hr) - chemical specific. Values from Table I-1.
ET = Exposure Time (hr/d)
EF = Exposure Frequency (d/yr)
ED = Exposure Duration (yr)
CF = Volumetric Conversion Factor for Water ($1L/1000cm^3$)
BW = Body Weight (Kg)
AT = Averaging Time (days)
AD = Absorbed Dose (mg/kg-day) = CW x SA x PC x ET x EF x ED_{child} x CF / BW_{child} / AT_{child} + CW x SA x PC x ET x EF x ED_{adult} x CF / BW_{adult} / AT_{adult}
RfDo = Oral Reference Dose (mg/kg-d)
HQ = Calculated Hazard Quotient (unitless) = AD / RfDo

End of Calculations

Table C-13. Risk-Based Action Standard Recalculation Results

Area	Constituent	Toxicity Effect	RBAS (mg/kg)	Previous 1997 RBAS (mg/kg)
Domestic Septic System 3	mercury	non-carcinogenic	1.13	0.22
	heptachlor epoxide	carcinogenic	0.0689	0.00857
	heptachlor epoxide	non-carcinogenic	1.33	0.00057
Domestic Septic System 6	mercury	non-carcinogenic	0.77	0.22

Abbreviations
mg/kg milligrams per kilogram
RBAS risk-based action standard

APPENDIX D

DESIGNATED-LEVEL MODELING INPUT AND RESULTS

Table D-1. Domestic Septic System 3 Vadose Zone Modeling Results

Constituent of Concern	NUFT Soil Result (mg/kg)	Contamination Depth Interval	Time to peak at Ground Water Goal Level[1] (years)	Ground Water Goal Conc. (µg/L)	Goal Reference
Mercuric Chloride	0.760	4-12ft	3390	11	MCL
Mercuric Chloride	0.00759	4-12ft	3415	0.10	1/2 L BG DL
Formaldehyde	0.0151	0-25 ft	10	100	Ca DHS
Formaldehyde	0.167	0-25 ft	10	1,140	BG
Hexavalent Chromium	0.809	0-25 ft	0	50	MCL
Hexavalent Chromium	0.638	0-25 ft	0	39.4	BG
Chromium	1.49	4-12 ft	1221	50	MCL
Chromium	0.809	4-12 ft	1192	25	BG
Molybdenum	3.11	8-25 ft	0	183	PRG
Molybdenum	0.253	8-25 ft	0	14.9	BG
Nitrate (as Nitrogen)	2.60	6-13 ft	13.5	10,000	MCL
Nitrate (as Nitrogen)	6.22	6-13 ft	13.2	25,100	BG
Silver	2.68	8-11 ft	500	100	MCL
Silver	0.143	8-11 ft	500	5.0	1/2 L BG DL

Notes

[1] Calculated using a 10.8 centimeters per year water filtration value.

MCL State of California Primary Maximum Contaminant Level for ground water.

PRG Region 9 Environmental Protection Agency, Preliminary Remediation Goal.

Ca DHS California State Action Level, California Department of Health Services.

BG Background value based on concentrations detected in well UCD1-18 sample.

½ L BG DL One-half of the lowest reported background detection limit for well UCD1-18 samples. Applies to constituents of concern whose UCD1-18 results were all not detected.

Table D-1. Domestic Septic System 3 Vadose Zone Modeling Results (continued)

Abbreviations

Conc.	concentration
ft	feet
MCL	maximum contaminant level
mg/kg	milligrams per kilogram
NUFT	Non-isothermal, Unsaturated Flow and Transport model
µg/l	micrograms per liter

Table D-2. Domestic Septic System 6 Vadose Zone Modeling Results

Constituent of Concern	NUFT Soil Result (mg/kg)	Depth Interval of Contamination	Time to peak at Ground Water Goal Level (years)	Ground Water Goal Conc. (µg/l)	Goal Reference
Mercuric Chloride	0.522	4-20 ft	1860	11	MCL
Mercuric Chloride	0.00475	4-20 ft	1780	0.10	1/2 L BG DL
Hexavalent Chromium	0.809	0-25 ft	0	50	MCL
Hexavalent Chromium	0.638	0-25 ft	0	39.4	BG

Notes

[1] Calculated using a 10.8 centimeters per year water filtration value.

MCL State of California Primary Maximum Contaminant Level for ground water.

BG Background value based on concentrations detected in well UCD1-18 samples.

½ L BG DL One half of the lowest reported background detection limit for well UCD1-18 samples. Applies to constituents of concern whose UCD1-18 results were all not detected.

Abbreviations

Conc. concentration
ft feet
mg/kg milligrams per kilogram
N/A Not Available
NUFT Non-isothermal, Unsaturated Flow and Transport model
µg/l micrograms per liter

Table D-3. Summary of Chemical-Specific Parameters and Soil Physical Parameters for Domestic Septic System Areas 3 and 6 Modeling

Chemical Specific Parameters		
COC	**Kd (ml/g)**	**Mol Wt**
Mercuric chloride	52	236.04
Formaldehyde	0.0018	30.03
Hexavalent chromium	19	51.996
Chromium	19	51.996
Molybdenum	20	95.94
Nitrate	0	14
Silver	8.3	107.90

Soil Type	**Total Porosity**	**Hydraulic Conductivity (cm/s)**	**Dry Bulk Density (g/cm3)**	**Van Genuten Parameter**	
				alpha (1/cm)	**m**
clayey sandy silt	0.35	1.00E-06	1.7	0.021	0.23

Abbreviations

cm/s	centimeters per second
g/cm^3	grams per cubic centimeter
K_d	adsorption coefficient
m	meter
ml/g	milliliters per gram
Mol Wt	molecular weight

APPENDIX E

IMPORT BACKFILL ANALYTICAL RESULTS

Weiss Associates
Environmental Science, Engineering, and Management
5801 Christie Avenue, Suite 600, Emeryville, CA 94608-1827 Fax: 510-547-5043 Phone: 510-450-6000

RECORD COPY
PROJECT: 17823
CAT. 7.5.4

June 19, 2002

Mr. Jay Tomlin
Department of Energy
Oakland Operations Office
1301 Clay Street
Oakland, CA 94612-5208

RE: Domestic Septic Systems 3 and 6 Removal Action Import Fill Analytical Results

Dear Mr. Tomlin:

This letter describes analytical results for potential import fill material and assesses the suitability of this material for use as excavation backfill for Domestic Septic Systems (DSS) 3 and 6 Removal Actions. To determine its suitability for use as backfill, a representative sample of the material was collected and analyzed for specific chemical and radionuclide constituents, as discussed below.

Approximately 300 cubic yards (cu yd) of soil will be required for backfilling the DSS 3 and 6 Areas. The identified off-site source of clean fill is located at the Teichert Aggregates site in Esparto, California which is approximately 25 miles northwest of the Laboratory for Energy-Related Health Research (LEHR) site. The fill material is overburden soil taken from ground surface to four feet below ground surface during gravel quarrying activities. The overburden soil was stockpiled between 1991 and 1994 at a separate location from the gravel quarrying operations. Prior to the gravel quarrying operations, the site was used for agricultural purposes. One representative 4-point composite sample (SSIBF155) and one field duplicate (SSIBF156) were collected from the soil source. Composite points were selected based on a grid pattern that was laid out across the soil pile. Each composite point was collected within a grid square that was selected using a random number generator. These samples were analyzed for radionuclides using U.S. Environmental Protection Agency (EPA) methods and laboratory standard operating procedures; volatile organic compounds (VOC), semi-volatile organic compounds (SVOC), pesticides/polychlorinated biphenyls (PCBs) metals, hexavalent chromium and nitrate using EPA methods.

All analytical results are discussed below. A copy of the sample results is provided as Attachment 1 to this letter. Table 1 presents a summary of the analytes detected in the samples. The results of the sample and field duplicate analysis were compared and the higher concentration of the two samples is presented in Table 1. If the results were non-detect in both samples, the result that was judged to have better data quality based on data validation was selected for use in Table 1.

Discussion of Results

Each subsection below presents the results.

Volatile Organic Compounds

1,3-Dichlorobenzene (0.286 micrograms per kilogram [µg/kg]), 1,4-dichlorobenzene (0.579 µg/kg), acetone (6.46 µg/kg), isopropylbenzene (1.47 µg/kg), methylene chloride (4.25 µg/kg), styrene (0.326 µg/kg), toluene (0.867 µg/kg), and trichlorofluoromethane (1.18 µg/kg) were reported from analysis of the sample. The concentrations of the detected analytes were below their respective reporting limits. The acetone, methylene chloride, styrene, and toluene sample results were significantly below the risk-based action standard (RBAS) values of 1,700 µg/kg, 132 µg/kg, 76,000 µg/kg, and 19,000 µg/kg, respectively. RBAS values have not been developed for 1,3-dichlorobenzene, 1,4-dichlorobenzene, and trichlorofluoromethane; however, the results were below the Residential PRGs of 13,000 µg/kg, 3,400 µg/kg and 390,000 µg/kg, respectively. No RBAS or PRG values have been developed for isopropylbenzene. Toluene is not a designated level (DL) constituent of concern (COC) because it is readily biodegradable in soil and its concentration was low.

1,4-Dichlorobenzene, and methylene chloride were detected in the laboratory method blank, which indicates these results are false positives due to laboratory contamination. Acetone, styrene, and toluene are common laboratory contaminants. The low levels of volatile organic compounds detected in the method blank indicate that the low level sample results may be due to contamination in the laboratory.

No other VOCs were detected in the samples. Reporting limits ranged from 11 µg/kg to 34.4 µg/kg.

Semi-Volatile Organic Compounds

2-Methylnaphthalene (0.57 µg/kg), acetophenone (2.1 µg/kg), benzaldehyde (15.6 µg/kg) bis(2-ethylhexyl)phthalate (20.9 µg/kg), butylbenzylphthalate (0.59 µg/kg), di-n-butylphthalate (2.9 µg/kg), di-n-octylphthalate (0.49 µg/kg), diethylphthalate (0.6 µg/kg), and pyrene (0.81 µg/kg) were detected. The bis(2-ethylhexyl)phthalate, di-n-butylphthalate, di-n-octylphthalate, diethylphthalate, and pyrene results were significantly below the RBAS values of 7,700 µg/kg, 890,000 µg/kg, 4,900,000 µg/kg, 220,000 µg/kg, and 490,000 µg/kg, respectively. RBAS values have not been developed for acetophenone, benzaldehyde, and butylbenzylphthalate; however, the results were below the Residential PRGs of 490 µg/kg, 6,100,000 µg/kg and 12,000,000 µg/kg, respectively. No RBAS or PRG values have been developed for 2-methylnaphthalene. These constituents are not DL COCs because they are organic compounds with K_d greater than 10 ml/g.

2-Methylnaphthalene, acetophenone, benzaldehyde, bis(2-ethylhexyl)phthalate and di-n-butylphthalate were detected in the samples and laboratory method blank, which indicates these results are false positives due to laboratory contamination. Butylbenzylphthalate, di-n-octylphthalate, and diethylphthalate are also a common laboratory contaminants

No other SVOCs were detected in the samples. Reporting limits ranged from 374 µg/kg to 939 µg/kg.

Pesticides/PCBs

4,4'-DDE (0.53 µg/kg), 4,4'-DDT (0.53 µg/kg), dieldrin (2.4 µg/kg), endrin aldehyde (0.35 µg/kg) and methoxychlor (0.38 µg/kg) were detected in the sample. The concentrations of the detected analytes were below their respective reporting limits. 4,4'-DDE, 4,4'-DDT, dieldrin, and methoxychlor were below their RBAS values of 5,611 µg/kg, 5,611 µg/kg, 15.3 µg/kg, and 100,000 µg/kg, respectively. No RBAS or PRG values have been developed for endrin aldehyde; however, the endrin aldehyde result was below the endrin Residential PRG of 18 ug/kg. These constituents are not DL COCs because they are organic compounds with K_d greater than 10 ml/g.

4,4'-DDE, 4,4'-DDT, and methoxychlor were detected in the samples and laboratory method blank, which indicates these results are false positives due to laboratory contamination.

No other pesticides/PCBs were detected in the samples. Reporting limits ranged from 1.9 µg/kg to 187 µg/kg.

Metals

All metal results were below the site background values except for arsenic (8.6 milligrams per kilogram (mg/kg); background = 8.14 mg/kg), thallium (2.1 mg/kg; background = 1.6 mg/kg), and zinc (80.3 mg/kg; background = 72.4 mg/kg). The zinc concentration did not exceed the RBAS value (3,400 mg/kg). RBAS values have not been developed for arsenic and thallium; however, the thallium result was below the Residential PRGs of 5.2 mg/kg, and arsenic was only slightly above background. Designated level modeling is expected to show that the arsenic, thallium and zinc concentrations will not threaten ground water quality.

Antimony was not detected in the sample and the result was qualified as rejected due to low matrix spike (MS) recovery (12 %). The laboratory re-analyzed the sample and found similar MS recovery (17%). Because the antimony recovery was acceptable in the laboratory control sample during the original analysis and re-analysis, the antimony MS recovery failures are attributable to sample matrix effects. Antimony appears to be unavailable in the sample matrix and should not pose a threat to human health or ground water quality.

Hexavalent Chromium and Nitrate

Hexavalent chromium was not detected in the sample. The reporting limit for hexavalent chromium analysis was 0.0393 mg/kg. The nitrate (as N) concentration (2.5 mg/kg) was below the background value of 36 mg/kg.

Radiochemistry

The only radionuclide detected above site background was cesium-137 (0.0282 pCi/g; background = 0.00695 pCi/g). The cesium-137 result did not exceed the RBAS value of 0.1 pCi/g. Cesium-137 is not a DL COC because it has a Kd of 1,000 ml/g.

Recommendations for Imported Fill Material Use as Backfill

Based on a review of the analytical results, the imported fill material does not contain chemicals and radionuclides at concentrations that will adversely impact ground water quality or exceed RBAS/Residential PRG levels. Therefore we conclude that the material is suitable for use as backfill at the DSS 3 and 6 Areas.

If you have any questions regarding this memorandum, please contact me at (510) 450-6144.

Sincerely,

Robert O. Devany

Robert O. Devany
Project Manager

Enclosures: Table 1. Summary of DSS 3 and 6 Import Fill Data
Attachment 1. Import Fill Soil Analytical Results

cc: Catherine Luu, DOE/OAK (w/o attachments)
LEHR Library, WA

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TABLE 1

SUMMARY OF DSS 3 AND 6 IMPORT FILL DATA

Table 1. Comparison of Import Fill Data to Background and RBAS, LEHR Site, University of California, Davis

Sample ID	Class	COPC	Units	DL_FLAG	Concentration	Error	Detection Limit	RBAS	Background	Risk/DL Comparison	ER_Q
SSIBF155	GEN	Hexavalent Chromium	MG/KG	<			0.0393	3.80	0.054	Pass[b]	UJ
SSIBF156	GEN	Nitrate	MG/KG		2.5		0.104		36	Pass[b]	J
SSIBF155	METAL	Antimony	MG/KG	<			1.1	0.30	1.4	n	R
SSIBF155RE	METAL	Antimony	MG/KG	<			0.54	0.30	1.4	n	R
SSIBF155	METAL	Arsenic	MG/KG		8.6		0.57		8.14	Pass[k]	J
SSIBF155	METAL	Barium	MG/KG		197		0.054	53	211	Pass[b]	
SSIBF155	METAL	Beryllium	MG/KG		0.44		0.046		0.564	Pass[b]	
SSIBF155	METAL	Cadmium	MG/KG	<			0.091	0.38	0.51	Pass[b]	
SSIBF155	METAL	Chromium	MG/KG		97		0.12	722	125	Pass[b]	
SSIBF155	METAL	Cobalt	MG/KG		20		0.16		31	Pass[b]	
SSIBF155	METAL	Copper	MG/KG		44.7		0.22	28	48.8	Pass[b]	
SSIBF155	METAL	Iron	MG/KG		38200		0.49		44,000	Pass[b]	
SSIBF155	METAL	Lead	MG/KG		7.5		0.53	0.044	9.5	Pass[b]	
SSIBF155	METAL	Manganese	MG/KG		683		0.081	36	750	Pass[b]	
SSIBF155	METAL	Mercury	MG/KG		0.1		0.0032	0.22	0.248	Pass[b]	J
SSIBF155	METAL	Molybdenum	MG/KG	<			0.25		0.26	Pass[b]	
SSIBF155	METAL	Nickel	MG/KG		162		0.28		246	Pass[b]	
SSIBF155	METAL	Selenium	MG/KG	<			0.76	58	1.2	Pass[b]	
SSIBF155	METAL	Silver	MG/KG	<			0.15	3.8	0.55	Pass[b]	
SSIBF156	METAL	Thallium	MG/KG		2.1		1.1		1.6	Pass[c]	
SSIBF155	METAL	Vanadium	MG/KG		66		0.11		66.8	Pass[b]	
SSIBF155	METAL	Zinc	MG/KG		80.3		0.11	3,400	72.4	Pass[a]	
SSIBF156	PES	4,4'-DDD	UG/KG	<			3.7	7,948		Pass[f]	
SSIBF156	PES	4,4'-DDE	UG/KG		0.53		3.7	5,611		Pass[L]	UJ
SSIBF156	PES	4,4'-DDT	UG/KG		0.53		3.7	5,611		Pass[L]	UJ
SSIBF156	PES	Aldrin	UG/KG	<			1.9			Pass[e]	UJ
SSIBF156	PES	alpha-BHC	UG/KG	<			1.9	7.5		Pass[f]	
SSIBF156	PES	alpha-Chlordane	UG/KG	<			1.9	800		Pass[f]	
SSIBF156	PES	Aroclor-1016	UG/KG	<			37.4			Pass[e]	
SSIBF156	PES	Aroclor-1221	UG/KG	<			74.8			Pass[e]	
SSIBF156	PES	Aroclor-1232	UG/KG	<			37.4			Pass[e]	
SSIBF156	PES	Aroclor-1242	UG/KG	<			37.4			Pass[e]	

Table 1. Comparison of Import Fill Data to Background and RBAS, LEHR Site, University of California, Davis (continued)

Sample ID	Class	COPC	Units	DL_FLAG	Concentration	Error	Detection Limit	RBAS	Background	Risk/DL Comparison	ER_Q
SSIBF156	PES	Aroclor-1248	UG/KG	<			37.4			Pass[e]	
SSIBF156	PES	Aroclor-1254	UG/KG	<			37.4			Pass[e]	
SSIBF156	PES	Aroclor-1260	UG/KG	<			37.4	248		Pass[f]	
SSIBF156	PES	beta-BHC	UG/KG	<			1.9			Pass[e]	
SSIBF156	PES	delta-BHC	UG/KG	<			1.9	13.0		Pass[f]	
SSIBF156	PES	Dieldrin	UG/KG		2.4		3.7	15.3		Pass[d]	J
SSIBF156	PES	Endosulfan I	UG/KG	<			1.9	29,000		Pass[f]	
SSIBF156	PES	Endosulfan II	UG/KG	<			3.7			Pass[e]	
SSIBF156	PES	Endosulfan sulfate	UG/KG	<			3.7	26,000		Pass[f]	
SSIBF156	PES	Endrin	UG/KG	<			3.7			Pass[e]	
SSIBF156	PES	Endrin aldehyde	UG/KG		0.35		3.7			Pass[o]	J
SSIBF156	PES	Endrin ketone	UG/KG	<			3.7			Pass[e]	
SSIBF156	PES	gamma-BHC (Lindane)	UG/KG	<			1.9	30.4		Pass[f]	UJ
SSIBF156	PES	gamma-Chlordane	UG/KG	<			1.9	810		Pass[f]	
SSIBF156	PES	Heptachlor	UG/KG	<			1.9	170		Pass[f]	UJ
SSIBF156	PES	Heptachlor epoxide	UG/KG	<			1.9	0.567		Pass[f]	
SSIBF156	PES	Methoxychlor	UG/KG		0.38		18.7	100,000		Pass[L]	UJ
SSIBF156	PES	Toxaphene	UG/KG	<			187			Pass[e]	
SSIBF156	RAD	Actinium-228	PCI/G		0.503	0.0708	0.0153		0.633	Pass[b]	
SSIBF156	RAD	Americium-241	PCI/G		0.0101	0.0101	0.00755	0.0920	0.014	Pass[b]	
SSIBF156	RAD	Bismuth-212	PCI/G		0.304	0.0581	0.0327		0.388	Pass[b]	
SSIBF156	RAD	Bismuth-214	PCI/G		0.375	0.0485	0.00752		0.54	Pass[b]	
SSIBF155	RAD	Carbon-14	PCI/G	<	0.0595	0.0482	0.0805	4,200	0.13	Pass[b]	
SSIBF156	RAD	Cesium-137	PCI/G		0.0282	0.0059	0.00457	0.100	0.00695	Pass[a]	
SSIBF156	RAD	Cobalt-60	PCI/G	<	0.0011	0.00278	0.00482	0.022	0.006	Pass[b]	
SSIBF155	RAD	Gross Alpha	PCI/G		8.19	1.68	1.63		7.42	N/A	
SSIBF155	RAD	Gross Beta	PCI/G		16.6	1.34	1.23		15	N/A	
SSIBF156	RAD	Lead-210	PCI/G		0.48	0.103	0.0691	9.6	1.6	Pass[b]	
SSIBF155	RAD	Lead-212	PCI/G		0.507	0.0599	0.00738		0.684	Pass[b]	
SSIBF155	RAD	Lead-214	PCI/G		0.419	0.0509	0.00865		0.55	Pass[b]	
SSIBF155	RAD	Plutonium-241	PCI/G	<	0.342	0.219	0.364	3.2	0.5	Pass[b]	
SSIBF155	RAD	Potassium-40	PCI/G		11.3	1.4	0.0372		14	Pass[b]	

Table 1. Comparison of Import Fill Data to Background and RBAS, LEHR Site, University of California, Davis (continued)

Sample ID	Class	COPC	Units	DL_FLAG	Concentration	Error	Detection Limit	RBAS	Background	Risk/DL Comparison	ER_Q
SSIBF155	RAD	Radium-223	PCI/G	<	0.0068	0.0537	0.0844			Pass[g]	
SSIBF155	RAD	Radium-226	PCI/G		0.527	0.0723	0.0248	0.00420	0.752	Pass[b]	
SSIBF156	RAD	Radium-228	PCI/G		0.503	0.0708	0.0153		0.63	Pass[b]	
SSIBF155	RAD	Strontium-90	PCI/G		0.0428	0.011	0.0154	10	0.056	Pass[b]	
SSIBF155	RAD	Thallium-208	PCI/G		0.158	0.0186	0.00423		0.204	Pass[b]	
SSIBF155	RAD	Thorium-228	PCI/G		0.529	0.162	0.158	0.0320	0.627	Pass[b]	
SSIBF155	RAD	Thorium-230	PCI/G		0.574	0.181	0.201		1.04	Pass[b]	
SSIBF155	RAD	Thorium-232	PCI/G		0.48	0.134	0.0821	0.0220	0.63	Pass[b]	
SSIBF155	RAD	Thorium-234	PCI/G		0.689	0.31	0.212	3.20	0.78	Pass[b]	
SSIBF156	RAD	Tritium	PCI/G	<	0.0575	0.525	0.899	5.40	1.2	Pass[b]	J
SSIBF155	RAD	Uranium-233/234	PCI/G		0.411	0.0604	0.0104		0.559	Pass[b]	
SSIBF155	RAD	Uranium-235/236	PCI/G		0.0205	0.0108	0.00411	0.150	0.038	Pass[b]	
SSIBF156	RAD	Uranium-238	PCI/G		0.463	0.0679	0.00454		0.565	Pass[b]	
SSIBF155	SVOC	1,1'-Biphenyl	UG/KG	<			376			Pass[e]	
SSIBF155	SVOC	2,2'-oxybis(1-Chloropropane)	UG/KG	<			376			Pass[e]	
SSIBF155	SVOC	2,4,5-Trichlorphenol	UG/KG	<			939			Pass[e]	
SSIBF155	SVOC	2,4,6-Trichlorophenol	UG/KG	<			376			Pass[e]	
SSIBF155	SVOC	2,4-Dichlorophenol	UG/KG	<			376			Pass[e]	
SSIBF155	SVOC	2,4-Dimethyphenol	UG/KG	<			376			Pass[e]	
SSIBF155	SVOC	2,4-Dinitrophenol	UG/KG	<			939			Pass[e]	
SSIBF155	SVOC	2,4-Dinitrotoluene	UG/KG	<			376			Pass[e]	
SSIBF155	SVOC	2,6-Dinitrotoluene	UG/KG	<			376			Pass[e]	
SSIBF155	SVOC	2-Chloronaphthalene	UG/KG	<			376			Pass[e]	
SSIBF155	SVOC	2-Chlorophenol	UG/KG	<			376			Pass[e]	
SSIBF155	SVOC	2-Methyl-4,6-dinitrophenol	UG/KG	<			939			Pass[e]	
SSIBF155	SVOC	2-Methylnaphthalene	UG/KG		0.57		376			Pass[L]	UJ
SSIBF155	SVOC	2-Nitrophenol	UG/KG	<			376			Pass[e]	
SSIBF155	SVOC	3,3'-Dichlorobenzidine	UG/KG	<			376			Pass[e]	
SSIBF155	SVOC	4-Bromophenylphenylether	UG/KG	<			376			Pass[e]	
SSIBF155	SVOC	4-Chloro-3-Methylphenol	UG/KG	<			376			Pass[e]	
SSIBF155	SVOC	4-Chloroaniline	UG/KG	<			376			Pass[e]	
SSIBF155	SVOC	4-Chlorophenylphenylether	UG/KG	<			376			Pass[e]	

Table 1. Comparison of Import Fill Data to Background and RBAS, LEHR Site, University of California, Davis (continued)

Sample ID	Class	COPC	Units	DL_FLAG	Concentration	Error	Detection Limit	RBAS	Background	Risk/DL Comparison	ER_Q
SSIBF155	SVOC	4-Nitrophenol	UG/KG	<			939			Pass[e]	UJ
SSIBF155	SVOC	Acenaphthene	UG/KG	<			376	250,000		Pass[f]	
SSIBF155	SVOC	Acenaphthylene	UG/KG	<			376			Pass[e]	
SSIBF155	SVOC	Acetophenone	UG/KG		2.1		376			Pass[L]	UJ
SSIBF155	SVOC	Anthracene	UG/KG	<			376	1,400,000		Pass[f]	
SSIBF155	SVOC	Atrazine	UG/KG	<			376			Pass[e]	
SSIBF155	SVOC	Benzaldehyde	UG/KG		15.6		376			Pass[L]	UJ
SSIBF155	SVOC	Benzo(a)anthracene	UG/KG	<			376	1,199		Pass[f]	
SSIBF155	SVOC	Benzo(a)pyrene	UG/KG	<			376	237		Pass[f]	
SSIBF155	SVOC	Benzo(b)fluoranthene	UG/KG	<			376	2,613		Pass[f]	
SSIBF155	SVOC	Benzo(ghi)perylene	UG/KG	<			376	9,100,000		Pass[f]	
SSIBF155	SVOC	Benzo(k)fluoranthene	UG/KG	<			376	26,132		Pass[f]	
SSIBF155	SVOC	bis(-2-Chloroethoxy)methane	UG/KG	<			376			Pass[e]	
SSIBF155	SVOC	bis(-2-Chloroethyl)Ether	UG/KG	<			376			Pass[e]	
SSIBF155	SVOC	bis(2-Ethylhexyl)phthalate	UG/KG		20.9		376	7,700		Pass[L]	UJ
SSIBF155	SVOC	Butylbenzylphthalate	UG/KG		0.59		376			Pass[m]	
SSIBF155	SVOC	Caprolactam	UG/KG	<			376			Pass[e]	
SSIBF155	SVOC	Carbazole	UG/KG	<			376	2,226		Pass[f]	
SSIBF155	SVOC	Chrysene	UG/KG	<			376	20,269		Pass[f]	
SSIBF155	SVOC	Di-n-butylphthalate	UG/KG		2.9		376	890,000		Pass[d]	UJ
SSIBF155	SVOC	Di-n-octylphthalate	UG/KG		0.49		376	4,900,000		Pass[d]	
SSIBF155	SVOC	Dibenzo(a,h)anthracene	UG/KG	<			376	261		Pass[f]	
SSIBF155	SVOC	Dibenzofuran	UG/KG	<			376	14,000		Pass[f]	
SSIBF156	SVOC	Diethylphthalate	UG/KG		0.6		374	220,000		Pass[d]	
SSIBF155	SVOC	Dimethylphthalate	UG/KG	<			376			Pass[e]	
SSIBF155	SVOC	Diphenylamine	UG/KG	<			376			Pass[e]	
SSIBF155	SVOC	Fluoranthene	UG/KG	<			376	1,800,000		Pass[f]	
SSIBF155	SVOC	Fluorene	UG/KG	<			376	170,000		Pass[f]	
SSIBF155	SVOC	Hexachlorobenzene	UG/KG	<			376			Pass[e]	
SSIBF155	SVOC	Hexachlorobutadiene	UG/KG	<			376			Pass[e]	
SSIBF155	SVOC	Hexachlorocyclopentadiene	UG/KG	<			376			Pass[e]	
SSIBF155	SVOC	Hexachloroethane	UG/KG	<			376			Pass[e]	

Table 1. Comparison of Import Fill Data to Background and RBAS, LEHR Site, University of California, Davis (continued)

Sample ID	Class	COPC	Units	DL_FLAG	Concentration	Error	Detection Limit	RBAS	Background	Risk/DL Comparison	ER_Q
SSIBF155	SVOC	Indeno(1,2,3-cd)pyrene	UG/KG	<			376	2,613		Pass[f]	
SSIBF155	SVOC	Isophorone	UG/KG	<			376			Pass[e]	
SSIBF155	SVOC	m,p-Cresols	UG/KG	<			376			Pass[e]	
SSIBF155	SVOC	m-Nitroaniline	UG/KG	<			939			n	R
SSIBF155	SVOC	N-Nitrosodipropylamine	UG/KG	<			376			Pass[e]	UJ
SSIBF155	SVOC	Naphthalene	UG/KG	<			376	39,000		Pass[f]	
SSIBF155	SVOC	Nitrobenzene	UG/KG	<			376			Pass[e]	
SSIBF155	SVOC	o-Cresol	UG/KG	<			376			Pass[e]	
SSIBF155	SVOC	o-Nitroaniline	UG/KG	<			939			Pass[e]	UJ
SSIBF155	SVOC	p-Nitroaniline	UG/KG	<			939			n	R
SSIBF155	SVOC	Pentachlorophenol	UG/KG	<			939	13,351		Pass[f]	
SSIBF155	SVOC	Phenanthrene	UG/KG	<			376	1,200,000		Pass[f]	
SSIBF155	SVOC	Phenol	UG/KG	<			376			Pass[e]	
SSIBF155	SVOC	Pyrene	UG/KG		0.81		376	490,000		Pass[d]	
SSIBF155	VOC	1,1,1-Trichloroethane	UG/KG	<			11			Pass[e]	
SSIBF155	VOC	1,1,2,2-Tetrachloroethane	UG/KG	<			11			Pass[e]	
SSIBF155	VOC	1,1,2-Trichloroethane	UG/KG	<			11			Pass[e]	
SSIBF155	VOC	1,1-Dichloroethane	UG/KG	<			11			Pass[e]	
SSIBF155	VOC	1,1-Dichloroethylene	UG/KG	<			11			Pass[e]	
SSIBF156	VOC	1,2,4-Trichlorobenzene	UG/KG	<			11.4			Pass[e]	
SSIBF155	VOC	1,2-Dibromo-3-chloropropane	UG/KG	<			11			Pass[e]	
SSIBF155	VOC	1,2-Dibromoethane	UG/KG	<			11			Pass[e]	
SSIBF155	VOC	1,2-Dichlorobenzene	UG/KG	<			11			Pass[e]	
SSIBF155	VOC	1,2-Dichloroethane	UG/KG	<			11			Pass[e]	
SSIBF155	VOC	1,2-Dichloropropane	UG/KG	<			11			Pass[e]	
SSIBF155	VOC	1,3-Dichlorobenzene	UG/KG		0.286		11			Pass[m]	J
SSIBF156	VOC	1,4-Dichlorobenzene	UG/KG		0.579		11.4			Pass[L]	UJ
SIBF155	VOC	2-Butanone	UG/KG	<			11	12,000		Pass[f]	
SSIBF155	VOC	2-Hexanone	UG/KG	<			11			Pass[e]	
SSIBF155	VOC	4-Methyl-2-pentanone	UG/KG	<			11			Pass[e]	
SSIBF155	VOC	Acetone	UG/KG		6.46		11	1,700		Pass[m]	J
SSIBF155	VOC	Benzene	UG/KG	<			11	14.7		Pass[f]	

Table 1. Comparison of Import Fill Data to Background and RBAS, LEHR Site, University of California, Davis (continued)

Sample ID	Class	COPC	Units	DL_FLAG	Concentration	Error	Detection Limit	RBAS	Background	Risk/DL Comparison	ER_Q
SSIBF155	VOC	Bromodichloromethane	UG/KG	<			11			Pass[e]	
SSIBF155	VOC	Bromoform	UG/KG	<			11			Pass[e]	
SSIBF155	VOC	Bromomethane	UG/KG	<			11			Pass[e]	
SSIBF155	VOC	Carbon disulfide	UG/KG	<			11			Pass[e]	
SSIBF155	VOC	Carbon tetrachloride	UG/KG	<			11	55.3		Pass[f]	
SSIBF155	VOC	Chlorobenzene	UG/KG	<			11			Pass[e]	
SSIBF155	VOC	Chloroethane	UG/KG	<			11			Pass[e]	
SSIBF155	VOC	Chloroform	UG/KG	<			11			Pass[e]	
SSIBF155	VOC	Chloromethane	UG/KG	<			11			Pass[e]	
SSIBF155	VOC	cis-1,2-Dichloroethylene	UG/KG	<			11			Pass[e]	
SSIBF155	VOC	cis-1,3-Dichloropropylene	UG/KG	<			11			Pass[e]	
SSIBF155	VOC	Cyclohexane	UG/KG	<			11			Pass[e]	
SSIBF155	VOC	Dibromochloromethane	UG/KG	<			11			Pass[e]	
SSIBF155	VOC	Dichlorodifluoromethane	UG/KG	<			11			Pass[e]	
SSIBF155	VOC	Ethylbenzene	UG/KG	<			11	10,000		Pass[f]	
SSIBF155	VOC	Isopropylbenzene	UG/KG		1.47		11			Pass[m]	J
SSIBF155	VOC	Methyl acetate	UG/KG	<			11			Pass[e]	
SSIBF155	VOC	Methylcyclohexane	UG/KG	<			11			Pass[e]	
SSIBF155	VOC	Methylene chloride	UG/KG		4.25		11	132		Pass[L]	UJ
SSIBF155	VOC	Styrene	UG/KG		0.326		11	76,000		Pass[m]	J
SSIBF155	VOC	tert-Butyl methyl ether	UG/KG	<			11			Pass[e]	
SSIBF155	VOC	Tetrachloroethylene	UG/KG	<			11			Pass[e]	
SSIBF155	VOC	Toluene	UG/KG		0.867		11	19,000		Pass[m]	J
SSIBF155	VOC	trans-1,2-Dichloroethylene	UG/KG	<			11			Pass[e]	
SSIBF155	VOC	trans-1,3-Dichloropropylene	UG/KG	<			11			Pass[e]	
SSIBF155	VOC	Trichloroethylene	UG/KG	<			11			Pass[e]	
SSIBF155	VOC	Trichlorofluoromethane	UG/KG		1.18		11			Pass[m]	J
SSIBF155	VOC	Trichlorotrifluoroethane	UG/KG	<			11			Pass[e]	
SSIBF155	VOC	Vinyl chloride	UG/KG	<			11			Pass[e]	
SSIBF155	VOC	Xylenes (total)	UG/KG	<			33.2	700,000		Pass[f]	

Table 1. Comparison of Import Fill Data to Background and RBAS, LEHR Site, University of California, Davis (continued)

Notes

a Concentration is below RBAS but above background, DL modeling expected to show constituent is not a threat to ground water.
b Concentration/activity is below background, constituent passes risk and DL screening.
c Not a risk COPC, concentration/activity above background, Kd > 1000 ml/g (inorganics) - not a DL COPC.
d Concentration is below RBAS. Background is unavailable because COPC is not naturally occurring, Kd > 10 ml/g (organics) - not a DL COPC.
e Not a risk COPC. Background is unavailable because COPC is not naturally occurring. COPC is ND - not a DL COPC.
f Concentration is below RBAS. Background is unavailable because COPC is not naturally occurring. Constituent not detected - not a DL COPC.
g Not a risk COPC. Background is not available. Activity is below MDA - not a DL COPC.
h Activity is below RBAS but above background. Half life is < 1 year - not a DL COPC
j Concentration is below RBAS. Background is unavailable because COPC is not naturally occurring. Concentration is low and constituent is readily biodegradable - not a DL COPC.
k Not a risk COPC. Concentration is above background, DL modeling expected to show constituent is not a threat to ground water.
l Concentration is a false positive result due to laboratory contamination. Similar concentration of constituent was detected in the laboratory method blank.
m Concentration is believed to be a false positive result due to evidence of laboratory contamination in the method blank.
n Original analysis and re-analysis results indicated matrix spike recovery failure. Laboratory control sample recovery was acceptable in both analyses, indicating sample matrix is causing the recovery failure.
o Not a risk COPC. Background is unavailable because COPC is not naturally occurring, Kd > 10 ml/g (organics) - not a DL COPC.
J Constituent is present in sample but reported concentration may lack accuracy.
UJ Constituent was not detected in sample but reported detection limit may lack accuracy.
R The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria.

Abbreviations

Background	80 % lower confidence limit on the 95th quantile of background sample data
COPC	constituent of potential concern
DL Flag	< flag applied if constituent was not detected or below the MDA
DL	designated level
ER_Q	expert review qualifier of laboratory data
GEN	general chemistry analysis
MDA	minimum detectable activity
N/A	not applicable
ND	not detected
PES	pesticide analysis
RAD	radiochemistry analysis
RBAS	risk-based action standard
Risk/DL Comparison	Screening evaluation to determine whether data indicate unacceptable risk or potential ground water impact from import fill.
SVOC	semi-volatile organic compound analysis
VOC	volatile organic compound analysis

ATTACHMENT 1

IMPORT FILL SOIL ANALYTICAL RESULTS

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

SSIBF155

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 57915

Matrix: (soil/water) SOIL Lab Sample ID: 57915001

Sample wt/vol: 5.1 (g/mL) G Lab File ID: 8D109

Level: (low/med) LOW Date Received: 03/22/02

% Moisture: not dec. 11 Date Analyzed: 04/01/02

GC Column: DB624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(ul) Soil Aliquot Volume: _____(ul

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
74-87-3	Chloromethane	11.0	U
74-83-9	Bromomethane	11.0	U
75-01-4	Vinyl chloride	11.0	U
75-00-3	Chloroethane	11.0	U
75-09-2	Methylene chloride	4.25	BJ
67-64-1	Acetone	6.46	J
75-15-0	Carbon disulfide	11.0	U
75-35-4	1,1-Dichloroethylene	11.0	U
75-34-3	1,1-Dichloroethane	11.0	U
67-66-3	Chloroform	11.0	U
107-06-2	1,2-Dichloroethane	11.0	U
78-93-3	2-Butanone	11.0	U
156-60-5	trans-1,2-Dichloroethylene	11.0	U
71-55-6	1,1,1-Trichloroethane	11.0	U
56-23-5	Carbon tetrachloride	11.0	U
75-27-4	Bromodichloromethane	11.0	U
78-87-5	1,2-Dichloropropane	11.0	U
156-59-2	cis-1,2-Dichloroethylene	11.0	U
79-01-6	Trichloroethylene	11.0	U
124-48-1	Dibromochloromethane	11.0	U
79-00-5	1,1,2-Trichloroethane	11.0	U
71-43-2	Benzene	11.0	U
75-25-2	Bromoform	11.0	U
108-10-1	4-Methyl-2-pentanone	11.0	U
591-78-6	2-Hexanone	11.0	U
127-18-4	Tetrachloroethylene	11.0	U
79-34-5	1,1,2,2-Tetrachloroethane	11.0	U
108-88-3	Toluene	0.867	J
108-90-7	Chlorobenzene	11.0	U
100-41-4	Ethylbenzene	11.0	U
100-42-5	Styrene	0.326	J
10061-01-5	cis-1,3-Dichloropropylene	11.0	U
10061-02-6	trans-1,3-Dichloropropylene	11.0	U

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

SSIBF155

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 57915

Matrix: (soil/water) SOIL Lab Sample ID: 57915001

Sample wt/vol: 5.1 (g/mL) G Lab File ID: 8D109

Level: (low/med) LOW Date Received: 03/22/02

% Moisture: not dec. 11 Date Analyzed: 04/01/02

GC Column: DB624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(ul) Soil Aliquot Volume: _____(ul

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
120-82-1	1,2,4-Trichlorobenzene	0.539	BJ
96-12-8	1,2-Dibromo-3-chloropropane	11.0	U
110-82-7	Cyclohexane	11.0	U
98-82-8	Isopropylbenzene	1.47	J
79-28-9	Methyl acetate	11.0	U
108-87-2	Methylcyclohexane	11.0	U
76-13-1	Trichlorotrifluoroethane	11.0	U
1634-04-4	tert-Butyl methyl ether	11.0	U
75-71-8	Dichlorodifluoromethane	11.0	U
75-69-4	Trichlorofluoromethane	1.18	J
106-93-4	1,2-Dibromoethane	11.0	U
1330-20-7	Xylenes (total)	33.2	U
541-73-1	1,3-Dichlorobenzene	0.286	J
106-46-7	1,4-Dichlorobenzene	0.673	BJ
95-50-1	1,2-Dichlorobenzene	11.0	U

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

SSIBF155

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 57915

Matrix: (soil/water) SOIL Lab Sample ID: 57915001

Sample wt/vol: 5.1 (g/mL) G Lab File ID: 8D109

Level: (low/med) LOW Date Received: 03/22/02

% Moisture: not dec. 11 Date Analyzed: 04/01/02

GC Column: DB624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(ul) Soil Aliquot Volume: _____(ul

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/Kg

Number TICs found: 2

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	UNKNOWN	1.92	474	JB
2. 98-83-9	.ALPHA.-METHYLSTYRENE	10.62	12.4	NJ
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1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

SSIBF156

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 57915

Matrix: (soil/water) SOIL Lab Sample ID: 57915002

Sample wt/vol: 4.9 (g/mL) G Lab File ID: 8D110

Level: (low/med) LOW Date Received: 03/22/02

% Moisture: not dec. 11 Date Analyzed: 04/01/02

GC Column: DB624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(ul) Soil Aliquot Volume: _____(ul

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
74-87-3	Chloromethane	11.4	U
74-83-9	Bromomethane	11.4	U
75-01-4	Vinyl chloride	11.4	U
75-00-3	Chloroethane	11.4	U
75-09-2	Methylene chloride	4.54	BJ
67-64-1	Acetone	6.45	J
75-15-0	Carbon disulfide	11.4	U
75-35-4	1,1-Dichloroethylene	11.4	U
75-34-3	1,1-Dichloroethane	11.4	U
67-66-3	Chloroform	11.4	U
107-06-2	1,2-Dichloroethane	11.4	U
78-93-3	2-Butanone	11.4	U
156-60-5	trans-1,2-Dichloroethylene	11.4	U
71-55-6	1,1,1-Trichloroethane	11.4	U
56-23-5	Carbon tetrachloride	11.4	U
75-27-4	Bromodichloromethane	11.4	U
78-87-5	1,2-Dichloropropane	11.4	U
156-59-2	cis-1,2-Dichloroethylene	11.4	U
79-01-6	Trichloroethylene	11.4	U
124-48-1	Dibromochloromethane	11.4	U
79-00-5	1,1,2-Trichloroethane	11.4	U
71-43-2	Benzene	11.4	U
75-25-2	Bromoform	11.4	U
108-10-1	4-Methyl-2-pentanone	11.4	U
591-78-6	2-Hexanone	11.4	U
127-18-4	Tetrachloroethylene	11.4	U
79-34-5	1,1,2,2-Tetrachloroethane	11.4	U
108-88-3	Toluene	0.651	J
108-90-7	Chlorobenzene	11.4	U
100-41-4	Ethylbenzene	11.4	U
100-42-5	Styrene	11.4	U
10061-01-5	cis-1,3-Dichloropropylene	11.4	U
10061-02-6	trans-1,3-Dichloropropylene	11.4	U

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

SSIBF156

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 57915

Matrix: (soil/water) SOIL Lab Sample ID: 57915002

Sample wt/vol: 4.9 (g/mL) G Lab File ID: 8D110

Level: (low/med) LOW Date Received: 03/22/02

% Moisture: not dec. 11 Date Analyzed: 04/01/02

GC Column: DB624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(ul) Soil Aliquot Volume: _____(ul

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
120-82-1	1,2,4-Trichlorobenzene	11.4	U
96-12-8	1,2-Dibromo-3-chloropropane	11.4	U
110-82-7	Cyclohexane	11.4	U
98-82-8	Isopropylbenzene	1.36	J
79-28-9	Methyl acetate	11.4	U
108-87-2	Methylcyclohexane	11.4	U
76-13-1	Trichlorotrifluoroethane	11.4	U
1634-04-4	tert-Butyl methyl ether	11.4	U
75-71-8	Dichlorodifluoromethane	11.4	U
75-69-4	Trichlorofluoromethane	0.830	J
106-93-4	1,2-Dibromoethane	11.4	U
1330-20-7	Xylenes (total)	34.4	U
541-73-1	1,3-Dichlorobenzene	11.4	U
106-46-7	1,4-Dichlorobenzene	0.579	BJ
95-50-1	1,2-Dichlorobenzene	11.4	U

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

SSIBF156

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 57915

Matrix: (soil/water) SOIL Lab Sample ID: 57915002

Sample wt/vol: 4.9 (g/mL) G Lab File ID: 8D110

Level: (low/med) LOW Date Received: 03/22/02

% Moisture: not dec. 11 Date Analyzed: 04/01/02

GC Column: DB624 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume:_____(ul) Soil Aliquot Volume: _____(ul

Number TICs found: 3

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	UNKNOWN	1.92	233	JB
2. 124-18-5	DECANE	10.15	5.99	NJ
3. 98-83-9	.ALPHA.-METHYLSTYRENE	10.62	12.1	NJ
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1B
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

SSIBF155

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 57915

Matrix: (soil/water) SOIL Lab Sample ID: 57915001

Sample wt/vol: 30.0 (g/mL) G Lab File ID: S7D0205

Level: (low/med) LOW Date Received: 03/22/02

% Moisture: 11 decanted: (Y/N) N Date Extracted: 03/27/02

Concentrated Extract Volume: 0.50 (mL) Date Analyzed: 04/02/02

Injection Volume: 2.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) Y

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
100-52-7	Benzaldehyde	15.6	J
108-95-2	Phenol	376	U
111-44-4	bis(-2-Chloroethyl)Ether	376	U
95-57-8	2-Chlorophenol	376	U
95-48-7	o-Cresol	376	U
108-60-1	2,2'-oxybis(1-Chloropropane)	376	U
98-86-2	Acetophenone	2.1	J
106-44-5	m,p-Cresols	376	U
621-64-7	N-Nitroso-di-n-propylamine	376	U
67-72-1	Hexachloroethane	376	U
98-95-3	Nitrobenzene	376	U
78-59-1	Isophorone	376	U
88-75-5	2-Nitrophenol	376	U
105-67-9	2,4-Dimethyphenol	376	U
111-91-1	bis(-2-Chloroethoxy)methane	376	U
120-83-2	2,4-Dichlorophenol	376	U
91-20-3	Naphthalene	376	U
106-47-8	4-Chloroaniline	376	U
87-68-3	Hexachlorobutadiene	376	U
105-60-2	Caprolactam	376	U
59-50-7	4-Chloro-3-Methylphenol	376	U
91-57-6	2-Methylnaphthalene	0.57	J
77-47-4	Hexachlorocyclopentadiene	376	U
88-06-2	2,4,6-Trichlorophenol	376	U
95-95-4	2,4,5-Trichlorphenol	939	U
92-52-4	1,1'-Biphenyl	376	U
91-58-7	2-Chloronaphthalene	376	U
88-74-4	2-Nitroaniline	939	U
131-11-3	Dimethylphthalate	376	U
606-20-2	2,6-Dinitrotoluene	376	U
208-96-8	Acenaphthylene	376	U
99-09-2	3-Nitroaniline	939	U
83-32-9	Acenaphthene	376	U

1C
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

SSIBF155

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 57915

Matrix: (soil/water) SOIL Lab Sample ID: 57915001

Sample wt/vol: 30.0 (g/mL) G Lab File ID: S7D0205

Level: (low/med) LOW Date Received: 03/22/02

% Moisture: 11 decanted: (Y/N) N Date Extracted: 03/27/02

Concentrated Extract Volume: 0.50 (mL) Date Analyzed: 04/02/02

Injection Volume: 2.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) Y

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
51-28-5	2,4-Dinitrophenol	939	U
100-02-7	4-Nitrophenol	939	U
132-64-9	Dibenzofuran	376	U
121-14-2	2,4-Dinitrotoluene	376	U
84-66-2	Diethylphthalate	376	U
7005-72-3	4-Chlorophenyl-phenylether	376	U
86-73-7	Fluorene	376	U
100-01-6	4-Nitroaniline	939	U
534-52-1	4,6-Dinitro-2-methylphenol	939	U
101-55-3	4-Bromophenyl-phenylether	376	U
122-39-4	Diphenylamine	376	U
118-74-1	Hexachlorobenzene	376	U
1912-24-9	Atrazine	376	U
87-86-5	Pentachlorophenol	939	U
85-01-8	Phenanthrene	376	U
120-12-7	Anthracene	376	U
86-74-8	Carbazole	376	U
84-74-2	Di-n-butylphthalate	2.9	J
206-44-0	Fluoranthene	376	U
129-00-0	Pyrene	0.81	J
85-68-7	Butylbenzylphthalate	0.59	J
91-94-1	3,3'-Dichlorobenzidine	376	U
56-55-3	Benzo(a)anthracene	376	U
218-01-9	Chrysene	376	U
117-81-7	bis(2-Ethylhexyl)phthalate	20.9	J
117-84-0	Di-n-octylphthalate	0.49	J
205-99-2	Benzo(b)fluoranthene	376	U
207-08-9	Benzo(k)fluoranthene	376	U
50-32-8	Benzo(a)pyrene	376	U
193-39-5	Indeno(1,2,3-cd)pyrene	376	U
53-70-3	Dibenzo(a,h)anthracene	376	U
191-24-2	Benzo(g,h,i)perylene	376	U

1F

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

SSIBF155

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 57915

Matrix: (soil/water) SOIL Lab Sample ID: 57915001

Sample wt/vol: 30.0 (g/mL) G Lab File ID: S7D0205

Level: (low/med) LOW Date Received: 03/22/02

% Moisture: 11 decanted: (Y/N) N Date Extracted: 03/27/02

Concentrated Extract Volume: 0.50 (mL) Date Analyzed: 04/02/02

Injection Volume: 2.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) Y pH: 7.0

Number TICs found: 2

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/Kg

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	UNKNOWN ALDOL CONDENSATE	5.23	1060	JA
2. 7683-64-9	SQUALENE	17.98	52.5	NJ
3.				
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1B
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

SSIBF156

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 57915

Matrix: (soil/water) SOIL Lab Sample ID: 57915002

Sample wt/vol: 30.0 (g/mL) G Lab File ID: S7D0208

Level: (low/med) LOW Date Received: 03/22/02

% Moisture: 11 decanted: (Y/N) N Date Extracted: 03/27/02

Concentrated Extract Volume: 0.50 (mL) Date Analyzed: 04/02/02

Injection Volume: 2.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) Y

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
100-52-7	Benzaldehyde	24.0	J
108-95-2	Phenol	374	U
111-44-4	bis(-2-Chloroethyl)Ether	374	U
95-57-8	2-Chlorophenol	374	U
95-48-7	o-Cresol	374	U
108-60-1	2,2'-oxybis(1-Chloropropane)	374	U
98-86-2	Acetophenone	3.1	J
106-44-5	m,p-Cresols	374	U
621-64-7	N-Nitroso-di-n-propylamine	374	U
67-72-1	Hexachloroethane	374	U
98-95-3	Nitrobenzene	374	U
78-59-1	Isophorone	374	U
88-75-5	2-Nitrophenol	374	U
105-67-9	2,4-Dimethyphenol	374	U
111-91-1	bis(-2-Chloroethoxy)methane	374	U
120-83-2	2,4-Dichlorophenol	374	U
91-20-3	Naphthalene	374	U
106-47-8	4-Chloroaniline	374	U
87-68-3	Hexachlorobutadiene	374	U
105-60-2	Caprolactam	374	U
59-50-7	4-Chloro-3-Methylphenol	374	U
91-57-6	2-Methylnaphthalene	0.38	J
77-47-4	Hexachlorocyclopentadiene	374	U
88-06-2	2,4,6-Trichlorophenol	374	U
95-95-4	2,4,5-Trichlorphenol	935	U
92-52-4	1,1'-Biphenyl	374	U
91-58-7	2-Chloronaphthalene	374	U
88-74-4	2-Nitroaniline	935	U
131-11-3	Dimethylphthalate	374	U
606-20-2	2,6-Dinitrotoluene	374	U
208-96-8	Acenaphthylene	374	U
99-09-2	3-Nitroaniline	935	U
83-32-9	Acenaphthene	374	U

1C
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

SSIBF156

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 57915

Matrix: (soil/water) SOIL Lab Sample ID: 57915002

Sample wt/vol: 30.0 (g/mL) G Lab File ID: S7D0208

Level: (low/med) LOW Date Received: 03/22/02

% Moisture: 11 decanted: (Y/N) N Date Extracted: 03/27/02

Concentrated Extract Volume: 0.50 (mL) Date Analyzed: 04/02/02

Injection Volume: 2.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) Y

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
51-28-5	2,4-Dinitrophenol	935	U
100-02-7	4-Nitrophenol	935	U
132-64-9	Dibenzofuran	374	U
121-14-2	2,4-Dinitrotoluene	374	U
84-66-2	Diethylphthalate	0.60	J
7005-72-3	4-Chlorophenyl-phenylether	374	U
86-73-7	Fluorene	374	U
100-01-6	4-Nitroaniline	935	U
534-52-1	4,6-Dinitro-2-methylphenol	935	U
101-55-3	4-Bromophenyl-phenylether	374	U
122-39-4	Diphenylamine	374	U
118-74-1	Hexachlorobenzene	374	U
1912-24-9	Atrazine	374	U
87-86-5	Pentachlorophenol	935	U
85-01-8	Phenanthrene	374	U
120-12-7	Anthracene	374	U
86-74-8	Carbazole	374	U
84-74-2	Di-n-butylphthalate	3.8	J
206-44-0	Fluoranthene	374	U
129-00-0	Pyrene	0.51	J
85-68-7	Butylbenzylphthalate	374	U
91-94-1	3,3'-Dichlorobenzidine	374	U
56-55-3	Benzo(a)anthracene	374	U
218-01-9	Chrysene	374	U
117-81-7	bis(2-Ethylhexyl)phthalate	374	U
117-84-0	Di-n-octylphthalate	374	U
205-99-2	Benzo(b)fluoranthene	374	U
207-08-9	Benzo(k)fluoranthene	374	U
50-32-8	Benzo(a)pyrene	374	U
193-39-5	Indeno(1,2,3-cd)pyrene	374	U
53-70-3	Dibenzo(a,h)anthracene	374	U
191-24-2	Benzo(g,h,i)perylene	374	U

1F

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

SSIBF156

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 57915

Matrix: (soil/water) SOIL Lab Sample ID: 57915002

Sample wt/vol: 30.0 (g/mL) G Lab File ID: S7D0208

Level: (low/med) LOW Date Received: 03/22/02

% Moisture: 11 decanted: (Y/N) N Date Extracted: 03/27/02

Concentrated Extract Volume: 0.50 (mL) Date Analyzed: 04/02/02

Injection Volume: 2.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) Y pH: 7.0

Number TICs found: 1

CONCENTRATION UNITS:
(ug/L or ug/Kg) ug/Kg

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.		UNKNOWN ALDOL CONDENSATE	5.14	137	JA
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					
13.					
14.					
15.					
16.					
17.					
18.					
19.					
20.					
21.					
22.					
23.					
24.					
25.					
26.					
27.					
28.					
29.					
30.					

1D
PESTICIDE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

SSIBF155

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 57915

Matrix: (soil/water) SOIL Lab Sample ID: 57915001

Sample wt/vol: 30.0 (g/mL) G Lab File ID: 006F0601

% Moisture: 11 decanted: (Y/N) N Date Received: 03/22/02

Extraction: (SepF/Cont/Sonc) SONC Date Extracted: 03/29/02

Concentrated Extract Volume: 5.00 (mL) Date Analyzed: 05/03/02

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) Y

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
319-84-6	alpha-BHC	0.21	JP
319-85-7	beta-BHC	1.9	U
319-86-8	delta-BHC	1.9	U
58-89-9	gamma-BHC (Lindane)	0.24	J
76-44-8	Heptachlor	0.23	J
309-00-2	Aldrin	0.19	J
1024-57-3	Heptachlor epoxide	1.9	U
959-98-8	Endosulfan I	1.9	U
60-57-1	Dieldrin	2.2	J
72-55-9	4,4'-DDE	0.52	J
72-20-8	Endrin	3.8	U
33213-65-9	Endosulfan II	3.8	U
72-54-8	4,4'-DDD	3.8	U
1031-07-8	Endosulfan sulfate	3.8	U
50-29-3	4,4'-DDT	0.54	J
72-43-5	Methoxychlor	0.74	J
53494-70-5	Endrin ketone	3.8	U
7421-93-4	Endrin aldehyde	3.8	U
8001-35-2	Toxaphene	188	U
12674-11-2	Aroclor-1016	37.6	U
11104-28-2	Aroclor-1221	75.1	U
1114-16-5	Aroclor-1232	37.6	U
53469-21-9	Aroclor-1242	37.6	U
12672-29-6	Aroclor-1248	37.6	U
11097-69-1	Aroclor-1254	37.6	U
11096-82-5	Aroclor-1260	37.6	U
5103-74-2	gamma-Chlordane	1.9	U
5103-71-9	alpha-Chlordane	1.9	U

1D
PESTICIDE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

SSIBF156

Lab Name: GENERAL ENGINEERING LABOR Contract: N/A

Lab Code: N/A Case No.: N/A SAS No.: N/A SDG No.: 57915

Matrix: (soil/water) SOIL Lab Sample ID: 57915002

Sample wt/vol: 30.0 (g/mL) G Lab File ID: 007F0701

% Moisture: 11 decanted: (Y/N) N Date Received: 03/22/02

Extraction: (SepF/Cont/Sonc) SONC Date Extracted: 03/29/02

Concentrated Extract Volume: 5.00 (mL) Date Analyzed: 05/03/02

Injection Volume: 1.0 (uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) Y

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG	Q
319-84-6	alpha-BHC	1.9	U
319-85-7	beta-BHC	1.9	U
319-86-8	delta-BHC	1.9	U
58-89-9	gamma-BHC (Lindane)	1.9	U
76-44-8	Heptachlor	1.9	U
309-00-2	Aldrin	1.9	U
1024-57-3	Heptachlor epoxide	1.9	U
959-98-8	Endosulfan I	2.4	J
60-57-1	Dieldrin	0.53	J
72-55-9	4,4'-DDE	3.7	U
72-20-8	Endrin	3.7	U
33213-65-9	Endosulfan II	3.7	U
72-54-8	4,4'-DDD	3.7	U
1031-07-8	Endosulfan sulfate	0.53	J
50-29-3	4,4'-DDT	0.38	JP
72-43-5	Methoxychlor	3.7	U
53494-70-5	Endrin ketone	0.35	J
7421-93-4	Endrin aldehyde	187	U
8001-35-2	Toxaphene	37.4	U
12674-11-2	Aroclor-1016	74.8	U
11104-28-2	Aroclor-1221	37.4	U
1114-16-5	Aroclor-1232	37.4	U
53469-21-9	Aroclor-1242	37.4	U
12672-29-6	Aroclor-1248	37.4	U
11097-69-1	Aroclor-1254	37.4	U
11096-82-5	Aroclor-1260	1.9	U
5103-74-2	gamma-Chlordane	1.9	U
5103-71-9	alpha-Chlordane		

General Engineering Laboratories

TOTAL METALS

-1-

INORGANIC ANALYSIS DATA SHEET

SAMPLE NO.

SSIBF155

Contract: WEIS00199

Lab Code: GEL Case No.: GEL SAS No.: SDG NO.: 57915

Matrix (soil/water): SOIL Lab Sample ID: 57915001

Level (low/med): LOW Date Received: 3/22/2002

% Solids: 88.7

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	1.1	U	N	P
7440-38-2	Arsenic	8.6			P
7440-39-3	Barium	197			P
7440-41-7	Beryllium	0.44	B		P
7440-43-9	Cadmium	0.09	U		P
7440-47-3	Chromium	97.0			P
7440-48-4	Cobalt	20.0			P
7440-50-8	Copper	44.7			P
7439-89-6	Iron	38200			P
7439-92-1	Lead	7.5			P
7439-96-5	Manganese	683			P
7439-97-6	Mercury	0.10		*N	AV
7439-98-7	Molybdenum	0.25	U		P
7440-02-0	Nickel	162			P
7782-49-2	Selenium	0.76	U		P
7440-22-4	Silver	0.15	U		P
7440-28-0	Thallium	1.1	U		P
7440-62-2	Vanadium	66.0			P
7440-66-6	Zinc	80.3			P

Color Before: Dark Brown Clarity Before: Texture: Coarse

Color After: Yellow Clarity After: Artifacts: Y

Comments:

General Engineering Laboratories

TOTAL METALS
-1-
INORGANIC ANALYSIS DATA SHEET

SAMPLE NO.

SSIBF156

Contract: WEIS00199

Lab Code: GEL Case No.: GEL SAS No.: SDG NO.: 57915

Matrix (soil/water): SOIL Lab Sample ID: 57915002

Level (low/med): LOW Date Received: 3/22/2002

% Solids: 89.1

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7440-36-0	Antimony	1.1	U	N	P
7440-38-2	Arsenic	8.4			P
7440-39-3	Barium	193			P
7440-41-7	Beryllium	0.42	B		P
7440-43-9	Cadmium	0.09	U		P
7440-47-3	Chromium	90.3			P
7440-48-4	Cobalt	19.8			P
7440-50-8	Copper	44.5			P
7439-89-6	Iron	38100			P
7439-92-1	Lead	7.2			P
7439-96-5	Manganese	678			P
7439-97-6	Mercury	0.04		*N	AV
7439-98-7	Molybdenum	0.25	U		P
7440-02-0	Nickel	160			P
7782-49-2	Selenium	0.75	U		P
7440-22-4	Silver	0.14	U		P
7440-28-0	Thallium	2.1	B		P
7440-62-2	Vanadium	64.7			P
7440-66-6	Zinc	79.4			P

Color Before: Dark Brown Clarity Before: Texture: Coarse

Color After: Yellow Clarity After: Artifacts: Y

Comments:

Certificate of Analysis

Company : Weiss Associates
Address : 5801 Christie Ave
Suite 600
Emeryville, California 94608
Contact: Tim Utterback
Project: Routine Analytical (Non-radiochem)

Report Date: April 29, 2002

Client Sample ID: SSIBF155
Sample ID: 57915001
Matrix: Soil
Collect Date: 21-MAR-02
Receive Date: 22-MAR-02
Collector: Client
Moisture: 11.3%

Project: WEIS00199
Client ID: WEIS001

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Ion Chromatography Federal											
EPA 300.0 Nitrate in Soil											
Nitrate-N	H	1.13	0.112	1.12	mg/kg	1	BJB	03/25/02	2042	153769	2
Spectrometric Analysis Federal											
SW846_7196A Hexavalent Chromium											
Hexavalent Chromium	U	-0.359	0.0393	0.224	mg/kg	1	BEP1	03/29/02	1645	154960	3

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
EPA 300.0 PREP	EPA 300.0 Total Anions in Soil	BJB	03/22/02	1800	153768
ILM 4.0 CLP	ILM 4.0 CLP Mercury in Soil Prep	ARD	03/27/02	1800	155180
ILM 4.0 CLP	ILMO 4.0 CLP Metals Prep	FGA	04/04/02	1150	155069
OLM 4.2 CLP Prep	OLM 4.2 Pesticide/PCB CLP Prep	RDH	03/29/02	1357	155370
OLM 4.2 CLP Prep	OML 4.2 Volatile CLP Prep in solid Federal	RMB	04/01/02	0924	155243
SW846 3060A	SW846_7196A Hexavalent Chromium in Soil	BEP1	03/29/02	1400	154959

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EPA 300.0	
2	EPA 300.0	
3	SW846 7196A	

Notes:
The Qualifiers in this report are defined as follows :

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< Actual result is less than amount reported
> Actual result is greater than amount reported
B Analyte found in the sample as well as the associated blank.
E Concentration exceeds instrument calibration range
H Holding time exceeded
J Indicates an estimated value. The result was greater than the detection limit, but less than the reporting limit.
U Indicates the compound was analyzed for but not detected above the detection limit
UI Uncertain identification for gamma spectroscopy.

Certificate of Analysis

Company : Weiss Associates
Address : 5801 Christie Ave
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Contact: Tim Utterback
Project: Routine Analytical (Non-radiochem)

Report Date: April 29, 2002

Client Sample ID: SSIBF155
Sample ID: 57915001

Project: WEIS00199
Client ID: WEIS001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method

X Lab-specific qualifier - must be fully described in case narrative and data summary package

The above sample is reported on a dry weight basis except where prohibited by the analytical procedure. Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the Certificate of Analysis.

This data report has been prepared and reviewed in accordance with General Engineering Laboratories, Inc. standard operating procedures. Please direct any questions to your Project Manager, Cheryl Jones.

Reviewed by

Certificate of Analysis

Company : Weiss Associates
Address : 5801 Christie Ave
Suite 600
Emeryville, California 94608
Contact: Tim Utterback
Project: Routine Analytical (Non-radiochem)

Report Date: April 29, 2002

Client Sample ID:	SSIBF156	Project:	WEIS00199
Sample ID:	57915002	Client ID:	WEIS001
Matrix:	Soil		
Collect Date:	21-MAR-02		
Receive Date:	22-MAR-02		
Collector:	Client		
Moisture:	10.9%		

Parameter	Qualifier	Result	DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Ion Chromatography Federal											
EPA 300.0 Nitrate in Soil											
Nitrate-N	H	2.50	0.104	1.04	mg/kg	1	BJB	03/29/02	0502	153769	2
Spectrometric Analysis Federal											
SW846_7196A Hexavalent Chromium											
Hexavalent Chromium	U	-0.302	0.0392	0.224	mg/kg	1	BEP1	03/29/02	1645	154960	3

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
EPA 300.0 PREP	EPA 300.0 Total Anions in Soil	BJB	03/22/02	1800	153768
ILM 4.0 CLP	ILM 4.0 CLP Mercury in Soil Prep	ARD	03/27/02	1800	155180
ILM 4.0 CLP	ILMO 4.0 CLP Metals Prep	FGA	04/04/02	1150	155069
OLM 4.2 CLP Prep	OLM 4.2 Pesticide/PCB CLP Prep	RDH	03/29/02	1357	155370
OLM 4.2 CLP Prep	OML 4.2 Volatile CLP Prep in solid Federal	RMB	04/01/02	0924	155243
SW846 3060A	SW846_7196A Hexavalent Chromium in Soil	BEP1	03/29/02	1400	154959

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	EPA 300.0	
2	EPA 300.0	
3	SW846 7196A	

Notes:
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H Holding time exceeded
J Indicates an estimated value. The result was greater than the detection limit, but less than the reporting limit.
U Indicates the compound was analyzed for but not detected above the detection limit
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X Lab-specific qualifier - must be fully described in case narrative and data summary package

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Project: Routine Analytical (Non-radiochem)

Report Date: April 29, 2002

Client Sample ID: SSIBF156
Sample ID: 57915002

Project: WEIS00199
Client ID: WEIS001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method

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Reviewed by

GENERAL ENGINEERING LABORATORIES

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Certificate of Analysis

Company : Weiss Associates
Address : 5801 Christie Ave
Suite 600
Emeryville, California 94608
Contact: Tim Utterback
Project: Routine Analytical (Radiochemistry)

Report Date: May 3, 2002

Client Sample ID: SSIBF155
Sample ID: 57917001
Matrix: Soil
Collect Date: 21-MAR-02
Receive Date: 22-MAR-02
Collector: Client

Project: WEIS00299
Client ID: WEIS001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Alpha Spec												
Alphaspec Am241, Cm, Solid												
Americium-241	U	0.00472	+/-0.0067	0.00709	0.010	pCi/g		JLE	04/23/02	1349	154791	1
Alphaspec Th, Solid												
Thorium-228		0.529	+/-0.162	0.158	0.100	pCi/g		JLE	05/01/02	2104	154792	2
Thorium-230		0.574	+/-0.181	0.201	0.050	pCi/g						
Thorium-232		0.480	+/-0.134	0.0821	0.050	pCi/g						
Alphaspec U, Solid												
Uranium-233/234		0.411	+/-0.0604	0.0104	0.025	pCi/g		JLE	04/20/02	1912	154793	3
Uranium-235/236		0.0205	+/-0.0108	0.00411	0.010	pCi/g						
Uranium-238		0.396	+/-0.0589	0.0104	0.025	pCi/g						
Liquid Scint Pu241, Solid												
Plutonium-241	U	0.342	+/-0.219	0.364	0.500	pCi/g		LDM	04/11/02	2136	154794	4
Rad Gamma Spec												
Gamma, Ra226, Solid												
Radium-226		0.527	+/-0.0723	0.0248	0.100	pCi/g		CRB	04/25/02	1730	155719	5
Gammaspec, Gamma, Solid												
Actinium-228		0.483	+/-0.0763	0.0163	0.100	pCi/g		CRB	04/01/02	2108	155720	6
Bismuth-212		0.286	+/-0.061	0.0348	0.100	pCi/g						
Bismuth-214		0.351	+/-0.042	0.00851	0.100	pCi/g						
Cesium-137		0.0261	+/-0.00496	0.00479	0.010	pCi/g						
Cobalt-60	U	-0.00177	+/-0.00298	0.00491	0.005	pCi/g						
Lead-210	U	0.170	+/-0.597	0.684	0.500	pCi/g						
Lead-212		0.507	+/-0.0599	0.00738	0.100	pCi/g						
Lead-214		0.419	+/-0.0509	0.00865	0.100	pCi/g						
Potassium-40		11.3	+/-1.40	0.0372	1.00	pCi/g						
Radium-223	U	0.0068	+/-0.0537	0.0844	2.00	pCi/g						
Radium-228		0.483	+/-0.0763	0.0163	0.100	pCi/g						
Thallium-208		0.158	+/-0.0186	0.00423	0.050	pCi/g						
Thorium-234		0.689	+/-0.310	0.212	0.500	pCi/g						
Rad Gas Flow												
GFPC, Gross A/B, solid												
Alpha		8.19	+/-1.68	1.63	1.00	pCi/g		LJG1	04/23/02	0118	158266	7
Beta		16.6	+/-1.34	1.23	1.00	pCi/g						
GFPC, Sr90, solid												
Strontium-90		0.0428	+/-0.011	0.0154	0.050	pCi/g		AB2	05/02/02	1947	159147	8
Rad Liquid Scint												

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GENERAL ENGINEERING LABORATORIES

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Certificate of Analysis

Company : Weiss Associates
Address : 5801 Christie Ave
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Emeryville, California 94608
Contact: Tim Utterback
Project: Routine Analytical (Radiochemistry)

Report Date: May 3, 2002

Client Sample ID: SSIBF155
Sample ID: 57917001

Project: WEIS00299
Client ID: WEIS001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Liquid Scint												
LSC, Tritium Dist, Solid												
Tritium	U	-0.225	+/-0.489	0.849	1.00	pCi/g		LAG1	04/24/02	2001	159467	9
Liquid Scint C14, Solid												
Carbon-14	U	0.0595	+/-0.0482	0.0805	0.100	pCi/g		PD	04/26/02	1831	159143	10

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Ash Soil Prep	Ash Soil Prep RAD A-021,A-021B,A-026	WEO	03/25/02	1518	154557
Dry Soil Prep	Dry Soil Prep RAD A-021,A-021B,A-026	WEO	03/22/02	1645	153686

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	DOE EML HASL 300	
2	DOE EML HASL 300	
3	DOE EML HASL 300	
4	DOE EML HASL 300	
5	DOE EML HASL 300	
6	DOE EML HASL 300	
7	EPA 900.0	
8	EPA 905.0 Modified	
9	EPA 906.0	
10	EPA EERF C-01	

Notes:
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U Indicates the compound was analyzed for but not detected above the detection limit
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Contact: Tim Utterback
Project: Routine Analytical (Radiochemistry)

Report Date: May 3, 2002

Client Sample ID: SSIBF155
Sample ID: 57917001

Project: WEIS00299
Client ID: WEIS001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the Certificate of Analysis.

This data report has been prepared and reviewed in accordance with General Engineering Laboratories, Inc. standard operating procedures. Please direct any questions to your Project Manager, Cheryl Jones.

Reviewed by

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GENERAL ENGINEERING LABORATORIES

Meeting today's needs with a vision for tomorrow.

Certificate of Analysis

Company : Weiss Associates
Address : 5801 Christie Ave
Suite 600
Emeryville, California 94608
Contact: Tim Utterback
Project: Routine Analytical (Radiochemistry)

Report Date: May 3, 2002

Client Sample ID: SSIBF156
Sample ID: 57917002
Matrix: Soil
Collect Date: 21-MAR-02
Receive Date: 22-MAR-02
Collector: Client

Project: WEIS00299
Client ID: WEIS001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Alpha Spec												
Alphaspec Am241, Cm, Solid												
Americium-241		0.0101	+/-0.0101	0.00755	0.010	pCi/g		JLE	04/24/02	1941	154791	1
Alphaspec Th, Solid												
Thorium-228		0.462	+/-0.164	0.193	0.100	pCi/g		JLE	05/01/02	2104	154792	2
Thorium-230		0.449	+/-0.131	0.0996	0.050	pCi/g						
Thorium-232		0.358	+/-0.115	0.0937	0.050	pCi/g						
Alphaspec U, Solid												
Uranium-233/234		0.404	+/-0.0622	0.0145	0.025	pCi/g		JLE	04/20/02	1913	154793	3
Uranium-235/236		0.0197	+/-0.0111	0.00456	0.010	pCi/g						
Uranium-238		0.463	+/-0.0679	0.00454	0.025	pCi/g						
Liquid Scint Pu241, Solid												
Plutonium-241	U	0.305	+/-0.194	0.323	0.500	pCi/g		LDM	04/12/02	0040	154794	4
Rad Gamma Spec												
Gamma, Ra226, Solid												
Radium-226		0.474	+/-0.069	0.0233	0.100	pCi/g		CRB	04/25/02	1730	155719	5
Gammaspec, Gamma, Solid												
Actinium-228		0.503	+/-0.0708	0.0153	0.100	pCi/g		CRB	04/01/02	2109	155720	6
Bismuth-212		0.304	+/-0.0581	0.0327	0.100	pCi/g						
Bismuth-214		0.375	+/-0.0485	0.00752	0.100	pCi/g						
Cesium-137		0.0282	+/-0.0059	0.00457	0.010	pCi/g						
Cobalt-60	U	0.0011	+/-0.00278	0.00482	0.005	pCi/g						
Lead-210		0.480	+/-0.103	0.0691	0.500	pCi/g						
Lead-212		0.482	+/-0.0552	0.00602	0.100	pCi/g						
Lead-214		0.407	+/-0.0495	0.00717	0.100	pCi/g						
Potassium-40		11.3	+/-1.16	0.0339	1.00	pCi/g						
Radium-223	U	-0.0291	+/-0.045	0.0674	2.00	pCi/g						
Radium-228		0.503	+/-0.0708	0.0153	0.100	pCi/g						
Thallium-208		0.153	+/-0.0193	0.00399	0.050	pCi/g						
Thorium-234		0.604	+/-0.151	0.0773	0.500	pCi/g						
Rad Gas Flow												
GFPC, Gross A/B, solid												
Alpha		4.93	+/-1.55	1.96	1.00	pCi/g		LJG1	04/23/02	0118	158266	7
Beta		12.7	+/-1.36	1.60	1.00	pCi/g						
GFPC, Sr90, solid												
Strontium-90		0.0389	+/-0.014	0.0247	0.050	pCi/g		AB2	05/02/02	1947	159147	8
Rad Liquid Scint												
LSC, Tritium Dist, Solid												

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GENERAL ENGINEERING LABORATORIES

Meeting today's needs with a vision for tomorrow.

Certificate of Analysis

Company : Weiss Associates
Address : 5801 Christie Ave
Suite 600
Emeryville, California 94608
Contact: Tim Utterback
Project: Routine Analytical (Radiochemistry)

Report Date: May 3, 2002

Client Sample ID: SSIBF156
Sample ID: 57917002

Project: WEIS00299
Client ID: WEIS001

Parameter	Qualifier	Result		DL	RL	Units	DF	Analyst	Date	Time	Batch	Method
Rad Liquid Scint												
LSC, Tritium Dist, Solid												
Tritium	U	0.0575	+/-0.525	0.899	1.00	pCi/g		LAG1	04/24/02	2205	159467	9
Liquid Scint C14, Solid												
Carbon-14	U	-0.0229	+/-0.0462	0.0795	0.100	pCi/g		PD	04/26/02	2004	159143	10

The following Prep Methods were performed

Method	Description	Analyst	Date	Time	Prep Batch
Ash Soil Prep	Ash Soil Prep RAD A-021,A-021B,A-026	WEO	03/25/02	1518	154557
Dry Soil Prep	Dry Soil Prep RAD A-021,A-021B,A-026	WEO	03/22/02	1645	153686

The following Analytical Methods were performed

Method	Description	Analyst Comments
1	DOE EML HASL 300	
2	DOE EML HASL 300	
3	DOE EML HASL 300	
4	DOE EML HASL 300	
5	DOE EML HASL 300	
6	DOE EML HASL 300	
7	EPA 900.0	
8	EPA 905.0 Modified	
9	EPA 906.0	
10	EPA EERF C-01	

Notes:
The Qualifiers in this report are defined as follows :

** Indicates the analyte is a surrogate compound.
< Actual result is less than amount reported
> Actual result is greater than amount reported
B Analyte found in the sample as well as the associated blank.
E Concentration exceeds instrument calibration range
H Holding time exceeded
J Indicates an estimated value. The result was greater than the detection limit, but less than the reporting limit.
U Indicates the compound was analyzed for but not detected above the detection limit
UI Uncertain identification for gamma spectroscopy.
X Lab-specific qualifier - must be fully described in case narrative and data summary package

The above sample is reported on a dry weight basis except where prohibited by the analytical procedure.

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Report Date: May 3, 2002

Client Sample ID: SSIBF156
Sample ID: 57917002

Project: WEIS00299
Client ID: WEIS001

Parameter	Qualifier	Result	DL	RL	Units	DF	AnalystDate	Time	Batch	Method

Where the analytical method has been performed under NELAP certification, the analysis has met all of the requirements of the NELAC standard unless qualified on the Certificate of Analysis.

This data report has been prepared and reviewed in accordance with General Engineering Laboratories, Inc. standard operating procedures. Please direct any questions to your Project Manager, Cheryl Jones.

Reviewed by

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TOTAL METALS

- 1 -

INORGANIC ANALYSIS DATA PACKAGE

SDG No.: 60897 **Method Type:** SW846

Sample ID: 60897001 **Client ID:** SSIBF155 [illegible]

Contract: WEIS00199 **Lab Code:** GEL **Case No.:** GEL **SAS No.:**

Matrix: SOIL **Date Received:** 5/22/2002 **Level:** LOW **% Solids:** 88.70

CAS No.	Analyte	Concentration	Units	C	Qual	M	DL	Instrument ID	Analytical Run
7440-36-0	Antimony	540	µg/kg	U	N	P	540	TJA61 Trace ICP2	60402

Color Before: **Clarity Before:** **Texture:**

Color After: **Clarity After:** **Artifacts:**

Comments:

TOTAL METALS
- 1 -
INORGANIC ANALYSIS DATA PACKAGE

SDG No.: 60897 **Method Type:** SW846

Sample ID: 60897002 **Client ID:** SSIBF156 NE

Contract: WEIS00199 **Lab Code:** GEL **Case No.:** GEL **SAS No.:**

Matrix: SOIL **Date Received:** 5/22/2002 **Level:** LOW **% Solids:** 89.10

CAS No.	Analyte	Concentration	Units	C	Qual	M	DL	Instrument ID	Analytical Run
7440-36-0	Antimony	527	µg/kg	U	N	P	527	TJA61 Trace ICP2	60402

Color Before: **Clarity Before:** **Texture:**

Color After: **Clarity After:** **Artifacts:**

Comments: