**U.S. Department of Energy**

Oakland Operations Office, Oakland, California


# FINAL
# WESTERN DOG PENS AREA REMOVAL ACTION 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:*


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



October 11, 2002
Rev. 0

DOE Oakland Operations Contract DE-AC03-96SF20686



Weiss Associates
Environmental Science, Engineering and Management

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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 |
| CFR | Code of Federal Regulations |
| Co-60 | cobalt-60 |
| COCs | constituents of concern |
| COPC | constituent of potential concern |
| cu yd | cubic yard(s) |
| D&D | decontamination and decommissioning |
| DAC | derived air concentration |
| DL | designated-level |
| DOE | United States Department of Energy |
| EDE | Effective Dose Equivalent |
| EDP(s) | Eastern Dog Pen(s) |
| EE/CA | Engineering Evaluation/Cost Analysis |
| ft | feet |
| GEL | General Engineering Laboratories |
| H&S | health and safety |
| HDPE | high-density polyethylene |
| HQ | hazard quotient |
| HSP | Health and Safety Procedure |
| HW | hazardous waste |
| in. | inches |
| LEHR | Laboratory for Energy-Related Health Research |

| | |
|---|---|
| LLW | low-level waste |
| MCL | maximum contaminant level |
| mg/kg | milligrams per kilogram |
| $mg/m^3$ | milligrams per cubic meter |
| mrem | millirem |
| NaI | sodium iodide |
| NUFT | Non-isothermal, Unsaturated Flow and Transport |
| OSHA | Occupational Safety and Health Administration |
| pCi/g | picoCuries per gram |
| PEL | permissible exposure limit |
| 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 |
| RBAS | risk-based action standard |
| RCT | Radiological Control Technician |
| RME | reasonable maximum exposure |
| RPM | Remedial Project Manager |
| RPP | Radiological Protection Plan |
| RSO | Radiological Safety Officer |
| SC | screening criteria |
| SHSO | Site Health and Safety Officer |
| SOP | Standard Operating Procedure |
| Sr-90 | strontium-90 |
| SWT | Southwest Trenches |

| | |
|---|---|
| TSMs | tailgate safety meetings |
| TWA | time-weighted average |
| UC Davis | University of California, Davis |
| UCL | upper confidence limit |
| US EPA | United States Environmental Protection Agency |
| VOC | volatile organic compound |
| WA | Weiss Associates |
| WDP(s) | Western Dog Pen(s) |
| WP | work plan |
| WRS | Wilcoxon Rank Sum |
| μg/kg | micrograms per kilogram |

# EXECUTIVE SUMMARY

A non-time-critical removal action (RA) was conducted at the Western Dog Pens (WDPs) area located at the Laboratory for Energy-Related Health Research (LEHR or the Site), University of California, Davis (UC Davis) (Figure 1-1). The RA was conducted according to the National Contingency Plan, 40 Code of Federal Regulations, Part 300.415. This RA Confirmation Report was prepared according to "Superfund Removal Procedures, Removal Response Reporting: POLREPS and OSC Reports" (US EPA, 1994b).

The RA objectives at LEHR were defined in an Engineering Evaluation/Cost Analysis (WA, 2001c) as follows:

- Mitigate potential 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;
- Reduce the non-cancer hazard quotient (HQ) below 1.0;
- Mitigate potential future impact to ground water;
- Mitigate potential ecological risks during and after the RA; and,
- Minimize impact to on-site university research.

The RA at the WDPs was conducted according to the *Dog Pens Removal Action Work Plan* (RA WP) (WA, 2001e). RA activities began in April 2001 and were completed by November 2001 (Figure 1-2). The WDPs consisted of 256 individual concrete pens lined with gravel up to one foot in depth. Sixteen rows of dog pens were separated by eight asphalt walkways with the entire area enclosed by a chainlink fence.

Approximately 1,325 linear feet (ft) of chainlink fence were removed from the WDPs perimeter. The fencing was rolled up, placed on pallets and transported to the former Cobalt-60 (Co-60) Field for temporary storage. Approximately 160 cubic yards (cu yd) of chlordane-impacted asphalt and soil were removed from Aisle 3 of the WDPs and packaged for off-site disposal. The remaining seven aisles generated 650 cu yd of asphalt and road base which is currently stockpiled and covered in the Former Co-60 Field.

Approximately 2,275 cu yd of gravel and soil were removed from the western dog pens and transported to a lined, temporary staging cell in the Southwest Trenches Area. This material was mechanically screened to yield 1,725 cu yd of gravel which was segregated into stockpiles based on existing characterization data (Figure 2-3). The 550 cu yd of separated soil was analyzed on site for radium-226 (Ra-226) and strontium-90 (Sr-90) to ensure that it was not contaminated during the gravel removal process. The analytical results confirmed that the soil was below the screening criteria and the soil was returned to the excavation.

An estimated 18,460 linear ft of concrete curbing were removed from the WDPs and the area surrounding the Cellular Biology Building. The concrete was crushed to a volume of 750 cu yd and stockpiled. In addition approximately 40 cu yd of metal debris and wood were removed and stockpiled

Due to on-site storage limitations, a portion of the WDPs was designated for storing material/waste stockpiles. After excavation activities, collecting confirmation samples and surveying the WDPs excavation area, clean fill was brought on site and the southern WDPs area was backfilled and compacted to grade. Material/waste stockpile cells were established within the backfilled areas (Figure 2-4). Disposition of the material/waste consisting of concrete, asphalt, metal and wood will be addressed in a future work plan addendum pending evaluation of characterization results.

A two-phased data evaluation was used to determine if the removal action objectives (RAOs) were achieved during the WDPs RA. The Phase I Data Evaluation occurred immediately following the RA and was based on analyses of screening samples collected during the RA that were analyzed only for "driver" constituents of concern (COCs). The Driver COCs for the WDPs RA were Ra-226 and Sr-90. Prior to collecting confirmation samples, screening sample analytical results were presented to the LEHR Remedial Project Managers (RPMs) at a meeting held on August 6, 2001 to reach consensus on whether screening criteria were attained for driver COCs. These meetings satisfied the Phase I Data Evaluation objectives as described in the RA WP (WA, 2001e). At the meeting, a decision was reached to collect confirmation samples, backfill the excavations and restore the Site.

Additional samples were characterized for chlordane analysis in Aisle 3 and the cobble trenches at the request of the RPMs (November 6, 2000). The original location was resampled along with locations in the lateral and vertical directions. Analytical results from the chlordane resampling were incorporated into the Phase II data evaluation. The Phase II data evaluation is addressed in this report and was completed after all analytical results from the RA confirmation sampling were received. The primary objective of the confirmation sampling was to ensure attainment of cleanup goals using a statistically-based sampling design. The statistical approach used to determine the required number of confirmation samples was in accordance with United States Environmental Protection Agency (US EPA) guidance (US EPA, 1994a).

The confirmation samples were collected from the excavation area to verify that cleanup criteria for all COCs were met (Figure 5-2). COCs for the WDPs RA are Ra-226, Sr-90, mercury, chlordane and hexavalent chromium. A total of 33 samples and 5 duplicate samples were collected between 0.5 and 3 ft below ground surface (bgs) from the WDPs excavation. The excavation confirmation samples were packaged and shipped to an off-site laboratory for analyses.

The Phase II Data Evaluation consisted of conducting a risk analysis and RA completion analysis. The risk analysis assessed whether RAOs 1 and 2 for the WDPs RA were attained. The risk analysis consisted of the following:

- 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 (PRGs); and,
- Completing a hot measurement analysis.

The risk analysis demonstrated that the cumulative residual risk for carcinogens were below the US EPA's Comprehensive Environmental Response, Compensation and Liability Act risk range of $10^{-4}$ to $10^{-6}$. Thus, RAO 1 has been attained by reducing the cumulative cancer risk below the nominal range of $10^{-4}$ to $10^{-6}$.

RAO 2 has been attained for the non-carcinogenic COCs following the RA activities by reducing the non-cancer HQ to below 1.0.

All mercury, alpha-and gamma-chlordane confirmation sample results were below their respective residential PRG values. Ra-226 results were below background. Hexavalent chromium and Sr-90 were below their lowest respective RBAS values. Achievement of the WDPs RAOs is discussed below.

## Removal Action Objective 1–Reduce Cancer Risk

This objective has been attained since RA activities reduced the cumulative cancer risk to below the nominal range of $10^{-4}$ to $10^{-6}$.

## 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 6.3.3.2, this RAO has been attained for all COCs. Therefore this RAO has been attained by reducing the non-cancer HQ for all COCs below 1.0.

## Removal Action Objective 3–Mitigate Ground Water Impact

Ground water impact evaluation employing vadose zone modeling indicated that above-background constituents in the WDPs soil will not impact underlying ground water above water quality goals (WA, 2001c). However, subsequent DL analyses of the confirmation sample results suggest that mercury exceeds the allowable DL concentration. The estimated time required for this impact to occur is almost 6,000 years. This RAO has been obtained with this exception.

## Removal Action Objective 4–Mitigate Ecological Risk

During the RA, mitigation measures (fencing) 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–Minimize Disruption to University Research

The RA conducted at the WDPs area during the summer of 2001 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 action (RA) conducted at the Western Dog Pens (WDPs) located at the Laboratory for Energy-Related Health Research (LEHR or the Site), University of California, Davis (UC Davis) (Figure 1-1). This RA Confirmation Report includes the Phase II Data Evaluation described in the Dog Pens RA Work Plan (WP) (WA, 2001e), documents the RA activities performed and timeline (Figure 1-2) at the WDPs Area, presents the analytical results of the sampling performed, and evaluates whether removal action objectives (RAOs) 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, 1994b). This report was prepared by Weiss Associates (WA) under United States Department of Energy (DOE) Environmental Restoration/Waste Management Contract No. DE-AC03-96SF20686.

Section 1.1 discusses site background, including historical and current uses of the WDPs and conditions prior to start of the RA. Section 1.2 states the constituents of concern (COCs). The RAOs are presented in Section 1.3 and the report organization is described in Section 1.4.

## 1.1 Site Background

The Atomic Energy Commission (now DOE) and its predecessor, the Manhattan Engineering District of the Defense Department, began conducting radiological studies on laboratory animals at UC Davis in 1951. Initial studies were carried out on the main UC Davis campus and involved the irradiation of beagles. The Site began operating in its present location in 1958 when the project outgrew the main campus facility. 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).

Beagles that had been exposed to radioactive substances were moved outside to the Dog Pens (Figures 1-1 and 1-3). From available architectural drawings and site documents, 64 outside pens (Rows A and B) were nearly completed, except for installation of dog houses and gravel floors, by June 1958. These outside pens were scheduled to be completed and occupied by September 1958. By 1960, 96 outdoor pens (Rows A through C) were completed and put into operation. By February 3, 1961, 128 pens (Rows A through D) were complete. Based on site investigations, Rows A through D contain sub-grade, cobble-filled trenches that are oriented in an east-west direction. Construction drawings indicate that these trenches contain a water line, but their purpose is not known. Between 1961 and 1964, an additional 64 pens were constructed (Rows E and F) for a total of 192 pens. Between 1964 and 1968, the remaining 128 WDPs were constructed (Rows G through J). Field observations and construction drawings indicate that the cobble-filled trenches are not present in Rows E through J. In 1975, 64 pens (Rows A and B) were removed during construction of the Cellular Biology Laboratory (Figure 1-3). The gravel and interior curbing for Rows A and B were removed, but the perimeter curbing was left in place.

The aboveground dog pen structures were dismantled and removed in 1995 and 1996. The concrete pedestals and wooden barrels used to house the dogs were disposed as low-level waste (LLW) at Hanford.

The Site was placed on the United States Environmental Protection Agency's (US EPA's) National Priorities List in May 1994. UC Davis is currently using the Site for research activities and is likely to continue these activities in the foreseeable future.

## 1.2 Constituents of Concern

Statistical evaluation of the WDPs analytic data indicates that COCs (i.e., radionuclides, metals and pesticides) in soil beneath the WDPs are below the risk-based target levels (WA, 2001c). However, the analytical data for the gravel, asphalt and concrete from curbs that comprise the WDPs are not sufficient to eliminate them as potential risks (WA, 2001e). The COCs for the WDPs RA are Ra-226, Sr-90, mercury, chlordane and hexavalent chromium

## 1.3 Removal Action Objectives

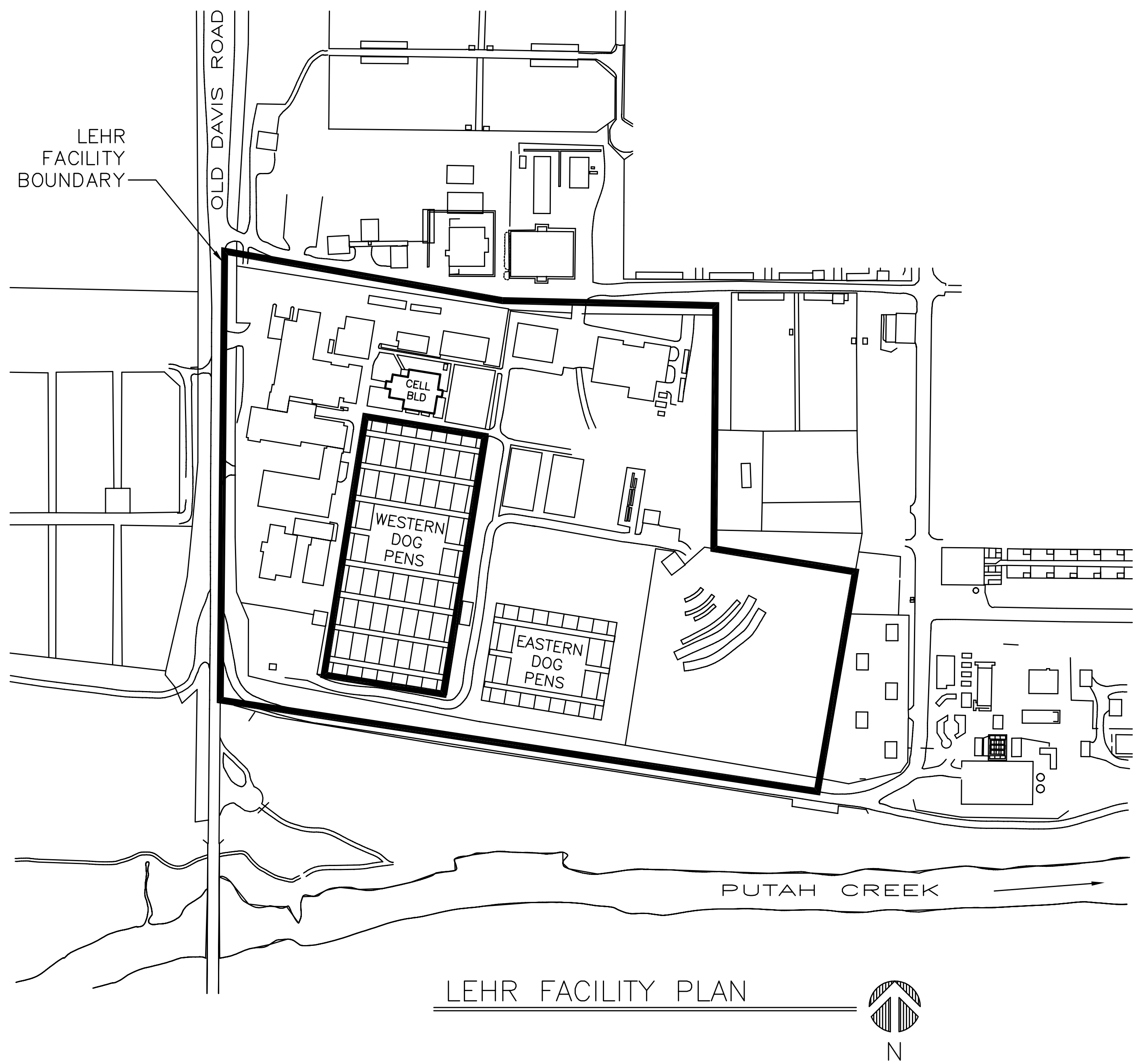
The objectives of the WDPs RA were defined in the Dog Pens Engineering Evaluation/Cost Analysis (EE/CA) as:

- Mitigate potential 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;
- Reduce the non-cancer hazard quotient (HQ) below 1.0;
- Mitigate potential future impact to ground water;
- Mitigate potential ecological risks during and after the RA; and,
- Minimize impact to on-site university research.

As discussed in the Dog Pens RA WP (WA, 2001e), two phases of data evaluation were conducted to determine attainment of the RAOs. Phase I occurred immediately following the RA and was based on field screening sample results. Phase II is presented in this report and is based on the confirmation sample results.

## 1.4 Report Organization

Section 2 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 RA. Section 5 presents the sampling activities and analytical results generated as a result of the RA. 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 RA.



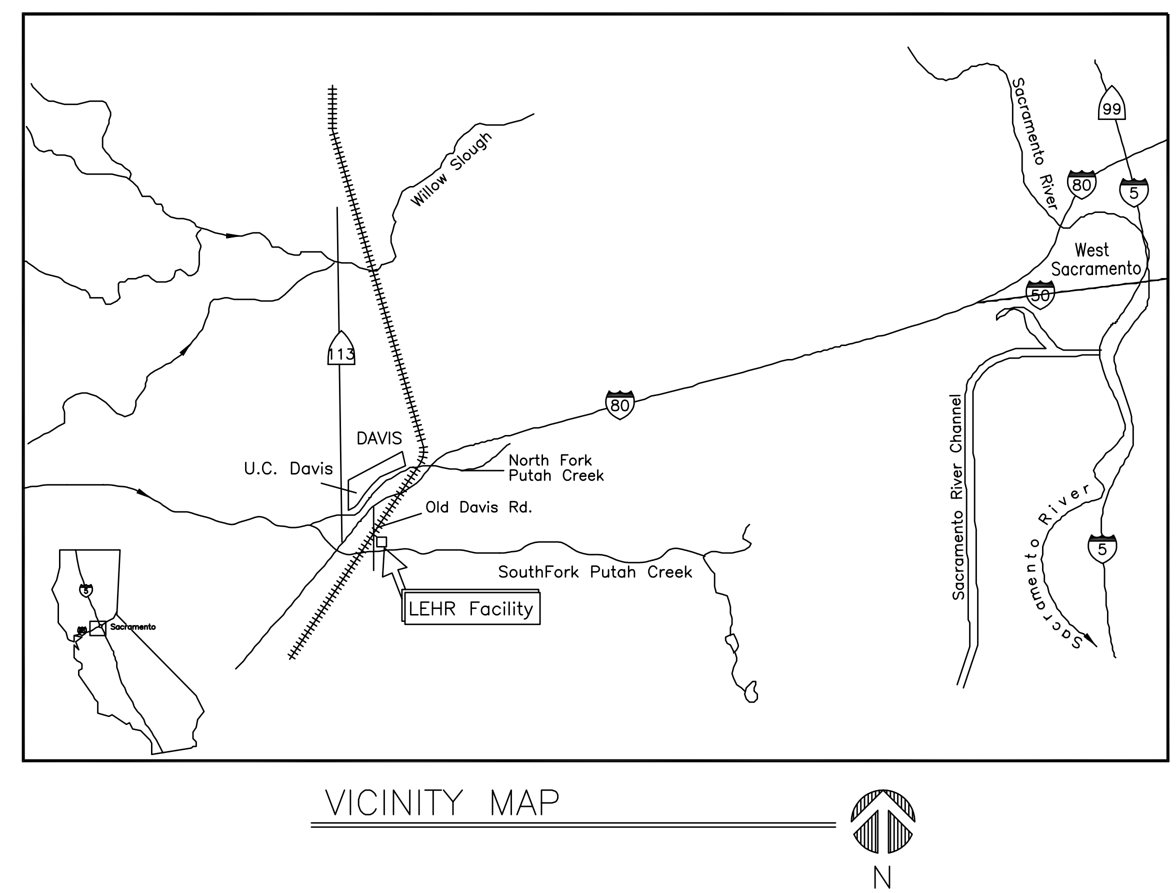




Figure 1-1. LEHR Site Location Map, UC Davis, California

*WEISS ASSOCIATES*

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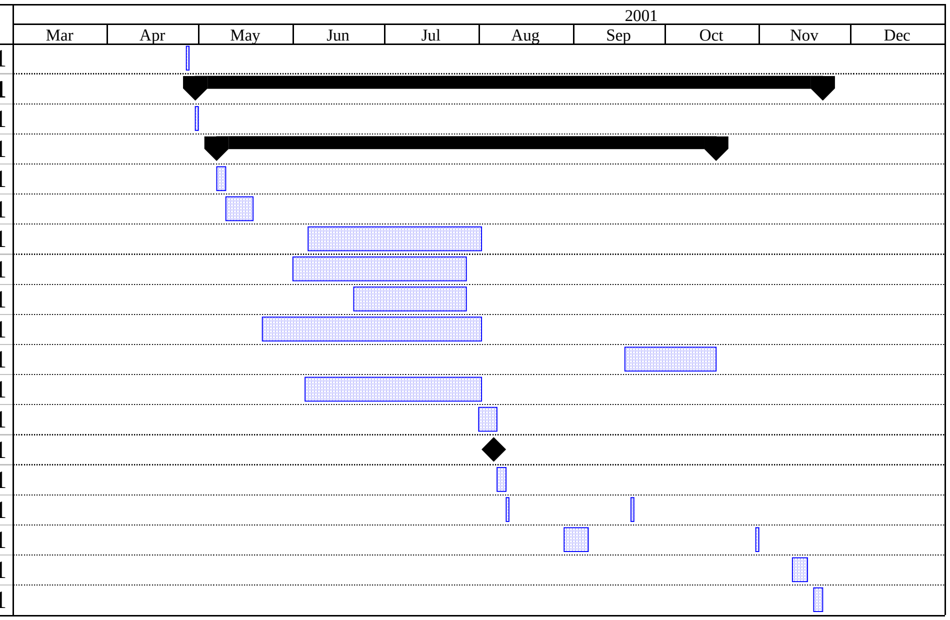
Figure 1-2. Western Dog Pens Removal Action Timeline

| Task Name | Start | Finish |
|---|---|---|
| Readiness Review | Fri 4/27/01 | Fri 4/27/01 |
| **Western Dog Pens Removal Action** | **Mon 4/30/01** | **Wed 11/21/01** |
| Mobilization and Site Setup | Mon 4/30/01 | Mon 4/30/01 |
| Material/Waste Removal and Staging | Mon 5/7/01 | Wed 10/17/01 |
| Perimeter Fence Removal | Mon 5/7/01 | Wed 5/9/01 |
| Aisle 3 Asphalt Removal | Thu 5/10/01 | Fri 5/18/01 |
| Remaining Asphalt Removal | Wed 6/6/01 | Wed 8/1/01 |
| Concrete Removal | Fri 6/1/01 | Fri 7/27/01 |
| Concrete Processing | Thu 6/21/01 | Fri 7/27/01 |
| Gravel Removal | Tue 5/22/01 | Wed 8/1/01 |
| Gravel Processing | Tue 9/18/01 | Wed 10/17/01 |
| Excavation Screening Sampling | Tue 6/5/01 | Wed 8/1/01 |
| Phase I Data Evaluation | Wed 8/1/01 | Mon 8/6/01 |
| Remedial Project Manager Presentation | Mon 8/6/01 | Mon 8/6/01 |
| Confirmation Sampling | Tue 8/7/01 | Thu 8/9/01 |
| Land Survey of Excavation Limits | Fri 8/10/01 | Thu 9/20/01 |
| Backfill and Compaction | Wed 8/29/01 | Fri 11/2/01 |
| Site Restoration | Mon 11/12/01 | Fri 11/16/01 |
| Demobilization | Mon 11/19/01 | Wed 11/21/01 |



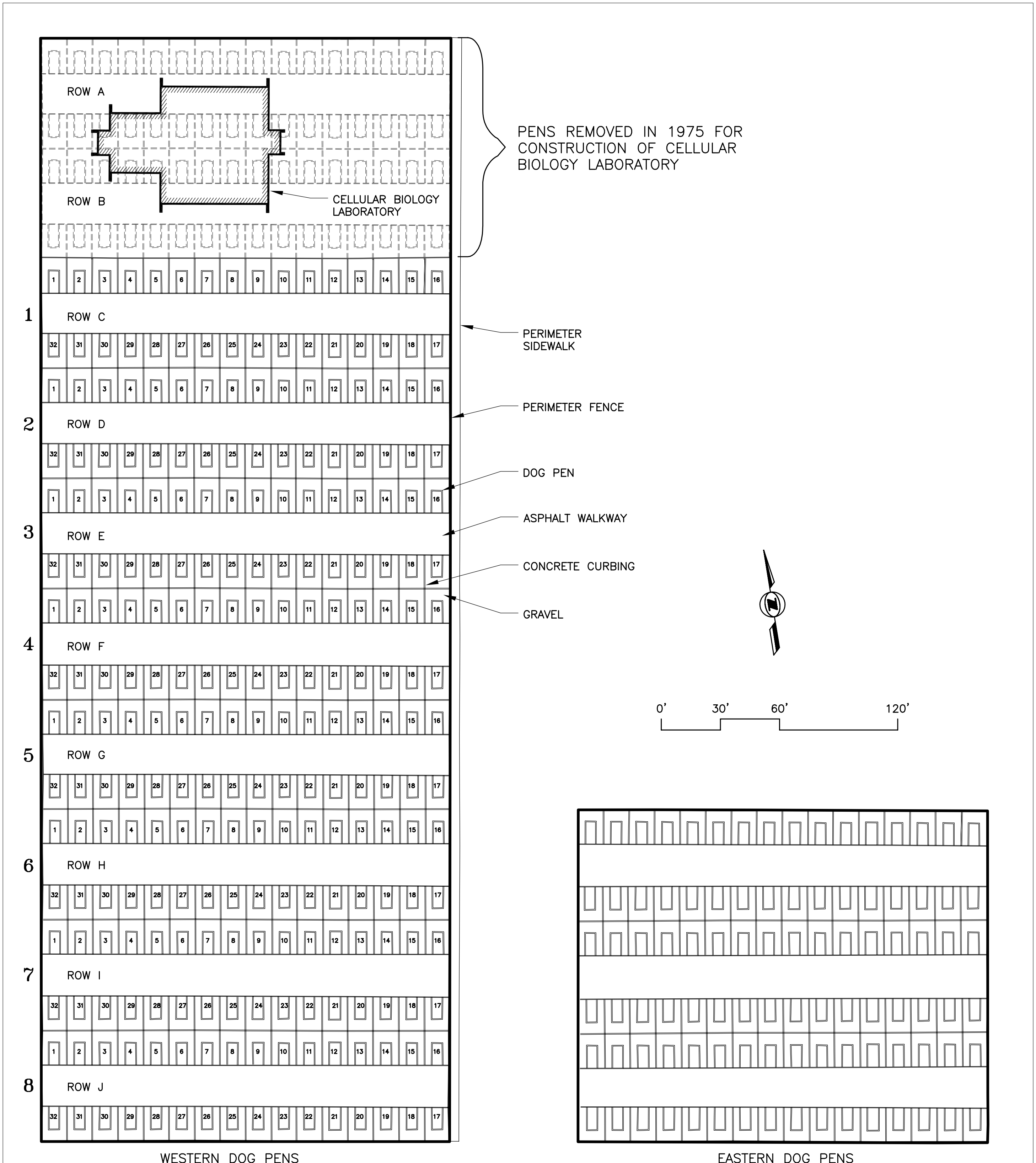



Figure 1-3. LEHR Dog Pens Area

WEISS ASSOCIATES

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# 2. REMOVAL ACTION ACTIVITIES

The WDPs RA was conducted in accordance with the Dog Pens RA WP (WA, 2001e). The Dog Pens consist of two separate areas, the eastern and western pens. This report covers only the WDPs RA, which occurred from April to November 2001.

## 2.1 Pre-Job Activities/Planning

Several tasks were completed prior to the start of the RA to facilitate field operations. These included:

- Conducting a geophysical survey of the work area;
- Rerouting a utility line; and,
- Performing air modeling for H&S purposes.

A geophysical survey was conducted in the WDPs and around the Cellular Biology Laboratory to locate underground utilities. A private contractor was utilized to locate underground utilities within the construction area and mark their locations on the ground surface. UC Davis site drawings were also reviewed and Underground Services Alert was contacted. An underground utility line serving the washdown pad located on the southwest side of the WDPs (Figure 2-1) was rerouted due to its proximity to the WDPs.

Air modeling was conducted prior to the start of the WDPs RA to ensure emissions generated were below 10 millirem (mrem) per year standard. This level is in compliance with the requirements of 40 CFR Part 61 Subpart H – National Emissions Standards for Hazardous Air Pollutants for Emissions of Radionuclides from DOE Facilities (WA, 2001d).

The emissions rates for concrete curb removal, pulverizing and waste container loading were calculated using the American Society for Testing and Materials (ASTM) Risk-Based Corrective Action Box Model. The maximum Ra-226 and Sr-90 concentrations from available concrete curb samples and the calculated emissions rates were used to determine the CAP88-PC Dose Assessment Model input parameters. Results of the CAP88-PC modeling indicated an effective dose equivalent (EDE) of 1.24E-04 mrem per year. The EDE is the sum of the products of the dose equivalent received by specified tissues of the body and appropriate weighting factors. It includes the dose from radiation sources internal and external to the body. This value is less than 1% of the 10 mrem per year standard.

## 2.2 Mobilization and Site Setup

Weiss Associates and its subcontractor, IT Corporation, arrived on site in late April 2001 to begin preparation for the RA. Activities conducted prior to the start of work included the following:

- Mobilizing personnel and equipment to the Site;
- Training workers;
- Installing a temporary perimeter fence and windscreen around the WDPs Area;
- Performing weed abatement and tree removal;
- Preparing the material/waste storage areas;
- Installing and testing scales for weighing soft-sided waste containers;
- Removing 440 cubic yards (cu yd) of soil stored in Aisle 2 of the WDPs;
- Transferring soft-sided waste containers to the Eastern Dog Pens (EDPs);
- Removing the eastern perimeter sidewalk;
- Establishing a grid coordinate system; and,
- Setting up the on-site laboratory.

The WDPs construction area was prepared by installing approximately 1,300 linear feet (ft) of temporary fence to control access (Figure 2-1). Weed abatement occurred in portions of the WDPs, EDPs and the former Cobalt-60 (Co-60) Field, in addition to a 30-ft tall pine tree requiring removal from the southern portion of the WDPs. Disposition of the felled pine tree along with other miscellaneous waste is discussed in Section 3.1.4.

To facilitate removal activities in the WDPs, material/waste generated from previous RAs and stored in the aisles were relocated. Soft-sided containers stored in Aisles 6, 7 and 8 were transferred to aisles in the EDPs and overburden soil stored in Aisle 2 was transferred to the former Co-60 Field and covered (Figure 2-2).

Environmental protection measures were implemented to prevent impacts to the surrounding environment. These included:

- Sensitive habitat protection;
- Storm water/runoff protection; and,
- Monitoring well protection.

Three elderberry shrubs, which are a potential habitat for the endangered valley elderberry longhorn beetle, are located within the WDPs (Figure 2-1). Metal stakes and orange construction netting were used to construct a 20-ft radius fence around each of the elderberry shrubs to minimize disturbance to the shrubs during RA activities. Aboveground monitoring wells in potential traffic routes and storage areas were also protected with construction netting to prevent damage.

An on-site laboratory used for screening material and excavation field samples for potential radiological impacts was established in Animal Hospital 1 (Figure 2-1). A gamma spectrometer was used for Ra-226 analyses and a BetaScint detector was used for Sr-90 analyses. On-site laboratory setup consisted of cleaning the designated lab area, covering surfaces with plastic sheeting, and calibrating the gamma spectrometer and the BetaScint detector. Once the on-site laboratory was set up and ready to receive samples, it was posted as a contamination area.

The perimeter sidewalk located outside the WDPs along the eastern boundary (Figure 2-1) was removed and disposed prior to removal activities. An excavator was used to remove the sidewalk, and a front-end loader direct-loaded the material into dumptrucks for off-site disposal.

All site workers who performed RA and support activities completed all required training defined in Section 3.1.4 of the RA WP (WA, 2001e). 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 placed into the project file in accordance with the Quality Assurance Project Plan (QAPP) (WA, 2000b).

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

Pre-construction meetings were held with project management personnel prior to the start and during the RA 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 material/waste was removed following preparation of the staging, storage and processing areas within the construction area (Figure 2-2).

### *2.3.1 Perimeter Fence*

Approximately 1,325 ft of chainlink fence were removed from the perimeter of the WDPs. Prior to the fence removal, a radiological survey was performed to determine if fixed radioactive contamination was present at the base of the fence. A Radiological Control Technician (RCT) performed the survey using a hand-held Geiger Mueller probe to scan the bottom three feet of the fence. Results of the survey determined that no contamination was present on the fence. The chainlink fence was removed in manageable sections by laborers using bolt cutters to cut the fence from the support posts and along the base embedded in the curbing. Removed sections of the perimeter fence were rolled up, placed on pallets and transported to the former Co-60 Field for storage and further evaluation.

Fence posts were left in the concrete curbing and later removed with the excavator during curb removal. The posts were eventually transferred along with the curbing to the concrete processing area and separated during concrete processing. The posts were segregated and stockpiled along with other the metal encountered during removal activities.

### *2.3.2 Dog Pens Gravel*

The WDPs contained 256 individual gravel-lined pens. Each pen contained approximately 6.5 cu yd of gravel. The gravel was sampled for Ra-226, Sr-90, gross alpha and gross beta in March 2001 (WA, 2001a) and the results were used to guide the removal process. Based on these sample results, gravel from individual pens was classified according to its degree of radiological impact and labeled with the indicator colors of green, blue or red prior to removal (Figure 2-3).

The gravel was removed from each pen with a backhoe and loaded into a dumptruck for transport to the temporary gravel staging area (Figure 2-2). Efforts were made to minimize the removal of underlying soil during the gravel removal process, but the removal of some soil was unavoidable. The removed gravel and soil were transported to appropriate stockpiles in the Southwest Trenches area (SWT) and placed on 20-mil high-density polyethylene (HDPE) sheeting for surface protection.

At the completion of gravel removal and staging, material stockpile cells were established in the backfilled portions of the WDPs (Figure 2-4). A mechanical screening unit was brought on site to separate the gravel from soil. The material was placed into the mechanical screener, where a series of belts deposited the gravel and soil onto screens that segregated it based on size. The segregated gravel was collected by underlying conveyor belts and ultimately transported to the appropriate stockpile cell correlating to its degree of radiological impact.

The soil separated during the gravel screening process was transported by dumptrucks and temporarily stockpiled in the WDPs. Initially stored in 10 cu yd stockpiles, all screened soil was sampled and analyzed on site for Ra-226 and Sr-90 (Section 5-3) to ensure that the soil and screening equipment were not contaminated during gravel processing. Once on-site analytical results for the screened soil were evaluated, the soil was consolidated into one stockpile in the WDPs (Figure 2-2).

### *2.3.3 Asphalt*

Each of the eight WDPs aisles was paved with two to three inches of asphalt. All asphalt was treated as potential LLW until on-site analysis indicated otherwise. In seven of the aisles (1, 2, 4, 5, 6, 7 and 8), only the top layer containing asphalt was removed; the road base material was left in place. The asphalt was removed using an excavator and deposited into dumptrucks for transport and storage in the former Co-60 Field (Figure 2-2).

Aisle 3 was temporarily used to store stockpiles containing chlordane-impacted soil generated during the SWT RA in the summer of 1998. The chlordane-impacted soil was disposed off site as hazardous waste (HW) in the summer of 1999. During the loading process, residual soil was left on the surface of Aisle 3 due to heavy equipment operation damaging the asphalt and overlying HDPE liner. Due to a concern of inadvertently mixing the radiologically impacted soil and asphalt with the HW, this aisle was removed, handled, stored and sampled separately from the other asphalt to determine whether it was impacted by the HW stockpiles. Asphalt, residual soil and underlying soil to a depth of six inches below grade from Aisle 3 were removed with an excavator, and loaded into soft-sided containers pending characterization. The soft-sided containers were removed from the work area by a forklift, then weighed prior to being stored in the former Co-60 Field.

### *2.3.4 Dog Pens Curbing*

An estimated 18,075 linear ft of unreinforced concrete curbing existed in the WDPs. Except for the curbing in the immediate vicinity of the Cellular Biology Laboratory and the protected elderberry shrubs, most of the curbing was removed with a track-mounted excavator using a thumb attachment. Upon removal, the curbing was deposited into dumptrucks and transported to the concrete staging area located adjacent to the concrete processing area in the WDPs (Figure 2-2).

Approximately 385 ft of perimeter curbing remained around the Cellular Biology Laboratory (Figure 2-2). In this area, significant efforts were made to prevent damage to existing utilities, asphalt and sidewalk. A backhoe and hand tools were used to excavate the soil on the interior side of the curbing, which was then pulled away from the surrounding structures for removal. After the perimeter curbing was removed and screening samples were collected from the underlying soil, the area was immediately backfilled and compacted to grade with clean soil.

A track-mounted excavator was brought on site with a concrete processing attachment designed to crush and reduce the concrete curbing to rubble. The concrete processing area was prepared by removing the existing pen curbing and installing 20-mil HDPE sheeting beneath steel plates. Eight steel plates were assembled to provide a stable, flat work area and a misting system was set up to control dust generated during operations.

The concrete curbing was crushed and transported to the processed concrete storage cell in the WDPs (Figure 2-2). This process significantly reduced void space during stockpiling and allowed metal such as fence posts to be segregated. The processed concrete was eventually transferred to a permanent material/waste storage cell in the WDPs (Figure 2-4) after backfilling and compaction occurred in this area.

### *2.3.5 Metals*

During the WDP RA, all metal was segregated from other debris and stockpiled separately. Metal removed from the WDPs consisted of steel grates from the pens, fence posts, and abandoned subsurface water and power lines. Due to the porous nature of the deteriorating metal, the material was handled as potential LLW.

## 2.4 Excavation Sampling

Following the removal of material/waste described in this section, soil samples were collected from the WDPs excavation area 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 immediate results. Upon review of the screening sample results, either additional excavation and sampling collection would occur at that location, or the area would be deemed clean and excavation activities would continue elsewhere in the WDPs area.

The excavation screening sample data for the WDPs were presented to the Remedial Project Managers (RPMs) 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 cleanup goals. The excavation confirmation samples were collected prior to the excavation area backfilling activities.

## 2.5 Surveys and Backfilling

Following excavation, processing and sampling activities within the WDPs, a radiological surface scan of the WDPs was conducted between August 21, 2001 and September 17, 2001 by WA and the California Department of Health Services. The objective of the survey was to supplement soil sampling activities by identifying 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.

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

Approximately 1,800 cu yd of soil were acquired for backfilling portions of the WDPs excavation area. 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 EPA methods and laboratory standard operating procedures (WA, 2001f). In addition to the chemical and radiochemical analyses, geotechnical tests were performed on the imported fill, including a hydraulic conductivity (permeability) test using 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 risk-based action standards (RBAS)/residential preliminary remediation goals (PRGs) ($10^{-6}$ risk), and was therefore deemed suitable for use as backfill within the WDPs Area (Appendix B). The material exhibited an average permeability of $2 \times 10^{-6}$ centimeters per second as measured by ASTM Method D-5084, at 85% of optimum compaction.

Each eight-inch lift of loose backfill was compacted using a sheepsfoot roller to the required minimum of 85% compaction in the unpaved areas. Backfill and compaction activities conformed to Specification 02200, Earthwork, of the UC Davis Campus Standards and Design (UC Davis, 1994). A compaction test was conducted with a nuclear density gauge for every 5,000 square ft of compacted soil. The in-place soil density and moisture content was tested using a portable nuclear density/moisture gauge.

## 2.6 Site Restoration

Site restoration included surface grading, implementing site access controls, winterizing and housekeeping. No utility restoration was required after removal activities, however several small sections of asphalt removed from the WDP perimeter will be restored during field activities to be conducted in the summer of 2002.

Due to the limited availability of suitable backfill, approximately half of the WDPs surface area was restored to match original grade and the remaining area was sloped inward to create a slight depression (Figure 2-4). Material/waste storage cells within the backfilled portions of the WDPs are elevated at least four inches above the ground surface to prevent storm water from accumulating in the storage cells. Additional backfilling and grading will be completed in the WDPs area when the storage cells are dismantled and additional backfill material is acquired.

When surface grading and stockpile activity were completed, the temporary fence surrounding the construction area was reduced to enclose only the WDPs material/waste storage cells (Figure 2-4). This area was secured and posted according to the Radiological Protection Plan (RPP) requirements for LLW storage. Metal stakes and orange safety fence were installed to enclose the northern portion of the WDPs perimeter to prevent vehicle and pedestrian access.

Stockpiles and other waste storage areas were winterized to prevent damage or environmental releases that may be caused by high winds or storm water. Concrete, asphalt, soil, metal and wood stockpiles were enclosed in a Hercushield reinforced cover and secured by sandbags, stakes and rope. The SWT area was restored after gravel stockpiles were removed and the original cover was restored.

Tools, equipment and unused material were stored and secured according to LEHR property management practices.

## 2.7 Demobilization

The WDPs RA was conducted in parallel with other site activities. These activities included the shipment of LLW to the Nevada Test Site and the Domestic Septic Systems Investigation and RA. A gradual downsizing of personnel and equipment started on October 1, 2001, and all equipment and personnel were demobilized from the Site on November 21, 2001.

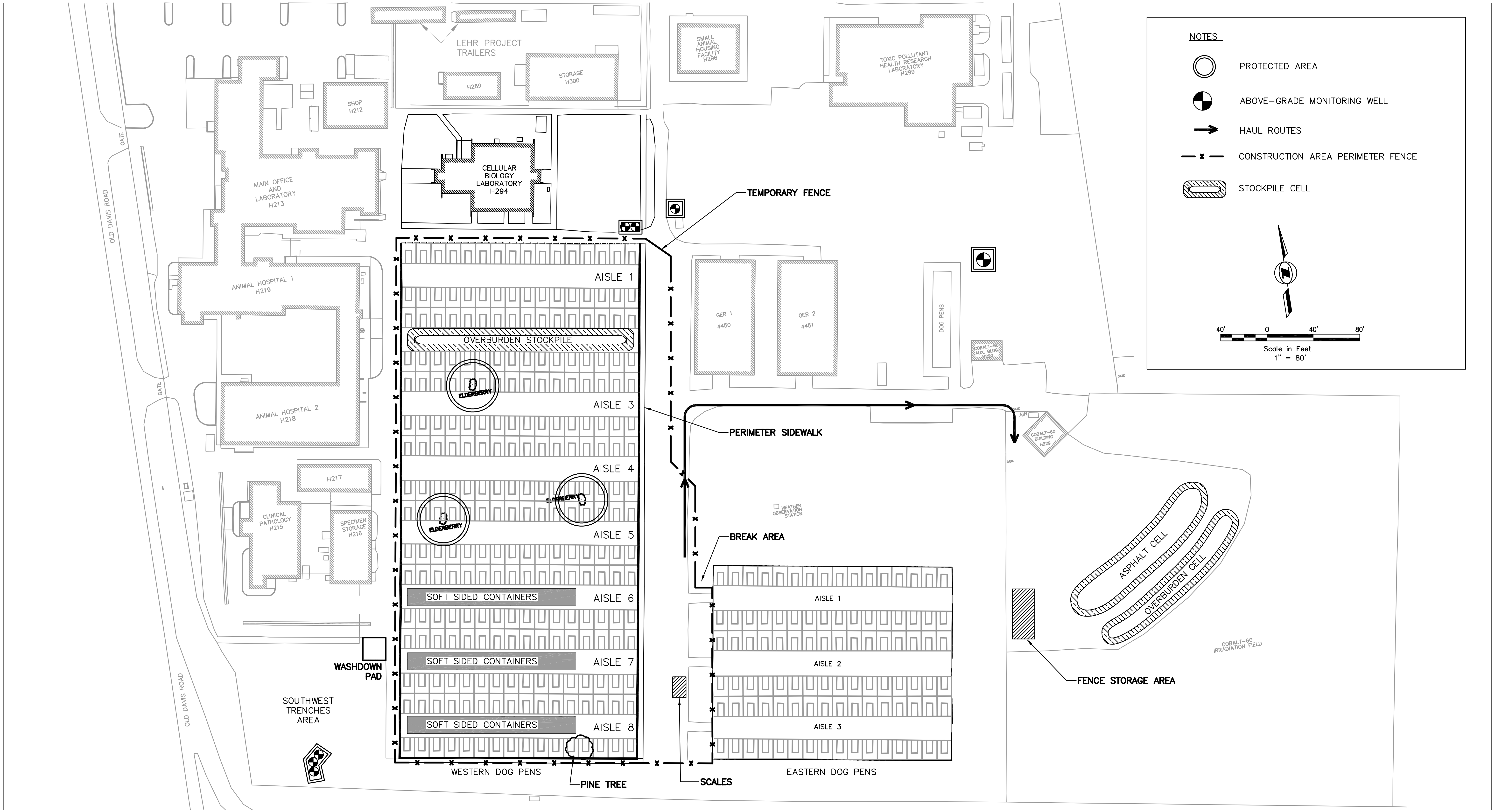


Figure 2-1. Western Dog Pens Site Preparation Activity Locations

WEISS ASSOCIATES

FILE: L:\LEHR\4007\523-RACR\4007-523-06.dwg

DATE: 02/15/05 – 4:03pm

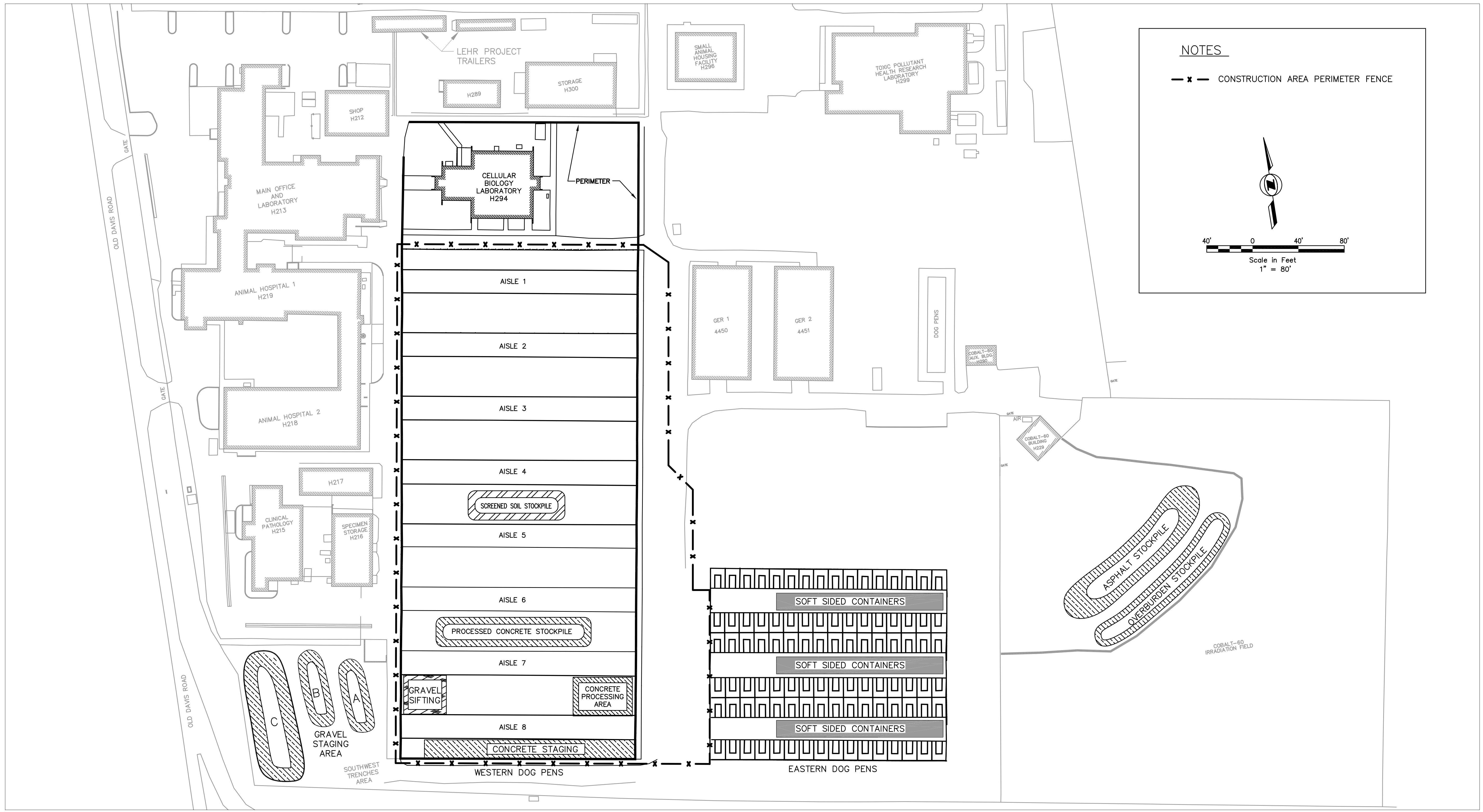


Figure 2-2. Western Dog Pens Removal Action Construction Activity Locations

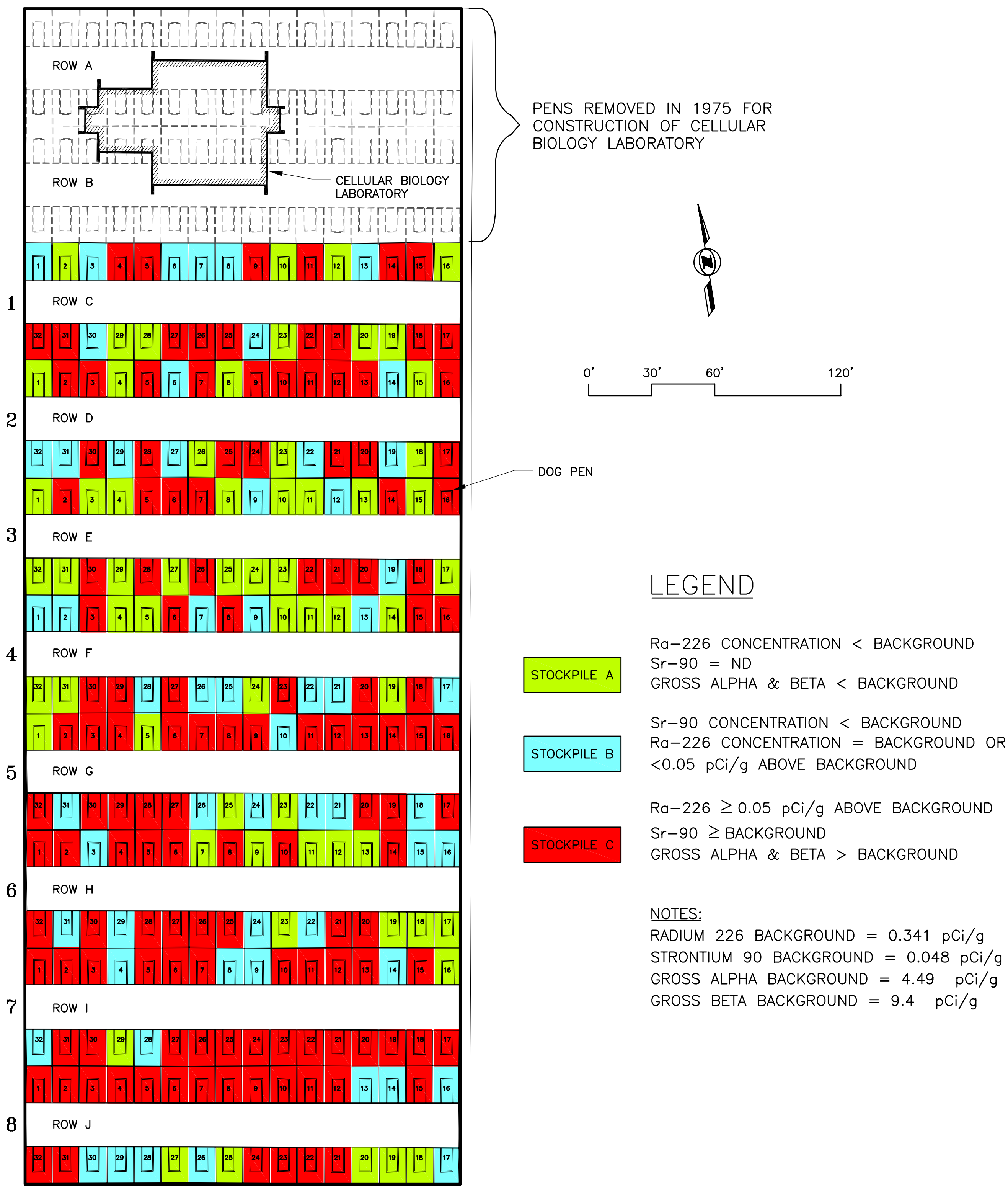


Figure 2-3. Western Dog Pens Gravel Segregation Map

*WEISS ASSOCIATES*

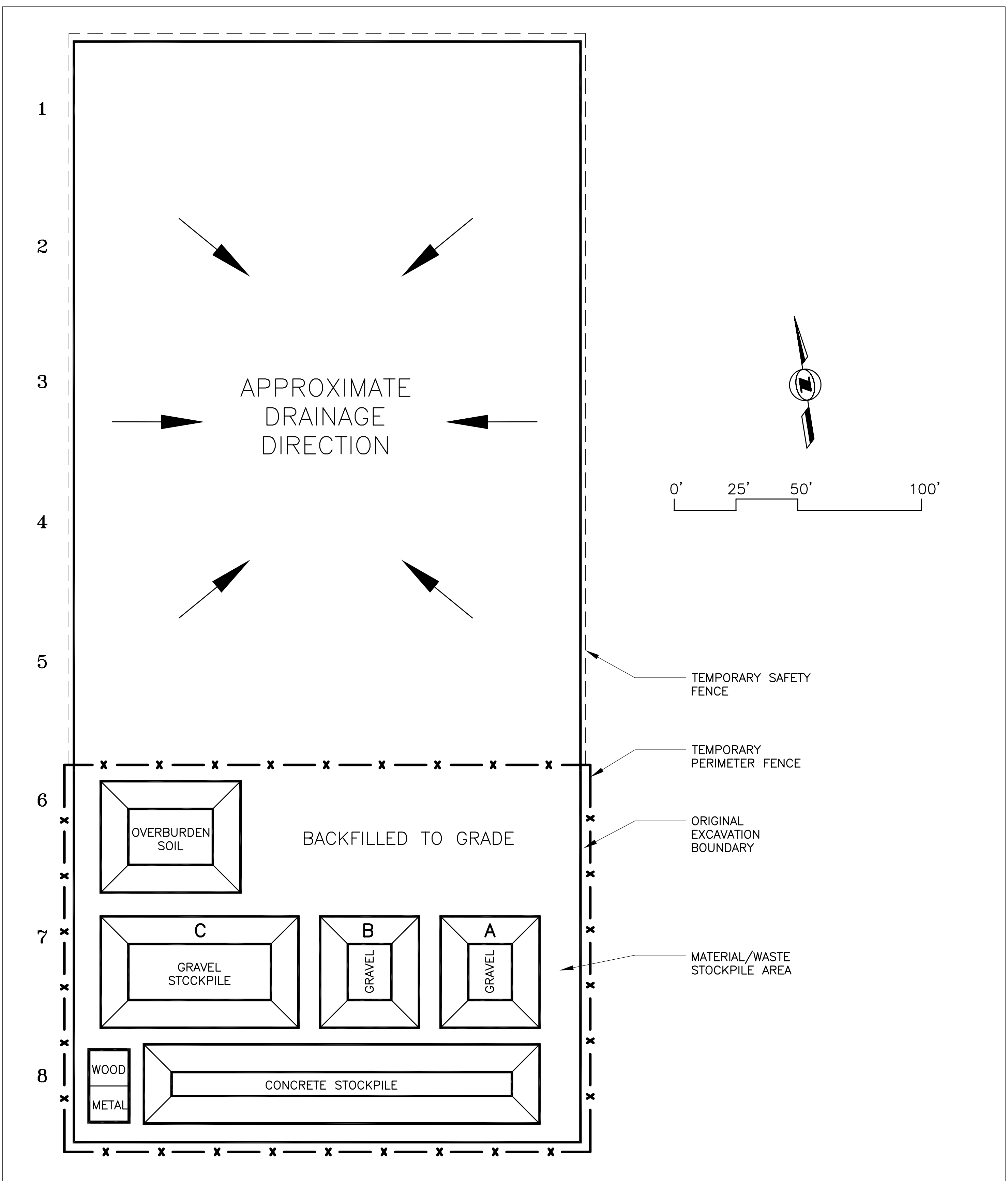


Figure 2-4. Western Dog Pens Stockpile Locations and Surface Grading

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# 3. WASTE MANAGEMENT ACTIVITIES

## 3.1 Western Dog Pens Waste

Material/waste generated during the WDPs removal activities consisted of asphalt, gravel, concrete, metal, wood and soil. Material/waste was segregated during the removal process to facilitate stockpiling of individual waste streams. Each material/waste stockpile volume was calculated and a pre-determined sampling frequency was utilized for characterization. Each of the waste streams is described below.

### *3.1.1 Asphalt*

During the WDPs RA approximately 650 cu yd of asphalt and soil were excavated from Aisles 1, 2, 4, 5, 6, 7, and 8 of the WDPs and transported to a lined stockpile cell in the former Co-60 Field storage area (Figure 3-2 and Table 3-1, Item 21). The asphalt and soil were crushed and homogenized as part of the removal and transportation process. In addition, residual asphalt stored in the former Co-60 Field from previous decontamination and decommissioning (D&D) activities (legacy waste) was crushed and combined with this waste stream.

On-site laboratory analyses indicated that the asphalt and soil do not contain radionuclides at levels above site cleanup goals. Therefore, this material is currently being managed as non-radioactive, pending review of off-site laboratory analytical results. The stockpile was sampled and sealed with an HDPE cover in November 2001.

Crushed asphalt and soil from Aisle 3 of the WDPs were characterized and are known to contain chlordane. This material was sampled, excavated and packaged during the initial stages of the WDPs RA. Package type, identification numbers and associated sample information are shown in Table 3-1, Items 1 to 19. Sampling results indicated that the material was a Characteristic Non-RCRA HW containing low-level radioactivity. The material was shipped to Envirocare of Utah for disposal in December of 2001

### *3.1.2 Gravel*

Prior to commencing WDPs RA activities, a composite gravel sample was collected from each dog pen and analyzed on site for Ra-226 and off site for Sr-90 and gross alpha/beta. The analytical results from this activity guided the removal and segregation of approximately 1,725 cu yd of dog pens gravel into three stockpiles based on radionuclide concentrations (Table 3-1, Items 22 to 24). The three piles were mechanically screened to segregate the 550 cu yd of clean soil that was over-excavated during the gravel removal.

The gravel is currently being managed as radioactive pending review of analytical results. The gravel stockpile was sampled and covered in November 2001.

### *3.1.3 Concrete*

Approximately 635 cu yd of concrete were removed during the WDPs RA. The waste consists of dog pens interior curbing, perimeter curbing, fence post footings and sidewalk slabs. In addition, approximately 115 cu yd of concrete stored in the former Co-60 Field from previous D&D activities were crushed and combined with this waste. Approximately 750 cu yd of concrete were placed into storage in a lined stockpile cell in the WDPs (Table 3-1, Item 20). Screening sample analytical results indicate that the material contains added radioactivity, so the concrete is currently being managed as low-level radioactive waste pending review of analytical results. The concrete stockpile was sampled and covered in November 2001.

### *3.1.4 Other Miscellaneous Material/Waste*

Approximately 40 cu yd of debris consisting of the felled pine tree, metal, personal protective equipment (PPE) and HDPE sheeting were generated during the WDPs RA (Items 25 through 30, Table 3-1). The metal, pine tree, PPE and HDPE are being managed as LLW and are considered LLW by process knowledge. Final disposition options are being evaluated, however this material will not be directly sampled due to the relative low volume and the high cost for characterization. PPE and HDPE generated during RA activities are stored in sealed B-25 Boxes. The metal and wood is being stored in covered stockpiles located in the WDPs

In addition, several hundred feet of chainlink fence and fence posts were directly surveyed by LEHR RCTs and removed from the construction area. This material was placed on pallets and transported to the former Co-60 field for storage and further evaluation. The fence is currently managed as LLW and is controlled under the current DOE moratorium on recycling of metal from a radiological area.

## 3.2 Waste Sampling

### *3.2.1 Strategy*

LEHR staff collected samples from stockpile locations determined by random number generation. Samples were shipped to General Engineering Laboratories (GEL) in Charleston, South

Carolina for analysis. This strategy provided representative samples based on the homogenization of the material/waste and the random sample locations. The stockpiles consisted of material/waste segregated by type (asphalt, gravel and concrete) that were completely mixed during the excavation, crushing, sorting and transfer process. In addition, knowledge of the dog pen operational history indicates that the levels and types of contamination are consistent through the waste or material type.

A two-dimensional grid system was generated and superimposed on each stockpile (Figures 3-1 through 3-5). The stockpiles were divided into sections equal to or less than 200 cu yd. A grid system was established over each of the 200-cu yd sections. Each grid unit was assigned consecutive numbers and a random number generator selected four random grid units for composite sample collection. One four-point composite sample was collected per 200 cu yd of material/waste. A minimum of two samples and a duplicate sample were collected for each stockpile. Specific sample locations, sample frequency, sample volumes and sample suites are shown in Table 3-1. All samples were analyzed for radiological and chemical suites and 10% of the samples were analyzed for the disposal suite shown in Table 3-1. The requested analyses and associated detection limits are shown in Table 3-2.

### *3.2.2 Referenced Procedures and Documents*

Sample collection, handling, packaging, storage and shipping were conducted according to the following documents and LEHR Standard Operating Procedures (SOPs) (WA, 2001i):

- Dog Pens RA WP (WA, 2001e);
- RPP (WA, 1999a);
- QAPP (WA, 2000b);
- 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.

### *3.2.3 Stockpile-Specific Sample Information*

Stockpile-specific sample information is provided in Table 3-1 and Figures 3-1 through 3-5. The information shown in the table and figures include:

- Stockpile numbers;
- Stockpile storage locations;
- Stockpile configurations;
- Stockpile grid systems;

- Sample frequencies;
- Sample locations;
- Duplicate sample locations;
- Sample nomenclature;
- Sample volumes;
- Sample containers; and,
- Requested analysis analyses.

Samples were collected from the specified grid section of the 200-cu yd stockpile segments and were composited in the field in a stainless steel bowl. The composited sample was then labeled and placed into appropriate sample containers. Because some of the material/waste from the specified sample locations were too large to fit into standard sample containers, rock hammers or other suitable hand tools were used to break the waste matrix into appropriately sized pieces. Extra sample volume was returned to the 200-cu yd stockpile section of origin. Sample equipment was decontaminated between 200-cu yd stockpile sections.

Volatile organic compound (VOC) composite samples were collected using separate containers at each of the four composite points. The sample containers were labeled and shipped to the laboratory for analysis. The laboratory composited the samples prior to analyzing them for VOCs according to US EPA Method 8260/5030 (Table 3-2).

### *3.2.4 Quality Assurance/Quality Control Samples*

Duplicate (split) samples were collected at a rate of 10%, with at least one duplicate sample collected per stockpile. Duplicate sample locations are listed in Table 3-1.

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.

One soil quality control (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 Appendix A of the Sampling and Analysis Plan for the WDPs Removal Action Waste and Material (WA, 2001j). The soil QC blank is identified in Table 3-1.

Three trip blanks prepared by GEL were sent with each sample cooler to evaluate whether 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. The trip blanks are identified in Table 3-1.

## 3.3 Other Waste

A small quantity of HDPE and used PPE was generated during concrete stockpile sampling. This waste was bagged and packaged in B-25 boxes. Sample equipment decontamination water was distributed over the stockpile where the samples originated, eliminating the need to dispose the liquid separately. Process knowledge will be used to characterize investigation-derived waste for disposition.

# Table 3-1. Western Dog Pens Removal Action Material/Waste Sampling and Analysis Protocols

| Item | LEHR Package | Package Type | Description | Volume (cu yd) | Storage Location | Sample ID | Sample Location | Sample Strategy | Completed Analysis | Preliminary Designation |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | LEHR1619 | Lift Liner™ | Asphalt/Soil Aisle 3 | 8.5 | N/A | CWWDC001 CWWDC002 | N/A | composite pt. | RS, CS, DS | LLW |
| 2 | LEHR1620 | Lift Liner™ | Asphalt/Soil Aisle 3 | 8.5 | N/A | CWWDC001 CWWDC002 | N/A | composite pt. | RS, CS, DS | LLW |
| 3 | LEHR1621 | Lift Liner™ | Asphalt/Soil Aisle 3 | 8.5 | N/A | CWWDC001 CWWDC002 | N/A | composite pt. | RS, CS, DS | LLW |
| 4 | LEHR1622 | Lift Liner™ | Asphalt/Soil Aisle 3 | 8.5 | N/A | CWWDC001 CWWDC002 | N/A | composite pt. | RS, CS, DS | LLW |
| 5 | LEHR1623 | Lift Liner™ | Asphalt/Soil Aisle 3 | 8.5 | N/A | CWWDC001 CWWDC002 | N/A | composite pt. | RS, CS, DS | LLW |
| 6 | LEHR1624 | Lift Liner™ | Asphalt/Soil Aisle 3 | 8.5 | N/A | CWWDC001 CWWDC002 | N/A | composite pt. | RS, CS, DS | LLW |
| 7 | LEHR1625 | Lift Liner™ | Asphalt/Soil Aisle 3 | 8.5 | N/A | CWWDC001 CWWDC002 | N/A | composite pt. | RS, CS, DS | LLW |
| 8 | LEHR1626 | Lift Liner™ | Asphalt/Soil Aisle 3 | 8.5 | N/A | CWWDC001 CWWDC002 | N/A | composite pt. | RS, CS, DS | LLW |
| 9 | LEHR1627 | Lift Liner™ | Asphalt/Soil Aisle 3 | 8.5 | N/A | CWWDC001 CWWDC002 | N/A | composite pt. | RS, CS, DS | LLW |
| 10 | LEHR1628 | Lift Liner™ | Asphalt/Soil Aisle 3 | 8.5 | N/A | CWWDC001 CWWDC002 | N/A | composite pt. | RS, CS, DS | LLW |
| 11 | LEHR1629 | Lift Liner™ | Asphalt/Soil Aisle 3 | 8.5 | N/A | CWWDC001 CWWDC002 | N/A | composite pt. | RS, CS, DS | LLW |
| 12 | LEHR1630 | Lift Liner™ | Asphalt/Soil Aisle 3 | 8.5 | N/A | CWWDC001 CWWDC002 | N/A | composite pt. | RS, CS, DS | LLW |
| 13 | LEHR1631 | Lift Liner™ | Asphalt/Soil Aisle 3 | 8.5 | N/A | CWWDC001 CWWDC002 | N/A | composite pt. | RS, CS, DS | LLW |
| 14 | LEHR1632 | Lift Liner™ | Asphalt/Soil Aisle 3 | 8.5 | N/A | CWWDC001 CWWDC002 | N/A | composite pt. | RS, CS, DS | LLW |
| 15 | LEHR1633 | Lift Liner™ | Asphalt/Soil Aisle 3 | 8.5 | N/A | CWWDC001 CWWDC002 | N/A | composite pt. | RS, CS, DS | LLW |
| 16 | LEHR1637 | Lift Liner™ | Asphalt/Soil Aisle 3 | 8.5 | N/A | CWWDC001 CWWDC002 | N/A | composite pt. | RS, CS, DS | LLW |

Table 3-1. Western Dog Pens Removal Action Material/Waste Sampling and Analysis Protocols (continued)

| Item | LEHR Package | Package Type | Description | Volume (cu yd) | Storage Location | Sample ID | Sample Location | Sample Strategy | Completed Analysis | Preliminary Designation |
|---|---|---|---|---|---|---|---|---|---|---|
| 17 | LEHR1638 | Lift Liner™ | Asphalt/Soil Aisle 3 | 8.5 | N/A | CWWDC001 CWWDC002 | N/A | composite pt. | RS, CS, DS | LLW |
| 18 | LEHR1639 | Lift Liner™ | Asphalt/Soil Aisle 3 | 8.5 | N/A | CWWDC001 CWWDC002 | N/A | composite pt. | RS, CS, DS | LLW |
| 19 | LEHR1640 | Lift Liner™ | Asphalt/Soil Aisle 3 | 8.5 | N/A | CWWDC001 CWWDC002 | N/A | composite pt. | RS, CS, DS | LLW |
| 20 | LEHR1684 | Stockpile | Concrete | 743 | WDPs Aisle 8 | CWWDP003 | See Figure 3-1 | 4-pt composite | RS, CS | LLW |
| | | | | | | CWWDP004 | See Figure 3-1 | 4-pt composite | RS, CS | |
| | | | | | | CWWDP005 | See Figure 3-1 | 4-pt composite | RS, CS | |
| | | | | | | CWWDP006[a] | See Figure 3-1 | 4-pt composite | RS, CS, DS | |
| | | | | | | CWWDP007[a] | See Figure 3-1 | 4-pt composite | RS, CS, DS | |
| 21 | LEHR1658 | Stockpile | Asphalt/Soil Aisles 1, 2, 4, 5, 6, 7, 8 | 646 | Co-60 Field | CWWDP008 | See Figure 3-2 | 4-pt composite | RS, CS | LLW |
| | | | | | | CWWDP009 | See Figure 3-2 | 4-pt composite | RS, CS | |
| | | | | | | CWWDP010 | See Figure 3-2 | 4-pt composite | RS, CS | |
| | | | | | | CWWDP011[a] | See Figure 3-2 | 4-pt composite | RS, CS, DS | |
| | | | | | | CWWDP012[a] | See Figure 3-2 | 4-pt composite | RS, CS, DS | |
| 22 | LEHR1686 | Stockpile | Gravel | 318 | WDPs, Aisle 7 | CWWDP013 | See Figure 3-3 | 4-pt composite | RS, CS | LLW |
| | | | | | | CWWDP014[a] | See Figure 3-3 | 4-pt composite | RS, CS, DS | |
| | | | | | | CWWDP015[a] | See Figure 3-3 | 4-pt composite | RS, CS, DS | |
| | | | | | | CWWDP016 | See Figure 3-3 | 4-pt composite | RS, CS | |
| 23 | LEHR1687 | Stockpile | Gravel | 300 | WDPs, Aisle 7 | CWWDP017 | See Figure 3-4 | 4-pt composite | RS, CS | LLW |
| | | | | | | CWWDP018[a] | See Figure 3-4 | 4-pt composite | RS, CS, DS | |
| | | | | | | CWWDP019[a] | See Figure 3-4 | 4-pt composite | RS, CS, DS | |
| | | | | | | CWWDP020 | See Figure 3-4 | 4-pt composite | RS, CS | |
| 24 | LEHR1688 | Stockpile | Gravel | 1,104 | WDPs, Aisle 7 | CWWDP021 | See Figure 3-5 | 4-pt composite | RS, CS | LLW |
| | | | | | | CWWDP022 | See Figure 3-5 | 4-pt composite | RS, CS | |
| | | | | | | CWWDP023 | See Figure 3-5 | 4-pt composite | RS, CS | LLW |
| | | | | | | CWWDP024 | See Figure 3-5 | 4-pt composite | RS, CS | |
| | | | | | | CWWDP025 | See Figure 3-5 | 4-pt composite | RS, CS | |
| | | | | | | CWWDP026[a] | See Figure 3-5 | 4-pt composite | RS, CS, DS | |
| | | | | | | CWWDP027[a] | See Figure 3-5 | 4-pt composite | RS, CS, DS | |

Table 3-1. Western Dog Pens Removal Action Material/Waste Sampling and Analysis Protocols (continued)

| Item | LEHR Package | Package Type | Description | Volume (cu yd) | Storage Location | Sample ID | Sample Location | Sample Strategy | Completed Analysis | Preliminary Designation |
|---|---|---|---|---|---|---|---|---|---|---|
| 25 | LEHR1685 | Stockpile | Metal/Wood | 40 | WDPs, Aisle 8 | N/A | N/A | Process knowledge | N/A | LLW |
| 26 | LEHR1656 | B-25 Box | PPE | 3 | Co-60 Field | N/A | N/A | Process knowledge | N/A | LLW |
| 27 | LEHR1657 | B-25 Box | PPE | 3 | Co-60 Field | N/A | N/A | Process knowledge | N/A | LLW |
| 28 | LEHR1681 | B-25 Box | HDPE | 3 | Co-60 Field | N/A | N/A | Process knowledge | N/A | LLW |
| 29 | LEHR1682 | B-25 Box | HDPE | 3 | Co-60 Field | N/A | N/A | Process knowledge | N/A | LLW |
| 30 | LEHR1683 | B-25 Box | HDPE | 3 | Co-60 Field | N/A | N/A | Process knowledge | N/A | LLW |
| 31 | N/A | N/A | Sampling Equipment Rinseate [1] | N/A | N/A | WSWDPC01 | N/A | 1-pt | RS, CS | N/A |
| 32 | N/A | N/A | VOC Trip Blank [2] | N/A | N/A | CWWDP028T | N/A | 1-pt | VOC | N/A |
| 33 | N/A | N/A | VOC Trip Blank [2] | N/A | N/A | CWWDP029T | N/A | 1-pt | VOC | N/A |
| 34 | N/A | N/A | VOC Trip Blank [2] | N/A | N/A | CWWDP030T | N/A | 1-pt | VOC | N/A |
| 35 | N/A | N/A | Soil QC Blank [3] | N/A | N/A | CWWDP031 | N/A | 1-pt | VOC | N/A |

**Note**

[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 evaluate whether 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 Appendix A of the Sampling and Analysis Plan for the WDPs Removal Action Waste and Material.

**Abbreviations**

| | |
|---|---|
| Co-60 | former Cobalt-60 Field |
| CS | chemical disposal suite (see Table 3-2) |
| DS | disposal suite (see Table 3-2) |
| HDPE | high-density polyethylene |
| ID | identification (number) |
| L | liter |
| LLW | Low-Level Waste |
| N/A | not applicable |
| Non Haz | non hazardous waste |
| oz | ounce |
| PPE | personal protective equipment |
| pt | point |
| QC | quality control |
| RS | radiological suite (see Table 3-2) |
| TM | trade mark protected by Transport Plastics, Inc. |
| VOC | volatile organic compound |
| WDPs | Western Dog Pens |

Table 3-2. Analytical Methods and Detection Limits for Western Dog Pens Removal Action 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 Western Dog Pens Removal Action Material/Waste (continued)

| Sample Suite | Analysis | Required Detection Limit (pCi/g for radionuclides, mg/kg for metals/general chemistry, μg/kg for organics) |
|---|---|---|
| Chemicals | Nickel | 1 |
| (continued) | 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 |
| Ed. | Edition |
| EPA | United States Environmental Protection Agency |
| mg/kg | milligrams per kilogram |
| PCBs | polychlorinated biphenyls |
| pCi/g | picoCuries per gram |
| Pest | Pesticides |
| 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 |

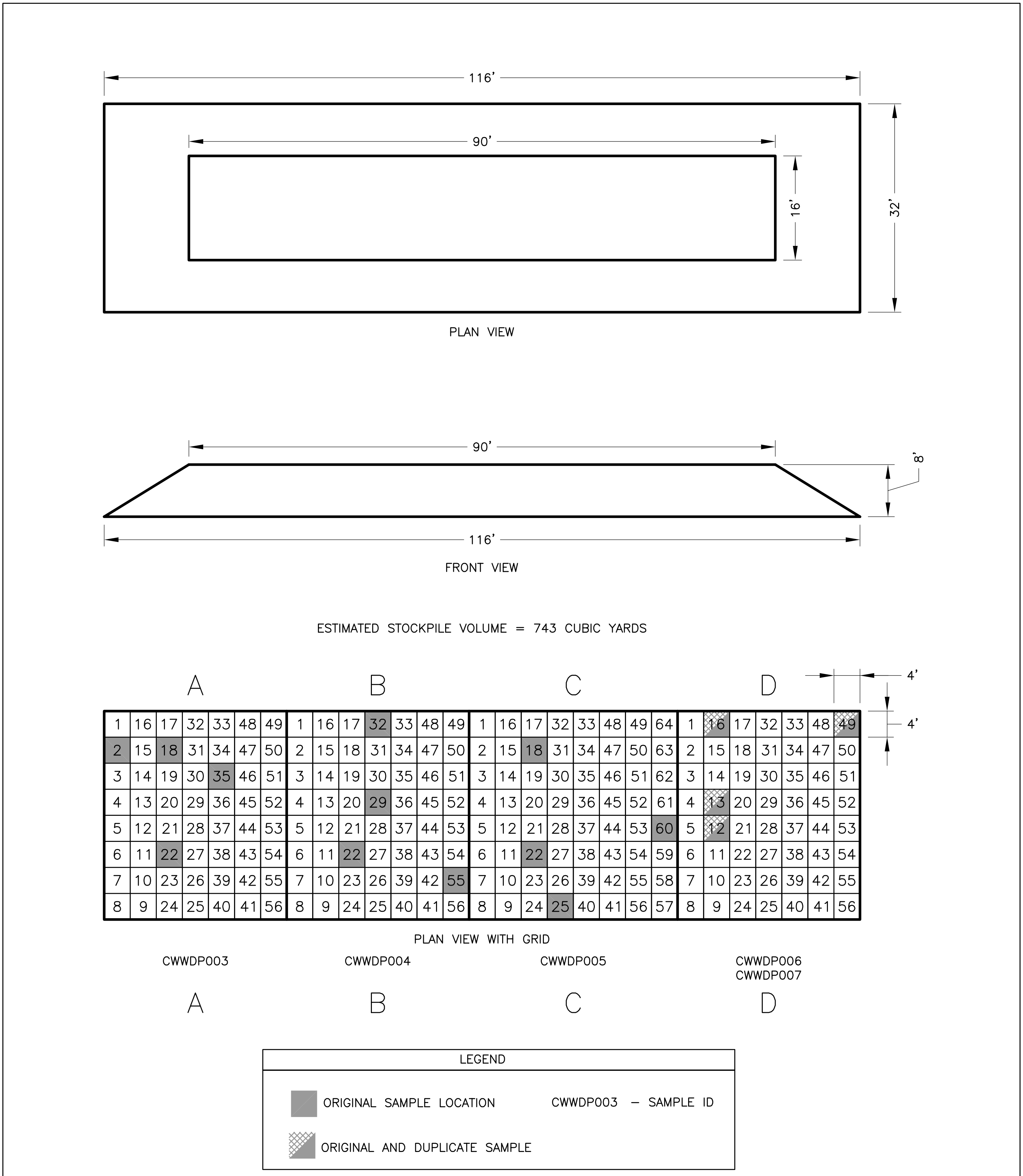


Figure 3–1. Western Dog Pens Removal Action Concrete Stockpile, Dimensions and Sample Locations

WEISS ASSOCIATES

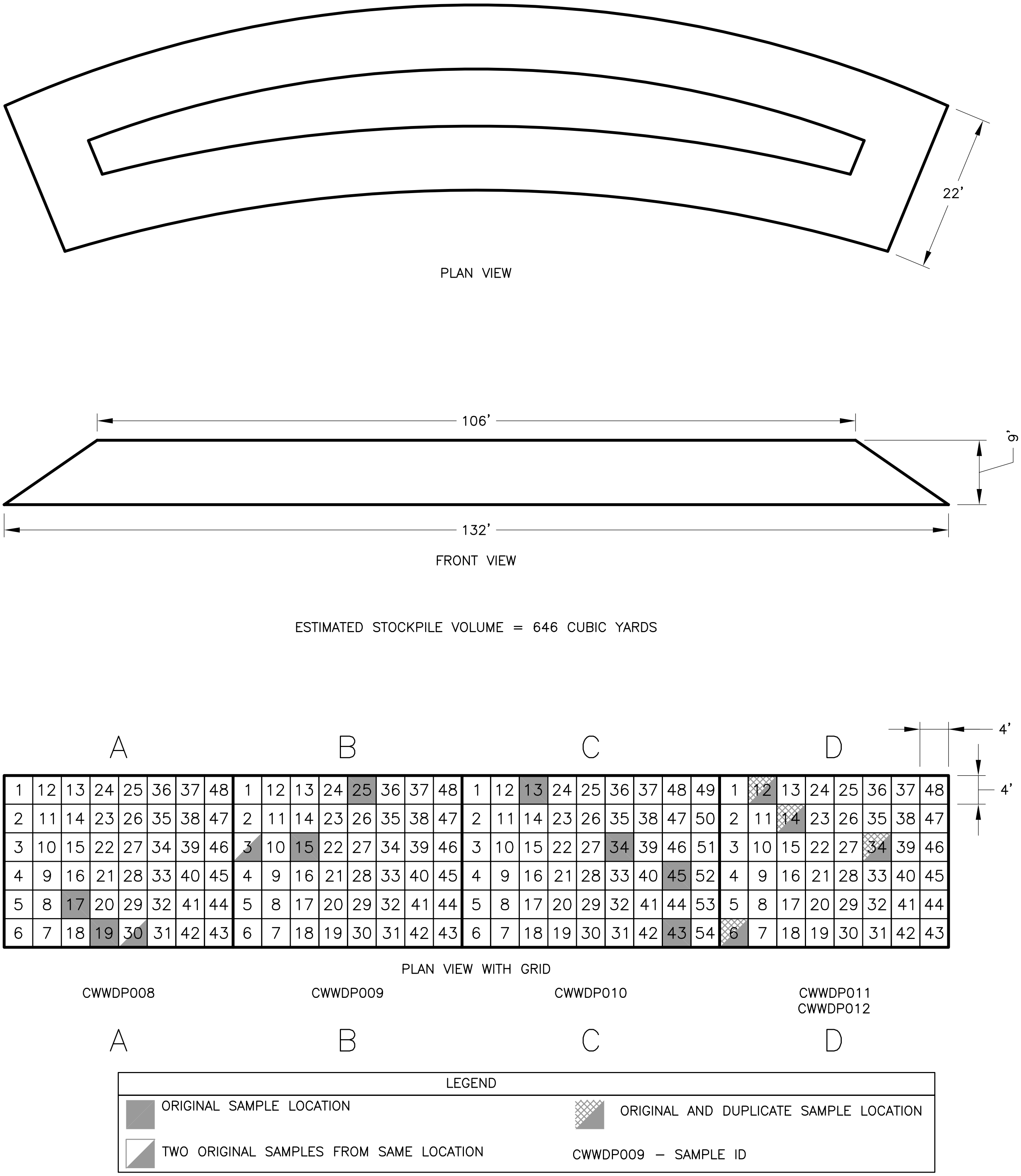


Figure 3–2. Western Dog Pens Removal Action Asphalt Stockpile, Dimensions and Sample Locations

*WEISS ASSOCIATES*

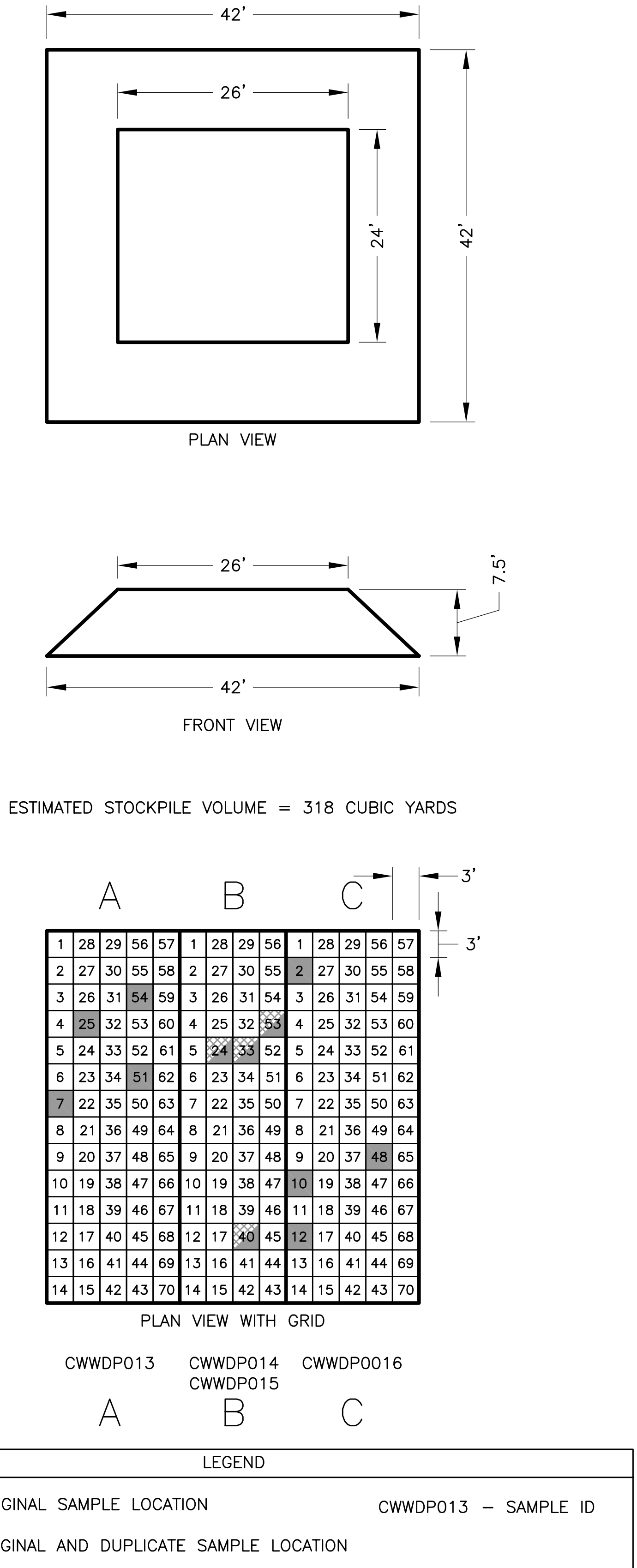


Figure 3–3. Western Dog Pens Removal Action Gravel Stockpile A, Dimensions and Sample Locations

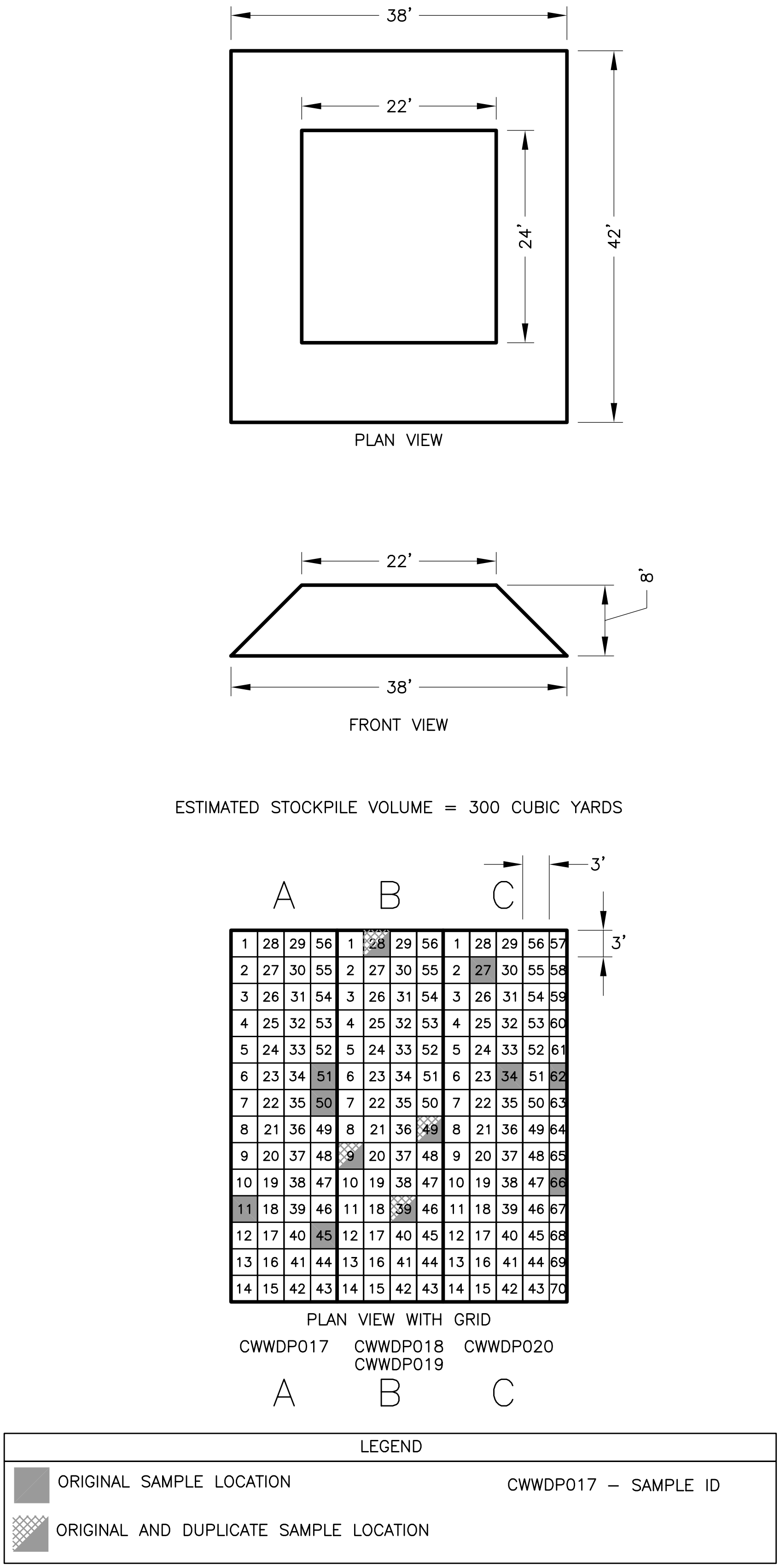


Figure 3–4. Western Dog Pens Removal Action Gravel Stockpile B, Dimensions and Sample Locations

*WEISS ASSOCIATES*

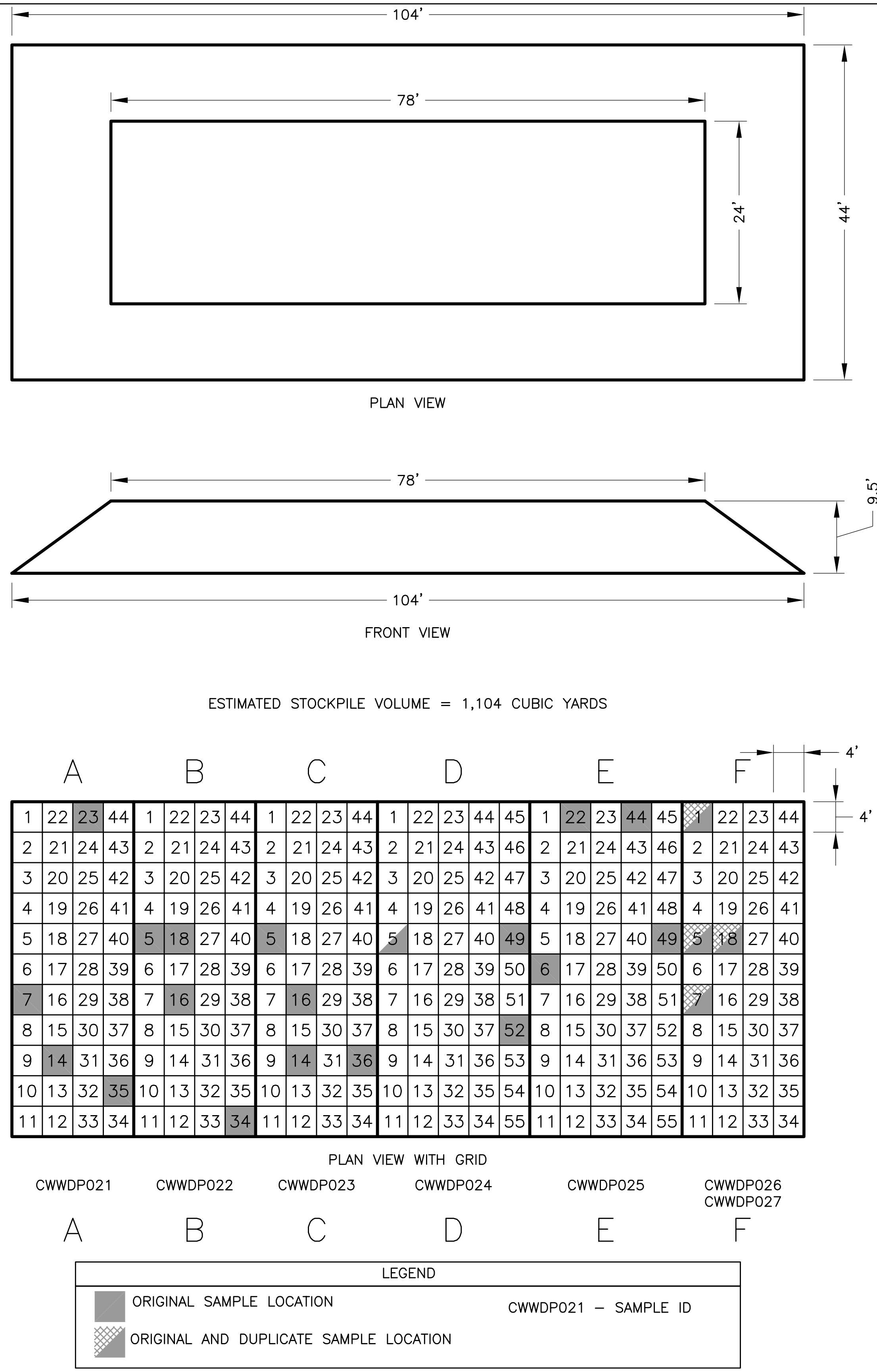


Figure 3–5. Western Dog Pens Removal Action Gravel Stockpile C, Dimensions and Sample Locations

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# 4. HEALTH AND SAFETY ACTIVITIES

H&S activities for the WDPs RA were addressed in the RA WP (WA, 2001e). The RA WP incorporated the following LEHR H&S documents:

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

The H&S program implemented during the WDPs RA 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 was documented for each task in Appendix C2 of the RA WP (WA, 2001e). The tasks analyzed included:

- Transfer to Waste Containers;
- Soil Excavation in Areas with Underground Utilities;
- Equipment Operation under Overhead Electrical Lines;
- Equipment Fueling Operations;
- Heavy Equipment Operation;
- Concrete Demolition of WDPs Curbs;
- Mechanical Sifting;
- Stockpile Management;
- Trips and Falls;

- Material Handling;
- Repetitive Motion Hazards;
- Puncture Hazards; and,
- Biological Hazards.

The controls developed in the WP were followed during the RA activities. Additional AHAs were developed, as required, when planned activities were not addressed by the WDPs WP or referenced documents.

### *4.1.1 Identified Potential Chemical and Particulate Exposure*

The following WDPs activities presented potential for chemical and particulate exposure to workers through contact, ingestion and inhalation:

- Soil, gravel, asphalt and concrete excavation;
- Concrete demolition;
- Soil, gravel and concrete stockpiling;
- Material/waste (i.e., soil, concrete, etc.) sifting and sorting; and,
- Soil, gravel and concrete sampling.

The chlordane in Aisle 3 of the WDPs was the only constituent of potential occupational concern during pre-RA characterization. Respirable dust was identified as potential hazard during all soil handling, concrete demolition, waste removal, stockpiling, sorting, packaging and sampling activities.

### *4.1.2 Identified Potential Radiological Exposure*

The potential for occupational exposure to radionuclides at the WDPs was minimal and primarily limited to “hot spots” in the concrete curbing. The radionuclides of potential occupational concern were Ra-226 and Sr-90. Potential exposure through contact, ingestion and inhalation was associated with removal, stockpiling, sorting, packaging and sampling of contaminated curbing.

## 4.2 Hazard Monitoring

### *4.2.1 Air Monitoring*

Air monitoring was essential to ensure that all field personnel were adequately protected from airborne contaminants. Air monitoring was conducted in accordance with HSP 6.1, Air Monitoring; HSP 14.1, Airborne Radioactivity Monitoring; Section 11 of the PHSP; and the RPP. All equipment was maintained and calibrated according to the manufacturer's recommendations; SOP 25.1, Radiological Surveys and Instrumentation; and HSP 14, Airborne Radioactivity Monitoring.

All personal integrated air monitoring samples and direct instrumentation readings taken for the purpose of determining appropriate H&S precautions were collected/taken in the approximate "breathing zone" of site personnel and integrated over an appropriate time interval.

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 respirable dust exposure was conducted daily until collected data were sufficient to predict exposures to airborne contaminants and when activities were modified. The results never exceeded the action limit which was half of the Occupational Safety and Health Administration (OSHA) permissible exposure limit (PEL).

#### 4.2.1.1 Nuisance Dust

During excavation, stockpiling, sorting and sampling activities, real-time continuous airborne dust monitoring was conducted using a hand-held dust monitoring device (DataRAM). The airborne dust levels remained below the action limits set in Section 6 of the PHSP and never required PPE modifications.

Air samples were also collected using air sampling pumps worn by workers likely to have the highest exposure to nuisance dust. Time-weighted average (TWA) air samples were collected on polyvinyl chloride filters for analysis of dust exposures and sent to a state-certified lab for nuisance respirable dust analysis by National Institute for Occupational Safety and Health Method 0600. The concentrations of respirable dust were far below the prescribed action levels in Section 6 of the PHSP (<0.071 milligrams per cubic meter [$mg/m^3$]), confirming the accuracy of the real-time monitoring instruments and that no additional control measures or PPE modifications were required.

#### 4.2.1.2 Chlordane

TWA monitoring for chlordane was conducted during activities in Aisle 3 to meet the requirements of 29 CFR 1910.120. Samples were collected on OSHA Versatile Sampler-2 Tubes and sent to a state-certified laboratory for analysis by Occupational Safety and Health Administration Method 67. The concentrations reported for chlordane at 0.00043 $mg/m^3$ and 0.00038 $mg/m^3$ were far below the PEL of 0.5 $mg/m^3$.

#### 4.2.1.3 Airborne Radioactivity

Radiological field surveys and area air monitoring were performed during WDPs RA activities to ensure that the assumptions stated in Section 2.1 remain valid and to confirm that occupational exposure monitoring is not required for occupational compliance purposes.

General area radiological air monitoring locations were established in areas having the highest potential for generating airborne radioactive contaminants. This monitoring was conducted daily during activities with potential to generate airborne radioactive contamination.

## 4.3 Radiological Monitoring

General area radiological air monitoring was conducted daily, as required by the RSO in locations near/within the work area having the highest potential for generating airborne radioactive contaminants. General area air samples were compared to airborne radioactive contaminants and their derived air concentrations (DACs) listed in 10 CFR 835, Appendix A. If the general air samples indicated that workers were exposed to airborne radiation contaminants greater than 10% of their respective DAC, then personal air samples (eight-hour TWA) would additionally be used to monitor worker exposure, and the RSO would take steps to reduce exposure through engineering controls. General area air samples indicated workers were not exposed to airborne radioactive contaminants at any time. Therefore, personal air sampling for radionuclides was not conducted during the RA.

Exposure to radionuclides was evaluated and controlled by the 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 (Geiger-Mueller probe, scintillation detector) and utilized as indicators of the presence 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 (WA, 2001b).

### *4.3.1 Physiological Monitoring*

The RA was conducted between May and October 2001 when 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 (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*

Noise surveys were conducted during RA activities using a noise level meter to determine the need for hearing protection. Noise levels above 85 decibels were not encountered during any RA activities, and consequently hearing protection was not required. Nonetheless, hearing protection was available to workers who chose to use it.

### *4.3.3 Light Monitoring*

Some RA activities were conducted through November 2000. In the early morning hours between 5 A.M. and 6 A.M., light measurements were made to ensure that sufficient lighting was available for work activities, as defined in Section 5.4.2.10 of the PHSP. If lighting was insufficient to allow for outdoor work, alternative activities were undertaken until proper lighting conditions were present.

## 4.4 Hazard Controls

The following control measures were implemented during the WDPs RA, as discussed in the RA WP (WA, 2001e):

- 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 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.

### *4.4.2 Personal Protective Equipment*

During the RA, contact with chemicals and radioactive contamination was controlled by the proper use of PPE. Modified level D PPE (Tyvek coveralls, gloves, booties, safety glasses and hard hats) was used during concrete demolition due to the potential presence of radiological contamination. Chemical-resistant PPE was required for work on the ground in Aisle 3 where chlordane may have been present. Ingestion of chemicals was minimized by the use of proper personal hygiene (e.g., washing hands and face).

### *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 monitoring conducted during the RA, no action levels were exceeded that would have required PPE modifications and no additional engineering controls were implemented other than for dust suppression. Workers were not exposed to any form of contamination. By extrapolation, other on-site personnel, off-site neighbors, and off-site receptors were not exposed to any contaminants during the WDPs RA.

# 5. SAMPLING ACTIVITIES AND ANALYTICAL RESULTS

This section describes sampling activities and presents the analytical results associated with the WPD. WDPs sampling activities commenced on June 5, 2001 and were completed in November 2001. Sampling was conducted in accordance with the RA WP and applicable project documents. Deviations from or modifications to the WP that resulted from field conditions are discussed with the sampling activities and analytical results.

A 25-ft by 25-ft grid coordinate system was established throughout the RA area as the horizontal coordinate reference system for marking and locating samples in the field (Figure 5-1). The origin of the grid system was located at the northwest corner of the WDP Area. The north-south gridlines were labeled with an “S” or “N” and numerically increased from “0” to “18” and “0” to “4”, respectively. Similarly, the east-west gridlines were labeled with an “E” and increased from “0” to “8” from west to east. For example, E7S8 meant a location within the RA area that was 175 ft east and 200 ft south of the origin.

## 5.1 Excavation Screening Sampling

Following the waste removal described in Sections 2 and 3, soil samples were collected from the WDPs excavation area and analyzed for driver COCs to confirm that RA activities did not impact the underlying soil. Ra-226 and Sr-90 analyses were conducted using the on-site laboratory.

The screening analytical results were compared to the SC defined in the RA WP (WA, 2001e):

- Ra-226 = 0.8 picoCuries per gram (pCi/g); and,
- Sr-90 = 10 pCi/g.

### *5.1.1 Sampling*

The screening samples were collected at approximately 25-ft intervals across the WDPs. The soil beneath the cobble trenches located between the first three aisles of the existing WDPs was also sampled. At three random locations in each trench, soil samples were collected at the soil/cobble interface for on-site analysis. Screening samples were also collected beneath the curbing that was removed from the area surrounding the Cellular Biology Laboratory. Figure 5-1 shows the WDPs excavation area and screening sample locations.

### *5.1.2 Analytical Results*

A total of 199 screening samples (not including field duplicates) were collected and analyzed for Ra-226 and Sr-90. A total of 183 samples were collected from the WDPs, including 12 samples beneath the cobble trenches. Sixteen screening samples were collected beneath the curbing surrounding the Cellular Biology Building. A total of 21 field duplicates were collected. The screening sample results are shown in Table 5-1. Of the 199 samples analyzed, none were above the SC for Ra-226 (0.8 pCi/g) and Sr-90 (10 pCi/g).

## 5.2 Excavation Confirmation Sampling

The excavation screening sample data for the WDPs were presented to the RPMs on August 2, 2001 as part of the Phase I Data Evaluation. Based on the screening sample data, the RPMs approved collection of the recommended confirmation samples. Both random-based and discretionary hot-spot confirmation samples were collected to ensure attainment of cleanup 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, 1994a).

### *5.2.1 Sampling*

The WDPs confirmation samples were collected between August 8 and August 10, 2001. A total of 33 confirmation samples and 5 field duplicates were collected between 0.5 and 3 ft below ground surface (bgs). The confirmation sampling included 24 soil samples (including 3 field duplicates) that were collected at grid locations determined by the Noether Calculation (a random-start grid sampling approach). One soil and one cobble sample were collected at random locations from each of the four cobble trenches in the WDPs as part of confirmation sampling. Five cobble samples (including one field duplicate) were collected from these trenches. Four soil samples were also collected at the soil/cobble interface.

The random grid did not identify any confirmation sample locations in Aisle 3, where stockpiles containing chlordane-impacted soil from the SWT were stored. Therefore, discretionary samples were collected from Aisle 3 to verify that no residual chlordane remained after the asphalt removal. Five surface soil samples (including one field duplicate) were collected from four random locations within Aisle 3 and shipped off site for chlordane analyses only.

All of the confirmation samples were placed directly into pre-sterilized glass jars, packaged and shipped to the off-site laboratory. With the exception of the Aisle 3 samples, all of the confirmation samples were analyzed for Ra-226, Sr-90, hexavalent chromium, total mercury and chlordane. The WDPs confirmation sample locations are shown on Figure 5-2.

### *5.2.2 Analytical Results*

Table 5-2 summarizes the WDPs confirmation sampling analytical results. The maximum reported Sr-90 concentration, 0.491 pCi/g, was detected in soil sample SSWDC019. This sample was collected at a depth of 1.5 ft bgs from Pen I-28 (Figure 5-2). The maximum reported mercury concentration, 5.1 milligrams per kilogram (mg/kg), was detected in soil sample SSWDC020. Sample SSWDC020 was collected 1.5 ft bgs in Pen I-22. There was no mercury concentration distribution trend observed in the confirmation data (Figure 5-3).

The locations of cobble samples SSWDC021, SSWDC022, SSWDC025, SSWDC027 and SSWDC028 are shown on Figure 5-2. The maximum reported concentration of Ra-226, 0.664 pCi/g, was detected in cobble sample SSWDC022 and collected two feet bgs beneath Pen D-21. The three maximum reported hexavalent chromium concentration, 0.5 mg/kg, 0.465 mg/kg and 0.357 mg/kg, were detected in soil samples SSWDC028, SSWDC021 and SSWDC023. The three discretionary samples were collected from the cobble trenches located within the first three rows on the WDPs.

Sample SSWDC033 had the maximum reported alpha plus gamma chlordane (873 micrograms per kilogram [µg/kg]) and total chlordane concentrations (2,120 µg/kg). Sample SSWDC033 was collected from the eastern side of Aisle 3 (Figure 5-4). Samples SSWDC023 and SSWDC029 had the second and third highest alpha plus gamma chlordane concentrations, 333 µg/kg and 244 µg/kg, respectively. Samples SSWDC023 and SSWDC029 were both collected beneath the cobble trenches.

At the request of the RPMs, sample locations SSWDC033, SSWDC023 and SSWDC029 were re-sampled for chlordane on December 13 and 18, 2001 to confirm the reported elevated concentrations. Additional samples were also collected around each sample location to determine the vertical and lateral extents of contamination. A sample was collected one foot below each of the original locations. Samples were also collected five lateral feet from sample SSWDC033 in all four compass directions, and five feet east and west from the locations of samples SSWDC023 and SSWDC029 (Figure 5-5).

Sample SSWDC050 was collected from sample location SSWDC033, which had the maximum alpha plus gamma chlordane concentration of 873 µg/kg. Alpha plus gamma chlordane was not detected above the detection limit of 1.9 µg/kg in sample SSWDC050. However, sample SSWDC051, collected five feet north of sample SSWDC033 and SSWDC050, had an alpha plus gamma chlordane concentration of 1,529 µg/kg. All of the other samples collected around sample location SSWDC033 were well below the action levels (Figure 5-5 and Table 5-3).

Sample SSWDC040 was collected from sample location SSWDC029. The alpha plus gamma chlordane concentration for sample SSWDC040 at 214 µg/kg was slightly lower than the SSWDC029 concentration of 244 µg/kg. The samples collected to the east and west of sample location SSWDC029/040 had similar alpha plus gamma chlordane concentrations (Figure 5-5). All of the samples collected at or in the vicinity of sample location SSWDC023 had alpha plus gamma chlordane concentrations that were significantly lower than the original concentration (Figure 5-5).

All of the samples collected beneath the original sample locations showed that chlordane concentrations attenuated with depth. The reasonable maximum exposures (RME) for alpha-chlordane (82.45 µg/kg) and gamma-chlordane (102.1 µg/kg) were well below the RBASs of 800 µg/kg and 810 µg/kg, respectively. Furthermore, the maximum detected alpha and gamma chlordane concentrations were well below their respective allowable soil concentrations of 59,000 µg/kg and 1.32E+7 µg/kg, as determined by Non-isothermal, Unsaturated Flow and Transport (NUFT) vadose zone modeling.

## 5.3 Sifted Soil Sampling

As discussed in Section 2.3.2, the soil removed during the gravel removal phase of the WDP RA was segregated from the gravel using a mechanical sifter. Approximately 550 cu yd of sifted soil were segregated from the WDPs gravel. This soil was temporarily placed in 10 cu yd stockpiles on site prior to sampling.

### *5.3.1 Sampling*

Four-point composite soil samples were collected at an approximate frequency of one per 10 cu yd of loose material. A total of 55 sifted soil samples were analyzed on site for Ra-226 and Sr-90.

### *5.3.2 Analytical Results*

The analytical results from the sifted soil samples are presented in Table 5-4. All of the results were below the SC for Ra-226 (0.8 pCi/g) and Sr-90 (10 pCi/g). Following evaluation of these results, the sifted soil was consolidated for reuse on site as backfill in the WDPs.

## 5.4 Air Sampling

Air samples were collected during the RA from three stations around the perimeter of the Site and one distant 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 5-6.

- AM-2 is located at the upper northeast corner of the Toxic Pollutant Health Research Laboratory;
- AM-7, a mobile monitoring station, was placed near the northeast corner of the WDPs;

- AM-3, the current background station, is located east of the LEHR site; and,
- AM-5 is situated near the southwest corner of the WDPs.

### *5.4.1 Sampling Schedule*

Air sampling was conducted to monitor for potential releases of Ra-226, Sr-90, chlordane, and particulate matter less than 10 microns in aerodynamic diameter ($PM_{10}$) into ambient air that may have been associated with the RA. Pre-, post- and bi-monthly WDPs RA air samples were collected and analyzed for $PM_{10}$, Ra-226, Sr-90, and chlordane. All LEHR air samples were analyzed by either California State-certified or Contract Laboratory Program laboratories.

### *5.4.2 Analytical Results*

Air monitoring was conducted in the WDPs area before, during and after the RA. Statistical tests were conducted on these air monitoring data to determine if the concentrations of COCs in air exceeded regulatory limits. Detailed descriptions of the sampling and analysis, statistical test methods and results are presented in Appendix C of this report. Statistical analysis of on-site air monitoring data collected during the WDP RA indicated that ambient air concentrations did not exceed applicable regulatory limits.

Table 5-1. Western Dog Pens Excavation Screening Sampling Analytical Results

| Sample ID | Grid Location | Radium-226 Concentration (pCi/g)[1] | Strontium-90 Concentration (pCi/g)[2] |
|---|---|---|---|
| SSWDF001 | 13S 1E | 0.48 | 0.59 |
| SSWDF002 | 14S 1E | 0.29 | 0.21 |
| SSWDF003 | 13S 2E | 0.29 | 0.22 |
| SSWDF004 | 14S 2E | 0.26 | -0.02 |
| SSWDF005 | 13S 3E | 0.34 | 0.09 |
| SSWDF006 | 14S 3E | 0.39 | -0.09 |
| SSWDF007 | 13S 4E | 0.37 | -0.48 |
| SSWDF008 | 14S 4E | 0.38 | 0.27 |
| SSWDF009 | 14S 5E | 0.36 | -0.17 |
| SSWDF010 [3] | 14S 5E | 0.37 | -0.22 |
| SSWDF011 | 13S 5E | 0.36 | 0.44 |
| SSWDF012 [3] | 13S 5E | 0.37 | 0.51 |
| SSWDF013 | 14S 6E | 0.42 | 0.22 |
| SSWDF014 [3] | 14S 6E | 0.42 | 0.35 |
| SSWDF015 | 13S 6E | 0.36 | 0.63 |
| SSWDF016 [3] | 13S 6E | 0.32 | 0.38 |
| SSWDF017 | 13S 7E | 0.39 | 0.35 |
| SSWDF018 | 14S 7E | 0.41 | -0.22 |
| SSWDF019 | 14S 0E | 0.35 | 0.15 |
| SSWDF020 | 13S 0E | 0.33 | -0.20 |
| SSWDF021 | 11S 0E | 0.36 | 0.38 |
| SSWDF022 | 12S 0E | 0.32 | 0.06 |
| SSWDF023 | 11S 1E | 0.40 | 0.24 |
| SSWDF024 | 12S 1E | 0.38 | 0.48 |
| SSWDF025 [3] | 12S 1E | 0.41 | 0.51 |
| SSWDF026 | 11S 2E | 0.33 | 0.39 |
| SSWDF027 | 12S 2E | 0.37 | 0.03 |
| SSWDF028 [3] | 12S 2E | 0.36 | 0.35 |
| SSWDF029 | 11S 3E | 0.33 | 0.37 |

Table 5-1. Western Dog Pens Excavation Screening Sampling Analytical Results (continued)

| Sample ID | Grid Location | Radium-226 Concentration (pCi/g)[1] | Strontium-90 Concentration (pCi/g)[2] |
|---|---|---|---|
| SSWDF030 | 12S 3E | 0.36 | 0.33 |
| SSWDF031 | 11S 4E | 0.34 | 0.24 |
| SSWDF032 | 12S 4E | 0.28 | 0.30 |
| SSWDF033 | 11S 5E | 0.55 | 0.35 |
| SSWDF034 | 12S 5E | 0.54 | 0.33 |
| SSWDF035 | 11S 6E | 0.41 | 0.44 |
| SSWDF036 | 12S 6E | 0.16 | 0.37 |
| SSWDF037 | 11S 7E | 0.55 | 0.38 |
| SSWDF038 | 12S 7E | 0.35 | 0.36 |
| SSWDF049 | 10S 0E | 0.29 | -0.33 |
| SSWDF050 | 10S 1E | 0.28 | -0.14 |
| SSWDF051 | 10S 2E | 0.25 | -0.65 |
| SSWDF052 | 10S 3E | 0.28 | -0.38 |
| SSWDF053 | 10S 4E | 0.20 | -0.75 |
| SSWDF054 | 10S 5E | 0.28 | -0.80 |
| SSWDF055 | 10S 6E | 0.23 | -0.79 |
| SSWDF056 | 10S 7E | 0.26 | -0.47 |
| SSWDF057 | 9S 0E | 0.39 | -0.02 |
| SSWDF058 | 9S 1E | 0.37 | 0.11 |
| SSWDF059 | 9S 2E | 0.32 | 0.56 |
| SSWDF060 | 9S 3E | 0.34 | 0.45 |
| SSWDF061 | 9S 4E | 0.39 | 0.53 |
| SSWDF062 | 9S 5E | 0.38 | 0.08 |
| SSWDF063 [3] | 9S 5E | 0.39 | 0.23 |
| SSWDF064 | 9S 6E | 0.35 | 0.03 |
| SSWDF065 | 9S 7E | 0.37 | 0.91 |
| SSWDF066 | 8S 0E | 0.35 | -0.15 |
| SSWDF067 | 8S 1E | 0.31 | -0.16 |
| SSWDF068 | 8S 2E | 0.29 | -0.04 |

Table 5-1. Western Dog Pens Excavation Screening Sampling Analytical Results (continued)

| Sample ID | Grid Location | Radium-226 Concentration (pCi/g)[1] | Strontium-90 Concentration (pCi/g)[2] |
|---|---|---|---|
| SSWDF069 | 8S 3E | 0.27 | 0.02 |
| SSWDF070 | 8S 4E | 0.31 | -0.11 |
| SSWDF071 | 8S 5E | 0.29 | 0.03 |
| SSWDF072 | 8S 6E | 0.33 | -0.23 |
| SSWDF073 | 7S 0E | 0.38 | 0.41 |
| SSWDF074 | 7S 1E | 0.40 | 0.53 |
| SSWDF075 | 7S 2E | 0.38 | 0.56 |
| SSWDF076 | 7S 3E | 0.36 | 0.95 |
| SSWDF077 | 7S 4E | 0.34 | 0.50 |
| SSWDF078 | 7S 5E | 0.36 | 0.21 |
| SSWDF079 | 7S 6E | 0.35 | 0.25 |
| SSWDF080 | 7S 7E | 0.36 | 0.26 |
| SSWDF081 | 6S 0E | 0.38 | -0.08 |
| SSWDF082 | 6S 1E | 0.42 | 0.34 |
| SSWDF083 | 6S 2E | 0.39 | -0.25 |
| SSWDF084 | 6S 3E | 0.40 | -0.17 |
| SSWDF085 [3] | 6S 3E | 0.37 | 0.27 |
| SSWDF086 | 6S 4E | 0.36 | -0.17 |
| SSWDF087 | 6S 5E | 0.34 | -0.19 |
| SSWDF088 | 6S 6E | 0.34 | 0.11 |
| SSWDF089 | 6S 7E | 0.37 | 0.24 |
| SSWDF090 [3] | 6S 7E | 0.38 | 0.47 |
| SSWDF091 | 5S 0E | 0.39 | 0.32 |
| SSWDF092 | 5S 1E | 0.36 | 0.41 |
| SSWDF093 | 5S 2E | 0.38 | 0.28 |
| SSWDF094 [3] | 5S 2E | 0.33 | -0.06 |
| SSWDF095 | 5S 3E | 0.35 | 0.60 |
| SSWDF096 | 5S 4E | 0.35 | -0.10 |
| SSWDF097 | 5S 5E | 0.34 | 0.23 |

Table 5-1. Western Dog Pens Excavation Screening Sampling Analytical Results (continued)

| Sample ID | Grid Location | Radium-226 Concentration (pCi/g)[1] | Strontium-90 Concentration (pCi/g)[2] |
|---|---|---|---|
| SSWDF098 | 5S 6E | 0.30 | -0.07 |
| SSWDF099 | 5S 6E | 0.31 | -0.25 |
| SSWDF100 | 5S 7E | 0.36 | -0.20 |
| SSWDF101 | 4S 0E | 0.38 | 0.05 |
| SSWDF102 | 4S 1E | 0.33 | -0.19 |
| SSWDF103 | 4S 2E | 0.32 | 0.15 |
| SSWDF104 | 4S 3E | 0.37 | 0.29 |
| SSWDF105 | 4S 4E | 0.35 | 0.35 |
| SSWDF106 | 4S 5E | 0.37 | 0.58 |
| SSWDF107 | 4S 6E | 0.32 | 0.28 |
| SSWDF108 | 4S 7E | 0.32 | 0.00 |
| SSWDF109 [4] | 4.3N 1E | 0.37 | 0.40 |
| SSWDF110 | 3S 0E | 0.37 | 0.57 |
| SSWDF111 [3] | 3S 0E | 0.38 | -0.03 |
| SSWDF112 | 3S 1E | 0.36 | 0.50 |
| SSWDF113 | 3S 2E | 0.38 | 0.26 |
| SSWDF114 | 3S 3E | 0.42 | 0.33 |
| SSWDF115 | 3S 4E | 0.38 | 0.41 |
| SSWDF116 | 3S 5E | 0.37 | 0.02 |
| SSWDF117 [3] | 3S 5E | 0.34 | 0.42 |
| SSWDF118 | 3S 6E | 0.28 | -0.04 |
| SSWDF119 | 3S 7E | 0.31 | -0.10 |
| SSWDF120 [4] | 2N 8E | 0.38 | 0.00 |
| SSWDF121 [4] | 3N 8E | 0.41 | -0.12 |
| SSWDF122 [3, 4] | 3N 8E | 0.37 | 0.33 |
| SSWDF123 [4] | 4N 8E | 0.41 | 0.24 |
| SSWDF124 [4] | 2N 0E | 0.39 | 0.09 |
| SSWDF125 [4] | 3N 0E | 0.38 | 0.08 |
| SSWDF126 [4] | 4.3N 8E | 0.41 | 0.23 |

Table 5-1. Western Dog Pens Excavation Screening Sampling Analytical Results (continued)

| Sample ID | Grid Location | Radium-226 Concentration (pCi/g)[1] | Strontium-90 Concentration (pCi/g)[2] |
|---|---|---|---|
| SSWDF127 [4] | 4.3N 7E | 0.45 | 0.14 |
| SSWDF128 [4] | 1N 0E | 0.38 | 0.57 |
| SSWDF129 [4] | 1N 8E | 0.38 | 0.71 |
| SSWDF130 | 0S 0E | 0.39 | 0.36 |
| SSWDF131 | 1S 0E | 0.33 | -0.26 |
| SSWDF132 | 2S 0E | 0.33 | 0.40 |
| SSWDF133 | 0S 1E | 0.38 | 0.55 |
| SSWDF134 | 1S 1E | 0.29 | 0.45 |
| SSWDF135 | 2S 1E | 0.31 | 0.34 |
| SSWDF136 | 1S 2E | 0.38 | 0.61 |
| SSWDF137 | 2S 2E | 0.36 | 0.60 |
| SSWDF138 [3] | 2S 2E | 0.37 | 0.07 |
| SSWDF139 [4] | 4.3N 6E | 0.36 | 0.20 |
| SSWDF140 | 0S 2E | 0.41 | 0.67 |
| SSWDF141 | 0S 3E | 0.36 | 0.10 |
| SSWDF142 | 1S 3E | 0.27 | -0.61 |
| SSWDF143 | 2S 3E | 0.40 | 0.22 |
| SSWDF144 | 0S 4E | 0.42 | 0.41 |
| SSWDF145 [3] | 0S 4E | 0.36 | 0.44 |
| SSWDF146 | 1S 4E | 0.29 | 0.10 |
| SSWDF147 | 2S 4E | 0.33 | 0.38 |
| SSWDF148 | 0S 5E | 0.32 | 0.36 |
| SSWDF149 | 1S 5E | 0.31 | -0.63 |
| SSWDF150 | 2S 5E | 0.40 | 0.08 |
| SSWDF151 | 0S 6E | 0.39 | 0.27 |
| SSWDF152 | 1S 6E | 0.30 | -0.23 |
| SSWDF153 | 2S 6E | 0.32 | 0.26 |
| SSWDF154 | 0S 7E | 0.39 | 0.30 |
| SSWDF155 | 1S 7E | 0.28 | -0.51 |

Table 5-1. Western Dog Pens Excavation Screening Sampling Analytical Results (continued)

| Sample ID | Grid Location | Radium-226 Concentration (pCi/g)[1] | Strontium-90 Concentration (pCi/g)[2] |
|---|---|---|---|
| SSWDF156 | 2S 7E | 0.36 | 0.39 |
| SSWDF157 | 0S 8E | 0.39 | 0.26 |
| SSWDF158 | 1S 8E | 0.34 | -0.34 |
| SSWDF159 | 2S 8E | 0.33 | 0.54 |
| SSWDF160 [3] | 2S 8E | 0.36 | 0.17 |
| SSWDF161 [4] | 4.3N 2E | 0.41 | -0.32 |
| SSWDF162 [4] | 4.3N 3E | 0.37 | 0.24 |
| SSWDF163 [4] | 4.3N 4E | 0.37 | -0.19 |
| SSWDF164 [4] | 4.3N 5E | 0.37 | 0.11 |
| SSWDF165 | 3S 8E | 0.35 | -0.29 |
| SSWDF166 | 4S 8E | 0.39 | -0.32 |
| SSWDF167 | 5S 8E | 0.36 | -0.03 |
| SSWDF168 | 6S 8E | 0.33 | -0.15 |
| SSWDF169 | 7S 8E | 0.37 | -0.01 |
| SSWDF170 | 8S 8E | 0.32 | 0.01 |
| SSWDF171 | 8S 7E | 0.32 | 0.14 |
| SSWDF172 | 9S 8E | 0.33 | 0.30 |
| SSWDF173 [3] | 9S 8E | 0.32 | 0.05 |
| SSWDF174 | 10S 8E | 0.27 | -0.48 |
| SSWDF175 | 11S 8E | 0.35 | 0.33 |
| SSWDF176 [3] | 11S 8E | 0.39 | 0.27 |
| SSWDF177 [4] | 4N 0E | 0.38 | 0.02 |
| SSWDF178 | 12S 8E | 0.37 | -0.13 |
| SSWDF179 | 13S 8E | 0.38 | 0.21 |
| SSWDF180 | 17S 0E | 0.36 | -0.08 |
| SSWDF181 | 18S 0E | 0.33 | 0.26 |
| SSWDF182 | 17S 1E | 0.31 | -0.39 |
| SSWDF183 | 18S 1E | 0.29 | 0.03 |
| SSWDF184 | 17S 2E | 0.29 | -0.46 |

Table 5-1. Western Dog Pens Excavation Screening Sampling Analytical Results (continued)

| Sample ID | Grid Location | Radium-226 Concentration (pCi/g)[1] | Strontium-90 Concentration (pCi/g)[2] |
|---|---|---|---|
| SSWDF185 | 18S 2E | 0.34 | 0.06 |
| SSWDF186 | 17S 3E | 0.27 | -0.21 |
| SSWDF187 | 18S 3E | 0.38 | -0.31 |
| SSWDF188 [5] | 0.2S 0.8E | 0.42 | 0.33 |
| SSWDF189 [5] | 0.2S 3.4E | 0.39 | 0.12 |
| SSWDF190 [3, 5] | 0.2S 3.4E | 0.42 | 0.51 |
| SSWDF191 [5] | 0.2S 5.9E | 0.36 | 0.26 |
| SSWDF192 [5] | 2.2S 0.5E | 0.38 | 0.22 |
| SSWDF193 [5] | 2.2S 1.8E | 0.43 | -0.26 |
| SSWDF194 [5] | 2.2S 7.8E | 0.32 | -0.29 |
| SSWDF195 [5] | 2.5S 1.3E | 0.37 | -0.21 |
| SSWDF196 [5] | 2.5S 5.2E | 0.39 | 0.11 |
| SSWDF197 [5] | 2.5S 6.3E | 0.43 | 0.11 |
| SSWDF198 [5] | 4.4S 1.2E | 0.42 | -0.07 |
| SSWDF199 [5] | 4.4S 4.5E | 0.29 | -0.21 |
| SSWDF200 [5] | 4.4S 8.1E | 0.39 | 0.09 |
| SSWDF201 | 14S 8E | 0.36 | 0.33 |
| SSWDF202 | 18S 4E | 0.41 | 0.41 |
| SSWDF203 | 18S 5E | 0.40 | 0.19 |
| SSWDF204 | 18S 6E | 0.35 | 0.41 |
| SSWDF205 | 18S 7E | 0.29 | -0.35 |
| SSWDF206 | 18S 8E | 0.37 | -0.19 |
| SSWDF207 | 17S 4E | 0.30 | -0.53 |
| SSWDF208 | 17S 5E | 0.30 | 0.17 |
| SSWDF209 | 17S 6E | 0.27 | -0.26 |
| SSWDF210 | 17S 7E | 0.32 | 0.46 |
| SSWDF211 | 17S 8E | 0.30 | -0.15 |
| SSWDF212 | 15S 0E | 0.33 | 0.08 |
| SSWDF213 | 16S 0E | 0.33 | 0.09 |

Table 5-1. Western Dog Pens Excavation Screening Sampling Analytical Results (continued)

| Sample ID | Grid Location | Radium-226 Concentration (pCi/g)[1] | Strontium-90 Concentration (pCi/g)[2] |
|---|---|---|---|
| SSWDF214 | 15S 1E | 0.38 | 0.23 |
| SSWDF215 | 16S 1E | 0.39 | -0.17 |
| SSWDF216 | 15S 2E | 0.34 | 0.52 |
| SSWDF217 [3] | 15S 2E | 0.32 | 0.97 |
| SSWDF218 | 16S 2E | 0.35 | 0.27 |
| SSWDF219 | 15S 3E | 0.38 | 1.02 |
| SSWDF220 | 16S 3E | 0.36 | -0.15 |
| SSWDF221 | 15S 4E | 0.34 | -0.16 |
| SSWDF222 | 16S 4E | 0.39 | 0.40 |
| SSWDF223 | 15S 5E | 0.36 | 0.12 |
| SSWDF224 | 16S 5E | 0.30 | 0.14 |
| SSWDF225 | 15S 6E | 0.35 | 0.35 |
| SSWDF226 | 16S 6E | 0.30 | -0.30 |
| SSWDF227 | 15S 7E | 0.34 | 0.14 |
| SSWDF228 | 16S 7E | 0.33 | -0.16 |
| SSWDF229 | 15S 8E | 0.31 | 0.29 |
| SSWDF230 | 16S 8E | 0.32 | -0.25 |

**Notes**

All excavation screening samples were collected from a depth of 0.5 to 2.5 feet below ground surface.

The excavation screening samples matrix consisted of clayey silt.

[1]Analyzed by an on-site gamma spectrometer. Screening criteria is 0.8 pCi/g.

[2]Analyzed by an on-site beta scintillation detector. The concentrations were judged qualitatively, not quantitatively, due to low concentrations. Screening criteria is 10 pCi/g.

[3]Field duplicate of previous sample number.

[4]Sample collected from curbing around Cellular Biology Building.

[5]Sample collected from WDP cobble-lined trenches.

**Abbreviations**

| | |
|---|---|
| E | East |
| ID | identification (number) |
| N | North |
| pCi/g | picoCuries per gram |
| S | South |

## Table 5-2. Western Dog Pens Confirmation Sampling Analytical Results Summary

| Constituent | Units | Total Number of Samples | Number of Samples > Detection Limit | Concentration Range | Sample ID of Maximum Concentration | Location/ Pen ID |
|---|---|---|---|---|---|---|
| Hexavalent Chromium | mg/kg | 29 | 24 | <0.0267 to 0.51 | SSWDC028 | C-19 |
| Mercury | mg/kg | 29 | 29 | 0.15 to 5.1 | SSWDC020 | I-22 |
| Alpha and Gamma-Chlordane | µg/kg | 47 | 44 | <3.6 to 1,529 | SSWDC051 | Aisle 3 |
| Radium-226 | pCi/g | 47 | 44 | 0.16 to 0.664 | SSWDC022 | D-21 |
| Strontium-90 | pCi/g | 29 | 17 | <0.0231 to 0.491 | SSWDC019 | I-28 |

**Abbreviations**

| | |
|---|---|
| ID | identification (number) |
| mg/kg | milligrams per kilogram |
| pCi/g | picoCuries per gram |
| µg/kg | micrograms per kilogram |

## Table 5-3. Western Dog Pens Chlordane Delineation Sample Analytical Results Summary

| Sample ID | Constituent | Concentration (µg/kg) | Location/ Pen ID | Depth (ft bgs) |
|---|---|---|---|---|
| SSWDC040 | Alpha and Gamma-Chlordane | 214 | Re-sample of SSWDC029/ Pen 1-19 | 2 |
| | Chlordane (tech.) | 1010 | | |
| SSWDC041 | Alpha and Gamma-Chlordane | 1.43 | 1 ft beneath SSWDC029/ Pen 1-19 | 3 |
| | Chlordane (tech.) | <50.4 | | |
| SSWDC042 | Alpha and Gamma-Chlordane | 323 | 5 ft west of SSWDC029/ Pen 1-20 | 2 |
| | Chlordane (tech.) | 1310 | | |
| SSWDC043 | Alpha and Gamma-Chlordane | 238 | 5 ft east of SSWDC029/ Pen 1-20 | 2 |
| | Chlordane (tech.) | 1200 | | |
| SSWDC044 (FD) | Alpha and Gamma-Chlordane | 307 | 5 ft east of SSWDC029/ Pen 1-20 | 2 |
| | Chlordane (tech.) | 1320 | | |
| SSWDC045 | Alpha and Gamma-Chlordane | 112.6 | 5 ft west of SSWDC023/ Pen 2-22 | 2 |
| | Chlordane (tech.) | 497 | | |
| SSWDC046 | Alpha and Gamma-Chlordane | 45 | Re-sample of SSWDC023/ Pen 2-22 | 2 |
| | Chlordane (tech.) | 365 | | |
| SSWDC047 (FD) | Alpha and Gamma-Chlordane | 63.5 | Re-sample of SSWDC023/ Pen 2-22 | 2 |
| | Chlordane (tech.) | 319 | | |
| SSWDC048 | Alpha and Gamma-Chlordane | 25 | 1 ft beneath SSWDC023/ Pen 2-22 | 3 |
| | Chlordane (tech.) | 174 | | |
| SSWDC049 | Alpha and Gamma-Chlordane | 60.3 | 5 ft east of SSWDC049/ Pen 2-21 | 2 |
| | Chlordane (tech.) | 507 | | |
| SSWDC050 | Alpha and Gamma-Chlordane | <1.9 | Re-sample of SSWDC033/ Aisle 3 | 0.5 |
| | Chlordane (tech.) | <9.4 | | |
| SSWDC051 | Alpha and Gamma-Chlordane | 1529 | 5 ft north of SSWDC051/ Aisle 3 | 0.5 |
| | Chlordane (tech.) | 4340 | | |
| SSWDC052 | Alpha and Gamma-Chlordane | 18.9 | 5 ft east of SSWDC033/ Aisle 3 | 0.5 |
| | Chlordane (tech.) | 19.8 | | |
| SSWDC053 | Alpha and Gamma-Chlordane | 6.4 | 5 ft west of SSWDC033/ Aisle 3 | 0.5 |
| | Chlordane (tech.) | 17.9 | | |
| SSWDC054 | Alpha and Gamma-Chlordane | 1.22 | 5 ft south of SSWDC033/ Aisle 3 | 1 |
| | Chlordane (tech.) | <9.5 | | |
| SSWDC055 | Alpha and Gamma-Chlordane | <1.8 | 1 ft beneath SSWDC033/ Aisle 3 | 1.5 |
| | Chlordane (tech.) | <9.2 | | |

**Abbreviations**

| | |
|---|---|
| bgs | below ground surface |
| FD | field duplicate of the prior sample |
| ft | foot/feet |
| ID | identification (number) |
| µg/kg | micrograms per kilogram |

## Table 5-4. Western Dog Pens Sifted Soil Sample Analytical Results Summary

| Sample Identification | Radium-226 Concentration (pCi/g)[1] | Strontium-90 Concentration (pCi/g)[2] |
|---|---|---|
| SSWDF268 | 0.45 | 0.59 |
| SSWDF282 | 0.45 | 0.45 |
| SSWDF236 | 0.45 | 0.59 |
| SSWDF231 | 0.44 | 0.74 |
| SSWDF232 | 0.44 | 0.87 |
| SSWDF280 | 0.44 | 0.17 |
| SSWDF244 | 0.43 | 0.44 |
| SSWDF281 | 0.43 | 0.27 |
| SSWDF275 | 0.43 | 0.13 |
| SSWDF274 | 0.43 | 0.21 |
| SSWDF270 | 0.42 | 0.66 |
| SSWDF234 | 0.42 | 0.55 |
| SSWDF245 | 0.42 | 0.17 |
| SSWDF243 | 0.41 | 0.57 |
| SSWDF272 | 0.41 | 0.40 |
| SSWDF233 | 0.40 | 0.59 |
| SSWDF266 | 0.40 | 0.78 |
| SSWDF284 | 0.40 | 0.19 |
| SSWDF267 | 0.40 | 0.24 |
| SSWDF238 | 0.39 | 0.65 |
| SSWDF248 | 0.39 | 0.79 |
| SSWDF269 | 0.39 | 0.42 |
| SSWDF276 | 0.39 | 0.42 |
| SSWDF257 | 0.39 | 0.71 |
| SSWDF239 | 0.38 | 0.63 |
| SSWDF283 | 0.38 | 0.29 |
| SSWDF285 | 0.37 | 0.37 |
| SSWDF259 | 0.37 | 0.74 |
| SSWDF263 | 0.37 | 0.54 |
| SSWDF235 | 0.37 | 0.44 |

Table 5-4. Western Dog Pens Sifted Soil Sample Analytical Results Summary (continued)

| Sample Identification | Radium-226 Concentration (pCi/g)[1] | Strontium-90 Concentration (pCi/g)[2] |
|---|---|---|
| SSWDF240 | 0.37 | 0.35 |
| SSWDF246 | 0.37 | 0.30 |
| SSWDF253 | 0.36 | 0.02 |
| SSWDF256 | 0.36 | 0.86 |
| SSWDF277 | 0.36 | 0.38 |
| SSWDF279 | 0.36 | 0.36 |
| SSWDF249 | 0.36 | 0.71 |
| SSWDF278 | 0.36 | 0.23 |
| SSWDF250 | 0.36 | 0.50 |
| SSWDF260 | 0.36 | 0.63 |
| SSWDF241 | 0.36 | 0.12 |
| SSWDF237 | 0.35 | 0.43 |
| SSWDF265 | 0.35 | 0.65 |
| SSWDF273 | 0.35 | 0.67 |
| SSWDF254 | 0.35 | 0.43 |
| SSWDF255 | 0.34 | 0.90 |
| SSWDF258 | 0.33 | 0.88 |
| SSWDF271 | 0.32 | 0.65 |
| SSWDF247 | 0.32 | 0.55 |
| SSWDF262 | 0.32 | 0.53 |
| SSWDF264 | 0.32 | 0.30 |
| SSWDF252 | 0.32 | 0.12 |
| SSWDF242 | 0.31 | 0.42 |
| SSWDF261 | 0.31 | 0.28 |
| SSWDF251 | 0.30 | 0.18 |

**Notes**
[1]Analyzed by an on-site gamma spectrometer.
[2]Analyzed by on-site beta scintillation detector.

**Abbreviation**
pCi/g picoCuries per gram

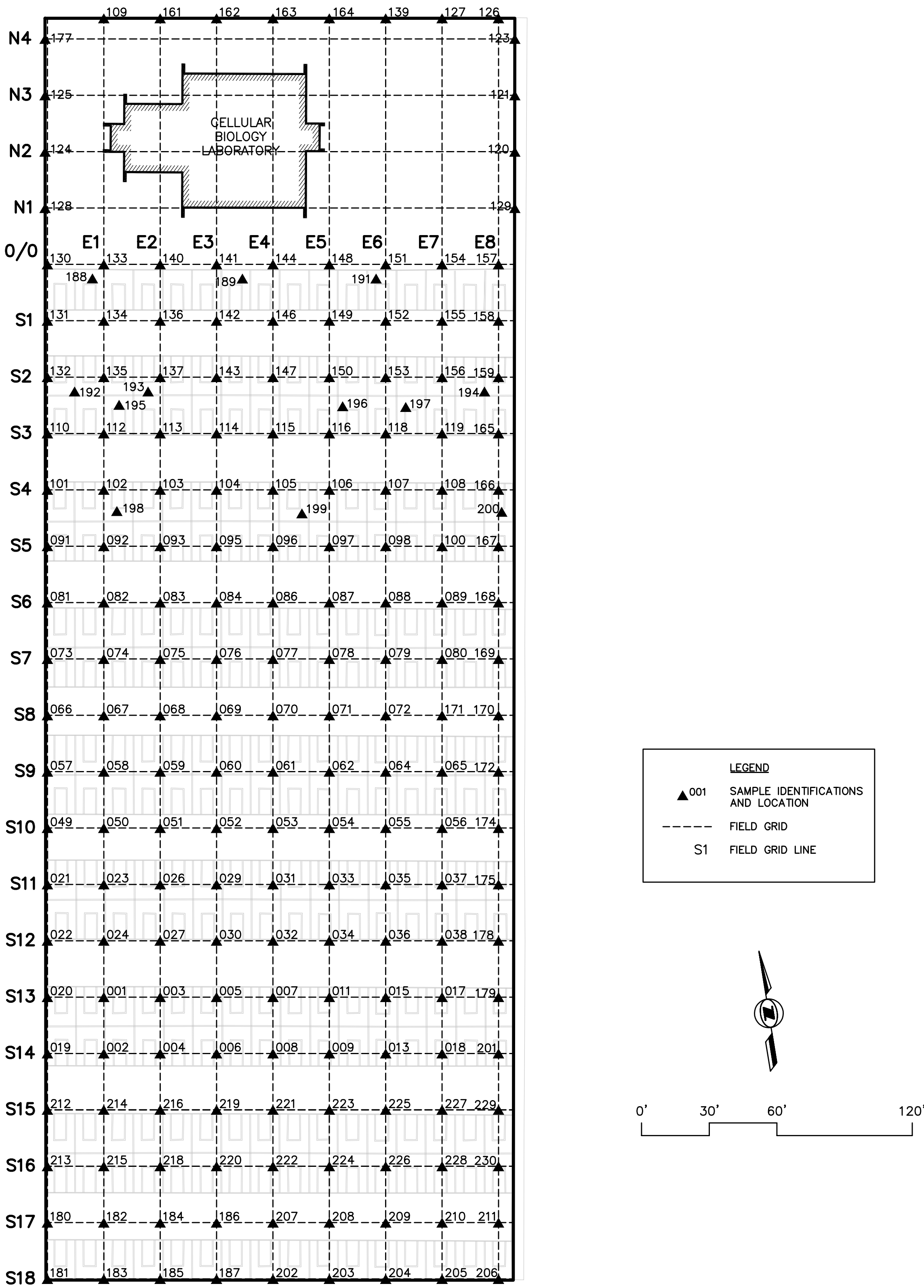


Figure 5-1. Western Dog Pens Excavation Screening Sample Locations and Grid Map

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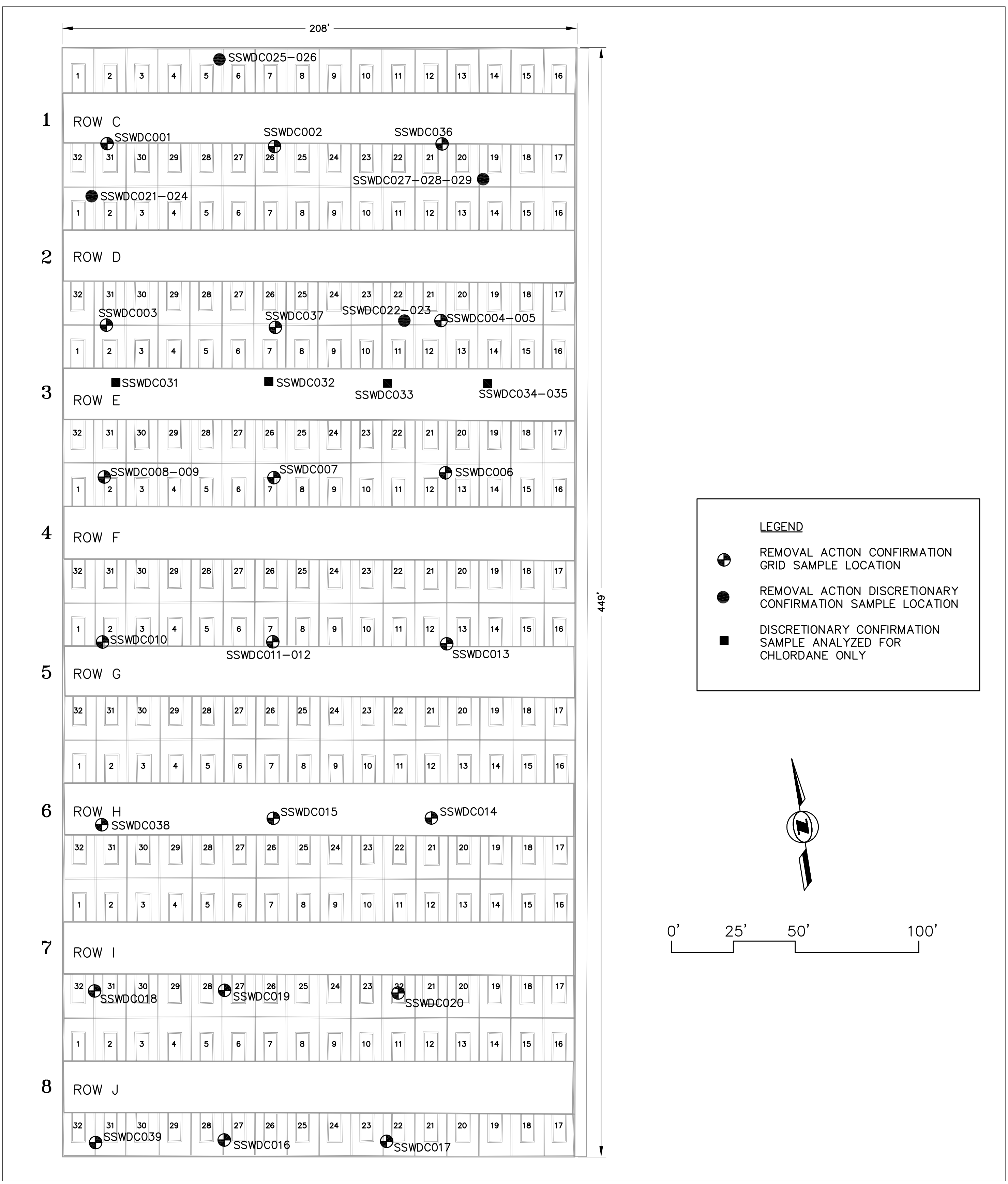


Figure 5-2. Western Dog Pens Excavation Confirmation Sample Locations

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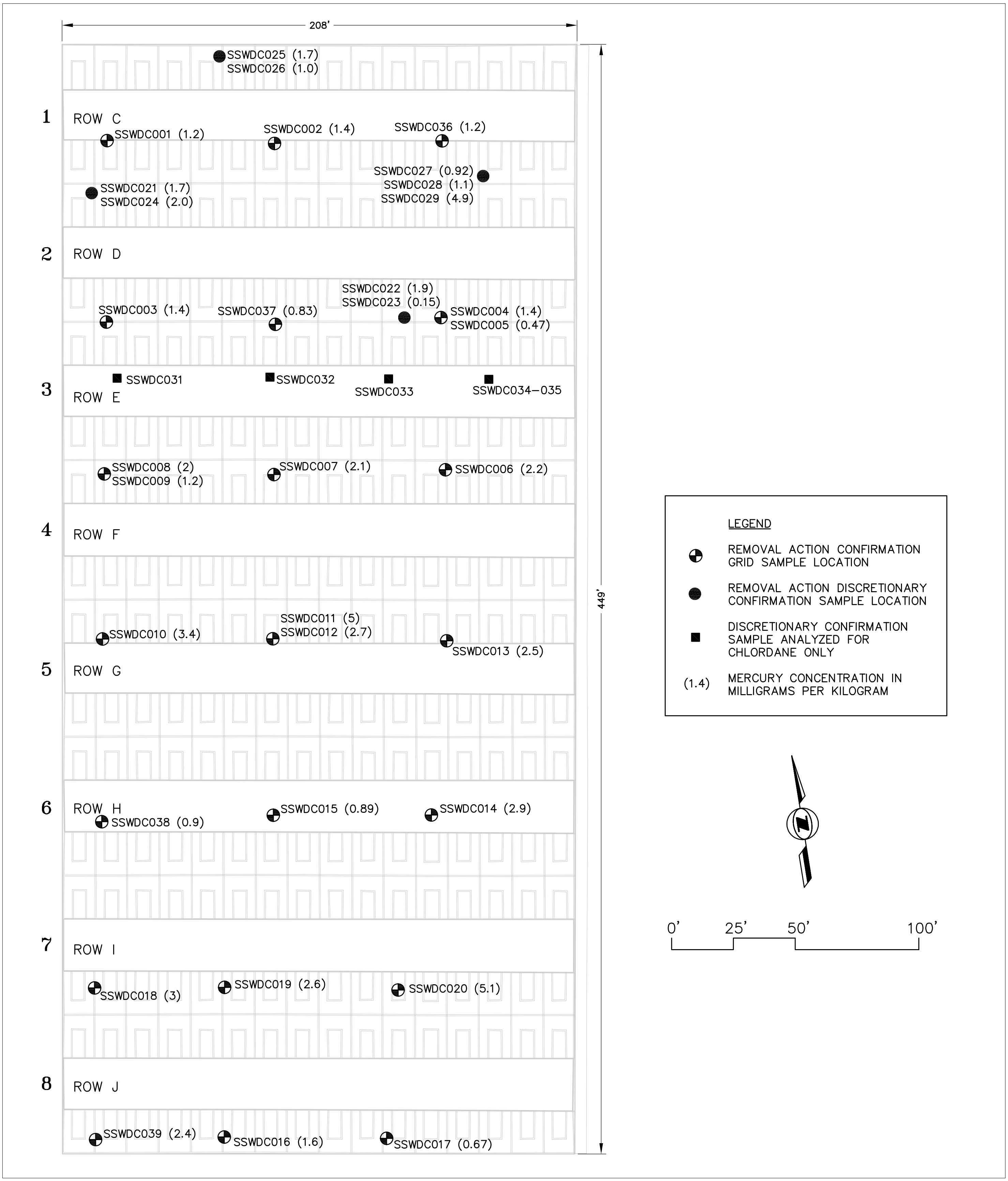


Figure 5-3. Western Dog Pens Excavation Confirmation Sample Locations and Mercury Concentrations

*WEISS ASSOCIATES*

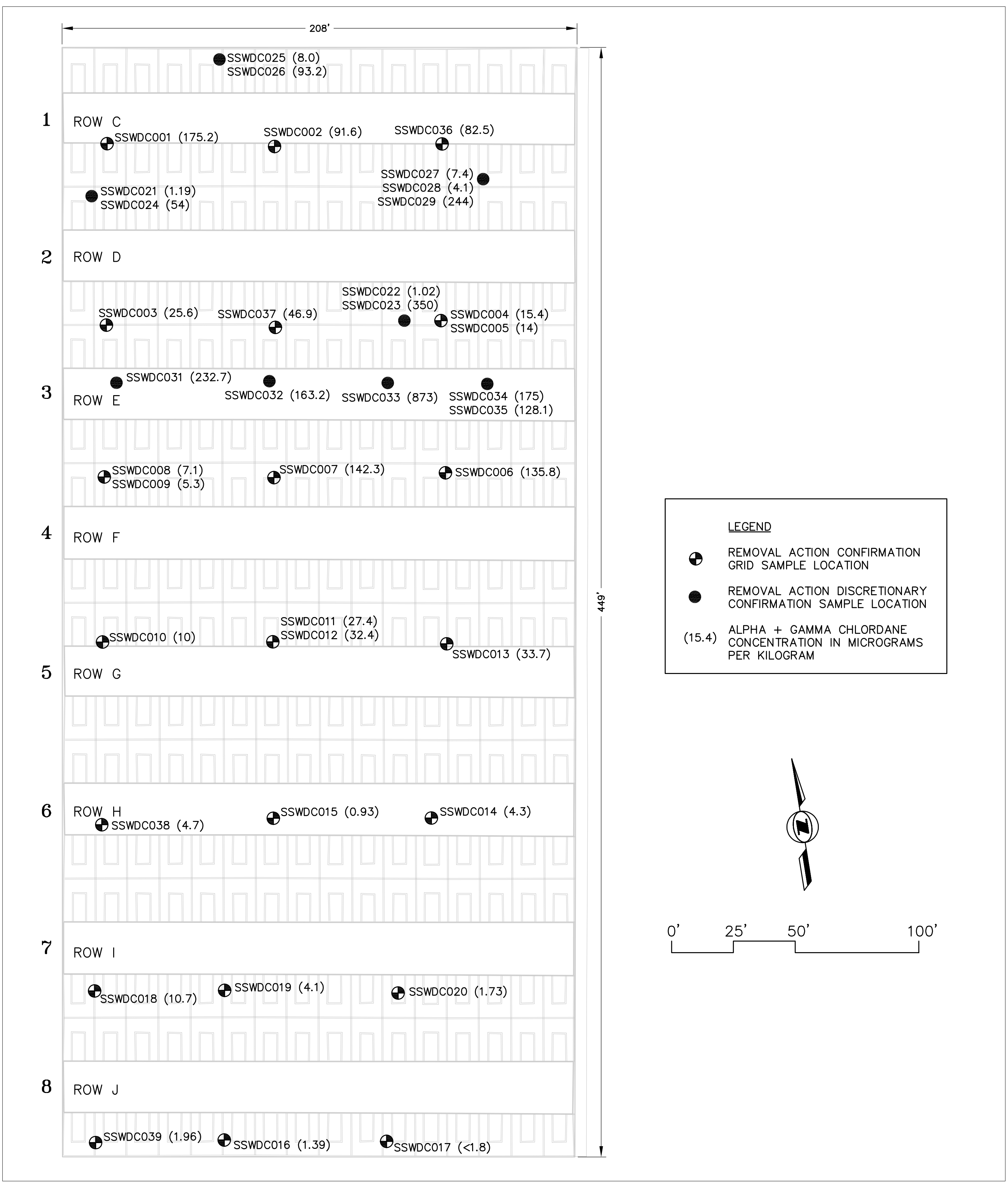


Figure 5-4. Western Dog Pens Excavation Confirmation Sample Locations and Alpha + Gamma Chlordane Concentrations

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DATE: 02/15/05 - 4:00pm

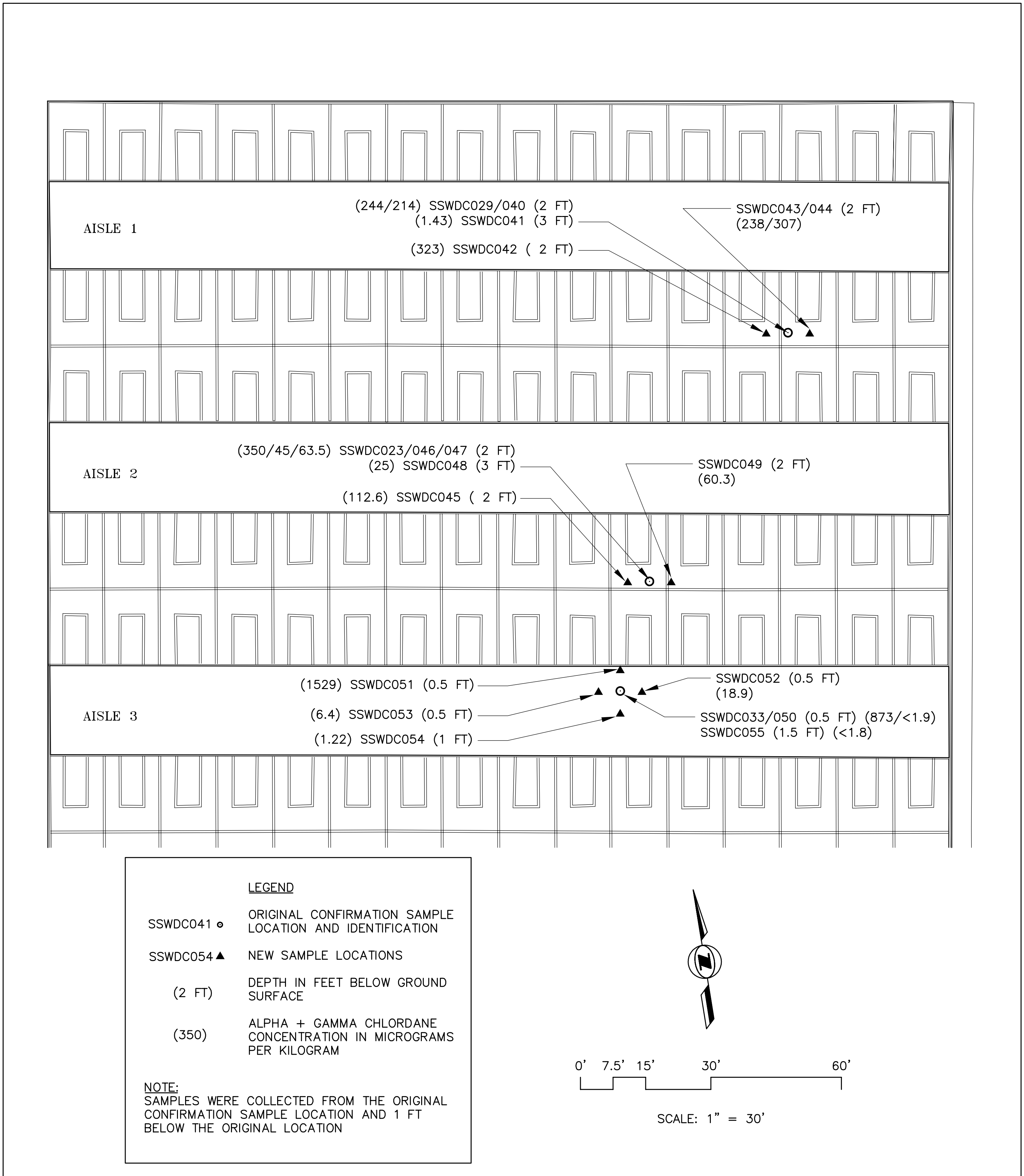


Figure 5-5. Western Dog Pens Additional Chlordane Sample Locations and Analytical Results

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Figure 5-6. LEHR Air Monitoring Station Locations

# 6. PHASE II DATA EVALUATION

The data from the WDPs RA were evaluated in two phases:

- The Phase I Data Evaluation was based on field sampling and screening methods, summarized in Section 5; and,
- The Phase II Data Evaluation was based on analytical laboratory results of confirmation 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. The Phase I data were used to verify that underlying soil was not impacted during material/waste removal, and were based on screening sample analyses conducted during the RA.

The Phase II Data Evaluation, described in this section, was completed after all analytical results from the confirmation sampling were received. Figure 6-2 presents the data evaluation process. During the Phase II Data Evaluation, confirmation results were validated, imported into the project database, compared to background data, compared to the RBAS on an individual and a cumulative basis, and analyzed for hot measurements. These steps were used to determine whether the RAOs were attained and, if not, make recommendations regarding any additional required actions.

## 6.1 Data Reduction/Verification/Reporting and Records Management

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

Per the QAPP and the RA WP, the following activities were conducted to ensure data usability:

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

Each is described below.

### *6.1.1 Quality Assurance/Quality Control Sample Collection*

Field QA/QC samples were collected to ensure reliability of field sampling procedures and materials. Seven field duplicates or almost 15% of the 48 confirmation samples and one equipment rinseate blank were collected following the RA as required in the QAPP (WA, 2000b) and SAP (WA, 2001e). These values meet or exceed specifications in the QAPP.

### *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 outlined in the QAPP and the RA WP.

Independent of the laboratory review, WA performed data validation and verification on the analyzed samples using guidance in the *US EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review* (US EPA, 1998a) and *US EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (US EPA, 1998b). Analytical results were qualified as a result of the data validation process according to the flagging convention described in the QAPP.

Sample results and associated QA/QC results that were reviewed included (as applicable): holding times, field rinseate and laboratory blank results, laboratory control sample spike results, matrix spike/matrix spike duplicate results, laboratory matrix duplicate results, surrogate recoveries and internal standard performance. All sample results were identified as usable (no qualifier or P) or estimated and usable (with J or UJ qualifier). No data were rejected (R qualifier) or found to contain serious deficiencies in the ability to analyze the samples and meet QC criteria.

Detection limits reported for the hexavalent chromium confirmation sample data exceeded the contract-specified limits. The WDP hexavalent chromium confirmation samples were re-collected and re-analyzed. The laboratory reported acceptable detection limits and these data were used in place of the earlier data for data evaluation and risk assessment.

### *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.

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 terms used in the risk analysis, 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 analysis (Gilbert, 1987).

### *6.1.4 Data Summary*

Analytical results are compared to RBAS values in Section 6.3. Notable findings based on review of the confirmation data include:

- All Ra-226 and mercury confirmation results were above the detection limits.
- Sr-90, hexavalent chromium, alpha-chlordane, and gamma-chlordane were below the detection limit in one or more confirmation samples.
- All Ra-226 confirmation results were below the background concentration.
- All mercury and alpha-chlordane results were below the PRGs and lowest RBAS values.
- All hexavalent chromium and Sr-90 confirmation results were below their lowest respective RBAS value.

## 6.2 Background Comparison

Background concentrations of Ra-226, Sr-90, mercury, and hexavalent chromium in LEHR-area soil were calculated using analytical results of off-site soil samples and US EPA-approved statistical methods. Background concentrations presented in Appendix C of the *Work Plan for Removal Actions in the Southwest Trenches, Ra/Sr Treatment Systems, and Domestic Septic Systems Areas* (WA, 2000c) were compared to confirmation sample analyses. 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.

The RA confirmation samples were collected at depths ranging from 0.5 ft bgs to 3.5 ft bgs. Because the background mercury concentration is known to be stratified with depth at the LEHR site as determined in Appendix C of the *Work Plan for Removal Actions in the Southwest Trenches, Ra/Sr Treatment Systems and Domestic Septic Systems Areas* (WA, 2000c) only the mercury background value for soil between ground surface and four feet bgs was used. Background values for soil located at all sampled depths were used for Ra-226, Sr-90, and hexavalent chromium because their background concentration is not significantly stratified with depth at LEHR.

Ra-226 was the only WDPs COC with an RBAS (0.0042 pCi/g) less than the background value (0.75 pCi/g). Statistical comparisons between confirmation and background data were not applicable to Sr-90, mercury, and hexavalent chromium because their lowest RBAS values were above background. No statistical comparisons were made between off-site background data and confirmation data for chlordane, alpha-chlordane, and gamma-chlordane because these COCs are not naturally occurring and their background value is assumed to be zero. Table 6-3 shows the number of detections above background for each confirmation sample analyte.

US EPA guidance recommends the WRS and Quantile Tests to perform the background comparison. These tests are outlined in *Statistical Method for Evaluating the Attainment of Cleanup Standards* (US EPA, 1994a). 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 when an RA has failed in only a few areas within the cleanup unit.

The results of the WRS and Quantile Tests indicated that Ra-226 confirmation data is statistically equivalent to the background levels. Thus, Ra-226 was eliminated prior to the WDPs Area risk analysis since it does not contribute to excess or incremental risk at the Site.

## 6.3 Risk Analysis

The risk analysis evaluated potential impacts to human health at the three receptor locations shown in Figure 6-3 and discussed in Section 6.3.1. A risk-screening evaluation was conducted using RBAS values developed for the LEHR site (Section 6.3.1). As stated in the RA WP (WA, 2001e) the WDPs COCs are Ra-226, Sr-90, mercury, hexavalent chromium, and chlordane. The purpose of the risk analysis was to determine if post-RA cancer risk was within or lower than the US EPA acceptable range of $10^{-4}$ to $10^{-6}$, and if noncarcinogenic effects were less than the HQ of 1.0.

### *6.3.1 Risk-Based Action Standards*

RBAS 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:

- 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 Ra-226, Sr-90, mercury, hexavalent chromium, and chlordane were identified as COCs in the RA WP (WA, 2001e);
- 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 (all WDPs COCs), the RBAS values used in this risk analysis are based upon a level of protection equal to the excess upper bound lifetime cancer risk of $10^{-6}$. For systemic non-carcinogenic compounds (mercury and hexavalent chromium), the RBAS values are equivalent to an HQ of 1.0, representing no significant adverse effect during a lifetime. The non-carcinogenic RBAS value for mercury in Scenario 2 was updated to include new mercury speciation analysis at LEHR and new lithologic information specific to the WDPs Area as reported in the *Addendum to Former Dog Pens Technical Memoranda* (WA, 2000f).

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 analysis.

Three risk exposure scenarios were developed 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 WDPs 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), inhalation of fugitive dust, soil ingestion, and agricultural foods 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 generally toward the east, away from this receptor location, and ground water contamination does not impact Putah Creek.

### *6.3.2 Reasonable Maximum Exposure*

The guidance document *Statistical Methods for Evaluating the Attainment of Cleanup Standards* (US EPA, 1994a) recommends using an 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 guidance (US EPA, 1994a), statistical calculations were performed for each COC to determine the concentration terms. The statistical calculations included determining the 95% upper confidence limit (UCL) on the mean of data (Table 6-3). 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 limit such as the RBAS.

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 sample population 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 population mean can only be known by sampling all of the soil at the Site, which is not technically or economically realistic. The RMEs for WDPs Area COCs are shown in Table 6-3.

The 95% UCL provides reasonable confidence that the true site average concentration will not be underestimated. The 95% UCL is 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 is not available in reality.

The 95% UCL 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; and,

N = Number of samples.

The 95% UCL on the mean was calculated to determine the concentration term or RME for the COCs, using US EPA procedures (US EPA, 1992).

### *6.3.3 Risk Calculation*

The risk analysis assessed whether the first and second RAOs (Executive Summary) for the WDPs RAs were attained. The risk analysis 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 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 analysis concludes the second RAO has been attained.

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

**Individual COC**

$\frac{RME_1}{RBAS_{1Scenario_n}}$ = 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**

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**

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

Table 6-4 contains 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. Table 6-5 shows 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.

The quantification of total chlordane for risk assessment purposes was addressed by summing the alpha and gamma chlordane results from Contract Laboratory Program (CLP), Organic Laboratory Method (OLM) 3.1. Although chlordane consists of a mixture of more that 100 substances, 60 to 85% of the chlordane mixture consists of alpha and gamma chlordane (Buchert et al., 1989, Worthing and Walker, 1987). The calculation of cumulative risk was conservatively estimated by summing the risk contribution from the individual alpha and gamma chlordane concentrations, and the estimated total chlordane concentration (i.e., sum of alpha and gamma chlordane) (Table 6-4). Because alpha and gamma chlordane risk contributions were added twice in the cumulative risk determination, the risk from chlordane has been conservatively overestimated. This approach adequately compensates for the potential underestimation of total chlordane concentrations caused by not quantifying the other chlordane constituents.

Although total chlordane data was acquired during the Western Dog Pens confirmation sampling using SW-846 Method 8081A, these data are regarded as semi-quantitative and were not used in this risk assessment since the total chlordane standard used in method 8081A does not reflect the degraded chlordane mixture in the soil samples.

Comparison of the RBAS values to the RMEs for the three risk scenarios indicates that:

- None of the individual COC RMEs exceed the carcinogenic RBAS values in the WDPs for the $10^{-6}$, $10^{-5}$, or $10^{-4}$ target risk levels after the RA.
- None of the cumulative RME/RBAS ratios exceed 1.0.

#### 6.3.3.1 Cancer Risk Calculations

The data in Table 6-5 demonstrate that the cumulative residual risk for carcinogens falls below the US EPA Comprehensive Environmental Response, Compensation and Liability Act risk range of $10^{-4}$ to $10^{-6}$. Thus, the RA achieved RAO 1 by reducing the cumulative cancer risk below $10^{-6}$.

#### 6.3.3.2 Non-Cancer Risk Calculations

Comparison of the RBAS values to the post-RA confirmation data indicates that none of the COCs exceed their non-carcinogenic RBAS values based on an HQ of 1.0. Tables 6-4 and 6-5 show individual non-carcinogenic COC RME/RBAS ratios and the cumulative non-carcinogen RME/RBAS ratio, respectively.

Based on the confirmation data, the RA has achieved the second RAO by reducing the non-cancer HQ to below 1.0.

#### 6.3.3.3 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, October 2001; and
- Radionuclides—Radionuclide PRGs established by US EPA Region 9 on May 29, 2002.

Mercury, hexavalent chromium, and chlordane were the only COCs with a non-carcinogenic PRG values.. As shown on Table 6-3, all COC RMEs were either below background or the PRG.

### *6.3.4 Hot Measurement Analysis*

A hot measurement analysis was performed to determine if any COC concentrations after the RA exceeded their 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 was conducted using the methodology described in *Statistical Methods for Evaluating the Attainment of Cleanup Standards* (US EPA, 1994a).

The hot measurement analysis is typically used in background comparisons in conjunction with the WRS and Quantile Tests to help ensure that high concentrations 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 RA 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. All non radiological COCs were compared to values 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 median of the three cancer risk levels. The non-carcinogenic RBAS values were treated differently because, in contrast to carcinogens which have various risk levels such as $10^{-6}$, $10^{-5}$, and $10^{-4}$, risk assessments typically use only one risk level for non-carcinogens: HQ = 1.0.

Derived Concentration Guideline Level Elevated Measurement Comparison ($DCGL_{EMC}$) values were calculated for Ra-226 and Sr-90 (Appendix A). The Ra-226 $DCGL_{EMC}$ (1.42 pCi/g) is the product of the background value (0.752 pCi/g) and the Area Factor (1.89). The Area Factor for Ra-226 was obtained from Table 5.6 of the Multi-Agency Radiation Survey and Site Investigation Manual (NRC, 1997) based on the 25 ft excavation screening sample grid spacing. The Sr-90 Area Factor is 19. The Area Factor for Sr-90 was obtained from Figure 8.2 of NUREG-1505 based on the 25-ft excavation screening sample grid spacing. The Sr-90 $DCGL_{EMC}$ (1,900 pCi/g) is the product of the Area Factor and the risk-based action standard (100 pCi/g), based on $10^{-4}$ risk. Sr-90 background (0.054 pCi/g) was not used as a basis for the $DCGL_{EMC}$ because it cannot be detected with field screening instruments. All of the Ra-226 and Sr-90 concentrations measured in the confirmation samples are below their respective $DCGL_{EMC}$ values. The scan minimum detectable concentration values (Appendix A) for the radiological field survey are below the $DCGL_{EMC}$ values. No areas in the WDPs exhibited radiation levels above the $DCGL_{EMC}$ values during of the radiological field survey.

The hot measurement analysis is presented in Table 6-6. All of the COCs passed the hot measurement analysis indicating that no hot spots remain after the RA that would be a human health concern.

### *6.3.5 Ground Water Impacts*

WDPs ground water impacts were previously evaluated according to *The Designated Level Methodology for Waste Classification and Cleanup Level Determination issued by the Central Valley Regional Water Quality Control Board* (CRWQCB, 1986). DL COCs were identified for the WDPs Area and DL modeling was performed to determine concentrations in WDPs soil that are protective of water quality based on State of California maximum contaminant level (MCL) standards for drinking water. DL modeling was carried out using NUFT (Nitao, 1998), a numerical code, to simulate downward COC migration to ground water. A one-dimensional model representing the soil profile beneath the WDPs was used. The State of California MCL was the ground water goal for each COC. Iterative modeling runs were conducted to determine the allowable soil concentration that would produce a peak ground water concentration equivalent to the ground water goal. The previous evaluation was presented in the *Addendum to Former Dog Pens Technical Memoranda* (WA, 2000f).

The results for WDP confirmation samples indicated that hexavalent chromium was above background in the gravel trenches and should be evaluated as a DL COC. An allowable DL soil concentration was determined for hexavalent chromium using the NUFT (Nitao, 1998) code and DL model previously developed for the WDPs (WA, 2000f). The allowable DL soil concentrations and a summary of WDP RA confirmation sampling results are shown in Table 6-7. No DL soil concentration was determined for radium-226 because the results of WRS and Quantile statistical tests indicated that radium-226 concentrations were indistinguishable from background (Section 6.2), and thus, Ra-226 is not a DL COC. As shown in Table 6-7, only mercury exceeds the allowable DL concentration. However, the estimated time required for this impact to occur is almost 6,000 years.

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 | Units | Background Concentration | Scenario 1 $10^{-6}$ Risk | Scenario 2 $10^{-6}$ Risk | Scenario 3 $10^{-6}$ Risk | 2000 Residential PRG[3] |
| Hexavalent Chromium | mg/kg | 0.054 | 100 | >100,000[2] | 23,000 | 30 |
| Alpha-Chlordane | mg/kg | None | 1.5 | 0.80 | 5.9 | 1.6 total |
| Chlordane | mg/kg | None | 1.5 | 0.78 | 5.9 | 1.6 total |
| Gamma-Chlordane | mg/kg | None | 1.5 | 0.81 | 6.4 | 1.6 total |
| Radium-226+D | pCi/g | 0.75 | 0.0042 | 1,100 | 1,100 | 0.0012 |
| Strontium-90+D | pCi/g | 0.056 | 10 | 290,000 | 34,000 | 0.23 |

**Notes**

[1]Background concentration calculations are presented in Appendix C of the *Work Plan for Removal Actions in the Southwest Trenches, Ra/Sr Treatment Systems, and Domestic Septic Systems Areas* (WA, 2000c).

[2]Risk not exceeded at 10% hexavalent chromium by weight (i.e., 100,000 mg/kg) concentration.

[3]PRG values for hexavalent chromium, mercury and chlordane are taken from the Region 9 PRGs Table dated October 2002. PRG values for radium-226 and strontium-90 taken from Radionuclide Toxicity and Preliminary Remediation Goals for Superfund, May 29, 2002.

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

**Abbreviations**

+D plus daughter product(s)
mg/kg milligrams per kilogram
N/A not applicable
None Analyte is not present in background soil samples.
pCi/g picoCuries per gram
PRG preliminary remediation goal (United States Environmental Protection Agency)

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

| Analyte | Background Concentration (mg/kg)[1] | Risk-Based Action Standards | | | PRG[3] Residential HI = 1.0 (mg/kg) |
|---|---|---|---|---|---|
| | | Scenario 1 (mg/kg) | Scenario 2 (mg/kg) | Scenario 3 (mg/kg) | |
| Chlordane | N/A | NC | NC | NC | 35 |
| Hexavalent Chromium | 0.054 | 8,500 | 3.8 | 740 | 230 |
| Mercury | 3.94 | 510 | 5.75[2] | 6.4 | 23 |

**Notes**

[1]Background concentration calculations are presented in Appendix C of the *Work Plan for Removal Actions in the Southwest Trenches, Ra/Sr Treatment Systems, and Domestic Septic Systems Areas* (WA, 2000c).

[2]Scenario 2 mercury RBAS is specific to potential source soil in the Western Dog Pens area (WA, 2000f).

[3]PRG values for hexavalent chromium and mercury were taken from the Region 9 PRGs, Table 2000.

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

**Abbreviations**

HI hazard index
mg/kg milligrams per kilogram
N/A not available
PRG preliminary remediation goal
NC not calculated

Table 6-3. Sample Statistics, Background, 95% Upper Confidence Limit, and Reasonable Maximum Exposure Concentration for the Western Dog Pens Removal Action

| Constituent | Units | Number of Samples Analyzed | Number of Samples > Detection Limit | Number of Detections > Background | Background Concentration [a] (0 to 4 ft bgs) [b] | Concentration Range | Sample ID of Maximum Concentration | RME [c] | Carc. [d] RBAS[f] Scenario 1 | Carc. RBAS[f] Scenario 2 | Carc. RBAS[f] Scenario 3 | Non-Carc. RBAS[f] Scenario 1 | Non-Carc. RBAS[f] Scenario 2 | Non-Carc. [e] RBAS [f] Scenario 3 | Carc. Residential PRG [g] | Non-Carc. Residential PRG |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hexavalent Chromium | mg/kg | 29 | 24 | 22 | 0.054 | <0.0267 to 0.51 | SSWDC028 | 0.26 | 100 | 100,000 | 23,000 | 8,500 | 3.80 | 740 | 0.30 | 230 |
| Mercury | mg/kg | 29 | 29 | 3 | 3.94 | 0.15 to 5.1 | SSWDC020 | 2.46 | 16,000 | 15 | 540 | 510 | 5.75 [h] | 6.40 | N/A | 23 |
| Alpha-Chlordane | µg/kg | 47 | 44 | 44 | 0 | <1.8 to 680 | SSWDC051 | 87.8 | 1,500 | 800 | 5,900 | N/A | N/A | N/A | 1,600 | N/A |
| Chlordane [i] | µg/kg | 47 | 44 | 44 | 0 | <3.6 to 1529 | SSWDC051 | 197 | 1,500 | 780 | 5,900 | N/A | N/A | N/A | 1,600 | 35 |
| Gamma-Chlordane | µg/kg | 47 | 44 | 44 | 0 | <1.8 to 849 | SSWDC051 | 109 | 1,500 | 810 | 6,400 | N/A | N/A | N/A | 1,600 | N/A |
| Radium-226 | pCi/g | 29 | 29 | 0 | 0.752 | 0.16 to 0.664 | SSWDC022 | 0.464 | 0.0042 | 1,100 | 1,100 | N/A | N/A | N/A | 0.0012 | N/A |
| Strontium-90 | pCi/g | 29 | 17 | 11 | 0.056 | <0.0231 to 0.491 | SSWDC019 | 0.115 | 10 | 290,000 | 34,000 | N/A | N/A | N/A | 0.23 | N/A |

**Notes**

[a] 80% lower confidence limit on 95th percentile of background data.

[b] Background value was determined from samples collected at depths ranging from 0 feet to 4 feet below ground surface when constituent concentration was known to vary with depth.

[c] 95% upper confidence limit on the mean concentration.

[d] Based on carcinogenic toxicity.

[e] Based on non-carcinogenic toxicity.

[f] $10^{-6}$ risk for carcinogenic effects and a hazard quotient of 1.0 for non-carcinogenic effects (WA, 1997a).

[g] PRG values for hexavalent chromium, mercury and chlordane taken from the US EPA Region 9 PRGs Table dated October 2002. PRG values for radium-226 and strontium-90 taken from Radionuclide Toxicity and Preliminary Remediation Goals for Superfund, May 29, 2002.

[h] Western Dog Pens-specific RBAS (WA, 2000f).

[i] Chlordane concentration in confirmation samples was assumed to equal the sum of alpha-chlordane and gamma-chlordane results from analysis by Contract Laboratory Program Organic Laboratory Method 3.1 (CCLP OLM 3.1).

**Abbreviations**

| | |
|---|---|
| bgs | below ground surface |
| Carc. | carcinogenic |
| COCs | constituents of concern |
| ft | feet |
| ID | identification number |
| mg/kg | milligrams per kilogram |
| N/A | not available |
| Non-Carc. | non-carcinogenic |
| pCi/g | picoCuries per gram |
| PRG | preliminary remediation goal (United States Environmental Protection Agency) |
| RME | reasonable maximum exposure |
| UCL | upper confidence limit |
| µg/kg | micrograms per kilogram |

Table 6-4. Screening Analysis for Risk Constituents of Concern for the Western Dog Pens Removal Action

| 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 | 0.07 | 0.00 | 0.009 | 0.001 |
| Mercury | 0.00 | | 0.00 | 0.00 | 0.43 | 0.38 | N/A | 0.11 |
| Alpha-Chlordane | 0.06 | 0.11 | 0.01 | N/A | N/A | N/A | 0.05 | N/A |
| Chlordane | 0.13 | 0.25 | 0.03 | N/A | N/A | N/A | 0.12 | .006 |
| Gamma-Chlordane | 0.07 | 0.13 | 0.02 | N/A | N/A | N/A | 0.07 | N/A |
| Radium-226 | a | a | a | N/A | N/A | N/A | a | N/A |
| Strontium-90 | 0.01 | 0.00 | 0.00 | N/A | N/A | N/A | 0.5 | N/A |
| Sum of RME/RBAS Ratio | 0.28 | 0.49 | 0.07 | 0.00 | 0.5 | 0.38 | 0.75 | 0.12 |

**Notes**

a The RBAS for this constituent of concern 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 an 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. | Carcinogenic |
| N/A | not applicable |
| Non-Carc. | non-carcinogenic |
| PRG | preliminary remediation goal concentration |
| RBAS | risk-based action standard determined specifically for the LEHR site |
| RME | reasonable maximum exposure concentration, the 95% upper confidence limit was used as the RME |
| Scen. | scenario |

Table 6-5. Risk Analysis Summary, Reasonable Maximum Exposure/Risk-Based Action Standard Sums for the Western Dog Pens Removal Action

| Excess Risk | Carc. Scenario 1 | Carc. Scenario 2 | Carc. Scenario 3 | Non-Carc. Scenario 1 | Non-Carc. Scenario 2 | Non-Carc. Scenario 3 |
|---|---|---|---|---|---|---|
| $10^{-6}$ | 0.28 | 0.66 | 0.07 | N/A | N/A | N/A |
| $10^{-5}$ | 0.028 | 0.066 | 0.007 | N/A | N/A | N/A |
| $10^{-4}$ | 0.003 | 0.007 | 0.001 | N/A | N/A | N/A |
| HI = 1 | N/A | N/A | N/A | 0.00 | 0.5 | 0.38 |

**Abbreviations**

| | |
|---|---|
| Carc. | carcinogenic |
| HI | hazard index |
| N/A | not applicable |
| Non-Carc. | non-carcinogenic |
| RME | reasonable maximum exposure = 95% upper confidence limit |

Table 6-6. Hot Measurement Analysis for the Western Dog Pens Removal Action

| Constituent | Units | Maximum Concentration | Sample ID of Maximum Concentration | Background Concentration [a] (0 to 4 ft bgs) | $DCGL_{EMC}$ Value | Lowest Carcinogenic $10^{-5}$ RBAS [b] | Lowest Non-Carcinogenic RBAS |
|---|---|---|---|---|---|---|---|
| Hexavalent Chromium | mg/kg | 0.51 | SSWDC028 | 0.054 | N/A | 1000 | 3.80 |
| Mercury | mg/kg | 5.1 | SSWDC020 | 3.94 | N/A | 150 | 5.75 [c] |
| Alpha-Chlordane | µg/kg | 680 | SSWDC033 | 0 [d] | N/A | 8000 | N/A |
| Chlordane | µg/kg | 1529 | SSWDC033 | 0 | N/A | 7800 | N/A |
| Gamma-Chlordane | µg/kg | 849 | SSWDC033 | 0 | N/A | 8100 | N/A |
| Radium-226 | pCi/g | 0.664 | SSWDC022 | 0.752 | 1.42 | 0.042 | N/A |
| Strontium-90 | pCi/g | 0.491 | SSWDC019 | 0.056 | 1900 | 100 | N/A |

**Notes**

[a] 80% lower confidence limit on 95th percentile of background distribution

[b] Risk-based action standard (WA, 1997f).

[c] Scenario 2 mercury RBAS is specific to potential source soil in the Western Dog Pens Area (WA, 2000).

[d] Background for these anthropogenic compounds is assumed to be zero.

**Abbreviations**

| | |
|---|---|
| bgs | below ground surface |
| $DCGL_{EMC}$ | Derived Concentration Guideline Level Elevated Measurement Comparison values |
| ft | feet |
| ID | identification (number) |
| mg/kg | milligrams per kilogram |
| pCi/g | picoCuries per gram |
| RBAS | risk-based action standard |
| µg/kg | micrograms per kilogram |

# Table 6-7. Western Dog Pen Lithology Designated Level Comparison

| | | | | | | | Confirmation | | Confirmation | |
|---|---|---|---|---|---|---|---|---|---|---|
| Constituent of Concern | Ground Water Goal Conc. (ug/L) or (pCi/L) | Goal Reference | NUFT Soil Result (mg/kg) or (pCi/g) | Depth Interval of Contamination | Half Life (years) | Time to peak at Ground Water Goal (years) | Maximum (mg/kg) or (pCi/g) | Depth of Maximum (ft) | 95% UCL (mg/kg) or (pCi/g) | Result of Comparison (Pass/Fail) |
| Hexavalent Chromium | 50 | MCL[1] | 0.810 | 0-27 ft | N/A | 0 | 0.51 | 2.5 | 0.26 | P |
| Mercury [2] | 2 | MCL | 0.62 | 0-2 ft | N/A | 5,927 | 5.1 | 1.5 | 2.46 | F |
| alpha-Chlordane | 0.10 | MCL | 59 | 0-2 ft | 1,520 | 10,008 | 0.68 | 0.25 | 0.0878 | P |
| gamma-Chlordane | 0.10 | MCL | 13,246 | 0-2 ft | 1,520 | 15,516 | 0.849 | 0.25 | 0.109 | P |
| Radium-226 [3] | 5 | MCL | N/A | N/A | 1,600 | N/A | 0.664 | 2 | 0.464 | N/A |
| Strontium-90 | 8 | MCL | 3.28E+18 | 0-2 ft | 29 | 660 | 0.491 | 1.5 | 0.115 | P |

**Notes**

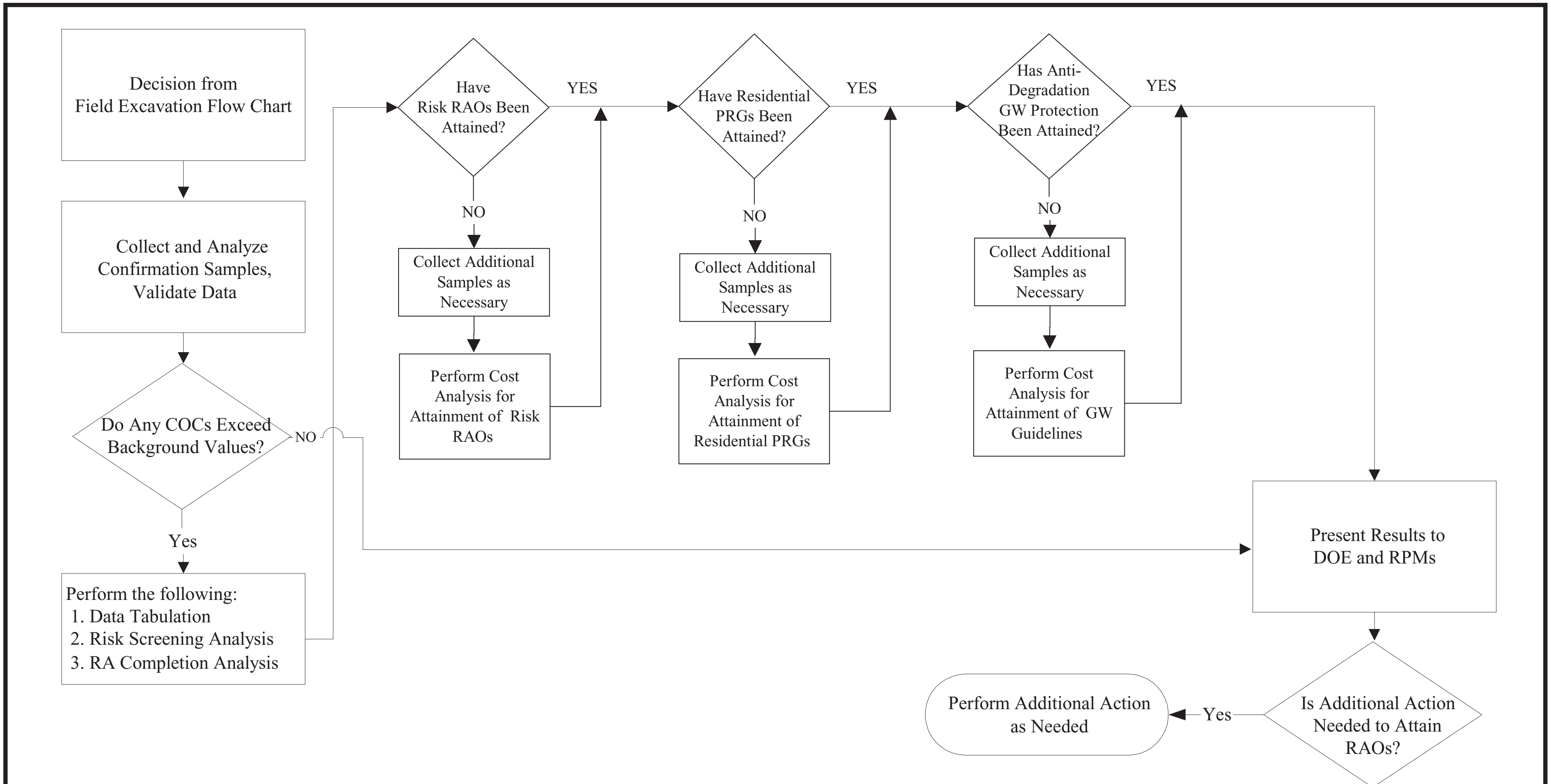
[1] MCL for total chromium.

[2] All mercury species assumed to be mercury sulfide.

[3] Radium-226 is not a designated level COC in the Western Dog Pens Area. The results of statistical comparisons using the WRS Test and Quantile Test indicated background was not exceed.

**Abbreviations**

| | |
|---|---|
| 95% UCL | 95% Upper confidence limit on the true mean based on sample data |
| ft | feet |
| MCL | Primary Maximum Contaminant Level for Ground Water |
| N/A | not applicable |
| NUFT | Non-isothermal, Unsaturated Flow and Transport model |
| pCi/g | picoCuries per gram |




| **Abbreviations** | |
|---|---|
| COC | constituent of concern |
| GW | ground water |
| PRG | preliminary remediation goal (US EPA) |
| RA | removal action |
| RAOs | removal action objectives |
| RPM | Remedial Project Manager |

Figure 6-1. Western Dog Pens Area Removal Action Phase II Data Evaluation Decision Flow Diagram

*Weiss Associates*

01/07/02

4007-523-10.ai

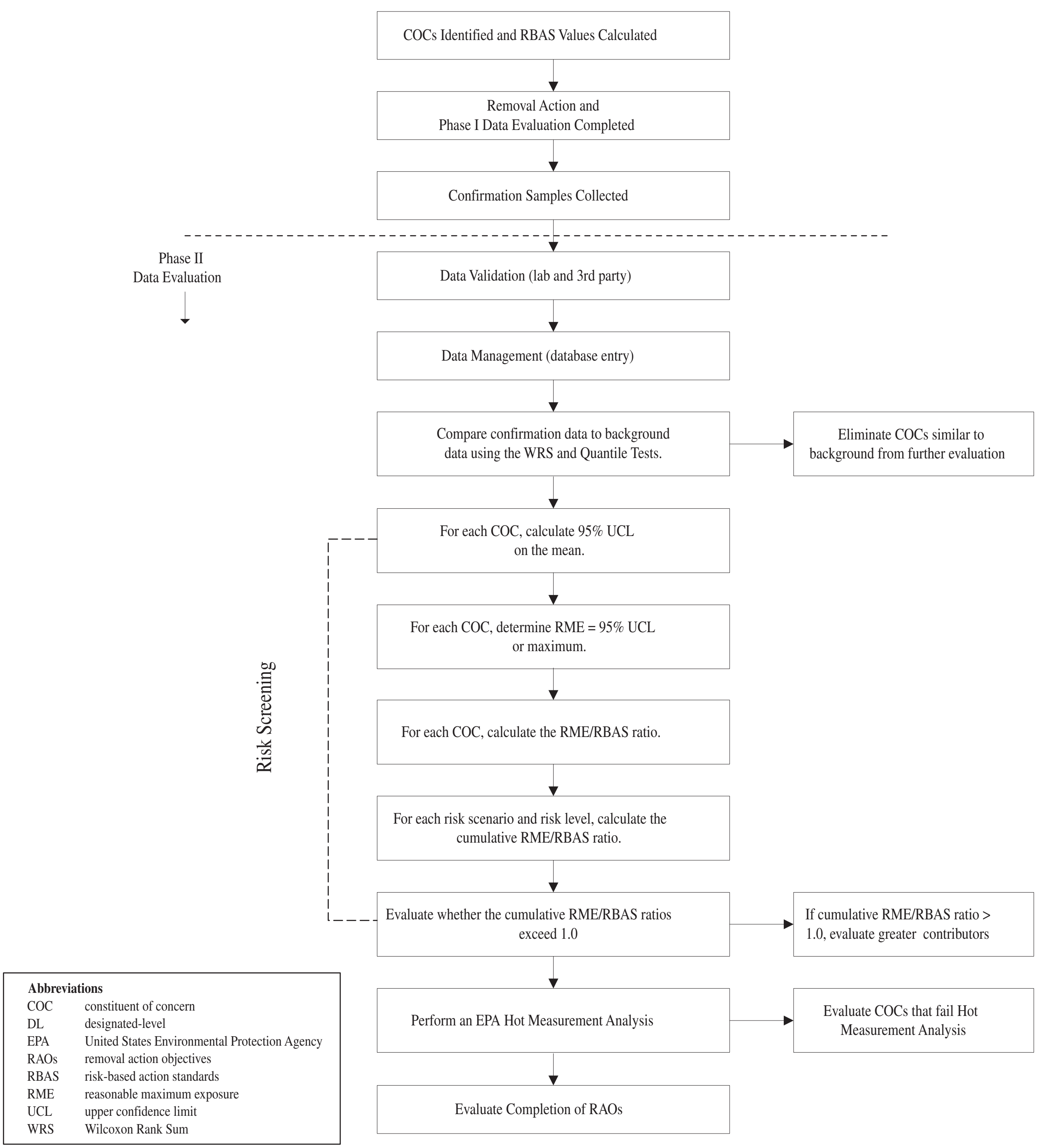



Figure 6-2. Western Dog Pens Data Evaluation Process

Weiss Associates

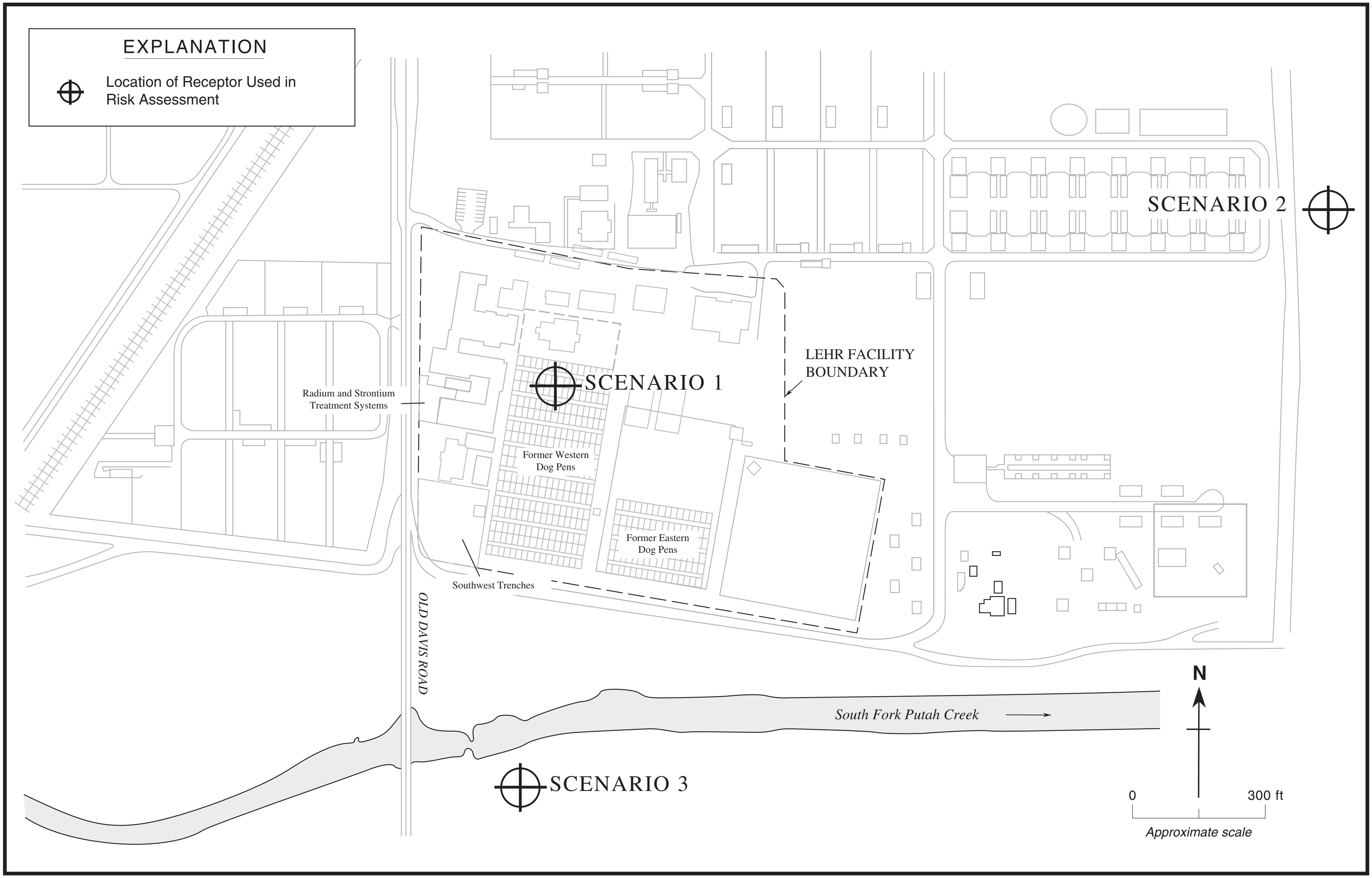



Figure 6-3. Western Dog Pens Locations of Receptors for Risk Scenarios 1,2, and 3

Weiss Associates

4007-523-12.ai

01/07/02

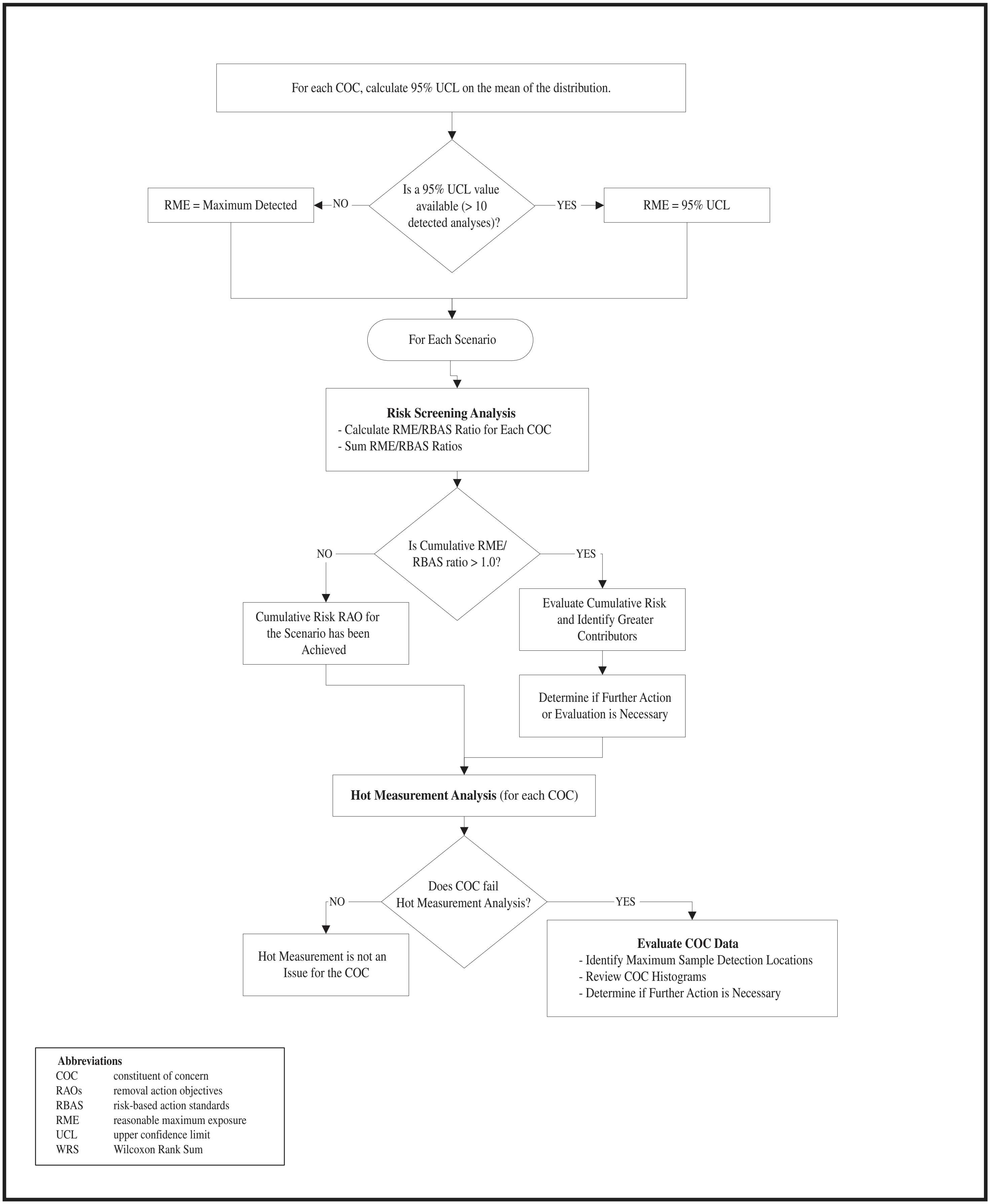



Figure 6-4. Domestic Septic Systems 3 and 6 Confirmation Risk Screening Analysis Decision Flow Chart

Weiss Associates

4007-534-04.ai 8/5/02

# 7. REMOVAL ACTION COMPLETION ANALYSIS

In the EE/CA, (WA, 2001c), six objectives were defined for the WDPs RA. 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 WDPs area to the nominal range of $10^{-4}$ to $10^{-6}$ using $10^{-6}$ as the point of departure. As discussed in Section 6.3.3, the post-RA excess cumulative cancer risk is below $10^{-6}$. Therefore, this objective has been attained.

## 7.2 Removal Action Objective 2–Reduce Non-Cancer Hazard Quotient

The second RAO was to reduce the non-cancer HQ below 1.0. As discussed in Section 6.3.3.2, this RAO has been attained for all COCs. Therefore this RAO has been attained.

## 7.3 Removal Action Objective 3–Mitigate Ground Water Impact

The third RAO was to mitigate potential future impacts to ground water associated with residual COC concentrations in soil. The ground water impact evaluation indicated that potentially above-background constituents in the WDPs soil will not impact underlying ground water in concentrations above target (WA, 2001c). However, subsequent DL analyses of the confirmation sample results suggest that mercury exceeds the allowable DL concentration. The estimated time required for this impact to occur is almost 6,000 years. This RAO has been obtained with this exception.

## 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 (fencing) 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.

## 7.5 Removal Action Objective 5–Minimize Disruption to University Research

The fifth RAO is to minimize disruption to University research activities while conducting the RA. The RA implemented at the WDPs area during the summer of 2001 did not significantly disrupt University research. Therefore this objective has been attained.

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# APPENDIX A

## WESTERN DOG PENS RADIOLOGICAL FIELD SURVEY

# A. WESTERN DOG PENS RADIOLOGICAL FIELD SURVEY

At the completion of excavation and sampling activities in the WDPs area, a 100% surface scan was performed to identify any localized areas of elevated surface radioactivity. The constituents of concern in the WDPs area surface scan were strontium-90 (Sr-90) and radium-226 (Ra-226).

## A.1 Remedial Action Goals

Derived Concentration Guideline Level Elevated Measurement Comparison ($DCGL_{EMC}$) values were derived for radium-226 and strontium-90 using methodologies from the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) (NRC, 1997a), and NUREG-1505, A Nonparametric Statistical Methodology for the Design and Analysis of Final Status Decommissioning Surveys (NRC, 1997b). The Ra-226 $DCGL_{EMC}$ (1.42 pCi/g) was the product of native background and the area factor (1.89) obtained from Table 5.6 of MARSSIM. The Sr-90 $DCGL_{EMC}$ (1,900 pCi/g) was the product of its LEHR risk based action standard (100 pCi/g based on $10^{-5}$ risk) and the area factor (19) obtained from Figure 8.2 of NUREG-1505. Sr-90 background (0.054 pCi/g) was not used as a basis for the $DCGL_{EMC}$ because it cannot be detected with field screening instruments. Both area factors were based on the 25 foot by 25 foot grid system used to guide the WDPs area surface scan.

## A.2 Instrumentation

A cart-mounted gas proportional detector (Ludlum 43-37) was selected to scan for elevated Sr-90 activity in surface soil. A two-inch by two-inch sodium iodide (NaI) detector was used to scan for elevated Ra-226 activities. The scan minimum detectable concentrations for Ra-226 using the NaI detector and Sr-90 using the gas proportional detector were 1.42 pCi/g and 367 pCi/g, respectively. The associated calculations and assumptions for the gas proportional counter and NaI detector are provided in Table A-1.

## A.3 Background Count Rates

Thirty background count rate measurements were collected using the NaI and gas proportional detectors. The average background count rate for the NaI detector was 6,456 counts per minute (cpm) and the average background count rate for the proportional detector was 689 cpm.

## A.4 Field Procedure

Operation of the instrumentation was conducted in accordance with manufacturer operating instructions. Both detectors were used with Ludlum rate-meters, containing audio as well as meter response. A field survey crew consisting of two radiological control technicians (RCTs) scanned the entire surface of the WDPs at a speed no greater than four inches per second with the cart-mounted gas proportional detector. The WDPs were also surveyed at a speed no greater than 0.5 meters per second with the NaI detector. The distance between the detector and the WDPs surface was 0.25 to 0.50 inches (in.) for the proportional detector and approximately 2.5 in. for the NaI detector. This survey utilized the same 25-ft by 25-ft grid system that was established throughout the RA area as the horizontal coordinate reference system for marking and locating sample locations in the field. The grid was physically marked over the entire WDPs area. The surveyors recorded the average count rate for each square of the grid.

## A.5 Results

The gamma scan count rate for the WDPs area surface scan ranged from 5,721 cpm to 6,882 cpm. Following the elevated measurement comparison procedures in Section 8 of NUREG-1505, the mean background value (6,456 cpm) was subtracted from the gamma scan results. The maximum scan result after background subtraction corresponded to 0.497 pCi/g, which was below the 1.42 pCi/g $DCGL_{EMC}$.

Without background subtraction, the maximum beta scan measurement (812 cpm) corresponded to approximately 1,060 pCi/g, which was below the Sr-90 $DCGL_{EMC}$ of 1,910 pCi/g.

Based on this comparison of survey results to $DCGL_{EMC}$ values, no localized areas of elevated radiological activity are present in the WDPs area.

## A.6 References

Nuclear Regulatory Commission (NRC) 1997a, Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), NUREG-1575, EPA 402-R-97-016, NRC, Washington, D.C., December 1997.

NRC 1997b, A Nonparametric Statistical Methodology for the Design and Analysis of Final Status Decommissioning Surveys, NUREG-1505, NRC, Washington, D.C., July 1997.

# Table A-1. Radiological Field Survey, Scan Minimum Detectable Concentrations

| **Radionuclide:** | **Radium-226** |
|---|---|
| *Instrument* | 2x2 sodium iodide detector, Ludlum 44-10 |
| *Background* | 6,456 cpm (actual 2001 background count rate) |
| *Minimum detectable count rate surveyor* | 1,210 cpm |
| *Minimum detectable exposure rate* | (1,210 cpm)/(760 cpm/µR/hr) = 1.6 µR/hr |
| *Scan minimum detectable concentration* | 50 pCi/g (1.6 µR/hr/56.4 µR/hr) = 1.42 pCi/g Ra-226 + progeny |
| *Assumption* | Microshield conversion consistent with assumed inputs shown in United States Nuclear Regulatory Guide 1507. |

| **Radionuclide:** | **Strontium-90** | | |
|---|---|---|---|
| *Instrument* | Ludlum 43-37 gas proportional detector | | |
| *Scan minimum detectable concentration* | =281 cpm / (0.71)(0.14)(0.52)(5.73) = 949 dpm/100 $cm^2$ = 428 pCi/100 $cm^2$ | | |
| | Where: | | |
| | Background | = | 689 cpm (actual) |
| | Minimum Detectable Count Rate | = | 281 cpm |
| | surveyor efficiency | = | 0.5 (square root (0.71), shown above) |
| | surface efficiency | = | 0.52 |
| | actual efficiency (equiv. strontium/yttrium 90) | = | 14% |
| | probe area correction to 100 $cm^2$ | = | 5.73 |
| *Assumption* | The surface soil type in the Western Dog Pens was classified as clayey sandy silt. Silt and clay materials are particles passing a No. 200 sieve (diameter = 0.0075 cm). | | |
| *Given a layer of 0.0075 cm diameter spheres in a triangular array, the conversion factor formula from pCi/$cm^2$ to pCi/g is:* | Array surface area per particle ($cm^2$)/(particle density (g/$cm^3$) * particle volume) = 85.8 $cm^2$/g | | |
| | Where: | | |
| | d | = | the particle diameter |
| | Array surface area per particle | = | d^$^2$ * sin (60 deg) = 4.87 E-5 $cm^2$ |
| | particle density | = | 2.57 g/$cm^3$ (Battelle, 1996) |
| | particle volume | = | d^$^3$ * pi/6 = 2.21 E-7 $cm^3$ |
| *Sr-90 scan minimum detectable concentration in pCi/g* | = (428 pCi/100 $cm^2$) * 85.8 $cm^2$/g = 367 pCi/g | | |

**Reference**

Battelle, 1996. Hydraulic Properties of LEHR/UC Davis Soil Samples

**Abbreviations**

| | |
|---|---|
| cm | centimeter |
| cpm | counts per minute |
| dpm | disintegrations per minute |
| g | gram |
| pCi/g | picoCurie per gram |
| µR/hr | microRoentgen per hour |

# APPENDIX B

## IMPORT BACKFILL ANALYTICAL RESULTS

# Table 1. Import Fill Data and Comparisons to Background and Risk-Based Action Standard

| PCLASS | LAB_CHEM | SAMP_ID | RBAS | Background | Risk/DL Comparison | Concentration | DL_FLAG | ERROR | DET_LIMIT | UNITS | ER_Q |
|---|---|---|---|---|---|---|---|---|---|---|---|
| GEN | Hexavalent Chromium | SSIBF148 | 3.8 | 0.054 | Pass[l] | 0.134 | | | 0.0361 | mg/kg | UJ |
| GEN | Hexavalent Chromium | SSIBF149 | 3.8 | 0.054 | Pass[l] | 0.145 | | | 0.0363 | mg/kg | UJ |
| GEN | Hexavalent Chromium | SSIBF151 | 3.8 | 0.054 | Pass[l] | 0.0628 | | | 0.0366 | mg/kg | UJ |
| GEN | Hexavalent Chromium | SSIBF152 | 3.8 | 0.054 | Pass[l] | 0.196 | | | 0.0361 | mg/kg | UJ |
| GEN | Hexavalent Chromium | SSIBF153 | 3.8 | 0.054 | Pass[l] | | < | | 0.0364 | mg/kg | UJ |
| GEN | Nitrate | SSIBF148 | | 36 | Pass[b] | 25.9 | | | 0.517 | mg/kg | |
| GEN | Nitrate | SSIBF149 | | 36 | Pass[b] | 3.68 | | | 0.517 | mg/kg | |
| GEN | Nitrate | SSIBF151 | | 36 | Pass[b] | 7.87 | | | 0.512 | mg/kg | |
| GEN | Nitrate | SSIBF152 | | 36 | Pass[b] | 3.82 | | | 0.514 | mg/kg | |
| GEN | Nitrate | SSIBF153 | | 36 | Pass[b] | 7.99 | | | 0.513 | mg/kg | |
| METAL | Antimony | SSIBF148 | 0.30 | 1.4 | m | | < | | 0.512 | mg/kg | R |
| METAL | Antimony | SSIBF149 | 0.30 | 1.4 | m | | < | | 0.527 | mg/kg | R |
| METAL | Antimony | SSIBF151 | 0.30 | 1.4 | m | | < | | 0.525 | mg/kg | R |
| METAL | Antimony | SSIBF152 | 0.30 | 1.4 | m | | < | | 0.526 | mg/kg | R |
| METAL | Antimony | SSIBF153 | 0.30 | 1.4 | m | | < | | 0.516 | mg/kg | R |
| METAL | Arsenic | SSIBF148 | | 8.14 | Pass[b] | 7.85 | | | 0.262 | mg/kg | |
| METAL | Arsenic | SSIBF149 | | 8.14 | Pass[b] | 7.82 | | | 0.269 | mg/kg | |
| METAL | Arsenic | SSIBF151 | | 8.14 | Pass[k] | 8.29 | | | 0.268 | mg/kg | |
| METAL | Arsenic | SSIBF152 | | 8.14 | Pass[b] | 7.57 | | | 0.269 | mg/kg | |
| METAL | Arsenic | SSIBF153 | | 8.14 | Pass[k] | 8.25 | | | 0.264 | mg/kg | |
| METAL | Barium | SSIBF148 | 53 | 211 | Pass[b] | 196 | | | 0.025 | mg/kg | |
| METAL | Barium | SSIBF150 | 53 | 211 | Pass[b] | 200 | | | 0.025 | mg/kg | |
| METAL | Barium | SSIBF151 | 53 | 211 | Pass[b] | 205 | | | 0.026 | mg/kg | |
| METAL | Barium | SSIBF152 | 53 | 211 | Pass[b] | 196 | | | 0.026 | mg/kg | |
| METAL | Barium | SSIBF153 | 53 | 211 | Pass[b] | 202 | | | 0.025 | mg/kg | |
| METAL | Beryllium | SSIBF148 | | 0.564 | Pass[b] | 0.464 | | | 0.021 | mg/kg | |
| METAL | Beryllium | SSIBF150 | | 0.564 | Pass[b] | 0.454 | | | 0.021 | mg/kg | |
| METAL | Beryllium | SSIBF151 | | 0.564 | Pass[b] | 0.468 | | | 0.022 | mg/kg | |
| METAL | Beryllium | SSIBF152 | | 0.564 | Pass[b] | 0.449 | | | 0.022 | mg/kg | |
| METAL | Beryllium | SSIBF153 | | 0.564 | Pass[b] | 0.459 | | | 0.022 | mg/kg | |
| METAL | Cadmium | SSIBF148 | 0.38 | 0.51 | Pass[b] | 0.352 | | | 0.042 | mg/kg | |
| METAL | Cadmium | SSIBF150 | 0.38 | 0.51 | Pass[b] | 0.395 | | | 0.041 | mg/kg | |
| METAL | Cadmium | SSIBF151 | 0.38 | 0.51 | Pass[b] | 0.426 | | | 0.043 | mg/kg | |
| METAL | Cadmium | SSIBF152 | 0.38 | 0.51 | Pass[b] | 0.435 | | | 0.043 | mg/kg | |
| METAL | Cadmium | SSIBF153 | 0.38 | 0.51 | Pass[b] | 0.473 | | | 0.042 | mg/kg | |
| METAL | Chromium | SSIBF148 | 722 | 199 | Pass[b] | 103 | | | 0.058 | mg/kg | |

## Table 1. Import Fill Data and Comparisons to Background and Risk-Based Action Standard (continued)

| PCLASS | LAB_CHEM | SAMP_ID | RBAS | Background | Risk/DL Comparison | Concentration | DL_FLAG | ERROR | DET_LIMIT | UNITS | ER_Q |
|---|---|---|---|---|---|---|---|---|---|---|---|
| METAL | Chromium | SSIBF150 | 722 | 199 | Pass[b] | 98.9 | | | 0.057 | mg/kg | |
| METAL | Chromium | SSIBF151 | 722 | 199 | Pass[b] | 102 | | | 0.059 | mg/kg | |
| METAL | Chromium | SSIBF152 | 722 | 199 | Pass[b] | 104 | | | 0.059 | mg/kg | |
| METAL | Chromium | SSIBF153 | 722 | 199 | Pass[b] | 99 | | | 0.058 | mg/kg | |
| METAL | Cobalt | SSIBF148 | | 31 | Pass[b] | 19.9 | | | 0.074 | mg/kg | |
| METAL | Cobalt | SSIBF150 | | 31 | Pass[b] | 19.6 | | | 0.073 | mg/kg | |
| METAL | Cobalt | SSIBF151 | | 31 | Pass[b] | 20 | | | 0.076 | mg/kg | |
| METAL | Cobalt | SSIBF152 | | 31 | Pass[b] | 19.3 | | | 0.076 | mg/kg | |
| METAL | Cobalt | SSIBF153 | | 31 | Pass[b] | 19.8 | | | 0.075 | mg/kg | |
| METAL | Copper | SSIBF148 | 28 | 48.8 | Pass[b] | 43 | | | 0.103 | mg/kg | |
| METAL | Copper | SSIBF150 | 28 | 48.8 | Pass[b] | 43.6 | | | 0.102 | mg/kg | |
| METAL | Copper | SSIBF151 | 28 | 48.8 | Pass[b] | 44.4 | | | 0.105 | mg/kg | |
| METAL | Copper | SSIBF152 | 28 | 48.8 | Pass[b] | 41.8 | | | 0.105 | mg/kg | |
| METAL | Copper | SSIBF153 | 28 | 48.8 | Pass[b] | 43.6 | | | 0.103 | mg/kg | |
| METAL | Iron | SSIBF148 | | 44000 | Pass[b] | 36200 | | | 2.26 | mg/kg | |
| METAL | Iron | SSIBF150 | | 44000 | Pass[b] | 37800 | | | 2.23 | mg/kg | |
| METAL | Iron | SSIBF151 | | 44000 | Pass[b] | 38400 | | | 2.31 | mg/kg | |
| METAL | Iron | SSIBF152 | | 44000 | Pass[b] | 37800 | | | 2.32 | mg/kg | |
| METAL | Iron | SSIBF153 | | 44000 | Pass[b] | 38400 | | | 2.27 | mg/kg | |
| METAL | Lead | SSIBF148 | 0.044 | 9.5 | Pass[b] | 6.95 | | | 0.245 | mg/kg | |
| METAL | Lead | SSIBF150 | 0.044 | 9.5 | Pass[b] | 7.12 | | | 0.242 | mg/kg | |
| METAL | Lead | SSIBF151 | 0.044 | 9.5 | Pass[b] | 7.21 | | | 0.251 | mg/kg | |
| METAL | Lead | SSIBF152 | 0.044 | 9.5 | Pass[b] | 6.86 | | | 0.251 | mg/kg | |
| METAL | Lead | SSIBF153 | 0.044 | 9.5 | Pass[b] | 7.18 | | | 0.247 | mg/kg | |
| METAL | Manganese | SSIBF148 | 36 | 750 | Pass[b] | 652 | | | 0.037 | mg/kg | |
| METAL | Manganese | SSIBF150 | 36 | 750 | Pass[b] | 654 | | | 0.037 | mg/kg | |
| METAL | Manganese | SSIBF151 | 36 | 750 | Pass[b] | 666 | | | 0.038 | mg/kg | |
| METAL | Manganese | SSIBF152 | 36 | 750 | Pass[b] | 645 | | | 0.038 | mg/kg | |
| METAL | Manganese | SSIBF153 | 36 | 750 | Pass[b] | 653 | | | 0.038 | mg/kg | |
| METAL | Mercury | SSIBF148 | 0 | 3.94 | Pass[b] | 0.12 | | | 0 | mg/kg | |
| METAL | Mercury | SSIBF149 | 0 | 3.94 | Pass[b] | 0.1 | | | 0 | mg/kg | |
| METAL | Mercury | SSIBF151 | 0 | 3.94 | Pass[b] | 0.1 | | | 0 | mg/kg | |
| METAL | Mercury | SSIBF152 | 0 | 3.94 | Pass[b] | 0.05 | | | 0 | mg/kg | |
| METAL | Mercury | SSIBF153 | 0 | 3.94 | Pass[b] | 0.07 | | | 0 | mg/kg | |
| METAL | Molybdenum | SSIBF148 | | 0.26 | Pass[k] | 0.461 | | | 0.117 | mg/kg | |
| METAL | Molybdenum | SSIBF150 | | 0.26 | Pass[b] | 0.258 | | | 0.116 | mg/kg | |

## Table 1. Import Fill Data and Comparisons to Background and Risk-Based Action Standard (continued)

| PCLASS | LAB_CHEM | SAMP_ID | RBAS | Background | Risk/DL Comparison | Concentration | DL_FLAG | ERROR | DET_LIMIT | UNITS | ER_Q |
|---|---|---|---|---|---|---|---|---|---|---|---|
| METAL | Molybdenum | SSIBF151 | | 0.26 | Pass[k] | 0.315 | | | 0.12 | mg/kg | |
| METAL | Molybdenum | SSIBF152 | | 0.26 | Pass[k] | 0.435 | | | 0.12 | mg/kg | |
| METAL | Molybdenum | SSIBF153 | | 0.26 | Pass[k] | 0.356 | | | 0.118 | mg/kg | |
| METAL | Nickel | SSIBF148 | | 334 | Pass[b] | 159 | | | 0.127 | mg/kg | |
| METAL | Nickel | SSIBF150 | | 334 | Pass[b] | 155 | | | 0.126 | mg/kg | |
| METAL | Nickel | SSIBF151 | | 334 | Pass[b] | 158 | | | 0.13 | mg/kg | |
| METAL | Nickel | SSIBF152 | | 334 | Pass[b] | 154 | | | 0.13 | mg/kg | |
| METAL | Nickel | SSIBF153 | | 334 | Pass[b] | 156 | | | 0.128 | mg/kg | |
| METAL | Selenium | SSIBF148 | 58 | 1.2 | Pass[a] | 1.84 | | | 0.352 | mg/kg | |
| METAL | Selenium | SSIBF150 | 58 | 1.2 | Pass[a] | 1.87 | | | 0.348 | mg/kg | |
| METAL | Selenium | SSIBF151 | 58 | 1.2 | Pass[a] | 1.21 | | | 0.361 | mg/kg | |
| METAL | Selenium | SSIBF152 | 58 | 1.2 | Pass[a] | 1.36 | | | 0.361 | mg/kg | |
| METAL | Selenium | SSIBF153 | 58 | 1.2 | Pass[a] | 1.23 | | | 0.354 | mg/kg | |
| METAL | Silver | SSIBF148 | 3.8 | 0.55 | Pass[b] | | < | | 0.067 | mg/kg | |
| METAL | Silver | SSIBF149 | 3.8 | 0.55 | Pass[b] | | < | | 0.069 | mg/kg | |
| METAL | Silver | SSIBF151 | 3.8 | 0.55 | Pass[b] | | < | | 0.069 | mg/kg | |
| METAL | Silver | SSIBF152 | 3.8 | 0.55 | Pass[b] | | < | | 0.069 | mg/kg | |
| METAL | Silver | SSIBF153 | 3.8 | 0.55 | Pass[b] | | < | | 0.068 | mg/kg | |
| METAL | Thallium | SSIBF148 | | 1.6 | Pass[c] | | < | | 4.97 | mg/kg | |
| METAL | Thallium | SSIBF149 | | 1.6 | Pass[c] | | < | | 5.11 | mg/kg | |
| METAL | Thallium | SSIBF151 | | 1.6 | Pass[c] | | < | | 5.09 | mg/kg | |
| METAL | Thallium | SSIBF152 | | 1.6 | Pass[c] | | < | | 5.1 | mg/kg | |
| METAL | Thallium | SSIBF153 | | 1.6 | Pass[c] | | < | | 5 | mg/kg | |
| METAL | Vanadium | SSIBF148 | | 66.8 | Pass[c] | 71.4 | | | 0.049 | mg/kg | |
| METAL | Vanadium | SSIBF150 | | 66.8 | Pass[c] | 73.2 | | | 0.048 | mg/kg | |
| METAL | Vanadium | SSIBF151 | | 66.8 | Pass[c] | 75.5 | | | 0.05 | mg/kg | |
| METAL | Vanadium | SSIBF152 | | 66.8 | Pass[c] | 72.6 | | | 0.05 | mg/kg | |
| METAL | Vanadium | SSIBF153 | | 66.8 | Pass[c] | 73.6 | | | 0.049 | mg/kg | |
| METAL | Zinc | SSIBF148 | 3400 | 72.4 | Pass[a] | 77.9 | | | 0.05 | mg/kg | |
| METAL | Zinc | SSIBF150 | 3400 | 72.4 | Pass[a] | 81.3 | | | 0.049 | mg/kg | |
| METAL | Zinc | SSIBF151 | 3400 | 72.4 | Pass[a] | 82.8 | | | 0.051 | mg/kg | |
| METAL | Zinc | SSIBF152 | 3400 | 72.4 | Pass[a] | 79.4 | | | 0.051 | mg/kg | |
| METAL | Zinc | SSIBF153 | 3400 | 72.4 | Pass[a] | 81.9 | | | 0.05 | mg/kg | |
| PES | 4,4'-DDD | SSIBF148 | 7948 | | Pass[f] | | < | | 3.4 | µg/kg | UJ |
| PES | 4,4'-DDD | SSIBF149 | 7948 | | Pass[f] | | < | | 3.4 | µg/kg | UJ |
| PES | 4,4'-DDD | SSIBF151 | 7948 | | Pass[f] | | < | | 3.4 | µg/kg | UJ |

Table 1. Import Fill Data and Comparisons to Background and Risk-Based Action Standard (continued)

| PCLASS | LAB_CHEM | SAMP_ID | RBAS | Background | Risk/DL Comparison | Concentration | DL_FLAG | ERROR | DET_LIMIT | UNITS | ER_Q |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PES | 4,4'-DDD | SSIBF152 | 7948 | | Pass[f] | | < | | 3.4 | µg/kg | UJ |
| PES | 4,4'-DDD | SSIBF153 | 7948 | | Pass[f] | | < | | 3.4 | µg/kg | UJ |
| PES | 4,4'-DDE | SSIBF148 | 5611 | | Pass[d] | 0.83 | | | 3.4 | µg/kg | J |
| PES | 4,4'-DDE | SSIBF150 | 5611 | | Pass[d] | 1.1 | | | 3.4 | µg/kg | J |
| PES | 4,4'-DDE | SSIBF151 | 5611 | | Pass[d] | 0.59 | | | 3.4 | µg/kg | J |
| PES | 4,4'-DDE | SSIBF152 | 5611 | | Pass[d] | 0.63 | | | 3.4 | µg/kg | J |
| PES | 4,4'-DDE | SSIBF153 | 5611 | | Pass[d] | 0.6 | | | 3.4 | µg/kg | J |
| PES | 4,4'-DDT | SSIBF148 | 5611 | | Pass[f] | | < | | 3.4 | µg/kg | UJ |
| PES | 4,4'-DDT | SSIBF149 | 5611 | | Pass[f] | | < | | 3.4 | µg/kg | UJ |
| PES | 4,4'-DDT | SSIBF151 | 5611 | | Pass[f] | | < | | 3.4 | µg/kg | UJ |
| PES | 4,4'-DDT | SSIBF152 | 5611 | | Pass[f] | | < | | 3.4 | µg/kg | UJ |
| PES | 4,4'-DDT | SSIBF153 | 5611 | | Pass[f] | | < | | 3.4 | µg/kg | UJ |
| PES | Aldrin | SSIBF148 | | | Pass[e] | | < | | 1.8 | µg/kg | UJ |
| PES | Aldrin | SSIBF149 | | | Pass[e] | | < | | 1.8 | µg/kg | UJ |
| PES | Aldrin | SSIBF151 | | | Pass[e] | | < | | 1.8 | µg/kg | UJ |
| PES | Aldrin | SSIBF152 | | | Pass[e] | | < | | 1.8 | µg/kg | UJ |
| PES | Aldrin | SSIBF153 | | | Pass[e] | | < | | 1.8 | µg/kg | UJ |
| PES | alpha-BHC | SSIBF148 | 7.5 | | Pass[f] | | < | | 0.69 | µg/kg | UJ |
| PES | alpha-BHC | SSIBF149 | 7.5 | | Pass[f] | | < | | 0.7 | µg/kg | UJ |
| PES | alpha-BHC | SSIBF151 | 7.5 | | Pass[f] | | < | | 0.69 | µg/kg | UJ |
| PES | alpha-BHC | SSIBF152 | 7.5 | | Pass[f] | | < | | 0.69 | µg/kg | UJ |
| PES | alpha-BHC | SSIBF153 | 7.5 | | Pass[f] | | < | | 0.7 | µg/kg | UJ |
| PES | alpha-Chlordane | SSIBF148 | 800.0 | | Pass[f] | | < | | 1.8 | µg/kg | UJ |
| PES | alpha-Chlordane | SSIBF149 | 800.0 | | Pass[f] | | < | | 1.8 | µg/kg | UJ |
| PES | alpha-Chlordane | SSIBF151 | 800.0 | | Pass[f] | | < | | 1.8 | µg/kg | UJ |
| PES | alpha-Chlordane | SSIBF152 | 800.0 | | Pass[f] | | < | | 1.8 | µg/kg | UJ |
| PES | alpha-Chlordane | SSIBF153 | 800.0 | | Pass[f] | | < | | 1.8 | µg/kg | UJ |
| PES | Aroclor-1016 | SSIBF148 | | | Pass[e] | | < | | 34.2 | µg/kg | UJ |
| PES | Aroclor-1016 | SSIBF149 | | | Pass[e] | | < | | 34.6 | µg/kg | UJ |
| PES | Aroclor-1016 | SSIBF151 | | | Pass[e] | | < | | 34.5 | µg/kg | UJ |
| PES | Aroclor-1016 | SSIBF152 | | | Pass[e] | | < | | 34.2 | µg/kg | UJ |
| PES | Aroclor-1016 | SSIBF153 | | | Pass[e] | | < | | 34.5 | µg/kg | UJ |
| PES | Aroclor-1221 | SSIBF148 | | | Pass[e] | | < | | 69.4 | µg/kg | UJ |
| PES | Aroclor-1221 | SSIBF149 | | | Pass[e] | | < | | 70 | µg/kg | UJ |
| PES | Aroclor-1221 | SSIBF151 | | | Pass[e] | | < | | 69.8 | µg/kg | UJ |
| PES | Aroclor-1221 | SSIBF152 | | | Pass[e] | | < | | 69.2 | µg/kg | UJ |

Table 1. Import Fill Data and Comparisons to Background and Risk-Based Action Standard (continued)

| PCLASS | LAB_CHEM | SAMP_ID | RBAS | Background | Risk/DL Comparison | Concentration | DL_FLAG | ERROR | DET_LIMIT | UNITS | ER_Q |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PES | Aroclor-1221 | SSIBF153 | | | Pass[e] | | < | | 69.9 | µg/kg | UJ |
| PES | Aroclor-1232 | SSIBF148 | | | Pass[e] | | < | | 34.2 | µg/kg | UJ |
| PES | Aroclor-1232 | SSIBF149 | | | Pass[e] | | < | | 34.6 | µg/kg | UJ |
| PES | Aroclor-1232 | SSIBF151 | | | Pass[e] | | < | | 34.5 | µg/kg | UJ |
| PES | Aroclor-1232 | SSIBF152 | | | Pass[e] | | < | | 34.2 | µg/kg | UJ |
| PES | Aroclor-1232 | SSIBF153 | | | Pass[e] | | < | | 34.5 | µg/kg | UJ |
| PES | Aroclor-1242 | SSIBF148 | | | Pass[e] | | < | | 34.2 | µg/kg | UJ |
| PES | Aroclor-1242 | SSIBF149 | | | Pass[e] | | < | | 34.6 | µg/kg | UJ |
| PES | Aroclor-1242 | SSIBF151 | | | Pass[e] | | < | | 34.5 | µg/kg | UJ |
| PES | Aroclor-1242 | SSIBF152 | | | Pass[e] | | < | | 34.2 | µg/kg | UJ |
| PES | Aroclor-1242 | SSIBF153 | | | Pass[e] | | < | | 34.5 | µg/kg | UJ |
| PES | Aroclor-1248 | SSIBF148 | | | Pass[e] | | < | | 34.2 | µg/kg | UJ |
| PES | Aroclor-1248 | SSIBF149 | | | Pass[e] | | < | | 34.6 | µg/kg | UJ |
| PES | Aroclor-1248 | SSIBF151 | | | Pass[e] | | < | | 34.5 | µg/kg | UJ |
| PES | Aroclor-1248 | SSIBF152 | | | Pass[e] | | < | | 34.2 | µg/kg | UJ |
| PES | Aroclor-1248 | SSIBF153 | | | Pass[e] | | < | | 34.5 | µg/kg | UJ |
| PES | Aroclor-1254 | SSIBF148 | | | Pass[e] | | < | | 34.2 | µg/kg | UJ |
| PES | Aroclor-1254 | SSIBF149 | | | Pass[e] | | < | | 34.6 | µg/kg | UJ |
| PES | Aroclor-1254 | SSIBF151 | | | Pass[e] | | < | | 34.5 | µg/kg | UJ |
| PES | Aroclor-1254 | SSIBF152 | | | Pass[e] | | < | | 34.2 | µg/kg | UJ |
| PES | Aroclor-1254 | SSIBF153 | | | Pass[e] | | < | | 34.5 | µg/kg | UJ |
| PES | Aroclor-1260 | SSIBF148 | | | Pass[e] | | < | | 34.2 | µg/kg | UJ |
| PES | Aroclor-1260 | SSIBF149 | | | Pass[e] | | < | | 34.6 | µg/kg | UJ |
| PES | Aroclor-1260 | SSIBF151 | | | Pass[e] | | < | | 34.5 | µg/kg | UJ |
| PES | Aroclor-1260 | SSIBF152 | | | Pass[e] | | < | | 34.2 | µg/kg | UJ |
| PES | Aroclor-1260 | SSIBF153 | | | Pass[e] | | < | | 34.5 | µg/kg | UJ |
| PES | beta-BHC | SSIBF148 | | | Pass[e] | | < | | 0.69 | µg/kg | UJ |
| PES | beta-BHC | SSIBF149 | | | Pass[e] | | < | | 0.7 | µg/kg | UJ |
| PES | beta-BHC | SSIBF151 | | | Pass[e] | | < | | 0.69 | µg/kg | UJ |
| PES | beta-BHC | SSIBF152 | | | Pass[e] | | < | | 0.69 | µg/kg | UJ |
| PES | beta-BHC | SSIBF153 | | | Pass[e] | | < | | 0.7 | µg/kg | UJ |
| PES | Chlordane (tech.) | SSIBF148 | 780.00 | | Pass[f] | | < | | 8.6 | µg/kg | UJ |
| PES | Chlordane (tech.) | SSIBF149 | 780.00 | | Pass[f] | | < | | 8.7 | µg/kg | UJ |
| PES | Chlordane (tech.) | SSIBF151 | 780.00 | | Pass[f] | | < | | 8.7 | µg/kg | UJ |
| PES | Chlordane (tech.) | SSIBF152 | 780.00 | | Pass[f] | | < | | 8.6 | µg/kg | UJ |
| PES | Chlordane (tech.) | SSIBF153 | 780.00 | | Pass[f] | | < | | 8.7 | µg/kg | UJ |

Table 1. Import Fill Data and Comparisons to Background and Risk-Based Action Standard (continued)

| PCLASS | LAB_CHEM | SAMP_ID | RBAS | Background | Risk/DL Comparison | Concentration | DL_FLAG | ERROR | DET_LIMIT | UNITS | ER_Q |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PES | delta-BHC | SSIBF148 | 13.00 | | Pass[f] | | < | | 1.8 | µg/kg | UJ |
| PES | delta-BHC | SSIBF149 | 13.00 | | Pass[f] | | < | | 1.8 | µg/kg | UJ |
| PES | delta-BHC | SSIBF151 | 13.00 | | Pass[f] | | < | | 1.8 | µg/kg | UJ |
| PES | delta-BHC | SSIBF152 | 13.00 | | Pass[f] | | < | | 1.8 | µg/kg | UJ |
| PES | delta-BHC | SSIBF153 | 13.00 | | Pass[f] | | < | | 1.8 | µg/kg | UJ |
| PES | Dieldrin | SSIBF148 | 15.26 | | Pass[d] | 3.4 | | | 3.4 | µg/kg | J |
| PES | Dieldrin | SSIBF150 | 15.26 | | Pass[d] | 3.4 | | | 3.4 | µg/kg | J |
| PES | Dieldrin | SSIBF151 | 15.26 | | Pass[d] | 1.9 | | | 3.4 | µg/kg | J |
| PES | Dieldrin | SSIBF152 | 15.26 | | Pass[d] | 2.6 | | | 3.4 | µg/kg | J |
| PES | Dieldrin | SSIBF153 | 15.26 | | Pass[d] | 2.6 | | | 3.4 | µg/kg | J |
| PES | Endosulfan I | SSIBF148 | 29000 | | Pass[f] | | < | | 1.8 | µg/kg | UJ |
| PES | Endosulfan I | SSIBF149 | 29000 | | Pass[f] | | < | | 1.8 | µg/kg | UJ |
| PES | Endosulfan I | SSIBF151 | 29000 | | Pass[f] | | < | | 1.8 | µg/kg | UJ |
| PES | Endosulfan I | SSIBF152 | 29000 | | Pass[f] | | < | | 1.8 | µg/kg | UJ |
| PES | Endosulfan I | SSIBF153 | 29000 | | Pass[f] | | < | | 1.8 | µg/kg | UJ |
| PES | Endosulfan II | SSIBF148 | | | Pass[e] | | < | | 3.4 | µg/kg | UJ |
| PES | Endosulfan II | SSIBF149 | | | Pass[e] | | < | | 3.4 | µg/kg | UJ |
| PES | Endosulfan II | SSIBF151 | | | Pass[e] | | < | | 3.4 | µg/kg | UJ |
| PES | Endosulfan II | SSIBF152 | | | Pass[e] | | < | | 3.4 | µg/kg | UJ |
| PES | Endosulfan II | SSIBF153 | | | Pass[e] | | < | | 3.4 | µg/kg | UJ |
| PES | Endosulfan sulfate | SSIBF148 | 26000 | | Pass[f] | | < | | 3.4 | µg/kg | UJ |
| PES | Endosulfan sulfate | SSIBF149 | 26000 | | Pass[f] | | < | | 3.4 | µg/kg | UJ |
| PES | Endosulfan sulfate | SSIBF151 | 26000 | | Pass[f] | | < | | 3.4 | µg/kg | UJ |
| PES | Endosulfan sulfate | SSIBF152 | 26000 | | Pass[f] | | < | | 3.4 | µg/kg | UJ |
| PES | Endosulfan sulfate | SSIBF153 | 26000 | | Pass[f] | | < | | 3.4 | µg/kg | UJ |
| PES | Endrin | SSIBF148 | | | Pass[e] | | < | | 3.4 | µg/kg | UJ |
| PES | Endrin | SSIBF149 | | | Pass[e] | | < | | 3.4 | µg/kg | UJ |
| PES | Endrin | SSIBF151 | | | Pass[e] | | < | | 3.4 | µg/kg | UJ |
| PES | Endrin | SSIBF152 | | | Pass[e] | | < | | 3.4 | µg/kg | UJ |
| PES | Endrin | SSIBF153 | | | Pass[e] | | < | | 3.4 | µg/kg | UJ |
| PES | Endrin aldehyde | SSIBF148 | | | Pass[e] | | < | | 3.4 | µg/kg | UJ |
| PES | Endrin aldehyde | SSIBF149 | | | Pass[e] | | < | | 3.4 | µg/kg | UJ |
| PES | Endrin aldehyde | SSIBF151 | | | Pass[e] | | < | | 3.4 | µg/kg | UJ |
| PES | Endrin aldehyde | SSIBF152 | | | Pass[e] | | < | | 3.4 | µg/kg | UJ |
| PES | Endrin aldehyde | SSIBF153 | | | Pass[e] | | < | | 3.4 | µg/kg | UJ |
| PES | Endrin ketone | SSIBF148 | | | Pass[e] | | < | | 3.4 | µg/kg | UJ |

Table 1. Import Fill Data and Comparisons to Background and Risk-Based Action Standard (continued)

| PCLASS | LAB_CHEM | SAMP_ID | RBAS | Background | Risk/DL Comparison | Concentration | DL_FLAG | ERROR | DET_LIMIT | UNITS | ER_Q |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PES | Endrin ketone | SSIBF149 | | | Pass[e] | | < | | 3.4 | µg/kg | UJ |
| PES | Endrin ketone | SSIBF151 | | | Pass[e] | | < | | 3.4 | µg/kg | UJ |
| PES | Endrin ketone | SSIBF152 | | | Pass[e] | | < | | 3.4 | µg/kg | UJ |
| PES | Endrin ketone | SSIBF153 | | | Pass[e] | | < | | 3.4 | µg/kg | UJ |
| PES | gamma-BHC (Lindane) | SSIBF148 | 30 | | Pass[f] | | < | | 1.8 | µg/kg | UJ |
| PES | gamma-BHC (Lindane) | SSIBF149 | 30 | | Pass[f] | | < | | 1.8 | µg/kg | UJ |
| PES | gamma-BHC (Lindane) | SSIBF151 | 30 | | Pass[f] | | < | | 1.8 | µg/kg | UJ |
| PES | gamma-BHC (Lindane) | SSIBF152 | 30 | | Pass[f] | | < | | 1.8 | µg/kg | UJ |
| PES | gamma-BHC (Lindane) | SSIBF153 | 30 | | Pass[f] | | < | | 1.8 | µg/kg | UJ |
| PES | gamma-Chlordane | SSIBF148 | 810 | | Pass[f] | | < | | 1.8 | µg/kg | UJ |
| PES | gamma-Chlordane | SSIBF149 | 810 | | Pass[f] | | < | | 1.8 | µg/kg | UJ |
| PES | gamma-Chlordane | SSIBF151 | 810 | | Pass[f] | | < | | 1.8 | µg/kg | UJ |
| PES | gamma-Chlordane | SSIBF152 | 810 | | Pass[f] | | < | | 1.8 | µg/kg | UJ |
| PES | gamma-Chlordane | SSIBF153 | 810 | | Pass[f] | | < | | 1.8 | µg/kg | UJ |
| PES | Heptachlor | SSIBF148 | 170 | | Pass[f] | | < | | 1.8 | µg/kg | UJ |
| PES | Heptachlor | SSIBF149 | 170 | | Pass[f] | | < | | 1.8 | µg/kg | UJ |
| PES | Heptachlor | SSIBF151 | 170 | | Pass[f] | | < | | 1.8 | µg/kg | UJ |
| PES | Heptachlor | SSIBF152 | 170 | | Pass[f] | | < | | 1.8 | µg/kg | UJ |
| PES | Heptachlor | SSIBF153 | 170 | | Pass[f] | | < | | 1.8 | µg/kg | UJ |
| PES | Heptachlor epoxide | SSIBF148 | 1 | | Pass[f] | | < | | 1.8 | µg/kg | UJ |
| PES | Heptachlor epoxide | SSIBF149 | 1 | | Pass[f] | | < | | 1.8 | µg/kg | UJ |
| PES | Heptachlor epoxide | SSIBF151 | 1 | | Pass[f] | | < | | 1.8 | µg/kg | UJ |
| PES | Heptachlor epoxide | SSIBF152 | 1 | | Pass[f] | | < | | 1.8 | µg/kg | UJ |
| PES | Heptachlor epoxide | SSIBF153 | 1 | | Pass[f] | | < | | 1.8 | µg/kg | UJ |
| PES | Methoxychlor | SSIBF148 | 100000 | | Pass[f] | | < | | 17.6 | µg/kg | UJ |
| PES | Methoxychlor | SSIBF149 | 100000 | | Pass[f] | | < | | 17.8 | µg/kg | UJ |
| PES | Methoxychlor | SSIBF151 | 100000 | | Pass[f] | | < | | 17.8 | µg/kg | UJ |
| PES | Methoxychlor | SSIBF152 | 100000 | | Pass[f] | | < | | 17.6 | µg/kg | UJ |
| PES | Methoxychlor | SSIBF153 | 100000 | | Pass[f] | | < | | 17.8 | µg/kg | UJ |
| PES | Toxaphene | SSIBF148 | | | Pass[e] | | < | | 176 | µg/kg | UJ |
| PES | Toxaphene | SSIBF149 | | | Pass[e] | | < | | 178 | µg/kg | UJ |
| PES | Toxaphene | SSIBF151 | | | Pass[e] | | < | | 178 | µg/kg | UJ |
| PES | Toxaphene | SSIBF152 | | | Pass[e] | | < | | 176 | µg/kg | UJ |
| PES | Toxaphene | SSIBF153 | | | Pass[e] | | < | | 178 | µg/kg | UJ |
| RAD | Actinium-228 | SSIBF148 | | 0.633 | Pass[b] | 0.491 | | 0.0784 | 0.00859 | pCi/g | |
| RAD | Actinium-228 | SSIBF149 | | 0.633 | Pass[b] | 0.505 | | 0.0783 | 0.00826 | pCi/g | |

Table 1. Import Fill Data and Comparisons to Background and Risk-Based Action Standard (continued)

| PCLASS | LAB_CHEM | SAMP_ID | RBAS | Background | Risk/DL Comparison | Concentration | DL_FLAG | ERROR | DET_LIMIT | UNITS | ER_Q |
|---|---|---|---|---|---|---|---|---|---|---|---|
| RAD | Actinium-228 | SSIBF151 | | 0.633 | Pass[b] | 0.517 | | 0.029 | 0.00901 | pCi/g | |
| RAD | Actinium-228 | SSIBF152 | | 0.633 | Pass[b] | 0.463 | | 0.0715 | 0.0167 | pCi/g | |
| RAD | Actinium-228 | SSIBF153 | | 0.633 | Pass[b] | 0.495 | | 0.0738 | 0.0161 | pCi/g | |
| RAD | Americium-241 | SSIBF148 | 0.092 | 0.014 | Pass[b] | 0.00884 | | 0.00557 | 0.00563 | pCi/g | |
| RAD | Americium-241 | SSIBF150 | 0.092 | 0.014 | Pass[b] | 0.0016 | < | 0.00505 | 0.00982 | pCi/g | |
| RAD | Americium-241 | SSIBF151 | 0.092 | 0.014 | Pass[b] | 0.00821 | | 0.00553 | 0.00274 | pCi/g | |
| RAD | Americium-241 | SSIBF152 | 0.092 | 0.014 | Pass[b] | 0.00869 | | 0.00608 | 0.00665 | pCi/g | |
| RAD | Americium-241 | SSIBF153 | 0.092 | 0.014 | Pass[b] | 0.000794 | < | 0.00159 | 0.00238 | pCi/g | |
| RAD | Bismuth-212 | SSIBF148 | | 0.388 | Pass[b] | 0.314 | | 0.0529 | 0.0175 | pCi/g | |
| RAD | Bismuth-212 | SSIBF150 | | 0.388 | Pass[b] | 0.318 | | 0.0526 | 0.0166 | pCi/g | |
| RAD | Bismuth-212 | SSIBF151 | | 0.388 | Pass[b] | 0.335 | | 0.0435 | 0.0186 | pCi/g | |
| RAD | Bismuth-212 | SSIBF152 | | 0.388 | Pass[b] | 0.327 | | 0.0565 | 0.0339 | pCi/g | |
| RAD | Bismuth-212 | SSIBF153 | | 0.388 | Pass[b] | 0.356 | | 0.0621 | 0.034 | pCi/g | |
| RAD | Bismuth-214 | SSIBF148 | | 0.54 | Pass[b] | 0.414 | | 0.0482 | 0.00399 | pCi/g | |
| RAD | Bismuth-214 | SSIBF149 | | 0.54 | Pass[b] | 0.425 | | 0.0491 | 0.00393 | pCi/g | |
| RAD | Bismuth-214 | SSIBF151 | | 0.54 | Pass[b] | 0.428 | | 0.0149 | 0.00441 | pCi/g | |
| RAD | Bismuth-214 | SSIBF152 | | 0.54 | Pass[b] | 0.405 | | 0.047 | 0.00788 | pCi/g | |
| RAD | Bismuth-214 | SSIBF153 | | 0.54 | Pass[b] | 0.439 | | 0.0502 | 0.00786 | pCi/g | |
| RAD | Carbon-14 | SSIBF148 | 4200 | 0.13 | Pass[b] | 0.02 | < | 0.0486 | 0.0826 | pCi/g | |
| RAD | Carbon-14 | SSIBF150 | 4200 | 0.13 | Pass[b] | 0.025 | < | 0.0525 | 0.0891 | pCi/g | |
| RAD | Carbon-14 | SSIBF151 | 4200 | 0.13 | Pass[b] | -0.0102 | < | 0.0486 | 0.0839 | pCi/g | |
| RAD | Carbon-14 | SSIBF152 | 4200 | 0.13 | Pass[b] | 0.0229 | < | 0.0507 | 0.0861 | pCi/g | |
| RAD | Carbon-14 | SSIBF153 | 4200 | 0.13 | Pass[b] | 0.0148 | < | 0.0473 | 0.0806 | pCi/g | |
| RAD | Cesium-137 | SSIBF148 | 0.1 | 0.102 | Pass[b] | 0.0333 | | 0.00565 | 0.0023 | pCi/g | |
| RAD | Cesium-137 | SSIBF150 | 0.1 | 0.102 | Pass[b] | 0.0312 | | 0.00554 | 0.0021 | pCi/g | |
| RAD | Cesium-137 | SSIBF151 | 0.1 | 0.102 | Pass[b] | 0.0286 | | 0.00527 | 0.00255 | pCi/g | |
| RAD | Cesium-137 | SSIBF152 | 0.1 | 0.102 | Pass[b] | 0.0257 | | 0.00479 | 0.00436 | pCi/g | |
| RAD | Cesium-137 | SSIBF153 | 0.1 | 0.102 | Pass[b] | 0.0237 | | 0.00521 | 0.00487 | pCi/g | |
| RAD | Cobalt-60 | SSIBF148 | 0.022 | 0.006 | Pass[b] | 0.000159 | < | 0.00362 | 0.00263 | pCi/g | |
| RAD | Cobalt-60 | SSIBF149 | 0.022 | 0.006 | Pass[b] | 0.00179 | < | 0.00297 | 0.00257 | pCi/g | |
| RAD | Cobalt-60 | SSIBF151 | 0.022 | 0.006 | Pass[b] | -0.000134 | < | 0.00323 | 0.00267 | pCi/g | |
| RAD | Cobalt-60 | SSIBF152 | 0.022 | 0.006 | Pass[b] | -0.00061 | < | 0.00349 | 0.00514 | pCi/g | |
| RAD | Cobalt-60 | SSIBF153 | 0.022 | 0.006 | Pass[b] | 0.000425 | < | 0.00284 | 0.00507 | pCi/g | |
| RAD | Gross Alpha | SSIBF148 | | 7.42 | N/A | 7.39 | | 1.37 | 1.31 | pCi/g | J |
| RAD | Gross Alpha | SSIBF150 | | 7.42 | N/A | 6.73 | | 1.62 | 1.90 | pCi/g | J |
| RAD | Gross Alpha | SSIBF151 | | 7.42 | N/A | 3.81 | | 1.11 | 1.41 | pCi/g | J |

Table 1. Import Fill Data and Comparisons to Background and Risk-Based Action Standard (continued)

| PCLASS | LAB_CHEM | SAMP_ID | RBAS | Background | Risk/DL Comparison | Concentration | DL_FLAG | ERROR | DET_LIMIT | UNITS | ER_Q |
|---|---|---|---|---|---|---|---|---|---|---|---|
| RAD | Gross Alpha | SSIBF152 | | 7.42 | N/A | 5.8 | | 1.51 | 1.81 | pCi/g | J |
| RAD | Gross Alpha | SSIBF153 | | 7.42 | N/A | 5.75 | | 1.21 | 1.11 | pCi/g | J |
| RAD | Gross Beta | SSIBF148 | | 15 | N/A | 15.4 | | 1.20 | 1.16 | pCi/g | |
| RAD | Gross Beta | SSIBF150 | | 15 | N/A | 13.3 | | 1.10 | 0.998 | pCi/g | |
| RAD | Gross Beta | SSIBF151 | | 15 | N/A | 11.1 | | 0.930 | 0.915 | pCi/g | |
| RAD | Gross Beta | SSIBF152 | | 15 | N/A | 13.2 | | 1.23 | 1.39 | pCi/g | |
| RAD | Gross Beta | SSIBF153 | | 15 | N/A | 12.2 | | 0.976 | 0.839 | pCi/g | |
| RAD | Lead-210 | SSIBF148 | 9.6 | 1.6 | Pass[b] | 0.616 | | 0.707 | 0.348 | pCi/g | |
| RAD | Lead-210 | SSIBF150 | 9.6 | 1.6 | Pass[b] | 0.335 | | 0.550 | 0.329 | pCi/g | |
| RAD | Lead-210 | SSIBF151 | 9.6 | 1.6 | Pass[b] | 0 | < | 1.12 | 0.545 | pCi/g | |
| RAD | Lead-210 | SSIBF152 | 9.6 | 1.6 | Pass[b] | 0.726 | < | 0.903 | 1.51 | pCi/g | |
| RAD | Lead-210 | SSIBF153 | 9.6 | 1.6 | Pass[b] | 0.214 | < | 0.608 | 0.785 | pCi/g | |
| RAD | Lead-212 | SSIBF148 | | 0.691 | Pass[b] | 0.538 | | 0.0631 | 0.00426 | pCi/g | |
| RAD | Lead-212 | SSIBF149 | | 0.691 | Pass[b] | 0.568 | | 0.0642 | 0.00379 | pCi/g | |
| RAD | Lead-212 | SSIBF151 | | 0.691 | Pass[b] | 0.582 | | 0.0135 | 0.00443 | pCi/g | |
| RAD | Lead-212 | SSIBF152 | | 0.691 | Pass[b] | 0.527 | | 0.0584 | 0.00783 | pCi/g | |
| RAD | Lead-212 | SSIBF153 | | 0.691 | Pass[b] | 0.536 | | 0.0604 | 0.00776 | pCi/g | |
| RAD | Lead-214 | SSIBF148 | | 0.55 | Pass[b] | 0.481 | | 0.0581 | 0.00429 | pCi/g | |
| RAD | Lead-214 | SSIBF149 | | 0.55 | Pass[b] | 0.49 | | 0.0567 | 0.00424 | pCi/g | |
| RAD | Lead-214 | SSIBF151 | | 0.55 | Pass[b] | 0.517 | | 0.0176 | 0.00491 | pCi/g | |
| RAD | Lead-214 | SSIBF152 | | 0.55 | Pass[b] | 0.466 | | 0.0537 | 0.0088 | pCi/g | |
| RAD | Lead-214 | SSIBF153 | | 0.55 | Pass[b] | 0.497 | | 0.0573 | 0.0085 | pCi/g | |
| RAD | Plutonium-241 | SSIBF148 | 3.2 | 0.5 | Pass[b] | -0.0675 | < | 0.213 | 0.362 | pCi/g | |
| RAD | Plutonium-241 | SSIBF149 | 3.2 | 0.5 | Pass[b] | -0.142 | < | 0.211 | 0.361 | pCi/g | |
| RAD | Plutonium-241 | SSIBF151 | 3.2 | 0.5 | Pass[b] | -0.314 | < | 0.236 | 0.407 | pCi/g | |
| RAD | Plutonium-241 | SSIBF152 | 3.2 | 0.5 | Pass[b] | -0.0614 | < | 0.365 | 0.488 | pCi/g | |
| RAD | Plutonium-241 | SSIBF153 | 3.2 | 0.5 | Pass[b] | -0.315 | < | 0.252 | 0.435 | pCi/g | |
| RAD | Potassium-40 | SSIBF148 | | 14 | Pass[b] | 12.2 | | 1.37 | 0.0194 | pCi/g | |
| RAD | Potassium-40 | SSIBF149 | | 14 | Pass[b] | 12.2 | | 1.33 | 0.0177 | pCi/g | |
| RAD | Potassium-40 | SSIBF151 | | 14 | Pass[b] | 12.3 | | 0.180 | 0.0188 | pCi/g | |
| RAD | Potassium-40 | SSIBF152 | | 14 | Pass[b] | 12.1 | | 1.40 | 0.0357 | pCi/g | |
| RAD | Potassium-40 | SSIBF153 | | 14 | Pass[b] | 11.7 | | 1.33 | 0.0363 | pCi/g | |
| RAD | Radium-223 | SSIBF148 | | | Pass[g] | 0 | < | 0.0552 | 0.0428 | pCi/g | |
| RAD | Radium-223 | SSIBF149 | | | Pass[g] | 0.000684 | < | 0.0494 | 0.0421 | pCi/g | |
| RAD | Radium-223 | SSIBF151 | | | Pass[g] | 0.00393 | < | 0.0631 | 0.0482 | pCi/g | |
| RAD | Radium-223 | SSIBF152 | | | Pass[g] | 0.0444 | < | 0.054 | 0.086 | pCi/g | |

Table 1. Import Fill Data and Comparisons to Background and Risk-Based Action Standard (continued)

| PCLASS | LAB_CHEM | SAMP_ID | RBAS | Background | Risk/DL Comparison | Concentration | DL_FLAG | ERROR | DET_LIMIT | UNITS | ER_Q |
|---|---|---|---|---|---|---|---|---|---|---|---|
| RAD | Radium-223 | SSIBF153 | | | Pass[g] | -0.00706 | < | 0.0672 | 0.0817 | pCi/g | |
| RAD | Radium-226 | SSIBF148 | 0.0042 | 0.752 | Pass[b] | 0.44 | | 0.0652 | 0.0127 | pCi/g | |
| RAD | Radium-226 | SSIBF149 | 0.0042 | 0.752 | Pass[b] | 0.437 | | 0.0677 | 0.0135 | pCi/g | |
| RAD | Radium-226 | SSIBF151 | 0.0042 | 0.752 | Pass[b] | 0.456 | | 0.0893 | 0.0176 | pCi/g | |
| RAD | Radium-226 | SSIBF152 | 0.0042 | 0.752 | Pass[b] | 0.45 | | 0.0697 | 0.0136 | pCi/g | |
| RAD | Radium-226 | SSIBF153 | 0.0042 | 0.752 | Pass[b] | 0.517 | | 0.0885 | 0.0184 | pCi/g | |
| RAD | Radium-228 | SSIBF148 | | 0.63 | Pass[b] | 0.491 | | 0.0784 | 0.00859 | pCi/g | |
| RAD | Radium-228 | SSIBF149 | | 0.63 | Pass[b] | 0.505 | | 0.0783 | 0.00826 | pCi/g | |
| RAD | Radium-228 | SSIBF151 | | 0.63 | Pass[b] | 0.517 | | 0.029 | 0.00901 | pCi/g | |
| RAD | Radium-228 | SSIBF152 | | 0.63 | Pass[b] | 0.463 | | 0.0715 | 0.0167 | pCi/g | |
| RAD | Radium-228 | SSIBF153 | | 0.63 | Pass[b] | 0.495 | | 0.0738 | 0.0161 | pCi/g | |
| RAD | Strontium-90 | SSIBF148 | 10 | 0.056 | Pass[b] | 0.0061 | < | 0.0163 | 0.0276 | pCi/g | |
| RAD | Strontium-90 | SSIBF149 | 10 | 0.056 | Pass[b] | 0.012 | < | 0.0151 | 0.0305 | pCi/g | |
| RAD | Strontium-90 | SSIBF151 | 10 | 0.056 | Pass[b] | 0.0191 | < | 0.0188 | 0.0373 | pCi/g | |
| RAD | Strontium-90 | SSIBF152 | 10 | 0.056 | Pass[b] | 0.0188 | < | 0.0153 | 0.0298 | pCi/g | |
| RAD | Strontium-90 | SSIBF153 | 10 | 0.056 | Pass[b] | 0.0104 | < | 0.0133 | 0.0266 | pCi/g | |
| RAD | Thallium-208 | SSIBF148 | | 0.204 | Pass[b] | 0.16 | | 0.0182 | 0.00224 | pCi/g | |
| RAD | Thallium-208 | SSIBF150 | | 0.204 | Pass[b] | 0.164 | | 0.0188 | 0.00204 | pCi/g | |
| RAD | Thallium-208 | SSIBF151 | | 0.204 | Pass[b] | 0.176 | | 0.00827 | 0.00246 | pCi/g | |
| RAD | Thallium-208 | SSIBF152 | | 0.204 | Pass[b] | 0.163 | | 0.0185 | 0.00431 | pCi/g | |
| RAD | Thallium-208 | SSIBF153 | | 0.204 | Pass[b] | 0.16 | | 0.0176 | 0.00461 | pCi/g | |
| RAD | Thorium-228 | SSIBF148 | 0.032 | 0.627 | Pass[b] | 0.579 | | 0.123 | 0.0744 | pCi/g | |
| RAD | Thorium-228 | SSIBF149 | 0.032 | 0.627 | Pass[b] | 0.555 | | 0.113 | 0.0556 | pCi/g | |
| RAD | Thorium-228 | SSIBF151 | 0.032 | 0.627 | Pass[b] | 0.602 | | 0.123 | 0.0568 | pCi/g | |
| RAD | Thorium-228 | SSIBF152 | 0.032 | 0.627 | Pass[b] | 0.523 | | 0.107 | 0.0515 | pCi/g | |
| RAD | Thorium-228 | SSIBF153 | 0.032 | 0.627 | Pass[b] | 0.534 | | 0.125 | 0.105 | pCi/g | |
| RAD | Thorium-230 | SSIBF148 | | 1.04 | Pass[b] | 0.555 | | 0.113 | 0.0331 | pCi/g | |
| RAD | Thorium-230 | SSIBF150 | | 1.04 | Pass[b] | 0.54 | | 0.109 | 0.0428 | pCi/g | |
| RAD | Thorium-230 | SSIBF151 | | 1.04 | Pass[b] | 0.596 | | 0.119 | 0.0329 | pCi/g | |
| RAD | Thorium-230 | SSIBF152 | | 1.04 | Pass[b] | 0.588 | | 0.113 | 0.0298 | pCi/g | |
| RAD | Thorium-230 | SSIBF153 | | 1.04 | Pass[b] | 0.576 | | 0.118 | 0.0387 | pCi/g | |
| RAD | Thorium-232 | SSIBF148 | 0.022 | 0.63 | Pass[b] | 0.467 | | 0.101 | 0.0331 | pCi/g | |
| RAD | Thorium-232 | SSIBF149 | 0.022 | 0.63 | Pass[b] | 0.442 | | 0.094 | 0.0307 | pCi/g | |
| RAD | Thorium-232 | SSIBF151 | 0.022 | 0.63 | Pass[b] | 0.502 | | 0.106 | 0.0379 | pCi/g | |
| RAD | Thorium-232 | SSIBF152 | 0.022 | 0.63 | Pass[b] | 0.534 | | 0.106 | 0.0298 | pCi/g | |
| RAD | Thorium-232 | SSIBF153 | 0.022 | 0.63 | Pass[b] | 0.48 | | 0.105 | 0.043 | pCi/g | |

## Table 1. Import Fill Data and Comparisons to Background and Risk-Based Action Standard (continued)

| PCLASS | LAB_CHEM | SAMP_ID | RBAS | Background | Risk/DL Comparison | Concentration | DL_FLAG | ERROR | DET_LIMIT | UNITS | ER_Q |
|---|---|---|---|---|---|---|---|---|---|---|---|
| RAD | Thorium-234 | SSIBF148 | 3.2 | 0.78 | Pass[b] | 0.575 | | 0.250 | 0.105 | pCi/g | |
| RAD | Thorium-234 | SSIBF150 | 3.2 | 0.78 | Pass[b] | 0.713 | | 0.260 | 0.0995 | pCi/g | |
| RAD | Thorium-234 | SSIBF151 | 3.2 | 0.78 | Pass[b] | 0.552 | | 0.284 | 0.138 | pCi/g | |
| RAD | Thorium-234 | SSIBF152 | 3.2 | 0.78 | Pass[b] | 0.517 | | 0.336 | 0.298 | pCi/g | |
| RAD | Thorium-234 | SSIBF153 | 3.2 | 0.78 | Pass[h] | 0.812 | | 0.343 | 0.215 | pCi/g | |
| RAD | Tritium | SSIBF148 | 5.4 | 1.2 | Pass[b] | 0.127 | < | 0.507 | 0.893 | pCi/g | |
| RAD | Tritium | SSIBF149 | 5.4 | 1.2 | Pass[b] | 0.522 | < | 0.553 | 0.920 | pCi/g | |
| RAD | Tritium | SSIBF151 | 5.4 | 1.2 | Pass[b] | 0 | < | 0.507 | 0.911 | pCi/g | |
| RAD | Tritium | SSIBF152 | 5.4 | 1.2 | Pass[b] | 0.391 | < | 0.541 | 0.917 | pCi/g | |
| RAD | Tritium | SSIBF153 | 5.4 | 1.2 | Pass[b] | 0.511 | < | 0.541 | 0.899 | pCi/g | |
| RAD | Uranium-233/234 | SSIBF148 | | 0.559 | Pass[b] | 0.481 | | 0.0847 | 0.0208 | pCi/g | |
| RAD | Uranium-233/234 | SSIBF150 | | 0.559 | Marginal | 0.565 | | 0.104 | 0.0416 | pCi/g | |
| RAD | Uranium-233/234 | SSIBF151 | | 0.559 | Pass[b] | 0.383 | | 0.0876 | 0.0831 | pCi/g | |
| RAD | Uranium-233/234 | SSIBF152 | | 0.559 | Pass[b] | 0.468 | | 0.0812 | 0.0329 | pCi/g | |
| RAD | Uranium-233/234 | SSIBF153 | | 0.559 | Pass[b] | 0.488 | | 0.0932 | 0.054 | pCi/g | |
| RAD | Uranium-235/236 | SSIBF148 | | 0.038 | Pass[b] | 0.03 | | 0.0183 | 0.00817 | pCi/g | |
| RAD | Uranium-235/236 | SSIBF150 | | 0.038 | N/A[i] | 0.0441 | | 0.0314 | 0.0418 | pCi/g | |
| RAD | Uranium-235/236 | SSIBF151 | | 0.038 | N/A[i] | 0.0144 | < | 0.0351 | 0.0623 | pCi/g | |
| RAD | Uranium-235/236 | SSIBF152 | | 0.038 | N/A[i] | 0.0566 | | 0.027 | 0.0272 | pCi/g | |
| RAD | Uranium-235/236 | SSIBF153 | | 0.038 | N/A[i] | 0.0428 | < | 0.0314 | 0.044 | pCi/g | |
| RAD | Uranium-238 | SSIBF148 | | 0.565 | Pass[b] | 0.494 | | 0.0869 | 0.030 | pCi/g | |
| RAD | Uranium-238 | SSIBF149 | | 0.565 | Pass[b] | 0.495 | | 0.0869 | 0.0212 | pCi/g | |
| RAD | Uranium-238 | SSIBF151 | | 0.565 | Pass[b] | 0.446 | | 0.0866 | 0.053 | pCi/g | |
| RAD | Uranium-238 | SSIBF152 | | 0.565 | Pass[b] | 0.441 | | 0.0768 | 0.00736 | pCi/g | |
| RAD | Uranium-238 | SSIBF153 | | 0.565 | Pass[b] | 0.427 | | 0.0856 | 0.0492 | pCi/g | |
| SVOC | 1,2,4-Trichlorobenzene | SSIBF148 | | | Pass[e] | | < | | 343 | µg/kg | |
| SVOC | 1,2,4-Trichlorobenzene | SSIBF149 | | | Pass[e] | | < | | 346 | µg/kg | |
| SVOC | 1,2,4-Trichlorobenzene | SSIBF151 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | 1,2,4-Trichlorobenzene | SSIBF152 | | | Pass[e] | | < | | 342 | µg/kg | |
| SVOC | 1,2,4-Trichlorobenzene | SSIBF153 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | 1,2-Dichlorobenzene | SSIBF148 | | | Pass[e] | | < | | 343 | µg/kg | |
| SVOC | 1,2-Dichlorobenzene | SSIBF149 | | | Pass[e] | | < | | 346 | µg/kg | |
| SVOC | 1,2-Dichlorobenzene | SSIBF151 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | 1,2-Dichlorobenzene | SSIBF152 | | | Pass[e] | | < | | 342 | µg/kg | |
| SVOC | 1,2-Dichlorobenzene | SSIBF153 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | 1,3-Dichlorobenzene | SSIBF148 | | | Pass[e] | | < | | 343 | µg/kg | |

Table 1. Import Fill Data and Comparisons to Background and Risk-Based Action Standard (continued)

| PCLASS | LAB_CHEM | SAMP_ID | RBAS | Background | Risk/DL Comparison | Concentration | DL_FLAG | ERROR | DET_LIMIT | UNITS | ER_Q |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SVOC | 1,3-Dichlorobenzene | SSIBF149 | | | Pass[e] | | < | | 346 | µg/kg | |
| SVOC | 1,3-Dichlorobenzene | SSIBF151 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | 1,3-Dichlorobenzene | SSIBF152 | | | Pass[e] | | < | | 342 | µg/kg | |
| SVOC | 1,3-Dichlorobenzene | SSIBF153 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | 1,4-Dichlorobenzene | SSIBF148 | | | Pass[e] | | < | | 343 | µg/kg | |
| SVOC | 1,4-Dichlorobenzene | SSIBF149 | | | Pass[e] | | < | | 346 | µg/kg | |
| SVOC | 1,4-Dichlorobenzene | SSIBF151 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | 1,4-Dichlorobenzene | SSIBF152 | | | Pass[e] | | < | | 342 | µg/kg | |
| SVOC | 1,4-Dichlorobenzene | SSIBF153 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | 2,4,5-Trichlorophenol | SSIBF148 | | | Pass[e] | | < | | 862 | µg/kg | |
| SVOC | 2,4,5-Trichlorophenol | SSIBF149 | | | Pass[e] | | < | | 870 | µg/kg | |
| SVOC | 2,4,5-Trichlorophenol | SSIBF151 | | | Pass[e] | | < | | 867 | µg/kg | |
| SVOC | 2,4,5-Trichlorophenol | SSIBF152 | | | Pass[e] | | < | | 859 | µg/kg | |
| SVOC | 2,4,5-Trichlorophenol | SSIBF153 | | | Pass[e] | | < | | 868 | µg/kg | |
| SVOC | 2,4,6-Trichlorophenol | SSIBF148 | | | Pass[e] | | < | | 343 | µg/kg | |
| SVOC | 2,4,6-Trichlorophenol | SSIBF149 | | | Pass[e] | | < | | 346 | µg/kg | |
| SVOC | 2,4,6-Trichlorophenol | SSIBF151 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | 2,4,6-Trichlorophenol | SSIBF152 | | | Pass[e] | | < | | 342 | µg/kg | |
| SVOC | 2,4,6-Trichlorophenol | SSIBF153 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | 2,4-Dichlorophenol | SSIBF148 | | | Pass[e] | | < | | 343 | µg/kg | |
| SVOC | 2,4-Dichlorophenol | SSIBF149 | | | Pass[e] | | < | | 346 | µg/kg | |
| SVOC | 2,4-Dichlorophenol | SSIBF151 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | 2,4-Dichlorophenol | SSIBF152 | | | Pass[e] | | < | | 342 | µg/kg | |
| SVOC | 2,4-Dichlorophenol | SSIBF153 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | 2,4-Dimethylphenol | SSIBF148 | | | Pass[e] | | < | | 343 | µg/kg | |
| SVOC | 2,4-Dimethylphenol | SSIBF149 | | | Pass[e] | | < | | 346 | µg/kg | |
| SVOC | 2,4-Dimethylphenol | SSIBF151 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | 2,4-Dimethylphenol | SSIBF152 | | | Pass[e] | | < | | 342 | µg/kg | |
| SVOC | 2,4-Dimethylphenol | SSIBF153 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | 2,4-Dinitrophenol | SSIBF148 | | | Pass[e] | | < | | 862 | µg/kg | UJ |
| SVOC | 2,4-Dinitrophenol | SSIBF149 | | | Pass[e] | | < | | 870 | µg/kg | UJ |
| SVOC | 2,4-Dinitrophenol | SSIBF151 | | | Pass[e] | | < | | 867 | µg/kg | UJ |
| SVOC | 2,4-Dinitrophenol | SSIBF152 | | | Pass[e] | | < | | 859 | µg/kg | UJ |
| SVOC | 2,4-Dinitrophenol | SSIBF153 | | | Pass[e] | | < | | 868 | µg/kg | UJ |
| SVOC | 2,4-Dinitrotoluene | SSIBF148 | | | Pass[e] | | < | | 343 | µg/kg | |
| SVOC | 2,4-Dinitrotoluene | SSIBF149 | | | Pass[e] | | < | | 346 | µg/kg | |

Table 1. Import Fill Data and Comparisons to Background and Risk-Based Action Standard (continued)

| PCLASS | LAB_CHEM | SAMP_ID | RBAS | Background | Risk/DL Comparison | Concentration | DL_FLAG | ERROR | DET_LIMIT | UNITS | ER_Q |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SVOC | 2,4-Dinitrotoluene | SSIBF151 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | 2,4-Dinitrotoluene | SSIBF152 | | | Pass[e] | | < | | 342 | µg/kg | |
| SVOC | 2,4-Dinitrotoluene | SSIBF153 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | 2,6-Dinitrotoluene | SSIBF148 | | | Pass[e] | | < | | 343 | µg/kg | |
| SVOC | 2,6-Dinitrotoluene | SSIBF149 | | | Pass[e] | | < | | 346 | µg/kg | |
| SVOC | 2,6-Dinitrotoluene | SSIBF151 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | 2,6-Dinitrotoluene | SSIBF152 | | | Pass[e] | | < | | 342 | µg/kg | |
| SVOC | 2,6-Dinitrotoluene | SSIBF153 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | 2-Chloronaphthalene | SSIBF148 | | | Pass[e] | | < | | 343 | µg/kg | |
| SVOC | 2-Chloronaphthalene | SSIBF149 | | | Pass[e] | | < | | 346 | µg/kg | |
| SVOC | 2-Chloronaphthalene | SSIBF151 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | 2-Chloronaphthalene | SSIBF152 | | | Pass[e] | | < | | 342 | µg/kg | |
| SVOC | 2-Chloronaphthalene | SSIBF153 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | 2-Chlorophenol | SSIBF148 | | | Pass[e] | | < | | 343 | µg/kg | |
| SVOC | 2-Chlorophenol | SSIBF149 | | | Pass[e] | | < | | 346 | µg/kg | |
| SVOC | 2-Chlorophenol | SSIBF151 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | 2-Chlorophenol | SSIBF152 | | | Pass[e] | | < | | 342 | µg/kg | |
| SVOC | 2-Chlorophenol | SSIBF153 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | 2-Methyl-4,6-dinitrophenol | SSIBF148 | | | Pass[e] | | < | | 862 | µg/kg | UJ |
| SVOC | 2-Methyl-4,6-dinitrophenol | SSIBF149 | | | Pass[e] | | < | | 870 | µg/kg | UJ |
| SVOC | 2-Methyl-4,6-dinitrophenol | SSIBF151 | | | Pass[e] | | < | | 867 | µg/kg | UJ |
| SVOC | 2-Methyl-4,6-dinitrophenol | SSIBF152 | | | Pass[e] | | < | | 859 | µg/kg | UJ |
| SVOC | 2-Methyl-4,6-dinitrophenol | SSIBF153 | | | Pass[e] | | < | | 868 | µg/kg | UJ |
| SVOC | 2-Methylnaphthalene | SSIBF148 | | | Pass[e] | | < | | 343 | µg/kg | |
| SVOC | 2-Methylnaphthalene | SSIBF149 | | | Pass[e] | | < | | 346 | µg/kg | |
| SVOC | 2-Methylnaphthalene | SSIBF151 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | 2-Methylnaphthalene | SSIBF152 | | | Pass[e] | | < | | 342 | µg/kg | |
| SVOC | 2-Methylnaphthalene | SSIBF153 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | 2-Nitrophenol | SSIBF148 | | | Pass[e] | | < | | 343 | µg/kg | |
| SVOC | 2-Nitrophenol | SSIBF149 | | | Pass[e] | | < | | 346 | µg/kg | |
| SVOC | 2-Nitrophenol | SSIBF151 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | 2-Nitrophenol | SSIBF152 | | | Pass[e] | | < | | 342 | µg/kg | |
| SVOC | 2-Nitrophenol | SSIBF153 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | 3,3'-Dichlorobenzidine | SSIBF148 | | | Pass[e] | | < | | 343 | µg/kg | |
| SVOC | 3,3'-Dichlorobenzidine | SSIBF149 | | | Pass[e] | | < | | 346 | µg/kg | |
| SVOC | 3,3'-Dichlorobenzidine | SSIBF151 | | | Pass[e] | | < | | 345 | µg/kg | |

Table 1. Import Fill Data and Comparisons to Background and Risk-Based Action Standard (continued)

| PCLASS | LAB_CHEM | SAMP_ID | RBAS | Background | Risk/DL Comparison | Concentration | DL_FLAG | ERROR | DET_LIMIT | UNITS | ER_Q |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SVOC | 3,3'-Dichlorobenzidine | SSIBF152 | | | Pass[e] | | < | | 342 | µg/kg | |
| SVOC | 3,3'-Dichlorobenzidine | SSIBF153 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | 4-Bromophenylphenylether | SSIBF148 | | | Pass[e] | | < | | 343 | µg/kg | |
| SVOC | 4-Bromophenylphenylether | SSIBF149 | | | Pass[e] | | < | | 346 | µg/kg | |
| SVOC | 4-Bromophenylphenylether | SSIBF151 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | 4-Bromophenylphenylether | SSIBF152 | | | Pass[e] | | < | | 342 | µg/kg | |
| SVOC | 4-Bromophenylphenylether | SSIBF153 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | 4-Chloro-3-methylphenol | SSIBF148 | | | Pass[e] | | < | | 343 | µg/kg | |
| SVOC | 4-Chloro-3-methylphenol | SSIBF149 | | | Pass[e] | | < | | 346 | µg/kg | |
| SVOC | 4-Chloro-3-methylphenol | SSIBF151 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | 4-Chloro-3-methylphenol | SSIBF152 | | | Pass[e] | | < | | 342 | µg/kg | |
| SVOC | 4-Chloro-3-methylphenol | SSIBF153 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | 4-Chloroaniline | SSIBF148 | | | Pass[e] | | < | | 862 | µg/kg | |
| SVOC | 4-Chloroaniline | SSIBF149 | | | Pass[e] | | < | | 870 | µg/kg | |
| SVOC | 4-Chloroaniline | SSIBF151 | | | Pass[e] | | < | | 867 | µg/kg | |
| SVOC | 4-Chloroaniline | SSIBF152 | | | Pass[e] | | < | | 859 | µg/kg | |
| SVOC | 4-Chloroaniline | SSIBF153 | | | Pass[e] | | < | | 868 | µg/kg | |
| SVOC | 4-Chlorophenylphenylether | SSIBF148 | | | Pass[e] | | < | | 343 | µg/kg | |
| SVOC | 4-Chlorophenylphenylether | SSIBF149 | | | Pass[e] | | < | | 346 | µg/kg | |
| SVOC | 4-Chlorophenylphenylether | SSIBF151 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | 4-Chlorophenylphenylether | SSIBF152 | | | Pass[e] | | < | | 342 | µg/kg | |
| SVOC | 4-Chlorophenylphenylether | SSIBF153 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | 4-Nitrophenol | SSIBF148 | | | Pass[e] | | < | | 862 | µg/kg | |
| SVOC | 4-Nitrophenol | SSIBF149 | | | Pass[e] | | < | | 870 | µg/kg | |
| SVOC | 4-Nitrophenol | SSIBF151 | | | Pass[e] | | < | | 867 | µg/kg | |
| SVOC | 4-Nitrophenol | SSIBF152 | | | Pass[e] | | < | | 859 | µg/kg | |
| SVOC | 4-Nitrophenol | SSIBF153 | | | Pass[e] | | < | | 868 | µg/kg | |
| SVOC | Acenaphthene | SSIBF148 | 250000 | | Pass[f] | | < | | 343 | µg/kg | |
| SVOC | Acenaphthene | SSIBF149 | 250000 | | Pass[f] | | < | | 346 | µg/kg | |
| SVOC | Acenaphthene | SSIBF151 | 250000 | | Pass[f] | | < | | 345 | µg/kg | |
| SVOC | Acenaphthene | SSIBF152 | 250000 | | Pass[f] | | < | | 342 | µg/kg | |
| SVOC | Acenaphthene | SSIBF153 | 250000 | | Pass[f] | | < | | 345 | µg/kg | |
| SVOC | Acenaphthylene | SSIBF148 | | | Pass[e] | | < | | 343 | µg/kg | |
| SVOC | Acenaphthylene | SSIBF149 | | | Pass[e] | | < | | 346 | µg/kg | |
| SVOC | Acenaphthylene | SSIBF151 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | Acenaphthylene | SSIBF152 | | | Pass[e] | | < | | 342 | µg/kg | |

Table 1. Import Fill Data and Comparisons to Background and Risk-Based Action Standard (continued)

| PCLASS | LAB_CHEM | SAMP_ID | RBAS | Background | Risk/DL Comparison | Concentration | DL_FLAG | ERROR | DET_LIMIT | UNITS | ER_Q |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SVOC | Acenaphthylene | SSIBF153 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | Anthracene | SSIBF148 | 1400000 | | Pass[f] | | < | | 343 | µg/kg | |
| SVOC | Anthracene | SSIBF149 | 1400000 | | Pass[f] | | < | | 346 | µg/kg | |
| SVOC | Anthracene | SSIBF151 | 1400000 | | Pass[f] | | < | | 345 | µg/kg | |
| SVOC | Anthracene | SSIBF152 | 1400000 | | Pass[f] | | < | | 342 | µg/kg | |
| SVOC | Anthracene | SSIBF153 | 1400000 | | Pass[f] | | < | | 345 | µg/kg | |
| SVOC | Benzo(a)anthracene | SSIBF148 | 1198.6475 | | Pass[f] | | < | | 343 | µg/kg | |
| SVOC | Benzo(a)anthracene | SSIBF149 | 1198.6475 | | Pass[f] | | < | | 346 | µg/kg | |
| SVOC | Benzo(a)anthracene | SSIBF151 | 1198.6475 | | Pass[f] | | < | | 345 | µg/kg | |
| SVOC | Benzo(a)anthracene | SSIBF152 | 1198.6475 | | Pass[f] | | < | | 342 | µg/kg | |
| SVOC | Benzo(a)anthracene | SSIBF153 | 1198.6475 | | Pass[f] | | < | | 345 | µg/kg | |
| SVOC | Benzo(a)pyrene | SSIBF148 | 237.05594 | | Pass[f] | | < | | 343 | µg/kg | |
| SVOC | Benzo(a)pyrene | SSIBF149 | 237.05594 | | Pass[f] | | < | | 346 | µg/kg | |
| SVOC | Benzo(a)pyrene | SSIBF151 | 237.05594 | | Pass[f] | | < | | 345 | µg/kg | |
| SVOC | Benzo(a)pyrene | SSIBF152 | 237.05594 | | Pass[f] | | < | | 342 | µg/kg | |
| SVOC | Benzo(a)pyrene | SSIBF153 | 237.05594 | | Pass[f] | | < | | 345 | µg/kg | |
| SVOC | Benzo(b)fluoranthene | SSIBF148 | 2613.1689 | | Pass[f] | | < | | 343 | µg/kg | |
| SVOC | Benzo(b)fluoranthene | SSIBF149 | 2613.1689 | | Pass[f] | | < | | 346 | µg/kg | |
| SVOC | Benzo(b)fluoranthene | SSIBF151 | 2613.1689 | | Pass[f] | | < | | 345 | µg/kg | |
| SVOC | Benzo(b)fluoranthene | SSIBF152 | 2613.1689 | | Pass[f] | | < | | 342 | µg/kg | |
| SVOC | Benzo(b)fluoranthene | SSIBF153 | 2613.1689 | | Pass[f] | | < | | 345 | µg/kg | |
| SVOC | Benzo(ghi)perylene | SSIBF148 | 9100000 | | Pass[f] | | < | | 343 | µg/kg | |
| SVOC | Benzo(ghi)perylene | SSIBF149 | 9100000 | | Pass[f] | | < | | 346 | µg/kg | |
| SVOC | Benzo(ghi)perylene | SSIBF151 | 9100000 | | Pass[f] | | < | | 345 | µg/kg | |
| SVOC | Benzo(ghi)perylene | SSIBF152 | 9100000 | | Pass[f] | | < | | 342 | µg/kg | |
| SVOC | Benzo(ghi)perylene | SSIBF153 | 9100000 | | Pass[f] | | < | | 345 | µg/kg | |
| SVOC | Benzo(k)fluoranthene | SSIBF148 | 26131.689 | | Pass[f] | | < | | 343 | µg/kg | |
| SVOC | Benzo(k)fluoranthene | SSIBF149 | 26131.689 | | Pass[f] | | < | | 346 | µg/kg | |
| SVOC | Benzo(k)fluoranthene | SSIBF151 | 26131.689 | | Pass[f] | | < | | 345 | µg/kg | |
| SVOC | Benzo(k)fluoranthene | SSIBF152 | 26131.689 | | Pass[f] | | < | | 342 | µg/kg | |
| SVOC | Benzo(k)fluoranthene | SSIBF153 | 26131.689 | | Pass[f] | | < | | 345 | µg/kg | |
| SVOC | bis(2-Chloroethoxy)methane | SSIBF148 | | | Pass[e] | | < | | 343 | µg/kg | |
| SVOC | bis(2-Chloroethoxy)methane | SSIBF149 | | | Pass[e] | | < | | 346 | µg/kg | |
| SVOC | bis(2-Chloroethoxy)methane | SSIBF151 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | bis(2-Chloroethoxy)methane | SSIBF152 | | | Pass[e] | | < | | 342 | µg/kg | |
| SVOC | bis(2-Chloroethoxy)methane | SSIBF153 | | | Pass[e] | | < | | 345 | µg/kg | |

Table 1. Import Fill Data and Comparisons to Background and Risk-Based Action Standard (continued)

| PCLASS | LAB_CHEM | SAMP_ID | RBAS | Background | Risk/DL Comparison | Concentration | DL_FLAG | ERROR | DET_LIMIT | UNITS | ER_Q |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SVOC | bis(2-Chloroethyl) ether | SSIBF148 | | | Pass[e] | | < | | 343 | µg/kg | |
| SVOC | bis(2-Chloroethyl) ether | SSIBF149 | | | Pass[e] | | < | | 346 | µg/kg | |
| SVOC | bis(2-Chloroethyl) ether | SSIBF151 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | bis(2-Chloroethyl) ether | SSIBF152 | | | Pass[e] | | < | | 342 | µg/kg | |
| SVOC | bis(2-Chloroethyl) ether | SSIBF153 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | bis(2-Chloroisopropyl)ether | SSIBF148 | | | Pass[e] | | < | | 343 | µg/kg | |
| SVOC | bis(2-Chloroisopropyl)ether | SSIBF149 | | | Pass[e] | | < | | 346 | µg/kg | |
| SVOC | bis(2-Chloroisopropyl)ether | SSIBF151 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | bis(2-Chloroisopropyl)ether | SSIBF152 | | | Pass[e] | | < | | 342 | µg/kg | |
| SVOC | bis(2-Chloroisopropyl)ether | SSIBF153 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | bis(2-Ethylhexyl)phthalate | SSIBF148 | 7700 | | Pass[L] | 119 | | | 343 | µg/kg | UJ |
| SVOC | bis(2-Ethylhexyl)phthalate | SSIBF150 | 7700 | | Pass[L] | 94.8 | | | 346 | µg/kg | UJ |
| SVOC | bis(2-Ethylhexyl)phthalate | SSIBF151 | 7700 | | Pass[L] | 109 | | | 345 | µg/kg | UJ |
| SVOC | bis(2-Ethylhexyl)phthalate | SSIBF152 | 7700 | | Pass[L] | 111 | | | 342 | µg/kg | UJ |
| SVOC | bis(2-Ethylhexyl)phthalate | SSIBF153 | 7700 | | Pass[L] | 88.3 | | | 345 | µg/kg | UJ |
| SVOC | Butylbenzylphthalate | SSIBF148 | | | Pass[e] | | < | | 343 | µg/kg | |
| SVOC | Butylbenzylphthalate | SSIBF149 | | | Pass[e] | | < | | 346 | µg/kg | |
| SVOC | Butylbenzylphthalate | SSIBF151 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | Butylbenzylphthalate | SSIBF152 | | | Lab Contaminant | 16.6 | | | 342 | µg/kg | J |
| SVOC | Butylbenzylphthalate | SSIBF153 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | Carbazole | SSIBF148 | 2226.0294 | | Pass[d] | 6.9 | | | 343 | µg/kg | J |
| SVOC | Carbazole | SSIBF149 | 2226.0294 | | Pass[f] | | < | | 346 | µg/kg | |
| SVOC | Carbazole | SSIBF151 | 2226.0294 | | Pass[f] | | < | | 345 | µg/kg | |
| SVOC | Carbazole | SSIBF152 | 2226.0294 | | Pass[f] | | < | | 342 | µg/kg | |
| SVOC | Carbazole | SSIBF153 | 2226.0294 | | Pass[f] | | < | | 345 | µg/kg | |
| SVOC | Chrysene | SSIBF148 | 20268.949 | | Pass[f] | | < | | 343 | µg/kg | |
| SVOC | Chrysene | SSIBF149 | 20268.949 | | Pass[f] | | < | | 346 | µg/kg | |
| SVOC | Chrysene | SSIBF151 | 20268.949 | | Pass[f] | | < | | 345 | µg/kg | |
| SVOC | Chrysene | SSIBF152 | 20268.949 | | Pass[f] | | < | | 342 | µg/kg | |
| SVOC | Chrysene | SSIBF153 | 20268.949 | | Pass[f] | | < | | 345 | µg/kg | |
| SVOC | Dibenzo(a,h)anthracene | SSIBF148 | 261.31689 | | Pass[f] | | < | | 343 | µg/kg | UJ |
| SVOC | Dibenzo(a,h)anthracene | SSIBF149 | 261.31689 | | Pass[f] | | < | | 346 | µg/kg | UJ |
| SVOC | Dibenzo(a,h)anthracene | SSIBF151 | 261.31689 | | Pass[f] | | < | | 345 | µg/kg | UJ |
| SVOC | Dibenzo(a,h)anthracene | SSIBF152 | 261.31689 | | Pass[f] | | < | | 342 | µg/kg | UJ |
| SVOC | Dibenzo(a,h)anthracene | SSIBF153 | 261.31689 | | Pass[f] | | < | | 345 | µg/kg | UJ |
| SVOC | Dibenzofuran | SSIBF148 | 14000 | | Pass[f] | | < | | 343 | µg/kg | |

Table 1. Import Fill Data and Comparisons to Background and Risk-Based Action Standard (continued)

| PCLASS | LAB_CHEM | SAMP_ID | RBAS | Background | Risk/DL Comparison | Concentration | DL_FLAG | ERROR | DET_LIMIT | UNITS | ER_Q |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SVOC | Dibenzofuran | SSIBF149 | 14000 | | Pass[f] | | < | | 346 | µg/kg | |
| SVOC | Dibenzofuran | SSIBF151 | 14000 | | Pass[f] | | < | | 345 | µg/kg | |
| SVOC | Dibenzofuran | SSIBF152 | 14000 | | Pass[f] | | < | | 342 | µg/kg | |
| SVOC | Dibenzofuran | SSIBF153 | 14000 | | Pass[f] | | < | | 345 | µg/kg | |
| SVOC | Diethylphthalate | SSIBF148 | 220000 | | Pass[f] | | < | | 343 | µg/kg | |
| SVOC | Diethylphthalate | SSIBF149 | 220000 | | Pass[f] | | < | | 346 | µg/kg | |
| SVOC | Diethylphthalate | SSIBF151 | 220000 | | Pass[f] | | < | | 345 | µg/kg | |
| SVOC | Diethylphthalate | SSIBF152 | 220000 | | Pass[f] | | < | | 342 | µg/kg | |
| SVOC | Diethylphthalate | SSIBF153 | 220000 | | Pass[f] | | < | | 345 | µg/kg | |
| SVOC | Dimethylphthalate | SSIBF148 | | | Pass[e] | | < | | 343 | µg/kg | |
| SVOC | Dimethylphthalate | SSIBF149 | | | Pass[e] | | < | | 346 | µg/kg | |
| SVOC | Dimethylphthalate | SSIBF151 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | Dimethylphthalate | SSIBF152 | | | Pass[e] | | < | | 342 | µg/kg | |
| SVOC | Dimethylphthalate | SSIBF153 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | Di-n-butylphthalate | SSIBF148 | 890000 | | Pass[f] | | < | | 343 | µg/kg | |
| SVOC | Di-n-butylphthalate | SSIBF149 | 890000 | | Pass[f] | | < | | 346 | µg/kg | |
| SVOC | Di-n-butylphthalate | SSIBF151 | 890000 | | Pass[f] | | < | | 345 | µg/kg | |
| SVOC | Di-n-butylphthalate | SSIBF152 | 890000 | | Pass[f] | | < | | 342 | µg/kg | |
| SVOC | Di-n-butylphthalate | SSIBF153 | 890000 | | Pass[f] | | < | | 345 | µg/kg | |
| SVOC | Di-n-octylphthalate | SSIBF148 | 4900000 | | Pass[f] | | < | | 343 | µg/kg | UJ |
| SVOC | Di-n-octylphthalate | SSIBF149 | 4900000 | | Pass[f] | | < | | 346 | µg/kg | UJ |
| SVOC | Di-n-octylphthalate | SSIBF151 | 4900000 | | Pass[f] | | < | | 345 | µg/kg | UJ |
| SVOC | Di-n-octylphthalate | SSIBF152 | 4900000 | | Pass[f] | | < | | 342 | µg/kg | UJ |
| SVOC | Di-n-octylphthalate | SSIBF153 | 4900000 | | Pass[f] | | < | | 345 | µg/kg | UJ |
| SVOC | Diphenylamine | SSIBF148 | | | Pass[L] | 23.2 | | | 343 | µg/kg | UJ |
| SVOC | Diphenylamine | SSIBF149 | | | Pass[e] | | < | | 346 | µg/kg | |
| SVOC | Diphenylamine | SSIBF151 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | Diphenylamine | SSIBF152 | | | Pass[e] | | < | | 342 | µg/kg | |
| SVOC | Diphenylamine | SSIBF153 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | Fluoranthene | SSIBF148 | 1800000 | | Pass[d] | 149 | | | 343 | µg/kg | J |
| SVOC | Fluoranthene | SSIBF149 | 1800000 | | Pass[f] | | < | | 346 | µg/kg | UJ |
| SVOC | Fluoranthene | SSIBF151 | 1800000 | | Pass[d] | 144 | | | 345 | µg/kg | J |
| SVOC | Fluoranthene | SSIBF152 | 1800000 | | Pass[d] | 146 | | | 342 | µg/kg | J |
| SVOC | Fluoranthene | SSIBF153 | 1800000 | | Pass[f] | | < | | 345 | µg/kg | UJ |
| SVOC | Fluorene | SSIBF148 | 170000 | | Pass[f] | | < | | 343 | µg/kg | |
| SVOC | Fluorene | SSIBF149 | 170000 | | Pass[f] | | < | | 346 | µg/kg | |

Table 1. Import Fill Data and Comparisons to Background and Risk-Based Action Standard (continued)

| PCLASS | LAB_CHEM | SAMP_ID | RBAS | Background | Risk/DL Comparison | Concentration | DL_FLAG | ERROR | DET_LIMIT | UNITS | ER_Q |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SVOC | Fluorene | SSIBF151 | 170000 | | Pass[f] | | < | | 345 | µg/kg | |
| SVOC | Fluorene | SSIBF152 | 170000 | | Pass[f] | | < | | 342 | µg/kg | |
| SVOC | Fluorene | SSIBF153 | 170000 | | Pass[f] | | < | | 345 | µg/kg | |
| SVOC | Hexachlorobenzene | SSIBF148 | | | Pass[e] | | < | | 343 | µg/kg | |
| SVOC | Hexachlorobenzene | SSIBF149 | | | Pass[e] | | < | | 346 | µg/kg | |
| SVOC | Hexachlorobenzene | SSIBF151 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | Hexachlorobenzene | SSIBF152 | | | Pass[e] | | < | | 342 | µg/kg | |
| SVOC | Hexachlorobenzene | SSIBF153 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | Hexachlorobutadiene | SSIBF148 | | | Pass[e] | | < | | 343 | µg/kg | |
| SVOC | Hexachlorobutadiene | SSIBF149 | | | Pass[e] | | < | | 346 | µg/kg | |
| SVOC | Hexachlorobutadiene | SSIBF151 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | Hexachlorobutadiene | SSIBF152 | | | Pass[e] | | < | | 342 | µg/kg | |
| SVOC | Hexachlorobutadiene | SSIBF153 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | Hexachlorocyclopentadiene | SSIBF148 | | | Pass[e] | | < | | 343 | µg/kg | UJ |
| SVOC | Hexachlorocyclopentadiene | SSIBF149 | | | Pass[e] | | < | | 346 | µg/kg | UJ |
| SVOC | Hexachlorocyclopentadiene | SSIBF151 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | Hexachlorocyclopentadiene | SSIBF152 | | | Pass[e] | | < | | 342 | µg/kg | |
| SVOC | Hexachlorocyclopentadiene | SSIBF153 | | | Pass[e] | | < | | 345 | µg/kg | UJ |
| SVOC | Hexachloroethane | SSIBF148 | | | Pass[e] | | < | | 343 | µg/kg | |
| SVOC | Hexachloroethane | SSIBF149 | | | Pass[e] | | < | | 346 | µg/kg | |
| SVOC | Hexachloroethane | SSIBF151 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | Hexachloroethane | SSIBF152 | | | Pass[e] | | < | | 342 | µg/kg | |
| SVOC | Hexachloroethane | SSIBF153 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | Indeno(1,2,3-cd)pyrene | SSIBF148 | 2613.1689 | | Pass[f] | | < | | 343 | µg/kg | |
| SVOC | Indeno(1,2,3-cd)pyrene | SSIBF149 | 2613.1689 | | Pass[f] | | < | | 346 | µg/kg | |
| SVOC | Indeno(1,2,3-cd)pyrene | SSIBF151 | 2613.1689 | | Pass[f] | | < | | 345 | µg/kg | |
| SVOC | Indeno(1,2,3-cd)pyrene | SSIBF152 | 2613.1689 | | Pass[f] | | < | | 342 | µg/kg | |
| SVOC | Indeno(1,2,3-cd)pyrene | SSIBF153 | 2613.1689 | | Pass[f] | | < | | 345 | µg/kg | |
| SVOC | Isophorone | SSIBF148 | | | Pass[e] | | < | | 343 | µg/kg | |
| SVOC | Isophorone | SSIBF149 | | | Pass[e] | | < | | 346 | µg/kg | |
| SVOC | Isophorone | SSIBF151 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | Isophorone | SSIBF152 | | | Pass[e] | | < | | 342 | µg/kg | |
| SVOC | Isophorone | SSIBF153 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | m,p-Cresols | SSIBF148 | | | Pass[e] | | < | | 343 | µg/kg | |
| SVOC | m,p-Cresols | SSIBF149 | | | Pass[e] | | < | | 346 | µg/kg | |
| SVOC | m,p-Cresols | SSIBF151 | | | Pass[e] | | < | | 345 | µg/kg | |

Table 1. Import Fill Data and Comparisons to Background and Risk-Based Action Standard (continued)

| PCLASS | LAB_CHEM | SAMP_ID | RBAS | Background | Risk/DL Comparison | Concentration | DL_FLAG | ERROR | DET_LIMIT | UNITS | ER_Q |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SVOC | m,p-Cresols | SSIBF152 | | | Pass[e] | | < | | 342 | µg/kg | |
| SVOC | m,p-Cresols | SSIBF153 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | m-Nitroaniline | SSIBF148 | | | Pass[e] | | < | | 862 | µg/kg | |
| SVOC | m-Nitroaniline | SSIBF149 | | | Pass[e] | | < | | 870 | µg/kg | |
| SVOC | m-Nitroaniline | SSIBF151 | | | Pass[e] | | < | | 867 | µg/kg | |
| SVOC | m-Nitroaniline | SSIBF152 | | | Pass[e] | | < | | 859 | µg/kg | |
| SVOC | m-Nitroaniline | SSIBF153 | | | Pass[e] | | < | | 868 | µg/kg | |
| SVOC | Naphthalene | SSIBF148 | 39000 | | Pass[f] | | < | | 343 | µg/kg | |
| SVOC | Naphthalene | SSIBF149 | 39000 | | Pass[f] | | < | | 346 | µg/kg | |
| SVOC | Naphthalene | SSIBF151 | 39000 | | Pass[f] | | < | | 345 | µg/kg | |
| SVOC | Naphthalene | SSIBF152 | 39000 | | Pass[f] | | < | | 342 | µg/kg | |
| SVOC | Naphthalene | SSIBF153 | 39000 | | Pass[f] | | < | | 345 | µg/kg | |
| SVOC | Nitrobenzene | SSIBF148 | | | Pass[e] | | < | | 343 | µg/kg | |
| SVOC | Nitrobenzene | SSIBF149 | | | Pass[e] | | < | | 346 | µg/kg | |
| SVOC | Nitrobenzene | SSIBF151 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | Nitrobenzene | SSIBF152 | | | Pass[e] | | < | | 342 | µg/kg | |
| SVOC | Nitrobenzene | SSIBF153 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | N-Nitrosodipropylamine | SSIBF148 | | | Pass[e] | | < | | 343 | µg/kg | |
| SVOC | N-Nitrosodipropylamine | SSIBF149 | | | Pass[e] | | < | | 346 | µg/kg | |
| SVOC | N-Nitrosodipropylamine | SSIBF151 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | N-Nitrosodipropylamine | SSIBF152 | | | Pass[e] | | < | | 342 | µg/kg | |
| SVOC | N-Nitrosodipropylamine | SSIBF153 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | o-Cresol | SSIBF148 | | | Pass[e] | | < | | 343 | µg/kg | |
| SVOC | o-Cresol | SSIBF149 | | | Pass[e] | | < | | 346 | µg/kg | |
| SVOC | o-Cresol | SSIBF151 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | o-Cresol | SSIBF152 | | | Pass[e] | | < | | 342 | µg/kg | |
| SVOC | o-Cresol | SSIBF153 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | o-Nitroaniline | SSIBF148 | | | Pass[e] | | < | | 862 | µg/kg | |
| SVOC | o-Nitroaniline | SSIBF149 | | | Pass[e] | | < | | 870 | µg/kg | |
| SVOC | o-Nitroaniline | SSIBF151 | | | Pass[e] | | < | | 867 | µg/kg | |
| SVOC | o-Nitroaniline | SSIBF152 | | | Pass[e] | | < | | 859 | µg/kg | |
| SVOC | o-Nitroaniline | SSIBF153 | | | Pass[e] | | < | | 868 | µg/kg | |
| SVOC | Pentachlorophenol | SSIBF148 | 13350.872 | | Pass[f] | | < | | 862 | µg/kg | |
| SVOC | Pentachlorophenol | SSIBF149 | 13350.872 | | Pass[f] | | < | | 870 | µg/kg | |
| SVOC | Pentachlorophenol | SSIBF151 | 13350.872 | | Pass[f] | | < | | 867 | µg/kg | |
| SVOC | Pentachlorophenol | SSIBF152 | 13350.872 | | Pass[f] | | < | | 859 | µg/kg | |

## Table 1. Import Fill Data and Comparisons to Background and Risk-Based Action Standard (continued)

| PCLASS | LAB_CHEM | SAMP_ID | RBAS | Background | Risk/DL Comparison | Concentration | DL_FLAG | ERROR | DET_LIMIT | UNITS | ER_Q |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SVOC | Pentachlorophenol | SSIBF153 | 13350.872 | | Pass[f] | | < | | 868 | µg/kg | |
| SVOC | Phenanthrene | SSIBF148 | 1200000 | | Pass[d] | 12 | | | 343 | µg/kg | J |
| SVOC | Phenanthrene | SSIBF149 | 1200000 | | Pass[f] | | < | | 346 | µg/kg | |
| SVOC | Phenanthrene | SSIBF151 | 1200000 | | Pass[f] | | < | | 345 | µg/kg | |
| SVOC | Phenanthrene | SSIBF152 | 1200000 | | Pass[d] | 9.9 | | | 342 | µg/kg | J |
| SVOC | Phenanthrene | SSIBF153 | 1200000 | | Pass[f] | | < | | 345 | µg/kg | |
| SVOC | Phenol | SSIBF148 | | | Pass[e] | | < | | 343 | µg/kg | |
| SVOC | Phenol | SSIBF149 | | | Pass[e] | | < | | 346 | µg/kg | |
| SVOC | Phenol | SSIBF151 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | Phenol | SSIBF152 | | | Pass[e] | | < | | 342 | µg/kg | |
| SVOC | Phenol | SSIBF153 | | | Pass[e] | | < | | 345 | µg/kg | |
| SVOC | p-Nitroaniline | SSIBF148 | | | Pass[e] | | < | | 862 | µg/kg | |
| SVOC | p-Nitroaniline | SSIBF149 | | | Pass[e] | | < | | 870 | µg/kg | |
| SVOC | p-Nitroaniline | SSIBF151 | | | Pass[e] | | < | | 867 | µg/kg | |
| SVOC | p-Nitroaniline | SSIBF152 | | | Pass[e] | | < | | 859 | µg/kg | |
| SVOC | p-Nitroaniline | SSIBF153 | | | Pass[e] | | < | | 868 | µg/kg | |
| SVOC | Pyrene | SSIBF148 | 490000 | | Pass[f] | | < | | 343 | µg/kg | |
| SVOC | Pyrene | SSIBF149 | 490000 | | Pass[f] | | < | | 346 | µg/kg | |
| SVOC | Pyrene | SSIBF151 | 490000 | | Pass[f] | | < | | 345 | µg/kg | |
| SVOC | Pyrene | SSIBF152 | 490000 | | Pass[f] | | < | | 342 | µg/kg | |
| SVOC | Pyrene | SSIBF153 | 490000 | | Pass[f] | | < | | 345 | µg/kg | |
| VOC | 1,1,1-Trichloroethane | SSIBF148 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | 1,1,1-Trichloroethane | SSIBF149 | | | Pass[e] | | < | | 1.0 | µg/kg | |
| VOC | 1,1,1-Trichloroethane | SSIBF151 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | 1,1,1-Trichloroethane | SSIBF152 | | | Pass[e] | | < | | 1 | µg/kg | |
| VOC | 1,1,1-Trichloroethane | SSIBF153 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | 1,1,2,2-Tetrachloroethane | SSIBF148 | | | Pass[e] | | < | | 1.1 | µg/kg | UJ |
| VOC | 1,1,2,2-Tetrachloroethane | SSIBF149 | | | Pass[e] | | < | | 1.0 | µg/kg | UJ |
| VOC | 1,1,2,2-Tetrachloroethane | SSIBF151 | | | Pass[e] | | < | | 1.1 | µg/kg | UJ |
| VOC | 1,1,2,2-Tetrachloroethane | SSIBF152 | | | Pass[e] | | < | | 1 | µg/kg | |
| VOC | 1,1,2,2-Tetrachloroethane | SSIBF153 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | 1,1,2-Trichloroethane | SSIBF148 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | 1,1,2-Trichloroethane | SSIBF149 | | | Pass[e] | | < | | 1.0 | µg/kg | |
| VOC | 1,1,2-Trichloroethane | SSIBF151 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | 1,1,2-Trichloroethane | SSIBF152 | | | Pass[e] | | < | | 1 | µg/kg | |
| VOC | 1,1,2-Trichloroethane | SSIBF153 | | | Pass[e] | | < | | 1.1 | µg/kg | |

Table 1. Import Fill Data and Comparisons to Background and Risk-Based Action Standard (continued)

| PCLASS | LAB_CHEM | SAMP_ID | RBAS | Background | Risk/DL Comparison | Concentration | DL_FLAG | ERROR | DET_LIMIT | UNITS | ER_Q |
|---|---|---|---|---|---|---|---|---|---|---|---|
| VOC | 1,1-Dichloroethane | SSIBF148 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | 1,1-Dichloroethane | SSIBF149 | | | Pass[e] | | < | | 1.0 | µg/kg | |
| VOC | 1,1-Dichloroethane | SSIBF151 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | 1,1-Dichloroethane | SSIBF152 | | | Pass[e] | | < | | 1 | µg/kg | |
| VOC | 1,1-Dichloroethane | SSIBF153 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | 1,1-Dichloroethylene | SSIBF148 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | 1,1-Dichloroethylene | SSIBF149 | | | Pass[e] | | < | | 1.0 | µg/kg | |
| VOC | 1,1-Dichloroethylene | SSIBF151 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | 1,1-Dichloroethylene | SSIBF152 | | | Pass[e] | | < | | 1 | µg/kg | |
| VOC | 1,1-Dichloroethylene | SSIBF153 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | 1,2-Dibromo-3-chloropropane | SSIBF148 | | | Pass[e] | | < | | 1.1 | µg/kg | UJ |
| VOC | 1,2-Dibromo-3-chloropropane | SSIBF149 | | | Pass[e] | | < | | 1.0 | µg/kg | UJ |
| VOC | 1,2-Dibromo-3-chloropropane | SSIBF151 | | | Pass[e] | | < | | 1.1 | µg/kg | UJ |
| VOC | 1,2-Dibromo-3-chloropropane | SSIBF152 | | | Pass[e] | | < | | 1 | µg/kg | |
| VOC | 1,2-Dibromo-3-chloropropane | SSIBF153 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | 1,2-Dibromoethane | SSIBF148 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | 1,2-Dibromoethane | SSIBF149 | | | Pass[e] | | < | | 1.0 | µg/kg | |
| VOC | 1,2-Dibromoethane | SSIBF151 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | 1,2-Dibromoethane | SSIBF152 | | | Pass[e] | | < | | 1 | µg/kg | |
| VOC | 1,2-Dibromoethane | SSIBF153 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | 1,2-Dichloroethane | SSIBF148 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | 1,2-Dichloroethane | SSIBF149 | | | Pass[e] | | < | | 1.0 | µg/kg | |
| VOC | 1,2-Dichloroethane | SSIBF151 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | 1,2-Dichloroethane | SSIBF152 | | | Pass[e] | | < | | 1 | µg/kg | |
| VOC | 1,2-Dichloroethane | SSIBF153 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | 1,2-Dichloropropane | SSIBF148 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | 1,2-Dichloropropane | SSIBF149 | | | Pass[e] | | < | | 1.0 | µg/kg | |
| VOC | 1,2-Dichloropropane | SSIBF151 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | 1,2-Dichloropropane | SSIBF152 | | | Pass[e] | | < | | 1 | µg/kg | |
| VOC | 1,2-Dichloropropane | SSIBF153 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | 2-Butanone | SSIBF148 | 12000 | | Pass[f] | | < | | 5.3 | µg/kg | |
| VOC | 2-Butanone | SSIBF149 | 12000 | | Pass[f] | | < | | 5.1 | µg/kg | |
| VOC | 2-Butanone | SSIBF151 | 12000 | | Pass[f] | | < | | 5.3 | µg/kg | |
| VOC | 2-Butanone | SSIBF152 | 12000 | | Pass[j] | 1.7 | | | 5.1 | µg/kg | J |
| VOC | 2-Butanone | SSIBF153 | 12000 | | Pass[f] | | < | | 5.3 | µg/kg | UJ |
| VOC | 2-Hexanone | SSIBF148 | | | Pass[e] | | < | | 5.3 | µg/kg | |

Table 1. Import Fill Data and Comparisons to Background and Risk-Based Action Standard (continued)

| PCLASS | LAB_CHEM | SAMP_ID | RBAS | Background | Risk/DL Comparison | Concentration | DL_FLAG | ERROR | DET_LIMIT | UNITS | ER_Q |
|---|---|---|---|---|---|---|---|---|---|---|---|
| VOC | 2-Hexanone | SSIBF149 | | | Pass[e] | | < | | 5.1 | µg/kg | |
| VOC | 2-Hexanone | SSIBF151 | | | Pass[e] | | < | | 5.3 | µg/kg | |
| VOC | 2-Hexanone | SSIBF152 | | | Pass[e] | | < | | 5.1 | µg/kg | |
| VOC | 2-Hexanone | SSIBF153 | | | Pass[e] | | < | | 5.3 | µg/kg | |
| VOC | 4-Methyl-2-pentanone | SSIBF148 | | | Pass[e] | | < | | 5.3 | µg/kg | |
| VOC | 4-Methyl-2-pentanone | SSIBF149 | | | Pass[e] | | < | | 5.1 | µg/kg | |
| VOC | 4-Methyl-2-pentanone | SSIBF151 | | | Pass[e] | | < | | 5.3 | µg/kg | |
| VOC | 4-Methyl-2-pentanone | SSIBF152 | | | Pass[e] | | < | | 5.1 | µg/kg | |
| VOC | 4-Methyl-2-pentanone | SSIBF153 | | | Pass[e] | | < | | 5.3 | µg/kg | |
| VOC | Acetone | SSIBF148 | 1700 | | Pass[f] | | < | | 26.6 | µg/kg | |
| VOC | Acetone | SSIBF149 | 1700 | | Pass[L] | 9.4 | | | 25.6 | µg/kg | UJ |
| VOC | Acetone | SSIBF151 | 1700 | | Pass[f] | | < | | 26.7 | µg/kg | |
| VOC | Acetone | SSIBF152 | 1700 | | Lab Contaminant | 6 | | | 25.4 | µg/kg | J |
| VOC | Acetone | SSIBF153 | 1700 | | Pass[f] | | < | | 26.7 | µg/kg | UJ |
| VOC | Benzene | SSIBF148 | 14.679066 | | Pass[f] | | < | | 1.1 | µg/kg | |
| VOC | Benzene | SSIBF149 | 14.679066 | | Pass[f] | | < | | 1.0 | µg/kg | |
| VOC | Benzene | SSIBF151 | 14.679066 | | Pass[f] | | < | | 1.1 | µg/kg | |
| VOC | Benzene | SSIBF152 | 14.679066 | | Pass[f] | | < | | 1 | µg/kg | |
| VOC | Benzene | SSIBF153 | 14.679066 | | Pass[f] | | < | | 1.1 | µg/kg | |
| VOC | Bromochloromethane | SSIBF148 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | Bromochloromethane | SSIBF149 | | | Pass[e] | | < | | 1.0 | µg/kg | |
| VOC | Bromochloromethane | SSIBF151 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | Bromochloromethane | SSIBF152 | | | Pass[e] | | < | | 1 | µg/kg | |
| VOC | Bromochloromethane | SSIBF153 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | Bromodichloromethane | SSIBF148 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | Bromodichloromethane | SSIBF149 | | | Pass[e] | | < | | 1.0 | µg/kg | |
| VOC | Bromodichloromethane | SSIBF151 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | Bromodichloromethane | SSIBF152 | | | Pass[e] | | < | | 1 | µg/kg | |
| VOC | Bromodichloromethane | SSIBF153 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | Bromoform | SSIBF148 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | Bromoform | SSIBF149 | | | Pass[e] | | < | | 1.0 | µg/kg | |
| VOC | Bromoform | SSIBF151 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | Bromoform | SSIBF152 | | | Pass[e] | | < | | 1 | µg/kg | |
| VOC | Bromoform | SSIBF153 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | Bromomethane | SSIBF148 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | Bromomethane | SSIBF149 | | | Pass[e] | | < | | 1.0 | µg/kg | |

Table 1. Import Fill Data and Comparisons to Background and Risk-Based Action Standard (continued)

| PCLASS | LAB_CHEM | SAMP_ID | RBAS | Background | Risk/DL Comparison | Concentration | DL_FLAG | ERROR | DET_LIMIT | UNITS | ER_Q |
|---|---|---|---|---|---|---|---|---|---|---|---|
| VOC | Bromomethane | SSIBF151 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | Bromomethane | SSIBF152 | | | Pass[e] | | < | | 1 | µg/kg | |
| VOC | Bromomethane | SSIBF153 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | Carbon disulfide | SSIBF148 | | | Pass[e] | | < | | 5.3 | µg/kg | |
| VOC | Carbon disulfide | SSIBF149 | | | Pass[e] | | < | | 5.1 | µg/kg | |
| VOC | Carbon disulfide | SSIBF151 | | | Pass[e] | | < | | 5.3 | µg/kg | |
| VOC | Carbon disulfide | SSIBF152 | | | Pass[e] | | < | | 5.1 | µg/kg | |
| VOC | Carbon disulfide | SSIBF153 | | | Pass[e] | | < | | 5.3 | µg/kg | |
| VOC | Carbon tetrachloride | SSIBF148 | 55.300954 | | Pass[f] | | < | | 1.1 | µg/kg | |
| VOC | Carbon tetrachloride | SSIBF149 | 55.300954 | | Pass[f] | | < | | 1.0 | µg/kg | |
| VOC | Carbon tetrachloride | SSIBF151 | 55.300954 | | Pass[f] | | < | | 1.1 | µg/kg | |
| VOC | Carbon tetrachloride | SSIBF152 | 55.300954 | | Pass[f] | | < | | 1 | µg/kg | |
| VOC | Carbon tetrachloride | SSIBF153 | 55.300954 | | Pass[f] | | < | | 1.1 | µg/kg | |
| VOC | Chlorobenzene | SSIBF148 | | | Pass[e] | | < | | 1.1 | µg/kg | UJ |
| VOC | Chlorobenzene | SSIBF149 | | | Pass[e] | | < | | 1.0 | µg/kg | UJ |
| VOC | Chlorobenzene | SSIBF151 | | | Pass[e] | | < | | 1.1 | µg/kg | UJ |
| VOC | Chlorobenzene | SSIBF152 | | | Pass[e] | | < | | 1 | µg/kg | |
| VOC | Chlorobenzene | SSIBF153 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | Chloroethane | SSIBF148 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | Chloroethane | SSIBF149 | | | Pass[e] | | < | | 1.0 | µg/kg | |
| VOC | Chloroethane | SSIBF151 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | Chloroethane | SSIBF152 | | | Pass[e] | | < | | 1 | µg/kg | |
| VOC | Chloroethane | SSIBF153 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | Chloroform | SSIBF148 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | Chloroform | SSIBF149 | | | Pass[e] | | < | | 1.0 | µg/kg | |
| VOC | Chloroform | SSIBF151 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | Chloroform | SSIBF152 | | | Pass[e] | | < | | 1 | µg/kg | |
| VOC | Chloroform | SSIBF153 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | Chloromethane | SSIBF148 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | Chloromethane | SSIBF149 | | | Pass[e] | | < | | 1.0 | µg/kg | |
| VOC | Chloromethane | SSIBF151 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | Chloromethane | SSIBF152 | | | Pass[e] | | < | | 1 | µg/kg | |
| VOC | Chloromethane | SSIBF153 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | cis-1,2-Dichloroethylene | SSIBF148 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | cis-1,2-Dichloroethylene | SSIBF149 | | | Pass[e] | | < | | 1.0 | µg/kg | |
| VOC | cis-1,2-Dichloroethylene | SSIBF151 | | | Pass[e] | | < | | 1.1 | µg/kg | |

Table 1. Import Fill Data and Comparisons to Background and Risk-Based Action Standard (continued)

| PCLASS | LAB_CHEM | SAMP_ID | RBAS | Background | Risk/DL Comparison | Concentration | DL_FLAG | ERROR | DET_LIMIT | UNITS | ER_Q |
|---|---|---|---|---|---|---|---|---|---|---|---|
| VOC | cis-1,2-Dichloroethylene | SSIBF152 | | | Pass[e] | | < | | 1 | µg/kg | |
| VOC | cis-1,2-Dichloroethylene | SSIBF153 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | cis-1,3-Dichloropropylene | SSIBF148 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | cis-1,3-Dichloropropylene | SSIBF149 | | | Pass[e] | | < | | 1.0 | µg/kg | |
| VOC | cis-1,3-Dichloropropylene | SSIBF151 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | cis-1,3-Dichloropropylene | SSIBF152 | | | Pass[e] | | < | | 1 | µg/kg | |
| VOC | cis-1,3-Dichloropropylene | SSIBF153 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | Dibromochloromethane | SSIBF148 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | Dibromochloromethane | SSIBF149 | | | Pass[e] | | < | | 1.0 | µg/kg | |
| VOC | Dibromochloromethane | SSIBF151 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | Dibromochloromethane | SSIBF152 | | | Pass[e] | | < | | 1 | µg/kg | |
| VOC | Dibromochloromethane | SSIBF153 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | Ethylbenzene | SSIBF148 | 10000 | | Pass[f] | | < | | 1.1 | µg/kg | |
| VOC | Ethylbenzene | SSIBF149 | 10000 | | Pass[f] | | < | | 1.0 | µg/kg | |
| VOC | Ethylbenzene | SSIBF151 | 10000 | | Pass[f] | | < | | 1.1 | µg/kg | |
| VOC | Ethylbenzene | SSIBF152 | 10000 | | Pass[f] | | < | | 1 | µg/kg | |
| VOC | Ethylbenzene | SSIBF153 | 10000 | | Pass[f] | | < | | 1.1 | µg/kg | |
| VOC | Methylene chloride | SSIBF148 | 131.59701 | | Pass[L] | 3.5 | | | 5.3 | µg/kg | UJ |
| VOC | Methylene chloride | SSIBF149 | 131.59701 | | Pass[L] | 8 | | | 5.1 | µg/kg | UJ |
| VOC | Methylene chloride | SSIBF151 | 131.59701 | | Pass[L] | 5.6 | | | 5.3 | µg/kg | UJ |
| VOC | Methylene chloride | SSIBF152 | 131.59701 | | Pass[L] | 82.1 | | | 5.1 | µg/kg | |
| VOC | Methylene chloride | SSIBF153 | 131.59701 | | Pass[L] | 14.2 | | | 5.3 | µg/kg | |
| VOC | Styrene | SSIBF148 | 76000 | | Pass[f] | | < | | 1.1 | µg/kg | |
| VOC | Styrene | SSIBF149 | 76000 | | Pass[f] | | < | | 1.0 | µg/kg | |
| VOC | Styrene | SSIBF151 | 76000 | | Pass[f] | | < | | 1.1 | µg/kg | |
| VOC | Styrene | SSIBF152 | 76000 | | Pass[f] | | < | | 1 | µg/kg | |
| VOC | Styrene | SSIBF153 | 76000 | | Pass[f] | | < | | 1.1 | µg/kg | |
| VOC | Tetrachloroethylene | SSIBF148 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | Tetrachloroethylene | SSIBF149 | | | Pass[e] | | < | | 1.0 | µg/kg | |
| VOC | Tetrachloroethylene | SSIBF151 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | Tetrachloroethylene | SSIBF152 | | | Pass[e] | | < | | 1 | µg/kg | |
| VOC | Tetrachloroethylene | SSIBF153 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | Toluene | SSIBF148 | 19000 | | Pass[f] | | < | | 1.1 | µg/kg | |
| VOC | Toluene | SSIBF149 | 19000 | | Pass[f] | | < | | 1.0 | µg/kg | |
| VOC | Toluene | SSIBF151 | 19000 | | Pass[f] | | < | | 1.1 | µg/kg | |
| VOC | Toluene | SSIBF152 | 19000 | | Pass[j] | 0.89 | | | 1 | µg/kg | J |

## Table 1. Import Fill Data and Comparisons to Background and Risk-Based Action Standard (continued)

| PCLASS | LAB_CHEM | SAMP_ID | RBAS | Background | Risk/DL Comparison | Concentration | DL_FLAG | ERROR | DET_LIMIT | UNITS | ER_Q |
|---|---|---|---|---|---|---|---|---|---|---|---|
| VOC | Toluene | SSIBF153 | 19000 | | Pass[j] | 0.58 | | | 1.1 | µg/kg | J |
| VOC | trans-1,2-Dichloroethylene | SSIBF148 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | trans-1,2-Dichloroethylene | SSIBF149 | | | Pass[e] | | < | | 1.0 | µg/kg | |
| VOC | trans-1,2-Dichloroethylene | SSIBF151 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | trans-1,2-Dichloroethylene | SSIBF152 | | | Pass[e] | | < | | 1 | µg/kg | |
| VOC | trans-1,2-Dichloroethylene | SSIBF153 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | trans-1,3-Dichloropropylene | SSIBF148 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | trans-1,3-Dichloropropylene | SSIBF149 | | | Pass[e] | | < | | 1.0 | µg/kg | |
| VOC | trans-1,3-Dichloropropylene | SSIBF151 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | trans-1,3-Dichloropropylene | SSIBF152 | | | Pass[e] | | < | | 1 | µg/kg | |
| VOC | trans-1,3-Dichloropropylene | SSIBF153 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | Trichloroethylene | SSIBF148 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | Trichloroethylene | SSIBF149 | | | Pass[e] | | < | | 1.0 | µg/kg | |
| VOC | Trichloroethylene | SSIBF151 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | Trichloroethylene | SSIBF152 | | | Pass[e] | | < | | 1 | µg/kg | |
| VOC | Trichloroethylene | SSIBF153 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | Vinyl chloride | SSIBF148 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | Vinyl chloride | SSIBF149 | | | Pass[e] | | < | | 1.0 | µg/kg | |
| VOC | Vinyl chloride | SSIBF151 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | Vinyl chloride | SSIBF152 | | | Pass[e] | | < | | 1 | µg/kg | |
| VOC | Vinyl chloride | SSIBF153 | | | Pass[e] | | < | | 1.1 | µg/kg | |
| VOC | Xylenes (total) | SSIBF148 | 700000 | | Pass[f] | | < | | 2.1 | µg/kg | |
| VOC | Xylenes (total) | SSIBF149 | 700000 | | Pass[f] | | < | | 2.0 | µg/kg | |
| VOC | Xylenes (total) | SSIBF151 | 700000 | | Pass[f] | | < | | 2.1 | µg/kg | |
| VOC | Xylenes (total) | SSIBF152 | 700000 | | Pass[f] | | < | | 2 | µg/kg | |
| VOC | Xylenes (total) | SSIBF153 | 700000 | | Pass[f] | | < | | 2.1 | µg/kg | |

Table 1. Import Fill Data and Comparisons to Background and Risk-Based Action Standard (continued)

**Note**

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
i = Laboratory is re-analyzing soil for uranium-235/236. Data were not useable for risk and DL comparisons due laboratory failure to meet contract detection limits.
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 = Antimony results rejected - low matrix spike recovery. Acceptable antimony results for previous import fill samples from same soil source indicate antimony concentrations are below background.
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 | Semivolatile organic compound analysis |
| VOC | Volatile organic compound analysis |

# APPENDIX C

## WESTERN DOG PENS REMOVAL ACTION AIR MONITORING

# C. WESTERN DOG PENS REMOVAL ACTION AIR MONITORING

## C.1 Western Dog Pens Removal Action Air Monitoring

Based on the constituents of concern (COCs) detected in soil at the Western Dog Pens (WDPs) area prior to the 2001 removal action (RA), the following RA air monitoring program was established: pre-RA, post-RA sampling and monthly sampling for Ra-226, Sr-90, chlordane and particulate matter less than 10 microns in diameter ($PM_{10}$). Air monitoring data gathered before, during and after the Western Dog Pens (WDPs) remvoal action (RA) had a very limited number of dections (Table C-1). Therefore, no statistical tests were conducted on the data. The detected air concentrations were compared to three regulatory risk guidelines depending on which value was available for each COC:

- US EPA Region 9 Preliminary Remediation Goal (PRG) ambient air value (if available)—The PRG values are health-based concentrations (assuming an exposure duration of 30 years) that correspond to either a one-in-one million (1E-06) cancer risk or a chronic health quotient of one, whichever is lower (PNNL, 1996);
- Occupational Safety and Health Administration (OSHA) permissible exposure limits (PELs)—The OSHA PELs are maximum air concentrations of specific constituents allowed to exposed workers based on a time-weighted averaged for an eight-hour workshift;
- DOE Derived Concentration Guide (DCG) for ambient air radionuclides—The DCG values represent the concentrations of radionuclides in air that an individual could continuously inhale and be immersed at average annual rates without receiving an effective dose equivalent to, or greater than, 100 millirems per year (PNNL, 1996).

Table C-1 present the number of samples and detections, the range of detected concentrations, PELs, PRGs, and DCGs for all of the constituents with concentrations greater than their detection limits.

### *C.1.1 Chlordane*

Chlordane was not detected in any of the pre-RA or post-RA samples. One sample collected during the RA had a concentration greater than the detection limit. The only detected concentration, 0.159 micrograms per cubic meter ($\mu g/m^3$), was above the PRG, but well below the PEL. Although

RA activities may have cause a temporary exceedance of the chlordane PRG for ambient air, the chlordane concentration did not pose a health risk to site works or laboratory personnel at LEHR due to its short duration.

### *C.1.2 PM$_{10}$*

US EPA specifies a size-specific air quality standard for ambient air particulate. The standard applies to particles with aerodynamic diameters less than or equal to 10 micrometers ($PM_{10}$) [US EPA, 1987]. $PM_{10}$ concentrations did not exceed 150 µg/m$^3$ standard for a 24-hour period.

### *C.1.3 Ra-226 and Sr-90*

Sr-90 was not reported above the detection limit in any of the air samples collected during the WDPs RA. Ra-226 was detected in one of three samples during the pre- and post-RA sampling events. Ra-226 was detected in four of the nine sample collected during the RA. All of the Ra-226 air concentrations were well below the DCG.

### *C.1.4 Conclusion*

On-site air monitoring data collected during the WDPs RA indicated that ambient air concentrations did not pose any health risks to site workers or laboratory personnel at LEHR.

## C.2 References

Pacific Northwest National Laboratory (PNNL), 1996, Baseline Investigation of Radionuclides and Non-Radionuclides Contaminants in Ambient Air at the Laboratory for Energy-Related Health Research at Davis, California, August 1995 to August 1996, December 1996.

United States Environmental Protection Agency (US EPA), 1987, Revisions to the National Ambient Air Quality Standard for Particulate Matter: Final Rule. Federal Register 1987;52:24634.

US EPA, 1994, Statistical Methods for Evaluating the Attainment of Cleanup Standards, Vol. 3: Reference-Based Standards for Soils and Solid Media, Environmental Statistics and Information Division, Office of Policy, Planning and Evaluation, U.S. Environmental Protection Agency, Washington, D.C. US EPA/230-R-94-004 (PB94-176831), June.

Table C-1. Statistical Test Results Summary for the Western Dog Pens Removal Action Air Monitoring Data

| Contaminant of Concern | Number of Samples | Number of Detections | Range of Detected Concentrations ($\mu g/m^3$) | PRG ($\mu g/m^3$) | PEL ($\mu g/m^3$) |
|---|---|---|---|---|---|
| **Pre-RA** | | | | | |
| Chlordane | 3 | 0 | <0.01 | 0.019 | 500 |
| **During RA** | | | | | |
| Chlordane | 9 | 1 | 0.159 | 0.019 | 500 |
| **Post-RA** | | | | | |
| Chlordane | 3 | 0 | <0.01 | 0.019 | 500 |

| Contaminant of Concern | Number of Samples | Number of Detections | Range of Detected Concentrations (μCi/ml) | DCG (μCi/ml) |
|---|---|---|---|---|
| **Pre-RA** | | | | |
| Radium-226 | 3 | 1 | 5.17E-15 | 1E-12 [(1)] |
| **During RA** | | | | |
| Radium-226 | 9 | 4 | 7.89E-16- 6.94E-15 | 1E-12 [(1)] |
| **Post-RA** | | | | |
| Radium-226 | 3 | 1 | 3.19E-15 | 1E-12 [(1)] |

**Notes**
[(1)] DCG value is for lung retention class "W".

**Abbreviations**

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