



## **U.S. Department of Energy**

Oakland Operations Office, Oakland, California

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### **ADDITIONAL BACKGROUND INVESTIGATION: ADDENDUM TO FINAL WORK PLAN FOR WESTERN DOG PENS, BACKGROUND, AND OFF-SITE INVESTIGATIONS**

at the

**LABORATORY FOR ENERGY-RELATED HEALTH  
RESEARCH (LEHR)  
UNIVERSITY OF CALIFORNIA AT DAVIS, CALIFORNIA**

*Prepared for:*

**United States Department of Energy**  
Oakland Operations Office  
1301 Clay Street  
Oakland, California 95612-5208

*Prepared by:*

**Weiss Associates**  
5500 Shellmound Street  
Emeryville, California 94608

January 27, 1999

Rev. 0

DOE Oakland Operations Contract DE-AC03-96SF20686

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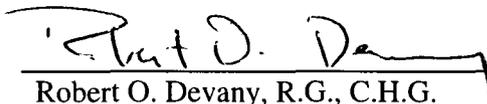


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## ADDENDUM

This addendum to the *Final Work Plan for the Western Dog Pens, Background, and Off-Site Investigations* (Weiss Associates [WA], 1997a) describes additional soil sampling locations and activities associated with the Background Investigation (BI) (Figure 1).

The primary objective of collecting additional background data is to assist in establishing cleanup goals for certain metals and radionuclides at the site. Based on statistical re-analysis of the data collected to date for the BI, it has been determined that mercury (Hg), nickel (Ni), chromium (Cr), barium (Ba), beryllium (Be), cesium-137 (Cs-137), thorium-228 (Th-228), Th-232, and uranium-238 (U-238), unlike the majority of the other contaminants of concern, are stratified with depth. Because of this stratification, there are not enough data points from the surface or near-surface locations for these constituents. Therefore, this additional activity of surface and near-surface sampling is important to:

- determine background concentrations for Hg, Ni, Cr, Ba, Be, Cs-137, Th-228, Th-232, and U-238 vertically; and,
- to meet the data quality objectives presented in the Final Work Plan for the Western Dog Pens, Background, and Off-Site Investigations (WA, 1997a).

Additional BI sampling and analysis will be performed in accordance with this addendum, the *Final Work Plan for the Western Dog Pens, Background and Off-Site Investigations*, the QAPP, the Project Health and Safety Plan and appropriate SOPs.

Specific issues outlined in this addendum include:

- Summary of previous background investigation;
- Identification of sampling locations;
- Underground utility clearance;
- Soil sampling; and,
- Lithologic logging, sample collection, and sample analysis (Table 1).

Each of these is described in greater detail below.

### Summary of Previous Background Investigation

Six background borings drilled during the October 1997 BI were sampled and analyzed to supplement data from the six background borings drilled by Dames & Moore in 1994. As described in detail in Appendix C of the *Draft Final Work Plan for Removal Actions in the Southwest Trenches, Ra/Sr Treatment Systems, and Domestic Septic System Areas* (WA, 1998a), the

radionuclide and metals results from both the 1994 and 1997 BI borings were statistically analyzed and levels representative of background were calculated for each inorganic constituent of concern. These background levels represent the 80% lower confidence limit (LCL) of the 95<sup>th</sup> percentile for each constituent's data set. In most cases, the data sets included both the 1994 and 1997 results. However, in some cases only 1994 or only 1997 data were available, and in some cases the consolidation of the 1994 and 1997 data was not appropriate because of statistically significant differences, in which case only the 1997 data were used.

The new background levels are presented in Tables 1 and 2 of the *Final Technical Report: Results of Western Dog Pens, Background and Off-site Investigations* (WA, 1998b) along with the previous background levels used in the *Draft Final RBAS Report* (WA, 1997b) for comparison. Also shown in these tables are separate background levels calculated for clay/clayey-silt and sand/sandy-silt for those constituents that showed statistically significant differences based on soil type.

In the cases of Hg and Cs-137, it was noted that surface (0 ft bgs) background levels were statistically significantly higher than subsurface (4 to 40 ft bgs) background levels. Therefore, separate surface soil background levels were calculated for these two constituents. These surface background levels were calculated to be 0.99 mg/kg for mercury and 0.043 pCi/g for Cs-137.

After the *Final Technical Report: Results of Western Dog Pens, Background and Off-site Investigations* was submitted, additional statistical analysis indicated that surface background levels for Ni, Cr, Ba, Be, Th-228, Th-232, and U-238 were also significantly different from deeper background levels. It was also determined that additional data points were needed to develop surface and near-surface background levels for these constituents.

## Identification of Sampling Locations

Table 1 summarizes the general locations, depths, planned number and type of samples that will be collected during this sampling activity, and the planned analyses to be performed. From 20 boring locations, a total of 20 surface samples and 20 samples from a depth of 2 ft will be collected during this sampling activity (Figure 1). The samples will be analyzed for Hg, Ni, Cr, Be, and Ba using CLP SOW ILM 02.1, Cs-137 using EPA Method 901.1, and Th-228, Th-232, and U-238 using the contract laboratory's approved Standard Operating Procedures (SOPs). Table 2 summarizes the contract required detection units for each of the constituents listed above. Duplicate samples will be collected for QC purposes. The number of duplicate samples will be 10% of the field samples collected.

Figure 1 shows the proposed boring locations for surface and near-surface samples. The boring locations were randomly placed within the area where previous background samples were collected. The number and depths of samples are based on statistical calculations.

## Underground Utility Clearance

Because a hand auger will be used to drill into the sediments and the total depth is only 2 ft, no underground utility clearance will be performed prior to the proposed sampling activities.

## Soil Sampling Activities

Soil from the 20 surface sample locations will be collected using a hand trowel after removing approximately 2 inches of debris including leaves and branches. The borings for the near-surface samples collected from 2 ft will be hand augered and the sample will be collected using a hand trowel as described in SOP 3.1, Surface and Shallow Subsurface Soil Sampling, presented in Appendix A of the *Final Work Plan for Western Dog Pens, Background, and Off-Site Investigations* (WA, 1997a). Hand augering has been used several times in different areas of the site successfully.

During logging of the cuttings, a photoionization detector (PID) will be used to screen for organic vapors. At the conclusion of the soil sampling, the borehole will be backfilled with unused soil cuttings. Remaining unused cuttings, if any, will be spread out immediately near its point of origin. Prior to the samples being shipped off-site, they will be smeared for radioactivity.

## Lithologic Logging and Sample Collection

Lithologic core logging will be performed using the Unified Soil Classification System (USCS) method as described in SOP 15.1, Logging of Soils – Visual Unified Soil Classification. Furthermore, soil sample collection during hand augering will be conducted according to SOP 3.1, Surface and Shallow Subsurface Soil Sampling, presented in Appendix A of the *Final Work Plan for Western Dog Pens, Background, and Off-Site Investigations* (WA, 1997a).

Sample handling, packaging, and shipping procedures will be followed in accordance with SOP 2.1 as presented in Appendix A of the *Final Work Plan for Western Dog Pens, Background, and Off-Site Investigations* (WA, 1997a).

## Summary

Fieldwork will be conducted according to the SOPs presented in Appendix A of the *Final Work Plan for Western Dog Pens, Background, and Off-Site Investigations* (WA, 1997a). The field activities anticipated for the additional Background Investigation include:

- Chain-of-Custody (SOP 1.1);
- Sample Handling, Packaging, and Shipping (SOP 2.1);
- Surface and Shallow Subsurface Soil Sampling (SOP 3.1); and,
- Lithologic Logging (SOP 15.1).

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As presented in Table 1 of this addendum, a contract laboratory will analyze soil samples collected during this additional Background Investigation for Hg, Ni, Cr, Be, and Ba using CLP SOW ILM 02.1 (or more recent CLP method), Cs-137 using EPA Method 901.1, and Th-228, Th-232, and U-238 using the approved laboratory SOPs.

The data for all three phases of the Background Investigations will be described in a Technical Memorandum to be prepared after the additional soil sample results are received and validated.

**FIGURE**

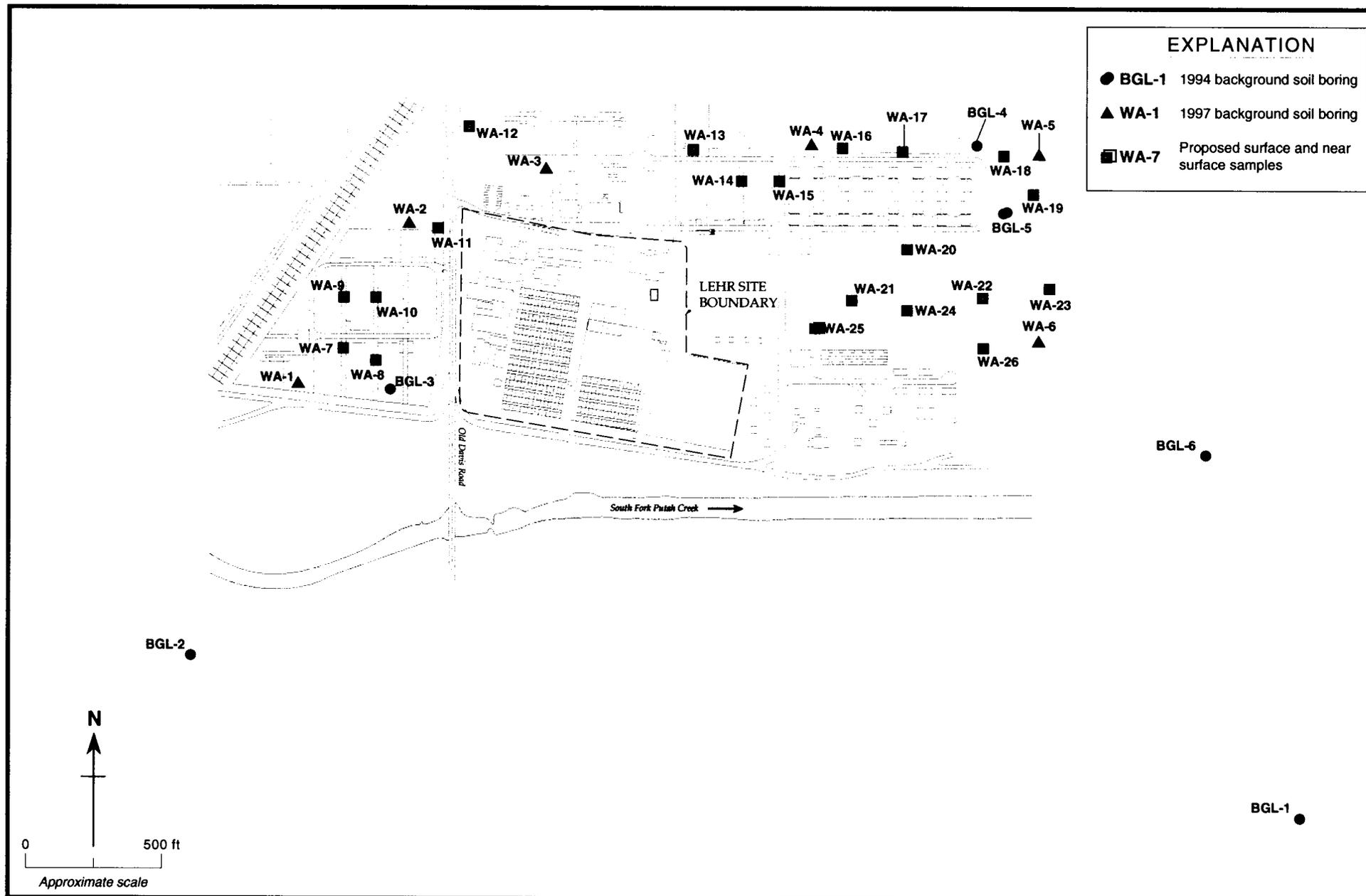


Figure 1. Proposed Soil Boring Locations for Additional Background Investigation, LEHR Site, UC Davis, California

Weiss Associates

## **TABLES**

Table 1. Background Investigation Sampling and Analysis Summary

Boring Location	Sample ID	Sample Depth (ft)	Number of Containers	Sample/ Container Type <sup>1</sup>	Preservative (specified)	Analyze for:	Analytical Method	Comments
WA-7	SSBG0120	surface	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	
WA-7	SSBG0121	2 ft	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	
WA-7	SSBG0122	2 ft	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	FIELD DUPLICATE
WA-8	SSBG0123	surface	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	
WA-8	SSBG0124	2 ft	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	
WA-9	SSBG0125	surface	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	
WA-9	SSBG0126	2 ft	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	
WA-10	SSBG0127	surface	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	
WA-10	SSBG0128	2 ft	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	

Table 1. Background Investigation Sampling and Analysis Summary (continued)

Boring Location	Sample ID	Sample Depth (ft)	Number of Containers	Sample/ Container Type <sup>1</sup>	Preservative (specified)	Analyze for:	Analytical Method	Comments
WA-11	SSBG0129	surface	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	
WA-11	SSBG0130	2 ft	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	
WA-12	SSBG0131	surface	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	
WA-12	SSBG0132	2 ft	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	
WA-13	SSBG0133	surface	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	
WA-13	SSBG0134	2 ft	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	
WA-14	SSBG0135	surface	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	
WA-14	SSBG0136	2 ft	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	
WA-15	SSBG0137	surface	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	

Table 1. Background Investigation Sampling and Analysis Summary (continued)

Boring Location	Sample ID	Sample Depth (ft)	Number of Containers	Sample/ Container Type <sup>1</sup>	Preservative (specified)	Analyze for:	Analytical Method	Comments
WA-15	SSBG0138	2 ft	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	
WA-16	SSBG0139	surface	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	
WA-16	SSBG0140	2 ft	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	
WA-16	SSBG0141	2 ft	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	FIELD DUPLICATE
WA-17	SSBG0142	surface	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	
WA-17	SSBG0143	2 ft	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	
WA-18	SSBG0144	surface	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	
WA-18	SSBG0145	2 ft	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	
WA-19	SSBG0146	surface	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	

Table 1. Background Investigation Sampling and Analysis Summary (continued)

Boring Location	Sample ID	Sample Depth (ft)	Number of Containers	Sample/ Container Type <sup>1</sup>	Preservative (specified)	Analyze for:	Analytical Method	Comments
WA-19	SSBG0147	2 ft	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	
WA-20	SSBG0148	surface	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	
WA-20	SSBG0149	surface	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	FIELD DUPLICATE
WA-20	SSBG0150	2 ft	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	
WA-21	SSBG0151	surface	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	
WA-21	SSBG0152	2 ft	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	
WA-22	SSBG0153	surface	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	
WA-22	SSBG0154	2 ft	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	
WA-23	SSBG0155	surface	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	

Table 1. Background Investigation Sampling and Analysis Summary (continued)

Boring Location	Sample ID	Sample Depth (ft)	Number of Containers	Sample/ Container Type <sup>1</sup>	Preservative (specified)	Analyze for:	Analytical Method	Comments
WA-23	SSBG0156	surface	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	FIELD DUPLICATE
WA-23	SSBG0157	2 ft	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	
WA-24	SSBG0158	surface	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	
WA-24	SSBG0159	2 ft	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	
WA-25	SSBG0160	surface	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	
WA-25	SSBG0161	2 ft	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	
WA-26	SSBG0162	surface	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	
WA-26	SSBG0163	2 ft	2	S/8-oz jar	None	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	
Equipment Rinseate Sample	WSBG0003	---	2	W/0.5 L P	HNO <sub>3</sub>	Mercury, Nickel, Chromium, Beryllium, Barium, Cs-137, Th-228, Th-232, and U-238	CLP SOW ILM 02.1, EPA Method 901.1, and Lab SOPs	

Notes:

1 = W=Water; S = Soil; jar = glass jar; P=Plastic bottle

Table 2. Contract Required Detection Limits for the Additional Background Investigation

Parameter	Analytical Method	Contract Required Detection Limit (pCi/g for radionuclides, mg/kg for chemicals)
<u>Radionuclides:</u>		
Cesium-137	Lab SOP	0.005
Thorium-228	Lab SOP	0.1
Thorium-232	Lab SOP	0.05
Uranium-238	Lab SOP	0.025
<u>Metals/Other Inorganics:</u>		
Barium	CLP SOW ILM 02.1	40
Beryllium	CLP SOW ILM 02.1	1
Chromium (total)	CLP SOW ILM 02.1	1
Mercury	CLP SOW ILM 02.1	0.1
Nickel	CLP SOW ILM 02.1	1

Abbreviations:

CLP SOW = Contract Laboratory Program Statement of Work  
ILM 02.1 = Inorganic Laboratory Method 02.1.

## **REFERENCES**

- Weiss Associates (WA), 1997a, Final Work Plan for Western Dog Pens, Background, and Off-Site Investigations, Laboratory for Energy-related Health Research (LEHR), University of California at Davis, California, October 3, 1997, 31 pp., 4 tables, 8 figures, 1 appendix.
- WA, 1997b, Draft Final Determination of Risk-Based Action Standards for DOE Areas, Volumes 1 and 2, August.
- WA, 1998a, Draft Final Work Plan for Removal Actions in the Southwest Trenches, Ra/Sr Treatment Systems, and Domestic Septic System Areas, LEHR, University of California at Davis, California.
- WA, 1998b, Final Technical Report: Results of Western Dog Pens, Background, and Off-Site Investigations, Laboratory for Energy-related Health Research (LEHR), University of California at Davis, California, June, 29 pp., 3 tables, 11 figures, 3 appendices.