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Date: September 26, 2003
Refer to: ER2003-0614

Mr. John Young, Corrective Action Project Leader
Permits Management Program
NMED – Hazardous Waste Bureau
2905 Rodeo Park Drive East
Building 1
Santa Fe, NM 87505-6303

SUBJECT: SUBMITTAL OF VOLUNTARY CORRECTIVE ACTION COMPLETION REPORT FOR PRSs 0-030(B)-00, 0-030(A), 0-029(A,B,C), 0-010(A,B) AND 0-033(A) AND INTERIM ACTION FOR PRS 21-021

Dear Mr. Young:

Enclosed are two copies of the Los Alamos National Laboratory (LANL) Remediation Service (RS) Project VCA Completion Report for PRSs 0-030(b)-00, 0-030(a), 029(a,b,c), 0-010(a,b), 0-033(a). As you may recall, this report is being submitted in the "old" format (pre corrective action order) as agreed during the order discussions with your staff.

If you have any questions please contact Terry Rust at (505) 665-8843 or Bob Enz at (505) 667-7640.

Sincerely,

David McInroy, Deputy Project Director
Remediation Services
Los Alamos National Laboratory

Sincerely,

David Gregory, Project Manager
Department of Energy
Los Alamos Site Operations

DM/DG/TR/jr

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Voluntary Correction Action Completion Report

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September 2003
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Completion Report for the VCA at SWMUs 0-030(a), 0-030(b)-00, and 0-033(a) and AOCs 0-029(a,b,c) and 0-010(a,b) and for the IA at SWMU 21-021-99

Los Alamos
NATIONAL LABORATORY
Los Alamos NM 87545

This document contains data regarding radioactive wastes, the management of which is regulated under the Atomic Energy Act and specifically excluded from regulation under the Resource Conservation and Recovery Act and the New Mexico Hazardous Waste Act. These data are provided to the New Mexico Environment Department for information purposes only.

Produced by Risk Reduction and Environmental Stewardship—Remediation Services

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EXECUTIVE SUMMARY

This report documents the voluntary corrective action (VCA) and related activities performed by the Risk Reduction and Environmental Stewardship—Remediation Services (RRES-RS) project at Solid Waste Management Units (SWMUs) 0-030(a), 0-030(b)-00, and 0-033(a) and Areas of Concern (AOCs) 0-029(a,b,c) and 0-010(a,b) and for the interim action (IA) activities at SWMU 21-021-99 at Los Alamos National Laboratory (the Laboratory). These activities were guided by the VCA/IA plan (LANL 2002, 73579) in June 2002, which was approved by the New Mexico Environment Department (NMED) in February 2003. All the SWMUs and AOCs, with the exception of SWMU 21-021-99, are located in Technical Area (TA) 0. SWMU 21-021-99 is located in TA-21, immediately east of the TA-0 sites on DP Road.

The SWMUs that are listed in Table A of the Module VIII of the Laboratory's Hazardous Waste Facility Permit are SWMU 0-030(a); SWMUs 0-030(b,l,m), and SWMU 0-033 [SWMU 0-033 includes SWMU 0-033(a) and AOC 0-033(b)], which are all part of consolidated SWMU 00-030(b)-00; and SWMU 21-021, which is part of consolidated SWMU 21-021-99.

The only portion of SWMU 21-021 included in this report is the vacant field south and west of Material Disposal Area (MDA) B and east of SWMU 0-030(b). SWMU 21-021, which is a systematic, sitewide airborne release of radionuclides from stacks at facilities in TA-21, was sampled to better characterize potential surface contamination from deposition of airborne emissions of radionuclides at TA-21. This activity is considered an interim action that will contribute to a possible future baseline risk assessment for TA-21. No further action (NFA) is recommended for the portion of SWMU 21-021 investigated during this IA; the remaining portions of the SWMU are under investigation separately as part of TA-21 RRES-RS activities.

Remediation activities were completed at two SWMUs, 0-030(b) and 0-030(l), and additional samples were collected to address gaps in previously collected site characterization data. Human health and ecological screening assessments indicate that under a residential land use scenario, no unacceptable potential risk exists because of any residual contamination at these sites. Both SWMUs are therefore recommended for NFA based on Criterion 5 (NMED 1998, 57897).

Samples were collected at AOC 0-004, SWMU 0-030(m), AOC 0-033(b), and AOCs 0-029(a,b,c) to address gaps in previously-collected data, in order to better determine the nature and extent of possible contamination. Human health and ecological screening assessments indicate no unacceptable potential risk to human health or the environment under a residential land use scenario. Each of these SWMUs and AOCs, therefore, is recommended for NFA based on Criterion 5 (NMED 1998, 57897).

No remedial or sampling activities were conducted at SWMU 0-033(a) or at AOCs 0-010(a,b). AOCs 0-010(a,b) are administratively complete, NFA having been approved by the US Department of Energy (DOE) on September 30, 1997 (LANL 1997, 56752) and September 21, 1998 (DOE 1998, 59694), respectively. SWMU 0-033(a), the site of a former underground storage tank (UST) that was investigated and removed in September 1995 (LANL 1996, 55203) pursuant to the NMED UST Bureau Regulations Section 401(a), was proposed for NFA under Criterion 4 and included on the request for permit modification in September 1996 (LANL 1996, 55035), and again in June 2000 (LANL 2000, 67472). SWMU 0-033(a) is here again recommended for NFA under Criterion 4 (NMED 1998, 57897).

At AOC 0-027, an SVE system to remove organic chemicals from the subsurface is still in operation. The SVE system will be operated until it is clear that the concentrations of chemicals of potential concern have been reduced to an acceptable level or that the efficiency of extraction has declined beyond the point of cost-effectiveness. When the SVE operation ends, confirmation samples will be collected to document the reduction in subsurface contaminants, and the results will be reported in an addendum to this report.

Table ES-1
Summary of Proposed Actions for SWMUs and AOCs Included in this Report

SWMU/AOC	Description	HSWA[a]?	Radionuclide Component?	Proposed Action	Rationale for Recommendation	Section Number
AOC 0-004	Indoor container storage area	No	No	NFA, Criterion 5[b]	Residual contamination poses no unacceptable potential risk.	2.0
AOCs 0-010(a,b)	Disposal areas	No	No	None, administratively complete	Not applicable	5.0
AOC 0-027	Former drum storage area	No	No	Continue SVE, confirmation sampling when complete	SVE continues to be effective in removing residual contamination.	[c]
AOC 0-029(a)	Former PCB transformer site	No	No	NFA, Criterion 5	Residual contamination poses no unacceptable potential risk.	4.0
AOC 0-029(b)	Former PCB transformer site	No	No	NFA, Criterion 5	Residual contamination poses no unacceptable potential risk.	4.0
AOC 0-029(c)	Former PCB transformer site	No	No	NFA, Criterion 5	Residual contamination poses no unacceptable potential risk.	4.0
SWMU 0-030(a)	Septic system	Yes	Yes	NFA, Criterion 5	Residual contamination poses no unacceptable potential risk.	7.0
SWMU 0-030(b)	Septic system	Yes	Yes	NFA, Criterion 5	Residual contamination poses no unacceptable potential risk.	3.0
SWMU 0-030(l)	Septic system	Yes	Yes	NFA, Criterion 5	Residual contamination poses no unacceptable potential risk.	2.0
SWMU 0-030(m)	Septic system	Yes	Yes	NFA, Criterion 5	Residual contamination poses no unacceptable potential risk.	3.0
SWMU 0-033(a)	Former UST	Yes [0-033]	No	NFA, Criterion 4	UST was investigated and remediated under UST regulations.	5.0
AOC 0-033(b)	Contaminated soil, drainlines, outfall	Yes [0-033]	Yes	NFA, Criterion 5	Residual contamination poses no unacceptable potential risk.	2.0
SWMU 21-021	Surface deposition of emissions from TA-21 stacks	Yes	Yes	NFA, Criterion 5[d]	Residual contamination poses no unacceptable potential risk.	6.0

[a] If the site is listed in Module VIII of the Laboratory's Hazardous Waste Facility Permit, then "yes" applies. Otherwise, "no" applies.

[b] NFA criteria are listed in Section II.B.4.a.(4).(b), "No Further Action (NFA) Proposals Criteria," in the *NMED RCRA Permits Management Program Document Requirement Guide* (NMED 1998, 57897).

[c] SVE operations are currently ongoing at AOC 0-027; results will be reported in an addendum to this report when the operation is completed.

[d] Only a portion of SWMU 21-021 was included in the interim action activities reported here. Further, SWMU 21-021 is part of consolidated SWMU 21-021-99; conditions at the portion sampled warrant recommendation of NFA for that portion, but NFA cannot be recommended for the entire SWMU on this basis.

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1.0 INTRODUCTION

Los Alamos National Laboratory (the Laboratory) is a multidisciplinary research facility owned by the US Department of Energy (DOE) and managed by the University of California. The Laboratory is located in north-central New Mexico approximately 60 mi northeast of Albuquerque and 20 mi northwest of Santa Fe (see Figure 1.0-1). The site covers 40 mi^2 of the Pajarito Plateau, which consists of a series of finger-like mesas that are separated by deep canyons containing perennial and intermittent streams running from west to east. Mesa tops range in elevation from approximately 6200 to 7800 ft. The eastern portion of the plateau stands 300 to 1000 ft above the Rio Grande.

The environmental restoration (ER) work done by the Laboratory's Risk Reduction and Environmental Stewardship–Remediation Services (RRES-RS) project (formerly known as the ER Project) is part of a national DOE effort to clean up facilities that had been involved in weapons production. The goal of ER activities is to ensure that DOE's past operations do not pose a potential unacceptable threat to human or environmental health and safety in and around Los Alamos County. To achieve that goal, RRES-RS is investigating sites that were potentially contaminated by past Laboratory operations.

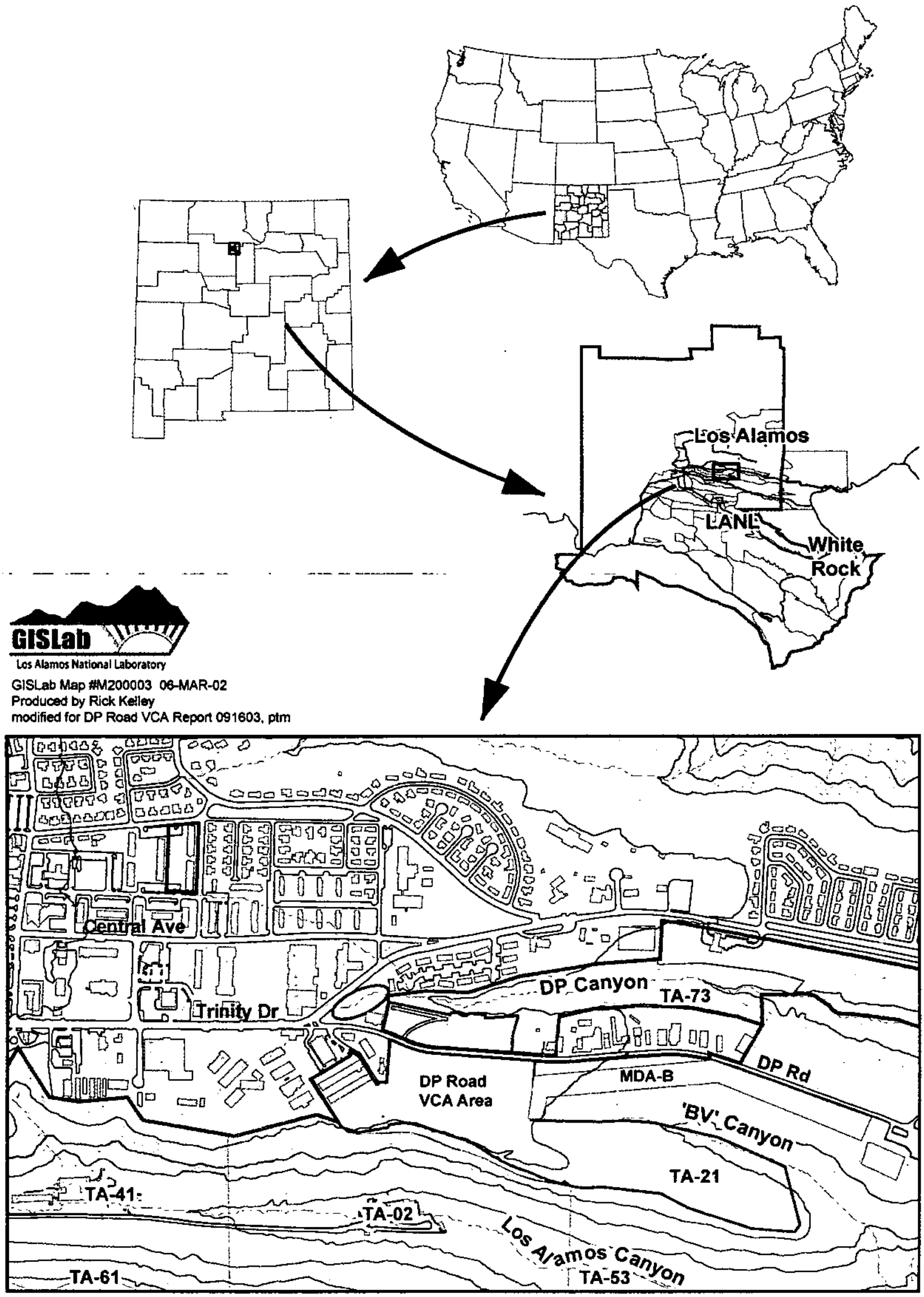
This voluntary corrective action (VCA) completion report describes the execution and results of activities prescribed in the VCA/interim action [IA] plan, "Plan for the Voluntary Corrective Action at Potential Release Sites (PRSs) 0-030(b)-00, 0-027, 0-030(a), 0-029(a,b,c), 0-010(a,b), and 0-033(a), and the Interim Action at PRS 21-021" (LANL 2002, 73579) (see Table 1.0-1). Area of Concern (AOC) 0-027 and SWMU 0-030(a) are located on land owned by the Archdiocese of Santa Fe. AOCs 0-029(a,b) are on land owned by the San Ildefonso Pueblo, and AOC 0-029(c) is on land managed by the Santa Fe National Forest. SWMU 0-030(a) and consolidated SWMU 0-030(b)-00, which includes AOCs 0-004 and 0-033(b), and SWMUs 0-030(b,l,m), are listed in Table A of the Module VIII of the Laboratory's Hazardous Waste Facility permit (EPA 1990, 01585; EPA 1994, 44146). SWMUs 0-033(b) and 0-030(b,l,m) are now part of consolidated SWMU 0-030(b)-00.

Detailed discussions of VCA investigation and remedial activities are presented in Sections 2.4, 3.4, 4.4, 5.4, 6.4, and 7.4. The VCA activities reported here were designed to

- collect additional data, where necessary, to fill gaps in previous site characterization data;
- remove piping, where practicable, from inactive septic systems;
- define the nature and extent of any residual contamination at the SWMUs/AOCs; and
- provide a basis for evaluating potential human health and ecological risks associated with any residual contamination at the SWMUs/AOCs.

These activities will allow the SWMUs to be completed and subsequently removed from Module VIII of the Laboratory's Hazardous Waste Facility permit (if applicable).

Activities at AOC 0-027 included the installation of several shallow boreholes and a soil vapor extraction (SVE) system to extract volatile and semivolatile organic chemicals from the subsurface. Because operation of that system is not complete at the time of submission of this report, those activities will be reported, with the results of the SVE operation and post-operation confirmation sampling, in an addendum to this report.



GISLab Map #M200003 06-MAR-02
Produced by Rick Kelley
modified for DP Road VCA Report 091603, ptm

Figure 1.0-1. Location map of New Mexico, LANL, and DP Road VCA Area

Table 1.0-1
Summary of SWMUs/AOCs Included in this Report

SWMU/ AOC	Description	Action Performed	Current Land Owner	Relevant Sections of this Report
0-027	Former drum storage area	Soil vapor extraction (in progress)	Private	To be discussed in future addendum
0-004	Former indoor container storage area	Additional sampling	DOE	2.0
0-010(a,b)	Disposal areas	None (administratively complete)	DOE	5.0
0-030(a)	Septic system	Reviewed data, including Reach DP-1	Private	7.0
0-030(b)	Septic system	Additional sampling, piping removal	DOE/Private	3.0
0-030(l)	Septic system	Additional sampling, piping removal	DOE	2.0
0-030(m)	Septic system	Additional sampling, piping removal	DOE	3.0
0-033(a)	Former underground storage tank	None	DOE	5.0
0-033(b)	Contaminated soil, drainlines, outfall	Additional sampling	DOE	2.0
0-029(a)	Former polychlorinated biphenyl (PCB) transformer site	Additional sampling	San Ildefonso Pueblo	4.0
0-029(b)	Former PCB transformer site	Additional sampling	San Ildefonso Pueblo	4.0
0-029(c)	Former PCB transformer site	Additional sampling	Public, Santa Fe National Forest mgt.	4.0
21-021-99	Surface deposition of emissions from TA-21 stacks	Additional sampling	DOE	6.0

2.0 AOCs 0-004 AND 0-033(b) AND SWMU 0-030(l)

2.1 Summary

The 6th Street Warehouse area, also known as the Zia Warehouses, includes Areas of Concern (AOCs) 0-004 and 0-033(b) and Solid Waste Management Unit (SWMU) 0-030(l) (see Figure 2.1-1). These sites are located near each other and included piping and surface drainages that crossed the area south of the 6th Street Warehouses.

The 1990 SWMU report states that in 1946 there were five warehouse buildings and a cold-storage plant at the site(LANL 1990, 07511). There were storm drains around the two buildings (Warehouses 1 and 2 are connected as a single building and Warehouses 3 and 4 are connected as another single building), and these drains terminated at outfalls into Los Alamos Canyon. In 1948, a materials testing laboratory (MTL) was constructed south of Warehouses 3 and 4. In this MTL, three floor drains connected to two drainlines that also terminated at outfalls near the rim of Los Alamos Canyon.

Possible contaminant releases include subsurface leaks from outfall pipes [AOC 0-033(b)], a septic tank and associated plumbing [SWMU 0-030(l)], and surface releases from spills (AOC 0-004) or outfall pipes [SWMU 0-030(l) and AOC 0-033(b)]. Contaminants of potential concern (COPCs) associated with these sites include volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), metals, and radionuclides. The 6th Street Warehouse SWMUs/AOCs are bordered by private property to the west, Los Alamos Canyon to the south, and SWMU 0-030(b) to the east. Commercial development exists within 50 ft to the north and northeast. The area of the 6th Street Warehouse SWMUs/AOCs has undergone heavy commercial and urban development. Soils have been disturbed through excavation and backfilling.

The VCA/IA plan called for the following actions at the 6th Street Warehouse SWMUs/AOCs:

- additional sampling at AOC 0-004 to provide additional nature and extent information and to provide sufficient data for human health and ecological risk screening;
- confirmation sampling of the septic tank area and outfall at SWMU 0-030(l) to fill nature and extent data gaps left by previous composite samples and mobile chemical analytical laboratory (MCAL) analyses, and removal of septic system outlet piping; and
- additional sampling at AOC 0-033(b) to fill data gaps (previous outfall and drainline sampling did not include analyses for target analyte list (TAL) metals or VOCs).

2.2 Site Description and Operational History

2.2.1 Site Description

AOC 0-004, Container Storage Area

AOC 0-004 was a container storage area located inside 6th Street Warehouses 3 and 4. A paved parking area south of the building slopes south-southeast where unlined drainage ditches extend toward the rim of Los Alamos Canyon. The AOC includes the unlined drainage ditches that collect runoff from both the east and west sides of the warehouse area; the eastern drainage turns to the west and meets the western drainage just above the rim of the canyon. After turning west, the eastern drainage passes downslope of AOC 0-033(b); potential contaminants from the eastern drainage of AOC 0-004 may have comingled with potential contaminants from AOC 0-033(b). AOC 0-004 is part of consolidated SWMU 0-030(b)-00 [together with SWMUs 0-030(b,l,m) and AOC 0-033(b)].

SWMU 0-030(l), Septic System

SWMU 0-030(l) consisted of a single 1000-gal. concrete septic tank (10 ft long by 6 ft wide by approximately 5 ft deep) with 6-in.-diameter vitrified clay pipe (VCP) drainlines. The outlet line discharged to Los Alamos Canyon.

AOC 0-033(b), Soil Contamination, Drainlines, and Outfalls

The SWMU report describes SWMU 0-033 as one unit that included soil contamination, an underground storage tank (UST), storm drains and outfalls, and drainlines (LANL 1990, 0145). Since that time, the UST has been designated as SWMU 0-033(a). The rest of the area has been designated as AOC 0-033(b), and includes soil contamination associated with the following areas: storm drains around all four warehouses and their outfalls into Los Alamos Canyon, and MTL floor drains connected to two drainlines with outfalls into Los Alamos Canyon. AOC 0-033(b) connects to AOC 0-004 at the drainage ditches (see Figure 2.3-1).

2.2.2 Operational History

AOC 0-004

The container storage area inside Warehouses 3 and 4 were primarily used to store solvents, but other materials that may have been stored at this site by the Zia Company include asphalt, lubricants, pesticides, and herbicides (LANL 1990, 7511). On March 15, 1984, an undocumented quantity of methylethyl ketone peroxide was spilled, and the potential for interaction with other materials posed a high-explosive (HE) risk. Several drums were temporarily removed from the warehouses to the parking lot and the entire area was hosed down by the fire department. Another incident involved solvents that had crystallized on the outside of their containers. The containers of crystallized solvent reportedly were taken to the parking lot and washed down with water. The resulting effluent and the wash water drained from the parking lot into the unlined drainage ditches leading toward Los Alamos Canyon. AOC 0-004 connects to AOC 0-033(b) at the drainage ditches (see Figure 2.1-1). Both incidents occurred inside the warehouses, and this area was also washed with water (LANL 1992, 07667). The container storage area was relocated to the loading dock on the south side of Warehouses 3 and 4 some time after the 1996 Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) report (LANL 1996, 54616).

SWMU 0-030(l)

This septic system reportedly handled sanitary wastes from Warehouses 3 and 4 and discharges from a blow-down tank that released pressure from a boiler (LANL 1992, 07667). Chemicals used to descale boilers may have been released to the septic tank through the blow-down tank. The RFI work plan for Operable Unit (OU) 1071 reports, "No information exists as to the nature of these chemicals" (LANL 1992, 07667). Therefore, the site was sampled for a suite of analytes that included SVOCs, PCBs/pesticides, radionuclides, and TAL metals.

AOC 0-033(b)

AOC 0-033(b) includes potential soil contamination from the MTL drainlines . Operations at the MTL involved the use of solvents, asphalt leaching, destructive tests of concrete cylinders, and sieve tests of aggregates for roadwork. The MTL was constructed south of Warehouses 3 and 4 in 1948; it operated no later than 1961, at which time the warehouses were leased for commercial use (LANL 1990, 07511). Soil contamination in this area may also have resulted from the spills at AOC 0-004, as the drainages from that AOC intersect with AOC 0-033(b). Potential contaminants at AOC 0-033(b) include polycyclic

SWMU 0-030(l), Septic System

SWMU 0-030(l) consisted of a single 1000-gal. concrete septic tank (10 ft long by 6 ft wide by approximately 5 ft deep) with 6-in.-diameter vitrified clay pipe (VCP) drainlines. The outlet line discharged to Los Alamos Canyon.

AOC 0-033(b), Soil Contamination, Drainlines, and Outfalls

The SWMU report describes SWMU 0-033 as one unit that included soil contamination, an underground storage tank (UST), storm drains and outfalls, and drainlines (LANL 1990, 0145). Since that time, the UST has been designated as SWMU 0-033(a). The rest of the area has been designated as AOC 0-033(b), and includes soil contamination associated with the following areas: storm drains around all four warehouses and their outfalls into Los Alamos Canyon, and MTL floor drains connected to two drainlines with outfalls into Los Alamos Canyon. AOC 0-033(b) connects to AOC 0-004 at the drainage ditches (see Figure 2.3-1).

2.2.2 Operational History

AOC 0-004

The container storage area inside Warehouses 3 and 4 were primarily used to store solvents, but other materials that may have been stored at this site by the Zia Company include asphalt, lubricants, pesticides, and herbicides (LANL 1990, 7511). On March 15, 1984, an undocumented quantity of methylethyl ketone peroxide was spilled, and the potential for interaction with other materials posed a high-explosive (HE) risk. Several drums were temporarily removed from the warehouses to the parking lot and the entire area was hosed down by the fire department. Another incident involved solvents that had crystallized on the outside of their containers. The containers of crystallized solvent reportedly were taken to the parking lot and washed down with water. The resulting effluent and the wash water drained from the parking lot into the unlined drainage ditches leading toward Los Alamos Canyon. AOC 0-004 connects to AOC 0-033(b) at the drainage ditches (see Figure 2.1-1). Both incidents occurred inside the warehouses, and this area was also washed with water (LANL 1992, 07667). The container storage area was relocated to the loading dock on the south side of Warehouses 3 and 4 some time after the 1996 Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) report (LANL 1996, 54616).

SWMU 0-030(l)

This septic system reportedly handled sanitary wastes from Warehouses 3 and 4 and discharges from a blow-down tank that released pressure from a boiler (LANL 1992, 07667). Chemicals used to descale boilers may have been released to the septic tank through the blow-down tank. The RFI work plan for Operable Unit (OU) 1071 reports, "No information exists as to the nature of these chemicals" (LANL 1992, 07667). Therefore, the site was sampled for a suite of analytes that included SVOCs, PCBs/pesticides, radionuclides, and TAL metals.

AOC 0-033(b)

AOC 0-033(b) includes potential soil contamination from the MTL drainlines . Operations at the MTL involved the use of solvents, asphalt leaching, destructive tests of concrete cylinders, and sieve tests of aggregates for roadwork. The MTL was constructed south of Warehouses 3 and 4 in 1948; it operated no later than 1961, at which time the warehouses were leased for commercial use (LANL 1990, 07511). Soil contamination in this area may also have resulted from the spills at AOC 0-004, as the drainages from that AOC intersect with AOC 0-033(b). Potential contaminants at AOC 0-033(b) include polycyclic aromatic hydrocarbons (PAHs), PCBs, SVOCs, VOCs, pesticides, and metals, originating in the 6th Street warehouses and in the MTL. Contamination from radionuclides is not expected.

2.3 Previous Activities

2.3.1 Previous Investigations

AOC 0-004

In 1995, five samples were collected at AOC 0-004 to characterize the nature and extent of potential contamination (LANL 1996, 54616). One surface-soil sample was collected near the head of a drainage ditch approximately 25 ft south of the culvert on the east side of the parking lot (location 00-04238, Figure 2.3-1). Two surface soil samples were collected from locations (locations 00-04223 and 00-04224, Figure 2.3-1) upgradient of the SWMU 0-030(l) septic system outfall within an obvious sediment catchment of the drainage channel. Two surface samples were collected from a sediment catchment below the rim of the mesa in a natural drainage that appears to have existed before the storm water was directed to the west (locations 00-04221 and 00-04225, Figure 2.3-1). All the samples were analyzed at a fixed laboratory for SVOCs, PCBs, and pesticides, and all but one (sample 0100-95-0457) for radionuclides. All of the samples were also analyzed for metals by x-ray fluorescence (XRF), and one sample (sample 0100-95-0457) was also submitted to the MCAL for VOC analysis. The lack of fixed laboratory analytical data for VOCs and metals constituted a data gap that needed to be addressed before human health and ecological risks associated with this AOC could be evaluated. Sampling during the 2002 VCA activities (Section 2.4.1) was designed to obtain the additional data required (LANL 2002, 73579).

SWMU 0-030(l)

The SWMU 0-030(l) septic tank was sampled in July 1995 (LANL 1996, 55203). The tank walls were constructed of 4- to 6-in.-thick concrete reinforced with rebar and wire mesh. The tank was originally covered with three concrete panels, each approximately 6 ft long by 3 ft wide. One panel had collapsed, allowing the tank to fill with soil from the surrounding area. Four samples were collected inside the tank; all were submitted to a fixed laboratory for analysis of SVOCs, PCBs, pesticides, and radionuclides; one of these was also analyzed for TAL metals. (The material inside the tank was later removed, and the four samples from that material are not reported here.) In addition, one composite soil sample was collected from multiple points outside the tank and submitted to a fixed laboratory for analysis of SVOCs, PCBs, pesticides, TAL metals, and radionuclides. Because it could not be determined where or at what depths the multiple sample points were located, the composite sample is not reported here.

Three samples were collected below the VCP inlet pipe (two at location 00-04423 and one at location 00-04310); one of the location 00-04423 samples and the location 00-04310 sample were analyzed at a fixed laboratory for SVOCs, PCBs, pesticides, and radionuclides, while the second sample from location 00-04423 was analyzed for TAL metals only. One sample was collected from within the inlet pipe near its connection to the septic tank (location 00-04325), and analyzed for SVOCs, PCBs, pesticides, TAL metals and radionuclides at a fixed laboratory (this waste characterization sample was subsequently removed and is not reported here). Two samples were collected from the outfall channel (locations 00-04222 and 00-04226) and analyzed for SVOCs, PCBs, pesticides, and radionuclides at a fixed laboratory.

The septic tank and approximately 40 ft of inlet line were excavated and removed in October 1995 (Figure 2.3-2). The tank contents and inlet pipe were placed in one B25 box and eight 55-gal. drums. The septic tank was disposed of at Area J, while the B25 box and drums were shipped off the site for disposal as nonhazardous chemical waste (LANL 1996, 55203). Four confirmation samples were collected at two

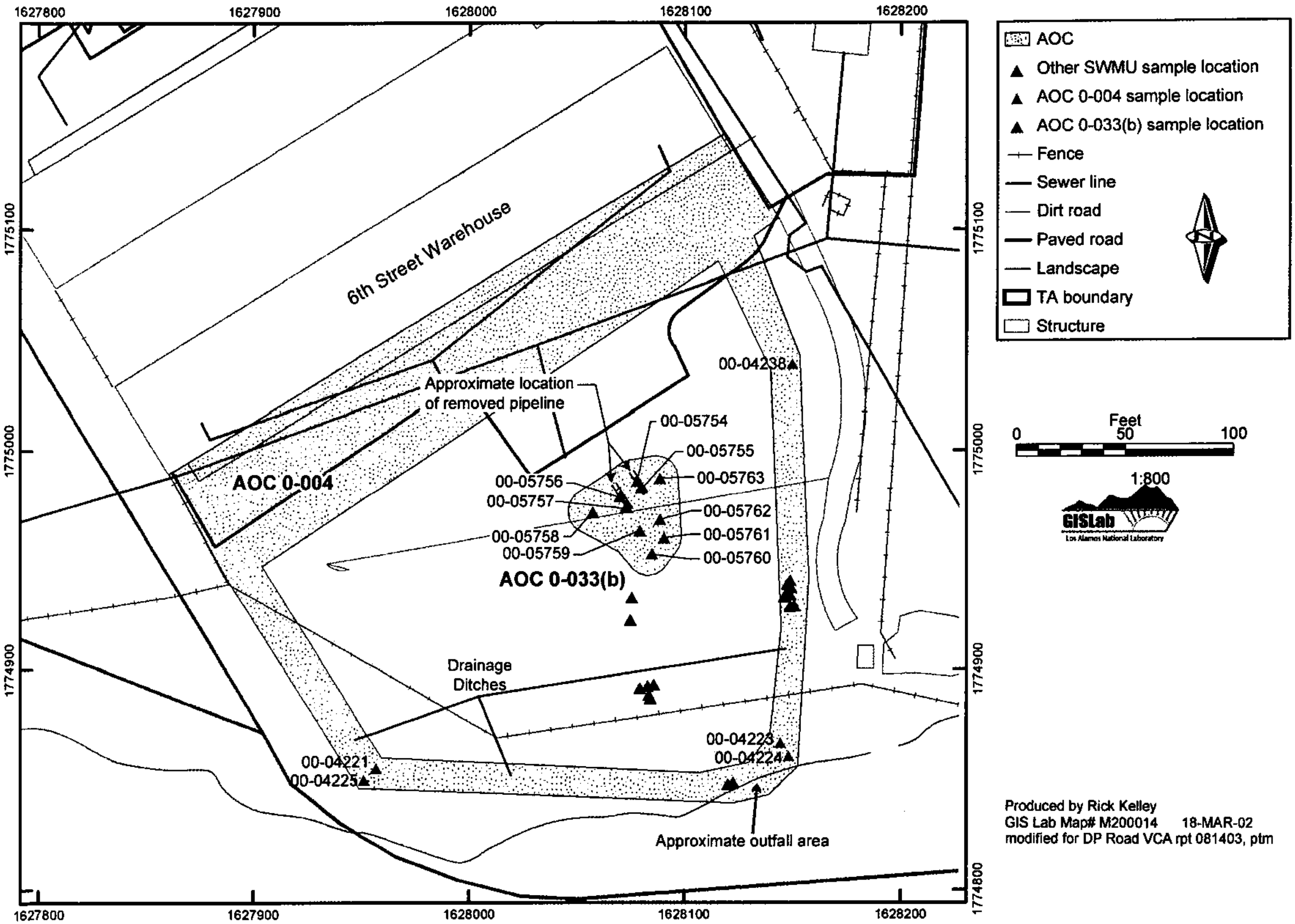


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Figure 2.3-1. AOCs 0-004 and 0-033(b) previous investigation sample locations

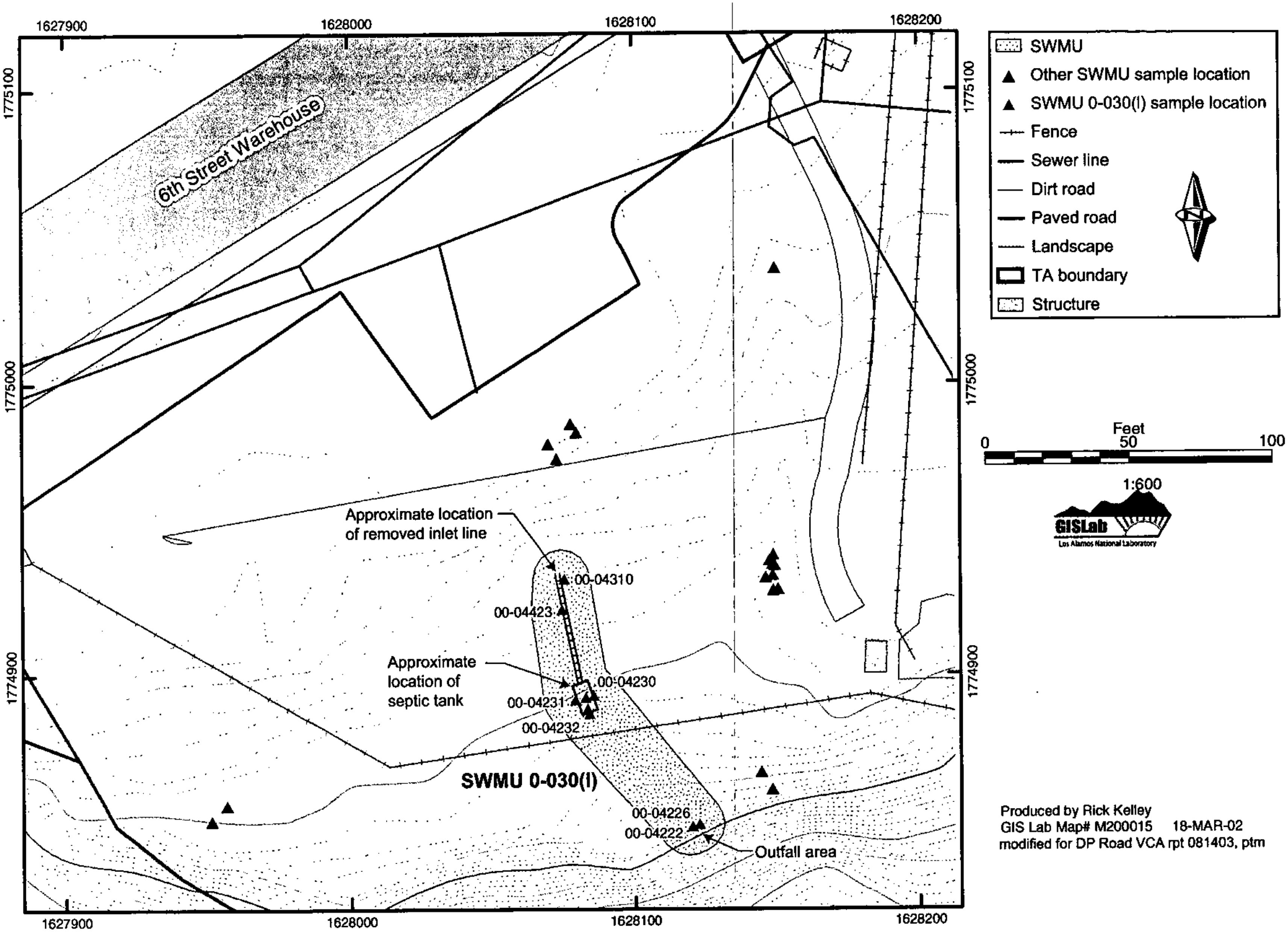

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Figure 2.3-2. SWMU 0-030(l) previous investigation sample locations

locations (00-04318 and 00-04319) beneath the former tank location. Two of these samples (one from each location) were analyzed for SVOCs, PCBs, pesticides, XRF metals, and radionuclides at a fixed laboratory. The two additional samples (from location 00-04318) were analyzed for TAL metals and tritium, respectively, at a fixed laboratory. The excavation area from the tank and inlet pipe was backfilled, and the area was restored to its original contour.

Sample data collected during the 1995 activities at SWMU 0-030(l) included no VOC data and only limited TAL metals data. The nature and extent of contamination were not defined; additional samples were collected in 2002 to address these data gaps.

AOC 0-033(b)

A 1995 RFI field investigation at AOC 0-033(b) concentrated on potential soil contamination surrounding the drainlines that served the MTL (LANL 1996, 54760). It is possible that past spills at the MTL would have drained to the building storm drains. Five trenches were excavated to locate the drainlines and the septic tank. They were excavated to the top of the tuff, 3 to 10 ft below ground surface (bgs) or deeper. Neither the excavation nor the geophysical surveys could locate the septic tank, the outlet pipeline, or the outfall. Sheet 5 of the blueprints for the MTL revealed that two liquid waste lines exited the south side of the building, one cast iron and the other VCP (LANL 1996, 54760). Both liquid waste lines ended within the soil of the embankment 13 to 15 ft south of the building. Although the waste lines did not daylight at the time of the field investigation, it is believed that they had at one time. The construction activity related to removing the MTL and replacing it with transportables may have resulted in additional soil being placed on the embankment to cover the end of the waste lines. The waste lines may have ended in a small drainage ditch that led toward the berm, then around the berm and to the canyon. Three samples were collected during the 1995 investigation from within and beneath the waste lines; they were analyzed for SVOCs, PCBs, pesticides, TAL metals, and radionuclides (this sampled material was subsequently removed by VCA activities, therefore the locations are not shown in Figure 2.3-1, and the samples are not included in Table 2.4-1).

Because the initial RFI analytical results for AOC 0-033(b) indicated a potential increased risk to human health due to PAHs, alpha-chlordane, and gamma-chlordane, a VCA was conducted at the site in July 1996 (LANL 1996, 62536). Both the VCP and the cast iron pipe were located and removed. The soil, to a depth of 1 ft under both pipes, was removed and placed in drums. A confirmatory sample and a duplicate sample were collected from beneath the VCP drainline after it was removed (location 00-05756, Figure 2.3-1). Two additional samples were collected from the trench where the cast iron pipe was excavated (locations 00-05754 and 00-05755, Figure 2.3-1). One of these samples was collected 5 ft from the south wall of the MTL foundation and 5 ft bgs. The other sample was collected 8.5 ft from the south wall of the MTL foundation and 4 ft bgs. Both were located 1 ft below the level of the cast iron pipe. All four samples were submitted to a fixed analytical laboratory for SVOC, PCB, pesticide, and TAL metals analyses. An additional sample was collected from beneath the former VCP, 12 ft south of the foundation (location 00-05757, Figure 2.3-1), and analyzed for SVOCs, PCBs, and pesticides. Six surface soil samples were collected (locations 00-05758 through 00-05763, Figure 2.3-1), four of these downgradient of both the VCP and cast iron drainlines. The other two samples were collected upgradient of the two outfalls, one from the northwest side of the VCP outfall, and one from the northeast side of the cast-iron drainline outfall. These samples were analyzed for lead, SVOCs, pesticides, and PCBs by a fixed analytical laboratory.

The analytical results for the confirmatory samples from the 1996 VCA activities did not show any concentrations of chemicals that would present a potential unacceptable risk to human health (LANL 1996, 62536). An assessment of risk to ecological receptors was not performed at that time. The lack of VOC and inorganic data (other than lead) and the surface-only sampling at six locations represented a data gap such that nature and extent of contamination were not known with confidence. Therefore the VCA/IA plan (LANL 2002, 73579) proposed that additional samples be collected to obtain the necessary VOC and TAL metals data. The additional samples were collected in 2002.

2.3.2 Preliminary Conceptual Model

The preliminary site conceptual model for the 6th Street Warehouse SWMUs/AOCs is presented in Figure 2.3-3. Potential contaminant sources include warehouse drainage into the south field, septic tanks and drainlines, and the outfalls. For the mesa top area, leaks from or the contents of the subsurface piping and septic tanks [e.g., SWMU 0-030(m) was a porous wooden tank] represent a possible source of subsurface contamination. For subsurface exposure to human or ecological receptors to be complete, one or both of the following scenarios must occur: deep-rooted plants or burrowing animals encounter this potential subsurface contamination or site excavation activities redistribute this subsurface material to the surface. The historic outfall effluent releases are subject to surface water run-off and erosion. Surface transport from overland flow and outfalls may cause potential contaminants to become concentrated in drainages and contaminants may infiltrate into subsurface soils/tuff. Surface materials not directly associated with outfalls (e.g., AOC 0-004) on the mesa top are subject to surface runoff (e.g., sheet flow runoff), wind erosion and dust suspension. Existing information does not indicate a pathway for aquatic receptors (runoff and infiltration from rain events and snowmelt are the only aspects of surface water hydrology at the 6th Street Warehouse SWMUs/AOCs), therefore they are not part of the model.

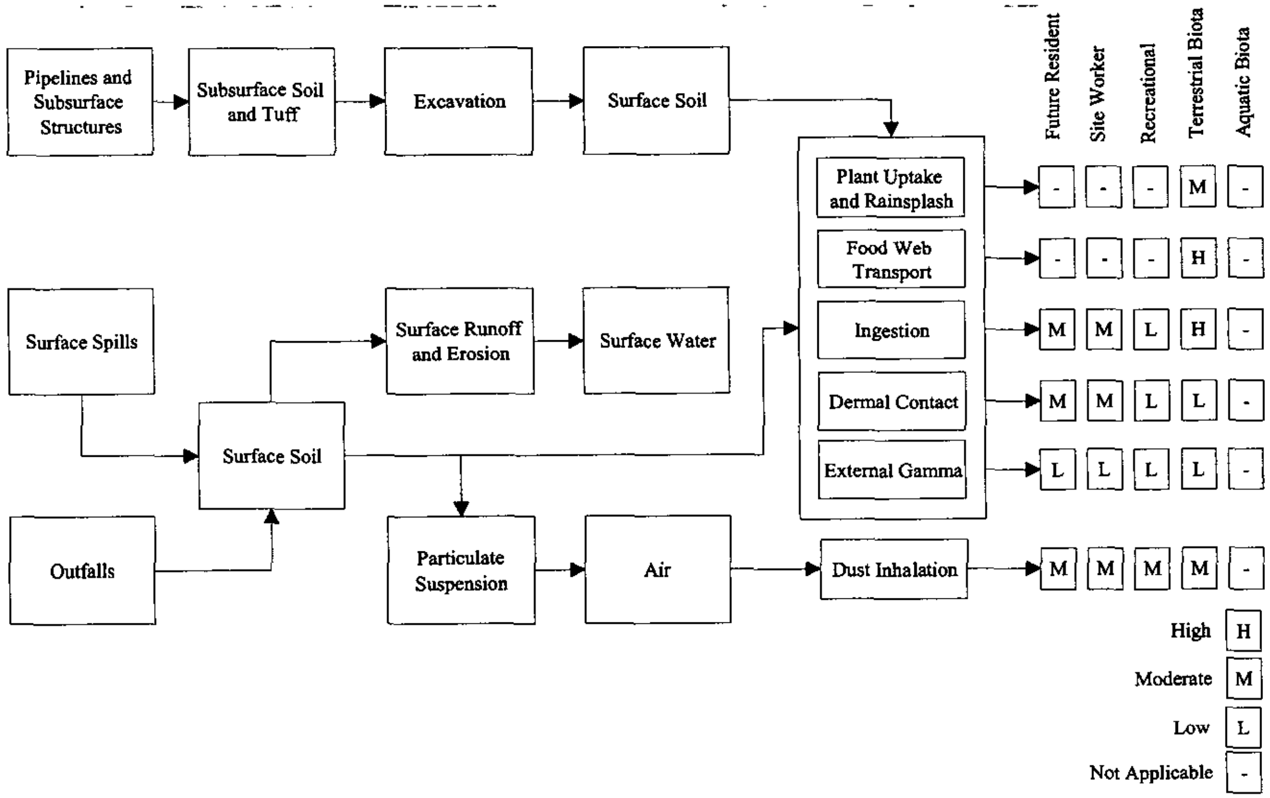


Figure 2.3-3. Preliminary conceptual model for SWMUs 0-030(b), 0-030(l), 0-030(m), 0-033(a), and 21-021-99, and AOCs 0-004, 0-033(b), and 0-029(a,b,c)

2.4 Remedial Activities

2.4.1 Investigative Activities During VCA

Geomorphic Assessment

The VCA/IA plan (LANL 2002, 73579) called for a geomorphic assessment to identify sediment catchments potentially impacted by the spills at AOC 0-004. Both spills reportedly resulted in discharge into an unlined stormwater drainage ditch, although it was not clear whether the discharge flowed off the east or west end of the paved parking area. Currently, drainage ditches are present near both the southeast and southwest corners of the parking area.

The geomorphic assessment and selection of sample locations at AOC 0-004 were conducted on May 5, 2002. Adjacent to the southwest portion of the parking area is a large unpaved gravel area that extends to the edge of the flat mesa-top and slopes slightly to the south. On the south side of the gravel area is an artificial drainage channel with a 2- to 3-ft-high berm on its south side. The drainage channel drains west-southwestward onto a short slope that terminates in a larger channel or ditch. The larger ditch drains directly off the mesa into Los Alamos Canyon via a steep rock face.

The first catchment (see location 00-02-19698, Figure 2.4-1) was selected in this larger drainage ditch, in a low-lying location about 15 to 20 ft from the cliff edge. This portion of the drainage is very sediment-poor, with mostly large non-indigenous gravel over a thin (~6 in. or less), weakly-developed but relatively clay-rich soil. The soil is dark brown, with abundant organic matter, including roots, leaf matter, pine needles and pine cones. The gravel on the surface consists largely of rounded quartzose gravel and cobbles, similar to what is found in the unpaved area adjacent to the parking area above. The surface is blanketed with 3 to 6 in. of litter, mostly pine needles and deciduous leaves. Man-made debris is common on the surface, including lengths of rusted pipe and the discarded hood off a vehicle. The catchment selected contains little sediment in the usual sense, but is a low flat area in the drainage where runoff is likely to have pooled or slowed significantly. The relatively fine-grained soil is likely to have retained some portion of any contaminants entrained in the flow at this location.

The second catchment (location 00-02-19699, Figure 2.4-1) receives runoff from areas that are almost entirely paved, but includes a fine-grained weak soil covered by non-native gravel and plant litter. This catchment is at a point that receives runoff from two minor drainages, both of which potentially drain the western part of the parking area. The location selected is a relatively flat area where runoff would be retained or delayed in its path to the larger drainage ditch.

Two additional locations were selected, one in each of the two unpaved gravel areas adjacent to the parking area (locations 00-02-19695 and 00-02-19700, Figure 2.4-1). These were chosen because it appears likely that runoff from the parking area would have had to cross the unpaved areas before entering either drainage channel, and the lack of pavement would likely have allowed some infiltration in those areas.

In the eastern drainage, it was determined that the previously collected "upgradient" sample (location 00-04238) was located in the approximate area of the drainage channel that would have received runoff from the east end of the parking lot, and was not an upgradient sample at all. Therefore, a location was selected to serve as the upgradient location; this was selected on the east side of the warehouse (building 21-1002), in a minor drainage between the building and the street (location 00-02-19701, Figure 2.4-1). This location is likely to have received runoff only from paved and grassy areas on the east and north sides of the warehouses, and would not have received any runoff from the spills documented in AOC 0-004. This drainage does, however, join downstream with the eastern drainage associated with AOC 0-004.

The previous sample location (00-04238) was, however, determined to be a suitable location to collect an additional sample to determine whether any contamination is present from the spills. A location was selected about 6 ft west of the previous sample location, in the lowest part of the drainage (location 00-02-19696, Figure 2.4-1). This location had 3 to 4 in. of coarse sandy sediment on the surface, overlying a dark, relatively clay-rich soil similar to that found in the western drainages. The drainage is overgrown with trees and shrubs. This location is believed to be the farthest point up the drainage that runoff from the parking area would enter the channel.

Another location (location 00-02-19697, Figure 2.4-1) was selected about 100 ft down the drainage from the previous location. At this point, the drainage makes a turn to the west, being guided by an apparently artificial berm that prevents flow from heading directly south into the canyon. The channel continues westward, and is the same drainage as the larger ditch mentioned previously, below the west end of the parking area. The location selected is at the bend of the drainage, where flow is likely to have slowed down and potentially allowed increased infiltration into the sediment and soil. This location contains somewhat finer sandy sediment that is lighter in color than the upgradient locations. Grassy vegetation is very thick at this location.

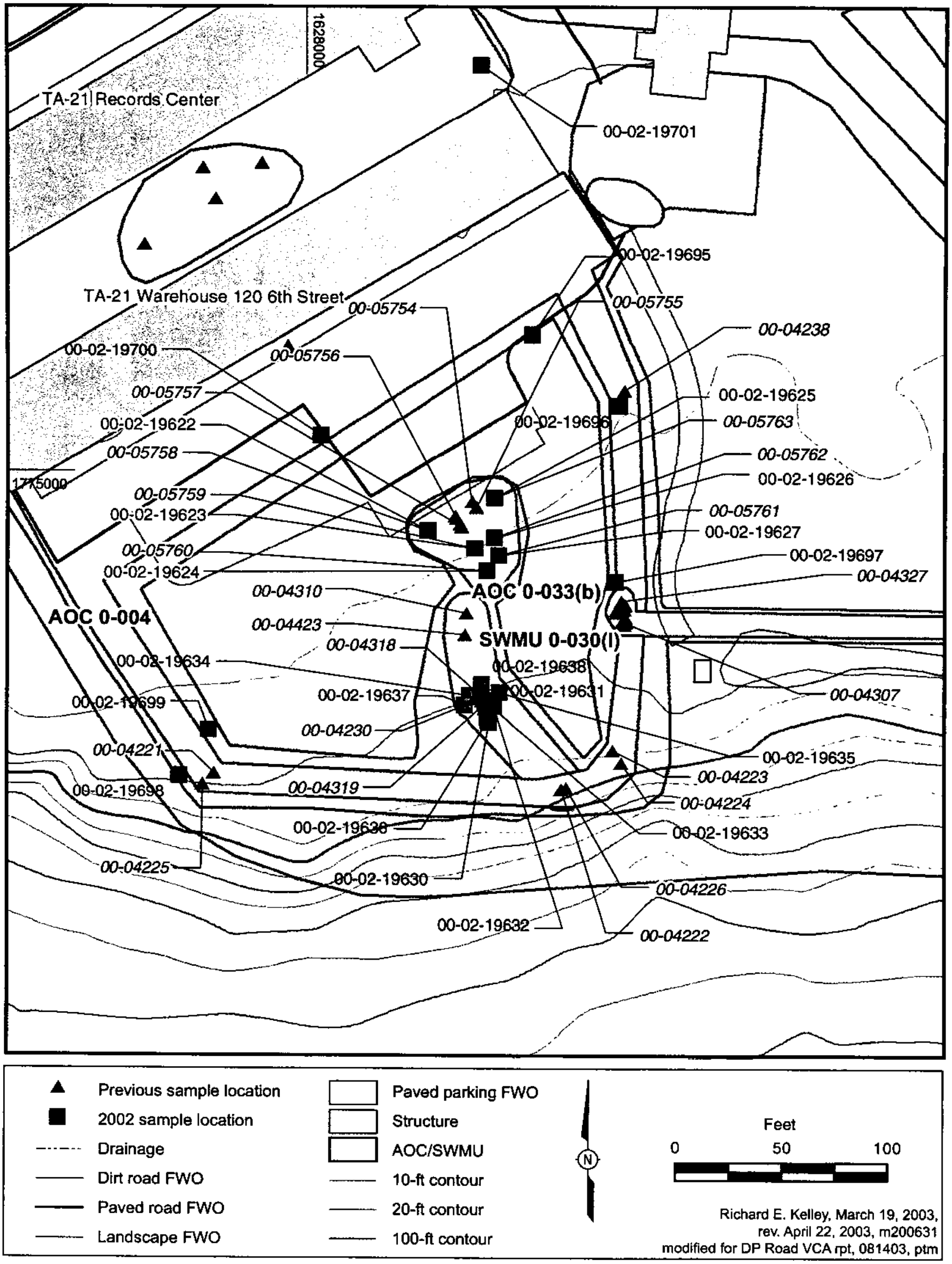
AOC 0-004

In June 2002, surface (0 to 6 in.) and subsurface (6 to 12 in.) soil samples were collected within the two drainages at AOC 0-004 based upon the results/recommendations of the geomorphic survey (Figure 2.4-1). The sample collection deviated from the VCA/IA plan in that three locations were chosen from each drainage rather than two (locations 00-02-19695 through 00-02-19700). Two depths were sampled from each of the six sample locations. All samples were analyzed at a fixed laboratory for TAL metals, isotopic plutonium, isotopic uranium, gamma-emitting radionuclides, PCBs, pesticides, and SVOCs. Five samples were also analyzed for VOCs (Table 2.4-1). An upgradient sample location (location 00-02-19701, Figure 2.4-1) was selected on the east side of Warehouses 3 and 4 (Building 21-1002) in a minor drainage between the building and the street. The two samples collected at that location are considered outside the influence of any of the 6th Street Warehouse SWMUs/AOCs (Table 2.4-2). Because the 6th Street Warehouses are located in the Los Alamos town site, an area of heavy commercial/industrial development, these samples were intended to provide evidence of any contaminants being transported onto the sites by runoff from other areas (e.g., PAHs are common contaminants found in many urban/industrial settings). One field duplicate sample (location 00-02-19699) was collected for the 14 samples.

Samples were collected in accordance with LANL-ER-SOP-6.10, Rev. 1, "Hand Auger and Thin-Wall Tube Sampler," or LANL-ER-SOP-6.09, Rev. 1, ICN, "Spade and Scoop Method for Collection of Soil Samples." The samples collected at AOC 0-004 were screened for VOCs with a photoionization detector (PID) for health and safety purposes. The samples were taken to American Radiation Services for gross radiological screening (for US Department of Transportation [DOT] purposes) prior to shipment to an off-site laboratory. See Section 2.4.3 for further discussion of samples collected and data review.

SWMU 0-030(l)

The VCA/IA plan (LANL 2002, 73579) called for the removal of the outlet piping and the collection of three samples from the SWMU 0-030(l) tank footprint; three samples from outside the former tank walls; two samples each from one location beneath the inlet pipe and one location beneath the outlet pipe; two surface samples from below the tank outfall; and one sample from the outlet pipe (waste characterization).



Richard E. Kelley, March 19, 2003,
rev. April 22, 2003, m200631
modified for DP Road VCA rpt, 081403, ptm

Figure 2.4-1. AOCs 0-004 and 0-033(b) and SWMU 0-030(l) RFI and VCA sample locations

Table 2.4-1
Summary of Soil, Tuff, and Fill Samples Collected at AOCs 0-004 and 0-033(b) and SWMU 0-030(l)

Sample ID	Location ID	Depth (ft)	Media	Metals	Am-241[a]	Gamma Spectroscopy	Tritium	Isotopic Plutonium	Isotopic Uranium	PCBs	Pesticides	Pesticides/ PCBs	SVOCs	VOCs
0100-95-0457	00-04238	0–0.5	Soil	—[b]	—	—	—	—	—	—	—	865	865	—
0100-95-0490	00-04310	4–4.5	Soil	—	1003	1003	—	1003	1123	—	—	1002	1002	—
0100-95-0514	00-04222	0–0.5	Soil	—	—	823	—	—	—	—	—	822	822	—
0100-95-0515	00-04224	0–0.25	Soil	—	—	823	—	—	—	—	—	822	822	—
0100-95-0516	00-04223	0–0.33	Soil	—	—	823	—	—	—	—	—	822	822	—
0100-95-0517	00-04221	0–0.33	Soil	—	—	823	—	—	—	—	—	822	822	—
0100-95-0518	00-04225	0–0.5	Soil	—	—	823	—	—	—	—	—	822	822	—
0100-95-0519	00-04226	0–0.5	Soil	—	—	823	—	—	—	—	—	822	822	—
0100-95-0627	00-04423	5–6	Qbt 3	781	—	—	—	—	—	—	—	—	—	—
0100-95-0668	00-04423	5–6	Qbt 3	—	—	784	—	—	—	—	—	780	780	—
0100-95-0694	00-04318	5–5.5	Soil	—	1353	1353	—	1353	—	—	—	1351	1351	—
0100-95-0695	00-04319	5–5.5	Soil	—	1353	1353	—	1353	—	—	—	1351	1351	—
0100-95-0700	00-04318	5–5.5	Soil	—	—	—	1353	—	—	—	—	—	—	—
0100-95-0701	00-04318	5–5.5	Soil	1352	—	—	—	—	—	—	—	—	—	—
0100-96-1754	00-05754	5–5.5	Soil	2460	—	—	—	—	—	2459	2459	—	2459	—
0100-96-1755	00-05755	4–4.5	Soil	2460	—	—	—	—	—	2459	2459	—	2459	—
0100-96-1756	00-05756	5–5.5	Soil	2460	—	—	—	—	—	2459	2459	—	2459	—
0100-96-1761	00-05757	4–4.5	Soil	—	—	—	—	—	—	2484	2484	—	2484	—
0100-96-1762	00-05758	0–0.5	Soil	—	—	—	—	—	—	2559	2559	—	2559	—
0100-96-1763	00-05759	0–0.5	Soil	—	—	—	—	—	—	2559	2559	—	2559	—
0100-96-1764	00-05760	0–0.5	Soil	—	—	—	—	—	—	2559	2559	—	2559	—
0100-96-1765	00-05761	0–0.5	Soil	—	—	—	—	—	—	2559	2559	—	2559	—
0100-96-1766	00-05762	0–0.5	Soil	—	—	—	—	—	—	2559	2559	—	2559	—
0100-96-1767	00-05763	0–0.5	Soil	—	—	—	—	—	—	2559	2559	—	2559	—
RE00-02-45447	00-02-19622	1–1.5	Soil	1171S	—	—	—	—	—	—	—	—	—	1170S
RE00-02-45448	00-02-19623	1–1.5	Soil	1171S	—	—	—	—	—	—	—	—	—	1170S

Table 2.4-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Metals	Am-241[a]	Gamma Spectroscopy	Tritium	Isotopic Plutonium	Isotopic Uranium	PCBs	Pesticides	Pesticides/ PCBs	SVOCs	VOCs
RE00-02-45449	00-02-19624	1–1.5	Soil	1171S	—	—	—	—	—	—	—	—	—	1170S
RE00-02-45450	00-02-19625	1–1.5	Soil	1171S	—	—	—	—	—	—	—	—	—	1170S
RE00-02-45451	00-02-19626	1–1.5	Soil	1171S	—	—	—	—	—	—	—	—	—	1170S
RE00-02-45452	00-02-19627	1–1.5	Soil	1171S	—	—	—	—	—	—	—	—	—	1170S
RE00-02-45606	00-02-19695	0–0.5	Fill	886S	—	887S	—	887S	887S	885S	885S	—	885S	—
RE00-02-45607	00-02-19695	0.5–1	Fill	886S	—	887S	—	887S	887S	885S	885S	—	885S	885S
RE00-02-45608	00-02-19696	0–0.5	Soil	881S	—	882S	—	882S	882S	880S	880S	—	880S	—
RE00-02-45609	00-02-19696	0.5–1	Soil	881S	—	882S	—	882S	882S	880S	880S	—	880S	880S
RE00-02-45610	00-02-19697	0–0.5	Soil	881S	—	882S	—	882S	882S	880S	880S	—	880S	—
RE00-02-45611	00-02-19697	0.5–1	Soil	881S	—	882S	—	882S	882S	880S	880S	—	880S	880S
RE00-02-45612	00-02-19698	0–0.5	Soil	886S	—	887S	—	887S	887S	885S	885S	—	885S	—
RE00-02-45613	00-02-19698	0.5–1	Qbt 3	886S	—	887S	—	887S	887S	885S	885S	—	885S	885S
RE00-02-45614	00-02-19699	0–0.5	Soil	886S	—	887S	—	887S	887S	885S	885S	—	885S	—
RE00-02-45615	00-02-19699	0.5–1	Qbt 3	886S	—	887S	—	887S	887S	885S	885S	—	885S	885S
RE00-02-45616	00-02-19700	0–0.5	Fill	886S	—	887S	—	887S	887S	885S	885S	—	885S	—
RE00-02-45617	00-02-19700	0.5–1	Fill	886S	—	887S	—	887S	887S	885S	885S	—	885S	885S
RE00-02-47819	00-02-19630	3–3.5	Soil	1143S	—	1144S	—	1144S	1144S	1142S	1142S	—	1142S	1142S
RE00-02-47820	00-02-19630	4–4.5	Qbt 3	1143S	—	1144S	—	1144S	1144S	1142S	1142S	—	1142S	1142S
RE00-02-47821	00-02-19632	10–10.5	Qbt 3	1150S	—	1151S	—	1151S	1151S	1149S	1149S	—	1149S	1149S
RE00-02-47822	00-02-19633	10–10.5	Qbt 3	1150S	—	1151S	—	1151S	1151S	1149S	1149S	—	1149S	1149S
RE00-02-47823	00-02-19634	10–10.5	Qbt 3	1150S	—	1151S	—	1151S	1151S	1149S	1149S	—	1149S	1149S
RE00-02-47824	00-02-19635	7.5–8	Qbt 3	1150S	—	1151S	—	1151S	1151S	1149S	1149S	—	1149S	1149S
RE00-02-47825	00-02-19636	4.5–5.5	Qbt 3	1150S	—	1151S	—	1151S	1151S	1149S	1149S	—	1149S	1149S
RE00-02-47826	00-02-19637	8–8.5	Qbt 3	1150S	—	1151S	—	1151S	1151S	1149S	1149S	—	1149S	1149S
RE00-02-47827	00-02-19638	4–4.5	Qbt 3	1150S	—	1151S	—	1151S	1151S	1149S	1149S	—	1149S	1149S
RE00-02-47828	00-02-19638	5–5.5	Qbt 3	1150S	—	1151S	—	1151S	1151S	1149S	1149S	—	1149S	1149S

[a] Americium-241 by alpha spectroscopy.

[b] — = Not analyzed.

Table 2.4-2
Summary of Non-Site-Related Samples at AOCs 0-004 and 0-033(b) and SWMU 0-030(l)

Sample ID	Location ID	Depth (ft)	Media	METALS	Gamma Spectroscopy	Isotopic Plutonium	Isotopic Uranium	PCBs	Pesticides	SVOCs	VOCs
AOC 0-004											
RE00-02-45618	00-02-19701	0–0.5	Soil	886S	887S	887S	887S	885S	885S	885S	—*
RE00-02-45619	00-02-19701	0.5–1.0	Soil	886S	887S	887S	887S	885S	885S	885S	885S

*— = Not analyzed.

SWMU 0-030(l) was investigated in August 2002. A backhoe was used to remove fill that had been placed in the former septic tank hole during the 1995 VCA. The backhoe was used to collect subsurface soil/tuff samples from each side of the former tank as well as below the tank.

Eleven samples were collected, including one field duplicate, at eight locations (Figure 2.4-1). Two samples were collected beneath the outlet pipe after it was removed (location 00-02-19630, 3 to 3.5 ft and 4 to 4.5 ft bgs), and two samples were collected beneath the location where the former inlet pipe had entered the septic tank (location 00-02-19638, 4 to 4.5 ft and 5 to 5.5 ft bgs). Six samples (plus one duplicate) were collected from the former septic tank location: three samples within the footprint of the former tank (locations 00-02-19632, 00-02-19633, and 00-02-19634) at a depth of 10 to 10.5 ft bgs, and three samples immediately outside the east (location 00-02-19635, 7.5 to 8 ft bgs), south (location 00-02-19636, 4.5 to 5.5 ft bgs), and west (location 00-02-19637, 8 to 8.5 ft bgs) walls. The planned outfall locations were found to have bare, relatively welded tuff at the surface, and were inaccessible for sampling by backhoe because of a fence. For that reason, the two planned surface outfall samples were not collected, which was a deviation from the VCA/IA plan. All samples were submitted to a fixed laboratory and analyzed for TAL metals, isotopic uranium, isotopic plutonium, gamma-emitting radionuclides, PCBs, pesticides, SVOCs, and VOCs (Table 2.4-1).

Samples were collected using LANL-ER-SOP-6.09, Rev. 1, ICN, "Spade and Scoop Method for Collection of Soil Samples," to obtain samples from the backhoe bucket. All sample material was field-screened for gross alpha radiation using a Ludlum 139 radiation meter, and for gross beta/gamma radiation using an ESP 1 radiation meter with an HP 260 pancake probe. The samples were also screened for VOCs with a PID for health and safety purposes. The samples were taken to American Radiation Services for gross radiological screening (for DOT purposes) prior to shipment to an off-site laboratory. See Section 2.4.3 for further discussion of samples collected and data review.

AOC 0-033(b)

AOC 0-033(b) was investigated in August 2002. The field team collected seven soil samples (including one field duplicate) at 6 locations (Figure 2.4-1) using a hand auger and according to ER-SOP-6.10, Rev. 1, "Hand Auger and Thin-Wall Tube Sampler". In accordance with the VCA/IA plan (LANL 2002, 73579), one sample was collected on the northwest side of the VCP outfall (location 00-02-19622, 1 to 1.5 ft bgs); two samples were collected down-gradient of the VCP drainline (locations 00-02-19623 and 00-02-19624,); one sample was collected on the northeast side of the cast iron drainline outfall (location 00-02-19625); and two samples were collected down-gradient of the cast iron drainline (locations 00-02-19626 and 00-02-19627), plus a field duplicate sample at location 00-02-19626. A single depth was collected at each location; the plan allowed for field determination of sampling depths based on observed conditions. All samples were collected at a depth of 1 to 1.5 ft bgs, and were analyzed at a fixed laboratory for TAL metals and VOCs, as indicated in Table 2.4-1.

All sample material was screened for gross alpha radiation using a Ludlum 139 radiation meter, and for gross beta/gamma radiation using an ESP 1 radiation meter with an HP 260 pancake probe. The samples collected at AOC 0-033(b) were screened for VOCs with a PID (for health and safety purposes). The samples were taken to American Radiation Services for gross radiological screening (for DOT purposes) prior to shipment to an off-site laboratory.

2.4.2 Remediation Activities

AOC 0-004

No remediation activities were conducted at AOC 0-004 during this VCA. Activities consisted of sampling to fill previous data gaps (see Sections 2.3.1 and 2.4.1).

SWMU 0-030(l)

The outfall pipe associated with the former septic tank was located and removed by excavation. Approximately 6 ft of 6-in. VCP was removed from a depth of 2.5 to 3 ft. The location of the outfall pipe allowed identification of the previous excavation where the septic tank was removed during the 1995 VCA. The floor, walls and inlet pipe location were excavated for sampling (see Section 2.4.1), after which the excavation was backfilled and the site was restored to its previous condition.

AOC 0-033(b)

No remediation activities were conducted at AOC 0-033(b) during this VCA. Activities consisted of sampling to address previous data gaps (see Sections 2.3.1 and 2.4.1).

2.4.3 Sample Data Review

The RFI data set for AOCs 0-004 and 0-033(b) and SWMU 0-030(l) includes analytical data from 40 soil and fill samples (35 soil samples and 5 fill samples) and 13 tuff samples collected from Qbt 3. Additionally, two soil samples were collected upgradient of these SWMUs/AOCs at location 00-02-19701. These two soil samples were collected as non-site related samples. The analytical results from these samples are used to evaluate what may be entering the site from non-related sources (e.g., townsite sources, streets). Table 2.4-1 summarizes all samples collected from these SWMUs/AOCs. The request number is shown in the table for each analysis that was requested for an individual sample. Figure 2.4-1 shows the sample locations. All data used quantitatively to identify COPCs at AOCs 0-004 and 0-033(b) and SWMU 0-030(l) were subjected to RRES-RS quality assurance (QA)/quality control (QC). The results of a detailed review of QA/QC activities are provided in Appendix C.

The data review process for identifying COPCs begins with a comparison of site data with

1. naturally occurring background concentrations for inorganic chemicals,
2. naturally occurring background or fallout concentrations for radionuclides, and
3. analytical detection limits for organic chemicals.

Background comparisons and a variety of statistical and graphical methods are used to compare site inorganic and radionuclide data with background data. Organic chemical data are evaluated for detection status only. For background comparisons, the first step is to compare the site data with a background value (BV), which is an estimated value for the background data set (upper tolerance limit [UTL] [95, 95] or the 95% upper confidence bound on the 95th percentile). If a site-specific datum exceeds its BV, additional evaluation of the datum may be performed by comparing the range of values in the site data set for that chemical to the range of values for that chemical in the background data set. Graphical analyses (e.g., box plots) may be used, or if adequate data are available, statistical tests that evaluate differences in distribution may be utilized. Nonparametric tests commonly used to assess data distributions include the Gehan, quantile, and slippage tests. Together these tests assess complete shifts in distributions, shifts of a subset of the data, and the potential for some of the site data to be greater than the maximum BV. Observed significance levels (p-values) are obtained; these values indicate whether a difference does or does not exist between the data sets. A p-value of less than 0.05 indicates that a difference between the distributions (i.e., the site data are different from the background data), while a p-value greater than 0.05 is used to infer that there is no difference between distributions (i.e., site and background data are similar). Statistical tests, graphical analyses, and results are discussed in Appendix E.

Only data that are relevant to identifying COPCs are included in this section; this includes measurements that are above applicable thresholds or whose detection limits are greater than an applicable threshold. Tables D-2.0-1, D-2.0-2, D-2.0-3, D-2.0-4, D-2.0-5, and D-2.0-6 in Appendix D include the data for all analytes (detected and undetected).

2.4.3.1 Soil and Fill Samples

Samples were collected from both soil and fill. Two samples (RE00-02-45618 and RE00-02-45619) were collected as non-site related samples. Both were collected at location 00-02-19701 (Figure 2.4-1) at depths of 0 to 0.5 ft and 0.5 to 1 ft. Table 2.4-2 summarizes the non-site related samples collected. These samples were intended to provide additional context for a discussion of inorganic chemicals and radionuclides detected above BVs and detected organic chemicals at the site.

The results of these non-site related samples are not included in the frequency of detect or the analytes above BV tables in the data review sections. The data from the non-site related samples are discussed in Sections 2.4.3.1.1, 2.4.3.1.2, and 2.4.3.1.3.

2.4.3.1.1 Inorganic Chemical Comparison with BVs

Seventeen soil and four fill samples were analyzed for TAL metals at AOCs 0-004 and 0-033(b) and SWMU 0-030(l). The results for antimony were rejected for six samples due to a matrix spike recovery of less than 30%. These six samples were collected at AOC 0-033(b). Table C-5.0-2 in Appendix C presents detailed results of the QA/QC assessment. Although samples were identified as either soil or fill, they will be grouped together to compare the site data to BVs. Sample concentrations were compared with appropriate all-horizon soil background data sets (LANL 1998, 59730). Table 2.4-3 presents the frequency of detected inorganic chemicals above BV in soil and fill.

Cadmium, calcium, chromium, lead, manganese, mercury, and zinc were detected above the soil BV in at least one sample. Antimony, cadmium, mercury, and silver all had at least one detection limit above the BV. Further statistical tests were run for all these analytes except silver because there is no background data set for silver. The probability values for these tests are presented in Table E-3.1-1 in Appendix E.

Table 2.4-3
Frequency of Inorganic Chemicals Above BVs in Soil and Fill Samples at AOCs 0-004 and 0-033(b) and SWMU 0-030(l)

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	BV (mg/kg)	Frequency of Detects Above BV	Frequency of Nondetects Above BV
Aluminum	Soil	17	17	4860 to 10300	29200	0/17	0/17
Aluminum	Fill	4	4	6080 to 13830	29200	0/4	0/4
Antimony	Soil	11	5	0.0569 to [11]	0.83	0/11	4/11
Antimony	Fill	4	1	0.0578 to [0.445]	0.83	0/4	0/4
Arsenic	Soil	17	17	1.6 to 4.2	8.17	0/17	0/17
Arsenic	Fill	4	4	1.98 to 3	8.17	0/4	0/4
Barium	Soil	17	17	31.5 to 239	295	0/17	0/17
Barium	Fill	4	4	80.5 to 148	295	0/4	0/4
Beryllium	Soil	17	16	0.264 to 0.749	1.83	0/17	0/17
Beryllium	Fill	4	4	0.317 to 0.736	1.83	0/4	0/4
Cadmium	Soil	17	13	[0.06] to 1.9	0.4	4/17	3/17
Cadmium	Fill	4	4	0.139 to 0.282	0.4	0/4	0/4
Calcium	Soil	17	17	1060 to 11300	6120	1/17	0/17
Calcium	Fill	4	4	2940 to 6160	6120	1/4	0/4
Chromium	Soil	17	17	2.8 to 11.2	19.3	0/17	0/17
Chromium	Fill	4	4	10.5 to 39.1	19.3	1/4	0/4
Cobalt	Soil	17	17	0.65 to 8	8.64	0/17	0/17
Cobalt	Fill	4	4	2.87 to 5.11	8.64	0/4	0/4
Copper	Soil	17	17	4.1 to 14.1	14.7	0/17	0/17
Copper	Fill	4	4	7.76 to 10.1	14.7	0/4	0/4
Iron	Soil	17	17	6240 to 12500	21500	0/17	0/17
Iron	Fill	4	4	8980 to 12760	21500	0/4	0/4
Lead	Soil	17	17	6.7 to 77.7	22.3	9/17	0/17
Lead	Fill	4	4	6.59 to 25.4	22.3	1/4	0/4
Magnesium	Soil	17	17	772 to 2130	4610	0/17	0/17
Magnesium	Fill	4	4	1530 to 2570	4610	0/4	0/4
Manganese	Soil	17	17	194 to 687	671	1/17	0/17
Manganese	Fill	4	4	220 to 336	671	0/4	0/4
Mercury	Soil	17	13	0.0174 to 0.35	0.1	6/17	3/17
Mercury	Fill	4	4	0.00359 to 0.147	0.1	1/4	0/4
Nickel	Soil	17	17	2.8 to 8.6	15.4	0/17	0/17
Nickel	Fill	4	4	5.84 to 9.28	15.4	0/4	0/4
Potassium	Soil	17	17	281 to 1550	3460	0/17	0/17
Potassium	Fill	4	4	897 to 1560	3460	0/4	0/4
Selenium	Soil	17	6	0.11 to [0.63]	1.52	0/17	0/17

Table 2.4-3 (continued)

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	BV (mg/kg)	Frequency of Detects Above BV	Frequency of Nondetects Above BV
Selenium	Fill	4	4	0.217 to 0.411	1.52	0/4	0/4
Silver	Soil	17	13	0.0319 to [2.2]	1	0/17	3/17
Silver	Fill	4	4	0.0395 to 0.986	1	0/4	0/4
Sodium	Soil	17	17	73.3 to 187	915	0/17	0/17
Sodium	Fill	4	4	356 to 644	915	0/4	0/4
Thallium	Soil	17	12	0.0607 to [0.56]	0.73	0/17	0/17
Thallium	Fill	4	4	0.104 to 0.174	0.73	0/4	0/4
Vanadium	Soil	17	17	5.5 to 25.3	39.6	0/17	0/17
Vanadium	Fill	4	4	18.3 to 25.9	39.6	0/4	0/4
Zinc	Soil	17	17	29 to 87.8	48.8	8/17	0/17
Zinc	Fill	4	4	24.2 to 54.2	48.8	2/4	0/4

The results of the Gehan and quantile tests show that antimony, cadmium, calcium, lead, mercury, and zinc were significantly different from background. The box plots for these analytes are presented in Figures E-3.1-1 to E-3.1-6. Chromium and manganese are not retained as COPCs. Antimony and silver were not detected, but detection limits for samples collected in 1995 and 1996 were higher than BVs. Eight other samples were collected and analyzed for antimony. These were all collected at locations surrounding the samples from AOC 0-033(b) and were all reported below the BV. Figure E-3.1-1 shows the distribution of antimony data. All samples collected in the same area in 2002 and analyzed for antimony and silver were reported as nondetects with detection limits below the BVs. Therefore, antimony and silver are not retained as COPCs. Table 2.4-4 presents the concentrations above the BV in soil and fill. Cadmium, calcium, lead, mercury, and zinc are retained as COPCs.

Non-Site-Related Samples

The inorganic chemical results of the non-site related samples listed in Table 2.4-2 were compared to the all-soil horizon BV. This list of analytes was compared to the COPC list from the site data. Table 2.4-5 lists analytes that were detected above BVs at least once in the non-site related samples. Cadmium, lead, mercury, and zinc were identified as COPCs in the site data and are also above BVs in the non-site-related data. The detected concentrations of zinc in the non-site-related samples are actually greater than the maximum detected concentration in the site data. Although calcium had 2 detects out of 21 samples that were above BVs in the site data, calcium was not detected above its BV in either of the non-site-related samples. Silver, however, was detected above BV in one of the two non-site-related samples. All detects of silver in the site data were below the BV, and only three detection limits from samples collected in 1996 were above BVs.

Figures E-4.1-1 to E-4.1-5 show how the non-site-related data compare to both the site data and background data. All of the soil data for the site was included with depths from 0 to 5.5 ft.

Table 2.4-4
Inorganic Chemicals Above BVs in
Soil and Fill Samples at AOCs 0-004 and 0-033(b) and SWMU 0-030(l)

Sample ID	Location ID	Depth (ft)	Media	Cadmium (mg/kg)	Calcium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Zinc (mg/kg)
Soil Background Value (mg/kg)				**0.4**	**6120**	**22.3**	**0.1**	**48.8**
RE00-02-45606	00-02-19695	0–0.5	Fill	—*	—	25.4 (J)	—	50.6 (J+)
RE00-02-45607	00-02-19695	0.5–1	Fill	—	—	—	0.147 (J+)	54.2 (J+)
RE00-02-45608	00-02-19696	0–0.5	Soil	—	—	37.4	0.175 (J+)	65.4
RE00-02-45609	00-02-19696	0.5–1	Soil	0.639	—	53.2	0.312 (J+)	87.8
RE00-02-45611	00-02-19697	0.5–1	Soil	—	—	—	0.11 (J+)	—
RE00-02-45612	00-02-19698	0–0.5	Soil	—	—	51.6 (J)	—	61.3 (J+)
RE00-02-45614	00-02-19699	0–0.5	Soil	—	—	77.7 (J)	—	50 (J+)
RE00-02-45616	00-02-19700	0–0.5	Fill	—	6160 (J)	—	—	—
RE00-02-47819	00-02-19630	3–3.5	Soil	1.9	—	—	—	50.9
0100-95-0701	00-04318	5–5.5	Soil	—	—	—	—	—
0100-96-1754	00-05754	5–5.5	Soil	0.55 (U)	—	—	0.11 (U)	—
0100-96-1755	00-05755	4–4.5	Soil	0.56 (U)	—	23	0.11 (U)	—
0100-96-1756	00-05756	5–5.5	Soil	0.54 (U)	—	—	0.11 (U)	—
RE00-02-45448	00-02-19623	1–1.5	Soil	—	11300	34.2	0.35	81.6
RE00-02-45449	00-02-19624	1–1.5	Soil	—	—	25.7	—	—
RE00-02-45451	00-02-19626	1–1.5	Soil	0.54	—	27.6	0.2	68.1
RE00-02-45452	00-02-19627	1–1.5	Soil	0.85	—	34.6	0.25	79.9

*— = Not above BV.

Table 2.4-5
Inorganic Chemicals Above BVs in
Non-Site-Related Samples at AOCs 0-004 and 0-033(b) and SWMU 0-030(l)

Sample ID	Location ID	Depth (ft)	Media	Cadmium (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Silver (mg/kg)	Zinc (mg/kg)
Soil Background Value (mg/kg)				0.4	22.3	0.1	1	48.8
RE00-02-45618	00-02-19701	0–0.5	Soil	0.485	32.7	0.0659	0.709	104
RE00-02-45619	00-02-19701	0.5–1	Soil	0.555	65	0.139	1.82	89.3

2.4.3.1.2 Radionuclide Comparison with BVs and Fallout Values

Fourteen soil and fill samples were analyzed at AOC 0-004 and SWMU 0-030(l) for isotopic plutonium, three samples for americium-241 by alpha spectroscopy, one sample for tritium, twelve samples for isotopic uranium, and twenty samples for gamma-emitting radionuclides (no radionuclide analyses were requested for samples from AOC 0-033[b]). The full-suite analyte list in the analytical services statement of work (LANL 1995, 49738; LANL 2000, 71233) includes the decay series of the naturally occurring radionuclides, uranium-235, uranium-238, and thorium-232, as well as fission and activation products and their progeny. The primary radionuclides reliably measured by gamma spectroscopy include activation products (americium-241, cobalt-60, and sodium-22), fission products (cesium-134, cesium-137, europium-152, and ruthenium-106), and uranium-235. Uranium-235 is both naturally occurring and a potential historical contaminant from Laboratory operations.

Table C-5.0-4 in Appendix C presents detailed results of the QA/QC assessment. Although samples were identified as either soil or fill, they were grouped together for purposes of comparing the site data to BVs and fallout values (FVs). Sample concentrations were compared with appropriate all horizon soil background data sets or FVs (LANL 1998, 59730). Table 2.4-6 presents the frequency of detects of the radionuclides in soil and fill. Note that the numbers of analyses for specific radionuclides may differ from each other and from the total number of analyses requested; the list of analytes reported by the analytical laboratories, particularly for gamma-emitting radionuclides, has not been consistent throughout the years.

Plutonium-239, uranium-234, and uranium-238 were all detected above the BV or FV in samples that were collected within 6 in. of the surface. Americium-241, cesium-137, plutonium-238, and uranium-235 were detected in samples collected below 6 in. bgs. Two samples with detects of americium-241 and one sample with a detect of plutonium-238 were collected between 4 and 5.5 ft bgs in soil. Soil at this depth is usually not associated with fallout. However, this area was disturbed when the tank and piping were installed as well as when the tank and piping were removed in 1995. During these activities, soil from the surface could have been moved to deeper depths. Cesium-137 was detected above its FV in only one sample that was collected at a depth of less than 1 ft. The one detect of cesium-137 is well below the soil BV. The sample was collected within 1 ft of the surface, and cesium-137 was not detected in other samples. Similarly, uranium-235 was detected in one sample that was collected within 1 ft of the surface. This one detected value exceeds the soil BV, which is a surrogate from sediment data. Table E-3.1-2 presents the results of statistical tests comparing all soil and fill data, regardless of depth, to the background data sets for americium-241, cesium-137, plutonium-238, and plutonium-239. The only analyte that still shows a significant difference from background is plutonium-239.

Because the soil is more than 5 ft deep in some locations, analytes that were detected below 1 ft bgs will be retained as COPCs for further evaluation. Therefore, americium-241, plutonium-238, plutonium-239, uranium-234, and uranium-238 are retained as COPCs in the soil and fill and will be evaluated further. Table 2.4-7 presents the concentrations above the BV or fallout value in soil and fill as well as detected concentrations below a depth of 6 in. Uranium-235 and cesium-137 are not retained as COPCs.

Non-Site-Related Samples

The two non-site-related samples were analyzed for isotopic plutonium, isotopic uranium, and gamma-emitting radionuclides as shown in Table 2.4-2. Both non-site-related samples were collected within 1 ft of the surface. The radionuclide results from these two samples were compared to the all-soil horizon BV or FV, where applicable. Radionuclides from this comparison were then compared to the COPC list from the site data. Plutonium-239 was detected above the BV at a concentration of 0.292 pCi/g in the non-site-related sample collected at 0.5 to 1 ft bgs. Figure E-4.1-6 (Appendix E) compares distributions for the site data, non-site-related data, and background data. All other radionuclides were not detected or were detected below an applicable BV.

Table 2.4-6
Frequency of Detected Radionuclides in Soil and Fill Samples at AOCs 0-004 and 0-033(b) and SWMU 0-030(l)

Analyte	Media	Number of Analyses[b]	Number of Detects	Concentration Range (pCi/g)	BV (pCi/g)	Frequency of Detects Above BV or FV or Detected Below 6 in.
Americium-241	Fill	4	0	[-0.0714 to 0.00941]	0.013	0/4
Americium-241	Soil	16	2	[-0.11] to [0.075]	0.013	2/16
Cesium-134	Fill	4	0	[-0.205 to –0.0019]	NA[a]	0/4
Cesium-134	Soil	9	0	[-0.107 to 0.034]	NA	0/9
Cesium-137	Fill	4	0	[-0.0133 to –0.000728]	1.65	0/4
Cesium-137	Soil	16	9	[-0.0176] to 1.47	1.65	1/16
Cobalt-60	Fill	4	0	[-0.00686 to 0.00557]	NA	0/4
Cobalt-60	Soil	16	0	[-0.04 to 0.08]	NA	0/16
Europium-152	Fill	4	0	[-0.0581 to 0.00878]	NA	0/4
Europium-152	Soil	16	0	[-0.55 to 0.171]	NA	0/16
Plutonium-238	Fill	4	0	[-0.00168 to 0.00502]	0.023	0/4
Plutonium-238	Soil	10	1	[-0.00355] to 0.016	0.023	1/10
Plutonium-239	Fill	4	1	[0.00495] to 0.0581	0.054	¼
Plutonium-239	Soil	10	7	[0.002] to 0.169	0.054	6/10
Ruthenium-106	Fill	4	0	[-0.0179 to 0.112]	NA	0/4
Ruthenium-106	Soil	16	0	[-0.407 to 0.253]	NA	0/16
Sodium-22	Fill	4	0	[-0.00256 to –0.000683]	NA	0/4
Sodium-22	Soil	15	0	[-0.066 to 0.039]	NA	0/15
Tritium	Soil	1	0	[0.036]	0.766 pCi/mL	0/1
Uranium-234	Fill	4	4	0.593 to 1.11	2.59	0/4
Uranium-234	Soil	8	8	0.97 to 2.79	2.59	2/8
Uranium-235	Fill	4	4	0.0497 to 0.054	0.2	0/4
Uranium-235	Soil	10	7	-0.057 to [0.42]	0.2	1/10
Uranium-238	Fill	4	4	0.632 to 1.1	2.29	0/4
Uranium-238	Soil	8	8	0.978 to 2.96	2.29	2/8

[a] NA = Not available.

[b] Numbers of analyses for gamma-emitting radionuclides varies because of inconsistencies and changes in the list of analytes reported by various laboratories over the years.

Table 2.4-7
Radionuclide COPCs Detected Above BVs in Soil and Fill Samples at AOCs 0-004 and 0-033(b) and SWMU 0-030(l)

Sample ID	Location ID	Depth (ft)	Media	Americium-241 (pCi/g)	Plutonium-238 (pCi/g)	Plutonium-239 (pCi/g)	Uranium-234 (pCi/g)	Uranium-238 (pCi/g)
RE00-02-45608	00-02-19696	0–0.5	Soil	—*	—	—	2.79	2.96
RE00-02-45609	00-02-19696	0.5–1	Soil	—	—	0.026	2.65	2.68
RE00-02-45610	00-02-19697	0–0.5	Soil	—	—	0.0958	—	—
RE00-02-45611	00-02-19697	0.5–1	Soil	—	—	0.0572	—	—
RE00-02-45612	00-02-19698	0–0.5	Soil		—	—	—	—
0100-95-0490	00-04310	4–4.5	Soil	0.016	—	0.145	—	—
0100-95-0694	00-04318	5–5.5	Soil	—	0.016	0.169	—	—
0100-95-0695	00-04319	5–5.5	Soil	0.007	—	—	—	—
RE00-02-47819	00-02-19630	3–3.5	Soil	—	—	0.073	—	—

*— = Not above the BV or not detected.

2.4.3.1.3 Evaluation of Organic Chemicals

Thirty-one soil and fill material samples were analyzed for PCBs, pesticides, and SVOCs. Eleven soil and fill samples were analyzed for VOCs. Table C-5.0-3 in Appendix C presents detailed results of the QA/QC assessment. Sample concentrations were reviewed for detection status. Table 2.4-8 presents the frequency of detected organic chemicals in soil and fill.

Forty-two organic chemicals were detected in the soil and fill data. Three of these organic chemicals (dichlorodiphenyldichloroethane [DDE], dichlorodiphenyltrichloroethane [DDT], and phenanthrene) were detected in over half the samples collected. Table 2.4-9 presents the detected concentrations in soil and fill. All 42 detected organic chemicals presented in Table 2.4-8 are retained as COPCs.

Non-Site-Related Samples

The two non-site-related samples listed in Table 2.4-4 were analyzed for pesticides, PCBs, SVOCs, and VOCs. There were 19 detected organic chemicals in the non-site-related samples. Of these 19 chemicals, all were also detected in the data from the site samples, with the exception of tetrachloroethene (TCE). Tetrachloroethene was detected in one non-site-related sample, but not in any site samples. The PAHs as well as benzoic acid and dibenzofuran were detected at higher concentrations in the non-site-related sample data than in the site sample data. Figures E-4.1-7 to E-4.1-9 show the site data and the non-site-related data for Aroclor-1260, 4,4'-DDT, and pyrene to compare a PCB, a pesticide, and a PAH. Table 2.4-10 shows the results for all organic chemicals detected in the non-site-related samples.

Table 2.4-8
Frequency of Detected Organic Chemicals in Soil and Fill Samples at AOCs 0-004 and 0-033(b) and SWMU 0-030(l)

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	Frequency of Detects
Acenaphthene	Soil	27	4	0.024 to [0.57]	4/27
Acetone	Fill	2	1	[0.006] to 0.081	1/2
Aldrin	Soil	27	4	0.0004 to [0.18]	4/27
Anthracene	Soil	27	3	[0.034] to [0.57]	3/27
Aroclor-1254	Fill	4	2	[0.004] to 0.584	2/4
Aroclor-1254	Soil	27	2	[0.003] to [3.6]	2/27
Aroclor-1260	Fill	4	3	[0.004] to 0.18	3/4
Aroclor-1260	Soil	27	9	[0.037] to [3.6]	9/27
Benzene	Soil	9	1	0.0007 to [0.0059]	1/9
Benz(a)anthracene	Soil	27	4	[0.034] to 0.5	4/27
Benzo(a)pyrene	Soil	27	7	[0.034] to 0.64	7/27
Benzo(b)fluoranthene	Soil	27	8	[0.034] to 1.3	8/27
Benzo(g,h,i)perylene	Soil	27	3	[0.034] to [0.57]	3/27
Benzo(k)fluoranthene	Soil	27	4	[0.034] to [0.57]	4/27
Benzoic Acid	Soil	27	5	0.11 to [3.7]	5/27
BHC[alpha-]	Soil	27	1	[0.0007] to [0.18]	1/27
Bis(2-ethylhexyl)phthalate	Soil	27	2	[0.059] to 3.1	2/27
Butanone[2-]	Fill	2	1	[0.006] to 0.013	1/2
Butylbenzylphthalate	Soil	27	1	[0.035] to [0.57]	1/27
Chlordane[alpha-]	Soil	27	12	[0.0007] to 1.9	12/27
Chlordane[gamma-]	Soil	27	11	0.0006 to 2.6	11/27
Chrysene	Soil	27	11	[0.034] to 0.64	11/27
DDD[4,4'-]	Fill	4	1	0.0003 to [0.014]	1/4
DDD[4,4'-]	Soil	27	2	[0.002] to [0.36]	2/27
DDE[4,4'-]	Fill	4	2	0.0002 to [0.014]	2/4
DDE[4,4'-]	Soil	27	19	0.002 to 1.3	19/27
DDT[4,4'-]	Soil	27	17	[0.0034] to 1.8	17/27
Dibenz(a,h)anthracene	Soil	27	1	[0.034] to [0.57]	1/27
Dibenzofuran	Soil	27	1	0.018 to [0.57]	1/27
Dieldrin	Soil	27	5	0.0006 to [0.36]	5/27
Dimethyl Phthalate	Soil	27	1	[0.18] to [0.57]	1/27
Di-n-butylphthalate	Soil	27	6	0.027 to [0.57]	6/27
Endosulfan II	Soil	27	2	0.0008 to [0.36]	2/27
Endrin	Soil	27	2	[0.0013] to [0.36]	2/27

Table 2.4-8 (continued)

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	Frequency of Detects
Fluoranthene	Fill	4	2	[0.036] to [0.15]	2/4
Fluoranthene	Soil	27	12	0.038 to 1.09	12/27
Fluorene	Soil	27	3	0.006 to [0.57]	3/27
Heptachlor	Soil	27	2	0.0006 to [0.18]	2/27
Heptachlor Epoxide	Soil	27	1	[0.0007] to [0.18]	1/27
Indeno(1,2,3-cd)pyrene	Soil	27	3	[0.034 to 0.57]	3/27
Isopropyltoluene[4-]	Soil	9	4	0.0007 to 0.008	4/9
Methoxychlor[4,4'-]	Soil	27	2	0.003 to [1.8]	2/27
Phenanthrene	Fill	4	2	0.032 to [0.15]	2/4
Phenanthrene	Soil	27	10	0.021 to 0.59	10/27
Pyrene	Fill	4	2	[0.036] to [0.18]	2/4
Pyrene	Soil	27	14	0.059 to 1.3	14/27
Styrene	Fill	2	2	0.002 to 0.002	2/2
Styrene	Soil	9	2	0.003 to [0.006]	2/9
Toluene	Fill	2	2	0.0005 to 0.0007	2/2
Toluene	Soil	9	2	0.001 to [0.006]	2/9
Trichloroethene	Soil	9	4	0.0008 to 0.008	4/9

Table 2.4-9
Detected Organic Chemicals in Soil and Fill Samples at AOCs 0-004 and 0-033(b) and SWMU 0-030(l)

Sample ID	Location ID	Depth (ft)	Media	Acenaphthene (mg/kg)	Acetone (mg/kg)	Aldrin (mg/kg)	Anthracene (mg/kg)	Aroclor-1254 (mg/kg)	Aroclor-1260 (mg/kg)	Benzene (mg/kg)	Benz(a)anthracene (mg/kg)
RE00-02-45606	00-02-19695	0–0.5	Fill	—[a]	NA[b]	—	—	—	0.026	NA	—
RE00-02-45607	00-02-19695	0.5–1	Fill	—	0.081	—	—	0.023	0.027	—	—
RE00-02-45608	00-02-19696	0–0.5	Soil	0.024 (J)	NA	—	0.0463	—	0.12	NA	0.16 (J)
RE00-02-45609	00-02-19696	0.5–1	Soil	0.048	—	—	0.09	0.11	0.31	—	0.5
RE00-02-45610	00-02-19697	0–0.5	Soil	0.12	NA	—	—	—	0.051	NA	—
RE00-02-45611	00-02-19697	0.5–1	Soil	0.22	—	—	—	—	0.041	—	—
RE00-02-45612	00-02-19698	0–0.5	Soil	—	NA	—	—	—	0.28	NA	—
RE00-02-45614	00-02-19699	0–0.5	Soil	—	NA	—	—	0.097	0.47	NA	—
RE00-02-45616	00-02-19700	0–0.5	Fill	—	NA	—	—	0.58	0.18	NA	—
RE00-02-45617	00-02-19700	0.5–1	Fill	—	—	—	—	—	—	—	—
0100-95-0517	00-04221	0–0.33	Soil	—	NA	0.0005 (J)	—	—	0.19	NA	—
0100-95-0516	00-04223	0–0.33	Soil	—	NA	0.0004 (J)	—	—	—	NA	—
0100-95-0515	00-04224	0–0.25	Soil	—	NA	0.0008 (J)	—	—	—	NA	—
0100-95-0518	00-04225	0–0.5	Soil	—	NA	0.0006 (J-)	—	—	0.21 (J-)	NA	0.16 (J)
0100-95-0457	00-04238	0–0.5	Soil	—	NA	—	—	—	0.069	NA	—
0100-95-0514	00-04222	0–0.5	Soil	—	NA	—	—	—	—	NA	—
RE00-02-47819	00-02-19630	3–3.5	Soil	—	—	—	—	—	—	—	—
0100-95-0519	00-04226	0–0.5	Soil	—	NA	—	—	—	—	NA	—
0100-95-0694	00-04318	5–5.5	Soil	—	NA	—	—	—	—	NA	—

Table 2.4-9 (continued)

Sample ID	Location ID	Depth (ft)	Media	Acenaphthene (mg/kg)	Acetone (mg/kg)	Aldrin (mg/kg)	Anthracene (mg/kg)	Aroclor-1254 (mg/kg)	Aroclor-1260 (mg/kg)	Benzene (mg/kg)	Benz(a)anthracene (mg/kg)
0100-96-1756	00-05756	5–5.5	Soil	—	NA	—	—	—	—	NA	—
0100-96-1761	00-05757	4–4.5	Soil	—	NA	—	—	—	—	NA	—
0100-96-1762	00-05758	0–0.5	Soil	—	NA	—	—	—	—	NA	—
0100-96-1763	00-05759	0–0.5	Soil	—	NA	—	—	—	—	NA	—
0100-96-1764	00-05760	0–0.5	Soil	—	NA	—	—	—	—	NA	—
0100-96-1765	00-05761	0–0.5	Soil	—	NA	—	—	—	—	NA	—
0100-96-1766	00-05762	0–0.5	Soil	—	NA	—	—	—	—	NA	—
0100-96-1767	00-05763	0–0.5	Soil	—	NA	—	0.047 (J)	—	—	NA	0.17 (J)
RE00-02-45448	00-02-19623	1–1.5	Soil	—	—	—	—	—	—	—	—
RE00-02-45449	00-02-19624	1–1.5	Soil	—	—	—	—	—	—	—	—
RE00-02-45450	00-02-19625	1–1.5	Soil	—	—	—	—	—	—	—	—
RE00-02-45451	00-02-19626	1–1.5	Soil	—	—	—	—	—	—	—	—
RE00-02-45452	00-02-19627	1–1.5	Soil	—	—	—	—	—	—	0.0007 (J)	—

Table 2.4-9 (continued)

Sample ID	Location ID	Depth (ft)	Media	Benzo(a)pyrene (mg/kg)	Benzo(b)fluoranthene (mg/kg)	Benzo(g,h,i)perylene (mg/kg)	Benzo(k)fluoranthene (mg/kg)	Benzoic Acid (mg/kg)	BHC[alpha-] (mg/kg)	Bis(2-ethylhexyl)phthalate (mg/kg)	Butanone[2-] (mg/kg)	Butylbenzylphthalate (mg/kg)
RE00-02-45606	00-02-19695	0–0.5	Fill	—	—	—	—	—	—	—	—	—
RE00-02-45607	00-02-19695	0.5–1	Fill	—	—	—	—	—	—	—	0.013	—
RE00-02-45608	00-02-19696	0–0.5	Soil	—	0.39	—	—	0.18 (J)	—	—	—	—
RE00-02-45609	00-02-19696	0.5–1	Soil	0.64	1.3	—	—	0.18 (J)	—	—	—	—
RE00-02-45610	00-02-19697	0–0.5	Soil	—	—	—	—	—	—	—	—	—
RE00-02-45611	00-02-19697	0.5–1	Soil	—	—	—	—	—	—	—	—	—
RE00-02-45612	00-02-19698	0–0.5	Soil	—	—	—	—	—	—	—	—	—
RE00-02-45614	00-02-19699	0–0.5	Soil	—	—	—	—	—	—	—	—	—
RE00-02-45616	00-02-19700	0–0.5	Fill	—	—	—	—	—	—	—	—	—
RE00-02-45617	00-02-19700	0.5–1	Fill	—	—	—	—	—	—	—	—	—
0100-95-0517	00-04221	0–0.33	Soil	0.09 (J)	0.15 (J)	—	—	0.14 (J)	—	—	—	—
0100-95-0516	00-04223	0–0.33	Soil	—	—	—	—	—	0.002	—	—	—
0100-95-0515	00-04224	0–0.25	Soil	—	—	—	—	—	—	—	—	—
0100-95-0518	00-04225	0–0.5	Soil	0.21 (J)	0.35 (J)	—	—	0.32 (J)	—	3.1 (J)	—	—
0100-95-0457	00-04238	0–0.5	Soil	0.078 (J)	0.096 (J)	—	0.096 (J)	—	—	0.1 (J)	—	0.12 (J)
0100-95-0514	00-04222	0–0.5	Soil	—	—	—	—	—	—	—	—	—
RE00-02-47819	00-02-19630	3–3.5	Soil	—	—	—	—	—	—	—	—	—
0100-95-0519	00-04226	0–0.5	Soil	—	—	—	—	—	—	—	—	—
0100-95-0694	00-04318	5–5.5	Soil	—	—	—	—	—	—	—	—	—

Table 2.4-9 (continued)

Sample ID	Location ID	Depth (ft)	Media	Benzo(a)pyrene (mg/kg)	Benzo(b)fluoranthene (mg/kg)	Benzo(g,h,i)perylene (mg/kg)	Benzo(k)fluoranthene (mg/kg)	Benzoic Acid (mg/kg)	BHC[alpha-] (mg/kg)	Bis(2-ethylhexyl)phthalate (mg/kg)	Butanone[2-] (mg/kg)	Butylbenzylphthalate (mg/kg)
0100-96-1756	00-05756	5–5.5	Soil	—	—	—	—	—	—	—	—	—
0100-96-1761	00-05757	4–4.5	Soil	—	—	—	—	—	—	—	—	—
0100-96-1762	00-05758	0–0.5	Soil	0.057 (J)	0.056 (J)	0.041 (J)	0.056 (J)	—	—	—	—	—
0100-96-1763	00-05759	0–0.5	Soil	—	—	—	—	—	—	—	—	—
0100-96-1764	00-05760	0–0.5	Soil	—	—	—	—	—	—	—	—	—
0100-96-1765	00-05761	0–0.5	Soil	0.049 (J)	0.051 (J)	0.042 (J)	0.038 (J)	—	—	—	—	—
0100-96-1766	00-05762	0–0.5	Soil	—	—	—	—	—	—	—	—	—
0100-96-1767	00-05763	0–0.5	Soil	0.14 (J)	0.13 (J)	0.09 (J)	0.14 (J)	0.11 (J)	—	—	—	—
RE00-02-45448	00-02-19623	1–1.5	Soil	—	—	—	—	—	—	—	—	—
RE00-02-45449	00-02-19624	1–1.5	Soil	—	—	—	—	—	—	—	—	—
RE00-02-45450	00-02-19625	1–1.5	Soil	—	—	—	—	—	—	—	—	—
RE00-02-45451	00-02-19626	1–1.5	Soil	—	—	—	—	—	—	—	—	—
RE00-02-45452	00-02-19627	1–1.5	Soil	—	—	—	—	—	—	—	—	—

Table 2.4-9 (continued)

Sample ID	Location ID	Depth (ft)	Media	Chlordane[alpha-] (mg/kg)	Chlordane[gamma-] (mg/kg)	Chrysene (mg/kg)	DDD[4,4'-] (mg/kg)	DDE[4,4'-] (mg/kg)	DDT[4,4'-] (mg/kg)	Dibenz(a,h)anthracene (mg/kg)	Dibenzofuran (mg/kg)
AOC 0-004											
RE00-02-45606	00-02-19695	0–0.5	Fill	—	—	—	—	—	—	—	—
RE00-02-45607	00-02-19695	0.5–1	Fill	—	—	—	—	—	—	—	—
RE00-02-45608	00-02-19696	0–0.5	Soil	—	—	0.23 (J)	—	0.038	—	—	—
RE00-02-45609	00-02-19696	0.5–1	Soil	0.001 (J)	0.004	0.64	—	0.02	0.086	0.23	0.018 (J)
RE00-02-45610	00-02-19697	0–0.5	Soil	—	—	7.080001E-02	—	0.0213	0.044	—	—
RE00-02-45611	00-02-19697	0.5–1	Soil	—	—	—	—	0.026	0.058	—	—
RE00-02-45612	00-02-19698	0–0.5	Soil	0.003 (J)	0.006	0.055	—	0.009	0.064	—	—
RE00-02-45614	00-02-19699	0–0.5	Soil	0.001 (J)	0.002 (J)	0.037	—	0.002 (J)	—	—	—
RE00-02-45616	00-02-19700	0–0.5	Fill	—	—	—	—	0.0002 (J)	—	—	—
RE00-02-45617	00-02-19700	0.5–1	Fill	—	—	—	0.0003 (J)	0.001 (J)	—	—	—
0100-95-0517	00-04221	0–0.33	Soil	—	—	0.12 (J)	0.002 (J)	0.008	0.036	—	—
0100-95-0516	00-04223	0–0.33	Soil	—	—	—	—	1.3	1.8	—	—
0100-95-0515	00-04224	0–0.25	Soil	—	0.003	—	—	0.3	0.36	—	—
0100-95-0518	00-04225	0–0.5	Soil	0.003 (J-)	—	0.29 (J)	—	0.008 (J-)	—	—	—
0100-95-0457	00-04238	0–0.5	Soil	0.002	—	0.097 (J)	0.015	0.035	0.18	—	—
0100-95-0514	00-04222	0–0.5	Soil	—	0.0006 (J)	—	—	0.006	0.008	—	—
RE00-02-47819	00-02-19630	3–3.5	Soil	—	—	—	—	0.068	0.033	—	—
0100-95-0519	00-04226	0–0.5	Soil	0.0008 (J)	—	—	—	0.032	0.033	—	—
0100-95-0694	00-04318	5–5.5	Soil	—	—	—	—	0.014	0.034	—	—
0100-96-1756	00-05756	5–5.5	Soil	0.38	0.41	—	—	—	—	—	—
0100-96-1761	00-05757	4–4.5	Soil	1.9	2.6	—	—	—	—	—	—

Table 2.4-9 (continued)

Sample ID	Location ID	Depth (ft)	Media	Chlordane[alpha-] (mg/kg)	Chlordane[gamma-] (mg/kg)	Chrysene (mg/kg)	DDD[4,4'-] (mg/kg)	DDE[4,4'-] (mg/kg)	DDT[4,4'-] (mg/kg)	Dibenz(a,h)anthracene (mg/kg)	Dibenzofuran (mg/kg)
0100-96-1762	00-05758	0–0.5	Soil	0.007	0.006	0.049 (J)	—	—	—	—	—
0100-96-1763	00-05759	0–0.5	Soil	0.024	0.027	—	—	0.007 (J)	0.022	—	—
0100-96-1764	00-05760	0–0.5	Soil	—	—	—	—	0.12	0.7	—	—
0100-96-1765	00-05761	0–0.5	Soil	0.03	0.026	0.043 (J)	—	0.2	1.3	—	—
0100-96-1766	00-05762	0–0.5	Soil	0.021	0.019	—	—	0.17 (J)	1.2	—	—
0100-96-1767	00-05763	0–0.5	Soil	—	—	0.18 (J)	—	—	0.006	—	—
RE00-02-45448	00-02-19623	1–1.5	Soil	—	—	—	—	—	—	—	—
RE00-02-45449	00-02-19624	1–1.5	Soil	—	—	—	—	—	—	—	—
RE00-02-45450	00-02-19625	1–1.5	Soil	—	—	—	—	—	—	—	—
RE00-02-45451	00-02-19626	1–1.5	Soil	—	—	—	—	—	—	—	—
RE00-02-45452	00-02-19627	1–1.5	Soil	—	—	—	—	—	—	—	—

Table 2.4-9 (continued)

Sample ID	Location ID	Depth (ft)	Media	Dieldrin (mg/kg)	Dimethyl Phthalate (mg/kg)	Di-n-butylphthalate (mg/kg)	Endosulfan II (mg/kg)	Endrin (mg/kg)	Fluoranthene (mg/kg)	Fluorene (mg/kg)	Heptachlor (mg/kg)	Heptachlor Epoxide (mg/kg)
RE00-02-45606	00-02-19695	0–0.5	Fill	—	—	—	—	—	0.048	—	—	—
RE00-02-45607	00-02-19695	0.5–1	Fill	—	—	—	—	—	—	—	—	—
RE00-02-45608	00-02-19696	0–0.5	Soil	—	0.185 (J)	—	—	—	0.297	0.018 (J)	—	—
RE00-02-45609	00-02-19696	0.5–1	Soil	—	—	0.035 (J)	—	—	1.09	0.038	—	—
RE00-02-45610	00-02-19697	0–0.5	Soil	—	—	0.029 (J)	—	—	0.097	0.006 (J)	—	—
RE00-02-45611	00-02-19697	0.5–1	Soil	—	—	0.04 (J)	—	—	0.038	—	—	—
RE00-02-45612	00-02-19698	0–0.5	Soil	—	—	0.027 (J)	—	—	0.073	—	—	—
RE00-02-45614	00-02-19699	0–0.5	Soil	—	—	0.031 (J)	—	—	0.045	—	—	—
RE00-02-45616	00-02-19700	0–0.5	Fill	—	—	—	—	—	0.045	—	—	—
RE00-02-45617	00-02-19700	0.5–1	Fill	—	—	—	—	—	—	—	—	—
0100-95-0517	00-04221	0–0.33	Soil	0.004	—	—	—	—	0.15 (J)	—	0.0008 (J)	—
0100-95-0516	00-04223	0–0.33	Soil	0.002 (J)	—	0.12 (J)	—	0.002 (J)	—	—	0.0006 (J)	—
0100-95-0515	00-04224	0–0.25	Soil	0.004 (J)	—	—	—	—	—	—	—	0.0007 (J)
0100-95-0518	00-04225	0–0.5	Soil	0.01 (J-)	—	—	—	0.011 (J-)	0.34 (J)	—	—	—
0100-95-0457	00-04238	0–0.5	Soil	—	—	—	—	—	0.19 (J)	—	—	—
0100-95-0514	00-04222	0–0.5	Soil	—	—	—	0.0008 (J)	—	—	—	—	—
RE00-02-47819	00-02-19630	3–3.5	Soil	—	—	—	—	—	—	—	—	—
0100-95-0519	00-04226	0–0.5	Soil	0.0006 (J)	—	—	0.0008 (J)	—	—	—	—	—
0100-95-0694	00-04318	5–5.5	Soil	—	—	—	—	—	—	—	—	—

Table 2.4-9 (continued)

Sample ID	Location ID	Depth (ft)	Media	Dieldrin (mg/kg)	Dimethyl Phthalate (mg/kg)	Di-n-butylphthalate (mg/kg)	Endosulfan II (mg/kg)	Endrin (mg/kg)	Fluoranthene (mg/kg)	Fluorene (mg/kg)	Heptachlor (mg/kg)	Heptachlor Epoxide (mg/kg)
0100-96-1756	00-05756	5–5.5	Soil	—	—	—	—	—	—	—	—	—
0100-96-1761	00-05757	4–4.5	Soil	—	—	—	—	—	—	—	—	—
0100-96-1762	00-05758	0–0.5	Soil	—	—	—	—	—	0.062 (J)	—	—	—
0100-96-1763	00-05759	0–0.5	Soil	—	—	—	—	—	—	—	—	—
0100-96-1764	00-05760	0–0.5	Soil	—	—	—	—	—	—	—	—	—
0100-96-1765	00-05761	0–0.5	Soil	—	—	—	—	—	0.05 (J)	—	—	—
0100-96-1766	00-05762	0–0.5	Soil	—	—	—	—	—	—	—	—	—
0100-96-1767	00-05763	0–0.5	Soil	—	—	—	—	—	0.39	—	—	—
RE00-02-45448	00-02-19623	1–1.5	Soil	—	—	—	—	—	—	—	—	—
RE00-02-45449	00-02-19624	1–1.5	Soil	—	—	—	—	—	—	—	—	—
RE00-02-45450	00-02-19625	1–1.5	Soil	—	—	—	—	—	—	—	—	—
RE00-02-45451	00-02-19626	1–1.5	Soil	—	—	—	—	—	—	—	—	—
RE00-02-45452	00-02-19627	1–1.5	Soil	—	—	—	—	—	—	—	—	—

Table 2.4-9 (continued)

Sample ID	Location ID	Depth (ft)	Media	Indeno(1,2,3-cd)pyrene (mg/kg)	Isopropyltoluene[4-] (mg/kg)	Methoxychlor[4,4'-] (mg/kg)	Phenanthrene (mg/kg)	Pyrene (mg/kg)	Styrene (mg/kg)	Toluene (mg/kg)	Trichloroethene (mg/kg)
RE00-02-45606	00-02-19695	0–0.5	Fill	—	—	—	0.034 (J)	0.074	—	—	—
RE00-02-45607	00-02-19695	0.5–1	Fill	—	—	—	—	—	0.002	0.0007 (J)	—
RE00-02-45608	00-02-19696	0–0.5	Soil	—	—	—	0.241	0.518 (J)	—	—	—
RE00-02-45609	00-02-19696	0.5–1	Soil	0.427	0.002	—	0.585	1.25	0.003	0.002	—
RE00-02-45610	00-02-19697	0–0.5	Soil	—	—	—	0.074	0.139	—	—	—
RE00-02-45611	00-02-19697	0.5–1	Soil	—	0.008	—	0.021 (J)	0.063	0.003	0.001 (J)	—
RE00-02-45612	00-02-19698	0–0.5	Soil	—	—	—	0.035	0.084	—	—	—
RE00-02-45614	00-02-19699	0–0.5	Soil	—	—	—	0.026 (J)	0.062	—	—	—
RE00-02-45616	00-02-19700	0–0.5	Fill	—	—	—	0.032 (J)	0.049	—	—	—
RE00-02-45617	00-02-19700	0.5–1	Fill	—	—	—	—	—	0.002	0.0005 (J)	—
0100-95-0517	00-04221	0–0.33	Soil	—	—	—	0.08 (J)	0.19 (J)	—	—	—
0100-95-0516	00-04223	0–0.33	Soil	—	—	—	—	0.081 (J)	—	—	—
0100-95-0515	00-04224	0–0.25	Soil	—	—	0.017 (J)	—	0.082 (J)	—	—	—
0100-95-0518	00-04225	0–0.5	Soil	—	—	—	0.17 (J)	0.45 (J)	—	—	—
0100-95-0457	00-04238	0–0.5	Soil	—	—	—	0.086 (J)	0.14 (J)	—	—	—
0100-95-0514	00-04222	0–0.5	Soil	—	—	—	—	—	—	—	—
RE00-02-47819	00-02-19630	3–3.5	Soil	—	—	—	—	—	—	—	—
0100-95-0519	00-04226	0–0.5	Soil	—	—	0.003 (J)	—	—	—	—	—
0100-95-0694	00-04318	5–5.5	Soil	—	—	—	—	—	—	—	—

Table 2.4-9 (continued)

Sample ID	Location ID	Depth (ft)	Media	Indeno(1,2,3-cd)pyrene (mg/kg)	Isopropyltoluene[4-] (mg/kg)	Methoxychlor[4,4'-] (mg/kg)	Phenanthrene (mg/kg)	Pyrene (mg/kg)	Styrene (mg/kg)	Toluene (mg/kg)	Trichloroethene (mg/kg)
0100-96-1756	00-05756	5–5.5	Soil	—	—	—	—	—	—	—	—
0100-96-1761	00-05757	4–4.5	Soil	—	—	—	—	—	—	—	—
0100-96-1762	00-05758	0–0.5	Soil	0.035 (J)	—	—	—	0.07 (J)	—	—	—
0100-96-1763	00-05759	0–0.5	Soil	—	—	—	—	—	—	—	—
0100-96-1764	00-05760	0–0.5	Soil	—	—	—	—	—	—	—	—
0100-96-1765	00-05761	0–0.5	Soil	—	—	—	—	0.059 (J)	—	—	—
0100-96-1766	00-05762	0–0.5	Soil	—	—	—	—	—	—	—	—
0100-96-1767	00-05763	0–0.5	Soil	0.09 (J)	—	—	0.21 (J)	0.35 (J)	—	—	—
RE00-02-45448	00-02-19623	1–1.5	Soil	—	0.0007 (J)	—	—	—	—	—	0.0008 (J)
RE00-02-45449	00-02-19624	1–1.5	Soil	—	—	—	—	—	—	—	0.006 (J)
RE00-02-45450	00-02-19625	1–1.5	Soil	—	0.0011 (J)	—	—	—	—	—	—
RE00-02-45451	00-02-19626	1–1.5	Soil	—	—	—	—	—	—	—	0.008
RE00-02-45452	00-02-19627	1–1.5	Soil	—	—	—	—	—	—	—	0.004 (J)

[a] — = Not detected.

[b] NA = Not analyzed

Table 2.4-10
Detected Organic Chemicals in Non-Site-Related Samples at AOCs 0-004 and 0-033(b) and SWMU 0-030(l)

Part 1

Sample ID	Location ID	Depth (ft)	Media	Acenaphthene (mg/kg)	Anthracene (mg/kg)	Aroclor-1260 (mg/kg)	Benz(a)anthracene (mg/kg)	Benzo(a)pyrene (mg/kg)	Benzo(b)fluoranthene (mg/kg)	Benzo(g,h,i)perylene (mg/kg)
RE00-02-45618	00-02-19701	0–0.5	Soil	0.19	0.338	—[a]	1.3	1.34	1.87	—
RE00-02-45619	00-02-19701	0.5–1	Soil	0.0528	0.113	0.116	0.6	0.758	1.18	0.274

Part 2

Sample ID	Location ID	Depth (ft)	Media	Benzoic Acid (mg/kg)	Chrysene (mg/kg)	DDE[4,4'-] (mg/kg)	DDT[4,4'-] (mg/kg)	Dibenzofuran (mg/kg)	Fluoranthene (mg/kg)
RE00-02-45618	00-02-19701	0–0.5	Soil	0.837	1.52	—	—	0.0918	2.82
RE00-02-45619	00-02-19701	0.5–1	Soil	0.157	0.789	0.0035	0.0433	0.0205	1.27

Part 3

Sample ID	Location ID	Depth (ft)	Media	Fluorene (mg/kg)	Indeno(1,2,3-cd)pyrene (mg/kg)	Phenanthrene (mg/kg)	Pyrene (mg/kg)	Styrene (mg/kg)	Tetrachloroethene (mg/kg)
RE00-02-45618	00-02-19701	0–0.5	Soil	0.152	1.03	2.09	3.67	NR[b]	NR
RE00-02-45619	00-02-19701	0.5–1	Soil	0.0418	0.452	0.644	1.57	0.0019	0.0018

[a] — = Not detected.

[b] NR = Not reported.

2.4.3.2 Tuff Samples

Thirteen samples were collected from unit Qbt3 of the Tshirege Member of the Bandelier Tuff in AOCs 0-004 and 0-033(b) and SWMU 0-030(l). Table 2.4-1 summarizes all of the tuff samples collected. The request number is shown in the table for each analysis that was requested for an individual sample.

2.4.3.2.1 Inorganic Chemical Comparison with Tuff BVs

Twelve tuff samples were analyzed for TAL metals at AOCs 0-004 and 0-033(b) and SWMU 0-030(l). Table C-5.0-2 in Appendix C presents detailed results of the QA/QC assessment. Sample concentrations were compared with the BV for Qbt 2,3,4 tuff (LANL 1998, 59730). Table 2.4-11 presents the frequency of inorganic chemicals in the tuff.

Table 2.4-11
Frequency of Inorganic Chemicals Above BVs in Tuff Samples at AOCs 0-004 and 0-033(b) and SWMU 0-030(l)

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	Background Value (mg/kg)	Frequency of Detects Above Background Value	Frequency of Nondetects Above Background Value
Aluminum	Qbt 3	12	12	687 to 10070	7340	1/12	0/12
Antimony	Qbt 3	12	1	0.0715 to [0.75]	0.5	0/12	1/12
Arsenic	Qbt 3	12	12	0.53 to 4.27	2.79	2/12	0/12
Barium	Qbt 3	12	12	11.9 to 88.4	46	4/12	0/12
Beryllium	Qbt 3	12	12	0.26 to 0.75	1.21	0/12	0/12
Cadmium	Qbt 3	12	12	0.024 to 0.45	1.63	0/12	0/12
Calcium	Qbt 3	12	12	249 to 2160	2200	0/12	0/12
Chromium	Qbt 3	12	9	0.27 to 10.3	7.14	2/12	0/12
Cobalt	Qbt 3	12	12	0.32 to 2.65	3.14	0/12	0/12
Copper	Qbt 3	12	12	1.5 to 21.5	4.66	2/12	0/12
Iron	Qbt 3	12	12	2820 to 9840	14500	0/12	0/12
Lead	Qbt 3	12	12	3 to 94.9	11.2	2/12	0/12
Magnesium	Qbt 3	12	12	182 to 1640	1690	0/12	0/12
Manganese	Qbt 3	12	12	99.9 to 434	482	0/12	0/12
Mercury	Qbt 3	12	7	0.00769 to 0.21	0.1	1/12	0/12
Nickel	Qbt 3	12	12	0.96 to 5.23	6.58	0/12	0/12
Potassium	Qbt 3	12	12	142 to 1090	3500	0/12	0/12
Selenium	Qbt 3	12	11	0.153 to [0.82]	0.3	1/12	1/12
Silver	Qbt 3	12	2	0.039 to [0.18]	1	0/12	0/12
Sodium	Qbt 3	12	12	83.4 to 375	2770	0/12	0/12
Thallium	Qbt 3	12	2	[0.034] to [1.4]	1.1	0/12	1/12
Vanadium	Qbt 3	12	12	1.4 to 15.5	17	0/12	0/12
Zinc	Qbt 3	12	12	19.2 to 92.8	63.5	1/12	0/12

Nine inorganic chemicals (aluminum, arsenic, barium, chromium, copper, lead, mercury, selenium, and zinc) were detected above the Qbt 3 BV in at least one sample. (There is no background data set for mercury in tuff.) Antimony, selenium, and thallium had one detection limit above the BV. These elevated detection limits were all in the same sample at location 00-04423, where other inorganic chemicals were well above their BVs. Further statistical tests were performed for the eight inorganic chemicals that were detected above the BV. The results of the Gehan and Quantile tests are presented in Table E-3.2-1 (Appendix E). The probability values for arsenic, copper, lead, and selenium were significant, indicating that these inorganic chemicals are elevated in comparison to background. Figures E-3.2-1 to E-3.2-3 in Appendix E show the distribution of site data for arsenic, copper, and lead. Figure E-3.2-4 shows the box plots for selenium to illustrate the one high detection limit and the detected concentrations of selenium in the site data in comparison to the background data set.

Table 2.4-12 presents the concentrations above the BV in the tuff. Arsenic, copper, lead, mercury, and selenium are retained as COPCs.

Table 2.4-12
Inorganic Chemicals Above BVs in
Tuff Samples at AOCs 0-004 and 0-033(b) and SWMU 0-030(l)

Sample ID	Location ID	Depth (ft)	Media	Arsenic (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Selenium (mg/kg)
Qbt 2,3,4 Background Value				**2.79**	**4.66**	**11.2**	**0.1**	**0.3**
0100-95-0627	00-04423	5–6	Qbt 3	3.4	21.5	28	0.21	0.82 (U)
RE00-02-45613	00-02-19698	0.5–1	Qbt 3	4.27	8.19	94.9 (J)	—*	0.34 (J)

*— = Not above the BV.

2.4.3.2.2 Radionuclide Comparison with Tuff BVs

Twelve tuff samples were analyzed for gamma-emitting radionuclides. Eleven tuff samples were analyzed for isotopic uranium and isotopic plutonium. The full-suite analyte list in the RRES-RS analytical services statement of work (LANL 1995, 49738; LANL 2000, 71233) includes the decay series of the naturally occurring radionuclides uranium-235, uranium-238, and thorium-232, as well as fission and activation products and their progeny. The primary radionuclides reliably measured by gamma spectroscopy include activation products (americium-241, cobalt-60, and sodium-22), fission products (cesium-134, cesium-137, europium-152, and ruthenium-106), and uranium-235. Uranium-235 is both naturally occurring and a potential historical contaminant from Laboratory operations.

Table 2.4-13
Frequency of Detected Radionuclides in
Tuff Samples at AOCs 0-004 and 0-033(b) and SWMU 0-030(l)

Analyte	Media	Number of Analyses[c]	Number of Detects	Concentration Range (pCi/g)	Background Value (pCi/g)	Frequency of Detects Above Background Value
Americium-241[a]	Qbt 3	12	0	[-0.159 to 0.23]	NA[b]	0/12
Cesium-134	Qbt 3	11	0	[-0.04 to 0.088]	NA	0/11
Cesium-137	Qbt 3	12	1	[-0.064] to [0.114]	NA	1/12
Cobalt-60	Qbt 3	12	0	[-0.0158 to 0.052]	NA	0/12
Europium-152	Qbt 3	12	0	[-0.14 to 0.48]	NA	0/12
Plutonium-238	Qbt 3	11	0	[-0.0016 to 0.0095]	NA	0/11
Plutonium-239	Qbt 3	11	2	[-0.00355] to 0.102	NA	2/11
Ruthenium-106	Qbt 3	12	0	[-0.32 to 0.7]	NA	0/12
Sodium-22	Qbt 3	3	0	[0.017 to 0.0323]	NA	0/3
Uranium-234	Qbt 3	11	11	0.674 to 1.14	1.98	0/11
Uranium-235	Qbt 3	11	7	[0.016] to [0.081]	0.09	0/11
Uranium-238	Qbt 3	11	11	0.628 to 1.28	1.93	0/11

[a] Americium-241 results by gamma spectroscopy.

[b] NA = Not available.

[c] Numbers of analyses for gamma-emitting radionuclides varies because of inconsistencies and changes in the list of analytes reported by various laboratories over the years.

Table C-5.0-4 in Appendix C presents detailed results of the QA/QC assessment. Sample concentrations were compared with appropriate tuff background value or detection status if no background value is available. Table 2.4-13 presents the frequency of detected radionuclides in tuff.

Table 2.4-13
Frequency of Detected Radionuclides in Tuff Samples at AOCs 0-004 and 0-033(b) and SWMU 0-030(l)

Analyte	Media	Number of Analyses[c]	Number of Detects	Concentration Range (pCi/g)	Background Value (pCi/g)	Frequency of Detects Above Background Value
Americium-241[a]	Qbt 3	12	0	[-0.159 to 0.23]	NA[b]	0/12
Cesium-134	Qbt 3	11	0	[-0.04 to 0.088]	NA	0/11
Cesium-137	Qbt 3	12	1	[-0.064] to [0.114]	NA	1/12
Cobalt-60	Qbt 3	12	0	[-0.0158 to 0.052]	NA	0/12
Europium-152	Qbt 3	12	0	[-0.14 to 0.48]	NA	0/12
Plutonium-238	Qbt 3	11	0	[-0.0016 to 0.0095]	NA	0/11
Plutonium-239	Qbt 3	11	2	[-0.00355] to 0.102	NA	2/11
Ruthenium-106	Qbt 3	12	0	[-0.32 to 0.7]	NA	0/12
Sodium-22	Qbt 3	3	0	[0.017 to 0.0323]	NA	0/3
Uranium-234	Qbt 3	11	11	0.674 to 1.14	1.98	0/11
Uranium-235	Qbt 3	11	7	[0.016] to [0.081]	0.09	0/11
Uranium-238	Qbt 3	11	11	0.628 to 1.28	1.93	0/11

[a] Americium-241 results by gamma spectroscopy.

[b] NA = Not available.

[c] Numbers of analyses for gamma-emitting radionuclides varies because of inconsistencies and changes in the list of analytes reported by various laboratories over the years.

Americium-241 was analyzed by gamma spectroscopy for all twelve samples. The results did not show any detects of americium-241. Cesium-137, plutonium-239, uranium-234, uranium-235, and uranium-238 were detected in at least one tuff sample. Background values are available only for isotopic uranium, and these BVs were calculated from total uranium analysis data. The other radionuclides are evaluated based on detection status. Uranium-234, uranium-235, and uranium-238 were not detected above the BV. Therefore, cesium-137 and plutonium-239 are retained as COPCs. Table 2.4-14 presents the detected concentrations for these two radionuclides.

Table 2.4-14
Radionuclides Detected in Tuff Samples at AOCs 0-004 and 0-033(b) and SWMU 0-030(l)

Sample ID	Location ID	Depth (ft)	Media	Cesium-137 (pCi/g)	Plutonium-239 (pCi/g)
RE00-02-47824	00-02-19635	7.5–8	Qbt 3	—*	0.102
RE00-02-47827	00-02-19638	4–4.5	Qbt 3	—	0.0364
RE00-02-45613	00-02-19698	0.5–1	Qbt 3	0.103	—

*— = Not detected.

2.4.3.2.3 Evaluation of Organic Chemicals

Twelve tuff samples were analyzed for PCBs, pesticides, and SVOCs. Eleven of the tuff samples were also analyzed for VOCs. Table C-5.0-3 in Appendix C presents detailed results of the QA/QC assessment. Sample concentrations were reviewed for detection status. Table 2.4-15 presents the frequency of detected organic chemicals in tuff.

Table 2.4-15
Frequency of Detected Organic Chemicals in Tuff Samples at AOCs 0-004 and 0-033(b) and SWMU 0-030(l)

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	Frequency of Detects
Acetone	Qbt 3	11	1	[0.0054] to 0.235	1/11
Aroclor-1242	Qbt 3	12	1	[0.0069] to [0.0362]	1/12
Aroclor-1254	Qbt 3	12	1	[0.0069] to [0.0362]	1/12
Aroclor-1260	Qbt 3	12	2	0.0236 to 0.0746	2/12
BHC[beta-]	Qbt 3	12	1	0.00026 to [0.0035]	1/12
Butanone[2-]	Qbt 3	11	1	[0.0054] to [0.027]	1/11
Chlordane[alpha-]	Qbt 3	12	1	[0.00067] to [0.00186]	1/12
Chlordane[gamma-]	Qbt 3	12	1	[0.00067] to 0.0032	1/12
Chrysene	Qbt 3	12	1	[0.0336] to [0.35]	1/12
DDE[4,4'-]	Qbt 3	12	10	0.00023 to 0.056	10/12
DDT[4,4'-]	Qbt 3	12	8	[0.0013] to 0.035	8/12
Dieldrin	Qbt 3	12	1	[0.0013] to 0.0075	1/12
Di-n-butylphthalate	Qbt 3	12	1	0.0251 to [0.36]	1/12
Endrin Ketone	Qbt 3	12	1	[0.0013] to [0.0069]	1/12
Fluoranthene	Qbt 3	12	1	0.0192 to [0.36]	1/12
Isopropyltoluene[4-]	Qbt 3	11	2	0.001 to 0.0094	2/11
Nitroaniline[2-]	Qbt 3	12	1	[0.336] to [1.7]	1/12
Pyrene	Qbt 3	12	1	0.0207 to [0.36]	1/12
Styrene	Qbt 3	11	2	0.0019 to [0.0067]	2/11
Toluene	Qbt 3	11	2	0.00043 to [0.0067]	2/11

Twenty organic chemicals were detected in the tuff at AOCs 0-004 and 0-033(b) and SWMU 0-030(l). 4,4'-DDE and 4,4'-DDT had the highest frequency of detects with 10 and 8 detects, respectively, out of 12 tuff samples. All other organic chemicals were detected only once or twice in the tuff. Most of the organic chemicals that were detected only once or twice were detected at locations 00-02-19698 and 00-02-19699. Table 2.4-16 presents the detected concentrations in the tuff samples.

Table 2.4-16
Detected Organic Chemicals in Tuff Samples at AOCs 0-004 and 0-033(b) and SWMU 0-030(l)

Sample ID	Location ID	Depth (ft)	Media	Acetone	Aroclor-1242 (mg/kg)	Aroclor-1254 (mg/kg)	Aroclor-1260 (mg/kg)	BHC[beta-] (mg/kg)	Butanone[2-] (mg/kg)	Chlordane[alpha-] (mg/kg)	Chlordane[gamma-] (mg/kg)	Chrysene (mg/kg)	DDE[4,4'-] (mg/kg)
RE00-02-45613	00-02-19698	0.5–1	Qbt 3	0.235	—*	—	0.0746	—	0.0138	0.0012 (J)	0.0032 (J)	—	0.0032 (J)
RE00-02-45615	00-02-19699	0.5–1	Qbt 3	—	0.0112	0.0114	0.0236	0.00026 (J)	—	—	—	—	0.00023 (J)
RE00-02-47820	00-02-19630	4–4.5	Qbt 3	—	—	—	—	—	—	—	—	—	0.0045
RE00-02-47823	00-02-19634	10–10.5	Qbt 3	—	—	—	—	—	—	—	—	—	0.0067
RE00-02-47824	00-02-19635	7.5–8	Qbt 3	—	—	—	—	—	—	—	—	—	0.056
RE00-02-47825	00-02-19636	4.5–5.5	Qbt 3	—	—	—	—	—	—	—	—	—	0.0089
RE00-02-47826	00-02-19637	8–8.5	Qbt 3	—	—	—	—	—	—	—	—	—	0.0026
RE00-02-47827	00-02-19638	4–4.5	Qbt 3	—	—	—	—	—	—	—	—	—	0.0049
RE00-02-47828	00-02-19638	5–5.5	Qbt 3	—	—	—	—	—	—	—	—	—	0.009 (J-)
0100-95-0668	00-04423	5–6	Qbt 3	—	—	—	—	—	—	—	—	0.11 (J)	0.00616

Table 2.4-16 (continued)

Sample ID	Location ID	Depth (ft)	Media	DDT[4,4'-] (mg/kg)	Dieldrin (mg/kg)	Di-n-butylphthalate (mg/kg)	Endrin Ketone (mg/kg)	Fluoranthene (mg/kg)	Isopropyltoluene[4-] (mg/kg)	Nitroaniline[2-] (mg/kg)	Pyrene (mg/kg)	Styrene (mg/kg)	Toluene (mg/kg)
RE00-02-45613	00-02-19698	0.5–1	Qbt 3	0.0162	—	—	—	0.0192 (J)	0.0094	—	0.0207 (J)	0.0021	0.0012
RE00-02-45615	00-02-19699	0.5–1	Qbt 3	—	—	0.0251 (J)	—	—	0.001 (J)	—	—	0.0019	0.00043 (J)
RE00-02-47820	00-02-19630	4–4.5	Qbt 3	0.0021	—	—	—	—	—	—	—	—	—
RE00-02-47823	00-02-19634	10–10.5	Qbt 3	0.0069	—	—	—	—	—	—	—	—	—
RE00-02-47824	00-02-19635	7.5–8	Qbt 3	0.035	—	—	—	—	—	—	—	—	—
RE00-02-47825	00-02-19636	4.5–5.5	Qbt 3	0.0034	—	—	—	—	—	—	—	—	—
RE00-02-47826	00-02-19637	8–8.5	Qbt 3	—	0.0075	—	—	—	—	—	—	—	—
RE00-02-47827	00-02-19638	4–4.5	Qbt 3	0.008	—	—	—	—	—	—	—	—	—
RE00-02-47828	00-02-19638	5–5.5	Qbt 3	0.021 (J-)	—	—	0.0029 (J-)	—	—	—	—	—	—
0100-95-0668	00-04423	5–6	Qbt 3	0.0136	—	—	—	—	—	0.88	—	—	—

*— = Not detected.

2.4.4 Revised Site Conceptual Model

The revised site conceptual model is not different from the preliminary conceptual model. The preliminary conceptual model identified the following potential release mechanisms:

- effluent and subsurface leaks from outfall pipes,
- subsurface leaks from the pipelines and subsurface structures (e.g. septic tanks), and
- surface releases from spills.

The primary exposure pathways for human health were soil ingestion, dermal contact, dust inhalation, and external gamma. The primary exposure pathways for ecological receptors were plant uptake, rain splash, soil ingestion, and food web transport.

2.4.4.1 Nature and Extent of Contamination

Nature and extent of contaminant releases from AOCs 0-004 and 0-033(b) and SWMU 0-030(l) were defined by the environmental samples collected in 1995, 1996, and 2002. Nature and extent were determined by collecting soil and tuff samples from the drainages; beneath the former septic tank and pipes; from soil downgradient of pipes; and within the tuff next to the former septic tank.

The inorganic COPCs were detected at low levels in the soil and/or tuff (Figure 2.4-2). The inorganic chemicals were detected above BVs at one location within the western drainage and at one location within the eastern drainage. Within the eastern drainage, the concentrations of COPCs decreased from location 00-02-019696 to location 00-02-019697. Although the sample location of the western drainage was located just north of the edge of the canyon, it was a sediment catchment area where runoff from AOC 0-004 and the current warehouse activities is likely to have pooled or slowed significantly. At AOC 0-033(b) and SWMU 0-030(l), inorganic COPCs were detected above BVs at several of the sample locations. There is no definite trend in concentration at the site, but all concentrations are at low levels. The sample collected from 3 to 3.5 ft at location 00-02-19630 had cadmium and zinc detected above the BV, but the sample collected at 4 to 4.5 ft had no inorganic chemicals above the BVs. This location was underneath the 6-in. clay outlet pipe.

Radionuclides were detected above background/fallout values at seven locations in the soil and at three locations in the tuff samples (Figure 2.4-3). The drainage samples show decreasing concentrations with depth. Uranium–234 and uranium-238 are detected at location 00-02-19696, but they are not detected in the next downgradient location, 00-02-19697. The radionuclide COPCs at SWMU 0-030(l) did not show a trend, but all were detected at low levels in the soil and/or tuff. All of the plutonium-239 values were in the range of 0.036 to 0.169 pCi/g for both the soil and tuff samples.

Detected organic chemicals are shown in Figure 2.4-4.

Pesticides and insecticides were generally detected infrequently at the 6th Street Warehouse SWMUs/AOCs. The exceptions were alpha and gamma chlordane, which were detected in 33% and 31% of samples, respectively. The rest were detected in less than 15% of the samples. All of the pesticides and insecticides were detected at low concentrations.

PCBs were detected within the drainages only, and the values show a decreasing trend with depth with the exception of sample location 00-02-19696, which has an increase of Aroclor-1260 from 0.121 to 0.305 mg/kg.

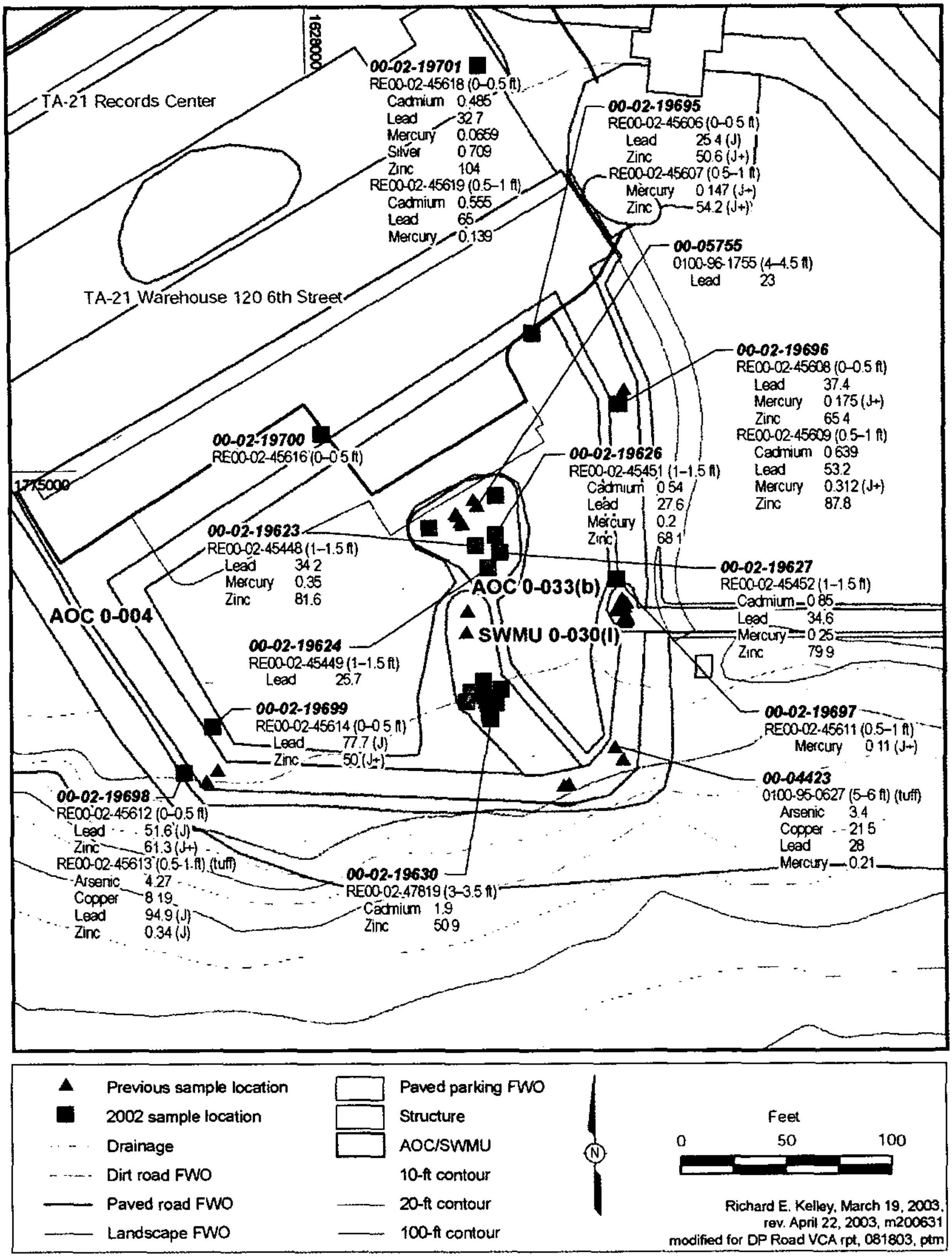


Figure 2.4-2. Inorganic chemicals detected above BVs at AOCs 0-004 and 0-033(b) and SWMU 0-030(l)

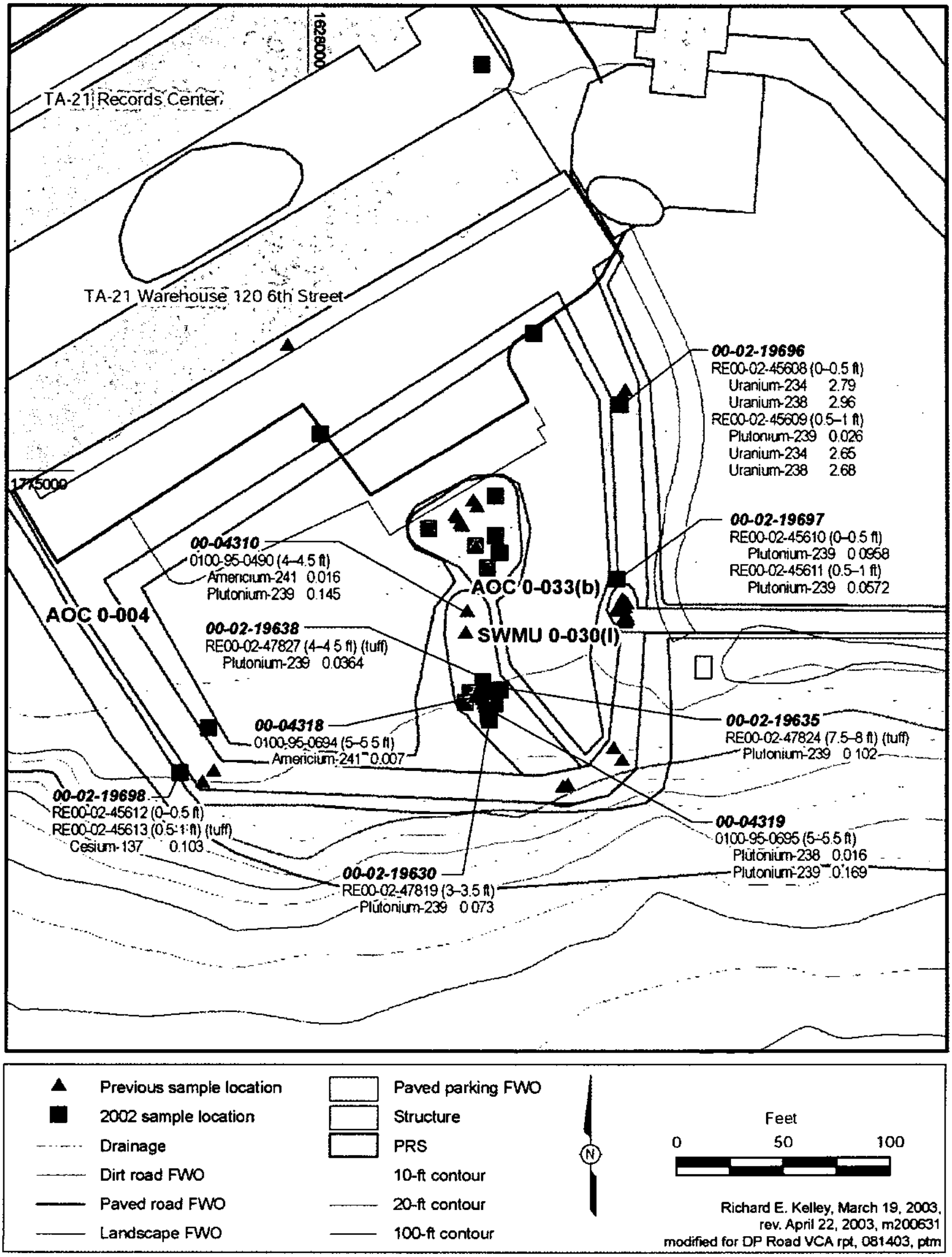
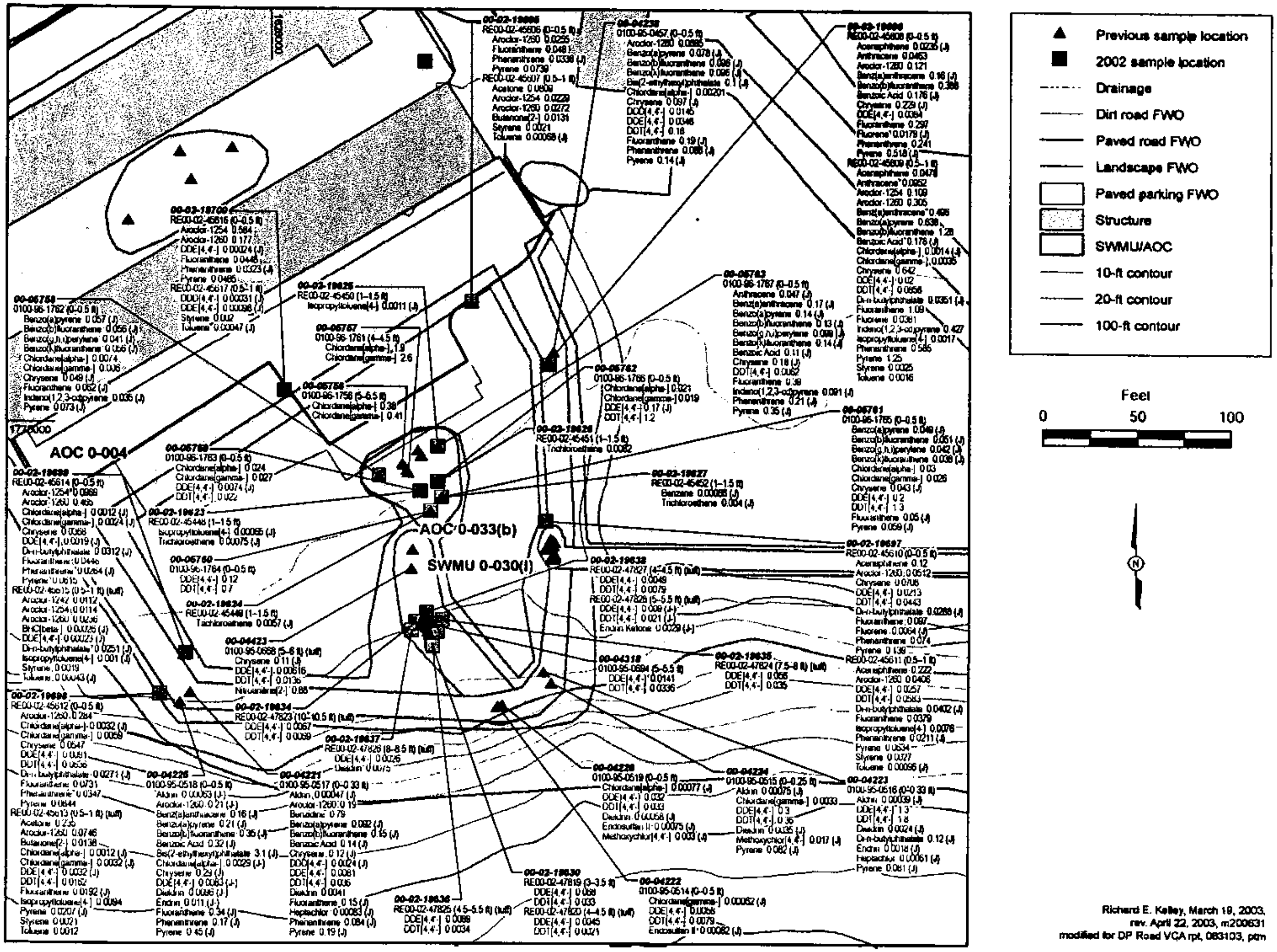


Figure 2.4-3. Radionuclides detected above BVs at AOCs 0-004 and 0-033(b) and SWMU 0-030(l)



Richard E. Kelley, March 19, 2003,
rev. April 22, 2003, m200631
modified for DP Road VCA rpt, 083103, pdm

Figure 2.4-4. Detected organic chemicals at AOCs 0-004 and 0-033(b) and SWMU 0-030(l)

The VOCs were detected in subsurface samples at AOCs 0-004 and 0-033(b), but not at SWMU 0-030(l). All were at low concentrations with the exception of one acetone value of 0.235 mg/kg. The SVOCs were detected infrequently and at low concentrations at the 6th Street Warehouse SWMUs/AOCs. PAHs were detected across the 6th Street Warehouse SWMUs/AOCs. In general they show a decreasing trend in concentrations with depth.

DDT and its metabolites (DDxs) were detected across the site in surface and subsurface soil and tuff. With the exception of sample location 00-02-19697, the drainages sample concentrations at AOC 0-004 show a decreasing trend with depth. However, at location 00-02-19697 the value of 4,4'-DDE increases from 0.0213 to 0.0257 mg/kg, and the value of 4,4'-DDT increases from 0.0443 to 0.0583 mg/kg.

Besides SWMU/AOC releases, non-site-related sources exist for some of the COPCs detected in the soil and tuff. The non-site-related samples have reported concentrations of inorganic chemicals, radionuclides, and organic chemicals that are similar to or higher than the reported concentrations from the SWMUs/AOCs. Table 2.4-17 presents comparisons among soil/fill and tuff BVs, non-site-related source values, and maximum concentrations of COPCs from the 6th Street Warehouse SWMU/AOC site data.

Table 2.4-17
Comparisons of BVs and Site Data for AOCs 0-004 and 0-033(b) and SWMU 0-030(l)

Analyte	Soil/Fill BV	Max in Non-site Sources	Max in Soil Less than 1 ft	Max in Soil Greater than 1 ft	Qbt 3 BV	Max Concentration in Qbt 3
Inorganic Chemicals (mg/kg)						
Arsenic	8.17	3.05	3.54	4.2	2.79	4.27
Cadmium	0.4	0.555	0.639	1.9	1.63	0.45
Calcium	6120	4260	6160	11300	2200	2160
Copper	14.7	14.3	13.5	14.1	4.66	21.5
Lead	22.3	65	77.7	34.6	11.2	94.9
Mercury	0.1	0.139	0.312	0.35	0.1	0.21
Selenium	1.52	0.244	0.411	0.25	0.3	0.34
Zinc	48.8	104	87.8	81.6	63.5	92.8
Radionuclides (pCi/g)						
Americium-241	0.013	0.0171	0.0275	0.016	n/a	0.23
Cesium-137	1.65	0.158	1.47	0.022	n/a	0.114
Plutonium-238	0.023	0.003	0.005	0.016	n/a	0.0095
Plutonium-239	0.054	0.292	0.0958	0.169	n/a	0.102
Uranium-234	2.59	1.08	2.79	1.37	1.98	1.14
Uranium-238	2.29	1.06	2.96	1.59	1.93	1.28
Organic Chemicals (mg/kg)						
Acenaphthene	n/a[a]	0.19	0.222	ND[b]	n/a	ND
Acetone	n/a	ND	0.0809	ND	n/a	0.235
Aldrin	n/a	ND	0.00075	ND	n/a	ND
Anthracene	n/a	0.338	0.0952	ND	n/a	ND
Aroclor-1242	n/a	ND	ND	ND	n/a	0.0112
Aroclor-1254	n/a	ND	0.584	ND	n/a	0.0114

Table 2.4-17 (continued)

Analyte	Soil/Fill BV	Max in Non-site Sources	Max in Soil Less than 1 ft	Max in Soil Greater than 1 ft	Qbt 3 BV	Max Concentration in Qbt 3
Aroclor-1260	n/a	0.116	0.465	ND	n/a	0.0746
Benzene	n/a	ND	ND	0.00066	n/a	ND
Benz(a)anthracene	n/a	1.3	0.496	ND	n/a	ND
Benzo(a)pyrene	n/a	1.34	0.638	ND	n/a	ND
Benzo(b)fluoranthene	n/a	1.87	1.28	ND	n/a	ND
Benzo(g,h,i)perylene	n/a	0.274	0.099	ND	n/a	ND
Benzo(k)fluoranthene	n/a	ND	0.14	ND	n/a	ND
Benzoic Acid	n/a	0.837	0.32	ND	n/a	ND
BHC[alpha-]	n/a	ND	0.0018	ND	n/a	ND
BHC[beta-]	n/a	ND	ND	ND	n/a	0.00026
Bis(2-ethylhexyl)phthalate	n/a	ND	3.1	ND	n/a	ND
Butanone[2-]	n/a	ND	0.0131	ND	n/a	0.0138
Butylbenzylphthalate	n/a	ND	0.12	ND	n/a	ND
Chlordane[alpha-]	n/a	ND	0.03	1.9	n/a	0.0012
Chlordane[gamma-]	n/a	ND	0.027	2.6	n/a	0.0032
Chrysene	n/a	1.52	0.642	ND	n/a	0.11
DDD[4,4'-]	n/a	ND	0.0145	ND	n/a	ND
DDE[4,4'-]	n/a	0.0035	1.3	0.068	n/a	0.056
DDT[4,4'-]	n/a	0.0433	1.8	0.0336	n/a	0.035
Dibenz(a,h)anthracene	n/a	ND	0.226	ND	n/a	ND
Dibenzofuran	n/a	0.0918	0.0184	ND	n/a	ND
Dieldrin	n/a	ND	0.0096	ND	n/a	0.0075
Dimethyl Phthalate	n/a	ND	0.185	ND	n/a	ND
Di-n-butylphthalate	n/a	ND	0.12	ND	n/a	0.0251
Endosulfan II	n/a	ND	0.00082	ND	n/a	ND
Endrin	n/a	ND	0.011	ND	n/a	ND
Endrin Ketone	n/a	ND	ND	ND	n/a	0.0029
Fluoranthene	n/a	2.82	1.09	ND	n/a	0.0192
Fluorene	n/a	0.152	0.0381	ND	n/a	ND
Heptachlor	n/a	ND	0.00083	ND	n/a	ND
Heptachlor Epoxide	n/a	ND	0.00068	ND	n/a	ND
Indeno(1,2,3-cd)pyrene	n/a	1.03	0.427	ND	n/a	ND
Isopropyltoluene[4-]	n/a	ND	0.0076	0.0011	n/a	0.0094
Methoxychlor[4,4'-]	n/a	ND	0.017	ND	n/a	ND
Nitroaniline[2-]	n/a	ND	ND	ND	n/a	0.88
Phenanthrene	n/a	2.09	0.585	ND	n/a	ND
Pyrene	n/a	3.67	1.25	ND	n/a	0.0207
Styrene	n/a	0.0019	0.0027	ND	n/a	0.0021
Toluene	n/a	ND	0.0016	ND	n/a	0.0012
Trichloroethene	n/a	ND	ND	0.0082	n/a	ND

[a] n/a = Not applicable.

[b] ND = Not detected.

The two non-site samples were analyzed for pesticides, PCBs, SVOCs, and VOCs, as shown in Table 2.4.4. Tetrachloroethene was detected in one non site sample, but not in any site samples. The PAHs as well as benzoic acid and dibenzofuran were detected at higher concentrations in the non site sample data than in the site sample data. In some cases, the non-site-related value was three times higher than the SWMU/AOC value (anthracene, benz[a]anthracene, and fluorene). This indicates that there is potential for off site sources to be contributing to the PAHs detected at the 6th Street Warehouses. Figures E-4.1-7 to E-4.1-9 show the site data and the non site data for Aroclor-1260, 4,4'-DDT, and pyrene to illustrate the comparison for a PCB, a pesticide, and a PAH. Table 2.4-10 shows the results for all of the organic chemicals detected in the non site samples.

Cadmium, calcium, lead, mercury, and zinc were retained as COPCs in soil, and arsenic, copper, lead, mercury, and selenium were retained as COPCs in tuff. The non-site-related location samples that were collected upgradient of the 6th Street Warehouse SWMUs/AOCs were collected to determine what contaminants may be coming on to the site from activities unrelated to the SWMUs/AOCs. The detects of zinc in the non-site-related samples are actually greater than the maximum detect in the site data. Silver was detected above the BV in one of the two non-site-related samples. All detects of silver in the site data were below the LANL BV, and only three detection limits from samples collected in 1996 were above the BV.

The two non-site-related samples listed in Table 2.4-4 were analyzed for isotopic plutonium, isotopic uranium, and gamma-emitting radionuclides as shown in Table 2.4-4. Both non-site-related samples were collected within 1 ft of the surface. The radionuclide results from these two samples were compared to the all soil horizon BV or fallout value, where applicable. The radionuclides from this comparison were then compared to the COPC list from the site data. Plutonium-239 was detected above the BV at a concentration of 0.292 pCi/g in non-site-related sample collected at a depth of 0.5 to 1 ft. Figure E-4.1-6 shows how the distributions for the site data, non-site-related data, and background data compare to each other. All other radionuclides either were not detected or were detected below an applicable BV.

2.4.4.2 Environmental Fate and Transport

The evaluation of environmental fate addresses the chemical processes that affect the persistence of a chemical in the environment. The evaluation of transport addresses the physical processes affecting mobility along the migration pathway. Infiltration into surface soils depends on the rate of precipitation or snowmelt, antecedent soil water status, depth of soil, and soil hydraulic properties. Infiltration into the tuff depends on the unsaturated flow properties of the tuff. Joints and fractures in the tuff may provide additional pathways for moisture to enter the subsurface regime. COPCs at the 6th Street Warehouse SWMUs/AOCs include inorganic and organic chemicals and radionuclides.

2.4.4.2.1 Inorganic Chemicals

Arsenic, calcium, cadmium, copper, lead, mercury, selenium, and zinc were retained as COPCs in the soil and tuff. In general, inorganic chemicals are not highly soluble or mobile in the environment, particularly in a semiarid climate, though there are some exceptions. Appendix F provides detailed information of the properties that affect fate and transport for each of the inorganic COPCs identified for this group of SWMUs/AOCs. The following paragraph briefly discusses the mobility of the inorganic COPCs at the 6th Street Warehouse SWMUs/AOCs.

Arsenic is insoluble in water and tends to adsorb to soils or sediments. Cadmium compounds dissolve in water to varying degrees depending upon which element it is combined. Cadmium compounds are often found attached to small particles present in air, and can travel great distances before coming down to the earth. Copper is strongly adsorbed on soil particles and usually remains in the upper few centimeters of soil. Copper's movement in soil is determined by the physical and chemical interactions of copper with the soil components. Copper will adsorb mainly to organic matter, carbonate minerals, clay minerals, or hydrous iron and manganese oxides. Most lead is retained in soil, and very little is transported into surface water or groundwater. It sorbs strongly to organic matter in soil. Mercury tightly binds to both organic and inorganic particles. In general, selenium is stable in soils and is found at low levels in water. Zinc sorbs strongly onto soil particles, and it can occur in both suspended and dissolved forms in surface water. Zinc is stable in dry air.

2.4.4.2.2 Radionuclides

Americium-241, cesium-137, plutonium-238, plutonium-239, uranium-234, and uranium-238 were identified as COPCs based on the data review. Several of these radionuclides are actinides, including americium-241, plutonium-239, uranium-234, and uranium-238. These actinides have similar chemical properties. The following information is summarized from Whicker and Schultz (1982, 58209).

In general, the actinide nuclides form comparatively insoluble compounds in the environment and are not considered biologically mobile. The actinides are transported in ecosystems mainly by physical and, sometimes, chemical processes. Uptake of actinides by plants from soil is considered to be generally low. Plutonium in the environment undergoes hydrolysis and oxidation, with plutonium oxide as a common form. Under most environmental conditions, plutonium occurs in forms that are poorly transferred across biological membranes; therefore, movement of plutonium from soil and sediments to plants and animals is greatly inhibited.

Because plutonium and americium, under oxidizing conditions, preferentially bind to fine soil or sediment particles and to organic matter with high surface-to-volume ratios, it is likely they will be transported and deposited with sediments or remain relatively immobile in the subsurface.

Uranium-234 is fairly mobile and is moderately long lived with a half-life of 250,000 years. Uranium can exist in the +3, +4, +5, and +6 oxidation states, the most common of which are +4 and +6. In water, uranium adsorbs strongly to mineral surfaces and tends to partition into organic matter, thereby reducing its mobility.

Cesium-137 is a fission product that occurs ubiquitously at the earth's surface as a result of global fallout. Cesium-137 has a half-life of approximately 30 years. Cesium-137 is so tightly bound by the clay minerals of soil that root uptake is slight (Eisenbud and Gessell 1977, 70130).

2.4.4.2.3 Organic Chemicals

Properties such as vapor pressure and solubility in water are important in evaluating organic chemical mobility. The following information, summarized from Ney (1995, 58210), is presented to illustrate some aspects of the fate and transport tendencies of organic chemicals.

Water solubility. Water solubility is perhaps the most important chemical characteristic used to assess mobility of organic chemicals. The higher the water solubility of a chemical, the more likely it is to be mobile and the less likely it is to accumulate, bioaccumulate, volatilize, or persist in the environment. A highly soluble chemical (>1000 mg/L) is prone to biodegradation and metabolism that may detoxify the parent chemical. Acetone, benzene, benzoic acid, 2-butanone, dimethyl phthalate, 2-nitroaniline, and trichloroethene have water solubilities greater than 1000 mg/L.

The lower the water solubility of a chemical (especially <10 mg/L), the more likely it will be immobilized via adsorption. Such chemicals tend to be more accumulative or bioaccumulative, persistent in the environment, are slightly prone to biodegradation, and may be metabolized in plants and animals. Most of the organic COPCs with the exception of the ones listed above and a few others have water solubilities less than 10 mg/L.

Vapor pressure. Chemicals with vapor pressure greater than 0.01 millimeter mercury (mm Hg) are more likely to volatilize and diffuse through the soil pore gas, with potential release to the atmosphere. These include acetone, benzene, 2-butanone, and trichloroethene. Chemicals with vapor pressures less than 0.000001 mm Hg are less likely to volatilize, and therefore tend to remain immobile.

Octanol water partition coefficient. The octanol water partition coefficient (K_{ow}) is an indicator of the bioaccumulation or bioconcentration potential of a chemical in the fatty tissue of living organisms. The unitless K_{ow} value is an indicator of water solubility, mobility, sorption, and bioaccumulation. The higher the K_{ow} (>1000), the greater the affinity of the chemical to bioaccumulate/bioconcentrate in the food chain, the greater its potential for sorption in soil and the lower its mobility (Ney 1995, 58210). Organic COPCs with a K_{ow} of greater than 1000 include all of them with the exception of the ones listed in the paragraph below.

A K_{ow} of less than 500 indicates high water solubility, mobility, little to no bioaccumulation, and degradability by microbes, plants, and animals. Organic COPCs with a K_{ow} of less than 500 are acetone, benzene, benzoic acid, 2-butanone, dimethyl phthalate, styrene, toluene, and trichloroethene. Table 2.4-18 shows the water solubilities, the vapor pressure, K_{ow}, and K_{oc} for the organic COPCs.

Table 2.4-18
Physiochemical Properties for Organic COPCs

Name	Water Solubility (mg/L)[a]	Vapor Pressure (mm Hg)[a] at 25°C	K_{ow} [a,b]	K_{oc} [a,c]
Acenaphthene	3.8	4.93E-06	9.22E+03	4.90E+03
Acetone	6.04E+05	2.99E-01	6.00E-01	9.51E-01
Aldrin	7.84E-02	2.20E-08	1.51E+06	4.87E+04
Anthracene	5.37E-02	3.35E-08	2.95E+04	2.35E+04
Aroclor-1242[d]	2.4E-01	4.06E-04	3.98E+05	No data
Aroclor-1254[d]	1.2E-02	7.71E-05	3.2E+06	No data
Aroclor-1260[d]	2.7E-03	4.05E-05	6.3E+06	No data
Benzene	1.78E+03	1.25E-01	137	62
Benz(a)anthracene	1.28E-02	2.03E-10	4.77E+05	2.6E+05
Benzo(a)pyrene	1.94E-03	6.43E-12	1.35E+06	9.69E+05
Benzo(b)fluoranthene	4.33E-03	1.06E-10	1.59E+06	8.36E+05
Benzo(g,h,i)perylene[e]	7.00e-04	1.03E-10	3.23E+06	1.6E+06
Benzo(k)fluoranthene	8.0E-04	1.32E-12	1.56E+06	8.32E-05
Benzoic Acid[e]	2.7E+03	No data	74.1	No data
BHC[alpha-][e]	1.63	2.50E-05	7.9E+03	3.8E+03
BHC[beta-][e]	2.4E-01	2.8E-07	7.9E+03	3.8E+03
Bis(2-ethylhexyl)phthalate	3.96E-01	8.49E-09	1.6E+05	1.11E+05
Butanone[2-][e]	2.68E+05	77.5	1.82	4.5

Table 2.4-18 (continued)

Name	Water Solubility (mg/L)[a]	Vapor Pressure (mm Hg)[a] at 25°C	K_{ow} [a,b]	K_{oc} [a,c]
Butylbenzylphthalate	2.58	1.58E-08	2.59E+04	1.37E+04
Chlordane[alpha-]	5.51E-01	3.55E-08	8.66E+05	5.13E+04
Chlordane[gamma-]	5.51E-01	3.55E-08	8.66E+05	5.13E+04
Chrysene	1.94E-03	1.03E-11	5.48E+05	2.97E+05
DDD[4,4'-]	7.33E-02	1.14E-09	1.32E+06	4.58E+04
DDE[4,4'-]	1.92E-02	7.45E-09	1.80E+06	8.64E+02
DDT[4,4'-]	3.41E-03	5.17E-10	1.17E+06	6.78E+05
Dibenz(a,h)anthracene	6.70E-04	2.70E-14	3.53E+06	1.79E+06
Dibenzofuran[f]	1.0E-01	No data	No data	4.6 to 6.35E+03
Dieldrin	1.87E-01	1.31E-09	1.86E+05	2.55E+04
Dimethyl Phthalate	4.19E+03	2.17E-06	43	30.9
Di-n-butylphthalate	10.8	5.55E-08	5.25E+04	1.57E+03
Endosulfan II	2.31E-01	1.72E-11	3.02E+03	2.04E+03
Endrin	2.46E-01	7.68E-10	7.79E+04	1.08E+04
Endrin Ketone	2.46E-01	7.68E-10	7.79E+04	1.08E+04
Fluoranthene	2.32E-01	1.07E-06	1.21E+05	4.91E+04
Fluorene	1.9	8.17E-07	1.47E+04	7.71E+03
Heptachlor	27.3	4.29E-07	1.04E+05	9.53E+03
Heptachlor Epoxide	2.68E-01	5.79E-09	5.62E+04	7.18E+03
Indeno(1,2,3-cd)pyrene	1.07E-02	1.88E-13	8.22E+06	4.11E+06
Isopropyltoluene[4-]	56	6.00E-03	4.10E+03	9.31E+03
Methoxychlor[4,4'-]	8.84E-02	1.62E-09	3.36E+04	8.00E+02
Nitroaniline[2-][e]	1.47E+04	No data	No data	61.7
Phenanthrene	1.28	1.35E-03	3.55E+04	2.09E+02
Pyrene	1.3E-01	5.59E-09	1.0E+05	6.8E+04
Styrene	257	8.21E-03	8.49E+02	9.12E+02
Toluene	558	3.71E-02	465	140
Trichloroethene[e]	1.10E+03	57.9	240	126

[a] Denotes reference information from http://www.epa.gov/earth1r6/6pd/rcra_c/pd-o/appd1a.pdf.

[b] K_{ow} = Octanol water partition coefficient.

[c] K_{oc} = Adsorption coefficient.

[d] Denotes reference information from http://www.atsdr.cdc.gov/toxprofiles/tp17-c4.pdf.

[e] Information from Superfund Public Health Evaluation Manual EPA 540/1-86-060, 1986.

[f] Information from Spectrum Laboratories Website, http://speclab.com/compound/c132649.htm.

2.5 Site Assessments

2.5.1 Screening Assessments

2.5.1.1 Human Health

The human health screening assessment was performed according to guidance outlined in the draft installation work plan (LANL 2000, 66802) and in the "Human Health Risk-Based Screening Methodology" (LANL 2002, 72639). The human health screening assessment consists of four parts: scoping, screening evaluation, uncertainty analysis, and interpretation.

(a) Scoping

Land use at the 6th Street Warehouse SWMUs/AOCs [AOCs 0-004 and 0-033(b) and SWMU 0-030(l)] is currently industrial, and is expected to remain industrial for the foreseeable future.

The potential for human exposure to residual concentrations of chemicals and radionuclides in the environment at the site is moderate because the site has restricted access at night and weekends (i.e., fenced and locked). During the work day the site is open.

Currently the people who work in the 6th Street Warehouses do not work outside in the area where AOCs 0-004 and 0-033(b) and SWMU 0-030(l) are located. The area may be used when an employee is on a break, but it is probably not visited frequently.

Sample values to a depth of 10.5 ft were considered in this evaluation as media (soil and tuff) from that depth could be excavated and brought to the surface for exposure. No samples were collected deeper than 10.5 ft.

The 6th Street Warehouse area is a small hillside leading down to a flat area, then the mesa drops off to Los Alamos (LA) Canyon. AOC 0-004 consists of two drainages on the east and west side of the hillside, which join a drainage below AOC 0-033(b). Although a residential scenario is unlikely under current and projected future site conditions, the potential present-day risks were evaluated using this scenario because it is protective of human health. The screening action levels (SALs) used in the screening evaluation reflect a residential scenario that is based on an exposure of 24 hr/day and 350 days/yr.

From the spills that occurred at AOC 0-004, the contaminants are expected to have washed into the unlined drainages, which flowed to either the drainage below AOC 0-033(b) or over the mesa edge to LA Canyon. The SWMU 0-030(l) septic tank was removed, and samples were collected from beneath it, as well as from the sides to determine if it leaked. AOC 0-033(b) were pipes that drained to an unlined drainage ditch south of the MTL. As described in Section 2.3.2.2, the COPCs from these SWMUs/AOCs generally are not mobile and would likely remain within the surface soil, or in the case of the tank, if it leaked, the COPCs would remain close to the tank.

(b) Screening Evaluation

If a sufficient number of samples are included in a data set (generally 10 or more), the 95% UCL of the mean is used as the representative concentration for screening assessments. If fewer samples are available, the maximum concentrations of each analyte may be used as the representative concentration. The representative concentration used in this screening assessment was the 95% upper confidence level (UCL) of the mean (see Appendix F). The 95% UCL was determined using data from both soil and tuff at depths from 0–10.5 ft.

A total of 60 analytes were identified as COPCs at the 6th Street Warehouse SWMUs/AOCs based on the data review. These COPCs are evaluated further in this section by comparing the 95% UCL to the appropriate SAL for each chemical. The chemical SALs are calculated based on the methodology provided in Appendix C of the draft installation work plan (LANL 2000, 66802) and in the "Human Health Risk-Based Screening Methodology" (LANL 2002, 72639), and are based on guidance from NMED (NMED 2000, 68554) and EPA Region 6 (EPA 2002, 73691). For radionuclides, the SALs are derived according to "Derivation and Use of Radionuclide Screening Action Levels" (LANL 2001, 69683) and the SALs used are derived from RESRAD Version 6.21 (LANL 2002, 73705). The SALs for noncarcinogens are based on a hazard quotient (HQ) of 1.0. The SALs for carcinogens are based on a cancer risk level of 10^{-6}. The SALs for radionuclides are based on a dose of 15 mrem/yr. The representative concentration for each COPC was compared with the SAL for carcinogens, and radionuclides, and 0.1 SAL for noncarcinogens because more than one noncarcinogenic COPC has been identified.

The comparison between 95% UCL and SALs is shown in Tables 2.5-1 through 2.5-3. COPCs whose 95% UCL exceeds the screening criterion are indicated by bold type.

Calcium does not have a published toxicity value, but is among those elements identified in Section 5.9.4 of Risk Assessment Guidance for Superfund [RAGS] (EPA 1989, 08021) as an essential macronutrient. Following the guidance in RAGS, the maximum value of calcium in the samples is 11300 mg/kg, which is less than twice the BV of 6120 mg/kg. Therefore, calcium is not expected to result in adverse health effects, and is not discussed further.

Some chemicals (acenaphthylene, benzo[g,h,i]perylene, alpha chlordane, gamma chlordane, endrin ketone, endosulfan II, and isopropyltoluene) do not have toxicity values published in the EPA's IRIS database, HEAST, or by EPA's National Center for Environmental Assessment (NCEA). For those chemicals, surrogate chemical toxicity values have been used based on similarity in chemical structure. The SALs for these surrogates were used to evaluate whether the COPCs should be retained for further evaluation in a risk assessment.

The 95% UCL of noncarcinogenic COPCs were all less than SAL and less than 0.1 SAL, with the exception of arsenic, Aroclor-1254, and 2-nitroaniline. The hazard index (HI) (the sum of the ratios of representative concentration divided by the SAL) is approximately 0.68 (see Appendix F, Table F-4.3-1), which is less than NMED's target HI of 1.0 (NMED 2000, 68554). This indicates that a human health hazard is not expected from residual concentrations of noncarcinogenic COPCs at the 6th Street Warehouse SWMUs/AOCs.

The representative concentrations of the carcinogenic COPCs arsenic, Aroclor-1242, Aroclor-1254, Aroclor-1260, benzo(a)pyrene, dibenz(a,h)anthracene, and Dieldrin were greater than or equal to their respective SALs. The rest of the representative concentrations of the carcinogenic COPCs were less than their respective SALs. The total potential excess cancer risk from exposure to carcinogenic COPCs at the 6th Street Warehouse SWMUs/AOCs [AOCs 0-004 and 0-033(b) and SWMU 0-030(l)] is approximately 2.2×10^{-5} (see Appendix F, Table F-4.3-2). NMED's target risk level for carcinogenic risk of 1 in 100,000 (1×10^{-5}) (NMED 2000, 68554) is similar to this site.

The 95% UCL for radionuclide COPCs were all less than their respective SALs. The total estimated radionuclide dose is approximately 1.6 mrem/yr (see Appendix F, Table F-4.3-3) mainly from cesium-137, compared to the soil background dose of 5.7 mrem/yr from these COPCs. Therefore the dose is less than DOE's dose for free release of property (15 mrem/yr) (DOE 2000, 67489). This site results in 4.1 mrem/yr below background, and does not pose an unacceptable dose to human health.

Table 2.5-1
Screening Evaluation for Noncarcinogenic COPCs at 6th Street Warehouse SWMUs/AOCs

Chemical	95% UCL Value (mg/kg)	SAL (mg/kg)	0.1 SAL (mg/kg)
Arsenic	**2.52**	22	**2.2**
Cadmium	0.36	70	7.0
Copper	10.3	2800	280
Lead	28.75	400	40
Mercury	0.096	23	2.3
Selenium	0.18	380	38
Zinc	51.1	23000	2300
Acenaphthene	0.30	2800	370
Acetone	0.047	1600	160
Anthracene	0.29	16000	2200
Aroclor-1254	**0.32**	1.1	**0.11**
Benzo(g,h,i)perylene[a]	0.28	1800	180
Benzoic Acid	1.70	1.0E+05	1.0E+04
Butanone[2-]	0.022	37000	3700
Butylbenzylphthalate	0.24	240	24
Dibenzofuran	0.35	290	29
Dimethyl Phthalate	0.35	1.0E+05	1.0E+04
Di-n-butylphthalate	0.32	6100	610
Endosulfan II[b]	0.035	370	37
Endrin	0.035	18	1.8
Endrin Ketone[c]	0.040	18	1.8
Fluoranthene	0.31	2300	230
Fluorene	0.29	2100	210
Isopropyltoluene[4-][d]	0.0057	370	37
Methoxychlor[4,4-]	0.092	310	31
Nitroaniline[2-]	**0.68**	3.7	**0.37**
Phenanthrene	0.28	1800	180
Pyrene	0.32	1800	180
Styrene	0.0053	1700	170
Toluene	0.0042	180	18

Note: Bolded text means the 95% UCL exceeds the 0.1 SAL.

[a] Pyrene used as a surrogate for benzo(g,h,i)perylene.

[b] Endosulfan used as a surrogate for Endosulfan II

[c] Endrin used as a surrogate for Endrin Ketone.

[d] Isopropylbenzene used as a surrogate for isopropyltoluene.

Table 2.5-2
Screening Evaluation for Carcinogenic COPCs at 6th Street Warehouse SWMUs/AOCs

Chemical	95% UCL (mg/kg)	Soil SAL (mg/kg)
Arsenic	**2.52**	**0.39**
Aldrin	0.015	0.029
Aroclor-1242	**0.29**	**0.22**
Aroclor-1254	**0.32**	**0.22**
Aroclor-1260	**0.34**	**0.22**
Benzene	0.0032	0.64
Benz(a)anthracene	0.20	0.62
Benzo(a) pyrene	**0.20**	**0.062**
Benzo(b)fluoranthene	0.29	0.62
Benzo(k)fluoranthene	0.17	6.2
Bis(2-ethylhexyl)phthalate	0.53	35
BHC[alpha-]	0.015	0.09
BHC[beta-]	0.015	0.32
Chlordane [alpha-]*	0.25	1.6
Chlordane [gamma-]*	0.34	1.6
Chrysene	0.21	61
DDD [4,4'-]	0.030	2.4
DDE [4,4'-]	0.12	1.7
DDT [4,4'-]	0.40	1.7
Dibenz(a,h)anthracene	**0.23**	**0.062**
Dieldrin	**0.030**	**0.03**
Heptachlor	0.015	0.11
Heptachlor Epoxide	0.015	0.053
Indeno(1,2,3-cd)pyrene	0.19	0.62
Trichloroethene	0.0052	16

Note: Bolded text means the 95% UCL exceeds the SAL.

*Total chlordane used as a surrogate for alpha chlordane and gamma chlordane.

Table 2.5-3
Screening Evaluation for Radionuclides at 6th Street Warehouse SWMUs/AOCs

Chemical	95% UCL (pCi/g)	Soil SAL (pCi/g)
Americium-241	0.013	39
Cesium-137	0.35	5.3
Plutonium-238	0.0056	49
Plutonium-239	0.0056	44
Uranium-234	1.32	63
Uranium-238	1.37	86

(c) Uncertainty Analysis

The analysis presented in this human health screening assessment is subject to varying degrees and kinds of uncertainty. The uncertainties associated with the background data, the data evaluation, exposure assessment, toxicity assessment, the additive approach, and the use of surrogates may affect the results.

At AOCs 0-004 and 0-033(b) and SWMU 0-030(l), 80% of the risk is from arsenic, PCBs, and benzo(a)pyrene.

Background data. Background data for arsenic in soil ranges from 0.3 mg/kg to 9.3 mg/kg, with a median value of 4 mg/kg (LANL 1998, 59730). Background data for arsenic in tuff ranges from 0.25 mg/kg to 5 mg/kg, with a median value of 0.7 mg/kg (LANL 1998, 59730). The majority of the higher arsenic values are found in the soil. Three exceptions to this are from locations 00-02-19698 and 00-02-19699, which are shallow tuff and location 00-04423, which is a deeper tuff sample. The arsenic detected at the 6th Street Warehouse SWMUs/AOCs (95% UCL = 2.52 mg/kg) is similar to the soil background; therefore, it will not be included in the risk calculations.

Data evaluation and COPC identification process. Uncertainties associated with the data can include sampling errors, laboratory analysis errors, and data analysis errors. For this site, these uncertainties are expected to have little effect on the results even though the detected concentrations of some organic COPCs were qualified J, because the values were less than EQLs and were estimated.

The representative concentrations for all noncarcinogens were less than their respective SALs and less than 0.1 SAL, with the exception of arsenic, Aroclor-1254, and 2-nitroaniline. The representative concentration of arsenic (2.52 mg/kg) is less than the background mean for arsenic (3.95 mg/kg in soil) (LANL 1998, 59730); therefore the exposure to arsenic is similar to the soil background. Aroclor-1254 was detected five times (0.0114 to 0.584 mg/kg), but had detection limits (0.14 to 3.6 mg/kg) that exceeded 0.1 SAL (0.11 mg/kg). The detected concentrations of Aroclor-1254 are less than the SAL of 1.1 mg/kg. Nitroaniline[2-] was detected once (0.88 mg/kg), but had detection limits (0.82 to 2 mg/kg) that exceeded 0.1 SAL (0.37 mg/kg). The detected concentrations of 2-nitroaniline and the detection limits are less than the SAL of 3.7 mg/kg. This indicates that the elevated detection limits for Aroclor-1254 and 2-nitroaniline overestimates their concentrations at this site.

Using the 95% UCL as the representative concentration for each COPC may overestimate the risk if the analyte has high detection limits. For example, Aroclor-1242, Aroclor-1254, Aroclor-1260 had detection limits of 3.6 mg/kg and 1.8 mg/kg in two samples, while the rest of the detection limits ranged from 0.034 to 0.57 mg/kg. Because the 95% UCL uses one-half the detection limit, these higher detection limits bias the 95% UCL high and may overestimate the risk for the analyte.

Exposure assessment: Uncertainties and biases were identified in four areas of the exposure assessment process.

- *Identification of receptors.* Land use and activity patterns are not represented by those activities assumed by the residential land-use scenario; therefore, biases are introduced. Because the potentially exposed individual is an industrial worker who does not conduct any work around the SWMUs/AOCs, the screening assessment overestimates the exposure and subsequently overestimates the current potential hazard, risk, and dose.
- *Exposure pathway assumptions.* For each exposure pathway, assumptions are made concerning the parameters, the routes of exposure, the amount of contaminated media to which an individual can be exposed, and intake rates for different routes of exposure. In the absence of site-specific

data, the assumptions used are consistent with EPA-approved parameters and default values (EPA 2002, 73691). When several upper-bound values are combined to estimate exposure for any one pathway, the resulting risks can be in excess of the 99th percentile and therefore outside the range than may be reasonably expected. Residential scenarios overestimates exposure so risk is overestimated. Because the risk for residential receptors is equivalent to the NMED target, then the risk will be less for industrial receptors.

Analytical data from 0 to 10.5 ft were used in the screening assessment. Currently the pathway to the deepest sample (10.5 ft) is unavailable unless a backhoe is brought onto the site. If the site remains undisturbed, industrial workers would be exposed to only the surface soil.

Use of surrogate chemicals. Some chemicals do not have EPA-approved or provisional toxicity values. In these cases a similar chemical with available toxicity values are used as a surrogate. At this site pyrene was used as a surrogate for benzo(g,h,i)perylene because they have similar structures. The difference between the two chemicals is the additional two benzene rings. The additional benzene rings add stability to the structure making the surrogate pyrene more reactive than benzo(g,h,i)perylene. Because benzo(g,h,i)perylene is less reactive than its surrogate, the risk is overestimated for this analyte.

Endrin was used as a surrogate for endrin ketone, which is a breakdown product of endrin when it is exposed to light. Photochemical isomerization of endrin, primarily to the pentacyclic ketone commonly called endrin ketone, was observed after exposure of thin layers of solid endrin on glass to sunlight (ATSDR 1997, 56531). Results of seasonal studies indicated that this isomerization proceeds with a half-life of 5 to 9 days in intense summer sunlight, with complete conversion to endrin ketone in 15 to 19 days. Endrin was only detected in 2 of 38 samples, and endrin ketone was detected only once in 32 samples; therefore the risk from both of these analytes is minimal.

Endosulfan was used as a surrogate for endosulfan II because endosulfan II is an isomer of endosulfan. These chemicals have the same chemical weight and the same molecules. The risk from these chemicals is potentially the same.

Isopropylbenzene was used as a surrogate for 4-isopropyltoluene based on its structural similarity. The difference between the two chemicals is a carbon molecule for 2-isopropyltoluene, which makes this chemical more reactive. Although this underestimates the risk from 4-isopropyltoluene, it is not a major contributor to the risk at the site because it was detected in only 6 of the 19 samples.

Total chlordane was used as a surrogate for alpha and gamma chlordane. Alpha and gamma chlordane are two of the components that make up total chlordane. Alpha chlordane was detected in 13 of 39 samples and gamma chlordane was detected in 12 of 39 samples, and are not major contributors to the risk at the site.

Toxicity values. The primary uncertainty associated with the SALs is related to derivation of toxicity values used in the calculation. EPA toxicity values (reference doses [RfDs] and slope factors [SFs]) were used to derive the SALs used in this risk screening assessment (EPA 2001, 70109; EPA 1997, 58968). Uncertainties were identified in three areas with respect to the toxicity values: (1) extrapolation from animals to humans, (2) extrapolation from one route of exposure to another route of exposure, and (3) interindividual variability in the human population.

- *Extrapolation from animals to humans.* The SFs and RfDs are often determined based on extrapolation from animal data to humans, which may result in uncertainties in toxicity values because differences exist in chemical absorption, metabolism, excretion, and toxic response between animals and humans. The EPA takes into account differences in body weight, surface area, and pharmacokinetic relationships between animals and humans to minimize the potential to underestimate the dose-response relationship. However, more conservatism is usually incorporated in these steps.

- *Extrapolation from one route of exposure to another route of exposure.* The SFs and RfDs can often contain extrapolations from one route of exposure to another. The extrapolation from the oral route to the inhalation and/or the dermal route is used and is based on the EPA's Integrated Risk Information System database (EPA 2001, 70109). Differences between the two exposure pathways could result in an overestimation of the risk.
- *Interindividual variability in the human population.* For noncarcinogenic effects, the amount of human variability in physical characteristics is important in determining the risks that can be expected at low exposures and in determining the no observed adverse effect level (NOAEL). The NOAEL/uncertainty factor approach incorporates a 10-fold factor to reflect the possible interindividual variability in the human population and is generally considered a conservative estimate.

Additive approach. For noncarcinogens, the effects of a mixture of chemicals are generally unknown and possible interactions could be synergistic or antagonistic, thereby overestimating or underestimating the risk. Additionally, the RfDs for different chemicals are not based on the same severity, effect, or target organ. Therefore, the potential for occurrence of noncarcinogenic effects can be overestimated for chemicals that act by different mechanisms and on different target organs but are addressed additively.

DDT spraying. The National Forest Service was involved in spraying of DDT in the 1950s in the Jemez Mountains (LASL 1963, 64879). Documentation does not state whether the spraying occurred in the Los Alamos townsite, but it is possible that it did. If such spraying did occur in this area, then that would be an explanation for DDT, DDE, and DDD to occur in the samples, over estimating the risk from non-site-related activities.

(d) Interpretation

Based on a residential scenario, the HI (0.68) is less than NMED's target level of 1.0. The carcinogenic risk, with arsenic is 2.2×10^{-5}, and without arsenic is 1.5×10^{-5}, which is equivalent to NMED's target risk of 1×10^{-5}. The total radiological dose of 1.6 mrem/yr is less than the DOE's target dose of 15 mrem/yr. The screening assessments indicate that given the current and anticipated future land use (Los Alamos County Master Plan) there is no potential unacceptable risk to human health at AOCs 0-004 and 0-033(b) and SWMU 0-030(l).

2.5.1.2 Ecological

The ecological screening evaluation was performed in accordance with the process outlined in "Screening Level Ecological Risk Assessment Methods" (LANL 1999, 64783). This ecological screening assessment consists of four parts: the scoping evaluation, the screening evaluation, uncertainty analysis, and risk interpretation. The scoping evaluation includes (1) the data assessment step, which identifies the list of COPCs; and (2) the problem formulation step for the specific site under investigation. The basis for AOCs 0-004 and 0-033(b) and SWMU 0-030(l) problem formulation is found in the scoping checklist (Appendix F of this document). The scoping checklist is a useful tool for organizing existing ecological information and for focusing the site visit on the information needed to develop the site conceptual model.

The screening evaluation includes the comparison of representative media concentrations to the final (minimum) ecological screening levels (ESLs). Representative media concentrations are either maximums or the 95% UCL of the mean concentration depending on the data available for the site. The final ESLs are media-specific concentrations that represent the lowest value amongst an array of ecological receptors associated with no adverse ecological effects. Derivation of final ESLs is a process dependent on numerous equations and information sources; see Section 4.5, "Screening Level Ecological Risk Assessment Methods" (LANL 1999, 64783) for information about how the final ESLs are derived. ESLs were developed for a suite of receptors designed to represent individual feeding guilds, such as invertivorous mammal or carnivorous bird. Robins and kestrels were modeled with three and two different diets respectively so that they could represent multiple feeding guilds. For example, the omnivorous robin actually represents the feeding guild of all omnivorous birds, while the herbivorous robin represents all herbivorous birds. The representative concentration of each COPC was compared with the final ESL from the September 2002 version 1.5 of the Ecorisk Database (LANL 2002, 73702). Final soil ESLs for antimony, uranium, and zinc were corrected following revisions to ESLs made in 2003 (LANL 2003, 74012). The ESLs from the database used in evaluation of this site are included in Table F-1.0-1 in Appendix F.

To provide additional information on the potential effects to representative ecological receptors, hazard quotients (HQs) and hazard indices (HIs) for all COPCs are calculated for all terrestrial screening receptors. The HQ is the ratio of the calculated representative concentration to the receptor [based on COPC concentrations at AOCs 0-004 and 0-033(b) and SWMU 0-030(l)] to the ESL, which is a dose that has been determined to be acceptable (based on toxicity studies and expected exposure parameters for the receptor). An HI is a sum of HQs, across contaminants with like effects, for a given screening receptor. Because it is not known how the effects of chemicals combine, the simplest assumption of additivity was made for the screening assessment.

An HI greater than 1 is an indication of potential adverse impacts, and COPCs that contribute HQ >0.3 are identified as chemicals of potential ecological concern (COPECs). In addition to identifying COPECs, HI/HQ results can be used for a qualitative assessment of possible adverse effects on individuals or populations. Because EPA guidance is to manage ecological risks to populations (EPA 1999, 70086), some level of adverse effects of chemical stressors on individuals is acceptable. Potential risks to populations from COPECs at this site were assessed during the screening using population area-use factors (PAUFs) using an approach described in part (b) of this section and in Appendix F-2.0. An exception is a T&E species, for which it is appropriate to evaluate potential adverse effects on individuals.

The uncertainty analysis section following the COPEC identification section describes the key sources of uncertainty in the screening assessment. The uncertainty analysis can result in adding chemicals or removing them from the list of COPECs.

The last part of the screening assessment interprets the results in the context of a risk management decision. This primarily involves an assessment of potential ecological risk versus the potential impacts of further remediation

(a) Scoping Evaluation

Data Assessment

The approach taken to characterize releases from AOCs 0-004 and 0-033(b) and SWMU 0-030(l) was designed to provide information on the nature and extent of COPCs at this site. The data collected in soil and tuff were adequate to confirm that the COPCs are distributed along the drainages behind the 6th Street Warehouses. For many of the COPCs, there is sufficient sample coverage of the combined SWMUs/AOCs to calculate representative concentrations of COPCs instead of using the maximum concentration in screening. Representative concentrations used in this assessment are 95% UCLs of the mean concentration, unless the number of detected concentrations in the data set was insufficient to calculate a 95% UCL of the mean value; then the maximum concentration was used. These 95% UCLs of the mean were calculated following EPA guidance "Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites" (EPA 2002, 73593.1). The UCLs were calculated using normal, lognormal, or nonparametric (Chebyshev's) tests depending on which distribution provided the best fit to the data for that COPC. Samples in which an analyte was not detected were considered as having a concentration of one half the detection limit for that analyte. In assessing this site, all samples designated as soil, fill, or sediment were included in the data set used to generate representative concentrations.

Problem Formulation

AOCs 0-004 and 0-033(b) and SWMU 0-030(l) include the areas behind the 6th Street Warehouses. While the buildings themselves and the paved parking area are considered an industrial area, the surrounding top of East Mesa has an almost continuous vegetative cover, numerous shrubs, and a number of mature trees. There are a number of animal burrows on the site indicating the presence of burrowing animals such as gophers. Although heavy previous disturbance through bulldozing, excavation and backfilling at the site has led to the site having characteristics of disturbed sites undergoing secondary succession, the habitat represents primarily meadow with some ponderosa pine and abundant signs of wildlife use. Proximity to Los Alamos Canyon provides additional opportunities for wildlife to access the site. Potential receptors include plants, soil invertebrates, deer mice, rabbits, gophers, deer, and all types of birds.

T&E species are potential receptors for contaminant releases from AOCs 0-004 and 0-033(b) and SWMU 0-030(l). Based on a comparison of SWMU/AOC location to GIS-based habitat databases for the Mexican spotted owl (a threatened or endangered species), this species may forage with a relatively high frequency in the area of these SWMUs/AOCs though they do not lie within the potential nesting habitat for the species (LANL 2001, 76092) The kestrel screening receptor with an all-flesh diet serves as a surrogate for avian T&E receptors in the screening calculations.

There is no aquatic habitat present on the mesa top. Potential impact to aquatic habitat in Los Alamos Canyon is unlikely because there are no established aquatic communities in the canyon below the area of the SWMUs/AOCs; the ephemeral nature of the stream within this section of the canyon prevents aquatic communities from becoming established there. Therefore, impacts on aquatic communities are not considered as part of this ecological screening assessment. More detailed information on habitat is presented in the ecological scoping checklist in Appendix F-3.0.

For ecological risk screening, the comprehensive list of primary impacted media are the surface and subsurface soil, and fill. Previous activities at the site may have released subsurface contamination; this contamination could have reached the surface during recontouring activities after removal of the Material Testing Laboratory. Discharge from outfalls could also have impacted surface soils at the site. The major pathways through which wildlife receptors could potentially contact this contamination are ingestion of soil and ingestion of compounds through the food chain that were originally taken up through plant roots. Burrowing animals could also be exposed through dust inhalation while digging and VOC vapors while in their burrows. Typically, all complete exposure pathways should be at least qualitatively evaluated in the screening process. However, soil ESLs do not include exposure to vapors or particulates in air nor do they account for exposure through dermal contact. The importance of these pathways is discussed in the uncertainty analysis.

(b) Screening Evaluation

To determine which of the COPCs should be retained for the uncertainty analysis, representative concentrations were compared to the final soil ESLs. COPCs that contribute an HQ > 0.3 are identified as COPECs. Because the final ESLs may be based on different receptors for different compounds, the HQs generated by them cannot be summed to produce a single HI for the site. Instead, each HQ was evaluated directly against the benchmark of 0.3. The HQ for comparison to the lowest ESL is larger than 0.3 for 5 metals and 11 organic compounds. The mean concentration (unless a mean could not be calculated) of the COPEC, the ESL, and the HQ are given in Table 2.5-4, for each of the COPCs detected at the site. Background values for inorganic chemicals and radionuclides are provided in the data review section (Section 2.4.3).

There are no LANL ESLs for several COPCs. For 4,4'-DDD, endosulfan II, and heptachlor epoxide, 4,4'-DDE, endosulfan, and heptachlor were used as surrogates. Aldrin, 4-isopropyltoluene, and styrene did not have surrogates with ESLs; these potential COPECs are discussed in the uncertainty section.

Inorganic COPCs that have an HQ greater than 0.3 using the final ESLs were carried through the assessment as COPECs. The benchmark of an HQ of 0.3 is used to account for potential additive effects of chemicals, and to insure that no chemical that may contribute substantially to the HI of an individual receptor is overlooked. For this site cadmium, lead, inorganic mercury, methylmercury, and zinc were carried forward as COPECs. No radionuclides were COPECs because the 95% UCL of the mean detected concentrations for these chemicals generated HQs of <0.01 and an HI of <1.0. Several organic COPCs generated HQs exceeding 0.3: acenaphthene, Aroclor-1254, Aroclor-1260, DDD[4,4'-], DDE[4,4'-], DDT[4,4'-], Endrin, gamma-chlordane, di-n-butylphthalate, heptachlor epoxide, and bis(2-ethylhexyl)phthalate. Each of these organic chemicals was identified as a COPEC.

For those COPECs for which the HQ from the comparison of the 95% UCL of the mean concentration to the lowest ESL was still greater than 0.3, a comparison to the ESLs for all terrestrial receptors at the site was also performed. The resulting HQs and HIs are shown in Table 2.5-5.

Table 2.5-4
Final ESL Comparison for AOCs 0-004 and 0-033(b) and SWMU 0-030(l)

COPEC	95% UCL of the Mean Concentration (mg/kg)	Final Soil ESL (mg/kg)	Receptor for Final ESL	HQ
Inorganic chemicals				
Cadmium	0.569	0.0047	shrew	**121**
Lead	36.2	100	shrew	**0.36**
Mercury (total as inorganic)	0.252	0.05	earthworm	**5.0**
Mercury (methyl)[a]	0.000504	0.00035	Insectivorous robin	**1.4**
Zinc	58.4	10	Plant	**5.84**
Radionuclides				
Americium-241	0.0127	44	earthworm	**<0.01**
Plutonium-238	0.0069	44	earthworm	**<0.01**
Plutonium-239	0.078	47	earthworm	**<0.01**
Uranium-234	1.6	51	earthworm	**0.03**
Uranium-238	1.6	55	earthworm	**0.03**

Table 2.5-4 (continued)

Organic chemicals				
Acenaphthene	0.191	0.25	plant	**0.8**
Acetone	0.033	3.8	deer mouse	**<0.01**
Anthracene	0.181	220	shrew	<0.01
Aroclor-1254	0.552	0.022	shrew	**25.1**
Aroclor-1260	0.421	0.44	insectivorous robin	**1.0**
BHC[alpha-]	0.026	0.97	shrew	0.03
Benzene[b]	0.00138	55	deer mouse	<0.01
Benz(a)anthracene	0.245	3	shrew	0.1
Benzo(a)pyrene	0.217	9.6	shrew	0.02
Benzo(b)fluoranthene	0.342	18	plant	0.02
Benzo(g,h,i)perylene	0.176	12	shrew	0.01
Benzo(k)fluoranthene	0.197	62	shrew	<0.01
Benzoic Acid	1.033	7.3	deer mouse	0.1
Bis(2-ethylhexyl)phthalate	0.671	1	insectivorous robin	**0.67**
Butanone[2-]	0.013	1300	deer mouse	<0.01
Butylbenzylphthalate	0.271	340	shrew	<0.01
Chlordane[alpha-]	0.465	2.1	shrew	0.22
Chlordane[gamma-]	0.941	2.1	shrew	**0.45**
Chrysene	0.231	2.4	shrew	0.10
DDD[4,4'-][b,c]	0.0145	0.0026	insectivorous robin	**5.6**
DDE[4,4'-]	0.275	0.0026	insectivorous robin	**105.6**
DDT[4,4'-]	0.813	0.0026	insectivorous robin	**312.7**
Di-n-butylphthalateb	0.12	0.17	insectivorous robin	**0.7**
Dibenz(a,h)anthracene	0.190	12	shrew	**0.02**
Dibenzofuran	0.272	6.1	plant	**0.04**
Dieldrinb	0.0096	0.04	shrew	**0.24**
Dimethyl Phthalate	0.275	10	earthworm	**0.03**
Endosulfan IId	0.052	0.35	shrew	**0.15**
Endrinb	0.011	0.0034	plant	**3.2**
Fluoranthene	0.238	26	shrew	**0.01**
Fluorene	0.211	1.7	earthworm	**0.12**
Heptachlorb	0.00083	0.059	shrew	**0.01**
Heptachlor Epoxidee	0.026	0.059	shrew	**0.44**
Indeno(1,2,3-cd)pyrene	0.235	62	shrew	**<0.01**
Methoxychlor[4,4'-]	0.262	8.4	shrew	**0.03**
Phenanthrene	0.225	11	shrew	**0.02**
Pyrene	0.245	15	shrew	**0.02**
Toluene	0.002	70	shrew	**<0.01**
Trichloroethene	0.007	270	shrew	**<0.01**

Note: Black shading = HQ >0.3.

[a] Not analyzed directly. Methylmercury estimated at 0.2% of total mercury based on previously collected data. See Appendix F.

[b] Maximum value used (max< UCL).

[c] DDE used as a surrogate compound.

[d] Endosulfan used as a surrogate.

[e] Heptachlor used as a surrogate.

Table 2.5-5
Hazard Quotients and Indices for All Receptors for Remaining COPECs at AOCs 0-004 and 0-033(b) and SWMU 0-030(l)

Receptor	95% UCL	Omnivorous Kestrel	Carnivorous Kestrel	Herbivorous Robin	Invertivorous Robin	Omnivorous Robin	Deer Mouse	Cottontail	Red fox	Shrew	Earthworm	Plant
Cadmium	0.569	0.11	<0.01	0.07	0.80	0.44	62.6	3.8	0.14	121.1	0.06	0.57
Lead	36.2	0.03	<0.01	0.12	0.24	0.18	0.17	0.04	0.01	0.36	0.02	0.07
Inorganic mercury	0.252	0.05	0.02	0.18	0.41	0.29	0.01	<0.01	<0.01	0.01	5.0	0.01
Methyl mercury[a]	0.000504	0.24	0.07	0.01	1.44	0.71	0.08	<0.01	0.01	0.16	<0.01	na[b]
Zinc	58.4	0.09	0.01	0.28	0.60	0.45	0.24	0.06	0.01	0.32	0.17	5.8
Aroclor-1254	0.552	3.2	2.5	0.39	13.4	6.9	12.2	0.20	3.7	25.1	na	na
DDD[4,4'-]	0.0145	1.7	2.0	0.11	5.6	2.8	<0.01	<0.01	<0.01	<0.01	na	na
DDE[4,4'-]	0.275	33.1	37.2	2.1	105.8	52.9	0.02	<0.01	0.01	0.04	na	na
DDT[4,4'-]	0.813	87.4	88.4	6.8	312.7	156.3	0.39	<0.01	0.18	0.81	na	0.22
Acenaphthene	0.191	na	na	na	na	na	<0.01	<0.01	<0.01	<0.01	na	0.76
Bis(2-ethylhexyl)phthalate	0.671	0.29	0.39	0.03	0.67	0.35	0.01	<0.01	0.01	0.02	na	na
Chlordane[gamma-]	0.941	0.11	0.10	0.03	0.43	0.23	0.22	0.01	0.09	0.45	na	0.43
Di-n-butylphthalate	0.12	0.11	0.03	0.13	0.71	0.41	<0.01	<0.01	<0.01	<0.01	na	<0.01
Endrin	0.011	0.16	0.07	0.13	1.0	0.52	0.03	<0.01	<0.01	0.06	na	3.2
Aroclor-1260	0.421	0.23	0.19	0.03	1.0	0.49	0.04	<0.01	0.01	0.08	na	na
Heptachlor epoxide	0.03	0.02	0.02	<0.01	0.09	0.04	0.24	<0.01	0.08	0.44	na	0.07
HI for Receptor		126.8	131.0	10.4	444.9	223.0	76.1	4.1	4.2	148.9	5.3	11.1
HI adjusted by individual AUF		0.253	0.262	6.2	264.7	132.3	76.1	0.332	<0.01	95.1	5.3	11.1

Note: Black shading = HQ >0.3 or HI >1.

[a] Not analyzed directly. Methylmercury estimated at 0.2% of total mercury based on previously collected data. See Appendix F.

[b] na = No ESLs available.

In addition to the direct comparison of the 95% UCL of the mean concentration to the ESL, Table 2.5-5 shows the HI due to all COPECs for each receptor and the HI adjusted by the area-use factor (AUF). The HI is adjusted by multiplying it by an AUF to account for the amount of time that the receptor is likely to spend within the contaminated area based in the size of the receptor's home range. AUFs for individual receptors were developed by dividing the size of the area of the site by the home range for that receptor species. The home ranges for these receptor species were based on EPA (1993, 59384) and Gallegos et al. (1996, 57915). As explained in Appendix F, the site of the site was estimated at 0.25 ha. This site size was used to generate the individual AUFs shown in Table 2.5-6.

Table 2.5-6
Area-Use Factors for AOCs 0-004 and 0-033(b) and SWMU 0-030(l)

Receptor	Home Range (ha)	Individual Area-Use Factor (ha)
American kestrel	106	0.002
American robin	0.42	0.595
Deer mouse	0.077	1.0*
Vagrant shrew	0.39	0.641
Desert cottontail	3.1	0.081
Red fox	1038	0.0002

* If the size of the site exceeds the home range of the receptor, the AUF is set to the default value of 1.

Application of the AUFs for individual animals to the HIs in Table 2.5-5 demonstrates that none of the remaining COPECs represent a potential risk to the carnivorous kestrel, which is a surrogate for the Mexican spotted owl. This result occurs using the home range of the kestrel for the calculations; the home range for the Mexican spotted owl is much larger than the home range of the kestrel and use of the Mexican spotted owl home range would reduce the HI even further. The hazard indices modified by individual AUFs also do not indicate potential for ecological risk to the omnivorous kestrel, which represents the feeding guild of omnivorous birds, including the kestrel. Even when AUFs are considered, the hazard indices for several other receptors remain elevated above the benchmark of one, indicating that there is potential for effects on individuals of that species.

Screening for Population-Level Effects

Except when evaluating threatened or endangered species, EPA guidance recommends evaluating ecological effects at the population level rather than at the individual level (EPA 1999, 70086). For this aggregate screening for population-level effects was also conducted as described in this section for COPECs that generated an HI above 0.3 after being adjusted by individual AUFs. However, any COPEC that generated an HQ >0.3 without AUF adjustment (showing potential risk to individuals) is discussed in the uncertainty section even if it did not generate an HQ high enough to indicate potential population-level effects.

One approach for assessing effects on populations is through the use of a PAUF. The modification of a hazard quotient or HI with a PAUF uses the estimated area covered by the population of a receptor species and the size of the contaminated site to assess the likelihood of any individual within a given population encountering the contaminated area, while using the same ESL based on effects to individuals to determine the impact of this contact with the contaminated area. The PAUF assumes that there may be some impact to the individual receptor, and estimates the effect on the population of that impact based on the likelihood that an individual in that population will contact the contaminated area. The basis and development of this approach are described fully in Appendix F-2.0. For this aggregate of SWMUs/AOCs, the area of the contaminated site was initially considered to be the entire area that was sampled; the PAUFs for robin, deer mouse, and shrew at this site are provided in Table F-2.0-2. Based on that site size, the calculations reproduced in Appendix F yielded the adjusted HIs shown in Table F-2.0-3 and Table 2.5-7.

Table 2.5-7
PAUF-Adjusted HIs for AOCs 0-004 and 0-033(b) and SWMU 0-030(l)

Receptor	Herbivorous Robin	Invertivorous Robin	Omnivorous Robin	Deer Mouse	Shrew
HI adjusted by PAUF	0.17	7.1	3.6	6.3	2.5

Note: Black shading = HI >1.0.

These hazard indices indicate some potential for population level risk to four of the representative receptors. Table F-2.0-4 in Appendix F presents the population-level hazard quotient for each COPC for these receptors. This table shows that over 80% of the risk to both the shrew and the mouse is a result of exposure to cadmium. The table also shows that over 90% of the risk to the robin using both modeled diets is due to 4,4'-DDT and 4,4'-DDE. All other COPECs generated hazard quotients less than 0.3 when adjusted by the PAUF to assess population level effects.

The results for cadmium and mammalian receptors are discussed in the uncertainty section. For 4,4'-DDT and 4,4'-DDE, an examination of the sampling results indicated two small subareas within the sampled area that appeared to have concentrations elevated above that seen in the remainder of the sampled area. Appendix F discusses the individual results and shows in Figure F-2.0-1 how the area was subdivided into two smaller areas so that the elevated results are considered to represent only the area directly around those samples. The maximum detected 4,4'-DDT and 4,4'-DDE concentrations within each of these small subareas was used to generate a hazard quotient adjusted by the PAUF for the 2 small subareas. The PAUFs for the subareas are given in Table F-2.0-5 and the adjusted HQs and HIs are provided in Table 2.5-8.

Table 2.5-8
PAUF-Adjusted HIs for Subareas Within AOCs 0-004 and 0-033(b) and SWMU 0-030(l)

Receptor	Invertivorous Robin	Omnivorous Robin
4,4'-DDE (1.3 mg/kg)	0.44	0.22
4,4'-DDT (1.8 mg/kg)	0.60	0.30
HI for DDT & DDE	1.0	0.52

The PAUF-adjusted HIs for DDT and metabolites for these two small subareas combined are less than or equal to one for the receptors representing both feeding guilds. PAUFs were then developed for the remainder of the sampled area excluding these two subareas to determine the potential for population-level risk to avian receptors from the residual levels of DDT and DDE found at the site out side the two identified subareas. These PAUFs are presented in Table F-2.0-8. A 95% UCL of the mean concentration of both 4,4'-DDE and 4,4'-DDT was developed for this area without the samples included in the separately considered small subareas described above. These calculations are provided in Table F-2.0-9 and yielded hazard indices of less than 1.0 for each receptor for the sum of 4,4'-DDT and 4,4'-DDE.

(c) Uncertainty Analysis

Screening assessments for ecological risk incorporate a number of assumptions that may be sources of uncertainty. For this site, viable ecological habitat exists at the site and is being utilized by various ecological receptors. The suite of terrestrial wildlife receptors for which ESLs have been generated is adequate to assess the feeding guilds likely to be encountered at this site. The COPECs left at this site include metals and organic compounds. The exposure pathways considered for this site were ingestion of soil both during feeding and grooming activities as well as COPECs taken up through plant roots and later ingested as food. For the type and distribution of contaminants seen at this site, these are expected to represent the major pathways for potential exposure. The exposure pathways addressed by the ESL and HQ/HI analysis include all complete exposure pathways with the exception of inhalation and dermal exposure. Although these pathways contribute to the dose received by animals, it is expected that the contribution of these pathways is relatively small and does not interfere with COPEC determination. Dermal contact and inhalation/respiration pathways have not typically been assessed quantitatively in ecological risk assessments, based on guidance that indicates that the ingestion route is most important to terrestrial animals (EPA 1997, 59370). Inhalation is viewed to be an insignificant pathway for contaminated soil in areas where plants cover the contaminated ground surface or where much of the contamination is buried. Dermal exposure to wildlife is mitigated by the fur or feathers that cover the bodies of most vertebrates. In addition, the incidental consumption of soil during grooming is assumed to be included in the direct soil ingestion estimates. Soil exposure pathway analysis has shown that inhalation and dermal pathways contribute a small fraction of the dose obtained orally (EPA 2000, 70094). Therefore, the exposure pathways considered in the development of the ESLs used in screening assessment for this site are likely to capture the primary exposures for wildlife receptors at this site.

Other exposure assumptions made during the screening assessment are very protective and likely to overestimate the actual exposure of wildlife receptors to the contaminants at this site. The first tier of the screening assessment assumes 100% exposure of the receptor to the contaminant representative concentration at the site; this is unlikely for most of the wildlife receptors evaluated. The concentration for each contaminant is conservatively calculated as the 95% UCL of the mean concentration. Therefore, even the screening using the 95% UCL of the mean concentration is likely to overestimate exposure to contaminants at the site. In assessing this site, all samples designated as soil, fill, or sediment were included in the data set used to generate representative concentrations, regardless of the depth at which the sample was taken. Samples taken in tuff were not considered in the ecological risk screening as material within the tuff matrix is generally not accessible to ecological receptors. The "Screening Level Ecological Risk Assessment Methods" (LANL 1999, 64783) guidance generally recommends that ecological screening can include only the first 5 ft of soil bgs since this is likely to include most of the burrowing and rooting activity. At this site excavation and backfilling were performed repeatedly in the past and may occur under projected future use of the site. These activities can change the depth at which contamination in found and potentially bring subsurface contamination to the surface, therefore soil and fill from all depths at the site was considered in calculating the 95% UCL of the mean representative concentration.

Additional sources of uncertainty in an ecological risk screening appear in the derivation of the toxicity information and benchmarks for ecological receptors. The toxicity data and uncertainty factors used to develop the ESLs may potentially underestimate or overestimate the actual toxicity of a chemical to a receptor, particularly when that data is extrapolated from one species to another. In addition, the comparison of site concentrations to ESLs assumes that the chemical species or form occurring at the site is identical to the chemical species used in the toxicity analysis. The screening comparison also assumes that all chemicals are in a form that is bioavailable to the exposed receptor. This assumption overestimates the bioavailability of some COPECs. Consideration of the effects of exposure to more than a single chemical at a site is modeled on the assumption of additive effects of chemicals. This assumption could overestimate or underestimate the actual impact of exposure to multiple contaminants due to synergistic or antagonistic effects. No information is available for most chemicals on synergistic or antagonistic effects, therefore almost all risk screenings and assessments assume the effects are additive when multiple chemical contaminants are present.

There are no ESLs available for aldrin, 4-isopropyltoluene, or styrene; these chemicals cannot be considered quantitatively for potential ecological risk. Styrene was detected 6 times at the site; the detected concentrations were all 0.002 mg/kg and were found in various locations within the drainage area, not within a single small area. There is an EPA Region VI human health soil screening level to which these detections can be qualitatively compared. The EPA Region 6 level for noncarcinogenic effects to humans for styrene is limited only by soil saturation at 1700 mg/kg in soil, which is 100,000 times the concentration seen at this site. Use of the saturation-based level indicates that styrene has very low mammalian toxicity, and that the residual concentrations at this site are not of concern. There were only four estimated detected concentrations of aldrin at this site; all the estimated concentrations were below 1 µg/kg. EPA Region VI provides a human health soil screening level based on carcinogenicity for aldrin of 29 µg/kg; about 30 times the level found at the site. The human health screening level is not directly applicable to ecological receptors, but provides a qualitative estimate of the toxicity of this chemical to mammals. Isopropyltoluene was detected 6 times at this site with all detected concentrations at less than 10 µg/kg. EPA has not issued any screening levels for this chemical, but isopropylbenzene can serve as a surrogate (LANL 2002, 72639). There are also no ESLs for the surrogate, but the EPA Region 6 screening level is 370 mg/kg, which again indicates very low potential toxicity from this chemical. For all three of these COPCs, the low concentrations detected, the diffuse locations of the detected concentrations, and the large differences between the detected concentrations and human health screening levels, these COPCs are not believed to present an ecological risk to receptors at this site.

Cadmium. The 95% UCL of the mean concentration for cadmium (0.57 mg/kg) generates HQs greater than one for small mammal receptors: cottontail rabbit, deer mouse, and the vagrant shrew as shown in Table 2.5-5. Even when the hazard quotients are adjusted by a PAUF as described in Appendix F, the hazard quotient for cadmium remains at 5.2 for the deer mouse and 2.1 for the shrew. These values for hazard quotients would appear to indicate the potential for population-level risk to small mammalian receptors from cadmium. However, the detected concentrations of cadmium at this site are similar to concentrations seen in background. The BV for cadmium of 0.4 mg/kg is based on the detection limit for cadmium because the data set contains a number of non-detects. However, the values for the detected cadmium concentrations in the background dataset (0.2 to 2.6 mg/kg) encompass the range of cadmium values detected at AOCs 0-004 and 0-033(b) and SWMU 0-030(l). Cadmium was also detected in some of the samples taken in the area near this group of SWMUs/AOCs but not influenced by contamination related to this group of SWMUs/AOCs. In addition, all detected cadmium values at this site lie within the range of soil cadmium concentrations (up to 2 mg/kg) shown for the Western United States in section 5.3 of EPA's Ecological Soil Screening Level Guidance document (EPA 2000, 73306). It is likely that the levels of cadmium seen in the soils at AOCs 0-004 and 0-033(b) and SWMU 0-030(l) are reflective of the varying naturally occurring levels in this area. Although these levels are above the ESLs for cadmium in small mammals, these ESLs do not correspond to actual risk to these species because even the BV would generate an HQ of 44 and 85 for the deer mouse and the shrew, yet these species are commonly found throughout the local area. Because exposure across the site is similar to concentrations seen in background, cadmium is not retained as a COPEC.

Lead. Lead was retained because the hazard quotient for the shrew was 0.36. The home range of the shrew is given in Table 2.5-6 is larger than the area of the site, and adjustment of the HQ by the individual AUF modifies the HQ to 0.23. In addition, the HQ for lead was modified in Appendix F in Table F-2.0-5 with the population AUF for the shrew at this site. The modified HQ for population level effects is 0.006. This screening comparison indicates that lead is unlikely to affect either individuals or populations of species represented by the shrew at this site. Lead is not retained as a COPEC.

Mercury. Mercury was not speciated into inorganic mercury and methylmercury during sampling at this site, but has been speciated in the investigation of another site at the Laboratory, SWMU 0-019 (LANL 2001, 71417.2). The sampling results from that study for the two forms of mercury are presented in Table F-2.0-12 of Appendix F: these results demonstrate that an average of 0.2% of mercury is in the methylmercury form at these dry mesa top sites with little organic matter in the soil. Therefore, it was assumed that 0.2% of the total mercury in samples from this group of SWMUs/AOCs was in the methylmercury form. Using that ratio, methylmercury generated HQs of 1.4 and 0.71 for the invertivorous robin and the omnivorous robin. When individual AUFs from Table 2.5-6 are used to adjust these HQs, they become 0.85 and 0.42. These values are below the benchmark of one used to assess effects to individuals. In addition, if these HQs are adjusted using the PAUFs from Table F-2.0-3, the HQs become 0.02 and 0.01. These adjusted HQs indicate no potential for population level effects to avian receptors from methylmercury at this site. Inorganic mercury generates a hazard quotient of 5.0 for the earthworm, but hazard quotients for all other receptors are below 0.3 except for the invertivorous robin, which has an HQ of 0.4. The hazard quotient for the robin is 0.24 when the individual AUF is applied, indicating that ecological risk to individuals in this feeding guild is unlikely. AUFs do not apply to the earthworm, which represents the feeding guild of soil invertebrates. The scoping checklist (see Appendix F) indicates evidence (ant mounds) of at least some soil invertebrates present at the site. Because only the earthworm generated an HQ greater than 0.3 and there is evidence of soil invertebrate communities at the site, inorganic mercury is not retained as a COPEC for this site.

Zinc. The individual HQs for zinc were well within acceptable limits for all terrestrial wildlife receptors except the plant. The plant ESL may not be a good indicator of risk to receptors at the site for zinc because vegetation at the site was abundant and did not appear stressed. Therefore, zinc is not retained as a COPEC.

Aroclors. The 95% UCL of the mean concentration of Aroclor-1260 present at these SWMUs/AOCs corresponds to HQs up to but not exceeding one. The HQ is above 0.5 only for the robin with an insectivorous diet. When this hazard quotient is adjusted by an individual AUF, the hazard quotient is reduced to 0.29, which indicates that effects on individuals from Aroclor-1260 are unlikely when the size of the species' home range is considered. Aroclor-1260 therefore was not retained as a COPEC for this site.

The 95% UCL of the mean concentration of Aroclor-1254 at the site generates HQs above one for several of the terrestrial receptors. When the hazard indices for all receptors were adjusted using the individual AUF, the kestrel (as both omnivore and carnivore) has an HI <1.0, indicating that no COPCs including Aroclor-1254 are likely to represent a risk to individuals of these receptor species. The area surrounding the SWMUs/AOCs is estimated at 7500 square meters (0.75 hectare); the home range of the kestrel is 166 hectares (LANL 2003, LA-UR-03-2028), which gives an AUF of 0.0045. Employing the AUF reduces the HQs for the kestrel itself to 0.01 for both modeled diets. The kestrel modeled as a carnivore also serves as a surrogate for the T&E species. Using the home range of 366 for the Mexican spotted owl (Gallegos et al. 1996, 57915) to generate an AUF of 0.002, the HQ for the kestrel as a surrogate for the Mexican spotted owl becomes <0.01. The residual Aroclor-1254 at this site therefore does not represent a risk to T& E receptors at this site. Aroclor-1254 also generated elevated HQs for the robin, mouse, and shrew receptors. Use of individual AUFs does not reduce these hazard quotients to levels below the benchmarks indicative of potential ecological risk. As described in Appendix F, hazard quotients were adjusted by a population AUF to examine the potential for population-level effects on these receptor species from Aroclor-1254. As shown in Table F-2.0-5 the adjusted hazard quotients for Aroclor-1254 for all these species are at or below 1.0. The residual levels of Aroclor-1254 at this site may impact individual receptors in the omnivorous mammal and insectivorous bird feeding guilds, but will not adversely impact the populations of these receptors. Therefore, Aroclor-1254 was not retained as a COPEC at this site.

Endrin. The maximum detected concentration of endrin generated an HQ of 3.2 in comparison to the lowest ESL, but no 95% UCL of the mean could be generated because the chemical was detected only twice. The HQ of 3.2 applies to the plant. The plant ESL may not be a good indicator of risk to receptors at the site for endrin because vegetation at the site was abundant and did not appear stressed. The HQ is 1.0 for the invertivorous robin and 0.52 for the omnivorous robin. If these hazard quotients are adjusted by an individual AUF, they would become 0.59 and 0.31. A PAUF was also applied to the hazard quotient as shown in table F-2.0-5 in Appendix F. The HQ for endrin is <0.02 when adjusted by the PAUF. Endrin is unlikely to present a risk to either individuals or populations of avian species represented by the robin. Therefore, endrin was not retained as a COPEC.

DDT and metabolites. Hazard quotients for all avian receptors were elevated for 4,4'-DDT and its metabolites 4,4'-DDD, and 4,4'-DDE. For the T&E species for which the kestrel is a surrogate, the adjustment of the HQs by the AUF for the Mexican spotted owl of 0.002 (0.75/366 hectares) reduces the total HI for T&E (which is dominated by DDT and metabolites to 0.26. This is below the benchmark of one for an HI that would indicate any potential for effects to individuals of these species. Impacts to populations of non-T&E species were assessed using the PAUF approach. HIs adjusted by the PAUF for the entire site indicated potential for some population level effects to avian receptors from these COPECs if the 95% UCL of the mean was used to represent the level of these COPECs across the entire site. A reanalysis of the sample results indicates that concentrations within two subareas of the site may represent a different statistical population from the surrounding portion of the SWMUs/AOCs. A separate PAUF was developed for the portion of AOCs 0-004 and 0-033(b) containing the three higher detected concentrations. A PAUF was also developed for the average concentration for the remainder of the site. These three PAUFs were used to develop hazard quotients for population level effects for each of the three site portions, then the HQs were summed to estimate the impact of DDT and metabolites on populations from all three areas of the site. This approach yielded an HQ of 1.0 for the invertivorous robin and 0.52 for the omnivorous robin for the overall site based on the summation of the potential impact of each subarea. This analysis would indicate that there is potential for impacts to individuals but not to populations from residual concentrations of DDT and metabolites at this site.

Other COPECs. Bis(2-ethylhexyl)phthalate, acenaphthene, di-n-butylphthalate, heptachlor epoxide, and gamma-chlordane were all detected at mean concentrations that generated HQs between 0.3 and 1.0 for the lowest ESL and some other receptors. Acenaphthene and gamma-chlordane had HQs above 0.3 for the plant, but the healthy and apparently unstressed vegetation at the site and the fact that each HQ is below the ESL indicate that these HQs do not correspond to ecological risk for plants at this site. These COPECs had HQs between 0.3 and 1 for invertivorous robins, herbivorous robins, and (for gamma-chlordane only) the shrew. PAUFs for these receptors were applied to these Hazard quotients and, as shown in Table F-2.05, all the resulting HQs for population level effects were <0.01. Therefore, none of these COPECs were retained for this site.

(d) Interpretation

Eighteen COPECs (including three COPECs without ESLs) were identified based on the ecological screening assessment for AOCs 0-004 and 0-033(b) and SWMU 0-030(l). However, all of these COPECs were eliminated in the uncertainty analysis by considering a number of factors including background levels, field observations on effects at the outfalls, the likely chemical form of the COPECs, and the analysis for potential effects to populations instead of individuals. The decision criteria were no adverse effects on individuals of T&E species and populations of other species. As stated previously these decision criteria are consistent with EPA guidance on risk management for ecological risk assessments (EPA 1999, 70086).

2.5.2 Other Applicable Assessments

2.5.2.1 Surface Water Assessment

AOCs 0-004 and 0-033(b) and SWMU 0-030(l) were evaluated for surface runoff and erosion potential on September 21, 2001 (see Appendix F). The SWMUs/AOCs have erosion matrix scores of 10.6, 10.6, and 22.3 (out of 100), respectively. There was no visible sign of runoff discharging offsite or of runoff causing visible erosion at the SWMUs/AOCs; therefore, the runoff subscores are zero in all cases. The sites may collect upgradient runoff (e.g., Merrick Bldg. parking lot). Runoff and infiltration from rain events and snowmelt are the only aspects of surface water hydrology at the 6th Street Warehouse SWMUs/AOCs. Flow off western and eastern ends of the Warehouses 3 and 4 parking lot are causing erosive gullies on site. In addition, parking lot and roof runoff from up-gradient businesses have the potential to contribute to surface flow in AOC 0-004. Surface transport may cause potential contaminants to become concentrated in drainages. Aeolian (wind-driven) contaminant entrainment and transport is unlikely considering the extensive vegetation cover. Surface water transport off the mesa top is minimized by site topography and existing BMPs, although drainage into the canyon is evident. The potential for any impact on alluvial groundwater in Los Alamos Canyon is very low considering the distance from the mesa top to the ephemeral stream in the Canyon.

2.5.2.2 Groundwater Assessment

The regional aquifer beneath the 6th Street Warehouse area is at an elevation of approximately 5900 ft (determined in Test Well 2 in Pueblo Canyon, and in Otowi Well 4 in Los Alamos Canyon), chiefly within sediments of the Puye and Tesuque Formations (Purtymun 1995, 45344; Broxton et al. 1995, 50119). At the 6th Street Warehouse SWMUs/AOCs, more than 1200 ft of tuff and volcaniclastic sediments separate the surface from the main aquifer. Runoff or infiltration from these sites is unlikely to reach the regional aquifer or any other body of groundwater.

2.5.2.3 Underground Storage Tanks Assessment

No underground storage tanks are present at AOCs 0-004 and 0-033(b) or at SWMU 0-030(l).

2.5.3 Conclusions and Recommendations

The results of the human health risk screening assessment in Section 2.5.1 show that under a conservative residential scenario there is no unacceptable potential risk to human health from residual contamination at AOCs 0-004 and 0-033(b) and SWMU 0-030(l). The ecological risk screening assessment shows that no COPECs were retained; therefore, no unacceptable potential for adverse ecological effects exists.

Accordingly, AOCs 0-004 and 0-033(b) and SWMU 0-030(l) are recommended for no further action (NFA) under Criterion 5: "The PRS has been characterized or remediated in accordance with current and applicable state or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected land use" (NMED 1998, 57761).

3.0 SWMUs 0-030(b) AND 0-030(m)

3.1 Summary

SWMUs 0-030(b,m) are discussed together because the two septic systems had drainlines that were connected to one another, and because they both occupy the area to the east of the 6th Street Warehouses [as AOCs 0-004 and 0-033(b) and SWMU 0-030(l) were grouped because of their location in the area south of the warehouses, all 5 SWMUs/AOCs are part of consolidated SWMU 0-030(b)-00]. The outlet pipe from SWMU 0-030(m) joins the outlet pipe from SWMU 0-030(b) approximately 400 ft east of the SWMU 0-030(m) septic tank. The SWMUs are located south of the intersection between DP Road and Trinity Drive, on the top and upper slopes of East Mesa north of Los Alamos Canyon.

3.2 Description and Operational History

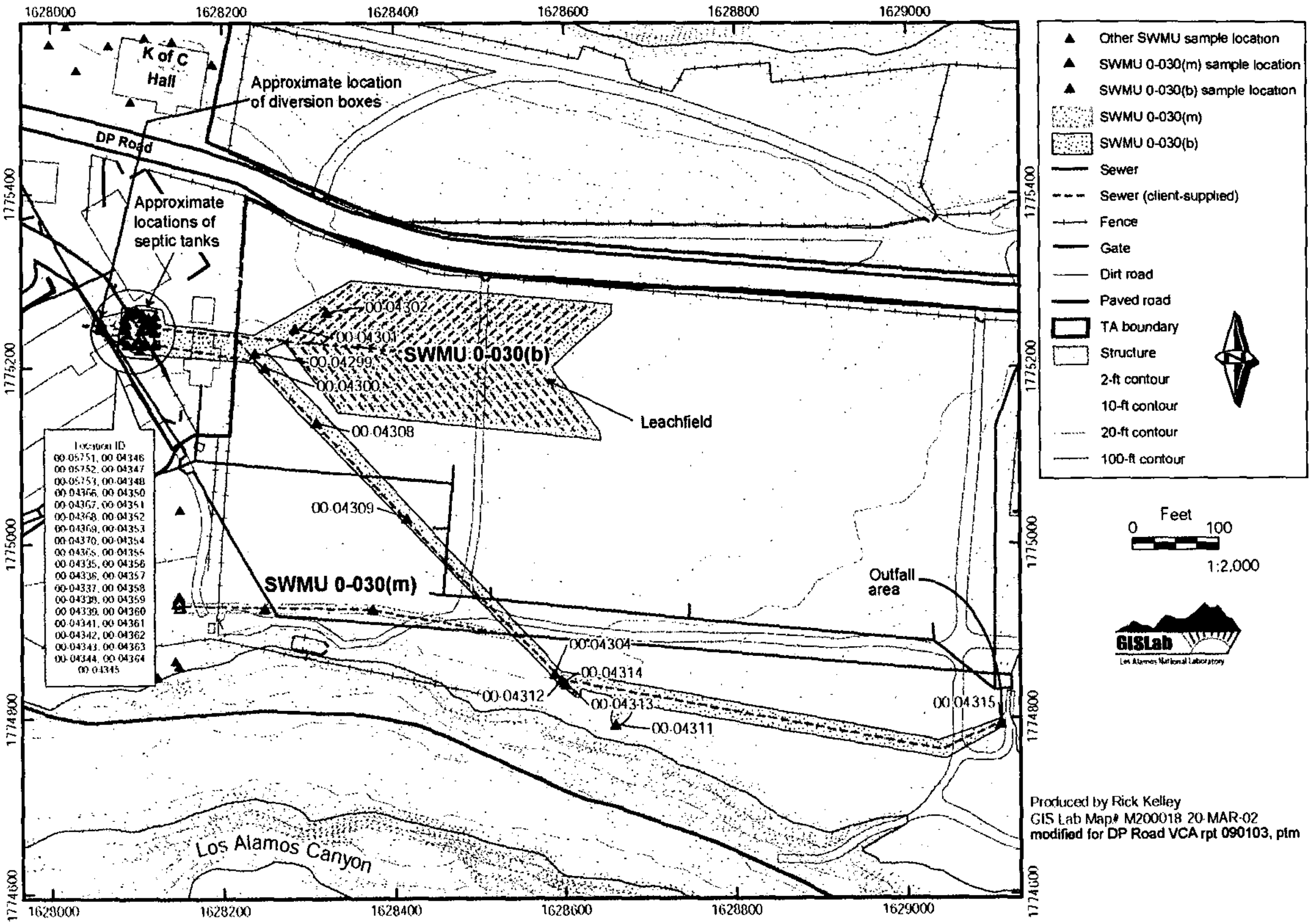
3.2.1 Site Description

SWMU 0-030(b), Septic System

SWMU 0-030(b) is a septic system that served 6th Street Warehouses 1 through 4, an office building, the cold storage plant, and the eastern portion of TA-1 (LANL 1996, 54616). The septic system consisted of two diversion boxes, four septic tanks (a north unit consisting of three adjacent tanks with two cells each, and a single south unit with two cells), and associated piping and leach field. The diversion boxes received waste from drains in the buildings and directed the sewage flow to the septic tanks, which then directed the sewage via drainlines to a leach field and an outfall in BV Canyon. The north diversion box, constructed of concrete, directed flow to the two northernmost septic tanks, while the southern diversion box, constructed of brick, directed flow to the southern two septic tanks. The diversion boxes were located adjacent to 6th Street, between the street and Warehouse 1 (see Figure 3.2-1). The septic tanks were located approximately 35 ft east of Warehouse 1, partially under the 6th Street pavement. The leach field extends eastward from the tanks approximately 500 ft, and the outlet piping extends southeast then east, ending at an outfall in BV Canyon (LANL 1996, 54616). The leach field consisted of a central line running east, with numerous branch, or lateral, lines extending from it toward the northeast and southeast. Each lateral line was approximately 90 to 100 ft long (Figure 3.2-1).

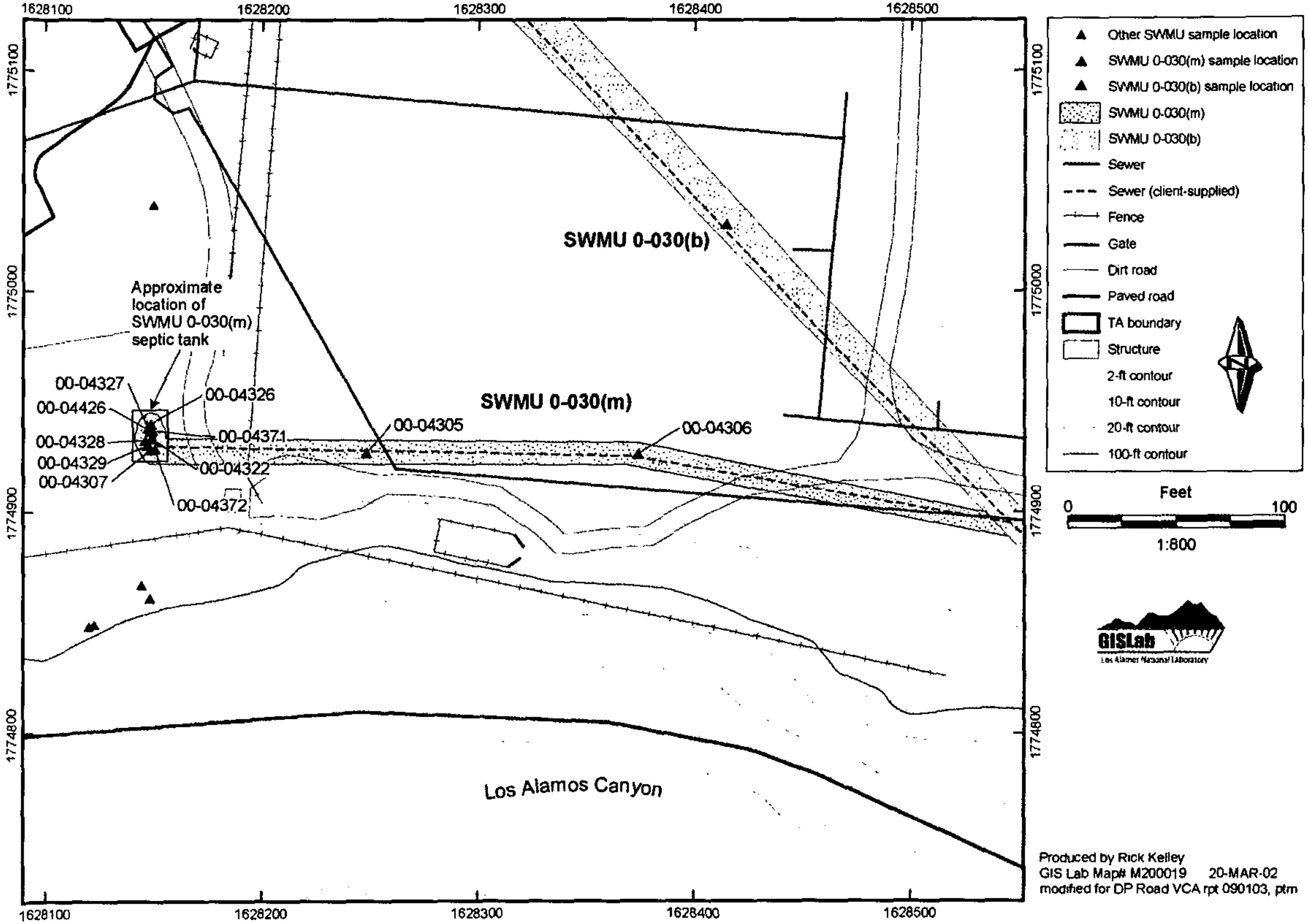
SWMU 0-030(m), Septic System

SWMU 0-030(m) consisted of a single wooden sanitary septic tank with 6-in.-diameter VCP inlet and outlet lines, located south of Warehouses 3 and 4 and approximately 18 ft southeast of the incinerator building. The tank itself measured approximately 10 ft long by 6 ft wide by 6 ft deep (LANL 1996, 55203).The outlet line reportedly (LANL 1996, 55203) exited the tank toward the south, then turned to the east a few feet south of the tank, ran east along the edge of the mesa for approximately 400 ft, connecting to the outfall line from SWMU 0-030(b) and discharging into BV Canyon (see Figures 3.2-1 and 3.2-2). There was no leach field for the SWMU 0-030(m) septic system as there was for the SWMU 0-030(b) septic system.



Produced by Rick Kelley
GIS Lab Map# M200018 20-MAR-02
modified for DP Road VCA rpt 090103, ptm

Figure 3.2-1. SWMU 0-030(b) previous investigation sample locations



Produced by Rick Kelley
GIS Lab Map# M200019 20-MAR-02
modified for DP Road VCA rpt 090103, ptm

Figure 3.2-2. SWMU 0-030(m) previous investigation sample locations

3.2.2 Operational History

SWMU 0-030(b)

The septic system at SWMU 0-030(b) reportedly served the 6th Street Warehouses, an office building, a cold storage plant, and the eastern portion of TA-1 from 1943 until approximately 1950 (LANL 1996, 54616). In the early 1950s the leach field, which is located east of the 6th Street Warehouses, was bulldozed and distributed on the mesa top as part of site preparation for a mobile home park. Trenches dug in 1995 to locate the leach field components and drainlines found only a few branches of leach field piping, consisting of 2-ft sections of VCP loosely laid end to end and underlain by a shallow gravel-filled trench. These were found in the far northwest portion of the leach field area (LANL 1996, 54616). It was clear from comparisons of 1943 engineering drawings to surveyed elevations of points in the field in 1995 that a considerable amount of soil was removed from portions of the field prior to construction of the mobile home park. The 1995 elevations were found to be as much as 5 to 6 ft lower than elevations shown on the engineering drawings. The soil removed from portions of the field was presumably used as fill material to build up the south side of the field near the rim of Los Alamos Canyon. This excavation and recontouring of the field probably accounts for the numerous fragments of VCP found on the surface of the field, and for the general absence of intact leach field structures (LANL 1996, 54616). Mobile homes were placed on the site of the former leach field by 1951. The mobile homes were removed from the site by 1974, and the site has been vacant since that time (see Figures 3.2-3 and 3.2-4).

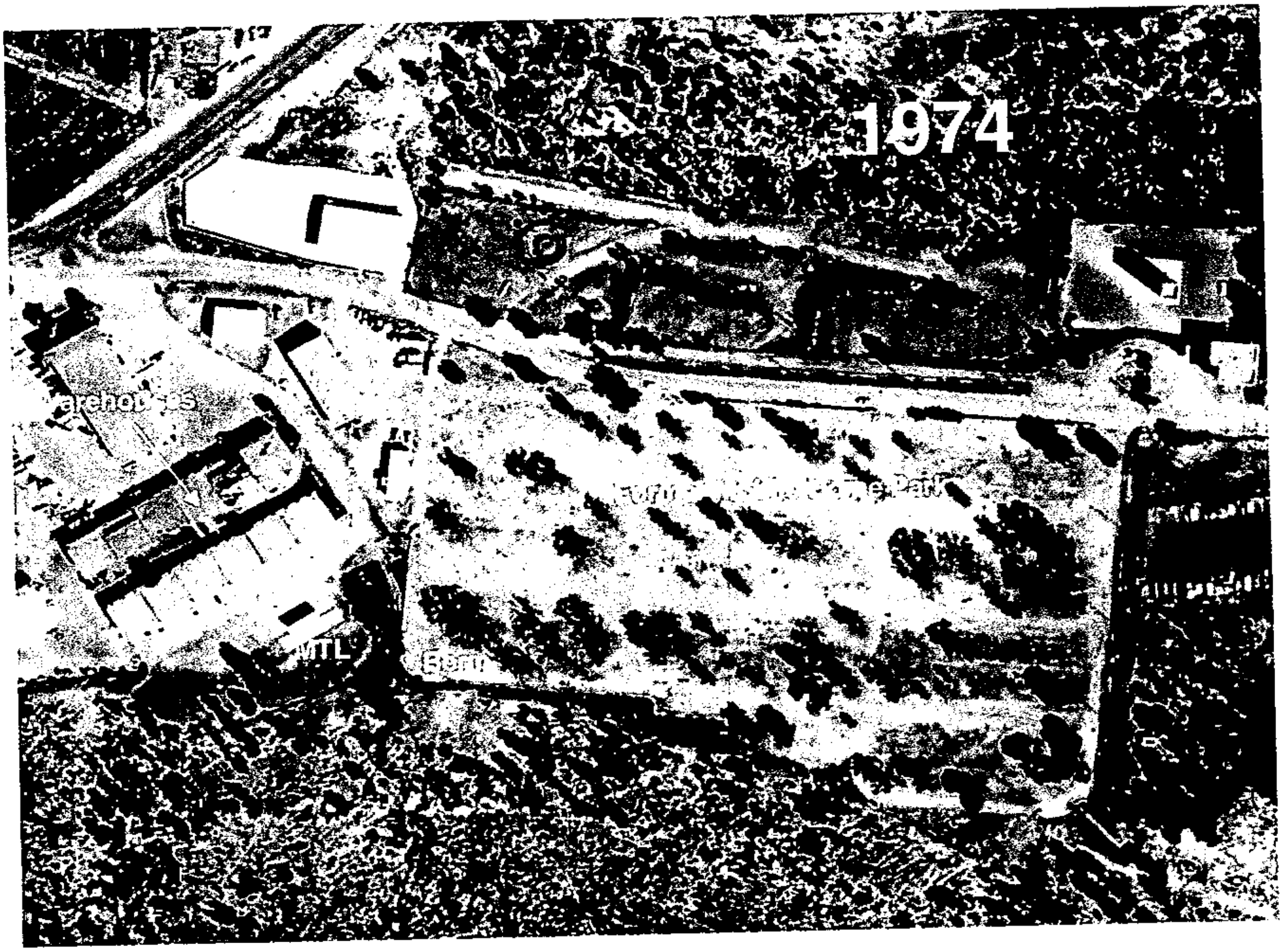


Figure 3.2-3. **1974 aerial photograph of 6th Street Warehouse area**

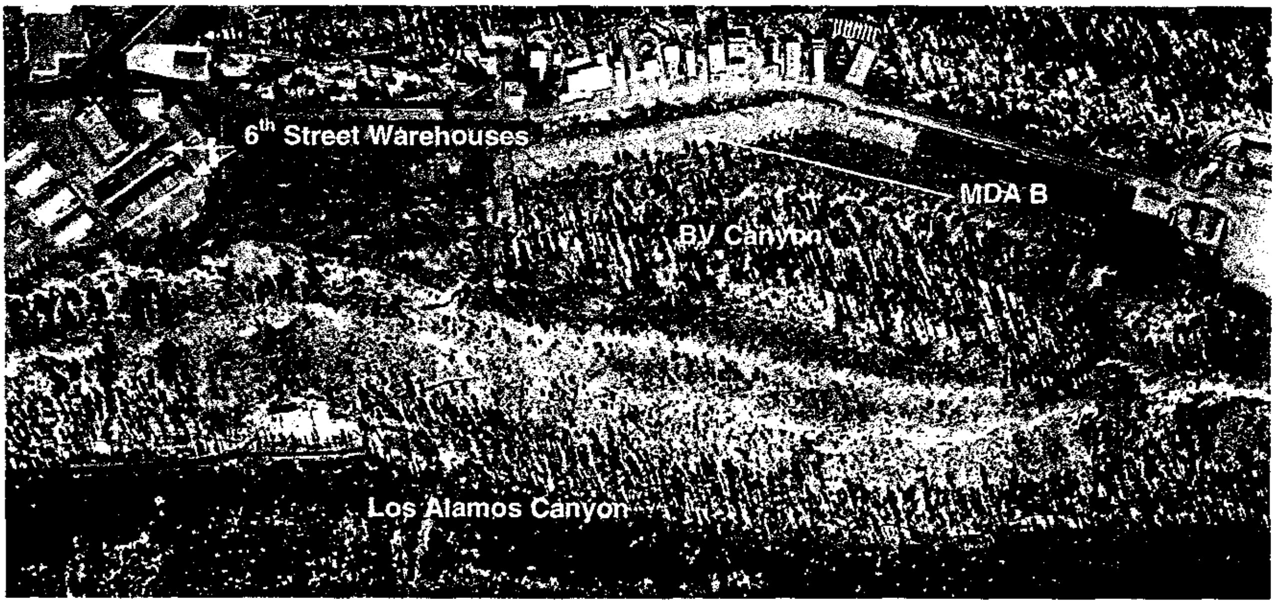


Figure 3.2-4. 1986 aerial photograph of 6th Street Warehouse area

Available information indicates that the septic system handled only sanitary waste; however, since it served portions of TA-1, there is a potential for nonsanitary wastes in the system (LANL 1992, 07667; LANL 1996, 54616). Potential contaminants therefore include VOCs, SVOCs, PCBs/pesticides, TAL metals, and radionuclides.

SWMU 0-030(m)

This septic system served an incinerator building where garbage collected from private residences was burned. Prior to incinerating the garbage, excess liquids were allowed to drain off and were piped into the septic tank (LANL 1992, 07667; LANL 1996, 55203). The system also handled sanitary wastes from the incinerator building itself. The 1990 SWMU report (LANL 1990, 07511) listed the period of use as beginning in the late 1940s, but no end date was identified. The SWMU report also indicated that the septic tank served the MTL rather than the incinerator building. The incinerator building had been removed prior to 1974, as shown by the 1974 aerial photograph (Figure 3.2-3) in which no incinerator or other building is visible to the south of the MTL. The MTL was built in 1948, ceased operations by 1961(LANL 1990, 07511), and was removed between 1974 and 1986 (Figures 3.2-3 and 3.2-4). The outlet line from the septic tank ran east along the edge of the mesa for approximately 400 ft, connecting to the outfall line from SWMU 0-030(b), then discharging into BV Canyon (see Figures 3.2-1 and 3.2-2).

3.3 Previous Activities

3.3.1 Previous Investigations

SWMU 0-030(b)

RFI field work for SWMU 0-030(b) began in July 1995 (LANL 1996, 54616), and continued into 1996 with VCA activities (LANL 1996, 54760; LANL 1996, 62536). A backhoe was used to attempt to locate the septic system components and determine their size and design.

The field team dug a trench along the line that led from the septic tanks to the southeast. Along the southeast-trending section of the line, four trenches were dug and samples were collected from beneath the pipes. The team attempted to locate the outfall along the diagonal by trenching south of the fence along the mesa edge, but no evidence of an outfall was found. The field team then trenched back toward the north to locate the end of the pipe. The pipe was found connected to an eastward-trending metal pipe. Trenching was conducted at intervals along the metal pipe until the broken end of the pipe was found. The team attempted to determine if the pipe continued to the east, but the metal pipe could not be located. There has been much activity in the area by the Los Alamos County utility department, and it is believed that this activity resulted in the rest of the pipe being either removed or cut. All of the drainlines located by the field team were left in place.

Trenching was conducted within the former leach field to attempt to locate the central drainline and the lateral Y branches. Four north-south trending trenches were dug in the leach field area. The central drainline could not be located. In the northwest corner, four 2-ft-long sections of VCP were found, but longer sections of piping were not found. The majority of the leach field lines, including the central drain line, were believed to have been destroyed or removed during recontouring of the field prior to construction of the mobile home park in 1951.

Three large trenches were excavated to locate the end of the northwest-southeast trending VCP outfall. The trenches exposed from 4 to 6 ft of fill, with the contact between the fill and native soil or tuff frequently marked by a thin, discontinuous layer of coal pieces. The coal was presumably a remnant of the coal storage yard which occupied a portion of the field in the 1940s (LANL 1996, 54616). The end of the VCP outlet pipe was located at a depth of about 8 ft. A 6-in.-diameter steel pipe had been connected to the end of the VCP, and a concrete patch had been placed around the connection. Additional trenches were dug to trace the 6-in. steel pipe and locate its end. The end of the steel pipe was located at the far east end of the field, approximately 530 ft due east of its connection with the VCP. This point was apparently the outfall, at the head of BV Canyon, which terminates at the rim of Los Alamos Canyon about 2000 ft to the east.

A geophysical survey was used to determine the approximate location of the septic tanks beneath 6th Street, and a backhoe was used to excavate that area and expose the tanks. A single septic tank was found on the south side of the area, and three additional tanks were located together slightly to the north of that tank. Each of the septic tanks was found to comprise two cells divided by a concrete wall. The western cell of each tank is approximately 25 ft long by 10 ft wide, and the eastern cell is approximately 10 ft long by 10 ft wide. A VCP outlet was found in the bottom of the eastern cell of the southern tank, as opposed to the side of the tank. The north septic tank unit is composed of three individual septic tanks, each constructed with the same two-cell design as the south septic tank. Two of the tanks share a common wall, which is interpreted as indicating that they were constructed at the same time. It is believed that the two northernmost tanks were added later, because the 1943 engineering drawing showed two tanks instead of four. The tank walls were constructed of 4- to 6-in.-thick rebar-reinforced concrete.

Two diversion boxes were found by excavating in the area between 6th Street and Warehouse 1.The south diversion box (2 ft by 3 ft) was constructed of brick and was partially demolished. During the characterization activities, it was discovered that the west and south walls were missing, probably having been partially demolished in the process of constructing 6th Street. The base of the box was constructed of concrete and contained channels that were used for directing sewage flow. The inlet pipe was missing, but was presumed to have been oriented approximately east to west. The outlet pipes (two) were not excavated, but appeared to be oriented such that they led to the southern two septic tanks (LANL 1996, 54616).

The north diversion box (3 ft by 3.5 ft) was constructed of concrete. The outlet lines were not exposed, but the inlet pipe was intact and was oriented northwest to southeast. It was hypothesized that the north box was added after the south box, and was built to direct flow to the northern two septic tanks, which were also presumed to have been added at a later date than the south diversion box and southern two septic tanks (LANL 1996, 54616).

The 1995 field team found that none of the septic tanks had tops or covers in place, and the tank walls had been partially broken off, presumably during construction of 6th Street. The septic tanks and the diversion boxes had been backfilled with a silty, sandy, clayey fill material. Concrete chunks, presumably pieces of broken tank walls, were common within the fill material. It appeared that the original contents of the tanks and diversion boxes had been mostly removed before backfilling; only rarely was a darker, organic material found near the bottom of the tanks and diversion boxes (LANL 1996, 54616).

A total of 67 samples were collected from the septic system during the 1995 RFI activities (LANL 1996, 54616). Three samples were collected from the leach field, one from within a section of VCP (location 00-04301) and two beneath the VCP sections (locations 00-04301 and 00-04302). The three leach field samples were analyzed for SVOCs, PCBs, pesticides, and radionuclides by a fixed analytical laboratory, and for VOCs and metals by the MCAL. Twelve samples were collected from within and beneath the northwest/southeast trending outlet pipeline. Six of these were waste characterization samples and are not included in the data set for this report; the remaining six samples (locations 00-04304, 00-04308, and 00-04309) are included in Table 3.4-1. Three samples were collected from what was possibly the original outfall channel leading from the end of the VCP (locations 00-04311, 00-04313, and 00-04314). One sample was collected from within and below the end of the steel outfall pipe at location 00-04315 (no seams or connections that potentially could have leaked were found along the exposed portions of the steel pipe). A total of 44 samples were collected from within and beneath the septic tanks and their outlet pipes. Twenty-two of these were waste characterization samples and are not included in the data set for this report; the remaining 22 samples (locations 00-04335, 00-04344, 00-04345, 00-04346, 00-04347, 00-04353 through 00-04364, 00-04367, and 00-04368) are included in Table 3.4-1.An additional four samples were collected from within and beneath the diversion boxes and the inlet pipe to the concrete diversion box (this material subsequently removed; samples not included in Table 3.4-1 or Figure 3.4-1).

As samples were collected within and below the outlet piping and the leach field VCP, the excavations were immediately backfilled. The septic tank excavations were covered with polyethylene sheeting and left open until sample data were received and reviewed. Because the MCAL/mobile radiological analytical laboratory sample results showed very few low-level detects of VOCs, SVOCs, pesticides, and PCBs, the decision was made to close the tanks in place. Prior to backfilling the excavations, the inlet line to the concrete diversion box and all four outlet lines from the septic tanks were broken and sealed with concrete. The excavations were then backfilled with crushed tuff in 6- to 8-in. lifts and compacted. They were then covered with 4 to 6 in. of compacted base course material and approximately 3 in. of asphalt.

Because samples from the diversion boxes contained Aroclor-1260 (PCB) at concentrations up to 2.1 mg/kg, the decision was made to excavate the diversion box area. The VCA was executed during the summer of 1996 (LANL 1996, 62536). The contents of the concrete diversion box were removed, and the sides and floor were scraped and then swept clean. Prior to removal of the concrete diversion box, it was screened and found to have no detectable radioactivity.

The brick diversion box had been partially demolished previously, as described above. The remaining portions of the box, as well as the brick and concrete debris, were also removed in 1996. Approximately 1 ft of soil was removed from below the box prior to collecting confirmatory samples. Three confirmatory samples were collected in July 1996 for pesticide/PCB analysis. The first sample was collected 1 ft under the brick diversion box (location 00-05751), the second was collected 1 ft under the area where the two diversion boxes were joined (location 00-05753), and the third was collected 1 ft under the midpoint of the concrete diversion box (location 00-05752) (LANL 1996, 62536).

The small number of samples collected from the leach field and the general lack of TAL metals data for the piping areas constituted a data gap, and the VCA/IA plan (LANL 2002, 73579) called for additional sampling in the leach field area to address that gap.

SWMU 0-030(m)

SWMU 0-030(m) was investigated beginning in August 1995 (LANL 1996, 55203). The septic tank was found by excavating trenches which first located the inlet and outlet piping, then the tank in between. The tank was approximately 10 ft long by 6 ft wide by 6 ft deep. The tank had no lid at the time it was excavated, and was filled with what appeared to be soil from the surrounding area. The tank contained a few inches of soil that graded into a moist to wet, dark gray organic clay to silty, sandy clay. Below the tank, approximately 1.1 ft of dark gray to black silt and very fine sand with occasional brownish pebbles and broken glass were encountered. This layer was in contact with reddish-gray tuff.

Three samples were collected below the tank by hand augering through the decayed wooden tank bottom. Two of the samples were submitted for fixed laboratory analyses of SVOCs, PCBs, pesticides, TAL metals, and radionuclides; the third sample was submitted for TAL metals only. This material was later removed, and these samples are not included in Table 3.4-1.

Seven samples, including one field duplicate, were collected from inside the tank. Five of the samples were submitted to a fixed laboratory for analyses of SVOCs, PCBs, pesticides, and radionuclides (these samples also were analyzed for VOCs and XRF metals at the MCAL) ; one was analyzed for TAL metals only, and one for radionuclides only (LANL 1996, 55203). This material was later removed, and these samples are not included in Table 3.4-1. A single composite sample (location 00-04327) was collected outside the tank.

Two samples, including one field duplicate, were collected from inside the inlet pipeline, and one sample from was collected from below the inlet pipeline 1 ft north of the septic tank (location 00-04326). These three samples were analyzed for SVOCs, PCBs, pesticides, and radionuclides (and for VOCs and metals at the MCAL). The inlet pipe content samples were waste characterization samples and are not included in Table 3.4-1.

Five samples were collected from inside and beneath the outlet pipeline: one inside and one below the outlet pipe about 95 ft east of the septic tank (location 00-04305); one below the outlet pipe about 220 ft east of the tank (location 00-04306); one inside and one below the outlet pipe just south of the septic tank (location 00-04307). These five samples were analyzed at a fixed laboratory for SVOCs, PCBs, pesticides, and radionuclides, and for VOCs and metals at the MCAL.

The analytical results for SWMU 0-030(m) indicated that the material inside the tank contained elevated concentrations of several pesticides, SVOCs (primarily PAHs), and metals. Elevated radiological constituents were also reported, confined primarily to the silty-sand layer immediately below the tank. Radionuclides detected above BVs were americium-241, plutonium-238, plutonium-239/240, radium-226, and uranium-235. Thirty-five organic chemicals were detected, and another 16 were not detected but had EQLs higher than their respective SALs. On the basis of the results of a screening assessment, a VCA was conducted in November 1995 to remove the septic tank and the entire inlet pipeline (LANL 1996, 55203).

In November 1995, the septic tank and inlet pipeline were excavated and removed. The silty sand layer below the tank also was removed, and approximately 6 to 8 in. of tuff was excavated from beneath and around the tank on all sides in an attempt to remove any residual contamination. The tank contents, surrounding soil and tuff, and inlet line were placed into four B25 boxes and forty-two 1-yd^3 soil bags. As part of the removal with the backhoe, decayed wood from the tank itself was mixed with the soil in the B25 boxes. Two confirmatory samples (Locations 00-04371 and 00-04372, Figure 3.2-2) were collected after the tank, soil, and tuff were excavated. These samples were from beneath the tank and the removed sand and tuff, and were analyzed for SVOCs, PCBs, pesticides, and radionuclides by a fixed laboratory. After excavation and confirmation sampling were completed, the inlet pipeline excavation was immediately backfilled and the area was restored to its original contours. The septic tank excavation was covered with plastic and left open until preliminary radiological analysis results were obtained. When the preliminary results showed no elevated radionuclides, the tank excavation was backfilled with clean crushed tuff, and the entire area was restored to original contours. The disturbed area was reseeded and erosion control mats were installed. The outlet pipeline was left in place (LANL 1996, 55203).

The site characterization and confirmation sampling left data gaps that were to be addressed by the 2002 VCA activities (LANL 2002, 73579). The two confirmatory samples were analyzed for VOCs and metals by the MCAL. In addition, all but four of the metals analyses of the site characterization samples were conducted by XRF, which is no longer considered an acceptable method for obtaining metals data. No samples were collected from outside the footprint of the septic tank (except part of the one composite sample) either during the investigation sampling or after the tank was removed. This constituted a data gap because it is unknown whether the wooden tank may have leaked laterally. In addition, trenching was not conducted south of the tank to ensure that the tank did not have an outfall to the south leading to Los Alamos Canyon.

3.3.2 Preliminary Site Conceptual Model

The preliminary site conceptual model for the 6th Street Warehouse area, including SWMUs 0-030(b,m), is presented graphically in Figure 2.3-3. Potential contaminant sources include warehouse drainage into the south field, septic tanks and drain lines, and the outfalls. For the warehouse area and the leachfield site, leaks from or the contents of the subsurface piping and septic tanks [e.g., SWMU 0-030(m) was a porous wooden tank] represent a potential source of subsurface contamination.

While contamination was originally limited to the subsurface in the unpaved portion of SWMU 0-030(b), the leach field experienced substantial re-contouring activities during development and following the relocation of the former trailer park. This could have brought subsurface contamination to the surface, as evidenced by numerous scraps of previously buried VCP observed on the ground surface throughout the site. Contaminants in the area under the pavement should be confined to depths greater than 3 ft, the approximate depth of the bottom of the former diversion boxes, and the asphalt cover would have prevented activities (e.g., earthmoving) that could have brought potential contamination closer to the surface.

For subsurface exposure to human or ecological receptors to be complete, one or both of the following scenarios must occur: deep-rooted plants encounter this potential subsurface contamination, or burrowing animals or site excavation activities (e.g., leachfield bulldozing) redistribute this subsurface material to the surface. The historic outfall effluent releases are subject to surface water run-off and erosion. Surface transport from overland flow and outfalls may cause potential contaminants to become concentrated in drainages and may result in infiltration of contaminants into subsurface soils/tuff. Surface materials not directly associated with outfalls (e.g., AOC 0-004) on the mesa slope are subject to surface water runoff (e.g., sheet flow), wind erosion and dust suspension. There are no pathways for aquatic receptors (runoff and infiltration from rain events and snowmelt are the only aspects of surface water hydrology at the 6th Street SWMUs/AOCs), therefore they were not considered as part of the site conceptual model.

3.4 Remedial Activities

3.4.1 Investigative Activities During VCA

SWMU 0-030(b)

An investigation of SWMU 0-030(b) began on May 15, 2002, with excavations designed to locate the piping and collect waste characterization samples of the pipe contents. The pipe at the west end of the septic system near the manhole was located with a backhoe, and two interior pipe samples were collected for waste characterization from locations north and south of the manhole. The excavation was backfilled after collection of samples and examination of the pipe.

Next, the surveyed eastern end of the outfall pipe was located, a trench was dug 11 ft west, and a sample was collected from within the pipe for waste characterization. Another trench was dug in the surveyed location of the bend in the pipe, and another sample was collected from within the pipe for waste characterization.

The backhoe was used to scrape away soil overlying the leachfield in an attempt to locate the leach field lateral pipes. Many of the northern laterals were found in place, but the southern laterals were not found.

A total of 60 samples, including 4 field duplicates, were collected at SWMU 0-030(b) during the 2002 VCA. Seven waste characterization samples were collected, including three from leach field lateral piping and four from the outfall piping; these samples are not included in Table 3.4-1. Thirty-six confirmation samples, plus 4 field duplicates, were collected at 18 locations, as discussed in Section 3.4.2 (duplicate samples are not included in Table 3.4-1). The confirmation sampling included 26 samples beneath the outfall piping (Locations 00-02-20782 through 00-02-20794), and 10 samples from beneath the central leach field drain line and lateral pipes (Locations 00-02-20795 through 00-02-20799). Four leach field surface characterization samples were collected (Locations 00-02-20800 through 00-02-20803). Nine samples were collected north of the leach field in an area believed to be unaffected by any potential contamination form SWMU 0-030(b) (Locations 00-02-20804 through 00-02-20812, Table 3.4-2). Samples were collected in accordance with ER-SOP-6.10, Rev. 1, "Hand Auger and Thin-Wall Tube Sampler," or ER-SOP-6.09, Rev. 1, ICN, "Spade and Scoop Method for Collection of Soil Samples." A summary of the samples collected is presented in Tables 3.4-1 and 3.4-2 (non-site-related samples).

SWMU 0-030(m)

The septic tank outfall pipe for SWMU 0-030(m) was sampled on May 21, 2002. A single sample was collected from inside the outfall pipe (Location 00-02-19785, Figure 3.4-1). This sample was originally intended to characterize the waste that would be removed with the pipe. Because the pipe was ultimately not removed, however (see Section 3.4.2), the sample is now considered an investigation sample representing in-place material. The sample was submitted to a fixed laboratory for analyses of VOCs, SVOCs, PCBs, pesticides, isotopic uranium, isotopic plutonium, and gamma-emitting radionuclides. Because the sample was collected as a waste characterization sample, only TCLP metals analysis was requested.

On May 21, 2002, excavation was proceeding to locate the intersection of piping from SWMUs 0-030(b,m), when an east to west trending pipe was located at a depth of 6.5 ft. During excavation to uncover that line, another line was encountered running at a diagonal to the east-west line. When the pipe was hit by the backhoe, clear water began pouring into the excavation. The line was later determined

Table 3.4-1
Summary of Soil, Fill, Sediment, and Tuff Samples Collected at SMWUs 0-030(b,m)

Sample ID	Location ID	Depth (ft)	Media	Metals	Am-241	Gamma Spectroscopy	Tritium	Isotopic Plutonium	Isotopic Uranium	PCBs	Pesticides	Pesticides/ PCBs	SVOCs	VOCs
0100-95-0454	00-04327	10.5–11	Soil	—[a]	798	798	—	798	—	—	—	796	796	—
0100-95-0472	00-04301	0–0.5	Soil	—	944	944	—	944	—	—	—	943	943	—
0100-95-0473	00-04302	0–0.5	Soil	—	944	944	—	944	—	—	—	943	943	—
0100-95-0478	00-04301	0–0.5	Soil	—	944	944	—	944	—	—	—	943	943	—
0100-95-0479	00-04304	10–10.3	Soil	984	985	985	—	985	—	—	—	983	983	—
0100-95-0480	00-04305	11–11.2	Soil	—	991	991	—	991	—	—	—	989	989	—
0100-95-0481	00-04305	11.3–11.5	Soil	—	991	991	—	991	—	—	—	989	989	—
0100-95-0482	00-04306	11.3–11.5	Soil	—	991	991	—	991	—	—	—	989	989	—
0100-95-0483	00-04307	5.5–6	Soil	—	994	994	—	994	—	—	—	992	992	—
0100-95-0484	00-04308	4.5–4.7	Soil	—	—	—	994	—	—	—	—	—	—	—
0100-95-0485	00-04308	4.5–4.7	Soil	993	—	—	—	—	—	—	—	—	—	—
0100-95-0486	00-04307	6–6.5	Soil	—	994	994	—	994	—	—	—	992	992	—
0100-95-0487	00-04308	4.5–4.7	Soil	—	994	994	—	994	—	—	—	992	992	—
0100-95-0488	00-04308	4.7–5	Soil	—	994	994	—	994	—	—	—	992	992	—
0100-95-0489	00-04309	4.2–4.8	Soil	—	1003	1003	—	1003	—	—	—	1002	1002	—
0100-95-0491	00-04311	0–0.5	Soil	—	1003	1003	—	1003	—	—	—	1002	1002	—
0100-95-0677	00-04326	5.5–6	Soil	—	798	798	—	1123	1123	—	—	796	796	—
0100-95-0687	00-04313	9–9.5	Sediment	—	1263	1263	—	1263	—	—	—	1262	1262	—
0100-95-0688	00-04314	9–9.5	Sediment	—	1263	1263	—	1263	—	—	—	1262	1262	—
0100-95-0689	00-04315	5–5.2	Soil	—	1330	1330	—	1330	—	—	—	1328	1328	—
0100-95-0704	00-04335	9–9.5	Soil	1478	1479	1479	1479	1479	—	—	—	1476	1476	1476
0100-95-0715	00-04344	10–11	Soil	1488	1489	1489	1489	1489	—	—	—	1486	1486	1486

Table 3.4-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Metals	Am-241	Gamma Spectroscopy	Tritium	Isotopic Plutonium	Isotopic Uranium	PCBs	Pesticides	Pesticides/ PCBs	SVOCs	VOCs
0100-95-0716	00-04345	4.5–5.5	Soil	1495	1496	1496	1496	1496	—	—	—	1497	1497	1497
0100-95-0717	00-04346	7.5–8.5	Soil	1495	1496	1496	1496	1496	—	—	—	1497	1497	1497
0100-95-0718	00-04347	4–5	Soil	1495	1496	1496	1496	1496	—	—	—	1497	1497	1497
0100-95-0725	00-04353	6.5–7	Soil	1506	1507	1507	1507	1507	—	—	—	1505	1505	1505
0100-95-0726	00-04354	0–9	Soil	1515	1516	1516	1516	1516	—	—	—	1514	1514	1514
0100-95-0727	00-04355	6–7	Soil	1515	1516	1516	1516	1516	—	—	—	1514	1514	1514
0100-95-0728	00-04355	8–9	Soil	1515	1516	1516	1516	1516	—	—	—	1514	1514	1514
0100-95-0729	00-04356	2–8	Soil	1515	1516	1516	1516	1516	—	—	—	1514	1514	1514
0100-95-0730	00-04357	4–5	Soil	1515	1516	1516	1516	1516	—	—	—	1514	1514	1514
0100-95-0731	00-04357	6–7	Soil	1515	1516	1516	1516	1516	—	—	—	1514	1514	1514
0100-95-0732	00-04358	4.5–4.7	Soil	1515	1516	1516	1516	1516	—	—	—	1514	1514	1514
0100-95-0733	00-04359	0–6	Soil	1515	1516	1516	1516	1516	—	—	—	1514	1514	1514
0100-95-0734	00-04360	3–4	Soil	1515	1516	1516	1516	1516	—	—	—	1514	1514	1514
0100-95-0735	00-04360	5–6	Soil	1515	1516	1516	1516	1516	—	—	—	1514	1514	1514
0100-95-0740	00-04361	4.5–4.8	Soil	1572	1573	1573	1573	1573	—	—	—	1571	1571	1571
0100-95-0741	00-04362	9–10	Soil	1572	1573	1573	1573	1573	—	—	—	1571	1571	1571
0100-95-0742	00-04363	9–10	Soil	1572	1573	1573	1573	1573	—	—	—	1571	1571	1571
0100-95-0743	00-04364	10–11	Soil	1572	1573	1573	1573	1573	—	—	—	1571	1571	1571
0100-95-0749	00-04367	0–9	Soil	1572	1573	1573	1573	1573	—	—	—	1571	1571	1571
0100-95-0750	00-04368	10–11	Soil	1572	1573	1573	1573	1573	—	—	—	1571	1571	1571
0100-95-0914	00-04371	11–11.5	Soil	—	1612	1612	—	1612	—	—	—	1611	1611	—
0100-95-0915	00-04372	11–11.5	Soil	—	1612	1612	—	1612	—	—	—	1611	1611	—
0100-96-1751	00-05751	4–4.5	Soil	—	—	—	—	—	—	2462	2462	—	—	—
0100-96-1752	00-05752	4–4.5	Soil	—	—	—	—	—	—	2468	2468	—	—	—

Table 3.4-1 (continued)

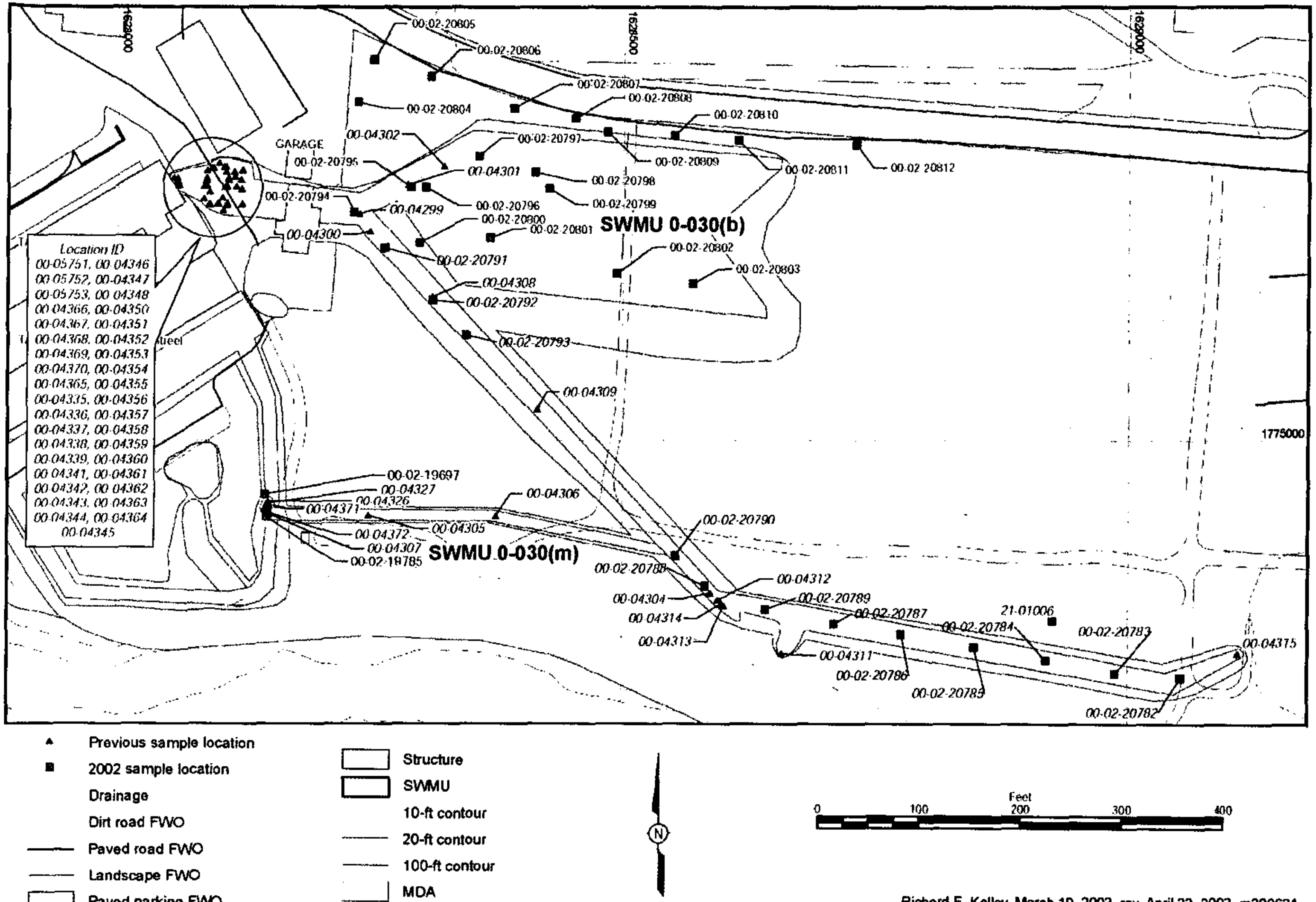
Sample ID	Location ID	Depth (ft)	Media	Metals	Am-241	Gamma Spectroscopy	Tritium	Isotopic Plutonium	Isotopic Uranium	PCBs	Pesticides	Pesticides/ PCBs	SVOCs	VOCs
0100-96-1753	00-05753	3.5–4	Soil	—	—	—	—	—	—	2468	2468	—	—	—
RE00-02-46452	00-02-20782	6.5–7	Fill	957S	—	958S	—	958S	958S	956S	956S	—	956S	956S
RE00-02-46453	00-02-20782	7.5–8	Fill	957S	—	958S	—	958S	958S	956S	956S	—	956S	956S
RE00-02-46454	00-02-20783	6.5–8	Fill	957S	—	958S	—	958S	958S	956S	956S	—	956S	956S
RE00-02-46455	00-02-20783	7.5–8	Fill	957S	—	958S	—	958S	958S	956S	956S	—	956S	956S
RE00-02-46456	00-02-20784	5.5–6	Fill	963S	—	964S	—	964S	964S	962S	962S	—	962S	962S
RE00-02-46457	00-02-20784	6.5–7	Fill	963S	—	964S	—	964S	964S	962S	962S	—	962S	962S
RE00-02-46458	00-02-20785	6.5–7	Qbt 3	963S	—	964S	—	964S	964S	962S	962S	—	962S	962S
RE00-02-46459	00-02-20785	7.5–8	Qbt 3	963S	—	964S	—	964S	964S	962S	962S	—	962S	962S
RE00-02-46460	00-02-20786	7.25–7.75	Qbt 3	963S	—	964S	—	964S	964S	962S	962S	—	962S	962S
RE00-02-46461	00-02-20786	8.25–8.75	Qbt 3	963S	—	964S	—	964S	964S	962S	962S	—	962S	962S
RE00-02-46462	00-02-20787	9.5–10	Qbt 3	966S	—	967S	—	967S	967S	965S	965S	—	965S	965S
RE00-02-46463	00-02-20787	10.5–11	Qbt 3	966S	—	967S	—	967S	967S	965S	965S	—	965S	965S
RE00-02-46464	00-02-20788	10–10.5	Qbt 3	969S	—	970S	—	970S	970S	968S	968S	—	968S	968S
RE00-02-46465	00-02-20788	10.5–11	Qbt 3	969S	—	970S	—	970S	970S	968S	968S	—	968S	968S
RE00-02-46466	00-02-20789	9.4–9.7	Qbt 3	969S	—	970S	—	970S	970S	968S	968S	—	968S	968S
RE00-02-46467	00-02-20789	10.4–10.7	Qbt 3	969S	—	970S	—	970S	970S	968S	968S	—	968S	968S
RE00-02-46468	00-02-20790	9.83–10.33	Qbt 3	972S	—	973S	—	973S	973S	971S	971S	—	971S	971S
RE00-02-46469	00-02-20790	10.33–10.83	Qbt 3	972S	—	973S	—	973S	973S	971S	971S	—	971S	971S
RE00-02-46470	00-02-20791	1.7–2	Fill	980S	—	981S	—	981S	981S	979S	979S	—	979S	979S
RE00-02-46471	00-02-20791	2.3–2.8	Fill	980S	—	981S	—	981S	981S	979S	979S	—	979S	979S
RE00-02-46472	00-02-20792	5.5–6	Fill	980S	—	981S	—	981S	981S	979S	979S	—	979S	979S
RE00-02-46473	00-02-20792	6.5–7	Qbt 3	980S	—	981S	—	981S	981S	979S	979S	—	979S	979S
RE00-02-46474	00-02-20793	2.5–2.8	Fill	984S	—	985S	—	985S	985S	983S	983S	—	983S	983S

Table 3.4-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Metals	Am-241	Gamma Spectroscopy	Tritium	Isotopic Plutonium	Isotopic Uranium	PCBs	Pesticides	Pesticides/ PCBs	SVOCs	VOCs
RE00-02-46475	00-02-20793	3–3.3	Qbt 3	984S	—	985S	—	985S	985S	983S	983S	—	983S	983S
RE00-02-46476	00-02-20794	2–2.5	Qbt 3	984S	—	985S	—	985S	985S	983S	983S	—	983S	983S
RE00-02-46477	00-02-20794	2.5–3	Qbt 3	984S	—	985S	—	985S	985S	983S	983S	—	983S	983S
RE00-02-46478	00-02-20795	1–1.5	Fill	1072S	—	1073S	—	1073S	1073S	1071S	1071S	—	1071S	1071S
RE00-02-46479	00-02-20795	1.83–2.33	Fill	1072S	—	1073S	—	1073S	1073S	1071S	1071S	—	1071S	1071S
RE00-02-46480	00-02-20796	0.83–1.17	Fill	1072S	—	1073S	—	1073S	1073S	1071S	1071S	—	1071S	1071S
RE00-02-46481	00-02-20796	1.83–2.33	Fill	1072S	—	1073S	—	1073S	1073S	1071S	1071S	—	1071S	1071S
RE00-02-46482	00-02-20797	0.83–1.33	Fill	1072S	—	1073S	—	1073S	1073S	1071S	1071S	—	1071S	1071S
RE00-02-46483	00-02-20797	1.83–2.33	Fill	1072S	—	1073S	—	1073S	1073S	1071S	1071S	—	1071S	1071S
RE00-02-46484	00-02-20798	0.83–1.33	Fill	1072S	—	1073S	—	1073S	1073S	1071S	1071S	—	1071S	1071S
RE00-02-46485	00-02-20798	1.83–2.33	Fill	1072S	—	1073S	—	1073S	1073S	1071S	1071S	—	1071S	1071S
RE00-02-46486	00-02-20799	0.67–1.17	Fill	1036S	—	1037S	—	1037S	1037S	1035S	1035S	—	1035S	1035S
RE00-02-46487	00-02-20799	1.67–2.17	Fill	1036S	—	1037S	—	1037S	1037S	1035S	1035S	—	1035S	1035S
RE00-02-46488	00-02-20800	0–0.5	Fill	1022S	—	1023S	—	1023S	1023S	1021S	1021S	—	1021S	—
RE00-02-46489	00-02-20801	0–0.5	Fill	1022S	—	1023S	—	1023S	1023S	1021S	1021S	—	1021S	—
RE00-02-46490	00-02-20802	0–0.5	Fill	1022S	—	1023S	—	1023S	1023S	1021S	1021S	—	1021S	—
RE00-02-46491	00-02-20803	0–0.5	Fill	1022S	—	1023S	—	1023S	1023S	1021S	1021S	—	1021S	—
RE00-02-45745	00-02-19785	6–6.5	Sludge	—[b]	—	814S	814S	814S	814S	812S	812S	—	812S	812S

[a]— = Not analyzed.

[b]— = Metals by TCLP only.



Richard E. Kelley, March 19, 2003, rev. April 22, 2003, m200631
modified for DP Road VCA rpt 081903, ptm

Figure 3.4-1. SWMUs 0-030(b,m) RFI and VCA sample locations to be an active return sewer line that was not in the location, nor running in the direction that had previously been indicated by the Los Alamos County Utilities Department. Additional unidentified lines were also encountered, including a 1-in. copper pipe, a 5.5-in.-diameter VCP, and another metal pipe. The additional samples planned for the area around the septic tank were not collected because of safety concerns related to the close proximity of the multiple unmarked active utility lines that were discovered during the excavation.

3.4.2 Remediation Activities

SWMU 0-030(b)

In July 2002 approximately 570 ft of steel pipe was excavated and disposed of (500 ft of 6-in. steel pipe, 70 ft of 4-in. steel pipe). The steel pipe included sewer lines running from the warehouses to the septic system and the outfall drainline that bypassed the leach field to the south. Approximately 500 ft of vitrified clay pipe from the septic system lateral lines and an abandoned water line was also removed. Confirmation samples were collected from two depths at each of 18 locations (Locations 00-02-20782 through 00-02-20794 associated with outfall piping, and 00-02-20795 through 00-02-20799 associated with the leach field)after the pipe was removed. The confirmation samples were submitted to a fixed laboratory for analysis of TAL metals, SVOCs, VOCs, PCBs, pesticides, isotopic uranium, isotopic plutonium, and gamma-emitting radionuclides (Table 3.4-1). As the piping was removed, seven samples of the pipe contents were collected for waste characterization purposes.

SWMU 0-030(m)

The VCA/IA plan (LANL 2002, 73579) called for removing the outlet piping associated with the septic system at SWMU 0-030(m). However, during excavation to locate the piping, the field team encountered and broke an unmarked active sewer return line near the intersection of SWMU 0-030(b) and SWMU 0-030(m). Several other unidentified lines were also encountered, and concerns were raised regarding worker safety and the possibility that unmarked or incorrectly marked electrical or gas lines might be present in the area. The decision was made to cease excavations, leaving the remaining septic system piping in place. A sample of the outlet pipe contents was collected before the excavations were backfilled; this sample was collected as a waste characterization sample, but is included as an investigation sample because the piping was not removed (Location 00-02-19785). Excavation and sampling of the SWMU 0-030(b) piping beyond its intersection with the SWMU 0-030(m) piping were later completed as planned.

3.4.3 Confirmatory Sampling Data Review

The data set for SWMUs 0-030(b,m) includes analytical data from 71 soil/fill/sediment samples (45 soil samples, 2 sediment samples, and 24 fill samples) and 16 tuff samples collected from Qbt 3. Table 3.4-1 summarizes all of the samples collected from these SWMUs. The request number is shown in the table for each analysis that was requested for an individual sample. One sample was also collected inside the outfall pipe at a depth of 6 ft bgs. Material within the outfall pipe is not likely to migrate out of the pipe because there is nothing flowing through the pipe and the septic tank has been removed. The results of the analysis of this sample are presented in Sections 3.4.3.1.2 and 3.4.3.1.3, but are not combined with the rest of the data set. Additionally, nine soil samples were collected upgradient of these SWMUs. These samples were collected from an area north of the leach field, which is an area not affected by SWMU 0-030(b). The nine samples will be referred to as non-site-related samples and will distinguish constituents associated with SWMU 0-030(b) from those associated with other activities. Table 3.4-2 summarizes the non-site-related samples. The request number is shown in the table for each analysis that was requested for an individual sample. The data from the non-site-related samples are discussed at the end of Sections 3.4.3.1.1, 3.4.3.1.2, and 3.4.3.1.3. Figure 3.4-1 shows the sample locations. All data used quantitatively to identify COPCs at SWMUs 0-030(b,m) were subjected to RRES-RS QA/QC. The results of a detailed review of QA/QC activities are provided in Appendix C.

Table 3.4-2
Summary of Non-Site-Related Samples Associated with SWMUs 0-030(b,m)

Sample ID	Location ID	Depth (ft)	Media	TAL Metals	Gamma Spectroscopy	Isotopic Plutonium	Isotopic Uranium	PCBs	Pesticides	SVOCs
RE00-02-46492	00-02-20804	0–0.5	Fill	1022S	1023S	1023S	1023S	1021S	1021S	1021S
RE00-02-46493	00-02-20805	0–0.5	Fill	1022S	1023S	1023S	1023S	1021S	1021S	1021S
RE00-02-46494	00-02-20806	0–0.5	Fill	1022S	1023S	1023S	1023S	1021S	1021S	1021S
RE00-02-46495	00-02-20807	0–0.5	Fill	1022S	1023S	1023S	1023S	1021S	1021S	1021S
RE00-02-46496	00-02-20808	0–0.5	Fill	1022S	1023S	1023S	1023S	1021S	1021S	1021S
RE00-02-46497	00-02-20809	0–0.5	Fill	1022S	1023S	1023S	1023S	1021S	1021S	1021S
RE00-02-46498	00-02-20810	0–0.5	Fill	1022S	1023S	1023S	1023S	1021S	1021S	1021S
RE00-02-46499	00-02-20811	0–0.5	Fill	1022S	1023S	1023S	1023S	1021S	1021S	1021S
RE00-02-46500	00-02-20812	0–0.5	Fill	1022S	1023S	1023S	1023S	1021S	1021S	1021S

The data review process for identifying COPCs begins with a comparison of site data with

1. naturally occurring background concentrations for inorganic chemicals,
2. naturally occurring background or fallout concentrations for radionuclides, and
3. analytical detection limits for organic chemicals.

Background comparisons and a variety of statistical and graphical methods are used to compare site inorganic and radionuclide data with Laboratory background data. Organic chemical data are evaluated for detection status only. For background comparisons, the first step is to compare the site data with a BV, which is an estimated value for the background data set (upper tolerance limit [95, 95] or the 95% upper confidence bound on the 95th percentile) (LANL 1998, 59730). If a site-specific datum exceed its BV, additional evaluation of the datum may be performed by comparing the range of values in the site data set for that chemical to the range of values for that chemical in the background data set. Graphical analyses (e.g., box plots) may be used, or if adequate data are available, statistical tests that evaluate differences in distribution may be utilized. Nonparametric tests commonly used to assess data distributions include the Gehan, quantile, and slippage tests. Together these tests assess complete shifts in distributions, shifts of a subset of the data, and the potential for some of the site data to be greater than background. Observed significance levels (p-values) are obtained; these values indicate whether a difference does or does not exist between the data sets. A p-value of less than 0.05 is used to infer that there is a difference between the distributions (i.e., the site data are different from the background data), while a p-value greater than 0.05 is used to infer that there is no difference between distributions (i.e., site and background data are similar). Statistical tests, graphical analyses, and results are discussed in Appendix E. Tables D-2.0-1, D-2.0-2, D-2.0-3, D-2.0-4, D-2.0-5, and D-2.0-6 in Appendix D include the data for all analytes (detected and undetected).

3.4.3.1 Soil and Fill Samples

Samples were collected from soil, sediment, and fill material.

3.4.3.1.1 Inorganic Chemical Comparison with BVs

Twenty-four surface soil and twenty-four fill samples were analyzed for TAL metals. Table C-5.0-2 in Appendix C presents detailed results of the QA/QC assessment. Although samples were identified as either soil or fill, they will be grouped together for purposes of comparing the site data to BVs. Sample concentrations were compared with appropriate Laboratory all horizon soil background data set (LANL 1998, 59730). Table 3.4-3 presents the frequency of inorganic chemicals greater than the BV in soil and fill.

Table 3.4-3
Frequency of Inorganic Chemicals Above BVs in Soil and Fill Samples at SWMUs 0-030(b,m)

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	Background Value (mg/kg)	Frequency of Detects Above Background Value	Frequency of Nondetects Above Background Value
Aluminum	Fill	24	24	3980 to 15100	29200	0/24	0/24
Aluminum	Soil	24	24	1810 to 11300	29200	0/24	0/24
Antimony	Fill	24	14	[0.08]8 to [0.23]	0.83	0/24	0/24
Antimony	Soil	24	1	[0.1]1 to [6.9]	0.83	0/24	22/24
Arsenic	Fill	24	24	0.39 to 4.5	8.17	0/24	0/24
Arsenic	Soil	24	24	0.64 to 4.3	8.17	0/24	0/24
Barium	Fill	24	24	51.6 to 225	295	0/24	0/24
Barium	Soil	24	24	27.1 to 301	295	1/24	0/24
Beryllium	Fill	24	24	0.22 to 0.85	1.83	0/24	0/24
Beryllium	Soil	24	21	[0.43] to 1.9	1.83	1/24	0/24
Cadmium	Fill	24	24	0.034 to 0.19	0.4	0/24	0/24
Cadmium	Soil	24	2	0.46 to 0.93	0.4	2/24	22/24
Calcium	Fill	24	24	1590 to 11400	6120	2/24	0/24
Calcium	Soil	24	24	879 to 9170	6120	1/24	0/24
Chromium	Fill	24	24	3.5 to 10	19.3	0/24	0/24
Chromium	Soil	24	24	4.5 to 21.1	19.3	1/24	0/24
Cobalt	Fill	24	24	2 to 11.1	8.64	2/24	0/24
Cobalt	Soil	24	24	1.3 to 9	8.64	1/24	0/24
Copper	Fill	24	24	3.3 to 7.9	14.7	0/24	0/24
Copper	Soil	24	24	2.5 to 77.2	14.7	2/24	0/24
Iron	Fill	24	24	4630 to 16600	21500	0/24	0/24
Iron	Soil	24	24	4110 to 13500	21500	0/24	0/24
Lead	Fill	24	24	6.6 to 46.8	22.3	1/24	0/24
Lead	Soil	24	24	4.7 to 169	22.3	3/24	0/24
Magnesium	Fill	24	24	976 to 3180	4610	0/24	0/24

Table 3.4-3 (continued)

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	Background Value (mg/kg)	Frequency of Detects Above Background Value	Frequency of Nondetects Above Background Value
Magnesium	Soil	24	24	413 to 2450	4610	0/24	0/24
Manganese	Fill	24	24	98 to 495	671	0/24	0/24
Manganese	Soil	24	24	110 to 951	671	1/24	0/24
Mercury	Fill	24	22	0.0094 to [0.036]	0.1	0/24	0/24
Mercury	Soil	24	11	0.04 to 8.4	0.1	6/24	0/24
Nickel	Fill	24	24	3.6 to 10.8	15.4	0/24	0/24
Nickel	Soil	24	24	3.8 to 8.8	15.4	0/24	0/24
Potassium	Fill	24	24	782 to 1950	3460	0/24	0/24
Potassium	Soil	24	24	378 to 1780	3460	0/24	0/24
Selenium	Fill	24	11	0.1 to [0.23]	1.52	0/24	0/24
Selenium	Soil	24	1	[0.22] to 0.5	1.52	0/24	0/24
Silver	Fill	24	16	[0.034] to 0.49	1	0/24	0/24
Silver	Soil	24	6	[0.53] to 21.1	1	6/24	0/24
Sodium	Fill	24	24	56.3 to 1040	915	1/24	0/24
Sodium	Soil	24	24	151 to 696	915	0/24	0/24
Thallium	Fill	24	24	0.095 to 0.44	0.73	0/24	0/24
Thallium	Soil	24	2	0.14 to [0.27]	0.73	0/24	0/24
Thorium	Soil	22	22	4.41 to 13.2	14.6	0/22	0/22
Uranium	Soil	22	22	2.11 to 4.57	1.82	22/22	0/22
Vanadium	Fill	24	24	10 to 29.7	39.6	0/24	0/24
Vanadium	Soil	24	24	5.7 to 24.7	39.6	0/24	0/24
Zinc	Fill	24	24	17.1 to 53.1	48.8	1/24	0/24
Zinc	Soil	24	24	17 to 110	48.8	4/24	0/24

Barium, beryllium, cadmium, calcium, chromium, cobalt, copper, lead, manganese, mercury, silver, sodium, uranium, and zinc were detected above the soil BV in at least one sample. Antimony and cadmium had detection limits above the BV. Further statistical tests were run for all of these analytes except silver. The BV for silver is a detection limit and there is no background data set to perform further statistical tests. The probability values for the statistical tests are presented in Table E-3.1-3 in Appendix E. The results of the Gehan and Quantile tests show that only cadmium, calcium, mercury, and sodium were significantly above background; barium, beryllium, chromium, cobalt, lead, manganese, uranium, and zinc were not significantly above background. The distributions of calcium and mercury data are shown with LANL background data in Figures E-3.1-7 and E-3.1-8. Because copper and lead also had maximum concentrations at the same location as the maximum concentration of mercury, the slippage test was also run to evaluate the impact of these high concentrations on the data set. As discussed in Section E-3.1.2, lead is retained as a COPC, but copper is not a COPC. Figure E-3.1-9 shows the distribution of sodium site data in comparison to the LANL background data for sodium. Sodium had one detected value above the BV and all of the sodium results are well within the range of the background data. Sodium is not retained as a COPC. Antimony was also significantly above background due to a subset of the results where the detection limit was elevated. Figures E-3.1-1 and E-3.1-2 show the distribution of antimony with and without the elevated detection limits. Further discussion of the antimony data is presented in Appendix E. Antimony is not retained as a COPC. Cadmium, calcium, lead, mercury, and silver are retained as COPCs.

Table 3.4-4 presents the concentrations above the BV in soil and fill.

Table 3.4-4
Inorganic Chemicals Above BVs in Soil and Fill Samples at SWMUs 0-030(b,m)

Sample ID	Location ID	Depth (ft)	Media	Cadmium (mg/kg)	Calcium (mg/kg)	Mercury (mg/kg)	Silver (mg/kg)
Soil Background Value (mg/kg)				**0.4**	**6120**	**0.1**	**1**
RE00-02-46456	00-02-20784	5.5–6	Fill	—*	9110	—	—
RE00-02-46457	00-02-20784	6.5–7	Fill	—	11400	—	—
0100-95-0479	00-04304	10–10.3	Soil	0.93	—	8.4	21.1
0100-95-0485	00-04308	4.5–4.7	Soil	0.46 (J)	—	—	1.1 (J)
0100-95-0704	00-04335	9–9.5	Soil	—	—	0.65 (J+)	—
0100-95-0715	00-04344	10–11	Soil	—	9170	—	—
0100-95-0716	00-04345	4.5–5.5	Soil	—	—	0.47	13.8 (J-)
0100-95-0717	00-04346	7.5–8.5	Soil	—	—	0.24	13.3 (J-)
0100-95-0718	00-04347	4–5	Soil	—	—	0.64	4.6 (J-)
0100-95-0740	00-04361	4.5–4.8	Soil	—	—	0.45 (J-)	3.9 (J-)

*— = Not above the BV.

Non-Site-Related Samples

The results of the non-site-related samples listed in Table 3.4-2 were compared to the all soil horizon BV. This list of analytes was compared to the COPC list from the site data. Table 3.4-5 shows the analytes that had at least one detect above the BV in the non-site-related samples. Cadmium, lead, and mercury were retained as COPCs from the site data and were also above the BV in at least one non-site-related sample. Figures E-4.2-1 and E-4.2-2 in Appendix E show the site data, non-site-related data, and background data for calcium and mercury. Calcium and silver were not detected above a BV in the non-site-related data. However, other various metals were detected in non-site-related samples above the BV, particularly at Locations 00-02-20805 and 00-02-20806. Lead was detected above the BV in six of the nine non-site-related samples. Figure E-4.2-3 shows a comparison of site data, non-site-related data, and background data for lead at SWMUs 0-030(b,m).

3.4.3.1.2 Radionuclide Comparison with BVs and Fallout Values

Forty-two soil and sediment samples were analyzed for americium-241, 66 soil, sediment, and fill samples were analyzed for isotopic plutonium and for gamma-emitting radionuclides, 23 soil samples were analyzed for tritium, and twenty-five soil and fill samples were analyzed for isotopic uranium. Table C-5.0-4 in Appendix C presents detailed results of the QA/QC assessment. Two samples were classified as sediment samples. The BV for sediment is more applicable to canyon sediment and not to the sediment that may be found on the mesa top in the same area as soil and fill. So, the sediment, soil, and fill sample data are grouped together for purposes of this background comparison. Sample concentrations were compared with appropriate Laboratory all horizon soil background data set or fallout value. Table 3.4-6 presents the frequency of detected of the radionuclides collected in surface soil, sediment, and fill. Note

Table 3.4-5
Inorganic Chemicals Above BVs in Non-Site-Related Samples at SWMUs 0-030(b,m)

Sample ID	Location ID	Depth (ft)	Media	Cadmium (mg/kg)	Cobalt (mg/kg)	Lead (mg/kg)	Manganese (mg/kg)	Mercury (mg/kg)	Zinc (mg/kg)
Soil Background Value (mg/kg)				0.4	8.64	22.3	671	0.1	48.8
SWMU 0-030(b)									
RE00-02-46493	00-02-20805	0–0.5	Fill	—*	16.7	46.5	1830	—	—
RE00-02-46494	00-02-20806	0–0.5	Fill	0.43	—	64.9	—	0.6	88.6
RE00-02-46496	00-02-20808	0–0.5	Fill	—	—	56.5	—	—	50.1
RE00-02-46497	00-02-20809	0–0.5	Fill	—	—	22.7	—	—	—
RE00-02-46498	00-02-20810	0–0.5	Fill	—	—	26.7	—	—	—
RE00-02-46500	00-02-20812	0–0.5	Fill	—	—	25.6	—	—	—

*— = Not above the BV.

Table 3.4-6
Frequency of Detected Radionuclides
Above BVs or FVs in Soil, Sediment, and Fill Samples at SWMUs 0-030(b,m)

Analyte	Media	Number of Analyses[b]	Number of Detects	Concentration Range (pCi/g)	Background Value (pCi/g)	Frequency of Detects Above BV or FV or Detected Below 6 in.
Americium-241	Fill	24	0	[-0.19 to 0.15]	0.013	0/24
Americium-241	Sediment	2	2	0.014 to 0.025	0.013	2/2
Americium-241	Soil	40	28	[-0.002] to 0.963	0.013	26/40
Cesium-134	Fill	24	0	[-0.061 to 0.062]	na[a]	0/24
Cesium-134	Sediment	2	0	[0.08 to 0.12]	na	0/2
Cesium-134	Soil	11	0	[-0.016 to 0.16]	na	0/11
Cesium-137	Fill	24	0	[-0.121 to 0.044]	1.65	0/24
Cesium-137	Sediment	2	0	[0.12 to 0.13]	1.65	0/2
Cesium-137	Soil	40	3	[0.037] to 0.302	1.65	2/40
Cobalt-60	Fill	24	0	[-0.074 to 0.083]	na	0/24
Cobalt-60	Sediment	2	0	[0.04 to 0.07]	na	0/2
Cobalt-60	Soil	40	0	[0.032 to 0.12]	na	0/40
Europium-152	Fill	24	0	[-0.14 to 0.37]	na	0/24
Europium-152	Soil	34	0	[-0.083 to 0.49]	na	0/34
Plutonium-238	Fill	24	0	[-0.0038 to 0.0087]	0.023	0/24
Plutonium-238	Sediment	2	1	[0.003] to 0.01	0.023	1/2
Plutonium-238	Soil	40	9	[-0.007] to 0.027	0.023	8/40
Plutonium-239	Fill	24	0	[-0.0045 to 0.032]	0.054	0/24

Table 3.4-6 (continued)

Analyte	Media	Number of Analyses[b]	Number of Detects	Concentration Range (pCi/g)	Background Value (pCi/g)	Frequency of Detects Above BV or FV or Detected below 6 in.
Plutonium-239	Sediment	2	1	[0.004] to 0.12	0.054	1/2
Plutonium-239	Soil	40	28	[-0.002] to 7.232	0.054	26/40
Ruthenium-106	Fill	24	0	[-0.5 to 0.52]	na	0/24
Ruthenium-106	Sediment	2	0	[0.42 to 0.76]	na	0/2
Ruthenium-106	Soil	40	0	[-0.294 to 1.12]	na	0/40
Sodium-22	Sediment	2	0	[0.06 to 0.07]	na	0/2
Sodium-22	Soil	40	0	[-0.041 to 0.1]	na	0/40
Tritium	Soil	23	3	[-1.07] to 0.63 pCi/mL	0.766 pCi/mL	3/23
Uranium-234	Fill	24	24	0.64 to 1.04	2.59	0/24
Uranium-234	Soil	1	1	7.378 to 7.378	2.59	1/1
Uranium-235	Fill	24	5	[0.023] to 0.077	0.2	0/24
Uranium-235	Sediment	2	0	[0.12 to 0.15]	0.2	0/2
Uranium-235	Soil	11	1	[-0.249] to [0.58]	0.2	1/11
Uranium-238	Fill	24	24	0.62 to 1	2.29	0/24
Uranium-238	Soil	1	1	7.167 to 7.167	2.29	1/1

[a] na = Not available.

[b] Numbers of analyses for gamma-emitting radionuclides varies because of inconsistencies and changes in the list of analytes reported by various laboratories over the years.

that the numbers of analyses for specific radionuclides may differ from each other and from the total number of analyses requested; the list of analytes reported by the analytical laboratories, particularly for gamma-emitting radionuclides, has not been consistent throughout the years.

Americium-241, cesium-137, plutonium-238, plutonium-239, tritium, uranium-234, uranium-235, and uranium-238 were detected above the BV or FV in at least one sample.

Americium-241 was not detected in the fill samples collected in 2002. These twenty-four samples were analyzed by gamma spectroscopy, which is not directly comparable to the FV for americium-241 since the background samples were analyzed by alpha spectroscopy, which is a more sensitive method. Americium-241, however, was detected in twenty-eight soil samples and 26 of these detected concentrations were above the FV. Figure E-3.1-13 shows the distribution of the site data compared to background data. Americium-241 is retained as a COPC.

Cesium-137 was detected in three soil samples. The FV was compared to surface samples (0 to 0.5 ft) and the sample collected near the surface had a detected concentration of cesium-137 that was less than the FV. The other two detected concentrations of cesium-137 were also collected in soil, but at depths between 7.5 and 10.5 ft in areas where the soil has been disturbed. Statistical tests indicate that the cesium-137 is not different than background. These results are presented in Table E-3.1-4. Figure E-3.1-14 shows the actual distribution of the cesium-137 data for both site and background data. Cesium-137 is not retained as a COPC.

Plutonium-238 was detected in ten soil and sediment samples and nine of these samples were collected below a depth of 4 ft, but collected from disturbed soil. An evaluation of the plutonium-238 data and the background data indicate that the plutonium-238 distribution is not different from background. Plutonium-239 was detected in twenty-nine samples out of sixty-six samples. Similar to the plutonium-238 samples, only one sample with detected plutonium-239 is within 0.5 ft of the surface. The other samples where plutonium-239 was detected were collected from disturbed soil. If these data are grouped together regardless of depth, the box plots of site and background data and the statistical tests indicate that plutonium-239 is elevated above background. Figure E-3.1-15 compares the distributions of the site data, non-site-related data, and the background data for plutonium-239. Results of the statistical tests for the soil and fill data are presented in Table E-3.1-4. Plutonium-239 is retained as a COPC.

Tritium was detected in three samples. The tritium data were all converted to pCi/mL in order to compare the results to the FV of 0.76 pCi/mL for soil samples. Tritium was above the FV of 0.76 pCi/mL in two samples. Both of the samples that had detected concentrations of tritium were collected at least 4.5 ft bgs in disturbed soil, so the FV may be used for comparison at these depths. Statistical tests (Table E-3.1-4) show that tritium is significantly different from background. Tritium is retained as a COPC.

Of the detected results for isotopic uranium, uranium-234, uranium-235, and uranium-238 were each detected once above the BV. The maximum detected values for each were also in the same sample, which was collected under the inlet pipe at SWMU 0-030(m) The BVs for isotopic uranium are surrogates from sediment data, so a background data set is not available for further statistical tests. Uranium-234, uranium-235, and uranium-238 are retained as COPCs.

Therefore, americium-241, plutonium-239, tritium, uranium-234, uranium-235, and uranium-238 are retained as COPCs in the soil, sediment, and fill material and are further evaluated in the site assessments. Table 3.4-7 presents the concentrations above the BV or fallout value in soil, sediment, and fill material as well as detected concentrations below a depth of 6 in. for COPCs.

Table 3.4-7
Radionuclides Above BVs or FVs in Soil, Sediment, and Fill Samples at SWMUs 0-030(b,m)

Sample ID	Location ID	Depth (ft)	Media	Americium-241 (pCi/g)	Plutonium-239 (pCi/g)	Tritium (pCi/mL)	Uranium-234 (pCi/g)	Uranium-235 (pCi/g)	Uranium-238 (pCi/g)
Soil Background Value (pCi/g)				**0.013**	**0.054**	**0.766 pCi/mL**	**2.59**	**0.2**	**2.29**
0100-95-0473	00-04302	0–0.5	Soil	0.018	—*	—	—	—	—
0100-95-0479	00-04304	10–10.3	Soil	0.049	7.232 (J)	—	—	—	—
0100-95-0484	00-04308	4.5–4.7	Soil	0.025	—	1.56	—	—	—
0100-95-0489	00-04309	4.2–4.8	Soil	0.011	—	—	—	—	—
0100-95-0491	00-04311	0–0.5	Soil	0.034	0.056	—	—	—	—
0100-95-0687	00-04313	9-9.5	Sediment	0.014			—	—	—
0100-95-0688	00-04314	9–9.5	Sediment	—	0.12	—	—	—	—
0100-95-0689	00-04315	5–5.2	Soil	—	0.086	—	—	—	—
0100-95-0715	00-04344	10–11	Soil	0.004	—	4.8	—	—	—
0100-95-0716	00-04345	4.5–5.5	Soil	—	0.894	—	—	—	—

Table 3.4-7 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241 (pCi/g)	Plutonium-239 (pCi/g)	Tritium (pCi/mL)	Uranium-234 (pCi/g)	Uranium-235 (pCi/g)	Uranium-238 (pCi/g)
0100-95-0717	00-04346	7.5–8.5	Soil	—	0.8	—	—	—	—
0100-95-0718	00-04347	4–5	Soil	—	0.401	—	—	—	—
0100-95-0725	00-04353	6.5–7	Soil	—	0.016	—	—	—	—
0100-95-0726	00-04354	0–9	Soil	0.031	—	—	—	—	—
0100-95-0727	00-04355	6–7	Soil	—	—	—	—	—	—
0100-95-0728	00-04355	8–9	Soil	—	0.023	—	—	—	—
0100-95-0729	00-04356	2–8	Soil	0.113	—	—	—	—	—
0100-95-0730	00-04357	4–5	Soil	0.225	0.02	—	—	—	—
0100-95-0731	00-04357	6–7	Soil	0.21	—	—	—	—	—
0100-95-0732	00-04358	4.5–4.7	Soil	0.466	0.15	—	—	—	—
0100-95-0733	00-04359	0–6	Soil	0.043	0.072	—	—	—	—
0100-95-0734	00-04360	3–4	Soil	0.963	0.021	—	—	—	—
0100-95-0735	00-04360	5–6	Soil	0.133	0.016	—	—	—	—
0100-95-0740	00-04361	4.5–4.8	Soil	0.026	0.219	—	—	—	—
0100-95-0741	00-04362	9–10	Soil	0.029	0.008	—	—	—	—
0100-95-0742	00-04363	9–10	Soil	0.04	—	—	—	—	—
0100-95-0743	00-04364	10–11	Soil	0.029	—	—	—	—	—
0100-95-0749	00-04367	0–9	Soil	0.045	0.042	—	—	—	—
0100-95-0750	00-04368	10–11	Soil	0.035	0.004	—	—	—	—
0100-95-0480	00-04305	11–11.2	Soil	0.011	0.534	—	—	—	—
0100-95-0481	00-04305	11.3–11.5	Soil	0.016	0.122	—	—	—	—
0100-95-0482	00-04306	11.3–11.5	Soil	0.023	0.135	—	—	—	—
0100-95-0483	00-04307	5.5–6	Soil	—	0.286	—	—	—	—
0100-95-0486	00-04307	6–6.5	Soil	—	0.111	—	—	—	—
0100-95-0677	00-04326	5.5–6	Soil	0.009	0.923	—	7.34	0.35	7.17
0100-95-0454	00-04327	10.5–11	Soil	0.01	0.214	—	—	—	—
0100-95-0914	00-04371	11–11.5	Soil	0.027	0.112	—	—	—	—
0100-95-0915	00-04372	11–11.5	Soil	0.025	0.574	—	—	—	—

* — = Not above the BV.

The sample of material collected inside the pipe was analyzed for isotopic uranium, isotopic plutonium, strontium-90, tritium, and radionuclides by gamma spectroscopy. The results were reviewed for detection status. Plutonium-239, uranium-234, uranium-235, and uranium-238 were all detected in this sample. Table 3.4-8 presents the concentrations of the radionuclides in the sample that were detected. The BV for soil is also presented for comparison purposes although the material in the pipe was not assigned a media code.

Table 3.4-8
Detected Radionuclides in Inside Pipe Sample at SWMUs 0-030(b,m)

Sample ID	Location ID	Depth (ft)	Media	Plutonium-239 (pCi/g)	Uranium-234 (pCi/g)	Uranium-235 (pCi/g)	Uranium-238 (pCi/g)
Soil Background Value (pCi/g)				0.054	2.59	0.2	2.29
RE00-02-45745	00-02-19785	6–6.5	n/a*	0.532	3	0.163	2.69

Note: Units are pCi/g.

*n/a = Not applicable.

Non-Site-Related Samples

The nine non-site-related samples were analyzed for isotopic plutonium, isotopic uranium, and gamma-emitting radionuclides. Plutonium-239 was detected in six of the nine samples, and three of these detected concentrations were above the BV. Cesium-137, uranium-234, uranium-235, and uranium-238 were also detected, but below the BV and FVs. The remaining radionuclides were not detected in any of the nine samples. Table 3.4-9 shows the concentrations of plutonium-239 detected above the FV. Figures E-4.2-4 to E-4.2-6 show the comparison of the site data, non-site-related data, and the LANL background data for americium-241, cesium-137, and plutonium-239.

Table 3.4-9
Radionuclides Detected Above BVs or FVs in Non-Site-Related Samples of Fill at SWMUs 0-030(b,m)

Sample ID	Location ID	Depth (ft)	Media	Plutonium-239 (pCi/g)
Soil Background Value (pCi/g)				0.054
RE00-02-46494	00-02-20806	0–0.5	Fill	0.104
RE00-02-46495	00-02-20807	0–0.5	Fill	0.282
RE00-02-46496	00-02-20808	0–0.5	Fill	0.165

3.4.3.1.3 Evaluation of Organic Chemicals

Sixty-nine soil, sediment, and fill samples were analyzed for pesticides and PCBs, and 66 samples were analyzed for SVOCs. Forty-two soil and fill samples were analyzed for VOCs. Table C-5.0-3 in Appendix C presents detailed results of the QA/QC assessment. Sample results were reviewed for detection status. Table 3.4-10 presents the frequency of detected organic chemicals in soil and fill.

Table 3.4-10
Frequency of Detected Organic Chemicals in Soil, Sediment, and Fill Samples at SWMUs 0-030(b,m)

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	Frequency of Detects
Acetone	Soil	22	1	[0.013] to 0.073	1/22
Aldrin	Soil	43	2	0.00042 to [0.0092]	2/43
Anthracene	Soil	40	3	0.038 to [0.8]	3/40

Table 3.4-10 (continued)

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	Frequency of Detects
Aroclor-1254	Fill	24	2	[0.034] to 0.17	2/24
Aroclor-1260	Soil	43	2	[0.033] to [0.18]	2/43
Benz(a)anthracene	Soil	40	6	0.043 to 1.1	6/40
Benzo(a)pyrene	Soil	40	5	0.042 to 1.2	5/40
Benzo(b)fluoranthene	Soil	40	6	0.031 to 1.4	6/40
Benzo(g,h,i)perylene	Soil	40	3	0.073 to 1.1	3/40
Benzo(k)fluoranthene	Soil	40	5	0.04 to 1.2	5/40
Benzoic Acid	Fill	24	6	0.07 to [1.8]	6/24
Benzoic Acid	Soil	40	1	0.31 to [9]	1/40
Bis(2-ethylhexyl)phthalate	Fill	24	2	0.14 to 0.39	2/24
Bis(2-ethylhexyl)phthalate	Soil	40	3	0.054 to [1.8]	3/40
Chlordane[alpha-]	Fill	24	1	[0.0017 to 0.046]	1/24
Chlordane[alpha-]	Soil	43	4	0.0013 to [0.0092]	4/43
Chlordane[gamma-]	Fill	24	1	[0.0017] to [0.046]	1/24
Chlordane[gamma-]	Soil	43	1	0.00093 to [0.0092]	1/43
Chrysene	Soil	40	7	0.04 to 1.6	7/40
DDD[4,4'-]	Soil	43	13	[0.0033] to 0.463	13/43
DDE[4,4'-]	Fill	24	2	[0.0017] to [0.046]	2/24
DDE[4,4'-]	Soil	43	10	[0.0033] to 0.16	10/43
DDT[4,4'-]	Fill	24	2	[0.0017 to 0.046]	2/24
DDT[4,4'-]	Sediment	2	1	[0.004] to 0.011	1/2
DDT[4,4'-]	Soil	43	16	[0.0033] to 0.672	16/43
Dibenz(a,h)anthracene	Soil	40	1	[0.34] to [0.8]	1/40
Dichlorobenzene[1,2-]	Fill	44	1	0.00055 to [0.38]	1/44
Dichlorobenzene[1,4-]	Soil	62	2	[0.00]5 to [1.8]	2/62
Dichloroethene[cis-1,2-]	Soil	22	1	0.002 to [0.006]	1/22
Dieldrin	Soil	43	2	[0.0033] to [0.018]	2/43
Di-n-butylphthalate	Soil	40	3	0.058 to [1.8]	3/40
Dinitro-2-methylphenol[4,6-]	Fill	24	1	0.2 to [1.8]	1/24
Dinitrophenol[2,4-]	Fill	24	1	0.12 to [1.8]	1/24
Endrin	Soil	43	1	[0.0033] to [0.018]	1/43
Endrin Aldehyde	Soil	43	1	[0.0004] to [0.018]	1/43
Ethylbenzene	Soil	22	1	0.002 to [0.006]	1/22
Fluoranthene	Fill	24	1	0.16 to [0.38]	1/24
Fluoranthene	Soil	40	10	0.053 to 1.3	10/40
Indeno(1,2,3-cd)pyrene	Soil	40	3	0.06 to 1.1	3/40
Isopropyltoluene[4-]	Fill	20	2	0.0004 to [0.0058]	2/20
Isopropyltoluene[4-]	Soil	22	1	[0.005] to 0.02	1/22

Table 3.4-10 (continued)

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	Frequency of Detects
Methylene Chloride	Soil	22	1	0.002 to [0.017]	1/22
Pentachlorophenol	Soil	40	1	0.23 to [4]	1/40
Phenanthrene	Soil	40	9	0.042 to [0.8]	9/40
Propylbenzene[1-]	Soil	22	1	0.004 to [0.006]	1/22
Pyrene	Soil	40	10	0.04 to 1.8	10/40
Tetrachloroethene	Soil	22	10	0.001 to 0.031	10/22
Toluene	Fill	20	6	[0.00041] to 0.0094	6/20
Toluene	Soil	22	6	0.001 to [0.006]	6/22
Trimethylbenzene[1,2,4-]	Soil	22	1	[0.005] to 0.039	1/22
Trimethylbenzene[1,3,5-]	Soil	22	1	[0.005] to 0.013	1/22
Xylene (Total)	Soil	12	1	0.004 to [0.006]	1/12
Xylene[1,2-]	Soil	20	1	0.003 to [0.006]	1/20

There were 43 organic chemicals detected in the soil, sediment, and fill. The organic chemicals that were detected in more than two samples were primarily PAHs, DDE, and DDT. Table 3.4-11 presents the detected concentrations in soil, sediment, and fill. All 43 detected organic chemicals presented in Table 3.4-10 are retained as COPCs.

The sample of material collected inside the pipe was analyzed for PCBs, pesticides, SVOCs, and VOCs. The results were reviewed for detection status. Twenty organic chemicals were detected in this sample. Table 3.4-12 summarizes the concentrations of detected organic chemicals in this sample.

Non-Site-Related Samples

The nine non-site-related samples listed in Table 3.4-2 were analyzed for pesticides, PCBs, and SVOCs. There were 16 detected organics in the non-site-related samples that were primarily PAHs and PCBs. PCBs and PAHs were also detected in the SWMUs 0-030(b,m) site samples. Locations 00-02-20806, 00-02-20807, 00-02-20808 were the locations with most of the detected organic chemicals. Two locations, 00-02-20809 and 00-02-20812, did not have any detected organic chemicals. The data for the organic chemicals that were detected in the non-site-related samples are presented in Table 3.4-13. Figure E-4.2-7 to E-4.2-9 show the distributions of site data and non-site-related data for benz(a)anthracene, 4,4'-DDT, and fluoranthene.

Table 3.4-11
Detected Organic Chemicals in Soil, Sediment, and Fill Samples at SWMUs 0-030(b,m)

Sample ID	Location ID	Depth (ft)	Media	Acetone (mg/kg)	Aldrin (mg/kg)	Anthracene (mg/kg)	Aroclor-1254 (mg/kg)	Aroclor-1260 (mg/kg)	Benz(a)anthracene (mg/kg)	Benzo(a)pyrene (mg/kg)	Benzo(b)fluoranthene (mg/kg)	Benzo(g,h,i)perylene (mg/kg)	Benzo(k)fluoranthene (mg/kg)
SWMU 0-030(b)													
RE00-02-46452	00-02-20782	6.5–7	Fill	—*	—	—	—	—	—	—	—	—	—
RE00-02-46453	00-02-20782	7.5–8	Fill	—	—	—	—	—	—	—	—	—	—
RE00-02-46454	00-02-20783	6.5–8	Fill	—	—	—	—	—	—	—	—	—	—
RE00-02-46455	00-02-20783	7.5–8	Fill	—	—	—	—	—	—	—	—	—	—
RE00-02-46456	00-02-20784	5.5–6	Fill	—	—	—	—	—	—	—	—	—	—
RE00-02-46457	00-02-20784	6.5–7	Fill	—	—	—	—	—	—	—	—	—	—
RE00-02-46470	00-02-20791	1.7–2	Fill	—	—	—	0.072	—	—	—	—	—	—
RE00-02-46471	00-02-20791	2.3–2.8	Fill	—	—	—	0.17	—	—	—	—	—	—
RE00-02-46472	00-02-20792	5.5–6	Fill	—	—	—	—	—	—	—	—	—	—
RE00-02-46474	00-02-20793	2.5–2.8	Fill	—	—	—	—	—	—	—	—	—	—
RE00-02-46486	00-02-20799	0.67–1.17	Fill	—	—	—	—	—	—	—	—	—	—
RE00-02-46488	00-02-20800	0–0.5	Fill	—	—	—	—	—	—	—	—	—	—
RE00-02-46490	00-02-20802	0–0.5	Fill	—	—	—	—	—	—	—	—	—	—
RE00-02-46491	00-02-20803	0–0.5	Fill	—	—	—	—	—	—	—	—	—	—
0100-95-0472	00-04301	0–0.5	Soil	—	—	—	—	—	—	—	—	—	—
0100-95-0479	00-04304	10–10.3	Soil	—	—	—	—	8.19E-02	—	—	—	—	—
0100-95-0491	00-04311	0–0.5	Soil	—	—	—	—	—	—	—	—	—	—
0100-95-0688	00-04314	9–9.5	Sediment	—	—	—	—	—	—	—	—	—	—
0100-95-0715	00-04344	10–11	Soil	—	—	—	—	—	—	—	—	—	—
0100-95-0716	00-04345	4.5–5.5	Soil	—	—	—	—	—	0.06 (J)	0.051 (J)	0.049 (J)	—	0.051 (J)
0100-95-0717	00-04346	7.5–8.5	Soil	—	—	—	—	—	—	—	—	—	—
0100-95-0718	00-04347	4–5	Soil	—	—	—	—	—	—	—	—	—	—
0100-95-0725	00-04353	6.5–7	Soil	—	—	—	—	—	—	—	—	—	—

Table 3.4-11 (continued)

Sample ID	Location ID	Depth (ft)	Media	Acetone (mg/kg)	Aldrin (mg/kg)	Anthracene (mg/kg)	Aroclor-1254 (mg/kg)	Aroclor-1260 (mg/kg)	Benz(a)anthracene (mg/kg)	Benzo(a)pyrene (mg/kg)	Benzo(b)fluoranthene (mg/kg)	Benzo(g,h,i)perylene (mg/kg)	Benzo(k)fluoranthene (mg/kg)
0100-95-0726	00-04354	0–9	Soil	—	—	—	—	—	—	—	—	—	—
0100-95-0727	00-04355	6–7	Soil	7.3E-02	—	—	—	—	—	—	—	—	—
0100-95-0728	00-04355	8–9	Soil	—	—	—	—	—	—	—	—	—	—
0100-95-0729	00-04356	2–8	Soil	—	—	0.038 (J)	—	—	0.054 (J)	0.042 (J)	0.038 (J)	—	0.04 (J)
0100-95-0730	00-04357	4–5	Soil	—	—	—	—	—	—	—	—	—	—
0100-95-0731	00-04357	6–7	Soil	—	—	—	—	—	—	—	—	—	—
0100-95-0732	00-04358	4.5–4.7	Soil	—	—	—	—	—	—	—	—	—	—
0100-95-0733	00-04359	0–6	Soil	—	—	—	—	—	—	—	—	—	—
0100-95-0734	00-04360	3–4	Soil	—	—	—	—	—	—	—	—	—	—
0100-95-0735	00-04360	5–6	Soil	—	—	—	—	—	0.043 (J)	—	0.031 (J)	—	0.046 (J)
0100-95-0740	00-04361	4.5–4.8	Soil	—	—	0.19 (J)	—	—	1.1 (J)	1.2 (J)	1.4 (J)	1.1 (J)	1.2 (J)
0100-95-0743	00-04364	10–11	Soil	—	—	—	—	—	—	—	—	—	—
0100-95-0749	00-04367	0–9	Soil	—	—	—	—	—	—	—	—	—	—
0100-95-0750	00-04368	10–11	Soil	—	—	—	—	—	—	—	—	—	—
0100-96-1751	00-05751	4–4.5	Soil	—	—	—	—	0.17	—	—	—	—	—
SWMU 0-030(m)													
0100-95-0480	00-04305	11–11.2	Soil	—	—	—	—	—	—	—	—	—	—
0100-95-0481	00-04305	11.3–11.5	Soil	—	—	—	—	—	—	—	—	—	—
0100-95-0482	00-04306	11.3–11.5	Soil	—	—	—	—	—	—	—	—	—	—
0100-95-0483	00-04307	5.5–6	Soil	—	—	—	—	—	0.5	0.45	0.37 (J)	0.21 (J)	—
0100-95-0486	00-04307	6–6.5	Soil	—	—	—	—	—	—	—	—	—	—
0100-95-0677	00-04326	5.5–6	Soil	—	—	0.046 (J)	—	—	0.082 (J)	0.089 (J)	0.081 (J)	7.3E-02 (J)	0.072 (J)
0100-95-0454	00-04327	10.5–11	Soil	—	—	—	—	—	—	—	—	—	—
0100-95-0914	00-04371	11–11.5	Soil	—	0.00046 (J)	—	—	—	—	—	—	—	—
0100-95-0915	00-04372	11–11.5	Soil	—	0.00042 (J)	—	—	—	—	—	—	—	—

Table 3.4-11 (continued)

Sample ID	Location ID	Depth (ft)	Media	Dichlorobenzene[1,2-] (mg/kg)	Dichlorobenzene[1,4-] (mg/kg)	Dichloroethene[cis-1,2-] (mg/kg)	Dieldrin (mg/kg)	Di-n-butylphthalate (mg/kg)	Dinitro-2-methylphenol[4,6-] (mg/kg)	Dinitrophenol[2,4-] (mg/kg)	Endrin (mg/kg)	Endrin Aldehyde (mg/kg)
SWMU 0-030(b)												
RE00-02-46452	00-02-20782	6.5–7	Fill	—	—	—	—	—	—	—	—	—
RE00-02-46453	00-02-20782	7.5–8	Fill	—	—	—	—	—	—	—	—	—
RE00-02-46454	00-02-20783	6.5–8	Fill	—	—	—	—	—	—	—	—	—
RE00-02-46455	00-02-20783	7.5–8	Fill	—	—	—	—	—	—	—	—	—
RE00-02-46456	00-02-20784	5.5–6	Fill	0.00055 (J)	—	—	—	—	0.2 (J)	0.12 (J)	—	—
RE00-02-46457	00-02-20784	6.5–7	Fill	—	—	—	—	—	—	—	—	—
RE00-02-46470	00-02-20791	1.7–2	Fill	—	—	—	—	—	—	—	—	—
RE00-02-46471	00-02-20791	2.3–2.8	Fill	—	—	—	—	—	—	—	—	—
RE00-02-46472	00-02-20792	5.5–6	Fill	—	—	—	—	—	—	—	—	—
RE00-02-46474	00-02-20793	2.5–2.8	Fill	—	—	—	—	—	—	—	—	—
RE00-02-46486	00-02-20799	0.67–1.17	Fill	—	—	—	—	—	—	—	—	—
RE00-02-46488	00-02-20800	0–0.5	Fill	—	—	—	—	—	—	—	—	—
RE00-02-46490	00-02-20802	0–0.5	Fill	—	—	—	—	—	—	—	—	—
RE00-02-46491	00-02-20803	0–0.5	Fill	—	—	—	—	—	—	—	—	—
0100-95-0472	00-04301	0–0.5	Soil	—	—	—	—	—	—	—	—	—
0100-95-0479	00-04304	10–10.3	Soil	—	—	—	7.9E-03	—	—	—	—	—
0100-95-0491	00-04311	0–0.5	Soil	—	—	—	—	—	—	—	—	—
0100-95-0688	00-04314	9–9.5	Sediment	—	—	—	—	—	—	—	—	—
0100-95-0715	00-04344	10–11	Soil	—	—	—	—	—	—	—	—	—
0100-95-0716	00-04345	4.5–5.5	Soil	—	—	—	—	—	—	—	—	—
0100-95-0717	00-04346	7.5–8.5	Soil	—	—	—	—	—	—	—	—	—
0100-95-0718	00-04347	4–5	Soil	—	—	—	—	—	—	—	—	—
0100-95-0725	00-04353	6.5–7	Soil	—	—	—	0.0054	—	—	—	—	—
0100-95-0726	00-04354	0–9	Soil	—	—	—	—	0.081 (J)	—	—	—	—

Table 3.4-11 (continued)

Sample ID	Location ID	Depth (ft)	Media	Dichlorobenzene[1,2-] (mg/kg)	Dichlorobenzene[1,4-] (mg/kg)	Dichloroethene[cis-1,2-] (mg/kg)	Dieldrin (mg/kg)	Di-n-butylphthalate (mg/kg)	Dinitro-2-methylphenol[4,6-] (mg/kg)	Dinitrophenol[2,4-] (mg/kg)	Endrin (mg/kg)	Endrin Aldehyde (mg/kg)
0100-95-0727	00-04355	6–7	Soil	—	—	—	—	—	—	—	—	—
0100-95-0728	00-04355	8–9	Soil	—	—	—	—	0.058 (J)	—	—	—	—
0100-95-0729	00-04356	2–8	Soil	—	—	—	—	—	—	—	—	—
0100-95-0730	00-04357	4–5	Soil	—	—	—	—	—	—	—	—	—
0100-95-0731	00-04357	6–7	Soil	—	—	—	—	—	—	—	—	—
0100-95-0732	00-04358	4.5–4.7	Soil	—	—	—	—	0.062 (J)	—	—	—	—
0100-95-0733	00-04359	0–6	Soil	—	—	—	—	—	—	—	—	—
0100-95-0734	00-04360	3–4	Soil	—	—	—	—	—	—	—	—	—
0100-95-0735	00-04360	5–6	Soil	—	—	—	—	—	—	—	—	—
0100-95-0740	00-04361	4.5–4.8	Soil	—	—	—	—	—	—	—	—	—
0100-95-0743	00-04364	10–11	Soil	—	—	—	—	—	—	—	—	—
0100-95-0749	00-04367	0–9	Soil	—	0.11	0.002 (J)	—	—	—	—	—	—
0100-95-0750	00-04368	10–11	Soil	—	—	—	—	—	—	—	—	—
0100-96-1751	00-05751	4–4.5	Soil	—	—	—	—	—	—	—	—	—
SWMU 0-030(m)												
0100-95-0480	00-04305	11–11.2	Soil	—	—	—	—	—	—	—	0.00402	0.00758
0100-95-0481	00-04305	11.3–11.5	Soil	—	—	—	—	—	—	—	—	—
0100-95-0482	00-04306	11.3–11.5	Soil	—	—	—	—	—	—	—	—	—
0100-95-0483	00-04307	5.5–6	Soil	—	—	—	—	—	—	—	—	—
0100-95-0486	00-04307	6–6.5	Soil	—	—	—	—	—	—	—	—	—
0100-95-0677	00-04326	5.5–6	Soil	—	—	—	—	—	—	—	—	—
0100-95-0454	00-04327	10.5–11	Soil	—	—	—	—	—	—	—	—	—
0100-95-0914	00-04371	11–11.5	Soil	—	—	—	—	—	—	—	—	—
0100-95-0915	00-04372	11–11.5	Soil	—	—	—	—	—	—	—	—	—

Table 3.4-11 (continued)

Sample ID	Location ID	Depth (ft)	Media	Ethylbenzene (mg/kg)	Fluoranthene (mg/kg)	Indeno(1,2,3-cd)pyrene (mg/kg)	Isopropyltoluene[4-] (mg/kg)	Methylene Chloride (mg/kg)	Pentachlorophenol (mg/kg)	Phenanthrene (mg/kg)	Propylbenzene[1-] (mg/kg)
SWMU 0-030(b)											
RE00-02-46452	00-02-20782	6.5–7	Fill	—	—	—	—	—	—	—	—
RE00-02-46453	00-02-20782	7.5–8	Fill	—	—	—	—	—	—	—	—
RE00-02-46454	00-02-20783	6.5–8	Fill	—	—	—	—	—	—	—	—
RE00-02-46455	00-02-20783	7.5–8	Fill	—	—	—	—	—	—	—	—
RE00-02-46456	00-02-20784	5.5–6	Fill	—	—	—	—	—	—	—	—
RE00-02-46457	00-02-20784	6.5–7	Fill	—	—	—	0.0004 (J)	—	—	—	—
RE00-02-46470	00-02-20791	1.7–2	Fill	—	—	—	—	—	—	—	—
RE00-02-46471	00-02-20791	2.3–2.8	Fill	—	—	—	—	—	—	—	—
RE00-02-46472	00-02-20792	5.5–6	Fill	—	—	—	—	—	—	—	—
RE00-02-46474	00-02-20793	2.5–2.8	Fill	—	—	—	0.0036 (J)	—	—	—	—
RE00-02-46486	00-02-20799	0.67–1.17	Fill	—	—	—	—	—	—	—	—
RE00-02-46488	00-02-20800	0–0.5	Fill	—	—	—	—	—	—	—	—
RE00-02-46490	00-02-20802	0–0.5	Fill	—	—	—	—	—	—	—	—
RE00-02-46491	00-02-20803	0–0.5	Fill	—	0.16 (J)	—	—	—	—	—	—
0100-95-0472	00-04301	0–0.5	Soil	—	—	—	—	—	—	—	—
0100-95-0479	00-04304	10–10.3	Soil	—	—	—	—	—	—	—	—
0100-95-0491	00-04311	0–0.5	Soil	—	—	—	—	—	—	—	—
0100-95-0688	00-04314	9–9.5	Sediment	—	—	—	—	—	—	—	—
0100-95-0715	00-04344	10–11	Soil	—	—	—	—	—	—	—	—
0100-95-0716	00-04345	4.5–5.5	Soil	—	0.11 (J)	—	—	—	—	0.051 (J)	—
0100-95-0717	00-04346	7.5–8.5	Soil	—	—	—	—	—	—	—	—
0100-95-0718	00-04347	4–5	Soil	—	—	—	—	—	—	—	—
0100-95-0725	00-04353	6.5–7	Soil	—	—	—	—	—	—	—	—
0100-95-0726	00-04354	0–9	Soil	—	—	—	—	—	—	—	—

Table 3.4-11 (continued)

Sample ID	Location ID	Depth (ft)	Media	Ethylbenzene (mg/kg)	Fluoranthene (mg/kg)	Indeno(1,2,3-cd)pyrene (mg/kg)	Isopropyltoluene[4-] (mg/kg)	Methylene Chloride (mg/kg)	Pentachlorophenol (mg/kg)	Phenanthrene (mg/kg)	Propylbenzene[1-] (mg/kg)
0100-95-0727	00-04355	6–7	Soil	—	—	—	—	—	—	—	—
0100-95-0728	00-04355	8–9	Soil	—	—	—	—	—	—	—	—
0100-95-0729	00-04356	2–8	Soil	—	0.14 (J)	—	—	—	—	0.15 (J)	—
0100-95-0730	00-04357	4–5	Soil	—	—	—	—	—	—	0.042 (J)	—
0100-95-0731	00-04357	6–7	Soil	—	0.059 (J)	—	—	—	—	0.071 (J)	—
0100-95-0732	00-04358	4.5–4.7	Soil	—	—	—	—	—	—	—	—
0100-95-0733	00-04359	0–6	Soil	—	—	—	—	—	—	—	—
0100-95-0734	00-04360	3–4	Soil	—	7.6E-02 (J)	—	—	—	—	—	—
0100-95-0735	00-04360	5–6	Soil	—	9.1E-02 (J)	—	—	—	—	0.078 (J)	—
0100-95-0740	00-04361	4.5–4.8	Soil	—	1.3 (J)	1.1 (J)	—	0.002 (J)	0.23 (J)	0.72 (J)	—
0100-95-0743	00-04364	10–11	Soil	—	—	—	—	—	—	—	—
0100-95-0749	00-04367	0–9	Soil	0.002 (J)	—	—	0.02	—	—	—	0.004 (J)
0100-95-0750	00-04368	10–11	Soil	—	—	—	—	—	—	—	—
0100-96-1751	00-05751	4–4.5	Soil	—	—	—	—	—	—	—	—
SWMU 0-030(m)											
0100-95-0480	00-04305	11–11.2	Soil	—	0.24 (J)	—	—	—	—	0.18 (J)	—
0100-95-0481	00-04305	11.3–11.5	Soil	—	—	—	—	—	—	—	—
0100-95-0482	00-04306	11.3–11.5	Soil	—	—	—	—	—	—	—	—
0100-95-0483	00-04307	5.5–6	Soil	—	0.56	0.17 (J)	—	—	—	0.57	—
0100-95-0486	00-04307	6–6.5	Soil	—	0.053 (J)	—	—	—	—	—	—
0100-95-0677	00-04326	5.5–6	Soil	—	0.2 (J)	6.5E-02 (J)	—	—	—	0.14 (J)	—
0100-95-0454	00-04327	10.5–11	Soil	—	—	—	—	—	—	—	—
0100-95-0914	00-04371	11–11.5	Soil	—	—	—	—	—	—	—	—
0100-95-0915	00-04372	11–11.5	Soil	—	—	—	—	—	—	—	—

Table 3.4-11 (continued)

Sample ID	Location ID	Depth (ft)	Media	Pyrene (mg/kg)	Tetrachloroethene (mg/kg)	Toluene (mg/kg)	Trimethylbenzene[1,2,4-] (mg/kg)	Trimethylbenzene[1,3,5-] (mg/kg)	Xylene (Total) (mg/kg)	Xylene[1,2-] (mg/kg)
SWMU 0-030(b)										
RE00-02-46452	00-02-20782	6.5–7	Fill	—	—	0.00057 (J)	—	—	—	—
RE00-02-46453	00-02-20782	7.5–8	Fill	—	—	0.00046 (J)	—	—	—	—
RE00-02-46454	00-02-20783	6.5–8	Fill	—	—	0.00045 (J)	—	—	—	—
RE00-02-46455	00-02-20783	7.5–8	Fill	—	—	0.00063 (J)	—	—	—	—
RE00-02-46456	00-02-20784	5.5–6	Fill	—	—	—	—	—	—	—
RE00-02-46457	00-02-20784	6.5–7	Fill	—	—	—	—	—	—	—
RE00-02-46470	00-02-20791	1.7–2	Fill	—	—	—	—	—	—	—
RE00-02-46471	00-02-20791	2.3–2.8	Fill	—	—	0.00067 (J)	—	—	—	—
RE00-02-46472	00-02-20792	5.5–6	Fill	—	—	—	—	—	—	—
RE00-02-46474	00-02-20793	2.5–2.8	Fill	—	—	0.0094	—	—	—	—
RE00-02-46486	00-02-20799	0.67–1.17	Fill	—	—	—	—	—	—	—
RE00-02-46488	00-02-20800	0–0.5	Fill	—	—	—	—	—	—	—
RE00-02-46490	00-02-20802	0–0.5	Fill	—	—	—	—	—	—	—
RE00-02-46491	00-02-20803	0–0.5	Fill	—	—	—	—	—	—	—
0100-95-0472	00-04301	0–0.5	Soil	—	—	—	—	—	—	—
0100-95-0479	00-04304	10–10.3	Soil	—	—	—	—	—	—	—
0100-95-0491	00-04311	0–0.5	Soil	—	—	—	—	—	—	—
0100-95-0688	00-04314	9–9.5	Sediment	—	—	—	—	—	—	—
0100-95-0715	00-04344	10–11	Soil	—	0.003 (J)	—	—	—	—	—
0100-95-0716	00-04345	4.5–5.5	Soil	0.097 (J)	—	—	—	—	—	—
0100-95-0717	00-04346	7.5–8.5	Soil	—	0.001 (J)	—	—	—	—	—
0100-95-0718	00-04347	4–5	Soil	—	0.006	—	—	—	—	—
0100-95-0725	00-04353	6.5–7	Soil	—	—	—	—	—	—	—
0100-95-0726	00-04354	0–9	Soil	—	—	—	—	—	—	—

Table 3.4-11 (continued)

Sample ID	Location ID	Depth (ft)	Media	Pyrene (mg/kg)	Tetrachloroethene (mg/kg)	Toluene (mg/kg)	Trimethylbenzene[1,2,4-] (mg/kg)	Trimethylbenzene[1,3,5-] (mg/kg)	Xylene (Total) (mg/kg)	Xylene[1,2-] (mg/kg)
0100-95-0727	00-04355	6–7	Soil	—	—	—	—	—	—	—
0100-95-0728	00-04355	8–9	Soil	—	—	—	—	—	—	—
0100-95-0729	00-04356	2–8	Soil	0.1 (J)	—	0.001 (J)	—	—	—	—
0100-95-0730	00-04357	4–5	Soil	—	—	0.002 (J)	—	—	—	—
0100-95-0731	00-04357	6–7	Soil	0.04 (J)	0.01	0.002 (J)	—	—	—	—
0100-95-0732	00-04358	4.5–4.7	Soil	—	—	0.001 (J)	—	—	—	—
0100-95-0733	00-04359	0–6	Soil	—	0.005 (J)	—	—	—	—	—
0100-95-0734	00-04360	3–4	Soil	6.5E-02 (J)	0.003 (J)	—	—	—	—	—
0100-95-0735	00-04360	5–6	Soil	0.097 (J)	0.005 (J)	0.002 (J)	—	—	—	—
0100-95-0740	00-04361	4.5–4.8	Soil	1.8	0.031	0.002 (J)	—	—	—	—
0100-95-0743	00-04364	10–11	Soil	—	0.017	—	—	—	—	—
0100-95-0749	00-04367	0–9	Soil	—	—	—	0.039	0.013	0.004 (J)	0.003 (J)
0100-95-0750	00-04368	10–11	Soil	—	0.006	—	—	—	—	—
0100-96-1751	00-05751	4–4.5	Soil	—	—	—	—	—	—	—
SWMU 0-030(m)										
0100-95-0480	00-04305	11–11.2	Soil	0.25 (J)	—	—	—	—	—	—
0100-95-0481	00-04305	11.3–11.5	Soil	—	—	—	—	—	—	—
0100-95-0482	00-04306	11.3–11.5	Soil	—	—	—	—	—	—	—
0100-95-0483	00-04307	5.5–6	Soil	0.43 (J)	—	—	—	—	—	—
0100-95-0486	00-04307	6–6.5	Soil	0.045 (J)	—	—	—	—	—	—
0100-95-0677	00-04326	5.5–6	Soil	0.13 (J)	—	—	—	—	—	—
0100-95-0454	00-04327	10.5–11	Soil	—	—	—	—	—	—	—
0100-95-0914	00-04371	11–11.5	Soil	—	—	—	—	—	—	—
0100-95-0915	00-04372	11–11.5	Soil	—	—	—	—	—	—	—

*— = Not detected.

Table 3.4-12
Detected Organic Chemicals in Inside Pipe Sample at SWMUs 0-030(b,m)

Part 1

Sample ID	Location ID	Depth (ft)	Media	Acetone (mg/kg)	Anthracene (mg/kg)	Aroclor-1260 (mg/kg)	Benzo(a)pyrene (mg/kg)	Benzo(b)fluoranthene (mg/kg)	Benzo(g,h,i)perylene (mg/kg)	Chrysene (mg/kg)	DDD[4,4'-] (mg/kg)	DDE[4,4'-] (mg/kg)	DDT[4,4'-] (mg/kg)
RE00-02-45745	00-02-19785	6–6.5	NA	0.0062 (J)	0.128	0.0248	0.244	0.362	0.143	0.211	0.324	0.338	0.592

Part 2

Sample ID	Location ID	Depth (ft)	Media	Dibenzofuran (mg/kg)	Di-n-butylphthalate (mg/kg)	Fluoranthene (mg/kg)	Fluorene (mg/kg)	Indeno(1,2,3-cd)pyrene (mg/kg)	Isopropyltoluene[4-] (mg/kg)	Methylnaphthalene[2-] (mg/kg)	Naphthalene (mg/kg)	Phenanthrene (mg/kg)	Pyrene (mg/kg)
RE00-02-45745	00-02-19785	6–6.5	NA	0.0392 (J)	0.0291 (J)	0.564	0.0491	0.17	0.0034	0.0444	0.0367	0.418	0.369

Table 3.4-13
Detected Organic Chemicals in the Non-Site-Related Fill Samples at SWMUs 0-030(b,m)

Sample ID	Location ID	Depth (ft)	Media	Aroclor-1254 (mg/kg)	Aroclor-1260 (mg/kg)	Benz(a)anthracene (mg/kg)	Benzo(a)pyrene (mg/kg)	Benzo(b)fluoranthene (mg/kg)	Benzo(k)fluoranthene (mg/kg)	Benzoic Acid (mg/kg)	Bis(2-ethylhexyl)phthalate (mg/kg)	Chrysene (mg/kg)	DDE[4,4'-] (mg/kg)	DDT[4,4'-] (mg/kg)	Fluoranthene (mg/kg)	Methylnaphthalene[2-] (mg/kg)	Naphthalene (mg/kg)	Phenanthrene (mg/kg)	Pyrene (mg/kg)
SWMU 0-030(b)																			
RE00-02-46492	00-02-20804	0–0.5	Fill	—*	—	—	—	—	—	—	—	—	—	—	0.16	—	—	—	—
RE00-02-46493	00-02-20805	0–0.5	Fill	—	—	—	—	—	—	—	—	—	0.21	0.098	0.1	—	—	—	—
RE00-02-46494	00-02-20806	0–0.5	Fill	0.55	—	0.18	0.2	0.22	0.27	—	0.81	0.31	0.38	0.28	0.59	—	—	0.35	0.38
RE00-02-46495	00-02-20807	0–0.5	Fill	—	0.073	0.096	0.1	0.15	0.13	—	—	0.24	0.093	0.18	0.21	0.57	0.29	0.22	0.13
RE00-02-46496	00-02-20808	0–0.5	Fill	—	0.036	—	—	0.13	—	—	—	0.17	—	0.078	0.2	0.1	—	0.11	0.11
RE00-02-46498	00-02-20810	0–0.5	Fill	—	—	—	—	—	—	—	—	—	—	—	0.1	—	—	—	—
RE00-02-46499	00-02-20811	0–0.5	Fill	—	—	—	—	—	—	0.075	—	0.13	—	—	0.16	—	—	—	—

*— = Not detected.

3.4.3.2 Subsurface Tuff Samples

Sixteen samples were collected from Qbt 3 of the Tshirege Member of the Bandelier Tuff in SWMUs 0-030(b,m). Table 3.4-1 summarizes all of the subsurface tuff samples collected.

3.4.3.2.1 Inorganic Chemical Comparison with BV

Sixteen samples were analyzed for TAL metals. Table C-5.0-2 in Appendix C presents detailed results of the QA/QC assessment. Sample concentrations were compared with the LANL BV for Qbt 2,3,4 tuff. Table 3.4-14 presents the frequency of detects above BV of the inorganic chemicals in the subsurface tuff.

Twelve inorganic chemicals (aluminum, arsenic, barium, calcium, cobalt, copper, iron, lead, magnesium, mercury, nickel, and silver) were detected above the Qbt 3 BV in at least one sample. There were no detection limits above the BV. Further statistical tests were performed for eleven of the inorganic chemicals that were detected above the BV since mercury doesn't have a background data set for tuff material. The results of the Gehan and Quantile tests are presented in Table E-3.2-2. The probability values for aluminum, arsenic, barium, calcium, copper, lead, magnesium, nickel and silver were significant indicating that these inorganic chemicals are different from background. The distributions of site and background data for aluminum, barium, calcium, and nickel are all similar. Figure E-3.2-5 shows the box plots for barium to illustrate the general pattern. Figures E-3.2-6 to E-3.2-8 show the box plots for arsenic, copper, and lead. Based on further evaluation of these plots (see Appendix E) only aluminum, barium, calcium, copper, nickel, and silver are retained as COPCs.

Table 3.4-15 presents the concentrations above background in the subsurface tuff. Aluminum, barium, calcium, copper, mercury, nickel, and silver are retained as COPCs.

3.4.3.2.2 Radionuclide Comparison with Background

Sixteen subsurface tuff samples were analyzed for gamma-emitting radionuclides, isotopic uranium, and isotopic plutonium (see Table 3.4-1). The full-suite analyte list in the analytical services statement of work (LANL 1995, 49738; LANL 2000, 71233) includes the decay series of the naturally occurring radionuclides, uranium-235, uranium-238, and thorium-232, as well as fission and activation products and their progeny. The primary radionuclides reliably measured by gamma spectroscopy include activation products (americium-241, cobalt-60, and sodium-22), fission products (cesium-134, cesium-137, europium-152, and ruthenium-106), and uranium-235.

Table C-5.0-4 in Appendix C presents detailed results of the QA/QC assessment. There are no BVs for radionuclides in tuff except isotopic uranium. Sample concentrations were evaluated based on detection status. Table 3.4-16 presents the frequency of detects and detects above the BV of the radionuclides in subsurface tuff.

Table 3.4-14
Frequency of Inorganic Chemicals Above BVs in Subsurface Tuff Samples at SWMUs 0-030(b,m)

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	Background Value (mg/kg)	Frequency of Detects Above Background Value	Frequency of Nondetects Above Background Value
Aluminum	Qbt 3	16	16	567 to 10800	7340	5/16	0/16
Antimony	Qbt 3	16	8	0.097 to [0.21]	0.5	0/16	0/16
Arsenic	Qbt 3	16	16	0.84 to 3.1	2.79	1/16	0/16
Barium	Qbt 3	16	16	9.8 to 163	46	10/16	0/16
Beryllium	Qbt 3	16	16	0.12 to 0.92	1.21	0/16	0/16
Cadmium	Qbt 3	16	16	0.011 to 0.11	1.63	0/16	0/16
Calcium	Qbt 3	16	16	380 to 4990	2200	8/16	0/16
Chromium	Qbt 3	16	13	[0.36] to 5.3	7.14	0/16	0/16
Cobalt	Qbt 3	16	16	0.32 to 5.2	3.14	1/16	0/16
Copper	Qbt 3	16	16	0.72 to 5.7	4.66	5/16	0/16
Iron	Qbt 3	16	16	1580 to 21100	14500	1/16	0/16
Lead	Qbt 3	16	16	1.4 to 11.9	11.2	1/16	0/16
Magnesium	Qbt 3	16	16	187 to 2020	1690	1/16	0/16
Manganese	Qbt 3	16	16	49.8 to 251	482	0/16	0/16
Mercury	Qbt 3	16	13	0.0087 to 0.35	0.1	3/16	0/16
Nickel	Qbt 3	16	16	0.82 to 9.3	6.58	1/16	0/16
Potassium	Qbt 3	16	16	144 to 1500	3500	0/16	0/16
Selenium	Qbt 3	16	14	0.11 to 0.22	0.3	0/16	0/16
Silver	Qbt 3	16	6	[0.052] to 4.2	1	3/16	0/16
Sodium	Qbt 3	16	16	58.3 to 215	2770	0/16	0/16
Thallium	Qbt 3	16	13	0.049 to 0.18	1.1	0/16	0/16
Vanadium	Qbt 3	16	16	1.5 to 11.2	17	0/16	0/16
Zinc	Qbt 3	16	16	6.5 to 41.9	63.5	0/16	0/16

Table 3.4-15
Inorganic Chemicals Above BVs in Subsurface Tuff Samples at SWMUs 0-030(b,m)

Sample ID	Location ID	Depth (ft)	Media	Aluminum (mg/kg)	Barium (mg/kg)	Calcium (mg/kg)	Copper (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Silver (mg/kg)
Qbt 2,3,4 Background Value (mg/kg)				**7340**	**46**	**2200**	**4.66**	**0.1**	**6.58**	
SWMU 0-030(b)										
RE00-02-46458	00-02-20785	6.5–7	Qbt 3	7410	102	4990	—	—*	—	—
RE00-02-46459	00-02-20785	7.5–8	Qbt 3	7730	80.2	4810	—	—	—	—
RE00-02-46460	00-02-20786	7.25–7.75	Qbt 3	—	68	—	—	—	—	—
RE00-02-46461	00-02-20786	8.25–8.75	Qbt 3	10800	83.4	2980	4.8	—	—	—
RE00-02-46462	00-02-20787	9.5–10	Qbt 3	—	95.8	2660	—	—	—	—
RE00-02-46463	00-02-20787	10.5–11	Qbt 3	—	77.7	—	—	—	—	—
RE00-02-46464	00-02-20788	10–10.5	Qbt 3	—	—	—	5	0.35 (J+)	—	4.2
RE00-02-46465	00-02-20788	10.5–11	Qbt 3	—	76.6	—	5.3	0.23 (J+)	—	2.6
RE00-02-46466	00-02-20789	9.4–9.7	Qbt 3	7480	163	3490	—	—	—	—
RE00-02-46467	00-02-20789	10.4–10.7	Qbt 3	7680	107	3220	4.7	—	—	—
RE00-02-46475	00-02-20793	3–3.3	Qbt 3	—	—	2900	—	—	—	—
RE00-02-46476	00-02-20794	2–2.5	Qbt 3	—	50.2	4010	5.7	0.19	9.3	1.1

*— = Not above the BV.

Table 3.4-16
Frequency of Radionuclides Detected or Detected Above BVs in Subsurface Tuff Samples at SWMUs 0-030(b,m)

Analyte	Media	Number of Analyses [b]	Number of Detects	Concentration Range (pCi/g)	Background Value (pCi/g)	Frequency of Detects Above Background Value
Americium-241	Qbt 3	16	0	[-0.22 to 0.11]	na [a]	0/16
Cesium-134	Qbt 3	16	0	[-0.055 to 0.06]	na	0/16
Cesium-137	Qbt 3	16	0	[-0.091 to 0.073]	na	0/16
Cobalt-60	Qbt 3	16	0	[-0.068 to 0.046]	na	0/16
Europium-152	Qbt 3	16	0	[-0.31 to 0.58]	na	0/16
Plutonium-238	Qbt 3	16	0	[-0.0028 to 0.084]	na	0/16
Plutonium-239	Qbt 3	16	1	[-0.0052] to 0.286	na	1/16
Ruthenium-106	Qbt 3	16	0	[-0.52 to 0.92]	na	0/16
Uranium-234	Qbt 3	16	16	0.6 to 0.97	1.98	0/16
Uranium-235	Qbt 3	16	3	[0.0027] to 0.129	0.09	1/16
Uranium-238	Qbt 3	16	16	0.65 to 1.11	1.93	0/16

[a] na = Not available.

[b] Numbers of analyses for gamma-emitting radionuclides varies because of inconsistencies and changes in the list of analytes reported by various laboratories over the years.

Plutonium-239 was detected in one sample. Uranium-234 and uranium-238 were detected in all samples, but all results were below the BV. Uranium-235 had one detected concentration above the BV.

Therefore plutonium-239 and uranium-235 are retained as COPCs. Table 3.4-17 presents the data above BV for these two radionuclides.

Table 3.4-17
Radionuclides Detected or Detected Above BVs in Subsurface Samples at SWMUs 0-030(b,m)

Sample ID	Location ID	Depth (ft)	Media	Plutonium-239 (pCi/g)	Uranium-235 (pCi/g)
Qbt 2,3,4 Background Value (pCi/g)				—*	**0.09**
SWMU 0-030(b)					
RE00-02-46466	00-02-20789	9.4–9.7	Qbt 3	—	0.129
RE00-02-46476	00-02-20794	2–2.5	Qbt 3	0.286	—

*— = No BV available.

3.4.3.2.3 Evaluation of Organic Chemicals

Sixteen subsurface tuff samples were analyzed for PCBs, pesticides, SVOCs and VOCs. Table C-5.0-3 in Appendix C presents detailed results of the QA/QC assessment. Sample results were evaluated based on detection status. Table 3.4-18 presents the frequency of detected organic chemicals in subsurface tuff.

Table 3.4-18
Frequency of Detected Organic Chemicals in Subsurface Tuff Samples at SWMUs 0-030(b,m)

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	Frequency of Detects
Acetone	Qbt 3	16	2	[0.0091 to 0.034]	2/16
Benzene	Qbt 3	16	1	0.001 to [0.0068]	1/16
Benzoic Acid	Qbt 3	16	1	0.13 to [1.7]	1/16
Butanone[2-]	Qbt 3	16	1	[0.022] to 0.043	1/16
Chlordane[alpha-]	Qbt 3	16	1	[0.0017] to 0.0035	1/16
Chlordane[gamma-]	Qbt 3	16	1	[0.0017] to 0.0038	1/16
DDD[4,4'-]	Qbt 3	16	2	[0.0017] to 0.0064	2/16
DDE[4,4'-]	Qbt 3	16	2	[0.0017] to 0.0048	2/16
DDT[4,4'-]	Qbt 3	16	5	[0.0017] to 0.032	5/16

Nine organic chemicals were detected in the subsurface tuff at SWMUs 0-030(b,m). 4,4'-DDT had the highest frequency of detects with 5 out of 16 subsurface tuff samples. All other organic chemicals were detected once or twice in the tuff. Table 3.4-19 presents the detected concentrations of organic chemicals in the subsurface tuff samples.

Table 3.4-19
Detected Organic Chemicals in Subsurface Tuff Samples at SWMUs 0-030(b,m)

Sample ID	Location ID	Depth (ft)	Media	Acetone (mg/kg)	Benzene (mg/kg)	Benzoic Acid (mg/kg)	Butanone[2-] (mg/kg)	Chlordane[alpha-] (mg/kg)	Chlordane[gamma-] (mg/kg)	DDD[4,4'-] (mg/kg)	DDE[4,4'-] (mg/kg)	DDT[4,4'-] (mg/kg)
SWMU 0-030(b)												
RE00-02-46458	00-02-20785	6.5–7	Qbt 3	—*	—	—	—	—	—	—	—	0.011
RE00-02-46460	00-02-20786	7.25–7.75	Qbt 3	—	—	—	—	—	—	—	—	0.0033 (J+)
RE00-02-46461	00-02-20786	8.25–8.75	Qbt 3	—	—	—	—	—	—	—	—	0.0018
RE00-02-46462	00-02-20787	9.5–10	Qbt 3	0.027	—	—	—	—	—	—	—	—
RE00-02-46463	00-02-20787	10.5–11	Qbt 3	0.024 (J)	—	—	—	—	—	—	—	—
RE00-02-46464	00-02-20788	10–10.5	Qbt 3	—	—	—	—	—	—	0.0041	0.0048	0.032
RE00-02-46465	00-02-20788	10.5–11	Qbt 3	—	—	—	—	0.0035	0.0038	0.0064	0.0042	0.028
RE00-02-46466	00-02-20789	9.4–9.7	Qbt 3	—	0.001 (J)	—	—	—	—	—	—	—
RE00-02-46476	00-02-20794	2–2.5	Qbt 3	—	—	0.13 (J)	0.043	—	—	—	—	—

*— = Not detected.

3.4.4 Revised Site Conceptual Model

The preliminary conceptual model is described in Section 3.3.2 and shown in Figure 2.2-3. The revised conceptual model has not changed from the preliminary conceptual model. The preliminary conceptual model identified the following potential release mechanisms:

- subsurface leaks from outfall pipes and the leachfield laterals and
- subsurface leaks from the septic tanks and associated plumbing.

The primary exposure pathways for human health were soil ingestion, dermal contact, dust inhalation, and external gamma. The primary exposure pathways for ecological receptors were plant uptake, rain splash, soil ingestion, and food web transport.

3.4.4.1 Nature and Extent of Contamination

Nature and extent of chemical releases from SWMUs 0-030(b,m) have been defined by the environmental samples that have been collected in 1995, 1996, and 2002. The extent has been determined by collecting samples in soil and tuff from beneath and beside the former septic tank and pipes and from underneath the leachfield laterals.

One sludge sample (RE00-02-45745) was collected within the outfall pipe of SWMU 0-030(m). The data from this sample is not included with the soil data for several reasons. Sludge within the outfall pipe is not likely to migrate out of the pipe because there is nothing flowing through the pipe and the septic tank has been removed. In addition the pipe is 6.5 ft below the surface so no pathway exist for ecological receptors. Unless the area is excavated, there is no pathway for human health receptors, either. Comparing the radionuclide data from the sludge sample with the 1995 sludge data from inside the septic tank (LANL 1996, 55203) shows that the septic tank had the highest concentrations of plutonium-239. The uranium data from inside the tank was not available. This higher concentration of plutonium inside the tank implies that contaminants settled in the tank. The inorganic data shows a similar pattern, with the exception that the highest inorganic chemicals were detected below the tank (LANL 1996, 55203). In addition, the data from RE00-02-45745 (inside the pipe) have higher concentrations of organics and radionuclides than sample 0100-95-0486, which was collected beneath the outlet pipe in 1995. The lower concentrations in the soil below the pipe show that it is unlikely to have leaked.

Besides SWMU releases, additional sources exist for the contaminants that were detected in the soil and tuff. The non-site-related soil samples show elevated levels of the metals, radionuclides, and organic chemicals compared to the analytical data from the 6th Street Septic System SWMUs. Table 3.4-20 shows the Laboratory soil and tuff background values, the local non-site-related values, and the maximum values of COPCs from SWMUs 0-030(b,m).

The inorganic COPCs (aluminum, barium, cadmium, copper, lead, mercury, nickel, and silver) were detected infrequently in the soil and tuff above background values (Figure 3.4-2). The exception to this was barium, which was detected above BV in 10 of 16 samples in the tuff. In soil, cadmium had two detects and 22 nondetects above background values. In general, there is a decreasing concentration of inorganic COPCs with depth along the outlet pipe and the leachfield laterals.

Table 3.4-20
Comparisons of LANL BVs, Non-Site-Related Values, and Site Data for SWMUs 0-030(b,m)

Analyte	BV	Non-Site-Related Values	Max in Soil less than 1 ft	Max in Soil Greater than 1 ft	Qbt 3 BV	Max Concentration in Qbt 3	Units
Inorganic chemicals							
Aluminum	29200	9790	11400	15100	7340	10800	mg/kg
Barium	295	282	168	301	46	163	mg/kg
Cadmium	0.4	0.43	0.19	0.93	1.63	0.11	mg/kg
Calcium	6120			11400	2200	4990	mg/kg
Copper	14.7	13	7.8	77.2	4.66	5.7	mg/kg
Lead	22.3	64.9	46.8	169	11.2	11.9	mg/kg
Mercury	0.1	0.6	0.022	8.4	0.1	0.35	mg/kg
Nickel	15.4	8.4	8.4	10.8	6.58	9.3	mg/kg
Silver	1	0.4	0.2	21.1	1	4.2	mg/kg
Radionuclides							
Americium-241	0.013	0.08	0.1	0.963	NA[a]	0.11	pCi/g
Plutonium-239	0.054	0.282	0.056	7.232	NA	0.286	pCi/g
Tritium	0.76	NA	NA	4.8	NA	NA	pCi/ml
Uranium-234	2.59	1.28	7.378	NA	1.98	NA	pCi/g
Uranium-235	0.2	0.066	0.077	0.58	0.09	0.129	pCi/g
Uranium-238	2.29	1.25	7.167	NA	1.93	NA	pCi/g
Organic chemicals							
Acetone	NA	ND[b]	ND	0.073	NA	0.027	mg/kg
Aldrin	NA	ND	ND	0.00046	NA	ND	mg/kg
Anthracene	NA	ND	ND	0.19	NA	ND	mg/kg
Aroclor-1254	NA	0.55	ND	0.17	NA	ND	mg/kg
Aroclor-1260	NA	0.073	ND	0.17	NA	ND	mg/kg
Benzene	NA	ND	ND	ND	NA	0.001	mg/kg
Benz(a)anthracene	NA	0.18	ND	1.1	NA	ND	mg/kg
Benzo(a)pyrene	NA	0.2	ND	1.2	NA	ND	mg/kg
Benzo(b)fluoranthene	NA	0.22	ND	1.4	NA	ND	mg/kg
Benzo(g,h,i)perylene	NA	ND	ND	1.1	NA	ND	mg/kg
Benzo(k)fluoranthene	NA	0.27	ND	1.2	NA	ND	mg/kg
Benzoic Acid	NA	0.075	0.14	0.31	NA	0.13	mg/kg
Bis(2-ethylhexyl)phthalate	NA	0.81	0.39	0.16	NA	ND	mg/kg
Butanone[2-]	NA	ND	ND	ND	NA	0.043	mg/kg
Chlordane[alpha-]	NA	ND	0.00304	0.017	NA	0.0035	mg/kg
Chlordane[gamma-]	NA	ND	ND	0.011	NA	0.0038	mg/kg
Chrysene	NA	0.31	ND	1.6	NA	ND	mg/kg
DDD[4,4'-]	NA	ND	ND	0.463	NA	0.0064	mg/kg
DDE[4,4'-]	NA	0.38	ND	0.16	NA	0.0048	mg/kg
DDT[4,4'-]	NA	0.28	0.00523	0.672	NA	0.032	mg/kg
Dibenz(a,h)anthracene	NA	ND	ND	0.58	NA	ND	mg/kg

Table 3.4-20 (continued)

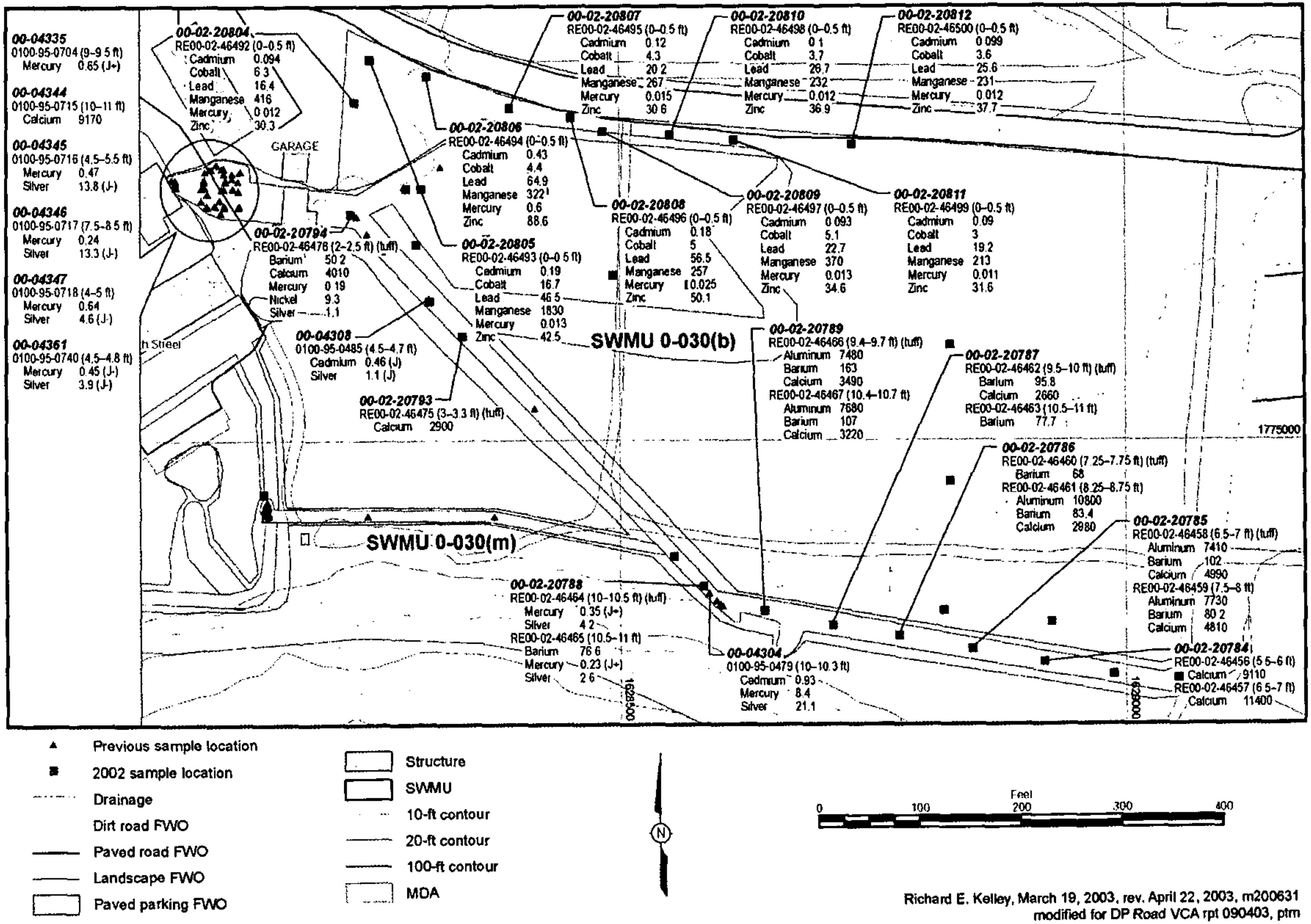
Analyte	BV (mg/kg or pCi/g)	Non-Site-Related Values	Max in Soil less than 1 ft	Max in Soil Greater than 1 ft	Qbt 3 BV	Max Concentration in Qbt 3	Units
Dichlorobenzene[1,2-]	NA	ND	ND	0.00055	NA	ND	mg/kg
Dichlorobenzene[1,4-]	NA	ND	ND	0.11	NA	ND	mg/kg
Dichloroethene[cis-1,2-]	NA	ND	ND	0.002	NA	ND	mg/kg
Dieldrin	NA	ND	ND	0.0079	NA	ND	mg/kg
Di-n-butylphthalate	NA	ND	ND	0.081	NA	ND	mg/kg
Dinitro-2-methylphenol[4,6-]	NA	ND	ND	0.2	NA	ND	mg/kg
Dinitrophenol[2,4-]	NA	ND	ND	0.12	NA	ND	mg/kg
Endrin	NA	ND	ND	0.00402	NA	ND	mg/kg
Endrin Aldehyde	NA	ND	ND	0.00758	NA	ND	mg/kg
Ethylbenzene	NA	ND	ND	0.002	NA	ND	mg/kg
Fluoranthene	NA	0.59	0.16	1.3	NA	ND	mg/kg
Indeno(1,2,3-cd)pyrene	NA	ND	ND	1.1	NA	ND	mg/kg
Isopropyltoluene[4-]	NA	ND	ND	0.02	NA	ND	mg/kg
Methylene Chloride	NA	ND	ND	0.002	NA	ND	mg/kg
Pentachlorophenol	NA	ND	ND	0.23	NA	ND	mg/kg
Phenanthrene	NA	0.35	ND	0.72	NA	ND	mg/kg
Propylbenzene[1-]	NA	ND	ND	0.004	NA	ND	mg/kg
Pyrene	NA	0.38	ND	1.8	NA	ND	mg/kg
Tetrachloroethene	NA	ND	ND	0.031	NA	ND	mg/kg
Toluene	NA	ND	ND	0.0094	NA	ND	mg/kg
Trimethylbenzene[1,2,4-]	NA	ND	ND	0.039	NA	ND	mg/kg
Trimethylbenzene[1,3,5-]	NA	ND	ND	0.013	NA	ND	mg/kg
Xylene (Total)	NA	ND	ND	0.004	NA	ND	mg/kg
Xylene[1,2-]	NA	ND	ND	0.003	NA	ND	mg/kg

[a] NA = not applicable.

[b] ND = not detected.

The highest values for the COPCs are usually in the leachfield, but an exception to this is Location 00-04304, which has the highest values for cadmium, copper, lead, mercury, and silver. But generally, the analyte values in the leachfield were higher than those under the outlet pipe.

The radionuclide COPCs generally were detected infrequently in the soil and/or tuff samples (Figure 3.4-3). There is a decreasing trend in concentrations with depth. Uranium-235 was detected above the soil background value (0.20 pCi/g) in three samples, and above the tuff background value (0.09 pCi/g) in one sample. Two tuff samples were collected at the location (00-02-20789) where the background value was exceeded. The sample from 9.4 to 9.7 ft had a uranium-235 value of 0.129 pCi/g, while the sample from 10.4 to 10.7 had a value of 0.032 pCi/g. Americium-241 and plutonium-239 exceeded the soil background values in a number of samples (see Table 3.4-6).



Richard E. Kelley, March 19, 2003, rev. April 22, 2003, m200631
modified for DP Road VCA rpt 090403, ptm

Figure 3.4-2. Inorganic chemicals detected above background at SWMUs 0-030(b,m)

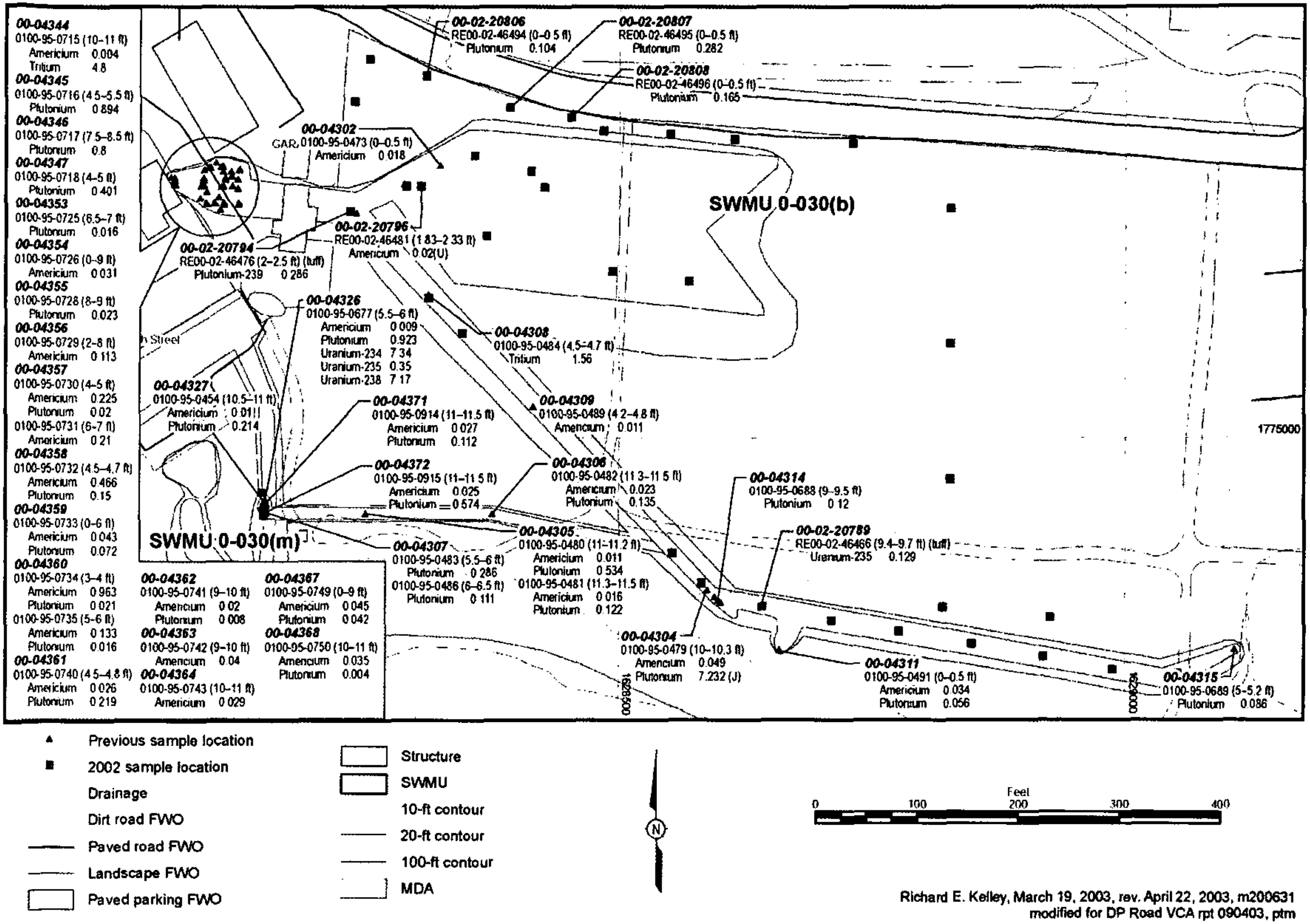


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Figure 3.4-3. Radionuclides detected above background at SWMUs 0-030(b,m)

Detected organic chemicals are shown in Figure 3.4-4.

VOCs were detected at low concentrations under the outlet pipe and under the former SWMU 0-030(b) septic tank location. SVOCs were detected sporadically across the 6th Street Septic System SWMUs at very low concentrations. High detection limits have contributed to the representative concentrations being elevated.

The PAHs were detected in twelve locations at the 6th Street Septic Systems SWMUs. None were detected below the outlet pipe, but analytes were detected at one location in the leachfield and most were detected under the former septic tank at SWMU 0-030(b).

PCBs were detected in only four locations across the site. Pesticides and insecticides were detected at eight locations across the 6th Street Septic System SWMUs at very low concentrations. The detected values of all of the analytes were below their SALs. There is no trend to the detections of these COPCs. DDT and its metabolites (DDx) were detected in 20 sample locations, and in the six locations where samples were collected deeper, the concentrations decrease with depth. Most of the detected DDx concentrations were under the outlet pipes and former septic tanks, with only one detected concentration in the leachfield. The analytes show no other trends.

3.4.4.2 Environmental Fate and Transport

The evaluation of environmental fate addresses the chemical processes that affect the persistence of a chemical in the environment. The evaluation of transport addresses the physical processes affecting mobility along the migration pathway. Infiltration into surface soils depends on the rate of precipitation or snowmelt, antecedent soil water status, depth of soil, and soil hydraulic properties. Infiltration into the tuff depends on the unsaturated flow properties of the tuff. Joints and fractures in the tuff may provide additional pathways for moisture to enter the subsurface regime. COPCs at the 6th Street Septic System SWMUs include inorganic and organic chemicals and radionuclides.

3.4.4.2.1 Inorganic Chemicals

Aluminum, barium, cadmium, calcium, copper, lead, mercury, nickel, and silver were retained as COPCs in the soil and tuff. In general, metals and other inorganic chemicals are not highly soluble or mobile in the environment, particularly in a semiarid climate, though there are some exceptions. Appendix F provides detailed information of the properties that affect fate and transport for each of the inorganic COPCs identified for this group of SWMUs. The following paragraph briefly discusses the mobility of the inorganic COPCs at the 6th Street Septic System SWMUs.

Aluminum occurs naturally in soil, water, and air, and is redistributed or moved by natural and human activities. It can attach to very small or large particles. Aluminum is not very soluble in water. Barium reacts with metal oxides and hydroxides in soil and is subsequently adsorbed onto soil particulates. Barium compounds that do not dissolve well in water, such as barium sulfate and barium carbonate, can last a long time in the environment. Barium compounds that dissolve easily in water usually do not last a long time in the environment. Barium that is dissolved in water quickly combines with sulfate or carbonate ions and becomes the longer lasting forms (barium sulfate and barium carbonate). Cadmium compounds dissolve in water to varying degrees depending upon which element it is combined. Cadmium compounds are often found attached to small particles present in air, and can travel great distances before coming

Aluminum occurs naturally in soil, water, and air, and is redistributed or moved by natural and human activities. It can attach to very small or large particles. Aluminum is not very soluble in water. Barium

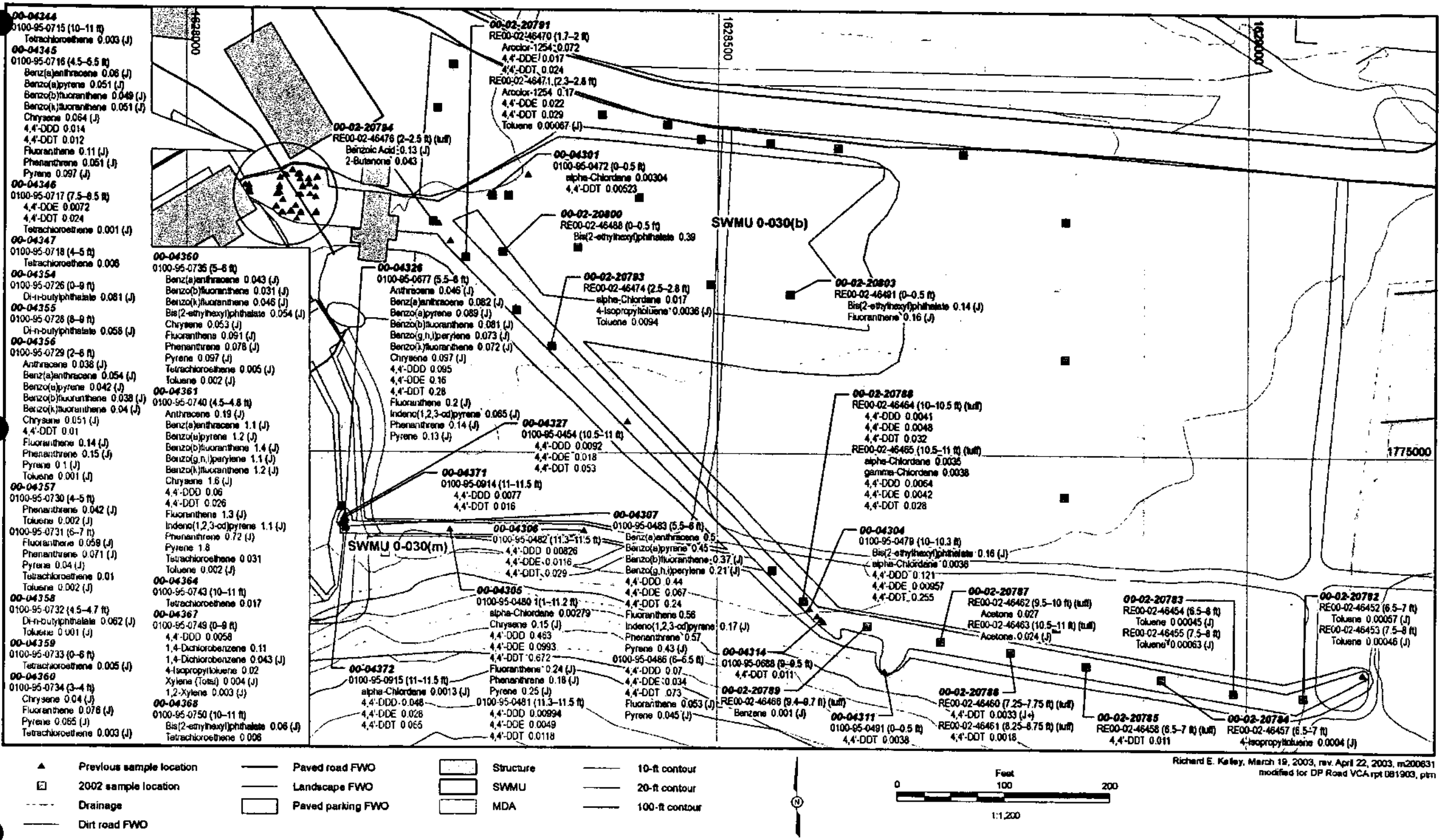

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Figure 3.4-4. Detected organic chemicals at SWMUs 0-030(b,m) reacts with metal oxides and hydroxides in soil and is subsequently adsorbed onto soil particulates. Barium compounds that do not dissolve well in water, such as barium sulfate and barium carbonate, can last a long time in the environment. Barium compounds that dissolve easily in water usually do not last a long time in the environment. Barium that is dissolved in water quickly combines with sulfate or carbonate ions and becomes the longer lasting forms (barium sulfate and barium carbonate). Cadmium compounds dissolve in water to varying degrees depending upon which element it is combined. Cadmium compounds are often found attached to small particles present in air, and can travel great distances before coming down to the earth. Copper is strongly adsorbed on soil particles and usually remains in the upper few centimeters of soil. But copper's movement in soil is determined by the physical and chemical interactions of copper with the soil components. Copper will adsorb mainly to organic matter, carbonate minerals, clay minerals, or hydrous iron and manganese oxides. Most lead is retained strongly in soil, and very little is transported in to surface water or groundwater. Lead is strongly sorbed to organic matter in soil. Mercury tightly binds to both organic and inorganic particles. Nickel and nickel compounds have negligible vapor pressures. Therefore, volatilization of nickel from the soil into the air is not expected to be a pathway of concern. Nickel is strongly adsorbed by soil. Silver is stable. Silver that is released into the environment may be carried long distances in air and water. Rain washes silver compounds out of many soils so that it could potentially move into groundwater if the groundwater is relatively shallow.

3.4.4.2.2 Radionuclides

Three of the radionuclides identified as COPCs at SWMUs 0-030(b,m) are actinides (americium-241, plutonium-239, and uranium-235). These actinides have similar chemical properties. The following information is summarized from Whicker and Schultz (1982, 58209).

In general, the actinide nuclides form comparatively insoluble compounds in the environment and are not considered biologically mobile. The actinides are transported in ecosystems mainly by physical and sometimes chemical processes. Uptake of actinides by plants from soil is considered to be generally low. Plutonium in the environment undergoes hydrolysis and oxidation with plutonium oxide as a common form. Under most environmental conditions, plutonium occurs in forms that are poorly transferred across biological membranes; therefore, movement of plutonium from soil and sediments to plants and animals is greatly inhibited.

Because plutonium and americium, under oxidizing conditions, preferentially bind to fine soil or sediment particles to organic matter with high surface to volume ratios, it is likely they will be transported and deposited with sediments.

Uranium-235 is fairly mobile and is moderately long lived with a half-life of 700 million years. Uranium can exist in the +3, +4, +5, and +6 oxidation states, the most common of which are +4 and +6. In water, uranium adsorbs strongly to mineral surfaces and tends to partition into organic matter, thereby reducing its mobility.

Tritium, which has a half-life of approximately 12 years, generally follows the hydrologic cycle if it is in the form of tritiated water. Tritium released in liquid form can be diluted by water and is subject to physical dispersion, percolation, and evaporation. Tritium readily enters plants by way of the roots (Whicker and Schultz 1982, 58209).

3.4.4.2.3 Organic Chemicals

Properties such as vapor pressure and solubility in water are important in evaluating organic chemical mobility. The following information, summarized from Ney (1995, 58210), is presented to give an indication of the fate and transport tendencies of organic chemicals.

Water solubility. Water solubility is perhaps the most important chemical characteristic used to assess mobility of organic chemicals. The higher the water solubility of a chemical, the more likely it is to be mobile and the less likely it is to accumulate, bioaccumulate, volatilize, or persist in the environment. A highly soluble chemical (>1000 mg/L) is prone to biodegradation and metabolism that may detoxify the parent chemical. Acetone, benzene, benzoic acid, 2-butanone, cis-1,2-dichloroethene, 2,4-dinitrophenol, and methylene chloride have water solubilities greater than 1000 mg/L.

The lower the water solubility of a chemical (especially <10 mg/L) the more likely it will be immobilized via adsorption. Such chemicals tend to be more accumulative or bioaccumulative, persistent in the environment, are slightly prone to biodegradation, and may be metabolized in plants and animals. Most of the organic COPCs with the exception of the ones listed above and a few others have water solubilities less than 10 mg/L.

Vapor pressure. Chemicals with vapor pressure greater than 0.01 millimeter mercury are more likely to volatilize and diffuse through the soil pore-gas with potential release to the atmosphere. These include acetone, benzene, 2-butanone, cis-1,2-dichloroethene, and methylene chloride. Chemicals with vapor pressures less than 0.000001 mm Hg are less likely to volatilize and therefore, remain immobile.

Octanol water partition coefficient. The octanol water partition coefficient (K_{ow}) is an indicator of the bioaccumulation or bioconcentration potential of a chemical in the fatty tissue of living organisms. The unitless K_{ow} value is an indicator of water solubility, mobility, sorption, and bioaccumulation. The higher the K_{ow} (>1000), the greater the affinity of the chemical to bioaccumulate/bioconcentrate in the food chain, the greater its potential for sorption in soil and the lower its mobility (Ney 1995, 58210). Organic COPCs with a K_{ow} of greater than 1000 include all of them with the exception of the ones listed in the paragraph below.

A K_{ow} of less than 500 indicates high water solubility, mobility, little to no bioaccumulation, and degradability by microbes, plants, and animals. Organic COPCs with a K_{ow} of less than 500 are acetone, benzene, benzoic acid, 2-butanone, cis-1,2-dichloroethene, 2,4-dinitrophenol, methylene chloride, and tetrachloroethene. Table 3.4-21 shows the water solubilities, the vapor pressure, K_{ow}, and K_{oc} for the organic COPCs.

Table 3.4-21
Physiochemical Properties for Organic COPCs

Name	Water Solubility (mg/L)[a]	Vapor Pressure (mm Hg)[a] at 25°C	K_{ow} [a,b]	K_{oc} [a,c]
Acetone	6.04E+05	2.99E-01	6.00E-01	9.51E-01
Aldrin	7.84E-02	2.20E-08	1.51E+06	4.87E+04
Anthracene	5.37E-02	3.35E-08	2.95E+04	2.35E+04
Aroclor-1254[d]	1.2E-02	7.71E-05	3.2E+06	No Data
Aroclor-1260[d]	2.7E-03	4.05E-05	6.3E+06	No Data
Benzene	1.78E+03	1.25E-01	137	62
Benz(a)anthracene	1.28E-02	2.03E-10	4.77E+05	2.6E+05
Benzo(a)pyrene	1.94E-03	6.43E-12	1.35E+06	9.69E+05
Benzo(b)fluoranthene	4.33E-03	1.06E-10	1.59E+06	8.36E+05
Benzo(g,h,i)perylene[e]	7.00e-04	1.03E-10	3.23E+06	1.6E+06
Benzo(k)fluoranthene	8.0E-04	1.32E-12	1.56E+06	8.32E-05

Table 3.4-21 (continued)

Name	Water Solubility (mg/L)[a]	Vapor Pressure (mm Hg)[a] at 25°C	K_{ow} [a,b]	K_{oc} [a,c]
Benzoic Acid[e]	2.7E+03	No data	74.1	No data
Bis(2-ethylhexyl)phthalate	3.96E-01	8.49E-09	1.6E+05	1.11E+05
Butanone[2-][e]	2.68E+05	77.5	1.82	4.5
Chlordane[alpha-]	5.51E-01	3.55E-08	8.66E+05	5.13E+04
Chlordane[gamma-]	5.51E-01	3.55E-08	8.66E+05	5.13E+04
Chrysene	1.94E-03	1.03E-11	5.48E+05	2.97E+05
DDD[4,4'-]	7.33E-02	1.14E-09	1.32E+06	4.58E+04
DDE[4,4'-]	1.92E-02	7.45E-09	1.80E+06	8.64E+02
DDT[4,4'-]	3.41E-03	5.17E-10	1.17E+06	6.78E+05
Dibenz(a,h)anthracene	6.70E-04	2.70E-14	3.53E+06	1.79E+06
Dichlorobenzene[1,2-]	125	1.79E-03	2.79E+03	379
Dichlorobenzene[1,4-]	73	1.39E-03	2.58E+03	6.16E+02
Dichloroethene[cis-1,2-]	4.94E+03	2.30E-01	96	498
Dieldrin	1.87E-01	1.31E-09	1.86E+05	2.55E+04
Di-n-butylphthalate	10.8	5.55E-08	5.25E+04	1.57E+03
Dinitro-2-methylphenol[4,6-][e]	290	5.0E-02	501	240
Dinitrophenol[2,4-]	5.8E+03	1.52E-07	33.0	0.02[f]
Endrin	2.46E-01	7.68E-10	7.79E+04	1.08E+04
Endrin Aldehyde	No data	No data	No data	No data
Ethylbenzene	173	1.26E-02	1.33E+03	204
Fluoranthene	2.32E-01	1.07E-06	1.21E+05	4.91E+04
Indeno(1,2,3-cd)pyrene	1.07E-02	1.88E-13	8.22E+06	4.11E+06
Isopropyltoluene[4-]	56	6.00E-03	4.10E+03	9.31E+03
Methylene Chloride	1.74E+04	4.87E-01	18	10
Pentachlorophenol	13.4	7.11E-07	1.2E+05	1.42E+03[f]
Phenanthrene	1.28	1.35E-03	3.55E+04	2.09E+02
Propylbenzene[1-]	No data	No data	No data	No data
Pyrene	1.3E-01	5.59E-09	1.0E+05	6.8E+04
Tetrachloroethene	232	2.42E-02	351	265
Toluene	558	3.71E-02	465	140
Trimethylbenzene[1,2,4-]	No data	No data	No data	No data
Trimethylbenzene[1,3,5-]	No data	No data	No data	No data
Xylene[1,2-]	186	1.06E-02	1.35E+03	241

[a] Denotes reference information from http://www.epa.gov/earth1r6/6pd/rcra_c/pd-o/appd1a.pdf.

[b] K_{ow} – octanol water partition coefficient.

[c] K_{oc} – adsorption coefficient.

[d] Denotes reference information from http://www.atsdr.cdc.gov/toxprofiles/tp17-c4.pdf.

[e] Information from Superfund Public Health Evaluation Manual EPA 540/1-86-060, 1986.

[f] K_{oc} at pH = 6.

3.5 Site Assessments

3.5.1 Screening Assessment

3.5.1.1 Human Health

The human health screening assessment was performed according to guidance outlined in the draft installation work plan (LANL 2000, 66802) and in the "Human Health Risk-Based Screening Methodology" (LANL 2002, 72639). The human health screening assessment consists of four parts: scoping, screening evaluation, uncertainty analysis, and interpretation.

(a) Scoping

Land use at SWMUs 0-030(b,m) is industrial. At present, the potential for human exposure to residual concentrations of chemicals and radionuclides in the environment at the site is moderate to low because the site has restricted access (i.e., fenced and locked). This site, which is an open field with trees and grass, was used as a leachfield for SWMU 0-030(b) and the outlet pipes from the septic tanks at SWMUs 0-030(b,m) went across the field. RRES-RS does not plan to remove any of the remaining pipes at the site due to the number of County owned unmarked utilities in the area. Removing the lines would create a safety hazard for RRES-RS personnel.

Although a residential scenario is unlikely under current and projected future site conditions, the potential present-day risks were evaluated using this scenario because it is protective of human health. The SALs used in the screening evaluation reflect a residential scenario that is based on an exposure of 24 hr/day and 350 days/yr. Sample values to a depth of 12 ft were considered in this evaluation as media from that depth could be excavated and brought to the surface for exposure. No samples were collected deeper than 12 ft.

(b) Screening Evaluation

If a sufficient number of samples are included in a data set (generally 10 or more), the 95% UCL of the mean is used as the representative concentration for screening assessments. If fewer samples are available, the maximum concentrations of each analyte may be used as the representative concentration. The representative concentration used in this screening assessment was the 95% UCL of the mean, except for tritium, for which the maximum detected concentration was used because there was not enough data to calculate a 95% UCL (Appendix F). The 95% UCL was determined using data from both soil and tuff at depths from 0 to 12 ft.

A total of 60 analytes were identified as COPCs at the 6th Street Septic System SWMUs based on the data review. These COPCs are evaluated further in this section by comparing the 95% UCL to the appropriate SAL. The chemical SALs are calculated based on the methodology provided in Appendix C of the draft installation work plan (LANL 2000, 66802) and in the "Human Health Risk-Based Screening Methodology" (2002, 72639), and are based on guidance from NMED (NMED 2000, 68554) and EPA Region 6 (EPA 2002, 73691). For radionuclides, the SALs are derived according to LANL's "Derivation and Use of Radionuclide Screening Action Levels" (LANL 2001, 69683) and the SALs used are derived from RESRAD Version 6.21 (LANL 2002, 73705). The SALs for noncarcinogens are based on a hazard quotient (HQ) of 1.0. SALs for carcinogens are based on a cancer risk level of 10^{-6}. SALs for radionuclides are based on a dose of 15 mrem/yr. The representative concentration for each COPC was compared with the SAL for carcinogens and radionuclides, and 0.1 SAL for noncarcinogens because more than one noncarcinogenic COPC has been identified.

Calcium does not have a published toxicity value, but is among those elements identified in Section 5.9.4 of Risk Assessment Guidance for Superfund [RAGS] (EPA 1989, 08021) as an essential macronutrient. Following the guidance in RAGS, the maximum value of calcium in the samples is 11400 mg/kg, which is less than twice the BV of 6120 mg/kg. Therefore, calcium is not expected to result in adverse health effects, and will not be discussed further.

The comparisons of 95% UCL to SALs are shown in Tables 3.5-1 through 3.5-3. COPCs whose 95% UCL exceeds the screening criterion appear in bold.

Some chemicals (benzo[g,h,i]perylene, endrin aldehyde, and 4-isopropyltoluene) do not have toxicity values published in the EPA's IRIS database, HEAST, or by EPA's National Center for Environmental Assessment (NCEA). For those chemicals, surrogate chemical toxicity values have been used based on similarity in chemical structure. The SALs for these surrogates were used to evaluate whether the COPCs (benzo[g,h,i]perylene, endrin aldehyde, and 4-isopropyltoluene) should be retained. In all cases, the 95% UCL value of the COPC was at least two orders of magnitude less than 0.1 SAL.

The 95% UCLs of noncarcinogenic COPCs were all less than SAL and less than 0.1 SAL, with the exception of aluminum. The HI (the sum of the ratios of exposure point concentration divided by the SAL) is approximately 0.31 (see Appendix F, Table F-4.3-4), which is less than NMED's target HI of 1.0 (NMED 2000, 68554). This indicates that a human health hazard is not expected from residual concentrations of noncarcinogenic COPCs at the 6th Street Septic System SWMUs.

The representative concentration of the carcinogenic COPC benzo(a)pyrene and dibenz(a,h)anthracene were greater than their SALs. The rest of the representative concentrations of the carcinogenic COPCs were less than their respective SALs. The total potential excess cancer risk from exposure to carcinogenic COPCs at SWMUs 0-030(b,m) is approximately 1.6 $\times 10^{-5}$ (see Appendix F, Table F-4.3-5). NMED's target risk level for carcinogenic risk is 1 in 100,000 (1×10^{-5}) (NMED 2000, 68554).

The 95% UCL for radionuclide COPCs were all less than their respective SALs. The total estimated radionuclide dose is approximately 0.91 mrem/yr (Appendix F, Table F-4.3-6) compared to the soil background dose of 1.22 mrem/yr. DOE's acceptable dose for free release of property of 15 mrem/yr (DOE 2000, 67489).

(c) Uncertainty Analysis

The analysis presented in this human health screening assessment is subject to varying degrees and kinds of uncertainty. The uncertainties associated with the Laboratory background data, data evaluation, exposure assessment, toxicity assessment, the additive approach, and the use of surrogates may affect the results.

Laboratory background data. Laboratory background data for aluminum in tuff ranges from 350 mg/kg to 8370 mg/kg, with a median value of 1,900 mg/kg (LANL 1998, 59730). The aluminum detected across the site at the 6th Street Septic System SWMUs (8240 mg/kg) is similar to the tuff background.

Data evaluation and COPC identification process. Uncertainties associated with the data can include sampling errors, laboratory analysis errors, and data analysis errors. For this site, these uncertainties are expected to have little effect on the results even though the detected concentrations of some organic COPCs were qualified J, indicating the values were less than EQLs and could only be estimated.

Table 3.5-1
Screening Evaluation of Noncarcinogenic COPCs from the 6th Street Septic Systems

Chemical	95% UCL (mg/kg)	SAL (mg/kg)	0.1 SAL (mg/kg)
Aluminum	**8240**	74000	**7400**
Barium	122	5200	520
Cadmium	0.32	70	7.0
Cobalt	4.55	4500	450
Copper	11.5	2800	280
Lead	26.2	400	40
Mercury	0.43	23	2.3
Nickel	6.35	1500	150
Silver	2.03	380	38
Acetone	0.024	1600	160
Anthracene	0.38	16000	1600
Aroclor-1254	0.047	1.1	0.11
Benzo(g,h,i)perylene[a]	0.40	1800	180
Benzoic Acid	1.25	1.0E+05	1.0E+04
Butanone[2-]	0.024	37000	3700
Di-n-butylphthalate	0.38	6100	610
Dichlorobenzene [1,2-]	0.16	85	8.5
Dichloroethene [cis –1,2-]	0.0056	41	4.1
Dinitro-2-methylphenol [4,6-]	1.11	120	12
Dinitrophenol [2,4-]	1.11	120	12
Endrin	0.0070	18	1.8
Endrin Aldehyde[b]	0.0070	18	1.8
Ethylbenzene	0.0058	68	6.8
Fluoranthene	0.38	2300	230
Isopropyltoluene[4-][c]	0.0063	370	37
Phenanthrene	0.38	1800	180
Propylbenzene [1-]	0.0030	140	14
Pyrene	0.40	1800	180
Toluene	0.0048	180	18
Trimethylbenzene [1,2,4-]	0.0073	52	5.2
Trimethylbenzene [1,3,5-]	0.0061	21	2.1
Xylene (total)	0.0055	210	21
Xylene [1,2-]	0.0031	280	28

Note: Bolded text means the 95% UCL exceeds 0.1 SAL.

[a] Pyrene used as a surrogate for benzo(g,h,i)perylene.

[b] Endrin used as a surrogate for endrin aldehyde.

[c] Isopropylbenzene used as a surrogate for 4-isopropyltoluene.

Table 3.5-2
Screening Evaluation of Carcinogenic COPCs from the 6th Street Septic Systems

Chemical	95% UCL (mg/kg)	SAL (mg/kg)
Aldrin	0.0035	0.029
Aroclor-1254	0.047	0.22
Aroclor-1260	0.047	0.22
Benzene	0.0059	0.64
Benz(a)anthracene	0.39	0.62
Benzo(a)pyrene	**0.40**	**0.062**
Benzo(b)fluoranthene	0.40	0.62
Benzo(k)fluoranthene	0.39	6.2
Bis(2-ethylhexyl) phthalate	0.38	1200
Chlordane – alpha*	0.0060	1.6
Chlordane – gamma*	0.0059	1.6
Chrysene	0.40	61
Dibenz(a,h)anthracene	**0.39**	**0.062**
Dichlorobenzene [1,4-]	0.16	3.2
Dieldrin	0.0070	0.03
DDD [4,4'-]	0.033	2.4
DDE [4,4'-]	0.015	1.7
DDT [4,4'-]	0.042	1.7
Indeno(1,2,3-cd)pyrene	0.40	0.62
Methylene Chloride	0.0013	8.9
Pentachlorophenol	0.96	3.0
Tetrachloroethene	0.0071	1.5

Note: Bolded text means the 95% UCL exceeds the SAL.

*Chlordane used as a surrogate for alpha chlordane and gamma chlordane.

Table 3.5-3
Screening Evaluation of Radionuclide COPCs from the 6th Street Septic Systems

Chemical	95% UCL (pCi/g)	SAL (pCi/g)
Americium-241	0.11	39
Plutonium-239	0.56	44
Tritium*	0.63	890
Uranium-234	1.31	63
Uranium-235	0.14	17
Uranium-238	1.34	86

*Value for tritium represents a maximum detected value.

The representative concentrations for all noncarcinogens were less than their respective SALs and less than 0.1 SAL, with the exception of aluminum. As stated above, the exposure to aluminum across the site is similar to background.

The representative concentrations for all carcinogens were less than their respective SALs, with the exception of benzo(a)pyrene and dibenz(a,h)anthracene. Benzo(a)pyrene was detected in 5 of the 40 samples (12%), and dibenz(a,h)anthracene was detected in 1 of the 40 samples (2.5%). The exposure to these two PAHs is infrequent and not homogenous across the site. Retaining these PAHs in the screening assessment overestimates the risk across the site. The maximum values for the PAHs are found at Location 00-04361, which was collected from inside the outlet pipe of Tank 1. But the sample collected beneath the pipe had nondetects for the PAHs. The value of 1.6×10^{-5} is comparable to NMED's 10^{-5} target level given the conservative assumptions for exposure and relatively infrequent detection of COPCs.

Exposure assessment. Uncertainties were identified in two areas of the exposure assessment process.

- *Identification of receptors.* Land use and activity patterns are not represented by those activities assumed by the residential land-use scenario; therefore, uncertainties are introduced. Because the potentially exposed individual is an industrial worker, the screening assessment overestimates the exposure and subsequently overestimates the potential hazard, risk, and dose.
- *Exposure pathway assumptions.* For each exposure pathway, assumptions are made concerning the parameters, the routes of exposure, the amount of contaminated media to which an individual can be exposed, and intake rates for different routes of exposure. In the absence of site-specific data, the assumptions used are consistent with EPA-approved parameters and default values (EPA 2002, 73691). When several upper-bound values are combined to estimate exposure for any one pathway, the resulting risks can be in excess of the 99th percentile and therefore outside the range that may be reasonably expected. Analytical data from 0–12 ft were used in the screening assessment, but the entire depth profile is not available unless areas are excavated.

Toxicity values. The primary uncertainty associated with the SALs is related to the derivation of toxicity values used in the calculation. EPA toxicity values (reference doses [RfDs] and slope factors [SFs]) were used to derive the nonradiological SALs used in this risk screening assessment (EPA 2001, 70109; EPA 1997, 58968). Uncertainties were identified in three areas with respect to the toxicity values: (1) extrapolation from animals to humans, (2) extrapolation from one route of exposure to another route of exposure, and (3) interindividual variability in the human population.

- *Extrapolation from animals to humans.* The SFs and RfDs are often determined based on extrapolation from animal data to humans, which may result in uncertainties in toxicity values because differences exist in chemical absorption, metabolism, excretion, and toxic response between animals and humans. The EPA takes into account differences in body weight, surface area, and pharmacokinetic relationships between animals and humans to minimize the potential to underestimate the dose-response relationship. However, more conservatism is usually incorporated in these steps.
- *Extrapolation from one route of exposure to another route of exposure.* The SFs and RfDs can often contain extrapolations from one route of exposure to another. Extrapolation from the oral route to the inhalation and/or the dermal route is used and is based on the EPA's Integrated Risk Information System database (EPA 2001, 70109). Differences between the two exposure pathways could result in an overestimation of the risk.

- *Interindividual variability in the human population.* For noncarcinogenic effects, the amount of human variability in physical characteristics is important in determining the risks that can be expected at low exposures and in determining the NOAEL. The NOAEL/uncertainty factor approach incorporates a 10-fold factor to reflect the possible interindividual variability in the human population and is generally considered a conservative estimate.

Additive Approach. For noncarcinogens, the effects of a mixture of chemicals are generally unknown and possible interactions could be synergistic or antagonistic, thereby overestimating or underestimating the risk. Additionally, the RfDs for different chemicals are not based on the same severity, effect, or target organ. Therefore, the potential for occurrence of noncarcinogenic effects can be overestimated for chemicals that act by different mechanisms and on different target organs but are addressed additively.

Surrogates. Some chemicals do not have EPA-approved or provisional toxicity values. In these cases a similar chemical with available toxicity values are used as a surrogate. Pyrene was used as a surrogate for benzo(g,h,i)perylene because they have similar structures. The difference between the two chemicals is the additional two benzene rings. The additional benzene rings add stability to the structure making the surrogate pyrene more reactive than benzo(g,h,i)perylene. Because benzo(g,h,i)perylene is less reactive than its surrogate, the risk is overestimated for this analyte.

Endrin was used as a surrogate for endrin aldehyde, which is an impurity and a breakdown product of Endrin. Photochemical isomerization of endrin was observed after exposure of thin layers of solid endrin on glass to sunlight (ATSDR 1997, 56531). Minor amounts of endrin aldehyde were formed in this reaction. Endrin and endrin aldehyde were both detected only once in 43 samples (2.3%); therefore the risk from both of these analytes in minimal.

Isopropylbenzene was used as a surrogate for 4-isopropyltoluene based on its structural similarity. The difference between the two chemicals is a carbon molecule for 2-isopropyltoluene, which makes this chemical more reactive. Although this underestimates the risk from 4-isopropyltoluene, it is not a major contributor to the risk at the site because it was detected in only 3 of the 42 samples.

Total chlordane was used as a surrogate for alpha and gamma chlordane. Alpha and gamma chlordane are two of the components that make up total chlordane. Alpha chlordane was detected in 6 of 83 samples and gamma chlordane was detected in 3 of 83 samples, and are not major contributors to the risk at the site.

(d) Interpretation

Based on the screening assessment with a residential scenario, the HI (0.31) is less than NMED's target level of 1.0. The carcinogenic risk of 1.6×10^{-5} is equivalent to NMED's target risk of 1×10^{-5}. The radiological dose (1.22 mrem/yr) is less than the DOE's target dose of 15 mrem/yr. The screening assessments indicate that there is no potential unacceptable risk to human health at SWMUs 0-030(b,m).

3.5.1.2 Ecological

The ecological screening evaluation was performed in accordance with the process outlined in "Screening Level Ecological Risk Assessment Methods" (LANL 1999, 64783). This ecological screening assessment consists of four parts: the scoping evaluation, the screening evaluation, uncertainty analysis, and risk interpretation. The scoping evaluation includes (1) the data assessment step, which identifies the list of Contaminants of Potential Concern (COPCs); and (2) the problem formulation step for the specific site under investigation. The basis for SWMUs 0-030(b,m) problem formulation is found in the scoping checklist (Appendix F of this document). The scoping checklist is a useful tool for organizing existing ecological information and for focusing the site visit on the information needed to develop the site conceptual model.

The screening evaluation includes the comparison of representative media concentrations to the final ESLs. Representative media concentrations are either maximum or the 95% UCL of the mean concentration depending on the data support for the site. The final ESLs are media-specific concentrations that represent the lowest value amongst a suite of ecological receptors. The NOAEL is the highest concentration of a COPC associated with no adverse ecological effects over an array of ecological receptors. Derivation of final ESLs is a complex process dependent on numerous equations and information sources; see Section 4.5, "Screening Level Ecological Risk Assessment Methods" (LANL 1999, 64783) for information about how the ESLs are derived. ESLs were developed for a suite of receptors designed to represent individual feeding guilds, such as invertivorous mammal or carnivorous bird. Robins and kestrels were modeled with three and two different diets respectively so that they could represent multiple feeding guilds. For example, the omnivorous robin actually represents the feeding guild of all omnivorous birds, while the herbivorous robin represents all herbivorous birds. The representative concentration of each COPEC was compared with the final ESL from the September 2002 version (Release 1.5) of the LANL Ecorisk Database (LANL 2002, 73702). ESLs for soil for antimony, uranium, and zinc were corrected to incorporate revisions to ESLs made in 2003 (LANL 2003, 74012). The ESLs from the database used in evaluation of this site are included in Table F-1.0-1 in Appendix F.

To provide additional information on the potential effects to representative ecological receptors, hazard quotients (HQs) and hazard indices (HIs) for all COPECs are calculated for all terrestrial screening receptors. The HQ is the ratio of the calculated representative concentration to the receptor [based on COPC concentrations at SWMUs 0-030(b,m)] to the ESL, which is a dose that has been determined to be acceptable (based on toxicity studies and expected exposure parameters for the receptor). An HI is a sum of HQs, across contaminants with like effects, for a given screening receptor. Because it is not known how the effects of chemicals combine, the simplest assumption of additivity was made for the screening assessment.

An HI greater than 1 is an indication of potential adverse impacts, and the chemical constituents that contribute HQ >0.3 to an HI greater than 1 are identified as COPECs. In addition to identifying COPECs, HI/HQ results can be used for a qualitative assessment of possible adverse effects on individuals or populations. Potential risks to populations from COPCs at this site were assessed during the screening using PAUFs using an approach described in part (b) of this section and in Appendix F-2.0. Because EPA guidance is to manage ecological risks to populations (EPA 1999, 70086), some level of adverse effects of chemical stressors on individuals is acceptable. An exception is a T&E species, for which it is appropriate to evaluate potential adverse effects on individuals.

The uncertainty analysis section following the COPEC identification section describes the key sources of uncertainty in the screening assessment. The uncertainty analysis can result in adding chemicals or removing them from the list of COPECs.

The last part of the screening assessment interprets the results in the context of a risk management decision. This primarily involves an assessment of potential ecological risk versus the potential impacts of further remediation

(a) Scoping Evaluation

Data Assessment

The approach taken to characterize releases from SWMUs 0-030(b,m) was designed to provide information on the nature and extent of COPCs at this site. The data collected in soil and tuff were adequate to confirm that the COPCs are distributed along the drainages behind the 6th St. warehouses. For many of the COPCs, there is sufficient sample coverage of the combined SWMUs to calculate representative concentrations of COPCs instead of using the maximum concentration in screening. Representative concentrations used in this assessment are 95% UCLs of the mean concentration, unless the number of detected concentrations in the data set was insufficient to calculate a 95% UCL of the mean value; then the maximum concentration was used. These 95% UCLs of the mean were calculated following EPA guidance "Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites" (EPA 2002, 73593.1). The UCLs were calculated using normal, lognormal, or nonparametric (Chebyshev's) tests depending on which distribution provided the best fit to the data for that COPC. Samples in which an analyte was not detected were considered as having a concentration of one half the detection limit for that analyte. In assessing this site, all samples designated as soil, fill, or sediment were included in the data set used to generate representative concentrations.

Problem Formulation

SWMUs 0-030(b,m) include the former leach field area and pipeline, drain line, and outfall areas of the former septic systems. These areas now consist of vegetated fields with trees scattered at the edges of the fields. The surrounding area has an almost continuous vegetative cover, numerous shrubs, and a number of mature trees. There are a number of animal burrows on the site indicating the presence of burrowing animals such as gophers. Although heavy previous disturbance through bulldozing, excavation and backfilling at the site has led to the site having characteristics of disturbed sites undergoing secondary succession, the habitat represents a grassland of mixed forbs with some remaining stands of ponderosa pine and other trees, with abundant signs of wildlife use. Proximity to Los Alamos Canyon provides additional opportunities for wildlife to access the site. Potential receptors include plants, soil invertebrates, deer mice, rabbits, gophers, deer, and all types of birds. T&E species are potential receptors for contaminant releases from SWMUs 0-030(b,m). Based on a comparison of SWMU location to GIS-based habitat databases for the Mexican spotted owl (a threatened or endangered species), this species may forage at the site with a relatively high frequency in the area of these SWMUs though they do not lie within the potential nesting habitat for the species (LANL 2001, 76092). The kestrel screening receptor with an all-flesh diet serves as a surrogate for avian T&E receptors in the screening calculations.

Previous activities at the site may have released subsurface contamination from the leach field. This contamination could have reached the surface during recontouring activities after removal of the trailer park from the area. Discharge from outfalls could also have impacted surface soils at the site. The major pathways through which wildlife receptors could potentially contact this contamination are ingestion of soil and ingestion of bioaccumulated compounds through the food chain. Burrowing animals could also be exposed through dust inhalation while digging and VOC vapors while in their burrows.

There is no aquatic habitat present on the mesa top. Potential impact to aquatic habitat in Los Alamos Canyon is unlikely because there are no established aquatic communities in the canyon below the area of the SWMUs; the ephemeral nature of the stream within this section of the canyon prevents aquatic communities from becoming established there. Therefore, impacts on aquatic communities are not considered as part of this ecological screening assessment. More detailed information on habitat is presented in the ecological scoping checklists in Appendix F-3.0.

For ecological risk screening, the comprehensive list of primary impacted media includes the surface and subsurface soil, and fill. Previous activities at the site may have released subsurface contamination from the former septic tank and leach field areas; this contamination could have reached the surface during recontouring activities after removal of the trailer park from the area.. The major pathways through which wildlife receptors could potentially contact this contamination are ingestion of soil and ingestion of compounds through the food chain that were originally taken up through plant roots. Burrowing animals could also be exposed through dust inhalation while digging and VOC vapors while in their burrows. Typically, all complete exposure pathways should be at least qualitatively evaluated in the screening process. However, soil ESLs do not include exposure to vapors or particulates in air nor do they account for exposure through dermal contact. The importance of these pathways is discussed in the uncertainty analysis.

(b) Screening Evaluation

To determine which of the COPCs should be retained as COPECs, representative concentrations were compared to the final soil ESLs. COPCs that contribute HQs>0.3 are identified as COPECs. Because the final ESLs may be based on different receptors for different compounds, the HQs generated cannot be summed to produce a single HI for the site. Instead, each HQ was evaluated directly against the benchmark of 0.3. The HQ for comparison to the final ESL is larger than 0.3 for 4 metals and 8 organic compounds (Table 3.5-4).

Table 3.5-4
Final ESL Comparison for SWMUs 0-030(b,m)

COPC	95% UCL of the Mean Concentration (mg/kg)	Final Soil ESL (mg/kg)	Receptor for Final ESL	HQ
Inorganic chemicals				
Cadmium	0.301	0.0047	shrew	64.0
Lead	20.9	100	shrew	0.21
Mercury (total as inorganic)	1.012	0.05	shrew	20.2
Mercury (methyl)[a]	0.002	0.00035	insectivorous robin	5.8
Silver	4.012	0.05	plant	80.2
Radionuclides				
Americium-241	0.15	44	earthworm	<0.01
Plutonium-239, 240	1.37	47	earthworm	0.03
Tritium	0.49	36000	plant	<0.01
Uranium-234	1.31	51	earthworm	0.02
Uranium-235	0.143	55	earthworm	<0.01
Uranium-238	1.336	55	earthworm	0.02
Organic chemicals				
Anthracene	0.0356	220	shrew	<0.01
Benz(a)anthracene	0.2785	3	shrew	0.09
Benzo(a)pyrene	0.2898	9.6	shrew	0.03
Benzo(b)fluoranthene	0.2681	18	plant	0.01
Benzo(g,h,i)perylene	0.2715	12	shrew	0.02
Benzo(k)fluoranthene	1.3554	62	shrew	0.02

Table 3.5-4 (continued)

COPEC	95% UCL of the Mean Concentration (mg/kg)	Final Soil ESL (mg/kg)	Receptor for Final ESL	HQ
Chrysene	0.0278	2.4	shrew	0.01
Dibenz(a,h)anthracene	0.2420	12	shrew	0.02
Fluoranthene	0.265	26	shrew	0.01
Indeno(1,2,3-cd)pyrene	0.0055	62	shrew	<0.01
Phenanthrene	0.3204	11	shrew	0.03
Pyrene	0.0034	15	shrew	<0.01
Aroclor-1254	0.032	0.022	shrew	1.5
Aroclor-1260	0.032	0.44	insectivorous robin	0.07
Chlordane[alpha-]	.0052	2.1	shrew	<0.01
Chlordane[gamma-]	0.3009	2.1	shrew	0.14
DDD [4,4'-][b]	0.0806	0.0026	insectivorous robin	31
DDE[4,4'-]	0.018	0.0026	insectivorous robin	7.1
DDT[4,4'-]	0.065	0.0026	insectivorous robin	25.1
Dieldrin	0.005	0.04	shrew	0.13
Endrin	0.004	0.0034	plant	1.2
Endrin aldehyde[c]	0.00758	0.0034	plant	2.2
Benzoic Acid	0.2557	7.3	deer mouse	0.04
Bis(2-ethylhexyl)phthalate	0.005	1	insectivorous robin	<0.01
Di-n-Butyl Phthalate	0.235	0.17	insectivorous robin	1.4
Pentachlorophenol[c]	0.23	0.032	plant	7.6
Acetone	0.0199	3.8	deer mouse	<0.01
Butanone[2-]	0.043	1300	deer mouse	<0.01
Dichlorobenzene[1,4-]	0.0059	1.2	earthworm	<0.01
Dichlorobenzene[1,2 -][c]	0.00055	1.2	earthworm	<0.01
Dichloroethene[cis-1,2-]	0.002	82	deer mouse	<0.01
Methylene Chloride	0.2468	7.1	deer mouse	0.03
Tetrachloroethene	0.0074	5.4	deer mouse	<0.01
Toluene	0.0041	70	shrew	<0.01
Xylene (Total)	0.0054	5.4	shrew	<0.01

Note: Black shading = HQ >0.3.

[a] Not analyzed directly. Methylmercury estimated at 0.2% of total mercury based on previously collected data. See Appendix F.

[b] DDT used as a surrogate compound.

[c] Max value used because no UCL.

There are no ESLs for several COPCs. These compounds are aldrin, 4,6-dinitro-2-methylphenol, 2,4-dinitrophenol, ethylbenzene, 4-isopropyltoluene, 1-propylbenzene, 1,2,4-trimethylbenzene, and 1,3,5-trimethylbenzene. These potential COPECs are discussed in the uncertainty section. Inorganic COPCs that have an HQ greater than 0.3 using the final ESLs were carried through the assessment as COPECs. The benchmark of an HQ of 0.3 is used to account for potential additive effects of chemicals, and to insure that no chemical that may contribute substantially to the HI for an individual receptor is overlooked. Four metals (cadmium, mercury, methylmercury, and silver) were carried through to the next level of screening, as were 8 organic compounds. Hazard quotients for each receptor for each of these COPECs are presented in Table 3.5-5.

Table 3.5-5
Hazard Quotients Hazard Indices for COPECs at SWMUs 0-030(b,m)

Receptor	Omnivorous Kestrel	Carnivorous Kestrel	Herbivorous Robin	Invertivorous Robin	Omnivorous Robin	Deer Mouse	Cottontail	Red Fox	Shrew	Earthworm	Plant
Cadmium	0.06	<0.01	0.03	0.42	0.23	33.1	2.0	0.07	64.0	0.03	0.30
Mercury (total as inorganic)	0.22	0.08	0.72	1.7	1.2	0.02	<0.01	<0.01	0.05	20.2	0.03
Mercury (methyl)[a]	0.95	0.26	0.03	5.7	2.8	0.32	<0.01	0.02	0.64	<0.01	—[b]
Silver	0.04	<0.01	0.13	0.29	0.21	0.03	<0.01	<0.01	0.05	—	80.2
Aroclor-1254	0.19	0.15	0.02	0.78	0.40	0.71	0.01	0.21	1.5	—	<0.01
DDD[4,4'-][c]	9.7	10.9	0.62	31.0	15.5	<0.01	<0.01	<0.01	0.01	—	—
DDE[4,4'-]	2.2	2.4	0.14	6.9	3.5	<0.01	<0.01	<0.01	<0.01	—	—
DDT[4,4'-]	7.0	7.1	0.54	25.0	12.5	0.03	<0.01	0.01	0.07	—	0.02
Di-n-butylphthalate	0.21	0.06	0.26	1.4	0.81	<0.01	<0.01	<0.01	<0.01	—	<0.01
Endrin	0.07	0.03	0.06	0.46	0.24	0.01	<0.01	<0.01	0.03	—	1.2
Endrin aldehyde	0.11	0.05	0.09	0.69	0.36	0.02	<0.01	<0.01	0.04	—	2.2
Pentachlorophenol	0.01	<0.01	<0.01	0.06	0.03	0.25	0.02	0.03	0.46	0.02	7.2
HI for receptor	20.8	21.0	2.6	74.4	37.8	34.5	2.0	0.36	66.8	20.3	91.2
HI adjusted by individual AUF	0.15	0.15	2.6	74.4	37.8	34.5	0.50	<0.01	66.8	20.3	91.2

Note: Black shading = HQ >0.3 or HI >1.

[a] Not analyzed directly. Methylmercury estimated at 0.2% of total mercury based on previously collected data. See Appendix F.

[b] — = No LANL ESL available.

[c] DDE used as a surrogate compound.

In addition to the direct comparison of the 95% UCL of the mean concentration to the ESL, Table 3.5-5 shows the HI due to all COPCs for each receptor and the adjusted HI when the HI is multiplied by an AUF to account for the amount of time that the receptor is likely to spend within the contaminated area based in the size of the receptor's home range. AUFs for individual receptors were developed by dividing the size of the area of the site by the individual home range for that receptor species (Table 3.5-6). The home ranges for these receptor species were based on EPA (1993, 59384) and Gallegos et al. (1996, 57915). As explained in Appendix F, the size of the site was estimated at 0.775 ha.

Table 3.5-6
Area-Use Factors

Receptor	Home Range (ha)	Individual AUF (ha)
American kestrel	106	0.0073
American robin	0.42	1*
Deer Mouse	0.077	1*
Vagrant shrew	0.39	1*
Desert cottontail	3.1	0.2500
Red Fox	1038	0.00007

* If the size of the site exceeds the home range of the receptor, the AUF is set to the default value of 1.

Application of the AUFs for individual animals in the receptor species demonstrates that none of the remaining COPECs represent a potential risk to the carnivorous kestrel, which is a surrogate for the Mexican spotted owl. This result occurs using only the home range of the kestrel for the calculations; the home range for the Mexican spotted owl is much larger than the home range of the kestrel. The hazard indices modified by individual AUFs also do not indicate potential for ecological risk to the omnivorous kestrel, which represents the feeding guild of omnivorous birds, including the kestrel. HIs modified by the AUF also indicate no potential for ecological risk to the fox or cottontail rabbit. Even when AUFs are considered, the hazard indices for the remaining receptors remain elevated above the benchmark of one, indicating that there is potential for effects on individuals of that species.

Screening for Population-Level Effects

Except when evaluating threatened or endangered species, EPA guidance recommends evaluating ecological effects at the population level rather than at the individual level (EPA 1999, 70086). For this aggregate, screening for population-level effects was also conducted as described in this section for COPECs that generated an HI above 0.3 after being adjusted by individual AUFs. However, any COPEC that generated an HQ >0.3 without AUF adjustment (showing potential risk to individuals) is discussed in the uncertainty section even if it did not generate an HQ high enough to indicate potential population-level effects.

An approach for assessing effects on populations is through the use of a PAUF. The modification of a hazard quotient or HI with a PAUF uses the estimated area covered by the population of a receptor species and the size of the contaminated site to assess the likelihood of any individual within a given population encountering the contaminated area, while using the same ESL based on effects to individuals to determine the impact of this contact with the contaminated area. The PAUF assumes that there may be some impact to the individual receptor, and estimates the effect on the population of that impact based on the likelihood that an individual in that population will contact the contaminated area. The basis and development of this approach are described fully in Appendix F-2.0. For this aggregate of SWMUs, the area of the contaminated site was initially considered to be the entire area that was sampled. Based on that site size, the calculations in Appendix F using the PAUFs in Tables F-2.0-10 yielded the adjusted HIs shown in Table 3.5-7.

Table 3.5-7
PAUF-Adjusted HIs for SWMUs 030 (b,m)

Receptor	Herbivorous Robin	Invertivorous Robin	Omnivorous Robin	Deer Mouse	Shrew
HI adjusted by PAUF	0.13	3.6	1.8	8.9	3.5

Four of these PAUF-adjusted HIs are still elevated above 1, indicating the potential for some population level risk to these receptors. The hazard quotients for each COPC for each of these receptors is shown in Appendix F in Table F-2.0-11 and identifies the COPCs contributing significantly to this HI: almost all of the potential risk to the deer mouse and shrew is accounted for by cadmium, almost all of the potential risk to avian receptors is accounted for by exposure to DDT and its breakdown product DDD. The uncertainty section provides a further discussion of each of these COPCs.

(c) Uncertainty Analysis

Screening assessments for ecological risk incorporate a number of assumptions that may be sources of uncertainty.

For this site, viable ecological habitat exists at the site and is being utilized by various ecological receptors. The suite of terrestrial wildlife receptors for which ESLs have been generated are adequate to assess the feeding guilds likely to be encountered at this site. The COPECs left at this site include metals and some non-volatile organic compounds. The exposure pathways considered for this site were ingestion of soil both during feeding and grooming activities as well as COPECs taken up through plant roots and later ingested as food. For the type and distribution of contaminants seen at this site, these are expected to represent the major pathways for potential exposure. The exposure pathways addressed by the ESL and HQ/HI analysis include all complete exposure pathways with the exception of inhalation and dermal exposure. Although these pathways contribute to the dose received by animals, it is expected that the contribution of these pathways is relatively small and does not interfere with COPEC determination. Dermal contact and inhalation/respiration pathways have not typically been assessed quantitatively in ecological risk assessments, based on guidance that suggests that the ingestion route is most important to terrestrial animals (EPA 1997, 59370). Inhalation is viewed to be an insignificant pathway for contaminated soil in areas where plants cover the contaminated ground surface or where much of the contamination is buried. Dermal exposure to wildlife is mitigated by the fur or feathers that cover the bodies of most vertebrates. In addition, the incidental consumption of soil during grooming is included in the direct soil ingestion estimates. Soil exposure pathway analysis has shown that inhalation and dermal pathways contribute a small fraction of the dose obtained orally (EPA 2000, 70094). Thus, consideration of the dermal pathway would have little practical impact on the ecological screening assessment. Therefore, the exposure pathways considered in the development of the ESLs used in screening assessment for this site are likely to capture the primary exposures for wildlife receptors at this site.

Other exposure assumptions made during the screening assessment are very protective and likely to overestimate the actual exposure of wildlife receptors to the contaminants at this site. The first tier of the screening process assumes 100% exposure of the receptor to the contaminant representative concentration at the site; this is unlikely for most of the wildlife receptors evaluated. For those COPECs for which a mean can be calculated, this level is conservatively calculated as the 95% UCL of the mean concentration and the second level of screening also assumes that the receptor spend 100% of its time at the site. Therefore, even the screening using the 95% UCL of the mean concentration is likely to be a conservative estimate of exposure to contaminants at the site. In assessing this site, all samples designated as soil, fill, or sediment (not rock or tuff) were included in the data set used to generate representative concentrations, regardless of the depth at which the sample was taken. The "Screening Level Ecological Risk Assessment Methods" (LANL 1999, 64783) guidance generally recommends that ecological screening include only the first 5 ft of soil below ground surface since this interval is likely to include most of the burrowing and rooting activity. At this site excavation and backfilling were performed repeatedly in the past and may occur under projected future use of the site. These activities can change the depth at which contamination in found and potentially bring subsurface contamination to the surface, therefore soil and fill from all depths at the site was considered in calculating the 95% UCL of the mean representative concentration.

Additional sources of uncertainty in an ecological risk screening appear in the derivation of the toxicity information and benchmarks for ecological receptors. The toxicity data and uncertainty factors used to develop the ESLs may potentially underestimate or overestimate the actual toxicity of a chemical to a receptor, particularly when that data is extrapolated from one species to another. In addition, the comparison of site concentrations to ESLs assumes that the chemical species or form occurring at the site is identical to the chemical species used in the toxicity analysis. The screening comparison also assumes that 100% of the chemical is bioavailable to the exposed receptor. Because toxicity testing generally uses more bioavailable and potentially toxic forms of the chemical being studied, the assumptions of speciation and bioavailability are conservative and likely to overestimate the actual risk to wildlife from exposure to the residual contamination. Consideration of the effects of exposure to more than a single chemical at a site is modeled on the assumption of additive effects of chemicals. This assumption could overestimate or underestimate the actual impact of exposure to multiple contaminants due to synergistic or antagonistic effects. No information is available for most chemicals or synergistic or antagonistic effects, therefore almost all risk screenings and assessments assume the effects are additive when multiple chemical contaminants are present.

Eight COPECs without ESLs were detected a single time in the sampling. This group includes: 4,6-dinitro-2-methylphenol, 2,4-dinitrophenol, ethylbenzene, 1-propylbenzene, 1,2,4-trimethylbenzene, and 1,3,5-trimethylbenzene. For each of these COPECs the single detection represents 4% of the samples. At this frequency of detection, receptors are unlikely to contact these COPCs, and therefore they are not retained as COPECs. Aldrin was detected at a concentration of 0.4 µg/kg twice in 43 samples, which also represents 4% of the total samples. EPA Region VI provides a human health soil screening level based on carcinogenicity for aldrin of 29 µg/kg; about 72 times the level found at the site. The human health screening level is not directly applicable to ecological receptors, but provides a qualitative estimate of the toxicity of this chemical to mammals. There were 3 detections of 4-isopropyltoluene. EPA has not issued any screening levels for this chemical, but isopropylbenzene can serve as a surrogate (LANL 2002, 72639). There are also no ESLs for the surrogate, but the EPA Region 6 screening level is 370 mg/kg, which again indicates very low potential toxicity from this chemical, particularly at this site where the maximum concentration detected was 20 µg/kg. For all of these COPCs, the low concentrations detected, the diffuse locations of the detected concentrations, and the large differences between the detected concentrations and human health screening levels, these COPCs are not believed to present an ecological risk to receptors at this site.

Calcium and sodium. Although calcium and sodium were identified in the data review as statistically different from background, these two elements have not been carried through the ecological screening as potential COPECs. Sodium and calcium are essential nutrients, therefore they were not considered further as COPECs.

Cadmium. The 95% UCL of the mean concentration for cadmium generates HQs greater than one for small mammal receptors: cottontail rabbit, deer mouse, and the vagrant shrew. When individual AUFs from Table 3.5-6 are applied to the HIs, the cottontail rabbit is no longer of concern for any COPCs, including cadmium. For the shrew and deer mouse, PAUF factors were developed to assess the potential for risk to populations of these receptors. Table F-2.0-11 in Appendix F shows the PAUF-adjusted HQs for cadmium are still 8.5 for the deer mouse and 3.3 for the shrew. The LANL background value for cadmium of 0.4 mg/kg is based on the detection limit for cadmium because the data set contains a number of non-detects. However, the values for the detected cadmium concentrations in the LANL background dataset (up to 2.6 mg/kg) encompass the range of cadmium values detected at SWMUs 0-030(b,m). In addition, all detected cadmium values at this site lie within the range of soil cadmium concentrations (up to 2 mg/kg) shown for the Western United States in section 5.3 of EPA's Ecological Soil Screening Level Guidance document (EPA 2000, 73306). It is likely that the levels of cadmium seen in the soils at SWMUs 0-030(b,m) are reflective of the varying naturally occurring levels in this area. Although these levels are above the ESLs for cadmium in small mammals, these ESLs do not correspond to actual risk to these species because even the BV would generate an HQ of 44 and 85 for the deer mouse and the shrew. Therefore, cadmium is not retained as a COPEC.

Mercury. Mercury was not speciated into inorganic mercury and methylmercury during sampling at this site, but has been speciated in the investigation of another site at the Laboratory, SWMU 0-019 (LANL 2001, 71417.2). The sampling results from that study for the two forms of mercury are presented in Appendix F: these results demonstrate that an average value of 0.2% of mercury is in the methylmercury form at these dry mesa top sites with little organic matter in the soil. Therefore, it was assumed that 0.2% of the total mercury in samples from this group of SWMUs was in the methylmercury form. Based on that assumption, in the initial comparison to ESLs, methylmercury generates HQs above 0.3 for the omnivorous kestrel, the omnivorous robin, the invertivorous robin and the shrew. When the HI for the omnivorous kestrel was adjusted by the AUF for individuals, no COPCs including methylmercury were still of concern for that species. In Table F-2.0-11 the adjustment of the methylmercury HQs for the other three receptors using a PAUF demonstrates that there is no concern for population-level effects to these receptors from methylmercury. This same table also demonstrates that there is no risk of population level effects to the other three receptors from inorganic mercury at the site. Therefore, neither inorganic mercury nor methylmercury is retained as a COPEC for these sites.

Silver. The individual HQs for silver were well within acceptable limits for all terrestrial wildlife receptors except the plant. The final ESLs may not be a good indicator of risk to receptors at the site for this compound because the site contains a widespread and apparently healthy plant community as described in the ecological scoping checklist in Appendix F. Therefore, silver is not retained as a COPEC.

Aroclor-1254. This organic chemical generated an HQ above one (1.5) only for the shrew receptor. The site is larger in size than the home range of the shrew, so this HQ could not be adjusted by an AUF for individuals. Aroclor-1254 was therefore one of the COPCs included in Table F-2.0-11 in Appendix F for analysis of population-level impacts to the shrew using the PAUF approach. PAUF-adjusted HQ for Aroclor-1254 for the shrew is less than 0.1, indicating no population-level ecological risk to the shrew. Therefore, Aroclor-1254 is not retained as a COPEC for this site.

Di-n-butyl phthalate. This organic chemical generated HQs of 1.4 for the robin modeled with a 100% insect diet. The PAUF-adjusted HQ for this receptor in Table F-2.0-11 is less than 0.1, indicating no risk of population-level effects from Di-n-butyl phthalate. Di-n-butyl phthalate is therefore not retained as a COPEC for this site.

DDT, DDE, and DDD. Hazard quotients for all avian receptors were elevated for 4,4'-DDT and its metabolites, and breakdown product 4,4-DDD and 4,4'-DDE. For the T&E species for which the kestrel is a surrogate, the adjustment of the HQs by the AUF for the Mexican spotted owl of 0.002 (0.7/366 ha) reduces the HQs for 4,4'-DDE and 4,4'-DDT for the Mexican spotted owl to 0.019, 0.005, and 0.014, respectively. These would sum only to 0.038, indicating no potential ecological risk to threatened and endangered species from residual DDT and metabolites at the site. For other receptors HQs and HIs for 4,4'-DDT, 4,4'-DDD, and 4,4'-DDE were recalculated using PAUFs to assess the potential for ecological impacts to populations. Table F-2.0-11 in Appendix F presents these adjusted HIs and HQs for the robin (using all three modeled diets) the deer mouse, and the shrew. All HQs for 4,4-DDD are at or below 0.3 when adjusted by the PAUF, so 4,4-DDD is not considered further. For the robin on one of the diets (invertivore) the HQs for DDT and DDE remain elevated above 1.0 at 1.2 and 1.5, respectively. However, many of the detections of 4,4'-DDT and 4,4'-DDE occurred at greater than 5 ft bgs. This is generally considered to be below the depth at which contamination is easily biologically accessible. The 95% UCL of the mean concentration of 4,4'-DDT between 0 and 5 ft bgs is 0.023 mg/kg, which generates an HQ of 0.42 for the invertivorous robin. This same reasoning applies to 4,4'-DDE, which was detected only twice at depths between 0 and 5 ft bgs; both detections of 4,4'-DDE were 0.02 mg/kg, which generates a PAUF-adjusted HQ of 0.37. These HQs indicate that the easily accessible concentrations of DDT and DDE are unlikely to result in population level affects to avian receptors. Therefore the COPCs are not retained as COPECs.

Endrin and endrin aldehyde. Both of these COPCs were detected only once in 43 samples. This represents 2.3% of the samples, and therefore these COPCs are not retained as COPECs.

Pentachlorophenol. Pentachlorophenol generated an HQ of concern only for the plant. A 95% UCL of the mean could not be calculated for pentachlorophenol because there was only a single detection (0.23 mg/kg) at 4.5 ft bgs, out of 41 samples taken at the site. Therefore, the likelihood of a receptor contacting this COPC is small due to its depth and the low frequency of detection (2.5% of the samples). Therefore, pentachlorophenol is not retained as a COPEC.

(d) Interpretation

Twenty COPECs (including eight COPECs without ESLs) were identified based on the ecological screening assessment for SWMUs 0-030(b,m). However, all of these COPECs were eliminated in the uncertainty analysis by considering a number of factors including the likely chemical form of the COPECs, the number of detections of the COPEC, potential for population effects as estimated using PAUFs, the distribution of the COPCs in the soil, and the ecological risk decision criteria for the VCA. The decision criteria were no adverse effects on individuals of T&E species and populations of other species. As stated previously these decision criteria are consistent with EPA guidance on risk management for ecological risk assessments (EPA 1999, 70086).

3.5.2 Other Applicable Assessments

3.5.2.1 Surface Water

SWMUs 0-030(b,m) have erosion matrix potential scores of 17.5 each (see Appendix F), indicating low potential for erosion. There is evidence of runoff discharging but no evidence of visible erosion at the sites. The surface water runoff subscores are both 6.9. Surface water runoff normally terminates by infiltration at the head of BV Canyon. Runoff and infiltration from rain events and snowmelt are the only aspects of surface water hydrology at the septic tank SWMUs. Surface transport from overland flow and outfalls may cause contaminants to become potentially concentrated in drainages and may cause infiltration of contaminants into subsurface soil or tuff. Aeolian (wind-driven) contaminant entrainment and transport is unlikely considering extensive vegetation cover. While offsite transport to the western end of BV Canyon is observed, there are no visible signs of erosion at the sites. Portions of the SWMUs are paved with asphalt, and vegetative cover is stabilizing the shallow soil across the majority of the remaining area.

3.5.2.2 Groundwater

The regional aquifer beneath the 6th Street Warehouse area is at an elevation of approximately 5900 ft (determined in Test Well 2 in Pueblo Canyon, and in Otowi 4 in Los Alamos Canyon), chiefly within sediments of the Puye and Tesuque Formations (Purtymun 1995, 45344; Broxton et al. 1995, 50119). At SWMUs 0-030(b,m), the regional aquifer is approximately 1200 ft bgs. Runoff or infiltration from the SWMUs is unlikely to reach the regional aquifer. No perched or alluvial groundwater has been identified beneath these SWMUs.

3.5.2.3 Underground Storage Tanks

No underground storage tanks are present at SWMUs 0-030(b,m).

3.5.3 Conclusions and Recommendations

The results of the human health risk screening assessment in Section 3.5.1 show that under a residential scenario there is no unacceptable potential risk to human health from residual contamination at SWMUs 0-030(b,m). The ecological risk screening assessment shows that no COPECs were retained. Therefore no potential unacceptable adverse ecological effects exist due to residual contamination at this site.

Therefore, SWMUs 0-030(b,m) are recommended for NFA under Criterion 5: "The PRS has been characterized or remediated in accordance with current and applicable state or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected land use" (NMED 1998, 57761).

4.0 AOCs 0-029(a,b,c)

4.1 Summary

AOCs 0-029(a,b,c) are identified in the SWMU report (LANL 1990, 0145) as Aggregate 0-G, leakage from transformers containing PCBs (Figure 4.1-1). AOCs 0-029(a,b) are two former production well sites located on San Ildefonso Pueblo property, and AOC 0-029(c) is a former production well site located on public land managed as part of the Santa Fe National Forest in Guaje Canyon. The AOCs consist of potentially contaminated soil resulting from releases from transformers located on power poles.

AOCs 0-029(a,b,c) were investigated in 1992, and an RFI Phase Report was written (LANL 1993, 26972). The goal of the RCRA process for these AOCs was to ensure that any residual contamination within the sites is below the cleanup level for PCBs in soil established by the Toxic Substances Control Act (TSCA) (FR 52[63]:10688). At the time of the initial RFI activities in 1992, that level was 10 mg/kg (LANL 1993, 26972). The current Laboratory preliminary remediation goal (PRG) for PCB-contaminated sites is 1 mg/kg. Although data from the sites indicated no PCB contamination requiring remediation, the Laboratory chose to perform a voluntary cleanup at AOC 0-029(a) by cleaning the pump house and removing soil. These AOCs were resampled in 2002 because the 1992 samples did not include sufficient QA/QC documentation. The intent of the 2002 sampling was to determine whether residual PCB contamination is present at the AOCs, and to confirm the effectiveness of the 1992 remediation at AOC 0-029(a).

4.2 Description and Operational History

4.2.1 Site Description

AOC 0-029(a), Leakage From PCB Transformers

AOC 0-029(a) is the location of potential soil contamination due to releases from two transformers that were located on a power pole near a former groundwater production well (Well #5) on San Ildefonso Pueblo land in Los Alamos Canyon (Figure 4.1-1). The well was located in the bottom of Los Alamos Canyon, about 100 ft from the stream channel and approximately 0.5 mi upstream from Totavi.

AOC 0-029(b), Leakage From PCB Transformers

AOC 0-029(b) is the location of potential soil contamination due to releases from three transformers located on a power pole that supplied electric power to a former groundwater production well (Well #4) in Los Alamos Canyon (Figure 4.1-1). The well was located in the bottom of Los Alamos Canyon, adjacent to the stream channel and approximately 1 mile upstream from Totavi on San Ildefonso Pueblo land. The power pole was located about 110 ft from the stream channel. The site boundary is approximately 50 ft from the stream channel.

AOC 0-029(c), Leakage From PCB Transformers

AOC 0-029(c) is the location of potential soil contamination due to leakage from a transformer located on a power pole that supplied electrical power to a former groundwater production well (Guaje Well #1) in Guaje Canyon (Figure 4.1-1). The well was located approximately 2 miles upstream from Guaje Canyon's confluence with Los Alamos Canyon. The power pole and transformer was located about 250 ft from the stream channel. This AOC is located on public land managed by the USDA as part of the Santa Fe National Forest.

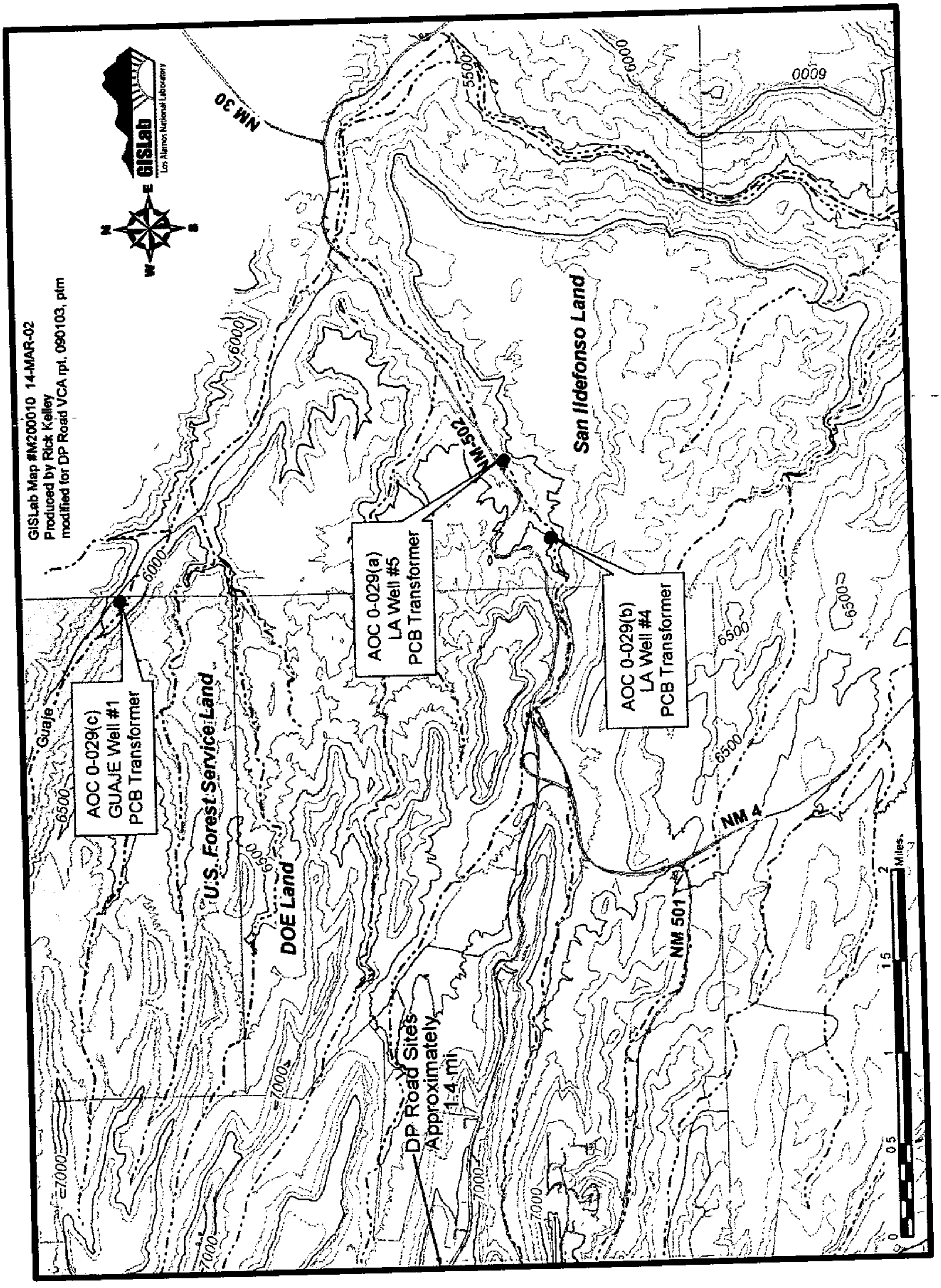

Figure 4.1-1. Locations of AOCs 0-029(a,b,c)

4.2.2 Operational History

AOC 0-029(a)

Two transformers were located on a power pole adjacent to Los Alamos Canyon groundwater production well #5, and were part of the power supply system for the well. The transformers reportedly released an unknown quantity of PCB-contaminated oil to the environment (LANL 1990, 07511). The date(s) of the leakage are not known. Each of the transformers at the site had a capacity of approximately 43 gal.

The two transformers at AOC 0-029(a) were removed on October 14, 1987. Oil from the transformers showed PCB concentrations of 162 mg/kg and 292 mg/kg (LANL 1990, 07511; Bailey 1992, 02007).

Los Alamos Canyon well #5 is no longer operational, and its shaft has been removed (LANL 1992, 07667). The pump house was scheduled for demolition in 1992, but was instead turned over to San Ildefonso Pueblo at its request (LANL 1993, 26972).

AOC 0-029(b)

Three transformers were located on a power pole adjacent to Los Alamos Canyon groundwater production well #4, and were part of the power supply system for the well. The transformers reportedly released an unknown quantity of PCB-contaminated oil to the environment (LANL 1990, 07511). The dates of the leakage are not known. Each of the transformers had a capacity of approximately 43 gal.

The three transformers were removed on October 14, 1987. Oil from the transformers showed PCB concentrations of 231 mg/kg, 206 mg/kg, and 362 mg/kg (LANL 1992, 07667; Bailey 1992, 02007).

Los Alamos Canyon well #4 was decommissioned and the pump house was removed in 1989 (Aldrich 1991, 71266; LANL 1992, 07667).

AOC 0-029(c)

A single transformer was located on a power pole near Guaje Canyon well #1, and was part of the power supply system for the well. The transformer reportedly released an unknown quantity of PCB-contaminated oil to the environment (LANL 1990, 07511). The dates of the leakage are not known. The transformer had a capacity of approximately 43 gal.

The transformer was removed on April 19, 1986, and contained oil with a PCB concentration of less than 50 mg/kg PCBs (Aldrich 1991, 71265).

4.3 Previous Activities

4.3.1 Previous Investigations

AOC 0-029(a)

The OU 1071 RFI work plan called for collecting 20 surface soil samples at each AOC and analyzing the samples for PCBs (LANL 1992, 07667). If PCBs were found above the TSCA action level (10 ppm at that time), the potential for off-site migration would be evaluated.

RFI sampling at AOC 0-029(a) was conducted in March 1992. A 100-ft by 50-ft grid was established, and 15 soil samples were collected at regular intervals along the grid (see Figure 4.3-1). Five additional samples, plus one field duplicate sample, were collected in the area around the power pole, one at the

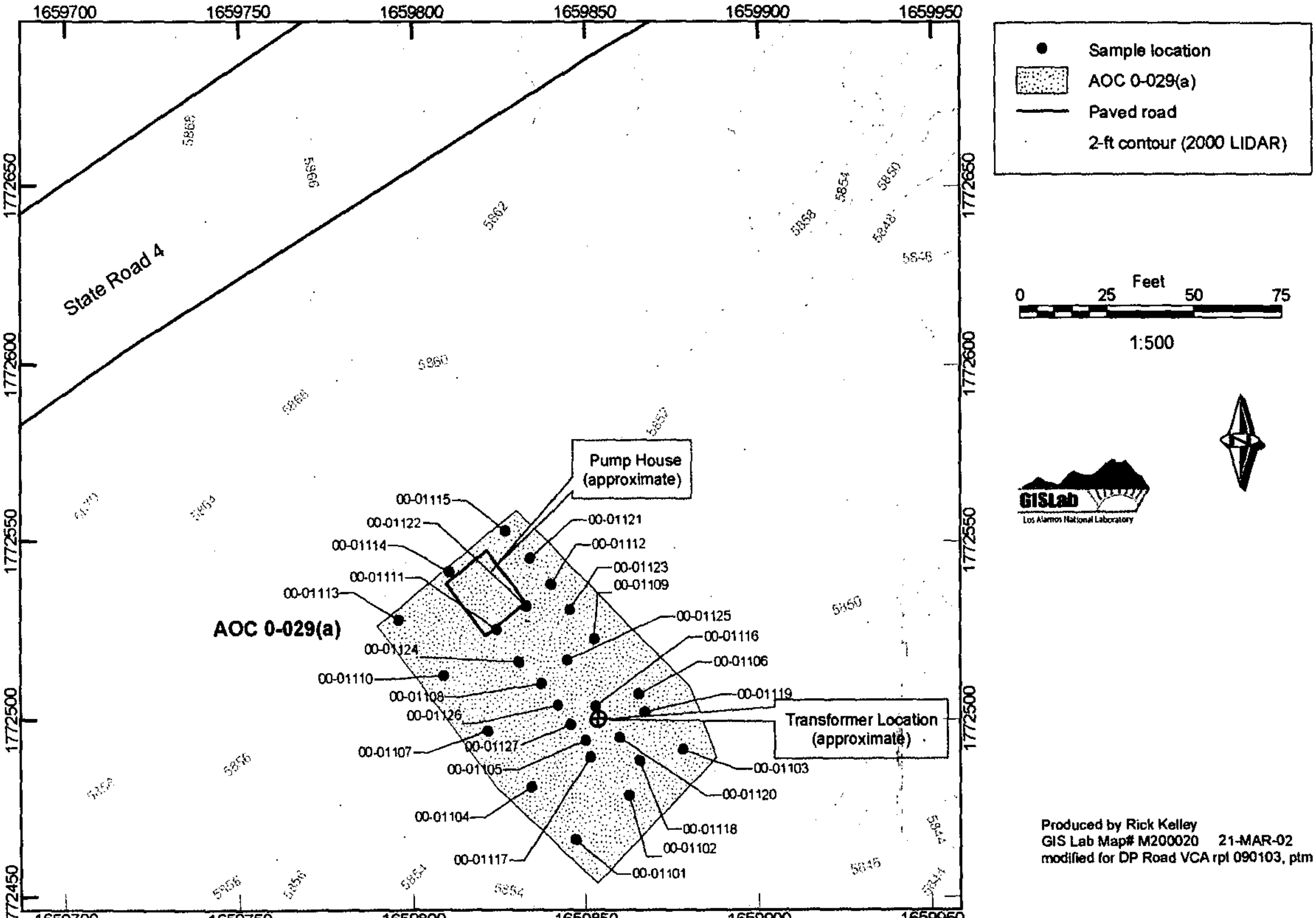

Figure 4.3-1. AOC 0-029(a) previous investigation sample locations

base. All samples were collected from a depth of 0 to 6 in. The samples were submitted to the LANL Environmental Chemistry Group (EM-9) for PCB analysis using gas chromatograph electron capture according to EPA method SW-8080 (LANL 1993, 26972). The soil samples also were screened for gross alpha, beta, and gamma activity (for health and safety and transportation purposes only) prior to submittal to the laboratory. The analytical results indicated that the PCB levels in two of the samples were 0.09 mg/kg, and in the remaining 18 samples PCBs were undetected.

Although the PCB levels were an order of magnitude below the TSCA action level of 10 mg/kg, a decision was made to collect additional samples to define the nature and extent of the contamination. Six additional surface soil samples were collected in the area between the pump house and the power pole (Figure 4.3-1). The sampling sites were selected to more closely delineate the boundary of the suspected contaminated area (LANL 1993, 26972). These samples also were collected from a depth of 0 to 6 in. These samples were analyzed in the same way as the previous samples. Analytical results showed PCB concentrations of 0.14 and 0.40 mg/kg in two samples; PCBs were undetected in the other four samples.

During the second sampling event, an area of "oil-stained" soil was noted south of the pump house. An additional surface soil sample was collected within this stained area and analyzed for PCBs, VOCs and total recoverable petroleum hydrocarbons. No VOCs or PCBs were detected. The sample contained no petroleum hydrocarbons, but contained mineral oil in the range of 140,000 to 216,000 mg/kg. The conclusion reached was that the stained soil contained a non-hazardous mineral oil used at the pump house (LANL 1993, 26972).

The original plan had been to remove the pump house, but San Ildefonso Pueblo informed the Laboratory in March 1992 that they wanted the building left intact. Because the pump house was now to be left in place, additional samples were collected inside the pump house. These samples included a swipe sample from the floor near the drain, and a sample of oil from inside a turbine located in the pump house. The floor swipe contained 2.3 mg/kg PCBs and the turbine oil contained less than 5 mg/kg PCBs.

Although the PCB contamination in the soil was below the TSCA cleanup level of 10 mg/kg, the Laboratory elected to remove the contaminated soil and to decontaminate the pump house. The boundary of the area identified for excavation was conservatively selected to ensure that all contaminated soil would be removed. The pump house was decontaminated first, by washing the floor with Capsure, a cleaner used for PCB cleanups. Following the pump house cleanup, approximately 20 yd^3 of soil was removed between the pump house and the transformer pole, including the "oil stained" area (LANL 1993, 26972). Soil was removed to a depth of approximately 6 in. The cleanup was completed on August 6, 1992. No confirmatory sampling was conducted because the levels of PCBs had already been found to be less than the TSCA cleanup level (LANL 1993, 26972).

The September 1996 permit modification request recommended NFA at AOC 0-029(a) under Criterion 5, "The AOC has been characterized or remediated in accordance with current and applicable state or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected land use" (NMED 1998, 57761). Subsequently, the RRES-RS Project determined that use of the 1992 sample data was questionable because of the lack of QA/QC information for those samples, which were analyzed at LANL. For that reason, the 1992 samples are not presented here except in summary, and those data are not included in the data review or screening assessments presented in this report.

AOC 0-029(b)

Sampling at AOC 0-029(b) was conducted in March 1992 (LANL 1993, 26972). A 50-ft by 100-ft grid was established, and 15 soil samples were collected at regular intervals along the grid (see Figure 4.3-2). Five additional soil samples, plus one field duplicate sample, were collected near the base of the power pole. All samples were collected from a depth of 0 to 6 in.

The 20 samples (plus one field duplicate) were collected and submitted to the LANL Environmental Chemistry Group (formerly EM-9, now C-ACS) for analysis of PCBs using gas chromatograph electron capture according to EPA Method SW-8080 (LANL 1993, 26972). The soil samples also were screened for gross alpha, beta, and gamma radioactivity (for health and safety and transportation purposes only) prior to submittal to the laboratory. The analytical results showed that PCBs were undetected in all of the samples.

The analytical results for AOC 0-029(b) indicated that the PCB concentrations in all of the soil samples were well below the TSCA cleanup level of 10 mg/kg (all samples were below the detection limit of 0.06 mg/kg). No additional action was performed or recommended (LANL 1993, 26972).

The September 1996 permit modification request recommended NFA at AOC 0-029(b) under Criterion 5, "The AOC has been characterized or remediated in accordance with current and applicable state or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected land use" (NMED 1998, 57761). Subsequently, the RRES-RS Project determined that use of the 1992 sample data was questionable because of the lack of QA/QC information for those samples. For that reason, the 1992 samples are not presented here except in summary, and those data are not included in the data review or screening assessments presented in this report.

AOC 0-029(c)

Sampling at AOC 0-029(c) was conducted in March 1992. A 75-ft by 65-ft grid was established, and sixteen soil samples were collected. Five additional samples, plus one field duplicate sample, were collected from the area around the power pole (see Figure 4.3-3). All samples were collected from a depth of 0 to 6 in.

The 22 samples were collected and submitted to the LANL Environmental Chemistry Group (formerly EM-9, now C-ACS) for analysis of PCBs. The soil samples also were screened for gross alpha, beta, and gamma radioactivity (for health and safety and transportation purposes only) prior to submittal to the laboratory. The analytical results for AOC 0-029(c) indicated that the PCB levels in all of the soil samples were well below the TSCA cleanup level of 10 mg/kg (the maximum concentration detected was 0.09 mg/kg, and PCBs were undetected in all but one of the remaining samples). No additional action was performed or recommended in the RFI Report (LANL 1993, 26972).

The September 1996 permit modification request recommended NFA at AOC 0-029(a) under Criterion 5, "The AOC has been characterized or remediated in accordance with current and applicable state or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected land use" (NMED 1998, 57761). Subsequently, the RRES-RS Project determined that use of the 1992 sample data was questionable because of the lack of QA/QC information for those samples. For that reason, the 1992 samples are not presented here except in summary, and those data are not included in the data review or screening assessments presented in this report.

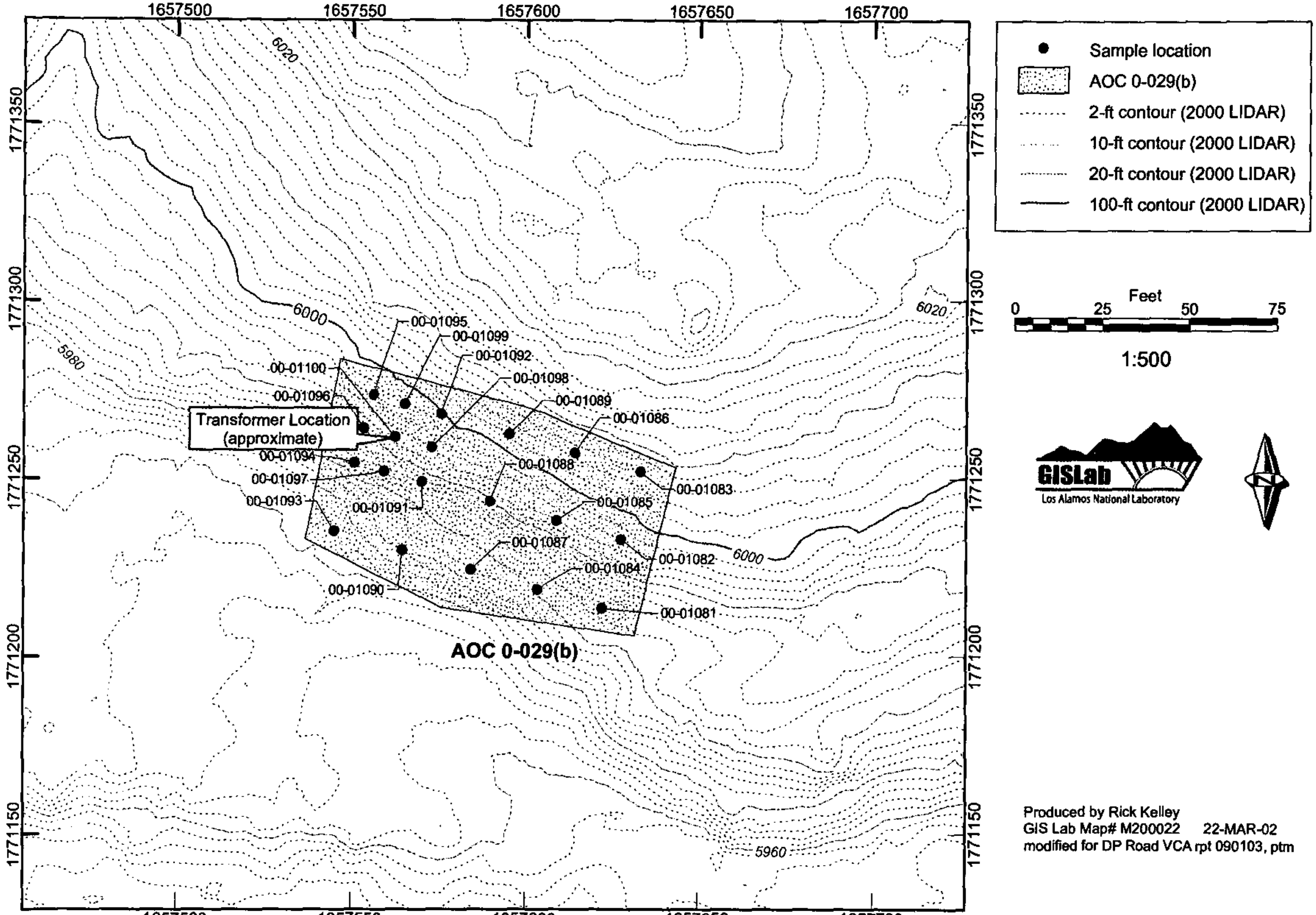

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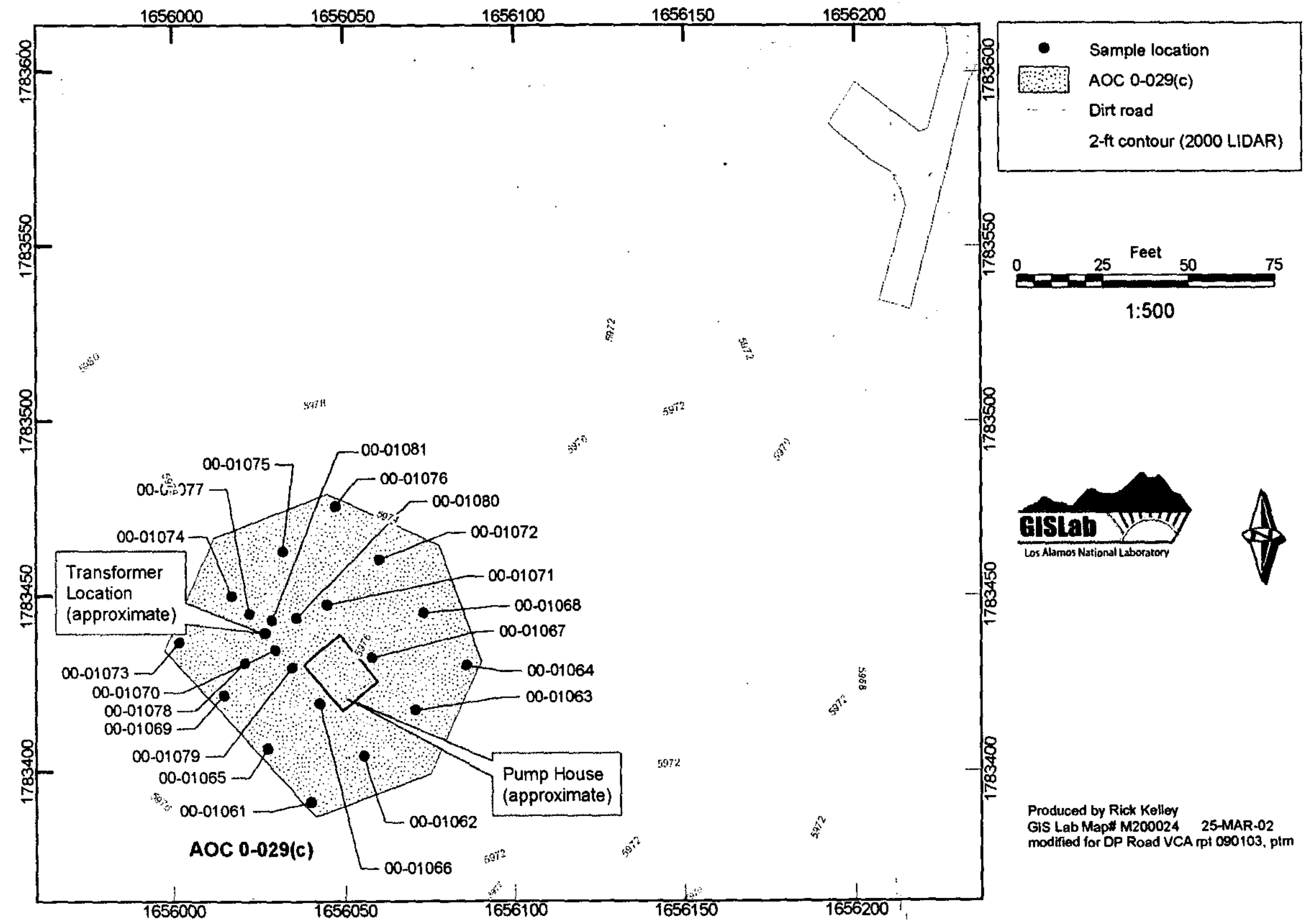
Figure 4.3-2. AOC 0-029(b) previous investigation sample locations



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modified for DP Road VCA rpt 090103, ptm

Figure 4.3-3. AOC 0-029(c) previous investigation sample locations

4.3.2 Preliminary Site Conceptual Model

Potential contaminant sources at AOCs 0-029(a,b,c) are leaks from transformers formerly located on utility poles at each site. Leaks of PCB-containing oil potentially contaminated surface soils in the areas surrounding the utility poles. Contaminants are likely to have remained relatively immobile in the surface few inches of soil. Surface runoff from storms or snow melt could potentially have transported contaminated soil some distance during intense runoff events. Evaluations of the runoff and erosion potential of the sites, however, indicated that visible erosion is not present, and runoff is unlikely.

The primary potential ecological exposure pathways are plant uptake and rainsplash, food web transport, soil ingestion, dermal contact, and inhalation. The primary potential human exposure pathways are ingestion, dermal contact, and dust inhalation (Figure 4.3-4).

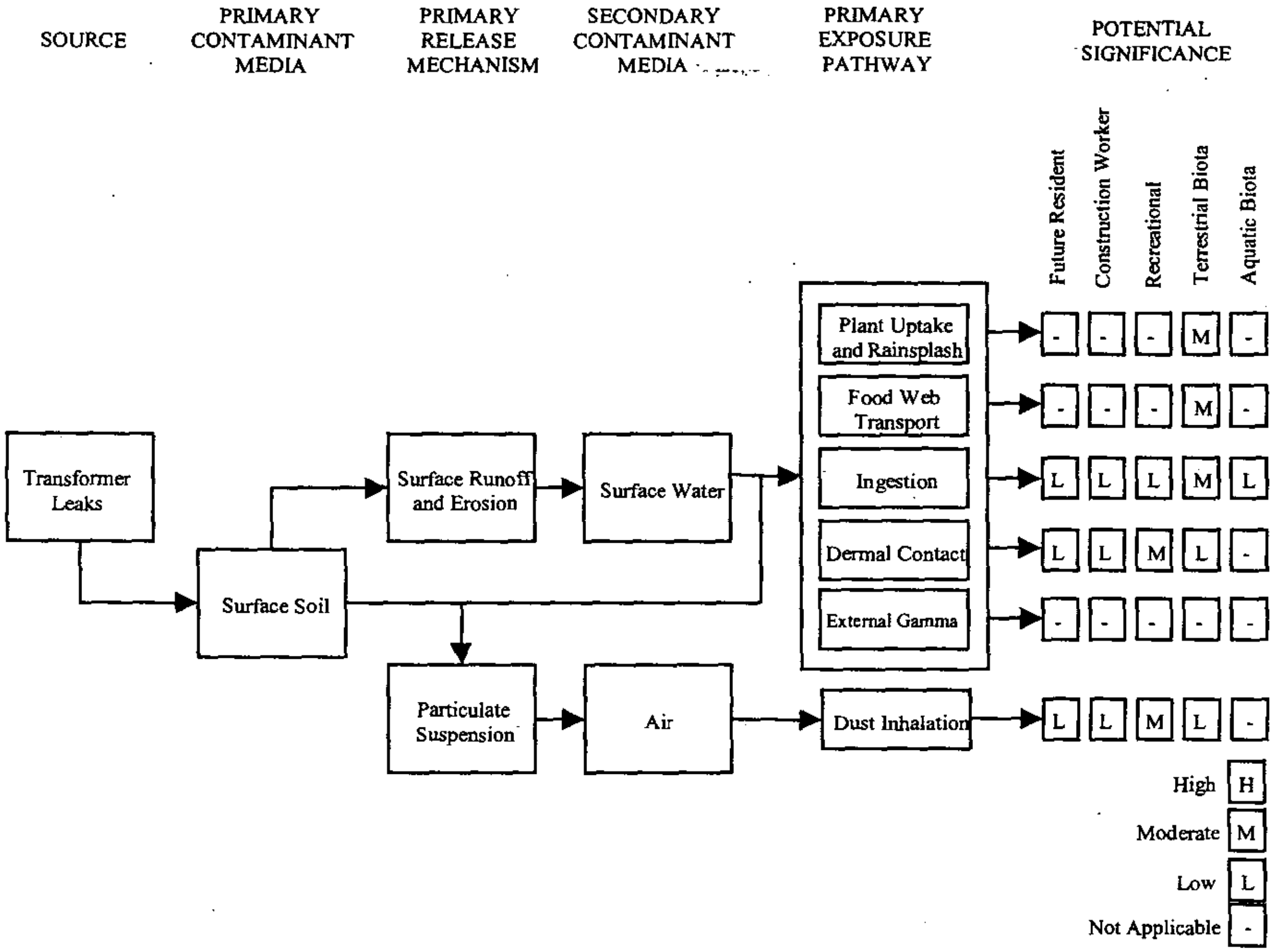


Figure 4.3-4. Preliminary conceptual model for AOCs 0-029(a,b,c)

4.4 Remedial Activities

4.4.1 Investigative Activities During VCA

Sampling was conducted at AOCs 0-029(a,b) on October 28, 2002, through October 31, 2002, and at AOC 0-029(c) on November 11, 2002. Samples were collected in accordance with ER-SOP-6.10, Rev. 1, "Hand Auger and Thin-Wall Tube Sampler," or ER-SOP-6.09, Rev. 1, ICN, "Spade and Scoop Method for Collection of Soil Samples." Sample locations were surveyed according to ER-SOP-3.11, Rev. 1, "Coordinating and Evaluating Geodetic Surveys", using a total station.

AOC 0-029(a)

Thirty-six samples (including two field duplicate samples) were collected from 17 locations at AOC 0-029(a) (see Figure 4.4-1). Ten sample locations (Locations 00-02-20039, 00-02-20040, 00-02-20043, 00-02-20046, 00-02-20047, 00-02-20048, 00-02-20049, 00-02-20052, 00-02-20054, and 00-02-20055) were placed approximately on the 50-ft by 100-ft grid near locations used in the 1992 RFI sampling. One sample location (00-02-20041) was placed at the base of the former transformer-bearing utility pole, and 3 locations (00-02-20042, 00-02-20044, and 00-02-20053) were placed in the area near the utility pole. Two sample locations (00-02-20050, and 00-02-20045) were selected along a small drainage on the northwest side of the pump house. One sample location (00-02-20051) was placed to the north of the pump house. At each location, samples were collected from two depths, 0 to 0.5 ft and approximately 1 to 1.5 ft. All samples were submitted to a fixed laboratory for analysis of PCBs and pesticides (the intent was to analyze for PCBs only, the pesticide analysis request was an unintentional deviation from the VCA/IA plan [LANL 2002, 73579]).

AOC 0-029(b)

Forty-two samples (including two field duplicate samples) were collected from 20 locations at AOC 0-029(b) (see Figure 4.4-2). Fifteen sample locations (00-02-20063 through 00-02-20074, 00-02-20079, 00-02-20080, and 00-02-20082) were selected on a 65-ft by 75-ft grid, and 5 sample locations (00-02-20075, 00-02-20076, 00-02-20077, 00-02-20078, and 00-02-20081) were selected near the base of the former transformer-bearing utility pole. At each location, samples were collected from two depths, 0–0.5 ft and approximately 1 to 1.5 ft. All samples were submitted to a fixed laboratory for analysis of PCBs and pesticides (the intent was to analyze for PCBs only, the pesticide analysis request was an unintentional deviation from the VCA/IA plan [LANL 2002, 73579]).

AOC 0-029(c)

Forty-four samples (including two field duplicate samples) were collected from 21 locations at AOC 0-029(c) (see Figure 4.4-3). Fifteen sample locations (00-02-20087 through 00-02-20090, 00-02-20094, 00-02-20095, 00-02-20099, 00-02-20100, and 00-02-20102 through 00-02-20107) were selected on 65-ft by 75-ft grid, and six sample locations (00-02-20091, 00-02-20092, 00-02-20096, 00-02-20097, 00-02-20098, and 00-02-20101) were selected from the area near the former transformer-bearing utility pole. At each location, samples were collected from two depths, 0 to 0.5 ft and approximately 1 to 1.5 ft. All samples were submitted to a fixed laboratory for analysis of PCBs and pesticides (the intent was to analyze for PCBs only, the pesticide analysis request was an unintentional deviation from the VCA/IA plan [LANL 2002, 73579]).

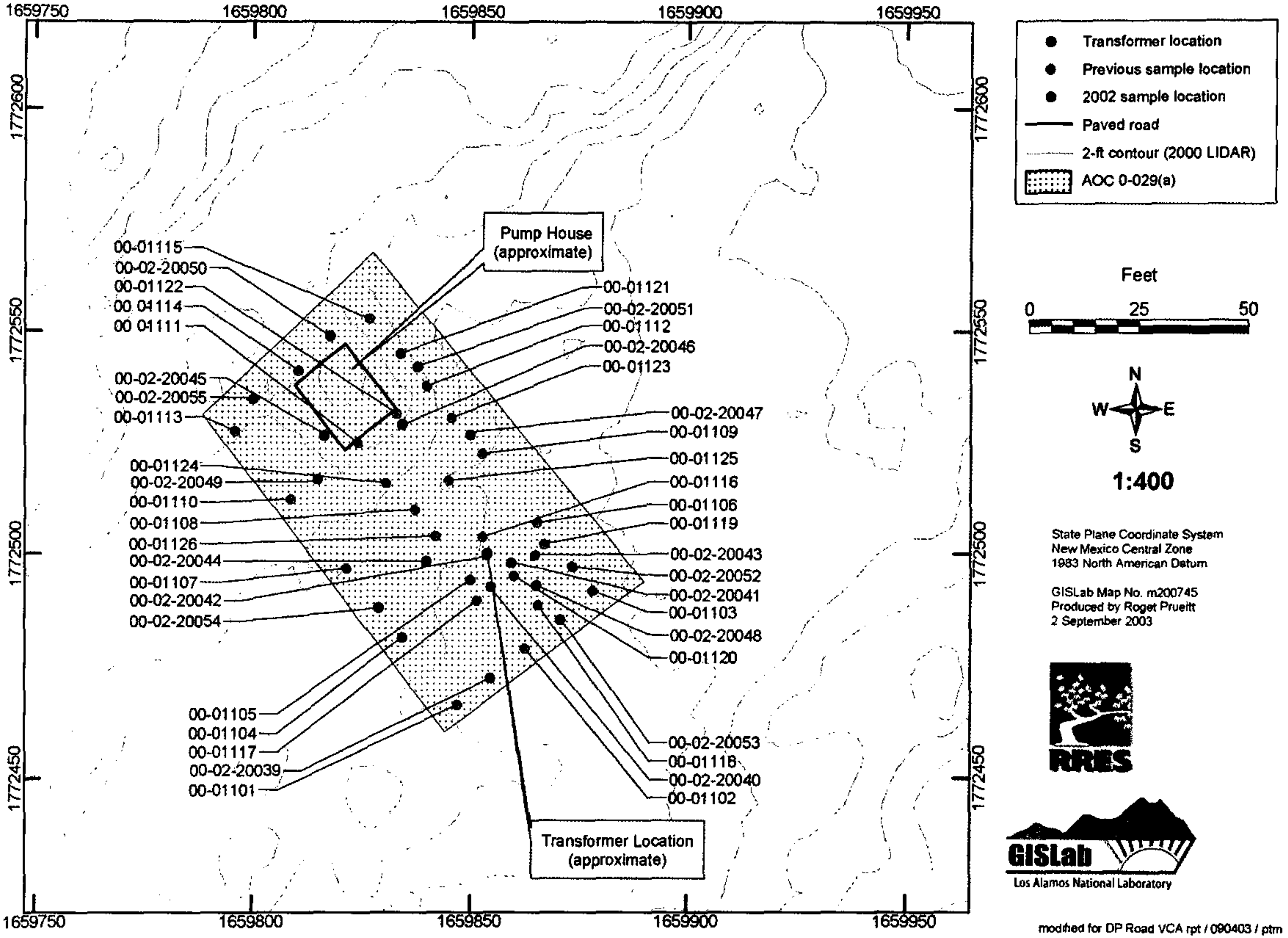


Figure 4.4-1. AOC 0-029(a) RFI and VCA sample locations

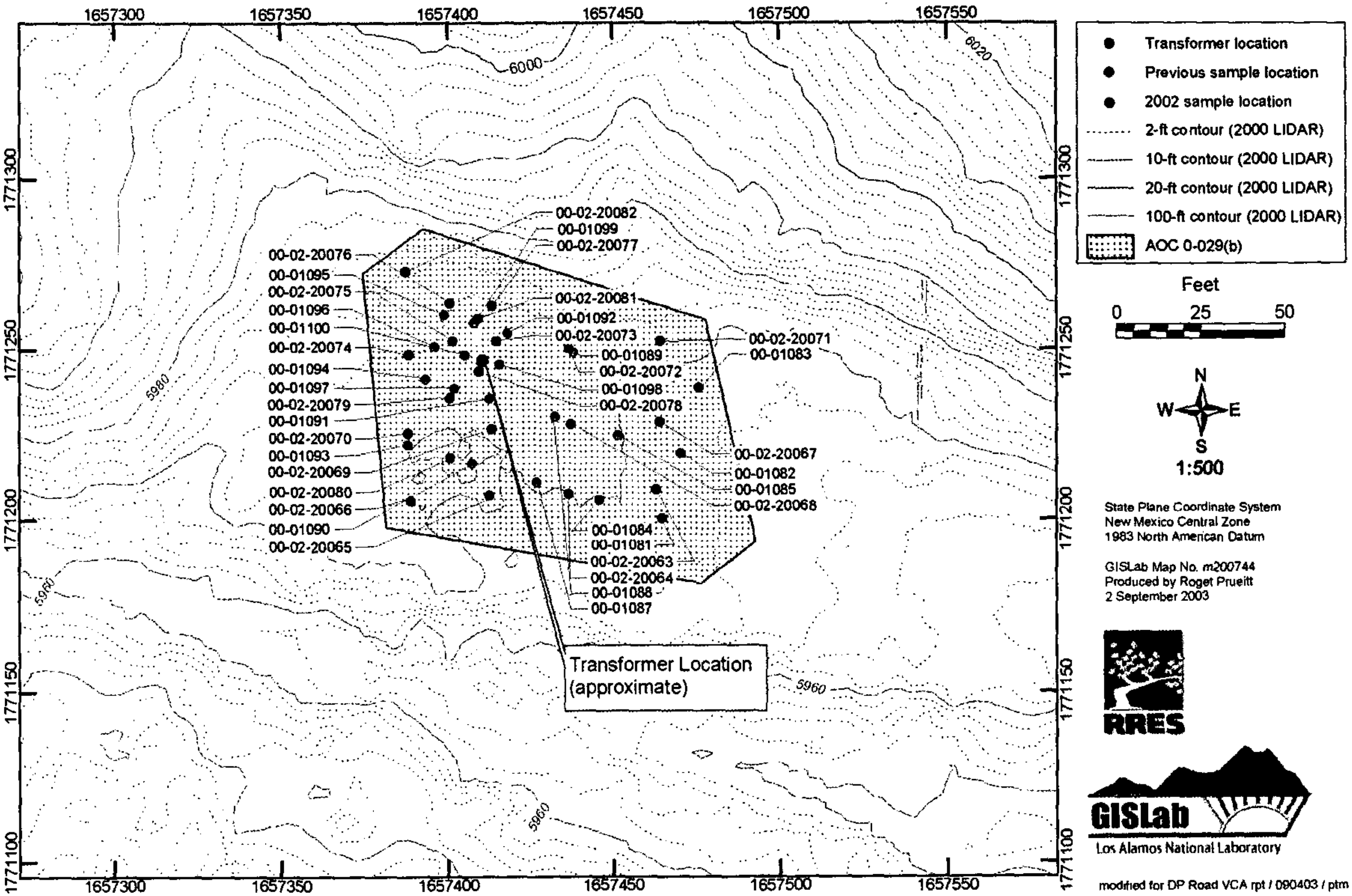


Figure 4.4-2. AOC 0-029(b) RFI and VCA sample locations

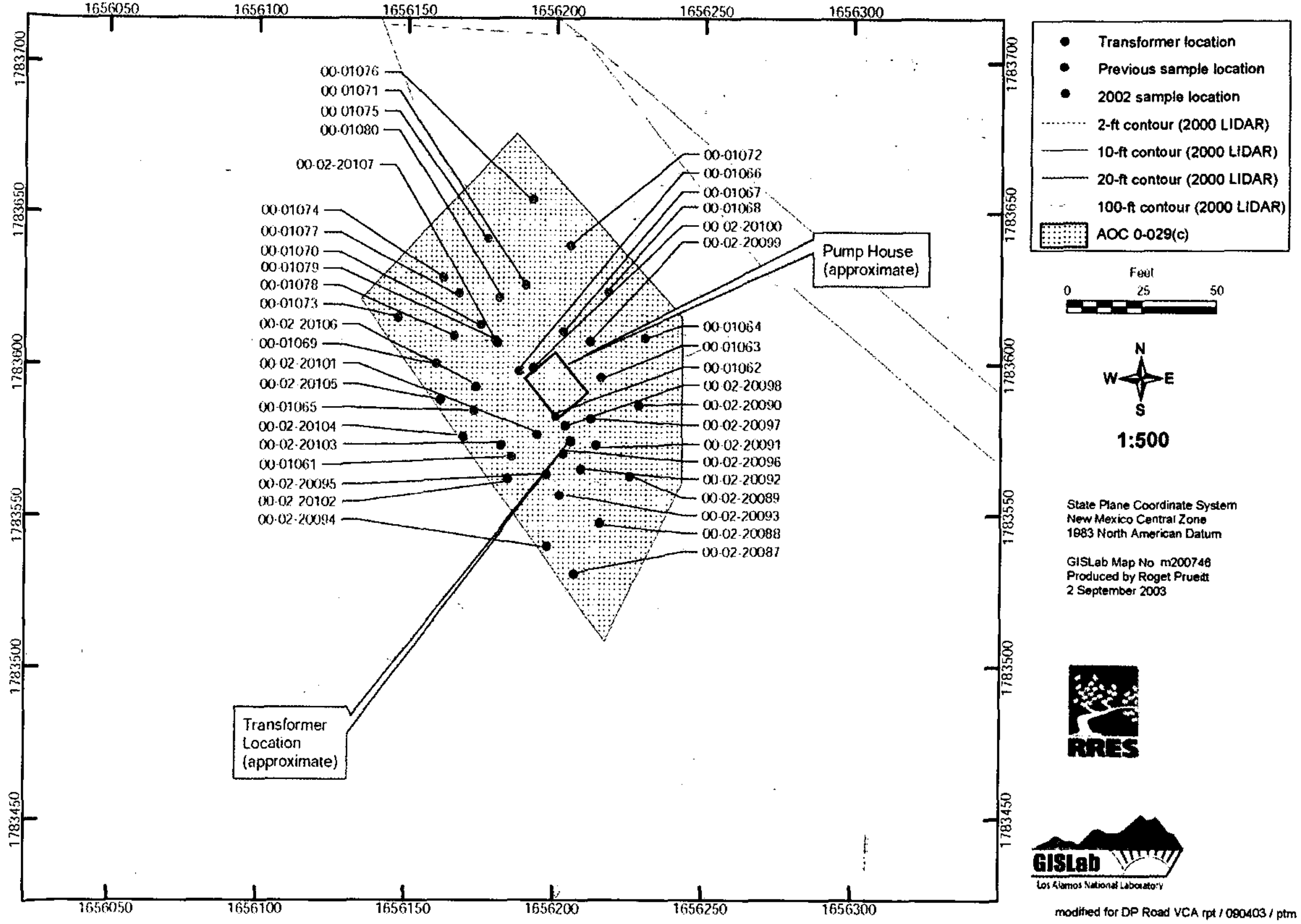


Figure 4.4-3. AOC 0-029(c) RFI and VCA sample locations

4.4.2 Remediation Activities

AOC 0-029(a)

No remediation activities were conducted at AOC 0-029(a) during this VCA. Activities consisted of sampling to address gaps in the data from the 1992 RFI sampling.

AOC 0-029(b)

No remediation activities were conducted at AOC 0-029(b) during this VCA. Activities consisted of sampling to address gaps in the data from the 1992 RFI sampling.

AOC 0-029(c)

No remediation activities were conducted at AOC 0-029(c) during this VCA. Activities consisted of sampling to address gaps in the data from the 1992 RFI sampling.

4.4.3 Sample Data Review

Samples collected at AOCs 0-029(a,b,c) were analyzed for PCBs and pesticides only. The data review process for identifying COPCs begins with a review of detection status. Tables D-2.0-1, D-2.0-2, D-2.0-3, D-2.0-4, D-2.0-5, and D-2.0-6 in Appendix D include the data for all analytes (detected and undetected).

4.4.3.1 Organic Chemicals

AOC 0-029(a)

Thirty-four samples (plus 2 field duplicates) were collected and analyzed for PCBs and pesticides . A summary of these samples is presented in Table 4.4-1. The surface soil data for AOC 0-029(a) are of good quality and are suitable for data assessments. Table C-5.0-3 in Appendix C presents detailed results of the QA/QC assessment. Sample results were reviewed for detection status.

Table 4.4-1
Summary of Soil Samples Collected at AOC 0-029(a)

Sample ID	Location ID	Depth (ft)	Media	PCBs	Pesticides
RE00-02-46167	00-02-20039	0–0.5	Soil	1357S	1357S
RE00-02-46168	00-02-20039	1–1.5	Soil	1357S	1357S
RE00-02-46169	00-02-20040	0–0.5	Soil	1357S	1357S
RE00-02-46170	00-02-20040	1–1.5	Soil	1357S	1357S
RE00-02-46171	00-02-20041	0–0.5	Soil	1357S	1357S
RE00-02-46172	00-02-20041	0.7–1.2	Soil	1357S	1357S
RE00-02-46173	00-02-20042	0–0.5	Soil	1357S	1357S
RE00-02-46174	00-02-20042	1–1.5	Soil	1357S	1357S
RE00-02-46175	00-02-20043	0–0.5	Soil	1357S	1357S
RE00-02-46176	00-02-20043	1–1.5	Soil	1357S	1357S
RE00-02-46177	00-02-20044	0–0.5	Soil	1357S	1357S
RE00-02-46178	00-02-20044	1–1.5	Soil	1357S	1357S
RE00-02-46179	00-02-20045	0–0.5	Soil	1357S	1357S
RE00-02-46180	00-02-20045	0.8–1.25	Soil	1357S	1357S
RE00-02-46181	00-02-20046	0–0.5	Soil	1357S	1357S
RE00-02-46182	00-02-20046	1–1.5	Soil	1357S	1357S
RE00-02-46183	00-02-20047	0–0.5	Soil	1357S	1357S
RE00-02-46184	00-02-20047	1–1.5	Soil	1357S	1357S
RE00-02-46185	00-02-20048	0–0.5	Soil	1357S	1357S
RE00-02-46186	00-02-20048	1–1.5	Soil	1357S	1357S
RE00-02-46187	00-02-20049	0–0.5	Soil	1357S	1357S
RE00-02-46188	00-02-20049	1–1.5	Soil	1357S	1357S
RE00-02-46189	00-02-20050	0–0.5	Soil	1357S	1357S
RE00-02-46190	00-02-20050	1–1.5	Soil	1357S	1357S
RE00-02-46191	00-02-20051	0–0.5	Soil	1357S	1357S
RE00-02-46192	00-02-20051	1–1.5	Soil	1357S	1357S
RE00-02-46193	00-02-20052	0–0.5	Soil	1357S	1357S
RE00-02-46194	00-02-20052	1–1.5	Soil	1357S	1357S
RE00-02-46195	00-02-20053	0–0.5	Soil	1357S	1357S
RE00-02-46196	00-02-20053	1–1.4	Soil	1357S	1357S
RE00-02-46197	00-02-20054	0–0.5	Soil	1357S	1357S
RE00-02-46198	00-02-20054	1–1.5	Soil	1357S	1357S
RE00-02-46199	00-02-20055	0–0.5	Soil	1357S	1357S
RE00-02-46200	00-02-20055	1–1.5	Soil	1357S	1357S

Table 4.4-2 presents the frequency of detected organic chemicals in soil at AOC 0-029(a).

Table 4.4-2
Frequency of Detected Organic Chemicals in Soil Samples at AOC 0-029(a)

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	Frequency of Detects
Aroclor-1242	Soil	34	1	[0.0034] to 0.0302	1/34
Aroclor-1254	Soil	34	7	[0.0034] to 0.0938	7/34
Aroclor-1260	Soil	34	28	0.0019 to 0.0645	28/34
Chlordane[alpha-]	Soil	34	1	[0.00069 to 0.008]	1/34
DDD[4,4'-]	Soil	34	1	0.00056 to [0.016]	1/34
DDE[4,4'-]	Soil	34	1	0.00021 to [0.016]	1/34
DDT[4,4'-]	Soil	34	16	[0.0014 to 0.016]	16/34
Dieldrin	Soil	34	1	0.00028 to [0.016]	1/34
Endrin	Soil	34	2	0.00036 to [0.016]	2/34
Endrin Aldehyde	Soil	34	1	0.00062 to [0.016]	1/34
Methoxychlor[4,4'-]	Soil	34	1	[0.0069 to 0.08]	1/34

There were eleven organic chemicals detected at AOC 0-029(a). Aroclor-1254, Aroclor-1260 and 4,4'-DDT were the only organic chemicals detected in more than 2 of the thirty-four samples collected. Table 4.4-3 presents the detected concentrations in surface soil. All eleven detected organic chemicals presented in Table 4.4-2 are retained as COPCs.

AOC 0-029(b)

Forty samples (plus 2 field duplicates) were collected and analyzed for pesticides and PCBs. A summary of these samples is presented in Table 4.4-4. The surface soil data for AOC 0-029(b) are of good quality and are suitable for data assessments. Table C-5.0-3 in Appendix C presents detailed results of the QA/QC assessment. Sample concentrations were reviewed for detection status.

Table 4.4-5 presents the frequency of detected organic chemicals in soil at AOC 0-029(b). There were sixteen organic chemicals detected at AOC 0-029(b). Aroclor-1242, Aroclor-1254, Aroclor-1260, 4,4'-DDE, 4,4'-DDT, and heptachlor were the only organic chemicals detected in more than 2 of the forty samples collected. Table 4.4-6 presents the detected concentrations in surface soil. All sixteen detected organic chemicals presented in Table 4.4-5 are retained as COPCs.

Table 4.4-3
Detected Organic Chemicals in Soil Samples at AOC 0-029(a)

Sample ID	Location ID	Depth (ft)	Media	Aroclor-1242 (mg/kg)	Aroclor-1254 (mg/kg)	Aroclor-1260 (mg/kg)	Chlordane[alpha-] (mg/kg)	DDD[4,4'-] (mg/kg)	DDE[4,4'-] (mg/kg)
RE00-02-46167	00-02-20039	0.00–0.50	Soil	—*	—	0.0023 (J)	—	0.00056 (J+)	—
RE00-02-46168	00-02-20039	1.00–1.50	Soil	—	—	—	0.00076	—	—
RE00-02-46169	00-02-20040	0.00–0.50	Soil	—	—	—	—	—	—
RE00-02-46170	00-02-20040	1.00–1.50	Soil	—	—	0.02	—	—	—
RE00-02-46171	00-02-20041	0.00–0.50	Soil	—	—	0.0042	—	—	—
RE00-02-46172	00-02-20041	0.70–1.20	Soil	—	—	0.0052	—	—	—
RE00-02-46173	00-02-20042	0.00–0.50	Soil	—	—	0.0035 (J)	—	—	—
RE00-02-46174	00-02-20042	1.00–1.50	Soil	—	—	0.0088	—	—	—
RE00-02-46175	00-02-20043	0.00–0.50	Soil	—	—	0.0074	—	—	—
RE00-02-46176	00-02-20043	1.00–1.50	Soil	—	0.0091	0.0239	—	—	—
RE00-02-46177	00-02-20044	0.00–0.50	Soil	—	—	0.0019 (J)	—	—	—
RE00-02-46178	00-02-20044	1.00–1.50	Soil	—	0.0057	0.008	—	—	—
RE00-02-46179	00-02-20045	0.00–0.50	Soil	—	—	0.0146	—	—	—
RE00-02-46180	00-02-20045	0.80–1.25	Soil	—	—	0.0036	—	—	—
RE00-02-46181	00-02-20046	0.00–0.50	Soil	—	—	—	—	—	—
RE00-02-46183	00-02-20047	0.00–0.50	Soil	—	—	—	—	—	—
RE00-02-46184	00-02-20047	1.00–1.50	Soil	—	—	0.0504	—	—	—
RE00-02-46185	00-02-20048	0.00–0.50	Soil	—	—	0.0036 (J)	—	—	—
RE00-02-46186	00-02-20048	1.00–1.50	Soil	0.0302 (J+)	0.0223 (J+)	0.0387 (J+)	—	—	—
RE00-02-46187	00-02-20049	0.00–0.50	Soil	—	—	0.0098	—	—	—
RE00-02-46188	00-02-20049	1.00–1.50	Soil	—	—	0.0283	—	—	—
RE00-02-46189	00-02-20050	0.00–0.50	Soil	—	—	0.0113	—	—	—
RE00-02-46190	00-02-20050	1.00–1.50	Soil	—	0.0938	0.0393	—	—	—
RE00-02-46191	00-02-20051	0.00–0.50	Soil	—	0.0085	0.0234	—	—	—
RE00-02-46192	00-02-20051	1.00–1.50	Soil	—	—	0.0042	—	—	0.00021 (J)
RE00-02-46193	00-02-20052	0.00–0.50	Soil	—	—	0.0155	—	—	—
RE00-02-46195	00-02-20053	0.00–0.50	Soil	—	0.0098	0.0271	—	—	—
RE00-02-46196	00-02-20053	1.00–1.40	Soil	—	—	0.002 (J)	—	—	—
RE00-02-46197	00-02-20054	0.00–0.50	Soil	—	—	0.002 (J)	—	—	—
RE00-02-46198	00-02-20054	1.00–1.50	Soil	—	—	0.024	—	—	—
RE00-02-46199	00-02-20055	0.00–0.50	Soil	—	—	0.0083	—	—	—
RE00-02-46200	00-02-20055	1.00–1.50	Soil	—	0.0372	0.0645	—	—	—

Table 4.4-3 (continued)

Sample ID	Location ID	Depth (ft)	Media	DDT[4,4'-] (mg/kg)	Dieldrin (mg/kg)	Endrin (mg/kg)	Endrin Aldehyde (mg/kg)	Methoxychlor[4,4'-] (mg/kg)
RE00-02-46167	00-02-20039	0.00–0.50	Soil	0.0036 (J+)	0.00028 (J+)	0.00036 (J+)	0.00062 (J+)	—
RE00-02-46168	00-02-20039	1.00–1.50	Soil	—	—	—	—	—
RE00-02-46169	00-02-20040	0.00–0.50	Soil	0.0028	—	—	—	—
RE00-02-46170	00-02-20040	1.00–1.50	Soil	0.0033	—	—	—	—
RE00-02-46171	00-02-20041	0.00–0.50	Soil	—	—	—	—	—
RE00-02-46172	00-02-20041	0.70–1.20	Soil	—	—	—	—	—
RE00-02-46173	00-02-20042	0.00–0.50	Soil	0.0028 (J+)	—	—	—	—
RE00-02-46174	00-02-20042	1.00–1.50	Soil	—	—	—	—	0.0093
RE00-02-46175	00-02-20043	0.00–0.50	Soil	0.003	—	—	—	—
RE00-02-46176	00-02-20043	1.00–1.50	Soil	0.0033	—	—	—	—
RE00-02-46177	00-02-20044	0.00–0.50	Soil	0.0026	—	—	—	—
RE00-02-46178	00-02-20044	1.00–1.50	Soil	0.003 (J+)	—	—	—	—
RE00-02-46179	00-02-20045	0.00–0.50	Soil	—	—	—	—	—
RE00-02-46180	00-02-20045	0.80–1.25	Soil	0.0028 (J+)	—	—	—	—
RE00-02-46181	00-02-20046	0.00–0.50	Soil	0.0044 (J+)	—	—	—	—
RE00-02-46183	00-02-20047	0.00–0.50	Soil	0.003 (J+)	—	—	—	—
RE00-02-46184	00-02-20047	1.00–1.50	Soil	—	—	—	—	—
RE00-02-46185	00-02-20048	0.00–0.50	Soil	—	—	—	—	—
RE00-02-46186	00-02-20048	1.00–1.50	Soil	—	—	—	—	—
RE00-02-46187	00-02-20049	0.00–0.50	Soil	—	—	—	—	—
RE00-02-46188	00-02-20049	1.00–1.50	Soil	—	—	—	—	—
RE00-02-46189	00-02-20050	0.00–0.50	Soil	0.0039	—	—	—	—
RE00-02-46190	00-02-20050	1.00–1.50	Soil	—	—	—	—	—
RE00-02-46191	00-02-20051	0.00–0.50	Soil	—	—	—	—	—
RE00-02-46192	00-02-20051	1.00–1.50	Soil	0.0042	—	—	—	—
RE00-02-46193	00-02-20052	0.00–0.50	Soil	—	—	—	—	—
RE00-02-46195	00-02-20053	0.00–0.50	Soil	0.0045	—	0.00056 (J)	—	—
RE00-02-46196	00-02-20053	1.00–1.40	Soil	—	—	—	—	—
RE00-02-46197	00-02-20054	0.00–0.50	Soil	0.0029 (J+)	—	—	—	—
RE00-02-46198	00-02-20054	1.00–1.50	Soil	—	—	—	—	—
RE00-02-46199	00-02-20055	0.00–0.50	Soil	0.0036	—	—	—	—
RE00-02-46200	00-02-20055	1.00–1.50	Soil	—	—	—	—	—

*— = Not detected.

Table 4.4-4
Summary of Soil Samples Collected at AOC 0-029(b)

Sample ID	Location ID	Depth (ft)	Media	PCBs	Pesticides
RE00-02-46217	00-02-20063	0–0.5	Soil	1358S	1358S
RE00-02-46218	00-02-20063	0.8–1.2	Soil	1358S	1358S
RE00-02-46219	00-02-20064	0–0.5	Soil	1358S	1358S
RE00-02-46220	00-02-20064	1–1.5	Soil	1358S	1358S
RE00-02-46221	00-02-20065	0–0.5	Soil	1358S	1358S
RE00-02-46222	00-02-20065	1–1.5	Soil	1358S	1358S
RE00-02-46223	00-02-20066	0–0.5	Soil	1358S	1358S
RE00-02-46224	00-02-20066	0.8–1	Soil	1358S	1358S
RE00-02-46225	00-02-20067	0–0.5	Soil	1358S	1358S
RE00-02-46226	00-02-20067	1–1.5	Soil	1358S	1358S
RE00-02-46227	00-02-20068	0–0.5	Soil	1358S	1358S
RE00-02-46228	00-02-20068	1–1.5	Soil	1358S	1358S
RE00-02-46229	00-02-20069	0–0.5	Soil	1358S	1358S
RE00-02-46230	00-02-20069	1–1.3	Soil	1358S	1358S
RE00-02-46231	00-02-20070	0–0.5	Soil	1358S	1358S
RE00-02-46232	00-02-20070	1–1.5	Soil	1358S	1358S
RE00-02-46233	00-02-20071	0–0.5	Soil	1358S	1358S
RE00-02-46234	00-02-20071	0.5–1	Soil	1358S	1358S
RE00-02-46235	00-02-20072	0–0.5	Soil	1358S	1358S
RE00-02-46236	00-02-20072	0.8–1.2	Soil	1358S	1358S
RE00-02-46237	00-02-20073	0–0.5	Soil	1358S	1358S
RE00-02-46238	00-02-20073	1–1.5	Soil	1358S	1358S
RE00-02-46239	00-02-20074	0–0.5	Soil	1358S	1358S
RE00-02-46240	00-02-20074	1–1.5	Soil	1358S	1358S
RE00-02-46241	00-02-20075	0–0.5	Soil	1358S	1358S
RE00-02-46242	00-02-20075	1–1.5	Soil	1358S	1358S
RE00-02-46243	00-02-20076	0–0.5	Soil	1358S	1358S
RE00-02-46244	00-02-20076	1–1.5	Soil	1358S	1358S
RE00-02-46245	00-02-20077	0–0.5	Soil	1358S	1358S
RE00-02-46246	00-02-20077	1–1.5	Soil	1358S	1358S
RE00-02-46247	00-02-20078	0–0.5	Soil	1358S	1358S
RE00-02-46248	00-02-20078	1–1.5	Soil	1358S	1358S
RE00-02-46249	00-02-20079	0–0.5	Soil	1358S	1358S
RE00-02-46250	00-02-20079	0.75–1	Soil	1358S	1358S
RE00-02-46251	00-02-20080	0–0.5	Soil	1358S	1358S
RE00-02-46252	00-02-20080	0.75–1.2	Soil	1358S	1358S
RE00-02-46253	00-02-20081	0–0.5	Soil	1358S	1358S
RE00-02-46254	00-02-20081	0.8–1.2	Soil	1358S	1358S
RE00-02-46255	00-02-20082	0–0.5	Soil	1358S	1358S
RE00-02-46256	00-02-20082	1–1.5	Soil	1358S	1358S

Table 4.4-5
Frequency of Detected Organic Chemicals in Soil Samples at AOC 0-029(b)

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	Frequency of Detects
Aroclor-1242	Soil	40	5	[0.0035] to 0.137	5/40
Aroclor-1254	Soil	40	19	[0.0035 to 0.0372]	19/40
Aroclor-1260	Soil	40	30	0.002 to 0.0778	30/40
BHC[beta-]	Soil	40	1	[0.00068 to 0.00082]	1/40
BHC[delta-]	Soil	40	1	0.00057 to [0.00082]	1/40
BHC[gamma-]	Soil	40	1	0.00062 to [0.00082]	1/40
Chlordane[gamma-]	Soil	40	1	[0.00068 to 0.00082]	1/40
DDD[4,4'-]	Soil	40	1	0.00034 to [0.0074]	1/40
DDE[4,4'-]	Soil	40	8	0.00023 to 0.002	8/40
DDT[4,4'-]	Soil	40	24	0.0006 to 0.0352	24/40
Endosulfan I	Soil	40	1	0.00062 to [0.00082]	1/40
Endosulfan II	Soil	40	1	0.00077 to [0.0016]	1/40
Endrin	Soil	40	1	0.00068 to [0.0074]	1/40
Endrin Aldehyde	Soil	40	1	0.00036 to [0.0074]	1/40
Heptachlor	Soil	40	3	0.0003 to [0.00082]	3/40
Heptachlor Epoxide	Soil	40	1	0.00061 to [0.00082]	1/40

Table 4.4-6
Detected Organic Chemicals in Soil Samples at AOC 0-029(b)

Sample ID	Location ID	Depth (ft)	Media	Aroclor-1242 (mg/kg)	Aroclor-1254 (mg/kg)	Aroclor-1260 (mg/kg)	BHC[beta-] (mg/kg)	BHC[delta-] (mg/kg)	BHC[gamma-] (mg/kg)	Chlordane[gamma-] (mg/kg)	DDD[4,4'-] (mg/kg)
RE00-02-46217	00-02-20063	0.00–0.50	Soil	—*	—	0.011 (J-)	—	—	—	—	—
RE00-02-46218	00-02-20063	0.80–1.20	Soil	0.137 (J-)	—	0.0146 (J-)	—	—	—	—	—
RE00-02-46219	00-02-20064	0.00–0.50	Soil	—	—	0.0095 (J-)	—	—	—	—	—
RE00-02-46220	00-02-20064	1.00–1.50	Soil	—	0.0369 (J-)	0.078 (J-)	—	—	—	—	—
RE00-02-46221	00-02-20065	0.00–0.50	Soil	—	0.0168 (J-)	0.048 (J-)	—	—	—	—	—
RE00-02-46222	00-02-20065	1.00–1.50	Soil	—	—	—	—	—	—	—	—
RE00-02-46223	00-02-20066	0.00–0.50	Soil	—	—	—	—	—	—	—	—
RE00-02-46224	00-02-20066	0.80–1.00	Soil	—	—	—	—	—	—	—	—
RE00-02-46225	00-02-20067	0.00–0.50	Soil	—	0.0051 (J-)	0.0085 (J-)	—	—	—	—	—
RE00-02-46226	00-02-20067	1.00–1.50	Soil	—	—	0.0066 (J-)	—	—	—	—	—
RE00-02-46227	00-02-20068	0.00–0.50	Soil	—	—	0.0099 (J-)	—	—	—	—	—
RE00-02-46228	00-02-20068	1.00–1.50	Soil	—	0.0144 (J-)	0.0216 (J-)	—	—	—	—	—
RE00-02-46229	00-02-20069	0.00–0.50	Soil	—	0.0133 (J-)	0.0257 (J-)	—	—	—	—	—
RE00-02-46230	00-02-20069	1.00–1.30	Soil	0.0092 (J-)	0.0216 (J-)	0.0265 (J-)	—	—	—	—	—
RE00-02-46231	00-02-20070	0.00–0.50	Soil	—	—	—	—	—	—	—	—
RE00-02-46232	00-02-20070	1.00–1.50	Soil	—	—	—	—	—	—	—	0.00034 (J)
RE00-02-46233	00-02-20071	0.00–0.50	Soil	—	—	—	—	—	—	—	—
RE00-02-46234	00-02-20071	0.50–1.00	Soil	—	—	0.0026 (J-)	—	—	—	—	—
RE00-02-46235	00-02-20072	0.00–0.50	Soil	—	0.0138 (J-)	0.0093 (J-)	—	—	—	—	—
RE00-02-46236	00-02-20072	0.80–1.20	Soil	—	0.0153 (J-)	0.0228 (J-)	—	—	—	—	—
RE00-02-46237	00-02-20073	0.00–0.50	Soil	—	0.0263	0.0421	—	—	—	—	—
RE00-02-46238	00-02-20073	1.00–1.50	Soil	—	—	—	—	—	—	—	—
RE00-02-46239	00-02-20074	0.00–0.50	Soil	—	—	0.0049	—	—	—	—	—

Table 4.4-6 (continued)

Sample ID	Location ID	Depth (ft)	Media	Aroclor-1242 (mg/kg)	Aroclor-1254 (mg/kg)	Aroclor-1260 (mg/kg)	BHC[beta-] (mg/kg)	BHC[delta-] (mg/kg)	BHC[gamma-] (mg/kg)	Chlordane[gamma-] (mg/kg)	DDD[4,4'-] (mg/kg)
RE00-02-46240	00-02-20074	1.00–1.50	Soil	—	—	—	0.00076 (J)	0.00057 (J)	0.00062 (J)	0.00069 (J)	—
RE00-02-46241	00-02-20075	0.00–0.50	Soil	—	0.0208	0.0273	—	—	—	—	—
RE00-02-46242	00-02-20075	1.00–1.50	Soil	—	—	0.0037	—	—	—	—	—
RE00-02-46243	00-02-20076	0.00–0.50	Soil	—	0.0135	0.0248	—	—	—	—	—
RE00-02-46244	00-02-20076	1.00–1.50	Soil	—	0.0059	0.0117	—	—	—	—	—
RE00-02-46245	00-02-20077	0.00–0.50	Soil	—	0.0104	0.0111	—	—	—	—	—
RE00-02-46246	00-02-20077	1.00–1.50	Soil	—	—	0.0035 (J)	—	—	—	—	—
RE00-02-46247	00-02-20078	0.00–0.50	Soil	0.0078	0.0202	0.0318	—	—	—	—	—
RE00-02-46248	00-02-20078	1.00–1.50	Soil	0.0081	0.0211	0.0175	—	—	—	—	—
RE00-02-46249	00-02-20079	0.00–0.50	Soil	—	0.0204	0.0165	—	—	—	—	—
RE00-02-46250	00-02-20079	0.75–1.00	Soil	—	0.0058	0.0095	—	—	—	—	—
RE00-02-46251	00-02-20080	0.00–0.50	Soil	—	—	0.005	—	—	—	—	—
RE00-02-46252	00-02-20080	0.75–1.20	Soil	—	—	—	—	—	—	—	—
RE00-02-46253	00-02-20081	0.00–0.50	Soil	0.0098	0.0212	0.0215	—	—	—	—	—
RE00-02-46254	00-02-20081	0.80–1.20	Soil	—	0.0072	0.0112	—	—	—	—	—
RE00-02-46255	00-02-20082	0.00–0.50	Soil	—	—	0.002 (J)	—	—	—	—	—
RE00-02-46256	00-02-20082	1.00–1.50	Soil	—	—	—	—	—	—	—	—

Table 4.4-6 (continued)

Sample ID	Location ID	Depth (ft)	Media	DDE[4,4'-] (mg/kg)	DDT[4,4'-] (mg/kg)	Endosulfan I (mg/kg)	Endosulfan II (mg/kg)	Endrin (mg/kg)	Endrin Aldehyde (mg/kg)	Heptachlor (mg/kg)	Heptachlor Epoxide (mg/kg)
RE00-02-46217	00-02-20063	0.00–0.50	Soil	—	—	—	—	—	—	—	—
RE00-02-46218	00-02-20063	0.80–1.20	Soil	—	0.00088 (J)	—	—	—	—	—	—
RE00-02-46219	00-02-20064	0.00–0.50	Soil	—	0.0037	—	—	—	—	—	—
RE00-02-46220	00-02-20064	1.00–1.50	Soil	0.002	0.0074	—	—	—	—	—	—
RE00-02-46221	00-02-20065	0.00–0.50	Soil	—	0.0027	—	—	—	—	—	—
RE00-02-46222	00-02-20065	1.00–1.50	Soil	—	0.002	—	—	—	—	—	—
RE00-02-46223	00-02-20066	0.00–0.50	Soil	—	0.0057	—	—	—	—	—	—
RE00-02-46224	00-02-20066	0.80–1.00	Soil	—	0.0352	—	—	—	—	—	—
RE00-02-46225	00-02-20067	0.00–0.50	Soil	—	0.0038	—	—	—	—	—	—
RE00-02-46226	00-02-20067	1.00–1.50	Soil	—	0.0021	—	—	—	—	—	—
RE00-02-46227	00-02-20068	0.00–0.50	Soil	—	0.0027	—	—	—	—	—	—
RE00-02-46228	00-02-20068	1.00–1.50	Soil	—	0.0041	—	—	—	—	—	—
RE00-02-46229	00-02-20069	0.00–0.50	Soil	—	0.0039	—	—	—	—	—	—
RE00-02-46230	00-02-20069	1.00–1.30	Soil	—	—	—	—	—	—	—	—
RE00-02-46231	00-02-20070	0.00–0.50	Soil	—	0.0014 (J)	—	—	—	—	—	—
RE00-02-46232	00-02-20070	1.00–1.50	Soil	—	0.0017	—	—	—	—	—	—
RE00-02-46233	00-02-20071	0.00–0.50	Soil	0.00054 (J)	0.0054	—	—	—	—	—	—
RE00-02-46234	00-02-20071	0.50–1.00	Soil	0.00086 (J)	0.0011 (J)	—	—	—	—	—	—
RE00-02-46235	00-02-20072	0.00–0.50	Soil	—	0.0036	—	—	—	—	—	—
RE00-02-46236	00-02-20072	0.80–1.20	Soil	—	0.0048	—	—	—	—	—	—
RE00-02-46237	00-02-20073	0.00–0.50	Soil	—	0.0033	—	—	0.00068 (J)	—	—	—
RE00-02-46238	00-02-20073	1.00–1.50	Soil	—	0.0006 (J)	—	—	—	—	—	—
RE00-02-46239	00-02-20074	0.00–0.50	Soil	0.00049 (J)	0.0018	—	—	—	—	—	—
RE00-02-46240	00-02-20074	1.00–1.50	Soil	0.0019 (J)	—	0.00062 (J)	0.00077 (J)	—	—	0.00066 (J)	0.00061 (J)

Table 4.4-6 (continued)

Sample ID	Location ID	Depth (ft)	Media	DDE[4,4'-] (mg/kg)	DDT[4,4'-]- (mg/kg)	Endosulfan I (mg/kg)	Endosulfan II (mg/kg)	Endrin (mg/kg)	Endrin Aldehyde (mg/kg)	Heptachlor (mg/kg)	Heptachlor Epoxide (mg/kg)
RE00-02-46241	00-02-20075	0.00–0.50	Soil	—	—	—	—	—	—	—	—
RE00-02-46242	00-02-20075	1.00–1.50	Soil	—	—	—	—	—	—	—	—
RE00-02-46243	00-02-20076	0.00–0.50	Soil	—	—	—	—	—	—	—	—
RE00-02-46244	00-02-20076	1.00–1.50	Soil	—	—	—	—	—	—	—	—
RE00-02-46245	00-02-20077	0.00–0.50	Soil	0.00036 (J)	—	—	—	—	—	—	—
RE00-02-46246	00-02-20077	1.00–1.50	Soil	0.00023 (J)	0.0006 (J)	—	—	—	—	—	—
RE00-02-46247	00-02-20078	0.00–0.50	Soil	—	—	—	—	—	—	—	—
RE00-02-46248	00-02-20078	1.00–1.50	Soil	—	—	—	—	—	—	0.0003 (J)	—
RE00-02-46249	00-02-20079	0.00–0.50	Soil	—	0.001 (J)	—	—	—	—	—	—
RE00-02-46250	00-02-20079	0.75–1.00	Soil	0.00082 (J)	—	—	—	—	—	—	—
RE00-02-46251	00-02-20080	0.00–0.50	Soil	—	—	—	—	—	—	—	—
RE00-02-46252	00-02-20080	0.75–1.20	Soil	—	—	—	—	—	—	0.00036 (J)	—
RE00-02-46253	00-02-20081	0.00–0.50	Soil	—	—	—	—	—	—	—	—
RE00-02-46254	00-02-20081	0.80–1.20	Soil	—	—	—	—	—	—	—	—
RE00-02-46255	00-02-20082	0.00–0.50	Soil	—	0.0008 (J)	—	—	—	—	—	—
RE00-02-46256	00-02-20082	1.00–1.50	Soil	—	—	—	—	—	0.00036 (J)	—	—

*— = Not detected.

AOC 0-029(c)

Forty-two samples (plus 2 field duplicates) were collected and analyzed for pesticides and PCBs. A summary of these samples is presented in Table 4.4-7. The surface soil data for AOC 0-029(c) are of good quality and are suitable for data assessments. Table C-5.0-3 in Appendix C presents detailed results of the QA/QC assessment. Sample concentrations were reviewed for detection status.

Table 4.4-7
Summary of Soil Samples Collected at AOC 0-029(c)

Sample ID	Location ID	Depth (ft)	Media	PCBs	Pesticides
RE00-02-46273	00-02-20087	0–0.5	Soil	1368S	1368S
RE00-02-46274	00-02-20087	1–1.5	Soil	1368S	1368S
RE00-02-46275	00-02-20088	0–0.5	Soil	1368S	1368S
RE00-02-46276	00-02-20088	1–1.5	Soil	1368S	1368S
RE00-02-46277	00-02-20089	0–0.5	Soil	1368S	1368S
RE00-02-46278	00-02-20089	0.8–1.1	Soil	1368S	1368S
RE00-02-46279	00-02-20090	0–0.5	Soil	1368S	1368S
RE00-02-46280	00-02-20090	1–1.5	Soil	1368S	1368S
RE00-02-46281	00-02-20091	0–0.5	Soil	1368S	1368S
RE00-02-46282	00-02-20091	0.8–1.1	Soil	1368S	1368S
RE00-02-46283	00-02-20092	0–0.5	Soil	1368S	1368S
RE00-02-46284	00-02-20092	1–1.5	Soil	1368S	1368S
RE00-02-46285	00-02-20093	0–0.5	Soil	1368S	1368S
RE00-02-46286	00-02-20093	1–1.5	Soil	1368S	1368S
RE00-02-46287	00-02-20094	0–0.5	Soil	1368S	1368S
RE00-02-46288	00-02-20094	1–1.5	Soil	1368S	1368S
RE00-02-46289	00-02-20095	0–0.5	Soil	1368S	1368S
RE00-02-46290	00-02-20095	1–1.5	Soil	1368S	1368S
RE00-02-46291	00-02-20096	0–0.5	Soil	1368S-1	1368S
RE00-02-46292	00-02-20096	1–1.5	Soil	1368S-1	1368S
RE00-02-46293	00-02-20097	0–0.5	Soil	1368S-1	1368S
RE00-02-46294	00-02-20097	0.9–1.2	Soil	1368S-1	1368S
RE00-02-46295	00-02-20098	0–0.5	Soil	1368S-1	1368S
RE00-02-46296	00-02-20098	0.5–1	Soil	1368S-1	1368S
RE00-02-46297	00-02-20099	0–0.5	Soil	1368S-1	1368S
RE00-02-46298	00-02-20099	0.5–1	Soil	1368S-1	1368S
RE00-02-46299	00-02-20100	0–0.5	Soil	1368S-1	1368S
RE00-02-46300	00-02-20100	1–1.5	Soil	1368S-1	1368S
RE00-02-46301	00-02-20101	0–0.5	Soil	1368S-1	1368S
RE00-02-46302	00-02-20101	1–1.5	Soil	1368S-1	1368S

Table 4.4-7 (continued)

Sample ID	Location ID	Depth (ft)	Media	PCBs	Pesticides
RE00-02-46303	00-02-20102	0–0.5	Soil	1368S-1	1368S
RE00-02-46304	00-02-20102	1–1.5	Soil	1368S-1	1368S
RE00-02-46305	00-02-20103	0–0.5	Soil	1368S-1	1368S
RE00-02-46306	00-02-20103	1–1.5	Soil	1368S-1	1368S
RE00-02-46307	00-02-20104	0–0.5	Soil	1368S-1	1368S
RE00-02-46308	00-02-20104	1–1.5	Soil	1368S-1	1368S
RE00-02-46309	00-02-20105	0–0.5	Soil	1368S-1	1368S
RE00-02-46310	00-02-20105	0.5–1	Soil	1368S-1	1368S
RE00-02-46311	00-02-20106	0–0.5	Soil	1368S	1368S
RE00-02-46312	00-02-20106	0.5–1	Soil	1368S	1368S
RE00-02-46313	00-02-20107	0–0.5	Soil	1368S	1368S
RE00-02-46314	00-02-20107	1–1.5	Soil	1368S	1368S

Table 4.4-8 presents the frequency of detected organic chemicals in soil at AOC 0-029(c).

Table 4.4-8
Frequency of Detected Organic Chemicals in Soil Samples at AOC 0-029(c)

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	Frequency of Detects
Aroclor-1242	Soil	42	1	[0.0034 to 0.0197]	1/42
Aroclor-1254	Soil	42	22	0.0016 to 0.175	22/42
Aroclor-1260	Soil	42	38	0.0018 to 0.134	38/42
DDD[4,4'-]	Soil	42	3	0.00046 to [0.0154]	3/42
DDE[4,4'-]	Soil	42	10	[0.00026 to 0.0154]	10/42
DDT[4,4'-]	Soil	42	30	0.001 to [0.0154]	30/42
Dieldrin	Soil	42	1	0.00029 to [0.0154]	1/42
Endosulfan Sulfate	Soil	42	1	0.00039 to [0.0154]	1/42
Endrin	Soil	42	6	0.00022 to [0.0154]	6/42
Endrin Aldehyde	Soil	42	2	0.0004 to [0.0154]	2/42
Endrin Ketone	Soil	42	1	0.00049 to [0.0154]	1/42

Eleven organic chemicals were detected at AOC 0-029(c). Aroclor-1254, Aroclor-1260, 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, and endrin were the only organic chemicals detected in more than 2 out of the forty-two samples collected. Table 4.4-9 presents the detected concentrations in surface soil. All eleven detected organic chemicals presented in Table 4.4-8 are retained as COPCs.

Table 4.4-9
Detected Organic Chemicals in Soil Samples at AOC 0-029(c)

Sample ID	Location ID	Depth (ft)	Media	Aroclor-1242 (mg/kg)	Aroclor-1254 (mg/kg)	Aroclor-1260 (mg/kg)	DDD[4,4'-] (mg/kg)	DDE[4,4'-] (mg/kg)	DDT[4,4'-] (mg/kg)
RE00-02-46273	00-02-20087	0.00–0.50	Soil	—*	—	0.0018 (J)	—	—	0.003
RE00-02-46274	00-02-20087	1.00–1.50	Soil	—	0.0029 (J-)	0.0054 (J-)	—	—	0.0024
RE00-02-46275	00-02-20088	0.00–0.50	Soil	—	0.0016 (J)	0.002 (J)	—	—	0.0015 (J)
RE00-02-46276	00-02-20088	1.00–1.50	Soil	—	0.0023 (J)	0.0046	—	—	0.0014
RE00-02-46277	00-02-20089	0.00–0.50	Soil	—	0.0019 (J)	0.0044	—	—	0.0027
RE00-02-46278	00-02-20089	0.80–1.10	Soil	—	0.0024 (J)	0.01	—	—	0.0016
RE00-02-46279	00-02-20090	0.00–0.50	Soil	—	0.07 (J+)	0.0569 (J+)	—	—	0.0041
RE00-02-46280	00-02-20090	1.00–1.50	Soil	—	—	0.0023 (J)	—	—	0.0015
RE00-02-46281	00-02-20091	0.00–0.50	Soil	—	0.0567 (J+)	0.104 (J+)	—	—	0.005
RE00-02-46282	00-02-20091	0.80–1.10	Soil	—	0.0056	0.0069	—	—	0.0107
RE00-02-46283	00-02-20092	0.00–0.50	Soil	—	—	0.0192	—	0.0032	0.0053
RE00-02-46284	00-02-20092	1.00–1.50	Soil	—	0.003 (J)	0.0036	—	—	0.0024
RE00-02-46285	00-02-20093	0.00–0.50	Soil	—	—	0.0143	—	0.0033	0.0045
RE00-02-46286	00-02-20093	1.00–1.50	Soil	—	0.0197	0.0307	—	—	0.0027
RE00-02-46287	00-02-20094	0.00–0.50	Soil	—	—	—	0.001 (J)	0.0069	0.0052
RE00-02-46288	00-02-20094	1.00–1.50	Soil	—	—	0.0068	—	—	0.0015
RE00-02-46289	00-02-20095	0.00–0.50	Soil	—	0.0581	0.0448	—	—	0.003
RE00-02-46290	00-02-20095	1.00–1.50	Soil	—	—	0.0141	—	—	0.0019
RE00-02-46291	00-02-20096	0.00–0.50	Soil	—	0.175	0.134	—	—	—
RE00-02-46292	00-02-20096	1.00–1.50	Soil	—	0.0062	0.0131	—	—	—
RE00-02-46293	00-02-20097	0.00–0.50	Soil	—	0.013	0.0369	—	—	0.003
RE00-02-46294	00-02-20097	0.90–1.20	Soil	—	0.0068	0.0218	—	0.0025	0.0023
RE00-02-46295	00-02-20098	0.00–0.50	Soil	—	0.0122	0.0188	—	—	—
RE00-02-46296	00-02-20098	0.50–1.00	Soil	—	0.0044	0.0067	—	—	—
RE00-02-46297	00-02-20099	0.00–0.50	Soil	—	0.0156	0.0284	—	—	0.002
RE00-02-46298	00-02-20099	0.50–1.00	Soil	—	0.0133	0.0195	—	—	—
RE00-02-46299	00-02-20100	0.00–0.50	Soil	—	—	0.0441	—	0.00094 (J)	—
RE00-02-46300	00-02-20100	1.00–1.50	Soil	—	—	0.0036	—	—	—
RE00-02-46301	00-02-20101	0.00–0.50	Soil	—	0.0165	0.0389	—	—	0.0026
RE00-02-46302	00-02-20101	1.00–1.50	Soil	—	—	0.0075	—	0.0011 (J)	0.001 (J)
RE00-02-46303	00-02-20102	0.00–0.50	Soil	0.0137	0.0117	0.0227	—	0.0013 (J)	0.0016 (J)
RE00-02-46304	00-02-20102	1.00–1.50	Soil	—	—	0.0165	—	—	—
RE00-02-46305	00-02-20103	0.00–0.50	Soil	—	—	0.0279	0.0005 (J)	0.0013 (J)	0.0027
RE00-02-46307	00-02-20104	0.00–0.50	Soil	—	—	0.0215	—	—	0.0015 (J)
RE00-02-46308	00-02-20104	1.00–1.50	Soil	—	—	0.0057	—	—	0.0019
RE00-02-46309	00-02-20105	0.00–0.50	Soil	—	0.0055	0.0142	—	0.0015 (J)	0.0017
RE00-02-46310	00-02-20105	0.50–1.00	Soil	—	—	0.0111	—	—	—
RE00-02-46311	00-02-20106	0.00–0.50	Soil	—	—	0.0029 (J)	—	—	0.0016 (J-)
RE00-02-46313	00-02-20107	0.00–0.50	Soil	—	—	0.0132	—	—	—
RE00-02-46314	00-02-20107	1.00–1.50	Soil	-	—	—	0.00046 (J-)	0.0022 (J-)	0.0027 (J-)

Table 4.4-9 (continued)

Sample ID	Location ID	Depth (ft)	Media	Dieldrin (mg/kg)	Endosulfan Sulfate (mg/kg)	Endrin (mg/kg)	Endrin Aldehyde (mg/kg)	Endrin Ketone (mg/kg)
RE00-02-46273	00-02-20087	0.00–0.50	Soil	—	—	—	—	—
RE00-02-46274	00-02-20087	1.00–1.50	Soil	—	—	—	—	—
RE00-02-46275	00-02-20088	0.00–0.50	Soil	—	—	—	—	—
RE00-02-46276	00-02-20088	1.00–1.50	Soil	—	—	—	—	—
RE00-02-46277	00-02-20089	0.00–0.50	Soil	—	—	—	—	—
RE00-02-46278	00-02-20089	0.80–1.10	Soil	—	—	—	—	—
RE00-02-46279	00-02-20090	0.00–0.50	Soil	—	—	—	—	—
RE00-02-46280	00-02-20090	1.00–1.50	Soil	—	—	—	—	—
RE00-02-46281	00-02-20091	0.00–0.50	Soil	—	—	—	—	—
RE00-02-46282	00-02-20091	0.80–1.10	Soil	—	—	—	—	—
RE00-02-46283	00-02-20092	0.00–0.50	Soil	—	—	—	—	—
RE00-02-46284	00-02-20092	1.00–1.50	Soil	—	—	—	—	—
RE00-02-46285	00-02-20093	0.00–0.50	Soil	—	—	—	—	—
RE00-02-46286	00-02-20093	1.00–1.50	Soil	—	—	—	—	—
RE00-02-46287	00-02-20094	0.00–0.50	Soil	—	—	—	—	—
RE00-02-46288	00-02-20094	1.00–1.50	Soil	—	—	—	—	—
RE00-02-46289	00-02-20095	0.00–0.50	Soil	—	—	—	—	—
RE00-02-46290	00-02-20095	1.00–1.50	Soil	—	—	—	—	—
RE00-02-46291	00-02-20096	0.00–0.50	Soil	—	—	0.0016	—	—
RE00-02-46292	00-02-20096	1.00–1.50	Soil	—	—	0.00022 (J)	—	—
RE00-02-46293	00-02-20097	0.00–0.50	Soil	—	—	0.0003 (J)	—	—
RE00-02-46294	00-02-20097	0.90–1.20	Soil	—	—	0.00032 (J)	—	—
RE00-02-46295	00-02-20098	0.00–0.50	Soil	—	—	—	—	—
RE00-02-46296	00-02-20098	0.50–1.00	Soil	—	—	—	—	—
RE00-02-46297	00-02-20099	0.00–0.50	Soil	—	—	0.00045 (J)	—	—
RE00-02-46298	00-02-20099	0.50–1.00	Soil	—	—	—	—	—
RE00-02-46299	00-02-20100	0.00–0.50	Soil	—	—	—	—	—
RE00-02-46300	00-02-20100	1.00–1.50	Soil	—	—	—	0.0016 (J)	—
RE00-02-46301	00-02-20101	0.00–0.50	Soil	—	—	—	—	—
RE00-02-46302	00-02-20101	1.00–1.50	Soil	—	—	—	—	—
RE00-02-46303	00-02-20102	0.00–0.50	Soil	—	—	—	—	—
RE00-02-46304	00-02-20102	1.00–1.50	Soil	—	—	—	—	—
RE00-02-46305	00-02-20103	0.00–0.50	Soil	—	—	—	—	—
RE00-02-46307	00-02-20104	0.00–0.50	Soil	—	—	—	—	—
RE00-02-46308	00-02-20104	1.00–1.50	Soil	—	—	—	—	—
RE00-02-46309	00-02-20105	0.00–0.50	Soil	—	—	—	—	—
RE00-02-46310	00-02-20105	0.50–1.00	Soil	—	—	—	—	—
RE00-02-46311	00-02-20106	0.00–0.50	Soil	—	—	—	—	—
RE00-02-46313	00-02-20107	0.00–0.50	Soil	—	—	—	—	—
RE00-02-46314	00-02-20107	1.00–1.50	Soil	0.00029 (J-)	0.00039 (J-)	0.00033 (J-)	0.0004 (J-)	0.00049 (J-)

*— = Not detected.

4.4.4 Revised Site Conceptual Model

The preliminary conceptual model is described in Section 4.2.2, and the revised site conceptual model for AOCs 0-029(a,b,c) is not changed. The preliminary conceptual model identified potential leaks from the transformers as the release mechanism.

The primary exposure pathways for human health were soil ingestion, dust inhalation, and dermal contact. The primary exposure pathways for ecological receptors are plant uptake and rain splash, food web transport, soil ingestion, dermal contact, and dust inhalation.

4.4.4.1 Nature and Extent of Contamination

Nature and extent of contaminant releases from AOCs 0-029(a,b,c) have been defined by the environmental samples collected in 2002. The extent was determined by collecting surface and subsurface soil samples beneath the former locations of PCB transformers and downslope.

Several organic COPCs were detected at each AOC (Figures 4.4-4 through 4.4-6). However, all of the detected concentrations were very low (all <0.2 mg/kg, most <0.08 mg/kg). At AOC 0-029(a), Aroclor-1254 was detected in 7 samples, and Aroclor-1260 was detected in 28 samples. Most of the detected PCBs were in the samples from around the pump house and from the former location of the transformer.

At AOC 0-029(b), the majority of the detected PCBs were located in the vicinity of the former transformer, and most of the samples showed a decreasing trend in concentration with depth. At AOC 0-029(c), the majority of the detected PCBs and DDT and its metabolites DDE and DDD showed a decreasing trend in concentration with depth.

4.4.4.2 Environmental Fate and Transport

The evaluation of environmental fate addresses the chemical processes that affect the persistence of a chemical in the environment. The evaluation of transport addresses the physical processes affecting mobility along the migration pathway. Infiltration into surface soils depends on the rate of precipitation or snowmelt, antecedent soil water status, depth of soil, and soil hydraulic properties. Infiltration into the tuff depends on the unsaturated flow properties of the tuff. Joints and fractures in the tuff may provide additional pathways for moisture to enter the subsurface regime. COPCs at AOCs 0-029(a,b,c) include only organic chemicals.

Properties such as vapor pressure and solubility in water are important in evaluating organic chemical mobility. The following information, summarized from Ney (1995, 58210) and ATSDR (http://www.atsdr.cdc.gov), is presented to give an indication of the fate and transport tendencies of the detected organic chemicals.

Water solubility. Water solubility is perhaps the most important chemical characteristic used to assess mobility of organic chemicals detected at these AOCs. The higher the water solubility, the more likely the organic chemical is to be mobile and the less likely it is to accumulate, bioaccumulate, volatilize, or persist in the environment. A highly soluble chemical (>1000 mg/L) is prone to biodegradation and metabolism that may detoxify the parent chemical.

The lower the water solubility (especially solubilities <10 mg/L) the more likely the organic chemical will be immobilized via adsorption. Such chemicals tend to be more accumulative or bioaccumulative and persistent in the environment, are slightly prone to biodegradation, and may be metabolized in plants and animals. At this site, all of the detected organic chemicals, with the exception of delta-BHC and heptachlor, have water solubilities less than 10 mg/L.

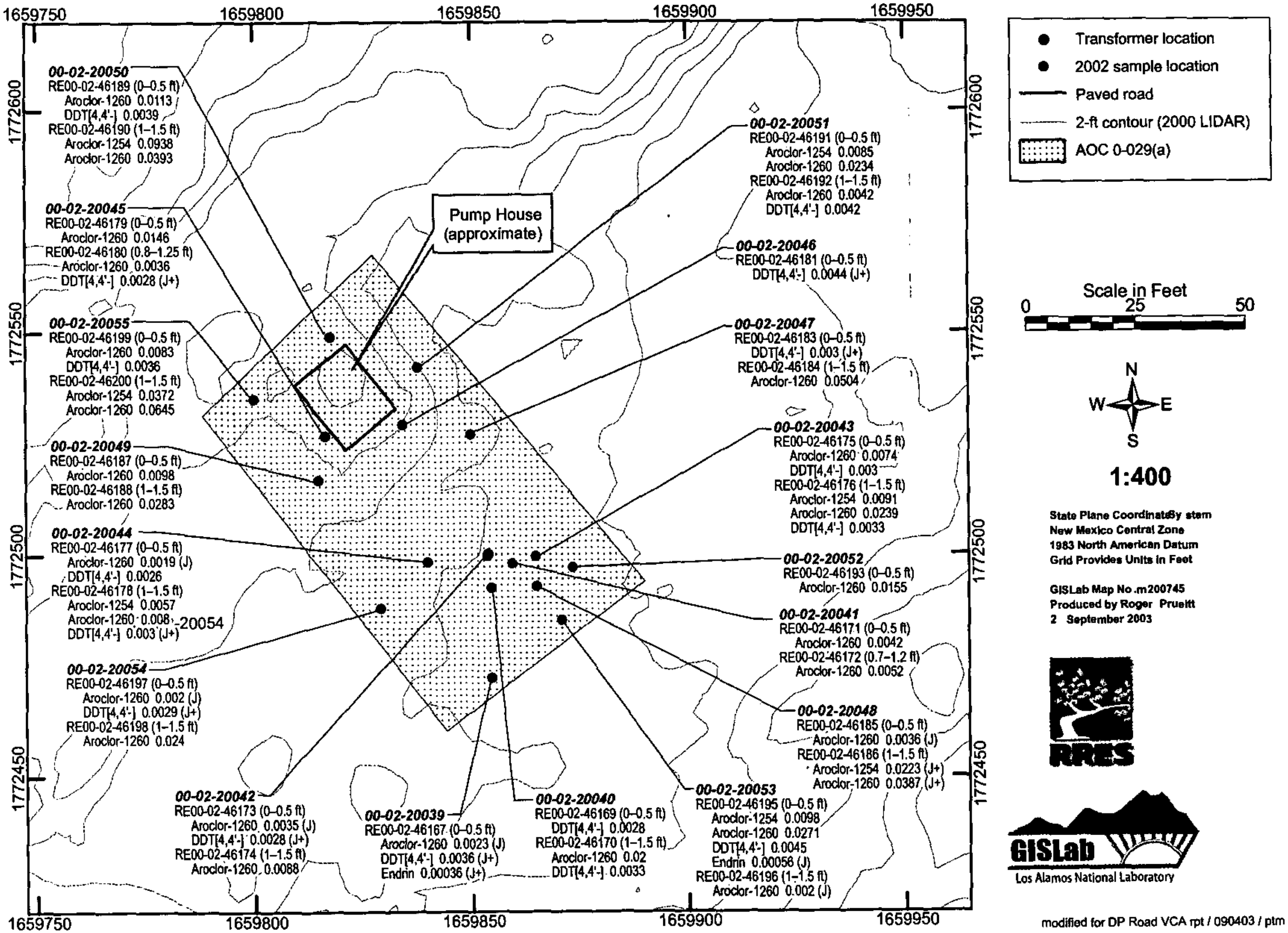


Figure 4.4-4. Detected organic chemicals at AOC 0-029(a)

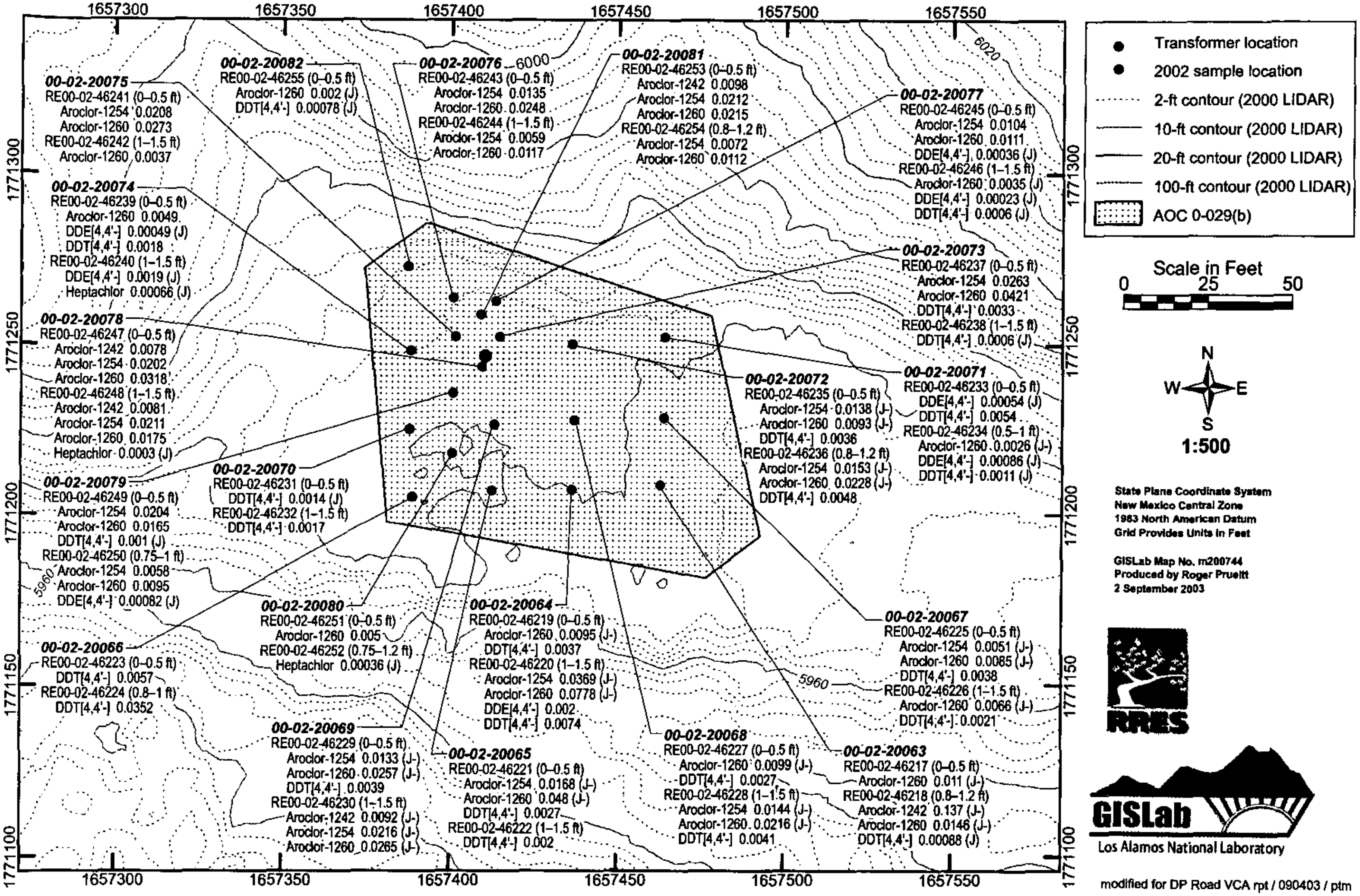


Figure 4.4-5. Detected organic chemicals at AOC 0-029(b)

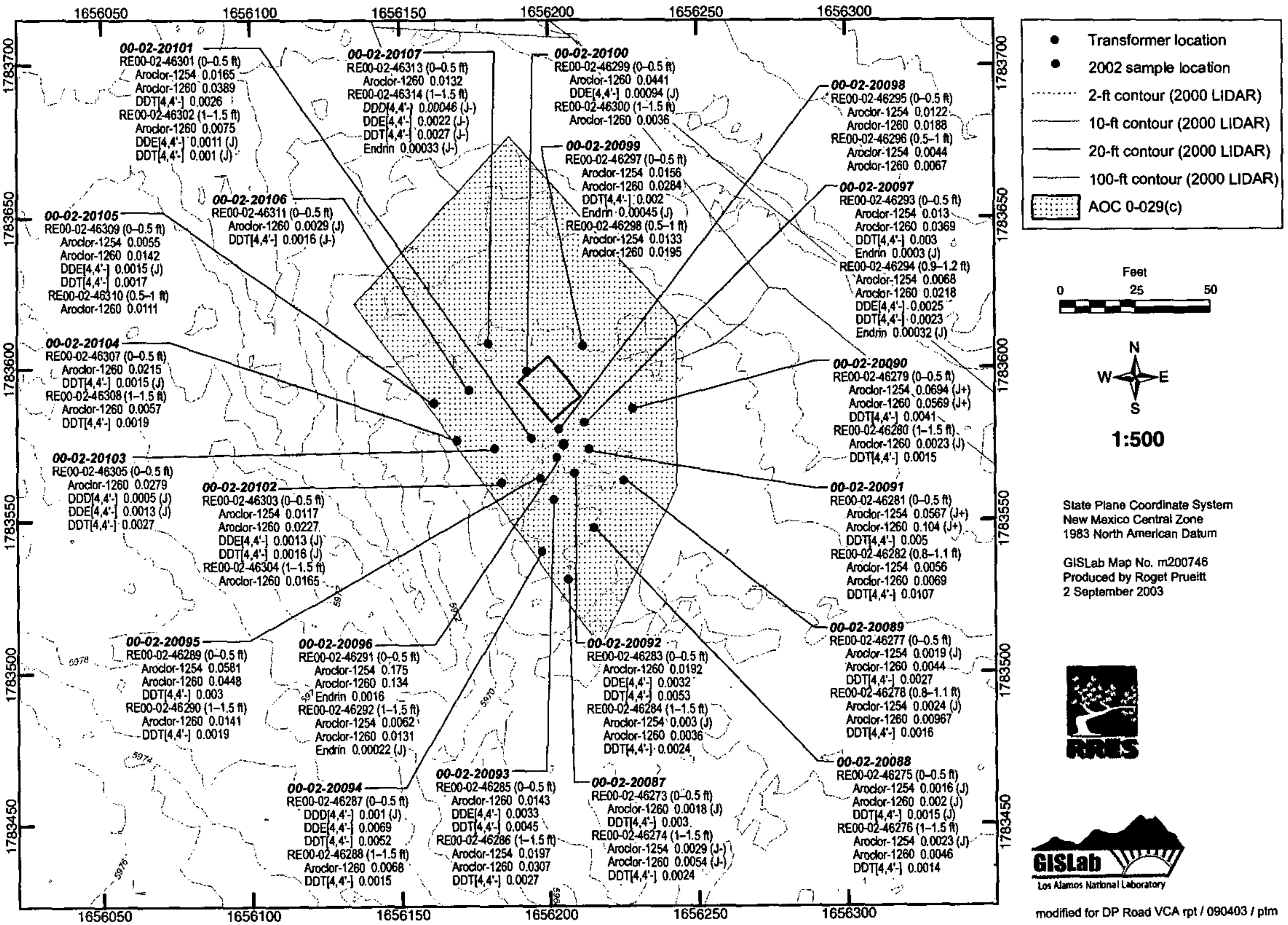


Figure 4.4-6. Detected organic chemicals at AOC 0-029(c)

Vapor pressure. Chemicals with vapor pressure greater than 0.01 mm Hg are more likely to volatilize and diffuse through the soil pore gas with potential release to the atmosphere. Chemicals with vapor pressures less than 0.000001 mm Hg are less likely to volatilize, and therefore tend to remain immobile. PCBs fall in between these two numbers, and tend to remain immobile.

Octanol water partition coefficient. The octanol water partition coefficient (K_{ow}) is an indicator of the bioaccumulation or bioconcentration potential of a chemical in the fatty tissue of living organisms. The unitless K_{ow} value is an indicator of water solubility, mobility, sorption, and bioaccumulation. The higher the K_{ow} (>1000), the greater the affinity of the chemical to bioaccumulate/bioconcentrate in the food chain, the greater its potential for sorption in soil and the lower its mobility (Ney 1995, 58210). A K_{ow} of less than 500 indicates high water solubility, mobility, little to no bioaccumulation, and degradability by microbes, plants, and animals. Table 4.4-10 shows the water solubilities, vapor pressures, K_{ow}, and K_{oc} for the organic COPCs. The PCBs have water solubilities of 0.24, 0.012, and 0.0027 mg/L, and K_{ow} much greater than 500. Therefore, they are likely to be immobilized in soil. It is unlikely for the PCBs to have moved any significant distance laterally or vertically at these sites.

Table 4.4-10
Physiochemical Properties for Organic COPCs

Name	Water Solubility (mg/L)[a]	Vapor Pressure (mm Hg)[a] at 25°C	K_{ow} [a, b]	K_{oc} [a, c]
Aroclor-1242	2.4E-01	4.06E-04	3.98E+05	No data
Aroclor-1254[d]	1.2E-02	7.71E-05	3.2E+06	No data
Aroclor-1260[d]	2.7E-03	4.05E-05	6.3E+06	No data
BHC[beta-][e]	2.4E-01	2.8E-07	7.9E+03	3.8E+03
BHC[delta-][e]	31.4	1.7E-05	1.3E+04	6.6E+03
BHC[gamma-][e]	7.8	1.6E-04	7.9E+03	1.1E+03
Chlordane[alpha-]	5.51E-01	3.55E-08	8.66E+05	5.13E+04
Chlordane[gamma-]	5.51E-01	3.55E-08	8.66E+05	5.13E+04
DDD[4,4'-]	7.33E-02	1.14E-09	1.32E+06	4.58E+04
DDE[4,4'-]	1.92E-02	7.45E-09	1.80E+06	8.64E+02
DDT[4,4'-]	3.41E-03	5.17E-10	1.17E+06	6.78E+05
Dieldrin	1.87E-01	1.31E-09	1.86E+05	2.55E-04
Endosulfan I	2.31E-01	1.72E-11	3.02E+03	2.04E+03
Endosulfan II	2.31E-01	1.72E-11	3.02E+03	2.04E+03
Endosulfan Sulfate	No data	No data	No data	No data
Endrin	2.46E-01	7.68E-10	7.79E+04	1.08E+04
Endrin Aldehyde	No data	No data	No data	No data
Endrin Ketone	2.46E-01	7.68E-10	7.79E+04	1.08E+04
Heptachlor	27.3	4.29E-07	1.04E+05	9.53E+03
Heptachlor Epoxide	2.68E-01	5.79E-09	5.62E+04	7.18E+03
Methoxychlor[4,4'-]	8.84E-02	1.62E-09	3.36E+04	8.00E+02

[a] Denotes reference information from http://www.epa.gov/earth1r6/6pd/rcra_c/pd-o/appd1a.pdf.

[b] K_{ow} – octanol water partition coefficient.

[c] K_{oc} – adsorption coefficient.

[d] Denotes reference information from http://www.atsdr.cdc.gov/toxprofiles/tp17-c4.pdf.

[e] Information from Superfund Public Health Evaluation Manual EPA 540/1-86-060, 1986.

4.5 Site Assessments

4.5.1 Screening Assessments

4.5.1.1 Human Health

The human health screening assessment was performed according to guidance outlined in the draft installation work plan (LANL 2000, 66802) and in the "Human Health Risk-Based Screening Methodology" (LANL 2002, 72639). The human health screening assessment consists of four parts: scooping, screening evaluation, uncertainty analysis, and interpretation.

(a) Scoping

Land use at AOC 0-029(a) is considered industrial (recreational use is unlikely due to the locked tall fence around the site). Land use at AOCs 0-029(b,c) is considered recreational. Although a residential scenario is unlikely under current and projected future site conditions, the potential present-day risks were evaluated using this scenario because it is protective of human health. The screening action levels (SALs) used in the screening evaluation reflect a residential scenario that is based on an exposure of 24 hr/day and 350 days/yr.

The potential for human exposure to residual concentrations of chemicals in the environment at AOCs 0-029(a,b) is low because the sites have restricted access (i.e., fenced and locked). To reach AOCs 0-029(a,b), a gate along the road must be unlocked. AOC 0-029(a) is just off the road, but is completely surrounded by an approximately 10 ft tall fence with barbed wire on the top. AOC 0-029(b) is farther up the four-wheel drive road. The potential for human exposure to residual concentrations of chemicals in the environment at AOC 0-029(c) is moderate because the site is unrestricted to the public, although it is located at the edge of the National Forest Service Boundary bordering San Ildefonso Pueblo property, which is off-limits to the general public.

(b) Screening Evaluation

If a sufficient number of samples are included in a data set (generally 10 or more), the 95% UCL of the mean is used as the representative concentration for screening assessments. If fewer samples are available, the maximum concentrations of each analyte may be used as the representative concentration. The representative concentration used in this screening assessment was the 95% UCL of the mean (Appendix F).

A total of 21 analytes were identified as COPCs at the former PCB transformer site AOCs based on the data review. These COPCs are evaluated further in this section by comparing the 95% UCL to the appropriate SAL. The chemical SALs are calculated based on the methodology provided in Appendix C of the draft installation work plan (LANL 2000, 66802) and in the "Human Health Risk-Based Screening Methodology" (LANL 2002, 72639), and are based on guidance from NMED (NMED 2000, 68554) and EPA Region 6 (EPA 2002, 73691). The SALs for noncarcinogens are based on an HQ of 1.0. SALs for carcinogens are based on a cancer risk level of 10^{-6}. The exposure point concentration for each COPC was compared with its respective SAL for carcinogens, and 0.1 SAL for noncarcinogens because more than two noncarcinogenic COPCs have been identified.

The comparison between 95% UCL and SALs is shown in Tables 4.5-1 and 4.5-2. COPCs whose 95% UCL exceeds the screening criterion are indicated by highlighting.

Table 4.5-1
Screening Evaluation for Noncarcinogenic COPCs from the Former PCB Transformer AOCs in Soil

Chemical	95% UCL for AOC 0-029(a) (mg/kg)	95% UCL for AOC 0-029(b) (mg/kg)	95% UCL for AOC 0-029(c) (mg/kg)	SAL (mg/kg)	0.1 SAL (mg/kg)
Aroclor 1254	0.020	0.016	0.033	1.1	0.11
Endosulfan I[a]	ND[c]	0.00040	ND	370	37
Endosulfan II[a]	ND	0.00076	ND	370	37
Endosulfan Sulfate[a]	ND	ND	0.0017	370	37
Endrin	0.0020	0.0011	0.0017	18	1.8
Endrin Aldehyde[b]	0.0020	0.0014	0.0016	18	1.8
Endrin Ketone[b]	ND	ND	0.0017	18	1.8
Methoxychlor[4,4-]	0.010	ND	ND	310	31

[a] Endosulfan used as a surrogate for Endosulfan I, II, and endosulfan sulfate

[b] Endrin used as a surrogate for Endrin Aldehyde and Endrin Ketone

[c] ND = Not detected at this AOC.

Table 4.5-2
Screening Evaluation for Carcinogenic COPCs from the Former PCB Transformer AOCs in Soil

Chemical	95% UCL for AOC 0-029(a) (mg/kg)	95% UCL for AOC 0-029(b) (mg/kg)	95% UCL for AOC 0-029(c) (mg/kg)	SAL (mg/kg)
Aroclor 1242	0.0063	0.022	0.0040	0.22
Aroclor 1254	0.020	0.016	0.033	0.22
Aroclor 1260	0.025	0.019	0.038	0.22
BHC[beta-]	ND[c]	0.00042	ND	0.32
BHC[delta-][a]	ND	0.00040	ND	0.32
BHC[gamma-]	ND	0.00040	ND	4.4
Chlordane [alpha-][b]	0.0010	ND	ND	1.6
Chlordane [gamma-][b]	ND	0.00041	ND	1.6
DDD [4,4'-]	0.0020	0.0011	0.0017	2.4
DDE [4,4'-]	0.0020	0.00097	0.0024	1.7
DDT [4,4'-]	0.0035	0.0067	0.0038	1.7
Dieldrin	0.0020	ND	0.0017	0.03
Heptachlor	ND	0.00041	ND	0.11
Heptachlor Epoxide	ND	0.00040	ND	0.053

[a] BHC [gamma] used as a surrogate for BHC [delta].

[b] Total Chlordane used as a surrogate for alpha chlordane and gamma chlordane.

[c] ND = Not detected at this AOC.

The 95% UCLs for noncarcinogenic COPCs were all less than their respective SALs and less than 0.1 SAL. The HI (the sum of the ratios of representative concentration divided by the SAL) is approximately 0.02 for AOC 0-029(a), 0.01 for AOC 0-029(b), and 0.03 for AOC 0-029(c) (see Appendix F, Table F-4.3-7, Table F-4.3-9, and Table F-4.3-11), which are all less than NMED's target HI of 1.0 (NMED 2000, 68554). This indicates that a human health hazard is not expected from residual concentrations of noncarcinogenic COPCs at the former PCB transformer AOCs.

The 95% UCLs of the carcinogenic COPCs were less than their respective SALs. The total potential excess cancer risk from exposure to carcinogenic COPCs at AOC 0-029(a) is approximately 3.0×10^{-7}, at AOC 0-029(b) approximately 3.0×10^{-7}, and at AOC 0-029(c) approximately 4.0×10^{-7} (see Appendix F, Table F-4.3-8, Table F-4.3-10, and Table F-4.3-12). NMED's target risk level for carcinogenic risk is 1 in 100,000 (1×10^{-5}) (NMED 2000, 68554), which is not exceeded at these sites.

(c) Uncertainty Analysis

The analysis presented in this human health screening assessment is subject to varying degrees and kinds of uncertainty. The uncertainties associated with the data evaluation, exposure assessment, toxicity assessment, the additive approach, and the use of surrogates may affect the results.

Data evaluation and COPC identification process. Uncertainties associated with the data can include sampling errors, laboratory analysis errors, and data analysis errors. For this site, these uncertainties are expected to have little effect on the results even though the detected concentrations of some organic COPCs were qualified J, indicating the values were less than EQLs and could only be estimated.

Exposure assessment. Uncertainties were identified in two areas of the exposure assessment process.

- *Identification of receptors.* Land use and activity patterns are not represented by those activities assumed by the residential land-use scenario; therefore, uncertainties are introduced. Because the potentially exposed individual is an industrial worker or recreational user, the residential screening assessment overestimates the exposure and subsequently overestimates the potential hazard, risk, and dose. Even the industrial scenario would also be conservative because AOC 0-029(a) is visited by workers only infrequently to check the pump house, much less exposure than is assumed in the industrial scenario.

- *Exposure pathway assumptions.* For each exposure pathway, assumptions are made concerning the parameters, the routes of exposure, the amount of contaminated media to which an individual can be exposed, and intake rates for different routes of exposure. In the absence of site-specific data, the assumptions used are consistent with EPA-approved parameters and default values (EPA 2002, 73691). When several upper-bound values are combined to estimate exposure for any one pathway, the resulting risks can be in excess of the 99th percentile and therefore outside the range that may be reasonably expected.

Toxicity values. The primary uncertainty associated with the SALs is related to derivation of toxicity values used in the calculation. EPA toxicity values (reference doses [RfDs] and slope factors [SFs]) were used to derive the SALs used in this risk screening assessment (EPA 2001, 70109; EPA 1997, 58968). Uncertainties were identified in three areas with respect to the toxicity values: (1) extrapolation from animals to humans, (2) extrapolation from one route of exposure to another route of exposure, and (3) interindividual variability in the human population.

- *Extrapolation from animals to humans.* The SFs and RfDs are often determined based on extrapolation from animal data to humans, which may result in uncertainties in toxicity values because differences exist in chemical absorption, metabolism, excretion, and toxic response between animals and humans. The EPA takes into account differences in body weight, surface area, and pharmacokinetic relationships between animals and humans to minimize the potential to underestimate the dose-response relationship. However, more conservatism is usually incorporated in these steps.

- *Extrapolation from one route of exposure to another route of exposure*. The SFs and RfDs can often contain extrapolations from one route of exposure to another. The extrapolation from the oral route to the inhalation and/or the dermal route is used and is based on the EPA's Integrated Risk Information System database (EPA 2001, 70109). Differences between the two exposure pathways could result in an overestimation of the risk.
- *Interindividual variability in the human population*. For noncarcinogenic effects, the amount of human variability in physical characteristics is important in determining the risks that can be expected at low exposures and in determining the NOAEL. The NOAEL/uncertainty factor approach incorporates a 10-fold factor to reflect the possible interindividual variability in the human population and is generally considered a conservative estimate.

Additive approach. For noncarcinogens, the effects of a mixture of chemicals are generally unknown and possible interactions could be synergistic or antagonistic, thereby overestimating or underestimating the risk. Additionally, the RfDs for different chemicals are not based on the same severity, effect, or target organ. Therefore, the potential for occurrence of noncarcinogenic effects can be overestimated for chemicals that act by different mechanisms and on different target organs but are addressed additively.

Use of surrogate chemicals. Some chemicals do not have EPA-approved or provisional toxicity values. In these cases a similar chemical with available toxicity values are used as a surrogate.

Endrin was used as a surrogate for endrin ketone, which is a breakdown product of endrin when it is exposed to light. Photochemical isomerization of endrin, primarily to the pentacyclic ketone commonly called endrin ketone, was observed after exposure of thin layers of solid endrin on glass to sunlight (ATSDR 1997, 56531). Results of seasonal studies indicated that this isomerization proceeds with a half-life of 5 to 9 days in intense summer sunlight, with complete conversion to endrin ketone in 15 to 19 days. Endrin ketone was detected in 1 of 42 samples at AOC 0-029(c), and does not contribute to the risk (HQ = 0.001).

Endrin was used as a surrogate for endrin aldehyde, which is an impurity and a breakdown product of Endrin. Photochemical isomerization of endrin was observed after exposure of thin layers of solid endrin on glass to sunlight (ATSDR 1997, 56531). Minor amounts of endrin aldehyde were formed in this reaction. Endrin aldehyde was detected in 1 of 34 samples at AOC 0-029(a), in 1 of 40 samples at AOC 0-029(b), and in 2 of 42 samples at AOC 0-029(c), and does not contribute to the risk (HQs = 0.0008 to 0.001).

Endosulfan was used as a surrogate for endosulfan I and endosulfan II because they are isomers of endosulfan. The risk from these chemicals should be the same. Endosulfan was used as a surrogate for endosulfan sulfate because endosulfan sulfate is a breakdown product of endosulfan I and endosulfan II. Endosulfan and endosulfan sulfate exhibit similar toxicities.

Total chlordane was used as a surrogate for alpha chlordane and gamma chlordane. Alpha chlordane was detected in 1 of 34 samples at AOC 0-029(a).Gamma chlordane was detected in 1 of 40 samples at AOC 0-029(b). Neither is a major contributor to risk (HQs <0.006).

(d) Interpretation

Based on the screening assessment using a residential scenario, the HIs (0.02, 0.01, and 0.03) are less than NMED's target level of 1.0, and the carcinogenic risks (3.0×10^{-7}, 3.0×10^{-7}, 4.0×10^{-7}) are less than NMED's target risk of 1×10^{-5}. The results indicate that there is no potential unacceptable risk to human health at these AOCs.

4.5.1.2 Ecological

The ecological screening evaluation was performed in accordance with the process outlined in "Screening Level Ecological Risk Assessment Methods" (LANL 1999, 64783). This ecological screening assessment consists of four parts: the scoping evaluation, the screening evaluation, uncertainty analysis, and risk interpretation. The scoping evaluation includes (1) the data assessment step, which identifies the list of COPCs; and (2) the problem formulation step for the specific site under investigation. The basis for AOCs 0-029(a,b,c) problem formulation is found in the scoping checklist (Appendix F of this document). The scoping checklist is a useful tool for organizing existing ecological information and for focusing the site visit on the information needed to develop the site conceptual model. The scoping checklist also provides the basis for evaluating the adequacy of the data for ecological risk screening.

The screening evaluation includes the comparison of representative concentrations to the final (minimum) ESLs. Representative media concentrations are either maximum or average values depending on the data for the site. The final ESLs are media-specific concentrations that represent the lowest value amongst an array of ecological receptors associated with no adverse ecological effects. Derivation of final ESLs is a process dependent on numerous equations and information sources; see Section 4.5, "Screening Level Ecological Risk Assessment Methods" (LANL 1999, 64783) for information about how the ESLs are derived. ESLs were developed for a suite of receptors designed to represent individual feeding guilds, such as invertivorous mammal or carnivorous bird. Robins and kestrels were modeled with three and two different diets respectively so that they could represent multiple feeding guilds. For example, the omnivorous robin actually represents the feeding guild of all omnivorous birds, while the herbivorous robin represents all herbivorous birds. The representative concentration of each COPEC was compared with the final ESL from the September 2002 version (Release 1.5) of the LANL Ecorisk Database (LANL 2002, 73702). The ESLs from the database used in evaluation of this site are included in Table F-1.0-1 in Appendix F.

To provide additional information on the potential effects to representative ecological receptors, hazard quotients (HQs) and hazard indices (HIs) for all COPECs are calculated for all terrestrial screening receptors. The HQ is the ratio of the calculated representative concentration to the receptor (based on COPC concentrations at AOCs 0-029[a,b,c]) to the ESL which is a dose that has been determined to be acceptable (based on toxicity studies and expected exposure parameters for the receptor). An HI is a sum of HQs, across contaminants with like effects, for a given screening receptor. Because it is not known how the effects of chemicals combine, the simplest assumption of additivity was made for the screening assessment.

An HI greater than 1 is an indication of potential adverse impacts, and the COPCs that contribute HQ >0.3 are identified as COPECs. In addition to identifying COPECs, HI/HQ results can be used for a qualitative assessment of possible adverse effects on individuals or populations. Because the HQ values are based on NOAELs, HQ/HI less than one represent no adverse effects on individuals or populations. Because EPA guidance is to manage ecological risks to populations (EPA 1999, 70086), some level of adverse effects of chemical stressors on individuals is acceptable. An exception is a T&E species, for which it is appropriate to evaluate potential adverse effects on individuals. The kestrel screening receptor with an all-flesh diet serves as the surrogate for avian T&E receptors in the screening calculations.

The uncertainty analysis section following the COPEC identification section describes the key sources of uncertainty in the screening assessment. The uncertainty analysis can result in adding chemicals to or removing them from the list of COPECs.

The last part of the screening assessment interprets the results in the context of a risk management decision. This primarily involves an assessment of potential ecological risk versus the potential impacts of further remediation

AOC 0-029(a)

(a) Scoping

Data Assessment

The approach taken to characterize releases from AOC 0-029(a) was designed to provide information on the nature and extent of COPCs at this site. The data collected in soil were adequate to confirm the COPCs distribution. Representative concentrations used in this assessment are 95% UCLs of the mean concentration, unless the number of detected concentrations in the data set was insufficient to calculate a 95% UCL of the mean value, then the maximum concentration was used. These 95% UCLs of the mean were calculated following EPA guidance "Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites" (EPA 2002, 73593.1). The UCLs were calculated using normal, lognormal, or nonparametric (Chebyshev's) tests depending on which distribution provided the best fit to the data for that COPC. Samples in which an analyte was not detected were considered as having a concentration of one half the detection limit for that analyte. In assessing this site, all samples were included in the data set used to generate representative concentrations.

Problem Formulation

AOC 0-029(a) is a former production well (well #4) site located on San Ildefonso Pueblo property near State Road 4 at the bottom of Los Alamos Canyon. This site has potential soil contamination caused by leaks from transformers mounted on power poles at the site. AOC 0-029(a) is vegetated with grasses and forbs and shows evidence of usage by mammalian receptors.

Based on a comparison of AOC location to GIS-based habitat databases, the Mexican spotted owl (a threatened or endangered species) may forage with very low frequency in the area, though the AOC does not lie within the potential nesting habitat for the species (LANL 2002, 76091). Potential impact to aquatic habitat is unlikely because there are no established aquatic communities in the area of the AOCs; the ephemeral nature of the stream within this section of the canyon prevents aquatic communities from becoming established there. Therefore aquatic pathways were not considered in this ecological screening assessment. The completed ecological scoping checklist for the AOC 0-029(a) is included in Appendix F-3.0.

For ecological risk screening, the primary impacted medium is the surface soil. Electrical transformers previously located at the site may have released PCB-containing oil to the surface soil at the site. The exposure pathways for ecological receptors considered for this site were plant uptake and rainsplash, ingestion of soil, ingestion through the food chain, dermal contact, and inhalation. For the type and distribution of contaminants seen at this site, these are expected to represent the major pathways for potential exposure.

(b) Screening Evaluation

For AOC 0-029(a) all soil samples were used to calculate the 95% UCL for ecological receptors. The 95% UCL of the mean (if one could be calculated) or the maximum detected concentration of each COPC was compared with the final soil ESL from Release 1.5 of the LANL Ecorisk Database (LANL 2002, 73702). Because the final ESLs may be based on different receptors for different compounds, the HQs generated by them cannot be summed to produce a single HI for the site. The exposure concentration of the COPCs at the sites, the final ESLs, and the HQ are presented in Table 4.5-3.

Table 4.5-3
COPC Screening for AOC 0-029(a)

COPEC	95% UCL of the Mean Concentration (mg/kg)	Final Soil ESL (mg/kg)	Receptor for Final ESL	HQ
Aroclor-1242[a]	0.03	0.041	invertivorous robin	0.73
Aroclor-1254	0.013	0.022	shrew	0.59
Aroclor-1260	0.025	0.44	invertivorous robin	0.06
Chlordane[alpha-][a]	0.00076	2.1	shrew	<0.01
DDD[4,4'-][a,b]	0.00056	0.0026	invertivorous robin	0.22
DDE[4,4'-][a]	0.00021	0.0026	invertivorous robin	0.08
DDT[4,4'-]	0.0037	0.0026	invertivorous robin	1.4
Dieldrin[a]	0.00028	0.04	shrew	0.01
Endrin[a]	0.00056	0.0034	plant	0.16
Endrin aldehyde[c]	0.00036	0.0034	plant	0.11
Methoxychlor[4,4'-][a]	0.0093	8.4	shrew	<0.01

[a] Maximum detected value used because there was only one detection in data set.

[b] DDE used as a surrogate.

[c] Endrin used as a surrogate.

Three organic COPCs generated HQs exceeding 0.3: Aroclor-1242, Aroclor-1254, and DDT [4,4']. Each of these organic COPCs was carried forward in the assessment as a COPEC. The benchmark of an HQ of 0.3 is used to account for potential additive effects of chemicals, and to ensure that no COPC that may contribute significantly to the HI of a receptor is overlooked.

Table 4.5-4 shows the HQs and the HIs adjusted by individual AUFs that adjust the HI for the portion of the receptor's home range that is made up of the site. AOC 0-029(a) has an area of 0.046 ha. The individual AUFs based on this site size are given in Table 4.5-5.

Table 4.5-4
Hazard Quotients and Hazard Indices for COPECs at AOC 0-029(a)

Receptor	Omnivorous kestrel	Carnivorous Kestrel	Herbivorous Robin	Invertivorous Robin	Omnivorous Robin	Deer Mouse	Cottontail	Red fox	Shrew	Earthworm	Plant
Aroclor-1242	0.12	0.02	0.07	0.73	0.40	0.25	0.02	0.01	0.44	NA*	NA
Aroclor-1254	0.08	0.06	0.01	0.32	0.16	0.29	<0.01	0.09	0.59	NA	<0.01
DDT[4,4'-]	0.40	0.40	0.03	1.4	0.71	<0.01	<0.01	<0.01	<0.01	NA	<0.01
HI for receptor	0.6	0.48	0.11	2.5	1.3	0.54	0.02	0.10	1.0	NA	<0.01
HI adjusted by individual AUF	<0.01	<0.01	0.01	0.27	0.14	0.32	<0.01	<0.01	0.12	NA	<0.01

Note: Black shading = HQ >0.3 or HI >1.
*NA = No ESL available.

Table 4.5-5
Area-Use Factors for AOC 0-029(a)

Receptor	Home Range (ha)	Individual AUF (ha)
American kestrel	106	0.0004
American Robin	0.42	0.109
Deer Mouse	0.077	0.597
Vagrant shrew	0.39	0.118
Desert cottontail	3.1	0.015
Red Fox	1038	0.00004

(c) Uncertainty Analysis

Screening assessments for ecological risk incorporate a number of assumptions that may be sources of uncertainty.

Viable ecological habitat exists at the site and is being utilized by various ecological receptors. The suite of terrestrial wildlife receptors for which ESLs have been generated is adequate to assess the feeding guilds likely to be encountered at this site. The COPECs at this site include three organic compounds. The exposure pathways considered for this site were ingestion of soil both during feeding and grooming activities as well as COPECs taken up through plant roots and later ingested as food. For the type and distribution of contaminants seen at this site, these are expected to represent the major pathways for potential exposure. The exposure pathways addressed by the ESL and HQ/HI analysis include all complete exposure pathways with the exception of inhalation and dermal contact. Although these pathways contribute to the dose received by animals, it is expected that the contribution of these pathways is relatively small and does not interfere with COPEC determination. Dermal contact and inhalation/respiration pathways have not typically been assessed quantitatively in ecological risk assessments, based on guidance that indicates that the ingestion route is most important to terrestrial animals (EPA 1997, 59370). Inhalation is viewed to be an insignificant pathway for contaminated soil in areas where plants cover the contaminated ground surface or where much of the contamination is buried. Dermal exposure to wildlife is mitigated by the fur or feathers that cover the bodies of most vertebrates. In addition, the incidental consumption of soil during grooming is assumed to be included in the direct soil ingestion estimates. Soil exposure pathway analysis has shown that inhalation and dermal pathways contribute a small fraction of the dose obtained orally (EPA 2000, 70094). The exposure pathways considered in the development of the ESLs used in screening assessment for this site are likely to capture the primary exposures for wildlife receptors at this site.

Other exposure assumptions made during the screening assessment are very conservative and likely to overestimate the actual exposure of wildlife receptors to the contaminants at this site. The first tier of the screening assessment assumes 100% exposure of the receptor to the contaminant representative concentration at the site; this is unlikely for most of the wildlife receptors evaluated. For COPECs for which a mean value could be calculated, this level is conservatively calculated as the 95% UCL of the mean concentration. Therefore, even the screening using the 95% UCL of the mean concentration is likely to overestimate exposure to contaminants at the site.

Additional sources of uncertainty in an ecological risk screening appear in the derivation of the toxicity information and benchmarks for ecological receptors. The toxicity data and uncertainty factors used to develop the ESLs may overestimate the actual toxicity of a chemical to a receptor, particularly when that data is extrapolated from one species to another. In addition, the comparison of site concentrations to ESLs assumes that the chemical species or form occurring at the site is identical to the chemical species used in the toxicity analysis. The screening comparison also assumes that 100% of each chemical is bioavailable to the exposed receptor. Because toxicity testing generally uses more bioavailable and potentially toxic forms of the chemical being studied, the assumptions of speciation and bioavailability are conservative and likely to overestimate the actual risk to wildlife from exposure to the residual contamination. Consideration of the effects of exposure to more than a single chemical at a site is modeled on the assumption of additive effects of chemicals. This assumption could overestimate or underestimate the actual impact of exposure to multiple contaminants due to synergistic or antagonistic effects. No information is available for most chemicals on synergistic or antagonistic effects. Therefore almost all risk screenings and assessments assume the effects are additive when multiple chemical contaminants are present.

When the HIs generated for each receptor and COPEC were adjusted by AUFs, all were well below the benchmark of one and indicate no ecological risk to individuals of any of the receptor species at this site. Therefore no COPECs were retained at AOC 0-029(a).

(d) Interpretation

Comparison to the final soil ESL for ecological receptors to the mean or maximum concentration produced HQs below 0.3 (indicating no potential for ecological risk) for all COPCs at AOC 0-029(a) except for Aroclor-1242, Aroclor-1254 and 4,4'-DDT.

When individual AUFs were applied to the HIs for these COPCs, the adjusted HIs did not indicate any ecological risk to individual receptors from these COPCs. Therefore none of these COPCs were retained as COPECs for this site. As stated previously these decision criteria are consistent with EPA guidance on risk management for ecological risk assessments (EPA 1999, 70086). The decision criteria were no adverse effects on individuals of T&E species and populations of other species.

AOC 0-029(b)

(a) Scoping

Data Assessment

The approach taken to characterize releases from AOC 0-029(b) was designed to provide information on the nature and extent of COPCs at this site. The data collected in soil were adequate to confirm the COPC distribution. Representative concentrations used in this assessment are 95% UCLs of the mean concentration, unless the number of detected concentrations in the data set was insufficient to calculate a 95% UCL of the mean value, then the maximum concentration was used. These 95% UCLs of the mean were calculated following EPA guidance "Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites" (EPA 2002, 73593.1). The UCLs were calculated using normal, lognormal, or nonparametric (Chebyshev's) tests depending on which distribution provided the best fit to the data for that COPC. Samples in which an analyte was not detected were considered as having a concentration of one half the detection limit for that analyte. In assessing this site, all samples were included in the data set used to generate representative concentrations.

Problem Formulation

AOC 0-029(b) is a former production well site located on San Ildefonso Pueblo property near State Road 4 at the bottom of Los Alamos Canyon. This site has potential soil contamination from leaks from transformers mounted on power poles at the site. AOC 0-029(b) is vegetated with grasses and forbs and shows evidence of usage by mammalian receptors. Based on a comparison of AOC location to GIS-based habitat databases for the Mexican spotted owl (a threatened or endangered species), the owl may forage at the site with a very low frequency in the area, though the AOC does not lie within the potential nesting habitat for the species (LANL 2002, 76091). Potential impact to aquatic habitat is unlikely because there are no established aquatic communities in the area of the AOCs; the ephemeral nature of the stream within this section of the canyon prevents aquatic communities from becoming established. Therefore aquatic pathways were not considered in this ecological screening assessment. The completed ecological scoping checklist for this site is included in Appendix F-3.0.

For ecological risk screening, the primary impacted medium is the surface soil. Electrical transformers previously located at the site may have released PCB-containing oil to the surface soil at the site. The exposure pathways for ecological receptors considered for this site were ingestion of soil and ingestion of compounds through the food chain that were originally taken up through plant roots. For the type and distribution of contaminants seen at this site, these are expected to represent the major pathways for potential exposure.

(b) Screening Evaluation

For AOC 0-029(b) all soil samples were used to calculate the 95% UCL of the mean concentration. The 95% UCL of the mean (if one could be calculated) or the maximum detected concentration of each COPC was compared with the final soil ESL from Release 1.5 of the Ecorisk Database (LANL 2002, 73702). Because the final ESLs may be based on different receptors for different compounds, the HQs generated by them cannot be summed to produce a single HI for the site. The representative concentrations of COPCs detected at the site, the final ESL, and the HQ are presented in Table 4.5-6. All soil samples were used to calculate the UCL for ecological receptors.

Table 4.5-6
COPC Screening for AOC 0-029(b)

COPEC	95% UCL of the Mean Concentration (mg/kg)	Final Soil ESL (mg/kg)	Receptor for Final ESL	HQ
Aroclor-1242	0.017	0.041	invertivorous robin	0.41
Aroclor-1254	0.016	0.022	shrew	0.73
Aroclor-1260	0.019	0.44	invertivorous robin	0.04
BHC[beta-] [a]	0.00076	0.97	shrew	<0.01
BHC[delta-] [a, b]	0.00057	0.034	shrew	0.02
BHC[gamma-] [a]	0.00062	0.034	shrew	0.02
Chlordane[gamma-] [a]	0.00069	2.1	shrew	0.02
DDD[4,4'] [a, c]	0.00034	0.0026	invertivorous robin	0.13
DDE[4,4'-]	0.00097	0.0026	invertivorous robin	0.37
DDT[4,4'-]	0.0047	0.0026	invertivorous robin	1.8
Endosulfan (I & II) [a,d]	0.00139	0.35	shrew	<0.01
Endrin [a]	0.00068	0.0034	plant	0.20
Endrin aldehyde [a,e]	0.00036	0.0034	plant	0.11
Heptachlor	0.00066	0.059	shrew	0.01
Heptachlor epoxide [f]	0.00061	0.059	shrew	0.01

Note: Black shading = HQ >0.3.

[a] Maximum detected value used because there was only one detection in data set.

[b] BHC[gamma] used as a surrogate.

[c] DDE used as a surrogate.

[d] Combined because endosulfan was used as a surrogate for both.

[e] Endrin used as a surrogate.

[f] Heptachlor used as surrogate.

In this comparison to final ESLs, four organic COPCs generated HQs exceeding 0.3: Aroclor-1242, Aroclor-1254, 4,4'-DDE, and DDT[4,4'-]. Each of these was carried forward in the assessment as a COPEC.

Table 4.5-7 shows the HQs, HIs, and the HIs adjusted by individual AUFs that adjust the HI for the portion of the receptor's home range that is made up of the site. AOC 0-029(b) has an area of 0.049 ha. The individual AUFs for receptors based on this site size are given in Table 4.5-8.

Table 4.5-7
Hazard Quotients and Hazard Indices for COPECs at AOC 0-029(b)

Receptor	Omnivorous kestrel	Carnivorous Kestrel	Herbivorous Robin	Invertivorous Robin	Omnivorous Robin	Deer Mouse	Cottontail	Red fox	Shrew	Earthworm	Plant
Aroclor-1242	0.07	0.01	0.04	0.41	0.23	0.14	0.01	0.01	0.25	NA*	NA
Aroclor-1254	0.09	0.07	0.01	0.39	0.20	0.36	0.01	0.11	0.73	NA	<0.01
DDE[4,4'-]	0.12	0.13	0.01	0.37	0.19	<0.01	<0.01	<0.01	<0.01	NA	NA
DDT[4,4'-]	0.51	0.51	0.04	1.8	0.90	<0.01	<0.01	<0.01	<0.01	NA	<0.01
HI for receptor	0.79	0.72	0.10	3.0	1.5	0.50	0.02	0.12	0.98	NA	NA
HI adjusted by individual AUF	<0.01	<0.01	0.01	0.35	0.18	0.32	<0.01	<0.01	0.12	NA	NA

Note: Black shading = HQ >0.3 or HI >1.
*NA = No ESL available.

Table 4.5-8
Area-Use Factors for AOC 0-029(b)

Receptor	Home Range (ha)	Individual AUF (ha)
American kestrel	106	0.0005
American Robin	0.42	0.117
Deer Mouse	0.077	0.636
Vagrant shrew	0.39	0.126
Desert cottontail	3.1	0.016
Red Fox	1038	0.00005

(c) Uncertainty Analysis

Screening assessments for ecological risk incorporate a number of assumptions that may be sources of uncertainty.

Viable ecological habitat exists at the site and is being utilized by various ecological receptors. The suite of terrestrial wildlife receptors for which ESLs have been generated is adequate to assess the feeding guilds likely to be encountered at this site. The residual contaminants at this site include PCBs and pesticides. The exposure pathways considered for this site were inhalation of dust and ingestion of soil both during feeding and grooming activities as well as COPECs taken up through plant roots and later ingested as food. For the type and distribution of contaminants seen at this site, these are expected to represent the major pathways for potential exposure. The exposure pathways addressed by the ESL and HQ/HI analysis include all complete exposure pathways with the exception of inhalation and dermal contact. Although these pathways contribute to the dose received by animals, it is expected that the contribution of these pathways is relatively small and does not interfere with COPEC determination. Dermal contact and inhalation/respiration pathways have not typically been assessed quantitatively in ecological risk assessments, based on guidance that indicates that the ingestion route is most important to terrestrial animals (EPA 1997, 59370). Inhalation is viewed to be an insignificant pathway for contaminated soil in areas where plants cover the contaminated ground surface or where much of the contamination is buried. The fur or feathers that cover the bodies of most vertebrates mitigate dermal exposure to wildlife. In addition, the incidental consumption of soil during grooming is assumed to be included in the direct soil ingestion estimates. Soil exposure pathway analysis has shown that inhalation and dermal pathways contribute a small fraction of the dose obtained orally (EPA 2000, 70094). The exposure pathways considered in the development of the ESLs used in screening assessment for this site are likely to capture the primary exposures for wildlife receptors at this site.

Other exposure assumptions made during the screening assessment are very conservative and likely to overestimate the actual exposure of wildlife receptors to the contaminants at this site. The first tier of the screening assessment assumes 100% exposure of the receptor to the contaminant representative concentration at the site; this is extremely unlikely for most of the wildlife receptors evaluated. For those COPECs for which a mean concentration could be calculated, this mean value is conservatively calculated as the 95% UCL of the mean concentration. Therefore, even the screening using the 95% UCL of the mean concentration is likely to overestimate exposure to contaminants at the site

Additional sources of uncertainty in an ecological risk screening appear in the derivation of the toxicity information and benchmarks for ecological receptors. The toxicity data and uncertainty factors used to develop the ESLs may overestimate the actual toxicity of a chemical to a receptor, particularly when that data is extrapolated from one species to another. In addition, the comparison of site concentrations to ESLs assumes that the chemical species or form occurring at the site is identical to the chemical species used in the toxicity analysis. The screening comparison also assumes that 100% of each chemical is bioavailable to the exposed receptor. Because toxicity testing generally uses more bioavailable and potentially toxic forms of the chemical being studied, the assumptions of speciation and bioavailability are conservative and likely to overestimate the actual risk to wildlife from exposure to the residual contamination. Consideration of the effects of exposure to more than a single chemical at a site is modeled on the assumption of additive effects of chemicals. The use of the benchmark of an HQ of 0.3 is used to account for these potential additive effects of chemicals. This assumption could overestimate or underestimate the actual impact of exposure to multiple contaminants due to synergistic or antagonistic effects. No information is available for most chemicals on synergistic or antagonistic effects, therefore almost all risk screenings and assessments assume the effects are additive when multiple chemical contaminants are present.

When adjusted by the individual AUFs for each receptor, the HIs for all receptors at this site were well below one. Therefore, no COPECs were retained for this site.

(d) Interpretation

Comparison of the final soil ESL for ecological receptors to the 95% UCL or maximum concentration produced HQs below 0.3 (indicating no potential for ecological risk) for all COPCs at AOC 0-029(b) except for Aroclor-1242, Aroclor-1254, 4,4'-DDE, and 4,4'-DDT. When individual AUFs were applied to the HIs for these COPCs, the adjusted HIs did not indicate any ecological risk to individual receptors from these COPCs. Therefore none of these COPECs were retained for this site. As stated previously these decision criteria are consistent with EPA guidance on risk management for ecological risk assessments (EPA 1999, 70086). The decision criteria were no adverse effects on individuals of T&E species and populations of other species.

AOC 0-029(c)

(a) Scoping

Data Assessment

The approach taken to characterize releases from AOC 0-029(c) was designed to provide information on the nature and extent of COPCs at this site. The data collected in soil were adequate to confirm the COPCs distribution. Representative concentrations used in this assessment are 95% UCLs of the mean concentration, unless the number of detected concentrations in the data set was insufficient to calculate a 95% UCL of the mean value, then the maximum concentration was used. These 95% UCLs of the mean were calculated following EPA guidance "Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites" (EPA 2002, 73593.1). The UCLs were calculated using normal, lognormal, or nonparametric (Chebyshev's) tests depending on which distribution provided the best fit to the data for that COPC. Samples in which an analyte was not detected were considered as having a concentration of one half the detection limit for that analyte. In assessing this site, all samples were included in the data set used to generate representative concentrations.

Problem Formulation

AOC 0-029(c) is at the site of former production well #1, located on Santa Fe National Forest property in Guaje Canyon. This site has potential soil contamination from leaks from transformers mounted on power poles at the site. AOC 0-029(c) is partially vegetated with grasses but shows substantial evidence of disturbance and areas denuded of vegetation. Based on a comparison of AOC location to GIS-based habitat databases for the Mexican spotted owl (a threatened or endangered species), the Mexican spotted owl may forage at the site with moderate frequency though the AOC does not lie within the potential nesting habitat for the species (LANL 2002, 76091). Potential impact to aquatic habitat is unlikely because there are no established aquatic communities in the area of the AOCs; the ephemeral nature of the stream within this section of the canyon prevents aquatic communities from becoming established. Therefore aquatic pathways were not considered in this ecological screening assessment. The completed ecological scoping checklist for this site is included in Appendix F-3.0.For ecological risk screening, the primary impacted medium is the surface soil. Electrical transformers previously located at the site may have released PCB-containing oil to the surface soil at the site. The exposure pathways for ecological receptors considered for this site were ingestion of soil and ingestion of compounds through the food chain. For the type and distribution of contaminants seen at this site, these are expected to represent the major pathways for potential exposure.

(b) Screening Evaluation

For AOC 0-029(c) all samples were used to calculate the 95% UCL for ecological receptors. The 95% UCL of the mean (if one could be calculated) or the maximum detected concentration was compared with the final soil ESL from Release 1.5 of the LANL Ecorisk Database (LANL 2002, 73702). Because the final ESLs may be based on different receptors for different compounds, the HQs generated by them cannot be summed to produce a single HI for the site. The 95% UCL of the mean concentrations of COPCs detected at the sites, the final ESLs, and the HQs are given in Table 4.5-9.

Table 4.5-9
Final ESL Comparison for AOC 0-029(c)

COPEC	95% UCL of the Mean Concentration (mg/kg)	Final Soil ESL (mg/kg)	Receptor for final ESL	HQ
Aroclor-1242	0.004	0.041	invertivorous robin	0.10
Aroclor-1254	0.033	0.022	shrew	1.5
Aroclor-1260	0.038	0.44	invertivorous robin	0.09
DDD[4,4'-] [a,b]	0.001	0.0026	invertivorous robin	0.38
DDE[4,4'-]	0.0024	0.0026	invertivorous robin	0.9
DDT[4,4'-]	0.0038	0.0026	invertivorous robin	1.5
Dieldrin [b]	0.00029	0.04	shrew	<0.01
Endosulfan sulfate [c]	0.00039	0.35	shrew	<0.01
Endrin	0.0017	0.0034	plant	0.50
Endrin aldehyde [d]	0.0016	0.0034	plant	0.47
Endrin ketone [d]	0.00049	0.0034	plant	0.14

Note: Black shading = HQ> 0.3.

[a] DDE used as a surrogate.

[b] Maximum detected value used because only one detection or because UCL exceeds maximum value.

[c] Endosulfan used as a surrogate.

[d] Endrin used as a surrogate.

Six COPCs generated HQs exceeding 0.3: Aroclor-1254, DDD[4,4'-], DDE[4,4'-], DDT[4,4'-], endrin, and endrin aldehyde. The benchmark of an HQ of 0.3 is used to account for potential additive effects of chemicals, and to insure that no COPC which may contribute significantly for the HI of a receptor is overlooked. Each of these was carried forward in the assessment as a COPEC.

Table 4.5-10 shows the HQs and the HIs adjusted by individual AUFs that adjust the HI for the portion of the receptor's home range that is made up of the site. The square area sampled in AOC 0-029(c) has an area of 0.039 ha. The individual AUFs based on this site size are given in Table 4.5-11.

Table 4.5-10
Hazard Quotients and Hazard Indices for COPECs at AOC 0-029(c)

Receptor	Omnivorous kestrel	Carnivorous Kestrel	Herbivorous Robin	Invertivorous Robin	Omnivorous Robin	Deer Mouse	Cottontail	Red fox	Shrew	Earthworm	Plant
Aroclor-1254	0.19	0.15	0.02	0.80	0.41	0.73	0.01	0.22	1.50	NA*	<0.01
DDD[4,4'-]	0.12	0.14	.01	0.38	0.19	<0.01	<0.01	<0.01	<0.01	NA	NA
DDE[4,4'-]	0.29	0.32	0.02	0.92	0.46	<0.01	<0.01	<0.01	<0.01	NA	NA
DDT[4,4'-]	0.41	0.41	0.03	1.5	0.73	<0.01	<0.01	<0.01	<0.01	NA	<0.01
Endrin	0.02	0.01	0.02	0.15	0.08	<0.01	<0.01	<0.01	0.01	NA	0.50
Endrin aldehyde	0.02	0.01	0.02	0.15	0.08	<0.01	<0.01	<0.01	0.01	NA	0.50
HI for receptor	1.1	1.0	0.12	3.9	2.0	0.73	0.01	0.22	1.5	NA	NA
HI adjusted by individual AUF	<0.01	<0.01	0.01	0.36	0.18	0.07	<0.01	<0.01	0.15	NA	NA

Note: Black shading = HQ >0.3 or HI >1.
*NA = No ESL available.

Table 4.5-11
Area-Use Factors for AOC 0-029(c)

Receptor	Home Range (ha)	Individual AUF (ha)
American kestrel	106	0.00037
American Robin	0.42	0.0928
Deer Mouse	0.077	0.506
Vagrant shrew	0.39	0.10
Desert cottontail	3.1	0.012
Red Fox	1038	0.00004

(c) Uncertainty Analysis

Screening assessments for ecological risk incorporate a number of assumptions that may be sources of uncertainty.

Viable ecological habitat exists at the site and is being utilized by various ecological receptors. The suite of terrestrial wildlife receptors for which ESLs have been generated is adequate to assess the feeding guilds likely to be encountered at this site. The COPECs at this site include non-volatile organic compounds. The exposure pathways considered for this site were ingestion of soil both during feeding and grooming activities as well as COPECs taken up through plant roots and later ingested as food. For the type and distribution of contaminants seen at this site, these are expected to represent the major pathways for potential exposure. The exposure pathways addressed by the ESL and HQ/HI analysis include all complete exposure pathways with the exception of inhalation and dermal contact. Although these pathways contribute to the dose received by animals, it is expected that the contribution of these pathways is relatively small and does not interfere with COPEC determination. Dermal contact and inhalation/respiration pathways have not typically been assessed quantitatively in ecological risk assessments, based on guidance that indicates that the ingestion route is most important to terrestrial animals (EPA 1997, 59370). Inhalation is viewed to be an insignificant pathway for contaminated soil in areas where plants cover the contaminated ground surface or where much of the contamination is buried. Dermal exposure to wildlife is mitigated by the fur or feathers that cover the bodies of most vertebrates. In addition, the incidental consumption of soil during grooming is assumed to be included in the direct soil ingestion estimates. Soil exposure pathway analysis has shown that inhalation and dermal pathways contribute a small fraction of the dose obtained orally (EPA 2000, 70094). The exposure pathways considered in the development of the ESLs used in screening assessment for this site are likely to capture the primary exposures for wildlife receptors at this site.

Other exposure assumptions made during the screening assessment are very conservative and likely to overestimate the actual exposure of wildlife receptors to the contaminants at this site. The first tier of the screening assessment assumes 100% exposure of the receptor to the contaminant representative concentration at the site; this is extremely unlikely for most of the wildlife receptors evaluated. Therefore, the use of the maximum or the 95% UCL of the mean concentration is likely to overestimate exposure to contaminants at the site.

Additional sources of uncertainty in an ecological risk screening appear in the derivation of the toxicity information and benchmarks for ecological receptors. The toxicity data and uncertainty factors used to develop the ESLs may overestimate the actual toxicity of a chemical to a receptor, particularly when that data is extrapolated from one species to another. In addition, the comparison of site concentrations to ESLs assumes that the chemical species or form occurring at the site is identical to the chemical species used in the toxicity analysis. The screening comparison also assumes that 100% of each chemical is bioavailable to the exposed receptor. Because toxicity testing generally uses more bioavailable and potentially toxic forms of the chemical being studied, the assumptions of speciation and bioavailability are conservative and likely to overestimate the actual risk to wildlife from exposure to the residual contamination. Consideration of the effects of exposure to more than a single chemical at a site is modeled on the assumption of additive effects of chemicals. This assumption could overestimate or underestimate the actual impact of exposure to multiple contaminants due to synergistic or antagonistic effects. No information is available for most chemicals or synergistic or antagonistic effects, therefore almost all risk screenings and assessments assume the effects are additive when multiple chemical contaminants are present.

When the HIs for each receptor were adjusted by the individual AUF, all HIs were significantly below one. Therefore, no COPECs were retained at AOC 0-029(c).

(d) Interpretation

Comparison to the final soil ESL for ecological receptors to the 95% UCL or maximum concentration produced HQs below 0.3 (indicating no potential for ecological risk) for all COPCs at AOC 0-029(c) except for Aroclor-1254, 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, endrin, and endrin aldehyde. When individual AUFs were applied to the HIs for these COPCs, the adjusted HIs did not indicate any ecological risk to individual receptors. Therefore, none of these COPECs were retained for this site. As stated previously these decision criteria are consistent with EPA guidance on risk management for ecological risk assessments (EPA 1999, 70086). The decision criteria were no adverse effects on individuals of T&E species and populations of other species.

4.5.2 Other Applicable Assessments

4.5.2.1 Surface Water

Surface water site assessments were performed at all three AOCs. AOC 0-029(a), evaluated on January 15, 2002, received an erosion matrix score of 38.7 (out of 100). There is visible evidence of discharge at the site, but the runoff subscore (based on a combination of factors affecting surface water runoff) is only 17.9. The site has substantial groundcover of shrubs and grasses. Even though runoff may occur, it was judged that runoff from this site is likely to infiltrate the ground surface before reaching the ephemeral stream channel. The finding of the assessment was that the potential for soil erosion is low.

AOC 0-029(b), evaluated on January 15, 2002, received an erosion matrix score of 42.8 with a runoff subscore of 24. There were no visible signs of runoff from AOC 0-029(b). The site has substantial groundcover of shrubs and grasses, although the vegetation was somewhat disturbed (flattened apparently by vehicle traffic). The finding of the assessment was that the potential for soil erosion is low.

AOC 0-029(c) received an erosion matrix score of 31.8 with a runoff subscore of 0. Contamination from AOC 0-029(c) is unlikely to affect surface water given its negligible runoff potential and distance from the stream bed (~250 ft). There were no visible signs of runoff from AOC 0-029(c) at the time of evaluation (January 15, 2002). Water transport through erosion from AOC 0-029(c) is not likely given the lack of contributing factors from surface water runoff. Precipitation events could cause contaminants to infiltrate into the subsurface.

4.5.2.2 Groundwater

The regional aquifer beneath AOCs 0-029(a,b) in Los Alamos Canyon is estimated to be at an elevation of between 5615 and 5692 ft (Stone et al. 2001, 69830). AOC 0-029(a) is at an elevation of approximately 5850 ft. AOC 0-029(b) is at an elevation of approximately 5970 ft. AOC 0-029(c) is at an elevation of approximately 5975 ft. Therefore the regional aquifer is at an estimated depth of from 10 to 150 ft bgs at AOCs 0-029(a,b), and about 270 ft at AOC 0-029(c) (Stone et al. 2001, 69830). Runoff and infiltration from these AOCs is unlikely to reach the regional aquifer. Sampling of groundwater from several wells in both Los Alamos Canyon and Guaje Canyon is performed on a routine basis, separately from this investigation.

4.5.2.3 Underground Storage Tanks

No underground storage tanks are present in AOCs 0-029(a,b,c).

4.5.3 Conclusions and Recommendations

The results of the human health risk screening assessment in Section 4.5.1, show that under a residential scenario there is no unacceptable risk to human health from residual contamination at AOCs 0-029(a,b,c). The ecological risk screening assessment shows that no COPECs were retained. Therefore, no unacceptable potential for adverse ecological effects exists.

Accordingly, AOCs 0-029(a,b,c) are recommended for NFA under Criterion 5: "The PRS has been characterized or remediated in accordance with current and applicable state or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected land use" (NMED 1998, 57761).

5.0 AOCs 0-010(a,b) AND SWMU 0-033(a)

5.1 Summary

The UST at SWMU 0-033(a) was removed in 1995. It was recommended for NFA in 1996 and 2000, but its final disposition has not been determined. SWMU 0-033(a) is part of SWMU 0-033 [as is AOC 0-033(b), for which activities are reported in Section 2.0]. AOCs 0-010(a) and 0-010(b) were approved for NFA and are administratively complete. Summaries of these SWMUs/AOCs are included in this report for completeness. The intent is to provide complete information for all the SWMUs and AOCs in the DP Road/6th Street Warehouse area.

5.2 Site Description and Operational History

5.2.1 Site Description

AOC 0-010(a), Surface Disposal

AOC 0-010(a) was originally identified in the 1990 SWMU report as a surface disposal area located on a small mesa southwest of Material Disposal Area (MDA) B, along DP Road near TA-21 (see Figure 2.1-1) (LANL 1990, 07511; LANL 1992, 07667). It was first identified as a SWMU based on a preliminary review of aerial photographs taken in the mid-1940s, which seemed to indicate the presence of a drum storage area and several trenches.

AOC 0-010(b), Landfill

AOC 0-010(b) was a purported excavation to the east of 6th Street Warehouses 1 through 4. Aerial photographs taken in 1946 showed this area as a dark area (Figure 5.2-1). It was assumed that this area was an excavation located adjacent to a warehouse building, and was used for some type of disposal activity. However, no definitive evidence of a waste disposal pit is available (LANL 1992, 07667).

SWMU 0-033(a), Underground Storage Tank

SWMU 0-033(a) was a 5000-gal. steel underground fuel oil storage tank (UST) located adjacent to the north side of Warehouse 3 (Figure 2.1-1). The tank reportedly stored diesel fuel for a boiler inside Warehouses 3 and 4 (LANL 1990, 07511; LANL 1992, 07667).

5.2.2 Operational History

AOC 0-010(a)

The area originally identified as AOC 0-010(a) was later determined to have been used by the Zia Company in the mid-1940s for stockpiling roofing material. In the early 1950s the site became a playground for a mobile home park (LANL 1992, 07667), which was removed by 1974. The site is currently a vacant field.

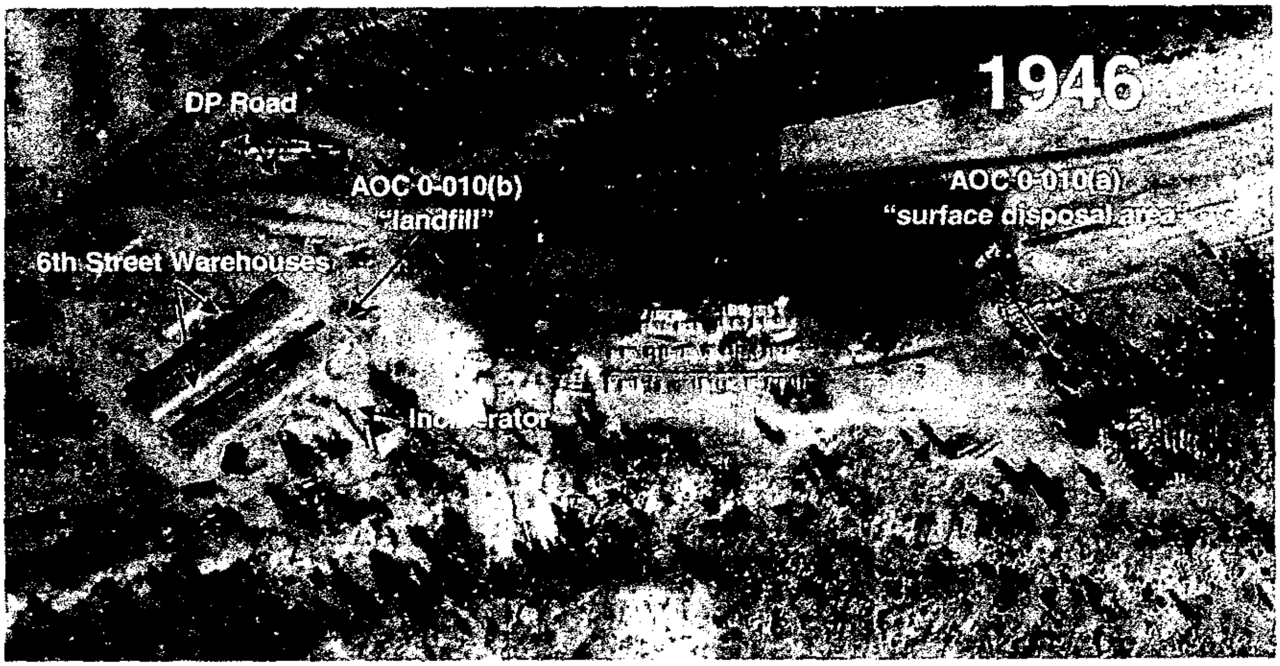


Figure 5.2-1. 1946 aerial photograph

AOC 0-010(b)

No records have been found of any LANL operations corresponding to AOC 0-010(b). The 1990 SWMU report description of the site describes trenches located to the south of MDA B, but does not mention an excavation or landfill near the 6th Street Warehouses (LANL 1990, 07511; LANL 1992, 07667).

SWMU 0-033(a)

The SWMU report (LANL 1990, 07511) lists the period of use for SWMU 0-033 as 1946 to 1961, but it is not clear whether that refers to the tank or to the whole of the 6th Street Warehouses, which were leased for commercial use in 1961. On November 13, 1995, the UST was excavated and removed pursuant to the NMED UST Bureau Regulations Section 401(a), which requires all USTs installed prior to 1989 to be upgraded or removed prior to December 22, 1998. The removal of the UST was reported in the 1996 VCA completion report (LANL 1996, 55203).

5.3 Previous Activities

5.3.1 Previous Investigations

AOC 0-010(a)

Prior to the submittal of the OU 1071 RFI work plan, an in-depth analysis of aerial photographs from the mid-1940s was performed, the same time period of the photographs on which initial identification of AOC 0-010(a) was based. The AOC was proposed for NFA in the OU 1071 RFI work plan (LANL 1992, 07667). Analysis of the photographs indicated that the items initially thought to be trenches and 55-gal. drums were in fact rows of stockpiled supplies. In an interview with a former Zia Company employee who had worked in the area, it was determined that the stored materials were canisters of roofing asphalt and roofing coal tar pitch (LANL 1996, 71415). Thus, it was determined that the AOC had been incorrectly identified in the SWMU report (LANL 1990, 0145).

No further field investigation has occurred at this AOC. A determination of NFA was requested under Criterion 2 ["The site was never used for the management (that is, generation, treatment, storage, or disposal) of RCRA solid or hazardous wastes and/or constituents." (NMED 1998, 57897)], based on the detailed re-evaluation of the aerial photograph that clearly showed the open storage area in which supplies were stockpiled (Figure 5.2-1). EPA concurred with the original NFA recommendation in a Notice of Deficiency dated October 16, 1992 (LANL 1992, 11810). DOE approved the NFA on September 30, 1997 (LANL 1997, 56752), and the site is now administratively complete.

AOC 0-010(b)

Visual surveys and detailed administrative reviews of available records were performed for this site during preparation of the OU 1071 RFI work plan (LANL 1992, 07667) and subsequently. No records or data were discovered suggesting that such an excavation existed or was used for waste disposal purposes. During RFI activities in 1996, two aerial photos from November and December 1946 were closely examined and revealed no evidence of an excavation in the area (LANL 1996, 54616). A visual survey of the area revealed no clues as to the existence of a former excavation. Based on this lack of evidence, it has been determined that no excavation ever existed at this AOC.

As stated in the 1996 RFI Report (LANL 1996, 54616), "The evidence for listing this supposed excavation as a PRS in the first place was insufficient, consisting of nothing more than an interpretation of a single aerial photograph that now cannot be found." Figure 5.2-1 does not show an excavation, and that photo was taken in the same year as the photo that was reported to have shown the excavation. NFA was recommended (LANL 1996, 54616) for this AOC based on Criterion 2, "The site was never used for the management (that is, generation, treatment, storage, or disposal) of RCRA solid or hazardous wastes and/or constituents" (NMED 1998, 57897). NFA was approved by DOE on September 21, 1998 (DOE 1998, 59694). The site is now administratively complete.

SWMU 0-033(a)

Field activities began in July 1995, when a visual inspection of the site was performed in an effort to ascertain the location of the UST. This resulted in little usable information. Subsequently, the location of the UST (adjacent to the north side of Warehouse 3, near the end closest to Warehouse 4) was confirmed by geophysical surveys, including electromagnetic, ground-penetrating radar, and pipe tracking surveys (LANL1996, 55203). The UST was excavated and removed on November 13, 1995. After the excavation and removal of the UST, a visual inspection revealed an approximate 2-in. diameter hole in the lower west end of the tank (LANL 1996, 55203). The soil surrounding the UST appeared to have been contaminated with fuel oil. Following removal of the UST, the contaminated material was removed and the tuff below the tank was removed to a depth of approximately 10 ft bgs. Four confirmatory samples of tuff from below the tank were collected and submitted to LANL's mobile chemical analytical laboratory (MCAL) for total petroleum hydrocarbon (TPH) analysis.

Two soil samples were collected from the excavated material for waste characterization purposes. These samples were analyzed for VOCs, benzene, toluene, ethylbenzene, and xylene (BTEX), TPH, and radionuclides at the Laboratory's MCAL. The results showed that BTEX components were present at concentrations less than or equal to 0.041 mg/kg, 0.061 mg/kg, 0.123 mg/kg, and 0.157 mg/kg, respectively. TPH was detected at a maximum concentration of 11,331 mg/kg.

In December 1995, 5 boreholes were drilled, ranging in depth from 3 ft to 40 ft, with one borehole located within the footprint of the UST and the others located to the east, west, north, and south of the former UST (because the UST excavation was immediately adjacent to Warehouse 3, the south borehole was located approximately 15 ft south of the warehouse). A total of 43 samples were collected from the boreholes, at 5-ft intervals and from zones of possible contamination. All samples were submitted to the MCAL for TPH analysis. TPH was detected in the samples at concentrations ranging from approximately 3000 to 10,000 mg/kg.

The 1996 VCA Completion Report stated that the analytical data adequately defined the vertical and horizontal extent of the TPH contamination (LANL 1996, 55203). At the greatest sampled depth, the TPH concentrations did not exceed 5500 ppm. The analytical data from Location 00-04373, which is the borehole within the footprint of the former UST, shows that TPH does not extend deeper than 35 ft bgs. Data from the four surrounding boreholes indicate that there has been little, if any, horizontal movement of the TPH. The Laboratory proposed three reasons for the lack of migration of the fuel oil. The first is that the moderately welded tuff lacks sufficient permeability for migration. The second is that the fractures in the tuff that were observed during drilling were mostly clay lined, which would inhibit migration. The third reason is that a zone of moisture at a depth of 30 to 35 ft bgs at Location 00-04373 has acted as a barrier to vertical migration (LANL 1996, 55203).

The VCA Completion Report (LANL 1996, 55203) stated that the NMED UST Department (now the NMED Petroleum Storage Tank Bureau) had determined that this site does not pose an immediate public or environmental threat for the following reasons:

- The horizontal and vertical extent of soil contamination has been adequately defined, and the soil contamination is greater than 900 ft above high static ground water.
- The contaminated soils were excavated and disposed of properly.
- The depth to groundwater at the site is greater than 1000 ft bgs.

SWMU 0-033(a) was proposed for NFA under Criterion 4 [The site is regulated under another state and/or federal authority. If the site is known or suspected of releasing RCRA solid or hazardous wastes and/or constituents to the environment, it has been or will be investigated and/or remediated in accordance with the applicable state and/or federal regulations." (NMED 1998, 57897)] and included on the request for permit modification in September 1996 (LANL 1996, 55035) and again in June 2000 (LANL 2000, 67472).

5.4 Remedial Activities

5.4.1 Investigative Activities During VCA

AOC 0-010(a)

No additional investigative activities were conducted at AOC 0-010(a) during this VCA.

AOC 0-010(b)

No additional investigative activities were conducted at AOC 0-010(b) during this VCA.

SWMU 0-033(a)

No additional investigative activities were conducted at SWMU 0-033(a) during this VCA.

5.4.2 Remediation Activities

AOC 0-010(a)

No remediation activities were conducted at AOC 0-010(a) during this VCA.

AOC 0-010(b)

No remediation activities were conducted at AOC 0-010(b) during this VCA.

SWMU 0-033(a)

No remediation activities were conducted at SWMU 0-033(a) during this VCA.

5.5 Conclusions and Recommendations

AOCs 0-010(a) and 0-010(b) are administratively complete, and no further action is required. NFA was approved for these AOCs under Criterion 2 ("The site was never used for the management [that is, generation, treatment, storage, or disposal] of RCRA solid or hazardous wastes and/or constituents" [NMED 1998, 57897]).

SWMU 0-033(a) has previously been recommended for NFA (LANL 1996, 55035; LANL 2000, 67472), but its status is pending. The SWMU has been remediated; confirmation samples and additional borehole samples indicate that the nature and extent of residual contamination have been defined (LANL 1996, 55203). SWMU 0-033(a) is here again recommended for NFA under Criterion 4: "The site is regulated under another state and/or federal authority. If the site is known or suspected of releasing RCRA solid or hazardous wastes and/or constituents to the environment, it has been or will be investigated and/or remediated in accordance with the applicable state and/or federal regulations" (NMED 1998, 57897).

6.0 SWMU 21-021

6.1 Summary

SWMU 21-021 consists of areas in TA-21 that may have surface contamination resulting from historical airborne releases of radionuclides from TA-21 facilities. SWMU 21-021 is part of consolidated SWMU 21-021-99, which includes several other SWMUs. Only a portion of SWMU 21-021 was investigated, comprising the area to the south and immediately to the west of Material Disposal Area (MDA) B, as seen in Figure 6.1-1. This portion of SWMU 21-021 was investigated because of its proximity to the TA-0 SWMUs/AOCs in the 6th Street Warehouse area. The remainder of SWMU 21-021 and consolidated SWMU 21-021-99 are not included in the activities in this report. Sampling was conducted at SWMU 21-021 as an IA to obtain additional data for the determination of nature and extent of surface contamination (LANL 2002, 73579).

6.2 Description and Operational History

6.2.1 Site Description

SWMU 21-021 consists of potential surface soil contamination from historical airborne releases from incinerators, stacks, and filter houses at TA-21. The portion of this consolidated SWMU included for investigation during this IA is the mesa top area to the south of MDA B (SWMU 21-015), as shown in Figure 6.1-1. The area investigated includes portions of a small tributary canyon (BV Canyon) that drains into Los Alamos Canyon.

Site visits to the west end of the SWMU show that much of the mesa top has been disturbed as a result of construction of roads, a former county building located near the end of the SWMU 0-030(b) piping, and regrading/recontouring during construction of a former mobile home park. There are no visible above-ground or known subsurface structures within this area except a small building owned by Los Alamos County near the southwest end of MDA B.

6.2.2 Operational History

TA-21 was used primarily for plutonium research and metal production and related activities from 1945 to 1978 (LANL 1994, 26073). After the major plutonium research and metal production activities at TA-21 ceased around 1978, subsequent unrelated office and small scale research activities have continued to the present time. Historical airborne releases of radionuclides from stacks at TA-21 have been documented. The RFI work plan for TA-21 (LANL 1991, 07528) provides summaries of radioactive airborne releases at TA-21 from 1951 to 1971 and from 1973 to 1989. A minimum of approximately 2 Ci/yr of plutonium-239 and plutonium-240 was released from all TA-21 stacks in the 1950s.

6.3 Previous Activities

6.3.1 Previous Investigations

In 1990, 1992, and 1994, surface sampling was conducted across the entirety of TA-21 for several reasons. The first was to provide data about target analytes and establish a baseline for comparison to published regional background data. The second was to investigate area-wide airborne emission deposition. The final reason was to provide preliminary TA-wide information for a future baseline risk assessment (LANL 1991, 07528; LANL 1991, 10923). In 1994, 61 samples were analyzed for metals, 17 for organic chemicals (17 for SVOCs, 3 for VOCs), and 48 for radionuclides (37 for americium-241; 20 for isotopic plutonium, strontium-90, and tritium; and 4 for isotopic uranium and thorium). Results of the multiple sampling events were reported in a 1994 Phase I RFI report (LANL 1994, 26073).

6.3.2 Preliminary Conceptual Model

Surface soils within the vicinity of TA-21, including SWMU 21-021, are potentially contaminated with radionuclides from past airborne emissions from incinerators, stacks, and filter houses.

The primary potential exposure pathways are plant uptake and rainsplash, food web transport, and soil ingestion for ecological receptors, and dermal contact, inhalation, and external irradiation for human receptors. Existing information does not indicate a pathway for exposure of aquatic receptors, the nearest of which would be located in the bottom of Los Alamos Canyon. Therefore aquatic receptors were not considered as part of the model.

6.4 Remedial Activities

6.4.1 Investigative Activities During IA

Surface (0 to 1 in. and 1 to 6 in.) soil samples were collected according to the VCA/IA plan (LANL 2002, 73579). The sampling was based on a grid system similar to the one that was used for the 1992 sampling (LANL 1994, 26073). A number of the original 1992 sample locations were resampled in 2002 to replace samples for which there were data quality issues. Sample locations (previous and 2002) are shown in Figure 6.1-1. Table 6.4-1 lists the 1992 locations that were resampled in 2002. Table 6.4-2 lists all the SWMU 21-021 samples included in the current evaluation of the site.

A total of 86 soil samples (including 4 field duplicate samples not included Table 6.4-2) were collected in 2002 at SWMU 21-021. Sixty-five samples, including three field duplicate samples, were collected from the 0 to 1 in. depth at 62 locations. Twenty-one soil samples, including one field duplicate sample, were collected from the 1 to 6 in. depth at 20 of those 62 locations. All samples were collected in accordance with ER-SOP-6.09, R1, "Spade and Scoop method for Collection of Soil Samples". All samples were submitted for analysis at on offsite fixed laboratory. Samples were analyzed for TAL metals, isotopic plutonium, tritium, strontium-90, and gamma-emitting radionuclides according to the VCA/IA plan (LANL 2002, 73579).

6.4.2 Remediation Activities

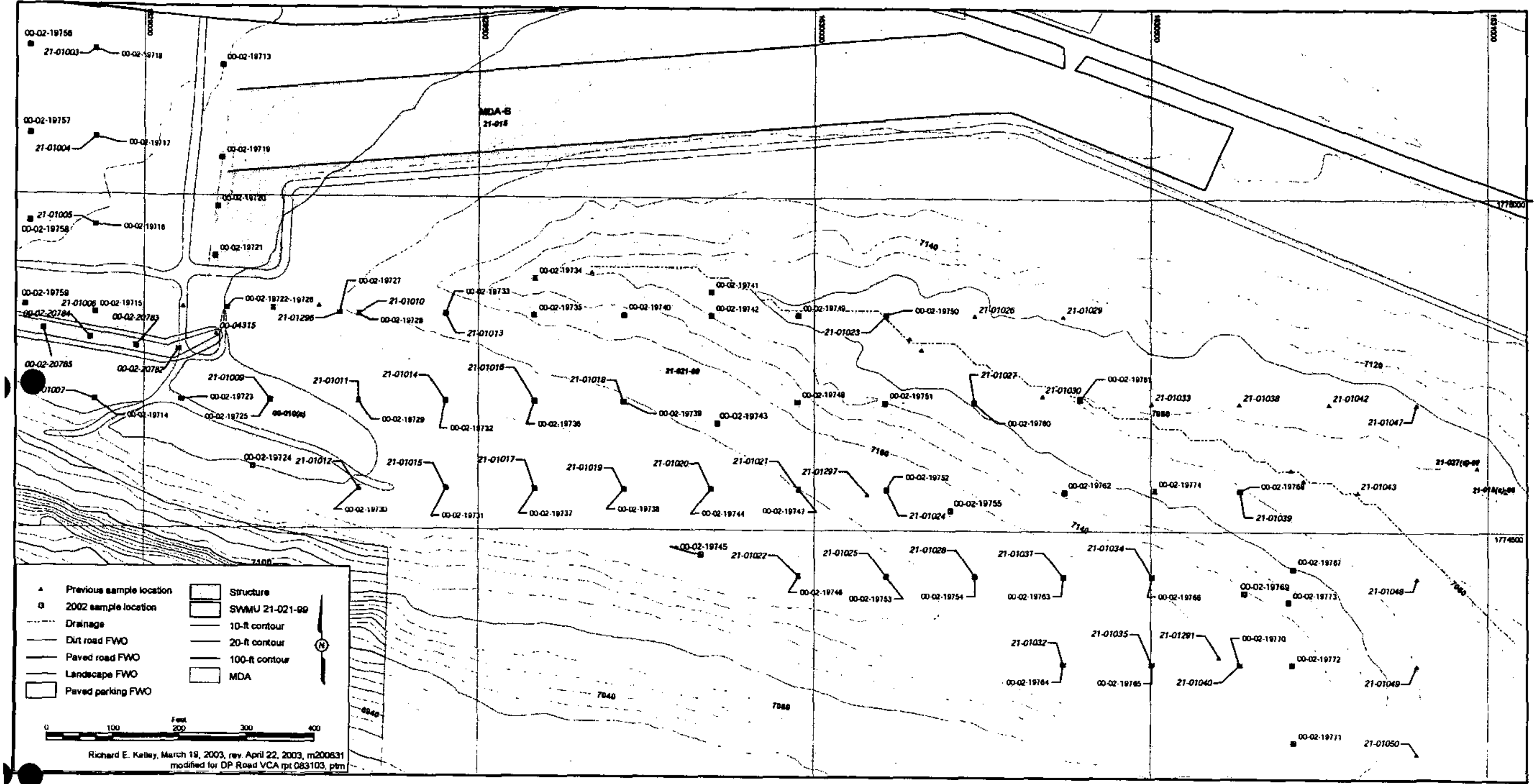
No remediation activities were conducted at this SWMU during this IA.

6.4.3 Confirmatory Sampling Data Review

The locations listed in Table 6.4-1 were re-sampled in 2002 to replace samples for which there were data quality issues. Sample results from 2002 replaced previous analytical results only if the same location, depth, and analytical suite were reported. The RFI data set for SWMU 21-021 includes analytical data from 102 surface soil samples. Figure 6.1-1 shows the sample locations. All data used quantitatively to identify COPCs at SWMU 21-021 were subjected to RRES-RS QA/QC. The results of a detailed review of QA/QC activities are provided in Appendix C.

The data review process for identifying COPCs begins with a comparison of site data with

1. naturally occurring background concentrations for inorganic chemicals,
2. naturally occurring background or fallout concentrations for radionuclides, and
3. analytical EQLs for organic chemicals.



Richard E. Kelley, March 19, 2003, rev. April 22, 2003, m200631
modified for DP Road VCA rpt 083103, ptm

Figure 6.1-1. SWMU 21-021 RFI and IA sample locations

Table 6.4-1
Resampled Locations at SWMU 21-021-99

Old Location ID	Old Depth (ft.)	New (2002) Location ID	Depth (ft.)	Sample ID
21-01003	0–0.083	00-02-19718	0–0.083	RE00-02-45641
21-01004	0–0.5	00-02-19717	0–0.083	RE00-02-45640
21-01005	0–0.083	00-02-19716	0–0.083	RE00-02-45639
			0.083–0.5	RE00-02-45714
21-01006	0–0.5	00-02-19715	0–0.083	RE00-02-45638
21-01007	0–0.083	00-02-19714	0–0.083	RE00-02-45637
			0.083–0.5	RE00-02-45715
21-01009	0–0.083	00-02-19725	0–0.083	RE00-02-45648
			0.083–0.5	RE00-02-45704
21-01010	0–0.5	00-02-19728	0–0.083	RE00-02-45651
		(duplicate)	0–0.083	RE00-02-45700
21-01011	0–0.083	00-02-19729	0–0.083	RE00-02-45652
21-01012	0–0.083	00-02-19730	0–0.083	RE00-02-45653
			0.083–0.5	RE00-02-45712
21-01013	0–0.083	00-02-19733	0–0.083	RE00-02-45656
21-01014	0–0.5	00-02-19732	0–0.083	RE00-02-45655
			0.083–0.5	RE00-02-45705
21-01015	0–0.083	00-02-19731	0–0.083	RE00-02-45654
21-01016	0–0.083	00-02-19736	0–0.083	RE00-02-45659
21-01017	0–0.5	00-02-19737	0–0.083	RE00-02-45660
21-01018	0–0.083	00-02-19739	0–0.083	RE00-02-45662
			0.083–0.5	RE00-02-45702
21-01019	0–0.083	00-02-19738	0–0.083	RE00-02-45661
21-01020	0–0.5	00-02-19744	0–0.083	RE00-02-45667
21-01021	0–0.083	00-02-19747	0–0.083	RE00-02-45670
			0.083–0.5	RE00-02-45707
21-01022	0–0.083	00-02-19746	0–0.083	RE00-02-45669
21-01023	0–0.5	00-02-19750	0–0.083	RE00-02-45673
			0.083–0.5	RE00-02-45713
21-01024	0–0.5	00-02-19752	0–0.083	RE00-02-45675
21-01025	0–0.083	00-02-19753	0–0.083	RE00-02-45676
21-01027	0–0.083	00-02-19760	0–0.083	RE00-02-45683
			0.083–0.5	RE00-02-45717
21-01028	0–0.083	00-02-19754	0–0.083	RE00-02-45677
			0.083–0.5	RE00-02-45708

Table 6.4-1 (continued)

Old Location ID	Old Depth (ft.)	New (2002) Location ID	Depth (ft.)	Sample ID
21-01031	0–0.5	00-02-19763	0–0.083	RE00-02-45686
21-01032	0–0.083	00-02-19764	0–0.083	RE00-02-45687
			0.083–0.5	RE00-02-45719
21-01034	0–0.083	00-02-19766	0–0.083	RE00-02-45689
21-01035	0–0.083	00-02-19765	0–0.083	RE00-02-45688
21-01039	0–0.083	00-02-19768	0–0.083	RE00-02-45691
			0.083–0.5	RE00-02-45720
21-01040	0–0.5	00-02-19770	0–0.083	RE00-02-45693
21-01296	0–0.083	00-02-19727	0–0.083	RE00-02-45650
			0.083–0.5	RE00-02-45709
21-01951	0–0.083	00-02-19722	0–0.083	RE00-02-45645
21-10561	0–0.083	00-02-19713	0–0.083	RE00-02-45636
21-10562	0–0.083	00-02-19720	0–0.083	RE00-02-45643
			0.083–0.5	RE00-02-45706
21-10563	0–0.083	00-02-19719	0–0.083	RE00-02-45642
21-10567	0–0.083	00-02-19721	0–0.083	RE00-02-45644
21-10568	0–0.083	00-02-19726	0–0.083	RE00-02-45649

Background comparisons and a variety of statistical and graphical methods are used to compare site inorganic and radionuclide data with Laboratory background values (BVs). Organic chemical data are evaluated for detection status only. For background comparisons, the first step is to compare the site data with a BV, which is an estimated value for the background data set (upper tolerance limit [95, 95] or the 95% upper confidence bound on the 95th quartile) (LANL 1998, 59730). If a site-specific datum exceed its BV, additional evaluation of the datum may be performed by comparing the range of values in the site data set for that chemical to the range of values for that chemical in the background data set. Graphical analyses (e.g., box plots) may be used, or if adequate data are available, statistical tests that evaluate differences in distribution may be utilized. Nonparametric tests commonly used to assess data distributions include the Gehan, quantile, and slippage tests. Together these tests assess complete shifts in distributions, shifts of a subset of the data, and the potential for some of the site data to be greater than the maximum BV. Observed significance levels (p-values) are obtained; these values indicate whether a difference does or does not exist between the data sets. A p-value of less than 0.05 indicates that there is a difference between the distributions (i.e., the site data are different from the background data), while a p-value greater than 0.05 indicates that there is no difference between distributions (i.e., site and background data are similar). Statistical tests, graphical analyses, and results are discussed in Appendix E. Tables D-2.0-1, D-2.0-2, D-2.0-3, D-2.0-4, D-2.0-5, and D-2.0-6 in Appendix D include the data for all analytes (detected and undetected).

6.4.3.1 Soil Samples

Table 6.4-2 summarizes all of the soil samples in the SWMU 21-021 data set. The request number is shown in the table for each analysis that was requested for an individual sample.

Table 6.4-2
Summary of Soil Samples Collected at SWMU 21-021

Sample ID	Location ID	Depth (ft)	Media	TAL METALS	Uranium	Am-241	Gamma Spectroscopy	Tritium	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	Strontium-90	SVOCs	VOCs
RE00-02-45636	00-02-19713	0–0.08	Soil	778S	—*	—	779S	779S	779S	—	—	779S	—	—
RE00-02-45637	00-02-19714	0–0.08	Soil	778S	—	—	779S	779S	779S	—	—	779S	—	—
RE00-02-45715	00-02-19714	0.08–0.5	Soil	778S	—	—	779S	779S	779S	—	—	779S	—	—
RE00-02-45638	00-02-19715	0–0.08	Soil	778S	—	—	779S	779S	779S	—	—	779S	—	—
RE00-02-45639	00-02-19716	0–0.08	Soil	778S	—	—	779S	779S	779S	—	—	779S	—	—
RE00-02-45714	00-02-19716	0.08–0.5	Soil	778S	—	—	779S	779S	779S	—	—	779S	—	—
RE00-02-45640	00-02-19717	0–0.08	Soil	778S	—	—	779S	779S	779S	—	—	779S	—	—
RE00-02-45641	00-02-19718	0–0.08	Soil	778S	—	—	779S	779S	779S	—	—	779S	—	—
RE00-02-45642	00-02-19719	0–0.08	Soil	778S	—	—	779S	779S	779S	—	—	779S	—	—
RE00-02-45643	00-02-19720	0–0.08	Soil	778S	—	—	779S	779S	779S	—	—	779S	—	—
RE00-02-45706	00-02-19720	0.08–0.5	Soil	778S	—	—	779S	779S	779S	—	—	779S	—	—
RE00-02-45644	00-02-19721	0–0.08	Soil	782S	—	—	783S	783S	783S	—	—	783S	—	—
RE00-02-45645	00-02-19722	0–0.08	Soil	782S	—	—	783S	783S	783S	—	—	783S	—	—
RE00-02-45646	00-02-19723	0–0.08	Soil	782S	—	—	783S	783S	783S	—	—	783S	—	—
RE00-02-45647	00-02-19724	0–0.08	Soil	782S	—	—	783S	783S	783S	—	—	783S	—	—
RE00-02-45648	00-02-19725	0–0.08	Soil	782S	—	—	783S	783S	783S	—	—	783S	—	—
RE00-02-45704	00-02-19725	0.08–0.5	Soil	782S	—	—	783S	783S	783S	—	—	783S	—	—
RE00-02-45649	00-02-19726	0–0.08	Soil	782S	—	—	783S	783S	783S	—	—	783S	—	—
RE00-02-45650	00-02-19727	0–0.08	Soil	782S	—	—	783S	783S	783S	—	—	783S	—	—
RE00-02-45709	00-02-19727	0.08–0.5	Soil	782S	—	—	783S	783S	783S	—	—	783S	—	—
RE00-02-45651	00-02-19728	0–0.08	Soil	782S	—	—	783S	783S	783S	—	—	783S	—	—
RE00-02-45652	00-02-19729	0–0.08	Soil	782S	—	—	783S	783S	783S	—	—	783S	—	—
RE00-02-45653	00-02-19730	0–0.08	Soil	782S	—	—	783S	783S	783S	—	—	783S	—	—

Table 6.4-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	TAL METALS	Uranium	Am-241	Gamma Spectroscopy	Tritium	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	Strontium-90	SVOCs	VOCs
RE00-02-45712	00-02-19730	0.08–0.5	Soil	782S	—	—	783S	783S	783S	—	—	783S	—	—
RE00-02-45654	00-02-19731	0–0.08	Soil	782S	—	—	783S	783S	783S	—	—	783S	—	—
RE00-02-45655	00-02-19732	0–0.08	Soil	782S	—	—	783S	783S	783S	—	—	783S	—	—
RE00-02-45705	00-02-19732	0.08–0.5	Soil	782S	—	—	783S	783S	783S	—	—	783S	—	—
RE00-02-45656	00-02-19733	0–0.08	Soil	782S	—	—	783S	783S	783S	—	—	783S	—	—
RE00-02-45657	00-02-19734	0–0.08	Soil	788S	—	—	789S	789S	789S	—	—	789S	—	—
RE00-02-45701	00-02-19734	0.08–0.5	Soil	788S	—	—	789S	789S	789S	—	—	789S	—	—
RE00-02-45658	00-02-19735	0–0.08	Soil	788S	—	—	789S	789S	789S	—	—	789S	—	—
RE00-02-45659	00-02-19736	0–0.08	Soil	788S	—	—	789S	789S	789S	—	—	789S	—	—
RE00-02-45660	00-02-19737	0–0.08	Soil	788S	—	—	789S	789S	789S	—	—	789S	—	—
RE00-02-45661	00-02-19738	0–0.08	Soil	788S	—	—	789S	789S	789S	—	—	789S	—	—
RE00-02-45662	00-02-19739	0–0.08	Soil	788S	—	—	789S	789S	789S	—	—	789S	—	—
RE00-02-45702	00-02-19739	0.08–0.5	Soil	788S	—	—	789S	789S	789S	—	—	789S	—	—
RE00-02-45663	00-02-19740	0–0.08	Soil	788S	—	—	789S	789S	789S	—	—	789S	—	—
RE00-02-45664	00-02-19741	0–0.08	Soil	788S	—	—	789S	789S	789S	—	—	789S	—	—
RE00-02-45665	00-02-19742	0–0.08	Soil	788S	—	—	789S	789S	789S	—	—	789S	—	—
RE00-02-45666	00-02-19743	0–0.08	Soil	796S	—	—	797S	797S	797S	—	—	797S	—	—
RE00-02-45667	00-02-19744	0–0.08	Soil	796S	—	—	797S	797S	797S	—	—	797S	—	—
RE00-02-45668	00-02-19745	0–0.08	Soil	796S	—	—	797S	797S	797S	—	—	797S	—	—
RE00-02-45703	00-02-19745	0.08–0.3	Soil	796S	—	—	797S	797S	797S	—	—	797S	—	—
RE00-02-45669	00-02-19746	0–0.08	Soil	796S	—	—	797S	797S	797S	—	—	797S	—	—
RE00-02-45670	00-02-19747	0–0.08	Soil	798S	—	—	799S	799S	799S	—	—	799S	—	—
RE00-02-45707	00-02-19747	0.08–0.5	Soil	798S	—	—	799S	799S	799S	—	—	799S	—	—
RE00-02-45671	00-02-19748	0–0.08	Soil	798S	—	—	799S	799S	799S	—	—	799S	—	—

Table 6.4-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	TAL METALS	Uranium	Am-241	Gamma Spectroscopy	Tritium	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	Strontium-90	SVOCs	VOCs
RE00-02-45710	00-02-19748	0.08–0.5	Soil	798S	—	—	799S	799S	799S	—	—	799S	—	—
RE00-02-45672	00-02-19749	0–0.08	Soil	798S	—	—	799S	799S	799S	—	—	799S	—	—
RE00-02-45673	00-02-19750	0–0.08	Soil	798S	—	—	799S	799S	799S	—	—	799S	—	—
RE00-02-45713	00-02-19750	0.08–0.5	Soil	798S	—	—	799S	799S	799S	—	—	799S	—	—
RE00-02-45674	00-02-19751	0–0.08	Soil	798S	—	—	799S	799S	799S	—	—	799S	—	—
RE00-02-45675	00-02-19752	0–0.08	Soil	798S	—	—	799S	799S	799S	—	—	799S	—	—
RE00-02-45676	00-02-19753	0–0.08	Soil	798S	—	—	799S	799S	799S	—	—	799S	—	—
RE00-02-45677	00-02-19754	0–0.08	Soil	798S	—	—	799S	799S	799S	—	—	799S	—	—
RE00-02-45708	00-02-19754	0.08–0.5	Soil	798S	—	—	799S	799S	799S	—	—	799S	—	—
RE00-02-45678	00-02-19755	0–0.08	Soil	798S	—	—	799S	799S	799S	—	—	799S	—	—
RE00-02-45679	00-02-19756	0–0.08	Soil	827S	—	—	828S	828S	828S	—	—	828S	—	—
RE00-02-45680	00-02-19757	0–0.08	Soil	827S	—	—	828S	828S	828S	—	—	828S	—	—
RE00-02-45681	00-02-19758	0–0.08	Soil	827S	—	—	828S	828S	828S	—	—	828S	—	—
RE00-02-45682	00-02-19759	0–0.08	Soil	827S	—	—	828S	828S	828S	—	—	828S	—	—
RE00-02-45721	00-02-19759	0.08–0.5	Soil	827S	—	—	828S	828S	828S	—	—	828S	—	—
RE00-02-45683	00-02-19760	0–0.08	Soil	822S	—	—	823S	823S	823S	—	—	823S	—	—
RE00-02-45717	00-02-19760	0.08–0.5	Soil	822S	—	—	823S	823S	823S	—	—	823S	—	—
RE00-02-45684	00-02-19761	0–0.08	Soil	822S	—	—	823S	823S	823S	—	—	823S	—	—
RE00-02-45685	00-02-19762	0–0.08	Soil	822S	—	—	823S	823S	823S	—	—	823S	—	—
RE00-02-45718	00-02-19762	0.08–0.5	Soil	822S	—	—	823S	823S	823S	—	—	823S	—	—
RE00-02-45686	00-02-19763	0–0.08	Soil	822S	—	—	823S	823S	823S	—	—	823S	—	—
RE00-02-45687	00-02-19764	0–0.08	Soil	822S	—	—	823S	823S	823S	—	—	823S	—	—
RE00-02-45719	00-02-19764	0.08–0.5	Soil	822S	—	—	823S	823S	823S	—	—	823S	—	—
RE00-02-45688	00-02-19765	0–0.08	Soil	822S	—	—	823S	823S	823S	—	—	823S	—	—
RE00-02-45689	00-02-19766	0–0.08	Soil	822S	—	—	823S	823S	823S	—	—	823S	—	—

Table 6.4-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	TAL METALS	Uranium	Am-241	Gamma Spectroscopy	Tritium	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	Strontium-90	SVOCs	VOCs
RE00-02-45690	00-02-19767	0–0.08	Soil	825S	—	—	826S	826S	826S	—	—	826S	—	—
RE00-02-45691	00-02-19768	0–0.08	Soil	825S	—	—	826S	826S	826S	—	—	826S	—	—
RE00-02-45720	00-02-19768	0.08–0.5	Soil	825S	—	—	826S	826S	826S	—	—	826S	—	—
RE00-02-45692	00-02-19769	0–0.08	Soil	822S	—	—	823S	823S	823S	—	—	823S	—	—
RE00-02-45693	00-02-19770	0–0.08	Soil	822S	—	—	823S	823S	823S	—	—	823S	—	—
RE00-02-45694	00-02-19771	0–0.08	Soil	825S	—	—	826S	826S	826S	—	—	826S	—	—
RE00-02-45716	00-02-19771	0.08–0.5	Soil	825S	—	—	826S	826S	826S	—	—	826S	—	—
RE00-02-45695	00-02-19772	0–0.08	Soil	825S	—	—	826S	826S	826S	—	—	826S	—	—
RE00-02-45696	00-02-19773	0–0.08	Soil	825S	—	—	826S	826S	826S	—	—	826S	—	—
RE00-02-45697	00-02-19774	0–0.08	Soil	825S	—	—	826S	826S	826S	—	—	826S	—	—
AAA0457	21-01003	0–0.08	Soil	—	13054	13054	—	—	—	—	—	—	—	—
AAA0458	21-01004	0–0.08	Soil	—	13054	—	—	—	—	—	—	—	—	—
AAA0459	21-01004	0–0.5	Soil	—	13054	—	—	—	—	—	—	—	13046	—
AAA0460	21-01005	0–0.08	Soil	—	13054	13054	—	—	—	—	—	—	—	—
AAA0461	21-01006	0–0.08	Soil	—	13054	13054	—	—	—	—	—	—	—	—
AAA0462	21-01006	0–0.5	Soil	—	13054	13054	—	—	—	13054	13054	—	13046	—
AAA0464	21-01007	0–0.08	Soil	—	13054	13054	—	—	—	—	—	—	—	—
AAA0472	21-01009	0–0.08	Soil	—	13045	—	—	—	—	—	—	—	—	—
AAA0465	21-01010	0–0.08	Soil	—	13045	13045	—	—	—	—	—	—	—	—
AAA0466	21-01010	0–0.5	Soil	—	13045	13045	—	—	—	—	—	—	13046	—
AAA0473	21-01011	0–0.08	Soil	—	13045	13045	—	—	—	—	—	—	—	—
AAA0474	21-01012	0–0.08	Soil	—	13045	13045	—	—	—	—	—	—	—	—
AAA0469	21-01013	0–0.08	Soil	—	13045	—	—	—	—	—	—	—	—	—
AAA0475	21-01014	0–0.08	Soil	—	13045	—	—	—	—	—	—	—	—	—
AAA0476	21-01014	0–0.5	Soil	—	13045	—	—	—	—	—	—	—	13046	—

Table 6.4-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	TAL METALS	Uranium	Am-241	Gamma Spectroscopy	Tritium	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	Strontium-90	SVOCs	VOCs
AAA0477	21-01015	0–0.08	Soil	—	13045	13045	—	—	—	—	—	—	—	—
AAA0478	21-01016	0–0.08	Soil	—	13045	13045	—	—	—	—	—	—	—	—
AAA0479	21-01017	0–0.08	Soil	—	13045	13045	—	—	—	—	—	—	—	—
AAA0480	21-01017	0–0.33	Soil	—	13045	—	—	—	—	13045	13045	—	13046	—
AAA0481	21-01018	0–0.08	Soil	—	13045	—	—	—	—	—	—	—	—	—
AAA0482	21-01019	0–0.08	Soil	—	13041	13041	—	—	—	—	—	—	—	—
AAA0483	21-01020	0–0.08	Soil	—	13041	13041	—	—	—	—	—	—	—	—
AAA0484	21-01020	0–0.5	Soil	—	13041	13041	—	—	—	—	—	—	13031	13031
AAA0485	21-01021	0–0.08	Soil	—	13041	13041	—	—	—	—	—	—	—	—
AAA0487	21-01022	0–0.08	Soil	—	13041	—	—	—	—	—	—	—	—	—
AAA0494	21-01023	0–0.08	Soil	—	13054	13054	—	—	—	—	—	—	—	—
AAA0495	21-01023	0–0.5	Soil	—	13054	13054	—	—	—	13054	13054	—	13046	—
AAA0488	21-01024	0–0.08	Soil	—	13041	13041	—	—	—	—	—	—	—	—
AAA0489	21-01024	0–0.25	Soil	—	13041	13041	—	—	—	—	—	—	13031	13031
AAA0492	21-01025	0–0.08	Soil	—	13041	—	—	—	—	—	—	—	—	—
AAA0496	21-01026	0–0.08	Soil	—	13054	—	—	13054	13054	—	—	13054	—	—
AAA0497	21-01027	0–0.08	Soil	—	13054	—	—	—	—	—	—	—	—	—
AAA0493	21-01028	0–0.08	Soil	—	13041	13041	—	—	—	—	—	—	—	—
AAA0202	21-01029	0–0.08	Soil	12741	12743	—	—	12743	12743	—	—	12743	—	—
AAA0203	21-01030	0–0.08	Soil	12741	12743	12743	—	12743	12743	—	—	12743	—	—
AAA0204	21-01030	0–0.5	Soil	12741	12743	12743	—	12743	12743	—	—	12743	12742	—
AAA0247	21-01031	0–0.08	Soil	—	12759	12759	—	—	—	—	—	—	—	—
AAA0248	21-01031	0–0.5	Soil	—	12759	12759	—	—	—	—	—	—	12742	—
AAA0249	21-01032	0–0.08	Soil	—	12759	—	—	—	—	—	—	—	—	—
AAA0205	21-01033	0–0.08	Soil	12741	12743	—	—	12743	12743	—	—	12743	—	—

Table 6.4-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	TAL METALS	Uranium	Am-241	Gamma Spectroscopy	Tritium	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	Strontium-90	SVOCs	VOCs
AAA0250	21-01034	0–0.08	Soil	—	12759	—	—	—	—	—	—	—	—	—
AAA0251	21-01035	0–0.08	Soil	—	12759	—	—	—	—	—	—	—	—	—
AAA0206	21-01038	0–0.08	Soil	12741	12743	—	—	12743	12743	—	—	12743	—	—
AAA0207	21-01038	0–0.42	Soil	12741	12743	—	—	12743	12743	—	—	12743	12742	—
AAA0208	21-01039	0–0.08	Soil	—	12743	12743	—	—	—	—	—	—	—	—
AAA0252	21-01040	0–0.08	Soil	—	12759	12759	—	—	—	—	—	—	—	—
AAA0253	21-01040	0–0.5	Soil	12758	12759	12759	—	12759	12759	—	—	12759	—	—
AAA0209	21-01042	0–0.08	Soil	12741	12743	—	—	12743	12743	—	—	12743	12742	—
AAA0210	21-01043	0–0.08	Soil	12741	12743	—	—	12743	12743	—	—	12743	—	—
AAA0211	21-01047	0–0.08	Soil	12741	12743	12743	—	12743	12743	—	—	12743	—	—
AAA0212	21-01047	0–0.5	Soil	12741	12743	12743	—	12743	12743	12743	12743	12743	12742	—
AAA0216	21-01048	0–0.08	Soil	12741	12743	—	—	12743	12743	—	—	12743	—	—
AAA0217	21-01048	0–0.5	Soil	12741	12743	—	—	12743	12743	—	—	12743	12742	—
AAA0218	21-01049	0–0.08	Soil	12758	12759	—	—	12759	12759	—	—	12759	—	—
AAA0219	21-01050	0–0.08	Soil	12758	12759	12759	—	12759	12759	—	—	12759	—	—
AAA0254	21-01291	0–0.08	Soil	12758	12759	12759	—	12759	12759	—	—	12759	—	—
AAA0255	21-01291	0–0.5	Soil	12758	12759	12759	—	12759	12759	—	—	12759	12742	—
AAA0467	21-01296	0–0.08	Soil	—	13045	13045	—	—	—	—	—	—	—	—
AAA0468	21-01296	0–0.17	Soil	—	13045	13045	—	—	—	—	—	—	13046	—
AAA0490	21-01297	0–0.5	Soil	—	13041	13041	—	13041	13041	—	—	13041	—	—
AAA0491	21-01297	0–0.5	Soil	—	13041	13041	—	13041	13041	—	—	13041	13031	13031

*— = Not analyzed.

6.4.3.1.1 Inorganic Chemical Comparison with BV

Eighty-two soil samples were analyzed for inorganic chemicals. An additional seventeen samples were analyzed for a limited list of TAL metals. Antimony was the only analyte that was qualified as rejected for any sample. Fifty-one samples had the results for antimony rejected due to a matrix spike recovery of less than 30%. One result for antimony was rejected because quality deficiencies were identified. The remaining results for antimony are sufficient for this assessment, and the decision was not affected by rejection of some antimony data. Table C-5.0-2 in Appendix C presents detailed results of the QA/QC assessment. Sample concentrations were compared with appropriate Laboratory soil background data set (LANL 1998, 59730). Table 6.4-3 presents the frequency of inorganic chemicals above BV in surface soil.

Table 6.4-3
Frequency of Inorganic Chemicals Above BVs in Soil Samples at SWMU 21-021

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	Background Value (mg/kg)	Frequency of Detects Above Background Value	Frequency of Nondetects Above Background Value
Aluminum	Soil	82	82	4100 to 36730	29200	2/82	0/82
Antimony	Soil	47	14	0.051 to [6]	0.83	0/47	17/47
Arsenic	Soil	98	98	0.8 to 7.71	8.17	0/98	0/98
Barium	Soil	99	99	29.1 to 570	295	7/99	0/99
Beryllium	Soil	99	99	0.267 to 4.6	1.83	19/99	0/99
Cadmium	Soil	99	74	0.0507 to [2]	0.4	9/99	25/99
Calcium	Soil	82	82	787 to 9860	6120	4/82	0/82
Chromium	Soil	99	98	[2] to 42	19.3	1/99	0/99
Cobalt	Soil	99	98	0.815 to 10.2	8.64	1/99	0/99
Copper	Soil	99	99	1.54 to 63.3	14.7	10/99	0/99
Iron	Soil	82	82	4240 to 29090	21500	1/82	0/82
Lead	Soil	99	99	7.67 to 290	22.3	43/99	0/99
Lithium	Soil	17	17	17 to 27	20.8[a]	13/17	NA
Magnesium	Soil	88	88	470 to 4920	4610	1/88	0/88
Manganese	Soil	99	99	142 to 1200	671	4/99	0/99
Mercury	Soil	82	77	[0.0051] to 0.332	0.1	7/82	0/82
Molybdenum	Soil	17	0	[4 to 4]	NA[b]	0/17	NA
Nickel	Soil	99	96	1.78 to 12.2	15.4	0/99	0/99
Potassium	Soil	82	82	526 to 2880	3460	0/82	0/82
Selenium	Soil	98	11	0.181 to [1.25]	1.52	0/98	0/98
Silver	Soil	98	85	0.0147 to 65.8	1	7/98	0/98
Sodium	Soil	82	82	47 to 153	915	0/82	0/82
Strontium	Soil	17	17	27 to 116	52.1[a]	8/17	NA
Thallium	Soil	99	82	0.042 to [20]	0.73	0/99	17/99
Uranium	Soil	61	61	3.2 to 15.95	1.82	61/61	0/61
Vanadium	Soil	99	99	5 to 39	39.6	0/99	0/99
Zinc	Soil	99	99	19.6 to 263	48.8	45/99	0/99

[a] UTL presented in Ryti 1997, 58239.

[b] NA = Not available.

Aluminum, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, silver, uranium, and zinc were detected above the soil BV in at least one sample. Lithium and strontium were detected in all samples, and as discussed in "Technical Position Paper on Use of TA-21 Process Area Baseline Data for RFI Reports" (Ryti 1997, 58239), the LANL-wide background soil data may be supplemented by the process area baseline data for lithium, molybdenum, selenium and strontium. Both lithium and strontium were detected above the UTLs that were calculated from the process area baseline data (as shown in Table 6.4-3). Lithium and strontium are retained as COPCs. Antimony and thallium were not detected above the BV, but both analytes had 17 samples with detection limits above the BV. Further statistical tests were run for all of the analytes with a background data set. Silver does not have background data sets, so it is retained as a COPC. The probability values for the statistical tests are presented in Table E-3.1-5 in Appendix E. The results of the Gehan and Quantile tests show that cadmium, calcium, copper, lead, mercury, uranium, and zinc were significantly different from background and are evaluated further. Aluminum, barium, beryllium, chromium, cobalt, iron, magnesium, and manganese were not significantly different from background and are not retained as COPCs.

There were seventeen detection limits above the BV for antimony and thallium. There were also fifty-two rejected results for antimony. The rejected results for antimony are grouped in three places on the grid that was sampled. Antimony was rejected in most of the samples on the west end of the grid, in a group in the middle of the grid, and one smaller group near the east side of the grid. Antimony data were reported as undetected with low detection limits or as detected concentrations well below the BV in most of the middle section of the grid. The samples reported with detection limits of 6 mg/kg were along the eastern and northeastern edge of the grid. Further review of the inorganic data set shows that the other inorganic chemicals identified as COPCs for this SWMU (i.e., lead and zinc) were detected above the BV in samples where antimony data of good quality were reported. Figure E-3.1-16 shows the distribution of the antimony data that were reported and that, with the exception of the high detection limits, all reported results are well below the distribution of the LANL background data. Since any contamination at this site would have been due to airborne deposition from TA-21 activities, there may be a correlation among the inorganic chemical data that may have been deposited at the site. Where there is antimony data at SWMU 21-021 of good quality that does not show any elevated antimony there are other inorganic chemicals at the same locations that are above background. In the remainder of the site where there are no usable antimony data to represent subsections of SWMU 21-021, there are not other inorganic chemicals that are elevated above background. Therefore, antimony is not expected to be elevated in these areas and it is not be retained as a COPC.

Thallium also had higher detection limits in the same samples where antimony data had high detection limits. Figure E-3.1-17 shows the high detection limits in comparison to the rest of the data at the site and to the LANL background data. These samples are in the east and northeast section of the grid. The results for thallium are not above the BV in any other sample. Because any contamination at this site would have been due to airborne deposition from TA-21 activities, the contamination would not be expected to settle only in one small corner of the site. Therefore, thallium is not retained as COPCs. Cadmium has detection limits above the BV in 25 samples, but cadmium was also detected above the BV and is retained as a COPC. Table 6.4-4 presents the concentrations above background in soil.

Cadmium, calcium, copper, lead, lithium, mercury, silver, strontium, uranium, and zinc are retained as COPCs for the surface soil.

Table 6.4-4
Inorganic Chemicals Detected Above BVs in Soil Samples at SWMU 21-021

Sample ID	Location ID	Depth (ft)	Media	Cadmium (mg/kg)	Calcium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Lithium (mg/kg)	Mercury (mg/kg)	Silver (mg/kg)	Strontium (mg/kg)	Uranium (mg/kg)	Zinc (mg/kg)
Soil Background Value				**0.4**	**6120**	**14.7**	**22.3**	**20.8**[b]	**0.1**	**1**	**52.1**[b]	**1.82**	**48.8**
RE00-02-45636	00-02-19713	0–0.08	Soil	0.555	—[a]	63.3	80.3 (J-)	—	—	—	—	—	177
RE00-02-45715	00-02-19714	0.08–0.5	Soil	—	—	—	26.7 (J-)	—	—	—	—	—	—
RE00-02-45638	00-02-19715	0–0.08	Soil	—	—	—	28.5 (J-)	—	—	—	—	—	80.9
RE00-02-45639	00-02-19716	0–0.08	Soil	—	—	16.6	65.3 (J-)	—	0.275 (J-)	—	—	—	149
RE00-02-45714	00-02-19716	0.08–0.5	Soil	—	—	18.1	83.4 (J-)	—	0.236 (J-)	—	—	—	263
RE00-02-45640	00-02-19717	0–0.08	Soil	—	—	—	—	—	—	—	—	—	51.7
RE00-02-45641	00-02-19718	0–0.08	Soil	—	—	23	32.1 (J-)	—	—	—	—	—	68
RE00-02-45642	00-02-19719	0–0.08	Soil	1.64	—	33.7	290 (J-)	—	—	—	—	—	206
RE00-02-45643	00-02-19720	0–0.08	Soil	—	—	27.2	23.5 (J-)	—	—	—	—	—	70.5
RE00-02-45706	00-02-19720	0.08–0.5	Soil	—	—	—	—	—	—	—	—	—	71.7
RE00-02-45644	00-02-19721	0–0.08	Soil	—	—	—	—	—	—	—	—	—	55.1
RE00-02-45645	00-02-19722	0–0.08	Soil	—	—	41.2	29.9 (J-)	—	0.332	—	—	—	71.9
RE00-02-45646	00-02-19723	0–0.08	Soil	—	—	—	—	—	—	—	—	—	54.4
RE00-02-45647	00-02-19724	0–0.08	Soil	—	6780	—	—	—	—	—	—	—	—
RE00-02-45649	00-02-19726	0–0.08	Soil	—	—	—	—	—	—	—	—	—	51.2
RE00-02-45651	00-02-19728	0–0.08	Soil	—	—	—	31.3 (J-)	—	—	—	—	—	—
RE00-02-45657	00-02-19734	0–0.08	Soil	—	—	17.4	25.2	—	—	—	—	—	—
RE00-02-45701	00-02-19734	0.08–0.5	Soil	—	—	—	38.5	—	—	—	—	—	64.1
RE00-02-45658	00-02-19735	0–0.08	Soil	—	—	—	40.5	—	—	—	—	—	68.9
RE00-02-45659	00-02-19736	0–0.08	Soil	—	—	—	32.1	—	—	—	—	—	—
RE00-02-45662	00-02-19739	0–0.08	Soil	—	—	—	138	—	—	—	—	—	111
RE00-02-45702	00-02-19739	0.08–0.5	Soil	—	—	—	92	—	—	—	—	—	107
RE00-02-45663	00-02-19740	0–0.08	Soil	0.568	7610	—	59.5	—	—	—	—	—	74.2

Table 6.4-4 (continued)

Sample ID	Location ID	Depth (ft)	Media	Cadmium (mg/kg)	Calcium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Lithium (mg/kg)	Mercury (mg/kg)	Silver (mg/kg)	Strontium (mg/kg)	Uranium (mg/kg)	Zinc (mg/kg)
RE00-02-45666	00-02-19743	0–0.08	Soil	—	—	—	42.1	—	—	—	—	—	51.1
RE00-02-45668	00-02-19745	0–0.08	Soil	—	—	—	69.5	—	—	—	—	—	78.4
RE00-02-45703	00-02-19745	0.08–0.3	Soil	—	—	—	37.8	—	—	—	—	—	51.9
RE00-02-45669	00-02-19746	0–0.08	Soil	—	—	—	59.6	—	—	—	—	—	56.3
RE00-02-45671	00-02-19748	0–0.08	Soil	—	—	—	31.4	—	—	—	—	—	—
RE00-02-45672	00-02-19749	0–0.08	Soil	0.5	—	—	29.2	—	0.116	1.61	—	—	63.6
RE00-02-45673	00-02-19750	0–0.08	Soil	0.509	—	—	27.2	—	—	1.13	—	—	59.2
RE00-02-45713	00-02-19750	0.08–0.5	Soil	0.527	—	—	27.3	—	—	1.18	—	—	60.5
RE00-02-45674	00-02-19751	0–0.08	Soil	0.629	9560	—	62.8	—	—	—	—	—	61.6
RE00-02-45675	00-02-19752	0–0.08	Soil	—	—	—	24.1	—	—	—	—	—	—
RE00-02-45708	00-02-19754	0.08–0.5	Soil	0.418 (J)	—	—	—	—	—	—	—	—	58.9
RE00-02-45680	00-02-19757	0–0.08	Soil	—	—	—	—	—	0.254	—	—	—	49.8
RE00-02-45681	00-02-19758	0–0.08	Soil	—	—	—	39.4	—	0.115	—	—	—	91.4
RE00-02-45682	00-02-19759	0–0.08	Soil	—	—	—	58.1	—	—	—	—	—	61.2
RE00-02-45721	00-02-19759	0.08–0.5	Soil	—	—	—	22.7	—	—	—	—	—	55.3
RE00-02-45684	00-02-19761	0–0.08	Soil	—	—	—	22.7	—	—	1.41	—	—	52.9
RE00-02-45685	00-02-19762	0–0.08	Soil	0.548	9860	—	63.8	—	0.147	—	—	—	73.6
RE00-02-45686	00-02-19763	0–0.08	Soil	—	—	—	30.3	—	—	—	—	—	51.3
RE00-02-45689	00-02-19766	0–0.08	Soil	—	—	—	31.4	—	—	—	—	—	—
RE00-02-45690	00-02-19767	0–0.08	Soil	—	—	—	24.3	—	—	—	—	—	—
RE00-02-45691	00-02-19768	0–0.08	Soil	—	—	—	22.8	—	—	—	—	—	56.6
RE00-02-45693	00-02-19770	0–0.08	Soil	—	—	—	26	—	—	—	—	—	—
RE00-02-45695	00-02-19772	0–0.08	Soil	—	—	—	25.7	—	—	—	—	—	—
AAA0457	21-01003	0–0.08	Soil	—	—	—	—	—	—	—	—	3.2	—
AAA0458	21-01004	0–0.08	Soil	—	—	—	—	—	—	—	—	4.1	—

Table 6.4-4 (continued)

Sample ID	Location ID	Depth (ft)	Media	Cadmium (mg/kg)	Calcium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Lithium (mg/kg)	Mercury (mg/kg)	Silver (mg/kg)	Strontium (mg/kg)	Uranium (mg/kg)	Zinc (mg/kg)
AAA0459	21-01004	0–0.5	Soil	—	—	—	—	—	—	—	—	3.9	—
AAA0460	21-01005	0–0.08	Soil	—	—	—	—	—	—	—	—	4.1	—
AAA0461	21-01006	0–0.08	Soil	—	—	—	—	—	—	—	—	4	—
AAA0462	21-01006	0–0.5	Soil	—	—	—	—	—	—	—	—	3.9	—
AAA0464	21-01007	0–0.08	Soil	—	—	—	—	—	—	—	—	3.6	—
AAA0472	21-01009	0–0.08	Soil	—	—	—	—	—	—	—	—	3.5	—
AAA0465	21-01010	0–0.08	Soil	—	—	—	—	—	—	—	—	6.5	—
AAA0466	21-01010	0–0.5	Soil	—	—	—	—	—	—	—	—	5	—
AAA0473	21-01011	0–0.08	Soil	—	—	—	—	—	—	—	—	4.3	—
AAA0474	21-01012	0–0.08	Soil	—	—	—	—	—	—	—	—	6	—
AAA0469	21-01013	0–0.08	Soil	—	—	—	—	—	—	—	—	9.3	—
AAA0475	21-01014	0–0.08	Soil	—	—	—	—	—	—	—	—	7.2	—
AAA0476	21-01014	0–0.5	Soil	—	—	—	—	—	—	—	—	5	—
AAA0477	21-01015	0–0.08	Soil	—	—	—	—	—	—	—	—	4.7	—
AAA0478	21-01016	0–0.08	Soil	—	—	—	—	—	—	—	—	8.9	—
AAA0479	21-01017	0–0.08	Soil	—	—	—	—	—	—	—	—	5.5	—
AAA0480	21-01017	0–0.33	Soil	—	—	—	—	—	—	—	—	5.1	—
AAA0481	21-01018	0–0.08	Soil	—	—	—	—	—	—	—	—	10	—
AAA0482	21-01019	0–0.08	Soil	—	—	—	—	—	—	—	—	5.58	—
AAA0483	21-01020	0–0.08	Soil	—	—	—	—	—	—	—	—	4.8	—
AAA0484	21-01020	0–0.5	Soil	—	—	—	—	—	—	—	—	4.56	—
AAA0485	21-01021	0–0.08	Soil	—	—	—	—	—	—	—	—	4.3	—
AAA0487	21-01022	0–0.08	Soil	—	—	—	—	—	—	—	—	9.23	—
AAA0494	21-01023	0–0.08	Soil	—	—	—	—	—	—	—	—	4.1	—
AAA0495	21-01023	0–0.5	Soil	—	—	—	—	—	—	—	—	4	—

Table 6.4-4 (continued)

Sample ID	Location ID	Depth (ft)	Media	Cadmium (mg/kg)	Calcium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Lithium (mg/kg)	Mercury (mg/kg)	Silver (mg/kg)	Strontium (mg/kg)	Uranium (mg/kg)	Zinc (mg/kg)
AAA0488	21-01024	0–0.08	Soil	—	—	—	—	—	—	—	—	10.24	—
AAA0489	21-01024	0–0.25	Soil	—	—	—	—	—	—	—	—	14.2	—
AAA0492	21-01025	0–0.08	Soil	—	—	—	—	—	—	—	—	9.06	—
AAA0496	21-01026	0–0.08	Soil	—	—	—	—	—	—	—	—	7.6	—
AAA0497	21-01027	0–0.08	Soil	—	—	—	—	—	—	—	—	6.4	—
AAA0493	21-01028	0–0.08	Soil	—	—	—	—	—	—	—	—	5.01	—
AAA0202	21-01029	0–0.08	Soil	—	—	—	—	23	—	—	28	5.43	59
AAA0203	21-01030	0–0.08	Soil	—	—	—	—	22	—	—	66	5.15	80
AAA0204	21-01030	0–0.5	Soil	—	—	25	35	27	—	10.8	98	8.39	130
AAA0247	21-01031	0–0.08	Soil	—	—	—	—	—	—	—	—	10.7	—
AAA0248	21-01031	0–0.5	Soil	—	—	—	—	—	—	—	—	6.1	—
AAA0249	21-01032	0–0.08	Soil	—	—	—	—	—	—	—	—	5.7	—
AAA0205	21-01033	0–0.08	Soil	—	—	—	—	20	—	—	43	4.86	—
AAA0250	21-01034	0–0.08	Soil	—	—	—	—	—	—	—	—	6.3	—
AAA0251	21-01035	0–0.08	Soil	—	—	—	—	—	—	—	—	5.6	—
AAA0206	21-01038	0–0.08	Soil	—	—	—	—	21	—	—	33	5.6	76
AAA0207	21-01038	0–0.42	Soil	—	—	—	—	23	—	—	27	5.6	62
AAA0208	21-01039	0–0.08	Soil	—	—	—	—	—	—	—	—	8.98	—
AAA0252	21-01040	0–0.08	Soil	—	—	—	—	—	—	—	—	12.2	—
AAA0253	21-01040	0–0.5	Soil	—	—	—	—	23	—	—	80	5.1	—
AAA0209	21-01042	0–0.08	Soil	—	—	—	—	21	—	—	31	6.17	—
AAA0210	21-01043	0–0.08	Soil	—	—	59	83	26	—	65.8	116	15.95	210
AAA0211	21-01047	0–0.08	Soil	—	—	—	30	23	—	1.9	43	5.44	60
AAA0212	21-01047	0–0.5	Soil	—	—	—	31	23	—	—	37	5.87	52
AAA0216	21-01048	0–0.08	Soil	—	—	—	—	19	—	—	62	5.75	50

Table 6.4-4 (continued)

Sample ID	Location ID	Depth (ft)	Media	Cadmium (mg/kg)	Calcium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Lithium (mg/kg)	Mercury (mg/kg)	Silver (mg/kg)	Strontium (mg/kg)	Uranium (mg/kg)	Zinc (mg/kg)
AAA0217	21-01048	0–0.5	Soil	—	—	—	26	17	—	—	102	5.75	78
AAA0218	21-01049	0–0.08	Soil	—	—	—	—	24	—	—	39	6.1	—
AAA0219	21-01050	0–0.08	Soil	—	—	—	—	23	—	—	32	8	—
AAA0254	21-01291	0–0.08	Soil	—	—	—	—	19	—	—	77	8.3	—
AAA0255	21-01291	0–0.5	Soil	—	—	—	—	21	—	—	87	5.8	—
AAA0467	21-01296	0–0.08	Soil	—	—	—	—	—	—	—	—	5.7	—
AAA0468	21-01296	0–0.17	Soil	—	—	—	—	—	—	—	—	6.5	—
AAA0490	21-01297	0–0.5	Soil	—	—	—	—	—	—	—	—	4.62	—
AAA0491	21-01297	0–0.5	Soil	—	—	—	—	—	—	—	—	4.28	—

[a] — = Not above the BV.

[b] UTL presented in (Ryti 1997, 58239).

6.4.3.1.2 Radionuclide Comparison with BVs and Fallout Values

Thirty-seven soil samples were analyzed for americium-241 by alpha spectroscopy, one hundred and two samples were analyzed for isotopic plutonium, tritium, and strontium-90, four samples for isotopic uranium and isotopic thorium, and eighty-two samples for gamma-emitting radionuclides. The tritium data were reported in two different ways. Twenty samples collected in 1992 were analyzed for tritium and reported in pCi/L with no moisture data. Eighty-two samples were collected in 2002 and analyzed for tritium. Due to lack of moisture, the analytical laboratory had to add water to the sample in order to perform the analysis. The results for these tritium samples were converted to pCi/g by the analytical laboratory and reported in pCi/g with no moisture data available. Therefore, neither subset of tritium data can be converted to other units for comparison of the data set as a whole. Tritium is reported in two different units in this section of the report depending on the year collected and analyzed. Table C-5.0-4 in Appendix C presents detailed results of the QA/QC assessment. Sample concentrations were compared with appropriate Laboratory all horizon soil background data set or fallout value (LANL 1998, 59730). Table 6.4-5 presents the frequency of detected radionuclides above background/fallout in soil. Note that the numbers of analyses for specific radionuclides may differ from each other and from the total number of analyses requested; the list of analytes reported by the analytical laboratories, particularly for gamma-emitting radionuclides, has not been consistent throughout the years.

Table 6.4-5
Frequency of Detected Radionuclides Above BVs or FVs in Soil Samples at SWMU 21-021

Analyte	Media	Number of Analyses[b]	Number of Detects	Concentration Range (pCi/g)	Background Value or Fallout Value (pCi/g)	Frequency of Detects Above Background Value or Fallout Value
Americium-241	Soil	116	24	[-0.116] to 0.197	0.013	20/116
Cesium-134	Soil	82	0	[-0.238 to 0.0429]	NA[a]	0/82
Cesium-137	Soil	82	77	[0.0244] to 6.03	1.65	12/82
Cobalt-60	Soil	82	0	[-0.0373 to 0.0473]	NA	0/82
Europium-152	Soil	82	0	[-0.203 to 0.129]	NA	0/82
Plutonium-238	Soil	102	7	[-0.0111] to 0.0638	0.023	4/102
Plutonium-239	Soil	102	91	[0.0016] to 5.79	0.054	77/102
Ruthenium-106	Soil	81	0	[-0.342 to 0.388]	NA	0/81
Sodium-22	Soil	80	0	[-0.0647 to 0.0462]	NA	0/80
Strontium-90	Soil	102	40	[-0.1] to 1.65	1.31	1/102
Thorium-228	Soil	4	4	1.5 to 2.3	2.28	1/4
Thorium-230	Soil	4	4	1.34 to 1.9	2.29	0/4
Thorium-232	Soil	4	4	1.28 to 2.1	2.33	0/4
Tritium	Soil	82	0	[-1.68 to 1.75]	NA	0/82
Tritium (pCi/mL)	Soil	20	17	[-0.1] to 8.1 (pCi/mL)	0.76 (pCi/mL)	17/20
Uranium-234	Soil	4	4	1.39 to 1.79	2.59	0/4
Uranium-235	Soil	81	2	[0.00213 to 0.407]	0.2	2/81
Uranium-238	Soil	4	4	1.58 to 1.9	2.29	0/4

[a] NA = Not available.

[b] Numbers of analyses for gamma-emitting radionuclides varies because of inconsistencies and changes in the list of analytes reported by various laboratories over the years

Americium-241, cesium-137, plutonium-238, plutonium-239, strontium-90, thorium-228, tritium, and uranium-235 were all detected above the BV. The BVs for thorium-228 and uranium-235 are surrogates from sediment data, so further statistical tests cannot be performed. The maximum detected value for thorium-228 is 2.3 pCi/g compared to a BV of 2.28 pCi/g. Since all other detects of thorium-228 are below the BV and the maximum is at the BV, thorium-228 is not retained as a COPC. Table E-3.1-6 presents the results of statistical tests for all of the other radionuclides above the BV. These statistical test results show that americium-241, cesium-137, and plutonium-239 are significantly different from background. The statistical tests show that plutonium-238 and strontium-90 are not significantly different from background, so they are not retained as COPCs. Statistical tests were not run for tritium because of the inconsistency in the reporting units. Since tritium was detected in 17 out of 20 samples above the BV in the 1992 data, tritium is retained as a COPC.

Therefore, americium-241, cesium-137, plutonium-239, tritium, and uranium-235 are retained as COPCs in the soil. Table 6.4-6 presents the concentrations above the background or fallout value in soil.

Table 6.4-6
Radionuclides Detected Above BVs or FVs in Soil Samples at SWMU 21-021-99

Sample ID	Location ID	Depth (ft)	Media	Americium-241 (pCi/g)	Cesium-137 (pCi/g)	Plutonium-239 (pCi/g)	Tritium (pCi/mL)	Uranium-235 (pCi/g)
Soil Background Value or Fallout Value (pCi/g)				**0.013**	**1.65**	**0.054**	**0.766 pCi/mL**	**0.2**
RE00-02-45636	00-02-19713	0–0.08	Soil	—*	—	0.142	—	—
RE00-02-45715	00-02-19714	0.08–0.5	Soil	—	—	0.126	—	—
RE00-02-45642	00-02-19719	0–0.08	Soil	—	—	0.204	—	—
RE00-02-45643	00-02-19720	0–0.08	Soil	—	—	0.866	—	—
RE00-02-45706	00-02-19720	0.08–0.5	Soil	—	—	0.9	—	—
RE00-02-45644	00-02-19721	0–0.08	Soil	—	—	5.79	—	—
RE00-02-45645	00-02-19722	0–0.08	Soil	—	—	0.348	—	—
RE00-02-45647	00-02-19724	0–0.08	Soil	—	—	—	—	—
RE00-02-45649	00-02-19726	0–0.08	Soil	—	—	0.107	—	—
RE00-02-45650	00-02-19727	0–0.08	Soil	—	—	0.125	—	—
RE00-02-45709	00-02-19727	0.08–0.5	Soil	—	—	0.21	—	—
RE00-02-45651	00-02-19728	0–0.08	Soil	—	—	0.39	—	—
RE00-02-45653	00-02-19730	0–0.08	Soil	—	—	0.0656	—	—
RE00-02-45654	00-02-19731	0–0.08	Soil	—	—	0.0619	—	—
RE00-02-45705	00-02-19732	0.08–0.5	Soil	—	—	0.0644	—	—
RE00-02-45656	00-02-19733	0–0.08	Soil	—	—	0.288	—	—
RE00-02-45657	00-02-19734	0–0.08	Soil	—	—	0.226	—	—
RE00-02-45701	00-02-19734	0.08–0.5	Soil	—	—	0.141	—	—
RE00-02-45658	00-02-19735	0–0.08	Soil	—	2.06	1.2	—	—
RE00-02-45659	00-02-19736	0–0.08	Soil	—	1.95	0.241	—	—
RE00-02-45661	00-02-19738	0–0.08	Soil	—	—	0.107	—	—

Table 6.4-6 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241 (pCi/g)	Cesium-137 (pCi/g)	Plutonium-239 (pCi/g)	Tritium (pCi/mL)	Uranium-235 (pCi/g)
RE00-02-45662	00-02-19739	0–0.08	Soil	—	—	0.32	—	—
RE00-02-45702	00-02-19739	0.08–0.5	Soil	—	—	0.342	—	—
RE00-02-45663	00-02-19740	0–0.08	Soil	—	2.81	1.01	—	—
RE00-02-45664	00-02-19741	0–0.08	Soil	—	—	0.286	—	—
RE00-02-45665	00-02-19742	0–0.08	Soil	—	—	0.5	—	—
RE00-02-45666	00-02-19743	0–0.08	Soil	—	2.13	0.569	—	0.343
RE00-02-45667	00-02-19744	0–0.08	Soil	—	—	0.0977	—	—
RE00-02-45668	00-02-19745	0–0.08	Soil	—	—	0.159	—	—
RE00-02-45703	00-02-19745	0.08–0.3	Soil	—	—	0.0607	—	—
RE00-02-45669	00-02-19746	0–0.08	Soil	—	—	0.142	—	—
RE00-02-45707	00-02-19747	0.08–0.5	Soil	—	—	1.5	—	—
RE00-02-45671	00-02-19748	0–0.08	Soil	—	1.83	0.77	—	—
RE00-02-45710	00-02-19748	0.08–0.5	Soil	—	—	0.134	—	—
RE00-02-45672	00-02-19749	0–0.08	Soil	—	—	0.334	—	—
RE00-02-45673	00-02-19750	0–0.08	Soil	—	—	0.353	—	—
RE00-02-45713	00-02-19750	0.08–0.5	Soil	—	—	0.742	—	—
RE00-02-45674	00-02-19751	0–0.08	Soil	—	2.94	—	—	—
RE00-02-45677	00-02-19754	0–0.08	Soil	—	—	0.0573	—	—
RE00-02-45708	00-02-19754	0.08–0.5	Soil	—	—	0.295	—	—
RE00-02-45678	00-02-19755	0–0.08	Soil	—	—	1.09	—	—
RE00-02-45683	00-02-19760	0–0.08	Soil	—	—	0.221	—	0.332
RE00-02-45717	00-02-19760	0.08–0.5	Soil	—	—	0.126	—	—
RE00-02-45684	00-02-19761	0–0.08	Soil	—	—	1.09	—	—
RE00-02-45685	00-02-19762	0–0.08	Soil	—	6.03	4.12	—	—
RE00-02-45718	00-02-19762	0.08–0.5	Soil	—	—	0.321	—	—
RE00-02-45686	00-02-19763	0–0.08	Soil	—	2.36	0.543	—	—
RE00-02-45687	00-02-19764	0–0.08	Soil	—	—	0.12	—	—
RE00-02-45719	00-02-19764	0.08–0.5	Soil	—	—	0.0588	—	—
RE00-02-45688	00-02-19765	0–0.08	Soil	—	—	0.221	—	—
RE00-02-45689	00-02-19766	0–0.08	Soil	—	2.13	0.374	—	—
RE00-02-45690	00-02-19767	0–0.08	Soil	—	2.15	0.716	—	—
RE00-02-45691	00-02-19768	0–0.08	Soil	—	—	0.336	—	—
RE00-02-45720	00-02-19768	0.08–0.5	Soil	—	—	0.0788	—	—
RE00-02-45692	00-02-19769	0–0.08	Soil	—	—	1.01	—	—
RE00-02-45693	00-02-19770	0–0.08	Soil	—	3.56	0.861	—	—

Table 6.4-6 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241 (pCi/g)	Cesium-137 (pCi/g)	Plutonium-239 (pCi/g)	Tritium (pCi/mL)	Uranium-235 (pCi/g)
RE00-02-45694	00-02-19771	0–0.08	Soil	—	—	0.511	—	—
RE00-02-45716	00-02-19771	0.08–0.5	Soil	—	—	0.0679	—	—
RE00-02-45695	00-02-19772	0–0.08	Soil	—	2.56	0.736	—	—
RE00-02-45696	00-02-19773	0–0.08	Soil	—	—	0.414	—	—
RE00-02-45697	00-02-19774	0–0.08	Soil	—	—	0.518	—	—
AAA0496	21-01026	0–0.08	Soil	—	—	1.288	2.3	—
AAA0202	21-01029	0–0.08	Soil	—	—	0.106	3.4	—
AAA0203	21-01030	0–0.08	Soil	0.014	—	0.725	—	—
AAA0204	21-01030	0–0.5	Soil	0.031	—	1.835	—	—
AAA0247	21-01031	0–0.08	Soil	0.061	—	—	—	—
AAA0248	21-01031	0–0.5	Soil	0.024	—	—	—	—
AAA0205	21-01033	0–0.08	Soil	—	—	0.104	2.2	—
AAA0206	21-01038	0–0.08	Soil	—	—	0.204	1.4	—
AAA0207	21-01038	0–0.42	Soil	—	—	0.073	1.3	—
AAA0208	21-01039	0–0.08	Soil	0.062	—	—	—	—
AAA0252	21-01040	0–0.08	Soil	0.04	—	—	—	—
AAA0253	21-01040	0–0.5	Soil	—	—	0.094	1.6	—
AAA0209	21-01042	0–0.08	Soil	—	—	0.294	3.7	—
AAA0210	21-01043	0–0.08	Soil	—	—	4.458	4.4	—
AAA0211	21-01047	0–0.08	Soil	0.197	—	3.093	1.9	—
AAA0212	21-01047	0–0.5	Soil	0.014	—	0.171	1.9	—
AAA0216	21-01048	0–0.08	Soil	—	—	0.456	7.3	—
AAA0217	21-01048	0–0.5	Soil	—	—	0.775	8.1	—
AAA0218	21-01049	0–0.08	Soil	—	—	0.163	2.9	—
AAA0219	21-01050	0–0.08	Soil	—	—	0.211	6.1	—
AAA0254	21-01291	0–0.08	Soil	0.032	—	0.265	2	—
AAA0255	21-01291	0–0.5	Soil	0.019	—	0.128	1.3	—
AAA0467	21-01296	0–0.08	Soil	0.039	—	—	—	—
AAA0468	21-01296	0–0.17	Soil	0.032	—	—	—	—
AAA0490	21-01297	0–0.5	Soil	—	—	—	1.4	—

*— = Not above the BV.

6.4.3.2 Evaluation of Organic Chemicals

Seventeen soil samples were analyzed for SVOCs. Three soil samples were analyzed for VOCs. Table 6.4-2 shows the samples that were analyzed for SVOCs and VOCs. Table C-5.0-3 in Appendix C presents detailed results of the QA/QC assessment. Sample results were reviewed for detection status. There were no organic chemicals detected in these samples, therefore no organic chemicals are retained as COPCs at SWMU 21-021.

6.4.4 Revised Site Conceptual Model

The preliminary conceptual model is described in Section 6.3.2. The preliminary conceptual model identified airborne emissions as the potential release mechanism for SWMU 21-021.

The primary exposure pathways for human health were soil ingestion, dermal contact, dust inhalation, and external irradiation. The primary exposure pathways for ecological receptors were soil ingestion, plant uptake, rain splash, dermal contact, and food web transport.

6.4.4.1 Nature and Extent of Contamination

The purpose for sampling at this section of SWMU 21-021 was to characterize the surface and shallow surface soil to determine if an unacceptable risk is present to human or ecological health. The nature and extent of the contamination at the portion of SWMU 21-021 included in this report have been defined by the environmental samples that have been collected in 1990, 1992, 1994, and 2002. The extent has been determined by collecting samples in soil from the mesa top and slope to BV Canyon.

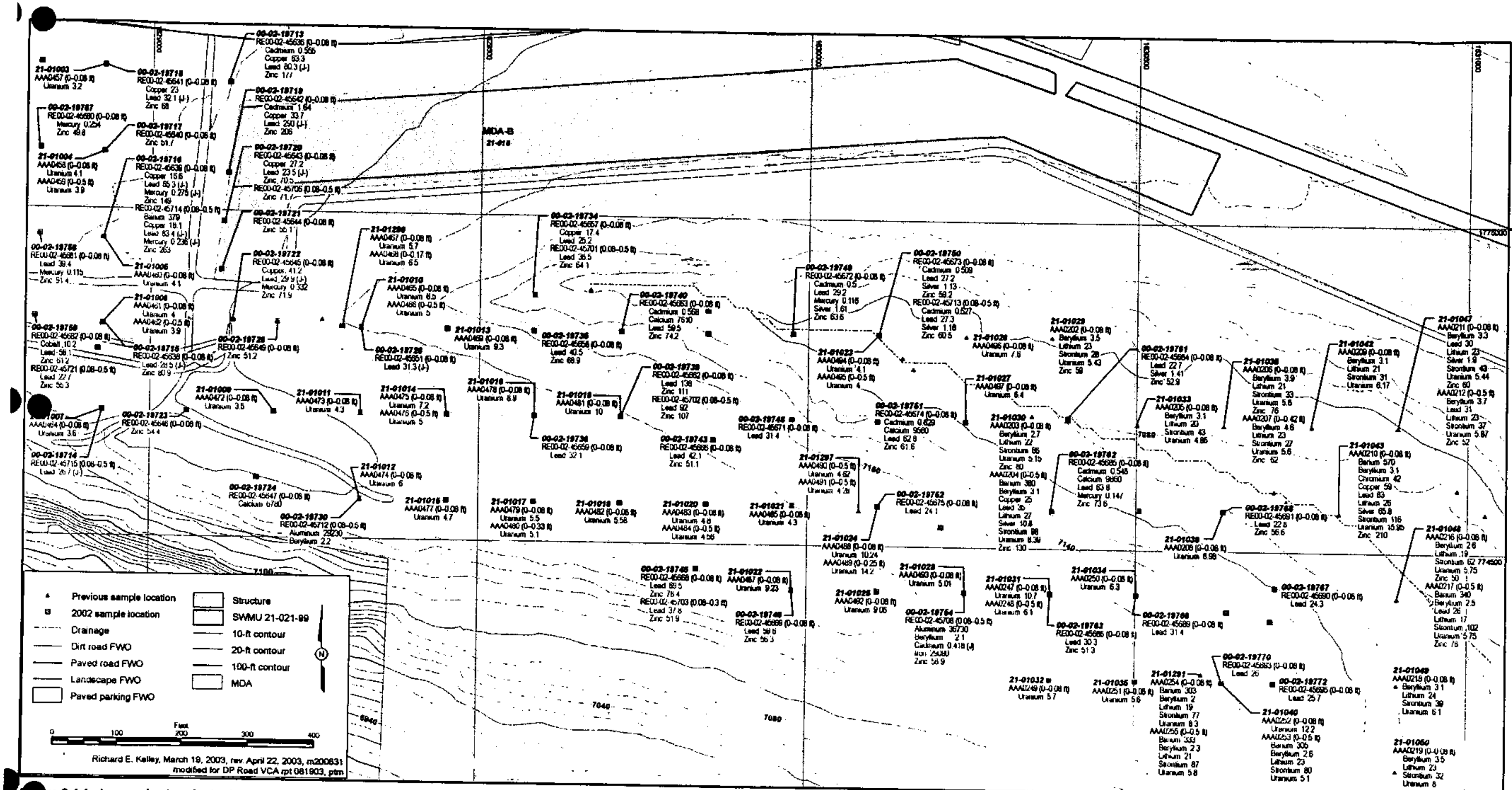
The source for the contaminants at the site is air deposition from TA-21. Because the source is aerial deposition, the extent of the contaminants should be spread over the mesa top, which is what the data from the sampling events showed. The majority of the analytes are distributed fairly uniformly across the sampling area (Figures 6.4-1 and 6.4-2).

6.4.4.2 Environmental Fate and Transport

The evaluation of environmental fate addresses the chemical processes that affect the persistence of a chemical in the environment. The evaluation of transport addresses the physical processes affecting mobility along the migration pathway. Infiltration into surface soils depends on the rate of precipitation or snowmelt, antecedent soil water status, depth of soil, and soil hydraulic properties. Infiltration into the tuff depends on the unsaturated flow properties of the tuff. Joints and fractures in the tuff may provide additional pathways for moisture to enter the subsurface regime. COPCs at SWMU 21-021 include inorganic chemicals and radionuclides.

6.4.4.2.1 Inorganic Chemicals

Cadmium, calcium, copper, lead, lithium, mercury, silver, strontium, uranium, and zinc were retained as COPCs from the data review (Section 6.4.3.1.1). The fate and distribution of chemicals in the environment are determined by several variables that can interact in numerous ways, e.g., physiochemical properties of the individual chemical and the physical transport systems such as rainwater or snowmelt runoff. The physicochemical properties, such as water solubility, soil adsorption, and volatilization, are all important in determining the routes by which a metal may enter the environment and be distributed. Appendix F provides detailed information of the properties that affect fate and transport for each of the inorganic COPCs. The following paragraph briefly discusses the mobility of the inorganic COPCs at the SWMU 21-021.



Richard E. Kelley, March 19, 2003, rev. April 22, 2003, m200831
modified for DP Road VCA rpt 081903, ptm

re 6.4-1. Inorganic chemicals detected above background at SWMU 21-021-99

Cadmium compounds are often found attached to small particles present in air, and can travel great distances before coming down to the earth. Cadmium is relatively nonmobile in insoluble complexes or adsorbed to sediments. Copper is strongly adsorbed on soil particles and usually remains in the upper few centimeters of soil. But copper's movement in soil is determined by the physical and chemical interactions of copper with the soil components. Copper will adsorb mainly to organic matter, carbonate minerals, clay minerals, or hydrous iron and manganese oxides. Lead is transferred continuously between air, water, and soil by natural chemical and physical processes. Atmospheric deposition is the largest source of lead found in soils. It sorbs strongly to organic matter in soil. Lithium occurs mainly as salts, and is very soluble. It does not readily adsorb to soil. The ionic nature of lithium makes it essentially nonvolatile. Therefore, it exists only in the particulate phase in air and does not volatilize from soil. Mercury is relatively immobile when deposited on soil or water. It tightly binds to both organic and inorganic particles. Silver that is released into the environment may be carried long distances in air and water. Rain washes silver compounds out of many soils so that it eventually moves into the groundwater. Strontium has moderate mobility in soils and sediments, and sorbs moderately to metal oxides and clays. At higher concentrations, precipitation of strontianite (strontium carbonate) occurs and strontium is likely less mobile. In air, strontium compounds are present mostly as dust. These particles of strontium eventually end up back in the soil. Uranium can undergo oxidation-reduction reactions in the environment or microbial reactions to form complexes with organic matter. Uranium can become airborne, and deposition of atmospheric uranium may occur by wet (rain, sleet, or snow) or dry (gravitation or wind turbulence) processes. The rate of deposition is dependent upon such factors as particle size, particle density, particle concentration, wind turbulence, and chemical form. Zinc sorbs strongly onto soil particles, and it can occur in both suspended and dissolved forms in surface water. Zinc is stable in dry air.

6.4.4.2.2 Radionuclides

The COPCs for this section of SWMU 21-021 are americium-241, cesium-137, plutonium-239, tritium, and uranium-235 (Section 6.4.3.1.2). Three of the radionuclides identified as COPCs at SWMU 21-021 are actinides (americium-241, plutonium-239, and uranium-235). These actinides have similar chemical properties. The following information is summarized from Whicker and Schultz (1982, 58209).

In general, the actinide nuclides form comparatively insoluble compounds in the environment and are not considered biologically mobile. The actinides are transported in ecosystems mainly by physical and, sometimes, chemical processes. Uptake of actinides by plants from soil is considered to be generally low. Plutonium in the environment undergoes hydrolysis and oxidation, with plutonium oxide as a common form. Under most environmental conditions, plutonium occurs in forms that are poorly transferred across biological membranes; therefore, movement of plutonium from soil and sediments to plants and animals is greatly inhibited.

Because plutonium and americium, under oxidizing conditions, preferentially bind to fine soil or sediment particles and to organic matter with high surface-to-volume ratios, it is likely they will be transported and deposited with sediments or remain relatively immobile in the subsurface.

Uranium-235 is fairly mobile and is long lived with a half-life of 700 million years. Uranium can exist in the +3, +4, +5, and +6 oxidation states, the most common of which are +4 and +6. In water, uranium adsorbs strongly to mineral surfaces and tends to partition into organic matter, thereby reducing its mobility.

The remaining radionuclide COPCs at this section of SWMU 21-021 are tritium and cesium-137. Tritium, which has a half-life of approximately 12 years, generally follows the hydrologic cycle if it is in the form of tritiated water. Cesium-137 is a fission product that occurs ubiquitously at the earth's surface as a result of global fallout. Cesium-137 has a half-life of approximately 30 years. Cesium-137 is tightly bound by the clay minerals of soil so that root uptake is slight (Eisenbud and Gessell 1977, 70130).

6.5 Site Assessments

6.5.1 Screening Assessments

6.5.1.1 Human Health

The human health screening assessment was performed according to guidance outlined in the draft installation work plan (LANL 2000, 66802) and in the "Human Health Risk-Based Screening Methodology" (LANL 2002, 72639). The human health screening assessment consists of four parts: scoping, screening evaluation, uncertainty analysis, and interpretation.

(a) Scoping

Current land use at SWMU 21-021 is industrial. The expected land use for the foreseeable future is also industrial. The potential for human exposure to residual concentrations of chemicals and radionuclides in the environment at the site is currently low because the site has restricted access (i.e., fenced and locked).

Although a residential scenario is unlikely under current and projected future site conditions, the potential present-day risks were evaluated using this scenario because it is protective of human health. The SALs used in the screening evaluation reflect a residential scenario that is based on an exposure of 24 hr/day and 350 days/yr.

(b) Screening Evaluation

If a sufficient number of samples are included in a data set (generally 10 or more), the 95% UCL of the mean is used as the representative concentration for screening assessments. If fewer samples are available, the maximum concentrations of each analyte may be used as the representative concentration. The representative concentration used in this screening assessment was the 95% UCL of the mean, or the maximum detected concentration if there was not enough data to calculate a 95% UCL (see Appendix F).

A total of 15 COPCs were identified at SWMU 21-021 based on the data review. These COPCs are evaluated further in this section by comparing the 95% UCL to the appropriate SAL for each chemical. The chemical SALs are calculated based on the methodology provided in Appendix C of the draft installation work plan (LANL 2000, 66802) and in the "Human Health Risk-Based Screening Methodology" (LANL 2002, 72639), and are based on guidance from NMED (NMED 2000, 68554) and EPA Region 6 (EPA 2002, 73691). For radionuclides, the SALs are derived according to LANL's "Derivation and Use of Radionuclide Screening Action Levels" (LANL 2001, 69683) and the SALs used are derived from RESRAD Version 6.21 (LANL 2002, 73705). The SALs for noncarcinogens are based on a hazard quotient (HQ) of 1.0. SALs for radionuclides are based on a dose of 15 mrem/yr. The 95% UCL for each COPC was compared with its respective SAL for radionuclides, and 0.1 SAL for noncarcinogens because more than two noncarcinogenic COPCs have been identified.

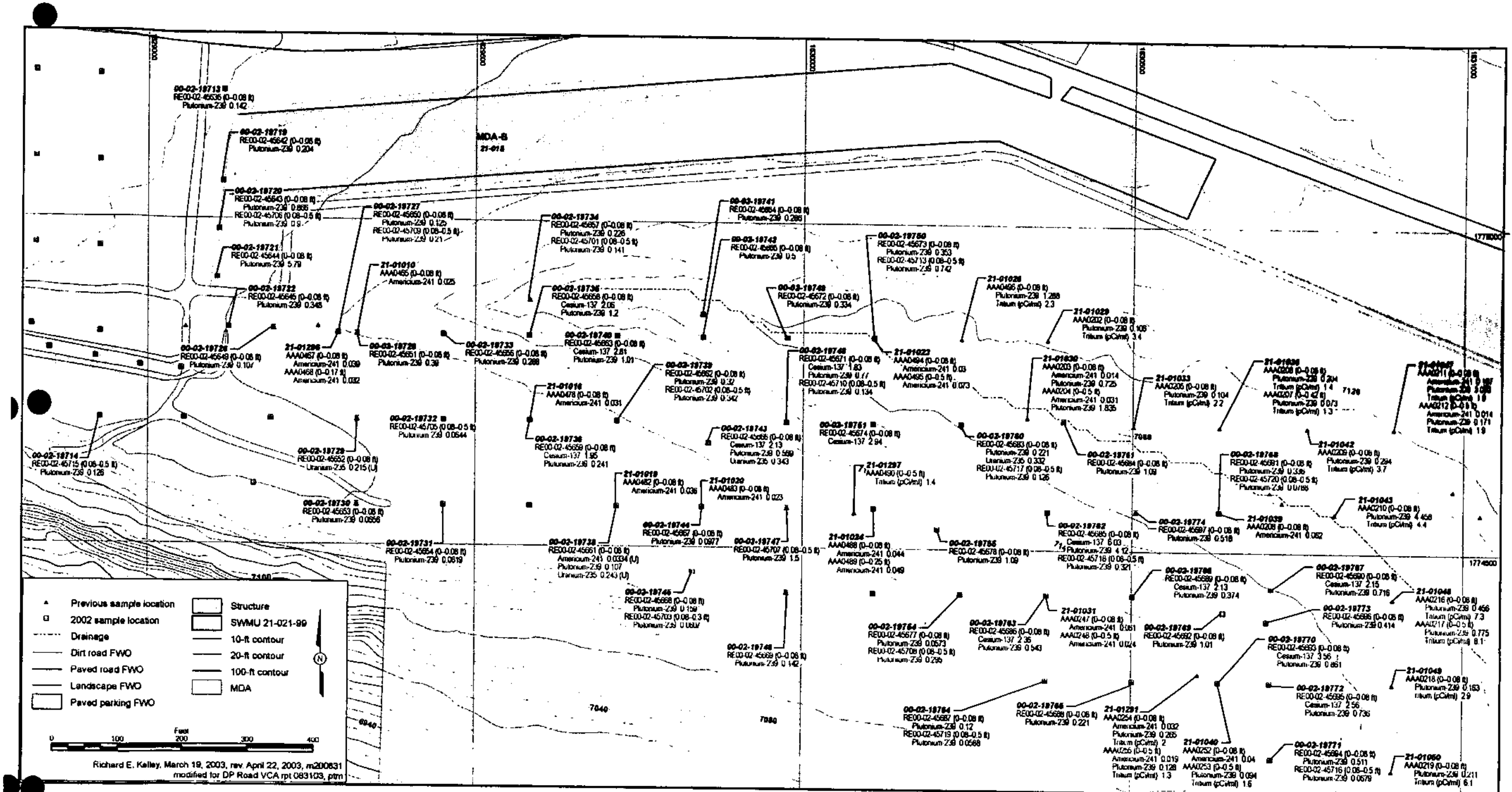


Figure 6.4-2. Radionuclides detected above background at SWMU 21-021-99

The comparison between 95% UCL and SALs is shown in Tables 6.5-1 and 6.5-2. COPCs whose 95% UCL exceeds a screening criterion are indicated by highlighting.

Table 6.5-1
Screening Evaluation for Noncarcinogenic COPCs from SWMU 21-021 in Soil

Chemical	95% UCL Value (mg/kg)	SAL (mg/kg)	0.1 SAL (mg/kg)
Cadmium	0.54	70	7.0
Copper	13.9	2800	280
Lead	**45**	**400**	**40**
Lithium	23.1	1600	160
Mercury	0.054	23	2.3
Silver	3.96	380	38
Strontium	76.5	37000	3700
Uranium	7.77	230	23
Zinc	74.4	23000	2300

Note: Bolded text means the 95% UCL exceeds 0.1 SAL.

Table 6.5-2
Screening Evaluation for Radionuclides from SWMU 21-021 in Soil

Chemical	95% UCL (pCi/g)	SAL (pCi/g)
Americium-241	0.051	39
Cesium-137	1.28	5.3
Plutonium-239	0.87	44
Tritium*	1.75	890
Uranium-235	0.15	17

*Value for tritium represents a maximum value for data reported as pCi/g.

Calcium does not have a published toxicity value, but is among those elements identified in Section 5.9.4 of Risk Assessment Guidance for Superfund [RAGS] (EPA 1989, 08021) as an essential macronutrient. Following the guidance in RAGS, the maximum value of calcium in the samples is 9860 mg/kg, which is less than twice the BV of 6120 mg/kg. Therefore, calcium is not expected to result in adverse health effects, and is not discussed further.

The 95% UCLs of noncarcinogenic COPCs were all less than their respective SALs and less than 0.1 SAL, with the exception of lead. The HI (the sum of the ratios of representative concentration divided by the SAL) is approximately 0.3 (see Appendix F, Table F-4.3-13), which is less than NMED's target HI of 1.0 (NMED 2000, 68554). This indicates that a human health hazard is not expected from residual concentrations of noncarcinogenic COPCs at SWMU 21-021.

The 95% UCLs for radionuclide COPCs were less than their respective SALs. The total estimated radionuclide dose is approximately 4.1 mrem/yr (see Appendix F, Table F-4.3-14), compared to the soil background dose of 4.9 mrem/yr from these COPCs. DOE's acceptable dose for free release of property is 15 mrem/yr (DOE 2000, 67489). This site does not pose an unacceptable dose to human health.

(c) Uncertainty Analysis

The analysis presented in this human health screening assessment is subject to varying degrees and kinds of uncertainty. The uncertainties associated with the data evaluation, exposure assessment, toxicity assessment, and the additive approach may affect the results.

Data evaluation and COPC identification process. Uncertainties associated with the data can include sampling errors, laboratory analysis errors, and data analysis errors. For this site, these uncertainties are expected to have little effect on the results even though the detected concentrations of some organic COPCs were qualified J, indicating the values were less than EQLs and could only be estimated.

The representative concentrations for all noncarcinogens were less than their respective SALs and less than 0.1 SAL, with the exception of lead. The representative concentration of lead (45 mg/kg) is only slightly higher than the 0.1 SAL of 40 mg/kg and less than the SAL of 400 mg/kg. Therefore, blood lead levels are less than 10 µg/dL from exposure at this site.

Exposure assessment. Uncertainties were identified in three areas of the exposure assessment process.

- *Identification of receptors.* Land use and activity patterns are not represented by those activities assumed by the residential land-use scenario; therefore, uncertainties are introduced. Because the potentially exposed individual is an industrial worker, the screening assessment overestimates the exposure and subsequently overestimates the potential hazard, risk, and dose. In the event the site becomes commercial, recreational, or residential, then the risk to human health has been evaluated using the most conservative assumptions.
- *Exposure pathway assumptions.* For each exposure pathway, assumptions are made concerning the parameters, the routes of exposure, the amount of contaminated media to which an individual can be exposed, and intake rates for different routes of exposure. In the absence of site-specific data, the assumptions used are consistent with EPA-approved parameters and default values (EPA 2002, 73691). When several upper-bound values are combined to estimate exposure for any one pathway, the resulting risks can in excess of the 99th percentile and therefore outside the range than may be reasonably expected.
- *Derivation of representative concentrations.* The maximum detected concentration used for comparison to the tritium SAL leads to an overestimation of the exposure across the entire site for tritium. It also results in an overestimation of the potential risk to human health. The use of the 95% UCL may also lead to an overestimation of the exposure due to some high nondetects in the inorganic chemicals.

Toxicity values. The primary uncertainty associated with the SALs is related to derivation of toxicity values used in the calculation. EPA toxicity values (reference doses [RfDs] and slope factors [SFs]) were used to derive the nonradiological SALs used in this risk screening assessment (EPA 2001, 70109; EPA 1997, 58968). Uncertainties were identified in three areas with respect to the toxicity values: (1) extrapolation from animals to humans, (2) extrapolation from one route of exposure to another route of exposure, and (3) interindividual variability in the human population.

- *Extrapolation from animals to humans.* The SFs and RfDs are often determined based on extrapolation from animal data to humans, which may result in uncertainties in toxicity values because differences exist in chemical absorption, metabolism, excretion, and toxic response between animals and humans. The EPA takes in account differences in body weight, surface area, and pharmacokinetic relationships between animals and humans to minimize the potential to underestimate the dose-response relationship. However, more conservatism is usually incorporated in these steps.

- *Extrapolation from one route of exposure to another route of exposure.* The SFs and RfDs can often contain extrapolations from one route of exposure to another. The extrapolation from the oral route to the inhalation and/or the dermal route is used and is based on the EPA's Integrated Risk Information System database (EPA 2001, 70109). Differences between the two exposure pathways could result in an overestimation of the risk.
- *Interindividual variability in the human population.* For noncarcinogenic effects, the amount of human variability in physical characteristics is important in determining the risks that can be expected at low exposures and in determining the NOAEL. The NOAEL/uncertainty factor approach incorporates a 10-fold factor to reflect the possible interindividual variability in the human population and is generally considered a conservative estimate.

Additive approach. For noncarcinogens, the effects of a mixture of chemicals are generally unknown and possible interactions could be synergistic or antagonistic, thereby overestimating or underestimating the risk. Additionally, the RfDs for different chemicals are not based on the same severity, effect, or target organ. Therefore, the potential for occurrence of noncarcinogenic effects can be overestimated for chemicals that act by different mechanisms and on different target organs but are addressed additively.

(d) Interpretation

Based on the screening assessment with a residential scenario, the HI (0.3) is less than NMED's target level of 1.0, there is no carcinogenic risk, and the radiological dose (4.1 mrem/yr) is less than the DOE's target dose of 15 mrem/yr. The results indicate that there is no potential unacceptable risk to human health at this site.

6.5.1.2 Ecological

The ecological screening evaluation was performed in accordance with the process outlined in "Screening Level Ecological Risk Assessment Methods" (LANL 1999, 64783). This ecological screening assessment consists of four parts: the scoping evaluation, the screening evaluation, uncertainty analysis, and risk interpretation. The scoping evaluation includes (1) the data assessment step, which identifies the list of COPCs; and (2) the problem formulation step for the specific site under investigation. The basis for SWMU 21-021 problem formulation is found in the scoping checklist (Appendix F of this document). The scoping checklist is a useful tool for organizing existing ecological information and for focusing the site visit on the information needed to develop the site conceptual model.

The screening evaluation includes the comparison of representative concentrations to the final ESLs. Representative concentrations are either maximum concentrations or the 95% UCL of the mean concentration depending on the data support for the site. The final ESLs are media-specific concentrations that represent the lowest value amongst an array of ecological receptors associated with no adverse ecological effects. Derivation of final ESLs is a complex process dependent on numerous equations and information sources; see Section 4.5, "Screening Level Ecological Risk Assessment Methods" (LANL 1999, 64783) for information about how the ESLs are derived. ESLs were developed for a suite of receptors designed to represent individual feeding guilds, such as invertivorous mammal or carnivorous bird. Robins and kestrels were modeled with three and two different diets, respectively, so that they could represent multiple feeding guilds. For example, the omnivorous robin actually represents the feeding guild of all omnivorous birds, while the herbivorous robin represents all herbivorous birds. The representative concentration of each COPC was compared with the LANL final ESL from the September 2002 version (Release 1.5) of the LANL Ecorisk Database (LANL 2002, 73702). Final soil ESLs for antimony, uranium, and zinc were corrected following revisions to ESLs made in 2003 (LANL 2003, 74012). The ESLs used in evaluation of this site are included in Table F-1.0-1 in Appendix F.

To provide additional information on the potential effects to representative ecological receptors, hazard quotients (HQs) and hazard indices (HIs) for all COPCs are calculated for all terrestrial screening receptors. The HQ is the ratio of the calculated representative concentration to the ESL. An HI is a sum of HQs, across contaminants for each receptor.

An HI greater than 1 is an indication of potential adverse impacts; the COPCs that contribute HQ >0.3 to an HI greater than 1 are identified as COPECs. In addition to identifying COPECs, HI/HQ results can be used for a qualitative assessment of possible adverse effects on individuals or populations. Potential risks to populations from COPECs at this site were assessed during the screening using PAUFs using an approach described in part (b) of this section and in Appendix F-2.0. Because EPA guidance is to manage ecological risks to populations (EPA 1999, 70086), some level of adverse effects of chemical stressors on individuals is acceptable. An exception is a T&E species, for which it is appropriate to evaluate potential adverse effects on individuals. The kestrel screening receptor with an all-flesh diet serves as the surrogate for avian T&E receptors in the screening calculations.

The uncertainty analysis section following the COPEC identification section describes the key sources of uncertainty in the screening assessment. The uncertainty analysis can result in adding chemicals or removing them from the list of COPECs.

The last part of the screening assessment interprets the results in the context of a risk management decision. This primarily involves an assessment of potential ecological risk versus the potential impacts of further remediation

(a) Scoping

Data Assessment

The approach taken to characterize releases from SWMU 21-021 was designed to provide information on the nature and extent of COPCs at this site. The data collected in soil were adequate to provide the distribution of COPCs across the site. Representative concentrations used in this assessment are 95% UCLs of the mean concentration, unless the number of detections in the data set was insufficient to calculate a 95% UCL of the mean value, then the maximum concentration was used. These 95% UCLs of the mean were calculated following EPA guidance "Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites" (EPA 2002, 73593.1). The UCLs were calculated using normal, lognormal, or nonparametric (Chebyshev's) tests depending on which distribution provided the best fit to the data for that COPC. Samples in which an analyte was not detected were considered as having a concentration of one half the detection limit for that analyte. In assessing this site, all samples were included in the data set used to generate exposure point concentrations, regardless of the depth at which the sample was taken.

Problem Formulation

The portion of SWMU 21-021 included in this report has an almost continuous vegetative cover, numerous shrubs, and a number of mature trees. There are a number of animal burrows on the site indicating the presence of burrowing animals such as gophers. Although heavy previous disturbance occurred near the site, this habitat represents a mixed cover with grassland areas, ponderosa pine, piñon, and juniper trees with abundant signs of wildlife use. Proximity to Los Alamos Canyon provides additional opportunities for wildlife to access the site. Potential receptors include plants, soil invertebrates, deer mice, rabbits, gophers, deer, and all types of birds. Based on a comparison of SWMU location to GIS-based habitat databases for the Mexican spotted owl (a threatened or endangered species), may forage with high frequency in the area, though the SWMU does not lie within the potential nesting habitat for the species (LANL 2001, 76092). The kestrel screening receptor with an all-flesh diet serves as the surrogate for avian T&E receptors in the screening calculations.

There is no aquatic habitat on the mesa top. Potential impact to aquatic habitat in Los Alamos Canyon is unlikely considering the distance from the mesa top to the ephemeral stream in the Canyon. Therefore, impacts on aquatic communities are not considered as part of this ecological screening assessment.

This area of the mesa top was not a process area. However, historical releases from stacks at TA-21 could potentially have deposited on the surface soil in this area. For ecological risk screening, the primary impacted media is the surface soil. The primary exposure pathways through which wildlife receptors could potentially contact this contamination are ingestion of soil and ingestion through the food chain. Burrowing animals could also be exposed through dust inhalation while digging. ESLs do not include exposure to particulates in air nor do they account for exposure through dermal contact. The importance of these pathways is discussed in the uncertainty analysis.

(b) Screening Evaluation

To determine which of the COPCs should be retained as COPECs, representative concentrations were compared to the final soil ESLs. COPCs that contribute HQ > 0.3 are identified as COPECs. Because the final ESLs may be based on different receptors for different compounds, the HQs generated by them cannot be summed to produce a single HI for the site. The HQ for comparison to the final ESL is larger than 0.3 for 6 of 8 metals. No radionuclides generated an HQ > 0.3. The benchmark of an HQ of 0.3 is used to account for potential additive effects of chemicals, and to insure that no chemical that may contribute significantly for the HI of a receptor is overlooked.

The representative concentration of the COPC, the final ESLs, and the HQs are presented in Table 6.5-3. Soil ESLs for individual receptors for cadmium and zinc were corrected following the latest revised ESLs (LANL 2003, 74012).

There are no ESLs for lithium; this COPC is discussed in the uncertainty section. Inorganic COPCs that were detected at concentrations exceeding LANL background values and also generated an HQ greater than 0.3 using the final ESLs were carried through to the assessment as COPECs. For these COPECs, a comparison to the ESLs for all terrestrial receptors at the site was also performed. The resulting HQs and HIs are shown in Table 6.5-4. The area of SWMU 21-021 is 9.84 hectares; this area is larger than the individual home ranges (see Table F-2.0-2) for the robin, deer mouse, vagrant shrew and cottontail. The individual AUF for these receptors would therefore be assigned a default value of 1 that would not adjust the HIs for this site. The PAUF approach is applied because the assessment population area for these species is larger than the site. The development of the PAUF approach is explained in Appendix F, and the calculation of the PAUFs for this site are provided in Table F-2.0-12. HIs as adjusted by the PAUF are provided in Table 6.5-4 for those receptors with an HI >1.

Table 6.5-3
Final ESL Comparison at SWMU 21-021

COPEC	95 % UCL of the Mean Concentration (mg/kg)	Final Soil ESL (mg/kg)	Receptor for Final ESL	HQ
Inorganic chemicals				
Cadmium	0.30	0.0047	shrew	64.0
Copper	13.9	10	plant	1.4
Lead	45	100	shrew	0.45
Mercury (total as inorganic)	0.054	0.05	shrew	1.0
Mercury (methyl)[a]	0.0001	0.00035	Invertivorous robin	0.28
Silver	3.96	0.05	plant	79.2
Strontium (stable)	76.5	71.0	Deer mouse	1.1
Uranium	7.77	25	plant	0.31
Zinc	74.4	10	plant	7.4
Radionuclides				
Americium-241	0.0508	44	earthworm	<0.01
Cesium-137	1.277	680	red fox	<0.01
Plutonium-239	0.62	47.0	earthworm	0.01
Tritium	1[b]	36000	plant	<0.01
Uranium-235	0.146	55	earthworm	<0.01

Note: Black shading = HQ >0.3.

[a] Not analyzed directly. Methyl mercury estimated at 0.2% of total mercury based on previously collected data. See Appendix F.

[b] Converted from 8.1 pCi/mL assuming 10% soil moisture.

Table 6.5-4
Hazard Quotients and Hazard Indices for COPECs at SWMU 21-021

Receptor	Omnivorous kestrel	Carnivorous Kestrel	Herbivorous Robin	Invertivorous Robin	Omnivorous Robin	Deer Mouse	Cottontail	Red fox	Shrew	Earthworm	Plant
Cadmium	0.06	<0.01	0.03	0.42	0.23	33.1	2.0	0.08	63.9	0.03	0.30
Copper	0.07	0.01	0.82	0.56	0.69	0.18	0.11	<0.01	0.19	1.1	1.4
Lead	0.03	0.01	0.15	0.30	0.22	0.20	0.05	0.01	0.45	0.02	0.09
Mercury (total as inorganic)	0.01	<0.01	0.04	0.08	0.06	<0.01	<0.01	<0.01	<0.01	1.0	<0.01
Silver	0.04	<0.01	0.13	0.28	0.21	0.03	0.01	<0.01	0.05	NA	79.2
Strontium (stable)	NA	NA	NA*	NA	NA	1.1	0.70	<0.01	0.70	NA	NA
Zinc	0.11	0.02	0.35	0.77	0.57	0.30	0.08	0.01	0.41	0.21	7.4
HI for receptor	0.32	0.04	1.5	2.4	2.0	34.9	2.9	.09	65.7	2.4	88.4
HI for receptor adjusted by PAUF	Unadjusted HI <1	Unadjusted HI <1	0.92	1.5	1.2	PAUF = 1	0.24	Unadjusted HI <1	43.1	No PAUF	No PAUF

Note: Black shading = HQ >0.3 or HI >1.0.

*NA = No ESL available.

HIs for the plant and earthworm are not adjusted by PAUFs because these receptors do not have home ranges from which a PAUF would be developed. The HQs and HIs for these receptors at this site are discussed in the uncertainty section. The PAUF for the deer mouse is assigned the default value of one because, as explained in Appendix F, the estimated area covered by a population of deer mice would be smaller than the area of SWMU 21-021. The HQs for deer mice due to cadmium and strontium are discussed in the uncertainty section. After applications of the PAUFs, the HI is <1 for the herbivorous robin, the red fox, and the cottontail. The HI is slightly greater than one for the invertivorous robin and the omnivorous robin. The individual HQs for the invertivorous robin, the omnivorous robin, and the shrew as adjusted by the PAUF are provided in Table 6.5-5 to illustrate which COPECs contribute to the elevated HIs.

Table 6.5-5
Hazard Quotients Adjusted by PAUF for Selected Receptors

Receptor	Invertivorous Robin	Omnivorous Robin	Shrew
Cadmium	0.26	0.14	41.9
Copper	0.34	0.42	0.12
Lead	0.18	0.14	0.30
Mercury (total as inorganic)	0.05	0.04	<0.01
Strontium (stable)	NA	NA	0.46
Zinc	0.47	0.35	0.27
HI for receptor adjusted by PAUF	1.5	1.2	43.1

Note: Black shading = HQ >0.3.

The potential risk to receptors from the COPECs is discussed in the uncertainty section.

(c) Uncertainty Analysis

Screening assessments for ecological risk incorporate a number of assumptions that may be sources of uncertainty.

Viable ecological habitat exists at the site and is being utilized by various ecological receptors. The suite of terrestrial wildlife receptors for which ESLs have been generated is adequate to assess the feeding guilds likely to be encountered at this site. The COPECs at this site include several metals. The exposure pathways considered for this site were ingestion of soil both during feeding and grooming activities, ingestion of compounds through the food chain. For the type and distribution of contaminants seen at this site, these are expected to represent the major pathways for potential exposure. The exposure pathways addressed by the ESL and HQ/HI analysis include all complete exposure pathways with the exception of inhalation and dermal exposure. Although these pathways must contribute to the dose received by plants and animals, it is expected that the contribution of these pathways is relatively small and does not interfere with COPEC determination. Dermal contact and inhalation/respiration pathways have not typically been assessed quantitatively in ecological risk assessments, based on guidance that suggests that the ingestion route is most important to terrestrial animals (EPA 1997, 59370). Inhalation is viewed to be an insignificant pathway for contaminated soil in areas where plants cover the contaminated ground surface or where much of the contamination is buried. Dermal exposure to wildlife is mitigated by the fur or feathers that cover the bodies of most vertebrates. In addition, the incidental consumption of soil during grooming is assumed to be included in the direct soil ingestion estimates. Soil exposure pathway analysis has shown that inhalation and dermal pathways contribute a small fraction of the dose obtained orally

(EPA 2000, 70094). The exposure pathways considered in the development of the ESLs used in screening assessment for this site are likely to capture the primary exposures for wildlife receptors at this site.

Other exposure assumptions made during the screening assessment are very conservative and likely to overestimate the actual exposure of wildlife receptors to the contaminants at this site. The screening process assumes 100% exposure of the receptor to the contaminant representative concentration at the site; this is extremely unlikely for most of the receptor species considered. For those COPECs for which a mean can be calculated, this level is conservatively calculated as the 95% UCL of the mean concentration and the second level of screening also assumes that the receptor spend 100% of its time at the site. Therefore, even the screening using the 95% UCL of the mean concentration is likely to be a conservative estimate of exposure to contaminants at the site. In assessing this site, all samples were included in the data set used to generate representative concentrations.

Additional sources of uncertainty in an ecological risk screening appear in the derivation of the toxicity information and benchmarks for ecological receptors. The toxicity data and uncertainty factors used to develop the ESLs may overestimate the actual toxicity of a chemical to a receptor, particularly when that data is extrapolated from one species to another. In addition, the comparison of site concentrations to ESLs assumes that the chemical species or form occurring at the site is identical to the chemical species used in the toxicity analysis. The screening comparison also assumes that 100% of the chemical is bioavailable to the exposed receptor. Because toxicity testing generally uses more bioavailable and potentially toxic forms of the chemical being studied, the assumptions of speciation and bioavailability are conservative and likely to overestimate the actual risk to wildlife from exposure to the residual contamination. Consideration of the effects of exposure to more than a single chemical at a site is modeled on the assumption of additive effects of chemicals. This assumption could overestimate or underestimate the actual impact of exposure to multiple contaminants due to synergistic or antagonistic effects. No information is available for most chemicals on synergistic or antagonistic effects, therefore almost all risk screenings and assessments assume the effects are additive when multiple chemical contaminants are present.

Lithium. There are no ESLs for lithium, so it cannot be considered quantitatively for potential ecological risk. Lithium was detected in 17 out of 17 samples with similar concentrations among those samples. Because it is a naturally occurring element and present at what appear to be naturally occurring concentrations, lithium is not retained as a COPEC.

Cadmium. The 95% UCL of the mean concentration for cadmium generates HQs greater than one for small mammal receptors: cottontail rabbit, deer mouse, and the vagrant shrew. The LANL background value for cadmium of 0.4 mg/kg is based on the detection limit for cadmium because the data set contains a number of non-detects. However, the values for the detected cadmium concentrations in the LANL background dataset are from 0.2 to 2.6 mg/kg (LANL 1998, 59730) and encompass the range of cadmium values detected at SWMU 21-021 (0.05 to 1.6 mg/kg) and the 2 mg/kg detection limit for many of the cadmium samples. Only 10 % of the cadmium samples had detected concentrations above the BV. In addition, all detected cadmium values at this site lie within the range of soil cadmium concentrations (up to 2 mg/kg) shown for the Western United States in section 5.3 of EPA's Ecological Soil Screening Level Guidance document (EPA 2000, 73306). The levels of cadmium detected in the soils at SWMU 21-021 are reflective of the varying naturally occurring levels in this area. Although these levels are above the ESLs for cadmium in small mammals, these ESLs do not correspond to actual risk to these species because the LANL BV would generate an HQ of 44 and 85 for the deer mouse and the shrew. Because the potential exposure and the HQs generated are similar to those from background, cadmium is not retained as a COPEC.

Calcium. Although calcium was identified in the data review as statistically different from background, this element has not been carried through the ecological screening as potential COPECs because calcium is an essential nutrient.

Mercury. Mercury was not speciated into inorganic mercury and methyl mercury during sampling at this site, but has been speciated in the investigation of another site at the Laboratory, SWMU 0-019 (LANL 2001, 71417.2). The sampling results from that study for the two forms of mercury are presented in Appendix F: these results demonstrate that an average value of 0.2% of mercury is in the methyl mercury form at these dry mesa top sites with little organic matter in the soil. Therefore, it was assumed that 0.2% of the total mercury in samples from this group of SWMUs was in the methyl mercury form. Using this ratio to calculate the potential concentration of methyl mercury yields an exposure concentration of 0.0001 mg/kg; this concentration produces an HQ <0.3 for all receptors. Inorganic mercury produced an HQ greater than 0.3 only for the earthworm, which had an HQ of 1.0. Because only one other COPEC (copper) had an HQ greater than 0.3 for the earthworm, it is unlikely that the HQ between 0.3 and 1.0 reflects ecological risk to the feeding guild represented by the earthworm. Therefore, mercury is not retained as a COPEC.

Silver. Silver generated an HQ >0.3 for only one receptor, the plant. Although the HQ of 79 would indicate possible effects on plants, the vegetation at the site is abundant, diverse, and does not appear to be stressed. Therefore, silver was not retained as a COPEC.

Other metals. The HQs for invertivorous and omnivorous robins for copper and zinc are each less than 0.5, therefore effects to populations of these receptors are unlikely even with both metals present at the site. Copper and zinc were therefore dropped as COPECs for this site. Stable strontium generated an HQ of 0.46 for the shrew. Because all other COPECs for the shrew were eliminated, an HQ<0.5 for this COPEC does not represent a risk to the shrew. Stable strontium also generated an HQ of 1.1 for the deer mouse. Because all other COPECs for the deer mouse have been eliminated for the deer mouse, the strontium HQ can be compared directly to the benchmark of one, not the 0.3 used to screen multiple contaminants. Therefore, stable strontium was not retained as a COPEC.

(d) Interpretation

Nine COPECs (including one COPEC without any ESLs) were identified based on the ecological screening assessment for SWMU 21-021. However, all of these COPECs were eliminated in the uncertainty analysis by considering a number of factors including the likely chemical form of the COPECs, similarity to background concentrations, the magnitude by which the HQ exceeded applicable benchmarks, and the ecological risk decision criteria for the VCA. The decision criteria were no adverse effects on individuals of T&E species and populations of other species. As stated previously these decision criteria are consistent with EPA guidance on risk management for ecological risk assessments (EPA 1999, 70086).

6.5.2 Other Applicable Assessments

6.5.2.1 Surface Water

No permanent surface water exists in the portion of SWMU 21-021 investigated during this IA. Rainfall or melting snow could occasionally result in brief surface runoff events. The site has substantial and widespread vegetation, including shrubs, grasses, and small trees, reducing the likelihood of both runoff and erosion. Even though runoff may occur, it was judged that runoff from this site is likely to infiltrate the ground surface before reaching the drainage in BV Canyon. The potential for soil erosion is low.

6.5.2.2 Groundwater

The regional aquifer beneath SWMU 21-021 is at an elevation of approximately 5900 ft (determined in Test Well 2 in Pueblo Canyon, and in Otowi 4 in Los Alamos Canyon), chiefly within sediments of the Puye and Tesuque Formations (Purtymun 1995, 45344; Broxton et al. 1995, 50119). At the western end of SWMU 21-021 (elevation approximately 7200 ft), the regional aquifer is more than 1200 ft bgs. No perched or alluvial groundwater is known to exist at this SWMU, and runoff and infiltration from SWMU 21-021 are unlikely to reach the regional aquifer.

6.5.2.3 Underground Storage Tanks

No underground storage tanks are present in the portion of SWMU 21-021 included in this report.

6.5.3 Conclusions and Recommendations

The results of the human health risk screening assessment in Section 6.5.1 show that under a residential scenario there is no unacceptable potential risk to human health from residual contamination at SWMU 21-021. The ecological risk screening assessment similarly shows that no COPECs were retained. Therefore no potential unacceptable adverse ecological effects exist due to residual contamination at this site.

Accordingly, the portion of SWMU 21-021 investigated is recommended for NFA under Criterion 5: "The PRS has been characterized or remediated in accordance with current and applicable state or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected land use" (NMED 1998, 57761).

7.0 SWMU 0-030(a)

7.1 Summary

SWMU 0-030(a) is a former septic system associated with the former DP Road storage area. The septic system was the subject of a VCA in 1996. No additional remediation or sampling has been conducted at the SWMU. At the request of the administrative authority (NMED 2003, 73823.1), additional data from sediment samples collected separately in DP Canyon have been compared to the SWMU data to provide additional context for discussion of nature and extent of potential contamination related to the SWMU.

7.2 Description and Operational History

7.2.1 Site Description

SWMU 0-030(a) consists of a septic system and associated inlet and outlet piping that served the fuel dispatch office of the former DP Road storage area (AOC 0-027). The location of the septic system is on private property near the head of DP Canyon, approximately 110 ft north of the Knights of Columbus Hall. It lies partially within the current footprint of AOC 0-027. The 1990 SWMU report lists the size of the septic tank as 6.6 ft by 3.6 ft by 5.75 ft, and indicates that the piping was 4-in.-diameter VCP (LANL 1990, 07511). A 4-in. cast-iron line carried waste from the dispatch office building to the septic tank. The outfall pipe discharged into DP Canyon to the east of the septic tank (LANL 1992, 07667). A large amount of concrete rubble (unrelated to the SWMU) is present in the head of DP Canyon at the projected location of the outfall pipe, so that the field team was unable to locate the outfall point for SWMU 0-030(a). Above-ground structures in the area of the SWMU now include the Knights of Columbus Hall, a parking area (partially paved with concrete), and a microwave tower with associated surface structures.

7.2.2 Operational History

The septic system was installed about 1946 to handle sanitary wastes from the former DP Road storage area fuel dispatch office. The DP Road storage area was used as a fuel tank farm (AOC 0-027) from 1946 until mid-1948, when it was converted into a drum storage area. The septic system may have remained in service until the site was decommissioned in the late 1950s (LANL 1993, 76116). The OU 1071 RFI work plan (LANL 1992, 07667) identified the following as potential contaminants: VOCs, SVOCs, TPH, TAL metals, PCBs/pesticides, uranium-234, uranium-236, plutonium-238, plutonium-239/240, americium-241, and tritium.

7.3 Previous Activities

7.3.1 Previous Investigations

A VCA was conducted in the spring and summer of 1996 to determine whether any COPCs were present at the site. In order to locate the positions of the former structures, a geodetic survey and a geophysical survey were conducted. The geophysical results were inconclusive; therefore, exploratory trenches were excavated to locate the tank or the tank inlet pipe. The foundation of the dispatch office building was located, as well as the inlet pipe into the septic tank. A 4-in.-diameter cast-iron pipe (not VCP as mentioned in the SWMU report and the OU 1071 RFI work plan) was found exiting the dispatch building below the bottom of the foundation at a depth of 9 ft bgs. The septic tank was found by following the pipe, but the pipe ended approximately 32 ft east of the dispatch building foundation. The septic tank was located approximately 45 ft east of the dispatch building foundation at a depth of 9 ft. The tank measured 6.67 ft long by 3.67 ft wide by 5.5 ft deep, thus the bottom of the septic tank was approximately 14.5 ft bgs. A covered manhole was found in the northwest corner of the tank. The manhole was removed and the field team found that the tank had not been backfilled, and contained only 3 to 4 in. of dry sludge. The septic tank was found to be physically intact and devoid of cracks, holes, or other damage that might have allowed release of the contents. The inlet and outlet piping were removed during initial trenching operations (LANL 1996, 59576).

Two samples were collected from outside the tank, and one sample of the dry sludge material was collected from inside the tank at Location 00-05101. One of the external samples was collected beneath the inlet pipe (Location 00-05102) and the other was collected beneath the outlet pipe (Location 00-05103) after the pipes were removed. In accordance with the VCA plan (LANL 1996, 54353) the three samples were submitted for fixed laboratory analysis of VOCs, SVOCs, TPH, TAL metals, PCBs/pesticides, and radionuclides (uranium-234, uranium-238, plutonium-239/240, tritium, and gamma-emitting radionuclides). The samples were analyzed for toxicity characteristic leaching procedure (TCLP) metals (in addition to TAL metals) to provide waste characterization data in the event the decision was made to remove the tank (LANL 1996, 59576).

The outfall from the septic tank was not sampled, but a sample was collected beneath the outlet pipe adjacent to the septic tank. The outfall was not located because of the large amount of concrete debris covering the projected location of the outfall.

A human health screening assessment using the SWMU 0-030(a) data indicated no potential unacceptable risks. The tank was closed according to the regulatory guidance of and concurrence from the NMED Waste Water Bureau. Pathways to ecological receptors are considered incomplete based on the depth of the tank (approximately 14.5 ft bgs), so no ecological screening assessment was necessary. indicated that there was no potential unacceptable risk to human health or ecological receptors at this site. Therefore, the septic system was crushed and left in place as approved by the NMED Waste Water Bureau. Each wall of the tank, including the bottom and the top, was broken into small fragments and mixed with the surrounding debris and fill material. The trench was backfilled with existing fill material, then clean fill and gravel were brought in to level the disturbed areas, and the site was graded (LANL 1996, 59576).

The Canyons Focus Area collected samples of sediment in Reach DP-1 of DP Canyon in 1998 (LANL 1999, 63915). Reach DP-1 is the westernmost reach of the canyon, and these sample locations are downstream of the projected location of the outfall from SWMU 0-030(a), which was never located. The results of analyses of those sediment samples provide additional information related to nature and extent of any releases from the outfall.

The DP Canyon sediment sample data from Reach DP-1 indicate the presence of metals above BVs (cadmium, calcium, chromium, copper, lead, mercury, and zinc; see Table 7.3-1), radionuclides above BVs or fallout values, if available (plutonium-239 and tritium; see Table 7.3-2), and 32 detected organic chemicals (see Table 7.3-3) in Reach DP-1.

Table 7.3-1 provides comparisons among the maximum detected concentrations of inorganic chemicals at SWMU 0-030(a) and in DP Canyon, LANL BVs, and SALs. Seven inorganic chemicals were detected above BV in SWMU 0-030(a) and in Reach DP-1 samples, although not the same seven; 5 chemicals (cadmium, calcium, copper, lead, and zinc) were above BV in both sets of samples. Of those 5 chemicals, the higher values are reported in the SWMU 0-030(a) samples for 3 chemicals (cadmium, copper, and zinc), while the higher values are reported in the DP-1 samples for 2 chemicals (calcium and lead). Silver and vanadium were at or above BVs in SWMU 0-030(a) but not in Reach DP-1; chromium and mercury were above BVs in Reach DP-1 but not in SWMU 0-030(a). No reported concentrations for any inorganic chemicals were above their respective SALs.

Table 7.3-1
Evaluation of Inorganic Data from Reach DP-1 and SWMU 0-030(a)

Analyte	Maximum Detect in Reach DP-1 (mg/kg)	Maximum Detect in SWMU 0-030(a) (mg/kg)	Background Value (mg/kg)	SAL (mg/kg)
Aluminum	5460	14500	29200	74000
Antimony	ND[a,b]	—[c]	0.83	30
Arsenic	3	15.3	8.17	0.39
Barium	135	259	295	5200
Beryllium	0.66	0.88	1.83	150
Cadmium	**0.67**	**1.7**	0.4	70
Calcium	**12000**	**6410**	6120	na[d]
Chromium, total	**20.4**	19	19.3	210
Cobalt	4.2	5.5	8.64	4500
Copper	**15**	**23.9**	14.7	2800
Iron	8460	15900	21500	23000
Lead	**207**	**43.3**	22.3	400
Magnesium	1420	2260	4610	na
Manganese	321	362	671	7800
Mercury	**0.25**	—[c]	0.1	23
Nickel	8.7	10.9	15.4	1500
Potassium	1290	2260	3460	na
Selenium	1.1	0.84	1.52	380
Silver	0.37	**1**	1	380
Sodium	169	574	915	na
Thallium	ND[e]	0.35	0.73	6.1
Vanadium	17.2	**49.5**	39.6	5340
Zinc	**166**	**480**	48.8	23000

Note: Bold text indicates detected value greater than BV.

[a] ND = Not detected.

[b] Detection limit greater than BV in 4 of 18 samples.

[c] Data rejected for data quality reasons.

[d] na = Not available.

[e] Detection limit greater than BV in 6 of 18 samples.

Table 7.3-2
Evaluation of Radionuclide Data from Reach DP-1 and SWMU 0-030(a)

Analyte	Maximum Detect in Reach DP-1 (pCi/g)	Maximum Detect in SWMU 0-030(a) (pCi/g)	Background/Fallout Value (pCi/g)	SAL (pCi/g)
Cesium-137	0.62	ND[a]	1.65	5.3
Plutonium-239/240	0.075	0.445	0.068	44
Strontium-90	0.27	NA[b]	1.04	5.7
Tritium	0.13	0.15	0.766 pCi/ml	880
Uranium-234	1.84	—[d]	2.59	63
Uranium-235	0.105	—[d]	0.2	17
Uranium-238	2.04	—[d]	2.29	93

[a] ND = Not detected.

[b] NA = Not analyzed.

[c] na = Not available.

[d] Data rejected for data quality reasons.

Table 7.3-3
Evaluation of Organic Data from Reach DP-1 and SWMU 0-030(a)

Analyte	Maximum Detect in Reach DP-1 (mg/kg)	Maximum Detect in SWMU 0-030(a) (mg/kg)	SAL (mg/kg)
Acenaphthene	0.24	0.046	2800
Anthracene	0.62	0.071	16000
Aroclor-1254	ND[a]	0.52	1.1
Aroclor-1260	1	0.56	0.22
Benz(a)anthracene	3	0.143	0.62
Benzo(b)fluoranthene	3.8	0.334	0.62
Benzo(a)pyrene	3.2	0.195	0.062
Benzo(g,h,i)perylene	5	0.223	1800
Bis(2-ethylhexyl)phthalate	1.7	0.138	35
Butylbenzylphthalate	0.5	0.077	240
4-Chlorophenyl ether	ND	0.049	na[b]
Chrysene	3.3	0.21	61
DDD [4,4'-]	ND	0.0017	2.4
DDE [4,4'-]	ND	0.0076	1.7
DDT [4,4'-]	0.12	0.0064	1.7
Dibenz(a,h)anthracene	0.98	0.092	0.062
Di-n-butyl phthalate	ND	0.14	6100
Dimethyl phthalate	ND	0.064	100000
Fluoranthene	4.4	0.265	2300
Indeno(1,2,3-cd) pyrene	3.8	0.194	0.062
Phenanthrene	3.2	0.182	1800

Table 7.3-3 (continued)

Analyte	Maximum Detect in Reach DP-1 (mg/kg)	Maximum Detect in SWMU 0-030(a) (mg/kg)	SAL (mg/kg)
Pyrene	12	0.263	1800
Toluene	ND	0.001	180
TPH	NA[c]	90	na
Carbazole	0.5	ND	24
α-Chlordane	0.25	ND	1.6
γ-Chlordane	0.18	ND	1.6
Fluorene	0.047	ND	2100
Heptachlor Epoxide	0.11	ND	0.053
2-Methylnaphthalene	0.046	ND	53
Naphthalene	0.62	ND	53
Organics, diesel range	680	NA	na

[a] ND = Not detected.

[b] na = Not available.

[c] NA = Not analyzed.

The 1999 reach report (LANL 1999, 63915) data for Reaches DP-2, DP-3, and DP-4 show that concentrations of inorganic chemicals generally decrease with distance downstream, and concludes that "the nature and spatial trend of inorganic COPCs in DP Canyon largely indicate that the cumulative effects of urban activity within the Los Alamos townsite are responsible for many of the inorganic COPCs."

Plutonium-239/240 and tritium are COPCs in both SWMU 0-030(a) and in Reach DP-1. Uranium-234 and uranium-238 were reported in 1996 to have been detected slightly above BV in one sample from SWMU 0-030(a). When the 1996 SWMU 0-030(a) data were screened in 2003 using current standards for data quality, the uranium-234 and uranium-238 results were rejected because of data quality issues. Plutonium-239/-240, and tritium were detected at concentrations slightly above background value in Reach DP-1. One possible explanation for these slightly elevated concentrations is stack emissions or other airborne deposition of these contaminants from TA-21 sources. This explanation seems likely based on the elevated concentrations detected in a 'baseline' study of mesa-top soils at TA-21, which showed elevated isotopic plutonium, uranium, and tritium levels in soils surrounding the main TA-21 industrial complex (LANL 1997, 58239).

Table 7.3-2 presents comparisons among the maximum detected concentrations of radionuclides at SWMU 0-030(a) and in DP Canyon, and LANL BVs/fallout values. The maximum concentrations of tritium are similar in both SWMU 0-030(a) and Reach DP-1, while plutonium was detected at a higher concentration in SWMU 0-030(a).

Sixteen organic chemicals (acenaphthene, anthracene, Aroclor-1260, benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, benzo(g,h,i)perylene, bis(2-ethylhexyl)phthalate, butylbenzylphthalate, chrysene, DDT, dibenz(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene) were detected in both the SWMU 0-030(a) samples and in the reach DP-1 sediment samples. Eight organic chemicals detected in SWMU 0-030(a) but not in the sediment samples are Aroclor-1254, 4-chlorophenyl ether, DDD, DDE, di-n-butyl phthalate, dimethyl phthalate, toluene, and

TPH (TPH analyzed as diesel range organics in sediment samples). Detected organic chemicals are listed in Table 7.3-3.

7.4 Remedial Activities

7.4.1 Investigative Activities During VCA

No additional investigative activities were conducted at SWMU 0-030(a) during the 2002 VCA. The data from samples collected in 1996 have been reevaluated using current background values, and data obtained from sediment samples in Reach DP-1 of DP Canyon have been compared to the SWMU 0-030(a) data. Comparing the 1996 data to current background values did not result in any changes to the list of analytes that were detected at levels above BVs as reported in the 1996 VCA report.

7.4.2 Remediation Activities

No additional remediation activities were conducted at SWMU 0-030(a) during this VCA.

7.4.3 Nature and Extent of Contamination

The analytical results for SWMU 0-030(a), reported in the VCA Completion Report (LANL 1996, 59576) indicate the presence of several COPCs. Inorganic chemicals detected at or above BVs are cadmium, calcium, copper, lead, silver, vanadium, and zinc (Table 7.3-1). Plutonium-239/240 and tritium were the only radionuclides detected (Table 7.3-2); uranium-234 and -238 results were rejected for data quality reasons. Twenty-four organic chemicals were detected at SWMU 0-030(a), and 24 in the reach DP-1 sediment samples (Table 7.3-3); 16 organic chemicals were detected in both sample sets. The highest concentrations of most of the detected chemicals are in the dry sludge sample collected from within the septic tank. Although no samples were collected beneath the septic tank, the concrete tank walls, floor, and top were reported to be in good condition with no visible holes or cracks that might have allowed leakage from the tank.

Because the septic system was connected to an outfall in DP Canyon, sample data from Reach DP-1, collected in 1998 by the Canyons Focus Area were evaluated in support of determining nature and extent for SWMU 0-030(a). The septic system has been inactive since the late 1950s, when the DP Road storage area was decommissioned, so any releases from the outfall to the canyon were probably subject to dilution, redistribution, and/or downstream transport by storm water runoff for approximately 40 yr prior to collection of sediment samples in 1998. Therefore the potential relationship between any SWMU 0-030(a) releases and contaminants detected in Reach DP-1 sediment samples is uncertain.

The nature and concentrations of inorganic and radionuclide COPCs in SWMU 0-030(a) and Reach DP-1 are similar. For most chemicals, including those that were not detected above BVs, the maximum concentration is higher in the dry sludge from SWMU 0-030(a) than in Reach DP-1 sediment. Calcium and lead were detected at significantly higher maximum concentrations in Reach DP-1, and cesium-137 was detected in sediment samples but not in SWMU 0-030(a) samples. There are greater differences in the nature and concentrations of detected organic chemicals between the two data sets. Sixteen organic chemicals were detected in both the SWMU 0-030(a) samples and the Reach DP-1 samples, while each sample set includes 8 organic chemicals that were not detected in the other set. For most of the chemicals that were detected in both sets, the maximum detected concentration in the sediment samples is approximately an order of magnitude higher than the maximum in the septic system samples (Table 7.3-3).

The nature and extent of contamination at SWMU 0-030(a) is sufficiently defined by the samples collected at the site during the 1996 VCA, and by the Reach DP-1 sediment samples collected in 1998. Inorganic and organic contaminants in DP Canyon sediments are interpreted as being derived from non-Laboratory sources (oils and other petroleum products and metals from industrial, commercial, residential, and automotive sources) in the Los Alamos townsite, while radionuclides in the sediments are believed to be a result of historical stack emissions of radionuclides from facilities at TA-21(LANL 1999, 63915; Section 3.2). Some portion of the contaminant inventories in DP Canyon may have been derived from undocumented releases from SWMU 0-030(a) prior to 1960. Whether or not that is the case, the nature and extent of residual contamination at SWMU 0-030(a) are bounded within the general decreasing concentrations of COPCs with distance downstream in DP Canyon (LANL 1999, 63915).

7.5 Site Assessments

7.5.1 Screening Assessments

7.5.1.1 Human Health

A human health screening assessment was conducted and reported in the 1996 VCA Completion Report (LANL 1996, 59576). The results of that assessment indicate that no unacceptable potential for adverse human health effects exists at the site. No additional screening assessment was performed for SWMU 0-030(a).

7.5.1.2 Ecological

No ecological screening assessment was performed following the 1996 VCA because no complete pathways to ecological receptors existed from a depth of approximately 14 ft bgs, the depth of the bottom of the septic tank. Conditions have not changed at the site, and no complete pathways currently exist, as documented by the ecological scoping checklist included in the VCA/IA plan (LANL 2002, 73579).

7.5.2 Other Applicable Assessments

7.5.2.1 Surface Water

SWMU 0-030(a) was evaluated for surface water runoff and erosion potential on September 28, 2001, and received an erosion matrix score of 8.8 with BMPs in place, indicating low erosion potential. The surface water runoff subscore for SWMU 0-030(a) is zero, indicating that surface runoff is not a factor for this SWMU. Infiltration from rain events and snowmelt is the only aspect of surface water hydrology that potentially affects the SWMU, and it is unlikely that infiltration from the surface would reach the depth of the former tank. There is no outfall connected to the septic system that could allow releases of any residual contaminants to surface water in DP Canyon. Concrete pavement prevents surface erosion or infiltration from much of the surrounding area.

7.5.2.2 Groundwater

The regional aquifer beneath SWMU 0-030(a) is at an elevation of approximately 5900 ft (determined in Test Well 2 in Pueblo Canyon, and in Otowi 4 in Los Alamos Canyon), chiefly within sediments of the Puye and Tesuque Formations (Purtymun 1995, 45344; Broxton et al. 1995, 50119). More than 1200 ft of tuff and volcaniclastic sediments separate the ground surface from the regional aquifer. Infiltration from the SWMU is unlikely to reach the regional aquifer.

Alluvial groundwater exists only within two limited segments of DP Canyon, reach DP-2 and lower reach DP-4 (LANL 1999, 63915). No alluvial groundwater is known to exist in reach DP-1 or in the vicinity of SWMU 0-030(a).

7.5.2.3 Underground Storage Tanks

No underground storage tanks are present at SWMU 0-030(a).

7.5.3 Conclusions and Recommendations

Sediment deposits in Reach DP-1 of DP Canyon to the east of the SWMU were sampled and analyzed for a broad range of analytes by the Canyons Focus Area (LANL 1999, 63915). Comparisons of those data to the data from SWMU 0-030(a) samples show similarities in the lists of inorganic and radionuclide COPCs, with the maximum detected concentration in SWMU 0-030(a) generally higher than in the maximum in Reach DP-1. For organic chemicals, the maximum detected concentration was typically much higher in Reach DP-1 sediment samples than in SWMU 0-030(a). In addition, there were 8 analytes detected in each of the organic data sets that were not detected in the other. The reach report concludes on the basis of data from all reaches of DP Canyon that inorganic and organic contaminants in the sediment samples are derived from non-Laboratory sources in the Los Alamos townsite. These contaminants are not considered indicators of releases from Laboratory SWMUs and are not considered key contaminants for the purpose of developing a revised site conceptual model by interpreting their spatial distribution or sediment transport dynamics in DP Canyon. The report also states that much of the radionuclide contamination in DP Canyon can be attributed to historical airborne releases from stacks at TA-21 (LANL 1999, 63915).

On the basis of data from SWMU 0-030(a), the site's current condition, and data from DP Canyon sediment samples, it is unlikely that the SWMU has contributed contaminants to DP Canyon since it was removed from service, although it is possible that some small portion of the existing contaminant inventory in the canyon was derived from potential, but undocumented, SWMU 0-030(a) releases prior to about 1960. The intact condition of the septic tank when it was sampled, and the data from samples outside the tank, indicate that no releases had occurred during or after operation of the tank except possibly through the outfall to DP Canyon while the tank was in use. The outfall pipe, the outfall end of which was never located due to concrete debris lining the upper part of DP Canyon, was disconnected from the tank at the time of the VCA in 1996 and does not currently represent a potential pathway for contaminant migration.

The septic tank at SWMU 0-030(a) was crushed and backfilled in place in 1996, with concurrence from the New Mexico State Drinking Water Bureau. As reported in the VCA Completion Report (LANL 1996, 59576), the site presents no potential unacceptable risk to human health from residual contaminants at the site, which are located beneath approximately 14 ft of backfill. There are no complete pathways from the site to ecological receptors, so there is no potential ecological risk from the SWMU in its current condition.

SWMU 0-030(a) is recommended for NFA under Criterion 5: "The site has been characterized or remediated in accordance with current and applicable state or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected land use" (NMED 1998, 57761).

8.0 WASTE MANAGEMENT

The waste generated during this VCA/IA consisted of both waste with detectable radioactivity but not meeting the criteria for low-level waste, and requiring no special transportation or shipping procedures, and low level radioactive waste. A total of approximately 1080 ft^3 of waste was removed from all the SWMUs/AOCs involved (excluding AOC 0-027, where the SVE system is still in operation). The waste consisted of vitrified clay pipe, steel pipe, and minor amounts of soil. The waste streams were packaged and transported in separate 20-yd^3 roll-off containers and disposed of at LANL TA-54, Area G.

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Appendix A

Acronyms, Glossary, and Metric Conversion Table

APPENDIX A ACRONYMS, GLOSSARY, AND METRIC CONVERSION TABLE

ACRONYMS

AOC	area of concern
AUF	area-use factor
bgs	below ground surface
BV	background value
COPC	chemical of potential concern
COPEC	chemical of potential ecological concern
DDE	dichlorodiphenyldichloroethylene
DDD	dichlorodiphenyldichloroethane
DDT	p,p'-dichlorodiphenyltrichloroethane
DOE	(US) Department of Energy
EDL	estimated detection limit
EM	electromagnetic
EPA	(US) Environmental Protection Agency
EQL	estimated quantitation limit
ER	Environmental Restoration
ESL	ecological screening level
FIMAD	Facility for Information Management, Analysis, and Display
FV	fallout value
FY	fiscal year
GAC	granular activated carbon
GPS	global positioning system
HI	hazard index
HSWA	Hazardous and Solid Waste Amendments
IA	interim action
LANL	Los Alamos National Laboratory
MCAL	mobile chemical analytical laboratory
MCE	multiple chemical evaluation
MDA	material disposal area
mrem	millirem
MTL	materials testing laboratory
NFA	no further action
NMED	New Mexico Environmental Department

NOAEL	no observed adverse effect level
OU	operable unit
PAH	polycyclic aromatic hydrocarbon
PAUF	population area-use factor
PCB	polychlorinated biphenyl
PEST	pesticide
PID	photoionization detector
ppm	parts per million
PRS	potential release site
PVC	polyvinyl chloride
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
RCRA	Resource Conservation and Recovery Act
RFI	RCRA facility investigation
SAL	screening action level
SAP	sampling and analysis plan
SMO	sample management office
SOP	standard operating procedure
SVE	soil vapor extraction
SVOC	semivolatile organic compound
SWMU	solid waste management unit
TA	technical area
TAL	target analyte list
TCLP	toxicity characteristic leaching procedure
TPH	total petroleum hydrocarbons
TSCA	Toxic Substances Control Act
UCL	upper confidence limit
UST	underground storage tank
UTL	upper tolerance limit
VCA	voluntary corrective action
VCP	vitrified clay pipe
VOC	volatile organic compound
XRF	x-ray fluorescence

GLOSSARY

Absorption. The penetration of substances into the bulk of a solid or liquid.

Accelerated cleanup. An action taken at a site ahead of the ER Project prioritized, planned schedule. Accelerated actions may include removal, protection, hardening, installation of best management practices, or collection of characterization date. Accelerated actions may or may not be a final remedy for the site.

Accuracy. The extent to which the results of a calculation or measurement approach the true values of the calculated or measured quantities, and are free from error.

Administrative authority. The federal or state agency that reviews and approves the corrective action process for each PRS at the Laboratory. The New Mexico Environment Department (NMED) is the administrative authority for PRSs that are contaminated by hazardous chemicals and therefore are listed on the Laboratory's RCRA Hazardous Waste Facility permit. The Department of Energy (DOE) provides oversight for PRSs with radiological contamination.

Adsorption. The surface retention of solid, liquid, or gas molecules, atoms, or ions by a solid or liquid.

Aggregate. Physical delineation within a watershed that is used for grouping contaminated sites for the purposes of planning and implementing the Laboratory's ER Project corrective action process in a more efficient and systems-oriented manner.

Alluvial. Said of materials or features deposited by running water.

Alluvium. Clay, silt, sand, gravel, or other rock materials transported by water and deposited in fairly recent geologic time as sorted or semisorted sediments in riverbeds, flood plains, lake shores, and fans at the base of mountain slopes.

Alpha radiation. Radiation composed of alpha particles emitted during the radioactive decay of certain nuclides. The least penetrating of the three common types of radiation (alpha, beta, and gamma), alpha radiation can be blocked easily (for example by a sheet of paper or the outer layer of skin).

Analysis. A process used to measure one or more attributes of a sample in a clearly defined, controlled, systematic manner. Often requires treating a sample chemically or physically before measurement.

Analyte. The particular chemical or radiochemical species to be identified and/or quantified.

Analytical laboratory data qualifiers. Data qualifiers that are attached to sample results by the analytical laboratory that performed the sample analysis.

The following letter qualifier flags are for **inorganic analyses**:

"U" The compound was analyzed for but was not detected. The associated numerical value is the estimated detection limit.

"B" The reported value was obtained from a reading that was less than the estimated detection limit but greater than or equal to the instrument detection limit.

"E" The reported value is estimated because of the presence of interference.

"M" Duplicate injection precision was not within control limits.

"N" Spiked sample recovery was not within control limits.

"S" The reported value was determined by the Method of Standard Additions.

"W" Post-digestion spike for GFAA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.

- "*" Duplicate sample analysis was not within control limits.
- "+" Correlation coefficient for the Method of Standard Additions is less than 0.995.

The following letter qualifier flags are for **organic analyses**:

- **"U"** The compound was analyzed for but was not detected. The reported numerical value is the estimated quantitation limit.
- **"J"** Indicates an estimated value. The "J" flag is used if the compound is present but the result is less than the sample estimated quantitation limit and greater then the instrument detection limit.
- **"B"** The analyte was found in the associated method blank as well as in the sample.
- **"E"** The concentrations of the analyte exceeded the calibration range of the instrument.
- **"D"** The analyte was identified in an analysis at a secondary dilution factor.
- **"C"** Identification of a pesticide/PCB has been confirmed by GC/MS.
- **"P"** The percent difference between a pesticide/PCB result obtained on the primary and secondary columns was greater than 25%.
- **"N"** There is presumptive evidence of the presence of a tentatively identified compound based on mass spectral matching.
- **"A"** A tentatively identified compound is a suspected aldol-condensation product.

Aquifer. A permeable body of geologic material capable of yielding groundwater to wells or springs.

Ash-flow tuff. A tuff deposited by a hot dense volcanic current. Ash-flow tuff can be either welded or nonwelded.

Area of concern (AOC). An area at the Laboratory known, or suspected, to be contaminated with radionuclides but not contaminated by hazardous chemicals or hazardous waste.

Background level. The naturally occurring levels of an inorganic chemical or naturally occurring radionuclides in soil, sediment, and tuff.

Background value (BV). Background values exist for inorganic chemicals and radionuclides. The background values are the upper tolerance limits (UTLs) of background sample results, calculated as the upper 95% confidence limit for the 95th percentile. In cases where a UTL cannot be calculated, either the detection limit or maximum reported value is used as a BV. Background values are used as simple threshold numbers to identify potentially contaminated site sample results as greater than background levels.

Barrier. Any material or structure that prevents or substantially delays movement of solid-, liquid-, or gaseous-phase chemicals in environmental media.

Best management practice (BMP). For facilities that manufacture, use, store, or discharge toxic or hazardous pollutants as defined by the 1977 Clean Water Act, a required program to control the potential spill or release of those materials to surface waters.

Beta radiation. Radioactive transformation of a nuclide in which the nucleus emits a beta particle (electron or positron). Beta radiation can be blocked by an inch of wood or by a thin sheet of aluminum.

Bias. (1) The degree to which the value obtained for a measured parameter deviates from the value accepted as the true, or reference, value. (2) A systematic deviation from the true value that remains constant over replicated measurements within the statistical precision of the measurement process.

Blank sample. A sample expected to have negligible or unmeasurable amounts of analytes. Results of blank sample analyses indicate whether or not field samples might have been contaminated during one or more steps of the sample collection, transport, storage, preparation and analysis process.

Calibration. A process used to identify the relationship between the true, or reference, analyte concentration or other variable and the response of a measurement instrument, chemical analysis method, or other measurement system.

Characterization, characterization process. See **site characterization**

Chemical. Any naturally occurring or man-made substance characterized by a definite molecular composition, including molecules that contain radionuclides.

Chemical of concern. Chemical identified as a potential risk during a site-specific, human-health, or ecological risk assessment.

Chemical of potential concern (COPC). Chemical, detected at a site, that has the potential to adversely affect human and/or ecological receptors due to its concentration, distribution, and mechanism of toxicity. A COPC remains a concern until exposure pathways and receptors are evaluated in a site-specific risk assessment.

Chemical of potential ecological concern (COPEC). A chemical, detected at a site, that has the potential to adversely affect ecological receptors due to its concentration, distribution, and mechanism of toxicity.

Cleanup. Any action that physically removes or treats a hazardous substance that threatens or potentially threatens human health and welfare and the environment. Cleanup actions may include covering and containing a source of contamination to prevent its spread, placing controls on future land use, and excavating and/or treating the contamination source.

Cleanup levels. Media-specific contaminant concentration levels that must be met by a selected corrective action. Cleanup levels are established by using criteria such as protection of human health and the environment; compliance with regulatory requirements; reduction of toxicity, mobility, or volume through treatment; long-and short-term effectiveness; implementability; cost; and public acceptance.

Conceptual model. See also ***Site conceptual model.***

Constituent. Any compound or element present in environmental media, including both naturally occurring and man-made elements.

Contaminant. Any chemical (including radionuclides) present in environmental media or on structural debris at a concentration that may present a risk to human health or the environment.

Contamination. Substances introduced into the environment as a result of people's activities, regardless of whether the concentration is a threat to health (see pollution).

Controlled area or property. Laboratory area to which access is controlled to protect individuals from exposure to radiation and/or hazardous materials.

Corrective action. An action taken to rectify conditions adverse to human health or the environment. Corrective actions are considered complete at a site when

- The ER Project has demonstrated and documented that the site either poses no risk to humans and ecological receptors or that the risk is acceptable, or that a final remedy has been evaluated, selected, and implemented to reduce or eliminate risk, and
- The administrative authority has concurred.

Corrective action process. One or more of a series of activities (initial site assessment, site characterization, interim actions, evaluation of remedial alternatives, and implementation of selected remedy); also refers to RCRA facility assessments, RFIs, corrective measures studies, and corrective measures implementations.

Cumulative risk. Risk that integrates multiple sources, effects, pathways, and contaminants through common human and ecological receptors, points of compliance, and/or times of compliance.

Curie. A unit of radioactivity defined as that quantity of any radioactive nuclide that has an activity of 3.7 x 10^{10} disintegrations per second.

Data quality assessment. A statistical and scientific evaluation of the data set to assess the validity and performance of the data collection design and statistical test, and to establish whether a data set is adequate for its intended use.

Data quality objectives (DQOs). The qualitative and quantitative goals that are developed before sampling begins that clarify the investigation objectives and identify the type, quantity and quality of data needed to support decisions.

Data validation. A systematic process that applies a defined set of performance-based criteria to a body of data that may result in qualification of the data. This process is performed independently of the analytical laboratory generating the data set and occurs prior to drawing a conclusion from the data. It may comprise a standardized review (routine validation) and/or a problem-specific review (focused validation) of the data.

Detection limit. Minimum concentration that can be determined by a single measurement by an instrument; implies a specified statistical confidence that the analytical concentration is greater than zero.

Discharge (as defined under RCRA, 40 CFR 260.10). Accidental or intentional spilling, leaking, pumping, pouring, emitting, emptying, or dumping of hazardous waste into or on any land or water.

Disposal. Discharging, depositing, injecting, dumping, spilling, leaking, or placing any solid waste or hazardous waste into or on any land or water so that such solid or hazardous waste, or any constituent thereof, may enter the environment, be emitted into the air, or discharged into any waters, including groundwaters.

U.S. Department of Energy (DOE). The federal agency that sponsors energy research and regulates nuclear materials for weapons production.

Dose. The quantity of radiation absorbed, per unit of mass, by the body or by any portion of the body.

Dose equivalent. An estimate of the amount of biological damage (in rems) done by the deposition in tissue of a given unit of absorbed radiation dose.

Ecological screening level (ESL). An organism's exposure-response threshold for a given chemical constituent. It is the concentration of a substance in a particular medium that corresponds to a hazard quotient (HQ) of 1.0 for a given organism and below which no risk is indicated.

Effluent. Liquid discharged as a waste, such as contaminated water from a factory or the outflow from a sewage works; water discharged from a storm sewer or from land after irrigation.

U.S. Environmental Protection Agency (EPA). The federal agency responsible for enforcing environmental laws. While state regulatory agencies may be authorized to administer some of this responsibility, EPA retains oversight authority to ensure protection of human health and the environment.

Environmental surveillance. Collection and analysis of samples of air, water, soil, foodstuffs, biota, and other media to determine the environmental quality of an industry or community. Environmental surveillance commonly is performed at sites that contain nuclear facilities.

Eolian. Pertaining to the wind, especially said of sediment deposition by the wind, of structures such as wind-formed ripple marks, or of erosion accomplished by the wind.

Ephemeral stream. Said of a stream or spring that flows only during and immediately after periods of rainfall or snowmelt.

Equipment blank. A blank sample that is used to rinse the sample collection equipment and is then transferred to a sampling container. The equipment blank is collected after equipment decontamination is completed but prior to collection of another field sample.

Erosion. Wearing away the land surface by natural agents such as moving water, wind, organisms, and gravity that involved the transport of rock debris.

Estimated quantitation limit. The lowest concentration that can be reliably achieved within specified limits of precision and accuracy during routine analytical laboratory operating conditions. Sample estimated quantitation limits are highly matrix-dependent, and the specified estimated quantitation limits might not always be achievable.

Exposure pathway. An exposure pathway outlines the route a contaminant may follow to reach humans. Contaminants may enter the local environment by air or water and pass through soil, plants, livestock, or wildlife, ultimately reaching humans through inhalation (breathing), ingestion (eating and drinking) or adsorption through skin or wounds.

Exposure unit. The bounded area or volume within which a person or other receptor may be exposed to contaminants that have been released to the environment.

Field blank. A blank sample either prepared in the field or carried to the sampling site, exposed to sampling conditions (e.g., bottle caps removed, preservatives added), and returned to a laboratory for analysis in the same manner in which environmental samples are analyzed. Used to identify the presence of contamination potentially added during the sampling and analysis process.

Field duplicate. A second sample collected as near as possible to the original sample.

Gamma radiation. A form of electromagnetic, high-energy radiation emitted from a nucleus. Gamma rays are essentially the same as e-rays and require heavy shielding, such as concrete or steel, to be blocked.

Geohydrology. The science that applies hydrologic methods to the understanding of geologic phenomena.

Grab sample. A specimen collected by a single application of a field sampling procedure to a target population, e.g. the surface soil from a single hole collected following the spade and scoop sampling procedure, or a single air filter left in the field for three months.

Groundwater. Water found beneath the surface of the ground. Groundwater usually refers to a zone of complete water saturation containing no air.

Half-life. The time required for one-half of the radioactive atoms initially present in a sample to decay. Each radionuclide has a characteristic half-life ranging from a fraction of a second to thousands of years.

Hazardous and Solid Waste Amendments (HSWA) Module. Module VIII of the Laboratory's RCRA Hazardous Waste Facility Permit. The permit allows the Laboratory to operate as a treatment, storage, and disposal facility. Module VIII regulates the cleanup of inactive sites and the activities of the ER Project for those PRSs listed on the permit.

Hazardous substance (As defined by 40 CFR 302.3). Any substance designated pursuant to 40 CFR 302. 40 CFR 302.4 – Designation of Hazardous Substances:

(a) *Listed hazardous substances.* The elements, compounds and hazardous wastes appearing in Table 302.4 are designated as hazardous substances under section 102(a) of the CERCLA.

(b) *Unlisted hazardous substances.* A solid waste, defined in 40 CFR 261.2, which is not excluded from regulation as a hazardous waste under 40 CFR 261.4(b), is a hazardous substance under section 101(14) of the CERCLA if it exhibits any of the characteristics identified in 40 CFR 261.20 through 261.24. Note: This definition incorporates by reference, substances listed in CWA sections 311 and 307(a); CAA section 112; RCRA section 3001; and TSCA section 7.

Hazardous waste (As defined by RCRA 40 CFR261.3). Any solid waste is generally a hazardous waste if it

- is not excluded from regulation as a hazardous waste;
- is listed in the regulations as a hazardous waste;
- exhibits any of the defined characteristics of hazardous waste (ignitability, corrosivity, reactivity, or toxicity); or
- is a mixture of solid waste and hazardous waste.

Although the legal definition of hazardous waste is complex, the term generally refers to any waste that the EPA believes could pose a threat to human health and the environment if managed improperly.

High-explosives (HE). The three most common high explosive substances found at the Laboratory are RDX (Royal Demolition eXplosive), TNT (2,4,6-initrotoluene), and HMX (High Melting eXplosive). These highly explosive materials do not occur naturally in the environment and are all used in making military shells, bombs, and grenades. Exposures to these materials are rare because they are generally used in controlled areas. People can be exposed to these chemicals by breathing dust contaminated with the materials, getting it on their skin, or drinking contaminated water.

Holding time. The maximum elapse of time that one can expect to store a sample without unacceptable changes in analyte concentrations. Holding times apply under prescribed storage conditions and deviations in storage conditions may affect the holding time. Extraction Holding Time refers to the time lapse from sample collection to sample preparation; Analytical Holding Time refers to the time lapse between sample preparation and analysis.

HSWA module. A portion of the Laboratory's permit to operate under RCRA that contains requirements specific to Los Alamos National Laboratory. It is this portion of the permit that contains the list of solid waste management units that must be cleaned up in accordance with RCRA procedures.

Hydrogeology. The science that applies geologic methods to the understanding of hydrologic phenomena.

Industrial use scenario. Industrial use is the future use scenario in which current Laboratory operations continue. Any necessary remediation involves cleanup to standards designed to ensure a safe and healthy work environment for Laboratory workers.

Infiltration. Entry of water into the ground.

Inorganic chemical. Compounds of elements other than carbon such as hexavalent chromium (the form of chromium in a valence state of +6).

Interim measures. Those activities used to control or lessen ongoing risks to human health or the environment in advance of a final cleanup solution. The actions used to achieve the goal of stabilization at contaminated sites that present serious and immediate health hazards.

In situ stabilization. A cleanup strategy that leaves the contaminants in place but unable to migrate or be released into the environment.

Institutional controls. Controls prohibiting or limiting access to contaminated media; may consist of deed restrictions, use restrictions, permitting requirements, etc.

Interference. A chemical or physical entity whose influence results in a decrease or increase in the response of an analytical method or other measurement system relative to the response obtained in the absence of the entity.

Intermittent stream. Said of a stream that flows only in certain reaches due to losing and gaining characteristics of the channel bed.

Laboratory duplicate sample. The portions of a sample taken from the same sample container, prepared for analysis and analyzed independently but under identical conditions. Each duplicate sample is expected to be equally representative of the original material.

LANL data validation qualifiers. Data qualifiers used in the LANL ER Project baseline validation process are as follows:

"A"	Contractually required data are not available for data review and evaluation.
"U"	The analyte was analyzed for but not detected.
"J"	The analyte was positively identified, and the associated numerical value is estimated to be more uncertain than would normally be expected for that analysis.
"J+"	The analyte was positively identified, and the result is likely to be biased high.
"J-"	The analyte was positively identified, and the result is likely to be biased low.
"UJ"	The analyte was not positively identified in the sample, and the associated value is an estimate of the sample-specific detection or quantitation limit.
"RPM"	Without further review of the raw data, the sample results are unusable due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. Presence or absence cannot be verified. Any results qualified as RPM must be evaluated for relevance to data use.
"P"	Professional judgment should be applied to using the data in decision-making.
"PM"	Professional judgment should be applied to using the data in decision-making. A manual review of raw data is recommended t determine if the defect impacts data use for decision-making.
"R"	The data is rejected as a result of major problems with quality assurance/qualify control (QA/QC) parameters.

Long-term surveillance and monitoring. Collecting periodic measurements over time to assess status and trends.

Long-term maintenance. Maintaining the conditions and assumptions under which risk-based decisions were made.

Material disposal area (MDA). An area used any time between the beginning of Laboratory operations in the early 1940s and the present for disposing of chemically and/or radioactively contaminated materials.

Matrix. See also *sample matrix.*

Matrix spike. An aliquot of sample spiked with a known concentration of target analyte(s). The spiking typically occurs before sample preparation and analysis.

Matrix spike duplicate. An intralaboratory duplicate sample spiked with a known amount of target analyte(s). Spiking occurs prior to sample preparation and analysis.

Media/medium (environmental). Any material capable of absorbing or transporting constituents including tuffs, soils and sediments derived from these tuffs, surface water, groundwater, air, structural surfaces, and debris.

Medium (geological). The solid part of the hydrogeological system; may be unsaturated or saturated.

Method. A body of procedures and techniques for systematically performing an activity.

Method blank. An analyte-free matrix to which all reagents are added in the same volumes or proportions as those used in the environmental sample processing and which is prepared and analyzed in the same manner as the corresponding environmental samples. The method blank is used to assess the potential for contamination to the sample during preparation and analysis.

Method detection limit (MDL). The minimum concentration of a substance that can be measured and reported with a known statistical confidence that the analyte concentration is greater than zero. The MDL is determined from analysis of samples of a given matrix type containing the analyte after subjecting the sample to the usual preparation and analyses. The MDL is used to establish detection status.

Migration. The movement of inorganic and organic species through unsaturated or saturated materials.

Migration pathway. A route (e.g., a stream or subsurface flow path that controls the potential movement of contaminants to environmental receptors (plants, animals, humans).

Mixed waste. Waste that contains both hazardous waste (as defined by RCRA and its amendments) and radioactive waste (as defined by the AEA and its amendments).

Model. A mathematical approximation of a physical, biological, or social system.

Monitoring well. A well drilled at a specific location on or off a hazardous waste site for the purpose of sampling groundwater or measuring water levels. Typically constructed with a moderate screen interval placed so as to straddle the water table or potentiometric surface associated with the saturated zone of interest.

Nature and extent of contamination. The "nature" of contamination is the chemicals (naturally occurring or man-made) present in or that have been released to the environment and are determined by detection of a chemical in one or more environmental samples. In the case of naturally occurring or widespread man-made chemicals, detection is determined by comparison to background levels. The "extent" of contamination means how much of a given chemical is present in the environment and is determined by comparison to site baseline values, if applicable, and/or analysis of trends in the data.

No further action (NFA). A decision that no further investigation or remediation is warranted for a PRS, based on risk levels for residential use, recreational use, or industrial use. NFA recommendations are based on one or more of the following criteria:

- The site does not exist, is a duplicate of another site, cannot be located, or is located within another site and has been or will be investigated as part of that site
- The site was never used for the management (i.e., generation, treatment, storage, or disposal) of RCRA solid or hazardous wastes and/or constituents.

- The site is not known to have released nor is it suspected of releasing or having released RCRA solid or hazardous wastes and/or constituents to the environment.
- The site is regulated under another state and/or federal authority. If the site is known to have released or is suspected of releasing or having released RCRA solid or hazardous wastes and/or constituents to the environment, it has been or will be investigated and/or cleaned up in accordance with applicable state and/or federal regulations.
- The site was characterized or cleaned up in accordance with current applicable state and/or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk, assuming current and projected future land use.

Notice of deficiency (NOD). A notice issued to DOE and the Laboratory by the administrative authority which states that some aspect(s) of a plan, report, or application does not meet their requirements or that requires clarification or correction.

Operable unit (OU). At LANL, one of 24 areas originally established for administering the ER Project. Set up as groups of potential release sites, the OUs were aggregated based on geographic proximity for the purpose of planning and conducting the cleanup effort. As the project matured, it became apparent that 24 were too many to allow efficient communication and to ensure consistency in approach. Therefore, in 1994, the 24 OUs were reduced to six administrative "field units".

Organic chemical. Compound of elements that contains carbon such as carbon dioxide.

Outfall. The vent or end of a drain, pipe, sewer, ditch, or other conduit that carries wastewater, sewage, storm runoff, or other effluent into a stream.

Perched groundwater. Groundwater that lies above the regional water table and is separated from it by an unsaturated zone.

Percolation. Gravity flow of groundwater through the pore spaces in rock or soil below the ground surface.

Perennial Stream. Said of a stream or reach that flows continuously throughout the year.

Permit modification. A request by either the permittee or the administrative authority to change a condition of the Laboratory's RCRA Hazardous Waste Facility permit.

Pollutant. Any substance, produced and released into the environment as a result of human activity, that has damaging effects on humans or ecological receptors.

Polychlorinated biphenyls (PCB). PCBs are either oily liquids or solids and are colorless to light yellow in color. They have no known smell or taste. There are no known natural sources of PCB. These mixtures of individual chemicals are no longer produced in the US but are still found in the environment. They are chemically, electrically, and thermally stable and are found in old fluorescent lighting fixtures, electrical appliances containing PCB capacitors, old microscope oil, and hydraulic fluids. People exposed to PCB in the air for a long time have experienced irritation of the nose, lungs, and skin. It is not known if PCBs cause birth defects or reproductive problems in people. The US Department of Health and Human Services has determined that PCB may reasonably be anticipated to be carcinogens.

Population (statistical). A set of entities or a continuum in a physical, biological or social system of interest, e.g., the residents of Los Alamos County, the water in an alluvial aquifer, or the plants in Pajarito Canyon.

Porosity. The ratio of the volume of interstices in rock or soil to its total volume expressed as a percentage or as a fraction.

Potential release site (PRS). A site suspected of releasing contaminants into the environment. PRS is a generic term that includes SWMUs, hazardous waste sites listed in Module VII of the Laboratory's Hazardous Waste Facility Permit, and sites that have been identified as potentially contaminated by radioactivity.

Preliminary remediation goal (PRG). Acceptable exposure levels, protective of human health and the environment that are used as a risk-based tool for evaluating remedial alternatives.

Preliminary risk assessment. A risk assessment conducted using conservative assumptions and scenarios and assuming no mitigating or corrective measures beyond those already in place.

Qualifier flag. A letter code indicating, on a gross scale, a verifiable or potential data deficiency. Qualifier flags are assigned to data based on the outcome of data validation checks.

Quality control (QC) sample. A sample which, upon analysis, provides information useful for adjusting, controlling, or verifying continuing acceptability of sampling and/or analysis activities that are in progress.

Quaternary. The second period of the Cenozoic Era, following the Tertiary, and including the last 2 – 3 million years.

Radiation. Energy emitted in the form of rays or particles that are thrown off by disintegrating atoms. The rays or particles emitted may consist of neutrons, positrons, alpha particles, beta particles, or gamma radiation.

Radionuclide. A nuclide (species of atom) capable of spontaneous transformation into other nuclides through changes in its nuclear configuration or energy level. This transformation is accompanied by the emission of photons or particles.

RCRA facility investigation (RFI). The second step of a RCRA corrective action, to gather enough data to fully characterize the nature, extent, and rate of migration of contaminants to determine the appropriate response action. The RFI is generally equivalent to the RI portion of the Superfund process.

Reason code. A code used in the ER data validation process to indicate why a qualifier flag has been assigned to a datum.

Receptor. A person, plant, animal, or geographical location that is exposed to a chemical or physical agent released to the environment by human activities.

Recreational use scenario. Recreational use refers to current and future use scenarios in which cleanup of a PRS is completed to a level that permits the public to safely use it on an intermittent basis for activities such as hiking and camping. The standards are more stringent than they are for the industrial use scenario but not as stringent as those for residential use.

Release. Any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing of hazardous waste or hazardous constituents into the environment (including the abandonment or discarding of barrels, containers, and other closed receptacles that contain any hazardous substance, pollutant or contaminant.

Remediation. The process of reducing the concentration of a contaminant (or contaminants) in air, water, or soil media to a level that poses an acceptable risk to human health; the act of restoring a contaminated area to a usable condition based on specified standards.

Remedy or remedial action. Those actions consistent with permanent remedy instead of or in addition to removal actions in the event of a release or threatened release of a hazardous substance into the environment. Those actions used to prevent or minimize the release of hazardous substances so that they do not migrate to cause substantial danger to present or future public health or welfare of the environment.

Remove or removal. The cleanup or removal of released hazardous substances from the environment.

Residential use scenario. The standards for residential use are the most stringent of the three current and future use scenarios being considered by the ER Project and is the level of cleanup EPA is currently specifying for SWMUs located off the Laboratory site and for those released for non-Laboratory use.

Resource Conservation and Recovery Act (RCRA). The Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1976 (40 CFR 60.2). In RCRA, Congress established initial directives and guidelines for EPA to regulate hazardous wastes from generation to ultimate disposal.

RCRA Hazardous Waste Facility Permit. EPA or an authorized state issues RCRA permits to regulate the storage, treatment, and disposal of hazardous waste and the hazardous component of radioactive mixed waste. See also **HSWA Module**.

Rinsate blank. See also *Equipment blank*.

Risk. A measure of a negative or undesirable impact associated with an event.

Risk assessment. A site-specific analysis of the potential adverse effects of hazardous materials that are released from a site in the absence of any control or mitigation actions. Also called a baseline risk assessment.

Risk characterization. The summarization and integration of the results of toxicity and exposure assessments into quantitative and qualitative expressions of risk. The major assumptions, scientific judgments, and sources of uncertainty related to the assessment are also presented.

Routine analysis. The analysis categories of inorganics, metals, organics, radiochemistry and high explosives as defined in the current contract laboratory statement of work.

Routine data validation. The process of reviewing analytical data relative to quantitative routine acceptance criteria. The objective of routine data validation is two-fold: one objective is to estimate the technical quality of the data relative to minimum national standards adopted by LANL ER; the other objective is to indicate to data users the technical data quality at a gross level by assigning qualifier flags to environmental data whose quality indicators do not meet acceptance criteria.

Runoff. The portion of the precipitation on a drainage area that is discharged from the area either by sheet flow or adjacent stream channels.

Run-on. Surface water flowing onto an area as a result of runoff occurring higher up on the slope.

Sample. A portion of a material (e.g., rock, soil, water, air), which, alone or in combination with other samples, is expected to be representative of the material or area from which it is taken. Samples are typically sent to a laboratory for analysis or inspection or are analyzed in the field. When referring to samples of environmental media, the term *field sample* may be used.

Sample matrix. In chemical analysis, that portion of a sample which is exclusive of the analytes of interest. Together, the matrix and analytes of interest form the sample.

Screening action level (SAL). Medium-specific concentration level for a chemical derived using conservative criteria below which it is generally assumed that there is no potential for unacceptable risk to human health. The derivation of a SAL is based on conservative exposure and land use assumptions. However, if an applicable regulatory standard exists that is less than the value derived by risk-based computations, it will be used for the SAL.

Screening assessment. A process designed to determine whether contamination detected in a particular medium at a site may present a potentially unacceptable human-health and/or ecological risk. The assessment uses screening levels that are either human-health or ecologically based concentrations derived by using chemical-specific toxicity information and standardized exposure assumptions below which no additional actions are generally warranted.

Sediment. (1) A mass of fragmented inorganic solid that comes from the weathering of rock and is carried or dropped by air, water, gravity, or ice; or a mass that is accumulated by any other natural agent and that forms in layers on the earth's surface such as sand, gravel, silt, mud, fill, or loess. (2) A solid material that is not in solution and either is distributed through the liquid or has settled out of the liquid.

Site characterization. The process of defining the pathways and methods of migration of the hazardous waste or constituents, including the media affected, the extent, direction and speed of the contaminants, complicating factors influencing movement and concentration profiles.

Site conceptual model. A qualitative or quantitative description of sources of contamination, environmental transport pathways for contamination, and biota that may be impacted by contamination (called receptors) and whose relationships describe qualitatively or quantitatively the release of contamination from the sources, the movement of contamination along the pathways to the exposure points, and the uptake of contaminant by the receptors. A site conceptual model is a three-dimensional picture of site conditions that conveys what is known or suspected about the sources, releases and release mechanisms; contaminant toxicity, mobility, and persistence; exposure pathways and potential receptors; and risks.

Soil erosion. The removal and thinning of the soil layer due to climatic and physical process such as high rainfall that is greatly accelerated by certain activities such as deforestation as after a fire.

Solid waste. Any garbage; refuse; sludge from a waste treatment plant, water-supply treatment plants, or air-pollution-control facility; and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations and from community activities.

Solid waste management unit (SWMU). Any identifiable site at which solid wastes have been placed at any time, irrespective of whether the unit was intended for the management of solid or hazardous waste. Such units include any area at or around a facility at which solid wastes have been routinely and systematically stored, such as waste tanks, septic tanks, firing sites, burn pits, sumps, landfills (material disposal areas), wastewater outfall areas, canyons around the Laboratory, and contaminated areas resulting from leaking product storage tanks (including petroleum).

Stakeholder. Any party or agency, whether inside or outside the Laboratory, interested in or affected by ER Project issues and activities.

Standard operating procedure (SOP). A written document that details the method for an operation, analysis, or action with thoroughly prescribed techniques and steps, and is officially approved as the method for performing certain routine or repetitive tasks.

Stratigraphy. The science dealing with the succession, age, composition and history of strata.

Surface water. No perennial surface water flows extend completely across the Laboratory in any canyon. Periodic natural surface runoff occurs in two modes:

1. Spring snowmelt runoff that occurs over days to weeks at a low discharge rate and sediment load, and
2. Summer runoff from thunderstorms that occurs over hours at a high discharge rate and sediment load.

The surface water within the Laboratory is not a source of municipal, industrial, or irrigation water, though wildlife does use the waters.

Surrogate compound (surrogate). An organic compound used in the analyses of organic target analytes that is similar in composition and behavior to target analytes but is not normally found in field samples. Surrogates are added to every blank and spike sample to evaluate the efficiency with which analytes are recovered during extraction and analysis.

Target analyte. A chemical or parameter, the concentration, mass or magnitude of which is designed to be quantified by use of a particular test method.

Technical Area (TA). Laboratory-established administrative units for its operations. There are currently 49 active TAs spread over 43 square miles.

Topography. The physical features of a place or region.

Trip blank. A sample of analyte-free media taken to the sampling site and returned to the analytical laboratory unopened along with samples taken in the field. Used to monitor cross contamination of samples during handling and storage both in the field and in the analytical laboratory.

Tuff. A compacted deposit of volcanic ash and dust that contains rock and mineral fragments accumulated during an eruption.

Underground storage tank (As defined in Section 9001(1) of the Solid Waste Disposal Act). The term "underground storage tank" means any one or combination of tanks (including underground pipes connected thereto) which is used to contain an accumulation of regulated substances, and the volume of which (including the volume of the underground pipes connected thereto) is 10% or more beneath the surface of the ground. This term does not include any

(A) farm or residential tank of 1,100 gallons or less capacity used for storing motor fuel for noncommercial purposes;

(B) tank used for string heating oil for consumptive use on the premises where stored;

(C) septic tank;

(D) pipeline facility (including gathering lines) regulated under

i) the Natural Gas Pipeline Safety Act of 1968 (49 USC App. 1671 et seq.),

ii) the Hazardous Liquid Pipeline Safety Act of 1979 (49 USC App. 2001 et seq.), or

iii) which is an intrastate pipeline facility regulated under state laws comparable to the provisions of law referred to in Clause (i) or (ii) of this subparagraph;

(E) surface impoundment, pit, pond, or lagoon,

(F) storm water or waste water collection system;

(G) flow-through process tank;

(H) liquid trap or associated gathering lines directly related to oil or gas production and gathering operations; or

(l) storage tank situated in an underground area (such as a basement, cellar, mine working, drift, shaft, or tunnel) if the storage tank is situated upon or above the surface of the floor.

Unsaturated zone. The zone between the land surface and the regional water table. Generally, fluid pressure in this zone is less than atmospheric pressure, and some of the voids may contain air or other gases at atmospheric pressure. Alternatively, the unsaturated zone generally has moisture contents less than saturation.

Watershed. The region drained by, or contributing waters to, a stream, lake, or other body of water and separated from adjacent drainage areas by divides such as a ridge or summit of high ground.

Water table. The top of the saturated zone; the water level associated with an unconfined aquifer.

Welded tuff. A volcanic deposit hardened by the action of heat, pressures from overlying material, and hot gases.

METRIC CONVERSION TABLE

Metric to US Customary Unit Conversions

Multiply SI (Metric) Unit	by	To Obtain US Customary Unit
kilometers (km)	0.622	miles (mi)
kilometers (km)	3281	feet (ft)
meters (m)	3.281	feet (ft)
meters (m)	39.37	inches (in.)
centimeters (cm)	0.03281	feet (ft)
centimeters (cm)	0.394	inches (in.)
millimeters (mm)	0.0394	inches (in.)
micrometers or microns (μm)	0.0000394	inches (in.)
square kilometers (km^2)	0.3861	square miles (mi^2)
hectares (ha)	2.5	acres
square meters (m^2)	10.764	square feet (ft^2)
cubic meters (m^3)	35.31	cubic feet (ft^3)
kilograms (kg)	2.2046	pounds (lb)
grams (g)	0.0353	ounces (oz)
grams per cubic centimeter (g/cm^3)	62.422	pounds per cubic foot (lb/ft^3)
milligrams per kilogram (mg/kg)	1	parts per million (ppm)
micrograms per gram (μg/g)	1	parts per million (ppm)
liters (L)	0.26	gallons (gal.)
milligrams per liter (mg/L)	1	parts per million (ppm)
degrees Celsius (°C)	9/5 + 32	degrees Fahrenheit (°F)

Appendix B

Environmental Setting

APPENDIX B ENVIRONMENTAL SETTING

The environmental setting of Los Alamos National Laboratory (the Laboratory) is described in Section 2.4 of the RRES-RS Project installation work plan (LANL 1998, 62060). A detailed discussion of the environmental setting for the DP Road sites, including climate, geology, hydrology, and a conceptual hydrogeologic model for the area and its surroundings, is presented in the RCRA Facility Investigation (RFI) work plan for Operable Unit (OU) 1071 (LANL 1992, 07667). A summary is presented in the following sections.

Climate

Los Alamos County has a semiarid, temperate, mountain climate. Summers are generally sunny with moderate, warm days and cool nights. The high altitude, light winds, clear skies, and dry atmosphere result in summer temperatures ranging from 50°F to 90°F. During the winter, temperatures typically range from 15°F to 50°F. Normal annual precipitation in Los Alamos, including rainfall and water-equivalent snowfall, is 18 in. Of this total, approximately 40% occurs as brief, intense thunderstorms during July and August. Stream flow in canyons can occur as a result of these storms. Spring snowmelt runoff may also induce stream flow in area canyons. Winter snowfall averages 51 in. annually. Wind speeds are less than 2.5 m/s (5.5 mph) about 40% of the time and greater than 5 m/s (11 mph) about 20% of the time. Strong winds occur mainly in the spring. The predominant wind direction is from the south-southwest (Bowen 1990, 06899).

Geology

The SWMUs/AOCs along DP Road included in this report are located on East Mesa. The mesa surface slopes gently to the east, with elevations ranging from approximately 7200 to 7240 ft. The south side of the area is bounded by Los Alamos Canyon.

The bedrock that underlies the site and forms the walls of Los Alamos Canyon below are units of the Bandelier Tuff, composed of fallout and ash flow deposits of rhyolitic volcanic rock. At the DP Road sites, the uppermost bedrock unit is Unit 3 of the Tshirege Member of the Bandelier Tuff (Qbt 3). In this area, the unit is predominantly composed of light gray to reddish gray, partially to moderately welded tuff with abundant phenocrysts. The mesa top is mantled with a thin, variable layer of reworked alluvium, colluvium, and fill material that ranges from less than 1 ft to as much as 10 ft thick.

The Tshirege Member is a multiple-flow, ash-and-pumice sheet that forms the prominent cliffs in most of the canyons of the Pajarito Plateau. It is generally over 200 ft thick (Broxton and Reneau 1996, 55429). The Tshirege Member is a compound cooling unit, consisting of at least four cooling subunits that display variable physical properties vertically and horizontally (Smith and Bailey 1966, 21584; Broxton et al. 1995, 50121). The welding and crystallization variability in the Tshirege Member produce recognizable vertical variations in properties such as density, porosity, hardness, composition, color, and surface weathering patterns.

Unit 3 of the Tshirege Member (Qbt 3) is a nonwelded to partially welded, vapor-phase altered tuff. Its base consists of a purple gray, unconsolidated, porous, and crystal-rich nonwelded tuff that underlies a broad, gently sloping bench developed on top of Qbt2. This basal, nonwelded portion forms relatively soft outcrops that weather into low, rounded mounds with a white color. The middle and upper portions of Qbt 3 form cliffs of partially welded tuff (LANL 1997, 55622).

Soils

Soils at the DP Road SWMUs/AOCs have been variably disturbed by human activity, including construction, paving, and grading of sites. Because of these disturbances, the surface material in some areas consists of fill material rather than native soil. The fill is of undocumented origin and may include crushed tuff, cobbles, gravel, and sand. Native soils, where not disturbed or replaced by fill material, belong mainly to the Pogna fine sandy loam series (Nyhan et al. 1978, 05702) of shallow, well-drained soils formed in alluvium and colluvium overlying tuff. Textures of this soil series range from fine sandy loam to sandy loam. The available water capacity of these moderately permeable soils is low, and the effective rooting depth is relatively shallow (8 to 20 in.) A detailed discussion of the soils of the Los Alamos area can be found in Section 2.5.1.3 of the installation work plan (LANL 1998, 62060).

Surface Water

Most surface water on the Pajarito Plateau and its canyon systems occurs as ephemeral (flowing in response to precipitation), intermittent (flowing in response to availability of snowmelt or groundwater discharge), or interrupted (alternating perennial, ephemeral, and intermittent stretches) streams. Neither Los Alamos Canyon, DP Canyon, nor Guaje Canyon contain perennial reaches within Laboratory boundaries (LANL 1997, 55622). Los Alamos Canyon contains an interrupted stream. Below Los Alamos Reservoir, flow is seasonally variable. In lower Los Alamos Canyon during most of the year, surface water flow results from discharge from the Los Alamos County sewage treatment plant. This flow combines with perennial flow from Basalt Spring on San Ildefonso Pueblo land and often extends to the Rio Grande. DP Canyon, in the vicinity of DP Road, contains only an ephemeral stream that flows in response to precipitation in the Los Alamos town site. Guaje Canyon contains an interrupted stream, with an intermittent reach from some distance downstream of Guaje Reservoir to the confluence with Los Alamos Canyon.

If sufficient runoff is generated, surface water from the DP Road SWMUs/AOCs drains either eastward into DP Canyon [from AOCs 0-027 and SWMU 0-030(a)], eastward into BV Canyon and from there into Los Alamos Canyon, or onto the south-facing cliffs/slopes of Los Alamos Canyon.

Site-specific surface water assessments were performed using LANL-ER-SOP-2.01-R0, "Surface Water Site Assessments. These assessments use current site conditions (e.g., slope, ground cover, visible erosion features) to evaluate the potential for surface water runoff, erosion, and sediment transport. For these sites, the erosion matrix scores are all less than 50 out of a maximum possible 100, indicating generally low potential for erosion and sediment transport. The surface water assessment worksheets are included in Appendix F.

Groundwater

The regional aquifer beneath the DP Road area is at an elevation of approximately 5900 ft (determined in Test Well 2 in Pueblo Canyon, and in the Otowi 4 well in Los Alamos Canyon), mainly within sediments of the Puye and Tesuque Formations (Purtymun 1995, 45344; Broxton et al. 1995, 50119). Thus, for mesa top sites along DP Road, more than 1200 ft of tuff and volcaniclastic sediments separate the surface from the main aquifer. Although Unit 3 of the Bandelier tuff is often highly fractured, the fractures are typically discontinuous and do not form a likely pathway for infiltration to deep groundwater. Alluvial groundwater is present only within two limited segments of DP Canyon, reach DP-2 and lower reach DP-4 (LANL 1999, 63915). Reach DP-2 is approximately 4000 to 5000 ft east of the nearest site reported in this document. No alluvial groundwater is known to exist in reach DP-1, the reach nearest to the DP Road SWMUs/AOCs, or in the vicinity of the sites included in this report.

In the area of AOCs 0-029(a,b,c), the regional aquifer is expected to be closer to the surface, based on measured water levels in wells around the area (Stone et al. 2001, 69830). These AOCs are in canyon settings, while the other SWMUs/AOCs in this report are mesa-top sites.

Biological Surveys

Biological and ecological surveys have been conducted for OU 1071, including the DP Road area (LANL 1995, 56100; LANL 1996, 62928). Site assessments specific to each group of SWMUs/AOCs were conducted and documented in Ecological Scoping Checklists, which are included in Appendix F.

AOC 0-027 and SWMU 0-030(a) are entirely within an area in which the Mexican spotted owl can be conservatively assumed to forage at a relatively moderate frequency and the bald eagle is conservatively assumed to forage at a relatively low frequency. While threatened and endangered species (T&E) habitat overlaps with the SWMUs/AOCs, these sites offer marginal habitat. Owls are known to forage on parking lots but prey (e.g., rodents) captured there are assumed to originate from off-site areas given the lack of fossorial habitat.

The 6th Street Warehouse SWMUs/AOCs and the former leach field area are in the vicinity of potential Mexican spotted owl nesting habitat, approximately 0 to 450 ft away from potential habitat in Los Alamos Canyon and approximately 1000 to 1800 ft from potential habitat in Pueblo Canyon. The SWMUs/AOCs are entirely within an area in which the Mexican spotted owl can be conservatively assumed to forage at a relatively high frequency.

The mesa top area of the 6th Street Warehouse SWMUs/AOCs has undergone heavy commercial and urban development. Ponderosa pine dominated in pre-urban conditions, but pines are now reduced to scattered stands. The area is characteristic of disturbed sites undergoing secondary succession. Ample forb ground cover exists, consisting predominantly of red sorrel and grasses. Soils have been previously disturbed through excavation and backfilling. The mesa-top soils are exposed in a few patches but they primarily support a continuous cover of grasses (buffalo grass, fescue) and forbs (red sorrel, chamisa, clover, aster, sweet pea). Ponderosa pine stands and other trees surround the southern portion of the area. Signs of animal life on the mesa top include evidence of small mammal usage, including gopher burrowing, and observations of garter snakes, fence lizards, skinks, and numerous birds (e.g., raven, American robin). Although the area has been physically disturbed, signs of stress on the mesa-top plant life are not apparent. Stressors on wildlife do not appear to be significant either as there are abundant signs of wildlife using the area.

AOCs 0-029(a,b) are not in the vicinity of any potential T&E species habitat. AOC 0-029(c) is in the vicinity of potential Mexican spotted owl nesting habitat, located approximately 1 mi away. The Mexican spotted owl and the bald eagle can be conservatively assumed to forage at very low frequency at AOCs 0-029(a,b). The Mexican spotted owl can be conservatively assumed to forage at a moderate frequency at AOC 0-029(c). AOCs 0-029(a,b) have ground cover of forbs (primarily chamisa and sagebrush) and grasses. The grasses and shrubs covering the surface of AOC 0-029(b) were disturbed (flattened by apparent vehicle traffic). The northern half of AOC 0-029(c) is sparsely vegetated with native grasses. Piñon and juniper trees bordered the periphery of the sites. The soils primarily support a cover of grasses and forbs (chamisa, sagebrush). Signs of animal life include evidence of small mammal usage (burrows) and scat (probably coyote). Although two of the AOCs 0-029(b,c) have been moderately disturbed, signs of stress on the plant life were limited to what appeared to be physical (traffic), rather than chemical, stressors. Stressors on wildlife do not appear to be significant either as there are abundant signs of wildlife using the area (e.g., evidence of burrowing activity and scat).

Cultural Surveys

As required by the National Historic Preservation Act of 1966 (as amended), cultural resource surveys of the DP Road area have been performed (Larson 1992, 28310; LANL 1996, 63323). The methods and techniques used for these surveys conform to those specified in the Secretary of the Interior's standards and guidelines for archeology and historic preservation. There are no archeological sites located within the DP Road area eligible for inclusion in the National Register of Historic Places under Criterion D (LANL 1992, 07667).

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Appendix C

Results of Quality Assurance/Quality Control Activities

APPENDIX C RESULTS OF QUALITY ASSURANCE/QUALITY CONTROL ACTIVITIES

C-1.0 SUMMARY OF QUALITY ASSURANCE/QUALITY CONTROL ACTIVITIES

This appendix consists of an assessment of the quality of analytical results obtained at SWMU 21-021, AOCs 0-004 and 0-033(b), SWMU 0-030(l), SWMUs 0-030(b,m), and AOCs 0-029(a,b,c) from 1992 to 2003. Analytical results for all samples collected at these SWMUs/AOCs are included in this appendix. This includes all samples that are used for decision making purposes in this report as well as samples which represent material that is no longer in place at these SWMUs/AOCs. Table C-1.0-1 presents the analytical suites analyzed for all the samples during this investigation.

Table C-1.0-1
Analytical Suites

Chemical Category	Analyte List	Analytical Method
Radionuclides	Gamma Emitting Radionuclides	Gamma Spectroscopy
	Isotopic Uranium	Chemical Separation
	Isotopic Plutonium Americium 241	Chemical Separation Alpha Spectroscopy
	Tritium	Liquid Scintillation
	Strontium 90	Gas Proportional Counting
Inorganic Chemicals	Target Analyte Metals	EPA Methods 6010B and 6020
	Mercury	EPA Method 7471A
Organic Chemicals	Polychlorinated Biphenyls	EPA Method 8082
	Pesticides	EPA Method 8081A
	Volatile Organic Compounds	EPA Method 8260
	Semivolatile Organic Compounds	EPA Method 8270

Quality assurance (QA), quality control (QC), and data validation procedures were implemented in accordance with the requirements of the *Quality Assurance Project Plan Requirements for Sampling and Analysis* (LANL 1996, 54609), and the Laboratory Environmental Restoration (ER) Project analytical services statement of work (SOW) for contract laboratories (LANL 1995, 49738; LANL 2000, 71233). The results of the QA/QC activities were used to estimate accuracy, bias, and precision of the analytical measurements. QC samples including method blanks, blank spikes, matrix spikes, and laboratory control samples to assess accuracy and bias. Internal standards, external standards, surrogates, and tracers were also used to assess accuracy. The type and frequency of QC analyses are described in the ER Project analytical services SOWs (LANL 1995, 49738; LANL 2000, 71233). Other QC factors such as sample preservation and holding times were also assessed. The requirements for sample preservation and holding times are given in the ER Project standard operating procedure LANL-ER-SOP-1.02, Rev. 0, "Sample Containers and Preservation." Evaluating these QC indicators allows estimates to be made of the accuracy, bias, and precision of the analytical suites. A focused data validation was also performed for all the data packages (also referred to as request numbers). The focused validation followed the same procedure discussed above and included a more detailed review of the raw data results generated by the analytical laboratory.

Data validation results including, request numbers, sample identification numbers, and their associated qualifiers, are given in Section C-5.0. The data, including the qualified data, are usable for evaluation and interpretive purposes. The entire data set meets the standards set for use in this report with the following exceptions.

C-1.1 Samples Collected

A summary of the soil samples collected for analyses is presented in Table C-1.1-1.

Table C-1.1-1
SWMU/AOC and Request Numbers with Analytical Suites

SWMU/AOC (Group)	Analytical Request Numbers	Analytical Suite
21-021	778S, 782S, 788S, 796S, 798S, 822S, 825S, 827S, 12741, 12743, 12758, 12759, 13041, 13045, 13054	TAL Metals SVOC VOC Gamma Spectroscopy Alpha Spectroscopy Isotopic Uranium Isotopic Plutonium Tritium, Americium-241 Strontium-90
0-004, 0-033(b), 0-030(l) (6th Street Warehouse SWMUs/AOCs)	781, 823, 865, 880S, 881S, 882S, 885S, 886S, 887S, 1003, 1123, 1143S, 1144S, 1352, 1353, 1150S, 1151S, 1171S, 2459, 2460, 2484, 12742	TAL Metals SVOC VOC Pesticides PCBs Gamma Spectroscopy Alpha Spectroscopy Isotopic Uranium Isotopic Plutonium Tritium, Americium-241
0-030(b,m) (6th Street Septic System SWMUs)	796, 943, 956S, 957S, 962S, 963S, 965S, 966S, 968S, 971S, 972S, 979S, 980S, 983S, 984S, 992S, 993S, 1002, 1021S, 1022S, 1035S, 1036S, 1071S, 1072S, 1262, 1328, 1476, 1478, 1486, 1488, 1495, 1497, 1505, 1506, 1514, 1515, 1571, 1572, 1611, 2462, 2468	TAL Metals SVOC VOC Pesticides PCBs Gamma Spectroscopy Alpha Spectroscopy Isotopic Uranium Isotopic Plutonium Tritium, Americium-241 Strontium-90
0-029(a,b,c)	1357S, 1358S, 1368S	Pesticides PCBs

Summaries of the analytical methods for metals, radionuclides, and organic analytes are provided in the following sections. The contract-required detection limit (CRDL) for each analyte listed is provided in Appendix D. These limits are also detailed in the RRES-RS analytical services SOWs (LANL 1995, 49738; LANL 2000, 71233).

C-2.0 INORGANIC CHEMICAL METHODS

A total of 160 samples were analyzed for the target analyte list (TAL) metals at SWMU 21-021, 34 samples were analyzed for the TAL metals at AOCs 0-004 and 0-033(b) and SWMU 0-030(l) (6th Street Warehouse) and 65 samples were analyzed at SWMUs 0-030(b,m) (6th Street Septic System). For these samples EPA Method 7471A, Cold Vapor Atomic Absorption (CVAA) (EPA 1987, 57589) was used to analyze for mercury. The other TAL metals were analyzed by EPA Method 6010B, inductively coupled plasma emission spectroscopy (ICPES) or 6020, inductively coupled plasma mass spectrometry (ICP/MS).

The inorganic methods for this data set are summarized in Table C-2.0-1. Holding times were met for all inorganic chemical digestions and analyses.

The CRDLs defined by the RRES-RS analytical services SOWs (LANL 1995, 49738; LANL 2000, 71233) for inorganic chemicals are provided in Appendix D. However, some analyses were performed prior to this SOW and may differ. The qualifiers for inorganic analytes are provided in Section C-5.0.

Table C-2.0-1
Analytical Methods for Inorganic Chemical Analysis

Analytical Method	Analytical Description	Analytical Suite
EPA SW-846 Method 6010B	Inductively coupled plasma emission spectroscopy (ICPES)	Aluminum, antimony, arsenic, barium, beryllium, calcium, cadmium, cobalt, chromium, copper, iron, lead, magnesium, manganese, nickel, potassium, selenium, sodium, silver, thallium, vanadium, and zinc. (TAL metals)
EPA SW-846 Method 6020	Inductively coupled plasma mass spectrometry	Aluminum, antimony, arsenic, barium, beryllium, calcium, cadmium, cobalt, chromium, copper, iron, lead, magnesium, manganese, nickel, potassium, selenium, sodium, silver, thallium, vanadium, and zinc. (TAL metals)
EPA SW-846 Method 7471A	Cold vapor atomic absorption (CVAA)	Mercury (TAL metal)

C-2.1 Inorganic Quality Assurance/Quality Control Samples

Laboratory control samples (LCS), method blanks, matrix spike samples, field duplicate samples, interference check samples and serial dilution samples were analyzed to assess accuracy and precision for inorganic chemical analyses. Each of these QA/QC sample types is defined in the ER Project analytical services SOWs (LANL 1995, 49738; LANL 2000, 71233) and described briefly in the sections below. Because some of the analyses were performed prior to this SOW, slightly different QA/QC procedures may have been followed.

The LCS serves as a monitor of the overall performance of each step during the analysis, including sample digestion. The analytical results for the samples were qualified according to National Functional Guidelines if the individual LCS recovery indicated an unacceptable bias in the measurement of individual analytes. The LCS recoveries should fall into the control limits of 75%–125% (LANL 1995, 49738; LANL 2000, 71233).

Preparation blanks are used as a measurement of bias and potential cross contamination. The blank results for inorganic chemical analyses were within acceptable limits for all the analyses. All target analytes should be below the contract required detection limit in the preparation blank.

Accuracy for inorganic chemical analyses is also assessed using matrix spike samples. A matrix spike sample is designed to provide information about the effect of each sample matrix on the sample preparation procedures and analytical technique. The spike sample recoveries should be within the acceptance range of 75%–125%.

Analyzing field duplicate samples assessed precision of inorganic chemical analyses. All relative percent differences between the sample and field duplicate should be ±35%.

C-2.2 Inorganic Chemical Background Values

It is important to note that the previously used RRES-RS analytical services SOW (LANL 1995, 49738) was issued before the widespread use of axial view ICPES (also known as *trace* ICPES), and before the development of the LANL soil inorganic background data set. With the advent of axial view ICPES, detection limits for inorganic chemicals have greatly improved. As an example, antimony soil detection limits for the older radial view ICPES are typically on the order of 12 mg/kg, while on the *trace* ICPES the detection limits are as low as 0.5 mg/kg.

The "Inorganic and Radionuclide Background Data for Soils, Canyon Sediments, and Bandelier Tuff at Los Alamos National Laboratory" (LANL 1998, 59730) was developed after *trace* ICPES was widely used. However, since some of this work was performed prior to widespread *trace* ICPES use, not all detection limits are below the background values.

C-3.0 ORGANIC CHEMICAL ANALYSES

Seventeen samples were collected for volatile organic analysis (VOC) using EPA Method 5035/8260, and/or semivolatile organic compound (SVOC) analysis using EPA Method 8270 at SWMU 21-021; 140 samples were collected for VOC, SVOC and polychlorinated biphenyls (PCBs) using EPA Method 8082 and Pesticides using EPA Method 8081A at AOCs 0-004 and 0-033(b) and SWMU 0-030(l) (6th Street Warehouse); 269 samples were collected for organic analyses at SWMUs 0-030(b,m) (6th Street Septic System); and 69 samples were collected for PCB and pesticide analysis at AOCs 0-029(a,b,c). Methods are summarized in Table C-3.0-1. The summaries for these analyses are presented in the sections below. All QC procedures were followed as required in the ER Project analytical services SOWs (LANL 1995, 49738; LANL 2000, 71233). No samples analyzed for organic constituents were rejected.

C-3.1 Semivolatile Organic Compound Analysis

SVOC analysis was performed using EPA SW-846 Method 3540 for extraction and Method 8270 B for analysis. The SVOC target analyte list including the required estimated quantitation limits (EQLs) is provided in Appendix D. Holding times for extraction and analysis were met for all samples. Qualifiers applied to these samples due to internal standard and surrogate recoveries are presented in Section C-5.0.

Table C-3.0-1
Analytical Methods for Organic Chemical Analysis

Analytical Method	Analytical Description	Target Compound List
EPA Method 3540 – Extraction EPA SW-846 Method 8270 - Analysis	Semivolatile organic compounds (SVOCs)	ER Project analytical services SOW (LANL 1995, 49738; LANL 2000, 71233). Also in Appendix D of this report.
EPA Method 5035 – Sampling EPA Method 5035 – Extraction EPA SW-846 Method 8260 - Analysis	Volatile organic compounds (VOCs)	ER Project analytical services SOW (LANL 1995, 49738; LANL 2000, 71233). Also in Appendix D of this report.
EPA Method 3540 – Extraction EPA SW-846 Method 8082 - Analysis	Polychlorinated biphenyls (PCBs)	ER Project analytical services SOW (LANL 1995, 49738; LANL 2000, 71233). Also in Appendix D of this report.
EPA Method 3540 – Extraction EPA SW-846 Method 8082 – Analysis	Pesticides	ER Project analytical services SOW (LANL 1995, 49738; LANL 2000, 71233). Also in Appendix D of this report.

C-3.2 Polychlorinated Biphenyl Chemical Analysis

PCB samples were analyzed using EPA SW-846 Method 3540 for extraction and EPA SW-846 Method 8082 for determination. Holding times for extraction and analyses were not met for the PCB analyses of a number of samples, resulting in qualification of those data. The PCB analyte list with contract required detection limits can be found in Appendix D.

C-3.3 Volatile Organic Chemical Analyses

The VOC samples were collected and extracted using EPA Method 5035. The samples were analyzed using EPA SW-846 Method 8260. All holding times were met for the VOC analyses.

C-4.0 RADIOCHEMICAL ANALYSES

A total of 754 samples were analyzed for radioactivity and radionuclides by the methods listed in Table C-4.0-1. From this total 433 samples were acquired at SWMU 21-021; 80 samples at AOCs 0-004 and 0-033(b) and SWMU 0-030(l) (6th Street Warehouse); and 241 samples acquired for SWMUs 0-030(b,m) (6th Street Septic System). The maximum allowable reporting limit as defined in the RRES-RS analytical services SOWs for radiochemicals are provided in Appendix D.

Table C-4.0-1
Analytical Methods for Radiochemical Analyses

Radionuclides	Analytical Technique
Gamma-emitting radionuclides	Gamma spectroscopy
Isotopic plutonium	Chemical Separation/Alpha Spectroscopy
Isotopic uranium	Chemical Separation/Alpha Spectroscopy
Americium-241	Chemical Separation/Alpha Spectroscopy
Tritium	Liquid Scintillation
Strontium-90	Chemical Separation/Gas Proportional Counting

Radionuclides with reported values less than the minimum detectable activity (MDA) were qualified as non-detected (U). The radionuclides qualified as non-detected based on the MDA are summarized in Table C-5.0-4. Each radionuclide result was also compared with the corresponding 1-sigma total propagated uncertainty (TPU). If the result was not greater than three times the total propagated uncertainty, it was qualified as non-detected (U). Radionuclides qualified as non-detected (U) based on the 1-sigma TPU are also presented in Table C-5.0-4.

Certain gamma spectroscopy analytes are subject to spectral interference from energies of other radionuclides. When this occurs it is not possible to reliably measure these radionuclides. Laboratory results indicated spectral interference for several gamma spectroscopy analytes. These values were rejected (R) due to spectral interference, as summarized in Section C-5.3. All other radionuclide results including the qualified data are usable for evaluation and interpretive purposes.

C-4.1 Discussion of Radiochemical Quality Assurance/Quality Control Samples

Precision and bias of radiochemical analyses performed at off-site fixed laboratories were assessed using matrix spike samples, laboratory control samples, method blanks, duplicates and tracers.

The ER Project analytical services SOW (LANL 1995, 49738; LANL 2000, 71233) specifies that spike sample recoveries should be within ± 25% of the certified value. All spike sample recoveries met this acceptance criteria.

LCSs were analyzed to assess accuracy for radionuclide analyses. The LCSs serve as a monitor of the overall performance of each step during the analysis, including the radiochemical separation preparation. The ER Project analytical services SOW (LANL 1995, 49738; LANL 2000, 71233) specifies that LCS recoveries should be within ± 25% of the certified value. The analytical results for individual LCSs were all within the ± 25% recovery control limit.

Method blanks are also used to assess bias. The ER Project analytical services SOW (LANL 1995, 49738) specifies that the method blank concentration should not exceed the required EQL. All method blanks met these criteria.

C-5.0 DATA VALIDATION

The following tables present the data qualifiers applied to each analyte for a given sample. The data qualifiers are defined in Table C-5.0-1. Table C-5.0-2 (inorganic data quality), Table C-5.0-3 (organic data quality), and Table C-5.0-4 (radionuclide data quality) summarize the qualifiers for this data set.

C-5.1 Inorganic Data Review

Table C-5.0-2 presents the analytes that were qualified. A number of the analyses resulted in detected analytes between the method detection limit and practical quantitation limit (J qualifier) as well as U qualifiers associated with samples that contained analytes less than or equal to five times the blank level. Several request numbers including 1171S and 1072S showed precision of duplicate samples greater than the advisory limits along with low or high spike recoveries.

Table C-5.0-1
Explanation of Data Qualifiers Used in the Data Validation Procedure

Qualifier	Explanation
U	The analyte was analyzed for but not detected. Reported value is the sample-specific estimated quantitation limit or detection limit.
J	The reported value should be regarded as estimated.
J+	The reported value should be regarded as estimated and biased high.
J-	The reported value should be regarded as estimated and biased low.
UJ	The analyte was analyzed for but not detected. Reported value is an estimate of the sample-specific quantitation limit or detection limit.
R	The sample results were rejected because of serious deficiencies in the ability to analyze the sample and meet quality control criteria; presence or absence cannot be verified.

Table C-5.0-2
Inorganic Chemical Data Quality Evaluation

Request	Sample ID	Location ID	Depth (ft)	Analyte	Qualifier	Explanation
0-004, 0-033(b), 0-030(l)						
1143S	RE00-02-47819	00-02-19630	3–3.5	Antimony	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-47820	00-02-19630	4–4.5	Cadmium Mercury	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-47819	00-02-19630	3–3.5	Silver Sodium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-47820	00-02-19630	4–4.5	Sodium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-47819	00-02-19630	3–3.5 4–4.5	Copper	J	The result for this analyte is estimated; its relative % difference from the duplicate was > the advisory limit.
	RE00-02-47820	00-02-19630	4–4.5	Silver	U	The result for this analyte is undetected; the concentration was < or = to 5x the concentration in the blank.
	RE00-02-47819	00-02-19630	3–3.5 4–4.5	Thallium	U	The result for this analyte is undetected; the concentration was < or = to 5x the concentration in the blank.

Table C-5.0-2 (continued)

Request	Sample ID	Location ID	Depth (ft)	Analyte	Qualifier	Explanation
1150S	RE00-02-47821	00-02-19632	10–10.5	Cadmium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-47822	00-02-19633	10–10.5			
	RE00-02-47823	00-02-19634	10–10.5			
	RE00-02-47824	00-02-19635	7.5–8			
	RE00-02-47825	00-02-19636	4.5–5.5			
	RE00-02-47826	00-02-19637	8–8.5			
	RE00-02-47827	00-02-19638	4–4.5			
	RE00-02-47828	00-02-19638	5–5.5			
	RE00-02-47822	00-02-19633	10–10.5	Calcium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-47826	00-02-19637	8–8.5			
	RE00-02-47825	00-02-19636	4.5–5.5	Chromium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-47827	00-02-19638	4–4.5			
	RE00-02-47828	00-02-19638	5–5.5			
	RE00-02-47821	00-02-19632	10–10.5	Cobalt	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-47822	00-02-19633	10–10.5			
	RE00-02-47825	00-02-19636	4.5–5.5			
	RE00-02-47826	00-02-19637	8–8.5			
	RE00-02-47828	00-02-19638	5–5.5			
	RE00-02-47821	00-02-19632	10–10.5	Magnesium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-47822	00-02-19633	10–10.5			
	RE00-02-47825	00-02-19636	4.5–5.5			
	RE00-02-47826	00-02-19637	8–8.5			
	RE00-02-47827	00-02-19638	4–4.5			
	RE00-02-47828	00-02-19638	5–5.5			
	RE00-02-47823	00-02-19634	10–10.5	Mercury	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-47824	00-02-19635	7.5–8			
	RE00-02-47825	00-02-19636	4.5–5.5			
	RE00-02-47821	00-02-19632	10–10.5	Potassium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-47822	00-02-19633	10–10.5			
	RE00-02-47824	00-02-19635	7.5–8			
	RE00-02-47825	00-02-19636	4.5–5.5			
	RE00-02-47826	00-02-19637	8–8.5			
	RE00-02-47827	00-02-19638	4–4.5			
	RE00-02-47828	00-02-19638	5–5.5			
	RE00-02-47826	00-02-19637	8–8.5	Selenium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-47828	00-02-19638	5–5.5			
	RE00-02-47821	00-02-19632	10–10.5	Sodium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-47822	00-02-19633	10–10.5			
	RE00-02-47823	00-02-19634	10–10.5			
	RE00-02-47824	00-02-19635	7.5–8			
	RE00-02-47825	00-02-19636	4.5–5.5			
	RE00-02-47826	00-02-19637	8–8.5			
	RE00-02-47827	00-02-19638	4–4.5			
	RE00-02-47828	00-02-19638	5–5.5			

Table C-5.0-2 (continued)

Request	Sample ID	Location ID	Depth (ft)	Analyte	Qualifier	Explanation
	RE00-02-47821	00-02-19632	10–10.5	Copper	J	The result for this analyte is estimated; its relative % difference from the duplicate was > the advisory limit.
	RE00-02-47822	00-02-19633	10–10.5			
	RE00-02-47823	00-02-19634	10–10.5			
	RE00-02-47824	00-02-19635	7.5–8			
	RE00-02-47825	00-02-19636	4.5–5.5			
	RE00-02-47826	00-02-19637	8–8.5			
	RE00-02-47827	00-02-19638	4–4.5			
	RE00-02-47828	00-02-19638	5–5.5			
	RE00-02-47821	00-02-19632	10–10.5	Silver	U	The result for this analyte is undetected; the concentration was < or = to 5x the concentration in the blank.
	RE00-02-47822	00-02-19633	10–10.5			
	RE00-02-47823	00-02-19634	10–10.5			
	RE00-02-47824	00-02-19635	7.5–8			
	RE00-02-47825	00-02-19636	4.5–5.5			
	RE00-02-47826	00-02-19637	8–8.5			
	RE00-02-47827	00-02-19638	4–4.5			
	RE00-02-47828	00-02-19638	5–5.5			
	RE00-02-47821	00-02-19632	10–10.5	Thallium	U	The result for this analyte is undetected; the concentration was < or = to 5x the concentration in the blank.
	RE00-02-47822	00-02-19633	10–10.5			
	RE00-02-47823	00-02-19634	10–10.5			
1171S	RE00-02-45447	00-02-19622	1–1.5	Cadmium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-45449	00-02-19624				
	RE00-02-45450	00-02-19625				
	RE00-02-45447	00-02-19622	1–1.5	Mercury	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-45447	00-02-19622	1–1.5	Selenium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-45449	00-02-19624				
	RE00-02-45450	00-02-19625				
	RE00-02-45451	00-02-19626				
	RE00-02-45447	00-02-19622	1–1.5	Silver	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-45449	00-02-19624				
	RE00-02-45451	00-02-19626				
	RE00-02-45452	00-02-19627				
	RE00-02-45447	00-02-19622	1–1.5	Sodium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-45448	00-02-19623				
	RE00-02-45449	00-02-19624				
	RE00-02-45450	00-02-19625				
	RE00-02-45451	00-02-19626				
	RE00-02-45452	00-02-19627				
	RE00-02-45447	00-02-19622	1–1.5	Thallium	J	The result for this analyte is estimated; its relative % difference from the duplicate was > the advisory limit.
	RE00-02-45448	00-02-19623				
	RE00-02-45449	00-02-19624				
	RE00-02-45450	00-02-19625				
	RE00-02-45451	00-02-19626				
	RE00-02-45452	00-02-19627				
	RE00-02-45447	00-02-19622	1–1.5	Barium Calcium Chromium Cobalt Nickel Vanadium Zinc	J	The result for this analyte is estimated; the relative % difference of the serial dilution sample was > the advisory limit.

Table C-5.0-2 (continued)

Request	Sample ID	Location ID	Depth (ft)	Analyte	Qualifier	Explanation
	RE00-02-45447 RE00-02-45448 RE00-02-45449 RE00-02-45450 RE00-02-45451 RE00-02-45452	00-02-19622 00-02-19623 00-02-19624 00-02-19625 00-02-19626 00-02-19627	1–1.5	Beryllium	J-	The result for this analyte is estimated and biased low; the spike % recovery was low.
	RE00-02-45447 RE00-02-45448 RE00-02-45449 RE00-02-45450 RE00-02-45451 RE00-02-45452	00-02-19622 00-02-19623 00-02-19624 00-02-19625 00-02-19626 00-02-19627	1–1.5	Copper	J-	The result for this analyte is estimated and biased low; the spike % recovery was low.
	RE00-02-45448 RE00-02-45449 RE00-02-45450 RE00-02-45451 RE00-02-45452	00-02-19623 00-02-19624 00-02-19625 00-02-19626 00-02-19627	1–1.5	Potassium	J-	The result for this analyte is estimated and biased low; the spike % recovery was low.
	RE00-02-45447	00-02-19622	1–1.5	Potassium	J+	The result for this analyte is estimated and biased high; the spike % recovery was high.
	RE00-02-45450	00-02-19625	1–1.5	Silver	U	The result for this analyte is undetected; the concentration was < or = to 5x the concentration in the blank.
1352	0100-95-0701	00-04318	5–5.5	Arsenic Barium Beryllium Cobalt Copper Magnesium Nickel Potassium Silver Sodium Vanadium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
2460	0100-96-1754 0100-96-1755 0100-96-1756	00-05754 00-05755 00-05756	5–5.5 4–4.5 5–5.5	Antimony Selenium	UJ	The reporting limit for this analyte is estimated; the spike % recovery was low.
781	0100-95-0627	00-04423	5–6	Beryllium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	0100-95-0627	00-04423	5–6	Cadmium Cobalt Nickel Potassium Sodium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
881S	RE00-02-45608 RE00-02-45610 RE00-02-45611	00-02-19696 00-02-19697 00-02-19697	0–0.5 0–0.5 0.5–1	Cadmium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-45610	00-02-19697	0–0.5	Selenium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.

Table C-5.0-2 (continued)

Request	Sample ID	Location ID	Depth (ft)	Analyte	Qualifier	Explanation
	RE00-02-45608	00-02-19696	0–0.5	Silver	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-45610	00-02-19697	0–0.5			
	RE00-02-45611	00-02-19697	0.5–1			
	RE00-02-45608	00-02-19696	0–0.5	Thallium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-45609	00-02-19696	0.5–1			
	RE00-02-45610	00-02-19697	0–0.5			
	RE00-02-45611	00-02-19697	0.5–1			
	RE00-02-45608	00-02-19696	0–0.5	Antimony	J-	The result for this analyte is estimated and biased low; the spike % recovery was low.
	RE00-02-45609	00-02-19696	0.5–1			
	RE00-02-45608	00-02-19696	0–0.5	Calcium Magnesium Mercury Potassium Sodium	J+	The result for this analyte is estimated and biased high; the spike % recovery was high.
	RE00-02-45609	00-02-19696	0.5–1			
	RE00-02-45610	00-02-19697	0–0.5			
	RE00-02-45611	00-02-19697	0.5–1			
	RE00-02-45610	00-02-19697	0–0.5	Antimony	UJ	The reporting limit for this analyte is estimated; the spike % recovery was low.
	RE00-02-45611	00-02-19697	0.5–1			
886S	RE00-02-45606	00-02-19695	0–0.5	Cadmium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-45607	00-02-19695	0.5–1			
	RE00-02-45612	00-02-19698	0–0.5			
	RE00-02-45613	00-02-19698	0.5–1			
	RE00-02-45614	00-02-19699	0–0.5			
	RE00-02-45615	00-02-19699	0.5–1			
	RE00-02-45616	00-02-19700	0–0.5			
	RE00-02-45617	00-02-19700	0.5–1			
	RE00-02-45606	00-02-19695	0–0.5	Selenium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-45607	00-02-19695	0.5–1			
	RE00-02-45613	00-02-19698	0.5–1			
	RE00-02-45615	00-02-19699	0.5–1			
	RE00-02-45616	00-02-19700	0–0.5			
	RE00-02-45617	00-02-19700	0.5–1			
	RE00-02-45606	00-02-19695	0–0.5	Silver	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-45612	00-02-19698	0–0.5			
	RE00-02-45613	00-02-19698	0.5–1			
	RE00-02-45614	00-02-19699	0–0.5			
	RE00-02-45615	00-02-19699	0.5–1			
	RE00-02-45616	00-02-19700	0–0.5			
	RE00-02-45617	00-02-19700	0.5–1			
	RE00-02-45606	00-02-19695	0–0.5	Calcium Chromium Lead Magnesium	J	The result for this analyte is estimated; its relative % difference from the duplicate was > the advisory limit.
	RE00-02-45607	00-02-19695	0.5–1			
	RE00-02-45612	00-02-19698	0–0.5			
	RE00-02-45613	00-02-19698	0.5–1			
	RE00-02-45614	00-02-19699	0–0.5			
	RE00-02-45615	00-02-19699	0.5–1			
	RE00-02-45616	00-02-19700	0–0.5			
	RE00-02-45617	00-02-19700	0.5–1			
	RE00-02-45606	00-02-19695	0–0.5	Antimony	J-	The result for this analyte is estimated and biased low; the spike % recovery was low.
	RE00-02-45612	00-02-19698	0–0.5			
	RE00-02-45613	00-02-19698	0.5–1			
	RE00-02-45614	00-02-19699	0–0.5			

Table C-5.0-2 (continued)

Request	Sample ID	Location ID	Depth (ft)	Analyte	Qualifier	Explanation
	RE00-02-45606 RE00-02-45607 RE00-02-45612 RE00-02-45613 RE00-02-45614 RE00-02-45615 RE00-02-45616 RE00-02-45617	00-02-19695 00-02-19695 00-02-19698 00-02-19698 00-02-19699 00-02-19699 00-02-19700 00-02-19700	0–0.5 0.5–1 0–0.5 0.5–1 0–0.5 0.5–1 0–0.5 0.5–1	Barium Mercury Potassium Sodium	J+	The result for this analyte is estimated and biased high; the spike % recovery was high.
	RE00-02-45606 RE00-02-45607	00-02-19695 00-02-19695	0–0.5 0.5–1	Zinc	J+	The result for this analyte is estimated and biased high; the spike % recovery was high.
	RE00-02-45612 RE00-02-45613 RE00-02-45614 RE00-02-45615 RE00-02-45616 RE00-02-45617	00-02-19698 00-02-19698 00-02-19699 00-02-19699 00-02-19700 00-02-19700	0–0.5 0.5–1 0–0.5 0.5–1 0–0.5 0.5–1	Zinc	J+	The result for this analyte is estimated and biased high; the spike % recovery was high.
	RE00-02-45607 RE00-02-45615 RE00-02-45616 RE00-02-45617	00-02-19695 00-02-19699 00-02-19700 00-02-19700	0.5–1 0.5–1 0–0.5 0.5–1	Antimony	UJ	The reporting limit for this analyte is estimated; the spike % recovery was low.
0-030(b,m)						
1022S	RE00-02-46488 RE00-02-46489 RE00-02-46491	00-02-20800 00-02-20801 00-02-20803	0–0.5	Antimony	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-46488 RE00-02-46489 RE00-02-46490 RE00-02-46491	00-02-20800 00-02-20801 00-02-20802 00-02-20803	0–0.5	Cadmium Sodium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-46489 RE00-02-46491	00-02-20801 00-02-20803	0–0.5	Mercury	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-46488 RE00-02-46489 RE00-02-46491	00-02-20800 00-02-20801 00-02-20803	0–0.5	Selenium Silver	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-46488 RE00-02-46489 RE00-02-46490 RE00-02-46491	00-02-20800 00-02-20801 00-02-20802 00-02-20803	0–0.5	Thallium	J	The result for this analyte is estimated; its relative % difference from the duplicate was > the advisory limit.
	RE00-02-46490	00-02-20802	0–0.5	Silver	U	The result for this analyte is undetected; the concentration was < or = to 5x the concentration in the blank.
1036S	RE00-02-46486 RE00-02-46487	00-02-20799 00-02-20799	0.67–1.17 1.67–2.17	Antimony Cadmium Mercury Silver Sodium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-46486 RE00-02-46487	00-02-20799 00-02-20799	0.67–1.17 1.67–2.17	Thallium	J	The result for this analyte is estimated; its relative % difference from the duplicate was > the advisory limit.

Table C-5.0-2 (continued)

Request	Sample ID	Location ID	Depth (ft)	Analyte	Qualifier	Explanation
1072S	RE00-02-46478	00-02-20795	1–1.5	Cadmium Mercury	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-46479	00-02-20795	1.83–2.33			
	RE00-02-46480	00-02-20796	0.83–1.17			
	RE00-02-46481	00-02-20796	1.83–2.33			
	RE00-02-46482	00-02-20797	0.83–1.33			
	RE00-02-46483	00-02-20797	1.83–2.33			
	RE00-02-46484	00-02-20798	0.83–1.33			
	RE00-02-46485	00-02-20798	1.83–2.33			
	RE00-02-46479	00-02-20795	1.83–2.33	Silver Sodium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-46480	00-02-20796	0.83–1.17			
	RE00-02-46481	00-02-20796	1.83–2.33			
	RE00-02-46482	00-02-20797	0.83–1.33			
	RE00-02-46483	00-02-20797	1.83–2.33			
	RE00-02-46484	00-02-20798	0.83–1.33			
	RE00-02-46485	00-02-20798	1.83–2.33			
	RE00-02-46478	00-02-20795	1–1.5	Sodium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-46478	00-02-20795	1–1.5	Cobalt Manganese Potassium Thallium	J	The result for this analyte is estimated; its relative % difference from the duplicate was > the advisory limit.
	RE00-02-46479	00-02-20795	1.83–2.33			
	RE00-02-46480	00-02-20796	0.83–1.17			
	RE00-02-46481	00-02-20796	1.83–2.33			
	RE00-02-46482	00-02-20797	0.83–1.33			
	RE00-02-46483	00-02-20797	1.83–2.33			
	RE00-02-46484	00-02-20798	0.83–1.33			
	RE00-02-46485	00-02-20798	1.83–2.33			
	RE00-02-46478	00-02-20795	1–1.5	Nickel Vanadium	J	The result for this analyte is estimated; the relative % difference of the serial dilution sample was > the advisory limit.
	RE00-02-46478	00-02-20795	1–1.5	Barium Copper Lead	J-	The result for this analyte is estimated and biased low; the spike % recovery was low.
	RE00-02-46479	00-02-20795	1.83–2.33			
	RE00-02-46480	00-02-20796	0.83–1.17			
	RE00-02-46481	00-02-20796	1.83–2.33			
	RE00-02-46482	00-02-20797	0.83–1.33			
	RE00-02-46483	00-02-20797	1.83–2.33			
	RE00-02-46484	00-02-20798	0.83–1.33			
	RE00-02-46485	00-02-20798	1.83–2.33			
	RE00-02-46478	00-02-20795	1–1.5	Selenium	J-	The result for this analyte is estimated and biased low; the spike % recovery was low.
	RE00-02-46481	00-02-20796	1.83–2.33			
	RE00-02-46482	00-02-20797	0.83–1.33			
	RE00-02-46484	00-02-20798	0.83–1.33			
	RE00-02-46478	00-02-20795	1–1.5	Zinc	J+	The result for this analyte is estimated and biased high; the spike % recovery was high.
	RE00-02-46479	00-02-20795	1.83–2.33			
	RE00-02-46480	00-02-20796	0.83–1.17			
	RE00-02-46481	00-02-20796	1.83–2.33			
	RE00-02-46482	00-02-20797	0.83–1.33			
	RE00-02-46483	00-02-20797	1.83–2.33			
	RE00-02-46484	00-02-20798	0.83–1.33			
	RE00-02-46485	00-02-20798	1.83–2.33			

Table C-5.0-2 (continued)

Request	Sample ID	Location ID	Depth (ft)	Analyte	Qualifier	Explanation
	RE00-02-46478 RE00-02-46479 RE00-02-46480 RE00-02-46481 RE00-02-46482 RE00-02-46484 RE00-02-46485	00-02-20795 00-02-20795 00-02-20796 00-02-20796 00-02-20797 00-02-20798 00-02-20798	1–1.5 1.83–2.33 0.83–1.17 1.83–2.33 0.83–1.33 0.83–1.33 1.83–2.33	Antimony	U	The result for this analyte is undetected; the concentration was < or = to 5x the concentration in the blank.
	RE00-02-46483	00-02-20797	1.83–2.33	Antimony	UJ	The reporting limit for this analyte is estimated; the spike % recovery was low.
	RE00-02-46479 RE00-02-46480 RE00-02-46483 RE00-02-46485	00-02-20795 00-02-20796 00-02-20797 00-02-20798	1.83–2.33 0.83–1.17 1.83–2.33 1.83–2.33	Selenium	UJ	The reporting limit for this analyte is estimated; the spike % recovery was low.
1478	0100-95-0704	00-04335	9–9.5	Cobalt Sodium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	0100-95-0704	00-04335	9–9.5	Mercury	J+	The result for this analyte is estimated and biased high; the spike % recovery was high.
	0100-95-0704	00-04335	9–9.5	Selenium	UJ	The reporting limit for this analyte is estimated; the spike % recovery was low.
1488	0100-95-0715	00-04344	10–11	Cobalt Sodium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	0100-95-0715	00-04344	10–11	Selenium	UJ	The reporting limit for this analyte is estimated; the spike % recovery was low.
1495	0100-95-0716 0100-95-0717 0100-95-0718	00-04345 00-04346 00-04347	4.5–5.5 7.5–8.5 4–5	Cobalt Sodium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	0100-95-0716 0100-95-0717 0100-95-0718	00-04345 00-04346 00-04347	4.5–5.5 7.5–8.5 4–5	Barium Silver	J-	The result for this analyte is estimated and biased low; the spike % recovery was low.
	0100-95-0716 0100-95-0717 0100-95-0718	00-04345 00-04346 00-04347	4.5–5.5 7.5–8.5 4–5	Selenium	UJ	The reporting limit for this analyte is estimated; the spike % recovery was low.
1506	0100-95-0725	00-04353	6.5–7	Cobalt Sodium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	0100-95-0725	00-04353	6.5–7	Barium Copper Lead	J-	The result for this analyte is estimated and biased low; the spike % recovery was low.

Table C-5.0-2 (continued)

Request	Sample ID	Location ID	Depth (ft)	Analyte	Qualifier	Explanation
1515	0100-95-0726	00-04354	0–9	Cobalt	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	0100-95-0727	00-04355	6–7			
	0100-95-0728	00-04355	8–9			
	0100-95-0730	00-04357	4–5			
	0100-95-0731	00-04357	6–7			
	0100-95-0732	00-04358	4.5–4.7			
	0100-95-0733	00-04359	0–6			
	0100-95-0734	00-04360	3–4			
	0100-95-0735	00-04360	5–6			
	0100-95-0728	00-04355	8–9	Mercury	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	0100-95-0729	00-04356	2–8			
	0100-95-0730	00-04357	4–5			
	0100-95-0726	00-04354	0–9	Sodium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	0100-95-0729	00-04356	2–8			
	0100-95-0730	00-04357	4–5			
	0100-95-0731	00-04357	6–7			
	0100-95-0732	00-04358	4.5–4.7			
	0100-95-0733	00-04359	0–6			
	0100-95-0734	00-04360	3–4			
	0100-95-0735	00-04360	5–6			
1572	0100-95-0741	00-04362	9–10	Arsenic	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	0100-95-0742	00-04363				
	0100-95-0740	00-04361	4.5–4.8	Beryllium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	0100-95-0743	00-04364	10–11			
	0100-95-0749	00-04367	0–9			
	0100-95-0740	00-04361	4.5–4.8	Cobalt	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	0100-95-0741	00-04362	9–10			
	0100-95-0742	00-04363	9–10			
	0100-95-0741	00-04362	9–10	Copper	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	0100-95-0742	00-04363				
	0100-95-0741	00-04362	9–10	Magnesium Mercury	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	0100-95-0740	00-04361	4.5–4.8	Nickel	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	0100-95-0741	00-04362	9–10			
	0100-95-0742	00-04363	9–10			
	0100-95-0741	00-04362	9–10	Potassium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	0100-95-0742	00-04363				
	0100-95-0740	00-04361	4.5–4.8	Sodium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	0100-95-0741	00-04362	9–10			
	0100-95-0742	00-04363	9–10			
	0100-95-0743	00-04364	10–11			
	0100-95-0749	00-04367	0–9			
	0100-95-0750	00-04368	10–11			

Table C-5.0-2 (continued)

Request	Sample ID	Location ID	Depth (ft)	Analyte	Qualifier	Explanation
	0100-95-0740	00-04361	4.5–4.8	Mercury Silver	J-	The result for this analyte is estimated and biased low; the spike % recovery was low.
	0100-95-0740 0100-95-0741 0100-95-0742 0100-95-0743 0100-95-0749 0100-95-0750	00-04361 00-04362 00-04363 00-04364 00-04367 00-04368	4.5–4.8 9–10 9–10 10–11 0–9 10–11	Selenium	UJ	The reporting limit for this analyte is estimated; the spike % recovery was low.
957S	RE00-02-46452 RE00-02-46453 RE00-02-46454 RE00-02-46455	00-02-20782 00-02-20782 00-02-20783 00-02-20783	6.5–7 7.5–8 6.5–8 7.5–8	Cadmium Mercury Sodium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-46454	00-02-20783	6.5–8	Arsenic Cobalt Copper Manganese Vanadium	J	The result for this analyte is estimated; the relative % difference of the serial dilution sample was > the advisory limit.
	RE00-02-46452 RE00-02-46453 RE00-02-46454 RE00-02-46455	00-02-20782 00-02-20782 00-02-20783 00-02-20783	6.5–7 7.5–8 6.5–8 7.5–8	Antimony	J-	The result for this analyte is estimated and biased low; the spike % recovery was low.
	RE00-02-46452 RE00-02-46453 RE00-02-46454 RE00-02-46455	00-02-20782 00-02-20782 00-02-20783 00-02-20783	6.5–7 7.5–8 6.5–8 7.5–8	Beryllium	J-	The result for this analyte is estimated and biased low; the spike % recovery was low.
	RE00-02-46452	00-02-20782	6.5–7	Silver	U	The result for this analyte is undetected; the concentration was < or = to 5x the concentration in the blank.
963S	RE00-02-46456 RE00-02-46457 RE00-02-46458 RE00-02-46459 RE00-02-46460 RE00-02-46461	00-02-20784 00-02-20784 00-02-20785 00-02-20785 00-02-20786 00-02-20786	5.5–6 6.5–7 6.5–7 7.5–8 7.25–7.75 8.25–8.75	Cadmium Mercury Sodium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-46457 RE00-02-46458 RE00-02-46459 RE00-02-46460 RE00-02-46461	00-02-20784 00-02-20785 00-02-20785 00-02-20786 00-02-20786	6.5–7 6.5–7 7.5–8 7.25–7.75 8.25–8.75	Selenium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-46456 RE00-02-46457 RE00-02-46458 RE00-02-46459 RE00-02-46460 RE00-02-46461	00-02-20784 00-02-20784 00-02-20785 00-02-20785 00-02-20786 00-02-20786	5.5–6 6.5–7 6.5–7 7.5–8 7.25–7.75 8.25–8.75	Antimony Beryllium	J-	The result for this analyte is estimated and biased low; the spike % recovery was low.
966S	RE00-02-46462 RE00-02-46463	00-02-20787 00-02-20787	9.5–10 10.5–11	Cadmium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-46462	00-02-20787	9.5–10	Selenium Sodium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.

Table C-5.0-2 (continued)

Request	Sample ID	Location ID	Depth (ft)	Analyte	Qualifier	Explanation
	RE00-02-46463	00-02-20787	10.5–11	Sodium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-46462 RE00-02-46463	00-02-20787 00-02-20787	9.5–10 10.5–11	Antimony Beryllium	J-	The result for this analyte is estimated and biased low; the spike % recovery was low.
969S	RE00-02-46464 RE00-02-46465 RE00-02-46466 RE00-02-46467	00-02-20788 00-02-20788 00-02-20789 00-02-20789	10–10.5 10.5–11 9.4–9.7 10.4–10.7	Cadmium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-46464 RE00-02-46466 RE00-02-46467	00-02-20788 00-02-20789 00-02-20789	10–10.5 9.4–9.7 10.4–10.7	Selenium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-46464 RE00-02-46465 RE00-02-46466 RE00-02-46467	00-02-20788 00-02-20788 00-02-20789 00-02-20789	10–10.5 10.5–11 9.4–9.7 10.4–10.7	Sodium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-46464	00-02-20788	10–10.5	Cobalt Nickel	J	The result for this analyte is estimated; the relative % difference of the serial dilution sample was > the advisory limit.
	RE00-02-46464 RE00-02-46465 RE00-02-46466 RE00-02-46467	00-02-20788 00-02-20788 00-02-20789 00-02-20789	10–10.5 10.5–11 9.4–9.7 10.4–10.7	Lead Mercury	J+	The result for this analyte is estimated and biased high; the spike % recovery was high.
	RE00-02-46466 RE00-02-46467	00-02-20789 00-02-20789	9.4–9.7 10.4–10.7	Silver	U	The result for this analyte is undetected; the concentration was < or = to 5x the concentration in the blank.
	RE00-02-46464 RE00-02-46465 RE00-02-46466 RE00-02-46467	00-02-20788 00-02-20788 00-02-20789 00-02-20789	10–10.5 10.5–11 9.4–9.7 10.4–10.7	Antimony	UJ	The reporting limit for this analyte is estimated; the spike % recovery was low.
972S	RE00-02-46468 RE00-02-46469	00-02-20790 00-02-20790	9.83–10.33 10.33–10.83	Cadmium Potassium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-46468	00-02-20790	9.83–10.33	Cobalt Magnesium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-46469	00-02-20790	10.33–10.83	Magnesium Selenium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-46468 RE00-02-46469	00-02-20790 00-02-20790	9.83–10.33 10.33–10.83	Sodium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.

Table C-5.0-2 (continued)

Request	Sample ID	Location ID	Depth (ft)	Analyte	Qualifier	Explanation
	RE00-02-46468 RE00-02-46469	00-02-20790 00-02-20790	9.83–10.33 10.33–10.83	Lead Mercury	J+	The result for this analyte is estimated and biased high; the spike % recovery was high.
	RE00-02-46468 RE00-02-46469	00-02-20790 00-02-20790	9.83–10.33 10.33–10.83	Chromium Thallium	U	The result for this analyte is undetected; the concentration was < or = to 5x the concentration in the blank.
	RE00-02-46468 RE00-02-46469	00-02-20790 00-02-20790	9.83–10.33 10.33–10.83	Antimony	UJ	The reporting limit for this analyte is estimated; the spike % recovery was low.
980S	RE00-02-46470 RE00-02-46471 RE00-02-46472 RE00-02-46473	00-02-20791 00-02-20791 00-02-20792 00-02-20792	1.7–2 2.3–2.8 5.5–6 6.5–7	Cadmium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-46473	00-02-20792	6.5–7	Calcium Cobalt Magnesium Potassium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-46472 RE00-02-46473	00-02-20792 00-02-20792	5.5–6 6.5–7	Selenium Silver	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-46470 RE00-02-46471 RE00-02-46473	00-02-20791 00-02-20791 00-02-20792	1.7–2 2.3–2.8 6.5–7	Sodium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-46471 RE00-02-46472	00-02-20791 00-02-20792	2.3–2.8 5.5–6	Antimony	J-	The result for this analyte is estimated and biased low; the spike % recovery was low.
	RE00-02-46470 RE00-02-46471 RE00-02-46472 RE00-02-46473	00-02-20791 00-02-20791 00-02-20792 00-02-20792	1.7–2 2.3–2.8 5.5–6 6.5–7	Lead	J+	The result for this analyte is estimated and biased high; the spike % recovery was high.
	RE00-02-46470 RE00-02-46471 RE00-02-46472	00-02-20791 00-02-20791 00-02-20792	1.7–2 2.3–2.8 5.5–6	Mercury	J+	The result for this analyte is estimated and biased high; the spike % recovery was high.
	RE00-02-46473	00-02-20792	6.5–7	Chromium Thallium	U	The result for this analyte is undetected; the concentration was < or = to 5x the concentration in the blank.
	RE00-02-46473	00-02-20792	6.5–7	Mercury	UJ	The reporting limit for this analyte is estimated; the spike % recovery was high.
	RE00-02-46470 RE00-02-46473	00-02-20791 00-02-20792	1.7–2 6.5–7	Antimony	UJ	The reporting limit for this analyte is estimated; the spike % recovery was low.
984	0100-95-0479	00-04304	10–10.3	Antimony Cobalt Selenium Sodium Thallium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.

Table C-5.0-2 (continued)

Request	Sample ID	Location ID	Depth (ft)	Analyte	Qualifier	Explanation
984S	RE00-02-46477	00-02-20794	2.5–3	Barium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-46474 RE00-02-46475 RE00-02-46476 RE00-02-46477	00-02-20793 00-02-20793 00-02-20794 00-02-20794	2.5–2.8 3–3.3 2–2.5 2.5–3	Cadmium Sodium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-46477	00-02-20794	2.5–3	Calcium Cobalt Lead Magnesium Potassium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-46474 RE00-02-46475 RE00-02-46477	00-02-20793 00-02-20793 00-02-20794	2.5–2.8 3–3.3 2.5–3	Mercury	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-46474 RE00-02-46476 RE00-02-46477	00-02-20793 00-02-20794 00-02-20794	2.5–2.8 2–2.5 2.5–3	Selenium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-46476 RE00-02-46477	00-02-20794 00-02-20794	2–2.5 2.5–3	Thallium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-46474	00-02-20793	2.5–2.8	Arsenic Cobalt Vanadium	J	The result for this analyte is estimated; the relative % difference of the serial dilution sample was > the advisory limit.
	RE00-02-46474 RE00-02-46475 RE00-02-46476	00-02-20793 00-02-20793 00-02-20794	2.5–2.8 3–3.3 2–2.5	Antimony	J-	The result for this analyte is estimated and biased low; the spike % recovery was low.
	RE00-02-46477	00-02-20794	2.5–3	Antimony	UJ	The reporting limit for this analyte is estimated; the spike % recovery was low.
993	0100-95-0485	00-04308	4.5–4.7	Cadmium Cobalt Mercury Silver Thallium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
21-021-99						
778S	RE00-02-45637 RE00-02-45638 RE00-02-45639 RE00-02-45640 RE00-02-45641 RE00-02-45643 RE00-02-45706 RE00-02-45714 RE00-02-45715	00-02-19714 00-02-19715 00-02-19716 00-02-19717 00-02-19718 00-02-19720 00-02-19720 00-02-19716 00-02-19714	0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0.08–0.5 0.08–0.5 0.08–0.5	Cadmium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-45638 RE00-02-45639 RE00-02-45640 RE00-02-45641 RE00-02-45643 RE00-02-45714	00-02-19715 00-02-19716 00-02-19717 00-02-19718 00-02-19720 00-02-19716	0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0.08–0.5	Silver	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.

Table C-5.0-2 (continued)

Request	Sample ID	Location ID	Depth (ft)	Analyte	Qualifier	Explanation
	RE00-02-45643	00-02-19720	0–0.08	Thallium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-45636	00-02-19713	0–0.08	Lead Mercury	J-	The result for this analyte is estimated and biased low; the spike % recovery was low.
	RE00-02-45637	00-02-19714	0–0.08			
	RE00-02-45638	00-02-19715	0–0.08			
	RE00-02-45639	00-02-19716	0–0.08			
	RE00-02-45640	00-02-19717	0–0.08			
	RE00-02-45641	00-02-19718	0–0.08			
	RE00-02-45642	00-02-19719	0–0.08			
	RE00-02-45643	00-02-19720	0–0.08			
	RE00-02-45706	00-02-19720	0.08–0.5			
	RE00-02-45714	00-02-19716	0.08–0.5			
	RE00-02-45715	00-02-19714	0.08–0.5			
782S	RE00-02-45645	00-02-19722	0–0.08	Cadmium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-45646	00-02-19723	0–0.08			
	RE00-02-45647	00-02-19724	0–0.08			
	RE00-02-45649	00-02-19726	0–0.08			
	RE00-02-45650	00-02-19727	0–0.08			
	RE00-02-45651	00-02-19728	0–0.08			
	RE00-02-45654	00-02-19731	0–0.08			
	RE00-02-45656	00-02-19733	0–0.08			
	RE00-02-45709	00-02-19727	0.08–0.5			
	RE00-02-45648	00-02-19725	0–0.08	Mercury	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-45644	00-02-19721	0–0.08	Silver	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-45645	00-02-19722	0–0.08			
	RE00-02-45646	00-02-19723	0–0.08			
	RE00-02-45647	00-02-19724	0–0.08			
	RE00-02-45648	00-02-19725	0–0.08			
	RE00-02-45649	00-02-19726	0–0.08			
	RE00-02-45650	00-02-19727	0–0.08			
	RE00-02-45651	00-02-19728	0–0.08			
	RE00-02-45652	00-02-19729	0–0.08			
	RE00-02-45653	00-02-19730	0–0.08			
	RE00-02-45654	00-02-19731	0–0.08			
	RE00-02-45655	00-02-19732	0–0.08			
	RE00-02-45656	00-02-19733	0–0.08			
	RE00-02-45704	00-02-19725	0.08–0.5			
	RE00-02-45705	00-02-19732	0.08–0.5	Silver	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-45709	00-02-19727	0.08–0.5			
	RE00-02-45712	00-02-19730	0.08–0.5			
	RE00-02-45648	00-02-19725	0–0.08	Thallium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-45652	00-02-19729	0–0.08			
	RE00-02-45654	00-02-19731	0–0.08			
	RE00-02-45655	00-02-19732	0–0.08			

Table C-5.0-2 (continued)

Request	Sample ID	Location ID	Depth (ft)	Analyte	Qualifier	Explanation
	RE00-02-45644	00-02-19721	0–0.08	Lead	J-	The result for this analyte is estimated and biased low; the spike % recovery was low.
	RE00-02-45645	00-02-19722	0–0.08			
	RE00-02-45646	00-02-19723	0–0.08			
	RE00-02-45647	00-02-19724	0–0.08			
	RE00-02-45648	00-02-19725	0–0.08			
	RE00-02-45649	00-02-19726	0–0.08			
	RE00-02-45650	00-02-19727	0–0.08			
	RE00-02-45651	00-02-19728	0–0.08			
	RE00-02-45652	00-02-19729	0–0.08			
	RE00-02-45653	00-02-19730	0–0.08			
	RE00-02-45656	00-02-19733	0–0.08	Antimony	J+	The result for this analyte is estimated and biased high; the laboratory control sample recovery associated with this analyte was high.
	RE00-02-45709	00-02-19727	0.08–0.5			
	RE00-02-45654	00-02-19731	0–0.08	Mercury	U	The result for this analyte is undetected; the concentration was < or = to 5x the concentration in the blank.
	RE00-02-45655	00-02-19732	0–0.08			
	RE00-02-45704	00-02-19725	0.08–0.5			
	RE00-02-45705	00-02-19732	0.08–0.5			
	RE00-02-45709	00-02-19727	0.08–0.5			
	RE00-02-45654	00-02-19731	0–0.08	Antimony	UJ	The reporting limit for this analyte is estimated; the spike % recovery was low.
	RE00-02-45655	00-02-19732	0–0.08			
	RE00-02-45704	00-02-19725	0.08–0.5			
	RE00-02-45705	00-02-19732	0.08–0.5			
	RE00-02-45712	00-02-19730	0.08–0.5			
788S	RE00-02-45657	00-02-19734	0–0.08	Cadmium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-45658	00-02-19735	0–0.08			
	RE00-02-45659	00-02-19736	0–0.08			
	RE00-02-45660	00-02-19737	0–0.08			
	RE00-02-45661	00-02-19738	0–0.08			
	RE00-02-45662	00-02-19739	0–0.08			
	RE00-02-45664	00-02-19741	0–0.08			
	RE00-02-45665	00-02-19742	0–0.08			
	RE00-02-45701	00-02-19734	0.08–0.5			
	RE00-02-45702	00-02-19739	0.08–0.5			
	RE00-02-45658	00-02-19735	0–0.08	Silver	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-45659	00-02-19736	0–0.08			
	RE00-02-45660	00-02-19737	0–0.08			
	RE00-02-45661	00-02-19738	0–0.08			
	RE00-02-45662	00-02-19739	0–0.08			
	RE00-02-45663	00-02-19740	0–0.08			
	RE00-02-45664	00-02-19741	0–0.08			
	RE00-02-45665	00-02-19742	0–0.08			
	RE00-02-45702	00-02-19739	0.08–0.5			
	RE00-02-45659	00-02-19736	0–0.08	Thallium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-45661	00-02-19738	0–0.08			
	RE00-02-45664	00-02-19741	0–0.08			
	RE00-02-45665	00-02-19742	0–0.08			
	RE00-02-45701	00-02-19734	0.08–0.5			

Table C-5.0-2 (continued)

Request	Sample ID	Location ID	Depth (ft)	Analyte	Qualifier	Explanation
	RE00-02-45657 RE00-02-45658 RE00-02-45659 RE00-02-45661 RE00-02-45662 RE00-02-45663 RE00-02-45664 RE00-02-45665 RE00-02-45701 RE00-02-45702	00-02-19734 00-02-19735 00-02-19736 00-02-19738 00-02-19739 00-02-19740 00-02-19741 00-02-19742 00-02-19734 00-02-19739	0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0.08–0.5 0.08–0.5	Antimony	J+	The result for this analyte is estimated and biased high; the laboratory control sample recovery associated with this analyte was high.
	RE00-02-45660	00-02-19737	0–0.08	Antimony	UJ	The reporting limit for this analyte is estimated; the spike % recovery was low.
796S	RE00-02-45666 RE00-02-45667 RE00-02-45668 RE00-02-45669 RE00-02-45703	00-02-19743 00-02-19744 00-02-19745 00-02-19746 00-02-19745	0–0.08 0–0.08 0–0.08 0–0.08 0.08–0.3	Cadmium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-45667	00-02-19744	0–0.08	Mercury Thallium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-45666 RE00-02-45667 RE00-02-45668 RE00-02-45669 RE00-02-45703	00-02-19743 00-02-19744 00-02-19745 00-02-19746 00-02-19745	0–0.08 0–0.08 0–0.08 0–0.08 0.08–0.3	Silver	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
798S	RE00-02-45670 RE00-02-45671 RE00-02-45675 RE00-02-45676 RE00-02-45677 RE00-02-45678 RE00-02-45707 RE00-02-45708 RE00-02-45710	00-02-19747 00-02-19748 00-02-19752 00-02-19753 00-02-19754 00-02-19755 00-02-19747 00-02-19754 00-02-19748	0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0.08–0.5 0.08–0.5 0.08–0.5	Cadmium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-45670 RE00-02-45707	00-02-19747 00-02-19747	0–0.08 0.08–0.5	Mercury	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-45670 RE00-02-45671 RE00-02-45674 RE00-02-45675 RE00-02-45676 RE00-02-45677 RE00-02-45678 RE00-02-45707 RE00-02-45708 RE00-02-45710	00-02-19747 00-02-19748 00-02-19751 00-02-19752 00-02-19753 00-02-19754 00-02-19755 00-02-19747 00-02-19754 00-02-19748	0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0.08–0.5 0.08–0.5 0.08–0.5	Silver	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-45670 RE00-02-45671 RE00-02-45675 RE00-02-45676 RE00-02-45678 RE00-02-45707	00-02-19747 00-02-19748 00-02-19752 00-02-19753 00-02-19755 00-02-19747	0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0.08–0.5	Thallium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.

Table C-5.0-2 (continued)

Request	Sample ID	Location ID	Depth (ft)	Analyte	Qualifier	Explanation
822S	RE00-02-45683	00-02-19760	0–0.08	Cadmium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-45684	00-02-19761	0–0.08			
	RE00-02-45686	00-02-19763	0–0.08			
	RE00-02-45687	00-02-19764	0–0.08			
	RE00-02-45688	00-02-19765	0–0.08			
	RE00-02-45689	00-02-19766	0–0.08			
	RE00-02-45692	00-02-19769	0–0.08			
	RE00-02-45693	00-02-19770	0–0.08			
	RE00-02-45717	00-02-19760	0.08–0.5			
	RE00-02-45718	00-02-19762	0.08–0.5			
	RE00-02-45719	00-02-19764	0.08–0.5			
	RE00-02-45683	00-02-19760	0–0.08	Selenium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-45684	00-02-19761	0–0.08			
	RE00-02-45686	00-02-19763	0–0.08			
	RE00-02-45687	00-02-19764	0–0.08			
	RE00-02-45688	00-02-19765	0–0.08			
	RE00-02-45689	00-02-19766	0–0.08			
	RE00-02-45693	00-02-19770	0–0.08			
	RE00-02-45718	00-02-19762	0.08–0.5			
	RE00-02-45719	00-02-19764	0.08–0.5			
	RE00-02-45683	00-02-19760	0–0.08	Silver	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-45685	00-02-19762	0–0.08			
	RE00-02-45686	00-02-19763	0–0.08			
	RE00-02-45687	00-02-19764	0–0.08			
	RE00-02-45688	00-02-19765	0–0.08	Silver	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-45689	00-02-19766	0–0.08			
	RE00-02-45692	00-02-19769	0–0.08			
	RE00-02-45693	00-02-19770	0–0.08			
	RE00-02-45717	00-02-19760	0.08–0.5			
	RE00-02-45718	00-02-19762	0.08–0.5			
	RE00-02-45719	00-02-19764	0.08–0.5			
	RE00-02-45686	00-02-19763	0–0.08	Thallium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-45687	00-02-19764	0–0.08			
	RE00-02-45692	00-02-19769	0–0.08			
	RE00-02-45693	00-02-19770	0–0.08			
	RE00-02-45717	00-02-19760	0.08–0.5			
	RE00-02-45718	00-02-19762	0.08–0.5			
	RE00-02-45719	00-02-19764	0.08–0.5			
	RE00-02-45684	00-02-19761	0–0.08	Antimony	J-	The result for this analyte is estimated and biased low; the spike % recovery was low.
	RE00-02-45685	00-02-19762	0–0.08			
	RE00-02-45683	00-02-19760	0–0.08	Antimony	UJ	The reporting limit for this analyte is estimated; the spike % recovery was low.
	RE00-02-45686	00-02-19763	0–0.08			
	RE00-02-45687	00-02-19764	0–0.08			
	RE00-02-45688	00-02-19765	0–0.08			
	RE00-02-45689	00-02-19766	0–0.08			
	RE00-02-45692	00-02-19769	0–0.08			
	RE00-02-45693	00-02-19770	0–0.08			
	RE00-02-45717	00-02-19760	0.08–0.5			
	RE00-02-45718	00-02-19762	0.08–0.5			
	RE00-02-45719	00-02-19764	0.08–0.5			

Table C-5.0-2 (continued)

Request	Sample ID	Location ID	Depth (ft)	Analyte	Qualifier	Explanation
825S	RE00-02-45690 RE00-02-45691 RE00-02-45694 RE00-02-45695 RE00-02-45696 RE00-02-45697 RE00-02-45716 RE00-02-45720	00-02-19767 00-02-19768 00-02-19771 00-02-19772 00-02-19773 00-02-19774 00-02-19771 00-02-19768	0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0.08–0.5 0.08–0.5	Cadmium Silver	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
	RE00-02-45690 RE00-02-45691 RE00-02-45694 RE00-02-45696 RE00-02-45697 RE00-02-45716 RE00-02-45720	00-02-19767 00-02-19768 00-02-19771 00-02-19773 00-02-19774 00-02-19771 00-02-19768	0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0.08–0.5 0.08–0.5	Thallium	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.
827S	RE00-02-45679 RE00-02-45680 RE00-02-45681 RE00-02-45682 RE00-02-45721	00-02-19756 00-02-19757 00-02-19758 00-02-19759 00-02-19759	0–0.08 0–0.08 0–0.08 0–0.08 0.08–0.5	Cadmium Silver	J	The result for this analyte is estimated; it was < the practical quantitation limit but above the method detection limit.

C-5.2 Organic Data Review

Table C-5.0-3 presents the data for the samples that were analyzed for organic analytes and qualified. A number of samples were qualified due to insufficient mass spectrometry information to provide detection (U qualifier used). The holding time for extraction was missed for several samples associated with request number 1358S.

Table C-5.0-3
Organic Chemical Data Quality Evaluation

Request	Sample ID	Location ID	Depth (ft)	Analytical Suite	Analyte	Qualifier	Explanation
823	0100-95-0517	00-04221	0–0.33	SVOC	Benz(a)anthracene Bis(2-ethylhexyl)phthalate Bromophenyl-phenylether[4-]	UJ	The reporting limit for this analyte is estimated; the internal standard % recovery of the continuing calibration verification did not meet method requirements.
880S	RE00-02-45608 RE00-02-45609 RE00-02-45610 RE00-02-45611	00-02-19696 00-02-19696 00-02-19697 00-02-19697	0–0.5 0.5–1 0–0.5 0.5–1	PEST	DDD[4,4'-]	U	The result for this analyte is undetected; the concentration was < or = to 5x the concentration in the blank.
880S	RE00-02-45610	00-02-19697	0–0.5	PEST	Aldrin BHC[alpha-] BHC[beta-] BHC[delta-] BHC[gamma-] Chlordane[alpha-] Chlordane[gamma-] Dieldrin Endosulfan I Endosulfan II Endosulfan Sulfate Endrin Endrin Aldehyde Endrin Ketone Heptachlor Heptachlor Epoxide Methoxychlor[4,4'-] Toxaphene (Technical Grade)	UJ	The reporting limit for this analyte is estimated; the surrogate % recovery was low.
880S	RE00-02-45608	00-02-19696	0–0.5	SVOC	Benz(a)anthracene Chrysene Pyrene	J	The result for this analyte is estimated; the internal standard % recovery of the continuing calibration verification did not meet method requirements.
880S	RE00-02-45608 RE00-02-45609 RE00-02-45610 RE00-02-45611	00-02-19696 00-02-19696 00-02-19697 00-02-19697	0–0.5 0.5–1 0–0.5 0.5–1	SVOC	Bis(2-ethylhexyl)phthalate	U	The result for this analyte is undetected; the concentration was < or = to 5x the concentration in the blank.
	RE00-02-45608	00-02-19696	0–0.5		Benzo(a)pyrene Dibenz(a,h)anthracene Indeno(1,2,3-cd)pyrene	U	The result for this analyte is undetected; the mass spectrum did not meet method requirements.
	RE00-02-45610	00-02-19697	0–0.5		Benzo(b)fluoranthene	U	The result for this analyte is undetected; the mass spectrum did not meet method requirements.

Table C-5.0-3 (continued)

Request	Sample ID	Location ID	Depth (ft)	Analytical Suite	Analyte	Qualifier	Explanation
	RE00-02-45608 RE00-02-45609	00-02-19696 00-02-19696	0–0.5 0.5–1		Benzo(g,h,i)perylene	U	The result for this analyte is undetected; the mass spectrum did not meet method requirements.
	RE00-02-45609	00-02-19696	0.5–1		Butylbenzylphthalate] Hexanone[2-]	U	The result for this analyte is undetected; the mass spectrum did not meet method requirements.
	RE00-02-45608	00-02-19696	0–0.5		Butylbenzylphthalate Dichlorobenzidine[3,3'-]	UJ	The reporting limit for this analyte is estimated; the internal standard % recovery of the continuing calibration verification did not meet method requirements.
	RE00-02-45609 RE00-02-45611	00-02-19696 00-02-19697	0.5–1 0.5–1	VOC	Acetone	U	The result for this analyte is undetected; the mass spectrum did not meet method requirements.
885S	RE00-02-45607 RE00-02-45612	00-02-19695 00-02-19698	0.5–1 0–0.5	PEST	DDD[4,4'-]	U	The result for this analyte is undetected; the concentration was < or = to 5x the concentration in the blank.
	RE00-02-45612 RE00-02-45613	00-02-19698 00-02-19698	0–0.5 0.5–1		Dieldrin	U	The result for this analyte is undetected; the concentration was < or = to 5x the concentration in the blank.
	RE00-02-45606 RE00-02-45612 RE00-02-45613 RE00-02-45614 RE00-02-45615 RE00-02-45616	00-02-19695 00-02-19698 00-02-19698 00-02-19699 00-02-19699 00-02-19700	0–0.5 0–0.5 0.5–1 0–0.5 0.5–1 0–0.5	SVOC	Bis(2-ethylhexyl)phthalate	U	The result for this analyte is undetected; the concentration was < or = to 5x the concentration in the blank.
	RE00-02-45606 RE00-02-45612	00-02-19695 00-02-19698	0–0.5 0–0.5		Benzo(b)fluoranthene	U	The result for this analyte is undetected; the mass spectrum did not meet method requirements.
	RE00-02-45607	00-02-19695	0.5–1		Pyrene	U	The result for this analyte is undetected; the mass spectrum did not meet method requirements.
	RE00-02-45606	00-02-19695	0–0.5		Benzo(a)pyrene Benzo(g,h,i)perylene Benzo(k)fluoranthene Dibenz(a,h)anthracene Indeno(1,2,3-cd)pyrene	UJ	The reporting limit for this analyte is estimated; the internal standard % recovery of the continuing calibration verification did not meet method requirements.
	RE00-02-45607	00-02-19695	0.5–1	VOC	Dichlorobenzene[1,4-]	U	The result for this analyte is undetected; the mass spectrum did not meet method requirements.
0-029(a)							
1357S	RE00-02-46186	00-02-20048	1–1.5	PCB	Aroclor-1242 Aroclor-1254 Aroclor-1260	J+	The result for this analyte is estimated and biased high; the surrogate % recovery was high.

Table C-5.0-3 (continued)

Request	Sample ID	Location ID	Depth (ft)	Analytical Suite	Analyte	Qualifier	Explanation
	RE00-02-46167	00-02-20039	0–0.5	PEST	DDD[4,4'-]	J+	The result for this analyte is estimated and biased high; the surrogate % recovery was high.
	RE00-02-46167	00-02-20039	0–0.5		DDT[4,4'-]	J+	The result for this analyte is estimated and biased high; the surrogate % recovery was high.
	RE00-02-46173	00-02-20042	0–0.5				
	RE00-02-46178	00-02-20044	1–1.5				
	RE00-02-46180	00-02-20045	0.8–1.25				
	RE00-02-46181	00-02-20046	0–0.5				
	RE00-02-46183	00-02-20047	0–0.5				
	RE00-02-46197	00-02-20054	0–0.5				
	RE00-02-46167	00-02-20039	0–0.5		Dieldrin Endrin Endrin Aldehyde	J+	The result for this analyte is estimated and biased high; the surrogate % recovery was high.
0-029(b)							
1358S	RE00-02-46218	00-02-20063	0.8–1.2	PCB	Aroclor-1242	J-	The result for this analyte is estimated and biased low; the sample was extracted outside the appropriate holding time.
	RE00-02-46230	00-02-20069	1–1.3				
	RE00-02-46220	00-02-20064	1–1.5		Aroclor-1254	J-	The result for this analyte is estimated and biased low; the sample was extracted outside the appropriate holding time.
	RE00-02-46221	00-02-20065	0–0.5				
	RE00-02-46225	00-02-20067	0–0.5				
	RE00-02-46228	00-02-20068	1–1.5				
	RE00-02-46229	00-02-20069	0–0.5				
	RE00-02-46230	00-02-20069	1–1.3				
	RE00-02-46235	00-02-20072	0–0.5				
	RE00-02-46236	00-02-20072	0.8–1.2				
	RE00-02-46217	00-02-20063	0–0.5		Aroclor-1260	J-	The result for this analyte is estimated and biased low; the sample was extracted outside the appropriate holding time.
	RE00-02-46218	00-02-20063	0.8–1.2				
	RE00-02-46219	00-02-20064	0–0.5				
	RE00-02-46220	00-02-20064	1–1.5				
	RE00-02-46221	00-02-20065	0–0.5				
	RE00-02-46225	00-02-20067	0–0.5				
	RE00-02-46226	00-02-20067	1–1.5				
	RE00-02-46227	00-02-20068	0–0.5				
	RE00-02-46228	00-02-20068	1–1.5				
	RE00-02-46229	00-02-20069	0–0.5				
	RE00-02-46230	00-02-20069	1–1.3				
	RE00-02-46234	00-02-20071	0.5–1				
	RE00-02-46235	00-02-20072	0–0.5				
	RE00-02-46236	00-02-20072	0.8–1.2				

Table C-5.0-3 (continued)

Request	Sample ID	Location ID	Depth (ft)	Analytical Suite	Analyte	Qualifier	Explanation
	RE00-02-46217	00-02-20063	0–0.5		Aroclor-1016	UJ	The reporting limit for this analyte is estimated; the sample was extracted outside the appropriate holding time.
	RE00-02-46218	00-02-20063	0.8–1.2				
	RE00-02-46219	00-02-20064	0–0.5				
	RE00-02-46220	00-02-20064	1–1.5				
	RE00-02-46221	00-02-20065	0–0.5				
	RE00-02-46222	00-02-20065	1–1.5				
	RE00-02-46223	00-02-20066	0–0.5				
	RE00-02-46224	00-02-20066	0.8–1				
	RE00-02-46225	00-02-20067	0–0.5				
	RE00-02-46226	00-02-20067	1–1.5				
	RE00-02-46227	00-02-20068	0–0.5				
	RE00-02-46228	00-02-20068	1–1.5				
	RE00-02-46229	00-02-20069	0–0.5				
	RE00-02-46230	00-02-20069	1–1.3				
	RE00-02-46231	00-02-20070	0–0.5				
	RE00-02-46232	00-02-20070	1–1.5				
	RE00-02-46233	00-02-20071	0–0.5				
	RE00-02-46234	00-02-20071	0.5–1				
	RE00-02-46235	00-02-20072	0–0.5				
	RE00-02-46236	00-02-20072	0.8–1.2				
	RE00-02-46252	00-02-20080	0.75–1.2				
	RE00-02-46217	00-02-20063	0–0.5		Aroclor-1221	UJ	The reporting limit for this analyte is estimated; the sample was extracted outside the appropriate holding time.
	RE00-02-46218	00-02-20063	0.8–1.2				
	RE00-02-46219	00-02-20064	0–0.5				
	RE00-02-46220	00-02-20064	1–1.5				
	RE00-02-46221	00-02-20065	0–0.5				
	RE00-02-46222	00-02-20065	1–1.5				
	RE00-02-46223	00-02-20066	0–0.5				
	RE00-02-46224	00-02-20066	0.8–1				
	RE00-02-46225	00-02-20067	0–0.5				
	RE00-02-46226	00-02-20067	1–1.5				
	RE00-02-46227	00-02-20068	0–0.5				
	RE00-02-46228	00-02-20068	1–1.5				
	RE00-02-46229	00-02-20069	0–0.5				
	RE00-02-46230	00-02-20069	1–1.3		Aroclor-1221	UJ	The reporting limit for this analyte is estimated; the sample was extracted outside the appropriate holding time.
	RE00-02-46231	00-02-20070	0–0.5				
	RE00-02-46232	00-02-20070	1–1.5				
	RE00-02-46233	00-02-20071	0–0.5				
	RE00-02-46234	00-02-20071	0.5–1				
	RE00-02-46235	00-02-20072	0–0.5				
	RE00-02-46236	00-02-20072	0.8–1.2				
	RE00-02-46252	00-02-20080	0.75–1.2				

Table C-5.0-3 (continued)

Request	Sample ID	Location ID	Depth (ft)	Analytical Suite	Analyte	Qualifier	Explanation
	RE00-02-46217	00-02-20063	0–0.5		Aroclor-1232	UJ	The reporting limit for this analyte is estimated; the sample was extracted outside the appropriate holding time.
	RE00-02-46218	00-02-20063	0.8–1.2				
	RE00-02-46219	00-02-20064	0–0.5				
	RE00-02-46220	00-02-20064	1–1.5				
	RE00-02-46221	00-02-20065	0–0.5				
	RE00-02-46222	00-02-20065	1–1.5				
	RE00-02-46223	00-02-20066	0–0.5				
	RE00-02-46224	00-02-20066	0.8–1				
	RE00-02-46225	00-02-20067	0–0.5				
	RE00-02-46226	00-02-20067	1–1.5				
	RE00-02-46227	00-02-20068	0–0.5				
	RE00-02-46228	00-02-20068	1–1.5				
	RE00-02-46229	00-02-20069	0–0.5				
	RE00-02-46230	00-02-20069	1–1.3				
	RE00-02-46231	00-02-20070	0–0.5				
	RE00-02-46232	00-02-20070	1–1.5				
	RE00-02-46233	00-02-20071	0–0.5				
	RE00-02-46234	00-02-20071	0.5–1				
	RE00-02-46235	00-02-20072	0–0.5				
	RE00-02-46236	00-02-20072	0.8–1.2				
	RE00-02-46252	00-02-20080	0.75–1.2				
	RE00-02-46217	00-02-20063	0–0.5		Aroclor-1242	UJ	The reporting limit for this analyte is estimated; the sample was extracted outside the appropriate holding time.
	RE00-02-46219	00-02-20064	0–0.5				
	RE00-02-46220	00-02-20064	1–1.5				
	RE00-02-46221	00-02-20065	0–0.5				
	RE00-02-46222	00-02-20065	1–1.5				
	RE00-02-46223	00-02-20066	0–0.5				
	RE00-02-46224	00-02-20066	0.8–1				
	RE00-02-46225	00-02-20067	0–0.5				
	RE00-02-46226	00-02-20067	1–1.5				
	RE00-02-46227	00-02-20068	0–0.5				
	RE00-02-46228	00-02-20068	1–1.5				
	RE00-02-46229	00-02-20069	0–0.5				
	RE00-02-46231	00-02-20070	0–0.5				
	RE00-02-46232	00-02-20070	1–1.5				
	RE00-02-46233	00-02-20071	0–0.5				
	RE00-02-46234	00-02-20071	0.5–1				
	RE00-02-46235	00-02-20072	0–0.5				
	RE00-02-46236	00-02-20072	0.8–1.2				
	RE00-02-46252	00-02-20080	0.75–1.2				

Table C-5.0-3 (continued)

Request	Sample ID	Location ID	Depth (ft)	Analytical Suite	Analyte	Qualifier	Explanation
	RE00-02-46217	00-02-20063	0–0.5		Aroclor-1248	UJ	The reporting limit for this analyte is estimated; the sample was extracted outside the appropriate holding time.
	RE00-02-46218	00-02-20063	0.8–1.2				
	RE00-02-46219	00-02-20064	0–0.5				
	RE00-02-46220	00-02-20064	1–1.5				
	RE00-02-46221	00-02-20065	0–0.5				
	RE00-02-46222	00-02-20065	1–1.5				
	RE00-02-46223	00-02-20066	0–0.5				
	RE00-02-46224	00-02-20066	0.8–1				
	RE00-02-46225	00-02-20067	0–0.5				
	RE00-02-46226	00-02-20067	1–1.5				
	RE00-02-46227	00-02-20068	0–0.5				
	RE00-02-46228	00-02-20068	1–1.5				
	RE00-02-46229	00-02-20069	0–0.5				
	RE00-02-46230	00-02-20069	1–1.3				
	RE00-02-46231	00-02-20070	0–0.5				
	RE00-02-46232	00-02-20070	1–1.5				
	RE00-02-46233	00-02-20071	0–0.5				
	RE00-02-46234	00-02-20071	0.5–1				
	RE00-02-46235	00-02-20072	0–0.5				
	RE00-02-46236	00-02-20072	0.8–1.2				
	RE00-02-46252	00-02-20080	0.75–1.2				
	RE00-02-46217	00-02-20063	0–0.5		Aroclor-1254	UJ	The reporting limit for this analyte is estimated; the sample was extracted outside the appropriate holding time.
	RE00-02-46218	00-02-20063	0.8–1.2				
	RE00-02-46219	00-02-20064	0–0.5				
	RE00-02-46222	00-02-20065	1–1.5				
	RE00-02-46223	00-02-20066	0–0.5				
	RE00-02-46224	00-02-20066	0.8–1				
	RE00-02-46226	00-02-20067	1–1.5				
	RE00-02-46227	00-02-20068	0–0.5				
	RE00-02-46231	00-02-20070	0–0.5				
	RE00-02-46232	00-02-20070	1–1.5				
	RE00-02-46233	00-02-20071	0–0.5				
	RE00-02-46234	00-02-20071	0.5–1				
	RE00-02-46252	00-02-20080	0.75–1.2				
	RE00-02-46222	00-02-20065	1–1.5		Aroclor-1260	UJ	The reporting limit for this analyte is estimated; the sample was extracted outside the appropriate holding time.
	RE00-02-46223	00-02-20066	0–0.5				
	RE00-02-46224	00-02-20066	0.8–1				
	RE00-02-46231	00-02-20070	0–0.5				
	RE00-02-46232	00-02-20070	1–1.5				
	RE00-02-46233	00-02-20071	0–0.5				
	RE00-02-46252	00-02-20080	0.75–1.2				
0-029(c)							
1368S	RE00-02-46274	00-02-20087	1–1.5	PCB	Aroclor-1254 Aroclor-1260	J-	The result for this analyte is estimated and biased low; the surrogate % recovery was low.
	RE00-02-46279	00-02-20090	0–0.5		Aroclor-1254 Aroclor-1260	J+	The result for this analyte is estimated and biased high; the surrogate % recovery was high.
	RE00-02-46281	00-02-20091	0–0.5				
	RE00-02-46274	00-02-20087	1–1.5	PCB	Aroclor-1016 Aroclor-1221 Aroclor-1232 Aroclor-1242 Aroclor-1248	UJ	The reporting limit for this analyte is estimated; the surrogate % recovery was low.

Table C-5.0-3 (continued)

Request	Sample ID	Location ID	Depth (ft)	Analytical Suite	Analyte	Qualifier	Explanation
	RE00-02-46314	00-02-20107	1–1.5	PEST	DDD[4,4'-] DDE[4,4'-]	J-	The result for this analyte is estimated and biased low; the laboratory control sample recovery associated with this analyte was low.
	RE00-02-46311 RE00-02-46314	00-02-20106 00-02-20107	0–0.5 1–1.5		DDT[4,4'-]	J-	The result for this analyte is estimated and biased low; the laboratory control sample recovery associated with this analyte was low.
	RE00-02-46314	00-02-20107	1–1.5		Dieldrin Endosulfan Sulfate Endrin Endrin Aldehyde Endrin Ketone	J-	The result for this analyte is estimated and biased low; the laboratory control sample recovery associated with this analyte was low.
	RE00-02-46273 RE00-02-46274 RE00-02-46277 RE00-02-46284 RE00-02-46301 RE00-02-46307	00-02-20087 00-02-20087 00-02-20089 00-02-20092 00-02-20101 00-02-20104	0–0.5 1–1.5 0–0.5 1–1.5 0–0.5 0–0.5		DDE[4,4'-]	U	The result for this analyte is undetected; the concentration was < or = to 5x the concentration in the blank.
	RE00-02-46311 RE00-02-46312 RE00-02-46313 RE00-02-46314	00-02-20106 00-02-20106 00-02-20107 00-02-20107	0–0.5 0.5–1 0–0.5 1–1.5		Aldrin BHC[alpha-] BHC[beta-] BHC[delta-] BHC[gamma-] Chlordane[alpha-] Chlordane[gamma-] Endosulfan I Endosulfan II Heptachlor Heptachlor Epoxide Methoxychlor[4,4'-] Toxaphene (Technical Grade)	UJ	The reporting limit for this analyte is estimated; the laboratory control sample recovery associated with this analyte was low.
	RE00-02-46311 RE00-02-46312 RE00-02-46313	00-02-20106 00-02-20106 00-02-20107	0–0.5 0.5–1 0–0.5		DDD[4,4'-] DDE[4,4'-] Dieldrin Endosulfan Sulfate Endrin Endrin Aldehyde Endrin Ketone	UJ	The reporting limit for this analyte is estimated; the laboratory control sample recovery associated with this analyte was low.
	RE00-02-46312 RE00-02-46313	00-02-20106 00-02-20107	0.5–1 0–0.5		DDT[4,4'-]	UJ	The reporting limit for this analyte is estimated; the laboratory control sample recovery associated with this analyte was low.

Table C-5.0-3 (continued)

Request	Sample ID	Location ID	Depth (ft)	Analytical Suite	Analyte	Qualifier	Explanation
	RE00-02-46295	00-02-20098	0–0.5		Aldrin BHC[alpha-] BHC[beta-] BHC[delta-] BHC[gamma-] Chlordane[alpha-] Chlordane[gamma-] DDD[4,4'-] DDE[4,4'-] DDT[4,4'-] Dieldrin Endosulfan I Endosulfan II Endosulfan Sulfate Endrin Endrin Aldehyde Endrin Ketone Heptachlor Heptachlor Epoxide Methoxychlor[4,4'-] Toxaphene (Technical Grade)	UJ	The reporting limit for this analyte is estimated; the surrogate % recovery was low.
0-030(b,m)							
1021S	RE00-02-46491	00-02-20803	0–0.5	SVOC	Benzo(a)pyrene Benzo(b)fluoranthene Benzo(g,h,i)perylene Benzo(k)fluoranthene Dibenz(a,h)anthracene Di-n-octylphthalate Indeno(1,2,3-cd)pyrene	UJ	The reporting limit for this analyte is estimated; the internal standard % recovery of the continuing calibration verification did not meet method requirements.
	RE00-02-46488 RE00-02-46489 RE00-02-46490 RE00-02-46491	00-02-20800 00-02-20801 00-02-20802 00-02-20803	0–0.5 0–0.5 0–0.5 0–0.5		Isophorone	UJ	The reporting limit for this analyte is estimated; the laboratory control standard recovery was low.
1035S	RE00-02-46486 RE00-02-46487	00-02-20799 00-02-20799	0.67–1.17 1.67–2.17	SVOC	Isophorone	UJ	The reporting limit for this analyte is estimated; the laboratory control standard recovery was low.
	RE00-02-46486 RE00-02-46487	00-02-20799 00-02-20799	0.67–1.17 1.67–2.17	VOC	Acetone Methylene Chloride	U	The result for this analyte is undetected; the concentration was < or = to 5x the concentration in the blank.
1071S	RE00-02-46478 RE00-02-46479 RE00-02-46480 RE00-02-46481 RE00-02-46482 RE00-02-46483 RE00-02-46484 RE00-02-46485	00-02-20795 00-02-20795 00-02-20796 00-02-20796 00-02-20797 00-02-20797 00-02-20798 00-02-20798	1–1.5 1.83–2.33 0.83–1.17 1.83–2.33 0.83–1.33 1.83–2.33 0.83–1.33 1.83–2.33	VOC	Acetone Methylene Chloride	U	The result for this analyte is undetected; the concentration was < or = to 5x the concentration in the blank.

Table C-5.0-3 (continued)

Request	Sample ID	Location ID	Depth (ft)	Analytical Suite	Analyte	Qualifier	Explanation
	RE00-02-46478	00-02-20795	1–1.5		Benzene Bromobenzene Bromochloromethane Bromodichloromethane Bromoform Bromomethane Butanone[2-] Butylbenzene[n-] Butylbenzene[sec-] Butylbenzene[tert-] Carbon Disulfide Carbon Tetrachloride Chlorobenzene Chlorodibromomethane Chloroethane Chloroform Chloromethane Chlorotoluene[2-] Chlorotoluene[4-] Dibromo-3-Chloropropane[1,2-] Dibromoethane[1,2-] Dibromomethane Dichlorobenzene[1,2-] Dichlorobenzene[1,3-] Dichlorobenzene[1,4-] Dichlorodifluoromethane Dichloroethane[1,1-] Dichloroethane[1,2-] Dichloroethene[1,1-] Dichloroethene[cis-1,2-] Dichloroethene[trans-1,2-] Dichloropropane[1,2-] Dichloropropane[1,3-] Dichloropropane[2,2-] Dichloropropene[1,1-] Dichloropropene[cis-1,3-] Dichloropropene[trans-1,3-] Ethylbenzene Hexanone[2-] Iodomethane Isopropylbenzene Isopropyltoluene[4-] Methyl-2-pentanone[4-] Propylbenzene[1-] Styrene Tetrachloroethane[1,1,1,2-] Tetrachloroethane[1,1,2,2-] Tetrachloroethene Toluene Trichloro-1,2,2-trifluoroethane[1,1,2-] Trichloroethane[1,1,1-] Trichloroethane[1,1,2-] Trichloroethene Trichlorofluoromethane Trichloropropane[1,2,3-] Trimethylbenzene[1,2,4-] Trimethylbenzene[1,3,5-] Vinyl Chloride Xylene (Total)	UJ	The reporting limit for this analyte is estimated; the internal standard % recovery of the continuing calibration verification did not meet method requirements.

Table C-5.0-3 (continued)

Request	Sample ID	Location ID	Depth (ft)	Analytical Suite	Analyte	Qualifier	Explanation
1505	0100-95-0725	00-04353	6.5–7	VOC	Methylene Chloride	U	The result for this analyte is undetected; the concentration was < or = to 5x the concentration in the blank.
1514	0100-95-0726 0100-95-0730	00-04354 00-04357	0–9 4–5	PEST/ PCB	Aldrin Aroclor-1016 Aroclor-1221 Aroclor-1232 Aroclor-1242 Aroclor-1248 Aroclor-1254 Aroclor-1260 BHC[alpha-] BHC[beta-] BHC[delta-] BHC[gamma-] Chlordane[alpha-] Chlordane[gamma-] DDD[4,4'-] DDE[4,4'-] DDT[4,4'-] Dieldrin Endosulfan I Endosulfan II Endosulfan Sulfate Endrin Endrin Aldehyde Endrin Ketone Heptachlor Heptachlor Epoxide Methoxychlor[4,4'-] Toxaphene (Technical Grade)	UJ	The reporting limit for this analyte is estimated; the surrogate % recovery was low.
	0100-95-0726 0100-95-0728 0100-95-0729 0100-95-0731	00-04354 00-04355 00-04356 00-04357	0–9 8–9 2–8 6–7	VOC	Acetone	U	The result for this analyte is undetected; the concentration was < or = to 5x the concentration in the blank.
	0100-95-0726 0100-95-0727 0100-95-0728 0100-95-0729 0100-95-0730 0100-95-0731 0100-95-0732 0100-95-0733 0100-95-0734 0100-95-0735	00-04354 00-04355 00-04355 00-04356 00-04357 00-04357 00-04358 00-04359 00-04360 00-04360	0–9 6–7 8–9 2–8 4–5 6–7 4.5–4.7 0–6 3–4 5–6		Methylene Chloride	U	The result for this analyte is undetected; the concentration was < or = to 5x the concentration in the blank.
1571	0100-95-0741 0100-95-0742 0100-95-0749 0100-95-0750	00-04362 00-04363 00-04367 00-04368	9–10 9–10 0–9 10–11	VOC	Acetone	U	The result for this analyte is undetected; the concentration was < or = to 5x the concentration in the blank.
	0100-95-0741 0100-95-0742 0100-95-0743 0100-95-0749 0100-95-0750	00-04362 00-04363 00-04364 00-04367 00-04368	9–10 9–10 10–11 0–9 10–11		Methylene Chloride	U	The result for this analyte is undetected; the concentration was < or = to 5x the concentration in the blank.

Table C-5.0-3 (continued)

Request	Sample ID	Location ID	Depth (ft)	Analytical Suite	Analyte	Qualifier	Explanation
956S	RE00-02-46452 RE00-02-46453 RE00-02-46454 RE00-02-46455	00-02-20782 00-02-20782 00-02-20783 00-02-20783	6.5–7 7.5–8 6.5–8 7.5–8	VOC	Acetone	U	The result for this analyte is undetected; the concentration was < or = to 5x the concentration in the blank.
	RE00-02-46452 RE00-02-46453 RE00-02-46454 RE00-02-46455	00-02-20782 00-02-20782 00-02-20783 00-02-20783	6.5–7 7.5–8 6.5–8 7.5–8		Methylene Chloride	U	The result for this analyte is undetected; the concentration was < or = to 5x the concentration in the blank.
962S	RE00-02-46460	00-02-20786	7.25–7.75	PEST	DDT[4,4'-]	J+	The result for this analyte is estimated and biased high; the surrogate % recovery was high.
	RE00-02-46456	00-02-20784	5.5–6		Aldrin BHC[alpha-] BHC[beta-] BHC[delta-] BHC[gamma-] Chlordane[alpha-] Chlordane[gamma-] DDD[4,4'-] DDE[4,4'-] DDT[4,4'-] Dieldrin Endosulfan I Endosulfan II Endosulfan Sulfate Endrin Endrin Aldehyde Endrin Ketone Heptachlor Heptachlor Epoxide Methoxychlor[4,4'-] Toxaphene (Technical Grade)	UJ	The reporting limit for this analyte is estimated; the surrogate % recovery was low.
	RE00-02-46456 RE00-02-46457 RE00-02-46458 RE00-02-46459 RE00-02-46460 RE00-02-46461	00-02-20784 00-02-20784 00-02-20785 00-02-20785 00-02-20786 00-02-20786	5.5–6 6.5–7 6.5–7 7.5–8 7.25–7.75 8.25–8.75	VOC	Acetone Methylene Chloride	U	The result for this analyte is undetected; the concentration was < or = to 5x the concentration in the blank.
	RE00-02-46456 RE00-02-46457 RE00-02-46458 RE00-02-46459 RE00-02-46460 RE00-02-46461	00-02-20784 00-02-20784 00-02-20785 00-02-20785 00-02-20786 00-02-20786	5.5–6 6.5–7 6.5–7 7.5–8 7.25–7.75 8.25–8.75		Toluene	U	The result for this analyte is undetected; the mass spectrum did not meet method requirements.
965S	RE00-02-46462 RE00-02-46463	00-02-20787 00-02-20787	9.5–10 10.5–11	VOC	Methylene Chloride	U	The result for this analyte is undetected; the concentration was < or = to 5x the concentration in the blank.
	RE00-02-46462	00-02-20787	9.5–10		Trichloroethene	U	The result for this analyte is undetected; the mass spectrum did not meet method requirements.

Table C-5.0-3 (continued)

Request	Sample ID	Location ID	Depth (ft)	Analytical Suite	Analyte	Qualifier	Explanation
	RE00-02-46464 RE00-02-46465 RE00-02-46466 RE00-02-46467	00-02-20788 00-02-20788 00-02-20789 00-02-20789	10–10.5 10.5–11 9.4–9.7 10.4–10.7		Acetone	U	The result for this analyte is undetected; the concentration was < or = to 5x the concentration in the blank.
	RE00-02-46464 RE00-02-46465 RE00-02-46466 RE00-02-46467	00-02-20788 00-02-20788 00-02-20789 00-02-20789	10–10.5 10.5–11 9.4–9.7 10.4–10.7		Methylene Chloride	U	The result for this analyte is undetected; the concentration was < or = to 5x the concentration in the blank.
971S	RE00-02-46468 RE00-02-46469	00-02-20790 00-02-20790	9.83–10.33 10.33–10.83	VOC	Acetone Methylene Chloride	U	The result for this analyte is undetected; the concentration was < or = to 5x the concentration in the blank.
979S	RE00-02-46470 RE00-02-46471 RE00-02-46472 RE00-02-46473	00-02-20791 00-02-20791 00-02-20792 00-02-20792	1.7–2 2.3–2.8 5.5–6 6.5–7	VOC	Acetone	U	The result for this analyte is undetected; the concentration was < or = to 5x the concentration in the blank.
	RE00-02-46470 RE00-02-46471 RE00-02-46472 RE00-02-46473	00-02-20791 00-02-20791 00-02-20792 00-02-20792	1.7–2 2.3–2.8 5.5–6 6.5–7		Methylene Chloride	U	The result for this analyte is undetected; the concentration was < or = to 5x the concentration in the blank.
979S	RE00-02-46471	00-02-20791	2.3–2.8	VOC	Benzene	U	The result for this analyte is undetected; the mass spectrum did not meet method requirements.
983S	RE00-02-46474 RE00-02-46475 RE00-02-46476 RE00-02-46477	00-02-20793 00-02-20793 00-02-20794 00-02-20794	2.5–2.8 3–3.3 2–2.5 2.5–3	VOC	Acetone Methylene Chloride	U	The result for this analyte is undetected; the concentration was < or = to 5x the concentration in the blank.
992	0100-95-0486 0100-95-0488	00-04307 00-04308	6–6.5 4.7–5	SVOC	Bis(2-ethylhexyl)phthalate	U	The result for this analyte is undetected; the concentration was < or = to 5x the concentration in the blank.

C-5.3 Radionuclide Data Review

Table C-5.0-4 presents the data for the samples that were analyzed for radionuclides and qualified. A number of samples were qualified as undetected due to a signal less than three times the 1-sigma total propagated uncertainty or less than the minimum detectable concentration. Potential bias due to low tracer recovery was also identified in a few samples.

Table C-5.0-4
Radionuclide Data Quality Evaluation

Request	Sample ID	Location ID	Depth	Analytical Suite	Analyte	Qualifier	Explanation
0-004. 0-033(b), 0-030(l)							
1003	0100-95-0490	00-04310	4–4.5	GAMMA_SPEC	Cesium-137 Cobalt-60 Europium-152 Ruthenium-106 Sodium-22	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
1003	0100-95-0490	00-04310	4–4.5	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
1144S	RE00-02-47819 RE00-02-47820	00-02-19630 00-02-19630	3–3.5 4–4.5	GAMMA_SPEC	Americium-241 Cesium-134 Cesium-137 Cobalt-60 Europium-152 Ruthenium-106	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
1144S	RE00-02-47819 RE00-02-47820	00-02-19630 00-02-19630	3–3.5 4–4.5	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
1144S	RE00-02-47820	00-02-19630	4–4.5	ISO_PU	Plutonium-239	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
1144S	RE00-02-47819	00-02-19630	3–3.5	ISO_U	Uranium-234 Uranium-238	J-	The result for this analyte is estimated and biased low; the tracer/carrier % recovery was low.
1144S	RE00-02-47819 RE00-02-47820	00-02-19630 00-02-19630	3–3.5 4–4.5	ISO_U	Uranium-235	U	The result for this analyte is undetected; the amount detected is < or = to 5x the amount in the blank.
1151S	RE00-02-47823	00-02-19634	10–10.5	ALPHA	Uranium-234 Uranium-238	J-	The result for this analyte is estimated and biased low; the tracer/carrier % recovery was low.

Table C-5.0-4 (continued)

Request	Sample ID	Location ID	Depth	Analytical Suite	Analyte	Qualifier	Explanation
1151S	RE00-02-47821 RE00-02-47822 RE00-02-47823 RE00-02-47824 RE00-02-47825 RE00-02-47826 RE00-02-47827	00-02-19632 00-02-19633 00-02-19634 00-02-19635 00-02-19636 00-02-19637 00-02-19638	10–10.5 10–10.5 10–10.5 7.5–8 4.5–5.5 8–8.5 4–4.5	ALPHA	Plutonium-238	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
1151S	RE00-02-47821 RE00-02-47822 RE00-02-47823 RE00-02-47826 RE00-02-47828	00-02-19632 00-02-19633 00-02-19634 00-02-19637 00-02-19638	10–10.5 10–10.5 10–10.5 8–8.5 5–5.5	ALPHA	Plutonium-239	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
1151S	RE00-02-47828	00-02-19638	5–5.5	ALPHA	Plutonium-238	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
1151S	RE00-02-47825	00-02-19636	4.5–5.5	ALPHA	Plutonium-239	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
1151S	RE00-02-47821 RE00-02-47822 RE00-02-47823 RE00-02-47824 RE00-02-47825 RE00-02-47826 RE00-02-47827 RE00-02-47828	00-02-19632 00-02-19633 00-02-19634 00-02-19635 00-02-19636 00-02-19637 00-02-19638 00-02-19638	10–10.5 10–10.5 10–10.5 7.5–8 4.5–5.5 8–8.5 4–4.5 5–5.5	GAMMA_SPEC	Americium-241 Cesium-134 Cesium-137 Cobalt-60 Ruthenium-106 Europium-152	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
1151S	RE00-02-47823 RE00-02-47827	00-02-19634 00-02-19638	10–10.5 4–4.5	ISO_U	Uranium-235	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
1151S	RE00-02-47826	00-02-19637	8–8.5	ISO_U	Uranium-235	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
1353	0100-95-0694	00-04318	5–5.5	AM_241	Americium-241	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
1353	0100-95-0694 0100-95-0695	00-04318 00-04319	5–5.5 5–5.5	GAMMA_SPEC	Cesium-134 Cesium-137 Cobalt-60 Europium-152 Ruthenium-106 Sodium-22 Uranium-235	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
1353	0100-95-0700	00-04318	5–5.5	H3	Tritium	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.

Table C-5.0-4 (continued)

Request	Sample ID	Location ID	Depth	Analytical Suite	Analyte	Qualifier	Explanation
1353	0100-95-0695	00-04319	5–5.5	ISO_PU	Plutonium-238 Plutonium-239	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
784	0100-95-0668	00-04423	5–6	GAMMA_SPEC	Americium-241 Cesium-137 Cobalt-60 Europium-152 Ruthenium-106 Sodium-22	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
785	0100-95-0672 0100-95-0672 0100-95-0672	00-04231 00-04230 00-04232	6–6.5 6–6.5 6–6.5	GAMMA_SPEC	Americium-241 Cesium-137 Cobalt-60 Europium-152 Ruthenium-106 Sodium-22	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
823	0100-95-0514 0100-95-0515 0100-95-0516 0100-95-0517 0100-95-0518 0100-95-0519	00-04222 00-04224 00-04223 00-04221 00-04225 00-04226	0–0.5 0–0.25 0–0.33 0–0.33 0–0.5 0–0.5	GAMMA_SPEC	Americium-241 Cobalt-60 Europium-152 Ruthenium-106 Sodium-22	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
823	0100-95-0519	00-04226	0–0.5	GAMMA_SPEC	Cesium-137	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
882S	RE00-02-45608 RE00-02-45609 RE00-02-45610 RE00-02-45611	00-02-19696 00-02-19696 00-02-19697 00-02-19697	0–0.5 0.5–1 0–0.5 0.5–1	GAMMA_SPEC	Americium-241 Cesium-134 Cobalt-60 Europium-152 Ruthenium-106 Sodium-22	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
882S	RE00-02-45610 RE00-02-45611	00-02-19697 00-02-19697	0–0.5 0.5–1	GAMMA_SPEC	Cesium-137	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
882S	RE00-02-45608 RE00-02-45609 RE00-02-45610 RE00-02-45611	00-02-19696 00-02-19696 00-02-19697 00-02-19697	0–0.5 0.5–1 0–0.5 0.5–1	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
882S	RE00-02-45608	00-02-19696	0–0.5	ISO_PU	Plutonium-239	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
887S	RE00-02-45606 RE00-02-45607 RE00-02-45612 RE00-02-45613 RE00-02-45614 RE00-02-45615 RE00-02-45616 RE00-02-45617	00-02-19695 00-02-19695 00-02-19698 00-02-19698 00-02-19699 00-02-19699 00-02-19700 00-02-19700	0–0.5 0.5–1 0–0.5 0.5–1 0–0.5 0.5–1 0–0.5 0.5–1	GAMMA_SPEC	Americium-241 Cesium-134 Cobalt-60 Europium-152 Ruthenium-106 Sodium-22	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.

Table C-5.0-4 (continued)

Request	Sample ID	Location ID	Depth	Analytical Suite	Analyte	Qualifier	Explanation
887S	RE00-02-45606 RE00-02-45607 RE00-02-45615 RE00-02-45616 RE00-02-45617	00-02-19695 00-02-19695 00-02-19699 00-02-19700 00-02-19700	0–0.5 0.5–1 0.5–1 0–0.5 0.5–1	GAMMA_SPEC	Cesium-137	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
887S	RE00-02-45606 RE00-02-45607 RE00-02-45612 RE00-02-45613 RE00-02-45614 RE00-02-45615 RE00-02-45616 RE00-02-45617	00-02-19695 00-02-19695 00-02-19698 00-02-19698 00-02-19699 00-02-19699 00-02-19700 00-02-19700	0–0.5 0.5–1 0–0.5 0.5–1 0–0.5 0.5–1 0–0.5 0.5–1	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
887S	RE00-02-45613 RE00-02-45614 RE00-02-45615 RE00-02-45616 RE00-02-45617	00-02-19698 00-02-19699 00-02-19699 00-02-19700 00-02-19700	0.5–1 0–0.5 0.5–1 0–0.5 0.5–1	ISO_PU	Plutonium-239	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
887S	RE00-02-45606	00-02-19695	0–0.5	ISO_PU	Plutonium-239	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
0-030(b,m)							
1003	0100-95-0489 0100-95-0491	00-04309 00-04311	4.2–4.8 0–0.5	GAMMA_SPEC	Cesium-137 Cobalt-60 Europium-152 Ruthenium-106 Sodium-22	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
1003	0100-95-0489	00-04309	4.2–4.8	ISO_PU	Plutonium-239	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
1003	0100-95-0491	00-04311	0–0.5	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
1023S	RE00-02-46488 RE00-02-46489 RE00-02-46490 RE00-02-46491	00-02-20800 00-02-20801 00-02-20802 00-02-20803	0–0.5 0–0.5 0–0.5 0–0.5	GAMMA_SPEC	Americium-241 Cesium-134 Cesium-137 Cobalt-60 Europium-152 Ruthenium-106	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
1023S	RE00-02-46488 RE00-02-46489 RE00-02-46490 RE00-02-46491	00-02-20800 00-02-20801 00-02-20802 00-02-20803	0–0.5 0–0.5 0–0.5 0–0.5	ISO_PU	Plutonium-238 Plutonium-239	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
1023S	RE00-02-46491	00-02-20803	0–0.5	ISO_U	Uranium-235	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.

Table C-5.0-4 (continued)

Request	Sample ID	Location ID	Depth	Analytical Suite	Analyte	Qualifier	Explanation
1023S	RE00-02-46489 RE00-02-46490	00-02-20801 00-02-20802	0–0.5 0–0.5	ISO_U	Uranium-235	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
1037S	RE00-02-46486 RE00-02-46487	00-02-20799 00-02-20799	0.67–1.17 1.67–2.17	GAMMA_SPEC	Americium-241 Cesium-134 Cesium-137 Cobalt-60 Europium-152 Ruthenium-106	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
1037S	RE00-02-46486 RE00-02-46487	00-02-20799 00-02-20799	0.67–1.17 1.67–2.17	ISO_PU	Plutonium-238 Plutonium-239	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
1037S	RE00-02-46487	00-02-20799	1.67–2.17	ISO_U	Uranium-235	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
1037S	RE00-02-46486	00-02-20799	0.67–1.17	ISO_U	Uranium-235	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
1073S	RE00-02-46478 RE00-02-46479 RE00-02-46480 RE00-02-46481 RE00-02-46482 RE00-02-46483 RE00-02-46484 RE00-02-46485	00-02-20795 00-02-20795 00-02-20796 00-02-20796 00-02-20797 00-02-20797 00-02-20798 00-02-20798	1–1.5 1.83–2.33 0.83–1.17 1.83–2.33 0.83–1.33 1.83–2.33 0.83–1.33 1.83–2.33	GAMMA_SPEC	Americium-241 Cesium-134 Cesium-137 Cobalt-60 Europium-152 Ruthenium-106	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
1073S	RE00-02-46478 RE00-02-46479 RE00-02-46480 RE00-02-46481 RE00-02-46482 RE00-02-46483 RE00-02-46484 RE00-02-46485	00-02-20795 00-02-20795 00-02-20796 00-02-20796 00-02-20797 00-02-20797 00-02-20798 00-02-20798	1–1.5 1.83–2.33 0.83–1.17 1.83–2.33 0.83–1.33 1.83–2.33 0.83–1.33 1.83–2.33	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
1073S	RE00-02-46478 RE00-02-46479 RE00-02-46481 RE00-02-46482 RE00-02-46483 RE00-02-46484 RE00-02-46485	00-02-20795 00-02-20795 00-02-20796 00-02-20797 00-02-20797 00-02-20798 00-02-20798	1–1.5 1.83–2.33 1.83–2.33 0.83–1.33 1.83–2.33 0.83–1.33 1.83–2.33	ISO_PU	Plutonium-239	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
1073S	RE00-02-46480	00-02-20796	0.83–1.17	ISO_PU	Plutonium-239	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.

Table C-5.0-4 (continued)

Request	Sample ID	Location ID	Depth	Analytical Suite	Analyte	Qualifier	Explanation
1073S	RE00-02-46479 RE00-02-46480	00-02-20795 00-02-20796	1.83–2.33 0.83–1.17	ISO_U	Uranium-235	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
1073S	RE00-02-46478 RE00-02-46481 RE00-02-46482 RE00-02-46485	00-02-20795 00-02-20796 00-02-20797 00-02-20798	1–1.5 1.83–2.33 0.83–1.33 1.83–2.33	ISO_U	Uranium-235	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
1123	0100-95-0677	00-04326	5.5–6	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
1263	0100-95-0687 0100-95-0688	00-04313 00-04314	9–9.5 9–9.5	GAMMA_SPEC	Cesium-134 Cesium-137 Cobalt-60 Ruthenium-106 Sodium-22 Uranium-235	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
1263	0100-95-0687	00-04313	9–9.5	ISO_PU	Plutonium-238 Plutonium-239	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
1330	0100-95-0689	00-04315	5–5.2	AM_241	Americium-241	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
1330	0100-95-0689	00-04315	5–5.2	GAMMA_SPEC	Cesium-134 Cesium-137 Cobalt-60 Europium-152 Ruthenium-106 Sodium-22 Uranium-235	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
1479	0100-95-0704	00-04335	9–9.5	AM_241	Americium-241	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
1479	0100-95-0704	00-04335	9–9.5	GAMMA_SPEC	Cesium-134 Cesium-137 Cobalt-60 Ruthenium-106 Sodium-22 Uranium-235	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
1479	0100-95-0704	00-04335	9–9.5	ISO_PU	Plutonium-238 Plutonium-239	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.

Table C-5.0-4 (continued)

Request	Sample ID	Location ID	Depth	Analytical Suite	Analyte	Qualifier	Explanation
1489	0100-95-0715	00-04344	10–11	GAMMA_SPEC	Cesium-134 Cesium-137 Cobalt-60 Europium-152 Ruthenium-106 Sodium-22 Uranium-235	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
1489	0100-95-0715	00-04344	10–11	ISO_PU	Plutonium-238 Plutonium-239	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
1496	0100-95-0716 0100-95-0717 0100-95-0718	00-04345 00-04346 00-04347	4.5–5.5 7.5–8.5 4–5	AM_241	Americium-241	U	The result for this analyte is undetected; the required blank information is missing.
1496	0100-95-0716 0100-95-0718	00-04345 00-04347	4.5–5.5 4–5	GAMMA_SPEC	Cesium-137	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
1496	0100-95-0716 0100-95-0717 0100-95-0718	00-04345 00-04346 00-04347	4.5–5.5 7.5–8.5 4–5	GAMMA_SPEC	Cobalt-60 Europium-152 Ruthenium-106 Sodium-22	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
1496	0100-95-0716 0100-95-0717 0100-95-0718	00-04345 00-04346 00-04347	4.5–5.5 7.5–8.5 4–5	H3	Tritium	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
1496	0100-95-0718	00-04347	4–5	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
1507	0100-95-0725	00-04353	6.5–7	AM_241	Americium-241	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
1507	0100-95-0725	00-04353	6.5–7	GAMMA_SPEC	Cesium-137 Cobalt-60 Europium-152 Ruthenium-106 Sodium-22	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
1507	0100-95-0725	00-04353	6.5–7	H3	Tritium	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
1516	0100-95-0727 0100-95-0728	00-04355 00-04355	6–7 8–9	AM_241	Americium-241	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.

Table C-5.0-4 (continued)

Request	Sample ID	Location ID	Depth	Analytical Suite	Analyte	Qualifier	Explanation
1516	0100-95-0726	00-04354	0–9	GAMMA_SPEC	Cesium-137 Cobalt-60 Europium-152 Ruthenium-106 Sodium-22	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
	0100-95-0727	00-04355	6–7				
	0100-95-0728	00-04355	8–9				
	0100-95-0729	00-04356	2–8				
	0100-95-0730	00-04357	4–5				
	0100-95-0731	00-04357	6–7				
	0100-95-0732	00-04358	4.5–4.7				
	0100-95-0733	00-04359	0–6				
	0100-95-0734	00-04360	3–4				
	0100-95-0735	00-04360	5–6				
1516	0100-95-0726	00-04354	0–9	H3	Tritium	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
	0100-95-0727	00-04355	6–7				
	0100-95-0728	00-04355	8–9				
	0100-95-0729	00-04356	2–8				
	0100-95-0730	00-04357	4–5				
	0100-95-0731	00-04357	6–7				
	0100-95-0732	00-04358	4.5–4.7				
	0100-95-0733	00-04359	0–6				
	0100-95-0734	00-04360	3–4				
	0100-95-0735	00-04360	5–6				
1516	0100-95-0726	00-04354	0–9	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
	0100-95-0727	00-04355	6–7				
	0100-95-0728	00-04355	8–9				
	0100-95-0729	00-04356	2–8				
	0100-95-0730	00-04357	4–5				
	0100-95-0731	00-04357	6–7				
	0100-95-0732	00-04358	4.5–4.7				
	0100-95-0733	00-04359	0–6				
	0100-95-0734	00-04360	3–4				
	0100-95-0735	00-04360	5–6				
1516	0100-95-0726	00-04354	0–9	ISO_PU	Plutonium-239	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
	0100-95-0727	00-04355	6–7				
	0100-95-0729	00-04356	2–8				
	0100-95-0731	00-04357	6–7				
1573	0100-95-0740	00-04361	4.5–4.8	GAMMA_SPEC	Cesium-137 Cobalt-60 Europium-152 Ruthenium-106 Sodium-22	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
	0100-95-0741	00-04362	9–10				
	0100-95-0742	00-04363	9–10				
	0100-95-0743	00-04364	10–11				
	0100-95-0749	00-04367	0–9				
	0100-95-0750	00-04368	10–11				
1573	0100-95-0740	00-04361	4.5–4.8	H3	Tritium	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
	0100-95-0741	00-04362	9–10				
	0100-95-0742	00-04363	9–10				
	0100-95-0743	00-04364	10–11				
	0100-95-0749	00-04367	0–9				
	0100-95-0750	00-04368	10–11				
1573	0100-95-0742	00-04363	9–10	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
	0100-95-0750	00-04368	10–11				

Table C-5.0-4 (continued)

Request	Sample ID	Location ID	Depth	Analytical Suite	Analyte	Qualifier	Explanation
1573	0100-95-0742	00-04363	9–10	ISO_PU	Plutonium-239	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
1573	0100-95-0741 0100-95-0743 0100-95-0749	00-04362 00-04364 00-04367	9–10 10–11 0–9	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the result was less than 3x the 1-sigma total propagated uncertainty.
1573	0100-95-0743	00-04364	10–11	ISO_PU	Plutonium-239	U	The result for this analyte is undetected; the result was less than 3x the 1-sigma total propagated uncertainty.
1612	0100-95-0914 0100-95-0915	00-04371 00-04372	11–11.5 11–11.5	GAMMA_SPEC	Cesium-134 Cesium-137 Cobalt-60 Europium-152 Ruthenium-106 Sodium-22 Uranium-235	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
1612	0100-95-0914	00-04371	11–11.5	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
798	0100-95-0454	00-04327	10.5–11	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
944	0100-95-0473 0100-95-0478	00-04302 00-04301	0–0.5 0–0.5	GAMMA_SPEC	Cesium-137	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
944	0100-95-0472 0100-95-0473 0100-95-0478	00-04301 00-04302 00-04301	0–0.5 0–0.5 0–0.5	GAMMA_SPEC	Cobalt-60 Europium-152 Ruthenium-106 Sodium-22	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
944	0100-95-0473 0100-95-0478	00-04302 00-04301	0–0.5 0–0.5	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
944	0100-95-0473	00-04302	0–0.5	ISO_PU	Plutonium-239	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
958S	RE00-02-46452 RE00-02-46453 RE00-02-46454 RE00-02-46455	00-02-20782 00-02-20782 00-02-20783 00-02-20783	6.5–7 7.5–8 6.5–8 7.5–8	GAMMA_SPEC	Americium-241 Cesium-134 Cesium-137 Cobalt-60 Europium-152 Ruthenium-106	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.

Table C-5.0-4 (continued)

Request	Sample ID	Location ID	Depth	Analytical Suite	Analyte	Qualifier	Explanation
958S	RE00-02-46452 RE00-02-46453 RE00-02-46454 RE00-02-46455	00-02-20782 00-02-20782 00-02-20783 00-02-20783	6.5–7 7.5–8 6.5–8 7.5–8	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
958S	RE00-02-46452 RE00-02-46453 RE00-02-46455	00-02-20782 00-02-20782 00-02-20783	6.5–7 7.5–8 7.5–8	ISO_PU	Plutonium-239	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
958S	RE00-02-46454	00-02-20783	6.5–8	ISO_PU	Plutonium-239	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
958S	RE00-02-46455	00-02-20783	7.5–8	ISO_U	Uranium-235	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
958S	RE00-02-46452 RE00-02-46453 RE00-02-46454	00-02-20782 00-02-20782 00-02-20783	6.5–7 7.5–8 6.5–8	ISO_U	Uranium-235	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
964S	RE00-02-46456 RE00-02-46457 RE00-02-46458 RE00-02-46459 RE00-02-46460 RE00-02-46461	00-02-20784 00-02-20784 00-02-20785 00-02-20785 00-02-20786 00-02-20786	5.5–6 6.5–7 6.5–7 7.5–8 7.25–7.75 8.25–8.75	GAMMA_SPEC	Americium-241 Cesium-134 Cesium-137 Cobalt-60 Europium-152 Ruthenium-106	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
964S	RE00-02-46456 RE00-02-46457 RE00-02-46458 RE00-02-46460 RE00-02-46461	00-02-20784 00-02-20784 00-02-20785 00-02-20786 00-02-20786	5.5–6 6.5–7 6.5–7 7.25–7.75 8.25–8.75	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
964S	RE00-02-46456 RE00-02-46457 RE00-02-46460 RE00-02-46461	00-02-20784 00-02-20784 00-02-20786 00-02-20786	5.5–6 6.5–7 7.25–7.75 8.25–8.75	ISO_PU	Plutonium-239	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
964S	RE00-02-46459	00-02-20785	7.5–8	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
964S	RE00-02-46458 RE00-02-46459	00-02-20785 00-02-20785	6.5–7 7.5–8	ISO_PU	Plutonium-239	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
964S	RE00-02-46456 RE00-02-46457 RE00-02-46458 RE00-02-46459 RE00-02-46460 RE00-02-46461	00-02-20784 00-02-20784 00-02-20785 00-02-20785 00-02-20786 00-02-20786	5.5–6 6.5–7 6.5–7 7.5–8 7.25–7.75 8.25–8.75	ISO_U	Uranium-235	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.

Table C-5.0-4 (continued)

Request	Sample ID	Location ID	Depth	Analytical Suite	Analyte	Qualifier	Explanation
967S	RE00-02-46462 RE00-02-46463	00-02-20787 00-02-20787	9.5–10 10.5–11	GAMMA_SPEC	Americium-241 Cesium-134 Cesium-137 Cobalt-60 Europium-152 Ruthenium-106	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
967S	RE00-02-46462 RE00-02-46463	00-02-20787 00-02-20787	9.5–10 10.5–11	ISO_PU	Plutonium-238 Plutonium-239	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
967S	RE00-02-46462 RE00-02-46463	00-02-20787 00-02-20787	9.5–10 10.5–11	ISO_U	Uranium-235	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
970S	RE00-02-46464 RE00-02-46465 RE00-02-46466 RE00-02-46467	00-02-20788 00-02-20788 00-02-20789 00-02-20789	10–10.5 10.5–11 9.4–9.7 10.4–10.7	GAMMA_SPEC	Americium-241 Cesium-134 Cesium-137 Cobalt-60 Europium-152 Ruthenium-106	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
970S	RE00-02-46464 RE00-02-46465 RE00-02-46466 RE00-02-46467	00-02-20788 00-02-20788 00-02-20789 00-02-20789	10–10.5 10.5–11 9.4–9.7 10.4–10.7	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
970S	RE00-02-46466	00-02-20789	9.4–9.7	ISO_PU	Plutonium-239	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
970S	RE00-02-46464 RE00-02-46465 RE00-02-46467	00-02-20788 00-02-20788 00-02-20789	10–10.5 10.5–11 10.4–10.7	ISO_PU	Plutonium-239	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
970S	RE00-02-46465	00-02-20788	10.5–11	ISO_U	Uranium-235	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
970S	RE00-02-46464 RE00-02-46467	00-02-20788 00-02-20789	10–10.5 10.4–10.7	ISO_U	Uranium-235	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
973S	RE00-02-46468 RE00-02-46469	00-02-20790 00-02-20790	9.83–10.33 10.33–10.83	GAMMA_SPEC	Americium-241 Cesium-134 Cesium-137 Cobalt-60 Europium-152 Ruthenium-106	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
973S	RE00-02-46468 RE00-02-46469	00-02-20790 00-02-20790	9.83–10.33 10.33–10.83	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.

Table C-5.0-4 (continued)

Request	Sample ID	Location ID	Depth	Analytical Suite	Analyte	Qualifier	Explanation
973S	RE00-02-46469	00-02-20790	10.33–10.83	ISO_PU	Plutonium-239	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
973S	RE00-02-46468	00-02-20790	9.83–10.33	ISO_PU	Plutonium-239	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
973S	RE00-02-46468 RE00-02-46469	00-02-20790 00-02-20790	9.83–10.33 10.33–10.83	ISO_U	Uranium-235	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
981S	RE00-02-46470 RE00-02-46471 RE00-02-46472 RE00-02-46473	00-02-20791 00-02-20791 00-02-20792 00-02-20792	1.7–2 2.3–2.8 5.5–6 6.5–7	GAMMA_SPEC	Americium-241 Cesium-134 Cesium-137 Cobalt-60 Europium-152 Ruthenium-106	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
981S	RE00-02-46470 RE00-02-46471 RE00-02-46472 RE00-02-46473	00-02-20791 00-02-20791 00-02-20792 00-02-20792	1.7–2 2.3–2.8 5.5–6 6.5–7	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
981S	RE00-02-46470 RE00-02-46471 RE00-02-46473	00-02-20791 00-02-20791 00-02-20792	1.7–2 2.3–2.8 6.5–7	ISO_PU	Plutonium-239	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
981S	RE00-02-46472	00-02-20792	5.5–6	ISO_PU	Plutonium-239	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
981S	RE00-02-46470 RE00-02-46471	00-02-20791 00-02-20791	1.7–2 2.3–2.8	ISO_U	Uranium-235	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
985	0100-95-0479	00-04304	10–10.3	GAMMA_SPEC	Cobalt-60 Europium-152 Ruthenium-106 Sodium-22	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
985	0100-95-0479	00-04304	10–10.3	ISO_PU	Plutonium-239	J	The result for this analyte is estimated; the associated duplicate information is missing.
985S	RE00-02-46474 RE00-02-46475 RE00-02-46476 RE00-02-46477	00-02-20793 00-02-20793 00-02-20794 00-02-20794	2.5–2.8 3–3.3 2–2.5 2.5–3	GAMMA_SPEC	Americium-241 Cesium-134 Cesium-137 Cobalt-60 Europium-152 Ruthenium-106	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.

Table C-5.0-4 (continued)

Request	Sample ID	Location ID	Depth	Analytical Suite	Analyte	Qualifier	Explanation
985S	RE00-02-46474 RE00-02-46475 RE00-02-46476 RE00-02-46477	00-02-20793 00-02-20793 00-02-20794 00-02-20794	2.5–2.8 3–3.3 2–2.5 2.5–3	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
985S	RE00-02-46474 RE00-02-46477	00-02-20793 00-02-20794	2.5–2.8 2.5–3	ISO_PU	Plutonium-239	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
985S	RE00-02-46475	00-02-20793	3–3.3	ISO_PU	Plutonium-239	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
985S	RE00-02-46475 RE00-02-46477	00-02-20793 00-02-20794	3–3.3 2.5–3	ISO_U	Uranium-235	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
991	0100-95-0480 0100-95-0481 0100-95-0482	00-04305 00-04305 00-04306	11–11.2 11.3–11.5 11.3–11.5	GAMMA_SPEC	Cesium-137 Cobalt-60 Europium-152 Ruthenium-106 Sodium-22	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
991	0100-95-0480 0100-95-0481 0100-95-0482	00-04305 00-04305 00-04306	11–11.2 11.3–11.5 11.3–11.5	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
994	0100-95-0483 0100-95-0486 0100-95-0487 0100-95-0488	00-04307 00-04307 00-04308 00-04308	5.5–6 6–6.5 4.5–4.7 4.7–5	AM_241	Americium-241	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
994	0100-95-0483 0100-95-0486 0100-95-0487 0100-95-0488	00-04307 00-04307 00-04308 00-04308	5.5–6 6–6.5 4.5–4.7 4.7–5	GAMMA_SPEC	Cesium-134 Cesium-137 Cobalt-60 Ruthenium-106 Sodium-22	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
994	0100-95-0483 0100-95-0486 0100-95-0487 0100-95-0488	00-04307 00-04307 00-04308 00-04308	5.5–6 6–6.5 4.5–4.7 4.7–5	GAMMA_SPEC	Uranium-235	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
994	0100-95-0487	00-04308	4.5–4.7	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
994	0100-95-0483 0100-95-0486 0100-95-0488	00-04307 00-04307 00-04308	5.5–6 6–6.5 4.7–5	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
994	0100-95-0487 0100-95-0488	00-04308 00-04308	4.5–4.7 4.7–5	ISO_PU	Plutonium-239	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.

Table C-5.0-4 (continued)

Request	Sample ID	Location ID	Depth	Analytical Suite	Analyte	Qualifier	Explanation
21-021-99							
12743	AAA0203 AAA0204	21-01030 21-01030	0–0.08 0–0.5	H3	Tritium	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
12743	AAA0202 AAA0203 AAA0204 AAA0205 AAA0206 AAA0207 AAA0210 AAA0212 AAA0216	21-01029 21-01030 21-01030 21-01033 21-01038 21-01038 21-01043 21-01047 21-01048	0–0.08 0–0.08 0–0.5 0–0.08 0–0.08 0–0.42 0–0.08 0–0.5 0–0.08	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
12743	AAA0211 AAA0217	21-01047 21-01048	0–0.08 0–0.5	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the result was less than 3x the 1-sigma total propagated uncertainty.
12743	AAA0212	21-01047	0–0.5	ISO_U	Uranium-235	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
12743	AAA0202 AAA0203 AAA0204 AAA0205 AAA0206 AAA0207 AAA0209 AAA0210 AAA0211 AAA0212 AAA0216 AAA0217	21-01029 21-01030 21-01030 21-01033 21-01038 21-01038 21-01042 21-01043 21-01047 21-01047 21-01048 21-01048	0–0.08 0–0.08 0–0.5 0–0.08 0–0.08 0–0.42 0–0.08 0–0.08 0–0.08 0–0.5 0–0.08 0–0.5	SR_90	Strontium-90	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
12759	AAA0253	21-01040	0–0.5	AM_241	Americium-241	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
12759	AAA0218 AAA0219 AAA0253 AAA0254 AAA0255	21-01049 21-01050 21-01040 21-01291 21-01291	0–0.08 0–0.08 0–0.5 0–0.08 0–0.5	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
12759	AAA0218 AAA0219 AAA0253 AAA0254 AAA0255	21-01049 21-01050 21-01040 21-01291 21-01291	0–0.08 0–0.08 0–0.5 0–0.08 0–0.5	SR_90	Strontium-90	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.

Table C-5.0-4 (continued)

Request	Sample ID	Location ID	Depth	Analytical Suite	Analyte	Qualifier	Explanation
13041	AAA0485 AAA0491 AAA0493	21-01021 21-01297 21-01028	0–0.08 0–0.5 0–0.08	AM_241	Americium-241	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
13041	AAA0491	21-01297	0–0.5	H3	Tritium	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
13041	AAA0490 AAA0491	21-01297 21-01297	0–0.5 0–0.5	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
13041	AAA0491	21-01297	0–0.5	ISO_PU	Plutonium-239	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
13041	AAA0490 AAA0491	21-01297 21-01297	0–0.5 0–0.5	SR_90	Strontium-90	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
13045	AAA0466 AAA0473 AAA0474 AAA0477 AAA0479	21-01010 21-01011 21-01012 21-01015 21-01017	0–0.5 0–0.08 0–0.08 0–0.08 0–0.08	AM_241	Americium-241	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
13045	AAA0480	21-01017	0–0.33	ISO_U	Uranium-235	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
13054	AAA0457 AAA0460 AAA0461 AAA0464	21-01003 21-01005 21-01006 21-01007	0–0.08 0–0.08 0–0.08 0–0.08	AM_241	Americium-241	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
13054	AAA0496	21-01026	0–0.08	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
13054	AAA0462 AAA0495	21-01006 21-01023	0–0.5 0–0.5	ISO_U	Uranium-235	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
13054	AAA0496	21-01026	0–0.08	SR_90	Strontium-90	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.

Table C-5.0-4 (continued)

Request	Sample ID	Location ID	Depth	Analytical Suite	Analyte	Qualifier	Explanation
779S	RE00-02-45636	00-02-19713	0–0.08	GAMMA_SPEC	Americium-241	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
	RE00-02-45637	00-02-19714	0–0.08				
	RE00-02-45638	00-02-19715	0–0.08				
	RE00-02-45639	00-02-19716	0–0.08				
	RE00-02-45640	00-02-19717	0–0.08				
	RE00-02-45641	00-02-19718	0–0.08				
	RE00-02-45642	00-02-19719	0–0.08				
	RE00-02-45643	00-02-19720	0–0.08				
	RE00-02-45706	00-02-19720	0.08–0.5				
	RE00-02-45714	00-02-19716	0.08–0.5				
779S	RE00-02-45636	00-02-19713	0–0.08	GAMMA_SPEC	Cesium-134 Cobalt-60 Europium-152 Ruthenium-106 Sodium-22	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
	RE00-02-45637	00-02-19714	0–0.08				
	RE00-02-45638	00-02-19715	0–0.08				
	RE00-02-45639	00-02-19716	0–0.08				
	RE00-02-45640	00-02-19717	0–0.08				
	RE00-02-45641	00-02-19718	0–0.08				
	RE00-02-45642	00-02-19719	0–0.08				
	RE00-02-45643	00-02-19720	0–0.08				
	RE00-02-45706	00-02-19720	0.08–0.5				
	RE00-02-45714	00-02-19716	0.08–0.5				
	RE00-02-45715	00-02-19714	0.08–0.5				
779S	RE00-02-45636	00-02-19713	0–0.08	GAMMA_SPEC	Uranium-235	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
	RE00-02-45637	00-02-19714	0–0.08				
	RE00-02-45638	00-02-19715	0–0.08				
	RE00-02-45640	00-02-19717	0–0.08				
	RE00-02-45641	00-02-19718	0–0.08				
	RE00-02-45643	00-02-19720	0–0.08				
	RE00-02-45715	00-02-19714	0.08–0.5				
779S	RE00-02-45639	00-02-19716	0–0.08	GAMMA_SPEC	Uranium-235	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
	RE00-02-45642	00-02-19719	0–0.08				
	RE00-02-45706	00-02-19720	0.08–0.5				
	RE00-02-45714	00-02-19716	0.08–0.5				
779S	RE00-02-45636	00-02-19713	0–0.08	H3	Tritium	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
	RE00-02-45637	00-02-19714	0–0.08				
	RE00-02-45638	00-02-19715	0–0.08				
	RE00-02-45639	00-02-19716	0–0.08				
	RE00-02-45640	00-02-19717	0–0.08				
	RE00-02-45641	00-02-19718	0–0.08				
	RE00-02-45642	00-02-19719	0–0.08				
	RE00-02-45643	00-02-19720	0–0.08				
	RE00-02-45706	00-02-19720	0.08–0.5				
	RE00-02-45714	00-02-19716	0.08–0.5				
	RE00-02-45715	00-02-19714	0.08–0.5				
779S	RE00-02-45637	00-02-19714	0–0.08	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
	RE00-02-45638	00-02-19715	0–0.08				
	RE00-02-45639	00-02-19716	0–0.08				
	RE00-02-45640	00-02-19717	0–0.08				
	RE00-02-45641	00-02-19718	0–0.08				
	RE00-02-45642	00-02-19719	0–0.08				
	RE00-02-45643	00-02-19720	0–0.08				
	RE00-02-45706	00-02-19720	0.08–0.5				
	RE00-02-45714	00-02-19716	0.08–0.5				

Table C-5.0-4 (continued)

Request	Sample ID	Location ID	Depth	Analytical Suite	Analyte	Qualifier	Explanation
779S	RE00-02-45640	00-02-19717	0–0.08	ISO_PU	Plutonium-239	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
	RE00-02-45641	00-02-19718	0–0.08				
779S	RE00-02-45636	00-02-19713	0–0.08	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
	RE00-02-45715	00-02-19714	0.08–0.5				
779S	RE00-02-45636	00-02-19713	0–0.08	SR_90	Strontium-90	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
	RE00-02-45637	00-02-19714	0–0.08				
	RE00-02-45638	00-02-19715	0–0.08				
	RE00-02-45639	00-02-19716	0–0.08				
	RE00-02-45640	00-02-19717	0–0.08				
	RE00-02-45641	00-02-19718	0–0.08				
	RE00-02-45642	00-02-19719	0–0.08				
	RE00-02-45643	00-02-19720	0–0.08				
	RE00-02-45706	00-02-19720	0.08–0.5				
	RE00-02-45714	00-02-19716	0.08–0.5				
	RE00-02-45715	00-02-19714	0.08–0.5				
783S	RE00-02-45645	00-02-19722	0–0.08	GAMMA_SPEC	Americium-241	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
	RE00-02-45646	00-02-19723	0–0.08				
	RE00-02-45647	00-02-19724	0–0.08				
	RE00-02-45648	00-02-19725	0–0.08				
	RE00-02-45649	00-02-19726	0–0.08				
	RE00-02-45650	00-02-19727	0–0.08				
	RE00-02-45651	00-02-19728	0–0.08				
	RE00-02-45652	00-02-19729	0–0.08				
	RE00-02-45653	00-02-19730	0–0.08				
	RE00-02-45654	00-02-19731	0–0.08				
	RE00-02-45655	00-02-19732	0–0.08				
	RE00-02-45656	00-02-19733	0–0.08				
	RE00-02-45704	00-02-19725	0.08–0.5				
	RE00-02-45705	00-02-19732	0.08–0.5				
	RE00-02-45709	00-02-19727	0.08–0.5				
	RE00-02-45712	00-02-19730	0.08–0.5				
783S	RE00-02-45644	00-02-19721	0–0.08	GAMMA_SPEC	Cesium-134 Cobalt-60 Europium-152 Ruthenium-106 Sodium-22 Uranium-235	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
	RE00-02-45645	00-02-19722	0–0.08				
	RE00-02-45646	00-02-19723	0–0.08				
	RE00-02-45647	00-02-19724	0–0.08				
	RE00-02-45648	00-02-19725	0–0.08				
	RE00-02-45649	00-02-19726	0–0.08				
	RE00-02-45650	00-02-19727	0–0.08				
	RE00-02-45651	00-02-19728	0–0.08				
	RE00-02-45652	00-02-19729	0–0.08				
	RE00-02-45653	00-02-19730	0–0.08				
	RE00-02-45654	00-02-19731	0–0.08				
	RE00-02-45655	00-02-19732	0–0.08				
	RE00-02-45656	00-02-19733	0–0.08				
	RE00-02-45704	00-02-19725	0.08–0.5				
	RE00-02-45705	00-02-19732	0.08–0.5				
	RE00-02-45709	00-02-19727	0.08–0.5				
	RE00-02-45712	00-02-19730	0.08–0.5				

Table C-5.0-4 (continued)

Request	Sample ID	Location ID	Depth	Analytical Suite	Analyte	Qualifier	Explanation
783S	RE00-02-45645	00-02-19722	0–0.08	GAMMA_SPEC	Cesium-137	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
	RE00-02-45704	00-02-19725	0.08–0.5				
783S	RE00-02-45644	00-02-19721	0–0.08	H3	Tritium	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
	RE00-02-45645	00-02-19722	0–0.08				
	RE00-02-45646	00-02-19723	0–0.08				
	RE00-02-45647	00-02-19724	0–0.08				
	RE00-02-45648	00-02-19725	0–0.08				
	RE00-02-45649	00-02-19726	0–0.08				
	RE00-02-45650	00-02-19727	0–0.08				
	RE00-02-45651	00-02-19728	0–0.08				
	RE00-02-45652	00-02-19729	0–0.08				
	RE00-02-45653	00-02-19730	0–0.08				
	RE00-02-45654	00-02-19731	0–0.08				
	RE00-02-45655	00-02-19732	0–0.08				
	RE00-02-45656	00-02-19733	0–0.08				
	RE00-02-45704	00-02-19725	0.08–0.5				
	RE00-02-45705	00-02-19732	0.08–0.5				
	RE00-02-45709	00-02-19727	0.08–0.5				
	RE00-02-45712	00-02-19730	0.08–0.5				
783S	RE00-02-45644	00-02-19721	0–0.08	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
	RE00-02-45646	00-02-19723	0–0.08				
	RE00-02-45647	00-02-19724	0–0.08				
	RE00-02-45648	00-02-19725	0–0.08				
	RE00-02-45649	00-02-19726	0–0.08				
	RE00-02-45650	00-02-19727	0–0.08				
	RE00-02-45652	00-02-19729	0–0.08				
	RE00-02-45653	00-02-19730	0–0.08				
	RE00-02-45655	00-02-19732	0–0.08				
	RE00-02-45656	00-02-19733	0–0.08				
	RE00-02-45704	00-02-19725	0.08–0.5				
	RE00-02-45709	00-02-19727	0.08–0.5				
783S	RE00-02-45648	00-02-19725	0–0.08	ISO_PU	Plutonium-239	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
	RE00-02-45704	00-02-19725	0.08–0.5				
783S	RE00-02-45645	00-02-19722	0–0.08	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
	RE00-02-45651	00-02-19728	0–0.08				
	RE00-02-45654	00-02-19731	0–0.08				
	RE00-02-45705	00-02-19732	0.08–0.5				
	RE00-02-45712	00-02-19730	0.08–0.5				

Table C-5.0-4 (continued)

Request	Sample ID	Location ID	Depth	Analytical Suite	Analyte	Qualifier	Explanation
783S	RE00-02-45644 RE00-02-45645 RE00-02-45646 RE00-02-45648 RE00-02-45649 RE00-02-45652 RE00-02-45653 RE00-02-45654 RE00-02-45655 RE00-02-45704 RE00-02-45705 RE00-02-45709 RE00-02-45712	00-02-19721 00-02-19722 00-02-19723 00-02-19725 00-02-19726 00-02-19729 00-02-19730 00-02-19731 00-02-19732 00-02-19725 00-02-19732 00-02-19727 00-02-19730	0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0.08–0.5 0.08–0.5 0.08–0.5 0.08–0.5	SR_90	Strontium-90	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
789S	RE00-02-45657 RE00-02-45658 RE00-02-45659 RE00-02-45660 RE00-02-45661 RE00-02-45662 RE00-02-45663 RE00-02-45664 RE00-02-45665 RE00-02-45701 RE00-02-45702	00-02-19734 00-02-19735 00-02-19736 00-02-19737 00-02-19738 00-02-19739 00-02-19740 00-02-19741 00-02-19742 00-02-19734 00-02-19739	0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0.08–0.5 0.08–0.5	GAMMA_SPEC	Americium-241 Cesium-134 Cobalt-60 Europium-152 Ruthenium-106 Uranium-235	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
789S	RE00-02-45658 RE00-02-45659 RE00-02-45660 RE00-02-45661 RE00-02-45662 RE00-02-45663 RE00-02-45664 RE00-02-45665 RE00-02-45701 RE00-02-45702	00-02-19735 00-02-19736 00-02-19737 00-02-19738 00-02-19739 00-02-19740 00-02-19741 00-02-19742 00-02-19734 00-02-19739	0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0.08–0.5 0.08–0.5	GAMMA_SPEC	Sodium-22	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
789S	RE00-02-45657 RE00-02-45658 RE00-02-45659 RE00-02-45660 RE00-02-45661 RE00-02-45662 RE00-02-45663 RE00-02-45664 RE00-02-45665 RE00-02-45701 RE00-02-45702	00-02-19734 00-02-19735 00-02-19736 00-02-19737 00-02-19738 00-02-19739 00-02-19740 00-02-19741 00-02-19742 00-02-19734 00-02-19739	0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0.08–0.5 0.08–0.5	H3	Tritium	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
789S	RE00-02-45659 RE00-02-45660 RE00-02-45664 RE00-02-45701 RE00-02-45702	00-02-19736 00-02-19737 00-02-19741 00-02-19734 00-02-19739	0–0.08 0–0.08 0–0.08 0.08–0.5 0.08–0.5	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
789S	RE00-02-45657 RE00-02-45661 RE00-02-45662 RE00-02-45665	00-02-19734 00-02-19738 00-02-19739 00-02-19742	0–0.08 0–0.08 0–0.08 0–0.08	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.

Table C-5.0-4 (continued)

Request	Sample ID	Location ID	Depth	Analytical Suite	Analyte	Qualifier	Explanation
789S	RE00-02-45657 RE00-02-45660 RE00-02-45665 RE00-02-45701	00-02-19734 00-02-19737 00-02-19742 00-02-19734	0–0.08 0–0.08 0–0.08 0.08–0.5	SR_90	Strontium-90	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
797S	RE00-02-45666 RE00-02-45667 RE00-02-45668 RE00-02-45669 RE00-02-45703	00-02-19743 00-02-19744 00-02-19745 00-02-19746 00-02-19745	0–0.08 0–0.08 0–0.08 0–0.08 0.08–0.3	GAMMA_SPEC	Americium-241 Cesium-134 Cobalt-60 Europium-152 Ruthenium-106 Sodium-22	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
797S	RE00-02-45668 RE00-02-45669 RE00-02-45703	00-02-19745 00-02-19746 00-02-19745	0–0.08 0–0.08 0.08–0.3	GAMMA_SPEC	Uranium-235	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
797S	RE00-02-45667	00-02-19744	0–0.08	GAMMA_SPEC	Uranium-235	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
797S	RE00-02-45666 RE00-02-45667 RE00-02-45668 RE00-02-45669 RE00-02-45703	00-02-19743 00-02-19744 00-02-19745 00-02-19746 00-02-19745	0–0.08 0–0.08 0–0.08 0–0.08 0.08–0.3	H3	Tritium	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
797S	RE00-02-45667 RE00-02-45668 RE00-02-45669 RE00-02-45703	00-02-19744 00-02-19745 00-02-19746 00-02-19745	0–0.08 0–0.08 0–0.08 0.08–0.3	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
797S	RE00-02-45668 RE00-02-45703	00-02-19745 00-02-19745	0–0.08 0.08–0.3	SR_90	Strontium-90	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
799S	RE00-02-45670 RE00-02-45671 RE00-02-45672 RE00-02-45673 RE00-02-45674 RE00-02-45675 RE00-02-45676 RE00-02-45677 RE00-02-45678 RE00-02-45707 RE00-02-45708 RE00-02-45710 RE00-02-45713	00-02-19747 00-02-19748 00-02-19749 00-02-19750 00-02-19751 00-02-19752 00-02-19753 00-02-19754 00-02-19755 00-02-19747 00-02-19754 00-02-19748 00-02-19750	0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0.08–0.5 0.08–0.5 0.08–0.5 0.08–0.5	GAMMA_SPEC	Americium-241 Cesium-134 Cobalt-60 Europium-152 Sodium-22 Uranium-235	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
799S	RE00-02-45708	00-02-19754	0.08–0.5	GAMMA_SPEC	Cesium-137	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.

Table C-5.0-4 (continued)

Request	Sample ID	Location ID	Depth	Analytical Suite	Analyte	Qualifier	Explanation
799S	RE00-02-45670	00-02-19747	0–0.08	GAMMA_SPEC	Ruthenium-106	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
	RE00-02-45671	00-02-19748	0–0.08				
	RE00-02-45672	00-02-19749	0–0.08				
	RE00-02-45674	00-02-19751	0–0.08				
	RE00-02-45675	00-02-19752	0–0.08				
	RE00-02-45676	00-02-19753	0–0.08				
	RE00-02-45677	00-02-19754	0–0.08				
	RE00-02-45678	00-02-19755	0–0.08				
	RE00-02-45707	00-02-19747	0.08–0.5				
	RE00-02-45708	00-02-19754	0.08–0.5				
	RE00-02-45710	00-02-19748	0.08–0.5				
	RE00-02-45713	00-02-19750	0.08–0.5				
799S	RE00-02-45670	00-02-19747	0–0.08	H3	Tritium	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
	RE00-02-45671	00-02-19748	0–0.08				
	RE00-02-45672	00-02-19749	0–0.08				
	RE00-02-45673	00-02-19750	0–0.08				
	RE00-02-45674	00-02-19751	0–0.08				
	RE00-02-45675	00-02-19752	0–0.08				
	RE00-02-45676	00-02-19753	0–0.08				
	RE00-02-45677	00-02-19754	0–0.08				
	RE00-02-45678	00-02-19755	0–0.08				
	RE00-02-45707	00-02-19747	0.08–0.5				
	RE00-02-45708	00-02-19754	0.08–0.5				
	RE00-02-45710	00-02-19748	0.08–0.5				
	RE00-02-45713	00-02-19750	0.08–0.5				
799S	RE00-02-45670	00-02-19747	0–0.08	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
	RE00-02-45671	00-02-19748	0–0.08				
	RE00-02-45672	00-02-19749	0–0.08				
	RE00-02-45673	00-02-19750	0–0.08				
	RE00-02-45674	00-02-19751	0–0.08				
	RE00-02-45675	00-02-19752	0–0.08				
	RE00-02-45677	00-02-19754	0–0.08				
	RE00-02-45678	00-02-19755	0–0.08				
	RE00-02-45708	00-02-19754	0.08–0.5				
	RE00-02-45710	00-02-19748	0.08–0.5				
	RE00-02-45713	00-02-19750	0.08–0.5				
799S	RE00-02-45674	00-02-19751	0–0.08	ISO_PU	Plutonium-239	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
	RE00-02-45675	00-02-19752	0–0.08				
799S	RE00-02-45676	00-02-19753	0–0.08	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
799S	RE00-02-45670	00-02-19747	0–0.08	SR_90	Strontium-90	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
	RE00-02-45677	00-02-19754	0–0.08				
	RE00-02-45707	00-02-19747	0.08–0.5				
	RE00-02-45713	00-02-19750	0.08–0.5				

Table C-5.0-4 (continued)

Request	Sample ID	Location ID	Depth	Analytical Suite	Analyte	Qualifier	Explanation
823S	RE00-02-45683	00-02-19760	0–0.08	GAMMA_SPEC	Americium-241 Cesium-134 Cobalt-60 Europium-152 Ruthenium-106 Sodium-22	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
	RE00-02-45684	00-02-19761	0–0.08				
	RE00-02-45686	00-02-19763	0–0.08				
	RE00-02-45687	00-02-19764	0–0.08				
	RE00-02-45688	00-02-19765	0–0.08				
	RE00-02-45689	00-02-19766	0–0.08				
	RE00-02-45692	00-02-19769	0–0.08				
	RE00-02-45693	00-02-19770	0–0.08				
	RE00-02-45717	00-02-19760	0.08–0.5				
	RE00-02-45718	00-02-19762	0.08–0.5				
	RE00-02-45719	00-02-19764	0.08–0.5				
823S	RE00-02-45684	00-02-19761	0–0.08	GAMMA_SPEC	Uranium-235	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
	RE00-02-45685	00-02-19762	0–0.08				
	RE00-02-45686	00-02-19763	0–0.08				
	RE00-02-45687	00-02-19764	0–0.08				
	RE00-02-45688	00-02-19765	0–0.08				
	RE00-02-45689	00-02-19766	0–0.08				
	RE00-02-45692	00-02-19769	0–0.08				
	RE00-02-45693	00-02-19770	0–0.08				
	RE00-02-45717	00-02-19760	0.08–0.5				
	RE00-02-45718	00-02-19762	0.08–0.5				
	RE00-02-45719	00-02-19764	0.08–0.5				
823S	RE00-02-45685	00-02-19762	0–0.08	GAMMA_SPEC	Americium-241	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
823S	RE00-02-45683	00-02-19760	0–0.08	H3	Tritium	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
	RE00-02-45684	00-02-19761	0–0.08				
	RE00-02-45685	00-02-19762	0–0.08				
	RE00-02-45686	00-02-19763	0–0.08				
	RE00-02-45687	00-02-19764	0–0.08				
	RE00-02-45688	00-02-19765	0–0.08				
	RE00-02-45689	00-02-19766	0–0.08				
	RE00-02-45692	00-02-19769	0–0.08				
	RE00-02-45693	00-02-19770	0–0.08				
	RE00-02-45717	00-02-19760	0.08–0.5				
	RE00-02-45718	00-02-19762	0.08–0.5				
	RE00-02-45719	00-02-19764	0.08–0.5				
823S	RE00-02-45683	00-02-19760	0–0.08	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
	RE00-02-45684	00-02-19761	0–0.08				
	RE00-02-45687	00-02-19764	0–0.08				
	RE00-02-45688	00-02-19765	0–0.08				
	RE00-02-45689	00-02-19766	0–0.08				
	RE00-02-45692	00-02-19769	0–0.08				
	RE00-02-45693	00-02-19770	0–0.08				
	RE00-02-45717	00-02-19760	0.08–0.5				
	RE00-02-45718	00-02-19762	0.08–0.5				
	RE00-02-45719	00-02-19764	0.08–0.5				
823S	RE00-02-45686	00-02-19763	0–0.08	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.

Table C-5.0-4 (continued)

Request	Sample ID	Location ID	Depth	Analytical Suite	Analyte	Qualifier	Explanation
823S	RE00-02-45687 RE00-02-45688 RE00-02-45692	00-02-19764 00-02-19765 00-02-19769	0–0.08 0–0.08 0–0.08	SR_90	Strontium-90	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
826S	RE00-02-45690 RE00-02-45691 RE00-02-45694 RE00-02-45695 RE00-02-45696 RE00-02-45697 RE00-02-45716	00-02-19767 00-02-19768 00-02-19771 00-02-19772 00-02-19773 00-02-19774 00-02-19771	0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0.08–0.5	GAMMA_SPEC	Americium-241 Sodium-22	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
826S	RE00-02-45690 RE00-02-45691 RE00-02-45694 RE00-02-45695 RE00-02-45696 RE00-02-45697 RE00-02-45716 RE00-02-45720	00-02-19767 00-02-19768 00-02-19771 00-02-19772 00-02-19773 00-02-19774 00-02-19771 00-02-19768	0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0.08–0.5 0.08–0.5	GAMMA_SPEC	Cesium-134 Cobalt-60 Europium-152 Ruthenium-106 Uranium-235	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
826S	RE00-02-45690 RE00-02-45691 RE00-02-45694 RE00-02-45695 RE00-02-45696 RE00-02-45697 RE00-02-45716 RE00-02-45720	00-02-19767 00-02-19768 00-02-19771 00-02-19772 00-02-19773 00-02-19774 00-02-19771 00-02-19768	0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0.08–0.5 0.08–0.5	H3	Tritium	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
826S	RE00-02-45690 RE00-02-45694 RE00-02-45696 RE00-02-45697 RE00-02-45716 RE00-02-45720	00-02-19767 00-02-19771 00-02-19773 00-02-19774 00-02-19771 00-02-19768	0–0.08 0–0.08 0–0.08 0–0.08 0.08–0.5 0.08–0.5	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
826S	RE00-02-45691	00-02-19768	0–0.08	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the result was < 3x the 1-sigma total propagated uncertainty.
826S	RE00-02-45694 RE00-02-45697 RE00-02-45716	00-02-19771 00-02-19774 00-02-19771	0–0.08 0–0.08 0.08–0.5	SR_90	Strontium-90	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
828S	RE00-02-45679 RE00-02-45680 RE00-02-45681 RE00-02-45682 RE00-02-45721	00-02-19756 00-02-19757 00-02-19758 00-02-19759 00-02-19759	0–0.08 0–0.08 0–0.08 0–0.08 0.08–0.5	GAMMA_SPEC	Americium-241 Cesium-134 Cobalt-60 Europium-152 Ruthenium-106 Sodium-22 Uranium-235	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
828S	RE00-02-45679 RE00-02-45680	00-02-19756 00-02-19757	0–0.08 0–0.08	GAMMA_SPEC	Cesium-137	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.

Table C-5.0-4 (continued)

Request	Sample ID	Location ID	Depth	Analytical Suite	Analyte	Qualifier	Explanation
828S	RE00-02-45679 RE00-02-45680 RE00-02-45681 RE00-02-45682 RE00-02-45721	00-02-19756 00-02-19757 00-02-19758 00-02-19759 00-02-19759	0–0.08 0–0.08 0–0.08 0–0.08 0.08–0.5	H3	Tritium	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
828S	RE00-02-45679 RE00-02-45680 RE00-02-45681 RE00-02-45682 RE00-02-45721	00-02-19756 00-02-19757 00-02-19758 00-02-19759 00-02-19759	0–0.08 0–0.08 0–0.08 0–0.08 0.08–0.5	ISO_PU	Plutonium-238	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
	RE00-02-45679 RE00-02-45680 RE00-02-45682 RE00-02-45721	00-02-19756 00-02-19757 00-02-19759 00-02-19759	0–0.08 0–0.08 0–0.08 0.08–0.5		Plutonium-239	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.
828S	RE00-02-45682 RE00-02-45721	00-02-19759 00-02-19759	0–0.08 0.08–0.5	SR_90	Strontium-90	U	The result for this analyte is undetected; the amount detected is < the minimum detectable activity.

C-6.0 REJECTED DATA

Table C-6.0-1 contains all rejected data.

Table C-6.0-1
All Rejected Data

Request	Sample ID	Location ID	Depth	Analytical Suite	Analyte	Qualifier	Explanation
0-004, 0-033(b), 0-030(l)							
1171S	RE00-02-45447	00-02-19622	1–1.5	METALS	Antimony	R	The result for this analyte is rejected; the matrix spike recovery was less than 30%.
	RE00-02-45448	00-02-19623	1–1.5				
	RE00-02-45449	00-02-19624	1–1.5				
	RE00-02-45450	00-02-19625	1–1.5				
	RE00-02-45451	00-02-19626	1–1.5				
	RE00-02-45452	00-02-19627	1–1.5				
21-021-99							
13040	AAA0482	21-01019	0–0.08	METALS	Aluminum Antimony Arsenic Barium Beryllium Cadmium Calcium Chromium Cobalt Copper Iron Lead Lithium Magnesium Manganese Molybdenum Nickel Potassium Selenium Silver Sodium Strontium Thallium Vanadium Zinc	R	The result for this analyte is rejected because of identified quality deficiencies.
	AAA0483	21-01020	0–0.08				
	AAA0484	21-01020	0–0.5				
	AAA0485	21-01021	0–0.08				
	AAA0487	21-01022	0–0.08				
	AAA0488	21-01024	0–0.08				
	AAA0489	21-01024	0–0.25				
	AAA0490	21-01297	0–0.5				
	AAA0491	21-01297	0–0.5				
	AAA0492	21-01025	0–0.08				
	AAA0493	21-01028	0–0.08				

Table C-6.0-1 (continued)

Request	Sample ID	Location ID	Depth	Analytical Suite	Analyte	Qualifier	Explanation
13047	AAA0465 AAA0466 AAA0467 AAA0468 AAA0469 AAA0472 AAA0473 AAA0474 AAA0475 AAA0476 AAA0477 AAA0478 AAA0479 AAA0480 AAA0481	21-01010 21-01010 21-01296 21-01296 21-01013 21-01009 21-01011 21-01012 21-01014 21-01014 21-01015 21-01016 21-01017 21-01017 21-01018	0–0.08 0–0.5 0–0.08 0–0.17 0–0.08 0–0.08 0–0.08 0–0.08 0–0.08 0–0.5 0–0.08 0–0.08 0–0.08 0–0.33 0–0.08	METALS	Aluminum Antimony Arsenic Barium Beryllium Cadmium Calcium Chromium Cobalt Copper Iron Lead Lithium Magnesium Manganese Molybdenum Nickel Potassium Selenium Silver Sodium Strontium Thallium Vanadium Zinc	R	The result for this analyte is rejected because of identified quality deficiencies.
13053	AAA0457 AAA0458 AAA0459 AAA0460 AAA0461 AAA0462 AAA0464 AAA0494 AAA0495 AAA0496 AAA0497	21-01003 21-01004 21-01004 21-01005 21-01006 21-01006 21-01007 21-01023 21-01023 21-01026 21-01027	0–0.08 0–0.08 0–0.5 0–0.08 0–0.08 0–0.5 0–0.08 0–0.08 0–0.5 0–0.08 0–0.08	METALS	Aluminum Antimony Arsenic Barium Beryllium Cadmium Calcium Chromium Cobalt Copper Iron Lead Lithium Magnesium Manganese Molybdenum Nickel Potassium Selenium Silver Sodium Strontium Thallium Vanadium Zinc	R	The result for this analyte is rejected because of identified quality deficiencies.

Table C-6.0-1 (continued)

Request	Sample ID	Location ID	Depth	Analytical Suite	Analyte	Qualifier	Explanation
778S	RE00-02-45636	00-02-19713	0–0.08	METALS	Antimony	R	The result for this analyte is rejected; the matrix spike recovery was less than 30%.
	RE00-02-45637	00-02-19714	0–0.08				
	RE00-02-45638	00-02-19715	0–0.08				
	RE00-02-45639	00-02-19716	0–0.08				
	RE00-02-45640	00-02-19717	0–0.08				
	RE00-02-45641	00-02-19718	0–0.08				
	RE00-02-45642	00-02-19719	0–0.08				
	RE00-02-45643	00-02-19720	0–0.08				
	RE00-02-45706	00-02-19720	0.08–0.5				
	RE00-02-45714	00-02-19716	0.08–0.5				
	RE00-02-45715	00-02-19714	0.08–0.5				
782S	RE00-02-45644	00-02-19721	0–0.08	METALS	Antimony	R	The result for this analyte is rejected; the matrix spike recovery was less than 30%.
	RE00-02-45645	00-02-19722	0–0.08				
	RE00-02-45646	00-02-19723	0–0.08				
	RE00-02-45647	00-02-19724	0–0.08				
	RE00-02-45648	00-02-19725	0–0.08				
	RE00-02-45649	00-02-19726	0–0.08				
	RE00-02-45650	00-02-19727	0–0.08				
	RE00-02-45651	00-02-19728	0–0.08				
	RE00-02-45652	00-02-19729	0–0.08				
	RE00-02-45653	00-02-19730	0–0.08				
796S	RE00-02-45666	00-02-19743	0–0.08	METALS	Antimony	R	The result for this analyte is rejected; the matrix spike recovery was less than 30%.
	RE00-02-45667	00-02-19744	0–0.08				
	RE00-02-45668	00-02-19745	0–0.08				
	RE00-02-45669	00-02-19746	0–0.08				
	RE00-02-45703	00-02-19745	0.08–0.3				
798S	RE00-02-45670	00-02-19747	0–0.08	METALS	Antimony	R	The result for this analyte is rejected; the matrix spike recovery was less than 30%.
	RE00-02-45671	00-02-19748	0–0.08				
	RE00-02-45672	00-02-19749	0–0.08				
	RE00-02-45673	00-02-19750	0–0.08				
	RE00-02-45674	00-02-19751	0–0.08				
	RE00-02-45675	00-02-19752	0–0.08				
	RE00-02-45676	00-02-19753	0–0.08				
	RE00-02-45677	00-02-19754	0–0.08				
	RE00-02-45678	00-02-19755	0–0.08				
	RE00-02-45707	00-02-19747	0.08–0.5				
	RE00-02-45708	00-02-19754	0.08–0.5				
	RE00-02-45710	00-02-19748	0.08–0.5				
	RE00-02-45713	00-02-19750	0.08–0.5				
825S	RE00-02-45690	00-02-19767	0–0.08	METALS	Antimony	R	The result for this analyte is rejected; the matrix spike recovery was less than 30%.
	RE00-02-45691	00-02-19768	0–0.08				
	RE00-02-45694	00-02-19771	0–0.08				
	RE00-02-45695	00-02-19772	0–0.08				
	RE00-02-45696	00-02-19773	0–0.08				
	RE00-02-45697	00-02-19774	0–0.08				
	RE00-02-45716	00-02-19771	0.08–0.5				
	RE00-02-45720	00-02-19768	0.08–0.5				
827S	RE00-02-45679	00-02-19756	0–0.08	METALS	Antimony	R	The result for this analyte is rejected; the matrix spike recovery was less than 30%.
	RE00-02-45680	00-02-19757	0–0.08				
	RE00-02-45681	00-02-19758	0–0.08				
	RE00-02-45682	00-02-19759	0–0.08				
	RE00-02-45721	00-02-19759	0.08–0.5				

Table C-6.0-1 (continued)

Request	Sample ID	Location ID	Depth	Analytical Suite	Analyte	Qualifier	Explanation
21-021-99							
779S	RE00-02-45715	00-02-19714	0.08–0.5	GAMMA_SPEC	Americium-241	R	The result for this analyte is rejected due to spectral interference that prevented positive identification of the analyte.
783S	RE00-02-45644	00-02-19721	0–0.08	GAMMA_SPEC	Americium-241	R	The result for this analyte is rejected due to spectral interference that prevented positive identification of the analyte.
789S	RE00-02-45657	00-02-19734	0–0.08	GAMMA_SPEC	Sodium-22	R	The result for this analyte is rejected due to spectral interference that prevented positive identification of the analyte.
799S	RE00-02-45673	00-02-19750	0–0.08	GAMMA_SPEC	Ruthenium-106	R	The result for this analyte is rejected due to spectral interference that prevented positive identification of the analyte.
826S	RE00-02-45720	00-02-19768	0.08–0.5	GAMMA_SPEC	Americium-241 Sodium-22	R	The result for this analyte is rejected due to spectral interference that prevented positive identification of the analyte.

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LANL (Los Alamos National Laboratory), March 1996. "Quality Assurance Project Plan Requirements for Sampling and Analysis," Los Alamos National Laboratory Report LA-UR-96-441, Los Alamos, New Mexico. (LANL 1996, 54609)

Ryti, R. T., P. A. Longmire, D. E. Broxton, S. L. Reneau, and E. V. McDonald, May 7, 1998. "Inorganic and Radionuclide Background Data for Soils, Canyon Sediments, and Bandelier Tuff at Los Alamos National Laboratory" (draft), Los Alamos National Laboratory Report, Los Alamos, New Mexico. (Ryti et al. 1998, 58093)

Appendix D

Analytical Suites and Results
(CD attached to inside of back cover)

Appendix E

Statistical Results for Chemical Analytical Data

APPENDIX E STATISTICAL RESULTS FOR CHEMICAL ANALYTICAL DATA

E-1.0 INTRODUCTION

This appendix provides detailed statistical evaluations that support the data review sections of the report including summary statistics, exploratory data analysis, and background comparisons. Statistical methods are described below. The plots and evaluation results are presented in Section E-3. Separate subsections in E-3 are presented for different environmental media, which include soil and fill (E-3.1) and subsurface tuff (E-3.2). Samples were analyzed for constituents including inorganic chemicals, radionuclides (americium-241, isotopic plutonium, isotopic uranium, tritium, gamma-emitting nuclides, and strontium-90), and organic chemicals (volatile organic compounds, semivolatile organic compounds, polychlorinated biphenyls, and pesticides). Section E-4 presents box plots containing site data, non-site-related data, and LANL background data. These box plots compare the distributions of site data and non-site-related data to support the text in the data review section of the report.

E-2.0 OVERVIEW OF STATISTICAL METHODS

A variety of statistical methods may be applied to each of the data sets. The use of any of these methods depends on how appropriate the method is for the available data.

E-2.1 Exploratory Data Analysis

Box plots provide a visual representation of the data and determine the presence of outliers or other anomalous data that might affect statistical results and interpretations. The plots allow a visual comparison among concentration distributions. The differences of interest may include an overall shift in concentration (shift of central location) or, when the centers are nearly equal, a difference between the upper tails of the two distributions (elevated concentrations in a small fraction of one distribution). The plots may be used in conjunction with the statistical tests (distributional comparisons) described below. Unless otherwise noted, the nondetects are included in the plots at their reported DL or EQL.

A box plot consists of a box, a line across the box, whiskers (lines extended beyond the box and terminated with a short perpendicular line), and points outside the whiskers. The box area of the plot is the region between the 25th percentile and the 75th percentile of the data, the interquartile range or middle half of the data. The horizontal line within the box represents the median (50th percentile) of the data. The whiskers give an interval of 1.5 times the interquartile range, outside of which data may be evaluated for their potential to be outliers. Often, the concentrations are plotted as points overlaying the box plot. When a data set contains both detected concentrations and nondetected results reported as DLs, the detected concentrations are plotted as x's, and the nondetected results are plotted as o's.

E-2.2 Distributional Comparisons

Comparisons between data sets that might represent different concentration distributions, such as site-specific data and Los Alamos National Laboratory (Laboratory) background data, are performed using a variety of statistical methods. For background comparisons, these methods begin with a simple comparison of site-specific data with an upper tolerance limit (UTL) estimated from the background data (UTL [95,95] or the 95% upper confidence bound on the 95th quantile). UTLs are used to represent the upper end of concentration distribution and are also referred to as BVs. UTL comparisons are followed, when appropriate, by statistical tests that evaluate potential differences between the distributions. These tests are used for testing hypotheses about data from two potentially different distributions, e.g., a test of the hypothesis that site concentrations are elevated above background levels. Nonparametric tests that are most commonly performed include the two-sample Wilcoxon Rank Sum test (Wilcoxon test), the Gehan test (modification of the Wilcoxon test), and the quantile test (Gehan 1965, 55611; Gilbert and Simpson 1990, 55612). The Gehan test is best suited for assessing complete shifts in distributions. This test accounts for nondetects at multiple DLs in a statistically robust manner. If there are no nondetects in the data, the Gehan test is equivalent to the Wilcoxon test. The quantile test is better suited for assessing shifts of a subset of the data[1]. Between the two tests (Gehan and quantile), most types of differences between distributions can be identified. Occasionally, if the differences between two distributions appear to occur far into the tails, the slippage test might be performed. This test evaluates the potential for some of the site data to be greater than the maximum BV if, in fact, the site data and background data came from the same distribution. If the data reasonably satisfy normality assumptions, as demonstrated with the exploratory data analysis[2], and there are relatively few nondetects, then a parametric t-test can be used to compare two distributions. Observed significance levels (p-values) are obtained from the Gehan, quantile, slippage, and/or t-tests. If a p-value is much less than a specified probability, e.g., 0.05 (a nominal significance level), then there is some reason to suspect that there is a difference between the distributions. If the p-value is much greater than 0.05, no difference is indicated. If the p-value is close to 0.05, then the need for further evaluation is indicated. In particular, when many tests are performed on the same set of data, there is an increased possibility of observing a p-value of less than 0.05 by random chance alone. Adjustments to the nominal significance level can be considered using methods described in Box et al. (1978, 56653, pp. 203–207) and Keppel (1982, 56652, pp. 145-165).

The standard set of tests is run whenever the detection rate for both the DP Road SWMU/AOC group and Laboratory background is greater than 50%; if there are fewer than 50% in either set, then the Gehan test is not applicable.

E-3.0 STATISTICAL RESULTS

The data from DP Road were divided into the following groups:

Section Number	Sub-Section Number	SWMU/AOC Group
E-3.1 Soil and Fill Sample Results	E-3.1.1	0-004, 0-030(l), 0-033(b)
	E-3.1.2	0-030(b,m)
	E-3.1.3	21-021-99
E-3.2 Subsurface Tuff Sample Results	E-3.2.1	0-004, 0-030(l), 0-033(b)
	E-3.2.2	0-030(b,m)
E-4 Comparison of Site Data and Non-Site-Related Data	E-4.1	0-004, 0-030(l), 0-033(b)
	E-4.2	0-030(b,m)
	Not presented in the appendix	0-029(a)
	Not presented in the appendix	0-029(b)
	Not presented in the appendix	0-029 (c)

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[1] The quantile test is performed at a specified quantile level, usually 80%. This threshold is established to determine if the relative proportion of the two populations being tested is different in the top 20% of the data than it is in the remainder of the data. If this difference is recognized, then there is reason to believe that the distributions are partially shifted because of different tail effects. However, this implies that this test cannot be performed if more than 80% (or the threshold percentage) of the combined data are nondetects.

[2] Formal tests for normality might also be performed, such as the Kolmogorov-Smirnov test (Gilbert 1987, 56179).

The sampling locations for each SWMU/AOC group are shown in Figures 2.4-1, 3.4-1, and 6.1-1 of the VCA/IA report.

E-3.1 Soil and Fill Sample Results

E-3.1.1 AOCs 0-004 and 0-033(b) and SWMU 0-030(l)

Inorganic Chemicals

Twenty-one soil and fill samples were collected from AOCs 0-004 and 0-033(b) and SWMU 0-030(l). Additionally two samples were collected upgradient of these SWMUs/AOCs to serve as non-site-related samples. All of these samples were analyzed for inorganic chemicals.

Inorganic chemical concentrations were compared with Laboratory-wide BVs for all soil horizon (ALLH) (LANL 1998, 59730). The frequency of detected inorganic chemicals above BV in soil and fill is summarized in Table 2.4-3. Cadmium, calcium, chromium, lead, manganese, mercury, and zinc were all detected above the BV in at least one sample. Antimony, cadmium, mercury, and silver all had at least one detection limit above the BV. All of these analytes have an all soil background data set except silver. The results of the Gehan and Quantile statistical tests for these analytes is presented in Table E-3.1-1.

Table E-3.1-1
Results of Statistical Tests for Inorganic Chemicals above BV in Soil and Fill Samples at AOCs 0-004 and 0-033(b) and SWMU 0-030(l)

Analyte	Gehan p-value	Quantile p-value	# Site Data	# Bkgd Data	Max Site (mg/kg)	Max Bkgd (mg/kg
Antimony	n/a*	<0.001	15	135	11	1
Cadmium	n/a	0.002	21	39	1.9	2.6
Calcium	0.006	0.098	21	173	11300	14000
Chromium	0.761	0.419	21	173	39.1	36.5
Lead	<0.001	<0.001	21	173	77.7	28
Manganese	0.939	0.993	21	173	687	1100
Mercury	n/a	<0.001	21	39	0.35	0.1
Zinc	<0.001	<0.001	21	172	87.8	75.5

*n/a = Not applicable.

Based on the results of the statistical test, antimony, cadmium, calcium, lead, mercury, and zinc are different than background. The box plots for these analytes are presented in Figures E-3.1-1 to E-3.1-6 for further evaluation.

Of the fifteen samples analyzed for antimony, three samples had a detection limit of 11 mg/kg and one had a detection limit of 3.3 mg/kg. The four samples that had the elevated detection limits were analyzed in 1996 by ICPES. One other sample that was analyzed by ICPES for antimony in 1995 was reported with a detection limit less than the BV. Ten additional samples were collected in the same area in 2002 and analyzed for antimony by ICPMS, which is the same method that was used to analyze the LANL background data set. As the box plot shows, all of the concentrations for samples analyzed in 1995 and 2002 were below the all soil horizon BV of 1 mg/kg. Based on the coverage of AOCs 0-004 and 0-033(b) and SWMU 0-030(l) with antimony data that met detection limits below the BV, antimony was not be evaluated further.

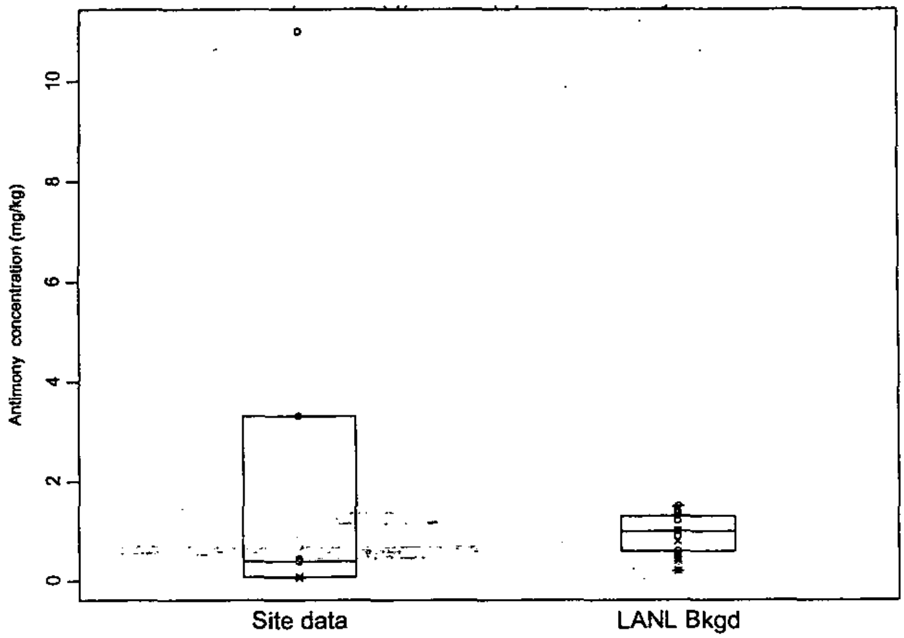

Figure E-3.1-1. Box plots of antimony chemical concentrations from LANL all horizon background data and soil and fill material at AOCs 0-004 and 0-033(b) and SWMU 0-030(l)

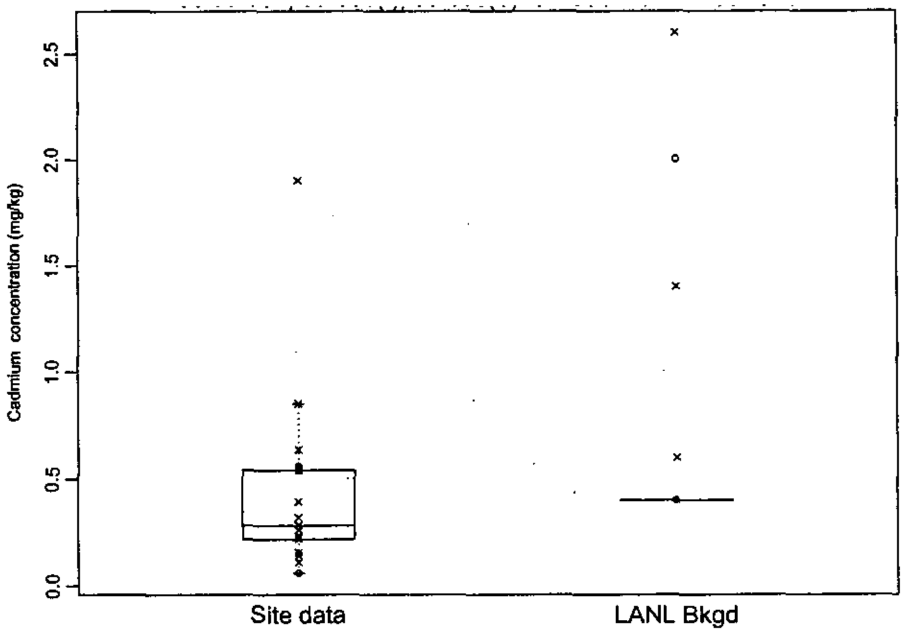

Figure E-3.1-2. Box plots of cadmium chemical concentrations from LANL all horizon background data and soil and fill material at AOCs 0-004 and 0-033(b) and SWMU 0-030(l)

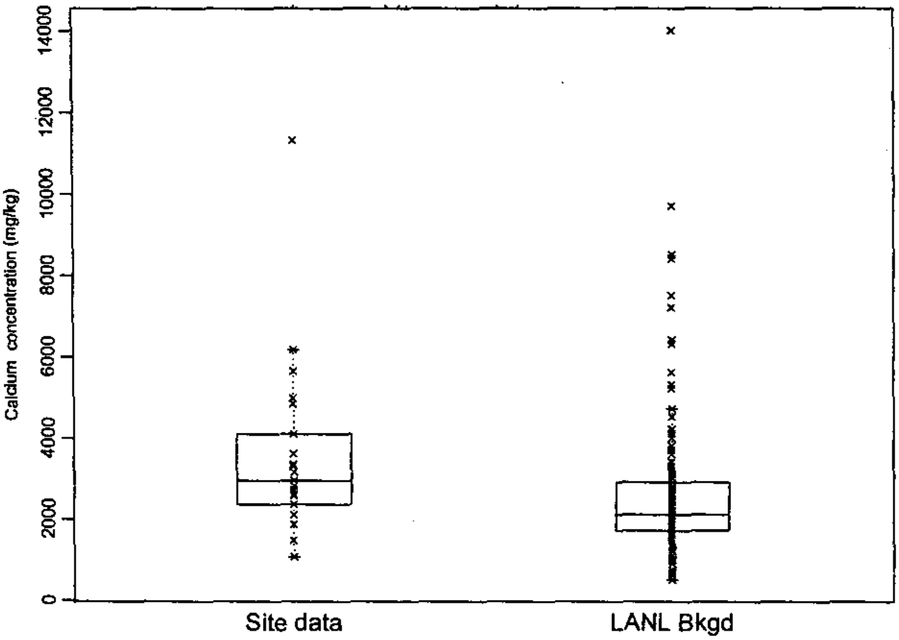

Figure E-3.1-3. **Box plots of calcium chemical concentrations from LANL all horizon background data and soil and fill material at AOCs 0-004 and 0-033(b) and SWMU 0-030(I)**

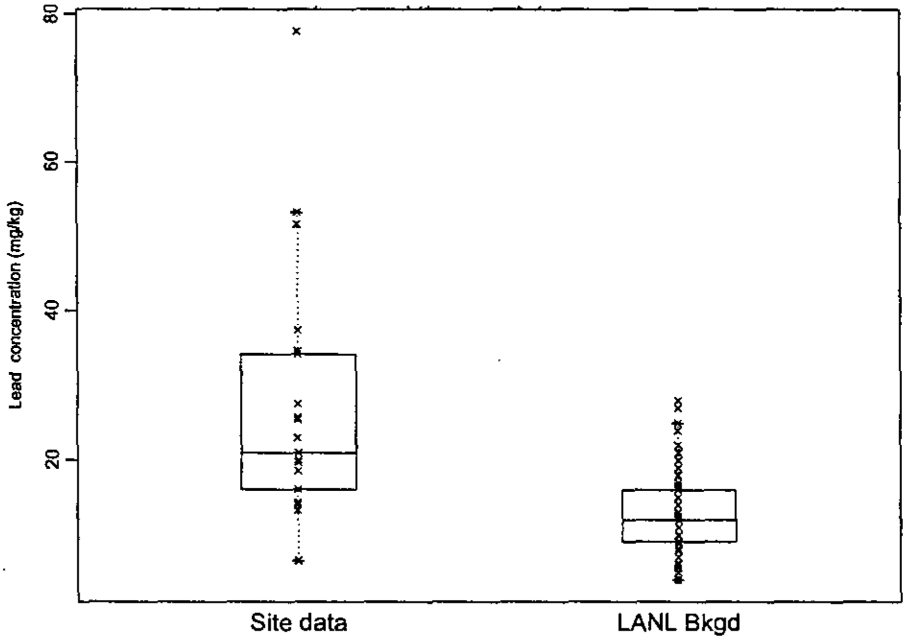

Figure E-3.1-4. **Box plots of lead chemical concentrations from LANL all horizon background data and soil and fill material at AOCs 0-004 and 0-033(b) and SWMU 0-030(I)**

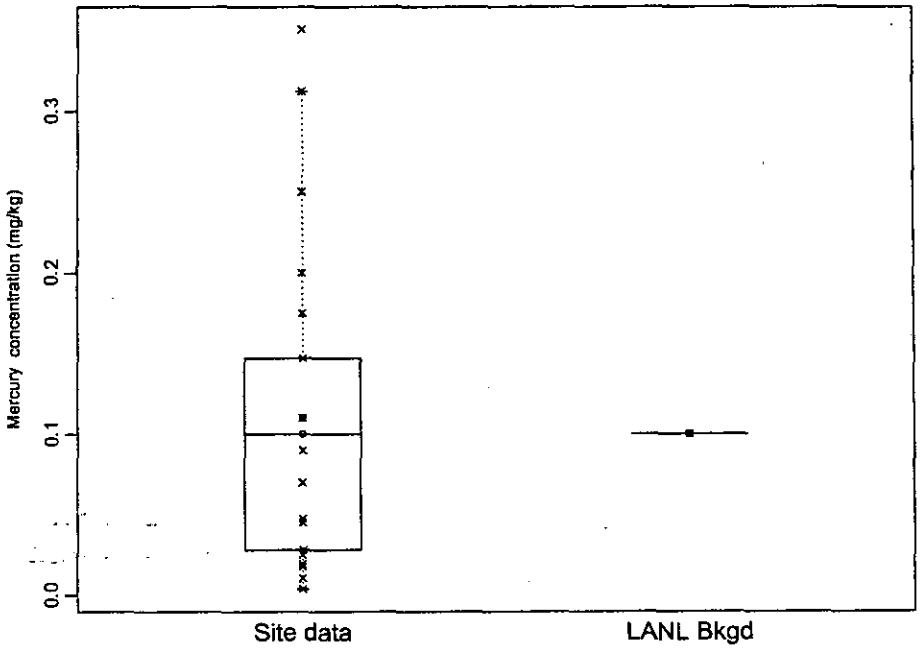

Figure E-3.1-5. Box plots of mercury chemical concentrations from LANL all horizon background data and soil and fill material at AOCs 0-004 and 0-033(b) and SWMU 0-030(I)

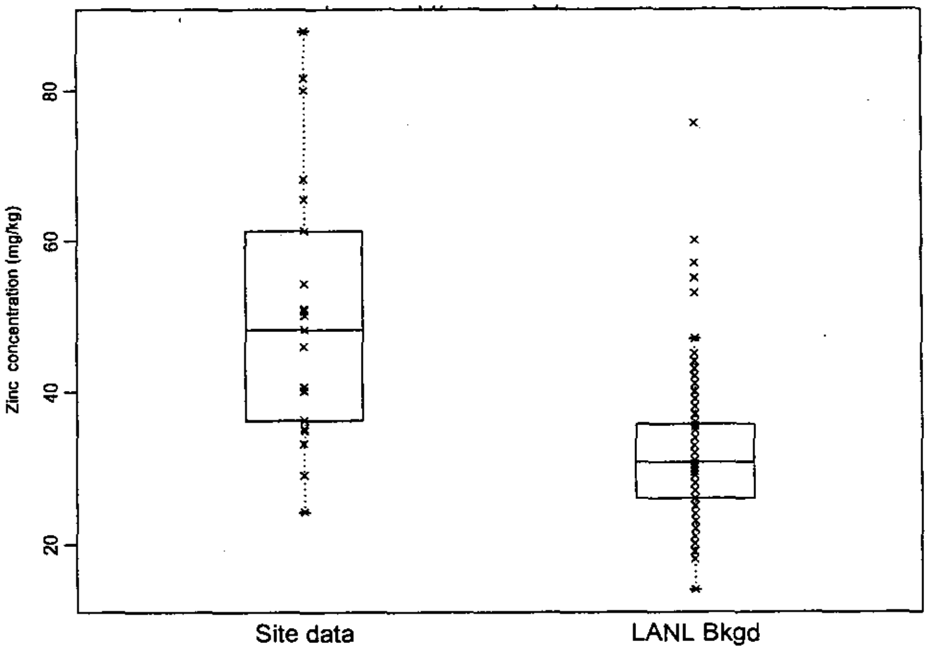

Figure E-3.1-6. Box plots of zinc chemical concentrations from LANL all horizon background data and soil and fill material at AOCs 0-004 and 0-033(b) and SWMU 0-030(I)

Similarly, silver had three detection limits above the BV of 1 mg/kg. These were the same three samples as the highest detection limits for antimony. As with antimony, the additional samples collected in 2002 were collected in the same vicinity as previous samples and these additional samples were analyzed by methods that met detection limits below the BV. Therefore silver was not evaluated further.

The Quantile test probability value was less than 0.05 for cadmium. The box plot illustrates that a subset of the cadmium data is different from the rest of the distribution. There were four detects that were above the BV for cadmium. The highest detect was 1.9 mg/kg compared to a BV of 0.4 mg/kg.

The Gehan test resulted in a probability value less than 0.05 for calcium. As a comparison of the boxes shows, the distribution of calcium is slightly elevated in comparison to the background distribution. The LANL background data set has 173 results compared to 21 results in the site data, and the calcium data in the LANL background data set is weighted more toward the lower concentrations. The maximum detect of calcium at the site is approximately twice the background value and there was only one detect in the background data set that was higher. Therefore, calcium is evaluated further.

For lead, mercury, and zinc, at least one of the probability values from the statistical tests was <0.001 (see Table E-3.1-1) . The box plots show that there are multiple detected concentrations above the maximum concentration in the LANL background data set as well as a definite shift in the distribution. These three analytes are retained as COPCs.

Radionuclides

Fourteen soil and fill samples were analyzed for americium-241 and isotopic plutonium, one sample for tritium, thirteen samples for isotopic uranium, and fifteen samples for gamma-emitting radionuclides at AOCs 0-004 and 0-033(b) and SWMU 0-030(l).

The detected concentrations of radionuclides were compared with LANL BVs. The fallout values (FVs) and BVs are listed in the Laboratory background document (LANL 1998, 59730). The frequency of detected radionuclides greater than BV or FV in soil and fill is summarized in Table 2.4-6. Plutonium-239, uranium-234, and uranium-238 were all detected above the BV in samples that were collected within six inches of the surface. Americium-241, cesium-137, plutonium-238, and uranium-235 were detected in samples collected below six inches in depth.

There was only one sample where cesium-137 and uranium-235 were detected below 0.5 ft and this was at a depth of 0.5 to 1 ft. Because of the depth and location of this sample, it is reasonable to compare the samples less than 1 ft in depth to the FV. Therefore, cesium-137 and uranium-235 are not evaluated further. There are no background data sets for isotopic uranium radionuclides, so no further statistical tests could be run for uranium-234 and uranium-238. Although some of the radionuclides were detected at depths below 1 ft, the statistical tests were run for americium-241, plutonium-238, and plutonium-239 using all of the soil and fill data from the site as a comparison to background. Table E-3.1-2 presents the results of the statistical tests for americium-241 and isotopic plutonium. Plutonium-239 was shown as significantly different from fallout with the probability value from the Quantile test less than 0.05. Although as a whole data set, americium-241 and plutonium-238 were below fallout values, the soil samples below 1 ft show detected concentrations and must be evaluated further.

Table E-3.1-2
Results of Statistical Tests for Radionuclides Above BV or FV in Soil and Fill Samples at AOCs 0-004 and 0-033(b) and SWMU 0-030(l)

Analyte	Gehan p-value	Quantile p-value	# Site Data	# Bkgd Data	Max Site (pCi/g)	Max Bkgd (pCi/g)
Am-241	0.418	0.257	14	27	0.0275	0.013
Pu-238	n/a*	0.97	14	56	0.016	0.037
Pu-239	n/a	0.005	14	56	0.169	0.055

*n/a = Not applicable.

E-3.1.2 SWMUs 0-030(b,m)

Inorganic Chemicals

Twenty-four soil and 24 fill samples were analyzed for TAL metals. Additionally nine samples were collected upgradient of these SWMUs to serve as non-site-related samples. Inorganic chemical concentrations were compared with Laboratory-wide BVs for all soil horizon (ALLH) (LANL 1998, 59730). The frequency of detected inorganic chemicals above BV in soil and fill is summarized in Table 3.4-3. Barium, beryllium, cadmium, calcium, chromium, cobalt, copper, lead, manganese, mercury, silver, sodium, uranium, and zinc were detected above the all soil horizon BV in at least one sample. Antimony and cadmium had at least one detection limit above the BV. Further statistical tests were run for all of these analytes except silver. The BV for silver is a detection limit and there is no background data set for comparison.

The results of the Gehan and Quantile statistical tests for these analytes is presented in Table E-3.1-3.

Table E-3.1-3
Results of Statistical Tests for Inorganic Chemicals in Soil and Fill Samples at SWMUs 0-030(b,m)

Analyte Name	Gehan p-Value	Quantile p-Value	# Site Data	# Bkgd Data	Max Site (mg/kg)	Max Bkgd (mg/kg)
Barium	0.910	0.985	48	173	301	410
Beryllium	1.000	0.999	48	174	1.9	3.95
Cadmium	n/a*	0.011	48	39	0.93	2.6
Calcium	0.001	0.500	48	173	11400	14000
Chromium	0.980	1.000	48	173	21.1	36.5
Cobalt	0.947	0.518	48	131	11.1	9.5
Copper	0.517	0.955	48	174	77.2	16
Lead	0.109	0.500	48	173	169	28
Manganese	0.878	0.897	48	173	951	1100
Mercury	n/a	0.002	48	39	8.4	0.1
Sodium	0.006	0.009	48	174	1040	1800
Uranium	0.086	0.958	22	322	4.57	6.728
Zinc	0.141	0.349	48	172	110	75.5

*n/a = Not applicable.

The results of the Gehan and Quantile tests show that cadmium, calcium, mercury, and sodium were significantly above background.

Figure E-3.1-7 shows a division in the cadmium site data where the BV of 0.4 mg/kg falls in between these two subsets. The cadmium site data contains non-detected results where the detection limit is above the BV. Cadmium is retained as a COPC.

As Figure E-3.1-8 shows, the site data for calcium has a slightly higher median than the background data. The site data show a normal distribution with the exception of the detected concentrations above 8000 mg/kg. These detected concentrations of calcium above the BV show a difference between the site and background and calcium is further evaluated.

Mercury was detected in six soil samples. The LANL background data set contains concentrations around 0.1 mg/kg. Figure E-3.1-9 shows that the detected concentrations of mercury in the site data are above the detected concentrations in background data set. Mercury is retained as a COPC.

Although copper and lead were not significantly different than the background data based on the Gehan and Quantile tests, these two analytes each had a maximum concentration that was much higher than the rest of the reported concentrations. Upon further review, these maximum concentrations were in the same sample as the maximum result for mercury (see Figure E-3.1-9). So, the slippage test was run for copper and mercury. This test is based on the maximum observed concentration in the background data set and the number ("n") of site concentrations that exceed the maximum concentration in the background set (Gilbert and Simpson 1990, 55612, pages 5-8). The test accounts for the number of samples in each data set (number of samples from the site and number of samples from background) and determines the probability of "n" (or more) exceedances if the two data sets came from identical distributions. This test is similar to the hot-measurement test in that it evaluates the largest site measurements. The p-value for copper was 0.216 indicating that copper is still no significantly above background. The p-value for lead was 0.002, indicating that the lead data had enough exceedances of the maximum background concentration to show a difference. Lead is retained as a COPC.

Although the results of the statistical tests indicate that sodium is different than background, the box plots in Figure E-3.1-10 show that there is not a lot of difference in the overall distributions. The difference in sample size in the two data sets has some effect on the statistical test results. There were 48 sample results in the site data set and 174 results in the background data set. A majority of the detected results in the background data set were lower than the site results. Overall, there was only one detected concentration of sodium above the BV, which is still less than the five highest detected concentrations in the background data set. Sodium will not be further evaluated.

Antimony detection limits were above the BV in 22 out of 48 samples. As Figure E-3.1-11 shows, there are two distinct subsets of data for the site concentrations of antimony. The samples with high detection limits for antimony were collected in 1995 and analyzed by ICPES. There were two samples analyzed in 1995 by a different laboratory where detection limits were below the BV. The background samples were analyzed by ICPMS, which generally results in lower detection limits for antimony. The area where the samples with higher detection limits for antimony were collected is under an asphalt road. Some remediation was done in this area after the original sampling. Additional samples were collected in 2002 in the area surrounding the locations of the 1995 samples. Figure E-3.1-12 shows the distribution of the antimony data in comparison to the background data using the twenty-six site samples collected in 1995 and 2002 that had detection limits less than the BV. These samples show that antimony was not detected above the BV in the samples that were collected in the area of the former SWMU 0-030(m) septic tank and all of the piping for both septic tanks. Antimony is not retained as a COPC.

Radionuclides

Forty-two soil samples were analyzed for americium-241, 37 soil and fill samples analyzed for gamma-emitting radionuclides, 23 soil samples analyzed for tritium, 66 soil and fill samples analyzed for isotopic plutonium, and 25 soil and fill samples for isotopic uranium at SWMUs 0-030(b,m).

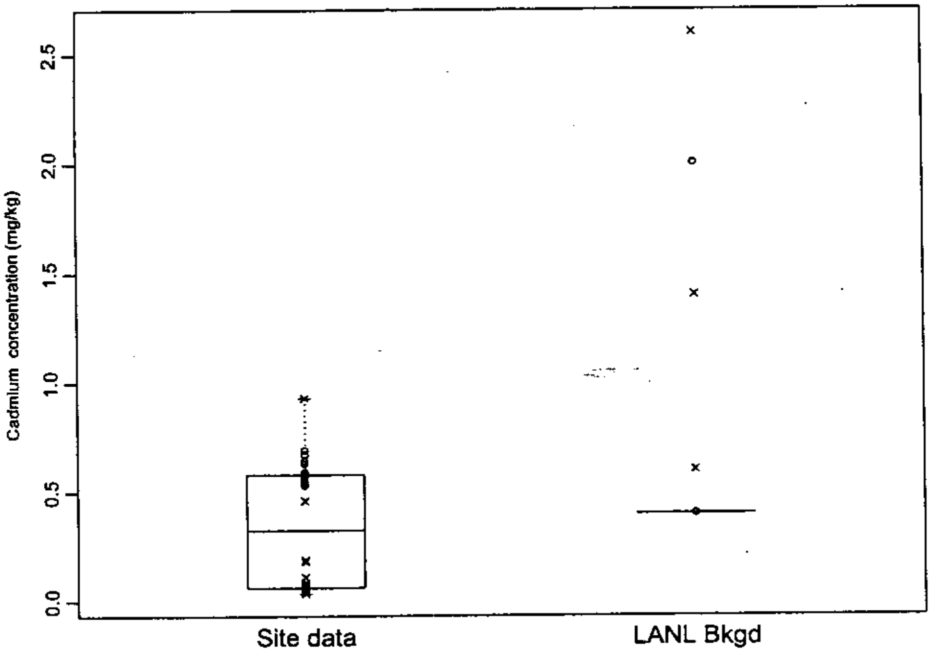

Figure E-3.1-7. **Box plots of cadmium chemical concentrations from LANL all horizon background data and soil and fill material at SWMUs 0-030(b,m)**

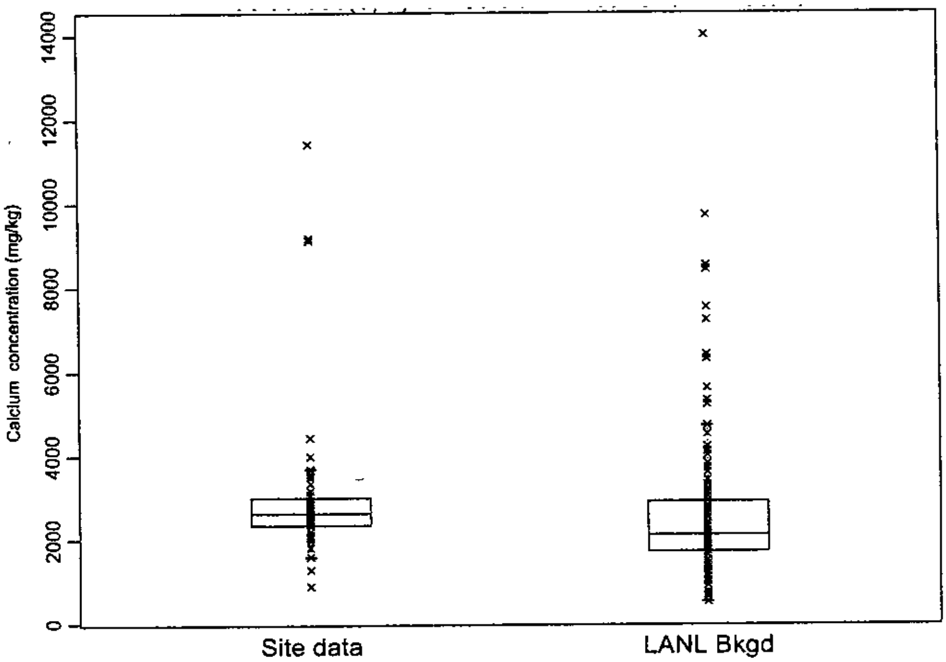

Figure E-3.1-8. **Box plots of calcium chemical concentrations from LANL all horizon background data and soil and fill material at SWMUs 0-030(b,m)**

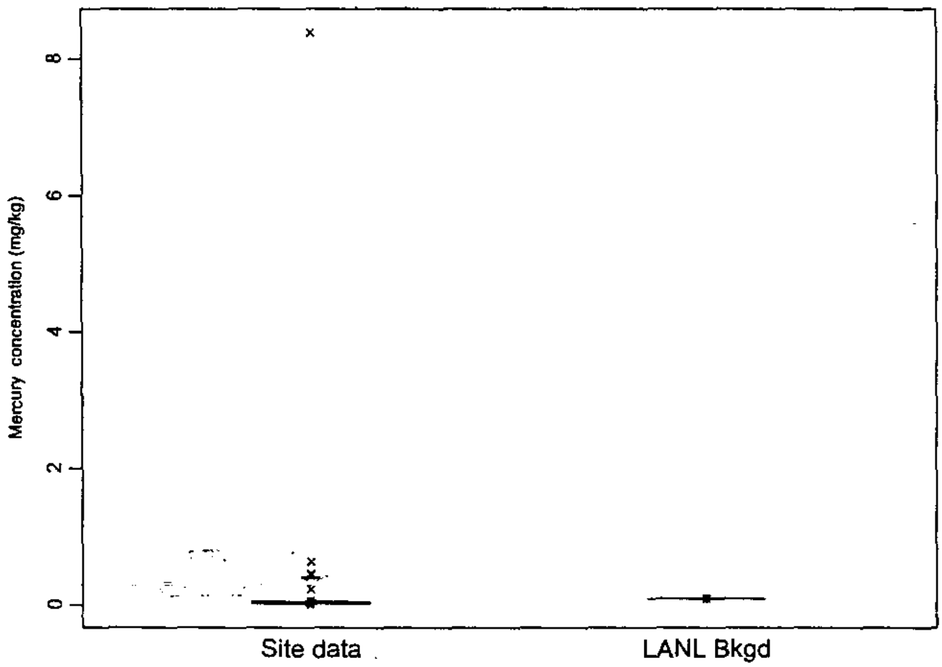

Figure E-3.1-9. **Box plots of mercury chemical concentrations from LANL all horizon background data and soil and fill material at SWMUs 0-030(b,m).**

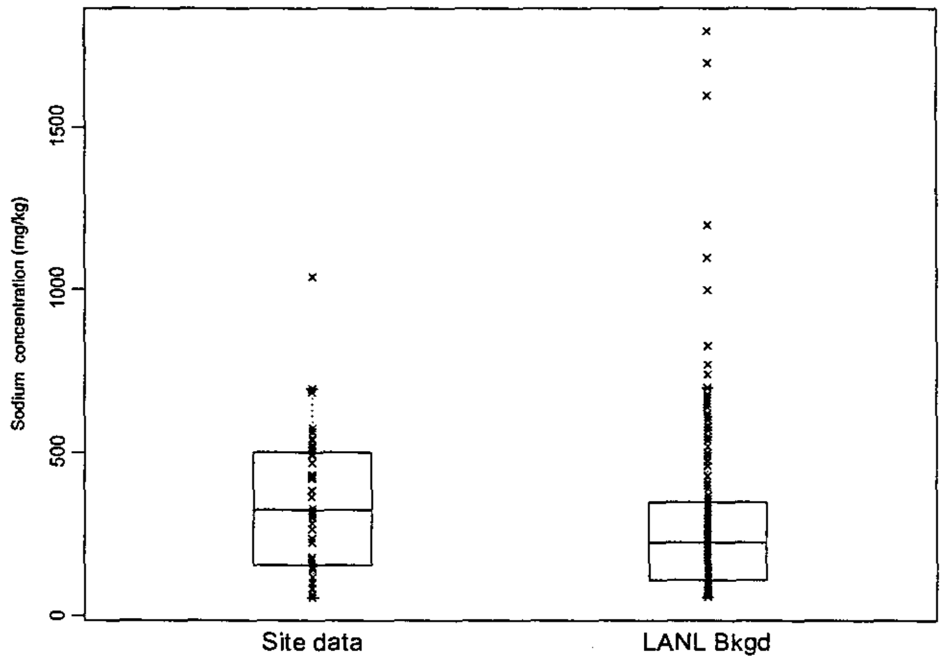

Figure E-3.1-10. **Box plots of sodium chemical concentrations from LANL all horizon background data and soil and fill material at SWMUs 0-030(b,m)**

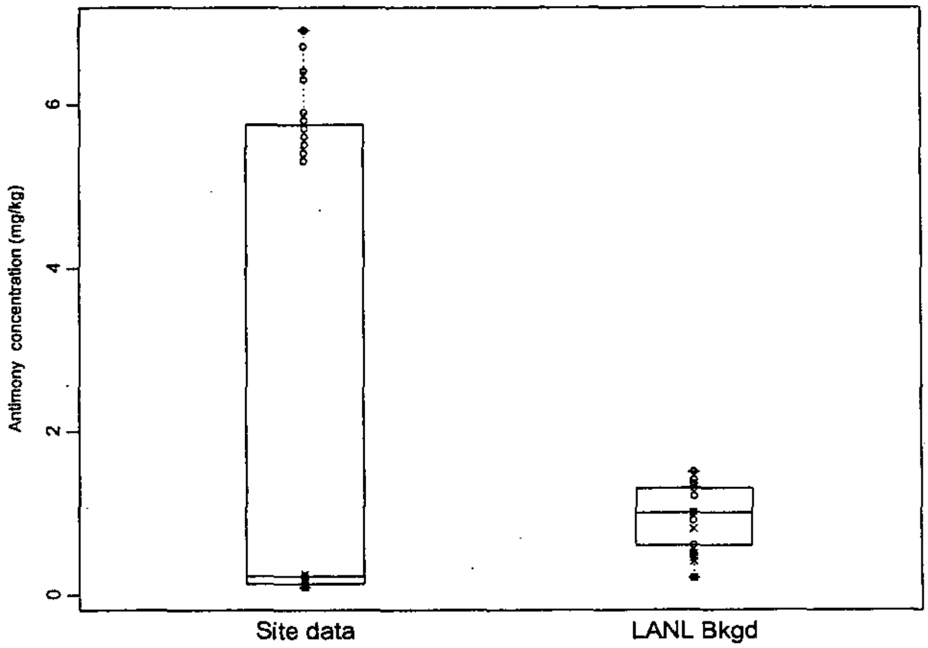

Figure E-3.1-11. Box plots of antimony chemical concentrations from LANL all horizon background data and soil and fill material at SWMUs 0-030(b,m)

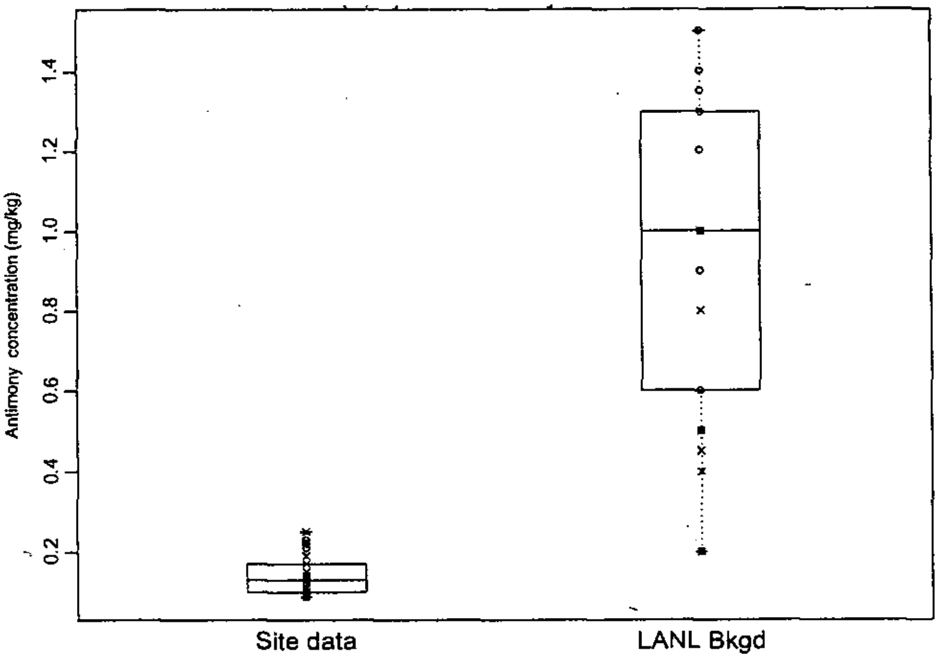

Figure E-3.1-12. Box plots of antimony chemical concentrations from LANL all horizon background data and a subset of soil and fill material concentrations at SWMUs 0-030(b,m)

The detected concentrations of radionuclides were compared with BVs. The fallout concentrations and BVs are listed in the Laboratory background document (LANL 1998, 59730). The frequency of detected radionuclides above BV or FV in soil and fill is summarized in Table 3.4-6. Americium-241, cesium-137, plutonium-238, plutonium-239, tritium, uranium-234, uranium-235, and uranium-238 were detected above the BV or FV in at least one sample or detected in samples collected at depths below six inches. There are no background data sets for isotopic uranium radionuclides, so no further statistical tests could be run for uranium-234, uranium-235, and uranium-238. Although some of the radionuclides were detected at depths below 1 ft, the Quantile test was run for americium-241, cesium-137, plutonium-238, plutonium-239, and tritium using all of the soil and fill data from the site as a comparison to background. The Gehan test was not run due to the large number of nondetected concentrations in the site data. Table E-3.1-4 presents the results of the statistical tests.

Table E-3.1-4
Results of Statistical Tests for Radionuclides
Above BV or FV in Soil and Fill Samples at SWMUs 0-030(b,m)

Analyte	Gehan p-Value	Quantile p-Value	# Site Data	# Bkgd Data	Max Site (pCi/g)	Max Bkgd (pCi/g)
Am-241	n/a*	0.001	64	27	0.963	0.013
Cs-137	n/a	1.000	35	56	0.302	1.7
Pu-238	n/a	0.934	64	56	0.027	0.037
Pu-239	n/a	0.001	64	56	7.232	0.055
Tritium	n/a	0.010	23	51	4.801034	0.9

*n/a = Not applicable.

Although 24 of the site samples were analyzed for americium-241 by gamma spectroscopy, which is a less sensitive method than alpha spectroscopy, there were still detects above the FV in samples that were analyzed by alpha spectroscopy. Figure E-3.1-13 shows a comparison of the site data and LANL background data for americium-241. Even without the distinction of the depth of the samples, the detected concentrations of americium-241 at the site are higher than any of the background data. Americium-241 is retained as a COPC.

Cesium-137 was detected in three soil and fill samples. One of these detected concentrations was in a sample collected near the surface and was below the FV. The other two detected concentrations were in samples collected at depths below 7 ft. These samples were close to locations where tuff was sampled at depths below 7 ft, indicating that the soil at these depths may be part of fill from previous work at the site. In this case, comparing these detected concentrations to the FV may be appropriate. Figure E-3.1-14 shows that the distribution of the cesium-137 site data has a distribution much lower than the distribution of the background data. Cesium-137 is not retained as a COPC.

The maximum detect of plutonium-239 is much higher than the FV. As Figure E-3.1-15 shows, the site data for plutonium-239 has numerous detected concentrations that are greater than all of the detected concentrations in the LANL background data. Plutonium-239 is retained as a COPC.

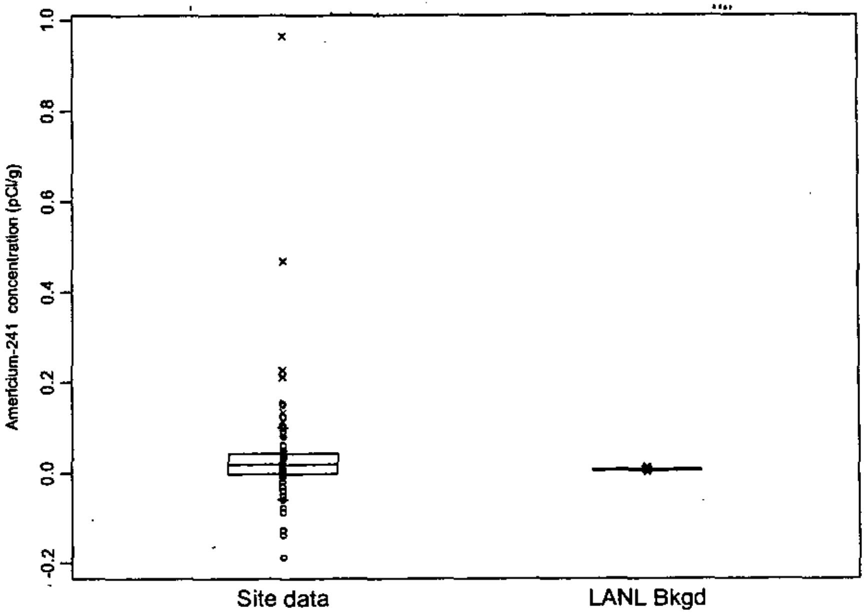

Figure E-3.1-13. Box plots of americium-241 chemical concentrations from LANL all horizon background data and a subset of soil and fill material concentrations at SWMUs 0-030(b,m)

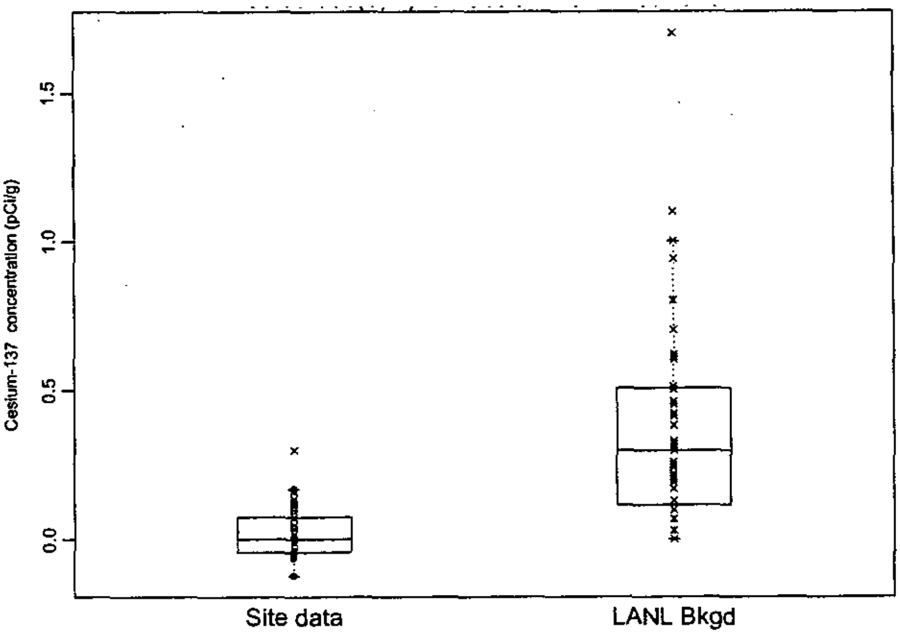

Figure E-3.1-14. Box plots of cesium-137 chemical concentrations from LANL all horizon background data and a subset of soil and fill material concentrations at SWMUs 0-030(b,m)

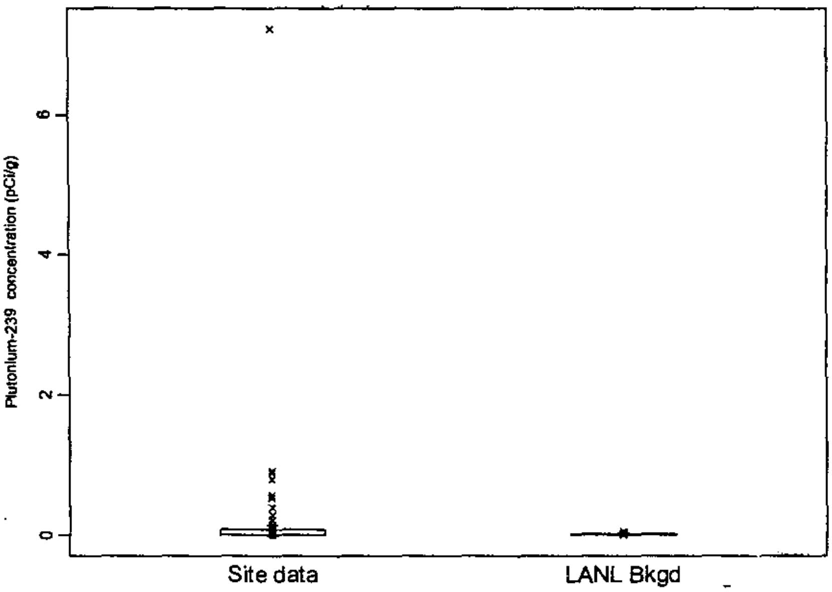

Figure E-3.1-15. Box plots of plutonium-239 chemical concentrations from LANL all horizon background data and a subset of soil and fill material concentrations at SWMUs 0-030(b,m)

E-3.1.3 SWMU 21-021-99

Inorganic Chemicals

Eighty-two soil samples were analyzed for inorganic chemicals. An additional seventeen samples were analyzed for a limited list of TAL metals. Inorganic chemical concentrations were compared with Laboratory-wide BVs for all soil horizon (ALLH) (LANL 1998, 59730). The frequency of detected inorganic chemicals above the BV in soil and fill is summarized in Table 6.4-3.

Aluminum, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, silver, uranium, and zinc were detected above the soil BV in at least one sample. Lithium and strontium were detected in all samples, and as discussed in "Technical Position Paper on Use of TA-21 Process Area Baseline Data for RFI Reports" (LANL 1997 58239), the LANL-wide background soil data may be supplemented by the process area baseline data for lithium, molybdenum, selenium and strontium. Both lithium and strontium were detected above the UTLs that were calculated from the process area baseline data (as shown in Table 6.4-3). Lithium and strontium are retained as COPCs. Antimony and thallium were not detected above the BV, but both analytes had at least one detection limit above the BV. Further statistical tests were run for all of the analytes with a background data set. Lithium, silver, and strontium do not have background data sets, so they are retained as COPCs. The probability values for the statistical tests are presented in Table E-3.1-5.

Table E-3.1-5
Results of Statistical Tests for Inorganic Chemicals Above BV in Soil Samples at SWMU 21-021-99

Analyte	Gehan p-Value	Quantile p-Value	# Site Data	# Bkgd Data	Max Site (mg/kg)	Max Bkgd (mg/kg)
Aluminum	0.889	0.903	82	174	36730	61500
Antimony	<0.001	0.000	47	135	6	1
Barium	0.999	0.996	99	173	570	410
Beryllium	1.000	0.383	99	174	4.6	3.95
Cadmium	n/a*	0.020	99	39	2	2.6
Calcium	0.015	0.086	82	173	9860	14000
Chromium	1.000	0.990	99	173	42	36.5
Cobalt	1.000	1.000	99	131	10.2	9.5
Copper	<0.001	<0.001	99	174	63.3	16
Iron	1.000	0.997	82	174	29090	36000
Lead	<0.001	<0.001	99	173	290	28
Magnesium	1.000	1.000	88	174	4920	10000
Manganese	0.928	0.996	99	173	1200	1100
Mercury	n/a	0.003	82	39	0.332	0.1
Thallium	1.000	0.840	99	173	20	1
Uranium	<0.001	<0.001	61	162	15.95	3.6
Zinc	<0.001	<0.001	99	172	263	75.5

*n/a = Not applicable.

The results of the Gehan and Quantile tests show that cadmium, calcium, copper, lead, mercury, uranium, and zinc were significantly above background. Antimony was also significantly different from background. As discussed in Section 3.4.3, there were fifty-two results for antimony that were rejected. These results are presented in Appendix C. Of the forty-seven samples that had antimony results reported, a majority of the middle of the sampled grid and the east side of the sampled grid have antimony data reported. The data from these forty-seven samples were grouped together to evaluate antimony. As Figure E-3.1-16 shows, all antimony results are well below background with the exception of a detection limit at 6 mg/kg for 17 samples out of 47. These seventeen samples were all collected on the east and northeast portion of the sampling grid in 1992 and were analyzed for antimony by ICPES, which generally has a higher detection limit than ICPMS. Additional samples were collected in 2002 and analyzed for antimony. The samples from 2002 were all collected from the middle of the grid as well as in the same area as the samples from 1992, and the detection limit was below the BV for antimony. These samples help support the conclusion that antimony is not above background at SWMU 21-021-99, and antimony is not a COPC.

Similar to antimony, thallium also had a high detection limit for 17 soil samples analyzed in 1992. Thallium was analyzed for in 99 samples at SWMU 21-021-99 and no data were rejected for thallium. As Figure E-3.1-17 shows, the 82 soil samples where the detection limit was not above the BV were not different from background. The samples from 2002 were all collected in the same general area as the samples from 1992, and the detection limit was below the BV for thallium. These samples help support the conclusion that thallium is not above background at SWMU 21-021-99, so thallium is not a COPC.

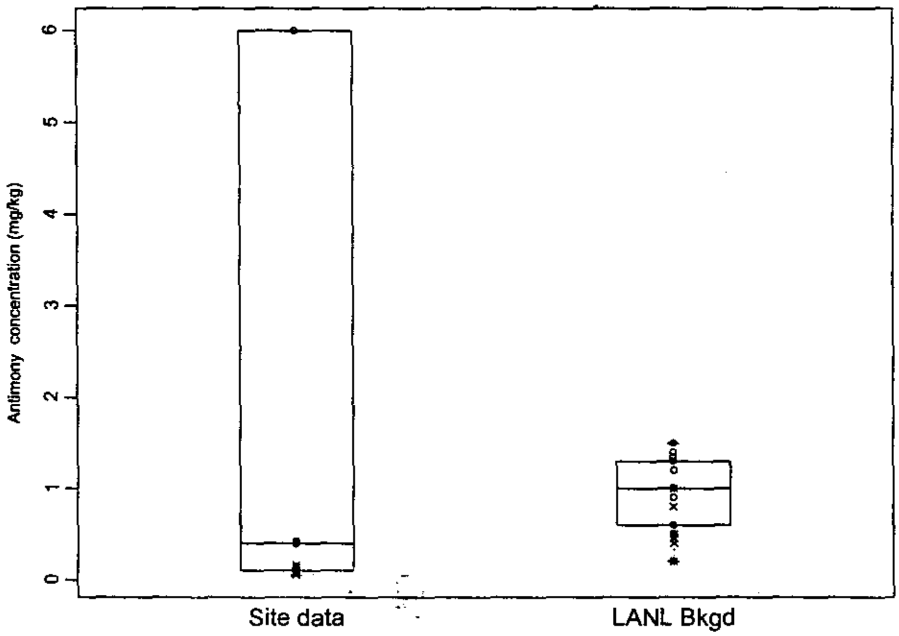

Figure E-3.1-16. Box plots of antimony chemical concentrations from LANL all horizon background data and soil concentrations at SWMU 21-021-99.

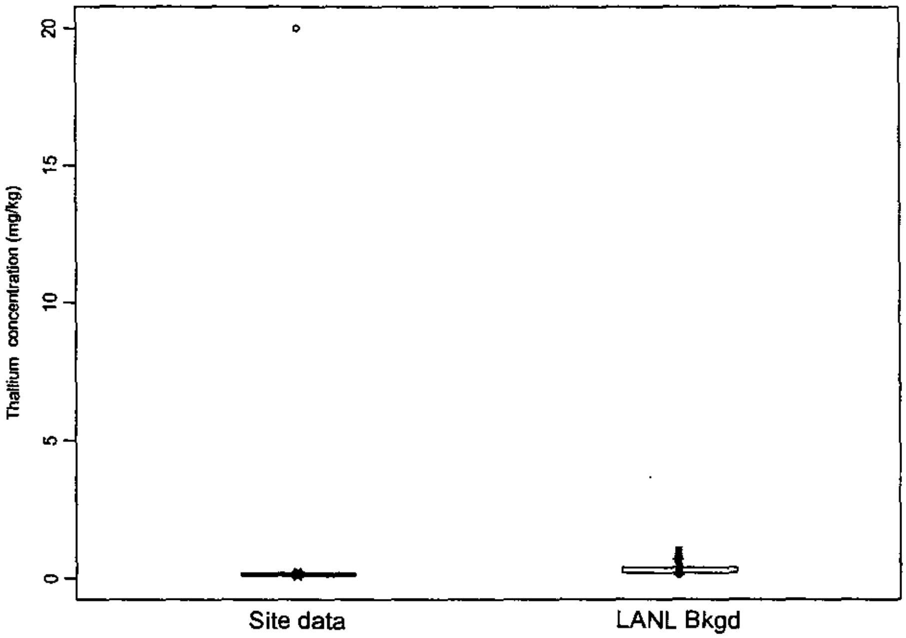

Figure E-3.1-17. Box plots of thallium chemical concentrations from LANL all horizon background data and soil concentrations at SWMU 21-021-99

Figures E-3.1-18 to E-3.1-24 show box plots to compare the site data and LANL background data sets for the seven COPCs (cadmium, calcium, copper, lead, mercury, uranium, and zinc) at SWMU 21-021-99 that have LANL background data for comparison.

Radionuclides

Thirty-seven soil samples were analyzed for americium-241, 102 samples were analyzed for isotopic plutonium, tritium, and strontium-90, four samples for isotopic uranium and isotopic thorium, and 82 samples for gamma-emitting radionuclides. Sample concentrations were compared with the appropriate Laboratory soil BV or FV. Table 6.4-5 presents the frequency of detected radionuclides above BV or FV in soil.

Americium-241, cesium-137, plutonium-238, plutonium-239, strontium-90, thorium-228, tritium, and uranium-235 were all detected above the BV or FV. The BVs for thorium-228 and uranium-235 are surrogates from sediment data, so further background tests cannot be performed. The tritium data were reported in two different units. Since tritium was detected above the FV in 17 out of 20 samples that were comparable to the FV, tritium is retained as a COPC. The results of the statistical tests are presented in Table E-3.1-6. Plutonium-238 and strontium-90 will not be retained as COPCs. For these statistical tests, there was a large difference in the number of samples in the site data sets and the Laboratory background data sets, so the box plots are relied on more to help interpret the statistical results.

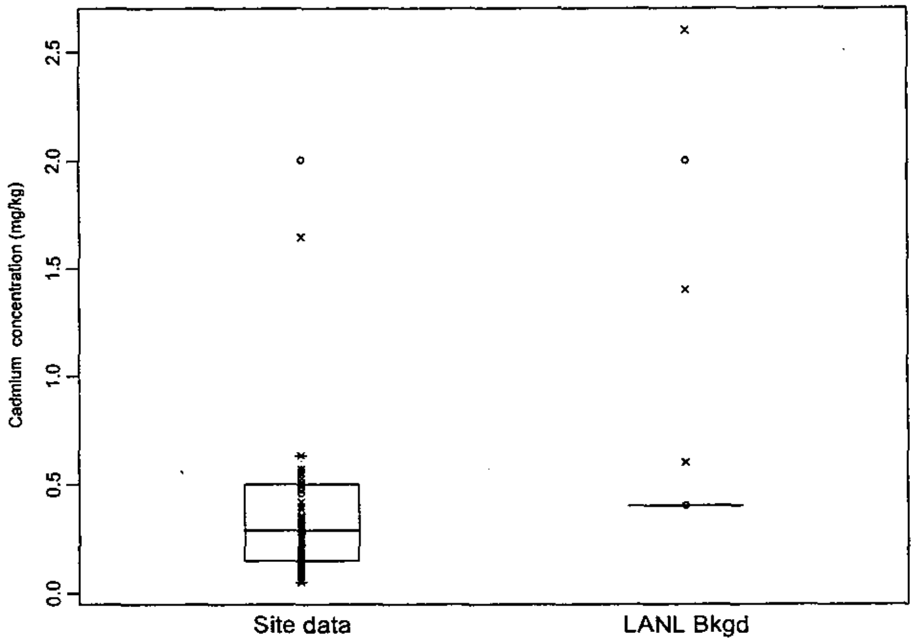

Figure E-3.1-18. Box plots of cadmium chemical concentrations from LANL all horizon background data and soil concentrations at SWMU 21-021-99

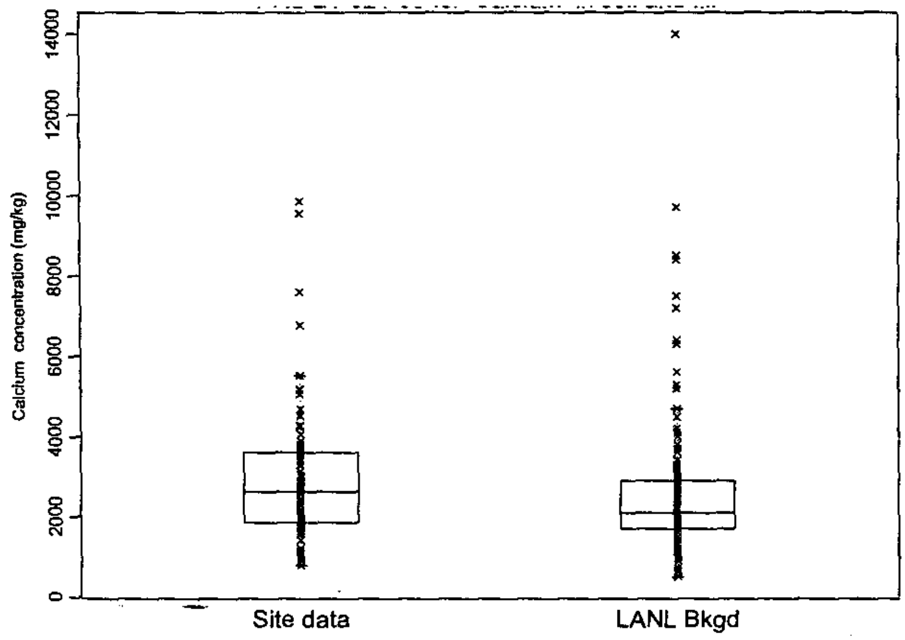

Figure E-3.1-19. Box plots of calcium chemical concentrations from LANL all horizon background data and soil concentrations at SWMU 21-021-99

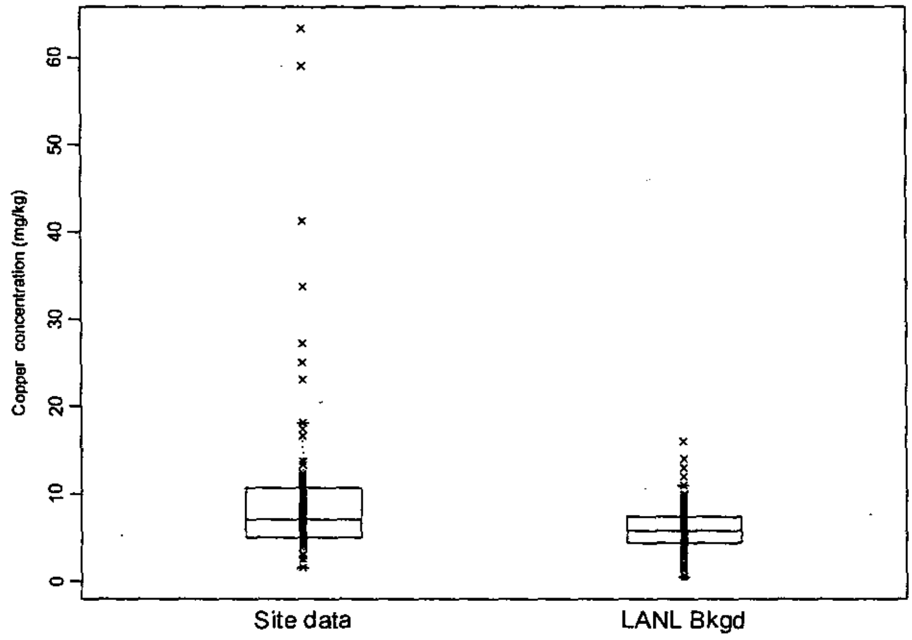

Figure E-3.1-20. Box plots of copper chemical concentrations from LANL all horizon background data and soil concentrations at SWMU 21-021-99

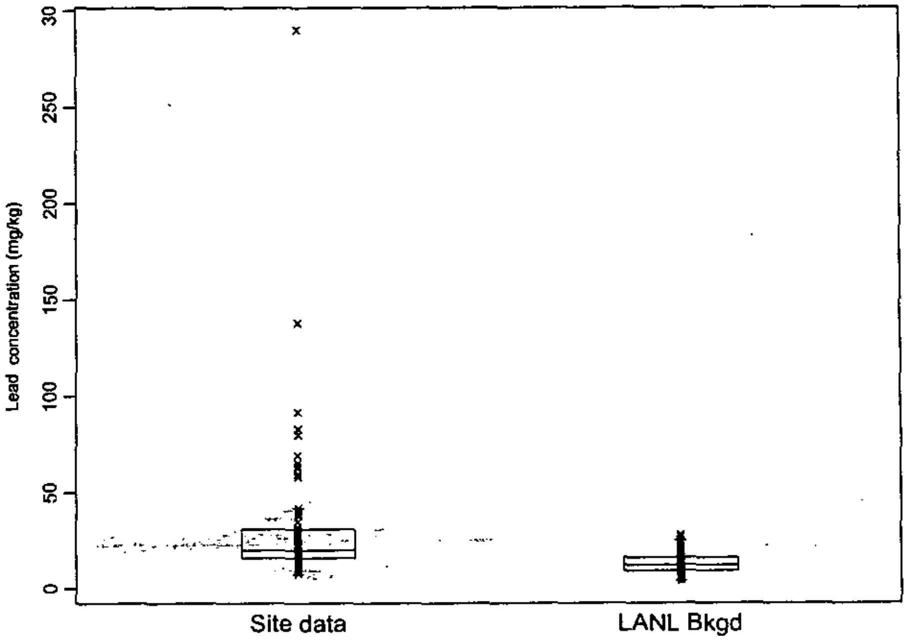

Figure E-3.1-21. Box plots of lead chemical concentrations from LANL all horizon background data and soil concentrations at SWMU 21-021-99

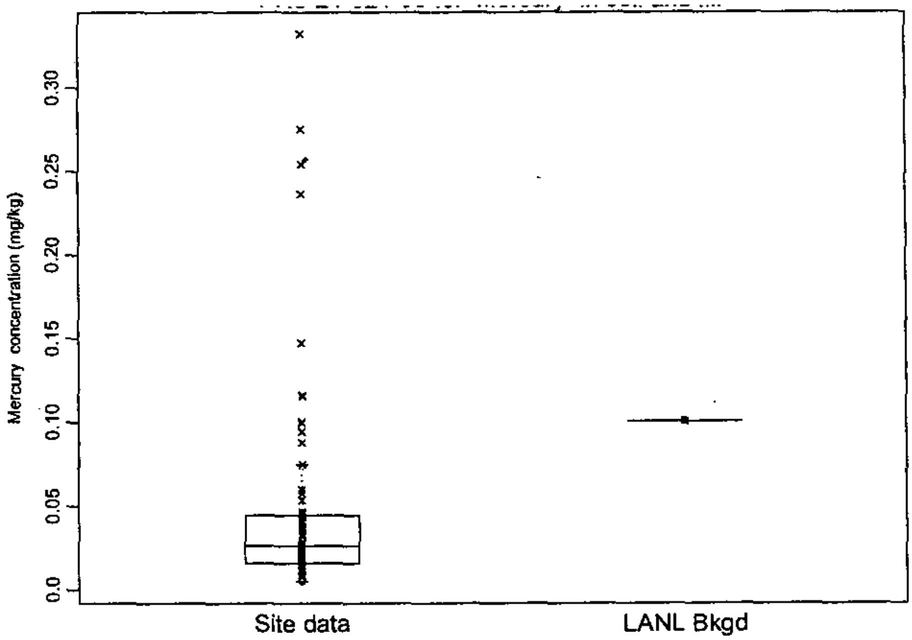

Figure E-3.1-22. Box plots of mercury chemical concentrations from LANL all horizon background data and soil concentrations at SWMU 21-021-99

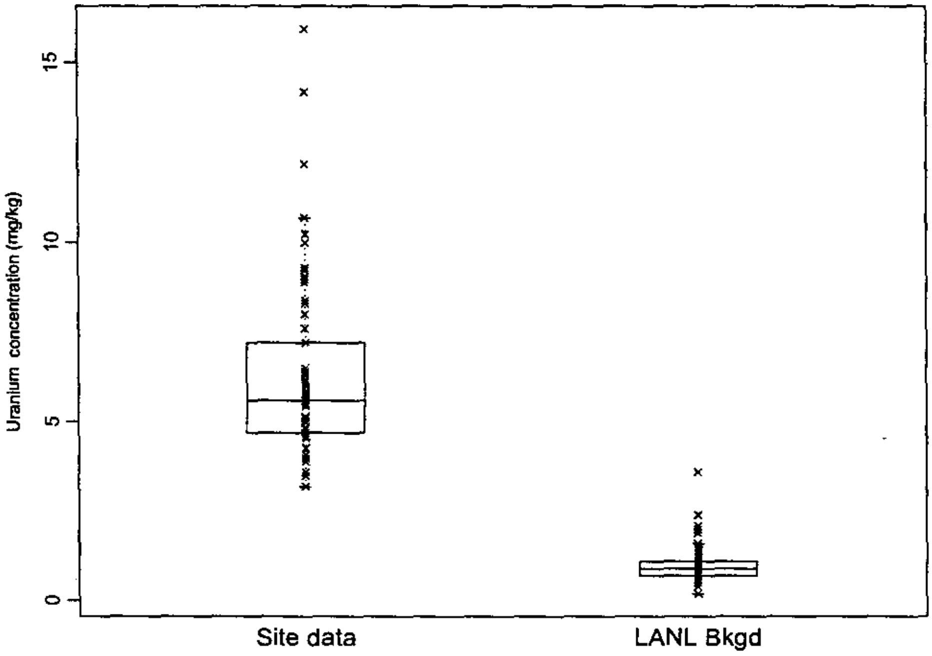

Figure E-3.1-23. Box plots of uranium chemical concentrations from LANL all horizon background data and soil concentrations at SWMU 21-021-99

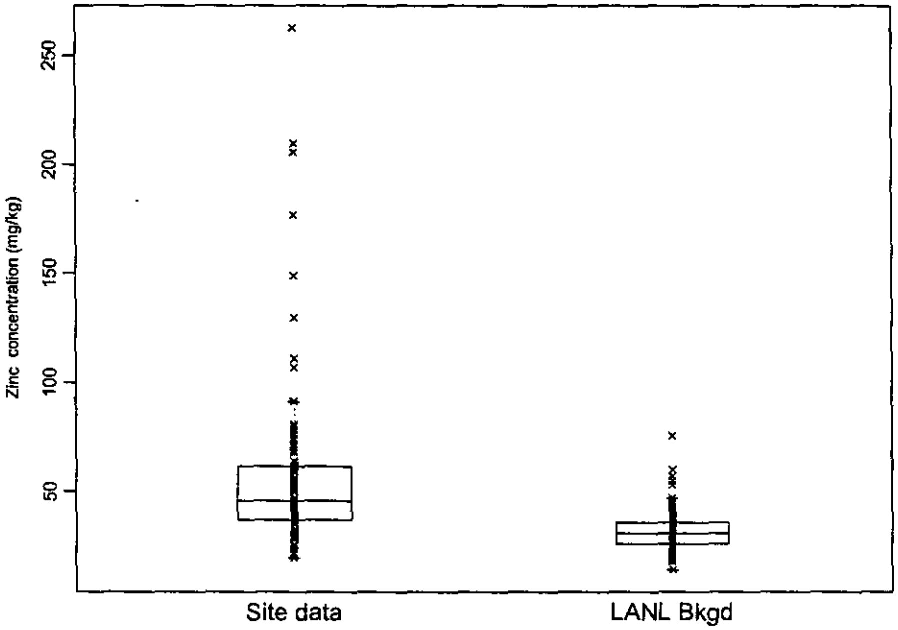

Figure E-3.1-24. Box plots of zinc chemical concentrations from LANL all horizon background data and soil concentrations at SWMU 21-021-99

Table E-3.1-6
Results of Statistical Tests for Radionuclides in Soil and Fill Samples at SWMU 21-021-99

Analyte	Gehan p-Value	Quantile p-Value	# Site Data	# Bkgd Data	Max Site (pCi/g)	Max Bkgd (pCi/g)
Am-241	n/a*	0.0013	115	27	0.197	0.013
Cs-137	0.0001	0.0057	80	56	6.03	1.7
Pu-238	n/a	0.4240	102	56	0.0638	0.037
Pu-239	<0.001	<0.001	102	56	5.79	0.055
Sr-90	n/a	0.8254	102	42	1.65	1.1

*n/a = Not applicable.

Americium-241 was detected above the FV in 20 samples. The box plots in Figure E-3.1-25 show that the maximum detect of americium-241 is well above all of the LANL background results. Although the medians are close together for cesium-137, Figure E-3.1-26 shows that cesium-137 also has numerous detects even above the maximum detect in the LANL background data set. The distribution for plutonium-239 in Figure E-3.1-27 is even more apparent that it is greater than the LANL background data distribution. Americium-241, cesium-137, and plutonium-239 are retained as COPCs.

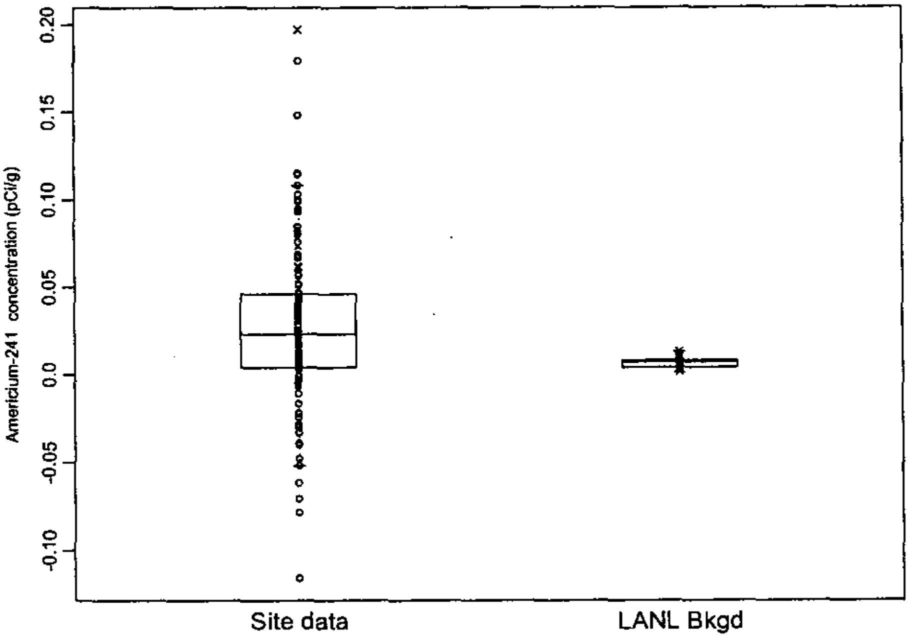

Figure E-3.1-25. Box plots of americium-241 chemical concentrations from LANL all horizon background data and soil concentrations at SWMU 21-021-99

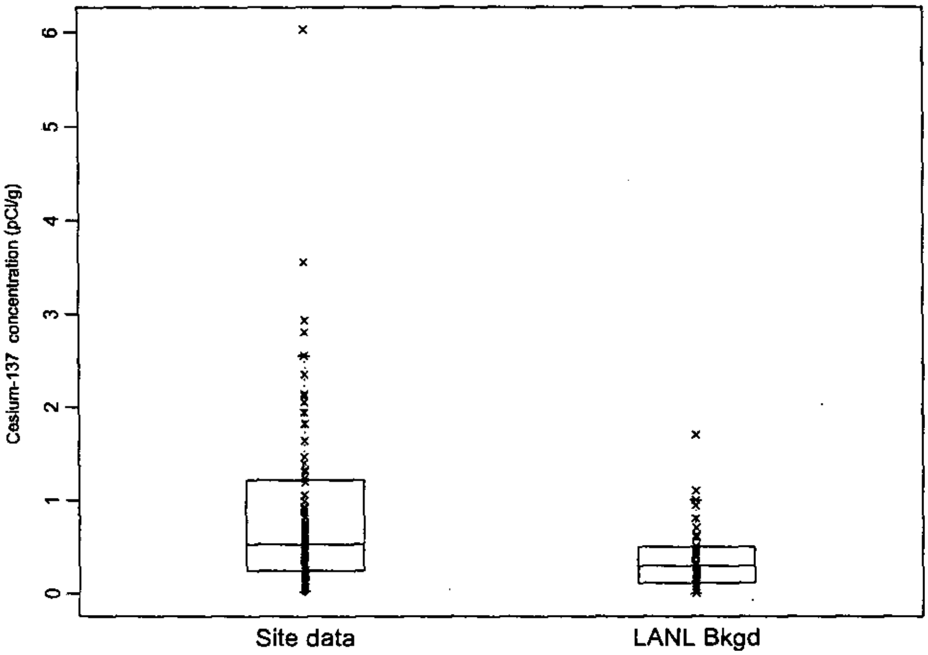

Figure E-3.1-26. **Box plots of cesium-137 chemical concentrations from LANL all horizon background data and soil concentrations at SWMU 21-021-99**

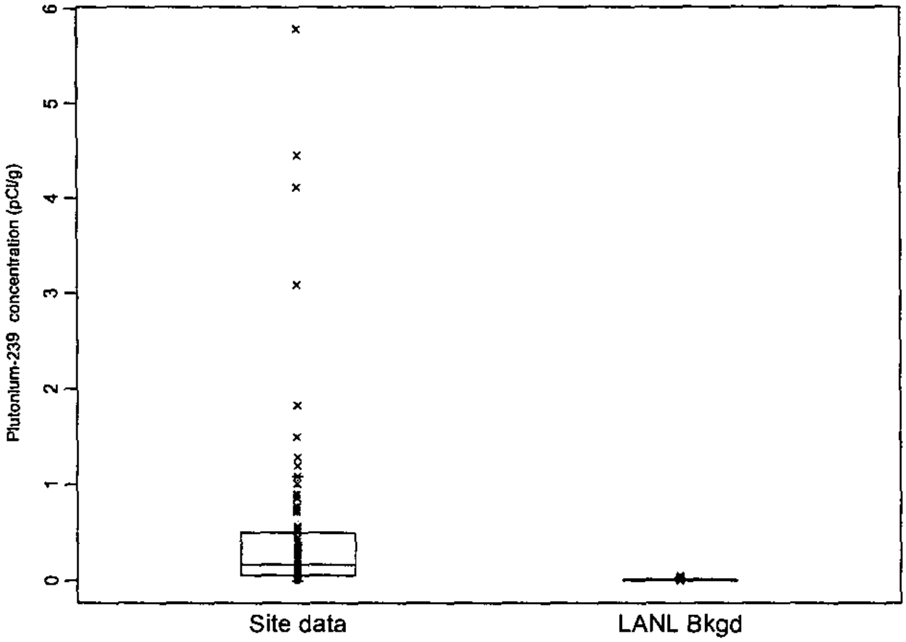

Figure E-3.1-27. **`Box plots of plutonium-239 chemical concentrations from LANL all horizon background data and soil concentrations at SWMU 21-021-99**

E-3.2 Subsurface Tuff Sample Results

E-3.2.1 AOCs 0-004 and 0-033(b) and SWMU 0-030(l)

Inorganic Chemicals

Twelve subsurface tuff samples were collected from AOCs 0-004 and 0-033(b) and SWMU 0-030(l). Inorganic chemical results for samples collected from the Qbt 3 tuff unit were compared with the BVs for upper Qbt units (Qbt 2, Qbt 3, Qbt 4) (LANL 1998, 59730). The frequency of detected inorganic chemicals above BV in subsurface tuff is summarized in Table 2.4-12.

Nine inorganic chemicals (aluminum, arsenic, barium, chromium, copper, lead, mercury, selenium, and zinc) were detected above the Qbt 3 BV in at least one sample. Antimony, selenium, and thallium had one detection limit above the BV. These elevated detection limits were all in the same sample at location 00-04423, where other inorganic chemicals were above their BVs. Further statistical tests were performed for eight of the inorganic chemicals that were detected above the BV, but not for antimony and thallium. There is not a background data set available for mercury in tuff. The results of the Gehan and Quantile tests are presented in Table E-3.2-1.

Table E-3.2-1
Results of Statistical Tests for Inorganic Chemicals above BV in Subsurface Tuff Samples at AOCs 0-004 and 0-033(b) and SWMU 0-030(l)

Analyte	Gehan p-Value	Quantile p-Value	# Site Data	# Bkgd Data	Max Site (mg/kg)	Max Bkgd (mg/kg)
Aluminum	0.223978	0.446628	12	63	10070	8370
Arsenic	0.008026	0.052538	12	64	4.27	5
Barium	0.102892	0.18915	12	63	88.4	51.6
Chromium	0.710918	0.436464	12	64	10.3	13
Copper	0.000135	0.052538	12	64	21.5	6.2
Lead	0.048216	0.055459	12	63	94.9	15.5
Selenium	n/a*	0.00981	12	15	0.34	-0.2
Zinc	0.628428	0.741685	12	64	92.8	65.6

*n/a = Not applicable.

The probability values for arsenic, copper, lead, and selenium were significant indicating that these inorganic chemicals are elevated in comparison to background.

Figures E-3.2-1 to E-3.2-3 verify that the distributions for the site data for arsenic, copper, and lead are elevated compared to the LANL background distributions. These figures also show the magnitude of the maximum detected concentrations in comparison to all of the LANL background data.

Although selenium only had one detection limit above the BV and one detect above the BV, there were other detects in the site data that were above the detection limits in the background data set. The box plots in Figure E-3.2-4 show the comparison between the two data sets. Because both statistical tests showed a significant difference from background, selenium is retained as a COPC.

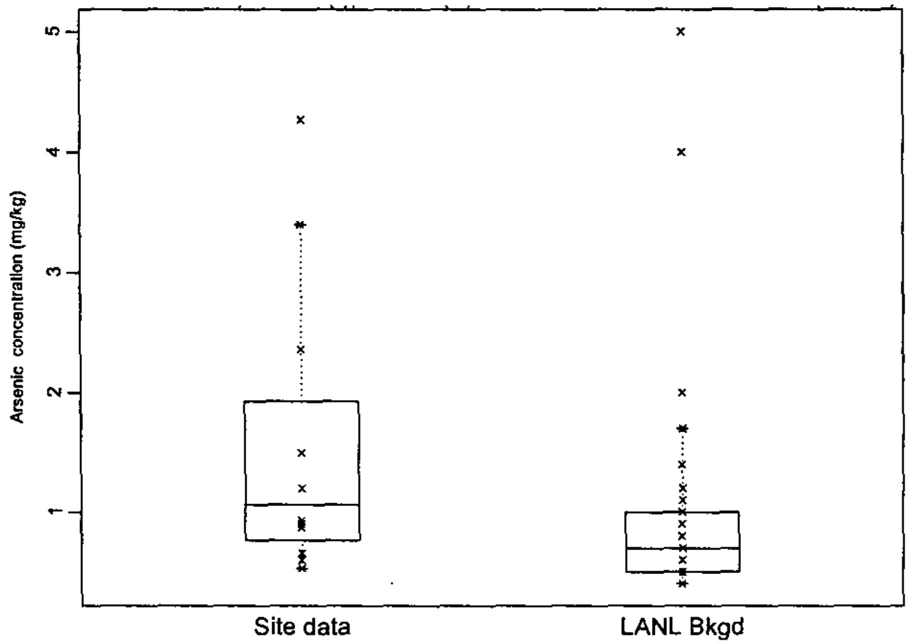

Figure E-3.2-1. **Box plots of arsenic chemical concentrations from LANL Qbt 2,3,4 background data and subsurface tuff at AOCs 0-004 and 0-033(b) and SWMU 0-030(l)**

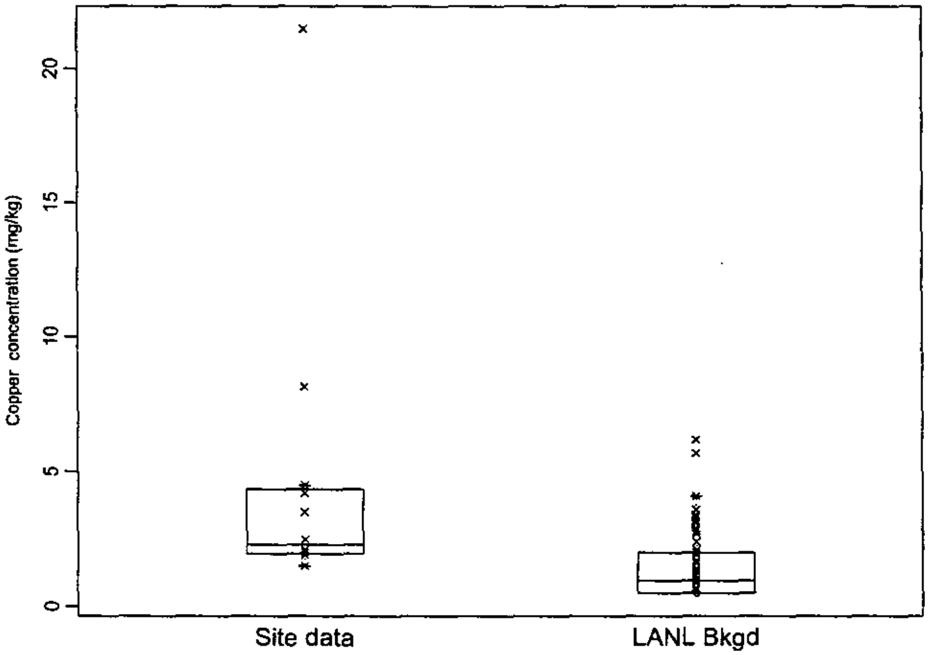

Figure E-3.2-2. **Box plots of copper chemical concentrations from LANL Qbt 2,3,4 background data and subsurface tuff at AOCs 0-004 and 0-033(b) and SWMU 0-030(l)**

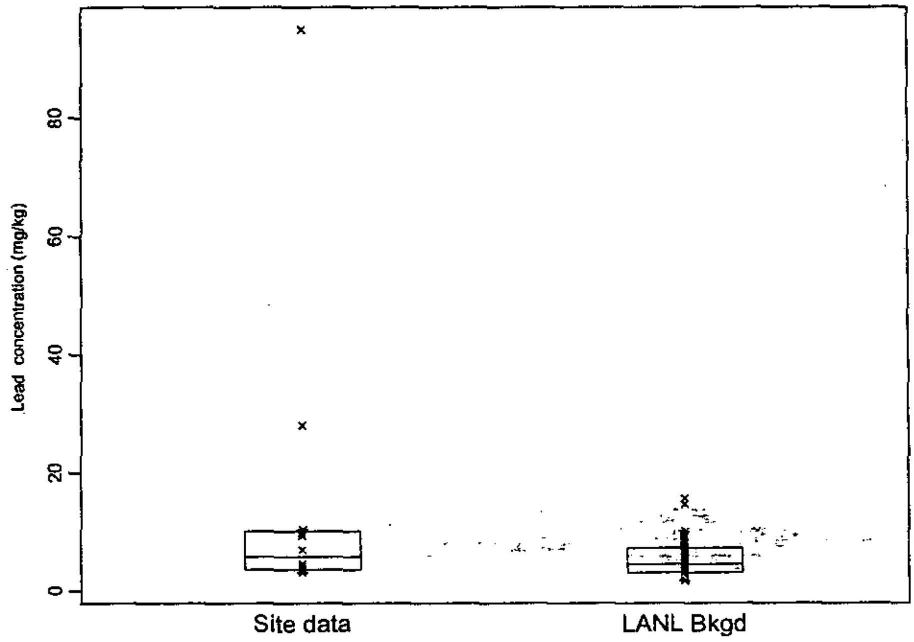

Figure E-3.2-3. **Box plots of lead chemical concentrations from LANL Qbt 2,3,4 background data and subsurface tuff at AOCs 0-004 and 0-033(b) and SWMU 0-030(I)**

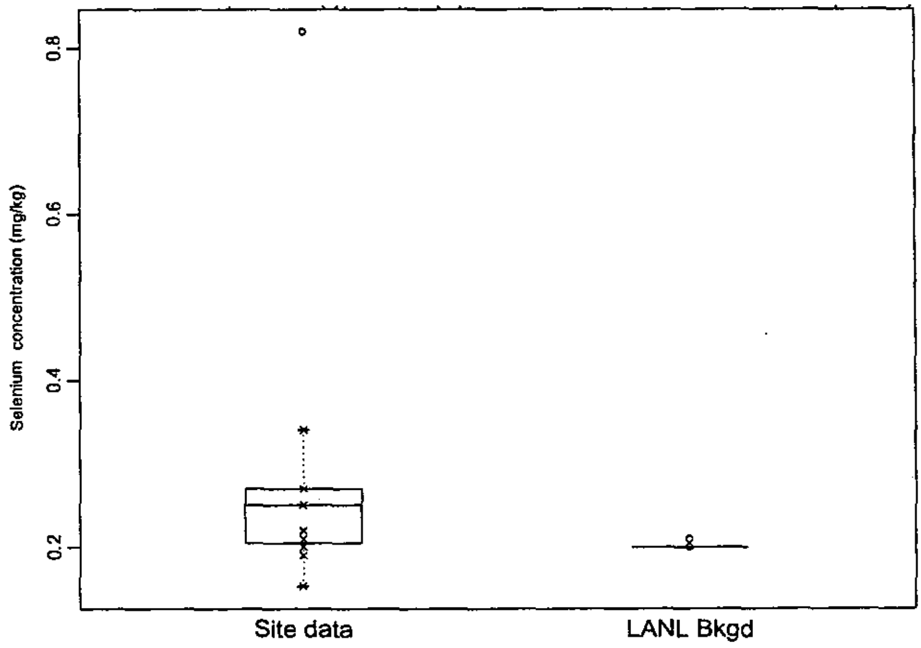

Figure E-3.2-4. **Box plots of selenium chemical concentrations from LANL Qbt 2,3,4 background data and subsurface tuff at AOCs 0-004 and 0-033(b) and SWMU 0-030(I)**

E-3.2.2 SWMUs 0-030(b,m)

Inorganic Chemicals

Sixteen subsurface tuff samples were collected from SWMUs 0-030(b,m). Inorganic chemical results for samples collected from the Qbt 3 tuff unit were compared with the BVs for upper Qbt units (Qbt 2, Qbt 3, Qbt 4) (LANL 1998, 59730). The frequency of detected inorganic chemicals above BV in subsurface tuff is summarized in Table 3.4-14.

Twelve inorganic chemicals (aluminum, arsenic, barium, calcium, cobalt, copper, iron, lead, magnesium, mercury, nickel, and silver) were detected above the Qbt 3 BV in at least one sample. There were no detection limits above the BV. Further statistical tests were performed for eleven of the inorganic chemicals that were detected above the BV since mercury doesn't have a background data set for tuff. The results of the Gehan and Quantile tests are presented in Table E-3.2-2.

Table E-3.2-2
Results of Statistical Tests for
Inorganic Chemicals in Subsurface Tuff Samples at SWMUs 0-030(b,m)

Analyte	Gehan p-Value	Quantile p-Value	# Site Data	# Bkgd Data	Max Site (mg/kg)	Max Bkgd (mg/kg)
Aluminum	<0.001	<0.001	16	63	10800	8370
Arsenic	<0.001	0.002	16	64	3.1	5
Barium	<0.001	<0.001	16	63	163	51.6
Calcium	<0.001	<0.001	16	64	4990	2230
Cobalt	0.080	0.302	16	11	5.2	3.1422
Copper	<0.001	<0.001	16	64	5.7	6.2
Iron	0.188	0.887	16	64	21100	19500
Lead	0.013	0.003	16	63	11.9	15.5
Magnesium	<0.001	<0.001	16	64	2020	2820
Nickel	<0.001	<0.001	16	63	9.3	7
Silver	0.097	<0.001	16	64	4.2	1.9

The probability values for aluminum, arsenic, barium, calcium, copper, lead, magnesium, nickel and silver were significant indicating that these inorganic chemicals are different from background. Aluminum, barium, calcium, and nickel all had significant probability values for both the Gehan and Quantile tests. Since the box plots for these inorganic chemicals have similar patterns in the data distributions, Figure E-3.2-5 shows the general pattern of the site and background distributions for these analytes using the barium data.

The probability values for arsenic and magnesium were significant. Further evaluation of the box plots show that while the distribution of the site data may be greater than the background data distribution, the maximum concentration in the site data is still within the range of the background data set. Figure E-3.2-6 shows the distribution of the site data and the background data for arsenic. The distributions are similar for magnesium. For both of these analytes, only one concentration was above the BV and that maximum concentration was very close to the BV. Therefore, arsenic and magnesium are not retained as COPCs.

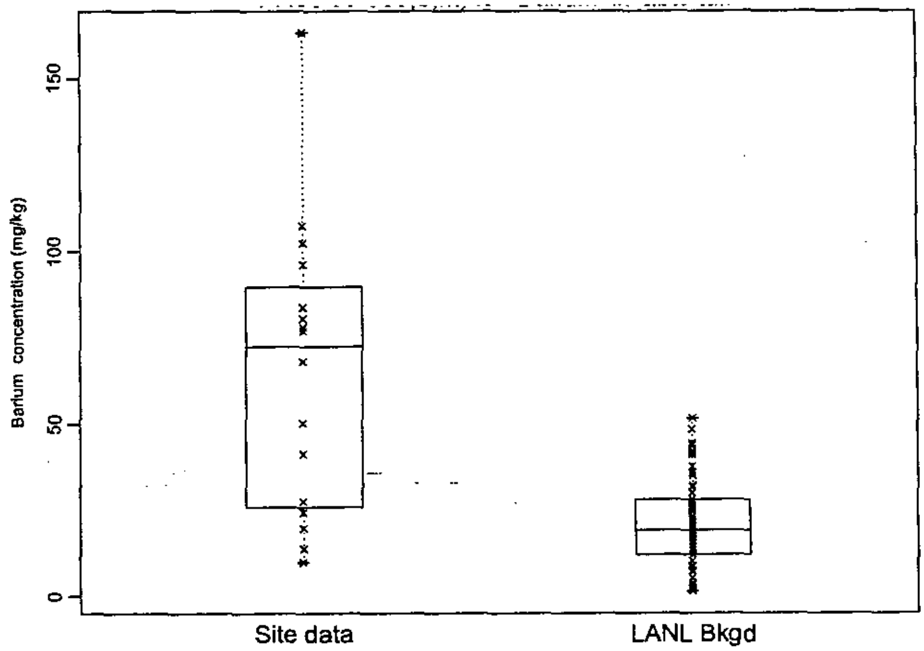

Figure E-3.2-5. Box plots of barium chemical concentrations from LANL Qbt 2,3,4 background data and subsurface tuff at SWMUs 0-030(b,m)

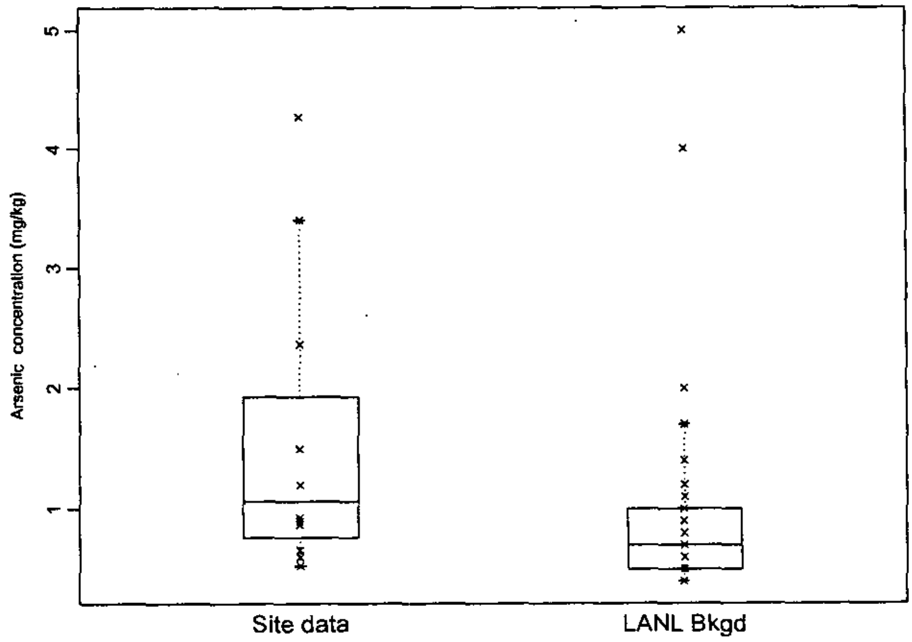

Figure E-3.2-6. Box plots of arsenic chemical concentrations from LANL Qbt 2,3,4 background data and subsurface tuff at SWMUs 0-030(b,m)

Copper was detected above the BV of 4.66 mg/kg in five Qbt 3 samples. Both probability values were significant, indicating that the copper distribution at the site is different than the LANL background distribution. As shown in Figure E-3.2-7, there is almost no overlap between the middle 50% of each data set. Copper is retained as a COPC.

The distributions of the site data and the LANL background data for lead overlap. Although Figure E-3.2-8 shows that there is a break in the lead distribution of site data, all of the detected lead concentrations are less than the BV except one. The maximum concentration of lead in the site data is 11.9 mg/kg compared to a BV of 11.2 mg/kg (LANL 1998, 59730), and the maximum concentration is within the range of the background data. Therefore, lead is not retained as a COPC.

The majority of the silver background data are detection limits at 1 mg/kg. Although, as shown in Figure E-3.2-9, the majority of the site data for silver is below the BV, there are a few detects that are different from the rest of the distribution of the site data. The site data for silver are significantly different from the background data and silver is retained as a COPC.

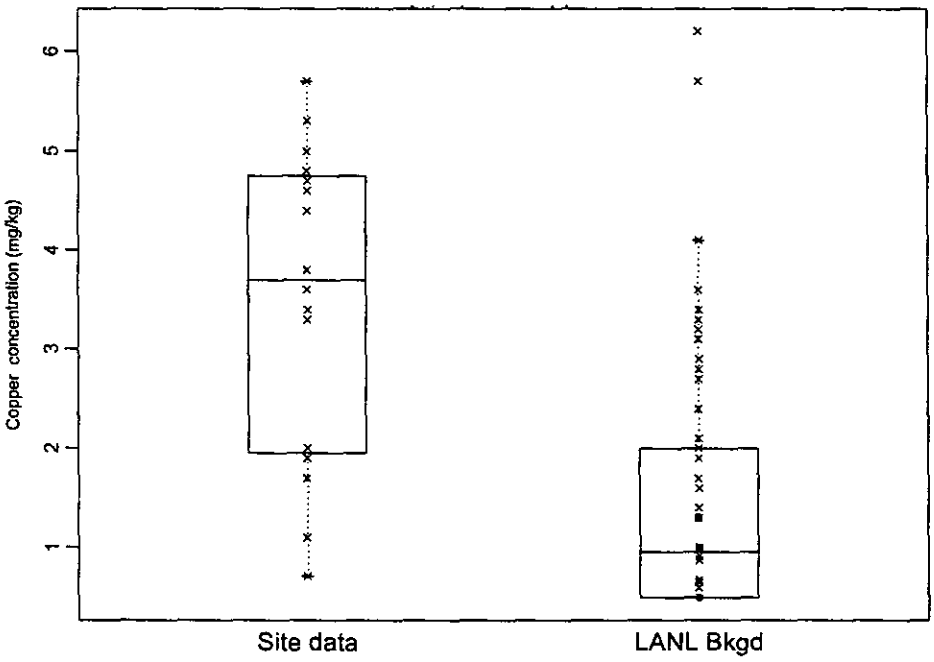

Figure E-3.2-7. Box plots of copper chemical concentrations from LANL Qbt 2,3,4 background data and subsurface tuff at SWMUs 0-030(b,m)

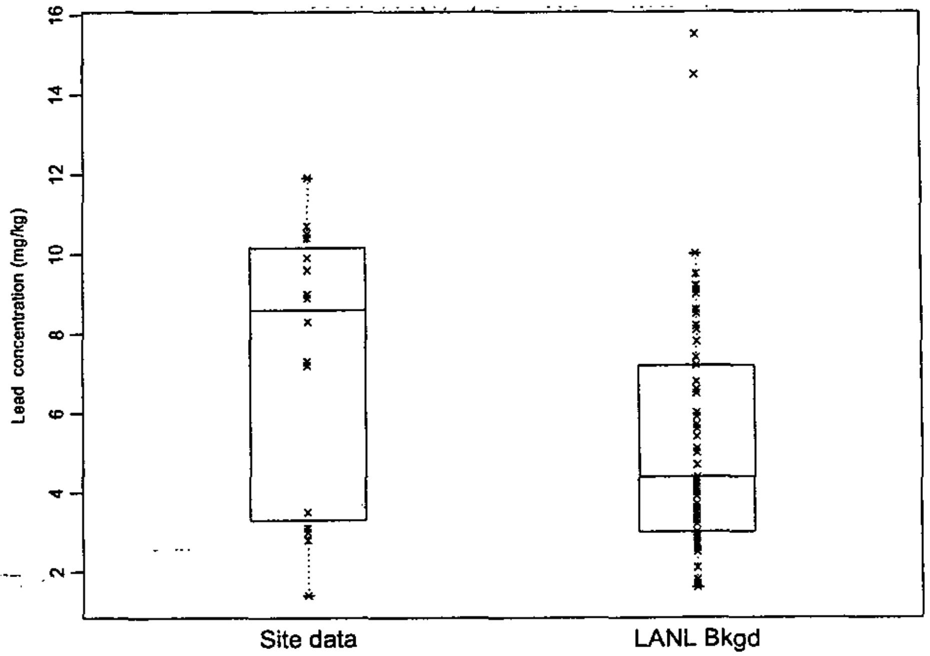

Figure E-3.2-8. **Box plots of lead chemical concentrations from LANL Qbt 2,3,4 background data and subsurface tuff at SWMUs 0-030(b,m)**

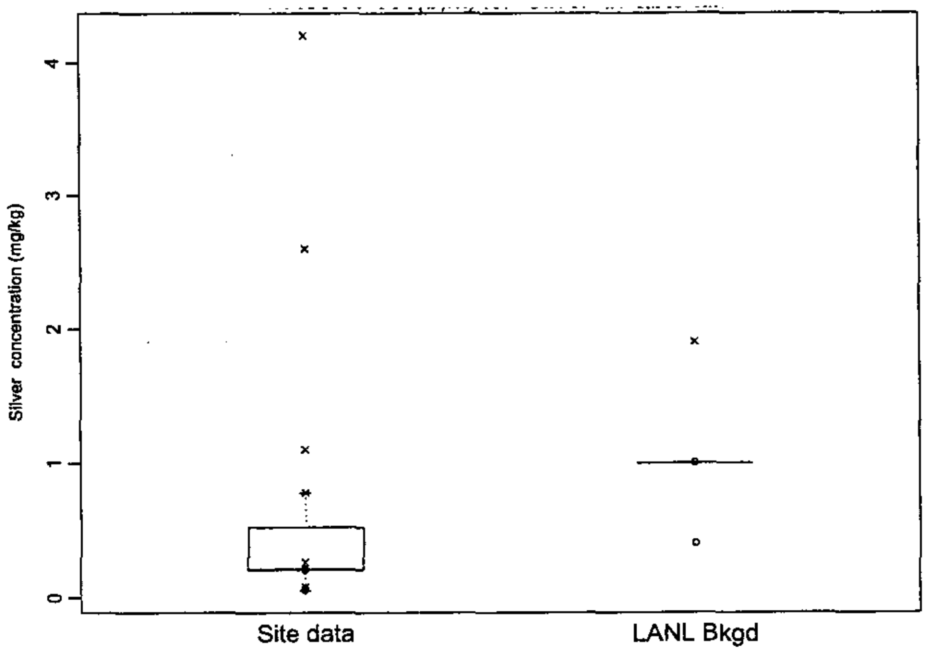

Figure E-3.2-9. **Box plots of silver chemical concentrations from LANL Qbt 2,3,4 background data and subsurface tuff at SWMUs 0-030(b,m)**

E-4 Non-Site-Related Samples

E-4.1 AOCs 0-004 and 0-033(b) and SWMU 0-030(l)

Two non-site-related samples were collected at location 00-02-19701. The results of these samples were reviewed and compared against BVs or detection limits, as appropriate, and discussed in Section 2.4.3. Figures E-4.1-1 to E-4.1-5 show the comparison between site data, non-site-related data, and LANL background data for the inorganic chemicals cadmium, lead, mercury, silver, and zinc. Figure E-4.1-6 presents box plots for site data, non-site-related data, and LANL background data for plutonium-239. Figures E-4.1-7 to E-4.1-9 present site data and non-site-related data for Aroclor-1260, 4,4'-DDT, and pyrene.

Inorganics

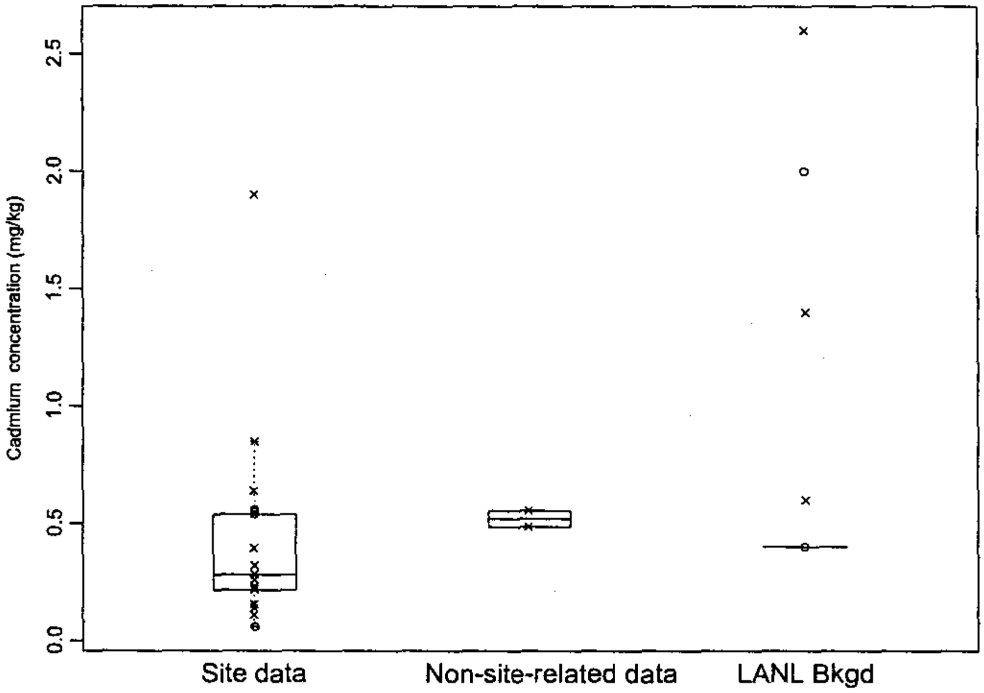

Figure E-4.1-1. **Box plots of cadmium chemical concentrations from LANL all soil horizon background data, non-site-related data, and soil and fill data at AOCs 0-004 and 0-033(b) and SWMU 0-030(l)**

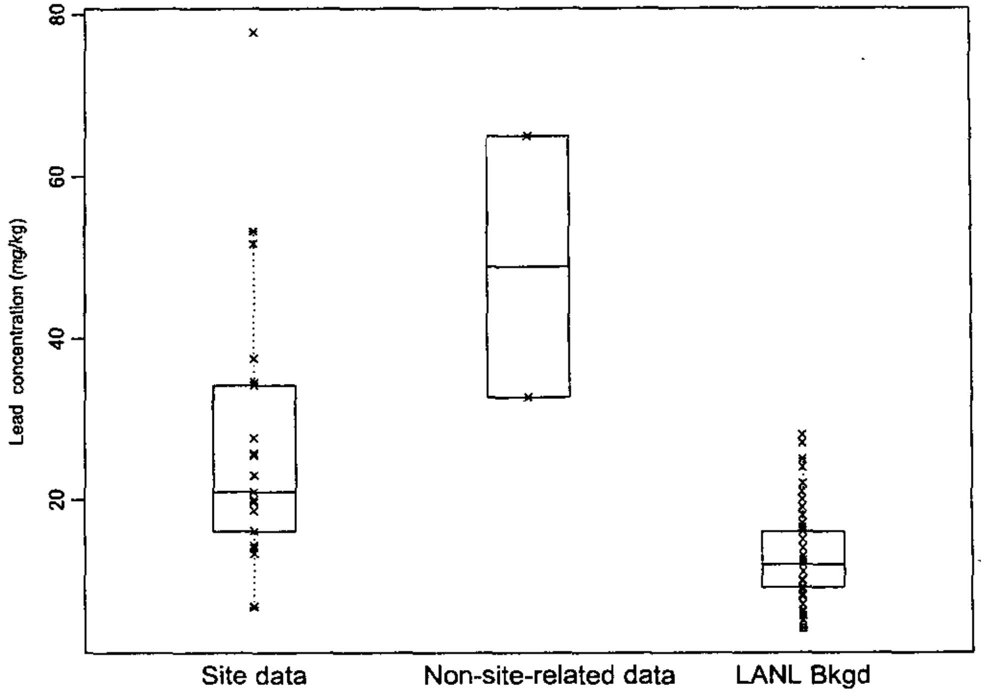

Figure E-4.1-2. Box plots of lead chemical concentrations from LANL all soil horizon background data, non-site-related data, and soil and fill data at AOCs 0-004 and 0-033(b) and SWMU 0-030(l)

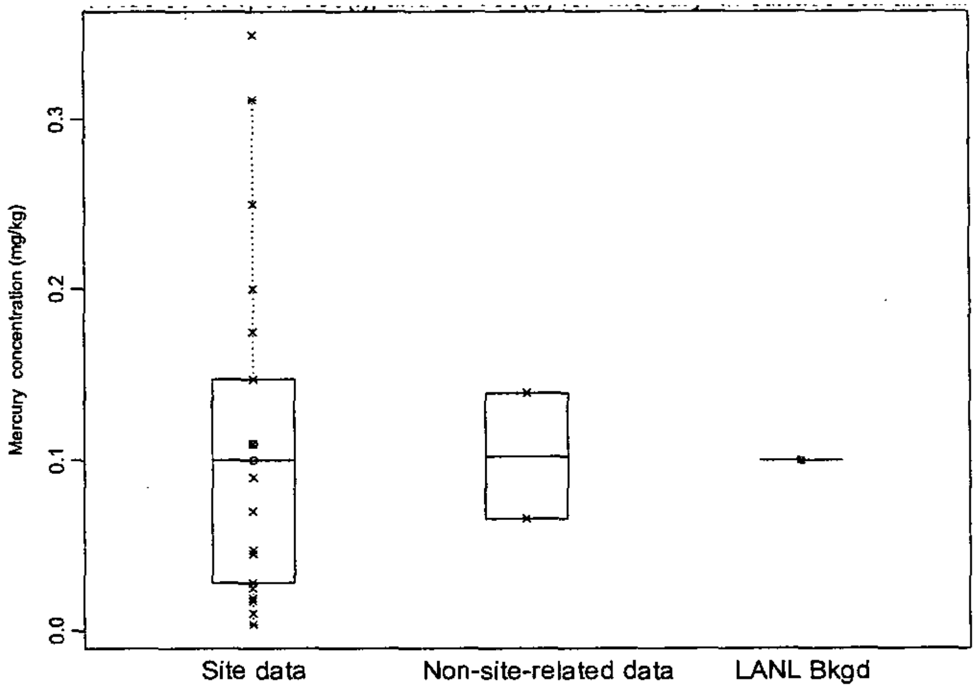

Figure E-4.1-3. Box plots of mercury chemical concentrations from LANL all soil horizon background data, non-site-related data, and soil and fill data at AOCs 0-004 and 0-033(b) and SWMU 0-030(l)

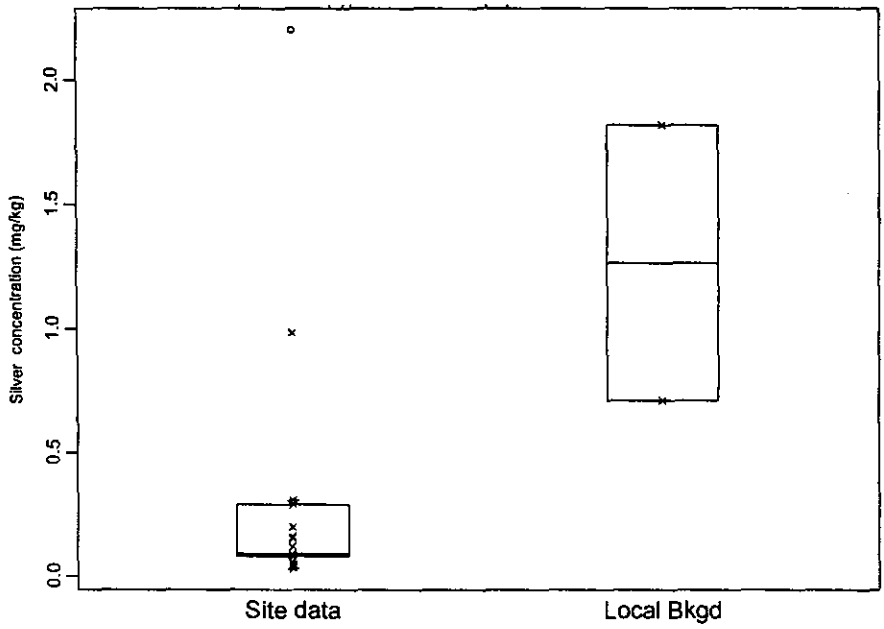

Figure E-4.1-4. Box plots of silver chemical concentrations from LANL all soil horizon background data, non-site-related data, and soil and fill data at AOCs 0-004 and 0-033(b) and SWMU 0-030(l)

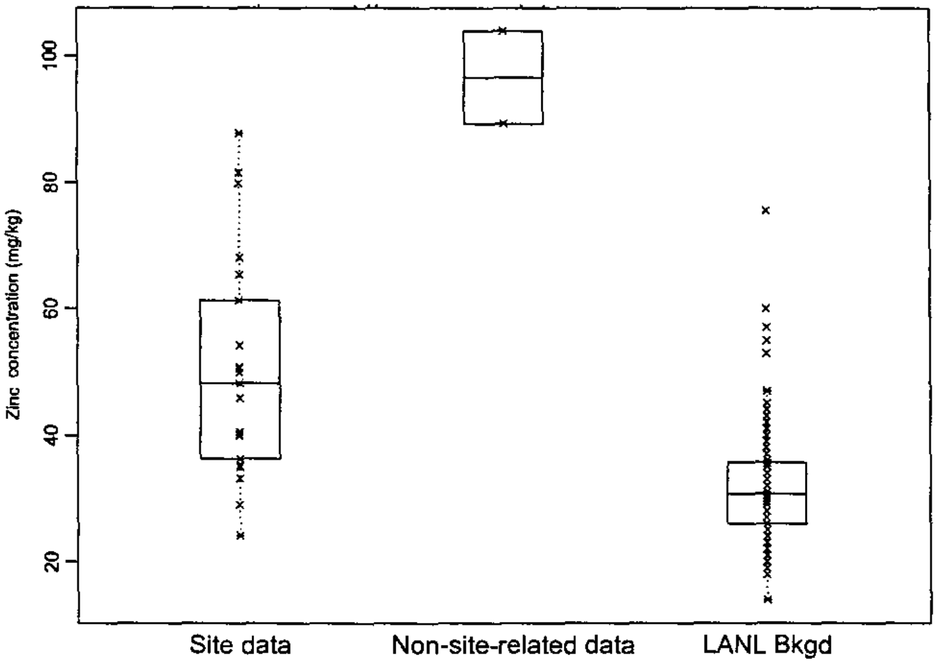

Figure E-4.1-5. Box plots of zinc chemical concentrations from LANL all soil horizon background data, non-site-related data, and soil and fill data at AOCs 0-004 and 0-033(b) and SWMU 0-030(l)

Radionuclides

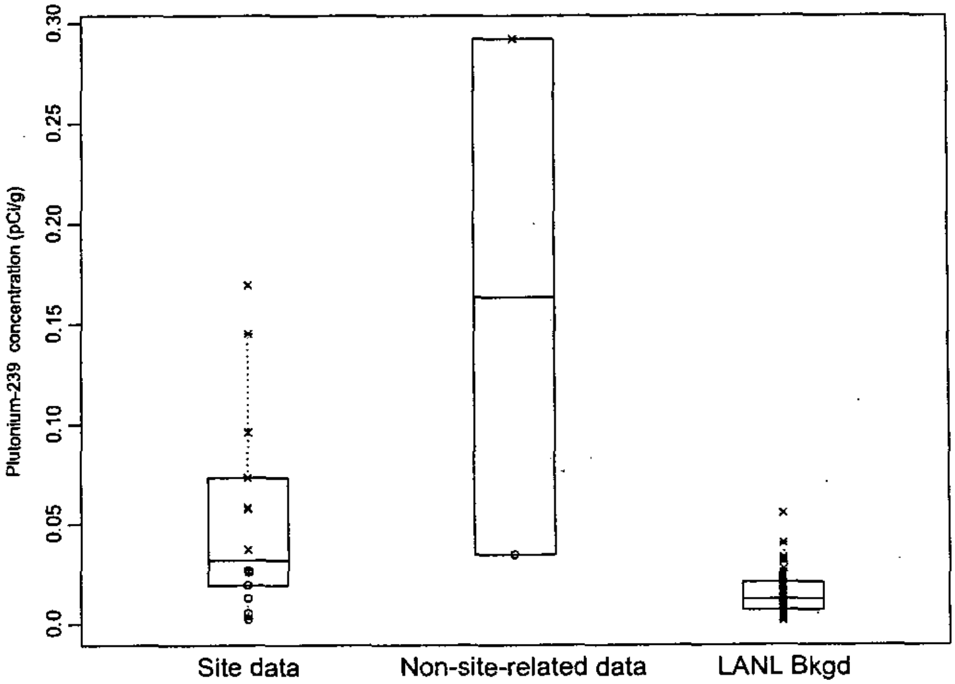

Figure E-4.1-6. **Box plots of plutonium-239 chemical concentrations from LANL all soil horizon background data, non-site-related data, and soil and fill data at AOCs 0-004 and 0-033(b) and SWMU 0-030(l)**

Organics

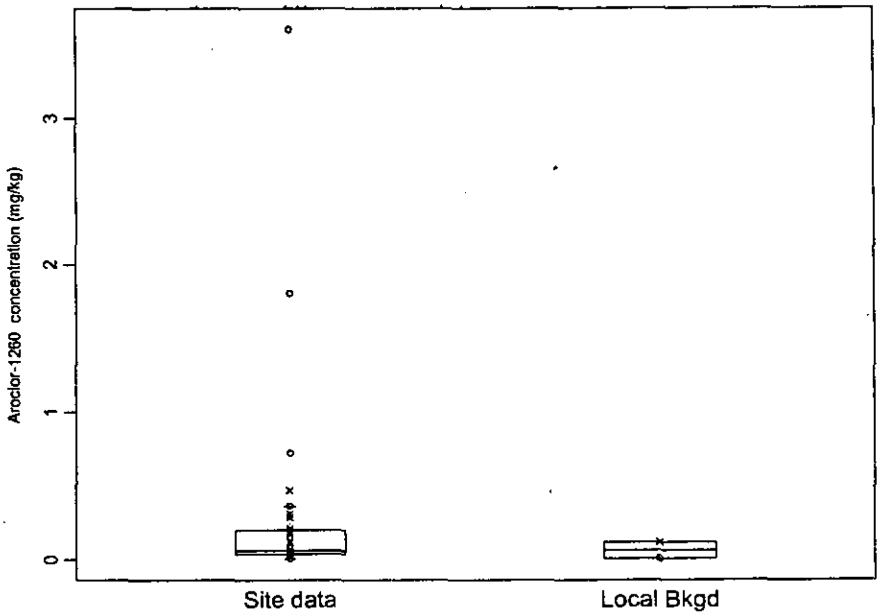

Figure E-4.1-7. **Box plots of Aroclor-1260 chemical concentrations from non-site-related data and soil and fill data at AOCs 0-004 and 0-033(b) and SWMU 0-030(l)**

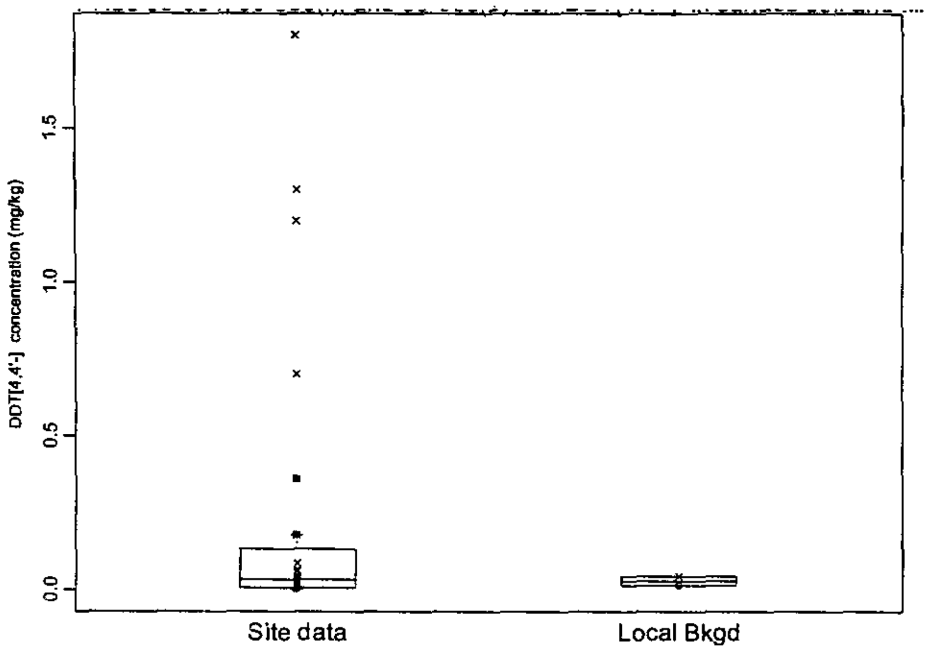

Figure E-4.1-8. **Box plots of 4,4'-DDT chemical concentrations from non-site-related data and soil and fill data at AOCs 0-004 and 0-033(b) and SWMU 0-030(I)**

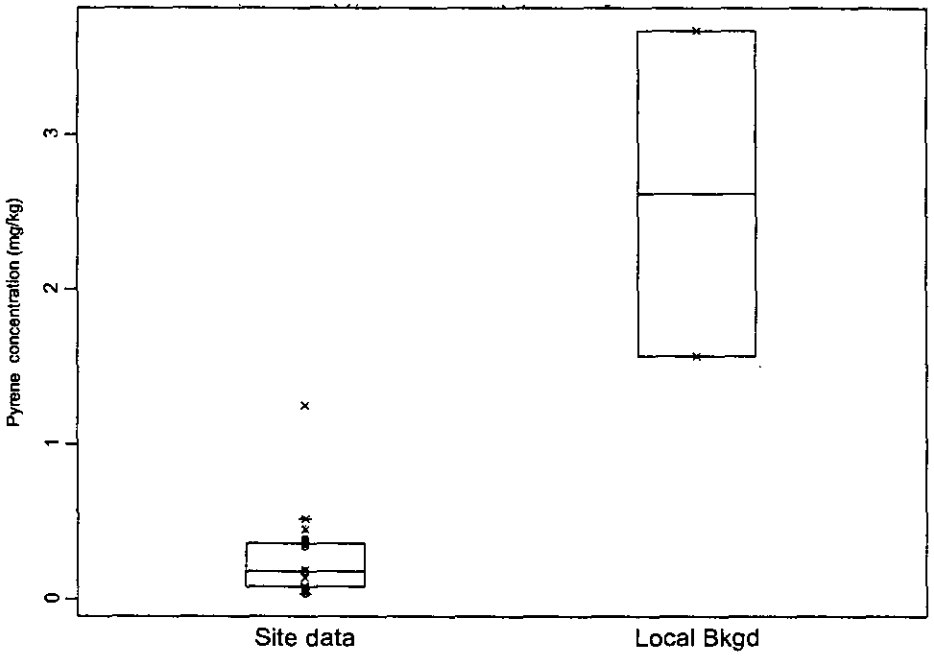

Figure E-4.1-9. **Box plots of pyrene chemical concentrations from non-site-related data and soil and fill data at AOCs 0-004 and 0-033(b) and SWMU 0-030(I)**

E-4.2 SWMUs 0-030(b,m)

Nine non-site-related samples were collected at locations upgradient of SWMU 0-030(b). The results of these samples were reviewed and compared against BVs or detection limits, as appropriate, and discussed in Section 3.4.3. Figures E-4.2-1 to E-4.2-3 show the comparison between site data, non-site-related data, and LANL background data for the inorganic chemicals cadmium, mercury, and lead . Figures E-4.2-4 to E-4.2-6 present box plots for site data, non-site-related data, and LANL background data for americium-241, cesium-137, and plutonium-239. Figures E-4.2-7 to E-4.2-9 present site data and non-site-related data for benz(a)anthracene, 4,4'-DDT, and fluoranthene.

Inorganics

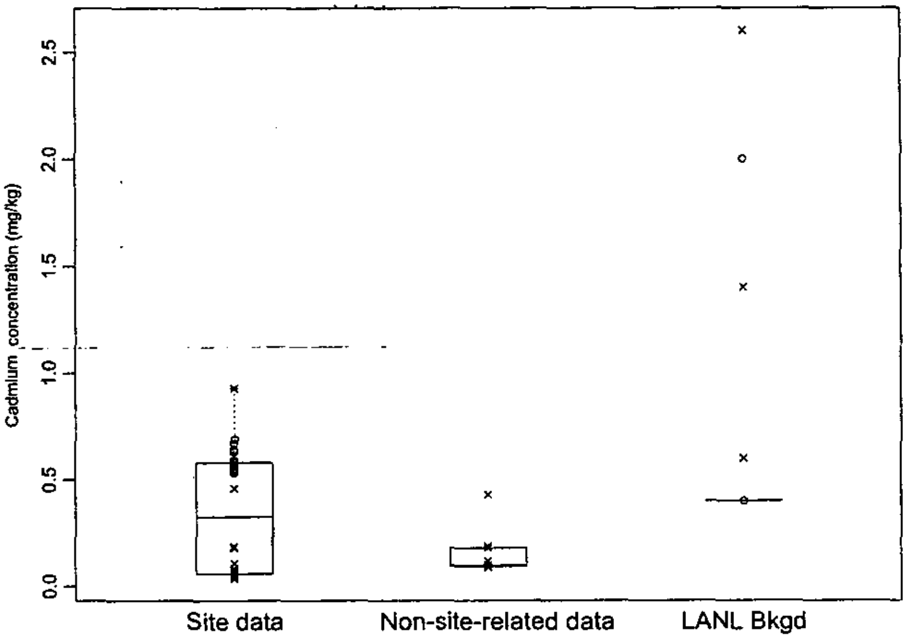

Figure E-4.2-1. **Box plots of cadmium chemical concentrations from LANL all soil horizon background data, non-site-related data, and soil and fill data at SWMUs 0-030(b,m)**

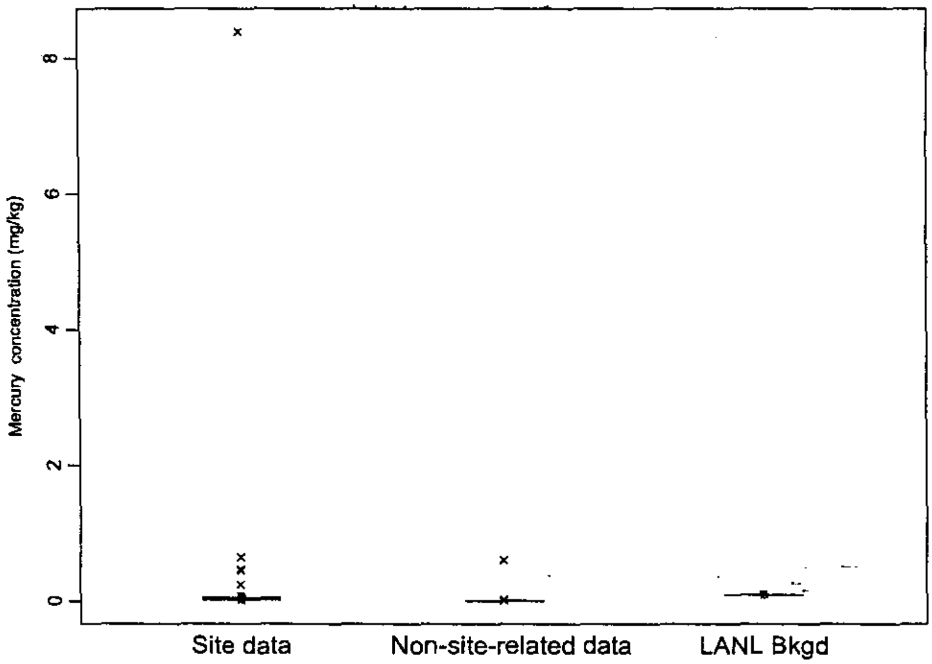

Figure E-4.2-2. **Box plots of mercury chemical concentrations from LANL all soil horizon background data, non-site-related data, and soil and fill data at SWMUs 0-030(b,m)**

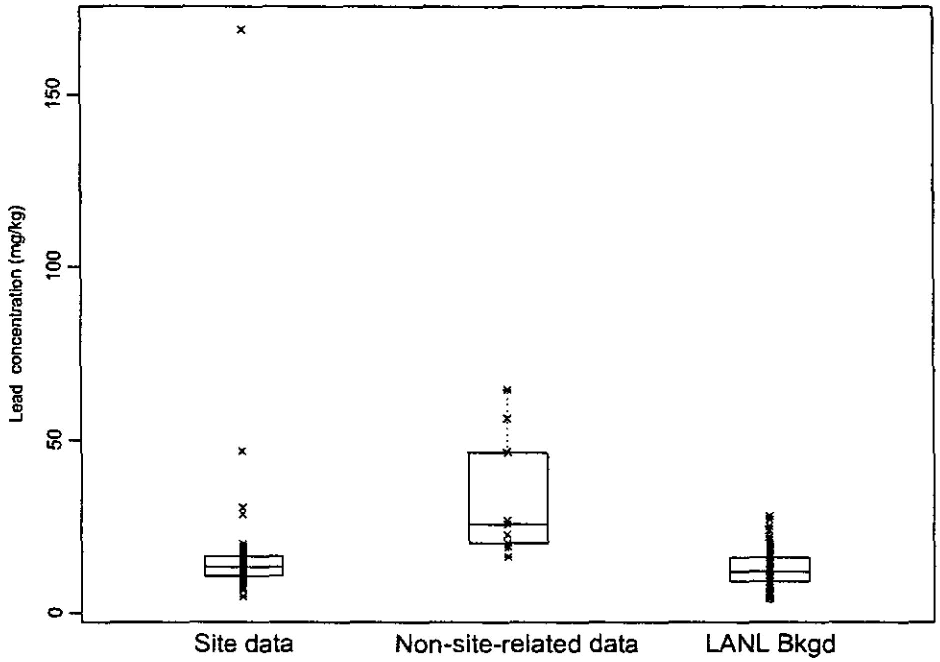

Figure E-4.2-3. **Box plots of lead chemical concentrations from LANL all soil horizon background data, non-site-related data, and soil and fill data at SWMUs 0-030(b,m)**

Radionuclides

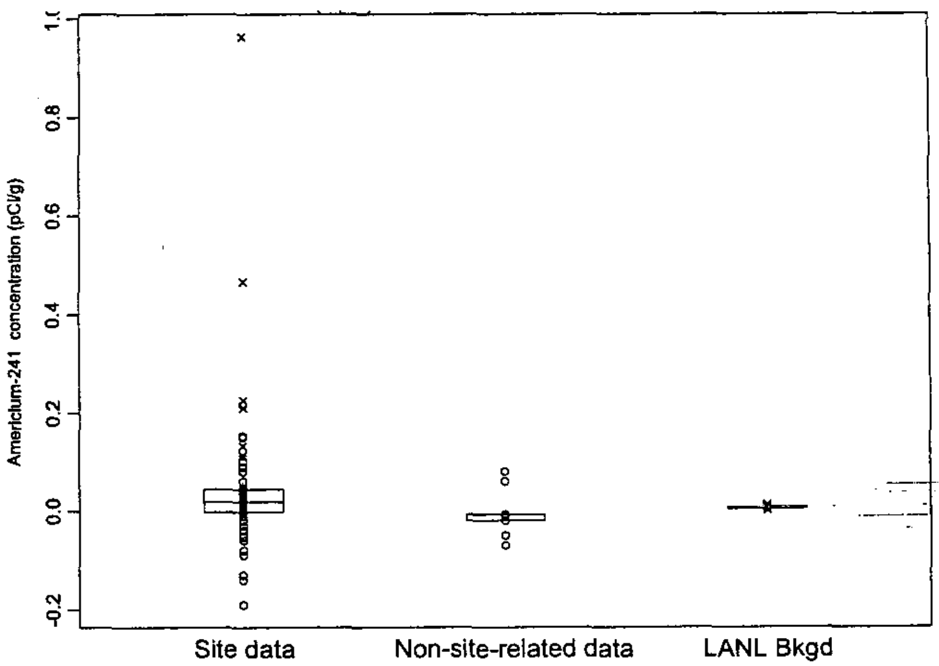

Figure E-4.2-4. **Box plots of americium-241 chemical concentrations from LANL all soil horizon background data, non-site-related data, and soil and fill data at SWMUs 0-030(b,m)**

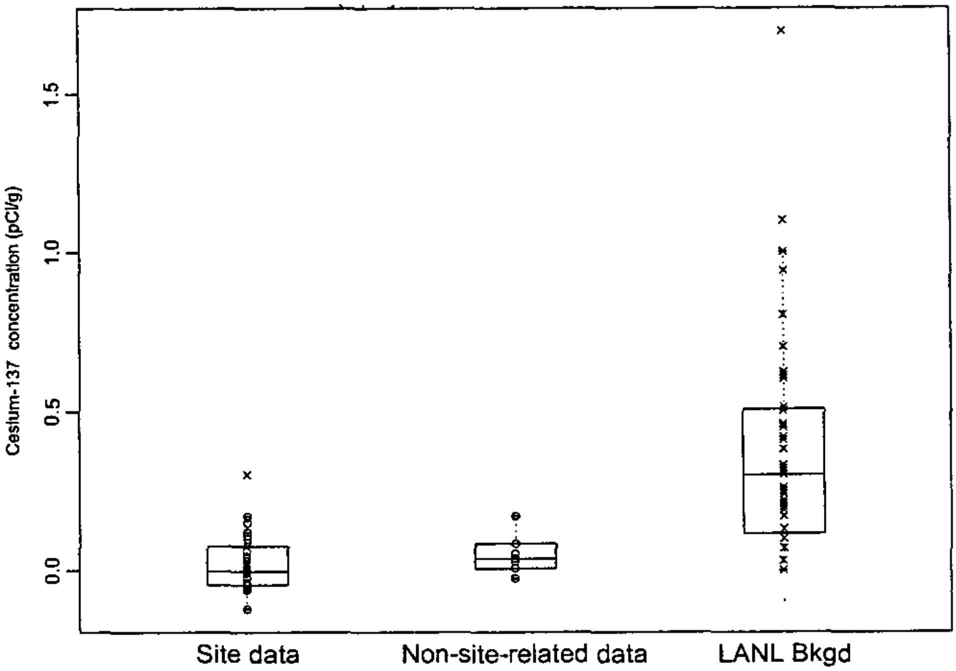

Figure E-4.2-5. **Box plots of cesium-137 chemical concentrations from LANL all soil horizon background data, non-site-related data, and soil and fill data at SWMUs 0-030(b,m)**

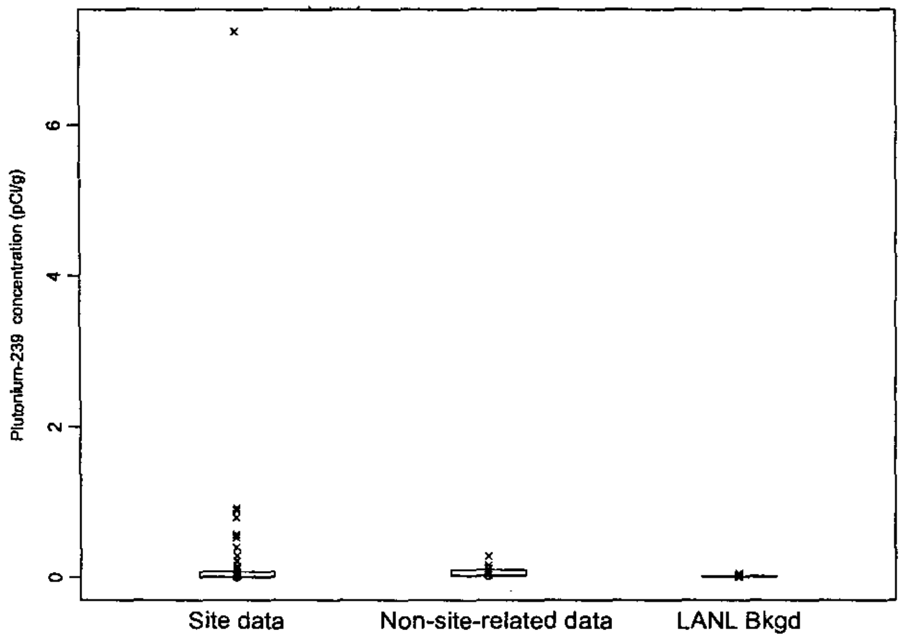

Figure E-4.2-6. Box plots of plutonium-239 chemical concentrations from LANL all soil horizon background data, non-site-related data, and soil and fill data at SWMUs 0-030(b,m)

Organics

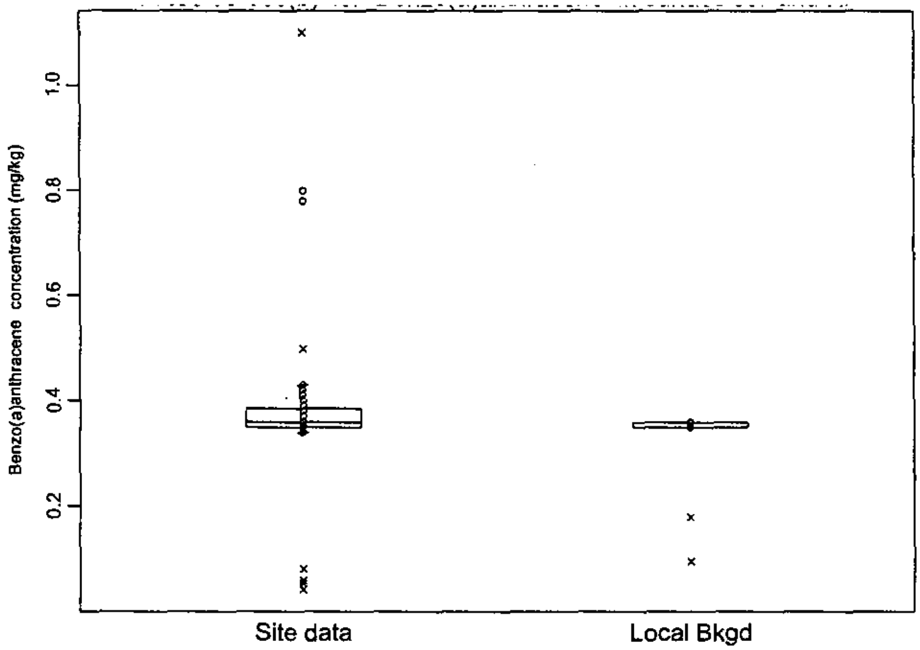

Figure E-4.2-7. Box plots of benz(a)anthracene chemical concentrations from non-site-related data and soil and fill data at SWMUs 0-030(b,m)

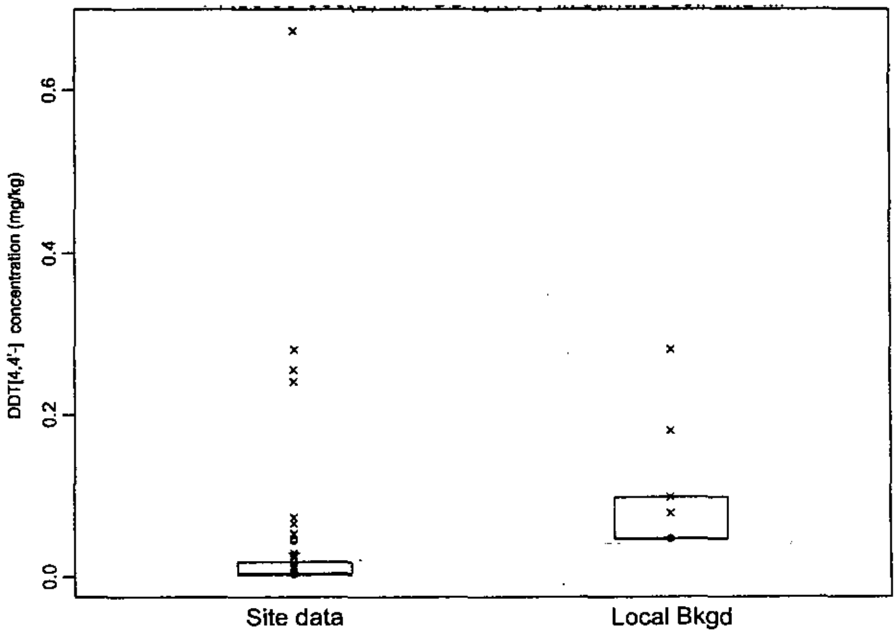

Figure E-4.2-8. Box plots of 4,4'-DDT chemical concentrations from non-site-related data and soil and fill data at SWMUs 0-030(b,m)

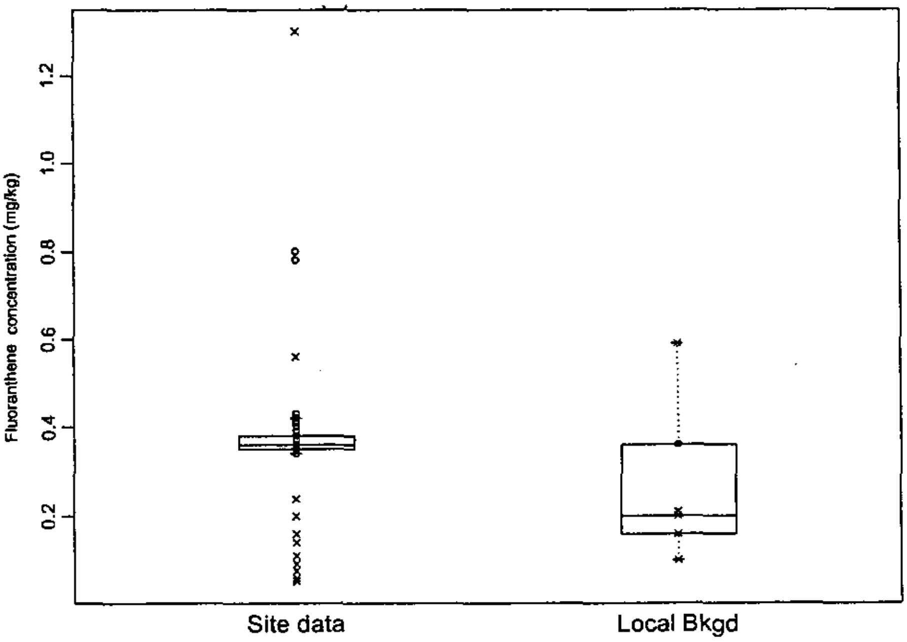

Figure E-4.2-9. Box plots of fluoranthene chemical concentrations from non-site-related data and soil and fill data at SWMUs 0-030(b,m)

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LANL (Los Alamos National Laboratory), September 22, 1998. "Inorganic and Radionuclide Background Data for Soils, Canyon Sediments, and Bandelier Tuff at Los Alamos National Laboratory," Los Alamos National Laboratory report LA-UR-98-4847, Los Alamos, New Mexico. (LANL 1998, 59730)

Appendix F

Ecological and Human Health Screening Calculations

1.0 ECOLOGICAL SCREENING LEVELS

The ecological screening levels (ESLs) for all terrestrial receptors considered in the evaluation of solid waste management units (SWMUs) in this document are given in Table F-1.0-1. ESLs are provided for each chemical or radionuclide identified as a chemical of potential concern (COPC) at any of the SWMUs for those receptors for which an ESL was available. The value for the lowest ESL for each chemical or radionuclide, which is used in the initial screening of a site, is provided in the last column of the table. The ESLs in the table originate from the September 2002 (Release 1.5) of the Laboratory Ecorisk Database (LANL 2002, 73702) including values updated in March 2003 (LANL 2003, 74012). The ESLs were developed using the approach described in "Screening Level Ecological Risk Assessment Methods" (LANL 1999, 64783).

F-2.0 DEVELOPMENT OF POPULATION AREA-USE FACTORS

Except when evaluating threatened or endangered species, EPA guidance recommends evaluating ecological effects at the population level rather than at the individual level (EPA 1999, 70086). The initial screening using ESLs generates hazard quotients (HQs) and hazard indexes (HIs) that are designed to estimate the potential for risk to individual ecological receptors assuming continuous exposure to the representative concentration of the COPC in question. The incorporation of an area-use factor (AUF) based on the home range of an individual receptor compensates for the fact that a receptor will actually move around its home range and not remain stationary at the contaminated area of the site. The individual AUF therefore assesses the level of individual exposure based on the area of the home range. The modification of an HQ or HI with a population area-use factor (PAUF) similarly uses the estimated area occupied by the population of a receptor species to assess the likelihood of any individual within a given population encountering the contaminated area, while using the same ESL based on effects to individuals to determine the impact of this contact with the contaminated area. The PAUF assumes that there may be some impact to the individual receptor, and estimates the effect on the population of that impact based on the likelihood that an individual in that population will contact the contaminated area. The PAUF modifies an HQ or HI developed from ESLs used in the initial screen; those ESLs are based on adverse effects to an individual.

PAUFs are developed based on investigations correlating the home range of a receptor with its dispersal distance (the distance that an animal moves from its natal home range). The dispersal distance has been shown to affect population structure, demographics, and spacing patterns, and can be used to determine the assessment population boundaries (Bowman et al. 2001, 73475) When home range is expressed as its linear dimension (the square root of home range), it has an extremely good linear correlation with dispersal distance for the same species (Bowman et al. 2002, 73745). For mammal species with similar home range sizes to the species used as screening receptors at Laboratory, dispersal distance is equal to 3.5 times the square root of the home range. The relationship holds well for small surface mammals such as mice and rabbits, but may overpredict dispersal distance for fossorial species, and slightly underpredict dispersal distance for some large herbivores such as the white-tailed deer (Ryti et al. 2003, 76074)

The mathematical relationship between home range and dispersal distance has been estimated only for mammals, but for the calculations at these sites the same methodology was applied to avian receptors. Bird species have higher median and maximum dispersal distances than similar-sized mammals (Sutherland et al, 2000, 73460), so application of the mammalian relationship should be protective of bird species because this relationship would underestimate the dispersal distance and therefore the assessment population area of bird species.

Table F-1.0-1
ESLs for Contaminants of Potential Concern and Terrestrial Receptors

Compound	Kestrel Omnivore	Kestrel Carnivore	Robin Herbivore	Robin Insectivore	Robin Omnivore	Deer Mouse	Cottontail	Red Fox	Shrew	Earth Worm	Plant	Final Soil ESL
Antimony	na*	na	na	na	na	0.24	1.4	23	0.13	na	0.05	0.05
Cadmium	5	660	8.8	0.71	1.3	0.0091	0.15	4	0.0047	10	1	0.0047
Copper	210	1400	17	25	20	76	130	3900	75	13	10	10
Lead	1400	7800	300	150	200	220	930	4600	100	2000	520	100
Mercury (inorganic)	4.6	12	1.4	0.61	0.87	44	250	450	20	0.05	34	0.05
Methyl mercury	0.0021	0.0076	0.075	0.00035	0.00071	0.0063	2.2	0.084	0.0031	2.5	na	0.00035
Silver	100	2400	30	14	19	130	490	14000	86	na	0.05	0.05
Strontium (stable)	na	na	na	na	na	71	110	19000	110	na	na	71
Uranium	1500	39000	1900	200	360	58	2000	4800	27	na	25	25
Zinc	660	4900	210	97	130	250	910	11000	180	350	10	10
Americium-241	35000	62000	13000	4000	4000	32000	32000	26000	31000	44	21000	44
Cesium-137	3700	2900	4200	3800	3700	2400	2300	680	2400	1700	2300	680
Plutonium-238	32000	130000	8300	2000	2100	110000	120000	30000	92000	44	110000	44
Plutonium-239, 240	34000	160000	8600	2100	2100	150000	170000	33000	110000	47	160000	47
Tritium	630000	580000	300000	600000	440000	330000	230000	190000	340000	48000	36000	36000
Uranium-234	120000	190000	48000	14000	14000	91000	96000	45000	94000	51	14000	51
Uranium-235	10000	10000	9000	6400	6400	5100	5100	4800	5100	55	4000	55
Uranium-238	4100	4200	3900	3400	3400	2100	2100	2000	2100	55	1800	55
Acetone	3100	56000	22	420	42	3.8	4.3	5100	37	na	na	3.8
Acenaphthene	na	na	na	na	na	260	1100	7800	160	na	0.25	0.25
Anthracene	na	na	na	na	na	390	2800	6100	220	na	na	220
Aroclor-1242	0.26	1.4	0.44	0.041	0.075	0.12	1.8	2.9	0.068	na	na	0.041
Aroclor-1254	0.17	0.22	1.4	0.041	0.08	0.045	2.8	0.15	0.022	na	10	0.022
Aroclor-1260	1.8	2.2	15	0.44	0.86	10	660	32	5	na	na	0.44

Table F-1.0-1 (continued)

Compound	Kestrel Omnivore	Kestrel Carnivore	Robin Herbivore	Robin Insectivore	Robin Omnivore	Deer Mouse	Cottontail	Red Fox	Shrew	Earth Worm	Plant	Final Soil ESL
Benzene	na	na	na	na	na	55	94	12000	76	na	na	55
Benz(a)anthracene	na	na	na	na	na	4.9	12	32	3	na	18	3
Benzo(a)pyrene	na	na	na	na	na	18	96	68	9.6	na	na	9.6
Benzo(b)fluoranthene	na	na	na	na	na	74	410	250	38	na	18	18
Benzo(g,h,i)perylene	na	na	na	na	na	25	1000	47	12	na	na	12
Benzo(k)fluoranthene	na	na	na	na	na	120	740	400	62	na	na	62
Benzoic Acid	na	na	na	na	na	7.3	11	1900	11	na	na	7.3
BHC[beta-]	350	2200	130	52	76	1.4	6.1	49	0.97	na	na	0.97
BHC[gamma-]	5.2	35	1.8	0.77	1	0.051	0.2	1.8	0.034		0.1	0.034
Bis(2-ethylhexyl)phthalate	2.3	1.7	23	1	1.9	61	3600	64	30	na	na	1
Butanone[2-]	na	na	na	na	na	1300	1600	880000	6000	na	na	1300
Butyl Benzyl Phthalate	na	na	na	na	na	630	5800	7300	340	na	na	340
Chlordane[alpha-]	8.8	9.6	34	2.2	4.1	4.3	130	11	2.1	na	2.2	2.1
Chlordane[gamma-]	8.8	9.6	34	2.2	4.1	4.3	130	11	2.1	na	2.2	2.1
Chrysene	na	na	na	na	na	4.1	12	25	2.4	na	na	2.4
DDE[4,4'-]	0.0083	0.0074	0.13	0.0026	0.0052	13	1400	23	6.6	na	na	0.0026
DDT[4,4'-]	0.0093	0.0092	0.12	0.0026	0.0052	2.1	200	4.6	1	na	3.7	0.0026
Dibenz(a,h)anthracene	na	na	na	na	na	26	180	54	12	na	na	12
Dibenzofuran	na	na	na	na	na	na	na	na	na	na	6.1	6.1
Dichlorobenzene[1,4-]	na	na	na	na	na	8.6	27	430	6.3	1.2	na	1.2
Dieldrin	0.48	0.94	0.78	0.089	0.16	0.078	1.1	0.53	0.04	na	10	0.04
Dimethyl Phthalate	na	na	na	na	na	120	180	40000	250	10	na	10
Di-n-Butyl Phthalate	1.1	3.7	0.89	0.17	0.29	2300	18000	34000	1300	na	200	0.17
Endosulfan	88	440	44	13	20	0.57	2.9	14	0.35	na	na	0.35
Endrin	0.069	0.16	0.085	0.011	0.021	0.36	4	3.3	0.19	na	0.0034	0.0034
Fluoranthene	na	na	na	na	na	49	570	430	26	na	na	26

Table F-1.0-1 (continued)

Compound	Kestrel Omnivore	Kestrel Carnivore	Robin Herbivore	Robin Insectivore	Robin Omnivore	Deer Mouse	Cottontail	Red Fox	Shrew	Earth Worm	Plant	Final Soil ESL
Fluorene	na	na	na	na	na	480	2700	10000	290	1.7	na	1.7
Heptachlor	1.2	1.3	14	0.3	0.6	0.11	10	0.33	0.059	na	0.4	0.059
Indeno(1,2,3-cd)pyrene	na	na	na	na	na	120	990	270	62	na	na	62
Methoxychlor[4,4'-]	170	420	220	30	54	15	170	140	8.4	na	na	8.4
Methylene Chloride	na	na	na	na	na	7.1	9.6	2800	18	na	1600	7.1
Pentachlorophenol	22	53	28	3.9	6.9	0.94	10	8.5	0.5	10	0.032	0.032
Phenanthrene	na	na	na	na	na	20	140	310	11	na	na	11
Pyrene	na	na	na	na	na	29	340	260	15	na	na	15
Tetrachloroethene	na	na	na	na	na	5.4	11	940	5.5	na	10	5.4
Toluene	na	na	na	na	na	73	160	12000	70	na	200	70
Trichloroethene	na	na	na	na	na	270	590	46000	270	na	na	270
Xylene (Total)	1000	10000	230	150	180	6.8	19	430	5.4	na	100	5.4

Notes: 1. The source for ESLs is the September 2002 version (Release 1.5) of the LANL Ecorisk Database (LANL 2002, 73702).

2. Units are mg/kg for organic and inorganic chemicals and pCi/g for radionuclides.

*na = ESL not available.

The dispersal distance from the center of the home range can be considered the radius of the animal's population area, with the area likely to be occupied by members of that population (the assessment population area) consisting of the circle described by the area covered by the dispersal distance. The assessment population area would therefore be equal to πr^2, which would be equal to $\pi^*(3.5^*\sqrt{\text{Home range}})^2$. This mathematical relationship can be simplified to 40* home range as a representation of the population area in hectares. Once the population area is calculated for each receptor species of interest, the area of the site of interest can be divided by the population area to develop a site-specific PAUF for that species. Table F-2.0-1 shows the development of the population area for each receptor species. The area of contamination at each of the DP Road sites are divided by each of these population areas to determine the PAUF for each receptor for each site.

Table F-2.0-1
Assessment Population Areas for Receptors

Receptor	Home Range (ha)	Assessment Population Area (40*HR) (ha)
American kestrel	106	4200
American robin	0.42	16
Deer mouse	0.077	3.0
Vagrant shrew	0.39	15
Desert cottontail	3.1	120
Red fox	1038	41000

PAUFs were not calculated for the plant and invertebrate screening receptors, as these species are not considered to have a home range that can be related to a population assessment area. Plant and invertebrate receptors are evaluated directly against their ESL media concentrations.

Calculations for SWMUs/AOCs Using Population Area-Use Factors

AOCs 0-004 and 0-033(b) and SWMU 0-030(l)

If the total area sampled during the investigation (Figure F-2.0-1) is considered to be the exposure area for the 95% upper confidence limit (UCL) of the mean of those COPECs that were not removed from consideration in the screening phase, the site area would be 26,740 ft^2, which is 0.25 ha. The PAUFs based on this area are given in Table F-2.0-2.

Table F-2.0-2
PAUFs for AOCs 0-004 and 0-033(b) and SWMU 0-030(l)

Receptor	Assessment Population Area (ha)	PAUF for 0.25- ha Site
American Robin	16	0.016
Deer Mouse	3.0	0.083
Vagrant shrew	15	0.017

These PAUFs can be used to adjust the HIs for each screening receptor from Table 2.5-5. The adjusted HQs are given in Table F-2.0-3.

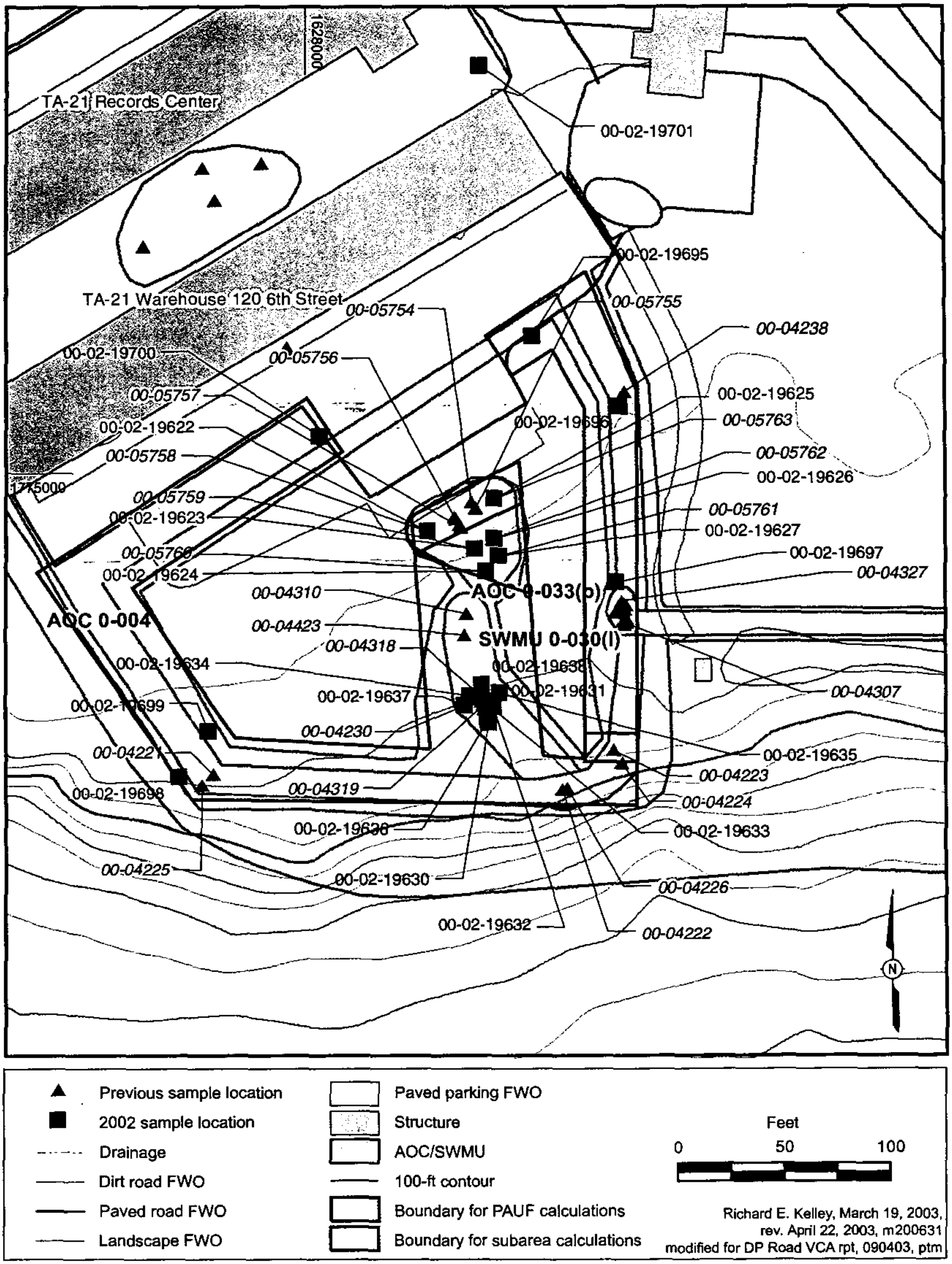


Figure F-2.0-1. AOCs 0-004 and 0-033(b) and SWMU 0-030(l) calculation areas

Table F-2.0-3
PAUF-Adjusted HIs for AOCs 0-004 and 0-033(b) and SWMU 0-030(l)

Receptor	Herbivorous Robin	Invertivorous Robin	Omnivorous Robin	Deer Mouse	Shrew
HI for Receptor	10.4	443.4	222.3	75.9	148.4
HI adjusted by PAUF	0.17	**7.1**	**3.6**	**6.3**	**2.5**

Note: Bold = HI >1.0.

For the robin as the surrogate for insectivorous birds, the robin as the surrogate for omnivorous birds, the mouse, and the shrew, the PAUF approach predicts the potential for some impact to these species on the population level. For these screening receptors, individual HQs for COPCs were adjusted by the PAUF to assess which COPCs contribute to the potential risk. These HQs are shown in Table F-2.0-4.

Table F-2.0-4
Hazard Quotients from Table 2.5-5 for Each COPC Adjusted by PAUF

Receptor	Invertivorous Robin	Omnivorous Robin	Deer Mouse	Shrew
Cadmium	0.01	0.01	**5.2**	**2.1**
Lead	<0.01	<0.01	0.01	0.01
Inorganic Mercury	0.01	0.01	<0.01	<0.01
Zinc	0.01	0.01	0.02	0.01
Aroclor-1254	0.21	0.11	1.0	**0.43**
DDD[4,4'-]	0.09	0.05	<0.01	<0.01
DDE[4,4'-]	**1.7**	**0.85**	<0.01	<0.01
DDT[4,4'-]	**5.0**	**2.5**	0.03	0.01
Acenapthene	NA	NA	<0.01	<0.01
Bis(2-ethylhexyl)phthalate	0.01	0.01	<0.01	<0.01
Chlordane[gamma-]	0.01	<0.01	0.02	0.01
Di-n-butylphthalate	0.01	0.01	<0.01	<0.01
Endrin	0.02	0.01	<0.01	<0.01
Aroclor-1260	0.02	0.01	<0.01	<0.01

Note: Bold = HQ >0.3.

For both the omnivorous and insectivorous avian receptors, the table above shows that only DDT and DDE contribute significantly to the overall hazard index, and for these receptors the subsequent analyses will focus only on these COPCs for the avian receptors. Risk to the deer mouse and shrew receptors was dominated by cadmium. Cadmium is discussed in the uncertainty section of Chapter 2. Because their HQs are greater than 0.3 but less than or equal to one, Aroclor-1254 may present a potential risk when other COPCs are also present at the site. This issue is also dealt with in the uncertainty section of Chapter 2.

An examination of the distribution of 4,4'-DDT and 4,4'-DDE detections with the 0.25 ha site that contains this group of SWMUs/AOCs shows that these detections may actually represent 2 statistical subgroups that should be evaluated individually. The three detected concentrations of 4,4'-DDD were not included because these detected concentrations do not co-occur with the 4,4'-DDT and 4,4'-DDE, and are scattered over different areas of the SWMU/AOC aggregate. The high detections of 4,4'-DDT and 4,4'-DDE within this group of SWMUs/AOCs occur in a small area within 0-030(b) and within the drainage channel near the edge of the mesa. These areas are shown on Figure F-2.0-1. The combined area for these two subareas is 1519 ft^2 (which corresponds to 141 m^2 or 0.014 ha). PAUFs developed for these subareas were developed as shown in Table F-2.0-5.

Table F-2.0-5
PAUFs for Combined Subareas of AOCs 0-004 and 0-033(b) and SWMU 0-030(l)

Receptor	Assessment Population Area (ha)	PAUF for 0.014-ha site (2 small subareas)
American robin	16	0.00087
Deer mouse	3.0	0.0047
Vagrant shrew	15	0.00093

These PAUF were then used to modify the hazard quotients for 4,4'-DDT and4,4'-DDE for the avian receptors based only on the sample results from within this area. The maximum detected concentrations of 4,4'-DDT was used to generate the hazard quotients which were modified by the PAUF; the maximum levels in the two subareas for 4,4'-DDT were very similar so they areas were combined and considered as one area of 0.014 ha. For 4,4'-DDE the concentrations between the two areas were not as similar, but the maximum value from the AOC 0-004 site of 1.3 mg/kg was again conservatively estimated to represent the exposure concentration for both these small areas shown on Figure F-2.0-1. The first subarea consists of the southern half of AOC 0-033(b). The second subarea encompasses the two sampling locations at the southeastern part of the SWMU/AOC group. The sample location IDs, 4,4'-DDE and 4,4'-DDT concentrations included in the two subareas are shown Table F-2.0-6.

Table F-2.0-6
Subarea Locations IDs, Depths, and 4,4'-DDE and 4,4'-DDT Concentrations

Location ID	Sample Depth (ft)	4,4'-DDE (mg/kg)	4,4'-DDT (mg/kg)
AOC 0-033(b) subarea			
00-05759	0.00–0.50	0.0074 (J)	0.022
00-05760	0.00–0.50	0.12	0.7
00-05761	0.00–0.50	0.2	1.3
00-05762	0.00–0.50	0.17 (J)	1.2
00-02-19623	1.00–1.50	ND	ND
00-02-19624	1.00–1.50	ND	ND
00-02-19627	1.00–1.50	ND	ND
00-02-19697	0.00–0.50	0.0213	0.0443
00-02-19697	0.50–1.00	0.0257	0.0583
AOC 0-004 subarea			
00-04223	0.00–0.33	1.3	1.8
00-04224	0.00–0.25	0.3	0.36

Using the maximum concentrations detected to generate a hazard quotient which was then adjusted using the PAUFs from Table F-2.0-6, the HQs for population-level effects for the two small subareas are as shown in Table F-2.0-7.

Table F-2.0-7
PAUF-Adjusted HQs for the Two Combined Subareas

Receptor	Max Detected Concentration	Invertivorous Robin HQ	Omnivorous Robin HQ
4,4'-DDE	1.3	0.435	0.218
4,4'-DDT	1.8	0.602	0.301
DDT plus DDE	—	1.037	0.0519

This calculation indicates that the concentrations of 4,4'-DDE and 4,4'-DDT in the two small subareas are unlikely to have population-level impacts on these avian receptors because, even though the concentrations are elevated, the area is a small portion of the estimated area occupied by a population of these receptors.

PAUF were then developed for the remainder of the sampled area excluding these two subareas to determine the potential for population-level risk to avian receptors from the residual levels of DDT and DDE found at the site out side the two identified subareas. This area would be 0.25-0.014 ha, which is 0.236 ha. PAUFs for the portion of the SWMUs/AOCs outside the two small subareas are provided in Table F-2.0-8. A 95% UCL of the mean of detected concentrations of both 4,4'-DDE and 4,4'-DDT was developed for this area without the samples included in the separately considered small subareas described above. The HQs adjusted by the PAUF for this area are given in Table F-2.0-9.

Table F-2.0-8
PAUFs for Area of
AOCs 0-004 and 0-033(b) and SWMU 0-030(l) Excluding the Two Combined Subareas

Receptor	Assessment Population Area (ha)	PAUF for 0.236-ha Site (outer AOC 0-004 group area)
American robin	16	0.01475
Deer mouse	3.0	.078667
Vagrant shrew	15	0.01573

Table F-2.0-9
PAUF-Adjusted HQs for
Area of AOCs 0-004 and 0-033(b) and SWMU 0-030(l) Excluding the Two Combined Subareas

Receptor	95% UCL of the Mean Detected Concentration	Invertivorous Robin HQ	Omnivorous Robin HQ
4,4'-DDE	0.051	0.289	0.145
4,4'-DDT	0.085	0.482	0.241
DDT plus DDE	—	0.771	0.386

These calculations show hazard indices of less than one for the summed hazard quotients of DDT and DDE, indicating that this area outside of the two smaller spots also does potentially provide unacceptable risk to avian receptors from DDT or its metabolites.

SWMUs 0-030(b,m)

This aggregate of SWMUs includes the leachfield area and the associated pipeline areas shown in Figure F-2.0-2. The field area east of the leachfield and north of the pipeline is part of the SWMU 21-021-99 area, so that portion of the area is not included in the calculation of the total area for this aggregate. The area outlined in blue was used to calculate a total area of 83,360 ft^2, which is 7,747 m^2 or 0.775 ha. Using this site size as representing the contaminated area, the home ranges for each receptor can be used to calculate area use factors for individuals of each species. The PAUFs were developed for this site using the same approach described above for the AOC 0-004 group aggregate; these PAUFs are given in Table F-2.0-10. These PAUFs were used to adjust the hazard quotients for the robin, deer mouse, and shrew receptors for SWMUs 0-030 (b,m) as shown in Table F-2.0-11.

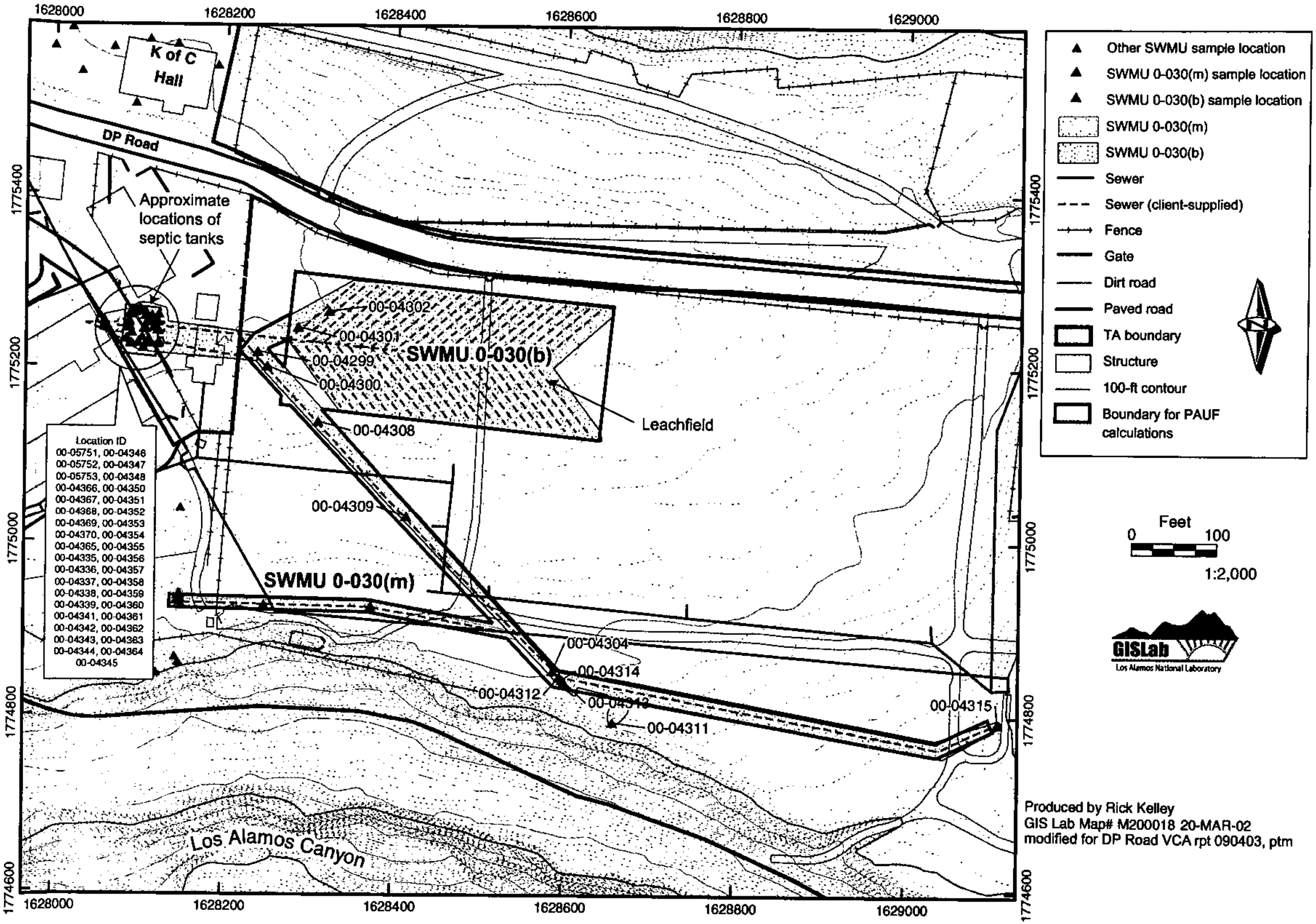
Table F-2.0-10
PAUFs for SWMUs 0-030(b,m)

Receptor	Assessment Population Area (ha)	PAUF for 0.775-ha Site
American robin	16	0.048
Deer mouse	3.0	0.258
Vagrant shrew	15	0.052

Table F-2.0-11
Hazard Quotients from Table 3.5-5 for Each COPC Adjusted by PAUF

Receptor	Herbivorous Robin	Invertivorous Robin	Omnivorous Robin	Deer Mouse	Shrew
Cadmium	0.002	0.020	0.011	**8.5**	**3.3**
Mercury (total as inorganic)	0.035	0.082	0.058	0.006	0.003
Mercury (methyl)[a]	0.001	0.274	0.134	0.082	0.033
Silver	0.006	0.014	0.010	0.008	0.002
Aroclor-1254	0.001	0.037	0.019	0.034	0.078
DDD[4,4'-][b]	0.030	**1.5**	**0.744**	0.002	<0.001
DDE[4,4'-]	0.007	0.331	0.168	<0.001	<0.001
DDT[4,4'-]	0.026	**1.2**	**0.600**	0.008	0.003
Di-n-butylphthalate	0.013	0.067	0.039	<0.001	<0.001
Endrin	0.003	0.022	0.011	0.004	0.001
Pentachlorophenol	<0.001	0.003	0.002	0.063	0.024
HI for receptor adjusted by PAUF	0.13	**3.6**	**1.8**	**8.9**	**3.5**

Note: Bold = HQ >0.3 or HI >1.0.



Produced by Rick Kelley
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Figure F-2.0-2. SWMU 0-030(b,m) area for PAUF calculations

SWMU 21-021

This aggregate includes the portion of East Mesa projecting east-southeast from the 6th Street Warehouse area, as shown in Figure F-2.0-3. The area outlined in blue was used to calculate a total area of 1,059,084 ft^2, which equals 9.84 ha. This area was used to calculate PAUFs for this aggregate; the PAUFs are given in Table F-2.0-12. These PAUFs were used to adjust the hazard quotients for the robin and shrew receptors; the adjusted hazard quotients are provided in Table F-2.0-13.

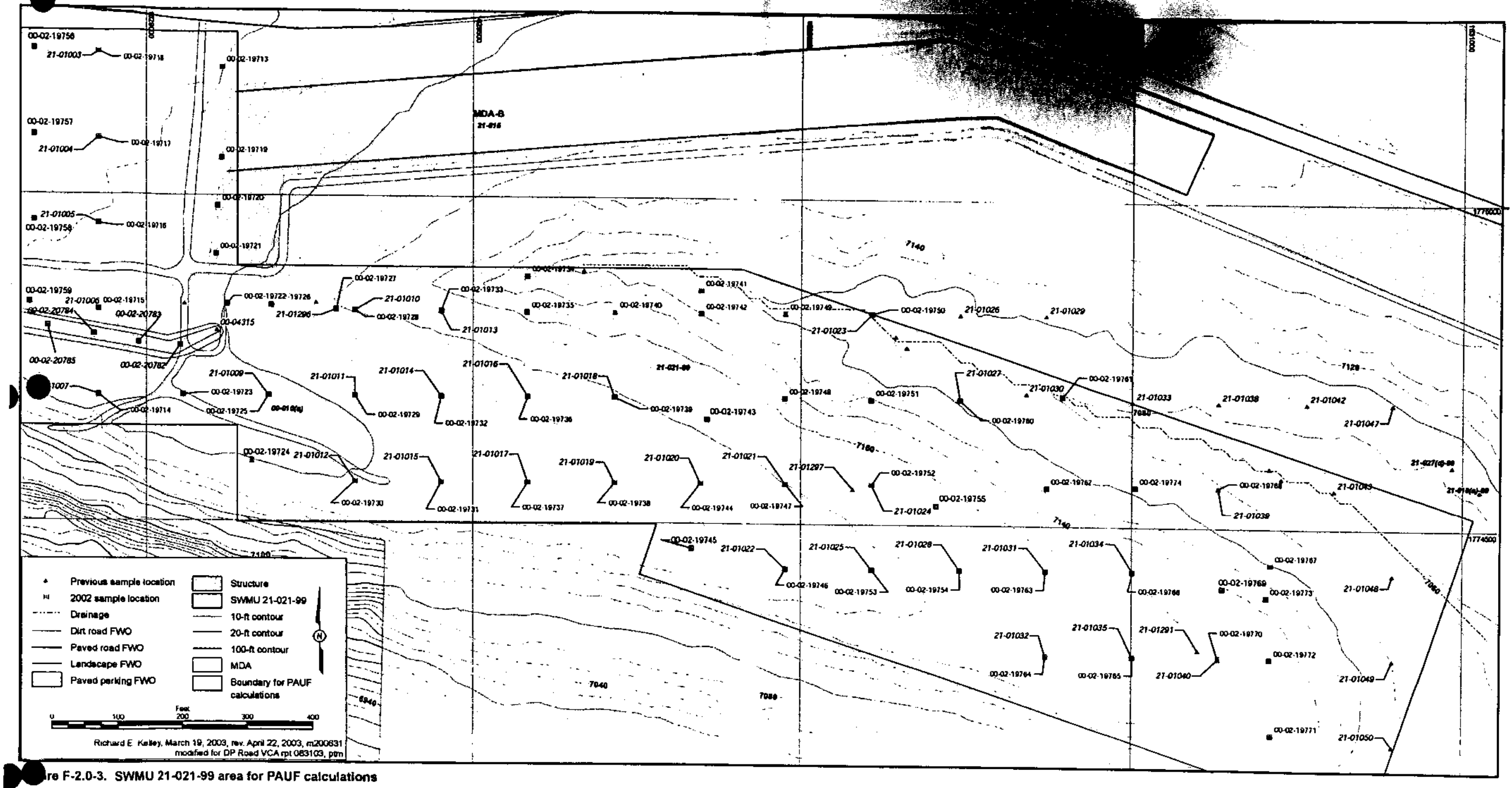
Table F-2.0-12
PAUFs for SWMU 21-021

Receptor	Assessment Population Area (ha)	PAUF for 9.84-ha Site
American robin	16	0.615
Deer mouse	3.0	1.0
Vagrant shrew	15	0.656
Desert cottontail	120	0.082

Table F-2.0-13
Hazard Quotients Adjusted by PAUF for Selected Receptors

Receptor	Invertivorous Robin	Omnivorous Robin	Shrew
cadmium	0.26	0.14	**41.9**
copper	**0.34**	**0.42**	0.12
lead	0.18	0.14	0.30
Mercury (total as inorganic)	0.05	0.04	<0.01
Silver	0.17	0.13	0.03
Strontium (stable)	NA	NA	**0.46**
zinc	**0.47**	**0.35**	0.27
HI for receptor adjusted by PAUF	**1.5**	**1.2**	**43.1**

Note: Bold = HQ >0.3 or HI >1.0.



re F-2.0-3. SWMU 21-021-99 area for PAUF calculations

Methyl Mercury to Inorganic Mercury Ratio

Mercury in soil can exist as two different forms, inorganic mercury and methyl mercury. These two forms have very different potential toxicity to life forms and therefore have different ESLs for the receptor species considered for these sites. The amount of mercury present in each form depends on a number of variables including soil chemistry and amount of organic matter present in the soil. The amounts of both the methylated and inorganic forms of mercury were measured at the Laboratory previously as part of the Potential Release Site (PRS) 0-019 VCA and are presented in the PRS 0-019 VCA completion report. The ratio of methyl mercury to total mercury for six soil samples and one tuff sample is presented in Table 2.0-14, this table is excerpted from the PRS 0-019 VCA completion report (LANL 2001, 71417). None of the ratios at PRS 0-019 exceeded 0.8%, and the average ratio of methylated to total mercury for the soil samples is 0.2%. This average ratio of 0.2% was used for AOCs 0-004 and 0-033(b) and SWMUs 0-030(l), 0-030(b,m), and 21-021-99 to separate the 95% UCL of the mean concentration of mercury into estimated 95% UCL of the mean concentrations for methyl mercury and inorganic mercury. Each of these values was then compared to the corresponding ESL for that form of mercury.

Table F-2.0-14
Results of Mercury Speciation at SWMU 0-019

Location ID	Sub-area	Media	Depth (ft)	Methyl Mercury(+1) Ion (mg/kg)	Depth (ft)	Mercury (mg/kg)	Ratio
00-10228	Upper bench	Qbt 3	0.50–1.00	0.000319	0.50–1.00	8.6	0.004%
00-10377	Canyon	Soil	0.00–0.50	0.000574	0.00–0.50	0.32	0.179%
00-10378	Canyon	Soil	0.00–0.50	0.000918	0.00–0.50	0.48	0.191%
00-10381	Canyon	Soil	0.50–1.00	0.00301	0.50–1.00	0.39	0.772%
00-10323	Lower Bench	Soil	0.00–0.50	0.00576	0.00–1.00	7.6	0.076%
00-10324	Lower Bench	Soil	0.00–0.50	0.0135	0.00–1.00	3.9	0.346%
00-10325	Lower Bench	Soil	0.00–0.50	0.0144	0.00–1.00	6.9	0.209%
Average value				0.00550		4.03	0.137%
Average value with tuff samples excluded.				0.00636		3.27	0.195%

F-3.0 REVISED ECOLOGICAL SCOPING CHECKLISTS

F-3.1 AOCs 0-004 and 0-033(b) and SWMU 0-030(l), (Drainage for 6th Street Warehouse)

F-3.2 SWMUs 0-030(b,m) (septic tanks, drainlines, leachfield, and outfall)

F-3.3 AOCs 0-029(a,b,c) (PCB transformer sites)

F-3.4 SWMU 21-021-99 (mesa top)

F-3.1 AOCs 0-004 and 0-033(b) and SWMU 0-030(I), (Drainage for 6th Street Warehouse)

F-3.1.1 Part A—Scoping Meeting Documentation

Site ID	AOCs 0-004 and 0-033(b) and SWMU 0-030(I)
Form of site releases (solid, liquid, vapor). Describe all relevant known or suspected mechanisms of release (spills, dumping, material disposal, outfall, explosive testing, etc.) and describe potential areas of release. Reference locations on a map as appropriate.	Solid and liquid releases include VOCs, SVOCs, pesticides, PCBs, metals, radionuclides. Waste releases include subsurface leaks from outfall pipes [AOC 0-033(b)], septic tank and associated plumbing [SWMU 0-030(I)], and surface releases from spills [AOC 0-004] or outfall pipes [AOC 0-033(b)]. The potentially impacted area is the field, located immediately south of these SWMUs/AOCs, that drains the warehouse parking lots and outfalls.
List of Primary Impacted Media **(Indicate all that apply.)**	**Surface soil** – warehouse spills washed through floor drains onto parking lot and from parking lot to site resulted in direct surface soil contamination. **Surface water/sediment** – NA **Subsurface** – Septic tanks releases occurred in subsurface (sampled to 15 ft bgs). **Groundwater** – NA **Other, explain** – NA.
FIMAD vegetation class based on ArcView vegetation coverage **(Indicate all that apply)**	**Water** – NA **Bare Ground/Unvegetated** – NA **Spruce/fir/aspen/mixed conifer** – NA **Ponderosa pine** –YES (southern portion of site) **Piñon juniper/juniper savannah** – NA **Grassland/shrubland** – NA **Developed** – YES (northern portion of site)
Is T&E Habitat Present? **If applicable, list species known or suspected to use the site for breeding or foraging.**	SWMU/AOC location information was intersected with T&E species habitat using GIS. The SWMUs/AOCs are in the vicinity of potential Mexican Spotted Owl nesting habitat: the SWMUs/AOCs are approximately 0 to 450 ft away from the potential habitat in Los Alamos Canyon and approximately 1000 to 1800 ft from the potential habitat in Pueblo Canyon. The SWMUs/AOCs are entirely within an area in which the Mexican Spotted Owl can be conservatively assumed to forage at a relatively high frequency.
Provide list, of Neighboring/ Contiguous/ Upgradient sites, includes a brief summary of COPCs and the form of releases for relevant sites and reference a map as appropriate. **(Use this information to evaluate the need to aggregate sites for screening.)**	Site is bordered by private property to the west, LA Canyon to the south, SWMUs 0-030(b,m) to the northeast, and DP road to the north. Commercial development exists within 50 ft to the east. Businesses immediately upgradient (northwest) of these SWMUs/AOCs include the Merrick Bldg. and Automotive Professionals. SWMU 0-033(a) is directly northwest of the site between the 6th street warehouse and the TA-21 records center. AOCs 0-004 and 0-033(b) and SWMU 0-030(I) are aggregated because their influence shares a common spatial boundary. All 3 SWMUs/AOCs lie within the drainage area southeast of the warehouse
Surface Water Erosion Potential Information **Summarize information from SOP 2.01, including the runoff subscore (maximum of 46); terminal point of surface water transport; slope; and surface water run-on sources.**	AOCs 0-033(b) and 0-004 and SWMU 0-030(I) have erosion matrix scores of 10.6, 10.6, and 29.2 (out of 100), respectively, the latter two SWMUs/AOCs employing BMPs. There was no visible sign of runoff discharging offsite or of runoff causing visible erosion at the SWMUs/AOCs; therefore, the runoff subscores are zero at AOCs 0-004 and 0-033(b). The runoff subscore was 5.0 at SWMU 0-030(I) due to the manmade drainage channels collecting runoff from the area around the warehouse and parking lot. These channels may also collect upgradient runoff (e.g., Merrick Bldg. parking lot).
Other Scoping Meeting Notes	In 1995 the septic tank at SWMU 0-030(I) was excavated in removed. In 2003 VCA the outfall pipe from that tank was removed and the location of the former tank was sampled and backfilled.

F-3.1.2 Part B—Site Visit Documentation

Site ID	AOCs 0-004 and 0-033(b) and SWMU 0-030(l)
Dates of Site Visit	September 21, 2001; May 21, 2003
Site Visit Conducted by	Jim Markwiese, Tracy McFarland. Ralph Perona, John Tauxe, Randall Ryti 2nd site visit: Kirby Olson, Kristen Lockhart, Tracy McFarland

Receptor Information:

Estimate cover	**Relative vegetative cover (high, medium, low, none)** = high **Relative wetland cover (high, medium, low, none)** = none **Relative structures/asphalt, etc. cover (high, medium, low, none)** = medium
Field notes on the FIMAD vegetation class to assist in ground-truthing the ArcView information	The mesa-top area of these SWMUs/AOCs has undergone heavy commercial and urban development. Ponderosa pine dominated in pre-urban conditions. Pines reduced to scattered stands. The area is characteristic of disturbed sites undergoing secondary succession. Ample forb ground cover exists, predominantly red sorrel, and grasses. Soils have been previously disturbed through excavation and backfilling.
Field notes on T&E Habitat, if applicable. Consider the need for a site visit by a T&E subject matter expert to support the use of the site by T&E receptors.	NA [See comments Part A, T&E habitat]
Are ecological receptors present at the site? **([✓ yes]/no/uncertain)** **Describe the general types of receptors present at the site (terrestrial and aquatic), and make notes on the quality of habitat present at the site.**	Yes. The mesa-top soils are exposed in a few patches but they primarily support a continuous cover of grasses (buffalo grass, fescue) and forbs (red sorrel, chamisa, clover, aster, sweet pea). The invasive growth of forbs and grasses is characteristic of a disturbed area undergoing secondary succession. Ponderosa pine stands and other trees surround the southern portion of the area. Signs of animal life on the mesa top include evidence of small mammal usage, including scattered gopher burrowing, and observations of a garter snake, fence lizards, skink, and numerous birds (e.g., raven, American Robin).

Contaminant Transport Information:

Surface water transport **Field notes on the erosion potential, including a discussion of the terminal point of surface water transport (if applicable).**	Runoff and infiltration from rain events and snowmelt are the only aspects of surface water hydrology at the warehouse SWMUs/AOCs. Flow off western and eastern ends of Warehouse 3/4 parking lot are channeled into the manmade drainage channels on site. These channels terminate as unlined dirt ditches at the edge of the undeveloped area of the site. In addition, parking lot and roof runoff from upgradient businesses have the potential to contribute to surface flow in AOC 0-004. A small area of the parking lot immediately north of AOC 0-033(b) is stained with oil residues. Surface transport may cause potential contaminants to become concentrated in drainages, particularly the dirt channels at the end of the drainages.
Are there any off-site transport pathways (surface water, air, or groundwater)? **(yes/no/uncertain)** **Provide explanation**	Yes. Results of 2002 sampling indicate that some contaminants (DDT, DDD, DDE) are concentrated in drainages. Surface water transport off the mesa top is minimized considering site topology and existing BMPs, although drainage into the canyon is evident. Considering depth to groundwater below the mesa top, contamination of groundwater unlikely. The potential impact on alluvial groundwater in LA Canyon is unlikely considering the distance from the mesa top to the ephemeral stream in the Canyon. Aeolian (wind-driven) contaminant entrainment and transport is unlikely considering extensive vegetation cover.

Interim action needed to limit off-site transport? **(yes/no/uncertain)** **Provide explanation/ recommendation to project lead for IA SMDP.**	No. BMPs were placed in pathway of erosion channels leading off mesa top. Mesh netting placed on surface soil to reduce erosion.

Ecological Effects Information:

Physical Disturbance **(Provide list of major types of disturbances, including erosion and construction activities, review historical aerial photos where appropriate.)**	Extensive excavation and backfilling from prior site activities have disturbed the site but vegetative regrowth is well established.
Are there obvious ecological effects? **(yes/no/uncertain)** **Provide explanation and apparent cause (e.g., contamination, physical disturbance, other).**	No. Although area has been physically disturbed, signs of stress on the mesa-top plant life are not apparent. Stressors on wildlife do not appear to be significant either as there are abundant signs of wildlife using the area.
Interim action needed to limit apparent ecological effects? **(yes/no/uncertain)** **Provide explanation and recommendations to mitigate apparent exposure pathways to project lead for IA SMDP.**	No. Second site visit confirmed that plant life was abundant and did not appear stressed. Signs of wildlife activity, including burrows of fossorial mammals, also indicated no apparent ecological effect.

No Exposure/Transport Pathways:

If there are no complete exposure pathways to ecological receptors onsite and no transport pathways to offsite receptors, the remainder of the checklist should not be completed. Stop here and provide additional explanation/justification for proposing an ecological No Further Action recommendation (if needed). At a minimum, the potential for future transport should include likelihood that future construction activities could make contamination more available for exposure or transport. This section is not applicable

Adequacy of Site Characterization:

Do existing or proposed data provide information on the nature, rate and extent of contamination? **(yes/no/uncertain)** **Provide explanation** **(Consider if the maximum value was captured by existing sample data.)**	Yes. Subsequent to the 2002 sampling, all SWMUs/AOCs have SVOC, pesticide, PCB, metal, and radionuclide data. The results of the sampling are adequate to describe the nature and extent of most contaminants
Do existing or proposed data for the site address potential transport pathways of site contamination? **(yes/no/uncertain)** **Provide explanation** **(Consider if other sites should aggregated to characterize potential ecological risk.)**	Yes. Data collected in 2002 is adequate to address the potential for surficial transport of site contaminants off the mesa top. Surface samples for pesticides/PCBs and SVOCs were taken at 0-030(l). Surface samples were collected at AOC 0-004 for PCBs, pesticides, SVOCs, and VOCs. Both AOC 0-033(b) and SWMU 0-030(l) were sampled subsurface for PCBs, pesticides, VOCs, and SVOCs. These sampling activities addressed previous data gaps for areal extent and nature of contamination. The 2002 sampling was adequate to delineate nature and extent. Metals across the site gener5ated HQs indicating the need for further analysis of the new data, as did DDT, DDD, and DDE levels found within the drainage channel. The berm that was built prior to 1951 collects and directs SWMU/AOC runoff in these channels.

Additional Field Notes:

Provide additional field notes on the site setting and potential ecological receptors. The area was heavily disturbed by remedial actions associated with VCAs, development, and commercial activities, although vegetative regrowth has become well established. On the second site visit vegetation was still seen to appear healthy and not stressed. Burrows of fossorial mammals were seen at the site, as well as birds and small lizards. There were also ant mounds at the site.

F-3.1.3 Part C—Ecological Pathways Conceptual Exposure Model

Provide answers to Questions A to V to develop the Ecological Pathways Conceptual Exposure Model

<u>Question A:</u>

Could soil contaminants reach receptors via vapors?

- **Volatility of the hazardous substance (volatile chemicals generally have Henry's Law constant >10^{-5} atm-m^3/mol and molecular weight <200 g/mol).**

Answer (likely/unlikely/uncertain): unlikely

Provide explanation:

Prior to 2002, VOCs had not been previously quantified for these SWMUs/AOCs. Process knowledge would indicate that a potential source term exists for VOC sources (neighboring SWMU 0-033(a) USTs). Unspecified crystallized solvents (AOC 0-004) were washed onto the site soils and fuel-related underground storage tanks were located up-gradient from sites. The USTs at SWMU 0-033(a) were, however, remediated in 1996. Results of sampling for organic chemicals done in 2002 detected only low levels of a few VOCs in surface or near surface soil at these SWMUs/AOCs. At AOC 0-004 0.002 mg/kg of styrene, up to 0.002 mg/kg of toluene, and up to 0.008 mg/kg of isopropyltoulene were detected in the 2002 sampling at both AOCs 0-004 and 0-033(b). Up to 0.008 mg/kg of Trichlorethene was detected at AOC 0-033(b), as was a single detection of benzene. These infrequent detections of low concentrations are unlikely to represent a significant risk pathway to ecological receptors at this site.

Question B:

Could the soil contaminants reach receptors through fugitive dust carried in air?

- **Soil contamination would have to be on the actual surface of the soil to become available for dust.**
- **In the case of dust exposures to burrowing animals, the contamination would have to occur in the depth interval where these burrows occur.**

Answer (likely/unlikely/uncertain): likely

Provide explanation: Extensive ground cover would prohibit air entrainment of contamination on particulates on the mesa top. But signs of burrowing activity (e.g., tunnels) observed. Persistent organics (pesticides, SVOCs) detected in subsurface. Dust inhalation could be a likely pathway for fossorial mammals. In the 2002 sampling at all three SWMUs/AOCs pesticides (chlordane, DDT/DDE/DDD) were detected in soil samples between the surface and one foot down, as were some low levels of PAHs. Aroclor-1254 and Aroclor-1260 were also detected at AOC 0-004.

Question C:

Can contaminated soil be transported to aquatic ecological communities (use SOP 2.01 run-off score and terminal point of surface water runoff to help answer this question)?

- **If the SOP 2.01 run-off score* for each PRS included in the site is equal to zero, this suggests that erosion at the site is not a transport pathway. (* note that the runoff score is not the entire erosion potential score, rather it is a subtotal of this score with a maximum value of 46 points).**
- **If erosion is a transport pathway, evaluate the terminal point to see if aquatic receptors could be affected by contamination from this site.**

Answer (likely/unlikely/uncertain): unlikely

Provide explanation:

Contaminated soil is not likely to be transported off the mesa top (See response to Part A, Surface Water Erosion Potential Information) into the Los Alamos Canyon below. There is no aquatic habitat on the mesa top or hill slope. Potential impact of aquatic habitat in Los Alamos Canyon is unlikely considering the distance from the mesa top to the ephemeral stream in the Canyon.

Question D:

Is contaminated groundwater potentially available to biological receptors through seeps or springs or shallow groundwater?

Known or suspected presence of contaminants in groundwater.

- **The potential for contaminants to migrate via groundwater and discharge into habitats and/or surface waters.**
- **Contaminants may be taken up by terrestrial and rooted aquatic plants whose roots are in contact with groundwater present within the root zone (~1 m depth).**
- **Terrestrial wildlife receptors generally will not contact groundwater unless it is discharged to the surface.**

Answer (likely/unlikely/uncertain): unlikely

Provide explanation:

Groundwater contamination is unlikely; there are no seeps or springs at the site, or any perched or alluvial groundwater. Mesa-top surface transport into the groundwater system within Los Alamos Canyon is also unlikely (See response to Part A, Surface Water Erosion Potential Information).

Question E:

Is infiltration/percolation from contaminated subsurface material a viable transport and exposure pathway?

- **Suspected ability of contaminants to migrate to groundwater.**
- **The potential for contaminants to migrate via groundwater and discharge into habitats and/or surface waters.**
- **Contaminants may be taken up by terrestrial and rooted aquatic plants whose roots are in contact with groundwater present within the root zone (~1 m depth).**
- **Terrestrial wildlife receptors generally will not contact groundwater unless it is discharged to the surface.**

Answer (likely/unlikely/uncertain): Provide explanation: unlikely

Depth to groundwater is 1200 feet from mesa top surface. No perched or alluvial groundwater exists beneath the site.

Question F:

Might erosion or mass wasting events be a potential release mechanism for contaminants from subsurface materials or perched aquifers to the surface?

- **This question is only applicable to release sites located on or near the mesa edge.**
- **Consider the erodibility of surficial material and the geologic processes of canyon/mesa edges.**

Answer (likely/unlikely/uncertain): unlikely

Provide explanation:

Vegetative cover overlies surface contamination, restricting erosion. There is evidence of upgradient surface flow coming into the sites but existing BMPs (berm, riprap and geotextile) appear to be a termination point for surface flow. Mass wasting could be a release mechanism because SWMU 0-030(l) extends to the cliff face and has some surface and shallow subsurface contamination.

Question G:

Could airborne contaminants interact with receptors through respiration of vapors?

- **Contaminants must be present as volatiles in the air.**
- **Consider the importance of inhalation of vapors for burrowing animals.**
- **Foliar uptake of organic vapors is typically not a significant exposure pathway.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 1

Terrestrial Animals: 1

Provide explanation:

During 2002 sampling volatile chemicals were quantified in fill material or soil on mesa top. At AOC 0-004 0.002 mg/kg of styrene, up to 0.002 mg/kg of toluene, and up to 0.008 mg/kg of isopropyltoulene were detected in the 2002 sampling at both AOCs 0-004 and 0-033(b). Up to 0.008 mg/kg of Trichlorethene was detected at AOC 0-033(b), as was a single detection of benzene. These infrequent detections of low concentrations are unlikely to represent a significant risk pathway to ecological receptors at this site.

Question H:

Could airborne contaminants interact with plants through deposition of particulates or with animals through inhalation of fugitive dust?

- **Contaminants must be present as particulates in the air or as dust for this exposure pathway to be complete.**
- **Exposure via inhalation of fugitive dust is particularly applicable to ground-dwelling species that would be exposed to dust disturbed by their foraging or burrowing activities or by wind movement.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 2

Terrestrial Animals: 2

Provide explanation:

Ground cover should minimize entrainment of dust particles and pathway to above-ground receptors is likely minor. Dust could, however, be a pathway for fossorial animals.

Question I:

Could contaminants interact with plants through root uptake or rain splash from surficial soils?

- **Contaminants in bulk soil may partition into soil solution, making them available to roots.**
- **Exposure of terrestrial plants to contaminants present in particulates deposited on leaf and stem surfaces by rain striking contaminated soils (i.e., rain splash).**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 3

Provide explanation:

Root uptake could be an important transport mechanism. Root uptake is most important for chemicals that can partition into soil aqueous phases. Metals go into solution readily. Metals data from the 2002 sampling indicate that several metals (cadmium, lead, mercury, and zinc) are present at elevated levels in the surface and shallow subsurface samples at these SWMUs/AOCs. Rain splash could represent a minor contaminant transport pathway.

Question J:

Could contaminants interact with receptors through food web transport from surficial soils?

- **The chemicals may bioaccumulate in animals.**
- **Animals may ingest contaminated food items.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 3

Provide explanation:

Several measured constituents (e.g., DDE, DDT, Chlordane, endrin, BEHP, DBP, Aroclor 1260) are known bioaccumulators. The 2002 sampling confirmed the presence of chlordane, DDT/DDD/DDE, and PCBs in surface and shallow subsurface soils at these SWMUs/AOCs. The presence of bioaccumulators in surficial soils makes bioaccumulation of contaminants through terrestrial pathways possible.

Question K:

Could contaminants interact with receptors via incidental ingestion of surficial soils?

- **Incidental ingestion of contaminated soil could occur while animals grub for food resident in the soil, feed on plant matter covered with contaminated soil or while grooming themselves clean of soil.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 3

Provide explanation:

Contaminants could interact with receptors via incidental ingestion of surficial soils, and through grooming themselves clean of soil. Subsequent to the 2002 sampling, a number of metals (cadmium, lead, mercury, and zinc) were found to be elevated in surface soils at these SWMUs/AOCs. Radionulcides and some organic chemicals (primarily pesticides and PCBs) were also found to be elevated in soil. All of these COPCs could be incidentally ingested with soil by receptors.

Question L:

Could contaminants interact with receptors through dermal contact with surficial soils?

- **Significant exposure via dermal contact would generally be limited to organic contaminants that are lipophilic and can cross epidermal barriers.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 2

Provide explanation:

Some of the COPCs at these SWMUs/AOCs are organic contaminants that are lipophilic and can cross epidermal barriers. This makes exposure via dermal contact via surficial soils a pathway. Even so, fur and feathers act as barriers to dermal uptake and this is less important than other pathways like ingestion. Other COPCs include metals and radionuclides for which the dermal exposure pathway would be expected to make only a minor contribution.

Question M:

Could contaminants interact with plants or animals through external irradiation?

- **External irradiation effects are most relevant for gamma emitting radionuclides.**
- **Burial of contamination attenuates radiological exposure.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 1

Terrestrial Animals: 1

Provide explanation:

Radionuclides detected in surficial soils are Americium-241, plutonium-238, 239, and uranium 234,238 (primarily alpha emitters and neutron emitters).

Question N:

Could contaminants interact with plants through direct uptake from water and sediment or sediment rain splash?

- **Contaminants may be taken-up by terrestrial plants whose roots are in contact with surface waters.**
- **Terrestrial plants may be exposed to particulates deposited on leaf and stem surfaces by rain striking contaminated sediments (i.e., rain splash) in an area that is only periodically inundated with water.**
- **Contaminants in sediment may partition into soil solution, making them available to roots.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 2

Provide explanation: Storm flow through the drainage channels could deposit dissolved and particle-bound contamination in puddles in the channels, from which plants might take up the contamination.

Question O:

Could contaminants interact with receptors through food web transport from water and sediment?

- **The chemicals may bioconcentrate in food items.**
- **Animals may ingest contaminated food items.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 0

Provide explanation: No aquatic environment exists on the mesa top or the hill slope.

Question P:

Could contaminants interact with receptors via ingestion of water and suspended sediments?

- **If sediments are present in an area that is only periodically inundated with water, terrestrial receptors may incidentally ingest sediments.**
- **Terrestrial receptors may ingest water-borne contaminants if contaminated surface waters are used as a drinking water source.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 0

Provide explanation: No aquatic environment exists on the mesa top or the hill slope.

Question Q:

Could contaminants interact with receptors through dermal contact with water and sediment?

- **If sediments are present in an area that is only periodically inundated with water, terrestrial species may be dermally exposed during dry periods.**
- **Terrestrial organisms may be dermally exposed to water-borne contaminants as a result of wading or swimming in contaminated waters.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 0

Provide explanation: No aquatic environment exists on the mesa top or the hill slope.

Question R:

Could contaminants interact with plants or animals through external irradiation?

- **External irradiation effects are most relevant for gamma emitting radionuclides.**
- **Burial of contamination attenuates radiological exposure.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 0

Terrestrial Animals: 0

Provide explanation: No aquatic habitat exists on the mesa top or the hill slope.

Question S:

Could contaminants bioconcentrate in free floating aquatic, attached aquatic plants, or emergent vegetation?

- **Aquatic plants are in direct contact with water.**
- **Contaminants in sediment may partition into pore water, making them available to submerged roots.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Aquatic Plants/Emergent Vegetation: 0

Provide explanation: No aquatic environment exists on the mesa top or the hill slope

Question T:

Could contaminants bioconcentrate in sedimentary or water column organisms?

- **Aquatic receptors may actively or incidentally ingest sediment while foraging.**
- **Aquatic receptors may be directly exposed to contaminated sediments or may be exposed to contaminants through osmotic exchange, respiration, or ventilation of sediment pore waters.**
- **Aquatic receptors may be exposed through osmotic exchange, respiration, or ventilation of surface waters.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Aquatic Animals: 0

Provide explanation: No aquatic environment exists on the mesa top or the hill slope

Question U:

Could contaminants bioaccumulate in sedimentary or water column organisms?

- **Lipophillic organic contaminants and some metals may concentrate in an organism's tissues**
- **Ingestion of contaminated food items may result in contaminant bioaccumulation through the food web.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Aquatic Animals: 0

Provide explanation: No aquatic environment exists on the mesa top or the hill slope

Question V:

Could contaminants interact with aquatic plants or animals through external irradiation?

- **External irradiation effects are most relevant for gamma emitting radionuclides.**
- **The water column acts to absorb radiation, thus external irradiation is typically more important for sediment dwelling organisms.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Aquatic Plants: 0

Aquatic Animals: 0

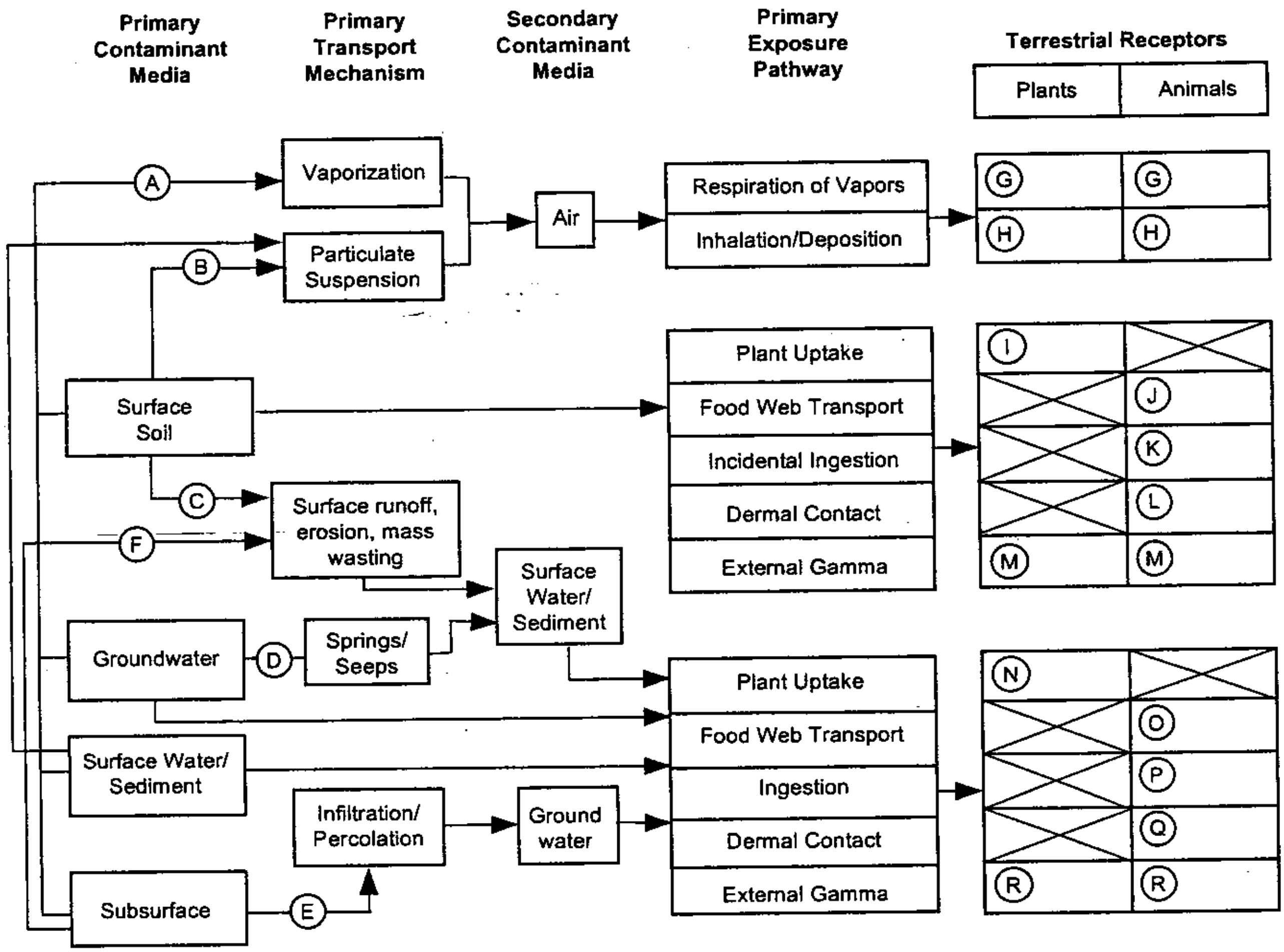
Provide explanation: No aquatic environment exists on the mesa top or the hill slope

Ecological Scoping Checklist

Terrestrial Receptors

Ecological Pathways Conceptual Exposure Model

NOTE:
Letters in circles refer to questions on the Scoping Checklist



Signatures and certifications:

Checklist completed by (provide name, organization and phone number):

Name (printed): James Markwiese, revised by Kirby Olson

Name (signature):

Organization: Neptune and Company

Phone number: 505-662-0707 (ext. 24)

Date completed: 28 September 01, revised August 27, 2003

Verification by a member of ER Project Ecological Risk Task Team (provide name, organization and phone number):

Name (printed): Richard Mirenda

Name (signature):

Organization: RRES

Phone number: 505/665-6953

F-3.2 SWMUs 0-030(b,m) (septic tanks, drainlines, leachfield, and outfall)

F-3.2.1 Part A—Scoping Meeting Documentation

Site ID	6th Street Leachfield and Septic Tank SWMUs 0-030(b,m)
Form of site releases (solid, liquid, vapor). Describe all relevant known or suspected mechanisms of release (spills, dumping, material disposal, outfall, explosive testing, etc.) and describe potential areas of release. Reference locations on a map as appropriate.	Solid and liquid releases include VOCs, SVOCs, pesticides, PCBs, metals, radionuclides. SWMU 0-030(b) consists of soil contamination within and around two diversion boxes that directed sewage flow to two septic tanks. These tanks served 6th St Warehouses 1–4, an office building, the cold storage plant, and the eastern portion of TA-1. The diversion boxes are located adjacent to 6th Street, between the street and Warehouse 1. In addition, SWMU 0-030(b) has contamination associated with drainlines and outfalls. SWMU 0-030(m) consisted of a single wooden septic tank with VCP drainlines that received excess liquids of unknown chemical content from trash containers prior to incineration of the municipal and sanitary waste. The outlet ran east along the mesa edge for ca. 120 m before connecting to the outfall line from 0-030(b) prior to discharging into Los Alamos Canyon.
List of Primary Impacted Media **(Indicate all that apply.)**	**Surface soil –** While contamination originally limited to subsurface, at least 0-030(b) has experienced significant recontouring activities following relocation of the former trailer park. This could bring previously buried waste to the surface (e.g., numerous scraps of previously buried VCP observed throughout site). Discharge from outfalls could also have impacted surface soils. **Surface water/sediment –** NA **Subsurface –** Septic tank and leachfield releases occurred in subsurface. **Groundwater –** NA **Other, explain –**
FIMAD vegetation class based on ArcView vegetation coverage **(Indicate all that apply.)**	**Water** – NA **Bare Ground/Unvegetated** –YES (tuff) **Spruce/fir/aspen/mixed conifer** – NA **Ponderosa pine** –YES **Piñon juniper/juniper savannah** – NA **Grassland/shrubland** – YES **Developed** – YES
Is T&E Habitat Present? **If applicable, list species known or suspected to use the site for breeding or foraging.**	SWMU location information was intersected with T&E species habitat using GIS. The SWMUs are in the vicinity of potential Mexican Spotted Owl nesting habitat, which is approximately 0 feet to 450 feet away from the potential habitat in Los Alamos Canyon and approximately 1,000 feet to 1,800 feet from the potential habitat in Pueblo Canyon. The SWMUs are entirely within an area in which the Mexican Spotted Owl can be conservatively assumed to forage at a relatively high frequency.
Provide list, of Neighboring/ Contiguous/ Upgradient sites, includes a brief summary of COPCs and the form of releases for relevant sites and reference a map as appropriate. **(Use this information to evaluate the need to aggregate sites for screening.)**	Sites are located south of the intersection between DP Road and Trinity Drive on the top and upper slopes of the East Mesa north of Los Alamos Canyon. The Canyon defines the southern boundary and DP Road defines the northern boundary. Surface contamination from DP Road may impact northern boundary of site. SWMUs 0-030(b,m) are aggregated because of their linkage through common drainline piping. These sites adjoin the 0-004, 0-30(l), 0-033(b) aggregate. SWMUs 0-033(a) and 0-030(a) are upgradient of the SWMUs considered here.

Surface Water Erosion Potential Information **Summarize information from SOP 2.01, including the run-off subscore (maximum of 46); terminal point of surface water transport; slope; and surface water runon sources.**	The SWMUs have a combined erosion matrix potential score of 17.5 each. These scores indicate a low potential for erosion. There is evidence of runoff discharging but no evidence of visible erosion at the sites. The surface water runoff subscores are both 6.9. Surface water terminates by infiltration at the western edge of LA Canyon.
Other Scoping Meeting Notes	None

F-3.2.2 Part B—Site Visit Documentation

Site ID	6th Street Leachfield SWMUs: 0-030(b), 0-030(m)
Date of Site Visit	21 September 2001; May 21, 2003
Site Visit Conducted by	Jim Markwiese, Tracy McFarland. Ralph Perona, John Tauxe, Randall Ryti 2nd site visit: Kirby Olson, Tracy McFarland, Kristen Lockhart

Receptor Information:

Estimate cover	**Relative vegetative cover (high, medium, low, none)** = high **Relative wetland cover (high, medium, low, none)** = none **Relative structures/asphalt, etc. cover (high, medium, low, none)** = low
Field notes on the FIMAD vegetation class to assist in ground-truthing the ArcView information	The mesa top area of SWMUs 0-030(b) and 0-030(m) have undergone heavy commercial and urban development. Soils have been previously disturbed, primarily through bulldozing the leachfield [0-030(b)] and to a lesser extent through excavation and backfilling (e.g., around 0-030(m)). The area is characteristic of disturbed sites undergoing secondary succession. There is ample ground cover of forbs and grasses. Shallow soil results in scattered patches of exposed tuff
Field notes on T&E Habitat, if applicable. Consider the need for a site visit by a T&E subject matter expert to support the use of the site by T&E receptors.	NA [See comments Part A, T&E habitat]
Are ecological receptors present at the site? **(yes/no/uncertain)** **Describe the general types of receptors present at the site (terrestrial and aquatic), and make notes on the quality of habitat present at the site.**	Yes. The mesa-top soils are exposed in a few patches, in some cases down to bedrock, but they primarily support a continuous cover of grasses and forbs (chamisa, aster, mullein, sunflower). The growth is characteristic of a disturbed area undergoing secondary succession. Ponderosa pines stands and other trees surround the area. Mature trees mainly limited to periphery of leachfield. Signs of animal life on the mesa top include numerous harvester ant mounds, evidence of small mammal usage, such as abundant gopher burrowing, and rabbit scat. Deer scat observed as well.

Contaminant Transport Information:

Surface water transport **Field notes on the erosion potential, including a discussion of the terminal point of surface water transport (if applicable).**	Runoff and infiltration from rain events and snowmelt are the only aspects of surface water hydrology at these SWMUs. Surface transport from overland flow and outfalls may cause contaminants to infiltrate into subsurface.

Are there any off-site transport pathways (surface water, air, or groundwater)? **(yes/no/[✓ uncertain])** **Provide explanation**	Yes. Aeolian (wind-driven) contaminant entrainment and transport is unlikely considering extensive vegetation cover. However, surface water transport off mesa top is likely near the mesa edge. Considering depth to groundwater, contamination of groundwater unlikely.
Interim action needed to limit off-site transport? **(yes/no/uncertain)** **Provide explanation/ recommendation to project lead for IA SMDP.**	No. While offsite transport to north edge of Los Alamos Canyon is observed, there are no visible signs of erosion at the sites. Where asphalt is not present, vegetative cover is holding down the shallow soil across the majority of the area.

Ecological Effects Information:

Physical Disturbance **(Provide list of major types of disturbances, including erosion and construction activities, review historical aerial photos where appropriate.)**	The site has been substantially disturbed during extensive contouring of site and excavation and backfilling from development/removal of trailer park and prior VCAs.
Are there obvious ecological effects? **(yes/[✓ no]/uncertain)** **Provide explanation and apparent cause (e.g., contamination, physical disturbance, other).**	No. Although area has been physically disturbed, signs of stress on the mesa-top plant life are not apparent. Stressors on wildlife do not appear to be significant either as there are abundant signs of wildlife using the area.
Interim action needed to limit apparent ecological effects? **(yes/no/uncertain)** **Provide explanation and recommendations to mitigate apparent exposure pathways to project lead for IA SMDP.**	No

No Exposure/Transport Pathways:

If there are no complete exposure pathways to ecological receptors onsite and no transport pathways to offsite receptors, the remainder of the checklist should not be completed. Stop here and provide additional explanation/justification for proposing an ecological No Further Action recommendation (if needed). At a minimum, the potential for future transport should include likelihood that future construction activities could make contamination more available for exposure or transport.

This section is not applicable

Adequacy of Site Characterization:

Do existing or proposed data provide information on the nature, rate and extent of contamination? **(yes/no/uncertain)** **Provide explanation** **(Consider if the maximum value was captured by existing sample data.)**	Yes. Much of the previous sampling for both SWMUs limited to sludge within septic tanks. Several samples taken in vicinity of drainlines to document the extent of contamination associated with piping. After 2002 sampling, all areas of SWMU 0-030(b) and SWMU 0-030(m) around leachfield and piping have been adequately sampled. Inorganic, organic, and radionuclide analyses were run in all samples. Samples were collected from the surface and the subsurface, in some cases to a depth of over 11 ft bgs.
Do existing or proposed data for the site address potential transport pathways of site contamination? **(yes/no/uncertain)** **Provide explanation** **(Consider if other sites should aggregated to characterize potential ecological risk.)**	Yes. Observed drainage patterns indicate that surficial transport of site contaminants off the mesa top and into LA Canyon exist. 2002 sampling provided the additional data needed on COPCs in surface soils, including filling the previous data gap for metals in surface soil. The 2002 sampling covered both the leachfield and piping areas of the SWMUs. These two SWMUs are aggregated because they were part of s common disposal system, but they do not need to be aggregated with the other neighboring SWMUs because the other sites do not drain or discharge onto these sites.

Additional Field Notes:

Provide additional field notes on the site setting and potential ecological receptors.

Numerous examples of shattered vitrified clay pipe and cobbles were observed. Also, coal observed across surface soils. The area was leveled after relocation of trailers and this contouring significantly disturbed land. Good vegetative cover seen on second site visit, except in areas of surface exposed tuff. Numerous examples of bioturbation through gopher burrowing and ant (large harvester ant mounds) activity.

F-3.2.3 Part C—Ecological Pathways Conceptual Exposure Model

Provide answers to Questions A to V to develop the Ecological Pathways Conceptual Exposure Model

Question A:

Could soil contaminants reach receptors via vapors?

- **Volatility of the hazardous substance (volatile chemicals generally have Henry's Law constant $>10^{-5}$ atm-m^3/mol and molecular weight <200 g/mol).**

Answer (likely/unlikely/uncertain): unlikely

Provide explanation:

The results of the 2002 sampling did detect some VOCs (toluene, tetrachloroethene) in the subsurface (below 2 ft bgs) at SWMU 0-030(b); this confirmed the results of earlier sampling. These detected concentrations were primarily at or below 0.006 mg/kg and are unlikely to result in significant exposure of ecological receptors at the site. Many of the detections were fairly deep subsurface as well. No VOCs were detected at SWMU 0-030(m).

Question B:

Could the soil contaminants reach receptors through fugitive dust carried in air?

- **Soil contamination would have to be on the actual surface of the soil to become available for dust.**
- **In the case of dust exposures to burrowing animals, the contamination would have to occur in the depth interval where these burrows occur.**

Answer (likely/unlikely/uncertain): likely

Provide explanation: Extensive ground cover would prohibit air entrainment of contamination on particulates on the mesa top. But signs of burrowing activity (e.g., tunnels) observed. Persistent organics (pesticides) detected in subsurface. Dust inhalation could be a likely pathway for fossorial mammals.

Question C:

Can contaminated soil be transported to aquatic ecological communities (use SOP 2.01 run-off score and terminal point of surface water runoff to help answer this question)?

- **If the SOP 2.01 run-off score* for each PRS included in the site is equal to zero, this suggests that erosion at the site is not a transport pathway. (* note that the runoff score is not the entire erosion potential score, rather it is a subtotal of this score with a maximum value of 46 points).**
- **If erosion is a transport pathway, evaluate the terminal point to see if aquatic receptors could be affected by contamination from this site.**

Answer (likely/unlikely/uncertain): unlikely

Provide explanation:

Contaminated soil could be transported off the mesa top (See response to Part A, Surface Water Erosion Potential Information). There is no aquatic habitat on the mesa top or the hill slopes. Potential impact of aquatic habitat in Los Alamos Canyon is unlikely considering the distance from the mesa top to the ephemeral stream in the Canyon.

Question D:

Is contaminated groundwater potentially available to biological receptors through seeps or springs or shallow groundwater?

Known or suspected presence of contaminants in groundwater.

- **The potential for contaminants to migrate via groundwater and discharge into habitats and/or surface waters.**
- **Contaminants may be taken up by terrestrial and rooted aquatic plants whose roots are in contact with groundwater present within the root zone (~1 m depth).**

- **Terrestrial wildlife receptors generally will not contact groundwater unless it is discharged to the surface.**

Answer (likely/unlikely/uncertain): unlikely

Provide explanation:

Groundwater contamination is unlikely; there are no seeps or springs at the site, or any perched or alluvial groundwater. Mesa-top surface transport into the groundwater system within Los Alamos Canyon is also unlikely. Off-site surface water transport into LA Canyon is observed, but it is unlikely to affect ground water considering the distance to the ephemeral stream in LA Canyon.

Question E:

Is infiltration/percolation from contaminated subsurface material a viable transport and exposure pathway?

- **Suspected ability of contaminants to migrate to groundwater.**
- **The potential for contaminants to migrate via groundwater and discharge into habitats and/or surface waters.**
- **Contaminants may be taken up by terrestrial and rooted aquatic plants whose roots are in contact with groundwater present within the root zone (~1 m depth).**
- **Terrestrial wildlife receptors generally will not contact groundwater unless it is discharged to the surface.**

Answer (likely/unlikely/uncertain): Provide explanation: unlikely

Depth to groundwater is over 1200 feet from mesa top surface and no hydraulic driver exists to push contamination that far into the subsurface. There is also no perched or alluvial groundwater beneath the site.

Question F:

Might erosion or mass wasting events be a potential release mechanism for contaminants from subsurface materials or perched aquifers to the surface?

- **This question is only applicable to release sites located on or near the mesa edge.**
- **Consider the erodibility of surficial material and the geologic processes of canyon/mesa edges.**

Answer (likely/unlikely/uncertain): unlikely

Provide explanation:

Vegetative cover is present in areas where asphalt cover is lacking. Although water may flow over the sites, erosion was not observed and SWMUs are some distance (ca. 25 ft) from cliff face. Therefore mass wasting is not an issue for these SWMUs. Also, no perched or alluvial groundwater exists beneath the mesa surface.

Question G:

Could airborne contaminants interact with receptors through respiration of vapors?

- **Contaminants must be present as volatiles in the air.**
- **Consider the importance of inhalation of vapors for burrowing animals.**
- **Foliar uptake of organic vapors is typically not a significant exposure pathway.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 1

Terrestrial Animals: 1

Provide explanation:

The results of the 2002 sampling did detect some VOCs (toluene, tetrachloroethene) in the subsurface (below 2 ft bgs) at SWMU 0-030(b); this confirmed the results of earlier sampling. These detected concentrations were primarily at or below 0.006 mg/kg and are unlikely to result in significant exposure of ecological receptors at the site. Many of the detections were fairly deep subsurface as well. No VOCs were detected at SWMU 0-030(m). Volatiles could represent an exposure pathway for burrowing animals but the contribution of inhalation to exposure is considerably (order of magnitude or more) less important than other routes (e.g., soil ingestion).

Question H:

Could airborne contaminants interact with plants through deposition of particulates or with animals through inhalation of fugitive dust?

- **Contaminants must be present as particulates in the air or as dust for this exposure pathway to be complete.**
- **Exposure via inhalation of fugitive dust is particularly applicable to ground-dwelling species that would be exposed to dust disturbed by their foraging or burrowing activities or by wind movement.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 2

Terrestrial Animals: 2

Provide explanation: Ground cover should minimize entrainment of dust particles and pathway to above-ground receptors is likely minor. Dust could, however, be a pathway for fossorial animals.

Question I:

Could contaminants interact with plants through root uptake or rain splash from surficial soils?

- **Contaminants in bulk soil may partition into soil solution, making them available to roots.**
- **Exposure of terrestrial plants to contaminants present in particulates deposited on leaf and stem surfaces by rain striking contaminated soils (i.e., rain splash).**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 3

Provide explanation: Root uptake could be an important exposure mechanism. For example, deep-rooted chamisa occurs which could represent a means of subsurface material being brought to the surface. Also surface metals can be taken up by more shallow-rooted plants. Results of the 2002 sampling indicated metals, radionuclides, pesticides, and PAHs were present at the site at elevated concentrations. These COPCs could be taken up through plant roots, resulting in exposure through the food chain to wildlife receptors.

Question J:

Could contaminants interact with receptors through food web transport from surficial soils?

- **The chemicals may bioaccumulate in animals.**
- **Animals may ingest contaminated food items.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 3

Provide explanation: Several COPCs detected during the 2002 sampling effort (e.g., benzo(a)anthracene, benzo(a)pyrene, chrysene, DDE, and DDT) are known bioaccumulators. The presence of bioaccumulators in surficial soils bioaccumulation of contaminants through terrestrial pathways possible.

Question K:

Could contaminants interact with receptors via incidental ingestion of surficial soils?

- **Incidental ingestion of contaminated soil could occur while animals grub for food resident in the soil, feed on plant matter covered with contaminated soil or while grooming themselves clean of soil.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 3

Provide explanation: Contaminants could interact with receptors via incidental ingestion of surficial soils, and through grooming themselves clean of soil. The 2002 sampling effort detected metals, radionuclides, PAHs, pesticides, and PCBs. All of these COPCs could be taken up by receptors through incidental ingestion of soil. Some of the COPCs were found in fairly deep subsurface samples where exposure is less likely, but some COPCs were found in surface or shallow subsurface soil.

Question L:

Could contaminants interact with receptors through dermal contact with surficial soils?

- **Significant exposure via dermal contact would generally be limited to organic contaminants that are lipophilic and can cross epidermal barriers.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 2

Provide explanation: Measured analytes consisted of organic contaminants that are lipophilic and can cross epidermal barriers. This makes exposure via dermal contact via surficial soils a pathway. Even so, fur and feathers act as barriers to dermal uptake and this is less important than other pathways like ingestion. While the contamination extent was originally confined to the subsurface, tilling of the leach field could have distributed buried contaminated material to the surface.

Question M:

Could contaminants interact with plants or animals through external irradiation?

- **External irradiation effects are most relevant for gamma emitting radionuclides.**
- **Burial of contamination attenuates radiological exposure.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 1

Terrestrial Animals: 1

Provide explanation: In 2002, only two samples contained detectable levels of cesium-137. These detections were at >7ft bgs; it is unlikely that receptors will contact these concentrations of this gamma-emitting radionulcide.

Question N:

Could contaminants interact with plants through direct uptake from water and sediment or sediment rain splash?

- **Contaminants may be taken-up by terrestrial plants whose roots are in contact with surface waters.**

- **Terrestrial plants may be exposed to particulates deposited on leaf and stem surfaces by rain striking contaminated sediments (i.e., rain splash) in an area that is only periodically inundated with water.**
- **Contaminants in sediment may partition into soil solution, making them available to roots.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 0

Provide explanation: There is no surface water or surface water channel on this site. Rain splash of contaminated soil onto leaves is unlikely given the vegetated nature of the site.

Question O:

Could contaminants interact with receptors through food web transport from water and sediment?

- **The chemicals may bioconcentrate in food items.**
- **Animals may ingest contaminated food items.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 0

Provide explanation: No aquatic environment exists on the mesa top or the hill slope.

Question P:

Could contaminants interact with receptors via ingestion of water and suspended sediments?

- **If sediments are present in an area that is only periodically inundated with water, terrestrial receptors may incidentally ingest sediments.**
- **Terrestrial receptors may ingest water-borne contaminants if contaminated surface waters are used as a drinking water source.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 0

Provide explanation: No aquatic environment exists on the mesa top or the hill slope.

Question Q:

Could contaminants interact with receptors through dermal contact with water and sediment?

- **If sediments are present in an area that is only periodically inundated with water, terrestrial species may be dermally exposed during dry periods.**
- **Terrestrial organisms may be dermally exposed to water-borne contaminants as a result of wading or swimming in contaminated waters.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 0

Provide explanation: No aquatic environment exists on the mesa top or the hill slope.

Question R:

Could contaminants interact with plants or animals through external irradiation?

- **External irradiation effects are most relevant for gamma emitting radionuclides.**
- **Burial of contamination attenuates radiological exposure.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 0

Terrestrial Animals: 0

Provide explanation: No aquatic environment exists on the mesa top or the hill slope.

Question S:

Could contaminants bioconcentrate in free floating aquatic, attached aquatic plants, or emergent vegetation?

- **Aquatic plants are in direct contact with water.**
- **Contaminants in sediment may partition into pore water, making them available to submerged roots.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Aquatic Plants/Emergent Vegetation: 0

Provide explanation: No aquatic environment exists on the mesa top or the hill slope.

Question T:

Could contaminants bioconcentrate in sedimentary or water column organisms?

- **Aquatic receptors may actively or incidentally ingest sediment while foraging.**
- **Aquatic receptors may be directly exposed to contaminated sediments or may be exposed to contaminants through osmotic exchange, respiration, or ventilation of sediment pore waters.**
- **Aquatic receptors may be exposed through osmotic exchange, respiration, or ventilation of surface waters.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Aquatic Animals: 0

Provide explanation: No aquatic environment exists on the mesa top or the hill slope.

Question U:

Could contaminants bioaccumulate in sedimentary or water column organisms?

- **Lipophillic organic contaminants and some metals may concentrate in an organism's tissues**
- **Ingestion of contaminated food items may result in contaminant bioaccumulation through the food web.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Aquatic Animals: 0

Provide explanation: No aquatic environment exists on the mesa top or the hill slope

Question V:

Could contaminants interact with aquatic plants or animals through external irradiation?

- **External irradiation effects are most relevant for gamma emitting radionuclides.**
- **The water column acts to absorb radiation, thus external irradiation is typically more important for sediment dwelling organisms.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

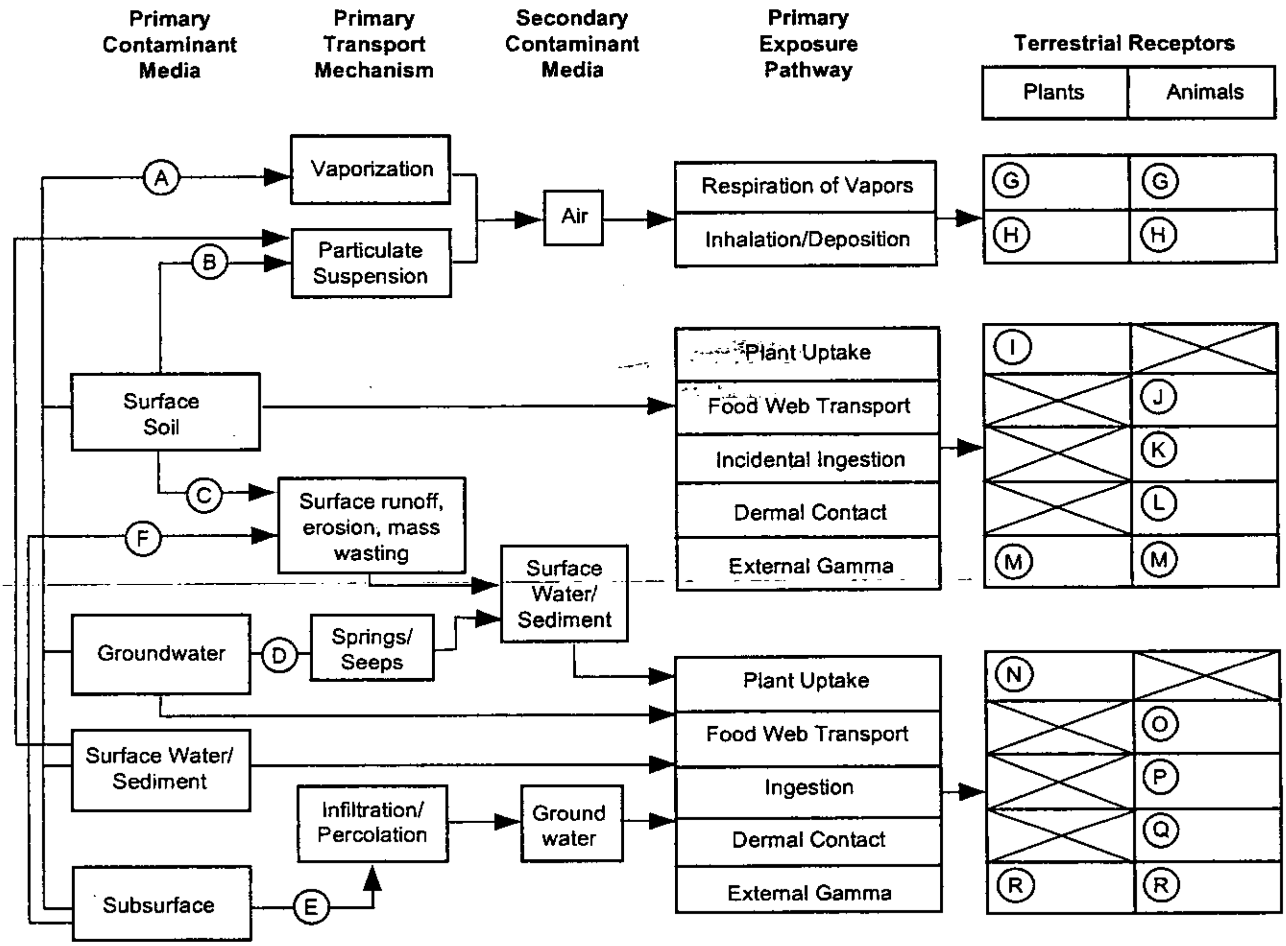
Aquatic Plants: 0

Aquatic Animals: 0

Provide explanation: No aquatic environment exists on the mesa top or the hill slope

Ecological Scoping Checklist
Terrestrial Receptors
Ecological Pathways Conceptual Exposure Model

NOTE:
Letters in circles
refer to questions
on the Scoping
Checklist



Signatures and certifications:

Checklist completed by (provide name, organization and phone number):

Name (printed): Jim Markwiese, updated by Kirby Olson

Name (signature):

Organization: Neptune and Company

Phone number: 505-662-0707 (ext. 22)

Date completed: 28 September 01; August 27, 2003

Verification by a member of ER Project Ecological Risk Task Team (provide name, organization and phone number):

Name (printed): Richard Mirenda

Name (signature):

Organization: RRES

Phone number: 505/665-6953

F-3.3 AOCs 0-029(a,b,c) (PCB transformer sites)

F-3.3.1 Part A—Scoping Meeting Documentation

Site ID	AOCs 0-029(a, b, and c)
Form of site releases (solid, liquid, vapor). Describe all relevant known or suspected mechanisms of release (spills, dumping, material disposal, outfall, explosive testing, etc.) and describe potential areas of release. Reference locations on a map as appropriate.	Liquid wastes limited to releases from transformers containing PCB-bearing oil. The transformers were located on power poles used to supply electricity to the ground water production wells associated with the AOCs. Leaked oil would have primarily impacted area directly below transformers. Distance to stream channels from the sites is 100 to 250 ft.
List of Primary Impacted Media **(Indicate all that apply.)**	**Surface soil** –PCB-oil leaks may have potentially impacted surface soils. **SURFACE WATER/SEDIMENT** – NA **Subsurface** – NA **Groundwater** – NA **Other, explain** – NA.
FIMAD vegetation class based on ArcView vegetation coverage **(Indicate all that apply.)**	**Water** – NA **Bare Ground/Unvegetated** –NA **Spruce/fir/aspen/mixed conifer** – NA **Ponderosa pine** –NA **Piñon juniper/juniper savannah** – YES (periphery of site) **Grassland/shrubland** – YES **Developed** – NA
Is T&E Habitat Present? **If applicable, list species known or suspected to use the site for breeding or foraging.**	AOC location information was intersected with T&E species habitat using GIS. AOCs 0-029 (a and b) are not in the vicinity of any potential T&E species habitat. AOC 0-029(c) is in the vicinity of potential Mexican Spotted Owl nesting habitat, located approximately 1 mile away. The Mexican Spotted Owl and the bald eagle can be conservatively assumed to forage at very low frequency at AOCs 0-029 (a and b). The Mexican Spotted Owl can be conservatively assumed to forage at a moderate frequency at AOC 0-029(c).
Provide list, of Neighboring/ Contiguous/ Upgradient sites, includes a brief summary of COPCs and the form of releases for relevant sites and reference a map as appropriate. **(Use this information to evaluate the need to aggregate sites for screening.)**	AOCs 0-029 (a and b) are located adjacent to the intermittent stream bed in Los Alamos Canyon near Totavi while AOC 0-029 (c) is located in the Santa Fe National Forest in Guaje Canyon approximately 2 miles directly north. Despite the spatial scale separating AOCs 0-029 (a and b) from AOC 0-029 (c), these sites are aggregated because of their commonality in the nature of site contamination; that is PCB-bearing oil leaked from transformers.
Surface Water Erosion Potential Information **Summarize information from SOP 2.01, including the run-off subscore (maximum of 46); terminal point of surface water transport; slope; and surface water runon sources.**	AOC 0-029(a) has an erosion matrix score of 38.7 (out of 100). There is visible evidence of discharge at the site and factors (i.e., the runoff subscore) affecting surface water runoff combined account for 17.9 points. AOC 0-029(b) has an erosion matrix score of 42.8 with a runoff subscore of 24. AOC 0-029(c) has an erosion matrix score of 31.8 with a runoff subscore of 0. AOC 0-029(a) is 100ft from the stream channel. AOC 0-029(b) is 110 ft from the stream channel. AOC 0-029(c) is 250 ft from the streambed. All 3 AOCs are unlikely to affect surface water due to the distance to the streambed from the potentially contaminated areas.

Other Scoping Meeting Notes	The stream in Los Alamos Canyon was flowing during the site visit on 15 Jan 02. The Guaje Canyon stream bed was dry at the time of the site visit.

F-3.3.2 Part B—Site Visit Documentation

Site ID	AOCs 0-029(a, b, and c)
Date of Site Visit	15 January 2002
Site Visit Conducted by	Jim Markwiese, Tracy McFarland, Randall Ryti, Randy Johnson, Terry Rust, Gerald Martinez

Receptor Information:

Estimate cover	**Relative vegetative cover (high, medium, low, none)** = medium [AOC 0-029(c)] – high [AOCs 0-029 (a and b)] **Relative wetland cover (high, medium, low, none)** = none **Relative structures/asphalt, etc. cover (high, medium, low, none)** = low
Field notes on the FIMAD vegetation class to assist in ground-truthing the ArcView information	AOCs 0-029(a and b) had ground cover of forbs (primarily chamisa and sagebrush) and grasses. The grasses and shrubs covering the surface of 0-029(b) were disturbed (flattened by apparent vehicle traffic). The northern half of 0-029(c) is sparsely vegetated with native grasses. Pinon and juniper trees bordered the periphery of the sites.
Field notes on T&E Habitat, if applicable. Consider the need for a site visit by a T&E subject matter expert to support the use of the site by T&E receptors.	NA [See comments Part A, T&E habitat]
Are ecological receptors present at the site? **(yes/no/uncertain)** **Describe the general types of receptors present at the site (terrestrial and aquatic), and make notes on the quality of habitat present at the site.**	Yes. The soils primarily support a cover of grasses and forbs (chamisa, sagebrush). Signs of animal life on the mesa top include evidence of small mammal usage (burrows) and scat (likely coyote).

Contaminant Transport Information:

Surface water transport **Field notes on the erosion potential, including a discussion of the terminal point of surface water transport (if applicable).**	Signs of runoff from rain events and/or snowmelt were evident at the AOC 0-029(a). Surface transport from overland flow off Highway 502 may cause potential contaminants to become concentrated in drainages and may drive contaminants into subsurface soils/tuff at 0-029(a and b). Signs of runoff from 0-029(b and c) were not evident.
Are there any off-site transport pathways (surface water, air, or groundwater)? **(yes/no/uncertain)** **Provide explanation**	No. Distance to streambed from contamination in AOCs and concentration of PCBs found at site during 2002 sampling make off-site transport unlikely. Aeolian (wind-driven) contaminant entrainment and transport is unlikely considering fairly developed vegetation cover and low volatility of PCBs.

Interim action needed to limit off-site transport? **(yes/no/uncertain)** **Provide explanation/ recommendation to project lead for IA SMDP.**	No. Interim action not necessary at AOCs 0-029(b and c) as there was no evidence of runoff from the sites and fairly low or no potential for surface erosion. There was evidence of a rill created under the transformer at 0-029(a) at the northeast corner that flowed across the eastern perimeter of the AOC. Low concentrations of PCBs seen in 2002 sampling do not indicate need for any interim action

Ecological Effects Information:

Physical Disturbance **(Provide list of major types of disturbances, including erosion and construction activities, review historical aerial photos where appropriate.)**	AOC 0-029(c) had the most physical disturbance as evidenced by a denuded flora over approximately half of the site. The vegetation was moderately disturbed (flattened grass and forbs) at AOC 0-029(b), probably as a result of vehicle traffic. The vegetation was minimally disturbed at 0-029(a) because of the chain-link fence enclosure; disturbance that was evident resulted from the rill passing along the eastern periphery of the site.
Are there obvious ecological effects? **(yes/no/uncertain)** **Provide explanation and apparent cause (e.g., contamination, physical disturbance, other).**	No. Although two of the AOCs 0-029 (b and c) have been moderately disturbed, signs of stress on the plant life were limited to what appeared to be physical (traffic), rather than chemical, stressors. Stressors on wildlife do not appear to be significant either as there are abundant signs of wildlife using the area (e.g., evidence of burrowing activity and scat).
Interim action needed to limit apparent ecological effects? **(yes/no/uncertain)** **Provide explanation and recommendations to mitigate apparent exposure pathways to project lead for IA SMDP.**	No.

No Exposure/Transport Pathways:

If there are no complete exposure pathways to ecological receptors onsite and no transport pathways to offsite receptors, the remainder of the checklist should not be completed. Stop here and provide additional explanation/justification for proposing an ecological No Further Action recommendation (if needed). At a minimum, the potential for future transport should include likelihood that future construction activities could make contamination more available for exposure or transport.

This section is not applicable

Adequacy of Site Characterization:

Do existing or proposed data provide information on the nature, rate and extent of contamination? **(yes/no/uncertain)** **Provide explanation** **(Consider if the maximum value was captured by existing sample data.)**	No. These sites were resampled in 2002. There were detections of PCBs and pesticides (DDT/DDE/DDD, chlordane, endrin, etc) at all 3 sites. However, when individual area use factors were applied to the 95% UCL of the mean concentrations of these COPCs, none were found to be at concentrations that warranted any further investigation or action at the site.
Do existing or proposed data for the site address potential transport pathways of site contamination? **(yes/no/uncertain)** **Provide explanation** **(Consider if other sites should aggregated to characterize potential ecological risk.)**	Yes. The 2002 sampling activity adequately addressed the presence and/or areal extent of PCB contamination and pesticide contamination at these sites and did not find any off-site migration around the periphery of the AOCs.

Additional Field Notes:

Provide additional field notes on the site setting and potential ecological receptors. The sites are all located within fairly close proximity (100-250 ft) from ephemeral stream channels. AOC 0-029(a) lies closest to a stream channel in Los Alamos Canyon; that stream was actively flowing at the time of the site visit. This is the site where approximately 20 cubic yards of soil were previously removed. There was no sign of runoff from the next closest AOC to the stream in Los Alamos Canyon [AOC 0-029(b)] and there was estimated to be no erosion potential from AOC 0-029(c) to the adjacent stream in Guaje Canyon (which was dry at the time of the field visit).

F-3.3.3 Part C—Ecological Pathways Conceptual Exposure Model

Provide answers to Questions A to V to develop the Ecological Pathways Conceptual Exposure Model

Question A:

Could soil contaminants reach receptors via vapors?

- **Volatility of the hazardous substance (volatile chemicals generally have Henry's Law constant $>10^{-5}$ atm-m^3/mol and molecular weight <200 g/mol).**

Answer (likely/unlikely/uncertain): unlikely

Provide explanation:

PCBs and the pesticides detected at these sites are not volatile.

Question B:

Could the soil contaminants reach receptors through fugitive dust carried in air?

- **Soil contamination would have to be on the actual surface of the soil to become available for dust.**
- **In the case of dust exposures to burrowing animals, the contamination would have to occur in the depth interval where these burrows occur.**

Answer (likely/unlikely/uncertain): unlikely

Provide explanation: Fairly extensive ground cover would prohibit air entrainment of contamination on particulates on most of the AOCs. While roughly half of the surface of AOC 0-029(c) is exposed soil/sand, the source of potential contamination was removed 15 years ago. Sampling of these AOCs in 2002 indicated that low concentrations of PCBs and some pesticides occur in surface soil at each of the sites. Fugitive dust is likely to be a minor pathway for these COPCs compared to soil ingestion.

Question C:

Can contaminated soil be transported to aquatic ecological communities (use SOP 2.01 run-off score and terminal point of surface water runoff to help answer this question)?

- **If the SOP 2.01 run-off score* for each PRS included in the site is equal to zero, this suggests that erosion at the site is not a transport pathway. (* note that the runoff score is not the entire erosion potential score, rather it is a subtotal of this score with a maximum value of 46 points).**
- **If erosion is a transport pathway, evaluate the terminal point to see if aquatic receptors could be affected by contamination from this site.**

Answer (likely/unlikely/uncertain): unlikely

Provide explanation:

Contaminated soil could theoretically be transported from AOC 0-029(a) but this would be limited due to the 100 ft distance to the stream channel from these AOCs. Signs of surface transport (erosion) were not evident at AOC 0-029(b) which is 120 ft from the stream channel and surface transport is not expected for AOC 0-029(c) which is 250 ft from the stream channel. The concentrations of PCBs and pesticides detected in the 2002 sampling at these AOCs are low; the 95% UCL of the mean is: for AOC 0-029(a) <0.030 mg/kg for each Aroclor and <0.001 mg/kg for each pesticide except DDT (.0037 mg/kg) and methoxychlor (0.0093 mg/kg); for AOC 0-029(b) <0.002 mg/kg for each Aroclor and <0.001 mg/kg for each pesticide measured; for AOC 0-029(c) <0.04 mg/kg for each Aroclor and < 0.002 mg/kg for each pesticide except DDT (0.0038 mg/kg). These COPC concentrations would be unlikely to pose a risk to ecological receptors, particularly once they were diluted by water during transport.

Question D:

Is contaminated groundwater potentially available to biological receptors through seeps or springs or shallow groundwater?

- **Known or suspected presence of contaminants in groundwater.**
- **The potential for contaminants to migrate via groundwater and discharge into habitats and/or surface waters.**
- **Contaminants may be taken up by terrestrial and rooted aquatic plants whose roots are in contact with groundwater present within the root zone (~1 m depth).**
- **Terrestrial wildlife receptors generally will not contact groundwater unless it is discharged to the surface.**

Answer (likely/unlikely/uncertain): unlikely

Provide explanation:

The groundwater in Los Alamos Canyon near the AOCs is unlikely to be impacted because PCBs are highly insoluble and the distance to the stream channel is 100-250 ft depending on the AOC. In addition, sampling during 2002 indicated that surficial PCB and pesticide contamination was present at low concentrations: for AOC 0-029(a) <0.030 mg/kg for each Aroclor and <0.001 mg/kg for each pesticide except DDT (.0037 mg/kg) and methoxychlor (0.0093 mg/kg); for AOC 0-029(b) <0.002 mg/kg for each Aroclor and <0.001 mg/kg for each pesticide measured; for AOC 0-029(c) <0.04 mg/kg for each Aroclor and < 0.002 mg/kg for each pesticide except DDT (0.0038 mg/kg).

Question E:

Is infiltration/percolation from contaminated subsurface material a viable transport and exposure pathway?

- **Suspected ability of contaminants to migrate to groundwater.**
- **The potential for contaminants to migrate via groundwater and discharge into habitats and/or surface waters.**
- **Contaminants may be taken up by terrestrial and rooted aquatic plants whose roots are in contact with groundwater present within the root zone (~1 m depth).**
- **Terrestrial wildlife receptors generally will not contact groundwater unless it is discharged to the surface.**

Answer (likely/unlikely/uncertain): Provide explanation: unlikely

Groundwater is unlikely to have been impacted at the AOCs because PCBs and DDT have low solubility and are present at these cites at low concentrations. No springs or seeps are found in the area of these AOCs. Infiltration through surface water into groundwater is unlikely because transport of these PCBs and pesticides is unlikely (see response to Question C). Thus infiltration/percolation is unlikely to be a transport mechanism and the suspected level of contamination precludes consideration of infiltration/percolation as a significant route of exposure.

Question F:

Might erosion or mass wasting events be a potential release mechanism for contaminants from subsurface materials or perched aquifers to the surface?

- **This question is only applicable to release sites located on or near the mesa edge.**
- **Consider the erodibility of surficial material and the geologic processes of canyon/mesa edges.**

Answer (likely/unlikely/uncertain): unlikely

Provide explanation:

Vegetative cover overlies most of the soil surface at the AOCs and the reportedly low PCB levels preclude attributing much significance into erosion as a significant transport mechanism. AOC 0-029(a) is 100 ft from the stream channel, AOC 0-029(b) is 120 ft from the stream channel, and AOC 0-029(c) is 250 ft from the stream channel; therefore erosion into the stream channel is unlikely at these sites. Mass wasting is not applicable as these AOCs are located in canyon bottoms.

Question G:

Could airborne contaminants interact with receptors through respiration of vapors?

- **Contaminants must be present as volatiles in the air.**
- **Consider the importance of inhalation of vapors for burrowing animals.**
- **Foliar uptake of organic vapors is typically not a significant exposure pathway.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 0

Terrestrial Animals: 0

Provide explanation:

PCBs are nonvolatile.

Question H:

Could airborne contaminants interact with plants through deposition of particulates or with animals through inhalation of fugitive dust?

- **Contaminants must be present as particulates in the air or as dust for this exposure pathway to be complete.**
- **Exposure via inhalation of fugitive dust is particularly applicable to ground-dwelling species that would be exposed to dust disturbed by their foraging or burrowing activities or by wind movement.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 1

Terrestrial Animals: 1

Provide explanation:

Ground cover should minimize entrainment of dust particles and pathway to above-ground receptors is likely minor. Dust could, however, be a potential but probably insignificant pathway for fossorial animals (inhalation is of much less importance than other exposure routes like ingestion).

Question I:

Could contaminants interact with plants through root uptake or rain splash from surficial soils?

- **Contaminants in bulk soil may partition into soil solution, making them available to roots.**
- **Exposure of terrestrial plants to contaminants present in particulates deposited on leaf and stem surfaces by rain striking contaminated soils (i.e., rain splash).**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 1

Provide explanation:

Root uptake is an unlikely exposure pathway because hydrophobic PCBs are unlikely to enter soil pore water, thus limiting the potential for root uptake.

Question J:

Could contaminants interact with receptors through food web transport from surficial soils?

- **The chemicals may bioaccumulate in animals.**
- **Animals may ingest contaminated food items.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 3

Provide explanation:

PCBs and DDT are known bioaccumulators. The presence of bioaccumulators in surficial soils makes bioaccumulation of contaminants through terrestrial pathways possible. Exposure through the food chain and direct soil ingestion are likely to be the major potential pathways of exposure at these sites.

Question K:

Could contaminants interact with receptors via incidental ingestion of surficial soils?

- **Incidental ingestion of contaminated soil could occur while animals grub for food resident in the soil, feed on plant matter covered with contaminated soil or while grooming themselves clean of soil.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 3

Provide explanation:

Contaminants could interact with receptors via incidental ingestion of surficial soils, and through grooming themselves clean of soil. Exposure through the food chain and direct soil ingestion are likely to be the major potential pathways of exposure at these sites.

Question L:

Could contaminants interact with receptors through dermal contact with surficial soils?

- **Significant exposure via dermal contact would generally be limited to organic contaminants that are lipophilic and can cross epidermal barriers.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 1

Provide explanation:

PCBs and DDT are lipophilic and can cross epidermal barriers. This makes exposure via dermal contact via surficial soils a pathway. Even so, fur and feathers act as barriers to dermal uptake and this is less important than other pathways like ingestion. The relative low level of contamination detected in the 2002 sampling of these AOCs further limits the potential contribution of dermal contact for exposure to PCBs and DDT.

Question M:

Could contaminants interact with plants or animals through external irradiation?

- **External irradiation effects are most relevant for gamma emitting radionuclides.**
- **Burial of contamination attenuates radiological exposure.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 0

Terrestrial Animals: 0

Provide explanation:

PCBs are the only COPCs at these AOCs.

Question N:

Could contaminants interact with plants through direct uptake from water and sediment or sediment rain splash?

- **Contaminants may be taken-up by terrestrial plants whose roots are in contact with surface waters.**
- **Terrestrial plants may be exposed to particulates deposited on leaf and stem surfaces by rain striking contaminated sediments (i.e., rain splash) in an area that is only periodically inundated with water.**
- **Contaminants in sediment may partition into soil solution, making them available to roots.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 2

Provide explanation: PCBs and DDT could deposit on plants through rain splash, contributing to the overall dose ingested through the food ingestion pathway. For these COPCs, this would be expected to be a smaller contribution than accumulation through the food chain.

Question O:

Could contaminants interact with receptors through food web transport from water and sediment?

- **The chemicals may bioconcentrate in food items.**
- **Animals may ingest contaminated food items.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 1

Provide explanation: The aquatic pathways are unlikely considering that PCBs are highly insoluble and these sites have low levels of contamination located in dry areas at some distance (100-250 ft) from the ephemeral stream channel.

Question P:

Could contaminants interact with receptors via ingestion of water and suspended sediments?

- **If sediments are present in an area that is only periodically inundated with water, terrestrial receptors may incidentally ingest sediments.**

- **Terrestrial receptors may ingest water-borne contaminants if contaminated surface waters are used as a drinking water source.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 1

Provide explanation: The aquatic pathways are unlikely considering that PCBs are highly insoluble and these sites have low levels of contamination located in dry areas at some distance (100-250 ft) from the ephemeral stream channel.

Question Q:

Could contaminants interact with receptors through dermal contact with water and sediment?

- **If sediments are present in an area that is only periodically inundated with water, terrestrial species may be dermally exposed during dry periods.**
- **Terrestrial organisms may be dermally exposed to water-borne contaminants as a result of wading or swimming in contaminated waters.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 1

Provide explanation: This is not expected to be a significant pathway (see response to Question L).

Question R:

Could contaminants interact with plants or animals through external irradiation?

- **External irradiation effects are most relevant for gamma emitting radionuclides.**
- **Burial of contamination attenuates radiological exposure.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 0

Terrestrial Animals: 0

Provide explanation: The only COPCs at the AOCs are PCBs and pesticides detected in the 2002 sampling event.

Question S:

Could contaminants bioconcentrate in free floating aquatic, attached aquatic plants, or emergent vegetation?

- **Aquatic plants are in direct contact with water.**
- **Contaminants in sediment may partition into pore water, making them available to submerged roots.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Aquatic Plants/Emergent Vegetation: 0

Provide explanation: Bioaccumulating COPCs are present at the site, but aquatic plants are not due to the ephemeral nature of the streams at these sites.

Question T:

Could contaminants bioconcentrate in sedimentary or water column organisms?

- **Aquatic receptors may actively or incidentally ingest sediment while foraging.**
- **Aquatic receptors may be directly exposed to contaminated sediments or may be exposed to contaminants through osmotic exchange, respiration, or ventilation of sediment pore waters.**
- **Aquatic receptors may be exposed through osmotic exchange, respiration, or ventilation of surface waters.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Aquatic Animals: 0

Provide explanation: Aquatic communities are not present at these sites due to the ephemeral nature of the stream at these sites.

Question U:

Could contaminants bioaccumulate in sedimentary or water column organisms?

- **Lipophillic organic contaminants and some metals may concentrate in an organism's tissues**
- **Ingestion of contaminated food items may result in contaminant bioaccumulation through the food web.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Aquatic Animals: 0

Provide explanation: Aquatic communities are not present at these sites due to the ephemeral nature of the stream at these sites.

<u>Question V:</u>

Could contaminants interact with aquatic plants or animals through external irradiation?

- **External irradiation effects are most relevant for gamma emitting radionuclides.**
- **The water column acts to absorb radiation, thus external irradiation is typically more important for sediment dwelling organisms.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

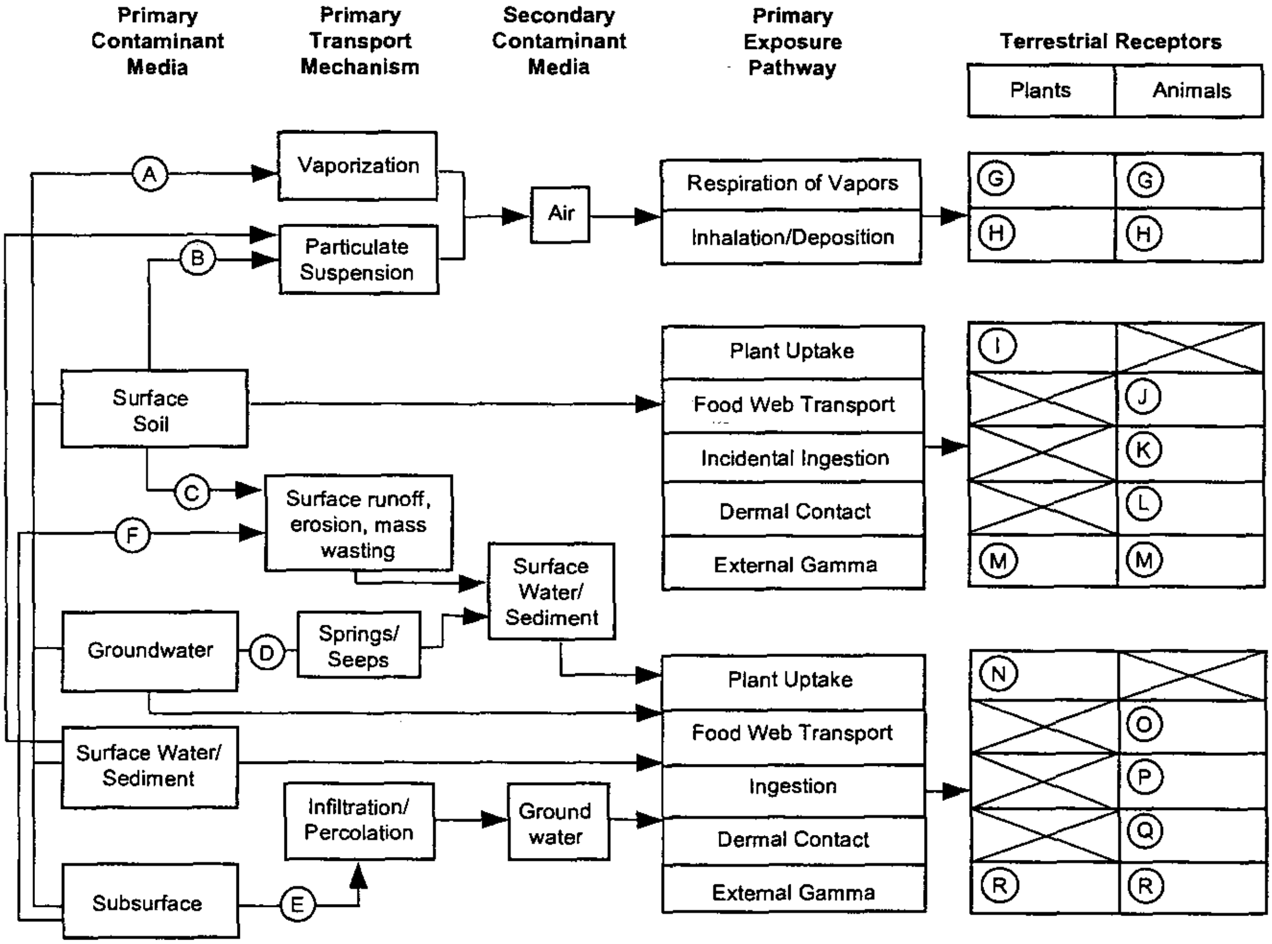
Aquatic Plants: 0

Aquatic Animals: 0

Provide explanation: PCBs and pesticides are the only COPCs detected at these sites during the 2002 sampling.

Ecological Scoping Checklist
Terrestrial Receptors
Ecological Pathways Conceptual Exposure Model

NOTE:
Letters in circles refer to questions on the Scoping Checklist



Signatures and certifications:

Checklist completed by (provide name, organization and phone number):

Name (printed): Jim Markwiese, revised by Kirby Olson

Name (signature):

Organization: Neptune and Company

Phone number: 505-662-0707 (ext. 22)

Date completed: 18 January 2002; revised 27 August 2003

Verification by a member of ER Project Ecological Risk Task Team (provide name, organization and phone number):

Name (printed): Richard Mirenda

Name (signature):

Organization: RRES

Phone number: 505/665-6953

F-3.4 SWMU 21-021-99 (mesa top)

A separate ecological scoping checklist was not filled out for SWMU 21-021-99. This area was not used as a process area or previously disturbed. This area may have been impacted solely by deposition of air emissions. Surface features, habitats, and wildlife present are the same as the undeveloped areas of the AOCs described in the previous checklists.

F-4.0 RISK ASSESSMENT CALCULATIONS

F-4.1 Calculation of 95% UCL

For many of the COPCs, there is sufficient sample coverage to calculate representative concentrations of COPCs instead of using the maximum concentration of the anlaytes. Representative concentrations used in this assessment are 95% UCLs of the mean concentration, unless the number of detected concentrations in the data set was insufficient to calculate a 95% UCL of the mean value, then the maximum concentration was used. The 95% UCLs of the mean were calculated following EPA guidance "Calculating Exposure Point Concentrations at Hazardous Waste Sites" (EPA 2002, 73593). The UCLs were calculated using normal, lognormal, or nonparametric (Chebyshev's) tests depending on which distribution provided the best fit to the data for that COPC.

Nondetects in the data set were included in the calculation for the 95% UCL. One-half the detection limit was used in place of the nondetected value.

F-4.2 Environmental Fate

The environmental fate of the inorganic chemicals is described in detail in Section F-4.2.1. The environmental fate of the organic chemicals and the radionuclides is described in detail in Sections 2.4.4.2, 3.4.4.2, 4.4.4.2, and 6.4.4.2 and will not be repeated here.

F-4.2.1 Inorganic Chemicals

The following inorganic COPCs were retained from the background comparison at some or all of the SWMUs/AOCs: aluminum, antimony, arsenic, barium, cadmium, cobalt, copper, lead, lithium, mercury, nickel, selenium, silver, strontium, uranium, and zinc.

Information presented here on the fate and transport of inorganic chemicals in the soil is from Caserett et al. (1986, 58204), Brady (1974, 57672), Budavari et al. (1996, 58033) and from toxicological profiles published by the Agency for Toxic Substances and Disease Registry (ATSDR). These profiles are contained in the CD-ROM distributed by ATSDR (ATSDR 1997, 56531).

The fate and distribution of chemicals in the environment are determined by several variables that can interact in numerous ways, e.g., physiochemical properties of the individual chemical and the physical transport systems such as rainwater or snowmelt runoff. The physicochemical properties, such as water solubility, soils adsorption, and volatilization, are all important in determining the routes by which a metal may enter the environment and be distributed. In general, metallic cations are quite soluble in soil, especially if the soil is not too acidic (Brady 1974, 57672). Adsorption to particulate matter is a major mechanism by which chemicals are removed from solution and is dependent upon the type of soil. Volatilization from soil and water is a function of the vapor pressure of a chemical, as well as temperature, degree of adsorption, soil properties, and soil water content (Caserett et al. 1986, 58204, pp. 827–828). Information about the inorganic chemicals that have been detected at the SWMUs/AOCs in this report (aluminum, antimony, arsenic, barium, cadmium, cobalt, copper, lead, lithium, mercury, nickel, selenium, silver, strontium, uranium, and zinc) is presented below.

Aluminum

Prediction of chemical valence states: Aluminum has a valence of +3.

Affinity for soil water, and air. Aluminum occurs widely in nature in silicates such as micas and feldspars, complexed with sodium and fluoride as cryolite, and in bauxite rock, which is composed of hydrous aluminum oxides, aluminum hydroxides, and impurities such as free silica. Because of its reactivity, aluminum is not found as a free metal in nature. Because aluminum has only one oxidation state (+3), its behavior or fate and transport in the environment depend upon its coordination chemistry and the characteristics of the local environmental system. Aluminum partitions between solid and liquid phases by reacting and complexing with water molecules and electron-rich anions such as chloride, fluoride, sulfate, nitrate, phosphate, and negatively charged functional groups on humic materials and clay. Depending on the degree of aluminum saturation on the clay surface, clays may act either as a sink or a source for soluble aluminum (ATSDR 1997, 56531).

Potential for uptake: Aluminum often is taken up and concentrated in root tissue. In subalpine ecosystems, the large root biomass of the Douglas fir, Abies ambilies, takes up aluminum and immobilizes it, preventing large accumulation in aboveground tissue. It is unclear to what extent aluminum is taken up into root food crops and leafy vegetables. An uptake factor (concentration of aluminum in the plant/concentration of aluminum in the soil) of 0.004 for leafy vegetables and 0.00065 for reproductive plant parts (including roots) has been reported, but the pH and plant species from which these uptake factors were derived are unclear. Based upon these values, however, aluminum is not bioconcentrated in plants, i.e., the concentration in soil is greater than the concentration in the plant tissue (ATSDR 1997, 56531).

Antimony and Arsenic

Some of antimony's chemical traits are similar to arsenic, such as a tendency to volatilize from water (Hem 1985, 67310). Information regarding the fate and transport of antimony is not readily available. Therefore, the following information pertains to arsenic but is also applicable to antimony.

Prediction of chemical valence states: Antimony and arsenic occur in the +3 and +5 oxidation states.

Affinity for soil, water, and air. Arsenic is stable in dry air and insoluble in water. Therefore volatilization of arsenic into the air and transport of arsenic as a dissolved component of water is not expected to be a concern (Budaveri 1996, 58033, p. 832). However, transport and partitioning of arsenic in water depends upon the chemical form (oxidation state and counter ion) of the arsenic and interactions with other materials present. Arsenic may be transported by leaching into rainfall or snowmelt. However, because many arsenic compounds tend to adsorb to soils or sediments, leaching usually results in transportation in soil over short distances only. Sediment-bound arsenic may be released back into the water by chemical or biological interconversions of arsenic species (ATSDR 1997, 56531).

Potential for uptake: Bioconcentration of arsenic occurs in aquatic organisms, primarily in algae and lower invertebrates. Bioconcentration factors (BCF) measured in freshwater invertebrates and fish for several arsenic compounds ranged from 0 to 17. Biomagnification in aquatic food chains does not appear to be significant, although some fish and invertebrates contain high levels of arsenic compounds. Terrestrial plants may accumulate arsenic by root uptake from the soil (ATSDR 1997, 56531).

Barium

Prediction of chemical valence states. Barium occurs in the +2 oxidation state.

Affinity for soil water, and air. Barium reacts with metal oxides and hydroxides in soil and is subsequently adsorbed onto soil particulates. Barium is also adsorbed onto soil and subsoil through electrostatic interactions. The cation exchange capacity of the sorbent largely controls the retention of barium in soil. Barium is adsorbed strongly by clay minerals. In general, the solubility of barium compounds increases with decreasing pH. Barium does not hydrolyze appreciably except in highly alkaline environments (i.e., at pH levels greater than or equal to 10). Barium also forms complexes with natural organics in water (e.g., fatty acids in acidic landfill leachates) to a limited extent. Elemental barium is oxidized readily in moist air. The residence time of barium in the atmosphere may be several days, depending on the size of the particulate formed, the chemical nature of the particulate, and environmental factors such as rainfall.

Potential for uptake. Barium added to soils (e.g., from the land farming of waste drilling muds) may either be taken up by vegetation or transported through soil with precipitation. Relative to the amount of barium found in soils, little is bioconcentrated by plants. However, this transport pathway has not been comprehensively studied. Barium was found to bioconcentrate in marine plants by a factor of 1000 times the level present in water (ATSDR 1997, 56531).

Cadmium

Prediction of chemical valence states. Cadmium occurs in the +2 oxidation state (ATSDR 1997, 56531).

Affinity for soil water, and air. Cadmium is not usually present in the environment as a pure metal, but as a mineral combined with other elements such as oxygen (cadmium oxide), chlorine (cadmium chloride), or sulfur (cadmium sulfate, cadmium sulfide). Cadmium is most often present in nature as complex oxides, sulfides, and carbonates in zinc, lead, and copper ores. It is rarely present in large quantities as the chlorides and sulfates. These different forms of cadmium compounds are solids that dissolve in water to varying degrees. The chlorides and sulfates are the forms that most easily dissolve in water (ATSDR 1997, 56531).

Cadmium compounds are often found in or attached to small particles present in air. Cadmium that is in or attached to small particles can enter the air and travel a long way before coming down to earth as dust, or in rain or snow. Some forms of the cadmium that goes into the water will bind to soil, but some will remain in the water. Some forms of cadmium in soil can enter water or be taken up by plants. Fish, plants, and animals can take some forms of cadmium into their bodies from air, water, or food.

Potential for uptake. Cadmium is effectively absorbed by the root and leaf systems of plants. Soil pH is the major soil factor controlling both total and relative uptake of cadmium. Greatest uptake is within a pH range of 4.5 to 5.5.

Cobalt

Prediction of chemical valence states. Cobalt occurs in the +1, 2, 3, and rarely +4 and 5 oxidation states (ATSDR 1997, 56531).

Affinity for soil water, and air. As for most metals, sediments and soils are the final repository for cobalt emitted into the environment by humans. Most of the cobalt released into water eventually reaches the lakes and the coastal zones of the oceans via river transport of dissolved and suspended particles. In a lake, the portion of the total metal load carried on suspended particles settles in areas with active sedimentation. However, the percent of cobalt that is transported in the particulate form in water varies from 0%, as in the case of Lake Washington (Washington State), to 98%, as in the case of the Columbia River near Richland, Washington. In the oxic zones of many surface waters, the dissolved cobalt concentration decreases with depth. This may be due to its continuous input into surface water from discharges, and to increased adsorption and precipitation of the soluble forms in suspended solids and sediments with increases in depth (ATSDR 1997, 56531).

The speciation of cobalt in soil depends on the nature of the soil, concentration of chelating/complexing agents, pH, and Eh (redox potential) of the soil. Dissolved cobalt may be absorbed by ion exchange and other mechanisms, or form complexes with fulvic acids, humic acid, or other ligands in soil. The humic and fulvic complexes of cobalt are not very stable, compared with copper, lead, iron, and nickel complexes (ATSDR 1997, 56531).

The transport of cobalt in soil depends on its adsorption/desorption. Cobalt is retained by oxides such as iron and manganese oxide, crystalline materials such as aluminosilicate and goethite, and natural organic substances in soil. In most soils, cobalt is more mobile than lead, chromium, zinc, and nickel, but less mobile than cadmium. The mobility of cobalt in soils increases as the pH decreases; it decreases as the availability of the oxides, crystalline materials, and other adsorbents in soils decreases. Organic complexing agents, such as those obtained from plant decay, may also increase cobalt mobility in soil. However, complexes decrease cobalt uptake by plants. Addition of sewage sludge to the soil also increases the mobility of cobalt, perhaps due to organic complexation of cobalt (ATSDR 1997, 56531).

There is a lack of data in the literature regarding the chemical forms of cobalt and their transformation in the atmosphere. It is not clear if, or how, any chemical speciation of cobalt occurs in the atmosphere.

Potential for uptake. The possibility of cobalt uptake by plants from soil has been reported in the literature. Elevated levels of cobalt have been found in the roots of sugar beets and potato tubers in soils with high cobalt concentrations (e.g., flyash-amended soil) due to absorption of cobalt from soil. The translocation of cobalt from roots to above-ground parts of plants is not significant in most soils, as indicated by the lack of cobalt in seeds of barley, oats, and wheat grown in high-cobalt soil. The enrichment ratio, defined as the concentration in a plant grown in amended soil (flyash) over the concentration in unamended soil, was about 1. The transfer coefficient (concentration in plant/concentration in soil) for cobalt is 0.01-0.3. There is little biomagnification of cobalt in animals of higher trophic level (ATSDR 1997, 56531).

Copper

Prediction of chemical valence states. Copper occurs in the +1 and +2 oxidation states.

Affinity for soil water, and air. Most copper deposited in soil will be strongly adsorbed and remain in the upper few centimeters of soil. Copper's movement in soil is determined by a host of physical and chemical interactions of copper with the soil components. In general, the copper will adsorb to organic matter, carbonate minerals, clay minerals, or hydrous iron and manganese oxides. Sandy soils with low pH have the greatest potential for leaching. However, the soil in the area is alkaline to neutral, so leaching of copper would not be a great concern at this site. In most temperate soil, the pH, organic matter, and ionic strength of the soil solutions are the key factors affecting adsorption. The ionic strength and pH of the soil solution affect the surface charge of soils and thereby influence ionic interaction. When the amount of organic matter is low, the mineral content of iron, manganese and aluminum oxides become important in determining the adsorption of copper (ATSDR 1997, 56531). Copper's affinity for air is demonstrated by the fact that copper becomes dull when exposed to air (Budavari et al. 1996, 58033).

A copper bind to soil much more strongly than other divalent cations, and the distribution of copper in the soil solution is less affected by pH than other metals. In a study of competitive adsorption and leaching of metals in soil columns of widely different characteristics, copper eluted much more slowly and in much lower quantities than zinc, cadmium, and nickel from two mineral soils and not at all from peat soil, which contained the greatest amount of organic matter. A study looked at pH-dependent adsorption of the bivalent transition metal cations (cadmium, copper, lead, and zinc) in two mineral soils and two soils containing considerable organic matter. Adsorption increased with pH, and copper and lead were much more strongly retained than cadmium and zinc. Reduction in absorptivity after removal of the organic matter demonstrated the importance of organic matter in binding copper (ATSDR 1997, 56531).

Copper shows a pronounced solubility in soil only in the oxidizing environment; in the reducing environment, solubility is low. Above pH 6, precipitation becomes the more dominant process for removing copper from water. Copper binding in soil may be correlated with pH, cation exchange capacity, the organic content of the soil, the presence of iron oxides, and even the presence of inorganic carbon such as carbonates. Copper may be incorporated also in mineral lattices where it is unlikely to have ecological significance. Broad generalizations are not possible since the situation will differ among different soils. In soils with a high organic carbon content, however, copper will be tightly bound to organic matter. In sediment, copper is generally associated with mineral matter or tightly bound to organic matter. As is common when a metal is associated with organic matter, copper is generally associated with fine, as opposed to coarse, sediment (ATSDR 1997, 56531). Therefore, copper would most likely be bound to the soil and move in the system by way of transport of soil particles by water as opposed to movement in the air because of volatilization or movement in the water as dissolved chemicals.

Potential for uptake. Ordinarily at pH values of 6.5 and above copper tends to be only slowly available to plants, especially if copper is present in the high-valent or oxidized forms. Consequently, most soils will tie up relatively large quantities of copper is the soil pH is high and the drainage good (Brady 1974, 57672). There is abundant evidence that there is no biomagnification of copper in the food chain (ATSDR 1997, 56531).

Lead

Prediction of chemical valence states. Lead occurs in the +2 and +4 oxidation states. Lead in the +2 oxidation state has some chemical similarities to calcium (Manahan 1989, 59377).

Affinity for soil water, and air. The fate of lead in soils is affected by the specific or exchange adsorption at mineral interfaces, the precipitation of sparingly soluble solid forms of the compound, and the formation of relatively stable organic-metal complexes or chelates with soil organic matter. These processes are dependent on such factors as soil pH, organic matter content of soil, the organic matter content of the soil, the presence of inorganic colloids and iron oxides, ion-exchange characteristics, and the amount of lead in the soil. The accumulation of lead in most soils is primarily a function of the rate of deposition from the atmosphere. Most lead is retained strongly in soil, and very little is transported into surface water or groundwater. Lead is strongly sorbed to organic matter in soil, and although not subject to leaching, it may enter surface waters as a result of erosion of lead containing soil particulates. Lead may be converted to lead sulfate at the soil surface, which is relatively soluble when compared with lead carbonate or phosphate. Inorganic lead may be bound into crystalline matrices of rocks and remain essentially immobile. Lead complexes and precipitates in soil and their transformation depend on the soil type. In soil with a high organic matter content and a pH of 6-8, lead may form insoluble organic complexes; if the soil has less organic matter at the same pH; hydrous lead oxide complexes may form or lead may precipitate out with carbonate or phosphate ions. Entrainment of soil particles is another route of lead transport. The downward movement of lead from soil to groundwater by leaching is very slow under natural conditions (ATSDR 1997, 56531).

Potential for uptake. Plants and animals may bioconcentrate lead, but biomagnification has not been detected Although the bioavailability of lead in soil to plants is limited because of the strong absorption of lead to soil organic matter, the bioavailability increases as the pH and the organic matter content of the soil are reduced. Lead is not biomagnified in aquatic or terrestrial food chains (ATSDR 1997, 56531).

Lithium

Prediction of chemical valence states. Lithium has a valence of +1 and exists as various lithium compounds or salts.

Affinity for soil water, and air. Lithium salts are very soluble. They do not readily adsorb to soil and easily leach through soils. The ionic nature of lithium makes it essentially nonvolatile. Therefore, it exists only in the particulate phase in air and does not volatilize from soil (HSDB 2003, 74017).

Potential for uptake. Uptake following oral administration is well documented since lithium carbonate is used pharmaceutically. It is adsorbed completely within 6 to 8 hours following oral dosing (HSDB 2003, 74017). Because it is soluble, it should be adsorbed to some extent by the lungs also.

Mercury

Prediction of chemical valence states. Mercury occurs in the +1 and +2 oxidation states. In soils and surface waters, mercury can exist in the mercuric (Hg+2) and mercurous (Hg+1) states as a number if complex ions with varying water solubilities (ATSDR 1997, 56531).

Affinity for soil water, and air. Mercury is transported to aquatic ecosystems by way of surface runoff. It is tightly bound to both organic and inorganic particles. Sediments with high sulfur content will strongly bind mercury. The methylation of mercury by microorganisms is a detoxification response that allows the organism to dispose of heavy-metal ions as small organometallic complexes. Conditions for methylation by sediment microorganisms are strict and occur within a narrow pH range only. The rate of synthesis of methyl mercury also depends on redox potential, composition of the microbial population, availability of Hg 2+, and temperature. The best conversion rate for inorganic mercury to methyl mercury under ideal conditions is less than 1.5% per month (Casarett et al. 1986, 58204, p 842.).

Mercuric mercury, present as complexes and chelates with ligands, is probably the predominant form of mercury present in surface waters. The transport and portioning of mercury in surface waters and soils is influenced by the particular form of the compound. More than 97% of the dissolved gaseous mercury found in water consists of elemental mercury. Volatile forms (e.g., metallic mercury and dimethylmercury) are expected to evaporate to the atmosphere, whereas solid forms partition to particulates in the soil or water column and are transported downward to the sediments in the water column (ATSDR 1997, 56531).

The sorption process is related to the organic matter content of the soil or sediment. Mercury is sobbed to soil with high iron and aluminum content up to a maximum loading capacity of 15 g/kg. Inorganic mercury sorbed to particulate material is not readily desorbed. Therefore, freshwater and marine sediments are important repositories for inorganic forms of the compound, and leaching is a relatively insignificant transport process in soils. However, surface runoff is an important mechanism for moving mercury from soil to water, particularly for soils with high humic content. Mobilization of sorbed mercury from particulates can occur through chemical or biological reduction to elemental mercury and bioconversion to volatile organic forms. Adsorption of mercury in soil is decreased with increasing pH and/or chloride ion concentration. Metallic mercury may move through the top 3-4 cm of dry soil at atmospheric pressure; however, it is unlikely that further penetration would occur (ATSDR 1997, 56531).

The volatilization and leaching of various forms of mercury (elemental, mercuric sulfide, mercuric oxide, and mercurous oxide) from soils or wastes has been studied using the headspace method for volatilization and the RCRA leaching protocols for leaching through soil to determine if the leachates exceeded the RCRA limit of 200 mg/L. With the exception of mercuric sulfide, the other forms of mercury increased in concentrations in thee headspace vapor and in the leachate as the soil concentrations increased, although the elemental mercury concentrations never exceeded the RCRA limit, indicating that it was relatively unleachable. Mercuric sulfide also did not exceed thee background level for the leachate and was consistently less than 0.001 mg/m^3 for the vapor concentrations, indicating that it too was unleachable and did not volatilize. This study showed also that concentrations of mercury in leachate could not be correlated with the concentration of mercury in the soil or in the headspace vapors. Mercuric sulfide has been found to adsorb strongly to soil, and even with weathering, any mercury released from the mercuric sulfide is readsorbed by the soil (ATSDR 1997, 565331).

Potential for uptake. Inorganic mercury compounds added to soils react quickly with the organic matter and clay minerals to form insoluble compounds. In this form, mercury is quite unavailable to growing plants (Brady 1974, 57672).

The potential for bioaccumulation in terrestrial food chains is demonstrated by the uptake of mercury by the edible mushroom, *Pleurotus ostreatus*, grown on compost containing mercury at concentrations of up to 0.2 mg/kg. The bioaccumulation factor was 65–140, indicating that there are risks to human health if these mushrooms are eaten. However, other data indicate that virtually no mercury is taken up from the soil into the shoots of plants such as peas, although mercury concentrations in the roots may be significantly elevated and reflect the mercury concentrations of the surrounding soil. The most common organic form of mercury, methylmercury, is soluble, mobile, and quickly enters the aquatic food chain (ATSDR 1997, 56531).

Nickel

Prediction of chemical valence states. While nickel can exist in oxidation states –1, 0, +2, +3, and +4, its only important oxidation state is nickel (+2) under environmental conditions. The divalent state of nickel forms an extensive series of compounds and is the only important oxidation state in aqueous systems. Other oxidation states occur in special complexes and oxides (ATSDR 1997, 56531).

Affinity for soil water, and air. Nickel and nickel compounds have negligible vapor pressures. Therefore, volatilization of nickel from the soil into the air is not expected to be a pathway of concern. Nickel is strongly adsorbed by soil, although to a lesser degree than degree than lead, copper, and zinc. Nickel is a natural constituent of soil and is transported into streams and waterways as runoff is associated with particulate matter and is transported and settles out in areas of active sedimentation (ATSDR 1997, 56531).

Potential for uptake. Nickel is not accumulated in significant amounts by aquatic organisms. The range of bioconcentration factors (BCFs) appears to be 40–100 in fish and 100–259 in invertebrates. The lack of significant bioaccumulation of nickel in aquatic organisms, voles, and rabbits would indicate that nickel is not biomagnified in the food chain (ATSDR 1997, 56531).

Selenium

Prediction of chemical valence states. The primary factor determining the fate of selenium in the environment is its oxidation state. Selenium is stable in four valence states (–2, 0, +4, and +6). The heavy metal selenides (-2) are insoluble in water, as is elemental selenium. The inorganic alkali selenites (+4) and selenates (+6) are soluble in water and are therefore more bioavailable.

Affinity for soil water, and air. In general, elemental selenium is stable in soils and is found at low levels in water due to its ability to coprecipitate with sediments. The forms of selenium expected to be found in surface water and the water contained in soils are the salts of selenic and selenous acids. Selenic acid is a strong acid. The soluble selenate salts of this acid are expected to occur in alkaline waters. Sodium selenate is one of the most mobile selenium compounds in the environment owing to its high solubility and inability to adsorb onto soil particles. Selenious acid is a weak acid, and the diselenite ion predominates in waters between pH 3.5 and 9. Most selenites are less soluble in water than the corresponding selenates. The volatile selenium compounds that partition into the atmosphere include the inorganic compounds selenium dioxide and hydrogen selenide and the organic compounds dimethyl selenide and dimethyl diselenide. Hydrogen selenide is highly reactive in air and is rapidly oxidized to elemental selenium and water, but the other compounds can persist in air (ATSDR 1997, 56531).

Potential for uptake. The soluble selenates are readily taken up by plants and converted to organic compounds such as selenomethionine, selenocysteine, dimethyl selenide, and dimethyl diselenide. Selenium is bioaccumulated by aquatic organisms and may biomagnify also in aquatic organisms (ATSDR 1997, 56531).

Silver

Prediction of chemical valence states. Silver occurs in the environment primarily in the +1 and +2 oxidation states.

Affinity for soil water, and air. The transport and portioning of silver in surface waters and soils is influenced by the particular form of the compound. Under oxidizing conditions, the primary silver compounds are bromides, chlorides, and iodides, while under reducing conditions the free metal and silver sulfides predominate. In water, the major forms of silver are as the monovalent ion in the form of sulfate, bicarbonate, or sulfate salts; as part of more complex ions with chlorides and sulfates; and as an integral part of, or adsorbed onto particulate matter. The mobility of silver in soils is affected by drainage (silver tends to be removed from well-drained soils), oxidation-reduction potential and pH conditions (which determine the reactivity of iron and manganese complexes which tend to immobilize silver), and the presence of organic matter (which complexes with silver and reduces its mobility).

Potential for uptake. In fresh water silver may form complex ions with chlorides, ammonium (in areas of maximum biological activity), and sulfates; form soluble organic compounds such as the acetate and the tartrate; become adsorbed onto humic complexes and suspended particulates; and become incorporated into, or adsorbed onto, aquatic biota. Bioconcentration (uptake from water) and bioaccumulation (uptake from food and water) studies of silver thiosulfate complexes in algae (*Scenedesmus sp.*), water flea (*Daphnia magna*), mussels (*Ligumia sp.* and *Margaritifera sp.*), and fathead minnow (*Pimephales promelas*) were conducted in 10-week exposures. Bioconcentration indices were 96–125 for algae, 12.2–26 for water flea, 5.9–8.5 for mussels, and 1.8–28 for fish. Bioaccumulation indices were 9–26 for water flea, 6.6–9.8 for mussels, and 4.0–6.2 for fish. These indices, which are based on measured wet-weight concentrations in biota and nominal concentrations in water, indicate little potential for silver biomagnification in the tested food chain. In soil, silver is toxic to soil microorganisms and inhibits bacterial enzymes. Therefore, biotransformation is not expected to be a significant process (ATSDR 1997, 56531).

Strontium

Prediction of chemical valence states. Strontium occurs naturally in the environment in the 0 and +2 oxidation states. Under normal environmental conditions, only the +2 oxidation state is stable enough to be important. Strontium exists as a hydrated cation, an ionic solution complex, or an ionic salt.

Affinity for soil water, and air. Because of strontium's high relativity, elemental (or metallic) strontium is not found in nature; it exists only as molecular compounds with other elements. Strontium has moderate mobility in soils and sediments, and sorbs moderately to metal oxides and clays (ATSDR 1997, 56531). Strontium sorbs as hydrated ions on the surface of clay minerals (kaolinite), weathered minerals (amorphous silica), and iron oxides. However, at higher concentrations, precipitation of strontianite (strontium carbonate) occurs and strontium is likely less mobile. The principal abiotic processes that transform strontium in soils and sediments are mediated by sorption and desorption reactions between the soil solution and matrix (precipitation, complexation, and ion exchange), and are controlled by pH, ionic strength, solution speciation, mineral composition, organic matter, biological organisms, and temperature. In air, strontium compounds are present mostly as dust. These particles of strontium eventually end up back in the soil. Strontium will form different species, some of which are more soluble than others.

Potential for uptake. Strontium is taken up and retained by aquatic and terrestrial plants. Because strontium is chemically similar to calcium, it is taken up from the soil by fruits and vegetables.

Uranium

Prediction of chemical valence states. Uranium can exist in five oxidations states: +2, +3, +4, +5, and +6; however only the +4 and +6 states are stable enough to be of practical importance. Tetravalent uranium forms hydroxides, hydrated fluorides, and phosphates of low solubility. Hexavalent uranium is the most stable state and commonly occurs as U_3O_8 (ATSDR 1997, 56531).

Affinity for soil water, and air. Uranium can undergo oxidation-reduction reactions in the environment or microbial reactions to form complexes with organic matter. Uranium can become airborne, and deposition of atmospheric uranium may occur by wet (rain, sleet, or snow) or dry (gravitation or wind turbulence) processes. The rate of deposition is dependent upon such factors as particle size, particle density, particle concentration, wind turbulence, and chemical form (ATSDR 1997, 56531).

Uranium in surface water can disperse over large distances to ponds, rivers, and oceans. The transport and dispersion of uranium in surface water and groundwater are affected by adsorption and desorption of uranium on aquatic sediments. Factors that control mobility include oxidation-reduction potential, pH, and sorbing characteristics of sediments and the suspended solids in the water (ATSDR 1997, 56531).

Potential for uptake. In plants uptake of uranium may be restricted to the root system and may actually represent adsorption to the outer root membrane rather than incorporation into the interior of the root system.

Zinc

Prediction of chemical valence states. Zinc occurs in the environment primarily in the +2 oxidation state. It dissolves in acids to form hydrated Zn +2 cations and I strong bases to form zincate anions (ATSDR 1997, 56531).

Affinity for soil water, and air. Zinc sorbs strongly onto soil particulates. Zinc can occur in both suspended and dissolved forms in surface water. Dissolved zinc may occur as the free (hydrated) zinc ion or as dissolved complexes and compounds with varying degrees of stability. Suspended (undissolved) zinc may be dissolved following minor changes in water chemistry or may be sorbed to suspended matter (ATSDR 1997, 56531). Zinc is stable in dry air (Budaveri et al. 1996, 58033).

The mobility of zinc in soils depends on the solubility of the speciated forms of the element and on soil properties such as cation exchange capacity, pH, redox potential, and chemical species present in soil; under anaerobic conditions, zinc sulfide is the controlling species. Since zinc sulfide is insoluble, the mobility of zinc in anaerobic soil is low. In a study of the effect of pH on zinc solubility, it was shown that when the pH is <7, and inverse relationship exists between the pH and the amount of zinc in solution. As negative charges on soil surfaces increase with increasing pH, additional sites for zinc adsorption are activated and the amount of zinc in solution decreases. The active zinc species in the adsorbed state is the singly-charged zinc hydroxide species (i.e., Zn[OH]+). The amount of zinc in solutions generally increases when the pH is >7 in soils high in organic matter. This is probably a result of either the release of organically complexed zinc, reduced zinc adsorption at higher pH, or an increase in the concentration of chelating agents in soil. Consequently, movement towards groundwater is expected to be slow (ATSDR 1997, 56531). Zinc would most likely be bound to the soil and move in the system by way of transport of soil particles by water as opposed to movement in the air because of volatilization or movement in the water as dissolved chemicals.

Potential for uptake. With respect to bioconcentration from soil by terrestrial plants, invertebrates, and mammals, bioconcentration factors of 0.4, 8, and 0.6, respectively, have been reported. The concentration of zinc in plants depends on the plant species, soil Ph, and the composition of the soil. Ordinarily, at pH values of 6.5 and above, zinc tends to be available to plants slowly, especially if zinc is present in their high-valent or oxidized forms. Consequently, most soils will tie up relatively large quantities of zinc if the soil pH is high and the drainage good (Brady 1974, 57672). Plant species do not concentrate zinc above the levels present in soil (ATSDR 1997, 56531).

F-4.3 Human Health Risk Calculations

Tables F-4.3-1 through F-4,3-14 present the human health screening assessment calculations for each SWMU/AOC group.

Table F-4.3-1
Calculation of Hazard Index for
Noncarcinogenic COPCs of 6th Street Warehouse SWMUs/AOCs in Soil and Tuff

Chemical	95% UCL Value (mg/kg)	SAL (mg/kg)	HQ
Arsenic	2.52	22	0.11
Cadmium	0.36	70	0.0051
Copper	10.3	2800	0.0037
Lead	28.75	400	0.072
Mercury	0.096	23	0.0042
Selenium	0.182	380	0.00048
Zinc	51.08	23000	0.0022
Acenaphthene	0.30	2800	0.00011
Acetone	0.047	1600	0.000029
Anthracene	0.29	16000	0.000018
Aroclor-1254	0.32	1.1	0.29
Benzo(g,h,i)perylene [a]	0.28	1800	0.00016
Benzoic Acid	1.70	1.0E+05	0.000017
Butanone[2-]	0.022	37000	5.95E-07
Butylbenzylphthalate	0.24	240	0.001
Dibenzofuran	0.35	290	0.0012
Dimethyl Phthalate	0.35	1.0E+05	0.0000035
Di-n-butylphthalate	0.32	6100	5.25E-05
Endosulfan II [b]	0.035	370	9.46E-05
Endrin	0.035	18	0.0019
Endrin Ketone [c]	0.040	18	0.0022
Fluoranthene	0.31	2300	0.00013
Fluorene	0.29	2100	0.00014
Isopropyltoluene[4-] [d]	0.0057	520	1.5E-05
Methoxychlor[4,4-]	0.092	310	0.00030
Nitroaniline[2-]	0.68	3.7	0.18
Phenanthrene	0.28	1800	0.00016
Pyrene	0.32	1800	0.00018
Styrene	0.0053	1700	3.12E-06
Toluene	0.0042	180	2.33E-05
			HI = 0.68

[a] Pyrene used as a surrogate for benzo(g,h,i)perylene.

[b] Endosulfan used as a surrogate for Endosulfan II.

[c] Endrin used as a surrogate for Endrin Ketone.

[d] Isopropylbenzene used as a surrogate for isopropyltoluene.

Table F-4.3-2
Calculation of Carcinogenic Human Health Risk at 6th Street Warehouse SWMUs/AOCs in Soil and Tuff

Chemical	95% UCL (mg/kg)	SAL (mg/kg)	Cancer Risk
Arsenic	2.52	0.39	6.46E-06
Aldrin	0.015	0.029	5.17E-07
Aroclor-1242	0.29	0.22	1.32E-06
Aroclor-1254	0.32	0.22	1.45E-06
Aroclor-1260	0.34	0.22	1.55E-06
Benzene	0.0032	0.64	5.00E-09
Benz(a)anthracene	0.20	0.62	3.23E-07
Benzo(a) pyrene	0.20	0.062	3.23E-06
Benzo(b)fluoranthene	0.29	0.62	4.68E-07
Benzo(k)fluoranthene	0.17	6.2	2.74E-08
Bis(2-ethylhexyl)phthalate	0.53	35	1.51E-08
BHC[alpha-]	0.015	0.09	1.67E-07
BHC[beta-]	0.015	0.32	4.69E-08
Butylbenzylphthalate	0.24	240	1.00E-09
Chlordane [alpha-]*	0.25	1.6	1.56E-07
Chlordane [gamma-]*	0.34	1.6	2.13E-07
Chrysene	0.21	61	3.44E-09
DDD [4,4'-]	0.030	2.4	1.25E-08
DDE [4,4'-]	0.12	1.7	7.06E-08
DDT [4,4'-]	0.40	1.7	2.35E-07
Dibenz(a,h)anthracene	0.23	0.062	3.71E-06
Dieldrin	0.030	0.03	1.00E-06
Heptachlor	0.015	0.11	1.36E-07
Heptachlor Epoxide	0.015	0.053	2.83E-07
Indeno(1,2,3-cd)pyrene	0.19	0.62	3.06E-07
Trichloroethene	0.0052	1.6	3.25E-09
			Total ICR = 2.2 x 10^{-5}

*Total chlordane used as a surrogate for alpha chlordane and gamma chlordane.

Table F-4.3-3
Calculation of Radionuclide Dose at 6th Street Warehouse SWMUs/AOCs in Soil and Tuff

Chemical	95% UCL (pCi/g)	SAL (pCi/g)	Total Dose (mrem/yr)	Soil Background/ Fallout (pCi/g)	Background Dose (mrem/yr)	Dose Due to Releases (mrem/yr)
Americium-241	0.013	39	0.0049	0.013	0.005	0.017
Cesium-137	0.35	5.3	0.99	1.65	4.67	-3.51
Plutonium-238	0.0056	49	0.0017	0.023	0.0070	-0.0049
Plutonium-239	0.063	44	0.021	0.054	0.0018	0.0252
Uranium-234	1.32	63	0.31	2.59	0.62	-0.24
Uranium-238	1.37	86	0.24	2.29	0.40	-0.12
Total Dose = 1.6 mrem/yr				Soil Background Dose = 5.7 mrem/yr		

Table F-4.3-4
Calculation of Hazard Index of Noncarcinogenic COPCs from the 6th Street Septic Systems

Chemical	95% UCL (mg/kg)	SAL (mg/kg)	HQ
Aluminum	8240	74000	0.11
Barium	122	5200	0.023
Cadmium	0.32	70	0.0046
Copper	11.5	2800	0.0041
Lead	26.2	400	0.066
Mercury	0.43	23	0.019
Nickel	6.35	1500	0.0042
Silver	2.03	380	0.0053
Acetone	0.024	1600	0.000015
Anthracene	0.38	16000	0.000024
Aroclor 1254	0.047	1.1	0.043
Benzo(g,h,i)perylene[a]	0.40	1800	0.00022
Benzoic Acid	1.25	1.0E+05	0.000012
Butanone[2-]	0.024	37000	6.5E-07
Di-n-butylphthalate	0.38	6100	6.2E-05
Dichlorobenzene [1,2-]	0.16	85	0.0019
Dichloroethene [cis –1,2-]	0.0056	41	0.00014
Dinitro-2-methylphenol [4,6-]	1.11	120	0.0092
Dinitrophenol [2,4-]	1.11	120	0.0092
Endrin	0.0070	18	0.00039
Endrin Aldehyde[b]	0.0070	18	0.00039
Ethylbenzene	0.0058	68	8.5E-05
Fluoranthene	0.38	2300	0.00017
Isopropyltoluene[4-][c]	0.0063	370	1.7E-05
Phenanthrene	0.38	1800	0.00021
Propylbenzene [1-]	0.0030	140	2.1E-05
Pyrene	0.40	1800	0.00022
Toluene	0.0048	180	2. 7E-05
Trimethylbenzene [1,2,4-]	0.0073	52	0.00014
Trimethylbenzene [1,3,5-]	0.0061	21	0.00029
Xylene (total)	0.0055	210	2.6E-05
Xylene [1,2-]	0.0031	280	1.1E-05
			HI = 0.31

[a] Pyrene used as a surrogate for benzo(g,h,i)perylene.

[b] Endrin used as a surrogate for endrin aldehyde.

[c] Isopropylbenzene used as a surrogate for 4-isopropyltoluene.

Table F-4.3-5
Calculation of Carcinogenic Human Health Risk at 6th Street Septic Systems

Chemical	95% UCL (mg/kg)	SAL (mg/kg)	Cancer Risk
Aldrin	0.0035	0.029	1.21E-07
Aroclor-1254	0.047	0.22	2.14E-07
Aroclor-1260	0.047	0.22	2.14E-07
Benzene	0.0059	0.64	9.22E-09
Benzo(a)anthracene	0.39	0.62	6.29E-07
Benzo(a)pyrene	0.40	0.062	6.45E-06
Benzo(b)fluoranthene	0.40	0.62	6.45E-07
Benzo(k)fluoranthene	0.39	6.2	6.29E-08
Bis(2-ethylhexyl) phthalate	0.38	1200	3.17E-10
Chlordane - alpha*	0.0060	1.6	3.75E-09
Chlordane - gamma*	0.0059	1.6	3.69E-09
Chrysene	0.40	61	6.56E-09
Dibenz(a,h)anthracene	0.39	0.062	6.29E-06
Dichlorobenzene [1,4-]	0.16	3.2	5.00E-08
Dieldrin	0.0070	0.03	2.33E-07
DDD [4,4'-]	0.033	2.4	1.38E-08
DDE [4,4'-]	0.015	1.7	8.82E-09
DDT [4,4'-]	0.042	1.7	2.47E-08
Indeno(1,2,3-cd)pyrene	0.40	0.62	6.45E-07
Methylene Chloride	0.013	8.9	1.46E-09
Pentachlorophenol	0.96	3.0	3.20E-07
Tetrachloroethene	0.0071	1.5	4.73E-09
			Total ICR = 1.6 x 10^{-5}

*Total chlordane used as a surrogate for alpha chlordane and gamma chlordane.

Table F-4.3-6
Calculation of Radionuclide Dose at 6th Street Septic Systems

Chemical	95% UCL (pCi/g)	SAL (pCi/g)	Dose (mrem/yr)	Soil Background/ Fallout (pCi/g)	Background Dose (mrem/yr)	Dose Due to Release (mrem/yr)
Americium-241	0.11	39	0.042	0.013	0.005	0.037
Plutonium-239	0.56	44	0.19	0.054	0.018	0.17
Tritium*	0.63	890	0.011	NA	NA	NA
Uranium-234	1.31	63	0.31	2.59	0.62	-0.30
Uranium-235	0.14	17	0.12	0.2	0.18	-0.053
Uranium-238	1.34	86	0.23	2.29	0.40	-0.17
			Total Dose = 0.91 mrem/yr	Soil Background Dose = 1.22 mrem/yr		

*Value for tritium represents a maximum value.

Table F-4.3-7
Calculation of Hazard Index for Noncarcinogenic COPCs from AOC 0-029(a)

Chemical	95% UCL Value (mg/kg)	SAL (mg/kg)	HQ
Aroclor 1254	0.020	1.1	0.018
Endrin	0.0020	18	0.00011
Endrin Aldehyde*	0.0020	18	0.00011
Methoxychlor[4,4-]	0.010	310	0.000032
			HI = 0.018

*Endrin used as a surrogate for endrin aldehyde.

Table F-4.3-8
Calculation of Carcinogenic Human Health Risk at AOC 0-029(a)

Chemical	95% UCL Value (mg/kg)	SAL (mg/kg)	Cancer Risk
Aroclor 1242	0.0063	0.22	2.8×10^{-8}
Aroclor 1254	0.020	0.22	9.1×10^{-8}
Aroclor 1260	0.025	0.22	1.1×10^{-7}
Chlordane [alpha-]*	0.0010	1.6	6.2×10^{-10}
DDD [4,4'-]	0.0020	2.4	8.3×10^{-10}
DDE [4,4'-]	0.0020	1.7	1.2×10^{-9}
DDT [4,4'-]	0.0035	1.7	2.1×10^{-9}
Dieldrin	0.0020	0.03	6.7×10^{-8}
			Total ICR = 3.0×10^{-7}

*Total chlordane used as a surrogate for alpha chlordane.

Table F-4.3-9
Calculation of Hazard Index for Noncarcinogenic COPCs from AOC 0-029(b)

Chemical	95% UCL Value (mg/kg)	SAL (mg/kg)	HQ
Aroclor 1254	0.016	1.1	0.014
Endosulfan I[a]	0.00040	370	1.1E-06
Endosulfan II[a]	0.00076	370	2.1E-06
Endrin	0.0011	18	6.1E-05
Endrin Aldehyde[b]	0.0014	18	7.8E-05
			HI = 0.014

[a] Endosulfan used as a surrogate for Endosulfan I, II, and endosulfan sulfate

[b] Endrin used as a surrogate for Endrin Aldehyde and Endrin Ketone.

Table F-4.3-10
Calculation of Carcinogenic Human Health Risk at AOC 0-029(b)

Chemical	95% UCL Value (mg/kg)	Residential Soil SAL (mg/kg)	Cancer Risk
Aroclor 1242	0.022	0.22	1.0×10^{-7}
Aroclor 1254	0.016	0.22	7.3×10^{-8}
Aroclor 1260	0.019	0.22	8.6×10^{-8}
BHC[beta-]	0.00042	0.32	1.3×10^{-9}
BHC[delta-] [a]	0.00040	0.32	1.2×10^{-9}
BHC[gamma-]	0.00040	4.4	9.1×10^{-11}
Chlordane [gamma-] [b]	0.00041	1.6	2.6×10^{-10}
DDD [4,4'-]	0.0011	2.4	4.6×10^{-10}
DDE [4,4'-]	0.00097	1.7	5.7×10^{-10}
DDT [4,4'-]	0.0067	1.7	3.9×10^{-9}
Heptachlor	0.00041	0.11	3.7×10^{-9}
Heptachlor Epoxide	0.00040	0.053	7.5×10^{-9}
			Total ICR = 3.0×10^{-7}

[a] BHC [gamma] used as a surrogate for BHC [delta].

[b] Chlordane used as a surrogate for gamma chlordane. SAL for total chlordane.

Table F-4.3-11
Calculation of Hazard Index for Noncarcinogenic COPCs from AOC 0-029(c)

Chemical	95% UCL Value (mg/kg)	SAL (mg/kg)	HQ
Aroclor 1254	0.033	1.1	0.03
Endosulfan Sulfate[a]	0.0017	18	9.4E-05
Endrin	0.0017	18	9.4E-05
Endrin Aldehyde[b]	0.0016	18	8.9E-05
Endrin Ketone[b]	0.0017	18	9.4E-05
			HI = 0.030

[a] Endosulfan used as a surrogate for endosulfan sulfate

[b] Endrin used as a surrogate for Endrin Aldehyde and Endrin Ketone.

Table F-4.3-12
Calculation of Carcinogenic Human Health Risk at AOC 0-029(c)

Chemical	95% UCL Value (mg/kg)	SAL (mg/kg)	Cancer Risk
Aroclor 1242	0.0040	0.22	1.8 x 10^{-8}
Aroclor 1254	0.033	0.22	1.5 x 10^{-7}
Aroclor 1260	0.038	0.22	1.7 x 10^{-7}
DDD [4,4'-]	0.0017	2.4	7.1 x 10^{-10}
DDE [4,4'-]	0.0024	1.7	1.4 x 10^{-9}
DDT [4,4'-]	0.0038	1.7	2.2 x 10^{-9}
Dieldrin	0.0017	0.03	5.7 x 10^{-8}
			Total ICR = 4.0 x 10^{-7}

Table F-4.3-13
Calculation of Hazard Index for Noncarcinogenic COPCs from SWMU 21-021-99

Chemical	95% UCL Value (mg/kg)	SAL (mg/kg)	HQ
Cadmium	0.54	70	0.0077
Copper	13.9	2800	0.0050
Lead	45	400	0.11
Lithium	23.1	1600	0.014
Mercury	0.054	23	0.0023
Silver	3.96	380	0.010
Strontium	76.5	37000	0.0021
Uranium	7.77	230	0.034
Zinc	74.4	23000	0.0032
			HI = 0.26

Table F-4.3-14
Calculation of Radionuclide Dose at SWMU 21-021-99

Chemical	95% UCL Value (pCi/g)	SAL (pCi/g)	Dose (mrem/yr)	Soil Background/ Fallout (pCi/g)	Background Dose (mrem/yr)	Dose Due to Releases (mrem/yr)
Americium-241	0.051	39	0.020	0.013	0.005	0.015
Cesium-137	1.28	5.3	3.6	1.65	4.7	-1.0
Plutonium-239	0.87	44	0.30	0.054	0.018	0.28
Tritium*	1.75	890	0.029	NA	NA	NA
Uranium-235	0.15	17	0.13	0.20	0.18	-0.04
			Total Dose = 4.1	Soil Background Dose = 4.9 mrem/yr		

*Value for tritium represents a maximum value for data reported as pCi/g

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Appendix G

VCA/IA Plan

ENVIRONMENTAL
RESTORATION
PROJECT

A Department of Energy
Environmental Cleanup Program

LA-UR-02-1081
June 2002
ER2002-0094

Plan for the Voluntary Corrective Action at Potential Release Sites (PRSs) 0-030(b)-00, 0-027, 0-030(a), 0-029(a,b,c), 0-010(a,b), and 0-033(a), and the Interim Action at PRS 21-021

Los Alamos
NATIONAL LABORATORY
Los Alamos NM 87545

Produced by the Remedial Actions Focus Area

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EXECUTIVE SUMMARY

This document is the voluntary corrective action (VCA) plan for potential release sites (PRSs) in the DP Road South and DP Road 4 land transfer parcels as well as several other PRSs. The PRSs included in this plan are 0-027, 0-030(a), 0-030(b)-00, 0-029(a,b,c), 0-010(a,b), and the 6th Street Warehouse PRSs [0-004, 0-030(l,m), and 0-033(a,b)]; all are in Technical Area 0 (TA-0) at Los Alamos National Laboratory (the Laboratory or LANL). PRSs 0-027 and 0-030(a) are not part of the land transfer, but have been included in this PRS aggregate because of their close proximity to the land transfer parcel. The PRSs that are listed in Table A of the Hazardous and Solid Waste Amendments (HSWA) of LANL's Hazardous Waste Facility Permit are PRS 0-030(a) and consolidated PRS 0-030(b)-00, which includes PRSs 0-030(b,l,m), 0-004, and 0-033(b).

This plan describes the sites and their histories; previous site activities, such as Resource Conservation and Recovery Act (RCRA) facility investigations (RFIs) and VCAs; proposed sampling activities to address data gaps; proposed cleanup activities; and planned site restoration. Also included in this plan is information about TA-21 and Material Disposal Area (MDA) B (PRS 21-015). This is because air emissions from TA-21 had the potential to affect surface soil within the DP Road land transfer parcel. PRS 21-015 is located directly north of the eastern boundary of the DP Road land transfer parcel.

PRS 0-027 was a fuel and lubricant drum storage area which is now on private property. A VCA is planned for PRS 0-027 because the site contains benzene, ethylbenzene, toluene, trimethylbenzene, and xylene (BTEX) at levels that pose a potentially unacceptable human health risk based on a residential scenario. These elevated levels of contaminants are mainly confined to the subsurface soil at depths greater than 10 ft). It is expected that the site potentially would meet the requirements for a risk-based closure even with no active remediation phase. However, an active remediation is being proposed to further reduce and/or accelerate reduction of potential risk from the subsurface contamination at the site. To accomplish this task, a soil vapor extraction (SVE) system is proposed. The SVE system will volatilize the BTEX and accelerate the reduction of potential risk at the site. SVE is viewed to be a cost-effective proactive remedial alternative.

PRSs 0-030(a,b,l,m) are septic systems. PRSs 0-030 (b,l,m) will be sampled to fill data gaps that were identified during the evaluation of existing PRS data. If, during the sampling, any unexpected areas of contamination are found, the contaminated material will be removed. The sampling proposed for each PRS is described in Appendix E to this plan. In addition, removal of the piping at PRSs 0-030(b) and 0-030(m) is proposed. Removal of this piping will ensure that future development in these areas will not result in contact with historically disposed waste that may have residual contamination associated with it. PRS 0-030(a) does not require any additional sampling and is proposed for no further action (NFA) under Criterion 5 on the basis of human health and ecological screening assessments using existing data. Criterion 5 states that the site was characterized or remediated in accordance with current applicable state and/or federal regulations, and the available data indicate that contaminants do not pose an unacceptable level of risk, assuming current and projected future land use.

PRS 0-004 was an indoor container storage area where at least two spills occurred. PRS 0-033(b) is contaminated soil, drainlines, and an outfall located near the 6th Street Warehouses. PRSs 0-029(a,b,c) are former polychlorinated biphenyl (PCB) transformer sites, two of which are located on San Ildefonso Pueblo property and one of which is located on Santa Fe National Forest property.

At PRSs 0-004 and 0-033(b), data gaps were found from the previous RFI and VCA activities in 1995 and 1996, respectively. These data gaps will be addressed by collecting additional samples. The sampling for each PRS is described in Appendix E to this plan.

The former PCB transformers [PRSs 0-029(a,b,c)] were sampled in 1992 as part of Phase I of the RFI. The quality assurance/quality control (QA/QC) information on the sample data was not available; therefore, the use of the sample data is questionable. Because the PRSs have been included in this VCA for convenience, economy of scale, and relative proximity to this project, the three sites will be resampled for PCBs using a grid system similar to the one used in 1992 (LANL 1993, 26972). This sampling is described in Appendix E to this plan.

PRSs 0-010(a,b) were described as surface disposal areas in the "Solid Waste Management Units [SWMU] Report" (LANL 1990, 0145) but have been proposed and approved for no further action (NFA) by the Department of Energy (DOE) under Criterion 2. Criterion 2 states that the site was never used for the management (i.e., generation, treatment, storage, or disposal) of RCRA solid or hazardous wastes and/or constituents. The PRSs are included in this plan because they are located within the land transfer boundary. Neither of the PRSs requires additional sampling.

PRS 0-033(a), a former underground storage tank (UST) which has been removed, has been proposed for NFA under Criterion 4. Criterion 4 states that the site is regulated under another state and/or federal authority. If the site is known to have released, or is suspected of releasing or having released RCRA solid or hazardous wastes and/or constituents to the environment, it has been or will be investigated and/or remediated in accordance with applicable state and/or federal regulations.

Additional surface soil samples will be collected within the land transfer boundary because of the potential for surface deposition of radionuclides from historical stack emissions at TA-21, and to verify that contaminants from MDA B (PRS 21-015) have not migrated to surface soils within the land transfer boundary. MDA B is located on the east side of the field associated with PRS 0-030(b) and the eastern portion of the land transfer area.

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1.0 INTRODUCTION

The Laboratory is a multidisciplinary research facility owned by the DOE and managed by the University of California. The Laboratory is located in north-central New Mexico approximately 60 mi northeast of Albuquerque and 20 mi northwest of Santa Fe (Figure 1.0-1). The Laboratory site covers 43 mi^2 of the Pajarito Plateau, which consists of a series of finger-like mesas that are separated by deep canyons containing perennial and intermittent streams running from west to east. Mesa tops range in elevation from approximately 6200 ft to 7800 ft. The eastern portion of the plateau stands 300 ft to 1000 ft above the Rio Grande.

The DOE is responsible for identifying and remediating, where necessary, environmental hazards attributable to past activities at LANL. As contractor to DOE, the Laboratory's Environmental Restoration (ER) Project is tasked with investigating all PRSs at LANL and executing a remedy at those PRSs where environmental hazards related to past operations pose an unacceptable risk to human health or the environment.

This VCA plan covers PRSs in the DP Road South (A8) and DP Road 4 (A11) land transfer parcels as well as several other PRSs. These PRSs are located in TA-0 at the Laboratory and include 0-027, 0-030(a), 0-030(b), 0-029(a,b,c), 0-010(a,b), and the 6th Street Warehouse PRSs [0-004, 0-030(l,m), and 0-033(a,b)] (Figures 1.0-1, 1.0-2, and 1.0-3). Figure 1.0-1 shows the DP Road land transfer parcel before subdivision. The subdivided parcels are not yet final; therefore, the division cannot be shown on Figure 1.0-1. PRSs 0-027 and 0-030(a) are not part of the land transfer, but are included in this PRS aggregate due to their close proximity to the land transfer parcel. PRSs 0-029(a,b,c) are also included in this PRS aggregate. The PRSs that are listed in Module VIII of LANL's Resource Conservation and Recovery Act (RCRA) Hazardous Waste Facility operating permit are PRS 0-030(a) and consolidated PRS 0-030(b)-00, which includes 0-030(b,l,m), 0-004, and 0-033(b). Additional information about TA-21 and Material Disposal Area (MDA) B (PRS 21-015) is included in this document because air emissions from TA-21 potentially affected surface soil within the DP Road land transfer parcel. PRS 21-015 is directly north of the eastern boundary of the DP Road South land transfer parcel. Sampling to determine nature and extent of contamination at PRS 21-015 has concluded that some contaminants have migrated to the eastern edge of the DP Road South land transfer parcel.

This plan proposes the work required to reduce the residual risk from past Laboratory and Laboratory support operations to human health and the environment. The document includes background information for the sites, existing site characterization data, descriptions of previous site activities, descriptions of previous corrective action plans, sampling plans to address data gaps, proposed cleanup activities, and planned site restoration. Table 1.0-1 lists the PRSs covered in this plan, the proposed action for each PRS, and the current owner of the land. Appendix E of this plan is an abbreviated sampling plan for sites that need additional sampling, including a part of the land transfer parcel that needs to be assessed for historical airborne releases from TA-21 (PRS 21-021).

1.1 Purpose and Scope

The purpose of the work proposed in this plan is to reduce the residual human health and ecological risk associated with past Laboratory and Laboratory support activities. The plan describes the PRSs included in this corrective action, the previous investigations conducted at each of the sites, the results of the investigations, the basis for additional cleanup or sampling, any proposed corrective action, the confirmatory sampling rationale, and waste management. Each PRS has been investigated and/or remediated previously, and most PRSs have been written about in RFI or VCA plans and reports that describe those activities. Previous investigations and activities related to each PRS are summarized in section 2.0. Except for PRS 0-027, potential impacts on human health could not be evaluated at the remaining PRSs because of insufficient data for identifying the nature and extent of contamination. The data gaps that precluded defining the nature and extent of contamination will be addressed in the abbreviated sampling and analysis plan (Appendix E). Ecological screening assessments were not performed for any of the PRSs either because complete exposure pathways do not exist for ecological receptors (e.g., a parking lot precludes access or the contaminants are buried at depth[1]; Appendix D) or because data were insufficient to define the nature and extent of contamination.

Table 1.0-1
PRSs Included in VCA Plan

PRS	Description	Proposed Action	Current Land Owner	Relevant Sections of This Plan
0-027	Drum storage area	Soil vapor extraction	Private	2.1, 3, 4, 5, 6, 7
0-004	Indoor container storage area	Additional sampling	DOE[b]	2.2, Appendix E
0-010(a, b)	Disposal areas	Administratively complete	DOE[b]	2.5
0-030(a)	Septic system	Propose for NFA, Criterion 5	Private	2.1
0-030(b)	Septic system	Additional sampling, piping removal	DOE[b]/Private	2.3, Appendix E
0-030(l)	Septic system	Additional sampling, piping removal	DOE[b]	2.2, Appendix E
0-030(m)	Septic system	Additional sampling, piping removal	DOE[b]	2.3, Appendix E
0-033(a)	UST[a]	Administratively complete	DOE	2.5
0-033(b)	Contaminated soil, drainlines, and an outfall	Additional sampling	DOE[b]	2.2, Appendix E
0-029(a)	PCB transformer site	Additional sampling	San Ildefonso	2.4, Appendix E
0-029(b)	PCB transformer site	Additional sampling	San Ildefonso	2.4, Appendix E
0-029(c)	PCB transformer site	Additional sampling	Santa Fe National Forest	2.4, Appendix E
21-021	Aerial deposition from TA-21 stacks	Additional sampling	DOE[b]	2.6, Appendix E

[a] UST = underground storage tank.

[b] Part of proposed DP Road South and DP Road 4 land transfer parcels.

The previous reports did not address ecological concerns and some did not address nature and extent of contamination. Because the guidelines for evaluating sites have become more stringent over the years, this plan will address data gaps for situations in which nature and extent are either undefined or incompletely defined.

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[1] It is important to note that ecological receptors are not expected to experience significant chemical exposure at more than 5 ft below the ground surface (bgs) because burrowing activity and most plant root development are unlikely this far below the surface; therefore, depths greater than 5 ft bgs were not screened for ecological receptors (LANL 1999, 64783).

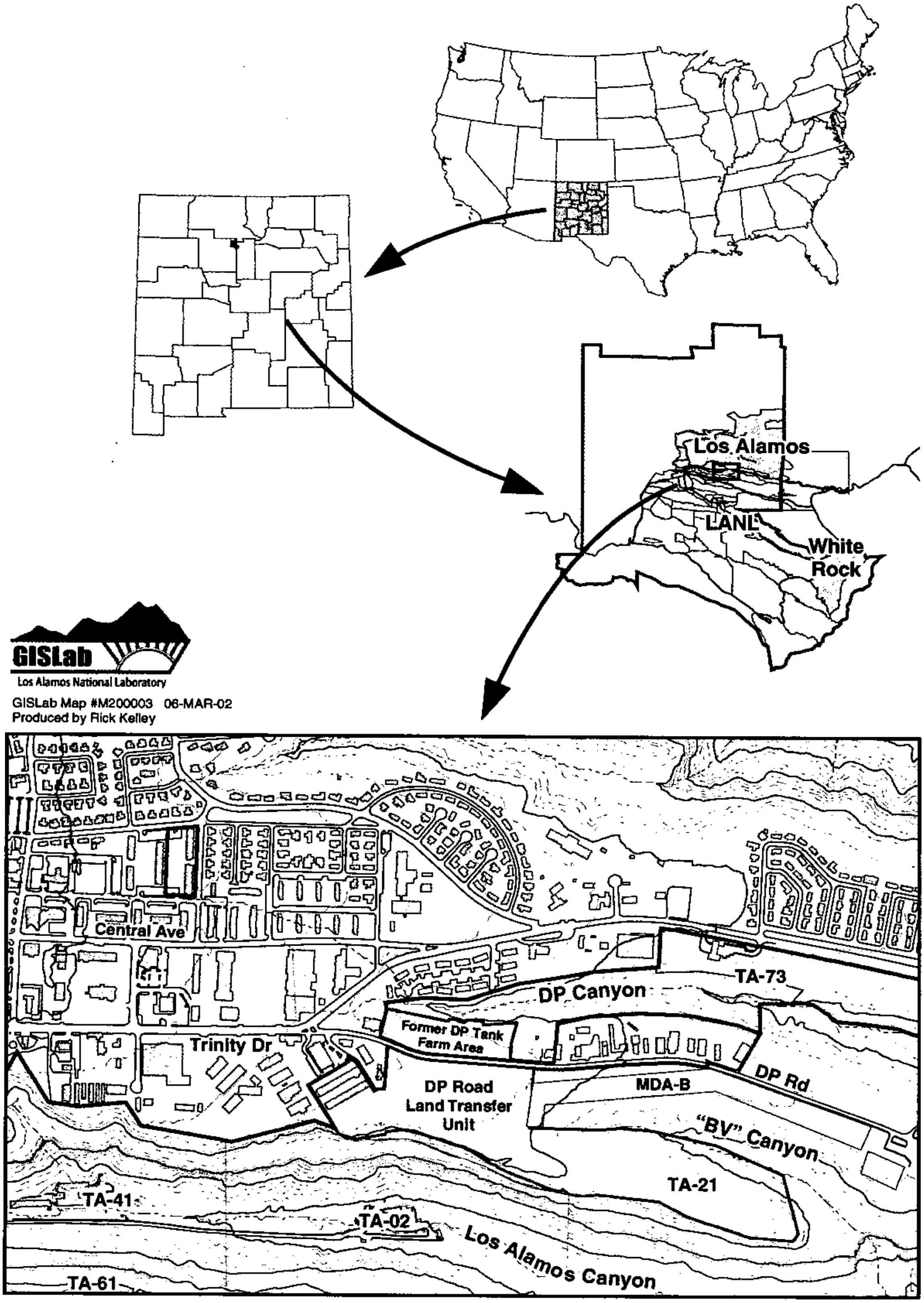

Figure 1.0-1. **Location map of New Mexico, LANL, and DP Road land transfer parcel**

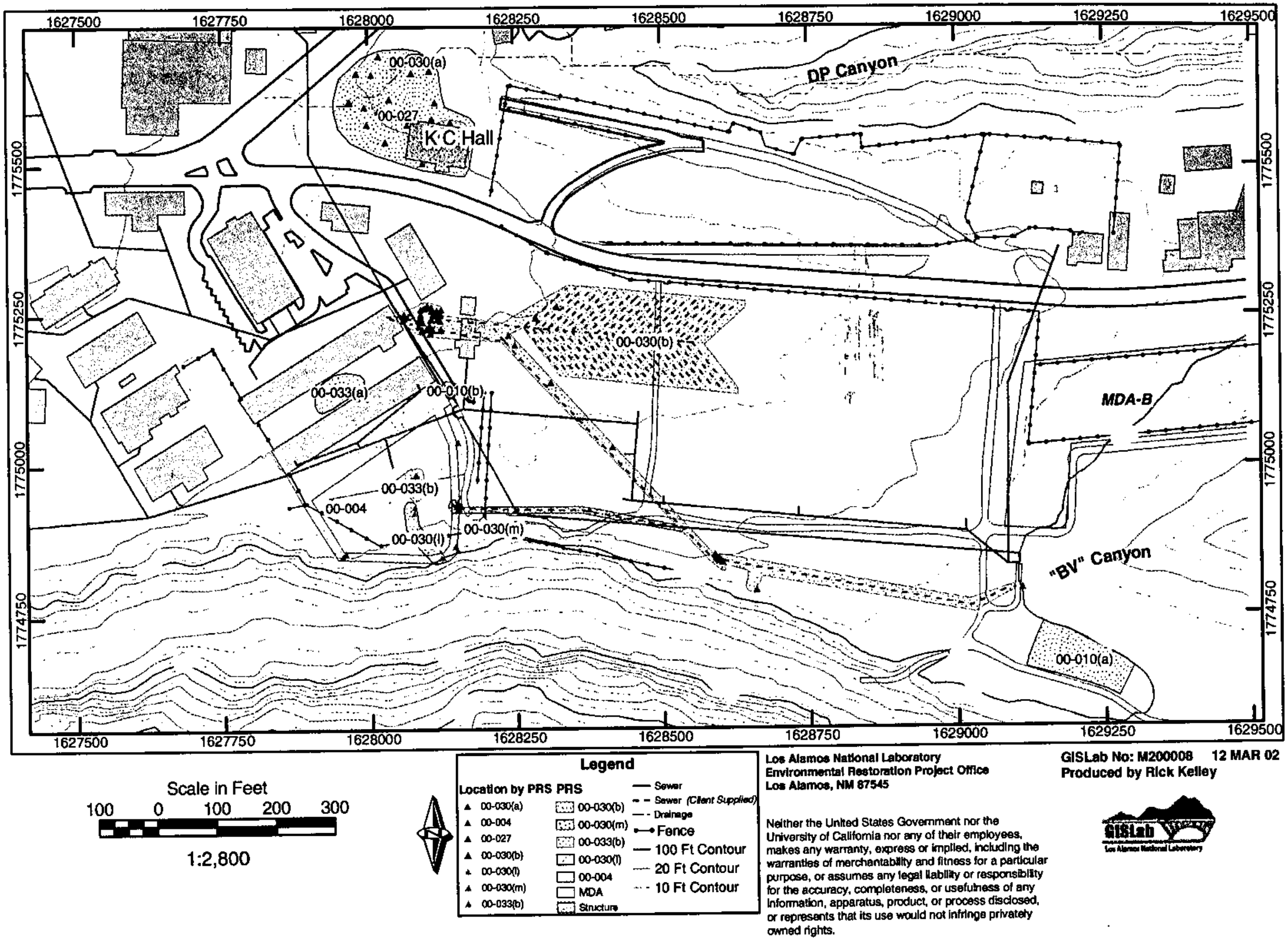

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Figure 1.0-2. DP land transfer potential release sites

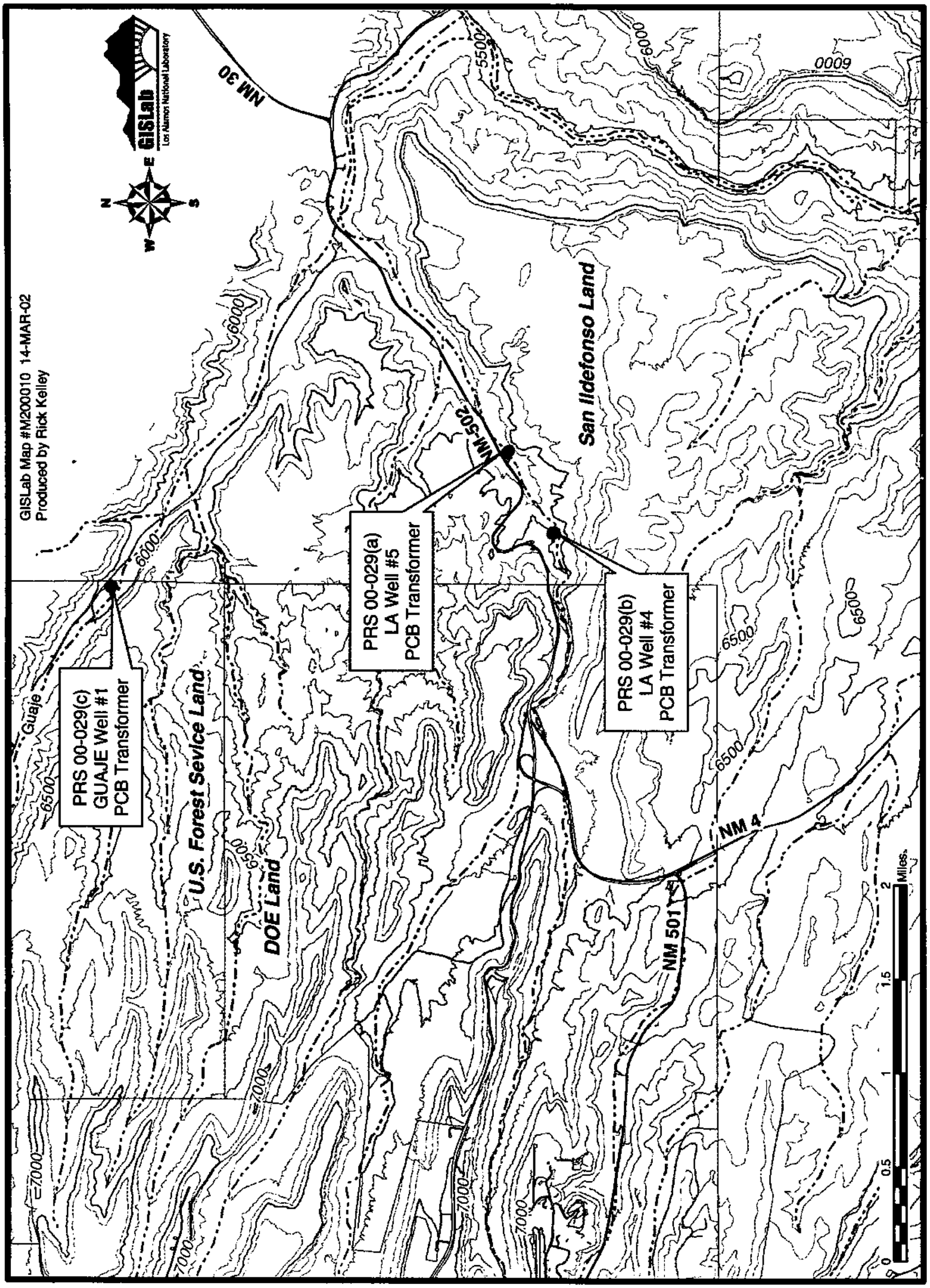


Figure 1.0-3. **Locations of PRSs 0-029(a,b,c)**

1.2 Regulatory History

Depending upon the type of contaminant(s) and the history of a PRS, either the New Mexico Environment Department (NMED) or the DOE has administrative authority over work performed by the ER Project. NMED, under the auspices of the State of New Mexico, has authority over sites with hazardous waste or hazardous constituents, including the hazardous waste portion of mixed waste (i.e., waste contaminated with both radioactive and hazardous constituents). Hazardous constituents are regulated under RCRA. The DOE has authority over sites with radioactive contamination; radionuclides are regulated under DOE Order 5400.5, "Radiation Protection of the Public and the Environment," and DOE Order 435.1, "Radioactive Waste Management."

Module VIII of the Laboratory's Hazardous Waste Facility Permit, hereinafter referred to as the HSWA module (EPA 1990, 1585), is regulated by NMED. The HSWA module specifies conditions and requirements for performing ER activities. The Environmental Protection Agency (EPA) issued the HSWA module on May 23, 1990, and revised it on May 19, 1994; the permit renewal application is currently undergoing review by NMED.

Although only PRSs 0-030(a,b,l,m) and 0-033(a) are listed in the HSWA module, all of the PRSs within the area to be transferred are included in this plan. DOE is the administrative authority for PRSs 0-027, 0-010(a,b), and 0-029(a,b,c). NMED is the administrative authority for PRSs 0-004, 0-030(a,b,l,m) and 0-033(b). DOE has approved NFA for PRSs 0-010(a,b) under Criterion 2. Criterion 2 states that the site was never used for the management (i.e., generation, treatment, storage, or disposal) of RCRA solid or hazardous wastes and/or constituents. The NFA for PRS 0-033(a) under Criterion 4 is pending NMED approval. Criterion 4 states that the site is regulated under another state and/or federal authority. If the site is known to have released, or is suspected of releasing or having released, RCRA solid or hazardous wastes and/or constituents to the environment, it has been or will be investigated and/or remediated in accordance with applicable state and/or federal regulations.

1.3 Rationale for Proposed Voluntary Corrective Action

Some of the PRSs are located on property that is slated for land transfer to Los Alamos County (Figures 1.0-1 and 1.0-2). Two of the PRSs that are not part of the land transfer parcel belong to the Archdiocese of Santa Fe [PRS 0-027 and PRS 0-030(a)] (Figure 1.0-2). The San Ildefonso Pueblo owns the land where PRSs 0-029(a) and 0-029(b) are located (Figure 1.0-3); and Santa Fe National Forest manages the land where PRS 0-029(c) is located (Figure 1.0-3). A portion of PRS 0-030(b) is private property; the remainder is located on DOE land.

The proposed VCA activities will remove residual contamination that could pose an unacceptable risk to human health or the environment from the Los Alamos town site, will allow the PRSs to be closed and subsequently removed from the Laboratory's operating permit, and will allow permanent transfer of the property to the county for commercial or private use. Previous RFI and VCA activities did not remove existing pipelines; therefore, these pipelines will be removed to prevent future exposure to any residual concentrations of chemicals of potential concern (COPCs). Because data gaps and COPCs were identified at some of the PRSs, additional sampling will be conducted to ensure that the extent of potential contamination has been defined and will provide sufficient information for human health and ecological assessments. Soil vapor extraction (SVE) is proposed for PRS 0-027 to remove elevated concentrations of volatile organic chemicals (VOCs) in the subsurface. SVE is viewed as a cost-effective, proactive remedial alternative and is preferred over additional characterization followed by a baseline risk assessment. It is anticipated that the VCA at PRS 0-027, as well as removal of any remaining piping and additional sampling at some of the other PRSs, will not generate a significant volume of waste. The anticipated wastes and recyclable materials generated during VCA activities should be easily accommodated at local facilities. Completion of these VCA activities will constitute final remedies at each of the PRSs.

2.0 PREVIOUS SITE CHARACTERIZATION

The PRSs included in this plan were previously described in the Laboratory "Solid Waste Management Units Report" (LANL 1990, 0145) and in the "RFI Work Plan for Operable Unit [OU)] 1071" (LANL 1992, 0781). The PRSs have been characterized, and in some cases remediated; those activities and associated analytical data have been reported in the following reports.

- "RFI Report for Potential Release Sites 0-030(b), 0-004, 0-010(b), 0-033(b), 6th Street Warehouses" (LANL 1996, 54616)
- "Voluntary Corrective Action Completion Report for 6th Street Warehouses, PRSs 0-030(l), 0-030(m), and 0-033(a)" (LANL 1996, 55203)
- "Voluntary Corrective Action Completion Plan for Potential Release Site 0-030(a)" (LANL 1996, 54353.3)
- "Voluntary Corrective Action Report for Solid Waste Management Unit 0-030(a)" (LANL 1996, 59576.1)
- "Voluntary Corrective Action Plan for Potential Release Sites at TA-0, PRSs 0-033(b) and 0-030(b)" (LANL 1996, 54760)
- "Voluntary Corrective Action Completion Report for TA-0, PRSs 0-033(b) and 0-030(b)" (LANL 1996, 62536)
- "RFI Phase Report, Operable Unit 1071, SWMU Aggregate 0-G, Leakage from PCB Transformers" (LANL 1993, 26972)
- "Phase Report 1B: TA-21 Operable Unit RCRA Facility Investigation Operable Unit–Wide Surface Soil, Deposition Layer and Filter Building Investigation" (LANL 1994, 26073)

The information in this plan has been summarized from the documents listed above. In addition, the existing analytical data were re-examined to determine if they were sufficient for defining nature and extent for the PRSs. If data were adequate to define nature and extent, the data for the PRSs were assessed to determine if COPCs pose an acceptable risk to human health and the environment.

A sequence of aerial photographs recorded the changes that have occurred at the PRSs on the mesa top since the Laboratory was established. Figure 2.0-1 (LANL 1946, 15463) shows the land transfer mesa-top parcels in 1946, with the 6th Street Warehouses clearly visible as a point of reference. Also shown in this photo is the incinerator, which was served by the septic system of PRS 0-030(m). PRS 0-027 appears as a fuel tank farm. Coal piles are visible east of the leach field for PRS 0-030(b). PRS 0-010(a) is visible on the east side of the photograph as a storage area.

Figure 2.0-2 is an aerial photograph from 1951 (LANL 1951, 15503) which shows the trailer park located over the former PRS 0-030(b) leach field. Also shown on this photograph is the Material Testing Laboratory (MTL), which tested concrete and asphalt; the incinerator is no longer present. A berm that is now located along the canyon north of PRSs 0-030(l) and 0-030(m) is visible in this photograph. PRS

0-027 is clearly visible as a drum storage area; the fuel tank farm had been moved to the east to PRS 21-029 (DP Tank Farm).

Figure 2.0-3 (LANL 1958, 15730) is a 1958 aerial photograph that shows the cells of the drum storage area (PRS 0-027). The 1965 photo (Figure 2.0-4) shows the current building located over part of the drum storage area that can be seen in earlier photographs. The photo from 1974, Figure 2.0-5, shows that the former drum storage area had been either paved or covered by the existing building, and the trailer park had been recently removed, as indicated by bare soil. Figure 2.0-6 is an aerial photograph from 1986 in which it appears that the MTL is no longer present. Grass and shrubs cover the former trailer court.

2.1 DP Road Drum Storage Area and Septic Tank [PRSs 0-027 and 0-030(a)]

As shown on Figure 2.1-1, PRSs 0-027 and PRS 0-030(a) are both located on the Knights of Columbus property at 104 DP Road. These PRSs are aggregated due to their spatial proximity and because PRS 0-030(a) was the septic tank and associated lines that were connected to the dispatch office for the tank farm and drum storage area (PRS 0-027). An RFI report was never completed for PRS 0-027; a VCA plan and a VCA completion report were submitted for PRS 0-030(a) (LANL 1996, 54353.3 and LANL 1996, 59576.1, respectively).

2.1.1 PRS 0-027, DP Road Drum Storage Area

2.1.1.1 PRS 0-027 Site Description and Operational History

PRS 0-027 is located at the intersection of Trinity Drive and DP Road, the current site of the Knights of Columbus Hall, which is owned by the Archdiocese of Santa Fe. This PRS is described in detail in section 5.7 of the "RFI Work Plan for OU 1071" (LANL 1992, 0781). The site was used as a fuel tank farm from 1946 to mid-1948. An aerial photograph (Figure 2.0-1) and engineering drawings from 1946 and 1947 indicate that at least eight above-ground oil storage tanks and three fill stations were located in the DP Road storage area. In mid-1948, the fuel tank farm was relocated to the area that is now PRS 21-029, and the oil tanks were decommissioned and moved to PRS 21-029, DP Tank Farm (LANL 1990, 0145).

After the oil tanks were removed, the site was converted into a drum storage area where metal 55-gal. drums of lubricants were stored for distribution to various job sites and craft shops. The storage capacity of the site was approximately 600 to 700 drums (LANL 1990, 0145) and consisted of 6 cells, each approximately 38 ft wide (LANL 1990, 0145) with varying lengths (Figures 2.0-2 and 2.0-3). The cells were separated by 2-ft-high earthen dikes around the northern perimeter and a concrete berm at the southern perimeter. The floor of each cell was sloped to the north and covered by 2 in. of gravel. Aerial photos show that the drum storage area was used until the early 1960s (Figures 2.0-3 and 2.0-4).

By 1965, the current Knights of Columbus building existed on the property (Figure 2.0-4). As seen in an aerial photo (Figure 2.0-5), the parking lot was paved with concrete by 1974. Since that time the configuration of the property has changed very little.

Based on the site history and documented use, the COPCs for PRS 0-027 are primarily constituents of petroleum fuels, lubricants, etc., including VOCs, semivolatile organic compounds (SVOCs), total petroleum hydrocarbons (TPH), and target analyte list (TAL) metals.

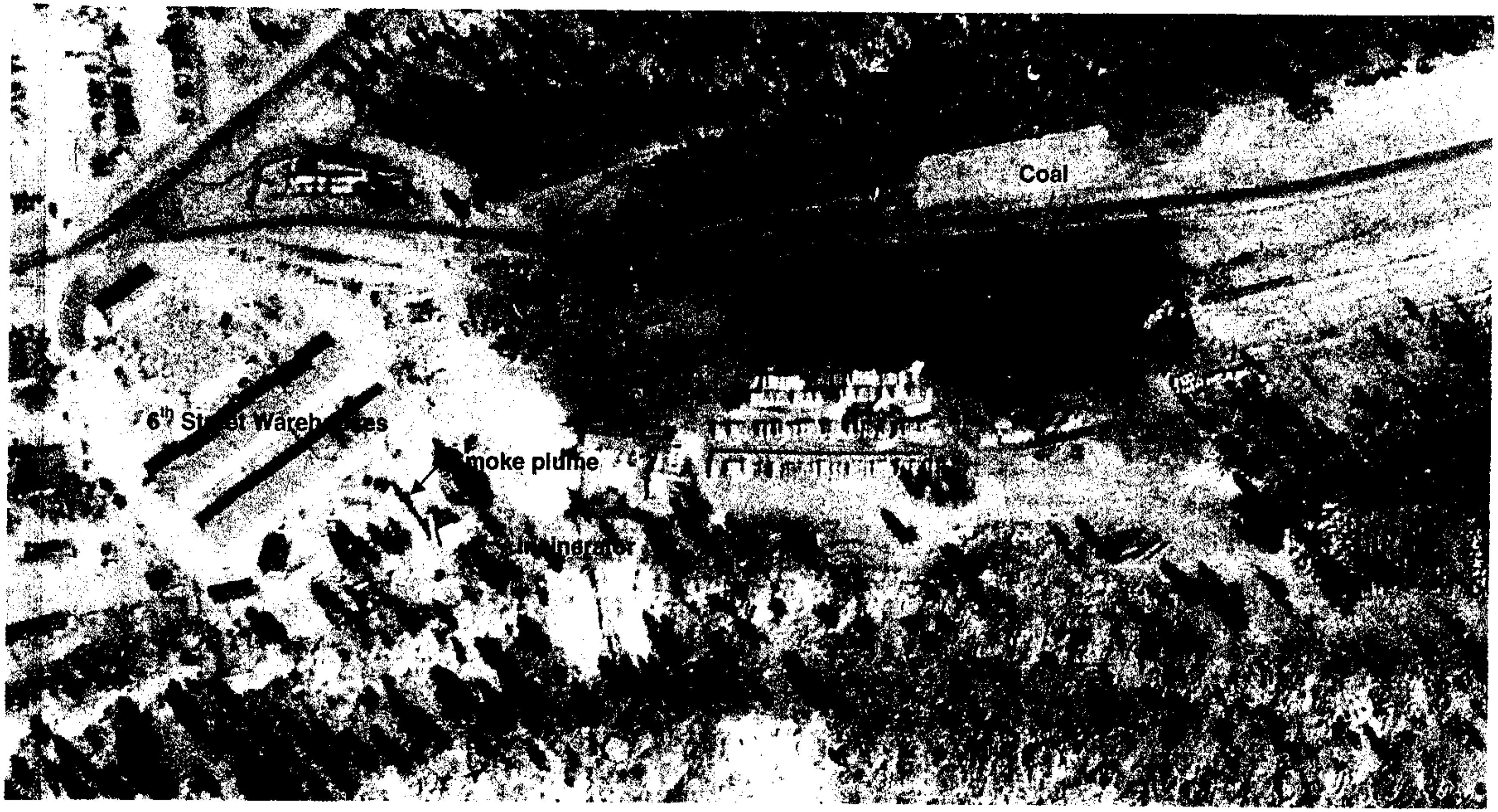


Figure 2.0-1. 1946 aerial photograph

Figure 2.0-2. 1951 aerial photograph (negative)

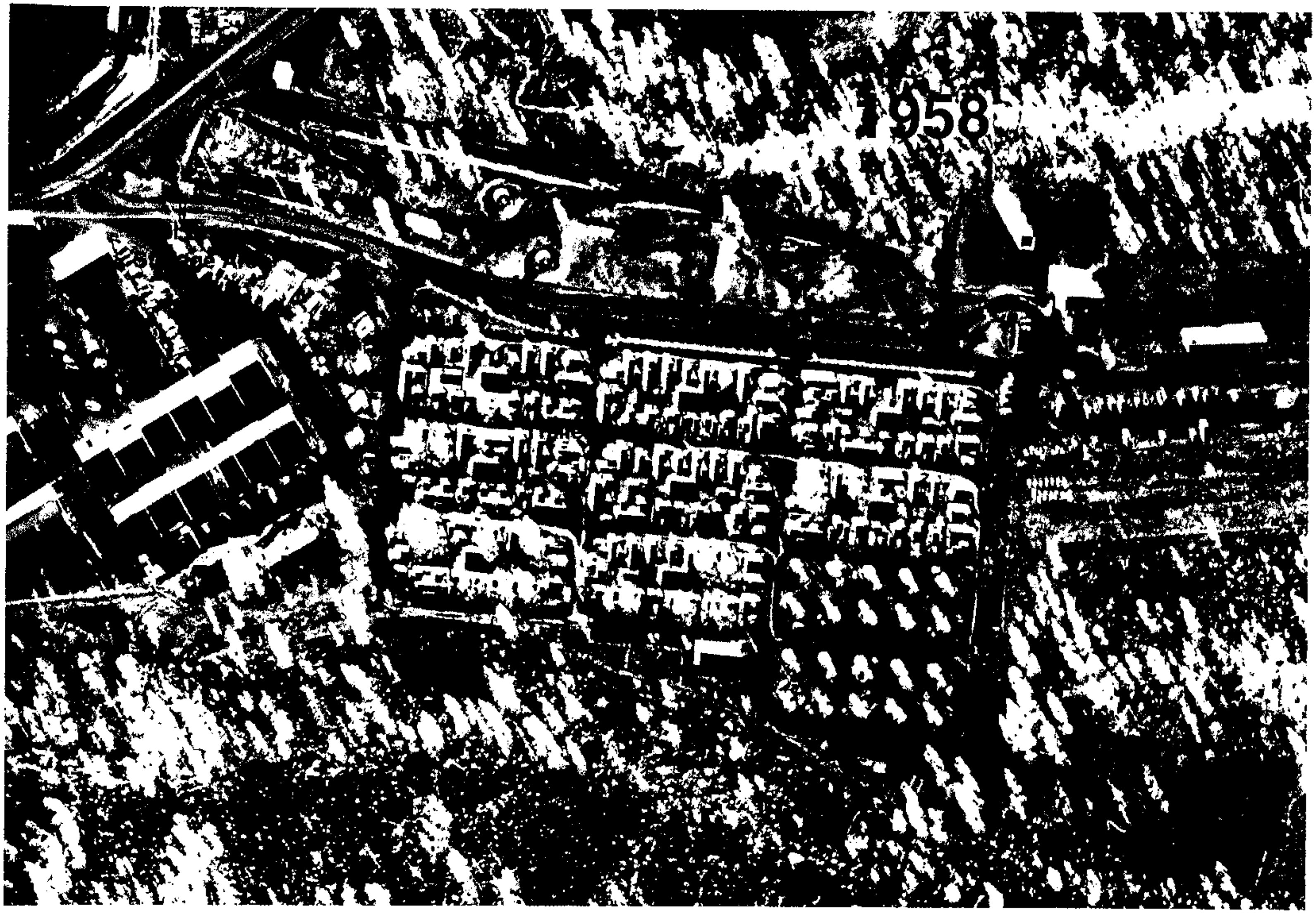


Figure 2.0-3. 1958 aerial photograph (negative)

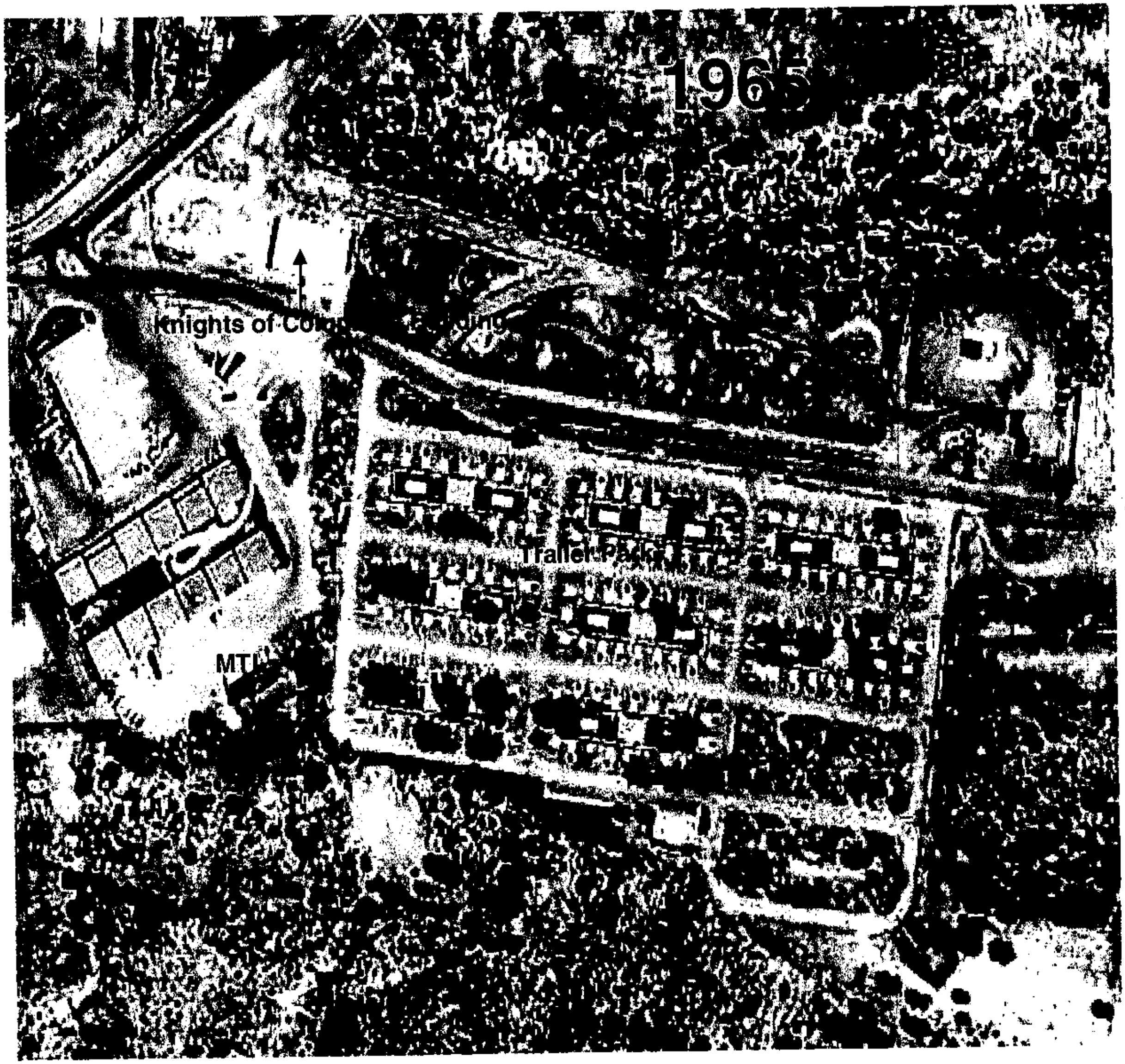


Figure 2.0-4. 1965 aerial photograph

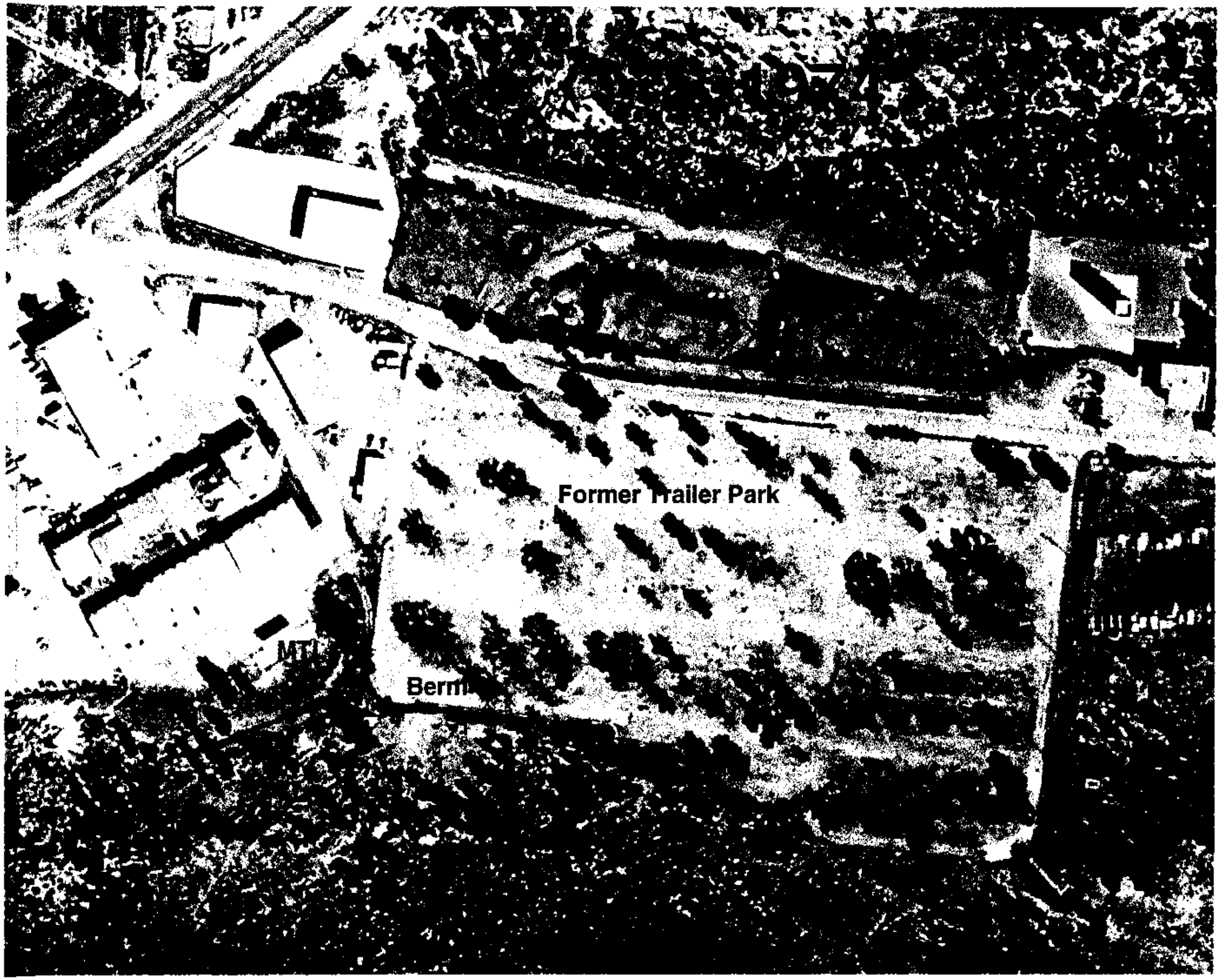


Figure 2.0-5. 1974 aerial photograph

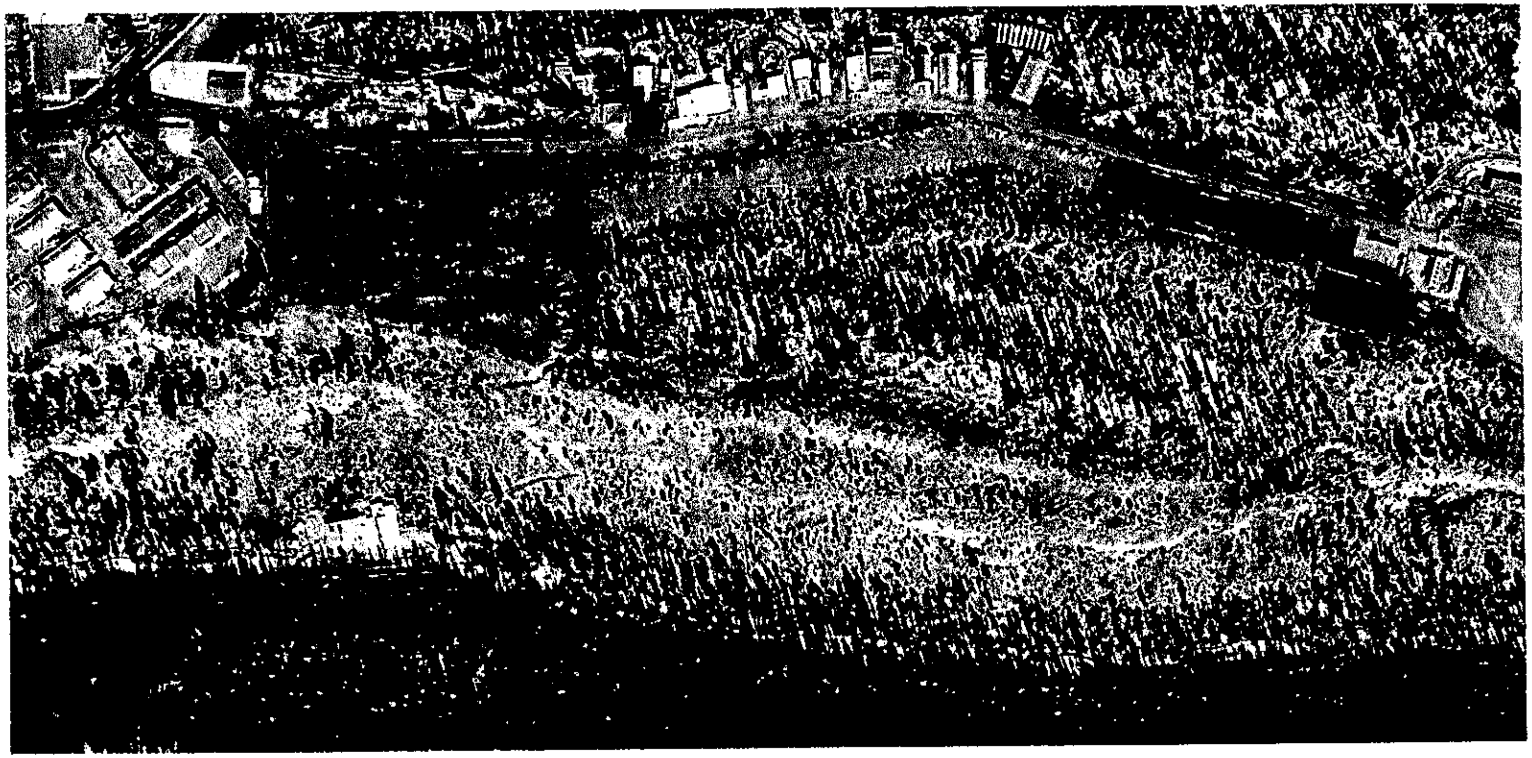


Figure 2.0-6. 1986 aerial photograph

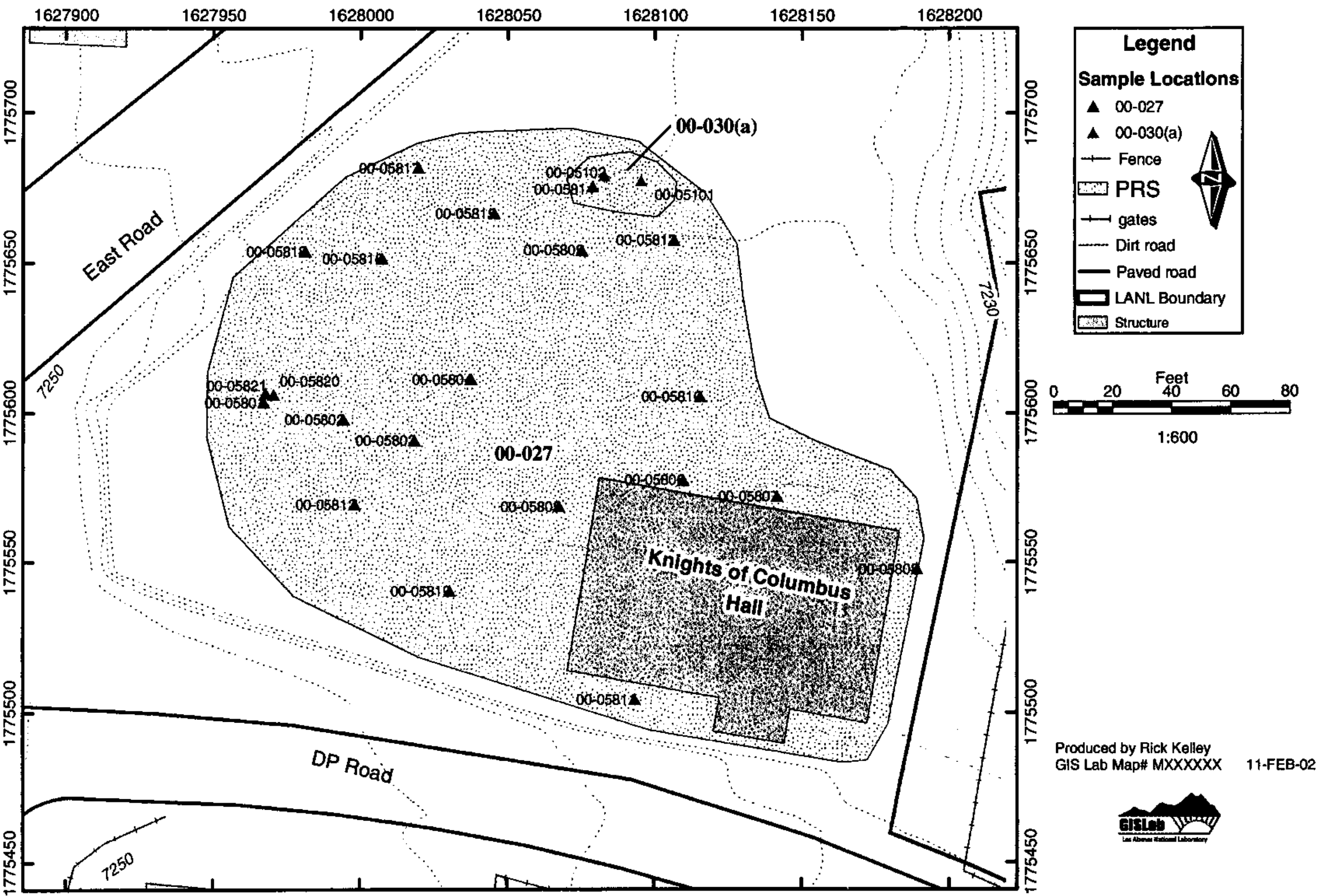


Figure 2.1-1. PRS 0-027 and PRS 0-030(a) sample location map

2.1.1.2 PRS 0-027, Previous Field Investigations

RFI field activities were conducted in the spring and fall of 1996 (Figure 2.1-1). The RFI report was never completed; therefore, all analytical data for PRS 0-027 will be presented in the VCA completion report to be prepared following completion of all proposed sampling and corrective measures as described in this plan. As stated in the RFI work plan (LANL 1992, 0781), the objectives of the RFI were to locate underground structures remaining after site decommissioning, to determine whether vapor phase contaminants existed in shallow soils or fill material at the drum storage areas, and to determine the nature and extent of contaminants, if any, in site media.

The following field activities were conducted at PRS 0-027:

- In early 1996, using site plans and archival maps as guides, a geodetic survey was conducted to determine the current locations of buried structures, drainlines, and outfall points, and the former locations of drum storage cells and above-ground fuel storage tanks. The survey was also used to identify soil vapor sample locations and borehole sample locations. The survey identified the locations of a former fuel dispatch office, the seven north-south trending earthen berms, and the eight former above-ground fuel storage tanks. Current structures were surveyed, including the Knights of Columbus Hall building, associated outbuildings, and a cement block wall along the south and west property lines.
- During the spring of 1996, a geophysical survey consisting of electromagnetic (EM) induction and magnetic methods was conducted to more precisely locate buried structures and drainlines.
- In June 1996, a soil vapor survey was conducted in the vicinity of the tank and drum storage areas to determine whether vapor phase contamination existed in the subsurface soils. Sampling was accomplished using probes that consisted of 5-ft lengths of 1 in. outside diameter stainless-steel pipe fitted with a 1-in. stainless-steel, retractable, disposable tip. In general, every attempt was made to drive the stainless-steel sampling probes to a target depth of approximately 6 ft bgs before collecting the soil vapor sample. At four locations, however, samples were collected at less than 6 ft bgs due to refusal. At two locations the probes were driven to a depth of 10 ft before sampling. Soil vapor samples were analyzed for benzene, toluene, ethylbenzene, and xylene (BTEX).
- In September and October of 1996, subsurface soil samples were collected at 21 borehole locations that were selected based on the locations of the former fuel storage cells and areas of contaminated soil that were identified by the soil vapor survey and the VCA investigation at PRS 0-030(a) (LANL 1996, 59576.1). Borehole depths ranged from 20 ft bgs to 60 ft bgs. Subsurface samples were analyzed for VOCs, SVOCs, TPH, TAL metals, and pesticides/polychlorinated biphenyls (PCBs).
- During December 1997, indoor air samples were collected within the Knights of Columbus Building in various locations to determine if VOCs were present in the building. A total of eight air samples were collected and analyzed for VOCs.

(a) Sample Analyses

All samples were collected in accordance with the sampling design specified in the "RFI Work Plan for OU 1071" (LANL 1992, 0781), with the exception of the indoor air samples, whose collection was a deviation from the work plan. The work plan did not require that indoor air samples be collected. Samples requiring chemical and radiological analyses and chain-of-custody documentation were submitted to the Mobile

Radiological Analysis Laboratory (MRAL) and the Mobile Chemical Analysis Laboratory (MCAL) for analyses before shipment from the Sample Management Office (SMO) to a fixed analytical laboratory. The indoor air samples were submitted to the SMO before shipment to a fixed analytical laboratory.

(b) Analytical Methods

All samples were analyzed by contract analytical laboratories using methods specified in the ER SMO analytical subcontracts (LANL 1995, 1278). The methods were current Environmental Protection Agency (EPA) SW-846 and Contract Laboratory Program (CLP) methods or equivalents for VOCs, SVOCs, TPH, TAL metals, and pesticides/PCBs. The indoor air samples were analyzed by method TO-14. Before analysis for inorganic chemicals, solid samples were digested according to EPA SW-846 method 3050 or equivalent (EPA 1992, 1207). The subcontracts specify LANL-approved methods for radiochemical analyses using the technologies identified in the subcontract (americium-241 by alpha spectroscopy). Analytical method selection is described in Appendix IV of the ER Project Quality Assurance Project Plan Requirements for Sampling and Analysis (QAPP), which is included as Chapter 4 of the "Installation Work Plan [IWP] for Environmental Restoration Program" (LANL 1996, 1379). For each analyte, quantitation or detection limits are specified as contract-required estimated quantitation limits (EQLs) for organic chemicals and radionuclides, and as estimated detection limits (EDLs) for inorganic chemicals. These limits are included in Appendix III of the ER Project QAPP, along with the target analytes for each analytical suite.

(c) Data Validation

Data verification and baseline validation procedures were used to determine if the data packages received for PRS 0-027 from the analytical laboratory were generated according to specifications and contained the information necessary for determining if the data are sufficient for decision-making. For analytical data used to support decisions discussed in this VCA plan, baseline data validation under the ER protocol was performed as described in the QAPP (LANL 1996, 1379). This process produced validation reports with data qualifiers indicating potential deficiencies for affected results. Each data qualifier is accompanied by a reason code that provides information about the deficiency that led to qualification of the data. A summary of the validation reports will be included in the VCA completion report.

Although data were qualified for a variety of reasons during the baseline data validation process, the quality of data obtained in the earlier investigation was good. The baseline validation procedure used for routine analytical services provides information about the reason the qualifier was applied and its potential impact on the affected data. The purpose is not to reject data but rather to ensure that the relative quality of the data is understood so that the data may be used appropriately.

(d) Field Investigation

The initial borehole locations at PRS 0-027 were selected using the criteria described in the "RFI Work Plan for OU 1071" (LANL 992, 0781). One borehole was placed inside the boundaries of each of the accessible drum storage cells (locations 00-05801, 00-05802, 00-05803, and 00-05805) (Figure 2.1-1). Because of problems with refusal, three boreholes were required to drill to the depth of 48 ft at borehole 00-05801. The first two attempts (location 00-5801 and 00-5802) met with refusal. A third attempt (location 00-05821) successfully reached 48 ft. Because the Knights of Columbus Hall currently covers the former two easternmost cells of the drum storage area, four boreholes (locations 00-05806, 00-05807, 00-05808, and 00-05811) were drilled around the perimeter of the building to detect contamination associated with these cells. One borehole (location 00-05804) was placed near a location (also the location of a former fill station) corresponding to high soil vapor concentrations identified during the soil vapor survey. Two boreholes (locations 00-05809 and 00-05815) were placed near areas of contaminated soil that were identified during the VCA at PRS 0-030(a) (LANL 1996, 59576.1). Additional boreholes were added to bound contaminant plumes intercepted by the initial boreholes drilled during these field activities.

Samples were collected from 20 of the 21 boreholes at 19 distinct locations. In accordance with the work plan, samples were collected from soils or fill material overlying the tuff, at or near the soil/tuff interface, and from within the tuff. Where field-screening results indicated the presence of contaminants in the upper tuff, drilling and screening of samples continued in 5-ft intervals. Drilling ceased for each borehole when field-screening results indicated that the augers had penetrated at least 5 ft deeper than the deepest zone of contamination. A final sample was collected at, or near, the final depth of each borehole. If contamination was noted in a borehole, subsequent adjacent boreholes were advanced to at least the known depth of contamination in the original borehole. Depths of the boreholes at the DP Road storage area ranged from 20 ft bgs at the east end of the Knights of Columbus Hall (location 00-05808) to 60 ft bgs near the northwest portion of the storage area (location 00-05816).

Based on field screening, MCAL data, and fixed laboratory data, the areal and vertical extent of potential subsurface contamination was defined. The contamination extends vertically from the surface soils underlying the concrete parking lot to a depth of approximately 43 ft at location 00-05802. The approximate areal extent of the risk-driver contaminants is shown in Figure 2.1-2. To keep the figure as clear as possible, other contaminants, which were detected at lower levels, are not presented on this figure.

After sampling was completed, cuttings were returned to the borehole from which they were retrieved. Cuttings were placed in the boreholes in their original vertical sequence. The upper 2 ft of each borehole was filled with concrete.

Solid wastes generated during this investigation, including drill cuttings and core, disposable sampling equipment, plastic sheeting, empty plastic cuttings bags, and personal protective equipment, were placed in 55-gal. drums. Liquid wastes produced during the decontamination of drilling and downhole sampling equipment and personal hand-wash rinse water were also stored in 55-gal. drums. Waste drums were staged in a temporary waste staging area and then transferred to the Laboratory's CST-5. All waste was then profiled, manifested, and transported off-site for disposal.

The following deviations from the work plan occurred during fieldwork:

- Geomorphic mapping was not conducted. The intent of the mapping was to locate first-order stream channels and sediment catchment areas below outfalls from the site. It is believed that the work plan was written without a site visit because the upper end of the canyon was filled in the 1960s and 1970s, burying the channel and any sediment catchment areas. The presence of fill material in the upper portion of DP Canyon made this task irrelevant and impossible.

- Subsurface sampling associated with outfall piping from the drum storage area was not conducted because no evidence was found to indicate that the piping or outfall existed.

- Because the Knights of Columbus Hall covers the two easternmost drum storage cells, no drilling was attempted in those cells. Instead, four boreholes were drilled around the perimeter of the building in an attempt to bound any contamination that may exist beneath the building.

- In an attempt to bound the extent of contamination at the site, borehole drilling and sampling operations were expanded to 19 distinct locations at the site.
- Indoor air samples were collected in 1997 to determine whether contaminants from PRS 0-027 were entering the building. Indoor air samples were not included in the work plan.

2.1.1.3 PRS 0-027, Results of Previous Investigations

Data collected for the PRS 0-027 RFI were adequate to define the nature and extent of contamination associated with the former fuel and lubricant storage operations. Figure 2.1-2 shows the sample locations and contour lines of analytical data and photo-ionization detector (PID) readings.

(a) Data Review

Inorganic Chemical Comparison to Background Values

Table 2.1-1 summarizes the inorganic chemical data. It lists each analyte with its number of detects, the range of concentrations, the frequency of detects above the background values (BVs), and the frequency of nondetects above the BVs. Table 2.1-2 shows the samples with concentrations above the corresponding BVs.

Three subsurface soil samples were collected. Antimony, calcium, and zinc were detected above their BVs in at least 1 of those samples. Antimony, cadmium, calcium, and lead were detected above their BVs in one or more of the 7 fill samples. Aluminum, barium, calcium, cobalt, copper, lead, magnesium, nickel, vanadium, and zinc were above their respective BVs in one or more of 23 tuff samples.

Organic Chemicals

Table 2.1-3 summarizes the organic chemical data by analyte, with number of detects, range of concentrations, and frequency of detects. Table 2.1-4 presents the detected concentrations for all of the organic chemicals that were detected in at least one sample.

Indoor Air Data

Eight indoor air samples were collected inside the Knights of Columbus Building and analyzed for VOCs. The results of the COPCs are included on Table 2.1-5. The values are given in parts per billion by volume (ppbv). This means that the analytical techniques determine the total weight of contaminant in the collection medium.

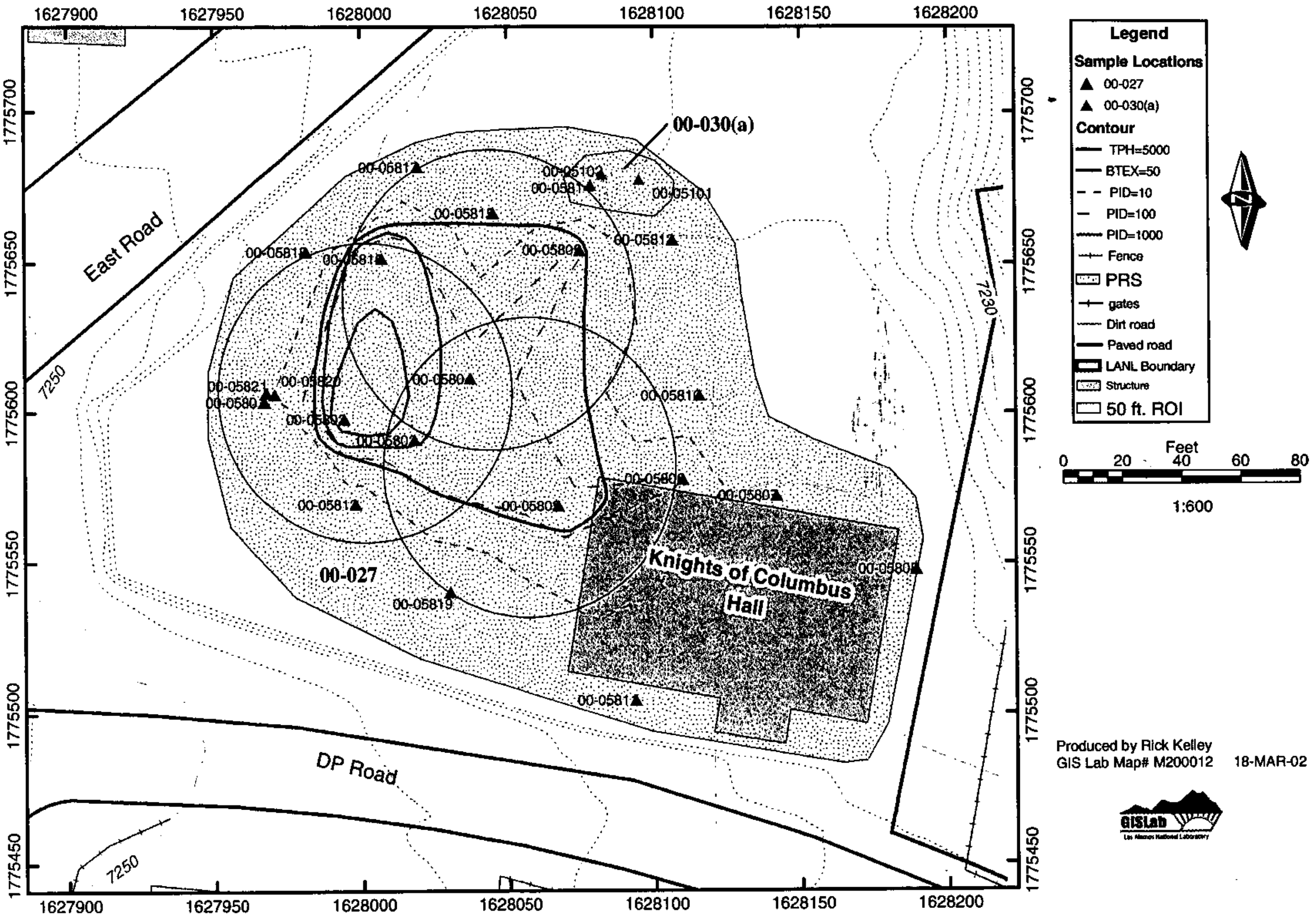


Figure 2.1-2. PRS 0-027, contaminant plume and maximum values of BTEX and TPH

(b) Results of Quality Assurance/Quality Control Activities

Most of the data were determined to be useable. A few organics had problems related to high or low surrogates. A complete data quality section will be included in the VCA completion report.

Table 2.1-1
Frequency of Detects for Inorganic Chemicals at PRS 0-027

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	BV (mg/kg)	Frequency of Detects Above BV[a]	Frequency of Nondetects Above BV[b]
Aluminum	Soil	3	3	4980 to 9890	29200	0/3	0/0
	Fill	7	7	1300 to 10400	29200	0/7	0/0
	Qbt 3	23	23	268 to 8490	7340	1/23	0/0
Antimony	Soil	3	1	[0.39] to 10.2	0.83	1/3	0/2
	Fill	7	1	[0.4] to 6.4	0.83	1/7	1/6
	Qbt 3	23	0	[0.38 to 6.2]	0.5	0/23	20/23
Arsenic	Soil	3	3	2.4 to 4.1	8.17	0/3	0/0
	Fill	7	7	1.3 to 3.3	8.17	0/7	0/0
	Qbt 3	23	21	0.23 to [11.2]	2.79	0/23	2/2
Barium	Soil	3	3	53.8 to 155	295	0/3	0/0
	Fill	7	7	17.4 to 170	295	0/7	0/0
	Qbt 3	23	23	6.2 to 317	46	2/23	0/0
Beryllium	Soil	3	3	0.51 to 0.79	1.83	0/3	0/0
	Fill	7	7	0.35 to 0.8	1.83	0/7	0/0
	Qbt 3	23	23	0.09 to 0.96	1.21	0/23	0/0
Cadmium	Soil	3	1	0.05 to [0.73]	0.4	0/3	1/2
	Fill	7	1	[0.04] to 0.77	0.4	1/7	0/6
	Qbt 3	23	0	[0.04 to 0.78]	1.63	0/23	0/23
Calcium	Soil	3	3	1150 to 14500	6120	1/3	0/0
	Fill	7	7	495 to 7050	6120	1/7	0/0
	Qbt 3	23	23	96.3 to 3530	2200	1/23	0/0
Chromium, total	Soil	3	3	4.1 to 10	19.3	0/3	0/0
	Fill	7	7	0.97 to 9.7	19.3	0/7	0/0
	Qbt 3	23	22	0.28 to 9.3	7.14	1/23	0/1
Cobalt	Soil	3	3	1.8 to 6.7	8.64	0/3	0/0
	Fill	7	7	0.81 to 6.7	8.64	0/7	0/0
	Qbt 3	23	17	0.22 to 8.3	3.14	1/23	0/6
Copper	Soil	3	3	2.4 to 7.7	14.7	0/3	0/0
	Fill	7	7	2.2 to 6.5	14.7	0/7	0/0
	Qbt 3	23	21	0.68 to 11.7	4.66	1/23	0/2
Iron	Soil	3	3	6640 to 12600	21500	0/3	0/0
	Fill	7	7	2610 to 11800	21500	0/7	0/0
	Qbt 3	23	23	1690 to 13200	14500	0/23	0/0

Table 2.1-1 (continued)

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	BV (mg/kg)	Frequency of Detects Above BV[a]	Frequency of Nondetects Above BV[b]
Lead	Soil	3	3	9.4 to 15.3	22.3	0/3	0/0
	Fill	7	7	6.3 to 27	22.3	2/7	0/0
	Qbt 3	23	23	2.6 to 38.7	11.2	7/23	0/0
Magnesium	Soil	3	3	787 to 2620	4610	0/3	0/0
	Fill	7	7	360 to 2000	4610	0/7	0/0
	Qbt 3	23	23	81.5 to 2010	1690	1/23	0/0
Manganese	Soil	3	3	128 to 335	671	0/3	0/0
	Fill	7	7	145 to 377	671	0/7	0/0
	Qbt 3	23	23	129 to 405	482	0/23	0/0
Mercury	Soil	3	0	[0.05 to 0.06]	0.1	0/3	0/3
	Fill	7	4	0.01 to [0.06]	0.1	0/7	0/3
	Qbt 3	23	11	0.01 to [0.06]	0.1	0/23	0/12
Nickel	Soil	3	2	[3.2] to 7.8	15.4	0/3	0/1
	Fill	7	7	2.4 to 6	15.4	0/7	0/0
	Qbt 3	23	18	0.66 to 7.9	6.58	1/23	0/5
Potassium	Soil	3	2	[473] to 1590	3460	0/3	0/1
	Fill	7	7	148 to 1420	3460	0/7	0/0
	Qbt 3	23	20	81.9 to 1190	3500	0/23	0/3
Selenium	Soil	3	0	[0.42 to 0.68]	1.52	0/3	0/3
	Fill	7	0	[0.42 to 0.65]	1.52	0/7	0/7
	Qbt 3	23	0	[0.33 to 11.3]	0.3	0/23	23/23
Silver	Soil	3	0	[0.2 to 1.6]	1	0/3	1/3
	Fill	7	0	[0.17 to 1.5]	1	0/7	1/7
	Qbt 3	23	0	[0.15 to 1.5]	1	0/23	4/23
Sodium	Soil	3	3	67.2 to 606	915	0/3	0/0
	Fill	7	7	51.8 to 224	915	0/7	0/0
	Qbt 3	23	23	66.3 to 284	2770	0/23	0/0
Thallium	Soil	3	0	[0.61 to 0.85]	0.73	0/3	1/3
	Fill	7	0	[0.63 to 0.81]	0.73	0/7	5/7
	Qbt 3	23	2	[0.16] to 1.1	1.1	0/23	0/21
Vanadium	Soil	3	3	6 to 26.3	39.6	0/3	0/0
	Fill	7	7	2.5 to 22.8	39.6	0/7	0/0
	Qbt 3	23	22	0.65 to 25.6	17	1/23	0/1
Zinc	Soil	3	3	30.9 to 121	48.8	1/3	0/0
	Fill	7	7	22.5 to 39	48.8	0/7	0/0
	Qbt 3	23	23	14.2 to 75.6	63.5	2/23	0/0

[a] Number of detects above BV out of the total number of analyses.

[b] Number of nondetects above BV out of the number of nondetects to express usability of nondetected data above BV for background comparisons.

Table 2.1-2
Samples Above BVs for Inorganic Chemicals at PRS 0-027

Sample ID	Location ID	Depth (ft)	Media	Aluminum	Antimony	Arsenic	Barium	Cadmium	Calcium	Chromium, Total	Cobalt	Copper	Lead	Magnesium	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
Soil BV				**29200**	**0.83**	**8.17**	**—**	**0.4**	**6120**	**19.3**	**8.64**	**14.7**	**22.3**	**4610**	**15.4**	**1.52**	**1**	**0.73**	**39.6**	**48.8**
Qbt 2,3,4 BV				**7340**	**0.5**	**2.79**	**46**	**1.63**	**2200**	**7.14**	**3.14**	**4.66**	**11.2**	**1690**	**6.58**	**0.3**	**1**	**1.1**	**17**	**63.5**
Fill BV				**29200**	**0.83**	**8.17**	**—**	**0.4**	**6120**	**19.3**	**8.64**	**14.7**	**22.3**	**4610**	**15.4**	**1.52**	**1**	**0.73**	**39.6**	**48.8**
0100-96-1871	00-05802	1.2–2.0	Fill	—	6.4(J)	—	—	0.77(J)	7050	—	—	—	25.4	—	—	—	1.5(U)	0.81(U)	—	—
0100-96-1872	00-05802	2.6–3.7	Soil	—	10.2(J)	—	—	0.73(U)	—	—	—	—	—	—	—	—	1.6(U)	0.85(U)	—	121
0100-96-1873	00-05802	20.0–21.0	Qbt 3	—	6.1(U)	—	—	—	—	—	—	—	—	—	—	0.63(U)	1.5(U)	—	—	—
0100-96-1874	00-05802	30.0–31.0	Qbt 3	—	6(U)	—	—	—	—	—	—	—	25	—	—	0.62(U)	1.5(U)	—	—	—
0100-96-1876	00-05802	39.8–41.0	Qbt 3	—	6.1(U)	11.2(U)	—	—	—	—	—	—	21.1	—	—	11.3(U)	1.5(U)	—	—	—
0100-96-1875	00-05802	47.0–48.5	Qbt 3	—	5.7(U)	10.5(U)	—	—	—	—	—	—	25.7	—	—	10.5(U)	1.4(U)	—	—	—
0100-96-1894	00-05803	3.4–4.0	Fill	—	1(U)	—	—	—	—	—	—	—	—	—	—	—	—	0.76(U)	—	—
0100-96-1895	00-05803	5.0–5.8	Qbt 3	—	0.9(U)	—	—	—	—	—	—	—	—	—	—	0.56(U)	—	—	—	—
0100-96-1896	00-05803	14.2–15.0	Qbt 3	—	0.92(U)	—	—	—	—	—	—	—	—	—	—	0.57(U)	—	—	—	—
0100-96-1897	00-05803	29.2–30.0	Qbt 3	—	0.9 (U)	—	61.9	—	—	—	—	—	—	—	—	0.56(U)	—	—	—	—
0100-96-1898	00-05803	38.2–40.0	Qbt 3	—	0.9(U)	—	—	—	—	—	—	—	12.9	—	—	0.55(U)	—	—	—	—
0100-96-1899	00-05803	49.2–50.0	Qbt 3	—	0.89(U)	—	—	—	—	—	—	—	—	—	—	0.55(U)	—	—	—	—
0100-96-1901	00-05804	8.4–8.9	Fill	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.81(U)	—	—
0100-96-1902	00-05804	12.0–12.5	Qbt 3	—	0.7(U)	—	—	—	—	—	—	—	—	—	—	0.42(U)	—	—	—	—
0100-96-1903	00-05804	19.2–20.0	Qbt 3	—	0.66(U)	—	—	—	—	—	—	—	—	—	—	0.4(U)	—	—	—	—
0100-96-1904	00-05804	29.4–30.0	Qbt 3	—	0.67(U)	—	—	—	—	—	—	—	—	—	—	0.4(U)	—	—	—	—
0100-96-1905	00-05805	2.5–4.0	Fill	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.8(U)	—	—
0100-96-1906	00-05805	2.5–4.0	Fill	—	—	—	—	—	—	—	—	—	27	—	—	—	—	0.8(U)	—	—
0100-96-1907	00-05805	4.0–5.0	Qbt 3	—	0.67(U)	—	—	—	—	—	—	—	—	—	—	0.4(U)	—	—	—	—

Table 2.1-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Aluminum	Antimony	Arsenic	Barium	Cadmium	Calcium	Chromium, Total	Cobalt	Copper	Lead	Magnesium	Nickel	Selenium	Silver	Thallium	Vanadium	Zinc
Soil BV				**29200**	**0.83**	**8.17**	**—**	**0.4**	**6120**	**19.3**	**8.64**	**14.7**	**22.3**	**4610**	**15.4**	**1.52**	**1**	**0.73**	**39.6**	**48.8**
Qbt 2,3,4 BV				**7340**	**0.5**	**2.79**	**46**	**1.63**	**2200**	**7.14**	**3.14**	**4.66**	**11.2**	**1690**	**6.58**	**0.3**	**1**	**1.1**	**17**	**63.5**
Fill BV				**29200**	**0.83**	**8.17**	**—**	**0.4**	**6120**	**19.3**	**8.64**	**14.7**	**22.3**	**4610**	**15.4**	**1.52**	**1**	**0.73**	**39.6**	**48.8**
0100-96-1908	00-05805	19.2–20.0	Qbt 3	—	0.68(U)	—	—	—	—	—	—	—	—	—	—	0.41(U)	—	—	—	—
0100-96-1909	00-05805	34.5–35.0	Qbt 3	—	0.65(U)	—	—	—	—	—	—	—	—	—	—	0.39(U)	—	—	—	—
0100-96-1886	00-05806	26.0–27.0	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—	0.41(U)	—	—	—	—
0100-96-1887	00-05807	10.5–11.5	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—	0.4(U)	—	—	—	—
0100-96-1891	00-05808	3.8–4.5	Soil	—	—	—	—	—	14500	—	—	—	—	—	—	—	—	—	—	—
0100-96-1893	00-05808	7.5–8.5	Qbt 3	—	—	—	—	—	—	—	—	—	13.9	—	—	0.41(U)	—	—	—	—
0100-96-1878	00-05820	4.8–6.0	Qbt 3	8490	5.9(U)	—	317	—	3530	9.3	8.3 (J)	11.7	38.7	2010	7.9(J)	0.33(U)	—	—	25.6	75.6
0100-96-1879	00-05821	5.1–6.1	Qbt 3	—	6(U)	—	—	—	—	—	—	—	11.9	—	—	0.4(U)	—	—	—	67
0100-96-1880	00-05821	10.5–12.0	Qbt 3	—	6.2(U)	—	—	—	—	—	—	—	—	—	—	0.39(U)	—	—	—	—
0100-96-1881	00-05821	30.0–31.2	Qbt 3	—	6.1(U)	—	—	—	—	—	—	—	—	—	—	0.39(U)	—	—	—	—
0100-96-1882	00-05821	47.5–48.7	Qbt 3	—	5.9(U)	—	—	—	—	—	—	—	—	—	—	0.37(U)	—	—	—	—

Notes: A dash indicates that the sample was not analyzed for the analyte or the reported concentration or detection limit was below the BV.
All units are mg/kg.

Table 2.1-3
Frequency of Detects for Organic Chemicals at PRS 0-027

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	EQL (µg/kg)	Frequency of Detects
Acetone	Fill	14	5	[0.009 to 1.3]	20	5/14
	Qbt 3	60	7	[0.005 to 56]	20	7/60
Aldrin	Qbt 3	23	1	[0.0018] to 0.0036	0.05 µg/L	1/23
Aroclor-1260	Qbt 3	23	1	[0.035] to 0.076	1.0 µg/L	1/23
Benzene	Fill	14	3	0.004 to 2.9	5	3/14
	Qbt 3	60	7	[0.005] to 40	5	7/60
Benzoic acid	Qbt 3	23	3	0.059 to [360]	3300	3/23
BHC[beta-]	Soil	3	1	[0.002] to 0.00252	0.05 µg/L	1/3
BHC[gamma-]	Qbt 3	23	2	[0.0018] to 0.0024	0.05 µg/L	2/23
Bis(2-ethylhexyl)phthalate	Qbt 3	23	1	0.05 to [36]	330	1/23
Butanone[2-]	Fill	14	2	0.005 to [2.4]	20	2/14
	Qbt 3	60	1	0.003 to [56]	20	1/60
Butylbenzene[n-]	Qbt 3	60	6	[0.005] to 42	5	6/60
Butylbenzene[sec-]	Qbt 3	60	5	[0.005] to 28	5	5/60
Butylbenzene[tert-]	Fill	14	1	[0.006 to 0.59]	5	1/14
Chlordane[gamma-]	Qbt 3	23	1	[0.0018] to 0.0022	17	1/23
Chloroaniline[4-]	Qbt 3	23	1	[0.35 to 150]	1300	1/23
Chlorotoluene[4-]	Fill	14	1	[0.006 to 0.59]	5	1/14
DDD[4,4'-]	Fill	7	1	[0.0038] to 0.0055	0.10 µg/L	1/7
	Qbt 3	23	1	[0.0035] to 0.006	0.10 µg/L	1/23
DDE[4,4'-]	Fill	7	1	0.0014 to [0.00391]	0.10 µg/L	1/7
	Qbt 3	23	1	0.0031 to [0.0039]	0.10 µg/L	1/23
DDT[4,4'-]	Soil	3	1	[0.0039] to 9.81E-03	0.10 µg/L	1/3
	Fill	7	1	0.0017 to [0.0058]	0.10 µg/L	1/7
	Qbt 3	23	1	[0.0035] to 0.025	0.10 µg/L	1/23
Dichlorobenzene[1,4-]	Fill	21	1	[0.006 to 40]	330	1/21
Dimethylphenol[2,4-]	Qbt 3	23	1	[0.35 to 36]	330	1/23
Ethylbenzene	Fill	14	3	[0.006] to 1.1	5	3/14
	Qbt 3	60	12	0.002 to 300	5	12/60
Fluoranthene	Qbt 3	23	1	0.049 to [36]	330	1/23
Heptachlor	Qbt 3	23	1	[0.0018] to 0.0024	0.05 µg/L	1/23
Hydrocarbons, total extractable petroleum	Fill	4	4	8900 to 17000		4/4
	Qbt 3	11	7	[5.3] to 9500		7/11
Isophorone	Qbt 3	23	1	[0.35 to 36]	330	1/23
Isopropyl benzene	Soil	4	1	[0.006] to 1.1	5	1/4
	Fill	14	2	[0.006 to 0.59]	5	2/14
	Qbt 3	60	8	[0.005] to 54	5	8/60

Table 2.1-3 (continued)

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	EQL (µg/kg)	Frequency of Detects
Isopropyl toluene[4-]	Soil	4	1	[0.006] to 3.7	5	1/4
	Fill	14	5	[0.006] to 3.6	5	5/14
	Qbt 3	60	10	[0.005] to 43	5	10/60
Methyl-2-pentanone[4-]	Qbt 3	60	1	0.004 to [56]	20	1/60
Methylene Chloride	Fill	14	3	[0.006] to 0.58	5	3/14
	Qbt 3	60	10	0.003 to [14]	5	10/60
Methylnaphthalene[2-]	Fill	7	2	[0.38 to 40]	330	2/7
	Qbt 3	23	7	[0.35] to 58	330	7/23
Naphthalene	Fill	11	3	[0.029 to 40]	330	3/11
	Qbt 3	34	9	[0.005] to 27	330	9/34
Nitrophenol[4-]	Qbt 3	23	1	[0.86 to 180]	1600	1/23
Organics, diesel range	Fill	4	1	[4.8] to 460		1/4
	Qbt 3	31	1	[4.3 to 1400]		1/31
Pentachlorophenol	Qbt 3	23	1	0.038 to [180]	1600	1/23
Propylbenzene[1-]	Fill	14	1	[0.006 to 0.59]	5	1/14
	Qbt 3	60	10	[0.005] to 82	5	10/60
Pyrene	Qbt 3	23	1	0.053 to [36]	330	1/23
Tetrachloroethene	Soil	4	1	0.001 to [0.75]	5	1/4
Toluene	Soil	4	1	[0.006 to 0.75]	5	1/4
	Fill	14	9	0.001 to 2.8	5	9/14
	Qbt 3	60	16	0.002 to 440	5	16/60
Total extractable hydrocarbons	Fill	3	1	[6] to 6.2	10,000	1/3
	Qbt 3	14	4	[5.3] to 17000	10,000	4/14
TPH-diesel	Soil	2	1	[6.1] to 45	10,000	1/2
	Fill	4	3	[28] to 5300	10,000	3/4
	Qbt 3	19	2	[5.4 to 1400]	10,000	2/19
Trichlorobenzene[1,2,3-]	Qbt 3	11	1	0.003 to [0.58]		1/11
Trichlorobenzene[1,2,4-]	Qbt 3	34	1	0.002 to [36]	330	1/34
Trimethylbenzene[1,2,4-]	Soil	4	1	[0.006] to 4.9	5	1/4
	Fill	14	4	[0.006] to 4.9	5	4/14
	Qbt 3	60	11	0.002 to 160	5	11/60
Trimethylbenzene[1,3,5-]	Fill	14	5	[0.006] to 2.5	5	5/14
	Qbt 3	60	6	[0.005] to 38	5	6/60
Xylene (Total)	Soil	4	1	[0.006] to 13	5	1/4
	Fill	14	5	[0.006] to 1.3	5	5/14
	Qbt 3	60	12	[0.005] to 510	5	12/60
Xylene[1,2-]	Fill	4	4	0.092 to 0.8	5	4/4
	Qbt 3	11	6	[0.005] to 9.7	5	6/11

Table 2.1-4
Detected Concentrations for Organic Chemicals at PRS 0-027

Part 1

Sample ID	Location ID	Depth (ft)	Media	Acetone	Aldrin	Aroclor-1260	Benzene	Benzoic Acid	BHC[beta-]	BHC[gamma-]	Bis(2-ethylhexyl)-phthalate	Butanone[2-]	Butylbenzene[n-]	Butylbenzene[sec-]	Butylbenzene[tert-]
0100-96-1872	00-05802	2.60–3.70	Soil	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1873	00-05802	20.00–21.00	Qbt 3	—	0.0036	—	—	—	—	—	—	—	27 (J+)	—	—
0100-96-1874	00-05802	30.00–31.00	Qbt 3	—	—	—	8(J+)	7.2 (J+)	—	0.0024	—	—	32	—	—
0100-96-1876	00-05802	39.80–41.00	Qbt 3	—	—	—	6.4 (J+)	—	—	0.0023	—	—	35 (J+)	—	—
0100-96-1875	00-05802	47.00–48.50	Qbt 3	0.024	—	—	—	0.76 (J)	—	—	0.05 (J)	0.003 (J)	—	—	—
0100-96-1894	00-05803	3.40–4.00	Fill	—	—	—	2.9	—	—	—	—	—	—	—	—
0100-96-1895	00-05803	5.00–5.80	Qbt 3	—	—	—	0.32 (J)	—	—	—	—	—	—	—	—
0100-96-1896	00-05803	14.20–15.00	Qbt 3	2.2	—	—	1.9	—	—	—	—	—	—	—	—
0100-96-1897	00-05803	29.20–30.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1898	00-05803	38.20–40.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1899	00-05803	49.20–50.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1901	00-05804	8.40–8.90	Fill	—	—	—	0.18	—	—	—	—	—	—	—	0.012 (J)
0100-96-1902	00-05804	12.00–12.50	Qbt 3	—	—	—	0.13 (J)	—	—	—	—	—	—	2.5	—
0100-96-1903	00-05804	19.20–20.00	Qbt 3	—	—	—	0.47 (J)	—	—	—	—	—	8.1	2.6	—
0100-96-1904	00-05804	29.40–30.00	Qbt 3	0.02 (J)	—	—	—	—	—	—	—	—	—	—	—
0100-96-1905	00-05805	2.50–4.00	Fill	0.22	—	—	0.004 (J)	—	—	—	—	—	—	—	—
0100-96-1906	00-05805	2.50–4.00	Fill	0.11 (J)	—	—	—	—	—	—	—	—	—	—	—
0100-96-1907	00-05805	4.00–5.00	Qbt 3	0.048 (J-)	—	—	—	—	—	—	—	—	—	—	—
0100-96-1908	00-05805	19.20–20.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	1.8	—
0100-96-1909	00-05805	34.50–35.00	Qbt 3	0.015 (J)	—	—	—	—	—	—	—	—	—	—	—
0100-96-1889	00-05806	9.00–10.00	Fill	0.016 (J)	—	—	—	—	—	—	—	0.005 (J)	—	—	—

Table 2.1-4 (continued)

Part 1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Acetone	Aldrin	Aroclor-1260	Benzene	Benzoic Acid	BHC[beta-]	BHC[gamma-]	Bis(2-ethylhexyl)-phthalate	Butanone[2-]	Butylbenzene[n-]	Butylbenzene[sec-]	Butylbenzene[tert-]
0100-96-1886	00-05806	26.00–27.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1888	00-05807	3.00–4.00	Fill	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1887	00-05807	10.50–11.50	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1891	00-05808	3.80–4.50	Soil	—	—	—	—	—	0.00252	—	—	—	—	—	—
0100-96-1883	00-05809	13.30–14.00	Fill	0.022 (J)	—	—	—	—	—	—	—	—	—	—	—
0100-96-1910	00-05810	2.50–3.00	Fill	0.15	—	—	—	—	—	—	—	0.025	—	—	—
0100-96-1911	00-05810	9.50–10.00	Fill	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1914	00-05811	1.50–2.00	Soil	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1919	00-05812	9.50–10.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1925	00-05813	17.00–17.50	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1926	00-05813	24.50–25.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1927	00-05813	27.50–28.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1928	00-05814	8.50–9.10	Fill	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1930	00-05814	24.50–25.00	Qbt 3	0.011 (J)	—	—	—	—	—	—	—	—	—	—	—
0100-96-1931	00-05815	9.30–9.80	Fill	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1934	00-05815	29.50–30.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1935	00-05816	3.40–3.90	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1936	00-05816	12.00–12.50	Qbt 3	0.011 (J)	—	—	—	—	—	—	—	—	42	26	—
0100-96-1937	00-05816	19.50–20.00	Qbt 3	—	—	—	40	—	—	—	—	—	42	28	—
0100-96-1938	00-05816	29.00–29.50	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1878	00-05820	4.80–6.00	Qbt 3	—	—	0.076	—	0.059 (J)	—	—	—	—	—	—	—

Table 2.1-4 (continued)

Part 2

Sample ID	Location ID	Depth (ft)	Media	Chlordane[gamma-]	Chloroaniline[4-]	Chlorotoluene[4-]	DDD[4,4'-]	DDE[4,4'-]	DDT[4,4'-]	Dichlorobenzene[1,4-]	Dimethylphenol[2,4-]	Ethylbenzene	Fluoranthene	Heptachlor	Hydrocarbons, Total Extractable Petroleum
0100-96-1872	00-05802	2.60–3.70	Soil	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1873	00-05802	20.00–21.00	Qbt 3	—	—	—	—	—	—	—	—	130 (J+)	—	0.0024	—
0100-96-1874	00-05802	30.00–31.00	Qbt 3	—	1.6 (J+)	—	—	—	—	—	0.49 (J+)	140	—	—	—
0100-96-1876	00-05802	39.80–41.00	Qbt 3	—	—	—	—	—	—	—	—	110 (J+)	—	—	—
0100-96-1875	00-05802	47.00–48.50	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1894	00-05803	3.40–4.00	Fill	—	—	—	—	—	—	—	—	1.1	—	—	17000
0100-96-1895	00-05803	5.00–5.80	Qbt 3	—	—	—	—	—	—	—	—	5.2	—	—	6000
0100-96-1896	00-05803	14.20–15.00	Qbt 3	—	—	—	—	—	—	—	—	15	—	—	9500
0100-96-1897	00-05803	29.20–30.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	270
0100-96-1898	00-05803	38.20–40.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1899	00-05803	49.20–50.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1901	00-05804	8.40–8.90	Fill	—	—	—	0.0055	0.0014 (J-)	0.0017 (J-)	—	—	0.27	—	—	16000
0100-96-1902	00-05804	12.00–12.50	Qbt 3	—	—	—	—	0.0031 (J)	0.025	—	—	1.8	—	—	7900
0100-96-1903	00-05804	19.20–20.00	Qbt 3	—	—	—	0.006	—	—	—	—	4	—	—	6200
0100-96-1904	00-05804	29.40–30.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1905	00-05805	2.50–4.00	Fill	—	—	—	—	—	—	—	—	—	—	—	11000
0100-96-1906	00-05805	2.50–4.00	Fill	—	—	—	—	—	—	—	—	—	—	—	8900
0100-96-1907	00-05805	4.00–5.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	6200
0100-96-1908	00-05805	19.20–20.00	Qbt 3	—	—	—	—	—	—	—	—	0.26 (J)	—	—	5300
0100-96-1909	00-05805	34.50–35.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1889	00-05806	9.00–10.00	Fill	—	—	—	—	—	—	—	—	—	—	—	—

Table 2.1-4 (continued)

Part 2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Chlordane[gamma-]	Chloroaniline[4-]	Chlorotoluene[4-]	DDD[4,4'-]	DDE[4,4'-]	DDT[4,4'-]	Dichlorobenzene[1,4-]	Dimethylphenol[2,4-]	Ethylbenzene	Fluoranthene	Heptachlor	Hydrocarbons, Total Extractable Petroleum
0100-96-1886	00-05806	26.00–27.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1888	00-05807	3.00–4.00	Fill	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1887	00-05807	10.50–11.50	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1891	00-05808	3.80–4.50	Soil	—	—	—	—	—	9.810001E-03	—	—	—	—	—	—
0100-96-1883	00-05809	13.30–14.00	Fill	—	—	0.041	—	—	—	—	—	0.093	—	—	—
0100-96-1910	00-05810	2.50–3.00	Fill	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1911	00-05810	9.50–10.00	Fill	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1914	00-05811	1.50–2.00	Soil	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1919	00-05812	9.50–10.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1925	00-05813	17.00–17.50	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1926	00-05813	24.50–25.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1927	00-05813	27.50–28.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1928	00-05814	8.50–9.10	Fill	—	—	—	—	—	—	0.006	—	—	—	—	—
0100-96-1930	00-05814	24.50–25.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1931	00-05815	9.30–9.80	Fill	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1934	00-05815	29.50–30.00	Qbt 3	—	—	—	—	—	—	—	—	0.003 (J)	—	—	—
0100-96-1935	00-05816	3.40–3.90	Qbt 3	—	—	—	—	—	—	—	—	—	—	—	—
0100-96-1936	00-05816	12.00–12.50	Qbt 3	—	—	—	—	—	—	—	—	290	—	—	—
0100-96-1937	00-05816	19.50–20.00	Qbt 3	—	—	—	—	—	—	—	—	300	—	—	—
0100-96-1938	00-05816	29.00–29.50	Qbt 3	—	—	—	—	—	—	—	—	0.002 (J)	—	—	—
0100-96-1878	00-05820	4.80–6.00	Qbt 3	0.0022	—	—	—	—	—	—	—	—	0.049 (J)	—	—

Table 2.1-4 (continued)

Part 3

Sample ID	Location ID	Depth (ft)	Media	Isophorone	Isopropyl benzene	Isopropyl toluene[4-]	Methyl-2-pentanone[4-]	Methylene Chloride	Methylnaphthalene[2-]	Naphthalene	Nitrophenol[4-]	Organics, Diesel Range	Pentachlorophenol	Propylbenzene[1-]
0100-96-1872	00-05802	2.60–3.70	Soil	—	1.1 (J+)	3.7 (J+)	—	—	—	—	—	—	—	—
0100-96-1873	00-05802	20.00–21.00	Qbt 3	1.3 (J+)	28 (J+)	25 (J+)	—	—	6.8 (J+)	5.5 (J+)	—	—	—	40 (J+)
0100-96-1874	00-05802	30.00–31.00	Qbt 3	—	29	23	—	—	5.9 (J+)	6.9 (J+)	1.2 (J+)	—	—	47
0100-96-1876	00-05802	39.80–41.00	Qbt 3	—	29 (J+)	28 (J+)	—	—	4.2	2.2	—	—	—	45 (J+)
0100-96-1875	00-05802	47.00–48.50	Qbt 3	—	—	—	—	—	—	—	—	—	—	—
0100-96-1894	00-05803	3.40–4.00	Fill	—	—	1.8	—	0.58 (J)	—	—	—	—	—	—
0100-96-1895	00-05803	5.00–5.80	Qbt 3	—	—	1.4	—	0.56	7.4 (J)	2.7	—	—	—	0.56
0100-96-1896	00-05803	14.20–15.00	Qbt 3	—	2.2	3.1	—	0.59	58	27 (J)	—	—	—	3.3
0100-96-1897	00-05803	29.20–30.00	Qbt 3	—	—	—	—	0.005 (J+)	—	—	—	—	—	—
0100-96-1898	00-05803	38.20–40.00	Qbt 3	—	—	—	—	0.006	—	—	—	—	—	—
0100-96-1899	00-05803	49.20–50.00	Qbt 3	—	—	—	—	0.006	—	—	—	—	—	—
0100-96-1901	00-05804	8.40–8.90	Fill	—	0.086	0.16	—	—	—	0.99	—	—	—	0.15
0100-96-1902	00-05804	12.00–12.50	Qbt 3	—	—	2.6	—	0.33 (J)	26	9.4	—	—	—	2
0100-96-1903	00-05804	19.20–20.00	Qbt 3	—	1.5	2.3	—	0.31 (J)	21	17	—	—	—	2.8
0100-96-1904	00-05804	29.40–30.00	Qbt 3	—	—	—	—	0.003 (J)	—	0.008	—	—	—	—
0100-96-1905	00-05805	2.50–4.00	Fill	—	—	0.11	—	0.015 (J)	26	5.4 (J)	—	—	—	—
0100-96-1906	00-05805	2.50–4.00	Fill	—	—	0.074	—	0.012 (J)	15 (J)	4.9 (J)	—	—	—	—
0100-96-1907	00-05805	4.00–5.00	Qbt 3	—	—	—	—	0.007 (J-)	—	—	—	—	—	—
0100-96-1908	00-05805	19.20–20.00	Qbt 3	—	0.61	3.1	—	0.32 (J)	—	—	—	—	—	0.46 (J)
0100-96-1909	00-05805	34.50–35.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—
0100-96-1889	00-05806	9.00–10.00	Fill	—	—	—	—	—	—	—	—	—	—	—

Table 2.1-4 (continued)

Part 3 (continued)

Sample ID	Location ID	Depth (ft)	Media	Isophorone	Isopropyl benzene	Isopropyl toluene[4-]	Methyl-2-pentanone[4-]	Methylene Chloride	Methylnaphthalene[2-]	Naphthalene	Nitrophenol[4-]	Organics, Diesel Range	Pentachlorophenol	Propylbenzene[1-]
0100-96-1886	00-05806	26.00–27.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—
0100-96-1888	00-05807	3.00–4.00	Fill	—	—	—	—	—	—	—	—	—	—	—
0100-96-1887	00-05807	10.50–11.50	Qbt 3	—	—	—	—	—	—	—	—	—	—	—
0100-96-1891	00-05808	3.80–4.50	Soil	—	—	—	—	—	—	—	—	—	—	—
0100-96-1883	00-05809	13.30–14.00	Fill	—	0.026	3.6	—	—	—	—	—	—	—	—
0100-96-1910	00-05810	2.50–3.00	Fill	—	—	—	—	—	—	—	—	—	—	—
0100-96-1911	00-05810	9.50–10.00	Fill	—	—	—	—	—	—	—	—	460	—	—
0100-96-1914	00-05811	1.50–2.00	Soil	—	—	—	—	—	—	—	—	—	—	—
0100-96-1919	00-05812	9.50–10.00	Qbt 3	—	—	—	—	—	—	—	—	130	—	—
0100-96-1925	00-05813	17.00–17.50	Qbt 3	—	—	—	—	—	—	—	—	—	—	—
0100-96-1926	00-05813	24.50–25.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—
0100-96-1927	00-05813	27.50–28.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—
0100-96-1928	00-05814	8.50–9.10	Fill	—	—	—	—	—	—	—	—	—	—	—
0100-96-1930	00-05814	24.50–25.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—
0100-96-1931	00-05815	9.30–9.80	Fill	—	—	—	—	—	—	—	—	—	—	—
0100-96-1934	00-05815	29.50–30.00	Qbt 3	—	—	—	0.004 (J)	—	—	—	—	—	—	—
0100-96-1935	00-05816	3.40–3.90	Qbt 3	—	—	—	—	—	—	—	—	—	—	—
0100-96-1936	00-05816	12.00–12.50	Qbt 3	—	54	43	—	—	—	—	—	—	—	81
0100-96-1937	00-05816	19.50–20.00	Qbt 3	—	52	41	—	—	—	—	—	—	—	82
0100-96-1938	00-05816	29.00–29.50	Qbt 3	—	—	—	—	—	—	—	—	—	—	—
0100-96-1878	00-05820	4.80–6.00	Qbt 3	—	—	—	—	—	—	—	—	—	0.038 (J)	—

Table 2.1-4 (continued)

Part 4

Sample ID	Location ID	Depth (ft)	Media	Pyrene	Tetrachloroethene	Toluene	Total Extractable Hydrocarbons	TPH-Diesel	Trichlorobenzene[1,2,3-]	Trichlorobenzene[1,2,4-]	Trimethylbenzene[1,2,4-]	Trimethylbenzene[1,3,5-]	Xylene (Total)	Xylene[1,2-]
0100-96-1872	00-05802	2.60–3.70	Soil	—	—	—	—	—	—	—	4.9 (J+)	—	13 (J+)	—
0100-96-1873	00-05802	20.00–21.00	Qbt 3	—	—	85 (J+)	—	—	—	—	84 (J+)	—	230 (J+)	—
0100-96-1874	00-05802	30.00–31.00	Qbt 3	—	—	150	—	—	—	—	85	—	290	—
0100-96-1876	00-05802	39.80–41.00	Qbt 3	—	—	96 (J+)	—	—	—	—	91 (J+)	—	210 (J+)	—
0100-96-1875	00-05802	47.00–48.50	Qbt 3	—	—	—	—	—	—	—	—	—	—	—
0100-96-1894	00-05803	3.40–4.00	Fill	—	—	2.8	—	—	—	—	—	0.67	0.78	0.8
0100-96-1895	00-05803	5.00–5.80	Qbt 3	—	—	5.5	—	—	—	—	3.2	—	7.2	3.9
0100-96-1896	00-05803	14.20–15.00	Qbt 3	—	—	26	—	—	—	—	19	—	20	9.7
0100-96-1897	00-05803	29.20–30.00	Qbt 3	—	—	—	—	—	—	—	—	0.007 (J+)	—	—
0100-96-1898	00-05803	38.20–40.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—
0100-96-1899	00-05803	49.20–50.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—
0100-96-1901	00-05804	8.40–8.90	Fill	—	—	0.077	—	—	—	—	0.87	0.41	0.45	0.38
0100-96-1902	00-05804	12.00–12.50	Qbt 3	—	—	—	—	—	—	—	11	3.4	3.1	1.1
0100-96-1903	00-05804	19.20–20.00	Qbt 3	—	—	0.48 (J)	—	—	—	—	9.2	3	4.7	1.2
0100-96-1904	00-05804	29.40–30.00	Qbt 3	—	—	—	—	—	0.003 (J)	0.002 (J)	—	—	—	—
0100-96-1905	00-05805	2.50–4.00	Fill	—	—	0.017 (J)	—	—	—	—	0.97	0.51	0.14	0.12
0100-96-1906	00-05805	2.50–4.00	Fill	—	—	—	—	—	—	—	0.88	0.49	0.11	0.092
0100-96-1907	00-05805	4.00–5.00	Qbt 3	—	—	0.009 (J-)	—	—	—	—	—	—	—	0.013 (J-)
0100-96-1908	00-05805	19.20–20.00	Qbt 3	—	—	—	—	—	—	—	8.9	4.7	0.81	1.2
0100-96-1909	00-05805	34.50–35.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—
0100-96-1889	00-05806	9.00–10.00	Fill	—	—	0.007	—	1500	—	—	—	—	—	—

Table 2.1-4 (continued)

Part 4 (continued)

Sample ID	Location ID	Depth (ft)	Media	Pyrene	Tetrachloroethene	Toluene	Total Extractable Hydrocarbons	TPH-Diesel	Trichlorobenzene-[1,2,3-]	Trichlorobenzene-[1,2,4-]	Trimethylbenzene-[1,2,4-]	Trimethylbenzene-[1,3,5-]	Xylene (total)	Xylene[1,2-]
0100-96-1886	00-05806	26.00–27.00	Qbt 3	—	—	—	—	7.1	—	—	—	—	—	—
0100-96-1888	00-05807	3.00–4.00	Fill	—	—	0.006	—	35	—	—	—	—	—	—
0100-96-1887	00-05807	10.50–11.50	Qbt 3	—	—	0.006	—	36	—	—	—	—	—	—
0100-96-1891	00-05808	3.80–4.50	Soil	—	—	0.026	—	45	—	—	—	—	—	—
0100-96-1883	00-05809	13.30–14.00	Fill	—	—	0.016	—	5300	—	—	4.9	2.5	1.3	—
0100-96-1910	00-05810	2.50–3.00	Fill	—	—	0.001 (J)	—	—	—	—	—	—	—	—
0100-96-1911	00-05810	9.50–10.00	Fill	—	—	0.002 (J)	—	—	—	—	—	—	—	—
0100-96-1914	00-05811	1.50–2.00	Soil	—	0.001 (J)	—	—	—	—	—	—	—	—	—
0100-96-1919	00-05812	9.50–10.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—
0100-96-1925	00-05813	17.00–17.50	Qbt 3	—	—	0.004 (J)	—	—	—	—	—	—	—	—
0100-96-1926	00-05813	24.50–25.00	Qbt 3	—	—	0.002 (J)	—	—	—	—	—	—	—	—
0100-96-1927	00-05813	27.50–28.00	Qbt 3	—	—	0.003 (J)	—	—	—	—	—	—	—	—
0100-96-1928	00-05814	8.50–9.10	Fill	—	—	—	6.2	—	—	—	—	—	—	—
0100-96-1930	00-05814	24.50–25.00	Qbt 3	—	—	—	—	—	—	—	—	—	—	—
0100-96-1931	00-05815	9.30–9.80	Fill	—	—	0.008	—	—	—	—	—	—	—	—
0100-96-1934	00-05815	29.50–30.00	Qbt 3	—	—	0.004 (J)	—	—	—	—	—	—	0.006	—
0100-96-1935	00-05816	3.40–3.90	Qbt 3	—	—	—	14	—	—	—	—	—	—	—
0100-96-1936	00-05816	12.00–12.50	Qbt 3	—	—	210	10000	—	—	—	160	38	440	—
0100-96-1937	00-05816	19.50–20.00	Qbt 3	—	—	440	17000	—	—	—	160	38	510	—
0100-96-1938	00-05816	29.00–29.50	Qbt 3	—	—	0.004 (J)	34	—	—	—	0.002 (J)	—	0.006	—
0100-96-1878	00-05820	4.80–6.00	Qbt 3	0.053 (J)	—	0.003 (J)	—	—	—	—	—	—	—	—

Notes: A dash indicates that the sample was not analyzed for the analyte or was not detected.

All units are mg/kg.

Table 2.1-5
Indoor Air Data from Knights of Columbus Hall, PRS 0-027

COPC	0100-97-0246 (ppbv) (background)	0100-97-0247 (ppbv) (bingo room door)	0100-97-0248 (ppbv) (bingo room wall)	0100-97-0249 (ppbv) (kitchen sink)	0100-97-0250 (ppbv) (bingo room center)	0100-97-0251 (ppbv) (men's room wall)	0100-97-0252 (ppbv) (meeting room intake)	0100-97-0253 (ppbv) (meeting room door)	0100-97-0255 (ppbv) (kitchen sink)
Benzene	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Toluene	<1.0	<1.0	<1.0	1.48	2.26	2.08	2.26	<1.0	1.18
Ethylbenzene	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Trimethylbenzene [1,3,5-]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Trimethylbenzene [1,2,4-]	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
1,3-Xylene	<1.0	<1.0	<1.0	1.20	1.50	2.10	1.86	<1.0	1.22

Note: All values of <1.0 ppbv are reported as undetected.

(c) *Screening Assessment Methods and Results*

A human health screening assessment was performed for PRS 0-027 (Appendix H). An ecological screening assessment was not performed because the completely paved surface prevents access to ecological receptors; that is, the exposure pathways to ecological receptors are incomplete (Appendix D). In addition, the bulk of the COPCs are measured in soil/fill or tuff at depths greater than 5 ft bgs, which is the typical depth assumed for complete ecological exposure pathways. Therefore, ecological impacts are not expected because no complete exposure pathways or offsite transport pathways exist.

Table 2.1-6 shows there are no data gaps by chemical suite for PRS 0-027. Based on process knowledge of site operations, there was no reason to expect radiological contamination at PRS 0-027; therefore, samples were not analyzed for radionuclides.

Table 2.1-6
Data Gap Assessment for Former Drum Storage Area, PRS 0-027

Suite	<2 ft	2 to 5 ft	5 to 15 ft	>15 ft
PCBs	√	√	√	√
Pesticides	√	√	√	√
Polycyclic aromatic hydrocarbons (PAHs)	√	√	√	√
VOCs	√	√	√	√
SVOCs	√	√	√	√
Inorganics	√	√	√	√

√ = Data available for analysis, indicating no data gap.

The COPCs with the potential to adversely affect human health at PRS 0-027 are volatile or semivolatile organics in the subsurface (Tables H-1, H-2 and H-3). Potential risks posed by these COPCs for PRS 0-027 can be reduced with a readily available and cost-effective technology: SVE. Thus, SVE is proposed as the remedial approach for this PRS. This remedial method is described in sections 4.2 and 4.3.

2.1.2 PRS 0-030(a), Septic System

2.1.2.1 PRS 0-030(a), Site Description and Operational History

PRS 0-030(a) consists of a septic system and associated inlet and outlet piping. The septic system was installed in about 1946 to handle sanitary wastes from the DP Road storage area fuel dispatch office. It probably remained in service until the site was decommissioned in the early 1960s. The RFI work plan (LANL 1992, 0781) identified the following as COPCs: VOCs, SVOCs, TPH, TAL metals, PCBs/pesticides, uranium, plutonium, americium-241, and tritium. Because no RFI activities were conducted at this site, the full suite of analyses was specified in the VCA plan (LANL 1996, 54353.3).

2.1.2.2 PRS 0-030(a), Previous Field Investigations

In the spring and summer of 1996, a VCA was conducted (instead of an RFI) to determine if the site had any COPCs to human health or the environment. To locate the positions of the former structures, a geodetic survey and a geophysical survey were conducted. The geophysical results were inconclusive; therefore, exploratory trenches were excavated to locate the tank or the tank inlet pipe. The foundation of the dispatch office building was located, as well as the inlet pipe into the septic tank. The 4-in. cast-iron pipe was found exiting the dispatch building below the bottom of the foundation at a depth of 9 ft bgs. The septic tank was found by following the pipe, but the pipe ended approximately 32 ft east of the dispatch building. The septic tank was located approximately 45 ft east of the building at a depth of 9 ft. The tank measured 6.67 ft long by 3.67 ft wide by 5.5 ft deep. A covered manhole was found in the northwest corner of the tank. The manhole was removed and the field team found that the tank was still intact and viable but had not been backfilled, and it contained only 3 to 4 in. of dry sludge (LANL 1996, 59576.1).

Two samples were collected from outside the tank, and one sample of the dry sludge material was collected from inside the tank at location 00-05101. One of the external samples was collected beneath the inlet pipe (location 00-05102) and the other was collected beneath the outlet pipe (location 00-0513). In accordance with the VCA plan (LANL 1996, 54353.3) all samples were submitted for fixed laboratory analysis of VOCs, SVOCs, TPH, TAL metals, PCBs/pesticides, toxicity characteristic leaching procedure (TCLP) metals, and radionuclides (total uranium, plutonium, and americium-241).

The outfall from the septic tank to the drainage in DP Canyon was not sampled, but a sample was collected beneath the outlet pipe location adjacent to the septic tank. The outfall was not located due to the depth of the septic tank and the outlet pipe and to the amount of fill covering this area.

2.1.2.3 PRS 0-030(a), Results of Previous Investigations

Several chemicals (inorganics, radionuclides, and organics) were detected in the sludge. According to the VCA report (LANL 1996, 59576.1), there was a small volume of dried sludge in the tank bottom. The field team reported difficulty in collecting an adequate amount of sample material to fill the containers. After the analytical data was received and reviewed, a decision was made to crush the tank in place. NMED approved the crushing of the tank and leaving it in place. Each wall of the tank, including the bottom and the top, was broken into small fragments and mixed with the surrounding debris and fill material. The trench was backfilled with existing fill material, then clean fill and gravel were brought in to level the disturbed areas and the site was graded.

The data collected for this septic tank was found to be adequate for defining the nature and extent of contamination because the tank was physically intact and devoid of cracks, holes, or other damage that might have allowed content release. Sludge in the tank was sampled, and two points of possible releases to the environment were also sampled (under the inlet and outlet pipes). According to the VCA completion report (LANL 1996, 59576.1), a human health risk assessment was conducted which determined that no pathway existed for exposure. Nature and extent was defined because the contaminant concentration values decreased from the inlet line to the outlet line. Pathways to ecological receptors are incomplete based on the depth of the tank, 9 ft below ground surface. The septic system was crushed and left in place as approved by NMED. Thus, NFA was proposed for PRS 0-030(a) under Criterion 5. Criterion 5 states that the site was characterized or remediated in accordance with current applicable state and/or federal regulations, and the available data indicate that contaminants do not pose an unacceptable level of risk, assuming current and projected future land use.

2.2 6th Street Warehouse PRSs [PRSs 0-004, 0-030(l,m), and 0-033(b)]

The 6th Street Warehouses, also known as the Zia Warehouses, include PRS 0-004, PRSs 0-030 (l,m), and PRS 0-033(b) (Figure 2.2-1). These PRSs are discussed together in this section based on their spatial proximity and similar operational histories. In addition, the drainages associated with PRS 0-004 connect with the drainages associated with PRS 0-033(b). These PRSs are located within the DP Road 4 (A11) land transfer parcel.

PRS 0-004 was a container storage area that was used for satellite storage of solvents. It was located in the 6th Street Warehouses (LANL 1990, 0145) but is no longer an active storage area.

PRS 0-030(l) is a septic system that served various Zia Company facilities. PRS 0-030(l) was reported (LANL 1990, 7511) to have served Zia Warehouses 3 and 4 and overflowed to an outfall. The SWMU report (LANL 1990, 7511) for PRS 0-033(b) states that, in 1946, there were five warehouse buildings and a cold storage plant. There were storm drains around the two buildings that were divided into Warehouse 1/2 and Warehouse 3/4, and these drains had outfalls into Los Alamos Canyon. In 1948, an MTL was constructed to the south of Warehouse 3/4. This MTL had three floor drains served by two drainlines that also had outfalls into Los Alamos Canyon.

PRS 0-033(b) includes soil contamination associated with the following: storm drains around Warehouse 1/2 and Warehouse 3/4 and their outfalls into Los Alamos Canyon, and MTL floor drains served by two drainlines with outfalls into Los Alamos Canyon.

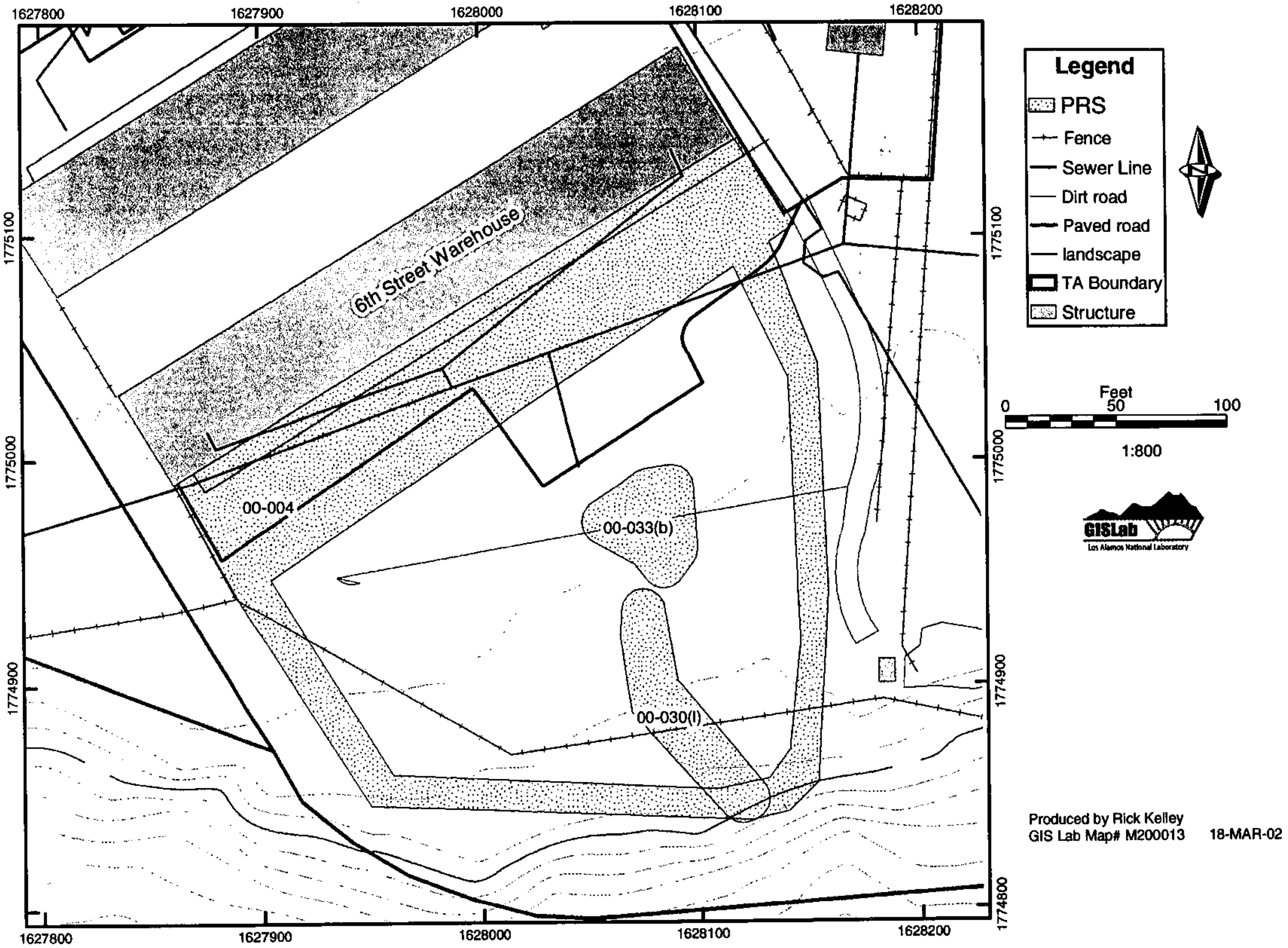


Figure 2.2-1. 6th Street Warehouse PRSs [PRSs 0-004, 0-030(l), and 0-033(b)]

The PRSs are discussed in the same section because their influence shares a common spatial boundary. The potentially impacted area is the drainage below the mesa top and the field, located immediately south of the 6th Street Warehouses, which drains the warehouse parking lots and outfalls and overlies former septic tank PRS 0-030(l). Possible contaminant releases include subsurface leaks from outfall pipes [PRS 0-033(b)] and a septic tank and associated plumbing [PRS 0-030(l)], and surface releases from spills (PRS 0-004) or outfall pipes [PRS 0-033(b)]. COPCs associated with these PRSs include VOCs, SVOCs, pesticides, PCBs, metals, and radionuclides. The 6th Street Warehouse PRSs are bordered by private property to the west, Los Alamos Canyon to the south, PRSs 0-030(b) and 0-030(m) to the east, and DP Road to the north. Commercial development exists within 50 ft to the east. The area of the 6th Street Warehouse PRSs has undergone heavy commercial and urban development. Soils have been disturbed through excavation and backfilling during construction activities.

2.2.1 PRS 0-004, Active Container Storage Area

2.2.1.1 PRS 0-004, Site Description and Operational History

PRS 0-004 was consolidated into PRS 00-030(b)-00, which resulted in PRS 0-004 being added to the HSWA permit. PRS 0-004 was a container storage area located inside 6th Street Warehouse 3/4. PRS 0-004 includes the drainages from the warehouses, and these drainages join the drainage from PRS 0-033(b). The storage area was primarily used to store solvents; however, other materials that may have been stored at this site by the Zia Company include asphalt, lubricants, pesticides, and herbicides.

On March 15, 1984, an undocumented quantity of methyl ethyl ketone peroxide (MEKP) spilled in one of the warehouses, and the potential interaction of chemicals posed a high-explosive risk. Several drums were temporarily removed from the warehouse to the parking lot and the entire area was hosed down by the fire department. Another incident involved solvents that had crystallized. The crystallized solvent containers were taken to the parking lot and washed down with water. The resulting effluent and the wash water drained from the parking lot into the unlined drainages ditches leading toward Los Alamos Canyon. PRS 0-004 connects to PRS 0-033(b) at the drainage ditches (Figure 2.2-1). Both spills occurred inside the warehouses, and this area was washed with water.

2.2.1.2 PRS 0-004, Previous Field Investigation

In 1995, five samples were collected to characterize the spills as part of the RFI activities. One sample was collected from a location upgradient of the outfall within an obvious sediment catchment of the drainage channel. A second sample was collected near the head of a drainage ditch approximately 25 ft south of the culvert and on the east side of the parking lot. Two surface samples were collected from a sediment catchment below the rim of the mesa in a natural drainage that appears to have existed before the storm water was physically directed to the west (Figure 2.2-2). The samples were analyzed for SVOCs, PCBs, pesticides, and radionuclides. Three samples were analyzed for metals by x-ray fluorescence (XRF). One sample was submitted to the MCAL for VOC analysis. The XRF measurements and the analyses performed in the MCAL have multiple shortcomings, including inadequate analytical rigor and/or elevated detection limits that preclude their use. Consequently, the lack of fixed-laboratory analytical data constitutes a data gap for VOCs and metals. This data gap will be addressed before human health and ecological risks associated with this PRS are evaluated.

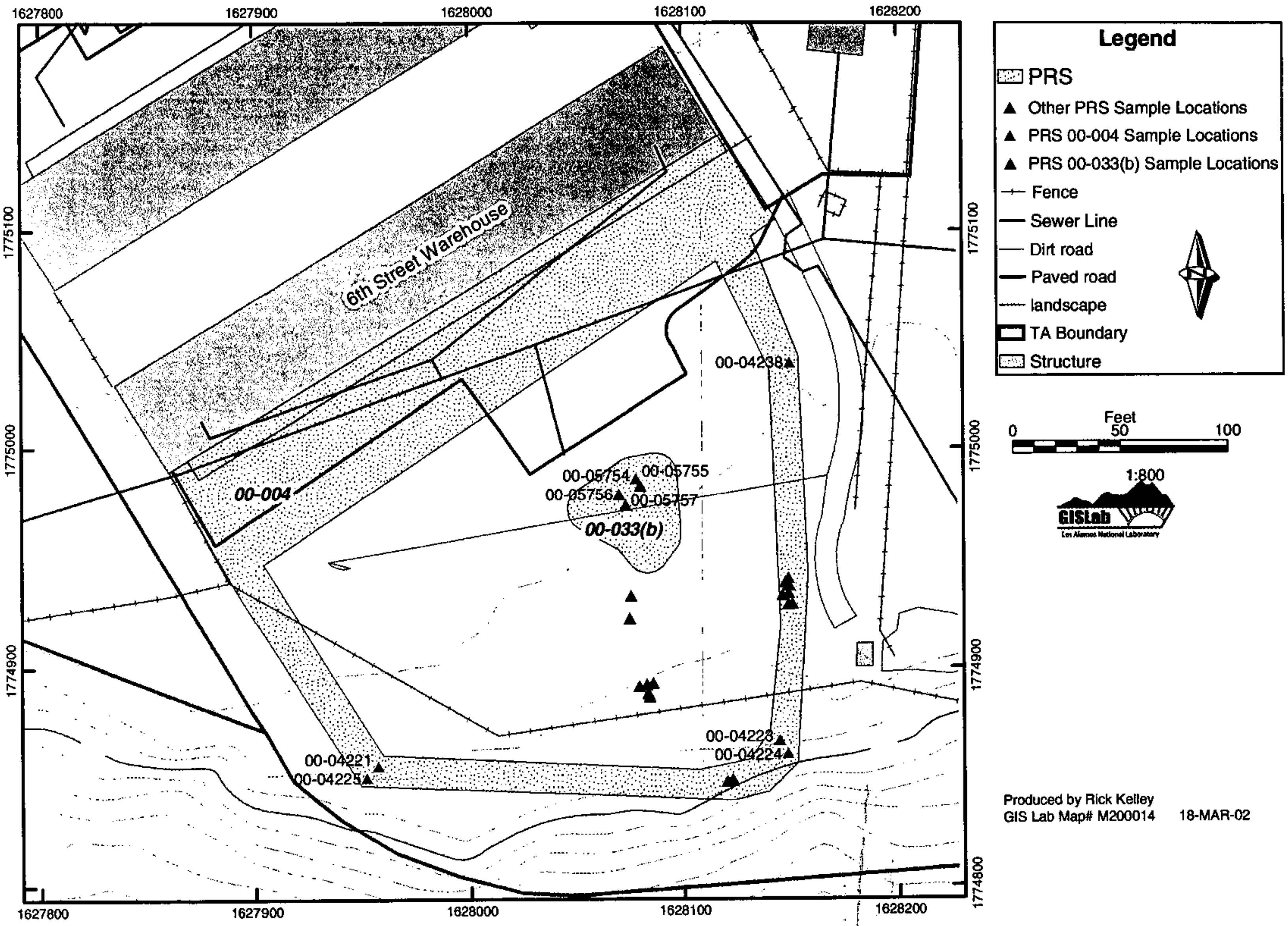


Figure 2.2-2. PRS 0-004 and PRS 0-033(b), sample locations

2.2.1.3 PRS 0-004, Results of Previous Investigations

In the 1996 RFI report (LANL 1996, 54616), no COPCs were retained by the human health screening assessment and the PRS was recommended for NFA based on Criterion 5. Five samples, as described in section 2.2.1.2, were collected to characterize the spills from this container storage area. Additional samples will be collected from the eastern and western drainages to provide information on the extent of potential contamination.

Table 2.2-1 shows existing information and data gaps for PRS 0-004. This PRS is characterized by surface releases. The surface hydrology of the site consists of runoff from rain events and snowmelt. Surface transport from overland flow and outfalls may cause contaminants to become concentrated in drainages. Consequently, contamination should be confined to the surface. Sampling to define the nature and extent of contamination will evaluate surficial (0–6 in.) and immediately subsurface (6–12 in.) soils to verify that contamination is limited to the surface (Appendix E).

Table 2.2-1
Data Gaps for Surface Drainage at 6th Street Warehouses, PRS 0-004

Suite	<2 ft
PCBs	√
Pesticides	√
PAHs	√
VOCs	No data
SVOCs	√
Inorganics	No data
Radionuclides	√

√ = Data available for analysis, indicating no data gap.

Because of the VOC and inorganic data gaps, this area will be resampled in order to collect enough information to determine nature and extent. The sampling design is described in Appendix E. If the screening assessments identify unacceptable risks to human health or the environment, an appropriate remedy will be developed and implemented, and will be presented in detail in the VCA completion report.

2.2.2 PRS 0-033(b), Soil Contamination, Drainlines, and Outfalls

2.2.2.1 PRS 0-033(b), Site Description and Operational History

The SWMU report (LANL 1990, 0145) describes PRS 0-033 as one unit which included soil contamination, a UST, storm drains and outfalls, and drainlines. Since that time, the UST has been labeled as PRS 0-033(a) and is described in section 2.5.3 of this plan. The rest of the area is designated as PRS 0-033(b) and includes soil contamination associated with the following areas: storm drains around Warehouse 1/2 and Warehouse 3/4 and their outfalls into Los Alamos Canyon, and MTL floor drains served by two drainlines with outfalls into Los Alamos Canyon. PRS 0-033(b) connects to PRS 0-004 at the drainage ditches.

PRS 0-033(b) includes potential soil contamination from the drainlines from the MTL. Operations at the testing laboratory involved the use of solvents, asphalt leaching, destructive tests of concrete cylinders, and sieve tests of aggregates for roadwork. COPCs at PRS 0-033(b) include PAHs, PCBs, SVOCs,

VOCs, pesticides, and metals originating in the 6th Street warehouses and in the MTL. Contamination from radionuclides is not expected.

2.2.2.2 PRS 0-033(b), Previous Field Investigations

A 1995 RFI field investigation (LANL 1996, 54616) at PRS 0-033(b) concentrated on the potential soil contamination surrounding the drainlines that served the MTL. It is possible that past spills at the MTL drained to the building storm drains. Five trenches were excavated to locate the pipelines and the alleged septic tank. The pipelines were excavated to the top of the tuff, approximately 3 to 10 ft bgs. Neither the excavation nor the geophysical surveys could locate the septic tank, the outlet pipeline, or the outfall. Sheet 5 of the blueprints for the MTL revealed that two liquid waste lines exited the south side of the building: one was cast iron and the other was vitrified clay pipe (VCP). Both liquid waste lines ended within the soil of the embankment, 13 to 15 ft south of the building. Although the waste lines did not daylight at the time of the field investigation, it is believed that they had at one time. As documented in the RFI report (LANL 1996, 54616), the construction activity related to removing the MTL and replacing it with transportables is believed to have resulted in additional soil being added to the embankment that covered the end of the waste lines. The waste lines may have ended in a small drainage ditch that led toward the berm, then around the berm and to the canyon. Three samples were collected from within and beneath the waste lines; they were analyzed for SVOCs, PCBs/pesticides, TAL metals, and radionuclides.

Because the initial RFI analytical results for PRS 0-033(b) indicated a potential increased risk to human health due to PAHs, alpha-chlordane, and gamma-chlordane, a VCA was conducted at the site (Figure 2.2-2) in July 1996 (LANL 1996, 62536). Both the VCP and the cast-iron pipe were located and removed. All soil to a depth of 1 ft under both pipes was removed and placed in drums. Eleven confirmatory samples, including a duplicate sample, were collected after the VCA. A confirmatory sample and a duplicate sample were collected from beneath the VCP drainline after it was removed. Two additional samples were collected from the trench where the cast-iron pipe was excavated. One of these samples was collected 5 ft from the south wall of the MTL foundation and 5 ft bgs. The other sample was collected 8.5 ft from the south wall of the MTL foundation and 4 ft bgs. Both were located 1 ft below the level of the cast-iron pipe. All four samples were submitted to a fixed analytical laboratory for pesticide/PCBs, SVOCs, and TAL metals analyses. Another sample was collected from beneath the former VCP, 12 ft south of the foundation. Six more samples were collected. Four of these were downgradient from both the VCP and cast-iron drainlines. The other two samples were collected upgradient from the two outfalls, one from the northwest side of the VCP outfall, and one from the northeast side of the cast-iron drainline outfall. These seven samples were analyzed for lead, SVOCs, and pesticides/PCBs by a fixed analytical laboratory.

2.2.2.3 PRS 0-033(b), Results of Previous Investigations

The analytical results for the confirmatory samples from the VCA activities did not show any concentrations of chemicals that present a potential risk to human health (LANL 1996, 62536). An assessment of risk to ecological receptors was not performed at that time. The lack of VOC and inorganic data (other than lead) represents a data gap which will be addressed by the sampling for this PRS as proposed in Appendix E.

Table 2.2-2 shows the data gaps identified by chemical suite and depth for PRS 0-033(b). Based on process knowledge, radiological contamination is not expected, nor is contamination above 2 ft or greater than 5 ft in depth.

Table 2.2-2
Data Gaps for Materials Testing Laboratory, PRS 0-033(b)

Suite	2 to 5 ft
PCBs	√
Pesticides	√
PAHs	√
VOCs	No data
SVOCs	√
Inorganics	√

√ = Data available for analysis, indicating no data gap.

To define nature and extent, additional data are required for this PRS. The additional sampling planned for this PRS is described in Appendix E. If the screening assessments identify unacceptable risks to human health or the environment, the selected remedy will be implemented and fully presented in the VCA completion report.

2.2.3 PRS 0-030(l), Septic System

2.2.3.1 PRS 0-030(l), Site Description and Operational History

PRS 0-030(l) consisted of a single, 1000-gal. concrete septic tank (10 ft long by 6 ft wide by approximately 5 ft deep) with VCP drainlines of 6 in. in diameter. The outlet line discharged to Los Alamos Canyon. This septic system reportedly handled sanitary wastes from Zia Warehouse 3/4 and discharged from a blow-down tank that released pressure from a boiler (LANL 1992, 0781). Chemicals used to descale boilers may have been released to the septic tank through the blow-down tank. The RFI work plan (LANL 1992, 0781) reports, "No information exists as to the nature of these chemicals." Thus, the COPCs for this site included SVOCs, PCBs/pesticides, radionuclides, and TAL metals.

2.2.3.2 PRS 0-030(l), Previous Field Investigation

The PRS 0-030(l) septic tank was sampled in July 1995 as part of an RFI (LANL 1996, 55203). Four soil samples were collected from inside the tank and all were submitted to a fixed analytical laboratory for SVOC, PCB/pesticide, and radionuclide analyses; two were analyzed for TAL metals.

Two tuff samples were collected from below the VCP inlet pipe and one sediment sample was collected from within the inlet pipe near its connection to the septic tank; all three samples were analyzed for SVOCs, PCBs/pesticides, and radionuclides. Additionally, one of the samples from below the VCP pipe and the sample from within the inlet pipe were analyzed for TAL metals. Two samples were collected from the outfall channel and analyzed for SVOCs, PCBs/pesticides, and radionuclides. Eleven samples were sent to the LANL MCAL for VOC analyses and metal analyses by XRF, but these data cannot be used to define nature and extent of contamination due to inadequate detection limits or lack of comparability of XRF data with published background values and no quality assurance.

The septic tank and approximately 40 ft of inlet line were excavated and removed in October 1995 during the VCA activities (Figure 2.2-3). Two confirmatory samples were collected from beneath the former tank location. These samples were analyzed for SVOCs, PCBs, pesticides, and radionuclides, and one sample was submitted for TAL metals analysis. The excavation area from the tank and inlet pipe was backfilled and the area was restored to its original contour.

The confirmatory samples that were collected on the outside of the tank were composited; therefore, a data gap exists regarding the nature of the soil on the sides of the former septic tank. Soil below the outlet VCP was sampled to determine if any contaminants were in the outfall. These samples were analyzed for SVOCs, PCBs/pesticides, and radiological constituents, by a fixed analytical laboratory, and for metals by XRF. The XRF measurements have multiple shortcomings, including inadequate sensitivity and comparability to Laboratory background data, that preclude their use for defining the nature and extent of contamination. Therefore, a data gap exists for metals due to the lack of fixed analytical laboratory data. Additional samples will be collected from each side of the former tank location. The tank location will be determined based on the Global Positioning System (GPS) coordinates. This data gap will be addressed before human health and ecological risks potentially associated with soil contaminants are evaluated.

2.2.3.3 PRS 0-030(l), Results of Previous Investigations

Because the data gaps for this PRS are related to composite samples and analytical results from mobile chemistry analytical laboratory, additional sampling and analysis are needed to define the nature and extent of contamination. Once the nature and extent are defined, the COPCs at the PRS can be evaluated for potential human health and ecological risk. Table 2.2-3 shows the data gaps by chemical suite and the depth for PRS 0-030(l).

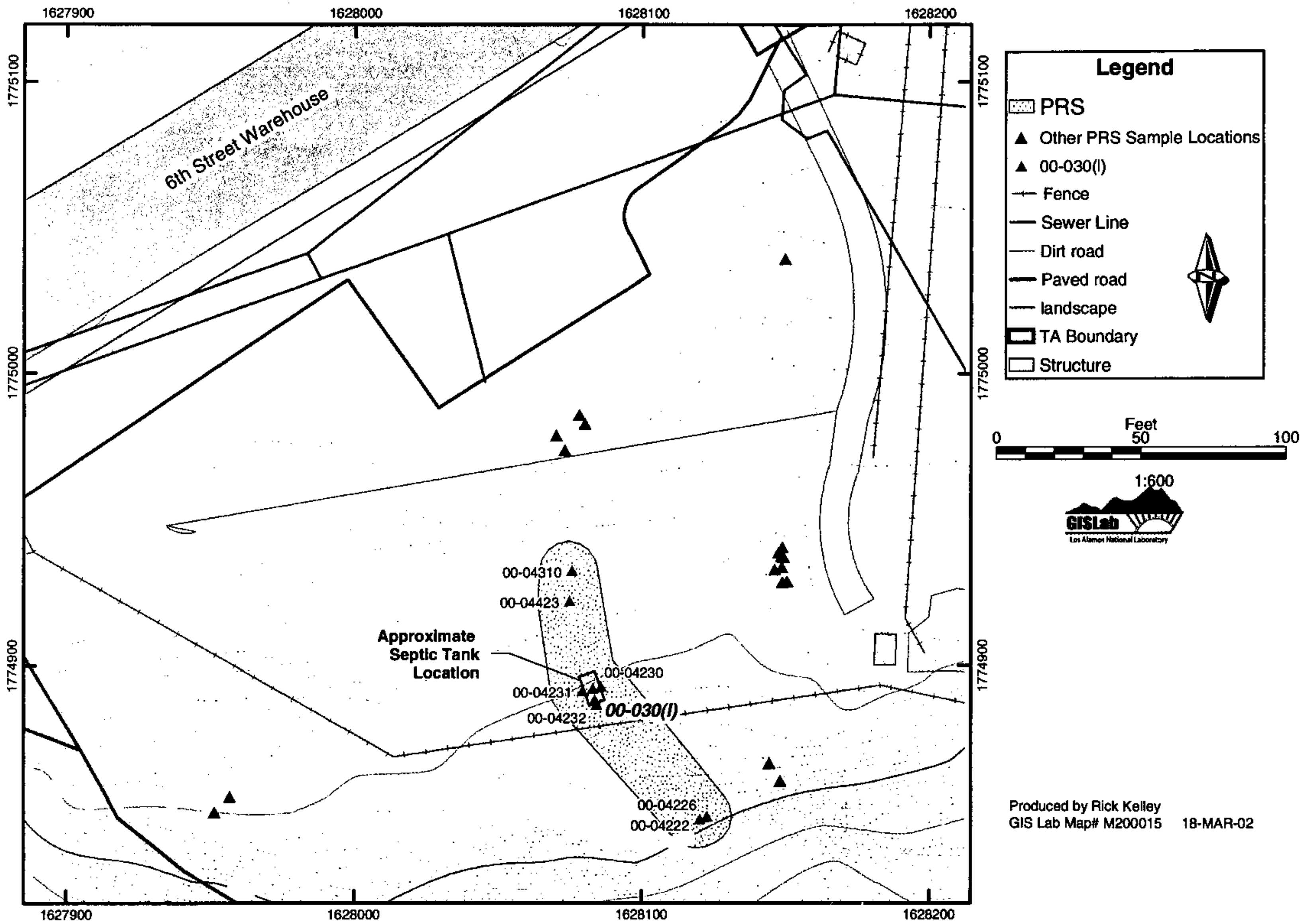
Previous remedial activities at PRS 0-030(l) did not remove the outlet pipe. Although this outlet pipe is inactive and the source was removed, the outlet pipe will be removed to prevent exposure to any residual concentrations of COPCs within the pipe. When the outlet pipe is removed, the soil in the trench can be visually inspected for staining as evidence of leaks from the pipe, then samples will be collected from visually stained areas and beneath selected pipe joints. The additional sampling for this PRS is described in Appendix E.

Table 2.2-3
Data Gap Identification for 6th Street Warehouse PRSs, PRS 0-030(l),

Suite	<2 ft	2 to 5 ft	5 to 15 ft
PCBs	√	√	√
Pesticides	√	√	√
PAHs	√	√	√
VOCs	No data	√	No data
SVOCs	√	√	√
Inorganics	No data	No data	√
Radionuclides	√	√	√

√ = Data available for analysis, indicating no data gap.

Figure 2.2-3. PRS 0-030(l)



Produced by Rick Kelley
GIS Lab Map# M200015 18-MAR-02

2.3 6th Street Septic Systems [PRSs 0-030(b) and 0-030(m)]

PRSs 0-030(b) and 0-030(m) are discussed together because they are in close proximity and are connected to one another (Appendix D). The outlet pipe from PRS 0-030(m) joins the outlet pipe from PRS 0-030(b) approximately 400 ft east of the PRS 0-030(m) septic tank. From that point, the line runs at least an additional 600 ft to where the pipe daylights (Figures 2.3-1 and 2.3-2). The PRSs are located south of the intersection between DP Road and Trinity Drive, on the top and upper slopes of East Mesa north of Los Alamos Canyon. The Canyon defines the southern boundary and DP Road defines the northern boundary of the PRSs. Surface contamination from DP Road may impact the northern portion of the site. PRS 0-030(b) and PRS 0-030(m) are located within DP Road South and DP Road 4 land transfer parcels.

2.3.1 PRS 0-030(b), Septic System

2.3.1.1 PRS 0-030(b), Site Description and Operational History

PRS 0-030(b) is a septic system that served 6th Street Warehouses 1 through 4, an office building, the cold storage plant, and the eastern portion of TA-1 in the late 1940s. The septic system consisted of two diversion boxes that directed sewage flow to two septic tanks (a north tank with six cells and a south tank with two cells), which then directed the sewage via drainlines to a leach field and an outfall in BV Canyon to the east. The diversion boxes were located adjacent to 6th Street, between the street and Warehouse 1 (Figure 2.3-1). Available information indicates that the septic system handled only sanitary waste; however, since it served portions of TA-1, there is a potential for nonsanitary wastes in the system. COPCs include VOCs, SVOCs, PCBs/pesticides, TAL metals, and radionuclides.

In the early 1950s, the leach field, which is located east of the 6th Street Warehouses, was bulldozed and distributed on the mesa top as part of the site preparation and leveling for a mobile home park. By 1951, trailer homes had been placed on the site of the former leach field (Figure 2.0-2). By 1974, the trailers had been removed from the site and the site has been vacant since that time (Figures 2.0-5 and 2.0-6). The outlet piping extends southeast across a field, then bends and extends eastward to where it daylighted into BV Canyon.

2.3.1.2 PRS 0-030(b), Previous Field Investigations

RFI fieldwork for PRS 0-030(b) began in the summer of 1995 (LANL 1996, 54616) and continued into 1996 with the VCA activities (LANL 1996, 54760; LANL 1996, 62536). Trenching was conducted to map the pipeline (Figure 2.3-1).

The field team dug a trench along the line that led from the septic tanks to the manhole, and then to where the line presumably daylighted in Los Alamos Canyon. Along the southeast-trending section of the line, four trenches were dug and samples were collected from beneath the pipes. The team attempted to locate the outfall along the diagonal by trenching south of the fence along the mesa edge, but no evidence of an outfall was found. The field team then trenched back toward the north to locate the end of the pipe. The pipe was found connected to an eastward-trending metal pipe. Samples were collected from beneath this connection. Trenching was conducted at intervals along the metal pipe until the broken end of the pipe was found near BV Canyon. A sample was collected from the soil beneath the end of the pipe. The team attempted to determine if the pipe continued to the east, but the metal pipe could not be located. There has been much activity in the area by the Los Alamos County utility department, and it is believed that this activity resulted in the rest of the pipe being either removed or cut. All of the drainlines located by the field team were left in place.

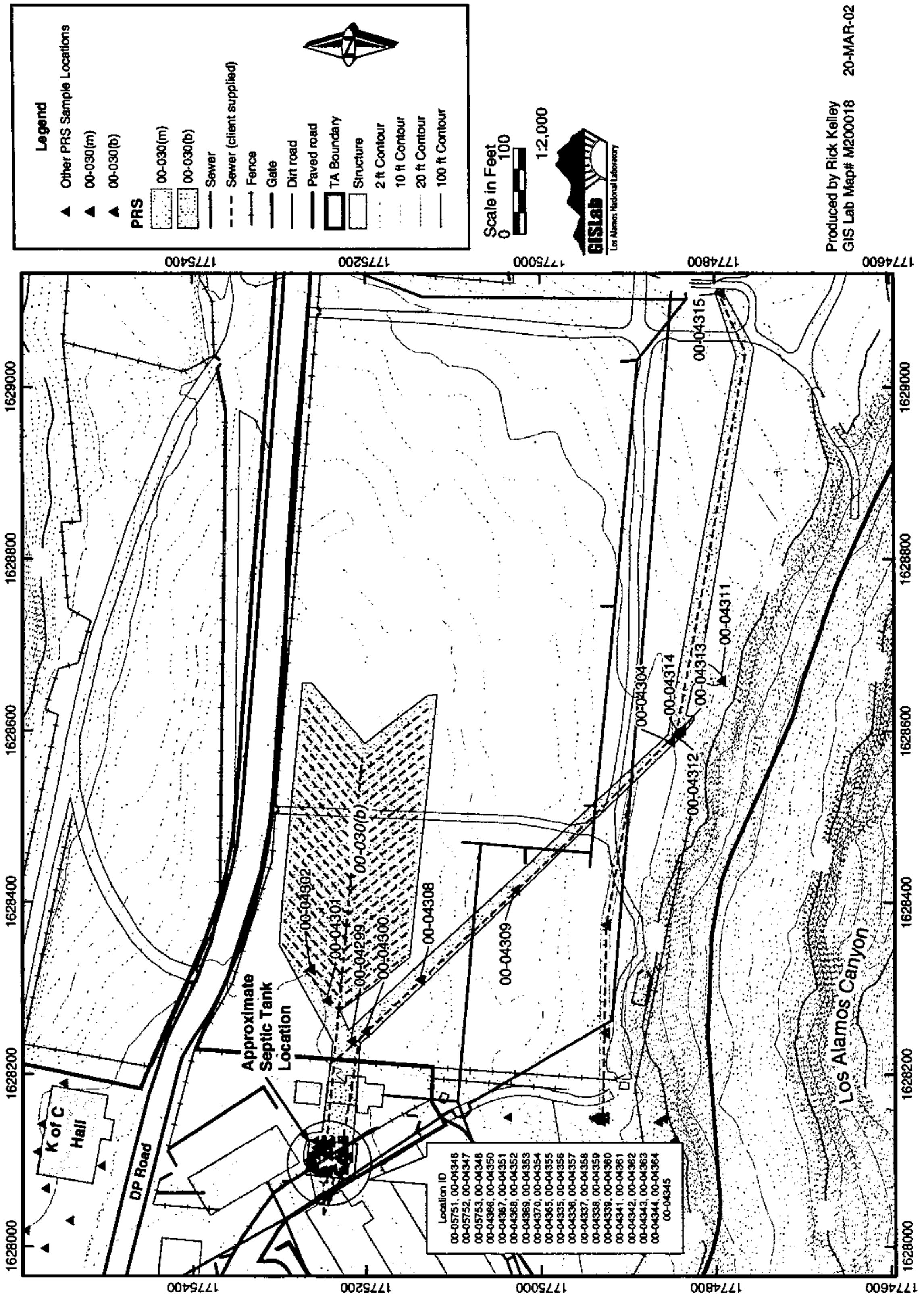
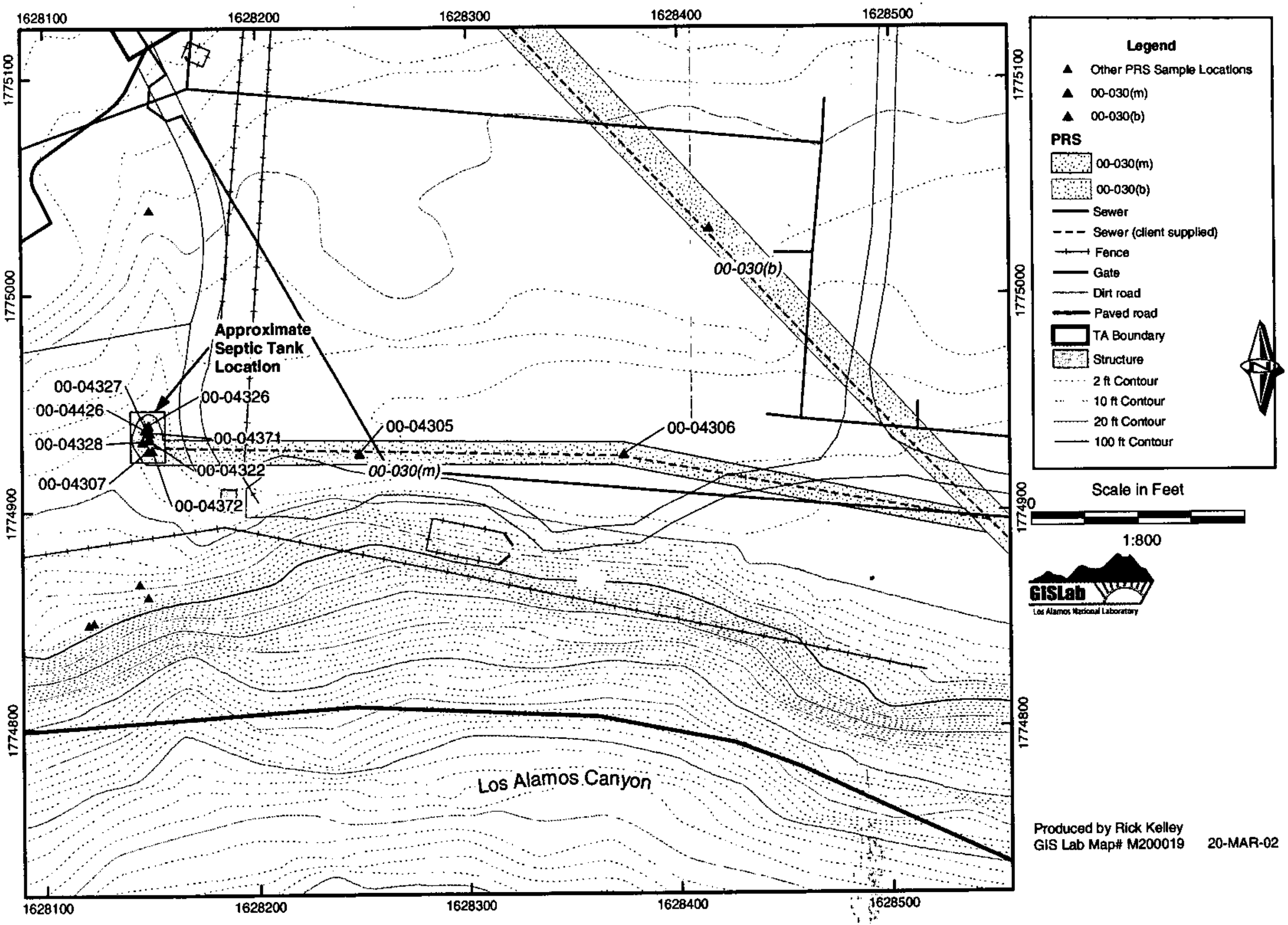


Figure 2.3-1. **PRS 0-030(b)**



Produced by Rick Kelley
GIS Lab Map# M200019 20-MAR-02

Figure 2.3-2. PRS 0-030(m)

The leach field associated with PRS 0-030(b) was approximately 325 ft long by 150 ft wide. Trenching was conducted within the former leach field to attempt to locate the central drainline and the lateral Y branches. In the northwest corner, four sections of 2-ft long VCP were located, but longer sections of piping were not found. Soil samples from two locations in the leach field were collected, both from the northwest corner because the associated piping had not been located during field investigations. The two samples were analyzed for SVOCs, PCBs, pesticides, and radionuclides by a fixed analytical laboratory, and for VOCs and metals by the MCAL. Additional trenching was conducted to locate the outfall drainline, and samples were collected from beneath joints and pipe pieces.

The south septic tank is composed of two cells divided by a concrete wall. The VCP outlet was found in the bottom of the tank as opposed to the side of the tank. The north septic tank is composed of three separate septic tanks, each constructed with the same two-cell design as the south septic tank. Two of the tanks share a common wall; this is interpreted to indicate that they were constructed at the same time. It is believed that those two tanks were added later because the 1943 engineering drawing shows two tanks instead of three.

The south diversion box, which was 2 ft by 3 ft, was constructed of brick and was partially demolished. During the characterization activities, it was discovered that the west and south walls were missing. The base was concrete and contained channels that were used for directing sewage flow. The north diversion box, which was 3 ft by 3.5 ft, was constructed of concrete. The field team speculated that it was a later addition to the system. The outlet lines were not exposed, but the inlet pipe was intact and was oriented northwest-southeast.

The 1995 field team found that the septic tanks and the diversion boxes had been backfilled with a silty sandy clayey fill material. Concrete chunks, presumably pieces of broken tank walls, were common within the fill material. It appeared that the original contents of the boxes had been mostly removed, but dark organic material was encountered infrequently near the bottom of the diversion boxes.

A total of 67 samples were collected from the septic system and analyzed. Three samples were collected from within and beneath the leach field Y branches. Twelve samples were collected from within and beneath the northwest-southeast-trending outlet pipeline, and 3 samples were collected from what was possibly the original outfall channel leading from the end of the VCP. One sample was collected from within and below the end of the steel outfall pipe. A total of 44 samples were collected from within and beneath the septic tanks and their outlet pipelines. Four samples were collected from within and beneath the diversion boxes and the inlet pipeline to the concrete diversion box.

2.3.1.3 PRS 0-030(b), Results of Previous Investigations

Based on the results of the 1995 RFI field activities at PRS 0-030(b), the decision was made to excavate the diversion box area, which showed chemical concentrations above SALs in the human health screening assessment (LANL 1996, 54616). The VCA took place during the summer of 1996 (LANL 1996, 62536). The contents of the concrete diversion box were removed, and the sides and floor were scraped and then swept clean. Before the concrete diversion box was removed, it was screened for waste characterization and found to have no detectable radioactivity.

The brick diversion box had been partially demolished, as described above. The remaining portions of the box, as well as the brick and concrete debris, were removed. Approximately 1 ft of soil was removed from below the box before collecting a confirmatory sample in July 1996. An additional confirmatory sample was collected from beneath the adjoining sides of the brick and concrete boxes. The first sample was collected 1 ft under the diversion box, the second was collected 1 ft under the area where the boxes were joined, and the third was collected 1 ft under the midpoint of the concrete diversion box. All three samples were submitted to a fixed analytical laboratory for pesticide/PCB analysis.

Before backfilling the excavations, the inlet line to the concrete diversion box and all of the four outlet lines from the septic tanks were broken and sealed with concrete. The excavations were then backfilled with crushed tuff in 6- to 8-in. lifts and compacted.

According to the VCA completion report (LANL 1996, 62536), the analytical results for the confirmatory samples did not show any concentrations of chemicals that present a potential unacceptable risk to human health.

Only two samples were collected from within the leach field; therefore, a data gap exists for this part of PRS 0-030(b). (Two sample locations are not adequate to define nature and extent.) The two samples were analyzed for SVOCs, PCBs, pesticides, and radionuclides by a fixed analytical laboratory, and for VOCs and metals by the MCAL. XRF data for metals cannot be used to characterize sites because XRF sample results are not comparable to Laboratory background data and XRF samples lack the quality assurance of fixed laboratory data. The lack of inorganic data at this site is a data gap. In addition, there are also data gaps with regard to the vertical distribution of contaminants; while contamination was originally limited to the subsurface in the unpaved portion of PRS 0-030(b), the leach field has experienced significant recontouring activities following relocation of the former trailer park. This could have brought previously buried waste to the surface, as evidenced by numerous scraps of previously buried VCP observed on the ground surface throughout the site (Appendix D). VOCs are not considered a data gap because the surface soil would no longer contain VOCs associated with Laboratory operations; over 50 years have elapsed since there were any Laboratory activities in this area. Additional sampling to address these data gaps will be conducted as described in Appendix E.

Tables 2.3-1 and 2.3-2 list the data gaps by chemical suite and depth. The subareas within PRS 0-030(b) were divided according to whether they occurred in the proximity of the paved area or the leach field. In contrast to the leach field, contaminants in the area under pavement should be confined to depths greater than 2 ft because the diversion boxes were buried and the asphalt cover would have prevented activities (e.g., earth moving) that could have brought potential contamination closer to the surface.

Table 2.3-1
Data Gaps for 6th Street Warehouse PRS 0-030(b), Area Under Pavement

Suite	2 to 5 ft	5 to 15 ft
PCBs	√	√
Pesticides	√	√
PAHs	√	√
VOCs	No data	√
SVOCs	√	√
Inorganics	√	√
Radionuclides	√	√

√ = Data available for analysis, indicating no data gap.

Table 2.3-2
Data Gaps for 6th Street Warehouse PRS 0-030(b), Leach Field

Suite	<2 ft	2 to 5 ft	5 to 15 ft
PCBs	√	√	√
Pesticides	√	√	√
PAHs	√	√	√
VOCs	No data	No data	√
SVOCs	√	√	√
Inorganics	No data	√	√
Radionuclides	√	√	√

√ = Data available for analysis, indicating no data gap.

The data gaps that have created uncertainties in the nature and extent of contamination (e.g., lack of inorganic chemical data for shallow depths and lack of VOC sample results) for PRS 0-030(b) subareas will be addressed by additional sampling as described in Appendix E. If the screening assessments identify potential risks to human health or the environment, and if a cost-effective remedy is available, the remedy will be implemented and then presented in detail in the VCA completion report.

Previous remedial activities at PRS 0-030(b) did not remove the outlet pipe. Although this outlet pipe is inactive and the source is removed, the outlet pipe will be removed to prevent exposure to any residual concentrations of COPCs within the pipe. When the outlet pipe has been removed, the soil in the trench can be visually inspected for staining as evidence of leaks from the pipe and the soil can be sampled.

2.3.2 PRS 0-030(m), Septic System

2.3.2.1 PRS 0-030(m), Site Description and Operational History

PRS 0-030(m) consisted of a single wooden sanitary septic tank with 6-in.-diameter VCP drainlines. The system handled sanitary wastes from the incinerator building (LANL 1992, 0781), and the outlet line ran east along the edge of the mesa for approximately 400 ft, connecting to the outfall line from PRS 0-030(b) (Figure 2.3-2) and discharging into BV Canyon. This septic system also served an incinerator building where garbage collected from private residences was burned. Before incinerating the garbage, excess liquids of unknown chemical content were allowed to drain off and were piped into the septic tank (LANL 1992, 0781).

2.3.2.2 PRS 0-030(m), Previous Field Investigations

PRS 0-030(m) was investigated beginning in August 1995 during RFI activities. The septic tank was found by excavating trenches and was approximately 10 ft long by 6 ft wide by 6 ft deep. The tank had no lid and was filled with what appeared to be soil from the surrounding area. Two samples were collected from below the tank by hand-augering through the decayed wooden tank bottom; the samples were submitted for fixed laboratory analyses of SVOCs, PCBs/pesticides, TAL metals, and radionuclides. The field team found that the tank contained a few inches of soil that graded from moist to wet and from dark gray organic clay to silty sandy clay. Below the tank, approximately 1.1 ft of dark gray to black silt and very fine sand with occasional brownish pebbles and broken glass was encountered. This layer was in contact with reddish-gray tuff. Sixteen additional samples were collected, including a composite sample from outside and below the tank (the composite sample cannot be used to determine nature and extent of contaminants). Seven samples were collected from inside the tank, including one duplicate sample. Five of the samples were analyzed by a fixed laboratory for SVOCs, PCBs/pesticides, and radionuclides; one was analyzed for TAL metals, and one for radionuclides only.

Three samples were collected from inside and below the inlet pipeline, including one duplicate sample; these were analyzed for SVOCs, PCBs/pesticides, and radionuclides. Five samples were collected from inside and beneath the outlet pipeline; these were analyzed for SVOCs, PCBs/pesticides, and radionuclides.

The analytical results for PRS 0-030(m) indicated that the tank contained elevated concentrations of several pesticides, SVOCs (primarily PAHs), and metals. Based on the results of the screening assessment, a VCA was conducted in 1995 (LANL 1996, 55203).

A VCA was conducted in November 1995, and the septic tank and inlet pipeline were excavated and removed (LANL 1996, 55203). The silty sand layer below the tank also was removed, and approximately 6 to 8 in. of tuff was excavated from beneath and around the tank in an attempt to remove any residual contamination. The tank contents, surrounding soil and tuff, and inlet line were placed in four B-25 boxes, and 42 yd^3 of soil was placed into bags. As part of the removal with the backhoe, decayed wood from the tank itself was mixed with the soil in the B-25 boxes. Two confirmatory samples were collected after the tank, soil, and tuff were excavated. These samples were collected from beneath the tank and the removed sand and tuff. They were analyzed for SVOCs, PCBs/pesticides, and radionuclides. The tank and inlet pipe excavation were backfilled, and the area was restored to its original contour.

2.3.2.3 PRS 0-030(m), Results of Previous Investigations

The confirmatory sample results for PRS 0-030(m) indicated that there was no potential unacceptable risk to human or ecological health, and NFA was recommended based on Criterion 5 (LANL 1996, 55203).

The two confirmatory samples were analyzed for VOCs and metals by the MCAL. The metals analysis was conducted by XRF, and XRF data can no longer be used to characterize nature and extent at PRSs. The lack of inorganic data from a fixed laboratory at this site constitutes a data gap. In addition, the analytical quality assurance and detection limits associated with MCAL VOC analyses are less rigorous than that necessary for defining nature and extent of contamination. Consequently, the lack of useable VOC data constitutes a data gap.

No samples were collected from the outside of the tank. This constitutes a data gap because it is not known if the wooden tank leaked laterally. In addition, trenching was not conducted south of the tank to ensure that the tank did not have an outfall to the south leading to Los Alamos Canyon.

Tables 2.3-3 and 2.3-4 list the data gaps identified by chemical suite and depth. The subareas within PRS 0-030(m) were divided according to whether they represent the septic tank or the leach field that is also associated with PRS 0-030(b). Because contamination is expected to be limited to the buried drainage/tank structures, no contamination above 5 ft in depth is expected.

Table 2.3-3
Data Gaps for Wooden Septic Tank Receiving Incinerator Waste, Septic Tank Area, PRS 0-030(m)

Suite	5 to 15 ft
PCBs	√
Pesticides	√
PAHs	√
VOCs	No data
SVOCs	√
Inorganics	No data
Radionuclides	No tritium data

√ = Data available for analysis, indicating no data gap.

Table 2.3-4
Data Gaps for Wooden Septic Tank Receiving Incinerator Waste, Area Draining into Leach Field, PRS 0-030(m)

Suite	5 to 15 ft
PCBs	√
Pesticides	√
PAHs	√
VOCs	No data
SVOCs	√
Inorganics	No data
Radionuclides	No tritium, isotopic-uranium data

√ = Data available for analysis, indicating no data gap.

Previous remedial activities at PRS 0-030(m) did not remove the outlet pipe. Although this outlet pipe is inactive and the source is removed, the outlet pipe will be removed to prevent exposure to any potential residual concentrations of COPCs within the pipe. When the outlet pipe is removed, the soil in the trench will be visually inspected for staining as evidence of leaks from the pipe.

The data gaps for the PRS 0-030(m) subareas will be addressed by additional sampling as described in Appendix E. If the screening assessments identify potential risks to human health or the environment, and if a cost-effective remedy is available, the remedy will be implemented and presented in the VCA completion report.

2.4 Former PCB Transformer Sites [PRS 0-029(a,b,c)]

PRSs 0-029(a,b,c) are identified in the SWMU report (LANL 1990, 0145) as Aggregate 0-G, leakage from transformers containing PCBs (Figure 1.0-3). PRSs 0-029(a,b) were two former production well sites located on San Ildefonso Pueblo property, and PRS 0-029(c) was a production well site located on Santa Fe National Forest land in Guaje Canyon. The PRSs consist of potentially contaminated soil resulting from leaks from transformers located on power poles.

PRSs 0-029(a,b,c) were investigated in 1992, and an RFI phase report was written and submitted (LANL 1993, 26972). The report contains the final analytical data for these PRSs, but these data were not submitted to the ER Project's analytical database (the Facility for Information Management, Analysis, and Display). The quality assurance/quality control information for the sample data was not available, therefore, the use of the sample data is questionable. These PRSs will be resampled to obtain data that meets current LANL quality assurance/quality control requirements.

PRSs 0-029(a,b) are located in Los Alamos Canyon on San Ildefonso Pueblo property near Totavi, and PRS 0-029(c) is located in the Santa Fe National Forest in Guaje Canyon approximately 2 mi directly north of PRSs 0-029(a,b). Despite the distance separating PRSs 0-029(a,b) and PRS 0-029(c), these sites are evaluated together because of the similar sources and nature of contamination (PCBs). The 0-029 PRSs are located near (within 50 to 200 ft of) intermittent stream beds (Appendix D, Ecological Checklists).

2.4.1 PRS 0-029(a), Leakage from PCB Transformers

2.4.1.1 PRS 0-029(a), Site Description and Operational History

PRS 0-029(a) is the location of potential soil contamination due to releases from two transformers located on a power pole used for a groundwater production well (Well #5) in Los Alamos Canyon (Figure 1.0-3). The well is located in the bottom of Los Alamos Canyon, adjacent to a stream channel; the power pole is located about 20 ft from the PRS boundary closest to the stream channel. The two transformers were removed in October 1987 and contained oil with PCB concentrations of 162 ppm and 292 ppm (LANL 1990, 0145; Bailey 1992, 02007.2).

2.4.1.2 PRS 0-029(a), Previous Field Investigations

Sampling at PRS 0-029(a) was conducted in March 1992. A 100-ft by 50-ft grid was established, and fifteen soil samples were collected at regular intervals along the grid (Figure 2.4-1). Five additional samples were collected in the area around the power pole; one at the base. The analytical results indicated that the PCB levels in two of the samples were 0.09 ppm and that the remaining 18 samples were below the analytical detection limit of 0.06 ppm.

Although the PCB levels were an order of magnitude below the cleanup level of 10 ppm, a decision was made to define the nature and extent of the contamination. To define the nature and extent, six additional soil samples were collected in the area between the pump house and the power pole (Figure 2.4-1). The sampling sites were selected to more closely delineate the boundary of the suspected contaminated area (LANL 1993, 26972).

During the two sampling events, a total of 26 samples were collected and submitted to the LANL Environmental Chemistry Group (formerly EM-9, now C-ACS) for analysis of PCBs. For health and safety reasons, the soil samples were also screened for gross-alpha, -beta, and -gamma activity before submittal to the laboratory. One sample was collected and analyzed for VOCs by purge and trap gas chromatography/mass spectrometry analysis, and for petroleum hydrocarbons by Fourier transform infrared spectroscopy.

The original plan had been to remove the well house and to plug the well, but San Ildefonso Pueblo informed the Laboratory that they wanted the building and the well. Because the well house was left in place, additional samples were collected inside the well house. These samples included a swipe sample from the floor near the drain, and a sample of oil from inside a turbine located in the well house. The floor swipe contained 2.3 ppm of PCBs and the turbine oil less than 5 ppm of PCBs.

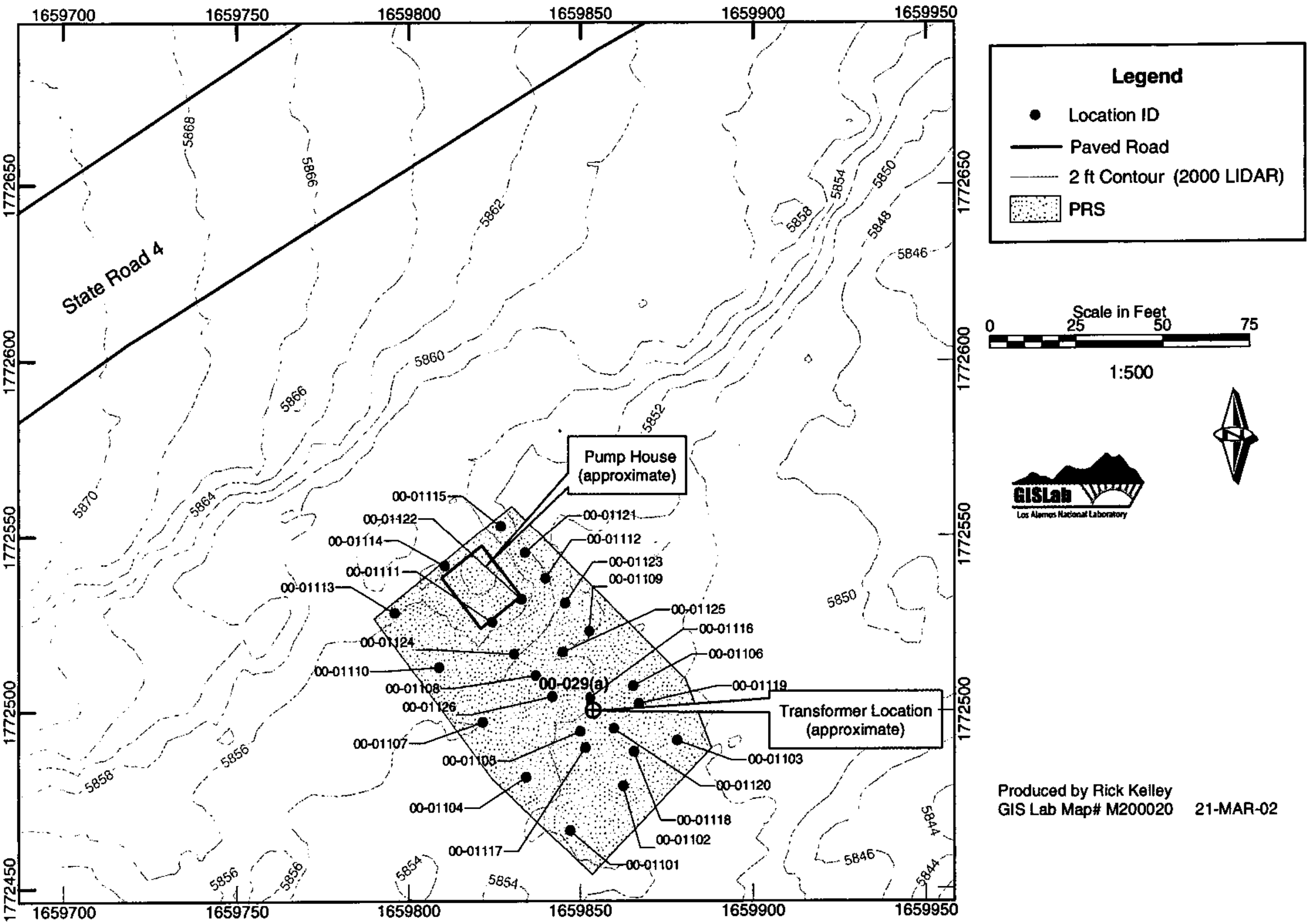


Figure 2.4-1. PRS 0-029(a), grid locations

During the second sampling event, an area of "oil-stained" soil was noted south of the pump house. An additional soil sample was collected from within this stained area and analyzed for VOCs, PCBs, and TPH. This sample had a PCB level below the detection limit of 0.06 ppm.

2.4.1.3 PRS 0-029(a), Results of Previous Investigations

Although the PCB contamination in the soil was below the Toxic Substances Control Act (TSCA) cleanup level of 10 ppm, the Laboratory elected to remove the contaminated soil. The boundary of the area identified for excavation was conservatively selected to ensure that all contaminated soil was removed. Approximately 20 yd^3 of soil was removed in August 1992 (LANL 1993, 26972). In addition to the soil removal, the well house was decontaminated. No confirmatory sampling was conducted because the levels of PCBs were less than the TSCA cleanup level.

The original data packages from the PRS 0-029(a) sampling events were not available for baseline or focused validation during preparation of this plan; thus the analytical data for these PRSs were not useable. Therefore, a PCBs data gap exists for this PRS. This PRS will be resampled for PCBs to obtain data that meet current LANL quality assurance/quality control requirements. The proposed sampling plan is described in Appendix E.

2.4.2 PRS 0-029(b), Leakage From PCB Transformers

2.4.2.1 PRS 0-029(b), Site Description and Operational History

PRS 0-029(b) is the location of potential soil contamination due to leaks from three transformers located on a power pole that supplied electric power to a groundwater production well (Well #4) in Los Alamos Canyon. The well was located in the bottom of Los Alamos Canyon, adjacent to a stream channel and approximately 1 mi upstream from Totavi. The power pole is located about 20 ft from the PRS boundary closest to the stream channel. The transformers were removed in October 1987 and contained oil with PCB concentrations of 231 ppm, 206 ppm, and 362 ppm (LANL 1992, 0781; Bailey 1992, 02007.2). The well was decommissioned and the well house removed in 1989 (Aldrich 1991, 71266).

2.4.2.2 PRS 0-029(b), Previous Field Investigations

Sampling at PRS 0-029(b) was conducted in March 1992. A 50-ft by 100-ft grid was established, and fifteen soil samples were collected at regular intervals along the grid (Figure 2.4-2). Five additional samples were collected at the base of the power pole.

2.4.2.3 PRS 0-029(b), Results of Previous Investigations

Twenty samples were collected and submitted to the LANL Environmental Chemistry Group (C-ACS) for analysis of PCBs. The soil samples were also screened for gross-alpha, -beta, and -gamma radioactivity before submittal. The PCB analytical data were less than the detection level of 0.06 ppm. Therefore, no additional action was performed or recommended at that time.

The original data packages were not available for baseline or focused validation during preparation of this plan; thus, the analytical data for these PRSs were not useable. Therefore, a data gap exists for this PRS for PCBs. This PRS will be resampled for PCBs to obtain data that meet current LANL quality assurance/quality control requirements.

2.4.3 PRS 0-029(c), Leakage from PCB Transformers

2.4.3.1 PRS 0-029(c), Site Description and Operational History

PRS 0-029(c) is the location of potential soil contamination due to leakage from a transformer located on a power pole that supplied electrical power to a groundwater production well (Well #1) in Guaje Canyon. The well was located about 100 ft from a stream channel, approximately 2 mi upstream of its confluence with Los Alamos Canyon. The power pole was located about 20 ft from the PRS boundary closest to the stream channel. The transformer was removed in April 1986 and the oil contained less than 50 ppm of PCBs (Aldrich 1991, 71265).

2.4.3.2 PRS 0-029(c), Previous Field Investigations

Sampling at PRS 0-029(c) was conducted in March 1992. A 75-ft by 65-ft grid was established, and sixteen soil samples were collected. Five additional samples were collected from the area around the power pole (Figure 2.4-3).

2.4.3.3 PRS 0-029(c), Results of Previous Investigations

The analytical results for PRS 0-029(c) indicated that the PCB levels in the soil samples were less than 0.09 ppm. No additional action was performed or recommended in the RFI report (LANL 1993, 26972).

The original data packages were not available for baseline or focused validation during preparation of this plan; thus, the analytical data for these PRSs were not useable. Therefore, a data gap exists for this PRS for PCBs. This PRS will be resampled for PCBs to obtain data that meet current LANL quality assurance/quality control requirements.

2.5 Non-HSWA PRSs Near the 6th Street Warehouses [PRSs 0-010(a,b) and 0-033(a)]

PRSs 0-010(a,b) and PRS 0-033(a) are grouped because they are non-HSWA PRSs that will not require additional sampling. Both PRS 0-010(a) and PRS 0-010(b) were approved for NFA by DOE under Criterion 2. PRS 0-033(a) was remediated, and an NFA was requested under Criterion 4. These PRSs are included in this VCA plan because they are located within the DP Road land transfer boundary.

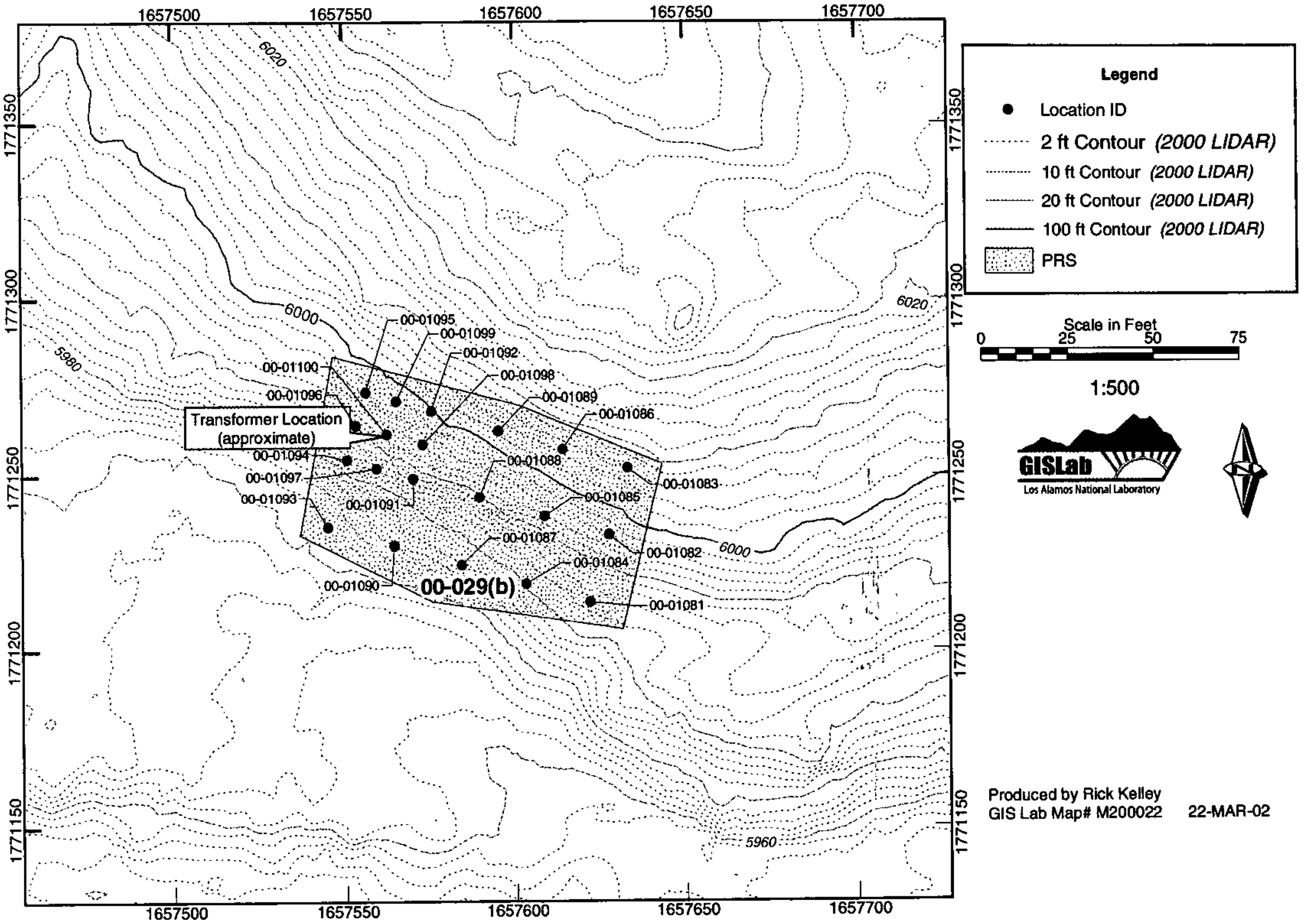
2.5.1 PRS 0-010(a), Surface Disposal

2.5.1.1 PRS 0-010(a), Site Description and Operational History

PRS 0-010(a) was identified originally as a surface disposal site located on a small mesa southwest of MDA B, along DP Road near TA-21 (Figure 1.0-2). It was first identified as a PRS based on a preliminary review of aerial photographs taken in the mid-1940s, which seemed to indicate the presence of a drum storage area and several trenches.

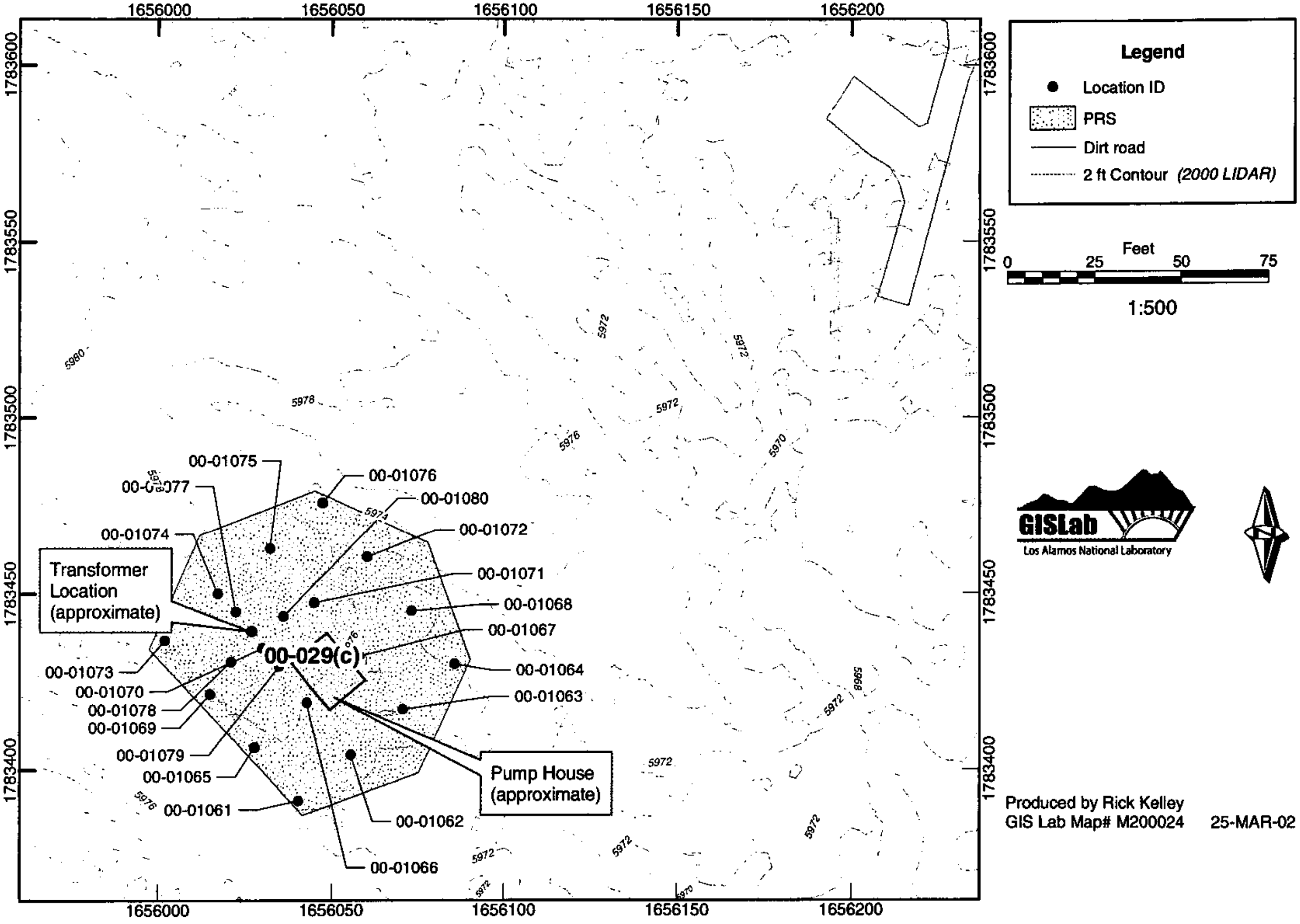
2.5.1.2 PRS 0-010(a), Previous Field Investigations

Figure 2.0-1, an aerial photo from 1946, clearly shows rows of material, not trenches. After an in-depth analysis of the photograph was performed before the submittal of the OU 1071 work plan (LANL 1992, 0781), the PRS was proposed for NFA under Criterion 2 (the site was never used for the management of RCRA solid or hazardous waste). Additional information gained in 1996 from an interview with a former Zia Company employee who had worked in the area identified the stored materials as canisters of roofing asphalt and roofing tar pitch (LANL 1996, 71415). Thus, it was determined that the PRS had been incorrectly identified on the SWMU report (LANL 1990, 0145).



Produced by Rick Kelley
GIS Lab Map# M200022 22-MAR-02

Figure 2.4-2. PRS 0-029(b), grid locations



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GIS Lab Map# M200024 25-MAR-02

Figure 2.4-3. PRS 0-029(c), grid locations

2.5.1.3 PRS 0-010(a), Results of Previous Investigations

No field investigation has taken place at this site. An NFA was requested for this PRS under Criterion 2 (the site was never used for the management of RCRA solid or hazardous waste), based on the detailed re-evaluation of the aerial photograph that showed the open storage area in which supplies were stockpiled (Figure 2.0-1). EPA concurred with the NFA in October 1992 (LANL 1992, 71416). DOE approved the NFA on September 30, 1997, and the site is now considered complete, with no further action necessary.

2.5.2 PRS 0-010(b), Landfill

2.5.2.1 PRS 0-010(b), Site Description and Operational History

PRS 0-010(b) was a purported excavation to the east of 6th Street Warehouses 1 through 4. Aerial photographs taken in 1946 showed this area as a dark area (Figure 2.0-1). It was assumed that this area was an excavation adjacent to a warehouse building, and that it was used for some type of disposal activity. However, no definitive evidence of a waste disposal pit was available (LANL 1992, 0781).

Two aerial photos from November and December 1946 were closely examined (LANL 1996, 54616) and revealed no evidence of an excavation in the area as previously concluded during the RFI. Furthermore, no records or data were discovered suggesting that such an excavation existed or was used for waste disposal purposes. A visual survey of the area revealed no clues as to the existence of a former excavation. Based on this lack of evidence, it has been determined that no excavation ever existed at this PRS.

2.5.2.2 PRS 0-010(b), Previous Field Investigation

A field investigation included a walk-over survey of the site.

2.5.2.3 PRS 0-010(b), Results of Previous Investigations

Visual surveys and detailed administrative reviews of available records have been conducted for this site. As stated in the RFI report (LANL 1996, 54616), "The evidence for listing this supposed excavation as a PRS in the first place was insufficient, consisting of nothing more than an interpretation of a single aerial photograph that now cannot be found." Figure 2.0-1 does not show an excavation, and this photo was taken in the same year as the photo that was reported to have shown the excavation. Based on Criterion 2, an NFA request was made for this PRS. The request was approved by DOE on September 15, 1998. The site is now administratively complete.

2.5.3 PRS 0-033(a), UST

2.5.3.1 PRS 0-033(a), Site Description and Operational History

PRS 0-033(a) was a 5000-gal. steel fuel UST located adjacent to the north side of Warehouse 3. On November 13, 1995, the UST was excavated and removed pursuant to the NMED UST Bureau Regulations Section 401(a), which required all USTs installed before 1989 to be upgraded or removed before December 22, 1998.

2.5.3.2 PRS 0-033(a), Previous Field Investigations

After the excavation and removal of the UST, which was done with the concurrence of the NMED UST Bureau, a visual inspection revealed an approximately 2-in.-diameter hole in the lower west end of the tank (LANL 1996, 55203). The soil surrounding the UST appeared to have been contaminated with fuel oil. Following removal of the UST, the contaminated fill material was removed and the tuff below the tank was removed to a depth of approximately 10 ft. Four confirmatory samples of tuff from below the tank were collected and submitted to LANL's MCAL for TPH analysis.

Five boreholes were drilled and sampled, and a total of 43 samples were collected at 5-ft intervals and from zones of possible contamination. All samples were submitted for TPH analysis. TPH concentrations ranging from approximately 3000 to 10,000 ppm were detected in the samples. The depth of the boreholes ranged from 3 ft to 40 ft. One borehole was located within the footprint of the UST; the other four boreholes were located east, west, north, and south of the former UST.

2.5.3.3 PRS 0-033(a), Results of Previous Investigations

The analytical data adequately defined the vertical and horizontal extent of the TPH contamination (LANL 1996, 55203). At the lowest depth, the TPH concentrations did not exceed 5500 ppm, and the TPH values decreased with depth. The analytical data from sample location 00-04373, which is the borehole within the footprint of the former UST, show that the TPH plume does not extend deeper than 35 ft. Because the analytical data does not show contamination, the four surrounding boreholes are indicators that there has been little, if any, horizontal movement of the TPH. The Laboratory proposed three primary reasons for the apparent lack of significant migration of the fuel oil (LANL 1996, 55203). The first is that the moderately welded tuff lacks sufficient permeability for significant migration. The second is that the fractures in the tuff that were observed during drilling were mostly clay lined, which would inhibit migration. The third is that the wet zone at a depth of 30 to 35 ft at location 00-04373 has acted as a barrier to vertical migration.

The VCA report (LANL 1996, 55203) states that the NMED UST Bureau has determined that this site does not pose an immediate public or environmental threat. The following reasons were given:

- The horizontal and vertical extent of soil contamination has been adequately defined, and the soil contamination is greater than 900 ft above high-static groundwater.
- The contaminated soils were excavated and disposed of properly.

Therefore, the site was proposed for NFA under Criterion 4, and it was included on the requests for permit modification on September 30, 1996, and June 2000. Its status is still pending.

2.6 TA-21

TA-21 was used primarily for plutonium research and metal production and related activities from 1945 to 1978 (LANL 1994, 26073). These activities may have resulted in aerial dispersion of COPCs from the stacks at TA-21. Subsequent unrelated office and small-scale research activities have continued at this TA to the present time. Because the major industrial activities at TA-21 were related to plutonium production, the major waste disposal activities were also plutonium-related.

PRS 21-021 is described as the airborne emissions from the two incinerators, eleven stacks, and three filter houses within TA-21, which is located approximately 4000 ft east of the DP Road South land transfer area. Airborne emissions occurred from approximately 1945 until 1991. The available information about the emissions that may be present in surface soil contaminations include incinerated tricresylphosphate contaminated with plutonium-239; plutonium waste; incinerated rags that were used for uranium-235 oxide; uranium-235; uranium-238; plutonium-239; tritium, deuterium-38; plutonium; and radionuclides (LANL 1991, 7528). The RFI work plan for TA-21 (LANL 1991, 7528) lists the radioactive airborne release summaries from 1951 to 1971 and from 1973 to 1989. It also references a document by J. W. Nyhan (Nyhan 1990, 12605) that provides a more detailed history of each stack, filter house, and incinerator, as well as their airborne emissions. A minimum of approximately 2 Ci of plutonium-239/240 per year exited all TA-21 stacks in the 1950s. High values occurred in 1973 when TA-21-12 emitted 1370 µCi of plutonium-239/240 itself. In 1989, the TA-21 stacks emitted 1.39 Ci of plutonium-239/240. Previous sampling has shown that the plutonium-239/240 concentration in the top 2 in. of soil is elevated above the worldwide fallout level (0.054 pCi/g) (LANL 1991, 7528).

MDA B (PRS 21-015) is the largest solid waste disposal site at TA-21, with an approximate area of 6.03 acres (LANL 1991, 7528). The buried waste pits occupy approximately 4,650 m^2 with an estimated volume of 21,240 m^3. MDA B consists of two areas: an unpaved eastern area and a paved, fenced western area.

MDA B was opened as a disposal area because the pits at MDA A were filling quickly. In 1945, four disposal pits were dug; these are believed to be 300 ft long, 15 ft wide, and 12 ft deep. These four disposal pits are believed to be parallel to the fence along DP Road and to at least one trench at the easternmost end of MDA B.

The waste that was disposed of in MDA B included solid wastes as well as radioactively contaminated paper, rags, rubber gloves, glassware, and metal. At least one truck contaminated with fission products from the Trinity Test is buried at MDA B. In addition, there are some indications that hazardous materials may be present at the east end. These chemicals included old bottles of organics, perchlorates, ethers, and solvents (LANL 1991, 7528).

Numerous sampling studies have taken place at MDA B, beginning in 1966, and continuing to the present. These sampling events have included surface and subsurface soil and vegetation.

In 1990, 1992, and 1994, surface sampling was conducted across the entirety of TA-21 for several reasons (LANL 1994, 26073). The first was to provide data about target analytes and establish a baseline for comparison to published regional background data. The second was to investigate airborne emission deposition. The final reason was to provide preliminary TA-wide information for a future baseline risk assessment.

Additional surface samples will be collected within the DP Road South land transfer area to ensure that no unacceptable risk to human health or the environment remains on the property before its transfer to Los Alamos County. The plan for these samples is described in Appendix E.

3.0 BASIS FOR VCA CLEANUP LEVELS

For most of the PRSs described in this VCA plan, no cleanup is anticipated. PRSs 0-029(a,b,c) are believed to have PCB levels less than the TSCA regulatory limit of 1 ppm, which the additional sampling will determine. PRSs 0-004, 0-033(b), and 0-030(b,l,m) have data gaps that will be addressed by additional sampling. If the analytical results from the sampling show contamination that is of potential concern to human or ecological health, then the site(s) will be remediated.

As discussed in section 2.1.1.3, contamination at PRS 0-027 is mainly confined to the subsurface soils. At depths greater than 10 ft bgs, the potential for direct receptor exposure to contaminants of concern in the soil is minimal. Since some of the major risk drivers at the site are VOCs with low risk-based screening levels, such as benzene, removal of these compounds from the subsurface should substantially reduce the potential risk associated with the site.

In addition, the site is entirely paved or covered by the existing building, which would further limit direct contact exposure pathways with contaminated soil/fill or tuff. The primary mechanism by which contamination in the subsurface could result in exposure to people is via vapor migration through the soil profile and entrance into current or future onsite structures. Another potential exposure scenario involves excavation and redistribution of contaminated subsurface material to the surface. Under this scenario, subsurface material could be brought to the surface during future construction or utilities maintenance activities. However, it is assumed that the site will remain developed as it is today and that direct exposure pathways will be limited or nonexistent. However, the human health risk assessment was conducted using a residential scenario. It is also highly unlikely for COPCs to migrate to groundwater from the subsurface under PRS 0-027, given the depth to groundwater (approximately 600 ft) and the lack of saturated conditions to aid contaminant transport.

Implementation of an SVE approach will reduce the total concentration of volatile fraction of the contaminant mass, by removing vapor concentrations that have already volatilized into the soil pore spaces and reached equilibrium. Continuing removal of vapor phase mass from the pore spaces will induce continued volatilization from the mass adsorbed on the soil and/or present in any non-aqueous phase liquid state.

When simple analytical diffusion calculations are applied to the existing PRS 0-027 subsurface conditions and the range of benzene concentrations observed at the site, they suggest that diffusion-dominated vapor migration into a building footprint at the site will be limited (Thomas 1982, 71475; Johnson and Ettinger 1991, 71474). With removal of some contaminant mass from the system, it appears that the expected time-averaged exposure will meet risk-based cleanup levels based on the average site benzene concentration. More detailed discussion of these comparisons is provided in Appendix G; the intent of the SVE is to remove sorbed, dissolved, and gas phase hydrocarbons, and to demonstrate how mass removal from the system will reduce associated risk and contribute to the attainment of risk-based cleanup levels.

An active remediation is being proposed to further reduce and/or accelerate reduction of potential risk from the subsurface contamination at the site. Removal of benzene and other volatile chemical mass from the subsurface soils is expected to further reduce risk. The mass of contaminants that may be removed from the subsurface cannot be predicted until initial testing at the site has been conducted. Upon review of initial test data, SVE system operational benchmarks can be selected to help evaluate the ongoing effectiveness of the remedial system. A cleanup goal for the remediation will be to remove some fraction of volatile organic chemical mass from the subsurface; however, the quantity can not be predicted until more site-specific operational information has been collected.

TPHs are also present at elevated levels in the subsurface soils at PRS 0-027. The SVE approach will remove only a small fraction of the TPH. TPH does not, however, have an associated toxicity or carcinogenicity factor. Rather, it is the constituent chemicals (volatile or semivolatile COPCs) that typically occur in petroleum mixtures that result in associated risk. As discussed above, the SVE approach will address those volatile compounds that have been identified at the site. Remaining hydrocarbon concentrations that may persist in the subsurface soils are not typically considered hazardous to human health, nor will they have a pathway to reach receptors at the surface, due to their non-volatile nature. Based on the lack of hazard and exposure pathways, these remaining compounds are not expected to pose an unacceptable level of risk.

While soil vapor extraction will not volatilize and remove the non-volatile components of TPH, it will have a positive benefit in that vapor extraction will tend to encourage inflow of atmospheric air into the subsurface. This will result in increased oxygen levels in the subsurface soils, which may stimulate naturally occurring aerobic microbial action and enhance increased biodegradation of the remaining TPH. Because specific removal of petroleum hydrocarbon mass from the subsurface is not the goal or focus of the SVE remedial approach, cleanup levels or goals for hydrocarbon reduction cannot be set for the system. Ongoing collection of data during system operation, however, will allow an evaluation of increased oxygenation effects in the subsurface that may result in enhanced biodegradation of the remaining TPH mass.

4.0 PROPOSED CORRECTIVE ACTION/MEASURE

The piping associated with PRSs 0-030(b) and 0-030(m) will be removed to ensure that future contact with remnant waste will not occur. PRS 0-027 will be remediated in situ. An SVE system will be installed and operated to further reduce levels of VOCs (hydrocarbons) in subsurface soils and thereby reduce potential residual risk to human health and the environment.

4.1 Conceptual Model

PRS 0-027 was used as a fuel tank farm and then converted to a drum storage area. Contamination on the site can therefore be attributed to petroleum products leaking from storage tanks, drums, or lines.

Samples were collected from 20 of 21 investigatory boreholes that were installed at the site. Borehole locations were selected based on the locations of former storage cells and areas of contaminated soil (as identified by the site soil vapor study). Samples were collected from soil or fill overlying the Bandelier Tuff, at or near the soil/tuff interface, and from within the Bandelier Tuff. Borehole depths ranged from 20 ft bgs to 60 ft bgs.

Borehole soil samples were analyzed for VOCs, SVOCs, TPH, TAL metals, and pesticides/PCBs. A risk-based screening assessment of sample results yielded the following five COPCs, which are all TPH components:

- benzene
- ethylbenzene
- toluene
- trimethylbenzene
- xylene

Elevated levels of BTEX compounds (benzene, toluene, ethylbenzene, and xylene) were found in borehole locations 00-05802, 00-05803, 00-05804, 00-05805, 00-05816, and 00-05806. Unlike the distribution of TPH, the maximum concentrations in these boreholes were vertically constrained to depths between roughly 13 ft and 30 ft. Maximum BTEX concentrations and sample depths are presented in Table 4.1-1.

Soil contaminated by TPH and its components is mainly confined to an area near the center of the site, as shown in Figure 2.1-2. This area includes borehole locations 00-05802, 00-05803, 00-05804, 00-05805, 00-05806, 00-05809, 00-05812, and 00-05816 from the site investigation. Soil sample results indicate that each of these boreholes contains intervals with TPH concentrations in excess of 1000 mg/kg, with the exception of location 00-05812. Concentrations of TPH in excess of 10,000 mg/kg were found at borehole locations 00-05803, 00-05804, 00-05805, and 00-05816. Borehole locations 00-05820 and 00-05810, which are located adjacent to the more highly contaminated area, contained maximum TPH concentrations of 550 and 460 mg/kg, respectively. The remaining borehole concentrations were either non-detects for TPH or contained less than 50 mg/kg TPH. The distribution of TPH contamination in the subsurface soils is of interest because it may represent areas where BTEX compounds exist as co-contaminants with the TPH in the soil or vapor phase, even if previous soil sampling did not explicitly identify detectable BTEX concentrations in the soils.

There is a large vertical distribution of TPH concentrations of 5000 mg/kg or greater. In borehole 00-05803, the maximum detected TPH concentration of 17,000 mg/kg occurred at a depth of 3.4 ft, whereas in adjacent borehole location 00-05802, the maximum detected concentration was 5000 mg/kg and occurred at a depth of 30 ft.

Table 4.1-1
Summary of Borehole Data from PRS 0-027

Location ID	Sample ID	Begin Depth	End Depth	TPH (mg/kg)	BTEX (mg/kg)*
00-05802	0100-96-1871	1.2	2	25	0.024
00-05802	0100-96-1872	2.6	3.7	700	15.25
00-05802	0100-96-1873	20	21	4700	459
00-05802	0100-96-1874	30	31	4900	588
00-05802	0100-96-1876	39.8	41	5000	422.4
00-05802	0100-96-1875	47	48.5	42	0.02
00-05803	0100-96-1894	3.4	4	17000	7.58
00-05803	0100-96-1895	5	5.8	6000	18.22
00-05803	0100-96-1896	14.2	15	9500	62.9
00-05803	0100-96-1897	29.2	30	270	0.0212
00-05803	0100-96-1898	38.2	40	5.3	0.021
00-05803	0100-96-1899	49.2	50	5.3	0.021
00-05804	0100-96-1901	8.4	8.9	16000	0.977
00-05804	0100-96-1902	12	12.5	7900	5.61
00-05804	0100-96-1903	19.2	20	6200	9.65
00-05804	0100-96-1904	29.4	30	5.6	0.023
00-05805	0100-96-1905	2.5	4	11000	0.19
00-05805	0100-96-1906	2.5	4	8900	0.197
00-05805	0100-96-1907	4	5	6200	0.0332
00-05805	0100-96-1908	19.2	20	5300	2.19
00-05805	0100-96-1909	34.5	35	5.4	0.0212
00-05806	0100-96-1889	9	10	1500	0.025
00-05806	0100-96-1886	26	27	7.1	0.02
00-05807	0100-96-1888	3	4	35	0.024
00-05807	0100-96-1887	10.5	11.5	36	0.021
00-05808	0100-96-1891	3.8	4.5	45	0.044
00-05809	0100-96-1883	13.3	14	5300	1.415
00-05810	0100-96-1910	2.5	3	4.8	0.019

Table 4.1-1 (continued)

Location ID	Sample ID	Begin Depth	End Depth	TPH(mg/kg)	BTEX (mg/kg)
00-05810	0100-96-1911	9.5	10	460	0.02
00-05811	0100-96-1914	1.5	2	4.6	0.024
00-05812	0100-96-1919	9.5	10	130	0.024
00-05813	0100-96-1925	17	17.5	5.9	0.022
00-05813	0100-96-1926	24.5	25	5.7	0.02
00-05813	0100-96-1927	27.5	28	5.9	0.021
00-05814	0100-96-1928	8.5	9.1	6.2	0.024
00-05815	0100-96-1931	9.3	9.8	6	0.026
00-05815	0100-96-1934	29.5	30	5.3	0.018
00-05816	0100-96-1935	3.4	3.9	14	0.024
00-05816	0100-96-1936	12	12.5	10000	940
00-05816	0100-96-1937	19.5	20	17000	1250
00-05816	0100-96-1938	29	29.5	34	0.017
00-05816	0100-96-1939	39.5	40	27	0.02
00-05817	0100-96-1940	11.4	11.9	27	0.02
00-05817	0100-96-1941	22	22.5	26	0.02
00-05817	0100-96-1942	29.5	30	27	0.02
00-05818	0100-96-1943	6.3	6.8	28	0.024
00-05818	0100-96-1944	11	12.5	28	0.024
00-05818	0100-96-1945	11	12.5	28	0.024
00-05818	0100-96-1946	19.5	20	28	0.024
00-05818	0100-96-1947	29.5	30	27	0.02
00-05819	0100-96-1948	4.5	5	30	0.024
00-05819	0100-96-2190	9.5	10	29	0.024
00-05819	0100-96-2191	19.2	20	27	0.02
00-05819	0100-96-2192	19.2	20	27	0.02
00-05819	0100-96-2193	29.5	30	26	0.02
00-05820	0100-96-1878	4.8	6	550	0.021

* BTEX concentrations are additive for benzene, toluene, ethylbenzene, and xylene.

The results of the previous soil sampling conducted at PRS 0-027 delineated the vertical and horizontal extent of BTEX and TPH contamination at the site. Maximum levels of both BTEX and TPH were identified at borehole location 00-05804, with the lateral extent of contamination extending approximately 100 ft in diameter from that central point. The vertical extent of contamination in the boreholes is generally to a depth of approximately 20 ft bgs, with limited occurrences of depths as great as 40 ft bgs.

The elevated BTEX and TPH concentrations detected at the site are probably related to petroleum products leaking from storage tanks, drums, and pipelines during past operations at the site. Isolated spills also may have occurred during site operation. Because the site was used as a fuel tank farm or drum storage area for approximately 15 years, it is likely that the contamination resulted from various leaks, spills, or poor housekeeping that occurred throughout the operational period. The facilities are no longer in use, and all associated structures have been removed, so any continuing source of soil contamination has been eliminated.

4.2 Vapor Monitoring and Extraction Point Installation and Supplemental Sampling

An SVE approach is being proposed for remediation of PRS 0-027. Figure 4.2-1 depicts the basic components of an SVE system. The primary remediation mechanism will be a phase of active vapor extraction from the subsurface through a series of newly installed vapor extraction wells. Following a period of continuous active SVE at the site, the system operation may be converted to a pulsed SVE, passive or active bioventing, and/or barometric pumping operational phase, depending on the observed vapor extraction effectiveness and volumes of contaminant mass being removed, as determined by monitoring contaminant concentrations in the system off-gas stream. Based on field conditions encountered at the time of SVE system construction, some supplemental discrete small-scale soil excavation may be conducted to address specific target areas of very elevated, near-surface soil contamination. Any limited excavation would be done in conjunction with the trenching and construction associated with the SVE system installation, and would be dependent on the final SVE system configuration.

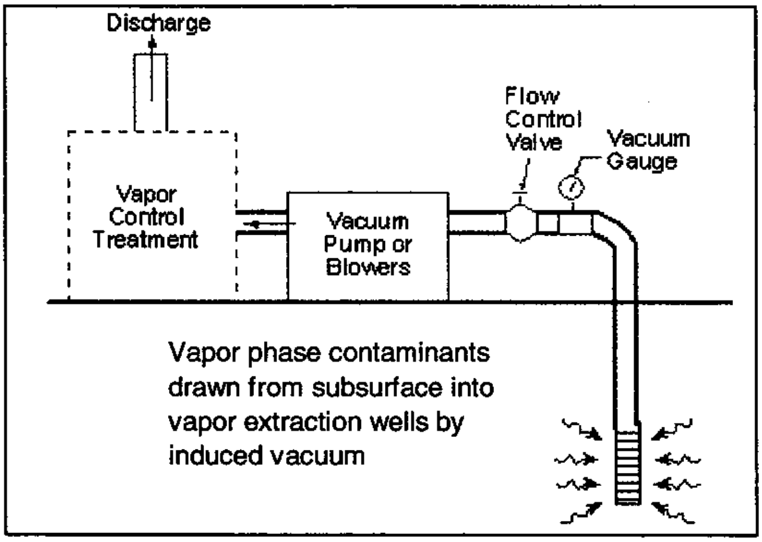

Figure 4.2-1. Basic SVE system configuration

The active SVE remedial approach will primarily address the volatile organic compounds of concern, such as BTEX. The SVE system may impact and remove some amount of petroleum hydrocarbons and semivolatile compounds, since some fraction of even these less volatile compounds can be induced to volatilize over time. More significantly, however, SVE will contribute to inducing air flow in the subsurface soils which may enhance any ongoing natural bioremediation as well as aid in further diffusion of the heavier compounds, both of which will contribute to further reducing the concentrations of these compounds.

4.2.1 Installation of SVE Wells

Three SVE wells will be installed at the site. The wells will be constructed of 4-in.-diameter PVC piping with 20-ft lengths of PVC screen. Wells will be installed to approximately 30 ft bgs. Final depths and screen placement will be based on observed subsurface conditions during drilling and PID field screening measurements. Wells will be installed with an appropriately sized gravel pack placed around the screen interval and brought roughly 2 ft above the top of the screen. A 3- to 5-ft seal of hydrated bentonite pellets or chips will be placed above the gravel pack, and the remaining annular space will be sealed with Portland cement.

The SVE wells will be located within the main BTEX plume area, with one well placed within the center of the highest detected BTEX concentrations on the western edge of the plume. The remaining two SVE wells will be triangulated to the north and southeast to provide overlapping radial coverage, based on an estimated radius of influence (ROI) of roughly 50 ft induced by each extraction well (Figure 4.2-2). The southeastern well location will also provide an extraction point adjacent to the Knights of Columbus building to help limit future migration of vapors into the structure. Due to the nature of the tuff at the PRS 0-027 site, it is difficult to predict the ROI that will be induced by SVE wells before site-specific testing has been performed. Because of the non-homogeneous distribution of fractures in the tuff, it is likely that different radii of influence will be induced by individual wells. For initial design considerations, a 50-ft radius of influence is being used, but more specific site information will be available following the pilot testing phase. The SVE system configuration and/or components may be modified at that time.

4.2.2 Installation of Vapor Monitoring Wells

In addition to vapor extraction wells, vapor monitoring wells will be installed at the site to help optimize the system operation and evaluate system effectiveness. Four monitoring wells will be installed on the exterior portions of the main BTEX plume, as shown in Figure 4.2-2. These wells will be constructed of 4-in.-diameter PVC and will have 20-ft PVC screens. Screen placement and well-completion depth will be the same as that for the vapor extraction wells. The top of the monitoring wells will be fitted with a barbed sampling port to allow collection of soil vapor samples from each well. The monitoring wells will be constructed of 4-in. PVC so that they can be converted to vapor extraction points if needed.

A fifth monitoring well will be installed in the interior portion of the BTEX plume, equidistant from the three vapor extraction wells. The interior monitoring location will be constructed as a nested set of three 1-in.-diameter PVC piezometer, each equipped with 2-ft-long screens. The three separate screen intervals at different depths will enable collection of data for evaluating vertical distribution of subsurface vacuum effects. The screen intervals for the nested piezometers are expected to be approximately 7–9 ft bgs within the overlying fill and approximately 15–17 ft bgs and 25–27 ft bgs within the tuff. The final depth will be based on observed subsurface conditions during drilling.

In addition to the nested screens, in-situ sensors specifically designed to monitor TPH and oxygen levels will be installed at the monitoring locations, based on availability of an appropriate supplier at the time. A BTEX sensor will be installed if an adequate product is available at the time of the installations. These sensors will be placed in the 1-ft interval directly beneath each of the nested screen intervals (i.e., roughly 9–10 ft, 17–18 ft, and 27–28 ft bgs). These sensors will be calibrated using analytical soil sample results collected from the corresponding interval and will allow continued collection of in-situ data, which will allow evaluation of system effectiveness.

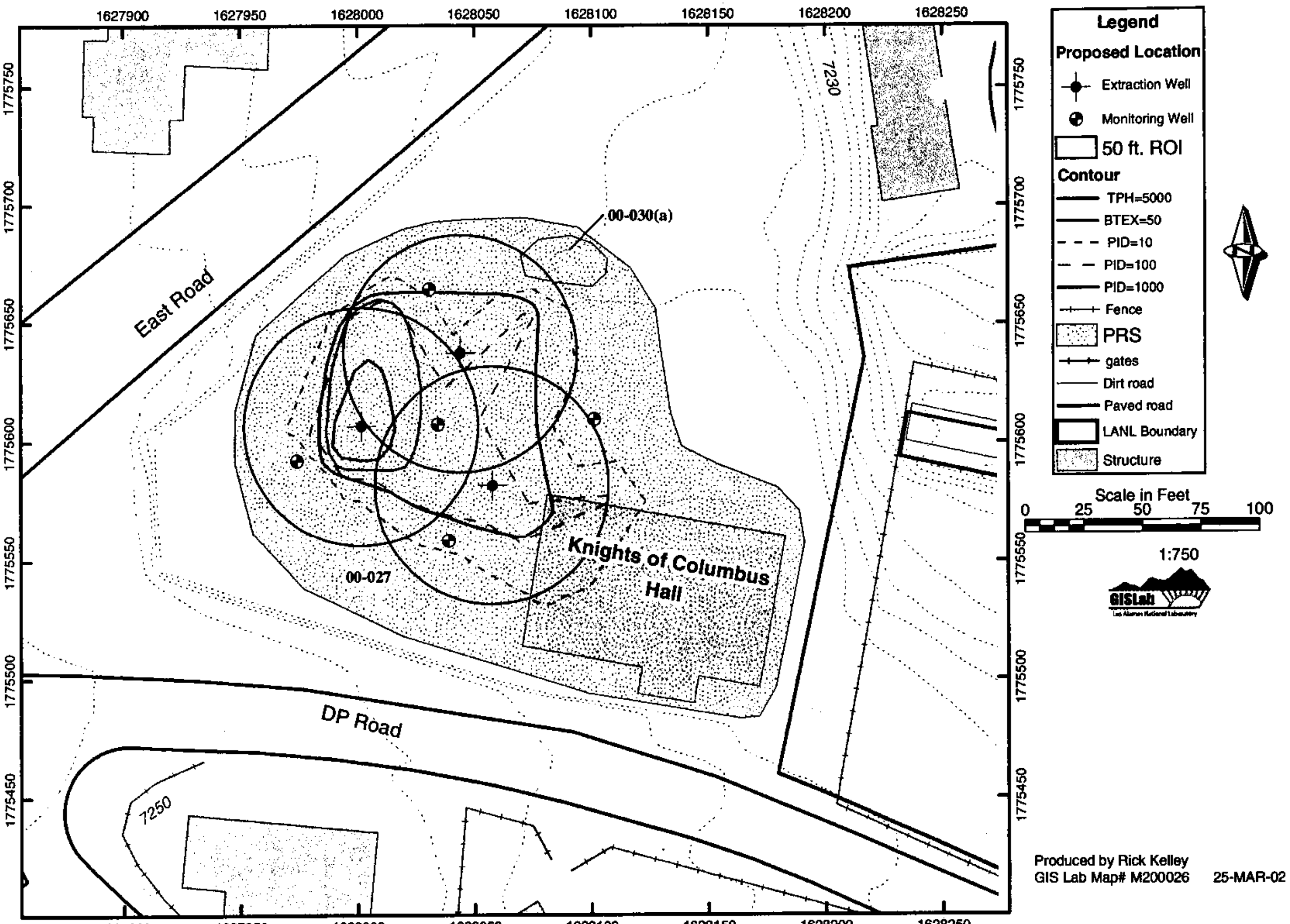

Figure 4.2-2. PRS 0-027, proposed well locations

Because of the nested screen intervals and possible in-situ sensor placements, the construction of the fifth interior monitoring well will be slightly different from the other well constructions. The in-situ sensor cables will be affixed to the exterior of each 1-in. PVC riser and screen, with the sensor itself placed to extend approximately 0.5 ft below the base of the screen. Installation of the deepest piezometer screen and sensor will occur first. An appropriately sized gravel pack will be installed from roughly 1 ft below the screen (encasing the underlying sensor) to approximately 2 ft above the top of the screen. The intervening 5 ft of annular space between the top of the bottom screen gravel pack and the placement location for the middle screen and sensor will be completed with hydrated bentonite pellets or chips. The installation procedure for the nested piezometer screens and sensors will be repeated for the middle and upper levels. Above the top piezometer screen interval, a 3- to 5-ft seal of hydrated bentonite pellets or chips will be placed above the gravel pack, and the remaining annular space will be sealed with Portland cement. The top of each piezometer will be fitted with a barbed sampling port.

4.2.3 System Pre-operation Data Collection

During advancement of all extraction and monitoring well boreholes, soil samples will be collected at 5-ft intervals. All samples will be field screened, and samples from 10 ft, 20 ft, and 30 ft bgs will be sent for laboratory analysis for TPH and BTEX, as will the sample with the highest field PID reading and the deepest sample depth (if different).

Additional soil samples will be collected from the interior nested monitoring well location from the 1-ft intervals in which the in-situ sensors are placed, approximately 7–8 ft, 15–16 ft, and 25–26 ft bgs. The samples will be analyzed for TPH and BTEX by EPA methods 8015B and 8260B, respectively. Analytical data from these samples will allow calibration of the in-situ sensors. All appropriate ER Project standard operating procedures (SOPs) will be followed for fieldwork and sample collection; these include SOP-1.01, -1.02, -1.03, -1.04, -1.05, -1.06, -1.08, -1.10, -1.12, -4.04, -5.01, -5.02, -5.03, -6.03, -6.09, -6.10, and -6.24.

4.3 Remedial Approach

4.3.1 SVE Pilot Operation

In order to select appropriate SVE hardware for purchase or extended rental, some site-specific vapor extraction data will need to be collected before specifying that equipment. Initially, a mobile SVE unit will be used to conduct a 3- to 5-day pilot operation. This will allow the collection of site-specific data to enable accurate sizing of the blower, estimates of off-gas treatment requirements, and prediction of the ROI that will result from extraction at various flow rates.

Data collection during the pilot operation will include

- collection of vacuum measurements from monitoring wells,
- collection of vapor samples from the system off-gas, and
- calibration and ongoing collection of data from in-situ loggers.

The vacuum measurements from the monitoring wells will be used to develop a relationship between flow and vacuum pressure at the wellhead. The ambient intake and flow control valve will be adjusted to create several flow conditions to assist in selecting an optimal operating vacuum condition and in sizing the blower for the final design.

Collected vapor samples will allow evaluation of expected contaminant concentrations in the system effluent and provide a basis for selecting off-gas treatment needs for the final system design.

4.3.2 Full-Scale SVE System Operation

4.3.2.1 Design of Full-Scale SVE System

Upon completion of the pilot operation phase, and based on the data collected during that phase as well as data from the monitoring well installations and previous site investigations, a final full-scale SVE system will be specified. A determination will also be made about whether the installed configuration of SVE wells and/or monitoring points are sufficient for the project, or if they need to be modified or supplemented.

Without considerable detailed geotechnical and vapor extraction pilot testing data, an observational approach must be taken to specifying the SVE system components and operation. Because of the relatively small size of the site, it is reasonable to make system component selections on the basis of a limited pilot testing phase. However, with this approach there is a possibility that the system may need to be modified in the future to more fully optimize its operation. Future modifications could include installation of additional extraction locations, further refinement of the intervals from which extraction occurs, an increase in blower size, or additional off-gas treatment needs.

The final system components that will be identified as part of the design process will include a blower, system piping, and off-gas treatment.

4.3.2.2 Full-Scale SVE System Description

The main component of the final vapor extraction system will be a system blower that will be connected to the SVE wells to extract vapor from the subsurface. The blower system will be connected to the extraction wells via underground piping that will be installed at the site. The SVE blower system inlet will have ports for measuring pressure and flow and for sampling. The inlet will also have a flow control valve, as well as an ambient air dilution valve to enable flow regulation.

The SVE system will also include a moisture separator, and the effluent gas will be exhausted through an off-gas treatment system (most probably granular activated carbon canisters). A redundant off-gas treatment system will be used in an attempt to achieve zero air emissions from the system. An electrical supply will be required, most likely provided by connecting a dedicated line to an onsite utility pole. System components will be contained in a small prefabricated building that will be placed on-site.

4.3.2.3 Full-Scale SVE System Construction, Installation, and Start-Up

The initial steps in installation of the full-scale system will be placement of the SVE blower assembly and connection of that system to the extraction wells through a series of subsurface pipes.

A variety of electrical and plumbing tasks will be required to make the system operational. Following initial system start-up, a 1- to 2-week testing phase will ensue to troubleshoot the system, optimize system operation, establish unattended operation, collect baseline off-gas data, make any modifications to off-gas treatment, and collect a series of baseline vacuum measurements and in-situ soil vapor sensor data from the monitoring wells.

4.3.2.4 Operation of SVE System

Initially, the SVE system will be expected to operate on a continuous basis. Analysis of off-gas samples during this preliminary operation phase will be at a higher frequency (e.g., weekly) to establish system operating effectiveness; analyses will be decreased to a lower frequency (quarterly) once the system operation is well established. Off-gas samples will be analyzed for TPH and target VOCs identified in the preliminary pilot operation.

Collection of data from the in-situ sensors will occur continuously. These data will be reviewed on a periodic basis to evaluate contaminant trends and identify system operating effects. Confirmation of in-situ sensor data will be provided by the analysis of soil vapor samples from monitoring wells at a quarterly or biannual frequency. An appropriate frequency will be selected based on changes observed in the in-situ data. Vapor samples will be analyzed for TPH and target VOCs as identified in the preliminary pilot operation.

Following a period of continuous active operation, system operation may be terminated or converted to an active pulsed operation, active or passive bioventing, or barometric pumping operation. Selection of the type of extended SVE operational phase will be based on the total and continuing contaminant mass being removed by the system, the reduction in risk, etc. An appropriate sampling schedule for system off-gas sampling and soil vapor sampling from the monitoring wells will be developed for the extended system operation.

4.4 Cleanup Activities

Decontamination of the drill rig after installation of the wells will be accomplished by pressure washing each auger flight that was used. A LANL radiological technician will screen the drill rig for radionuclides before its removal from the site. The decontamination of the sampling equipment will follow ER-SOP-1.08, "Field Decontamination of Drilling and Sampling Equipment."

4.5 Site Restoration

Upon termination of SVE system operations, the equipment will be demobilized from the site. If there is no need for continued monitoring or passive operation, the extraction wells, piping, and monitoring wells can be appropriately abandoned following ER-SOP-5.03, "Monitor Well and RFI Borehole Abandonment." The concrete on the parking lot will be replaced.

5.0 CONFIRMATORY SAMPLING

PRS 0-027 will receive ongoing monitoring of the SVE system efficiency for up to two years. The final plan for confirmatory samples will be refined over time, but the current expectation is that confirmatory samples will be collected from seven new boreholes, drilled near the previous SVE and monitoring well boreholes. Confirmatory samples will be collected from the same depths as the previous samples to document whether the SVE system effectively reduced the COPCs. A minimum of 21 soil/tuff samples will be collected. These samples will be taken from each of the three SVE locations and the four exterior monitoring well locations, for a total of seven locations and three depths: 10 ft, 20 ft, and 30 ft. Confirmatory samples will be analyzed for TPH, VOCs, and SVOCs. These samples will be collected at the completion of the two-year investigation.

At the PRSs where piping is removed, PRSs 0-030(b,m), confirmatory samples will be collected at two depths from locations that correspond to pipe joints. For the remaining PRSs, no cleanup activities are currently planned, and samples will be collected to fill data gaps only. If any contamination is located, it will be remediated and confirmatory samples will be collected at locations appropriate to the specific site and remediation performed.

6.0 WASTE MANAGEMENT

6.1 Estimated Types and Volumes of Waste

The Waste Characterization Strategy Form (WCSF) will describe the waste characterization sampling, waste management, and waste disposal plans to be implemented during the VCA. Recycling opportunities will be explored and taken advantage of if the waste falls into the appropriate category.

6.1.1 Soil Cuttings from Installation of Wells and Pipe Trenches

Soil cuttings will be generated during installation of the SVE and monitoring wells, and during the trenching needed to install the subsurface system piping. An estimated 12 yd^3 of soil will be generated and disposed of based on waste characterization sampling.

6.1.2 Spent Off-Gas Treatment (Granular Activated Carbon)

Spent media used to treat the off-gas generated during the SVE system operation will require disposal based on waste characterization sampling. The quantity of treatment media that will be consumed and require disposal cannot be predicted until an estimate is made of the contaminant loading in the effluent (this will be done during the pilot phase operation).

6.1.3 Construction Waste

Some construction and/or domestic solid waste (i.e., leftover PVC piping, plastic and cardboard containers, etc.) will be generated during installation and setup of the remedial system at PRS 0-027. An exact quantity of construction waste cannot be predicted, but it is not expected to be a large volume.

6.2 Method of Management and Disposal

During sampling and remediation activities, any waste generated will be stored in a protective manner within the boundaries of the PRSs. This procedure will follow "Management of ER Project Wastes" (LANL-ER-SOP-1.06) and "Waste Characterization" (LANL-ER-SOP-1.10). Waste will be managed in defined staging areas, and all waste will be characterized and managed as described in the WCSF. The media will be characterized before generation so that waste can be transported off-site and disposed of at the proper facilities as soon as possible after VCA activities.

6.2.1 Soil Cuttings

Soil cuttings and excavated soil material will be staged onsite during characterization. If the geotechnical properties of the material excavated from the trenches for installation of the subsurface system piping are appropriate and the material is not contaminated, some portion of the material may be used to backfill the trench areas following installation of the system piping.

Samples will be collected from the volume of waste soil and analyzed for SVOCs, VOCs, and TPH. Based on analytical results, the soil may be removed from the site and disposed of at an appropriate disposal facility.

6.2.2 Spent Off-Gas Treatment Material

The expected method of off-gas treatment will be the use of granular activated carbon (GAC). The system effluent stream will be passed through containers of GAC until the media becomes saturated, at which point the spent containers will be replaced with new containers. The spent material will be removed from the site and disposed of at an appropriate facility or sent to an appropriate recycling facility.

6.2.3 Construction Waste

This material will be staged in waste receptacles at the site and regularly removed to an appropriate disposal facility for non-hazardous solid waste.

7.0 PROPOSED SCHEDULE AND UNCERTAINTIES

Work on this VCA is expected to begin in fiscal year 2002 and proceed through completion in accordance with the ER Project baseline schedule in effect at the time of approval of this VCA plan.

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