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DEPARTMENT OF ENERGY
Environmental Management Los Alamos Field Office (EM-LA)
Los Alamos, New Mexico 87544

EMLA-2022-BF094-02-001

May 24, 2022

Mr. Rick Shean
Bureau Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6313

Subject: Submittal of the Supplemental Investigation Report for Sites at Technical Area 49 Inside the Nuclear Environmental Site Boundary, Revision 1

Dear Mr. Shean:

Enclosed please find two hard copies with electronic files of the "Supplemental Investigation Report for Sites at Technical Area 49 Inside the Nuclear Environmental Site Boundary, Revision 1." Enclosure 1 includes an electronic copy of a redline strikeout version of the report that incorporates all changes made in response to the New Mexico Environment Department's (NMED's) comments dated January 6, 2022; April 7, 2022; and May 10, 2022. Responses to NMED's January 6 comments were submitted on March 15, 2022, and a revised version in response to NMED's April 7 comments was submitted on April 21, 2022. Responses to NMED's May 10 comments are provided in Enclosure 2. Submittal of this report fulfills fiscal year 2022 Milestone #12 in Appendix B of the 2016 Compliance Order on Consent.

If you have any questions, please contact Emily Day at (505) 695-4243 (emily.day@em-la.doe.gov) or Cheryl Rodriguez at (505) 414-0450 (cheryl.rodriguez@em.doe.gov).

Sincerely,

ARTURO DURAN

Digitally signed by ARTURO DURAN
Date: 2022.05.18 20:22:10 -06'00'

Arturo Q. Duran
Compliance and Permitting Manager
U.S. Department of Energy
Environmental Management
Los Alamos Field Office

Enclosures:

1. Two hard copies with electronic files (including a redline strikeout version) – Supplemental Investigation Report for Sites at Technical Area 49 Inside the Nuclear Environmental Site Boundary, Revision 1 (EM2022-0110)
2. Response to the New Mexico Environment Department Draft Comments on U.S. Department of Energy Draft Responses for the Revised Supplemental Investigation Report for Sites at Technical Area 49 Inside the Nuclear Environmental Site Boundary, Dated May 10, 2022 (EM2022-0345)

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May 2022
EM2022-0110

Supplemental Investigation Report for Sites at Technical Area 49 Inside the Nuclear Environmental Site Boundary, Revision 1

N3B Los Alamos

Newport News Nuclear BWXT-Los Alamos, LLC (N3B), under the U.S. Department of Energy Office of Environmental Management Contract No. 89303318CEM000007 (the Los Alamos Legacy Cleanup Contract), has prepared this document pursuant to the Compliance Order on Consent, signed June 24, 2016. The Compliance Order on Consent contains requirements for the investigation and cleanup, including corrective action, of contamination at Los Alamos National Laboratory. The U.S. government has rights to use, reproduce, and distribute this document. The public may copy and use this document without charge, provided that this notice and any statement of authorship are reproduced on all copies.

EM2022-0110

Supplemental Investigation Report for Sites at Technical Area 49 Inside the Nuclear Environmental Site Boundary, Revision 1

May 2022

Responsible program director:

Michael O. Erickson		Program Director	RCRA Remediation Program	5/12/22
Printed Name	Signature	Title	Organization	Date

Responsible N3B representative:

Troy Thomson	for	Program Manager	N3B Environmental Remediation Program	5/12/22
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Responsible DOE EM-LA representative:

Arturo Q. Duran	ARTURO DURAN Digitally signed by ARTURO DURAN Date: 2022.05.18 20:22:40 -06'00'	Compliance and Permitting Manager	Office of Quality and Regulatory Compliance	
Printed Name	Signature	Title	Organization	Date

EXECUTIVE SUMMARY

This supplemental investigation report evaluates the nature and extent of contamination and potential human health and ecological risks for 10 solid waste management units (SWMUs) and areas of concern (AOCs) in Technical Area 49 (TA-49) inside the nuclear environmental site (NES) boundary at Los Alamos National Laboratory (LANL or the Laboratory). These 10 sites were investigated in 2009–2010, and the investigation results were documented in the investigation report for sites at TA-49 inside the NES, submitted by the U.S. Department of Energy (DOE) and Los Alamos National Security, LLC, to the New Mexico Environment Department (NMED) in September 2010. The approved investigation report concluded that additional sampling to define the extent of contamination was needed for the 10 SWMUs and AOCs discussed in this report. Additional sampling requirements for these sites were documented in the approved Phase II investigation work plan for sites at TA-49 inside the NES, submitted to NMED in March 2011. This revised supplemental investigation report, prepared by Newport News Nuclear BWXT-Los Alamos, LLC (N3B), addresses NMED's comments concerning the original submission of the supplemental investigation report.

After the investigation report had been approved, NMED and the U.S. Department of Energy (DOE) entered into a framework agreement for the realignment of environmental priorities at the Laboratory. Under the framework agreement, NMED and DOE agreed to review characterization efforts undertaken to date pursuant to the Compliance Order on Consent to identify those sites where the nature and extent of contamination has been adequately characterized. Pursuant to the framework agreement, the Laboratory reviewed its data evaluation process with respect to U.S. Environmental Protection Agency (EPA) guidance and the framework agreement principles and concluded that this process could be revised to more efficiently complete site characterization, while providing full protection of human health and the environment. Specifically, the process for evaluating data to define extent of contamination was revised to provide a greater emphasis on risk reduction, consistent with EPA guidance.

The revised process was used to evaluate the 2009–2010 data and previous decision-level investigation data for the 10 sites identified as requiring additional sampling to define extent. Based on the evaluation of investigation results using the revised process, the extent of contamination has been defined (or a determination has been made that no further sampling for extent is warranted) at the 10 sites. Human health and ecological risk assessments were performed for all sites.

The following recommendations are based on the results of data evaluations presented in this supplemental investigation report.

- The DOE Environmental Management Los Alamos Field Office (EM-LA) and N3B recommend corrective action complete without controls for four sites for which extent is defined and which pose no potential unacceptable human health risk under the industrial and residential scenarios and no unacceptable ecological risk.
- EM-LA and N3B recommend corrective action complete with controls for one site for which extent is defined and which poses no potential unacceptable human health risk under the industrial scenario and no unacceptable ecological risk but does pose potential unacceptable risk under the residential scenario.

EM-LA and N3B recommend performance of a corrective measures evaluation for five sites for which extent is defined and which pose no unacceptable present-day human-health risk under the industrial and/or residential scenarios but which have substantial chemical and radionuclide inventories that could pose potential future risk.

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1.0 INTRODUCTION

Los Alamos National Laboratory (LANL or the Laboratory) is a multidisciplinary research facility owned by the U.S. Department of Energy (DOE) and managed by Triad National Security, LLC. The Laboratory is located in north-central New Mexico, approximately 60 mi northeast of Albuquerque and 20 mi northwest of Santa Fe. The Laboratory site covers approximately 36 mi^2 of the Pajarito Plateau, which consists of a series of fingerlike mesas separated by deep canyons that contain perennial and intermittent streams running from west to east. Mesa tops range in elevation from approximately 6200 ft to 7800 ft above mean sea level (amsl).

The Laboratory has been a participant in a national effort by DOE to clean up sites and facilities formerly involved in weapons research and development. The goal of this effort is to ensure past operations do not threaten human or environmental health and safety in and around Los Alamos County, New Mexico. To achieve this goal, the Laboratory has investigated sites potentially contaminated by past Laboratory operations.

This supplemental investigation report addresses solid waste management units (SWMUs) and areas of concern (AOCs) at the Laboratory within the nuclear environmental site (NES) at Technical Area 49 (TA-49). The NES boundary used in this report is the boundary that existed at the time the investigation work plan was prepared in 2008. The boundary has subsequently been revised, and some sites are now outside the current NES boundary. These sites are potentially contaminated with hazardous chemicals and radionuclides. The New Mexico Environment Department (NMED), pursuant to the New Mexico Hazardous Waste Act, regulates cleanup of hazardous wastes and hazardous constituents. DOE regulates cleanup of radioactive contamination, pursuant to DOE Order 458.1, Change 4, Radiation Protection of the Public and the Environment, and DOE Order 435.1, Radioactive Waste Management. Information on radioactive materials and radionuclides, including the results of sampling and analysis of radioactive constituents, is voluntarily provided to NMED in accordance with DOE policy.

Corrective actions at the Laboratory are subject to a Compliance Order on Consent (the Consent Order). This supplemental investigation report describes work activities that were completed in accordance with the Consent Order.

1.1 General Site Information

The TA-49 sites inside the NES boundary consist of 11 SWMUs and AOCs, 1 of which has been approved for no further action (AOC 49-009) (Table 1.1-1). Historical details of previous investigations and data for all 11 sites are provided in the historical investigation report (HIR) for the TA-49 sites inside the NES boundary (LANL 2007, 098492).

The remaining 10 SWMUs and AOCs were investigated according to the approved investigation work plan (LANL 2008, 102691; NMED 2008, 100464). This supplemental investigation report presents the status and results from the 2009–2010 investigation activities conducted for the 10 sites, and recommendations for each site. The sites are subdivided into the following six areas according to their locations and operational histories:

- Area 1: SWMU 49-001(a), experimental shafts
- Material Disposal Area (MDA) AB:
    - Area 2: SWMU 49-001(b), Experimental shafts
    - Area 2: SWMU 49-001(g), Contaminated surface soil

    - ❖ Area 2A: SWMU 49-001(c), Experimental shafts
    - ❖ Area 2B: SWMU 49-001(d), Experimental shafts
- Area 3: SWMU 49-001(e), Experimental shafts
- Area 4: SWMU 49-001(f), Experimental shafts
- Area 11: SWMU 49-003 and AOC 49-008(c), Leach field, associated drainlines, and an area of potential soil contamination
- Area 12: AOC 49-008(d), Bottle House and Cable Pull Test Facility (CPTF)

Areas 2, 2A, and 2B are referred to as MDA AB. Table 1.1-1 lists the 11 TA-49 sites located inside the NES boundary, with a brief description, summary of previous investigations, investigation activities conducted in the 2009–2010 investigation for each site, and site status. Figure 1.1-1 shows the location of TA-49 with respect to the Laboratory, and Figure 1.1-2 shows the locations of the SWMUs and AOCs within TA-49 and identifies those located inside the NES boundary.

1.2 Purpose of the Supplemental Investigation Report

Ten SWMUs and AOCs inside the NES at TA-49 were addressed by the 2009–2010 investigation because these sites are potentially contaminated with hazardous chemicals and radionuclides, and final assessments of site contamination, associated risks, and recommendations for additional corrective actions remained incomplete. For each site, the objectives of the 2009–2010 investigation were to (1) establish the nature and extent of contamination; (2) determine whether current site conditions pose a potential unacceptable risk/dose to human health and/or the environment; and (3) assess whether any additional sampling and/or corrective actions are required.

Based on the data evaluation guidelines the Laboratory used at the time the investigation report was prepared, the Laboratory concluded that the extent of contamination was not defined for all 10 SWMUs and AOCs, and recommendations for additional sampling at these sites to define extent were incorporated into the approved Phase II investigation work plan (LANL 2011, 201570; NMED 2011, 204345). In January 2012, after the investigation report and Phase II investigation work plan were approved, NMED and DOE entered into a framework agreement for realignment of environmental priorities at the Laboratory. Under the framework agreement, NMED and DOE agreed to review characterization efforts undertaken to date pursuant to the Consent Order to identify those sites where the nature and extent of contamination have been adequately characterized. The framework agreement also stipulated the use of U.S. Environmental Protection Agency (EPA) guidance in this process, except in cases where EPA guidance was not supported by sound science. Pursuant to the framework agreement, the Laboratory reviewed its data evaluation process with respect to EPA guidance and the framework agreement principles and concluded that this process could be revised to complete site characterization more efficiently, while providing full protection of human health and the environment. Specifically, the process for evaluating data to define extent of contamination was revised to provide a greater emphasis on risk/dose reduction, consistent with EPA guidance. Key changes to the data evaluation process are as follows:

- Initially identify chemicals of potential concern (COPCs) to focus efforts on the constituents of most concern.
- Screen COPCs against soil screening levels (SSLs) and screening action levels (SALs) during determination of extent to focus efforts on characterizing contamination potentially posing a risk/dose and requiring corrective action.

- Perform screening level risk/dose evaluations on all sites, even if extent is not defined, to incorporate risk/dose reduction into recommendations for further actions.

The 2009–2010 investigation data for the 10 sites were reevaluated using this revised process, and the results are presented in this supplemental investigation report.

All analytical data collected from the 2009–2010 investigation activities are presented and evaluated in this report, along with decision-level data from previous investigations.

1.3 Document Organization

This report is organized in 9 sections, including this introduction, with multiple supporting appendixes. Section 2 provides details on site conditions (surface and subsurface). Section 3 provides an overview of the scope of the activities performed during implementation of the work plan. Section 4 describes the regulatory criteria used to evaluate potential risk/dose to ecological and human health receptors. Section 5 describes the data review methods. Section 6 presents an overview of the operational history of each site, historical releases, summaries of previous investigations, results of the field activities performed during the 2009–2010 investigation, site contamination, evaluation of the nature and extent of contamination, and summaries of the results of the human health and ecological risk-screening assessments. Section 7 presents the conclusions of the nature and extent of contamination investigation and risk-screening assessments. Section 8 discusses recommendations based on applicable data and the risk-screening assessments. Section 9 includes a list of references cited and the map data sources used in all the figures and plates.

The appendixes include acronyms, a metric conversion table, and definitions of data qualifiers used in this report (Appendix A); field methods (Appendix B); geodetic survey coordinates of sampling locations (Appendix C); field-screening results and borehole logs (Appendix D); investigation-derived waste (IDW) management (Appendix E); analytical program descriptions and summaries of data quality (Appendix F); analytical suites and results and analytical reports (Appendix G); box plots and statistical results (Appendix H); and risk-screening assessments (Appendix I).

2.0 SITE CONDITIONS

2.1 Surface Conditions

2.1.1 Soil

Soil at Areas 1, 3, 4, 11, and 12 and MDA AB has been disturbed. The soil was originally composed of Hackroy Series and Eutroboralf soil. The soil is intermixed with patches of bedrock, which occurs predominantly near the edges of the mesa east of the TA-49 areas.

Hackroy soil is classified as Alfisols and is described in “Soil Survey of Los Alamos County, New Mexico” as follows: “The surface layer of the Hackroy soil is a brown sandy loam, or loam, about 10 cm thick. The subsoil is reddish brown clay, gravelly clay, or clay loam about 20 cm thick. The depth to tuff bedrock and effective rooting depth is 20 to 50 cm.” (Nyhan et al. 1978, 005702).

The fine-loamy Typic Eutroboralf soil consists of deep, well-drained soil formed in material weathered from tuff on nearly level to gently-sloping mesa tops. The surface layer is a very dark grayish-brown loam, sandy loam, or very fine sandy loam, about 5 cm thick. The subsoil is a brown loam over a clay loam about 55 cm thick. The substratum is a brown, gravelly clay loam over reddish clay that may or may not contain pumice. Permeability is considered moderately slow (Nyhan et al. 1978, 005702, p. 32).

The sites within the NES boundary are located in the center of TA-49 where the topography is quite flat; therefore, surface-water runoff and soil erosion are minimal. No perennial sources of water at or near the site exist. No established runoff channels exist and surface water is expected to occur as sheet flow during strong rainfall events or rapid snowmelt. Run-on control is provided by drainage ditches along the roads within TA-49 (LANL 2007, 098492).

2.1.2 Surface Water

Most Los Alamos surface water occurs as ephemeral (flowing in response to precipitation), intermittent (flowing in response to availability of snowmelt or groundwater discharge), or interrupted (alternation of perennial, ephemeral, and intermittent stretches) streams in canyons cut into the Pajarito Plateau (Nylander et al. 2003, 076059.49, p. 4-1).

Runoff and infiltration are the critical components that influence the surface hydrology at TA-49. These mechanisms are the predominant pathways by which contaminants could be mobilized and transported from the site.

There is no current evidence of a hydraulic connection between the surface water and groundwater at TA-49. No perennial sources of water occur at TA-49 and no current evidence exists of a hydraulic connection between the surface water and groundwater (Weir and Purtymun 1962, 011890; Purtymun and Ahlquist 1986, 014722).

2.1.2.1 Surface-Water Runoff

Surface-water runoff control is provided by drainage ditches along the roads within TA-49. In addition, two sites [SWMU 49-001(g) and AOC 49-008(c)] are regulated under the Laboratory's National Pollutant Discharge Elimination System Individual Permit (IP), and site-specific storm water controls have been installed at these sites per the IP. Surface-water runoff potentially carries contaminants and drains off-site. The direction of surface-water runoff from Frijoles Mesa flows northward into Water Canyon, eastward into a tributary canyon to Ancho Canyon, or southward into Ancho Canyon (LANL 2007, 098492).

Runoff from summer storms on the Pajarito Plateau typically reaches a maximum discharge in less than 2 h and has duration of less than 24 h (Purtymun et al. 1980, 006048). When the discharge rate is high, runoff can carry large masses of suspended and bed-load sediment as far as the Rio Grande. Spring snowmelt occurs at a much less intense rate (e.g., over a period of several weeks to months). This lower flow rate also results in the movement of sediment, but with less surface erosion than during the summer storms. The Ancho and Water Canyons reaches downgradient of TA-49 experience ephemeral flow caused by runoff during the intense summer storms and snowmelt events.

2.1.2.2 Surface-Water Quality

Surface-water quality data have been collected for approximately 30 yr at the Beta borehole surface water station in Water Canyon (about 2000 ft north of MDA AB), in Water and Ancho Canyons at NM 4, and sporadically in drainages leading from MDA AB following intense rainfall events. No contamination of surface water at these locations by TA-49 contaminants has been identified in the 30 yr of monitoring (LANL 1992, 007670, p. 4-45; LANL 2006, 093925). Monitoring of storm water under the IP has shown detections of gross-alpha radioactivity above the target action level in the IP, but below the upper tolerance limit for runoff from undeveloped landscape (LANL 2016, 601395).

2.1.2.3 Surface-Water Infiltration

Surface-water infiltration provides a potential mechanism for contaminants to move into the subsurface (LANL 1992, 007670, p. 4-13). Surface-water infiltration studies conducted at Pajarito Canyon have indicated that infiltration through mesa-top soil into the tuff is not significant (LANL 2007, 098492). Surface-water infiltration pathways at TA-49 include native or disturbed soil, intact tuff, backfilled shafts, and fracture systems and boreholes.

Evapotranspiration (ET) processes limit the transfer of water to the Bandelier Tuff. The characteristics of the tuff (naturally low-moisture content and high porosity) provide a large storage capacity for infiltrating fluid and likely inhibit infiltrating liquid from penetrating the thick unsaturated zone at TA-49 (LANL 1992, 007670, p. 4-14).

2.2 Subsurface Conditions

2.2.1 Stratigraphic Units

TA-49 lies on the east side of the Jemez Mountain's volcanic field and on the western perimeter of the Española Basin of the Rio Grande rift. The bedrock at or near the surface of the mesa top are composed entirely of the Bandelier Tuff (LANL 1992, 007670, p. 4-33).

The stratigraphy of TA-49 was originally mapped in 1959 using three deep-test wells (DT-5A, DT-9, and DT-10) and four core holes (CH-1, CH-2, CH-3, and CH-4). The Tshirege Member of the Bandelier Tuff is approximately 595 to 670 ft thick beneath TA-49. Underlying the Tshirege Member is approximately 200 ft of the Otowi Member of the Bandelier Tuff.

In 1994, a 700-ft-deep borehole (location 49-02901) was drilled southeast of Area 2 to provide supplemental information to the geologic map of TA-49 (Stimac et al. 2002, 073391, p. 1). Geologic field observations confirm the exposed bedrock at TA-49 is restricted to units of the Tshirege Member of the Bandelier Tuff. Below the Tshirege Member, in descending order, are the Tsankawi Pumice Bed, tephras and volcaniclastic sediment of the Cerro Toledo interval, and the Otowi Member of the Bandelier Tuff.

The Bandelier Tuff consists of the Otowi and Tshirege Members, which are stratigraphically separated in many places by the tephras and volcaniclastic sediment of the Cerro Toledo interval. The Bandelier Tuff was emplaced during cataclysmic eruptions of the Valles Caldera between 1.61 and 1.22 million yr ago. The tuff is composed of pumice, minor rock fragments, and crystals supported in an ashy matrix. It is a prominent cliff-forming unit because of its generally strong consolidation (Broxton and Reneau 1995, 049726).

The Tshirege Member is the upper member of the Bandelier Tuff and is the most widely exposed bedrock unit of the Pajarito Plateau (Griggs and Hem 1964, 092516; Smith and Bailey 1966, 021584; Bailey et al. 1969, 021498; Smith et al. 1970, 009752). Emplacement of this unit occurred during eruptions of the Valles Caldera approximately 1.2 million yr ago (Izett and Obradovich 1994, 048817; Spell et al. 1996, 055542). The Tshirege Member is a multiple-flow, ash-and-pumice sheet that forms the prominent cliffs in most of the canyons on the Pajarito Plateau. Time breaks between the successive emplacements of flow units caused the tuff to cool as several distinct cooling units. For this reason, the Tshirege Member consists of at least four cooling subunits that display variable physical properties vertically and horizontally (Smith and Bailey 1966, 021584; Crowe et al. 1978, 005720; Broxton et al. 1995, 050121). From youngest to oldest the subunits are Qbt 4, Qbt 3, Qbt 2, Qbt 1v, and Qbt 1g. Qbt 4 is exposed on the surface or near surface at TA-49. The consolidation in this member is largely from compaction and welding at high temperatures after the tuff was emplaced. Its light brown, orange-brown, purplish, and white cliffs have numerous, mostly vertical fractures that may extend from several feet up to several tens of feet.

The Tshirege Member includes thin but distinctive layers of bedded, sand-sized particles called surge deposits that demark separate flow units within the tuff. Surge beds within the Bandelier Tuff are of particular interest with respect to the TA-49 subsurface hydrological conceptual model. A pyroclastic surge bed is found at a depth of about 60 ft below ground surface (bgs) in corehole CH-2. Surge beds tend to have a higher permeability than the surrounding tuff and may act as a capillary barrier, inhibiting downward transport of contaminants and promoting lateral flow and potentially acting as a perching layer. For that reason, boreholes drilled through this surge bed are particularly important when searching for perched water.

At least 21 boreholes and 30 test shafts penetrate the surge bed layer located at approximately 60 ft bgs between Qbt 4 and Qbt 3. No perched water was encountered at the surge bed layer within these boreholes and test shafts.

The Tshirege Member is underlain by the Otowi Member. It consists of moderately consolidated (indurated), porous, and nonwelded vitric tuff (ignimbrite) that forms gentle colluvium-covered slopes along the base of canyon walls. The Otowi ignimbrites contain light gray to orange pumice that is supported in a white to tan ash matrix (Broxton et al. 1995, 050121; Broxton et al. 1995, 050119; Goff 1995, 049682). The ash matrix consists of glass shards, broken pumice, and crystal fragments, and fragments of perlite.

Below the Otowi Member are interbedded Puye Formation conglomerates and basalts that sit atop the undivided siltstones and sandstones of the Santa Fe Group.

2.2.2 Hydrogeology

The subsurface hydrology at TA-49 is dominated by unsaturated conditions. The top of the regional saturated zone occurs approximately 1170 ft bgs near the center of MDA AB at deep test well DT-5A. The upper 800 ft of the unsaturated zone is within the Bandelier Tuff (LANL 1992, 007670, p. 4-18).

Relatively small volumes of water move beneath the mesa tops of the Pajarito Plateau under natural conditions because of low rainfall, high evaporation, and efficient water use by vegetation. During wetter years, vegetal growth is enhanced and is capable of removing larger volumes of available moisture. Atmospheric evaporation may extend within the mesas, further inhibiting downward flow (Rogers and Gallaher 1995, 097569, p. 27). Water content in the unsaturated zone within the tuff has been measured monthly or bimonthly in the unsaturated zone since 2000. It tends to range between 5% and 10% by volume under natural conditions (LANL 2005, 092389, pp. A-1-A-6).

Water content measured at locations within the boundary of the ET cover and the former asphalt pad at MDA AB is slightly higher, ranging from 5% to 20% by volume (LANL 2005, 092389, pp. A-3–A-6). Continuous moisture monitoring of the near-surface cover material at Area 2 shows that seasonal impulses of water are readily removed in the spring and summer when ET is maximized (LANL 2007, 098492).

2.2.2.1 Groundwater

In the Los Alamos area, groundwater occurs as (1) water in shallow alluvium in some of the larger canyons, (2) intermediate perched groundwater (a perched groundwater body lies above a less permeable layer and is separated from the underlying aquifer by an unsaturated zone), and (3) the regional aquifer (Collins et al. 2005, 092028). Numerous wells have been installed at the Laboratory and in the surrounding area to investigate the presence of groundwater in these zones and to monitor groundwater quality.

The Laboratory formulated a comprehensive groundwater protection plan for an enhanced set of characterization and monitoring activities. The annual Interim Facility-Wide Groundwater Monitoring Plan (e.g., LANL 2015, 600467) details the implementation of extensive groundwater characterization across the Pajarito Plateau within an area potentially affected by past and present Laboratory operations. The investigation of the Water Canyon/Cañon de Valle watershed was completed in 2011 (LANL 2011, 207069), although additional groundwater investigations are being conducted to support the future corrective measures evaluation for Consolidated Unit 16-021(c)-99.

Alluvial Groundwater

Surface-water infiltration creates small, localized saturated zones in the alluvial fill of the canyon bottoms of Pajarito Plateau (LANL 1992, 007670, p. 4-21). Water infiltrates the alluvium until it reaches less-permeable layers that slow or impede flow. The size of the perched water zones are affected by the rate of ET and the movement of water into underlying rock.

In 1990, three shallow monitoring wells were installed in Water Canyon downgradient of TA-49. No perched water zones were encountered during drilling activities. Springs and seeps are known to occur in the lower reaches of Water and Ancho Canyons, far downgradient of TA-49 (near the Rio Grande), but none have been identified within the boundaries of TA-49 (LANL 2007, 098492).

Lateral groundwater flow occurs between stratigraphic permeability barriers within the Bandelier Tuff. Lateral discharges from canyon walls or canyon bottoms could provide a potential for contaminant transport. However, this is not plausible, given the current average annual rainfall and infiltration quantities seen at TA-49 (LANL 1992, 007670, p. 4-21).

Intermediate-Perched Groundwater

The three test wells (DT-5A, DT-9, and DT-10) and other boreholes drilled within TA-49 have not indicated the presence of perched water in tuff or volcanics above the regional aquifer despite the presence of potential perching beds (Purtymun and Stoker 1987, 006688, p. 8). The absence of perched water indicates that no recharge to the regional aquifer occurs through the Pajarito Plateau in the vicinity of TA-49 (Purtymun and Stoker 1987, 006688, p. 8). Subsurface moisture monitoring conducted from 2000 to 2005 did not indicate the presence of perched groundwater beneath TA-49.

Regional Groundwater

Deep groundwater beneath TA-49 is part of the regional aquifer that serves all of the municipal and industrial water use in Los Alamos County (Purtymun 1984, 006513). Little to no recharge occurs through the mesa tops of the Pajarito Plateau to the regional aquifer (LANL 2007, 098492).

The potentiometric surface of the regional aquifer beneath TA-49 lies completely within the Puye Formation and the Cerros del Rio basalt. Groundwater moves eastward and discharges into the Rio Grande through seeps and springs (Purtymun et al. 1980, 006048). Aquifer tests performed in the three deep test wells at TA-49 found the average groundwater velocity to be 345 ft/yr in the upper 490 ft of the aquifer. The gradient on the upper surface of the aquifer is about 40 to 60 ft/mi beneath the western and central portion of the plateau within the volcanic sediment portion. It steepens to 80 to 120 ft/mi as the aquifer moves into the less-permeable sediment of the Tesuque Formation (Purtymun and Ahlquist 1986, 014722).

Well DT-5A showed an approximate 4-ft water-level decline from 1960 to 1964. This decline was attributed to pumping of supply wells located to the north. Well DT-9 recorded a 3-ft water-level decline over a 21-yr period from 1960 to 1982. At well DT-10, water levels declined 0.5 ft/yr from 1960 to 1967.

These declines in water levels reflect the normal, deep, groundwater-level trend for the region (Purtymun and Ahlquist 1986, 014722).

2.2.2.2 Vadose Zone

The unsaturated zone from the mesa surface to the top of the regional aquifer is referred to as the vadose zone. The source of moisture for the vadose zone is precipitation, but much of it runs off, evaporates, or is absorbed by plants. The subsurface vertical movement of water is influenced by properties and conditions of the materials that make up the vadose zone.

Although water moves slowly through the unsaturated tuff matrix, it can move rapidly through fractures if saturated conditions exist (Hollis et al. 1997, 063131). Fractures may provide conduits for fluid flow but probably only in discrete, disconnected intervals of the subsurface. Because they are open to the passage of both air and water, fractures can have both wetting and drying effects, depending on the relative abundance of water in the fractures and the tuff matrix.

The Bandelier Tuff is very dry and does not readily transmit moisture. Most of the pore spaces in the tuff are of capillary size and have a strong tendency to hold water against gravity by surface-tension forces. Vegetation is very effective at removing moisture near the surface. During the summer rainy season, when rainfall is highest, near-surface moisture content is variable because of higher rates of evaporation and of transpiration by vegetation, which flourishes during this time.

The various units of the Bandelier Tuff tend to have relatively high porosities. Porosity ranges between 30% and 60% by volume, generally decreasing for more highly welded tuff. Permeability varies for each cooling unit of the Bandelier Tuff. The moisture content of native tuff is low, generally less than 5% by volume throughout the profile (Kearl et al. 1986, 015368; Purtymun and Stoker 1990, 007508).

3.0 SCOPE OF ACTIVITIES

This section presents an overview of the field activities performed during the implementation of the TA-49 sites inside the NES boundary approved investigation work plan (LANL 2008, 102691; NMED 2008, 100464). The field-investigation results and observations obtained from this investigation are presented in detail in section 6 and in the supporting appendixes.

3.1 Field Activities

The following subsections describe the scope of field activities for the 2009–2010 investigations of the TA-49 sites within the NES boundary, including geodetic surveys; field screening; surface and shallow-subsurface soil investigations; borehole drilling, sampling, and pore-gas sampling; health and safety monitoring; and waste management activities. Details regarding the field methods and procedures used to perform these field activities are presented in Appendix B.

3.1.1 Geodetic Survey

Before initiation of field activities, the locations of all subsurface shafts and structures were located and field verified. Surface expression of locations of disposal units and shafts were marked and a geodetic survey was performed. Geodetic surveys were also conducted before and upon completion of the drilling and surface-sampling campaigns to establish the spatial coordinates for all sampling locations and boreholes. Geodetic surveys were conducted using a Trimble 5700 differential global positioning system. The survey data were collected by qualified personnel and conformed to Laboratory Information

Architecture project standards IA-CB02, “Geographical Information System, Horizontal Spatial Reference System,” and IA-D802, “Geospatial Positioning Accuracy Standard for A/E/C and Facility Management.” All coordinates are expressed as State Plane Coordinate System 83, New Mexico Central, U.S. ft coordinates and are presented in Appendix C.

3.1.2 Field Screening

Core samples, drill cuttings, surface, shallow-subsurface, and sediment sample material were screened for gross-alpha and -beta radiation. Screening was performed using an Eberline E600 with either a 380AB or SHP360 probe (or equivalent) in accordance with the Laboratory’s Standard Operating Procedure (SOP) 10.07, Field Monitoring for Surface and Volume Radioactivity Levels. The probe was held less than 1 in. away from the medium. Measurements were made by conducting a quick scan to find the location with the highest initial reading and then collecting a 1-min reading at that location to determine gross-alpha and -beta radiation levels. Soil and core material was sampled and logged only after radiological field-screening measurements were established so appropriate precautions could be taken, if necessary, before the sample was collected. Field personnel collected and recorded daily background measurements for gross-alpha and -beta radiation on borehole logs, sample collections logs, and in log books. Borehole logs are included in Appendix D, and sample collection logs are included in Appendix G.

All samples were submitted to American Radiation Services, Inc. in White Rock, New Mexico for gross-alpha, -beta, and -gamma analyses prior to shipment by the Laboratory’s Sample Management Office (SMO) to ensure compliance with U.S. Department of Transportation (DOT) requirements.

Surface samples from Areas 1, 3, 4, and 12, MDA AB, and the corridor locations were selected for off-site laboratory analysis based on the results of the gross-alpha and -beta results. Gross-alpha and -beta screening thresholds were established in the approved work plan (LANL 2008, 102691; NMED 2008, 100464). If surface sample results exceeded the screening thresholds for gross-alpha and/or -beta, they were submitted for laboratory analyses. Details regarding the surface sampling and field screening process are presented in section 3.1.3 and in the approved work plan (LANL 2008, 102691; NMED 2008, 100464).

Immediately after sample retrieval, organic vapor monitoring of subsurface samples was performed using a MiniRae 2000, Model PGM-7600 photoionization detector (PID) with an 11.7-electronvolt bulb. In addition, headspace vapor screening for organic vapors was performed on recovered subsurface media in accordance with SOP-06.33, Headspace Vapor Screening with a Photoionization Detector. Samples were placed in a glass container and covered with aluminum foil. The container was sealed, shaken gently, and allowed to equilibrate for 5 min. The sample was screened by inserting the PID probe into the container and measuring and recording any detected vapors. The workers’ breathing zone was also monitored using the MiniRae 2000.

Field-screening results were recorded on the borehole logs and/or corresponding sample collection logs, in the site safety officer’s field notebook, and in the radiation control technician’s (RCT’s) field notes. Field-screening results, along with the physical characteristics of the core (e.g., contacts, elevated moisture, or staining), were considered when sampling intervals were selected and are presented on the borehole logs included in Appendix D and on sample collection logs included in Appendix G. Field-screening results for organic vapors and alpha- and beta-radioactivity are summarized in Tables 3.1-1 through 3.1-7.

3.1.3 Surface and Shallow Subsurface Soil Investigation

A total of 1554 surface and shallow subsurface samples from 772 locations were collected for gross-alpha and -beta radiological screening in October, November, and December 2009 and January 2010 from Areas 1, 3, 4, and 12, MDA AB, and the overland corridors. A total of 194 surface and shallow subsurface samples were collected from 97 locations across Areas 1, 3, 4, and 12, MDA AB, and the corridor locations where step-out samples were collected. Of these screening samples, 618 samples from 326 locations were submitted for laboratory analysis. Surface and shallow subsurface samples were collected in accordance with the approved investigation work plan (LANL 2008, 102691; NMED 2008, 100464).

Extensive surface sampling was conducted at Areas 1, 3, 4, and 12 and MDA AB. The strategy for characterizing the nature and extent of surface contamination at these areas consisted of an iterative sampling approach that combined screening-level sampling with systematic, criteria-based biased laboratory analytical sampling. Surface samples were collected across a grid that extended a minimum of 100 ft from historical samples with detections of contaminants exceeding background values (BVs) or fallout values (FVs). Based on proximity to previously elevated concentrations, three categories of samples (Category I, II, and III) were established in each area. Category I samples are near the historical locations, Category II samples are located within 50 ft of the Category I samples, and Category III samples are located within 100 ft of the Category I samples. The locations of the 2009–2010 screening-level surface samples collected from Area 1, MDA AB (Areas 2, 2A, and 2B), and Areas 3, 4, and 12, and are presented in Figures 3.1-1 through 3.1-5, respectively. The sampling locations submitted for laboratory analyses and the analytical results are shown on plates included with this report.

All surface and shallow-subsurface samples were field-screened for gross-alpha and -beta radiation and submitted for laboratory analysis as specified in the guidelines established in the approved work plan (LANL 2008, 102691; NMED 2008, 100464). Laboratory samples were collected from predetermined biased locations and at screening-level locations where either gross-alpha and/or -beta exceeded the established screening thresholds of 25 pCi/g or 50 pCi/g, respectively. If a Category III screening-level sample exceeded either screening threshold, additional step-out surface samples were collected until the field-screening results were below predefined thresholds.

Screening-level surface samples were placed in 1-gal. plastic bags and stored in a locked sample container pending analysis of field-screening results. All biased samples were immediately placed in appropriate sample containers and submitted for laboratory analysis of the following analytical suites: americium-241, isotopic plutonium, isotopic uranium, and target analyte list (TAL) metals and by gamma spectroscopy. For biased samples, if gross beta exceeded 50 pCi/g, samples were also submitted for laboratory analysis of iodine-129, strontium-90, and technetium-99. For screening samples, if gross alpha exceeded 25 pCi/g, samples were submitted for laboratory analysis of radionuclides by gamma spectroscopy, americium-241, isotopic plutonium, isotopic uranium, and TAL metals; if gross beta exceeded 50 pCi/g, samples were also submitted for laboratory analysis of iodine-129, strontium-90, and technetium-99. The radiological-screening results that guided selection of samples for laboratory analyses are presented in Tables D-1 through D-42 in Appendix D.

Based on the gross-alpha and -beta radiation-screening results, the following number of samples was submitted for laboratory analyses: 59 samples from 30 locations at Area 1; 44 samples from 22 locations at MDA AB; 77 samples from 47 locations at Area 3; 77 samples from 46 locations at Area 4; and 57 samples from 31 locations at Area 12. The locations of 2009–2010 screening-level surface samples collected at Area 1, MDA AB (Areas 2, 2A, and 2B), and Areas 3, 4, and 12 are presented in Figures 3.1-1 through 3.1-5, respectively. The sampling locations submitted for laboratory analyses are shown on plates in section 6. Surface and shallow-subsurface samples were collected from 0.0 to 0.5 ft

and 0.5 to 1.5 ft bgs at each location using the hand-auger method in accordance with SOP-06.10, Hand Auger and Thin-Wall Tube Sampler.

A similar sampling strategy was used to sample the overland corridors that extend radially from Area 5 to Areas 1, 3, and 4 and MDA AB. The relationship of the overland corridors with the respective area and sampling locations is presented in Figure 1.1-2 and Figure 3.1-6. Before sampling, a walkover field survey was conducted and the corridors were mapped. A total of 147 sampling locations were selected based on the results of the field survey. Discrete samples were collected from 0.0 to 0.5 ft and 0.5 to 1.5 ft bgs for gross-alpha and -beta screening and for submittal for laboratory analysis of radionuclides by gamma spectroscopy, americium-241, isotopic plutonium, isotopic uranium, and TAL metals. If gross-alpha or -beta results exceeded the screening thresholds, all adjacent 10-ft-grid locations were sampled. The grid was expanded based on screening results to ensure the complete characterization of the extent of contamination. The radiological-screening results that guided selection of samples for laboratory analyses are presented in Tables D-1 through D-42 in Appendix D. A total of 304 samples from 152 locations were collected from the overland corridors. Data from the samples collected in the overland corridors are presented with the associated SWMUs and AOCs at Areas 1, 3, and 4 and MDA AB. The samples submitted for laboratory analyses and the analytical results are shown on plates included in this report.

Standard quality assurance/quality control (QA/QC) samples (field duplicates [FD] and rinsate samples) were collected in accordance with SOP-01.05, Field Quality Control Samples. All sample collection activities were coordinated with the SMO. Upon collection, samples remained in the controlled custody of the field team until delivered to the SMO. Sample custody was then relinquished to the SMO for delivery to a preapproved off-site analytical laboratory.

Specific details regarding the results of the field screening and subsequent sampling and laboratory analyses conducted at Area 1 [SWMU 49-001(a)]; MDA AB [SWMUs 49-001(b, c, d, g)]; Area 3 [SWMU 49-001(e)]; Area 4 [SWMU 49-001(f)]; Area 11 [SWMU 49-003 and AOC 49-008(c)]; and Area 12 [AOC 49-008(d)] are presented in section 6.

3.1.4 Subsurface Investigation

The 2009–2010 subsurface investigation at TA-49 sites inside the NES boundary included the drilling and sampling of 30 boreholes. All boreholes were logged by a geologist to distinguish between geologic units, identifying surge beds, fractures, and/or moisture, if encountered. Following drilling, pore-gas samples were collected from several boreholes for analysis of volatile organic compounds (VOCs) and tritium. The details of these subsurface investigations are discussed below.

3.1.4.1 Borehole Drilling and Subsurface Sampling

A total of 97 samples were collected from 30 boreholes drilled to depths ranging from 10 to 192 ft bgs. Subsurface soil and rock samples were collected and analyzed to further characterize the extent of subsurface contamination at TA-49 sites inside the NES boundary. All boreholes were drilled using a Construction Mine Equipment 85 hollow-stem auger drill rig equipped with a split core barrel continuous core-sampling system. Four boreholes each were drilled at Areas 1, 3, and 4 and MDA AB; 12 boreholes were drilled at Area 11; and two boreholes were drilled at Area 12. The locations of boreholes drilled at Area 1, MDA AB (Areas 2, 2A, and 2B), and Areas 3, 4, and 12 are presented in Figures 3.1-1 through 3.1-5, respectively. The locations of boreholes drilled at Area 11 are presented in Figure 6.9-1. The borehole logs are presented in Appendix D.

Samples were collected at target depth intervals based on criteria established in the approved work plan (LANL 2008, 102691; NMED 2008, 100464). All sampled core material was placed in the appropriate sampling containers, labeled, documented, and preserved (as appropriate) for transport to the SMO. Samples were submitted for laboratory analysis of the following analytical suites: explosive compounds, perchlorate, TAL metals, cyanide, americium-241, isotopic plutonium, isotopic uranium, VOCs, and semivolatile organic compounds (SVOCs).

Standard QA/QC samples (FDs and rinsate samples) were collected in accordance with SOP-01.05, Field Quality Control Samples. All sample-collection activities were coordinated with the SMO. Upon collection, samples remained in the controlled custody of the field team until delivered to the SMO. Sample custody was then relinquished to the SMO for delivery to a preapproved analytical laboratory.

3.1.4.2 Surge Beds and Fractures

The boreholes drilled during the 2009–2010 investigation encountered soil, fill, and units Qbt 4 and Qbt 3 of the Bandelier Tuff. The soil and/or fill ranged from a few in. to 3-ft thick. Qbt 4 and Qbt 3 lie beneath the soil and fill. Qbt 4 measures 60- to 80-ft thick at TA-49 and consists of poorly to moderately welded phenocryst-rich, ash-flow tuff characterized by the presence of relict pumice. Clay-filled fractures were encountered in the top of Qbt 4, rarely below 10 ft. The base of Qbt 4 is marked by a distinctive crystal-rich surge deposit. The surge bed that forms the base of Qbt 4 was recovered in many of the boreholes drilled during this investigation; however, surge-bed material is loose, with a sand-like texture and is often not fully recovered using an open core barrel sampling system.

The surge bed consists of at least 50% phenocrysts in an ashy matrix and ranges in thickness between a few inches to approximately 2-ft thick. Surge-bed material was recorded in perimeter boreholes drilled at Areas 1, 3, 4, 11, and 12 and MDA AB. Surge-bed material was encountered at depths ranging from 61 to 65 ft bgs at Area 4 and 76 to 80 ft bgs at the other areas. No moisture was noted in the surge-bed material recovered during this investigation. Underlying the surge bed is Qbt 3, which is characterized by partially welded ash-flow tuff with brown relict pumice in a matrix of ash, glass shards, and phenocrysts. Fractures were not encountered in Qbt 3. The results of the drilling indicate fractures are relatively uncommon in tuff at TA-49 and are not likely to represent potential transport pathways for contamination. The surge bed beneath TA-49 is generally laterally continuous, but ranges in thickness across the site.

3.1.4.3 Pore-Gas Sampling

After completion of drilling and geologic logging, subsurface pore-gas samples were collected from analysis of VOCs and tritium in accordance with SOP-5074, Sampling for Sub-atmospheric Air. A total of 24 pore-gas samples were collected from discrete subsurface intervals using a single and/or double-packer assembly.

The total depth (TD) pore-gas sample from each borehole was collected using a single inflatable packer. All subsequent pore-gas samples were collected using a straddle packer system that isolated a discrete 2-ft interval within the borehole. Before sampling, each interval was purged until measurements of carbon dioxide and oxygen were stable and representative of subsurface conditions. Subsurface pore-gas samples were collected in SUMMA canisters for VOC analysis and in silica gel samples for tritium analysis.

3.1.4.4 Neutron Logging of Borehole 49-02901

In lieu of drilling a 900-ft borehole in the center of MDA AB, subsurface moisture monitoring was conducted at borehole 49-02901 (NMED 2015, 600915), located north of Area 2 and east of Area 12 (Figure 3.1-2). Borehole 49-02901 was drilled to a depth 700 ft bgs. The moisture monitoring was

conducted using a CPN 503 neutron probe attached to a winch line. Measurements were recorded bottom to top. A laptop was used to record the results as raw counts per second. The raw counts were converted to volumetric moisture (% moisture). Neutron-logging results presented as % moisture are shown in Figure 3.1-7.

3.1.4.5 Evaluation of Perched Groundwater beneath MDA AB

In lieu of drilling a 900-ft borehole in the center of MDA AB, the presence of perched groundwater beneath MDA AB was evaluated using data collected during the drilling and installation of regional groundwater monitoring wells R-29 and R-30 (NMED 2009, 107002). Monitoring well R-29 is 1248 ft deep and located east of MDA AB in Area 10; monitoring well R-30 is 1196 ft deep and located south of MDA AB. Open-borehole video logging confirmed perched groundwater is not present at monitoring wells R-29 or R-30. Based on the absence of perched groundwater at R-29 and R-30, it is concluded that perched groundwater is not present beneath MDA AB or TA-49. Details regarding the drilling and installation of R-29 and R-30 are presented in the well completion reports for regional aquifer monitoring wells R-29 and R-30 (LANL 2010, 110478; LANL 2010, 110518).

3.1.5 Borehole Abandonment

Boreholes were abandoned in accordance with SOP-05.03, Monitoring Well and Borehole Abandonment. All boreholes were abandoned with bentonite grout by filling upward from the bottom via tremie pipe to within 2 ft of the surface. After 24 h to 48 h, the backfilled level was checked for settling, and additional grout was added as necessary. The remainder of each boring was capped with Portland type I/II cement to surface grade.

3.1.6 Equipment Decontamination

Drilling and sampling equipment was decontaminated to minimize the potential for cross-contamination between sampling locations. Dry decontamination methods were used whenever possible and included using Fantastik paper towels, and brushes. Decontamination procedures followed SOP-1.08, Field Decontamination of Drilling and Sampling Equipment. All equipment, including survey equipment and heavy equipment such as backhoes, excavators, forklifts, drill rigs, etc., were screened by an RCT and released following DOT regulations before entering and exiting the site.

3.1.7 Health and Safety Measures

All 2009–2010 investigation activities were conducted in accordance with a site-specific health and safety plan, an integrated work document, and a radiological work permit that detailed work steps, potential hazards, hazard controls, and required training to conduct work. These health and safety measures included the use of level-D personal protective equipment (PPE) and field monitoring for VOCs and gross-alpha and -beta radiation.

A site-specific security plan was required by the facility operations oversight organization to work in TA-49. All field team members were trained to and adhered to the security requirements.

3.1.8 Waste Management

All IDW generated during the TA-49 investigation was managed in accordance with the IDW management plan in the approved work plan (LANL 2008, 102691; NMED 2008, 100464) as well as applicable regulations and Laboratory SOPs. These SOPs incorporate the requirements of all applicable EPA and

NMED regulations. The SOP applicable to the characterization and management of IDW is SOP 5238, Characterization and Management of Environmental Project Waste.

The waste streams associated with the investigation included drill cuttings and core materials and contact IDW. Drill cuttings generated during drilling and sampling activities were placed in 1-yd^3 Wrangler bags or 55-gal. drums and staged in an appropriate area for less-than-90-day waste storage. This waste stream was characterized in accordance with the approved waste characterization strategy form (WCSF). The drill cutting and discarded core waste stream are classified as non-hazardous. PPE and other contact waste were stored in a single 55- or 30-gal. drum. Pending characterization, all drums were placed on pallets in appropriate less-than-90-day waste storage areas or satellite accumulation areas. As described in the WCSF, the contact IDW was characterized using knowledge of the waste-generating process and the levels of radioactive contamination encountered. Details regarding waste generated during the 2009–2010 investigation, including the WCSF and waste management and disposition, are presented in Appendix E.

3.2 Deviations

Deviations from the approved work plan (LANL 2008, 102691; NMED 2008, 100464) occurred during the implementation of the TA-49 investigation and are summarized below.

Four samples from two locations within Area 2 [SWMU 49-001(b)] were not collected because of the presence of a wire-mesh biointrusion barrier that covers the surface. The two locations, which were not assigned sample location IDs, are shown as two green triangles in Figure 3.1-2.

Two surface sampling locations within Area 12 [AOC 49-008(d)] were relocated approximately 10 ft north of their original location because they were within an archaeological site boundary. The samples were both Category III screening-level samples, did not exceed the screening-level thresholds, and were not submitted for laboratory analysis.

The approved work plan (LANL 2008, 102691; NMED 2008, 100464) prescribed the drilling of one moisture-monitoring borehole in the center of Area 2 to a depth of 900 ft bgs. Per NMED's approval of a request for deviations from the work plan (LANL 2009, 106718; NMED 2009, 107002), the Laboratory performed a downhole video log of existing borehole location 49-02901 (approximately 200 ft from the proposed location) and determined that the existing borehole could be used for moisture monitoring. Borehole location 49-02901 was neutron logged and the results are presented in Figure 3.1-7.

The approved work plan (LANL 2008, 102691; NMED 2008, 100464) prescribed the drilling of the 900-ft borehole to determine whether or not perched water was present at MDA AB. Per NMED's approval of a request for deviations from the work plan (LANL 2009, 106718; NMED 2009, 107002), the Laboratory used regional wells R-29 and R-30 to evaluate the presence of perched water (section 3.1.4.5).

4.0 REGULATORY CRITERIA

This section describes the criteria used for evaluating potential risk to ecological and human receptors. Regulatory criteria identified by medium in the Consent Order include cleanup standards, risk-based screening levels, and risk-based cleanup goals.

Human health risk-screening evaluations were conducted for the sites inside the NES at TA-49 using NMED guidance (NMED 2015, 600915). Ecological risk-screening assessments were performed using Laboratory guidance (LANL 2015, 600921).

4.1 Current and Future Land Use

The specific screening levels used in the risk evaluation and corrective-action decision process at a site depend on the current and reasonably foreseeable future land use(s). The current and reasonably foreseeable future land use(s) for a site determines the receptors and exposure scenarios used to select screening and cleanup levels. The land use within and surrounding the TA-49 NES is currently industrial and is expected to remain industrial for the reasonably foreseeable future. Activities within the NES are controlled to prevent disturbance of the ground surface. Construction activities within the NES are not anticipated and the construction worker scenario was not evaluated. The residential scenario is evaluated for comparison purposes per the Consent Order and is the decision scenario for sites that do not require controls.

4.2 Screening Levels

Human health and ecological risk-screening evaluations were conducted for the COPCs detected in solid media at sites inside the NES at TA-49. The human health risk-screening assessments (Appendix I) were performed on inorganic and organic COPCs using NMED SSLs for the industrial and residential scenarios (NMED 2015, 600915). When an NMED SSL was not available for a COPC, SSLs were obtained from May 2016 EPA regional tables (adjusted to a risk level of 1×10^{-5} for carcinogens). Radionuclides were assessed using the Laboratory SALs for the same scenarios (LANL 2015, 600929). Surrogate SSLs were used for some COPCs for which no SSLs were available based on structural similarity or breakdown products.

NMED guidance includes total chromium SSLs for the residential and industrial scenarios (NMED 2015, 600915). Because the toxicity of chromium strongly depends on its oxidation state, NMED and EPA have SSLs for trivalent chromium and hexavalent chromium. For screening purposes, the NMED SSLs for total chromium are typically used for comparison with total chromium results unless there is a known or suspected source of hexavalent chromium at the SWMU or AOC or site conditions could alter the speciation of chromium in the environment. Total chromium screening levels are appropriate for low-level releases to soil from sources not associated with hexavalent chromium. However, NMED and EPA recommend collecting valence-specific data for chromium when chromium is likely to be an important contaminant at a site and when hexavalent chromium may exist (NMED 2015, 600915; http://www2.epa.gov/risk/regional-screening-table-users-guide-june-2015).

There are no known sources of hexavalent chromium use (e.g., cooling towers, electroplating) at SWMUs and AOCs inside the NES at TA-49. Total chromium results for all sites are screened using the NMED SSLs for total chromium.

4.3 Ecological Screening Levels

The ecological risk-screening assessments (Appendix I) were conducted using ecological screening levels (ESLs) obtained from the ECORISK Database, Version 3.3 (LANL 2015, 600921). The ESLs are based on similar species and are derived from experimentally determined no observed adverse effect levels (NOAELs), lowest observed adverse effect levels (LOAELs), or doses determined lethal to 50% of the test population. Information relevant to the calculation of ESLs, including concentration equations, dose equations, bioconcentration factors, transfer factors, and toxicity reference values are presented in the ECORISK Database, Version 3.3 (LANL 2015, 600921).

4.4 Cleanup Standards

As specified in the Consent Order, SSLs for inorganic and organic chemicals (NMED 2015, 600915) are used as soil cleanup levels unless they are determined to be impracticable or values do not exist for the current and reasonably foreseeable future land uses. SALs are used as soil cleanup levels for radionuclides (LANL 2015, 600929). Screening assessments compare COPC concentrations for each site with industrial and residential SSLs and SALs.

The cleanup goals specified in Section VIII of the Consent Order are a target risk of 1×10^{-5} for carcinogens or a hazard index (HI) of 1 for noncarcinogens. For radionuclides, the target dose is 25 mrem/yr as authorized by DOE Order 458.1. The SSLs/SALs used for the risk-screening assessments in Appendix I are based on these cleanup goals.

4.5 Pore-Gas Screening Levels

The Consent Order does not identify any cleanup standards, risk-based screening levels, risk-based cleanup goals, or other regulatory criteria for pore gas. For TA-49 pore-gas samples, screening was performed for human health risk based on vapor intrusion into buildings and for potential contamination of groundwater. Vapor intrusion screening was performed using NMED's vapor intrusion screening levels (NMED 2015, 600915) or EPA regional screening values (http://www.epa.gov/risk/risk-based-screening-table-generic-tables) divided by the default attenuation factor of 0.11 (NMED 2015, 600915, p. 47).

A screening evaluation for potential contamination of groundwater by pore gas is provided comparing maximum concentrations of VOCs in pore gas with screening levels that are based on equilibrium partitioning using the appropriate Henry's law constant with groundwater standards or screening levels. This screening process evaluates the potential for the VOC concentrations to result in contamination of groundwater in excess of standards or screening levels. No applicable standards or screening levels are available for tritium in pore vapor; however, the approved work plan (LANL 2008, 102691; NMED 2008, 100464) prescribed a comparison of tritium pore-gas data with the EPA groundwater maximum contaminant level (MCL) for tritium.

The analysis evaluated the groundwater concentration that would be in equilibrium with the maximum concentrations of VOCs detected at TA-49. The equilibrium relationship between air and water concentrations is described by the following equation.

$$C_{water} = C_{air} / H' \qquad \textbf{Equation 4.5-1}$$

Where C_{water} = the volumetric concentration of contaminant in water,

C_{air} = the volumetric concentration of contaminant in air, and

H' = dimensionless form of Henry's law constant.

If the predicted concentration of a particular VOC in groundwater is less than the screening level, then no potential exists for an exceedance of the groundwater standards or screening levels at the contaminant/groundwater interface.

The screening evaluation is based on groundwater standards or tap water screening levels and Henry's law constants that describe the equilibrium relationship between vapor and water concentrations. The source of the Henry's law constants is the NMED risk assessment guidance document (NMED 2005, 600915) or the EPA regional screening tables (http://www.epa.gov/risk/risk-based-screening-table-generic-tables). The following dimensionless form of Henry's law constant was used:

$$H' = \frac{C_{air}}{C_{water}} \qquad \textbf{Equation 4.5-2}$$

Equation 4.5-2 can be used to calculate the screening value (SV):

$$SV = \frac{C_{air}}{1000 \times H' \times SL} \qquad \textbf{Equation 4.5-3}$$

Where C_{air} = the concentration of a particular VOC in the pore-gas sample (µg/m^3),

H' = the dimensionless Henry's law constant,

SL = the groundwater screening level (µg/L), and

1000 is a conversion factor from L to m^3.

The screening levels are the groundwater standards or tap water screening levels. The groundwater standards are the EPA MCL or New Mexico Water Quality Control Commission (NMWQCC) groundwater standard, whichever is lower. If no MCL or NMWQCC standard is available, the NMED tap water screening levels (NMED 2015, 600915) or the EPA regional tap water screening levels, adjusted to 10^{-5} risk for carcinogens, are used (http://www.epa.gov/risk/risk-based-screening-table-generic-tables). The numerator in Equation 4.5-3 is the concentration of the VOC in pore gas, and the denominator is the pore-gas screening level, which represents the pore-gas concentration needed to exceed the screening level. Therefore, if the SV is less than 1, the concentration of the VOC in pore gas does not exceed the screening level, even if the VOC plume were to come in contact with groundwater. Table 4.5-1 presents the calculated concentrations of contaminants in pore gas corresponding to groundwater standards and tap water screening levels.

Equation 4.5-3 was used to screen the maximum concentrations of VOCs detected in pore-gas samples from the investigation. Screening was performed for each of the VOCs detected in pore gas from samples collected at Areas 1, 3, 4, 11, and 12 and MDA AB using the maximum detected concentrations (Table 4.5-2).

5.0 DATA REVIEW METHODOLOGY

The purpose of the data review is to define the nature and extent of contaminant releases for each SWMU or AOC inside the NES at TA-49. The nature of a contaminant release refers to the specific contaminants present, the affected media, and associated concentrations. The nature of contamination is defined through identification of COPCs, which is discussed in section 5.1. The identification of a chemical or radionuclide as a COPC does not mean the constituent(s) is related to the site and a result of site operations. A COPC is identified because it is present at a site based on the criteria discussed below, but it might be present because of adjacent and/or upgradient operations and/or infrastructure typical of industrial and urban development. If such origins are evident, the constituents might be excluded from the data analyses and risk assessments. The extent of contamination refers to the spatial distribution of COPCs, with an emphasis on the distribution of COPCs potentially posing a risk or requiring corrective

action. The process for determining the extent of contamination or for concluding no further sampling for extent is warranted is discussed in section 5.2.

5.1 Identification of COPCs

COPCs are chemicals and radionuclides that may be present as a result of releases from SWMUs or AOCs. Inorganic chemicals and some radionuclides occur naturally, and inorganic chemicals and radionuclides detected because of natural background are not considered COPCs. Similarly, some radionuclides may be present as a result of fallout from historic nuclear weapons testing, and these radionuclides are also not considered COPCs. The Laboratory collected data on background concentrations of many inorganic chemicals, naturally occurring radionuclides and fallout radionuclides. These data have been used to develop media-specific BVs and FVs (LANL 1998, 059730). For inorganic chemicals and radionuclides for which BVs or FVs exist, identification of COPCs involves background comparisons, which are described in sections 5.1.1 and 5.1.2. If no BVs or FVs are available or if samples are collected where FVs are not appropriate (i.e., greater than 1-ft depth or in rock), COPCs are identified based on detection status (i.e., if the inorganic chemical or radionuclide is detected, it is identified as a COPC unless there is information indicating it is not present as a result of a release from the SWMU or AOC).

Organic chemicals may also be present as a result of anthropogenic activities unrelated to the SWMU or AOC or, to a lesser extent, from natural sources. Because no background data are available for organic chemicals, background comparisons cannot be performed in the same manner as for inorganic chemicals or radionuclides. Therefore, organic COPCs are identified on the basis of detection status (i.e., the organic chemical is detected). When the nature of contamination is assessed, the history of site operations may be evaluated to determine whether an organic COPC is present because of a release from a SWMU or AOC or is present from a non-site-related source. Organic chemicals that are clearly present from sources other than releases from a SWMU or AOC may be eliminated as COPCs and not evaluated further.

5.1.1 Inorganic Chemical and Radionuclide Background Comparisons

The COPCs are identified for inorganic chemicals and radionuclides according to Laboratory procedures EP-SOP-10071, Background Comparisons for Inorganic Chemicals, and EP-SOP-10073, Background Comparisons for Radionuclides. Inorganic COPCs are identified by comparing site data with BVs, by statistical comparisons, and with other lines of evidence, as applicable (LANL 1998, 059730). The upper end of the background data set may be used for comparison if one or more of the following conditions exist:

- Statistically determined BV is significantly greater than the maximum background concentration.
- Statistical tests cannot be performed because of insufficient data (fewer than eight samples and/or five detections per medium) or a high percentage of nondetections.
- Sufficient numbers of samples have been collected to determine nature and extent, but results are predominately nondetections.
- Site history does not indicate the constituent is directly related to site activities or to a dominant waste stream.
- Spatial analyses do not show a pattern or trend indicating contamination.
- The maximum detected concentration is statistically determined to be an outlier. (Note: A sufficient number of samples must be collected to show a point is an outlier and is not indicative of a hot spot.)

Radionuclides are identified as COPCs based on background comparisons and statistical methods if BVs or FVs are available, based on detection status if BVs or FVs have not been established, or based on other lines of evidence, as applicable.

Background data are generally available for inorganic chemicals in soil, sediment, and tuff (LANL 1998, 059730). However, some analytes (e.g., nitrate, perchlorate, and hexavalent chromium) have no BVs. A BV may be either a calculated value from the background data set (upper tolerance limit [UTL] or the 95% upper confidence bound on the 95th quantile) or a detection limit (DL). When a BV is based on a DL, there is no corresponding background data set for that analyte/media combination.

For inorganic chemicals, data are evaluated by sample media to facilitate the comparison with media-specific background data. To identify inorganic COPCs, the first step is to compare the sampling result with BVs. If sampling results are above the BV and sufficient data are available (eight or more sampling results and five or more detections), statistical tests are used to compare the site sample data with the background data set for the appropriate media. If statistical tests cannot be performed because of insufficient data or a high percentage of nondetections, the sampling results are compared with the BV and the upper end of the background concentrations for the appropriate media. If concentrations are above the BV but no results are greater than the upper end of the background data set, lines of evidence are presented to determine whether the inorganic chemical is or is not a COPC. If at least one sampling result is above the BV and the upper end of the background data set, the inorganic chemical is identified as a COPC. The same evaluation is performed using DLs when an inorganic chemical is not detected but has a DL above the BV. If no BV is available, detected inorganic chemicals are identified as COPCs.

Radionuclides are identified as COPCs based on comparisons with BVs for naturally occurring radionuclides or with FVs for fallout radionuclides. Thorium-228, thorium-230, thorium-232, uranium-234, uranium-235/236, and uranium-238 are naturally occurring radionuclides. Americium-241, cesium-137, plutonium-238, plutonium-239/240, strontium-90, and tritium are fallout radionuclides with FVs.

Naturally occurring radionuclides detected at activities above their respective BVs are identified as COPCs unless lines of evidence can be presented to establish that particular radionuclides are not COPCs. If there is no associated BV or FV and the radionuclide is detected, it is retained as a COPC.

The FVs for the fallout radionuclides apply to the top 0.0 to 1.0 ft of soil and fill and to sediment regardless of depth. If a fallout radionuclide is detected in soil or fill samples collected below 1.0 ft or in tuff samples, the radionuclide is identified as a COPC. For soil and fill samples from 1.0 ft bgs or less, if the activity of a fallout radionuclide is greater than the FV, comparisons of the top 0.0 to 1.0-ft sampling data are made with the fallout data set. The radionuclide is eliminated as a COPC if activities are similar to fallout activities or lines of evidence can be presented to establish the radionuclide is not a COPC. Sediment results are evaluated in the same manner, although all data are included, not just the data from 0.0 to1.0 ft bgs.

The FV for tritium in surface soil is in units of pCi/mL (LANL 1998, 059730). This FV requires using sample percent moisture to convert sample tritium data from pCi/g (as provided by analytical laboratories) to the corresponding values in units of pCi/mL. Because sample percent moisture historically has been determined using a variety of methods, often undocumented, the Laboratory adopted the conservative approach of identifying tritium in soil as a COPC based on detection status.

Sample media encountered during investigations at sites in the TA-49 NES include soil (all soil horizons, designated by the media code ALLH or SOIL), fill material (media code FILL), alluvial sediment (media code SED), and Bandelier Tuff (media codes Qbt 1v, Qbt 1g, Qbt 2, Qbt 3, and Qbt 4). Because no separate BVs are available for fill material, fill samples are evaluated by comparison with soil BVs (LANL 1998, 059730). In this report, the discussions of site contamination in soil include fill samples along

with soil samples in sample counts and comparisons with background. Fill samples are not discussed separately from soil. The units of the Upper Bandelier Tuff (Qbt 2, Qbt 3, and Qbt 4) are likewise evaluated together with respect to background, as are the units of the Lower Bandelier Tuff (Qbo, Qct, and Qbt 1g) (LANL 1998, 059730).

5.1.2 Statistical Methods Overview

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. The results of the statistical tests are presented in Appendix H tables.

5.1.2.1 Distributional Comparisons

Comparisons between site-specific data and Laboratory background data are performed using a variety of statistical methods. These methods begin with a simple comparison of site data with a UTL estimated from the background data (UTL or the 95% upper confidence bound on the 95th quantile). The UTLs are used to represent the upper end of the concentration distribution and are referred to as BVs. The UTL comparisons are then 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 most commonly performed include the Gehan test (modification of the Wilcoxon Rank Sum test) and the quantile test (Gehan 1965, 055611; Gilbert and Simpson 1990, 055612).

The Gehan test is recommended when between 10% and 50% of the data sets are nondetections. It handles data sets with nondetections reported at multiple DLs in a statistically robust manner (Gehan 1965, 055611; Millard and Deverel 1988, 054953). The Gehan test is not recommended if either of the two data sets has more than 50% nondetections. If there are no nondetected concentrations in the data, the Gehan test is equivalent to the Wilcoxon Rank Sum test. The Gehan test is the preferred test because of its applicability to a majority of environmental data sets and its recognition and recommendation in EPA-sponsored workshops and publications.

The quantile test is better suited to assessing shifts in a subset of the data. The quantile test determines whether more of the observations in the top chosen quantile of the combined data set come from the site data set than would be expected by chance, given the relative sizes of the site and background data sets. If the relative proportion of the two populations being tested is different in the top chosen quantile of the data from that of the remainder of the data, the distributions may be partially shifted because of a subset of site data. This test is capable of detecting a statistical difference when only a small number of concentrations are elevated (Gilbert and Simpson 1992, 054952). The quantile test is the most useful distribution shift test where samples from a release represent a small fraction of the overall data collected. The quantile test is applied at a prespecified quantile or threshold, usually the 80th percentile. The test cannot be performed if more than 80% (or, in general, more than the chosen percentile) of the combined data are nondetected values. It can be used when the frequency of nondetections is approximately the same as the quantile being tested. For example, in a case with 75% nondetections in the combined background and site data set, application of a quantile test comparing 80th percentiles is appropriate. However, the test cannot be performed if nondetections occur in the top chosen quantile. The threshold percentage can be adjusted to accommodate the detection rate of an analyte or to look for differences further into the distribution tails. The quantile test is more powerful than the Gehan test for detecting differences when only a small percentage of the site concentrations are elevated.

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 concentration in the background data set if, in fact, the site data and background data came from the same distribution. This test is based on the maximum 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, 055612, pp. 5–8). The result (p-value) of the slippage test is the probability that "n" site samples (or more) exceed the maximum background concentration by chance alone. 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 BV comparison in that it evaluates the largest site measurements but is more useful than the BV comparison because it is based on a statistical hypothesis test, not simply on a statistic calculated from the background distribution.

Statistical tests for radionuclides are performed only in limited cases. There are no background data sets for naturally occurring radionuclides in soil or tuff, so statistical tests were not performed if there were any detections of uranium isotopes above BV in soil or tuff. Although there are background data sets for fallout radionuclides in soil, the background data are limited to the depth range of 0.0 to 1.0 ft bgs for evaluation of fallout radionuclides. Therefore, statistical tests were not performed for fallout radionuclides in soil. Fallout values are not applicable for tuff, so statistical tests cannot be performed. Background data sets are available for naturally occurring and fallout radionuclides in sediment, and background evaluations for sediment are not limited to the depth range of 0.0 to 1.0 ft bgs. Therefore, statistical tests can be performed for radionuclides in sediment. However, statistical tests for radionuclides in sediment were not performed for a site if there were also detections of naturally occurring radionuclides above BV in soil, detections of fallout radionuclides above FV in soil in the 0.0 to 1.0 ft bgs depth range, detections of fallout radionuclides in soil below 1.0 ft bgs, and/or detections of fallout radionuclides in tuff.

For all statistical tests, a p-value less than 0.05 was the criterion for accepting the null hypothesis that site sampling results are different from background. If results from two of the three statistical tests described above (Gehan, quantile, and slippage) indicate site concentrations of a constituent are not statistically different from background, that constituent may be eliminated as a COPC.

5.1.2.2 Graphical Presentation

Box plots are provided in Appendix H for a visual representation of the data and to help illustrate the presence of outliers or other anomalous data that might affect statistical results and interpretations. The plots allow a visual comparison among data 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 above. Unless otherwise noted, the nondetected concentrations are included in the plots at their reported DL.

The box plots produced in Appendix H of this report consist 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 extend to the most extreme point that is not considered an outlier, with a maximum whisker length of 1.5 times the interquartile range, outside of which data may be evaluated for their potential to be outliers. The concentrations are plotted as points overlying the box plot. When a data set contains both detected concentrations and nondetected

concentrations reported as DLs, the detected concentrations are plotted as Xs and the nondetected concentrations are plotted as Os.

5.2 Extent of Contamination

Spatial concentration trends are initially used to determine whether the extent of contamination is defined. Evaluation of spatial concentration data considers the conceptual site model of the release and subsequent migration. Specifically, the conceptual site model should define where the highest concentrations would be expected if a release had occurred and how these concentrations should vary with distance and depth. If the results are different from the conceptual site model, it could indicate that no release has occurred or there are other sources of contamination.

In general, both laterally and vertically decreasing concentrations are used to define extent. If concentrations are increasing or not changing, other factors are considered to determine whether extent is defined or if additional extent sampling is warranted. These factors include

- the magnitude of concentrations and rate of increase compared with SSLs/SALs,
- the magnitude of concentrations of inorganic chemicals or radionuclides compared with the maximum background concentrations for the medium,
- concentrations of organic chemicals compared with estimated quantitation limits (EQLs), and
- results from nearby sampling locations.

The primary focus for defining the extent of contamination is characterizing contamination that potentially poses a potential unacceptable risk and may require additional corrective actions. As such, comparison with SSLs/SALs is used as an additional step following a determination of whether extent is defined by decreasing concentrations with depth and distance and whether concentrations are below EQLs or DLs. The initial SSL/SAL comparison uses the residential SSL/SAL (regardless of whether the current and reasonably foreseeable future land use is residential) because this value is typically the most protective. If the current and reasonably foreseeable future land use is not residential, and if the residential SSL/SAL is exceeded or otherwise similar to COPC concentrations, comparison with the relevant SSL/SAL may also be conducted. For all SWMUs and AOCs in the NES at TA-49, the current and reasonably foreseeable future land use is industrial (section 4.1).

The SSL/SAL comparison is not necessary if all COPC concentrations are decreasing with depth and distance. If, however, concentrations increase with depth and distance or do not display any obvious trends, the SSLs/SALs are used to determine whether additional sampling for extent is warranted. If the COPC concentrations are sufficiently below the SSL/SAL (e.g., the residential and/or industrial SSL/SAL is 10 times [an order of magnitude]) or more than all concentrations), the COPC does not pose a potential unacceptable risk and no further sampling for extent is warranted. The validity of the assumption that the COPC does not pose a risk is confirmed with the results of the risk-screening assessment. The calculation of risk also assists in determining whether additional sampling is warranted to define the extent of contamination needing additional corrective actions.

Calcium, magnesium, potassium, and sodium may be COPCs for some sites. These constituents are essential nutrients, and their maximum concentrations are compared with NMED's essential nutrient screening levels (NMED 2015, 600915). If the maximum concentration is less than the screening level(s), no additional sampling for extent is warranted and the inorganic chemical is eliminated from further evaluation in the risk assessment.

6.0 TA-49 SITES INSIDE NES BACKGROUND AND FIELD INVESTIGATION RESULTS

6.1 Background of TA-49

6.1.1 Site Description

TA-49, also known as the Frijoles Mesa Site, occupies approximately 1280 acres along the south-central boundary of the Laboratory (Figure 1.1-1). The mesa is centrally located on the Pajarito Plateau at an average elevation of approximately 7140 ft amsl. The plateau is roughly midway between the Jemez Mountains to the west and the White Rock Canyon of the Rio Grande to the east. TA-49 is located within the Ancho, North Ancho, and Water Canyon watersheds. The northern boundary of TA-49 is defined by the edge of the Frijoles Mesa, which overlooks Water Canyon, and forms the southern boundaries of TA-15 and TA-37. State highway NM 4 forms the southwest boundary of TA-49 as well as the Laboratory's boundary. The southeast boundary of TA-49 is formed by TA-39.

A period of experimental activity at TA-49 took place from late 1959 to mid-1961, during which hydronuclear and related experiments deposited plutonium, uranium, lead, and beryllium in underground shafts. These experiments were conducted in subsurface shafts located at MDA AB (Areas 2, 2A, and 2B) and Areas 1, 3, and 4. Thirty-five hydronuclear experiments and nine related calibration, equation-of-state, and criticality experiments, all involving some fissile material, were conducted in 3- or 6-ft-diameter shafts at depths ranging from 31 to 108 ft bgs (Purtymun and Stoker 1987, 006688, p. 2).

Areas 1, 3, and 4 and MDA AB each contain subsurface test shafts used from 1959 to 1961 for underground hydronuclear safety, tracer, and containment experiments. The test shafts drilled for hydronuclear safety experiments were 6 and 3 ft in diameter and from 31 to 108 ft bgs. The shafts in Areas 1, 3, and 4 and MDA AB are located in a grid pattern with 25-ft spacing on center. The design of the experimental layout was based on preliminary tests that indicated the explosive tests would not disperse radioactive material beyond a 15- to 20-ft radius centered on the shaft in the subsurface (LANL 2007, 098492).

The test shot was encased in lead and accounts for the largest mass of all the contaminants. Iron and steel cable, aluminum materials, and piping associated with the test shots are also in the shafts. Radioactive materials used in the downhole testing included isotopic plutonium, uranium-235, and uranium-238. Since 1961, the shafts have been inactive except for monitoring and maintenance activities associated with the concrete pads located over the shots (LANL 2007, 098492).

Area 11 is the site of a former radiochemistry laboratory, associated leach field, and subsurface test-shot area. Area 12 includes the former Bottle House and CPTF. Sporadic and noncontinuous areas of surface soil contaminated with hazardous and radioactive materials have historically been associated with each area.

The location of TA-49 if shown in Figure 1.1-1 and the location of each TA-49 SWMU and AOC, including those outside the NES boundary, is presented in Figure 1.1-2.

6.1.2 Operational History

Before 1959, the Laboratory recognized there were potential safety problems with nuclear weapons in the nation's stockpile. These problems were related to the possibility of a significant nuclear yield because of accidental detonation of the device's high explosive (HE) component. The possibility of detonation during the assembly stage or while the device was stored in the arsenal necessitated the design and implementation of underground experiments to assess this potential problem. Historical aspects of the decision to conduct the experiments are described in a Laboratory report (Thorn and Westervelt 1987, 006672, p. 1-3).

The favorable environmental setting of Frijoles Mesa, combined with its relatively remote location and the flat terrain that afforded desirable operational characteristics, led to the selection of the Frijoles Mesa Site for the experiments. In fall 1959, TA-49 was created on Frijoles Mesa and underground experiments were conducted through August 1961. The central portion of TA-49 was devoted to the site of the underground experiments conducted in Areas 1, 3, and 4 and MDA AB (Figure 1.1-2). These areas are described in the HIR and approved investigation work plan for the sites inside the NES boundary (LANL 2007, 098492; LANL 2008, 102691; NMED 2008, 100464).

The hydronuclear experiments ceased in summer 1961 (DOE 1987, 008663). In 1965, a Laboratory group studying atmospheric phenomena conducted lightning observation experiments using the photographic tower that remained in Area 5. More recently, the portion of TA-49 near the NES has been used for emergency response operations and training. TA-49 also serves as a buffer zone for activities at adjacent firing sites (TA-15 and TA-39).

6.1.3 Summary of Releases

An unexpected contamination incident occurred during the hydronuclear safety experiments at MDA AB in 1960 during the drilling and subsequent drifting of shaft 2-M (LANL 1992, 007670, p. 3-11). In November 1960, the horizontal drift for shaft 2-M was drilled toward the southwest and intercepted contamination from the southeast-trending horizontal drift from shaft 2-L (completed for shot 2-L). In December, contamination from shot 2-L was discovered around Area 2, found in Area 6, and traced to shops at TA-03. During cleanup, contaminated equipment and soil were placed into shaft 2-M (no shot was fired in shaft 2-M, but the shaft is filled with contaminated materials). In January 1961, the surface of Area 2 was capped with compacted clay and gravel after all the open shafts were filled with sand and crushed tuff. In September 1961, the cap was extended 12.5 ft beyond the outermost shafts and paved with 4 to 6 in. of asphalt to retard infiltration. The shaft 2-M contamination incident left near-surface radionuclide contamination beneath the Area 2 asphalt pad, later designated as SWMU 49-001(g). It is believed this is the source of most or all of the above-background levels of radionuclides historically detected in surface soil and drainage areas around Area 2 (LANL 1992, 007670, pp. 7-26–7-27).

Other releases of radionuclides occurred in January 1960 at shaft 2-H, in March 1960 at shaft 2-S, and in March 1961 at shaft 2B-H (Weir and Purtymun 1962, 011890). In all three cases, contamination was controlled by covering contaminated soil with concrete pads (LANL 1998, 059166, pp. 6-7).

The second significant event at shaft 2-M occurred in March 1975 when it was discovered that the asphalt pad over the backfilled shaft had collapsed, leaving an opening approximately 6 ft × 3 ft wide and 3 ft × 4 ft deep in the asphalt and underlying fill. An inspection of corehole CH-2 indicated the water level had risen to approximately 50 ft of standing water (approximately 450 ft bgs) since the previous inspection (LANL 1992, 007670, p. 7-28). The hole in the asphalt may have formed in late 1974 and collected snowmelt throughout the winter.

In September 1976, the opening over shaft 2-M was filled with crushed rock and clay, and the entire pad was repaved with another 4 to 6 in. of asphalt (Purtymun and Ahlquist 1986, 014722). Unfiltered samples of the water bailed from corehole CH-2 in October 1977 and August 1978 yielded concentrations of 1.7 pCi/L to 3.1 pCi/L of plutonium-239. It was concluded that the opening in the asphalt pad allowed water to collect, penetrate the pad, and contact subsurface contamination (possibly contaminated backfill in shaft 2-M) (Purtymun and Stoker 1987, 006688, p. 14). The contaminated water presumably moved through fractures to corehole CH-2 and traveled down the annular spacing between the casing and the borehole (LANL 1992, 007670, p. 7-28). Another possibility is that the enhanced infiltration caused by the collapsed hole created saturated soil conditions that extended laterally to corehole CH-2 and traveled down the annular spacing between the casing and the corehole. In this case, the source of the

contamination would be the soil rather than shaft 2-M. Corehole CH-2 was originally drilled to a diameter of 4 in. and reamed to a diameter of 6.5 in. to facilitate logging (Zia Company 1960-1962, 098490); the casing installed was 2-in. galvanized pipe (Weir and Purtymun 1962, 011890, p. 29). Because of the annular spacing between the casing and corehole, downward flow may have been likely given saturated soil conditions and the open space or loose backfill in the annular spacing.

6.1.4 Current Site Usage and Status

The Laboratory's Hazardous Devices Team (HDT) uses the HDT training facility, building 49-113 and the associated HE magazine building 49-114 for small-scale explosives training exercises. Additional training facilities have recently been constructed to include structures and equipment for simulated transportation and other emergencies. Additional expansion of these facilities is expected.

Building 49-113 also houses the Laboratory's Alternate Emergency Operations Center. This facility is equipped with extensive communications systems and computers. The Laboratory conducts electrical grounding measurements in a small area immediately west of the HDT's training facility.

The Laboratory also maintains the Bandelier Meteorological Station in the southeast portion of TA-49 as part of its network of meteorological stations (LANL 1992, 007670, p. 3-12).

6.2 SWMU 49-001(a), Experimental Shafts

6.2.1 Site Description and Operational History

SWMU 49-001(a), known as Area 1, consists of experimental shafts located in the northwest corner of the MDA AB NES boundary at TA-49 (Figure 6.2-1). Twenty-two shafts were drilled at Area 1 within a 100 ft × 100 ft area to depths ranging from 31 to 85 ft bgs. Ten of the 22 shafts were used for shot testing using radioactive materials, 5 of the shafts were used for containment testing using HE only, 6 of the shafts were not used and were backfilled, and 1 shaft was used as a gas-expansion hole. Substantial amounts of lead generally were present in the experimental packages, and small amounts of beryllium may have been used in some experiments (LANL 2007, 098492).

6.2.2 Relationship to Other SWMUs and AOCs

SWMU 49-001(a) is located within Area 1. SWMU 49-003 and AOC 49-008(c) are located within Area 11 directly southeast of Area 1 (Figure 1.1-2). Area 11 is the site of a former radiochemistry laboratory, associated leach field, and subsurface test-shot area. SWMU 49-007(b) is located within the Laboratory's HDT area, which houses the HDT training facility building 49-113 and associated HE magazine building 49-114, used by the HDT team for small-scale explosives training exercises. SWMU 49-007(b), the septic system for the HDT area, was approved by EPA for no further action (NFA) in 2005 (EPA 2005, 088464). The HDT area described above is located directly southwest of SWMU 49-001(a).

The overland corridors associated with Area 1 extend from the southeast corner of Area 1 to the northwest corner of Area 5 (Figure 1.1-2 and Figure 3.1-6).

6.2.3 Summary of Previous Investigations

During the 1987 soil and vegetation radiological-screening survey, 34 surface samples were collected from points on a 25-ft grid centered over the Area 1 shafts, and 10 vegetation samples were collected within and around Area 1 (LANL 1992, 007670). Samples were analyzed for radionuclides and results showed radionuclide activities at or slightly above BVs/FVs (LANL 1992, 007670). During the 1995

Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) conducted at Area 1, 20 surface samples (0.0 to 0.5 ft bgs) were collected on a 25-ft × 25-ft grid centered over the Area 1 shafts. Each sample was field-screened for gross radiation; radiation was not detected above background. All 20 samples were submitted for analysis of gamma-emitting radionuclides; a subset of 10 of the samples was submitted for analysis of TAL metals and isotopic plutonium (LANL 2007, 098492). Inorganic chemicals detected above soil BVs included total uranium and zinc. Mercury and thallium were not detected above soil BVs but had DLs above BVs. Plutonium-239/-240 was detected above FV in the 1995 RFI samples collected from SWMU 49-001(a) in one sample (LANL 1997, 056594, p. 77). Historical sampling locations and detected concentrations are presented on plates, and in figures, and tables included in this report.

Before the 2009–2010 investigation, no sampling was conducted in the overland corridors.

6.2.4 Site Contamination

6.2.4.1 Soil, Rock, and Sediment Sampling

Based on previous investigation results, further characterization was required to assess potential contamination at SWMU 49-001(a). As a result, the following activities were completed as part of the 2009−2010 investigation.

- A total of 139 samples were collected from 70 locations at SWMU 49-001(a) and the overland corridor associated with SWMU 49-001(a). At all but 1 location, samples were collected at the surface (0.0 to 0.5 ft bgs) and from the subsurface (0.5 to 1.5 ft bgs). At one location, only a surface (0.0 to 0.5 ft bgs) sample was collected. All samples were analyzed at off-site fixed laboratories for TAL metals.

- A total of 16 samples were collected from 4 boreholes around the perimeter of SWMU 49-001(a). Samples were collected from 4 depth intervals at each borehole over the range of 1.7 to 135.0 ft bgs. All samples were analyzed at off-site fixed laboratories for TAL metals, cyanide, perchlorate, explosive compounds, SVOCs, VOCs, americium-241, isotopic plutonium, isotopic uranium, and tritium.

The 2009–2010 sampling locations at SWMU 49-001(a) are shown on Plate 1, and sampling locations from the overland corridor associated with SWMU 49-001(a) are shown on Plate 5. Table 6.2-1 presents the samples collected and analyses requested for SWMU 49-001(a) and the associated overland corridor. The geodetic coordinates of sampling locations are presented in Appendix C.

6.2.4.2 Soil, Rock, and Sediment Field-Screening Results

Organic vapors were not detected above ambient air during headspace (PID) screening of samples at SWMU 49-001(a). No radiological-screening results exceeded twice the daily site background levels. Field-screening results are presented in Table 3.1-1. There were no changes to sampling or other activities as a result of health- and safety-based field-screening results.

One surface sample from SMWU 49-001(a) exceeded the gross-alpha screening threshold, and an additional sample was collected and submitted for appropriate laboratory analysis. Eight additional step-out surface and shallow subsurface screening samples from four locations were collected and screened for gross-alpha and -beta analysis but did not exceed screening thresholds and were not submitted for laboratory analysis. The gross-alpha and -beta screening results that guided additional sampling at SWMU 49-001(a) are presented in Tables D-1 through D-6 in Appendix D.

Two surface samples collected from the SWMU 49-001(a) overland corridor exceeded the gross-alpha screening threshold; therefore, an additional 14 corridor samples from 7 locations were collected and submitted for appropriate laboratory analysis. The gross-alpha and -beta screening results that guided additional sampling at SWMU 49-001(a) overland corridors are presented in Tables D-34 through D-38 in Appendix D.

6.2.4.3 Soil, Rock, and Sediment Sampling Analytical Results

Decision-level data at SWMU 49-001(a) consist of results from 175 samples (155 soil and 20 tuff) collected from 94 locations.

Inorganic Chemicals

A total of 165 samples (145 soil and 20 tuff) were collected at SWMU 49-001(a) and analyzed for TAL metals. Sixteen tuff samples were analyzed for cyanide and perchlorate, and 10 soil samples were analyzed for total uranium. Table 6.6-2 presents the inorganic chemicals above BVs and detected inorganic chemicals with no BVs. Plates 2 and 6 show the spatial distribution of inorganic chemicals detected or detected above BVs at SWMU 49-001(a) and in the overland corridor associated with SWMU 49-001(a), respectively.

Aluminum was detected above the Qbt 2,3,4 BV (7340 mg/kg) in five samples with a maximum concentration of 16,100 mg/kg. The Gehan and quantile tests indicated site concentrations of aluminum in tuff are statistically different from background (Figure H-1 and Table H-1). Aluminum is retained as a COPC.

Arsenic was detected above the Qbt 2,3,4 BV (2.79 mg/kg) in four samples with a maximum concentration of 4.1 mg/kg. The Gehan and quantile tests indicated site concentrations of arsenic in tuff are not statistically different from background (Figure H-2 and Table H-1). Arsenic is not a COPC.

Barium was detected above the soil and Qbt 2,3,4 BVs (295 mg/kg and 46 mg/kg) in one soil sample and eight tuff samples with a maximum concentration of 915 mg/kg. The Gehan and quantile tests indicated site concentrations of barium in soil are not statistically different from background (Figure H-3 and Table H-2). The Gehan and quantile tests indicated site concentrations of barium in tuff are statistically different from background (Figure H-4 and Table H-1). Barium is retained as a COPC.

Beryllium was detected above the Qbt 2,3,4 BV (1.21 mg/kg) in one sample at a concentration of 1.3 mg/kg. The Gehan and quantile tests indicated site concentrations of beryllium in tuff are not statistically different from background (Figure H-5 and Table H-1). Beryllium is not a COPC.

Calcium was detected above the soil and Qbt 2,3,4 BVs (6120 mg/kg and 2200 mg/kg) in two soil samples and six tuff samples with a maximum concentration of 8250 mg/kg. The Gehan and quantile tests indicated site concentrations of calcium in soil are not statistically different from background (Figure H-6 and Table H-2). The Gehan and quantile tests indicated site concentrations of calcium in tuff are statistically different from background (Figure H-7 and Table H-1). Calcium is retained as a COPC.

Chromium was detected above the soil and Qbt 2,3,4 BVs (19.3 mg/kg and 7.14 mg/kg) in one soil sample and five tuff samples with a maximum concentration of 25.4 mg/kg. The Gehan and quantile tests indicated site concentrations of chromium in soil are statistically different from background (Figure H-8 and Table H-2). The quantile and slippage tests indicated site concentrations of chromium in tuff are not statistically different from background (Figure H-9 and Table H-1). Chromium is retained as a COPC.

Cobalt was detected above the soil and Qbt 2,3,4 BVs (8.64 mg/kg and 3.14 mg/kg) in 31 soil samples and 2 tuff samples with a maximum concentration of 44.5 mg/kg. The Gehan and quantile tests indicated site concentrations of cobalt in soil are statistically different from background (Figure H-10 and Table H-2). The Gehan and quantile tests indicated site concentrations of cobalt in tuff are not statistically different from background (Figure H-11 and Table H-1). Cobalt is retained as a COPC.

Copper was detected above the Qbt 2,3,4 BV (4.66 mg/kg) in four samples with a maximum concentration of 7.6 mg/kg. The Gehan and quantile tests indicated site concentrations of copper in tuff are not statistically different from background (Figure H-12 and Table H-1). Copper is not a COPC.

Cyanide was not detected above the Qbt 2,3,4 BV (0.5 mg/kg) but had DLs (0.51 mg/kg to 0.54 mg/kg) above the BV in 11 samples. The DLs were only 0.01 mg/kg to 0.04 mg/kg above the BV and were approximately 10.7 mg/kg below the residential SSL. Cyanide was not detected with DLs below BV in the other 5 samples. Laboratory background soil samples were not analyzed for cyanide and the BV is based on DLs (LANL 1998, 059730). DLs slightly greater than BV, therefore, are not necessarily indicative of potential cyanide contamination. SWMU 49-001(a) consists of underground experimental shafts and there is no history of cyanide at the site. Cyanide is not a COPC.

Iron was detected above the Qbt 2,3,4 BV (14,500 mg/kg) in one sample at a concentration of 14,900 mg/kg. The Gehan and quantile tests indicated site concentrations of iron in tuff are not statistically different from background (Figure H-13 and Table H-1). Iron is not a COPC.

Lead was detected above the soil and Qbt 2,3,4 BVs (22.3 mg/kg and 11.2 mg/kg) in eight soil samples and four tuff samples with a maximum concentration of 77.4 mg/kg. The quantile and slippage tests indicated site concentrations of lead in soil are not statistically different from background (Figure H-14 and Table H-2). The Gehan and slippage tests indicated site concentrations of lead in tuff are not statistically different from background (Figure H-15 and Table H-1). Lead is not a COPC.

Magnesium was detected above the Qbt 2,3,4 BV (1690 mg/kg) in 4 samples with a maximum concentration of 2400 mg/kg. The Gehan and quantile tests indicated site concentrations of magnesium in tuff are not statistically different from background (Figure H-16 and Table H-1). Magnesium is not a COPC.

Manganese was detected above the soil BV (671 mg/kg) in 12 samples with a maximum concentration of 2430 mg/kg. The Gehan and quantile tests indicated site concentrations of manganese in soil are statistically different from background (Figure H-17 and Table H-2). Manganese is retained as a COPC.

Mercury was detected above the soil BV (0.1 mg/kg) in 1 sample at a concentration of 0.103 mg/kg and had DLs (0.11 mg/kg) above the BV in 3 samples. The detected concentration was only 0.003 mg/kg above BV and the DLs were only 0.01 mg/kg above BV. Mercury was not detected or detected below BVs in the other 122 samples (detected below BVs in 80 samples). Mercury is not a COPC.

Nickel was detected above the soil and Qbt 2,3,4 BVs (15.4 mg/kg and 6.58 mg/kg) in one soil sample and three tuff samples with a maximum concentration of 31.7 mg/kg. The Gehan and quantile tests indicated site concentrations of nickel in soil are statistically different from background (Figure H-18 and Table H-2). The quantile and slippage tests indicated site concentrations of nickel in tuff are statistically different from background (Figure H-19 and Table H-1). Nickel is retained as a COPC.

Perchlorate was detected in two samples with a maximum concentration of 0.0036 mg/kg. Perchlorate is retained as a COPC.

Selenium was detected above the soil and Qbt 2,3,4 BVs (1.52 mg/kg and 0.3 mg/kg) in 5 soil samples and 20 tuff samples with a maximum concentration of 2 mg/kg and had DLs (1.6 mg/kg to 2.1 mg/kg) above the Qbt 2,3,4 BV in 5 samples. The Gehan and quantile tests indicated site concentrations of selenium in soil are statistically different from background (Figure H-20 and Table H-2). Selenium is retained as a COPC.

Sodium was detected above the soil BV (915 mg/kg) in one sample at a concentration of 1300 mg/kg. The Gehan and quantile tests indicated site concentrations of sodium in soil are not statistically different from background (Figure H-21 and Table H-2). Sodium is not a COPC.

Thallium was detected above the soil BV (0.73 mg/kg) in 1 sample at a concentration of 0.88 mg/kg and had DLs (0.86 mg/kg to 1.4 mg/kg) above the BV in 20 samples. The Gehan and quantile tests indicated site concentrations of thallium in soil are not statistically different from background (Figure H-22 and Table H-2). Thallium is not a COPC.

Uranium was detected above the soil BV (1.82 mg/kg) in eight samples with a maximum concentration of 9.3 mg/kg. The Gehan and quantile tests indicated site concentrations of uranium in soil are not statistically different from background (Figure H-23 and Table H-2). Uranium is not a COPC.

Vanadium was detected above the soil and Qbt 2,3,4 BVs (39.6 mg/kg and 17 mg/kg) in three soil samples and two tuff samples with a maximum concentration of 56.2 mg/kg. The Gehan and quantile tests indicated site concentrations of vanadium in soil are statistically different from background (Figure H-24 and Table H-2). The Gehan and quantile tests indicated site concentrations of vanadium in tuff are not statistically different from background (Figure H-25 and Table H-1). Vanadium is retained as a COPC.

Zinc was detected above the soil BV (48.8 mg/kg) in one sample at a concentration of 51.2 mg/kg. The Gehan and quantile tests indicated site concentrations of zinc in soil are not statistically different from background (Figure H-26 and Table H-2). Zinc is not a COPC.

Organic Chemicals

A total of 16 tuff samples were collected at SWMU 49-001(a) and analyzed for explosive compounds, SVOCs, and VOCs. Table 6.2-3 summarizes the analytical results for detected organic chemicals. Plate 3 shows the spatial distribution of detected organic chemicals.

Organic chemicals detected at SWMU 49-001(a) include methylene chloride. The detected organic chemical is retained as a COPC.

Radionuclides

A total of 165 samples (145 soil and 20 tuff) were collected at SWMU 49-001(a) and analyzed for isotopic plutonium. A total of 155 samples (135 soil and 20 tuff) were collected and analyzed for americium-241 and isotopic uranium, 157 samples (153 soil and 4 tuff) for gamma-emitting radionuclides, and 16 tuff samples for tritium. Table 6.2-4 presents the radionuclides detected or detected above BVs/FVs. Plates 4 and 7 show the spatial distribution of detected radionuclides at SWMU 49-001(a) and in the overland corridor associated with SWMU 49-001(a), respectively.

Cesium-134 was detected in two samples with a maximum activity of 0.586 pCi/g. Cesium-134 is retained as a COPC.

Plutonium-238 was detected above the soil FV (0.023 pCi/g) in one sample at an activity of 0.057 pCi/g. The quantile and slippage tests indicated site activities of plutonium-238 in soil are not statistically different from background (Figure H-27 and Table H-2). Plutonium-238 is not a COPC.

Plutonium-239/240 was detected above the soil FV (0.054 pCi/g) in one sample at an activity of 0.0915 pCi/g. The quantile and slippage tests indicated site activities of plutonium-239 in soil are not statistically different from background (Figure H-28 and Table H-2). Plutonium-239/240 is not a COPC.

Tritium was detected in two samples with a maximum activity of 0.178 pCi/g. Tritium is retained as a COPC.

6.2.4.4 Nature and Extent of Contamination

The nature and extent of inorganic, organic, and radionuclide COPCs at SWMU 49-001(a) were evaluated using the process described in section 5.2 and are discussed below. As presented in the approved investigation work plan (LANL 2008, 102691; NMED 2008, 100464), four vertical boreholes (locations 49-610946, 49-610947, 49-610948, and 49-610949) were drilled along the perimeter of the SWMU within 25 ft from the perimeter of the experimental shaft area. One of the objectives of drilling the perimeter boreholes was to characterize the vertical extent of contamination beneath Area 1 and to determine the potential for off-site releases of VOCs at levels that would require additional characterization. Installation of boreholes to characterize subsurface contamination within the NES was not possible, and subsurface contamination will be characterized in the future.

Inorganic Chemicals

Inorganic COPCs at SWMU 49-001(a) include aluminum, barium, calcium, chromium, cobalt, manganese, nickel, perchlorate, selenium, and vanadium.

Aluminum was detected above the Qbt 2,3,4 BV in five samples with a maximum concentration of 16,100 mg/kg. Concentrations increased with depth at locations 49-610121, 49-610224, and 49-610232 but decreased with depth in the vertical perimeter boreholes at locations 49-610948 and 49-610949. Concentrations increased laterally at location 49-610232. The residential and industrial SSLs were approximately 4.8 times (61,900 mg/kg below the residential SSL) and 80 times the maximum concentration, respectively. Aluminum was detected below BV in 160 other samples. The spatial distribution of aluminum concentrations is not indicative of contamination from a release. Further sampling for extent of aluminum is not warranted.

Barium was detected above the soil and Qbt 2,3,4 BVs in one soil sample and 8 tuff samples with a maximum concentration of 915 mg/kg. Concentrations decreased with depth at all other locations (the concentration in the shallow sample at location 49-610231 was 109 mg/kg and below the soil BV [Appendix G, Pivot Tables]). Concentrations increased with depth at locations 49-610121, 49-610224, 49-610227, and 49-610232 but decreased with depth in the vertical perimeter boreholes at locations 49-610946, 49-610947, 49-610948, and 49-610949. Concentrations increased laterally at location 49-610227. The residential and industrial SSLs were approximately 17 times and 280 times the maximum concentration, respectively. Further sampling for extent of barium is not warranted.

Calcium was detected above the soil and Qbt 2,3,4 BVs in two soil samples and six tuff samples with a maximum concentration of 8250 mg/kg. Concentrations increased with depth at locations 49-610120, 49-610121, 49-610227, and 49-610232, with concentrations below the maximum soil background concentration (14,000 mg/kg) at locations 49-610120 and 49-610227. Concentrations decreased with depth in the vertical perimeter boreholes at locations 49-610946, 49-610947, 49-610948, and 49-610949. Concentrations increased laterally at location 49-610227 but were below the maximum soil background

concentration. The NMED residential essential nutrient SSL was approximately 1600 times the maximum concentration. Further sampling for extent of calcium is not warranted.

Chromium was detected above the soil and Qbt 2,3,4 BVs in one soil sample and five tuff samples with a maximum concentration of 25.4 mg/kg. Concentrations did not change substantially with depth (0.8 mg/kg, 0.1 mg/kg, and 0.8 mg/kg, respectively) at locations 49-610121, 49-610231, and 49-610232 (the concentrations in the shallow samples at locations 49-610121, 49-610231, and 49-610232 were 11.8 mg/kg, 8.0 mg/kg, and 10.3 mg/kg, respectively, and below the soil BV [Appendix G, Pivot Tables]). Concentrations decreased with depth at the other locations and decreased laterally. Chromium was either detected below BVs or decreased with depth in the vertical perimeter boreholes at locations 49-610946, 49-610947, 49-610948, and 49-610949. As discussed in section 4.2, because there was no known use of hexavalent chromium at this site, the results were compared with the residential SSL for trivalent chromium (117,000 mg/kg). The residential trivalent chromium SSL was approximately 4600 times the maximum concentration. The lateral extent of chromium is defined, and further sampling for vertical extent is not warranted.

Cobalt was detected above the soil and Qbt 2,3,4 BVs in 31 soil samples and 2 tuff samples with a maximum concentration of 44.5 mg/kg. Concentrations increased with depth at locations 49-610100, 49-610107, 49-610108, 49-610117, 49-610125, 49-610208, 49-610209, 49-610212, 49-610215, 49-610220, 49-610221, 49-610226, 49-611038, and 49-611140, but concentrations were below the maximum soil background concentration (9.5 mg/kg) at locations 49-610100, 49-610117, 49-610208, and 49-610220. Cobalt was detected below BVs at all depths in the vertical perimeter boreholes at locations 49-610946, 49-610947, 49-610948, and 49-610949. Concentrations did not change substantially with depth (1.0 mg/kg, 0.3 mg/kg, 1.1 mg/kg, and 0.8 mg/kg) at locations 49-610111, 49-610122, 49-610129, and 49-610232 (the concentration in the shallow sample at location 49-610232 was 4.8 mg/kg and below the soil BV [Appendix G, Pivot Tables]). Concentrations decreased with depth at all other locations and decreased laterally. Cobalt was detected above BV sporadically across the site, with most detections at locations outside the SWMU 49-001(a) footprint. The spatial distribution of cobalt does not appear indicative of contamination from a release. The industrial SSL was approximately 8.7 times the maximum concentration. All detections of cobalt where vertical extent is not defined were in the depth interval 0.5 to 1.5 ft bgs, and increasing concentrations at greater depths would not affect the risk to industrial workers. The hazard quotient (HQ) for cobalt under the industrial scenario is 0.0253 (Appendix I, Table I-4.2-2). The lateral extent of cobalt is defined, and further sampling for vertical extent is not warranted.

Manganese was detected above the soil BV in 12 samples with a maximum concentration of 2430 mg/kg. Concentrations increased with depth at locations 49-610125, 49-610209, 49-610221, 49-610226, and 611040; but were below the maximum soil background concentration (1100 mg/kg) at locations 49-610125, 49-610221, 49-610226, and 49-611040. Manganese was either detected below BVs or decreased with depth in the vertical perimeter boreholes at locations 49-610946, 49-610947, 49-610948, and 49-610949. Concentrations decreased with depth at all other locations and decreased laterally. Manganese was detected above BV sporadically across the site, with all detections at locations outside the SWMU 49-001(a) footprint. The spatial distribution of manganese does not appear indicative of contamination from a release. The residential and industrial SSLs were approximately 4.3 times and 66 times the maximum concentration. All detections of manganese where vertical extent is not defined were in the depth interval 0.0 to 1.5 ft bgs, and increasing concentrations at greater depths would not affect the risk to industrial workers. The HQ for manganese under the industrial scenario is 0.0027 (Appendix I, Table I-4.2-2). The lateral extent of manganese is defined, and further sampling for vertical extent is not warranted.

Nickel was detected above the soil and Qbt 2,3,4 BVs in one soil sample and three tuff samples with a maximum concentration of 31.7 mg/kg. Concentrations increased with depth at location 49-610209, did not change substantially with depth (1.2 mg/kg) at location 49-610232, and decreased with depth at locations 49-610121 and 49-610224 (the concentrations in the shallow samples at locations 49-610121 and 49-610224 were 10.5 mg/kg and 10.5 mg/kg and below the soil BV [Appendix G, Pivot Tables]). Nickel was detected below BVs in the vertical perimeter boreholes at locations 49-610946, 49-610947, 49-610948, and 49-610949. Concentrations decreased laterally. The residential SSL was approximately 49 times the maximum concentration. The lateral extent of nickel is defined, and further sampling for vertical extent is not warranted.

Perchlorate was detected in two samples with a maximum concentration of 0.0036 mg/kg. Concentrations decreased with depth and were below the estimated detection limit (EDL). In accordance with the approved work plan (LANL 2008, 102691; NMED 2008, 100464), perchlorate was only analyzed in samples from perimeter boreholes, so lateral extent was not evaluated. The residential SSL was approximately 15,000 times the maximum concentration. The vertical extent of perchlorate is defined, and further sampling for lateral extent is not warranted.

Selenium was detected above the soil and Qbt 2,3,4 BVs in 5 soil samples and 20 tuff samples with a maximum concentration of 2 mg/kg and had DLs (1.6 mg/kg to 2.1 mg/kg) above the Qbt 2,3,4 BV in 5 samples. Concentrations increased with depth at locations 49-610103, 49-610119, 49-610212, 49-610227, and 49-610230; did not change substantially with depth (no change, 0.1 mg/kg, 0.31 mg/kg, 0.3 mg/kg, respectively) at locations 49-610121, 49-610224, 49-610231, and 49-610232 (the concentrations in the shallower samples at locations 49-610121, 49-610224, 49-610231, and 49-610232 were 1.3 mg/kg, 1.2 mg/kg, 1.1 mg/kg, and 1.1 mg/kg, respectively, and below the soil BV [Appendix G, Pivot Tables]). Concentrations did not change substantially with depth in the vertical perimeter boreholes at locations 49-610946, 49-610947, 49-610948, and 49-610949 (0.2 mg/kg, 0.12 mg/kg, 0.3 mg/kg, 0.12 mg/kg, respectively). Concentrations increased laterally at location 49-610227. The residential SSL was approximately 196 times the maximum concentration and 186 times the maximum DL. Further sampling for extent of selenium is not warranted.

Vanadium was detected above the soil and Qbt 2,3,4 BVs in three soil samples and two tuff samples with a maximum concentration of 56.2 mg/kg. Concentrations increased with depth at location 49-610111, but the concentration was similar to the maximum soil background concentration (56.5 mg/kg). Vanadium was detected below BVs in the vertical perimeter boreholes at locations 49-610946, 49-610947, 49-610948, and 49-610949. Concentrations did not change substantially with depth (1.7 mg/kg) at location 49-610232 (the concentration in the shallower sample at location 49-610232 was 19.5 mg/kg and below the soil BV [Appendix G, Pivot Tables]). Concentrations decreased with depth at locations 49-610104, 49-610113, and 49-610121 (the concentration in the shallow sample at location 49-610121 was 35.9 mg/kg and below the soil BV [Appendix G, Pivot Tables]). Concentrations decreased laterally. Vanadium was detected above BV sporadically across the site, with all detections at locations outside the SWMU 49-001(a) footprint. The spatial distribution of vanadium does not appear indicative of contamination from a release. The residential and industrial SSLs were approximately 7 times and 116 times the maximum concentration, respectively. All detections of vanadium where vertical extent is not defined were in the depth interval 0.0 to 1.5 ft bgs, and increasing concentrations at greater depths would not affect the risk to industrial workers. The HQ for vanadium under the industrial scenario is 0.00406 (Appendix I, Table I-4.2-2). The lateral extent of vanadium is defined, and further sampling for vertical extent is not warranted.

Organic Chemicals

Organic COPCs at SWMU 49-001(a) include methylene chloride.

Methylene chloride was detected in three samples with a maximum concentration of 0.0033 mg/kg. Concentrations did not change substantially with depth (0.0005 mg/kg) and were below the EQLs. In accordance with the approved work plan (LANL 2008, 102691; NMED 2008, 100464), samples for VOC analysis were collected only from perimeter boreholes, so lateral extent was not evaluated. The residential SSL was approximately 124,000 times the maximum concentration. Further sampling for extent of methylene chloride is not warranted.

Radionuclides

Radionuclide COPCs at SWMU 49-001(a) include cesium-134 and tritium.

Cesium-134 was detected in two samples with a maximum activity of 0.586 pCi/g. Activities increased with depth at location 49-610288 and decreased with depth at location 49-610212 and increased laterally at location 49-610288. Cesium-134 was detected at only 2 of 70 sampling locations and the spatial distribution of cesium-134 does not appear indicative of contamination from a release. The residential and industrial SALs were approximately 8.5 times and 29 times the maximum activity, respectively. Further sampling for extent of cesium-134 is not warranted.

Tritium was detected in two samples with a maximum activity of 0.178 pCi/g. Activities decreased with depth at all locations. In accordance with the approved work plan (LANL 2008, 102691; NMED 2008, 100464), samples for tritium analysis were collected only from perimeter boreholes, so lateral extent was not evaluated. The residential SAL was approximately 9550 times the maximum activity. The vertical extent of tritium is defined, and further sampling for lateral extent is not warranted.

6.2.4.5 Subsurface Vapor Sampling and Results

Three pore-gas samples were collected from one borehole (location 49-610946) and analyzed for VOCs and tritium. Table 6.2-5 presents the pore gas samples collected and analyses requested for SWMU 49-001(a).

Table 6.2-6 summarizes the analytical results for detected VOCs in pore gas. Plate 3 shows the spatial distribution of detected VOCs. Table 6.2-7 presents the tritium detected in pore gas. Plate 4 shows the spatial distribution of detected tritium.

VOCs detected in pore gas at SWMU 49-001(a) include acetone; benzene; 2-butanone; carbon disulfide; chloromethane; dichlorodifluoromethane; ethylbenzene; 4-ethyltoluene; styrene; toluene; 1,2,4-trimethylbenzene; total xylenes; 1,2-xylene; and 1,3-xylene+1,4-xylene. The detected VOCs are retained as COPCs.

Tritium was detected in one sample at an activity of 2494 pCi/L. Tritium is retained as a COPC.

Nature and Extent of Contamination in Subsurface Pore Gas

The approved investigation work plan (LANL 2008, 102691; NMED 2008, 100464) prescribed the collection of pore-gas samples from intervals corresponding to the base of formation Qbt 4, at total depth (TD) of the closest experimental shaft, and from the TD of each borehole. If VOCs were detected in the vapor-phase sample at concentrations greater than 10% of the pore-gas screening levels presented in section 4.5 or if tritium was detected in the vapor-phase sample at a concentration greater than the groundwater MCL (20,000 pCi/L), the borehole would be completed as a vapor-monitoring well.

Screening was performed for each of the VOCs detected in pore-gas samples collected from SWMUs 49-001(a), 49-001(b), 49-001(c), 49-001(d), 49-001(e), and 49-001(f) and AOCs 49-008(c) and 49-008(d) using the maximum detected concentration from all sites. These results show that the SVs are below 0.1 in all cases, indicating that VOCs in subsurface pore gas are not a potential source of groundwater contamination (Table 4.5-2).

The detected tritium activity at SWMU 49-001(a) is below the groundwater MCL (20,000 pCi/L). Therefore, tritium is not a potential source of groundwater contamination.

The concentrations of all VOCs were less the 10% of the pore-gas screening level and the maximum tritium activity was less than the MCL. Therefore, the borehole at SWMU 49-001(a) was not completed as a vapor-monitoring well.

6.2.5 Summary of Human Health Risk Screening

Industrial Scenario

The total excess cancer risk for the industrial scenario is 2×10^{-7}, which is less than the NMED target risk level of 1×10^{-5} (NMED 2015, 600915). The industrial HI is 0.04, which is less than the NMED target HI of 1 (NMED 2015, 600915). The total dose is 0.9 mrem/yr, which is less than the target dose of 25 mrem/yr as authorized by DOE Order 458.1.

Residential Scenario

The total excess cancer risk for the residential scenario is 8×10^{-6}, which is less than the NMED target risk level of 1×10^{-5} (NMED 2015, 600915). The residential HI is 0.8, which is less than the NMED target HI of 1 (NMED 2015, 600915). The total dose is 3 mrem/yr, which is less than the target dose of 25 mrem/yr as authorized by DOE Order 458.1.

Based on the risk-screening assessment results, no potential unacceptable risks or doses exist for the industrial and residential scenarios at SWMU 49-001(a).

6.2.6 Summary of Ecological Risk Screening

Based on evaluations of the minimum ESLs, HI analyses, potential effects to populations (individuals for threatened and endangered [T&E] species), LOAEL analyses, the relationship of detected concentrations and screening levels to background concentrations, and chemicals of potential ecological concern (COPECs) without ESLs, no potential unacceptable ecological risks to the earthworm, plant, American robin, American kestrel, pocket gopher, deer mouse, montane shrew, desert cottontail, red fox, and Mexican spotted owl exist at SWMU 49-001(a).

6.3 SWMU 49-001(b), Experimental Shafts

6.3.1 Site Description and Operational History

SWMU 49-001(b), known as Area 2, is part of MDA AB. Area 2 consists of experimental shafts located within the northeast corner of the MDA AB NES boundary (Figure 6.3-1). Area 2 is approximately 100 ft × 100 ft. This area was designed to contain a maximum of 25 shafts on a uniform 25-ft × 25-ft grid (25-ft shaft spacing). A total of 22 experimental shafts were drilled at Area 2. Four of these shafts, ranging from 52 to 68 ft deep, were used for containment shots or shots with small amounts of uranium tracer. Sixteen shafts were used for other experiments involving radioactive materials, of which 12 used isotopic

plutonium, 1 used uranium-235, and 3 used uranium-238 as the principal radioactive materials. The experiments using isotopic plutonium also used uranium-238 and, in some cases, uranium-235. Similarly, the experiment using uranium-235 also used uranium-238. Most of the shafts used for shots with radioactive materials were 57 ft deep; one shaft was 78 ft deep. One 58-ft-deep shaft was backfilled without being used, and one 35-ft-deep shaft was used as a gas-expansion hole. Area 2 also contained five 3-ft-diameter × 30-ft-deep pipe dump holes where experimental equipment was placed after use. Some experiments conducted at Area 2 used downhole neutron sources that expended a total of a few curies of tritium; some experiments may have used liquid scintillation detectors containing organic chemicals, including p-terphenylene, toluene, polystyrene, and zinc stearate. These organic chemicals should have been consumed during the explosions. Substantial amounts of lead were typically present in the experimental packages, and small amounts of beryllium may have been used in some experiments. Large, portable, concrete radiation shields provided shielding during these experiments (LANL 2007, 098492).

In 1961, an asphalt pad was placed over Area 2 in response to the release of radioactive contamination during the drilling of shaft 2-M [SWMU 49-001(g)] (LANL 2007, 098492). In March 1975, the asphalt pad was discovered to have collapsed over shaft 2-M, creating an opening approximately 6 ft long × 3 ft wide × 3 ft to 4 ft deep in the asphalt and underlying fill. This opening allowed snowmelt to enter corehole CH-2, located approximately 10 ft from shaft 2-M. This infiltrating water apparently carried contamination from shaft 2-M into corehole CH-2; samples of water that accumulated in corehole CH-2 contained plutonium-239. In September 1976, the opening over shaft 2-M was filled with crushed rock and clay, and the entire pad covering Area 2 was repaved with another 4 to 6 in. of asphalt. Monitoring from 1980 to 1987 showed no standing water in corehole CH-2 (LANL 2007, 098492).

In May 1991, cracks were noted in the asphalt pad with vegetation growing through some of the cracks, and standing water was detected again in corehole CH-2 (LANL 1992, 007670, p. 7-34). In November 1991, these cracks were sealed with asphalt. Standing water continued to be detected in corehole CH-2 after the asphalt pad was repaired. The source of water in corehole CH-2 is believed to have originated from the following scenario: during RFI activities in 1994, the soil layer beneath the asphalt pad was observed to be saturated. The water was contaminated with plutonium-239 from shaft 2-M. Water flowed down the annular spacing between the corehole CH-2 casing and the borehole (the casing was 2 in. in diameter). The corehole was reamed to a diameter of 6.5 in. Downward flow in the annular spacing between the casing and corehole may have occurred given saturated soil conditions and the open space or loose backfill in the large annular spacing. Water entered the corehole CH-2 casing through the 20-ft slotted section at the bottom of the casing. The corehole CH-2 casing was removed, and the corehole was grouted in 1998 (LANL 2007, 098492).

6.3.2 Relationship to Other SWMUs and AOCs

SWMU 49-001(c) consists of a row of shafts known as Area 2A and is located adjacent to the west fence line of SWMU 49-001(b). SWMU 49-001(d) consists of an area of experimental shafts known as Area 2B and is located directly south of SWMU 49-001(b). SWMU 49-001(g) is an area consisting of soil contamination located to the north of SWMUs 49-001(b) and 49-001(c), resulting from the transport of surface and near-surface radionuclide contamination associated with the release from shaft 2-M in SWMU 49-001(b).

The overland corridors associated with MDA AB extend from the southwest corner of MDA AB to the northeast corner of Area 5 (Figure 1.1-2 and Figure 3.1-6).

6.3.3 Summary of Previous Investigations

During the initial surface soil investigation at Area 2 in 1987, 45 samples were collected for radionuclide analyses (Soholt 1990, 007510). Results showed concentrations of radionuclides to the south and west of the former asphalt pad at or slightly above background. Several sampling locations immediately adjacent to the former Area 2 asphalt pad showed activities of plutonium-238, plutonium-239/240, and americium-241 above background. Later sampling, including the 1987 study and the 1991 sampling effort described below, confirmed elevated levels of these radionuclides above background near the northeast corner of the former asphalt pad. As part of the 1987 survey, 49 vegetation samples were collected from 20 locations around Area 2 (Soholt 1990, 007510); results indicated the presence of americium-241, plutonium-238, plutonium-239, cesium-137, total uranium, lead, and beryllium (LANL 1992, 007670, pp. 7-23–7-44). An additional 20 soil samples were collected from the area northeast of the former Area 2 asphalt pad in September 1987 (LANL 1992, 007670, p. 7-37). Radionuclide activities at concentrations above background in these samples included gross-alpha activity and plutonium-239/240. Beryllium was also measured at a concentration above background in one sample.

In March 1991, 12 samples of pocket gopher soil diggings were collected from the northeast corner of the former Area 2 asphalt pad and analyzed for radionuclides. Plutonium-238, plutonium-239/240, and americium-241 were detected at activities of 24 pCi/g, 43 pCi/g, and 38 pCi/g, respectively. Gopher diggings were resampled at the same location in April 1991. Elevated gross-alpha activity (1200 pCi/g) was noted; however, isotopic analyses did not correlate with the earlier March sampling event (LANL 1992, 007670). Additional analyses did not detect VOCs, SVOCs, or polychlorinated biphenyls (PCBs).

In general, the 1987 and 1991 studies indicated that the majority of the elevated radionuclide levels with respect to background in surface soil at Area 2 were concentrated in the northeast corner of the site. The available information also indicated these radionuclides appeared to be associated with the excavation of contaminated soil beneath and next to the asphalt pad because of gopher activity (LANL 1992, 007670, p. 7-40).

RFI activities were conducted at Area 2 [SWMU 49-001(b)] from 1993 to 1998. During the 1993 RFI, 34 surface samples (0.0 to 0.5 ft bgs) were collected around the asphalt pad and in the drainage northeast of Area 2, SWMU 49-001(b). To establish background concentrations for the area, another nine samples were collected from areas with known or possible contamination and submitted for analysis of TAL metals and radionuclides (LANL 1999, 070349, p. 9). Phase I RFI surface-sampling data are screening-level data and are presented in Appendix B of the HIR (LANL 2007, 098492). Phase I RFI surface-sampling data showed cadmium and uranium detected above BVs and plutonium-239/240, radium-226, and thorium-232 activities detected above BVs/FVs.

During the 1994 RFI, a radiological field screening of surface soil in Area 2, SWMU 49-001(b), was performed using a Violinist III field instrument for detection of low-energy radiation. Soil was screened for plutonium-238, americium-241, and cesium-137. Field-screening results were compared with site background concentrations (LANL 1999, 070349, p. 14). In 1994, seven RFI boreholes (four 10-ft boreholes, two 150-ft boreholes, and one 700-ft borehole) were drilled at locations within and near the asphalt pad at Area 2 (LANL 1999, 070349). Borehole location 49-02901 was drilled to a depth of 700 ft with a recovery to 692 ft. The primary objective of borehole location 49-02901 was to evaluate the potential contaminant pathways for the near-surface and the vadose zone to a depth of at least 700 ft (across the potential water-perching Tshirege-Otowi contact) (LANL 2007, 098492). Phase I RFI subsurface-sampling data are screening-level data and are presented in Appendix B of the HIR (LANL 2007, 098492). Phase I RFI subsurface-sampling data showed barium, beryllium, cadmium, chromium, and lead detected above BVs and americium-241, cesium-137, plutonium-238, plutonium-239, plutonium-240, and tritium detected in subsurface soil and rock samples. The majority of the original 1994

sampling data for samples submitted for radiological analyses were rejected because of various laboratory analytical and reporting problems (LANL 1999, 070349, p. 17).

In 1998, the decision was made to reanalyze samples from seven of the original cores collected from borehole locations 49-02901, 49-02902, 49-02903, 49-02904, 49-02905, 49-02906, and 49-02907. The resampling included the collection of a sample as close as possible to each of the original sampling intervals. Each of the 50 samples collected from the 150- and 700-ft boreholes were analyzed for isotopic plutonium, isotopic or total uranium, and americium-241. The eight samples collected from the 10-ft boreholes were analyzed for one or more of the isotopic radionuclides. Four of the samples were also analyzed for inorganic chemicals. No inorganic chemicals were detected above BVs in the 1998 resampled core. Radionuclide activities detected above BVs/FVs, in the 1998 resampled (subsurface) core included americium-241, plutonium-238, and plutonium-239/240 in two, five, and two samples, respectively.

In 1998, a low-energy gamma detection probe was used to conduct a radiological field-screening survey of Area 2, SWMU 49-001(b); Area 12, AOC 49-008(d); and the drainage following the road to the south and stretching into the entrance of Water Canyon to the north. This survey was performed to determine potential release and/or redistribution of radionuclides within and around Area 2, SWMU 49-001(b) (LANL 2007, 098492). Results of this survey identified two locations of elevated gamma activity: one at the western side of the former Area 2 asphalt pad and one in the northeast drainage area (LANL 2007, 098492).

In March 1998, a shallow subsurface screening investigation was conducted beneath the asphalt pad at MDA AB (LANL 1999, 070349, p. 14). The investigation was undertaken in preparation for possible earth-moving activities associated with the removal of the asphalt. A total of 29 shallow borings were advanced beneath the asphalt pad. Based on radiological field-screening results, 20 soil samples were collected and analyzed from the 29 shallow borings. During the field investigation, the locations of the concrete caps (if present) covering the shot shafts were located beneath the asphalt pad to create a reference grid of the area (LANL 2007, 098492).

In May 1998, soil samples were collected beneath the Area 2 asphalt pad for a tritium screening analyses. A total of 28 samples were collected from locations above each shaft and at shallow borehole locations on the pad. In June 1998, three locations were sampled and field-screened for HE around shaft 2B-H, directly beneath the cement cap. The samples were collected from 2 to 4 in. bgs depending on the thickness of the asphalt at the surface (LANL 2007, 098492).

In 1998, a stabilization plan was prepared for implementing interim measure (IM) activities and best management practices at Areas 2, 2A, and 2B and SWMU 49-001(g) (LANL 1998, 059166). These activities were primarily designed to stabilize contamination beneath the asphalt cap and prevent further releases associated with moisture infiltration or biological intrusion. The IM activities were implemented from August 1998 to February 1999. IM activities included plugging and abandoning CH-2 and the two 150-ft RFI boreholes (locations 49-02906 and 49-02907), removing the existing asphalt cap, regrading the site with crushed tuff, placing a topsoil cover over the site, seeding the topsoil with shallow-rooting grasses, installing erosion controls and biological intrusion barriers, and replacing the security fence around the site (LANL 1999, 063919, p. 1). The removed asphalt was disposed of at the Laboratory's low-level radioactive waste disposal facility, MDA G, at TA-54 (LANL 1999, 063919, p. 6).

During the IM activities performed in 1998, 13 shallow boreholes were drilled into tuff along the western and southern perimeter of MDA AB to provide information on the subsurface stratigraphy. A total of 48 samples were collected from these 13 boreholes and submitted for laboratory analyses of inorganic chemicals, radionuclides, and percent moisture. The IM involved the removal of the asphalt pad within

Area 2. Upon removal, composite samples of asphalt were collected from each of the four corners and from the center of the pad location and were submitted for laboratory analyses of inorganic chemicals and radionuclides. Surface soil samples were collected from the soil immediately below the asphalt pad at each shaft location and from six additional locations for a total of 28 samples. These samples were analyzed for tritium and soil moisture (LANL 1999, 063918; LANL 1999, 063919; LANL 1999, 063920). Results of the screening analyses indicated the presence of tritium below the asphalt (LANL 2007, 098492).

Three locations were sampled around shaft 2B-H (LANL 1999, 070349, p. 17). HE spot tests were conducted at each location and showed no detectable HE. Soil samples were subsequently collected from between 2 and 4 in. bgs, depending on the thickness of the concrete at the surface, and submitted to a fixed laboratory for analyses. These sampling locations were selected based on the historical information discussed in the RFI work plan (LANL 1992, 007670) concerning the potential surficial release of HE (LANL 1999, 070349, p. 17). This activity was conducted specifically to support the IM but also contributed useful information about site conditions. HE was not detected (LANL 1999, 070349, p. 14).

Following the 1998 removal of the asphalt pad and installation of the ET cover at Area 2, a moisture-monitoring system was installed to evaluate moisture content and relative changes within and beneath the new cover material. In February 2000, three shallow neutron-logging access tubes were installed through the ET cover, each to a depth of 15.0 ft bgs. Four time-domain reflectometry (TDR) probes were also installed in the ET cover at two depths within two locations (0.5 ft and 6.0 ft bgs at one location and 0.5 ft and 10.0 ft bgs at the second location) (LANL 2005, 092389). The TDR probes collect measurements every 12 h to an automated data logger. The four neutron-logging access tubes were monitored monthly until 2003 when NMED approved bimonthly monitoring (LANL 2005, 092389). Additionally, eight neutron access holes surrounding Area 2 were monitored bimonthly (monthly until the first quarter of fiscal year 2002) for moisture content. Six additional access holes located across the TA-49 site, where bimonthly monitoring began in the fourth quarter of 2003, provided a more comprehensive data set describing moisture trends across TA-49 (LANL 2005, 092389). Moisture monitoring at TA-49 was suspended after the last monitoring event in November 2005 to address NES operational requirements and has not resumed (LANL 2007, 098492). Details on the neutron access holes, TDR probes, the cover, and the gopher barrier boundary are provided in the HIR (LANL 2007, 098492).

6.3.4 Site Contamination

6.3.4.1 Soil, Rock, and Sediment Sampling

Based on previous investigation results, further characterization was required to assess potential contamination at SWMU 49-001(b). Because SWMUs 49-001(b), 49-001(c), and 49-001(d) are next to each other, and SWMU 49-001(g) is associated with releases from SWMUs 49-001(b), 49-001(c), and 49-001(d), these four SWMUs were investigated collectively during the 2009–2010 investigation. The following activities were completed as part of the 2009−2010 investigation.

- A total of 104 samples were collected from 53 locations at SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g) and the overland corridor associated with SWMUs 49-001(b), 49-001(c), and 49-001(d). At all but 2 locations, samples were collected at the surface (0.0 to 0.5 ft bgs) and from the subsurface (0.5 to 1.5 ft bgs). At 1 location, a sample was collected only at the surface (0.0 to 0.5 ft bgs), and at 1 location a sample was collected only from the subsurface (0.5 to 1.5 ft bgs). All samples were analyzed at off-site fixed laboratories for TAL metals, americium-241, gamma-emitting radionuclides, isotopic plutonium, and isotopic uranium. Sixteen samples were also analyzed for strontium-90.

- A total of 12 samples were collected from 4 boreholes around the perimeter of SWMUs 49-001(b), 49-001(c), and 49-001(d). Samples were collected from 4 depth intervals at each borehole over the range of 8.0 to 130.0 ft bgs. All samples were analyzed at off-site fixed laboratories for TAL metals, cyanide, perchlorate, explosive compounds, SVOCs, VOCs, americium-241, isotopic plutonium, isotopic uranium, and tritium.

The 2009–2010 sampling locations at SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g) are shown on Plate 8 and sampling locations from the overland corridor associated with SWMUs 49-001(b), 49-001(c), and 49-001(d) are shown on Plate 5. Table 6.3-1 presents the samples collected and analyses requested for SWMU 49-001(b), 49-001(c), 49-001(d), and 49-001(g) and the associated overland corridor. The geodetic coordinates of sampling locations are presented in Appendix C.

6.3.4.2 Soil, Rock, and Sediment Field-Screening Results

Organic vapors were not detected above ambient air during headspace (PID) screening of samples at MDA AB. No radiological-screening results exceeded twice the daily site background levels. Field-screening results are presented in Table 3.1-2. There were no changes to sampling or other activities as a result of health- and safety-based field-screening results.

Two surface samples exceeded the gross-alpha screening threshold and were collected and submitted for appropriate laboratory analyses. Eight additional step-out surface and shallow subsurface screening samples from four locations were collected and screened for gross-alpha and -beta analysis but activities did not exceed screening thresholds and were not submitted for laboratory analysis. The gross-alpha and -beta screening results that guided additional sampling are presented in Tables D-7 through D-15 in Appendix D.

No samples collected from the overland corridor associated with SWMUs 49-001(b), 49-001(c), and 49-001(d) exceeded the gross-alpha or -beta screening thresholds. The gross-alpha and -beta screening results that guided additional sampling are presented in Tables D-34 through D-38 in Appendix D.

6.3.4.3 Soil, Rock, and Sediment Sampling Analytical Results

Decision-level data at SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g) consist of results from 179 samples (119 soil and 60 tuff) collected from 67 locations.

Inorganic Chemicals

A total of 120 samples (108 soil and 12 tuff) were collected at SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g) and analyzed for TAL metals. Twelve tuff samples were also analyzed for cyanide and perchlorate. Table 6.3-2 presents the inorganic chemicals above BVs and detected inorganic chemicals with no BVs. Plates 9 and 6 show the spatial distribution of inorganic chemicals detected or detected above BVs at SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g) and in the overland corridor associated with SWMUs 49-001(b), 49-001(c), and 49-001(d), respectively.

Arsenic was detected above the Qbt 2,3,4 BV (2.79 mg/kg) in one sample at a concentration of 4.3 mg/kg. The Gehan and quantile tests indicated site concentrations of arsenic in tuff are not statistically different from background (Figure H-29 and Table H-3). Arsenic is not a COPC.

Barium was detected above the Qbt 2,3,4 BV (46 mg/kg) in one sample at a concentration of 86 mg/kg. The Gehan and quantile tests indicated site concentrations of barium in tuff are not statistically different from background (Figure H-30 and Table H-3). Barium is not a COPC.

Calcium was detected above the soil BV (6120 mg/kg) in three samples with a maximum concentration of 10300 mg/kg. The Gehan and quantile tests indicated site concentrations of calcium in soil are not statistically different from background (Figure H-31 and Table H-4). Calcium is not a COPC.

Cobalt was detected above the soil BV (8.64 mg/kg) in seven samples with a maximum concentration of 14.1 mg/kg. The Gehan and quantile tests indicated site concentrations of cobalt in soil are statistically different from background (Figure H-32 and Table H-4). Cobalt is retained as a COPC.

Copper was detected above the soil BV (14.7 mg/kg) in two samples with a maximum concentration of 15.7 mg/kg. The quantile and slippage tests indicated site concentrations of copper in soil are not statistically different from background (Figure H-33 and Table H-4). Copper is not a COPC.

Cyanide was not detected above the Qbt 2,3,4 BV (0.5 mg/kg) but had DLs (0.51 mg/kg to 0.63 mg/kg) above the BV in five samples. The DLs were only 0.01 mg/kg to 0.13 mg/kg above the BV. Cyanide was not detected with DLs below BV in the other 5 samples. Cyanide is not a COPC.

Lead was detected above the soil and Qbt 2,3,4 BVs (22.3 mg/kg and 11.2 mg/kg) in two soil samples and two tuff samples with a maximum concentration of 69 mg/kg. The Gehan and quantile tests indicated site concentrations of lead in soil are not statistically different from background (Figure H-34 and Table H-4). The Gehan and quantile tests indicated site concentrations of lead in tuff are not statistically different from background (Figure H-35 and Table H-3). Lead is not a COPC.

Manganese was detected above the soil and Qbt 2,3,4 BVs (671 mg/kg and 482 mg/kg) in two soil samples and one tuff sample with a maximum concentration of 1010 mg/kg. The Gehan and quantile tests indicated site concentrations of manganese in soil are not statistically different from background (Figure H-36 and Table H-4). The Gehan and quantile tests indicated site concentrations of manganese in tuff are not statistically different from background (Figure H-37 and Table H-3). Manganese is not a COPC.

Selenium was detected above the Qbt 2,3,4 BV (0.3 mg/kg) in 12 samples with a maximum concentration of 1.8 mg/kg and had a DL (1.7 mg/kg) above the soil BV (1.52 mg/kg) in 1 sample. The Gehan and quantile tests indicated site concentrations of selenium in soil are statistically different from background (Figure H-38 and Table H-4). Selenium is retained as a COPC.

Thallium was not detected above the soil and Qbt 2,3,4 BVs (0.73 mg/kg and 1.1 mg/kg) but had DLs (1 mg/kg to 1.2 mg/kg) above BVs in 2 soil samples and 1 tuff samples. The Gehan and quantile tests indicated site concentrations of thallium in soil are not statistically different from background (Figure H-39 and Table H-4). The DL above the Qbt 2,3,4 BV (1.2 mg/kg) was only 0.1 mg/kg above BV and 0.5 mg/kg below the maximum Qbt 2,3,4 background concentration (1.7 mg/kg). Thallium was not detected with DLs below BV in the other 11 tuff samples. Thallium is not a COPC.

Vanadium was detected above the soil BV (39.6 mg/kg) in one sample at a concentration of 40.2 mg/kg. The Gehan and slippage tests indicated site concentrations of vanadium in soil are not statistically different from background (Figure H-40 and Table H-4). Vanadium is not a COPC.

Zinc was detected above the soil BV (48.8 mg/kg) in two samples with a maximum concentration of 85.2 mg/kg. The Gehan and quantile tests indicated site concentrations of zinc in soil are not statistically different from background (Figure H-41 and Table H-4). Zinc is not a COPC.

Organic Chemicals

A total of 12 tuff samples were collected at SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g) and analyzed for explosive compounds, SVOCs, and VOCs. Table 6.2-3 summarizes the analytical results for detected organic chemicals. Plate 10 shows the spatial distribution of detected organic chemicals.

Organic chemicals detected at SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g) include bis(2-ethylhexyl)phthalate. The detected organic chemical is retained as a COPC.

Radionuclides

A total of 163 samples (106 soil and 57 tuff) were collected at SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g) and analyzed for isotopic plutonium, 172 samples (114 soil and 58 tuff) for isotopic uranium, 165 samples (108 soil and 57 tuff) for americium-241, 12 tuff samples for tritium, and 16 soil samples for strontium-90. Table 6.3-4 presents the radionuclides detected or detected above BVs/FVs. Plates 11 and 7 show the spatial distribution of detected radionuclides at SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g) and in the overland corridor associated with SWMUs 49-001(b), 49-001(c), 49-001(d), respectively.

Americium-241 was detected above the soil FV (0.013 pCi/g) in 12 samples and was detected in 5 tuff samples with a maximum activity of 4.91 pCi/g. Americium-241 is retained as a COPC.

Plutonium-238 was detected above the soil FV (0.023 pCi/g) in two samples and was detected in six tuff samples with a maximum activity of 1.41 pCi/g. Plutonium-238 is retained as a COPC.

Plutonium-239/240 was detected above the soil FV (0.054 pCi/g) in 15 samples and was detected in 1 tuff sample with a maximum activity of 73.5 pCi/g. Plutonium-239/240 is retained as a COPC.

Tritium was detected in four samples with a maximum activity of 2.12 pCi/g. Tritium is retained as a COPC.

Uranium-238 was detected above the soil BV (2.29 pCi/g) in one sample at an activity of 4.98 pCi/g. Uranium-238 is retained as a COPC.

6.3.4.4 Nature and Extent of Contamination

The nature and extent of inorganic, organic, and radionuclide COPCs at SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g) were evaluated using the process described in section 5.2 and are discussed below. As presented in the approved investigation work plan (LANL 2008, 102691; NMED 2008, 100464), four vertical boreholes (locations 49-610942, 49-610943, 49-610944, and 49-610945) were drilled around the perimeter of MDA AB. One of the objectives of drilling the perimeter boreholes was to characterize the lateral and vertical extent of contamination beneath MDA AB and to determine the potential for off-site releases of VOCs at levels that would require additional characterization.

Inorganic Chemicals

Inorganic COPCs at SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g) include cobalt and selenium.

Cobalt was detected above the soil BV in seven samples with a maximum concentration of 14.1 mg/kg. Concentrations increased with depth at locations 49-610074, 49-610075, 49-610094, 49-610095, and 49-610139 and decreased with depth at locations 49-610079 and 49-610091. Concentrations increased laterally at locations 49-610095 and 49-610139. Cobalt was detected below BVs at all depths in the

perimeter boreholes at locations 49-610942, 49-610943, 49-610944, and 49-610945. Cobalt was detected above BV sporadically across the site, with all detections at locations outside the footprint of SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g). The spatial distribution of cobalt does not appear indicative of contamination from a release. The residential and industrial SSLs were approximately 1.6 times and 22 times the maximum concentration. All detections of cobalt where vertical extent is not defined were in the depth interval 0.5 to 1.5 ft bgs, and increasing concentrations at greater depths would not affect the risk to industrial workers. The HQ for cobalt under the industrial scenario is 0.0195 (Appendix I, Table I-4.2-7). Further sampling for extent of cobalt is not warranted.

Selenium was detected above Qbt 2,3,4 BV in 12 tuff samples with a maximum concentration of 1.8 mg/kg and had a DL (1.7 mg/kg) above the soil BV in 1 sample. Concentrations did not change substantially with depth (0.8 mg/kg, 0.1 mg/kg, 0.12 mg/kg, and 0.1 mg/kg, respectively) in the perimeter boreholes at locations 49-610942, 49-610943, 49-610944, and 49-610945. Concentrations increased laterally at location 49-610942. The residential SSL was approximately 217 times the maximum concentration and 230 times the maximum DL. Further sampling for extent of selenium is not warranted.

Organic Chemicals

Organic COPCs at SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g) include bis(2-ethylhexyl)phthalate.

Bis(2-ethylhexyl)phthalate was detected in four samples with a maximum concentration of 0.28 mg/kg. Concentrations decreased with depth at all locations. In accordance with the approved work plan (LANL 2008, 102691; NMED 2008, 100464), samples for SVOC analysis were collected only from perimeter boreholes, so lateral extent was not evaluated. The residential SSL was approximately 1360 times the maximum concentration. Further sampling for extent of bis(2-ethylhexyl)phthalate is not warranted.

Radionuclides

Radionuclide COPCs at SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g) include americium-241, plutonium-238, plutonium-239/240, tritium, and uranium-238.

Americium-241 was detected above the soil FV in 12 samples and was detected in 5 tuff samples with a maximum activity of 4.91 pCi/g. Activities increased with depth at locations 49-610077, 49-610151, and 49-610894; did not change substantially with depth (0.006 pCi/g and 0.038 pCi/g) at locations 49-02901 and 49-610890; and decreased with depth at location 49-02906, 49-02907, 49-610133, 49-610891, 49-610892, 49-610895, 49-610896, and 49-610897. Americium-241 was not detected in the perimeter boreholes at locations 49-610942, 49-610943, 49-610944, and 49-610945. Activities decreased laterally. The residential SAL was approximately 17 times the maximum activity. The lateral extent of americium-241 is defined, and further sampling for vertical extent is not warranted.

Plutonium-238 was detected above the soil FV in two samples and was detected in six tuff samples with a maximum activity of 1.41 pCi/g. Activities increased with depth at locations 49-610151 and 49-610890, decreased with depth at location 49-02901, did not change substantially with depth (0.167 mg/kg) at location 49-02906, and decreased laterally. Plutonium-238 was not detected in the perimeter boreholes locations 49-610942, 49-610943, 49-610944, and 49-610945. The residential SAL was approximately 60 times the maximum activity. The lateral extent of plutonium-238 is defined, and further sampling for vertical extent is not warranted.

Plutonium-239/240 was detected above the soil FV in 15 samples and was detected in 1 tuff sample with a maximum activity of 73.5 pCi/g. Activities increased with depth at locations 49-610077, 49-610131, and 49-610151; did not change substantially with depth (0.012 pCi/g and 0.64 pCi/g) at locations 49-610140 and 49-610890; and decreased with depth at location 49-02906, 49-610133, 49-610891, 49-610892, 49-610894, 49-610895, and 49-610896. Plutonium-239/240 was not detected in the perimeter boreholes locations 49-610942, 49-610943, 49-610944, and 49-610945. Activities decreased laterally. Plutonium-239/240 was detected above FV sporadically across the site, with most detections at locations outside the footprint of SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g). The spatial distribution of plutonium-239/240 does not appear indicative of contamination from a release. The residential and industrial SSLs were approximately 1.1 and 16 times the maximum activity, respectively. All detections of plutonium-239/240 where vertical extent is not defined were in the depth interval 0.5 to 1.5 ft bgs, and increasing activities at greater depths would not affect the dose to industrial workers. The estimated dose due to plutonium-239/240 under the industrial scenario is 0.0821 mrem/yr (Appendix I, Table I-4.2-8). The lateral extent of plutonium-239 is defined, and further sampling for vertical extent is not warranted.

Tritium was detected in four samples with a maximum activity of 2.12 pCi/g. Samples for tritium analysis were collected only from perimeter boreholes, so lateral extent was not evaluated. Tritium was either not detected or activities decreased with depth in the perimeter boreholes locations 49-610942, 49-610943, 49-610944, and 49-610945. The residential SAL was approximately 800 times the maximum activity. The vertical extent of tritium is defined, and further sampling for lateral extent is not warranted.

Uranium-238 was detected above the soil BV (2.29 pCi/g) in one sample at an activity of 4.98 pCi/g. Activities deceased with depth and decreased laterally. Uranium-238 was detected below BV in the perimeter boreholes locations 49-610942, 49-610943, 49-610944, and 49-610945. The lateral and vertical extent of uranium-238 is defined.

6.3.4.5 Subsurface Vapor Sampling and Results

Nine pore-gas samples were collected from four boreholes and analyzed for VOCs and tritium. Table 6.3-5 presents the pore gas samples collected and analyses requested for SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g).

Table 6.3-6 summarizes the analytical results for detected VOCs in pore gas. Plate 10 shows the spatial distribution of detected VOCs. Table 6.3-7 presents the tritium detected in pore gas. Plate 11 shows the spatial distribution of detected tritium.

VOCs detected in pore gas at SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g) include acetone; benzene; 2-butanone; carbon disulfide; chloromethane; dichlorodifluoromethane; ethylbenzene; 4-ethyltoluene; styrene; toluene; 1,2,4-trimethylbenzene; 1,3,5-trimethylbenzene; total xylenes; 1,2 xylene; and 1,3-xylene+1,4-xylene. The detected VOCs are retained as COPCs.

Tritium was detected in 6 samples with a maximum activity of 17,380 pCi/L. Tritium is retained as a COPC.

Nature and Extent of Contamination in Subsurface Pore Gas

The approved work plan (LANL 2008, 102691; NMED 2008, 100646) prescribed the collection of pore-gas samples from intervals corresponding to the base of formation Qbt 4, at TD of the closest experimental shaft and from the TD of each borehole. If VOCs were detected in the vapor-phase sample at concentrations greater than 10% of the pore-gas screening levels presented in section 4.5 or if tritium was detected in the vapor-phase sample at a concentration greater than the groundwater MCL (20,000 pCi/L), the borehole would be completed as a vapor-monitoring well.

Screening was performed for each of the VOCs detected in pore-gas samples collected from SWMUs 49-001(a), 49-001(b), 49-001(c), 49-001(d), 49-001(e), and 49-001(f) and AOCs 49-008(c) and 49-008(d) using the maximum detected concentrations from all sites. These results show that the SVs are below 0.1 in all cases, indicating that VOCs in subsurface pore gas are not a potential source of groundwater contamination (Table 4.5-2).

The maximum detected tritium activity at SWMUs 49-001(b), 49-001(c), and 49-001(d) is below the groundwater MCL (20,000 pCi/L). Therefore, tritium is not a potential source of groundwater contamination.

The concentrations of all VOCs were less the 10% of the pore-gas screening level and the maximum tritium activity was less than the MCL. Therefore, the boreholes at SWMUs 49-001(b), 49-001(c), and 49-001(d) were not completed as vapor-monitoring wells.

6.3.5 Summary of Human Health Risk Screening

Industrial Scenario

No carcinogenic COPCs were identified in the 0.0 to 1.0-ft depth interval. The industrial HI is 0.02, which is less than the NMED target HI of 1 (NMED 2015, 600915). The total dose is 0.1 mrem/yr, which is less than the target dose of 25 mrem/yr as authorized by DOE Order 458.1.

Residential Scenario

The total excess cancer risk for the residential scenario is 1×10^{-5}, which equivalent to the NMED target risk level of 1×10^{-5} (NMED 2015, 600915). The residential HI is 0.8, which is less than the NMED target HI of 1 (NMED 2015, 600915). The total dose is 2 mrem/yr, which is less than the target dose of 25 mrem/yr as authorized by DOE Order 458.1.

Based on the risk-screening assessment results, no potential unacceptable risks or doses exist for the industrial and residential scenarios at SWMUs 49-001(b,c,d,g).

6.3.6 Summary of Ecological Risk Screening

Based on evaluations of the minimum ESLs, HI analyses, potential effects to populations (individuals for T&E species), LOAEL analyses, the relationship of detected concentrations and screening levels to background concentrations, and COPECs without ESLs, no potential unacceptable ecological risks to the earthworm, plant, American robin, American kestrel, pocket gopher, deer mouse, montane shrew, desert cottontail, red fox, and Mexican spotted owl exist at SWMUs 49-001(b,c,d,g).

6.4 SWMU 49-001(c), Experimental Shafts

6.4.1 Site Description and Operational History

SWMU 49-001(c), known as Area 2A, is a row of experimental shafts located within the northeast corner of the MDA AB NES boundary (Figure 6.3-1). Area 2A is approximately 100 ft × 30 ft in area. Six experimental shafts were drilled in this area in a single row, spaced 25 ft apart, after Area 2 was closed in response to the contamination release at shaft 2-M [SWMU 49-001(g)] described above. Four shafts in Area 2A were used for experiments involving radioactive materials. Isotopic plutonium was used in three of these shafts and uranium-235 was used in one shaft. The shafts used for shots with radioactive materials were 57-ft and 58-ft-deep. Two shafts, both 58 ft deep, were backfilled without being

used for shots. Lead typically was present in the experimental packages, and small amounts of beryllium may have been used in some experiments (LANL 2007, 098492).

6.4.2 Relationship to Other SWMUs and AOCs

SWMU 49-001(b) consists of an area of experimental shafts known as Area 2 and is located next to the east fence line of SWMU 49-001(c). SWMU 49-001(d) consists of an area of experimental shafts known as Area 2B and is located south of SWMU 49-001(c). SWMU 49-001(g) is an area consisting soil contamination located to the north of SWMUs 49-001(b) and 49-001(c), resulting from the transport of surface and near-surface radionuclide contamination associated with the release from shaft 2-M in SWMU 49-001(b).

The overland corridors associated with MDA AB extend from the southwest corner of MDA AB to the northeast corner of Area 5 (Figures 1.1-2 and 2.1-6).

6.4.3 Summary of Previous Investigations

During the 1994 RFI, six surface samples (0.0 to 0.5 ft bgs) were collected from SWMU 49-001(c) and submitted for analysis of gamma-emitting radionuclides, gross alpha, gross beta, isotopic plutonium, and TAL metals. Data from the 1994 Phase I RFI are screening-level data and are presented in Appendix B of the HIR (LANL 2007, 098492). Phase I RFI data showed total uranium as the only inorganic chemical detected above the soil BV. Radionuclides detected or detected above BVs/FVs in Phase I RFI samples were plutonium-239/249, potassium-40, radium-226, and thorium-232.

6.4.4 Site Contamination

6.4.4.1 Soil, Rock, and Sediment Sampling

As described in section 6.3.4, because of the proximity of SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g), the four sites were investigated collectively. Section 6.3.4.1 discusses the sampling performed at SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g).

6.4.4.2 Soil, Rock, and Sediment Field-Screening Results

As described in section 6.3.4, because of the proximity of SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g), the four sites were investigated collectively. Section 6.3.4.2 discusses the field screening results for SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g).

6.4.4.3 Soil, Rock, and Sediment Sampling Analytical Results

As described in section 6.3.4, because of the proximity of SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g), the four sites were investigated collectively. Section 6.3.4.3 presents the evaluation of COPCs for SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g).

6.4.4.4 Nature and Extent of Contamination

As described in section 6.3.4, because of the proximity of SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g), the four sites were investigated collectively. Section 6.3.4.4 discusses the nature and extent of contamination for SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g).

6.4.5 Summary of Human Health Risk Screening

The human health risk screening for SWMU 49-001(c) was conducted in conjunction with SWMUs 49-001(b), 49-001(d), and 49-001(g), and the results are presented in section 6.3.5.

6.4.6 Summary of Ecological Risk Screening

The ecological risk screening for SWMU 49-001(c) was conducted in conjunction with SWMUs 49-001(b), 49-001(d), and 49-001(g), and the results are presented in section 6.3.6.

6.5 SWMU 49-001(d), Experimental Shafts

6.5.1 Site Description and Operational History

SWMU 49-001(d), known as Area 2B, is an area consisting of experimental shafts located in the northeast corner of the MDA AB NES boundary (Figure 6.3-1). Area 2B is approximately 200 ft ×100 ft in area. Shafts at Area 2B were aligned on a staggered grid with 11 shafts installed and another 15 proposed but were never drilled. Six shafts were used for experiments with radioactive materials. Isotopic plutonium was used as the principal material in five of these shafts, which ranged from 57 ft to 58 ft-deep, and uranium-235 was used in the other shaft, which was 78 ft deep. One 60-ft-deep shaft was used as a gas-expansion hole, and four other shafts (three 58 ft deep and one 78 ft deep) were backfilled without being used. Two pipe dump holes were installed approximately 100 ft south of the shaft area. Substantial amounts of lead were typically present in the experimental packages, and small amounts of beryllium may have been used in some experiments (LANL 2007, 098492).

6.5.2 Relationship to Other SWMUs and AOCs

SWMUs 49-001(b) and 49-001(c) consist of an area of experimental shafts known as Area 2 and Area 2A, respectively, and are located directly north of SWMU 49-001(d). SWMU 49-001(g) is an area consisting soil contamination located to the north of SWMUs 49-001(b) and 49-001(c), resulting from the transport of surface and near-surface radionuclide contamination associated with the release from shaft 2-M in SWMU 49-001(b).

The overland corridors associated with MDA AB extend from the southwest corner of MDA AB to the northeast corner of Area 5 (Figures 1.1-2 and 2.1-6).

6.5.3 Summary of Previous Investigations

During the 1994 RFI, six surface samples (0.0 to 0.5 ft bgs) were collected from SWMU 49-001(d) and submitted for analysis of gamma-emitting radionuclides, gross alpha, gross beta, isotopic plutonium, and TAL metals. Data from the 1994 Phase I RFI are screening-level data and are presented in Appendix B of the HIR (LANL 2007, 098492). Phase I RFI data showed no inorganic chemicals detected above BVs. Radionuclides detected or detected above BVs/FVs in Phase I RFI samples were plutonium-239/249, radium-226, and thorium-232.

6.5.4 Site Contamination

6.5.4.1 Soil, Rock, and Sediment Sampling

As described in section 6.3.4, because of the proximity of SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g), the four sites were investigated collectively. Section 6.3.4.1 discusses the sampling performed at SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g).

6.5.4.2 Soil, Rock, and Sediment Field-Screening Results

As described in section 6.3.4, because of the proximity of SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g), the four sites were investigated collectively. Section 6.3.4.2 discusses the field-screening results for SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g).

6.5.4.3 Soil, Rock, and Sediment Sampling Analytical Results

As described in section 6.3.4, because of the proximity of SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g), the four sites were investigated collectively. Section 6.3.4.3 presents the evaluation of COPCs for SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g).

6.5.4.4 Nature and Extent of Contamination

As described in section 6.3.4, because of the proximity of SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g), the four sites were investigated collectively. Section 6.3.4.4 discusses the nature and extent of contamination for SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g).

6.5.5 Summary of Human Health Risk Screening

The human health risk screening for SWMU 49-001(d) was conducted in conjunction with SWMUs 49-001(b), 49-001(c), and 49-001(g) and the results are presented in section 6.3.5.

6.5.6 Summary of Ecological Risk Screening

The ecological risk screening for SWMU 49-001(d) was conducted in conjunction with SWMUs 49-001(b), 49-001(c), and 49-001(g) and the results are presented in section 6.3.6.

6.6 SWMU 49-001(e), Experimental Shafts

6.6.1 Site Description and Operational History

SWMU 49-001(e), known as Area 3, consists of experimental shafts located in the southwest corner of the MDA AB NES boundary (Figure 6.6-1). Area 3 is approximately 100 ft long × 100 ft wide. Thirteen shafts, ranging between 57 ft and 142 ft deep, were drilled in a grid-like pattern in a 100 ft × 100 ft area. Seven of the shafts were shot with a tracer, four of the shafts were used for containment shots, and the remaining two shafts were not used and were backfilled (LANL 2007, 098492). Area 3 was used exclusively for developing confinement and sample-recovery techniques used in the other experimental areas.

6.6.2 Relationship to Other SWMUs and AOCs

SWMU 49-001(e) is located within Area 3. SWMU 49-006 and AOCs 49-005(b) and 49-008(a) within Area 5, the former Central Control Area, are located directly northeast of SWMU 49-001(e). Area 5 is located outside the TA-49 NES boundary and is discussed in the investigation report for sites at TA-49 outside the NES boundary (LANL 2010, 109318). SWMU 49-007(b) is located within the Laboratory's HDT area, which houses the HDT training facility building 49-113 and associated HE magazine building 49-114 used by the HDT team for small-scale explosives training exercises. SWMU 49-007(b), the septic system for the HDT area, was approved by EPA for NFA in 2005 (EPA 2005, 088464). The HDT area is located directly north of SWMU 49-001(e) and is discussed in the investigation report for sites at TA-49 outside the NES boundary (LANL 2010, 109318).

The overland corridors associated with Area 3 extend from the northeast corner of Area 3 to the southwest corner of Area 5 (Figure 1.1-2 and Figure 3.1-6).

6.6.3 Summary of Previous Investigations

During the 1987 soil and vegetation radiological-screening survey, 40 surface samples were collected from points on a 25-ft grid centered over the Area 3 shafts; and 45 vegetation samples were collected within and around Area 3 (LANL 1992, 007670). Samples were analyzed for radionuclides and results showed radionuclide activities at or slightly above BVs in use at that time (LANL 1992, 007670, pp. 7-40–7-41). During the 1995 RFI conducted at Area 3, SWMU 49-001(e), 20 surface samples (0.0 to 0.5 ft bgs) were collected on a 25-ft × 25-ft grid centered over the Area 3 shafts. Each sample was field-screened for gross radiation; radiation was not detected above local background. All 20 samples were submitted for analysis of gamma-emitting radionuclides; 10 were submitted for analysis of TAL metals and isotopic plutonium (LANL 2007, 098492). Inorganic chemicals detected above soil BVs included copper, lead, total uranium, and zinc. Copper and lead were each detected above the soil BV in 1 sample. Total uranium was detected above the soil BVs in 10 samples. Zinc was detected above the soil BV in 1 sample. Antimony and cadmium were not detected above soil BVs but had DLs above BVs. No radionuclides were detected or detected above BVs/FVs in the 1995 RFI samples collected from SWMU 49-001(e). Historical sampling locations and detected concentrations are provided on plates and in figures and tables included with this report.

Before the 2009−2010 investigation, no sampling was conducted in the overland corridors.

6.6.4 Site Contamination

6.6.4.1 Soil, Rock, and Sediment Sampling

Based on previous investigation results, further characterization was required to assess potential contamination at SWMU 49-001(e). As a result, the following activities were completed as part of the 2009−2010 investigation.

- A total of 159 samples were collected from 83 locations at SWMU 49-001(e) and the overland corridor associated with SWMU 49-001(e). At all but 7 locations, samples were collected at the surface (0.0 to 0.5 ft bgs) and from the subsurface (0.5 to 1.5 ft bgs). At 5 locations, a sample was collected only at the surface (0.0 to 0.5 ft bgs) and at 2 locations a sample was collected only from the subsurface (0.5 to 1.5 ft bgs). All samples were analyzed at off-site fixed laboratories for gamma-emitting radionuclides; 145 samples for TAL metals, americium-241, isotopic plutonium, and isotopic uranium; 18 samples for strontium-90 and technetium-99; and 15 samples for iodine-129.

- A total of 15 samples were collected from 4 boreholes around the perimeter of SWMU 49-001(e). Samples were collected from 4 depth intervals at 3 boreholes and 3 depth intervals at 1 borehole over the range of 0.5 to 192.0 ft bgs. All samples were analyzed at off-site fixed laboratories for TAL metals, cyanide, perchlorate, explosive compounds, SVOCs, VOCs, americium-241, isotopic plutonium, isotopic uranium, and tritium.

The 2009–2010 sampling locations at SWMU 49-001(e) are shown on Plate 12 and sampling locations from the overland corridor associated with SWMU 49-001(e) are shown on Plate 5. Table 6.6-1 presents the samples collected and analyses requested for SWMU 49-001(e) and the associated overland corridor. The geodetic coordinates of sampling locations are presented in Appendix C.

6.6.4.2 Soil, Rock, and Sediment Field-Screening Results

Organic vapors were not detected at more than 1.7 ppm above ambient air during headspace (PID) screening of samples at SWMU 49-001(e) and the overland corridors. No radiological-screening results exceeded twice the daily site background levels. Field-screening results are presented in Table 3.1-3. There were no changes to sampling or other activities as a result of health- and safety-based field-screening results.

A total of 22 surface and shallow subsurface samples at SWMU 49-001(e) exceeded the gross-alpha and/or -beta screening thresholds, and additional samples were collected and submitted for appropriate laboratory analysis. Additionally, 56 step-out surface and shallow subsurface screening samples from 28 locations were collected and screened for gross-alpha and -beta analysis, but did not exceed screening thresholds and were not submitted for laboratory analysis. The gross-alpha and -beta screening results that guided additional sampling at SWMU 49-001(e) are presented in Tables D-16 through D-21 in Appendix D.

One surface sample collected from the SWMU 49-001(e) corridor exceeded the gross-alpha screening threshold; therefore, an additional 12 corridor samples from 6 locations were submitted for appropriate laboratory analysis. The gross-alpha and -beta screening results that guided additional sampling at SWMU 49-001(e) are presented in Tables D-34 through D-38 in Appendix D.

6.6.4.3 Soil, Rock, and Sediment Sampling Analytical Results

Decision-level data at SWMU 49-001(e) consist of results from 194 samples (142 soil and 52 tuff) collected from 107 locations.

Inorganic Chemicals

A total of 170 samples (126 soil and 44 tuff) were collected at SWMU 49-001(e) and analyzed for TAL metals. Fifteen tuff samples were analyzed for cyanide and perchlorate. Table 6.6-2 presents the inorganic chemicals above BVs and detected inorganic chemicals with no BVs. Plates 13 and 6 show the spatial distribution of inorganic chemicals detected or detected above BVs at SWMU 49-001(e) and in the overland corridor associated with SWMU 49-001(e), respectively.

Aluminum was detected above the Qbt 2,3,4 BV (7340 mg/kg) in 22 samples with a maximum concentration of 24,400 mg/kg. The Gehan and quantile tests indicated site concentrations of aluminum in tuff are statistically different from background (Figure H-42 and Table H-5). Aluminum is retained as a COPC.

Antimony was not detected above the soil and Qbt 2,3,4 BVs (0.83 mg/kg and 0.5 mg/kg) but had DLs (0.54 mg/kg to 5.7 mg/kg) above BVs in 12 soil samples and 3 tuff samples. The quantile and slippage tests indicated site concentrations of antimony in soil are not statistically different from background (Figure H-43 and Table H-6). The quantile and slippage tests indicated site concentrations of antimony in tuff are not statistically different from background (Figure H-44 and Table H-5). Antimony is not a COPC.

Arsenic was detected above the Qbt 2,3,4 BV (2.79 mg/kg) in 31 samples with a maximum concentration of 10.3 mg/kg. The Gehan and quantile tests indicated site concentrations of arsenic in tuff are statistically different from background (Figure H-45 and Table H-5). Arsenic is retained as a COPC.

Barium was detected above the soil and Qbt 2,3,4 BVs (295 mg/kg and 46 mg/kg) in 6 soil samples and 30 tuff samples with a maximum concentration of 654 mg/kg. The quantile and slippage tests indicated site concentrations of barium in soil are not statistically different from background (Figure H-46 and

Table H-6). The Gehan and quantile tests indicated site concentrations of barium in tuff are statistically different from background (Figure H-47 and Table H-5). Barium is retained as a COPC.

Beryllium was detected above the Qbt 2,3,4 BV (1.21 mg/kg) in seven samples with a maximum concentration of 2.3 mg/kg. The Gehan and quantile tests indicated site concentrations of beryllium in tuff are statistically different from background (Figure H-48 and Table H-5). Beryllium is retained as a COPC.

Cadmium was not detected above the soil BV (0.4 mg/kg) but had DLs (0.58 mg/kg to 0.6 mg/kg) above BV in 10 samples. The DLs were only 0.18 mg/kg to 0.2 mg/kg above the BV, below the highest background DL (2 mg/kg), and below or similar to the 3 highest soil background concentrations (0.6 mg/kg, 1.4 mg/kg, and 2.6 mg/kg). Cadmium was not detected or not detected above BVs in the other 160 samples (detected below BVs in 158 samples). Cadmium is not a COPC.

Calcium was detected above the soil and Qbt 2,3,4 BVs (6120 mg/kg and 2200 mg/kg) in 5 soil samples and 16 tuff samples with a maximum concentration of 14,800 mg/kg. The Gehan and quantile tests indicated site concentrations of calcium in soil are not statistically different from background (Figure H-49 and Table H-6). The Gehan and quantile tests indicated site concentrations of calcium in tuff are statistically different from background (Figure H-50 and Table H-5). Calcium is retained as a COPC.

Chromium was detected above the Qbt 2,3,4 BV (7.14 mg/kg) in 28 samples with a maximum concentration of 21.2 mg/kg. The Gehan and quantile tests indicated site concentrations of chromium in tuff are statistically different from background (Figure H-51 and Table H-5). Chromium is retained as a COPC.

Cobalt was detected above the soil and Qbt 2,3,4 BVs (8.64 mg/kg and 3.14 mg/kg) in 13 soil samples and 15 tuff samples with a maximum concentration of 26 mg/kg. The Gehan and quantile tests indicated site concentrations of cobalt in soil are statistically different from background (Figure H-52 and Table H-6). The Gehan and slippage tests indicated site concentrations of cobalt in tuff are statistically different from background (Figure H-53 and Table H-5). Cobalt is retained as a COPC.

Copper was detected above the soil and Qbt 2,3,4 BVs (14.7 mg/kg and 4.66 mg/kg) in 3 soil samples and 22 tuff samples with a maximum concentration of 1780 mg/kg. The quantile and slippage tests indicated site concentrations of copper in soil are not statistically different from background (Figure H-54 and Table H-6). The maximum detected concentration in soil (1780 mg/kg) is substantially above the maximum soil background concentration (16 mg/kg). The Gehan and quantile tests indicated site concentrations of copper in tuff are statistically different from background (Figure H-55 and Table H-5). Copper is retained as a COPC.

Cyanide was not detected above the Qbt 2,3,4 BV (0.5 mg/kg) but had DLs (0.51 mg/kg to 0.58 mg/kg) above the BV in 10 samples. The DLs were only 0.01 mg/kg to 0.08 mg/kg above the BV. Cyanide was not detected or not detected above BVs in the other 5 samples (detected below BV in 1 sample). Cyanide is not a COPC.

Iron was detected above the soil and Qbt 2,3,4 BVs (21,500 mg/kg and 14,500 mg/kg) in six soil samples and nine tuff samples with a maximum concentration of 25,000 mg/kg. The Gehan and quantile tests indicated site concentrations of iron in soil are statistically different from background (Figure H-56 and Table H-6). The Gehan and quantile tests indicated site concentrations of iron in tuff are statistically different from background (Figure H-57 and Table H-5). Iron is retained as a COPC.

Lead was detected above the soil and Qbt 2,3,4 BVs (22.3 mg/kg and 11.2 mg/kg) in 8 soil samples and 23 tuff samples with a maximum concentration of 54.4 mg/kg. The quantile and slippage tests indicated site concentrations of lead in soil are not statistically different from background (Figure H-58 and

Table H-6). The Gehan and slippage tests indicated site concentrations of lead in tuff are statistically different from background (Figure H-59 and Table H-5). Lead is retained as a COPC.

Magnesium was detected above the Qbt 2,3,4 BV (1690 mg/kg) in 20 samples with a maximum concentration of 4110 mg/kg. The Gehan and quantile tests indicated site concentrations of magnesium in tuff are statistically different from background (Figure H-60 and Table H-5). Magnesium is retained as a COPC.

Manganese was detected above the soil BV (671 mg/kg) in 13 samples with a maximum concentration of 2060 mg/kg. The Gehan and quantile tests indicated site concentrations of manganese in soil are statistically different from background (Figure H-61 and Table H-6). Manganese is retained as a COPC.

Mercury was detected above the soil BV (0.1 mg/kg) in 1 sample at a concentration of 0.218 mg/kg. The detected concentration was only 0.118 mg/kg above BV. Mercury was not detected or detected below BVs in the other 167 samples (detected below BVs in 86 samples). Mercury is not a COPC.

Nickel was detected above the soil and Qbt 2,3,4 BVs (15.4 mg/kg and 6.58 mg/kg) in 3 soil samples and 20 tuff samples with a maximum concentration of 17.5 mg/kg. The Gehan and quantile tests indicated site concentrations of nickel in soil are statistically different from background (Figure H-62 and Table H-6). The quantile and slippage tests indicated site concentrations of nickel in tuff are statistically different from background (Figure H-63 and Table H-5). Nickel is retained as a COPC.

Perchlorate was detected in two samples with a maximum concentration of 0.0058 mg/kg. Perchlorate is retained as a COPC.

Selenium was detected above the soil and Qbt 2,3,4 BVs (1.52 mg/kg and 0.3 mg/kg) in 15 soil samples and 39 tuff samples with a maximum concentration of 2.9 mg/kg and had DLs (1.7 mg/kg to 2.8 mg/kg) above BVs in 15 soil samples and 5 tuff samples. The Gehan and quantile tests indicated site concentrations of selenium in soil are statistically different from background (Figure H-64 and Table H-6). Selenium is retained as a COPC.

Sodium was detected above the soil BV (915 mg/kg) in one sample at a concentration of 1270 mg/kg. The Gehan and quantile tests indicated site concentrations of sodium in soil are not statistically different from background (Figure H-65 and Table H-6). Sodium is not a COPC.

Thallium was detected above the soil and Qbt 2,3,4 BVs (0.73 mg/kg and 1.1 mg/kg) in eight soil samples and seven tuff samples with a maximum concentration of 5.3 mg/kg and had DLs (0.79 mg/kg to 1.1 mg/kg) above the soil BV in five samples. The Gehan and quantile tests indicated site concentrations of thallium in soil are statistically different from background (Figure H-66 and Table H-6). The quantile test indicated site concentrations of thallium in tuff are statistically different from background (Figure H-67 and Table H-5). Thallium is retained as a COPC.

Uranium was detected above the soil BV (1.82 mg/kg) in 10 samples with a maximum concentration of 3.9 mg/kg. The quantile and slippage tests indicated site concentrations of uranium in soil are not statistically different from background (Figure H-68 and Table H-6). Uranium is not a COPC.

Vanadium was detected above the soil and Qbt 2,3,4 BVs (39.6 mg/kg and 17 mg/kg) in 1 soil sample and 14 tuff samples with a maximum concentration of 42 mg/kg. The Gehan and quantile tests indicated site concentrations of vanadium in soil are statistically different from background (Figure H-69 and Table H-6). The Gehan and quantile tests indicated site concentrations of vanadium in tuff are statistically different from background (Figure H-70 and Table H-5). Vanadium is retained as a COPC.

Zinc was detected above the soil BV (48.8 mg/kg) in 8 samples with a concentration of 112 mg/kg. The Gehan and quantile tests indicated site concentrations of zinc in soil are not statistically different from background (Figure H-71 and Table H-6). Zinc is not a COPC.

Organic Chemicals

A total of 15 tuff samples were collected at SWMU 49-001(e) and analyzed for explosive compounds, SVOCs, and VOCs.

No organic chemicals were detected at SWMU 49-001(e).

Radionuclides

A total of 179 samples (142 soil and 37 tuff) were collected at SWMU 49-001(e) and analyzed for gamma-emitting radionuclides, 170 samples (126 soil and 44 tuff) for isotopic plutonium, 160 samples (116 soil and 44 tuff) for americium-241 and isotopic uranium, 18 tuff samples for iodine-129, strontium-90, and technetium-99, and 15 tuff samples for tritium. Table 6.6-3 presents the radionuclides detected or detected above BVs/FVs. Plates 15 and 7 show the spatial distribution of detected radionuclides at SWMU 49-001(e) and in the overland corridor associated with SWMU 49-001(e), respectively.

Cesium-134 was detected in two samples with a maximum activity of 0.082 pCi/g. Cesium-134 is retained as a COPC.

Cesium-137 was detected in one tuff sample at an activity of 0.214 pCi/g. Cesium-137 is retained as a COPC.

6.6.4.4 Nature and Extent of Contamination

The nature and extent of inorganic, organic, and radionuclide COPCs at SWMU 49-001(e) were evaluated using the process described in section 5.2 and are discussed below. As presented in the approved investigation work plan (LANL 2008, 102691; NMED 2008, 100464), four vertical boreholes (locations 49-609981, 49-609982, 49-609983, and 49-609984) were drilled around the perimeter of the SWMU within 25 ft from the perimeter of the experimental shaft area. One of the objectives of drilling the perimeter boreholes was to characterize the vertical extent of contamination beneath Area 3 and to determine the potential for off-site releases of VOCs at levels that would require additional characterization.

Inorganic Chemicals

Inorganic COPCs at SWMU 49-001(e) include aluminum, arsenic, barium, beryllium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, perchlorate, selenium, thallium, and vanadium.

Aluminum was detected above the Qbt 2,3,4 BV in 22 samples with a maximum concentration of 24,400 mg/kg. Concentrations decreased with depth at locations 49-609317, 49-610026, and 49-610031 and did not change substantially with depth (300 mg/kg and 400 mg/kg) at locations 49-609310 and 49-609311 (the concentrations in the shallow samples at locations 49-6109310, 49-609311, 49-609317, 49-610026, and 49-610031 were 10,400 mg/kg, 15,000 mg/kg, 10,600 mg/kg, 8810 mg/kg, and 16,000 mg/kg, respectively, and below the soil BV [Appendix G, Pivot Tables]). Concentrations increased with depth at other locations but were below the maximum Qbt 2,3,4 background concentration (8370 mg/kg) at location 49-609321. Aluminum was either detected below BV at all depths or its concentrations decreased with depth in the vertical perimeter boreholes at locations 49-609981, 49-609982, 49-609983, and 49-609984. Concentrations decreased laterally. The residential and industrial

SSLs were approximately 3.2 times (53,600 mg/kg below the residential SSL) and 53 times the maximum concentration, respectively. All detections of aluminum where vertical extent is not defined were in the depth interval 0.5 to 1.5 ft bgs, and increasing concentrations at greater depths would not affect the risk to industrial workers. The HQ for aluminum under the industrial scenario is 0.00938 (Appendix I, Table I-4.2-16). The lateral extent of aluminum is defined, and further sampling for vertical extent is not warranted.

Arsenic was detected above the Qbt 2,3,4 BV in 31 samples with a maximum concentration of 10.3 mg/kg. Concentrations did not change or did not change substantially with depth (0.6 mg/kg, 0.8 mg/kg, 0.2 mg/kg, 0.7 mg/kg, 0.8 mg/kg, 0.9 mg/kg, no change, 0.4 mg/kg, no change, 0.3 mg/kg, 0.3 mg/kg, 0.4 mg/kg, 0.6 mg/kg, 0.1 mg/kg, 0.7 mg/kg, and 0.5 mg/kg, respectively) at locations 49-609310, 49-609311, 49-609326, 49-609328, 49-609329, 49-609335, 49-601015, 49-601016, 49-601017, 49-601019, 49-601022, 49-610024, 49-610025, 49-601026, 49-610030, and 49-610031 (the concentrations in the shallow samples at locations 49-609310, 49-609311, 49-609326, 49-609328, 49-609329, 49-601015, 49-601016, 49-601017, 49-601019, 49-601022, 49-610024, 49-610025, 49-601026, 49-610030, and 49-610031 were 4.1 mg/kg, 5.7 mg/kg, 7 mg/kg, 3 mg/kg, 2.9 mg/kg, 4.2 mg/kg, 4.4 mg/kg, 3.9 mg/kg, 3.3 mg/kg, 4 mg/kg, 3.5 mg/kg, 3.5 mg/kg, 3.4 mg/kg, 3.6 mg/kg, and 3.5 mg/kg, respectively, and below the soil BV [Appendix G, Pivot Tables]). Concentrations increased with depth at other locations but were below the maximum Qbt 2,3,4 background concentration (5 mg/kg) at locations 49-609320 and 49-609321. Arsenic concentrations decreased with depth in the vertical perimeter boreholes at locations 49-609981, 49-609982, 49-609983, and 49-609984. Concentrations decreased laterally. Arsenic was detected sporadically across the site and was detected above BV in only 31 of 170 samples and only in tuff. The spatial distribution of arsenic does not appear indicative of contamination from a release. The industrial SSL was approximately 2.1 times the maximum concentration. All detections of arsenic where vertical extent is not defined were in the depth interval 0.5 to 1.5 ft bgs, and increasing concentrations at greater depths would not affect the risk to industrial workers. The cancer risk from arsenic under the industrial scenario is 1.87×10^{-6} (Appendix I, Table I-4.2-12). The lateral extent of arsenic is defined, and further sampling for vertical extent is not warranted.

Barium was detected above the soil and Qbt 2,3,4 BVs in 6 soil samples and 30 tuff samples with a maximum concentration of 654 mg/kg. Concentrations decreased with depth at locations 49-609307, 49-609310, 49-610007, 49-610026, 49-610027, and 49-610028, and concentrations did not change substantially with depth (5.8 mg/kg, 2.9 mg/kg, 9 mg/kg, 10 mg/kg, 3 mg/kg, 4 mg/kg, 1 mg/kg, 8 mg/kg, and 15 mg/kg, respectively) at locations 49-609317, 49-609320, 49-609326, 49-610015, 49-610017, 49-610022, 49-610023, 49-610024, and 49-610030 (the concentrations in the shallow samples at locations 49-609307, 49-609310, 49-609317, 49-609320, 49-609326, 49-610015, 49-610017, 49-610022, 49-610023, 49-610024, and 49-610030 were 136 mg/kg, 102 mg/kg, 83.1 mg/kg, 44.1 mg/kg, 113 mg/kg, 177 mg/kg, 167 mg/kg, 132 mg/kg, 169 mg/kg, 118 mg/kg, and 195 mg/kg, respectively, and below the soil BV [Appendix G, Pivot Tables]). Concentrations increased with depth at all other locations but were below the maximum soil background concentration (410 mg/kg) at locations 49-609312, 49-609314, 49-610009, and 49-610010. Barium was either detected below BV at all depths or concentrations decreased with depth in the vertical perimeter boreholes at locations 49-609981, 49-609982, 49-609983, and 49-609984. Concentrations decreased laterally. The residential SSL was approximately 24 times the maximum concentration. The lateral extent of barium is defined, and further sampling for vertical extent is not warranted.

Beryllium was detected above the Qbt 2,3,4 BV in 7 samples with a maximum concentration of 2.3 mg/kg. Concentrations increased with depth at locations 49-609308, 49-609313, and 49-610023; and did not change substantially with depth (0.1 mg/kg, 0.4 mg/kg, and 0.5 mg/kg, respectively) at locations 49-609311, 49-610017, and 49-610021 (the concentrations in the shallow samples at locations 49-609311, 49-610017, and 49-610021 were 1.2 mg/kg, 1 mg/kg, and 0.9 mg/kg, respectively, and below the soil BV [Appendix G,

Pivot Tables]). Beryllium was either detected below BV at all depths or concentrations decreased with depth in the vertical perimeter boreholes at locations 49-609981, 49-609982, 49-609983, and 49-609984. Concentrations decreased laterally. The residential SSL was approximately 68 times the maximum concentration. The lateral extent of beryllium is defined, and further sampling for vertical extent is not warranted.

Calcium was detected above the soil and Qbt 2,3,4 BVs in 5 soil samples and 16 tuff samples with a maximum concentration of 14,800 mg/kg. Concentrations did not change substantially with depth (110 mg/kg and 170 mg/kg) at locations 49-609309 and 49-610015 (the concentrations in shallow samples at locations 49-609309 and 49-610015 were 2330 mg/kg and 2350 mg/kg and below the soil BV [Appendix G, Pivot Tables]). Concentrations increased with depth at other locations but were below the maximum soil background concentration (14,000 mg/kg) at locations 49-610002, 49-610010, and 49-610014. Calcium was either detected below BV at all depths or had concentrations decreasing with depth in the vertical perimeter boreholes at locations 49-609981, 49-609982, 49-609983, and 49-609984. Concentrations decreased laterally. The NMED residential essential nutrient SSL was approximately 878 times the maximum concentration. The lateral extent of calcium is defined, and further sampling for vertical extent is not warranted.

Chromium was detected above the Qbt 2,3,4 BV in 28 samples with a maximum concentration of 21.2 mg/kg. Concentrations decreased with depth at location 49-610015 and did not change substantially with depth (1.1 mg/kg, 1.2 mg/kg, 0.8 mg/kg, 0.2 mg/kg, 0.9 mg/kg, 0.5 mg/kg, 0.6 mg/kg, 0.6 mg/kg, and 0.5 mg/kg, respectively) at locations 49-609311, 49-609322, 49-609326, 49-610016, 49-610019, 49-610026, 49-610028, 49-610030, and 49-610031 (the concentrations in surface samples at locations 49-609311, 49-609322, 49-609326, 49-610015, 49-610016, 49-610019, 49-610026, 49-610028, 49-610030, and 49-610031 were 13.4 mg/kg, 10.9 mg/kg, 8.8 mg/kg, 11.7 mg/kg, 10 mg/kg, 8.5 mg/kg, 8 mg/kg, 8.1 mg/kg, 9.1 mg/kg, and 10.2 mg/kg, respectively, and below the soil BV [Appendix G, Pivot Tables]). Concentrations increased with depth at other locations but were below or equivalent to the maximum Qbt 2,3,4 background concentration (13 mg/kg) at locations 49-609307, 49-609317, 49-609320, 49-609321, 49-609328, 49-609332, 49-609335, 49-610015, 49-610017, 49-610021, 49-610022, 49-610023, 49-610024, and 49-610025. Chromium was either detected below BV at all depths or concentrations decreased with depth in the vertical perimeter boreholes at locations 49-609981, 49-609982, 49-609983, and 49-609984. Concentrations decreased laterally. As discussed in section 4.2, because there was no known use of hexavalent chromium at this site, the results were compared with the residential SSL for trivalent chromium (117,000 mg/kg). The residential trivalent chromium SSL was approximately 5520 times the maximum concentration. The lateral extent of chromium is defined, and further sampling for vertical extent is not warranted.

Cobalt was detected above the soil and Qbt 2,3,4 BVs in 13 soil samples and 15 tuff samples with a maximum concentration of 26 mg/kg. Concentrations decreased with depth at locations 49-609308, 49-609323, 49-909997, 49-610001, 49-610007, 49-610010, 49-610016, 49-610017, 49-610019, 49-610021, 49-610022, 49-610023, 49-610024, 49-610026, 49-610028, 49-610030, 49-611025, and 49-611028 and did not change with depth at location 49-609313 (the concentrations in the surface samples at locations 49-609308, 49-609313, 49-610016, 49-610017, 49-610019, 49-610021, 49-610022, 49-610023, 49-610024, 49-610026, 49-610028, and 49-610030 were 7.6 mg/kg, 3.3 mg/kg, 6.4 mg/kg, 6.6 mg/kg, 5.3 mg/kg, 5.6 mg/kg, 6 mg/kg, 8 mg/kg, 4.8 mg/kg, 5 mg/kg, 5.2 mg/kg, and 6.1 mg/kg, respectively, and below the soil BV [Appendix G, Pivot Tables]). Concentrations increased with depth at other locations but were below or equivalent to the maximum soil background concentration (9.5 mg/kg) at locations 49-610006, 49-610009, and 49-610011. Cobalt was either detected below BV at all depths or concentrations decreased with depth in the vertical perimeter boreholes at locations 49-609981, 49-609982, 49-609983, and 49-609984. Concentrations decreased laterally. Cobalt was detected sporadically across the site and was detected above BV in only 28 of 170 samples. The spatial

distribution of cobalt does not appear indicative of contamination from a release. The industrial SSL was approximately 15 times the maximum concentration. All detections of cobalt where vertical extent is not defined were in the depth interval 0.5 to 1.5 ft bgs, and increasing concentrations at greater depths would not affect the risk to industrial workers. The HQ for cobalt under the industrial scenario is 0.0197 (Appendix I, Table I-4.2-13). The lateral extent of cobalt is defined, and further sampling for vertical extent is not warranted.

Copper was detected above the soil and Qbt 2,3,4 BVs in 3 soil samples and 22 tuff samples with a maximum concentration of 1780 mg/kg. Concentrations decreased with depth at locations 49-609307, 49-609322, 49-609335, and 49-610031 (the concentration in the surface sample at location 49-610031 was 7.2 mg/kg and below the soil BV [Appendix G, Pivot Table]). Concentrations did not change substantially with depth (0.5 mg/kg, 0.6 mg/kg, 0.4 mg/kg, 0.6 mg/kg, 0.5 mg/kg, 0.3 mg/kg, 0.7 mg/kg, 0.1 mg/kg, 0.6 mg/kg, 0.5 mg/kg, and 0.5 mg/kg, respectively) at locations 49-609310, 49-609311, 49-609313, 49-610016, 49-610017, 49-610019, 49-610021, 49-610022, 49-610024, 49-610028, and 49-610030 (the concentrations in the surface samples at locations 49-609310, 49-609311, 49-609313, 49-610016, 49-610017, 49-610019, 49-610021, 49-610022, 49-610024, 49-610028, and 49-610030 were 5.3 mg/kg, 6.7 mg/kg, 5.4 mg/kg, 7.1 mg/kg, 7.1 mg/kg, 5.0 mg/kg, 5.7 mg/kg, 5.7 mg/kg, 5.9 mg/kg, 5.8 mg/kg, and 6.5 mg/kg, respectively, and below the soil BV [Appendix G, Pivot Tables]). Only one depth was sampled at location 49-03011, but copper concentrations decreased with depth in a deeper sample at adjacent location 49-609307 (Plate 13). Concentrations increased with depth at other locations. Copper was either detected below BV at all depths or concentrations decreasing with depth in the vertical perimeter boreholes at locations 49-609981, 49-609982, 49-609983, and 49-609984. Concentrations decreased laterally. The residential SSL was approximately 184 times the maximum concentration where extent was not defined (17.3 mg/kg at location 49-610026). The lateral extent of copper is defined and further sampling for vertical extent is not warranted.

Iron was detected above the soil and Qbt 2,3,4 BVs in 6 soil samples and 9 tuff samples with a maximum concentration of 25,000 mg/kg. Concentrations decreased with depth at location 49-609312 and did not change substantially with depth (500 mg/kg, 1200 mg/kg, 500 mg/kg, and 1700 mg/kg, respectively) at locations 49-609311, 49-609316, 49-609322, and 49-610019 (the concentrations in the surface samples at locations 49-609311, 49-609322, and 49-610019 were 16,400 mg/kg, 15,500 mg/kg, and 13,400 mg/kg, respectively, and below the soil BV [Appendix G, Pivot Tables]). Concentrations increased with depth at all other locations but were less than or equivalent to the maximum soil and Qbt 2,3,4 background concentrations (36,000 mg/kg and 19500 mg/kg, respectively) at locations 49-609314, 49-609318, 49-609323, 49-610017, 49-610023, and 49-610025. Iron was either detected below BV at all depths or concentrations decreasing with depth in the vertical perimeter boreholes at locations 49-609981, 49-609982, 49-609983, and 49-609984. Concentrations decreased laterally. Iron was detected sporadically across the site and was detected above BV in only 15 of 170 samples. The spatial distribution of iron does not appear indicative of contamination from a release. The residential and industrial SSLs were approximately 2.2 times and 36 times the maximum concentration. All detections of iron where vertical extent is not defined were in the depth interval 0.5 to 1.5 ft bgs, and increasing concentrations at greater depths would not affect the risk to industrial workers. The HQ for iron under the industrial scenario is 0.0155 (Appendix I, Table I-4.2-13). The lateral extent of iron is defined and further sampling for vertical extent is not warranted.

Lead was detected above the soil and Qbt 2,3,4 BVs in 8 soil samples and 23 tuff samples with a maximum concentration of 54.4 mg/kg. Concentrations decreased with depth at locations 49-609321, 49-609322, 49-609326, 49-609997, 49-610001, 49-610015, 49-610017, 49-610022, 49-610024, and 49-610030 (concentrations in the surface samples at locations 49-609321, 49-609322, 49-609326, 49-610015, 49-610022, 49-610024, and 49-610030 were 19.7 mg/kg, 21.8 mg/kg, 19.5 mg/kg, 17 mg/kg, 14.7 mg/kg, 14.6 mg/kg, and 14.8 mg/kg, respectively, and below the soil BV [Appendix G, Pivot Tables]).

Concentrations did not change substantially with depth (0.3 mg/kg, 0.1 mg/kg, 2 mg/kg, 1.1 mg/kg, 0.5 mg/kg, 0.4 mg/kg, and 0.4 mg/kg, respectively) at locations 49-609311, 49-609313, 49-609328, 49-609335, 49-610019, 49-610023, and 49-610031 (concentrations in the surface samples at locations 49-609311, 49-609328, 49-610019, 49-610023, and 49-610031 were 20 mg/kg, 13.6 mg/kg, 12.7 mg/kg, 17.3 mg/kg, and 14.1 mg/kg, respectively, and below the soil BV [Appendix G, Pivot Tables]). Only one depth was sampled at location 49-03026, but the concentration was below the maximum soil background concentration (28 mg/kg), and concentrations were below BV in a deeper sample at adjacent location 49-609316 (Plate 13). Concentrations increased with depth at other locations but were less than or equivalent to the maximum soil and Qbt 2,3,4 background concentrations (28 mg/kg and 15.5 mg/kg, respectively) at locations 49-609314, 49-610000, and 49-610005. Lead was either detected below BV at all depths or concentrations decreasing with depth in the vertical perimeter boreholes at locations 49-609981, 49-609982, 49-609983, and 49-609984. Concentrations increased laterally at location 49-609329. Lead was detected sporadically across the site and was detected above BV in only 31 of 170 samples. The spatial distribution of lead does not appear indicative of contamination from a release. The residential and industrial SSLs were approximately 7.4 times and 15 times the maximum concentration. Further sampling for extent of lead is not warranted.

Magnesium was detected above the Qbt 2,3,4 BV in 20 samples with a maximum concentration of 4110 mg/kg. Concentrations decreased with depth at location 49-610031 and did not change substantially with depth (160 mg/kg, 120 mg/kg, 280 mg/kg, and 100 mg/kg, respectively) at locations 49-609308, 49-609326, 49-610022, and 49-610030 (the concentrations in surface samples at locations 49-609308, 49-609326, 49-610022, 49-610030, and 49-610031 were 1640 mg/kg, 1630 mg/kg, 1450 mg/kg, 1820 mg/kg, and 2760 mg/kg, respectively, and below the soil BV [Appendix G, Pivot Tables]). Concentrations increased with depth at other locations but were less than or equivalent to the maximum Qbt 2,3,4 background concentration (2820 mg/kg) at locations 49-609311, 49-609313, 49-609317, 49-60932, 49-610015, 49-610016, 49-610017, 49-610019, 49-610021, and 49-610025. Magnesium was either detected below BV at all depths or concentrations decreasing with depth in the vertical perimeter boreholes at locations 49-609981, 49-609982, 49-609983, and 49-609984. Concentrations decreased laterally. The NMED residential essential nutrient SSL was approximately 82 times the maximum concentration. The lateral extent of magnesium is defined, and further sampling for vertical extent is not warranted.

Manganese was detected above the soil BV in 13 samples with a maximum concentration of 2060 mg/kg. Concentration decreased with depth at locations 49-609997, 49-610001, 49-610007, 49-610010, and 49-610013 and did not change substantially with depth (91 mg/kg and 112 mg/kg, respectively) at locations 49-610006 and 49-610009 (the concentrations in surface samples at locations 49-610006 and 49-610009 were 594 mg/kg and 653 mg/kg, respectively, and below the soil BV [Appendix G, Pivot Tables]). Concentrations increased with depth at other locations but were below the maximum soil background concentration (1100 mg/kg) at locations 49-609333, 49-610000, and 49-610004. Manganese was detected below BV at all depths in the vertical perimeter boreholes at locations 49-609981, 49-609982, 49-609983, and 49-609984. Concentrations decreased laterally. Manganese was detected sporadically across the site and was detected above BV in only 13 of 170 samples. The spatial distribution of manganese does not appear indicative of contamination from a release. The residential and industrial SSLs were approximately 5.1 times and 78 times the maximum concentration. The lateral extent of manganese is defined, and further sampling for vertical extent is not warranted.

Nickel was detected above the soil and Qbt 2,3,4 BVs in 3 soil samples and 20 tuff samples with a maximum concentration of 17.5 mg/kg. Concentrations decreased with depth at locations 49-609311 and 49-610631 and did not change substantially with depth (0.9 mg/kg, 1 mg/kg, 0.1 mg/kg, 0.1 mg/kg, 0.8 mg/kg, 0.2 mg/kg, 0.2 mg/kg, respectively) at locations 49-609307, 49-609310, 49-609997, 49-610616, 49-610617, 49-610624, and 49-610630 (the concentrations in surface samples at

locations 49-609307, 49-609310, 49-609311, 49-610616, 49-610617, 49-610624, 49-610630, and 49-610631 were 7.7 mg/kg, 5.8 mg/kg, 13.1 mg/kg, 7.4 mg/kg, 8.3 mg/kg, 7 mg/kg, 8.1 mg/kg, and 9.1 mg/kg, respectively, and below the soil BV [Appendix G, Pivot Tables]). Concentrations increased with depth at other locations but were less than the maximum soil background concentration (29 mg/kg) at location 49-610001. Nickel was either detected below BV at all depths or concentrations decreased with depth in the vertical perimeter boreholes at locations 49-609981, 49-609982, 49-609983, and 49-609984. Concentrations decreased laterally. The residential SSL was approximately 89 times the maximum concentration. The lateral extent of nickel is defined, and further sampling for vertical extent is not warranted.

Perchlorate was detected in two samples with a maximum concentration of 0.0058 mg/kg. In accordance with the approved work plan (LANL 2008, 102691; NMED 2008, 100464), perchlorate was analyzed only in samples from perimeter boreholes, so lateral extent was not evaluated. Perchlorate was either not detected at all depths or its concentrations decreased with depth in the vertical perimeter boreholes at locations 49-609981, 49-609982, 49-609983, and 49-609984. The residential SSL was approximately 9450 times the maximum concentration. The vertical extent of perchlorate is defined, and further sampling for lateral extent is not warranted.

Selenium was detected above the soil and Qbt 2,3,4 BVs in 15 soil samples and 39 tuff samples with a maximum concentration of 2.9 mg/kg. Selenium also had DLs (1.7 mg/kg to 2.8 mg/kg) above the BVs in 15 soil samples and 5 tuff samples. Concentrations decreased with depth at locations 49-609331 and 49-610015 and did not change substantially with depth (0.3 mg/kg, no change, 0.1 mg/kg, 0.19 mg/kg, 0.2 mg/kg, 0.5 mg/kg, 0.1 mg/kg, 0.1 mg/kg, 0.1 mg/kg, 0.1 mg/kg, 0.1 mg/kg, 0.2 mg/kg, and 0.1 mg/kg, respectively) at locations 49-609317, 49-609318, 49-609319, 49-609321, 49-609326, 49-609327, 49-609328, 49-609335, 49-610016, 49-610024, 49-610025, 49-610026, and 49-610028 (the concentrations in surface samples at locations 49-609319, 49-609321, 49-609328, 49-610015, 49-610016, 49-610026, and 49-610028 were 1.5 mg/kg, 1.1 mg/kg, 1.2 mg/kg, 1.2 mg/kg, 1.4 mg/kg, 1 mg/kg, and 1.2 mg/kg, respectively, and below the soil BV [Appendix G, Pivot Tables]). Concentrations increased with depth at other locations but were equal to the maximum soil background concentration (1.7 mg/kg) at location 49-609337. Concentrations did not change substantially with depth in the vertical perimeter boreholes at locations 49-609981, 49-609982, 49-609983, and 49-609984 (0.24 mg/kg, 0.14 mg/kg, 0.75 mg/kg, and 0.1 mg/kg, respectively). Concentrations decreased laterally. The residential SSL was approximately 135 times the maximum concentration and 140 times the maximum DL. The lateral extent of selenium is defined, and further sampling for vertical extent is not warranted.

Thallium was detected above the soil and Qbt 2,3,4 BVs in eight soil samples and seven tuff samples with a maximum concentration of 5.3 mg/kg and had DLs (0.79 mg/kg to 1.1 mg/kg) above the soil BV in five samples. Concentrations decreased with depth at location 49-610002 and increased with depth at other locations., Concentrations were less than or equivalent to the maximum soil background concentration (1 mg/kg) at locations 49-609327, 49-610006, 49-610008, and 49-610014. Concentrations were less than the maximum Qbt 2,3,4 background concentration (1.7 mg/kg) at locations 49-609310, 49-609311, 49-609317, 49-609332, 49-610015, and 49-610021. Thallium was detected below BV in the vertical perimeter boreholes at locations 49-609981, 49-609982, 49-609983, and 49-609984. Concentrations decreased laterally. Thallium was detected sporadically across the site and was detected above BV in only 15 of 170 samples. The spatial distribution of thallium does not appear indicative of contamination from a release. The industrial SSL was approximately 2.4 times the maximum concentration. All detections of thallium where vertical extent is not defined were in the depth interval 0.5 to 1.5 ft bgs, and increasing concentrations at greater depths would not affect the risk to industrial workers. The HQ for thallium under the industrial scenario is 0.0415 (Appendix I, Table I-4.2-13). The lateral extent of thallium is defined, and further sampling for vertical extent is not warranted.

Vanadium was detected above the soil and Qbt 2,3,4 BVs in 1 soil sample and 14 tuff samples with a maximum concentration of 42 mg/kg. Concentrations decreased with depth at locations 49-609311, 49-609322, 49-609982, 49-610007, 49-610016, 49-610017, 49-610021, 49-610022, 49-610030, and 49-610031 and did not change substantially with depth (1.7 mg/kg, 2.7 mg/kg, and 0.6 mg/kg) at locations 49-609308, 49-610023, and 49-610024 (the concentrations in surface samples at locations 49-609308, 49-609311, 49-609322, 49-610016, 49-610017, 49-610021, 49-610022, 49-610023, 49-610024, 49-610030, and 49-610031 were 24.5 mg/kg, 25.5 mg/kg, 28.2 mg/kg, 27.3 mg/kg, 25.2 mg/kg, 23.6 mg/kg, 24.6 mg/kg, 27.6 mg/kg, 19.8 mg/kg, 23.8 mg/kg, and 25.5 mg/kg, respectively, and below the soil BV [Appendix G, Pivot Tables]). Concentrations increased with depth at other locations, and were below the maximum Qbt 2,3,4 background concentration (21 mg/kg) at location 49-609322. Vanadium was either detected below BV at all depths or concentrations decreased with depth in vertical perimeter boreholes at locations 49-609981, 49-609982, 49-609983, and 49-609984. Concentrations decreased laterally. The residential and industrial SSLs were approximately 9.3 times and 155 times the maximum concentration. The lateral extent of vanadium is defined, and further sampling for vertical extent is not warranted.

Organic Chemicals

There were no organic COPCs at SWMU 49-001(e).

Radionuclides

Radionuclide COPCs at SWMU 49-001(e) include cesium-134 and cesium-137.

Cesium-134 was detected in two samples with a maximum activity of 0.082 pCi/g. Activities increased with depth at location 49-609336, decreased with depth at location 49-610003, and increased laterally at location 49-609336. The residential SAL was approximately 61 times the maximum activity. Further sampling for extent of cesium-134 is not warranted.

Cesium-137 was detected in one tuff sample at an activity of 0.214 pCi/g. Activities decreased with depth and decreased laterally (the activity in the surface sample at location 49-609328 was 0.594 pCi/g and below the soil FV [Appendix G, Pivot Tables]). The lateral and vertical extent of cesium-137 are defined.

6.6.4.5 Subsurface Vapor Sampling

Two pore-gas samples were collected from one borehole (location 49-609981) and analyzed for VOCs and tritium. Table 6.6-4 presents the pore gas samples collected and analyses requested for SWMU 49-001(e).

Table 6.6-5 summarizes the analytical results for detected VOCs in pore gas. Plate 14 shows the spatial distribution of detected VOCs.

The VOCs detected in pore gas at SWMU 49-001(e) include acetone; benzene; 2-butanone; dichlorodifluoromethane; ethylbenzene; 4-ethyltoluene; styrene; toluene; 1,2,4-trimethylbenzene; 1,3,5-trimethylbenzene; total xylenes; 1,2-xylene; and 1,3-xylene+1,4-xylene. The detected VOCs are retained as COPCs.

Tritium was not detected in pore gas at SWMU 49-001(e).

Nature and Extent of Contamination in Subsurface Pore Gas

The approved work plan (LANL 2008, 102691; NMED 2008, 100464) prescribed the collection of pore-gas samples from intervals corresponding to the base of formation Qbt 4 at TD of the closest experimental shaft, and from the TD of each borehole. If VOCs were detected in the vapor-phase sample at concentrations greater than 10% of the pore-gas screening levels presented in section 4.5 or if tritium was detected in the vapor-phase sample at a concentration greater than the groundwater MCL (20,000 pCi/L), the borehole would be completed as a vapor-monitoring well.

Screening was performed for each of the VOCs detected in pore-gas samples collected from SWMUs 49-001(a,b,c,d,e,f) and AOCs 49-008(c and d) using the maximum detected concentrations from all sites. These results show that the SVs are below 0.1 in all cases, indicating that VOCs in subsurface pore gas are not a potential source of groundwater contamination (Table 4.5-2).

Tritium was not detected in pore gas. Therefore, tritium is not a potential source of groundwater contamination.

The concentrations of all VOCs were less the 10% of the pore-gas screening level and tritium was not detected. Therefore, the borehole at SWMU 49-001(e) was not completed as a vapor-monitoring well.

6.6.5 Summary of Human Health Risk Screening

Industrial Scenario

The total excess cancer risk for the industrial scenario is 2×10^{-6}, which is less than the NMED target risk level of 1×10^{-5} (NMED 2015, 600915). The industrial HI is 0.1, which is less than the NMED target HI of 1 (NMED 2015, 600915). The total dose is 0.2 mrem/yr, which is less than the target dose of 25 mrem/yr as authorized by DOE Order 458.1.

Residential Scenario

The total excess cancer risk for the residential scenario is 2×10^{-5}, which is above the NMED target risk level of 1×10^{-5} (NMED 2015, 600915). The residential HI is 2, which is above the NMED target HI of 1 (NMED 2015, 600915). The total dose is 0.5 mrem/yr, which is less than the target dose of 25 mrem/yr as authorized by DOE Order 458.1.

Based on the risk-screening assessment results, no potential unacceptable risks or doses exist for the industrial scenario at SWMU 49-001(e). There is no potential unacceptable dose for the residential scenario, but there are potential unacceptable cancer and noncancer risks for the residential scenario at SWMU 49-001(e).

6.6.6 Summary of Ecological Risk Screening

Based on evaluations of the minimum ESLs, HI analyses, potential effects to populations (individuals for T&E species), LOAEL analyses, the relationship of detected concentrations and screening levels to background concentrations, and COPECs without ESLs, no potential unacceptable ecological risks to the earthworm, plant, American robin, American kestrel, pocket gopher, deer mouse, montane shrew, desert cottontail, red fox, and Mexican spotted owl exist at SWMU 49-001(e).

6.7 SWMU 49-001(f), Experimental Shafts

6.7.1 Site Description and Operational History

SWMU 49-001(f), known as Area 4 is an area consisting of experimental shafts located in the southeast corner of the MDA AB NES boundary (Figure 6.7-1). Area 4 is approximately 100 ft × 125 ft in area. Area 4 was designed to contain 26 shafts on a uniform grid, but only 21 were drilled. The 21 shafts drilled at Area 4 ranged between 58 ft and 108 ft deep. Thirteen of the shafts were shot with radioactive material, one shaft was used for containment testing, one shaft was used as a gas expansion hole, three shafts were used for disposal of debris, and the remaining three shafts were not used and were backfilled (LANL 2007, 098492).

6.7.2 Relationship to Other SWMUs and AOCs

SWMU 49-001(f) is located within Area 4. SWMU 49-006 and AOCs 49-005(b) and 49-008(a) are within Area 5, directly north-northwest of SWMU 49-001(f) (Figure 1.1-2).

The overland corridors associated with Area 4 extend from the northwestern corner of Area 4 to the southeastern corner of Area 5 (Figure 1.1-2 and Figure 3.1-6).

6.7.3 Summary of Previous Investigations

During the 1987 soil and vegetation radiological-screening survey, 36 surface samples were collected from points on a 25-ft grid centered over the Area 4 shafts, and 25 vegetation samples were collected within and around Area 4 (LANL 1992, 007670). Samples were analyzed for radionuclides and results showed several radionuclide activities at or above BVs in use at that time (LANL 1992, 007670, pp. 7-43–7-44). During the 1995 RFI conducted at Area 4, SWMU 49-001(f), 20 surface samples (0.0 to 0.5 ft bgs) were collected on a 25-ft × 25-ft grid centered over the Area 4 shafts. Each sample was field-screened for gross radiation; radiation was not detected above background. All 20 samples were submitted for analysis of gamma-emitting radionuclides, and 10 samples were submitted for analysis of TAL metals and isotopic plutonium (LANL 2007, 098492). Inorganic chemicals detected above soil BVs included antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, magnesium, nickel, potassium, selenium, silver, thallium, total uranium, vanadium, and zinc. Radionuclides detected or detected above BVs/FVs included americium-241, plutonium-238, and plutonium-239/240. Historical sampling locations and detected concentrations are provided on plates and in figures and tables included with this report.

Before this investigation, no sampling was conducted in the overland corridors.

6.7.4 Site Contamination

6.7.4.1 Soil, Rock, and Sediment Sampling

Based on previous investigation results, further characterization was required to assess potential contamination at SWMU 49-001(f). As a result, the following activities were completed as part of the 2009−2010 investigation.

- A total of 159 samples were collected from 87 locations at SWMU 49-001(f) and the overland corridor associated with SWMU 49-001(f). At all but 15 locations, samples were collected at the surface (0.0 to 0.5 ft bgs) and from the subsurface (0.5 to 1.5 ft bgs). At 10 locations, a sample was collected only at the surface (0.0 to 0.5 ft bgs) and at 5 locations a sample was collected only

from the subsurface (0.5 to 1.5 ft bgs). All samples were analyzed at off-site fixed laboratories for gamma-emitting radionuclides; 140 samples for TAL metals, americium-241, isotopic plutonium, and isotopic uranium; and 25 samples for iodine-129, strontium-90 and technetium-99.

- A total of 16 samples were collected from 4 boreholes around the perimeter of SWMU 49-001(f). Samples were collected from 4 depth intervals at each borehole over the range of 0.7 to 158.0 ft bgs. All samples were analyzed at off-site fixed laboratories for TAL metals, cyanide, perchlorate, explosive compounds, SVOCs, VOCs, americium-241, isotopic plutonium, isotopic uranium, and tritium.

The 2009–2010 sampling locations at SWMU 49-001(f) are presented on Plate 16 and sampling locations from the overland corridor associated with SWMU 49-001(f) are presented on Plate 5. Table 6.7-1 presents the samples collected and analyses requested for SWMU 49-001(f) and the associated overland corridor. The geodetic coordinates of sampling locations are presented in Appendix C.

6.7.4.2 Soil, Rock, and Sediment Field-Screening Results

Organic vapors were not detected during headspace (PID) screening of samples at SWMU 49-001(f). No radiological-screening results exceeded twice the daily site background levels. Field-screening results are presented in Table 3.1-4. There were no changes to sampling or other activities as a result of health- and safety-based field-screening results.

A total of 25 surface and shallow subsurface samples from SWMU 49-001(f) exceeded the gross-beta screening threshold and additional samples were collected and submitted for appropriate laboratory analyses. Additionally, 72 step-out surface and shallow subsurface screening samples from 36 locations were collected and screened for gross-alpha and -beta analysis, but these samples did not exceed screening thresholds and were not submitted for laboratory analysis. The gross-alpha and -beta screening results that guided additional sampling at SWMU 49-001(f) are presented in Tables D-22 through D-27 in Appendix D.

One surface sample collected from the SWMU 49-001(f) corridor exceeded the gross-alpha screening threshold; therefore, an additional 10 corridor samples from 5 locations were collected and submitted for appropriate laboratory analysis. The gross-alpha and -beta screening results that guided additional sampling at SWMU 49-001(f) are presented in Tables D-34 through D-38 in Appendix D.

6.7.4.3 Soil, Rock, and Sediment Sampling Analytical Results

Decision-level data at SWMU 49-001(f) consist of results from 195 samples (159 soil and 36 tuff) collected from 111 locations.

Inorganic Chemicals

A total of 165 samples (134 soil and 31 tuff) were collected at SWMU 49-001(f) and analyzed for TAL metals. Sixteen tuff samples were collected and analyzed for cyanide and perchlorate and 10 soil samples for total uranium. Table 6.7-2 presents the inorganic chemicals above BVs and detected inorganic chemicals with no BVs. Plates 17 and 6 show the spatial distribution of inorganic chemicals detected or detected above BVs at SWMU 49-001(f) and in the overland corridor associated with SWMU 49-001(f), respectively.

Aluminum was detected above the Qbt 2,3,4 BV (7340 mg/kg) in 11 samples with a maximum concentration of 21,800 mg/kg. The quantile and slippage tests indicated site concentrations of aluminum in tuff are statistically different from background (Figure H-72 and Table H-7). Aluminum is retained as a COPC.

Antimony was not detected above the Qbt 2,3,4 BV (0.5 mg/kg) but had DLs (0.51 mg/kg to 0.52 mg/kg) above the BV in two samples. The quantile and slippage tests indicated site concentrations of antimony in tuff are not statistically different from background (Figure H-73 and Table H-7). Antimony is not a COPC.

Arsenic was detected above the Qbt 2,3,4 BV (2.79 mg/kg) in nine samples with a maximum concentration of 6.7 mg/kg. The Gehan and quantile tests indicated site concentrations of arsenic in tuff are statistically different from background (Figure H-74 and Table H-7). Arsenic is retained as a COPC.

Barium was detected above the soil and Qbt 2,3,4 BVs (295 mg/kg and 46 mg/kg) in 4 soil samples and 16 tuff samples with a maximum concentration of 435 mg/kg. The quantile and slippage tests indicated site concentrations of barium in soil are not statistically different from background (Figure H-75 and Table H-8). The Gehan and quantile tests indicated site concentrations of barium in tuff are statistically different from background (Figure H-76 and Table H-7). Barium is retained as a COPC.

Beryllium was detected above the Qbt 2,3,4 BV (1.21 mg/kg) in two samples with a maximum concentration of 1.4 mg/kg. The Gehan and quantile tests indicated site concentrations of beryllium in tuff are not statistically different from background (Figure H-77 and Table H-7). Beryllium is not a COPC.

Cadmium was detected above the soil BV (0.4 mg/kg) in one sample at a concentration of 0.42 mg/kg. This concentration was only 0.02 mg/kg above the BV and below the 3 highest background concentrations (0.6 mg/kg, 1.4 mg/kg, and 2.6 mg/kg). Cadmium was not detected or detected above BV in the other 164 samples (detected below BV in 149 samples). Statistical tests were not performed because the background data set for soil contains too few detections. Cadmium is not a COPC.

Calcium was detected above the soil and Qbt 2,3,4 BVs (6120 mg/kg and 2200 mg/kg) in 2 soil samples and 10 tuff samples with a maximum concentration of 9110 mg/kg. The Gehan and quantile tests indicated site concentrations of calcium in soil are not statistically different from background (Figure H-78 and Table H-8). The Gehan and quantile tests indicated site concentrations of calcium in tuff are statistically different from background (Figure H-79 and Table H-7). Calcium is retained as a COPC.

Chromium was detected above the Qbt 2,3,4 BV (7.14 mg/kg) in 12 samples with a maximum concentration of 20.1 mg/kg. The Gehan and quantile tests indicated site concentrations of chromium in tuff are statistically different from background (Figure H-80 and Table H-7). Chromium is retained as a COPC.

Cobalt was detected above the soil and Qbt 2,3,4 BVs (8.64 mg/kg and 3.14 mg/kg) in eight soil samples and nine tuff samples with a maximum concentration of 18.1 mg/kg. The quantile and slippage tests indicated site concentrations of cobalt in soil are statistically different from background (Figure H-81 and Table H-8). The Gehan and quantile tests indicated site concentrations of cobalt in tuff are not statistically different from background (Figure H-82 and Table H-7). Cobalt is retained as a COPC.

Copper was detected above the soil and Qbt 2,3,4s BV (14.7 mg/kg and 4.66 mg/kg) in four soil samples and nine tuff samples with a maximum concentration of 125 mg/kg. The Gehan and slippage tests indicated site concentrations of copper in soil are statistically different from background (Figure H-83 and Table H-8). The Gehan and quantile tests indicated site concentrations of copper in tuff are statistically different from background (Figure H-84 and Table H-7). Copper is retained as a COPC.

Cyanide was not detected above the Qbt 2,3,4 BV (0.5 mg/kg) but had DLs (0.51 mg/kg to 0.56 mg/kg) above the BV in 5 samples. The DLs were only 0.01 mg/kg to 0.06 mg/kg above the BV. Cyanide was not detected in the other 11 samples. Cyanide is not a COPC.

Iron was detected above the Qbt 2,3,4 BV (14,500 mg/kg) in one sample at a concentration of 14,900 mg/kg. The quantile and slippage tests indicated site concentrations of iron in tuff are not statistically different from background (Figure H-85 and Table H-6). Iron is not a COPC.

Lead was detected above the soil and Qbt 2,3,4 BVs (22.3 mg/kg and 11.2 mg/kg) in 5 soil samples and 11 tuff samples with a maximum concentration of 51.5 mg/kg. The Gehan and slippage tests indicated site concentrations of lead in soil are statistically different from background (Figure H-86 and Table H-8). The Gehan and quantile tests indicated site concentrations of lead in tuff are statistically different from background (Figure H-87 and Table H-7). Lead is retained as a COPC.

Magnesium was detected above the Qbt 2,3,4 BV (1690 mg/kg) in nine samples with a maximum concentration of 2510 mg/kg. The Gehan and quantile tests indicated site concentrations of magnesium in tuff are statistically different from background (Figure H-88 and Table H-7). Magnesium is retained as a COPC.

Manganese was detected above the soil BV (671 mg/kg) in four samples with a maximum concentration of 1390 mg/kg. The quantile and slippage tests indicated site concentrations of manganese in soil are not statistically different from background (Figure H-89 and Table H-8). Manganese is not a COPC.

Mercury was not detected above the soil BV (0.1 mg/kg) but had DLs (0.11 mg/kg to 1.1 mg/kg) above BV in four samples. Mercury is retained as a COPC.

Nickel was detected above the soil and Qbt 2,3,4 BVs (15.4 mg/kg and 6.58 mg/kg) in 1 soil sample and 10 tuff samples with a maximum concentration of 23.4 mg/kg. The Gehan and quantile tests indicated site concentrations of nickel in soil are statistically different from background (Figure H-90 and Table H-8). The quantile and slippage tests indicated site concentrations of nickel in tuff are statistically different from background (Figure H-91 and Table H-7). Nickel is retained as a COPC.

Selenium was detected above the soil and Qbt 2,3,4 BVs (1.52 mg/kg and 0.3 mg/kg) in 14 soil samples and 22 tuff samples with a maximum concentration of 2.1 mg/kg and had DLs (1.1 mg/kg to 1.9 mg/kg) above the BVs in 6 soil samples and 9 tuff samples. The Gehan and quantile tests indicated site concentrations of selenium in soil are statistically different from background (Figure H-92 and Table H-8). Selenium is retained as a COPC.

Thallium was detected above the soil and Qbt 2,3,4 BVs (0.73 mg/kg and 1.1 mg/kg) in four soil samples and one tuff sample with a maximum concentration of 1.8 mg/kg and had DLs (1 mg/kg to 1.4 mg/kg) above the soil BV in 9 samples. The quantile and slippage tests indicated site concentrations of thallium in soil are not statistically different from background (Figure H-93 and Table H-8). The quantile test indicated site concentrations of thallium in tuff are statistically different from background (Figure H-94 and Table H-7). Thallium is retained as a COPC.

Uranium was detected above the soil BV (1.82 mg/kg) in one sample at a concentration of 1.85 mg/kg. The Gehan and quantile tests indicated site concentrations of uranium in soil are not statistically different from background (Figure H-95 and Table H-8). Uranium is not a COPC.

Vanadium was detected above the Qbt 2,3,4 BV (17 mg/kg) in eight samples with a maximum concentration of 26.4 mg/kg. The Gehan and quantile tests indicated site concentrations of vanadium in tuff are statistically different from background (Figure H-96 and Table H-7). Vanadium is retained as a COPC.

Zinc was detected above the soil BV (48.8 mg/kg) in four samples with a concentration of 196 mg/kg. The Gehan and quantile tests indicated site concentrations of zinc in soil are not statistically different from background (Figure H-97 and Table H-8). Zinc is not a COPC.

Organic Chemicals

A total of 16 tuff samples were collected at SWMU 49-001(f) and analyzed for explosive compounds, SVOCs, and VOCs. Table 6.7-3 summarizes the analytical results for detected organic chemicals. Plate 18 shows the spatial distribution of detected organic chemicals.

Organic chemicals detected at SWMU 49-001(f) include acetone and bis(2-ethylhexyl)phthalate. The detected organic chemicals are retained as COPCs.

Radionuclides

A total of 179 samples (159 soil and 20 tuff) were collected at SWMU 49-001(f) and analyzed for gamma-emitting radionuclides; 166 samples (135 soil and 31 tuff) for isotopic plutonium; 156 samples (125 soil and 31 tuff) for americium-241 and isotopic uranium; 25 samples (18 soil and 7 tuff) for iodine-129, strontium-90, and technetium-99; and 16 tuff samples for tritium. Table 6.7-4 presents the radionuclides detected or detected above BVs/FVs. Plates 19 and 7 show the spatial distribution of detected radionuclides at SWMU 49-001(f) and in the overland corridor associated with SWMU 49-001(f), respectively.

Americium-241 was detected above the soil FV (0.013 pCi/g) in one sample and detected in one soil sample below 1.0 ft bgs with a maximum activity of 0.058 pCi/g. Americium-241 is retained as a COPC.

Cesium-134 was detected in one sample at an activity of 0.062 pCi/g. Cesium-134 is retained as a COPC.

Plutonium-238 was detected above the soil FV (0.023 pCi/g) in three samples with a maximum activity of 0.0628 pCi/g. The quantile and slippage tests indicated site activities of plutonium-238 in soil are not statistically different from background (Figure H-98 and Table H-8). Plutonium-238 is not a COPC.

Plutonium-239/240 was detected above the soil FV (0.054 pCi/g) in eight samples with a maximum activity of 0.215 pCi/g. The quantile and slippage tests indicated site activities of plutonium-239/240 in soil are not statistically different from background (Figure H-99 and Table H-8). Plutonium-239/240 is not a COPC.

Tritium was detected in eight samples with a maximum activity of 8.39 pCi/g. Tritium is retained as a COPC.

6.7.4.4 Nature and Extent of Soil and Rock Contamination

The nature and extent of inorganic, organic, and radionuclide COPCs at SWMU 49-001(f) were evaluated using the process described in section 5.2 and are discussed below. As presented in the approved investigation work plan (LANL 2008, 102691), four vertical boreholes (locations 49-610938, 49-610939, 49-610940, and 49-610941) were drilled around the perimeter of the SWMU within 25 ft from the perimeter of the experimental shaft area. One of the objectives of drilling the perimeter boreholes was to characterize the vertical extent of contamination beneath Area 4 and to determine the potential for off-site releases of VOCs at levels that would require additional characterization.

Inorganic Chemicals

Inorganic COPCs at SWMU 49-001(f) include aluminum, arsenic, barium, calcium, chromium, cobalt, copper, lead, magnesium, mercury, nickel, selenium, thallium, and vanadium.

Aluminum was detected above the Qbt 2,3,4 BV in 11 samples with a maximum concentration of 21,800 mg/kg. Concentrations did not change substantially with depth (1400 mg/kg) at location 49-610033 and increased with depth at other locations. Aluminum was either detected below BV at all depths or concentrations decreased with depth in the vertical perimeter boreholes at locations 49-610938, 49-610939, 49-610940, and 49-610941. Concentrations increased laterally at location 49-609682 (the concentration in the surface sample at location 49-610033 was 11,900 mg/kg and below the soil BV [Appendix G, Pivot Tables]). Aluminum was detected sporadically across the site, with all detections at locations outside the footprint of SMWU 49-001(f). The spatial distribution of aluminum does not appear indicative of contamination from a release. The residential and industrial SSLs were approximately 3.6 times (56,200 mg/kg below the residential SSL) and 59 times the maximum concentration, respectively. Further sampling for extent of aluminum is not warranted.

Arsenic was detected above the Qbt 2,3,4 BV in nine samples with a maximum concentration of 6.7 mg/kg. Concentrations did not change or did not change substantially with depth (no change and 0.1 mg/kg) at locations 49-610036 and 49-610043 (the concentrations in surface samples at locations 49-610036 and 49-610043 were 3.4 mg/kg and 2.9 mg/kg, respectively, and below the soil BV [Appendix G, Pivot Tables]). Concentrations increased with depth at other locations, but all detections of arsenic above BV were in tuff samples and arsenic was detected below BV in overlying soil samples at all locations. Arsenic was either detected below BV at all depths or concentrations decreased with depth in the vertical perimeter boreholes at locations 49-610938, 49-610939, 49-610940, and 49-610941. Concentrations were below the maximum Qbt 2,3,4 background concentration (5 mg/kg) at all locations, except at location 49-609682. Concentrations increased laterally at locations 49-609681 and 49-609682, but the concentration was below the maximum Qbt 2,3,4 background concentration at location 49-610681. Arsenic was detected above BV sporadically across the site, with all detections at locations outside the footprint of SWMU 49-001(f). The spatial distribution of arsenic does not appear indicative of contamination from a release. The maximum concentration (6.7 mg/kg at location 49-609682) exceeded the NMED residential SSL and was similar to the EPA regional residential SSL (6.8 mg/kg). The NMED industrial SSL was approximately 3.2 times and the EPA regional industrial SSL (30 mg/kg) was approximately 4.5 times the maximum concentration. The industrial total excess cancer risk for the SWMU was less than the NMED target risk level (section 6.7.5). Further sampling for extent of arsenic is not warranted.

Barium was detected above the soil and Qbt 2,3,4 BVs in 4 soil samples and 16 tuff samples with a maximum concentration of 435 mg/kg. Concentrations decreased with depth at locations 49-609677, 49-609685, 49-610043, and 49-610050 and did not change substantially with depth (10.8 mg/kg, 17 mg/kg, 2 mg/kg, and 4 mg/kg) at locations 49-609681, 49-609682, 49-610033 and 49-610037 (concentrations in the surface samples at locations 49-609677, 49-609681, 49-609682, 49-610033, 49-610037, and 49-610043 were 61.4 mg/kg, 92.2 mg/kg, 123 mg/kg, 174 mg/kg, 144 mg/kg, and 104 mg/kg, respectively, and below the soil BV [Appendix G, Pivot Tables]). Concentrations increased with depth at other locations but were below the maximum soil background concentration (410 mg/kg) at location 49-610035. Barium was either detected below BV at all depths or concentrations decreased with depth in the vertical perimeter boreholes at locations 49-610938, 49-610939, 49-610940, and 49-610941. Concentrations decreased laterally. The residential and industrial SSLs were approximately 36 times and 586 times the maximum concentration. The lateral extent of barium is defined, and further sampling for vertical extent is not warranted.

Calcium was detected above the soil and Qbt 2,3,4 BVs in 2 soil samples and 10 tuff samples with a maximum concentration of 9110 mg/kg. Concentrations increased with depth at 9 locations but were below the maximum soil background concentration (14,000 mg/kg) at locations 49-609674 and 49-610056. Calcium was either detected below BV at all depths or concentrations decreased with depth in the vertical perimeter boreholes at locations 49-610938, 49-610939, 49-610940, and 49-610941. Concentrations decreased laterally. The NMED residential essential nutrient SSL was approximately 1430 times the maximum concentration. The lateral extent of calcium is defined, and further sampling for vertical extent is not warranted.

Chromium was detected above the Qbt 2,3,4 BV in 12 samples with a maximum concentration of 20.1 mg/kg. Concentrations did not change substantially with depth (1.3 mg/kg, 1.5 mg/kg, 1.5 mg/kg, 0.3 mg/kg, 0.2 mg/kg, and 1 mg/kg, respectively) at locations 49-609669, 49-609679, 49-609681, 49-610033, 49-610036, and 49-610036 (the concentrations in the surface samples at locations 49-609669, 49-609679, 49-609681, 49-610033, 49-610036, and 49-610036 were 6.6 mg/kg, 6.2 mg/kg, 7.4 mg/kg, 10.5 mg/kg, 11 mg/kg, and 10.1 mg/kg, respectively, and below the soil BV [Appendix G, Pivot Tables]). Concentrations increased with depth at other locations but were below the maximum Qbt 2,3,4 background concentration (13 mg/kg) at locations 49-609657, 49-609673, 49-610040, 49-610042, and 49-610043. Chromium was detected below BV in the vertical perimeter boreholes at locations 49-610938, 49-610939, 49-610940, and 49-610941. Concentrations increased laterally at location 49-609682 (maximum concentration of 20.1 mg/kg). As discussed in section 4.2, because there was no known use of hexavalent chromium at this site, the results were compared with the residential SSL for trivalent chromium (117,000 mg/kg). The residential trivalent chromium SSL was approximately 5820 times the maximum concentration. Further sampling for extent of chromium is not warranted.

Cobalt was detected above the soil and Qbt 2,3,4 BVs in eight soil samples and nine tuff samples with a maximum concentration of 18.1 mg/kg. Concentrations decreased with depth at locations 49-609682, 49-610033, 49-610036, 49-610037, 49-610040, 49-610042, 49-610043, 49-610056, and 49-610063 and did not change substantially with depth (0.2 mg/kg) at location 49-609681 (the concentrations in surface samples at locations 49-609681, 49-609682, 49-610033, 49-610037, 49-610040, 49-610042, and 49-610043 were 3.4 mg/kg, 4.5 mg/kg, 7.2 mg/kg, 7 mg/kg, 6 mg/kg, 7 mg/kg, and 7.1 mg/kg, respectively, and below the soil BV [Appendix G, Pivot Tables]). Concentrations increased with depth at other locations, but the concentration was below the maximum soil background concentration (9.5 mg/kg) at location 49-610034. Cobalt was detected below BV in the vertical perimeter boreholes at locations 49-610938, 49-610939, 49-610940, and 49-610941. Concentrations did not change substantially laterally (less than 0.5 mg/kg above the Qbt 2,3,4 BV) at locations 49-609673, 49-609681, and 49-609682. Cobalt was detected above BV sporadically across the site, with all detections at locations outside the footprint of SWMU 49-001(f). The spatial distribution of cobalt does not appear indicative of contamination from a release. The residential and industrial SSLs were approximately 1.3 times and 17 times the maximum concentration. Further sampling for extent of cobalt is not warranted.

Copper was detected above the soil and Qbt 2,3,4 BVs in four soil samples and nine tuff samples with a maximum concentration of 125 mg/kg. Concentrations decreased with depth at locations 49-609682, 49-610033, 49-610036, 49-610037, 49-610043, and 49-610062 and did not change substantially with depth (0.1 mg/kg and 0.4 mg/kg) at locations 49-609681 and 49-610042 (the concentrations in surface samples at locations 49-609681, 49-609682, 49-610033, 49-610036, 49-610037, 49-610042, and 49-610043 were 5.5 mg/kg, 5.9 mg/kg, 8.1 mg/kg, 7.8 mg/kg,7.2 mg/kg, 6.5 mg/kg, and 6.3 mg/kg, respectively, and below the soil BV [Appendix G, Pivot Tables]). Only one depth was sampled at locations 49-04003 and 49-04016, but copper was not detected above BV in deeper samples at adjacent locations 49-606664 and 49-609657, respectively (Plate 17). Concentrations increased with depth at

other locations, but the concentration was below the maximum Qbt 2,3,4 background concentration (6.2 mg/kg) at location 49-609673. Copper was detected below BV in the vertical perimeter boreholes at locations 49-610938, 49-610939, 49-610940, and 49-610941. Concentrations decreased laterally (concentrations at locations 49-609673, 49-609681, and 49-609682 were below the maximum Qbt 2,3,4 background concentration). The residential and industrial SSLs were approximately 25 times and 415 times the maximum concentration. The lateral extent of copper is defined, and further sampling for vertical extent is not warranted.

Lead was detected above the soil and Qbt 2,3,4 BVs in 5 soil samples and 11 tuff samples with a maximum concentration of 51.5 mg/kg. Concentrations decreased with depth at locations 49-609682, 49-609657, 49-609663, 49-609668, 49-610033, 49-610037, and 49-610062 and did not change substantially with depth (1.2 mg/kg, 0.6 mg/kg, and 1.3 mg/kg) at locations 49-609681, 49-610040, and 49-610043 (the concentrations in surface samples at locations 49-609681, 49-609682, 49-610033, 49-610036, 49-610037, 49-610040, and 49-610043 were 13.6 mg/kg, 16.5 mg/kg, 14.4 mg/kg, 15 mg/kg, 14.3 mg/kg, 14.7 mg/kg, and 14 mg/kg, respectively, and below the soil BV [Appendix G, Pivot Tables]). Only one depth was sampled at location 49-04016, but concentrations decreased with depth at adjacent location 49-609657 (Plate 17). Concentrations increased with depth at locations 49-609673, 49-609679, and 49-610042, but the concentration was below the maximum Qbt 2,3,4 background concentration (15.5 mg/kg) at location 49-609679. Lead was detected below BV in the vertical perimeter boreholes at locations 49-610938, 49-610939, 49-610940, and 49-610941. Concentrations decreased laterally. The residential and industrial SSLs were approximately 19 times and 39 times the maximum concentration at location 49-609673 and 23 times and 46 times the maximum concentration at location 49-610042 where extent was not defined. The lateral extent of lead is defined, and further sampling for vertical extent is not warranted.

Magnesium was detected above the Qbt 2,3,4 BV in nine samples with a maximum concentration of 2510 mg/kg. Concentrations decreased with depth at location 49-610940 and did not change substantially with depth (10 mg/kg and 110 mg/kg) at locations 49-610033 and 49-610037 (the concentrations in surface samples at locations 49-610033 and 49-610037 were 1880 mg/kg and 1630 mg/kg, respectively, and below the soil BV [Appendix G, Pivot Tables]). Concentrations increased with depth at other locations but were below the maximum Qbt 2,3,4 background concentration (2820 mg/kg) at locations 49-609673, 49-609682, 49-610036, 49-610040, 49-610042, and 49-610043. Magnesium was either detected below BV at all depths or concentrations decreased with depth in the vertical perimeter boreholes at locations 49-610938, 49-610939, 49-610940, and 49-610941. Concentrations increased laterally at location 49-610682, but the concentration was below the maximum Qbt 2,3,4 background concentration. The NMED residential essential nutrient SSLs was approximately 135 times the maximum concentration. Further sampling for extent of magnesium is not warranted.

Mercury was not detected above the soil BV but had DLs (0.11 mg/kg to 1.1 mg/kg) above BV in four samples. Mercury was not detected (DLs less than BV) in the vertical perimeter boreholes at locations 49-610938, 49-610939, 49-610940, and 49-610941. The residential and industrial SSLs were approximately 21 times and 354 times the maximum DL. Further sampling for extent of mercury is not warranted.

Nickel was detected above the soil and Qbt 2,3,4 BVs in 1 soil sample and 10 tuff samples with a maximum concentration of 23.4 mg/kg. Concentrations decreased with depth at location 49-610033 and did not change substantially with depth (0.6 mg/kg, 0.2 mg/kg, and 1.1 mg/kg) at locations 49-610036, 49-610037, and 49-610043 (the concentrations in surface samples at locations 49-610033, 49-610036, 49-610037, and 49-610043 were 9.1 mg/kg, 9.1 mg/kg, 8.3 mg/kg, and 7.4 mg/kg, respectively, and below the soil BV [Appendix G, Pivot Tables]). Only one depth was sampled at location 49-04016, but nickel was not detected above BV in a deeper sample at adjacent location 49-609657 (Plate 17).

Concentrations increased with depth at other locations. Nickel was detected below BV at all depths in the vertical perimeter boreholes at locations 49-610938, 49-610939, 49-610940, and 49-610941. Concentrations increased laterally at locations 49-609679, 46-609681, and 49-609682. The residential SSL was approximately 75 times the maximum concentration (20.7 mg/kg) at these locations. Further sampling for extent of nickel is not warranted.

Selenium was detected above the soil and Qbt 2,3,4 BVs in 14 soil samples and 22 tuff samples with a maximum concentration of 2.1 mg/kg and had DLs (1.1 mg/kg to 1.9 mg/kg) above the BVs in 6 soil samples and 9 tuff samples. Concentrations decreased with depth at locations 49-609662, 49-609663, 49-609664, and 49-609669 and did not change or did not change substantially with depth (0.3 mg/kg, no change, 0.2 mg/kg, no change, 0.3 mg/kg, 0.5 mg/kg, and 0.15 mg/kg) at locations 49-609657, 49-609660, 49-609667, 49-609673, 49-609674, and 49-610060, respectively (the concentrations in the surface samples at locations 49-609667, 49-609669, 49-609673, and 49-609674 were 1.4 mg/kg, 1.4 mg/kg, 1.3 mg/kg, 1.3 mg/kg, respectively, and below the soil BV [Appendix G, Pivot Tables]). Concentrations increased with depth at other locations. Selenium did not change substantially with depth in the vertical perimeter boreholes at locations 49-610938, 49-610939, 49-610940, and 49-610941 (0.66 mg/kg, 0.08 mg/kg, 0.55 mg/kg, and 0.36 mg/kg, respectively). Concentrations decreased laterally. The residential SSL was approximately 186 times the maximum concentration and 206 times the maximum DL. The lateral extent of selenium is defined, and further sampling for vertical extent is not warranted.

Thallium was detected above the soil and Qbt 2,3,4 BVs in four soil samples and one tuff sample with a maximum concentration of 1.8 mg/kg and had DLs (1 mg/kg to 1.4 mg/kg) above the soil BV in nine samples. Concentrations increased with depth at locations 49-609681, 49-610035, and 49-610063, but concentrations were below the maximum soil background concentration (1 mg/kg) at locations 49-610035 and 49-610063 and below the maximum Qbt 2,3,4 background concentration (1.7 mg/kg) at location 49-609681. Only one depth was sampled at locations 49-04006 and 49-04009, but thallium was not detected in deeper samples at adjacent locations 49-609661 and 49-609660, respectively (Plate 17). Thallium was not detected or detected below BV at all depths in the vertical perimeter boreholes at locations 49-610938, 49-610939, 49-610940, and 49-610941. Concentrations decreased laterally. Thallium was detected above BV sporadically across the site, with most detections at locations outside the footprint of SWMU 49-001(f). The spatial distribution of thallium does not appear indicative of contamination from a release. The industrial SSL was approximately 7.2 times the maximum concentration and 9.3 times the maximum DL. Thallium DLs were below BVs in the other 152 samples. All detections of thallium where vertical extent is not defined were in the depth interval 0.5 to 1.5 ft bgs, and increasing concentrations at greater depths would not affect the risk to industrial workers. The HQ for thallium under the industrial scenario is 0.0253 (Appendix I, Table I-4.2-19). The lateral extent of thallium is defined, and further sampling for vertical extent is not warranted.

Vanadium was detected above the Qbt 2,3,4 BV in eight samples with a maximum concentration of 26.4 mg/kg. Concentrations decreased with depth at locations 49-610033, 49-610036, 49-610037, and 49-610043; and did not change substantially with depth (0.5 mg/kg, 0.6 mg/kg, and 0.9 mg/kg) at locations 49-609682, 49-610040, and 49-610042 (the concentrations in surface samples at locations 49-609682, 49-610033, 49-610036, 49-610037, 49-610040, 49-610042, and 49-610043 were 16.7 mg/kg, 25.9 mg/kg, 28.6 mg/kg, 25.9 mg/kg, 25.9 mg/kg, 24.3 mg/kg, and 22.4 mg/kg, respectively, and below the soil BV [Appendix G, Pivot Tables]). Concentrations increased with depth at location 49-609673, but the concentration was below the maximum Qbt 2,3,4 background concentration (21 mg/kg). Vanadium was detected below BV in the vertical perimeter boreholes at locations 49-610938, 49-610939, 49-610940, and 49-610941. Concentrations decreased laterally. The residential and industrial SSLs were approximately 15 times and 247 times the maximum concentration. The lateral extent of vanadium is defined, and further sampling for vertical extent is not warranted.

Organic Chemicals

Organic COPCs at SWMU 49-001(f) include acetone and bis(2-ethylhexyl)phthalate.

Acetone was detected in three samples with a maximum concentration of 0.01 mg/kg. In accordance with the approved work plan (LANL 2008, 102691; NMED 2008, 100464), samples for VOC analysis were collected only from perimeter boreholes, so lateral extent was not evaluated. Acetone was either not detected, concentrations decreased with depth, or concentrations did not change substantially with depth (0.0023 mg/kg) in the vertical perimeter boreholes at locations 49-610938, 49-610939, 49-610940, and 49-610941. Concentrations were below EQLs. The residential SSL was approximately 6,630,000 times the maximum concentration. Further sampling for extent of acetone is not warranted.

Bis(2-ethylhexyl)phthalate was detected in two samples with a maximum concentration of 0.24 mg/kg. In accordance with the approved work plan (LANL 2008, 102691; NMED 2008, 100464), samples for SVOC analysis were collected only from perimeter boreholes, so lateral extent was not evaluated. Bis(2-ethylhexyl)phthalate was either not detected or concentrations decreased with depth in the vertical perimeter boreholes at locations 49-610938, 49-610939, 49-610940, and 49-610941. Concentrations were below EQLs. The residential SSL was approximately 1580 times the maximum concentration. The vertical extent of bis(2-ethylhexyl)phthalate is defined, and further sampling for lateral extent is not warranted.

Radionuclides

Radionuclide COPCs at SWMU 49-001(f) include americium-241, cesium-134, and tritium.

Americium-241 was detected above the soil FV in one sample and detected in 1 soil sample below 1.0 ft bgs with a maximum activity of 0.058 pCi/g. Activities did not change substantially with depth (0.02 pCi/g) at location 49-609672. Americium-241 was not detected in the vertical perimeter boreholes at locations 49-610938, 49-610939, 49-610940, and 49-610941. Activities decreased laterally. The residential SAL was approximately 1430 times the maximum activity. The lateral extent of americium-241 is defined, and further sampling for vertical extent is not warranted.

Cesium-134 was detected in one sample at an activity of 0.062 pCi/g. Activities decreased with depth and decreased laterally. Cesium-134 was not detected in the vertical perimeter boreholes at locations 49-610938, 49-610939, 49-610940, and 49-610941. The lateral and vertical extent of cesium-134 are defined.

Tritium was detected in eight samples with a maximum activity of 8.39 pCi/g. In accordance with the approved work plan (LANL 2008, 102691; NMED 2008, 100464), samples for tritium analysis were collected only from perimeter boreholes, so lateral extent was not evaluated. Activities decreased with depth at locations 49-610438, 49-610439, and 49-610941and did not change substantially with depth (0.033 pCi/g) at location 49-610940. The residential SAL was approximately 203 times the maximum activity. Further sampling for extent of tritium is not warranted.

6.7.4.5 Subsurface Vapor Sampling and Results

Three pore-gas samples were collected from one borehole at location 49-610939 and analyzed for VOCs and tritium. Table 6.7-5 presents the pore gas samples collected and analyses requested for SWMU 49-001(f).

Table 6.7-6 summarizes the analytical results for detected VOCs in pore gas. Plate 18 shows the spatial distribution of detected VOCs. Table 6.7-7 presents the tritium detected in pore gas. Plate 19 shows the spatial distribution of detected tritium.

The VOCs detected in pore gas at SWMU 49-001(f) include acetone; benzene; 2-butanone; chloromethane; dichlorodifluoromethane; ethylbenzene; 4-ethyltoluene; styrene; toluene; 1,2,4-trimethylbenzene; 1,3,5-trimethylbenzene; total xylenes; 1,2-xylene; and 1,3-xylene+1,4-xylene. The detected VOCs are retained as COPCs.

Tritium was detected in three samples with a maximum activity of 67,776 pCi/L. Tritium is retained as a COPC.

Nature and Extent of Contamination in Subsurface Pore Gas

The approved work plan (LANL 2008, 102691; NMED 2008, 100464) prescribed the collection of pore-gas samples from intervals corresponding to the base of formation Qbt 4, at TD of the closest experimental shaft, and from the TD of each borehole. If VOCs were detected in the vapor-phase sample at concentrations greater than 10% of the pore-gas screening levels presented in section 4.5 or if tritium was detected in the vapor-phase sample at a concentration greater than the groundwater MCL (20,000 pCi/L), the borehole would be completed as a vapor-monitoring well.

Screening was performed for each of the VOCs detected in pore-gas samples collected from SWMUs 49-001(a,b,c,d,e,f) and AOCs 49-008(c and d) using the maximum detected concentration from all sites. These results show that the SVs are below 0.1 in all cases, indicating that VOCs in subsurface pore gas are not a potential source of groundwater contamination (Table 4.5-2).

Tritium was detected at a maximum activity of 67,776 pCi/L in a sample collected from 62 to 64 ft bgs at borehole location 49-610939. Although tritium was detected above the groundwater MCL in the shallowest sample, tritium activities decreased significantly with depth to 5946 pCi/L at TD (133.0 to 135.0 ft bgs). Detected tritium activity in the TD sample is below the groundwater MCL (20,000 pCi/L).

The concentrations of all VOCs were less the 10% of the pore-gas screening level and the tritium activity in the deepest sample was less than the MCL. Therefore, borehole location 49-610939 was not completed as a vapor-monitoring well.

6.7.5 Summary of Human Health Risk Screening

Industrial Scenario

The total excess cancer risk for the industrial scenario is 2×10^{-6}, which is less than the NMED target risk level of 1×10^{-5} (NMED 2015, 600915). The industrial HI is 0.08, which is less than the NMED target HI of 1 (NMED 2015, 600915). The total dose is 0.1 mrem/yr, which is less than the target dose of 25 mrem/yr as authorized by DOE Order 458.1.

Residential Scenario

The total excess cancer risk for the residential scenario is 2×10^{-5}, which is above the NMED target risk level of 1×10^{-5} (NMED 2015, 600915). The residential HI is approximately 1, which is equivalent to the NMED target HI of 1 (NMED 2015, 600915). The total dose is 0.6 mrem/yr, which is less than the target dose of 25 mrem/yr as authorized by DOE Order 458.1.

Based on the risk-screening assessment results, no potential unacceptable risks or doses exist for the industrial scenario at SWMU 49-001(f).

6.7.6 Summary of Ecological Risk Screening

Based on evaluations of the minimum ESLs, HI analyses, potential effects to populations (individuals for T&E species), LOAEL analyses, the relationship of detected concentrations and screening levels to background concentrations, and COPECs without ESLs, no potential unacceptable ecological risks to the earthworm, plant, American robin, American kestrel, pocket gopher, deer mouse, montane shrew, desert cottontail, red fox, and Mexican spotted owl exist at SWMU 49-001(f).

6.8 SWMU 49-001(g), Contaminated Surface Soil

6.8.1 Site Description and Operational History

SWMU 49-001(g) is an area consisting of soil contamination located to the north of SWMUs 49-001(b) and 49-001(c), resulting from the transport of surface and near-surface radionuclide contamination associated with the shaft 2-M incident at Area 2 discussed in section 2.2 of the HIR (LANL 2007, 098492) (Figure 6.3-1). SWMU 49-001(g) is the area of highest runoff and erosion potential, located on a slope that runs from the mesa-top portion of the MDA AB NES north to the bottom of Water Canyon (LANL 2007, 098492). In accordance with the IP, storm water controls consisting of earth berms, riprap, and a rock check dam have been installed at SWMU 49-001(g).

6.8.2 Relationship to Other SWMUs and AOCs

SWMUs 49-001(b) and 49-001(c) consist of an area of experimental shafts known as Area 2 and Area 2A, respectively, and are located to the south of SWMU 49-001(g). A release from shaft 2-M in SWMU 49-001(b) is the source of the soil contamination at SWMU 49-001(g).

6.8.3 Summary of Previous Investigations

During the 1994 RFI, 10 surface samples (0.0 to 0.5 ft bgs) were collected from SWMU 49-001(g) and submitted for analysis of gamma-emitting radionuclides, gross alpha, gross beta, isotopic plutonium, and TAL metals. Data from the 1994 Phase I RFI are screening-level data and are presented in Appendix B of the HIR (LANL 2007, 098492). Phase I RFI data showed cadmium and uranium were the only inorganic chemicals detected above BVs. Radionuclides detected or detected above BVs/FVs in Phase I RFI samples were cesium-137, plutonium-238, plutonium-239/249, potassium-40, radium-226, and thorium-232.

6.8.4 Site Contamination

6.8.4.1 Soil, Rock, and Sediment Sampling

As described in section 6.3.4, because of the proximity of SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g), the for sites were investigated collectively. Section 6.3.4.1 discusses the sampling performed at SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g).

6.8.4.2 Soil, Rock, and Sediment Field-Screening Results

As described in section 6.3.4, because of the proximity of SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g), the four sites were investigated collectively. Section 6.3.4.2 discusses the field-screening results for SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g).

6.8.4.3 Soil, Rock, and Sediment Sampling Analytical Results

As described in section 6.3.4, because of the proximity of SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g), the four sites were investigated collectively. Section 6.3.4.3 presents the evaluation of COPCs for SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g).

6.8.4.4 Nature and Extent of Contamination

As described in section 6.3.4, because of the proximity of SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g), the four sites were investigated collectively. Section 6.3.4.4 discusses the nature and extent of contamination for SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g).

6.8.5 Summary of Human Health Risk Screening

The human health risk screening for SWMU 49-001(g) was conducted in conjunction with SWMUs 49-001(b), 49-001(c), and 49-001(d), and the results are presented in section 6.3.5.

6.8.6 Summary of Ecological Risk Screening

The ecological risk screening for SWMU 49-001(g) was conducted in conjunction with SWMUs 49-001(b), 49-001(c), and 49-001(g), and the results are presented in section 6.3.6.

6.9 SWMU 49-003, Inactive Leach Field and Associated Drainlines

6.9.1 Site Description and Operational History

SWMU 49-003 is an inactive leach field and associated drainlines at Area 11 inside the northern MDA AB NES boundary at TA-49 (Figure 6.9-1). The leach field is located approximately 20 ft to 25 ft east of the location of former building 49-15 and was connected to the former building by a drainline. The leach field is believed to be constructed of vitrified clay pipe installed in gravel bedding. Former building 49-15 housed a radiochemistry laboratory and change house. The former building 49-15 laboratory was used to analyze samples collected during the experiments conducted in the experimental shafts at Areas 2, 2A, 2B, and 4. The estimated total volume of wastewater discharged to the leach field was less than several hundred gallons and less than 50 gal. of organic chemicals. Former building 49-15 and related structures including latrines, a storage building, and propane and butane tanks in Area 11 were decontaminated, demolished, and removed in 1970 and 1971; the leach field and drainlines were left in place (LANL 1992, 007670, pp. 6-2-6-6; LANL 2007, 098492).

6.9.2 Relationship to Other SWMUs and AOCs

SWMU 49-003 and AOC 49-008(c) are located within Area 11. SWMU 49-003, an inactive leach field and drainlines, is located within the boundary of AOC 49-008(c), which consists of potential soil contamination from historical operations at Area 11.

6.9.3 Summary of Previous Investigations

During the 1995 Phase I RFI, 12 shallow (less than 4.3 ft bgs) subsurface samples were collected from 12 locations within the leach field. All 12 samples were submitted for analysis of gamma-emitting radionuclides, and a subset of 6 samples was submitted for analysis of TAL metals and isotopic plutonium (LANL 2007, 098492). Inorganic chemicals detected above soil and/or tuff BVs included aluminum, antimony, arsenic, barium, beryllium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, selenium, total uranium, and vanadium. Radionuclides detected or detected above BVs/FVs included americium-241, cesium-137, europium-152, plutonium-238, and plutonium-239/240. Historical sampling locations and detected concentrations are provided on plates and in figures and tables included in this report.

6.9.4 Site Contamination

6.9.4.1 Soil, Rock, and Sediment Sampling

Based on previous investigation results, further characterization was required to assess potential contamination at SWMU 49-003. As a result, the following activities were completed as part of the 2009−2010 investigation.

- A total of 14 samples were collected from five boreholes at SWMU 49-003. Samples were collected from three depth intervals at four boreholes and two depth intervals at one borehole. A sample was collected at the surface (0.0 to 0.5 ft bgs) at each location. Subsurface samples were collected over a depth range of 7.5 to 20.0 ft bgs. All samples were analyzed at off-site fixed laboratories for TAL metals, cyanide, perchlorate, explosive compounds, SVOCs, VOCs, americium-241, isotopic plutonium, isotopic uranium, tritium, iodine-129, strontium-90, and technetium-99.

The 2009–2010 sampling locations at SWMU 49-003 are presented on Plate 20. Table 6.9-1 presents the samples collected and analyses requested for SWMU 49-003. The geodetic coordinates of sampling locations are presented in Appendix C.

6.9.4.2 Soil, Rock, and Sediment Field-Screening Results

Organic vapors were not detected above 1.6 ppm during headspace (PID) screening of samples at SWMU 49-003. No radiological-screening results exceeded twice the daily site background levels. Field-screening results are presented in Table 3.1-5. There were no changes to sampling or other activities as a result of health- and safety-based field-screening results.

6.9.4.3 Soil, Rock, and Sediment Sampling Analytical Results

Decision-level data at SWMU 49-003 consist of results from 26 samples (11 soil and 15 tuff) collected from 17 locations.

Inorganic Chemicals

A total of 20 samples (7 soil and 13 tuff) were collected at SWMU 49-003 and analyzed for TAL metals. Fourteen samples (5 soil and 9 tuff) were collected and analyzed for cyanide and perchlorate and 5 samples (2 soil and 3 tuff) for total uranium. Table 6.9-2 presents the inorganic chemicals above BVs and detected inorganic chemicals with no BVs. Plate 21 shows the spatial distribution of inorganic chemicals

detected or detected above BVs at SWMU 49-003. Because fewer than 8 soil samples were collected, statistical tests could not be performed for soil.

Aluminum was detected above the Qbt 2,3,4 BV (7340 mg/kg) in four samples with a maximum concentration of 23,100 mg/kg. The Gehan and quantile tests indicated site concentrations of aluminum in tuff are not statistically different from background (Figure H-100 and Table H-9). Aluminum is not a COPC.

Antimony was detected above the soil and Qbt 2,3,4 BVs (0.83 mg/kg and 0.5 mg/kg) in one soil sample and four tuff samples with a maximum concentration of 1 mg/kg. Antimony is retained as a COPC.

Arsenic was detected above the Qbt 2,3,4 BV (2.79 mg/kg) in five samples with a maximum concentration of 4.7 mg/kg. The Gehan and quantile tests indicated site concentrations of arsenic in tuff are statistically different from background (Figure H-101 and Table H-9). Arsenic is retained as a COPC.

Barium was detected above the soil and Qbt 2,3,4 BVs (295 mg/kg and 46 mg/kg) in two soil samples and five tuff samples with a maximum concentration of 460 mg/kg. The maximum concentration was greater than the maximum soil background concentration (410 mg/kg). The Gehan and quantile tests indicated site concentrations of barium in tuff are not statistically different from background (Figure H-102 and Table H-9). Barium is retained as a COPC.

Beryllium was detected above the Qbt 2,3,4 BV (1.21 mg/kg) in two samples with a maximum concentration of 1.7 mg/kg. The Gehan and quantile tests indicated site concentrations of beryllium in tuff are not statistically different from background (Figure H-103 and Table H-9). Beryllium is not a COPC.

Calcium was detected above the soil and Qbt 2,3,4 BVs (6120 mg/kg and 2200 mg/kg) in two soil samples and four tuff samples with a maximum concentration of 6510 mg/kg. The maximum site soil concentration (6510 mg/kg) was below the six highest soil background concentrations (7200 mg/kg, 7500 mg/kg, 8400 mg/kg, 8500 mg/kg, 9700 mg/kg, and 14,000 mg/kg). The Gehan and quantile tests indicated site concentrations of calcium in tuff are statistically different from background (Figure H-104 and Table H-9). Calcium is retained as a COPC.

Chromium was detected above the Qbt 2,3,4 BV (7.14 mg/kg) in three samples with a maximum concentration of 11.8 mg/kg. The quantile and slippage tests indicated site concentrations of chromium in tuff are not statistically different from background (Figure H-105 and Table H-9). Chromium is not a COPC.

Cobalt was detected above the soil and Qbt 2,3,4 BVs (8.64 mg/kg and 3.14 mg/kg) in two soil samples and three tuff samples with a maximum concentration of 12.2 mg/kg. The soil concentrations above BV (9.4 mg/kg and 9.5 mg/kg) were slightly below or similar to the two highest soil background concentrations (8.5 mg/kg and 9.5 mg/kg). Cobalt was detected below BV in the other five soil samples. The Gehan and quantile tests indicated site concentrations of cobalt in tuff are not statistically different from background (Figure H-106 and Table H-9). Cobalt is not a COPC.

Copper was detected above the Qbt 2,3,4 BV (4.66 mg/kg) in three samples with a maximum concentration of 12.6 mg/kg. The Gehan and slippage tests indicated site concentrations of copper in tuff are statistically different from background (Figure H-107 and Table H-9). Copper is retained as a COPC.

Cyanide was not detected above the soil and Qbt 2,3,4 BVs (0.5 mg/kg) but had DLs (0.51 mg/kg to 0.59 mg/kg) above BVs in five soil samples and nine tuff samples. The DLs were only 0.01 mg/kg to 0.09 mg/kg above the BVs. Cyanide was not detected above BVs in the other six samples. Laboratory background soil samples were not analyzed for cyanide and the BV is based on DLs (LANL 1998, 059730). DLs slightly greater than BV, therefore, are not necessarily indicative of potential cyanide

contamination. SWMU 49-003 consists of a leach field and drainlines associated with a radiochemistry laboratory and there is no history of cyanide use at the site. Cyanide is not a COPC.

Iron was detected above the Qbt 2,3,4 BV (14,500 mg/kg) in one sample at a concentration of 16,600 mg/kg. The Gehan and quantile tests indicated site concentrations of iron in tuff are not statistically different from background (Figure H-108 and Table H-9). Iron is not a COPC.

Lead was detected above the Qbt 2,3,4 BV (11.2 mg/kg) in three samples with a maximum concentration of 23.5 mg/kg. The Gehan and quantile tests indicated site concentrations of lead in tuff are not statistically different from background (Figure H-109 and Table H-9). Lead is not a COPC.

Magnesium was detected above the Qbt 2,3,4 BV (1690 mg/kg) in four samples with a maximum concentration of 4250 mg/kg. The Gehan and quantile tests indicated site concentrations of magnesium in tuff are statistically different from background (Figure H-110 and Table H-9). Magnesium is retained as a COPC.

Manganese was detected above the soil and Qbt 2,3,4 BVs (671 mg/kg and 482 mg/kg) in one soil sample and one tuff sample with a maximum concentration of 723 mg/kg. The maximum soil concentration (723 mg/kg) was below the five highest soil background concentrations (810 mg/kg, 860 mg/kg, 950 mg/kg, 1000 mg/kg, and 1100 mg/kg). The Gehan and quantile tests indicated site concentrations of manganese in tuff are not statistically different from background (Figure H-111 and Table H-9). Manganese is not a COPC.

Nickel was detected above the soil and Qbt 2,3,4 BVs (15.4 mg/kg and 6.58 mg/kg) in one soil sample and 3 tuff samples with a maximum concentration of 15.6 mg/kg. The maximum soil concentration (15.6 mg/kg) was below or similar to the five highest soil background concentrations (16 mg/kg, 17 mg/kg, 19 mg/kg, 24 mg/kg, and 29 mg/kg). The Gehan and quantile tests indicated site concentrations of nickel in tuff are statistically different from background (Figure H-112 and Table H-9). Nickel is retained as a COPC.

Perchlorate was detected in seven samples with a maximum concentration of 0.047 mg/kg. Perchlorate is retained as a COPC.

Selenium was detected above the soil and Qbt 2,3,4 BVs (1.52 mg/kg and 0.3 mg/kg) in 3 soil samples and 11 tuff samples with a maximum concentration of 2 mg/kg and had DLs (0.46 mg/kg to 2 mg/kg) above the BVs in 1 soil sample and 2 tuff samples. Selenium is retained as a COPC.

Uranium was detected above the soil BV (1.82 mg/kg) in two samples with a maximum concentration of 2.42 mg/kg. The maximum concentration was below or similar to the two highest soil background concentrations (2.4 mg/kg and 3.6 mg/kg) and uranium was detected below BV in the three tuff samples. No uranium isotopes were detected above BVs (Table 6.9-4). Uranium is not a COPC.

Vanadium was detected above the Qbt 2,3,4 BV (17 mg/kg) in two samples with a maximum concentration of 20.7 mg/kg. The quantile and slippage tests indicated site concentrations of vanadium in tuff are not statistically different from background (Figure H-113 and Table H-9). Vanadium is not a COPC.

Organic Chemicals

A total of 14 samples (5 soil and 9 tuff) were collected at SWMU 49-003 and analyzed for explosive compounds, SVOCs, and VOCs. Table 6.9-3 summarizes the analytical results for detected organic chemicals. Plate 22 shows the spatial distribution of detected organic chemicals.

Organic chemicals detected at SWMU 49-003 include acetone, benzyl alcohol, bis(2-ethylhexyl)phthalate, and methylene chloride. The detected organic chemicals are retained as COPCs.

Radionuclides

A total of 14 samples (5 soil and 9 tuff) were collected at SWMU 49-003 and analyzed for americium-241, isotopic uranium, tritium, iodine-129, strontium-90, and technetium-99. Twenty samples (7 soil and 13 tuff) were collected and analyzed for isotopic plutonium and 12 samples (6 soil and 6 tuff) for gamma-emitting radionuclides. Table 6.9-4 presents the radionuclides detected or detected above BVs/FVs. Plate 23 shows the spatial distribution of detected radionuclides at SWMU 49-003.

Americium-241 was detected above the soil FV (0.013 pCi/g) in two samples with a maximum activity of 0.653 pCi/g. Americium-241 is retained as a COPC.

Cesium-137 was detected in one soil sample below 1.0 ft bgs at an activity of 0.138 pCi/g. Cesium-137 is retained as a COPC.

Plutonium-238 was detected above the soil FV (0.023 pCi/g) in one sample, detected in two soil samples below 1.0 ft bgs and was detected in five tuff samples with a maximum activity of 0.088 pCi/g. Plutonium-238 is retained as a COPC.

Plutonium-239/240 was detected above the soil FV (0.054 pCi/g) in three samples, detected in one soil sample below 1.0 ft bgs, and detected in one tuff sample with a maximum activity of 4.87 pCi/g. Plutonium-239/240 is retained as a COPC.

Tritium was detected in one sample at an activity of 0.222 pCi/g. Tritium is retained as a COPC.

6.9.4.4 Nature and Extent of Contamination

The nature and extent of inorganic, organic, and radionuclide COPCs at SWMU 49-003 were evaluated using the process described in section 5.2 and are discussed below. As presented in the approved investigation work plan (LANL 2008, 102691; NMED 2008, 100464), four vertical boreholes (locations 49-610497, 49-610498, 49-610499, and 49-610500) were drilled at the locations of the drainlines to a depth of 20 ft bgs. An additional borehole (location 49-610496) was drilled to a depth of 10 ft bgs. The objective of drilling the boreholes was to characterize the vertical extent of contamination beneath the SWMU.

Inorganic Chemicals

Inorganic COPCs at SWMU 49-003 include antimony, arsenic, barium, calcium, copper, magnesium, nickel, perchlorate, and selenium.

Antimony was detected above the soil and Qbt 2,3,4 BVs in 1 soil sample and 4 tuff samples with a maximum concentration of 1 mg/kg. Only one depth was sampled at locations 49-08031, 49-08032, 49-08033, 49-08038, and 49-08040. Antimony was not detected in the vertical boreholes at locations 49-610496, 49-610497, 49-610498, 49-610499, and 49-610500. Concentrations decreased laterally. The lateral and vertical extent of antimony are defined.

Arsenic was detected above the Qbt 2,3,4 BV in five samples with a maximum concentration of 4.7 mg/kg. Only one depth was sampled at locations 49-08031, 49-08032, 49-08033, and 49-08038. Arsenic was not detected above BVs in the vertical boreholes at locations 49-610496, 49-610498, 49-610499, and 49-610500, and concentrations did not change substantially with depth (0.8 mg/kg) in the

vertical borehole at location 49-610497 (the concentration in the surface sample at location 49-610497 was 4.2 mg/kg and below the soil BV [Appendix G, Pivot Tables). All concentrations above the Qbt 2,34 BV were below the maximum Qbt 2,3,4 background concentration (5 mg/kg). Concentrations did not change substantially laterally (they ranged from 2.8 mg/kg to 4.7 mg/kg in the shallow samples) but were either below BVs or below the maximum Qbt 2,3,4 background concentration. The lateral and vertical extent of arsenic are defined.

Barium was detected above the soil and Qbt 2,3,4 BVs in two soil samples and five tuff samples with a maximum concentration of 460 mg/kg. Only one depth was sampled at locations 49-08031, 49-08032, 49-08033, 49-08038, and 49-08040. The concentration at location 49-08040 was below the maximum soil background concentration (410 mg/kg). Barium was detected below BVs in the vertical boreholes at locations 49-610496, 49-610498, 49-610499, and 49-610500, and concentrations decreased with depth in the vertical borehole at location 49-610497. Concentrations decreased laterally from location 49-610497. The lateral and vertical extent of barium are defined.

Calcium was detected above the soil and Qbt 2,3,4 BVs in two soil samples and four tuff samples with a maximum concentration of 6510 mg/kg. Only one depth was sampled at locations 49-08031, 49-08032, 49-08033, 49-08038, and 49-08040. The concentration at location 49-08040 was below the maximum soil background concentration (14,000 mg/kg). Calcium was detected below BVs in the vertical boreholes at locations 49-610496, 49-610498, 49-610499, and 49-610500, and concentrations decreased with depth in the vertical borehole at location 49-610497. Concentrations decreased laterally from location 49-610497. The lateral and vertical extent of calcium are defined.

Copper was detected above the Qbt 2,3,4 BV in three samples with a maximum concentration of 12.6 mg/kg. Only one depth was sampled at locations 49-08033 and 49-08038. Copper was detected below BVs in the vertical boreholes at locations 49-610496, 49-610498, 49-610499, and 49-610500, and concentrations decreased with depth at location 49-610497. Concentrations decreased laterally. The lateral and vertical extent of copper are defined.

Magnesium was detected above the Qbt 2,3,4 BV in four samples with a maximum concentration of 4250 mg/kg. Only one depth was sampled at locations 49-08031, 49-08032, 49-08033, and 49-08038. The concentrations were below the maximum Qbt 2,3,4 background concentration (2820 mg/kg) at locations 49-08031 and 49-08032. Magnesium was detected below BVs in the vertical boreholes at locations 49-610496, 49-610497, 49-610498, 49-610499, and 49-610500. Concentrations decreased laterally. The lateral and vertical extent of magnesium are defined.

Nickel was detected above the soil and Qbt 2,3,4 BVs in one soil sample and three tuff samples with a maximum concentration of 15.6 mg/kg. Only one depth was sampled at locations 49-08031, 49-08033, and 49-08038. Nickel was detected below BVs in the vertical boreholes at locations 49-610496, 49-610498, 49-610499, and 49-610500, and concentrations decreased with depth at location 49-610497. Concentrations decreased laterally from location 49-610497. The lateral and vertical extent of nickel are defined.

Perchlorate was detected in seven samples with a maximum concentration of 0.047 mg/kg. Concentrations decreased with depth at locations 49-610497 and 49-610500, did not change substantially with depth (0.0027 mg/kg) at location 49-610496, and increased with depth at location 49-610498. Concentrations did not change substantially laterally (0.026 mg/kg). The residential SSL was approximately 1160 times the maximum concentration. Further sampling for extent of perchlorate is not warranted.

Selenium was detected above the soil and Qbt 2,3,4 BVs in 3 soil samples and 11 tuff samples with a maximum concentration of 2 mg/kg and had DLs (0.46 mg/kg to 2 mg/kg) above the BVs in 1 soil sample and 2 tuff samples. Only 1 depth was sampled at locations 49-08031, 49-08033, and 49-08038.

Concentrations did not change substantially with depth (0.1 mg/kg, 0.3 mg/kg, 0.3 mg/kg, 0.4 mg/kg, and 0.5 mg/kg, respectively) in the vertical boreholes at locations 49-610496, 49-610497, 49-610498, 49-610499, and 49-610500 (the concentration in the surface sample at location 49-610496 was 1.4 mg/kg and below the soil BV [Appendix G, Pivot Tables]). Concentrations did not change substantially laterally (0.1 mg/kg to 0.2 mg/kg). The residential SSL was approximately 196 times the maximum concentration and maximum DL. Further sampling for extent of selenium is not warranted.

Organic Chemicals

Organic COPCs at SWMU 49-003 include acetone, benzyl alcohol, bis(2-ethylhexyl)phthalate, and methylene chloride.

Acetone was detected in one sample at a concentration of 0.009 mg/kg. In accordance with the approved work plan (LANL 2008, 102691; NMED 2008, 100464), samples for VOC analysis were collected only from perimeter boreholes, so lateral extent was not evaluated. Concentrations increased with depth at location 49-610498; the concentration was below the EQL. The residential SSL was approximately 7,370,000 times the maximum concentration. Further sampling for extent of acetone is not warranted.

Benzyl alcohol was detected in one sample at a concentration of 0.056 mg/kg. In accordance with the approved work plan (LANL 2008, 102691; NMED 2008, 100464), samples for SVOC analysis were collected only from perimeter boreholes, so lateral extent was not evaluated. Concentrations increased with depth at location 49-610496; the concentration was below the EQL. The residential SSL was approximately 112,000 times the maximum concentration. Further sampling for extent of benzyl alcohol is not warranted.

Bis(2-ethylhexyl)phthalate was detected in two samples with a maximum concentration of 0.068 mg/kg. In accordance with the approved work plan (LANL 2008, 102691; NMED 2008, 100464), samples for SVOC analysis were collected only from perimeter boreholes, so lateral extent was not evaluated. Concentrations decreased with depth at location 49-610498 and increased with depth at location 49-610499. Both concentrations were below the EQLs. The residential SSL was approximately 5590 times the maximum concentration. Further sampling for extent of bis(2-ethylhexyl)phthalate is not warranted.

Methylene chloride was detected in one sample at a concentration of 0.0028 mg/kg. In accordance with the approved work plan (LANL 2008, 102691; NMED 2008, 100464), samples for VOC analysis were collected only from perimeter boreholes, so lateral extent was not evaluated. Concentrations decreased with depth at location 49-610497, and the concentration was below the EQL. The vertical extent of methylene chloride is defined.

Radionuclides

Radionuclide COPCs at SWMU 49-003 include americium-241, cesium-137, plutonium-238, plutonium-239/240, and tritium.

Americium-241 was detected above the soil FV in three samples with a maximum activity of 0.653 pCi/g. Americium-241 was either not detected or activities decreased with depth in the vertical boreholes at locations 49-610496, 49-610497, 49-610498, 49-610499, and 49-610500. Activities decreased laterally. The lateral and vertical extent of americium-241 are defined.

Cesium-137 was detected in one soil sample below 1.0 ft bgs at an activity of 0.138 pCi/g. Only one depth was sampled at location 49-08029. Cesium-137 was not analyzed for in the vertical boreholes at locations 49-610496, 49-610497, 49-610498, 49-610499, and 49-610500. The residential SAL was approximately 87 times the concentration. Further sampling for extent of cesium-137 is not warranted.

Plutonium-238 was detected above the soil FV in one sample, detected in two soil samples below 1.0 ft bgs, and detected in five tuff samples with a maximum activity of 0.088 pCi/g. Only one depth was sampled at locations 49-08029, 49-08033, 49-08038, and 49-08040. Plutonium-238 was either not detected or activities decreased with depth in the vertical boreholes at locations 49-610496, 49-610497, 49-610498, 49-610499, and 49-610500. Activities decreased laterally. The lateral and vertical extent of plutonium-238 are defined.

Plutonium-239/240 was detected above the soil FV in three samples, detected in one soil sample below 1.0 ft bgs, and detected in 1 tuff sample with a maximum activity of 4.87 pCi/g. Only one depth was sampled at locations 49-08029, 49-08031, and 49-08040. Plutonium-239/240 was either not detected or activities decreased with depth in the vertical boreholes at locations 49-610496, 49-610497, 49-610498, 49-610499, and 49-610500. Activities decreased laterally. The lateral and vertical extent of plutonium-239/240 are defined.

Tritium was detected in one sample at an activity of 0.222 pCi/g. Tritium was either detected in the vertical boreholes at locations 49-610497, 49-610498, 49-610499, and 49-610500. Activities increased with depth and increased laterally in the vertical borehole at locations 49-610496. The residential SAL was approximately 7660 times the activity. Further sampling for extent of tritium is not warranted.

6.9.5 Summary of Human Health Risk Screening

Industrial Scenario

No carcinogenic COPCs were identified in the 0.0 to 1.0-ft depth interval. The industrial HI is 0.003, which is less than the NMED target HI of 1 (NMED 2015, 600915). The total dose is 0.1 mrem/yr, which is less than the target dose of 25 mrem/yr as authorized by DOE Order 458.1.

Residential Scenario

The total excess cancer risk for the residential scenario is 9×10^{-6}, which is less than the NMED target risk level of 1×10^{-5} (NMED 2015, 600915). The residential HI is 0.05, which is less than the NMED target HI of 1 (NMED 2015, 600915). The total dose is 0.8 mrem/yr, which is less than the target dose of 25 mrem/yr as authorized by DOE Order 458.1.

Based on the risk-screening assessment results, no potential unacceptable risks or doses exist for the industrial and residential scenarios at SWMU 49-003.

6.9.6 Summary of Ecological Risk Screening

Based on evaluations of the minimum ESLs, HI analyses, potential effects to populations (individuals for T&E species), LOAEL analyses, the relationship of detected concentrations and screening levels to background concentrations, and COPECs without ESLs, no potential unacceptable ecological risks to the earthworm, plant, American robin, American kestrel, deer mouse, montane shrew, desert cottontail, red fox, and Mexican spotted owl exist at SWMU 49-003.

6.10 AOC 49-008(c), Area of Potential Soil Contamination

6.10.1 Site Description and Operational History

AOC 49-008(c) consists of an area of potentially contaminated soil from historical radiochemistry operations and small-scale containment experiments at Area 11 inside the northern portion of the MDA AB NES boundary at TA-49 (Figure 6.9-1). Area 11 is approximately 220 ft × 300 ft. Activities conducted at Area 11 from 1959 to 1961 supported hydronuclear experiments conducted elsewhere at TA-49 (LANL 1992, 007670). Radiochemistry operations were conducted in a former laboratory and change house (former building 49-15) that was the main structure at Area 11. Other former structures included a small storage building, latrines, and butane and propane tanks. The former building 49-15 laboratory was used to analyze samples collected during experiments in the experimental shafts at Areas 2, 2A, 2B, and 4. Laboratory processes included sample dissolution in acids (nitric, hydrochloric, hydrofluoric, sulfuric, and perchloric) and solvent extraction using methyl isobutyl ketone, ammonium hydroxide, and sodium hydroxide. Wastes generated during radiochemical operations were typically collected in containers and transported to radioactive waste disposal facilities elsewhere at the Laboratory. Interim waste storage boxes were stored south of former building 49-15. Some liquid wastes were reportedly discharged to a leach field (SWMU 49-003). Small-scale containment experiments were conducted in 13 underground shafts located on the west side of Area 11. These shafts were drilled to a depth of 12 ft and lined with 10-in.-diameter steel casing. HE was placed in the shafts, which were backfilled to contain the explosions. Small amounts of irradiated uranium-238 tracer were used in some experiments. The structures in Area 11 were decontaminated and removed in 1970 and 1971. Contamination was detected in sinks, ducts, and hoods in former building 49-15. Contaminated debris was removed and disposed of at TA-54, and uncontaminated debris (approximately 2160 ft^3) was taken to the open-burning/landfill area at Area 6 West (SWMU 49-004) (LANL 2007, 098492).

6.10.2 Relationship to Other SWMUs and AOCs

SWMU 49-003 and AOC 49-008(c) are located within Area 11. SWMU 49-003, an inactive leach field and drainlines, is located within the boundary of AOC 49-008(c), which consists of potential soil contamination from historical operations at Area 11.

6.10.3 Summary of Previous Investigations

During the 1987 soil and vegetation radiological-screening survey, 22 surface samples were collected from points on a 25-ft grid within Area 11, and 20 vegetation samples were collected within and around Area 11 (LANL 1992, 007670). Samples were analyzed for radionuclides, and results showed radionuclides at background levels for most sampling locations; however, elevated levels of isotopes of plutonium, americium, and uranium were present in a sample from a location adjacent to what would have been the east corner of former building 49-15, possibly where the sink drain was located (LANL 1992, 007670). Vegetation samples showed no elevated radioactivity.

During the 1995 Phase I RFI conducted at AOC 49-008(c), two surface (0.0 to 0.5 ft bgs) samples and two subsurface (7.0 to 12.0 ft bgs) samples were collected from two locations within the former small-scale shot area (LANL 1997, 056594). All samples were submitted for analysis of gamma-emitting radionuclides and both subsurface samples were submitted for analysis of isotopic plutonium, TAL metals, uranium, HE, and SVOCs.

Inorganic chemicals detected above BVs included calcium. No organic chemicals were detected and no radionuclides were detected or detected above BVs/FVs. Historical sampling locations and detected concentrations are provided on plates and in figures and tables presented below.

6.10.4 Site Contamination

6.10.4.1 Soil, Rock, and Sediment Sampling

In accordance with the approved investigation work plan (LANL 2006, 092571.12; NMED 2006, 095416), investigation of contamination at AOC 49-008(c) was conducted. Based on previous investigation results, further characterization was required to assess potential contamination at AOC 49-008(c). As a result, the following activities were completed as part of the 2009−2010 investigation.

- A total of 16 samples were collected from 7 locations at AOC 49-008(c). Ten samples were collected from 5 locations within and around the perimeter of the former radiochemistry laboratory. At each location, samples were collected from 2 depth intervals (0.0 to 2.0 ft bgs and 8.0 to 10.0 ft bgs). Six samples were collected from 2 boreholes at the perimeter of the former small-scale shot area. At each location, samples were collected from the surface (0.0 to 2.0 ft bgs) and from 2 subsurface intervals (18.0 to 20.0 ft bgs and 33.0 to 35.0 ft bgs at one location and 63.0 to 65.0 ft bgs and 77.0 to 79.0 ft bgs at the other). All samples were analyzed at off-site fixed laboratories for TAL metals, cyanide, perchlorate, explosive compounds, SVOCs, VOCs, americium-241, isotopic plutonium, isotopic uranium, and tritium.

The 1995 and 2009–2010 sampling locations at AOC 49-008(c) are presented on Plate 20. Table 6.10-1 presents the samples collected and analyses requested for AOC 49-008(c). The geodetic coordinates of sampling locations are presented in Appendix C.

6.10.4.2 Soil, Rock, and Sediment Field-Screening Results

Organic vapors were not detected above 1.1 ppm during headspace (PID) screening of samples at AOC 49-008(c). No radiological-screening results exceeded twice the daily site background levels. Field-screening results are presented in Table 3.1-6. There were no changes to sampling or other activities as a result of health- and safety-based field-screening results.

6.10.4.3 Soil, Rock, and Sediment Sampling Analytical Results

Decision-level data from the 1995 RFI boreholes and 2009–2010 were investigation were evaluated to identify COPCs at AOC 49-008(c) and consist of results from 20 samples (9 soil and 11 tuff) collected from 9 locations.

Inorganic Chemicals

A total of 18 samples (7 soil and 11 tuff) were collected at AOC 49-008(c) and analyzed for TAL metals. Sixteen samples (7 soil and 9 tuff) were collected and analyzed for cyanide and perchlorate, and 2 tuff samples were collected and analyzed for total uranium. Table 6.10-2 presents the inorganic chemicals above BVs and detected inorganic chemicals with no BVs. Plate 21 shows the spatial distribution of inorganic chemicals detected or detected above BVs at SWMU 49-008(c). Because fewer than 8 soil samples were collected, statistical tests could not be performed for soil.

Arsenic was detected above the Qbt 2,3,4 BV (2.79 mg/kg) in one sample at a concentration of 3.4 mg/kg. The quantile and slippage tests indicated site concentrations of arsenic in tuff are not statistically different from background (Figure H-114 and Table H-10). Arsenic is not a COPC.

Barium was detected above the Qbt 2,3,4 BV (46 mg/kg) in one sample at a concentration of 84.4 mg/kg. The Gehan and quantile tests indicated site concentrations of barium in tuff are not statistically different from background (Figure H-115 and Table H-10). Barium is not a COPC.

Calcium was detected above the Qbt 2,3,4 BV (2200 mg/kg) in one sample at a concentration of 2720 mg/kg. The quantile and slippage tests indicated site concentrations of calcium in tuff are not statistically different from background (Figure H-116 and Table H-10). Calcium is not a COPC.

Chromium was detected above the Qbt 2,3,4 BV (7.14 mg/kg) in one sample at a concentration of 8.5 mg/kg. The quantile and slippage tests indicated site concentrations of chromium in tuff are not statistically different from background (Figure H-117 and Table H-10). Chromium is not a COPC.

Cyanide was not detected above the soil and Qbt 2,3,4 BVs (0.5 mg/kg for both) but had DLs (0.51 mg/kg to 0.56 mg/kg) above BV in 12 samples. The DLs were only 0.01 mg/kg to 0.06 mg/kg above the BVs. Cyanide was not detected with DLs below BV in the other 4 samples. Laboratory background soil samples were not analyzed for cyanide and the BV is based on DLs (LANL 1998, 059730). DLs slightly greater than BV, therefore, are not necessarily indicative of potential cyanide contamination. AOC 49-008(c) consists of potential soil contamination associated with a former radiochemistry laboratory and small-scale explosive tests and there is no history of cyanide use at the site. Cyanide is not a COPC.

Magnesium was detected above the Qbt 2,3,4 BV (1690 mg/kg) in one sample at a concentration of 1760 mg/kg. The quantile and slippage tests indicated site concentrations of magnesium in tuff are not statistically different from background (Figure H-118 and Table H-10). Magnesium is not a COPC.

Perchlorate was detected in nine samples with a maximum concentration of 0.16 mg/kg. Perchlorate is retained as a COPC.

Selenium was detected above the soil and Qbt 2,3,4 BVs (1.52 mg/kg and 0.3 mg/kg) in three soil samples and nine tuff samples with a maximum concentration of 2.5 mg/kg and had DLs (0.44 mg/kg) above the Qbt 2,3,4 BV in two samples. Selenium is retained as a COPC.

Organic Chemicals

A total of 18 samples (7 soil and 11 tuff) were collected at AOC 49-008(c) and analyzed for SVOCs, 18 samples (7 soil and 11 tuff) for explosive compounds, and 16 samples (7 soil and 9 tuff) for VOCs. Table 6.10-3 summarizes the analytical results for detected organic chemicals. Plate 22 shows the spatial distribution of detected organic chemicals.

Organic chemicals detected at AOC 49-008(c) include benzyl alcohol, bis(2-ethylhexyl)phthalate, 4-isopropyltoluene, nitroglycerin, and 3-nitrotoluene. The detected organic chemicals are retained as COPCs.

Radionuclides

A total of 18 samples (7 soil and 11 tuff) were collected at AOC 49-008(c) and analyzed for isotopic plutonium, 16 samples (7 soil and 9 tuff) for isotopic uranium, americium-241 and tritium, and 4 samples (2 soil and 2 tuff) for gamma-emitting radionuclides. Table 6.10-4 presents the radionuclides detected or detected above BVs/FVs. Plate 23 shows the spatial distribution of detected radionuclides at AOC 49-008(c).

Plutonium-238 was detected in one tuff sample at an activity of 0.009 pCi/g. Plutonium-238 is retained as a COPC.

Plutonium-239/240 was detected in five soil samples below 1.0 ft bgs and detected in one tuff sample with a maximum activity of 1.02 pCi/g. Plutonium-239/240 is retained as a COPC.

Tritium was detected in three samples with a maximum activity of 0.67 pCi/g. Tritium is retained as a COPC.

6.10.4.4 Nature and Extent of Contamination

The nature and extent of inorganic, organic, and radionuclide COPCs at AOC 49-008(c) were evaluated using the process described in section 5.2 and are discussed below.

Inorganic Chemicals

Inorganic COPCs at AOC 49-008(c) include perchlorate and selenium.

Perchlorate was detected in 9 samples with a maximum concentration of 0.16 mg/kg. Concentrations decreased with depth and were below the EDL at location 49-610495, did not change substantially with depth (0.054 mg/kg, 0.0007 mg/kg, and 0.151 mg/kg, respectively) at locations 49–610492, 49-610493, and 49-610494 and increased with depth but were below the EDL at location 49-610491. Concentrations did not change substantially laterally (they ranged from 0.055 mg/kg to 0.1 mg/kg). The residential SSL was approximately 340 times the maximum concentration. Further sampling for extent of subsurface perchlorate is not warranted.

Selenium was detected above the soil and Qbt 2,3,4 BVs in three soil samples and nine tuff samples with a maximum concentration of 2.5 mg/kg and had DLs (0.44 mg/kg) above the Qbt 2,3,4 BV in two samples. Concentrations increased with depth at location 49-610494 and did not change substantially with depth (0.2 mg/kg, 0.4 mg/kg, 0.1 mg/kg, 0.1 mg/kg, 0.2 mg/kg, and 0.6 mg/kg, respectively) at locations 49-610489, 49-610490, 49-610491, 49-610492, 49-610493, and 49-610495 (the concentrations in surface samples at locations 49-610489 and 49-610495 were 1.4 mg/kg and 1.3 mg/kg, respectively, and below the soil BV [Appendix G, Pivot Tables]). Concentrations did not change substantially (0.8 mg/kg) laterally. The residential SSL was approximately 156 times the maximum concentration and approximately 89 times the maximum DL. Further sampling for extent of selenium is not warranted.

Organic Chemicals

Organic COPCs at AOC 49-008(c) include benzyl alcohol, bis(2-ethylhexyl)phthalate, 4-isopropyltoluene, nitroglycerin, and 3-nitrotoluene.

Benzyl alcohol was detected in 16 samples with a maximum concentration of 0.19 mg/kg. Concentrations did not change substantially with depth (0.033 mg/kg, 0.016 mg/kg, 0.008 mg/kg, 0.004 mg/kg, 0.09 mg/kg, 0.094 mg/kg, and 0.006 mg/kg, respectively) at locations 49-610489, 49-610490, 49-610491, 49-610492, 49-610493, 49-610494, and 49-610495. Concentrations did not change substantially laterally (0.012 mg/kg, 0.134 mg/kg, 0.104 mg/kg, and 0.028 mg/kg, respectively) from location 49-610492 to locations 49-610491, 49-610493, 49-610494, and 49-610495. Concentrations were below the EQLs. The residential SSL was approximately 33,200 times the maximum concentration. Further sampling for extent of benzyl alcohol is not warranted.

Bis(2-ethylhexyl)phthalate was detected in four samples with a maximum concentration of 0.07 mg/kg. Concentrations increased with depth at location 49-610493 and did not change substantially with depth (0.003 mg/kg) at location 49-610494. Only one depth was analyzed for SVOCs at location 49-08049. Bis(2-ethylhexyl)phthalate was not detected in deeper samples at location 49-610490, which is 10 ft from location 49-08049 (Plate 22). Concentrations decreased laterally from location 49-08049 to location 49-610490 and increased laterally at locations 49-610493 and 49-610494. Concentrations were below the EQLs. The residential SSL was approximately 3800 times the maximum concentration. Further sampling for extent of bis(2-ethylhexyl)phthalate is not warranted.

Isopropyltoluene[4-] was detected in one sample at a concentration of 0.00029 mg/kg. Concentrations decreased with depth at location 49-610490 and increased laterally. The concentration was below the EQL. The residential SSL was approximately 8,140,000 times the maximum concentration. The vertical extent of 4-isopropyltoluene is defined, and further sampling for lateral extent is not warranted.

Nitroglycerin was detected in one sample at a concentration of 0.053 mg/kg. Concentrations increased with depth and increased laterally at location 49-610493. The concentration was below the EQL. The residential SSL was approximately 123 times the maximum concentration. Further sampling for extent of nitroglycerin is not warranted.

Nitrotoluene[3-] was detected in one sample at a concentration of 0.56 mg/kg. Concentrations decreased with depth and increased laterally at location 49-610491. The residential and industrial SSLs were approximately 11 times and 164 times the maximum concentration. The vertical extent of 3-nitrotoluene is defined and further sampling for lateral extent is not warranted.

Radionuclides

Radionuclide COPCs at AOC 49-008(c) include plutonium-238, plutonium-239/240, and tritium.

Plutonium-238 was detected in 1 tuff sample at an activity of 0.009 pCi/g. Only one subsurface depth was sampled at location 49-08049. Plutonium-238 was not detected in deeper samples from location 49-610490, which is 10 ft from location 49-08049 (Plate 23). Activities decreased laterally from location 49-08049. The lateral and vertical extent of plutonium-238 are defined.

Plutonium-239/240 was detected in 5 soil samples below 1.0 ft bgs and detected in 1 tuff sample with a maximum activity of 1.02 pCi/g. Activities decreased with depth at locations 49-610491, 49-610492, 49-610493, 49-610494, and 49-610495. Only one subsurface depth was sampled at location 49-08051. Plutonium-239/240 was not detected in deeper samples at location 49-610489, which is 25 ft from location 49-08051 (Plate 23). Activities decreased laterally. The lateral and vertical extent of plutonium-239/240 are defined.

Tritium was detected in three samples with a maximum activity of 0.67 pCi/g. Activities increased with depth at locations 49-610490 and 49-610493 and decreased with depth at location 49-610489. Activities increased laterally. The residential SAL was approximately 2540 times the maximum activity. Further sampling for extent of tritium is not warranted.

6.10.4.5 Subsurface Vapor Sampling and Results

Four pore-gas samples were collected from two boreholes at locations 49-610489 and 49-610490 and analyzed for VOCs and tritium. Table 6.10-5 presents the pore gas samples collected and analyses requested for AOC 49-008(c).

Table 6.10-6 summarizes the analytical results for detected VOCs in pore gas. Plate 22 shows the spatial distribution of detected VOCs. Table 6.10-7 presents the tritium detected in pore gas. Plate 23 shows the spatial distribution of detected tritium.

The VOCs detected in pore gas at AOC 49-008(c) include acetone; benzene; 2-butanone; carbon disulfide; chloromethane; dichlorodifluoromethane; ethylbenzene; 4-ethyltoluene; styrene; toluene; 1,2,4-trimethylbenzene; 1,3,5-trimethylbenzene; total xylenes; 1,2-xylene; and 1,3-xylene+1,4-xylene. The detected VOCs are retained as COPCs.

Tritium was detected in one sample at an activity of 1767 pCi/L. Tritium is retained as a COPC.

Nature and Extent of Contamination in Subsurface Pore Gas

The approved work plan (LANL 2008, 102691; NMED 2008, 100464) prescribed the collection of pore-gas samples from intervals corresponding to the base of formation Qbt 4, at TD of the small-scale shot experimental shafts, and from the TD of each borehole. If VOCs were detected in the vapor-phase sample at concentrations greater than 10% of the pore-gas screening levels presented in section 4.5 or if tritium was detected in the vapor-phase sample at a concentration greater than the groundwater MCL (20,000 pCi/L), the borehole would be completed as a vapor-monitoring well.

Screening was performed for each of the VOCs detected in pore-gas samples collected from SWMUs 49-001(a,b,c,d,e,f) and AOCs 49-008(c and d) using the maximum detected concentration from all sites. These results show that the SVs are below 0.1 in all cases, indicating VOCs in subsurface pore gas are not a potential source of groundwater contamination (Table 4.5-2).

Tritium was detected at a maximum activity of 1767 pCi/L in a sample collected from 29 to 31 ft bgs at borehole location 49-610489. Detected activities of tritium were below the groundwater MCL (20,000 pCi/L). Therefore, tritium is not a potential source of groundwater contamination.

The concentrations of all VOCs were less the 10% of the pore-gas screening level and the maximum tritium activity was less than the MCL. Therefore, the boreholes at AOC 49-008(c) were not completed as vapor-monitoring wells.

6.10.5 Summary of Human Health Risk Screening

Industrial Scenario

The total excess cancer risk for the industrial scenario is 3×10^{-10}, which is less than the NMED target risk level of 1×10^{-5} (NMED 2015, 600915). The industrial HI is 0.006, which is less than the NMED target HI of 1 (NMED 2015, 600915). The total dose is 0.02 mrem/yr, which is less than the target dose of 25 mrem/yr as authorized by DOE Order 458.1.

Residential Scenario

The total excess cancer risk for the residential scenario is 7×10^{-6}, which is less than the NMED target risk level of 1×10^{-5} (NMED 2015, 600915). The residential HI is 0.5, which is less than the NMED target HI of 1 (NMED 2015, 600915). The total dose is 0.09 mrem/yr, which is less than the target dose of 25 mrem/yr as authorized by DOE Order 458.1.

Based on the risk-screening assessment results, no potential unacceptable risks or doses exist for the industrial and residential scenarios at AOC 49-008(c).

6.10.6 Summary of Ecological Risk Screening

Based on evaluations of the minimum ESLs, HI analyses, potential effects to populations (individuals for T&E species), LOAEL analyses, and COPECs without ESLs, no potential unacceptable ecological risks to the earthworm, plant, American robin, American kestrel, pocket gopher, deer mouse, montane shrew, desert cottontail, red fox, and Mexican spotted owl exist at AOC 49-008(c).

6.11 AOC 49-008(d), Bottle House and Cable Pull Test Facility

6.11.1 Site Description and Operational History

AOC 49-008(d) is an area of potential soil contamination located within Area 12 in the northeast corner of the MDA AB NES boundary at TA-49 (Figure 6.10-1). Area 12 was used in 1960 and 1961 to conduct confinement experiments related to the hydronuclear experiments at MDA AB that involved HE detonations in sealed metal bottles. The bottles measured up to 5 ft diameter × 16 ft long and were placed in a 10-ft-diameter × 30-ft-deep underground shaft during the experiments. Former building 49-23 was constructed over the shaft and was known as the Bottle House. Approximately 26 confinement experiments were conducted at Area 12 (LANL 1992, 007670, p. 6.6-3). After the confinement experiments ceased, Area 12 was used to conduct tests to determine the strength of cables used in other experiments. The CPTF, former building 49-121, was constructed approximately 60 ft south of former building 49-23 in the early or mid-1960s to perform these tests (LANL 1992, 007670, p. 3-9). The shaft in former building 49-23 was backfilled with crushed tuff, and a hydraulic system was installed in the building. Underground hydraulic lines were run to former building 49-121. The total fluid capacity of the hydraulic system was estimated to have been less than 10 gal. (LANL 2007, 098492). The Bottle House and CPTF were removed in February 2006 (Beguin 2007, 098607); neither PCBs nor radioactivity above background levels was detected in any of the waste streams generated during decontamination and decommissioning activities (Beguin 2007, 098607). The site is used occasionally to support microwave experiments that involve portable equipment (LANL 2007, 098492).

6.11.2 Relationship to Other SWMUs and AOCs

AOC 49-008(d) is located within Area 12. SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g), collectively known as MDA AB, are located directly west of AOC 49-008(d). AOC 49-002 is an underground experimental calibration chamber and two associated shafts in Area 10, and SWMU 49-005(a) is an inactive landfill located east of Area 10. Area 10 is located east of Area 12, outside the NES boundary.

6.11.3 Summary of Previous Investigations

During the 1987 soil and vegetation radiological-screening survey, 12 surface samples were collected within Area 12, and 11 vegetation samples were collected within and around Area 12 (LANL 1992, 007670). Samples were analyzed for radionuclides and results showed radionuclides at background levels for most sampling locations; however, elevated levels of isotopes of plutonium and americium were present in a highly discontinuous distribution at several samples around the former Bottle House (LANL 1992; 007670). Several vegetation samples also showed slightly elevated radioactivity.

The 1995 Phase I RFI conducted at AOC 49-008(d) was directed at three specific areas: soil inside and around the former Bottle House (former building 49-23), soil around the former CPTF (former building 49-121), and a small area of stained soil approximately 80 ft south of former building 49-121. Radiation surveys were conducted at each of these areas, and radiation was not detected above background levels around the former CPTF or at the stained-soil site. However, four radiation survey points around the former Bottle House showed radiation levels above background levels (LANL 2007, 098492). A total of 22 surface-soil samples (0.0 to 0.5 ft bgs) were collected at the three areas of investigation described above. Additionally, three samples were collected from a depth of 0.5 to 1.0 ft bgs from three of the surface-sampling locations around the former Bottle House (locations 49-09007, 49-09032, and 49-09036). All samples were field-screened for radioactivity and submitted for analyses of gamma-emitting radionuclides. Samples from nine of the surface locations and the three subsurface samples were submitted for analysis of TAL metals and isotopic plutonium. Both surface and shallow subsurface samples

collected from sampling locations 49-09007, 49-09032, and 49-09036 were also submitted for analysis of isotopic uranium. Seven surface samples collected near the location of the hydraulic system in the former Bottle House and near the former CPTF were also submitted for analysis of SVOCs, and one surface sample was as submitted for analysis of pesticides and PCBs (LANL 2007, 098492).

Inorganic chemicals detected above BVs included cadmium, copper, lead, sodium, uranium, and zinc. Organic chemicals detected included alpha–benzene hexachloride (BHC), alpha-chlordane, and gamma-chlordane at trace concentrations in a surface sample collected inside the former Bottle House (location 49-09095). Radionuclides detected or detected above BVs/FVs included plutonium-238, uranium-234, uranium-235/236, and uranium-238. Based on these results, a voluntary corrective action (VCA) was proposed for soil around former building 49-23 (LANL 2007, 098492).

In 1997 and 1998, three VCAs were conducted at AOC 49-008(d). These VCAs consisted of radiological field screening in conjunction with soil sampling to remove isolated contamination (LANL 1997, 056923, p. 17). The initial VCA was conducted at AOC 49-008(d) in 1997 to remove soil contaminated with uranium-234, uranium-235, and/or uranium-238 above cleanup levels (LANL 1997, 056923, p. 17). Confirmation samples revealed contamination still present above cleanup levels (LANL 2007, 098492). A supplemental low-level gamma radiation survey of surface soil around the Bottle House was conducted in April 1998 (LANL 1998, 062405). Of 2000 measurements taken, 8 measurements were above 9000 counts per min (cpm) (9140 to 32,200 cpm), which was considered above background. All these detections were near areas where soil was removed during the 1997 VCA (LANL 2007, 098492). In November 1998, a remedial action was conducted to remove all brushy vegetation, and a pre-excavation radiological survey was conducted on a 3-ft × 3-ft grid that included some of the locations were covered in the April 1998 survey. Radiological-screening results were used to identify areas for additional soil removal, and soil was removed to a depth of 12 in. A post-excavation radiological survey was conducted in which three additional locations were identified that exceeded SALs. Additional small amounts of soil were removed at these locations (LANL 1998, 062405). Additional confirmatory sampling was conducted from the areas of the highest radiological survey measurements and from randomly selected locations. Analyses were performed on these samples for isotopic uranium. One of these confirmatory samples exceeded the cleanup level for uranium-238 (270 pCi/g) (LANL 2007, 098492). Following the confirmatory sampling, soil-removal areas were backfilled with clean crushed tuff, covered with a thin layer of topsoil, and seeded (Wilson 1999, 066470.426). Data from the 1997 and 1998 VCAs are screening-level data and are presented in Appendix B of the HIR (LANL 2007, 098492). Historical decision-level sampling locations not removed during the VCAs and detected concentrations are shown on plates and presented in figures and tables included in this report.

6.11.4 Site Contamination

6.11.4.1 Soil, Rock, and Sediment Sampling

Based on previous investigation results, further characterization was required to assess potential contamination at AOC 49-008(d). As a result, the following activities were completed as part of the 2009−2010 investigation.

- A total of 65 samples were collected from 33 locations at AOC 49-008(d). Fifty-seven samples were collected from 31 locations within AOC 49-008(d). At all but 5 locations, samples were collected at the surface (0.0 to 0.5 ft bgs) and from the subsurface (0.5 to 1.5 ft bgs). At 3 locations, a sample was collected only at the surface (0.0 to 0.5 ft bgs) and at 2 locations a sample was collected only from the subsurface (0.5 to 1.5 ft bgs). All samples were analyzed at off-site fixed laboratories for gamma-emitting radionuclides, SVOCs, VOCs, and PCBs;

62 samples for TAL metals, americium-241, isotopic plutonium, and isotopic uranium; and 4 samples for iodine-129, strontium-90, and technetium-99.

- A total of 8 samples were collected from 2 boreholes, 1 adjacent to the former Bottle House and 1 adjacent to the former CPTF. Samples were collected from 4 depth intervals at each borehole over the range of 2.0 to 120.0 ft bgs. All samples were analyzed at off-site fixed laboratories for TAL metals, cyanide, perchlorate, explosive compounds, SVOCs, VOCs, americium-241, isotopic plutonium, isotopic uranium, and tritium and 4 samples for total petroleum hydrocarbons–diesel range organics (TPH-DRO) and TPH–gasoline range organics (GRO).

The 2009–2010 sampling locations at AOC 49-008(d) are presented on Plate 24. Table 6.11-1 presents the samples collected and analyses requested for AOC 49-008(d). The geodetic coordinates of sampling locations are presented in Appendix C.

6.11.4.2 Soil, Rock, and Sediment Field-Screening Results

Organic vapors were not detected above 1.7 ppm during headspace (PID) screening of samples at AOC 49-008(d). No radiological-screening results exceeded twice the daily site background levels. Field-screening results are presented in Table 3.1-7. There were no changes to sampling or other activities as a result of health- and safety-based field-screening results.

Eight surface and shallow subsurface samples from AOC 49-008(d) exceeded the gross-alpha and/or -beta screening thresholds, and additional samples were collected and submitted for appropriate laboratory analysis. Fourteen additional step-out-surface and shallow-subsurface screening samples from seven locations were collected and screened for gross-alpha and -beta analysis but did not exceed screening thresholds and were not submitted for laboratory analysis. The gross-alpha and -beta screening results that guided additional sampling at AOC 49-008(d) are presented in Tables D-7 through D-15 in Appendix D.

6.11.4.3 Soil, Rock, and Sediment Sampling Analytical Results

Decision-level data at AOC 49-008(d) consist of results from 90 samples (84 soil and 6 tuff) collected from 54 locations.

Inorganic Chemicals

A total of 71 samples (65 soil and 5 tuff) were collected at AOC 49-008(d) and analyzed for TAL metals. Eight samples (2 soil and 6 tuff) were collected and analyzed for cyanide and perchlorate. Table 6.11-2 presents the inorganic chemicals above BVs and detected inorganic chemicals with no BVs. Plate 25 shows the spatial distribution of inorganic chemicals detected or detected above BVs at SWMU 49-008(d). Because fewer than 8 tuff samples were collected, statistical tests could not be performed for tuff.

Antimony was detected above the soil BV (0.83 mg/kg) in two samples with a maximum concentration of 2.1 mg/kg and had DLs (0.51 mg/kg) above the BV in three samples. The quantile test indicated site concentrations of antimony in soil are statistically different from background (Figure H-119 and Table H-11). Antimony is retained as a COPC.

Barium was detected above the soil BV (295 mg/kg) in three samples with a maximum concentration of 539 mg/kg. The Gehan and quantile tests indicated site concentrations of barium in soil are not statistically different from background (Figure H-120 and Table H-11). Barium is not a COPC.

Cadmium was detected above the soil BV (0.4 mg/kg) in 8 samples with a maximum concentration of 1.1 mg/kg. Statistical tests were not performed because the background data set for soil contains too few detections. The maximum concentration was 0.7 mg/kg above the BV and below the two highest background sample results (2.6 mg/kg and 1.4 mg/kg). Cadmium was not detected or detected above BV in the other 63 samples (detected below BV in 62 samples). Cadmium is not as a COPC.

Calcium was detected above the soil BV (6120 mg/kg) in five samples with a maximum concentration of 9760 mg/kg. The Gehan and quantile tests indicated site concentrations of calcium in soil are not statistically different from background (Figure H-121 and Table H-11). Calcium is not a COPC.

Chromium was detected above the soil BV (19.3 mg/kg) in one sample at a concentration of 21 mg/kg. The Gehan and quantile tests indicated site concentrations of chromium in soil are not statistically different from background (Figure H-122 and Table H-11). Chromium is not a COPC.

Cobalt was detected above the soil BV (8.64 mg/kg) in two samples with a maximum concentration of 15 mg/kg. The Gehan and quantile tests indicated site concentrations of cobalt in soil are not statistically different from background (Figure H-123 and Table H-11). Cobalt is not a COPC.

Copper was detected above the soil BV (14.7 mg/kg) in seven samples with a maximum concentration of 391 mg/kg. The Gehan and quantile tests indicated site concentrations of copper in soil are not statistically different from background (Figure H-124 and Table H-11). However, the maximum concentration is substantially above the maximum soil background concentration (16 mg/kg). Copper is retained as a COPC.

Cyanide was not detected above the soil and Qbt 2,3,4 BVs (0.5 mg/kg) but had DLs (0.51 mg/kg to 0.58 mg/kg) above the BVs in two soil samples and six tuff samples. The DLs were only 0.01 mg/kg to 0.08 mg/kg above the BV. Cyanide is not a COPC.

Lead was detected above the soil BV (22.3 mg/kg) in three samples with a maximum concentration of 38.2 g/kg. The Gehan and quantile tests indicated site concentrations of lead in soil are not statistically different from background (Figure H-125 and Table H-11). Lead is not a COPC.

Manganese was detected above the soil BV (671 mg/kg) in one sample at a concentration of 1020 mg/kg. Gehan and quantile tests indicated site concentrations of manganese in soil are not statistically different from background (Figure H-126 and Table H-11). Manganese is not a COPC.

Nickel was detected above the soil BV (15.4 mg/kg) in one sample at a concentration of 16.1 mg/kg. The Gehan and quantile tests indicated site concentrations of nickel in soil are not statistically different from background (Figure H-127 and Table H-11). Nickel is not a COPC.

Selenium was detected above the Qbt 2,3,4 BV (0.3 mg/kg) in six samples with a maximum concentration of 1.1 mg/kg. Selenium is retained as a COPC.

Sodium was detected above the soil BV (2770 mg/kg) in three samples with a maximum concentration of 5930 mg/kg. The Gehan and quantile tests indicated site concentrations of sodium in soil are not statistically different from background (Figure H-128 and Table H-11). Sodium is not a COPC.

Thallium was detected above the soil BV (0.73 mg/kg) in 3 samples with a maximum concentration of 1.7 mg/kg and had DLs (0.9 mg/kg to 1.3 mg/kg) above the BV in 17 samples. The slippage test indicated site concentrations of thallium in soil are statistically different from background (Figure H-129 and Table H-11). Thallium is retained as a COPC.

Uranium was detected above the soil BV (1.82 mg/kg) in nine samples with a maximum concentration of 68.4 mg/kg. The Gehan and quantile tests indicated site concentrations of uranium in soil are statistically different from background (Figure H-130 and Table H-11). Uranium is retained as a COPC.

Zinc was detected above the soil BV (48.8 mg/kg) in four samples with a maximum concentration of 171 mg/kg. The Gehan and quantile tests indicated site concentrations of zinc in soil are not statistically different from background (Figure H-131 and Table H-11). Zinc is not a COPC.

Organic Chemicals

A total of 72 samples (66 soil and 6 tuff) were collected at AOC 49-008(d) and analyzed for SVOCs, 65 samples (59 soil and 6 tuff) for VOCs, 57 soil samples for PCBs, 8 samples (2 soil and 6 tuff) were for explosive compounds, 1 soil sample for pesticides/PCBs, and 4 samples (1 soil and 3 tuff) for TPH-DRO and TPH-GRO. Table 6.11-3 summarizes the analytical results for detected organic chemicals. Plate 26 shows the spatial distribution of detected organic chemicals.

Organic chemicals detected at AOC 49-008(d) include acetone; Aroclor-1254; Aroclor-1260; benzo(g,h,i)perylene; alpha-BHC; bis(2-ethylhexyl)phthalate; alpha-chlordane; gamma-chlordane; chlorobenzene; chloromethane; 1,4-dichlorobenzene; 4-isopropyltoluene; and methylene chloride. The detected organic chemicals are retained as COPCs.

Radionuclides

A total of 71 samples (65 soil and 6 tuff) were collected at AOC 49-008(d) and analyzed for isotopic plutonium; 68 samples (62 soil and 6 tuff) for isotopic uranium; 82 soil samples for gamma-emitting radionuclides; 62 samples (56 soil and 6 tuff) for americium-241; 8 samples (2 soil and 6 tuff) for tritium; and 4 soil samples for iodine-129, strontium-90, and technetium-99. Table 6.11-4 presents the radionuclides detected or detected above BVs/FVs. Plate 27 shows the spatial distribution of detected radionuclides at AOC 49-008(d).

Americium-241 was detected above the soil FV (0.013 pCi/g) in one sample at an activity of 0.086 pCi/g. Americium-241 is retained as a COPC.

Cesium-134 was detected in one sample at an activity of 0.039 pCi/g. Cesium-134 is retained as a COPC.

Plutonium-239/240 was detected above the soil FV (0.054 pCi/g) in 16 samples with a maximum activity of 0.483 pCi/g. Plutonium-239/240 is retained as a COPC.

Tritium was detected in two samples with a maximum activity of 0.35 pCi/g. Tritium is retained as a COPC.

Uranium-234 was detected above the soil BV (2.59 pCi/g) in three samples with a maximum activity of 3.84 pCi/g. Uranium-234 is retained as a COPC.

Uranium-235/236 was detected above the soil BV (0.2 pCi/g) in two samples with a maximum activity of 0.42 pCi/g. Uranium-235/236 is retained as a COPC.

Uranium-238 was detected above the soil BV (2.29 pCi/g) in seven samples with a maximum activity of 22.74 pCi/g. Uranium-238 is retained as a COPC.

6.11.4.4 Nature and Extent of Contamination

The nature and extent of inorganic, organic, and radionuclide COPCs at AOC 49-008(d) are discussed below. As presented in the approved investigation work plan (LANL 2008, 102691; NMED 2008, 100464), one vertical borehole will be advanced at a location within 10 ft of the former Bottle House to a minimum depth of 120 ft bgs (location 49-610481), and one vertical borehole will be advanced to a minimum depth of 120 ft bgs beneath the location of the former CPTF (location 49-610485). One of the objectives of drilling the boreholes was to characterize the vertical extent of contamination beneath the Bottle House and CPTF.

Inorganic Chemicals

Inorganic COPCs at AOC 49-008(d) include antimony, copper, selenium, thallium, and uranium.

Antimony was detected above the soil BV in two samples with a maximum concentration of 2.1 mg/kg and had DLs (0.51 mg/kg) above the Qbt 2,3,4 BV in three samples. Concentrations did not change substantially with depth (0.6 mg/kg) at location 49-609903 and decreased laterally. Antimony was not detected above BVs in the vertical boreholes at locations 49-610481 and 49-610485. The residential SSL was approximately 15 times the maximum concentration and 61 times the maximum DL. The lateral extent of antimony is defined, and further sampling for vertical extent is not warranted.

Copper was detected above the soil BV in seven samples with a maximum concentration of 391 mg/kg. Concentrations decreased with depth at locations 49-09007, 49-09032, 49-609899, 49-609903, and 49-609950 and increased with depth at location 49-609891. Copper was not detected above BVs in the vertical boreholes at locations 49-610481 and 49-610485. Concentrations decreased laterally. The residential SSL was approximately 138 times the maximum concentration at location 49-609891 where extent is not defined. The lateral extent of copper is defined, and further sampling for vertical extent is not warranted.

Selenium was detected above the Qbt 2,3,4 BV in six samples with a maximum concentration of 1.1 mg/kg. Concentrations did not change substantially with depth (0.14 mg/kg and 0.13 mg/kg) in the vertical boreholes at locations 49-610481 and 49-610485. Concentrations decreased laterally. The residential SSL was approximately 355 times the maximum concentration. The lateral extent of selenium is defined, and further sampling for vertical extent is not warranted.

Thallium was detected above the soil BV in 3 samples with a maximum concentration of 1.7 mg/kg and had DLs (0.9 mg/kg to 1.3 mg/kg) above the BV in 17 samples. Concentrations decreased with depth at location 49-609889, increased with depth at locations 49-609909 and 49-609913, and increased laterally at locations 49-609909 and 49-609913. The concentration was below the maximum soil background concentration at location 49-609913 (1 mg/kg) and was only 0.7 mg/kg above the maximum soil background concentration and equal to the maximum Qbt 2,3,4 background concentration (1.7 mg/kg) at location 49-609909. Thallium was not detected above BVs in the vertical boreholes at locations 49-610481 and 49-610485. The concentrations and elevated DLs exceeded the residential SSL and the industrial SSL was approximately 7.6 times to 13.7 times the detected concentrations and 10 times the maximum DL. The residential HQ for thallium was 0.3 and the residential HI was 0.6 (section 6.11.5). Thallium was detected sporadically at only 3 of the 36 locations sampled. At each location, thallium was the only inorganic chemical detected above BV, and the spatial distribution of detections is not indicative of a contaminant release. Further sampling for extent of thallium is not warranted.

Uranium was detected above the soil BV in 9 samples with a maximum concentration of 68.4 mg/kg. Concentrations decreased with depth at all locations, except at location 49-09095 where only a surface sample was collected. A deeper sample at location 49-690891, which is next to location 49-09095, was

not analyzed for uranium but was analyzed for isotopic uranium and no isotopes were detected above BVs (Plate 25). Concentrations decreased laterally. The lateral and vertical extent of uranium are defined.

Organic Chemicals

Organic COPCs at AOC 49-008(d) include acetone; Aroclor-1254; Aroclor-1260; benzo(g,h,i)perylene; alpha-BHC; bis(2-ethylhexyl)phthalate; alpha-chlordane; gamma-chlordane; chlorobenzene; chloromethane; 1,4-dichlorobenzene; 4-isopropyltoluene; and methylene chloride.

Acetone was detected in four samples with a maximum concentration of 0.18 mg/kg. Concentrations increased with depth at locations 49-609898, 49-609901, and 49-609965 and decreased with depth at location 49-609895. Concentrations decreased laterally. The residential SSL was approximately 368,000 times the maximum concentration. The lateral extent of acetone is defined, and further sampling for vertical extent is not warranted.

Aroclor-1254 was detected in two samples with a maximum concentration of 0.055 mg/kg. Concentrations did not change substantially with depth (0.028 mg/kg) at location 49-609903 and decreased laterally. The residential SSL was approximately 21 times the maximum concentration. The lateral extent of Aroclor-1254 is defined, and further sampling for vertical extent is not warranted.

Aroclor-1260 was detected in two samples with a maximum concentration of 0.046 mg/kg. Concentrations did not change substantially with depth (0.033 mg/kg) at location 49-609894 and increased laterally. The residential SSL was approximately 53 times the maximum concentration. The vertical extent of Aroclor-1260 is defined, and further sampling for lateral extent is not warranted.

Benzo(g,h,i)perylene was detected in three samples with a maximum concentration of 0.049 mg/kg. Concentrations did not change substantially with depth (0.006 mg/kg) at location 49-609896, decreased with depth at location 49-609950, and did not change substantially laterally (less than 0.049 mg/kg) at location 49-609896. All concentrations were below the EQL. The residential SSL was approximately 35,500 times the maximum concentration. Further sampling for extent of benzo(g,h,i)perylene is not warranted.

BHC[alpha-], alpha-chlordane, and gamma-chlordane were each detected in one sample at concentrations of 0.0012 mg/kg, 0.0029 mg/kg, and 0.0024 mg/kg, respectively. Only one depth was sampled at location 49-09095, and no other samples were analyzed for alpha-BHC, alpha-chlordane, or and gamma-chlordane. The residential SSLs were approximately 704 times, 6100 times, and 7380 times the maximum concentrations, respectively. Further sampling for extent of alpha-BHC, alpha-chlordane, and gamma-chlordane is not warranted.

Bis(2-ethylhexyl)phthalate was detected in seven samples with a maximum concentration of 0.14 mg/kg. Concentrations increased with depth at location 49-610485; decreased with depth at locations 49-609891, 49-609909, 49-609910, 49-609950, 49-609955, and 49-610481; did not change substantially laterally (0.01 mg/kg) from location 49-609910 to location 49-609909; and decreased laterally at all other locations. All concentrations were below EQLs. The residential SSL was approximately 2710 times the maximum concentration. Further sampling for extent of bis(2-ethylhexyl)phthalate is not warranted.

Chlorobenzene was detected in four samples with a maximum concentration of 0.0011 mg/kg. Concentrations increased with depth at locations 49-609910 and 49-609912, decreased with depth at locations 49-609908 and 49-609913, and did not change substantially laterally (0.00019 mg/kg, 0.00045 mg/kg, and 0.00017 mg/kg, respectively) from location 49-609910 to locations 49-609908, 49-609912, and 49-609913. All concentrations were below EQLs. The residential SSL was approximately 334,000 times the maximum concentration. Further sampling for extent of chlorobenzene is not warranted.

Chloromethane was detected in one sample at a concentration of 0.0092 mg/kg. Concentrations decreased with depth and decreased laterally. The lateral and vertical extent of chloromethane are defined.

Dichlorobenzene[1,4-] was detected in three samples with a maximum concentration of 0.00071 mg/kg. Concentrations decreased with depth at locations 49-609908, 49-609911, and 49-609913 and did not change substantially laterally (0.00027 mg/kg) from location 49-609911 to location 49-609913. All concentrations were below EQLs. The residential SSL was approximately 46,200 times the maximum concentration. Further sampling for extent of 1,4-dichlorobenzene is not warranted.

Isopropyltoluene[4-] was detected in two samples with a maximum concentration of 0.023 mg/kg. Concentrations decreased with depth at locations 49-609891 and 49-609895 and did not change substantially laterally (0.0019 mg/kg) from location 49-609891 to location 49-609895. All concentrations were below EQLs. The residential SSL was approximately 1,030,000 times the maximum concentration. Further sampling for extent of 4-isopropyltoluene is not warranted.

Methylene chloride was detected in one sample at a concentration of 0.0033 mg/kg. Concentrations increased with depth at location 49-609965 and decreased laterally. The concentration was below the EQL. The residential SSL was approximately 124,000 times the maximum concentration. The lateral extent of methylene chloride is defined, and further sampling for vertical extent is not warranted.

Radionuclides

Radionuclide COPCs at AOC 49-008(d) include americium-241, cesium-134, plutonium-239/240, tritium, uranium-234, uranium-235/236, and uranium-238.

Americium-241 was detected above the soil FV in one sample at an activity of 0.086 pCi/g. Activities decreased with depth at location 49-609896 and increased laterally. The residential SAL was approximately 172 times the maximum activity. The vertical extent of americium-241 is defined, and further sampling for lateral extent is not warranted.

Cesium-134 was detected in one sample at an activity of 0.039 pCi/g. Activities decreased with depth at location 49-609895 and increased laterally. The residential SAL was approximately 128 times the maximum activity. The vertical extent of cesium-134 is defined, and further sampling for lateral extent is not warranted.

Plutonium-239/240 was detected above the soil FV in 16 samples with a maximum activity of 0.483 pCi/g. Activities decreased with depth at all locations, except at locations 49-609891 and 49-609903. Activities decreased laterally. The residential SAL was approximately 164 times the maximum activity. The lateral extent of plutonium-239/240 is defined, and further sampling for vertical extent is not warranted.

Tritium was detected in two samples with a maximum activity of 0.35 pCi/g. Activities decreased with depth at location 49-610485 and increased with depth at location 49-610481. Samples were analyzed only for tritium at these two locations, and lateral extent was not evaluated. The residential SAL was approximately 4860 times the maximum activity. Further sampling for extent of tritium is not warranted.

Uranium-234 was detected above the soil BV in three samples with a maximum activity of 3.84 pCi/g. Activities decreased with depth at locations 49-09007 and 49-09036, increased with depth at location 49-609890, but was only 0.1 pCi/g above BV, and decreased laterally. Uranium-234 was not detected above BVs in the vertical borehole at location 49-610481. The residential SAL was approximately 76 times the maximum activity. The lateral extent of uranium-234 is defined, and further sampling for vertical extent is not warranted.

Uranium-235/236 was detected above the soil BV in two samples with a maximum activity of 0.42 pCi/g. Activities decreased with depth at locations 49-09007 and 49-09036 and decreased laterally. The lateral and vertical extent of uranium-235/236 are defined.

Uranium-238 was detected above the soil BV in seven samples with a maximum activity of 22.74 pCi/g. Activities decreased with depth at locations 49-09007, 49-09032, and 49-09036, increased with depth at location 49-609890, and decreased laterally. Uranium-238 was not detected above BVs in the vertical borehole at location 49-610481. The residential SAL was approximately 30 times the maximum activity at location 49-609890. The lateral extent of uranium-238 is defined, and further sampling for vertical extent is not warranted.

6.11.4.5 Subsurface Vapor Sampling and Results

Three pore-gas samples were collected from one borehole at location 49-610481 and analyzed for VOCs and tritium. Table 6.11-5 presents the pore gas samples collected and analyses requested for AOC 49-008(d).

Table 6.11-6 summarizes the analytical results for detected VOCs in pore gas. Plate 26 shows the spatial distribution of detected VOCs. Table 6.11-7 presents the tritium detected in pore gas. Plate 27 shows the spatial distribution of detected tritium.

The VOCs detected in pore gas at AOC 49-008(d) include acetone; benzene; 2-butanone; carbon disulfide; chloromethane; dichlorodifluoromethane; ethylbenzene; 4-ethyltoluene; styrene; toluene; 1,2,4-trimethylbenzene; 1,3,5-trimethylbenzene; total xylenes; 1,2-xylene; and 1,3-xylene+1,4-xylene. The detected VOCs are retained as COPCs.

Tritium was detected in three samples with a maximum activity of 20,140 pCi/L. Tritium is retained as a COPC.

Nature and Extent of Contamination in Subsurface Pore Gas

The approved work plan (LANL 2008, 102691; NMED 2008, 100464) prescribed the collection of pore-gas samples from intervals corresponding to the base of formation Qbt 4, at TD of the small-scale shot experimental shafts, and from the TD of each borehole. If VOCs were detected in the vapor-phase sample at concentrations greater than 10% of the pore-gas screening levels presented in section 4.5 or if tritium was detected in the vapor-phase sample at a concentration greater than the groundwater MCL (20,000 pCi/L), the borehole would be completed as a vapor-monitoring well.

Screening was performed for each of the VOCs detected in pore-gas samples collected from SWMUs 49-001(a,b,c,d,e,f) and AOCs 49-008(c and d) using the maximum detected concentration from all sites. These results show that the SVs are below 0.1 in all cases, indicating that VOCs in subsurface pore gas are not a potential source of groundwater contamination (Table 4.5-2).

Tritium was detected at a maximum activity of 20,140 pCi/L in a sample collected from 82 to 84 ft bgs at borehole location 49-610481. Detected activities of tritium are below or equivalent to the groundwater MCL (20,000 pCi/L). Therefore, tritium is not a potential source of groundwater contamination.

The concentrations of all VOCs were less the 10% of the pore-gas screening level and the maximum tritium activity was equivalent to the MCL. Therefore, the borehole at AOC 49-008(d) was not completed as a vapor-monitoring well.

6.11.5 Summary of Human Health Risk Screening

Industrial Scenario

The total excess cancer risk for the industrial scenario is 9×10^{-8}, which is less than the NMED target risk level of 1×10^{-5} (NMED 2015, 600915). The industrial HI is 0.03, which is less than the NMED target HI of 1 (NMED 2015, 600915). The total dose is 0.2 mrem/yr, which is less than the target dose of 25 mrem/yr as authorized by DOE Order 458.1.

Residential Scenario

The total excess cancer risk for the residential scenario is 9×10^{-6}, which is less than the NMED target risk level of 1×10^{-5} (NMED 2015, 600915). The residential HI is 1, which is equivalent to the NMED target HI of 1 (NMED 2015, 600915). The total dose is 1 mrem/yr, which is less than the target dose of 25 mrem/yr as authorized by DOE Order 458.1.

Based on the risk-screening assessment results, no potential unacceptable risks or doses exist for the industrial and residential scenarios at AOC 49-008(d).

6.11.6 Summary of Ecological Risk Screening

Based on evaluations of the minimum ESLs, HI analyses, potential effects to populations (individuals for T&E species), LOAEL analyses, the relationship of detected concentrations and screening levels to background concentrations, and COPECs without ESLs, the potential for unacceptable ecological risks to the earthworm, plant, American robin, American kestrel, pocket gopher, deer mouse, montane shrew, desert cottontail, red fox, and Mexican spotted owl at AOC 49-008(d) is minimal.

7.0 CONCLUSIONS

7.1 Nature and Extent of Contamination

Based on the evaluation of the data, the nature and extent of contamination have been defined and/or no further sampling for extent is warranted for the 10 sites at TA-49 sites inside the NES.

The nature and extent of contamination have been defined and/or no further sampling for extent is warranted for the following TA-49 sites inside the NES:

- SWMU 49-001(a), Experimental Shafts
- SWMU 49-001(b), Experimental Shafts
- SWMU 49-001(c), Experimental Shafts
- SWMU 49-001(d), Experimental Shafts
- SWMU 49-001(e), Experimental Shafts
- SWMU 49-001(f), Experimental Shafts
- SWMU 49-001(g), Area of Potential Soil Contamination
- SWMU 49-003, Inactive Leach Field and Associated Drain Lines
- AOC 49-008(c), Area of Potential Soil Contamination
- AOC 49-008(d), Bottle House and Cable Pull Test Facility

7.2 Summary of Risk-Screening Assessments

Ten sites were evaluated for present-day human health and ecological risks.

7.2.1 Human Health Risk-Screening Assessment

The total excess cancer risks for the industrial scenario were less than the 1×10^{-5} target risk level at all sites. The HIs for the industrial scenario were also less than the target HI of 1 at all sites.

The total excess cancer risks for the residential scenario were less than or equivalent to 1×10^{-5} at eight sites and above 1×10^{-5} at two sites based on the soil and vapor intrusion screening results. Nine sites had HIs less than or equivalent to 1, and one site had an HI above 1 based on the soil and vapor intrusion screening results. SWMU 49-001(e) had a total excess cancer risk of 2×10^{-5} and an HI of 2, which are above the NMED target levels. SWMU 49-001(f) also had a total excess cancer risk of 2×10^{-5}.

The total doses were below the target dose limit of 25 mrem/yr as authorized by DOE Order 458.1 for the industrial and residential scenarios at all sites.

Sites at TA-49 are not accessible by the public and are not planned for release by DOE in the foreseeable future. Therefore, an as low as reasonably achievable (ALARA) evaluation for radiological exposure to the public is not currently required. Should DOE's plans for releasing these areas change, an ALARA evaluation will be conducted at that time.

The TA-49 sites inside the NES do not pose an unacceptable risk under present-day conditions. The sites containing shafts used in past hydronuclear testing [SWMUs 49-001(a), 49-001(b), 49-001(c), 49-001(d), and 49-001(f)] contain large inventories of chemicals and radionuclides associated with past testing. These materials are located at depths where exposure would not occur under current land use. These materials could, however, pose a potential risk in the future.

7.2.2 Ecological Risk-Screening Assessment

Based on evaluations of the minimum ESLs, HI analyses, potential effects to populations (individuals for T&E species), LOAEL analyses, the relationship of detected concentrations and screening levels to background concentrations, and COPECs without ESLs, the potential for unacceptable ecological risks to the earthworm, plant, American robin, American kestrel, pocket gopher, deer mouse, montane shrew, desert cottontail, red fox, and Mexican spotted owl at the TA-49 sites inside the NES is minimal.

8.0 RECOMMENDATIONS

The determination of site status is based on the results of the risk-screening assessments and the nature and extent evaluation. Depending upon the decision scenario used, the sites are recommended as corrective actions complete either with or without controls or for additional action. The residential scenario is the only scenario under which corrective action complete without controls is applicable; that is, no additional corrective actions or conditions are necessary. The other decision scenario (industrial) results in corrective action complete with controls; that is, some type of institutional controls must be in place to ensure land use remains consistent with site cleanup levels. The current and reasonably foreseeable future land use at TA-49 inside the NES is industrial.

8.1 Additional Field Characterization and Remediation Activities

Based on the results of the nature and extent evaluations and human health and ecological risk-screening assessments, no additional field characterization or remediation activities are recommended.

8.2 Recommendations for Corrective Actions Complete

The 10 sites evaluated in this supplemental investigation report do not pose a potential unacceptable risk or dose under the industrial scenario, have no potential ecological risks for any receptor, and have the nature and extent of contamination defined and/or no further sampling for extent is warranted. At these sites, the DOE Environmental Management Los Alamos Field Office and N3B recommend no further investigation or remediation activities are presently warranted (Table 8.2-1).

Five sites do not have chemical and radionuclide inventories associated with past hydronuclear testing and do not require further evaluation of potential future risk as part of a corrective measures evaluation (CME). Four of the sites have been found to pose no potential unacceptable risks or doses to human health under the industrial and residential scenarios and to ecological receptors and are appropriate for corrective actions complete without controls (Table 8.2-1). They include the following:

- SWMU 49-001(g), Area of Potential Soil Contamination
- SWMU 49-003, Inactive Leach Field and Associated Drain Lines
- AOC 49-008(c), Area of Potential Soil Contamination
- AOC 49-008(d), Bottle House and Cable Pull Test Facility

One site has been found to pose no potential unacceptable risks or dose to human health under the industrial scenario and to ecological receptors but poses potentially unacceptable risks to human health under the residential scenario. This site is appropriate for corrective actions complete with controls (Table 8.2-1).

- SWMU 49-001(e), Experimental Shafts

8.3 Recommendation for CME

Five sites have chemical and radionuclide inventories associated with past hydronuclear testing and will require further evaluation of potential future risk and associated corrective measures. Four of these sites have been found to pose no potential unacceptable present-day risks or doses to human health under the industrial and residential scenarios and to ecological receptors. One site has been found to pose no potential unacceptable present-day risks or doses to human health under the industrial scenario and to ecological receptors, but poses potentially unacceptable present day risks to human health under the residential scenario. Because these sites do not pose unacceptable present-day risks, no corrective actions are currently recommended. Because of the chemical and radionuclide inventories associated with these sites and the associated potential future risk, however, these sites are not recommended for corrective action complete. Rather, evaluation of these sites as part of a CME is recommended to evaluate potential future corrective measures (Table 8.2-1). They include the following:

- SWMU 49-001(a), Experimental Shafts
- SWMU 49-001(b), Experimental Shafts
- SWMU 49-001(c), Experimental Shafts

- SWMU 49-001(d), Experimental Shafts
- SWMU 49-001(f), Experimental Shafts

9.0 REFERENCES AND MAP DATA SOURCES

9.1 References

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9.2 Map Data Sources

Data sources used in original figures and/or plates created for this report are described below and identified by legend title.

LANL Technical Areas - Technical Area Boundaries; Los Alamos National Laboratory, Site Planning & Project Initiation Group, Infrastructure Planning Office; September 2007; as published 04 December 2008.

NES and Facility boundaries at TA-49 - Revised boundary shape files: TA49_NES_20090812_arc and TA49_FACILITY_20090812_arc, provided by LANL Site Technical Representative, dated 12 August 2009.

Paved roads - Paved Road Arcs; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009.

Dirt roads - Dirt Road Arcs; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009.

Drainages - WQH Drainage_arc; Los Alamos National Laboratory, ENV Water Quality and Hydrology Group; 1:24,000 Scale Data; 03 June 2003.

LANL structures - Structures; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009.

LANL fence lines - Security and Industrial Fences and Gates; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 28 May 2009.

Former/other existing TA-49 structures - Description of: Geospatial Data Created for Maps Appearing in TA-49 HIRS and IWPS, K. Crowell, ERID-098702, October 2007

TA-49 2009/10 sample locations - TPMC field survey data, now found in: Point Feature Locations of the Environmental Restoration Project Database; Los Alamos National Laboratory, Waste and Environmental Services Division, 12 April 2010.

LANL historical sample locations - Point Feature Locations of the Environmental Restoration Project Database; Los Alamos National Laboratory, Waste and Environmental Services Division, 21 January 2010.

Contours - Hypsography, 10, 20, and 100 Foot Contour Interval; Los Alamos National Laboratory, ENV Environmental Remediation and Surveillance Program; 1991.

Former TA-49 structures - Description of: Geospatial Data Created for Maps Appearing in TA-49 HIRS and IWPS, K. Crowell, ERID-098702, October 2007

Experimental shaft /pipe dump hole locations - Description of: Geospatial Data Created for Maps Appearing in TA-49 HIRS and IWPS, K. Crowell, ERID-098702, October 2007

Landfills, regraded areas, and former asphalt pad location - Description of: Geospatial Data Created for Maps Appearing in TA-49 HIRS and IWPS, K. Crowell, ERID-098702, October 2007

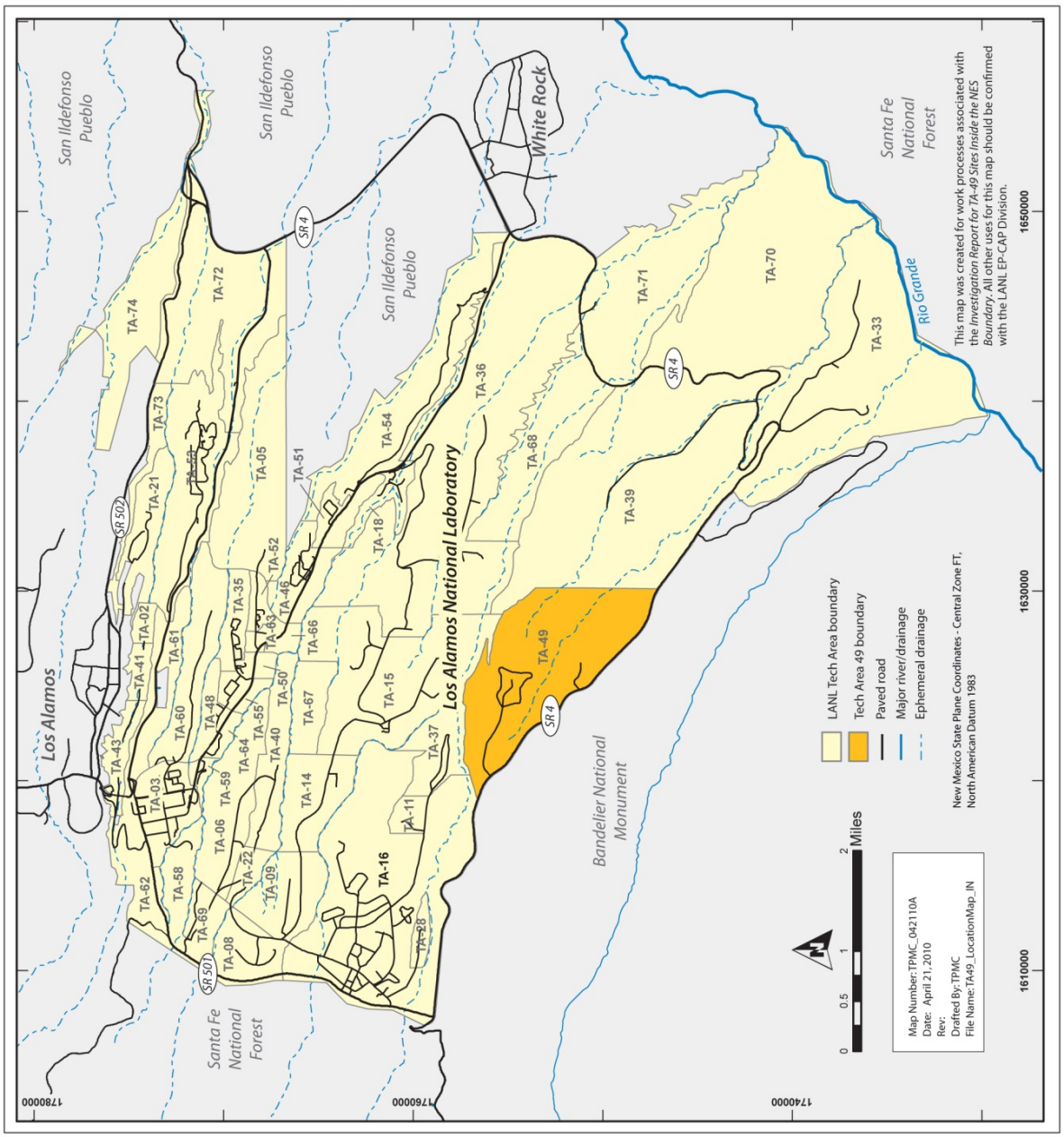

Figure 1.1-1 Location of TA-49 with respect to Laboratory TAs and surrounding land holdings

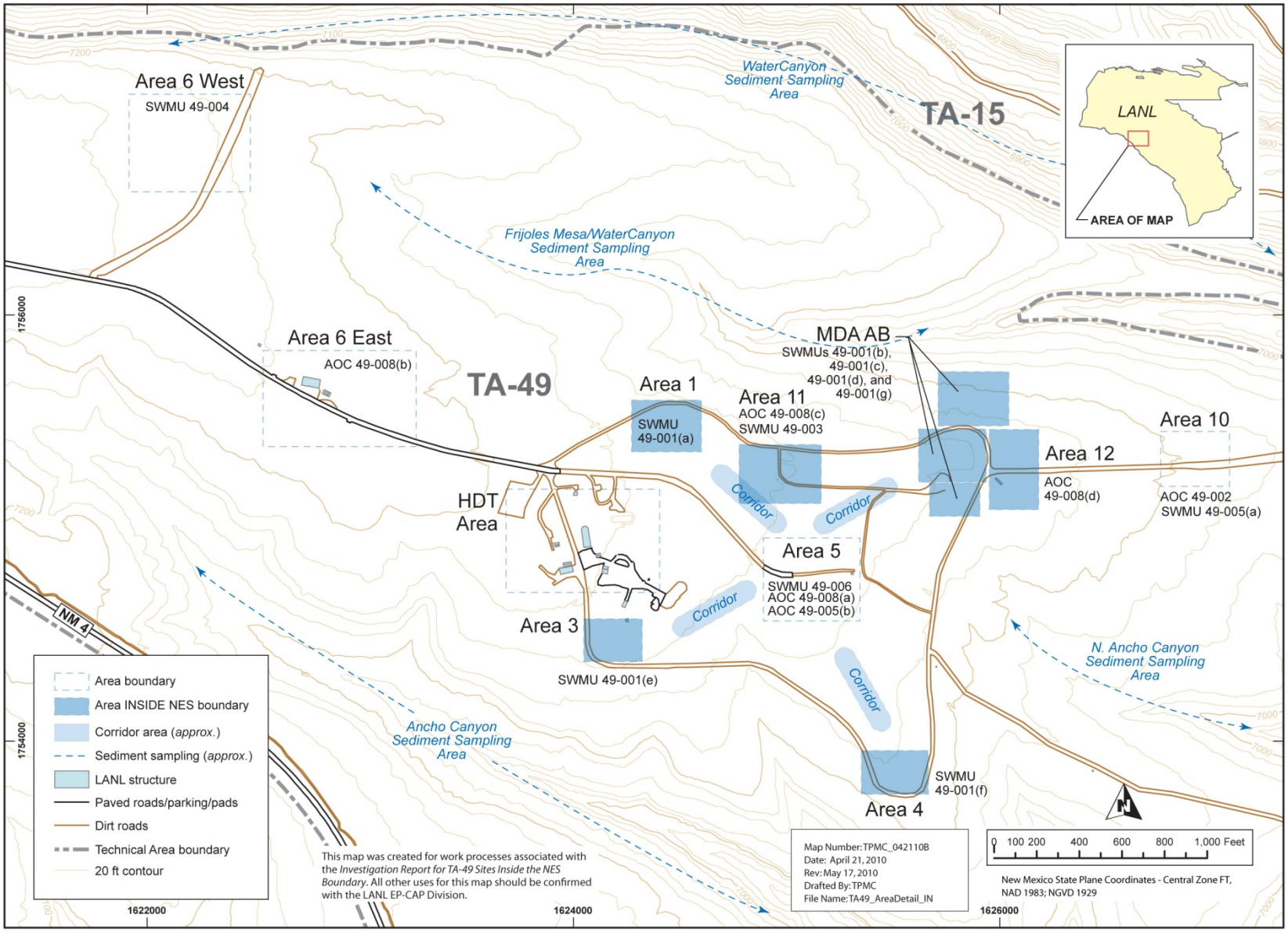

Figure 1.1-2 Location of TA-49 SWMUs and AOCs

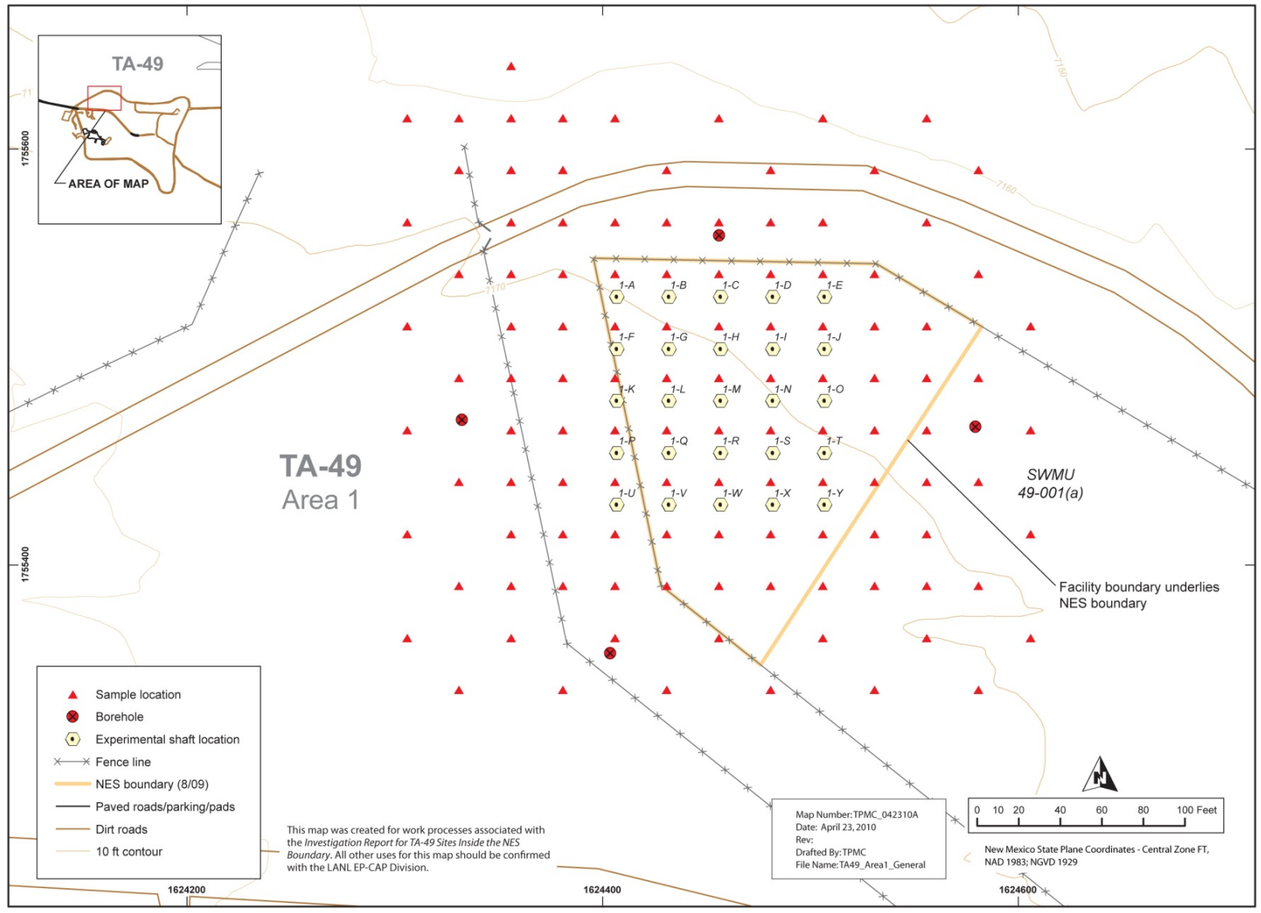

Figure 3.1-1 The 2009–2010 radiological screening-level surface sampling locations and boreholes associated with Area 1, SWMU 49-001(a)

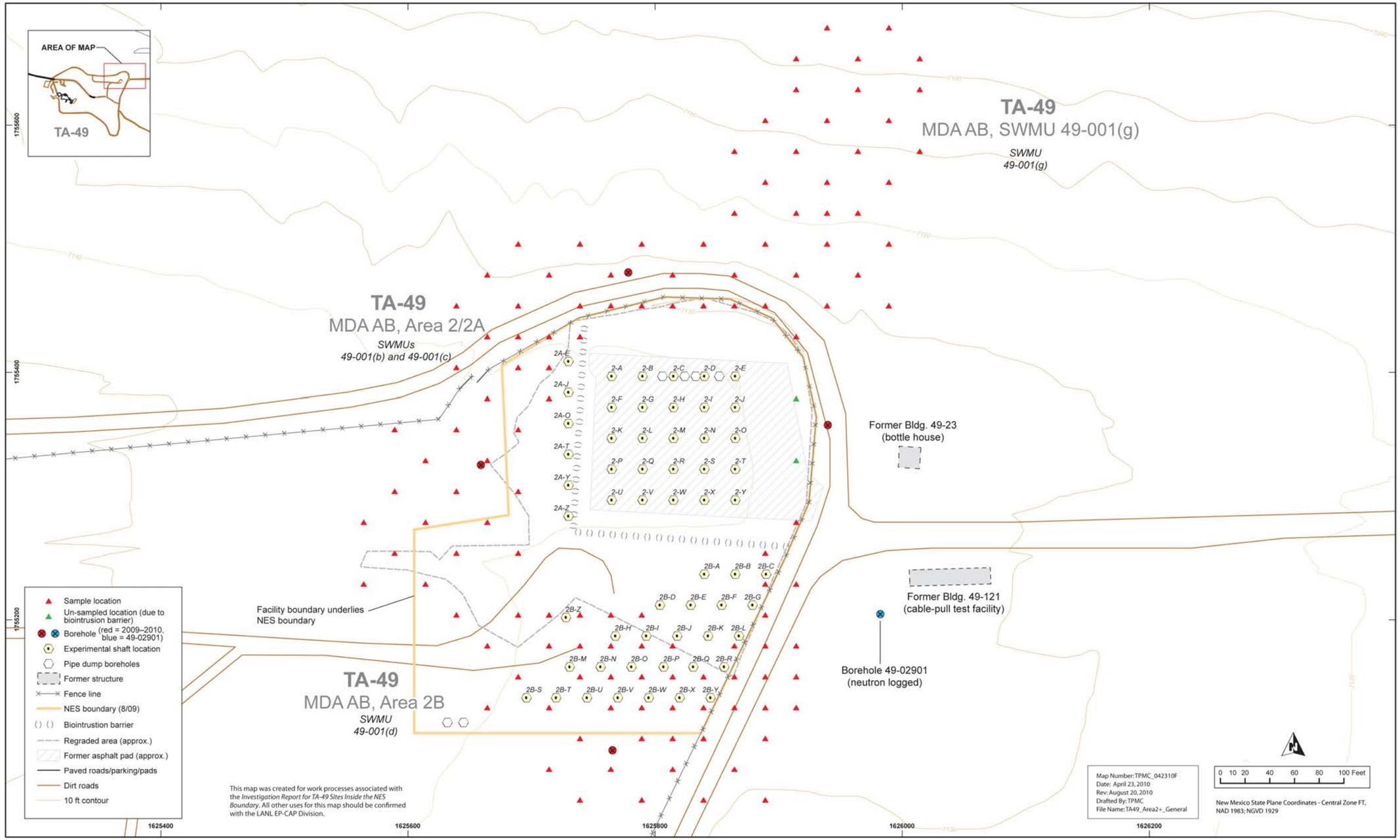

Figure 3.1-2 The 2009–2010 radiological screening-level sampling locations and boreholes associated with MDA AB, SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g)

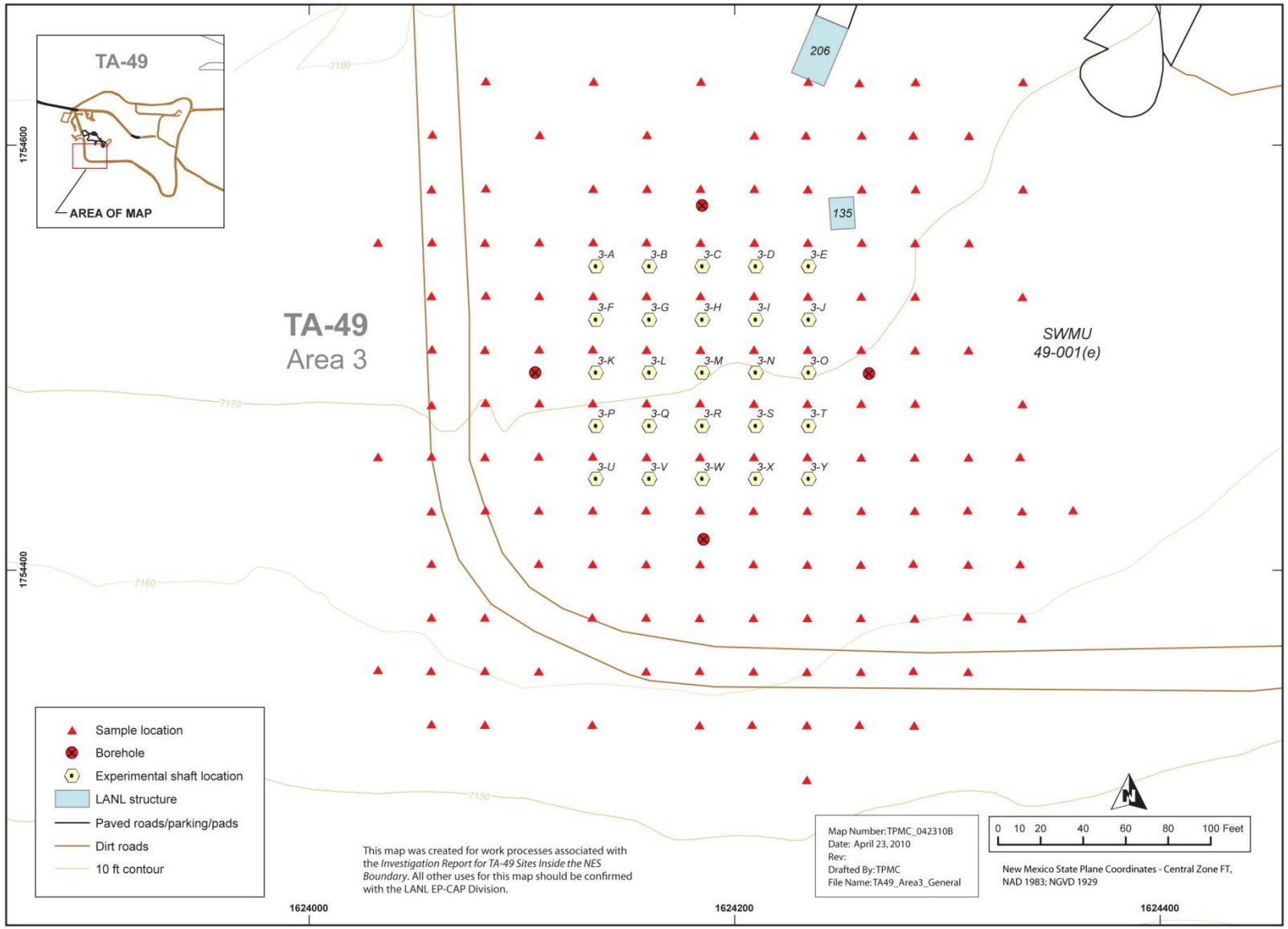

Figure 3.1-3 The 2009–2010 radiological screening-level surface sampling locations and boreholes associated with Area 3, SWMU 49-001(e)

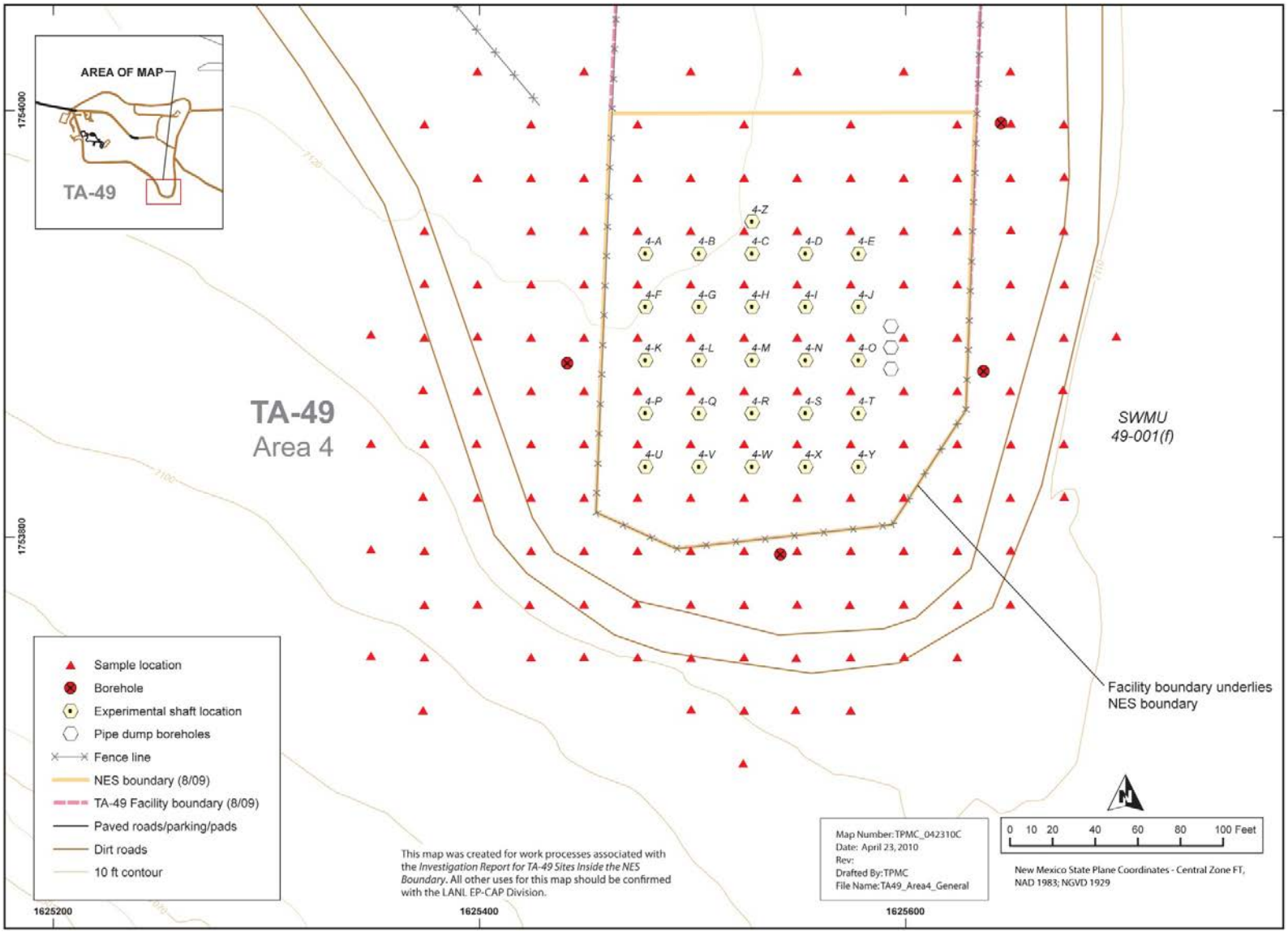

Figure 3.1-4 The 2009–2010 radiological screening-level surface sampling locations and boreholes associated with Area 4, SWMU 49-001(f)

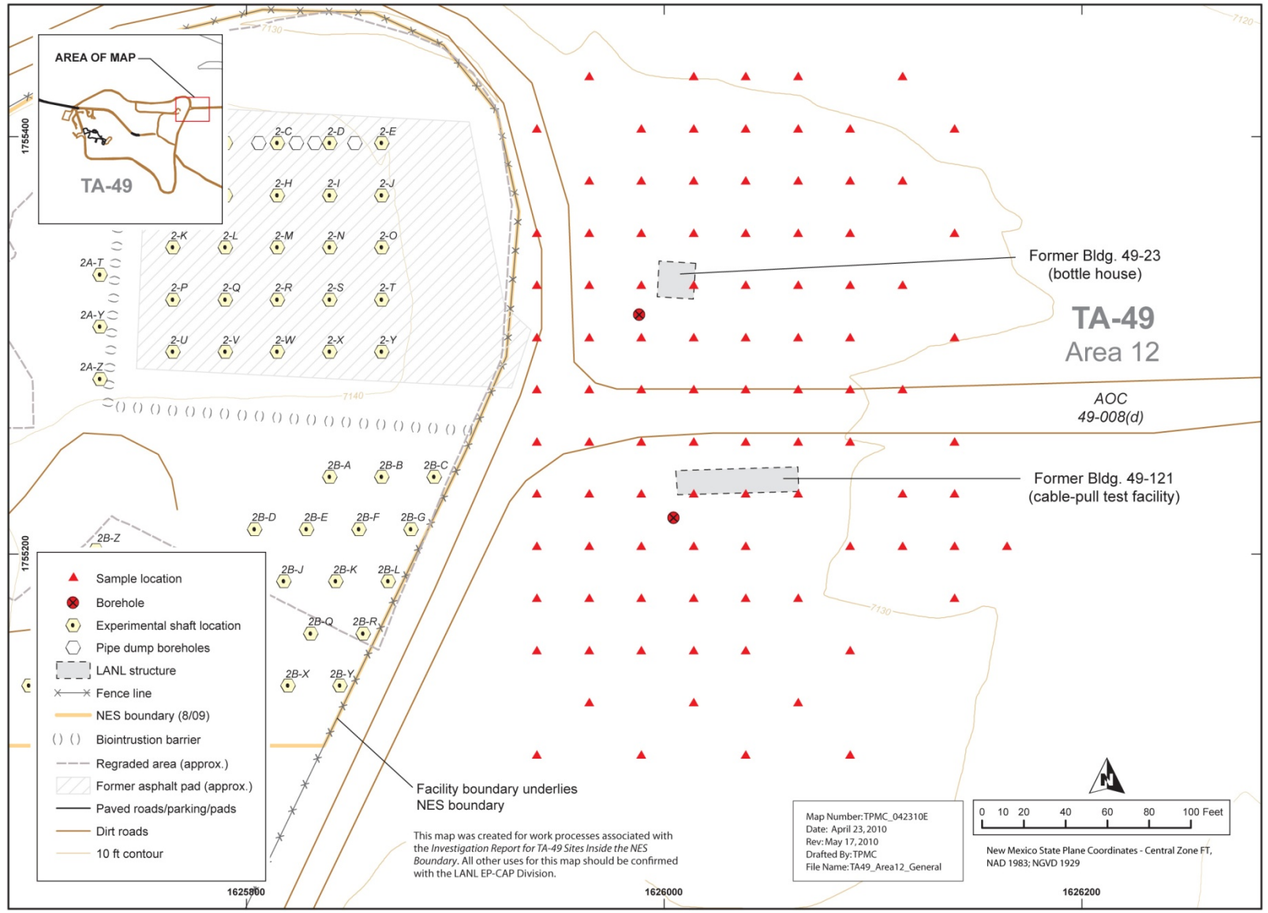

Figure 3.1-5 The 2009–2010 radiological screening-level surface sampling locations and boreholes associated with Area 12, AOC 49-008(d)

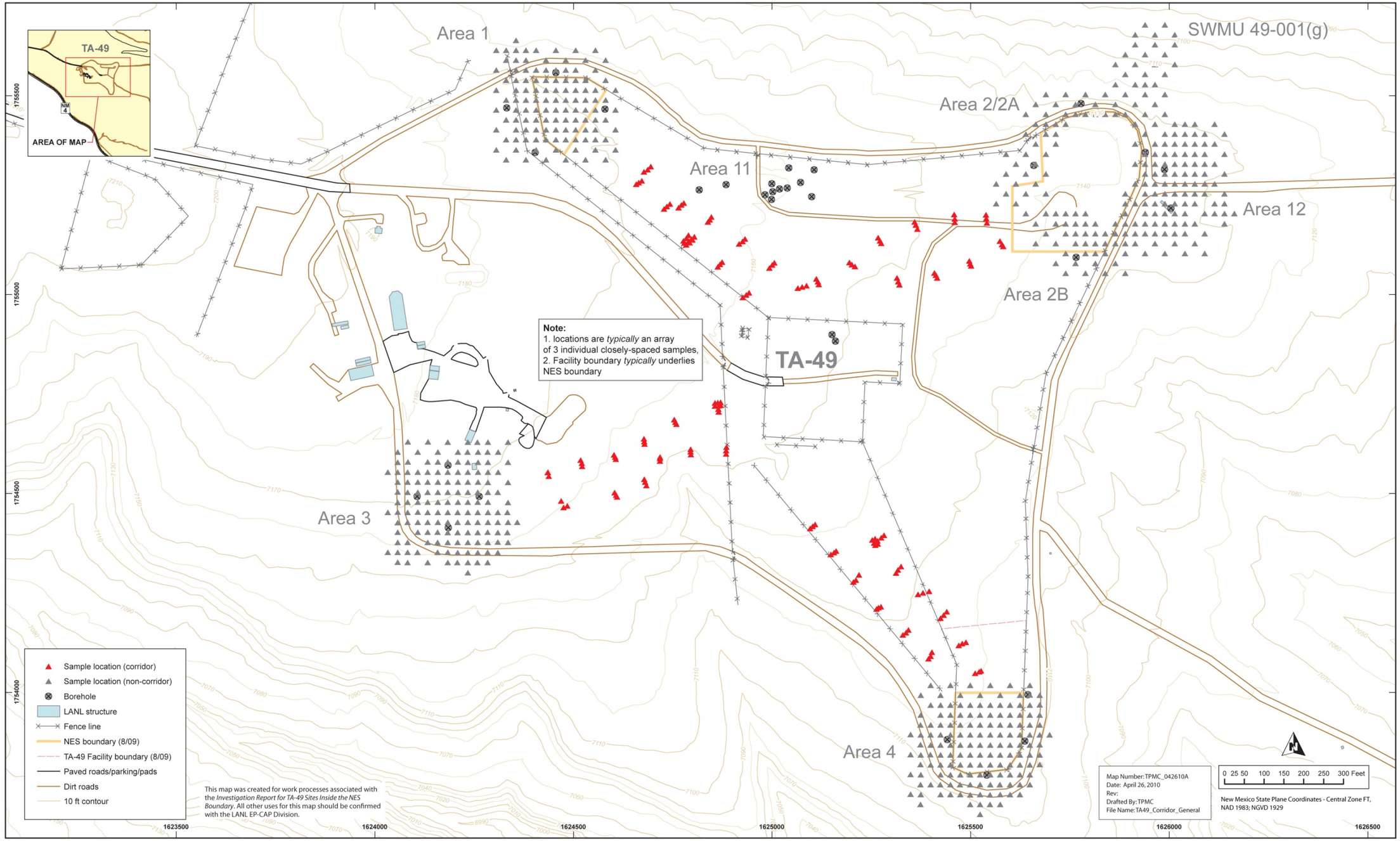

Figure 3.1-6 The 2009–2010 screening-level and decision-level surface-sampling locations associated with overland corridors

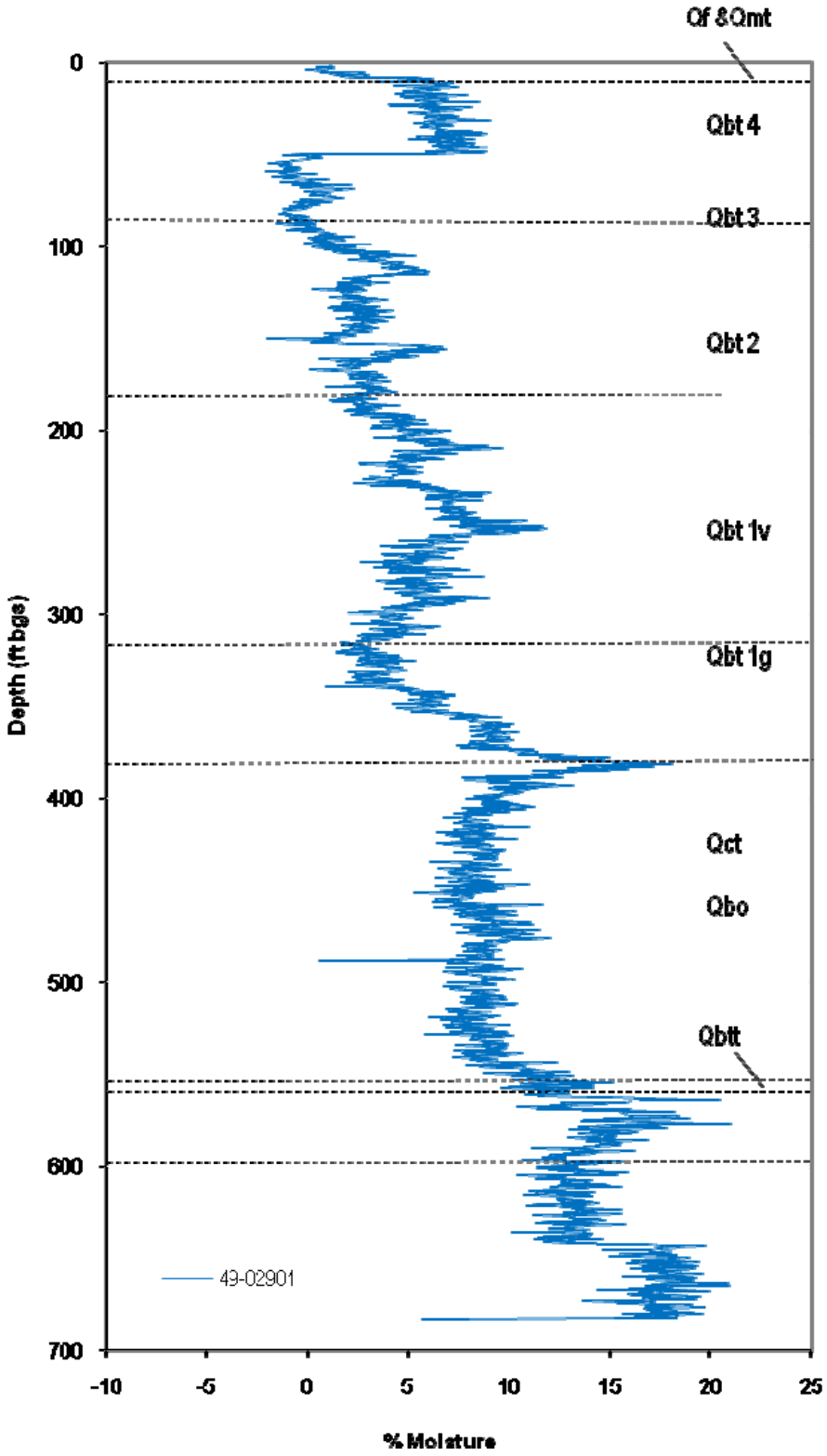

Figure 3.1-7 Water content (% moisture) profiles for borehole 49-02901

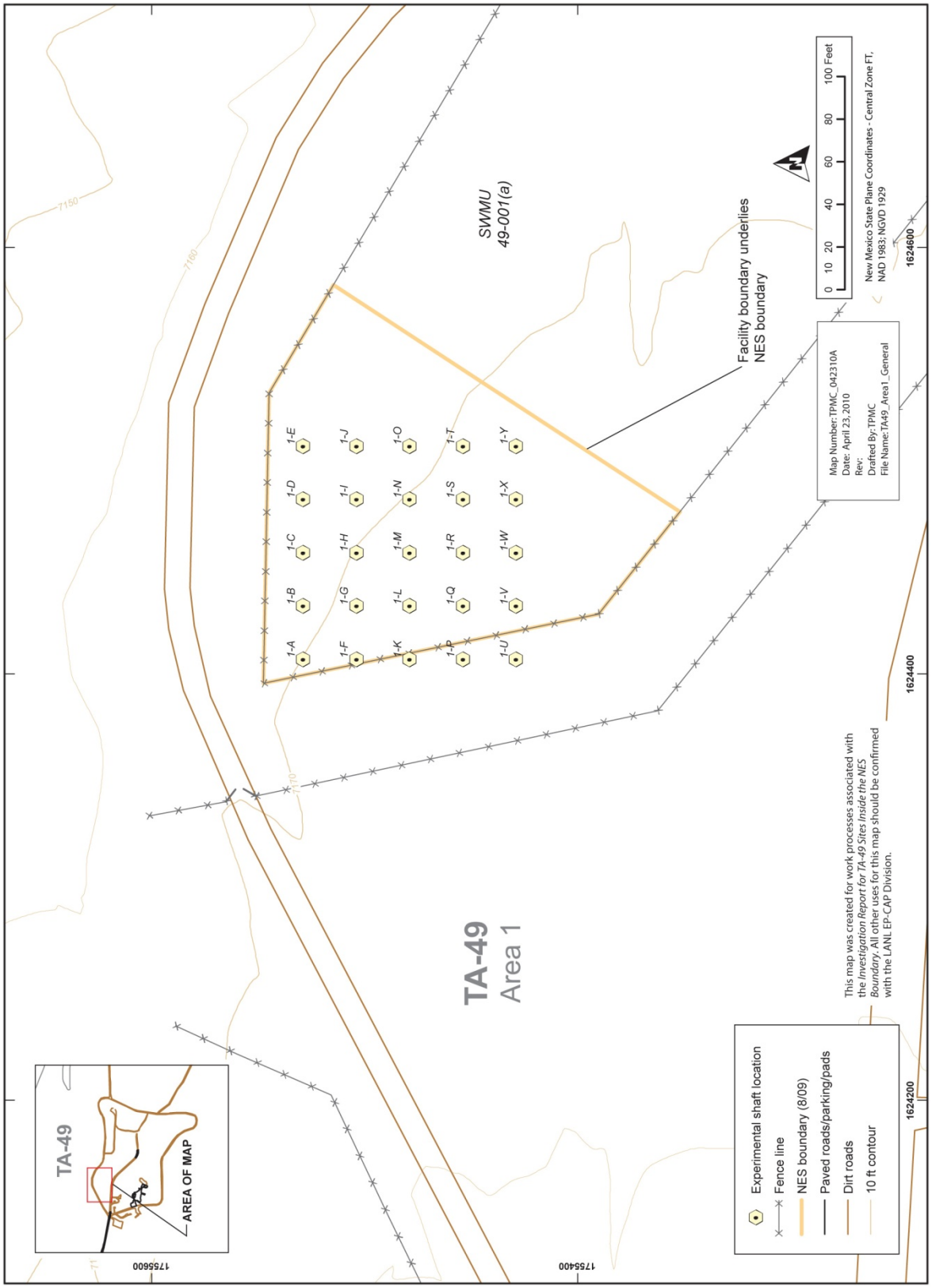

Figure 6.2-1 General site layout of Area 1, SWMU 49-001(a)

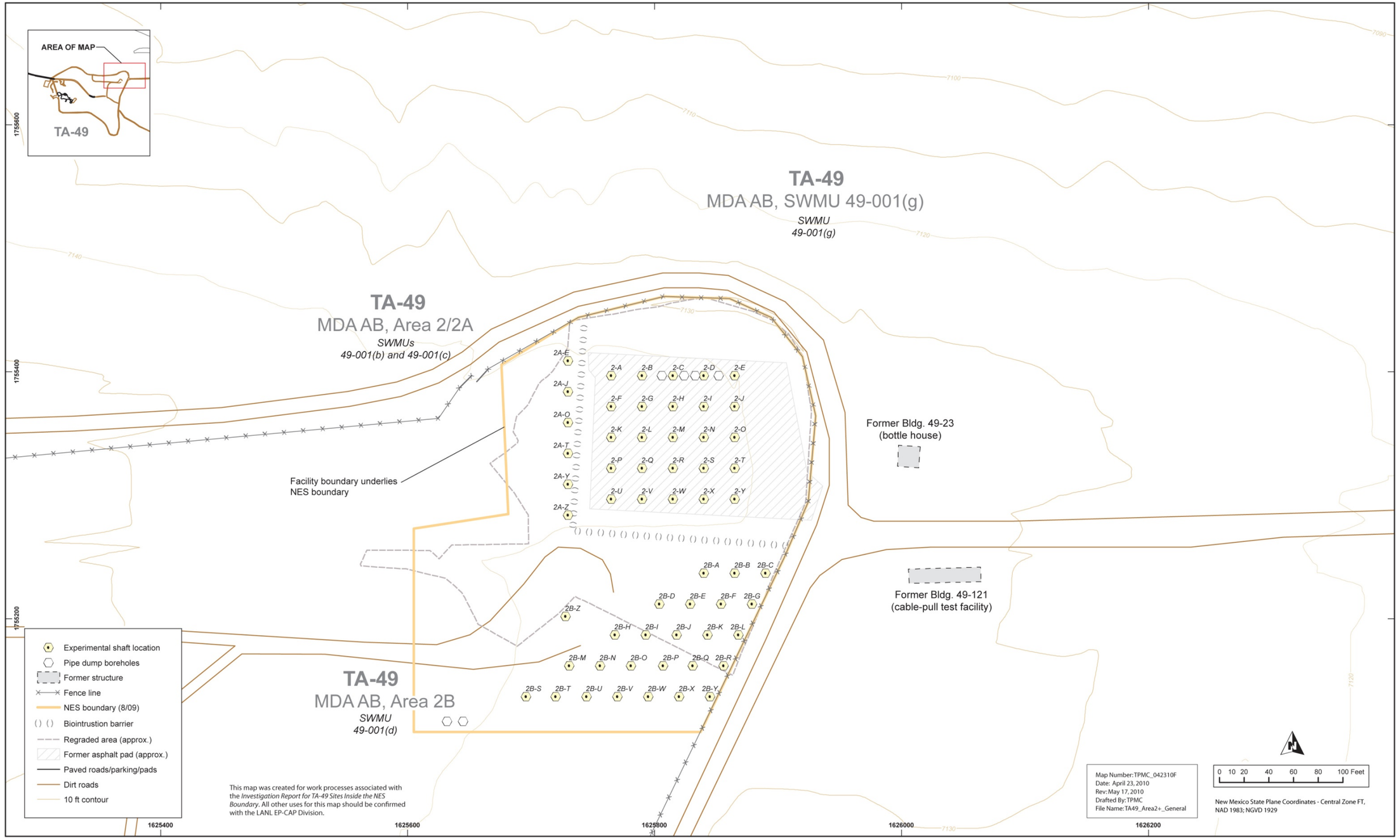

Figure 6.3-1 General site layout of MDA AB (Areas 2, 2A, and 2B)

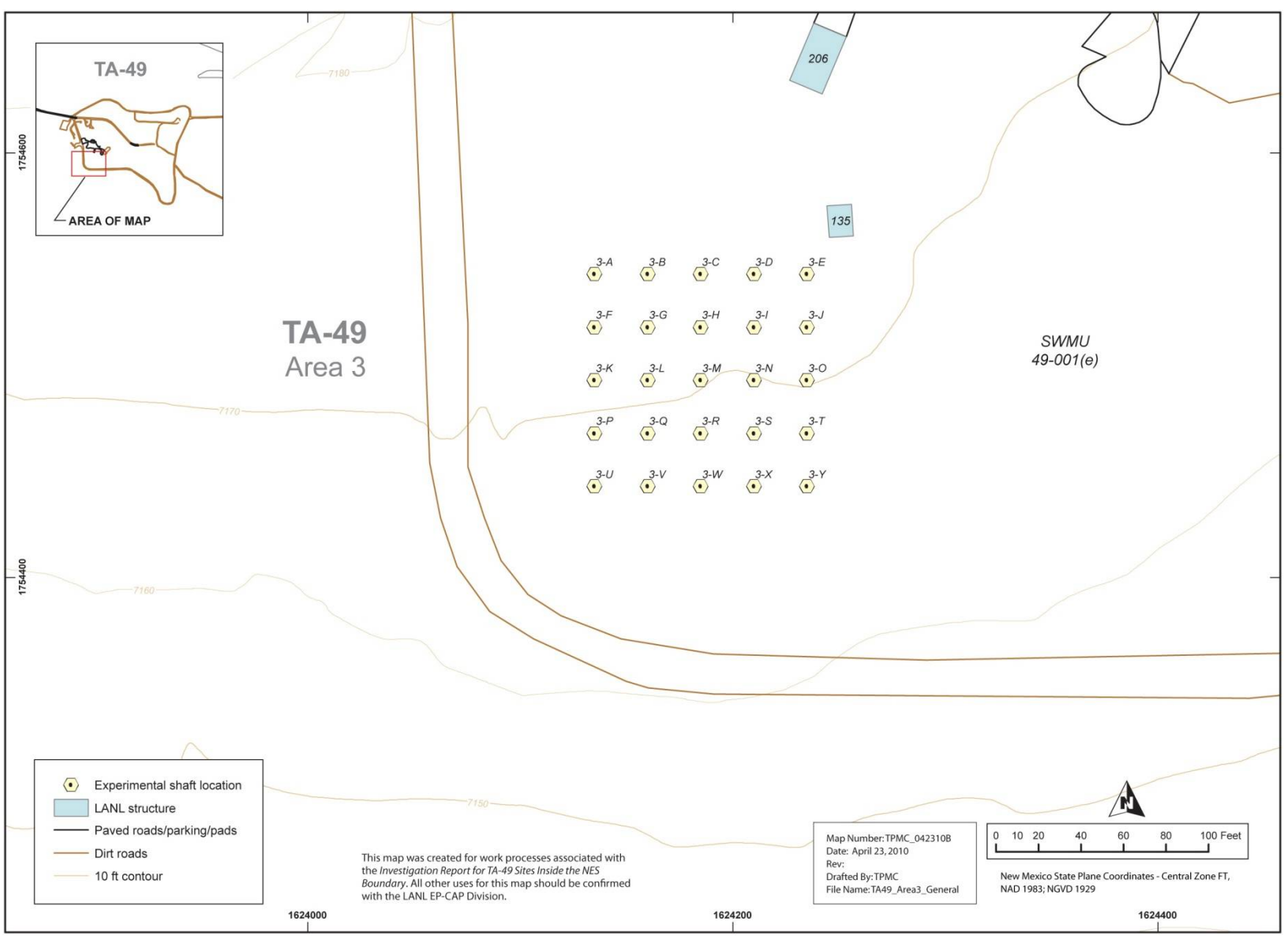

Figure 6.6-1 General site layout of Area 3, SWMU 49-001(e)

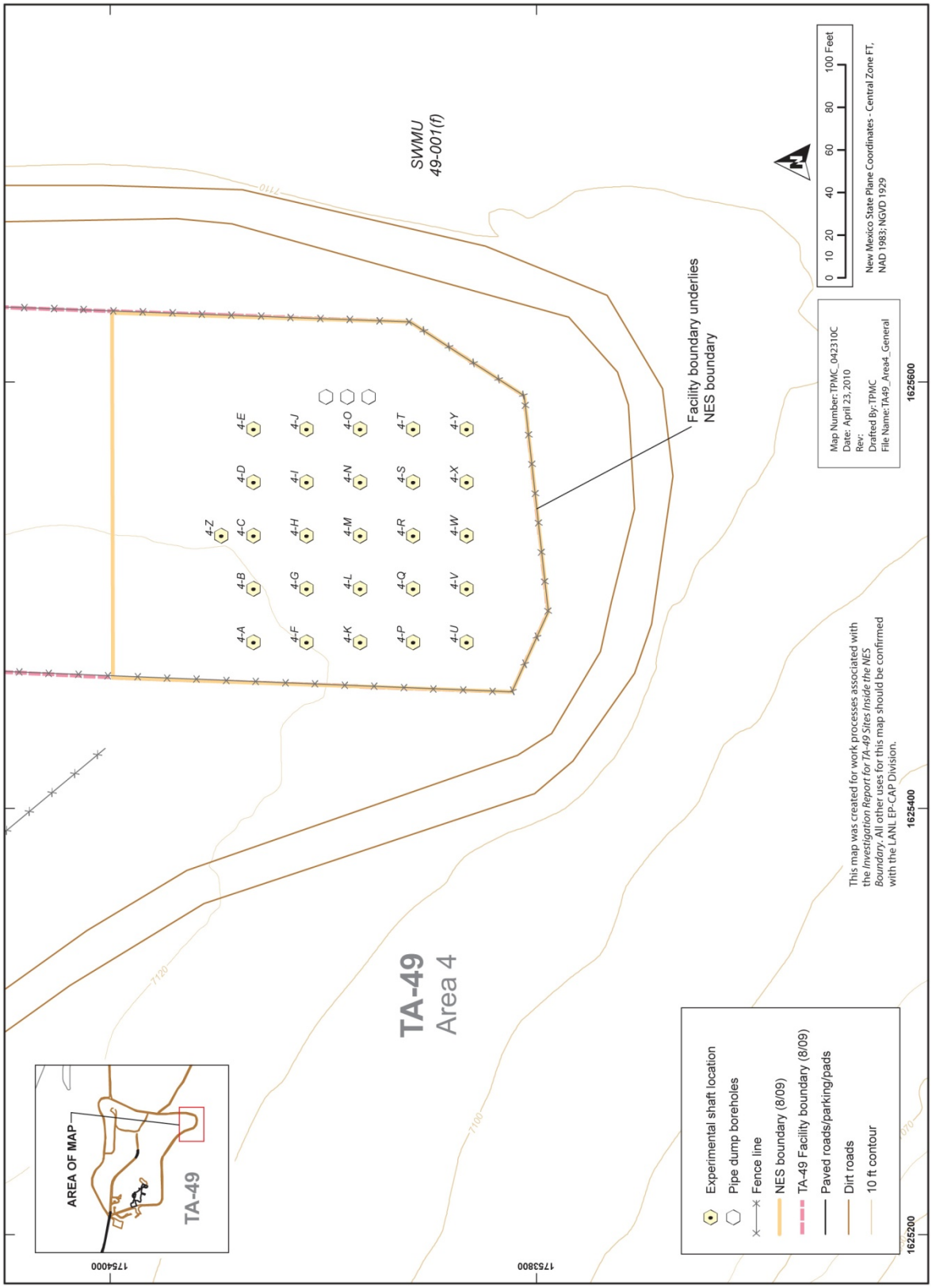

Figure 6.7-1 General site layout of Area 4, SWMU 49-001(f)

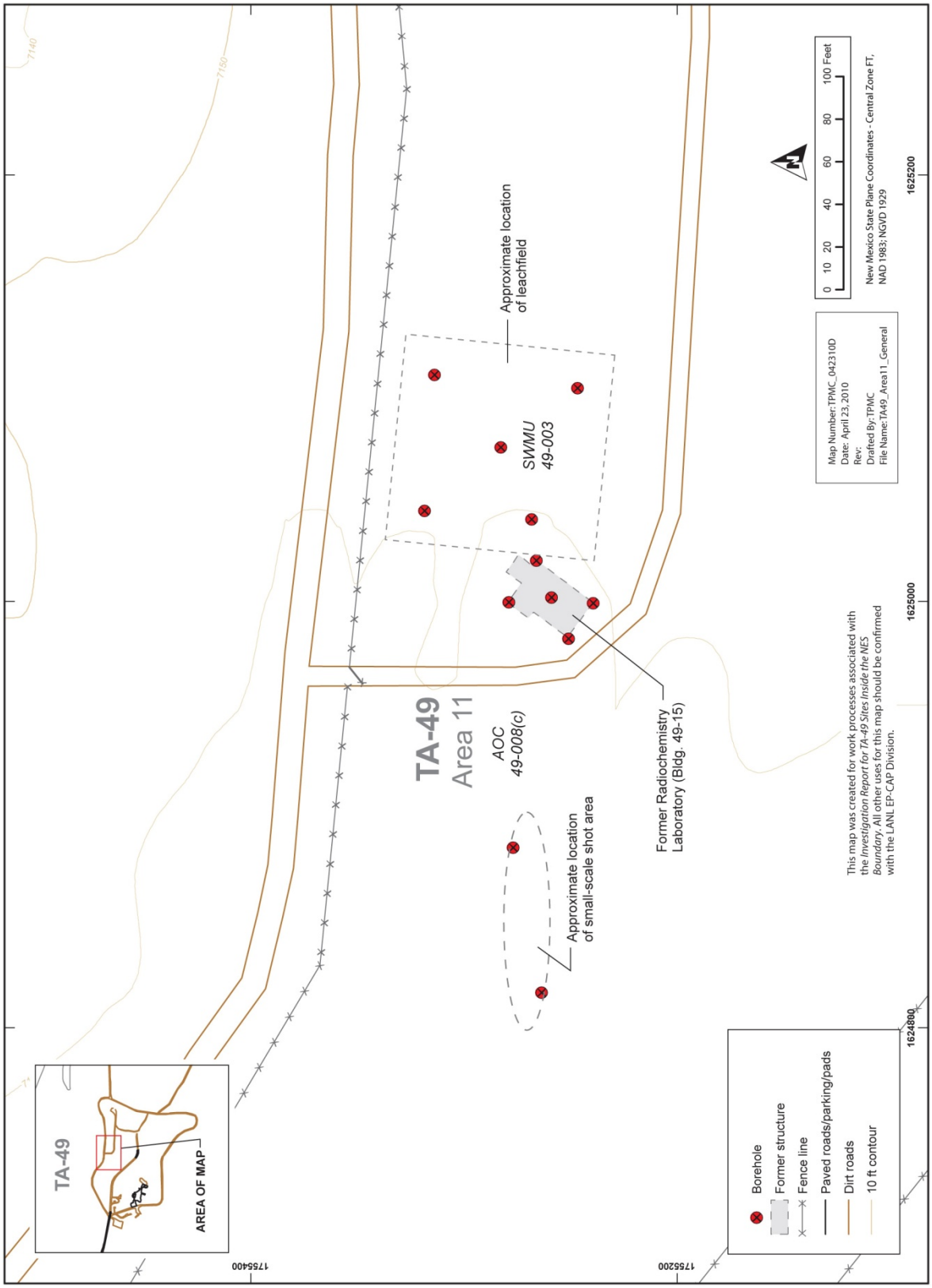

Figure 6.9-1 General site layout of Area 11, AOC 49-008(c) and SWMU 49-003

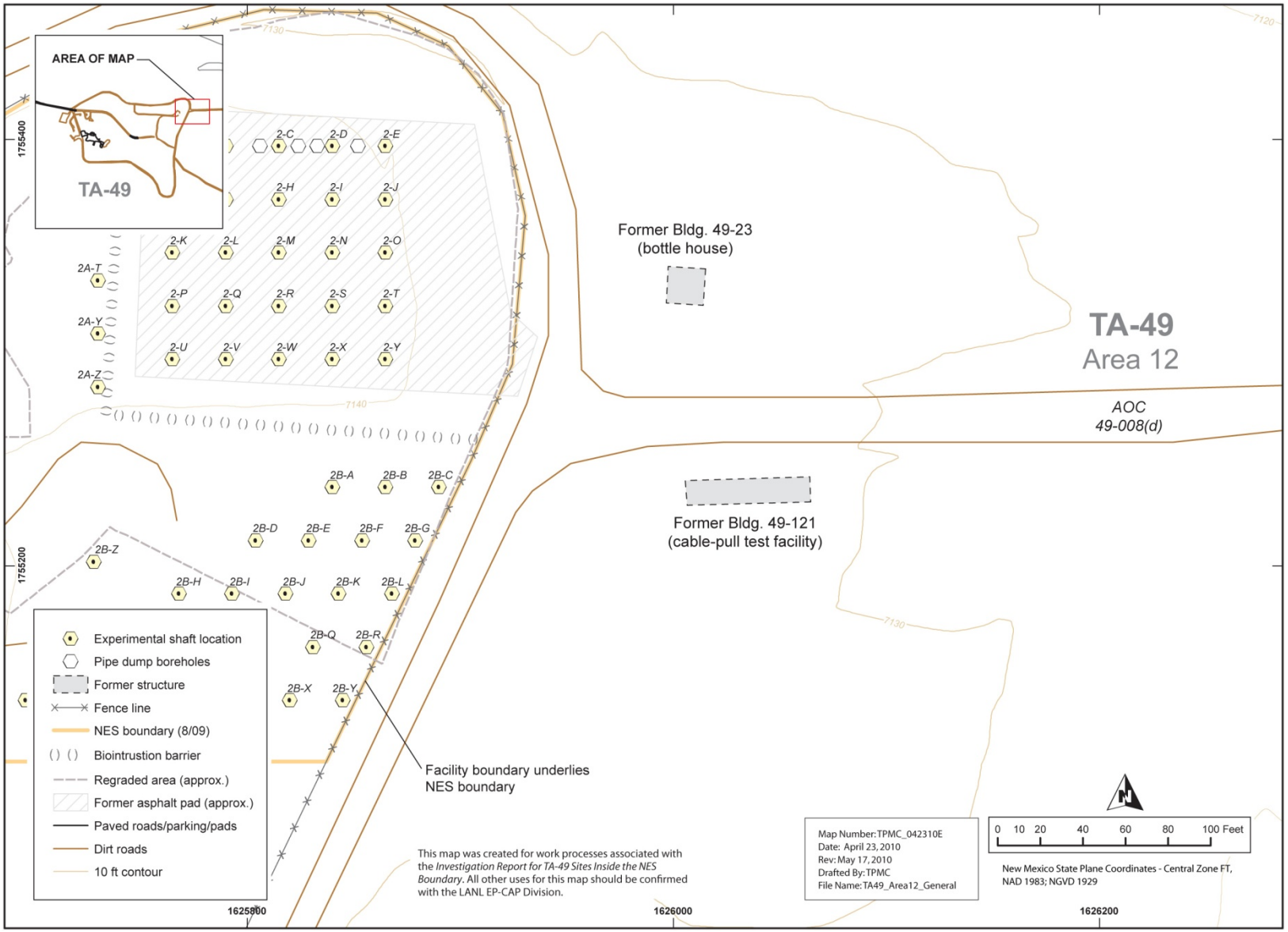

Figure 6.10-1 General site layout of Area 12, AOC 49-008(d)

Table 1.1-1
TA-49 Sites Inside the NES under Investigation

Area	SWMU/AOC	Brief Description	2009–2010 Investigation	Current Status
1	SWMU 49-001(a)	Experimental shafts	Surface, subsurface, and pore-gas samples collected	Supplemental investigation report (section 6.2)
Areas 2, 2A, 2B (MDA AB)	SWMU 49-001(b)	Experimental shafts	Surface, subsurface, and pore-gas samples collected	Supplemental investigation report (section 6.3)
	SWMU 49-001(c)	Experimental shafts	Surface, subsurface, and pore-gas samples collected	Supplemental investigation report (section 6.4)
	SWMU 49-001(d)	Experimental shafts	Surface, subsurface, and pore-gas samples collected	Supplemental investigation report (section 6.5)
	SWMU 49-001(g)	Area of soil contamination	Surface samples collected	Supplemental investigation report (section 6.6)
3	SWMU 49-001(e)	Experimental shafts	Surface, subsurface, and pore-gas samples collected	Supplemental investigation report (section 6.7)
4	SWMU 49-001(f)	Experimental shafts	Surface, subsurface, and pore-gas samples collected	Supplemental investigation report (section 6.8)
11	SWMU 49-003	Inactive leach field and associated drainlines	Surface and subsurface samples collected	Supplemental investigation report (section 6.9)
	AOC 49-008(c)	Area of soil contamination	Surface, subsurface, and pore-gas samples collected	Supplemental investigation report (section 6.10)
	AOC 49-009	Suspected underground fuel tank	None	No further action approved, 01/21/05; EPA 2005, 088464
12	AOC 49-008(d)	Bottle House and CPTF	Surface, subsurface, and pore-gas samples collected	Supplemental investigation report (section 6.11)

Note: Shading denotes no further action approved.

Table 3.1-1
Field-Screening Results for Samples Collected at Area 1, SWMU 49-001(a)

SWMU or AOC	Location ID	Depth (ft)	Sample ID	PID (ppm)	Alpha (dpm[a])	Beta/Gamma (dpm)
Area 1 Drilling Samples						
49-001(a)	49-610946	1.7–3.7	RE49-10-9047	0.0	104	2260
49-001(a)	49-610946	72.0–74.0	RE49-10-9051	0.0	42	2160
49-001(a)	49-610946	85.0–87.0	RE49-10-9052	0.0	9	2040
49-001(a)	49-610946	133.0–135.0	RE49-10-9068	0.0	28	1611
49-001(a)	49-610947	2.5–4.2	RE49-10-9049	0.0	98	2360
49-001(a)	49-610947	76.7–77.7	RE49-10-9063	0.0	9	1877
49-001(a)	49-610947	85.0–87.0	RE49-10-9064	0.0	28	1990
49-001(a)	49-610947	133.0–135.0	RE49-10-9066	0.0	37	1979
49-001(a)	49-610948	4.0–6.0	RE49-10-9050	0.0	81	2150
49-001(a)	49-610948	77.0–81.0	RE49-10-9057	0.0	18	2020
49-001(a)	49-610948	85.0–87.0	RE49-10-9058	0.0	23	2060
49-001(a)	49-610948	133.0–135.0	RE49-10-9059	0.0	4	2090
49-001(a)	49-610949	2.0–3.8	RE-49-10-9048	0.0	65	2560
49-001(a)	49-610949	76.0–78.0	RE49-10-9069	0.0	42	2000
49-001(a)	49-610949	85.0–87.0	RE49-10-9070	0.0	47	2200
49-001(a)	49-610949	133.0–135.0	RE49-10-9071	0.0	14	2260
Area 1 Surface and Shallow-Subsurface Samples						
49-001(a)	49-610206	0.0–0.5	RE49-10-6109	NA[b]	65	2510
49-001(a)	49-610206	0.5–1.5	RE49-10-6110	NA	23	1961
49-001(a)	49-610207	0.0–0.5	RE49-10-6111	NA	78	2490
49-001(a)	49-610207	0.5–1.5	RE49-10-6112	NA	28	1804
49-001(a)	49-610208	0.0–0.5	RE49-10-6113	NA	23	1509
49-001(a)	49-610208	0.5–1.5	RE49-10-6114	NA	85	2330
49-001(a)	49-610209	0.0–0.5	RE49-10-6115	NA	5	2008
49-001(a)	49-610209	0.5–1.5	RE49-10-6116	NA	35	2260
49-001(a)	49-610210	0.0–0.5	RE49-10-6117	NA	20	2190
49-001(a)	49-610210	0.5–1.5	RE49-10-6118	NA	10	2480
49-001(a)	49-610211	0.0–0.5	RE49-10-6119	NA	32	2570
49-001(a)	49-610211	0.5–1.5	RE49-10-6120	NA	35	2530
49-001(a)	49-610212	0.0–0.5	RE49-10-6121	NA	25	2160
49-001(a)	49-610212	0.5–1.5	RE49-10-6122	NA	15	2200
49-001(a)	49-610213	0.0–0.5	RE49-10-6123	NA	25	2430
49-001(a)	49-610213	0.5–1.5	RE49-10-6124	NA	30	2450
49-001(a)	49-610214	0.0–0.5	RE49-10-6125	NA	104	2590
49-001(a)	49-610214	0.5–1.5	RE49-10-6126	NA	78	2250
49-001(a)	49-610215	0.0–0.5	RE49-10-6127	NA	59	2270
49-001(a)	49-610215	0.5–1.5	RE49-10-6128	NA	52	2500

Table 3.1-1 (continued)

SWMU or AOC	Location ID	Depth (ft)	Sample ID	PID (ppm)	Alpha (dpm[a])	Beta/Gamma (dpm)
49-001(a)	49-610216	0.0–0.5	RE49-10-6129	NA	4	1821
49-001(a)	49-610216	0.5–1.5	RE49-10-6130	NA	14	1687
49-001(a)	49-610217	0.0–0.5	RE49-10-6131	NA	118	2640
49-001(a)	49-610217	0.5–1.5	RE49-10-6132	NA	33	1739
49-001(a)	49-610218	0.0–0.5	RE49-10-6133	NA	163	2720
49-001(a)	49-610218	0.5–1.5	RE49-10-6134	NA	33	1751
49-001(a)	49-610219	0.0–0.5	RE49-10-6135	NA	52	2530
49-001(a)	49-610219	0.5–1.5	RE49-10-6136	NA	14	1803
49-001(a)	49-610220	0.0–0.5	RE49-10-6137	NA	30	2006
49-001(a)	49-610220	0.5–1.5	RE49-10-6138	NA	30	2140
49-001(a)	49-610221	0.0–0.5	RE49-10-6139	NA	85	2500
49-001(a)	49-610221	0.5–1.5	RE49-10-6140	NA	14	1693
49-001(a)	49-610222	0.0–0.5	RE49-10-6141	NA	28	1987
49-001(a)	49-610222	0.5–1.5	RE49-10-6142	NA	30	2220
49-001(a)	49-610223	0.0–0.5	RE49-10-6143	NA	78	2400
49-001(a)	49-610223	0.5–1.5	RE49-10-6144	NA	37	1879
49-001(a)	49-610224	0.0–0.5	RE49-10-6145	NA	33	2030
49-001(a)	49-610224	0.5–1.5	RE49-10-6146	NA	28	2030
49-001(a)	49-610225	0.0–0.5	RE49-10-6147	NA	47	1980
49-001(a)	49-610225	0.5–1.5	RE49-10-6148	NA	42	2160
49-001(a)	49-610226	0.0–0.5	RE49-10-6153	NA	91	2420
49-001(a)	49-610226	0.5–1.5	RE49-10-6154	NA	18	1733
49-001(a)	49-610227	0.0–0.5	RE49-10-6155	NA	23	1792
49-001(a)	49-610227	0.5–1.5	RE49-10-6156	NA	98	2600
49-001(a)	49-610228	0.0–0.5	RE49-10-6157	NA	91	2750
49-001(a)	49-610228	0.5–1.5	RE49-10-6158	NA	118	2440
49-001(a)	49-610229	0.0–0.5	RE49-10-6159	NA	35	2300
49-001(a)	49-610229	0.5–1.5	RE49-10-6160	NA	25	2280
49-001(a)	49-610230	0.0–0.5	RE49-10-6161	NA	23	2030
49-001(a)	49-610230	0.5–1.5	RE49-10-6162	NA	18	2100
49-001(a)	49-610231	0.0–0.5	RE49-10-6163	NA	14	2070
49-001(a)	49-610231	0.5–1.5	RE49-10-6164	NA	18	1970
49-001(a)	49-610232	0.0–0.5	RE49-10-6165	NA	78	2300
49-001(a)	49-610232	0.5–1.5	RE49-10-6166	NA	124	2710
49-001(a)	49-610233	0.0–0.5	RE49-10-6167	NA	14	1891
49-001(a)	49-610233	0.5–1.5	RE49-10-6168	NA	28	1967
49-001(a)	49-610288	0.0–0.5	RE49-10-6286	NA	124	2440
49-001(a)	49-610288	0.5–1.5	RE49-10-6287	NA	37	1792
49-001(a)	49-610313	0.0–0.5	RE49-10-6336	NA	104	2930

[a] dpm = Disintegrations per minute.

[b] NA = Not analyzed.

Table 3.1-2
Field-Screening Results for Samples Collected at MDA AB

SWMU or AOC	Location ID	Depth (ft)	Sample ID	PID (ppm)	Alpha (dpm[a])	Beta/Gamma (dpm)
MDA AB Drilling Samples						
49-001(b), (c), (d)	49-610942	8.0–10.0	RE49-10-8999	0.0	78	2120
49-001(b), (c), (d)	49-610942	77.0–80.0	RE49-10-9000	0.0	91	2950
49-001(b), (c), (d)	49-610942	128.0–130.0	RE49-10-9001	0.0	42	2100
49-001(b), (c), (d)	49-610943	10.0–12.0	RE49-10-9009	0.0	28	1984
49-001(b), (c), (d)	49-610943	78.0–80.0	RE49-10-9010	0.0	14	1885
49-001(b), (c), (d)	49-610943	128.0–130.0	RE49-10-9011	0.0	28	1926
49-001(b), (c), (d)	49-610944	8.0–10.0	RE49-10-9019	0.0	33	1687
49-001(b), (c), (d)	49-610944	78.0–80.0	RE49-10-9020	0.0	28	1926
49-001(b), (c), (d)	49-610944	128.0–130.0	RE49-10-9021	0.0	23	1298
49-001(b), (c), (d)	49-610945	10.0–12.0	RE49-10-9029	0.0	91	2720
49-001(b), (c), (d)	49-610945	78.0–80.0	RE49-10-9030	0.0	98	2350
49-001(b), (c), (d)	49-610945	127.0–130.0	RE49-10-9031	0.0	85	2570
MDA AB Surface and Shallow-Subsurface Samples						
49-001(b), (c), (d)	49-610182	0.0–0.5	RE49-10-6006	NA[b]	14	1914
49-001(b), (c), (d)	49-610182	0.5–1.5	RE49-10-6007	NA	23	2050
49-001(b), (c), (d)	49-610186	0.0–0.5	RE49-10-6014	NA	14	1909
49-001(b), (c), (d)	49-610186	0.5–1.5	RE49-10-6015	NA	37	2020
49-001(b), (c), (d)	49-610187	0.0–0.5	RE49-10-6016	NA	23	1815
49-001(b), (c), (d)	49-610187	0.5–1.5	RE49-10-6017	NA	28	1833
49-001(b), (c), (d)	49-610131	0.0–0.5	RE49-10-5889	NA	131	2910
49-001(b), (c), (d)	49-610131	0.5–1.5	RE49-10-5890	NA	111	2510
49-001(b), (c), (d)	49-610132	0.0–0.5	RE49-10-5891	NA	131	2820
49-001(b), (c), (d)	49-610132	0.5–1.5	RE49-10-5892	NA	59	2610
49-001(b), (c), (d)	49-610133	0.0–0.5	RE49-10-5893	NA	18	1821
49-001(b), (c), (d)	49-610133	0.5–1.5	RE49-10-5894	NA	45	2520
49-001(b), (c), (d)	49-610134	0.0–0.5	RE49-10-5895	NA	33	2130
49-001(b), (c), (d)	49-610134	0.5–1.5	RE49-10-5896	NA	85	2600
49-001(b), (c), (d)	49-610135	0.0–0.5	RE49-10-5898	NA	78	2570
49-001(b), (c), (d)	49-610135	0.5–1.5	RE49-10-5899	NA	52	3000
49-001(b), (c), (d)	49-610136	0.0–0.5	RE49-10-5900	NA	72	2770
49-001(b), (c), (d)	49-610136	0.5–1.5	RE49-10-5901	NA	131	2630
49-001(b), (c), (d)	49-610137	0.0–0.5	RE49-10-5902	NA	78	2740
49-001(b), (c), (d)	49-610137	0.5–1.5	RE49-10-5903	NA	85	2320
49-001(b), (c), (d)	49-610138	0.0–0.5	RE49-10-5904	NA	65	2330
49-001(b), (c), (d)	49-610138	0.5–1.5	RE49-10-5905	NA	4	1745
49-001(b), (c), (d)	49-610139	0.0–0.5	RE49-10-5906	NA	14	1955

Table 3.1-2 (continued)

SWMU or AOC	Location ID	Depth (ft)	Sample ID	PID (ppm)	Alpha (dpm[a])	Beta/Gamma (dpm)
49-001(b), (c), (d)	49-610139	0.5–1.5	RE49-10-5907	NA	98	2410
49-001(b), (c), (d)	49-610140	0.0–0.5	RE49-10-5908	NA	65	2460
49-001(b), (c), (d)	49-610140	0.5–1.5	RE49-10-5909	NA	91	2620
49-001(b), (c), (d)	49-610151	0.5–1.5	RE49-10-5931	NA	18	1932
49-001(b), (c), (d)	49-610169	0.0–0.5	RE49-10-5966	NA	91	2630
SWMU 49-001(g) Surface and Shallow-Subsurface Samples						
49-001(g)	49-610890	0.0–0.5	RE49-10-8552	NA	14	1874
49-001(g)	49-610890	0.5–1.5	RE49-10-8553	NA	33	2050
49-001(g)	49-610891	0.0–0.5	RE49-10-8554	NA	9	1879
49-001(g)	49-610891	0.5–1.5	RE49-10-8555	NA	18	1944
49-001(g)	49-610892	0.0–0.5	RE49-10-8556	NA	9	1955
49-001(g)	49-610892	0.5–1.5	RE49-10-8557	NA	9	2060
49-001(g)	49-610893	0.0–0.5	RE49-10-8558	NA	18	2010
49-001(g)	49-610893	0.5–1.5	RE49-10-8559	NA	9	2140
49-001(g)	49-610894	0.0–0.5	RE49-10-8560	NA	4	1681
49-001(g)	49-610894	0.5–1.5	RE49-10-8561	NA	18	2100
49-001(g)	49-610895	0.0–0.5	RE-49-10-8562	NA	4	1739
49-001(g)	49-610895	0.5–1.5	RE49-10-8563	NA	23	1938
49-001(g)	49-610896	0.0–0.5	RE49-10-8564	NA	52	1763
49-001(g)	49-610896	0.5–1.5	RE49-1-8565	NA	37	2140
49-001(g)	49-610897	0.0–0.5	RE49-10-8566	NA	4	1768
49-001(g)	49-610897	0.5–1.5	RE49-10-8567	NA	18	2100

[a] dpm = Disintegrations per minute.

[b] NA = Not analyzed.

Table 3.1-3
Field-Screening Results for Samples Collected at Area 3, SWMU 49-001(e)

SWMU or AOC	Location ID	Depth (ft)	Sample ID	PID (ppm)	Alpha (dpm[a])	Beta/Gamma (dpm)
Area 3 Drilling Samples						
49-001(e)	49-609981	1.2–3.0	RE49-10-5367	0.0	59	1987
49-001(e)	49-609981	78.0–80.0	RE49-10-5374	1.3	45	2510
49-001(e)	49-609981	140.0–143.0	RE49-10-5375	0.3	45	2500
49-001(e)	49-609981	190.0–192.0	RE49-10-5376	0.4	98	2880
49-001(e)	49-609982	3.2–5.0	RE49-10-5365	0.0	32	2030
49-001(e)	49-609982	83.0–85.0	RE49-10-5372	0.0	72	2080
49-001(e)	49-609982	190.0–192.0	RE49-10-5373	0.0	78	2330
49-001(e)	49-609983	0.5–3.0	RE49-10-5364	0.0	39	2410
49-001(e)	49-609983	80.0–82.0	RE49-10-5377	0.5	78	2980
49-001(e)	49-609983	140.0–142.0	RE49-10-5378	0.8	85	2670
49-001(e)	49-609983	190.0–192.0	RE49-10-5379	0.0	121	3090
49-001(e)	49-609984	3.25–5.0	RE49-10-5366	1.7	111	2340
49-001(e)	49-609984	85.0–87.0	RE49-10-5380	0.5	52	2250
49-001(e)	49-609984	150.0–152.0	RE49-10-5381	0.1	59	2540
49-001(e)	49-609984	190.0–192.0	RE49-10-5382	0.0	45	2500
Area 3 Surface and Shallow-Subsurface Samples						
49-001(e)	49-609307	0.0–0.5	RE49-10-3254	NA[b]	98	2420
49-001(e)	49-609307	0.5–1.5	RE49-10-3255	NA	32	3440
49-001(e)	49-609308	0.0–0.5	RE49-10-3256	NA	54	1953
49-001(e)	49-609308	0.5–1.5	RE49-10-3257	NA	16	2360
49-001(e)	49-609309	0.0–0.5	RE49-10-3258	NA	85	2230
49-001(e)	49-609309	0.5–1.5	RE49-10-3259	NA	50	1948
49-001(e)	49-609310	0.0–0.5	RE49-10-3260	NA	98	2360
49-001(e)	49-609310	0.5–1.5	RE49-10-3261	NA	32	2180
49-001(e)	49-609311	0.0–0.5	RE49-10-3262	NA	45	2380
49-001(e)	49-609311	0.5–1.5	RE49-10-3263	NA	27	2410
49-001(e)	49-609329	0.0–0.5	RE49-10-3308	NA	48	1877
49-001(e)	49-609329	0.5–1.5	RE49-10-3309	NA	27	2500
49-001(e)	49-609330	0.0–0.5	RE49-10-3310	NA	38	2320
49-001(e)	49-609330	0.5–1.5	RE49-10-3311	NA	21	2090
49-001(e)	49-609331	0.0–0.5	RE49-10-3312	NA	32	2250
49-001(e)	49-609331	0.5–1.5	RE49-10-3313	NA	54	2050
49-001(e)	49-609332	0.0–0.5	RE49-10-3314	NA	38	2950
49-001(e)	49-609332	0.5–1.5	RE49-10-3315	NA	21	3750
49-001(e)	49-609333	0.0–0.5	RE49-10-3316	NA	16	2270
49-001(e)	49-609333	0.5–1.5	RE49-10-3317	NA	27	1943

Table 3.1-3 (continued)

SWMU or AOC	Location ID	Depth (ft)	Sample ID	PID (ppm)	Alpha (dpm[a])	Beta/Gamma (dpm)
49-001(e)	49-609334	0.0–0.5	RE49-10-3318	NA	38	2170
49-001(e)	49-609334	0.5–1.5	RE49-10-3319	NA	32	2350
49-001(e)	49-609335	0.0–0.5	RE49-10-3320	NA	72	2810
49-001(e)	49-609335	0.5–1.5	RE49-10-3321	NA	78	2500
49-001(e)	49-609336	0.0–0.5	RE49-10-3322	NA	85	2340
49-001(e)	49-609336	0.5–1.5	RE49-10-3323	NA	72	2540
49-001(e)	49-609337	0.0–0.5	RE49-10-3324	NA	94	2370
49-001(e)	49-609337	0.5–1.5	RE49-10-3325	NA	65	2180
49-001(e)	49-609344	0.5–1.5	RE49-10-3343	NA	27	2500
49-001(e)	49-609353	0.0–0.5	RE49-10-3360	NA	98	2610
49-001(e)	49-609355	0.5–1.5	RE49-10-3365	NA	118	2740
49-001(e)	49-609360	0.5–1.5	RE49-10-3375	NA	32	2960
49-001(e)	49-609385	0.0–0.5	RE49-10-3442	NA	92	2100
49-001(e)	49-609386	0.0–0.5	RE49-10-3444	NA	54	2200
49-001(e)	49-609402	0.5–1.5	RE49-10-3477	NA	38	3580
49-001(e)	49-609390	0.0–0.5	RE49-10-3452	NA	59	2260
49-001(e)	49-609400	0.0–0.5	RE49-10-3472	NA	43	2440
49-001(e)	49-609402	0.0–0.5	RE49-10-3476	NA	16	2430
49-001(e)	49-609404	0.5–1.5	RE49-10-3481	NA	27	3100
49-001(e)	49-609405	0.0–0.5	RE49-10-3482	NA	27	2550
49-001(e)	49-609407	0.0–0.5	RE49-10-3486	NA	98	2770
49-001(e)	49-609407	0.5–1.5	RE49-10-3487	NA	85	2460
49-001(e)	49-609414	0.5–1.5	RE49-10-3501	NA	78	2390

[a] dpm = Disintegrations per minute.

[b] NA = Not analyzed.

Table 3.1-4
Field-Screening Results for Samples Collected at Area 4, SWMU 49-001(f)

SWMU or AOC	Location ID	Depth (ft)	Sample ID	PID (ppm)	Alpha (dpm[a])	Beta/Gamma (dpm)
Area 4 Drilling Samples						
49-001(f)	49-610938	0.7–2.7	RE49-10-8964	0.0	18	1833
49-001(f)	49-610938	63.5–65.5	RE49-10-8965	0.0	23	1961
49-001(f)	49-610938	106.0–108.0	RE49-10-8966	0.0	42	1864
49-001(f)	49-610938	156.0–158.0	RE49-10-8967	0.0	37	1909
49-001(f)	49-610939	2.0–3.5	RE49-10-8974	0.0	18	1768
49-001(f)	49-610939	66.6–68.6	RE49-10-8975	0.0	28	1839
49-001(f)	49-610939	106.0–108.0	RE49-10-8976	0.0	28	2270
49-001(f)	49-610939	156.0–158.0	RE49-10-8977	0.0	27	1991
49-001(f)	49-610940	0.7–2.7	RE49-10-8980	0.0	23	1698
49-001(f)	49-610940	72.7–74.7	RE49-10-8981	0.0	37	2160
49-001(f)	49-610940	110.0–113.0	RE49-10-8982	0.0	19	2100
49-001(f)	49-610940	156.0–158.0	RE49-10-8983	0.0	14	2000
49-001(f)	49-610941	1.3–3.4	RE49-10-8986	0.0	18	1800
49-001(f)	49-610941	70.0–72.0	RE49-10-8987	0.0	85	2640
49-001(f)	49-610941	105.0–107.0	RE49-10-8988	0.0	65	2670
49-001(f)	49-610941	156.0–158.0	RE49-10-8989	0.0	78	2650
Area 4 Surface and Shallow Subsurface Samples						
49-001(f)	49-609657	0.0–0.5	RE49-10-4287	NA[b]	14	1897
49-001(f)	49-609657	0.5–1.5	RE49-10-4288	NA	28	2090
49-001(f)	49-609658	0.0–0.5	RE49-10-4289	NA	23	2200
49-001(f)	49-609658	0.5–1.5	RE49-10-4290	NA	9	2010
49-001(f)	49-609659	0.0–0.5	RE49-10-4291	NA	18	2350
49-001(f)	49-609659	0.5–1.5	RE49-10-4292	NA	42	2090
49-001(f)	49-609660	0.0–0.5	RE49-10-4293	NA	37	2110
49-001(f)	49-609660	0.5–1.5	RE49-10-4294	NA	28	1850
49-001(f)	49-609661	0.0–0.5	RE49-10-4295	NA	47	2110
49-001(f)	49-609661	0.5–1.5	RE49-10-4296	NA	9	2200
49-001(f)	49-609662	0.0–0.5	RE49-10-4297	NA	23	2460
49-001(f)	49-609662	0.5–1.5	RE49-10-4298	NA	23	2090
49-001(f)	49-609663	0.0–0.5	RE49-10-4299	NA	9	2100
49-001(f)	49-609663	0.5–1.5	RE49-10-4300	NA	18	1990
49-001(f)	49-609664	0.0–0.5	RE49-10-4301	NA	57	2270
49-001(f)	49-609664	0.5–1.5	RE49-10-4302	NA	18	2070

Table 3.1-4 (continued)

SWMU or AOC	Location ID	Depth (ft)	Sample ID	PID (ppm)	Alpha (dpm[a])	Beta/Gamma (dpm)
49-001(f)	49-609665	0.0–0.5	RE49-10-4307	NA	79	2260
49-001(f)	49-609665	0.5–1.5	RE49-10-4308	NA	46	2440
49-001(f)	49-609666	0.0–0.5	RE49-10-4309	NA	13	2560
49-001(f)	49-609666	0.5–1.5	RE49-10-4310	NA	39	2440
49-001(f)	49-609667	0.0–0.5	RE49-10-4311	NA	66	2390
49-001(f)	49-609667	0.5–1.5	RE49-10-4312	NA	59	2160
49-001(f)	49-609668	0.0–0.5	RE49-10-4313	NA	28	2220
49-001(f)	49-609668	0.5–1.5	RE49-10-4314	NA	28	2200
49-001(f)	49-609669	0.0–0.5	RE49-10-4315	NA	33	2360
49-001(f)	49-609669	0.5–1.5	RE49-10-4316	NA	72	2560
49-001(f)	49-609670	0.0–0.5	RE49-10-4317	NA	23	2060
49-001(f)	49-609670	0.5–1.5	RE49-10-4318	NA	33	2140
49-001(f)	49-609671	0.0–0.5	RE49-10-4319	NA	37	2230
49-001(f)	49-609671	0.5–1.5	RE49-10-4320	NA	14	2200
49-001(f)	49-609672	0.0–0.5	RE49-10-4321	NA	14	2030
49-001(f)	49-609672	0.5–1.5	RE49-10-4322	NA	28	1990
49-001(f)	49-609673	0.0–0.5	RE49-10-4323	NA	33	2340
49-001(f)	49-609673	0.5–1.5	RE49-10-4324	NA	39	2450
49-001(f)	49-609674	0.0–0.5	RE49-10-4325	NA	23	2040
49-001(f)	49-609674	0.5–1.5	RE49-10-4326	NA	23	2020
49-001(f)	49-609675	0.0–0.5	RE49-10-4327	NA	9	1944
49-001(f)	49-609675	0.5–1.5	RE49-10-4328	NA	23	1786
49-001(f)	49-609676	0.0–0.5	RE49-10-4329	NA	42	1932
49-001(f)	49-609676	0.5–1.5	RE49-10-4330	NA	66	1961
49-001(f)	49-609677	0.0–0.5	RE49-10-4337	NA	59	2490
49-001(f)	49-609677	0.5–1.5	RE49-10-4338	NA	13	2490
49-001(f)	49-609678	0.0–0.5	RE49-10-4339	NA	26	2480
49-001(f)	49-609678	0.5–1.5	RE49-10-4340	NA	72	2310
49-001(f)	49-609679	0.0–0.5	RE49-10-4341	NA	66	2540
49-001(f)	49-609679	0.5–1.5	RE49-10-4342	NA	26	2400
49-001(f)	49-609680	0.0–0.5	RE49-10-4343	NA	26	2220
49-001(f)	49-609680	0.5–1.5	RE49-10-4344	NA	39	2360
49-001(f)	49-609681	0.0–0.5	RE49-10-4345	NA	39	2360
49-001(f)	49-609681	0.5–1.5	RE49-10-4346	NA	19	2150
49-001(f)	49-609682	0.0–0.5	RE49-10-4347	NA	26	2150
49-001(f)	49-609682	0.5–1.5	RE49-10-4348	NA	59	2300
49-001(f)	49-609683	0.0–0.5	RE49-10-4349	NA	46	2510
49-001(f)	49-609683	0.5–1.5	RE49-10-4350	NA	39	2340

Table 3.1-4 (continued)

SWMU or AOC	Location ID	Depth (ft)	Sample ID	PID (ppm)	Alpha (dpm[a])	Beta/Gamma (dpm)
49-001(f)	49-609684	0.0–0.5	RE49-10-4351	NA	33	2130
49-001(f)	49-609684	0.5–1.5	RE49-10-4352	NA	9	1903
49-001(f)	49-609685	0.0–0.5	RE49-10-4353	NA	9	1891
49-001(f)	49-609685	0.5–1.5	RE49-10-4354	NA	18	1768
49-001(f)	49-609687	0.0–0.5	RE49-10-4361	NA	13	2530
49-001(f)	49-609688	0.0–0.5	RE49-10-4363	NA	46	2460
49-001(f)	49-609717	0.0–0.5	RE49-10-4421	NA	26	2440
49-001(f)	49-609735	0.0–0.5	RE49-10-4477	NA	46	2540
49-001(f)	49-609737	0.0–0.5	RE49-10-4481	NA	46	2500
49-001(f)	49-609738	0.0–0.5	RE49-10-4483	NA	39	2310
49-001(f)	49-609740	0.5–1.5	RE49-10-4488	NA	72	2590
49-001(f)	49-609742	0.0–0.5	RE49-10-4491	NA	72	2420
49-001(f)	49-609742	0.5–1.5	RE49-10-4492	NA	52	2450
49-001(f)	49-609743	0.0–0.5	RE49-10-4493	NA	39	2320
49-001(f)	49-609745	0.5–1.5	RE49-10-4498	NA	59	2330
49-001(f)	49-609746	0.0–0.5	RE49-10-4499	NA	26	2680
49-001(f)	49-609747	0.5–1.5	RE49-10-4502	NA	46	2500
49-001(f)	49-609748	0.0–0.5	RE49-10-4503	NA	33	2120
49-001(f)	49-609750	0.0–0.5	RE49-10-4507	NA	39	2330
49-001(f)	49-609750	0.5–1.5	RE49-10-4508	NA	26	2830
49-001(f)	49-609753	0.5–1.5	RE49-10-4514	NA	33	2240
49-001(f)	49-609758	0.5–1.5	RE49-10-4524	NA	66	2270
49-001(f)	49-611066	0.0–0.5	RE49-10-10932	NA	44	2430

[a] dpm = Disintegrations per minute.

[b] NA = Not analyzed.

Table 3.1-5
Field-Screening Results for Samples Collected at Area 11, SWMU 49-003

SWMU or AOC	Location ID	Depth (ft)	Sample ID	PID (ppm)	Alpha (dpm*)	Beta/Gamma (dpm)
Area 11 Drilling Samples						
49-003	49-610497	0.0–2.0	RE49-10-7109	0.0	91	2050
49-003	49-610497	13.0–15.0	RE49-10-7110	0.0	85	2430
49-003	49-610497	18.0–20.0	RE49-10-7111	0.0	104	2320
49-003	49-610498	0.0–2.0	RE49-10-7112	0.0	65	2390
49-003	49-610498	8.0–10.0	RE49-10-7113	0.1	85	2640
49-003	49-610498	18.0–20.0	RE49-10-7114	0.0	39	2310
49-003	49-610499	0.0–2.0	RE49-10-7115	0.0	59	2220
49-003	49-610499	13.0–15.0	RE49-10-7116	0.0	98	2370
49-003	49-610499	18.0–20.0	RE49-10-7117	0.0	137	2565
49-003	49-610500	0.0–2.0	RE49-10-7118	0.0	78	2100
49-003	49-610500	8.0–10.0	RE49-10-7119	0.0	28	2520
49-003	49-610500	18.0–20.0	RE49-10-7120	0.0	59	2350
49-003	49-610496	0.0–2.0	RE49-10-7122	0.0	98	2260
49-003	49-610496	7.5–10.0	RE49-10-7123	0.0	59	2470
49-003	49-610489	0.0–2.0	RE49-10-7087	0.0	37	1733

* dpm = Disintegrations per minute.

Table 3.1-6
Field-Screening Results for Samples Collected at Area 11, AOC 49-008(c)

SWMU or AOC	Location ID	Depth (ft)	Sample ID	PID (ppm)	Alpha (dpm[a])	Beta/Gamma (dpm)
Area 11 Drilling Samples						
49-008(c)	49-610489	63.0–65.0	RE49-10-7088	0.0	157	3040
49-008(c)	49-610489	77.0–79.0	RE49-10-7089	0.0	111	2800
49-008(c)	49-610490	0.0–2.0	RE49-10-7090	0.4	131	2250
49-008(c)	49-610490	18.0–20.0	RE49-10-7091	0.6	65	2650
49-008(c)	49-610490	33.0–35.0	RE49-10-7092	1.1	85	2740
49-008(c)	49-610491	0.0–2.0	RE49-10-7093	0.6	111	2170
49-008(c)	49-610491	8.0–10.0	RE49-10-7094	0.6	98	2340
49-008(c)	49-610492	0.0–2.0	RE49-10-7095	0.3	52	2210
49-008(c)	49-610492	8.0–10.0	RE49-10-7096	0.2	98	2500
49-008(c)	49-610493	0.0–2.5	RE49-10-7097	1.0	98	2260
49-008(c)	49-610493	8.0–10.0	RE49-10-7098	0.0	78	2560
49-008(c)	49-610494	0.0–2.0	RE49-10-7099	0.5	65	2360
49-008(c)	49-610494	8.0–10.0	RE49-10-7100	0.3	72	2410
49-008(c)	49-610495	0.0–2.0	RE49-10-7101	0.4	98	2170
49-008(c)	49-610495	8.0–10.0	RE49-10-7102	0.1	85	2115

Table 3.1-7
Field-Screening Results for Samples Collected at Area 12, AOC 49-008(d)

SWMU or AOC	Location ID	Depth (ft)	Sample ID	PID (ppm)	Alpha (dpm[a])	Beta/Gamma (dpm)
Area 12 Drilling Samples						
49-008(d)	49-610481	3.0–5.0	RE49-10-7045	0.0	53	2200
49-008(d)	49-610481	28.0–30.0	RE49-10-7046	0.0	72	2110
49-008(d)	49-610481	76.0–79.0	RE49-10-7047	0.0	85	2540
49-008(d)	49-610481	118.0–120.0	RE49-10-7044	0.5	45	2690
49-008(d)	49-610485	2.0–3.5	RE49-10-7048	0.0	39	1830
49-008(d)	49-610485	73.0–75.0	RE49-10-7049	1.7	59	2540
49-008(d)	49-610485	88.0–90.0	RE49-10-7050	0.7	91	2580
49-008(d)	49-610485	118.0–120.0	RE49-10-7051	0.8	85	2550
49-008(d)	49-609889	0.0–0.5	RE49-10-5089	NA[b]	60	2330
49-008(d)	49-609889	0.5–1.5	RE49-10-5090	NA	19	2220
49-008(d)	49-609890	0.0–0.5	RE49-10-5091	NA	15	2310
49-008(d)	49-609890	0.5–1.5	RE49-10-5092	NA	52	2370
49-008(d)	49-609891	0.0–0.5	RE49-10-5093	NA	59	2380
49-008(d)	49-609891	0.5–1.5	RE49-10-5094	NA	46	2340
49-008(d)	49-609892	0.0–0.5	RE49-10-5095	NA	52	2510
49-008(d)	49-609892	0.5–1.5	RE49-10-5096	NA	46	2360
49-008(d)	49-609893	0.0–0.5	RE49-10-5097	NA	39	2460
49-008(d)	49-609893	0.5–1.5	RE49-10-5098	NA	72	2110
Area 12 Surface and Shallow-Subsurface Samples						
49-008(d)	49-609894	0.0–0.5	RE49-10-5102	NA	19	2490
49-008(d)	49-609894	0.5–1.5	RE49-10-5103	NA	46	2330
49-008(d)	49-609895	0.0–0.5	RE49-10-5104	NA	33	2380
49-008(d)	49-609895	0.5–1.5	RE49-10-5105	NA	52	2220
49-008(d)	49-609896	0.0–0.5	RE49-10-5106	NA	26	2680
49-008(d)	49-609896	0.5–1.5	RE49-10-5107	NA	26	2160
49-008(d)	49-609897	0.0–0.5	RE49-10-5108	NA	50	2890
49-008(d)	49-609897	0.5–1.5	RE49-10-5109	NA	33	3060
49-008(d)	49-609898	0.0–0.5	RE49-10-5110	NA	28	2670
49-008(d)	49-609898	0.5–1.5	RE49-10-5111	NA	28	2720
49-008(d)	49-609899	0.0–0.5	RE49-10-5112	NA	56	2860
49-008(d)	49-609899	0.5–1.5	RE49-10-5113	NA	45	2530
49-008(d)	49-609900	0.0–0.5	RE49-10-5114	NA	67	2740
49-008(d)	49-609900	0.5–1.5	RE49-10-5115	NA	56	2670
49-008(d)	49-609901	0.0–0.5	RE49-10-5116	NA	45	2980
49-008(d)	49-609901	0.5–1.5	RE49-10-5117	NA	73	2690
49-008(d)	49-609902	0.0–0.5	RE49-10-5118	NA	50	3160

Table 3.1-7 (continued)

SWMU or AOC	Location ID	Depth (ft)	Sample ID	PID (ppm)	Alpha (dpm)	Beta/Gamma (dpm)
49-008(d)	49-609902	0.5–1.5	RE49-10-5119	NA	73	3210
49-008(d)	49-609903	0.0–0.5	RE49-10-5120	NA	28	3160
49-008(d)	49-609903	0.5–1.5	RE49-10-5121	NA	56	2840
49-008(d)	49-609904	0.0–0.5	RE49-10-5122	NA	101	3040
49-008(d)	49-609904	0.5–1.5	RE49-10-5123	NA	45	2990
49-008(d)	49-609905	0.0–0.5	RE49-10-5124	NA	11	2790
49-008(d)	49-609905	0.5–1.5	RE49-10-5125	NA	50	2900
49-008(d)	49-609906	0.0–0.5	RE49-10-5132	NA	56	3190
49-008(d)	49-609906	0.5–1.5	RE49-10-5133	NA	67	3430
49-008(d)	49-609907	0.0–0.5	RE49-10-5134	NA	101	3060
49-008(d)	49-609907	0.5–1.5	RE49-10-5135	NA	107	3150
49-008(d)	49-609908	0.0–0.5	RE49-10-5136	NA	90	3090
49-008(d)	49-609908	0.5–1.5	RE49-10-5137	NA	90	3590
49-008(d)	49-609909	0.0–0.5	RE49-10-5138	NA	67	2950
49-008(d)	49-609909	0.5–1.5	RE49-10-5139	NA	45	2730
49-008(d)	49-609910	0.0–0.5	RE49-10-5140	NA	73	3060
49-008(d)	49-609910	0.5–1.5	RE49-10-5141	NA	56	3000
49-008(d)	49-609911	0.0–0.5	RE49-10-5142	NA	45	2640
49-008(d)	49-609911	0.5–1.5	RE49-10-5143	NA	90	2770
49-008(d)	49-609912	0.0–0.5	RE49-10-5144	NA	79	2500
49-008(d)	49-609912	0.5–1.5	RE49-10-5145	NA	28	2960
49-008(d)	49-609913	0.0–0.5	RE49-10-5146	NA	67	3260
49-008(d)	49-609913	0.5–1.5	RE49-10-5147	NA	113	3410
49-008(d)	49-609925	0.0–0.5	RE49-10-5176	NA	39	2290
49-008(d)	49-609925	0.5–1.5	RE49-10-5177	NA	52	2250
49-008(d)	49-609950	0.0–0.5	RE49-10-5226	NA	84	2820
49-008(d)	49-609955	0.0–0.5	RE49-10-5236	NA	39	2840
49-008(d)	49-609956	0.5–1.5	RE49-10-5239	NA	50	2640
49-008(d)	49-609965	0.5–1.5	RE49-10-5284	NA	73	3320
49-008(d)	49-609976	0.0–0.5	RE49-10-5305	NA	84	2800

[a] dpm = Disintegrations per minute.

[b] NA = Not analyzed.

Table 4.5-1
Henry's Law Constants, Groundwater SLs, and
Pore-Gas Screening Levels for Detected VOCs in Pore Gas

VOC	Henry's Law Constant[a] (dimensionless)	Groundwater Screening Level (µg/L)	Pore-Gas Screening Level for Groundwater Protection[b] (µg/m^3)
Acetone	0.00144	14,100[c]	20,300
Benzene	0.228	5[d]	1140
Butanone[2-]	0.00233	5560[c]	13,000
Carbon disulfide	0.59	810[c]	478,000
Chloromethane	0.362	20.3[c]	7350
Dichlorodifluoromethane	14.1	197[c]	2,780,000
Ethylbenzene	0.323	700[d]	22,600
Ethyltoluene[4-]	na[e]	na	na
Styrene	0.113	100[d]	11,300
Toluene	0.272	750[f]	20,400
Trimethylbenzene[1,2,4-]	0.25[g]	15[h]	3750
Trimethylbenzene[1,3,5-]	0.36[g]	120[h]	43,200
Xylene (Total)	0.212	620[f]	131,000
Xylene[1,2-]	0.212	620[f]	132,000
Xylene[1,3-]+Xylene[1,4-]	0.294	620[f]	182,000

[a] NMED (2015, 600915, Appendix B) unless otherwise noted.

[b] Derived from denominator of Equation 4.5-3.

[c] Tap-water screening levels from NMED (2015, 600915).

[d] EPA MCL (40 Code of Federal Regulations 141.61).

[e] na = Not available.

[f] NMWQCC groundwater standard (20.6.2.3103 New Mexico Administrative Code).

[g] Henry's law constant from EPA regional screening tables (http://www.epa.gov/risk/risk-based-screening-table-generic-tables).

[h] EPA regional tap-water screening level (http://www.epa.gov/risk/risk-based-screening-table-generic-tables).

Table 4.5-2
Results of Pore-Gas Screening Based on Maximum Detected Concentrations

Chemical	Maximum Detected Concentration ($\mu g/m^3$)	Pore-Gas Screening Level for Groundwater Protection[a] ($\mu g/m^3$)	Screening Value
Acetone	46	20,300	0.0023
Benzene	60	1140	0.053
Butanone[2-]	15	13,000	0.0012
Carbon disulfide	98	478,000	0.00020
Chloromethane	2.9	7350	0.00040
Dichlorodifluoromethane	3.2	2,780,000	0.0000012
Ethylbenzene	17	22,600	0.00075
Ethyltoluene[4-]	16	na[a]	na
Styrene	4.9	11,300	0.00043
Toluene	100	20,400	0.0049
Trimethylbenzene[1,2,4-]	19	3750	0.0051
Trimethylbenzene[1,3,5-]	9.1	43,200	0.00007
Xylene (Total)	78	131,000	0.00021
Xylene[1,2-]	19	132,000	0.00014
Xylene[1,3-]+Xylene[1,4-]	58	182,000	0.00032

[a] Screening levels from Table 4.5-1.
[b] na = Not available.

Table 6.2-1
Samples Collected and Analyses Requested at Area 1, SWMU 49-001(a)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Gamma Spectroscopy	Tritium	Explosive Compounds	Isotopic Plutonium	Isotopic Uranium	Metals	Perchlorate	SVOCs	Uranium	VOCs	Cyanide
SWMU 49-001(a)															
0549-95-0191	49-01035	0.0–0.5	Soil	—*	841	—	—	841	—	840	—	—	841	—	—
0549-95-0192	49-01036	0.0–0.5	Soil	—	841	—	—	—	—	—	—	—	—	—	—
0549-95-0193	49-01037	0.0–0.5	Soil	—	841	—	—	—	—	—	—	—	—	—	—
0549-95-0194	49-01038	0.0–0.5	Soil	—	841	—	—	841	—	840	—	—	841	—	—
0549-95-0195	49-01039	0.0–0.5	Soil	—	841	—	—	—	—	—	—	—	—	—	—
0549-95-0196	49-01040	0.0–0.5	Soil	—	841	—	—	841	—	840	—	—	841	—	—
0549-95-0197	49-01041	0.0–0.5	Soil	—	841	—	—	—	—	—	—	—	—	—	—
0549-95-0198	49-01042	0.0–0.5	Soil	—	841	—	—	—	—	—	—	—	—	—	—
0549-95-0199	49-01043	0.0–0.5	Soil	—	841	—	—	841	—	840	—	—	841	—	—
0549-95-0200	49-01044	0.0–0.5	Soil	—	841	—	—	—	—	—	—	—	—	—	—
0549-95-0201	49-01045	0.0–0.5	Soil	—	841	—	—	—	—	—	—	—	—	—	—
0549-95-0202	49-01046	0.0–0.5	Soil	—	841	—	—	841	—	840	—	—	841	—	—
0549-95-0203	49-01047	0.0–0.5	Soil	—	841	—	—	841	—	840	—	—	841	—	—
0549-95-0204	49-01048	0.0–0.5	Soil	—	841	—	—	841	—	840	—	—	841	—	—
0549-95-0205	49-01049	0.0–0.5	Soil	—	841	—	—	—	—	—	—	—	—	—	—
0549-95-0206	49-01050	0.0–0.5	Soil	—	841	—	—	—	—	—	—	—	—	—	—
0549-95-0207	49-01051	0.0–0.5	Soil	—	841	—	—	841	—	840	—	—	841	—	—
0549-95-0208	49-01052	0.0–0.5	Soil	—	841	—	—	—	—	—	—	—	—	—	—
0549-95-0209	49-01053	0.0–0.5	Soil	—	841	—	—	841	—	840	—	—	841	—	—
0549-95-0210	49-01054	0.0–0.5	Soil	—	841	—	—	841	—	840	—	—	841	—	—
RE49-10-6109	49-610206	0.0–0.5	Soil	10-1136	10-1136	—	—	10-1136	10-1136	10-1136	—	—	—	—	—
RE49-10-6110	49-610206	0.5–1.5	Soil	10-1136	10-1136	—	—	10-1136	10-1136	10-1136	—	—	—	—	—
RE49-10-6111	49-610207	0.0–0.5	Soil	10-1136	10-1136	—	—	10-1136	10-1136	10-1136	—	—	—	—	—
RE49-10-6112	49-610207	0.5–1.5	Soil	10-1136	10-1136	—	—	10-1136	10-1136	10-1136	—	—	—	—	—
RE49-10-6113	49-610208	0.0–0.5	Soil	10-1136	10-1136	—	—	10-1136	10-1136	10-1136	—	—	—	—	—
RE49-10-6114	49-610208	0.5–1.5	Soil	10-1136	10-1136	—	—	10-1136	10-1136	10-1136	—	—	—	—	—
RE49-10-6115	49-610209	0.0–0.5	Soil	10-1136	10-1136	—	—	10-1136	10-1136	10-1136	—	—	—	—	—
RE49-10-6116	49-610209	0.5–1.5	Soil	10-1136	10-1136	—	—	10-1136	10-1136	10-1136	—	—	—	—	—
RE49-10-6117	49-610210	0.0–0.5	Soil	10-1136	10-1136	—	—	10-1136	10-1136	10-1136	—	—	—	—	—
RE49-10-6118	49-610210	0.5–1.5	Soil	10-1136	10-1136	—	—	10-1136	10-1136	10-1136	—	—	—	—	—
RE49-10-6119	49-610211	0.0–0.5	Soil	10-1136	10-1136	—	—	10-1136	10-1136	10-1136	—	—	—	—	—
RE49-10-6120	49-610211	0.5–1.5	Soil	10-1136	10-1136	—	—	10-1136	10-1136	10-1136	—	—	—	—	—
RE49-10-6121	49-610212	0.0–0.5	Soil	10-1136	10-1136	—	—	10-1136	10-1136	10-1136	—	—	—	—	—
RE49-10-6122	49-610212	0.5–1.5	Soil	10-1136	10-1136	—	—	10-1136	10-1136	10-1136	—	—	—	—	—
RE49-10-6123	49-610213	0.0–0.5	Soil	10-1136	10-1136	—	—	10-1136	10-1136	10-1136	—	—	—	—	—

Table 6.2-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Gamma Spectroscopy	Tritium	Explosive Compounds	Isotopic Plutonium	Isotopic Uranium	Metals	Perchlorate	SVOCs	Uranium	VOCs	Cyanide
RE49-10-6124	49-610213	0.5–1.5	Soil	10-1136	10-1136	—	—	10-1136	10-1136	10-1136	—	—	—	—	—
RE49-10-6125	49-610214	0.0–0.5	Soil	10-1136	10-1136	—	—	10-1136	10-1136	10-1136	—	—	—	—	—
RE49-10-6126	49-610214	0.5–1.5	Soil	10-1136	10-1136	—	—	10-1136	10-1136	10-1136	—	—	—	—	—
RE49-10-6127	49-610215	0.0–0.5	Soil	10-1136	10-1136	—	—	10-1136	10-1136	10-1136	—	—	—	—	—
RE49-10-6128	49-610215	0.5–1.5	Soil	10-1136	10-1136	—	—	10-1136	10-1136	10-1136	—	—	—	—	—
RE49-10-6129	49-610216	0.0–0.5	Soil	10-1138	10-1138	—	—	10-1138	10-1138	10-1138	—	—	—	—	—
RE49-10-6130	49-610216	0.5–1.5	Soil	10-1138	10-1138	—	—	10-1138	10-1138	10-1138	—	—	—	—	—
RE49-10-6131	49-610217	0.0–0.5	Soil	10-1138	10-1138	—	—	10-1138	10-1138	10-1138	—	—	—	—	—
RE49-10-6132	49-610217	0.5–1.5	Soil	10-1138	10-1138	—	—	10-1138	10-1138	10-1138	—	—	—	—	—
RE49-10-6133	49-610218	0.0–0.5	Soil	10-1138	10-1138	—	—	10-1138	10-1138	10-1138	—	—	—	—	—
RE49-10-6134	49-610218	0.5–1.5	Soil	10-1138	10-1138	—	—	10-1138	10-1138	10-1138	—	—	—	—	—
RE49-10-6135	49-610219	0.0–0.5	Soil	10-1138	10-1138	—	—	10-1138	10-1138	10-1138	—	—	—	—	—
RE49-10-6136	49-610219	0.5–1.5	Soil	10-1138	10-1138	—	—	10-1138	10-1138	10-1138	—	—	—	—	—
RE49-10-6137	49-610220	0.0–0.5	Soil	10-1138	10-1138	—	—	10-1138	10-1138	10-1138	—	—	—	—	—
RE49-10-6138	49-610220	0.5–1.5	Soil	10-1138	10-1138	—	—	10-1138	10-1138	10-1138	—	—	—	—	—
RE49-10-6139	49-610221	0.0–0.5	Soil	10-1138	10-1138	—	—	10-1138	10-1138	10-1138	—	—	—	—	—
RE49-10-6140	49-610221	0.5–1.5	Soil	10-1138	10-1138	—	—	10-1138	10-1138	10-1138	—	—	—	—	—
RE49-10-6141	49-610222	0.0–0.5	Soil	10-1138	10-1138	—	—	10-1138	10-1138	10-1138	—	—	—	—	—
RE49-10-6142	49-610222	0.5–1.5	Soil	10-1138	10-1138	—	—	10-1138	10-1138	10-1138	—	—	—	—	—
RE49-10-6143	49-610223	0.0–0.5	Soil	10-1138	10-1138	—	—	10-1138	10-1138	10-1138	—	—	—	—	—
RE49-10-6144	49-610223	0.5–1.5	Soil	10-1138	10-1138	—	—	10-1138	10-1138	10-1138	—	—	—	—	—
RE49-10-6145	49-610224	0.0–0.5	Soil	10-1138	10-1138	—	—	10-1138	10-1138	10-1138	—	—	—	—	—
RE49-10-6146	49-610224	0.5–1.5	Qbt4	10-1138	10-1138	—	—	10-1138	10-1138	10-1138	—	—	—	—	—
RE49-10-6147	49-610225	0.0–0.5	Soil	10-1138	10-1138	—	—	10-1138	10-1138	10-1138	—	—	—	—	—
RE49-10-6148	49-610225	0.5–1.5	Soil	10-1138	10-1138	—	—	10-1138	10-1138	10-1138	—	—	—	—	—
RE49-10-6153	49-610226	0.0–0.5	Soil	10-1139	10-1139	—	—	10-1139	10-1139	10-1139	—	—	—	—	—
RE49-10-6154	49-610226	0.5–1.5	Soil	10-1139	10-1139	—	—	10-1139	10-1139	10-1139	—	—	—	—	—
RE49-10-6155	49-610227	0.0–0.5	Soil	10-1139	10-1139	—	—	10-1139	10-1139	10-1139	—	—	—	—	—
RE49-10-6156	49-610227	0.5–1.5	Soil	10-1139	10-1139	—	—	10-1139	10-1139	10-1139	—	—	—	—	—
RE49-10-6157	49-610228	0.0–0.5	Soil	10-1139	10-1139	—	—	10-1139	10-1139	10-1139	—	—	—	—	—
RE49-10-6158	49-610228	0.5–1.5	Soil	10-1139	10-1139	—	—	10-1139	10-1139	10-1139	—	—	—	—	—
RE49-10-6159	49-610229	0.0–0.5	Soil	10-1139	10-1139	—	—	10-1139	10-1139	10-1139	—	—	—	—	—
RE49-10-6160	49-610229	0.5–1.5	Soil	10-1139	10-1139	—	—	10-1139	10-1139	10-1139	—	—	—	—	—
RE49-10-6161	49-610230	0.0–0.5	Soil	10-1139	10-1139	—	—	10-1139	10-1139	10-1139	—	—	—	—	—
RE49-10-6162	49-610230	0.5–1.5	Soil	10-1139	10-1139	—	—	10-1139	10-1139	10-1139	—	—	—	—	—
RE49-10-6163	49-610231	0.0–0.5	Soil	10-1139	10-1139	—	—	10-1139	10-1139	10-1139	—	—	—	—	—
RE49-10-6164	49-610231	0.5–1.5	Qbt4	10-1139	10-1139	—	—	10-1139	10-1139	10-1139	—	—	—	—	—
RE49-10-6165	49-610232	0.0–0.5	Soil	10-1139	10-1139	—	—	10-1139	10-1139	10-1139	—	—	—	—	—

Table 6.2-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Gamma Spectroscopy	Tritium	Explosive Compounds	Isotopic Plutonium	Isotopic Uranium	Metals	Perchlorate	SVOCs	Uranium	VOCs	Cyanide
RE49-10-6166	49-610232	0.5–1.5	Qbt4	10-1139	10-1139	—	—	10-1139	10-1139	10-1139	—	—	—	—	—
RE49-10-6167	49-610233	0.0–0.5	Soil	10-1139	10-1139	—	—	10-1139	10-1139	10-1139	—	—	—	—	—
RE49-10-6168	49-610233	0.5–1.5	Soil	10-1139	10-1139	—	—	10-1139	10-1139	10-1139	—	—	—	—	—
RE49-10-6286	49-610288	0.0–0.5	Soil	10-1139	10-1139	—	—	10-1139	10-1139	10-1139	—	—	—	—	—
RE49-10-6287	49-610288	0.5–1.5	Soil	10-1139	10-1139	—	—	10-1139	10-1139	10-1139	—	—	—	—	—
RE49-10-6336	49-610313	0.0–0.5	Soil	10-1139	10-1139	—	—	10-1139	10-1139	10-1139	—	—	—	—	—
RE49-10-9047	49-610946	1.7–3.7	Qbt4	10-1110	—	10-1110	10-1110	10-1110	10-1110	10-1111	10-1111	10-1110	—	10-1110	10-1111
RE49-10-9051	49-610946	72.0–74.0	Qbt3	10-1309	—	10-1309	10-1309	10-1309	10-1309	10-1309	10-1309	10-1309	—	10-1309	10-1309
RE49-10-9052	49-610946	85.0–87.0	Qbt3	10-1309	—	10-1309	10-1309	10-1309	10-1309	10-1309	10-1309	10-1309	—	10-1309	10-1309
RE49-10-9068	49-610946	133.0–135.0	Qbt3	10-1309	—	10-1309	10-1309	10-1309	10-1309	10-1309	10-1309	10-1309	—	10-1309	10-1309
RE49-10-9049	49-610947	2.5–4.2	Qbt4	10-1110	—	10-1110	10-1110	10-1110	10-1110	10-1111	10-1111	10-1110	—	10-1110	10-1111
RE49-10-9063	49-610947	76.7–77.7	Qbt3	10-1389	—	10-1389	10-1388	10-1389	10-1389	10-1389	10-1389	10-1388	—	10-1388	10-1389
RE49-10-9064	49-610947	85.0–87.0	Qbt3	10-1389	—	10-1389	10-1388	10-1389	10-1389	10-1389	10-1389	10-1388	—	10-1388	10-1389
RE49-10-9066	49-610947	133.0–135.0	Qbt3	10-1389	—	10-1389	10-1388	10-1389	10-1389	10-1389	10-1389	10-1388	—	10-1388	10-1389
RE49-10-9050	49-610948	4.0–6.0	Qbt4	10-1258	—	10-1258	10-1258	10-1258	10-1258	10-1258	10-1258	10-1258	—	10-1258	10-1258
RE49-10-9057	49-610948	77.0–81.0	Qbt3	10-1395	—	10-1395	10-1395	10-1395	10-1395	10-1395	10-1395	10-1395	—	10-1395	10-1395
RE49-10-9058	49-610948	85.0–87.0	Qbt3	10-1395	—	10-1395	10-1395	10-1395	10-1395	10-1395	10-1395	10-1395	—	10-1395	10-1395
RE49-10-9059	49-610948	133.0–135.0	Qbt3	10-1395	—	10-1395	10-1395	10-1395	10-1395	10-1395	10-1395	10-1395	—	10-1395	10-1395
RE49-10-9048	49-610949	2.0–3.8	Qbt4	10-1110	—	10-1110	10-1110	10-1110	10-1110	10-1111	10-1111	10-1110	—	10-1110	10-1111
RE49-10-9069	49-610949	76.0–78.0	Qbt3	10-1389	—	10-1389	10-1388	10-1389	10-1389	10-1389	10-1389	10-1388	—	10-1388	10-1389
RE49-10-9070	49-610949	85.0–87.0	Qbt3	10-1389	—	10-1389	10-1388	10-1389	10-1389	10-1389	10-1389	10-1388	—	10-1388	10-1389
RE49-10-9071	49-610949	133.0–135.0	Qbt3	10-1389	—	10-1389	10-1388	10-1389	10-1389	10-1389	10-1389	10-1388	—	10-1388	10-1389
Overland Corridor for SWMU 49-001(a)															
RE49-10-5823	49-610098	0.0–0.5	Soil	10-718	10-718	—	—	10-718	10-718	10-718	—	—	—	—	—
RE49-10-5824	49-610098	0.5–1.5	Soil	10-718	10-718	—	—	10-718	10-718	10-718	—	—	—	—	—
RE49-10-5825	49-610099	0.0–0.5	Soil	10-718	10-718	—	—	10-718	10-718	10-718	—	—	—	—	—
RE49-10-5826	49-610099	0.5–1.5	Soil	10-718	10-718	—	—	10-718	10-718	10-718	—	—	—	—	—
RE49-10-5827	49-610100	0.0–0.5	Soil	10-718	10-718	—	—	10-718	10-718	10-718	—	—	—	—	—
RE49-10-5828	49-610100	0.5–1.5	Soil	10-718	10-718	—	—	10-718	10-718	10-718	—	—	—	—	—
RE49-10-5829	49-610101	0.0–0.5	Soil	10-718	10-718	—	—	10-718	10-718	10-718	—	—	—	—	—
RE49-10-5830	49-610101	0.5–1.5	Soil	10-718	10-718	—	—	10-718	10-718	10-718	—	—	—	—	—
RE49-10-5831	49-610102	0.0–0.5	Soil	10-718	10-718	—	—	10-718	10-718	10-718	—	—	—	—	—
RE49-10-5832	49-610102	0.5–1.5	Soil	10-719	10-719	—	—	10-719	10-719	10-719	—	—	—	—	—
RE49-10-5833	49-610103	0.0–0.5	Soil	10-719	10-719	—	—	10-719	10-719	10-719	—	—	—	—	—
RE49-10-5834	49-610103	0.5–1.5	Soil	10-719	10-719	—	—	10-719	10-719	10-719	—	—	—	—	—
RE49-10-5835	49-610104	0.0–0.5	Soil	10-719	10-719	—	—	10-719	10-719	10-719	—	—	—	—	—
RE49-10-5836	49-610104	0.5–1.5	Soil	10-719	10-719	—	—	10-719	10-719	10-719	—	—	—	—	—
RE49-10-5837	49-610105	0.0–0.5	Soil	10-719	10-719	—	—	10-719	10-719	10-719	—	—	—	—	—

Table 6.2-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Gamma Spectroscopy	Tritium	Explosive Compounds	Isotopic Plutonium	Isotopic Uranium	Metals	Perchlorate	SVOCs	Uranium	VOCs	Cyanide
RE49-10-5838	49-610105	0.5–1.5	Soil	10-719	10-719	—	—	10-719	10-719	10-719	—	—	—	—	—
RE49-10-5839	49-610106	0.0–0.5	Soil	10-719	10-719	—	—	10-719	10-719	10-719	—	—	—	—	—
RE49-10-5840	49-610106	0.5–1.5	Soil	10-719	10-719	—	—	10-719	10-719	10-719	—	—	—	—	—
RE49-10-5841	49-610107	0.0–0.5	Soil	10-719	10-719	—	—	10-719	10-719	10-719	—	—	—	—	—
RE49-10-5842	49-610107	0.5–1.5	Soil	10-719	10-719	—	—	10-719	10-719	10-719	—	—	—	—	—
RE49-10-5843	49-610108	0.0–0.5	Soil	10-719	10-719	—	—	10-719	10-719	10-719	—	—	—	—	—
RE49-10-5844	49-610108	0.5–1.5	Soil	10-719	10-719	—	—	10-719	10-719	10-719	—	—	—	—	—
RE49-10-5845	49-610109	0.0–0.5	Soil	10-719	10-719	—	—	10-719	10-719	10-719	—	—	—	—	—
RE49-10-5846	49-610109	0.5–1.5	Soil	10-719	10-719	—	—	10-719	10-719	10-719	—	—	—	—	—
RE49-10-5847	49-610110	0.0–0.5	Soil	10-719	10-719	—	—	10-719	10-719	10-719	—	—	—	—	—
RE49-10-5848	49-610110	0.5–1.5	Soil	10-719	10-719	—	—	10-719	10-719	10-719	—	—	—	—	—
RE49-10-5849	49-610111	0.0–0.5	Soil	10-719	10-719	—	—	10-719	10-719	10-719	—	—	—	—	—
RE49-10-5850	49-610111	0.5–1.5	Soil	10-719	10-719	—	—	10-719	10-719	10-719	—	—	—	—	—
RE49-10-5851	49-610112	0.0–0.5	Soil	10-719	10-719	—	—	10-719	10-719	10-719	—	—	—	—	—
RE49-10-5852	49-610112	0.5–1.5	Soil	10-720	10-720	—	—	10-720	10-720	10-720	—	—	—	—	—
RE49-10-5853	49-610113	0.0–0.5	Soil	10-720	10-720	—	—	10-720	10-720	10-720	—	—	—	—	—
RE49-10-5854	49-610113	0.5–1.5	Soil	10-720	10-720	—	—	10-720	10-720	10-720	—	—	—	—	—
RE49-10-5855	49-610114	0.0–0.5	Soil	10-720	10-720	—	—	10-720	10-720	10-720	—	—	—	—	—
RE49-10-5856	49-610114	0.5–1.5	Soil	10-720	10-720	—	—	10-720	10-720	10-720	—	—	—	—	—
RE49-10-5857	49-610115	0.0–0.5	Soil	10-720	10-720	—	—	10-720	10-720	10-720	—	—	—	—	—
RE49-10-5858	49-610115	0.5–1.5	Soil	10-720	10-720	—	—	10-720	10-720	10-720	—	—	—	—	—
RE49-10-5859	49-610116	0.0–0.5	Soil	10-720	10-720	—	—	10-720	10-720	10-720	—	—	—	—	—
RE49-10-5860	49-610116	0.5–1.5	Soil	10-720	10-720	—	—	10-720	10-720	10-720	—	—	—	—	—
RE49-10-5861	49-610117	0.0–0.5	Soil	10-720	10-720	—	—	10-720	10-720	10-720	—	—	—	—	—
RE49-10-5862	49-610117	0.5–1.5	Soil	10-720	10-720	—	—	10-720	10-720	10-720	—	—	—	—	—
RE49-10-5863	49-610118	0.0–0.5	Soil	10-720	10-720	—	—	10-720	10-720	10-720	—	—	—	—	—
RE49-10-5864	49-610118	0.5–1.5	Soil	10-720	10-720	—	—	10-720	10-720	10-720	—	—	—	—	—
RE49-10-5865	49-610119	0.0–0.5	Soil	10-720	10-720	—	—	10-720	10-720	10-720	—	—	—	—	—
RE49-10-5866	49-610119	0.5–1.5	Soil	10-720	10-720	—	—	10-720	10-720	10-720	—	—	—	—	—
RE49-10-5867	49-610120	0.0–0. 5	Soil	10-720	10-720	—	—	10-720	10-720	10-720	—	—	—	—	—
RE49-10-5868	49-610120	0.5–1.5	Soil	10-720	10-720	—	—	10-720	10-720	10-720	—	—	—	—	—
RE49-10-5869	49-610121	0.0–0.5	Soil	10-720	10-720	—	—	10-720	10-720	10-720	—	—	—	—	—
RE49-10-5870	49-610121	0.5–1.5	Qbt4	10-720	10-720	—	—	10-720	10-720	10-720	—	—	—	—	—
RE49-10-5871	49-610122	0.0–0.5	Soil	10-720	10-720	—	—	10-720	10-720	10-720	—	—	—	—	—
RE49-10-5872	49-610122	0.5–1.5	Soil	10-721	10-721	—	—	10-721	10-721	10-721	—	—	—	—	—
RE49-10-5873	49-610123	0.0–0.5	Soil	10-721	10-721	—	—	10-721	10-721	10-721	—	—	—	—	—
RE49-10-5874	49-610123	0.5–1.5	Soil	10-721	10-721	—	—	10-721	10-721	10-721	—	—	—	—	—
RE49-10-5875	49-610124	0.0–0.5	Soil	10-721	10-721	—	—	10-721	10-721	10-721	—	—	—	—	—

Table 6.2-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Gamma Spectroscopy	Tritium	Explosive Compounds	Isotopic Plutonium	Isotopic Uranium	Metals	Perchlorate	SVOCs	Uranium	VOCs	Cyanide
RE49-10-5876	49-610124	0.5–1.5	Soil	10-721	10-721	—	—	10-721	10-721	10-721	—	—	—	—	—
RE49-10-5877	49-610125	0.0–0.5	Soil	10-721	10-721	—	—	10-721	10-721	10-721	—	—	—	—	—
RE49-10-5878	49-610125	0.5–1.5	Soil	10-721	10-721	—	—	10-721	10-721	10-721	—	—	—	—	—
RE49-10-5879	49-610126	0.0–0.5	Soil	10-721	10-721	—	—	10-721	10-721	10-721	—	—	—	—	—
RE49-10-5880	49-610126	0.5–1.5	Soil	10-721	10-721	—	—	10-721	10-721	10-721	—	—	—	—	—
RE49-10-5881	49-610127	0.0–0.5	Soil	10-721	10-721	—	—	10-721	10-721	10-721	—	—	—	—	—
RE49-10-5882	49-610127	0.5–1.5	Soil	10-721	10-721	—	—	10-721	10-721	10-721	—	—	—	—	—
RE49-10-5883	49-610128	0.0–0.5	Soil	10-721	10-721	—	—	10-721	10-721	10-721	—	—	—	—	—
RE49-10-5884	49-610128	0.5–1.5	Soil	10-721	10-721	—	—	10-721	10-721	10-721	—	—	—	—	—
RE49-10-5885	49-610129	0.0–0.5	Soil	10-721	10-721	—	—	10-721	10-721	10-721	—	—	—	—	—
RE49-10-5886	49-610129	0.5–1.5	Soil	10-721	10-721	—	—	10-721	10-721	10-721	—	—	—	—	—
RE49-10-5887	49-610130	0.0–0.5	Soil	10-721	10-721	—	—	10-721	10-721	10-721	—	—	—	—	—
RE49-10-5888	49-610130	0.5–1.5	Soil	10-721	10-721	—	—	10-721	10-721	10-721	—	—	—	—	—
RE49-10-10862	49-611035	0.0–0.5	Soil	10-1525	10-1525	—	—	10-1525	10-1525	10-1525	—	—	—	—	—
RE49-10-10863	49-611035	0.5–1.5	Soil	10-1525	10-1525	—	—	10-1525	10-1525	10-1525	—	—	—	—	—
RE49-10-10864	49-611036	0.0–0.5	Soil	10-1525	10-1525	—	—	10-1525	10-1525	10-1525	—	—	—	—	—
RE49-10-10865	49-611036	0.5–1.5	Soil	10-1525	10-1525	—	—	10-1525	10-1525	10-1525	—	—	—	—	—
RE49-10-10866	49-611037	0.0–0.5	Soil	10-1525	10-1525	—	—	10-1525	10-1525	10-1525	—	—	—	—	—
RE49-10-10867	49-611037	0.5–1.5	Soil	10-1525	10-1525	—	—	10-1525	10-1525	10-1525	—	—	—	—	—
RE49-10-10868	49-611038	0.0–0.5	Soil	10-1525	10-1525	—	—	10-1525	10-1525	10-1525	—	—	—	—	—
RE49-10-10869	49-611038	0.5–1.5	Soil	10-1525	10-1525	—	—	10-1525	10-1525	10-1525	—	—	—	—	—
RE49-10-10870	49-611039	0.0–0.5	Soil	10-1525	10-1525	—	—	10-1525	10-1525	10-1525	—	—	—	—	—
RE49-10-10871	49-611039	0.5–1.5	Soil	10-1525	10-1525	—	—	10-1525	10-1525	10-1525	—	—	—	—	—
RE49-10-10872	49-611040	0.0–0.5	Soil	10-1525	10-1525	—	—	10-1525	10-1525	10-1525	—	—	—	—	—
RE49-10-10873	49-611040	0.5–1.5	Soil	10-1525	10-1525	—	—	10-1525	10-1525	10-1525	—	—	—	—	—
RE49-10-10874	49-611041	0.0–0.5	Soil	10-1525	10-1525	—	—	10-1525	10-1525	10-1525	—	—	—	—	—
RE49-10-10875	49-611041	0.5–1.5	Soil	10-1525	10-1525	—	—	10-1525	10-1525	10-1525	—	—	—	—	—

Note: Numbers in analyte columns are request numbers.
*— = Analysis not requested.

Table 6.2-2
Summary of Inorganic Chemicals Detected or Detected above BVs at Area 1, SWMU 49-001(a)

Sample ID	Location ID	Depth (ft)	Media	Aluminum	Arsenic	Barium	Beryllium	Calcium	Chromium	Cobalt	Copper	Cyanide (Total)	Iron	Lead
Qbt 2,3,4 BV[a]				**7340**	**2.79**	**46**	**1.21**	**2200**	**7.14**	**3.14**	**4.66**	**0.5**	**14,500**	**11.2**
Soil BV[a]				**29,200**	**8.17**	**295**	**1.83**	**6120**	**19.3**	**8.64**	**14.7**	**0.5**	**21,500**	**22.3**
Residential SSL[b]				**78,000**	**4.25**	**15,600**	**156**	**13,000,000**	**96.6[c]**	**23[d]**	**3130**	**11.2**	**54,800**	**400**
Industrial SSL[b]				**1,290,000**	**21.5**	**255,000**	**2580**	**32,400,000**	**505[c]**	**350[d]**	**51,900**	**63.3**	**908,000**	**800**
SWMU 49-001(a)														
0549-95-0191	49-01035	0.0–0.5	Soil	—[e]	—	—	—	—	—	—	—	NA[f]	—	—
0549-95-0194	49-01038	0.0–0.5	Soil	—	—	—	—	—	—	—	—	NA	—	—
0549-95-0196	49-01040	0.0–0.5	Soil	—	—	—	—	—	—	—	—	NA	—	—
0549-95-0199	49-01043	0.0–0.5	Soil	—	—	—	—	—	—	—	—	NA	—	—
0549-95-0202	49-01046	0.0–0.5	Soil	—	—	—	—	—	—	—	—	NA	—	—
0549-95-0203	49-01047	0.0–0.5	Soil	—	—	—	—	—	—	—	—	NA	—	—
0549-95-0204	49-01048	0.0–0.5	Soil	—	—	—	—	—	—	—	—	NA	—	—
0549-95-0207	49-01051	0.0–0.5	Soil	—	—	—	—	—	—	—	—	NA	—	—
0549-95-0209	49-01053	0.0–0.5	Soil	—	—	—	—	—	—	—	—	NA	—	—
0549-95-0210	49-01054	0.0–0.5	Soil	—	—	—	—	—	—	—	—	NA	—	—
RE49-10-6114	49-610208	0.5–1.5	Soil	—	—	—	—	—	—	9.3	—	NA	—	—
RE49-10-6116	49-610209	0.5–1.5	Soil	—	—	—	—	—	—	44.5	—	NA	—	27.8
RE49-10-6122	49-610212	0.5–1.5	Soil	—	—	—	—	—	—	20.3	—	NA	—	—
RE49-10-6128	49-610215	0.5–1.5	Soil	—	—	—	—	—	—	10	—	NA	—	—
RE49-10-6131	49-610217	0.0–0.5	Soil	—	—	—	—	—	—	—	—	NA	—	—
RE49-10-6135	49-610219	0.0–0.5	Soil	—	—	—	—	—	—	9.6	—	NA	—	—
RE49-10-6138	49-610220	0.5–1.5	Soil	—	—	—	—	—	—	9.3	—	NA	—	—
RE49-10-6140	49-610221	0.5–1.5	Soil	—	—	—	—	—	—	13.3	—	NA	—	—
RE49-10-6145	49-610224	0.0–0.5	Soil	—	—	—	—	—	25.4	—	—	NA	—	—
RE49-10-6146	49-610224	0.5–1.5	Qbt4	11,800	2.8	151 (J+)	—	—	13	—	5.8	NA	—	13
RE49-10-6154	49-610226	0.5–1.5	Soil	—	—	—	—	—	—	9.8	—	NA	—	—
RE49-10-6156	49-610227	0.5–1.5	Soil	—	—	915	—	8250	—	—	—	NA	—	—
RE49-10-6161	49-610230	0.0–0.5	Soil	—	—	—	—	—	—	10.5	—	NA	—	—
RE49-10-6162	49-610230	0.5–1.5	Soil	—	—	—	—	—	—	—	—	NA	—	22.4
RE49-10-6164	49-610231	0.5–1.5	Qbt4	—	—	80.1	—	—	7.9	3.6	—	NA	—	—
RE49-10-6166	49-610232	0.5–1.5	Qbt4	13,000	4.1	142	—	2910	11.1	4	7.6	NA	—	11.9
RE49-10-9047	49-610946	1.7–3.7	Qbt4	—	—	48.3	—	3590 (J)	—	—	—	0.53 (UJ)	—	—
RE49-10-9051	49-610946	72.0–74.0	Qbt3	—	—	—	—	—	—	—	—	0.51 (U)	—	—
RE49-10-9052	49-610946	85.0–87.0	Qbt3	—	—	—	—	—	—	—	—	0.51 (U)	—	—
RE49-10-9068	49-610946	133.0–135.0	Qbt3	—	—	—	—	—	—	—	—	0.51 (U)	—	—
RE49-10-9049	49-610947	2.5–4.2	Qbt4	—	—	60.9	—	3930 (J)	—	—	—	0.53 (UJ)	—	—

Table 6.2-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Aluminum	Arsenic	Barium	Beryllium	Calcium	Chromium	Cobalt	Copper	Cyanide (Total)	Iron	Lead
Qbt 2,3,4 BV[a]				**7340**	**2.79**	**46**	**1.21**	**2200**	**7.14**	**3.14**	**4.66**	**0.5**	**14,500**	**11.2**
Soil BV[a]				**29,200**	**8.17**	**295**	**1.83**	**6120**	**19.3**	**8.64**	**14.7**	**0.5**	**21,500**	**22.3**
Residential SSL[b]				**78,000**	**4.25**	**15,600**	**156**	**13,000,000**	**96.6[c]**	**23[d]**	**3130**	**11.2**	**54,800**	**400**
Industrial SSL[b]				**1,290,000**	**21.5**	**255,000**	**2580**	**32,400,000**	**505[c]**	**350[d]**	**51,900**	**63.3**	**908,000**	**800**
RE49-10-9063	49-610947	76.7–77.7	Qbt3	—	—	—	—	—	—	—	—	0.51 (U)	—	77.4
RE49-10-9064	49-610947	85.0–87.0	Qbt3	—	—	—	—	—	—	—	—	0.51 (U)	—	—
RE49-10-9066	49-610947	133.0–135.0	Qbt3	—	—	—	—	—	—	—	—	—	—	—
RE49-10-9050	49-610948	4.0–6.0	Qbt4	9430 (J+)	2.8	115	—	3030	7.2	—	5.3	—	—	—
RE49-10-9057	49-610948	77.0–81.0	Qbt3	—	—	—	—	—	—	—	—	—	—	—
RE49-10-9058	49-610948	85.0–87.0	Qbt3	—	—	—	—	—	—	—	—	0.51 (U)	—	—
RE49-10-9059	49-610948	133.0–135.0	Qbt3	—	—	—	—	—	—	—	—	0.52 (U)	—	—
RE49-10-9048	49-610949	2.0–3.8	Qbt4	8520	—	84.8	—	4400 (J)	—	—	—	0.54 (UJ)	—	—
RE49-10-9069	49-610949	76.0–78.0	Qbt3	—	—	—	—	—	—	—	—	—	—	—
RE49-10-9070	49-610949	85.0–87.0	Qbt3	—	—	—	—	—	—	—	—	0.51 (U)	—	—
RE49-10-9071	49-610949	133.0–135.0	Qbt3	—	—	—	—	—	—	—	—	—	—	—
Overland Corridor for SWMU 49-00(a)														
RE49-10-5823	49-610098	0.0–0.5	Soil	—	—	—	—	—	—	—	—	NA	—	—
RE49-10-5824	49-610098	0.5–1.5	Soil	—	—	—	—	—	—	—	—	NA	—	—
RE49-10-5825	49-610099	0.0–0.5	Soil	—	—	—	—	—	—	—	—	NA	—	—
RE49-10-5826	49-610099	0.5–1.5	Soil	—	—	—	—	—	—	—	—	NA	—	—
RE49-10-5827	49-610100	0.0–0.5	Soil	—	—	—	—	—	—	—	—	NA	—	—
RE49-10-5828	49-610100	0.5–1.5	Soil	—	—	—	—	—	—	8.8	—	NA	—	—
RE49-10-5829	49-610101	0.0–0.5	Soil	—	—	—	—	—	—	9.3	—	NA	—	—
RE49-10-5830	49-610101	0.5–1.5	Soil	—	—	—	—	—	—	—	—	NA	—	—
RE49-10-5831	49-610102	0.0–0.5	Soil	—	—	—	—	—	—	—	—	NA	—	—
RE49-10-5834	49-610103	0.5–1.5	Soil	—	—	—	—	—	—	—	—	NA	—	—
RE49-10-5835	49-610104	0.0–0.5	Soil	—	—	—	—	—	—	13.2	—	NA	—	25.5 (J)
RE49-10-5839	49-610106	0.0–0.5	Soil	—	—	—	—	—	—	10.2	—	NA	—	—
RE49-10-5842	49-610107	0.5–1.5	Soil	—	—	—	—	—	—	10.5	—	NA	—	—
RE49-10-5844	49-610108	0.5–1.5	Soil	—	—	—	—	—	—	13.9	—	NA	—	—
RE49-10-5849	49-610111	0.0–0.5	Soil	—	—	—	—	—	—	10.7	—	NA	—	—
RE49-10-5850	49-610111	0.5–1.5	Soil	—	—	—	—	—	—	9.7	—	NA	—	24.9 (J)
RE49-10-5852	49-610112	0.5–1.5	Soil	—	—	—	—	—	—	—	—	NA	—	—
RE49-10-5853	49-610113	0.0–0.5	Soil	—	—	—	—	—	—	25.3	—	NA	—	27.6
RE49-10-5862	49-610117	0.5–1.5	Soil	—	—	—	—	—	—	9.1	—	NA	—	—
RE49-10-5866	49-610119	0.5–1.5	Soil	—	—	—	—	—	—	—	—	NA	—	23.4
RE49-10-5868	49-610120	0.5–1.5	Soil	—	—	—	—	6450	—	—	—	NA	—	—
RE49-10-5869	49-610121	0.0–0.5	Soil	—	—	—	—	—	—	16.2	—	NA	—	24.8

Table 6.2-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Aluminum	Arsenic	Barium	Beryllium	Calcium	Chromium	Cobalt	Copper	Cyanide (Total)	Iron	Lead
Qbt 2,3,4 BV[a]				**7340**	**2.79**	**46**	**1.21**	**2200**	**7.14**	**3.14**	**4.66**	**0.5**	**14,500**	**11.2**
Soil BV[a]				**29,200**	**8.17**	**295**	**1.83**	**6120**	**19.3**	**8.64**	**14.7**	**0.5**	**21,500**	**22.3**
Residential SSL[b]				**78,000**	**4.25**	**15,600**	**156**	**13,000,000**	**96.6[c]**	**23[d]**	**3130**	**11.2**	**54,800**	**400**
Industrial SSL[b]				**1,290,000**	**21.5**	**255,000**	**2580**	**32,400,000**	**505[c]**	**350[d]**	**51,900**	**63.3**	**908,000**	**800**
RE49-10-5870	49-610121	0.5–1.5	Qbt4	16,100	3.1	246 (J-)	1.3	5350	12.6	4.1	5.7	NA	14,900	18.4
RE49-10-5871	49-610122	0.0–0.5	Soil	—	—	—	—	—	—	9.9	—	NA	—	—
RE49-10-5872	49-610122	0.5–1.5	Soil	—	—	—	—	—	—	10.2 (J)	—	NA	—	—
RE49-10-5873	49-610123	0.0–0.5	Soil	—	—	—	—	—	—	15.6 (J)	—	NA	—	—
RE49-10-5874	49-610123	0.5–1.5	Soil	—	—	—	—	—	—	11.8 (J)	—	NA	—	—
RE49-10-5878	49-610125	0.5–1.5	Soil	—	—	—	—	—	—	17.1 (J)	—	NA	—	30.6
RE49-10-5884	49-610128	0.5–1.5	Soil	—	—	—	—	—	—	—	—	NA	—	—
RE49-10-5885	49-610129	0.0–0.5	Soil	—	—	—	—	—	—	9.5 (J)	—	NA	—	—
RE49-10-5886	49-610129	0.5–1.5	Soil	—	—	—	—	—	—	10.6 (J)	—	NA	—	—
RE49-10-10866	49-611037	0.0–0.5	Soil	—	—	—	—	—	—	11.4	—	NA	—	—
RE49-10-10869	49-611038	0.5–1.5	Soil	—	—	—	—	—	—	12	—	NA	—	—
RE49-10-10873	49-611040	0.5–1.5	Soil	—	—	—	—	—	—	17.5	—	NA	—	—

Table 6.2-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Magnesium	Manganese	Mercury	Nickel	Perchlorate	Selenium	Sodium	Thallium	Uranium	Vanadium	Zinc
Qbt 2,3,4 BV[a]				**1690**	**482**	**0.1**	**6.58**	**na[g]**	**0.3**	**2770**	**1.1**	**2.4**	**17**	**63.5**
Soil BV[a]				**4610**	**671**	**0.1**	**15.4**	**na**	**1.52**	**915**	**0.73**	**1.82**	**39.6**	**48.8**
Residential SSL[b]				**339,000**	**10,500**	**23.5**	**1560**	**54.8**	**391**	**7,820,000**	**0.782**	**234**	**394**	**23,500**
Industrial SSL[b]				**5,680,000**	**160,000**	**389**	**25,700**	**908**	**6490**	**35,700,000**	**13**	**3880**	**6530**	**389,000**
SWMU 49-001(a)														
0549-95-0191	49-01035	0.0–0.5	Soil	—	—	—	—	NA	—	—	1.2 (U)	—	—	—
0549-95-0194	49-01038	0.0–0.5	Soil	—	—	—	—	NA	—	—	1.3 (U)	8.21	—	51.2
0549-95-0196	49-01040	0.0–0.5	Soil	—	—	0.11 (U)	—	NA	—	—	1.4 (U)	3.07	—	—
0549-95-0199	49-01043	0.0–0.5	Soil	—	—	—	—	NA	—	—	1.3 (U)	2.03	—	—
0549-95-0202	49-01046	0.0–0.5	Soil	—	—	—	—	NA	—	—	1.3 (U)	9.3	—	—
0549-95-0203	49-01047	0.0–0.5	Soil	—	—	—	—	NA	—	—	1.3 (U)	2.78	—	—
0549-95-0204	49-01048	0.0–0.5	Soil	—	—	—	—	NA	—	—	1.3 (U)	3.56	—	—
0549-95-0207	49-01051	0.0–0.5	Soil	—	—	0.11 (U)	—	NA	—	—	1.4 (U)	1.95	—	—
0549-95-0209	49-01053	0.0–0.5	Soil	—	—	0.11 (U)	—	NA	—	—	1.3 (U)	—	—	—
0549-95-0210	49-01054	0.0–0.5	Soil	—	—	—	—	NA	—	—	1.4 (U)	1.87	—	—
RE49-10-6114	49-610208	0.5–1.5	Soil	—	—	—	—	NA	—	—	—	NA	—	—
RE49-10-6116	49-610209	0.5–1.5	Soil	—	2430 (J+)	—	31.7	NA	—	—	—	NA	—	—
RE49-10-6122	49-610212	0.5–1.5	Soil	—	—	—	—	NA	1.7	—	—	NA	—	—
RE49-10-6128	49-610215	0.5–1.5	Soil	—	—	—	—	NA	—	—	—	NA	—	—
RE49-10-6131	49-610217	0.0–0.5	Soil	—	—	0.103 (J-)	—	NA	—	—	—	NA	—	—
RE49-10-6135	49-610219	0.0–0.5	Soil	—	—	—	—	NA	—	—	—	NA	—	—
RE49-10-6138	49-610220	0.5–1.5	Soil	—	—	—	—	NA	—	—	—	NA	—	—
RE49-10-6140	49-610221	0.5–1.5	Soil	—	731 (J+)	—	—	NA	—	—	—	NA	—	—
RE49-10-6145	49-610224	0.0–0.5	Soil	—	—	—	—	NA	—	—	—	NA	—	—
RE49-10-6146	49-610224	0.5–1.5	Qbt4	1790 (J+)	—	—	8	NA	1.1	—	—	NA	—	—
RE49-10-6154	49-610226	0.5–1.5	Soil	—	713 (J+)	—	—	NA	—	—	—	NA	—	—
RE49-10-6156	49-610227	0.5–1.5	Soil	—	—	—	—	NA	2	—	—	NA	—	—
RE49-10-6161	49-610230	0.0–0.5	Soil	—	—	—	—	NA	—	—	—	NA	—	—
RE49-10-6162	49-610230	0.5–1.5	Soil	—	—	—	—	NA	1.8	—	—	NA	—	—
RE49-10-6164	49-610231	0.5–1.5	Qbt4	—	—	—	—	NA	0.79	—	—	NA	—	—
RE49-10-6166	49-610232	0.5–1.5	Qbt4	2110	—	—	8.7	NA	1.4	—	—	NA	21.2	—
RE49-10-9047	49-610946	1.7–3.7	Qbt4	—	—	—	—	—	0.91	—	—	NA	—	—
RE49-10-9051	49-610946	72.0–74.0	Qbt3	—	—	—	—	—	0.92	—	—	NA	—	—
RE49-10-9052	49-610946	85.0–87.0	Qbt3	—	—	—	—	—	1.1	—	—	NA	—	—
RE49-10-9068	49-610946	133.0–135.0	Qbt3	—	—	—	—	—	1.1	—	—	NA	—	—
RE49-10-9049	49-610947	2.5–4.2	Qbt4	—	—	—	—	—	1.3	—	—	NA	—	—

Table 6.2-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Magnesium	Manganese	Mercury	Nickel	Perchlorate	Selenium	Sodium	Thallium	Uranium	Vanadium	Zinc
Qbt 2,3,4 BV[a]				**1690**	**482**	**0.1**	**6.58**	**na[g]**	**0.3**	**2770**	**1.1**	**2.4**	**17**	**63.5**
Soil BV[a]				**4610**	**671**	**0.1**	**15.4**	**na**	**1.52**	**915**	**0.73**	**1.82**	**39.6**	**48.8**
Residential SSL[b]				**339,000**	**10,500**	**23.5**	**1560**	**54.8**	**391**	**7,820,000**	**0.782**	**234**	**394**	**23,500**
Industrial SSL[b]				**5,680,000**	**160,000**	**389**	**25,700**	**908**	**6490**	**35,700,000**	**13**	**3880**	**6530**	**389,000**
RE49-10-9063	49-610947	76.7–77.7	Qbt3	—	—	—	—	—	0.91	—	—	NA	—	—
RE49-10-9064	49-610947	85.0–87.0	Qbt3	—	—	—	—	—	0.84	—	—	NA	—	—
RE49-10-9066	49-610947	133.0–135.0	Qbt3	—	—	—	—	—	1	—	—	NA	—	—
RE49-10-9050	49-610948	4.0–6.0	Qbt4	2190	—	—	—	0.0027 (J)	0.89	—	—	NA	—	—
RE49-10-9057	49-610948	77.0–81.0	Qbt3	—	—	—	—	—	0.8	—	—	NA	—	—
RE49-10-9058	49-610948	85.0–87.0	Qbt3	—	—	—	—	—	1	—	—	NA	—	—
RE49-10-9059	49-610948	133.0–135.0	Qbt3	—	—	—	—	—	0.88	—	—	NA	—	—
RE49-10-9048	49-610949	2.0–3.8	Qbt4	—	—	—	—	0.0036 (J)	0.86	—	—	NA	—	—
RE49-10-9069	49-610949	76.0–78.0	Qbt3	—	—	—	—	—	0.77	—	—	NA	—	—
RE49-10-9070	49-610949	85.0–87.0	Qbt3	—	—	—	—	—	0.89	—	—	NA	—	—
RE49-10-9071	49-610949	133.0–135.0	Qbt3	—	—	—	—	—	0.87	—	—	NA	—	—
Overland Corridor for SWMU 49-00(a)														
RE49-10-5823	49-610098	0.0–0.5	Soil	—	—	—	—	NA	1.6 (U)	—	1.1 (U)	NA	—	—
RE49-10-5824	49-610098	0.5–1.5	Soil	—	—	—	—	NA	1.9 (U)	—	1.2 (U)	NA	—	—
RE49-10-5825	49-610099	0.0–0.5	Soil	—	—	—	—	NA	—	—	1.1 (U)	NA	—	—
RE49-10-5826	49-610099	0.5–1.5	Soil	—	—	—	—	NA	1.6 (U)	—	1.1 (U)	NA	—	—
RE49-10-5827	49-610100	0.0–0.5	Soil	—	—	—	—	NA	—	—	1.1 (U)	NA	—	—
RE49-10-5828	49-610100	0.5–1.5	Soil	—	—	—	—	NA	—	—	1.1 (U)	NA	—	—
RE49-10-5829	49-610101	0.0–0.5	Soil	—	—	—	—	NA	1.7 (U)	—	1.1 (U)	NA	—	—
RE49-10-5830	49-610101	0.5–1.5	Soil	—	—	—	—	NA	2.1 (U)	—	1.2 (U)	NA	—	—
RE49-10-5831	49-610102	0.0–0.5	Soil	—	—	—	—	NA	—	—	1.1 (U)	NA	—	—
RE49-10-5834	49-610103	0.5–1.5	Soil	—	—	—	—	NA	1.6	—	—	NA	—	—
RE49-10-5835	49-610104	0.0–0.5	Soil	—	1160	—	—	NA	—	—	—	NA	40.1	—
RE49-10-5839	49-610106	0.0–0.5	Soil	—	761	—	—	NA	—	—	—	NA	—	—
RE49-10-5842	49-610107	0.5–1.5	Soil	—	—	—	—	NA	—	—	—	NA	—	—
RE49-10-5844	49-610108	0.5–1.5	Soil	—	—	—	—	NA	—	—	—	NA	—	—
RE49-10-5849	49-610111	0.0–0.5	Soil	—	721	—	—	NA	—	—	—	NA	—	—
RE49-10-5850	49-610111	0.5–1.5	Soil	—	—	—	—	NA	—	—	—	NA	56.2	—
RE49-10-5852	49-610112	0.5–1.5	Soil	—	—	—	—	NA	—	—	0.88	NA	—	—
RE49-10-5853	49-610113	0.0–0.5	Soil	—	1070	—	—	NA	—	—	—	NA	47.2	—
RE49-10-5862	49-610117	0.5–1.5	Soil	—	—	—	—	NA	—	—	—	NA	—	—
RE49-10-5866	49-610119	0.5–1.5	Soil	—	—	—	—	NA	1.6	—	—	NA	—	—
RE49-10-5868	49-610120	0.5–1.5	Soil	—	—	—	—	NA	—	1300 (J-)	—	NA	—	—
RE49-10-5869	49-610121	0.0–0.5	Soil	—	913	—	—	NA	—	—	—	NA	—	—

Table 6.2-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Magnesium	Manganese	Mercury	Nickel	Perchlorate	Selenium	Sodium	Thallium	Uranium	Vanadium	Zinc
Qbt 2,3,4 BV[a]				**1690**	**482**	**0.1**	**6.58**	**na[g]**	**0.3**	**2770**	**1.1**	**2.4**	**17**	**63.5**
Soil BV[a]				**4610**	**671**	**0.1**	**15.4**	**na**	**1.52**	**915**	**0.73**	**1.82**	**39.6**	**48.8**
Residential SSL[b]				**339,000**	**10,500**	**23.5**	**1560**	**54.8**	**391**	**7,820,000**	**0.782**	**234**	**394**	**23,500**
Industrial SSL[b]				**5,680,000**	**160,000**	**389**	**25,700**	**908**	**6490**	**35,700,000**	**13**	**3880**	**6530**	**389,000**
RE49-10-5870	49-610121	0.5–1.5	Qbt4	2400	—	—	9.4	NA	1.3	—	—	NA	21.5	—
RE49-10-5871	49-610122	0.0–0.5	Soil	—	—	—	—	NA	—	—	—	NA	—	—
RE49-10-5872	49-610122	0.5–1.5	Soil	—	—	—	—	NA	—	—	—	NA	—	—
RE49-10-5873	49-610123	0.0–0.5	Soil	—	909 (J-)	—	—	NA	—	—	—	NA	—	—
RE49-10-5874	49-610123	0.5–1.5	Soil	—	—	—	—	NA	—	—	—	NA	—	—
RE49-10-5878	49-610125	0.5–1.5	Soil	—	895 (J-)	—	—	NA	—	—	—	NA	—	—
RE49-10-5884	49-610128	0.5–1.5	Soil	—	—	—	—	NA	—	—	0.86 (U)	NA	—	—
RE49-10-5885	49-610129	0.0–0.5	Soil	—	—	—	—	NA	—	—	—	NA	—	—
RE49-10-5886	49-610129	0.5–1.5	Soil	—	—	—	—	NA	—	—	—	NA	—	—
RE49-10-10866	49-611037	0.0–0.5	Soil	—	676	—	—	NA	—	—	—	NA	—	—
RE49-10-10869	49-611038	0.5–1.5	Soil	—	—	—	—	NA	—	—	—	NA	—	—
RE49-10-10873	49-611040	0.5–1.5	Soil	—	1050	—	—	NA	—	—	—	NA	—	—

Notes: All concentrations are in mg/kg. Data qualifiers are defined in Appendix A.

[a] BVs from LANL (1998, 059730).

[b] SSLs from NMED (2015, 600915) unless otherwise noted.

[c] SSL for total chromium.

[d] EPA regional screening level (http://www.epa.gov/risk/risk-based-screening-table-generic-tables).

[e] — = Not detected or not detected above BV.

[f] NA = Not analyzed.

[g] na = Not available.

Table 6.2-3
Summary of Organic Chemicals Detected at Area 1, SWMU 49-001(a)

Sample ID	Location ID	Depth (ft)	Media	Methylene Chloride
Residential SSL*				**409**
Industrial SSL*				**5130**
SWMU 49-001(a)				
RE49-10-9057	49-610948	77.0–81.0	Qbt3	0.0028 (J)
RE49-10-9058	49-610948	85.0–87.0	Qbt3	0.0033 (J)
RE49-10-9059	49-610948	133.0–135.0	Qbt3	0.003 (J)

Notes: All concentrations are in mg/kg. Data qualifiers are defined in Appendix A.
*SSLs from NMED (2015, 600915).

Table 6.2-4
Summary of Radionuclides Detected or Detected above BVs/FVs at Area 1, SWMU 49-001(a)

Sample ID	Location ID	Depth (ft)	Media	Cesium-134	Plutonium-238	Plutonium-239/240	Tritium
Qbt 2,3,4 BV[a]				**na**[b]	**na**	**na**	**na**
Soil BV[a]				**na**	**0.023**[c]	**0.054**[c]	**na**
Residential SAL[d]				**5**	**84**	**79**	**1700**
Industrial SAL[d]				**17**	**1300**	**1200**	**2,400,000**
SWMU 49-001(a)							
0549-95-0210	49-01054	0.0–0.5	Soil	NA[e]	—[f]	0.09152	NA
RE49-10-6121	49-610212	0.0–0.5	Soil	0.586	—	—	NA
RE49-10-6287	49-610288	0.5–1.5	Soil	0.081	—	—	NA
RE49-10-9047	49-610946	1.7–3.7	Qbt4	NA	—	—	0.145
RE49-10-9048	49-610949	2.0–3.8	Qbt4	NA	—	—	0.178
Overland Corridor for SWMU 49-001a							
RE49-10-10868	49-611038	0.0–0.5	Soil	—	0.057	—	NA

Note: All activities are in pCi/g.

[a] BVs/FVs from LANL (1998, 059730).

[b] na = Not available.

[c] FV applies to soil samples collected from 0–1 ft only.

[d] SALs from LANL (2015, 600929).

[e] NA = Not analyzed.

[f] — = Not detected or not detected above BV/FV.

Table 6.2-5
Summary of Pore-Gas Samples Collected
and Analyses Requested at Area 1, SWMU 49-001(a)

Sample ID	Location ID	Depth (ft)	Media	Tritium	VOCs
MD49-10-12130	49-610946	71.0–73.0	Pore gas	10-2161	10-2160
MD49-10-12129	49-610946	84.0–86.0	Pore gas	10-2161	10-2160
MD49-10-12128	49-610946	119.0–121.0	Pore gas	10-2161	10-2160

Table 6.2-6
Summary of Organic Chemicals Detected in Pore-Gas Samples at Area 1, SWMU 49-001(a)

Sample ID	Location ID	Depth (ft)	Media	Acetone	Benzene	Butanone[2-]	Carbon Disulfide	Chloromethane	Dichlorodifluoromethane	Ethylbenzene	Ethyltoluene[4-]	Styrene	Toluene	Trimethylbenzene[1,2,4-]	Xylene (Total)	Xylene[1,2-]	Xylene[1,3-]+Xylene[1,4-]
Residential Soil-Gas Vapor Intrusion Screening Level[a]				**323,000**	**36**	**52,100**	**7300**	**156**	**1040**	**112**	**52,100[b]**	**10,400**	**52,100**	**66[c]**	**1040**	**1040**	**1040[d]**
MD49-10-12130	49-610946	71.0–73.0	Pore gas	6.2	21	—[e]	—	—	2.2	6.8	7.3	2.9	44	8.6	33	8.7	24
MD49-10-12129	49-610946	84.0–86.0	Pore gas	21	2.8	3	6.6	1.7 (J+)	2.8	3.3	6.2	—	6.3	7.3	13	3.6	9.8
MD49-10-12128	49-610946	119.0–121.0	Pore gas	11	—	—	—	1.8 (J+)	2.9	—	—	—	1.5	—	—	—	—

Notes: All concentrations are in µg/m^3. Data qualifiers are defined in Appendix A.

[a] Screening levels from NMED (2015, 600915) unless otherwise noted.

[b] Toluene used as a surrogate based on structural similarity.

[c] Residential air screening level from EPA regional screening levels (http://www.epa.gov/risk/risk-based-screening-table-generic-tables) divided by default attenuation factor of 0.11 (NMED 2015, 600915, p. 47).

[d] Xylenes used as a surrogate based on structural similarity.

[e] — = Not detected.

Table 6.2-7
Summary of Tritium in
Pore-Gas Samples Detected at Area 1, SWMU 49-001(a)

Sample ID	Location ID	Depth (ft)	Media	Tritium
MD49-10-12128	49-610946	119.0–121.0	Pore gas	2494.03

Note: All activities are in pCi/L.

Table 6.3-1
Samples Collected and Analyses Requested at SWMUs 49-001(b, c, d, g)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Gamma Spectroscopy	Tritium	Explosive Compounds	Isotopic Plutonium	Isotopic Uranium	Metals	Perchlorate	Strontium-90	Stable Isotopes	SVOCs	VOCs	Cyanide
SWMU 49-001(b)																
MD49-98-0101	49-02901	2.5–2.6	Qbt4	4258R	—*	—	—	4258R	4258R	—	—	—	—	—	—	—
MD49-98-0102	49-02901	14.3–14.5	Qbt4	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
MD49-98-0103	49-02901	24.0–24.2	Qbt4	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
MD49-98-0104	49-02901	35.2–35.6	Qbt4	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
MD49-98-0105	49-02901	45.6–46.0	Qbt4	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
MD49-98-0107	49-02901	55.5–55.8	Qbt4	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
MD49-98-0108	49-02901	65.0–65.2	Qbt4	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
MD49-98-0109	49-02901	71.2–71.3	Qbt4	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
MD49-98-0110	49-02901	76.4–76.6	Qbt4	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
MD49-98-0111	49-02901	88.4–88.6	Qbt3	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
MD49-98-0112	49-02901	94.4–94.6	Qbt3	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
MD49-98-0113	49-02901	115.8–116.0	Qbt3	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
MD49-98-0114	49-02901	133.2–133.5	Qbt3	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
MD49-98-0115	49-02901	136.8–137.0	Qbt3	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
MD49-98-0116	49-02901	150.0–150.2	Qbt3	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
0549-98-0000	49-02902	3.8–4.1	Fill	—	—	—	—	—	4047R	—	—	—	—	—	—	—
0549-98-0001	49-02902	4.4–4.8	Fill	4047R	—	—	—	4047R	4047R	4046R	—	—	—	—	—	—
0549-98-0002	49-02902	7.2–7.4	Fill	—	—	—	—	—	4047R	—	—	—	—	—	—	—
0549-98-0003	49-02903	1.5–2.0	Fill	4047R	—	—	—	—	4047R	4046R	—	—	—	—	—	—
0549-98-0004	49-02903	7.2–7.8	Fill	4047R	—	—	—	—	4047R	4046R	—	—	—	—	—	—
0549-98-0005	49-02904	1.9–2.1	Fill	—	—	—	—	—	4047R	—	—	—	—	—	—	—
0549-98-0006	49-02904	5.6–6.0	Fill	—	—	—	—	—	4047R	—	—	—	—	—	—	—
0549-98-0007	49-02905	3.1–3.3	Qbt3	—	—	—	—	—	4047R	—	—	—	—	—	—	—
0549-98-0008	49-02905	6.9–7.0	Fill	—	—	—	—	—	4047R	—	—	—	—	—	—	—
0549-98-0009	49-02906	4.7–4.8	Fill	—	—	—	—	—	4047R	—	—	—	—	—	—	—
MD49-98-0069	49-02906	5.7–6.0	Qbt4	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
MD49-98-0070	49-02906	16.5–16.7	Qbt4	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
MD49-98-0071	49-02906	28.6–29.0	Qbt4	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
MD49-98-0072	49-02906	38.8–39.0	Qbt4	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
MD49-98-0073	49-02906	40.3–40.5	Qbt4	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
MD49-98-0074	49-02906	53.4–53.5	Qbt4	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
MD49-98-0075	49-02906	67.2–67.5	Qbt4	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
MD49-98-0076	49-02906	75.3–75.5	Qbt4	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
MD49-98-0077	49-02906	85.0–86.5	Qbt4	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—

Table 6.3-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Gamma Spectroscopy	Tritium	Explosive Compounds	Isotopic Plutonium	Isotopic Uranium	Metals	Perchlorate	Strontium-90	Stable Isotopes	SVOCs	VOCs	Cyanide
MD49-98-0078	49-02906	91.5–91.8	Qbt3	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
MD49-98-0079	49-02906	107.7–107.8	Qbt3	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
MD49-98-0080	49-02906	117.0–117.3	Qbt3	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
MD49-98-0081	49-02906	127.0–127.3	Qbt3	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
MD49-98-0082	49-02906	134.5–134.7	Qbt3	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
MD49-98-0083	49-02906	147.2–148.0	Qbt3	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
0549-98-0010	49-02907	3.7–4.6	Fill	4047R	—	—	—	4047R	4047R	4046R	—	—	—	—	—	—
MD49-98-0085	49-02907	5.5–5.7	Qbt4	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
MD49-98-0086	49-02907	16.5–16.8	Qbt4	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
MD49-98-0087	49-02907	25.0–25.5	Qbt4	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
MD49-98-0088	49-02907	37.0–37.2	Qbt4	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
MD49-98-0089	49-02907	47.5–47.7	Qbt4	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
MD49-98-0090	49-02907	54.2–54.5	Qbt4	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
MD49-98-0091	49-02907	65.4–65.6	Qbt4	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
MD49-98-0092	49-02907	76.2–76.5	Qbt4	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
MD49-98-0093	49-02907	84.5–84.7	Qbt3	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
MD49-98-0094	49-02907	95.5–95.8	Qbt3	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
MD49-98-0095	49-02907	106.5–106.7	Qbt3	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
MD49-98-0096	49-02907	115.0–115.3	Qbt3	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
MD49-98-0097	49-02907	126.5–126.6	Qbt3	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
MD49-98-0098	49-02907	138.7–138.9	Qbt3	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
MD49-98-0099	49-02907	146.6–146.8	Qbt3	4258R	—	—	—	4258R	4258R	—	—	—	—	—	—	—
MD49-00-0058	49-10046	1.3–2.0	Qbog	—	—	—	—	—	—	—	—	—	6735R	—	—	—
MD49-00-0052	49-10046	6.3–7.0	Soil	—	—	—	—	—	—	—	—	—	6735R	—	—	—
MD49-00-0053	49-10046	9.2–9.8	Soil	—	—	—	—	—	—	—	—	—	6735R	—	—	—
MD49-00-0054	49-10047	3.3–4.0	Soil	—	—	—	—	—	—	—	—	—	6735R	—	—	—
MD49-00-0055	49-10047	5.3–6.0	Qbog	—	—	—	—	—	—	—	—	—	6735R	—	—	—
MD49-00-0056	49-10048	3.7–4.3	Soil	—	—	—	—	—	—	—	—	—	6735R	—	—	—
MD49-00-0057	49-10048	11.0–11.7	Soil	—	—	—	—	—	—	—	—	—	6735R	—	—	—

Table 6.3-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Gamma Spectroscopy	Tritium	Explosive Compounds	Isotopic Plutonium	Isotopic Uranium	Metals	Perchlorate	Strontium-90	Stable Isotopes	SVOCs	VOCs	Cyanide
SWMUs 49-001(b, c, d)																
RE49-10-5889	49-610131	0.0–0.5	Soil	10-1142	10-1142	—	—	10-1142	10-1142	10-1142	—	—	—	—	—	—
RE49-10-5890	49-610131	0.5–1.5	Soil	10-1142	10-1142	—	—	10-1142	10-1142	10-1142	—	—	—	—	—	—
RE49-10-5891	49-610132	0.0–0.5	Soil	10-1142	10-1142	—	—	10-1142	10-1142	10-1142	—	—	—	—	—	—
RE49-10-5892	49-610132	0.5–1.5	Soil	10-1142	10-1142	—	—	10-1142	10-1142	10-1142	—	—	—	—	—	—
RE49-10-5893	49-610133	0.0–0.5	Soil	10-1142	10-1142	—	—	10-1142	10-1142	10-1142	—	—	—	—	—	—
RE49-10-5894	49-610133	0.5–1.5	Soil	10-1142	10-1142	—	—	10-1142	10-1142	10-1142	—	—	—	—	—	—
RE49-10-5895	49-610134	0.0–0.5	Soil	10-1142	10-1142	—	—	10-1142	10-1142	10-1142	—	—	—	—	—	—
RE49-10-5896	49-610134	0.5–1.5	Soil	10-1142	10-1142	—	—	10-1142	10-1142	10-1142	—	—	—	—	—	—
RE49-10-5898	49-610135	0.0–0.5	Fill	10-1142	10-1142	—	—	10-1142	10-1142	10-1142	—	—	—	—	—	—
RE49-10-5899	49-610135	0.5–1.5	Fill	10-1142	10-1142	—	—	10-1142	10-1142	10-1142	—	—	—	—	—	—
RE49-10-5900	49-610136	0.0–0.5	Soil	10-1142	10-1142	—	—	10-1142	10-1142	10-1142	—	—	—	—	—	—
RE49-10-5901	49-610136	0.5–1.5	Soil	10-1142	10-1142	—	—	10-1142	10-1142	10-1142	—	—	—	—	—	—
RE49-10-5902	49-610137	0.0–0.5	Soil	10-1142	10-1142	—	—	10-1142	10-1142	10-1142	—	—	—	—	—	—
RE49-10-5903	49-610137	0.5–1.5	Soil	10-1142	10-1142	—	—	10-1142	10-1142	10-1142	—	—	—	—	—	—
RE49-10-5904	49-610138	0.0–0.5	Soil	10-1142	10-1142	—	—	10-1142	10-1142	10-1142	—	—	—	—	—	—
RE49-10-5905	49-610138	0.5–1.5	Soil	10-1142	10-1142	—	—	10-1142	10-1142	10-1142	—	—	—	—	—	—
RE49-10-5906	49-610139	0.0–0.5	Soil	10-1142	10-1142	—	—	10-1142	10-1142	10-1142	—	—	—	—	—	—
RE49-10-5907	49-610139	0.5–1.5	Soil	10-1142	10-1142	—	—	10-1142	10-1142	10-1142	—	—	—	—	—	—
RE49-10-5889	49-610131	0.0–0.5	Soil	10-1142	10-1142	—	—	10-1142	10-1142	10-1142	—	—	—	—	—	—
RE49-10-5890	49-610131	0.5–1.5	Soil	10-1142	10-1142	—	—	10-1142	10-1142	10-1142	—	—	—	—	—	—
RE49-10-5891	49-610132	0.0–0.5	Soil	10-1142	10-1142	—	—	10-1142	10-1142	10-1142	—	—	—	—	—	—
RE49-10-5892	49-610132	0.5–1.5	Soil	10-1142	10-1142	—	—	10-1142	10-1142	10-1142	—	—	—	—	—	—
RE49-10-5893	49-610133	0.0–0.5	Soil	10-1142	10-1142	—	—	10-1142	10-1142	10-1142	—	—	—	—	—	—
RE49-10-5894	49-610133	0.5–1.5	Soil	10-1142	10-1142	—	—	10-1142	10-1142	10-1142	—	—	—	—	—	—
RE49-10-5895	49-610134	0.0–0.5	Soil	10-1142	10-1142	—	—	10-1142	10-1142	10-1142	—	—	—	—	—	—
RE49-10-5896	49-610134	0.5–1.5	Soil	10-1142	10-1142	—	—	10-1142	10-1142	10-1142	—	—	—	—	—	—
RE49-10-5898	49-610135	0.0–0.5	Fill	10-1142	10-1142	—	—	10-1142	10-1142	10-1142	—	—	—	—	—	—
RE49-10-5899	49-610135	0.5–1.5	Fill	10-1142	10-1142	—	—	10-1142	10-1142	10-1142	—	—	—	—	—	—
RE49-10-5900	49-610136	0.0–0.5	Soil	10-1142	10-1142	—	—	10-1142	10-1142	10-1142	—	—	—	—	—	—
RE49-10-5901	49-610136	0.5–1.5	Soil	10-1142	10-1142	—	—	10-1142	10-1142	10-1142	—	—	—	—	—	—
RE49-10-5902	49-610137	0.0–0.5	Soil	10-1142	10-1142	—	—	10-1142	10-1142	10-1142	—	—	—	—	—	—
RE49-10-5903	49-610137	0.5–1.5	Soil	10-1142	10-1142	—	—	10-1142	10-1142	10-1142	—	—	—	—	—	—
RE49-10-5904	49-610138	0.0–0.5	Soil	10-1142	10-1142	—	—	10-1142	10-1142	10-1142	—	—	—	—	—	—
RE49-10-5905	49-610138	0.5–1.5	Soil	10-1142	10-1142	—	—	10-1142	10-1142	10-1142	—	—	—	—	—	—
RE49-10-5906	49-610139	0.0–0.5	Soil	10-1142	10-1142	—	—	10-1142	10-1142	10-1142	—	—	—	—	—	—
RE49-10-5907	49-610139	0.5–1.5	Soil	10-1142	10-1142	—	—	10-1142	10-1142	10-1142	—	—	—	—	—	—
RE49-10-5908	49-610140	0.0–0.5	Fill	10-1142	10-1142	—	—	10-1142	10-1142	10-1142	—	—	—	—	—	—

Table 6.3-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Gamma Spectroscopy	Tritium	Explosive Compounds	Isotopic Plutonium	Isotopic Uranium	Metals	Perchlorate	Strontium-90	Stable Isotopes	SVOCs	VOCs	Cyanide
RE49-10-5909	49-610140	0.5–1.5	Fill	10-1142	10-1142	—	—	10-1142	10-1142	10-1142	—	—	—	—	—	—
RE49-10-5931	49-610151	0.5–1.5	Soil	10-1141	10-1141	—	—	10-1141	10-1141	10-1141	—	—	—	—	—	—
RE49-10-5966	49-610169	0.0–0.5	Fill	10-1141	10-1141	—	—	10-1141	10-1141	10-1141	—	—	—	—	—	—
RE49-10-6006	49-610182	0.0–0.5	Fill	10-1134	10-1134	—	—	10-1134	10-1134	10-1134	—	—	—	—	—	—
RE49-10-6007	49-610182	0.5–1.5	Fill	10-1134	10-1134	—	—	10-1134	10-1134	10-1134	—	—	—	—	—	—
RE49-10-6014	49-610186	0.0–0.5	Soil	10-1134	10-1134	—	—	10-1134	10-1134	10-1134	—	—	—	—	—	—
RE49-10-6015	49-610186	0.5–1.5	Soil	10-1134	10-1134	—	—	10-1134	10-1134	10-1134	—	—	—	—	—	—
RE49-10-6016	49-610187	0.0–0.5	Soil	10-1134	10-1134	—	—	10-1134	10-1134	10-1134	—	—	—	—	—	—
RE49-10-6017	49-610187	0.5–1.5	Soil	10-1134	10-1134	—	—	10-1134	10-1134	10-1134	—	—	—	—	—	—
RE49-10-8999	49-610942	8.0–10.0	Qbt4	10-1109	—	10-1109	10-1109	10-1109	10-1109	10-1109	10-1109	—	—	10-1109	10-1109	10-1109
RE49-10-9000	49-610942	77.0–80.0	Qbt4	10-1261	—	10-1261	10-1259	10-1261	10-1261	10-1260	10-1260	—	—	10-1259	10-1259	10-1260
RE49-10-9001	49-610942	128.0–130.0	Qbt3	10-1261	—	10-1261	10-1259	10-1261	10-1261	10-1260	10-1260	—	—	10-1259	10-1259	10-1260
RE49-10-9009	49-610943	10.0–12.0	Qbt4	10-1246	—	10-1246	10-1244	10-1246	10-1246	10-1245	10-1245	—	—	10-1244	10-1244	10-1245
RE49-10-9010	49-610943	78.0–80.0	Qbt4	10-1246	—	10-1246	10-1244	10-1246	10-1246	10-1245	10-1245	—	—	10-1244	10-1244	10-1245
RE49-10-9011	49-610943	128.0–130.0	Qbt3	10-1261	—	10-1261	10-1259	10-1261	10-1261	10-1260	10-1260	—	—	10-1259	10-1259	10-1260
RE49-10-9019	49-610944	8.0–10.0	Qbt4	10-1246	—	10-1246	10-1244	10-1246	10-1246	10-1245	10-1245	—	—	10-1244	10-1244	10-1245
RE49-10-9020	49-610944	78.0–80.0	Qbt4	10-1246	—	10-1246	10-1244	10-1246	10-1246	10-1245	10-1245	—	—	10-1244	10-1244	10-1245
RE49-10-9021	49-610944	128.0–130.0	Qbt3	10-1246	—	10-1246	10-1244	10-1246	10-1246	10-1245	10-1245	—	—	10-1244	10-1244	10-1245
RE49-10-9029	49-610945	10.0–12.0	Qbt4	10-1261	—	10-1261	10-1259	10-1261	10-1261	10-1260	10-1260	—	—	10-1259	10-1259	10-1260
RE49-10-9030	49-610945	78.0–80.0	Qbt4	10-1261	—	10-1261	10-1259	10-1261	10-1261	10-1260	10-1260	—	—	10-1259	10-1259	10-1260
RE49-10-9031	49-610945	127.0–130.0	Qbt3	10-1261	—	10-1261	10-1259	10-1261	10-1261	10-1260	10-1260	—	—	10-1259	10-1259	10-1260
Overland Corridor for SWMU 49-001 (b, c, d)																
RE49-10-5751	49-610068	0.0–0.5	Soil	10-715	10-715	—	—	10-715	10-715	10-715	—	—	—	—	—	—
RE49-10-5752	49-610068	0.5–1.5	Soil	10-715	10-715	—	—	10-715	10-715	10-715	—	—	—	—	—	—
RE49-10-5753	49-610069	0.0–0.5	Soil	10-715	10-715	—	—	10-715	10-715	10-715	—	—	—	—	—	—
RE49-10-5754	49-610069	0.5–1.5	Soil	10-715	10-715	—	—	10-715	10-715	10-715	—	—	—	—	—	—
RE49-10-5755	49-610070	0.0–0.5	Soil	10-715	10-715	—	—	10-715	10-715	10-715	—	—	—	—	—	—
RE49-10-5756	49-610070	0.5–1.5	Soil	10-715	10-715	—	—	10-715	10-715	10-715	—	—	—	—	—	—
RE49-10-5757	49-610071	0.0–0.5	Soil	10-715	10-715	—	—	10-715	10-715	10-715	—	—	—	—	—	—
RE49-10-5758	49-610071	0.5–1.5	Soil	10-715	10-715	—	—	10-715	10-715	10-715	—	—	—	—	—	—
RE49-10-5759	49-610072	0.0–0.5	Soil	10-715	10-715	—	—	10-715	10-715	10-715	—	—	—	—	—	—
RE49-10-5760	49-610072	0.5–1.5	Soil	10-715	10-715	—	—	10-715	10-715	10-715	—	—	—	—	—	—
RE49-10-5761	49-610073	0.0–0.5	Soil	10-715	10-715	—	—	10-715	10-715	10-715	—	—	—	—	—	—
RE49-10-5762	49-610073	0.5–1.5	Soil	10-715	10-715	—	—	10-715	10-715	10-715	—	—	—	—	—	—
RE49-10-5763	49-610074	0.0–0.5	Soil	10-715	10-715	—	—	10-715	10-715	10-715	—	—	—	—	—	—
RE49-10-5764	49-610074	0.5–1.5	Soil	10-715	10-715	—	—	10-715	10-715	10-715	—	—	—	—	—	—
RE49-10-5765	49-610075	0.0–0.5	Soil	10-715	10-715	—	—	10-715	10-715	10-715	—	—	—	—	—	—
RE49-10-5766	49-610075	0.5–1.5	Soil	10-715	10-715	—	—	10-715	10-715	10-715	—	—	—	—	—	—

Table 6.3-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Gamma Spectroscopy	Tritium	Explosive Compounds	Isotopic Plutonium	Isotopic Uranium	Metals	Perchlorate	Strontium-90	Stable Isotopes	SVOCs	VOCs	Cyanide
RE49-10-5767	49-610076	0.0–0.5	Soil	10-715	10-715	—	—	10-715	10-715	10-715	—	—	—	—	—	—
RE49-10-5768	49-610076	0.5–1.5	Soil	10-715	10-715	—	—	10-715	10-715	10-715	—	—	—	—	—	—
RE49-10-5769	49-610077	0.0–0.5	Soil	10-715	10-715	—	—	10-715	10-715	10-715	—	—	—	—	—	—
RE49-10-5770	49-610077	0.5–1.5	Soil	10-716	10-716	—	—	10-716	10-716	10-716	—	—	—	—	—	—
RE49-10-5771	49-610078	0.0–0.5	Soil	10-716	10-716	—	—	10-716	10-716	10-716	—	—	—	—	—	—
RE49-10-5772	49-610078	0.5–1.5	Soil	10-716	10-716	—	—	10-716	10-716	10-716	—	—	—	—	—	—
RE49-10-5773	49-610079	0.0–0.5	Soil	10-716	10-716	—	—	10-716	10-716	10-716	—	—	—	—	—	—
RE49-10-5774	49-610079	0.5–1.5	Soil	10-716	10-716	—	—	10-716	10-716	10-716	—	—	—	—	—	—
RE49-10-5775	49-610080	0.0–0.5	Soil	10-716	10-716	—	—	10-716	10-716	10-716	—	—	—	—	—	—
RE49-10-5776	49-610080	0.5–1.5	Soil	10-716	10-716	—	—	10-716	10-716	10-716	—	—	—	—	—	—
RE49-10-5777	49-610081	0.0–0.5	Soil	10-716	10-716	—	—	10-716	10-716	10-716	—	—	—	—	—	—
RE49-10-5778	49-610081	0.5–1.5	Soil	10-716	10-716	—	—	10-716	10-716	10-716	—	—	—	—	—	—
RE49-10-5779	49-610082	0.0–0.5	Soil	10-716	10-716	—	—	10-716	10-716	10-716	—	—	—	—	—	—
RE49-10-5780	49-610082	0.5–1.5	Soil	10-716	10-716	—	—	10-716	10-716	10-716	—	—	—	—	—	—
RE49-10-5781	49-610083	0.0–0.5	Soil	10-716	10-716	—	—	10-716	10-716	10-716	—	—	—	—	—	—
RE49-10-5782	49-610083	0.5–1.5	Soil	10-716	10-716	—	—	10-716	10-716	10-716	—	—	—	—	—	—
RE49-10-5783	49-610084	0.0–0.5	Soil	10-716	10-716	—	—	10-716	10-716	10-716	—	—	—	—	—	—
RE49-10-5784	49-610084	0.5–1.5	Soil	10-716	10-716	—	—	10-716	10-716	10-716	—	—	—	—	—	—
RE49-10-5785	49-610085	0.0–0.5	Soil	10-716	10-716	—	—	10-716	10-716	10-716	—	—	—	—	—	—
RE49-10-5786	49-610085	0.5–1.5	Soil	10-716	10-716	—	—	10-716	10-716	10-716	—	—	—	—	—	—
RE49-10-5787	49-610086	0.0–0.5	Soil	10-716	10-716	—	—	10-716	10-716	10-716	—	—	—	—	—	—
RE49-10-5788	49-610086	0.5–1.5	Soil	10-716	10-716	—	—	10-716	10-716	10-716	—	—	—	—	—	—
RE49-10-5789	49-610087	0.0–0.5	Soil	10-716	10-716	—	—	10-716	10-716	10-716	—	—	—	—	—	—
RE49-10-5790	49-610087	0.5–1.5	Soil	10-717	10-717	—	—	10-717	10-717	10-717	—	—	—	—	—	—
RE49-10-5791	49-610088	0.0–0.5	Soil	10-717	10-717	—	—	10-717	10-717	10-717	—	—	—	—	—	—
RE49-10-5792	49-610088	0.5–1.5	Soil	10-717	10-717	—	—	10-717	10-717	10-717	—	—	—	—	—	—
RE49-10-5793	49-610089	0.0–0.5	Soil	10-717	10-717	—	—	10-717	10-717	10-717	—	—	—	—	—	—
RE49-10-5794	49-610089	0.5–1.5	Soil	10-717	10-717	—	—	10-717	10-717	10-717	—	—	—	—	—	—
RE49-10-5795	49-610090	0.0–0.5	Soil	10-717	10-717	—	—	10-717	10-717	10-717	—	—	—	—	—	—
RE49-10-5796	49-610090	0.5–1.5	Soil	10-717	10-717	—	—	10-717	10-717	10-717	—	—	—	—	—	—
RE49-10-5797	49-610091	0.0–0.5	Soil	10-717	10-717	—	—	10-717	10-717	10-717	—	—	—	—	—	—
RE49-10-5798	49-610091	0.5–1.5	Soil	10-717	10-717	—	—	10-717	10-717	10-717	—	—	—	—	—	—
RE49-10-5799	49-610092	0.0–0.5	Soil	10-717	10-717	—	—	10-717	10-717	10-717	—	—	—	—	—	—
RE49-10-5800	49-610092	0.5–1.5	Soil	10-717	10-717	—	—	10-717	10-717	10-717	—	—	—	—	—	—
RE49-10-5801	49-610093	0.0–0.5	Soil	10-717	10-717	—	—	10-717	10-717	10-717	—	—	—	—	—	—
RE49-10-5802	49-610093	0.5–1.5	Soil	10-717	10-717	—	—	10-717	10-717	10-717	—	—	—	—	—	—
RE49-10-5803	49-610094	0.0–0.5	Soil	10-717	10-717	—	—	10-717	10-717	10-717	—	—	—	—	—	—
RE49-10-5804	49-610094	0.5–1.5	Soil	10-717	10-717	—	—	10-717	10-717	10-717	—	—	—	—	—	—

Table 6.3-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Gamma Spectroscopy	Tritium	Explosive Compounds	Isotopic Plutonium	Isotopic Uranium	Metals	Perchlorate	Strontium-90	Stable Isotopes	SVOCs	VOCs	Cyanide
RE49-10-5805	49-610095	0.0–0.5	Soil	10-717	10-717	—	—	10-717	10-717	10-717	—	—	—	—	—	—
RE49-10-5806	49-610095	0.5–1.5	Soil	10-717	10-717	—	—	10-717	10-717	10-717	—	—	—	—	—	—
RE49-10-5807	49-610096	0.0–0.5	Soil	10-717	10-717	—	—	10-717	10-717	10-717	—	—	—	—	—	—
RE49-10-5808	49-610096	0.5–1.5	Soil	10-717	10-717	—	—	10-717	10-717	10-717	—	—	—	—	—	—
RE49-10-5809	49-610097	0.0–0.5	Soil	10-717	10-717	—	—	10-717	10-717	10-717	—	—	—	—	—	—
RE49-10-5810	49-610097	0.5–1.5	Soil	10-718	10-718	—	—	10-718	10-718	10-718	—	—	—	—	—	—
SWMU 49-001(g)																
RE49-10-8552	49-610890	0.0–0.5	Fill	10-1135	10-1135	—	—	10-1135	10-1135	10-1135	—	10-1135	—	—	—	—
RE49-10-8553	49-610890	0.5–1.5	Fill	10-1135	10-1135	—	—	10-1135	10-1135	10-1135	—	10-1135	—	—	—	—
RE49-10-8554	49-610891	0.0–0.5	Soil	10-1135	10-1135	—	—	10-1135	10-1135	10-1135	—	10-1135	—	—	—	—
RE49-10-8555	49-610891	0.5–1.5	Soil	10-1135	10-1135	—	—	10-1135	10-1135	10-1135	—	10-1135	—	—	—	—
RE49-10-8556	49-610892	0.0–0.5	Soil	10-1135	10-1135	—	—	10-1135	10-1135	10-1135	—	10-1135	—	—	—	—
RE49-10-8557	49-610892	0.5–1.5	Soil	10-1135	10-1135	—	—	10-1135	10-1135	10-1135	—	10-1135	—	—	—	—
RE49-10-8558	49-610893	0.0–0.5	Soil	10-1135	10-1135	—	—	10-1135	10-1135	10-1135	—	10-1135	—	—	—	—
RE49-10-8559	49-610893	0.5–1.5	Soil	10-1135	10-1135	—	—	10-1135	10-1135	10-1135	—	10-1135	—	—	—	—
RE49-10-8560	49-610894	0.0–0.5	Fill	10-1135	10-1135	—	—	10-1135	10-1135	10-1135	—	10-1135	—	—	—	—
RE49-10-8561	49-610894	0.5–1.5	Fill	10-1135	10-1135	—	—	10-1135	10-1135	10-1135	—	10-1135	—	—	—	—
RE49-10-8562	49-610895	0.0–0.5	Soil	10-1135	10-1135	—	—	10-1135	10-1135	10-1135	—	10-1135	—	—	—	—
RE49-10-8563	49-610895	0.5–1.5	Soil	10-1135	10-1135	—	—	10-1135	10-1135	10-1135	—	10-1135	—	—	—	—
RE49-10-8564	49-610896	0.0–0.5	Soil	10-1135	10-1135	—	—	10-1135	10-1135	10-1135	—	10-1135	—	—	—	—
RE49-10-8565	49-610896	0.5–1.5	Soil	10-1135	10-1135	—	—	10-1135	10-1135	10-1135	—	10-1135	—	—	—	—
RE49-10-8566	49-610897	0.0–0.5	Soil	10-1135	10-1135	—	—	10-1135	10-1135	10-1135	—	10-1135	—	—	—	—
RE49-10-8567	49-610897	0.5–1.5	Soil	10-1135	10-1135	—	—	10-1135	10-1135	10-1135	—	10-1135	—	—	—	—

Note: Numbers in analyte columns are request numbers.
*— = Analysis not requested.

Table 6.3-2
Summary of Inorganic Chemicals Detected or Detected above BVs at SWMUs 49-001(b, c, d, g)

Sample ID	Location ID	Depth (ft)	Media	Arsenic	Barium	Calcium	Cobalt	Copper	Cyanide (Total)	Lead	Manganese	Selenium	Thallium	Vanadium	Zinc
Qbt 2,3,4 BV[a]				**2.79**	**46**	**2200**	**3.14**	**4.66**	**0.5**	**11.2**	**482**	**0.3**	**1.1**	**17**	**63.5**
Soil BV[a]				**8.17**	**295**	**6120**	**8.64**	**14.7**	**0.5**	**22.3**	**671**	**1.52**	**0.73**	**39.6**	**48.8**
Residential SSL[b]				**4.25**	**15,600**	**13,000,000**	**23[c]**	**3130**	**11.2**	**400**	**10,500**	**391**	**0.782**	**394**	**23,500**
Industrial SSL[b]				**21.5**	**255,000**	**32,400,000**	**350[c]**	**51,900**	**63.3**	**800**	**160,000**	**6490**	**13**	**6530**	**389,000**
SWMU 49-001(b, c, d)															
RE49-10-5889	49-610131	0.0–0.5	Soil	—[d]	—	—	—	—	NA[e]	—	—	—	—	—	85.2
RE49-10-5893	49-610133	0.0–0.5	Soil	—	—	—	—	15.7	NA	—	—	—	—	—	—
RE49-10-5903	49-610137	0.5–1.5	Soil	—	—	—	—	—	NA	47.3	—	—	—	—	—
RE49-10-5907	49-610139	0.5–1.5	Soil	—	—	—	10.5	—	NA	—	704	—	—	—	—
RE49-10-5931	49-610151	0.5–1.5	Soil	—	—	10,300	—	14.8	NA	—	—	—	—	—	—
RE49-10-6006	49-610182	0.0–0.5	Fill	—	—	—	—	—	NA	—	—	—	—	—	54.4
RE49-10-8999	49-610942	8.0–10.0	Qbt4	4.3	—	—	—	—	0.63 (U)	14.6 (J+)	—	1.8	—	—	—
RE49-10-9000	49-610942	77.0–80.0	Qbt4	—	—	—	—	—	0.52 (U)	—	—	0.81	—	—	—
RE49-10-9001	49-610942	128.0–130.0	Qbt3	—	—	—	—	—	0.53 (U)	—	—	1	—	—	—
RE49-10-9009	49-610943	10.0–12.0	Qbt4	—	—	—	—	—	—	69	—	1	—	—	—
RE49-10-9010	49-610943	78.0–80.0	Qbt4	—	—	—	—	—	—	—	—	0.9	—	—	—
RE49-10-9011	49-610943	128.0–130.0	Qbt3	—	—	—	—	—	—	—	—	1	—	—	—
RE49-10-9019	49-610944	8.0–10.0	Qbt4	—	—	—	—	—	0.52 (U)	—	—	0.8	—	—	—
RE49-10-9020	49-610944	78.0–80.0	Qbt4	—	—	—	—	—	—	—	—	0.92	—	—	—
RE49-10-9021	49-610944	128.0–130.0	Qbt3	—	—	—	—	—	—	—	—	0.87	—	—	—
RE49-10-9029	49-610945	10.0–12.0	Qbt4	—	86	—	—	—	—	—	487	1.1	1.2 (U)	—	—
RE49-10-9030	49-610945	78.0–80.0	Qbt4	—	—	—	—	—	—	—	—	1	—	—	—
RE49-10-9031	49-610945	127.0–130.0	Qbt3	—	—	—	—	—	0.51 (U)	—	—	1.1	—	—	—
Overland Corridor for SWMUs 49-001(b, c, d)															
RE49-10-5764	49-610074	0.5–1.5	Soil	—[d]	—	—	11	—	NA[e]	—	—	—	—	—	—
RE49-10-5766	49-610075	0.5–1.5	Soil	—	—	—	10	—	NA	—	—	—	—	—	—
RE49-10-5773	49-610079	0.0–0.5	Soil	—	—	—	9.4	—	NA	—	—	—	—	—	—
RE49-10-5779	49-610082	0.0–0.5	Soil	—	—	—	—	—	NA	—	—	—	1 (U)	—	—
RE49-10-5788	49-610086	0.5–1.5	Soil	—	—	6260	—	—	NA	—	—	—	—	—	—
RE49-10-5790	49-610087	0.5–1.5	Soil	—	—	8100	—	—	NA	—	—	—	—	—	—
RE49-10-5797	49-610091	0.0–0.5	Soil	—	—	—	8.8 (J)	—	NA	—	—	—	—	—	—
RE49-10-5804	49-610094	0.5–1.5	Soil	—	—	—	14.1 (J)	—	NA	24 (J)	1010 (J)	—	—	40.2	—
RE49-10-5806	49-610095	0.5–1.5	Soil	—	—	—	10.4 (J)	—	NA	—	—	—	—	—	—
RE49-10-5810	49-610097	0.5–1.5	Soil	—	—	—	—	—	NA	—	—	1.7 (U)	1.3 (U)	—	—

Notes: All concentrations are in mg/kg. Data qualifiers are defined in Appendix A.

[a] BVs from LANL (1998, 059730).

[b] SSLs from NMED (2015, 600915) unless otherwise noted.

[c] EPA regional screening level (http://www.epa.gov/risk/risk-based-screening-table-generic-tables).

[d] — = Not detected or not detected above BV.

[e] NA = Not analyzed.

Table 6.3-3
Summary of Organic Chemicals Detected at SWMUs 49-001(b, c, d, g)

Sample ID	Location ID	Depth (ft)	Media	Bis(2-ethylhexyl)phthalate
Residential SSL*				**380**
Industrial SSL*				**1830**
SWMUs 49-001(b, c, d)				
RE49-10-8999	49-610942	8.0–10.0	Qbt4	0.069 (J)
RE49-10-9011	49-610943	128.0–130.0	Qbt3	0.28 (J)
RE49-10-9029	49-610945	10.0–12.0	Qbt4	0.076 (J-)
RE49-10-9030	49-610945	78.0–80.0	Qbt4	0.18 (J)

Notes: All concentrations are in mg/kg. Data qualifiers are defined in Appendix A.
*SSLs from NMED (2015, 600915).

Table 6.3-4
Summary of Radionuclides Detected or Detected above BVs/FVs at SWMUs 49-001(b, c, d, g)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Plutonium-238	Plutonium-239/240	Tritium	Uranium-238
Qbt 2,3,4 BV[a]				**na[b]**	**na**	**na**	**na**	**1.93**
Soil BV[a]				**0.013[c]**	**0.023[c]**	**0.054[c]**	**na**	**2.29**
Residential SAL[d]				**83**	**84**	**79**	**1700**	**150**
Industrial SAL[d]				**1000**	**1300**	**1200**	**2,400,000**	**710**
SWMU 49-001(b)								
MD49-98-0102	49-02901	14.3–14.5	Qbt4	—[e]	0.038	—	NA[f]	—
MD49-98-0103	49-02901	24.0–24.2	Qbt4	0.039	—	—	NA	—
MD49-98-0111	49-02901	88.4–88.6	Qbt3	0.033	—	—	NA	—
MD49-98-0115	49-02901	136.8–137.0	Qbt3	0.039	—	—	NA	—
MD49-98-0073	49-02906	40.3–40.5	Qbt4	—	0.209	—	NA	—
MD49-98-0074	49-02906	53.4–53.5	Qbt4	—	0.042	—	NA	—
MD49-98-0075	49-02906	67.2–67.5	Qbt4	0.042	0.124	—	NA	—
MD49-98-0077	49-02906	85.0–86.5	Qbt4	—	0.052	—	NA	—
MD49-98-0078	49-02906	91.5–91.8	Qbt3	—	—	0.05	NA	—
MD49-98-0083	49-02906	147.2–148.0	Qbt3	—	0.042	—	NA	—
MD49-98-0098	49-02907	138.7–138.9	Qbt3	0.034	—	—	NA	—

Table 6.3-4 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Plutonium-238	Plutonium-239/240	Tritium	Uranium-238
Qbt 2,3,4 BV[a]				**na[b]**	**na**	**na**	**na**	**na**
Soil BV[a]				**0.013[c]**	**0.023[c]**	**0.054[c]**	**na**	**2.29**
Residential SAL[d]				**83**	**84**	**79**	**1700**	**150**
Industrial SAL[d]				**1000**	**1300**	**1200**	**2,400,000**	**710**
Overland Corridor for SWMUs 49-001(b, c, d)								
RE49-10-5769	49-610077	0.0–0.5	Soil	—	—	—	NA	4.98
RE49-10-5770	49-610077	0.5–1.5	Soil	0.079	—	0.099	NA	—
RE49-10-5890	49-610131	0.5–1.5	Soil	—	—	0.064	NA	—
RE49-10-5893	49-610133	0.0–0.5	Soil	0.307	—	1.47	NA	—
RE49-10-5894	49-610133	0.5–1.5	Soil	0.091	—	0.326	NA	—
RE49-10-5908	49-610140	0.0–0.5	Fill	—	—	0.101	NA	—
RE49-10-5909	49-610140	0.5–1.5	Fill	—	—	0.089	NA	—
RE49-10-5931	49-610151	0.5–1.5	Soil	4.91	1.41	73.5	NA	—
RE49-10-9020	49-610944	78.0–80.0	Qbt4	—	—	—	0.36	—
RE49-10-9029	49-610945	10.0–12.0	Qbt4	—	—	—	2.12	—
RE49-10-9030	49-610945	78.0–80.0	Qbt4	—	—	—	0.46	—
RE49-10-9031	49-610945	127.0–130.0	Qbt3	—	—	—	0.46	—
001(g)								
RE49-10-8552	49-610890	0.0–0.5	Fill	0.433	—	2.16	NA	—
RE49-10-8553	49-610890	0.5–1.5	Fill	0.471	0.071	2.8	NA	—
RE49-10-8554	49-610891	0.0–0.5	Soil	0.081	—	0.401	NA	—
RE49-10-8556	49-610892	0.0–0.5	Soil	0.064	—	0.1	NA	—
RE49-10-8561	49-610894	0.5–1.5	Fill	0.092	—	0.41	NA	—

Table 6.3-4 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Plutonium-238	Plutonium-239/240	Tritium	Uranium-238
Qbt 2,3,4 BV[a]				**na[b]**	**na**	**na**	**na**	**na**
Soil BV[a]				**0.013[c]**	**0.023[c]**	**0.054[c]**	**na**	**2.29**
Residential SAL[d]				**83**	**84**	**79**	**1700**	**150**
Industrial SAL[d]				**1000**	**1300**	**1200**	**2,400,000**	**710**
RE49-10-8562	49-610895	0.0–0.5	Soil	0.435	—	1.6	NA	—
RE49-10-8563	49-610895	0.5–1.5	Soil	—	—	0.075	NA	—
RE49-10-8564	49-610896	0.0–0.5	Soil	0.065	—	0.058	NA	—
RE49-10-8566	49-610897	0.0–0.5	Soil	0.044	—	—	NA	—

Note: All activities are in pCi/g.

[a] BVs/FVs from LANL (1998, 059730).

[b] na = Not available.

[c] FV applies to soil samples collected from 0–1 ft only.

[d] SALs from LANL (2015, 600929).

[e] — = Not detected or not detected above BV/FV.

[f] NA = Not analyzed.

Table 6.3-5
Summary of Pore-Gas Samples Collected and Analyses Requested at SWMUs 49-001(b, c, d, g)

Sample ID	Location ID	Depth (ft)	Media	Tritium	VOCs
MD49-10-12118	49-610942	77.0–79.0	Pore gas	10-1792	10-1791
MD49-10-12116	49-610942	80.0–82.0	Pore gas	10-1792	10-1791
MD49-10-12121	49-610943	79.0–81.0	Pore gas	10-1919	10-1918
MD49-10-12120	49-610943	86.0–88.0	Pore gas	10-1919	10-1918
MD49-10-12119	49-610943	120.0–122.0	Pore gas	10-1792	10-1791
MD49-10-12123	49-610944	79.0–81.0	Pore gas	10-2161	10-2160
MD49-10-12122	49-610944	123.0–125.5	Pore gas	10-2161	10-2160
MD49-10-12126	49-610945	79.0–81.0	Pore gas	10-2161	10-2160
MD49-10-12125	49-610945	110.0–112.0	Pore gas	10-2161	10-2160

Note: Numbers in analyte columns are request numbers. No pore gas samples were collected from SWMU 49-001(g).

Table 6.3-6
Summary of Organic Chemicals Detected in Pore-Gas Samples at SWMUs 49-001(b, c, d, g)

Sample ID	Location ID	Depth (ft)	Media	Acetone	Benzene	Butanone[2-]	Carbon Disulfide	Chloromethane	Dichlorodifluoromethane	Ethylbenzene	Ethyltoluene[4-]	Styrene	Toluene	Trimethylbenzene[1,2,4-]	Trimethylbenzene[1,3,5-]	Xylene (Total)	Xylene[1,2-]	Xylene[1,3-]+Xylene[1,4-]
Residential Soil-Gas Vapor Intrusion Screening Level[a]				**32,300**	**36**	**52100**	**7300**	**156**	**1040**	**112**	**52,100[b]**	**10,400**	**52,100**	**66[c]**	**66[d]**	**1040**	**1040**	**1040[e]**
MD49-10-12118	49-610942	77.0–79.0	Pore gas	14	2.1	—[f]	—	—	3	2.8	4	—	8.2	4.7	—	13	3.4	9.9
MD49-10-12116	49-610942	80.0–82.0	Pore gas	16	4.4	3.9	—	—	2.7	5.1	9.7	2	12	12	3.1	24	6.4	18
MD49-10-12121	49-610943	79.0–81.0	Pore gas	32	19	5.7	—	—	2.8	9.8	11	2.1	51	11	3.4	44	11	33
MD49-10-12120	49-610943	86.0–88.0	Pore gas	23	60	4.6	—	—	2.4	13	12	2.9	96	11	3.6	55	13	41
MD49-10-12119	49-610943	120.0–122.0	Pore gas	19 (J)	2.1	4.6	—	—	2.5	1.9	4.2	—	3.7	5.8	—	8.2	2.1	6
MD49-10-12123	49-610944	79.0–81.0	Pore gas	21	12	6.4	4.7	1.8 (J+)	2.8	6.2	8.9	1.8	28	11	3	28	7.4	20
MD49-10-12122	49-610944	123.0–125.5	Pore gas	11	13	4.4	—	1.9 (J+)	2.6	4	5.2	—	24	6.4	—	18	4.9	13
MD49-10-12126	49-610945	79.0–81.0	Pore gas	19 (J-)	18 (J-)	8.2 (J-)	20 (J-)	—	2.2 (J-)	7.9 (J-)	14 (J-)	2.4 (J-)	36 (J-)	19 (J-)	9.1 (J-)	48 (J-)	14 (J-)	33 (J-)
MD49-10-12125	49-610945	110.0–112.0	Pore gas	13 (J-)	5.7 (J-)	5.6 (J-)	5.7 (J-)	2 (J-)	2.6 (J-)	3.4 (J-)	5.5 (J-)	—	11 (J-)	6.8 (J-)	—	16 (J-)	4.3 (J-)	12 (J-)

Notes: All concentrations are in µg/m^3. Data qualifiers are defined in Appendix A.

[a] Screening levels from NMED (2015, 600915) unless otherwise noted.

[b] Toluene used as a surrogate based on structural similarity.

[c] Residential air screening level from EPA regional screening levels (http://www.epa.gov/risk/risk-based-screening-table-generic-tables) divided by default attenuation factor of 0.11 (NMED 2015, 600915, p. 47).

[d] Trimethylbenzene[1,2,4-] used as a surrogate based on structural similarity.

[e] Xylenes used as a surrogate based on structural similarity.

[f] — = Not detected.

Table 6.3-7
Summary of Tritium Detected in Pore-Gas Samples at SWMUs 49-001(b, c, d, g)

Sample ID	Location ID	Depth (ft)	Media	Tritium
MD49-10-12121	49-610943	79.0–81.0	Pore gas	651.758
MD49-10-12120	49-610943	86.0–88.0	Pore gas	2036.39
MD49-10-12123	49-610944	79.0–81.0	Pore gas	4407.05
MD49-10-12122	49-610944	123.0–125.5	Pore gas	2299.7
MD49-10-12126	49-610945	79.0–81.0	Pore gas	17382.5
MD49-10-12125	49-610945	110.0–112.0	Pore gas	16689.4

Note: All activities are in pCi/L.

Table 6.6-1
Samples Collected and Analysis Requested at Area 3, SWMU 49-001(e)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Gamma Spectroscopy	Iodine-129	Tritium	Explosive Compounds	Isotopic Plutonium	Isotopic Uranium	Metals	Perchlorate	Strontium-90	SVOCs	Technetium-99	VOCs	Cyanide
SWMU 49-001(e)																	
0549-95-0211	49-03000	0.0–0.5	Soil	—*	795	—	—	—	795	—	794, 795	—	—	—	—	—	—
0549-95-0212	49-03001	0.0–0.5	Soil	—	795	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0213	49-03002	0.0–0.5	Soil	—	795	—	—	—	795	—	794, 795	—	—	—	—	—	—
0549-95-0214	49-03003	0.0–0.5	Soil	—	795	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0215	49-03004	0.0–0.5	Soil	—	795	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0216	49-03005	0.0–0.5	Soil	—	795	—	—	—	795	—	794, 795	—	—	—	—	—	—
0549-95-0217	49-03006	0.0–0.5	Soil	—	795	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0218	49-03007	0.0–0.5	Soil	—	795	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0219	49-03008	0.0–0.5	Soil	—	795	—	—	—	795	—	794, 795	—	—	—	—	—	—
0549-95-0220	49-03009	0.0–0.5	Soil	—	795	—	—	—	795	—	794, 795	—	—	—	—	—	—
0549-95-0221	49-03010	0.0–0.5	Soil	—	795	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0222	49-03011	0.0–0.5	Soil	—	795	—	—	—	795	—	794, 795	—	—	—	—	—	—
0549-95-0223	49-03012	0.0–0.5	Soil	—	795	—	—	—	795	—	794, 795	—	—	—	—	—	—
0549-95-0224	49-03013	0.0–0.5	Soil	—	795	—	—	—	795	—	794, 795	—	—	—	—	—	—
0549-95-0225	49-03014	0.0–0.5	Soil	—	795	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0226	49-03022	0.0–0.5	Soil	—	795	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0227	49-03023	0.0–0.5	Soil	—	795	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0229	49-03024	0.0–0.5	Soil	—	795	—	—	—	795	—	794, 795	—	—	—	—	—	—
0549-95-0230	49-03025	0.0–0.5	Soil	—	795	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0231	49-03026	0.0–0.5	Soil	—	795	—	—	—	795	—	794, 795	—	—	—	—	—	—
RE49-10-3254	49-609307	0.0–0.5	Soil	10-842	10-842	—	—	—	10-842	10-842	10-842	—	—	—	—	—	—
RE49-10-3255	49-609307	0.5–1.5	Qbt4	10-842	10-842	10-842	—	—	10-842	10-842	10-842	—	10-842	—	10-842	—	—
RE49-10-3256	49-609308	0.0–0.5	Soil	10-842	10-842	—	—	—	10-842	10-842	10-842	—	—	—	—	—	—
RE49-10-3257	49-609308	0.5–1.5	Qbt4	10-842	10-842	—	—	—	10-842	10-842	10-842	—	—	—	—	—	—
RE49-10-3258	49-609309	0.0–0.5	Soil	10-842	10-842	—	—	—	10-842	10-842	10-842	—	—	—	—	—	—
RE49-10-3259	49-609309	0.5–1.5	Soil	10-842	10-842	—	—	—	10-842	10-842	10-842	—	—	—	—	—	—
RE49-10-3260	49-609310	0.0–0.5	Soil	10-842	10-842	—	—	—	10-842	10-842	10-842	—	—	—	—	—	—
RE49-10-3261	49-609310	0.5–1.5	Qbt4	10-842	10-842	—	—	—	10-842	10-842	10-842	—	—	—	—	—	—
RE49-10-3262	49-609311	0.0–0.5	Soil	10-842	10-842	—	—	—	10-842	10-842	10-842	—	—	—	—	—	—
RE49-10-3263	49-609311	0.5–1.5	Qbt4	10-842	10-842	—	—	—	10-842	10-842	10-842	—	—	—	—	—	—
RE49-10-3264	49-609312	0.0–0.5	Soil	10-842	10-842	—	—	—	10-842	10-842	10-842	—	—	—	—	—	—
RE49-10-3265	49-609312	0.5–1.5	Soil	10-842	10-842	—	—	—	10-842	10-842	10-842	—	—	—	—	—	—

Table 6.6-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Gamma Spectroscopy	Iodine-129	Tritium	Explosive Compounds	Isotopic Plutonium	Isotopic Uranium	Metals	Perchlorate	Strontium-90	SVOCs	Technetium-99	VOCs	Cyanide
RE49-10-3266	49-609313	0.0–0.5	Soil	10-842	10-842	—	—	—	10-842	10-842	10-842	—	—	—	—	—	—
RE49-10-3267	49-609313	0.5–1.5	Qbt4	10-842	10-842	—	—	—	10-842	10-842	10-842	—	—	—	—	—	—
RE49-10-3268	49-609314	0.0–0.5	Soil	10-842	10-842	—	—	—	10-842	10-842	10-842	—	—	—	—	—	—
RE49-10-3269	49-609314	0.5–1.5	Soil	10-842	10-842	—	—	—	10-842	10-842	10-842	—	—	—	—	—	—
RE49-10-3270	49-609315	0.0–0.5	Soil	10-842	10-842	—	—	—	10-842	10-842	10-842	—	—	—	—	—	—
RE49-10-3271	49-609315	0.5–1.5	Soil	10-842	10-842	—	—	—	10-842	10-842	10-842	—	—	—	—	—	—
RE49-10-3272	49-609316	0.0–0.5	Soil	10-842	10-842	—	—	—	10-842	10-842	10-842	—	—	—	—	—	—
RE49-10-3273	49-609316	0.5–1.5	Soil	10-842	10-842	—	—	—	10-842	10-842	10-842	—	—	—	—	—	—
RE49-10-3278	49-609317	0.0–0.5	Soil	10-839	10-839	—	—	—	10-839	10-839	10-839	—	—	—	—	—	—
RE49-10-3279	49-609317	0.5–1.5	Qbt4	10-839	10-839	—	—	—	10-839	10-839	10-839	—	—	—	—	—	—
RE49-10-3280	49-609318	0.0–0.5	Soil	10-839	10-839	—	—	—	10-839	10-839	10-839	—	—	—	—	—	—
RE49-10-3281	49-609318	0.5–1.5	Soil	10-839	10-839	—	—	—	10-839	10-839	10-839	—	—	—	—	—	—
RE49-10-3282	49-609319	0.0–0.5	Soil	10-839	10-839	—	—	—	10-839	10-839	10-839	—	—	—	—	—	—
RE49-10-3283	49-609319	0.5–1.5	Soil	10-839	10-839	—	—	—	10-839	10-839	10-839	—	—	—	—	—	—
RE49-10-3284	49-609320	0.0–0.5	Soil	10-839	10-839	—	—	—	10-839	10-839	10-839	—	—	—	—	—	—
RE49-10-3285	49-609320	0.5–1.5	Qbt4	10-839	10-839	—	—	—	10-839	10-839	10-839	—	—	—	—	—	—
RE49-10-3286	49-609321	0.0–0.5	Soil	10-839	10-839	—	—	—	10-839	10-839	10-839	—	—	—	—	—	—
RE49-10-3287	49-609321	0.5–1.5	Qbt4	10-839	10-839	—	—	—	10-839	10-839	10-839	—	—	—	—	—	—
RE49-10-3288	49-609322	0.0–0.5	Soil	10-839	10-839	—	—	—	10-839	10-839	10-839	—	—	—	—	—	—
RE49-10-3289	49-609322	0.5–1.5	Qbt4	10-839	10-839	—	—	—	10-839	10-839	10-839	—	—	—	—	—	—
RE49-10-3290	49-609323	0.0–0.5	Soil	10-839	10-839	—	—	—	10-839	10-839	10-839	—	—	—	—	—	—
RE49-10-3291	49-609323	0.5–1.5	Soil	10-839	10-839	—	—	—	10-839	10-839	10-839	—	—	—	—	—	—
RE49-10-3292	49-609324	0.0–0.5	Soil	10-839	10-839	—	—	—	10-839	10-839	10-839	—	—	—	—	—	—
RE49-10-3293	49-609324	0.5–1.5	Soil	10-839	10-839	—	—	—	10-839	10-839	10-839	—	—	—	—	—	—
RE49-10-3294	49-609325	0.0–0.5	Soil	10-839	10-839	—	—	—	10-839	10-839	10-839	—	—	—	—	—	—
RE49-10-3295	49-609325	0.5–1.5	Soil	10-839	10-839	—	—	—	10-839	10-839	10-839	—	—	—	—	—	—
RE49-10-3296	49-609326	0.0–0.5	Soil	10-839	10-839	—	—	—	10-839	10-839	10-839	—	—	—	—	—	—
RE49-10-3297	49-609326	0.5–1.5	Qbt4	10-839	10-839	10-839	—	—	10-839	10-839	10-839	—	10-839	—	10-839	—	—
RE49-10-3298	49-609327	0.0–0.5	Soil	10-839	10-839	—	—	—	10-839	10-839	10-839	—	—	—	—	—	—
RE49-10-3299	49-609327	0.5–1.5	Soil	10-839	10-839	—	—	—	10-839	10-839	10-839	—	—	—	—	—	—
RE49-10-3300	49-609328	0.0–0.5	Soil	10-839	10-839	—	—	—	10-839	10-839	10-839	—	—	—	—	—	—
RE49-10-3301	49-609328	0.5–1.5	Qbt3	10-839	10-839	—	—	—	10-839	10-839	10-839	—	—	—	—	—	—
RE49-10-3308	49-609329	0.0–0.5	Soil	10-840	10-840	—	—	—	10-840	10-840	10-840	—	—	—	—	—	—
RE49-10-3309	49-609329	0.5–1.5	Qbt4	10-840	10-840	10-840	—	—	10-840	10-840	10-840	—	10-840	—	10-840	—	—
RE49-10-3310	49-609330	0.0–0.5	Fill	10-840	10-840	—	—	—	10-840	10-840	10-840	—	—	—	—	—	—
RE49-10-3311	49-609330	0.5–1.5	Fill	10-840	10-840	—	—	—	10-840	10-840	10-840	—	—	—	—	—	—
RE49-10-3312	49-609331	0.0–0.5	Fill	10-840	10-840	—	—	—	10-840	10-840	10-840	—	—	—	—	—	—
RE49-10-3313	49-609331	0.5–1.5	Fill	10-840	10-840	—	—	—	10-840	10-840	10-840	—	—	—	—	—	—

Table 6.6-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Gamma Spectroscopy	Iodine-129	Tritium	Explosive Compounds	Isotopic Plutonium	Isotopic Uranium	Metals	Perchlorate	Strontium-90	SVOCs	Technetium-99	VOCs	Cyanide
RE49-10-3314	49-609332	0.0–0.5	Soil	10-840	10-840	—	—	—	10-840	10-840	10-840	—	—	—	—	—	—
RE49-10-3315	49-609332	0.5–1.5	Qbt4	10-840	10-840	—	—	—	10-840	10-840	10-840	—	—	—	—	—	—
RE49-10-3316	49-609333	0.0–0.5	Soil	10-840	10-840	—	—	—	10-840	10-840	10-840	—	—	—	—	—	—
RE49-10-3317	49-609333	0.5–1.5	Soil	10-840	10-840	—	—	—	10-840	10-840	10-840	—	—	—	—	—	—
RE49-10-3318	49-609334	0.0–0.5	Soil	10-840	10-840	—	—	—	10-840	10-840	10-840	—	—	—	—	—	—
RE49-10-3319	49-609334	0.5–1.5	Soil	10-840	10-840	—	—	—	10-840	10-840	10-840	—	—	—	—	—	—
RE49-10-3320	49-609335	0.0–0.5	Qbt4	10-840	10-840	—	—	—	10-840	10-840	10-840	—	—	—	—	—	—
RE49-10-3321	49-609335	0.5–1.5	Qbt4	10-840	10-840	—	—	—	10-840	10-840	10-840	—	—	—	—	—	—
RE49-10-3322	49-609336	0.0–0.5	Soil	10-840	10-840	—	—	—	10-840	10-840	10-840	—	—	—	—	—	—
RE49-10-3323	49-609336	0.5–1.5	Soil	10-840	10-840	—	—	—	10-840	10-840	10-840	—	—	—	—	—	—
RE49-10-3324	49-609337	0.0–0.5	Soil	10-840	10-840	—	—	—	10-840	10-840	10-840	—	—	—	—	—	—
RE49-10-3325	49-609337	0.5–1.5	Soil	10-840	10-840	—	—	—	10-840	10-840	10-840	—	—	—	—	—	—
RE49-10-3343	49-609344	0.5–1.5	Qbt4	—	10-841	10-841	—	—	—	—	—	—	10-841	—	10-841	—	—
RE49-10-3360	49-609353	0.0–0.5	Soil	—	10-841	10-841	—	—	—	—	—	—	10-841	—	10-841	—	—
RE49-10-3365	49-609355	0.5–1.5	Qbt4	—	10-841	10-841	—	—	—	—	—	—	10-841	—	10-841	—	—
RE49-10-3375	49-609360	0.5–1.5	Qbt4	—	10-841	10-841	—	—	—	—	—	—	10-841	—	10-841	—	—
RE49-10-3442	49-609385	0.0–0.5	Fill	—	10-838	10-838	—	—	—	—	—	—	10-838	—	10-838	—	—
RE49-10-3444	49-609386	0.0–0.5	Fill	10-838	10-838	10-838	—	—	10-838	10-838	10-838	—	10-838	—	10-838	—	—
RE49-10-3452	49-609390	0.0–0.5	Soil	—	10-838	10-838	—	—	—	—	—	—	10-838	—	10-838	—	—
RE49-10-3472	49-609400	0.0–0.5	Fill	—	10-838	10-838	—	—	—	—	—	—	10-838	—	10-838	—	—
RE49-10-3476	49-609402	0.0–0.5	Soil	—	10-838	10-838	—	—	—	—	—	—	10-838	—	10-838	—	—
RE49-10-3477	49-609402	0.5–1.5	Qbt4	—	10-838	10-838	—	—	—	—	—	—	10-838	—	10-838	—	—
RE49-10-3481	49-609404	0.5–1.5	Qbt4	—	10-838	10-838	—	—	—	—	—	—	10-838	—	10-838	—	—
RE49-10-3482	49-609405	0.0–0.5	Soil	—	10-838	10-838	—	—	—	—	—	—	10-838	—	10-838	—	—
RE49-10-3486	49-609407	0.0–0.5	Qbt4	—	10-838	10-838	—	—	—	—	—	—	10-838	—	10-838	—	—
RE49-10-3487	49-609407	0.5–1.5	Qbt4	—	10-838	10-838	—	—	—	—	—	—	10-838	—	10-838	—	—
RE49-10-3501	49-609414	0.5–1.5	Qbt4	—	10-838	10-838	—	—	—	—	—	—	10-838	—	10-838	—	—
RE49-10-5367	49-609981	1.2–3.0	Qbt4	10-531	—	—	10-531	10-529	10-531	10-531	10-530	10-530	—	10-529	—	10-529	10-530
RE49-10-5374	49-609981	78.0–80.0	Qbt3	10-592	—	—	10-592	10-591	10-592	10-592	10-592	10-592	—	10-591	—	10-591	10-592
RE49-10-5375	49-609981	140.0–143.0	Qbt3	10-592	—	—	10-592	10-591	10-592	10-592	10-592	10-592	—	10-591	—	10-591	10-592
RE49-10-5376	49-609981	190.0–192.0	Qbt3	10-592	—	—	10-592	10-591	10-592	10-592	10-592	10-592	—	10-591	—	10-591	10-592
RE49-10-5365	49-609982	3.2–5.0	Qbt4	10-531	—	—	10-531	10-529	10-531	10-531	10-530	10-530	—	10-529	—	10-529	10-530
RE49-10-5372	49-609982	83.0–85.0	Qbt3	10-531	—	—	10-531	10-529	10-531	10-531	10-530	10-530	—	10-529	—	10-529	10-530
RE49-10-5373	49-609982	190.0–192.0	Qbt4	10-531	—	—	10-531	10-529	10-531	10-531	10-530	10-530	—	10-529	—	10-529	10-530
RE49-10-5364	49-609983	0.5–3.0	Qbt4	10-531	—	—	10-531	10-529	10-531	10-531	10-530	10-530	—	10-529	—	10-529	10-530
RE49-10-5377	49-609983	80.0–82.0	Qbt3	10-592	—	—	10-592	10-591	10-592	10-592	10-592	10-592	—	10-591	—	10-591	10-592
RE49-10-5378	49-609983	140.0–142.0	Qbt3	10-679	—	—	10-679	10-677	10-679	10-679	10-678	10-678	—	10-677	—	10-677	10-678
RE49-10-5379	49-609983	190.0–192.0	Qbt3	10-679	—	—	10-679	10-677	10-679	10-679	10-678	10-678	—	10-677	—	10-677	10-678

Table 6.6-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Gamma Spectroscopy	Iodine-129	Tritium	Explosive Compounds	Isotopic Plutonium	Isotopic Uranium	Metals	Perchlorate	Strontium-90	SVOCs	Technetium-99	VOCs	Cyanide
RE49-10-5366	49-609984	3.2–5.0	Qbt4	10-531	—	—	10-531	10-529	10-531	10-531	10-530	10-530	—	10-529	—	10-529	10-530
RE49-10-5380	49-609984	85.0–87.0	Qbt3	10-679	—	—	10-679	10-677	10-679	10-679	10-678	10-678	—	10-677	—	10-677	10-678
RE49-10-5381	49-609984	150.0–152.0	Qbt3	10-679	—	—	10-679	10-677	10-679	10-679	10-678	10-678	—	10-677	—	10-677	10-678
RE49-10-5382	49-609984	190.0–192.0	Qbt3	10-679	—	—	10-679	10-677	10-679	10-679	10-678	10-678	—	10-677	—	10-677	10-678
Overland Corridor for SWMU 49-001(e)																	
RE49-10-5547	49-609996	0.0–0.5	Soil	10-708	10-708	—	—	—	10-708	10-708	10-708	—	—	—	—	—	—
RE49-10-5548	49-609996	0.5–1.5	Soil	10-708	10-708	—	—	—	10-708	10-708	10-708	—	—	—	—	—	—
RE49-10-5549	49-609997	0.0–0.5	Soil	10-708	10-708	—	—	—	10-708	10-708	10-708	—	—	—	—	—	—
RE49-10-5550	49-609997	0.5–1.5	Soil	10-708	10-708	—	—	—	10-708	10-708	10-708	—	—	—	—	—	—
RE49-10-5551	49-609998	0.0–0.5	Soil	10-708	10-708	—	—	—	10-708	10-708	10-708	—	—	—	—	—	—
RE49-10-5552	49-609998	0.5–1.5	Soil	10-708	10-708	—	—	—	10-708	10-708	10-708	—	—	—	—	—	—
RE49-10-5553	49-609999	0.0–0.5	Soil	10-708	10-708	—	—	—	10-708	10-708	10-708	—	—	—	—	—	—
RE49-10-5554	49-609999	0.5–1.5	Soil	10-708	10-708	—	—	—	10-708	10-708	10-708	—	—	—	—	—	—
RE49-10-5555	49-610000	0.0–0.5	Soil	10-708	10-708	—	—	—	10-708	10-708	10-708	—	—	—	—	—	—
RE49-10-5556	49-610000	0.5–1.5	Soil	10-708	10-708	—	—	—	10-708	10-708	10-708	—	—	—	—	—	—
RE49-10-5557	49-610001	0.0–0.5	Soil	10-708	10-708	—	—	—	10-708	10-708	10-708	—	—	—	—	—	—
RE49-10-5558	49-610001	0.5–1.5	Soil	10-708	10-708	—	—	—	10-708	10-708	10-708	—	—	—	—	—	—
RE49-10-5559	49-610002	0.0–0.5	Soil	10-708	10-708	—	—	—	10-708	10-708	10-708	—	—	—	—	—	—
RE49-10-5560	49-610002	0.5–1.5	Soil	10-708	10-708	—	—	—	10-708	10-708	10-708	—	—	—	—	—	—
RE49-10-5561	49-610003	0.0–0.5	Soil	10-708	10-708	—	—	—	10-708	10-708	10-708	—	—	—	—	—	—
RE49-10-5562	49-610003	0.5–1.5	Soil	10-708	10-708	—	—	—	10-708	10-708	10-708	—	—	—	—	—	—
RE49-10-5563	49-610004	0.0–0.5	Soil	10-708	10-708	—	—	—	10-708	10-708	10-708	—	—	—	—	—	—
RE49-10-5564	49-610004	0.5–1.5	Soil	10-708	10-708	—	—	—	10-708	10-708	10-708	—	—	—	—	—	—
RE49-10-5565	49-610005	0.0–0.5	Soil	10-708	10-708	—	—	—	10-708	10-708	10-708	—	—	—	—	—	—
RE49-10-5566	49-610005	0.5–1.5	Soil	10-708	10-708	—	—	—	10-708	10-708	10-708	—	—	—	—	—	—
RE49-10-5567	49-610006	0.0–0.5	Soil	10-709	10-709	—	—	—	10-709	10-709	10-709	—	—	—	—	—	—
RE49-10-5568	49-610006	0.5–1.5	Soil	10-709	10-709	—	—	—	10-709	10-709	10-709	—	—	—	—	—	—
RE49-10-5569	49-610007	0.0–0.5	Soil	10-709	10-709	—	—	—	10-709	10-709	10-709	—	—	—	—	—	—
RE49-10-5570	49-610007	0.5–1.5	Soil	10-709	10-709	—	—	—	10-709	10-709	10-709	—	—	—	—	—	—
RE49-10-5571	49-610008	0.0–0.5	Soil	10-709	10-709	—	—	—	10-709	10-709	10-709	—	—	—	—	—	—
RE49-10-5572	49-610008	0.5–1.5	Soil	10-709	10-709	—	—	—	10-709	10-709	10-709	—	—	—	—	—	—
RE49-10-5573	49-610009	0.0–0.5	Soil	10-709	10-709	—	—	—	10-709	10-709	10-709	—	—	—	—	—	—
RE49-10-5574	49-610009	0.5–1.5	Soil	10-709	10-709	—	—	—	10-709	10-709	10-709	—	—	—	—	—	—
RE49-10-5575	49-610010	0.0–0.5	Soil	10-709	10-709	—	—	—	10-709	10-709	10-709	—	—	—	—	—	—
RE49-10-5576	49-610010	0.5–1.5	Soil	10-709	10-709	—	—	—	10-709	10-709	10-709	—	—	—	—	—	—
RE49-10-5577	49-610011	0.0–0.5	Soil	10-709	10-709	—	—	—	10-709	10-709	10-709	—	—	—	—	—	—
RE49-10-5578	49-610011	0.5–1.5	Soil	10-709	10-709	—	—	—	10-709	10-709	10-709	—	—	—	—	—	—
RE49-10-5579	49-610012	0.0–0.5	Soil	10-709	10-709	—	—	—	10-709	10-709	10-709	—	—	—	—	—	—

Table 6.6-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Gamma Spectroscopy	Iodine-129	Tritium	Explosive Compounds	Isotopic Plutonium	Isotopic Uranium	Metals	Perchlorate	Strontium-90	SVOCs	Technetium-99	VOCs	Cyanide
RE49-10-5580	49-610012	0.5–1.5	Soil	10-709	10-709	—	—	—	10-709	10-709	10-709	—	—	—	—	—	—
RE49-10-5581	49-610013	0.0–0.5	Soil	10-709	10-709	—	—	—	10-709	10-709	10-709	—	—	—	—	—	—
RE49-10-5582	49-610013	0.5–1.5	Soil	10-709	10-709	—	—	—	10-709	10-709	10-709	—	—	—	—	—	—
RE49-10-5583	49-610014	0.0–0.5	Fill	10-709	10-709	—	—	—	10-709	10-709	10-709	—	—	—	—	—	—
RE49-10-5584	49-610014	0.5–1.5	Soil	10-709	10-709	—	—	—	10-709	10-709	10-709	—	—	—	—	—	—
RE49-10-5585	49-610015	0.0–0.5	Soil	10-709	10-709	—	—	—	10-709	10-709	10-709	—	—	—	—	—	—
RE49-10-5586	49-610015	0.5–1.5	Qbt4	10-709	10-709	—	—	—	10-709	10-709	10-709	—	—	—	—	—	—
RE49-10-5587	49-610016	0.0–0.5	Soil	10-710	10-710	—	—	—	10-710	10-710	10-710	—	—	—	—	—	—
RE49-10-5588	49-610016	0.5–1.5	Qbt4	10-710	10-710	—	—	—	10-710	10-710	10-710	—	—	—	—	—	—
RE49-10-5589	49-610017	0.0–0.5	Soil	10-710	10-710	—	—	—	10-710	10-710	10-710	—	—	—	—	—	—
RE49-10-5590	49-610017	0.5–1.5	Qbt4	10-710	10-710	—	—	—	10-710	10-710	10-710	—	—	—	—	—	—
RE49-10-5591	49-610018	0.0–0.5	Soil	10-710	10-710	—	—	—	10-710	10-710	10-710	—	—	—	—	—	—
RE49-10-5592	49-610018	0.5–1.5	Soil	10-710	10-710	—	—	—	10-710	10-710	10-710	—	—	—	—	—	—
RE49-10-5593	49-610019	0.0–0.5	Soil	10-710	10-710	—	—	—	10-710	10-710	10-710	—	—	—	—	—	—
RE49-10-5594	49-610019	0.5–1.5	Qbt4	10-710	10-710	—	—	—	10-710	10-710	10-710	—	—	—	—	—	—
RE49-10-5595	49-610020	0.0–0.5	Soil	10-710	10-710	—	—	—	10-710	10-710	10-710	—	—	—	—	—	—
RE49-10-5596	49-610020	0.5–1.5	Soil	10-710	10-710	—	—	—	10-710	10-710	10-710	—	—	—	—	—	—
RE49-10-5597	49-610021	0.0–0.5	Soil	10-710	10-710	—	—	—	10-710	10-710	10-710	—	—	—	—	—	—
RE49-10-5598	49-610021	0.5–1.5	Qbt4	10-710	10-710	—	—	—	10-710	10-710	10-710	—	—	—	—	—	—
RE49-10-5599	49-610022	0.0–0.5	Soil	10-710	10-710	—	—	—	10-710	10-710	10-710	—	—	—	—	—	—
RE49-10-5600	49-610022	0.5–1.5	Qbt4	10-710	10-710	—	—	—	10-710	10-710	10-710	—	—	—	—	—	—
RE49-10-5601	49-610023	0.0–0.5	Soil	10-710	10-710	—	—	—	10-710	10-710	10-710	—	—	—	—	—	—
RE49-10-5602	49-610023	0.5–1.5	Qbt4	10-710	10-710	—	—	—	10-710	10-710	10-710	—	—	—	—	—	—
RE49-10-5603	49-610024	0.0–0.5	Soil	10-710	10-710	—	—	—	10-710	10-710	10-710	—	—	—	—	—	—
RE49-10-5604	49-610024	0.5–1.5	Qbt4	10-710	10-710	—	—	—	10-710	10-710	10-710	—	—	—	—	—	—
RE49-10-5605	49-610025	0.0–0.5	Soil	10-710	10-710	—	—	—	10-710	10-710	10-710	—	—	—	—	—	—
RE49-10-5606	49-610025	0.5–1.5	Qbt4	10-710	10-710	—	—	—	10-710	10-710	10-710	—	—	—	—	—	—
RE49-10-5607	49-610026	0.0–0.5	Soil	10-711	10-711	—	—	—	10-711	10-711	10-711	—	—	—	—	—	—
RE49-10-5608	49-610026	0.5–1.5	Qbt4	10-711	10-711	—	—	—	10-711	10-711	10-711	—	—	—	—	—	—
RE49-10-5609	49-610027	0.0–0.5	Soil	10-711	10-711	—	—	—	10-711	10-711	10-711	—	—	—	—	—	—
RE49-10-5610	49-610027	0.5–1.5	Qbt4	10-711	10-711	—	—	—	10-711	10-711	10-711	—	—	—	—	—	—
RE49-10-5611	49-610028	0.0–0.5	Soil	10-711	10-711	—	—	—	10-711	10-711	10-711	—	—	—	—	—	—
RE49-10-5612	49-610028	0.5–1.5	Qbt4	10-711	10-711	—	—	—	10-711	10-711	10-711	—	—	—	—	—	—
RE49-10-5613	49-610029	0.0–0.5	Soil	10-711	10-711	—	—	—	10-711	10-711	10-711	—	—	—	—	—	—
RE49-10-5614	49-610029	0.5–1.5	Soil	10-711	10-711	—	—	—	10-711	10-711	10-711	—	—	—	—	—	—
RE49-10-5615	49-610030	0.0–0.5	Soil	10-711	10-711	—	—	—	10-711	10-711	10-711	—	—	—	—	—	—
RE49-10-5616	49-610030	0.5–1.5	Qbt4	10-711	10-711	—	—	—	10-711	10-711	10-711	—	—	—	—	—	—
RE49-10-5617	49-610031	0.0–0.5	Soil	10-711	10-711	—	—	—	10-711	10-711	10-711	—	—	—	—	—	—

Table 6.6-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Gamma Spectroscopy	Iodine-129	Tritium	Explosive Compounds	Isotopic Plutonium	Isotopic Uranium	Metals	Perchlorate	Strontium-90	SVOCs	Technetium-99	VOCs	Cyanide
RE49-10-5618	49-610031	0.5–1.5	Qbt4	10-711	10-711	—	—	—	10-711	10-711	10-711	—	—	—	—	—	—
RE49-10-10838	49-611025	0.0–0.5	Soil	10-1524	10-1524	—	—	—	10-1524	10-1524	10-1524	—	—	—	—	—	—
RE49-10-10839	49-611025	0.5–1.5	Soil	10-1524	10-1524	—	—	—	10-1524	10-1524	10-1524	—	—	—	—	—	—
RE49-10-10840	49-611026	0.0–0.5	Soil	10-1524	10-1524	—	—	—	10-1524	10-1524	10-1524	—	—	—	—	—	—
RE49-10-10841	49-611026	0.5–1.5	Soil	10-1524	10-1524	—	—	—	10-1524	10-1524	10-1524	—	—	—	—	—	—
RE49-10-10842	49-611027	0.0–0.5	Soil	10-1524	10-1524	—	—	—	10-1524	10-1524	10-1524	—	—	—	—	—	—
RE49-10-10843	49-611027	0.5–1.5	Soil	10-1524	10-1524	—	—	—	10-1524	10-1524	10-1524	—	—	—	—	—	—
RE49-10-10844	49-611028	0.0–0.5	Soil	10-1524	10-1524	—	—	—	10-1524	10-1524	10-1524	—	—	—	—	—	—
RE49-10-10845	49-611028	0.5–1.5	Soil	10-1524	10-1524	—	—	—	10-1524	10-1524	10-1524	—	—	—	—	—	—
RE49-10-10846	49-611029	0.0–0.5	Soil	10-1524	10-1524	—	—	—	10-1524	10-1524	10-1524	—	—	—	—	—	—
RE49-10-10847	49-611029	0.5–1.5	Soil	10-1524	10-1524	—	—	—	10-1524	10-1524	10-1524	—	—	—	—	—	—

Note: Numbers in analyte columns are request numbers.

*— = Analysis not requested.

Table 6.6-2
Summary of Inorganic Chemicals Detected or Detected above BVs at Area 3, SWMU 49-001(e)

Sample ID	Location ID	Depth (ft)	Media	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Cyanide (Total)	Iron
Qbt 2,3,4 BV[a]				**7340**	**0.5**	**2.79**	**46**	**1.21**	**1.63**	**2200**	**7.14**	**3.14**	**4.66**	**0.5**	**14500**
Soil BV[a]				**29,200**	**0.83**	**8.17**	**295**	**1.83**	**0.4**	**6120**	**19.3**	**8.64**	**14.7**	**0.5**	**21,500**
Residential SSL[b]				**78,000**	**31.3**	**4.25**	**15,600**	**156**	**70.5**	**13,000,000**	**96.6[c]**	**23[d]**	**3130**	**11.2**	**54,800**
Industrial SSL[b]				**1,290,000**	**519**	**21.5**	**255,000**	**2580**	**1110**	**32,400,000**	**505[c]**	**350[d]**	**51,900**	**63.3**	**908,000**
SWMU 49-001(e)															
0549-95-0211	49-03000	0.0–0.5	Soil	—[e]	5.5 (U)	—	—	—	0.59 (U)	—	—	—	—	NA[f]	—
0549-95-0213	49-03002	0.0–0.5	Soil	—	5.5 (U)	—	—	—	0.59 (U)	—	—	—	—	NA	—
0549-95-0216	49-03005	0.0–0.5	Soil	—	5.5 (U)	—	—	—	0.59 (U)	—	—	—	—	NA	—
0549-95-0219	49-03008	0.0–0.5	Soil	—	5.6 (U)	—	—	—	0.59 (U)	—	—	—	—	NA	—
0549-95-0220	49-03009	0.0–0.5	Soil	—	5.5 (U)	—	—	—	0.59 (U)	—	—	—	—	NA	—
0549-95-0222	49-03011	0.0–0.5	Soil	—	5.7 (U)	—	—	—	0.6 (U)	—	—	—	36.4	NA	—
0549-95-0223	49-03012	0.0–0.5	Soil	—	5.5 (U)	—	—	—	0.59 (U)	—	—	—	—	NA	—
0549-95-0224	49-03013	0.0–0.5	Soil	—	5.5 (U)	—	—	—	0.58 (U)	—	—	—	—	NA	—
0549-95-0229	49-03024	0.0–0.5	Soil	—	5.5 (U)	—	—	—	0.58 (U)	—	—	—	—	NA	—
0549-95-0231	49-03026	0.0–0.5	Soil	—	5.5 (U)	—	—	—	0.58 (U)	—	—	—	—	NA	—
RE49-10-3254	49-609307	0.0–0.5	Soil	—	0.85 (U)	—	—	—	—	—	—	—	18.5	NA	—
RE49-10-3255	49-609307	0.5–1.5	Qbt4	—	—	—	68.2	—	—	—	13.5	—	8.8	NA	—
RE49-10-3257	49-609308	0.5–1.5	Qbt4	18,700	0.68 (U)	10.3	521	1.9	—	14,000	21.2	3.6 (J)	8.8	NA	23,500
RE49-10-3258	49-609309	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-3259	49-609309	0.5–1.5	Soil	—	—	—	—	—	—	11,300	—	—	—	NA	—
RE49-10-3260	49-609310	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-3261	49-609310	0.5–1.5	Qbt4	10,100	—	4.7	84.2	—	—	2240	16.6	—	4.8	NA	—
RE49-10-3262	49-609311	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-3263	49-609311	0.5–1.5	Qbt4	14,600	—	6.5	211	1.3	—	3020	12.3	—	6.1	NA	16,900
RE49-10-3264	49-609312	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	25,000
RE49-10-3265	49-609312	0.5–1.5	Soil	—	—	—	299	—	—	—	—	—	—	NA	—
RE49-10-3266	49-609313	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-3267	49-609313	0.5–1.5	Qbt4	16,000	—	8.4	184	2.3	—	2900	17.9	3.3 (J)	5	NA	21,400
RE49-10-3268	49-609314	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-3269	49-609314	0.5–1.5	Soil	—	—	—	391	—	—	14,800	—	—	—	NA	22,000
RE49-10-3270	49-609315	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-3272	49-609316	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	21700 (J)
RE49-10-3273	49-609316	0.5–1.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	22900
RE49-10-3278	49-609317	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-3279	49-609317	0.5–1.5	Qbt4	8970	—	10.2	88.9	—	—	—	8.4	—	—	NA	—
RE49-10-3280	49-609318	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—

Table 6.6-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Cyanide (Total)	Iron
Qbt 2,3,4 BV[a]				**7340**	**0.5**	**2.79**	**46**	**1.21**	**1.63**	**2200**	**7.14**	**3.14**	**4.66**	**0.5**	**14,500**
Soil BV[a]				**29,200**	**0.83**	**8.17**	**295**	**1.83**	**0.4**	**6120**	**19.3**	**8.64**	**14.7**	**0.5**	**21,500**
Residential SSL[b]				**78,000**	**31.3**	**4.25**	**15,600**	**156**	**70.5**	**13,000,000**	**96.6[c]**	**23[d]**	**3130**	**11.2**	**54,800**
Industrial SSL[b]				**1,290,000**	**519**	**21.5**	**255,000**	**2580**	**1110**	**32,400,000**	**505[c]**	**350[d]**	**51,900**	**63.3**	**908,000**
RE49-10-3281	49-609318	0.5–1.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	23,200
RE49-10-3283	49-609319	0.5–1.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-3285	49-609320	0.5–1.5	Qbt4	—	—	4.5	47	—	—	—	7.6	—	—	NA	—
RE49-10-3287	49-609321	0.5–1.5	Qbt4	8570	—	4.5	140	—	—	5690	7.5	—	—	NA	—
RE49-10-3288	49-609322	0.0–0.5	Soil	—	2.8 (U)	—	—	—	—	—	—	—	1780 (J)	NA	—
RE49-10-3289	49-609322	0.5–1.5	Qbt4	15,000	—	9.5	533	—	—	6250	12.1	—	7.1 (J)	NA	16,000
RE49-10-3290	49-609323	0.0–0.5	Soil	—	—	—	—	—	—	—	—	10	—	NA	—
RE49-10-3291	49-609323	0.5–1.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	24,700
RE49-10-3292	49-609324	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-3296	49-609326	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-3297	49-609326	0.5–1.5	Qbt4	11,500	0.57 (U)	7.2	122	—	—	2580	9.6	—	—	NA	—
RE49-10-3298	49-609327	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-3299	49-609327	0.5–1.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-3301	49-609328	0.5–1.5	Qbt3	—	—	3.7	81.5	—	—	—	10.4	—	—	NA	—
RE49-10-3309	49-609329	0.5–1.5	Qbt4	—	—	3.7	—	—	—	—	—	—	—	NA	—
RE49-10-3312	49-609331	0.0–0.5	Fill	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-3315	49-609332	0.5–1.5	Qbt4	—	—	5.6	—	—	—	—	8.4	—	—	NA	—
RE49-10-3317	49-609333	0.5–1.5	Soil	—	—	—	—	—	—	—	—	8.8	—	NA	—
RE49-10-3320	49-609335	0.0–0.5	Qbt4	—	—	3.7	56.5	—	—	—	—	—	7.6	NA	—
RE49-10-3321	49-609335	0.5–1.5	Qbt4	—	—	4.6	65.8	—	—	—	7.6	—	—	NA	—
RE49-10-3323	49-609336	0.5–1.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-3325	49-609337	0.5–1.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-5367	49-609981	1.2–3.0	Qbt4	—	—	3.6	399 (J+)	—	—	6740	—	—	—	0.53 (U)	—
RE49-10-5374	49-609981	78.0–80.0	Qbt3	—	—	—	—	—	—	—	—	—	—	0.51 (U)	—
RE49-10-5375	49-609981	140.0–143.0	Qbt3	—	—	—	—	—	—	—	—	—	—	0.51 (U)	—
RE49-10-5376	49-609981	190.0–192.0	Qbt3	—	—	—	—	—	—	—	—	—	—	0.51 (U)	—
RE49-10-5365	49-609982	3.2–5.0	Qbt4	17,300	—	5	223 (J+)	1.6	—	5250	14.5	3.3 (J)	8.1	0.58 (U)	17,100
RE49-10-5372	49-609982	83.0–85.0	Qbt3	—	—	—	—	—	—	—	—	—	—	0.51 (U)	—
RE49-10-5373	49-609982	190.0–192.0	Qbt4	—	—	—	—	—	—	—	—	—	—	—	—
RE49-10-5364	49-609983	0.5–3.0	Qbt4	—	—	6.2	—	—	—	—	—	—	—	0.53 (U)	—
RE49-10-5377	49-609983	80.0–82.0	Qbt3	—	0.54 (U)	7.4	—	—	—	—	—	—	—	0.51 (U)	—
RE49-10-5378	49-609983	140.0–142.0	Qbt3	—	—	—	—	—	—	—	—	—	—	0.51 (U)	—
RE49-10-5379	49-609983	190.0–192.0	Qbt3	—	—	—	—	—	—	—	—	—	—	—	—
RE49-10-5366	49-609984	3.2–5.0	Qbt4	10,300	—	5.6	87.1 (J)	—	—	2710	9.4	—	4.8	0.56 (U)	—

Table 6.6-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Cyanide (Total)	Iron
Qbt 2,3,4 BV[a]				**7340**	**0.5**	**2.79**	**46**	**1.21**	**1.63**	**2200**	**7.14**	**3.14**	**4.66**	**0.5**	**14,500**
Soil BV[a]				**29,200**	**0.83**	**8.17**	**295**	**1.83**	**0.4**	**6120**	**19.3**	**8.64**	**14.7**	**0.5**	**21,500**
Residential SSL[b]				**78,000**	**31.3**	**4.25**	**15,600**	**156**	**70.5**	**13,000,000**	**96.6[c]**	**23[d]**	**3130**	**11.2**	**54,800**
Industrial SSL[b]				**1,290,000**	**519**	**21.5**	**255,000**	**2580**	**1110**	**32,400,000**	**505[c]**	**350[d]**	**51,900**	**63.3**	**908,000**
RE49-10-5380	49-609984	85.0–87.0	Qbt3	—	—	—	—	—	—	—	—	—	—	—	—
RE49-10-5381	49-609984	150.0–152.0	Qbt3	—	—	—	—	—	—	—	—	—	—	—	—
RE49-10-5382	49-609984	190.0–192.0	Qbt3	—	—	—	—	—	—	—	—	—	—	—	—
Overland Corridor for SWMU 49-001(e)															
RE49-10-5549	49-609997	0.0–0.5	Soil	—	—	—	—	—	—	—	—	11	—	NA	—
RE49-10-5550	49-609997	0.5–1.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-5556	49-610000	0.5–1.5	Soil	—	—	—	—	—	—	—	—	16.4	—	NA	—
RE49-10-5557	49-610001	0.0–0.5	Soil	—	—	—	—	—	—	—	—	13	—	NA	—
RE49-10-5558	49-610001	0.5–1.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-5559	49-610002	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-5560	49-610002	0.5–1.5	Soil	—	—	—	654	—	—	7390 (J-)	—	—	—	NA	—
RE49-10-5564	49-610004	0.5–1.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-5566	49-610005	0.5–1.5	Soil	—	—	—	—	—	—	—	—	25.3	—	NA	—
RE49-10-5568	49-610006	0.5–1.5	Soil	—	—	—	—	—	—	—	—	9.2	—	NA	—
RE49-10-5569	49-610007	0.0–0.5	Soil	—	—	—	301	—	—	—	—	26	—	NA	—
RE49-10-5572	49-610008	0.5–1.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-5574	49-610009	0.5–1.5	Soil	—	—	—	377	—	—	—	—	9.4	—	NA	—
RE49-10-5575	49-610010	0.0–0.5	Soil	—	—	—	—	—	—	—	—	10.1	—	NA	—
RE49-10-5576	49-610010	0.5–1.5	Soil	—	—	—	403	—	—	6470	—	—	—	NA	—
RE49-10-5578	49-610011	0.5–1.5	Soil	—	—	—	—	—	—	—	—	9.2	—	NA	—
RE49-10-5581	49-610013	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-5584	49-610014	0.5–1.5	Soil	—	—	—	—	—	—	9630	—	—	—	NA	—
RE49-10-5586	49-610015	0.5–1.5	Qbt4	18,200	—	4.2	187	—	—	2520	8.8	—	—	NA	—
RE49-10-5588	49-610016	0.5–1.5	Qbt4	15,100	—	4	248	—	—	2950	10.2	3.7	6.5	NA	—
RE49-10-5590	49-610017	0.5–1.5	Qbt4	14,600	—	3.9	170	1.4	—	—	11.4	4.5	6.5	NA	19,700
RE49-10-5594	49-610019	0.5–1.5	Qbt4	13,500	—	3.6	179	—	—	3150	9.4	4.3	5.1	NA	15,100
RE49-10-5598	49-610021	0.5–1.5	Qbt4	16,300	—	5.1	174	1.4	—	2330	11.2	3.3	6.4	NA	—
RE49-10-5600	49-610022	0.5–1.5	Qbt4	12,200	—	3.7	136	—	—	—	10	5	5.6	NA	—
RE49-10-5601	49-610023	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-5602	49-610023	0.5–1.5	Qbt4	24,400	—	5.7	170	1.7	—	4550	13.2	5.8	7.7	NA	18,600
RE49-10-5603	49-610024	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-5604	49-610024	0.5–1.5	Qbt4	10,700	—	3.1	110	—	—	—	10.7	3.9	5.3	NA	—
RE49-10-5605	49-610025	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-5606	49-610025	0.5–1.5	Qbt4	12,900	—	4.1	153	—	—	—	12.7	6	7.7	NA	15,200

Table 6.6-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Cyanide (Total)	Iron
Qbt 2,3,4 BV[a]				**7340**	**0.5**	**2.79**	**46**	**1.21**	**1.63**	**2200**	**7.14**	**3.14**	**4.66**	**0.5**	**14,500**
Soil BV[a]				**29,200**	**0.83**	**8.17**	**295**	**1.83**	**0.4**	**6120**	**19.3**	**8.64**	**14.7**	**0.5**	**21,500**
Residential SSL[b]				**78,000**	**31.3**	**4.25**	**15,600**	**156**	**70.5**	**13,000,000**	**96.6[c]**	**23[d]**	**3130**	**11.2**	**54,800**
Industrial SSL[b]				**1,290,000**	**519**	**21.5**	**255,000**	**2580**	**1110**	**32,400,000**	**505[c]**	**350[d]**	**51,900**	**63.3**	**908,000**
RE49-10-5608	49-610026	0.5–1.5	Qbt4	7440	—	3.3	90.6 (J+)	—	—	—	7.5	3.3	17.3	NA	—
RE49-10-5610	49-610027	0.5–1.5	Qbt4	—	—	—	69.4 (J+)	—	—	—	—	—	10.5	NA	—
RE49-10-5612	49-610028	0.5–1.5	Qbt4	—	—	—	76.6 (J+)	—	—	—	8.7	3.9	5.3	NA	—
RE49-10-5615	49-610030	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-5616	49-610030	0.5–1.5	Qbt4	13,300	—	2.9	210 (J+)	—	—	—	9.7	4.7	6	NA	—
RE49-10-5617	49-610031	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-5618	49-610031	0.5–1.5	Qbt4	12,200	—	3	320 (J+)	—	—	3900	9.7	7	6.2	NA	—
RE49-10-10838	49-611025	0.0–0.5	Soil	—	—	—	—	—	—	—	—	16	—	NA	—
RE49-10-10844	49-611028	0.0–0.5	Soil	—	—	—	—	—	—	—	—	14.8	—	NA	—

Table 6.6-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Lead	Magnesium	Manganese	Mercury	Nickel	Perchlorate	Selenium	Sodium	Thallium	Uranium	Vanadium	Zinc
Qbt 2,3,4 BV[a]				**11.2**	**1690**	**482**	**0.1**	**6.58**	**na[g]**	**0.3**	**2770**	**1.1**	**2.4**	**17**	**63.5**
Soil BV[a]				**22.3**	**4610**	**671**	**0.1**	**15.4**	**na**	**1.52**	**915**	**0.73**	**1.82**	**39.6**	**48.8**
Residential SSL[b]				**400**	**339,000**	**10,500**	**23.5**	**1560**	**54.8**	**391**	**7,820,000**	**0.782**	**234**	**394**	**23,500**
Industrial SSL[b]				**800**	**5,680,000**	**160,000**	**389**	**25,700**	**908**	**6490**	**35,700,000**	**13**	**3880**	**6530**	**389000**
SWMU 49-001(e)															
0549-95-0211	49-03000	0.0–0.5	Soil	—	—	—	—	—	NA	—	—	—	3.5	—	—
0549-95-0213	49-03002	0.0–0.5	Soil	—	—	—	—	—	NA	—	—	—	3.9	—	—
0549-95-0216	49-03005	0.0–0.5	Soil	—	—	—	—	—	NA	—	—	—	3.4	—	—
0549-95-0219	49-03008	0.0–0.5	Soil	—	—	—	—	—	NA	—	—	—	3.4	—	—
0549-95-0220	49-03009	0.0–0.5	Soil	—	—	—	—	—	NA	—	—	—	3.2	—	—
0549-95-0222	49-03011	0.0–0.5	Soil	—	—	—	—	—	NA	—	—	—	3.3	—	92.8 (J)
0549-95-0223	49-03012	0.0–0.5	Soil	—	—	—	—	—	NA	—	—	—	3.7	—	51.9 (J)
0549-95-0224	49-03013	0.0–0.5	Soil	—	—	—	—	—	NA	—	—	—	3	—	63.3 (J)
0549-95-0229	49-03024	0.0–0.5	Soil	—	—	—	—	—	NA	—	—	—	3.4	—	—
0549-95-0231	49-03026	0.0–0.5	Soil	22.8 (J-)	—	—	—	—	NA	—	—	—	3.6	—	112 (J)
RE49-10-3254	49-609307	0.0–0.5	Soil	—	—	—	—	—	NA	2.3 (U)	—	—	NA	—	68.8
RE49-10-3255	49-609307	0.5–1.5	Qbt4	—	—	—	—	6.8	NA	1.7 (U)	—	—	NA	—	—
RE49-10-3257	49-609308	0.5–1.5	Qbt4	20.5	4110	—	—	13.3	NA	1.7 (U)	—	—	NA	26.2	—
RE49-10-3258	49-609309	0.0–0.5	Soil	—	—	—	—	—	NA	2 (U)	—	—	NA	—	—
RE49-10-3259	49-609309	0.5–1.5	Soil	—	—	—	—	—	NA	2 (U)	—	1.4	NA	—	—
RE49-10-3260	49-609310	0.0–0.5	Soil	—	—	—	—	—	NA	2 (U)	—	0.88 (U)	NA	—	—
RE49-10-3261	49-609310	0.5–1.5	Qbt4	—	1800	—	—	6.8	NA	2.7 (U)	—	1.5	NA	—	—
RE49-10-3262	49-609311	0.0–0.5	Soil	—	—	—	—	—	NA	1.7 (U)	—	0.79 (U)	NA	—	—
RE49-10-3263	49-609311	0.5–1.5	Qbt4	20.3	2890	—	—	9.1	NA	2.3 (U)	—	1.5	NA	19.7	—
RE49-10-3264	49-609312	0.0–0.5	Soil	—	—	—	—	—	NA	1.9 (U)	—	—	NA	—	—
RE49-10-3265	49-609312	0.5–1.5	Soil	—	—	—	—	—	NA	2.3 (U)	—	—	NA	—	—
RE49-10-3266	49-609313	0.0–0.5	Soil	27.2	—	—	—	—	NA	2 (U)	—	2.8	NA	—	—
RE49-10-3267	49-609313	0.5–1.5	Qbt4	27.1	2880	—	—	11.2	NA	2.8 (U)	—	5.3	NA	22.8	—
RE49-10-3268	49-609314	0.0–0.5	Soil	—	—	—	—	—	NA	1.7 (U)	—	—	NA	—	—
RE49-10-3269	49-609314	0.5–1.5	Soil	26.1	—	—	—	—	NA	2 (U)	—	1.1 (U)	NA	—	—
RE49-10-3270	49-609315	0.0–0.5	Soil	—	—	—	0.218 (J—)	—	NA	2.1 (U)	—	—	NA	—	—
RE49-10-3272	49-609316	0.0–0.5	Soil	—	—	—	—	—	NA	1.7 (U)	—	0.84 (U)	NA	—	—
RE49-10-3273	49-609316	0.5–1.5	Soil	—	—	—	—	—	NA	1.7 (U)	—	—	NA	—	—
RE49-10-3278	49-609317	0.0–0.5	Soil	22.4	—	—	—	—	NA	1.9 (J-)	—	0.91 (J)	NA	—	—
RE49-10-3279	49-609317	0.5–1.5	Qbt4	27.4	1750 (J+)	—	—	7.9	NA	2.2 (J-)	—	1.5 (J)	NA	—	—
RE49-10-3280	49-609318	0.0–0.5	Soil	—	—	—	—	—	NA	1.9 (J-)	—	—	NA	—	52.7

Table 6.6-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Lead	Magnesium	Manganese	Mercury	Nickel	Perchlorate	Selenium	Sodium	Thallium	Uranium	Vanadium	Zinc
Qbt 2,3,4 BV[a]				**11.2**	**1690**	**482**	**0.1**	**6.58**	**na[g]**	**0.3**	**2770**	**1.1**	**2.4**	**17**	**63.5**
Soil BV[a]				**22.3**	**4610**	**671**	**0.1**	**15.4**	**na**	**1.52**	**915**	**0.73**	**1.82**	**39.6**	**48.8**
Residential SSL[b]				**400**	**339,000**	**10,500**	**23.5**	**1560**	**54.8**	**391**	**7,820,000**	**0.782**	**234**	**394**	**23,500**
Industrial SSL[b]				**800**	**5,680,000**	**160,000**	**389**	**25,700**	**908**	**6490**	**35,700,000**	**13**	**3880**	**6530**	**389000**
RE49-10-3281	49-609318	0.5–1.5	Soil	—	—	—	—	—	NA	1.9 (J-)	—	—	NA	—	50.3
RE49-10-3283	49-609319	0.5–1.5	Soil	—	—	—	—	—	NA	1.6 (J)	—	—	NA	—	—
RE49-10-3285	49-609320	0.5–1.5	Qbt4	—	—	—	—	—	NA	2.1 (J-)	—	—	NA	—	—
RE49-10-3287	49-609321	0.5–1.5	Qbt4	15.1	—	—	—	—	NA	0.91 (J-)	—	—	NA	—	—
RE49-10-3288	49-609322	0.0–0.5	Soil	—	—	—	—	—	NA	1.6 (J-)	—	—	NA	—	—
RE49-10-3289	49-609322	0.5–1.5	Qbt4	15.2	2610 (J+)	—	—	10.1	NA	2.6 (J-)	—	—	NA	18.6	—
RE49-10-3290	49-609323	0.0–0.5	Soil	—	—	—	—	—	NA	—	—	—	NA	—	—
RE49-10-3291	49-609323	0.5–1.5	Soil	—	—	—	—	—	NA	1.8 (J-)	—	—	NA	—	—
RE49-10-3292	49-609324	0.0–0.5	Soil	—	—	—	—	—	NA	—	—	—	NA	—	51.9
RE49-10-3296	49-609326	0.0–0.5	Soil	—	—	—	—	—	NA	1.9 (J-)	—	—	NA	—	—
RE49-10-3297	49-609326	0.5–1.5	Qbt4	16	1750 (J+)	—	—	—	NA	1.7 (J-)	—	—	NA	—	—
RE49-10-3298	49-609327	0.0–0.5	Soil	—	—	—	—	—	NA	1.6 (J-)	—	—	NA	—	—
RE49-10-3299	49-609327	0.5–1.5	Soil	—	—	—	—	—	NA	2.1 (J-)	—	0.87 (J)	NA	—	—
RE49-10-3301	49-609328	0.5–1.5	Qbt3	15.6	—	—	—	—	NA	1.1 (J-)	—	—	NA	—	—
RE49-10-3309	49-609329	0.5–1.5	Qbt4	54.4	—	—	—	—	NA	1.8 (J)	—	—	NA	—	—
RE49-10-3312	49-609331	0.0–0.5	Fill	—	—	—	—	—	NA	1.7 (J)	—	—	NA	—	—
RE49-10-3315	49-609332	0.5–1.5	Qbt4	—	—	—	—	—	NA	1.6 (J)	—	1.3	NA	—	—
RE49-10-3317	49-609333	0.5–1.5	Soil	—	—	747	—	—	NA	—	—	—	NA	—	—
RE49-10-3320	49-609335	0.0–0.5	Qbt4	14.1	—	—	—	—	NA	1.6 (J)	—	—	NA	—	—
RE49-10-3321	49-609335	0.5–1.5	Qbt4	15.2	—	—	—	—	NA	1.7 (J)	—	—	NA	—	—
RE49-10-3323	49-609336	0.5–1.5	Soil	—	—	—	—	—	NA	1.8 (J)	—	—	NA	—	—
RE49-10-3325	49-609337	0.5–1.5	Soil	—	—	—	—	—	NA	1.7 (J)	—	0.8 (U)	NA	—	—
RE49-10-5367	49-609981	1.2–3.0	Qbt4	—	1760	—	—	—	—	0.76	—	—	NA	—	—
RE49-10-5374	49-609981	78.0–80.0	Qbt3	—	—	—	—	—	—	0.89	—	—	NA	—	—
RE49-10-5375	49-609981	140.0–143.0	Qbt3	—	—	—	—	—	—	1.3	—	—	NA	—	—
RE49-10-5376	49-609981	190.0–192.0	Qbt3	—	—	—	—	—	—	1	—	—	NA	—	—
RE49-10-5365	49-609982	3.2–5.0	Qbt4	18.5	3030	—	—	12.1	0.0058	1	—	—	NA	25.1	—
RE49-10-5372	49-609982	83.0–85.0	Qbt3	—	—	—	—	—	—	0.91	—	—	NA	—	—
RE49-10-5373	49-609982	190.0–192.0	Qbt4	—	—	—	—	—	—	0.86	—	—	NA	—	—
RE49-10-5364	49-609983	0.5–3.0	Qbt4	—	—	—	—	—	—	1.6	—	—	NA	—	—
RE49-10-5377	49-609983	80.0–82.0	Qbt3	—	—	—	—	—	—	1	—	—	NA	—	—
RE49-10-5378	49-609983	140.0–142.0	Qbt3	—	—	—	—	—	—	1.1	—	—	NA	—	—
RE49-10-5379	49-609983	190.0–192.0	Qbt3	—	—	—	—	—	—	0.85	—	—	NA	—	—
RE49-10-5366	49-609984	3.2–5.0	Qbt4	14	2450	—	—	8	0.0044 (J)	1.2	—	—	NA	—	—

Table 6.6-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Lead	Magnesium	Manganese	Mercury	Nickel	Perchlorate	Selenium	Sodium	Thallium	Uranium	Vanadium	Zinc
Qbt 2,3,4 BV[a]				**11.2**	**1690**	**482**	**0.1**	**6.58**	**na[g]**	**0.3**	**2770**	**1.1**	**2.4**	**17**	**63.5**
Soil BV[a]				**22.3**	**4610**	**671**	**0.1**	**15.4**	**na**	**1.52**	**915**	**0.73**	**1.82**	**39.6**	**48.8**
Residential SSL[b]				**400**	**339,000**	**10,500**	**23.5**	**1560**	**54.8**	**391**	**7,820,000**	**0.782**	**234**	**394**	**23,500**
Industrial SSL[b]				**800**	**5,680,000**	**160,000**	**389**	**25,700**	**908**	**6490**	**35,700,000**	**13**	**3880**	**6530**	**389000**
RE49-10-5380	49-609984	85.0–87.0	Qbt3	—	—	—	—	—	—	0.98	—	—	NA	—	—
RE49-10-5381	49-609984	150.0–152.0	Qbt3	—	—	—	—	—	—	1.1	—	—	NA	—	—
RE49-10-5382	49-609984	190.0–192.0	Qbt3	—	—	—	—	—	—	1.3	—	—	NA	—	—
Overland Corridor for SWMU 49-001(e)															
RE49-10-5549	49-609997	0.0–0.5	Soil	24.3	—	954	—	17.4	NA	—	—	—	NA	—	—
RE49-10-5550	49-609997	0.5–1.5	Soil	—	—	—	—	17.5	NA	—	—	—	NA	—	—
RE49-10-5556	49-610000	0.5–1.5	Soil	25.3	—	826	—	—	NA	—	—	—	NA	—	—
RE49-10-5557	49-610001	0.0–0.5	Soil	23.6	—	988	—	—	NA	—	—	—	NA	—	—
RE49-10-5558	49-610001	0.5–1.5	Soil	—	—	—	—	16.8	NA	—	—	—	NA	—	—
RE49-10-5559	49-610002	0.0–0.5	Soil	—	—	—	—	—	NA	—	—	0.88	NA	—	—
RE49-10-5560	49-610002	0.5–1.5	Soil	—	—	—	—	—	NA	—	—	—	NA	—	—
RE49-10-5564	49-610004	0.5–1.5	Soil	—	—	677	—	—	NA	—	—	—	NA	—	—
RE49-10-5566	49-610005	0.5–1.5	Soil	24	—	2060	—	—	NA	—	—	—	NA	—	—
RE49-10-5568	49-610006	0.5–1.5	Soil	—	—	685	—	—	NA	—	—	0.92	NA	—	—
RE49-10-5569	49-610007	0.0–0.5	Soil	—	—	1780	—	—	NA	—	—	—	NA	42	—
RE49-10-5572	49-610008	0.5–1.5	Soil	—	—	—	—	—	NA	—	—	0.8	NA	—	—
RE49-10-5574	49-610009	0.5–1.5	Soil	—	—	765	—	—	NA	—	—	—	NA	—	—
RE49-10-5575	49-610010	0.0–0.5	Soil	—	—	857	—	—	NA	—	—	—	NA	—	—
RE49-10-5576	49-610010	0.5–1.5	Soil	—	—	—	—	—	NA	—	1270	—	NA	—	—
RE49-10-5578	49-610011	0.5–1.5	Soil	—	—	—	—	—	NA	—	—	—	NA	—	—
RE49-10-5581	49-610013	0.0–0.5	Soil	—	—	726	—	—	NA	—	—	—	NA	—	—
RE49-10-5584	49-610014	0.5–1.5	Soil	—	—	—	—	—	NA	—	—	1.1	NA	—	—
RE49-10-5586	49-610015	0.5–1.5	Qbt4	11.9	2680	—	—	—	NA	0.7	—	1.3	NA	—	—
RE49-10-5588	49-610016	0.5–1.5	Qbt4	—	2170	—	—	7.5	NA	1.5 (J-)	—	—	NA	18.4	—
RE49-10-5590	49-610017	0.5–1.5	Qbt4	13.3	2070	—	—	9.1	NA	1.8 (J-)	—	—	NA	21.2	—
RE49-10-5594	49-610019	0.5–1.5	Qbt4	13.1	2170	—	—	9.9	NA	1.4 (J-)	—	—	NA	—	—
RE49-10-5598	49-610021	0.5–1.5	Qbt4	20	2060	—	—	8.1	NA	1.6 (J-)	—	1.4	NA	21	—
RE49-10-5600	49-610022	0.5–1.5	Qbt4	12.6	1730	—	—	7.7	NA	1.6 (J-)	—	—	NA	22.4	—
RE49-10-5601	49-610023	0.0–0.5	Soil	—	—	—	—	—	NA	1.6 (J-)	—	—	NA	—	—
RE49-10-5602	49-610023	0.5–1.5	Qbt4	16.9	3690	—	—	10	NA	2.9	—	—	NA	30.3	—
RE49-10-5603	49-610024	0.0–0.5	Soil	—	—	—	—	—	NA	1.8 (J-)	—	—	NA	—	—
RE49-10-5604	49-610024	0.5–1.5	Qbt4	12.8	—	—	—	7.2	NA	1.7 (J-)	—	—	NA	19.2	—
RE49-10-5605	49-610025	0.0–0.5	Soil	—	—	—	—	—	NA	1.8 (J-)	—	—	NA	—	—
RE49-10-5606	49-610025	0.5–1.5	Qbt4	18.7	1900	—	—	8.6	NA	1.9 (J-)	—	—	NA	28.5	—

Table 6.6-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Lead	Magnesium	Manganese	Mercury	Nickel	Perchlorate	Selenium	Sodium	Thallium	Uranium	Vanadium	Zinc
Qbt 2,3,4 BV[a]				**11.2**	**1690**	**482**	**0.1**	**6.58**	**na[g]**	**0.3**	**2770**	**1.1**	**2.4**	**17**	**63.5**
Soil BV[a]				**22.3**	**4610**	**671**	**0.1**	**15.4**	**na**	**1.52**	**915**	**0.73**	**1.82**	**39.6**	**48.8**
Residential SSL[b]				**400**	**339,000**	**10,500**	**23.5**	**1560**	**54.8**	**391**	**7,820,000**	**0.782**	**234**	**394**	**23,500**
Industrial SSL[b]				**800**	**5,680,000**	**160,000**	**389**	**25,700**	**908**	**6490**	**35,700,000**	**13**	**3880**	**6530**	**389000**
RE49-10-5608	49-610026	0.5–1.5	Qbt4	—	—	—	—	—	NA	1.2	—	—	NA	—	—
RE49-10-5610	49-610027	0.5–1.5	Qbt4	—	—	—	—	—	NA	1.3	—	—	NA	—	—
RE49-10-5612	49-610028	0.5–1.5	Qbt4	—	—	—	—	8.5	NA	1.3	—	—	NA	—	—
RE49-10-5615	49-610030	0.0–0.5	Soil	—	—	—	—	—	NA	1.8 (U)	—	—	NA	—	—
RE49-10-5616	49-610030	0.5–1.5	Qbt4	13.3	1920	—	—	8.3	NA	0.87	—	—	NA	19.4	—
RE49-10-5617	49-610031	0.0–0.5	Soil	—	—	—	—	—	NA	1.7 (U)	—	—	NA	—	—
RE49-10-5618	49-610031	0.5–1.5	Qbt4	14.5	2100	—	—	7.4	NA	0.84	—	—	NA	21.9	—
RE49-10-10838	49-611025	0.0–0.5	Soil	—	—	904 (J-)	—	—	NA	—	—	—	NA	—	—
RE49-10-10844	49-611028	0.0–0.5	Soil	—	—	726 (J-)	—	—	NA	—	—	—	NA	—	—

Notes: All concentrations are in mg/kg. Data qualifiers are defined in Appendix A.

[a] BVs from LANL (1998, 059730).

[b] SSLs from NMED (2015, 600915) unless otherwise noted.

[c] SSL for total chromium.

[d] EPA regional screening level (http://www.epa.gov/risk/risk-based-screening-table-generic-tables).

[e] — = Not detected or not detected above BV.

[f] NA = Not analyzed.

[g] na = Not available.

Table 6.6-3
Summary of Radionuclides Detected or Detected above BVs/FVs at Area 3, SWMU 49-001(e)

Sample ID	Location ID	Depth (ft)	Media	Cesium-134	Cesium-137
Qbt 2,3,4 BV[a]				**na[b]**	**na**
Soil BV[a]				**na**	**1.65[c]**
Residential SAL[d]				**5**	**12**
Industrial SAL[d]				**17**	**41**
RE49-10-3301	49-609328	0.5–1.5	Qbt3	—[e]	0.214
RE49-10-3323	49-609336	0.5–1.5	Soil	0.054	—
RE49-10-5561	49-610003	0.0–0.5	Soil	0.082	—

Note: All activities are in pCi/g.

[a] BVs/FVs from LANL (1998, 059730).

[b] na = Not available.

[c] FV applies to soil samples collected from 0–1 ft only.

[d] SALs from LANL (2015, 600929).

[e] — = Not detected or not detected above BV/FV.

Table 6.6-4
Summary of Pore-Gas Samples Collected and Analyses Requested at Area 3, SWMU 49-001(e)

Sample ID	Location ID	Depth (ft)	Media	Tritium	VOCs
MD49-10-12141	49-609981	77.0–79.0	Pore gas	10-2161	10-2160
MD49-10-12139	49-609981	123.25–125.25	Pore gas	10-2161	10-2160

Note: Numbers in analyte columns are request numbers.

Table 6.6-5
Summary of Organic Chemicals Detected in Pore-Gas Samples at Area 3, SWMU 49-001(e)

Sample ID	Location ID	Depth (ft)	Media	Acetone	Benzene	Butanone[2-]	Dichlorodifluoromethane	Ethylbenzene	Ethyltoluene[4-]	Styrene	Toluene	Trimethylbenzene[1,2,4-]	Trimethylbenzene[1,3,5-]	Xylene (Total)	Xylene[1,2-]	Xylene[1,3-]+Xylene[1,4-]
Residential Soil-Gas Vapor Intrusion Screening Level[a]				**32,300**	**36**	**52,100**	**1040**	**112**	**52,100[b]**	**10400**	**52,100**	**66[c]**	**66[d]**	**1040**	**1040**	**1040[e]**
MD49-10-12141	49-609981	77.0–79.0	Pore gas	29	4.9	—[f]	2.6	2.6	2.6	—	11	—	—	11	2.9	7.9
MD49-10-12139	49-609981	123.25–125.25	Pore gas	10	19	4.5	2.6	6.5	7.6	2.4	34	8.9	2.6	31	8.4	23

Note: All concentrations are in µg/m^3.

[a] Screening levels from NMED (2015, 600915) unless otherwise noted.
[b] Toluene used as a surrogate based on structural similarity.
[c] Residential air screening level from EPA regional screening levels (http://www.epa.gov/risk/risk-based-screening-table-generic-tables) divided by default attenuation factor of 0.11 (NMED 2015, 600915, p. 47).
[d] Trimethylbenzene[1,2,4-] used as a surrogate based on structural similarity.
[e] Xylenes used as a surrogate based on structural similarity.
[f] — = Not detected.

Table 6.7-1
Samples Collected and Analyses Requested at Area 4, SWMU 49-001(f)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Gamma Spectroscopy	Iodine-129	Tritium	Explosive Compounds	Isotopic Plutonium	Isotopic Uranium	Metals	Perchlorate	Strontium-90	SVOCs	Technetium-99	Uranium	VOCs	Cyanide
SWMU 49-001(f)																		
0549-95-0232	49-04000	0.0–0.5	Soil	—*	841	—	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0233	49-04001	0.0–0.5	Soil	—	841	—	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0234	49-04002	0.0–0.5	Soil	—	841	—	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0235	49-04003	0.0–0.5	Soil	—	841	—	—	—	841	—	840	—	—	—	—	841	—	—
0549-95-0236	49-04004	0.0–0.5	Soil	—	841	—	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0237	49-04005	0.0–0.5	Soil	—	841	—	—	—	841	—	840	—	—	—	—	841	—	—
0549-95-0238	49-04006	0.0–0.5	Soil	—	841	—	—	—	841	—	840	—	—	—	—	841	—	—
0549-95-0239	49-04007	0.0–0.5	Soil	—	841	—	—	—	841	—	840	—	—	—	—	841	—	—
0549-95-0240	49-04008	0.0–0.5	Soil	—	841	—	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0241	49-04009	0.0–0.5	Soil	—	841	—	—	—	841	—	840	—	—	—	—	841	—	—
0549-95-0242	49-04010	0.0–0.5	Soil	—	841	—	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0243	49-04011	0.0–0.5	Soil	—	841	—	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0244	49-04012	0.0–0.5	Soil	—	841	—	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0245	49-04013	0.0–0.5	Soil	—	841	—	—	—	841	—	840	—	—	—	—	841	—	—
0549-95-0246	49-04014	0.0–0.5	Soil	—	841	—	—	—	841	—	840	—	—	—	—	841	—	—
0549-95-0247	49-04015	0.0–0.5	Soil	—	841	—	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0248	49-04016	0.0–0.5	Soil	—	841	—	—	—	841	—	840	—	—	—	—	841	—	—
0549-95-0249	49-04017	0.0–0.5	Soil	—	841	—	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0250	49-04018	0.0–0.5	Soil	—	841	—	—	—	841	—	840	—	—	—	—	841	—	—
0549-95-0251	49-04019	0.0–0.5	Soil	—	841	—	—	—	841	—	—	—	—	—	—	841	—	—
RE49-10-4287	49-609657	0.0–0.5	Soil	10-1043	10-1043	—	—	—	10-1043	10-1043	10-1043	—	—	—	—	—	—	—
RE49-10-4288	49-609657	0.5–1.5	Qbt4	10-1043	10-1043	—	—	—	10-1043	10-1043	10-1043	—	—	—	—	—	—	—
RE49-10-4289	49-609658	0.0–0.5	Soil	10-1043	10-1043	—	—	—	10-1043	10-1043	10-1043	—	—	—	—	—	—	—
RE49-10-4290	49-609658	0.5–1.5	Soil	10-1043	10-1043	—	—	—	10-1043	10-1043	10-1043	—	—	—	—	—	—	—
RE49-10-4291	49-609659	0.0–0.5	Soil	10-1043	10-1043	—	—	—	10-1043	10-1043	10-1043	—	—	—	—	—	—	—
RE49-10-4292	49-609659	0.5–1.5	Soil	10-1043	10-1043	—	—	—	10-1043	10-1043	10-1043	—	—	—	—	—	—	—
RE49-10-4293	49-609660	0.0–0.5	Soil	10-1043	10-1043	—	—	—	10-1043	10-1043	10-1043	—	—	—	—	—	—	—
RE49-10-4294	49-609660	0.5–1.5	Soil	10-1043	10-1043	—	—	—	10-1043	10-1043	10-1043	—	—	—	—	—	—	—
RE49-10-4295	49-609661	0.0–0.5	Soil	10-1043	10-1043	—	—	—	10-1043	10-1043	10-1043	—	—	—	—	—	—	—
RE49-10-4296	49-609661	0.5–1.5	Soil	10-1043	10-1043	—	—	—	10-1043	10-1043	10-1043	—	—	—	—	—	—	—
RE49-10-4297	49-609662	0.0–0.5	Soil	10-1043	10-1043	—	—	—	10-1043	10-1043	10-1043	—	—	—	—	—	—	—
RE49-10-4298	49-609662	0.5–1.5	Soil	10-1043	10-1043	—	—	—	10-1043	10-1043	10-1043	—	—	—	—	—	—	—
RE49-10-4299	49-609663	0.0–0.5	Soil	10-1043	10-1043	—	—	—	10-1043	10-1043	10-1043	—	—	—	—	—	—	—
RE49-10-4300	49-609663	0.5–1.5	Soil	10-1043	10-1043	—	—	—	10-1043	10-1043	10-1043	—	—	—	—	—	—	—
RE49-10-4301	49-609664	0.0–0.5	Soil	10-1043	10-1043	—	—	—	10-1043	10-1043	10-1043	—	—	—	—	—	—	—
RE49-10-4302	49-609664	0.5–1.5	Soil	10-1043	10-1043	—	—	—	10-1043	10-1043	10-1043	—	—	—	—	—	—	—

Table 6.7-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Gamma Spectroscopy	Iodine-129	Tritium	Explosive Compounds	Isotopic Plutonium	Isotopic Uranium	Metals	Perchlorate	Strontium-90	SVOCs	Technetium-99	Uranium	VOCs	Cyanide
RE49-10-4307	49-609665	0.0–0.5	Soil	10-1040	10-1040	10-1040	—	—	10-1040	10-1040	10-1040	—	10-1040	—	10-1040	—	—	—
RE49-10-4308	49-609665	0.5–1.5	Soil	10-1040	10-1040	10-1040	—	—	10-1040	10-1040	10-1040	—	10-1040	—	10-1040	—	—	—
RE49-10-4309	49-609666	0.0–0.5	Soil	10-1040	10-1040	—	—	—	10-1040	10-1040	10-1040	—	—	—	—	—	—	—
RE49-10-4310	49-609666	0.5–1.5	Qbt4	10-1040	10-1040	—	—	—	10-1040	10-1040	10-1040	—	—	—	—	—	—	—
RE49-10-4311	49-609667	0.0–0.5	Soil	10-1040	10-1040	—	—	—	10-1040	10-1040	10-1040	—	—	—	—	—	—	—
RE49-10-4312	49-609667	0.5–1.5	Soil	10-1040	10-1040	—	—	—	10-1040	10-1040	10-1040	—	—	—	—	—	—	—
RE49-10-4313	49-609668	0.0–0.5	Soil	10-1040	10-1040	—	—	—	10-1040	10-1040	10-1040	—	—	—	—	—	—	—
RE49-10-4314	49-609668	0.5–1.5	Soil	10-1040	10-1040	—	—	—	10-1040	10-1040	10-1040	—	—	—	—	—	—	—
RE49-10-4315	49-609669	0.0–0.5	Soil	10-1040	10-1040	10-1040	—	—	10-1040	10-1040	10-1040	—	10-1040	—	10-1040	—	—	—
RE49-10-4316	49-609669	0.5–1.5	Qbt4	10-1040	10-1040	—	—	—	10-1040	10-1040	10-1040	—	—	—	—	—	—	—
RE49-10-4317	49-609670	0.0–0.5	Soil	10-1040	10-1040	—	—	—	10-1040	10-1040	10-1040	—	—	—	—	—	—	—
RE49-10-4318	49-609670	0.5–1.5	Soil	10-1040	10-1040	—	—	—	10-1040	10-1040	10-1040	—	—	—	—	—	—	—
RE49-10-4319	49-609671	0.0–0.5	Soil	10-1040	10-1040	—	—	—	10-1040	10-1040	10-1040	—	—	—	—	—	—	—
RE49-10-4320	49-609671	0.5–1.5	Soil	10-1040	10-1040	—	—	—	10-1040	10-1040	10-1040	—	—	—	—	—	—	—
RE49-10-4321	49-609672	0.0–0.5	Soil	10-1040	10-1040	—	—	—	10-1040	10-1040	10-1040	—	—	—	—	—	—	—
RE49-10-4322	49-609672	0.5–1.5	Soil	10-1040	10-1040	—	—	—	10-1040	10-1040	10-1040	—	—	—	—	—	—	—
RE49-10-4323	49-609673	0.0–0.5	Soil	10-1040	10-1040	—	—	—	10-1040	10-1040	10-1040	—	—	—	—	—	—	—
RE49-10-4324	49-609673	0.5–1.5	Qbt4	10-1040	10-1040	10-1040	—	—	10-1040	10-1040	10-1040	—	10-1040	—	10-1040	—	—	—
RE49-10-4325	49-609674	0.0–0.5	Soil	10-1040	10-1040	—	—	—	10-1040	10-1040	10-1040	—	—	—	—	—	—	—
RE49-10-4326	49-609674	0.5–1.5	Soil	10-1040	10-1040	—	—	—	10-1040	10-1040	10-1040	—	—	—	—	—	—	—
RE49-10-4327	49-609675	0.0–0.5	Soil	10-1040	10-1040	—	—	—	10-1040	10-1040	10-1040	—	—	—	—	—	—	—
RE49-10-4328	49-609675	0.5–1.5	Soil	10-1040	10-1040	—	—	—	10-1040	10-1040	10-1040	—	—	—	—	—	—	—
RE49-10-4329	49-609676	0.0–0.5	Soil	10-1040	10-1040	—	—	—	10-1040	10-1040	10-1040	—	—	—	—	—	—	—
RE49-10-4330	49-609676	0.5–1.5	Soil	10-1040	10-1040	—	—	—	10-1040	10-1040	10-1040	—	—	—	—	—	—	—
RE49-10-4337	49-609677	0.0–0.5	Soil	10-1039	10-1039	—	—	—	10-1039	10-1039	10-1039	—	—	—	—	—	—	—
RE49-10-4338	49-609677	0.5–1.5	Qbt4	10-1039	10-1039	—	—	—	10-1039	10-1039	10-1039	—	—	—	—	—	—	—
RE49-10-4339	49-609678	0.0–0.5	Fill	10-1039	10-1039	—	—	—	10-1039	10-1039	10-1039	—	—	—	—	—	—	—
RE49-10-4340	49-609678	0.5–1.5	Soil	10-1039	10-1039	—	—	—	10-1039	10-1039	10-1039	—	—	—	—	—	—	—
RE49-10-4341	49-609679	0.0–0.5	Qbt4	10-1039	10-1039	—	—	—	10-1039	10-1039	10-1039	—	—	—	—	—	—	—
RE49-10-4342	49-609679	0.5–1.5	Qbt4	10-1039	10-1039	10-1039	—	—	10-1039	10-1039	10-1039	—	10-1039	—	10-1039	—	—	—
RE49-10-4343	49-609680	0.0–0.5	Soil	10-1039	10-1039	—	—	—	10-1039	10-1039	10-1039	—	—	—	—	—	—	—
RE49-10-4344	49-609680	0.5–1.5	Soil	10-1039	10-1039	—	—	—	10-1039	10-1039	10-1039	—	—	—	—	—	—	—
RE49-10-4345	49-609681	0.0–0.5	Soil	10-1039	10-1039	10-1039	—	—	10-1039	10-1039	10-1039	—	10-1039	—	10-1039	—	—	—
RE49-10-4346	49-609681	0.5–1.5	Qbt4	10-1039	10-1039	—	—	—	10-1039	10-1039	10-1039	—	—	—	—	—	—	—
RE49-10-4347	49-609682	0.0–0.5	Soil	10-1039	10-1039	—	—	—	10-1039	10-1039	10-1039	—	—	—	—	—	—	—
RE49-10-4348	49-609682	0.5–1.5	Qbt4	10-1039	10-1039	—	—	—	10-1039	10-1039	10-1039	—	—	—	—	—	—	—
RE49-10-4349	49-609683	0.0–0.5	Fill	10-1039	10-1039	—	—	—	10-1039	10-1039	10-1039	—	—	—	—	—	—	—
RE49-10-4350	49-609683	0.5–1.5	Fill	10-1039	10-1039	—	—	—	10-1039	10-1039	10-1039	—	—	—	—	—	—	—

Table 6.7-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Gamma Spectroscopy	Iodine-129	Tritium	Explosive Compounds	Isotopic Plutonium	Isotopic Uranium	Metals	Perchlorate	Strontium-90	SVOCs	Technetium-99	Uranium	VOCs	Cyanide
RE49-10-4351	49-609684	0.0–0.5	Soil	10-1039	10-1039	—	—	—	10-1039	10-1039	10-1039	—	—	—	—	—	—	—
RE49-10-4352	49-609684	0.5–1.5	Soil	10-1039	10-1039	—	—	—	10-1039	10-1039	10-1039	—	—	—	—	—	—	—
RE49-10-4353	49-609685	0.0–0.5	Soil	10-1039	10-1039	—	—	—	10-1039	10-1039	10-1039	—	—	—	—	—	—	—
RE49-10-4354	49-609685	0.5–1.5	Soil	10-1039	10-1039	—	—	—	10-1039	10-1039	10-1039	—	—	—	—	—	—	—
RE49-10-4361	49-609687	0.0–0.5	Soil	—	10-1042	10-1042	—	—	—	—	—	—	10-1042	—	10-1042	—	—	—
RE49-10-4363	49-609688	0.0–0.5	Soil	—	10-1042	10-1042	—	—	—	—	—	—	10-1042	—	10-1042	—	—	—
RE49-10-4421	49-609717	0.0–0.5	Soil	—	10-1042	10-1042	—	—	—	—	—	—	10-1042	—	10-1042	—	—	—
RE49-10-4477	49-609735	0.0–0.5	Soil	—	10-1041	10-1041	—	—	—	—	—	—	10-1041	—	10-1041	—	—	—
RE49-10-4481	49-609737	0.0–0.5	Fill	—	10-1041	10-1041	—	—	—	—	—	—	10-1041	—	10-1041	—	—	—
RE49-10-4483	49-609738	0.0–0.5	Fill	—	10-1041	10-1041	—	—	—	—	—	—	10-1041	—	10-1041	—	—	—
RE49-10-4488	49-609740	0.5–1.5	Qbt4	—	10-1041	10-1041	—	—	—	—	—	—	10-1041	—	10-1041	—	—	—
RE49-10-4491	49-609742	0.0–0.5	Soil	—	10-1041	10-1041	—	—	—	—	—	—	10-1041	—	10-1041	—	—	—
RE49-10-4492	49-609742	0.5–1.5	Qbt4	—	10-1041	10-1041	—	—	—	—	—	—	10-1041	—	10-1041	—	—	—
RE49-10-4493	49-609743	0.0–0.5	Soil	—	10-1041	10-1041	—	—	—	—	—	—	10-1041	—	10-1041	—	—	—
RE49-10-4498	49-609745	0.5–1.5	Fill	—	10-1041	10-1041	—	—	—	—	—	—	10-1041	—	10-1041	—	—	—
RE49-10-4499	49-609746	0.0–0.5	Fill	—	10-1041	10-1041	—	—	—	—	—	—	10-1041	—	10-1041	—	—	—
RE49-10-4502	49-609747	0.5–1.5	Fill	—	10-1041	10-1041	—	—	—	—	—	—	10-1041	—	10-1041	—	—	—
RE49-10-4503	49-609748	0.0–0.5	Soil	—	10-1041	10-1041	—	—	—	—	—	—	10-1041	—	10-1041	—	—	—
RE49-10-4507	49-609750	0.0–0.5	Fill	—	10-1041	10-1041	—	—	—	—	—	—	10-1041	—	10-1041	—	—	—
RE49-10-4508	49-609750	0.5–1.5	Qbt4	—	10-1041	10-1041	—	—	—	—	—	—	10-1041	—	10-1041	—	—	—
RE49-10-4514	49-609753	0.5–1.5	Fill	—	10-1041	10-1041	—	—	—	—	—	—	10-1041	—	10-1041	—	—	—
RE49-10-4524	49-609758	0.5–1.5	Qbt4	—	10-1041	10-1041	—	—	—	—	—	—	10-1041	—	10-1041	—	—	—
RE49-10-8964	49-610938	0.7–2.7	Qbt4	10-1107	—	—	10-1107	10-1106	10-1107	10-1107	10-1108	10-1108	—	10-1106	—	—	10-1106	10-1108
RE49-10-8965	49-610938	63.5–65.5	Qbt3	10-1312	—	—	10-1312	10-1310	10-1312	10-1312	10-1311	10-1311	—	10-1310	—	—	10-1310	10-1311
RE49-10-8966	49-610938	106.0–108.0	Qbt3	10-1312	—	—	10-1312	10-1310	10-1312	10-1312	10-1311	10-1311	—	10-1310	—	—	10-1310	10-1311
RE49-10-8967	49-610938	156.0–158.0	Qbt3	10-1387	—	—	10-1387	10-1387	10-1387	10-1387	10-1387	10-1387	—	10-1387	—	—	10-1387	10-1387
RE49-10-8974	49-610939	2.0–3.5	Qbt4	10-1107	—	—	10-1107	10-1106	10-1107	10-1107	10-1108	10-1108	—	10-1106	—	—	10-1106	10-1108
RE49-10-8975	49-610939	66.6–68.6	Qbt3	10-1312	—	—	10-1312	10-1310	10-1312	10-1312	10-1311	10-1311	—	10-1310	—	—	10-1310	10-1311
RE49-10-8976	49-610939	106.0–108.0	Qbt3	10-1312	—	—	10-1312	10-1310	10-1312	10-1312	10-1311	10-1311	—	10-1310	—	—	10-1310	10-1311
RE49-10-8977	49-610939	156.0–158.0	Qbt3	10-1312	—	—	10-1312	10-1310	10-1312	10-1312	10-1311	10-1311	—	10-1310	—	—	10-1310	10-1311
RE49-10-8980	49-610940	0.7–2.7	Qbt4	10-1107	—	—	10-1107	10-1106	10-1107	10-1107	10-1108	10-1108	—	10-1106	—	—	10-1106	10-1108
RE49-10-8981	49-610940	72.7–74.7	Qbt3	10-1312	—	—	10-1312	10-1310	10-1312	10-1312	10-1311	10-1311	—	10-1310	—	—	10-1310	10-1311
RE49-10-8982	49-610940	110.0–113.0	Qbt3	10-1312	—	—	10-1312	10-1310	10-1312	10-1312	10-1311	10-1311	—	10-1310	—	—	10-1310	10-1311
RE49-10-8983	49-610940	156.0–158.0	Qbt3	10-1312	—	—	10-1312	10-1310	10-1312	10-1312	10-1311	10-1311	—	10-1310	—	—	10-1310	10-1311
RE49-10-8986	49-610941	1.3–3.4	Qbt4	10-1107	—	—	10-1107	10-1106	10-1107	10-1107	10-1108	10-1108	—	10-1106	—	—	10-1106	10-1108
RE49-10-8987	49-610941	70.0–72.0	Qbt3	10-1107	—	—	10-1107	10-1106	10-1107	10-1107	10-1108	10-1108	—	10-1106	—	—	10-1106	10-1108
RE49-10-8988	49-610941	105.0–107.0	Qbt3	10-1107	—	—	10-1107	10-1106	10-1107	10-1107	10-1108	10-1108	—	10-1106	—	—	10-1106	10-1108
RE49-10-8989	49-610941	156.0–158.0	Qbt3	10-1107	—	—	10-1107	10-1106	10-1107	10-1107	10-1108	10-1108	—	10-1106	—	—	10-1106	10-1108

Table 6.7-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Gamma Spectroscopy	Iodine-129	Tritium	Explosive Compounds	Isotopic Plutonium	Isotopic Uranium	Metals	Perchlorate	Strontium-90	SVOCs	Technetium-99	Uranium	VOCs	Cyanide
Overland Corridor for SWMU 49-001(f)																		
RE49-10-5649	49-610032	0.0–0.5	Soil	10-712	10-712	—	—	—	10-712	10-712	10-712	—	—	—	—	—	—	—
RE49-10-5650	49-610032	0.5–1.5	Soil	10-712	10-712	—	—	—	10-712	10-712	10-712	—	—	—	—	—	—	—
RE49-10-5651	49-610033	0.0–0.5	Soil	10-712	10-712	—	—	—	10-712	10-712	10-712	—	—	—	—	—	—	—
RE49-10-5652	49-610033	0.5–1.5	Qbt4	10-712	10-712	—	—	—	10-712	10-712	10-712	—	—	—	—	—	—	—
RE49-10-5653	49-610034	0.0–0.5	Soil	10-712	10-712	—	—	—	10-712	10-712	10-712	—	—	—	—	—	—	—
RE49-10-5654	49-610034	0.5–1.5	Soil	10-712	10-712	—	—	—	10-712	10-712	10-712	—	—	—	—	—	—	—
RE49-10-5655	49-610035	0.0–0.5	Soil	10-712	10-712	—	—	—	10-712	10-712	10-712	—	—	—	—	—	—	—
RE49-10-5656	49-610035	0.5–1.5	Soil	10-712	10-712	—	—	—	10-712	10-712	10-712	—	—	—	—	—	—	—
RE49-10-5657	49-610036	0.0–0.5	Soil	10-712	10-712	—	—	—	10-712	10-712	10-712	—	—	—	—	—	—	—
RE49-10-5658	49-610036	0.5–1.5	Qbt4	10-712	10-712	—	—	—	10-712	10-712	10-712	—	—	—	—	—	—	—
RE49-10-5659	49-610037	0.0–0.5	Soil	10-712	10-712	—	—	—	10-712	10-712	10-712	—	—	—	—	—	—	—
RE49-10-5660	49-610037	0.5–1.5	Qbt4	10-712	10-712	—	—	—	10-712	10-712	10-712	—	—	—	—	—	—	—
RE49-10-5661	49-610038	0.0–0.5	Soil	10-712	10-712	—	—	—	10-712	10-712	10-712	—	—	—	—	—	—	—
RE49-10-5662	49-610038	0.5–1.5	Soil	10-712	10-712	—	—	—	10-712	10-712	10-712	—	—	—	—	—	—	—
RE49-10-5663	49-610039	0.0–0.5	Soil	10-712	10-712	—	—	—	10-712	10-712	10-712	—	—	—	—	—	—	—
RE49-10-5664	49-610039	0.5–1.5	Soil	10-712	10-712	—	—	—	10-712	10-712	10-712	—	—	—	—	—	—	—
RE49-10-5665	49-610040	0.0–0.5	Soil	10-712	10-712	—	—	—	10-712	10-712	10-712	—	—	—	—	—	—	—
RE49-10-5666	49-610040	0.5–1.5	Qbt4	10-712	10-712	—	—	—	10-712	10-712	10-712	—	—	—	—	—	—	—
RE49-10-5667	49-610041	0.0–0.5	Soil	10-712	10-712	—	—	—	10-712	10-712	10-712	—	—	—	—	—	—	—
RE49-10-5668	49-610041	0.5–1.5	Soil	10-712	10-712	—	—	—	10-712	10-712	10-712	—	—	—	—	—	—	—
RE49-10-5669	49-610042	0.0–0.5	Soil	10-713	10-713	—	—	—	10-713	10-713	10-713	—	—	—	—	—	—	—
RE49-10-5670	49-610042	0.5–1.5	Qbt4	10-713	10-713	—	—	—	10-713	10-713	10-713	—	—	—	—	—	—	—
RE49-10-5671	49-610043	0.0–0.5	Soil	10-713	10-713	—	—	—	10-713	10-713	10-713	—	—	—	—	—	—	—
RE49-10-5672	49-610043	0.5–1.5	Qbt4	10-713	10-713	—	—	—	10-713	10-713	10-713	—	—	—	—	—	—	—
RE49-10-5673	49-610044	0.0–0.5	Soil	10-713	10-713	—	—	—	10-713	10-713	10-713	—	—	—	—	—	—	—
RE49-10-5674	49-610044	0.5–1.5	Soil	10-713	10-713	—	—	—	10-713	10-713	10-713	—	—	—	—	—	—	—
RE49-10-5675	49-610045	0.0–0.5	Soil	10-713	10-713	—	—	—	10-713	10-713	10-713	—	—	—	—	—	—	—
RE49-10-5676	49-610045	0.5–1.5	Soil	10-713	10-713	—	—	—	10-713	10-713	10-713	—	—	—	—	—	—	—
RE49-10-5677	49-610046	0.0–0.5	Soil	10-713	10-713	—	—	—	10-713	10-713	10-713	—	—	—	—	—	—	—
RE49-10-5678	49-610046	0.5–1.5	Soil	10-713	10-713	—	—	—	10-713	10-713	10-713	—	—	—	—	—	—	—
RE49-10-5679	49-610047	0.0–0.5	Soil	10-713	10-713	—	—	—	10-713	10-713	10-713	—	—	—	—	—	—	—
RE49-10-5680	49-610047	0.5–1.5	Soil	10-713	10-713	—	—	—	10-713	10-713	10-713	—	—	—	—	—	—	—
RE49-10-5681	49-610048	0.0–0.5	Soil	10-713	10-713	—	—	—	10-713	10-713	10-713	—	—	—	—	—	—	—
RE49-10-5682	49-610048	0.5–1.5	Soil	10-713	10-713	—	—	—	10-713	10-713	10-713	—	—	—	—	—	—	—
RE49-10-5683	49-610049	0.0–0.5	Soil	10-713	10-713	—	—	—	10-713	10-713	10-713	—	—	—	—	—	—	—
RE49-10-5684	49-610049	0.5–1.5	Soil	10-713	10-713	—	—	—	10-713	10-713	10-713	—	—	—	—	—	—	—
RE49-10-5685	49-610050	0.0–0.5	Soil	10-713	10-713	—	—	—	10-713	10-713	10-713	—	—	—	—	—	—	—

Table 6.7-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Gamma Spectroscopy	Iodine-129	Tritium	Explosive Compounds	Isotopic Plutonium	Isotopic Uranium	Metals	Perchlorate	Strontium-90	SVOCs	Technetium-99	Uranium	VOCs	Cyanide
RE49-10-5686	49-610050	0.5–1.5	Soil	10-713	10-713	—	—	—	10-713	10-713	10-713	—	—	—	—	—	—	—
RE49-10-5687	49-610051	0.0–0.5	Soil	10-713	10-713	—	—	—	10-713	10-713	10-713	—	—	—	—	—	—	—
RE49-10-5688	49-610051	0.5–1.5	Soil	10-713	10-713	—	—	—	10-713	10-713	10-713	—	—	—	—	—	—	—
RE49-10-5689	49-610052	0.0–0.5	Soil	10-714	10-714	—	—	—	10-714	10-714	10-714	—	—	—	—	—	—	—
RE49-10-5690	49-610052	0.5–1.5	Soil	10-714	10-714	—	—	—	10-714	10-714	10-714	—	—	—	—	—	—	—
RE49-10-5691	49-610053	0.0–0.5	Soil	10-714	10-714	—	—	—	10-714	10-714	10-714	—	—	—	—	—	—	—
RE49-10-5692	49-610053	0.5–1.5	Soil	10-714	10-714	—	—	—	10-714	10-714	10-714	—	—	—	—	—	—	—
RE49-10-5693	49-610054	0.0–0.5	Soil	10-714	10-714	—	—	—	10-714	10-714	10-714	—	—	—	—	—	—	—
RE49-10-5694	49-610054	0.5–1.5	Soil	10-714	10-714	—	—	—	10-714	10-714	10-714	—	—	—	—	—	—	—
RE49-10-5695	49-610055	0.0–0.5	Soil	10-714	10-714	—	—	—	10-714	10-714	10-714	—	—	—	—	—	—	—
RE49-10-5696	49-610055	0.5–1.5	Soil	10-714	10-714	—	—	—	10-714	10-714	10-714	—	—	—	—	—	—	—
RE49-10-5697	49-610056	0.0–0.5	Soil	10-860	10-860	—	—	—	10-860	10-860	10-860	—	—	—	—	—	—	—
RE49-10-5698	49-610056	0.5–1.5	Soil	10-860	10-860	—	—	—	10-860	10-860	10-860	—	—	—	—	—	—	—
RE49-10-5699	49-610057	0.0–0.5	Soil	10-714	10-714	—	—	—	10-714	10-714	10-714	—	—	—	—	—	—	—
RE49-10-5700	49-610057	0.5–1.5	Soil	10-714	10-714	—	—	—	10-714	10-714	10-714	—	—	—	—	—	—	—
RE49-10-5701	49-610058	0.0–0.5	Soil	10-714	10-714	—	—	—	10-714	10-714	10-714	—	—	—	—	—	—	—
RE49-10-5702	49-610058	0.5–1.5	Soil	10-714	10-714	—	—	—	10-714	10-714	10-714	—	—	—	—	—	—	—
RE49-10-5703	49-610059	0.0–0.5	Soil	10-860	10-860	—	—	—	10-860	10-860	10-860	—	—	—	—	—	—	—
RE49-10-5704	49-610059	0.5–1.5	Soil	10-860	10-860	—	—	—	10-860	10-860	10-860	—	—	—	—	—	—	—
RE49-10-5705	49-610060	0.0–0.5	Soil	10-860	10-860	—	—	—	10-860	10-860	10-860	—	—	—	—	—	—	—
RE49-10-5706	49-610060	0.5–1.5	Soil	10-860	10-860	—	—	—	10-860	10-860	10-860	—	—	—	—	—	—	—
RE49-10-5707	49-610061	0.0–0.5	Soil	10-860	10-860	—	—	—	10-860	10-860	10-860	—	—	—	—	—	—	—
RE49-10-5708	49-610061	0.5–1.5	Soil	10-860	10-860	—	—	—	10-860	10-860	10-860	—	—	—	—	—	—	—
RE49-10-5709	49-610062	0.0–0.5	Soil	10-860	10-860	—	—	—	10-860	10-860	10-860	—	—	—	—	—	—	—
RE49-10-5710	49-610062	0.5–1.5	Soil	10-860	10-860	—	—	—	10-860	10-860	10-860	—	—	—	—	—	—	—
RE49-10-5711	49-610063	0.0–0.5	Soil	10-860	10-860	—	—	—	10-860	10-860	10-860	—	—	—	—	—	—	—
RE49-10-5712	49-610063	0.5–1.5	Soil	10-860	10-860	—	—	—	10-860	10-860	10-860	—	—	—	—	—	—	—
RE49-10-5713	49-610064	0.0–0.5	Soil	10-860	10-860	—	—	—	10-860	10-860	10-860	—	—	—	—	—	—	—
RE49-10-5714	49-610064	0.5–1.5	Soil	10-860	10-860	—	—	—	10-860	10-860	10-860	—	—	—	—	—	—	—
RE49-10-5715	49-610065	0.0–0.5	Soil	10-860	10-860	—	—	—	10-860	10-860	10-860	—	—	—	—	—	—	—
RE49-10-5716	49-610065	0.5–1.5	Soil	10-860	10-860	—	—	—	10-860	10-860	10-860	—	—	—	—	—	—	—
RE49-10-5717	49-610066	0.0–0.5	Soil	10-860	10-860	—	—	—	10-860	10-860	10-860	—	—	—	—	—	—	—
RE49-10-5718	49-610066	0.5–1.5	Soil	10-860	10-860	—	—	—	10-860	10-860	10-860	—	—	—	—	—	—	—
RE49-10-5719	49-610067	0.0–0.5	Soil	10-860	10-860	—	—	—	10-860	10-860	10-860	—	—	—	—	—	—	—
RE49-10-5720	49-610067	0.5–1.5	Soil	10-860	10-860	—	—	—	10-860	10-860	10-860	—	—	—	—	—	—	—
RE49-10-10850	49-611030	0.0–0.5	Soil	10-1524	10-1524	—	—	—	10-1524	10-1524	10-1524	—	—	—	—	—	—	—
RE49-10-10851	49-611030	0.5–1.5	Soil	10-1524	10-1524	—	—	—	10-1524	10-1524	10-1524	—	—	—	—	—	—	—
RE49-10-10852	49-611031	0.0–0.5	Soil	10-1524	10-1524	—	—	—	10-1524	10-1524	10-1524	—	—	—	—	—	—	—

Table 6.7-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Gamma Spectroscopy	Iodine-129	Tritium	Explosive Compounds	Isotopic Plutonium	Isotopic Uranium	Metals	Perchlorate	Strontium-90	SVOCs	Technetium-99	Uranium	VOCs	Cyanide
RE49-10-10853	49-611031	0.5–1.5	Soil	10-1524	10-1524	—	—	—	10-1524	10-1524	10-1524	—	—	—	—	—	—	—
RE49-10-10854	49-611032	0.0–0.5	Soil	10-1524	10-1524	—	—	—	10-1524	10-1524	10-1524	—	—	—	—	—	—	—
RE49-10-10855	49-611032	0.5–1.5	Soil	10-1524	10-1524	—	—	—	10-1524	10-1524	10-1524	—	—	—	—	—	—	—
RE49-10-10856	49-611033	0.0–0.5	Soil	10-1524	10-1524	—	—	—	10-1524	10-1524	10-1524	—	—	—	—	—	—	—
RE49-10-10857	49-611033	0.5–1.5	Soil	10-1524	10-1524	—	—	—	10-1524	10-1524	10-1524	—	—	—	—	—	—	—
RE49-10-10858	49-611034	0.0–0.5	Soil	10-1524	10-1524	—	—	—	10-1524	10-1524	10-1524	—	—	—	—	—	—	—
RE49-10-10859	49-611034	0.5–1.5	Soil	10-1525	10-1525	—	—	—	10-1525	10-1525	10-1525	—	—	—	—	—	—	—
RE49-10-10932	49-611066	0.0–0.5	Qbt4	—	10-1788	10-1788	—	—	—	—	—	—	10-1788	—	10-1788	—	—	—

Note: Numbers in analyte columns are request numbers.

*— = Analysis not requested.

Table 6.7-2
Summary of Inorganic Chemicals Detected or Detected above BVs at Area 4, SWMU 49-001(f)

Sample ID	Location ID	Depth (ft)	Media	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Cyanide (Total)	Iron
Qbt 2,3,4 BV[a]				**7340**	**0.5**	**2.79**	**46**	**1.21**	**1.63**	**2200**	**7.14**	**3.14**	**4.66**	**0.5**	**14500**
Soil BV[a]				**29,200**	**0.83**	**8.17**	**295**	**1.83**	**0.4**	**6120**	**19.3**	**8.64**	**14.7**	**0.5**	**21,500**
Residential SSL[b]				**78,000**	**31.3**	**4.25**	**15,600**	**156**	**70.5**	**13,000,000**	**96.6[c]**	**23[d]**	**3130**	**11.2**	**54,800**
Industrial SSL[b]				**1,290,000**	**519**	**21.5**	**255,000**	**2580**	**1110**	**32,400,000**	**505[c]**	**350[d]**	**51,900**	**63.3**	**908,000**
SWMU 49-001(f)															
0549-95-0235	49-04003	0.0–0.5	Soil	—[e]	—	—	—	—	—	—	—	—	28.4	NA[f]	—
0549-95-0237	49-04005	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
0549-95-0238	49-04006	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
0549-95-0239	49-04007	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
0549-95-0241	49-04009	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
0549-95-0245	49-04013	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
0549-95-0246	49-04014	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
0549-95-0248	49-04016	0.0–0.5	Soil	—	—	—	—	—	0.42 (J)	—	—	—	25.8 (J)	NA	—
0549-95-0250	49-04018	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-4287	49-609657	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-4288	49-609657	0.5–1.5	Qbt4	—	—	—	76.2	—	—	—	7.7	—	—	NA	—
RE49-10-4293	49-609660	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-4294	49-609660	0.5–1.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-4297	49-609662	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-4299	49-609663	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-4301	49-609664	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-4310	49-609666	0.5–1.5	Qbt4	—	—	—	84.8	—	—	—	—	—	—	NA	—
RE49-10-4312	49-609667	0.5–1.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-4313	49-609668	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-4314	49-609668	0.5–1.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-4316	49-609669	0.5–1.5	Qbt4	—	—	—	64.7	—	—	—	7.9 (J-)	—	—	NA	—
RE49-10-4317	49-609670	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-4324	49-609673	0.5–1.5	Qbt4	10,500 (J+)	—	3.6	130	—	—	2930	11.3 (J-)	3.5	5.8	NA	14,900
RE49-10-4326	49-609674	0.5–1.5	Soil	—	—	—	—	—	—	7040	—	—	—	NA	—
RE49-10-4330	49-609676	0.5–1.5	Soil	—	—	—	435	—	—	—	—	—	—	NA	—
RE49-10-4338	49-609677	0.5–1.5	Qbt4	—	—	—	50	—	—	—	—	—	—	NA	—
RE49-10-4339	49-609678	0.0–0.5	Fill	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-4341	49-609679	0.0–0.5	Qbt4	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-4342	49-609679	0.5–1.5	Qbt4	—	—	—	—	—	—	—	7.7	—	—	NA	—
RE49-10-4344	49-609680	0.5–1.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—

Table 6.7-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Cyanide (Total)	Iron
Qbt 2,3,4 BV[a]				**7340**	**0.5**	**2.79**	**46**	**1.21**	**1.63**	**2200**	**7.14**	**3.14**	**4.66**	**0.5**	**14,500**
Soil BV[a]				**29,200**	**0.83**	**8.17**	**295**	**1.83**	**0.4**	**6120**	**19.3**	**8.64**	**14.7**	**0.5**	**21,500**
Residential SSL[b]				**78,000**	**31.3**	**4.25**	**15,600**	**156**	**70.5**	**13,000,000**	**96.6[c]**	**23[d]**	**3130**	**11.2**	**54,800**
Industrial SSL[b]				**1,290,000**	**519**	**21.5**	**255,000**	**2580**	**1110**	**32,400,000**	**505[c]**	**350[d]**	**51,900**	**63.3**	**908,000**
RE49-10-4345	49-609681	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-4346	49-609681	0.5–1.5	Qbt4	9650	—	4.6 (J)	103	—	—	—	8.9	3.6	5.4 (J)	NA	—
RE49-10-4348	49-609682	0.5–1.5	Qbt4	21,500	—	6.7	140	—	—	2350	20.1	3.3	5.1 (J)	NA	—
RE49-10-4350	49-609683	0.5–1.5	Fill	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-4352	49-609684	0.5–1.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-4353	49-609685	0.0–0.5	Soil	—	—	—	305	—	—	—	—	—	—	NA	—
RE49-10-4354	49-609685	0.5–1.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-8964	49-610938	0.7–2.7	Qbt4	8730	—	3.3	163	—	—	3880 (J)	—	—	—	0.55 (UJ)	—
RE49-10-8965	49-610938	63.5–65.5	Qbt3	—	—	—	—	—	—	—	—	—	—	—	—
RE49-10-8966	49-610938	106.0–108.0	Qbt3	—	—	—	—	—	—	—	—	—	—	—	—
RE49-10-8967	49-610938	156.0–158.0	Qbt3	—	—	—	—	—	—	—	—	—	—	—	—
RE49-10-8974	49-610939	2.0–3.5	Qbt4	—	—	—	118	—	—	5660 (J)	—	—	—	0.55 (UJ)	—
RE49-10-8975	49-610939	66.6–68.6	Qbt3	—	—	—	—	—	—	—	—	—	—	—	—
RE49-10-8976	49-610939	106.0–108.0	Qbt3	—	—	—	—	—	—	—	—	—	—	—	—
RE49-10-8977	49-610939	156.0–158.0	Qbt3	—	—	—	—	—	—	—	—	—	—	—	—
RE49-10-8980	49-610940	0.7–2.7	Qbt4	13,500	—	2.9	291	—	—	6420 (J)	—	—	—	0.56 (UJ)	—
RE49-10-8981	49-610940	72.7–74.7	Qbt3	—	—	—	—	—	—	—	—	—	—	—	—
RE49-10-8982	49-610940	110.0–113.0	Qbt3	—	—	—	—	—	—	—	—	—	—	—	—
RE49-10-8983	49-610940	156.0–158.0	Qbt3	—	—	—	—	—	—	—	—	—	—	—	—
RE49-10-8986	49-610941	1.3–3.4	Qbt4	—	0.52 (U)	—	—	—	—	—	—	—	—	0.52 (UJ)	—
RE49-10-8987	49-610941	70.0–72.0	Qbt3	—	—	—	—	—	—	—	—	—	—	—	—
RE49-10-8988	49-610941	105.0–107.0	Qbt3	—	0.51 (U)	—	—	—	—	—	—	—	—	0.51 (U)	—
RE49-10-8989	49-610941	156.0–158.0	Qbt3	—	—	—	—	—	—	—	—	—	—	—	—
Overland Corridor for SWMU 49-001(f)															
RE49-10-5649	49-610032	0.0–0.5	Soil	—	—	—	—	—	—	—	—	10.3	—	NA	—
RE49-10-5650	49-610032	0.5–1.5	Soil	—	—	—	—	—	—	—	—	15.3	—	NA	—
RE49-10-5652	49-610033	0.5–1.5	Qbt4	13,300	—	—	176	—	—	3470 (J+)	10.2	6.3	6.2	NA	—
RE49-10-5654	49-610034	0.5–1.5	Soil	—	—	—	—	—	—	—	—	9.3	—	NA	—
RE49-10-5656	49-610035	0.5–1.5	Soil	—	—	—	365	—	—	—	—	—	—	NA	—
RE49-10-5657	49-610036	0.0–0.5	Soil	—	—	—	—	—	—	—	—	8.7	—	NA	—
RE49-10-5658	49-610036	0.5–1.5	Qbt4	14,700	—	3.4	242	—	—	3280 (J+)	11.2	5.9	6.9	NA	—
RE49-10-5660	49-610037	0.5–1.5	Qbt4	12,800	—	—	140	—	—	—	9.1	4.8	5.9	NA	—
RE49-10-5666	49-610040	0.5–1.5	Qbt4	21,800	—	4.9	311	1.4	—	2800 (J+)	12.5	4.9	7.2	NA	—
RE49-10-5670	49-610042	0.5–1.5	Qbt4	15,900	—	4.4	159 (J+)	1.4	—	3250	12	5 (J)	6.9	NA	—

Table 6.7-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Cyanide (Total)	Iron
Qbt 2,3,4 BV[a]				**7340**	**0.5**	**2.79**	**46**	**1.21**	**1.63**	**2200**	**7.14**	**3.14**	**4.66**	**0.5**	**14,500**
Soil BV[a]				**29,200**	**0.83**	**8.17**	**295**	**1.83**	**0.4**	**6120**	**19.3**	**8.64**	**14.7**	**0.5**	**21,500**
Residential SSL[b]				**78,000**	**31.3**	**4.25**	**15,600**	**156**	**70.5**	**13,000,000**	**96.6[c]**	**23[d]**	**3130**	**11.2**	**54,800**
Industrial SSL[b]				**1,290,000**	**519**	**21.5**	**255,000**	**2580**	**1110**	**32,400,000**	**505[c]**	**350[d]**	**51,900**	**63.3**	**908,000**
RE49-10-5672	49-610043	0.5–1.5	Qbt4	13,800	—	3	90.4 (J+)	—	—	2480	11	5 (J)	4.9	NA	—
RE49-10-5675	49-610045	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-5685	49-610050	0.0–0.5	Soil	—	—	—	328 (J+)	—	—	—	—	—	—	NA	—
RE49-10-5697	49-610056	0.0–0.5	Soil	—	—	—	—	—	—	—	—	18.1 (J)	—	NA	—
RE49-10-5698	49-610056	0.5–1.5	Soil	—	—	—	—	—	—	9110 (J+)	—	—	—	NA	—
RE49-10-5699	49-610057	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-5700	49-610057	0.5–1.5	Soil	—	—	—	—	—	—	—	—	11.6	—	NA	—
RE49-10-5704	49-610059	0.5–1.5	Soil	—	—	—	—	—	—	—	—	15.8 (J)	—	NA	—
RE49-10-5705	49-610060	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-5706	49-610060	0.5–1.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-5709	49-610062	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	125	NA	—
RE49-10-5710	49-610062	0.5–1.5	Soil	—	—	—	—	—	—	—	—	—	22.1	NA	—
RE49-10-5711	49-610063	0.0–0.5	Soil	—	—	—	—	—	—	—	—	9.6 (J)	—	NA	—
RE49-10-5712	49-610063	0.5–1.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-5713	49-610064	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-5716	49-610065	0.5–1.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-5717	49-610066	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
RE49-10-5720	49-610067	0.5–1.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—

Table 6.7-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Lead	Magnesium	Manganese	Mercury	Nickel	Selenium	Thallium	Uranium	Vanadium	Zinc
Qbt 2,3,4 BV[a]				**11.2**	**1690**	**482**	**0.1**	**6.58**	**0.3**	**1.1**	**2.4**	**17**	**63.5**
Soil BV[a]				**22.3**	**4610**	**671**	**0.1**	**15.4**	**1.52**	**0.73**	**1.82**	**39.6**	**48.8**
Residential SSL[b]				**400**	**339,000**	**10,500**	**23.5**	**1560**	**391**	**0.782**	**234**	**394**	**23,500**
Industrial SSL[b]				**800**	**5,680,000**	**160,000**	**389**	**25,700**	**6490**	**13**	**3880**	**6530**	**389,000**
SWMU 49-001(f)													
0549-95-0235	49-04003	0.0–0.5	Soil	—	—	—	—	—	—	1.2 (U)	—	—	—
0549-95-0237	49-04005	0.0–0.5	Soil	—	—	—	—	—	—	1.4 (U)	—	—	—
0549-95-0238	49-04006	0.0–0.5	Soil	—	—	—	—	—	—	1.8 (J)	—	—	—
0549-95-0239	49-04007	0.0–0.5	Soil	—	—	—	—	—	—	1.4 (U)	—	—	—
0549-95-0241	49-04009	0.0–0.5	Soil	—	—	—	1.1 (U)	—	—	1.3 (J)	—	—	—
0549-95-0245	49-04013	0.0–0.5	Soil	—	—	—	0.11 (U)	—	—	1.3 (U)	—	—	—
0549-95-0246	49-04014	0.0–0.5	Soil	—	—	—	0.11 (U)	—	—	1.3 (U)	1.85	—	—
0549-95-0248	49-04016	0.0–0.5	Soil	51.5 (J+)	—	—	0.11 (U)	23.4	—	1.4 (U)	—	—	50.3
0549-95-0250	49-04018	0.0–0.5	Soil	—	—	—	—	—	—	1.3 (U)	—	—	—
RE49-10-4287	49-609657	0.0–0.5	Soil	31.1	—	—	—	—	1.6 (J-)	—	NA	—	—
RE49-10-4288	49-609657	0.5–1.5	Qbt4	21.8	—	—	—	—	1.3 (J-)	—	NA	—	—
RE49-10-4293	49-609660	0.0–0.5	Soil	—	—	—	—	—	1.7 (J-)	—	NA	—	—
RE49-10-4294	49-609660	0.5–1.5	Soil	—	—	—	—	—	1.7 (J-)	—	NA	—	—
RE49-10-4297	49-609662	0.0–0.5	Soil	—	—	—	—	—	1.7 (J-)	—	NA	—	—
RE49-10-4299	49-609663	0.0–0.5	Soil	43.4	—	—	—	—	1.6 (J-)	—	NA	—	—
RE49-10-4301	49-609664	0.0–0.5	Soil	—	—	—	—	—	2 (J-)	—	NA	—	—
RE49-10-4310	49-609666	0.5–1.5	Qbt4	—	—	—	—	—	1.6 (J-)	—	NA	—	—
RE49-10-4312	49-609667	0.5–1.5	Soil	—	—	—	—	—	1.6 (J-)	—	NA	—	—
RE49-10-4313	49-609668	0.0–0.5	Soil	36.3	—	—	—	—	—	—	NA	—	196
RE49-10-4314	49-609668	0.5–1.5	Soil	—	—	—	—	—	—	—	NA	—	90.3 (J+)
RE49-10-4316	49-609669	0.5–1.5	Qbt4	—	—	—	—	—	0.92 (J-)	—	NA	—	—
RE49-10-4317	49-609670	0.0–0.5	Soil	—	—	—	—	—	—	1.1 (U)	NA	—	—
RE49-10-4324	49-609673	0.5–1.5	Qbt4	20.7	1990	—	—	9.4	1.3 (J-)	—	NA	19	—
RE49-10-4326	49-609674	0.5–1.5	Soil	—	—	—	—	—	1.6 (J-)	—	NA	—	—
RE49-10-4330	49-609676	0.5–1.5	Soil	—	—	—	—	—	—	—	NA	—	—
RE49-10-4338	49-609677	0.5–1.5	Qbt4	—	—	—	—	—	1.8 (U)	—	NA	—	—
RE49-10-4339	49-609678	0.0–0.5	Fill	—	—	—	—	—	1.8 (U)	—	NA	—	—
RE49-10-4341	49-609679	0.0–0.5	Qbt4	—	—	—	—	—	1.6 (U)	—	NA	—	—
RE49-10-4342	49-609679	0.5–1.5	Qbt4	14.6	—	—	—	7.3	1.9 (U)	—	NA	—	—
RE49-10-4344	49-609680	0.5–1.5	Soil	—	—	—	—	—	1.7 (U)	—	NA	—	—

Table 6.7-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Lead	Magnesium	Manganese	Mercury	Nickel	Selenium	Thallium	Uranium	Vanadium	Zinc
Qbt 2,3,4 BV[a]				**11.2**	**1690**	**482**	**0.1**	**6.58**	**0.3**	**1.1**	**2.4**	**17**	**63.5**
Soil BV[a]				**22.3**	**4610**	**671**	**0.1**	**15.4**	**1.52**	**0.73**	**1.82**	**39.6**	**48.8**
Residential SSL[b]				**400**	**339,000**	**10,500**	**23.5**	**1560**	**391**	**0.782**	**234**	**394**	**23,500**
Industrial SSL[b]				**800**	**5,680,000**	**160,000**	**389**	**25,700**	**6490**	**13**	**3880**	**6530**	**389,000**
RE49-10-4345	49-609681	0.0–0.5	Soil	—	—	—	—	—	1.7 (U)	—	NA	—	—
RE49-10-4346	49-609681	0.5–1.5	Qbt4	14.8	—	—	—	8.7	1.6 (U)	1.5	NA	—	—
RE49-10-4348	49-609682	0.5–1.5	Qbt4	11.8	2280 (J+)	—	—	12.7	1.6 (U)	—	NA	17.2	—
RE49-10-4350	49-609683	0.5–1.5	Fill	—	—	—	—	—	1.7 (U)	—	NA	—	—
RE49-10-4352	49-609684	0.5–1.5	Soil	—	—	—	—	—	1.7 (U)	—	NA	—	—
RE49-10-4353	49-609685	0.0–0.5	Soil	—	—	—	—	—	—	—	NA	—	—
RE49-10-4354	49-609685	0.5–1.5	Soil	—	—	—	—	—	1.8 (U)	—	NA	—	—
RE49-10-8964	49-610938	0.7–2.7	Qbt4	—	—	—	—	—	0.59	—	NA	—	—
RE49-10-8965	49-610938	63.5–65.5	Qbt3	—	—	—	—	—	0.93	—	NA	—	—
RE49-10-8966	49-610938	106.0–108.0	Qbt3	—	—	—	—	—	1.4	—	NA	—	—
RE49-10-8967	49-610938	156.0–158.0	Qbt3	—	—	—	—	—	0.74	—	NA	—	—
RE49-10-8974	49-610939	2.0–3.5	Qbt4	—	—	—	—	—	0.84	—	NA	—	—
RE49-10-8975	49-610939	66.6–68.6	Qbt3	—	—	—	—	—	0.99	—	NA	—	—
RE49-10-8976	49-610939	106.0–108.0	Qbt3	—	—	—	—	—	0.98	—	NA	—	—
RE49-10-8977	49-610939	156.0–158.0	Qbt3	—	—	—	—	—	0.91	—	NA	—	—
RE49-10-8980	49-610940	0.7–2.7	Qbt4	—	2110	—	—	—	0.57	—	NA	—	—
RE49-10-8981	49-610940	72.7–74.7	Qbt3	—	—	—	—	—	1.1	—	NA	—	—
RE49-10-8982	49-610940	110.0–113.0	Qbt3	—	—	—	—	—	1.1	—	NA	—	—
RE49-10-8983	49-610940	156.0–158.0	Qbt3	—	—	—	—	—	0.98	—	NA	—	—
RE49-10-8986	49-610941	1.3–3.4	Qbt4	—	—	—	—	—	0.55	—	NA	—	—
RE49-10-8987	49-610941	70.0–72.0	Qbt3	—	—	—	—	—	1	—	NA	—	—
RE49-10-8988	49-610941	105.0–107.0	Qbt3	—	—	—	—	—	1.2	—	NA	—	—
RE49-10-8989	49-610941	156.0–158.0	Qbt3	—	—	—	—	—	0.84	—	NA	—	—
Overland Corridor for SWMU 49-001(f)													
RE49-10-5649	49-610032	0.0–0.5	Soil	—	—	—	—	—	—	—	NA	—	—
RE49-10-5650	49-610032	0.5–1.5	Soil	—	—	887	—	—	—	—	NA	—	—
RE49-10-5652	49-610033	0.5–1.5	Qbt4	12.7	1890	—	—	7.6	1.1 (U)	—	NA	22.1	—
RE49-10-5654	49-610034	0.5–1.5	Soil	—	—	—	—	—	—	—	NA	—	—
RE49-10-5656	49-610035	0.5–1.5	Soil	—	—	—	—	—	—	0.74	NA	—	—
RE49-10-5657	49-610036	0.0–0.5	Soil	—	—	—	—	—	—	—	NA	—	—
RE49-10-5658	49-610036	0.5–1.5	Qbt4	12.4	2060	—	—	9.7	1.3 (U)	—	NA	23.7	—
RE49-10-5660	49-610037	0.5–1.5	Qbt4	11.4	1740	—	—	8.1	1.3 (U)	—	NA	19.1	—
RE49-10-5666	49-610040	0.5–1.5	Qbt4	15.3	2400	—	—	10.9	1.8 (U)	—	NA	26.4	—
RE49-10-5670	49-610042	0.5–1.5	Qbt4	17.3	2510 (J+)	—	—	10.5	1.4	—	NA	22.4	—

Table 6.7-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Lead	Magnesium	Manganese	Mercury	Nickel	Selenium	Thallium	Uranium	Vanadium	Zinc
Qbt 2,3,4 BV[a]				**11.2**	**1690**	**482**	**0.1**	**6.58**	**0.3**	**1.1**	**2.4**	**17**	**63.5**
Soil BV[a]				**22.3**	**4610**	**671**	**0.1**	**15.4**	**1.52**	**0.73**	**1.82**	**39.6**	**48.8**
Residential SSL[b]				**400**	**339,000**	**10,500**	**23.5**	**1560**	**391**	**0.782**	**234**	**394**	**23,500**
Industrial SSL[b]				**800**	**5,680,000**	**160,000**	**389**	**25,700**	**6490**	**13**	**3880**	**6530**	**389,000**
RE49-10-5672	49-610043	0.5–1.5	Qbt4	12.7	2260 (J+)	—	—	8.5	1.2	—	NA	19.2	—
RE49-10-5675	49-610045	0.0–0.5	Soil	—	—	—	—	—	—	1 (U)	NA	—	—
RE49-10-5685	49-610050	0.0–0.5	Soil	—	—	—	—	—	—	—	NA	—	—
RE49-10-5697	49-610056	0.0–0.5	Soil	—	—	1390 (J)	—	—	—	—	NA	—	—
RE49-10-5698	49-610056	0.5–1.5	Soil	—	—	—	—	—	—	—	NA	—	—
RE49-10-5699	49-610057	0.0–0.5	Soil	—	—	—	—	—	—	—	NA	—	60.4
RE49-10-5700	49-610057	0.5–1.5	Soil	—	—	706	—	—	—	—	NA	—	—
RE49-10-5704	49-610059	0.5–1.5	Soil	—	—	723 (J)	—	—	—	—	NA	—	—
RE49-10-5705	49-610060	0.0–0.5	Soil	—	—	—	—	—	1.7 (J-)	—	NA	—	—
RE49-10-5706	49-610060	0.5–1.5	Soil	—	—	—	—	—	2.1 (J-)	—	NA	—	—
RE49-10-5709	49-610062	0.0–0.5	Soil	26.8	—	—	—	—	—	—	NA	—	—
RE49-10-5710	49-610062	0.5–1.5	Soil	—	—	—	—	—	—	—	NA	—	—
RE49-10-5711	49-610063	0.0–0.5	Soil	—	—	—	—	—	—	—	NA	—	—
RE49-10-5712	49-610063	0.5–1.5	Soil	—	—	—	—	—	—	0.82	NA	—	—
RE49-10-5713	49-610064	0.0–0.5	Soil	—	—	—	—	—	1.7 (J-)	—	NA	—	—
RE49-10-5716	49-610065	0.5–1.5	Soil	—	—	—	—	—	1.6 (J-)	—	NA	—	—
RE49-10-5717	49-610066	0.0–0.5	Soil	—	—	—	—	—	1.7 (J-)	—	NA	—	—
RE49-10-5720	49-610067	0.5–1.5	Soil	—	—	—	—	—	1.9 (J-)	—	NA	—	—

Notes: All concentrations are in mg/kg. Data qualifiers are defined in Appendix A.

[a] BVs from LANL (1998, 059730).

[b] SSLs from NMED (2015, 600915) unless otherwise noted.

[c] SSL for total chromium.

[d] EPA regional screening level (http://www.epa.gov/risk/risk-based-screening-table-generic-tables).

[e] — = Not detected or not detected above BV.

[f] NA = Not analyzed.

Table 6.7-3
Summary of Organic Chemicals Detected at Area 4, SWMU 49-001(f)

Sample ID	Location ID	Depth (ft)	Media	Acetone	Bis(2-ethylhexyl)phthalate
Residential SSL[a]				**66,300**	**380**
Industrial SSL[a]				**960,000**	**1830**
SWMU 49-001(f)					
RE49-10-8964	49-610938	0.7–2.7	Qbt4	—[b]	0.056 (J)
RE49-10-8966	49-610938	106.0–108.0	Qbt3	0.0076 (J)	—
RE49-10-8976	49-610939	106.0–108.0	Qbt3	0.01 (J)	—
RE49-10-8977	49-610939	156.0–158.0	Qbt3	0.0077 (J)	—
RE49-10-8986	49-610941	1.3–3.4	Qbt4	—	0.24 (J)

Notes: All concentrations are in mg/kg. Data qualifiers are defined in Appendix A.

[a] SSLs from NMED (2015, 600915).

[b] — = Not detected.

Table 6.7-4
Summary of Radionuclides Detected or Detected above BVs/FVs at Area 4, SWMU 49-001(f)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Cesium-134	Plutonium-238	Plutonium-239/240	Tritium
Qbt 2,3,4 BV[a]				**na**[b]	**na**	**na**	**na**	**na**
Soil BV[a]				**0.013**[c]	**na**	**0.023**[c]	**0.054**[c]	**na**
Residential SAL[d]				**83**	**5**	**84**	**79**	**1700**
Industrial SAL[d]				**1000**	**17**	**1300**	**1200**	**2,400,000**
0549-95-0235	49-04003	0.0–0.5	Soil	NA[e]	NA	0.03432	—[f]	NA
0549-95-0238	49-04006	0.0–0.5	Soil	NA	NA	—	0.05837	NA
0549-95-0239	49-04007	0.0–0.5	Soil	NA	NA	—	0.1008	NA
0549-95-0246	49-04014	0.0–0.5	Soil	NA	NA	0.06285	0.08287	NA
0549-95-0251	49-04019	0.0–0.5	Soil	NA	NA	0.03798	0.2126	NA

Table 6.7-4 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Cesium-134	Plutonium-238	Plutonium-239/240	Tritium
Qbt 2,3,4 BV[a]				**na**[b]	**na**	**na**	**na**	**na**
Soil BV[a]				**0.013**[c]	**na**	**0.023**[c]	**0.054**[c]	**na**
Residential SAL[d]				**83**	**5**	**84**	**79**	**1700**
Industrial SAL[d]				**1000**	**17**	**1300**	**1200**	**2,400,000**
RE49-10-4299	49-609663	0.0–0.5	Soil	—	—	—	0.112	NA
RE49-10-4301	49-609664	0.0–0.5	Soil	—	—	—	0.215	NA
RE49-10-4302	49-609664	0.5–1.5	Soil	—	—	—	0.055	NA
RE49-10-4321	49-609672	0.0–0.5	Soil	0.038	—	—	—	NA
RE49-10-4322	49-609672	0.5–1.5	Soil	0.058	—	—	—	NA
RE49-10-4327	49-609675	0.0–0.5	Soil	—	—	—	0.166	NA
RE49-10-5651	49-610033	0.0–0.5	Soil	—	0.062	—	—	NA
RE49-10-8964	49-610938	0.7–2.7	Qbt4	—	NA	—	—	0.176
RE49-10-8965	49-610938	63.5–65.5	Qbt3	—	NA	—	—	4.11
RE49-10-8975	49-610939	66.6–68.6	Qbt3	—	NA	—	—	1.83
RE49-10-8982	49-610940	110.0–113.0	Qbt3	—	NA	—	—	0.255
RE49-10-8983	49-610940	156.0–158.0	Qbt3	—	NA	—	—	0.288
RE49-10-8986	49-610941	1.3–3.4	Qbt4	—	NA	—	—	8.39
RE49-10-8987	49-610941	70.0–72.0	Qbt3	—	NA	—	—	1.67
RE49-10-8988	49-610941	105.0–107.0	Qbt3	—	NA	—	—	1.48

Note: All activities are in pCi/g.

[a] BVs/FVs from LANL (1998, 059730).

[b] na = Not available.

[c] FV applies to soil samples collected from 0–1 ft only.

[d] SALs from LANL (2015, 600929).

[e] NA = Not analyzed.

[f] — = Not detected or not detected above BV/FV.

Table 6.7-5
Summary of Pore-Gas Samples Collected and Analyses Requested at Area 4, SWMU 49-001(f)

Sample ID	Location ID	Depth (ft)	Media	Tritium	VOCs
MD49-10-12146	49-610939	62.0–64.0	Pore gas	10-2161	10-2160
MD49-10-12145	49-610939	107.0–109.0	Pore gas	10-2161	10-2160
MD49-10-12142	49-610939	133.0–135.0	Pore gas	10-2161	10-2160

Note: Numbers in analyte columns are request numbers.

Table 6.7-6
Summary of Organic Chemicals Detected in Pore-Gas Samples at Area 4, SWMU 49-001(f)

Sample ID	Location ID	Depth (ft)	Media	Acetone	Benzene	Butanone[2-]	Chloromethane	Dichlorodifluoromethane	Ethylbenzene	Ethyltoluene[4-]	Styrene	Toluene	Trimethylbenzene[1,2,4-]	Trimethylbenzene[1,3,5-]	Xylene (Total)	Xylene[1,2-]	Xylene[1,3-]+Xylene[1,4-]
Residential Soil-Gas Vapor Intrusion Screening Level[a]				**32,300**	**36**	**52,100**	**156**	**1040**	**112**	**52,100[b]**	**10,400**	**52,100**	**66[c]**	**66[d]**	**1040**	**1040**	**1040[e]**
MD49-10-12146	49-610939	62.0–64.0	Pore gas	8.8	11	4	1.7 (J+)	2.8	6.9	11	2.8	30	14	4	34	9.4	25
MD49-10-12145	49-610939	107.0–109.0	Pore gas	14	37	6.3	1.7 (J+)	2.9	17	14	4.9	100	15	4.6	78	19	58
MD49-10-12142	49-610939	133.0–135.0	Pore gas	8.9	13	3.5	1.9 (J+)	2.8	6.9	8.5	2.5	34	9.9	3	33	8.6	24

Notes: All concentrations are in mg/kg. Data qualifiers are defined in Appendix A.

[a] Screening levels from NMED (2015, 600915) unless otherwise noted.

[b] Toluene used as a surrogate based on structural similarity..

[c] Residential air screening level from EPA regional screening levels (http://www.epa.gov/risk/risk-based-screening-table-generic-tables) divided by default attenuation factor of 0.11 (NMED 2015, 600915, p. 47).

[d] Trimethylbenzene[1,2,4-] used as a surrogate based on structural similarity.

[e] Xylenes used as a surrogate based on structural similarity.

Table 6.7-7
Summary of Tritium in Pore-Gas Samples at Area 4, SWMU 49-001(f)

Sample ID	Location ID	Depth (ft)	Media	Tritium
MD49-10-12146	49-610939	62.0–64.0	Pore gas	67,776.4
MD49-10-12145	49-610939	107.0–109.0	Pore gas	10,444.4
MD49-10-12142	49-610939	133.0–135.0	Pore gas	5946.37

Note: All activities are in pCi/L.

Table 6.9-1
Samples Collected and Analyses Requested at Area 11, SWMU 49-003

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Gamma Spectroscopy	Iodine-129	Tritium	Explosive Compounds	Isotopic Plutonium	Isotopic Uranium	Metals	Perchlorate	Strontium-90	SVOCs	Technetium-99	Uranium	VOCs	Cyanide
0549-95-0059	49-08027	1.0–1.5	Soil	—*	680	—	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0062	49-08028	2.5–3.5	Qbt4	—	680	—	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0065	49-08029	0.8–2.0	Soil	—	680	—	—	—	680	—	679	—	—	—	—	680	—	—
0549-95-0072	49-08031	3.3–4.3	Qbt4	—	680	—	—	—	680	—	679	—	—	—	—	680	—	—
0549-95-0075	49-08032	3.3–4.3	Qbt4	—	680	—	—	—	680	—	679	—	—	—	—	680	—	—
0549-95-0078	49-08033	3.0–3.5	Qbt4	—	680	—	—	—	680	—	679	—	—	—	—	680	—	—
0549-95-0081	49-08034	2.5–3.5	Qbt4	—	680	—	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0084	49-08037	2.5–3.5	Soil	—	680	—	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0087	49-08038	2.5–3.5	Qbt4	—	680	—	—	—	680	—	679	—	—	—	—	680	—	—
0549-95-0090	49-08039	2.8–3.8	Soil	—	680	—	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0093	49-08040	3.0–4.0	Soil	—	680	—	—	—	680	—	679	—	—	—	—	680	—	—
0549-95-0069	49-08041	2.3–3.3	Soil	—	680	—	—	—	—	—	—	—	—	—	—	—	—	—
RE49-10-7122	49-610496	0.0–2.0	Soil	10-985	—	10-985	10-985	10-984	10-985	10-985	10-986	10-986	10-985	10-984	10-985	—	10-984	10-986
RE49-10-7123	49-610496	7.5–10.0	Qbt4	10-873	—	10-873	10-873	10-871	10-873	10-873	10-872	10-872	10-873	10-871	10-873	—	10-871	10-872
RE49-10-7109	49-610497	0.0–2.0	Soil	10-985	—	10-985	10-985	10-984	10-985	10-985	10-986	10-986	10-985	10-984	10-985	—	10-984	10-986
RE49-10-7110	49-610497	13.0–15.0	Qbt4	10-985	—	10-985	10-985	10-984	10-985	10-985	10-986	10-986	10-985	10-984	10-985	—	10-984	10-986
RE49-10-7111	49-610497	18.0–20.0	Qbt4	10-985	—	10-985	10-985	10-984	10-985	10-985	10-986	10-986	10-985	10-984	10-985	—	10-984	10-986
RE49-10-7112	49-610498	0.0–2.0	Soil	10-985	—	10-985	10-985	10-984	10-985	10-985	10-986	10-986	10-985	10-984	10-985	—	10-984	10-986
RE49-10-7113	49-610498	8.0–10.0	Qbt4	10-985	—	10-985	10-985	10-984	10-985	10-985	10-986	10-986	10-985	10-984	10-985	—	10-984	10-986
RE49-10-7114	49-610498	18.0–20.0	Qbt4	10-985	—	10-985	10-985	10-984	10-985	10-985	10-986	10-986	10-985	10-984	10-985	—	10-984	10-986
RE49-10-7115	49-610499	0.0–2.0	Soil	10-985	—	10-985	10-985	10-984	10-985	10-985	10-986	10-986	10-985	10-984	10-985	—	10-984	10-986
RE49-10-7116	49-610499	13.0–15.0	Qbt4	10-985	—	10-985	10-985	10-984	10-985	10-985	10-986	10-986	10-985	10-984	10-985	—	10-984	10-986
RE49-10-7117	49-610499	18.0–20.0	Qbt4	10-985	—	10-985	10-985	10-984	10-985	10-985	10-986	10-986	10-985	10-984	10-985	—	10-984	10-986
RE49-10-7118	49-610500	0.0–2.0	Soil	10-985	—	10-985	10-985	10-984	10-985	10-985	10-986	10-986	10-985	10-984	10-985	—	10-984	10-986
RE49-10-7119	49-610500	8.0–10.0	Qbt3	10-985	—	10-985	10-985	10-984	10-985	10-985	10-986	10-986	10-985	10-984	10-985	—	10-984	10-986
RE49-10-7120	49-610500	18.0–20.0	Qbt4	10-985	—	10-985	10-985	10-984	10-985	10-985	10-986	10-986	10-985	10-984	10-985	—	10-984	10-986

Note: Numbers in analyte columns are request numbers.
*— = Analysis not requested.

Table 6.9-2
Summary of Inorganic Chemicals Detected or Detected above BVs at Area 11, SWMU 49-003

Sample ID	Location ID	Depth (ft)	Media	Aluminum	Antimony	Arsenic	Barium	Beryllium	Calcium	Chromium	Cobalt	Copper	Cyanide (Total)
Qbt 2,3,4 BV[a]				**7340**	**0.5**	**2.79**	**46**	**1.21**	**2200**	**7.14**	**3.14**	**4.66**	**0.5**
Soil BV[a]				**29,200**	**0.83**	**8.17**	**295**	**1.83**	**6120**	**19.3**	**8.64**	**14.7**	**0.5**
Residential SSL[b]				**78,000**	**31.3**	**4.25**	**15,600**	**156**	**13,000,000**	**96.6**[c]	**23**[d]	**3130**	**11.2**
Industrial SSL[b]				**1,290,000**	**519**	**21.5**	**255,000**	**2580**	**32,400,000**	**505**[c]	**350**[d]	**51,900**	**63.3**
0549-95-0065	49-08029	0.8–2.0	Soil	—[e]	—	—	—	—	—	—	—	—	NA[f]
0549-95-0072	49-08031	3.3–4.3	Qbt4	14,900	0.81 (J-)	3.6	175	—	4380	8	12.2	—	NA
0549-95-0075	49-08032	3.3–4.3	Qbt4	9060	0.61 (J-)	3.4	72.2	—	2980	—	—	—	NA
0549-95-0078	49-08033	3.0–3.5	Qbt4	14,200	0.91 (J-)	4.6	147	1.5	3510	9.3	3.3 (J)	6.8	NA
0549-95-0087	49-08038	2.5–3.5	Qbt4	23,100	0.94 (J-)	4.7	431	1.7	5950	11.8	3.9 (J)	7.5	NA
0549-95-0093	49-08040	3.0–4.0	Soil	—	1 (J-)	—	407	—	6330	—	—	—	NA
RE49-10-7122	49-610496	0.0–2.0	Soil	—	—	—	—	—	—	—	9.7	—	0.57 (U)
RE49-10-7123	49-610496	7.5–10.0	Qbt4	—	—	—	—	—	—	—	—	—	0.52 (UJ)
RE49-10-7109	49-610497	0.0–2.0	Soil	—	—	—	460	—	6510 (J+)	—	9.4	—	0.58 (U)
RE49-10-7110	49-610497	13.0–15.0	Qbt4	—	—	—	93.6	—	—	—	—	12.6	0.55 (U)
RE49-10-7111	49-610497	18.0–20.0	Qbt4	—	—	3.4	—	—	—	—	—	—	0.54 (U)
RE49-10-7112	49-610498	0.0–2.0	Soil	—	—	—	—	—	—	—	—	—	0.57 (U)
RE49-10-7113	49-610498	8.0–10.0	Qbt4	—	—	—	—	—	—	—	—	—	0.53 (U)
RE49-10-7114	49-610498	18.0–20.0	Qbt4	—	—	—	—	—	—	—	—	—	0.55 (U)
RE49-10-7115	49-610499	0.0–2.0	Soil	—	—	—	—	—	—	—	—	—	0.55 (U)
RE49-10-7116	49-610499	13.0–15.0	Qbt4	—	—	—	—	—	—	—	—	—	0.51 (U)
RE49-10-7117	49-610499	18.0–20.0	Qbt4	—	—	—	—	—	—	—	—	—	0.52 (U)
RE49-10-7118	49-610500	0.0–2.0	Soil	—	—	—	—	—	—	—	—	—	0.59 (U)
RE49-10-7119	49-610500	8.0–10.0	Qbt3	—	—	—	—	—	—	—	—	—	0.53 (U)
RE49-10-7120	49-610500	18.0–20.0	Qbt4	—	—	—	—	—	—	—	—	—	0.53 (U)

Table 6.9-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Iron	Lead	Magnesium	Manganese	Nickel	Perchlorate	Selenium	Uranium	Vanadium
Qbt 2,3,4 BV[a]				**14,500**	**11.2**	**1690**	**482**	**6.58**	**na[g]**	**0.3**	**2.4**	**17**
Soil BV[a]				**21,500**	**22.3**	**4610**	**671**	**15.4**	**na**	**1.52**	**1.82**	**39.6**
Residential SSL[b]				**54,800**	**400**	**339,000**	**105,00**	**1560**	**54.8**	**391**	**234**	**394**
Industrial SSL[b]				**908,000**	**800**	**568,000**	**160,000**	**25,700**	**908**	**6490**	**3880**	**6530**
0549-95-0065	49-08029	0.8–2.0	Soil	—	—	—	—	—	NA	—	2.42	—
0549-95-0072	49-08031	3.3–4.3	Qbt4	—	22.6	2340	497 (J+)	7.8 (J)	NA	0.75 (J)	—	17.3
0549-95-0075	49-08032	3.3–4.3	Qbt4	—	—	2270	—	—	NA	0.46 (U)	—	—
0549-95-0078	49-08033	3.0–3.5	Qbt4	—	15.4	3260	—	10	NA	0.69 (J)	—	—
0549-95-0087	49-08038	2.5–3.5	Qbt4	16,600	23.5	4250	—	11.9	NA	0.54 (J)	—	20.7
0549-95-0093	49-08040	3.0–4.0	Soil	—	—	—	—	—	NA	—	1.85	—
RE49-10-7122	49-610496	0.0–2.0	Soil	—	—	—	—	—	0.0044 (J)	—	NA	—
RE49-10-7123	49-610496	7.5–10.0	Qbt4	—	—	—	—	—	0.0071	1.4 (J)	NA	—
RE49-10-7109	49-610497	0.0–2.0	Soil	—	—	—	723	15.6	0.026	2 (U)	NA	—
RE49-10-7110	49-610497	13.0–15.0	Qbt4	—	—	—	—	—	—	2 (J-)	NA	—
RE49-10-7111	49-610497	18.0–20.0	Qbt4	—	—	—	—	—	0.0023 (J)	1.7 (J-)	NA	—
RE49-10-7112	49-610498	0.0–2.0	Soil	—	—	—	—	—	—	1.6 (J-)	NA	—
RE49-10-7113	49-610498	8.0–10.0	Qbt4	—	—	—	—	—	—	1.9 (J-)	NA	—
RE49-10-7114	49-610498	18.0–20.0	Qbt4	—	—	—	—	—	0.0038 (J)	1.6 (J-)	NA	—
RE49-10-7115	49-610499	0.0–2.0	Soil	—	—	—	—	—	—	1.7 (J-)	NA	—
RE49-10-7116	49-610499	13.0–15.0	Qbt4	—	—	—	—	—	—	1.3 (J-)	NA	—
RE49-10-7117	49-610499	18.0–20.0	Qbt4	—	—	—	—	—	—	1.5 (J-)	NA	—
RE49-10-7118	49-610500	0.0–2.0	Soil	—	—	—	—	—	0.047	1.8 (J-)	NA	—
RE49-10-7119	49-610500	8.0–10.0	Qbt3	—	—	—	—	—	0.0031 (J)	1.3 (U)	NA	—
RE49-10-7120	49-610500	18.0–20.0	Qbt4	—	—	—	—	—	—	1.5 (J-)	NA	—

Notes: All concentrations are in mg/kg. Data qualifiers are defined in Appendix A.

[a] BVs from LANL (1998, 059730).

[b] SSLs from NMED (2015, 600915) unless otherwise noted.

[c] SSL for total chromium.

[d] EPA regional screening level (http://www.epa.gov/risk/risk-based-screening-table-generic-tables).

[e] — = Not detected or not detected above BV.

[f] NA = Not analyzed.

[g] na = Not available.

Table 6.9-3
Summary of Organic Chemicals Detected at Area 11, SWMU 49-003

Sample ID	Location ID	Depth (ft)	Media	Acetone	Benzyl Alcohol	Bis(2-ethylhexyl)phthalate	Methylene Chloride
Residential SSL[a]				**66300**	**6300[b]**	**380**	**409**
Industrial SSL[a]				**960000**	**82000[b]**	**1830**	**5130**
RE49-10-7123	49-610496	7.5–10.0	Qbt4	—[c]	0.056 (J)	—	—
RE49-10-7109	49-610497	0.0–2.0	Soil	—	—	—	0.0028 (J)
RE49-10-7113	49-610498	8.0–10.0	Qbt4	—	—	0.051 (J)	—
RE49-10-7114	49-610498	18.0–20.0	Qbt4	0.009 (J)	—	—	—
RE49-10-7117	49-610499	18.0–20.0	Qbt4	—	—	0.068 (J)	—

Notes: All concentrations are in mg/kg. Data qualifiers are defined in Appendix A.

[a] SSLs from NMED (2015, 600915) unless otherwise noted.

[b] EPA regional screening level (http://www.epa.gov/risk/risk-based-screening-table-generic-tables).

[c] — = Not detected.

Table 6.9-4
Summary of Radionuclides Detected or Detected above BVs at Area 11, SWMU 49-003

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Cesium-137	Plutonium-238	Plutonium-239/240	Tritium
Qbt 2,3,4 BV[a]				**na[b]**	**na**	**na**	**na**	**na**
Soil BV[a]				**0.013[c]**	**1.65[c]**	**0.023[c]**	**0.054[c]**	**na**
Residential SAL[d]				**83**	**12**	**84**	**79**	**1700**
Industrial SAL[d]				**1000**	**41**	**1300**	**1200**	**2,400,000**
0549-95-0065	49-08029	0.8–2.0	Soil	NA[e]	0.138	0.029	0.82	NA
0549-95-0072	49-08031	3.3–4.3	Qbt4	NA	—[f]	—	0.002	NA
0549-95-0078	49-08033	3.0–3.5	Qbt4	NA	—	0.002	—	NA
0549-95-0087	49-08038	2.5–3.5	Qbt4	NA	—	0.002	—	NA
0549-95-0093	49-08040	3.0–4.0	Soil	NA	—	0.005	0.041	NA
RE49-10-7122	49-610496	0.0–2.0	Soil	0.653	NA	0.088	4.87	—
RE49-10-7123	49-610496	7.5–10.0	Qbt4	—	NA	—	—	0.222
RE49-10-7112	49-610498	0.0–2.0	Soil	0.043	NA	—	0.13	—
RE49-10-7115	49-610499	0.0–2.0	Soil	—	NA	—	0.09	—

Note: All activities are in pCi/g.

[a] BVs/FVs from LANL (1998, 059730).

[b] na = Not available.

[c] FV applies to soil samples collected from 0–1 ft only.

[d] SALs from LANL (2015, 600929).

[e] NA = Not analyzed.

[f] — = Not detected or not detected above BV/FV.

Table 6.10-1
Samples Collected and Analyses Requested at Area 11, AOC 49-008(c)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Gamma Spectroscopy	Tritium	Explosive Compounds	Isotopic Plutonium	Isotopic Uranium	Metals	Perchlorate	SVOCs	Uranium	VOCs	Cyanide
0549-95-0054	49-08049	0.0–0.5	Soil	—	657	—	—	—	—	—	—	—	—	—	—
0549-95-0099	49-08049	7.0–12.0	Qbt4	—	680	—	678	680	—	679	—	678	680	—	—
0549-95-0056	49-08051	0.0–0.5	Soil	—	657	—	—	—	—	—	—	—	—	—	—
0549-95-0100	49-08051	7.0–12.0	Qbt4	—	680	—	678	680	—	679	—	678	680	—	—
RE49-10-7087	49-610489	0.0–2.0	Soil	10-859	—	10-859	10-858	10-859	10-859	10-859	10-859	10-858	—	10-858	10-859
RE49-10-7088	49-610489	63.0–65.0	Qbt4	10-859	—	10-859	10-858	10-859	10-859	10-859	10-859	10-858	—	10-858	10-859
RE49-10-7089	49-610489	77.0–79.0	Qbt4	10-859	—	10-859	10-858	10-859	10-859	10-859	10-859	10-858	—	10-858	10-859
RE49-10-7090	49-610490	0.0–2.0	Soil	10-859	—	10-859	10-858	10-859	10-859	10-859	10-859	10-858	—	10-858	10-859
RE49-10-7091	49-610490	18.0–20.0	Qbt4	10-859	—	10-859	10-858	10-859	10-859	10-859	10-859	10-858	—	10-858	10-859
RE49-10-7092	49-610490	33.0–35.0	Qbt4	10-859	—	10-859	10-858	10-859	10-859	10-859	10-859	10-858	—	10-858	10-859
RE49-10-7093	49-610491	0.0–2.0	Soil	10-859	—	10-859	10-858	10-859	10-859	10-859	10-859	10-858	—	10-858	10-859
RE49-10-7094	49-610491	8.0–10.0	Qbt4	10-859	—	10-859	10-858	10-859	10-859	10-859	10-859	10-858	—	10-858	10-859
RE49-10-7095	49-610492	0.0–2.0	Soil	10-873	—	10-873	10-871	10-873	10-873	10-872	10-872	10-871	—	10-871	10-872
RE49-10-7096	49-610492	8.0–10.0	Qbt4	10-873	—	10-873	10-871	10-873	10-873	10-872	10-872	10-871	—	10-871	10-872
RE49-10-7097	49-610493	0.0–2.5	Soil	10-873	—	10-873	10-871	10-873	10-873	10-872	10-872	10-871	—	10-871	10-872
RE49-10-7098	49-610493	8.0–10.0	Qbt4	10-873	—	10-873	10-871	10-873	10-873	10-872	10-872	10-871	—	10-871	10-872
RE49-10-7099	49-610494	0.0–2.0	Soil	10-873	—	10-873	10-871	10-873	10-873	10-872	10-872	10-871	—	10-871	10-872
RE49-10-7100	49-610494	8.0–10.0	Qbt4	10-873	—	10-873	10-871	10-873	10-873	10-872	10-872	10-871	—	10-871	10-872
RE49-10-7101	49-610495	0.0–2.0	Soil	10-873	—	10-873	10-871	10-873	10-873	10-872	10-872	10-871	—	10-871	10-872
RE49-10-7102	49-610495	8.0–10.0	Qbt4	10-873	—	10-873	10-871	10-873	10-873	10-872	10-872	10-871	—	10-871	10-872

Note: Numbers in analyte columns are request numbers.
*— = Analysis not requested.

Table 6.10-2
Summary of Inorganic Chemicals Detected or Detected above BVs at Area 11, AOC 49-008(c)

Sample ID	Location ID	Depth (ft)	Media	Arsenic	Barium	Calcium	Chromium	Cyanide (Total)	Magnesium	Perchlorate	Selenium
Qbt 2,3,4 BV[a]				**2.79**	**46**	**2200**	**7.14**	**0.5**	**1690**	**na[b]**	**0.3**
Soil BV[a]				**8.17**	**295**	**6120**	**19.3**	**0.5**	**4610**	**na**	**1.52**
Residential SSL[c]				**4.25**	**15,600**	**13,000,000**	**96.6[d]**	**11.2**	**339,000**	**54.8**	**391**
Industrial SSL[c]				**21.5**	**255,000**	**32,400,000**	**505[d]**	**63.3**	**5,680000**	**908**	**6490**
0549-95-0099	49-08049	7.0–12.0	Qbt4	—[e]	—	—	—	NA[f]	—	NA	0.44 (U)
0549-95-0100	49-08051	7.0–12.0	Qbt4	—	—	2720	—	NA	—	NA	0.44 (U)
RE49-10-7088	49-610489	63.0–65.0	Qbt4	—	—	—	—	0.51 (U)	—	—	1.6 (J)
RE49-10-7089	49-610489	77.0–79.0	Qbt4	—	—	—	—	0.51 (U)	—	—	1.4 (J)
RE49-10-7090	49-610490	0.0–2.0	Soil	—	—	—	—	0.56 (U)	—	0.0055 (J)	1.9 (J)
RE49-10-7091	49-610490	18.0–20.0	Qbt4	—	—	—	—	0.52 (U)	—	—	1.5 (J)
RE49-10-7092	49-610490	33.0–35.0	Qbt4	—	—	—	—	—	—	—	1.6 (J)
RE49-10-7093	49-610491	0.0–2.0	Soil	—	—	—	—	—	—	—	1.9 (J)
RE49-10-7094	49-610491	8.0–10.0	Qbt4	—	—	—	—	0.54 (U)	—	0.0034 (J)	1.8 (J)
RE49-10-7095	49-610492	0.0–2.0	Soil	—	—	—	—	0.55 (UJ)	—	0.0053 (J)	1.7 (J)
RE49-10-7096	49-610492	8.0–10.0	Qbt4	—	—	—	—	0.54 (UJ)	—	0.059	1.8 (J)
RE49-10-7097	49-610493	0.0–2.5	Soil	—	—	—	—	0.56 (UJ)	—	0.0032 (J)	—
RE49-10-7098	49-610493	8.0–10.0	Qbt4	—	—	—	—	0.54 (UJ)	—	0.0039 (J)	1.7 (J)
RE49-10-7099	49-610494	0.0–2.0	Soil	—	—	—	—	—	—	0.0088	—
RE49-10-7100	49-610494	8.0–10.0	Qbt4	3.4	—	—	—	0.54 (UJ)	—	0.16	2.5 (J)
RE49-10-7101	49-610495	0.0–2.0	Soil	—	—	—	—	0.53 (UJ)	—	0.0042 (J)	—
RE49-10-7102	49-610495	8.0–10.0	Qbt4	—	84.4	—	8.5	0.53 (UJ)	1760	—	1.9 (J)

Notes: All concentrations are in mg/kg. Data qualifiers are defined in Appendix A.

[a] BVs from LANL (1998, 059730).

[b] na = Not available.

[c] SSLs from NMED (2015, 600915) unless otherwise noted.

[d] SSL for total chromium.

[e] — = Not detected or not detected above BV.

[f] NA = Not analyzed.

Table 6.10-3
Summary of Organic Chemicals Detected at Area 11, AOC 49-008(c)

Sample ID	Location ID	Depth (ft)	Media	Benzyl Alcohol	Bis(2-ethylhexyl)phthalate	Isopropyltoluene[4-]	Nitroglycerin	Nitrotoluene[3-]
Residential SSL[a]				**6300**[b]	**380**	**2360**[c]	**6.16**	**6.16**
Industrial SSL[a]				**82,000**[b]	**1830**	**14,200**[c]	**91.6**	**91.6**
0549-95-0099	49-08049	7.0–12.0	Qbt4	—[d]	0.07 (J)	NA[e]	NA	—
RE49-10-7087	49-610489	0.0–2.0	Soil	0.069 (J)	—	—	—	—
RE49-10-7088	49-610489	63.0–65.0	Qbt4	0.036 (J)	—	—	—	—
RE49-10-7089	49-610489	77.0–79.0	Qbt4	0.037 (J)	—	—	—	—
RE49-10-7090	49-610490	0.0–2.0	Soil	0.078 (J)	—	0.00029 (J)	—	—
RE49-10-7091	49-610490	18.0–20.0	Qbt4	0.066 (J)	—	—	—	—
RE49-10-7092	49-610490	33.0–35.0	Qbt4	0.062 (J)	—	—	—	—
RE49-10-7093	49-610491	0.0–2.0	Soil	0.048 (J)	—	—	—	0.56 (J)
RE49-10-7094	49-610491	8.0–10.0	Qbt4	0.04 (J)	—	—	—	—
RE49-10-7095	49-610492	0.0–2.0	Soil	0.056 (J)	—	—	—	—
RE49-10-7096	49-610492	8.0–10.0	Qbt4	0.06 (J)	—	—	—	—
RE49-10-7097	49-610493	0.0–2.5	Soil	0.19 (J)	—	—	—	—
RE49-10-7098	49-610493	8.0–10.0	Qbt4	0.1 (J)	0.057 (J)	—	0.053 (J)	—
RE49-10-7099	49-610494	0.0–2.0	Soil	0.16 (J)	0.056 (J)	—	—	—
RE49-10-7100	49-610494	8.0–10.0	Qbt4	0.066 (J)	0.053 (J)	—	—	—

Table 6.10-3 (continued)

Sample ID	Location ID	Depth (ft)	Media	Benzyl Alcohol	Bis(2-ethylhexyl)phthalate	Isopropyltoluene[4-]	Nitroglycerin	Nitrotoluene[3-]
Residential SSL[a]				**6300[b]**	**380**	**2360[c]**	**6.16**	**6.16**
Industrial SSL[a]				**82,000[b]**	**1830**	**14,200[c]**	**91.6**	**91.6**
RE49-10-7101	49-610495	0.0–2.0	Soil	0.084 (J)	—	—	—	—
RE49-10-7102	49-610495	8.0–10.0	Qbt4	0.09 (J)	—	—	—	—

Notes: All concentrations are in mg/kg. Data qualifiers are defined in Appendix A.

[a] SSLs from NMED (2015, 600915) unless otherwise noted.

[b] EPA regional screening level (http://www.epa.gov/risk/risk-based-screening-table-generic-tables).

[c] Isopropylbenzene used as a surrogate based on structural similarity.

[d] — = Not detected.

[e] Not analyzed.

Table 6.10-4
Summary of Radionuclides Detected or Detected above BVs/FVs at Area 11, AOC 49-008(c)

Sample ID	Location ID	Depth (ft)	Media	Plutonium-238	Plutonium-239/240	Tritium
Qbt 2,3,4 BV[a]				**na[b]**	**na**	**na**
Soil BV[a]				**0.023[c]**	**0.054[c]**	**na**
Residential SAL[d]				**84**	**79**	**1700**
Industrial SAL[d]				**1300**	**1200**	**2,400,000**
0549-95-0099	49-08049	7.0–12.0	Qbt4	0.009	—[e]	NA[f]
0549-95-0100	49-08051	7.0–12.0	Qbt4	—	0.005	NA
RE49-10-7088	49-610489	63.0–65.0	Qbt4	—	—	0.42 (J+)

Table 6.10-4 (continued)

Sample ID	Location ID	Depth (ft)	Media	Plutonium-238	Plutonium-239/240	Tritium
Qbt 2,3,4 BV[a]				**na[b]**	**na**	**na**
Soil BV[a]				**0.023[c]**	**0.054[c]**	**na**
Residential SAL[d]				**84**	**79**	**1700**
Industrial SAL[d]				**1300**	**1200**	**2,400,000**
RE49-10-7092	49-610490	33.0–35.0	Qbt4	—	—	0.67 (J+)
RE49-10-7093	49-610491	0.0–2.0	Soil	—	1.02	—
RE49-10-7095	49-610492	0.0–2.0	Soil	—	0.135	—
RE49-10-7097	49-610493	0.0–2.5	Soil	—	0.126	—
RE49-10-7098	49-610493	8.0–10.0	Qbt4	—	—	0.245
RE49-10-7099	49-610494	0.0–2.0	Soil	—	0.24	—

Note: All activities are in pCi/g.

[a] BVs/FVs from LANL (1998, 059730).

[b] na = Not available.

[c] FV applies to soil samples collected from 0–1 ft only.

[d] SALs from LANL (2015, 600929).

[e] — = Not detected or not detected above BV/FV.

[f] NA = Not analyzed.

Table 6.10-5
Summary of Pore-Gas Samples Collected and Analyses Requested at Area 11, AOC 49-008(c)

Sample ID	Location ID	Depth (ft)	Media	Tritium	VOCs
MD49-10-12157	49-610489	34.0–36.0	Pore gas	10-1919	10-1918
MD49-10-12155	49-610489	70.0–72.0	Pore gas	10-1919	10-1918
MD49-10-12168	49-610490	4.0–6.0	Pore gas	10-1919	10-1918
MD49-10-12159	49-610490	28.0–30.0	Pore gas	10-1919	10-1918

Note: Numbers in analyte columns are request numbers.

Table 6.10-6
Summary of Organic Chemicals Detected in Pore-Gas Samples Collected at Area 11, AOC 49-008(c)

Sample ID	Location ID	Depth (ft)	Media	Acetone	Benzene	Butanone[2-]	Carbon Disulfide	Chloromethane	Dichlorodifluoromethane	Ethylbenzene	Ethyltoluene[4-]	Styrene	Toluene	Trimethylbenzene[1,2,4-]	Trimethylbenzene[1,3,5-]	Xylene (Total)	Xylene[1,2-]	Xylene[1,3-]+Xylene[1,4-]
Residential Soil-Gas Vapor Intrusion Screening Level[a]				**32,300**	**36**	**52,100**	**7300**	**156**	**1040**	**112**	**52,100[b]**	**10,400**	**52,100**	**66[c]**	**66[d]**	**1040**	**1040**	**1040[e]**
MD49-10-12157	49-610489	34.0–36.0	Pore gas	12	16	—[f]	—	2	3.1	5.7	5.1	—	26	4	—	23	5.7	17
MD49-10-12155	49-610489	70.0–72.0	Pore gas	12	22	3.3	6.2	—	3.2	6.5	7.3	1.8	42	9.3	2.6	28	7	21
MD49-10-12168	49-610490	4.0–6.0	Pore gas	12	4.4	3.1	—	—	3.2	5.3	7.2	—	11	7.3	—	22	5.8	16
MD49-10-12159	49-610490	28.0–30.0	Pore gas	13	11	4.3	—	—	3.1	10	16	4.9	32	16	5.1	53	15	39

Note: All concentrations are in µg/m^3.

[a] Screening levels from NMED (2015, 600915) unless otherwise noted.

[b] Toluene used as a surrogate based on structural similarity..

[c] Residential air screening level from EPA regional screening levels (http://www.epa.gov/risk/risk-based-screening-table-generic-tables) divided by default attenuation factor of 0.11 (NMED 2015, 600915, p. 47).

[d] Trimethylbenzene[1,2,4-] used as a surrogate based on structural similarity.

[e] Xylenes used as a surrogate based on structural similarity.

[f] — = Not detected.

Table 6.10-7
Summary of Tritium in Pore Gas at Area 11, AOC 49-008(c)

Sample ID	Location ID	Depth (ft)	Media	Tritium
MD49-10-12155	49-610489	70.0–72.0	Pore gas	1766.53

Note: All activities are in pCi/L.

Table 6.11-1
Samples Collected and Analyses Requested at Area 12, AOC 49-008(d)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Gamma Spectroscopy	Iodine-129	Tritium	Explosive Compounds	Isotopic Plutonium	Isotopic Uranium	Metals	PCBs	Perchlorate	Pesticides/ PCBs	Strontium-90	SVOCs	Technetium-99	TPH – Diesel Range Organics	TPH – Gasoline Range Organics	VOCs	Cyanide
0549-95-0265	49-09007	0.0–0.5	Soil	—*	871	—	—	—	871	871	870, 871	—	—	—	—	—	—	—	—	—	—
0549-95-0266	49-09007	0.5–1.0	Soil	—	871	—	—	—	871	871	870, 871	—	—	—	—	—	—	—	—	—	—
0549-95-0267	49-09013	0.0–0.5	Soil	—	871	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0271	49-09026	0.0–0.5	Soil	—	871	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0272	49-09032	0.0–0.5	Soil	—	871	—	—	—	871	871	870, 871	—	—	—	—	—	—	—	—	—	—
0549-95-0273	49-09032	0.5–1.0	Soil	—	871	—	—	—	871	871	870, 871	—	—	—	—	—	—	—	—	—	—
0549-95-0274	49-09035	0.0–0.5	Soil	—	871	—	—	—	871	—	870, 871	—	—	—	—	—	—	—	—	—	—
0549-95-0275	49-09035	0.5–1.0	Soil	—	871	—	—	—	871	—	870, 871	—	—	—	—	—	—	—	—	—	—
0549-95-0276	49-09036	0.0–0.5	Soil	—	871	—	—	—	871	871	870, 871	—	—	—	—	—	—	—	—	—	—
0549-95-0277	49-09036	0.5–1.0	Soil	—	871	—	—	—	871	871	870, 871	—	—	—	—	—	—	—	—	—	—
0549-95-0278	49-09040	0.0–0.5	Soil	—	871	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0279	49-09049	0.0–0.5	Soil	—	871	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0280	49-09052	0.0–0.5	Soil	—	871	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0281	49-09054	0.0–0.5	Soil	—	871	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0282	49-09055	0.0–0.5	Soil	—	871	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0283	49-09056	0.0–0.5	Soil	—	871	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0284	49-09057	0.0–0.5	Soil	—	871	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0285	49-09058	0.0–0.5	Soil	—	871	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0286	49-09060	0.0–0.5	Soil	—	871	—	—	—	—	—	—	—	—	—	—	869	—	—	—	—	—
0549-95-0287	49-09062	0.0–0.5	Soil	—	871	—	—	—	—	—	—	—	—	—	—	869	—	—	—	—	—
0549-95-0288	49-09064	0.0–0.5	Soil	—	871	—	—	—	—	—	—	—	—	—	—	869	—	—	—	—	—
0549-95-0290	49-09066	0.0–0.5	Soil	—	871	—	—	—	—	—	—	—	—	—	—	869	—	—	—	—	—
0549-95-0292	49-09069	0.0–0.5	Soil	—	871	—	—	—	—	—	—	—	—	—	—	869	—	—	—	—	—
0549-95-0291	49-09070	0.0–0.5	Soil	—	871	—	—	—	—	—	—	—	—	—	—	869	—	—	—	—	—
0549-95-0015	49-09095	0.0–0.5	Soil	—	871	—	—	—	871	—	870, 871	—	—	869	—	869	—	—	—	—	—
RE49-10-5089	49-609889	0.0–0.5	Soil	10-565	10-565	—	—	—	10-565	10-565	10-565	10-564	—	—	—	10-564	—	—	—	10-564	—
RE49-10-5090	49-609889	0.5–1.5	Soil	10-565	10-565	—	—	—	10-565	10-565	10-565	10-564	—	—	—	10-564	—	—	—	10-564	—
RE49-10-5091	49-609890	0.0–0.5	Soil	10-565	10-565	—	—	—	10-565	10-565	10-565	10-564	—	—	—	10-564	—	—	—	10-564	—
RE49-10-5092	49-609890	0.5–1.5	Soil	10-565	10-565	10-565	—	—	10-565	10-565	10-565	10-564	—	—	10-565	10-564	10-565	—	—	10-564	—
RE49-10-5093	49-609891	0.0–0.5	Fill	10-565	10-565	—	—	—	10-565	10-565	10-565	10-564	—	—	—	10-564	—	—	—	10-564	—
RE49-10-5094	49-609891	0.5–1.5	Fill	10-565	10-565	—	—	—	10-565	10-565	10-565	10-564	—	—	—	10-564	—	—	—	10-564	—
RE49-10-5095	49-609892	0.0–0.5	Fill	10-565	10-565	—	—	—	10-565	10-565	10-565	10-564	—	—	—	10-564	—	—	—	10-564	—
RE49-10-5096	49-609892	0.5–1.5	Soil	10-565	10-565	—	—	—	10-565	10-565	10-565	10-564	—	—	—	10-564	—	—	—	10-564	—
RE49-10-5097	49-609893	0.0–0.5	Fill	10-565	10-565	—	—	—	10-565	10-565	10-565	10-564	—	—	—	10-564	—	—	—	10-564	—

Table 6.11-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Gamma Spectroscopy	Iodine-129	Tritium	Explosive Compounds	Isotopic Plutonium	Isotopic Uranium	Metals	PCBs	Perchlorate	Pesticides/ PCBs	Strontium-90	SVOCs	Technetium-99	TPH – Diesel Range Organics	TPH – Gasoline Range Organics	VOCs	Cyanide
RE49-10-5098	49-609893	0.5–1.5	Soil	10-565	10-565	—	—	—	10-565	10-565	10-565	10-564	—	—	—	10-564	—	—	—	10-564	—
RE49-10-5102	49-609894	0.0–0.5	Fill	10-569	10-569	—	—	—	10-569	10-569	10-569	10-568	—	—	—	10-568	—	—	—	10-568	—
RE49-10-5103	49-609894	0.5–1.5	Fill	10-569	10-569	—	—	—	10-569	10-569	10-569	10-568	—	—	—	10-568	—	—	—	10-568	—
RE49-10-5104	49-609895	0.0–0.5	Fill	10-569	10-569	—	—	—	10-569	10-569	10-569	10-568	—	—	—	10-568	—	—	—	10-568	—
RE49-10-5105	49-609895	0.5–1.5	Fill	10-569	10-569	—	—	—	10-569	10-569	10-569	10-568	—	—	—	10-568	—	—	—	10-568	—
RE49-10-5106	49-609896	0.0–0.5	Fill	10-569	10-569	—	—	—	10-569	10-569	10-569	10-568	—	—	—	10-568	—	—	—	10-568	—
RE49-10-5107	49-609896	0.5–1.5	Fill	10-569	10-569	—	—	—	10-569	10-569	10-569	10-568	—	—	—	10-568	—	—	—	10-568	—
RE49-10-5108	49-609897	0.0–0.5	Fill	10-569	10-569	—	—	—	10-569	10-569	10-569	10-568	—	—	—	10-568	—	—	—	10-568	—
RE49-10-5109	49-609897	0.5–1.5	Fill	10-569	10-569	—	—	—	10-569	10-569	10-569	10-568	—	—	—	10-568	—	—	—	10-568	—
RE49-10-5110	49-609898	0.0–0.5	Soil	10-569	10-569	—	—	—	10-569	10-569	10-569	10-568	—	—	—	10-568	—	—	—	10-568	—
RE49-10-5111	49-609898	0.5–1.5	Soil	10-569	10-569	—	—	—	10-569	10-569	10-569	10-568	—	—	—	10-568	—	—	—	10-568	—
RE49-10-5112	49-609899	0.0–0.5	Fill	10-569	10-569	—	—	—	10-569	10-569	10-569	10-568	—	—	—	10-568	—	—	—	10-568	—
RE49-10-5113	49-609899	0.5–1.5	Soil	10-569	10-569	—	—	—	10-569	10-569	10-569	10-568	—	—	—	10-568	—	—	—	10-568	—
RE49-10-5114	49-609900	0.0–0.5	Soil	10-569	10-569	—	—	—	10-569	10-569	10-569	10-568	—	—	—	10-568	—	—	—	10-568	—
RE49-10-5115	49-609900	0.5–1.5	Soil	10-569	10-569	—	—	—	10-569	10-569	10-569	10-568	—	—	—	10-568	—	—	—	10-568	—
RE49-10-5116	49-609901	0.0–0.5	Soil	10-569	10-569	—	—	—	10-569	10-569	10-569	10-568	—	—	—	10-568	—	—	—	10-568	—
RE49-10-5117	49-609901	0.5–1.5	Soil	10-569	10-569	—	—	—	10-569	10-569	10-569	10-568	—	—	—	10-568	—	—	—	10-568	—
RE49-10-5118	49-609902	0.0–0.5	Fill	10-569	10-569	—	—	—	10-569	10-569	10-569	10-568	—	—	—	10-568	—	—	—	10-568	—
RE49-10-5119	49-609902	0.5–1.5	Soil	10-569	10-569	—	—	—	10-569	10-569	10-569	10-568	—	—	—	10-568	—	—	—	10-568	—
RE49-10-5120	49-609903	0.0–0.5	Fill	10-569	10-569	—	—	—	10-569	10-569	10-569	10-568	—	—	—	10-568	—	—	—	10-568	—
RE49-10-5121	49-609903	0.5–1.5	Fill	10-569	10-569	—	—	—	10-569	10-569	10-569	10-568	—	—	—	10-568	—	—	—	10-568	—
RE49-10-5122	49-609904	0.0–0.5	Soil	10-571	10-571	—	—	—	10-571	10-571	10-571	10-570	—	—	—	10-570	—	—	—	10-570	—
RE49-10-5123	49-609904	0.5–1.5	Soil	10-571	10-571	—	—	—	10-571	10-571	10-571	10-570	—	—	—	10-570	—	—	—	10-570	—
RE49-10-5124	49-609905	0.0–0.5	Soil	10-571	10-571	—	—	—	10-571	10-571	10-571	10-570	—	—	—	10-570	—	—	—	10-570	—
RE49-10-5125	49-609905	0.5–1.5	Soil	10-571	10-571	—	—	—	10-571	10-571	10-571	10-570	—	—	—	10-570	—	—	—	10-570	—
RE49-10-5132	49-609906	0.0–0.5	Soil	10-567	10-567	—	—	—	10-567	10-567	10-567	10-566	—	—	—	10-566	—	—	—	10-566	—
RE49-10-5133	49-609906	0.5–1.5	Fill	10-567	10-567	—	—	—	10-567	10-567	10-567	10-566	—	—	—	10-566	—	—	—	10-566	—
RE49-10-5134	49-609907	0.0–0.5	Soil	10-567	10-567	—	—	—	10-567	10-567	10-567	10-566	—	—	—	10-566	—	—	—	10-566	—
RE49-10-5135	49-609907	0.5–1.5	Soil	10-567	10-567	—	—	—	10-567	10-567	10-567	10-566	—	—	—	10-566	—	—	—	10-566	—
RE49-10-5136	49-609908	0.0–0.5	Fill	10-567	10-567	—	—	—	10-567	10-567	10-567	10-566	—	—	—	10-566	—	—	—	10-566	—
RE49-10-5137	49-609908	0.5–1.5	Fill	10-567	10-567	—	—	—	10-567	10-567	10-567	10-566	—	—	—	10-566	—	—	—	10-566	—
RE49-10-5138	49-609909	0.0–0.5	Soil	10-567	10-567	—	—	—	10-567	10-567	10-567	10-566	—	—	—	10-566	—	—	—	10-566	—
RE49-10-5139	49-609909	0.5–1.5	Soil	10-567	10-567	—	—	—	10-567	10-567	10-567	10-566	—	—	—	10-566	—	—	—	10-566	—
RE49-10-5140	49-609910	0.0–0.5	Fill	10-567	10-567	—	—	—	10-567	10-567	10-567	10-566	—	—	—	10-566	—	—	—	10-566	—
RE49-10-5141	49-609910	0.5–1.5	Fill	10-567	10-567	—	—	—	10-567	10-567	10-567	10-566	—	—	—	10-566	—	—	—	10-566	—

Table 6.11-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Gamma Spectroscopy	Iodine-129	Tritium	Explosive Compounds	Isotopic Plutonium	Isotopic Uranium	Metals	PCBs	Perchlorate	Pesticides/ PCBs	Strontium-90	SVOCs	Technetium-99	TPH – Diesel Range Organics	TPH – Gasoline Range Organics	VOCs	Cyanide
RE49-10-5142	49-609911	0.0–0.5	Soil	10-567	10-567	—	—	—	10-567	10-567	10-567	10-566	—	—	—	10-566	—	—	—	10-566	—
RE49-10-5143	49-609911	0.5–1.5	Soil	10-567	10-567	—	—	—	10-567	10-567	10-567	10-566	—	—	—	10-566	—	—	—	10-566	—
RE49-10-5144	49-609912	0.0–0.5	Soil	10-567	10-567	—	—	—	10-567	10-567	10-567	10-566	—	—	—	10-566	—	—	—	10-566	—
RE49-10-5145	49-609912	0.5–1.5	Soil	10-567	10-567	—	—	—	10-567	10-567	10-567	10-566	—	—	—	10-566	—	—	—	10-566	—
RE49-10-5146	49-609913	0.0–0.5	Soil	10-567	10-567	—	—	—	10-567	10-567	10-567	10-566	—	—	—	10-566	—	—	—	10-566	—
RE49-10-5147	49-609913	0.5–1.5	Soil	10-567	10-567	—	—	—	10-567	10-567	10-567	10-566	—	—	—	10-566	—	—	—	10-566	—
RE49-10-5176	49-609925	0.0–0.5	Fill	10-573	10-573	—	—	—	10-573	10-573	10-573	10-572	—	—	—	10-572	—	—	—	10-572	—
RE49-10-5177	49-609925	0.5–1.5	Fill	—	10-573	10-573	—	—	—	—	—	10-572	—	—	10-573	10-572	10-573	—	—	10-572	—
RE49-10-5226	49-609950	0.0–0.5	Soil	10-573	10-573	—	—	—	10-573	10-573	10-573	10-572	—	—	—	10-572	—	—	—	10-572	—
RE49-10-5236	49-609955	0.0–0.5	Fill	—	10-573	10-573	—	—	—	—	—	10-572	—	—	10-573	10-572	10-573	—	—	10-572	—
RE49-10-5239	49-609956	0.5–1.5	Soil	10-573	10-573	—	—	—	10-573	10-573	10-573	10-572	—	—	—	10-572	—	—	—	10-572	—
RE49-10-5284	49-609965	0.5–1.5	Fill	10-574	10-574	—	—	—	10-574	10-574	10-574	10-574	—	—	—	10-574	—	—	—	10-574	—
RE49-10-5305	49-609976	0.0–0.5	Soil	—	10-574	10-574	—	—	—	—	—	10-574	—	—	10-574	10-574	10-574	—	—	10-574	—
RE49-10-7045	49-610481	3.0–5.0	Soil	10-706	—	—	10-706	10-705	10-706	10-706	10-706	—	10-706	—	—	10-705	—	—	—	10-705	10-706
RE49-10-7046	49-610481	28.0–30.0	Qbt4	10-706	—	—	10-706	10-705	10-706	10-706	10-706	—	10-706	—	—	10-705	—	—	—	10-705	10-706
RE49-10-7047	49-610481	76.0–79.0	Qbt3	10-706	—	—	10-706	10-705	10-706	10-706	10-706	—	10-706	—	—	10-705	—	—	—	10-705	10-706
RE49-10-7044	49-610481	118.0–120.0	Qbt3	10-772	—	—	10-772	10-772	10-772	10-772	10-772	—	10-772	—	—	10-772	—	—	—	10-772	10-772
RE49-10-7048	49-610485	2.0–3.5	Soil	10-706	—	—	10-706	10-705	10-706	10-706	10-706	—	10-706	—	—	10-705	—	10-705	10-705	10-705	10-706
RE49-10-7049	49-610485	73.0–75.0	Qbt4	10-706	—	—	10-706	10-705	10-706	10-706	10-706	—	10-706	—	—	10-705	—	10-705	10-705	10-705	10-706
RE49-10-7050	49-610485	88.0–90.0	Qbt3	10-706	—	—	10-706	10-705	10-706	10-706	10-706	—	10-706	—	—	10-705	—	10-705	10-705	10-705	10-706
RE49-10-7051	49-610485	118.0–120.0	Qbt3	10-706	—	—	10-706	10-705	10-706	10-706	10-706	—	10-706	—	—	10-705	—	10-705	10-705	10-705	10-706

Note: Numbers in analyte columns are request numbers.
*— = Analysis not requested.

Table 6.11-2
Summary of Inorganic Chemicals Detected or Detected above BVs at Area 12, AOC 49-008(d)

Sample ID	Location ID	Depth (ft)	Media	Antimony	Barium	Cadmium	Calcium	Chromium	Cobalt	Copper	Cyanide (Total)	Lead	Manganese	Nickel	Selenium	Sodium	Thallium	Uranium	Zinc
Qbt 2,3,4 BV[a]				**0.5**	**46**	**1.63**	**2200**	**7.14**	**3.14**	**4.66**	**0.5**	**11.2**	**482**	**6.58**	**0.3**	**2770**	**1.1**	**2.4**	**63.5**
Soil BV[a]				**0.83**	**295**	**0.4**	**6120**	**19.3**	**8.64**	**14.7**	**0.5**	**22.3**	**671**	**15.4**	**1.52**	**915**	**0.73**	**1.82**	**48.8**
Residential SSL[b]				**31.3**	**15,600**	**70.5**	**13,000,000**	**505[c]**	**23[d]**	**3130**	**11.2**	**400**	**10,500**	**1560**	**391**	**7,820,000**	**0.782**	**234**	**23500**
Industrial SSL[b]				**519**	**255,000**	**1110**	**32,400,000**	**96.6[c]**	**350[d]**	**51,900**	**63.3**	**800**	**160,000**	**25,700**	**6490**	**35,700,000**	**13**	**3880**	**389,000**
0549-95-0265	49-09007	0.0–0.5	Soil	—[e]	—	0.65	—	—	—	14.9	NA[f]	38.2 (J+)	—	—	—	—	—	49.6	—
0549-95-0266	49-09007	0.5–1.0	Soil	—	—	—	—	—	—	—	NA	—	—	—	—	—	—	23	—
0549-95-0272	49-09032	0.0–0.5	Soil	—	—	0.75	—	—	—	19.1	NA	—	—	—	—	—	—	16.8	110
0549-95-0273	49-09032	0.5–1.0	Soil	—	—	0.68	—	—	—	—	NA	—	—	—	—	—	—	13.7	—
0549-95-0274	49-09035	0.0–0.5	Soil	—	—	0.83	—	—	—	—	NA	—	—	—	—	—	—	18.1	52.1
0549-95-0275	49-09035	0.5–1.0	Soil	—	—	0.98	—	—	—	—	NA	—	—	—	—	—	—	6.1	—
0549-95-0276	49-09036	0.0–0.5	Soil	—	—	0.82	—	—	—	—	NA	—	—	—	—	—	—	68.4	—
0549-95-0277	49-09036	0.5–1.0	Soil	—	—	1.1	—	—	—	—	NA	—	—	—	—	—	—	8.6	—
0549-95-0015	49-09095	0.0–0.5	Soil	—	—	0.43 (J)	—	—	—	—	NA	27.5 (J+)	—	—	—	5930	—	4.4	—
RE49-10-5089	49-609889	0.0–0.5	Soil	—	—	—	—	—	—	—	NA	—	—	—	—	—	1.5	NA	—
RE49-10-5094	49-609891	0.5–1.5	Fill	—	—	—	—	—	—	22.6	NA	—	—	—	—	—	—	NA	—
RE49-10-5102	49-609894	0.0–0.5	Fill	—	—	—	—	—	—	—	NA	—	—	—	—	—	—	NA	171
RE49-10-5103	49-609894	0.5–1.5	Fill	—	—	—	—	—	—	—	NA	—	—	—	—	—	—	NA	75.9
RE49-10-5112	49-609899	0.0–0.5	Fill	—	—	—	9760 (J-)	—	—	41	NA	—	—	—	—	—	—	NA	—
RE49-10-5113	49-609899	0.5–1.5	Soil	—	—	—	—	—	—	—	NA	—	—	—	—	1020	—	NA	—
RE49-10-5115	49-609900	0.5–1.5	Soil	—	—	—	7450 (J-)	—	—	—	NA	—	—	—	—	—	—	NA	—
RE49-10-5117	49-609901	0.5–1.5	Soil	—	335	—	6200 (J-)	21	—	—	NA	—	—	16.1	—	—	—	NA	—
RE49-10-5119	49-609902	0.5–1.5	Soil	—	—	—	—	—	—	—	NA	31.3	—	—	—	—	0.9 (U)	NA	—
RE49-10-5120	49-609903	0.0–0.5	Fill	1.5	—	—	—	—	—	31.4	NA	—	—	—	—	—	—	NA	—
RE49-10-5121	49-609903	0.5–1.5	Fill	2.1	—	—	6390 (J-)	—	—	20.8	NA	—	—	—	—	—	—	NA	—
RE49-10-5124	49-609905	0.0–0.5	Soil	—	—	—	—	—	11.4 (J)	—	NA	—	—	—	—	—	—	NA	—
RE49-10-5125	49-609905	0.5–1.5	Soil	—	—	—	—	—	—	—	NA	—	—	—	—	—	0.9 (U)	NA	—
RE49-10-5132	49-609906	0.0–0.5	Soil	—	—	—	—	—	—	—	NA	—	—	—	—	—	1.3 (U)	NA	—
RE49-10-5133	49-609906	0.5–1.5	Fill	—	—	—	—	—	—	—	NA	—	—	—	—	—	1.2 (U)	NA	—
RE49-10-5134	49-609907	0.0–0.5	Soil	—	—	—	—	—	15	—	NA	—	1020	—	—	—	1.1 (U)	NA	—
RE49-10-5135	49-609907	0.5–1.5	Soil	—	539	—	7300 (J-)	—	—	—	NA	—	—	—	—	—	1.1 (U)	NA	—
RE49-10-5136	49-609908	0.0–0.5	Fill	—	—	—	—	—	—	—	NA	—	—	—	—	—	1.2 (U)	NA	—
RE49-10-5137	49-609908	0.5–1.5	Fill	—	—	—	—	—	—	—	NA	—	—	—	—	—	1.1 (U)	NA	—
RE49-10-5138	49-609909	0.0–0.5	Soil	—	—	—	—	—	—	—	NA	—	—	—	—	—	1.1 (U)	NA	—
RE49-10-5139	49-609909	0.5–1.5	Soil	—	—	—	—	—	—	—	NA	—	—	—	—	—	1.7	NA	—
RE49-10-5140	49-609910	0.0–0.5	Fill	—	—	—	—	—	—	—	NA	—	—	—	—	—	1.2 (U)	NA	—

Table 6.11-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Antimony	Barium	Cadmium	Calcium	Chromium	Cobalt	Copper	Cyanide (Total)	Lead	Manganese	Nickel	Selenium	Sodium	Thallium	Uranium	Zinc
Qbt 2,3,4 BV[a]				**0.5**	**46**	**1.63**	**2200**	**7.14**	**3.14**	**4.66**	**0.5**	**11.2**	**482**	**6.58**	**0.3**	**2770**	**1.1**	**2.4**	**63.5**
Soil BV[a]				**0.83**	**295**	**0.4**	**6120**	**19.3**	**8.64**	**14.7**	**0.5**	**22.3**	**671**	**15.4**	**1.52**	**915**	**0.73**	**1.82**	**48.8**
Residential SSL[b]				**31.3**	**15,600**	**70.5**	**13,000,000**	**505[c]**	**23[d]**	**3130**	**11.2**	**400**	**10,500**	**1560**	**391**	**7,820,000**	**0.782**	**234**	**23,500**
Industrial SSL[b]				**519**	**255,000**	**1110**	**32,400,000**	**96.6[c]**	**350[d]**	**51,900**	**63.3**	**800**	**160,000**	**25,700**	**6490**	**35,700,000**	**13**	**3880**	**389,000**
RE49-10-5141	49-609910	0.5–1.5	Fill	—	—	—	—	—	—	—	NA	—	—	—	—	—	1.1 (U)	NA	—
RE49-10-5142	49-609911	0.0–0.5	Soil	—	—	—	—	—	—	—	NA	—	—	—	—	—	1.1 (U)	NA	—
RE49-10-5143	49-609911	0.5–1.5	Soil	—	439	—	—	—	—	—	NA	—	—	—	—	—	1.1 (U)	NA	—
RE49-10-5144	49-609912	0.0–0.5	Soil	—	—	—	—	—	—	—	NA	—	—	—	—	—	1.2 (U)	NA	—
RE49-10-5145	49-609912	0.5–1.5	Soil	—	—	—	—	—	—	—	NA	—	—	—	—	—	1.1 (U)	NA	—
RE49-10-5146	49-609913	0.0–0.5	Soil	—	—	—	—	—	—	—	NA	—	—	—	—	—	1.3 (U)	NA	—
RE49-10-5147	49-609913	0.5–1.5	Soil	—	—	—	—	—	—	—	NA	—	—	—	—	—	0.95 (J)	NA	—
RE49-10-5226	49-609950	0.0–0.5	Soil	—	—	—	—	—	—	391 (J-)	NA	—	—	—	—	—	—	NA	—
RE49-10-5284	49-609965	0.5–1.5	Fill	—	—	—	—	—	—	—	NA	—	—	—	—	—	1.1 (U)	NA	—
RE49-10-7045	49-610481	3.0–5.0	Soil	—	—	—	—	—	—	—	0.58 (U)	—	—	—	—	2460 (J+)	—	NA	—
RE49-10-7046	49-610481	28.0–30.0	Qbt4	—	—	—	—	—	—	—	0.53 (U)	—	—	—	1.1	—	—	NA	—
RE49-10-7047	49-610481	76.0–79.0	Qbt3	—	—	—	—	—	—	—	0.51 (U)	—	—	—	0.75	—	—	NA	—
RE49-10-7044	49-610481	118.0–120.0	Qbt3	—	—	—	—	—	—	—	0.51 (U)	—	—	—	0.88 (J)	—	—	NA	—
RE49-10-7048	49-610485	2.0–3.5	Soil	—	—	—	—	—	—	—	0.56 (U)	—	—	—	—	—	—	NA	—
RE49-10-7049	49-610485	73.0–75.0	Qbt4	0.51 (U)	—	—	—	—	—	—	0.51 (U)	—	—	—	0.97	—	—	NA	—
RE49-10-7050	49-610485	88.0–90.0	Qbt3	0.51 (U)	—	—	—	—	—	—	0.51 (U)	—	—	—	1.1	—	—	NA	—
RE49-10-7051	49-610485	118.0–120.0	Qbt3	0.51 (U)	—	—	—	—	—	—	0.51 (U)	—	—	—	1.1	—	—	NA	—

Notes: All concentrations are in mg/kg. Data qualifiers are defined in Appendix A.

[a] BVs from LANL (1998, 059730).

[b] SSLs from NMED (2015, 600915) unless otherwise noted.

[c] SSL for total chromium.

[d] EPA regional screening level (http://www.epa.gov/risk/risk-based-screening-table-generic-tables).

[e] — = Not detected or not detected above BV.

[f] NA = Not analyzed.

Table 6.11-3
Summary of Organic Chemicals Detected at Area 12, AOC 49-008(d)

Sample ID	Location ID	Depth (ft)	Media	Acetone	Aroclor-1254	Aroclor-1260	Benzo(g,h,i)perylene	BHC[alpha-]	Bis(2-ethylhexyl)phthalate	Chlordane[alpha-]	Chlordane[gamma-]	Chlorobenzene	Chloromethane	Dichlorobenzene[1,4-]	Isopropyltoluene[4-]	Methylene Chloride
Residential SSL[a]				**66,300**	**1.14**	**2.43**	**1740**[b]	**0.845**	**380**	**17.7**[c]	**17.7**[c]	**378**	**41.1**	**32.8**	**2360**[d]	**409**
Industrial SSL[a]				**960,000**	**11.5**	**11.5**	**25,300**[b]	**4.07**	**1830**	**89**[c]	**89**[c]	**2160**	**201**	**159**	**14,200**[d]	**5130**
0549-95-0015	49-09095	0.0–0.5	Soil	NA[e]	—[f]	—	—	0.0012 (J)	—	0.0029 (J)	0.0024 (J)	NA	NA	—	NA	NA
RE49-10-5093	49-609891	0.0–0.5	Fill	—	—	—	—	NA	0.08 (J)	NA	NA	—	0.00092 (J+)	—	0.00042 (J+)	—
RE49-10-5102	49-609894	0.0–0.5	Fill	—	—	0.046	—	NA	—	NA	NA	—	—	—	—	—
RE49-10-5103	49-609894	0.5–1.5	Fill	—	—	0.013 (J)	—	NA	—	NA	NA	—	—	—	—	—
RE49-10-5104	49-609895	0.0–0.5	Fill	0.026	—	—	—	NA	—	NA	NA	—	—	—	0.0023 (J)	—
RE49-10-5106	49-609896	0.0–0.5	Fill	—	—	—	0.049 (J)	NA	—	NA	NA	—	—	—	—	—
RE49-10-5107	49-609896	0.5–1.5	Fill	—	—	—	0.043 (J)	NA	—	NA	NA	—	—	—	—	—
RE49-10-5111	49-609898	0.5–1.5	Soil	0.18	—	—	—	NA	—	NA	NA	—	—	—	—	—
RE49-10-5117	49-609901	0.5–1.5	Soil	0.0091 (J)	—	—	—	NA	—	NA	NA	—	—	—	—	—
RE49-10-5120	49-609903	0.0–0.5	Fill	—	0.027 (J)	—	—	NA	—	NA	NA	—	—	—	—	—
RE49-10-5121	49-609903	0.5–1.5	Fill	—	0.055 (J)	—	—	NA	—	NA	NA	—	—	—	—	—
RE49-10-5136	49-609908	0.0–0.5	Fill	—	—	—	—	NA	—	NA	NA	0.00091 (J+)	—	0.00063 (J+)	—	—
RE49-10-5138	49-609909	0.0–0.5	Soil	—	—	—	—	NA	0.13 (J)	NA	NA	—	—	—	—	—
RE49-10-5140	49-609910	0.0–0.5	Fill	—	—	—	—	NA	0.12 (J)	NA	NA	—	—	—	—	—
RE49-10-5141	49-609910	0.5–1.5	Fill	—	—	—	—	NA	—	NA	NA	0.0011 (J)	—	—	—	—
RE49-10-5142	49-609911	0.0–0.5	Soil	—	—	—	—	NA	—	NA	NA	—	—	0.00044 (J)	—	—
RE49-10-5145	49-609912	0.5–1.5	Soil	—	—	—	—	NA	—	NA	NA	0.00065 (J)	—	—	—	—
RE49-10-5146	49-609913	0.0–0.5	Soil	—	—	—	—	NA	—	NA	NA	0.00093 (J)	—	0.00071 (J)	—	—
RE49-10-5226	49-609950	0.0–0.5	Soil	—	—	—	0.04 (J)	NA	0.099 (J)	NA	NA	—	—	—	—	—
RE49-10-5236	49-609955	0.0–0.5	Fill	—	—	—	—	NA	0.14 (J)	NA	NA	—	—	—	—	—
RE49-10-5284	49-609965	0.5–1.5	Fill	0.0084 (J)	—	—	—	NA	—	NA	NA	—	—	—	—	0.0033 (J)
RE49-10-7045	49-610481	3.0–5.0	Soil	—	NA	NA	—	NA	0.069 (J)	NA	NA	—	—	—	—	—
RE49-10-7051	49-610485	118.0–120.0	Qbt3	—	NA	NA	—	NA	0.072 (J)	NA	NA	—	—	—	—	—

Notes: All concentrations are in mg/kg. Data qualifiers are defined in Appendix A.

[a] SSLs from NMED (2015, 600915).

[b] Pyrene used as a surrogate based on structural similarity.

[c] Chlordane used as a surrogate based on structural similarity.

[d] Isopropylbenzene used as a surrogate based on structural similarity.

[e] NA = Not analyzed.

[f] — = Not detected or not detected above BV.

Table 6.11-4
Summary of Radionuclides Detected or Detected above BVs/FVs at Area 12, AOC 49-008(d)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Cesium-134	Plutonium-239/240	Tritium	Uranium-234	Uranium-235/236	Uranium-238
Qbt 2,3,4 BV[a]				**na[b]**	**na**	**na**	**na**	**1.98**	**0.09**	**1.93**
Soil BV[a]				**0.013[c]**	**na**	**0.054[c]**	**na**	**2.59**	**0.2**	**2.29**
Residential SAL[d]				**83**	**5**	**79**	**1700**	**290**	**42**	**150**
Industrial SAL[d]				**1000**	**17**	**1200**	**2,400,000**	**3100**	**160**	**710**
0549-95-0265	49-09007	0.0–0.5	Soil	NA[e]	—[f]	0.077	NA	3.84	0.42	17.97
0549-95-0266	49-09007	0.5–1.0	Soil	NA	—	—	NA	—	—	7.71
0549-95-0272	49-09032	0.0–0.5	Soil	NA	—	0.483	NA	—	—	6.5
0549-95-0273	49-09032	0.5–1.0	Soil	NA	—	0.198	NA	—	—	3.36
0549-95-0274	49-09035	0.0–0.5	Soil	NA	—	0.22	NA	NA	NA	NA
0549-95-0275	49-09035	0.5–1.0	Soil	NA	—	0.079	NA	NA	NA	NA
0549-95-0276	49-09036	0.0–0.5	Soil	NA	—	0.211	NA	2.85	0.4	22.74
0549-95-0277	49-09036	0.5–1.0	Soil	NA	—	—	NA	—	—	3.23
RE49-10-5090	49-609889	0.5–1.5	Soil	—	—	—	NA	—	—	—
RE49-10-5091	49-609890	0.0–0.5	Soil	—	—	0.119	NA	—	—	—
RE49-10-5092	49-609890	0.5–1.5	Soil	—	—	—	NA	2.69	—	5.05
RE49-10-5094	49-609891	0.5–1.5	Fill	—	—	0.076	NA	—	—	—
RE49-10-5096	49-609892	0.5–1.5	Soil	—	—	—	NA	—	—	—
RE49-10-5097	49-609893	0.0–0.5	Fill	—	—	0.055	NA	—	—	—
RE49-10-5104	49-609895	0.0–0.5	Fill	—	0.039	—	NA	—	—	—
RE49-10-5106	49-609896	0.0–0.5	Fill	0.086	—	0.346	NA	—	—	—
RE49-10-5107	49-609896	0.5–1.5	Fill	—	—	0.062	NA	—	—	—

Table 6.11-4 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Cesium-134	Plutonium-239/240	Tritium	Uranium-234	Uranium-235/236	Uranium-238
Qbt 2,3,4 BV[a]				**na**[b]	**na**	**na**	**na**	**1.98**	**0.09**	**1.93**
Soil BV[a]				**0.013**[c]	**na**	**0.054**[c]	**na**	**2.59**	**0.2**	**2.29**
Residential SAL[d]				**83**	**5**	**79**	**1700**	**290**	**42**	**150**
Industrial SAL[d]				**1000**	**17**	**1200**	**2,400,000**	**3100**	**160**	**710**
RE49-10-5108	49-609897	0.0–0.5	Fill	—	—	0.074	NA	—	—	—
RE49-10-5114	49-609900	0.0–0.5	Soil	—	—	0.058	NA	—	—	—
RE49-10-5121	49-609903	0.5–1.5	Fill	—	—	0.129	NA	—	—	—
RE49-10-5146	49-609913	0.0–0.5	Soil	—	—	0.1	NA	—	—	—
RE49-10-5226	49-609950	0.0–0.5	Soil	—	—	0.137	NA	—	—	—
RE49-10-7044	49-610481	118.0–120.0	Qbt3	—	NA	—	0.35 (J+)	—	—	—
RE49-10-7050	49-610485	88.0–90.0	Qbt3	—	NA	—	0.265 (J+)	—	—	—

Notes: All activities are in pCi/g. Data qualifiers are defined in Appendix A.

[a] BVs/FVs from LANL (1998, 059730).

[b] na = Not available.

[c] FV applies to soil samples collected from 0–1 ft only.

[d] SALs from LANL (2015, 600929).

[e] NA = Not analyzed.

[f] — = Not detected or not detected above BV/FV.

Table 6.11-5
Summary of Pore-Gas Samples Collected and Analyses Requested at Area 12, AOC 49-008(d)

Sample ID	Location ID	Depth (ft)	Media	Tritium	VOCs
MD49-10-12183	49-610481	29.0–31.0	Pore gas	10-1792	10-1791
MD49-10-12181	49-610481	77.0–79.0	Pore gas	10-1792	10-1791
MD49-10-12179	49-610481	82.0–84.0	Pore gas	10-1581	10-1580

Note: Numbers in analyte columns are request numbers.

Table 6.11-6
Summary of Organic Chemicals Detected in Pore-Gas Samples Collected at Area 12, AOC 49-008(d)

Sample ID	Location ID	Depth (ft)	Media	Acetone	Benzene	Butanone[2-]	Carbon Disulfide	Chloromethane	Dichlorodifluoromethane	Ethylbenzene	Ethyltoluene[4-]	Styrene	Toluene	Trimethylbenzene[1,2,4-]	Trimethylbenzene[1,3,5-]	Xylene (Total)	Xylene[1,2-]	Xylene[1,3-]+Xylene[1,4-]
Residential Soil-Gas Vapor Intrusion Screening Level[a]				**323,000**	**36**	**52,100**	**7300**	**156**	**1040**	**112**	**52,100[b]**	**10,400**	**52,100**	**66[c]**	**66[d]**	**1040**	**1040**	**1040[e]**
MD49-10-12183	49-610481	29.0–31.0	Pore gas	26 (J)	13	4.8	4.2	—[f]	2.8	5.4	4.5	—	30	4.7	—	23	5.5	17
MD49-10-12181	49-610481	77.0–79.0	Pore gas	46 (J)	29	15	98	—	3	13	16	—	52	17	4.7	51	13	38
MD49-10-12179	49-610481	82.0–84.0	Pore gas	24	8.9	9.4	—	2.9	3	7.9	13	2.9	16	15	4.3	31	8.1	23

Notes: All concentrations are in mg/kg. Data qualifiers are defined in Appendix A.

[a] Screening levels from NMED (2015, 600915) unless otherwise noted.

[b] Toluene used as a surrogate based on structural similarity..

[c] Residential air screening level from EPA regional screening levels (http://www.epa.gov/risk/risk-based-screening-table-generic-tables) divided by default attenuation factor of 0.11 (NMED 2015, 600915, p. 47).

[d] Trimethylbenzene[1,2,4-] used as a surrogate based on structural similarity.

[e] Xylenes used as a surrogate based on structural similarity.

[f] — = Not detected.

Table 6.11-7
Summary of Tritium in Pore-Gas Samples at Area 12, AOC 49-008(d)

Sample ID	Location ID	Depth (ft)	Media	Tritium
MD49-10-12183	49-610481	29.0–31.0	Pore gas	6777.46 (J)
MD49-10-12181	49-610481	77.0–79.0	Pore gas	9661.86 (J)
MD49-10-12179	49-610481	82.0–84.0	Pore gas	20,140

Notes: All activities are in pCi/L. Data qualifiers are defined in Appendix A.

Table 8.2-1
Summary of Investigation Results and Recommendations

SWMU/AOC	Brief Description	Extent Defined or No Further Sampling Warranted?	Potential Unacceptable Risk/Dose?	Recommendation
SWMU 49-001(a)	Experimental shafts	Yes	No*	CME
SWMU 49-001(b)	Experimental shafts	Yes	No*	CME
SWMU 49-001(c)	Experimental shafts	Yes	No*	CME
SWMU 49-001(d)	Experimental shafts	Yes	No*	CME
SWMU 49-001(e)	Experimental shafts	Yes	Yes, Residential	Complete with controls
SWMU 49-001(f)	Experimental shafts	Yes	Yes, Residential*	CME
SWMU 49-001(g)	Area of soil contamination	Yes	No	Complete without controls
SWMU 49-003	Inactive leach field and associated drainlines	Yes	No	Complete without controls
AOC 49-008(c)	Area of soil contamination	Yes	No	Complete without controls
AOC 49-008(d)	Bottle house and cable pull test facility	Yes	No	Complete without controls

* Present-day risk only. Future risk to be evaluated as part of CME.

Appendix A

Acronyms and Abbreviations,
Metric Conversion Table, and Data Qualifier Definitions

A-1.0 ACRONYMS AND ABBREVIATIONS

$\%CO_2$	percent carbon dioxide
% moisture	percent moisture
$\%O_2$	percent oxygen
%R	percent recovery
AK	acceptable knowledge
ALARA	as low as reasonably achievable
amsl	above mean sea level
AOC	area of concern
ATSDR	Agency for Toxic Substances and Disease Registry
AUF	area use factor
bgs	below ground surface
BHC	benzene hexachloride
BV	background value
CCV	continuing calibration verification
CME	corrective measures evaluation
COC	chain of custody
Consent Order	Compliance Order on Consent
COPC	chemical of potential concern
COPEC	chemical of potential ecological concern
cpm	counts per minute
CPTF	Cable Pull Test Facility
CSM	conceptual site model
CVAA	cold vapor atomic absorption
D&D	decontamination and decommissioning
DAF	dilution attenuation factor
DGPS	differential global-positioning system
DL	detection limit
DOE	Department of Energy (U.S.)
DOT	Department of Transportation (U.S.)
dpm	disintegrations per minute
EDL	estimated detection limit
EH	redox potential

EM-LA	Environmental Management Los Alamos Field Office (DOE)
EPA	Environmental Protection Agency (U.S.)
EPC	exposure point concentration
EQL	estimated quantitation limit
ESH	Environment, Safety, and Health
ESL	ecological screening levels
ET	evapotranspiration
eV	electronvolt
FD	field duplicate
FV	fallout value
GC/MS	gas chromatography/mass spectrometry
HDT	Hazardous Devices Team
HE	high explosives
HI	hazard index
HIR	historical investigation report
HQ	hazard quotient
HR	home range
ICS	interference-check sample
ICV	initial calibration verification
I.D.	inside diameter
IDW	investigation-derived waste
IM	interim measure
IP	Individual Permit
IS	internal standard
Kd	soil-water partition coefficient
Koc	organic carbon partition coefficient
Kow	octanol/water partition coefficient
KPA	kinetic phosphorescence analysis
LAL	lower acceptance limit
LANL	Los Alamos National Laboratory
LCS	laboratory control sample
LOAEL	lowest observed adverse effect level
MCL	maximum contaminant level (EPA)
MDA	material disposal area

MDC	minimum detectable concentration
MDL	method detection limit
MS	matrix spike
MSD	matrix spike duplicate
MSW	municipal solid waste
N3B	Newport News Nuclear BWXT-Los Alamos, LLC
NES	nuclear environmental site
NFA	no further action
NMED	New Mexico Environment Department
NMWQCC	New Mexico Water Quality Control Commission
NOAEL	no observed adverse effect level
O.D.	outside diameter
PAUF	population area use factor
PCB	polychlorinated biphenyl
PID	photoionization detector
PPE	personal protective equipment
PQL	practical quantitation limit
QA	quality assurance
QC	quality control
QP	quality procedure
RCRA	Resource Conservation and Recovery Act
RCT	radiological control technician
RfD	reference dose
RFI	RCRA facility investigation
RL	reporting limit
RPD	relative percent difference
RRF	relative retention factor
SAL	screening action level
SCL	sample collection log
SF	slope factor
SMO	Sample Management Office
SNM	special nuclear material
SOP	standard operating procedure
SOW	statement of work

SSL	soil screening level
SV	screening value
SVOC	semivolatile organic compound
SWMU	solid waste management unit
T&E	threatened and endangered
TA	technical area
TAL	target analyte list [EPA]
TD	total depth
TDR	time-domain reflectometry
TPH-DRO	total petroleum hydrocarbons–diesel range organics
TPH-GRO	total petroleum hydrocarbons–gasoline range organics
TRV	toxicity reference value
UAL	upper acceptance limit
UCL	upper confidence limit
UTL	upper tolerance limit
VCA	voluntary corrective action
VOC	volatile organic compound
WCSF	waste characterization strategy form

A-2.0 METRIC CONVERSION TABLE

Multiply SI (Metric) Unit	by	To Obtain U.S. 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)

A-3.0 DATA QUALIFIER DEFINITIONS

Data Qualifier	Definition
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.
R	The data are rejected as a result of major problems with quality assurance/quality control parameters.

Appendix B

Field Methods

B-1.0 INTRODUCTION

This appendix summarizes field methods used during the 2009–2010 investigation at Technical Area 49 (TA-49). Table B-1.0-1 provides general method information, and the following sections provide additional details. All activities were conducted in accordance with the applicable standard operating procedures (SOPs) and quality procedures (QPs).

B-2.0 EXPLORATORY DRILLING CHARACTERIZATION

All drilling for the 2009–2010 investigation was conducted for the purpose of collecting investigation samples; no exploratory drilling characterization was conducted.

B-3.0 FIELD-SCREENING METHODS

This section summarizes the field-screening methods used during the 2009–2010 drilling and sampling activities at TA-49. The field-screening results are presented on in Appendix D (on CD), sample collection logs (SCLs) in Appendix G (on DVD), and in the main text under appropriate sections for each respective solid waste management unit (SWMU) or area of concern (AOC).

B-3.1 Field Screening for Radioactivity

Core, surface, shallow-subsurface, and sediment samples were screened for gross-alpha and -beta radiation. Screening was conducted by a Laboratory radiological control technician (RCT) using an Eberline E600 with either a 380AB or SHP360 probe (or equivalent) and an ESP-1 rate meter with a 210 probe (or equivalent) in accordance with the SOP-10.07, Field Monitoring for Surface and Volume Radioactivity Levels. Measurements were made by conducting a quick scan to find the location with the highest initial reading and the probe was held less than 1 in. away from the medium. Following the quick scan, a 1-min reading was collected to determine gross-alpha and -beta radiation levels. After radiological field-screening measurements were established, soil and core material was sampled and/or logged. Field personnel recorded background measurements for gross-alpha and -beta radiation daily. The background measurements are recorded in Appendix D (on CD) and on SCLs in Appendix G (on DVD).

B-3.2 Field Screening for Organic Vapors

Organic-vapor monitoring of subsurface samples was performed using a MiniRAE 2000, Model PGM-7600 photoionization detector (PID) with an 11.7-electronvolt (eV) bulb. Screening was performed in accordance with the manufacturer's specifications and SOP-06.33, Headspace Vapor Screening with a Photoionization Detector. Samples were placed in a glass container and covered with aluminum foil. The container was sealed, shaken gently, and allowed to equilibrate for 5 min. The sample was screened by inserting the PID probe into the container and measuring and recording any detected vapors. The workers' breathing zone was also monitored using the MiniRAE 2000 PID. Field-screening measurements are presented on SCLs included in Appendix G (on DVD).

B-3.3 Field Screening for Percent Oxygen and Percent Carbon Dioxide

Before each pore-gas sampling event, each sample port was purged and monitored with a LANDTEC GEM 2000 instrument (or equivalent) until the percent oxygen ($\%O_2$) and percent carbon dioxide ($\%CO_2$) levels stabilized at values representative of subsurface pore-gas conditions. Field-screening results were

recorded on the appropriate SCL and/or in the field logbook. The SCLs are provided in Appendix G (on DVD).

B-4.0 FIELD INSTRUMENT CALIBRATION

Instrument calibration and/or function check was completed daily. Calibration of the PID was conducted by the site safety officer. Calibration of the Eberline E-600 was conducted by the RCT. All calibrations were performed according to the manufacturer's specifications and requirements.

B-4.1 PID Calibration

The PID was calibrated both to ambient air and a standard reference gas (100 ppm isobutylene). The ambient-air calibration determined the zero point of the instrument sensor calibration curve in ambient air. Calibration with the standard reference gas determined a second point of the sensor calibration curve. Each calibration was within 3% of 100 ppm isobutylene, qualifying the instrument for use.

The following calibration information was recorded daily on operational calibration logs:

- instrument identification number
- final span settings
- date and time
- concentration and type of calibration gas used (isobutylene at 100 ppm)
- name of personnel performing calibration

All daily calibration procedures for the MiniRAE 2000 PID met the manufacturer's specifications for standard reference gas calibration.

B-4.2 Eberline E-600 Instrument Calibration

The Eberline E600 was calibrated daily by the RCT before local background levels for radioactivity were measured. The instrument was calibrated using plutonium-239 and chloride-36 sources for alpha and beta emissions, respectively. The following five checks were performed as part of the calibration procedures: calibration date, physical damage, battery, response to a source of radioactivity, and background. All calibrations performed for the Eberline E600 met the manufacturer's specifications and the applicable radiation detection instrument manual.

B-5.0 SURFACE, SHALLOW-SUBSURFACE, AND SUBSURFACE SAMPLING

This section summarizes the methods used for collecting samples for laboratory analysis, including surface soil, fill, sediment, tuff, and pore-gas samples. The samples were collected according to the approved investigation work plan (LANL 2008, 102691; NMED 2008, 100464).

B-5.1 Surface and Shallow-Subsurface Soil-Sampling Methods

Surface and shallow-subsurface samples, including sediment samples, were collected within TA-49 in accordance with SOP 06-10, Hand Auger and Thin-Wall Tube Sampler. A hand auger with a stainless-steel bucket was used to collect material in approximately 6-in. intervals. Samples were transferred to

sample-collection jars or bags for transport to the Sample Management Office (SMO) for shipment to analytical laboratories and American Radiation Services for a quick turnaround on radiological screening.

Samples were labeled, documented, and sealed with custody seals before to transportation in accordance with SOP-5057, Handling, Packaging, and Transporting Field Samples, and SOP-5058, Sample Control and Field Documentation.

All sample-collection tools were decontaminated immediately before collection of each sample in accordance with SOP-5061, Field Decontamination of Drilling and Sampling Equipment.

B-5.2 Borehole Drilling

For the 2009–2010 drilling investigation, 30 boreholes were drilled to depths ranging from 10 to 192 ft below ground surface. A Construction Mine Equipment 85 hollow-stem auger drill rig was employed for all drilling using 4.50-in.-inside–diameter (I.D.) and nominal 8.25-in.-outside-diameter (O.D.) augers. A hex-rod core retrieval system and 4-in.-O.D. stainless-steel core barrels were used for sampling. A nominal 8.50-in.-diameter drill bit was used for all borings. During drilling, continuous core was recovered using the stainless-steel core barrels through the center of the 4.50-in. drill string. Core was collected in 5-ft sample runs.

B-5.3 Borehole Logging

Borehole lithologic logs were completed for all borehole locations at TA-49 in 2009–2010. All boreholes were continuously cored and logged in 5.0-ft intervals in accordance with SOP-12.01, Field Logging, Handling, and Documentation of Borehole Materials. Information recorded on field-boring logs included footage and percent recovery, field-screening results for radioactivity and organic vapors, lithology, depth of samples collected, sample identification, and other relevant observations. The borehole logs are presented on CD in Appendix D.

B-5.4 Subsurface Soil- and Rock-Sampling Methods

The subsurface soil and rock samples were continuously cored from a stainless-steel split-spoon core-barrel sampler in accordance with SOP-6.24, Sample Collection from Split-Spoon Samplers and Shelby-Tube Samplers. The core was described for lithologic and structural features per SOP-9.10, Field Sampling of Core and Cuttings for Geological Analysis, and SOP-12.01, Field Logging, Handling, and Documentation of Borehole Materials. The borehole logs are provided in Appendix D (on CD).

Subsurface sampling intervals were selected based on data requirements in the approved investigation work plan (LANL 2008, 102691; NMED 2008, 100464) and/or

- the depth of the highest field-screening result, if applicable;
- the depth of geologically significant features;
- the discretion of the field geologist; and
- the total depth of the borehole.

Sample depth intervals and respective laboratory analysis for all samples collected are recorded on the SCLs and are presented in Appendix G (on DVD).

B-5.5 Pore-Gas Sampling

Pore-gas samples were collected from discrete subsurface intervals in open boreholes using a single- and/or double-packer assembly. Required total-depth samples were collected with a single-packer system. Samples collected at other discrete depths in open boreholes were collected using a double-packer system. All pore-gas samples were collected in accordance with SOP-5074, Sampling for Sub-Atmospheric Air. Pore-gas samples were collected and analyzed for volatile organic compounds (VOCs) and tritium.

Before each sampling event, each isolated interval/sample port was purged and monitored with a LANDTEC GEM 2000 instrument (or equivalent) until $\%O_2$ and $\%CO_2$ levels stabilized at values representative of subsurface pore-gas conditions. In addition, the vapor-sample tubing was purged of stagnant air by drawing air from the sampling interval through the line. To ensure the sample collected was representative of the subsurface air at depth, every sampling activity included a purge cycle.

B-5.6 Quality Assurance/Quality Control Samples

Quality assurance/quality control samples for soil, tuff and sediment were collected in accordance with SOP-5059, Field Quality Control Samples. Field-duplicate samples were collected at a frequency of at least 1 duplicate sample for every 10 samples. Field-rinsate samples were collected from sampling equipment at a frequency of at least 1 rinsate sample for every 10 samples. Field-trip blanks also were collected at a frequency of 1 per 10 samples for VOCs, if applicable.

B-5.7 Sample Documentation and Handling

Field personnel completed an SCL and a chain-of-custody (COC) form for each sample set (included in Appendix G, on DVD). Sample containers were sealed with COC seals and placed in coolers at approximately 4°C. Samples were packaged and preserved, as necessary, depending upon the analytical method to be used, packed, handled, and shipped in accordance with SOP-5057, Handling, Packaging, and Transporting Field Samples, and SOP-5056, Sample Containers and Preservation.

B-5.8 Borehole Abandonment

Based on the results of pore-gas sampling for VOCs and tritium, no boreholes were completed as monitoring wells. All boreholes were abandoned in accordance with SOP-5034, Monitor Well and RFI Borehole Abandonment.

B-5.9 Decontamination of Sampling Equipment

Drilling and sampling equipment was decontaminated to minimize the potential for cross-contamination between sampling locations. Decontamination was completed using a dry decontamination method with disposable paper towels and over-the-counter cleaner, such as Fantastik or equivalent. All decontamination procedures followed SOP-1.08, Field Decontamination of Drilling and Sampling Equipment. All heavy equipment, such as backhoes, forklifts, drill rigs, etc., were screened by an RCT and released before entering and exiting TA-49.

B-6.0 GEODETIC SURVERYING

Geodetic surveys were conducted during the TA-49 investigation to establish and mark all sampling and borehole locations. The planned sampling locations were determined based on location and results of historical borehole and surface samples. Geodetic surveys were conducted at the completion of the sampling campaign to establish the spatial coordinates for all sampling locations. Geodetic surveys were conducted in accordance with SOP 5028, Coordinating and Evaluating Geodetic Surveys, using a Trimble 5700 differential global-positioning system (DPGS). All coordinates are expressed in New Mexico State Plane Coordinate System 1983, New Mexico Central. Surveyed coordinates for all sampling locations are presented in Appendix C and in tables in the supplemental investigation report under the respective sections for each SWMU or AOC.

B-7.0 INVESTIGATION-DERIVED WASTE STORAGE AND DISPOSAL

Management of investigation-derived waste (IDW) is described in Appendix E. All drill cuttings were stored in less-than-90-day hazardous-waste storage areas and sampled within 10 d. All drill cutting waste was downgraded to nonhazardous and was land-applied in accordance with SOP-11.0, Land Application of Drill Cuttings.

B-8.0 REFERENCES

The following reference list includes documents cited in this appendix. Parenthetical information following each reference provides the author(s), publication date, and ERID, ESHID, or EMID. ERIDs were assigned by Los Alamos National Laboratory's (the Laboratory's) Associate Directorate for Environmental Management (IDs through 599999); ESHIDs were assigned by the Laboratory's Associate Directorate for Environment, Safety, and Health (IDs 600000 through 699999); and EMIDs are assigned by N3B (IDs 700000 and above).

LANL (Los Alamos National Laboratory), January 2008. "Investigation Work Plan for Sites at Technical Area 49 Inside the Nuclear Environmental Site Boundary, Revision 1," Los Alamos National Laboratory document LA-UR-08-0447, Los Alamos, New Mexico. (LANL 2008, 102691)

NMED (New Mexico Environment Department), February 14, 2008. "Approval with Modifications for the Investigation Work Plan for Sites at Technical Area 49 Inside the Nuclear Environmental Site Boundary," New Mexico Environment Department letter to D. Gregory (DOE-LASO) and D.McInroy (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NMED 2008, 100464)

Table B-1.0-1
Summary Description of Field Investigation Methods

Method	Summary
Hand-Auger Sampling	This method is typically used for sampling soil or sediment at depths of less than 10–15 ft but in some cases may be used to collect samples of weathered or nonwelded tuff. The method involves hand-turning a stainless-steel bucket auger (typically 3–4 in.-I.D.), creating a vertical hole that can be advanced to the desired sample depth. During the 2009–2010 investigation, when the desired depth was reached, the auger was decontaminated before the hole was advanced through the sample depth. The sample material was transferred from the auger bucket to a stainless-steel sampling bowl before the various required sample containers were filled.
Split-Spoon Core-Barrel Sampling	This method involves a stainless-steel core barrel (typically 4-in. I.D., 2.5 ft long), which is advanced using a powered drilling rig. The core barrel extracted a continuous length of soil and/or rock that can be examined as a unit. The split-spoon core barrel is a cylindrical barrel split lengthwise so the two halves can be separated to expose the core sample. Once the core sample was extracted, the section of core was screened for radioactivity and organic vapors, photographed, and described in a geologic log. A portion of the core was collected as a discrete sample from the desired depth.
Headspace Vapor Screening	Individual soil, rock, or sediment samples were field screened for organic vapors by placing a portion of the sample in a plastic sample bag or in a glass container with a foil-sealed cover. The container was sealed and gently shaken and allowed to equilibrate for 5 min. The sample was then screened by inserting a PID probe into the container and measuring and recording any detected vapors. PIDs must use lamps with voltage of 11.7 eV.
Handling, Packaging, and Shipping of Samples	Field team members sealed and labeled samples before packing and ensured that the sample containers and the containers used for transport were free of external contamination. Field team members packaged all samples to minimize the possibility of breakage during transportation. After all environmental samples were collected, packaged, and preserved, a field team member transported them to either the SMO or an SMO-approved radiation screening laboratory under COC. The SMO arranged for shipping of samples to analytical laboratories. The field team member informed the SMO and/or the radiation screening laboratory coordinator whenever levels of radioactivity were in the action-level or limited-quantity ranges.
Sample Control and Field Documentation	The collection, screening, and transport of samples were documented on standard forms generated by the SMO. These included SCLs, COC forms, and sample container labels. SCLs were completed at the time of sample collection and were signed by the sampler and a reviewer who verified the logs for completeness and accuracy. Corresponding labels were initialed and applied to each sample container, and custody seals were placed around container lids or openings. The COC forms were completed and assigned to verify that the samples were not left unattended.
Field Quality-Control Samples	Field quality-control samples were collected as follows: *Field Duplicates*: at a frequency of 10%; collected at the same time as a regular sample and submitted for the same analyses. *Equipment Rinsate Blank*: at a frequency of 10%; collected by rinsing sampling equipment with deionized water, which was collected in a sample container and submitted for laboratory analysis. *Trip Blanks*: required for all field events and included collecting samples for VOC analysis. Trip blanks are containers of certified clean sand that are opened and kept with the other sample containers during the sampling process.

Table B-1.0-1 (continued)

Method	Summary
Well and Borehole Abandonment	Shallower boreholes were abandoned by filling with bentonite chips or pellets, which were then hydrated. Boreholes with a total depth greater than 20 ft were abandoned with bentonite grout by filling upward from the bottom via tremie pipe to within 2 ft of the surface. The remainder was cemented/grouted to surface grade. After 24 h, the backfilled level was checked for settlement and additional concrete/grout was added as needed.
Field Decontamination of Drilling and Sampling Equipment	Dry decontamination was the preferred method to minimize the generation of liquid waste. Dry decontamination may include the use of a wire brush or other tool for removing soil or other material adhering to the sampling equipment, followed by use of a commercial cleaning agent (nonacid, waxless cleaners) and paper wipes. Dry decontamination may be followed by wet decontamination if necessary.
Containers and Preservation of Samples	Specific requirements/processes for sample containers, preservation techniques, and holding times are based on U.S. Environmental Protection Agency guidance for environmental sampling, preservation, and quality assurance. Specific requirements for each sample are printed on the sample collection logs provided by the SMO (size and type of container [e.g., glass, amber glass, and polyethylene]). All samples were preserved by placing them in insulated containers with ice to maintain a temperature of 4˚C. Other requirements, such as the use of nitric acid or other preservatives, may apply to different media or analytical requests.
Coordination and Evaluation of Geodetic Surveys	Geodetic surveys focused on obtaining survey data of acceptable quality for use during project investigations. Geodetic surveys were conducted with a Trimble 5700 DGPS. The survey data conformed to Laboratory Information Architecture project standards IA-CB02, GIS Horizontal Spatial Reference System, and IA-D802, Geospatial Positioning Accuracy Standard for A/E/C/ and Facility Management. All coordinates are expressed in New Mexico State Plane Coordinate System 1983, NM Central, U.S. ft coordinates. All elevation data are reported relative to the National Geodetic Vertical Datum of 1983.
Management of Waste and Waste Characterization	Investigation-derived waste (IDW) was managed, characterized, and stored in accordance with an approved waste characterization strategy form that documented site history, field activities, and the characterization approach for each waste stream managed. Waste characterization was adequate to comply with on- or off-site waste acceptance criteria. All stored IDW was marked with appropriate signage and labels. Drummed IDW was stored on pallets to prevent deterioration of containers. Generators were required to reduce the volume of waste generated by as much as was technically and economically feasible. The means to store, control, and transport each potential waste type and its classification was determined before the start of field operations that generated waste. A waste storage area was established before waste was generated. Waste storage areas located in controlled areas of the Laboratory were controlled as needed to prevent inadvertent addition or management of wastes by unauthorized personnel. Each container of waste generated was individually labeled with waste classification, item identification number, and radioactivity (if applicable), immediately following containerization. All waste was segregated by classification and compatibility to prevent cross-contamination. Management of IDW is presented in Appendix E.

Appendix C

Geodetic Survey Coordinates

Location Coordinates for 2009–2010 TA-49 Investigation

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
Area 1, Drilling			
49-001(a)	49-610946	1624456.252	1755558.556
49-001(a)	49-610948	1624579.504	1755466.562
49-001(a)	49-610947	1624403.9	1755357.743
49-001(a)	49-610949	1624332.567	1755470.067
Area 1, Surface and Shallow-Subsurface			
49-001(a)	49-610206	1624405.92	1755440.16
49-001(a)	49-610207	1624455.92	1755440.16
49-001(a)	49-610208	1624505.92	1755440.16
49-001(a)	49-610209	1624430.92	1755490.16
49-001(a)	49-610210	1624480.92	1755490.16
49-001(a)	49-610211	1624405.92	1755515.16
49-001(a)	49-610212	1624430.92	1755515.16
49-001(a)	49-610213	1624455.92	1755515.16
49-001(a)	49-610214	1624380.92	1755390.16
49-001(a)	49-610215	1624430.92	1755390.16
49-001(a)	49-610216	1624505.92	1755390.16
49-001(a)	49-610217	1624480.92	1755415.16
49-001(a)	49-610218	1624355.92	1755440.16
49-001(a)	49-610219	1624555.92	1755440.16
49-001(a)	49-610220	1624430.92	1755465.16
49-001(a)	49-610221	1624355.92	1755490.16
49-001(a)	49-610222	1624530.92	1755515.16
49-001(a)	49-610223	1624380.92	1755540.16
49-001(a)	49-610224	1624430.92	1755565.16
49-001(a)	49-610225	1624505.92	1755565.16
49-001(a)	49-610226	1624480.92	1755340.16
49-001(a)	49-610227	1624605.92	1755365.16
49-001(a)	49-610228	1624305.92	1755465.16
49-001(a)	49-610229	1624580.92	1755490.16
49-001(a)	49-610230	1624555.92	1755565.16
49-001(a)	49-610231	1624330.92	1755590.16
49-001(a)	49-610232	1624405.92	1755615.16
49-001(a)	49-610233	1624555.92	1755615.16
49-001(a)	49-610234	1624305.92	1755615.16
49-001(a)	49-610235	1624355.92	1755390.16
49-001(a)	49-610236	1624405.92	1755390.16
49-001(a)	49-610237	1624455.92	1755390.16
49-001(a)	49-610238	1624480.92	1755390.16

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
49-001(a)	49-610239	1624530.92	1755390.16
49-001(a)	49-610240	1624555.92	1755390.16
49-001(a)	49-610241	1624355.92	1755415.16
49-001(a)	49-610242	1624380.92	1755415.16
49-001(a)	49-610243	1624405.92	1755415.16
49-001(a)	49-610244	1624430.92	1755415.16
49-001(a)	49-610245	1624455.92	1755415.16
49-001(a)	49-610246	1624505.92	1755415.16
49-001(a)	49-610247	1624530.92	1755415.16
49-001(a)	49-610248	1624555.92	1755415.16
49-001(a)	49-610249	1624380.92	1755440.16
49-001(a)	49-610250	1624430.92	1755440.16
49-001(a)	49-610251	1624480.92	1755440.16
49-001(a)	49-610252	1624530.92	1755440.16
49-001(a)	49-610253	1624355.92	1755465.16
49-001(a)	49-610254	1624380.92	1755465.16
49-001(a)	49-610255	1624405.92	1755465.16
49-001(a)	49-610256	1624455.92	1755465.16
49-001(a)	49-610257	1624480.92	1755465.16
49-001(a)	49-610258	1624505.92	1755465.16
49-001(a)	49-610259	1624530.92	1755465.16
49-001(a)	49-610260	1624555.92	1755465.16
49-001(a)	49-610261	1624380.92	1755490.16
49-001(a)	49-610262	1624405.92	1755490.16
49-001(a)	49-610263	1624455.92	1755490.16
49-001(a)	49-610264	1624505.92	1755490.16
49-001(a)	49-610265	1624530.92	1755490.16
49-001(a)	49-610266	1624555.92	1755490.16
49-001(a)	49-610267	1624355.92	1755515.16
49-001(a)	49-610268	1624380.92	1755515.16
49-001(a)	49-610269	1624480.92	1755515.16
49-001(a)	49-610270	1624505.92	1755515.16
49-001(a)	49-610271	1624355.92	1755540.16
49-001(a)	49-610272	1624405.92	1755540.16
49-001(a)	49-610273	1624430.92	1755540.16
49-001(a)	49-610274	1624455.92	1755540.16
49-001(a)	49-610275	1624480.92	1755540.16
49-001(a)	49-610276	1624505.92	1755540.16
49-001(a)	49-610277	1624530.92	1755540.16
49-001(a)	49-610278	1624355.92	1755565.16

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
49-001(a)	49-610279	1624380.92	1755565.16
49-001(a)	49-610280	1624405.92	1755565.16
49-001(a)	49-610281	1624455.92	1755565.16
49-001(a)	49-610282	1624480.92	1755565.16
49-001(a)	49-610283	1624330.92	1755340.16
49-001(a)	49-610284	1624380.92	1755340.16
49-001(a)	49-610285	1624430.92	1755340.16
49-001(a)	49-610286	1624530.92	1755340.16
49-001(a)	49-610287	1624580.92	1755340.16
49-001(a)	49-610288	1624305.92	1755365.16
49-001(a)	49-610289	1624355.92	1755365.16
49-001(a)	49-610290	1624405.92	1755365.16
49-001(a)	49-610291	1624455.92	1755365.16
49-001(a)	49-610292	1624505.92	1755365.16
49-001(a)	49-610293	1624555.92	1755365.16
49-001(a)	49-610294	1624330.92	1755390.16
49-001(a)	49-610295	1624580.92	1755390.16
49-001(a)	49-610296	1624305.92	1755415.16
49-001(a)	49-610297	1624605.92	1755415.16
49-001(a)	49-610298	1624330.92	1755440.16
49-001(a)	49-610299	1624580.92	1755440.16
49-001(a)	49-610300	1624605.92	1755465.16
49-001(a)	49-610301	1624330.92	1755490.16
49-001(a)	49-610302	1624305.92	1755515.16
49-001(a)	49-610303	1624555.92	1755515.16
49-001(a)	49-610304	1624605.92	1755515.16
49-001(a)	49-610305	1624330.92	1755540.16
49-001(a)	49-610306	1624580.92	1755540.16
49-001(a)	49-610307	1624305.92	1755565.16
49-001(a)	49-610308	1624380.92	1755590.16
49-001(a)	49-610309	1624430.92	1755590.16
49-001(a)	49-610310	1624480.92	1755590.16
49-001(a)	49-610311	1624530.92	1755590.16
49-001(a)	49-610312	1624580.92	1755590.16
49-001(a)	49-610313	1624355.92	1755615.16
49-001(a)	49-610314	1624455.92	1755615.16
49-001(a)	49-610315	1624505.92	1755615.16

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
MDA AB, Drilling			
49-001(b)	49-610942	1625940.112	1755357.651
49-001(b)	49-610943	1625778.462	1755480.833
49-001(b)	49-610944	1625659.406	1755325.387
49-001(b)	49-610945	1625765.911	1755094.455
MDA AB, Surface and Shallow-Subsurface			
49-001(b,c,d)	49-610182	1625739.2	1755429.22
49-001(b,c,d)	49-610183	1625689.2	1755429.22
49-001(b,c,d)	49-610184	1625714.2	1755429.22
49-001(b,c,d)	49-610185	1625714.2	1755404.22
49-001(b,c,d)	49-610186	1625589.2	1755354.22
49-001(b,c,d)	49-610187	1625639.2	1755304.22
49-001(b,c,d)	49-610188	1625564.2	1755279.22
49-001(b,c,d)	49-610189	1625614.2	1755279.22
49-001(b,c,d)	49-610190	1625664.2	1755279.22
49-001(b,c,d)	49-610191	1625914.2	1755279.22
49-001(b,c,d)	49-610192	1625589.2	1755304.22
49-001(b,c,d)	49-610193	1625689.2	1755304.22
49-001(b,c,d)	49-610194	1625614.2	1755329.22
49-001(b,c,d)	49-610195	1625664.2	1755329.22
49-001(b,c,d)	49-610197	1625639.2	1755354.22
49-001(b,c,d)	49-610198	1625689.2	1755354.22
49-001(b,c,d)	49-610199	1625664.2	1755379.22
49-001(b,c,d)	49-610200	1625714.2	1755379.22
49-001(b,c,d)	49-610202	1625639.2	1755404.22
49-001(b,c,d)	49-610203	1625689.2	1755404.22
49-001(b,c,d)	49-610204	1625664.2	1755429.22
49-001(b,c,d)	49-610205	1625914.2	1755429.22
49-001(b,c,d)	49-610131	1625839.2	1755104.22
49-001(b,c,d)	49-610132	1625789.2	1755154.22
49-001(b,c,d)	49-610133	1625739.2	1755179.22
49-001(b,c,d)	49-610134	1625814.2	1755179.22
49-001(b,c,d)	49-610135	1625839.2	1755054.22
49-001(b,c,d)	49-610136	1625714.2	1755079.22
49-001(b,c,d)	49-610137	1625714.2	1755129.22
49-001(b,c,d)	49-610138	1625664.2	1755179.22
49-001(b,c,d)	49-610139	1625564.2	1755229.22
49-001(b,c,d)	49-610140	1625914.2	1755229.22
49-001(b,c,d)	49-610141	1625789.2	1755104.22
49-001(b,c,d)	49-610142	1625814.2	1755104.22

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
49-001(b,c,d)	49-610143	1625764.2	1755129.22
49-001(b,c,d)	49-610144	1625789.2	1755129.22
49-001(b,c,d)	49-610145	1625814.2	1755129.22
49-001(b,c,d)	49-610146	1625839.2	1755129.22
49-001(b,c,d)	49-610147	1625764.2	1755154.22
49-001(b,c,d)	49-610148	1625814.2	1755154.22
49-001(b,c,d)	49-610149	1625839.2	1755154.22
49-001(b,c,d)	49-610150	1625714.2	1755179.22
49-001(b,c,d)	49-610151	1625764.2	1755179.22
49-001(b,c,d)	49-610152	1625789.2	1755179.22
49-001(b,c,d)	49-610153	1625714.2	1755204.22
49-001(b,c,d)	49-610154	1625739.2	1755204.22
49-001(b,c,d)	49-610155	1625764.2	1755204.22
49-001(b,c,d)	49-610156	1625889.2	1755229.22
49-001(b,c,d)	49-610157	1625739.2	1755054.22
49-001(b,c,d)	49-610158	1625789.2	1755054.22
49-001(b,c,d)	49-610159	1625889.2	1755054.22
49-001(b,c,d)	49-610160	1625764.2	1755079.22
49-001(b,c,d)	49-610161	1625814.2	1755079.22
49-001(b,c,d)	49-610162	1625864.2	1755079.22
49-001(b,c,d)	49-610163	1625739.2	1755104.22
49-001(b,c,d)	49-610164	1625889.2	1755104.22
49-001(b,c,d)	49-610165	1625664.2	1755129.22
49-001(b,c,d)	49-610166	1625864.2	1755129.22
49-001(b,c,d)	49-610167	1625914.2	1755129.22
49-001(b,c,d)	49-610168	1625689.2	1755154.22
49-001(b,c,d)	49-610169	1625889.2	1755154.22
49-001(b,c,d)	49-610170	1625864.2	1755179.22
49-001(b,c,d)	49-610171	1625914.2	1755179.22
49-001(b,c,d)	49-610172	1625639.2	1755204.22
49-001(b,c,d)	49-610173	1625689.2	1755204.22
49-001(b,c,d)	49-610174	1625789.2	1755204.22
49-001(b,c,d)	49-610175	1625739.2	1755154.22
49-001(b,c,d)	49-610176	1625889.2	1755204.22
49-001(b,c,d)	49-610177	1625614.2	1755229.22
49-001(b,c,d)	49-610178	1625589.2	1755254.22
49-001(b,c,d)	49-610179	1625639.2	1755254.22
49-001(b,c,d)	49-610180	1625689.2	1755254.22
49-001(b,c,d)	49-610181	1625889.2	1755254.22
49-001(g)	49-610890	1625839.2	1755454.22

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
49-001(g)	49-610891	1625939.2	1755529.22
49-001(g)	49-610892	1625989.2	1755454.22
49-001(g)	49-610893	1625664.2	1755479.22
49-001(g)	49-610894	1625764.2	1755479.22
49-001(g)	49-610895	1625914.2	1755479.22
49-001(g)	49-610896	1625989.2	1755554.22
49-001(g)	49-610897	1625889.2	1755604.22
49-001(g)	49-610898	1625739.2	1755454.22
49-001(g)	49-610899	1625764.2	1755454.22
49-001(g)	49-610900	1625789.2	1755454.22
49-001(g)	49-610901	1625814.2	1755454.22
49-001(g)	49-610902	1625864.2	1755454.22
49-001(g)	49-610903	1625889.2	1755454.22
49-001(g)	49-610904	1625914.2	1755529.22
49-001(g)	49-610905	1625939.2	1755554.22
49-001(g)	49-610906	1625964.2	1755629.22
49-001(g)	49-610907	1625964.2	1755654.22
49-001(g)	49-610908	1625639.2	1755454.22
49-001(g)	49-610909	1625689.2	1755454.22
49-001(g)	49-610910	1625939.2	1755454.22
49-001(g)	49-610911	1625714.2	1755479.22
49-001(g)	49-610912	1625814.2	1755479.22
49-001(g)	49-610913	1625864.2	1755479.22
49-001(g)	49-610914	1625964.2	1755479.22
49-001(g)	49-610915	1625689.2	1755504.22
49-001(g)	49-610916	1625739.2	1755504.22
49-001(g)	49-610917	1625789.2	1755504.22
49-001(g)	49-610918	1625839.2	1755504.22
49-001(g)	49-610919	1625889.2	1755504.22
49-001(g)	49-610920	1625939.2	1755504.22
49-001(g)	49-610921	1625989.2	1755504.22
49-001(g)	49-610922	1625864.2	1755529.22
49-001(g)	49-610923	1625964.2	1755529.22
49-001(g)	49-610924	1625889.2	1755554.22
49-001(g)	49-610925	1625864.2	1755579.22
49-001(g)	49-610926	1625914.2	1755579.22
49-001(g)	49-610927	1625964.2	1755579.22
49-001(g)	49-610928	1626014.2	1755579.22
49-001(g)	49-610929	1625939.2	1755604.22
49-001(g)	49-610930	1625989.2	1755604.22

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
49-001(g)	49-610931	1625914.2	1755629.22
49-001(g)	49-610932	1626014.2	1755629.22
49-001(g)	49-610933	1625914.2	1755654.22
49-001(g)	49-610934	1626014.2	1755654.22
49-001(g)	49-610935	1625939.2	1755679.22
49-001(g)	49-610936	1625989.2	1755679.22
Area 3, Drilling			
49-001(e)	49-609981	1624106.558	1754493.145
49-001(e)	49-609982	1624184.798	1754571.654
49-001(e)	49-609983	1624185.608	1754414.635
49-001(e)	49-609984	1624263.308	1754492.605
Area 3, Surface and Shallow-Subsurface			
49-001(e)	49-609307	1624158.575	1754453.597
49-001(e)	49-609308	1624158.626	1754478.834
49-001(e)	49-609309	1624158.676	1754504.07
49-001(e)	49-609310	1624183.762	1754428.31
49-001(e)	49-609311	1624183.812	1754453.546
49-001(e)	49-609312	1624183.963	1754529.257
49-001(e)	49-609313	1624208.999	1754428.259
49-001(e)	49-609314	1624209.099	1754478.733
49-001(e)	49-609315	1624234.336	1754478.683
49-001(e)	49-609316	1624234.437	1754529.156
49-001(e)	49-609317	1624284.709	1754428.108
49-001(e)	49-609318	1624284.86	1754503.82
49-001(e)	49-609319	1624285.01	1754579.53
49-001(e)	49-609320	1624108.051	1754428.461
49-001(e)	49-609321	1624108.253	1754529.408
49-001(e)	49-609322	1624133.389	1754478.884
49-001(e)	49-609323	1624133.59	1754579.831
49-001(e)	49-609324	1624158.424	1754377.886
49-001(e)	49-609325	1624183.913	1754504.02
49-001(e)	49-609326	1624209.049	1754453.496
49-001(e)	49-609327	1624209.3	1754579.68
49-001(e)	49-609328	1624234.135	1754377.735
49-001(e)	49-609329	1624057.427	1754352.851
49-001(e)	49-609330	1624057.729	1754504.272
49-001(e)	49-609331	1624057.93	1754605.219
49-001(e)	49-609332	1624183.561	1754327.362
49-001(e)	49-609333	1624184.164	1754630.204
49-001(e)	49-609334	1624285.112	1754630.003

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
49-001(e)	49-609335	1624309.795	1754352.348
49-001(e)	49-609336	1624335.283	1754478.481
49-001(e)	49-609337	1624335.485	1754579.429
49-001(e)	49-609338	1624108.001	1754403.224
49-001(e)	49-609339	1624108.102	1754453.697
49-001(e)	49-609340	1624108.152	1754478.934
49-001(e)	49-609341	1624108.202	1754504.171
49-001(e)	49-609342	1624108.303	1754554.645
49-001(e)	49-609343	1624133.187	1754377.937
49-001(e)	49-609344	1624133.238	1754403.173
49-001(e)	49-609345	1624133.29	1754428.41
49-001(e)	49-609346	1624133.338	1754453.647
49-001(e)	49-609347	1624133.439	1754504.121
49-001(e)	49-609348	1624133.489	1754529.358
49-001(e)	49-609349	1624133.54	1754554.594
49-001(e)	49-609350	1624158.475	1754403.123
49-001(e)	49-609351	1624158.52	1754428.36
49-001(e)	49-609352	1624158.726	1754529.307
49-001(e)	49-609353	1624158.776	1754554.544
49-001(e)	49-609354	1624158.827	1754579.781
49-001(e)	49-609355	1624183.661	1754377.836
49-001(e)	49-609356	1624183.711	1754403.073
49-001(e)	49-609357	1624183.862	1754478.783
49-001(e)	49-609358	1624184.013	1754554.494
49-001(e)	49-609359	1624184.064	1754579.731
49-001(e)	49-609360	1624208.898	1754377.786
49-001(e)	49-609361	1624208.948	1754403.023
49-001(e)	49-609362	1624209.15	1754503.97
49-001(e)	49-609363	1624209.2	1754529.207
49-001(e)	49-609364	1624209.25	1754554.444
49-001(e)	49-609365	1624234.185	1754402.972
49-001(e)	49-609366	1624234.235	1754428.209
49-001(e)	49-609367	1624234.286	1754453.446
49-001(e)	49-609368	1624234.386	1754503.92
49-001(e)	49-609369	1624234.487	1754554.393
49-001(e)	49-609370	1624234.537	1754579.63
49-001(e)	49-609371	1624259.372	1754377.685
49-001(e)	49-609372	1624259.422	1754402.922
49-001(e)	49-609373	1624259.472	1754428.159
49-001(e)	49-609374	1624259.523	1754453.396

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
49-001(e)	49-609375	1624259.573	1754478.632
49-001(e)	49-609376	1624259.623	1754503.869
49-001(e)	49-609377	1624259.674	1754529.106
49-001(e)	49-609378	1624259.724	1754554.343
49-001(e)	49-609379	1624259.774	1754579.58
49-001(e)	49-609380	1624284.759	1754453.345
49-001(e)	49-609381	1624284.81	1754478.582
49-001(e)	49-609382	1624284.91	1754529.056
49-001(e)	49-609383	1624284.961	1754554.293
49-001(e)	49-609384	1624057.527	1754403.324
49-001(e)	49-609385	1624057.628	1754453.798
49-001(e)	49-609386	1624057.829	1754554.745
49-001(e)	49-609387	1624082.613	1754327.564
49-001(e)	49-609388	1624082.714	1754378.037
49-001(e)	49-609389	1624082.814	1754428.511
49-001(e)	49-609390	1624082.915	1754478.985
49-001(e)	49-609391	1624083.016	1754529.458
49-001(e)	49-609392	1624083.116	1754579.932
49-001(e)	49-609393	1624083.217	1754630.406
49-001(e)	49-609394	1624107.9	1754352.75
49-001(e)	49-609395	1624108.403	1754605.118
49-001(e)	49-609396	1624133.087	1754327.463
49-001(e)	49-609397	1624133.691	1754630.305
49-001(e)	49-609398	1624158.374	1754352.649
49-001(e)	49-609399	1624158.877	1754605.018
49-001(e)	49-609400	1624208.848	1754352.549
49-001(e)	49-609401	1624209.351	1754604.917
49-001(e)	49-609402	1624234.034	1754327.262
49-001(e)	49-609403	1624234.638	1754630.104
49-001(e)	49-609404	1624259.321	1754352.448
49-001(e)	49-609405	1624259.824	1754604.817
49-001(e)	49-609406	1624284.508	1754327.161
49-001(e)	49-609407	1624284.608	1754377.635
49-001(e)	49-609408	1624309.896	1754402.821
49-001(e)	49-609409	1624309.996	1754453.295
49-001(e)	49-609410	1624310.097	1754503.769
49-001(e)	49-609411	1624310.197	1754554.242
49-001(e)	49-609412	1624310.298	1754604.716
49-001(e)	49-609413	1624335.082	1754377.534
49-001(e)	49-609414	1624335.183	1754428.008

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
49-001(e)	49-609415	1624335.384	1754528.955
49-001(e)	49-609416	1624335.585	1754629.902
Area 4, Drilling			
49-001(f)	49-610938	1625644.768	1753994.297
49-001(f)	49-610939	1625636.55	1753877.81
49-001(f)	49-610940	1625541.246	1753792.037
49-001(f)	49-610941	1625441.279	1753881.535
Area 4, Surface and Shallow-Subsurface			
49-001(f)	49-609657	1625474.19	1753843.71
49-001(f)	49-609658	1625549.19	1753843.71
49-001(f)	49-609659	1625499.19	1753868.71
49-001(f)	49-609660	1625524.19	1753868.71
49-001(f)	49-609661	1625549.19	1753868.71
49-001(f)	49-609662	1625474.19	1753918.71
49-001(f)	49-609663	1625499.19	1753918.71
49-001(f)	49-609664	1625574.19	1753918.71
49-001(f)	49-609665	1625424.19	1753793.71
49-001(f)	49-609666	1625524.19	1753793.71
49-001(f)	49-609667	1625599.19	1753793.71
49-001(f)	49-609668	1625499.19	1753843.71
49-001(f)	49-609669	1625424.19	1753868.71
49-001(f)	49-609670	1625599.19	1753868.71
49-001(f)	49-609671	1625524.19	1753893.71
49-001(f)	49-609672	1625624.19	1753918.71
49-001(f)	49-609673	1625424.19	1753943.71
49-001(f)	49-609674	1625474.19	1753968.71
49-001(f)	49-609675	1625549.19	1753968.71
49-001(f)	49-609676	1625599.19	1753968.71
49-001(f)	49-609677	1625474.19	1753743.71
49-001(f)	49-609678	1625624.19	1753743.71
49-001(f)	49-609679	1625374.19	1753793.71
49-001(f)	49-609680	1625674.19	1753843.71
49-001(f)	49-609681	1625374.19	1753893.71
49-001(f)	49-609682	1625374.19	1753993.71
49-001(f)	49-609683	1625674.19	1753993.71
49-001(f)	49-609684	1625449.19	1754018.71
49-001(f)	49-609685	1625599.19	1754018.71
49-001(f)	49-609686	1625449.19	1753793.71
49-001(f)	49-609687	1625474.19	1753793.71
49-001(f)	49-609688	1625499.19	1753793.71

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
49-001(f)	49-609689	1625549.19	1753793.71
49-001(f)	49-609690	1625574.19	1753793.71
49-001(f)	49-609691	1625424.19	1753818.71
49-001(f)	49-609692	1625449.19	1753818.71
49-001(f)	49-609693	1625474.19	1753818.71
49-001(f)	49-609694	1625499.19	1753818.71
49-001(f)	49-609695	1625524.19	1753818.71
49-001(f)	49-609696	1625549.19	1753818.71
49-001(f)	49-609697	1625574.19	1753818.71
49-001(f)	49-609698	1625599.19	1753818.71
49-001(f)	49-609699	1625424.19	1753843.71
49-001(f)	49-609700	1625449.19	1753843.71
49-001(f)	49-609701	1625524.19	1753843.71
49-001(f)	49-609702	1625574.19	1753843.71
49-001(f)	49-609703	1625599.19	1753843.71
49-001(f)	49-609704	1625449.19	1753868.71
49-001(f)	49-609705	1625474.19	1753868.71
49-001(f)	49-609706	1625574.19	1753868.71
49-001(f)	49-609707	1625624.19	1753868.71
49-001(f)	49-609708	1625424.19	1753893.71
49-001(f)	49-609709	1625449.19	1753893.71
49-001(f)	49-609710	1625474.19	1753893.71
49-001(f)	49-609711	1625499.19	1753893.71
49-001(f)	49-609712	1625549.19	1753893.71
49-001(f)	49-609713	1625574.19	1753893.71
49-001(f)	49-609714	1625599.19	1753893.71
49-001(f)	49-609715	1625624.19	1753893.71
49-001(f)	49-609716	1625424.19	1753918.71
49-001(f)	49-609717	1625449.19	1753918.71
49-001(f)	49-609718	1625524.19	1753918.71
49-001(f)	49-609719	1625549.19	1753918.71
49-001(f)	49-609720	1625599.19	1753918.71
49-001(f)	49-609721	1625449.19	1753943.71
49-001(f)	49-609722	1625474.19	1753943.71
49-001(f)	49-609723	1625499.19	1753943.71
49-001(f)	49-609724	1625524.19	1753943.71
49-001(f)	49-609725	1625549.19	1753943.71
49-001(f)	49-609726	1625574.19	1753943.71
49-001(f)	49-609727	1625599.19	1753943.71
49-001(f)	49-609728	1625624.19	1753943.71

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
49-001(f)	49-609729	1625424.19	1753968.71
49-001(f)	49-609730	1625449.19	1753968.71
49-001(f)	49-609731	1625499.19	1753968.71
49-001(f)	49-609732	1625524.19	1753968.71
49-001(f)	49-609733	1625574.19	1753968.71
49-001(f)	49-609734	1625624.19	1753968.71
49-001(f)	49-609735	1625374.19	1753743.71
49-001(f)	49-609736	1625424.19	1753743.71
49-001(f)	49-609737	1625524.19	1753743.71
49-001(f)	49-609738	1625574.19	1753743.71
49-001(f)	49-609739	1625399.19	1753768.71
49-001(f)	49-609740	1625449.19	1753768.71
49-001(f)	49-609741	1625499.19	1753768.71
49-001(f)	49-609742	1625549.19	1753768.71
49-001(f)	49-609743	1625599.19	1753768.71
49-001(f)	49-609744	1625649.19	1753768.71
49-001(f)	49-609745	1625624.19	1753793.71
49-001(f)	49-609746	1625399.19	1753818.71
49-001(f)	49-609747	1625649.19	1753818.71
49-001(f)	49-609748	1625374.19	1753843.71
49-001(f)	49-609749	1625624.19	1753843.71
49-001(f)	49-609750	1625399.19	1753868.71
49-001(f)	49-609751	1625649.19	1753868.71
49-001(f)	49-609752	1625399.19	1753918.71
49-001(f)	49-609753	1625674.19	1753893.71
49-001(f)	49-609754	1625649.19	1753918.71
49-001(f)	49-609755	1625374.19	1753943.71
49-001(f)	49-609756	1625674.19	1753943.71
49-001(f)	49-609757	1625399.19	1753968.71
49-001(f)	49-609758	1625649.19	1753968.71
49-001(f)	49-609759	1625424.19	1753993.71
49-001(f)	49-609760	1625474.19	1753993.71
49-001(f)	49-609761	1625524.19	1753993.71
49-001(f)	49-609762	1625574.19	1753993.71
49-001(f)	49-609763	1625624.19	1753993.71
49-001(f)	49-609764	1625399.19	1754018.71
49-001(f)	49-609765	1625499.19	1754018.71
49-001(f)	49-609766	1625549.19	1754018.71
49-001(f)	49-609767	1625649.19	1754018.71

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
Area 11, Drilling			
49-003	49-610496	1625038.731	1755268
49-003	49-610497	1625072.338	1755283
49-003	49-610498	1625100.201	1755247
49-003	49-610499	1625106.376	1755314
49-003	49-610500	1625042.752	1755319
49-008(c)	49-610489	1624816.692	1755264
49-008(c)	49-610490	1624884.769	1755277
49-008(c)	49-610491	1624982.575	1755251
49-008(c)	49-610492	1625001.964	1755259
49-008(c)	49-610493	1625019.342	1755266
49-008(c)	49-610494	1624999.235	1755240
49-008(c)	49-610495	1624999.666	1755279
Area 12, Drilling			
49-008(d)	49-610481	1625988.19	1755314.838
49-008(d)	49-610485	1626004.738	1755217.536
Area 12, Surface and Shallow-Subsurface			
49-008(d)	49-609889	1625989.2	1755204.22
49-008(d)	49-609890	1625989.2	1755304.22
49-008(d)	49-609891	1626014.2	1755329.22
49-008(d)	49-609892	1626039.2	1755304.22
49-008(d)	49-609893	1626039.2	1755329.22
49-008(d)	49-609894	1625939.2	1755179.22
49-008(d)	49-609895	1625939.2	1755279.22
49-008(d)	49-609896	1625939.2	1755354.22
49-008(d)	49-609897	1625989.2	1755154.22
49-008(d)	49-609898	1625989.2	1755254.22
49-008(d)	49-609899	1625989.2	1755329.22
49-008(d)	49-609900	1626014.2	1755379.22
49-008(d)	49-609901	1626039.2	1755179.22
49-008(d)	49-609902	1626039.2	1755254.22
49-008(d)	49-609903	1626089.2	1755279.22
49-008(d)	49-609904	1626089.2	1755329.22
49-008(d)	49-609905	1626089.2	1755379.22
49-008(d)	49-609906	1625939.2	1755104.22
49-008(d)	49-609907	1626014.2	1755129.22
49-008(d)	49-609908	1626064.2	1755429.22
49-008(d)	49-609909	1626089.2	1755104.22
49-008(d)	49-609910	1626089.2	1755204.22
49-008(d)	49-609911	1626139.2	1755304.22

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
49-008(d)	49-609912	1626139.2	1755354.22
49-008(d)	49-609913	1626139.2	1755404.22
49-008(d)	49-609914	1625939.2	1755154.22
49-008(d)	49-609915	1625939.2	1755204.22
49-008(d)	49-609916	1625939.2	1755229.22
49-008(d)	49-609917	1625939.2	1755254.22
49-008(d)	49-609918	1625939.2	1755304.22
49-008(d)	49-609919	1625939.2	1755329.22
49-008(d)	49-609920	1625964.2	1755154.22
49-008(d)	49-609921	1625964.2	1755179.22
49-008(d)	49-609922	1625964.2	1755204.22
49-008(d)	49-609923	1625964.2	1755229.22
49-008(d)	49-609924	1625964.2	1755254.22
49-008(d)	49-609925	1625964.2	1755279.22
49-008(d)	49-609926	1625964.2	1755304.22
49-008(d)	49-609927	1625964.2	1755329.22
49-008(d)	49-609928	1625964.2	1755354.22
49-008(d)	49-609929	1625964.2	1755379.22
49-008(d)	49-609930	1625989.2	1755179.22
49-008(d)	49-609931	1625989.2	1755229.22
49-008(d)	49-609932	1625989.2	1755279.22
49-008(d)	49-609933	1625989.2	1755354.22
49-008(d)	49-609934	1625989.2	1755379.22
49-008(d)	49-609935	1626014.2	1755154.22
49-008(d)	49-609936	1626014.2	1755179.22
49-008(d)	49-609937	1626014.2	1755204.22
49-008(d)	49-609938	1626014.2	1755229.22
49-008(d)	49-609939	1626014.2	1755254.22
49-008(d)	49-609940	1626014.2	1755279.22
49-008(d)	49-609941	1626014.2	1755304.22
49-008(d)	49-609942	1626014.2	1755354.22
49-008(d)	49-609943	1626039.2	1755154.22
49-008(d)	49-609944	1626039.2	1755204.22
49-008(d)	49-609945	1626039.2	1755229.22
49-008(d)	49-609946	1626039.2	1755279.22
49-008(d)	49-609947	1626039.2	1755354.22
49-008(d)	49-609948	1626039.2	1755379.22
49-008(d)	49-609949	1626064.2	1755254.22
49-008(d)	49-609950	1626064.2	1755279.22
49-008(d)	49-609951	1626064.2	1755304.22

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
49-008(d)	49-609952	1626064.2	1755329.22
49-008(d)	49-609953	1626064.2	1755354.22
49-008(d)	49-609954	1626064.2	1755379.22
49-008(d)	49-609955	1626089.2	1755254.22
49-008(d)	49-609956	1626089.2	1755304.22
49-008(d)	49-609957	1626089.2	1755354.22
49-008(d)	49-609958	1625964.2	1755129.22
49-008(d)	49-609959	1625989.2	1755104.22
49-008(d)	49-609960	1626039.2	1755104.22
49-008(d)	49-609961	1625939.2	1755404.22
49-008(d)	49-609962	1625964.2	1755429.22
49-008(d)	49-609963	1625989.2	1755404.22
49-008(d)	49-609964	1626014.2	1755429.22
49-008(d)	49-609965	1626039.2	1755404.22
49-008(d)	49-609966	1626089.2	1755404.22
49-008(d)	49-609967	1626064.2	1755129.22
49-008(d)	49-609968	1626064.2	1755179.22
49-008(d)	49-609969	1626064.2	1755229.22
49-008(d)	49-609970	1626089.2	1755154.22
49-008(d)	49-609971	1626114.2	1755229.22
49-008(d)	49-609972	1626114.2	1755279.22
49-008(d)	49-609973	1626114.2	1755329.22
49-008(d)	49-609974	1626114.2	1755379.22
49-008(d)	49-609975	1626114.2	1755429.22
49-008(d)	49-609976	1626139.2	1755204.22
49-008(d)	49-609977	1626139.2	1755254.22
Corridor Surface and Shallow-Subsurface			
49-001(a)	49-610100	1624694.955	1755322.663
49-001(a)	49-610099	1624687.059	1755315.077
49-001(a)	49-610098	1624677.792	1755309.595
49-001(a)	49-610103	1624777.681	1755230.867
49-001(a)	49-610102	1624771.467	1755226.238
49-001(a)	49-610101	1624764.827	1755219.416
49-001(a)	49-610104	1624838.582	1755183.424
49-001(a)	49-610105	1624843.63	1755189.321
49-001(a)	49-610106	1624847.438	1755196.23
49-001(a)	49-610109	1624931.959	1755140.817
49-001(a)	49-610108	1624925.408	1755134.663
49-001(a)	49-610107	1624917.527	1755128.404
49-001(a)	49-610112	1625005.813	1755080.668

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
49-001(a)	49-610111	1625000.601	1755075.354
49-001(a)	49-610110	1624993.559	1755067.568
49-001(a)	49-610113	1625065.174	1755017.245
49-001(a)	49-610114	1625075.659	1755020.18
49-001(a)	49-610115	1625086.455	1755023.458
49-001(a)	49-610130	1624942.404	1755005.774
49-001(a)	49-610129	1624935.442	1755000.191
49-001(a)	49-610128	1624926.944	1754993.47
49-001(a)	49-610125	1624863.428	1755070.495
49-001(a)	49-610126	1624869.399	1755077.127
49-001(a)	49-610127	1624874.318	1755082.481
49-001(a)	49-610124	1624804.655	1755146.24
49-001(a)	49-610123	1624797.118	1755140.604
49-001(a)	49-610122	1624790.338	1755135.414
49-001(a)	49-611040	1624784.054	1755142.253
49-001(a)	49-611039	1624776.9	1755136.212
49-001(a)	49-611041	1624779.585	1755130.487
49-001(a)	49-611038	1624784.179	1755125.869
49-001(a)	49-611037	1624792.98	1755131.146
49-001(a)	49-611035	1624799.592	1755138.604
49-001(a)	49-611036	1624789.404	1755150.198
49-001(a)	49-610119	1624728.105	1755216.136
49-001(a)	49-610120	1624734.907	1755222.794
49-001(a)	49-610121	1624742.836	1755228.727
49-001(a)	49-610118	1624672.265	1755286.828
49-001(a)	49-610117	1624664.452	1755282.305
49-001(a)	49-610116	1624658.461	1755278.382
49-001(b,c,d)	49-610083	1625541.069	1755181.176
49-001(b,c,d)	49-610084	1625539.788	1755192.366
49-001(b,c,d)	49-610085	1625538.45	1755201.522
49-001(b,c,d)	49-610082	1625458.368	1755202.046
49-001(b,c,d)	49-610081	1625459.984	1755191.177
49-001(b,c,d)	49-610080	1625460.326	1755182.529
49-001(b,c,d)	49-610079	1625358.887	1755183.614
49-001(b,c,d)	49-610078	1625362.311	1755175.68
49-001(b,c,d)	49-610077	1625365.75	1755165.865
49-001(b,c,d)	49-610074	1625275.194	1755129.637
49-001(b,c,d)	49-610075	1625271.607	1755136.482
49-001(b,c,d)	49-610076	1625267.05	1755143.579
49-001(b,c,d)	49-610071	1625209.083	1755071.523

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
49-001(b,c,d)	49-610072	1625201.43	1755076.016
49-001(b,c,d)	49-610073	1625194.753	1755081.658
49-001(b,c,d)	49-610068	1625117.833	1755026.471
49-001(b,c,d)	49-610069	1625115.278	1755033.375
49-001(b,c,d)	49-610070	1625111.458	1755040.454
49-001(b,c,d)	49-610086	1625320.706	1755025.511
49-001(b,c,d)	49-610087	1625317.64	1755033.612
49-001(b,c,d)	49-610088	1625314.867	1755042.452
49-001(b,c,d)	49-610089	1625416.133	1755042.719
49-001(b,c,d)	49-610091	1625408.505	1755055.131
49-001(b,c,d)	49-610090	1625412.652	1755049.609
49-001(b,c,d)	49-610092	1625501.354	1755073.444
49-001(b,c,d)	49-610093	1625498.976	1755078.932
49-001(b,c,d)	49-610094	1625496.651	1755085.624
49-001(b,c,d)	49-610095	1625582.172	1755122.502
49-001(b,c,d)	49-610096	1625579.178	1755126.978
49-001(b,c,d)	49-610097	1625573.849	1755135.377
49-001(e)	49-610015	1624484.777	1754469.413
49-001(e)	49-610014	1624475.1	1754465.591
49-001(e)	49-610016	1624469.56	1754482.138
49-001(e)	49-610019	1624603.435	1754502.835
49-001(e)	49-610018	1624607.396	1754497.03
49-001(e)	49-610017	1624609.671	1754492.44
49-001(e)	49-610022	1624678.206	1754536.369
49-001(e)	49-610021	1624681.026	1754529.727
49-001(e)	49-610020	1624683.596	1754520.951
49-001(e)	49-610025	1624718.215	1754592.847
49-001(e)	49-610024	1624717.785	1754588.61
49-001(e)	49-610023	1624717.859	1754582.034
49-001(e)	49-610026	1624795.708	1754598.599
49-001(e)	49-610027	1624795.387	1754605.444
49-001(e)	49-610028	1624794.758	1754611.82
49-001(e)	49-610029	1624884.74	1754600.141
49-001(e)	49-610030	1624884.238	1754608.705
49-001(e)	49-610031	1624885.096	1754617.164
49-001(e)	49-610011	1624865.98	1754706.077
49-001(e)	49-610012	1624865.275	1754713.391
49-001(e)	49-610013	1624866.506	1754721.615
49-001(e)	49-610008	1624759.258	1754675.326
49-001(e)	49-610009	1624756.981	1754680.494

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
49-001(e)	49-610010	1624754.258	1754686.867
49-001(e)	49-610005	1624679.23	1754624.855
49-001(e)	49-610006	1624678.146	1754631.464
49-001(e)	49-610007	1624677.909	1754638.267
49-001(e)	49-610002	1624607.051	1754587.118
49-001(e)	49-610003	1624605.332	1754592.61
49-001(e)	49-610004	1624602.417	1754598.079
49-001(e)	49-609999	1624522.515	1754569.275
49-001(e)	49-610000	1624521.147	1754576.921
49-001(e)	49-610001	1624518.406	1754585.052
49-001(e)	49-609996	1624438.423	1754544.526
49-001(e)	49-609997	1624435.703	1754553.983
49-001(e)	49-609998	1624435.86	1754554.082
49-001(e)	49-611025	1624870.488	1754723.382
49-001(e)	49-611026	1624870.844	1754730.176
49-001(e)	49-611027	1624863.607	1754729.671
49-001(e)	49-611028	1624856.368	1754728.558
49-001(e)	49-611029	1624856.925	1754720.989
49-001(f)	49-610056	1625395.306	1754254.681
49-001(f)	49-610059	1625439.782	1754203.525
49-001(f)	49-610060	1625432.195	1754195.398
49-001(f)	49-610061	1625424.194	1754187.088
49-001(f)	49-610062	1625488.207	1754126.759
49-001(f)	49-610063	1625479.099	1754123.441
49-001(f)	49-610064	1625469.994	1754118.502
49-001(f)	49-610065	1625526.542	1754055.16
49-001(f)	49-610066	1625521.462	1754053.012
49-001(f)	49-610067	1625511.197	1754048.577
49-001(f)	49-610049	1625393.934	1754085.018
49-001(f)	49-610048	1625399.838	1754091.521
49-001(f)	49-610047	1625402.817	1754101.904
49-001(f)	49-610044	1625343.551	1754157.472
49-001(f)	49-610045	1625337.529	1754150.776
49-001(f)	49-610046	1625329.119	1754145.496
49-001(f)	49-610041	1625274.466	1754216.141
49-001(f)	49-610042	1625268.055	1754213.971
49-001(f)	49-610043	1625263.582	1754210.333
49-001(f)	49-610038	1625219.103	1754296.213
49-001(f)	49-610039	1625211.509	1754282.563
49-001(f)	49-610040	1625204.908	1754278.565

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
49-001(f)	49-610035	1625161.608	1754356.06
49-001(f)	49-610036	1625155.821	1754352.518
49-001(f)	49-610037	1625147.872	1754347.724
49-001(f)	49-610032	1625108.293	1754423.305
49-001(f)	49-610033	1625102.177	1754418.281
49-001(f)	49-610034	1625095.85	1754413.183
49-001(f)	49-610050	1625282.09	1754395.643
49-001(f)	49-610051	1625275.175	1754389.194
49-001(f)	49-610052	1625265.414	1754382.105
49-001(f)	49-611031	1625259.784	1754387.09
49-001(f)	49-611032	1625252.563	1754384.381
49-001(f)	49-611033	1625256.79	1754376.565
49-001(f)	49-611034	1625259.907	1754371.024
49-001(f)	49-611030	1625266.488	1754374.077
49-001(f)	49-610053	1625324.778	1754316.935
49-001(f)	49-610054	1625317.317	1754308.686
49-001(f)	49-610055	1625312.265	1754300.587
49-001(f)	49-610058	1625367.494	1754246.919
49-001(f)	49-610057	1625380.173	1754250.759

Appendix D

Gross-Alpha and Gross-Beta
Radiological-Screening Results and Borehole Logs
(on CD included with this document)

Appendix E

Investigation-Derived Waste Management

E-1.0 INTRODUCTION

This appendix contains the waste management records for the investigation-derived waste (IDW) generated during the implementation of the 2009–2010 investigation work plan of the Technical Area 49 (TA-49) sites inside the nuclear environmental site (NES) Boundary at Los Alamos National Laboratory (LANL or the Laboratory).

All IDW generated during the TA-49 investigation was managed in accordance with the IDW management plan in the approved work plan (LANL 2008, 102691) and standard operating procedure (SOP) 5238, Characterization and Management of Environmental Program Waste. SOP 5238 incorporates the requirements of all applicable U.S. Environmental Protection Agency and New Mexico Environment Department (NMED) waste regulations, U.S. Department of Energy orders, and other Laboratory procedures.

Consistent with SOP-5238, a waste characterization strategy form (WCSF) was prepared before IDW generation to address characterization approaches, on-site management, and final disposition options for wastes. Analytical data and information on wastes generated during previous investigations and/or acceptable knowledge (AK) were used to complete the WCSF. A copy of the approved WCSF is included in this appendix as Attachment E-1 (on CD).

Wastes were staged in clearly marked and appropriately constructed waste accumulation areas. Waste accumulation area postings, regulated storage duration, and inspection requirements were based on the type of IDW and its classification. Container and storage requirements were detailed in the WCSF and approved before waste was generated.

Investigation activities were conducted in a manner that minimized the generation of waste. Waste minimization was accomplished by implementing the most recent version of the Los Alamos National Laboratory Hazardous Waste Minimization Plan (LANL 2009, 109324).

E-2.0 WASTE STREAMS

The IDW streams generated and managed during the 2009–2010 investigation of TA-49 are described below and are summarized in Table E-2.0-1.

The waste numbers correspond with those identified in the WCSF, which is included in this appendix as Attachment E-1. Waste types 3 (decontamination fluids), 5 (New Mexico special waste), and 6 (returned or excess samples) were not generated and therefore are not listed below.

- Waste #1: Drill Cuttings (IDW) – This waste stream includes soil and rock cuttings generated from boreholes. Approximately 10 yd^3 of cuttings were generated and stored in Wrangler bags or 55-gal. drums. All containers were directly sampled. The cuttings were land-applied in accordance with the NMED-approved Notice of Intent decision tree, Land Application of IDW Solids from Construction of Wells and Boreholes, and the Laboratory radiological decision tree.
- WCSF Waste #2: Contact Waste – This waste stream includes personal protective equipment, contaminated sampling supplies, and dry decontamination waste that may have come in contact with contaminated environmental media and cannot be decontaminated. These wastes were containerized at the point of generation and were characterized based on AK of the waste materials, the methods of generation, and analytical data for the media with which they came into contact. These wastes were disposed of off-site as industrial waste or Green-Is-Clean wastes.

- WCSF Waste #4: Municipal Solid Waste (MSW) – This waste stream consists of noncontact trash and debris. All MSW was stored in plastic trash bags and disposed of at the Los Alamos County transfer station.

E-3.0 REFERENCES

The following reference list includes documents cited in this appendix. Parenthetical information following each reference provides the author(s), publication date, and ERID, ESHID, or EMID. ERIDs were assigned by Los Alamos National Laboratory's (the Laboratory's) Associate Directorate for Environmental Management (IDs through 599999); ESHIDs were assigned by the Laboratory's Associate Directorate for Environment, Safety, and Health (IDs 600000 through 699999); and EMIDs are assigned by N3B (IDs 700000 and above).

LANL (Los Alamos National Laboratory), January 2008. "Investigation Work Plan for Sites at Technical Area 49 Inside the Nuclear Environmental Site Boundary, Revision 1," Los Alamos National Laboratory document LA-UR-08-0447, Los Alamos, New Mexico. (LANL 2008, 102691)

LANL (Los Alamos National Laboratory), November 2009. "Los Alamos National Security, LLC, Hazardous Waste Minimization Plan," Los Alamos National Laboratory document LA-UR-09-07682, Los Alamos, New Mexico. (LANL 2009, 109324)

Table E-2.0-1
Summary of IDW Generation and Management

Waste Stream	Waste Type	Volume	Characterization Method	On-Site Management	Disposition
Drill Cuttings	LLW, industrial	10 yd^3	Direct sampling	Wrangler bags or 55-gal. drums	Land application
Contact Waste	LLW, Green-Is-Clean, industrial	<2 yd^3	AK and analytical results of site characterization	30- or 55-gal. drums	Authorized off-site disposal facility
Municipal Solid Waste	MSW	<5 yd^3	AK	Plastic trash bags	Off-site municipal landfill

Attachment E-1

Waste Characterization Strategy Form
(on CD included with this document)

Appendix F

Analytical Program

F-1.0 INTRODUCTION

This appendix discusses the analytical methods and data quality assessment for samples collected during investigations at Technical Area 49 (TA-49) [Solid Waste Management Units (SWMUs) 49-001(a), 49-001(e), 49-001(f), and 49-003; Areas of Concern (AOCs) 49-008(c) and 49-008(d); Material Disposal Area (MDA) AB [SWMUs 49-001(b,c,d,g)]; Ancho Canyon; and Water Canyon] inside the nuclear environmental site (NES) boundary. Additionally, this appendix summarizes the effects of data-quality issues on the acceptability of the analytical data.

Quality assurance (QA), quality control (QC), and data validation procedures were implemented in accordance with the Quality Assurance Project Plan Requirements for Sampling and Analysis (LANL 1996, 054609), and Los Alamos National Laboratory's statements of work (SOWs) for analytical laboratories (LANL 1995, 049738; LANL 2000, 071233). The results of the QA/QC procedures were used to estimate the accuracy, bias, and precision of the analytical measurements. Samples for QC include method blanks, matrix spikes (MSs), laboratory control samples (LCSs), internal standards (ISs), initial calibration verifications (ICVs) and continuing calibration verifications (CCVs), surrogates, and tracers.

The type and frequency of laboratory QC analyses are described in the SOWs for analytical laboratories (LANL 1995, 049738; LANL 2000, 071233). Other QC factors, such as sample preservation and holding times, were also assessed in accordance with the requirements outlined in Standard Operating Procedure (SOP) EP-ERSS-SOP-5056, Sample Containers and Preservation.

The following SOPs were used for data validation:

- SOP-5161, Routine Validation of Volatile Organic Data
- SOP-5162, Routine Validation of Semivolatile Organic Compound (SVOC) Analytical Data
- SOP-5163, Routine Validation of Organochlorine Pesticides and PCB Analytical Data
- SOP-5164, Routine Validation of High Explosives Analytical Data
- SOP-5165, Routine Validation of Metals Analytical Data
- SOP-5166, Routine Validation of Gamma Spectroscopy Data, Chemical Separation Alpha Spectrometry, Gas Proportional Counting, and Liquid Scintillation Analytical Data
- SOP-5168, Routine Validation of LC/MS/MS High Explosive Analytical Data

Routine data validation was performed for each data package (also referred to as request numbers), and analytical data were reviewed and evaluated based on U.S. Environmental Protection Agency (EPA) National Functional Guidelines, where applicable (EPA 1994, 048639; EPA 1999, 066649). As a result of the data validation and assessment efforts, qualifiers are assigned to the analytical records as appropriate. The data-qualifier definitions are provided in Appendix A.

F-2.0 ANALYTICAL DATA ORGANIZATION

The investigation of the TA-49 sites inside the NES boundary consisted of Areas 1, 2, 2A, 2B 3, 4, 11, and 12, Ancho Canyon, and Water Canyon. For purposes of analytical data presentation and review, the TA-49 inside NES boundary analytical data are included in Appendix G (provided on DVD) as eight separate databases corresponding to the eight main areas investigated:

- Area 1—SWMU 49-001(a);

- Areas 2, 2A, and 2B—MDA AB [SWMUs 49-001(b,c,d,g)];
- Area 3—SWMU 49-001(e);
- Area 4—SWMU 49-001(f);
- Area 11— SWMU 49-003 and AOC 49-008(c);
- Area 12—AOC 49-008(d);

All historical investigation samples were submitted to and analyzed by approved off-site laboratories. These data are determined to be of sufficient quality for decision-making purposes and have been reviewed and revalidated to current QA standards.

F-3.0 INORGANIC CHEMICAL ANALYSES

The analytical methods used for inorganic chemical analyses are summarized in Table F-3.0-1.

Area 1

At SWMU 49-001(a), a total of 165 samples (145 soil and 20 tuff), plus 12 field duplicates, were collected during historical and 2009–2010 investigations. All 165 samples were analyzed for target analyte list (TAL) metals; 16 samples each were analyzed for perchlorate and cyanide; and 10 samples were analyzed for uranium.

Areas 2, 2A, and 2B

At MDA AB SWMUs 49-001(b,c,d,g), a total of 120 samples (108 soil/fill and 12 tuff), plus 15 field duplicates, were collected during historical and 2009–2010 investigations. All 120 samples were analyzed for TAL metals and 12 samples each were analyzed for perchlorate and cyanide.

Area 3

At SWMU 49-001(e), a total of 170 samples (126 soil/fill and 44 tuff), plus 15 field duplicates, were collected during historical and 2009–2010 investigations. All 170 samples were analyzed for TAL metals and 15 samples were analyzed for perchlorate and cyanide.

Area 4

At SWMU 49-001(f), a total of 166 samples (135 soil/fill and 31 tuff), plus 18 field duplicates, were collected during historical and 2009–2010 investigations. All 166 samples were analyzed for TAL metals; 16 samples each were analyzed for perchlorate and cyanide; and 10 samples were analyzed for uranium.

Area 11

At AOC 49-008(c), a total of 18 samples (7 soil and 11 tuff), plus 1 field duplicate were collected during historical and 2009 investigations. All 18 samples were analyzed for TAL metals; 16 samples were analyzed for perchlorate and cyanide; and 2 samples were analyzed for uranium.

At SWMU 49-003, a total of 20 samples (7 soil and 13 tuff), plus 1 field duplicate were collected during historical and 2009–2010 investigations. All 20 samples were analyzed for TAL metals; 14 samples were analyzed for perchlorate and cyanide; and 6 samples were analyzed for uranium.

Area 12

At AOC 49-008(d), a total of 71 samples (65 soil/fill and 6 tuff), plus 3 field duplicates, were collected during historical and 2009 investigations. All 71 samples were analyzed for TAL metals and 8 samples were analyzed for perchlorate and cyanide.

Tables presented in the main text of the supplemental investigation report summarize the relevant samples collected and the analyses requested for the investigation of the TA-49 sites inside the NES boundary. All samples collected for the TA-49 inside the NES boundary investigation are presented in Appendix G (provided on DVD).

F-3.1 Inorganic Chemical QA/QC Samples

The use of QA/QC samples is designed to produce quantitative measures of the reliability of specific parts of an analytical procedure. The results of the QA/QC analyses performed on a sample provide confidence about whether the analyte is present and whether the concentration reported is accurate. To assess the accuracy and precision of inorganic chemical analyses LCSs, preparation blanks, MSs, laboratory duplicate samples, interference check samples (ICSs), and serial dilution samples were analyzed as part of the investigations at TA-49 for sites inside of the NES boundary. Each of these QA/QC sample types is defined in the analytical services SOWs (LANL 1995, 049738; LANL 2000, 071233) and is described in the sections below. For some of the analyses performed before the 1995 SOW was implemented, 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. For inorganic chemicals, LCS percent recoveries (%R) should fall within the control limits of 75%–125% (LANL 1995, 049738; LANL 2000, 071233).

The preparation blank is an analyte-free matrix to which all reagents are added in the same volumes or proportions as those used in the environmental sample processing; it is extracted and analyzed in the same manner as the corresponding environmental samples. Preparation blanks are used to measure bias and potential cross-contamination. All inorganic chemical results should be below the method detection limit (MDL).

The MS samples assess the accuracy of inorganic chemical analyses. These samples are designed to provide information about the effect of the sample matrix on the sample preparation procedures and analytical technique. The MS acceptance criterion is 75%–125%, inclusive, for all spiked analytes (LANL 1995, 049738; LANL 2000, 071233).

Laboratory duplicate samples assess the precision of inorganic chemical analyses. All relative percent differences (RPDs) between the sample and laboratory duplicate should be ±35% (LANL 1995, 049738; LANL 2000, 071233).

The ICSs assess the accuracy of the analytical laboratory's interelement and background correction factors used for inductively coupled plasma emission spectroscopy. The ICS %R should be within the acceptance range of 80%–120%. The QC acceptance limits are ±20%.

Serial dilution samples measure potential physical or chemical interferences and correspond to a sample dilution ratio of 1:5. The chemical concentration in the undiluted sample must be at least 50 times the MDL (100 times for inductively coupled plasma mass spectroscopy) for valid comparison. For sufficiently high concentrations, the RPD should be within 10%.

Details regarding the quality of the inorganic chemical analytical data included in the data set are summarized in the following subsections.

F-3.2 Data Quality Results for Inorganic Chemicals

The majority of the analytical results are qualified as not detected (U) because the analytes were not detected by the respective analytical methods. These data do not have any quality issues associated with the values presented.

F-3.2.1 Chain of Custody

Sample collection log (SCL)/chain-of-custody (COC) forms were maintained properly for all samples analyzed for inorganic chemicals (Appendix G provided on DVD).

F-3.2.2 Sample Documentation

All samples analyzed for inorganic chemicals were properly documented on SCL/COC forms in the field (Appendix G on DVD).

F-3.2.3 Sample Dilutions

Some samples were diluted for inorganic chemical analyses. No qualifiers were applied to any inorganic chemical sample results because of dilutions.

F-3.2.4 Sample Preservation

Preservation criteria were met for all samples analyzed for inorganic chemicals.

F-3.2.5 Holding Times

F-3.2.5.1 Areas 2, 2A, 2B, 11, and 12

Holding-time criteria were met for all samples analyzed for inorganic chemicals.

F-3.2.5.2 Area 1

Three cyanide results and 10 TAL metals results were qualified as estimated not detected (UJ) because the extraction/analytical holding time was exceeded by less than 2 times the published method for holding times.

One TAL metals result was qualified as estimated and biased low (J-) because the extraction/analytical holding time was exceeded by less than 2 times the published method for holding times.

A total of 14 TAL metals results were qualified as estimated and biased low (J-) because the extraction/analytical holding time was exceeded by greater than 2 times the published method for holding times.

F-3.2.5.3 Area 3

A total of 14 TAL metals results were qualified as estimated and biased low (J-) because the extraction/analytical holding time was exceeded by less than 2 times the published method for holding times.

A total of 32 TAL metals results were qualified as estimated and biased low (J-) because the extraction/analytical holding time was exceeded by greater than 2 times the published method for holding times.

F-3.2.5.4 Area 4

Three TAL metals results and four cyanide results were qualified as estimated not detected (UJ) because the extraction/analytical holding time was exceeded by less than 2 times the published method for holding times.

A total of 19 TAL metals results were qualified as estimated and biased low (J-) because the extraction/analytical holding time was exceeded by less than 2 times the published method for holding times.

A total of 13 TAL metals results were qualified as estimated and biased low (J-) because the extraction/analytical holding time was exceeded by greater than 2 times the published method for holding times.

F-3.2.6 Initial and Continuing Calibration Verifications

F-3.2.6.1 Areas 1, 2, 2A, 2B, 4, 11, and 12

Initial and continuing calibration verification criteria were met for all samples analyzed for inorganic chemicals.

F-3.2.6.2 Area 3

One TAL metals result was qualified as estimated (J) because the ICV and/or CCV was recovered outside the method-specific limits.

F-3.2.7 Interference Check Sample and/or Serial Dilutions

F-3.2.7.1 Areas 2, 2A, 2B, 3, 11, and 12

Interference check sample and serial dilution criteria were met for all samples analyzed for inorganic chemicals.

F-3.2.7.2 Area 1

A total of 10 TAL metals results were qualified as estimated and biased low (J-) because the associated ICSs were recovered below the lower warning limit but greater than or equal to the lower acceptable limit.

F-3.2.7.3 Area 4

A total of 10 TAL metals results were qualified as estimated and biased low (J-) because the associated ICSs were recovered below the lower warning limit but greater than or equal to the lower acceptable limit.

F-3.2.8 Laboratory Duplicate Samples

F-3.2.8.1 Area 1

A total of 79 TAL metals results were qualified as estimated (J) because both the sample and the duplicate sample results were greater than or equal to 5 times the reporting limit (RL) and the duplicate RPD was greater than 35%.

F-3.2.8.2 Areas 2, 2A, and 2B

A total of 63 TAL metals results were qualified as estimated (J) because the sample and the duplicate sample results were greater than or equal to 5 times the RL and the duplicate RPD was greater than 35% for soil samples.

F-3.2.8.3 Area 3

One TAL metals result was qualified as estimated not detected (UJ) because the sample and the duplicate sample results were greater than or equal to 5 times the RL and the duplicate RPD was greater than 35% for soil samples.

A total of 89 TAL metals results were qualified as estimated (J) because the sample and the duplicate sample results were greater than or equal to 5 times the RL and the duplicate RPD was greater than 35% for soil samples.

F-3.2.8.4 Area 4

A total of 119 TAL metals results were qualified as estimated (J) because the sample and the duplicate sample results were greater than or equal to 5 times the RL and the duplicate RPD was greater than 35% for soil samples.

F-3.2.8.5 Area 11

Laboratory duplicate sample precision criteria were met for all samples analyzed for inorganic chemicals.

F-3.2.8.6 Area 12

A total of 14 TAL metals results were qualified as estimated (J) because the sample and the duplicate sample results were greater than or equal to 5 times the RL and the duplicate RPD was greater than 35% for soil samples.

F-3.2.9 Preparation Blanks

F-3.2.9.1 Area 1

Five cyanide results and 56 TAL metal results were qualified as not detected (U) because the sample results were less than or equal to 5 times the concentration of the related analytes in the method blank, which indicates the reported detection is indistinguishable from contamination in the blank.

A total of 99 TAL metals results were qualified as not detected (U) because the sample results were less than or equal to the concentration of the related analyte in the initial calibration blank and or continuing calibration blank.

A total of 85 TAL metals results were qualified as not detected (U) because the sample result was less than or equal to 5 times the concentration of the related analyte in the trip blank, equipment blank, or rinsate blank.

A total of 12 TAL metals results were qualified as estimated (J) because the sample results were greater than 5 times the concentration of the related analytes in the method blank.

F-3.2.9.2 Areas 2, 2A, and 2B

Seven cyanide results and 42 TAL metal results were qualified as not detected (U) because the sample results were less than or equal to 5 times the concentration of the related analytes in the method blank, which indicates the reported detection is indistinguishable from contamination in the blank.

A total of 103 TAL metals results were qualified as not detected (U) because the sample results were less than or equal to the concentration of the related analyte in the initial calibration blank and or continuing calibration blank.

Two TAL metals results were qualified as not detected (U) because the sample result was less than or equal to 5 times the concentration of the related analyte in the trip blank, equipment blank, or rinsate blank.

A total of 20 TAL metals results were qualified as estimated (J) because the sample results were greater than 5 times the concentration of the related analytes in the method blank.

F-3.2.9.3 Area 3

A total of 120 TAL metal results were qualified as not detected (U) because the sample results were less than or equal to 5 times the concentration of the related analytes in the method blank, which indicates the reported detection is indistinguishable from contamination in the blank.

A total of 10 TAL metals results were qualified as not detected (U) because the sample results were less than 5 times the concentration of the related analytes in the associated preparation blank.

A total of 123 TAL metals results were qualified as not detected (U) because the sample results were less than or equal to the concentration of the related analyte in the initial calibration blank and or continuing calibration blank.

A total of 23 TAL metals results were qualified as estimated (J) because the sample results were greater than 5 times the concentration of the related analytes in the method blank.

F-3.2.9.4 Area 4

A total of 112 TAL metal results were qualified as not detected (U) because the sample results were less than or equal to 5 times the concentration of the related analytes in the method blank, which indicates the reported detection is indistinguishable from contamination in the blank.

One TAL metal result was qualified as not detected (U) because the sample results were less than 5 times the concentration of the related analytes in the associated preparation blank.

A total of 166 TAL metals results were qualified as not detected (U) because the sample results were less than or equal to the concentration of the related analyte in the initial calibration blank and or continuing calibration blank.

A total of 61 TAL metals results were qualified as estimated (J) because the sample results were greater than 5 times the concentration of the related analytes in the method blank.

F-3.2.9.5 Area 11

Three cyanide results and eight TAL metal results were qualified as not detected (U) because the sample results were less than or equal to 5 times the concentration of the related analytes in the method blank, which indicates the reported detection is indistinguishable from contamination in the blank.

A total of eight TAL metals results were qualified as not detected (U) because the sample results were less than or equal to the concentration of the related analyte in the initial calibration blank and or continuing calibration blank.

A total of seven TAL metals results were qualified as estimated (J) because the sample results were greater than 5 times the concentration of the related analytes in the method blank.

F-3.2.9.6 Area 12

A total of 19 TAL metal results were qualified as not detected (U) because the sample results were less than or equal to 5 times the concentration of the related analytes in the method blank, which indicates the reported detection is indistinguishable from contamination in the blank.

A total of 12 TAL metals results were qualified as not detected (U) because the sample results were less than 5 times the concentration of the related analytes in the associated preparation blank.

A total of 28 TAL metals results were qualified as not detected (U) because the sample results were less than or equal to the concentration of the related analyte in the initial calibration blank and or continuing calibration blank.

A total of 20 TAL metals results were qualified as not detected (U) because the sample result was less than or equal to 5 times the concentration of the related analyte in the trip blank, equipment blank, or rinsate.

One TAL metal result was qualified as estimated (J) because this analyte was identified in the method blank but was greater than 5 times the concentration of the related analytes in the associated preparation blank.

F-3.2.10 MS Samples

F-3.2.10.1 Area 1

Three TAL metals results were qualified as estimated not detected (UJ) because a low recovery (%R <75%) was observed for these analytes in the associated spike sample.

A total of 169 TAL metals results were qualified as estimated and biased low (J-) because a low recovery (%R <75%) was observed for these analytes in the associated spike sample.

A total of 273 TAL metals results were qualified as estimated and biased high (J+) because a high recovery (%R >125%) was observed for these analytes in the associated spike sample.

F-3.2.10.2 Areas 2, 2A, and 2B

A total of 14 TAL metals results were qualified as estimated not detected (UJ) because a high recovery (%R >125%) was observed for these analytes in the associated spike sample.

A total of 32 TAL metals results were qualified as estimated and biased low (J-) because a low recovery (%R <75%) was observed for these analytes in the associated spike sample.

A total of 264 TAL metals results were qualified as estimated and biased high (J+) because a high recovery (%R >125%) was observed for these analytes in the associated spike sample.

F-3.2.10.3 Area 3

Seven TAL metals results were qualified as estimated not detected (UJ) because a low recovery (%R <75%) was observed for these analytes in the associated spike sample.

Three TAL metals results were qualified as estimated not detected (UJ) because a high recovery (%R >125%) was observed for these analytes in the associated spike sample.

A total of 153 TAL metals results were qualified as estimated and biased low (J-) because a low recovery (%R <75%) was observed for these analytes in the associated spike sample.

A total of 250 TAL metals results were qualified as estimated and biased high (J+) because a high recovery (%R >125%) was observed for these analytes in the associated spike sample.

F-3.2.10.4 Area 4

A total of 27 TAL metals results were qualified as estimated not detected (UJ) because a low recovery (%R <75%) was observed for these analytes in the associated spike sample.

A total of 128 TAL metals results were qualified as estimated and biased low (J-) because a low recovery (%R <75%) was observed for these analytes in the associated spike sample.

A total of 265 TAL metals results were qualified as estimated and biased high (J+) because a high recovery (%R >125%) was observed for these analytes in the associated spike sample.

F-3.2.10.5 Area 11

A total of 16 TAL metals results and 8 total cyanide results were qualified as estimated not detected (UJ) because a low recovery (%R <75%) was observed for these analytes in the associated spike sample.

One TAL metal result was qualified as estimated and biased low (J-) because a low recovery (%R <75%) was observed for these analytes in the associated spike sample.

A total of 8 TAL metals results were qualified as estimated and biased high (J+) because a high recovery (%R >125%) was observed for these analytes in the associated spike sample.

F-3.2.10.6 Area 12

A total of seven cyanide results were qualified as estimated not detected (UJ) because a low recovery (10% <%R <75%) was observed for these analytes in the associated spike sample.

A total of 69 TAL metals results were qualified as estimated and biased low (J-) because a low recovery (10% <%R <75%) was observed for these analytes in the associated spike sample.

A total of 87 TAL metals results were qualified as estimated and biased high (J+) because a high recovery (%R >125%) was observed for these analytes in the associated spike sample.

F-3.2.11 LCS Recoveries

The LCS recovery criteria were met for all samples analyzed for inorganic chemicals.

F-3.2.12 Detection Limits

F-3.2.12.1 Area 1

A total of 41 TAL metals results were qualified as estimated (J) because the sample result was reported as detected between the estimated detection limit (EDL) and the MDL.

A total of 327 TAL metals results and 2 perchlorate results were qualified as estimated (J) because the sample result was reported as detected between the practical quantitation limit (PQL) and the MDL.

F-3.2.12.2 Areas 2, 2A, and 2B

A total of 13 TAL metals results were qualified as estimated (J) because the sample result was reported as detected between the EDL and the MDL.

A total of 256 TAL metals results were qualified as estimated (J) because the sample result was reported as detected between the PQL and the MDL.

F-3.2.12.3 Area 3

A total of 48 TAL metals results were qualified as estimated (J) because the sample result was reported as detected between the EDL and the MDL.

A total of 308 TAL metals results, 1 perchlorate result, and 1 cyanide result were qualified as estimated (J) because the sample result was reported as detected between the PQL and the MDL.

F-3.2.12.4 Area 4

A total of 79 TAL metals results were qualified as estimated (J) because the sample result was reported as detected between the EDL and the MDL.

A total of 325 TAL metals results were qualified as estimated (J) because the sample result was reported as detected between the PQL and the MDL.

F-3.2.12.5 Area 11

A total of 87 TAL metals results were qualified as estimated (J) because the sample result was reported as detected between the EDL and the MDL.

A total of 83 TAL metals results and 10 perchlorate results were qualified as estimated (J) because the sample result was reported as detected between the PQL and the MDL.

F-3.2.12.6 Area 12

A total of 29 TAL metals results were qualified as estimated (J) because the sample result was reported as detected between the EDL and the MDL.

A total of 137 TAL metals results were qualified as estimated (J) because the sample result was reported as detected between the PQL and the MDL.

F-3.2.13 Rejected Results

F-3.2.13.1 Areas 2, 2A, 2B, and 11

Sample results for inorganic chemical analyses were not qualified as rejected.

F-3.2.13.2 Area 1

A total of 19 mercury results were qualified as rejected (R) because a recovery of less than 10% was observed in the associated MS analysis.

A total of 20 mercury results were qualified as rejected (R) because the extraction/analytical holding times were exceeded by greater than 2 times the published method for holding times.

F-3.2.13.3 Area 3

A total of two mercury results were qualified as rejected (R) because the extraction/analytical holding times were exceeded by greater than 2 times the published method for holding times.

F-3.2.13.4 Area 4

A total of 20 manganese results were qualified as rejected (R) because a recovery of less than 10% was observed in the associated MS analysis.

A total of three mercury results were qualified as rejected (R) because the extraction/analytical holding time were exceeded by greater than 2 times the published method for holding times.

F-3.2.13.5 Area 12

A total of 14 manganese results were qualified as rejected (R) because a recovery of less than 10% was observed in the associated MS analysis.

A total of 9 antimony results were qualified as rejected (R) because a recovery of less than 10% was observed in the associated MS analysis.

The rejected data were not used to characterize the nature and extent of contamination or to conduct risk screening assessments. However, sufficient data of good quality are available to characterize the site(s). The results of other qualified data were used as reported and do not affect the usability of the sampling results.

F-4.0 ORGANIC CHEMICAL ANALYSES

Soil samples, tuff samples, and pore-gas samples collected during historical and 2009 investigations were analyzed for one or more of the following analytical suites: explosive compounds, semivolatile organic compounds (SVOCs), volatile organic compounds (VOCs), and polychlorinated biphenyl (PCB) compounds. Samples were analyzed using SW-846 Methods 8260B (VOCs), 8270C (SVOCs), 8321A (high explosives [HE]), and 8082 (PCBs).

Area 1

At SWMU 49-001(a), a total of 16 tuff samples, plus 2 field duplicates, and 3 pore-gas samples were collected during 2009–2010 investigations. All 16 samples were analyzed for explosive compounds, SVOCs, and VOCs. Pore-gas samples were analyzed for VOCs only.

Areas 2, 2A, and 2B

At MDA AB, SWMUs 49-001(b, c, d, g), a total of 12 tuff samples, plus 2 field duplicates, and 9 pore-gas samples were collected during 2009–2010 investigations. All 12 samples were analyzed for explosive compounds, SVOCs, and VOCs. Pore-gas samples were analyzed for VOCs only.

Area 3

At SWMU 49-001(e), a total of 15 tuff samples, plus 1 field duplicate, and 2 pore-gas samples were collected during 2009–2010 investigations. All 15 samples were analyzed for explosive compounds, SVOCs, and VOCs. Pore-gas samples were analyzed for VOCs only.

Area 4

At SWMU 49-001(f), a total of 16 tuff samples, plus 1 field duplicate, and 3 pore-gas samples were collected during 2009–2010 investigations. All 16 samples were analyzed for explosive compounds, SVOCs, and VOCs. Pore-gas samples were analyzed for VOCs only.

Area 11

At AOC 49-008(c), a total of 18 samples (7 soil and 11 tuff), plus 1 field duplicate, and 4 pore-gas samples were collected during historical and 2009 investigations. A total of 18 samples were analyzed for explosive compounds and SVOCs and 16 samples were analyzed for VOCs. Pore-gas samples were analyzed for VOCs only.

At SWMU 49-003 a total of 14 samples (5 soil and 9 tuff), plus 1 field duplicate, were collected during historical and 2009 investigations. All 14 samples were analyzed for explosive compounds, SVOCs, and VOCs.

Area 12

At AOC 49-008(d), a total of 72 samples (66 soil/fill and 6 tuff), plus 6 field duplicates, and 3 pore-gas samples were collected during historical and 2009 investigations. A total of 8 samples were analyzed for explosive compounds and 58 samples were analyzed for PCBs. All 72 samples were analyzed for SVOCs and 65 samples were analyzed for VOCs. Pore-gas samples were analyzed for VOCs only.

All QC procedures were followed as required by the analytical laboratory SOWs (LANL 1995, 049738; LANL 2000, 071233). The analytical methods used for organic chemicals are listed in Table F-3.0-1.

All organic chemical results are included in Appendix G (provided on DVD).

F-4.1 Organic Chemical QA/QC Samples

The use of QA/QC samples is designed to produce quantitative measures of the reliability of specific parts of an analytical procedure. The results of the QA/QC analyses performed on a sample provide confidence about whether the analyte is present and whether the concentration reported is accurate. Calibration verifications, LCSs, method blanks, MSs, surrogates, and ISs were analyzed to assess the accuracy and precision of organic chemical analyses. Each of these QA/QC sample types is defined in the analytical services SOW (LANL 2000, 071233) and described briefly below.

Calibration verification is the establishment of a quantitative relationship between the response of the analytical procedure and the concentration of the target analyte. There are two aspects of calibration verification: initial and continuing. The initial calibration verifies the accuracy of the calibration curve as well as the individual calibration standards used to perform the calibration. The continuing calibration ensures that the initial calibration is still holding and correct as the instrument is used to process samples. The continuing calibration also serves to determine that analyte identification criteria such as retention times and spectral matching are being met.

The LCS is a sample of a known matrix that has been spiked with compounds that are representative of the target analytes, and it serves as a monitor of overall performance. The LCS is the primary demonstration, on a daily basis, of the ability to analyze samples with good qualitative and quantitative accuracy. The LCS recoveries should be within the method-specific acceptance criteria.

A method blank is an analyte-free matrix to which all reagents are added in the same volumes or proportions as those used in the environmental sample processing; it is extracted and analyzed in the same manner as the corresponding environmental samples. Method blanks are used to assess the potential for sample contamination during extraction and analysis. All target analytes should be below the contract-required detection limit in the method blank (LANL 2000, 071233).

The MS samples are used to measure the ability to recover prescribed analytes from a native sample matrix and consist of aliquots of the submitted samples spiked with a known concentration of the target analyte(s). Spiking typically occurs before sample preparation and analysis. The spike sample recoveries should be between the lower acceptance limit (LAL) and upper acceptance limit (UAL).

A surrogate compound (surrogate) is an organic compound used in the analyses of target analytes that is similar in composition and behavior to the target analytes but is not normally found in environmental samples. Surrogates are added to every blank, sample, and spike to evaluate the efficiency with which analytes are recovered during extraction and analysis. The recovery percentage of the surrogates must be within specified ranges or the sample may be rejected or assigned a qualifier.

ISs are chemical compounds added to every blank, sample, and standard extract at a known concentration. They are used to compensate for (1) analyte concentration changes that might occur during storage of the extract, and (2) quantitation variations that can occur during analysis. The ISs are used as the basis for quantitation of target analytes. The %R for ISs should be within the range of 50%–200%.

Details regarding the quality of the organic chemical analytical data included in the data set are summarized in the following subsections.

F-4.2 Data Quality Results for Organic Chemicals

The majority of the analytical results were qualified as not detected (U) because the analytes were not detected by the respective analytical methods. These data did not have any quality issues associated with the values presented.

In Water Canyon, two SVOC results were qualified as not detected (U) because the mass spectra of the affected analytes did not meet specifications.

F-4.2.1 Maintenance of Chain of Custody

The COC forms were maintained properly for all samples analyzed for organic chemicals.

F-4.2.2 Sample Documentation

All samples analyzed for organic chemicals were properly documented on the SCLs in the field (Appendix G provided on DVD).

F-4.2.3 Sample Dilutions

Some samples were diluted for organic chemical analyses. No qualifiers were applied to any organic chemical sample results because of dilutions.

F-4.2.3.1 Area 1

A total of 68 SVOC results were qualified as estimated not detected (UJ) because of duplicates, dilutions, or re-analyses.

F-4.2.3.2 Areas 2, 2A, and 2B

A total of 408 SVOC results were qualified as estimated not detected (UJ) because of duplicates, dilutions, or reanalyses.

F-4.2.3.3 Area 3

A total of 16 HE results and 1 VOC result were qualified as estimated not detected (UJ) because of duplicates, dilutions, or reanalyses.

F-4.2.3.4 Area 4

A total of nine HE results were qualified as estimated not detected (UJ) because of duplicates, dilutions, or reanalyses.

F-4.2.4 Sample Preservation

Preservation criteria were met for all samples analyzed for organic chemicals.

F-4.2.5 Holding Times

F-4.2.5.1 Areas 2, 2A, 2B, 4, 11, and 12

Holding-time criteria were met for all samples analyzed for organic chemicals.

F-4.2.5.2 Area 1

A total of 136 SVOC results were qualified as estimated not detected (UJ) because the extraction/analytical holding time was exceeded by less than 2 times the published method for holding times.

F-4.2.5.3 Area 3

A total of 30 HE results and 68 SVOC results were qualified as estimated not detected (UJ) because the extraction/analytical holding time was exceeded by less than 2 times the published method for holding times.

F-4.2.5.4 Pore Gas

A total of 450 VOC results were qualified as estimated not detected (UJ) because the extraction/analytical holding time for 2 samples was exceeded by less than 2 times the published method for holding times.

A total of 162 VOC results were qualified as estimated and biased low (J-) because the extraction/analytical holding time for 2 samples was exceeded by less than 2 times the published method for holding times.

F-4.2.6 Initial and Continuing Calibration Verifications

F-4.2.6.1 Area 1

A total of 22 explosives compound results, 20 SVOC results, and 23 VOC results were qualified as estimated not detected (UJ) because the ICVs and/or CCVs were recovered outside the method-specific limits.

A total of 51 explosives compound results were qualified as estimated not detected (UJ) because the affected analytes were analyzed with a relative retention factor (RRF) of < 0.05 in the initial calibrations and/or CCVs.

F-4.2.6.2 Areas 2, 2A, and 2B

A total of 9 explosives compound results, 24 SVOC results, and 26 VOC results were qualified as estimated not detected (UJ) because the ICVs and/or CCVs were recovered outside the method-specific limits.

A total of 33 explosives compound results were qualified as estimated not detected (UJ) because the affected analytes were analyzed with a RRF of <0.05 in the initial calibrations and/or CCVs.

One SVOC result was qualified as estimated (J) because the ICV and/or CCV was recovered outside the method-specific limits.

F-4.2.6.3 Area 3

A total of 18 explosives compound results, 37 SVOC results, and 4 VOC results were qualified as estimated not detected (UJ) because the ICVs and/or CCVs were recovered outside the method-specific limits.

A total of 48 explosives compound results were qualified as estimated not detected (UJ) because the affected analytes were analyzed with a RRF of <0.05 in the initial calibrations and/or CCVs.

F-4.2.6.4 Area 4

A total of 30 explosives compound results, 21 SVOC results, and 21 VOC results were qualified as estimated not detected (UJ) because the ICVs and/or CCVs were recovered outside the method-specific limits.

A total of 55 explosives compound results were qualified as estimated not detected (UJ) because the affected analytes were analyzed with a RRF of <0.05 in the initial calibrations and/or CCVs.

Two SVOC results and three VOC results were qualified as estimated (J) because the ICVs and/or CCVs were recovered outside the method-specific limits.

F-4.2.6.5 Area 11

A total of 85 explosives compound results, 62 SVOC results, and 28 VOC results were qualified as estimated not detected (UJ) because the ICVs and/or CCVs were recovered outside the method-specific limits.

A total of 151 explosives compound results were qualified as estimated not detected (UJ) because the affected analytes were analyzed with a RRF of <0.05 in the ICVs and/or CCVs.

Two SVOC results and one VOC result were qualified as estimated (J) because the ICVs and/or CCVs were recovered outside the method-specific limits.

Two explosives compound results were qualified as estimated (J) because the affected analytes were analyzed with a RRF of <0.05 in the initial calibrations and/or CCVs.

F-4.2.6.6 Area 12

A total of 9 explosive compound results, 174 SVOC results, and 53 VOC results were qualified as estimated not detected (UJ) because the ICVs and/or CCVs were recovered outside the method-specific limits.

A total of 26 explosives compound results were qualified as estimated not detected (UJ) because the affected analytes were analyzed with a RRF of <0.05 in the initial calibrations and/or CCVs.

Two PCB results were qualified as estimated (J) because the multicomponent standard was not analyzed within 72 h of the initial analysis.

F-4.2.6.7 Pore Gas

A total of 52 VOC results were qualified as estimated not detected (UJ) because the affected analytes were analyzed with an initial calibration curve that exceeded the percent relative standard deviation criteria and/or the associated multipoint calibration correlation coefficient is <0.995.

A total of 144 VOC results were qualified as estimated not detected (UJ) because the ICVs and/or CCVs were recovered outside the method-specific limits.

A total of 10 VOC results were qualified as estimated (J) because the ICVs and/or CCVs were recovered outside the method-specific limits.

F-4.2.7 Surrogate Recoveries

F-4.2.7.1 Areas 3, 4, and 11 and Pore Gas

Surrogate recovery criteria were met for all samples analyzed for organic chemicals.

F-4.2.7.2 Area 1

A total of 67 SVOC results were qualified as estimated not detected (UJ) because the surrogate recovery was less than the LAL but were greater than or equal to 10%.

F-4.2.7.3 Areas 2, 2A, and 2B

A total of 131 SVOC results were qualified as estimated not detected (UJ) because the surrogate recovery was less than the LAL but was greater than or equal to 10%.

One SVOC result was qualified as estimated and biased low (J-) because the surrogate recovery was less than the LAL but was greater than or equal to 10%.

F-4.2.7.4 Area 12

A total of 59 VOC results were qualified as estimated not detected (UJ) because the surrogate recovery was less than the LAL but was greater than or equal to 10%.

A total of four VOC results were qualified as estimated and biased high (J+) because the surrogate %R was greater than the UAL, which indicated a potential for a high bias in the results and a potential for false positive results.

F-4.2.8 IS Responses

IS response criteria were met for all samples analyzed for organic compounds.

F-4.2.9 Method Blanks

F-4.2.9.1 Areas 2, 2A, and 2B

Three VOC results were qualified as not detected (U) because the sample result was less than or equal to 5 times (10 times for common laboratory contaminants) the concentration of the related analyte in the method blank.

F-4.2.9.2 Area 3

One VOC result was qualified as not detected (U) because the sample result was less than or equal to 5 times (10 times for common laboratory contaminants) the concentration of the related analyte in the method blank.

Five VOC results were qualified as not detected (U) because the sample result was less than or equal to 5 times the concentration of the related analyte in the trip blank, rinsate blank, or equipment blank.

F-4.2.9.3 Area 4

One VOC result was qualified as not detected (U) because the sample result was less than or equal to 5 times (10 times for common laboratory contaminants) the concentration of the related analyte in the method blank.

F-4.2.9.4 Area 12

Six SVOC results were qualified as not detected (U) because the sample result was less than or equal to 5 times (10 times for common laboratory contaminants) the concentration of the related analyte in the method blank.

F-4.2.9.5 Areas 1 and 11 and Pore Gas

Results for samples analyzed for organic compounds were not qualified because of blank contamination.

F-4.2.10 MS Samples

F-4.2.10.1 Area 1

Three HE results were qualified as estimated not detected (UJ) because the MS and/or MS duplicate (MSD) recovery was greater than 30%.

F-4.2.10.2 Areas 2, 2A, and 2B

One HE result was qualified as estimated not detected (UJ) because the MS/MSD recovery was greater than 30%.

F-4.2.10.3 Area 4

Fourteen HE results were qualified as estimated not detected (UJ) because the MS/MSD recovery was greater than 30%.

F-4.2.10.4 Area 11

A total of 30 HE results were qualified as estimated not detected (UJ) because the MS/MSD recovery was greater than 30%.

F-4.2.11 Laboratory Duplicate Samples

Laboratory duplicates collected for organic chemical analyses indicated acceptable precision for all samples.

F-4.2.12 LCS Recoveries

F-4.2.12.1 Areas 1, 3, 4, and 11

LCS recovery criteria were met for all samples analyzed for organic chemicals.

F-4.2.12.2 Areas 2, 2A, and 2B

A total of 18 SVOC results were qualified as estimated not detected (UJ) because the LCS %R was less than LAL but greater than 10%.

F-4.2.12.3 Area 12

A total of 27 VOC results were qualified as estimated not detected (UJ) because the LCS %R was less than the LAL but greater than 10%.

F-4.2.12.4 Pore Gas

A total of 26 VOC results were qualified as estimated not detected (UJ) because the LCS %R was less than the LAL but greater than 10%.

A total of 22 VOC results were qualified as estimated and biased high (J+) because the LCS %R was greater than the UAL.

F-4.2.13 Quantitation and Method Detection Limits

F-4.2.13.1 Areas 3 and 4 and Pore Gas

Results for samples analyzed for organic chemicals were not qualified because of quantitation limits and MDLs.

F-4.2.13.2 Area 1

Three VOC results were qualified as estimated (J) because the results were between the PQL and the MDL.

F-4.2.13.3 Areas 2, 2A, and 2B

Two SVOC results were qualified as estimated (J) because the results were between the PQL and the MDL.

F-4.2.13.4 Area 11

A total of 23 SVOC results and 2 VOC results were qualified as estimated (J) because the results were between the PQL and the MDL.

F-4.2.13.5 Area 12

Three PCB results, 10 SVOC results, and 9 VOC results were qualified as estimated (J) because the results were between the PQL and the MDL.

F-4.2.14 Rejected Data

F-4.2.14.1 Area 12

A total of 18 explosives compound results were qualified as rejected (R) because these analytes were not detected in the samples and the analyte retention time shifted by more than 0.05 min from the mid-level standard of the initial calibrations.

F-4.2.14.2 Areas 1, 2, 3, 4, and 11 and Pore Gas

Sample results for organic chemical analysis were not qualified as rejected (R).

The rejected data were not used to characterize the nature and extent of contamination or in the risk screening assessments. However, sufficient data of good quality were available to characterize the site(s). The results of other qualified data were used as reported and do not affect the usability of the sampling results.

F-5.0 RADIONUCLIDE ANALYSES

Soil and tuff samples were analyzed for tritium, strontium-90, gamma-emitting radionuclides, including iodine-129, if screening threshold was exceeded by gamma spectroscopy using EPA Method 901.1; and for americium-241, technetium-99, if screening threshold was exceeded, isotopic plutonium, and isotopic uranium by alpha spectroscopy (HASL-300 Methods). Pore-gas samples were collected and analyzed for

tritium using EPA Method 906.0. All QC procedures were followed as required by the analytical laboratories SOW (LANL 2000, 071233). The methods used for analyzing radionuclides are listed in Table F-3.0-1.

Area 1

At SWMU 49-001(a), a total of 174 samples (154 soil and 20 tuff), plus 12 field duplicates, and 3 pore-gas samples were collected during historical and 2009–2010 investigations. Sample analyses included 157 samples analyzed by gamma spectroscopy; 155 samples analyzed for americium-241 and isotopic uranium; 16 samples analyzed for tritium; and 165 samples analyzed for isotopic plutonium. The pore-gas samples were analyzed for tritium only.

Areas 2, 2A, and 2B

At MDA AB, SWMUs 49-001(b,c,d,g), a total of 172 samples (114 soil/fill and 58 tuff), plus 18 field duplicates, and 9 pore-gas samples were collected during historical and 2009–2010 investigations. Sample analyses included 104 samples analyzed by gamma spectroscopy; 165 samples analyzed for americium-241; 172 samples analyzed for isotopic uranium; 12 samples analyzed for tritium; 163 samples analyzed for isotopic plutonium; and 16 samples analyzed for strontium-90. The pore-gas samples were analyzed for tritium only.

Area 3

At SWMU 49-001(e), a total of 194 samples (142 soil/fill and 52 tuff), plus 21 field duplicates, and 2 pore-gas samples were collected during historical and 2009–2010 investigations. Sample analyses included 179 samples analyzed by gamma spectroscopy; 160 samples analyzed for americium-241 and isotopic uranium; 15 samples analyzed for tritium; 170 samples analyzed for isotopic plutonium; and 18 samples analyzed for strontium-90 and technetium-99. The pore-gas samples were analyzed for tritium only.

Area 4

At SWMU 49-001(f), a total of 195 samples (159 soil/fill and 36 tuff), plus 20 field duplicates, and 3 pore-gas samples were collected during historical and 2009–2010 investigations. Sample analyses included 179 samples analyzed by gamma spectroscopy; 156 samples analyzed for americium-241 and isotopic uranium; 16 samples analyzed for tritium; 166 samples analyzed for isotopic plutonium; and 25 samples each analyzed for strontium-90 and technetium-99. The pore-gas samples were analyzed for tritium only.

Area 11

At AOC 49-008(c), a total of 20 samples (9 soil and 11 tuff), plus 1 field duplicate, and 4 pore-gas samples were collected during historical and 2009 investigations. Sample analyses included 20 samples analyzed by gamma spectroscopy; 16 samples analyzed for americium-241, tritium, and isotopic uranium; and 18 samples analyzed for isotopic plutonium. The pore-gas samples were analyzed for tritium only.

At SWMU 49-003, a total of 26 samples (11 soil and 15 tuff), plus 2 field duplicates, were collected during historical and 2009 investigations. Sample analyses included 26 samples analyzed by gamma spectroscopy; 14 samples analyzed for americium-241, tritium, isotopic uranium, strontium-90, and technetium-99; and 20 samples analyzed for isotopic plutonium.

Area 12

At AOC 49-008(d), a total of 90 samples (84 soil/fill and 6 tuff), plus 6 field duplicates, and 3 pore-gas samples were collected during historical and 2009 investigations. Sample analyses included 82 samples analyzed by gamma spectroscopy; 62 samples analyzed for americium-241; 8 samples analyzed for tritium; 68 samples analyzed for isotopic uranium; 4 samples analyzed for strontium-90 and technetium-99; and 71 samples analyzed for isotopic plutonium. The pore-gas samples were analyzed for tritium only.

F-5.1 Radionuclide QA/QC Samples

All procedures were followed as required by the analytical services SOWs (LANL 1995, 049738; LANL 2000, 071233). Some sample results were qualified as not detected (U) because the associated sample concentration was less than or equal to the minimum detectable concentration (MDC). Some sample results were qualified as not detected (U) because the associated sample concentration was less than or equal to 3 times the total propagated uncertainty. This data qualification was related to detection status only not to data quality issues.

To assess the accuracy and precision of radionuclide analyses, LCSs, method blanks, MS samples, laboratory duplicate samples, and tracers were analyzed as part of the investigations. Each of these QA/QC sample types is defined in the analytical services SOWs (LANL 1995, 049738; LANL 2000, 071233) and is described below.

The LCS serves as a monitor of the overall performance of each step during the analysis, including sample digestion. For radionuclides in soil and/or tuff, LCS %R should fall between the control limits of 80%–120%.

A method blank is an analyte-free matrix to which all reagents are added in the same volumes or proportions as those used in the environmental sample processing; it is analyzed in the same manner as the corresponding environmental samples. Method blanks are used to assess the potential for sample contamination during analysis. All radionuclide results should be below the MDC.

MS samples assess the accuracy of inorganic chemical analyses. These samples are designed to provide information about the effect of the sample matrix on the sample preparation procedures and analytical technique. The MS acceptance criterion is 75%–125%.

Tracers are radioisotopes added to a sample for the purposes of monitoring losses of the target analyte. The tracer is assumed to behave in the same manner as the target analytes. The tracer recoveries should fall between the LAL and UAL.

Laboratory duplicate samples assess the precision of inorganic chemical analyses. All RPDs between the sample and laboratory duplicate should be ± 35% for soil and ± 20% for water (LANL 1995, 049738; LANL 2000, 071233).

Details regarding the quality of the radionuclide analytical data included in the data set are summarized in the following subsections.

F-5.2 Data Quality Results for Radionuclides

F-5.2.1 Chain of Custody

COC forms were maintained properly for all samples.

F-5.2.2 Sample Documentation

All samples were properly documented on the SCLs in the field.

F-5.2.3 Sample Dilutions

Some samples were diluted for radionuclide analyses. No qualifiers were applied to any radionuclide sample results because of dilutions.

F-5.2.4 Sample Preservation

Preservation criteria were met for all samples analyzed for radionuclides.

F-5.2.5 Holding Times

Holding-time criteria were met for all samples analyzed for radionuclides.

F-5.2.6 Method Blanks

F-5.2.6.1 Areas 1, 2, 2A, 2B, 11, and 12

Results for samples analyzed for radionuclides were not qualified because of blank contamination.

F-5.2.6.2 Area 3

Five isotopic uranium results were qualified as not detected (U) because the sample result was less than or equal to 5 times the concentration of the related analyte in the method blank.

F-5.2.6.3 Area 4

A total of 20 isotopic uranium results were qualified as estimated (J) because the sample results were greater than 5 times the concentration of the related analytes in the method blank.

F-5.2.6.4 Pore Gas

Six tritium results were qualified as not detected (U) because the sample result was less than or equal to 5 times the concentration of the related analyte in the method blank.

Two tritium results were qualified as estimated (J) because this analyte was identified in the method blank but was greater than 5 times.

F-5.2.7 MS Samples

F-5.2.7.1 Areas 1, 2, 2A, 2B, and 4 and Pore Gas

MS criteria were met for all samples analyzed for radionuclides.

F-5.2.7.2 Area 3

Four strontium-90 results and 15 tritium results were qualified as estimated not detected (UJ) because the associated matrix spike recovery was greater than 125%.

F-5.2.7.3 Area 11

A total of 19 tritium results were qualified as estimated not detected (UJ) because the associated MS recovery was greater than 125%.

Two tritium results were qualified as estimated and biased high (J+) because the associated MS recovery was greater than 125%.

F-5.2.7.4 Area 12

Six tritium results were qualified as estimated not detected (UJ) because the associated MS recovery was greater than 125%.

Two tritium results were qualified as estimated and biased high (J+) because the associated MS recovery was greater than 125%.

F-5.2.8 Tracer Recoveries

Tracer recovery criteria were met for all samples analyzed for radionuclides.

F-5.2.9 LCS Recoveries

LCS recovery criteria were met for all samples analyzed for radionuclides.

F-5.2.10 Laboratory Duplicate Samples Recoveries

F-5.2.10.1 Areas 2, 2A, 2B, 11, and 12 and Pore Gas

Laboratory duplicate sample recovery criteria were met for all samples analyzed for radionuclides.

F-5.2.10.2 Area 1

Nine radionuclide results were qualified as estimated not detected (UJ) because the duplicate sample was not prepared and/or analyzed with the samples for unspecified reasons. The duplicate information is missing.

Six radionuclide results were qualified as estimated (J) because the duplicate sample was not prepared and/or analyzed with the samples for unspecified reasons. The duplicate information is missing.

F-5.2.10.3 Area 3

Three radionuclide results were qualified as estimated not detected (UJ) because the duplicate sample was not prepared and/or analyzed with the samples for unspecified reasons. The duplicate information is missing.

F-5.2.10.4 Area 4

A total of 20 radionuclide results were qualified as estimated (J) because the associated duplicate sample had a duplicate error ratio or relative error ratio that was greater than the analytical laboratory's acceptance limits.

F-5.2.11 Rejected Data

F-5.2.11.1 Areas 1, 2, 2A, 2B, 4, 11, and 12 and Pore Gas

No radionuclide sample results were qualified as rejected (R).

F-5.2.11.2 Area 3

One iodine-129 result was qualified as rejected (R) because spectral interferences prevented positive identification.

F-6.0 REFERENCES

The following reference list includes documents cited in this appendix. Parenthetical information following each reference provides the author(s), publication date, and ERID, ESHID, or EMID. ERIDs were assigned by Los Alamos National Laboratory's (the Laboratory's) Associate Directorate for Environmental Management (IDs through 599999); ESHIDs were assigned by the Laboratory's Associate Directorate for Environment, Safety, and Health (IDs 600000 through 699999); and EMIDs are assigned by N3B (IDs 700000 and above).

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Table F-3.0-1
Inorganic Chemical, Organic Chemical, and
Radionuclide Analytical Methods for Samples Collected from TA-49

Analytical Method	Analytical Description	Analytical Suite
EPA 905.0	Gas flow proportional counting	Strontium-90
EPA 906.0	Distillation and liquid scintillation	Tritium
EPA SW-846: 6010/6010B	Inductively coupled plasma emission spectroscopy—atomic emission spectroscopy	Aluminum, antimony, arsenic, barium, beryllium, calcium, cadmium, cobalt, chromium, copper, iron, lead, magnesium, manganese, nickel, potassium, selenium, silver, sodium, thallium, uranium, vanadium, and zinc (TAL metals)
EPA SW-846:6020	Inductively coupled plasma mass spectrometry	Aluminum, antimony, arsenic, barium, beryllium, calcium, cadmium, cobalt, chromium, copper, iron, lead, magnesium, manganese, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc (TAL metals)
EPA SW-846: 9012A	Automated colorimetric/off-line distillation	Total cyanide
EPA SW-846:6850	Liquid chromatography-mass spectrometry/mass spectrometry	Perchlorate
EPA SW-846:7470A	Cold vapor atomic absorption (CVAA)	Mercury
EPA SW-846:7471	CVAA	Mercury
EPA SW-846:7471A	CVAA	Mercury
EPA SW-846: 8082	Gas chromatography	PCBs
EPA SW-846: 8260 and 8260B	Gas chromatography-mass spectrometry (GC/MS)	VOCs
EPA TO-15	GC/MS	VOCs (pore-gas)
EPA SW-846: 8270 and 8270C	GC/MS	SVOCs
EPA SW-846: 8321A	High-performance liquid chromatography	Explosive compounds
Generic: gamma spectroscopy	Gamma spectroscopy	Cesium-134, cesium-137, cobalt-60, sodium-22, iodine-129
Generic: kinetic phosphorescence analysis (KPA)	KPA	Uranium
HASL Method 300	Chemical separation alpha spectrometry	Isotopic uranium, isotopic plutonium, americium-241, technetium-99

Appendix G

Analytical Suites and Results and Analytical Reports
(on DVD included with this document)

Appendix H

Box Plots and Statistical Results

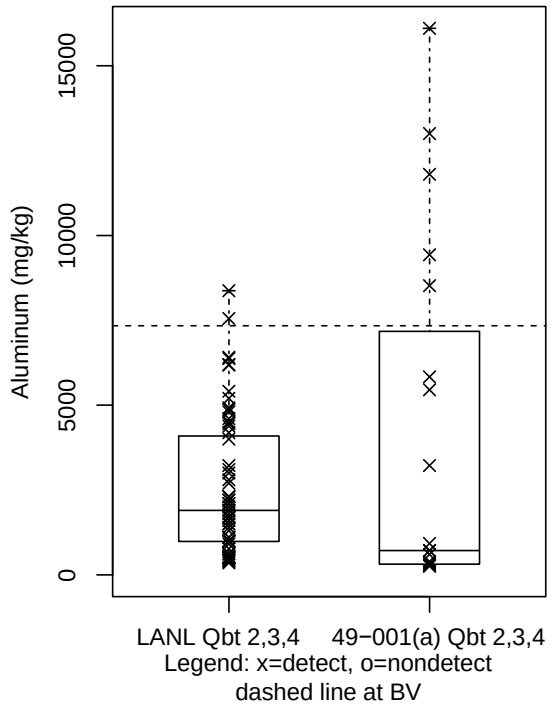

Figure H-1 Box plot for aluminum in tuff at Solid Waste Management Unit (SWMU) 49-001(a)

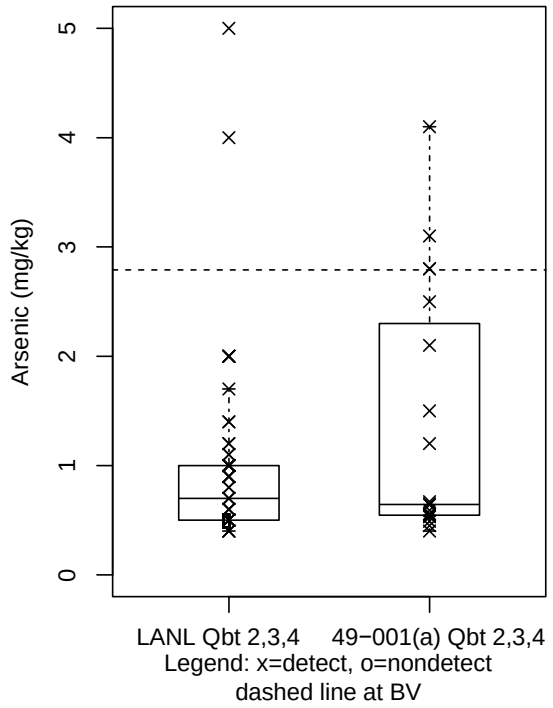

Figure H-2 Box plot for arsenic in tuff at SWMU 49-001(a)

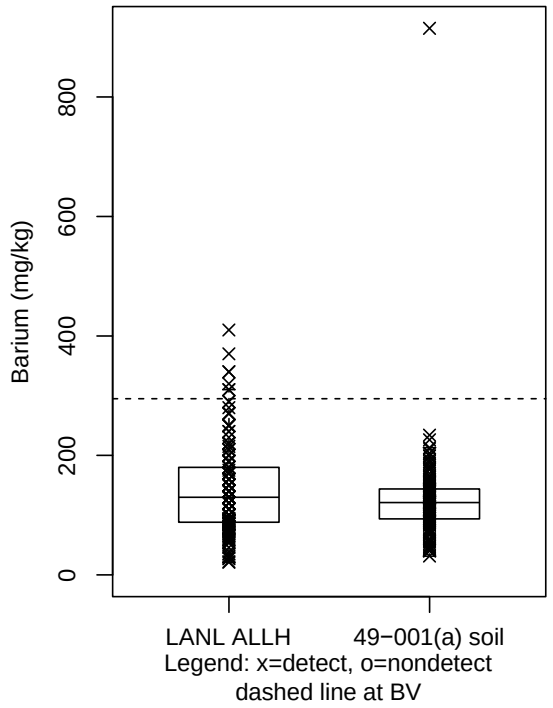

Figure H-3 Box plot for barium in soil at SWMU 49-001(a)

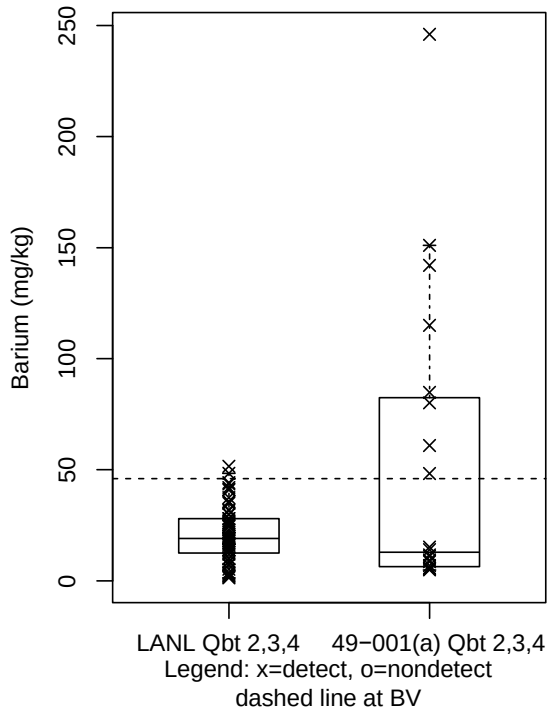

Figure H-4 Box plot for barium in tuff at SWMU 49-001(a)

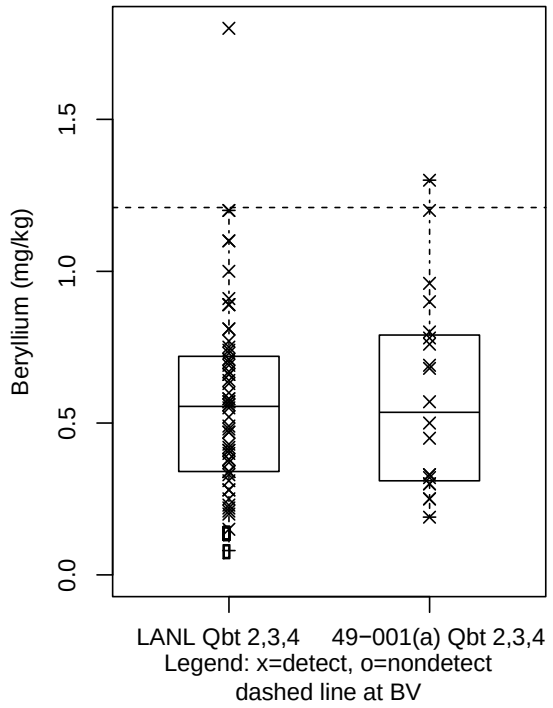

Figure H-5 Box plot for beryllium in tuff at SWMU 49-001(a)

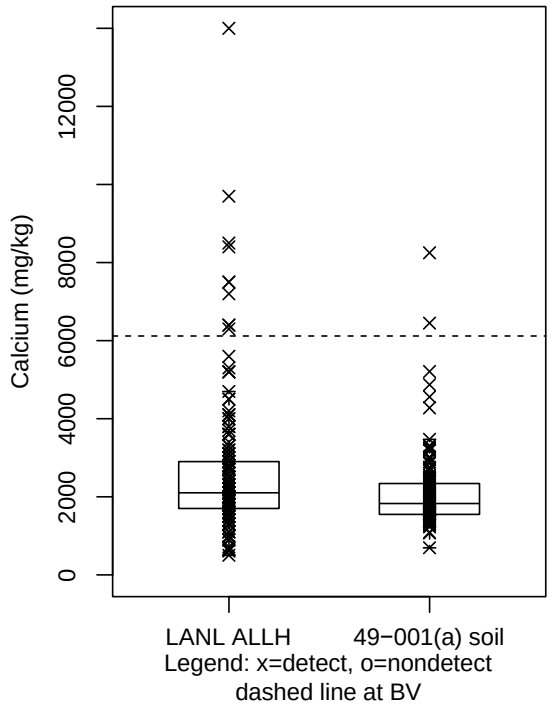

Figure H-6 Box plot for calcium in soil at SWMU 49-001(a)

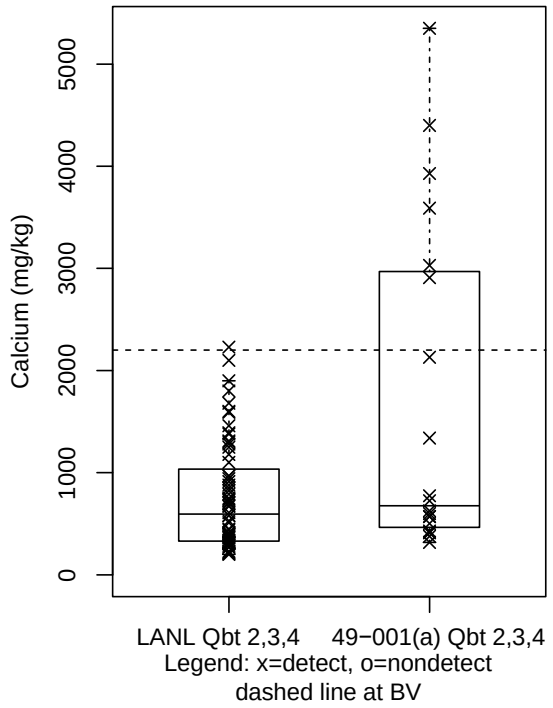

Figure H-7 Box plot for calcium in tuff at SWMU 49-001(a)

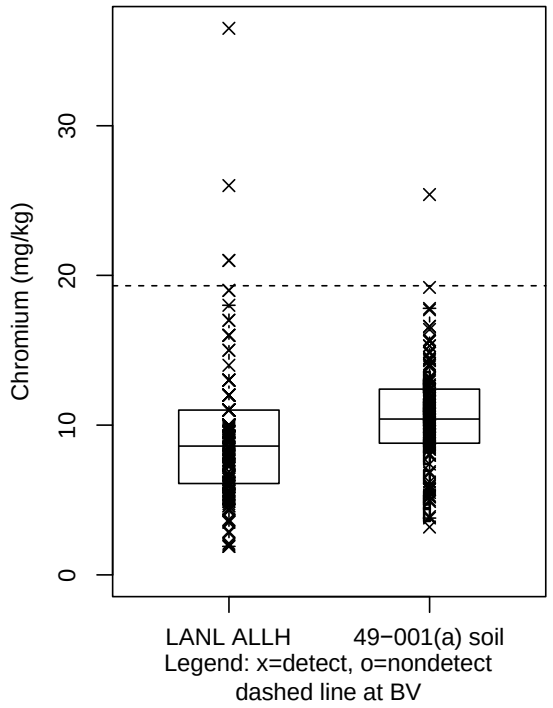

Figure H-8 Box plot for chromium in soil at SWMU 49-001(a)

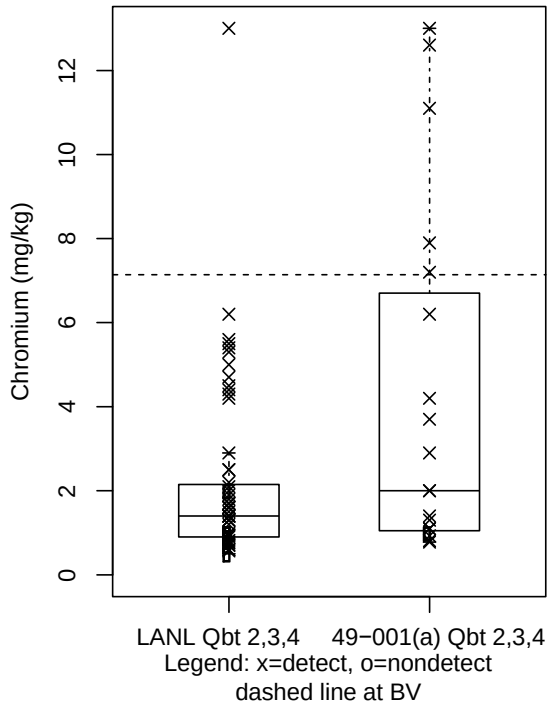

Figure H-9 Box plot for chromium in tuff at SWMU 49-001(a)

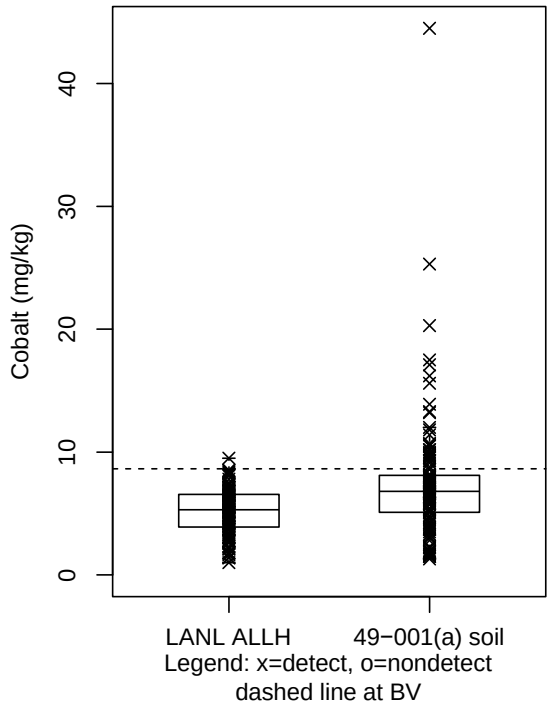

Figure H-10 Box plot for cobalt in soil at SWMU 49-001(a)

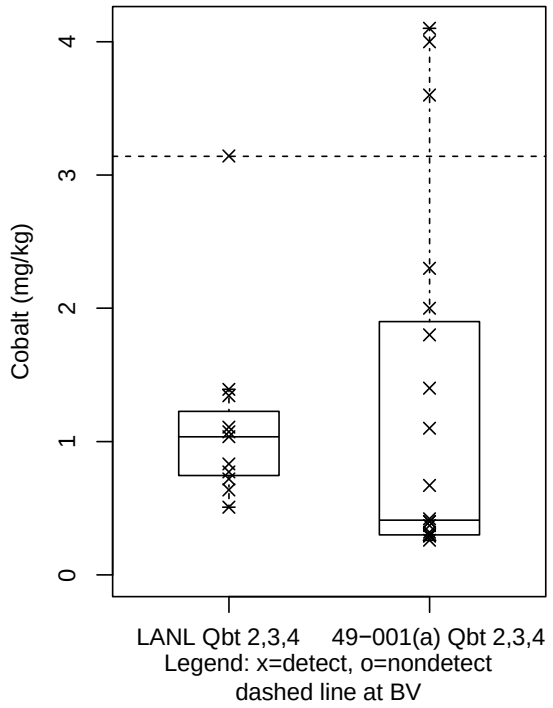

Figure H-11 Box plot for cobalt in tuff at SWMU 49-001(a)

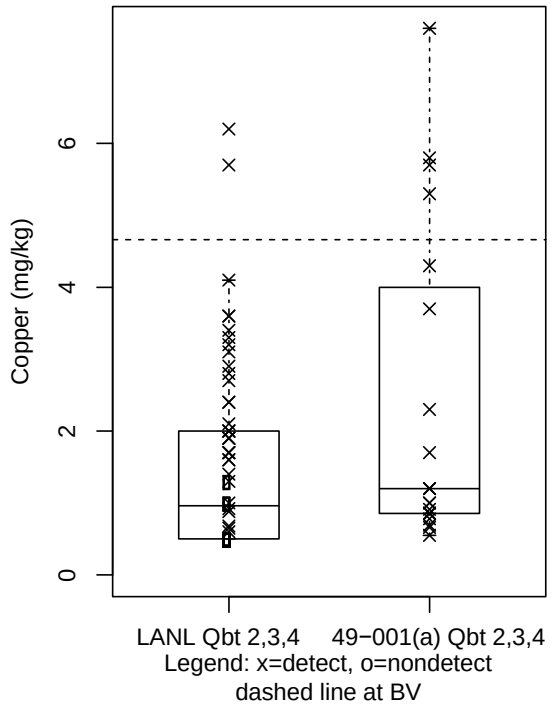

Figure H-12 Box plot for copper in tuff at SWMU 49-001(a)

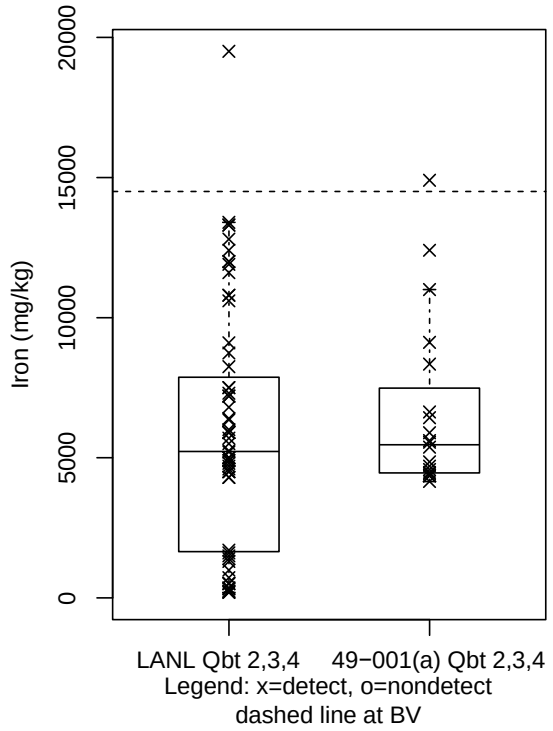

Figure H-13 Box plot for iron in tuff at SWMU 49-001(a)

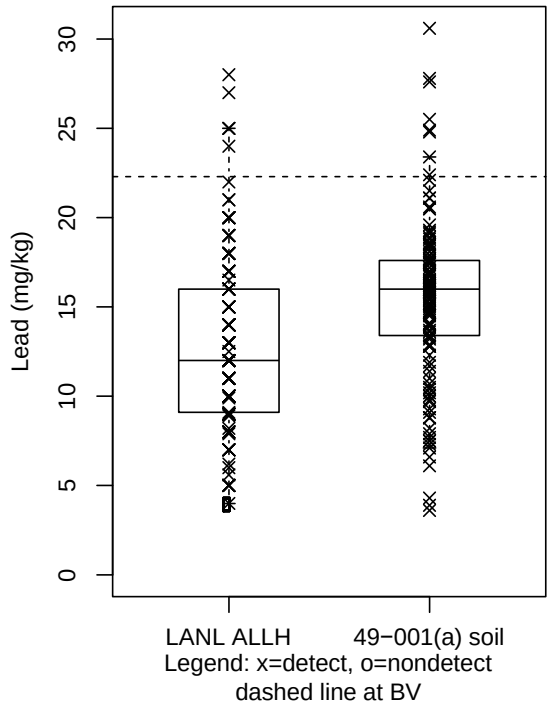

Figure H-14 Box plot for lead in in soil at SWMU 49-001(a)

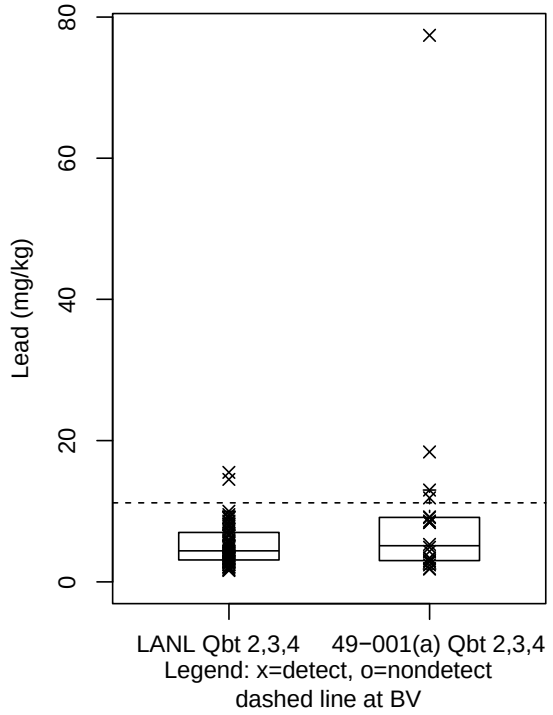

Figure H-15 Box plot for lead in in tuff at SWMU 49-001(a)

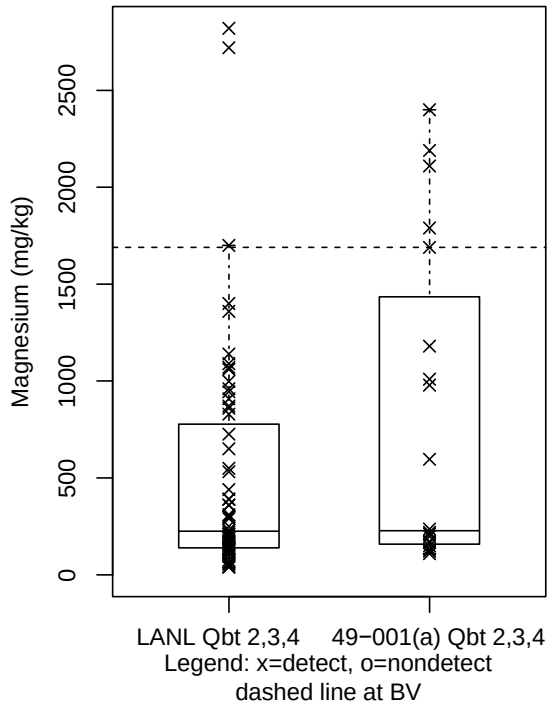

Figure H-16 Box plot for magnesium in tuff at SWMU 49-001(a)

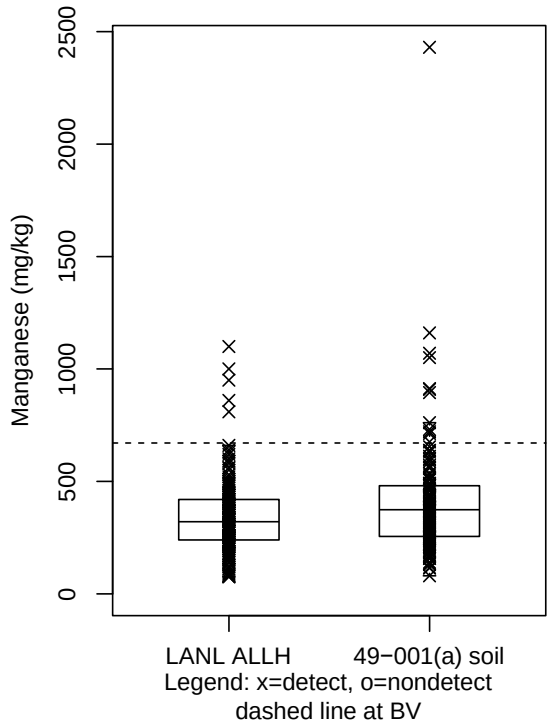

Figure H-17 Box plot for manganese in soil at SWMU 49-001(a)

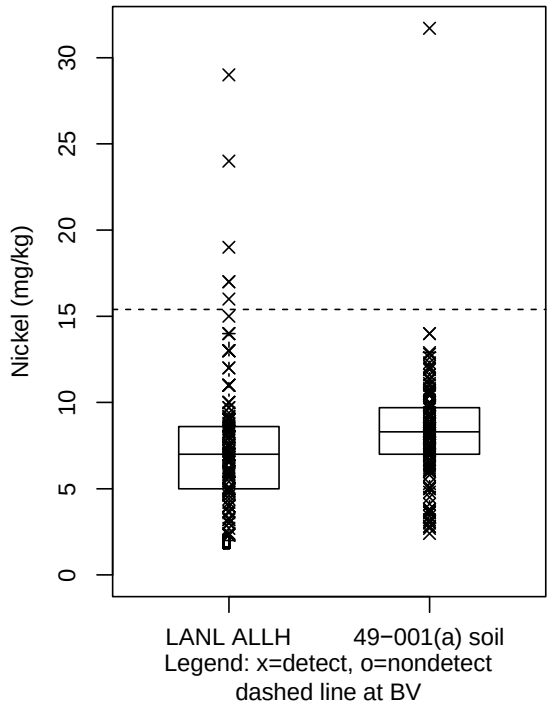

Figure H-18 Box plot for nickel in soil at SWMU 49-001(a)

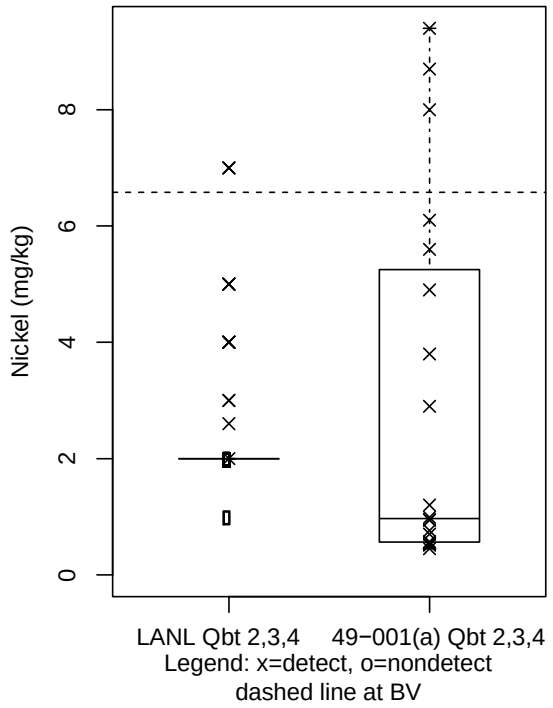

Figure H-19 Box plot for nickel in tuff at SWMU 49-001(a)

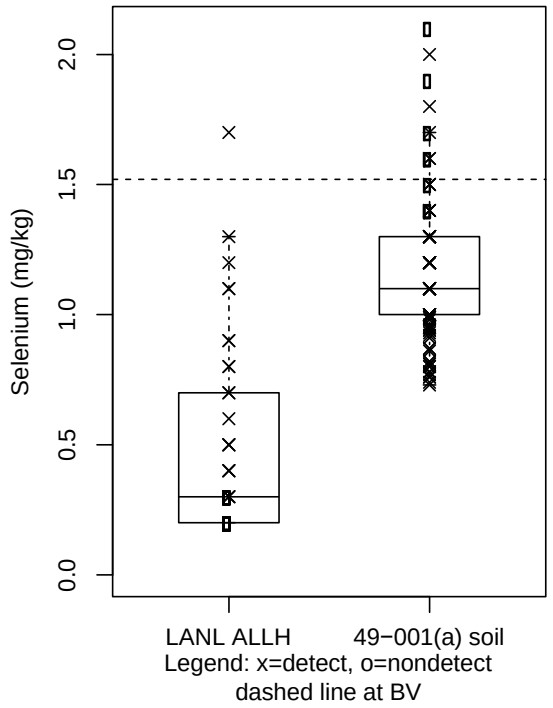

Figure H-20 Box plot for selenium in soil at SWMU 49-001(a)

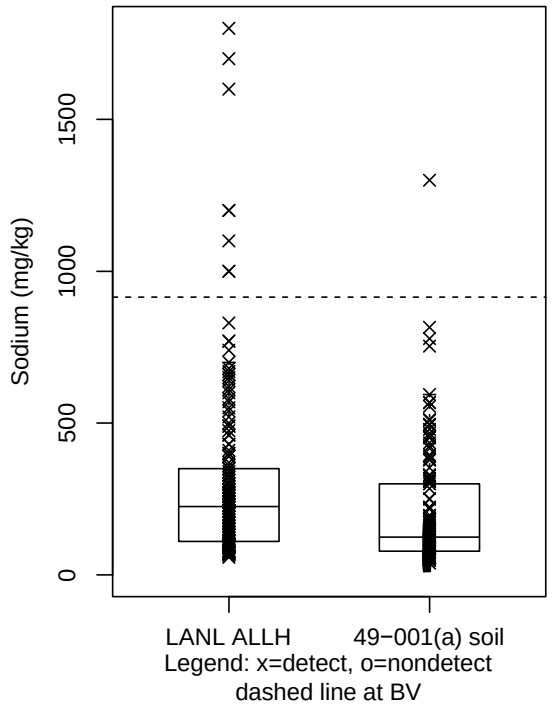

Figure H-21 Box plot for sodium in soil at SWMU 49-001(a)

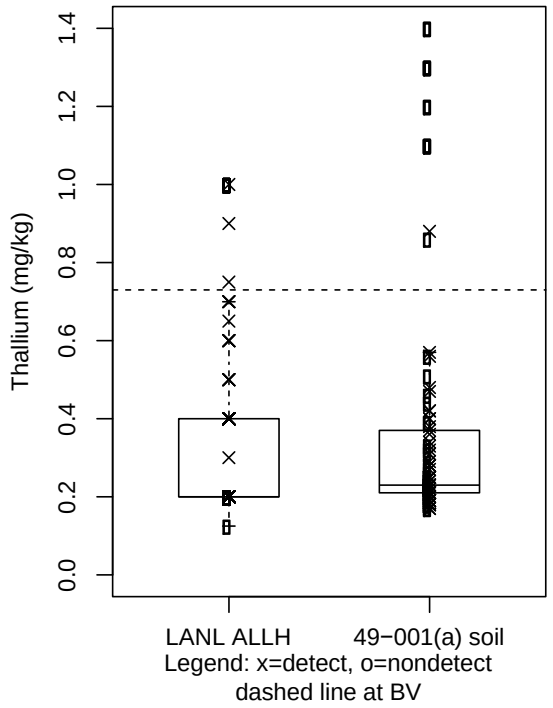

Figure H-22 Box plot for thallium in soil at SWMU 49-001(a)

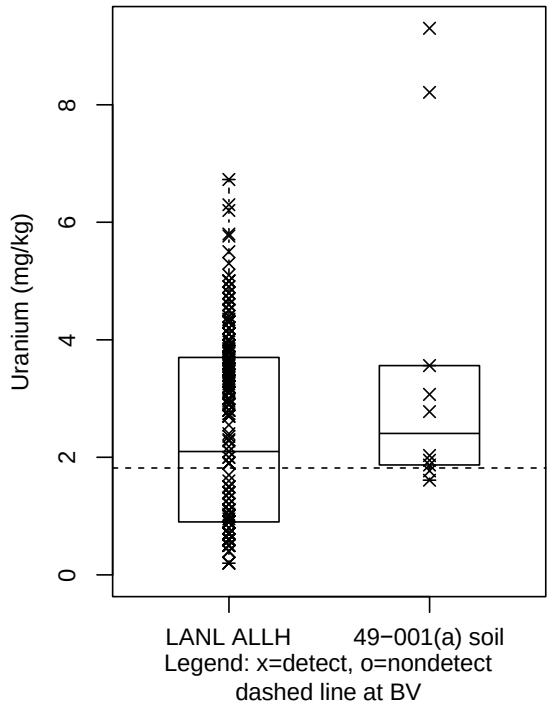

Figure H-23 Box plot for uranium in soil at SWMU 49-001(a)

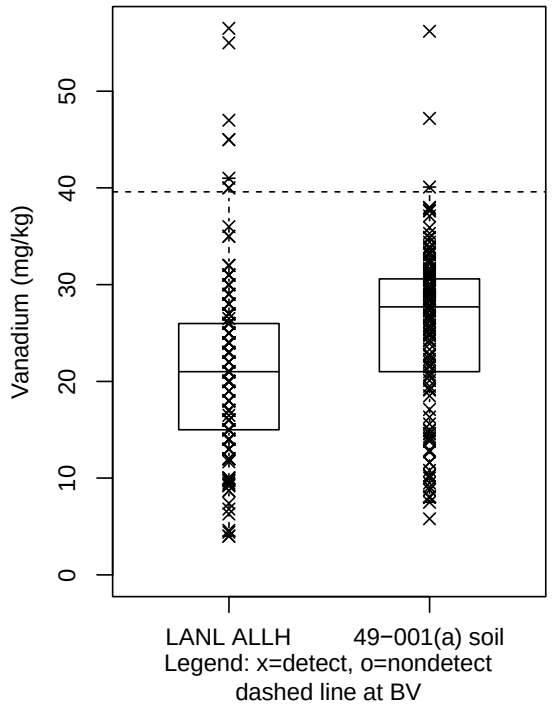

Figure H-24 Box plot for vanadium in soil at SWMU 49-001(a)

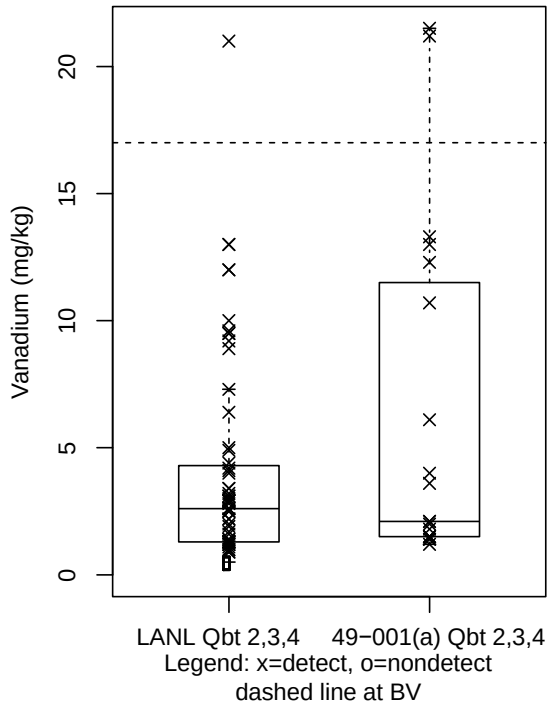

Figure H-25 Box plot for vanadium in tuff at SWMU 49-001(a)

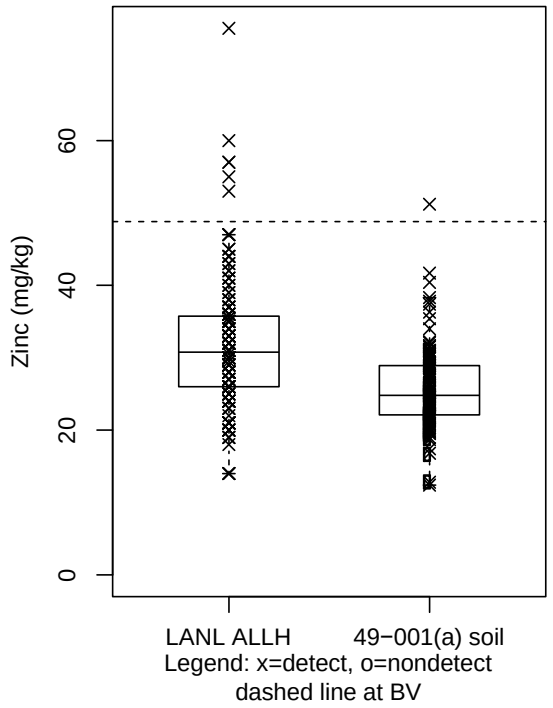

Figure H-26 Box plot for zinc in soil at SWMU 49-001(a)

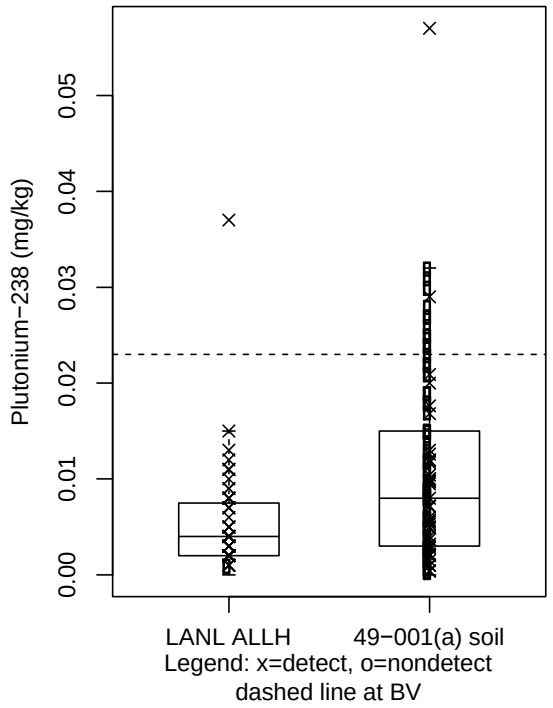

Figure H-27 Box plot for plutonium-238 in soil at SWMU 49-001(a)

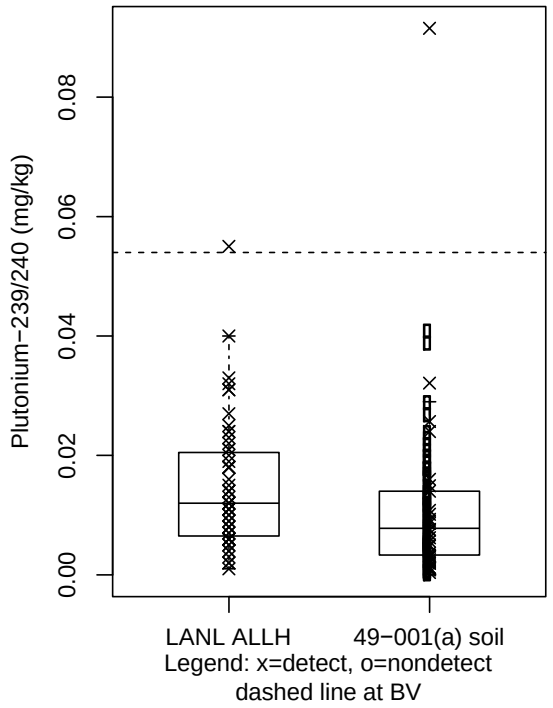

Figure H-28 Box plot for plutonium-239/240 in soil at SWMU 49-001(a)

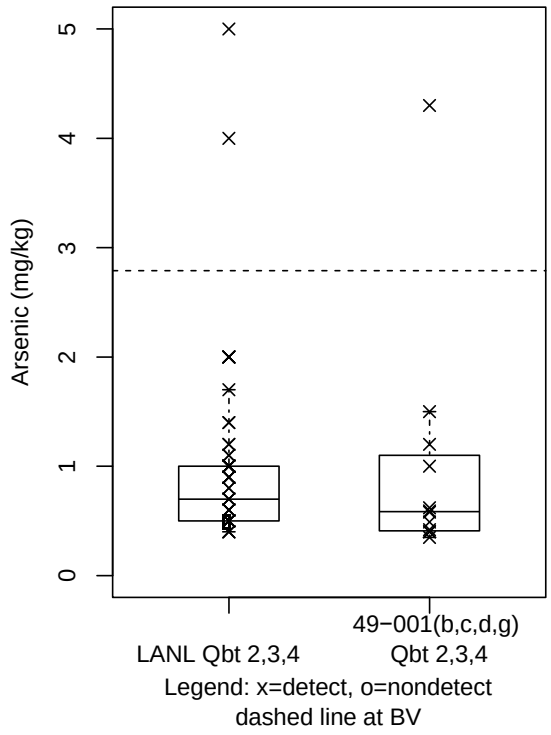

Figure H-29 Box plot for arsenic in tuff at SWMUs 49-001(b, c, d, g)

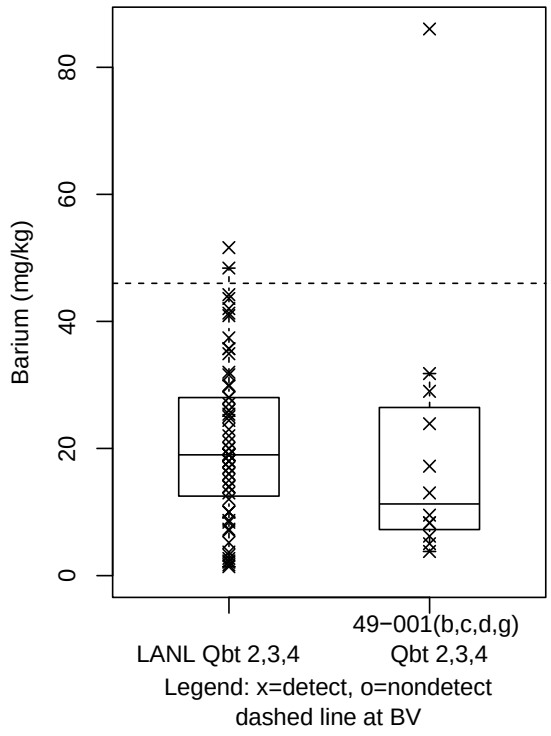

Figure H-30 Box plot for barium in tuff at SWMUs 49-001(b, c, d, g)

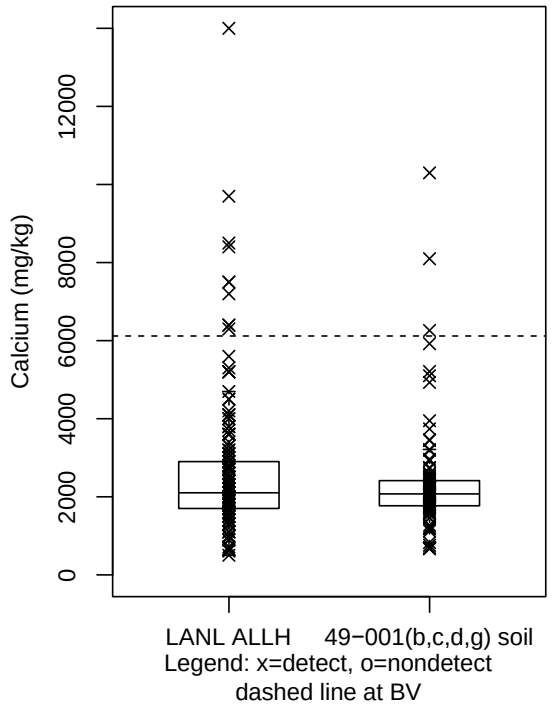

Figure H-31 Box plot for calcium in soil at SWMUs 49-001(b, c, d, g)

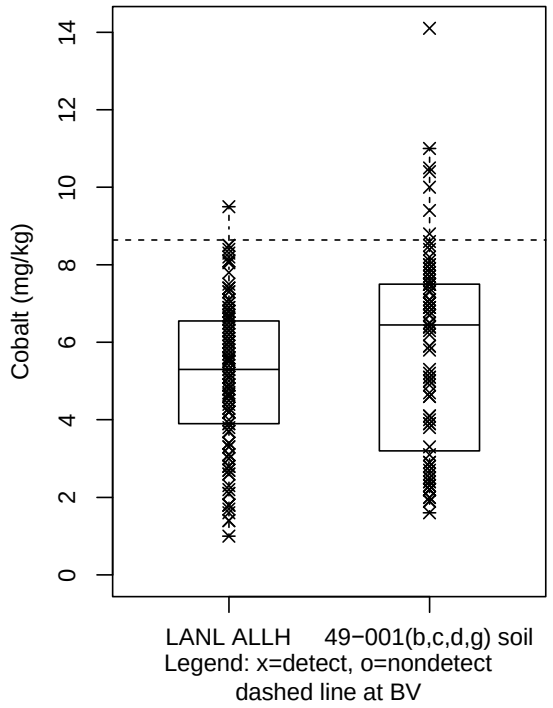

Figure H-32 Box plot for cobalt in soil at SWMUs 49-001(b, c, d, g)

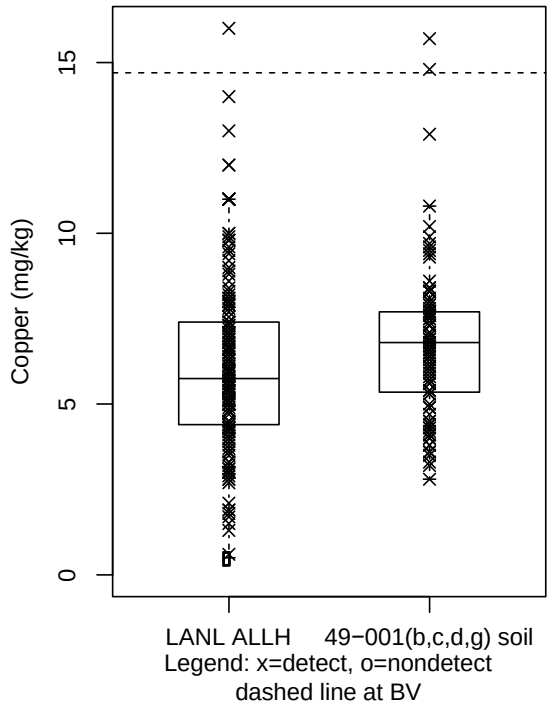

Figure H-33 Box plot for copper in soil at SWMUs 49-001(b, c, d, g)

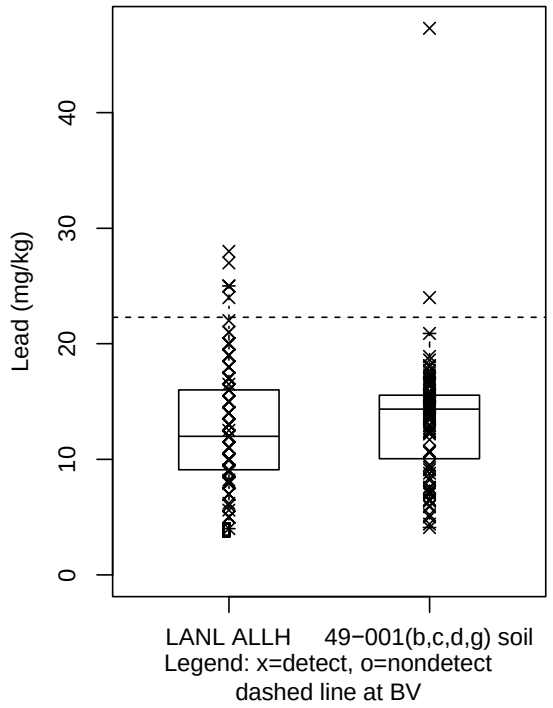

Figure H-34 Box plot for lead in soil at SWMUs 49-001(b, c, d, g)

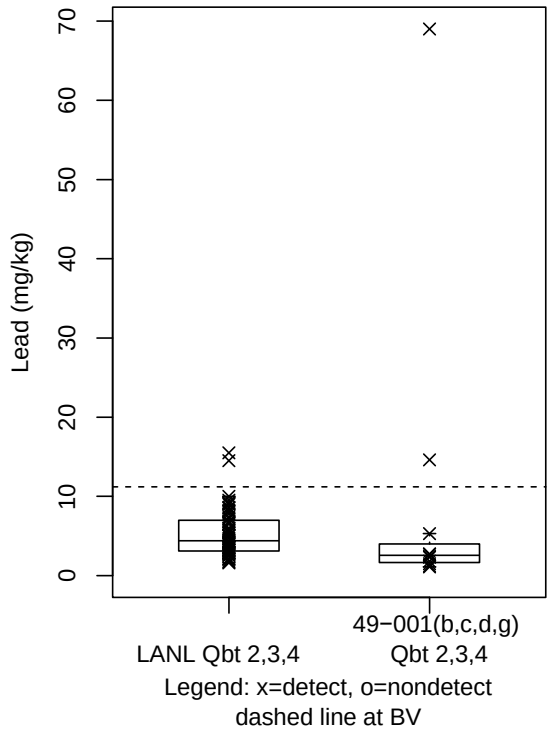

Figure H-35 Box plot for lead in tuff at SWMUs 49-001(b, c, d, g)

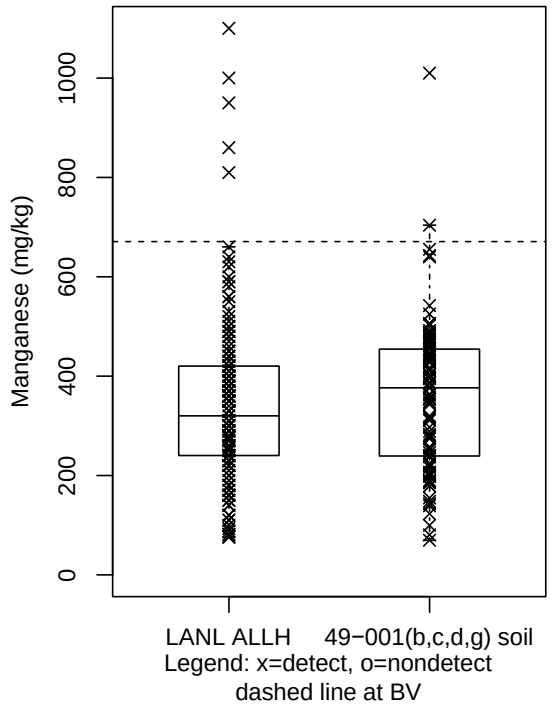

Figure H-36 Box plot for manganese in soil at SWMUs 49-001(b, c, d, g)

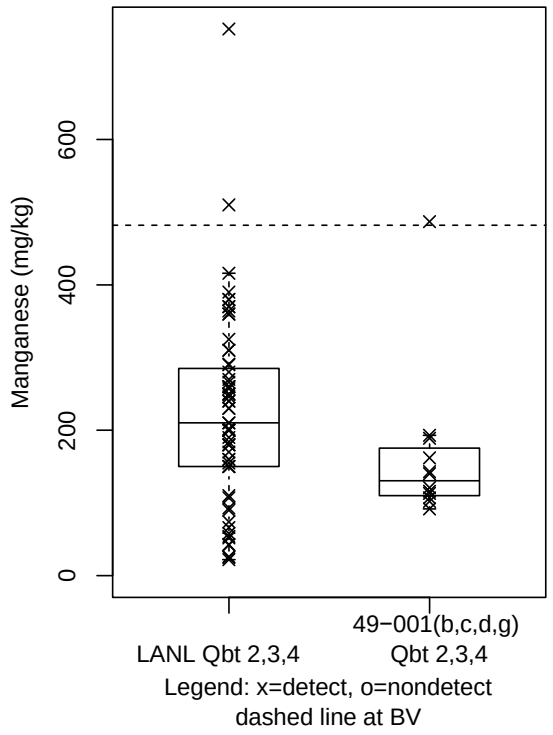

Figure H-37 Box plot for manganese in tuff at SWMUs 49-001(b, c, d, g)

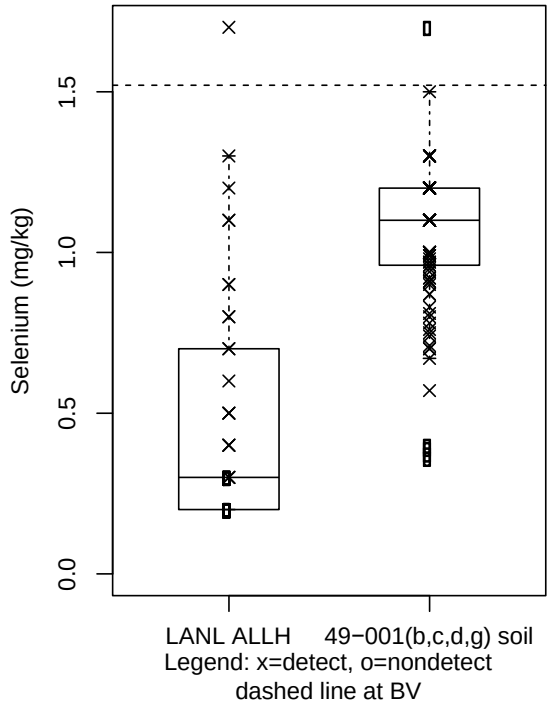

Figure H-38 Box plot for selenium in soil at SWMUs 49-001(b, c, d, g)

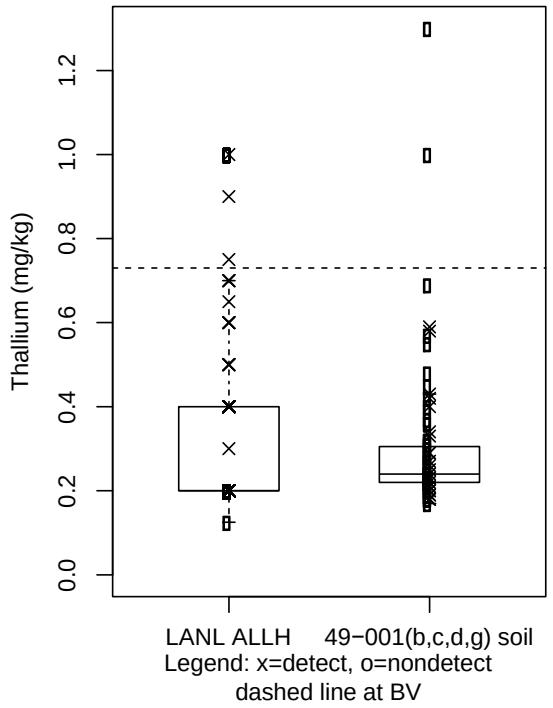

Figure H-39 Box plot for thallium in soil at SWMUs 49-001(b, c, d, g)

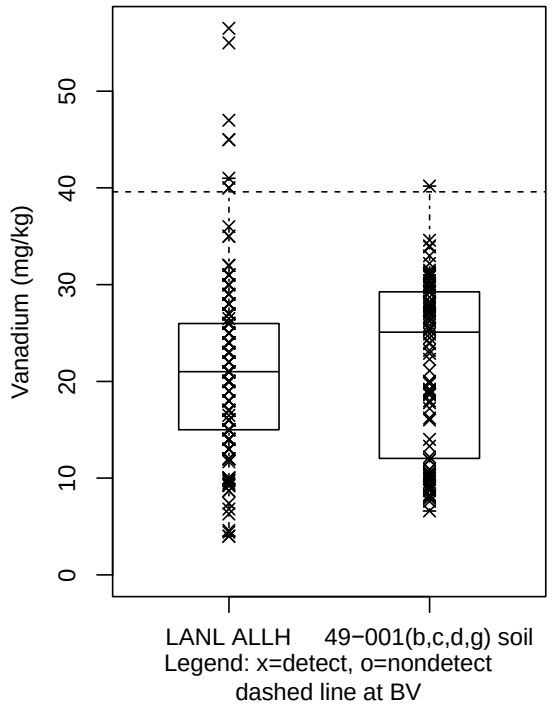

Figure H-40 Box plot for vanadium in soil at SWMUs 49-001(b, c, d, g)

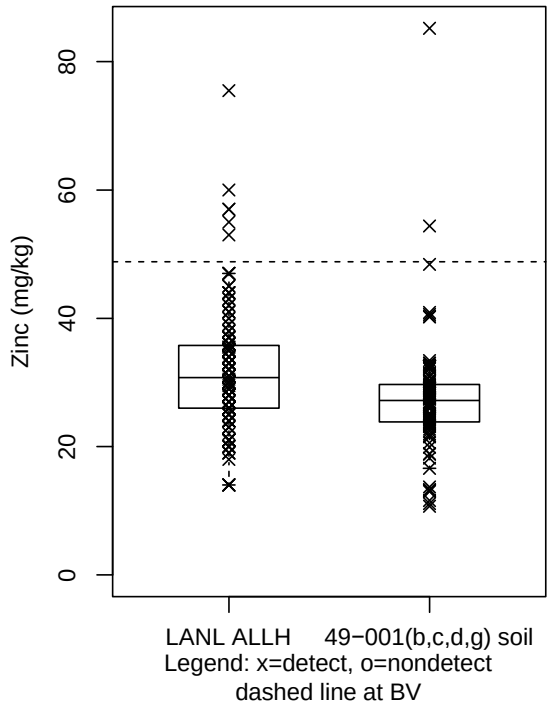

Figure H-41 Box plot for zinc in soil at SWMUs 49-001(b, c, d, g)

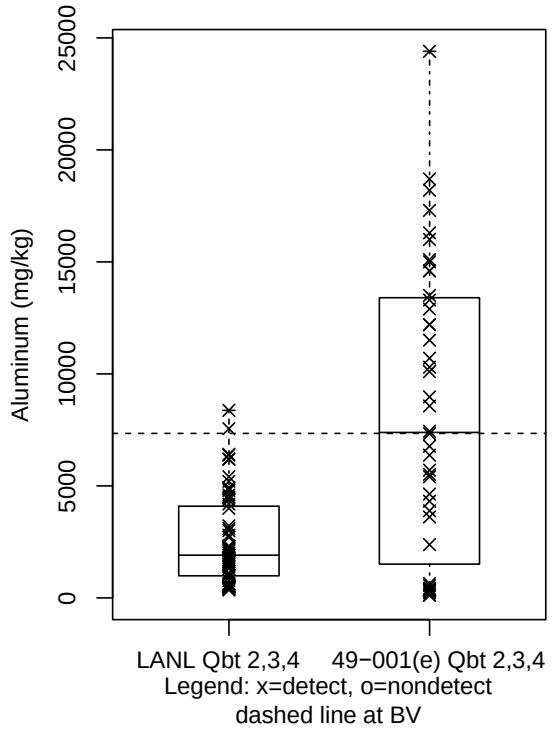

Figure H-42 Box plot for aluminum in tuff at SWMU 49-001(e)

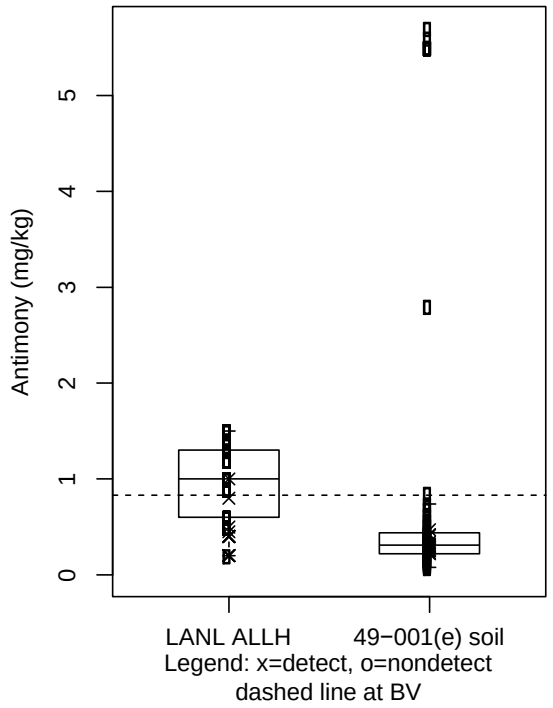

Figure H-43 Box plot for antimony in soil at SWMU 49-001(e)

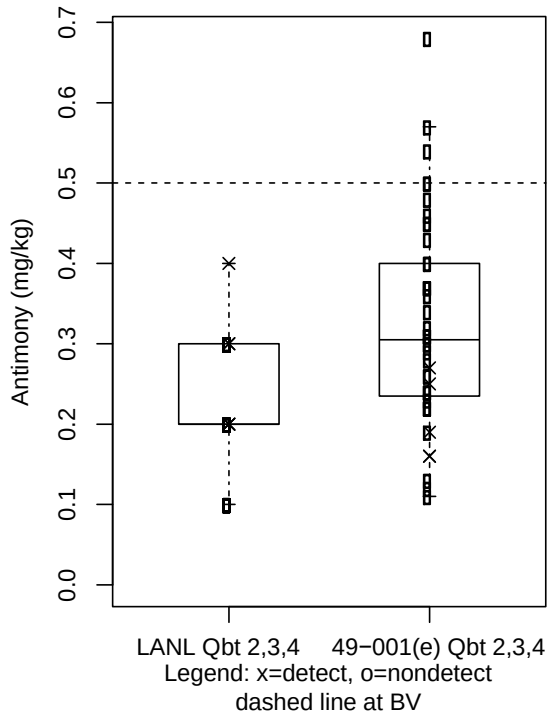

Figure H-44 Box plot for antimony in tuff at SWMU 49-001(e)

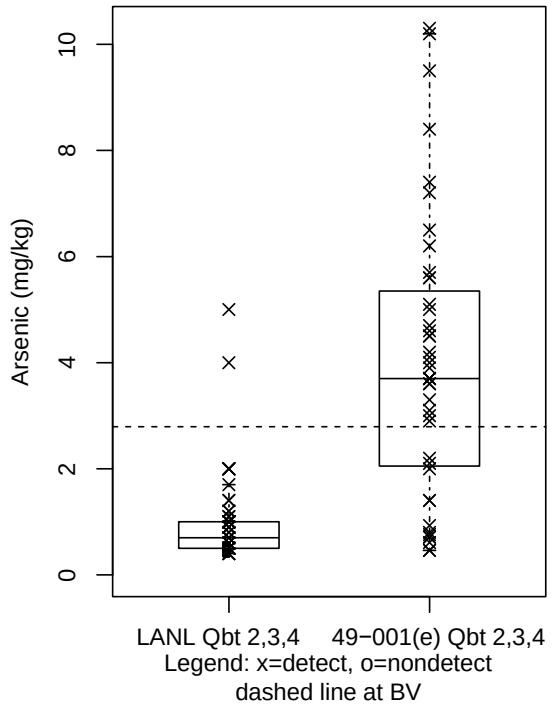

Figure H-45 Box plot for arsenic in tuff at SWMU 49-001(e)

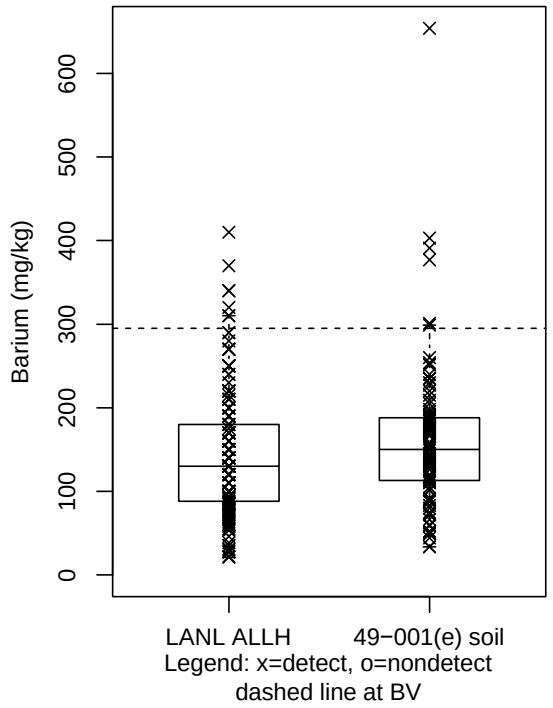

Figure H-46 Box plot for barium in soil at SWMU 49-001(e)

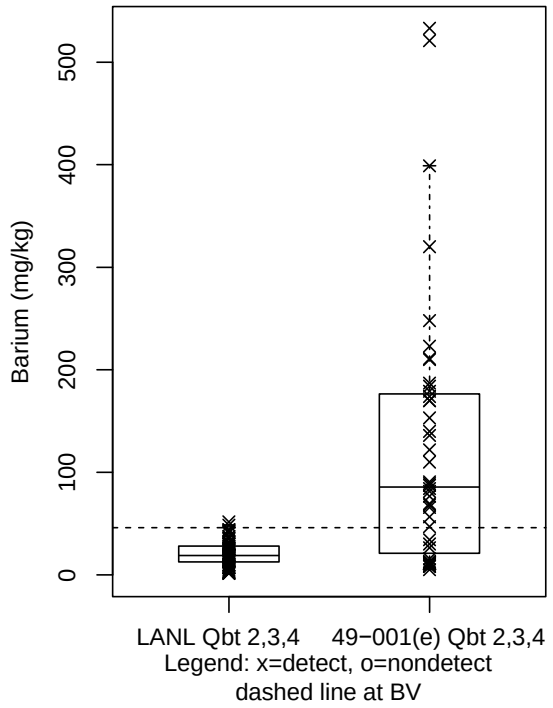

Figure H-47 Box plot for barium in tuff at SWMU 49-001(e)

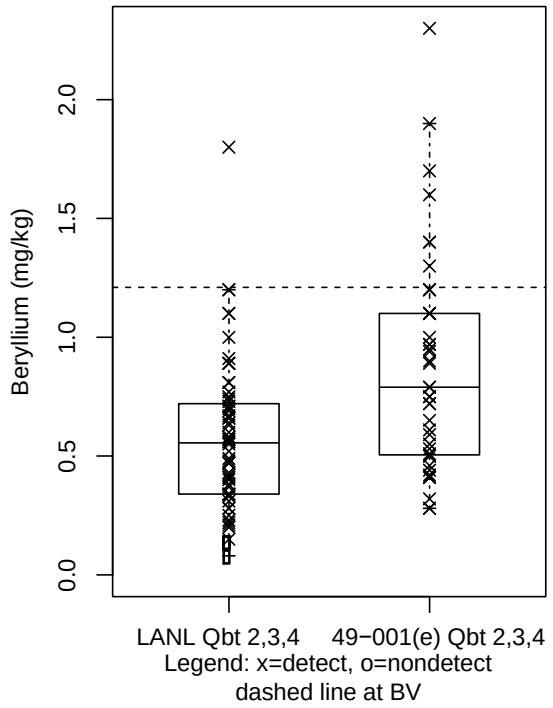

Figure H-48 Box plot for beryllium in tuff at SWMU 49-001(e)

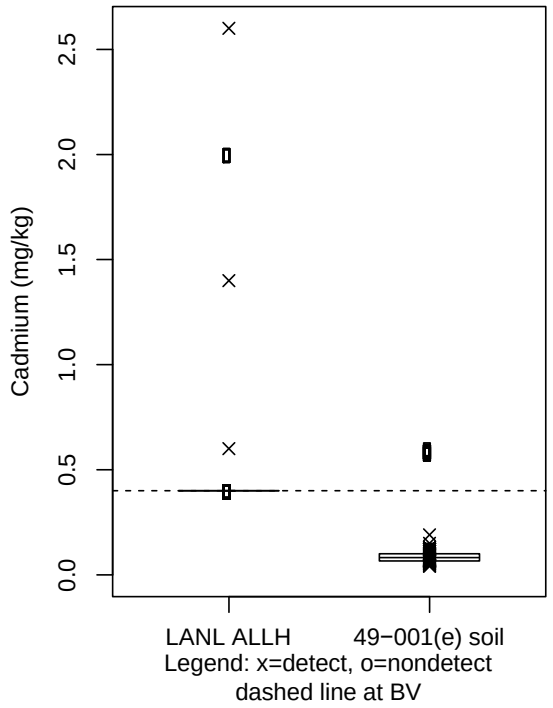

Figure H-49 Box plot for calcium in soil at SWMU 49-001(e)

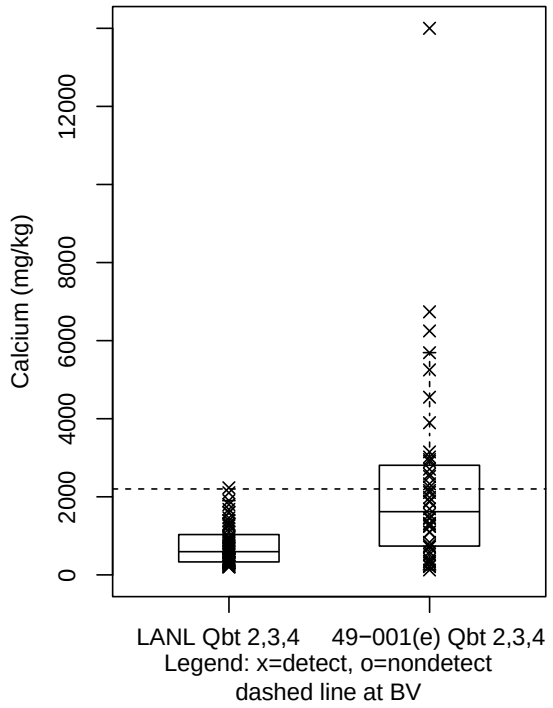

Figure H-50 Box plot for calcium in tuff at SWMU 49-001(e)

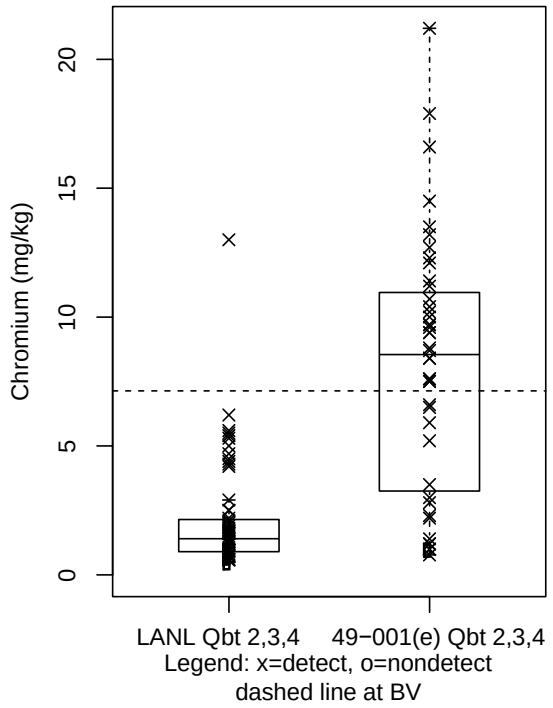

Figure H-51 Box plot for chromium in tuff at SWMU 49-001(e)

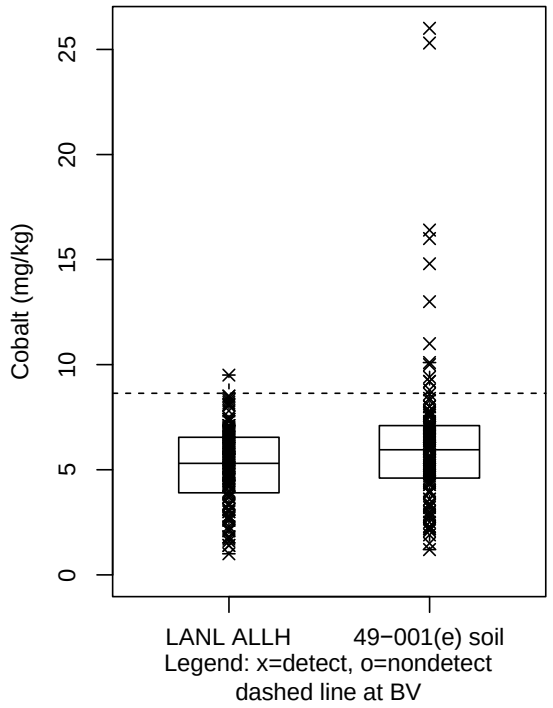

Figure H-52 Box plot for cobalt in soil at SWMU 49-001(e)

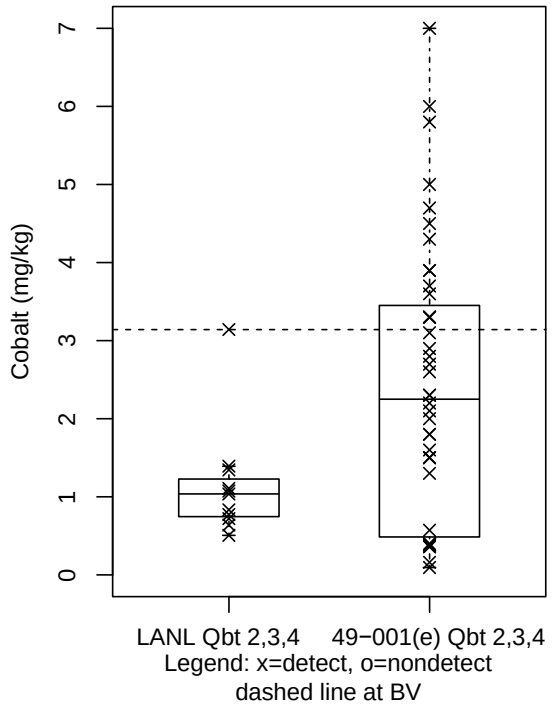

Figure H-53 Box plot for cobalt in tuff at SWMU 49-001(e)

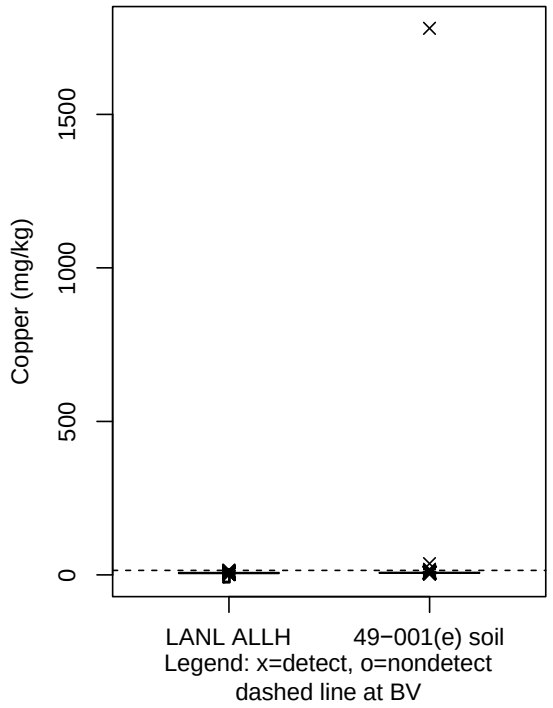

Figure H-54 Box plot for copper in soil at SWMU 49-001(e)

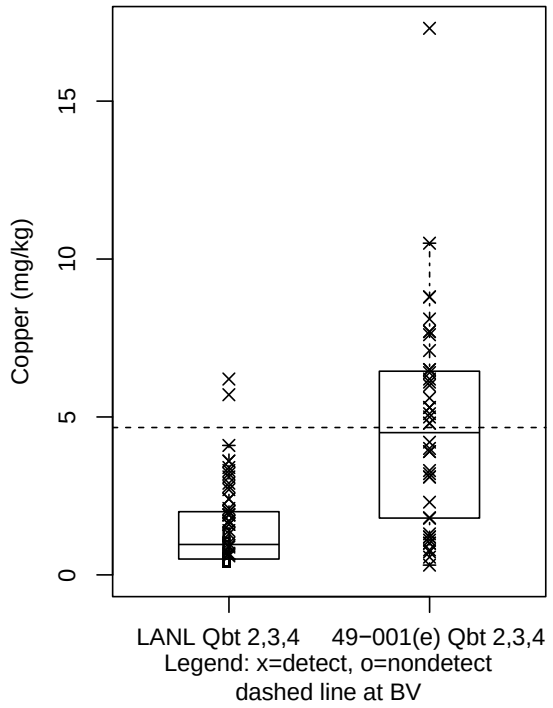

Figure H-55 Box plot for copper in tuff at SWMU 49-001(e)

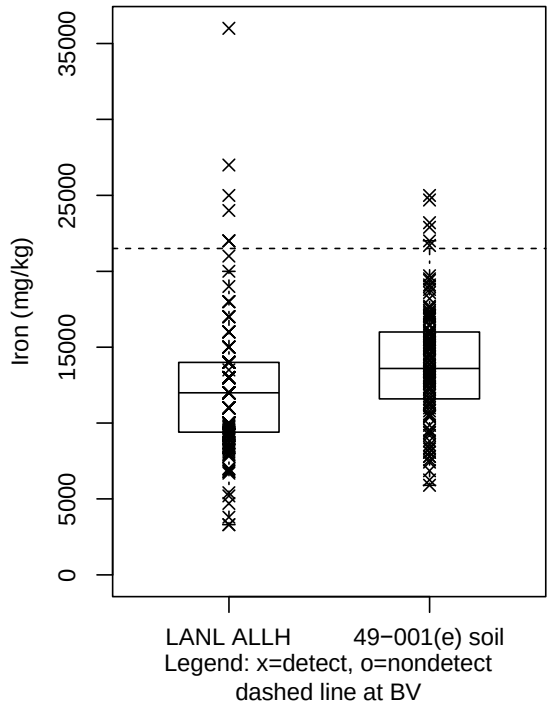

Figure H-56 Box plot for iron in soil at SWMU 49-001(e)

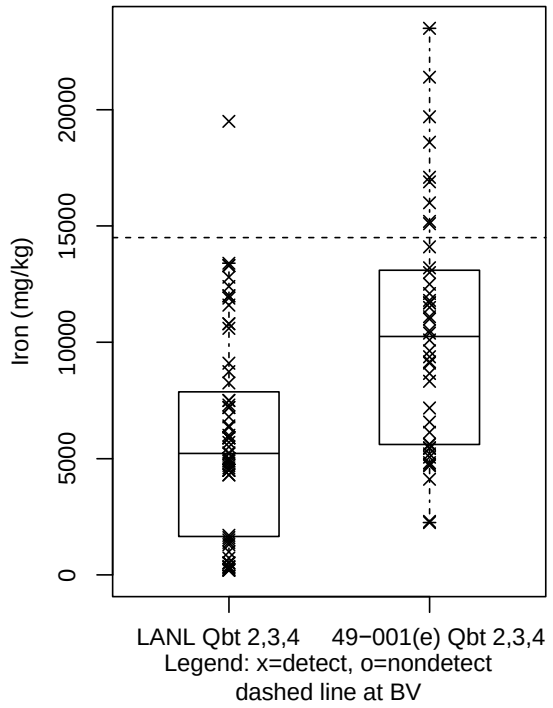

Figure H-57 Box plot for iron in tuff at SWMU 49-001(e)

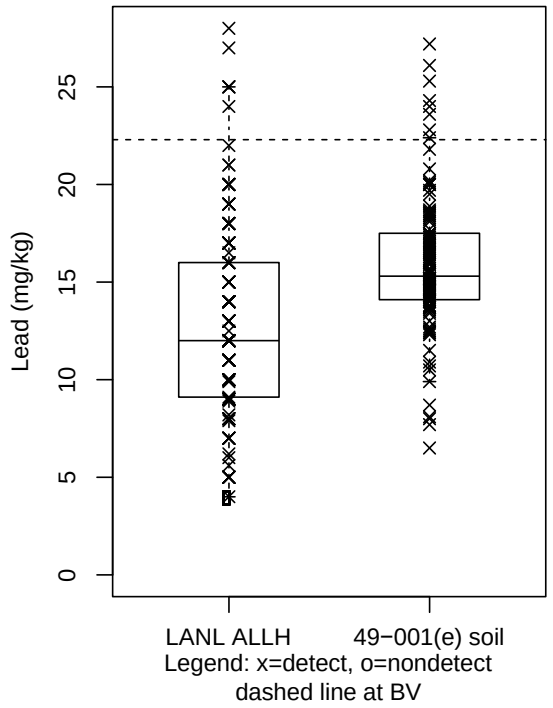

Figure H-58 Box plot for lead in soil at SWMU 49-001(e)

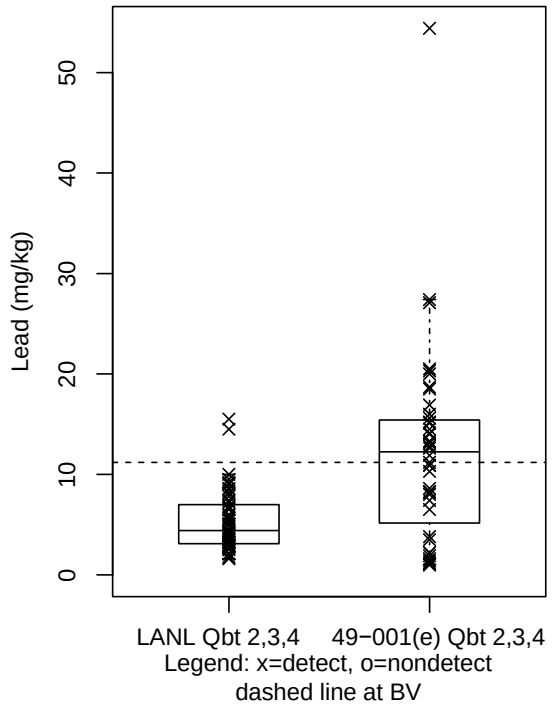

Figure H-59 Box plot for lead in tuff at SWMU 49-001(e)

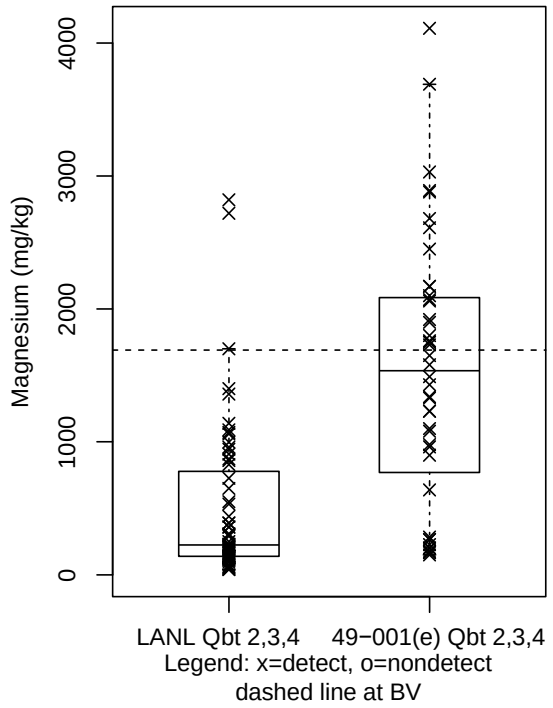

Figure H-60 Box plot for magnesium in tuff at SWMU 49-001(e)

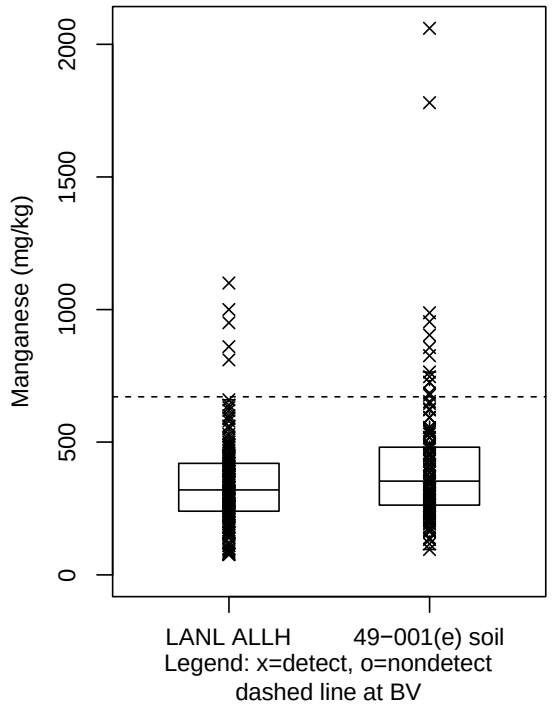

Figure H-61 Box plot for manganese in soil at SWMU 49-001(e)

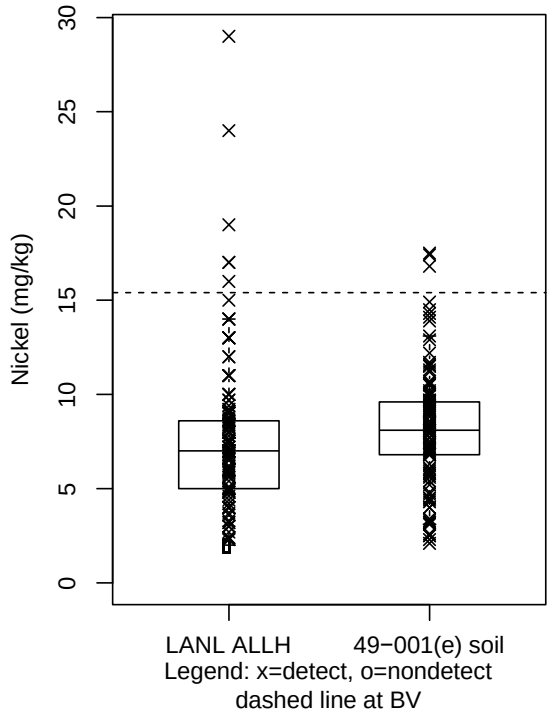

Figure H-62 Box plot for nickel in soil at SWMU 49-001(e)

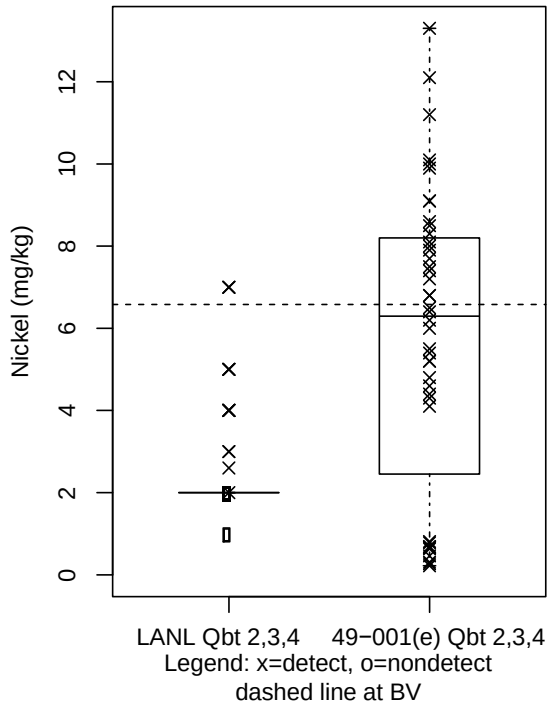

Figure H-63 Box plot for nickel in tuff at SWMU 49-001(e)

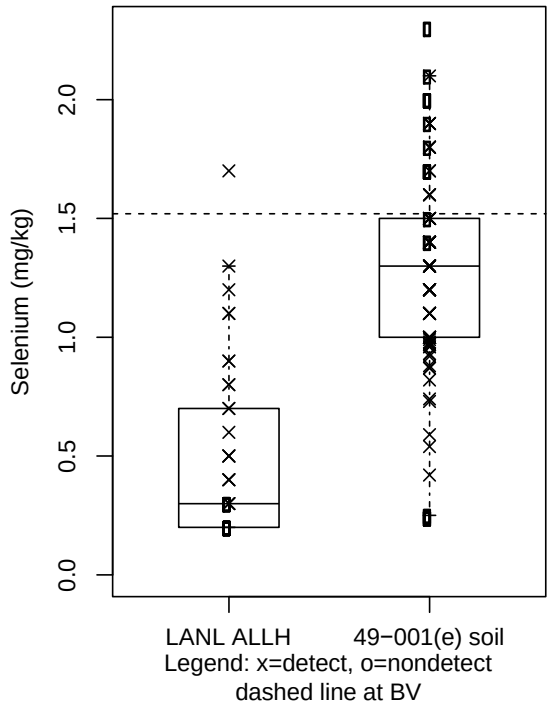

Figure H-64 Box plot for selenium in soil at SWMU 49-001(e)

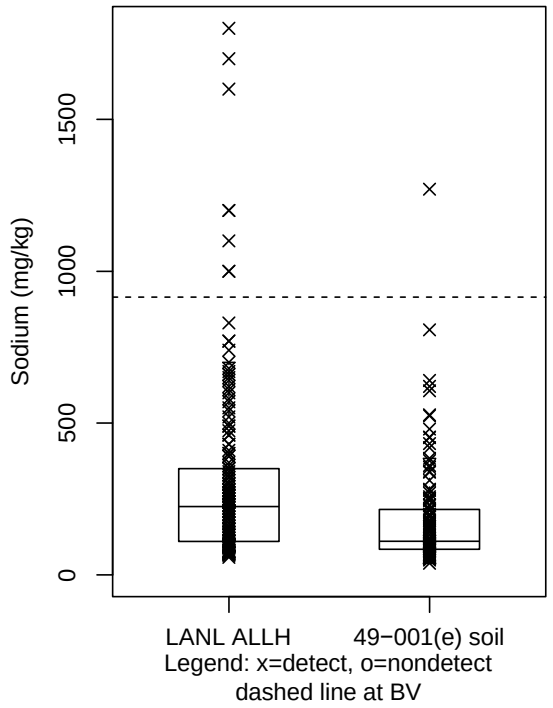

Figure H-65 Box plot for sodium in soil at SWMU 49-001(e)

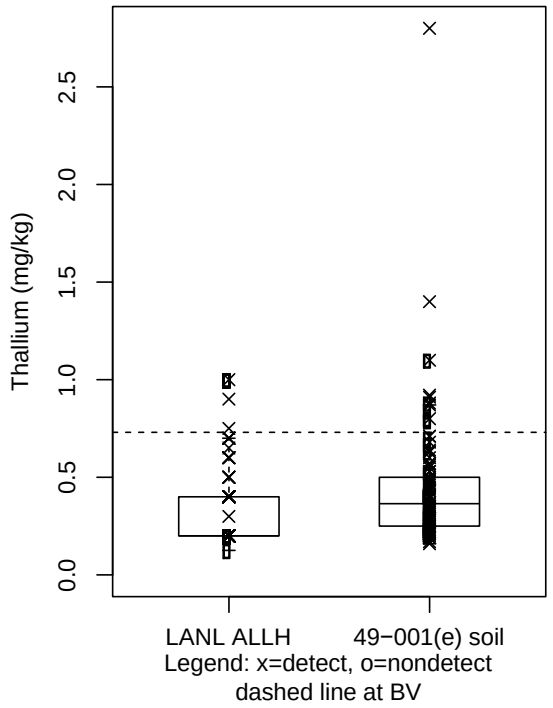

Figure H-66 Box plot for thallium in soil at SWMU 49-001(e)

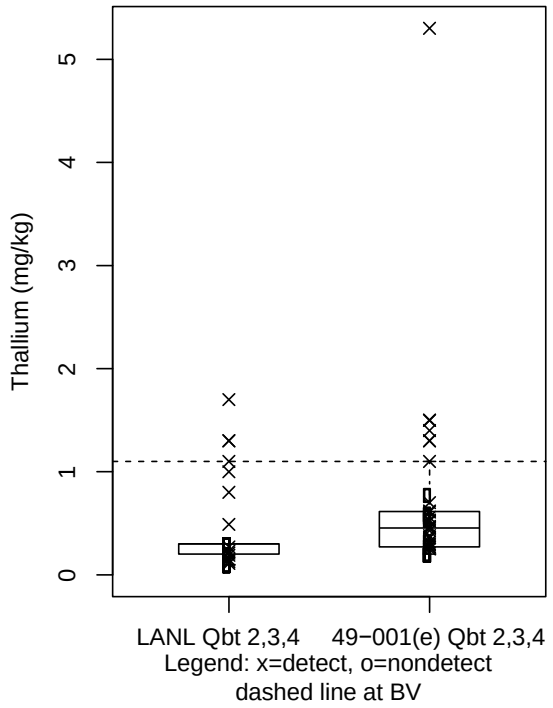

Figure H-67 Box plot for thallium in tuff at SWMU 49-001(e)

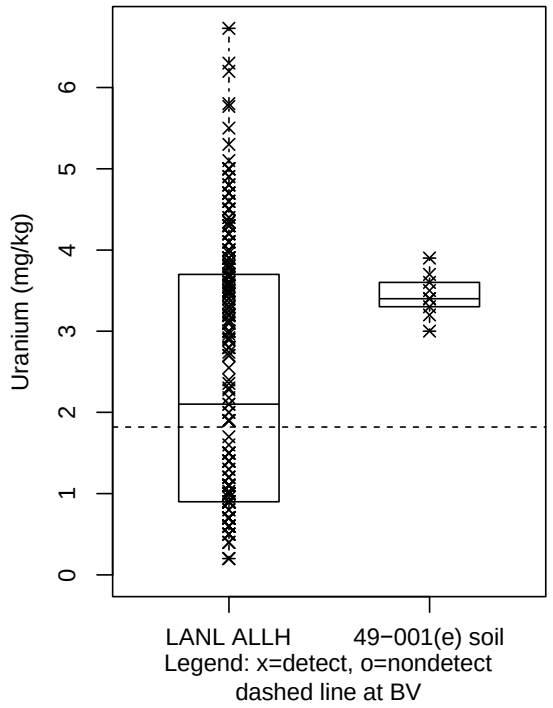

Figure H-68 Box plot for uranium in soil at SWMU 49-001(e)

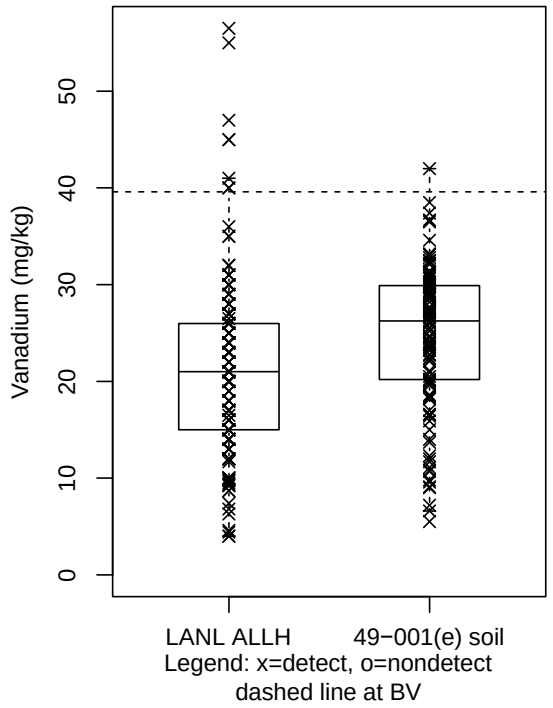

Figure H-69 Box plot for vanadium in soil at SWMU 49-001(e)

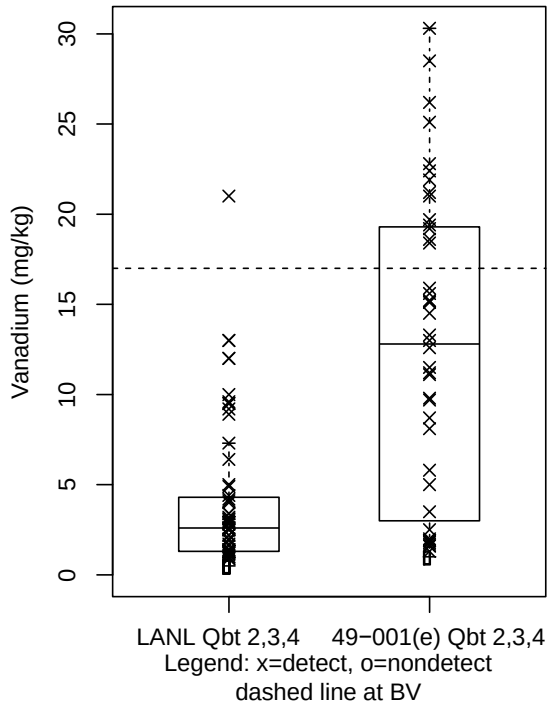

Figure H-70 Box plot for vanadium in tuff at SWMU 49-001(e)

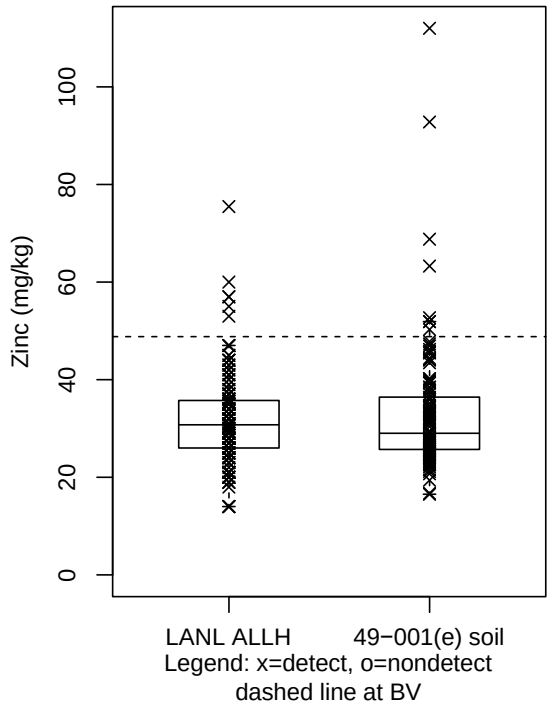

Figure H-71 Box plot for zinc in soil at SWMU 49-001(e)

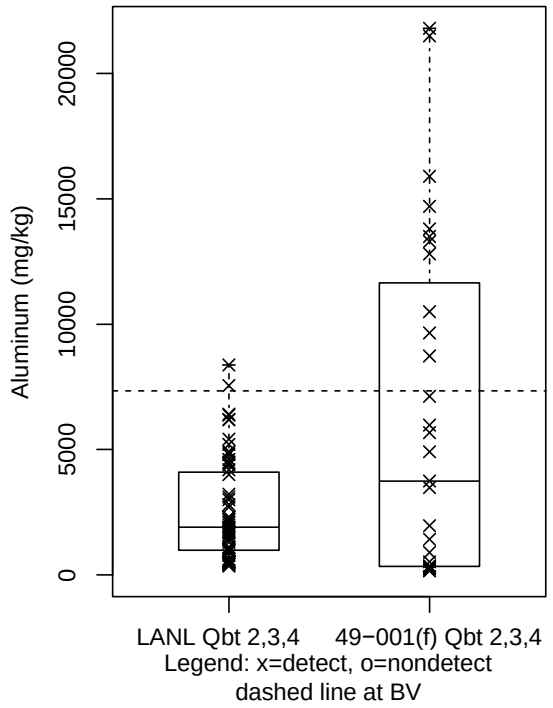

Figure H-72 Box plot for aluminum in tuff at SWMU 49-001(f)

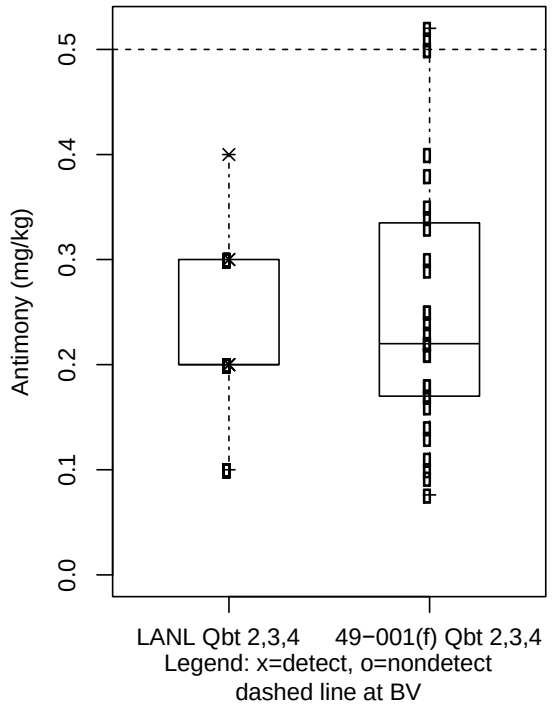

Figure H-73 Box plot for antimony in tuff at SWMU 49-001(f)

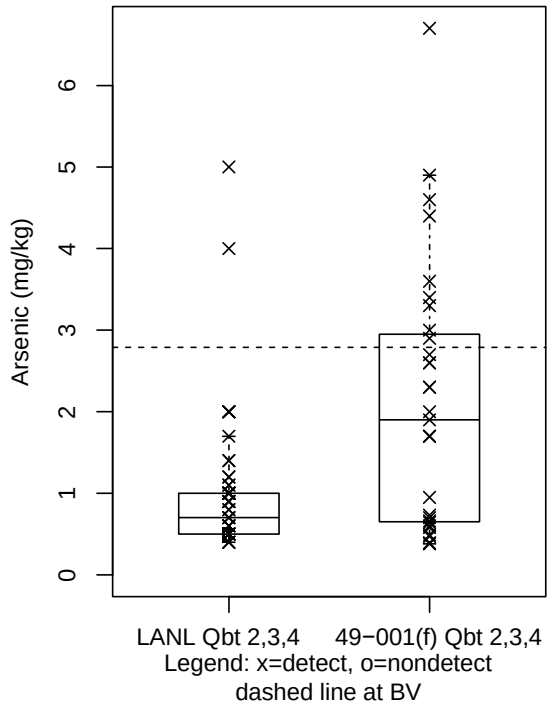

Figure H-74 Box plot for arsenic in tuff at SWMU 49-001(f)

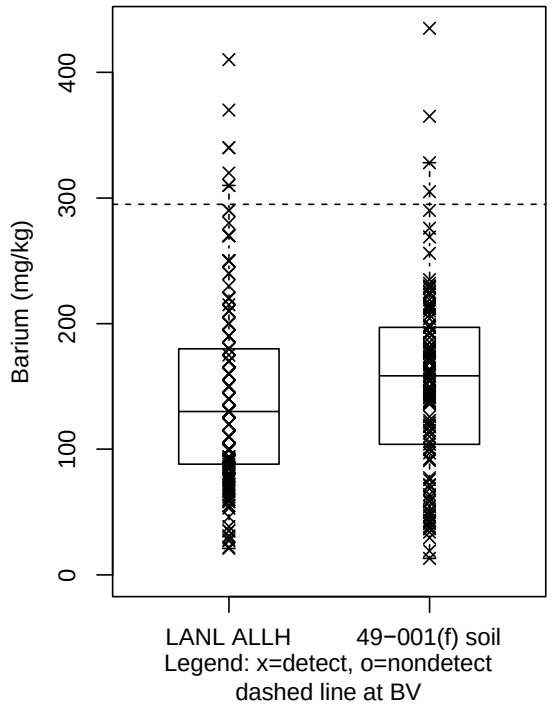

Figure H-75 Box plot for barium in soil at SWMU 49-001(f)

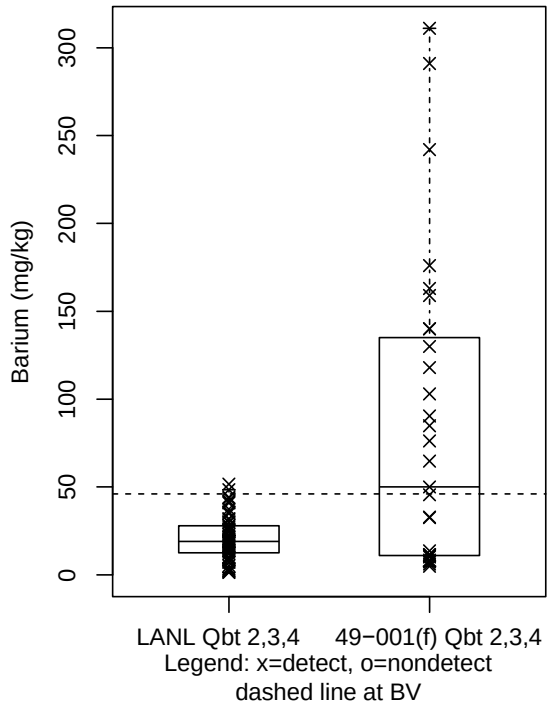

Figure H-76 Box plot for barium in tuff at SWMU 49-001(f)

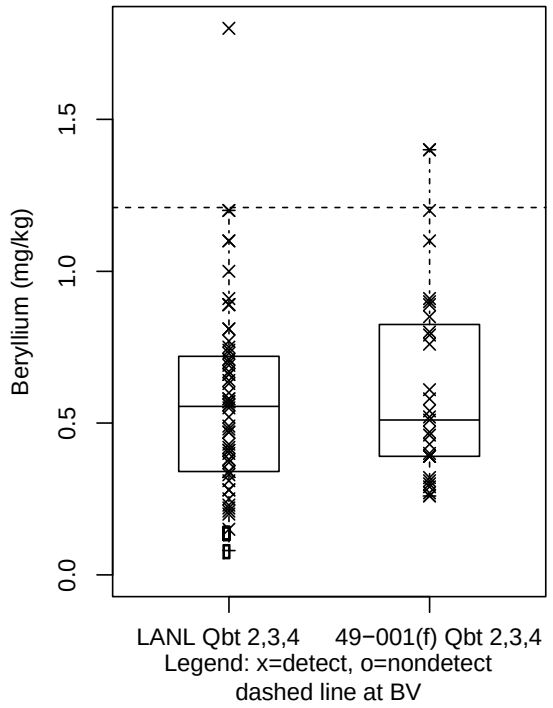

Figure H-77 Box plot for beryllium in tuff at SWMU 49-001(f)

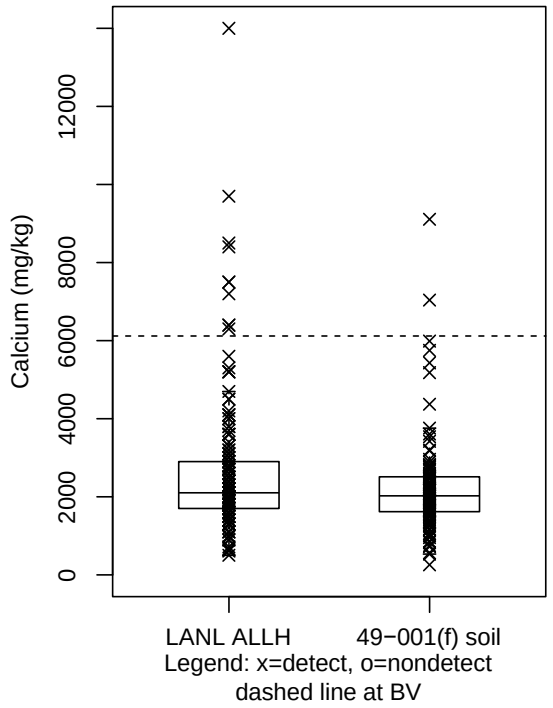

Figure H-78 Box plot for calcium in soil at SWMU 49-001(f)

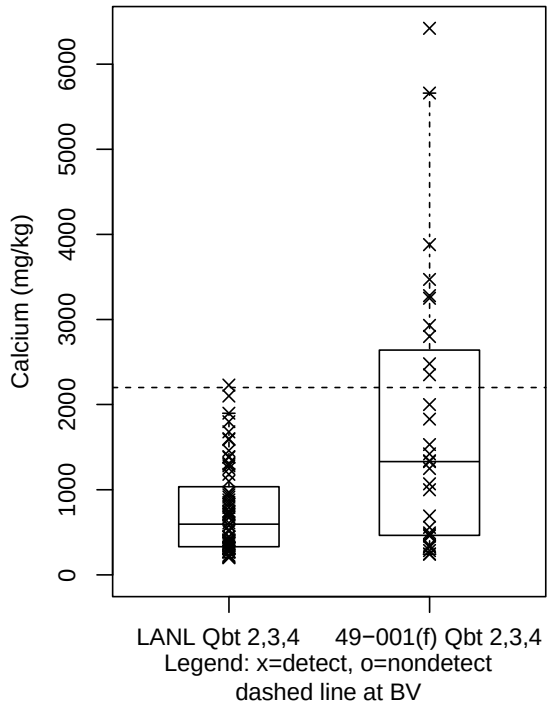

Figure H-79 Box plot for calcium in tuff at SWMU 49-001(f)

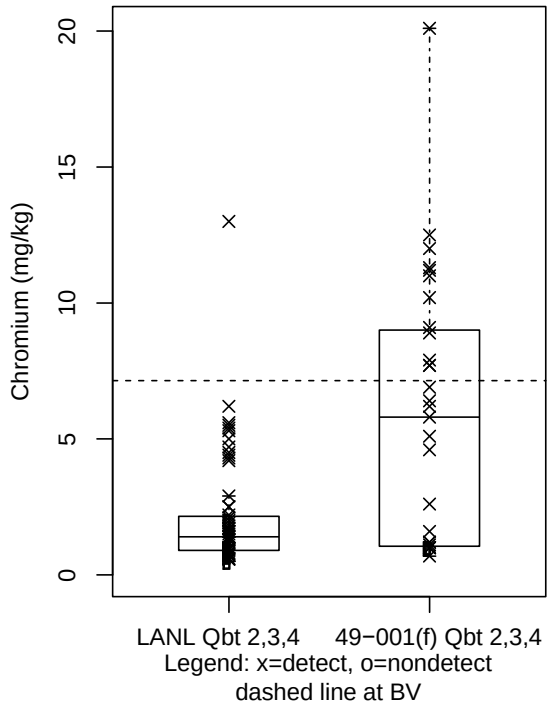

Figure H-80 Box plot for chromium in tuff at SWMU 49-001(f)

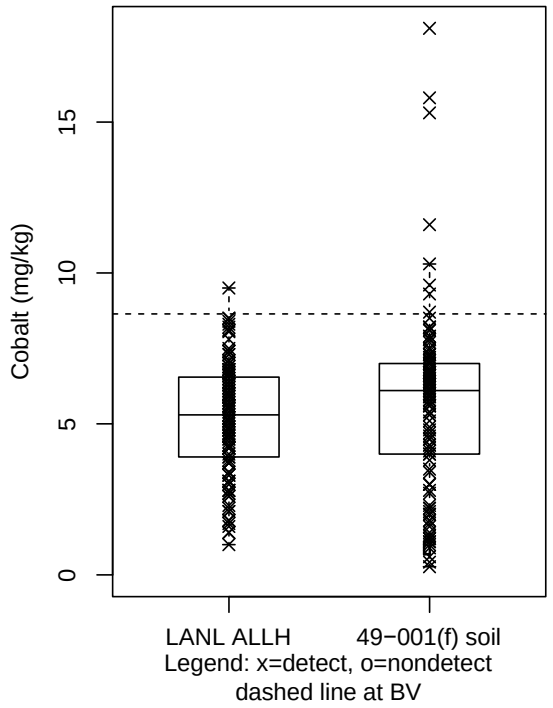

Figure H-81 Box plot for cobalt in soil at SWMU 49-001(f)

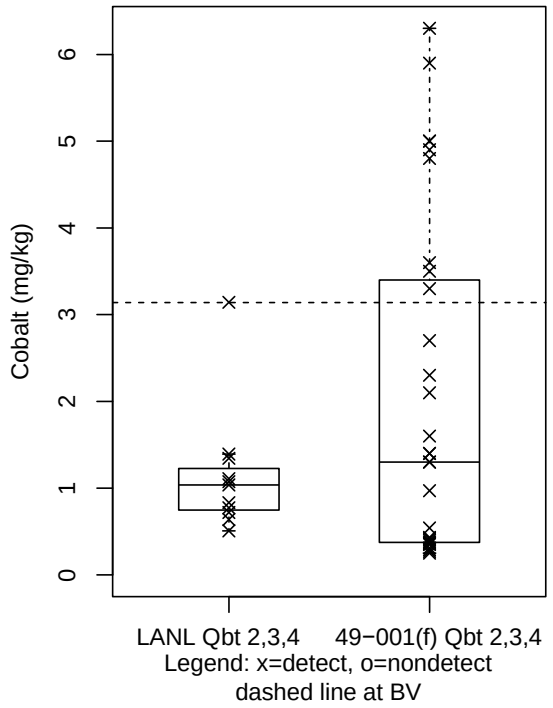

Figure H-82 Box plot for cobalt in tuff at SWMU 49-001(f)

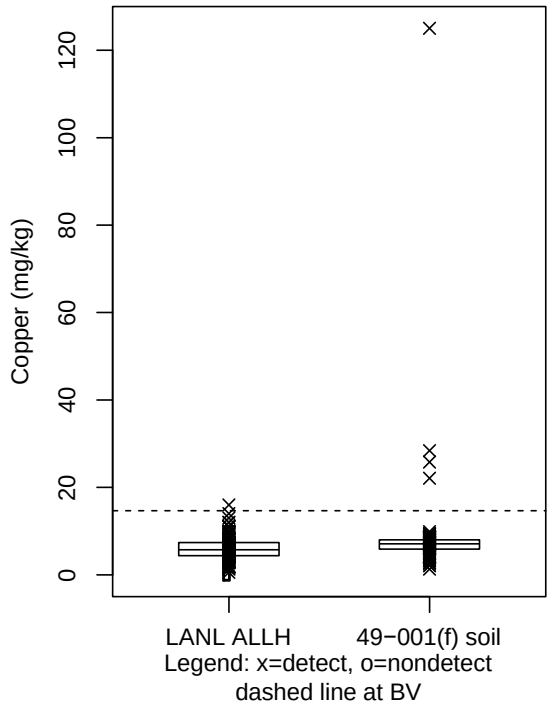

Figure H-83 Box plot for copper in soil at SWMU 49-001(f)

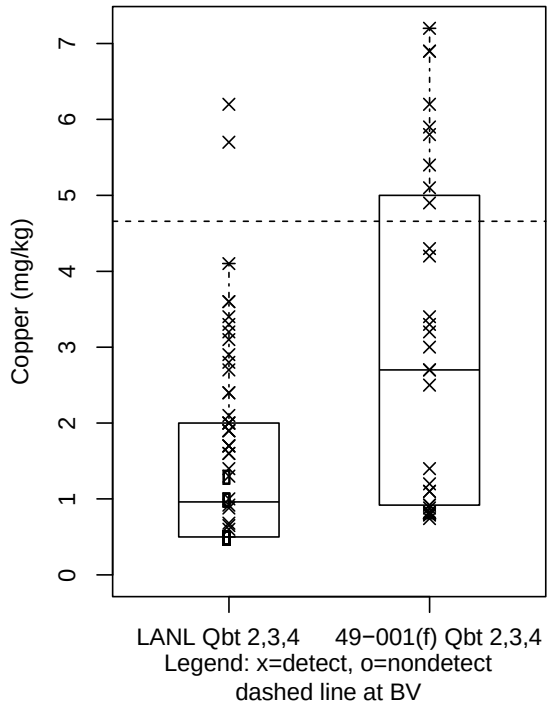

Figure H-84 Box plot for copper in tuff at SWMU 49-001(f)

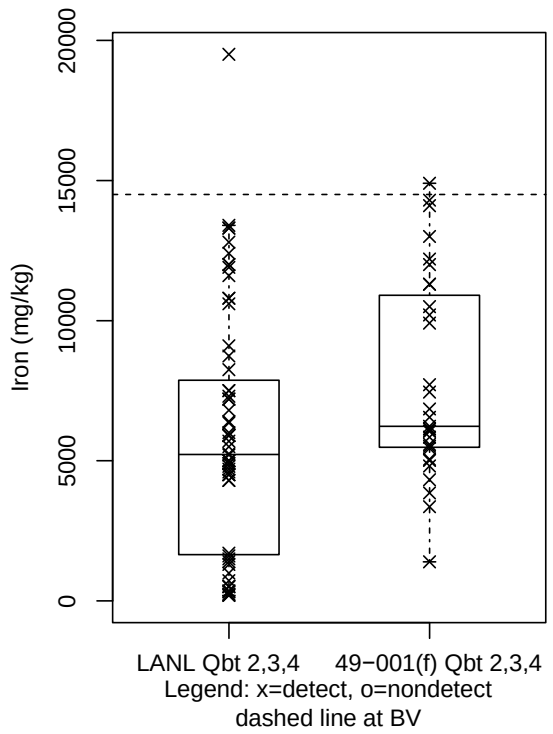

Figure H-85 Box plot for iron in tuff at SWMU 49-001(f)

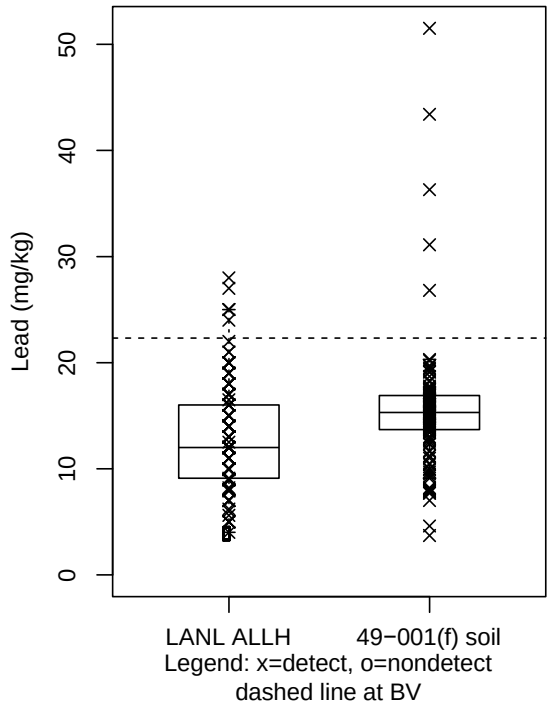

Figure H-86 Box plot for lead in soil at SWMU 49-001(f)

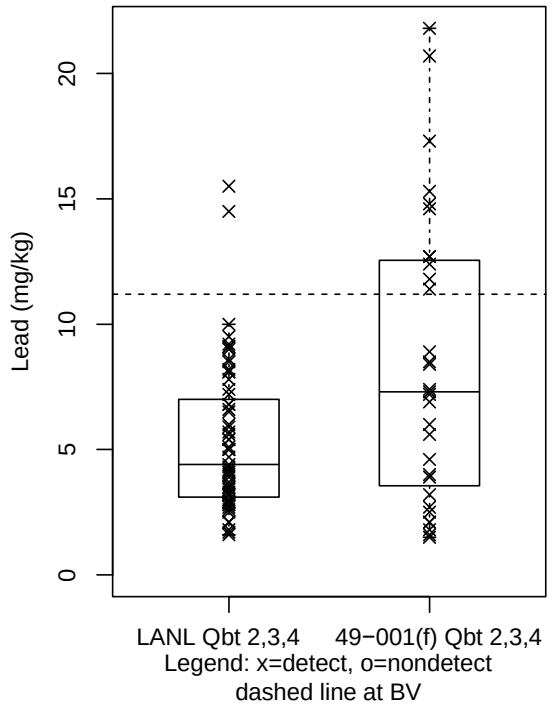

Figure H-87 Box plot for lead in tuff at SWMU 49-001(f)

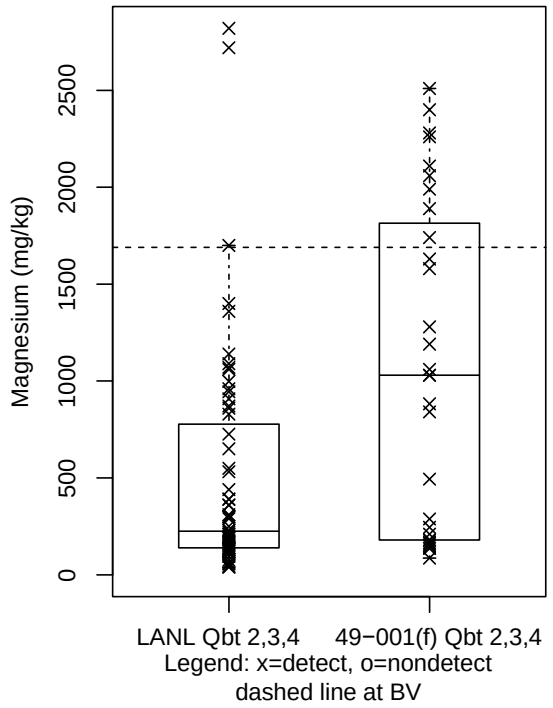

Figure H-88 Box plot for magnesium in tuff at SWMU 49-001(f)

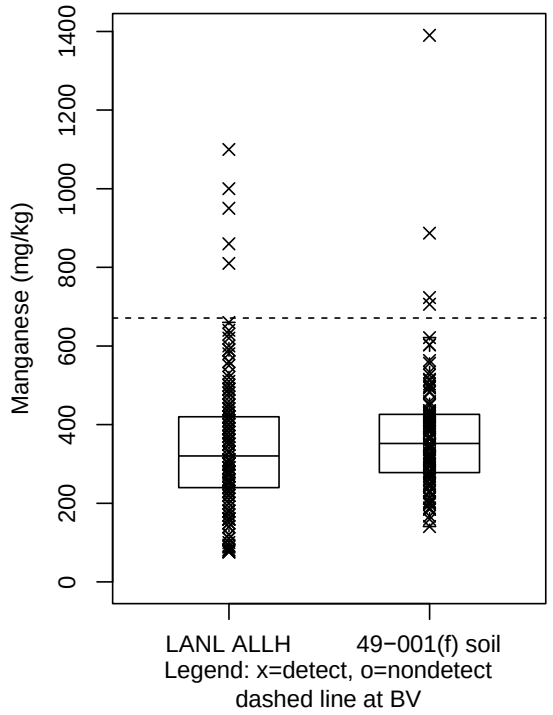

Figure H-89 Box plot for manganese in soil at SWMU 49-001(f)

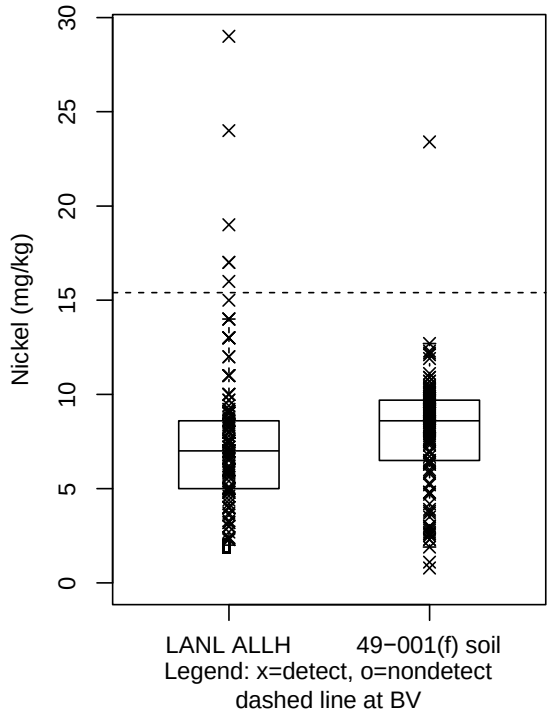

Figure H-90 Box plot for nickel in soil at SWMU 49-001(f)

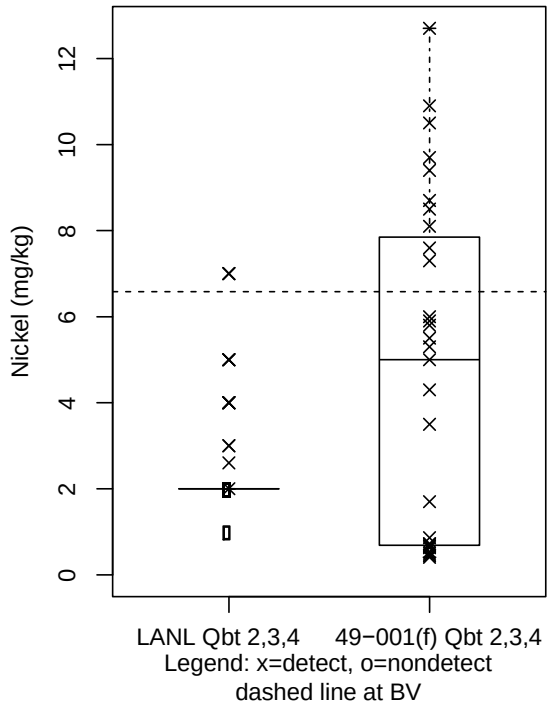

Figure H-91 Box plot for nickel in tuff at SWMU 49-001(f)

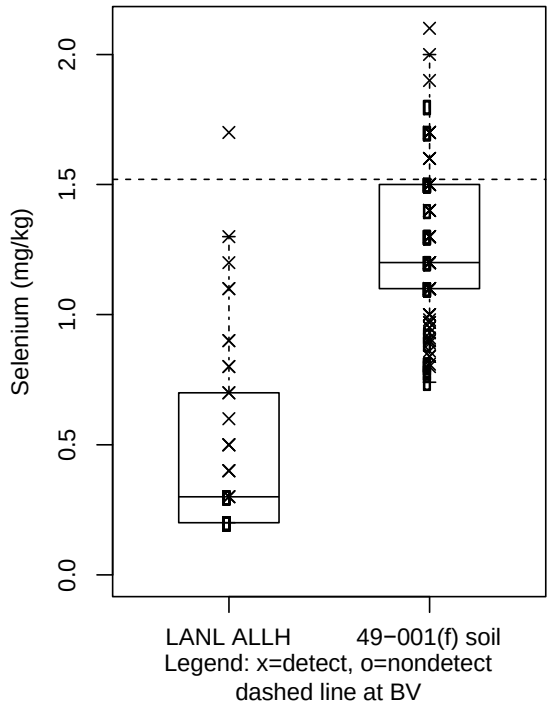

Figure H-92 Box plot for selenium in soil at SWMU 49-001(f)

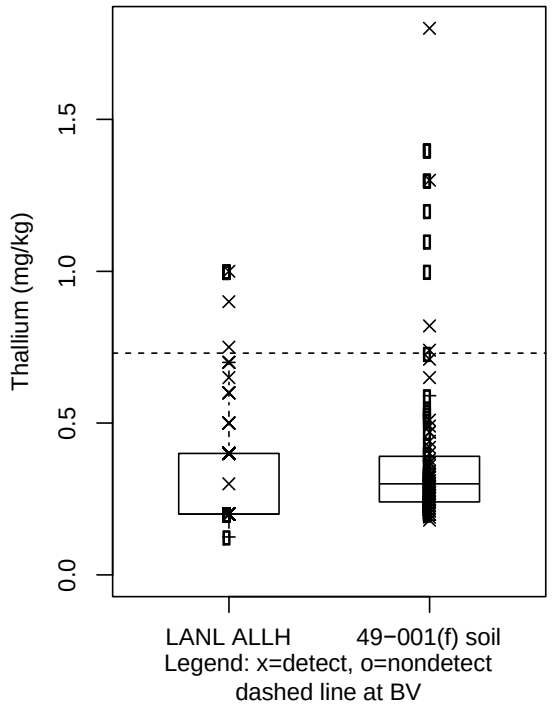

Figure H-93 Box plot for thallium in soil at SWMU 49-001(f)

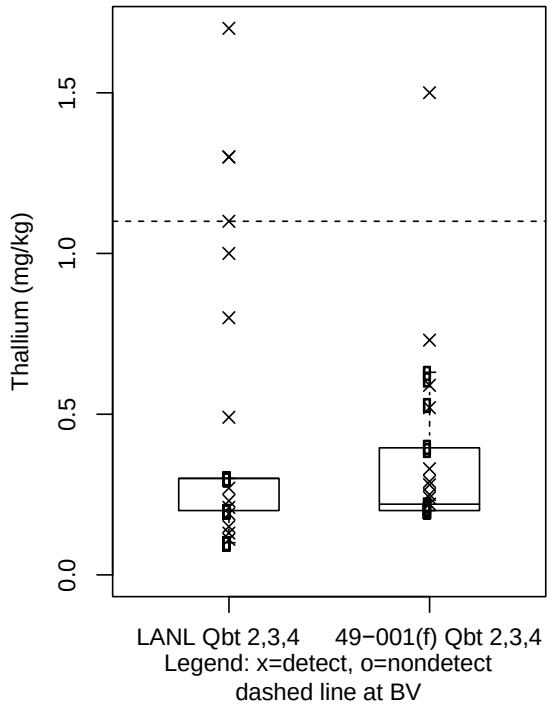

Figure H-94 Box plot for thallium in tuff at SWMU 49-001(f)

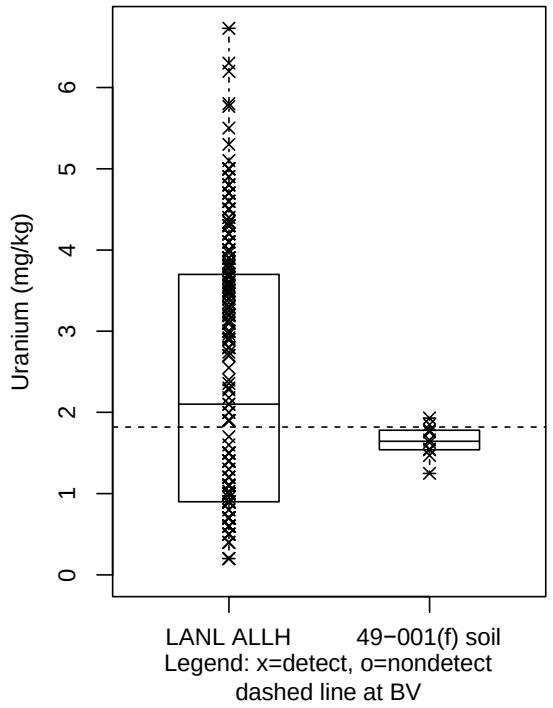

Figure H-95 Box plot for uranium in soil at SWMU 49-001(f)

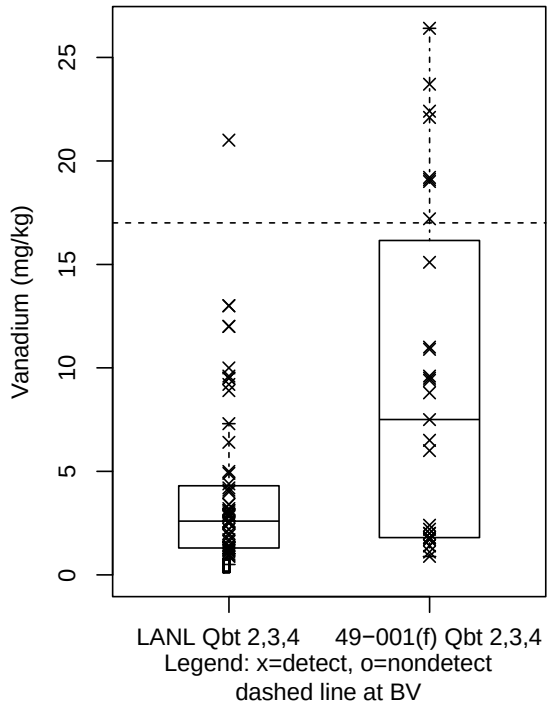

Figure H-96 Box plot for vanadium in tuff at SWMU 49-001(f)

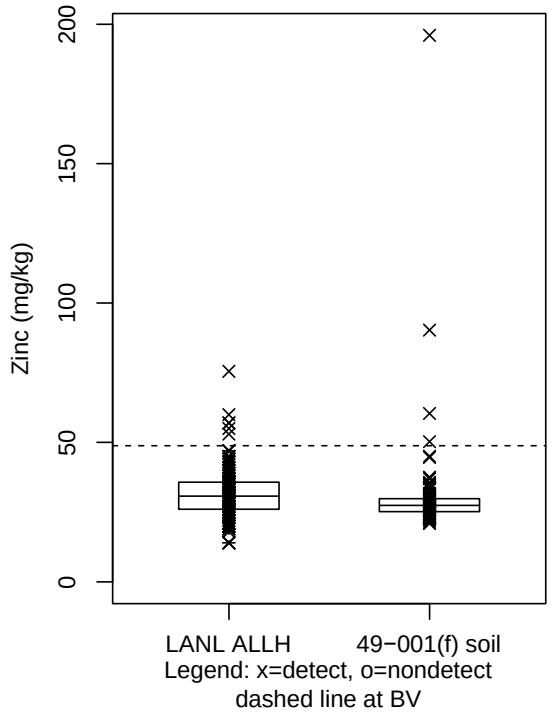

Figure H-97 Box plot for zinc in soil at SWMU 49-001(f)

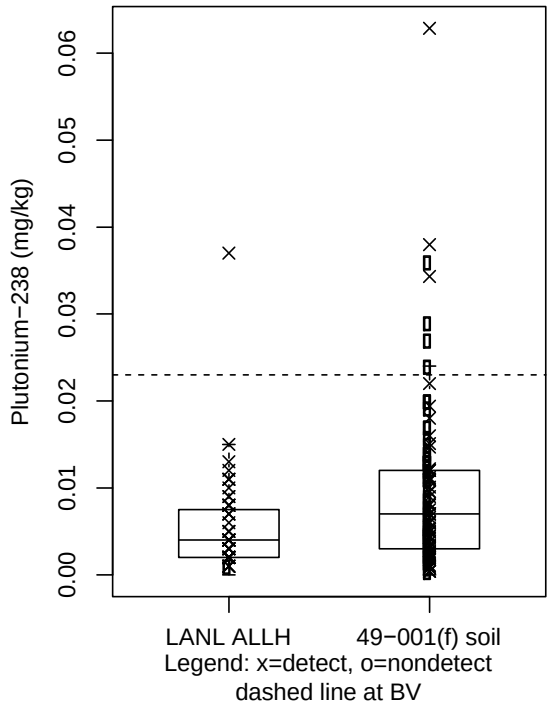

Figure H-98 Box plot for plutonium-238 in soil at SWMU 49-001(f)

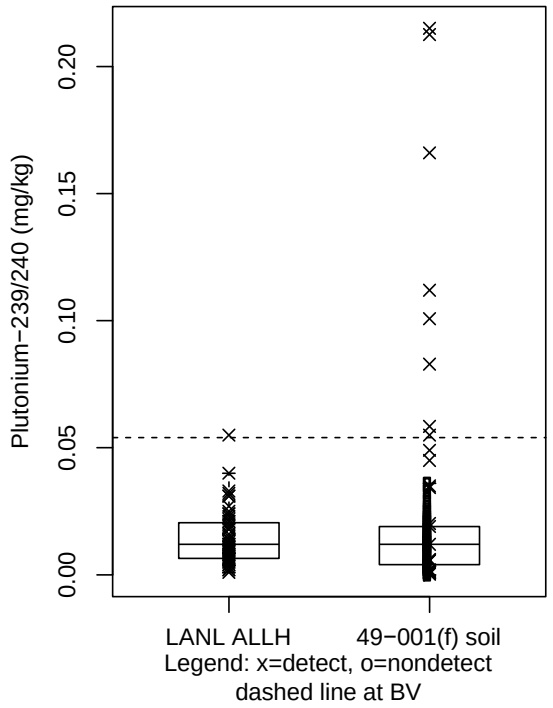

Figure H-99 Box plot for plutonium-239/240 in soil at SWMU 49-001(f)

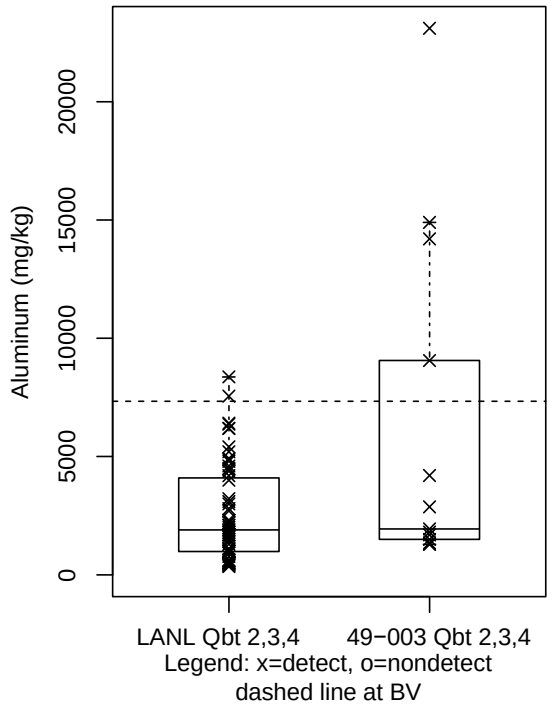

Figure H-100 Box plot for aluminum in tuff at SWMU 49-003

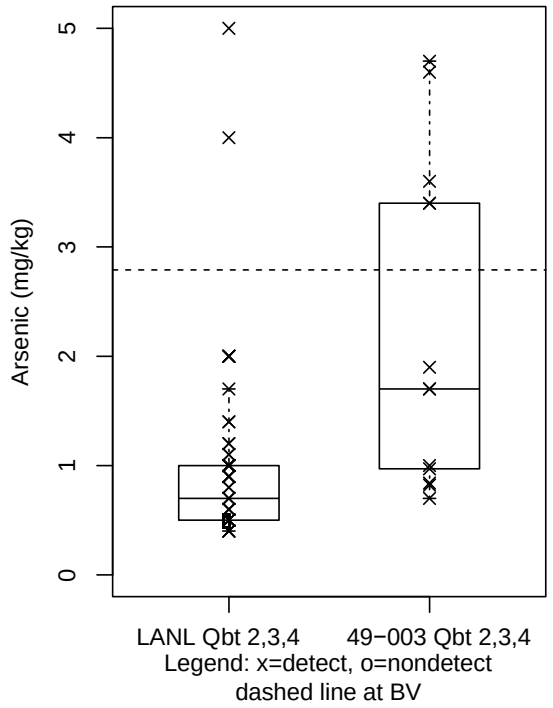

Figure H-101 Box plot for arsenic in tuff at SWMU 49-003

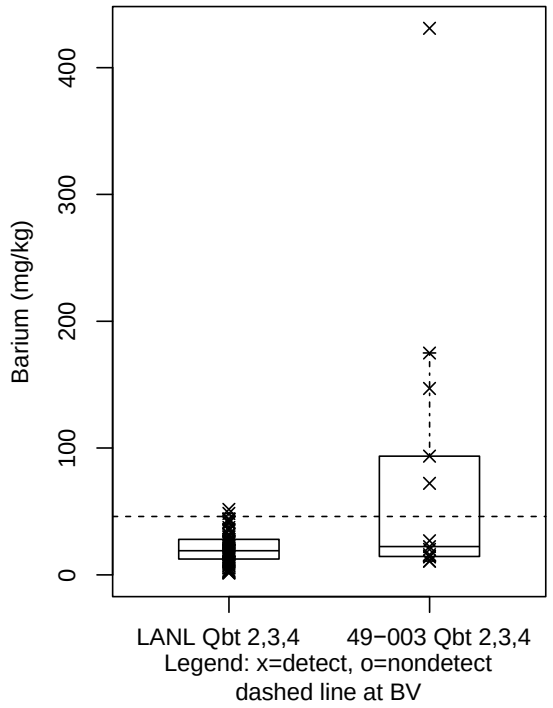

Figure H-102 Box plot for barium in tuff at SWMU 49-003

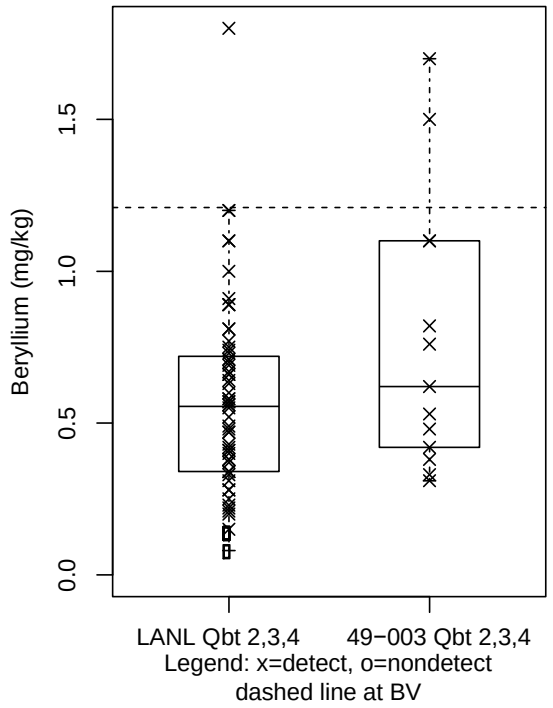

Figure H-103 Box plot for beryllium in tuff at SWMU 49-003

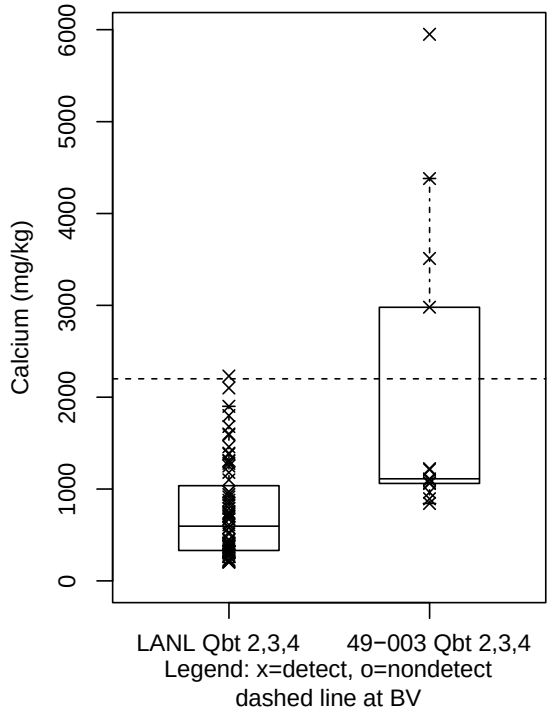

Figure H-104 Box plot for calcium in tuff at SWMU 49-003

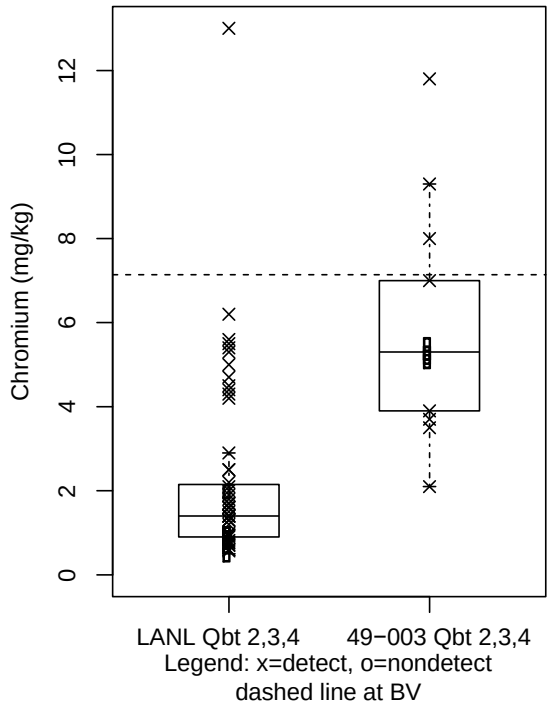

Figure H-105 Box plot for chromium in tuff at SWMU 49-003

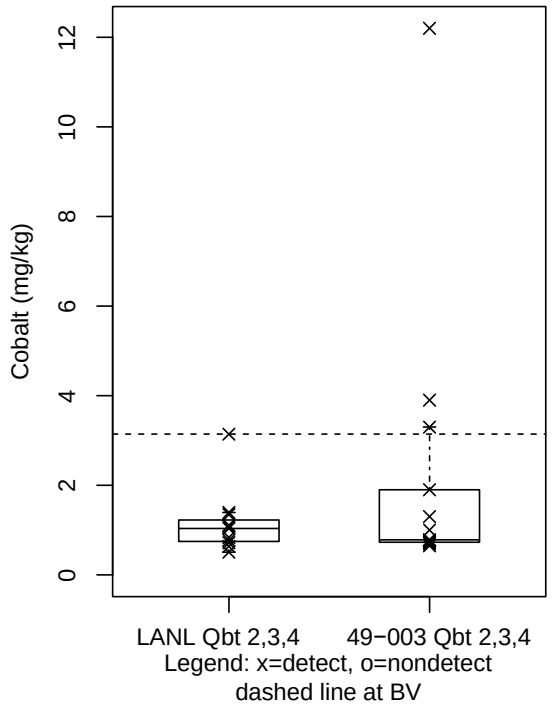

Figure H-106 Box plot for cobalt in tuff at SWMU 49-003

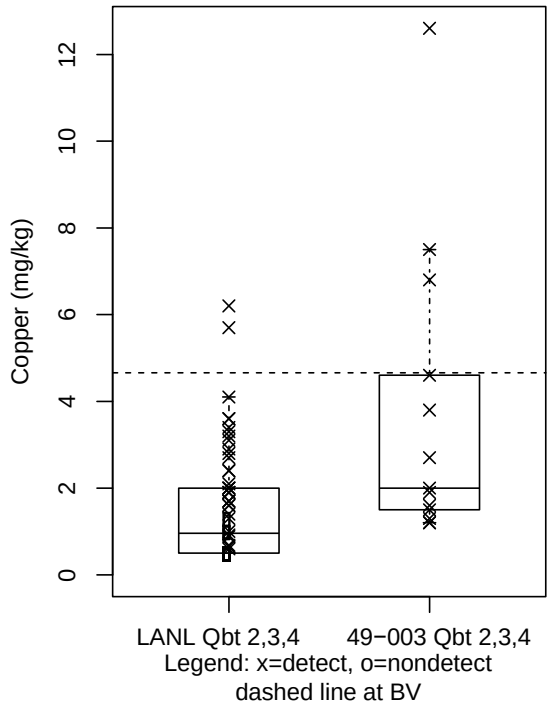

Figure H-107 Box plot for copper in tuff at SWMU 49-003

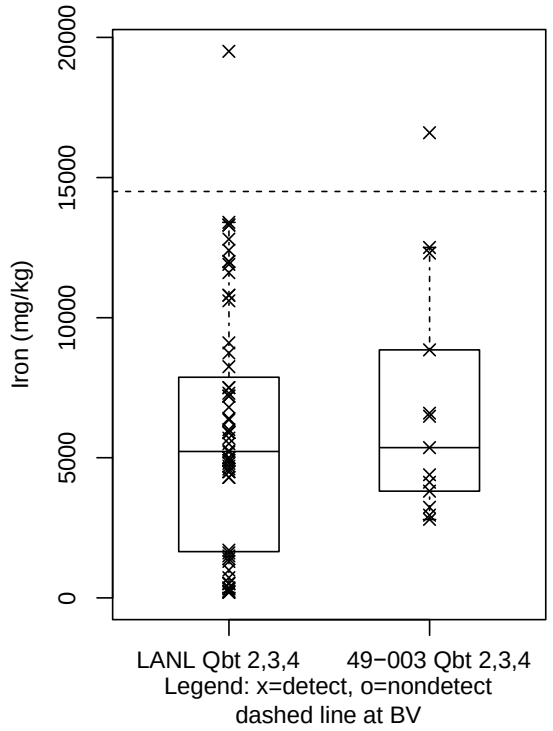

Figure H-108 Box plot for iron in tuff at SWMU 49-003

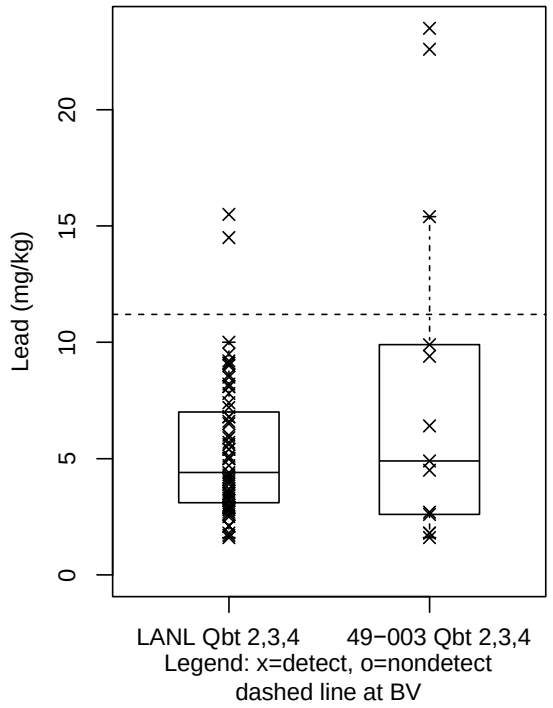

Figure H-109 Box plot for lead in tuff at SWMU 49-003

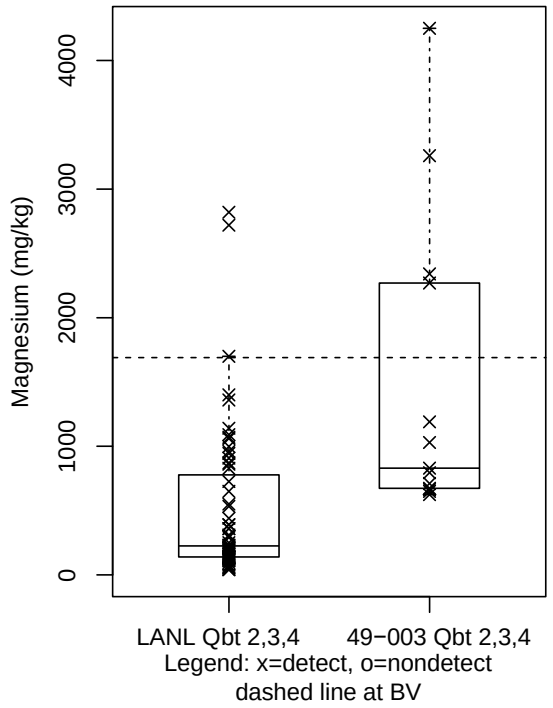

Figure H-110 Box plot for magnesium in tuff at SWMU 49-003

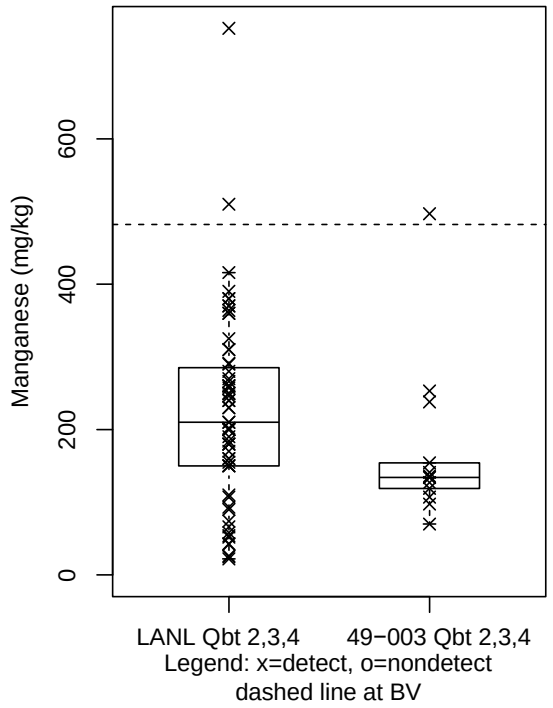

Figure H-111 Box plot for manganese in tuff at SWMU 49-003

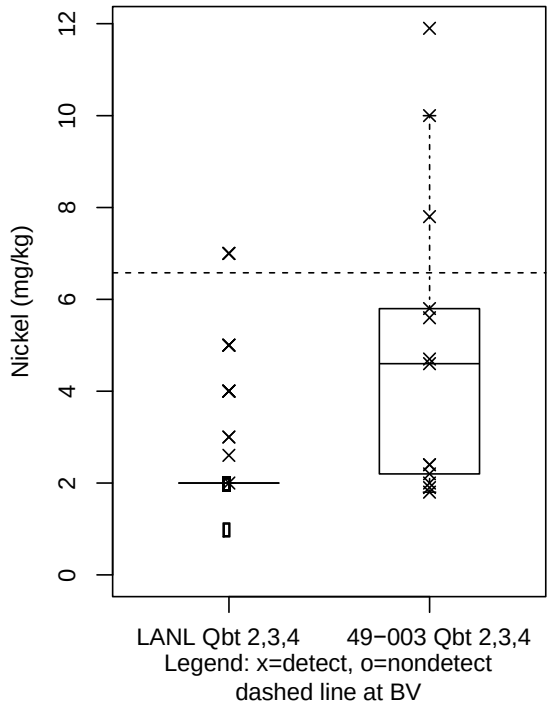

Figure H-112 Box plot for nickel in tuff at SWMU 49-003

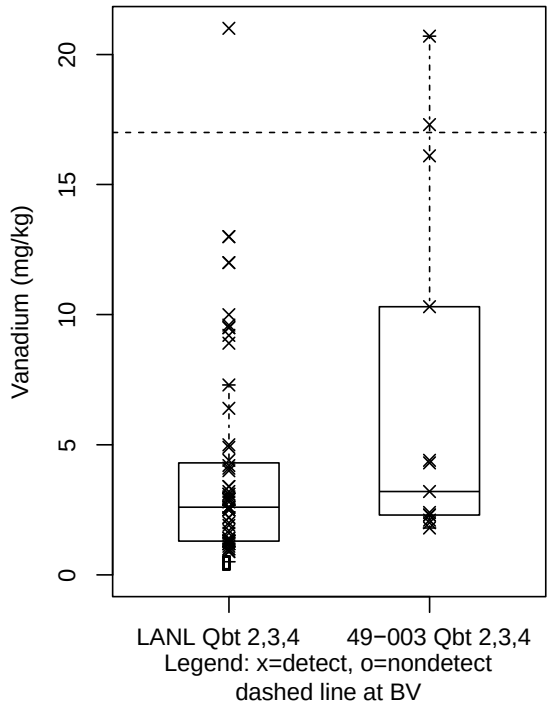

Figure H-113 Box plot for vanadium in tuff at SWMU 49-003

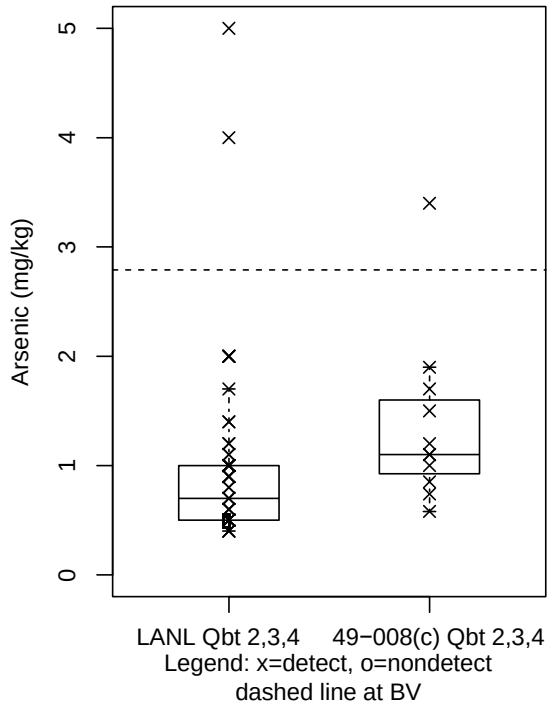

Figure H-114 Box plot for arsenic in tuff at Area of Concern (AOC) 49-008(c)

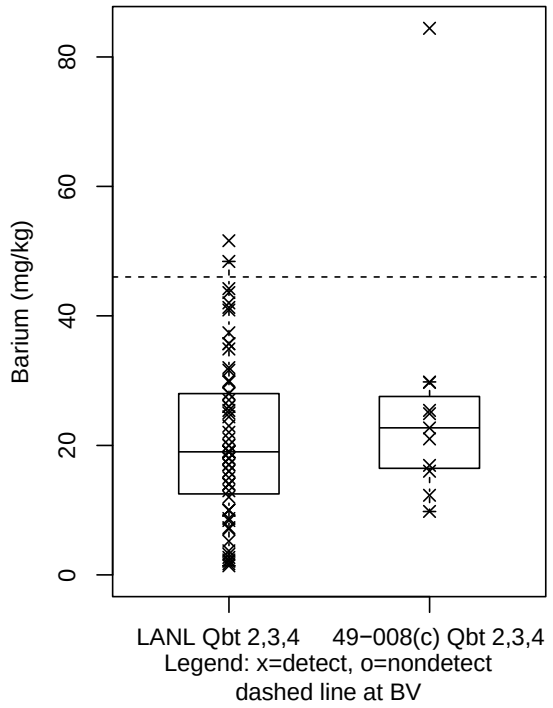

Figure H-115 Box plot for barium in tuff at AOC 49-008(c)

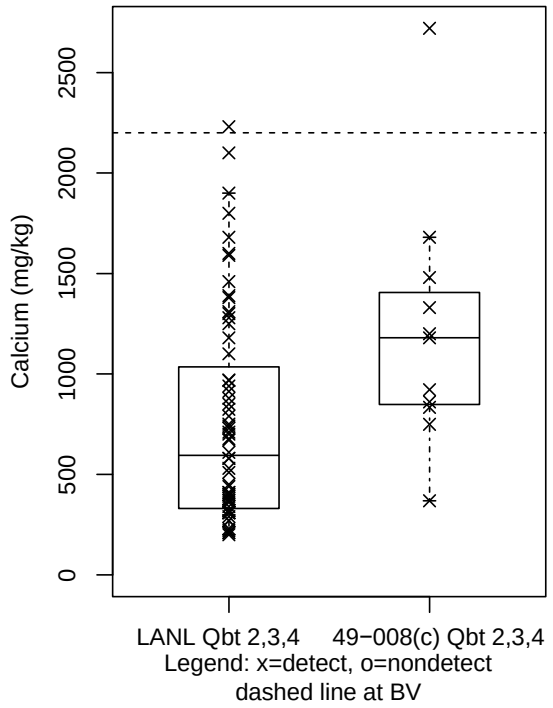

Figure H-116 Box plot for calcium in tuff at AOC 49-008(c)

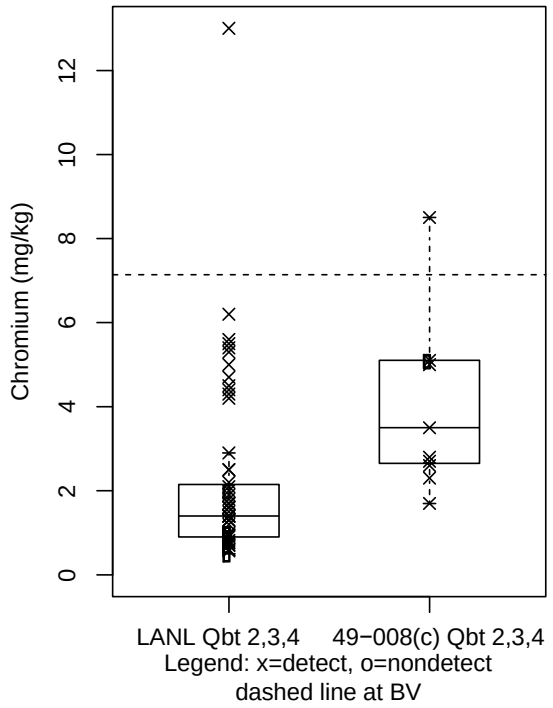

Figure H-117 Box plot for chromium in tuff at AOC 49-008(c)

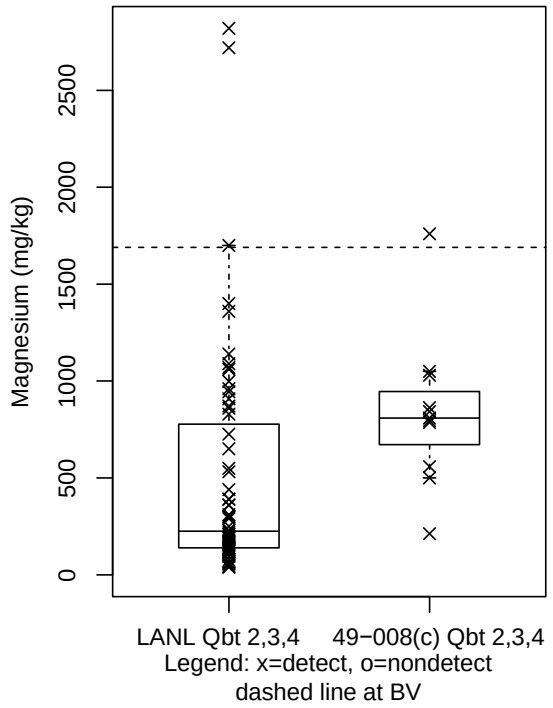

Figure H-118 Box plot for magnesium in tuff at AOC 49-008(c)

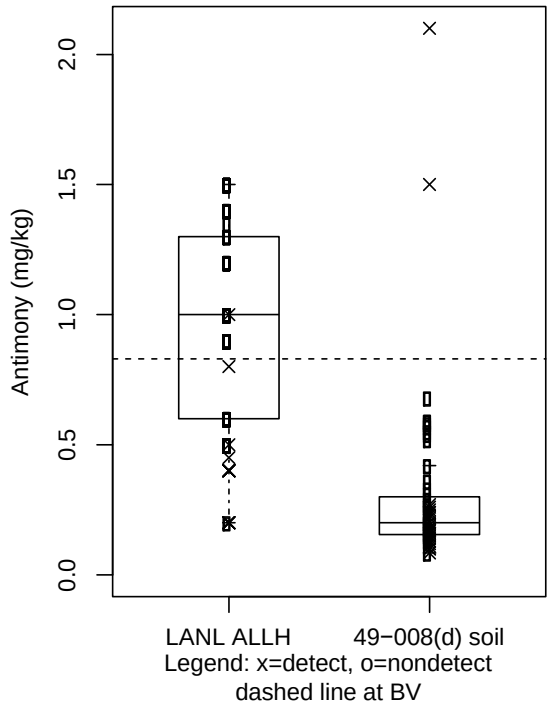

Figure H-119 Box plot for antimony in soil at AOC 49-008(d)

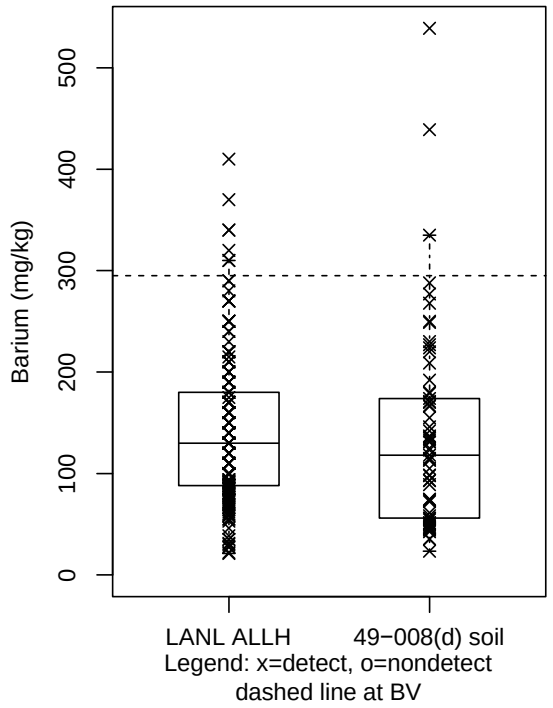

Figure H-120 Box plot for barium in soil at AOC 49-008(d)

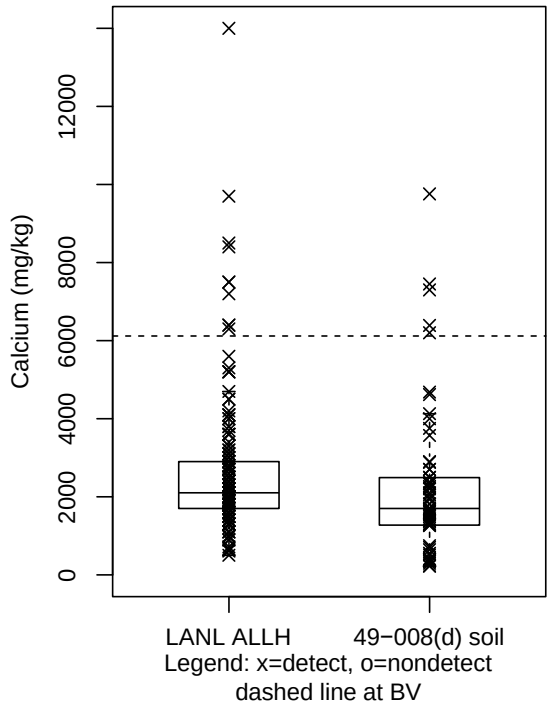

Figure H-121 Box plot for calcium in soil at AOC 49-008(d)

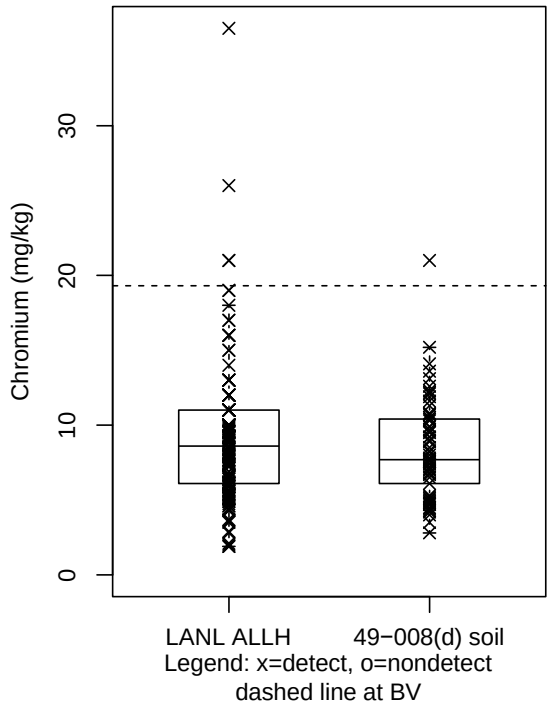

Figure H-122 Box plot for chromium in soil at AOC 49-008(d)

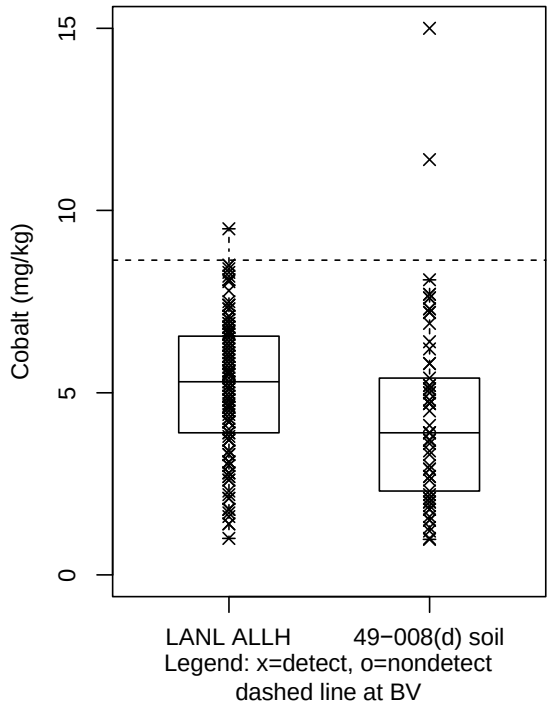

Figure H-123 Box plot for cobalt in soil at AOC 49-008(d)

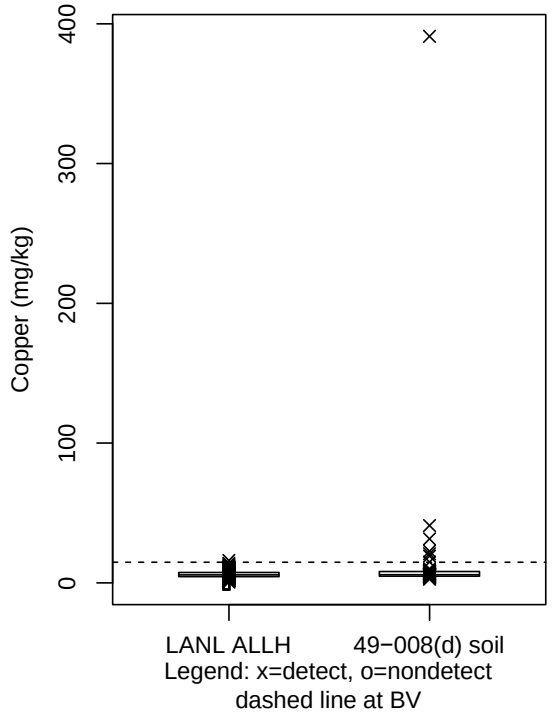

Figure H-124 Box plot for copper in soil at AOC 49-008(d)

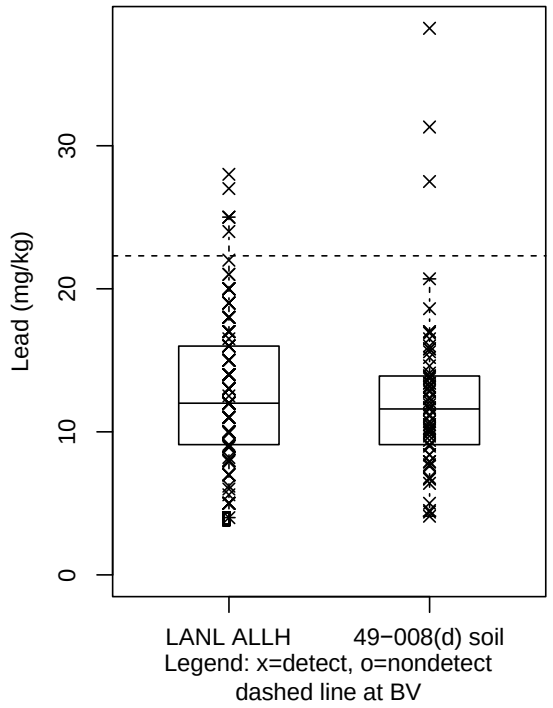

Figure H-125 Box plot for lead in soil at AOC 49-008(d)

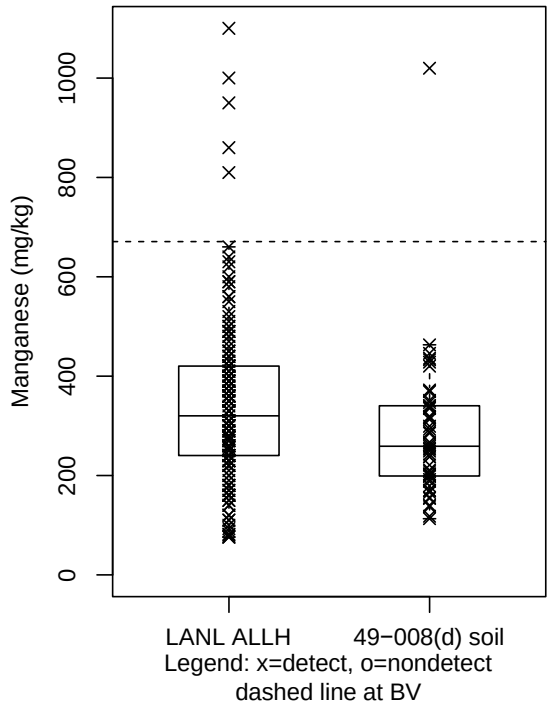

Figure H-126 Box plot for manganese in soil at AOC 49-008(d)

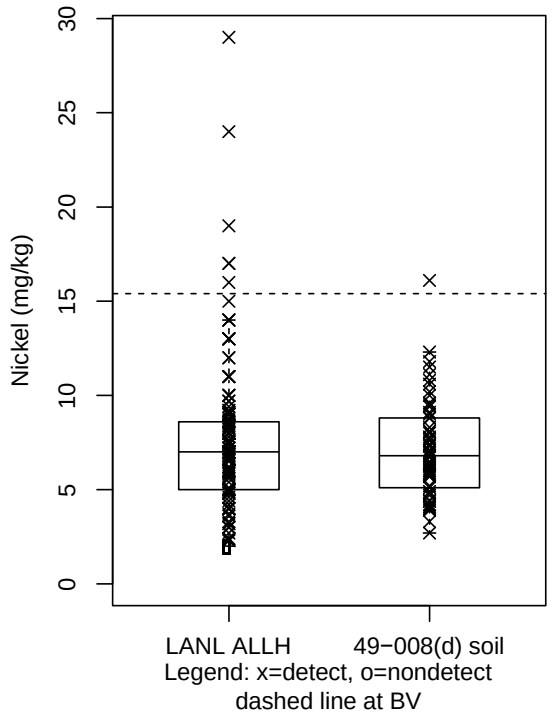

Figure H-127 Box plot for nickel in soil at AOC 49-008(d)

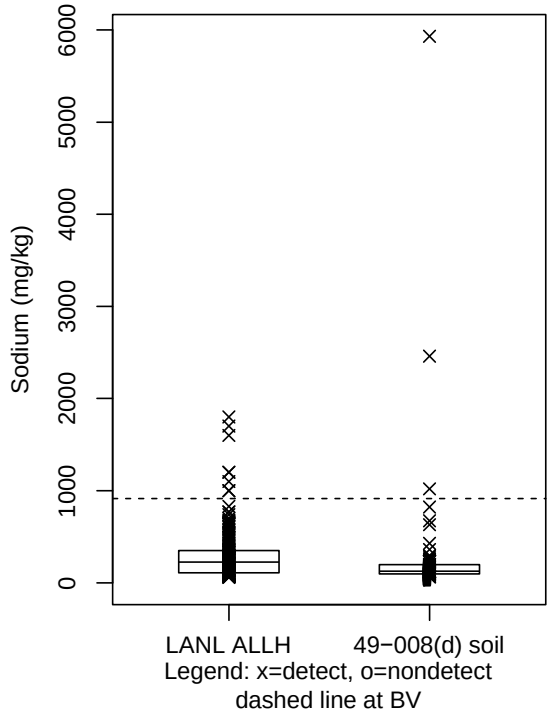

Figure H-128 Box plot for sodium in soil at AOC 49-008(d)

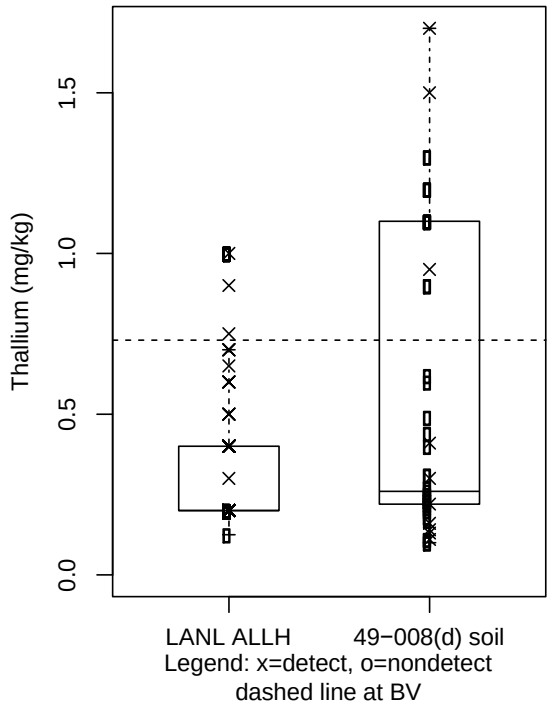

Figure H-129 Box plot for thallium in soil at AOC 49-008(d)

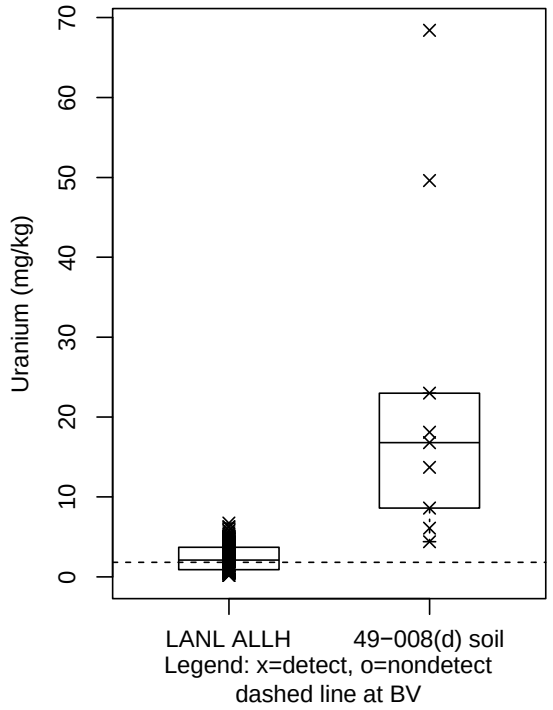

Figure H-130 Box plot for uranium at AOC 49-008(d)

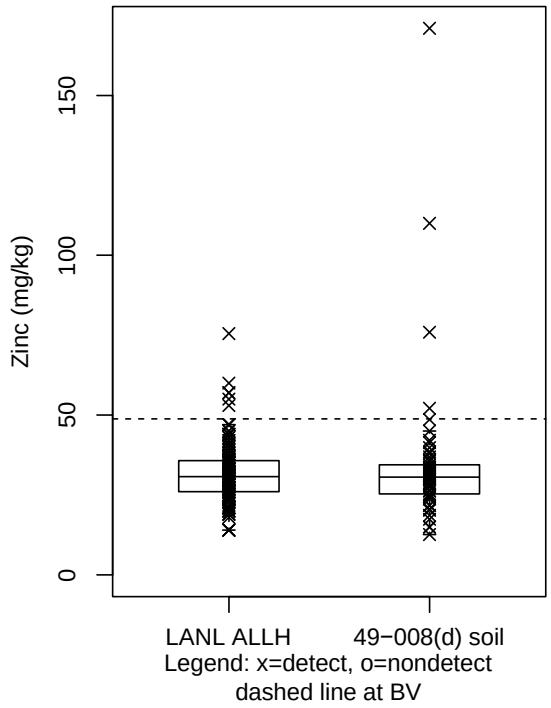

Figure H-131 Box plot for zinc in soil at AOC 49-008(d)

Table H-1
Results for Statistical Tests for Inorganic Chemicals in Tuff at SWMU 49-001(a)

Analyte	Gehan Test p-Value	Quantile Test p-Value	Slippage p-Value	COPC?
Aluminum	0.86	0.047	<0.001	Yes
Arsenic	0.07	0.063	n/a*	No
Barium	0.45	0.012	<0.001	Yes
Beryllium	0.38	0.57	n/a	No
Calcium	0.017	0.044	n/a	Yes
Chromium	0.013	0.14	1	No
Cobalt	0.88	0.28	n/a	No
Copper	<0.001	0.14	0.24	No
Iron	0.35	0.8	n/a	No
Lead	0.18	0.047	0.056	No
Magnesium	0.095	0.044	n/a	No
Nickel	n/a	0.23	0.012	Yes
Vanadium	0.13	0.14	n/a	No

* n/a = Not applicable.

Table H-2
Results for Statistical Tests for Inorganic Chemicals in Soil at SWMU 49-001(a)

Analyte	Gehan Test p-Value	Quantile Test p-Value	Slippage p-Value	COPC?
Barium	0.98	1	n/a*	No
Calcium	1	1	n/a	No
Chromium	<0.001	0.0017	n/a	Yes
Cobalt	<0.001	<0.001	n/a	Yes
Lead	<0.001	0.22	0.46	No
Manganese	0.0037	0.003	n/a	Yes
Nickel	<0.001	0.019	n/a	Yes
Selenium	<0.001	0.0045	n/a	Yes
Sodium	1	0.96	n/a	No
Thallium	n/a	1	1	No
Uranium	0.096	0.6	n/a	No
Vanadium	<0.001	<0.001	n/a	Yes
Zinc	1	1	n/a	No
Plutonium-238	n/a	1	0.72	No
Plutonium-239/240	n/a	1	0.72	No

* n/a = Not applicable.

Table H-3
Results for Statistical Tests for Inorganic Chemicals in Tuff at SWMUs 49-001(b, c, d, g)

Analyte	Gehan Test p-Value	Quantile Test p-Value	Slippage p-Value	COPC?
Arsenic	0.70	0.44	n/a*	No
Barium	0.88	0.75	n/a	No
Lead	0.99	0.75	n/a	No
Manganese	0.98	0.94	n/a	No

* n/a = Not applicable.

Table H-4
Results for Statistical Tests for Inorganic Chemicals in Soil at SWMUs 49-001(b, c, d, g)

Analyte	Gehan Test p-Value	Quantile Test p-Value	Slippage p-Value	COPC?
Calcium	0.81	1	n/a*	No
Cobalt	0.009	<0.001	n/a	Yes
Copper	0.0027	0.42	1	No
Lead	0.11	0.96	n/a	No
Manganese	0.056	0.064	n/a	No
Selenium	<0.001	0.001	n/a	Yes
Thallium	n/a	1	1	No
Vanadium	0.066	0.016	1	No
Zinc	1	1	n/a	No

* n/a = Not applicable.

Table H-5
Results for Statistical Tests for Inorganic Chemicals in Tuff at SWMU 49-001(e)

Analyte	Gehan Test p-Value	Quantile Test p-Value	Slippage p-Value	COPC?
Aluminum	<0.001	<0.001	n/a*	Yes
Antimony	n/a	0.49	1	No
Arsenic	<0.001	<0.001	n/a	Yes
Barium	<0.001	<0.001	n/a	Yes
Beryllium	<0.001	0.0017	n/a	Yes
Calcium	<0.001	<0.001	n/a	Yes
Chromium	<0.001	<0.001	n/a	Yes
Cobalt	0.027	0.064	0.019	Yes
Copper	<0.001	<0.001	n/a	Yes
Iron	<0.001	0.014	n/a	Yes
Lead	<0.001	<0.001	n/a	Yes
Magnesium	<0.001	<0.001	n/a	Yes
Nickel	n/a	<0.001	<0.001	Yes
Thallium	n/a	0.0075	0.41	Yes
Vanadium	<0.001	<0.001	n/a	Yes

* n/a = Not applicable.

Table H-6
Results for Statistical Tests for Inorganic Chemicals in Soil at SWMU 49-001(e)

Analyte	Gehan Test p-Value	Quantile Test p-Value	Slippage p-Value	COPC?
Antimony	n/a*	0.56	1	No
Barium	0.026	0.76	0.42	No
Calcium	0.24	0.65	n/a	No
Cobalt	0.0053	0.015	n/a	Yes
Copper	<0.001	0.079	0.073	No
Iron	<0.001	0.0053	n/a	Yes
Lead	<0.001	0.22	1	No
Manganese	0.0047	0.026	n/a	Yes
Nickel	<0.001	0.023	n/a	Yes
Selenium	<0.001	<0.001	n/a	Yes
Sodium	1	1	n/a	No
Thallium	<0.001	<0.001	n/a	Yes
Uranium	0.029	0.91	1	No
Vanadium	<0.001	<0.001	n/a	Yes
Zinc	0.48	0.15	n/a	No

* n/a = Not applicable.

Table H-7
Results for Statistical Tests for Inorganic Chemicals in Tuff at SWMU 49-001(f)

Analyte	Gehan Test p-Value	Quantile Test p-Value	Slippage p-Value	COPC?
Aluminum	0.17	0.0012	<0.001	Yes
Antimony	n/a*	0.85	0.095	No
Arsenic	<0.001	<0.001	n/a	Yes
Barium	0.0026	<0.001	n/a	Yes
Beryllium	0.28	0.18	n/a	No
Calcium	0.0017	0.0023	n/a	Yes
Chromium	<0.001	<0.001	n/a	Yes
Cobalt	0.39	0.067	n/a	No
Copper	<0.001	0.0011	n/a	Yes
Iron	0.0085	0.18	1	No
Lead	0.016	0.0064	n/a	Yes
Magnesium	0.001	<0.001	n/a	Yes
Nickel	n/a	<0.001	<0.001	Yes
Thallium	n/a	0.038	1	Yes
Vanadium	0.0031	0.0023	n/a	Yes

* n/a = Not applicable.

Table H-8
Results for Statistical Tests for Inorganic Chemicals in Soil at SWMU 49-001(f)

Analyte	Gehan Test p-Value	Quantile Test p-Value	Slippage p-Value	COPC?
Barium	0.032	0.29	0.44	No
Calcium	0.97	1	n/a*	No
Cobalt	0.051	0.037	0.016	Yes
Copper	<0.001	0.074	0.035	Yes
Lead	<0.001	0.25	0.035	Yes
Manganese	0.016	0.67	0.4	No
Nickel	<0.001	0.022	n/a	Yes
Selenium	<0.001	0.0019	n/a	Yes
Thallium	n/a	1	0.18	No
Uranium	0.66	1	n/a	No
Zinc	1	1	n/a	No
Plutonium-238	n/a	0.91	0.5	No
Plutonium-239/240	n/a	1	0.084	No

*n/a = Not applicable.

Table H-9
Results for Statistical Tests for Inorganic Chemicals in Tuff at SWMU 49-003

Analyte	Gehan Test p-Value	Quantile Test p-Value	Slippage p-Value	COPC?
Aluminum	0.062	0.23	n/a*	No
Arsenic	<0.001	<0.001	n/a	Yes
Barium	0.052	0.075	n/a	No
Beryllium	0.076	0.071	n/a	No
Calcium	<0.001	0.22	<0.001	Yes
Chromium	0.0034	0.22	1	No
Cobalt	0.39	0.36	n/a	No
Copper	<0.001	0.071	0.0039	Yes
Iron	0.32	0.49	n/a	No
Lead	0.36	0.075	n/a	No
Magnesium	<0.001	0.016	n/a	Yes
Manganese	0.97	0.95	n/a	No
Nickel	n/a	0.0015	0.0041	Yes
Vanadium	0.046	0.22	1	No

* n/a = Not applicable.

Table H-10
Results for Statistical Tests for Inorganic Chemicals in Tuff at AOC 49-008(d)

Analyte	Gehan Test p-Value	Quantile Test p-Value	Slippage p-Value	COPC?
Arsenic	0.0037	0.12	1	No
Barium	0.24	0.92	n/a*	No
Calcium	0.0058	0.14	0.15	No
Chromium	0.0026	0.38	1	No
Magnesium	0.003	0.38	1	No

* n/a = Not applicable.

Table H-11
Results for Statistical Tests for Inorganic Chemicals in Soil at AOC 49-008(d)

Analyte	Gehan Test p-Value	Quantile Test p-Value	Slippage p-Value	COPC?
Antimony	n/a*	0.0014	0.17	Yes
Barium	0.92	0.62	n/a	No
Calcium	1	0.83	n/a	No
Chromium	0.83	0.53	n/a	No
Cobalt	1	0.74	n/a	No
Copper	0.087	0.089	n/a	No
Lead	0.89	0.98	n/a	No
Manganese	1	0.96	n/a	No
Nickel	0.36	0.49	n/a	No
Sodium	1	0.99	n/a	No
Thallium	n/a	1	0.049	Yes
Uranium	<0.001	<0.001	n/a	Yes
Zinc	0.6	0.81	n/a	Yes

* n/a = Not applicable.

Appendix I

Risk Assessments

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I-1.0 INTRODUCTION

This appendix presents the results of the human health and ecological risk-screening evaluations conducted in support of the environmental characterization of Technical Area 49 (TA-49) sites inside the Nuclear Environmental Site (NES) boundary, located in the southern portion of Los Alamos National Laboratory (LANL or the Laboratory). The evaluations of potential risk at 10 solid waste management units (SWMUs) and areas of concern (AOCs) are based on decision-level data from historical (1995 and 1999) and 2009–2010 investigations.

I-2.0 BACKGROUND

Brief descriptions of TA-49 SWMUs and AOCs inside the NES boundary assessed for potential risk and dose are presented below.

I-2.1 Site Descriptions and Operational History

TA-49, also known as the Frijoles Mesa site, occupies approximately 1280 acres along the south-central boundary of the Laboratory. The mesa is centrally located on the Pajarito Plateau at an average elevation of approximately 7140 ft above mean sea level. The plateau is roughly midway between the Jemez Mountains to the west and the White Rock Canyon of the Rio Grande to the east. TA-49 is located within the Ancho, North Ancho, and Water Canyon watersheds. The northern boundary of TA-49 is defined by the edge of the Frijoles Mesa, which overlooks Water Canyon, and forms the southern boundaries of TA-15 and TA-37. State highway NM 4 forms the southwest boundary of TA-49 as well as the Laboratory's boundary. The southeast boundary of TA-49 is formed by TA-39.

Between 1959 and 1961, hydronuclear and related experiments were conducted at TA-49 that deposited plutonium, uranium, lead, and beryllium in underground shafts. These experiments were conducted in subsurface shafts located at Material Disposal Area (MDA) AB (Areas 2, 2A, and 2B) and Areas 1, 3, and 4. These areas are the subject of the "Investigation Work Plan for the TA-49 Sites Inside the Nuclear Environmental Site Boundary" (LANL 2008, 102691; NMED 2008, 100464). Investigation results for TA 49 sites outside the NES boundary are presented in a separate investigation report (LANL 2010, 110654.16).

Facilities in Areas 5 and 10 were used to support the experiments at the test shaft areas. Uncontaminated materials generated at these facilities were deposited into a landfill in Area 6. Additionally, general site cleanups conducted in 1971 and 1984 resulted in the disposal of uncontaminated structure debris and materials into the Area 6 landfill and the creation of small landfills at Areas 5 and 10 (LANL 1992, 007670, pp. 6-4–6-9).

I-2.1.1 SWMU 49-001(a)

SWMU 49-001(a), known as Area 1, is an area consisting of experimental shafts located in the northwest corner of the TA-49 NES boundary. Area 1 is approximately 100 ft × 100 ft. A total of 22 shafts were drilled at Area 1 to depths ranging from 31 ft to 85 ft below ground surface (bgs). Ten of the 22 shafts were used for shot testing using radioactive materials, 5 of the shafts were used for containment testing using high explosives (HE) only, 6 of the shafts were not used and were backfilled, and 1 shaft was used as a gas-expansion hole. Substantial amounts of lead generally were present in the experimental packages, and small amounts of beryllium may have been used in some experiments (LANL 2007, 098492).

I-2.1.2 SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g)

MDA AB includes Area 2, SWMU 49 001(b); Area 2A, SWMU 49-001(c); Area 2B, SWMU 49-001(d); and SWMU 49-001(g). With the exception of SWMU 49-001(g), all SWMUs are associated with hydronuclear and related experiments conducted at TA-49 from late 1959 to mid-1961. These experiments were conducted in underground shafts (typically 6 ft in diameter) drilled into the tuff at Areas 1, 2, 2A, 2B, 3, and 4 and involved the use of HE and radioactive materials such as special nuclear materials (SNM) (plutonium-239 and uranium-235). SWMU 49-001(g) is a site of contaminated surface soil associated with Area 2 activities (LANL 2007, 098492).

I-2.1.3 SWMU 49-001(e)

SWMU 49-001(e), known as Area 3, is an area consisting of experimental shafts located in the southwest corner of the MDA AB NES boundary. Area 3 is approximately 100 ft × 100 ft. A total of 13 shafts, ranging between 57 ft and 142 ft deep, were drilled in a grid-like pattern. Seven of the shafts were shot with a tracer, four of the shafts were used for containment shots, and the remaining two shafts were not used and backfilled (LANL 2007, 098492). Area 3 was used exclusively to develop confinement and sample-recovery techniques used in the other experimental areas.

I-2.1.4 SWMU 49-001(f)

SWMU 49-001(f), known as Area 4, is an area consisting of experimental shafts located in the southeast corner of the MDA AB NES boundary. Area 4 is approximately 100 ft × 125 ft. Area 4 was designed to contain 26 shafts on a uniform grid, but only 21 were drilled. The 21 shafts drilled at Area 4 ranged between 58 ft and 108 ft deep. Thirteen of the shafts were shot with radioactive material, one shaft was used for containment testing, one shaft was used as a gas expansion hole, three shafts were used for disposal of debris, and the remaining three shafts were not used and backfilled (LANL 2007, 098492).

I-2.1.5 SWMU 49-003

SWMU 49-003 is an inactive leach field and associated drainlines at Area 11 within the northern MDA AB NES boundary at TA-49. The leach field is located approximately 20 ft to 25 ft east of the location of former building 49-15 and was connected to the former building by a drainline. The leach field is believed to be constructed of vitrified clay pipe installed in gravel bedding. Former building 49-15 housed a radiochemistry laboratory and change house. The building 49-15 laboratory was used to analyze samples collected during the experiments conducted in the experimental shafts at Areas 2, 2A, 2B, and 4. The estimated total volume of wastewater discharged to the leach field was less than several hundred gallons and less than 50 gal. of organic chemicals. Former building 49-15 and related structures including latrines, a storage building, and propane and butane tanks in Area 11 were decontaminated, demolished, and removed in 1970 and 1971; the leach field and drainlines were left in place (LANL 1992, 007670, pp. 6 2–6-6; LANL 2007, 098492).

I-2.1.6 AOC 49-008(c)

AOC 49-008(c) consists of an area of potentially contaminated soil from historical radiochemistry operations and small-scale containment experiments at Area 11 within the northern portion of the MDA AB NES boundary at TA-49. Area 11 is approximately 220 ft × 300 ft. Activities conducted at Area 11 from 1959 to 1961 supported hydronuclear experiments conducted elsewhere at TA-49 (LANL 1992, 007670). Radiochemistry operations were conducted in a former laboratory and change house (former building 49-15) that was the main structure at Area 11. Other structures included a small

storage building, latrines, and butane and propane tanks. The former building 49-15 laboratory was used to analyze samples collected during experiments in the experimental shafts at Areas 2, 2A, 2B, and 4. Laboratory processes included sample dissolution in acids (nitric, hydrochloric, hydrofluoric, sulfuric, and perchloric) and solvent extraction using methyl isobutyl ketone, ammonium hydroxide, and sodium hydroxide. Wastes generated during radiochemical operations were typically collected in containers and taken to radioactive waste disposal facilities elsewhere at the Laboratory. Interim waste storage boxes were stored south of former building 49-15. Some liquid wastes reportedly discharged to a leach field (SWMU 49-003). Small-scale containment experiments were conducted in 13 underground shafts located on the west side of Area 11. These shafts were drilled to a depth of 12 ft and lined with 10-in.-diameter steel casing. HE was placed in the shafts, which were backfilled to contain the explosions. Small amounts of irradiated uranium-238 tracer were used in some experiments. The structures in Area 11 were decontaminated and removed in 1970 and 1971. Contamination was detected in sinks, ducts, and hoods in former building 49-15. Contaminated debris was removed and disposed of at TA-54, and uncontaminated debris (approximately 2160 ft^3) was taken to the open-burning/landfill area at Area 6 West (SWMU 49-004) (LANL 2007, 098492).

I-2.1.7 AOC 49-008(d)

AOC 49-008(d) is an area consisting of potential soil contamination located within Area 12 in the northeast corner of the MDA AB NES boundary at TA-49. Area 12 was used in 1960 and 1961 to conduct confinement experiments related to the hydronuclear experiments conducted at MDA AB. These experiments involved HE detonations in sealed metal bottles. The bottles measured up to 5 ft diameter × 16 ft long and were placed in a 10-ft-diameter × 30-ft-deep underground shaft during the experiments. Former building 49-23 constructed over the shaft was known as the Bottle House. Approximately 26 confinement experiments were conducted at Area 12 (LANL 1992, 007670, p. 6.6-3). After the confinement experiments ceased, Area 12 was used to conduct tests to determine the strength of cables used in other experiments. The Cable Pull Test Facility (CPTF), former building 49 121, was constructed approximately 60 ft south of former building 49-23 in the early or mid-1960s to perform these tests (LANL 1992, 007670, p. 3-9). The shaft in former building 49-23 was backfilled with crushed tuff, and a hydraulic system was installed in the building. Underground hydraulic lines were run to former building 49-121. The total fluid capacity of the hydraulic system was estimated to have been less than 10 gal. (LANL 2007, 098492). The Bottle House and CPTF were removed in February 2006 (Beguin 2007, 098607); neither polychlorinated biphenyls (PCBs) nor radioactivity above background levels was detected in any of the waste streams generated during decontamination and decomissioning (D&D) activities (Beguin 2007, 098607). The site is used occasionally to support microwave experiments that involve portable equipment (LANL 2007, 098492).

I-2.2 Investigation Sampling

The final data set used to identify chemicals of potential concern (COPCs) for TA-49 sites inside the NES boundary and used in this appendix to evaluate the potential risks to human health and the environment are the qualified analytical results from historical sampling activities (1995–1998) and the 2009–2010 investigation. Only those data determined to be of decision-level quality following the data quality assessment (Appendix F) are included in the final data set evaluated in this appendix.

I-2.3 Determination of COPCs

Section 5.0 of the supplemental investigation report summarizes the COPC selection process. Only COPCs detected above background (inorganic chemicals and naturally occurring radionuclides), with detection limits greater than background values (BVs) (inorganic chemicals), and detected organic

chemicals, inorganic chemicals with no BVs, and fallout radionuclides were retained. The industrial scenario and the ecological screening used data for samples collected from 0.0 to 1.0 ft and 0.0 to 5.0 ft bgs, respectively. The residential scenario used data for samples collected from 0.0 to 10.0 ft bgs. However, sampling depths often overlapped because of multiple investigations; therefore, samples with a starting depth less than the lower bound of the interval were included in the risk-screening assessments for a given scenario as appropriate.

Tables I-2.3-1 to I-2.3-16 summarize the COPCs evaluated for potential risk for each of the TA-49 sites inside the NES boundary. Some of the COPCs identified in this report may not be evaluated for potential risk under one or more scenarios because they were not within the specified depth intervals associated with a given scenario.

I-3.0 CONCEPTUAL SITE MODEL

The primary mechanisms of release related to historical contaminant sources are described in detail in the historical investigation report (LANL 2007, 098492) and summarized in section 2.0 of the approved investigation work plans (LANL 2008, 102691; LANL 2011, 201570; NMED 2011, 204345). Releases from TA-49 sites inside the NES boundary may have occurred as a result of air emissions, surface releases, subsurface leaks, or effluent discharges. Previous sampling results indicated contamination from inorganic chemicals, organic chemicals, and radionuclides (LANL 2010, 109319).

I-3.1 Receptors and Exposure Pathways

The primary exposure pathway for human receptors is surface soil and subsurface soil/tuff that may be brought to the surface through intrusive activities. Migration of contamination to groundwater through the vadose zone is unlikely given the depth to groundwater (greater than 1000 ft bgs). Human receptors may be exposed through direct contact with soil or suspended particulates by ingestion, inhalation, dermal contact, and external irradiation pathways. Direct contact exposure pathways from subsurface contamination to human receptors are complete for the resident. Migration of contamination to groundwater through the vadose zone is unlikely given the depth to groundwater (greater than 1000 ft bgs) at the site. The exposure pathways are the same as those for surface soil. Sources, exposure pathways, and receptors are shown in the conceptual site model (CSM) (Figure I-3.1-1).

New Mexico Environment Department (NMED) guidance (NMED 2015, 600915) requires that sites larger than 2 acres be evaluated to determine if beef ingestion is a plausible and complete exposure pathway. The TA-49 sites inside the NES boundary are mostly larger than 2 acres; the exception is SWMU 49-003. However, grazing is not allowed on Laboratory property. Therefore, further evaluation of the beef ingestion pathway is not necessary.

The TA-49 sites inside the NES boundary are industrial areas on Laboratory property. Although actively managed for waste isolation, these sites provide potential habitat for ecological receptors. Weathering of tuff is the only viable natural process that may result in the exposure of receptors to COPCs in tuff. However, because of the slow rate of weathering expected for tuff, exposure to COPCs in tuff is negligible, although it is included in the assessments. Exposure pathways to subsurface contamination below 5.0 ft (ecological) or 10.0 ft (human health) are not complete unless contaminated soil or tuff were excavated and brought to the surface.

Considering unpaved sites or areas where potential habitat is present, exposure pathways are complete to surface soil and tuff for ecological receptors. The potential pathways are root uptake by plants, inhalation of vapors (burrowing animals only), inhalation of dust, dermal contact, incidental ingestion of

soil, external irradiation, and food web transport. Pathways from subsurface releases may be complete for plants. Surface water exposure was not evaluated because of the lack of surface water features. Sources, exposure pathways, and receptors are presented in the CSM (Figure I-3.1-1).

I-3.2 Environmental Fate and Transport

The evaluation of environmental fate addresses the chemical processes affecting the persistence of chemicals in the environment and the evaluation of transport addresses the physical processes affecting mobility along a migration pathway. Migration into soil and tuff depends on precipitation or snowmelt, soil moisture content, depth of soil, soil hydraulic properties, and properties of the COPCs. Migration into and through tuff also depends on the unsaturated flow properties of the tuff and the presence of joints and fractures.

The most important factor with respect to the potential for COPCs to migrate to groundwater is the presence of saturated conditions. Downward migration in the vadose zone is also limited by a lack of hydrostatic pressure as well as the lack of a source for the continued release of contamination. Without sufficient moisture and a source, little or no potential migration of materials through the vadose zone to groundwater occurs.

Contamination at depth is addressed in the discussion of nature and extent in the supplemental investigation report. Results from the deepest samples collected at most sites showed either no detected concentrations of COPCs or low- to trace-level concentrations of only a few inorganic, radionuclide, and/or organic COPCs in tuff. The limited extent of contamination is related to the absence of the key factors that facilitate migration, as discussed above. Given how long the contamination has been present in the subsurface, the physical and chemicals properties of the COPCs, and the lack of saturated conditions, the potential for contaminant migration to groundwater is very low.

NMED guidance (NMED 2015, 600915) contains screening levels that consider the potential for contaminants in soil to result in groundwater contamination. These screening levels consider equilibrium partitioning of contaminants among solid, aqueous, and vapor phases and account for dilution and attenuation in groundwater through the use of dilution attenuation factors (DAFs). These DAF soil screening levels (SSLs) may be used to identify chemical concentrations in soil that have the potential to contaminate groundwater (EPA 1996, 059902). Screening contaminant concentrations in soil against these DAF SSLs does not, however, provide an indication of the potential for contaminants to migrate to groundwater. The assumptions used in the development of these DAF SSLs include an assumption of uniform contaminant concentrations from the contaminant source to the water table (i.e., it is assumed that migration to groundwater has already occurred). Furthermore, this assumption is inappropriate for cases such as these TA-49 sites inside the NES boundary where sampling has shown that contamination is vertically bounded near the surface and the distance from the surface to the water table is large. For these reasons, screening of contaminant concentrations in soil against the DAF SSLs was not performed.

The relevant release and transport processes of the COPCs are a function of chemical-specific properties that include the relationship between the physical form of the constituents and the nature of the constituent transport processes in the environment. Specific properties include the degree of saturation and the potential for ion exchange (barium and other inorganic chemicals) or sorption and the potential for natural bioremediation. The transport of volatile organic compounds (VOCs) occurs primarily in the vapor phase by diffusion or advection in subsurface air.

Current potential transport mechanisms that may lead to exposure include

- dissolution and/or particulate transport of surface contaminants during precipitation and runoff events,
- airborne transport of contaminated surface soil,
- continued dissolution and advective/dispersive transport of chemical contaminants contained in subsurface soil and tuff as a result of past operations,
- disturbance of contaminants in shallow soil and subsurface tuff by Laboratory operations, and
- disturbance and uptake of contaminants in shallow soil by plants and animals.

Contaminant distributions at the sites indicate that after the initial deposition of contaminants from operational activities and historical remediation efforts, elevated levels of COPCs tend to remain concentrated in the vicinity of the original release points. The primary potential release and transport mechanisms identified for TA-49 sites inside the NES boundary include direct discharge; precipitation, sorption, and mechanical transport; dissolution and advective transport in water; and volatilization, diffusion, and dispersion. Less significant transport mechanisms include wind entrainment and, given the asphalt pavement covering most sites, dispersal of surface soil and uptake of contaminants from soil and water by biota.

Gas or vapor-phase contaminants such as VOCs are likely to volatilize to the atmosphere from near-surface soil and sediment and/or migrate by diffusion through air-filled pores in the vadose zone. Migration of vapor-phase contaminants from tuff into ambient air may occur by diffusion or advection driven by barometric pressure changes.

I-3.2.1 Inorganic Chemicals

In general, and particularly in a semiarid climate, inorganic chemicals are not highly soluble or mobile in the environment, although there are exceptions. The physical and chemical factors that determine the distribution of inorganic COPCs within the soil and tuff at TA-49 sites inside the NES boundary are the soil-water partition coefficient (K_d) of the inorganic chemicals, the pH of the soil, soil characteristics (such as sand or clay content), and the redox potential (Eh). The interaction of these factors is complex, but the K_d values provide a general assessment of the potential for migration through the subsurface; chemicals with higher K_d values are less likely to be mobile than those with lower ones. Chemicals with K_d values greater than 40 are very unlikely to migrate through soil towards the water table (Kincaid et al. 1998, 093270). Table I-3.2-1 presents the K_d values and water solubility for the inorganic COPCs for TA-49 sites inside the NES boundary. Based on this criterion, the following COPCs have a low potential to mobilize and migrate through soil and the vadose zone: aluminum, antimony, barium, beryllium, cadmium, chromium, cobalt, lead, magnesium, manganese, mercury, nickel, thallium, vanadium, and zinc. The K_d values for arsenic, copper, iron, perchlorate, selenium, silver, and uranium are less than 40 and may indicate a greater potential to mobilize and migrate through soil and the vadose zone beneath the sites.

It is important to note that other factors besides the K_d values (e.g., speciation in soil, oxidation-reduction potential, pH, and soil mineralogy) also play significant roles in the likelihood that inorganic chemicals will migrate. The COPCs with K_d values less than 40 are discussed further below. Information about the fate and transport properties of inorganic chemicals was obtained from individual chemical profiles published by the Agency for Toxic Substances and Disease Registry (ATSDR) (ATSDR 1997, 056531, and http://www.atsdr.cdc.gov/toxpro2).

Arsenic may undergo a variety of reactions, including oxidation-reduction reactions, ligand exchange, precipitation, and biotransformation. Arsenic forms insoluble complexes with iron, aluminum, and magnesium oxides found in soil and in this form, arsenic is relatively immobile. However, under low pH and reducing conditions, arsenic can become soluble and may potentially leach into groundwater or result in runoff of arsenic into surface waters. Arsenic is expected to have low mobility under the environmental conditions (neutral to slightly alkaline soil pH and oxidizing near-surface conditions) present at TA-49 sites inside the NES boundary.

Copper movement in soil is determined by physical and chemical interactions with the soil components. Most copper deposited in soil will be strongly adsorbed and remains in the upper few centimeters of soil. Copper will adsorb to organic matter, carbonate minerals, clay minerals, or hydrous iron, and manganese oxides. In most temperate soil, pH, organic matter, and ionic strength of the soil solutions are the key factors affecting adsorption. Soil in the area is neutral to slightly alkaline, so the leaching of copper is not a concern at this site. Copper binds 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. Copper is expected to be bound to the soil and move in the system by way of transport of soil particles by water as opposed to movement as dissolved species.

Iron is naturally occurring in soil and tuff and may be relatively mobile under reducing conditions. Iron is sensitive to soil pH conditions, occurring in two oxidation states, iron(III), the insoluble oxidized form, and iron(II), the reduced soluble form. Most iron in well-drained neutral-to-alkaline soil is present as precipitates of iron(III) hydroxides and oxides. With time, these precipitates are mineralized and form various iron minerals, such as lepidcrocite, hematite, and goethite. Iron is not expected to be mobile in the neutral to slightly alkaline, well-drained soil at TA-49 sites inside the NES boundary.

Perchlorate is somewhat soluble in water and may migrate with water molecules in saturated soil. As noted above, the subsurface material beneath the sites has low moisture content, which inhibits the mobility of nitrate and perchlorate as well as most other inorganic chemicals.

Selenium is not often found in the environment in its elemental form but is usually combined with sulfide minerals or with silver, copper, lead, and nickel minerals. In soil, pH and Eh are determining factors in the transport and partitioning of selenium. In soil with a pH of greater than 7.5, selenates, which have high solubility and a low tendency to adsorb onto soil particles, are the major selenium species and are very mobile. The soil pH at TA-49 sites inside the NES boundary is neutral to slightly alkaline, indicating that selenium is not likely to migrate.

Uranium is a natural and commonly occurring radioactive element that is present in nearly all rock and soil. The mobility of uranium in soil and its vertical transport to groundwater depend on properties of the soil such as pH, Eh, concentration of complexing anions, porosity of the soil, soil-particle size, and sorption properties as well as the amount of water available. In general, the actinide nuclides form comparatively insoluble compounds in the environment and therefore are not considered biologically mobile. The actinides are transported in ecosystems mainly by physical and sometimes chemical processes. They tend to attach, sometimes strongly, to surfaces; and tend to accumulate in soil and sediment, which ultimately serve as strong reservoirs. Subsequent movement is largely associated with geological processes such as erosion and sometimes leaching.

I-3.2.2 Organic Chemicals

Table I-3.2-2 presents the physical and chemical properties (organic carbon partition coefficient [K_{oc}], logarithm to the base 10 octanol/water partition coefficient [log K_{ow}], and solubility) of the organic COPCs identified for TA-49 sites inside the NES boundary. The physical and chemical properties of organic

chemicals are important when evaluating their fate and transport. The following physiochemical property information illustrates some aspects of the fate and transport of COPCs at TA-49 sites inside the NES boundary. The information is summarized from Ney (1995, 058210).

Water solubility may be 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 (water solubility greater than 1000 mg/L) is prone to biodegradation and metabolism that may detoxify the parent chemical. Several detected at TA-49 sites inside the NES boundary have water solubilities greater than 1000 mg/L, including acetone, benzene, benzyl alcohol, 2-butanone, carbon disulfide, chloromethane, dichlorodifluoromethane, methylene chloride, and nitroglycerin.

The lower the water solubility of a chemical, especially below 10 mg/L, the more likely it will be immobilized by adsorption. Chemicals with lower water solubilities are more likely to accumulate or bioaccumulate and persist in the environment, are slightly prone to biodegradation, and are metabolized in plants and animals. The COPCs identified as having water solubilities less than 10 mg/L are Aroclor-1254; Aroclor-1260; benzo(g,h,i)perylene; benzo(k)fluoranthene; bis(2-ethylhexyl)phthalate; alpha–benzene hexachloride (BHC); alpha-chlordane; gamma-chlordane; and di-n-octylphthalate.

Vapor pressure is a chemical characteristic used to evaluate the tendency of organic chemicals to volatize. Chemicals with vapor pressure greater than 0.01 mm Hg are likely to volatilize and, therefore, concentrations at the site are reduced over time; vapors of these chemicals are more likely to travel toward the atmosphere and not migrate towards groundwater. Acetone; benzene; benzyl alcohol; 2-butanone; carbon disulfide; chlorobenzene; chloromethane; 1,4-dichlorobenzene; dichlorodifluoromethane; ethylbenzene; 4-ethyltoluene; 4-isopropyltoluene; methylene chloride; styrene; toluene; 1,2,4-trimethylbenzene; 1,3,5-trimethylbenzene; total xylenes; 1,2-xylene; and 1,3-xylene+1,4-xylene have vapor pressures greater than 0.01 mm Hg.

Chemicals with vapor pressures less than 0.000001 mm Hg are less likely to volatilize and, therefore, tend to remain immobile. Benzo(g,h,i)perylene, bis(2-ethylhexyl)phthalate, alpha-chlordane, gamma-chlordane, and di-n-octylphthalate, have vapor pressures less than 0.000001 mm Hg.

The K_{ow} is an indicator of a chemical's potential to bioaccumulate or bioconcentrate in the fatty tissues of living organisms. The unitless K_{ow} value is an indicator of water solubility, mobility, sorption, and bioaccumulation. The higher the K_{ow} above 1000, the greater the affinity the chemical has for bioaccumulation/bioconcentration in the food chain, the greater the potential for sorption in the soil, and the lower the mobility (Ney 1995, 058210). Aroclor-1254; Aroclor-1260; benzo(g,h,i)perylene; alpha-chlordane; gamma-chlordane; and bis(2-ethylhexyl)phthalate have a K_{ow} greater than 1000. A K_{ow} of less than 500 indicates high water solubility, mobility, little to no affinity for bioaccumulation, and degradability by microbes, plants, and animals. Acetone; benzene; benzyl alcohol; alpha-BHC; 2-butanone; carbon disulfide; chlorobenzene; chloromethane; 1,4-dichlorobenzene; dichlorodifluoromethane; nitroglycerin; ethylbenzene; 4-ethyltoluene; 4-isopropyltoluene; methylene chloride; nitroglycerin; 3-nitrotoluene; styrene; toluene; 1,2,4-trimethylbenzene; 1,3,5-trimethylbenzene; total xylenes; 1,2-xylene; and 1,3-xylene+1,4-xylene all have a K_{ow} much less than 500.

The K_{oc} measures the tendency of a chemical to adsorb to organic carbon in soil. K_{oc} values above 500 cm^3/g indicate a strong tendency to adsorb to soil, leading to low mobility (NMED 2015, 600915). Most organic COPCs have K_{oc} values above 500 cm^3/g, indicating a very low potential to migrate toward groundwater. The organic COPCs with K_{oc} values less than 500 cm^3/g include acetone; benzene; benzyl alcohol; 2-butanone; carbon disulfide; chlorobenzene; chloromethane; 1,4-dichlorobenzene; dichlorodifluoromethane; methylene chloride; nitroglycerin; and toluene.

Aroclor-1254; Aroclor-1260; benzo(g,h,i)perylene; and bis(2-ethylhexyl)phthalate are the least mobile and the most likely to bioaccumulate. Acetone, benzene, carbon disulfide, methylene chloride, and toluene are more soluble and volatile and are more likely to travel toward the atmosphere and not migrate toward groundwater. Because the organic COPCs were detected at low concentrations and extent is defined, they are not likely to migrate to groundwater.

I-3.2.3 Radionuclides

Radionuclides are generally not highly soluble or mobile in the environment, particularly in the semiarid climate of the Laboratory. The physical and chemical factors that determine the distribution of radionuclides within soil and tuff are the K_d, the pH of the soil and other soil characteristics (e.g., sand or clay content), and the Eh. The interaction of these factors is complex, but K_d values provide a general assessment of the potential for migration through the subsurface: chemicals with higher K_d values are less likely to be mobile than those with lower values. Radionuclides with K_d values greater than 40 are very unlikely to migrate through soil towards the water table (Kincaid et al. 1998, 093270).

Table I-3.2-3 gives physical and chemical properties of the radionuclide COPCs identified at TA-49 sites inside the NES boundary. Based on K_d values, americium-241, cesium-134, cesium-137, plutonium-238, and plutonium-239 have a very low potential to migrate towards groundwater at the TA-49 sites inside the NES boundary. The K_d values for tritium, uranium-234, uranium-235/236, and uranium-238 are less than 40 and indicate a potential to migrate towards groundwater.

Uranium is a natural and commonly occurring radioactive element that is present in nearly all rock and soil. The mobility of uranium in soil and its vertical transport to groundwater depend on properties of the soil such as pH, Eh, concentration of complexing anions, porosity of the soil, soil-particle size, and sorption properties as well as the amount of water available. In general, the actinide nuclides form comparatively insoluble compounds in the environment and therefore are not considered biologically mobile. The actinides are transported in ecosystems mainly by physical and sometimes chemical processes. They tend to attach, sometimes strongly, to surfaces and tend to accumulate in soil and sediment, which ultimately serve as strong reservoirs. Subsequent movement is largely associated with geological processes such as erosion and sometimes leaching.

Tritium's initial behavior in the environment is determined by the source. If it is released as a gas or vapor to the atmosphere, substantial dispersion can be expected, and the rapidity of deposition is dependent on climatic factors. If tritium is released in liquid form, it is diluted in surface water and is subject to physical dispersion, percolation, and evaporation (Whicker and Schultz 1982, 058209, p. 147). Tritium activities in the subsurface at the area of elevated radioactivity are low (generally <1 pCi/g), indicating the area of elevated radioactivity is not a significant source of tritium, although this radionuclide is relatively mobile. Because tritium migrates in association with moisture, the low moisture content of the subsurface limits the potential for tritium to migrate to groundwater.

I-3.3 Exposure Point Concentration Calculations

The exposure point concentrations (EPCs) represent upper bound concentrations of COPCs. For comparison to risk-screening levels, the upper confidence limit (UCL) of the arithmetic mean was calculated when possible and used as the EPC. The UCLs were calculated using all available decision-level data within the depth range of interest. If an appropriate UCL of the mean could not be calculated or if the UCL exceeded the maximum concentration, the maximum detected concentration of the COPC was used as the EPC (maximum detection limits were used as the EPCs for some inorganic COPCs). The summary statistics, including the EPC for each COPC for the human health and the ecological risk-

screening assessments and the distribution used for the calculation, are presented in Tables I-2.3-1 to I-2.3-16.

Calculation of UCLs of the mean concentrations was done using the U.S. Environmental Protection Agency (EPA) ProUCL 5.0.00 software (EPA 2013, 251074), which is based on EPA guidance (EPA 2002, 085640). The ProUCL program calculates 95%, 97.5%, and 99% UCLs and recommends a distribution and UCL. The 95% UCL for the recommended calculation method was used as the EPC. The ProUCL software performs distributional tests on the data set for each COPC and calculates the most appropriate UCL based on the distribution of the data set. Environmental data may have a normal, lognormal, or gamma distribution but are often nonparametric (no definable shape to the distribution). The ProUCL documentation strongly recommends against using the maximum detected concentration for the EPC. The maximum detected concentration was used to represent the EPC for COPCs only when the detections were too few to calculate a UCL. Input and output data files for ProUCL calculations are provided on CD as Attachment I-1.

I-4.0 HUMAN HEALTH RISK-SCREENING EVALUATIONS

The human health risk-screening assessments were conducted for TA-49 sites inside the NES boundary. All sites were screened for the residential scenario using data from 0.0 to 10.0 ft bgs. Sites were also screened for the industrial scenario using data from 0.0 to 1.0 ft bgs, where available. The human health risk-screening assessments compared either the 95% UCL of the mean concentration, the maximum detected concentration, or the maximum detection limit of each COPC with SSLs for chemicals and screening action levels (SALs) for radionuclides.

I-4.1 Human Health SSLs and SALs

Human health risk-screening assessments were conducted using SSLs for the industrial and residential scenarios obtained from NMED guidance (NMED 2015, 600915). The NMED SSLs are based on a target hazard quotient (HQ) of 1 and a target cancer risk of 1×10^{-5} (NMED 2015, 600915). If SSLs were not available from NMED guidance, the May 2016 EPA regional screening tables (http://www.epa.gov/risk/risk-based-screening-table-generic-tables) were used. The EPA regional screening levels for carcinogens were multiplied by 10 to adjust from a 10^{-6} cancer risk level to the NMED target cancer risk level of 10^{-5}. Surrogate chemicals were also used for some COPCs without an SSL based on structural similarity or because the COPC is a breakdown product (NMED 2003, 081172). Exposure parameters used to calculate the industrial and residential SSLs are presented in Table I-4.1-1.

Radionuclide SALs were used for comparison with radionuclide COPC EPCs and were derived using the RESRAD model, Version 7.0 (LANL 2015, 600929). The SALs are based on a 25-mrem/yr dose as authorized by U.S. Department of Energy (DOE) Order 458.1. Exposure parameters used to calculate the SALs are presented in Tables I-4.1-2 and I-4.1-3.

I-4.2 Results of Human Health Screening Evaluation

The EPC of each COPC was compared with the SSLs for the industrial and residential scenarios, as appropriate. For carcinogenic chemicals, the EPCs were divided by the SSL and multiplied by 1×10^{-5}. The sum of the carcinogenic risks was compared with the NMED target cancer risk level of 1×10^{-5}. For noncarcinogenic chemicals, a HQ was generated for each COPC by dividing the EPC by the SSL. The HQs were summed to generate a hazard index (HI). The HI was compared with the NMED target HI of 1. The radionuclide EPCs were divided by the SAL and multiplied by 25 mrem/yr. The total doses were

compared with the DOE target level of 25 mrem/yr, as authorized by DOE Order 458.1. The results are presented in Tables I-4.2-1 to I-4.2-40 and are described below for each SWMU and AOC evaluated.

I-4.2.1 SWMU 49-001(a)

The results of the risk-screening assessment for the industrial scenario are presented in Tables I-4.2-1, I-4.2-2, and I-4.2-3. The total excess cancer risk for the industrial scenario is 2×10^{-7}, which is less than the NMED target risk level of 1×10^{-5} (NMED 2015, 600915). The industrial HI is 0.04, which is less than the NMED target HI of 1 (NMED 2015, 600915). The total dose is 0.9 mrem/yr, which is less than the target dose of 25 mrem/yr as authorized by DOE Order 458.1.

The results of the risk-screening assessment for the residential scenario are presented in Tables I-4.2-4, I-4.2-5, and I-4.2-6. The total excess cancer risk for the residential scenario is 1×10^{-6}, which is less than the NMED target risk level of 1×10^{-5} (NMED 2015, 600915). The residential HI is 0.6, which is less than the NMED target HI of 1 (NMED 2015, 600915). The total dose is 3 mrem/yr, which is less than the target dose of 25 mrem/yr as authorized by DOE Order 458.1.

I-4.2.2 SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g)

The results of the risk-screening assessment for the industrial scenario are presented in Tables I-4.2-7 and I-4.2-8. No carcinogenic COPCs were identified in the 0.0 to1.0-ft depth interval. The industrial HI is 0.02, which is less than the NMED target HI of 1 (NMED 2015, 600915). The total dose is 0.1 mrem/yr, which is less than the target dose of 25 mrem/yr as authorized by DOE Order 458.1.

The results of the risk-screening assessment for the residential scenario are presented in Tables I-4.2-9, I-4.2-10, and I-4.2-11. The total excess cancer risk for the residential scenario is 2×10^{-9}, which is less than the NMED target risk level of 1×10^{-5} (NMED 2015, 600915). The residential HI is 0.3, which is less than the NMED target HI of 1 (NMED 2015, 600915). The total dose is 2 mrem/yr, which is less than the target dose of 25 mrem/yr as authorized by DOE Order 458.1.

I-4.2.3 SWMU 49-001(e)

The results of the risk-screening assessment for the industrial scenario are presented in Tables I-4.2-12, I-4.2-13, and I-4.2-14. The total excess cancer risk for the industrial scenario is 2×10^{-6}, which is less than the NMED target risk level of 1×10^{-5} (NMED 2015, 600915). The industrial HI is 0.1, which is less than the NMED target HI of 1 (NMED 2015, 600915). The total dose is 0.2 mrem/yr, which is less than the target dose of 25 mrem/yr as authorized by DOE Order 458.1.

The results of the risk-screening assessment for the residential scenario are presented in Tables I-4.2-15, I-4.2-16, and I-4.2-17. The total excess cancer risk for the residential scenario is 1×10^{-5}, which is equivalent to the NMED target risk level of 1×10^{-5} (NMED 2015, 600915). The residential HI is 2, which is above the NMED target HI of 1 (NMED 2015, 600915). The total dose is 0.5 mrem/yr, which is less than the target dose of 25 mrem/yr as authorized by DOE Order 458.1.

I-4.2.4 SWMU 49-001(f)

The results of the risk-screening assessment for the industrial scenario are presented in Tables I-4.2-18, I-4.2-19, and I-4.2-20. The total excess cancer risk for the industrial scenario is 2×10^{-6}, which is less than the NMED target risk level of 1×10^{-5} (NMED 2015, 600915). The industrial HI is 0.08, which is less

than the NMED target HI of 1 (NMED 2015, 600915). The total dose is 0.1 mrem/yr, which is less than the target dose of 25 mrem/yr as authorized by DOE Order 458.1.

The results of the risk-screening assessment for the residential scenario are presented in Tables I-4.2-21, I-4.2-22, and I-4.2-23. The total excess cancer risk for the residential scenario is 8×10^{-6}, which is less than the NMED target risk level of 1×10^{-5} (NMED 2015, 600915). The residential HI is 0.9, which is less than the NMED target HI of 1 (NMED 2015, 600915). The total dose is 0.6 mrem/yr, which is less than the target dose of 25 mrem/yr as authorized by DOE Order 458.1.

I-4.2.5 SWMU 49-003

The results of the risk-screening assessment for the industrial scenario are presented in Tables I-4.2-24 and I-4.2-25. No carcinogenic COPCs were identified in the 0.0 to1.0-ft depth interval. The industrial HI is 0.003, which is less than the NMED target HI of 1 (NMED 2015, 600915). The total dose is 0.1 mrem/yr, which is less than the target dose of 25 mrem/yr as authorized by DOE Order 458.1.

The results of the risk-screening assessment for the residential scenario are presented in Tables I-4.2-26, I-4.2-27, and I-4.2-28. The total excess cancer risk for the residential scenario is 9×10^{-6}, which is less than the NMED target risk level of 1×10^{-5} (NMED 2015, 600915). The residential HI is 0.05, which is less than the NMED target HI of 1 (NMED 2015, 600915). The total dose is 0.8 mrem/yr, which is less than the target dose of 25 mrem/yr as authorized by DOE Order 458.1.

I-4.2.6 AOC 49-008(c)

The results of the risk-screening assessment for the industrial scenario are presented in Tables I-4.2-29, I-4.2-30, and I-4.2-31. The total excess cancer risk for the industrial scenario is 3×10^{-10}, which is less than the NMED target risk level of 1×10^{-5} (NMED 2015, 600915). The industrial HI is 0.006, which is less than the NMED target HI of 1 (NMED 2015, 600915). The total dose is 0.02 mrem/yr, which is less than the target dose of 25 mrem/yr as authorized by DOE Order 458.1.

The results of the risk-screening assessment for the residential scenario are presented in Tables I-4.2-32, I-4.2-33, and I-4.2-34. The total excess cancer risk for the residential scenario is 2×10^{-9}, which is less than the NMED target risk level of 1×10^{-5} (NMED 2015, 600915). The residential HI is 0.1, which is less than the NMED target HI of 1 (NMED 2015, 600915). The total dose is 0.09 mrem/yr, which is less than the target dose of 25 mrem/yr as authorized by DOE Order 458.1.

I-4.2.7 AOC 49-008(d)

The results of the risk-screening assessment for the industrial scenario are presented in Tables I-4.2-35, I-4.2-36, and I-4.2-37. The total excess cancer risk for the industrial scenario is 9×10^{-8}, which is less than the NMED target risk level of 1×10^{-5} (NMED 2015, 600915). The industrial HI is 0.03, which is less than the NMED target HI of 1 (NMED 2015, 600915). The total dose is 0.2 mrem/yr, which is less than the target dose of 25 mrem/yr as authorized by DOE Order 458.1.

The results of the risk-screening assessment for the residential scenario are presented in Tables I-4.2-38, I-4.2-39, and I-4.2-40. The total excess cancer risk for the residential scenario is 2×10^{-7}, which is less than the NMED target risk level of 1×10^{-5} (NMED 2015, 600915). The residential HI is 0.6, which is less than the NMED target HI of 1 (NMED 2015, 600915). The total dose is 1 mrem/yr, which is less than the target dose of 25 mrem/yr as authorized by DOE Order 458.1.

I-4.3 Vapor Intrusion Pathway

NMED guidance (NMED 2015, 600915) requires an evaluation of the vapor intrusion pathway. The vapor intrusion pathway of VOCs into a building was evaluated where appropriate. The evaluation can be qualitative for a potentially complete pathway if the following criteria are met:

- Volatile and toxic compounds are minimally detected
- Concentrations are below NMED's vapor intrusion screening levels for soil-gas and/or groundwater. There is no suspected source(s) for volatile and toxic compounds, and
- Concentrations are decreasing with depth (for soil).

Soil-gas or bulk soil data are available for all of the sites. The vapor intrusion screening levels are applicable for SWMUs 49-001(a), 49-001(b,c,d,g), 49-001(e), and 49-001(f) and AOCs 49-008(c) and 49-008(d) because pore gas data are available. Only bulk soil data are available for SWMU 49-003 and residential soil screening values were calculated using the Johnson and Ettinger model (http://www.epa.gov/swerrims/riskassessment/airmodel/johnson_ettinger.htm) for subsurface vapor intrusion into buildings (EPA 2002, 094114). The advanced soil model (SL-ADV-REV2-4.xls) was used to calculate risk-based soil concentrations for VOCs at SWMU 49-003. The maximum detected concentrations of VOC COPCs were initially compared with the vapor intrusion screening levels or the risk-based concentration generated by the model for each site. If appropriate, 95% UCLs were calculated. The model inputs and risk-based concentrations generated are provided on CD as Attachment I-2. HQs and HIs were calculated for noncarcinogenic COPCs and total excess cancer risks for carcinogenic COPCs. The NMED target risk level of 1×10^{-5} and NMED target HI of 1 were applied.

The vapor intrusion pathway was qualitatively evaluated as part of the residential scenario for the sites in this report. Three of the site descriptions indicated that organic chemicals, including solvents were used. One of these sites is MDA AB [SWMUs 49-001(b,c,d,g)] and the other two sites [SWMU 49-003 and AOC 49-008(c)] were associated with the laboratory at former building 49-15. Former building 49-15 has been removed, and therefore this source is no longer present. No suspected sources of VOCs are present at the other four sites [SWMU 49-001(a), SWMU 49-001(e), SWMU 49-001(f), and AOC 49-008(d)].

VOCs were detected in pore gas or soil at each SWMU and AOC inside the NES boundary. The potential for the vapor intrusion pathway is discussed for each of these sites.

I-4.3.1 SWMU 49-001(a)

SWMU 49-001(a), known as Area 1, is an area consisting of experimental shafts located in the northwest corner of the TA-49 NES boundary. Area 1 is approximately 100 ft × 100 ft. A total of 22 shafts were drilled at Area 1 to depths ranging from 31 ft to 85 ft bgs. Ten of the 22 shafts were used for shot testing using radioactive materials, 5 of the shafts were used for containment testing using HE only, 6 of the shafts were not used and were backfilled, and 1 shaft was used as a gas expansion hole. Substantial amounts of lead generally were present in the experimental packages, and small amounts of beryllium may have been used in some experiments (LANL 2007, 098492). The site description does not indicate a history of solvent usage.

All 14 COPCs detected in soil-gas were screened using the vapor intrusion screening levels (NMED 2015, 600915). The results of the residential vapor intrusion screening assessment are presented in Tables I-4.3-1 and I-4.3-2. The HI is approximately 0.2, which is less than the NMED target HI of 1 (NMED 2015, 600915). The total excess cancer risk is 7×10^{-6}, which is less than the NMED target risk of 1×10^{-5} (NMED 2015, 600915).

The vapor intrusion pathway is potentially complete based on NMED guidance (NMED 2015, 600915), but no additional evaluation is necessary.

I-4.3.2 SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g)

MDA AB includes Area 2, SWMU 49-001(b), Area 2A, SWMU 49-001(c), Area 2B, SWMU 49-001(d), and SWMU 49-001(g). With the exception of SWMU 49-001(g), all SWMUs are associated with hydronuclear and related experiments conducted at TA-49 from late 1959 to mid-1961. These experiments were conducted in underground shafts (typically 6 ft in diameter) drilled into the tuff at Areas 1, 2, 2A, 2B, 3, and 4 and involved the use of HE and radioactive materials such as SNM (plutonium-239 and uranium-235). Some experiments may have used liquid scintillation detectors containing organic chemicals, including p-terphenylene, toluene, polystyrene, and zinc stearate, which should have been consumed during the explosions. SWMU 49-001(g) is a site of contaminated surface soil associated with Area 2 activities (LANL 2007, 098492). The site description does indicate a history of chemical usage, including some solvents.

All 15 COPCs detected in soil-gas were screened using the vapor intrusion screening levels (NMED 2015, 600915). The results of the residential vapor intrusion screening assessment are presented in Tables I-4.3-3 and I-4.3-4. The HI is approximately 0.5, which is less than the NMED target HI of 1 (NMED 2015, 600915). The total excess cancer risk is 2×10^{-5}, which is above the NMED target risk of 1×10^{-5} (NMED 2015, 600915). The excess cancer risk is almost entirely from benzene; the maximum benzene concentration is greater than the vapor intrusion screening level. Cancer risk using the 95% UCLs for benzene and ethylbenzene is approximately 1×10^{-5}, which is equivalent to the NMED target risk of 1×10^{-5} (NMED 2015, 600915).

The vapor intrusion pathway is potentially complete based on NMED guidance (NMED 2015, 600915), but no additional evaluation is necessary.

I-4.3.3 SWMU 49-001(e)

SWMU 49-001(e), known as Area 3, is an area consisting of experimental shafts located in the southwest corner of the MDA AB NES boundary. Area 3 is approximately 100 ft × 100 ft in area. A total of 13 shafts, ranging between 57 ft and 142 ft deep, were drilled in a grid-like pattern. Seven of the shafts were shot with a tracer, four of the shafts were used for containment shots, and the remaining two shafts were not used and backfilled (LANL 2007, 098492). Area 3 was used exclusively to develop confinement and sample-recovery techniques used in the other experimental areas. This site description does not indicate a history of solvent usage.

All 13 COPCs detected in soil-gas were screened using the vapor intrusion screening levels (NMED 2014, 600115). The results of the residential vapor intrusion screening assessment are presented in Tables I-4.3-5 and I-4.3-6. The HI is approximately 0.2, which is less than the NMED target HI of 1 (NMED 2015, 600915). The total excess cancer risk is 6×10^{-6}, which is less than the NMED target risk of 1×10^{-5} (NMED 2015, 600915).

The vapor intrusion pathway is potentially complete based on NMED guidance (NMED 2015, 600915), but no additional evaluation is necessary.

I-4.3.4 SWMU 49-001(f)

SWMU 49-001(f), known as Area 4, is an area consisting of experimental shafts located in the southeast corner of the MDA AB NES boundary. Area 4 is approximately 100 ft × 125 ft in area. Area 4 was designed to contain 26 shafts on a uniform grid, but only 21 were drilled. The 21 shafts drilled at Area 4 ranged between 58 ft and 108 ft deep. Thirteen of the shafts were shot with radioactive material, one shaft was used for containment testing, one shaft was used as a gas expansion hole, three shafts were used for disposal of debris, and the remaining three shafts were not used and backfilled (LANL 2007, 098492). The site description does not indicate a history of solvent usage.

All 14 COPCs detected in soil-gas were screened using the vapor intrusion screening levels (NMED 2015, 600915). The results of the residential vapor intrusion screening assessment are presented in Tables I-4.3-7 and I-4.3-8. The HI is approximately 0.5, which is less than the NMED target HI of 1 (NMED 2015, 600915). The total excess cancer risk is approximately 1×10^{-5}, which is equivalent to the NMED target risk of 1×10^{-5} (NMED 2014, 600115). The excess cancer risk is almost entirely from benzene; the maximum benzene concentration is similar to the vapor intrusion screening level.

The vapor intrusion pathway is potentially complete based on NMED guidance (NMED 2015, 600915), but no additional evaluation is necessary.

I-4.3.5 SWMU 49-003

SWMU 49-003 is an inactive leach field and associated drainlines at Area 11 within the northern MDA AB NES boundary at TA-49. The leach field is located approximately 20 ft to 25 ft east of the location of former building 49-15 and was connected to the former building by a drainline. The leach field is believed to be constructed of vitrified clay pipe installed in gravel bedding. Former building 49-15 housed a radiochemistry laboratory and change house. The building 49-15 laboratory was used to analyze samples collected during the experiments conducted in the experimental shafts at Areas 2, 2A, 2B, and 4. The estimated total volume of wastewater discharged to the leach field was less than several hundred gallons and less than 50 gal. of organic chemicals. Former building 49-15 and related structures including latrines, a storage building, and propane and butane tanks in Area 11 were decontaminated, demolished, and removed in 1970 and 1971; the leach field and drainlines were left in place (LANL 1992, 007670, pp. 6-2−6-6; LANL 2007, 098492). The site description does not specifically indicate a history of solvent usage, but solvents may have been used as part of radiochemistry laboratory processes in former building 49-15.

Two VOCs (acetone and methylene chloride) were detected at this site with 1 detected concentration in 14 soil samples; the concentrations were less than the EQLs.

Because of a potential VOC source the acetone and methylene chloride were evaluated in the screening assessment. The result of the residential vapor intrusion screening assessment is presented in Table I-4.3-9. The HI is approximately 0.00003, which is less than the NMED target HI of 1 (NMED 2015, 600915). The result does not change the HI calculated as a result of exposure to soil, discussed in section I-4.2.

The screening of the bulk soil data using the Johnson and Ettinger model indicates that the soil has not been impacted. The vapor intrusion pathway is potentially complete based on NMED guidance (NMED 2015, 600915) but no additional evaluation is necessary.

I-4.3.6 AOC 49-008(c)

AOC 49-008(c) consists of an area of potentially contaminated soil from historical radiochemistry operations and small-scale containment experiments at Area 11 within the northern portion of the MDA AB NES boundary at TA-49. Area 11 is an approximately 220- × 300-ft area. Activities conducted at Area 11 from 1959 to 1961 supported hydronuclear experiments conducted elsewhere at TA-49 (LANL 1992, 007670). Radiochemistry operations were conducted in a former laboratory and change house (former building 49-15) that was the main structure at Area 11. Other structures included a small storage building, latrines, and butane and propane tanks. The former building 49-15 laboratory was used to analyze samples collected during experiments in the experimental shafts at Areas 2, 2A, 2B, and 4. Laboratory processes included sample dissolution in acids (nitric, hydrochloric, hydrofluoric, sulfuric, and perchloric) and solvent extraction using methyl isobutyl ketone, ammonium hydroxide, and sodium hydroxide. Wastes generated during radiochemical operations were typically collected in containers and taken to radioactive waste disposal facilities elsewhere at the Laboratory. Interim waste storage boxes were stored south of former building 49-15. Some liquid wastes reportedly discharged to a leach field (SWMU 49-003). Small-scale containment experiments were conducted in 13 underground shafts located on the west side of Area 11. These shafts were drilled to a depth of 12 ft and lined with 10-in.-diameter steel casing. HE was placed in the shafts, which were backfilled to contain the explosions. Small amounts of irradiated uranium-238 tracer were used in some experiments. The structures in Area 11 were decontaminated and removed in 1970 and 1971. Contamination was detected in sinks, ducts, and hoods in former building 49-15. Contaminated debris was removed and disposed of at TA-54 and uncontaminated debris (approximately 2160 ft^3) was taken to the open-burning/landfill area at Area 6 (SWMU 49-004) (LANL 2007, 098492). The site description indicates a history of solvent usage, but the structures and sources have been removed.

All 15 COPCs detected in soil-gas were screened using the vapor intrusion screening levels (NMED 2015, 600915). The results of the residential vapor intrusion screening assessment are presented in Tables I-4.3-10 and I-4.3-11. The HI is approximately 0.4, which is less than the NMED target HI of 1 (NMED 2015, 600915). The total excess cancer risk is 7×10^{-6}, which is less than the NMED target risk of 1×10^{-5} (NMED 2015, 600915).

The vapor intrusion pathway is potentially complete based on NMED guidance (NMED 2015, 600915), but no additional evaluation is necessary.

I-4.3.7 AOC 49-008(d)

AOC 49-008(d) is an area consisting of potential soil contamination located within Area 12 in the northeast corner of the MDA AB NES boundary at TA-49. Area 12 was used in 1960 and 1961 to conduct confinement experiments related to the hydronuclear experiments conducted at MDA AB. These experiments involved HE detonations in sealed metal bottles. The bottles measured up to 5 ft diameter × 16 ft long and were placed in a 10-ft-diameter × 30-ft-deep underground shaft during the experiments. Former building 49-23 constructed over the shaft and was known as the Bottle House. Approximately 26 confinement experiments were conducted at Area 12 (LANL 1992, 007670, p. 6.6-3). After the confinement experiments at Area 12 ceased, Area 12 was used to conduct tests to determine the strength of cables used in other experiments. The CPTF, former building 49-121, was constructed approximately 60 ft south of former building 49-23 in the early or mid-1960s to perform these tests (LANL 1992, 007670, p. 3-9). The shaft in former building 49-23 was backfilled with crushed tuff, and a hydraulic system was installed in the building. Underground hydraulic lines were run to former building 49-121. The total fluid capacity of the hydraulic system was estimated to have been less than 10 gal. (LANL 2007, 098492). The Bottle House and CPTF were removed in February 2006 (Beguin 2007, 098607); neither PCBs nor radioactivity above background levels were detected in any of

the waste streams generated during D&D activities (Beguin 2007, 098607). The site is used occasionally to support microwave experiments that involve portable equipment (LANL 2007, 098492). The site description does not indicate a history of solvent usage.

All 15 COPCs detected in soil-gas were screened using the vapor intrusion screening levels (NMED 2015, 600915). The results of the residential vapor intrusion screening assessment are presented in Tables I-4.3-12 and I-4.3-13. The HI is approximately 0.4, which is less than the NMED target HI of 1 (NMED 2015, 600915). The total excess cancer risk is 9×10^{-6}, which is less than the NMED target risk of 1×10^{-5} (NMED 2015, 600915).

The vapor intrusion pathway is potentially complete based on NMED guidance (NMED 2015, 600915), but no additional evaluation is necessary.

I-4.4 Essential Nutrients

NMED has SSLs for evaluation of essential nutrients (NMED 2015, 600915). The maximum concentrations of calcium and magnesium were compared to the appropriate NMED SSLs at those sites where they were identified as COPCs. The results of the comparisons found calcium and magnesium to be substantially less than the SSLs as presented in Table I-4.4-1. Further evaluation of calcium and magnesium at these sites is not necessary.

I-4.5 Uncertainty Analysis

I-4.5.1 Data Evaluation and COPC Identification Process

A primary uncertainty associated with the COPC identification process is the possibility that a chemical may be inappropriately identified as a COPC when it is actually not a COPC or that a chemical may not be identified as a COPC when it actually should be identified as a COPC. Inorganic chemicals are appropriately identified as COPCs because only the chemicals detected or that have detection limits above background are retained for further analysis. No established BVs for organic chemicals and all detected organic chemicals are identified as COPCs and are retained for further analysis. Other uncertainties may include errors in sampling, laboratory analysis, and data analysis. However, because concentrations used in the risk-screening evaluations include those detected below the estimated quantitation limits and nondetects above BVs, data evaluation uncertainties are expected to have little effect on the risk-screening results.

I-4.5.2 Exposure Evaluation

The current and reasonably foreseeable future land use is industrial. To the degree actual activity patterns are not represented by those activities assumed by the industrial scenario, uncertainties are introduced in the assessment, and the evaluation presented in this assessment overestimates potential risk. An individual may be subject to exposures in a different manner than the exposure assumptions used to derive the industrial SSLs. For the sites evaluated, individuals may not be on-site at present or in the future for that frequency and duration. The industrial assumptions for the SSLs are that the potentially exposed individual is outside on-site for 8 h/d, 225 d/yr, and 25 yr (NMED 2015, 600915). The residential SSLs are based on exposure of 24 h/d, 350 d/yr, and 30 yr (NMED 2015, 600915). As a result, the industrial and residential scenarios evaluated at these sites likely overestimate the exposure and risk.

A number of assumptions are made relative to exposure pathways, including input parameters, completeness of a given pathway, the contaminated media to which an individual may be exposed, and intake rates for different routes of exposure. In the absence of site-specific data, the exposure assumptions

used were consistent with default values (NMED 2015, 600915). When several upper-bound values (as are found in NMED 2015, 600915) are combined to estimate exposure for any one pathway, the resulting risk estimate can exceed the 99th percentile, and therefore, can exceed the range of risk that may be reasonably expected. Also, the assumption that residual concentrations of chemicals in the tuff are available and result in exposure in the same manner as if they were in soil overestimates the potential exposure and risk to receptors.

Uncertainty is introduced in the concentration aggregation of data for estimating the EPCs at a site. Risk from a single location or area with relatively high COPC concentrations may be underestimated by using a representative site-wide value. The use of a UCL is intended to provide a protective upper-bound (i.e., conservative) COPC concentration and is assumed to be representative of the average exposure to a COPC across the entire site. Potential risk and exposure from a single location or area with relatively high COPC concentrations may be overestimated if a representative site-wide value is used. The use of the maximum detected concentration for the EPC overestimates the exposure to contamination because receptors are not consistently exposed to the maximum detected concentration across the site. In addition, the maximum detection limit was used as the EPC for some inorganic COPCs with elevated detection limits above BVs.

I-4.5.3 Toxicity Evaluation

The primary uncertainty associated with the SSLs is related to the derivation of toxicity values used in their calculation. Toxicity values (reference doses [RfDs] and slope factors [SFs]) were used to derive the SSLs used in this risk-screening evaluation (NMED 2015, 600915). Uncertainties were identified in five areas with respect to the toxicity values: (1) extrapolation from other animals to humans, (2) interindividual variability in the human population, (3) the derivation of RfDs and SFs, (4) the chemical form of the COPC, and (5) the use of surrogate chemicals. The impact of using the EPA SSL arsenic on the risk estimates is also discussed.

Extrapolation from Animals to Humans. The SFs and RfDs are often determined by extrapolation from animal data to humans, which may result in uncertainties in toxicity values because differences exist in chemical absorption, metabolism, excretion, and toxic responses between animals and humans. Differences in body weight, surface area, and pharmacokinetic relationships between animals and humans are taken into account to address these uncertainties in the dose-response relationship. However, conservatism is usually incorporated in each of these steps, resulting in the overestimation of potential risk.

Individual Variability in the Human Population. For noncarcinogenic effects, the degree of variability in human physical characteristics is important both in determining the risks that can be expected at low exposures and in defining the no observed adverse effect level (NOAEL). The NOAEL uncertainty factor approach incorporates a 10-fold factor to reflect individual variability within the human population that can contribute to uncertainty in the risk evaluation; this factor of 10 is generally considered to result in a conservative estimate of risk to noncarcinogenic COPCs.

Derivation of RfDs and SFs. The RfDs and SFs for different chemicals are derived from experiments conducted by different laboratories that may have different accuracy and precision that could lead to an over- or underestimation of the risk. The uncertainty associated with the toxicity factors for noncarcinogens is measured by the uncertainty factor, the modifying factor, and the confidence level. For carcinogens, the weight of evidence classification indicates the likelihood that a contaminant is a human carcinogen. Toxicity values with high uncertainties may change as new information is evaluated.

Arsenic

The May 2016 EPA regional screening values for arsenic employ a relative bioavailability value of 60% in calculating the industrial and residential soil screening levels (http://www.epa.gov/risk/risk-based-screening-table-generic-tables). The EPA document "Compilation and Review of Data on Relative Bioavailability of Arsenic in Soil" (EPA 2012, 262543) provides supporting information and the EPA policy memorandum "Recommendations for Default Value for Relative Bioavailability of Arsenic in Soil" (EPA 2012, 262542) recommends using this value, recognizing the default value is an estimate not likely to be exceeded at most sites and is preferable to the assumption of a relative bioavailability equal to 100%.

The use of the EPA regional residential screening value for arsenic of 6.8 mg/kg changes the total excess cancer risk results for three sites evaluated in this appendix. The changes are as follows:

- SWMU 49-001(e)—Residential cancer risk becomes 6×10^{-6};
- SWMU 49-001(f)—Residential cancer risk becomes 6×10^{-6}; and
- SWMU 49-003—Residential cancer risk becomes 6×10^{-6}.

Chemical Form of the COPC. COPCs may be bound to the environment matrix and not available for absorption into the human body. However, it is assumed that the COPCs are bioavailable. This assumption can lead to an overestimation of the total risk.

*Use of Surrogate Chemicals***.** The use of surrogates for chemicals that do not have EPA-approved or provisional toxicity values also contributes to uncertainty in the risk assessment. Surrogates were used to provide SSLs for benzo(g,h,i)perylene; alpha-chlordane; gamma-chlordane; 4-isopropyltoluene; and 1,3-xylene+1,4-xylene based on structural similarity. Surrogates were also used to provide vapor intrusion screening levels for 4-ethyltoluene; 1,3,5-trimethylbenzene; and 1,3-xylene+1,4-xylene based on structural similarity. The overall impact of surrogates on the risk assessment is minimal because these COPCs were detected at low concentrations.

I-4.5.4 Additive Approach

For noncarcinogens, the effects of exposure to multiple chemicals are generally unknown, and possible interactions could be synergistic or antagonistic, resulting in either an overestimation or underestimation of the potential risk. Additionally, RfDs used in the risk calculations typically are not based on the same endpoints with respect to severity, effects, or target organs. Therefore, the potential for noncarcinogenic effects may be overestimated for individual COPCs that act by different mechanisms or by different modes of action but are addressed additively.

I-4.6 Interpretation of Human Health Risk Screening Results

I-4.6.1 SWMU 49-001(a)

Industrial Scenario

The total excess cancer risk for the industrial scenario is 2×10^{-7}, which is less than the NMED target risk level of 1×10^{-5} (NMED 2015, 600915). The industrial HI is 0.04, which is less than the NMED target HI of 1 (NMED 2015, 600915). The total dose is 0.9 mrem/yr, which is less than the target dose of 25 mrem/yr as authorized by DOE Order 458.1. The total dose for the industrial scenario is equivalent to a total risk of 2×10^{-6}, based on conversion from dose using RESRAD Version 7.0.

Residential Scenario

The total excess cancer risk (soil and vapor intrusion screening results) for the residential scenario is 8×10^{-6}, which is less than the NMED target risk level of 1×10^{-5} (NMED 2015, 600915). The residential HI (soil and vapor intrusion screening results) is 0.8, which is less than the NMED target HI of 1 (NMED 2015, 600915). The total dose is 3 mrem/yr, which is less than the target dose of 25 mrem/yr as authorized by DOE Order 458.1. The total dose for the residential scenario is equivalent to a total risk of 8×10^{-6}, based on conversion from dose using RESRAD Version 7.0.

I-4.6.2 SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g)

Industrial Scenario

No carcinogenic COPCs were identified in the 0.0 to 1.0-ft depth interval. The industrial HI is 0.02, which is less than the NMED target HI of 1 (NMED 2015, 600915). The total dose is 0.1 mrem/yr, which is less than the target dose of 25 mrem/yr as authorized by DOE Order 458.1. The total dose for the industrial scenario is equivalent to a total risk of 1×10^{-6}, based on conversion from dose using RESRAD Version 7.0.

Residential Scenario

The total excess cancer risk (soil and vapor intrusion screening results) for the residential scenario is approximately 1×10^{-5}, which is equivalent to the NMED target risk level of 1×10^{-5} (NMED 2015, 600915). The residential HI (soil and vapor intrusion screening results) is 0.8, which is less than the NMED target HI of 1 (NMED 2015, 600915). The total dose is 2 mrem/yr, which is less than the target dose of 25 mrem/yr as authorized by DOE Order 458.1. The total dose for the residential scenario is equivalent to a total risk of 4×10^{-6}, based on conversion from dose using RESRAD Version 7.0.

I-4.6.3 SWMU 49-001(e)

Industrial Scenario

The total excess cancer risk for the industrial scenario is 2×10^{-6}, which is less than the NMED target risk level of 1×10^{-5} (NMED 2015, 600915). The industrial HI is 0.1, which is less than the NMED target HI of 1 (NMED 2015, 600915). The total dose is 0.2 mrem/yr, which is less than the target dose of 25 mrem/yr as authorized by DOE Order 458.1. The total dose for the industrial scenario is equivalent to a total risk of 8×10^{-7}, based on conversion from dose using RESRAD Version 7.0.

Residential Scenario

The total excess cancer risk (soil and vapor intrusion screening results) for the residential scenario is 2×10^{-5}, which is above the NMED target risk level of 1×10^{-5} (NMED 2015, 600915). The residential HI (soil and vapor intrusion screening results) is 2, which is above the NMED target HI of 1 (NMED 2015, 600915). The total dose is 0.5 mrem/yr, which is less than the target dose of 25 mrem/yr as authorized by DOE Order 458.1. The total dose for the residential scenario is equivalent to a total risk of 3×10^{-6}, based on conversion from dose using RESRAD Version 7.0.

I-4.6.4 SWMU 49-001(f)

Industrial Scenario

The total excess cancer risk for the industrial scenario is 2×10^{-6}, which is less than the NMED target risk level of 1×10^{-5} (NMED 2015, 600915). The industrial HI is 0.08, which is less than the NMED target HI of 1 (NMED 2015, 600915). The total dose is 0.1 mrem/yr, which is less than the target dose of 25 mrem/yr as authorized by DOE Order 458.1. The total dose for the industrial scenario is equivalent to a total risk of 4×10^{-7}, based on conversion from dose using RESRAD Version 7.0.

Residential Scenario

The total excess cancer risk (soil and vapor intrusion screening results) for the residential scenario is 2×10^{-5}, which is above the NMED target risk level of 1×10^{-5} (NMED 2015, 600915). The residential HI (soil and vapor intrusion screening results) is approximately 1, which is equivalent to the NMED target HI of 1 (NMED 2015, 600915). The total dose is 0.6 mrem/yr, which is less than the target dose of 25 mrem/yr as authorized by DOE Order 458.1. The total dose for the residential scenario is equivalent to a total risk of 3×10^{-6}, based on conversion from dose using RESRAD Version 7.0.

I-4.6.5 SWMU 49-003

Industrial Scenario

No carcinogenic COPCs were identified. The industrial HI is 0.003, which is less than the NMED target HI of 1 (NMED 2015, 600915). The total dose is 0.1 mrem/yr, which is less than the target dose of 25 mrem/yr as authorized by DOE Order 458.1. The total dose for the industrial scenario is equivalent to a total risk of 6×10^{-7}, based on conversion from dose using RESRAD Version 7.0.

Residential Scenario

The total excess cancer risk for the residential scenario is 9×10^{-6}, which is less than the NMED target risk level of 1×10^{-5} (NMED 2015, 600915). The residential HI is 0.05, which is less than the NMED target HI of 1 (NMED 2015, 600915). The total dose is 0.8 mrem/yr, which is less than the target dose of 25 mrem/yr as authorized by DOE Order 458.1. The total dose for the residential scenario is equivalent to a total risk of 1×10^{-5}, based on conversion from dose using RESRAD Version 7.0.

I-4.6.6 AOC 49-008(c)

Industrial Scenario

The total excess cancer risk for the industrial scenario is 3×10^{-10}, which is less than the NMED target risk level of 1×10^{-5} (NMED 2015, 600915). The industrial HI is 0.006, which is less than the NMED target HI of 1 (NMED 2015, 600915). The total dose is 0.02 mrem/yr, which is less than the target dose of 25 mrem/yr as authorized by DOE Order 458.1. The total dose for the industrial scenario is equivalent to a total risk of 1×10^{-7}, based on conversion from dose using RESRAD Version 7.0.

Residential Scenario

The total excess cancer risk (soil and vapor intrusion screening results) for the residential scenario is 7×10^{-6}, which is less than the NMED target risk level of 1×10^{-5} (NMED 2015, 600915). The residential HI (soil and vapor intrusion screening results) is 0.5, which is less than the NMED target HI of 1

(NMED 2015, 600915). The total dose is 0.09 mrem/yr, which is less than the target dose of 25 mrem/yr as authorized by DOE Order 458.1. The total dose for the residential scenario is equivalent to a total risk of 1×10^{-7}, based on conversion from dose using RESRAD Version 7.0.

I-4.6.7 AOC 49-008(d)

Industrial Scenario

The total excess cancer risk for the industrial scenario is 9×10^{-8}, which is less than the NMED target risk level of 1×10^{-5} (NMED 2015, 600915). The industrial HI is 0.03, which is less than the NMED target HI of 1 (NMED 2015, 600915). The total dose is 0.2 mrem/yr, which is less than the target dose of 25 mrem/yr as authorized by DOE Order 458.1. The total dose for the industrial scenario is equivalent to a total risk of 3×10^{-6}, based on conversion from dose using RESRAD Version 7.0.

Residential Scenario

The total excess cancer risk (soil and vapor intrusion screening results) for the residential scenario is 9×10^{-6}, which is less than the NMED target risk level of 1×10^{-5} (NMED 2015, 600915). The residential HI (soil and vapor intrusion screening results) is approximately 1, which is equivalent to the NMED target HI of 1 (NMED 2015, 600915). The total dose is 1 mrem/yr, which is less than the target dose of 25 mrem/yr as authorized by DOE Order 458.1. The total dose for the residential scenario is equivalent to a total risk of 1×10^{-5}, based on conversion from dose using RESRAD Version 7.0.

I-5.0 ECOLOGICAL RISK-SCREENING EVALUATIONS

The approach for conducting ecological evaluations is described in the “Screening Level Ecological Risk Evaluation Methods, Revision 4” (LANL 2015, 600982). The evaluation consists of four parts: a scoping evaluation, a screening evaluation, an uncertainty analysis, and an interpretation of the results.

I-5.1 Scoping Evaluation

The scoping evaluation establishes the breadth and focus of the screening evaluation. The ecological scoping checklist (Attachment I-3) is a useful tool for organizing existing ecological information. The information was used to determine whether ecological receptors might be affected, identify the types of receptors that might be present, and develop the ecological conceptual site model for TA-49 sites inside the NES boundary (Attachment I-3). Although the quality of the habitat varies, most of the land within the NES boundary has native grasses, forbs, and trees that can be suitable habitat for ecological receptors.

The scoping evaluation indicated that terrestrial receptors were appropriate for evaluating the concentrations of COPCs in soil and tuff. Exposure is assessed across a site to a depth of 0.0 to 5.0 ft bgs. Aquatic receptors were not evaluated because no aquatic communities and no aquatic habitat or perennial source of water exist at any of the sites. The depth of the regional aquifer (greater than 1000 ft bgs) and the semiarid climate limit transport to groundwater. The potential exposure pathways for terrestrial receptors in soil and tuff are root uptake, inhalation, soil ingestion, dermal contact, and food web transport (Attachment I-3). The weathering of tuff is the only viable natural process that may result in the exposure of receptors to contaminants in tuff. Because of the slow rate of weathering expected for tuff, exposure in tuff is negligible, although it is included in the assessment. Plant exposure in tuff is largely limited to fractures near the surface, which does not produce sufficient biomass to support an herbivore population. Consequently, the contaminants in tuff are unavailable to receptors.

The potential risk was evaluated in the risk-screening assessments for the following ecological receptors representing several trophic levels:

- plants
- soil dwelling invertebrates (represented by the earthworm)
- the deer mouse (mammalian omnivore)
- the montane shrew (mammalian insectivore)
- desert cottontail (mammalian herbivore)
- red fox (mammalian carnivore)
- pocket gopher (burrowing mammal air pathway only)
- American robin (avian insectivore, avian omnivore, and avian herbivore)
- American kestrel (avian intermediate carnivore and avian carnivore [surrogate for threatened and endangered [T&E] species (primarily the Mexican spotted owl)]

The rationale for using these receptors is presented in "Screening Level Ecological Risk Evaluation Methods, Revision 4" (LANL 2015, 600982). The Mexican spotted owl is the only T&E species known to frequent the area and may use the TA-49 sites inside the NES boundary for foraging.

I-5.2 Assessment Endpoints

An assessment endpoint is an explicit expression of the environmental value to be protected. The endpoints are ecologically relevant and help sustain the natural structure, function, and biodiversity of an ecosystem or its components (EPA 1998, 062809). In a screening-level ecological evaluation, receptors represent the populations and/or communities, and assessment endpoints are any adverse effects on the chosen ecological receptors. The purpose of the ecological evaluation is to protect populations and communities of biota rather than individual organisms, except for listed or candidate T&E species and treaty-protected species, when individuals must be protected (EPA 1999, 070086). Populations of protected species tend to be small, and the loss of an individual adversely affects the species as a whole (EPA 1997, 059370).

In accordance with this guidance, the Laboratory developed generic assessment endpoints (LANL 1999, 064137) to ensure that values at all levels of ecological organization are considered in the ecological screening process. These general assessment endpoints can be measured using impacts on reproduction, growth, and survival to represent categories of effects that may adversely impact populations. In addition, specific receptor species were chosen to represent each functional group. The receptor species were chosen because of their presence at the site, their sensitivity to the COPCs, and their potential for exposure to those COPCs. These categories of effects and the chosen receptor species were used to select the types of effects seen in toxicity studies considered in the development of the toxicity reference values (TRVs). Toxicity studies used in the development of TRVs included only studies in which the adverse effect evaluated affected reproduction, survival, and/or growth.

The selection of receptors and assessment endpoints is designed to be protective of both the representative species used as screening receptors and the other species within their feeding guilds and the overall food web for the terrestrial and aquatic ecosystems. Focusing the assessment endpoints on the general characteristics of species that affect populations (rather than the biochemical and behavioral changes that may affect only the studied species) also ensures the applicability to the ecosystem of concern.

I-5.3 Ecological Risk Screening Evaluation

The ecological screening evaluation identifies chemicals of potential ecological concern (COPECs) and is based on the comparison of EPCs (95% UCLs, maximum detected concentrations, or maximum detection limits) to ecological screening levels (ESLs). The EPCs used in the assessments for the TA-49 sites inside the NES boundary are presented in Tables I-2.3-1 through Table I-2.3-16.

The ESLs were obtained from the ECORISK Database, Version 3.3 (LANL 2015, 600921) and are presented in Table I-5.3-1. The ESLs are based on similar species and are derived from experimentally determined NOAELs, lowest observed adverse effect levels (LOAELs), or doses determined lethal to 50% of the test population. Information relevant to the calculation of ESLs, including concentration equations, dose equations, bioconcentration factors, transfer factors, and TRVs, are presented in the ECORISK Database, Version 3.3 (LANL 2015, 600921).

The analysis begins with a comparison of the minimum ESL for a given COPC to the EPC. The HQ is defined as the ratio of the EPC to the concentration that has been determined to be acceptable to a given ecological receptor (i.e., the ESL). The higher the contaminant levels relative to the ESLs, the higher the potential risk to receptors; conversely, the higher the ESLs relative to the contaminant levels, the lower the potential risk to receptors. HQs greater than 0.3 are used to identify COPECs requiring additional evaluation (LANL 2015, 600982). Individual HQs for a receptor are summed to derive an HI; COPCs without ESLs are retained as COPECs and evaluated further in the uncertainty section. An HI greater than 1 indicates further assessment may be needed to ensure exposure to multiple COPECs at a site will not lead to potential adverse impacts to a given receptor population. The HQ and HI analysis is a conservative indication of potential adverse effects and is designed to minimize the potential of overlooking possible COPECs at the site.

I-5.3.1 SWMU 49-001(a)

The results of the minimum ESL comparisons are presented in Table I-5.3-2. Barium, chromium, cobalt, manganese, nickel, selenium, and vanadium are retained as COPECs because the HQs were greater than 0.3.

Potential ecological risks associated with aluminum are based on soil pH. Aluminum is retained only in soil with a pH lower than 5.5, in accordance with EPA guidance (EPA 2003, 085645). Aluminum was eliminated as a COPEC and was not evaluated further because the soil pH for TA-49 sites inside the NES boundary is neutral to slightly alkaline.

Calcium and perchlorate do not have ESLs, are retained as COPECs, and are discussed in the uncertainty section.

The HQs and HIs for each COPEC and receptor combination are presented in Table I-5.3-3. The HI analysis indicates that the robin (all feeding guilds), shrew, deer mouse, earthworm, and plant have HIs greater than 1. The HI for the cottontail was equivalent to 1. The COPECs and receptors are discussed in the uncertainty section.

I-5.3.2 SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g)

The results of the minimum ESL comparisons are presented in Table I-5.3-4. Cobalt and selenium are retained as COPECs because the HQs were greater than 0.3.

The HQs and HIs for each COPEC and receptor combination are presented in Table I-5.3-5. The HI analysis indicates that the robin (insectivore), shrew, and plant have HIs greater than 1. The HIs for the robin (omnivore and herbivore) and deer mouse were equivalent to 1. The COPECs and receptors are discussed in the uncertainty section.

I-5.3.3 SWMU 49-001(e)

The results of the minimum ESL comparisons are presented in Table I-5.3-6. Arsenic, barium, beryllium, chromium, cobalt, copper, lead, manganese, nickel, selenium, thallium, and vanadium are retained as COPECs because the HQs were greater than 0.3.

Potential ecological risks associated with aluminum are based on soil pH. Aluminum is retained only in soil with a pH lower than 5.5, in accordance with EPA guidance (EPA 2003, 085645). Aluminum was eliminated as a COPEC and was not evaluated further because the soil pH for TA-49 sites inside the NES boundary is neutral to slightly alkaline.

Calcium, iron, magnesium, and perchlorate do not have ESLs, are retained as COPECs, and are discussed in the uncertainty section.

The HQs and HIs for each COPEC and receptor combination are presented in Table I-5.3-7. The HI analysis indicates that the kestrel (intermediate carnivore), robin (all feeding guilds), cottontail, shrew, deer mouse, earthworm, and plant have HIs greater than 1. The COPECs and receptors are discussed in the uncertainty section.

I-5.3.4 SWMU 49-001(f)

The results of the minimum ESL comparisons are presented in Table I-5.3-8. Arsenic, barium, chromium, cobalt, copper, lead, mercury, nickel, selenium, thallium, vanadium, and bis(2-ethylhexyl)phthalate are retained as COPECs because the HQs were greater than 0.3.

Potential ecological risks associated with aluminum are based on soil pH. Aluminum is retained only in soil with a pH lower than 5.5, in accordance with EPA guidance (EPA 2003, 085645). Aluminum was eliminated as a COPEC and was not evaluated further because the soil pH for TA-49 sites inside the NES boundary is neutral to slightly alkaline.

Calcium and magnesium do not have ESLs, are retained as COPECs, and are discussed in the uncertainty section.

The HQs and HIs for each COPEC and receptor combination are presented in Table I-5.3-9. The HI analysis indicates that the kestrel (intermediate carnivore), robin (all feeding guilds), shrew, deer mouse, earthworm, and plant have HIs greater than 1. The HI for the cottontail was equivalent to 1. The COPECs and receptors are discussed in the uncertainty section.

I-5.3.5 SWMU 49-003

The results of the minimum ESL comparisons are presented in Table I-5.3-10. Antimony, arsenic, barium, copper, nickel, and selenium are retained as COPECs because the HQs were greater than 0.3.

Calcium, magnesium, and perchlorate, do not have ESLs, are retained as COPECs, and are discussed in the uncertainty section.

The HQs and HIs for each COPEC and receptor combination are presented in Table I-5.3-11. The HI analysis indicates that the robin (all feeding guilds), shrew, deer mouse, earthworm, and plant have HIs greater than 1. The HI for the cottontail was equivalent to 1. The COPECs and receptors are discussed in the uncertainty section.

I-5.3.6 AOC 49-008(c)

The results of the minimum ESL comparisons are presented in Table I-5.3-12. Selenium and bis(2-ethylhexyl)phthalate are retained as COPECs because the HQs were greater than 0.3.

Perchlorate and 4-isopropyltoluene, do not have ESLs, are retained as COPECs, and are discussed in the uncertainty section.

The HQs and HIs for each COPEC and receptor combination are presented in Table I-5.3-13. The HI analysis indicates that the robin (all feeding guilds), shrew, deer mouse, and plant have HIs greater than 1. The HIs for the kestrel (intermediate carnivore) and cottontail were equivalent to 1. The COPECs and receptors are discussed in the uncertainty section.

I-5.3.7 AOC 49-008(d)

The results of the minimum ESL comparisons are presented in Table I-5.3-14, Copper, selenium, thallium, uranium, Aroclor-1254, and bis(2-ethylhexyl)phthalate are retained as COPECs because the HQs were greater than 0.3.

Chloromethane and 4-isopropyltoluene do not have ESLs, are retained as COPECs, and are discussed in the uncertainty section.

The HQs and HIs for each COPEC and receptor combination are presented in Table I-5.3-15. The HI analysis indicates that the kestrel (intermediate carnivore), robin (all feeding guilds), shrew, deer mouse, and plant have HIs greater than 1. The COPECs and receptors are discussed in the uncertainty section.

I-5.3.8 Evaluation of Burrow Air Pathway

Pore gas data are available for SWMUs 49-001(a), 49-001(b,c,d,g), 49-001(e), 49-001(f), and AOCs 49-008(c) and 49-008(d). As a conservative screen of this pathway the maximum pore gas concentrations for each VOC detected were compared to the burrow air ESLs (based on the pocket gopher). This comparison and the HI for this pathway are provided in Table I-5.3-16 and shows that the HI is 0.008 for the inhalation of burrow air pathway. Burrow air ESLs are not available for 2-butanone, carbon disulfide, and styrene. Given the low concentrations for these VOCs (maximum is 100 µg/m^3) and the relatively high burrow air ESLs (minimum is 21,000 µg/m^3), there is no potential risk to the gopher and no additional evaluation is required.

I-5.4 Uncertainty Analysis

The uncertainty analysis describes the key sources of uncertainty related to the screening evaluations. This analysis can result in either adding or removing chemicals from the list of COPECs for sites. The following narrative contains a qualitative uncertainty analysis of the issues relevant to evaluating the potential ecological risk at the TA-49 sites inside the NES boundary.

I-5.4.1 Chemical Form

The assumptions used in the ESL derivations were conservative and not necessarily representative of actual conditions. These assumptions include maximum chemical bioavailability, maximum receptor ingestion rates, minimum bodyweight, and additive effects of multiple COPECs. Most of these factors tend to result in conservative estimates of the ESLs, which may lead to an overestimation of the potential risk. The assumption of additive effects for multiple COPECs may result in an over- or underestimation of the potential risk to receptors.

The chemical form of the individual COPCs was not determined as part of the investigation, largely a limitation on analytical quantitation of individual chemical species. Toxicological data are typically based on the most toxic and bioavailable chemical species not likely found in the environment. The inorganic, organic, and radionuclide, COPECs are generally not 100% bioavailable to receptors in the natural environment because of the adsorption of chemical constituents to matrix surfaces (e.g., soil), or rapid oxidation or reduction changes that render harmful chemical forms unavailable to biotic processes. The ESLs were calculated to ensure a conservative indication of potential risk (LANL 2015, 600982), and the values were biased toward overestimating the potential risk to receptors.

I-5.4.2 Exposure Assumptions

The EPCs used in the calculations of HQs were the 95% UCL, the maximum detected concentration, or the maximum detection limit to a depth of 5.0 ft, thereby conservatively estimating the exposure to each COPC. As a result, the exposure of individuals within a population was evaluated using this specific concentration, which was assumed constant throughout the exposure area. The sampling also focused on areas of known contamination, and receptors were assumed to ingest 100% of their food and spend 100% of their time at the site. The assumptions made regarding exposure for terrestrial receptors results in an overestimation of the potential exposure and risk because COPECs varied across the site and were infrequently detected.

I-5.4.3 Toxicity Values

The HQs were calculated using ESLs, which are based on NOAELs as threshold effect levels; actual risk for a given COPEC/receptor combination occurs at a higher level, somewhere between the NOAEL-based threshold and the threshold based on the LOAEL. The use of NOAELs leads to an overestimation of potential risk to ecological receptors. ESLs are based on laboratory studies requiring extrapolation to wildlife receptors. Laboratory studies are typically based on “artificial” and maintained populations with genetically similar individuals and are limited to single chemical exposures in isolated and controlled conditions using a single exposure pathway. Wild species are concomitantly exposed to a variety of chemical and environmental stressors, potentially rendering them more susceptible to chemical stress. On the other hand, wild populations are likely more genetically diverse than laboratory populations, making wild populations, as a whole, less sensitive to chemical exposure than laboratory populations. The uncertainties associated with the ESLs may result in an under- or overestimation of potential risk.

I-5.4.4 Area Use Factors

In addition to the direct comparison of the EPC with the ESLs, area use factors (AUF) are used to account for the amount of time a receptor is likely to spend within the contaminated areas based on the size of the receptor’s home range (HR). The AUF for individual organisms is calculated by dividing the size of the site by the HR for that receptor. Because T&E species must be assessed on an individual basis (EPA 1999, 070086), the AUF is used for the Mexican spotted owl. The HR for the Mexican spotted

owl is 366 ha (EPA 1993, 059384). The site areas and AUFs for each site are presented in Table I-5.4-1. The kestrel (top carnivore) is used as the surrogate receptor for the Mexican spotted owl.

No sites had HIs for the kestrel (top carnivore) equivalent to or greater than 1. Application of the AUFs for the Mexican spotted owl to the HIs for the kestrel (top carnivore) resulted in adjusted HIs ranging from 0.00005 to 0.02. Therefore, no potential adverse impacts to the Mexican spotted owl exist at any of the sites.

I-5.4.5 Population Area Use Factors

EPA guidance is to manage the ecological risk to populations rather than to individuals, with the exception of T&E species (EPA 1999, 070086). One approach to address the potential effects on populations at these TA-49 sites inside the NES boundary is to estimate the spatial extent of the area inhabited by the local population that overlaps with the contaminated area. The population area for a receptor is based on the individual receptor HR and its dispersal distance. Bowman et al. (2002, 073475) estimate that the median dispersal distance for mammals is 7 times the linear dimension of the HR (i.e., the square root of the HR area). If only the dispersal distances for the mammals with HRs within the range of the screening receptors are used (Bowman et al. 2002, 073475), the median dispersal distance becomes 3.6 times the square root of the HR (R^2=0.91). If it is assumed that the receptors can disperse the same distance in any direction, the population area is circular and the dispersal distance is the radius of the circle. Therefore, the population area can be derived by $\pi(3.6\sqrt{HR})^2$ or approximately 40HR.

I-5.4.5.1 SWMU 49-001(a)

The area of SWMU 49-001(a) is approximately 20.8 ha. The population area use factors (PAUFs) are estimated by dividing the site area by the population area of each receptor population (Table I-5.4-2). The HQs and HIs are recalculated using the PAUFs. The HIs for the robin, shrew, and deer mouse are not adjusted by PAUFs because the site area is greater than the population areas, and the plant and earthworm HIs are not adjusted by PAUFs because these receptors do not have HRs.

The adjusted HIs are less than 1 for the red fox, kestrel, and cottontail (Table I-5.4-3). The robin (all feeding guilds), shrew, and deer mouse HIs were not adjusted and are greater than 1 (Table I-5.4-3). The plant had an unadjusted HI of 7 and the earthworm had an unadjusted HI of 2 (Table I-5.4-3).

I-5.4.5.2 SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g)

The area of SWMUs 49-001(b,c,d,g) is approximately 27.7 ha. The PAUFs are estimated by dividing the site area by the population area of each receptor population (Table I-5.4-4). The HQs and HIs are recalculated using the PAUFs. The HIs for the robin, shrew, and deer mouse are not adjusted by PAUFs because the site area is greater than the population areas, and the plant and earthworm HIs are not adjusted by PAUFs because these receptors do not have HRs.

The adjusted HIs are less than 1 for the red fox, kestrel, and cottontail (Table I-5.4-5). The robin (insectivore) and shrew HIs were not adjusted and are greater than 1, and the robin (herbivore and omnivore) and deer mouse HIs were not adjusted and are equivalent to 1 (Table I-5.4-5). The plant had an unadjusted HI of 3, and the earthworm had an unadjusted HI of 0.3 (Table I-5.4-5).

I-5.4.5.3 SWMU 49-001(e)

The area of SWMU 49-001(e) is approximately 19.6 ha. The PAUFs are estimated by dividing the site area by the population area of each receptor population (Table H-5.4-6). The HQs and HIs are recalculated using the PAUFs. The HIs for the robin, shrew, and deer mouse are not adjusted by PAUFs because the site area is greater than the population areas and the plant and earthworm HIs are not adjusted by PAUFs because these receptors do not have HRs.

The adjusted HIs are less than 1 for the red fox, kestrel, and cottontail (Table I-5.4-7). The robin (all feeding guilds), shrew, and deer mouse HIs were not adjusted and are greater than 1 (Table 5.4-7). The plant had an unadjusted HI of 20 and the earthworm had an unadjusted HI of 3 (Table I-5.4-7).

I-5.4.5.4 SWMU 49-001(f)

The area of SWMU 49-001(f) is approximately 20.8 ha. The PAUFs are estimated by dividing the site area by the population area of each receptor population (Table H-5.4-8). The HQs and HIs are recalculated using the PAUFs. The HIs for the robin, shrew, and deer mouse are not adjusted by PAUFs because the site area is greater than the population areas and the plant and earthworm HIs are not adjusted by PAUFs because these receptors do not have HRs.

The adjusted HIs are less than 1 for the red fox, kestrel, and cottontail (Table I-5.4-9). The robin (all feeding guilds), shrew, and deer mouse HIs were not adjusted and are greater than 1 (Table 5.4-9). The plant had an unadjusted HI of 12 and the earthworm had an unadjusted HI of 2 (Table I-5.4-9).

I-5.4.5.5 SWMU 49-003

The area of SWMU 49-003 is approximately 0.486 ha. The PAUFs are estimated by dividing the site area by the population area of each receptor population (Table I-5.4-10). The HQs and HIs are recalculated using the PAUFs. The HIs for the plant and earthworm are not adjusted by PAUFs because these receptors do not have HRs.

The adjusted HIs are less than 1 for all receptors (Table I-5.4-11). The plant had an unadjusted HI of 6, and the earthworm had an unadjusted HI of 2 (Table I-5.4-11).

I-5.4.5.6 AOC 49-008(c)

The area of AOC 49-008(c) is approximately 2.41 ha. The PAUFs are estimated by dividing the site area by the population area of each receptor population (Table I-5.4-12). The HQs and HIs are recalculated using the PAUFs. The HIs for the plant and earthworm are not adjusted by PAUFs because these receptors do not have HRs.

The adjusted HIs are less than 1 for all receptors, except for the deer mouse with an adjusted HI of 2. The plant had an unadjusted HI of 4, and the earthworm had an unadjusted HI of 0.5 (Table I-5.4-13).

I-5.4.5.7 AOC 49-008(d)

The area of AOC 49-008(d) is approximately 5.73 ha. The PAUFs are estimated by dividing the site area by the population area of each receptor population (Table I-5.4-14). The HQs and HIs are recalculated using the PAUFs. The HI for the deer mouse is not adjusted by the PAUF because the site area is greater than the population area and the HIs for the plant and earthworm are not adjusted by PAUFs because these receptors do not have HRs.

The adjusted HIs are less than 1 for all receptors, except for the robin (omnivore and insectivore) and shrew, which have HIs greater than 1 (Table 5.4-15). The deer mouse HI was not adjusted and is greater than 1 (Table 5.4-15). The plant had an unadjusted HI of 9, and the earthworm had an unadjusted HI of 0.8 (Table I-5.4-15).

I-5.4.6 LOAEL Analysis

Some of the sites have HIs greater than 1 for one or more receptors. To address the HIs and reduce the associated uncertainty, analyses were conducted using ESLs calculated based on a LOAEL rather than a NOAEL. The LOAEL-based ESLs were calculated based on toxicity information in the ECORISK Database, Release 3.3 (LANL 2015, 600921) and are presented in Table I-5.4-16. The analyses address some of the uncertainties and conservativeness of the ESLs used in the initial screening assessments. HI analyses and adjusted HI analyses were conducted using the LOAEL-based ESLs.

I-5.4.7 Site Discussions

I-5.4.7.1 SWMU 49-001(a)

The unadjusted HIs for SWMU 49-001(a) are greater than 1 for the robin (all diets), shrew, deer mouse, earthworm, and plant, with barium, chromium, cobalt, manganese, nickel, selenium, and vanadium being the primary COPECs for one or several receptors. The HI analysis using LOAEL-based ESLs resulted in HIs of 2 for the robin (herbivore and omnivore), 3 for the robin (insectivore), 2 for the shrew, approximately 1 for the deer mouse, 0.1 for the earthworm, and 2 for the plant (Table I-5.4-17).

The LOAEL-based plant HI is in part from barium and manganese (0.9). Barium was detected in all 153 samples in the 0.0 to 5.0-ft depth interval with an EPC of 136 mg/kg. The EPC, which represents the average exposure concentration, is below the maximum soil background concentration (410 mg/kg) and is similar to the average soil background concentration of 143 mg/kg. The plant LOAEL-based ESL for barium is 260 mg/kg, which is less than the soil BV (295 mg/kg) and is below the maximum soil background concentration. Manganese was detected in all 153 samples in the 0.0 to 5.0-ft depth interval with an EPC of 425 mg/kg. The EPC, which represents the average exposure concentration, is below the maximum soil and Qbt 2,3,4 background concentrations (1100 mg/kg and 752 mg/kg) and is similar to the average soil background concentration of 340 mg/kg. The plant LOAEL-based ESL for manganese is 1100 mg/kg, which is the same as the maximum soil background concentration. Therefore, the potential ecological risks to the plant from barium and manganese are overestimated.

The LOAEL-based shrew HI is in part from nickel (0.5). Nickel was detected in all 153 samples in the 0.0 to 5.0-ft depth interval with an EPC of 8.57 mg/kg. The EPC, which represents the average exposure concentration, is below the maximum soil background concentration (29 mg/kg) and is slightly above the average soil background concentration of 7.07 mg/kg. The shrew LOAEL-based ESL for nickel is 19 mg/kg, which is similar to the soil BV and is below the maximum soil background concentration. Therefore, the potential ecological risk to the shrew from nickel is overestimated.

The LOAEL-based robin, shrew, deer mouse, and plant HIs are in part or entirely from selenium and vanadium. Selenium was detected in 144 of the 153 samples in the 0.0 to 5.0-ft depth interval with an EPC of 1.15 mg/kg. The EPC, which represents the average exposure concentration, is below the maximum soil background concentration (1.7 mg/kg). The selenium LOAEL-based ESLs are between 0.99 mg/kg and 2 mg/kg for robin, shrew, and deer mouse and are below, similar to, or slightly above the soil BV (1.52 mg/kg) and/or the maximum soil background concentration. Vanadium was detected in all 153 samples in the 0.0 to 5.0-ft depth interval with an EPC of 26.1 mg/kg. The EPC, which represents the average exposure concentration, is below the maximum soil background concentration (56.5 mg/kg) and

is similar to the average soil background concentration of 21.3 mg/kg. The vanadium LOAEL-based ESLs for the robin (13 mg/kg, 15 mg/kg, and 17 mg/kg) are below the soil BV (39.6 mg/kg) and similar to the Qbt 2,3,4 BV (17 mg/kg) and below the maximum soil and Qbt 2,3,4 background concentrations (21 mg/kg). The EPCs indicate the average exposure to the COPECs is similar to background and some of the screening levels are also similar to background concentrations. Therefore, the potential ecological risks to the robin, shrew, deer mouse, and plant are overestimated.

In addition, field observations made during the site visit found no indication of adverse effects from COPECs on the plant community (Attachment I-3). The site currently has minimal active operations and is becoming naturalized, with abundant habitat for ecological receptors, including plants. Therefore, the HI does not indicate potential risk to plants or other biota.

I-5.4.7.2 SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g)

The unadjusted HIs for SWMUs 49-001(b,c,d,g) are equivalent to or greater than 1 for the robin (all diets), shrew, deer mouse, and plant, with cobalt and selenium being the primary COPECs. The HI analysis using LOAEL-based ESLs resulted in HIs less than 1 for all receptors, except for the shrew with an HI of 1 (Table I-5.4-18).

The LOAEL-based robin, shrew, deer mouse, and plant HIs are from selenium. Selenium was detected in 103 of the 107 samples in the 0.0 to 5.0-ft depth interval with an EPC of 1.08 mg/kg. Selenium was not detected above the BV in any samples in the 0.0 to 5.0-ft depth interval; only a detection limit of 1.7 mg/kg was reported above the soil BV. The detection limit is equivalent to the maximum soil background concentration. The EPC, which represents the average exposure concentration, is below the soil BV (1.52 mg/kg) and below the maximum soil background concentration (1.7 mg/kg). The selenium LOAEL-based ESL for the shrew is 0.99 mg/kg, which is below the soil BV and the maximum soil background concentration. The shrew EPC indicates the average exposure to the COPECs is similar to background. Therefore, the potential ecological risks to the robin, shrew, deer mouse, and plant from selenium are overestimated.

In addition, field observations made during the site visit found no indication of adverse effects from COPECs on the plant community (Attachment I-3). The site currently has minimal active operations and is becoming naturalized, with abundant habitat for ecological receptors, including plants. Therefore, the HI does not indicate potential unacceptable risk to plants or other biota.

I-5.4.7.3 SWMU 49-001(e)

The unadjusted HIs for SWMU 49-001(e) are equivalent to or greater than 1 for the robin (all diets), shrew, deer mouse, earthworm, and plant, with arsenic, barium, beryllium, chromium, cobalt, copper, lead, manganese, nickel, selenium, thallium, and vanadium being the primary COPECs for one or more receptors. The HI analysis using LOAEL-based ESLs resulted in HIs of 3 for the robin (herbivore), 4 for the robin (omnivore), 5 for the robin (insectivore), 3 for the shrew, 2 for the deer mouse, 0.4 for the earthworm, and 3 for the plant (Table I-5.4-19).

The LOAEL-based plant HI is in part from barium, manganese, and thallium (1.5). Barium was detected in all 159 samples in the 0.0 to 5.0-ft depth interval with an EPC of 190 mg/kg. The EPC, which represents the average exposure concentration, is below the maximum soil background concentration (410 mg/kg) and is slightly above the average soil background concentration of 143 mg/kg. The plant LOAEL-based ESL for barium is 260 mg/kg, which is less than the soil BV (295 mg/kg) and below the maximum soil background concentration. Manganese was detected in all 159 samples in the 0.0 to 5.0-ft depth interval with an EPC of 396 mg/kg. The EPC, which represents the average exposure concentration, is below the

maximum soil and Qbt 2,3,4 background concentrations (1100 mg/kg and 752 mg/kg) and slightly above the manganese soil background average concentration of 340 mg/kg. The plant LOAEL-based ESL for manganese is 1100 mg/kg, which is the same as the maximum soil background concentration. Thallium was detected in 108 of the 159 samples and the EPC (0.53 mg/kg) was below the maximum soil and Qbt 2,3,4 background concentrations (1 mg/kg and 1.7 mg/kg) and equivalent to the plant LOAEL-based ESL (0.5 mg/kg), which is below the soil and Qbt 2,3,4 BVs (0.73 mg/kg and 1.1 mg/kg). Therefore, the potential ecological risks to the plant from barium, manganese, and thallium are overestimated.

The LOAEL-based shrew HI is in part from nickel (0.4). Nickel was detected in all 159 samples in the 0.0 to 5.0-ft depth interval with an EPC of 8.42 mg/kg. The EPC, which represents the average exposure concentration, is below the maximum soil background concentration (29 mg/kg), slightly above the maximum Qbt 2,3,4 background concentration (7 mg/kg), and is slightly above the average soil background concentration of 7.07 mg/kg. The shrew LOAEL-based ESL for nickel is 19 mg/kg, which is similar to the soil BV (15.4 mg/kg) and is below the maximum soil background concentration. Therefore, the potential ecological risk to the shrew from nickel is overestimated.

The LOAEL-based robin HIs are in part from lead and vanadium (1.8, 2.1, 2.4). Lead was detected in all 159 samples in the 0.0 to 5.0-ft depth interval with an EPC of 16.5 mg/kg. The EPC is below the maximum soil background concentration (28 mg/kg), slightly above the maximum Qbt 2,3,4 background concentrations (15.5 mg/kg), and slightly above the average soil background concentration of 12.7 mg/kg. The robin (insectivore) LOAEL-based ESL for lead is 28 mg/kg, which is the minimum LOEAL-based ESL, and is the same as the maximum soil background concentration. Vanadium was detected in all 159 samples in the 0.0 to 5.0-ft depth interval with an EPC of 23.9 mg/kg. The EPC, which represents the average exposure concentration, is below the maximum soil background concentration (56.5 mg/kg), slightly above the maximum Qbt 2,3,4 background concentration (21 mg/kg), and slightly above the vanadium soil background average concentration of 21.3 mg/kg. The vanadium LOAEL-based ESLs for the robin (13 mg/kg, 15 mg/kg, and 17 mg/kg) are below the soil BV (39.6 mg/kg), similar to the Qbt 2,3,4 BV (17 mg/kg), and below the maximum soil and Qbt 2,3,4 background concentrations. The EPCs indicate the average exposure to the COPECs is similar to background, and some of the screening levels are also similar to background concentrations. Therefore, the potential ecological risks to the robin from lead and vanadium are overestimated.

The LOAEL-based robin, shrew, deer mouse, and plant HIs are in part or entirely from copper and selenium. Copper was detected in all 159 samples in the 0.0 to 5.0-ft depth interval with an EPC of 66.9 mg/kg and a maximum concentration of 1780 mg/kg (next highest concentration is 36.4 mg/kg), which strongly biases the copper EPC. Without the maximum concentration, the EPC is 7.58 mg/kg, which is below the maximum soil background concentrations (16 mg/kg), and is slightly above the average soil background concentration of 6.06 mg/kg. Selenium was detected in 130 of the 159 samples and the EPC (1.3 mg/kg) was below the maximum soil background concentration (1.7 mg/kg). The selenium LOAEL-based ESLs are between 0.99 mg/kg and 2 mg/kg for the robin, shrew, and deer mouse and are below, similar to, or slightly above the soil BV (1.52 mg/kg) and/or the maximum soil background concentration. Therefore, the potential ecological risks to the robin, shrew, deer mouse, and plant from copper and selenium are overestimated.

In addition, field observations made during the site visit found no indication of adverse effects from COPECs on the plant community (Attachment I-3). The site currently has minimal active operations and is becoming naturalized, with abundant habitat for ecological receptors, including plants. Therefore, the HI does not indicate potential unacceptable risk to plants or other biota.

I-5.4.7.4 SWMU 49-001(f)

The unadjusted HIs for SWMU 49-001(f) are equivalent to or greater than 1 for the robin (all diets), shrew, deer mouse, earthworm, and plant, with arsenic, barium, chromium, cobalt, copper, lead, mercury, nickel, selenium, thallium, vanadium, and bis(2-ethylhexyl)phthalate being the primary COPECs for one or more receptors. The HI analysis using LOAEL-based ESLs resulted in HIs of 2 for the robin (herbivore), 4 for the robin (omnivore), 5 for the robin (insectivore), 2 for the shrew, approximately 1 for the deer mouse, 0.1 for the earthworm, and 2 for the plant (Table I-5.4-20).

The LOAEL-based plant HI is in part from barium and thallium (1.3). Barium was detected in all 153 samples in the 0.0 to 5.0-ft depth interval with an EPC of 160 mg/kg. The EPC, which represents the average exposure concentration, is below the maximum soil background concentration (410 mg/kg), and is slightly above the average soil background concentration of 143 mg/kg. The LOAEL-based plant ESL for barium is 260 mg/kg, which is less than the soil BV (295 mg/kg) and below the maximum soil background concentration. Thallium was detected in 68 of the 153 samples and the EPC (0.328 mg/kg) was below the maximum soil and Qbt 2,3,4 background concentrations (1 mg/kg and 1.7 mg/kg) and less than the LOAEL-based plant ESL (0.5 mg/kg). The LOAEL-based plant ESL is below the soil and Qbt 2,3,4 BVs (0.73 mg/kg and 1.1 mg/kg). Therefore, the potential ecological risks to the plant from barium and thallium are overestimated.

The LOAEL-based shrew HI is in part from nickel (0.4). Nickel was detected in all 153 samples in the 0.0 to 5.0-ft depth interval with an EPC of 8.29 mg/kg. The EPC, which represents the average exposure concentration, is below the maximum soil background concentrations (29 mg/kg), slightly above the maximum Qbt 2,3,4 background concentration (7 mg/kg), and slightly above the average soil background concentration of 7.07 mg/kg. The shrew LOAEL-based ESL for nickel is 19 mg/kg, which is similar to the soil BV (15.4 mg/kg) and below the maximum soil background concentration. Therefore, the potential ecological risk to the shrew from nickel is overestimated.

The LOAEL-based robin HIs are in part from lead and vanadium (1.7, 2, 2.3). Lead was detected in all 153 samples in the 0.0 to 5.0-ft depth interval with an EPC of 15.7 mg/kg. The EPC, which represents the average exposure concentration, is below the maximum soil background concentration (28 mg/kg), slightly above the maximum Qbt 2,3,4 background concentration (15.5 mg/kg), and slightly above the average soil background concentration of 12.7 mg/kg. The robin (insectivore) LOAEL-based ESL for lead is 28 mg/kg, which is the minimum LOEAL-based ESL and is the same as the maximum soil background concentration. Vanadium was detected in all 153 samples in the 0.0 to 5.0-ft depth interval with an EPC of 22.9 mg/kg. The EPC, which represents the average exposure concentration, is below the maximum soil background concentration (56.5 mg/kg), slightly above the maximum Qbt 2,3,4 background concentration (21 mg/kg), and slightly above the average soil background concentration of 21.3 mg/kg. The vanadium LOAEL-based ESLs for the robin (13 mg/kg, 15 mg/kg, and 17 mg/kg) are below the soil BV (39.6 mg/kg), similar to the Qbt 2,3,4 BV (17 mg/kg), and below the maximum soil and Qbt 2,3,4 background concentrations. The EPCs indicate the average exposure to the COPECs is similar to background, and some of the screening levels are also similar to background concentrations. Therefore, the potential ecological risks to the robin from lead and vanadium are overestimated.

The LOAEL-based robin, shrew, deer mouse, and plant HIs are in part or entirely from selenium. Selenium was detected in 94 of the 153 samples, and the EPC (1.15 mg/kg) was below the maximum soil background concentration (1.7 mg/kg). The selenium LOAEL-based ESLs are between 0.99 mg/kg and 2 mg/kg for the robin, shrew, and deer mouse and are below, similar to, or slightly above the soil BV (1.52 mg/kg) and/or the maximum soil background concentration. Therefore, the potential ecological risks to the robin, shrew, deer mouse, and plant from selenium are overestimated.

The LOAEL-based robin (omnivore and insectivore) HIs are in part from bis(2-ethylhexyl)phthalate (0.6 and 1.2). Bis(2-ethylhexyl)phthalate was detected in 2 of 16 samples analyzed for semivolatile organic compounds, and the EPC is the maximum detected concentration; the other concentration was approximately an order of magnitude lower and approximately 240 ft northwest of the maximum. The mean of the 2 concentrations is 0.15 mg/kg and reduces the HQs by approximately one-third. Therefore, the potential risk to the robin from bis(2-ethylhexyl)phthalate is overestimated by the maximum detected concentration.

In addition, field observations made during the site visit found no indication of adverse effects from COPECs on the plant community (Attachment I-3). The site currently has minimal active operations and is becoming naturalized, with abundant habitat for ecological receptors, including plants. Therefore, the HI does not indicate potential risk to plants or other biota.

I-5.4.7.5 SWMU 49-003

The unadjusted HIs for SWMU 49-003 are greater than 1 for the earthworm and plant, with arsenic, barium, and selenium being the primary COPECs for one or both receptors. The HI analysis using LOAEL-based ESLs resulted in HIs of 0.2 for the earthworm and 2 for the plant (Table I-5.4-21).

The LOAEL-based plant HI is from barium and selenium (1.8). Barium was detected in all 11 samples in the 0.0 to 5.0-ft depth interval with an EPC of 337 mg/kg. The EPC, which represents the average exposure concentration, is below the maximum soil background concentration (410 mg/kg). The plant LOAEL-based ESL for barium is 260 mg/kg, which is less than the soil BV (295 mg/kg) and the maximum soil background concentration. Selenium was detected in 8 of the 11 samples and the EPC (1.38 mg/kg) was below the maximum soil background concentration (1.7 mg/kg). The average exposure to COPECs is similar to background, and some of the screening levels are also similar to background concentrations. Therefore, the potential for ecological risks to plants from barium and selenium are overestimated.

In addition, field observations made during the site visit found no indication of adverse effects from COPECs on the plant community (Attachment I-3). The site currently has minimal active operations and is becoming naturalized, with abundant habitat for ecological receptors, including plants. Therefore, the HI does not indicate potential risk to plants or other biota.

I-5.4.7.6 AOC 49-008(c)

The adjusted and unadjusted HIs for AOC 49-008(c) are equivalent to or greater than 1 for the deer mouse and plant, with selenium being the primary COPEC. The HI analysis using LOAEL-based ESLs resulted in HIs of 2 for the deer mouse and 0.6 for the plant (Table I-5.4-22). The adjusted HI analysis using the LOAEL-based ESL was equivalent to 1 for the deer mouse (Table I-5.4-23).

The LOAEL-based deer mouse HI is from selenium (1.6). Selenium was detected in six of the seven samples in the 0.0 to 5.0-ft depth interval and the EPC (1.9 mg/kg) is the maximum detected concentration. Only three of seven samples had concentrations above the soil BV, and two of those samples had concentrations above the maximum soil background concentration (1.7 mg/kg); the maximum detected concentration (1.9 mg/kg) were only 0.2 mg/kg above the maximum soil background concentration. The LOAEL-based selenium ESL for the deer mouse is 1.2 mg/kg, which is below the soil BV (1.52 mg/kg) and the maximum soil background concentration. The average exposure to selenium is similar to background, and the deer mouse screening level is also similar to background concentrations. Therefore, the potential for ecological risk to the deer mouse from selenium is overestimated.

In addition, field observations made during the site visit found no indication of adverse effects from COPECs on the plant community (Attachment I-3). The site currently has minimal active operations and is becoming naturalized, with abundant habitat for ecological receptors, including plants. Therefore, the HI does not indicate potential risk to plants or other biota.

I-5.4.7.7 AOC 49-008(d)

The adjusted and unadjusted HIs for AOC 49-008(d) are greater than 1 for the robin (insectivore and omnivore), shrew, deer mouse, and plant, with copper, selenium, thallium, uranium, Aroclor-1254, and bis(2-ethylhexyl)phthalate being the primary COPECs for one or more receptors. The HI analysis using LOAEL-based ESLs resulted in HIs of 2 for the robin (insectivore) and shrew and HIs of approximately 1 for the robin (omnivore), deer mouse, and plant (Table I-5.4-24). The adjusted HI analysis using LOAEL-based ESLs was less than 1 for the robin and shrew (Table I-5.4-25). The HI for the deer mouse is not adjusted by the PAUF because the site area is greater than the population area.

The LOAEL-based deer mouse and plant HIs are in part from selenium (0.8 and 0.3). Selenium was detected in 56 of the 65 samples in the 0.0 to 5.0-ft depth interval, and the EPC (1.01 mg/kg) was below the soil BV (1.52 mg/kg) and the maximum soil background concentration (1.7 mg/kg). The selenium LOAEL-based ESL for the deer mouse is 1.2 mg/kg, which is below the soil BV and the maximum soil background concentration. The average exposure to selenium is similar to background, and the deer mouse screening level is also similar to background concentrations. Therefore, the potential for ecological risks to the deer mouse and plant from selenium are overestimated.

The LOAEL-based plant HI is also in part from thallium (0.5). Thallium was detected in 10 of 65 samples in the 0.0 to 5.0-ft depth interval with an EPC of 0.259 mg/kg. The EPC, which represents the average exposure concentration, is below the soil BV (0.73 mg/kg), below the maximum soil background concentration (1 mg/kg), and similar to the average soil background concentration (0.276 mg/kg). The LOAEL-based plant ESL (0.5 mg/kg) is also below the soil BV and maximum soil background concentration. The EPC indicates the average exposure to selenium and thallium is similar to background, and the thallium and selenium screening levels are also similar to background concentrations. Therefore, the potential ecological risk to the plant from thallium is overestimated.

I-5.4.8 Chemicals without ESLs

Several COPECs do not have ESLs for any receptor in Version 3.3 of the ECORISK Database (LANL 2015, 600921). In an effort to address this uncertainty and to provide a quantitative assessment of potential ecological risk, several online toxicity databases searches were conducted to determine if any relevant toxicity information is available. The online searches of the following databases were conducted: EPA Ecotox Database, EPA Office of Pesticide Programs Aquatic Life Benchmarks, U.S. Army Corps of Engineers/EPA Environmental Residue-Effects, California Cal/Ecotox Database, Pesticide Action Network Pesticide Database, U.S. Army Wildlife Toxicity Assessment Program, U.S. Department of Agriculture Integrated Pesticide Management Database, American Bird Conservancy Pesticide Toxicity Database, and Oak Ridge National Laboratory Risk Assessment Information System. Some COPECs without ESLs do not have chemical-specific toxicity data or surrogate chemicals to be used in the screening assessments and cannot be assessed quantitatively for potential ecological risk.

In the absence of a chemical-specific ESL, COPEC concentrations can be compared with ESLs for a surrogate chemical. Comparison to surrogate ESLs provides an estimate of potential effects of a chemically related compound and a line of evidence to indicate the likelihood that ecological receptors are potentially impacted.

Some COPECs without ESLs do not have chemical-specific toxicity data or surrogate chemicals to be used in the screening assessments and cannot be assessed quantitatively for potential ecological risk. These COPECs are often infrequently detected across the site. In these cases, comparisons to residential human health SSLs are presented as part of a qualitative assessment. The comparison of COPEC concentrations to residential human health SSLs is a viable alternative for several reasons. Animal studies are used to infer effects on humans and is the basic premise of modern toxicology (EPA 1989, 008021). In addition, toxicity values derived for the calculation of human health SSLs are often based on potential effects that are more sensitive than the ones used to derive ESLs (e.g., cellular effects for humans versus survival or reproductive effects for terrestrial animals). The EPA also applies uncertainty factors or modifying factors to ensure that the toxicity values are protective (i.e., they are adjusted by uncertainty factors to values much lower than the study results). COPEC concentrations compared with these values are an order of magnitude or more below the SSLs, which corresponds to uncertainty factors of 10 or more. Therefore, it is assumed the differences in toxicity would not be more than an order of magnitude for any given chemical. The relative difference between values provides a weight of evidence that the potential toxicity of the COPC is likely to be low or very low to the receptor(s). The COPECs without ESLs were common to many of the sites and are discussed below for each site.

No ESLs are available for calcium, iron, magnesium, perchlorate, chloromethane, and 4-isopropyltoluene, and no surrogate or other toxicity information is available for calcium, iron, magnesium, perchlorate, and chloromethane. For 4-isopropyltoluene, a surrogate is used based on structural similarity to evaluate the potential toxicity.

Calcium was identified as a COPC from 0.0 to 5.0 ft at four sites, with maximum concentrations ranging from 6510 mg/kg to 14,800 mg/kg. As presented in Table I-4.4-1, concentrations of calcium are substantially less than the NMED essential nutrient SSLs. Calcium is eliminated as a COPEC.

Chloromethane was identified as a COPC from 0.0 to 5.0 ft at a site in one sample at a concentration of 0.00092 mg/kg. The NMED residential SSL for chloromethane is 6260 mg/kg, indicating that potential toxicity is very low. Because chloromethane is infrequently detected and the potential toxicity is very low, chloromethane is eliminated as a COPEC.

Iron was identified as a COPC from 0.0 to 5.0 ft at four sites, with a maximum concentration of 25,000 mg/kg. The concentrations are below the maximum soil background concentration (36,000 mg/kg). Iron is an essential micronutrient for plants and animals. Consequently, organisms regulate its uptake. In well-aerated soil between pH 5 and 8 (soil pH for the TA-49 sites inside the NES is neutral to slightly alkaline), iron is not expected to be toxic to plants (EPA 2003, 111415). In addition, the NMED residential SSL is 54,800 mg/kg, indicating that potential toxicity is very low. Iron is eliminated as a COPEC.

Isopropyltoluene[4-] was identified as a COPC from 0.0 to 5.0 ft at two sites, with concentrations ranging from 0.00029 mg/kg to 0.0023 mg/kg. The minimum ESL for toluene (23 mg/kg for the shrew) is used to screen 4-isopropyltoluene and results in a maximum HQ of 0.0001. Because the maximum HQ is less than 0.3, 4-isopropyltoluene is eliminated as a COPEC.

Magnesium was identified as a COPC from 0.0 to 5.0 ft at three sites, with maximum concentrations ranging from 3630 mg/kg to 4430 mg/kg. As presented in Table I-4.4-1, concentrations of magnesium are substantially less than the NMED essential nutrient SSLs. Magnesium is eliminated as a COPEC.

Perchlorate was identified as a COPC from 0.0 to 5.0 ft in nine samples at four sites, with concentrations ranging from 0.0027 mg/kg to 0.16 mg/kg. The NMED residential SSL for perchlorate is 54.5 mg/kg, indicating that potential toxicity is low. Because perchlorate is infrequently detected and the potential low toxicity, perchlorate is eliminated as a COPEC.

I-5.5 Interpretation of Ecological Risk-Screening Results

I-5.5.1 Receptor Lines of Evidence

Based on the ecological risk-screening assessments, several COPECs (including COPECs without an ESL) were identified for TA-49 sites inside the NES boundary. Receptors were evaluated using several lines of evidence: minimum ESL comparisons, HI analyses, potential effects to populations (individuals for T&E species), LOAEL analyses, and the relationship of detected concentrations and detection limits to background concentrations.

Plant

- Initial screening using the minimum ESLs eliminated a number of COPECs because the HQs for all of the receptors, including the plant, were less than 0.3.
- The HIs were greater than 1 for the plant at all sites.
- The HI analyses using the LOAEL-based ESLs resulted in HIs less than or equivalent to 1 for SWMUs 49-001(b,c,d,g) and AOCs 49-008(c) and 49-008(d).
- Field observations made during the site visits found no indication of adverse effects on the plant community from COPECs. The site currently has minimal active operations and is becoming naturalized, with abundant habitat for ecological receptors, including plants.
- As discussed in section I-5.4.7, the potential risks to the plant are overestimated.

These lines of evidence support the conclusion that no potential ecological risk to the plants exists at the TA-49 sites inside the NES boundary.

Earthworm (Invertebrate)

- Initial screening using the minimum ESLs eliminated a number of COPECs because the HQs for all of the receptors, including the earthworm, were less than 0.3.
- The HIs were greater than 1 for the earthworm at all sites, except at SWMUs 49-001(b,c,d,g) and AOCs 49-008(c) and 49-008(d).
- The HI analyses using the LOAEL-based ESLs resulted in HIs less than 1 for all sites.

These lines of evidence support the conclusion that no potential ecological risk to the earthworm exists at the TA-49 sites inside the NES boundary.

Montane Shrew (Insectivore)

- Initial screening using the minimum ESLs eliminated a number of COPECs because the HQs for all of the receptors, including the shrew, were less than 0.3.
- The HIs were greater than 1 for the shrew at all sites.
- The HIs were adjusted by the PAUFs, which is the ratio of the site area to the shrew's population area, for SWMU 49-003 and AOCs 49-008(c) and 49-008(d). The adjusted HIs were less than at SWMU 49-003 and AOC 49-008(c) but greater than 1 at AOC 49-008(d). The HIs for the other sites were not adjusted by the PAUFs because the site area exceeded the population area.

- The LOAEL-based ESL analyses resulted in HIs greater than or equivalent to 1 at SWMUs 49-001(a), 49-001(b,c,d,g), 49-001(e), and 49-001(f) and AOC 49-008(d). The HIs greater than 1 at these sites ranged from 2 to 3. The HIs were the result of exposure to inorganic COPECs with EPCs similar to background.
- The LOAEL-based HI was adjusted by the PAUF at AOC 49-008(d), which resulted in an HI less than 1.

These lines of evidence support the conclusion that no potential ecological risk to the montane shrew exists at the TA-49 sites inside the NES boundary.

Deer Mouse (Omnivore)

- Initial screening using the minimum ESLs eliminated a number of COPECs because the HQs for all of the receptors, including the deer mouse, were less than 0.3.
- The HIs were greater than or equivalent to 1 for the deer mouse at all sites.
- The HIs were adjusted by the PAUFs, which is the ratio of the site area to the deer mouse's population area, for SWMU 49-003 and AOC 49-008(c). The adjusted HIs were less than 1 for SWMU 49-003 and greater than 1 for AOC 49-008(c). The HIs for the other sites were not adjusted by the PAUFs because the site area exceeded the population area.
- The LOAEL-based ESL analyses resulted in HIs less than or equivalent to 1, except for SWMU 49-001(e). The HIs greater than or equivalent to 1 were the result of exposure to inorganic COPECs with EPCs similar to background.

These lines of evidence support the conclusion that no potential ecological risk to the deer mouse exists at the TA-49 sites inside the NES boundary.

Desert Cottontail (Herbivore)

- Initial screening using the minimum ESLs eliminated a number of COPECs because the HQs for all of the receptors, including the cottontail, were less than 0.3.
- The HIs were equivalent to or less than 1 for the cottontail at all sites, except at SWMU 49-001(e).
- The HIs were adjusted by the PAUFs, which is the ratio of the site area to the cottontail's population area. The adjusted HIs were less than 1 at all sites.

These lines of evidence support the conclusion that no potential ecological risk to the cottontail exists at the TA-49 sites inside the NES boundary.

Red Fox (Carnivore)

- Initial screening using the minimum ESLs eliminated a number of COPECs because the HQs for all of the receptors, including the fox, were less than 0.3.
- The HIs were less than 1 for the red fox at all sites.

These lines of evidence support the conclusion that no potential ecological risk to the red fox exists at the TA-49 sites inside the NES boundary.

Pocket Gopher (Burrowing Mammal, Air Pathway Only)

- Initial screening using the minimum ESLs eliminated all soil gas COPECs because the HQs for the pocket gopher were less than 0.3.
- The HI for the pocket gopher was less than 1.

These lines of evidence support the conclusion that no potential ecological risk to the gopher exists at the TA-49 sites inside the NES boundary.

Robin (All Feeding Guilds)

- Initial screening using the minimum ESLs eliminated a number of COPECs because the HQs for all of the receptors, including the robin, were less than 0.3.
- The HIs were greater than or equivalent to 1 for the robin (all feeding guilds) at all sites, except at AOC 49-008(c), which had an HI of less than 1 for the robin (herbivore).
- The HIs were adjusted by the PAUFs, which is the ratio of the site area to the robin's population area, for SWMU 49-003 and AOCs 49-008(c) and 49-008(d). The adjusted HIs were less than 1 at SWMU 49-003, less than or equivalent to 1 at AOC 49-008(c), and less than 1 for the robin (herbivore) but greater than 1 for the robin (omnivore and insectivore) at AOC 49-008(d). The HIs for the other sites were not adjusted by the PAUFs because the site area exceeded the population area.
- The LOAEL-based ESL analyses resulted in HIs less than 1 at SWMU 49-001(b,c,d,g) and AOC 49-008(c). The LOAEL-based HIs at SWMUs 49-001(a), 49-001(e), and 49-001(f) and AOC 49-008(d) were greater than or equivalent to 1. The HIs greater than or equivalent to 1 were the result of exposure to inorganic COPECs with EPCs similar to background.
- The LOAEL-based HIs were adjusted by the PAUF at AOC 49-008(d), which resulted in HIs less than 1.

These lines of evidence support the conclusion that no potential ecological risk to the robin (all feeding guilds) exists at the TA-49 sites inside the NES boundary.

Kestrel (Intermediate Carnivore)

- Initial screening using the minimum ESLs eliminated a number of COPECs because the HQs for all of the receptors, including the kestrel (intermediate carnivore), were less than 0.3.
- The HIs were greater than or equivalent to 1 for the kestrel (intermediate carnivore) at all sites, except at SWMUs 49-001(a), 49-001(b,c,d,g), and 49-003.
- The HIs were adjusted by the PAUFs, which is the ratio of the site area to the kestrel's population area. The adjusted HIs were less than 1 for all sites.

These lines of evidence support the conclusion that no potential ecological risk to the kestrel (intermediate carnivore) exists at the TA-49 sites inside the NES boundary.

Kestrel (Top Carnivore)

- Initial screening using the minimum ESLs eliminated a number of COPECs because the HQs for all of the receptors, including the kestrel (top carnivore), were less than 0.3.
- The HIs were less than 1 for the kestrel (top carnivore) at all sites.
- The kestrel (top carnivore) is a surrogate for the Mexican spotted owl. The HIs were adjusted by the Mexican spotted owl AUFs. The adjusted HIs were less than 1 at all sites.

These lines of evidence support the conclusion that no potential ecological risks to the kestrel (top carnivore) and the Mexican spotted owl exist at the TA-49 sites inside the NES boundary.

I-5.5.2 COPECs with No ESLs

COPECs without ESLs were eliminated based on comparisons to surrogate ESLs or human health SSLs. The analysis of COPECs without ESLs supports the conclusion that no potential ecological risk to receptors exists at the TA-49 sites inside the NES boundary.

I-5.5.3 Summary

Based on evaluations of the minimum ESLs, HI analyses, potential effects to populations (individuals for T&E species), LOAEL analyses, the relationship of detected concentrations and screening levels to background concentrations, and COPECs without ESLs, no potential ecological risks to the earthworm, plant, American robin, American kestrel, deer mouse, montane shrew, desert cottontail, red fox, pocket gopher, and Mexican spotted owl exist for the TA-49 sites inside the NES.

I-6.0 CONCLUSIONS

I-6.1 Human Health Risk

Ten sites were evaluated for potential present-day human health risks.

The total excess cancer risks for the industrial scenario were less than the 1×10^{-5} target risk level at all sites. The HIs for the industrial scenario were also less than the target HI of 1 at all sites.

The total excess cancer risks for the residential scenario were less than or equivalent to 1×10^{-5} at eight sites and above 1×10^{-5} at two sites based on the soil and vapor intrusion screening results. Nine sites had HIs less than or equivalent to 1, and one site had an HI above 1 based on the soil and vapor intrusion screening results. SWMU 49-001(e) had a total excess cancer risk of 2×10^{-5} and an HI of 2, which are above the NMED target levels. SWMU 49-001(f) also had a total excess cancer risk of 2×10^{-5}.

The total doses were below the target dose limit of 25 mrem/yr as authorized by DOE Order 458.1 for the industrial and residential scenarios at all sites. The total doses were equivalent to total risks ranging from 1×10^{-7} to 4×10^{-4} for the industrial scenario and from 1×10^{-7} to 1×10^{-5} for the residential scenario, based on conversion from dose using RESRAD Version 7.0.

Sites at TA-49 inside the NES boundary are not accessible by the public and are not planned for release by DOE in the foreseeable future. Therefore, an as low as reasonably achievable (ALARA) evaluation for radiological exposure to the public is not currently required. Should DOE's plans for releasing these areas change, an ALARA evaluation will be conducted at that time. It should be noted that the Laboratory addresses considerations for radiation exposures to workers under the Laboratory's occupational

radiological protection program in compliance with 10 Code of Federal Regulations 835. The Laboratory's radiation protection program implements ALARA and consists of the following elements: management commitment, training, design review, radiological work review, performance assessments, and documentation.

I-6.2 Ecological Risk

Based on evaluations of the minimum ESLs, HI analyses, potential effects to populations (individuals for T&E species), LOAEL analyses, the relationship of detected concentrations and screening levels to background concentrations, and COPECs without ESLs, no potential unacceptable ecological risks to the earthworm, plant, American robin, American kestrel, deer mouse, montane shrew, desert cottontail, red fox, pocket gopher, and Mexican spotted owl exist at TA-49 sites inside the NES boundary.

I-7.0 REFERENCES

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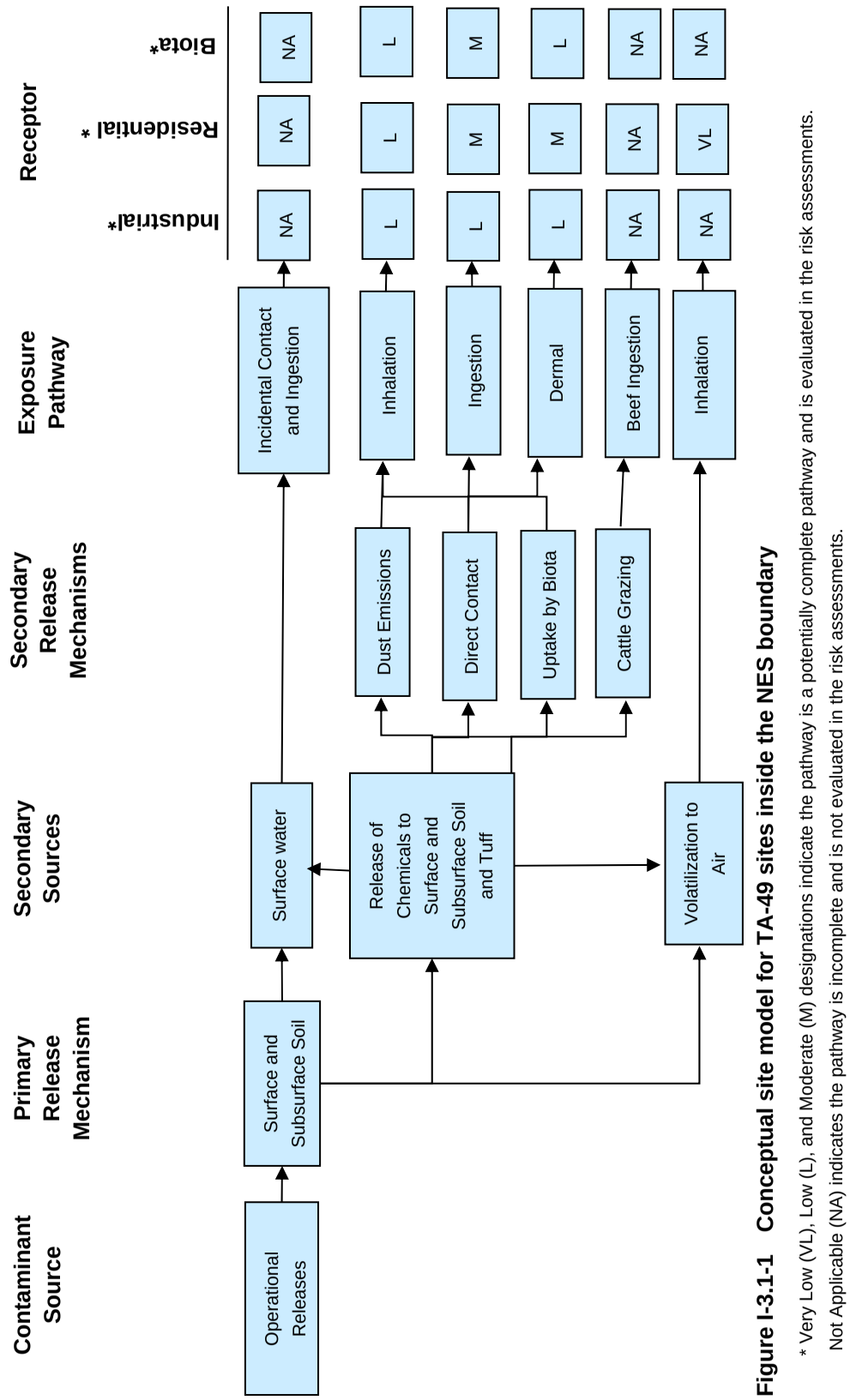


Figure I-3.1-1 Conceptual site model for TA-49 sites inside the NES boundary

* Very Low (VL), Low (L), and Moderate (M) designations indicate the pathway is a potentially complete pathway and is evaluated in the risk assessments.
Not Applicable (NA) indicates the pathway is incomplete and is not evaluated in the risk assessments.

Table I-2.3-1
EPCs at SWMU 49-001(a) for the Industrial Scenario

COPC	Number of Analyses	Number of Detects	Minimum Concentration	Maximum Concentration	Distribution	EPC	EPC Method
Inorganic Chemicals (mg/kg)							
Aluminum	149	149	2230	22300	Gamma	9640	95% Approximate Gamma
Barium	149	149	31.4	915	Nonparametric	137	95% Student's-t
Chromium (Total)	149	132	3.2	25.4	Normal	10.8	95% KM (t)
Cobalt	149	149	1.3	44.5	Nonparametric	8.87	95% Chebyshev (Mean, Sd)
Manganese	149	149	80.8	2430	Gamma	432	95% Approximate Gamma
Nickel	149	149	2.4	31.7	Nonparametric	8.66	95% Student's-t
Selenium	149	140	0.73	2.1(U)	Lognormal	1.15	95% KM (BCA)
Vanadium	149	149	5.8	56.2	Nonparametric	26.5	95% Student's-t
Radionuclides (pCi/g)							
Cesium-134	139	2	-0.238(U)	0.586	n/a*	0.586	Maximum detected concentration

Note: Data qualifiers are defined in Appendix A.
* n/a = Not applicable.

Table I-2.3-2
EPCs at SWMU 49-001(a) for the Residential Scenario and Ecological Risk

COPC	Number of Analyses	Number of Detects	Minimum Concentration	Maximum Concentration	Distribution	EPC	EPC Method
Inorganic Chemicals (mg/kg)							
Aluminum	153	153	2230	22300	Nonparametric	9540	95% Student's-t
Barium	153	153	31.4	915	Nonparametric	136	95% Student's-t
Chromium (Total)	153	136	2.9	25.4	Normal	10.7	95% KM (t)
Cobalt	153	153	1.1	44.5	Nonparametric	8.71	95% Chebyshev (Mean, Sd)
Manganese	153	153	80.8	2430	Gamma	425	95% Approximate Gamma
Nickel	153	153	2.4	31.7	Nonparametric	8.57	95% Student's-t

Table I-2.3-2 (continued)

COPC	Number of Analyses	Number of Detects	Minimum Concentration	Maximum Concentration	Distribution	EPC	EPC Method
Perchlorate	4	2	0.0027	0.0053(U)	n/a*	0.0036	Maximum detected concentration
Selenium	153	144	0.73	2.1(U)	Lognormal	1.15	95% KM (BCA)
Vanadium	153	153	4	56.2	Nonparametric	26.1	95% Student's-t
Radionuclides (pCi/g)							
Cesium-134	139	2	-0.238(U)	0.586	n/a	0.586	Maximum detected concentration
Tritium	4	2	-0.042(U)	0.178	n/a	0.178	Maximum detected concentration

Note: Data qualifiers are defined in Appendix A.

* n/a = Not applicable.

Table I-2.3-3
EPCs at SWMUs 49-001(b, c, d, g) for the Industrial Scenario

COPC	Number of Analyses	Number of Detects	Minimum Concentration	Maximum Concentration	Distribution	EPC	EPC Method
Inorganic Chemicals (mg/kg)							
Cobalt	104	104	1.6	14.1	Nonparametric	6.84	95% Chebyshev (Mean, Sd)
Selenium	104	103	0.57	1.7(U)	Lognormal	1.09	95% KM (BCA)
Radionuclides (pCi/g)							
Americium-241	104	12	-0.0186(U)	4.91	Nonparametric	0.269	95% KM Chebyshev
Plutonium-238	104	2	-0.032(U)	1.41	n/a*	1.41	Maximum detected concentration
Plutonium-239/240	104	17	-0.024(U)	73.5	Nonparametric	3.94	95% KM Chebyshev
Uranium-238	104	104	0.264	4.98	Lognormal	0.913	95% Student's-t

Note: Data qualifiers are defined in Appendix A.

* n/a = Not applicable.

Table I-2.3-4
EPCs at SWMU 49-001(b, c, d, g) for the Residential Scenario

COPC	Number of Analyses	Number of Detects	Minimum Concentration	Maximum Concentration	Distribution	EPC	EPC Method
Inorganic Chemicals (mg/kg)							
Cobalt	110	110	0.76	14.1	Nonparametric	6.75	95% Chebyshev (Mean, Sd)
Selenium	110	105	0.36(U)	1.8	Lognormal	1.08	95% KM (BCA)
Organic Chemicals (mg/kg)							
Bis(2-ethylhexyl)phthalate	2	1	0.069	0.34(UJ)	n/a*	0.069	Maximum detected concentration
Radionuclides (pCi/g)							
Americium-241	113	12	-0.0186(U)	4.91	Nonparametric	0.246	95% KM Chebyshev
Plutonium-238	111	2	-0.032(U)	1.41	n/a	1.41	Maximum detected concentration
Plutonium-239/240	111	18	-0.024(U)	73.5	Nonparametric	3.69	95% KM Chebyshev
Uranium-238	120	120	0.264	4.98	Lognormal	0.896	95% Student's-t

Note: Data qualifiers are defined in Appendix A.
* n/a = Not applicable.

Table I-2.3-5
EPCs at SWMUs 49-001(b, c, d, g) for Ecological Risk

COPC	Number of Analyses	Number of Detects	Minimum Concentration	Maximum Concentration	Distribution	EPC	EPC Method
Inorganic Chemicals (mg/kg)							
Cobalt	107	107	1.6	14.1	Nonparametric	6.84	95% Chebyshev (Mean, Sd)
Selenium	107	103	0.36(U)	1.7(U)	Lognormal	1.08	95% KM (BCA)
Radionuclides (pCi/g)							
Americium-241	108	12	-0.0186(U)	4.91	Nonparametric	0.258	95% KM Chebyshev
Plutonium-238	107	2	-0.032(U)	1.41	n/a*	1.41	Maximum detected concentration
Plutonium-239/240	107	18	-0.024(U)	73.5	Nonparametric	3.83	95% KM Chebyshev
Uranium-238	112	112	0.264	4.98	Lognormal	0.898	95% Student's-t

Note: Data qualifiers are defined in Appendix A.
* n/a = Not applicable.

Table I-2.3-6
EPCs at SWMU 49-001(e) for the Industrial Scenario

COPC	Number of Analyses	Number of Detects	Minimum Concentration	Maximum Concentration	Distribution	EPC	EPC Method
Inorganic Chemicals (mg/kg)							
Aluminum	156	156	2030	24400	Gamma	12100	95% Approximate Gamma
Arsenic	156	156	1.2	10.3	Nonparametric	4.03	95% Student's-t
Barium	156	156	26.4	654	Nonparametric	188	95% Chebyshev (Mean, Sd)
Beryllium	156	156	0.31	2.3	Nonparametric	1.01	95% Student's-t
Chromium (Total)	156	156	3.3	21.2	Normal	10.6	95% Student's-t
Cobalt	156	156	0.57	26	Nonparametric	6.9	95% Chebyshev (Mean, Sd)
Copper	156	156	1.8	1780	Nonparametric	68.1	95% Chebyshev (Mean, Sd)
Iron	156	156	2300	25000	Normal	14100	95% Student's-t
Lead	156	156	6.5	54.4	Nonparametric	16.5	95% Student's-t
Manganese	156	156	40.5	2060	Gamma	401	95% Approximate Gamma
Nickel	156	156	2.1	17.5	Nonparametric	8.42	95% Student's-t
Selenium	156	127	0.24(UJ)	2.9	Gamma	1.31	95% KM (BCA)
Thallium	156	105	0.16	5.3	Lognormal	0.54	95% KM (BCA)
Vanadium	156	156	3.5	42	Nonparametric	24.1	95% Student's-t
Radionuclides (pCi/g)							
Cesium-134	165	2	-0.174(U)	0.16(U)	n/a*	0.082	Maximum detected concentration
Cesium-137	165	36	-0.05(U)	0.75	Gamma	0.0518	95% KM (t)

Note: Data qualifiers are defined in Appendix A.

* n/a = Not applicable.

Table I-2.3-7
EPCs at SWMU 49-001(e) for the Residential Scenario and Ecological Risk

COPC	Number of Analyses	Number of Detects	Minimum Concentration	Maximum Concentration	Distribution	EPC	EPC Method
Inorganic Chemicals (mg/kg)							
Aluminum	159	159	2030	24400	Gamma	12100	95% Approximate Gamma
Arsenic	159	159	1.2	10.3	Nonparametric	4.05	95% Student's-t
Barium	159	159	26.4	654	Nonparametric	190	95% Chebyshev (Mean, Sd)
Beryllium	159	159	0.31	2.3	Nonparametric	1.01	95% Student's-t
Chromium (Total)	159	159	3.3	21.2	Normal	10.6	95% Student's-t
Cobalt	159	159	0.57	26	Nonparametric	6.83	95% Chebyshev (Mean, Sd)
Copper	159	159	1.8	1780	Nonparametric	66.9	95% Chebyshev (Mean, Sd)
Iron	159	159	2300	25000	Normal	14100	95% Student's-t
Lead	159	159	6.5	54.4	Nonparametric	16.5	95% Student's-t
Manganese	159	159	37.7	2060	Gamma	396	95% Approximate Gamma
Nickel	159	159	2.1	17.5	Nonparametric	8.42	95% Student's-t
Perchlorate	4	2	0.0044	0.0058	n/a*	0.0058	Maximum detected concentration
Selenium	159	130	0.24(UJ)	2.9	Gamma	1.3	95% KM (BCA)
Thallium	159	108	0.16	5.3	Lognormal	0.534	95% KM (BCA)
Vanadium	159	159	3.5	42	Nonparametric	23.9	95% Student's-t
Radionuclides (pCi/g)							
Cesium-134	165	2	-0.174(U)	0.16(U)	n/a	0.082	Maximum detected concentration
Cesium-137	165	36	-0.05(U)	0.75	Gamma	0.0518	95% KM (t)

Note: Data qualifiers are defined in Appendix A.

* n/a = Not applicable.

Table I-2.3-8
EPCs at SWMU 49-001(f) for the Industrial Scenario

COPC	Number of Analyses	Number of Detects	Minimum Concentration	Maximum Concentration	Distribution	EPC	EPC Method
Inorganic Chemicals (mg/kg)							
Aluminum	151	151	623	23500	Nonparametric	12200	95% Chebyshev (Mean, Sd)
Arsenic	151	145	0.54	7	Lognormal	3.12	95% KM (BCA)
Barium	151	151	13.1	435	Normal	161	95% Student's-t
Chromium (Total)	151	151	1.9	20.1	Nonparametric	9.65	95% Student's-t
Cobalt	151	150	0.27	18.1	Lognormal	5.74	95% KM (BCA)
Copper	151	151	1.3	125	Nonparametric	8.94	95% Student's-t
Lead	151	151	3.7	51.5	Nonparametric	15.9	95% Student's-t
Mercury	148	106	0.0131	1.1(U)	Gamma	0.0258	95% KM (Percentile Bootstrap)
Nickel	151	151	0.79	23.4	Nonparametric	8.34	95% Student’s-t
Selenium	151	92	0.57	2.1	Normal	1.15	95% KM (t)
Thallium	151	67	0.18	1.8	Lognormal	0.329	95% KM (t)
Vanadium	151	151	1.9	33.8	Nonparametric	23	95% Chebyshev (Mean, Sd)
Organic Chemicals (mg/kg)							
Bis(2-ethylhexyl)phthalate	2	1	0.056	0.37(UJ)	n/a*	0.056	Maximum detected concentration
Radionuclides (pCi/g)							
Americium-241	143	3	-0.0151(U)	0.5924	n/a	0.592	Maximum detected concentration
Cesium-134	140	1	-0.117(U)	0.062	n/a	0.062	Maximum detected concentration
Tritium	2	1	0.12(U)	0.176	n/a	0.176	Maximum detected concentration

Note: Data qualifiers are defined in Appendix A.

* n/a = Not applicable.

Table I-2.3-9
EPCs at SWMU 49-001(f) for the Residential Scenario and Ecological Risk

COPC	Number of Analyses	Number of Detects	Minimum Concentration	Maximum Concentration	Distribution	EPC	EPC Method
Inorganic Chemicals (mg/kg)							
Aluminum	153	153	623	23500	Nonparametric	12100	95% Chebyshev (Mean, Sd)
Arsenic	153	147	0.47	7	Lognormal	3.08	95% KM (BCA)
Barium	153	153	13.1	435	Normal	160	95% Student's-t
Chromium (Total)	153	153	1	20.1	Nonparametric	9.58	95% Student's-t
Cobalt	153	152	0.27	18.1	Lognormal	5.66	95% KM (BCA)
Copper	153	153	0.92	125	Nonparametric	11.1	95% Chebyshev (Mean, Sd)
Lead	153	153	3.7	51.5	Nonparametric	15.7	95% Student's-t
Mercury	150	106	0.0131	1.1(U)	Gamma	0.0258	95% KM (Percentile Bootstrap)
Nickel	153	153	0.79	23.4	Nonparametric	8.29	95% Student's-t
Selenium	153	94	0.55	2.1	Normal	1.15	95% KM (t)
Thallium	153	68	0.18	1.8	Lognormal	0.328	95% KM (t)
Vanadium	153	153	1.9	33.8	Nonparametric	22.9	95% Chebyshev (Mean, Sd)
Organic Chemicals (mg/kg)							
Bis(2-ethylhexyl)phthalate	4	2	0.056	0.37(UJ)	n/a*	0.24	Maximum detected concentration
Radionuclides (pCi/g)							
Americium-241	145	3	-0.0151(U)	0.5924	n/a	0.592	Maximum detected concentration
Cesium-134	140	1	-0.117(U)	0.062	n/a	0.062	Maximum detected concentration
Tritium	4	2	0.064(U)	8.39	n/a	8.39	Maximum detected concentration

Note: Data qualifiers are defined in Appendix A.

* n/a = Not applicable.

Table I-2.3-10
EPCs at SWMU 49-003 for the Industrial Scenario

COPC	Number of Analyses	Number of Detects	Minimum Concentration	Maximum Concentration	Distribution	EPC	EPC Method
Inorganic Chemicals (mg/kg)							
Barium	6	6	109	460	n/a*	460	Maximum detected concentration
Nickel	6	6	7	15.6	n/a	15.6	Maximum detected concentration
Perchlorate	5	3	0.0044	0.047	n/a	0.047	Maximum detected concentration
Selenium	6	5	1.1	2(U)	n/a	1.8	Maximum detected concentration
Organic Chemicals (mg/kg)							
Methylene chloride	5	1	0.0028	0.0059(U)	n/a	0.0028	Maximum detected concentration
Radionuclides (pCi/g)							
Americium-241	6	3	0.0054(U)	0.653	n/a	0.653	Maximum detected concentration
Plutonium-238	6	2	-0.011(U)	0.088	n/a	0.088	Maximum detected concentration
Plutonium-239/240	6	4	0.017(U)	4.87	n/a	4.87	Maximum detected concentration

Note: Data qualifiers are defined in Appendix A.

* n/a = Not applicable.

Table I-2.3-11
EPCs at SWMU 49-003 for the Residential Scenario

COPC	Number of Analyses	Number of Detects	Minimum Concentration	Maximum Concentration	Distribution	EPC	EPC Method
Inorganic Chemicals (mg/kg)							
Antimony	14	6	0.089(U)	1	Normal	0.591	95% KM (t)
Arsenic	14	14	0.84	4.7	Normal	3.84	95% Student's-t
Barium	14	14	14.1	460	Gamma	318	95% Adjusted Gamma
Copper	14	14	1.2	9.2	Normal	6.98	95% Student's-t
Nickel	14	14	1.8	15.6	Normal	10.2	95% Student's-t
Perchlorate	8	5	0.0031	0.047	Normal	0.0236	95% KM (t)
Selenium	14	10	0.46(U)	2(U)	Normal	1.4	95% KM (t)

Table I-2.3-11 (continued)

COPC	Number of Analyses	Number of Detects	Minimum Concentration	Maximum Concentration	Distribution	EPC	EPC Method
Organic Chemicals (mg/kg)							
Benzyl alcohol	8	1	0.056	0.39(U)	n/a*	0.056	Maximum detected concentration
Bis(2-ethylhexyl)phthalate	8	1	0.051	0.39(UJ)	n/a	0.051	Maximum detected concentration
Methylene chloride	8	1	0.0028	0.0059(U)	n/a	0.0028	Maximum detected concentration
Radionuclides (pCi/g)							
Americium-241	20	3	-0.139(U)	0.653	n/a	0.653	Maximum detected concentration
Cesium-137	12	1	-0.04(U)	0.138	n/a	0.138	Maximum detected concentration
Plutonium-238	14	5	-0.011(U)	0.088	Normal	0.0172	95% KM (t)
Plutonium-239/240	14	6	-0.002(U)	4.87	Gamma	1.07	95% KM (t)
Tritium	8	1	-0.026(UJ)	0.222	n/a	0.222	Maximum detected concentration

Note: Data qualifiers are defined in Appendix A.

* n/a = Not applicable.

Table I-2.3-12
EPCs at SWMU 49-003 for Ecological Risk

COPC	Number of Analyses	Number of Detects	Minimum Concentration	Maximum Concentration	Distribution	EPC	EPC Method
Inorganic Chemicals (mg/kg)							
Antimony	11	6	0.28(U)	1	Normal	0.742	95% KM (t)
Arsenic	11	11	2.8	4.7	Normal	4.13	95% Student's-t
Barium	11	11	72.2	460	Gamma	337	95% Adjusted Gamma
Copper	11	11	3.8	9.2	Normal	7.74	95% Student's-t
Nickel	11	11	5.6	15.6	Normal	11.4	95% Student's-t
Selenium	11	8	0.46(U)	2(U)	Normal	1.38	95% KM (t)
Organic Chemicals (mg/kg)							
Methylene chloride	5	1	0.0028	0.0059(U)	n/a*	0.0028	Maximum detected concentration

Table I-2.3-12 (continued)

COPC	Number of Analyses	Number of Detects	Minimum Concentration	Maximum Concentration	Distribution	EPC	EPC Method
Radionuclides (pCi/g)							
Americium-241	17	3	-0.139(U)	0.653	n/a	0.653	Maximum detected concentration
Cesium-137	12	1	-0.04(U)	0.138	n/a	0.138	Maximum detected concentration
Plutonium-238	11	5	-0.011(U)	0.088	Normal	0.0234	95% KM (t)
Plutonium-239/240	11	6	-0.002(U)	4.87	Gamma	1.41	95% KM (BCA)

Note: Data qualifiers are defined in Appendix A.

* n/a = Not applicable.

Table I-2.3-13
EPCs at AOC 49-008(c) for the Industrial Scenario and Ecological Risk

COPC	Number of Analyses	Number of Detects	Minimum Concentration	Maximum Concentration	Distribution	EPC	EPC Method
Inorganic Chemicals (mg/kg)							
Perchlorate	7	5	0.0032	0.0088	n/a*	0.0088	Maximum detected concentration
Selenium	7	6	1.3	1.9	n/a	1.9	Maximum detected concentration
Organic Chemicals (mg/kg)							
Benzyl alcohol	7	7	0.048	0.19	n/a	0.19	Maximum detected concentration
Bis(2-ethylhexyl)phthalate	7	1	0.056	0.37(U)	n/a	0.056	Maximum detected concentration
Isopropyltoluene[4-]	7	1	0.00029	0.0057(U)	n/a	0.00029	Maximum detected concentration
Nitrotoluene[3-]	7	1	0.43(U)	0.56	n/a	0.56	Maximum detected concentration
Radionuclides (pCi/g)							
Plutonium-239/240	7	5	7e-04(U)	1.02	n/a	1.02	Maximum detected concentration

Note: Data qualifiers are defined in Appendix A.

* n/a = Not applicable.

Table I-2.3-14
EPCs at AOC 49-008(c) for the Residential Scenario

COPC	Number of Analyses	Number of Detects	Minimum Concentration	Maximum Concentration	Distribution	EPC	EPC Method
Inorganic Chemicals (mg/kg)							
Perchlorate	12	9	0.0032	0.16	nonparametric	0.0811	95% KM Chebyshev UCL
Selenium	14	11	0.44(U)	2.5	Normal	1.81	95% KM (t)
Organic Chemicals (mg/kg)							
Benzyl alcohol	14	12	0.04	1.4(U)	Normal	0.11	95% KM (t)
Bis(2-ethylhexyl)phthalate	14	4	0.053	0.37(U)	n/a*	0.07	Maximum detected concentration
Isopropyltoluene[4-]	12	1	0.00029	0.0057(U)	n/a	0.00029	Maximum detected concentration
Nitroglycerin	12	1	0.053	0.71(UJ)	n/a	0.053	Maximum detected concentration
Nitrotoluene[3-]	14	1	0.25(U)	0.56	n/a	0.56	Maximum detected concentration
Radionuclides (pCi/g)							
Plutonium-238	14	1	-0.0037(U)	0.036(U)	n/a	0.009	Maximum detected concentration
Plutonium-239/240	14	6	0(U)	1.02	Gamma	0.253	95% KM (t)
Tritium	12	1	-0.043(U)	0.34(UJ)	n/a	0.245	Maximum detected concentration

Note: Data qualifiers are defined in Appendix A.
* n/a = Not applicable.

Table I-2.3-15
EPCs at AOC 49-008(d) for the Industrial Scenario

COPC	Number of Analyses	Number of Detects	Minimum Concentration	Maximum Concentration	Distribution	EPC	EPC Method
Inorganic Chemicals (mg/kg)							
Antimony	54	27	0.084	2.1	Nonparametric	0.29	95% KM (t)
Copper	63	63	2.6	391	Nonparametric	40.6	95% Chebyshev (Mean, Sd)
Selenium	63	54	0.21(U)	1.5	Normal	1.01	95% KM (t)
Thallium	63	10	0.1(U)	1.7	Gamma	0.263	95% KM (t)
Uranium	9	9	4.4	68.4	Normal	36.6	95% Student's-t

Table I-2.3-15 (continued)

COPC	Number of Analyses	Number of Detects	Minimum Concentration	Maximum Concentration	Distribution	EPC	EPC Method
Organic Chemicals (mg/kg)							
Acetone	57	4	0.0084	2.6(U)	n/a*	0.18	Maximum detected concentration
Aroclor-1254	58	2	0.027	0.17(U)	n/a	0.055	Maximum detected concentration
Aroclor-1260	58	2	0.013	0.17(U)	n/a	0.046	Maximum detected concentration
Benzo(g,h,i)perylene	64	3	0.04	66(U)	n/a	0.049	Maximum detected concentration
BHC[alpha-]	1	1	0.0012	0.0012	n/a	0.0012	Maximum detected concentration
Bis(2-ethylhexyl)phthalate	64	5	0.051(U)	66(U)	Normal	0.099	95% KM (t)
Chlordane[alpha-]	1	1	0.0029	0.0029	n/a	0.0029	Maximum detected concentration
Chlordane[gamma-]	1	1	0.0024	0.0024	n/a	0.0024	Maximum detected concentration
Chlorobenzene	57	4	0.00065	0.66(U)	n/a	0.0011	Maximum detected concentration
Chloromethane	57	1	0.00092	1.3(U)	n/a	0.00092	Maximum detected concentration
Dichlorobenzene[1,4-]	64	3	0.00044	66(U)	n/a	0.00071	Maximum detected concentration
Isopropyltoluene[4-]	57	2	0.00042	0.66(U)	n/a	0.0023	Maximum detected concentration
Methylene chloride	57	1	0.0033	0.66(U)	n/a	0.0033	Maximum detected concentration
Radionuclides (pCi/g)							
Americium-241	79	1	-0.0079(U)	0.53(U)	n/a	0.086	Maximum detected concentration
Cesium-134	79	1	-0.127(U)	0.18(U)	n/a	0.039	Maximum detected concentration
Plutonium-239/240	63	17	-0.0022(U)	0.483	Gamma	0.0568	95% KM (t)
Uranium-234	60	60	0.373	3.84	Lognormal	1.08	95% Student's-t
Uranium-235/236	60	10	0(U)	0.42	Nonparametric	0.0752	95% KM Chebyshev
Uranium-238	60	60	0.302	22.74	Nonparametric	3.93	95% Chebyshev (Mean, Sd)

Note: Data qualifiers are defined in Appendix A.

* n/a = Not applicable.

Table I-2.3-16
EPCs at AOC 49-008(d) for the Residential Scenario and Ecological Risk

COPC	Number of Analyses	Number of Detects	Minimum Concentration	Maximum Concentration	Distribution	EPC	EPC Method
Inorganic Chemicals (mg/kg)							
Antimony	56	29	0.084	2.1	Nonparametric	0.288	95% KM (t)
Copper	65	65	2.6	391	Nonparametric	39.6	95% Chebyshev (Mean, Sd)
Selenium	65	56	0.21(U)	1.5	Normal	1.01	95% KM (t)
Thallium	65	10	0.1(U)	1.7	Gamma	0.259	95% KM (t)
Uranium	9	9	4.4	68.4	Normal	36.6	95% Student's-t
Organic Chemicals (mg/kg)							
Acetone	59	4	0.0084	2.6(U)	n/a*	0.18	Maximum detected concentration
Aroclor-1254	58	2	0.027	0.17(U)	n/a	0.055	Maximum detected concentration
Aroclor-1260	58	2	0.013	0.17(U)	n/a	0.046	Maximum detected concentration
Benzo(g,h,i)perylene	66	3	0.04	66(U)	n/a	0.049	Maximum detected concentration
BHC[alpha-]	1	1	0.0012	0.0012	n/a	0.0012	Maximum detected concentration
Bis(2-ethylhexyl)phthalate	66	6	0.051(U)	66(U)	Normal	0.0964	95% KM (t)
Chlordane[alpha-]	1	1	0.0029	0.0029	n/a	0.0029	Maximum detected concentration
Chlordane[gamma-]	1	1	0.0024	0.0024	n/a	0.0024	Maximum detected concentration
Chlorobenzene	59	4	0.00065	0.66(U)	n/a	0.0011	Maximum detected concentration
Chloromethane	59	1	0.00092	1.3(U)	n/a	0.00092	Maximum detected concentration
Dichlorobenzene[1,4-]	66	3	0.00044	66(U)	n/a	0.00071	Maximum detected concentration
Isopropyltoluene[4-]	59	2	0.00042	0.66(U)	n/a	0.0023	Maximum detected concentration
Methylene chloride	59	1	0.0033	0.66(U)	n/a	0.0033	Maximum detected concentration
Radionuclides (pCi/g)							
Americium-241	81	1	-0.0079(U)	0.53(U)	n/a	0.086	Maximum detected concentration
Cesium-134	79	1	-0.127(U)	0.18(U)	n/a	0.039	Maximum detected concentration
Plutonium-239/240	65	17	-0.0022(U)	0.483	Gamma	0.0551	95% KM (t)
Uranium-234	62	62	0.373	3.84	Gamma	1.06	95% Approximate Gamma
Uranium-235/236	62	10	0(U)	0.42	Nonparametric	0.0728	95% KM Chebyshev
Uranium-238	62	62	0.302	22.74	Nonparametric	3.84	95% Chebyshev (Mean, Sd)

Note: Data qualifiers are defined in Appendix A.

* n/a = Not applicable.

Table I-3.2-1
Physical and Chemical Properties of
Inorganic COPCs for TA-49 Sites Inside the NES

COPC	K_d[a] (cm^3/g)	Water Solubility[a,b] (g/L)
Aluminum	1500	Insoluble
Antimony	45	Insoluble
Arsenic	29	Insoluble
Barium	41	Insoluble
Beryllium	790	Insoluble
Chromium (Total)	850	Insoluble
Cobalt	45	Insoluble
Copper	35	Insoluble
Iron	25	Insoluble
Lead	900	Insoluble
Manganese	65	Insoluble
Mercury	52	Insoluble
Nickel	65	Insoluble
Perchlorate	na[c]	245
Selenium	5	Insoluble
Thallium	71	Insoluble
Uranium	0.4	Insoluble
Vanadium	1000	Insoluble

[a] Information from http://rais.ornl.gov/cgi-bin/tox/TOX_select?select=nrad.

[b] Denotes reference information from http://www.epa.gov/superfund/sites/npl/hrsres/tools/scdm.htm.

[c] na = Not available.

Table I-3.2-2
Physical and Chemical Properties of Organic COPCs for TA-49 Sites Inside the NES

COPC	Water Solubility[a] (mg/L)	Organic Carbon Coefficient K_{oc}[a] (L/kg)	Log Octanol-Water Partition Coefficient K_{ow}[a]	Vapor Pressure[a] (mm Hg at 25°C)
Acetone	1.00E+06[b]	1.98E+00	-2.40E-01[b]	2.31E+02[b]
Aroclor-1254	3.40E-03[b]	5.30E+05[c]	6.79E+00[b]	6.53E-06[b]
Aroclor-1260	2.84E-04[b]	5.30E+05[c]	8.27E+00[b]	4.05E-05[b]
Benzene	1.79E+03	1.66E+02	2.13E+00	1.79E+03
Benzo(g,h,i)perylene	2.60E-04[b]	2.68E+06	6.63E+00[b]	1.00E-10[b]
Bis(2-ethylhexyl)phthalate	2.70E-01[b]	1.65E+05	7.60E+00[b]	1.42E-07[b]
Benzyl alcohol	4.30E+04[d]	2.10E+01[d]	1.10E+00[d]	9.40E-02
BHC[alpha-]	8.00E+00	2.81E+03	3.80E+00[d]	3.52E-05
Butanone[2-]	2.23E+05	3.83E+00	2.90E-01	9.06E+01
Carbon disulfide	1.18E+03	1.00E+00	1.94E+00	3.59E+02
Chlordane[alpha-]	5.60E-02	6.75E+04	6.22E+00	9.98E-06
Chlordane[gamma-]	5.60E-02	6.75E+04	6.22E+00	9.98E-06
Chlorobenzene	4.98E+02	2.34E+02	2.84E+00	1.20E+01
Chloromethane	5.32E+03	1.43E+01	9.10E-01	4.30E+03
Di-n-octylphthalate	2.20E-02	1.45E+05	8.10E+00	1.00E-07
Dichlorobenzene[1,4-]	8.13E+01	3.75E+02	3.44E+00	1.74E+00
Dichlorodifluoromethane	2.70E+03	3.18E+01	2.16E+00	4.85E+03
Ethylbenzene	1.69E+02	5.18E+02	3.15E+00	9.60E+00
Ethyltoluene[4-]	4.00E+01	na[e]	3.63E+00	6.66E+02
Isopropyltoluene[4-]	2.34E+01[b]	na	4.10E+00[b]	1.64E+00[b]
Methylene chloride	1.30E+04[b]	2.37E+01	1.30E+00[b]	4.30E+02[b]
Nitroglycerin	1.38E+03	1.16E+02	1.60E+00[d]	4.00E-04
Nitrotoluene[3-]	5.00E+02	3.63E+02	2.45E+00	2.05E-01
Styrene	3.10E+02	5.18E+02	2.95E+00	6.40E+00
Toluene	5.26E+02	2.68E+02	2.73E+00	2.84E+01
Trimethylbenzene[1,2,4-]	5.70E+01	7.18E+02	3.63E+00	2.10E+00
Trimethylbenzene[1,3,5-]	4.82E+01	6.02E+02	3.42E+00	2.10E+00
Xylene (Total)	1.78E+02	3.83E+02	3.12E+00	7.99E+00
Xylene[1,2-]	1.61E+02	4.34E+02	3.20E+00	8.29E+00
Xylene[1,3-]+1,4-Xylene[f]	1.78E+02	3.83E+02	3.12E+00	7.99E+00

[a] Information from http://rais.ornl.gov/cgi-bin/tools/TOX_search, unless noted otherwise.

[b] Information from http://www.epa.gov/superfund/sites/npl/hrsres/tools/scdm.htm.

[c] Information from NMED (2015, 600915).

[d] EPA regional screening tables (http://www.epa.gov/risk/risk-based-screening-table-generic-tables).

[e] na = Not available.

[f] Xylenes used as a surrogate.

Table I-3.2-3
Physical and Chemical Properties of
Radionuclide COPCs for TA-49 Sites Inside the NES

COPC	Soil-Water Partition Coefficient, K_d[a] (cm^3/g)	Water Solubility[b] (g/L)
Americium-241	680	Insoluble
Cesium-134	1000	Insoluble
Cesium-137	1000	Insoluble
Plutonium-238	4500	Insoluble
Plutonium-239/240	4500	Insoluble
Tritium	9.9	Soluble
Uranium-234	0.4	Insoluble
Uranium-235/236	0.4	Insoluble
Uranium-238	0.4	Insoluble

[a] Superfund Chemical Data Matrix (EPA 1996, 064708).

[b] Information from http://www.epa.gov/superfund/sites/npl/hrsres/tools/scdm.htm.

Table I-4.1-1
Exposure Parameters Used to Calculate
Chemical SSLs for the Industrial and Residential

Parameters	Residential Values	Industrial Values
Target HQ	1	1
Target cancer risk	10^{-5}	10^{-5}
Averaging time (carcinogen/mutagen)	70 yr × 365 d	70 yr × 365 d
Averaging time (noncarcinogen)	Exposure duration × 365 d	Exposure duration × 365 d
Skin absorption factor	Semivolatile organic compound (SVOC) = 0.1	SVOC = 0.1
	Chemical-specific	Chemical-specific
Adherence factor–child	0.2 mg/cm^2	n/a[a]
Body weight–child	15 kg (0–6 yr of age)	n/a
Cancer slope factor–oral (chemical-specific)	$(mg/kg\text{-}d)^{-1}$	$(mg/kg\text{-}d)^{-1}$
Inhalation unit risk (chemical-specific)	$(\mu g/m^3)$	$(\mu g/m^3)$
Exposure frequency	350 d/yr	225 d/yr
Exposure time	24 h/d	8 h/day
Exposure duration–child	6 yr[b]	n/a
Age-adjusted ingestion factor for carcinogens	36,750 mg/kg	n/a
Age-adjusted ingestion factor for mutagens	25,550 mg/kg	n/a
Soil ingestion rate–child	200 mg/d	n/a
Particulate emission factor	6.61×10^9 m^3/kg	6.61×10^9 m^3/kg
Reference dose–oral (chemical-specific)	(mg/kg-d)	(mg/kg-d)
Reference dose–inhalation (chemical-specific)	(mg/kg-d)	(mg/kg-d)
Exposed surface area–child	2690 cm^2/d	n/a
Age-adjusted skin contact factor for carcinogens	112266 mg/kg	n/a

Table I-4.1-1 (continued)

Parameters	Residential Values	Industrial Values
Age-adjusted skin contact factor for mutagens	166833 mg/kg	n/a
Volatilization factor for soil (chemical-specific)	(m^3/kg)	(m^3/kg)
Body weight–adult	80 kg	80 kg
Exposure duration[c]	30 yr[d]	25 yr
Adherence factor–adult	0.07 mg/cm^2	0.12 mg/cm^2
Soil ingestion rate–adult	100 mg/d	100 mg/d
Exposed surface area–adult	6032 cm^2/d	3470 cm^2/d

Note: Parameter values from NMED (2015, 600915).

[a] n/a = Not applicable.

[b] The child exposure duration for mutagens is subdivided into 0–2 yr and 2–6 yr.

[c] Exposure duration for lifetime resident is 26 yr. For carcinogens, the exposures are combined for child (6 yr) and adult (20 yr).

[d] The adult exposure duration for mutagens is subdivided into 6–16 yr and 16–30 yr.

Table I-4.1-2
Parameter Values Used to Calculate Radionuclide SALs for the Residential Scenario

Parameters	Residential, Child	Residential, Adult
Inhalation rate (m^3/yr)	4712[a]	7780[b]
Mass loading (g/m^3)	1.5×10^{-7}[c]	1.5×10^{-7}[c]
Outdoor time fraction	0.0926[d]	0.0934[e]
Indoor-time fraction	0.8656[f]	0.8648[g]
Soil ingestion (g/yr)	73[h]	36.5[i]

[a] Calculated as 12.9 m^3/d × 365.25 d/yr, where 12.9 m^3/d is the mean upper percentile daily inhalation rate of a child (EPA 2011, 208374, Table 6-1).

[b] Calculated as 21.3 m^3/d × 365.25 d/yr, where 21.3 m^3/d is the mean upper percentile daily inhalation rate of an adult from 21 to less than 61 yr old (EPA 2011, 208374, Table 6-1).

[c] Calculated as (1/6.6 × 10^9 m^3/kg) × 1000 g/kg, where 6.6 × 10^9 m^3/kg is the particulate emission factor (NMED 2015, 600915).

[d] Calculated as (2.32 h/d × 350 d/yr)/8766 h/yr, where 2.32 h/d (139 min) is the largest amount of time spent outdoors for child age groups between 1 to less than 3 mo and 3 to less than 6 yr (EPA 2011, 208374, Table 16-1) and is comparable with the adult time spent outdoors at a residence.

[e] Calculated as (2.34 h/d × 350 d/yr)/8766 h/yr, where 4.68 h/d is the average total time spent outdoors for adults age 18 to less than 65 yr in all environments (EPA 2011, 208374, Table 16-1); 50% of this value (2.34 h/d) was applied to time spent outdoors at a residence and is similar to mean time outdoors at a residence for this age group (EPA 2011, 208374, Table 16-22).

[f] Calculated as [(24 h/d–2.32 h/d) × 350 d/yr]/8766 h/yr.

[g] Calculated as [(24 h/d–2.34 h/d) × 350 d/yr]/8766 h/yr.

[h] The soil ingestion rate compensates for the time-based occupancy factor applied by RESRAD in calculating exposure from the soil ingestion pathway. Calculated as [0.2 g/d × 350 d/yr]/[indoor + outdoor time fractions], where 0.2 g/d is the upper percentile site-related daily child soil ingestion rate (NMED 2015, 600915; EPA 2011, 208374, Table 5-1).

[i] The soil ingestion rate compensates for the time-based occupancy factor applied by RESRAD in calculating exposure from the soil ingestion pathway. Calculated as [0.1 g/d × 350 d/yr]/[indoor + outdoor time fractions], where 0.1 g/d is the site-related daily adult soil ingestion rate (NMED 2015, 600915).

Table I-4.1-3
Parameter Values Used to Calculate Radionuclide SALs for the Industrial Scenario

Parameters	Industrial, Adult
Inhalation rate (m^3/yr)	7780[a]
Mass loading (g/m^3)	1.5×10^{-7}[b]
Outdoor time fraction	0.2053[c]
Indoor time fraction	0[d]
Soil ingestion (g/yr)	109.6[e]

[a] Calculated as [21.3 m^3/d × 365.25 d/yr], where 21.3 m^3/d is the upper percentile daily inhalation rate of an adult from 21 to less than 61 yr old (EPA 2011, 208374, Table 6-1).

[b] Calculated as (1 / 6.6×10^9 m^3/kg) x 1000 g/kg, where 6.6×10^9 m^3/kg is the particulate emission factor (NMED 2015, 600915).

[c] Calculated as (8 h/d × 225 d/yr)/8766 h/yr, where 8 h/d is an estimate of the average length of the work day and 225 d/yr is the exposure frequency (NMED 2015, 600915).

[d] The commercial/industrial worker is defined as someone who "spends most of the work day conducting maintenance or manual labor activities outdoors" (NMED 2015, 600915).

[e] The soil-ingestion rate compensates for the time-based occupancy factor applied by RESRAD in calculating exposure from the soil-ingestion pathway. Calculated as [0.1 g/d × 225 d/yr]/[indoor + outdoor time fractions], where 0.1 g/d is the site-related daily adult soil-ingestion rate (NMED 2015, 600915).

Table I-4.2-1
Industrial Carcinogenic Screening Evaluation for SWMU 49-001(a)

COPC	EPC (mg/kg)	Industrial SSL* (mg/kg)	Cancer Risk
Chromium (Total)	10.8	505	2.14E-07
		Total Excess Cancer Risk	**2E-07**

* SSLs from NMED (2015, 600915).

Table I-4.2-2
Industrial Noncarcinogenic Screening Evaluation for SWMU 49-001(a)

COPC	EPC (mg/kg)	Industrial SSL[a] (mg/kg)	HQ
Aluminum	9640	1,290,000	7.47E-03
Barium	137	255,000	5.37E-04
Cobalt	8.87	350[b]	2.53E-02
Manganese	432	160,000	2.70E-03
Nickel	8.66	25,700	3.37E-04
Selenium	1.15	6490	1.77E-04
Vanadium	26.5	6530	4.06E-03
		HI	**0.04**

[a] SSLs from NMED (2015, 600915) unless otherwise noted.

[b] EPA regional screening level (http://www.epa.gov/risk/risk-based-screening-table-generic-tables).

Table I-4.2-3
Industrial Radionuclide Screening Evaluation for SWMU 49-001(a)

COPC	EPC (pCi/g)	Industrial SAL* (pCi/g)	Dose (mrem/yr)
Cesium-134	0.586	17	8.62E-01
		Total Dose	**0.9**

* SALs from LANL (2015, 600929).

Table I-4.2-4
Residential Carcinogenic Screening Evaluation for SWMU 49-001(a)

COPC	EPC (mg/kg)	Residential SSL* (mg/kg)	Cancer Risk
Chromium (Total)	10.7	96.6	1.11E-06
		Total Excess Cancer Risk	**1E-06**

* SSLs from NMED (2015, 600915).

Table I-4.2-5
Residential Noncarcinogenic Screening Evaluation for SWMU 49-001(a)

COPC	EPC (mg/kg)	Residential SSL[a] (mg/kg)	HQ
Aluminum	9540	78,000	1.22E-01
Barium	136	15,600	8.72E-03
Cobalt	8.71	23[b]	3.79E-01
Manganese	425	10,500	4.05E-02
Nickel	8.57	1560	5.49E-03
Perchlorate	0.0036	54.8	6.57E-05
Selenium	1.15	391	2.94E-03
Vanadium	26.1	394	6.62E-02
		HI	**0.6**

[a] SSLs from NMED (2015, 600915) unless otherwise noted.

[b] EPA regional screening level (http://www.epa.gov/risk/risk-based-screening-table-generic-tables).

Table I-4.2-6
Residential Radionuclide Screening Evaluation for SWMU 49-001(a)

COPC	EPC (pCi/g)	Residential SAL* (pCi/g)	Dose (mrem/yr)
Cesium-134	0.586	5	2.93E+00
Tritium	0.178	1700	2.62E-03
		Total Dose	**3**

* SALs from LANL (2015, 600929).

Table I-4.2-7
Industrial Noncarcinogenic Screening Evaluation for SWMUs 49-001(b, c, d, g)

COPC	EPC (mg/kg)	Industrial SSL[a] (mg/kg)	HQ
Cobalt	6.84	350[b]	1.95E-02
Selenium	1.09	6490	1.68E-04
		HI	**0.02**

[a] SSLs from NMED (2015, 600915) unless otherwise noted.

[b] EPA regional screening level (http://www.epa.gov/risk/risk-based-screening-table-generic-tables).

Table I-4.2-8
Industrial Radionuclide Screening Evaluation for SWMUs 49-001(b, c, d, g)

COPC	EPC (pCi/g)	Industrial SAL* (pCi/g)	Dose (mrem/yr)
Americium-241	0.269	1000	6.73E-03
Plutonium-238	1.41	1300	2.71E-02
Plutonium-239/240	3.94	1200	8.21E-02
Uranium-238	0.913	710	3.21E-02
		Total Dose	**0.1**

* SALs from LANL (2015, 600929).

Table I-4.2-9
Residential Carcinogenic Screening Evaluation for SWMUs 49-001(b, c, d, g)

COPC	EPC (mg/kg)	Residential SSL* (mg/kg)	Cancer Risk
Bis(2-ethylhexyl)phthalate	0.069	380	1.82E-09
		Total Excess Cancer Risk	**2E-09**

* SSLs from NMED (2015, 600915).

Table I-4.2-10
Residential Noncarcinogenic Screening Evaluation for SWMUs 49-001(b, c, d, g)

COPC	EPC (mg/kg)	Residential SSL[a] (mg/kg)	HQ
Cobalt	6.75	23[b]	2.93E-01
Selenium	1.08	391	2.76E-03
		HI	**0.3**

[a] SSLs from NMED (2015, 600915) unless otherwise noted.

[b] EPA regional screening level (http://www.epa.gov/risk/risk-based-screening-table-generic-tables).

Table I-4.2-11
Residential Radionuclide Screening Evaluation for SWMUs 49-001(b, c,d, g)

COPC	EPC (pCi/g)	Residential SAL* (pCi/g)	Dose (mrem/yr)
Americium-241	0.246	83	7.41E-02
Plutonium-238	1.41	84	4.20E-01
Plutonium-239/240	3.69	79	1.17E+00
Uranium-238	0.896	150	1.49E-01
		Total Dose	**2**

* SALs from LANL (2015, 600929).

Table I-4.2-12
Industrial Carcinogenic Screening Evaluation for SWMU 49-001(e)

COPC	EPC (mg/kg)	Industrial SSL* (mg/kg)	Cancer Risk
Arsenic	4.03	21.5	1.87E-06
Chromium (Total)	10.6	505	2.10E-07
		Total Excess Cancer Risk	**2E-06**

* SSLs from NMED (2015, 600915).

Table I-4.2-13
Industrial Noncarcinogenic Screening Evaluation for SWMU 49-001(e)

COPC	EPC (mg/kg)	Industrial SSL[a] (mg/kg)	HQ
Aluminum	12100	1,290,000	9.38E-03
Barium	188	255,000	7.37E-04
Beryllium	1.01	2580	3.91E-04
Cobalt	6.9	350[b]	1.97E-02
Copper	68.1	51,900	1.31E-03
Iron	14100	908,000	1.55E-02
Lead	16.5	800	2.06E-02
Manganese	401	160,000	2.51E-03
Nickel	8.42	25,700	3.28E-04
Selenium	1.31	6490	2.02E-04
Thallium	0.54	13	4.15E-02
Vanadium	24.1	6530	3.69E-03
		HI	**0.1**

[a] SSLs from NMED (2015, 600915) unless otherwise noted.

[b] EPA regional screening level (http://www.epa.gov/risk/risk-based-screening-table-generic-tables).

Table I-4.2-14
Industrial Radionuclide Screening Evaluation for SWMU 49-001(e)

COPC	EPC (pCi/g)	Industrial SAL* (pCi/g)	Dose (mrem/yr)
Cesium-134	0.082	17	1.21E-01
Cesium-137	0.0518	41	3.16E-02
		Total Dose	**0.2**

* SALs from LANL (2015, 600929).

Table I-4.2-15
Residential Carcinogenic Screening Evaluation for SWMU 49-001(e)

COPC	EPC (mg/kg)	Residential SSL[a] (mg/kg)	Cancer Risk
Arsenic	4.05	4.25/6.8[b]	9.53E-06/5.96E-06
Chromium (Total)	10.6	96.6	1.10E-06
		Total Excess Cancer Risk	**1E-05/7E-06**

[a] SSLs from NMED (2015, 600915).

[b] EPA regional screening level (http://www.epa.gov/risk/risk-based-screening-table-generic-tables).

Table I-4.2-16
Residential Noncarcinogenic Screening Evaluation for SWMU 49-001(e)

COPC	EPC (mg/kg)	Residential SSL[a] (mg/kg)	HQ
Aluminum	12100	78,000	1.55E-01
Barium	190	15,600	1.22E-02
Beryllium	1.01	156	6.47E-03
Cobalt	6.83	23[b]	2.97E-01
Copper	66.9	3130	2.14E-02
Iron	14100	54,800	2.57E-01
Lead	16.5	400	4.13E-02
Manganese	396	10,500	3.77E-02
Nickel	8.42	1560	5.40E-03
Perchlorate	0.0058	54.8	1.06E-04
Selenium	1.3	391	3.32E-03
Thallium	0.534	0.782	6.83E-01
Vanadium	23.9	394	6.07E-02
		HI	**2**

[a] SSLs from NMED (2015, 600915) unless otherwise noted.

[b] EPA regional screening level (http://www.epa.gov/risk/risk-based-screening-table-generic-tables).

Table I-4.2-17
Residential Radionuclide Screening Evaluation for SWMU 49-001(e)

COPC	EPC (pCi/g)	Residential SAL* (pCi/g)	Dose (mrem/yr)
Cesium-134	0.082	5	4.10E-01
Cesium-137	0.0518	12	1.08E-01
		Total Dose	**0.5**

* SALs from LANL (2015, 600929).

Table I-4.2-18
Industrial Carcinogenic Screening Evaluation for SWMU 49-001(f)

COPC	EPC (mg/kg)	Industrial SSL* (mg/kg)	Cancer Risk
Arsenic	3.12	21.5	1.45E-06
Chromium (Total)	9.65	505	1.91E-07
Bis(2-ethylhexyl)phthalate	0.056	1830	3.06E-10
		Total Excess Cancer Risk	**2E-06**

* SSLs from NMED (2015, 600915).

Table I-4.2-19
Industrial Noncarcinogenic Screening Evaluation for SWMU 49-001(f)

COPC	EPC (mg/kg)	Industrial SSL[a] (mg/kg)	HQ
Aluminum	12200	1,290,000	9.46E-03
Barium	161	255,000	6.31E-04
Cobalt	5.74	350[b]	1.64E-02
Copper	8.94	51,900	1.72E-04
Lead	15.9	800	1.99E-02
Mercury	0.0258	389	6.63E-05
Nickel	8.34	25,700	3.25E-04
Selenium	1.15	6490	1.77E-04
Thallium	0.329	13	2.53E-02
Vanadium	23	6530	3.52E-03
		HI	**0.08**

[a] SSLs from NMED (2015, 600915) unless otherwise noted.

[b] EPA regional screening level (http://www.epa.gov/risk/risk-based-screening-table-generic-tables).

Table I-4.2-20
Industrial Radionuclide Screening Evaluation for SWMU 49-001(f)

COPC	EPC (pCi/g)	Industrial SAL* (pCi/g)	Dose (mrem/yr)
Americium-241	0.592	1000	1.48E-02
Cesium-134	0.062	17	9.12E-02
Tritium	0.176	2,400,000	1.83E-06
		Total Dose	**0.1**

* SALs from LANL (2015, 600929).

Table I-4.2-21
Residential Carcinogenic Screening Evaluation for SWMU 49-001(f)

COPC	EPC (mg/kg)	Residential SSL[a] (mg/kg)	Cancer Risk
Arsenic	3.08	4.25/6.8[b]	7.25E-06/4.53E-06
Chromium (Total)	9.58	96.6	9.92E-07
Bis(2-ethylhexyl)phthalate	0.24	380	6.32E-09
		Total Excess Cancer Risk	**8E-06/6E-06**

[a] SSLs from NMED (2015, 600915).

[b] EPA regional screening level (http://www.epa.gov/risk/risk-based-screening-table-generic-tables).

Table I-4.2-22
Residential Noncarcinogenic Screening Evaluation for SWMU 49-001(f)

COPC	EPC (mg/kg)	Residential SSL[a] (mg/kg)	HQ
Aluminum	12,100	78,000	1.55E-01
Barium	160	15,600	1.03E-02
Cobalt	5.66	23[b]	2.46E-01
Copper	11.1	3130	3.55E-03
Lead	15.7	400	3.93E-02
Mercury	0.0258	23.5	1.10E-03
Nickel	8.29	1560	5.31E-03
Selenium	1.15	391	2.94E-03
Thallium	0.328	0.782	4.19E-01
Vanadium	22.9	394	5.81E-02
		HI	**0.9**

[a] SSLs from NMED (2015, 600915) unless otherwise noted.

[b] EPA regional screening level (http://www.epa.gov/risk/risk-based-screening-table-generic-tables).

Table I-4.2-23
Residential Radionuclide Screening Evaluation for SWMU 49-001(f)

COPC	EPC (pCi/g)	Residential SAL* (pCi/g)	Dose (mrem/yr)
Americium-241	0.592	83	1.78E-01
Cesium-134	0.062	5	3.10E-01
Tritium	8.39	1700	1.23E-01
		Total Dose	**0.6**

* SALs from LANL (2015, 600929).

Table I-4.2-24
Industrial Noncarcinogenic Screening Evaluation for SWMU 49-003

COPC	EPC (mg/kg)	Industrial SSL* (mg/kg)	HQ
Barium	460	255,000	1.80E-03
Nickel	15.6	25,700	6.07E-04
Perchlorate	0.047	908	5.18E-05
Selenium	1.8	6490	2.77E-04
Methylene chloride	0.0028	5130	5.46E-07
		HI	**0.003**

* SSLs from NMED (2015, 600915).

Table I-4.2-25
Industrial Radionuclide Screening Evaluation for SWMU 49-003

COPC	EPC (pCi/g)	Industrial SAL* (pCi/g)	Dose (mrem/yr)
Americium-241	0.653	1000	1.63E-02
Plutonium-238	0.088	1300	1.69E-03
Plutonium-239/240	4.87	1200	1.01E-01
		Total Dose	**0.1**

* SALs from LANL (2015, 600929).

Table I-4.2-26
Residential Carcinogenic Screening Evaluation for SWMU 49-003

COPC	EPC (mg/kg)	Residential SSL[a] (mg/kg)	Cancer Risk
Arsenic	3.84	4.25/6.8[b]	9.04E-06/5.65E-06
Bis(2-ethylhexyl)phthalate	0.051	380	1.34E-09
		Total Excess Cancer Risk	**9E-06/6E-06**

[a] SSLs from NMED (2015, 600915).

[b] EPA regional screening level (http://www.epa.gov/risk/risk-based-screening-table-generic-tables).

Table I-4.2-27
Residential Noncarcinogenic Screening Evaluation for SWMU 49-003

COPC	EPC (mg/kg)	Residential SSL[a] (mg/kg)	HQ
Antimony	0.591	31.3	1.89E-02
Barium	318	15,600	2.04E-02
Copper	6.98	3130	2.23E-03
Nickel	10.2	1560	6.54E-03
Perchlorate	0.0236	54.8	4.31E-04
Selenium	1.4	391	3.58E-03
Benzyl alcohol	0.056	6300[b]	8.89E-06
Methylene chloride	0.0028	409	6.85E-06
		HI	**0.05**

[a] SSLs from NMED (2015, 600915) unless otherwise noted.

[b] EPA regional screening level (http://www.epa.gov/risk/risk-based-screening-table-generic-tables).

Table I-4.2-28
Residential Radionuclide Screening Evaluation for SWMU 49-003

COPC	EPC (pCi/g)	Residential SAL* (pCi/g)	Dose (mrem/yr)
Americium-241	0.653	83	1.97E-01
Cesium-137	0.138	12	2.88E-01
Plutonium-238	0.0172	84	5.12E-03
Plutonium-239/240	1.07	79	3.39E-01
Tritium	0.222	1700	3.26E-03
		Total Dose	**0.8**

* SALs from LANL (2015, 600929).

Table I-4.2-29
Industrial Carcinogenic Screening Evaluation for AOC 49-008(c)

COPC	EPC (mg/kg)	Industrial SSL* (mg/kg)	Cancer Risk
Bis(2-ethylhexyl)phthalate	0.056	1830	3.06E-10
		Total Excess Cancer Risk	**3E-10**

* SSLs from NMED (2015, 600915).

Table I-4.2-30
Industrial Noncarcinogenic Screening Evaluation for AOC 49-008(c)

COPC	EPC (mg/kg)	Industrial SSL[a] (mg/kg)	HQ
Perchlorate	0.0088	908	9.69E-06
Selenium	1.9	6490	2.93E-04
Benzyl alcohol	0.19	82,000[b]	2.32E-06
Isopropyltoluene[4-]	0.00029	14,200[c]	2.04E-08
Nitrotoluene[3-]	0.56	91.6	6.11E-03
		HI	**0.006**

[a] SSLs from NMED (2015, 600915) unless otherwise noted.

[b] EPA regional screening level (http://www.epa.gov/risk/risk-based-screening-table-generic-tables).

[c] Isopropylbenzene used a surrogate based on structural similarity.

Table I-4.2-31
Industrial Radionuclide Screening Evaluation for AOC 49-008(c)

COPC	EPC (pCi/g)	Industrial SAL* (pCi/g)	Dose (mrem/yr)
Plutonium-239/240	1.02	1200	2.13E-02
		Total Dose	**0.02**

* SALs from LANL (2015, 600929).

Table I-4.2-32
Residential Carcinogenic Screening Evaluation for AOC 49-008(c)

COPC	EPC (mg/kg)	Residential SSL* (mg/kg)	Cancer Risk
Bis(2-ethylhexyl)phthalate	0.07	380	1.84E-09
		Total Excess Cancer Risk	**2E-09**

* SSLs from NMED (2015, 600915).

Table I-4.2-33
Residential Noncarcinogenic Screening Evaluation for AOC 49-008(c)

COPC	EPC (mg/kg)	Residential SSL[a] (mg/kg)	HQ
Perchlorate	0.0811	54.8	1.48E-03
Selenium	1.81	391	4.63E-03
Benzyl alcohol	0.137	6300[b]	2.17E-05
Isopropyltoluene[4-]	0.00029	2360[c]	1.23E-07
Nitroglycerin	0.053	6.16	8.60E-03
Nitrotoluene[3-]	0.56	6.16	9.09E-02
		HI	**0.1**

[a] SSLs from NMED (2015, 600915) unless otherwise noted.

[b] EPA regional screening level (http://www.epa.gov/risk/risk-based-screening-table-generic-tables).

[c] Isopropylbenzene used a surrogate based on structural similarity.

Table I-4.2-34
Residential Radionuclide Screening Evaluation for AOC 49-008(c)

COPC	EPC (pCi/g)	Residential SAL* (pCi/g)	Dose (mrem/yr)
Plutonium-238	0.009	84	2.68E-03
Plutonium-239/240	0.253	79	8.01E-02
Tritium	0.245	1700	3.60E-03
		Total Dose	**0.09**

* SALs from LANL (2015, 600929).

Table I-4.2-35
Industrial Carcinogenic Screening Evaluation for AOC 49-008(d)

COPC	EPC (mg/kg)	Industrial SSL[a] (mg/kg)	Cancer Risk
Aroclor-1254	0.055	11.5	4.78E-08
Aroclor-1260	0.046	11.5	4.00E-08
BHC[alpha-]	0.0012	4.07	2.95E-09
Bis(2-ethylhexyl)phthalate	0.099	1830	5.41E-10
Chlordane[alpha-]	0.0029	89[b]	3.26E-10
Chlordane[gamma-]	0.0024	89[b]	2.70E-10
Chloromethane	0.00092	201	4.58E-11
Dichlorobenzene[1,4-]	0.00071	159	4.47E-11
		Total Excess Cancer Risk	**9E-08**

[a] SSLs from NMED (2015, 600915).

[b] Chlordane used a surrogate based on structural similarity.

Table I-4.2-36
Industrial Noncarcinogenic Screening Evaluation for AOC 49-008(d)

COPC	EPC (mg/kg)	Industrial SSL[a] (mg/kg)	HQ
Antimony	0.29	519	5.59E-04
Copper	40.6	51,900	7.82E-04
Selenium	1.01	6490	1.56E-04
Thallium	0.263	13	2.02E-02
Uranium	36.6	3880	9.43E-03
Acetone	0.18	960,000	1.88E-07
Benzo(g,h,i)perylene	0.049	25,300[b]	1.94E-06
Chlorobenzene	0.0011	2160	5.09E-07
Isopropyltoluene[4-]	0.0023	14,200[c]	1.62E-07
Methylene chloride	0.0033	5130	6.43E-07
		HI	**0.03**

[a] SSLs from NMED (2015, 600915).

[b] Pyrene used a surrogate based on structural similarity.

[c] Isopropylbenzene used a surrogate based on structural similarity.

Table I-4.2-37
Industrial Radionuclide Screening Evaluation for SWMU AOC 49-008(d)

COPC	EPC (pCi/g)	Industrial SAL* (pCi/g)	Dose (mrem/yr)
Americium-241	0.086	1000	2.15E-03
Cesium-134	0.039	17	5.74E-02
Plutonium-239/240	0.0568	1200	1.18E-03
Uranium-234	1.08	3100	8.71E-03
Uranium-235/236	0.0752	160	1.18E-02
Uranium-238	3.93	710	1.38E-01
		Total Dose	**0.2**

* SALs from LANL (2015, 600929).

Table I-4.2-38
Residential Carcinogenic Screening Evaluation for AOC 49-008(d)

COPC	EPC (mg/kg)	Residential SSL[a] (mg/kg)	Cancer Risk
Aroclor-1260	0.046	2.43	1.89E-07
BHC[alpha-]	0.0012	0.845	1.42E-08
Bis(2-ethylhexyl)phthalate	0.0964	380	2.54E-09
Chlordane[alpha-]	0.0029	17.7[b]	1.64E-09
Chlordane[gamma-]	0.0024	17.7[b]	1.36E-09
Chloromethane	0.00092	41.1	2.24E-10
Dichlorobenzene[1,4-]	0.00071	32.8	2.16E-10
		Total Excess Cancer Risk	**2E-07**

[a] SSLs from NMED (2015, 600915).

[b] Chlordane used a surrogate based on structural similarity.

Table I-4.2-39
Residential Noncarcinogenic Screening Evaluation for AOC 49-008(d)

COPC	EPC (mg/kg)	Residential SSL[a] (mg/kg)	HQ
Antimony	0.288	31.3	9.20E-03
Copper	39.6	3130	1.27E-02
Selenium	1.01	391	2.58E-03
Thallium	0.259	0.782	3.31E-01
Uranium	36.6	234	1.56E-01
Acetone	0.18	66,300	2.71E-06
Aroclor-1254	0.055	1.14	4.82E-02
Benzo(g,h,i)perylene	0.049	1740[b]	2.82E-05
Chlorobenzene	0.0011	378	2.91E-06
Isopropyltoluene[4-]	0.0023	2360[c]	9.75E-07
Methylene chloride	0.0033	409	8.07E-06
		HI	**0.6**

[a] SSLs from NMED (2015, 600915).

[b] Pyrene used a surrogate based on structural similarity.

[c] Isopropylbenzene used a surrogate based on structural similarity.

Table I-4.2-40
Residential Radionuclide Screening Evaluation for SWMU AOC 49-008(d)

COPC	EPC (pCi/g)	Residential SAL* (pCi/g)	Dose (mrem/yr)
Americium-241	0.086	83	2.59E-02
Cesium-134	0.039	5	1.95E-01
Plutonium-239/240	0.0551	79	1.74E-02
Uranium-234	1.06	290	9.14E-02
Uranium-235/236	0.0728	42	4.33E-02
Uranium-238	3.84	150	6.40E-01
		Total Dose	**1**

* SALs from LANL (2015, 600929).

Table I-4.3-1
Residential Noncarcinogenic Screening of Vapor Intrusion for SWMU 49-001(a)

COPC	EPC[a] (µg/m³)	Vapor Intrusion Screening Level[b] (µg/m³)	HQ
Acetone	21	323,000	6.50E-05
Butanone[2-]	3	52,100	5.76E-05
Carbon disulfide	6.6	7300	9.04E-04
Dichlorodifluoromethane	2.9	1040	2.79E-03
Ethyltoluene[4-]	7.3	52,100[c]	1.40E-04
Styrene	2.9	10,400	2.79E-04
Toluene	44	52,100	8.45E-04
Trimethylbenzene[1,2,4-]	8.6	66[d]	1.30E-01
Xylene[1,2-]	8.7	1040	8.37E-03
Xylene[1,3-]+1,4-Xylene	24	1040[e]	2.31E-02
Xylenes (Total)	33	1040	3.17E-02
		HI	**0.2**

[a] Maximum detected concentration.

[b] Vapor intrusion screening levels from NMED (2015, 600915) unless otherwise noted.

[c] Toluene used as a surrogate based on structural similarity.

[d] Screening value is from the EPA regional screening table (http://www.epa.gov/risk/risk-based-screening-table-generic-tables) divided by the default attenuation factor of 0.11 (NMED 2015, 600915, p. 47).

[e] Xylenes used as a surrogate based on structural similarity.

Table I-4.3-2
Residential Carcinogenic Screening of Vapor Intrusion for SWMU 49-001(a)

COPC	EPC[a] (µg/m³)	Vapor Intrusion Screening Level[b] (µg/m³)	Cancer Risk
Benzene	21	36	5.83E-06
Chloromethane	1.8	156	1.15E-07
Ethylbenzene	6.8	112	6.07E-07
		Total Excess Cancer Risk	**7E-06**

[a] Maximum detected concentration.

[b] Vapor intrusion screening levels from NMED (2015, 600915).

Table I-4.3-3
Residential Noncarcinogenic Screening of
Vapor Intrusion for SWMUs 49-001(b, c, d, g)

COPC	EPC[a] (µg/m³)	Vapor Intrusion Screening Level[b] (µg/m³)	HQ
Acetone	32	323,000	9.91E-05
Butanone[2-]	8.2	52,100	1.57E-04
Carbon disulfide	20	7300	2.74E-03
Dichlorodifluoromethane	3	1040	2.88E-03
Ethyltoluene[4-]	14	52,100[c]	2.69E-04
Styrene	2.9	10,400	2.79E-04
Toluene	96	52,100	1.84E-03
Trimethylbenzene[1,2,4-]	19	66[d]	2.88E-01
Trimethylbenzene[1,3,5-]	9.1	66[e]	1.38E-01
Xylene[1,2-]	14	1040	1.35E-02
Xylene[1,3-]+1,4-Xylene	41	1040[f]	3.94E-02
Xylene (Total)	55	1040	5.29E-02
		HI	**0.5**

[a] Maximum detected concentration.

[b] Vapor intrusion screening levels from NMED (2015, 600915) unless otherwise noted.

[c] Toluene used as a surrogate based on structural similarity.

[d] Screening value is from the EPA regional screening table (http://www.epa.gov/risk/risk-based-screening-table-generic-tables) divided by the default attenuation factor of 0.11 (NMED 2015, 600915, p. 47).

[e] Trimethylbenzene[1,2,4-] used as a surrogate based on structural similarity.

[f] Xylenes used as a surrogate based on structural similarity.

Table I-4.3-4
Residential Carcinogenic Screening
of Vapor Intrusion for SWMUs 49-001(b, c, d, g)

COPC	EPC[a] (µg/m³)	Vapor Intrusion Screening Level[b] (µg/m³)	Cancer Risk
Benzene	60/44.7[c]	36	1.67E-05/1.24E-05
Chloromethane	2	156	1.28E-07
Ethylbenzene	13/8.26[c]	112	1.16E-06/7.37E-07
		Total Excess Cancer Risk	**2E-05/1E-05**

[a] Maximum detected concentration.

[b] Vapor intrusion screening levels from NMED (2015, 600915).

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

Table I-4.3-5
Residential Noncarcinogenic Screening of Vapor Intrusion for SWMU 49-001(e)

COPC	EPC[a] (µg/m³)	Vapor Intrusion Screening Level[b] (µg/m³)	HQ
Acetone	29	323,000	8.98E-05
Butanone[2-]	4.5	52,100	8.64E-05
Dichlorodifluoromethane	2.6	1040	2.50E-03
Ethyltoluene[4-]	7.6	52,100[c]	1.46E-04
Styrene	2.4	10,400	2.31E-04
Toluene	34	52,100	6.53E-04
Trimethylbenzene[1,2,4-]	8.9	66[d]	1.35E-01
Trimethylbenzene[1,3,5-]	2.6	66[e]	3.94E-02
Xylene[1,2-]	8.4	1040	8.08E-03
Xylene[1,3-]+1,4-Xylene	23	1040[f]	2.21E-02
Xylenes (Total)	31	1040	2.98E-02
		HI	**0.2**

[a] Maximum detected concentration.

[b] Vapor intrusion screening levels from NMED (2015, 600915) unless otherwise noted.

[c] Toluene used as a surrogate based on structural similarity.

[d] Screening value is from the EPA regional screening table (http://www.epa.gov/risk/risk-based-screening-table-generic-tables) divided by the default attenuation factor of 0.11 (NMED 2015, 600915, p. 47).

[e] Trimethylbenzene[1,2,4-] used as a surrogate based on structural similarity.

[f] Xylenes used as a surrogate based on structural similarity.

Table I-4.3-6
Residential Carcinogenic Screening of Vapor Intrusion for SWMU 49-001(e)

COPC	EPC[a] (µg/m³)	Vapor Intrusion Screening Level[b] (µg/m³)	Cancer Risk
Benzene	19	36	5.28E-06
Ethylbenzene	6.5	112	5.80E-07
		Total Excess Cancer Risk	**6E-06**

[a] Maximum detected concentration.

[b] Vapor intrusion screening levels from NMED (2015, 600915).

Table I-4.3-7
Residential Noncarcinogenic Screening of Vapor Intrusion for SWMU 49-001(f)

COPC	EPC[a] (µg/m³)	Vapor Intrusion Screening Level[b] (µg/m³)	HQ
Acetone	14	323,000	4.33E-05
Butanone[2-]	6.3	52,100	1.21E-04
Dichlorodifluoromethane	2.9	1040	2.79E-03
Ethyltoluene[4-]	14	52,100[c]	2.69E-04
Styrene	4.9	10,400	4.71E-04
Toluene	100	52,100	1.92E-03
Trimethylbenzene[1,2,4-]	15	66[d]	2.27E-01
Trimethylbenzene[1,3,5-]	4.6	66[e]	6.97E-02
Xylene[1,2-]	19	1040	1.83E-02
Xylene[1,3-]+1,4-Xylene	58	1040[f]	5.58E-02
Xylene (Total)	78	1040	7.50E-02
		HI	**0.5**

[a] Maximum detected concentration.

[b] Vapor intrusion screening levels from NMED (2015, 600915) unless otherwise noted.

[c] Toluene used as a surrogate based on structural similarity.

[d] Screening value is from the EPA regional screening table (http://www.epa.gov/risk/risk-based-screening-table-generic-tables) divided by the default attenuation factor of 0.11 (NMED 2015, 600915, p. 47).

[e] Trimethylbenzene[1,2,4-] used as a surrogate based on structural similarity.

[f] Xylenes used as a surrogate based on structural similarity.

Table I-4.3-8
Residential Carcinogenic Screening of Vapor Intrusion for SWMU 49-001(f)

COPC	EPC[a] (µg/m³)	Vapor Intrusion Screening Level[b] (µg/m³)	Cancer Risk
Benzene	37	36	1.03E-05
Chloromethane	1.9	156	1.22E-07
Ethylbenzene	17	112	1.52E-06
		Total Excess Cancer Risk	**1E-05**

[a] Maximum detected concentration.

[b] Vapor intrusion screening levels from NMED (2015, 600915).

Table I-4.3-9
Residential Noncarcinogenic Screening of Vapor Intrusion for SWMU 49-003

COPC	EPC[a] (mg/kg)	Vapor Intrusion Risk-Based Concentration[b] (mg/kg)	HQ
Acetone	0.009	4940	1.82E-06
Methylene chloride	0.0029	103	2.82E-05
		HI	**0.00003**

[a] Maximum detected concentration.

[b] Vapor intrusion risk values generated by the Johnson and Ettinger advanced soil model.

Table I-4.3-10
Residential Noncarcinogenic Screening of Vapor Intrusion for AOC 49-008(c)

COPC	EPC[a] (µg/m^3)	Vapor Intrusion Screening Level[b] (µg/m^3)	HQ
Acetone	13	323,000	4.02E-05
Butanone[2-]	4.3	52,100	8.25E-05
Carbon disulfide	6.2	7300	8.49E-04
Dichlorodifluoromethane	3.2	1040	3.08E-03
Ethyltoluene[4-]	16	52,100[c]	3.07E-04
Styrene	4.9	10,400	4.71E-04
Toluene	42	52,100	8.06E-04
Trimethylbenzene[1,2,4-]	16	66[d]	2.42E-01
Trimethylbenzene[1,3,5-]	5.1	66[e]	7.73E-02
Xylene[1,2-]	15	1040	1.44E-02
Xylene[1,3-]+1,4-Xylene	39	1040[f]	3.75E-02
Xylene (Total)	53	1040	5.10E-02
		HI	**0.4**

[a] Maximum detected concentration.

[b] Vapor intrusion screening levels from NMED (2015, 600915) unless otherwise noted.

[c] Toluene used as a surrogate based on structural similarity.

[d] Screening value is from the EPA regional screening table (http://www.epa.gov/risk/risk-based-screening-table-generic-tables) divided by the default attenuation factor of 0.11 (NMED 2015, 600915, p. 47).

[e] Trimethylbenzene[1,2,4-] used as a surrogate based on structural similarity.

[f] Xylenes used as a surrogate based on structural similarity.

Table I-4.3-11
Residential Carcinogenic Screening of Vapor Intrusion for AOC 49-008(c)

COPC	EPC[a] (µg/m³)	Vapor Intrusion Screening Level[b] (µg/m³)	Cancer Risk
Benzene	22	36	6.11E-06
Chloromethane	2	156	1.28E-07
Ethylbenzene	10	112	8.93E-07
		Total Excess Cancer Risk	**7E-06**

[a] Maximum detected concentration.

[b] Vapor intrusion screening levels from NMED (2015, 600915).

Table I-4.3-12
Residential Noncarcinogenic Screening of Vapor Intrusion for AOC 49-008(d)

COPC	EPC[a] (µg/m³)	Vapor Intrusion Screening Level[b] (µg/m³)	HQ
Acetone	46	323,000	1.42E-04
Butanone[2-]	15	52,100	2.88E-04
Carbon disulfide	98	7300	1.34E-02
Dichlorodifluoromethane	3	1040	2.88E-03
Ethyltoluene[4-]	16	52,100[c]	3.07E-04
Styrene	2.9	10,400	2.79E-04
Toluene	52	52,100	9.98E-04
Trimethylbenzene[1,2,4-]	17	66[d]	2.58E-01
Trimethylbenzene[1,3,5-]	4.7	66[e]	7.12E-02
Xylene[1,2-]	13	1040	1.25E-02
Xylene[1,3-]+1,4-Xylene	38	1040[f]	3.65E-02
Xylene (Total)	51	1040	4.90E-02
		HI	**0.4**

[a] Maximum detected concentration.

[b] Vapor intrusion screening levels from NMED (2015, 600915) unless otherwise noted.

[c] Toluene used as a surrogate based on structural similarity.

[d] Screening value is from the EPA regional screening table (http://www.epa.gov/risk/risk-based-screening-table-generic-tables) divided by the default attenuation factor of 0.11 (NMED 2015, 600915, p. 47).

[e] Trimethylbenzene[1,2,4-] used as a surrogate based on structural similarity.

[f] Xylenes used as a surrogate based on structural similarity.

Table I-4.3-13
Residential Carcinogenic Screening of Vapor Intrusion for AOC 49-008(d)

COPC	EPC[a] (µg/m³)	Vapor Intrusion Screening Level[b] (µg/m³)	Cancer Risk
Benzene	29	36	8.06E-06
Chloromethane	2.9	156	1.86E-07
Ethylbenzene	13	112	1.16E-06
		Total Excess Cancer Risk	**9E-06**

[a] Maximum detected concentration.

[b] Vapor intrusion screening levels from NMED (2015, 600915).

Table I-4.4-1
Essential Nutrient Screening Assessment

SWMU	Scenario	COPC	Maximum Concentration (mg/kg)	SSL (mg/kg)*	Ratio
SWMU 49-001(a)	Industrial	Calcium	8250	32,400,000	0.00025
SWMU 49-001(a)	Residential	Calcium	8250	13,000,000	0.00063
SWMU 49-001(e)	Industrial	Calcium	14,800	32,400,000	0.00046
SWMU 49-001(e)	Industrial	Magnesium	4110	5,680,000	0.00072
SWMU 49-001(e)	Residential	Calcium	14,800	13,000,000	0.0011
SWMU 49-001(e)	Residential	Magnesium	4110	339,000	0.012
SWMU 49-001(f)	Industrial	Calcium	9110	32,400,000	0.00028
SWMU 49-001(f)	Industrial	Magnesium	2510	5,680,000	0.00044
SWMU 49-001(f)	Residential	Calcium	9110	13,000,000	0.0007
SWMU 49-001(f)	Residential	Magnesium	2510	339,000	0.0074
SWMU 49-003	Industrial	Calcium	6510	32,400,000	0.0002
SWMU 49-003	Residential	Calcium	6510	13,000,000	0.0005
SWMU 49-003	Residential	Magnesium	4250	339,000	0.013

* SSLs from NMED (2015, 600915).

Table I-5.3-1
Ecological Screening Levels for Terrestrial Receptors

COPEC	Red Fox (mammalian top carnivore)	American Kestrel (avian Top carnivore)	American Kestrel (avian intermediate carnivore)	American Robin (avian herbivore)	American Robin (avian omnivore)	American Robin (avian insectivore)	Desert Cottontail (mammalian herbivore)	Montane Shrew (mammalian insectivore)	Deer Mouse (mammalian omnivore)	Earthworm (soil dwelling invertebrate)	Generic Plant (terrestrial autotroph-producer)
Inorganic Chemicals (mg/kg)											
Antimony	46	na*	na	na	na	na	2.6	2.6	2.4	78	11
Arsenic	820	850	120	42	26	18	140	15	32	6.8	18
Barium	41,000	28,000	8600	820	930	1000	2900	1300	1800	330	110
Beryllium	420	na	na	na	na	na	150	18	56	40	2.5
Chromium (Total)	1800	1000	200	68	40	28	750	45	110	na	na
Cobalt	5500	2700	720	170	120	96	1600	160	400	na	13
Copper	4000	1300	92	38	22	15	240	38	64	80	70
Lead	3700	630	95	21	16	14	330	72	120	1700	120
Manganese	41,000	69,000	27,000	1400	1900	3100	1800	1500	1400	450	220
Mercury	61	0.29	0.066	0.07	0.022	0.013	20	1.7	3	0.05	34
Nickel	1200	2300	120	160	38	21	440	9.7	20	280	38
Selenium	90	81	4.3	1	0.87	0.75	1.9	0.66	0.83	4.1	0.52
Thallium	5.3	120	56	9.2	7.5	6.3	2.5	0.22	0.73	na	0.05
Uranium	4800	30,000	16,000	1900	1700	1600	1800	220	750	na	25
Vanadium	3300	130	64	8.9	7.6	6.7	1300	140	480	na	60

Table I-5.3-1 (continued)

COPEC	Red Fox (mammalian top carnivore)	American Kestrel (avian Top carnivore)	American Kestrel (avian intermediate carnivore)	American Robin (avian herbivore)	American Robin (avian omnivore)	American Robin (avian insectivore)	Desert Cottontail (mammalian herbivore)	Montane Shrew (mammalian insectivore)	Deer Mouse (mammalian omnivore)	Earthworm (soil dwelling invertebrate)	Generic Plant (terrestrial autotroph-producer)
Organic Chemicals (mg/kg)											
Acetone	7800	76000	970	7.5	14	170	1.3	15	1.2	na	na
Aroclor-1254	5.9	7.1	0.22	1.3	0.08	0.041	46	0.44	0.88	na	160
Aroclor-1260	14	400	4.8	46	1.7	0.88	2600	10	20	na	na
Benzo(g,h,i)perylene	3300	na	na	na	na	na	480	24	47	na	na
BHC[alpha-]	14,000	na	na	na	na	na	670	58	100	na	na
Bis(2-ethylhexyl)phthalate	380	8.1	0.1	20	0.04	0.02	2400	0.59	1.1	na	na
Chlordane[alpha-]	62	40	1.4	19	0.55	0.28	51	0.27	0.54	na	2.2
Chlordane[gamma-]	370	260	12	22	4.2	2.3	61	2.2	4.3	na	2.2
Di-n-octylphthalate	1000	na	na	na	na	na	11,000	0.91	1.8	na	na
Dichlorobenzene[1,4-]	380	na	na	na	na	na	10	0.88	1.5	1.2	na
Methylene chloride	4200	na	na	na	na	na	3	9	2.6	na	1600
Radionuclides (pCi/g)											
Americium-241	26,000	59,000	47,000	5000	6900	11,000	20,000	33,000	33,000	190	500
Cesium-134	730	1000	1000	690	1200	2100	550	1100	1100	1000	700
Cesium-137	1500	3900	4300	1400	2600	4600	1200	2400	2300	2300	1500
Plutonium-238	45,000	130,000	120,000	5200	7700	14,000	53,000	160,000	170,000	820	1800
Plutonium-239/240	51,000	160,000	140,000	5400	7900	14,000	62,000	270,000	280,000	870	1900
Tritium	220,000	550,000	610,000	300,000	440,000	600,000	210,000	340,000	330,000	48,000	36,000

Table I-5.3-1 (continued)

COPEC	Red Fox (mammalian top carnivore)	American Kestrel (avian Top carnivore)	American Kestrel (avian intermediate carnivore)	American Robin (avian herbivore)	American Robin (avian omnivore)	American Robin (avian insectivore)	Desert Cottontail (mammalian herbivore)	Montane Shrew (mammalian insectivore)	Deer Mouse (mammalian omnivore)	Earthworm (soil dwelling invertebrate)	Generic Plant (terrestrial autotroph-producer)
Radionuclides (pCi/g)											
Uranium-234	110,000	260,000	260,000	15,000	31,000	92,000	18,000	140,000	120,000	2200	440
Uranium-235/236	5200	10,000	10,000	6500	8200	9800	4200	5200	5200	1600	440
Uranium-238	2100	4200	4200	3400	3800	4100	1900	2100	2100	1100	400

* na = Not available.

Table I-5.3-2
Minimum ESL Comparison for SWMU 49-001(a)

COPC	EPC (mg/kg)	ESL (mg/kg)	Receptor	HQ
Inorganic Chemicals (mg/kg)				
Barium	136	110	Plant	**1.24**
Chromium (Total)	10.7	28	Robin (insectivore)	**0.38**
Cobalt	8.71	13	Plant	**0.67**
Manganese	425	220	Plant	**1.93**
Nickel	8.57	9.7	Shrew	**0.88**
Selenium	1.15	0.52	Plant	**2.21**
Vanadium	26.1	6.7	Robin (insectivore)	**3.9**
Radionuclides (pCi/g)				
Cesium-134	0.586	550	Cottontail	0.0011
Tritium	0.178	36,000	Plant	0.0000049

Note: Bolded values indicate HQs greater than 0.3.

Table I-5.3-3
HI Analysis for SWMU 49-001(a)

COPEC	EPC (mg/kg)	Red Fox (mammalian top carnivore)	American Kestrel (avian top carnivore)	American Kestrel (avian intermediate carnivore)	American Robin (avian herbivore)	American Robin (avian omnivore)	American Robin (avian insectivore)	Desert Cottontail (mammalian herbivore)	Montane Shrew (mammalian insectivore)	Deer Mouse (mammalian omnivore)	Earthworm (soil dwelling invertebrate)	Plant (terrestrial autotroph-producer)
Barium	136	3.3E-03	4.9E-03	0.016	0.17	0.15	0.14	0.047	0.1	0.076	**0.41**	**1.24**
Chromium	10.7	5.9E-03	0.011	0.054	0.16	0.27	**0.38**	0.014	0.24	0.097	na*	na
Cobalt	8.71	1.6E-03	3.2E-03	0.012	0.051	0.073	0.091	5.4E-03	0.054	0.022	na	**0.67**
Manganese	425	0.01	6.2E-03	0.016	0.3	0.22	0.14	0.24	0.28	0.3	**0.94**	**1.93**
Nickel	8.57	7.1E-03	3.7E-03	0.071	0.054	0.23	**0.41**	0.019	**0.88**	**0.43**	0.031	0.23
Selenium	1.15	0.013	0.014	0.27	**1.15**	**1.32**	**1.53**	**0.61**	**1.74**	**1.39**	0.28	**2.21**
Vanadium	26.1	7.9E-03	0.2	**0.41**	**2.93**	**3.43**	**3.9**	0.02	0.19	0.054	na	**0.44**
HI		0.05	0.2	0.8	**5**	**6**	**7**	1	**3**	**2**	**2**	**7**

Note: Bolded values indicate HQs greater than 0.3 or HI greater than 1.
* na = Not available.

Table I-5.3-4
Minimum ESL Comparison for SWMUs 49-001(b, c, d, g)

COPC	EPC (mg/kg)	ESL (mg/kg)	Receptor	HQ
Inorganic Chemicals (mg/kg)				
Cobalt	6.84	13	Plant	**0.53**
Selenium	1.08	0.52	Plant	**2.08**
Radionuclides (pCi/g)				
Americium-241	0.258	190	Earthworm	0.0014
Plutonium-238	1.41	820	Earthworm	0.0017
Plutonium-239/240	3.83	870	Earthworm	0.0044
Uranium-238	0.898	400	Plant	0.0022

Note: Bolded values indicate HQs greater than 0.3.

Table I-5.3-5
HI Analysis for SWMUs 49-001(b, c, d, g)

COPEC	EPC (mg/kg)	Red Fox (mammalian top carnivore)	American Kestrel (avian top carnivore)	American Kestrel (avian intermediate carnivore)	American Robin (avian herbivore)	American Robin (avian omnivore)	American Robin (avian insectivore)	Desert Cottontail (mammalian herbivore)	Montane Shrew (mammalian insectivore)	Deer Mouse (mammalian omnivore)	Earthworm (soil dwelling invertebrate)	Plant (terrestrial autotroph-producer)
Cobalt	6.84	1.2E-03	2.5E-03	9.5E-03	0.04	0.057	0.071	4.3E-03	0.043	0.017	na*	**0.53**
Selenium	1.08	0.012	0.013	0.25	**1.08**	**1.24**	**1.44**	**0.57**	**1.64**	**1.3**	0.26	**2.08**
HI		0.01	0.02	0.3	1	1	**2**	0.6	**2**	1	0.3	**3**

Note: Bolded values indicate HQs greater than 0.3 or HI greater than 1.
* na = Not available.

Table I-5.3-6
Minimum ESL Comparison for SWMU 49-001(e)

COPC	EPC (mg/kg)	ESL (mg/kg)	Receptor	HQ
Inorganic Chemicals (mg/kg)				
Arsenic	4.05	6.8	Earthworm	**0.6**
Barium	190	110	Plant	**1.73**
Beryllium	1.01	2.5	Plant	**0.4**
Chromium (Total)	10.6	28	Robin (insectivore)	**0.38**
Cobalt	6.83	13	Plant	**0.53**
Copper	66.9	15	Robin (insectivore)	**4.46**
Lead	16.5	14	Robin (insectivore)	**1.18**
Manganese	396	220	Plant	**1.8**
Nickel	8.42	9.7	Shrew	**0.87**
Selenium	1.3	0.52	Plant	**2.5**
Thallium	0.534	0.05	Plant	**10.7**
Vanadium	23.9	6.7	Robin (insectivore)	**3.57**
Radionuclides (pCi/g)				
Cesium-134	0.082	550	Cottontail	0.00015
Cesium-137	0.0518	1200	Cottontail	0.000043

Note: Bolded values indicate HQs greater than 0.3.

Table I-5.3-7
HI Analysis for SWMU 49-001(e)

COPEC	EPC (mg/kg)	Red Fox (mammalian top carnivore)	American Kestrel (avian top carnivore)	American Kestrel (avian intermediate carnivore)	American Robin (avian herbivore)	American Robin (avian omnivore)	American Robin (avian insectivore)	Desert Cottontail (mammalian herbivore)	Montane Shrew (mammalian insectivore)	Deer Mouse (mammalian omnivore)	Earthworm (soil dwelling invertebrate)	Plant (terrestrial autotroph-producer)
Arsenic	4.05	4.9E-03	4.8E-03	0.034	0.096	0.16	0.23	0.029	0.27	0.13	**0.6**	0.23
Barium	190	4.6E-03	6.8E-03	0.022	0.23	0.2	0.19	0.066	0.15	0.11	**0.58**	**1.73**
Beryllium	1.01	2.4E-03	na*	na	na	na	na	6.7E-03	0.056	0.018	0.025	**0.4**
Chromium (Total)	10.6	5.9E-03	0.011	0.053	0.16	0.27	**0.38**	0.014	0.24	0.096	na	na
Cobalt	6.83	1.2E-03	2.5E-03	9.5E-03	0.04	0.057	0.071	4.3E-03	0.043	0.017	na	**0.53**
Copper	66.9	0.017	0.051	**0.73**	**1.76**	**3.04**	**4.46**	0.28	**1.76**	**1.05**	**0.84**	**0.96**
Lead	16.5	4.5E-03	0.026	0.17	**0.79**	**1.03**	**1.18**	0.05	0.23	0.14	9.7E-03	0.14
Manganese	396	9.7E-03	5.7E-03	0.015	0.28	0.21	0.13	0.22	0.26	0.28	**0.88**	**1.8**
Nickel	8.42	7.0E-03	3.7E-03	0.07	0.053	0.22	**0.4**	0.019	**0.87**	**0.42**	0.03	0.22
Selenium	1.3	0.014	0.016	0.3	**1.3**	**1.5**	**1.73**	**0.68**	**1.97**	**1.57**	**0.32**	**2.5**
Thallium	0.534	0.1	4.5E-03	9.5E-03	0.058	0.071	0.085	0.21	**2.42**	**0.73**	na	**10.7**
Vanadium	23.9	7.2E-03	0.18	**0.37**	**2.69**	**3.14**	**3.57**	0.018	0.17	0.05	na	**0.4**
HI		0.2	0.3	**2**	**7**	**10**	**12**	**2**	**8**	**5**	**3**	**20**

Note: Bolded values indicate HQs greater than 0.3 or HI greater than 1.
*na = Not available.

Table I-5.3-8
Minimum ESL Comparison for SWMU 49-001(f)

COPC	EPC (mg/kg)	ESL (mg/kg)	Receptor	HQ
Inorganic Chemicals (mg/kg)				
Arsenic	3.08	6.8	Earthworm	**0.45**
Barium	160	110	Plant	**1.45**
Chromium (Total)	9.58	28	Robin (insectivore)	**0.34**
Cobalt	5.66	13	Plant	**0.44**
Copper	11.1	15	Robin (insectivore)	**0.74**
Lead	15.7	14	Robin (insectivore)	**1.12**
Mercury	0.0258	0.013	Robin (insectivore)	**1.98**
Nickel	8.29	9.7	Shrew	**0.85**
Selenium	1.15	0.52	Plant	**2.21**
Thallium	0.328	0.05	Plant	**6.56**
Vanadium	22.9	6.7	Robin (insectivore)	**3.42**
Organic Chemicals (mg/kg)				
Bis(2-ethylhexyl)phthalate	0.24	0.02	Robin (insectivore)	**12**
Radionuclides (pCi/g)				
Americium-241	0.592	190	Earthworm	0.0031
Cesium-134	0.062	550	Cottontail	0.00011
Tritium	8.39	36000	Plant	0.00023

Note: Bolded values indicate HQs greater than 0.3.

Table I-5.3-9
HI Analysis for SWMU 49-001(f)

COPEC	EPC (mg/kg)	Red Fox (mammalian top carnivore)	American Kestrel (avian top carnivore)	American Kestrel (avian intermediate carnivore)	American Robin (avian herbivore)	American Robin (avian omnivore)	American Robin (avian insectivore)	Desert Cottontail (mammalian herbivore)	Montane Shrew (mammalian insectivore)	Deer Mouse (mammalian omnivore)	Earthworm (soil dwelling invertebrate)	Plant (terrestrial autotroph-producer)
Arsenic	3.08	3.8E-03	3.6E-03	0.026	0.073	0.12	0.17	0.022	0.21	0.096	**0.45**	0.17
Barium	160	3.9E-03	5.7E-03	0.019	0.2	0.17	0.16	0.055	0.12	0.089	**0.48**	**1.45**
Chromium (Total)	9.58	5.3E-03	9.6E-03	0.048	0.14	0.24	**0.34**	0.013	0.21	0.087	na*	na
Cobalt	5.66	1.0E-03	2.1E-03	7.9E-03	0.033	0.047	0.059	3.5E-03	0.035	0.014	na	**0.44**
Copper	11.1	2.8E-03	8.5E-03	0.12	0.29	**0.5**	**0.74**	0.046	0.29	0.17	0.14	0.16
Lead	15.7	4.2E-03	0.025	0.17	**0.75**	**0.98**	**1.12**	0.048	0.22	0.13	9.2E-03	0.13
Mercury	0.0258	4.2E-04	0.089	**0.39**	**0.37**	**1.17**	**1.98**	1.3E-03	0.015	8.6E-03	**0.51**	7.6E-04
Nickel	8.29	6.9E-03	3.6E-03	0.069	0.052	0.22	**0.39**	0.019	**0.85**	**0.41**	0.03	0.22
Selenium	1.15	0.013	0.014	0.27	**1.15**	**1.32**	**1.53**	**0.61**	**1.74**	**1.39**	0.28	**2.21**
Thallium	0.328	0.062	2.7E-03	5.9E-03	0.036	0.044	0.052	0.13	**1.49**	**0.45**	na	**6.56**
Vanadium	22.9	6.9E-03	0.18	**0.36**	**2.57**	**3.01**	**3.42**	0.018	0.16	0.048	na	**0.38**
Bis(2-ethylhexyl)phthalate	0.24	6.3E-04	0.03	**2.4**	0.012	**6**	**12**	1.0E-04	**0.41**	0.22	na	na
HI		0.1	0.4	**4**	**6**	**14**	**22**	1	**6**	**3**	**2**	**12**

Note: Bolded values indicate HQs greater than 0.3 or HI greater than 1.

* na = Not available.

Table I-5.3-10
Minimum ESL Comparison for SWMU 49-003

COPC	EPC (mg/kg)	ESL (mg/kg)	Receptor	HQ
Inorganic Chemicals (mg/kg)				
Antimony	0.742	2.4	Deer mouse	**0.31**
Arsenic	4.13	6.8	Earthworm	**0.61**
Barium	337	110	Plant	**3.06**
Copper	7.74	15	Robin (insectivore)	**0.52**
Nickel	11.4	9.7	Shrew	**1.18**
Selenium	1.38	0.52	Plant	**2.65**
Organic Chemicals (mg/kg)				
Methylene chloride	0.0028	2.6	Deer mouse	0.0011
Radionuclides (pCi/g)				
Americium-241	0.653	190	Earthworm	0.0034
Cesium-137	0.138	1200	Dessert cottontail	0.00012
Plutonium-238	0.0234	820	Earthworm	0.000029
Plutonium-239/240	1.41	870	Earthworm	0.0016

Note: Bolded values indicate HQs greater than 0.3.

Table I-5.3-11
HI Analysis for SWMU 49-003

COPEC	EPC (mg/kg)	Red Fox (mammalian top carnivore)	American Kestrel (avian top carnivore)	American Kestrel (avian intermediate carnivore)	American Robin (avian herbivore)	American Robin (avian omnivore)	American Robin (avian insectivore)	Desert Cottontail (mammalian herbivore)	Montane Shrew (mammalian insectivore)	Deer Mouse (mammalian omnivore)	Earthworm (soil dwelling invertebrate)	Plant (terrestrial autotroph-producer)
Antimony	0.742	0.016	na*	na	na	na	na	0.29	0.29	**0.31**	9.5E-03	0.067
Arsenic	4.13	5.0E-03	4.9E-03	0.034	0.098	0.16	0.23	0.03	0.28	0.13	**0.61**	0.23
Barium	337	8.2E-03	0.012	0.039	**0.41**	**0.36**	**0.34**	0.12	0.26	0.19	**1.02**	**3.06**
Copper	7.74	1.9E-03	6.0E-03	0.084	0.2	**0.35**	**0.52**	0.032	0.2	0.12	0.097	0.11
Nickel	11.4	9.5E-03	5.0E-03	0.095	0.071	0.3	**0.54**	0.026	**1.18**	**0.57**	0.041	0.3
Selenium	1.38	0.015	0.017	**0.32**	**1.38**	**1.59**	**1.84**	**0.73**	**2.09**	**1.66**	**0.34**	**2.65**
HI		0.06	0.04	0.6	**2**	**3**	**3**	1	**4**	**3**	**2**	**6**

Notes: Bolded values indicate HQs greater than 0.3 or HI greater than 1. Data qualifiers are defined in Appendix A.

Table I-5.3-12
Minimum ESL Comparison for AOC 49-008(c)

COPC	EPC (mg/kg)	ESL (mg/kg)	Receptor	HQ
Inorganic Chemicals (mg/kg)				
Selenium	1.9	0.52	Plant	**3.65**
Organic Chemicals (mg/kg)				
Benzyl alcohol	0.19	120	Deer mouse	0.0016
Bis(2-ethylhexyl)phthalate	0.056	0.02	Robin (insectivore)	**2.8**
Nitrotoluene[3-]	0.56	12	Deer mouse	0.047
Radionuclides (pCi/g)				
Plutonium-239/240	1.02	870	Earthworm	0.0012

Note: Bolded values indicate HQs greater than 0.3.

Table I-5.3-13
HI Analysis for AOC 49-008(c)

COPEC	EPC (mg/kg)	Red Fox (mammalian top carnivore)	American Kestrel (avian top carnivore)	American Kestrel (avian intermediate carnivore)	American Robin (avian herbivore)	American Robin (avian omnivore)	American Robin (avian insectivore)	Desert Cottontail (mammalian herbivore)	Montane Shrew (mammalian insectivore)	Deer Mouse (mammalian omnivore)	Earthworm (soil dwelling invertebrate)	Plant (terrestrial autotroph-producer)
Selenium	1.9	0.021	0.023	**0.44**	**1.9**	**2.18**	**2.53**	**1**	**2.88**	**2.29**	**0.46**	**3.65**
Bis(2-ethylhexyl)phthalate	0.1	0.00015	0.0069	**0.56**	0.0028	**1.4**	**2.8**	2.3E-05	0.095	0.05	na*	na
HI		0.02	0.03	1	**2**	**4**	**5**	1	**3**	**2**	0.5	**4**

Note: Bolded values indicate HQs greater than 0.3 or HI greater than 1.
* na = Not available.

Table I-5.3-14
Minimum ESL Comparison for AOC 49-008(d)

COPC	EPC (mg/kg)	ESL (mg/kg)	Receptor	HQ
Inorganic Chemicals (mg/kg)				
Antimony	0.288	2.4	Deer mouse	0.12
Copper	39.6	15	Robin (insectivore)	**2.64**
Selenium	1.01	0.52	Plant	**1.94**
Thallium	0.259	0.05	Plant	**5.18**
Uranium	36.6	25	Plant	**1.46**
Organic Chemicals (mg/kg)				
Acetone	0.18	1.2	Deer mouse	0.15
Aroclor-1254	0.055	0.041	Robin (insectivore)	**1.34**
Aroclor-1260	0.046	0.88	Robin (insectivore)	0.052
Benzo(g,h,i)perylene	0.049	24	Shrew	0.002
BHC[alpha-]	0.0012	58	Shrew	0.000021
Bis(2-ethylhexyl)phthalate	0.0964	0.02	Robin (insectivore)	**4.82**
Chlordane[alpha-]	0.0029	0.27	Shrew	0.011
Chlordane[gamma-]	0.0024	2.2	Plant	0.0011
Chlordane[gamma-]	0.0024	2.2	Shrew	0.0011
Chlorobenzene	0.0011	2.4	Earthworm	0.00046
Dichlorobenzene[1,4-]	0.00071	0.88	Shrew	0.00081
Methylene chloride	0.0033	2.6	Deer mouse	0.0013
Radionuclides (pCi/g)				
Americium-241	0.086	190	Earthworm	0.00045
Cesium-134	0.039	550	Cottontail	0.000071
Plutonium-239/240	0.0551	870	Earthworm	0.000063
Uranium-234	1.06	440	Plant	0.0024
Uranium-235/236	0.0728	440	Plant	0.00017
Uranium-238	3.84	400	Plant	0.0096

Note: Bolded values indicate HQs greater than 0.3.

Table I-5.3-15
HI Analysis for AOC 49-008(d)

COPEC	EPC (mg/kg)	Red Fox (mammalian top carnivore)	American Kestrel (avian top carnivore)	American Kestrel (avian intermediate carnivore)	American Robin (avian herbivore)	American Robin (avian omnivore)	American Robin (avian insectivore)	Desert Cottontail (mammalian herbivore)	Montane Shrew (mammalian insectivore)	Deer Mouse (mammalian omnivore)	Earthworm (soil dwelling invertebrate)	Plant (terrestrial autotroph-producer)
Copper	39.6	9.9E-03	0.03	**0.43**	**1.04**	**1.8**	**2.64**	0.17	**1.04**	**0.62**	**0.5**	**0.57**
Selenium	1.01	0.011	0.012	0.23	**1.01**	**1.16**	**1.35**	**0.53**	**1.53**	**1.22**	0.25	**1.94**
Thallium	0.259	0.049	2.2E-03	4.6E-03	0.028	0.035	0.041	0.1	**1.18**	**0.35**	na*	**5.18**
Uranium	36.6	7.6E-03	1.2E-03	2.3E-03	0.019	0.022	0.023	0.02	0.17	0.049	na	**1.46**
Aroclor-1254	0.055	9.3E-03	7.7E-03	0.25	0.042	**0.69**	**1.34**	1.2E-03	0.13	0.063	na	3.4E-04
Bis(2-ethylhexyl)phthalate	0.0964	2.5E-04	0.012	**0.96**	4.8E-03	**2.41**	**4.82**	4.0E-05	0.16	0.088	na	na
HI		0.09	0.07	**2**	**2**	**7**	**11**	0.9	**5**	**3**	0.8	**9**

Notes: Bolded values indicate HQs greater than 0.3 or HI greater than 1. Data qualifiers are defined in Appendix A.
*na = Not available.

Table I-5.3-16
Burrow Air Screening

COPC	EPC[a] (µg/m³)	Gopher Burrow Air ESL (µg/m³)[b]	HQ
Acetone	46	530,000	8.68E-05
Benzene	60	25,000	2.40E-03
Chloromethane	2.9	21,000	1.38E-04
Dichlorodifluoromethane	3.2	2,600,000	1.23E-06
Ethylbenzene	17	25,000[c]	6.80E-04
Ethyltoluene[4-]	16	60,000[d]	2.67E-04
Toluene	100	60,000	1.67E-03
Trimethylbenzene[1,2,4-]	19	25,000[c]	7.60E-04
Trimethylbenzene[1,3,5-]	9.1	25,000[c]	3.64E-04
Xylene[1,2-]	19	87,000[e]	2.18E-04
Xylene[1,3-]+1,4-Xylene	58	87,000[e]	6.67E-04
Xylene (Total)	78	87,000	8.97E-04
		HI	**0.008**

[a] Maximum detected concentration.

[b] Burrow air ESLs are from (LANL 2015, 600921) using parameters in (LANL 2015, 600982).

[c] Benzene used as a surrogate based on structural similariaty.

[d] Toluene used as a surrogate based on structural similariaty.

[e] Total xylenes used as a surrogate based on structural similariaty.

Table I-5.4-1
Mexican Spotted Owl AUFs for
TA-49 Sites within the NES Boundary

Site	Site Area (ha)	AUF[a]	American Kestrel (avian top carnivore) HI[b]	AUF-Adjusted HI for the Mexican Spotted Owl
SWMU 49-001(a)	20.8	0.0569	0.2	0.01
SWMU 49-001(b,c,d,g)	27.7	0.0756	0.02	0.002
SWMU 49-001(e)	19.6	0.0535	0.3	0.02
SWMU 49-001(f)	20.8	0.0569	0.4	0.02
SWMU 49-003	0.49	0.00133	0.04	0.00005
AOC 49-008(c)	2.4	0.00659	0.03	0.0002
AOC 49-008(d)	5.7	0.0157	0.07	0.001

[a] AUF is calculated as the area of the site divided by the owl HR of 366 ha.

[b] Using the American kestrel as a surrogate for the Mexican spotted owl.

Table I-5.4-2
PAUFs for Ecological Receptors for SWMU 49-001(a)

Receptor	HR (ha)[a]	Population Area (ha)	PAUF[b]
American Kestrel	106	4240	4.91E-03
American Robin	0.42	16.8	1.00E+00
Deer Mouse	0.077	3	1.00E+00
Desert Cottontail	3.1	124	1.68E-01
Montane Shrew	0.39	15.6	1.00E+00
Red Fox	1038	41,520	5.01E-04

[a] Values from EPA (1993, 059384).

[b] PAUF is calculated as the area of the site (20.8 ha) divided by the population area.

Table I-5.4-3
Adjusted HIs for SWMU 49-001(a)

COPEC	EPC (mg/kg)	Red Fox (mammalian top carnivore)	American Kestrel (avian Top carnivore)	American Kestrel (avian intermediate carnivore)	American Robin (avian herbivore)	American Robin (avian omnivore)	American Robin (avian insectivore)	Desert Cottontail (mammalian herbivore)	Montane Shrew (mammalian insectivore)	Deer Mouse (mammalian omnivore)	Earthworm (soil dwelling invertebrate)	Plant (terrestrial autotroph-producer)
Barium	136	1.7E-06	2.4E-05	7.8E-05	0.17	0.15	0.14	7.9E-03	0.1	0.076	**0.41**	**1.24**
Chromium (Total)	10.7	3.0E-06	5.3E-05	2.6E-04	0.16	0.27	**0.38**	2.4E-03	0.24	0.097	na*	na
Cobalt	8.71	7.9E-07	1.6E-05	5.9E-05	0.051	0.073	0.091	9.1E-04	0.054	0.022	na	**0.67**
Manganese	425	5.2E-06	3.0E-05	7.7E-05	0.3	0.22	0.14	0.04	0.28	0.3	**0.94**	**1.93**
Nickel	8.57	3.6E-06	1.8E-05	3.5E-04	0.054	0.23	**0.41**	3.3E-03	**0.88**	**0.43**	0.031	0.23
Selenium	1.15	6.4E-06	7.0E-05	1.3E-03	**1.15**	**1.32**	**1.53**	0.1	**1.74**	**1.39**	0.28	**2.21**
Vanadium	26.1	4.0E-06	9.9E-04	2.0E-03	**2.93**	**3.43**	**3.9**	3.4E-03	0.19	0.054	na	**0.44**
Adjusted HI		2E-05	0.002	0.006	**5**	**6**	**7**	0.2	**4**	**2**	**2**	**7**

Note: Bolded values indicate HQs greater than 0.3 or HI greater than 1.

*na = Not available.

Table I-5.4-4
PAUFs for Ecological Receptors for SWMUs 49-001(b, c, d, g)

Receptor	HR (ha)[a]	Population Area (ha)	PAUF[b]
American Kestrel	106	4240	6.52E-03
American Robin	0.42	16.8	1.00E+00
Deer Mouse	0.077	3	1.00E+00
Desert Cottontail	3.1	124	2.23E-01
Montane Shrew	0.39	15.6	1.00E+00
Red Fox	1038	41,520	6.66E-04

[a] Values from EPA (1993, 059384).

[b] PAUF is calculated as the area of the site (27.7 ha) divided by the population area.

Table I-5.4-5
Adjusted HIs for SWMUs 49-001(b, c, d, g)

COPEC	EPC (mg/kg)	Red Fox (mammalian top carnivore)	American Kestrel (avian Top carnivore)	American Kestrel (avian intermediate carnivore)	American Robin (avian herbivore)	American Robin (avian omnivore)	American Robin (avian insectivore)	Desert Cottontail (mammalian herbivore)	Montane Shrew (mammalian insectivore)	Deer Mouse (mammalian omnivore)	Earthworm (soil dwelling invertebrate)	Plant (terrestrial autotroph-producer)
Cobalt	6.84	8.3E-07	1.7E-05	6.2E-05	0.04	0.057	0.071	9.5E-04	0.043	0.017	na*	**0.53**
Selenium	1.08	8.0E-06	8.7E-05	1.6E-03	**1.08**	**1.24**	**1.44**	0.13	**1.64**	**1.3**	0.26	**2.08**
Adjusted HI		9E-06	1E-04	0.002	1	1	**2**	0.1	**2**	1	0.3	**3**

Note: Bolded values indicate HQs greater than 0.3 or HI greater than 1.
*na = Not available.

Table I-5.4-6
PAUFs for Ecological Receptors for SWMU 49-001(e)

Receptor	HR (ha)[a]	Population Area (ha)	PAUF[b]
American Kestrel	106	4240	4.62E-03
American Robin	0.42	16.8	1.00E+00
Deer Mouse	0.077	3	1.00E+00
Desert Cottontail	3.1	124	1.58E-01
Montane Shrew	0.39	15.6	1.00E+00
Red Fox	1038	41,520	4.72E-04

[a] Values from EPA (1993, 059384).

[b] PAUF is calculated as the area of the site (19.6 ha) divided by the population area.

Table I-5.4-7
Adjusted HIs for SWMU 49-001(e)

COPEC	EPC (mg/kg)	Red Fox (mammalian top carnivore)	American Kestrel (avian Top carnivore)	American Kestrel (avian intermediate carnivore)	American Robin (avian herbivore)	American Robin (avian omnivore)	American Robin (avian insectivore)	Desert Cottontail (mammalian herbivore)	Montane Shrew (mammalian insectivore)	Deer Mouse (mammalian omnivore)	Earthworm (soil dwelling invertebrate)	Plant (terrestrial autotroph-producer)
Arsenic	4.05	2.3E-06	2.2E-05	1.6E-04	0.096	0.16	0.23	4.6E-03	0.27	0.13	**0.6**	0.23
Barium	190	2.2E-06	3.1E-05	1.0E-04	0.23	0.2	0.19	0.01	0.15	0.11	**0.58**	**1.73**
Beryllium	1.01	1.1E-06	na*	na	na	na	na	1.1E-03	0.056	0.018	0.025	**0.4**
Chromium (Total)	10.6	2.8E-06	4.9E-05	2.4E-04	0.16	0.27	**0.38**	2.2E-03	0.24	0.096	na	na
Cobalt	6.83	5.9E-07	1.2E-05	4.4E-05	0.04	0.057	0.071	6.7E-04	0.043	0.017	na	**0.53**
Copper	66.9	7.9E-06	2.4E-04	3.4E-03	**1.76**	**3.04**	**4.46**	0.044	**1.76**	**1.05**	**0.84**	**0.96**
Lead	16.5	2.1E-06	1.2E-04	8.0E-04	**0.79**	**1.03**	**1.18**	7.9E-03	0.23	0.14	9.7E-03	0.14
Manganese	396	4.6E-06	2.7E-05	6.8E-05	0.28	0.21	0.13	0.035	0.26	0.28	**0.88**	**1.8**
Nickel	8.42	3.3E-06	1.7E-05	3.2E-04	0.053	0.22	**0.4**	3.0E-03	**0.87**	**0.42**	0.03	0.22
Selenium	1.3	6.8E-06	7.4E-05	1.4E-03	**1.3**	**1.49**	**1.73**	0.11	**1.97**	**1.57**	**0.32**	**2.5**
Thallium	0.534	4.8E-05	2.1E-05	4.4E-05	0.058	0.071	0.085	0.034	**2.43**	**0.73**	na	**10.7**
Vanadium	23.9	3.4E-06	8.5E-04	1.7E-03	**2.69**	**3.14**	**3.57**	2.9E-03	0.17	0.05	na	**0.4**
Adjusted HI		8E-05	0.001	0.008	**7**	**10**	**12**	0.3	**8**	**5**	**3**	**20**

Note: Bolded values indicate HQs greater than 0.3 or HI greater than 1.
*na = Not available.

Table I-5.4-8
PAUFs for Ecological Receptors for SWMU 49-001(f)

Receptor	HR (ha)[a]	Population Area (ha)	PAUF[b]
American Kestrel	106	4240	4.91E-03
American Robin	0.42	16.8	1.00E+00
Deer Mouse	0.077	3	1.00E+00
Desert Cottontail	3.1	124	1.68E-01
Montane Shrew	0.39	15.6	1.00E+00
Red Fox	1038	41,520	5.02E-04

[a] Values from EPA (1993, 059384).

[b] PAUF is calculated as the area of the site (20.8 ha) divided by the population area.

Table I-5.4-9
Adjusted HIs for SWMU 49-001(f)

COPEC	EPC (mg/kg)	Red Fox (mammalian top carnivore)	American Kestrel (avian Top carnivore)	American Kestrel (avian intermediate carnivore)	American Robin (avian herbivore)	American Robin (avian omnivore)	American Robin (avian insectivore)	Desert Cottontail (mammalian herbivore)	Montane Shrew (mammalian insectivore)	Deer Mouse (mammalian omnivore)	Earthworm (soil dwelling invertebrate)	Plant (terrestrial autotroph-producer)
Arsenic	3.08	1.9E-06	1.8E-05	1.3E-04	0.073	0.12	0.17	3.7E-03	0.21	0.096	**0.45**	0.17
Barium	160	2.0E-06	2.8E-05	9.1E-05	0.2	0.17	0.16	9.3E-03	0.12	0.089	**0.48**	**1.45**
Chromium (Total)	9.58	2.7E-06	4.7E-05	2.4E-04	0.14	0.24	**0.34**	2.1E-03	0.21	0.087	na*	na
Cobalt	5.66	5.2E-07	1.0E-05	3.9E-05	0.033	0.047	0.059	5.9E-04	0.035	0.014	na	**0.44**
Copper	11.1	1.4E-06	4.2E-05	5.9E-04	0.29	**0.5**	**0.74**	7.8E-03	0.29	0.17	0.14	0.16
Lead	15.7	2.1E-06	1.2E-04	8.1E-04	**0.75**	**0.98**	**1.12**	8.0E-03	0.22	0.13	9.2E-03	0.13
Mercury	0.0257	2.1E-07	4.4E-04	1.9E-03	**0.37**	**1.17**	**1.98**	2.2E-04	0.015	8.6E-03	**0.51**	7.6E-04
Nickel	8.29	3.5E-06	1.8E-05	3.4E-04	0.052	0.22	**0.39**	3.2E-03	**0.85**	**0.41**	0.03	0.22
Selenium	1.15	6.4E-06	7.0E-05	1.3E-03	**1.15**	**1.32**	**1.53**	0.1	**1.74**	**1.39**	0.28	**2.21**
Thallium	0.328	3.1E-05	1.3E-05	2.9E-05	0.036	0.044	0.052	0.022	**1.49**	**0.45**	na	**6.56**
Vanadium	22.9	3.5E-06	8.7E-04	1.8E-03	**2.57**	**3.01**	**3.42**	3.0E-03	0.16	0.048	na	**0.38**
Bis(2-ethylhexyl)phthalate	0.24	3.2E-07	1.5E-04	0.012	0.012	**6**	**12**	1.7E-05	**0.41**	0.22	na	na
Adjusted HI		6E-05	0.002	0.02	**6**	**14**	**22**	0.2	**6**	**3**	**2**	**12**

Note: Bolded values indicate HQs greater than 0.3 or HI greater than 1.
*na = Not available.

Table I-5.4-10
PAUFs for Ecological Receptors for SWMU 49-003

Receptor	HR (ha)[a]	Population Area (ha)	PAUF[b]
American Kestrel	106	4240	1.15E-04
American Robin	0.42	16.8	2.89E-02
Deer Mouse	0.077	3	1.62E-01
Desert Cottontail	3.1	124	3.92E-03
Montane Shrew	0.39	15.6	3.12E-02
Red Fox	1038	41,520	1.17E-05

[a] Values from EPA (1993, 059384).

[b] PAUF is calculated as the area of the site (0.49 ha) divided by the population area.

Table I-5.4-11
Adjusted HIs for SWMU 49-003

COPEC	EPC (mg/kg)	Red Fox (mammalian top carnivore)	American Kestrel (avian Top carnivore)	American Kestrel (avian intermediate carnivore)	American Robin (avian herbivore)	American Robin (avian omnivore)	American Robin (avian insectivore)	Desert Cottontail (mammalian herbivore)	Montane Shrew (mammalian insectivore)	Deer Mouse (mammalian omnivore)	Earthworm (soil dwelling invertebrate)	Plant (terrestrial autotroph-producer)
Antimony	0.742	1.9E-07	na*	na	na	na	na	1.1E-03	8.9E-03	0.05	9.5E-03	0.067
Arsenic	4.13	5.9E-08	5.6E-07	3.9E-06	2.8E-03	4.6E-03	6.6E-03	1.2E-04	8.6E-03	0.021	**0.61**	0.23
Barium	337	9.6E-08	1.4E-06	4.5E-06	0.012	0.01	9.8E-03	4.6E-04	8.1E-03	0.03	**1.02**	**3.06**
Copper	7.74	2.3E-08	6.8E-07	9.6E-06	5.9E-03	0.01	0.015	1.3E-04	6.3E-03	0.02	0.097	0.11
Nickel	11.4	1.1E-07	5.7E-07	1.1E-05	2.1E-03	8.7E-03	0.016	1.0E-04	0.037	0.092	0.041	0.3
Selenium	1.38	1.8E-07	2.0E-06	3.7E-05	0.04	0.046	0.053	2.8E-03	0.065	0.27	**0.34**	**2.65**
Adjusted HI		7E-07	6E-06	7E-05	0.06	0.08	0.1	0.005	0.1	0.5	**2**	**6**

Note: Bolded values indicate HQs greater than 0.3 or HI greater than 1.
*na = Not available.

Table I-5.4-12
PAUFs for Ecological Receptors for AOC 49-008(c)

Receptor	HR (ha)[a]	Population Area (ha)	PAUF[b]
American Kestrel	106	4240	5.68E-04
American Robin	0.42	16.8	1.43E-01
Deer Mouse	0.077	3	8.03E-01
Desert Cottontail	3.1	124	1.94E-02
Montane Shrew	0.39	15.6	1.55E-01
Red Fox	1038	41,520	5.81E-05

[a] Values from EPA (1993, 059384).

[b] PAUF is calculated as the area of the site (2.4ha) divided by the population area.

Table I-5.4-13
Adjusted HIs for AOC 49-008(c)

COPEC	EPC (mg/kg)	Red Fox (mammalian top carnivore)	American Kestrel (avian Top carnivore)	American Kestrel (avian intermediate carnivore)	American Robin (avian herbivore)	American Robin (avian omnivore)	American Robin (avian insectivore)	Desert Cottontail (mammalian herbivore)	Montane Shrew (mammalian insectivore)	Deer Mouse (mammalian omnivore)	Earthworm (soil dwelling invertebrate)	Plant (terrestrial autotroph-producer)
Selenium	1.9	1.2E-06	1.3E-05	2.5E-04	0.27	0.31	0.36	0.019	0.44	1.84	**0.46**	**3.65**
Bis(2-ethylhexyl)phthalate	0.02	8.6E-09	3.9E-06	3.2E-04	4.0E-04	0.2	0.4	4.5E-07	0.015	0.041	na*	na
Adjusted HI		1E-06	2E-05	6E-04	0.3	0.5	0.8	0.02	0.5	**2**	0.5	**4**

Note: Bolded values indicate HQs greater than 0.3 or HI greater than 1.

*na = Not available.

Table I-5.4-14
PAUFs for Ecological Receptors for AOC 49-008(d)

Receptor	HR (ha)[a]	Population Area (ha)	PAUF[b]
American Kestrel	106	4240	1.34E-03
American Robin	0.42	16.8	3.39E-01
Deer Mouse	0.077	3	1.00E+00
Desert Cottontail	3.1	124	4.60E-02
Montane Shrew	0.39	15.6	3.65E-01
Red Fox	1038	41,520	1.37E-04

[a] Values from EPA (1993, 059384).

[b] PAUF is calculated as the area of the site (5.7 ha) divided by the population area.

Table I-5.4-15
Adjusted HIs for AOC 49-008(d)

COPEC	EPC (mg/kg)	Red Fox (mammalian top carnivore)	American Kestrel (avian Top carnivore)	American Kestrel (avian intermediate carnivore)	American Robin (avian herbivore)	American Robin (avian omnivore)	American Robin (avian insectivore)	Desert Cottontail (mammalian herbivore)	Montane Shrew (mammalian insectivore)	Deer Mouse (mammalian omnivore)	Earthworm (soil dwelling invertebrate)	Plant (terrestrial autotroph-producer)
Copper	39.6	1.4E-06	4.1E-05	5.8E-04	**0.36**	**0.61**	**0.9**	7.6E-03	**0.38**	**0.62**	**0.5**	**0.57**
Selenium	1.01	1.5E-06	1.7E-05	3.2E-04	**0.34**	**0.4**	**0.46**	0.025	**0.56**	**1.22**	0.25	**1.94**
Thallium	0.259	6.7E-06	2.9E-06	6.2E-06	9.6E-03	0.012	0.014	4.8E-03	**0.43**	**0.35**	na*	**5.18**
Uranium	36.6	1.1E-06	1.6E-06	3.1E-06	6.6E-03	7.3E-03	7.8E-03	9.4E-04	0.061	0.049	na	**1.46**
Aroclor-1254	0.055	1.3E-06	1.0E-05	3.4E-04	0.014	0.23	**0.46**	5.5E-05	0.046	0.063	na	3.4E-04
Bis(2-ethylhexyl)phthalate	0.0964	3.5E-08	1.6E-05	1.3E-03	1.6E-03	**0.82**	**1.64**	1.9E-06	0.06	0.088	na	na
Adjusted HI		1E-05	9E-05	0.003	0.8	**2**	**4**	0.04	**2**	**3**	0.8	**9**

Note: Bolded values indicate HQs greater than 0.3 or HI greater than 1.
*na = Not available.

Table I-5.4-16
Summary of LOAEL-Based ESLs for Terrestrial Receptors

COPEC	Receptor	LOAEL-Based ESL* (mg/kg)
Arsenic	Earthworm	68
Barium	Earthworm	3200
	Plant	260
Beryllium	Plant	25
Chromium (Total)	American Robin—insectivore	280
Cobalt	Plant	130
Copper	American Robin—herbivore	110
	American Robin—insectivore	46
	American Robin—omnivore	66
	Deer Mouse	100
	Montane shrew	63
	Earthworm	530
	Plant	490
Lead	American Robin—herbivore	42
	American Robin—insectivore	28
	American Robin—omnivore	33
Manganese	Earthworm	4500
	Plant	1100
Mercury	American Robin—herbivore	0.7
	American Robin—insectivore	0.13
	American Robin—omnivore	0.22
	Earthworm	0.5
Nickel	American Robin—insectivore	210
	Deer Mouse	41
	Montane shrew	19
Selenium	American Robin—herbivore	2
	American Robin—insectivore	1.5
	American Robin—omnivore	1.7
	Deer Mouse	1.2
	Earthworm	41
	Montane shrew	0.99
	Plant	3
Thallium	Deer Mouse	7.3
	Montane shrew	2.2
	Plant	0.5

Table I-5.4-16 (continued)

COPEC	Receptor	LOAEL-Based ESL* (mg/kg)
Vanadium	American Robin—herbivore	17
	American Robin—insectivore	13
	American Robin—omnivore	15
	Plant	80
Aroclor-1254	American Robin—insectivore	0.41
Bis(2-ethylhexyl)phthalate	American Robin—insectivore	0.2
	American Robin—omnivore	0.4
	Montane shrew	5.9

*LOAEL-based ESLs from ECORISK Database, Version 3.3 (LANL 2015, 600929).

Table I-5.4-17
HI Analysis Using LOAEL-Based ESLs for SWMU 49-001(a)

COPEC	EPC (mg/kg)	American Robin (herbivore)	American Robin (omnivore)	American Robin (insectivore)	Montane Shrew	Deer Mouse	Earthworm	Plant
Barium	136	n/a[a]	n/a	n/a	n/a	n/a	0.043	**0.52**
Chromium (Total)	10.7	n/a	n/a	0.038	n/a	n/a	na[b]	na
Cobalt	8.71	n/a	n/a	n/a	n/a	n/a	na	0.067
Manganese	425	n/a	n/a	n/a	n/a	n/a	0.094	**0.39**
Nickel	8.57	n/a	n/a	0.041	**0.45**	0.21	n/a	n/a
Selenium	1.15	**0.58**	**0.68**	**0.77**	**1.16**	**0.96**	n/a	**0.38**
Vanadium	26.1	**1.54**	**1.74**	**2.01**	n/a	n/a	na	**0.33**
HI		**2**	**2**	**3**	**2**	1	0.1	**2**

Note: Bolded values indicate HQ greater than 0.3 or HI greater than 1.

[a] n/a = Not applicable.

[b] na = Not available.

Table I-5.4-18
HI Analysis Using LOAEL-Based ESLs for SWMUs 49-001(b, c, d, g)

COPEC	EPC (mg/kg)	American Robin (herbivore)	American Robin (omnivore)	American Robin (insectivore)	Montane Shrew	Deer Mouse	Plant
Cobalt	6.84	n/a*	n/a	n/a	n/a	n/a	0.053
Selenium	1.08	**0.54**	**0.64**	**0.72**	**1.09**	**0.9**	**0.36**
HI		0.5	0.6	0.7	1	0.9	0.4

Note: Bolded values indicate HQ greater than 0.3 or HI greater than 1.

* n/a = Not applicable.

Table I-5.4-19
HI Analysis Using LOAEL-Based ESLs for SWMU 49-001(e)

COPEC	EPC (mg/kg)	American Robin (herbivore)	American Robin (omnivore)	American Robin (insectivore)	Montane Shrew	Deer Mouse	Earthworm	Plant
Arsenic	4.05	n/a[a]	n/a	n/a	n/a	n/a	0.06	n/a
Barium	190	n/a	n/a	n/a	n/a	n/a	0.059	**0.73**
Beryllium	1.01	n/a	n/a	n/a	n/a	n/a	n/a	0.04
Chromium (Total)	10.6	n/a	n/a	0.038	n/a	n/a	n/a	n/a
Cobalt	6.83	n/a	n/a	n/a	n/a	n/a	na[b]	0.053
Copper	66.9	**0.61**	**1.01**	**1.45**	**1.06**	**0.67**	0.13	0.14
Lead	16.5	**0.39**	**0.5**	**0.59**	n/a	n/a	n/a	n/a
Manganese	396	n/a	n/a	n/a	n/a	n/a	0.088	**0.36**
Nickel	8.42	n/a	n/a	0.04	**0.44**	0.21	n/a	n/a
Selenium	1.3	**0.65**	**0.76**	**0.87**	**1.31**	**1.08**	0.031	**0.43**
Thallium	0.534	n/a	n/a	n/a	0.24	0.073	na	**1.07**
Vanadium	23.9	**1.41**	**1.59**	**1.84**	n/a	n/a	na	0.3
HI		**3**	**4**	**5**	**3**	**2**	0.4	**3**

Note: Bolded values indicate HQ greater than 0.3 or HI greater than 1.

[a] n/a = Not applicable.

[b] na = Not available.

Table I-5.4-20
HI Analysis Using LOAEL-Based ESLs for SWMU 49-001(f)

COPEC	EPC (mg/kg)	American Robin (herbivore)	American Robin (omnivore)	American Robin (insectivore)	Montane Shrew	Deer Mouse	Earthworm	Plant
Arsenic	3.08	n/a[a]	n/a	n/a	n/a	n/a	0.045	n/a
Barium	160	n/a	n/a	n/a	n/a	n/a	0.05	**0.62**
Chromium (Total)	9.58	n/a	n/a	0.034	n/a	n/a	n/a	n/a
Cobalt	5.66	n/a	n/a	n/a	n/a	n/a	na[b]	0.044
Copper	11.1	n/a	0.17	0.24	n/a	n/a	n/a	n/a
Lead	15.7	**0.37**	**0.48**	**0.56**	n/a	n/a	n/a	n/a
Mercury	0.0257	0.037	0.12	0.2	n/a	n/a	0.051	n/a
Nickel	8.29	n/a	n/a	0.039	**0.44**	0.2	n/a	n/a
Selenium	1.15	**0.58**	**0.68**	**0.77**	**1.16**	**0.96**	n/a	**0.38**
Thallium	0.328	n/a	n/a	n/a	0.15	0.045	na	**0.66**
Vanadium	22.9	**1.35**	**1.53**	**1.76**	n/a	n/a	na	0.29
Bis(2-ethylhexyl)phthalate	0.24	n/a	**0.6**	**1.2**	0.041	n/a	na	na
HI		**2**	**4**	**5**	**2**	1	0.1	**2**

Note: Bolded values indicate HQ greater than 0.3 or HI greater than 1.

[a] n/a = Not applicable.

[b] na = Not available.

Table I-5.4-21
HI Analysis Using LOAEL-Based ESLs for SWMU 49-003

COPEC	EPC (mg/kg)	Earthworm	Plant
Arsenic	4.13	0.061	n/a*
Barium	337	0.11	**1.3**
Selenium	1.38	0.034	**0.46**
	HI	0.2	**2**

Note: Bolded values indicate HQ greater than 0.3 or HI greater than 1.
*n/a = Not applicable.

Table I-5.4-22
HI Analysis Using LOAEL-Based ESLs for AOC 49-008(c)

COPEC	EPC (mg/kg)	Deer Mouse	Plant
Selenium	1.9	**1.58**	**0.63**
	HI	**2**	0.6

Note: Bolded values indicate HQ greater than 0.3 or HI greater than 1.

Table I-5.4-23
Adjusted HI Analysis Using LOAEL-Based ESLs for AOC 49-008(c)

COPEC	EPC (mg/kg)	Deer Mouse
Selenium	1.9	**1.27**
	HI	1

Note: Bolded values indicate HQ greater than 0.3 or HI greater than 1.

Table I-5.4-24
HI Analysis Using LOAEL-Based ESLs for AOC 49-008(d)

COPEC	EPC (mg/kg)	American Robin (omnivore)	American Robin (insectivore)	Montane Shrew	Deer Mouse	Plant
Copper	39.6	**0.6**	**0.86**	**0.63**	**0.4**	0.081
Selenium	1.01	**0.59**	**0.67**	**1.02**	**0.84**	**0.34**
Thallium	0.259	n/a*	n/a	0.12	0.035	**0.52**
Uranium	36.6	n/a	n/a	n/a	n/a	0.15
Aroclor-1254	0.055	n/a	0.13	n/a	n/a	n/a
Bis(2-ethylhexyl)phthalate	0.0964	0.24	**0.48**	n/a	n/a	na[b]
HI		1	**2**	**2**	1	1

Note: Bolded values indicate HQ greater than 0.3 or HI greater than 1.

[a] n/a = Not applicable.

[b] na = Not available.

Table I-5.4-25
Adjusted HI Analysis Using LOAEL-Based ESLs for AOC 49-008(d)

COPEC	EPC (mg/kg)	American Robin (omnivore)	American Robin (insectivore)	Montane Shrew	Deer Mouse
Copper	39.6	0.2	0.29	0.23	**0.4**
Selenium	1.01	0.2	0.23	**0.37**	**0.84**
Thallium	0.259	n/a*	n/a	0.044	0.035
Aroclor-1254	0.055	n/a	0.044	n/a	n/a
Bis(2-ethylhexyl)phthalate	0.0964	0.081	0.16	n/a	n/a
Adjusted HI		0.5	0.7	0.6	1

Note: Bolded values indicate HQ greater than 0.3 or HI greater than 1.

* n/a = Not applicable.

Attachment I-1

ProUCL Files
(on CD included with this document)

Attachment I-2

Vapor Intrusion Spreadsheets
(on CD included with this document)

Attachment I-3

Ecological Scoping Checklist

I3-1.0 PART A—SCOPING MEETING DOCUMENTATION

Site IDs	Solid Waste Management Units (SWMUs) 49-001(a), 49-001(b), 49-001(c), 49-001(d), 49-001(g), 49-001(e), 49-001(f), 49-003, Areas of Concern (AOCs) 49-008(c) and 49-008(d)
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.	Hydronuclear and related experiments were conducted at Technical Area 49 (TA-49) between 1959 and 1961. The experiments deposited plutonium, uranium, lead, and beryllium in underground shafts. SWMU 49-001(a), known as Area 1, consists of experimental shafts located in the northwest corner of the TA-49 NES boundary. SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g) are parts of Material Disposal Area (MDA) AB. SWMU 49-001(e), known as Area 3, consists of experimental shafts located in the southwest corner of the MDA AB NES boundary. SWMU 49-001(f), known as Area 4, consists of experimental shafts located in the southeast corner of the MDA AB nuclear environmental site (NES) boundary. SWMU 49-003 is an inactive leach field and associated drainlines at Area 11 within the northern MDA AB NES boundary at TA-49. AOC 49-008(c) consists of an area of potentially contaminated soil from historical radiochemistry operations and small-scale containment experiments at Area 11. AOC 49-008(d) consists of potential soil contamination located within Area 12. Area 12 was used in 1960 and 1961 to conduct confinement experiments related to the hydronuclear experiments conducted at MDA AB.
List of Primary Impacted Media **(Indicate all that apply.)**	**Surface soil –** X **Surface water/sediment –** NA **Subsurface –** X **Groundwater –** NA **Other, explain –** NA
Vegetation Class Based on GIS Vegetation Coverage **(Indicate all that apply.)**	**Water** – NA **Bare ground/unvegetated** – X **Spruce/fir/aspen/mixed conifer** – NA **Ponderosa pine –** NA **Piñon juniper/juniper savannah** – X **Grassland/shrubland** – X **Developed** – X **Burned –** NA
Is T&E habitat present? **If applicable, list species known or suspected of using the site for breeding or foraging.**	No threatened and endangered (T&E) species nesting habitat is present at the site. However, the area is within the foraging range of the Mexican spotted owl.
Provide list of neighboring/ contiguous/upgradient sites, include 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.)**	TA-49 is geographically isolated from other Los Alamos National Laboratory TAs. However, SWMUs and AOCs at TA-49 are located outside the NES boundary. They include AOC 49-002 and SWMUs 49-004 and 49-005(a).
Surface Water Erosion Potential Information	The sites are relatively flat. There is no visible evidence of run-on or runoff. The potential for surface water transport is therefore low for this

Surface water erosion potential is based on site observations	site.

I3-2.0 PART B—SITE VISIT DOCUMENTATION

Site ID	SWMUs 49-001(a), 49-001(b), 49-001(c), 49-001(d), 49-001(g), 49-001(e), 49-001(f), 49-003, AOCs 49-008(c) and 49-008(d)
Date of Site Visit	3/31/2016
Site Visit Conducted by	Randall Ryti, Kent Rich, Richard Mirenda, Tracy McFarland, Joe English, Larry Salazar

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, gravel roads surround the site and a gravel road leads to the entrance of TA-49
Field Notes on the GIS Vegetation Class to Assist in Verifying the Arcview Information	TA-49, in general, has been disturbed and consists primarily of soil intermixed with patches of bedrock, which occurs predominantly near the edges of the mesa east of developed areas. Removal actions have taken place and numerous gravel and dirt roads traverse the area. The dominant overstory vegetation type surrounding the area is ponderosa pine, with minor vegetation components of fir (white and Douglas) and piñon. The understory contains mostly native and nonnative grasses and ruderal species indicative of disturbance, with a few shrubs and forbs. Habitat fragmentation at the site is high. The general habitat quality in undisturbed areas is sufficient to support grazing and foraging by terrestrial receptors.
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 vegetation at the site is healthy and varied. No adverse impacts on plants were noted during field activities, and the habitat is sufficient for supporting foraging of terrestrial receptors. Small mammals and birds are present within the area. The following wildlife has been observed or known to be present while conducting fieldwork at the site: bobcats, elk, mule deer, coyotes, rabbits, mice, and birds. Mountain lions and bears were not spotted, but tracks were identified.

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)	Surface water transport and erosion potential on the mesa top is low because of the relatively flat terrain (<10% slope). Surface water transport and erosion potential are higher near the slopes. The terminal point of surface water transport is northward to Water Canyon, eastward into a tributary canyon to Ancho Canyon, or southward into Ancho Canyon.
Are there any off-site transport pathways (surface water, air, or groundwater) (yes/no/uncertain)? Provide explanation.	Yes. Surface water run-on to the sites and runoff leaving the sites generally enters Water or Ancho Canyons. There may be some air dispersion when the area is dry, but it is a minor transport pathway. A pathway to groundwater is unlikely, because regional groundwater is greater than 1000 ft below ground surface (bgs) to the aquifer. No intermediate or alluvial groundwater is in the vicinity of the sites.

Ecological Effects Information:

Physical Disturbance (Provide list of major types of disturbances, including erosion and construction activities; review historical aerial photos where appropriate.)	No. There is little evidence of disturbances or erosion on mesa tops.
Are there obvious ecological effects (yes/ no/uncertain)? Provide explanation and apparent cause (e.g., contamination, physical disturbance, other).	No. The habitat is healthy and wildlife is abundant.

No Exposure/Transport Pathways:

If there are no complete exposure pathways to ecological receptors on-site and no transport pathways to off-site 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 the likelihood that future construction activities could make contamination more available for exposure or transport.
Not applicable

Adequacy of Site Characterization:

Do existing or proposed data provide information on the nature and extent of contamination (yes/ no/uncertain)? Provide explanation (consider whether the maximum value was captured by existing sample data).	Yes. The sampling approach in the approved investigation work plans (LANL 2008, 102691; NMED 2009, 107002; LANL 2011, 201570; NMED 2011, 204345) included biased sampling to determine the nature and extent of contamination within the aggregate area.

Do existing or proposed data for the site address potential transport pathways of site contamination (yes/ no/uncertain)? **Provide explanation (consider whether other sites should be aggregated to characterize potential ecological risk).**	Yes. Data from samples collected within the SWMUs and AOCs address potential transport pathways and characterize the potential ecological risk. The results indicate the nature and extent of contamination at the sites have been defined.

Additional Field Notes:

Provide additional field notes on the site setting and potential ecological receptors.

The field visit on March 31, 2016, consisted of driving along the perimeter of the NES fence boundary and stopping at various points to approach the fence and view the ecological habitat inside the boundary. Signs of elk and deer sign (tracks and scat) were noted outside the fence. Some deer were also observed outside the fence. The project personnel were asked if large grazers or browsers were ever inside the NES fence. They had not been observed, but it was noted that coyotes were digging under the NES fence, and in several places the boundary of the soil and the fence had been armored with medium-sized rocks (approximately 10–20 cm). The fence has been present for decades as evidenced by the large juniper growing through the fence (several about 1 m tall and some appeared to be 2–3 m tall). Overall, the area is becoming naturalized with abundant habitat for terrestrial receptors.

SWMU 49-001(a). Area 1 had large ponderosa pines as well grasses, forbs, shrubs, and evidence of burrowing activity.

SWMUs 49-001(b), 49-001(c), 49-001(d), and 49-001(g). MDA AB had grasses, forbs, shrubs, and evidence of burrowing activity

SWMU 49-001(e). Area 3 had grasses, forbs, shrubs, and evidence of burrowing activity.

SWMU 49-001(f). Area 4 had grasses, forbs, shrubs, and evidence of burrowing activity.

SWMU 49-003. Area 11 had grasses, forbs, shrubs, and evidence of burrowing activity.

AOC 49-008(c). Area 11 had grasses, forbs, shrubs, and evidence of burrowing activity.

AOC 49-008(d). Area 12 had grasses, forbs, shrubs, and evidence of burrowing activity.

I3-3.0 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 through 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): Likely

Provide explanation: Volatile organic compounds **(**VOCs) were detected in pore gas.

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: Chemicals of potential concern (COPCs) were detected in surface soil.

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 SWMU and/or AOC 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 whether aquatic receptors could be affected by contamination from this site.**

Answer (likely/unlikely/uncertain): Unlikely

Provide explanation: No aquatic communities are present within TA-49 or in close proximity.

Question D:

Is contaminated groundwater potentially available to biological receptors through seeps, springs, or shallow groundwater?

- **Known or suspected presence of contaminants in groundwater.**
- **The potential exists for contaminants to migrate through 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.**
- **Terrestrial wildlife receptors generally will not contact groundwater unless it is discharged to the surface.**

Answer (likely/unlikely/uncertain): Unlikely

Provide explanation: The depth to regional groundwater is greater than 1000 ft. There are no seeps, springs, or shallow groundwater within TA-49.

Question E:

Is infiltration/percolation from contaminated subsurface material a viable transport and exposure pathway?

- **The potential exists for contaminants to migrate to groundwater.**
- **The potential exists for contaminants to migrate through 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.**
- **Terrestrial wildlife receptors generally will not contact groundwater unless it is discharged to the surface.**

Answer (likely/unlikely/uncertain): Unlikely

Provide explanation: The depth to regional groundwater is greater than 1000 ft. There are no seeps, springs, or shallow groundwater within TA-49.

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 erodability of surficial material and the geologic processes of canyon/mesa edges.**

Answer (likely/unlikely/uncertain): Unlikely

Provide explanation: Sites are not located near the main canyon edge, so mass wasting is not relevant. There is minimal evidence of erosion at the sites.

Question G:

Could airborne contaminants interact with receptors through the respiration of vapors?

- **Contaminants must be present as volatiles in the air.**
- **Consider the importance of the inhalation of vapors for burrowing animals.**
- **Foliar uptake of 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: 2

Terrestrial Animals: 2

Provide explanation: VOCs were detected at low concentrations. Screening of pore-gas data did not indicate potential impacts to the gopher.

Question H:

Could airborne contaminants interact with plants through the deposition of particulates or with animals through the inhalation of fugitive dust?

- **Contaminants must be present as particulates in the air or as dust for this exposure pathway to be complete.**
- **Exposure through the 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: 3

Terrestrial Animals: 3

Provide explanation: COPCs were detected in surface soil.

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 is 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: COPCs were detected in surface soil.

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: COPCs are detected in the surface soil.

Question K:

Could contaminants interact with receptors through the 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 groom 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: COPCs are detected in the surface soil.

Question L:

Could contaminants interact with receptors through dermal contact with surficial soils?

- **Significant exposure through 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: Low concentrations of lipophilic COPCs were detected in surface soil.

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: 2

Terrestrial Animals: 2

Provide explanation: Radionuclides were identified as COPCs.

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: No water or sediment was sampled.

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 water or sediment was sampled.

Question P:

Could contaminants interact with receptors through the 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 water or sediment was sampled.

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 water or sediment was sampled.

Question R:

Could suspended or sediment-based 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 water or sediment was sampled.

Question S:

Could contaminants bioconcentrate in free-floating aquatic plants, 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 habitat is present at the 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: No aquatic habitat is present at the sites.

Question U:

Could contaminants bioaccumulate in sedimentary or water-column organisms?

- **Lipophilic 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 habitat is present at the sites.

Question V:

Could contaminants interact with aquatic plants or animals through external irradiation?

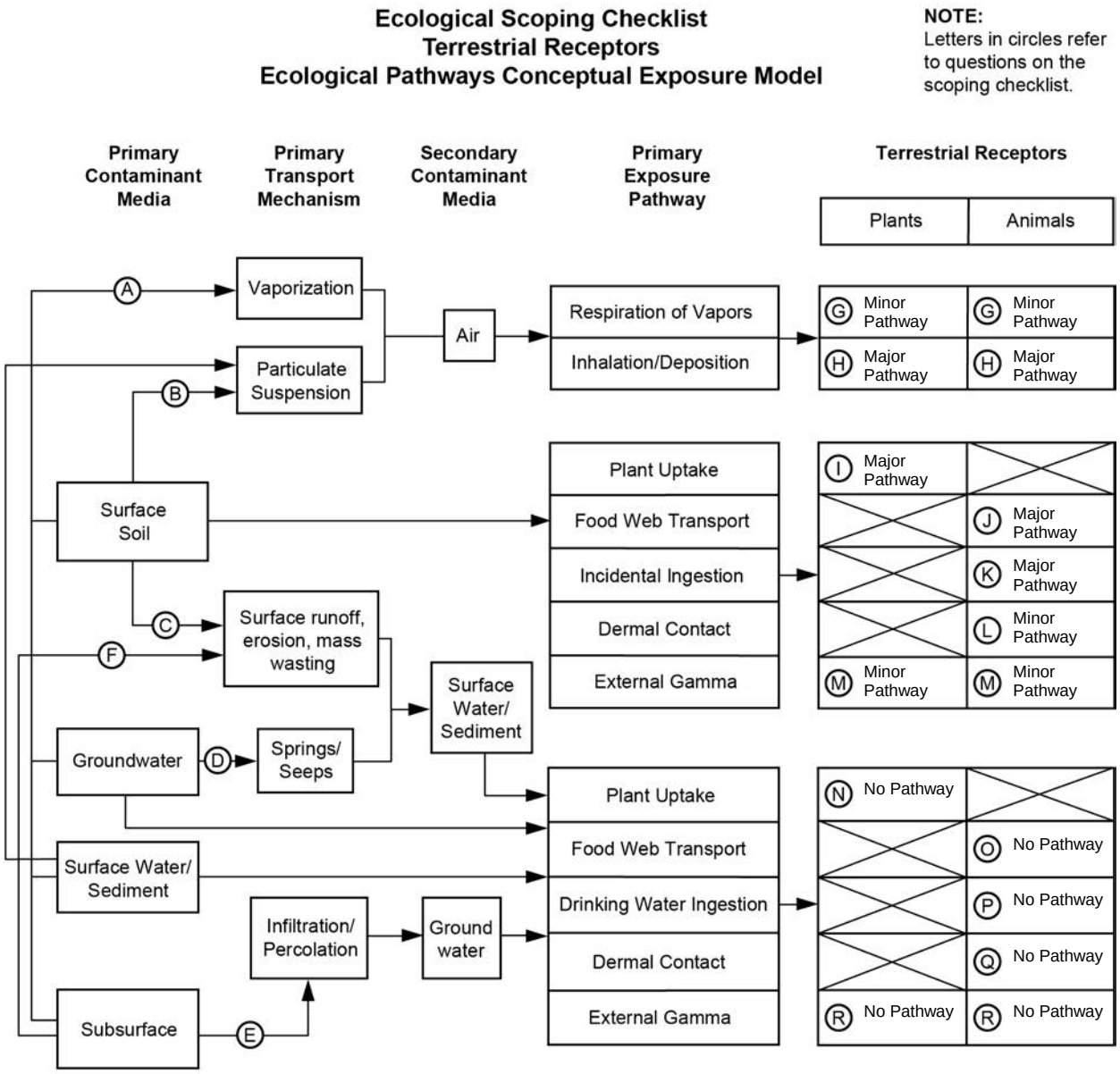
- **External irradiation effects are most relevant for gamma-emitting radionuclides.**
- **The water column acts to absorb radiation; therefore, external irradiation is typically more important for sediment-dwelling organisms.**

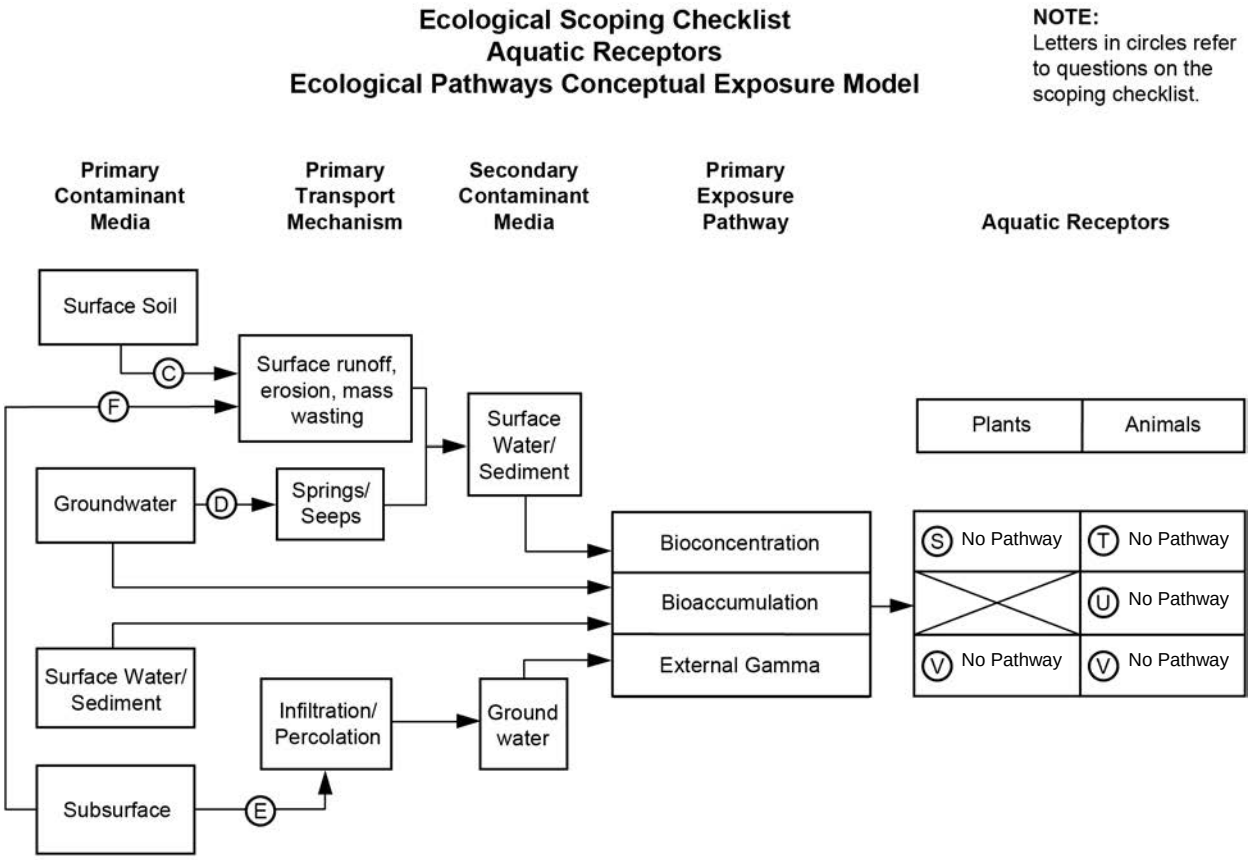
Provide quantification of exposure pathway (0 = no pathway, 1 = unlikely pathway, 2 = minor pathway, 3 = major pathway):

Aquatic Plants: 0

Aquatic Animals: 0

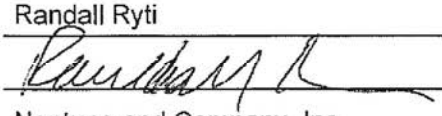
Provide explanation: No aquatic habitat is present at the sites.


Ecological Scoping Checklist
Terrestrial Receptors
Ecological Pathways Conceptual Exposure Model
NOTE:
Letters in circles refer to questions on the scoping checklist.
Primary Contaminant Media
Primary Transport Mechanism
Secondary Contaminant Media
Primary Exposure Pathway
Terrestrial Receptors
Plants
Animals
A
Vaporization
Particulate Suspension
B
Air
Respiration of Vapors
Inhalation/Deposition
G Minor Pathway
H Major Pathway
Surface Soil
C
Surface runoff, erosion, mass wasting
F
Surface Water/ Sediment
Plant Uptake
Food Web Transport
Incidental Ingestion
Dermal Contact
External Gamma
I Major Pathway
J Major Pathway
K Major Pathway
L Minor Pathway
M Minor Pathway
Groundwater
D
Springs/ Seeps
Surface Water/ Sediment
Infiltration/ Percolation
Ground water
Subsurface
E
Plant Uptake
Food Web Transport
Drinking Water Ingestion
Dermal Contact
External Gamma
N No Pathway
O No Pathway
P No Pathway
Q No Pathway
R No Pathway

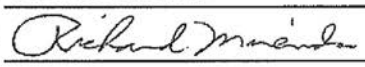

Ecological Scoping Checklist
Aquatic Receptors
Ecological Pathways Conceptual Exposure Model
NOTE:
Letters in circles refer to questions on the scoping checklist.
Primary Contaminant Media
Primary Transport Mechanism
Secondary Contaminant Media
Primary Exposure Pathway
Aquatic Receptors
Surface Soil
C
F
Surface runoff, erosion, mass wasting
Surface Water/ Sediment
Groundwater
D
Springs/ Seeps
Surface Water/ Sediment
Infiltration/ Percolation
Ground water
Subsurface
E
Bioconcentration
Bioaccumulation
External Gamma
Plants
Animals
S No Pathway
T No Pathway
U No Pathway
V No Pathway
V No Pathway

SIGNATURES AND CERTIFICATION

Checklist completed by:

Name (printed): Randall Ryti
Name (signature): 
Organization: Neptune and Company, Inc.
Date completed: March 31, 2016

Checklist reviewed by:

Name (printed): Richard Mirenda
Name (signature): 
Organization: Los Alamos National Laboratory
Date reviewed: 7/20/16

I3-4.0 REFERENCES

The following reference list includes documents cited in this attachment. Parenthetical information following each reference provides the author(s), publication date, and ERID, ESHID, or EMID. ERIDs were assigned by Los Alamos National Laboratory's (the Laboratory's) Associate Directorate for Environmental Management (IDs through 599999); ESHIDs were assigned by the Laboratory's Associate Directorate for Environment, Safety, and Health (IDs 600000 through 699999); and EMIDs are assigned by N3B (IDs 700000 and above).

LANL (Los Alamos National Laboratory), January 2008. "Investigation Work Plan for Sites at Technical Area 49 Inside the Nuclear Environmental Site Boundary, Revision 1," Los Alamos National Laboratory document LA-UR-08-0447, Los Alamos, New Mexico. (LANL 2008, 102691)

LANL (Los Alamos National Laboratory), March 2011. "Phase II Investigation Work Plan for Sites at Technical Area 49 Inside the Nuclear Environmental Site Boundary," Los Alamos National Laboratory document LA-UR-11-1818, Los Alamos, New Mexico. (LANL 2011, 201570)

NMED (New Mexico Environment Department), August 31, 2009. "Approval, Request for Deviations from the Approved Investigation Work Plan for Sites at Technical Area 49 Inside the Nuclear Environmental Sites (NES) Boundary," New Mexico Environment Department letter to D. Gregory (DOE-LASO) and D. McInroy (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NMED 2009, 107002)

NMED (New Mexico Environment Department), June 30, 2011. "Approval, Phase II Investigation Work Plan for Sites at Technical Area 49 Inside the Nuclear Environmental Site Boundary," New Mexico Environment Department letter to G.J. Rael (DOE-LASO) and M.J. Graham (LANL) from J.E. Kieling (NMED-HWB), Santa Fe, New Mexico. (NMED 2011, 204345)