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

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Prepared by the Environmental Programs Directorate

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EXECUTIVE SUMMARY

The Los Alamos National Laboratory Environmental Programs Directorate–Corrective Actions Program has investigated the Technical Area 49 (TA-49) sites outside the nuclear environmental site (NES) boundary. This investigation report presents the investigation activities at six solid waste management units (SWMUs) and areas of concern (AOCs) The SWMUs and AOCs are located in Area 5 [AOC 49-005(b), SWMU 49-006, and AOC 49-008(a)]; Area 6 West (SWMU 49-004); and Area 10 [AOC 49-002 and SWMU 49-005(a)]. AOCs 49-007(a) and 49-007(b) located in Area 6 East have been approved for no further action by the U.S. Environmental Protection Agency and will not be discussed in this report. Additionally, investigation of surface-soil contamination at AOCs 49-008(a) and 49-008(b) is deferred per Table IV-2 of the Compliance Order on Consent; however, limited surface sampling was conducted at AOC 49-008(a) and the results are discussed in this report. No investigation activities were implemented at AOC 49-008(b) at Area 6 East.

A period of experimental activity at TA-49 took place from late 1959 to mid-1961. The hydronuclear and related experiments conducted at TA-49 deposited plutonium, uranium, lead, and beryllium in underground shafts. Area 5 served as a central control area for hydronuclear and related experiments. Area 6 contains an inactive landfill and open burning area used for the disposal of solid material generated from activities conducted elsewhere at TA-49 and a general support area. Area 10 contains an inactive landfill and a calibration chamber used for experimental measurements and calibration tests related to the hydronuclear experiments.

Investigation activities were conducted between October 2009 and February 2010. The objective of the 2009–2010 investigation was to determine the nature and extent of contamination in soil and rock at TA-49 sites outside the NES boundary and obtain general site characterization data for evaluation of remedial alternatives.

The 2009–2010 investigation activities included collection of 660 surface and shallow subsurface soil samples from 330 locations for gross-alpha and -beta radiological screening. Of these screening samples, 206 samples from 103 locations were submitted for laboratory analyses. In addition to the surface sampling, 47 soil and tuff samples were collected from 11 boreholes with a maximum depth of 65 ft below ground surface. Data from the samples collected during the 2009–2010 investigation were combined with data collected from previous investigations completed between 1995 and 1998 that meet current Laboratory data-quality requirements and are incorporated in this investigation report. Pore-gas samples were collected from one borehole at each area and analyzed for volatile organic compounds (VOCs) and tritium.

The sampling data indicate the extent of contamination has been defined at Area 5 [AOC 49-005(b) and SWMU 49-006]. These sites have been determined to pose no potential unacceptable risk or dose to human health or the environment under the current and reasonably foreseeable future land use. No further investigation or remediation activities are warranted at Area 5.

The extent of contamination has not been defined at Area 10 [AOC 49-002 and SWMU 49-005(a)]. Additional sampling is necessary to define the vertical extent of one or more contaminants at each of these sites. Extent of contamination at Area 6 West (SWMU 49-004) is also defined, but additional sampling is necessary to address potential contamination of dioxins and furans. The Laboratory will provide a Phase II investigation work plan to address the additional sampling and data analysis required to define extent at the sites identified in this report. Once additional data are available and extent is defined, human health and ecological risk screening assessments will be conducted to determine if the sites pose a potential unacceptable risk or dose to human health or the environment.

The VOC pore-gas data collected from TA-49 were compared to screening values based on equilibrium partitioning of vapor with groundwater standards or screening levels, to evaluate the potential for the reported VOC concentrations to result in contamination of groundwater. Pore-gas data indicate that VOCs in subsurface pore gas are not a potential source of groundwater contamination. Tritium activities in vapor samples were low and are not a potential source of groundwater contamination.

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1.0 INTRODUCTION

This investigation report presents the October 2009 through February 2010 investigation of Technical Area 49 (TA-49) sites outside the nuclear environmental site (NES) boundary at Los Alamos National Laboratory (LANL or the Laboratory) and presents a comprehensive assessment of current site conditions based on the results of this and previous investigations.

The Laboratory is a multidisciplinary research facility owned by the U.S. Department of Energy (DOE) and managed by Los Alamos 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 (Figure 1.0-1). The Laboratory site covers 40 mi^2 of the Pajarito Plateau, which consists of a series of fingerlike mesas that are separated by deep canyons containing perennial and intermittent streams running from west to east. Mesa tops range in elevation from approximately 6200 ft to 7800 ft. The eastern portion of the plateau stands 300 ft to 1000 ft above the Rio Grande.

The Environmental Programs (EP) Directorate is leading the Laboratory's participation in a national DOE effort to clean up sites and facilities formerly involved in weapons research and development. The EP Directorate's goal is to ensure that past operations do not threaten human or environmental health and safety in and around Los Alamos County. To achieve this goal, the Laboratory is currently investigating sites potentially contaminated by past operations; the sites under investigation are designated as consolidated units, solid waste management units (SWMUs), or areas of concern (AOCs).

This investigation report addresses SWMUs and AOCs outside the NES boundary within TA-49 at the Laboratory. These sites are potentially contaminated with hazardous chemicals and radionuclides. Corrective actions at the Laboratory are subject to the Compliance Order on Consent (the Consent Order). Information on radioactive materials and radionuclides, including the results of sampling and analysis of radioactive constituents, is voluntarily provided to the New Mexico Environment Department (NMED) in accordance with DOE policy.

1.1 General Site Information

The TA-49 sites outside the NES boundary consist of nine SWMUs and AOCs, two of which have been previously investigated and/or remediated and have been approved for no further action (Figure 1.0-2). The investigation of AOC 49-008(a) and SWMU 49-008(b) is deferred per Table IV-2 of the Consent Order; however, samples were collected around former transformer pads located within AOC 49-008(a). Historical details of previous investigations and data for all nine sites are provided in the historical investigation report (HIR) for the TA-49 sites outside the NES boundary (LANL 2007, 098492). The remaining six SWMUs and AOCs were evaluated in the approved investigation work plan (LANL 2008, 102215). This investigation report describes the investigation status and results from sampling activities conducted in 2009–2010 for the six sites investigated and is subdivided into the following three areas according to their locations and operational histories:

- Area 5: AOC 49-005(b), SWMU 49-006, and AOC 49-008(a): Main Control Area
- Area 6 West: SWMU 49-004: Burn Site and Landfill
- Area 10: AOC 49-002 and SWMU 49-005(a): Underground Calibration Chamber and Shafts and Landfill

Table 1.1-1 lists the nine TA-49 sites located outside the NES boundary with a brief description, summary of previous investigations, and investigation activities conducted in 2009–2010 for each site.

1.2 Purpose of Investigation

The objective of the investigation was to collect samples to define the nature and the lateral and vertical extent of contamination for the sampled SWMUs and AOCs located at TA-49 outside the NES boundary and obtain general site characterization data for evaluation of remedial alternatives (LANL 2008, 102215). Another objective was to determine whether contamination at any of the sites poses a potential unacceptable risk to human health or the environment. This report presents details and results of the 2009–2010 investigation activities conducted at six sites located outside the NES boundary within TA-49 and presents recommendations for each site.

1.3 Document Organization

This investigation report is organized in 12 sections, including this introduction, and multiple supporting appendixes. The introduction includes an overview of the investigation and presents the document organization. Section 2 presents the scope of investigation activities, health and safety, waste management, and deviations from the approved work plan (LANL 2008, 102215). Section 3 presents the regulatory criteria. Section 4 presents the methodology used for identification of chemicals of potential concern (COPCs). Section 5 presents an overview of the site characteristics and operational history of TA-49. Sections 6 through 8 present an overview of the site characteristics; operational history; results of previous investigations; field investigation results; contamination based on the analytical results; the identification of COPCs, distribution of contaminations, and the summary of risk screening assessment results, if nature and extent are defined. Section 9 presents conclusions based on applicable historical data as well as the 2009–2010 investigation data and summaries. Section 10 discusses recommendations for additional actions, if warranted, based on applicable data and the risk-screening assessments. Section 11 presents a schedule for recommended activities. Section 12 includes a list of references cited in this report and the map data sources.

Appendixes A through G present field documentation and associated information, the analytical data (on DVD), a quality assurance/quality control (QA/QC) review of analytical data, and supplemental reports. Appendix H presents box plots and results of statistical tests used to identify COPCs. Appendix I details the risk-screening assessments and the results.

2.0 SCOPE OF ACTIVITIES

This section presents an overview of the field activities performed during the implementation of the TA-49 sites outside the NES boundary approved investigation work plan (LANL 2008, 102215). The field investigation results and observations obtained from this investigation are presented in detail in sections 6 through 8, and in the supporting appendixes.

2.1 Field Activities

The following subsections describe the scope of field activities for the 2009–2010 TA-49 investigation 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.

2.1.1 Geodetic Survey

Geodetic surveys were conducted to identify historical, surface and shallow subsurface, and borehole sampling locations. These surveys were conducted before and upon completion of the drilling and surface

sampling campaigns to establish the spatial coordinates for all sampling locations and boreholes. A Trimble 5700 differential global positioning system was used and survey data were collected by qualified personnel and conform 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 as State Plane Coordinate System 83, New Mexico Central, U.S. ft coordinates and are presented in tables in sections 6 through 8 and in Appendix C.

2.1.2 Field Screening

Core samples, drill cuttings, surface, and shallow-subsurface 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 gross-beta radiation and recorded the measurements on boring logs, sample collections logs, and in log books. Borehole logs are presented in Appendix D, and sample collection logs are presented in Appendix G.

All samples were also submitted to the American Radiation Services, Inc. laboratory in White Rock, New Mexico, and Port Allen, Louisiana, for gross-alpha, -beta, and -gamma analysis 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 Area 6 and Area 10 were selected for laboratory analyses 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, 102215). 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 2.1.3 and in the approved work plan (LANL 2008, 102215).

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-electron-volt bulb. In addition, headspace vapor screening for volatile organic compounds (VOCs) 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 field notebook, and in the radiological control technician (RCT) 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 shown in the borehole logs presented in Appendix D and sample collection logs presented in Appendix G.

2.1.3 Surface and Shallow Subsurface Soil Investigation

A total of 660 surface and shallow subsurface soil samples from 330 locations were collected for gross-alpha and -beta radiological screening in October and November 2009 from Areas 5, 6 West, and 10. Of these screening samples, 206 samples from 103 locations were submitted for laboratory analyses. Surface and shallow-subsurface samples were collected in accordance with the approved investigation work plan (LANL 2008, 102215).

Limited surface sampling was conducted at the two transformer pads located within Area 5 [AOC 49-008(a)] because the potential contaminants related to the transformers are distinguishable from potential firing-site contaminants associated with the area. A total of 16 samples from 8 locations were submitted for laboratory analysis of polychlorinated biphenyls (PCBs). The location of the surface samples collected from Area 5 [AOC 49-008(a)] are presented in Figure 2.1-1.

Extensive surface sampling was conducted at Area 6 West (SWMU 49-004) and Area 10 [AOC 49-002 and SWMU 49-005(a)]. The strategy for characterizing the nature and extent of surface contamination at Area 6 West and Area 10 consisted of an iterative sampling approach that combined screening-level sampling with systematic and 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 in excess of 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 historical locations, Category II samples are within 50 ft of the Category I samples, and Category III samples are within 100 ft of the Category I samples. The locations of screening-level surface samples collected from Area 6 West (SWMU 49-004) and Area 10 [AOC 49-002 and SWMU 49-005(a)] are presented in Figures 2.1-2 and 2.1-3, respectively.

All surface and shallow-subsurface samples were screened for gross-alpha and -beta radiation by American Radiation Services, Inc. and submitted for laboratory analyses based on the screening results as specified in the guidelines established in the approved work plan (LANL 2008, 102215). Samples for laboratory analyses 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 picocuries per gram (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 the 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: gamma spectroscopy, americium-241, isotopic plutonium, isotopic uranium, and total analyte (TAL) metals. 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 bottled and submitted for laboratory analysis of the following analytical suites: 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-10 in Appendix D. It should be noted that total uranium was a common analyte for many of the site characterization samples collected from SWMUs and AOCs throughout the Laboratory during the 1990s. Because of the presence of naturally occurring uranium in geologic formations throughout northern New Mexico and the Laboratory, isotopic uranium replaced total uranium in the analytical suites for site characterization samples collected at many SWMUs and AOCs at the Laboratory. Analysis of site characterization samples for isotopic uranium is more accurate than the

analysis for total uranium, and isotopic uranium results more clearly indicate if detected uranium is natural or from historical Laboratory operations at the site.

Based on the gross-alpha and -beta radiation screening results, a total of 126 samples from 63 locations from Area 6 West were submitted for laboratory analyses and a total of 64 samples from 32 locations from Area 10 were submitted for laboratory analyses. Surface and shallow-subsurface samples were collected from 0 to 0.5 ft and 0.5 to 1.5 ft at each location using the hand-auger method in accordance with SOP-06.10, Hand Auger and Thin-Wall Tube Sampler.

Standard QA/QC samples (field duplicates 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.

A summary of the surface and shallow-subsurface samples collected in 2009–2010 from TA-49 sites outside the NES boundary and the requested analyses are presented in Table 2.1-1. Specific details regarding the results of the field screening and subsequent sampling and laboratory analyses conducted at Areas 5 [AOC 49-008(a)], 6 West (SWMU 49-004), and 10 [AOC 49-002 and SWMU 49-005(a)] are presented in sections 6 through 8 below.

2.1.4 Subsurface Investigation

The 2009–2010 subsurface investigation at TA-49 sites outside the NES boundary included the drilling and sampling of 11 boreholes. Following drilling, pore-gas samples were collected from several boreholes for analysis of VOCs and tritium. The details of these subsurface investigations are discussed below.

2.1.4.1 Borehole Drilling and Subsurface Sampling

A total of 47 samples were collected from 11 boreholes drilled to depths ranging from 10 to 65 ft below ground surface (bgs). Subsurface soil, fill and rock samples were collected and analyzed to further characterize the TA-49 sites outside the NES boundary. All boreholes were drilled using a CME-85 hollow-stem auger drill rig equipped with a split core barrel continuous core sampling system. Three boreholes were drilled in Area 5, 4 boreholes were drilled in both Area 6 and Area 10. The locations of the boreholes drilled in Areas 5, 6, and 10 are presented in Figures 2.1-1, 2.1-2, and 2.1-3, respectively. A summary of the boreholes drilled, samples collected, and laboratory analyses performed is presented in Table 2.1-2. 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, 102215). 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). Area 5 and Area 10 subsurface samples were also submitted for laboratory analysis of nitrate (Table 2.1-2). It should be noted that total uranium was a common analyte for many of the site characterization samples collected from SWMUs and AOCs throughout the Laboratory during the 1990s. Because of the presence of naturally occurring uranium in geologic formations throughout northern New Mexico and the Laboratory, isotopic uranium replaced total uranium in the analytical suites for site characterization samples collected at many SWMUs and AOCs at the Laboratory. Analysis of site characterization samples for isotopic uranium is more accurate than the analysis for total uranium, and

isotopic uranium results more clearly indicate if detected uranium is natural or from historical Laboratory operations at the site.

Standard QA/QC samples (field duplicates 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.

2.1.4.2 Pore-Gas Sampling

After completion of drilling, subsurface pore-gas samples were collected in accordance with SOP-5074, Sampling for Sub-atmospheric Air and submitted for laboratory analysis of VOCs and tritium. A total of 4 pore-gas samples were collected from discrete subsurface depth intervals using a single and/or double-packer assembly. A summary of the pore-gas samples collected and laboratory analyses performed is presented in Table 2.1-3.

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. Prior to 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.

2.1.5 Borehole Abandonment

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

2.1.6 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 cleaner, 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 forklifts, drill rigs, etc., were screened by an RCT and released following DOT regulations before entering and exiting the site.

2.1.7 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 facility operations to work in TA-49. All field team members were trained to and adhered to the security requirements.

2.1.8 Waste Management

All investigation-derived waste (IDW) generated during the TA-49 investigation was managed in accordance with the IDW management plan in the approved work plan (LANL 2008, 102215) as well as applicable regulations and Laboratory SOPs. These SOPs incorporate the requirements of all applicable U.S. Environmental Protection Agency (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. All drums were placed on pallets in appropriate less-than-90-day waste storage areas or satellite accumulation areas, pending characterization. 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.

2.2 Deviations

Deviations from the approved work plan (LANL 2008, 102215) occurred during the implementation of the TA-49 investigation.

Two surface sampling locations within Area 6 West (SWMU 49-004) were relocated approximately 5 to 10 ft west 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 analyses.

The approved work plan (LANL 2008, 102215) prescribed the drilling of one angled boring beneath Area 5, AOC 49-005(b). Samples were collected and analyzed in accordance with the work plan; however vertical drilling techniques were used in lieu of angle drilling. The basement foundation was not encountered during drilling operations and the approved sample depth intervals were appropriately sampled.

The approved work plan (LANL 2008, 102215) prescribed the drilling of four angled borings beneath Area 6 West, SWMU 49-004; however, the presence of an overhead power line prevented drilling in the area. Per NMED's approval letter (NMED 2009, 108131), LANL relocated the four boreholes and they were drilled as vertical boreholes in the center of the SWMU rather than as angled boreholes.

The approved work plan (LANL 2008, 102215) prescribed the drilling of one angled boring beneath Area 10, SWMU 49-005(a). A total of 86 surface and shallow subsurface samples were collected at SMWU 49-005(a) and the existence of the landfill in the area was not evident. Because the landfill boundaries were not identified, an angled borehole was not drilled under the center of the landfill. Four vertical boreholes were drilled in the area associated with SWMU 49-005(a) and all approved samples were collected.

The approved work plan (LANL 2008, 102215) prescribed sampling to determine the nature and extent of contamination at four trenches located west of SWMU 49-004. LANL conducted a field verification and

preliminary archeological assessment of the four trenches and determined that the trenches were most likely archaeological sites, not disposal pits. Per NMED's approval letter (NMED 2009, 108131), LANL documented the results of the archeological assessment, presented in Appendix J of this investigation report.

3.0 REGULATORY CRITERIA

This section describes the criteria used for screening COPCs and 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. The applicable soil screening levels (SSLs) for inorganic and organic COPCs and screening action levels (SALs) for radionuclide COPCs at TA-49 sites outside the NES boundary are presented in the sample results tables.

The objective of the current investigation is to determine the nature and extent of contamination in soil and rock at TA-49 and obtain general site characterization data for the evaluation of remedial alternatives. For each SWMU and AOC, the regulatory criteria and the data gathered during the investigation are used to identify COPCs and their distribution in the environment and the resulting potential human and ecological risks (Appendix I) if the nature and extent of contamination at the site are defined. The results of the data assessment as well as the risk-screening assessments confirm the physical location and extent of specific sites and determine if corrective actions at the site(s) are needed.

All analytical results obtained from samples collected during the 2009–2010 investigation, as well as relevant historical investigations, are reviewed for quality (Appendix F), and all data found to be validated to current standards for data usability are regarded as "qualified data." Only qualified data are included in the final dataset used to characterize the nature and extent and evaluate potential risk associated with the TA-49 SWMUs and AOCs outside the NES boundary.

3.1 Current and Future Land Use

The land use within TA-49 is currently industrial and is expected to remain industrial for the reasonably foreseeable future. The current institutional controls at TA-49 include a fence with a locked gate and security patrols of the area. These controls are expected to remain in effect throughout the institutional control period. A construction worker scenario is evaluated because maintenance or repair of underground utilities is a reasonable possibility in the foreseeable future. The residential scenario is also evaluated per the Consent Order to determine if site controls are needed.

3.2 Human Health Screening Levels

Human health risk-screening assessments were conducted for the solid media at the TA-49 sites outside the NES boundary if the nature and extent of contamination were defined by site data. The human health screening assessment (Appendix I) was performed on inorganic and organic COPCs using NMED SSLs (NMED 2009, 108070) for the industrial, construction worker and residential scenarios. Radionuclides were assessed using the Laboratory SALs (LANL 2005, 088493; LANL 2009, 107655). When an NMED SSL is not available for a COPC, the EPA regional screening level (http://www.epa.gov/region06/6pd/rcra_c/pd-n/screen.htm) is used (adjusted to a risk level of 10^{-5} for carcinogens). If an SSL was not available and if sufficient toxicity information was available, a SSL was calculated. A surrogate SSL is used for some COPCs based on structural similarity or breakdown products. Applicable SSLs for inorganic and organic COPCs and SALs for radionuclide COPCs are presented in the data summary tables for each site.

3.3 Ecological Screening Levels

The ecological screening levels (ESLs) were obtained from the ECORISK Database, Version 2.4 (LANL 2009, 107524). The ESLs are based on similar species and are derived from experimentally determined no-observed-adverse-effect levels, lowest-observed-adverse-effect levels, 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 2.4 (LANL 2009, 107524). Ecological risks are assessed in Appendix I.

3.4 Cleanup Goals

The cleanup goals specified in the Consent Order are a target risk of 10^{-5} for carcinogens or a hazard index (HI) of 1 for noncarcinogens. The screening levels described in section 3.2 are based on these cleanup goals and, per DOE, a dose of 15 millirem per yr (mrem/yr) for radionuclides (DOE 2000, 067489). As specified in the Consent Order, the screening levels will be used as cleanup levels unless determined to be impracticable or if the SSLs do not exist for current and reasonably foreseeable future land use.

3.5 Pore-Gas Sampling

The Consent Order does not identify any cleanup standards, risk-based screening levels (SLs), risk-based cleanup goals, or other regulatory criteria for pore gas. For TA-49 pore-gas samples, a screening evaluation is provided comparing maximum concentrations of VOCs in pore gas with SLs. These SLs 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 the standards or screening levels. There are no applicable standards or screening levels for tritium in vapor.

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.

$$C_{water} = C_{air} / H' \qquad \textbf{Equation 3.5-1}$$

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 SL, 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 SLs 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 technical background document (NMED 2009, 108070) or the EPA

regional screening tables (http://www.epa.gov/region06/6pd/rcra_c/pd-n/screen.htm). The following dimensionless form of Henry's law constant was used:

$$H' = \frac{C_{air}}{C_{water}} \qquad \textbf{Equation 3.5-2}$$

Equation 3.5-2 can be used to calculate the screening value (SV):

$$SV = \frac{C_{air}}{1000 \times H' \times SL} \qquad \textbf{Equation 3.5-3}$$

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 screening level (µg/L), and

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

The SLs are the standards or tap water SLs. The groundwater standards are the EPA maximum contaminant level (MCL) or New Mexico Water Quality Control Commission (NMWQCC) groundwater standard, whichever is lower. If there is no MCL or NMWQCC standard, the NMED tap water SLs (NMED 2009, 108070) or the EPA regional tap water SLs (http://www.epa.gov/region06/6pd/rcra_c/pd-n/screen.htm) adjusted to 10^{-5} risk for carcinogens are used. The numerator in Equation 3.5-3 is the concentration of the VOC in pore gas, and the denominator represents the pore-gas concentration needed to exceed the SL. Therefore, if the SV is less than 1, the concentration of the VOC in pore gas does not exceed the SL, even if the VOC plume were to come in contact with groundwater. Table 3.5-1 presents the calculated concentrations of contaminants in pore gas corresponding to groundwater SLs. The results of the screening evaluation are presented in Appendix I.

4.0 IDENTIFICATION OF CHEMICALS OF POTENTIAL CONCERN

The purpose of the data review is to identify COPCs for each of the TA-49 sites outside the NES boundary. COPCs are identified for inorganic chemicals, organic chemicals, and radionuclides only if nature and extent are defined for the site. Extent is determined for inorganic chemicals and radionuclides by comparison to BVs or FVs, and by detection for organic chemicals.

If nature and extent have been defined for the site, COPC identification is performed. If nature and extent are not defined, the COPC identification process is not performed and the site is recommended for further investigation. COPCs are identified for inorganic chemicals and radionuclides following SOPs 5245 and 5246, respectively, as described in section 4.1. The statistical methodology used is presented in section 4.2.

4.1 Identification of Chemicals of Potential Concern

Inorganic COPCs are identified by comparing site data with BVs and maximum concentrations in a background dataset (LANL 1998, 059730) or statistical comparisons depending on whether there are 10 or more samples per medium evaluated. Organic chemicals have no BVs and are identified as COPCs based on detection status. Radionuclides are identified as COPCs based on background comparisons if a BV or FV is available, or based on detection status if no BV or FV is available.

Background data are generally available for 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 dataset (upper tolerance limit 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 dataset for that analyte/media combination.

4.1.1 Inorganic and Radionuclide Background Comparisons

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 sample result with the BV. If sampling results are above the BV and sufficient data are available (10 or more sampling results), statistical tests are used to compare the site sample data with the background dataset for the appropriate media. If statistical tests cannot be performed because of insufficient data or a high percentage of nondetects, the sampling results are compared only to the greater of the BV or the maximum background concentration in the appropriate media. If any sampling result is above the BV or maximum background concentration, the chemical is identified as a COPC. The same evaluation is performed using sample DLs when an inorganic chemical is not detected but has DLs above the BV. If no BV is available, detected inorganic chemicals are identified as COPCs.

Radionuclides are identified as COPCs based on comparisons to BVs for naturally occurring radionuclides or to FVs for fallout radionuclides. Isotopic thorium, 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.

Naturally occurring radionuclides detected at activities above their respective BVs are identified as COPCs. There are no background datasets for these radionuclides so a comparison to the range of background concentrations is not conducted.

The FVs for the fallout radionuclides apply to the top 0 to 1 ft of soil and fill. If a fallout radionuclide is detected in site samples with a bottom depth greater than 1 ft, the radionuclide is identified as a COPC. If the activity of a fallout radionuclide is greater than the FV, comparisons of the top 0- to 1-ft sample data are made with the fallout dataset and the radionuclide is eliminated as a COPC if activities are similar to fallout activities (based on statistical comparisons or comparisons to the maximum fallout concentration).

The FV for tritium in surface soil (LANL 1998, 059730) is in units of picocuries per milliliter (pCi/mL). Use of 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 has adopted the conservative approach of identifying tritium in soil as a COPC based on detection status.

Sample media encountered in this investigation include soil (all soil horizons, designated by the media code ALLH or SOIL); fill material (media code FILL); and Bandelier Tuff (media codes Qbt3 and Qbt4). Because separate BVs are not available for fill material, fill samples are evaluated by comparison to soil BVs (LANL 1998, 059730).

4.2 Statistical Methods Overview

A variety of statistical methods may be applied to each of the datasets. The use of any of these methods depends on how appropriate the method is for the available data.

4.2.1 Distributional Comparisons

Comparisons between site-specific data and Laboratory background data are performed using a variety of statistical methods. These methods begin with a comparison of site data with an upper tolerance limit (UTL) estimated from the background data (UTL [95, 95] or the 95% upper confidence bound on the 95th quantile). The UTLs are used to represent the upper end of 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 the 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 nondetects are relatively frequent (greater than 10% and less than 50%). It handles datasets with nondetects reported at multiple detection limits in a statistically robust manner (Gehan 1965, 055611; Millard and Deverel 1988, 054953). The Gehan test is not recommended if either of the two datasets has more than 50% nondetects. 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 datasets, and its recognition and recommendation in EPA-sponsored workshops and publications.

The quantile test is better suited to assessing shifts of a subset of the data. The quantile test determines whether more of the observations in the top 20% (chosen percentile) of the combined dataset come from the site dataset than would be expected by chance, given the relative sizes of the site and background datasets. If the relative proportion of the two populations being tested is different in the top 20% of the data than in the remainder of the data, the distributions may be partially shifted due to 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 nondetects is approximately the same as the quantile being tested. The quantile test is more powerful than the Gehan test for detecting differences when only a small percentage of the site concentrations are elevated.

The results (p-values) of the Gehan and quantile tests are used to evaluate if sample concentrations are similar to or different than background levels. A sample will either pass (p-value >0.05) or fail (p-value <0.05) the statistical tests. If the p-value is >0.05, the site concentrations are not statistically different than background levels, and if the p-value is <0.05, the site concentrations are considered statistically different than background levels.

Between the two tests (Gehan and quantile), most types of differences between distributions can be identified. Occasionally, if the differences between two distributions appear to occur far into the tails, the slippage test might be performed. This test evaluates the potential for some of the site data to be greater than the maximum concentration in the background dataset if, in fact, the site data and background data came from the same distribution. This test is based on the maximum observed concentration in the background dataset 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 dataset (number of samples from the site and number of samples from background) and determines the probability of n (or more) exceedances if the two datasets 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.

4.2.2 Graphical Representation

Graphical analyses for these datasets include box plots. These analyses provide a visual representation of the data and determine the presence of outliers or other anomalous data that might affect statistical results and interpretations. The plots allow a visual comparison among data distributions. The differences 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 or estimated quantitation limit (EQL).

The box plots produced in 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 dataset contains both detected concentrations and nondetected concentrations reported as DLs, the detected concentrations are plotted as X's, and the nondetected concentrations are plotted as O's. Box plots are presented in Appendix H.

5.0 TA-49 BACKGROUND

This section provides a general description of TA-49, its operational history, and the current surface and subsurface conditions at the site. Specific details including site descriptions and a summary of previous investigations for Area 5 [AOCs 49-005(b) and 49-008(a), and SWMU 49-006], Area 6 West (SWMU 49-004), and Area 10 [AOC 49-002 and SWMU 49-005(a)] are presented below in sections 6, 7, and 8.

5.1 Site Description and Operational History

5.1.1 Description of TA-49

TA-49, also known as the Frijoles Mesa site, occupies approximately 1280 acres along the south-central boundary of the Laboratory (Figure 1.0-1). 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 took place 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 (Figure 1.0-2). These areas are the subject of the "Investigation Work Plan for the TA-49 Sites Inside

the Nuclear Environmental Site Boundary" (LANL 2008, 102691). Investigation results for TA-49 sites inside the NES boundary are presented in a separate investigation report (LANL 2010, 109319).

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).

The location of TA-49 is shown in Figure 1.0-1, and the location of each TA-49 SWMU and AOC is presented in Figure 1.0-2.

5.1.2 TA-49 Operational History

This section summarizes historical operations that have taken place at TA-49.

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-explosives (HE) component. The possibility of detonation during the assembly stage or while the device was stored in the arsenal required further investigation. Underground experiments were designed and conducted to assess this potential problem. Historical aspects of the decision to conduct the experiments are contained in a Laboratory report (Thorn and Westervelt 1987, 006672, pp. 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 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 underground experiments conducted in Areas 1, 2 (MDA AB), 3, and 4 (Figure 1.0-2). These areas are described in the HIR and investigation work plan for the sites within the NES boundary (LANL 2007, 098492; LANL 2008, 102691).

Between 1959 and 1961, auxiliary areas were operated to support the experiments conducted at TA-49. Area 5 served as the central control area for the hydronuclear experiments conducted at MDA AB and Areas 1, 3, and 4. A network of buried cables radiating out from Area 5 allowed for remote electronic measurements of the hydronuclear experiments. Most of these cables were later removed and disposed of in landfills at TA-49 (LANL 1997, 056594, pp. 3-4).

Area 6 West contains an inactive landfill and open burning area used for the disposal of solid material generated from activities conducted elsewhere at TA-49. Nonradioactive materials were burned or buried at SWMU 49-004 in Area 6 West between 1959 and 1961. This open burning/landfill area was also used for the burial of uncontaminated materials generated during general site cleanups in 1971 and 1984 (LANL 1992, 007670, p. 6.4-9).

Area 10 contained a calibration chamber used to perform tests related to the hydronuclear experiments performed elsewhere at TA-49.

Lead shielding was used in Areas 5 and 10 and may be present in surface soil. Based on the detailed historical information available, it is evident that other chemicals were used in very limited quantities at TA-49 (LANL 1992, 007670, pp. 3-8).

In 1977, the La Mesa fire burned much of TA-49, destroying essentially all remaining combustible structures at the site (LANL 1992, 007670, pp. 3-10). As part of the 1984 cleanup, two small landfills [AOC 49-005(b) at Area 5 and SWMU 49-005(a) at Area 10] were created to bury uncontaminated construction debris (LANL 1992, 007670, pp. 3-11).

Extensive interviews with site personnel and archival searches indicate that all of these landfills were used for the burial of uncontaminated debris (LANL 1992, 007670, pp. 6.3-3-6.3-12). All radioactively contaminated surface debris from the various TA-49 cleanup campaigns was transported to the Laboratory's low-level radioactive waste disposal sites at TA-50 and TA-54 (LANL 1997, 056594, p. 4).

Since the hydronuclear experiments ceased in summer 1961, TA-49 has been used lightly and sporadically (DOE 1987, 008663; DOE 1987, 008664). In 1965, a Laboratory group studying atmospheric phenomena conducted lightning observation experiments using the photographic tower that remained in Area 5. The primary historic use of TA-49 as a buffer zone for activities at adjacent firing sites (TA-15 and TA-39) is expected to continue indefinitely according to the Laboratory's "Ten-Year Comprehensive Site Plan" (LANL 2001, 070210).

Currently, there are only a few small-scale on-site uses of TA-49. The Laboratory's high-power microwave group occasionally uses the day room in building 49-115 and its immediate vicinity for equipment development and the roadway between Areas 10 and 12 as a microwave test range. 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.

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, pp. 3-12).

5.2 Site Conditions

5.2.1 Soil and Topography

Soil at Areas 5, 6, and 10 has been disturbed. The soil was originally composed of Hackroy Series and Typic Eutroboralf soil. The soil is intermixed with patches of bedrock, which occurs predominantly near the edges of the mesa, east of developed areas of TA-49.

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

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).

Area 5 is located in the center of TA-49 where the slope is quite flat. At present, the only surface structures remaining in Area 5 are the DT-5A observation well enclosure (structure 49-101), the concrete pads of the former transformer station (structure 49-14), and the photographic tower (structure 49-96).

Areas 6 and 10 are also located on relatively flat portions of Frijoles Mesa but have the greatest potential for runoff and erosion due to their proximity to Water Canyon. Area 6 West (SWMU 49-004) and Area 10 [AOC 49-002 and SWMU 49-005(a)] are located northwest and northeast, respectively, of Area 5 and on the edge of the mesa near Water Canyon.

Surface structures in AOC 49-002 consist of six concrete pads. Two of the concrete pads cover the calibration and elevator shafts, which were a part of the calibration chamber. No surface structures remain at SWMUs 49-004 and 49-005(a).

5.2.2 Surface Water Conditions

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 2003, 076059.1, p. 4-1). Surface-water runoff and infiltration are the critical components that influence the surface hydrology at TA-49. These mechanisms are the predominant pathways for off-site mobilization and transport of contaminants from TA-49.

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

5.2.2.1 Surface-Water Runoff

Surface-water runoff control is provided by drainage ditches along the roads within TA-49. 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 Canyon and Water Canyon reaches downgradient of TA-49 experience ephemeral flow caused by runoff during the intense summer storms and snowmelt events.

5.2.2.2 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 TA-49), and sporadically in drainages leading from the area following intense rainfall events. No contamination from TA-49 sites has been identified in the 30 yr of monitoring (LANL 1992, 007670, p. 4-45; LANL 2006, 093925).

5.2.2.3 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 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).

5.3 Subsurface Conditions

This section provides a description of the geology and hydrogeology encountered at TA-49.

5.3.1 Geology

TA-49 lies on the east side of the Jemez Mountains 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 that 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 emplacement 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 ft up to several tens of ft.

The Tshirege Member includes thin but distinctive layers of bedded, sand-sized particles called surge deposits that demarcate 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 in core hole 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 3 and Qbt 4. 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.

5.3.2 Groundwater Conditions

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 TA-49 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, due to 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. Water content ranges between 5% and 10% by volume under natural conditions (LANL 2005, 092389, pp. A-1-A-3).

5.3.2.1 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 through 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 evapotranspiration 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).

5.3.2.2 Perched Intermediate 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 in spite of 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 through 2005 did not indicate the presence of perched groundwater beneath TA-49.

5.3.2.3 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 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 drop over a 21-yr period from 1960 to 1982. At well DT-10, water levels dropped 0.5 ft/yr from 1960 to 1967. These drops in water levels reflect the normal deep, groundwater-level trend for the region (Purtymun and Ahlquist 1986, 014722).

6.0 AREA 5: BACKGROUND AND FIELD INVESTIGATION RESULTS

This section presents the background, operational history, and summary of previous investigations for the AOCs and SWMUs that comprise Area 5. This section also presents the field investigation results from Area 5 and discusses the nature and extent of contamination of the sampled media. For AOCs and SWMUs for which nature and extent are defined, this section presents the COPC identification and a summary of the ecological and human health risk-screening assessments.

6.1 Background of Area 5

Area 5 served as the main control area for hydronuclear and related experiments conducted at TA-49 from 1959 to 1961 (LANL 1992, 007670, p. 6.4-2). Area 5 originally consisted of an approximately 250-ft × 300-ft fenced area that was later expanded by an additional area of 90 ft × 150 ft to the northeast corner of the site. Figure 2.1-1 shows Area 5 and associated SWMUs and AOCs.

A 1960 site sketch showed 25 structures consisting primarily of transportable buildings (trailers) located at the site (LANL 1992, 007670, p. 6.4-6). Most of the structures were located in the eastern half of Area 5. An elevated tower (former structure 49-96), located in the northwest corner of Area 5, was used to photograph hydronuclear and related experiments in Areas 1 through 4. Photographic activities probably occurred for the most part in a trailer (former structure J-13-3) that contained a darkroom with a drainline

(LANL 1992, 007670, p. 6.4-2). Former trailer J-11-4 housed a radiochemistry laboratory. Waste chemicals from operations in the laboratory were bottled for off-site disposal. Lead sheets (used in former trailers J-11-4 and J-16-8) and lead bricks were used as shielding during the counting of low-level radioactive samples. Lead bricks were also stored along the north Area 5 fence line (LANL 1992, 007670, pp. 6.4-6.8).

The Zia Engineering diary indicates that in November 1959 two sump holes were drilled in Area 5 (Zia Company 1960-1962, 098490). The exact number of sumps drilled and their ultimate use is unknown. However, no sumps are shown on any of the engineering drawings of Area 5 (LANL 1997, 056594, p. 67). Historical engineering drawings show an underground counting room (structure 49-67) equipped with a concrete sump measuring 1.5 ft x 1.5 ft (LANL 1992, 007670, p. 6.4-2). It is unknown whether the sump ever collected any waste.

Electrical transformers were located on concrete pads adjacent to the northwest and northeast corners of the Area 5 fence (LANL 1992, 007670, p. 6.4-8).

During 1960 or 1961, an 8-ft-deep × 6-ft-diameter hole in the floor of structure 49-8 was used in calibration activities (LANL 1992, 007670, p. 6.4-2).

Operations at Area 5 did not involve large quantities of hazardous or radioactive materials (LANL 1992, 007670, p. 6.4-8). Activities conducted at Area 5 after 1961 were limited and most of the structures were removed or destroyed during routine equipment removal operations in 1964 and the major cleanup campaigns carried out in 1971 and 1984. Other combustible structures were destroyed by the La Mesa fire in June 1977 (LANL 1992, 007670, p. 6.4-9).

COPCs include inorganic chemicals; radionuclides around former structure locations; PCBs at the two former electrical transformer locations; and SVOCs at the sump location and landfill. The total quantity of photographic solutions generated during all Area 5 activities was likely less than a few hundred gal. (LANL 1992, 007670, p. 6.4-9).

6.1.1 Historical Releases

There are no documented releases associated with activities at Area 5. Any release would have been through drains to the sump or nearby soil. Airborne and other inadvertent transport of extremely low levels of radionuclides from Area 2 (and possibly from Areas 1, 2A, 2B, 4, and 11) to Area 5 soil is a possibility. Small amounts of metallic debris remain on the surface (LANL 1992, 007670, pp. 6.4-6.9).

6.1.2 Relationship to Other SWMUs and AOCs

Area 5 is located in the center of TA-49 and served as the main control area for hydronuclear and related experiments conducted from 1959 to 1961 (LANL 1992, 007670, p. 6.4-2). The AOCs and SWMUs of Area 5 include AOC 49-005(b), SWMU 49-006, and AOC 49-008(a).

AOC 49-005(b) and SWMU 49-006 are located entirely within AOC 49-008(a). AOC 49-008(a) consists of surface soil throughout Area 5 potentially contaminated from historical operations conducted at the site from 1959 to 1961.

Investigation of AOC 49-008(a) is deferred per Table IV-2 of the Consent Order (Table 1.1-1). Therefore, surface samples were not collected for AOC 49-005(b) or SWMU 49-006 during the 2009–2010 investigation.

6.2 AOC 49-005(b): Small Landfill

6.2.1 Site Description and Operational History

AOC 49-005(b) is a small landfill used to dispose of uncontaminated construction debris from the 1971 and 1984 cleanup operations at Area 5 (Figure 2.1-1). The landfill was created within the four concrete walls of the basement of the former counting room (former structure 49-67) with dimensions of less than 10 ft × 10 ft × 10 ft (LANL 1992, 007670, p. 6.4-9). Building 49-67 was removed in 1964; however, the subsurface basement walls were left in place. Debris from site cleanup campaigns carried out in 1971 and 1984 was placed within the concrete walls and covered with soil. The below-ground concrete walls and landfill remain at the site.

6.2.2 Summary of Previous Investigations

During the 1995 Remedial Facility Investigation (RFI), a radiological survey conducted at AOC 49-005(b) was performed as part of a larger grid (40-ft × 40-ft grid) survey conducted at AOC 49-008(a). Field-screening radiation survey results showed no radiologically contaminated areas (Blair 1996, 055332). The tops of the concrete walls were still visible during the 1995 RFI. Two surface samples were collected from the site of the landfill within the concrete walls and submitted for analysis of TAL metals, isotopic plutonium, and by gamma spectroscopy. Two boreholes drilled into the landfill could only be drilled to a depth of 5 ft before the concrete counting room floor was encountered (LANL 1997, 056594, p. 74). Each core was field screened for radiation and VOCs; radiation was not detected above background and VOCs were not detected. One sample was collected from the bottom of each borehole from a depth interval of 3.3 to 5 ft bgs and 3.6 to 5 ft bgs, respectively, and submitted for analysis of SVOCs, TAL metals, and isotopic plutonium, and by gamma spectroscopy. Samples 0549-05-0135 and 0549-05-0136 from location 49-05078 and samples 0549-05-0137 and 0549-05-0139 from location 49-05049 were incorrectly associated with AOC 49-008(a) in the investigation work plan (LANL 2008, 102215).

Inorganic chemicals detected above BVs included potassium and uranium. Mercury and thallium were not detected above soil BVs but had detection limits above BVs. No SVOCs were detected in the 1995 RFI samples collected from AOC 49-005(b). Plutonium-238, plutonium-239/240, and cesium-137 were detected or detected above FVs (LANL 1997, 056594, p. 77). Historical sample locations and detected concentrations are provided in plates, figures, and tables presented below.

6.2.3 Site Contamination

6.2.3.1 Soil and Rock Sampling

Additional subsurface samples were collected in 2009–2010 at AOC 49-005(b), per the approved investigation work plan (LANL 2008, 102215) were collected from one borehole drilled using a drill rig equipped with a continuous core barrel sampling system. The borehole location is presented in Figure 2.1-1. All samples were submitted through the SMO for analyses at off-site laboratories. All 2009–2010 sample locations were surveyed by LANL using a global positioning system (GPS) (Table 6.2-1). Sample collection and screening methods are described in Appendix B.

Five subsurface samples (two soil and three tuff), were collected in 2009 from one borehole location (location 49-610488) at AOC 49-005(b) (Figure 2.1-1). Data from these samples were combined with decision-level data from previous investigations conducted in 1995. The final dataset includes nine samples (four soil, two fill, and three tuff), plus four field duplicates, collected in 1995 and 2009 from three locations at AOC 49-005(b), with a maximum sample depth of 15 ft bgs (Figure 2.1-1). Table 6.2-2 lists the samples collected and the analyses requested.

6.2.3.2 Soil and Rock Sample Field-Screening Results

All borehole samples collected in 2009 were screened for organic vapors and for alpha and beta/gamma radioactivity at the time they were collected. No organic vapors were detected above ambient air during headspace (PID) screening of samples at AOC 49-005(b). No radiological screening results exceeded twice the daily site background levels. Field-screening results are presented in Table 6.2-3 and on borehole logs in Appendix D and sample-collection logs in Appendix G. There were no changes to sampling or other activities as a result of field-screening results.

6.2.3.3 Soil and Rock Sample Analytical Results

The nature and extent of AOC 49-005(b) are defined by site data; therefore, COPCs were identified and risk-screening assessments were conducted.

Inorganic Chemicals

Inorganic chemicals were detected above BVs, had DLs above BVs, or were detected but have no BV at AOC 49-005(b) (Plate 1). Table 6.2-4 presents the concentrations of inorganic chemicals detected above BVs, detected with no BV, or with DLs above BVs.

Inorganic COPCs in Soil

Six soil/fill samples were collected and analyzed for inorganic chemicals. Each sample was analyzed for TAL metals. Two samples were also analyzed for cyanide, nitrate, and perchlorate. Two samples were analyzed for uranium. Table 6.2-2 summarizes samples collected and the requested analyses for each sample.

- Table 6.2-4 lists the inorganic chemicals above BVs and detected inorganic chemicals that have no BV. The sampling locations and detected concentrations are shown on Plate 1. No statistical comparisons were conducted for inorganic COPCs at AOC 49-005(b) because there are less than 10 samples in the site dataset.
- Cyanide was not detected, but had a DL (0.56) above the BV (0.5 mg/kg) in one of two soil samples. Therefore, cyanide is retained as a COPC in soil.
- Nitrate was detected in two soil samples. Nitrate is retained as a COPC in soil because there is no established BV for nitrate.
- Mercury was not detected above the BV, but had a DL (0.11–0.12 mg/kg) above the BV (0.1 mg/kg) in three soil samples. Therefore, mercury is retained as a COPC in soil.
- Potassium was detected above the BV (3460 mg/kg) in one of five soil samples, with a maximum detected concentration of 3500 mg/kg. Because there were fewer than ten samples, statistical tests could not be performed. No sample results exceeded the maximum background concentration of potassium in soil (6850 mg/kg). The box plot is presented in Figure H-1. Potassium is not identified as a COPC in soil because it is infrequently detected, detected slightly above the BV but below the maximum background concentration, and is an essential nutrient (EPA 1989, 008021).
- Thallium was not detected above BV (0.73 mg/kg), but had DLs (1.4–1.5 mg/kg) above the BV and the maximum background concentration (1 mg/kg) in four soil samples. Therefore, thallium is retained as a COPC in soil.

- Uranium was detected above the BV (1.82 mg/kg) and the maximum background value concentration (3.6 mg/kg) in four soil samples, with a maximum detected concentration of 4.23 mg/kg. The box plot for uranium in soil is presented in Figure H-1. Uranium is retained as a COPC.

Inorganic COPCs in Tuff

Three tuff samples were collected and analyzed for inorganic chemicals including TAL metals, cyanide, nitrate, and perchlorate. Table 6.2-2 summarizes samples collected and the requested analyses for each sample.

- Table 6.2-4 lists the inorganic chemicals above BVs and detected inorganic chemicals that have no BV. The sampling locations and detected concentrations are shown on Plate 1. No statistical comparisons were conducted for inorganic COPCs at AOC 49-005(b) because there are less than ten samples in the dataset.
- Cyanide was not detected in site samples, but had DLs (0.55–0.57 mg/kg) above the BV (0.5 mg/kg) in two of three tuff samples. Therefore, cyanide is retained as a COPC in tuff.
- Nitrate and perchlorate were detected in three of three tuff samples and there are no established BVs for these chemicals. Nitrate and perchlorate are retained as COPCs in tuff.
- Selenium was detected at concentrations exceeding the BV (0.3 mg/kg) in two of three tuff samples with concentrations of 0.53 mg/kg and 1.2 mg/kg. Additionally, there was one DL above the BV (0.37 mg/kg). Selenium is identified as a COPC in tuff.

Organic Chemicals

Four soil/fill samples were collected and analyzed for SVOCs. Two soil samples were also analyzed for VOCs and explosive compounds. Three tuff samples were collected from tuff and analyzed for VOCs, SVOCs, and explosive compounds. The sampling locations and detected concentrations are shown on Plate 2. Table 6.2-2 summarizes the samples collected and the requested analyses for each sample.

Organic chemicals were not detected in soil or tuff samples collected from AOC 49-005(b).

Radionuclides

Radionuclides were detected above BVs/FVs or detected with no BV/FV at AOC 49-005(b). Table 6.2-5 presents the concentrations of radionuclides detected above BVs/FVs or detected with no BV/FV. The sampling locations and detected concentrations are shown on Plate 3.

Radionuclide COPCs in Soil

Six soil/fill samples were collected and analyzed for radionuclides. All six samples were analyzed for isotopic plutonium. Four samples were also analyzed by gamma spectroscopy and two samples were also analyzed for americium-241, tritium, and isotopic uranium. Table 6.2-2 summarizes the samples collected and the requested analyses for each sample.

- Table 6.2-5 presents the radionuclides detected above BVs/FVs, detected radionuclides that have no BV/FV, and detected radionuclides for which FVs do not apply. The sampling locations and detected concentrations are shown on Plate 3. No statistical comparisons were conducted for radionuclide COPCs at AOC 49-005(b) because there are less than ten samples in the dataset.

- Cesium-137 was detected at a concentration of 0.13 pCi/g in one fill sample from a depth where the FV does not apply. Cesium-137 is identified as a COPC in soil.
- Plutonium-238 was detected at a concentration of 0.007 pCi/g in one fill sample from a depth where the FV does not apply. Plutonium-238 is identified as a COPC in soil.
- Plutonium-239/240 was detected at concentrations of 0.025 pCi/g and 0.009 pCi/g in two fill samples from depths where the FV does not apply. Plutonium-239/240 is identified as a COPC in soil.

Radionuclide COPCs in Tuff

- Three tuff samples were collected and analyzed for americium-241, tritium, isotopic plutonium, and isotopic uranium. Table 6.2-2 summarizes the samples collected and the requested analyses for each sample. No statistical comparisons were conducted for radionuclide COPCs at AOC 49-005(b) because there are less than ten samples in the dataset.
- Table 6.2-5 presents the radionuclides detected above BVs/FVs, detected radionuclides that have no BV/FV, and detected radionuclides for which FVs do not apply. The sampling locations and detected concentrations are shown on Plate 3.
- Tritium was detected in one tuff sample at a concentration of 0.223 pCi/g and is identified as a COPC in tuff.

6.2.3.4 Nature and Extent of Soil and Rock Contamination at AOC 49-005(b)

Based on the historical investigations, the approved work plan (LANL 2008, 102215) determined that insufficient data exist to define the nature and extent of contamination at Area 5 and the following data needs for AOC 49-005(b) were indentified:

- Vertical extent of contamination for the small landfill at Area 5 [AOC 49-005(b)], which is located within the concrete walls and floor of the former counting room, has not been defined.

A total of seven inorganic COPCs (cyanide, nitrate, mercury, perchlorate, selenium, thallium, and uranium) and four radionuclides (plutonium-238, plutonium-239/-240, cesium-137, and tritium) were identified in soil and tuff from AOC 49-005(b) as a result of historical investigations and the 2009–2010 investigation. No VOCs, SVOCs or explosive compounds were detected from the 2009–2010 samples.

Inorganic Chemicals

Cyanide was not detected but had DLs above BV at borehole location 49-610488. The lateral and vertical extent of cyanide are defined because it was not detected.

Nitrate was detected at borehole location 49-610488 at a concentration of 1.7 mg/kg. The concentration of nitrate is likely naturally occurring. The lateral and vertical extent of nitrate are defined.

Mercury was not detected but had DLs above the BVs at locations 49-05078 and 49-05079. The lateral and vertical extent of mercury are defined because it was not detected.

Perchlorate was detected at borehole location 49-610488 at a concentration of 0.0065 mg/kg. Concentrations of perchlorate remain low and are essentially the same with depth. The distribution of these low concentrations resembles natural variability. Therefore, the extent is defined for perchlorate.

Selenium was detected above BV at borehole location 49-610488. Concentration decreased with depth. Selenium was not detected above BV at locations 49-05078 and 49-05079. The lateral and vertical extent of selenium are defined.

Thallium was not detected but had DLs above the BVs at locations 49-05078 and 49-05079. The lateral and vertical extent of thallium are defined because it was not detected.

Uranium was detected above BV at locations 49-05078 and 45-05079. Isotopic uranium was not detected above BVs in borehole location 49-610488. Therefore, lateral and vertical extent of uranium are defined.

Organic Chemicals

No SVOCs, VOCs, or explosive compounds were detected in samples collected from AOC 49-005(b). The lateral and vertical extent of SVOCs, VOCs, or explosive compounds are defined.

Radionuclides

Cesium-137 was detected at location 49-05078. Cesium-137 increased with depth at this location but was not detected 10 ft away in samples collected from similar depths at location 49-05079. The vertical and lateral extent of cesium-137 are defined.

Plutonium-238 was detected at location 49-05079. Plutonium-238 was not detected at similar or deeper depths at nearby locations 49-05078 and 49-610488. The vertical and lateral extent of plutonium-238 are defined.

Plutonium-239/240 was detected at locations 49-05078 and 49-05079. Plutonium-239/240 was not detected at similar or deeper depths at nearby location 49-610488. The vertical and lateral extent of plutonium-239/240 are defined.

Tritium was detected at a low level (0.223 pCi/g) in only one sample at location 49-610488. Tritium was not detected at depth. The extent of tritium is defined.

6.2.3.5 Subsurface Vapor Sampling

In 2010, one pore-gas sample was collected from borehole location 49-610488 and analyzed for VOCs and tritium. Table 6.2-6 presents the pore-gas samples collected and the analyses requested.

6.2.3.6 Subsurface Vapor Sample Analytical Results

Table 6.2-7 presents the VOCs detected in the pore-gas samples collected from AOC 49-005(b). The sampling location and detected concentrations are shown on Plate 2. The VOCs detected in pore gas are acetone; benzene; butanone[2-]; chloromethane; dichlorodifluoromethane; ethylbenzene; ethyltoluene[4-]; tetrachloroethene; toluene; trimethylbenzene[1,2,4-]; trimethylbenzene[1,3,5-]; xylene (total); xylene[1,2-]; and xylene[1,3-]+xylene[1,4-]. Tritium was not detected in the pore-gas sample collected from AOC 49-005(b).

6.2.3.7 Nature and Extent of Contamination in Subsurface Pore Gas

The approved work plan (LANL 2008, 102215) prescribed the collection of one pore gas sample from the TD of the borehole drilled at AOC 49-005(b) to determine whether the borehole should be completed as a vapor-monitoring well. If VOCs were detected in the vapor-phase sample at concentrations greater than

10% of the screening levels described in section 3.5, or if tritium was detected in the vapor-phase sample at a concentration greater than the screening levels based on groundwater cleanup levels, the borehole would be completed as a vapor-monitoring well.

Pore-gas data were compared to groundwater standards and screening levels and the results indicate that VOCs in subsurface pore gas are not a potential source of groundwater contamination. Tritium was not detected. Therefore, the nature and extent of contamination of VOCs and tritium in pore gas are defined and the borehole was not completed as a vapor-monitoring well (Tables 3.5-1 and I-3.2-3).

6.2.4 Summary of Human Health Risk Screening

The human health risk screening assessment for AOC 49-005(b) is discussed in Appendix I, section I-4.2.

There are no carcinogenic COPCs for AOC 49-005(b) for the industrial, construction worker, and residential scenarios. The HIs are 0.004, 0.03, and 0.1, respectively, which are below the NMED target HI of 1.0 (NMED 2009, 108070).

The total dose for the industrial scenario is 0.09 mrem/yr, the total dose for the construction worker scenario is 0.38 mrem/yr, and the total dose for the residential scenario is 0.13 mrem/yr, which are below the DOE target dose limit of 15 mrem/yr (DOE 2000, 067489).

Based on the risk-screening assessment results, there are no potential unacceptable risks or doses from COPCs for the industrial, construction worker and residential scenarios.

6.2.5 Summary of Ecological Risk Screening

The ecological risk assessment is presented in Appendix I, section I-5.3. No potential ecological risks were found for any receptor based on minimum ESL comparisons, HI analyses, comparisons to background concentrations, and potential effects to populations (individuals for threatened and endangered [T&E] species).

6.3 SWMU 49-006: Sump

6.3.1 Site Description and Operational History

SWMU 49-006 is the supposed location of a former sump in Area 5 (Figure 2.1-1). Historical engineering documents discuss the construction of two sumps in Area 5 in 1959, although no other existing records or drawings confirm the presence of this sump and it is not known exactly where in Area 5 the sump may have been located (LANL 1992, 007670, p. 6.4-8). Photographic liquids may have been discharged to the sump from a trailer that housed a darkroom. A radiochemistry laboratory in one of the former trailers is another potential source of liquid at Area 5, although this material was reportedly disposed of off-site (LANL 1992, 007670, p. 6.4-8).

6.3.2 Summary of Previous Investigations

The 1995 RFI Phase I included a radiological survey of the site and installation of a borehole at the purported sump location. Because no records defined the sump location, the sample location was based on the presence of vegetation believed to indicate increased liquid infiltration associated with a sump. This location was also near the former location of the photography trailer. One borehole was advanced to a depth of 10 ft bgs at this location; samples were collected from depths of 0 to 0.5 ft and 5 to 10 ft bgs. Both samples were submitted for analysis of SVOCs, isotopic plutonium, and TAL metals, and by gamma

spectroscopy. Antimony, potassium and thallium were not detected above soil BVs but had detection limits above BVs. SVOCs were not detected in samples collected from SWMU 49-006. Plutonium-238 was detected in the subsurface sample collected from Qbt 4 (LANL 1997, 056594, pp. 67-83). Historical sample locations and detected concentrations are provided in plates, maps, and tables presented below. Sample 0549-95-0133 from sample location 49-05095 was incorrectly associated with AOC 49-008(a) in the investigation work plan (LANL 2008, 102215).

6.3.3 Site Contamination

6.3.3.1 Soil and Rock Sampling

Additional samples were collected in 2009 at SWMU 49-006, per the approved investigation work plan (LANL 2008, 102215). Samples were collected using a drill rig equipped with a continuous core-barrel sampling system. All samples were screened for organic vapors and for alpha and beta/gamma radioactivity at the time they were collected. All samples were submitted through the SMO for analyses at off-site laboratories. All sample locations were surveyed by the Laboratory using GPS (Table 6.3-1). Sample collection and screening methods are described in Appendix B.

Sixteen samples (3 soil and 13 tuff) were collected in 2009 from two locations at SWMU 49-006. Data from the samples collected in 2009 were combined with decision-level data from previous investigations. The final dataset includes 17 samples (3 soil and 14 tuff), plus 4 field duplicates, collected in 1995 and 2009 from three locations at SWMU 49-006, with a maximum sample depth of 40 ft bgs (Figure 2.1-1). Table 6.3-2 lists the samples collected and the analyses requested.

6.3.3.2 Soil and Rock Sample Field-Screening Results

Organic vapors were not detected above 0.5 ppm during headspace (PID) screening of samples at SWMU 49-006. No radiological screening results exceeded twice the daily site background levels. Field-screening results are presented in Table 6.3-3. There were no changes to sampling or other activities as a result of field-screening results.

6.3.3.3 Soil and Rock Sample Analytical Results

Inorganic Chemicals

Inorganic chemicals were detected above BVs, had DLs above BVs, or were detected but have no BV at SWMU 49-006. Table 6.3-4 presents the concentrations of inorganic chemicals detected above BVs, detected with no available BV, or with DLs above BVs. The sampling locations and detected concentrations are shown on Plate 1.

Inorganic COPCs in Soil

Three soil samples were collected and analyzed for inorganic chemicals. Each sample was analyzed for TAL metals, cyanide, nitrate, and perchlorate. Table 6.3-2 summarizes samples collected and the requested analyses for each sample.

- Table 6.3-4 lists the inorganic chemicals above BVs and detected inorganic chemicals that have no BV. The sampling locations and detected concentrations are shown on Plate 1. No statistical comparisons were conducted for inorganic COPCs at SWMU 49-006 because there are less than ten samples in the dataset.

- Calcium was detected in one soil sample at a concentration (7010 mg/kg) above the BV (6120 mg/kg), but below the maximum background concentration (14,000 mg/kg). The box plot for calcium is presented in Figure H-2. Calcium is not identified as a COPC in soil because it is infrequently detected, detected slightly above BV but below the maximum background concentration, and is an essential nutrient (EPA 1989, 008021).
- Cyanide was not detected above the BV (0.5 mg/kg), but had DLs (0.55 mg/kg) above the BV in one soil sample. Therefore, cyanide is identified as a COPC.
- Mercury was detected above the BV (0.1 mg/kg) in one soil sample at a concentration of 0.12 mg/kg. Therefore, mercury is identified as a COPC.
- Nitrate was detected in all three soil samples. Nitrate is identified as COPC because there is no established BV for nitrate.

Inorganic COPCs in Tuff

Fourteen tuff samples were collected and analyzed for inorganic chemicals. Thirteen samples were analyzed for TAL metals, cyanide, nitrate, and perchlorate. One sample was analyzed for TAL metals only. Table 6.3-2 summarizes samples collected and the requested analyses for each sample.

- Table 6.3-4 lists the inorganic chemicals above BVs and detected inorganic chemicals that have no BV. The sampling locations and detected concentrations are shown on Plate 1.
- Antimony was not detected in tuff above the BV, but had a DL (0.75 mg/kg) above the BV (0.5 mg/kg) in one sample. Antimony is identified as a COPC in tuff.
- Chromium was detected in one tuff sample at a concentration (8.8 mg/kg) above the BV (7.14 mg/kg), but below the maximum background concentration (13 mg/kg). Statistical tests were performed to determine if the site-sampling results for chromium are different than background. The statistical test results are presented in Table H-1. The results of the Gehan test indicate that the site sample result is statistically different than background. The box plot for chromium is presented in Figure H-2. Chromium is identified as a COPC in tuff.
- Cyanide was not detected, but had DLs (0.53–0.54 mg/kg) above the BV (0.5 mg/kg) in 13 tuff samples. Therefore, cyanide is identified as a COPC in tuff.
- Lead was detected in one tuff sample at a concentration (15.4 mg/kg) above the BV (11.2 mg/kg), but below the maximum tuff background concentration (15.5 mg/kg). Statistical tests were performed to determine if the site sample results for lead are different than background. The statistical test results are presented in Table H-1. The results of both the Gehan and quantile test indicate that the site-sampling results are not statistically different than background. The box plot for lead is presented in Figure H-3. Lead is not identified as COPC in tuff.
- Nitrate was detected in 13 tuff samples. Nitrate is identified as COPC in tuff because there is no established BV for nitrate.
- Selenium was not detected but had DLs (0.32–0.82mg/kg) above the BV (0.3 mg/kg) in 11 tuff samples. Selenium is identified as a COPC in tuff.
- Thallium was not detected in tuff above the BV, but had a DL (1.4 mg/kg) above the BV (1.1 mg/kg), but below the maximum background concentration of thallium in tuff (1.7 mg/kg) in one tuff sample. Statistical tests were performed to determine if the site sample results for thallium are different than background. The statistical test results are presented in Table H-1. The results of both the Gehan test indicate that the site-sampling results are not statistically different

than background. The quantile test could not be evaluated because there are too many nondetect concentrations in the site dataset. The box plot for thallium is presented in Figure H-3. Thallium is not retained as a COPC in tuff.

Organic Chemicals

Organic chemicals were detected at SWMU 49-006. Table 6.3-5 presents the concentrations of detected organic chemicals. The sampling locations and detected concentrations are shown on Plate 2.

Organic COPCs in Soil

Three soil samples were collected and analyzed for organic chemicals. Each sample was analyzed for VOCs, SVOCs, and explosive compounds. Table 6.3-2 summarizes the samples collected and the requested analyses for each sample.

Two organic chemicals [2-butanone and bis(2-ethylhexyl)phthalate] were detected in one sample. Table 6.3-5 presents the detected concentrations and Plate 2 shows the sampling locations and detected concentrations. Butanone[2-] and bis(2-ethylhexyl)phthalate are retained as COPCs.

Organic COPCs in Tuff

Fourteen tuff samples were collected and analyzed for organic chemicals. Thirteen samples were analyzed for VOCs, SVOCs, and explosive compounds. One sample was analyzed for SVOCs only. Table 6.3-2 summarizes the samples collected and the requested analyses for each sample.

Six organic chemicals [amino-4,6-dinitrotoluene[2-], bis(2-ethylhexyl)phthalate, dinitrotoluene[2,4-], dinitrotoluene[2,6-], trinitrotoluene[2,4,6-], and tris (o-cresyl) phosphate] were detected in one or two tuff samples. Table 6.3-5 presents the detected concentrations and Plate 2 shows the sampling locations and detected concentrations. Amino-4,6-dinitrotoluene[2-], bis(2-ethylhexyl)phthalate, dinitrotoluene[2,4-], dinitrotoluene[2,6-], trinitrotoluene[2,4,6-], and tris (o-cresyl) phosphate are retained as COPCs in tuff.

Radionuclides

Radionuclides were detected above BVs/FVs or detected with no BV/FV at SWMU 49-006. Table 6.3-6 presents the concentrations of radionuclides detected above BVs/FVs or detected with no BV/FV. The sampling locations and detected concentrations are shown on Plate 3.

Radionuclide COPCs in Soil

Three soil samples were collected and analyzed for americium-241, tritium, isotopic plutonium, and isotopic uranium. Table 6.3-2 summarizes the samples collected and the requested analyses for each sample.

Table 6.3-6 presents the radionuclides detected above BVs/FVs, detected radionuclides that have no BV/FV, and detected radionuclides for which FVs do not apply. The sampling locations and detected concentrations are shown on Plate 3.

- Tritium was detected in one soil sample and is retained as a COPC.

Radionuclide COPCs in Tuff

Fourteen samples were collected from Qbt 4. Thirteen samples were analyzed for americium-241, tritium, isotopic plutonium, and isotopic uranium. One sample was analyzed for radionuclides by gamma spectroscopy and isotopic plutonium. Table 6.3-2 summarizes the samples collected and the requested analyses for each sample.

Table 6.3-6 presents the radionuclides detected above BVs/FVs, detected radionuclides that have no BV/FV, and detected radionuclides for which FVs do not apply. The sampling locations and detected concentrations are shown on Plate 3.

- Plutonium-238 was detected (0.005 mg/kg) at a depth where the FV does not apply in one tuff sample and is retained as a COPC.
- Tritium was detected in four tuff samples and is retained as a COPC in tuff.

6.3.3.4 Nature and Extent of Soil and Rock Contamination

Based on historical investigations, the approved work plan (LANL 2008, 102215) determined that insufficient data exist to define the nature and extent of contamination at Area 5 and the following data needs for SWMU 49-006 were identified:

- Nature and extent of potential contamination associated with SWMU 49-006 in Area 5 (SWMU 49-006) have not been determined because these features have not been positively located.

A total of five inorganic COPCs (antimony, chromium, cyanide, nitrate, and selenium), seven organic COPCs [Amino-4,6-dinitrotoluene[2-]; Bis(2-ethylhexyl)phthalate; Dinitrotoluene[2,4-]; Dinitrotoluene[2,6-]; Trinitrotoluene[2,4,6-]; and Tris (o-cresyl) phosphate]; and 2 radionuclides (plutonium-238 and tritium) were identified in soil and tuff in SWMU 49-006 during the historical and the 2009–2010 investigations.

Inorganic Chemicals

Antimony was not detected above BV, but had a DL above the BV at location 49-05095. Because all results were nondetect concentrations, the lateral and vertical extent of antimony are defined.

Chromium was detected above the BV in one tuff sample at borehole location 49-610487. Chromium concentrations decreased with depth at borehole location 49-610487. Chromium was not detected above BV at borehole 49-610486, located approximately 15 ft from borehole location 49-610487. The vertical and lateral extent of chromium are defined.

Cyanide was not detected above BV but had DLs above the BVs at locations 49-610486 and 49-610487. Because all results were nondetect concentrations, the lateral and vertical extent of cyanide are defined.

Nitrate was detected at locations 49-610486 and 49-610487 with a maximum concentration of 0.46 mg/kg. The concentrations of nitrate are likely naturally occurring. The lateral and vertical extent of nitrate are defined.

Selenium was not detected, but had DLs above the BVs at locations 49-610486 and 49-610487. Because all results were nondetect concentrations, the lateral and vertical extent of selenium are defined.

Organic Chemicals

Butanone[2-] was detected at borehole location 49-610486. Butanone[2-] was not detected at depth or in nearby borehole location 49-610487 located within 15 ft of borehole location 49-610486. The lateral and vertical extent of butanone[2-] are defined.

Bis(2-ethylhexyl)phthalate was detected at location 49-610486. The concentrations decreased with depth and bis(2-ethylhexyl)phthalate was not detected at borehole 49-610487, located 15 ft from borehole location 49-610486. The lateral and vertical extent of bis(2-ethylhexyl)phthalate are defined.

Amino-4,6-dinitrotoluene[2-]; dinitrotoluene[2,4-]; dinitrotoluene[2,6-]; trinitrotoluene[2,4,6-]; and tris(o-cresyl)phosphate were detected at location 49-610487 in the same sample. These organic chemicals were not detected at depth or in borehole 49-610486, located 15 ft from borehole location 49-610487. The lateral and vertical extent of amino-4,6-dinitrotoluene[2-]; dinitrotoluene[2,4-]; dinitrotoluene[2,6-]; trinitrotoluene[2,4,6-]; and tris(o-cresyl)phosphate are defined.

Radionuclides

Plutonium-238 was detected at a concentration of 0.005 pCi/g at location 49-05095. Plutonium was not detected in samples from borehole 49-610486 and 49-610487, located within 10 ft of location 49-05095. The vertical and lateral extent of plutonium-238 are defined.

Tritium was detected at concentrations ranging from 0.279 to 0.480 pCi/g at locations 49-610486 and 49-610487. The concentrations of tritium are low and do not change substantially with depth in location 49-610486. Concentrations decrease with depth in location 49-610487. The lateral and vertical extent of tritium are defined.

6.3.3.5 Subsurface Vapor Sampling

No pore-gas samples were collected from SWMU 49-006.

6.3.4 Summary of Human Health Risk Screening Assessment

The human health risk screening assessment for SWMU 49-006 is discussed in Appendix I, section I-4.2.

No COPCs were detected in the 0- to 1-ft depth interval. There are no carcinogenic, noncarcinogenic, or radionuclide COPCs for the industrial scenario at SWMU 49-006.

There are no carcinogenic COPCs for the construction scenario at SWMU 49-006. The construction worker HI is 0.03, which is below the NMED target HI of 1.0 (NMED 2009, 108070). The total dose is 0.002 mrem/yr, which is below the DOE target dose limit of 15 mrem/yr (DOE 2000, 067489).

The total excess cancer risk for the residential scenario is 2×10^{-9}, which is below the NMED target risk level of 1×10^{-5} (NMED 2009, 108070). The HI is 0.08, which is below the NMED target HI of 1.0 (NMED 2009, 108070). The total dose is 0.01 mrem/yr, which is below the DOE target dose limit of 15 mrem/yr (DOE 2000, 067489).

Based on the risk-screening assessment results, there are no potential unacceptable risks or doses from COPCs for the industrial, construction worker, and residential scenarios.

6.3.5 Summary of Ecological Screening Assessment

The ecological risk assessment is presented in Appendix I, section 1-5.3. No potential ecological risks were found for any receptor based on minimum ESL comparisons, HI analyses, comparisons to background concentrations, and potential effects to populations (individuals for T&E species).

6.4 AOC 49-008(a): Area of Potential Soil Contamination

6.4.1 Site Description and Operational History

AOC 49-008(a) consists of surface soil throughout Area 5, potentially contaminated from historical central control area operations conducted from 1959 to 1961. The investigation of AOC 49-008(a) is deferred per Table IV of the Consent Order (Table 1.1-1).

Two concrete pads are located directly outside the northeast and northwest corners of Area 5. Electrical transformers were located on each concrete pad from 1959 to 1961. It is not known whether the transformer oil contained PCBs. Oil staining was observed on the concrete pad located outside the northwest corner of Area 5 (former structure 49-14) (LANL 1992, 007670, p. 6.4-8).

6.4.2 Summary of Previous Investigations

Four concrete chip samples were collected from the two transformer pads and screened for gross alpha and beta radiation and PCBs. Data from the 1995 RFI concrete chip samples are screening-level data and were presented in Appendix B of the HIR (LANL 2007, 098523). Aroclor-1260 was detected at the northeast transformer pad (LANL 1997, 056594, pp. 74-83).

6.4.3 Site Contamination

Although investigation of AOC 49-008(a) is deferred per Table IV of the Consent Order, contaminant-specific surface sampling was prescribed in the approved work plan (LANL 2008, 102215) for the two transformer pads associated with AOC 49-008(a). Potential PCB contamination related to the transformers is distinguishable from potential contaminants associated with the nearby firing sites. PCB sampling results are presented in this report to determine the extent of PCB contamination at the site and to evaluate the risk of PCB releases, if present, to human health and the environment.

6.4.3.1 Soil Sampling

Additional samples were collected around the former transformer pads in 2009 at AOC 49-008(a), per the approved investigation work plan (LANL 2008, 102215), using a hand auger. All samples were submitted through the SMO for analyses at off-site laboratories. All sample locations were surveyed by the Laboratory using GPS (Table 6.4-1). Sample collection and screening methods are described in Appendix B.

Sixteen soil samples were collected from depth intervals ranging from 0 to 0.5 ft bgs and 0.5 to 1.5 ft bgs, plus two duplicates were collected in 2009 from eight locations at AOC 49-008(a) (Figure 2.1-1). The samples were analyzed for PCBs only. Table 6.4-2 lists the samples collected and the analyses requested.

6.4.3.2 Soil Sample Field-Screening Results

No radiological screening results exceeded twice the daily site background levels. Field-screening results are presented in Table 6.4-3. There were no changes to sampling or other activities as a result of field-screening results.

6.4.3.3 Soil Sample Analytical Results

Samples were not collected from AOC 49-008(a) for analyses of inorganic chemicals or radionuclides.

Organic Chemicals

Organic chemicals were detected in soil samples at AOC 49-008(a). Plate 2 shows the sampling locations and detected concentrations. Table 6.4-4 presents the concentrations of detected organic chemicals.

Organic COPCs in Soil

Sixteen soil samples were collected and analyzed for PCBs. Table 6.4-2 summarizes the samples collected and the requested analyses for each sample.

Aroclor-1260 was detected in four soil samples. Table 6.4-4 presents the detected concentrations and Plate 2 shows the sampling locations and detected concentrations.

6.4.3.4 Nature and Extent of Soil Contamination

Based on historical investigations, the approved work plan (LANL 2008, 102215) determined that insufficient data exist to define the nature and extent of contamination at Area 5 and the following data needs for AOC 49-008(a) were identified:

- Vertical extent of subsurface radionuclide contamination in the center portion of Area 5, AOC 49-008(a) has not been defined.

The approved work plan (LANL 2008, 102215) incorrectly identified this as a data need for AOC 49-008(a). The data need is acknowledged; however, no subsurface investigations were prescribed in the work plan for AOC 49-008(a) nor are they warranted at this time for the site. Investigation of AOC 49-008(a) is deferred per Table IV of the Consent Order due to the presence of proximate firing sites.

In the approved work plan, contaminant-specific surface sampling was proposed for the two transformer pads associated with AOC 49-008(a) because potential PCB contamination related to the transformers is distinguishable from potential contamination associated with the nearby firing sites.

One organic COPCs (Aroclor-1260) was identified in soil around one of the transformer pads at AOC 49-008(a) as a result of the limited 2009–2010 investigation.

Organic Chemicals

Aroclor-1260 was detected in the surface sample (0 to 0.5 ft bgs) at locations 49-609417, 49-609418, and 49-609420 around the northwest transformer pad. Concentrations decreased with depth. The lateral and vertical extent of Aroclor-1260 are defined.

6.4.3.5 Subsurface Vapor Sampling

No pore-gas samples were collected from AOC 49-008(a).

6.4.4 Summary of Human Health Risk Screening

The human health risk screening assessment for PCB data collected from AOC 49-008(a) is discussed in Appendix I, section I-4.2.

The total excess cancer risks for the industrial, construction worker, and residential scenarios are 8×10^{-8}, 9×10^{-9}, and 3×10^{-7}, respectively, which are below the NMED target risk level of 1×10^{-5} (NMED 2009, 108070). There are no noncarcinogenic or radionuclide COPCs for AOC 49-008(a) for the industrial, construction worker, or residential scenarios.

6.4.5 Summary of Ecological Risk Screening

The ecological risk assessment for PCB data collected from AOC 49-008(a) is presented in Appendix I, section I-5.3. No potential ecological risks were found for any receptor based on minimum ESL comparisons and HI analyses.

7.0 AREA 6 WEST BACKGROUND AND FIELD INVESTIGATION RESULTS

This section presents the background, operational history, and summary of previous investigations for the AOCs and SWMUs that comprise Area 6 West. This section also presents the field investigation results from Area 6 West and discusses the nature and extent of contamination of the sampled media. For AOCs and SWMUs for which nature and extent are defined, this section also presents the COPC identification and a summary of the ecological and human health risk screening assessments.

7.1 Background of Area 6

Area 6 consists of two primary areas: Area 6 East, a general support area, and Area 6 West, an open-burning/landfill area (Figure 1.0-2). AOC 49-008(b), located in Area 6 East is deferred per Table IV of the Consent Order.

SWMU 49-004, located in Area 6 West, is an inactive open-burning area and landfill historically used for the disposal of solid wastes generated from TA-49 experimental activities, located on the far northwest side of TA-49 (Figures 1.0-2 and 7.1-1)

7.1.2 Historical Releases

There are no documented historical releases associated with activities conducted at Area 6.

7.1.3 Relationship to Other SWMUs and AOCs

SWMU 49-004 in Area 6 West and SWMU 49-008(b) in Area 6 East are not associated with or located in close proximity to other SWMUs or AOCs.

7.2 SWMU 49-004: Landfill, Area 6 West

7.2.1 Site Description and Operational History

SWMU 49-004 is a landfill in Area 6 West used from 1959 to 1961 for open-pit burning of combustible construction materials and for the burial of uncontaminated residues generated from other areas at TA-49 (Purtymun and Stoker 1987, 006688) (Figure 7.1-1). Wastes disposed of at this site were reportedly screened for radioactivity before burial (LANL 1992, 007670, p. 6.3-6). No documentation exists concerning disposal of hazardous chemicals, but this is unlikely based on the nature of activities conducted at TA-49. During the 1971 cleanup of TA-49, the landfill was reopened for disposal of uncontaminated materials, principally from Area 11. Similarly, the site was reopened during the 1984 general cleanup of TA-49 when a trench measuring 30 ft × 100 ft × 15 ft was excavated at the site for the disposal of uncontaminated solid materials (LANL 1992, 007670, p. 6.3-7).

The RFI work plan (LANL 1992, 007670) describes four open trenches located west of SWMU 49-004, although not part of SWMU 49-004 (Figure 7.1-1). The work plan also indicates that these previously undocumented trenches were identified from a review of historical aerial photographs. The trenches were not present in photographs taken in 1935 but were present in photographs taken in 1954, 1965, and 1977. Construction of these trenches, therefore, appears to predate activities at TA-49. The trenches were examined during a 1991 field inspection and noted to be approximately 10 ft × 6 ft × 100 ft. One trench appeared to have been backfilled, and one passed through a prehistoric ruin. No evidence of debris was present in or around the trenches. The work plan also noted that interviews and archival searches did not identify additional information concerning these trenches (LANL 1992, 007670, pp. 6.3-11-6.3-12). The possibility that the trenches were utilized by the Laboratory for material disposal or other purposes cannot be categorically excluded (LANL 1997, 056594, p. 52).

In 2009, the Laboratory Cultural Resources Team evaluated the possible origin and nature of the four open trenches located west of SWMU 49-004. The documented results of the archeological assessment are presented in Appendix J of this investigation report.

The Laboratory Cultural Resource Team concluded that two of the trenches (Trenches B and C) are directly associated with visible ancestral pueblo masonry room blocks sites (LA 15861 and LA 15866A, respectively) and were purposefully placed to gain information and/or artifacts from the trench excavations. The Laboratory Cultural Resources Team memorandum states that Trenches A and D could have also been used to explore ancestral field house structures; however, this does not preclude the possibility that one of these two trenches (Trench D), was later used for disposal of debris from TA-49. The Laboratory Cultural Resources Team's report is presented in Appendix J.

7.2.2 Summary of Previous Investigations

During a 1987 environmental survey, surface soil samples (0 to 0.5 ft bgs) and vegetation samples were collected at the open-burning/landfill area and analyzed for TAL metals and radionuclides. Results showed elevated levels of radionuclides, lead, and beryllium (LANL 1992, 007670, p. 6.3-7).

During the June 1991 geophysical survey conducted at the open burning/landfill area, magnetic and electromagnetic anomalies observed were likely due to cable and other metallic debris reportedly buried in the landfill. Survey results indicated that the trench extends northeast about 130 ft beyond the staked area to the edge of Water Canyon increasing total landfill lateral dimensions to approximately 35 ft × 330 ft (LANL 1992, 007670, pp. 6.3-7-6.3-10).

Evaluation of the 1991 geophysical survey results revealed that the 1987 survey sampling locations were not over the main body of the landfill (LANL 1992, 007670, p. 6.3-11).

During the 1995 RFI, a radiological survey was conducted on a 25 ft × 25 ft grid at SWMU 49-004. Based on survey results, an additional 18 survey points were added at the northwest corner of the grid. No radiologically contaminated areas were identified, however field-screening results were above background levels at several locations (Blair 1996, 055332). Thirty-four surface (0 to 0.5 ft bgs) samples were collected from 34 locations on the sampling grid established over SWMU 49-004 and from the grid points added at the northwest corner of SWMU 49-004 based on the 1991 geophysical survey. The samples were field screened for beta/gamma radiation and VOCs and submitted for analysis by gamma spectroscopy. A subset of 18 of the samples were also submitted for analysis of isotopic plutonium and TAL metals (LANL 1997, 056594, pp. 53-67).

During the 1995 RFI, boreholes were drilled at seven locations approximately 50 ft apart along the longitudinal axis of the SWMU 49-004 disposal area. Boreholes were advanced to a depth of 15 ft bgs or until undisturbed tuff was encountered, whichever occurred first. Cores were collected for each 5-ft interval; a total of 18 samples were collected from the seven boreholes. All samples were field screened for beta/gamma radiation and VOCs and submitted for analysis by gamma spectroscopy. A subset of nine samples (at least one from each borehole) was submitted for analysis of isotopic plutonium, TAL metals, and SVOCs.

Inorganic chemicals detected above background included aluminum, barium, calcium, chromium, cobalt, copper, lead, magnesium, manganese, mercury, nickel, potassium, silver, uranium, vanadium, and zinc (LANL 2007, 098523). One organic chemical, 2-chloronaphthalene, was detected in one subsurface fill sample at SWMU 49-004. Radionuclides detected, or detected above BVs/FVs, included americium-241, cesium-137, europium-152, plutonium-238, and plutonium-239/240. Historical sample locations and detected concentrations are provided in plates, maps, and tables presented below.

During the 1995 RFI, a gamma survey was conducted on a 10 ft × 10 ft grid over the four open trenches located west of SWMU 49-004. No radiologically contaminated areas were identified (LANL 1997, 056594, p. 53). Single auger holes were drilled at three of the four open trenches and the soil was examined. Each site had 1.5 to 3 ft of clay soil underlain by pumice. This same pumice material was on the piles of excavated soil at the ends of the trenches. No foreign debris was seen in the augered cuttings. Beta/gamma field screening of the cuttings indicated measurements below background. Based on field observations, it appeared that no material was buried in the trenches (LANL 1997, 056594, p. 53). No samples were collected from the four open trenches during the 1995 RFI.

7.2.3 Site Contamination

7.2.3.1 Soil and Rock Sampling

Additional samples were collected in 2009 at SWMU 49-004, per the approved investigation work plan (LANL 2008, 102215). Samples were collected either by hand auger or by core barrel sampling with a drill rig. All samples were submitted through the SMO for analyses at off-site laboratories. All sample locations were surveyed by LANL using GPS (Table 7.2-1). Sample collection and screening methods are described in Appendix B.

A total of 138 samples (129 soil and 9 tuff), plus 13 field duplicates, were collected in 2009 from 68 locations at SWMU 49-004. Data from the samples collected in 2009–2010 were combined with decision-level data from samples from previous investigations. The final dataset includes 190 samples (176 soil/fill and 14 tuff), plus 15 field duplicates, collected in 1995 and 2009–2010 from 109 locations at

SWMU 49-004, with a maximum sample depth of 65 ft bgs (Plate 4). Table 7.2-2 lists the samples collected and the analyses requested.

7.2.3.2 Soil and Rock Field-Screening Results

Organic vapors were not detected above 1.4 ppm during headspace (PID) screening of samples at SWMU 49-004. No radiological field-screening results exceeded twice the daily site background levels. Field-screening results are presented in Table 7.2-3. There were no changes to sampling or other activities as a result of health and safety-based field-screening results.

Seven shallow or shallow subsurface samples from SMWU 49-004 exceeded either the gross-alpha and/or -beta screening thresholds and additional samples were collected and submitted for appropriate laboratory analyses. The gross-alpha and/or -beta screening results that guided additional sampling are presented in Tables D-1 through D-5 in Appendix D.

7.2.3.3 Soil and Rock Sample Analytical Results

Inorganic Chemicals

Inorganic chemicals were detected above BVs, had DLs above BVs, or were detected but have no BV at SWMU 49-004. Plate 4 shows the sampling locations and Plate 5 detected concentrations. Table 7.2-4 presents the concentrations of inorganic chemicals detected above BVs, detected with no available BV, or with DLs above BVs.

Inorganic COPCs in Soil

A total of 152 soil/fill samples were collected and analyzed for inorganic chemicals. Each sample was analyzed for TAL metals. Seventeen samples were also analyzed for uranium and three samples were analyzed for cyanide, nitrate, and perchlorate. Table 7.2-2 summarizes samples collected and the requested analyses for each sample.

Table 7.2-4 presents the inorganic chemicals above BVs and detected inorganic chemicals that have no BV. The sampling locations and detected concentrations are shown on Plate 5.

- Aluminum was detected at a concentration (35,100 mg/kg) above the BV (29,200 mg/kg) but below the maximum background concentration in soil (61,500 mg/kg) in one soil sample. Statistical tests were performed to determine if site-sampling results for aluminum are different than background. The statistical results are presented in Table H-2 in Appendix H. The result of the Gehan test indicates that the site-sampling results are statistically different than background. The box plot for aluminum is presented in Figure H-4. Aluminum is identified as a COPC in soil.
- Antimony was not detected above BV, but had DLs (1.05 to 6.4 mg/kg) above the BV (0.83 mg/kg) and above the maximum background concentration of antimony in soil (1 mg/kg) in eight soil samples. Antimony is identified as a COPC in soil.
- Barium was detected above the BV (295 mg/kg) but below the maximum background concentration in soil (410 mg/kg) in four soil samples, with a maximum concentration of 403 mg/kg. Statistical tests were performed to determine if site-sampling results for barium are different than background. The statistical results are presented in Table H-2. The result of the Gehan test indicates that the site-sampling results are statistically different than background. The box plot for barium is presented in Figure H-4. Barium is identified as a COPC in soil.

- Beryllium was detected above the BV (1.83 mg/kg) but below the maximum background concentration in soil (3.95 mg/kg) in two soil samples, with a maximum concentration of 2 mg/kg. Statistical test were performed to determine if site-sampling results for beryllium are different than background. The statistical results are presented in Table H-2. The result of the Gehan test indicates that the site-sampling results are statistically different than background. The box plot for beryllium is presented in Figure H-5. Beryllium is identified as a COPC in soil.
- Calcium was detected at a concentration (8190 mg/kg) above the BV (6120 mg/kg) in one soil sample, but below the maximum background concentration of calcium in soil (14,000 mg/kg). Statistical tests were performed to determine if the site-sampling results for calcium are different than background. The statistical test results are presented in Table H-2. The results of both the Gehan test and the quantile test indicate that the site-sampling results are not statistically different than background. The box plot for calcium in soil is presented in Figure H-5. Calcium is not identified as a COPC in soil.
- Cadmium was not detected above the BV, but had DLs (0.527 to 0.69 mg/kg) above the BV (0.4 mg/kg) in eight soil samples. None of the DLs exceeded the maximum background concentration of cadmium in soil (2.6 mg/kg). The box plot for cadmium in soil is presented in Figure H-6. Cadmium is not identified as a COPC in soil.
- Cobalt was detected above the BV (8.64 mg/kg) in nine soil samples and the maximum background concentration of cobalt (9.5 mg/kg) in three soil samples, with concentrations ranging from 8.7 to 14.9 mg/kg. Statistical test were performed to determine if site-sampling results for cobalt are different than background. The statistical results are presented in Table H-2. The result of the Gehan test indicates that the site-sampling results are statistically different than background. The box plot for cobalt is presented in Figure H-6. Cobalt is identified as a COPC in soil.
- Copper was detected above the BV (14.7 mg/kg) in 13 soil samples and the maximum background concentration of copper (16 mg/kg) in 9 soil samples, with concentrations ranging from 14.8 to 120 mg/kg. Statistical test were performed to determine if the site sample results for copper are different from background. The result of the Gehan test indicates that the site-sampling results are statistically different than background. The statistical results are presented in Table H-2. The box plot for copper is presented in Figure H-7. Copper is identified as a COPC in soil.
- Lead was detected above the BV (22.3 mg/kg) in 6 soil samples and the maximum background concentration of lead (28 mg/kg) in 3 soil samples, with concentrations ranging from 23 to 45.5 mg/kg). The box plot for lead is presented in Figure H-7. The maximum detected concentration was interpreted as substantially greater than the BV, and no further evaluation is necessary. Lead is identified as a COPC in soil.
- Manganese was detected above the BV (671 mg/kg) but below the maximum background concentration in soil (1100 mg/kg) in six soil samples, with concentrations of ranging from 703 to 1030 mg/kg. Statistical test were performed to determine if site-sampling results for manganese are different than background. The statistical results are presented in Table H-2. The result of the Gehan test indicates that the site-sampling results are statistically different than background. The box plot for manganese is presented in Figure H-8. Manganese is identified as a COPC in soil.
- Nickel was detected at a concentration (19.6 mg/kg) above the BV (15.4 mg/kg) but below the maximum background concentration in soil (29 mg/kg) in one soil sample. Statistical test were performed to determine if site-sampling results for nickel are different than background. The statistical results are presented in Table H-2. The result of the Gehan test indicates that the site-

sampling results are statistically different than background. The box plot for nickel is presented in Figure H-8. Nickel is identified as a COPC in soil.

- Mercury was detected above the BV (0.1 mg/kg) in one soil sample, with a maximum concentration of 0.11 mg/kg. Mercury also had DLs (0.11 to 0.12 mg/kg) above the BV in 15 soil samples. Mercury is identified as a COPC in soil.
- Perchlorate was detected in one soil sample. Perchlorate is identified as a COPC in soil because it was detected in site samples and there is no established BV.
- Potassium was detected above the BV (3460 mg/kg) in six soil samples, with a maximum detected concentration of 4310 mg/kg. The sample results did not exceed the maximum soil background concentration 6850 mg/kg. Statistical tests were performed to determine if the site-sampling results for potassium are different than background. The statistical test results are presented in Table H-2. The results of both the Gehan test and the quantile test indicate that the site-sampling results are not statistically different than background. The box plot for potassium in soil is presented in Figure H-9. Potassium is not identified as a COPC in soil.
- Selenium was detected above the BV (1.52 mg/kg) and above the maximum background concentration of selenium in soil (1.7 mg/kg) in two soil samples, with a maximum concentration of 1.9 mg/kg. Statistical tests were performed to determine if the site-sampling results for selenium are different than background. The statistical test results are presented in Table H-2. The result of the Gehan test indicates that the site-sampling results are statistically different than background. The box plot for selenium is presented in Figure H-9. Selenium is identified as a COPC in soil.
- Silver was detected above the BV (1 mg/kg) in three soil samples, with a maximum concentration of 11.6 mg/kg. Silver also had DLs (1.4 to 1.6 mg/kg) above the BV in nine soil samples. Results were compared only to the BV because a background dataset for silver in soil is not available. Silver is identified as a COPC in soil.
- Sodium was detected above the BV (915 mg/kg) in three soil samples, with a maximum concentration of 1840 mg/kg. One concentration exceeded the maximum background concentration of sodium in soil (1800 mg/kg). Statistical tests were performed to determine if the site-sampling results for sodium are different than background. The statistical test results are presented in Table H-2. The results of both the Gehan test and the quantile test indicate that the site-sampling results are not statistically different than background. The box plot for sodium in soil is presented in Figure H-10. Sodium is not identified as a COPC in soil.
- Thallium was detected in two soil samples at concentrations (0.74 and 0.77 mg/kg) above the BV (0.73 mg/kg), but below the maximum background concentration (1 mg/kg). Thallium also had DLs (0.97 to 1.4 mg/kg) above the BV in 20 soil samples. Statistical tests could not be performed because of the large percentage of nondetect concentrations in the site and background datasets. The box plot for thallium in soil is presented in Figure H-10. Thallium is identified as a COPC in soil.
- Uranium was detected (1.85 to 10.7 mg/kg) above the BV (1.82 mg/kg) in 19 soil samples. Uranium is interpreted as being substantially above background, and no further evaluation is necessary. The box plot for uranium in soil is presented in Figure H-11. Uranium is identified as a COPC.
- Zinc was detected (49.8 to 812 mg/kg) above the BV (48.8 mg/kg) in 25 soil samples. Zinc is interpreted as being substantially above background, and no further evaluation is necessary. The box plot for zinc in soil is presented in Figure H-11. Zinc is identified as a COPC.

Inorganic COPCs in Tuff

Twelve tuff samples were collected and analyzed for inorganic chemicals. Each sample was analyzed for TAL metals. Nine samples were also analyzed for cyanide, nitrate, and perchlorate. Table 7.2-2 summarizes samples collected and the requested analyses for each sample.

Table 7.2-4 lists the inorganic chemicals above BVs and detected inorganic chemicals that have no BV. The sampling locations are presented on Plate 4 and detected concentrations are shown on Plate 5.

- Aluminum was detected above the BV (7340 mg/kg) and maximum tuff background concentration (8370 mg/kg) in five tuff samples, with a maximum concentration of 12,400 mg/kg. Statistical tests were performed to determine if the site-sampling results for aluminum are different than background. The statistical test results are presented in Table H-3 in Appendix H. The results of both the Gehan and quantile tests indicate that the site-sampling results are statistically different than background. The box plot for aluminum in tuff is presented in Figure H-12. Aluminum is identified as a COPC in tuff.
- Antimony was not detected, but had DLs (0.992 to 6.5 mg/kg) above the BV (0.5 mg/kg) in 12 tuff samples. Antimony is identified as a COPC in tuff.
- Barium was detected above the BV (46 mg/kg) and above the maximum tuff background concentration (51.6 mg/kg) in six tuff samples, with a maximum concentration of 154 mg/kg. Barium is interpreted as being substantially above background, and no further evaluation is necessary. The box plot for barium in tuff is presented in Figure H-12. Barium is identified as a COPC in tuff.
- Calcium was detected above both the BV (2200 mg/kg) and maximum tuff background concentration (2230 mg/kg) in five tuff samples, with a maximum concentration of 10,800 mg/kg. Statistical tests were performed to determine if the site-sampling results for calcium are different than background. The statistical test results are presented in Table H-3. The results of both the Gehan test and the quantile test indicate that the site-sampling results are statistically different than background. The box plot for calcium in tuff is presented in Figure H-13. Calcium is identified as a COPC in tuff.
- Chromium was detected above the BV (7.14 mg/kg), but below the maximum tuff background concentration (13 mg/kg) in five tuff samples, with a maximum concentration of 10.4 mg/kg. Statistical tests were performed to determine if the site-sampling results for chromium are different than background. The statistical test results are presented in Table H-3. The result of the Gehan test indicates that the site-sampling results are statistically different than background. The box plot for chromium in tuff is presented in Figure H-13. Chromium is identified as a COPC in tuff.
- Cobalt was detected above the BV (3.14 mg/kg) in five tuff samples, with a maximum concentration of 6.1 mg/kg. Statistical tests were performed to determine if the site-sampling results for cobalt are different than background. The statistical test results are presented in Table H-3. The results of the both the Gehan and quantile tests indicate that the site-sampling results are not statistically different than background. The box plot for cobalt in tuff is presented in Figure H-14. Cobalt is not identified as a COPC in tuff.
- Copper was detected above both the BV (4.66 mg/kg) and maximum tuff background concentration (6.2 mg/kg) in five tuff samples, with a maximum a concentration of 339 mg/kg. Copper is interpreted as being substantially above background, and no further evaluation is

necessary. The box plot for copper in tuff is presented in Figure H-14. Copper is identified as a COPC in tuff.

- Iron was detected above the BV (14,500 mg/kg) in one tuff sample, at a concentration of 16,400 mg/kg. Statistical tests were performed to determine if the site-sampling results for iron are different than background. The statistical test results are presented in Table H-3. The results of the Gehan test indicate that the site-sampling results are statistically different than background. The box plot for iron in tuff is presented in Figure H-15. Iron is identified as a COPC in tuff.
- Lead was detected above the BV (11.2 mg/kg), with a maximum concentration of 64.5 mg/kg. Lead is interpreted as being substantially above background, and no further evaluation is necessary. Lead is identified as a COPC in tuff. The box plot for lead in tuff is presented in Figure H-15. Lead is identified as a COPC in tuff.
- Magnesium was detected above the BV (1690 mg/kg) in six tuff samples, at a maximum concentration of 2760 mg/kg. Statistical tests were performed to determine if the site-sampling results for magnesium are different than background. The statistical test results are presented in Table H-3. The results of the Gehan test indicate that the site-sampling results are statistically different than background. The box plot for magnesium in tuff is presented in Figure H-16. Magnesium is identified as a COPC in tuff.
- Nickel was detected above the BV (6.58 mg/kg) and, if applicable, above the maximum tuff background concentration (7 mg/kg) in six tuff samples, with a maximum concentration of 8.55 mg/kg. Statistical tests were performed to determine if the site-sampling results for nickel are different than background. The statistical test results are presented in Table H-3. The results of the quantile test indicate that the site-sampling results are statistically different than background. The box plot for nickel in tuff is presented in Figure H-16. Nickel is identified as a COPC in tuff.
- Perchlorate was detected in five tuff samples and there is no established BV. Perchlorate is identified as COPC in tuff.
- Selenium was not detected above BV but had DLs (0.998 to 1.14 mg/kg) above the BV (0.3 mg/kg) in nine tuff samples. Selenium is identified as a COPC in tuff.
- Uranium was detected above the BV (2.4 mg/kg) in three tuff samples, with a maximum concentration of 3.6 mg/kg. Because there are fewer than 10 samples, statistical tests could not be performed, so uranium data were compared to the maximum background value. All uranium results were below the maximum tuff background concentration (5 mg/kg). Uranium is not identified as a COPC in tuff.
- Vanadium was detected above the BV (17 mg/kg) in four tuff samples, with a maximum sample concentration of 22.1 mg/kg. One sample result exceeded the maximum background concentration (21 mg/kg). Statistical tests were performed to determine if the site-sampling results for vanadium are different than background. The statistical test results are presented in Table H-3. The results of the Gehan test indicate that the site-sampling results are statistically different than background. The box plot for vanadium in tuff is presented in Figure H-17. Vanadium is identified as a COPC in tuff.
- Zinc was detected above the BV (63.5 mg/kg) in two tuff samples, with a maximum concentration of 216 mg/kg. Statistical tests were performed to determine if the site-sampling results for zinc are different than background. The statistical test results are presented in Table H-3. The results of the Gehan and quantile tests indicate that the site-sampling results are not statistically different than background. The box plot for zinc in tuff is presented in Figure H-17. Zinc is not identified as a COPC in tuff.

Organic Chemicals

Organic chemicals were detected in samples from SWMU 49-004. Table 7.2-5 presents the concentrations of detected organic chemicals. The sampling locations are presented on Plate 4 and detected concentrations are shown on Plate 6.

Organic COPCs in Soil

Nine soil samples were collected and analyzed for organic chemicals. All samples were analyzed for SVOCs and three samples were also analyzed for VOCs and explosive compounds. Table 7.2-2 summarizes the samples collected and the requested analyses for each sample.

One organic chemical (chloronaphthalene[2-]) was detected in one soil sample. Table 7.2-5 presents the detected concentrations and Plate 6 shows the sampling locations and detected concentrations. Chloronaphthalene[2-] is identified as COPC in soil.

Organic COPCs in Tuff

Twelve tuff samples were collected and analyzed for organic chemicals. All samples were analyzed for SVOCs and nine samples were also analyzed for VOCs and explosive compounds. Table 7.2-2 summarizes the samples collected and the requested analyses for each sample.

Five organic chemicals (bis[2-ethylhexyl]phthalate; methylene chloride; methylnaphthalene[2-]; naphthalene; and pyrene) were detected in at least one sample from tuff. Table 7.2-5 presents the detected concentrations, and Plate 6 shows the sampling locations and detected concentrations. Bis[2-ethylhexyl]phthalate; methylene chloride; methylnaphthalene[2-]; naphthalene; and pyrene are identified as COPCs in tuff.

Radionuclides

Radionuclides were detected above BVs/FVs or detected with no BV/FV in samples from SWMU 49-004 (Plate 7). Table 7.2-6 presents the concentrations of radionuclides detected above BVs/FVs or detected with no BV/FV. Statistical comparisons were not conducted because the radionuclides have no BV/FV dataset or are fallout radionuclides detected in soil and tuff below 1 ft bgs, so they are retained as COPCs.

Radionuclide COPCs in Soil

A total of 176 soil/fill samples were collected and analyzed for radionuclides, of which 173 were analyzed for radionuclides by gamma spectroscopy; 129 analyzed for americium-241 and isotopic uranium; 152 analyzed for isotopic plutonium; 5 analyzed for strontium-90 and technicium-99; and 3 analyzed for tritium. Table 7.2-2 summarizes the samples collected and the requested analyses for each sample.

Table 7.2-6 presents the radionuclides detected above BVs/FVs, detected radionuclides that have no BV/FV, and detected radionuclides for which FVs do not apply. The sampling locations and detected concentrations are shown on Plate 7.

- Americium-241 was detected above the FV (0.13 pCi/g) in four samples, and was also detected in two samples from depths for which the FV does not apply, with a maximum concentration of 0.43 pCi/g. Americium-241 is identified as a COPC in soil.

- Cesium-134 was detected in one soil sample. Because there is no FV for cesium-134, it is retained as a COPC in soil.
- Cesium-137 was detected above the FV (1.65 pCi/g) in four samples, and was also detected in one sample from depths for which the FV does not apply, with a maximum concentration of 3.28 pCi/g. Cesium-137 is identified as a COPC in soil.
- Europium-152 was detected in two samples. Because there is no FV for europium-152, it is retained as a COPC in soil.
- Plutonium-238 was detected above the FV (0.023 pCi/g) in one sample, and was also detected in two samples from depths for which the FV does not apply, with a maximum concentration of 0.025 pCi/g. Plutonium-238 is identified as a COPC in soil.
- Plutonium-239/240 was detected above the FV in 13 samples, and was also detected in 10 samples at sampling depths where the FVs do not apply, with a maximum concentration of 0.998 pCi/g. Plutonium-239/240 is retained as a COPC in soil and fill.

Radionuclide COPCs in Tuff

Fourteen tuff samples were collected and analyzed for radionuclides. Four tuff samples were analyzed for radionuclides by gamma spectroscopy and three tuff samples were also analyzed for isotopic plutonium. Nine samples were analyzed for americium-241, tritium, isotopic plutonium and isotopic uranium. Table 7.2-2 summarizes the samples collected and the requested analyses for each sample.

Table 7.2-6 presents the radionuclides detected above BVs/FVs, detected radionuclides that have no BV/FV, and detected radionuclides for which FVs do not apply. The sampling locations and detected concentrations are shown on Plate 7.

- Americium-241 was detected in one tuff samples with a maximum concentration of 0.0995 pCi/g. Americium-241 is identified as a COPC in tuff.
- Plutonium-239/240 was detected in three tuff samples with a maximum concentration of 0.435 pCi/g. Plutonium-239/240 is identified as a COPC in tuff.
- Tritium was detected in two tuff samples with concentrations of 0.025 and 0.031 pCi/g. Tritium is identified as a COPC in tuff.

7.2.3.4 Nature and Extent of Soil and Rock Contamination

Based on historical investigations, the approved work plan (LANL 2008, 102215) determined that insufficient data exist to define the nature and extent of contamination at Area 6 West and the following data needs for SWMU 49-004 were identified:

- Vertical and lateral extent of inorganic chemical and radionuclide contamination for the open-burning/landfill area in Area 6 West (SWMU 49-004)

A total of 24 inorganic COPCs (aluminum, antimony, barium, beryllium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, perchlorate, selenium, silver, thallium, uranium, vanadium, and zinc), 6 organic COPCs [bis(2-ethylhexyl)phthalate; chloronaphthalene[2-]; methylene chloride; methylnaphthalene[2-]; naphthalene; and pyrene], and 7 radionuclides (americium-241, cesium-134, cesium-137, europium-152, plutonium-238, plutonium-239/240, and tritium) were identified in soil and tuff in SWMU 49-004 from historical investigations and the 2009–2010 investigation.

Inorganic Chemicals

Aluminum was detected above the BV at borehole locations 49-06219, 49-609883, 49-609884, and 49-609885 and surface location 49-608967. Concentrations decreased with depth at borehole locations 49-609883, 49-609884, and 49-609885 and increased with depth at location 49-608967. The vertical extent of aluminum at location 49-06219 is defined by samples results from collocated borehole location 49-609885 where aluminum concentrations decreased with depth. Aluminum was not detected above the BV in surface samples collected within 20 ft of location 49-608967 nor was aluminum detected in borehole 49-06217 located 10 ft away. The lateral and vertical extent of aluminum are defined.

Antimony was not detected but has DLs above the BVs at several borehole and surface locations. The lateral and vertical extent of antimony are defined because it was not detected.

Barium was detected above the BV at borehole locations 49-06219, 49-609882, 49-609883, 49-609884, and 49-609885 and surface locations 49-608961, 49-608964, and 49-608967. Concentrations decreased with depth at borehole locations 49-609882, 49-609883, 49-609884, and 49-609885. The vertical extent of barium at location 49-06219 is defined by sample results from collocated borehole location 49-609885 where barium concentrations decreased with depth. Barium was not detected above the BV in surface samples within 25 ft of locations 49-608961, 49-608964, and 49-608967. The lateral and vertical extent of barium are defined.

Beryllium was detected above the BV at surface locations 49-608962 and 49-608967. Beryllium concentrations decreased with depth at location 49-608962 and increased with depth at location 49-608967. Beryllium was not detected above BV in boreholes 49-609883 and 49-06217, located between 10 and 25 ft from location 49-608967. Beryllium was not detected above BV in surface samples collected within 25 ft of locations 49-608962 and 49-60967. The lateral and vertical extent of beryllium are defined.

Calcium was detected above the BV at borehole locations 49-06219, 49-609882, 49-609883, and 49-609884. Concentrations decreased with depth at all four borehole locations. Calcium was not detected above the BV at the other seven boreholes at the site. The lateral and vertical extent of calcium are defined.

Chromium was detected above the BV at borehole locations 49-06219, 49-609883, 49-609884, and 49-609885. Concentrations decreased with depth at borehole locations 49-609883, 49-609884, and 49-609885. The vertical extent of chromium at location 49-06219 is defined by sample results from collocated borehole 49-609885 where chromium concentrations decreased with depth. Chromium was not detected above the BV at the other seven boreholes at the site. The lateral extent of chromium is also defined.

Cobalt was detected above the BV at borehole locations 49-06213, 49-06214, and 49-06219 and nine surface locations across the site. Concentrations decreased with depth at borehole location 49-06213 and 48-06214. The vertical extent of cobalt at borehole location 49-06219 is defined by the co-located borehole location 49-609885 where cobalt concentrations decreased with depth. Cobalt concentrations in surface and shallow subsurface samples decreased with depth at three locations and increased with depth at six locations. Cobalt was not detected above BV in surface samples located within 25 to 50 ft of these locations. The lateral and vertical extent of cobalt are defined.

Copper was detected above the BV at six borehole locations and nine surface locations across the site. Concentrations decrease with depth at five borehole locations. The vertical extent in borehole location 49-06219 is defined by sample results from collocated borehole 49-609885 where copper concentration

decreases with depth. Copper concentrations decreased with depth at six surface locations and increased with depth at surface locations 49-608979, 49-608981, and 49-608998. The vertical extent of copper in surface samples is defined deeper samples collected in borehole locations 49-609883, 49-609884, and 49-609885, located within 10 ft of the surface sample locations. Copper concentrations at locations 49-608979 and 49-608981 are also less than or equivalent to the maximum background concentration. The lateral and vertical extent of copper are defined.

Iron was detected above BV at borehole location 49-609883. The concentrations decreased with depth and iron was not detected above the BV at similar depths at nearby borehole locations 49-609884 and 49-609885, located approximately 80 ft away. The lateral and vertical extent of iron are defined.

Lead was detected above BV at five borehole locations and six surface locations. Concentrations decreased with depth at three borehole locations and increased with depth at borehole locations 49-06219 and 49-609882. The vertical extent in borehole location 49-06219 is defined by sample results from collocated borehole location 49-609885 where lead decreases with depth. The lead concentrations at borehole locations 49-06219 and 49-609882 are less than the maximum background concentration (15.5 mg/kg). Lead concentrations decreased with depth in four surface samples and increased with depth at locations 49-608978 and 49-608998. The vertical extent of lead at locations 49-608978 and 49-608998 are defined by deeper samples collected from nearby borehole location 49-609885. Lead was not detected above BV in surface samples collected from similar depths within 25 ft of locations 49-608978 and 49-608998. The lateral and vertical extent of lead are defined.

Magnesium was detected above BV at borehole locations 49-06219, 49-609882, 49-609883, 49-609884, and 49-609885. Concentrations decreased with depth at four borehole locations. The vertical extent in borehole location 49-06219 is defined by sample results from collocated borehole location 49-609885. Magnesium was not detected above the BV at similar depths at nearby borehole locations 49-06215 and 49-06216, located a maximum of 50 ft away. The lateral and vertical extent of magnesium are defined.

Manganese was detected above BV at borehole location 49-06214 and surface locations 49-06138, 49-608971, 49-608961, 49-608998, and 49-609008. Manganese was not detected above BV in borehole 49-609882 located a few ft from borehole location 49-06214. Manganese concentrations in surface samples decreased with depth at locations 49-608971, 49-608998, and 49-609008 and increased with depth at location 49-608961. A single sample was collected from location 49-06138. Manganese was not detected above BV in surface samples collected from similar depths and located within 25 ft of sample locations 49-608961 and 49-06138, or in deeper samples collected from boreholes 49-06213 and 49-609885. The lateral and vertical extent of manganese are defined.

Mercury was detected above BV at location 49-06116. The concentration decreased with depth and mercury was not detected above BV in surface samples collected from similar depths within 20 ft of sample location 49-06116. The lateral and vertical extent of mercury are defined.

Nickel was detected above BV at borehole locations 49-06219, 49-609882, 49-609883, 49-609884, 49-609885 and surface location 49-608979. Concentrations decreased with depth at four borehole locations. The vertical extent in borehole location 49-06219 is defined by collocated borehole location 49-609885. Nickel was detected in the deeper sample at location 49-608979, but the concentration is below the maximum background concentration. Nickel was not detected above BV in deeper samples from nearby borehole locations 49-609883 and 49-609885 or in surface samples collected from similar depths. The lateral and vertical extent of nickel are defined.

Perchlorate was detected at very low concentrations at borehole locations 49-609882, 49-609883, and 49-609884. Concentrations decreased from the maximum concentration with depth in all three borehole locations. The lateral and vertical extent of perchlorate are defined.

Selenium was detected above BV in the deeper sample at locations 49-608998 and 49-609021. Selenium was not detected above BV at any other surface or borehole locations at the site. The lateral and vertical extent of selenium are defined.

Silver was detected above BV at borehole location 49-06215 and locations 49-608978 and 49-608998. Concentrations decreased with depth at locations 49-06215 and 49-608978 and increased with depth at location 49-608998. Silver was not detected of BV in deeper samples collected from boreholes 49-609885 and 49-06218, located approximately 25 ft away from 49-608998. The lateral and vertical extent of silver are defined.

Thallium was detected above BV at surface samples 49-608979 and 49-608966. Concentrations decreased with depth at both locations. Thallium was not detected above the BV at nearby surface locations from similar depths. The lateral and vertical extent of thallium are defined.

Uranium was detected above BV at borehole locations 49-06213, 49-06214, 49-06217, 49-06218, and 49-06219 and 18 surface locations across the site. Samples collected in 2009–2010 were analyzed for isotopic uranium. Uranium concentrations were less than the maximum tuff background concentration in each borehole. The highest concentration of uranium (10.7 mg/kg) was detected at location 49-06227. Uranium concentrations in this area may be related to the high percentage of pumice fragments in some samples. Elevated uranium concentrations are most likely representative of formation geochemistry rather than site contamination. In addition, isotopic uranium was not detected above BVs in the 2009–2010 samples. The lateral and vertical extent of uranium are defined.

Vanadium was detected above BV at borehole locations 49-06219, 49-609883, and 49-609885. Concentrations decreased with depth in two boreholes and increased with depth at borehole location 49-06219. The vertical extent in borehole location 49-06219 is defined by deeper samples collected from collocated borehole 49-609885. All detected concentrations of vanadium were below maximum tuff background concentration. Vanadium was not detected above the BV at similar depths in nearby locations 49-06218 and 49-609884. The lateral and vertical extent of vanadium are defined.

Zinc was detected above BV at borehole location 49-609883 and 20 surface locations across the site. Concentrations decreased with depth at borehole location 49-609883 and zinc was not detected above BV in nearby borehole samples collected from similar depths. The vertical extent of zinc in surface samples is defined by deeper samples collected from nearby boreholes. Zinc was not detected above the BV in nearby surface samples from similar depths. The lateral and vertical extent of zinc are defined.

Organic Chemicals

Bis(2-ethylhexyl)phthalate was detected in one sample at borehole location 49-609883. In deeper samples from this location, bis(2-ethylhexyl)phthalate was not detected, and it was not detected at any other locations. The lateral and vertical extent of bis(2-ethylhexyl)phthalate are defined.

Chloronaphthalene[2-] was detected in one sample at borehole location 49-06214. In deeper samples from this location, chloronaphthalene[2-] was not detected, and it was not detected at any other locations. The lateral and vertical extent of chloronaphthalene[2-] are defined.

Methylene chloride was detected in one sample at borehole location 49-609883. In deeper samples from this location, methylene chloride was not detected, and it was not detected at any other locations. The lateral and vertical extent of methylene chloride are defined.

Methylnaphthalene[2-] was detected in one sample at borehole location 49-609883. In deeper samples from this location, methylnaphthalene[2-] was not detected, and it was not detected at any other locations. The lateral and vertical extent of methylnaphthalene[2-] are defined.

Naphthalene was detected in one sample at borehole location 49-609883. In deeper samples from this location, naphthalene was not detected, and it was not detected at any other locations. The lateral and vertical extent of naphthalene are defined.

Pyrene was detected in one sample at borehole location 49-609883. In deeper samples from this, pyrene was not detected, and it was not detected at any other locations. The lateral and vertical extent of pyrene are defined.

Radionuclides

Americium-241 was detected at borehole locations 49-06214 and 49-609883 and surface locations 49-06106, 49-06108, 49-06223, and 49-608985; locations 49-06106, 49-06108, and 49-06223 had only a single sample collected. Americium-241 decreased with depth at both borehole locations and all surface locations except location 49-608985. Americum-241 was not detected in borehole location 49-609882, located within 20 ft of location 49-608985. Amercium-241 was not detected in nearby surface samples collected from similar depths. The lateral and vertical extent of americium-241 are defined.

Cesium-134 was detected in only one sample at location 49-609001, where concentration decreased with depth. Cesium-134 was not detected at any other nearby sampling locations. The lateral and vertical extent of cesium-134 are defined.

Cesium-137 was detected in surface locations 49-06221, 49-06222, 49-06226, 49-06227, and 49-609008; locations 49-06221, 49-06222, 49-06226, and 49-06227 had only surface samples collected. Cesium-137 was not detected at similar and deeper depths at nearby surface sampling locations or in nearby borehole location 49-06219. The lateral and vertical extent of cesium-137 are defined.

Europium-152 was detected in surface locations 49-06113 and 49-06148 at similar trace concentrations (0.209 pCi/g and 0.259 pCi/g). Europium-152 was not detected in any other surface samples or deeper samples. The lateral and vertical extent of europium-152 are defined.

Plutonium-238 was detected in surface locations 49-06216 and 49-06137. Plutonium-238 was not detected at similar and deeper depths at nearby surface samples. The lateral and vertical extent of plutonium-238 are defined.

Plutonium-239/240 was detected in 8 borehole locations and 16 surface locations across the site. Plutonium-239/240 decreased with depth at 6 borehole locations. Plutonium-239/240 was detected in the deepest sample at borehole locations 49-06213 and 49-06218, but was not detected at deeper sample depths in nearby borehole locations 49-609882 and 49-609885. Plutonium-239/240 concentrations decreased with depth in surface locations, except for locations 49-608978, 49-608985, and 49-608980. The vertical extent of plutonium-239/240 at these locations is defined by deeper samples from nearby borehole locations 49-609883 and 49-609885. Plutonium-239/240 was not detected in surface samples at nearby sampling locations. The lateral and vertical extent of plutonium-239/240 are defined.

Tritium was detected in at borehole locations 49-609883 and 49-609884. Tritium decreased with depth at both locations and was not detected in nearby borehole locations 49-609882 and 49-609885. The lateral and vertical extent of tritium are defined.

7.2.3.5 Subsurface Vapor Sampling

In 2010, two pore-gas samples were collected from borehole location 49-609882 and analyzed for VOCs and tritium. Table 7.2-7 lists the pore-gas samples collected and the analyses requested.

7.2.3.6 Subsurface Vapor Sample Analytical Results

Table 7.2-8 presents the VOCs detected in the pore-gas samples collected from SWMU 49-004. The sampling location and detected concentrations are shown on Plate 6. The VOCs detected in pore gas are acetone; benzene; butanone[2-]; chloromethane; dichlorodifluoromethane; ethylbenzene; ethyltoluene[4-]; styrene; toluene; trimethylbenzene[1,2,4-]; trimethylbenzene[1,3,5-]; xylene (total); xylene[1,2-]; and xylene[1,3-]+xylene[1,4-].

Table 7.2-9 presents the detected concentrations of tritium in the pore-gas samples collected from SWMU 49-004. The sampling location and detected concentrations are shown on Plate 7.

7.2.3.7 Nature and Extent of Contamination in Subsurface Pore Gas

The approved work plan (LANL 2008, 102215) prescribed the collection of two pore-gas samples from the bottom of the landfill and TD at one of the boreholes drilled at SWMU 49-004 to determine whether the boring should be completed as a vapor monitoring well. If VOCs were detected in the vapor-phase sample at concentrations greater than 10% of the screening levels described in section 3.5, or if tritium was detected in the vapor-phase sample at a concentration greater than the screening levels based on groundwater cleanup levels, the borehole would be completed as a vapor-monitoring well.

Acetone; benzene; butanone[2-]; dichlorodifluoromethane; ethylbenzene; ethyltoluene[4-]; styrene; toluene; trimethylbenzene[1,2,4-]; trimethylbenzene[1,3,5-]; xylene (total); xylene[1,2-]; and xylene[1,3-]+xylene[1,4-] were detected in both samples collected from location 49-609882. Concentrations of all VOCs decreased with depth or remained essentially the same. Chloromethane was only detected in the deep sample. Pore-gas data indicate that VOCs in subsurface pore gas are not a potential source of groundwater contamination; therefore, the nature and extent of contamination of VOCs in pore gas are defined.

Tritium was detected in one sample at borehole location 49-609882 and the concentration decreased with depth. The extent of pore gas is defined and the concentration of tritium in pore gas is not a potential source of groundwater contamination and the borehole was not completed as a vapor-monitoring well

7.2.4 Summary of Human Health Risk Screening

The human health risk screening assessment for SWMU 49-004 is discussed in Appendix I, section I-4.2.

There are no carcinogenic COPCs for the industrial scenario at SWMU 49-004. The HI for the industrial scenario is approximately 0.1, which is below the NMED target HI of 1.0 (NMED 2009, 108070). The total dose is approximately 0.75 mrem/yr, which is below the DOE target dose limit of 15 mrem/yr (DOE 2000, 067489).

The total excess cancer risk for the construction worker scenario is approximately 1×10^{-10}, which is below the NMED target risk level of 1×10^{-5} (NMED 2009, 108070). The HI is approximately 1.6, which is slightly above the NMED target HI of 1.0 (NMED 2009, 108070). The slightly elevated HI is primarily due to manganese. The manganese soil concentrations (99.7 mg/kg to 1030 mg/kg) were comparable with the range of soil background concentrations (76 mg/kg to 1100 mg/kg) and the EPC is 424 mg/kg, which is also similar to the soil and tuff BVs (671 mg/kg and 482 mg/kg, respectively, and the range of background concentrations [LANL 1998, 059730]). In addition, the manganese SSL (432 mg/kg) is less than the soil and tuff BVs. The HI without manganese is approximately 0.7, which is below the NMED target HI of 1.0. The total dose is approximately 3 mrem/yr, which is below the DOE target dose limit of 15 mrem/yr (DOE 2000, 067489).

The total excess cancer risk for the residential scenario is approximately 3×10^{-7}, which is below the NMED target risk level of 1×10^{-5} (NMED 2009, 108070). The HI is approximately 1.0, which is equivalent to the NMED target HI of 1.0 (NMED 2009, 108070). The total dose is approximately 1 mrem/yr, which is below the DOE target dose limit of 15 mrem/yr (DOE 2000, 067489).

However, additional sampling at SWMU 49-004 is necessary to address potential contamination from dioxins and furans, which may affect the potential risk.

7.2.5 Summary of Ecological Risk Screening

The ecological risk assessment is presented in Appendix I, section 1-5.3. No potential ecological risks were found for any receptor based on minimum ESL comparisons, HI analyses, comparisons to background concentrations, and potential effects to populations (individuals for T&E species).

8.0 AREA 10 BACKGROUND AND FIELD INVESTIGATION RESULTS

This section presents the background, operational history, and summary of previous investigations for the AOC and SWMU that comprise Area 10. This section also presents the field investigation results from Area 10 and discusses the nature and extent of contamination of the sampled media.

During the 2009–2010 investigation, a field assessment of the AOC 49-002 calibration chamber and elevator shaft was conducted to determine whether the area could be safely sampled. The results of the field assessment identified several large (18 to 24 in.) shafts open to variable depths, exposed 6-in. casing broken off at ground surface, and partially buried wire and cable located in an area overgrown with grass and brush. The area was determined unsafe and was roped off to prevent field crews from stepping into or falling over the open shafts. No sampling was conducted near the shafts.

The surface sampling grid at Area 10 was to be used to determine nature and extent of contamination of both AOC 49-002 and SWMU 49-005(a). Therefore, the surface samples are associated with both the AOC and SWMU. However, the surface sampling results and the nature and extent discussion are presented only once in section 8.2.3.4. The Area 10 boreholes were drilled to define the subsurface contamination associated the SWMU 49-005(a). The results of the samples collected from boreholes are presented in section 8.3.3.4.

8.1 Background of Area 10: Calibration Chamber and Small Landfill

Area 10 is the site of AOC 49-002, an underground calibration chamber and elevator shaft used for experimental measurements and calibrations in support of hydronuclear tests. Area 10 is also the site of

SWMU 49-005(a), a small pit landfill dug in 1984 to dispose of uncontaminated debris generated during cleanup activities (Figures 1.0-2 and 8.1-1).

In 1960 and 1961, experimental measurements and calibrations were performed in a calibration chamber located at Area 10 (AOC 49-002). The calibration chamber consisted of two vertical shafts. One of the shafts was an elevator shaft used to transport personnel and equipment to the underground calibration chamber. The second shaft, known as the calibration shaft, was used to place a portable pulse neutron source over the calibration samples in the calibration room (LANL 1992, 007670, p. 6.5-2). Figure 8.1-1 illustrates Area 10 and the related SWMU and AOC.

After 1961, the chamber was used for experiments that did not involve radioactive or hazardous materials, the only exception being small radioactive sources for radiochemical counting, which were thought to have been removed at the conclusion of each experiment (LANL 1997, 056594, pp. 24-25).

During the 1984 general site cleanup at TA-49, a small landfill, SWMU 49-005(a), was created to dispose of uncontaminated debris. The landfill was located 50 to 100 ft northeast of the calibration chamber. Characteristics of the material disposed at the landfill are not known, but the waste material is believed to have consisted primarily of wood and small pieces of metal (LANL 1997, 056594, pp. 24-25).

8.1.1 Historical Releases

There are no documented historical releases associated with activities conducted at Area 10.

8.1.2 Relationship to Other SWMUs and AOCs

There are no other SWMUs or AOCs present in Area 10.

8.2 AOC 49-002: Calibration Chamber Facility

8.2.1 Site Description and Operational History

AOC 49-002 is an underground experimental calibration chamber and there are two associated shafts located in Area 10 (Figure 8.1-1). This site was used for calibration tests associated with hydronuclear experiments performed elsewhere at TA-49 in 1960 and 1961. Each shaft is approximately 6 ft to 7 ft × 64 ft. One is an elevator shaft used to transport personnel and equipment; an elevator building previously located over the elevator shaft has been removed. The other shaft is the calibration shaft. The shafts are connected at the bottom by a tunnel or gallery that is 4 ft × 7 ft × 12 ft. The calibration room, which is 14 ft × 10 ft, was lined with 8 in. of reinforced concrete faced with a 1-in. steel plate. The calibration shaft was used to place a portable pulse neutron source over calibration samples placed in the calibration room. A hydraulic lift platform at the bottom of the calibration room was connected to a hydraulic oil reservoir at the surface. Concrete radiation shields at the top of the calibration shaft are still in place. A concrete pad around the top of both shafts served as a foundation for the elevator building and shielding wall and is still in place.

The entrances to both shafts have been covered with concrete blocks. The elevator shaft is believed to still be open, while the calibration shaft was reportedly backfilled with soil and crushed tuff. Other surface features, including the hydraulic oil reservoir, have been removed. Small amounts (e.g., milligram quantities) of enriched uranium were occasionally released through spallation from critical assemblies during tests, although this material generally was cleaned up. Operation of the pulse neutron source may have activated surrounding soil and structures, but by now activation products have decayed to undetectable levels. The total volume of hydraulic oil in the lift system was estimated to be less than

100 gal. and is not believed to contain PCBs. Use of the site after 1961 did not involve hazardous materials other than small radioactive sources used for radiochemical counting (LANL 1992, 007670, pp. 6.5-1-6.5-6).

8.2.2 Summary of Previous Investigations

During the 1995 RFI, a gamma survey was conducted at 18 locations on a 25 ft × 25 ft grid established over the area above the shafts, around the concrete pads covering the shafts, and around structure locations at AOC 49-002. No radiologically contaminated areas were identified (LANL 1997, 056594, p. 53). Twelve surface soil samples (0 to 0.5 ft bgs) were collected from twelve grid locations around the concrete pads covering the shafts. All 12 samples were field screened for beta/gamma radiation and submitted for analysis by gamma spectroscopy; a subset of six samples was also submitted for analysis of TAL metals. One additional sample was collected from the former location of the hydraulic oil reservoir for the former elevator. This sample was field screened for beta/gamma radiation and submitted for analysis of TAL metals, SVOCs, isotopic plutonium, and pesticides/PCBs, and by gamma spectroscopy. Inorganic chemicals detected above BVs included antimony, copper, lead, mercury, uranium and zinc. No organic chemicals were detected. No radionuclides were detected or detected above BVs/FVs (LANL 1997, 056594, pp. 23-35). Historical sample locations and detected concentrations are provided in plates, maps, and tables presented below.

8.2.3 Site Contamination

8.2.3.1 Soil and Rock Sampling

Samples were collected in 2009 at AOC 49-002 per the approved investigation work plan (LANL 2008, 102215). Samples were collected by hand auger. All required samples were submitted through the SMO for analyses at off-site laboratories. All sample locations were surveyed by LANL using GPS (Table 8.2-1). Sample collection and screening methods are described in Appendix B.

Sixty-four samples (63 soil or fill and 1 tuff), plus 8 field duplicates, were collected in 2009 from 33 locations at AOC 49-002. Data from the samples collected in 2009 were combined with decision-level data from samples from previous investigations. The final dataset includes 77 samples (76 soil/fill and 1 tuff), plus 8 field duplicates, collected in 1995 and 2009 from 46 locations at AOC 49-002, with a maximum sample depth of 1.5 ft bgs (Plate 8). Table 8.2-2 lists the samples collected and the analyses requested.

8.2.3.2 Soil and Rock Sample Field-Screening Results

Organic vapors were not detected above 0.7 ppm during headspace (PID) field screening of samples at AOC 49-002. No radiological screening results exceeded twice the daily site background levels. Field-screening results are presented in Table 8.2-3. There were no changes to sampling or other activities as a result of health- and safety-based field-screening results.

Two surface samples from AOC 49-002 exceeded either the gross-alpha and/or -beta screening thresholds and additional samples were collected and submitted for appropriate laboratory analyses. The gross-alpha and -beta screening results that guided additional sampling are presented in Tables D-6 through D-10 in Appendix D.

8.2.3.3 Soil and Rock Sample Analytical Results

Inorganic Chemicals

Inorganic chemicals were detected above BVs, had DLs above BVs, or were detected but have no BV at AOC 49-002. The sampling locations are presented on Plate 8 and detected concentrations are shown on Plate 9. Table 8.2-4 presents the concentrations of inorganic chemicals detected above BVs, detected with no available BV, or with DLs above BVs.

Inorganic Chemicals in Soil

A total of 76 soil/fill samples were collected and analyzed for inorganic chemicals. Each sample was analyzed for TAL metals only. Table 8.2-2 summarizes samples collected and the requested analyses for each sample.

Table 8.2-4 presents the inorganic chemicals above BVs and detected inorganic chemicals that have no BV. The sampling locations and detected concentrations are shown on Plate 9. The identification of COPCs was not performed at this time because extent of contamination is not defined for the site.

Inorganic Chemicals in Tuff

One tuff sample was collected and analyzed for TAL metals. Table 8.2-2 summarizes samples collected and the requested analyses.

Table 8.2-4 presents the inorganic chemicals above BVs and detected inorganic chemicals that have no BV. The sampling locations and detected concentrations are shown on Plate 9. The identification of COPCs was not performed at this time because extent of contamination is not defined for the site.

Organic Chemicals

One soil sample was collected and analyzed for organic chemicals. The sample was analyzed for SVOCs, pesticides, and PCBs. Table 8.2-2 summarizes the samples collected and the requested analyses. No organic chemicals were detected at AOC 49-002.

Radionuclides

Radionuclides were detected above BVs/FVs or detected with no BV/FV at AOC 49-002 (Plate 11). Table 8.2-5 presents the concentrations of radionuclides detected above BVs/FVs or detected with no BV/FV.

Radionuclides in Soil

A total of 76 soil/fill samples were collected and analyzed for radionuclides, of which 63 samples were analyzed for radionuclides by gamma spectroscopy and for americium-241, isotopic plutonium, and isotopic uranium; 7 samples were analyzed for radionuclides by gamma spectroscopy and isotopic plutonium; and 6 samples were analyzed by gamma spectroscopy only. Table 8.2-2 summarizes the samples collected and the requested analyses for each sample.

Table 8.2-5 presents the radionuclides detected above BVs/FVs, detected radionuclides that have no BV/FV, and detected radionuclides for which FVs do not apply. The sampling locations and detected

concentrations are shown on Plate 11. The identification of COPCs was not performed at this time because the extent of contamination is not defined for the site.

Radionuclides in Tuff

One tuff sample was collected and analyzed for radionuclides by gamma spectroscopy and for americium-241, isotopic plutonium, and isotopic uranium. Table 8.2-2 summarizes the samples collected and the requested analyses.

Table 8.2-5 presents the radionuclides detected above BVs/FVs, detected radionuclides that have no BV/FV, and detected radionuclides for which FVs do not apply. The sampling locations and detected concentrations are shown on Plate 11. The identification of COPCs was not performed at this time because extent of contamination is not defined for the site.

8.2.3.4 Nature and Extent of Soil and Rock Contamination

The nature and extent for all inorganic chemicals, organic chemicals, and radionuclides detected above BVs, or detected above BVs/FVs for AOC 49-002 is presented below. Data from near surface samples collected from SMWU 49-005(a) was used to determine lateral extent for AOC 49-002 and is presented below.

Inorganic Chemicals

Aluminum, barium, chromium, nickel, and vanadium were only detected above the tuff BVs in the deeper samples at location 49-609560. This sample was a mixture of sandy soil and weathered tuff and may be better represented by the soil BVs. The aluminum, barium, chromium, nickel, and vanadium detected in this one sample are well below the soil BVs. The lateral and vertical extent of aluminum, barium, chromium, nickel, and vanadium are defined.

Antimony was detected above the soil BV at location 49-07542 where only one surface sample was collected. Antimony was not detected above the soil BV at locations 49-609543 or 49-609545, located within 20 ft of location 49-07542 where soil samples were collected from similar and deeper depths. The lateral and vertical extent of antimony are defined.

Cadmium was detected above BV at locations 49-07536, 49-609543, 49-609544, and 49-609545. Cadmium concentrations decreased with depth at locations 49-609544 and 49-609545 and increased with depth at location 49-609543. Location 49-07536 was only a surface location and extent is defined by the surrounding locations where cadmium was not detected above BV. The concentration of cadmium at location 49-609543 is less than the maximum soil background concentration (2.6 mg/kg). Cadmium was not detected above BV in nearby surface samples from similar depths located within 25 ft of location 49-609543. The lateral and vertical extent of cadmium are defined.

Calcium was detected above BV in the deeper sample at locations 49-609545, 49-609553, and 49-609554. The calcium concentrations (6720–10,000 mg/kg) were less than the maximum soil background concentration (14,000 mg/kg). Calcium was not detected above background in nearby surface samples from similar depths located within 25 ft from locations 49-609545, 49-609553, and 49-609554. The lateral and vertical extent of calcium are defined.

Cobalt was detected above BV in the deeper sample at locations 49-609548 and 49-609560. The sample from location 49-609560 was a mixture of soil and tuff and the cobalt concentration is below the soil BV. At location 49-609548, cobalt is above the maximum soil background concentration (9.5 mg/kg) but less

than twice BV. Cobalt was not detected above BV in nearby surface samples from similar depths located within 50 ft of locations 49-609548 and 49-609560. The lateral and vertical extent of cobalt are defined.

Copper was detected above BVs at locations 49-07539, 49-07548, 49-609544, and 49-609560. A single sample was collected from locations 49-07536 and 49-07548. Copper concentrations decreased with depth at location 49-609544 and increased with depth at location 49-609560. The concentration at location 49-609560 is less than the maximum tuff background concentration. Copper was not detected above BV in nearby surface samples from similar depths located within 50 ft of locations 49-07536, 49-07548, and 49-609544. The lateral and vertical extent of copper are defined.

Lead was detected above BV at locations 49-07536, 49-07539, 49-609544, 49-609545, and 49-609558. The concentrations decreased with depth at locations 49-609544, 49-609545, and 49-609558. A single samples was collected from locations 49-07536 and 47-07539, but lead decreased with depth at collocated surface locations 49-609544 and 49-609545. Lead was not detected above BV in nearby surface samples from similar depths located within 20 ft of locations 49-07536, 49-07539, 49-609544, 49-609545, and 49-609558. The lateral and vertical extent of lead are defined.

Manganese was detected above BV in the deeper sample at location 49-609548, but below the maximum soil background concentration (1100 mg/kg). Manganese was not detected above BV in nearby surface samples from similar depths located within 50 ft of 49-609548. The lateral and vertical extent of manganese are defined.

Mercury was detected above BV at locations 49-07536, 49-07539, and 49-609545. Only a surface sample was collected from locations 49-07536 and 47-07539. Mercury concentration decreased with depth at location 49-609545. Mercury was not detected above BV in nearby surface samples from similar depths located within 5 ft of locations 49-07536, 49-07539, and 49-609545. The lateral and vertical extent of mercury are defined.

Uranium was detected above BV at 7 locations where only surface samples were collected, with a maximum concentration of 4.2 mg/kg. At locations 49-07539 and 49-07548, uranium was slightly above the maximum soil background concentration (3.6 mg/kg). In addition, isotopic uranium was not detected above BVs in the 2009–2010 samples collected from SWMU 49-005(a). The lateral and vertical extent of uranium are defined.

Selenium was not detected above BV but had one DL above the tuff BV. The lateral and vertical extent of selenium are defined because it was not detected.

Zinc was detected above BV at ten locations. Only a surface sample was collected from three locations. Zinc decreased with depth at six locations, but increased with depth at locations 49-609543 and 49-609544, with a maximum concentration of 446 mg/kg at location 49-609544. The vertical extent of zinc is not defined. Zinc was not detected above BV at surface locations collected from similar depths within 20 ft of locations 49-609543 and 49-609544. The lateral extent of zinc is defined.

Organic Chemicals

No organic chemicals were detected at AOC 49-002.

Radionuclides

Amercium-241 was detected at location 49-609552 in the deeper sample. The vertical extent of americium-241 is defined by borehole location 49-609987, located within 30 ft of location 49-609552,

where americium-241 was not detected. Americum-241 was not detected above FV at surface samples collected from similar depths located within 25 ft of location 49-609552. The lateral and vertical extent of americum-241 are defined.

Cesium-137 was detected in the deeper samples at 11 locations, with a maximum concentration of 0.211 pCi/g. Concentrations decreased with depth or remained essentially the sample at all locations. Cesium-137 was not detected above FV in nearby borehole locations 49-07512 and 49-07527 or at surface samples collected from similar depths. The lateral and vertical extent of cesium-137 are defined.

Plutonium-239/240 was detected in the deeper sample at location 49-609559. Plutonium-239/240 was not detected above FV at nearby surface samples from similar depths located within 50 ft of 49-609559. The lateral and vertical extent of plutonium-239/240 are defined.

8.2.3.5 Subsurface Vapor Sampling

No pore gas samples were collected from AOC 49-002.

8.2.4 Summary of Human Health Risk Screening

Because the extent of contamination is not defined at AOC 49-002, a human health risk-screening assessment was not performed.

8.2.5 Summary of Ecological Risk Screening

Because the extent of contamination is not defined at AOC 49-002, an ecological risk-screening assessment was not performed.

8.3 SWMU 49-005(a): Landfill

8.3.1 Site Description and Operational History

SWMU 49-005(a) is an inactive landfill located east of Area 10 (Figure 8.1-1). The landfill, described as a small pit, was constructed north of the road that runs east from Area 10 and is approximately 50 ft to 100 ft northeast of the Area 10 experimental chamber and shafts (AOC 49-002). SWMU 49-005(a) was constructed in 1984 as a disposal area for nonradiologically contaminated debris generated during the 1984 general surface cleanup of TA-49 (LANL 1997, 056594, p. 25).

8.3.2 Summary of Previous Investigations

During the 1995 RFI, a radiological survey was conducted over the landfill area; no measurements above background were detected. Two surface samples (0 to 0.5 ft bgs) and two subsurface samples (4 to 9 ft and 7.3 to 10 ft bgs) were collected from two borehole locations within the suspected landfill. The samples were field screened for beta/gamma radiation and submitted for analyses of isotopic plutonium, TAL metals, SVOCs, and by gamma spectroscopy. Inorganic chemicals detected above BVs included arsenic, barium, beryllium, calcium, chromium, copper, magnesium, nickel, potassium, and uranium. Two organic chemicals [bis(2-ethylhexyl)phthalate and 2-butanone] were detected. Radionuclides detected or detected above BVs/FVs included plutonium-238 and plutonium-239/240 (LANL 1997, 056594, pp. 25-35). Sample locations and detected concentrations are provided in plates, maps, and tables presented below.

8.3.3 Site Contamination

8.3.3.1 Soil and Rock Sampling

Samples were collected in 2009–2010 at SWMU 49-005(a), per the approved investigation work plan (LANL 2008, 102215). Samples were collected by either a hand auger or drill rig equipped with a continuous core barrel sampling system. All samples were submitted through the SMO for analyses at off-site laboratories. All sample locations were surveyed by LANL using GPS (Table 8.2-1). Sample collection and screening methods are described in Appendix B.

A total of 86 surface and subsurface samples (76 soil/fill and 10 tuff), plus 8 field duplicates were collected in 2009–2010 from 37 locations at SWMU 49-005(a). Data from the samples collected in 2009 were combined with data from previous investigations conducted in 1995. The final dataset includes 90 samples (78 soil or fill and 12 tuff), plus 8 field duplicates, collected in 1995 and 2009 from 39 locations at SWMU 49-005(a), with a maximum sample depth of 10 ft bgs (Plate 8). Table 8.3-1 lists the samples collected and the analyses requested.

8.3.3.2 Soil and Rock Sample Field-Screening Results

Organic vapors were not detected above 0.7 ppm during headspace (PID) screening of samples at SWMU 49-005(a). No radiological screening results exceeded twice the daily site background levels. The field-screening results are presented in Table 8.2-3. There were no changes to sampling or other activities as a result of field-screening results.

8.3.3.3 Soil and Rock Sample Analytical Results

Inorganic Chemicals

Inorganic chemicals were detected above BVs, had DLs above BVs, or were detected but have no BV at SWMU 49-005(a). Table 8.3-2 presents the concentrations of inorganic chemicals detected above BVs, detected with no available BV, or with DLs above BVs. The sampling locations are presented on Plate 8 and detected concentrations are shown on Plate 9.

Inorganic Chemicals in Soil

A total of 70 soil/fill samples were collected and analyzed for inorganic chemicals. Each sample was analyzed for TAL metals; 5 samples were also analyzed for cyanide, nitrate, and perchlorate; and 2 samples were analyzed for uranium only. Table 8.3-1 summarizes samples collected and the requested analyses for each sample.

Table 8.3-2 lists the inorganic chemicals above BVs and detected inorganic chemicals that have no BV. The sampling locations and detected concentrations are shown on Plate 9. The identification of COPCs was not performed at this time because extent of contamination is not defined for the site.

Inorganic Chemicals in Tuff

A total of 12 tuff samples were collected and analyzed for inorganic chemicals. All samples were analyzed for TAL metals; 10 samples were also analyzed for cyanide, nitrate, and perchlorate. Table 8.3-1 summarizes samples collected and the requested analyses for each sample.

Table 8.3-2 presents the inorganic chemicals above BVs and detected inorganic chemicals that have no BV. The sampling locations and detected concentrations are shown on Plate 9. The identification of COPCs was not performed at this time because extent of contamination is not defined for the site.

Organic Chemicals

Organic chemicals were detected at SWMU 49-005(a). The sampling locations and detected concentrations are shown on Plate 10. Table 8.3-3 presents the concentrations of detected organic chemicals.

Organic Chemicals in Soil

Seven soil/fill samples were collected and analyzed for organic chemicals. Each sample was analyzed for SVOCs. Five samples were also analyzed for VOCs and explosive compounds. Table 8.3-1 summarizes samples collected and the requested analyses for each sample.

Two organic chemicals [bis(2-ethylhexyl)phthalate and 2-butanone] were detected in one sample from soil or fill. Table 8.3-3 presents the detected concentrations, and Plate 10 shows the sampling locations and detected concentrations.

Organic Chemicals in Tuff

Nine tuff samples were collected and analyzed for organic chemicals. Each sample was analyzed for VOCs, SVOCs, and explosive compounds. Table 8.3-1 summarizes samples collected and the requested analyses for each sample.

One organic chemical [bis(2-ethylhexyl)phthalate] was detected in one sample from tuff. Table 8.3-3 presents the detected concentrations, and Plate 10 shows the sampling locations and detected concentrations.

Radionuclides

Radionuclides were detected above BVs/FVs or detected with no BV/FV at AOC 49-005(a). The sampling locations and detected concentrations are shown on Plate 11. Table 8.3-4 presents the concentrations of radionuclides either detected above BVs/FVs or detected with no BV/FV.

Radionuclides in Soil

A total of 70 soil/tuff samples were collected and analyzed for radionuclides. All 70 samples were analyzed for isotopic plutonium; 65 samples were analyzed for radionuclides by gamma spectroscopy; 68 samples were analyzed for americium-241, isotopic plutonium, and isotopic uranium. Table 8.3-1 summarizes the samples collected and the requested analyses for each sample.

Table 8.3-4 presents the radionuclides detected above BVs/FVs, detected radionuclides that have no BV/FV, and detected radionuclides for which FVs do not apply. The sampling locations and detected concentrations are shown on Plate 11. The identification of COPCs was not performed at this time because extent of contamination is not defined for the site.

Radionuclides in Tuff

A total of 12 tuff samples were collected and analyzed for radionuclides. All 12 samples were analyzed for isotopic plutonium; 3 samples were analyzed for radionuclides by gamma spectroscopy; 10 samples were analyzed for americium-241 and isotopic uranium. Table 8.3-1 summarizes the samples collected and the requested analyses for each sample. The sampling locations and detected concentrations are shown on Plate 11. The identification of COPCs was not performed at this time because extent of contamination is not defined for the site.

8.3.3.4 Nature and Extent of Soil and Rock Contamination

The extent of inorganic chemicals in the 64 samples (63 soil or fill and 1 tuff) collected in 2009–2010 from 33 surface and shallow-subsurface locations is described above under AOC 49-002 (section 8.2.3). The data from these samples are also being used to determine the nature and extent of contamination associated with SWMU 49-005(a), but the nature and extent discussion is not repeated here. The data presented here are specific to SWMU 49-005(a) and include 18 samples from 6 borehole locations.

Inorganic Chemicals

Aluminum was detected above BV at five borehole locations, with a maximum concentration of 21,900 mg/kg. Concentrations decreased with depth at three borehole locations and increased with depth at borehole locations 49-07527 and 49-07512. The vertical extent of aluminum is not defined. Aluminum was not detected above BV at similar depths at borehole location 49-609989, located 20 ft away. The lateral extent of aluminum is defined.

Arsenic was detected above BV at four borehole locations. Arsenic was detected above BV at four borehole locations. Concentrations were 3.1 mg/kg, 3.2 mg/kg, and 2.9 mg/kg at locations 49-609986, 49-609987, and 49-609988, respectively. The concentrations decreased with depth at these three borehole locations. Arsenic concentrations increased with depth at borehole location 49-07527. The concentration of arsenic at depth at location 49-07527 (7.3–10.0 ft) was 3.4 mg/kg, which is below the maximum tuff background concentration (5 mg/kg). Arsenic was not detected above BV at similar depths at borehole locations 49-07512 and 49-609989, located within 30 ft of borehole location 49-07527. The lateral and vertical extent of arsenic are defined.

Barium was detected above BV at five borehole locations, with a maximum detected concentration of 165 mg/kg. Concentrations decreased with depth at three borehole locations and increased with depth at borehole locations 49-07527 and 49-07512. The vertical extent of barium is not defined. Barium was not detected above BV at similar depths at borehole 49-609989 located 30 ft from borehole locations 49-07527 and 49-07512. The lateral extent of barium is defined.

Beryllium was detected above BV in the deeper sample at borehole location 49-07527. The concentration was less than twice the BV and slightly above the maximum background concentration (1.8 mg/kg). Beryllium was not detected above BV at similar depths from borehole locations 49-07512, 49-609986, and 49-609989 located within 30 ft of borehole location 49-07527. The lateral and vertical extent of beryllium are defined.

Calcium was detected above BV at four borehole locations, with a maximum concentration of 3320 mg/kg. Concentrations decreased with depth at two borehole locations and increased with depth at borehole locations 49-07527 and 49-07512. Concentrations are less than twice the BV and calcium was not detected above BV at similar depths from nearby borehole locations 49-609988 and 49-609989

located 30 ft from borehole locations 49-07527 and 49-07512. The lateral and vertical extent of calcium are defined.

Chromium was detected above BV at five borehole locations, with a maximum concentration of 18.4 mg/kg. Concentrations decreased with depth at three borehole locations and increased with depth at borehole locations 49-07527 and 49-07512. Chromium detected at depth is below the maximum background concentrations (13 mg/kg). Chromium was not detected above BV at similar depths at borehole 49-609989, located 30 ft from borehole locations 49-07527 and 49-07512. The lateral and vertical extent of chromium are defined.

Cobalt was detected above BV at three borehole locations, with a maximum detected concentration of 6.4 mg/kg at borehole location 49-609987. Concentrations decreased with depth at all borehole locations. Cobalt was not detected above BV at similar depths at borehole locations 49-07527, 49-07512, and 49-609989 located within 40 ft. The lateral and vertical extent of cobalt are defined.

Copper was detected above BV at five borehole locations, with a maximum detected concentration of 8.5 mg/kg at borehole location 49-609988. Concentrations decreased with depth at three borehole locations and increased with depth at borehole locations 49-07527 and 49-07512. The concentrations of copper at depth are less than twice the BV. Copper was not detected above BV at similar depths at borehole location 49-609989, located within 30 ft. The lateral and vertical extent of copper are defined.

Lead was detected above BV at two borehole locations, with a maximum concentration of 12.3 mg/kg. Concentrations decreased with depth at both locations. Lead was not detected above BV at similar depths from borehole locations 49-609988, 49-609989, 49-07527 and 49-07512 located a maximum of 40 ft away. The lateral and vertical extent of lead are defined.

Magnesium was detected above BV at five borehole locations, with a maximum concentration of 3720 mg/kg. Concentrations decreased with depth at three borehole locations and increased with depth at borehole locations 49-07527 and 49-07512. The concentrations are more than twice the BV, but not more than twice the maximum background concentration. Magnesium was not detected above BV at similar depths at borehole location 49-609989. The vertical and lateral extent of magnesium are defined.

Nickel was detected above BV at five borehole locations, with a maximum concentration of 9 mg/kg. Concentrations decreased with depth at three borehole locations and increased with depth at borehole locations 49-07527 and 49-07512. The concentrations are less than twice the BV and the maximum background concentration. Nickel was not detected above BV at similar depths at borehole location 49-609989. The lateral and vertical extent of nickel are defined.

Nitrate was detected above BV at four borehole locations. The detected concentrations (0.095–1.8 mg/kg) are likely naturally occurring. The lateral and vertical extent of nitrate are defined.

Perchlorate was detected in the deepest sample at borehole location 49-609987 at a concentration of 0.0037 mg/kg. Perchlorate was not detected in any other samples at the site. The lateral and vertical extent of perchlorate are defined.

Potassium was detected above BV in the deepest sample at only one borehole location 49-07527, but below the maximum background concentration (4720 mg/kg). The lateral and vertical extent of potassium are defined.

Selenium was detected above BV at four borehole locations. The detected concentrations of selenium are essentially the same across the site and do not change significantly with depth. The lateral and vertical extent of selenium are defined.

Uranium was detected above BV at two borehole locations, with a maximum concentration of 4.09 mg/kg. Concentrations decreased with depth a borehole location 49-05712 and increased with depth at borehole location 49-07527. The maximum detected concentration is below the maximum tuff background concentration (5 mg/kg). In addition, isotopic uranium was not detected above BVs in the 2009–2010 samples. The lateral and vertical extent of uranium are defined.

Vanadium was detected above BV at three borehole locations. Concentrations decreased with depth at all locations. Vanadium was not detected above BV at similar depths at nearby borehole locations 49-07527 and 49-07512, located approximately 25 ft away. The lateral and vertical extent of vanadium are defined.

Organic Chemicals

Bis(2-ethylexyl)phthalate was detected at two borehole locations. Concentrations decreased with depth at borehole location 49-609989. Bis(2-ethylexyl)phthalate was detected only in the deepest sample at borehole location 49-609988, with a concentration of 0.046 mg/kg. The concentration is less than the EQL of 0.39 mg/kg. The lateral and vertical extent of bis(2-ethylexyl)phthalate are defined.

Butanone[2-] was detected in the shallow sample at only one borehole location 49-609989. The concentration is less than the EQL of 0.024 mg/kg. The lateral and vertical extent of 2-Butanone are defined.

Radionuclides

Plutonium-238 was detected at two borehole locations. Concentrations decreased with depth at borehole location 49-07512 and increased with depth at location 49-07527, to a concentration of 0.007 pCi/g. Plutonium-238 was not detected at similar depths in nearby borehole locations 49-609986, 49-609987, 49-609988, and 49-608889. The lateral and vertical extent of plutonium-238 are defined.

Plutonium-239/240 was detected at one borehole location. Concentrations decreased with depth at borehole location 49-07512. Plutonium-239/240 was not detected at similar depths in nearby borehole locations 49-609986, 49-609987, 49-609988, and 49-608889. The lateral and vertical extent of plutonium-239/240 are defined.

8.3.3.5 Subsurface Vapor Sampling

In 2010, one pore-gas sample was collected from borehole location 49-609887 and analyzed for VOCs and tritium. Table 8.3-5 presents the pore-gas samples collected and the analyses requested.

8.3.3.6 Subsurface Vapor Sample Analytical Results

Table 8.3-6 presents the VOCs detected in the pore-gas samples collected from SWMU 49-005(a). The sampling location and detected concentrations are shown on Plate 10. The VOCs detected in pore gas are acetone; benzene; butanone[2-]; chloromethane; dichlorodifluoromethane; ethylbenzene; ethyltoluene[4-]; styrene; toluene; trimethylbenzene[1,2,4-]; trimethylbenzene[1,3,5-]; xylene (total); xylene[1,2-]; and xylene[1,3-]+xylene[1,4-].

Table 8.3-7 presents the detected concentrations of tritium in pore-gas samples collected from SWMU 49-005(a). The sampling location and detected concentration are shown on Plate 11.

8.3.3.7 Nature and Extent of Contamination in Subsurface Pore Gas

The approved work plan (LANL 2008, 102215) prescribed the collection of one pore-gas sample from the TD of the borehole drilled at SWMU 49-005(a) to determine whether the boring should be completed as a vapor monitoring well. If VOCs were detected in the vapor-phase sample at concentrations greater than 10% of the screening levels presented in section 3.5, or if tritium was detected in the vapor-phase sample at a concentration greater than the screening levels based on groundwater cleanup level, the borehole would be completed as a vapor-monitoring well.

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-] were detected in the sample collected from borehole location 49-609887. Pore-gas data were compared to groundwater screening levels based on groundwater cleanup levels and the results indicate that VOCs in subsurface pore gas are not a potential source of groundwater contamination; therefore the nature and extent of VOCs in pore gas are defined.

Tritium was detected in one sample at borehole location 49-609887. Tritium in pore gas is not a potential source of groundwater contamination.

8.3.4 Summary of Human Health Risk Screening

Because the extent of contamination is not defined at SWMU 49-005(a) a human health risk-screening assessment was not performed.

8.3.5 Summary of Ecological Risk Screening

Because the extent of contamination is not defined at SWMU 49-005(a) an ecological risk-screening assessment was not performed.

9.0 CONCLUSIONS

The TA-49 sites outside the NES boundary that were part of the 2009–2010 investigation consist of six AOCs or SWMUs in Areas 5, 6, and 10. The SWMUs and AOCs in Area 5 include AOC 49-005(b), SWMU 49-006, and AOC 49-008(a); Area 6 West includes SWMU 49-004; and Area 10 includes AOC 49-002 and SWMU 49-005(a). The objective of the 2009–2010 investigation was to determine the nature and extent of contamination and obtain general site characterization data for evaluation of remedial alternatives.

Data from the samples collected during the 2009–2010 investigation were combined with decision-level data collected from previous investigations to provide an understanding of site contamination and potential human health and ecological risks.

The sampling data presented in this report indicate the extent of contamination has been defined at Area 5 [AOC 49-005(b) and SWMU 49-006]. These sites have been determined to pose no potential unacceptable risk or dose to human health or the environment under the current and reasonably foreseeable future land use. No further investigation or remediation activities are warranted at these sites.

The extent of contamination has not been defined at Area 10 [AOC 49-002 and SWMU 49-005(a)] and at Area 6 West (SWMU 49-004). Additional sampling is needed to define the vertical extent of one or more chemicals at each of these sites.

9.1 Nature and Extent of Contamination

The nature and extent of contamination in solid media have been defined for two sites investigated during the TA-49 sites outside the NES boundary investigation. Summaries of the nature and extent of contamination and remaining extent requirements are presented in the following sections.

9.1.1 Area 5

The nature and extent of contamination in solid media at AOC 49-005(b) are defined by existing data. COPCs include inorganic chemicals (cyanide, mercury, nitrate, perchlorate, selenium, thallium and uranium), and radionuclides (cesium-137, plutonium-238, plutonium-239/240, and tritium).

The nature and extent of subsurface vapor at AOC 49-005(b) are defined by existing data. VOCs detected in pore gas include acetone; benzene; butanone[2-]; chloromethane; dichlorodifluoromethane; ethylbenzene; ethyltoluene[4-]; tetrachloroethene; toluene; trimethylbenzene[1,2,4-]; trimethylbenzene [1,3,5-]; xylene (total); xylene[1,2-]; and xylene[1,3-]+xylene[1,4-] detected in trace concentrations. These VOCs do not pose a potential source of contamination to groundwater.

The nature and extent of contamination in solid media at SWMU 49-006 are defined by existing data. COPCs include inorganic chemicals (antimony, chromium, cyanide, mercury, nitrate, and selenium), organic chemicals (amino-4,6-dinitrotoluene[2-]; bis(2-ethylhexyl)phthalate; 2-butanone; dinitrotoluene[2,4-]; dinitrotoluene[2,6-]; trinitrotolenene[2,4,6-]; and tris(o-cresyl)phosphate); and radionuclides (plutonium-238 and tritium).

The nature and extent of PCB contamination in solid media at AOC 49-008(a) are defined by existing data. However, the investigation of the rest of AOC 49-008(a) is deferred per Table IV in the Consent Order (Table 1.1-1).

9.1.2 Area 6 West

The nature and extent of contamination in solid media at SWMU 49-004 are defined by existing data. COPCs include inorganic chemicals (aluminum, antimony, barium, beryllium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, perchlorate, selenium, silver, sodium, thallium, uranium, vanadium, and zinc; organic chemicals [bis(2-ethylhexyl)phthalate; 2-chloronaphthalene; methylene chloride; 2-methylnaphthalene; naphthalene; and pyrene]; and radionuclides (americium-241, cesium-134, cesium-137, europium-152, plutonium-238, plutonium-239/240, and tritium).

The nature and extent of subsurface vapor at SWMU 49-004 are defined by existing data. VOCs detected in pore gas include acetone; benzene; butanone[2-]; chloromethane; dichlorodifluoromethane; ethylbenzene; ethyltoluene[4-]; styrene; toluene; trimethylbenzene[1,2,4-]; trimethylbenzene[1,3,5-]; xylene (total); xylene[1,2-]; and xylene[1,3-]+xylene[1,4-] detected in trace concentrations. Tritium was also detected in subsurface vapor at SWMU 49-004. These VOCs and tritium do not pose a potential source of contamination to groundwater.

The nature and extent of contamination at SWMU 49-005(a) are not defined for dioxins and furans.

9.1.3 Area 10

The vertical extent of contamination at AOC 49-002 is not defined for zinc.

The vertical extent of contamination at SWMU 49-005(a) is not defined for aluminum and barium.

The nature and extent of subsurface vapor at SWMU 49-005(a) are defined by existing data. VOCs detected in pore gas include acetone; benzene; butanone[2-]; chloromethane; dichlorodifluoromethane; ethylbenzene; ethyltoluene[4-]; tetrachloroethene; toluene; trimethylbenzene[1,2,4-]; trimethylbenzene[1,3,5-]; xylene (total); xylene[1,2-]; and xylene[1,3-]+xylene[1,4-] detected in trace concentrations. Tritium was also detected in subsurface vapor at AOC 49-002. These VOCs and tritium do not pose a potential source of contamination to groundwater.

Human health and ecological risk-screening assessments were not conducted for AOC 49-002 and SWMU 49-005(a) because the extent of contamination is not defined.

9.2 Summary of Risk-Screening Assessments

Human health and ecological risk-screening assessments were performed for three sites for which nature and extent of contamination have been defined. Human health and ecological risk assessments were performed at AOC 49-008(a) for PCBs only.

9.2.1 Human Health Risk-Screening Assessment

Human health risk-screening assessments are presented in Appendix I-4.2.

The human health risk-screening assessments found no unacceptable risks or doses under the industrial, construction worker, and residential scenarios for AOCs 49-005(b) and 49-008(a) and SWMU 49-006. The potential risk was also evaluated for SWMU 49-004, but additional sampling is necessary to address potential contamination from dioxins and furans.

The total excess cancer risks were below the NMED target risk level of 1×10^{-5} (NMED 2009, 108070). The HIs were below the NMED target HI of 1.0 (NMED 2009, 108070) for AOC 49-005(b) and SWMU 49-006. The HIs for the industrial and residential scenarios at SWMU 49-004 are below 1.0. However, the HI for the construction worker scenario was slightly above 1.0 due to aluminum and manganese. The exposure point concentration for these inorganic COPCs are similar to BVs and the manganese SSL is less than the BVs. Without aluminum and manganese the HI is 0.4, which is less than the NMED target HI of 1.0.

The total doses are below the DOE target dose limit of 15 mrem/yr for all sites. The equivalent risks range from 2×10^{-7} to 7×10^{-6} based on a comparison with EPA's preliminary remediation goals for radionuclides (http://www.epa-prgs.ornl.gov/radionuclides/download/rad_master_prg_table_pci.xls).

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. 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.

For pore-gas samples, the SVs for the VOCs were below 1, indicating that the VOCs are not a potential source of groundwater contamination. Tritium was also detected in two pore-gas samples at a maximum concentration of 673.9 pCi/L. There is no screening value for tritium. The low moisture content of the

subsurface limits the potential for tritium to migrate to groundwater at such low concentrations. No installation of a vapor monitoring well or additional pore-gas monitoring are required because tritium was well below screening levels based on groundwater cleanup levels

9.2.2 Ecological Risk-Screening Assessment

For Area 5 [AOC 49-005(b), AOC 49-004, and AOC 49-008(a)] and Area 6 West (SWMU 49-004), no potential ecological risks were found for any receptor based on minimum ESL comparisons, HI analyses, comparisons to background concentrations, and potential effects to populations (individuals for T&E species). These lines of evidence support the conclusion that no potential ecological risks exist at the TA-49 sites outside the NES boundary. However, additional sampling at SWMU 49-004 is necessary to address potential contamination from dioxins and furans. In addition, the VOC concentrations in pore gas do not pose a potential risk to the pocket gopher.

10.0 RECOMMENDATIONS

The determination of site status is based on the results of the risk-screening assessments and the determination of nature and extent. Depending upon the decision scenario used, the sites are recommended as corrective action 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 scenarios (industrial and construction worker) result in corrective action complete with controls; that is, some type of institutional controls must be in place to ensure that the land use remains consistent with site cleanup levels. The current and reasonably foreseeable future land use for the TA-49 outside the NES boundary is industrial.

10.1 Additional Field Characterization Activities

The extent of contamination has not been defined for three sites investigated in the TA-49 sites outside the NES boundary. Additional sampling is needed to define the extent of contamination at the sites in Area 10 [AOC 49-002 and SWMU 49-005(a)]:

- AOC 49-002—vertical extent of zinc
- SWMU 49-005(a)—vertical extent of aluminum and barium

Additional sampling is also required at Area 6 West:

- SWMU 49-004—extent of dioxins and furans

A Phase II investigation work plan will be developed specifying sampling locations, numbers of samples, and analytical suites required to define the extent of contamination for AOC 49-002, SWMU 49-005(a), and SWMU 49-004. Upon completion of the proposed Phase II sampling and data analyses, the data will be used to confirm that the extent of contamination has been defined and human health and ecological risk-screening assessments will be completed for the remaining sites. The results will be presented in a Phase II investigation report for TA-49 sites outside the NES boundary.

AOC 49-008(a) in Area 5 is a deferred site, but the approved work plan prescribed sampling for PCBs to determine the nature and extent of PCB contamination around the transformer pads. The Laboratory recommends no further investigation is necessary to define the nature and extent of PCB contamination at AOC 49-008(a), but additional investigation will be necessary when the site is no longer deferred.

10.2 Recommendations for Corrective Action - Complete

Two sites for which the nature and extent of contamination are defined do not pose a potential unacceptable risk or dose under the industrial, construction worker, and residential scenarios. At these sites, the Laboratory recommends no further investigation or remediation activities are warranted. The two sites are

- AOCs 49-005(b) and 49-006 in Area 5

These two sites are appropriate for corrective actions complete without controls because they do not pose potential unacceptable risks or doses under a residential scenario and to the environment.

11.0 SCHEDULE FOR RECOMMENDED ACTIVITIES

A Phase II investigation work plan will be developed and submitted to NMED within 6 mo of approval of this investigation report. The work plan will provide details and a schedule for the implementation of remediation and sampling activities and submittal of a Phase II investigation report.

12.0 REFERENCES AND MAP DATA SOURCES

12.1 References

The following list includes all documents cited in this report. Parenthetical information following each reference provides the author(s), publication date, and ER ID. This information is also included in text citations. ER IDs are assigned by the Environmental Programs Directorate's Records Processing Facility (RPF) and are used to locate the document at the RPF and, where applicable, in the master reference set.

Copies of the master reference set are maintained at the NMED Hazardous Waste Bureau and the Directorate. The set was developed to ensure that the administrative authority has all material needed to review this document, and it is updated with every document submitted to the administrative authority. Documents previously submitted to the administrative authority are not included.

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12.2 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.

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

LANL PRS boundaries - Potential Release Sites; Los Alamos National Laboratory, Waste and Environmental Services Division, Environmental Data and Analysis Group, EP2009-0137; 1:2,500 Scale Data; 13 March 2009.

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.

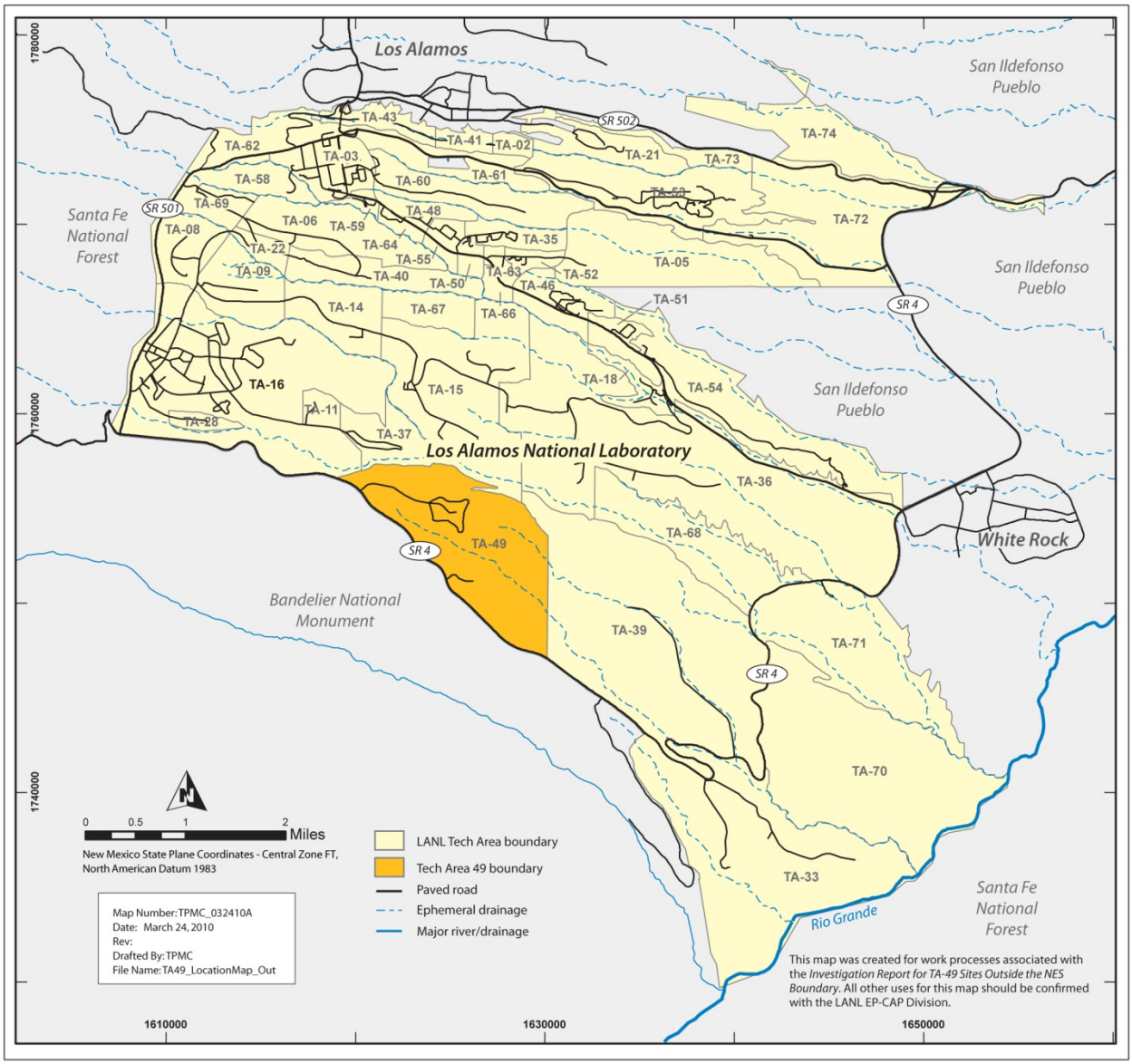


Figure 1.0-1 Location of TA-49 with respect to Laboratory technical areas and surrounding land holdings

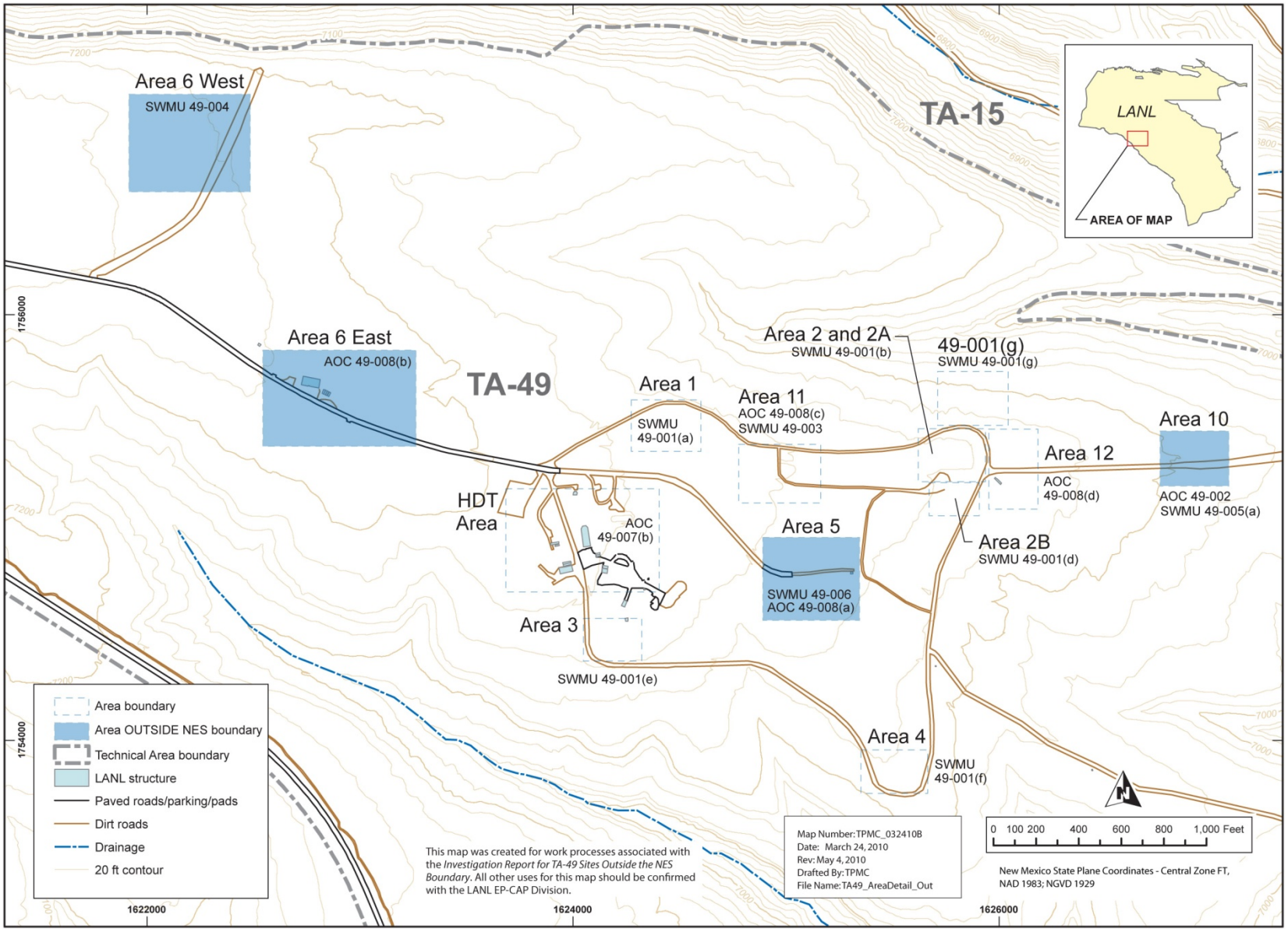


Figure 1.0-2 Locations of TA-49 SWMUs and AOCs

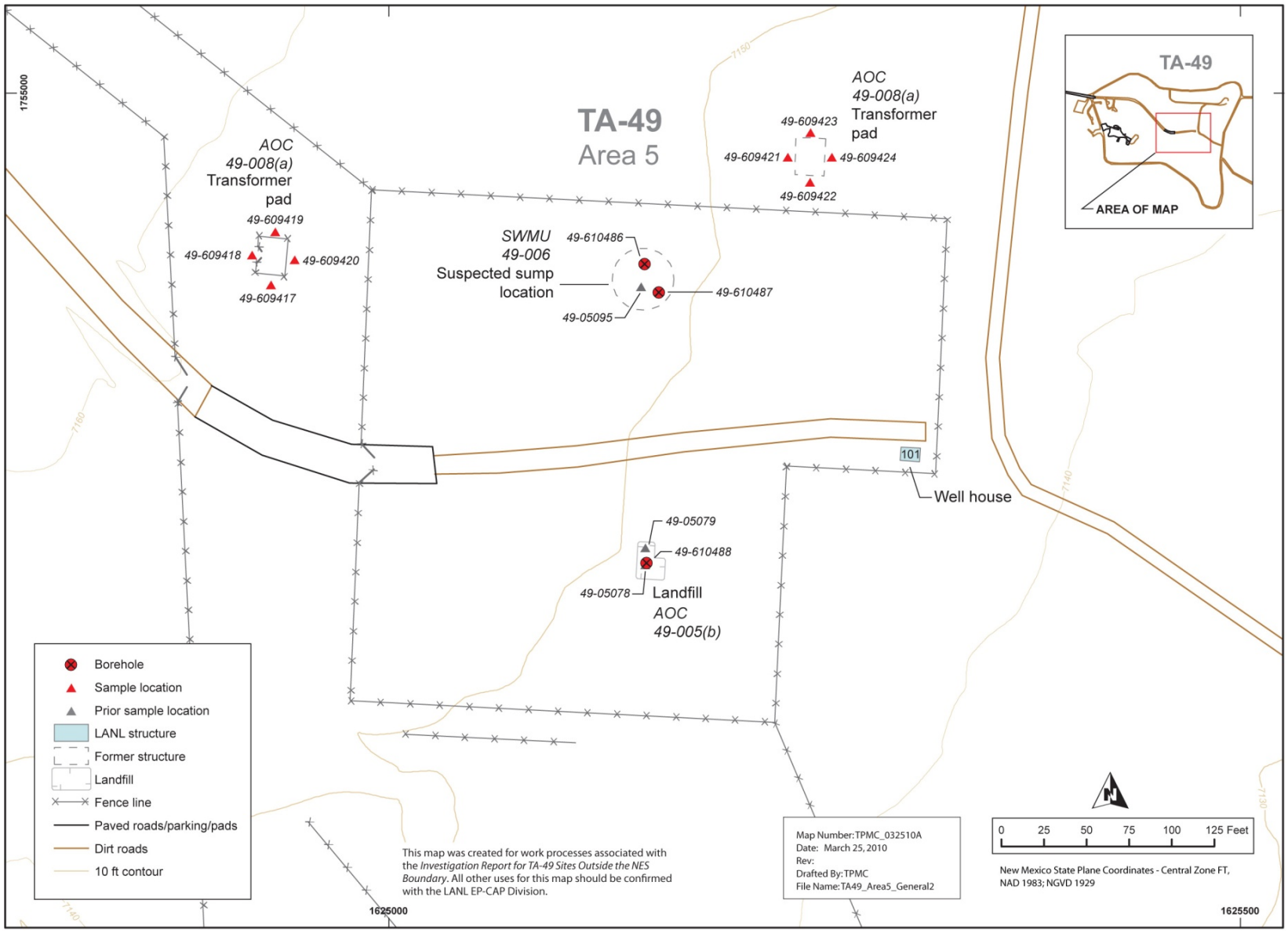


Figure 2.1-1 Current and historical sampling locations associated with Area 5 SWMUs and AOCs

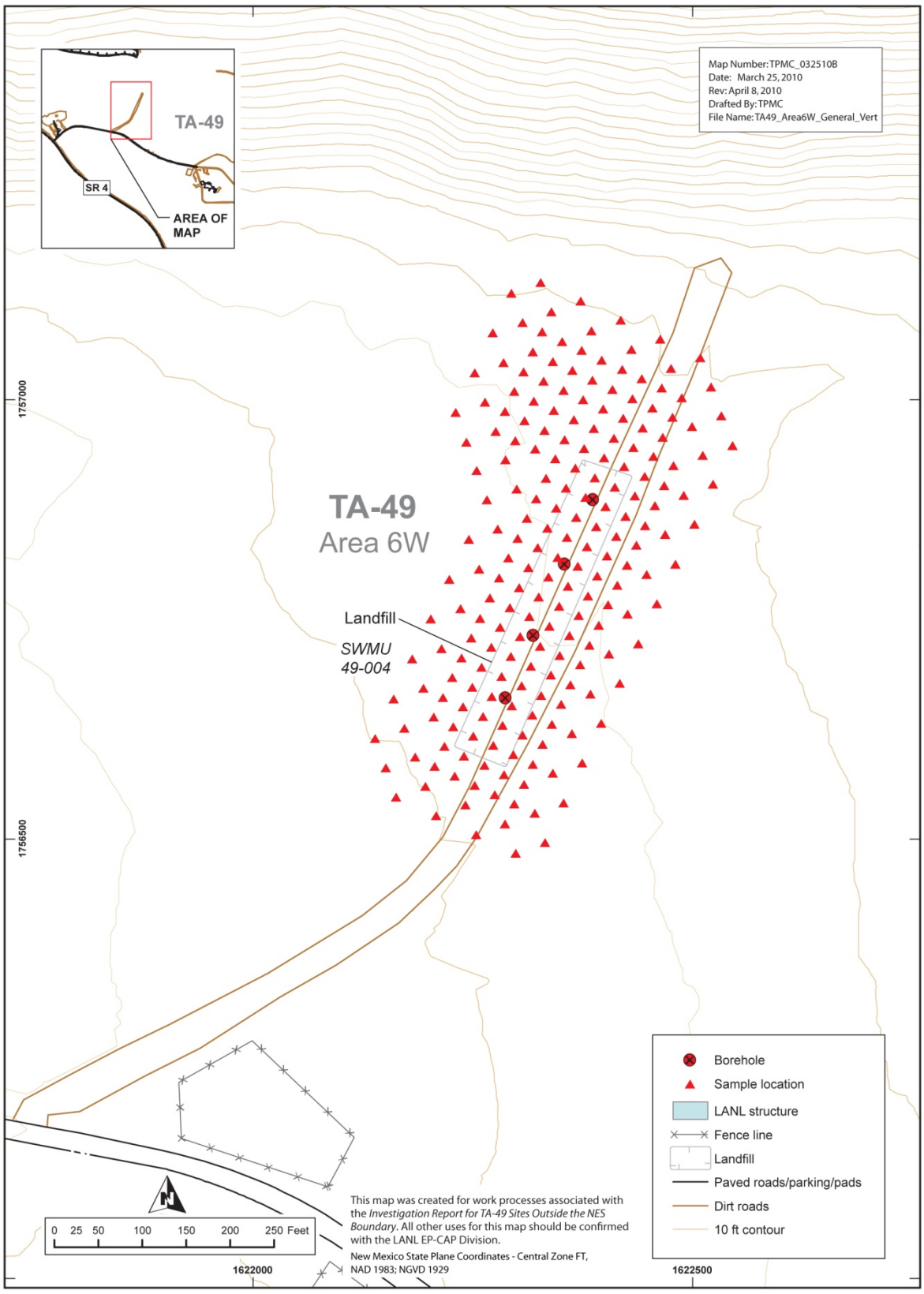


Figure 2.1-2 2009–2010 radiological screening-level sampling locations and boreholes associated with Area 6 West, SWMU 49-004

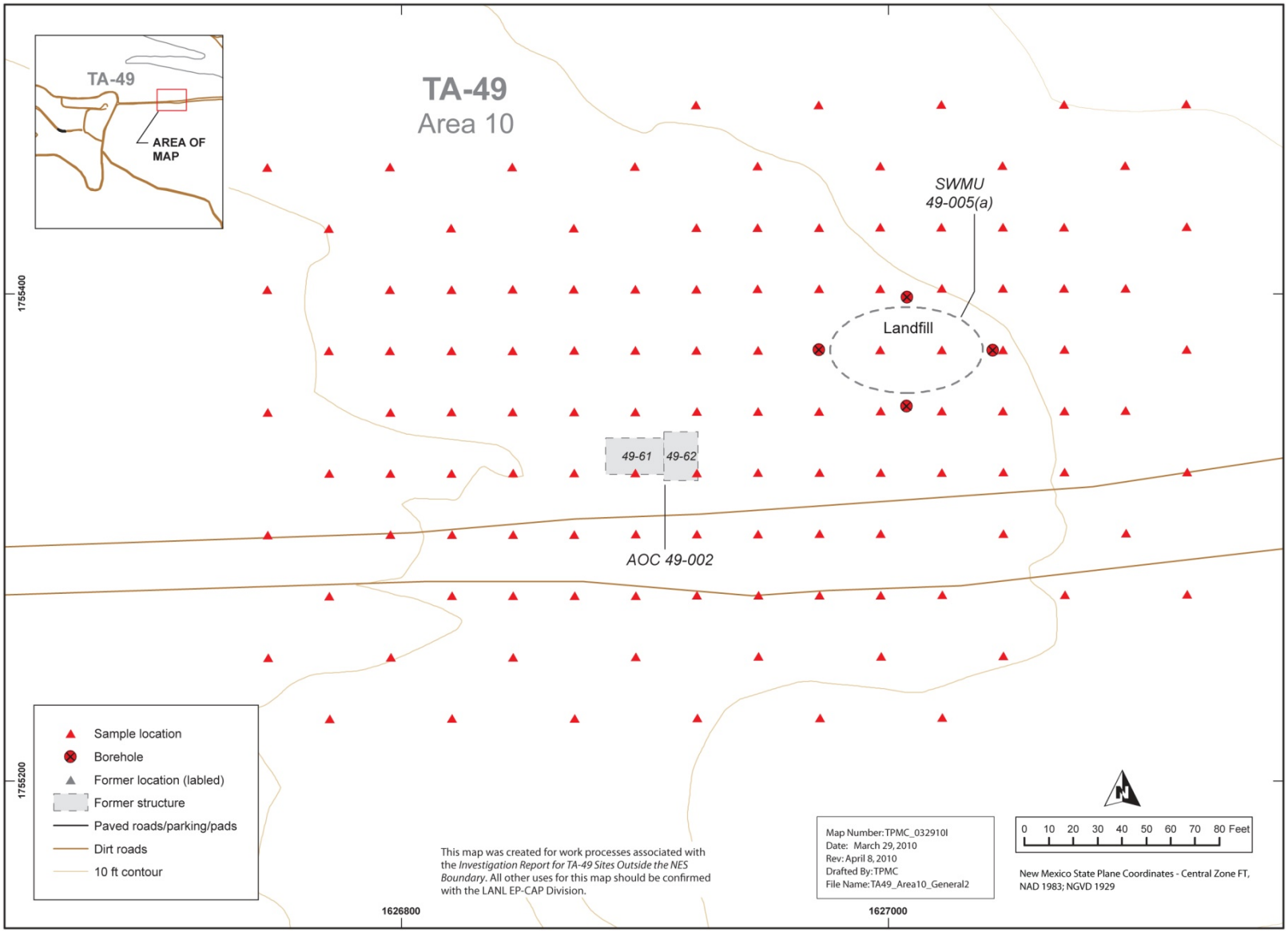


Figure 2.1-3 2009–2010 radiological screening-level sampling locations and boreholes associated with Area 10, AOC 49-002 and SWMU 49-005(a)

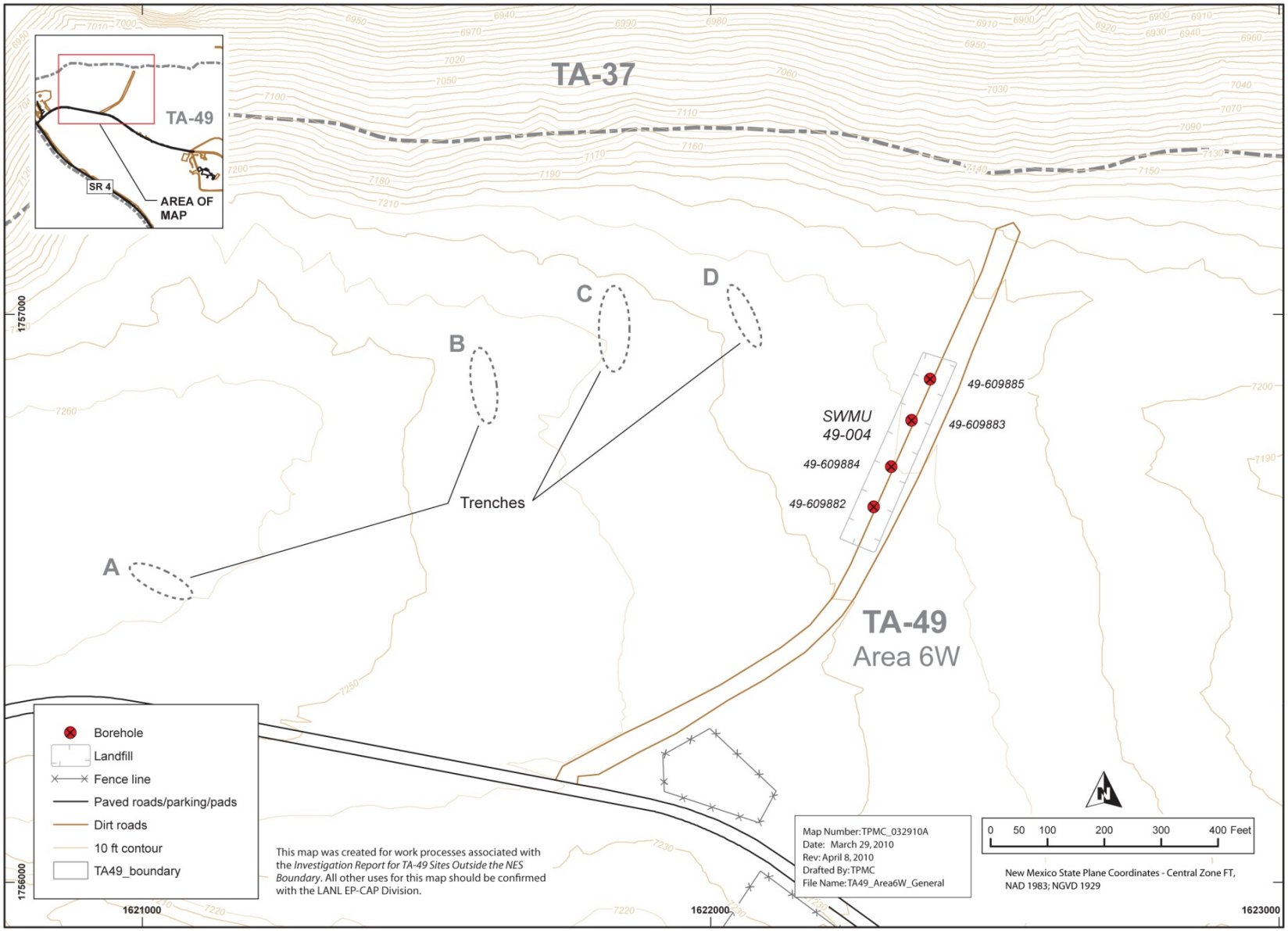


Figure 7.1-1 General site layout of Area 6 West

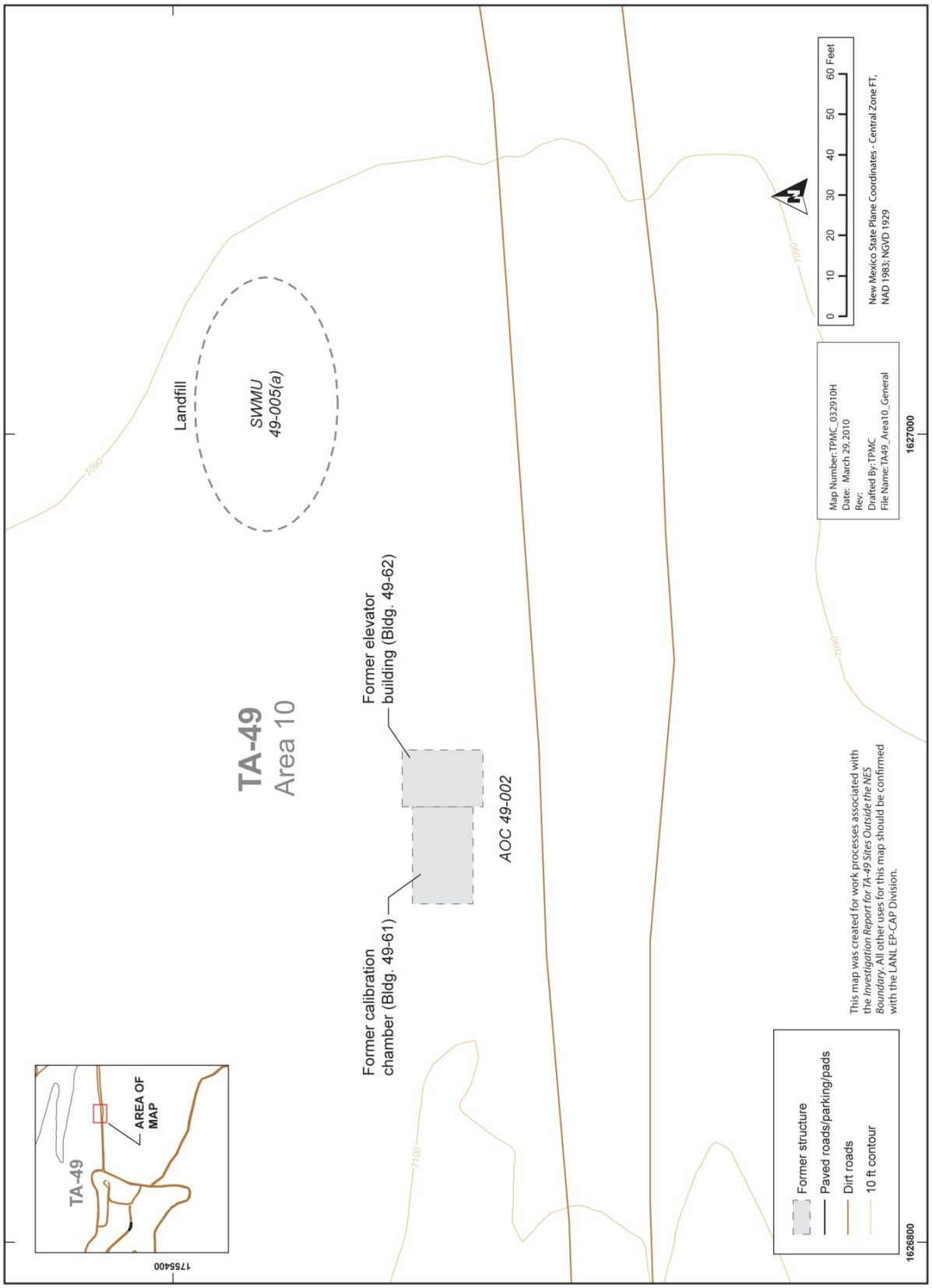


Figure 8.1-1 General site layout of Area 10, AOC 49-002 and SWMU 49-005(a)

Table 1.1-1
Status of SWMUs and AOCs Located Outside the NES Boundary at TA-49

Area	Site ID	Brief Description	Investigation(s) Prior to 2009	Investigation(s) Conducted in 2009/2010
5	AOC 49-005(b)	Small debris landfill	1995 surface and subsurface RFI	Subsurface and pore-gas samples collected
	SWMU 49-006	Former sump	1995 surface RFI	Subsurface samples collected
	AOC 49-008(a)	Potential soil contamination from historical central control area	1995 surface RFI	Samples collected for PCBs only; Deferred per Table IV-2 of the Consent Order
6 East	AOC 49-008(b)	Former general support area with potential contamination	1995 surface RFI	Deferred per Table IV-2 of the Consent Order
	AOC 49-007(a)*	Former sanitary septic system	NFA approved, 01/21/05; EPA 2005, 088464	NFA approved, 01/21/05; EPA 2005, 088464
	AOC 49-007(b)	Former sanitary leach field	NFA approved, 01/21/05; EPA 2005, 088464	NFA approved, 01/21/05; EPA 2005, 088464
6 West	SWMU 49-004	Inactive open-burning area and landfill	1987 environmental survey 1991 geophysical survey 1995 surface and subsurface RFI	Surface, subsurface, and pore-gas samples collected
10	AOC 49-002	Underground calibration chamber and elevator shaft	1995 surface RFI	Surface samples collected
	SWMU 49-005(a)	Inactive small debris landfill	1995 surface and subsurface RFI	Surface, subsurface, and pore-gas samples collected

*Shading denotes no further action (NFA) approved.

Table 2.1-1
Summary of Surface and Shallow-Subsurface Samples Collected and Analyses Requested at TA-49 Sites Outside the NES Boundary

Sampling Locations	Number of Samples		Total Depth (ft)	Screening	Laboratory Analysis			
	Field Screening	Off -Site Analytical		Gross Alpha and Beta Radiation Screening	Uranium, Plutonium, or Americium (HASL-300)	I-129, Sr-90, Tc-99 (HASL-300, EPA 905.0)	TAL Metals (EPA SW-846: 6010B/6020)	PCBs (EPA SW-846:8082)
Area 5	16	16	0–0.5 0.5–1.5	X[a]	—[b]	—	—	X
Area 6 West	410	126	0–0.5 0.5–1.5	X	X[c]	X[d]	X[c]	—
Area 10	234	64	0–0.5 0.5–1.5	X	X[c]	X[d]	X[c]	—

[a] Samples collected.

[b] — = Not requested.

[c] Analysis for americium-241, isotopic plutonium, isotopic uranium, TAL metals, and gamma spectroscopy was performed if gross alpha >25 pCi/g.

[d] Analysis for iodine-129, strontium-90, and technetium-99 was performed if gross beta >50 pCi/g.

Table 2.1-2
Summary of Boreholes Drilled and
Subsurface Samples Collected at TA-49 Sites Outside the NES Boundary

Sampling Locations	Borehole ID	Number of Samples	Total Depth (ft)	Screening		Laboratory Analysis							
				Gross Alpha and Beta Radiation Screening	VOC Screening	Cyanide (EPA SW-846:9012A)	Uranium, Plutonium, or Americium (HASL-300)	TAL Metals (EPA SW-846:6010B/6020)	Explosives (EPA SW-846:8330B/8141A)	Perchlorate (EPA SW-846:6850)	Nitrate (EPA SW-846:300)	VOCs and SVOCs (EPA SW-846: 8260B and 8270C)	Vapor-Phase Sampling VOCs (EPA TO-15) Tritium (EPA 906)
Area 5 AOC 49-005(b)	49-610486	8	40	X[a]	X	X	X	X	X	X	X	X	—[b]
	49-610487	8	40	X	X	X	X	X	X	X	X	X	—
	49-610488	5	15	X	X	X	X	X	X	X	X	X	X
Area 6 West SWMU 49-004	49-609885	3	65	X	X	X	X	X	X	X	—	X	—
	49-609884	3	65	X	X	X	X	X	X	X	—	X	—
	49-609882	3	65	X	X	X	X	X	X	X	—	X	X
	49-609883	3	65	X	X	X	X	X	X	X	—	X	—
Area 10 SWMU 49-005(a)	49-609988	3	10	X	X	X	X	X	X	X	X	X	—
	49-609986	3	10	X	X	X	X	X	X	X	X	X	—
	49-609989	3	10	X	X	X	X	X	X	X	X	X	—
	49-609987	5	10	X	X	X	X	X	X	X	X	X	X

[a] Samples collected.

[b] — = Not requested.

Table 2.1-3
Summary of Pore-Gas Samples Collected and
Analyses Requested at TA-49 Sites Outside the NES Boundary

Sampling Locations	Location ID	Number of Samples	Total Depth (ft bgs)	Laboratory Analysis	
				Tritium	VOCs
Area 5 AOC 49-005(b)	49-610488	1	11.0–13.5	X*	X
Area 6 West SWMU 49-004	49-609882	2	9.0–11.0 58.0–60.0	X	X
Area 10 SWMU 49-005(a)	49-609987	1	4.0–6.5	X	X

*Samples collected.

Table 3.5-1
Henry's Law Constants, Groundwater SLs, and
Calculated Concentrations Corresponding to Groundwater SLs for Detected VOCs in Pore Gas

VOC	Henry's Law Constant[a] (dimensionless)	Groundwater Screening Level (µg/L)	Maximum Detected Concentration (µg/m^3)	Calculated Concentrations in Pore Gas Corresponding to Groundwater Standard[b] (µg/m^3)
Acetone	0.0016	21,800[c]	31	34880
Benzene	0.228	5[d]	12	1140
Butanone[2-]	0.0023	7060[c]	10	16238
Chloromethane	0.360	17.8[c]	1.7	6408
Dichlorodifluoromethane	14.0	395[c]	3.2	5530000
Ethylbenzene	0.323	700[d]	13	22610
Ethyltoluene[4-]	na[e]	na	17	na
Styrene	0.110	100[d]	3.2	11000
Tetrachloroethene	0.720	5[d]	7.3	3600
Toluene	0.272	750	34	20400
Trimethylbenzene[1,2,4-]	0.25[f]	15[g]	18	3750
Trimethylbenzene[1,3,5-]	0.36[f]	370[g]	5.4	133200
Xylene (Total)	0.270	620[h]	50	167400
Xylene[1,2-]	0.213	620[h]	13	132060
Xylene[1,3-]+Xylene[1,4-]	0.270	620[h]	37	167400

[a] NMED (2009, 108070, Appendix B) unless otherwise noted.

[b] Derived from denominator of Equation 3.5-3.

[c] Tap-water screening levels from NMED (2009, 108070).

[d] EPA MCL (40 Code of Federal Regulations 141.61).

[e] na = Not available.

[f] Henry's law constant from EPA regional screening tables (http://www.epa.gov/region06/6pd/rcra_c/pd-n/screen.htm).

[g] EPA regional tap-water screening level (http://www.epa.gov/region06/6pd/rcra_c/pd-n/screen.htm).

[h] NMWQCC groundwater standard (20.6.2.3103 New Mexico Administrative Code).

Table 6.2-1
Surveyed Coordinates for
2009/2010 Borehole Locations at Area 5, AOC 49-005(b)

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
49-005(b)	49-610488	1625152.321	1754724.079

Table 6.2-2
Samples Collected and Analyses Requested at Area 5, AOC 49-005(b)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Anions	Gamma Spectroscopy	Tritium	High Explosives	Isotopic Plutonium	Isotopic Uranium	TAL Metals	Perchlorate	SVOCs	Uranium	VOCs	Wet Chemistry
0549-95-0136	49-05078	0.0–0.5	Soil	—*	—	720	—	—	720	—	719	—	—	720	—	—
0549-95-0135	49-05078	3.6–5.0	Fill	—	—	728	—	—	728	—	727, 728	—	726	—	—	—
0549-95-0139	49-05079	0.0–0.5	Soil	—	—	720	—	—	720	—	719	—	—	720	—	—
0549-95-0137	49-05079	3.3–5.0	Fill	—	—	728	—	—	728	—	727, 728	—	726	—	—	—
RE49-10-7075	49-610488	0.0–2.5	Soil	10-799	10-798	—	10-799	10-797	10-799	10-799	10-798	10-798	10-797	—	10-797	10-798
RE49-10-7076	49-610488	2.5–4.3	Soil	10-799	10-798	—	10-799	10-797	10-799	10-799	10-798	10-798	10-797	—	10-797	10-798
RE49-10-7077	49-610488	5.0–7.5	Qbt4	10-799	10-798	—	10-799	10-797	10-799	10-799	10-798	10-798	10-797	—	10-797	10-798
RE49-10-7078	49-610488	7.5–10.0	Qbt4	10-799	10-798	—	10-799	10-797	10-799	10-799	10-798	10-798	10-797	—	10-797	10-798
RE49-10-7079	49-610488	12.5–15.0	Qbt4	10-799	10-798	—	10-799	10-797	10-799	10-799	10-798	10-798	10-797	—	10-797	10-798

Notes: The numbers in the analytical request columns are analytical request numbers. Anions refers to total cyanide and nitrate.
*— = Not requested.

Table 6.2-3
Field-Screening Results for Samples Collected at Area 5, AOC 49-005(b)

AOC/SWMU	Location ID	Depth (ft)	Sample ID	PID (ppm)	Alpha (dpm)	Beta/Gamma (dpm)
49-005(b)	49-610488	0.0–2.5	RE49-10-7075	0.0	45	2340
49-005(b)	49-610488	2.5–4.3	RE49-10-7076	0.0	45	2340
49-005(b)	49-610488	5.0–7.5	RE49-10-7077	0.0	98	2460
49-005(b)	49-610488	7.5–10.0	RE49-10-7078	0.0	98	2460
49-005(b)	49-610488	12.5–15.0	RE49-10-7079	0.0	111	2390

Table 6.2-4
Summary of Inorganic Chemicals Detected or Detected above BVs at Area 5, AOC 49-005(b)

Sample ID	Location ID	Depth (ft)	Media	Cyanide (Total)	Lead	Mercury	Nitrate	Perchlorate	Potassium	Selenium	Thallium	Uranium
Qbt4 Background Value[a]				**0.5**	**11.2**	**0.1**	**na**[b]	**na**	**3500**	**0.3**	**1.1**	**2.4**
Soil Background Value[a]				**0.5**	**22.3**	**0.1**	**na**	**na**	**3460**	**1.52**	**0.73**	**1.82**
Residential SSL[c]				**1.56E+03**	**4.00E+02**	**2.30E+01**[d]	**1.25E+05**	**5.48E+01**	**na**	**3.91E+02**	**5.16E+00**	**2.35E+02**
Industrial SSL[c]				**2.27E+04**	**8.00E+02**	**3.10E+02**[d]	**1.82E+06**	**7.95E+02**	**na**	**5.68E+03**	**7.49E+01**	**3.41E+03**
Construction Worker SSL[c]				**6.19E+03**	**8.00E+02**	**9.29E+01**	**4.96E+05**	**2.17E+02**	**na**	**1.55E+03**	**2.04E+01**	**9.29E+02**
0549-95-0136	49–05078	0.0–0.5	Soil	NA[f]	NA	0.12 (U)	NA	NA	NA	—[g]	1.5 (U)	3.72
0549-95-0135	49–05078	3.6–5.0	Fill	NA	—	0.12 (U)	NA	NA	—	—	1.4 (U)	4.23
0549-95-0139	49–05079	0.0–0.5	Soil	NA	—	—	NA	NA	3500	—	1.5 (U)	3.51
0549-95-0137	49–05079	3.3–5.0	Fill	NA	—	0.11 (U)	NA	NA	—	—	1.4 (U)	3.15
RE49-10-7075	49–610488	0.0–2.5	Soil	—	—	—	1.7	—	—	—	—	NA
RE49-10-7076	49–610488	2.5–4.3	Soil	0.56 (U)	—	—	0.22	—	—	—	—	NA
RE49-10-7077	49–610488	5.0–7.5	Qbt4	0.55 (U)	—	—	0.79	0.0025 (J)	—	1.2	—	NA
RE49-10-7078	49–610488	7.5–10.0	Qbt4	0.57 (U)	—	—	1.2	0.0032 (J)	—	0.37 (U)	—	NA
RE49-10-7079	49–610488	12.5–15.0	Qbt4	—	—	—	1	0.0065	—	0.53 (J-)	—	NA

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 (2009, 108070) unless otherwise noted.

[d] EPA regional screening level (http://www.epa.gov/region06/6pd/rcra_c/pd-n/screen.htm).

[e] Construction worker SSL calculated using toxicity value from EPA regional screening tables (http://www.epa.gov/region06/6pd/rcra_c/pd-n/screen.htm) and equation and parameters from NMED (2009, 108070).

[f] NA = Not analyzed.

[g] — = Not detected or not detected above BV.

Table 6.2-5
Summary of Radionuclides Detected or Detected above BVs/FVs at Area 5, AOC 49-005(b)

Sample ID	Location ID	Depth (ft)	Media	Cesium-137	Plutonium-238	Plutonium-239/240	Tritium
Qbt4 Background Value[a]				**na**[b]	**na**	**na**	**na**
Soil Background Value[a]				**1.65**	**0.023**	**0.054**	**na**
Residential SSL[c]				**na**	**na**	**na**	**na**
Industrial SSL[c]				**na**	**na**	**na**	**na**
0549-95-0135	49-05078	3.6–5.0	Fill	0.13	—[d]	0.025	NA[e]
0549-95-0137	49-05079	3.3–5.0	Fill	—	0.007	0.009	NA
RE49-10-7078	49-610488	7.5–10.0	Qbt4	NA	—	—	0.223 (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] SSLs from NMED (2009, 106420).

[d] — = Analyzed for but not detected.

[e] NA = Not analyzed.

Table 6.2-6
Summary of Pore-Gas Samples Collected
and Analyses Requested at Area 5, AOC 49-005(b)

Sample ID	Location ID	Depth (ft)	Media	Tritium	VOCs
RE49-10-11867	49-610488	11.0–13.5	Pore gas	10-1583	10-1582

Note: The numbers in the analytical request columns are analytical request numbers.

Table 6.2-7
Summary of Organic Chemicals Detected in Pore-Gas Samples at Area 5, AOC 49-005(b)

Sample ID	Location ID	Depth (ft)	Media	Acetone	Benzene	Butanone[2-]	Chloromethane	Dichlorodifluoromethane	Ethylbenzene	Ethyltoluene[4-]	Tetrachloroethene	Toluene	Trimethylbenzene[1,2,4-]	Trimethylbenzene[1,3,5-]	Xylene (Total)	Xylene[1,2-]	Xylene[1,3-]+Xylene[1,4-]
RE49-10-11867	49-610488	11.0–13.5	Pore gas	18	6	5.4	1.7	3	7.4	10	7.3	24	9.9	3.4	29	7.3	21

Note: All concentrations are in $\mu g/m^3$.

Table 6.3-1
Surveyed Coordinates for
2009 Borehole Locations at Area 5, SWMU 49-006

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
49-006	49-610486	1625151.305	1754899.823
49-006	49-610487	1625159.566	1754883.073

Table 6.3-2
Samples Collected and Analyses Requested at Area 5, SWMU 49-006

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Anions	Gamma Spectroscopy	Tritium	High Explosives	Isotopic Plutonium	Isotopic Uranium	TAL Metals	Perchlorate	SVOCs	VOCs	Wet Chemistry
0549-95-0133	49-05095	5.0–10.0	Qbt4	—*	—	728	—	—	728	—	727, 728	—	726	—	—
RE49-10-7059	49-610486	3.0–5.0	Soil	10-799	10-798	—	10-799	10-797	10-799	10-799	10-798	10-798	10-797	10-797	10-798
RE49-10-7060	49-610486	8.0–10.0	Qbt4	10-799	10-798	—	10-799	10-797	10-799	10-799	10-798	10-798	10-797	10-797	10-798
RE49-10-7061	49-610486	13.0–15.0	Qbt4	10-799	10-798	—	10-799	10-797	10-799	10-799	10-798	10-798	10-797	10-797	10-798
RE49-10-7062	49-610486	18.0–20.0	Qbt4	10-799	10-798	—	10-799	10-797	10-799	10-799	10-798	10-798	10-797	10-797	10-798
RE49-10-7063	49-610486	23.0–25.0	Qbt4	10-799	10-798	—	10-799	10-797	10-799	10-799	10-798	10-798	10-797	10-797	10-798
RE49-10-7064	49-610486	28.0–30.0	Qbt4	10-799	10-798	—	10-799	10-797	10-799	10-799	10-798	10-798	10-797	10-797	10-798
RE49-10-7065	49-610486	33.0–35.0	Qbt4	10-799	10-798	—	10-799	10-797	10-799	10-799	10-798	10-798	10-797	10-797	10-798
RE49-10-7066	49-610486	38.0–40.0	Qbt4	10-799	10-798	—	10-799	10-797	10-799	10-799	10-798	10-798	10-797	10-797	10-798
RE49-10-7074	49-610487	1.5–3.0	Soil	10-799	10-798	—	10-799	10-797	10-799	10-799	10-798	10-798	10-797	10-797	10-798
RE49-10-7073	49-610487	6.8–8.8	Soil	10-799	10-798	—	10-799	10-797	10-799	10-799	10-798	10-798	10-797	10-797	10-798
RE49-10-7069	49-610487	13.0–15.0	Qbt4	10-799	10-798	—	10-799	10-797	10-799	10-799	10-798	10-798	10-797	10-797	10-798
RE49-10-7068	49-610487	18.0–20.0	Qbt4	10-799	10-798	—	10-799	10-797	10-799	10-799	10-798	10-798	10-797	10-797	10-798
RE49-10-7067	49-610487	23.0–25.0	Qbt4	10-799	10-798	—	10-799	10-797	10-799	10-799	10-798	10-798	10-797	10-797	10-798
RE49-10-7070	49-610487	28.0–30.0	Qbt4	10-799	10-798	—	10-799	10-797	10-799	10-799	10-798	10-798	10-797	10-797	10-798
RE49-10-7071	49-610487	33.0–35.0	Qbt4	10-799	10-798	—	10-799	10-797	10-799	10-799	10-798	10-798	10-797	10-797	10-798
RE49-10-7072	49-610487	38.0–40.0	Qbt4	10-799	10-798	—	10-799	10-797	10-799	10-799	10-798	10-798	10-797	10-797	10-798

Notes: The numbers in the analytical request columns are analytical request numbers. Anions refers to total cyanide and nitrate.
*— = Not requested.

Table 6.3-3
Field-Screening Results for Samples Collected at Area 5, SWMU 49-006

SWMU or AOC	Location ID	Depth (ft)	Sample ID	PID (ppm)	Alpha (dpm)	Beta/Gamma (dpm)
49-006	49-610486	3.0–5.0	RE49-10-7059	0.5	33	1821
49-006	49-610486	8.0–10.0	RE49-10-7060	0.1	65	2730
49-006	49-610486	13.0–15.0	RE49-10-7061	0.1	65	2430
49-006	49-610486	18.0–20.0	RE49-10-7062	0.3	65	2250
49-006	49-610486	23.0–25.0	RE49-10-7063	0.2	98	2610
49-006	49-610486	28.0–30.0	RE49-10-7064	0.0	52	2640
49-006	49-610486	33.0–35.0	RE49-10-7065	0.0	111	2950
49-006	49-610486	38.0–40.0	RE49-10-7066	0.0	91	2440
49-006	49-610487	1.5–3.0	RE49-10-7074	0.0	59	2020
49-006	49-610487	6.8–8.8	RE49-10-7073	0.0	50	2310
49-006	49-610487	13.0–15.0	RE49-10-7069	0.0	50	2310
49-006	49-610487	18.0–20.0	RE49-10-7068	0.1	72	2750
49-006	49-610487	23.0–25.0	RE49-10-7067	0.3	72	2470
49-006	49-610487	28.0–30.0	RE49-10-7070	0.0	85	2640
49-006	49-610487	33.0–35.0	RE49-10-7071	0.0	59	2580
49-006	49-610487	38.0–40.0	RE49-10-7072	0.0	59	2250

Table 6.3-4
Summary of Inorganic Chemicals Detected or Detected above BVs at Area 5, SWMU 49-006

Sample ID	Location ID	Depth (ft)	Media	Antimony	Calcium	Chromium	Cyanide (Total)	Lead	Mercury	Nitrate	Perchlorate	Selenium	Thallium
Qbt4 Background Value[a]				**0.5**	**2200**	**7.14**	**0.5**	**11.2**	**0.1**	**na**[b]	**na**	**0.3**	**1.1**
Soil Background Value[a]				**0.83**	**6120**	**19.3**	**0.5**	**22.3**	**0.1**	**na**	**na**	**1.52**	**0.73**
Residential SSL[c]				**3.13E+01**	**na**	**2.19E+02**[d]	**1.56E+03**	**4.00E+02**	**2.30E+01**[e]	**1.25E+05**	**5.48E+01**	**3.91E+02**	**5.16E+00**
Industrial SSL[c]				**4.54E+02**	**na**	**2.92E+03**[d]	**2.27E+04**	**8.00E+02**	**3.10E+02**[e]	**1.82E+06**	**7.95E+02**	**5.68E+03**	**7.49E+01**
Construction Worker SSL[c]				**1.24E+02**	**na**	**4.49E+02**[d]	**6.19E+03**	**8.00E+02**	**9.29E+01**[f]	**4.96E+05**	**2.17E+02**	**1.55E+03**	**2.04E+01**
0549-95-0133	49-05095	5.0–10.0	Qbt4	0.75 (UJ)	—[g]	—	NA[h]	—	—	NA	NA	0.82 (U)	1.4 (U)
RE49-10-7059	49-610486	3.0–5.0	Soil	—	7010 (J+)	—	—	—	—	0.23	—	—	—
RE49-10-7060	49-610486	8.0–10.0	Qbt4	—	—	—	0.54 (U)	—	—	0.21 (J)	—	0.36 (U)	—
RE49-10-7061	49-610486	13.0–15.0	Qbt4	—	—	—	0.54 (U)	—	—	0.17 (J)	—	0.34 (U)	—
RE49-10-7062	49-610486	18.0–20.0	Qbt4	—	—	—	0.54 (U)	—	—	0.22	—	—	—
RE49-10-7063	49-610486	23.0–25.0	Qbt4	—	—	—	0.54 (U)	—	—	0.33	—	0.32 (U)	—
RE49-10-7064	49-610486	28.0–30.0	Qbt4	—	—	—	0.54 (U)	—	—	0.46	—	—	—
RE49-10-7065	49-610486	33.0–35.0	Qbt4	—	—	—	0.54 (U)	—	—	0.44	—	0.39 (U)	—
RE49-10-7066	49-610486	38.0–40.0	Qbt4	—	—	—	0.53 (U)	—	—	0.36	—	—	—
RE49-10-7074	49-610487	1.5–3.0	Soil	—	—	—	—	—	—	0.26	—	—	—
RE49-10-7073	49-610487	6.8–8.8	Soil	—	—	—	0.55 (U)	—	0.12	0.12 (J)	—	—	—
RE49-10-7069	49-610487	13.0–15.0	Qbt4	—	—	—	0.53 (U)	—	—	0.16 (J)	—	0.37 (U)	—
RE49-10-7068	49-610487	18.0–20.0	Qbt4	—	—	—	0.54 (U)	—	—	0.46	—	0.33 (U)	—
RE49-10-7067	49-610487	23.0–25.0	Qbt4	—	—	—	0.53 (U)	—	—	0.35	—	0.35 (U)	—
RE49-10-7070	49-610487	28.0–30.0	Qbt4	—	—	—	0.53 (U)	—	—	0.22	—	—	—

Table 6.3-4 (continued)

Sample ID	Location ID	Depth (ft)	Media	Antimony	Calcium	Chromium	Cyanide (Total)	Lead	Mercury	Nitrate	Perchlorate	Selenium	Thallium
Qbt4 Background Value[a]				**0.5**	**2200**	**7.14**	**0.5**	**11.2**	**0.1**	**na**[b]	**na**	**0.3**	**1.1**
Soil Background Value[a]				**0.83**	**6120**	**19.3**	**0.5**	**22.3**	**0.1**	**na**	**na**	**1.52**	**0.73**
Residential SSL[c]				**3.13E+01**	**na**	**2.19E+02**[d]	**1.56E+03**	**4.00E+02**	**2.30E+01**[e]	**1.25E+05**	**5.48E+01**	**3.91E+02**	**5.16E+00**
Industrial SSL[c]				**4.54E+02**	**na**	**2.92E+03**[d]	**2.27E+04**	**8.00E+02**	**3.10E+02**[e]	**1.82E+06**	**7.95E+02**	**5.68E+03**	**7.49E+01**
Construction Worker SSL[c]				**1.24E+02**	**na**	**4.49E+02**[d]	**6.19E+03**	**8.00E+02**	**9.29E+01**[f]	**4.96E+05**	**2.17E+02**	**1.55E+03**	**2.04E+01**
RE49-10-7071	49-610487	33.0–35.0	Qbt4	—	—	8.8	0.53 (U)	—	—	0.31	—	0.42 (U)	—
RE49-10-7072	49-610487	38.0–40.0	Qbt4	—	—	—	0.53 (U)	15.4	—	0.31	—	0.32 (U)	—

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 (2009, 108070) unless otherwise noted.

[d] SSL for hexavalent chromium.

[e] EPA regional screening level (http://www.epa.gov/region06/6pd/rcra_c/pd-n/screen.htm).

[f] Construction worker SSL calculated using toxicity value from EPA regional screening tables (http://www.epa.gov/region06/6pd/rcra_c/pd-n/screen.htm) and equation and parameters from NMED (2009, 108070).

[g] — = Not detected or not detected above BV.

[h] NA = Not analyzed.

Table 6.3-5
Summary of Organic Chemicals Detected at Area 5, SWMU 49-006

Sample ID	Location ID	Depth (ft)	Media	Amino-4,6-dinitrotoluene[2-]	Bis(2-ethylhexyl)phthalate	Butanone[2-]	Dinitrotoluene[2,4-]	Dinitrotoluene[2,6-]	Trinitrotoluene[2,4,6-]	Tris (o-cresyl) phosphate
Residential SSL[a]				**1.50E+02**[b]	**3.47E+02**	**3.96E+04**	**1.57E+01**	**6.12E+01**	**3.59E+01**	**na**[c]
Industrial SSL[a]				**2.00E+03**[b]	**1.37E+03**	**3.69E+05**	**1.03E+02**	**6.87E+02**	**4.69E+02**	**na**
Construction Worker SSL[a]				**6.01E+02**[d]	**4.76E+03**	**1.48E+05**	**4.76E+02**	**2.39E+02**	**1.41E+02**	**na**
RE49-10-7059	49-610486	3.0–5.0	Soil	—[e]	0.066 (J)	0.0058 (J)	—	—	—	—
RE49-10-7062	49-610486	18.0–20.0	Qbt4	—	0.047 (J)	—	—	—	—	—
RE49-10-7069	49-610487	13.0–15.0	Qbt4	0.0098 (J)	—	—	0.0088 (J)	0.0063 (J)	0.0074 (J)	0.012 (J)

Notes: All concentrations are in mg/kg. Data qualifiers are defined in Appendix A.

[a] SSLs from NMED (2009, 108070) unless otherwise noted.

[b] EPA regional screening level (http://www.epa.gov/region06/6pd/rcra_c/pd-n/screen.htm).

[c] na = Not available.

[d] Construction worker SSL calculated using toxicity value from EPA regional screening tables (http://www.epa.gov/region06/6pd/rcra_c/pd-n/screen.htm) and equation and parameters from NMED (2009, 108070).

[e] — = Not detected.

Table 6.3-6
Summary of Radionuclides Detected or Detected above BVs/FVs at Area 5, SWMU 49-006

Sample ID	Location ID	Depth (ft)	Media	Plutonium-238	Tritium
Qbt4 Background Value[a]				**na**[b]	**na**
Soil Background Value[a]				**0.023**	**na**
Residential SAL[c]				**37**	**750**
Industrial SAL[c]				**240**	**440000**
Construction Worker SAL[c]				**40**	**320000**
0549-95-0133	49-05095	5.0000–10.0000	Qbt4	0.005	NA[d]
RE49-10-7059	49-610486	3.0000–5.0000	Soil	—[e]	0.408 (J+)
RE49-10-7063	49-610486	23.0000–25.0000	Qbt4	—	0.279 (J+)
RE49-10-7065	49-610486	33.0000–35.0000	Qbt4	—	0.309 (J+)
RE49-10-7066	49-610486	38.0000–40.0000	Qbt4	—	0.345 (J+)
RE49-10-7067	49-610487	23.0000–25.0000	Qbt4	—	0.431 (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] Screening action levels (SALs) from LANL (2009, 107655).

[d] NA = Not analyzed.

[e] — = Not detected or not detected above BV/FV.

Table 6.4-1
Surveyed Coordinates for 2009 Locations at Area 5, AOC 49-008(a)

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
49-008 (a)	49-609417	1624931.723	1754887.493
49-008 (a)	49-609418	1624920.559	1754905.013
49-008 (a)	49-609419	1624934.3	1754918.582
49-008 (a)	49-609420	1624945.636	1754902.265
49-008 (a)	49-609421	1625235.056	1754962.641
49-008 (a)	49-609422	1625248.212	1754947.812
49-008 (a)	49-609423	1625248.44	1754977.014
49-008 (a)	49-609424	1625260.912	1754962.641

Table 6.4-2
Samples Collected and Analysis Requested at Area 5, AOC 49-008(a)

Sample ID	Location ID	Depth (ft)	Media	PCBs
RE49-10-3520	49-609417	0.0–0.5	Soil	10-440
RE49-10-3521	49-609417	0.5–1.5	Soil	10-440
RE49-10-3522	49-609418	0.0–0.5	Soil	10-440
RE49-10-3523	49-609418	0.5–1.5	Soil	10-440
RE49-10-3524	49-609419	0.0–0.5	Soil	10-440
RE49-10-3525	49-609419	0.5–1.5	Soil	10-440
RE49-10-3526	49-609420	0.0–0.5	Soil	10-440
RE49-10-3527	49-609420	0.5–1.5	Soil	10-440
RE49-10-3528	49-609421	0.0–0.5	Soil	10-440
RE49-10-3529	49-609421	0.5–1.5	Soil	10-440
RE49-10-3530	49-609422	0.0–0.5	Soil	10-440
RE49-10-3531	49-609422	0.5–1.5	Soil	10-440
RE49-10-3532	49-609423	0.0–0.5	Soil	10-440
RE49-10-3533	49-609423	0.5–1.5	Soil	10-440
RE49-10-3534	49-609424	0.0–0.5	Soil	10-440
RE49-10-3535	49-609424	0.5–1.5	Soil	10-440

Note: The numbers in the PCBs column are analytical request numbers.

Table 6.4-3
Field-Screening Results for Samples Collected at Area 5, AOC 49-008(a)

SWMU or AOC	Location ID	Depth (ft)	Sample ID	Alpha (dpm)	Beta/Gamma (dpm)
49-008(a)	49-609417	0.0–0.5	RE49-10-3520	52	2040
49-008(a)	49-609417	0.5–1.5	RE49-10-3521	59	2100
49-008(a)	49-609418	0.0–0.5	RE49-10-3522	46	2080
49-008(a)	49-609418	0.5–1.5	RE49-10-3523	39	1959
49-008(a)	49-609419	0.0–0.5	RE49-10-3524	59	2100
49-008(a)	49-609419	0.5–1.5	RE49-10-3525	72	2080
49-008(a)	49-609420	0.0–0.5	RE49-10-3526	52	2180
49-008(a)	49-609420	0.5–1.5	RE49-10-3527	39	1982
49-008(a)	49-609421	0.0–0.5	RE49-10-3528	26	2170
49-008(a)	49-609421	0.5–1.5	RE49-10-3529	39	2250
49-008(a)	49-609422	0.0–0.5	RE49-10-3530	66	2150
49-008(a)	49-609422	0.5–1.5	RE49-10-3531	66	2430

Table 6.4-4
Summary of Organic Chemicals Detected
around Former Transformer Pads at Area 5, AOC 49-008(a)

Sample ID	Location ID	Depth (ft)	Media	Aroclor-1260
Residential SSL*				**2.22E+00**
Industrial SSL*				**8.26E+00**
Construction Worker SSL*				**7.58E+01**
RE49-10-3520	49-609417	0.0–0.5	Soil	0.0135
RE49-10-3522	49-609418	0.0–0.5	Soil	0.0059
RE49-10-3526	49-609420	0.0–0.5	Soil	0.0681
RE49-10-3527	49-609420	0.5–1.5	Soil	0.0567

Note: All concentrations are in mg/kg.
*SSLs from NMED (2009, 108070).

Table 7.2-1
Surveyed Coordinates for
2009 Locations at Area 6 West, SWMU 49-004

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
Area 6 West Drilling			
49-004	49-609882	1622287.472	1756661.486
49-004	49-609883	1622354.581	1756813.742
49-004	49-609884	1622318.736	1756732.418
49-004	49-609885	1622386.778	1756886.791
Area 6 West Surface and Shallow Subsurface			
49-004	49-608961	1622273.551	1756607.425
49-004	49-608962	1622283.93	1756630.129
49-004	49-608963	1622294.633	1756652.735
49-004	49-608964	1622305.66	1756675.114
49-004	49-608965	1622316.104	1756697.656
49-004	49-608966	1622337.51	1756743.063
49-004	49-608967	1622358.592	1756788.794
49-004	49-608968	1622390.701	1756856.191
49-004	49-608969	1622401.015	1756879.121
49-004	49-608970	1622411.718	1756901.5
49-004	49-608971	1622410.421	1756956.897
49-004	49-608972	1622388.041	1756967.924
49-004	49-608973	1622365.338	1756977.979
49-004	49-608974	1622398.615	1756990.239
49-004	49-608975	1622375.911	1757000.942
49-004	49-608976	1622353.208	1757011.645
49-004	49-608977	1622389.014	1756912.204

Table 7.2-1 (continued)

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
Area 6 West Surface and Shallow Subsurface (continued)			
49-004	49-608978	1622378.636	1756889.5
49-004	49-608979	1622357.294	1756844.19
49-004	49-608980	1622346.591	1756821.552
49-004	49-608981	1622336.213	1756799.173
49-004	49-608982	1622314.806	1756754.09
49-004	49-608983	1622304.103	1756731.386
49-004	49-608984	1622282.632	1756685.817
49-004	49-608985	1622271.929	1756663.114
49-004	49-608986	1622297.552	1756540.612
49-004	49-608987	1622318.634	1756586.019
49-004	49-608988	1622350.743	1756654.032
49-004	49-608989	1622393.296	1756744.36
49-004	49-608990	1622436.108	1756835.109
49-004	49-608991	1622478.207	1756925.761
49-004	49-608992	1622349.186	1756709.656
49-004	49-608993	1622391.998	1756800.47
49-004	49-608994	1622252.145	1756562.018
49-004	49-608995	1622348.213	1756765.766
49-004	49-608996	1622465.104	1757014.24
49-004	49-608997	1622261.551	1756640.41
49-004	49-608998	1622367.997	1756866.894
49-004	49-608999	1622420.021	1757035.321
49-004	49-609000	1622206.738	1756583.425
49-004	49-609001	1622205.44	1756639.437
49-004	49-609002	1622248.318	1756729.765
49-004	49-609003	1622290.806	1756820.579
49-004	49-609004	1622308.904	1756976.746
49-004	49-609005	1622351.91	1757067.106
49-004	49-609006	1622307.801	1757032.727
49-004	49-609007	1622377.014	1756945.286
49-004	49-609008	1622333.229	1756911.231
49-004	49-609009	1622353.337	1756541.91
49-004	49-609010	1622396.15	1756632.724
49-004	49-609011	1622438.703	1756723.278
49-004	49-609012	1622480.542	1756813.703
49-004	49-609013	1622545.539	1756948.724
49-004	49-609014	1622253.766	1756505.908
49-004	49-609015	1622150.952	1756582.03

Table 7.2-1 (continued)

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
Area 6 West Surface and Shallow Subsurface (continued)			
49-004	49-609016	1622266.48	1756887.003
49-004	49-609017	1622223.668	1756796.254
49-004	49-609018	1622181.44	1756705.926
49-004	49-609019	1622294.179	1757121.854
49-004	49-609020	1622230.739	1756986.152
49-004	49-609021	1622418.399	1757091.367
49-004	49-609022	1622521.214	1757015.472
49-004	49-609023	1622308.255	1756563.316
49-004	49-609024	1622329.661	1756608.398
49-004	49-609025	1622340.04	1756631.426
49-004	49-609026	1622361.186	1756676.574
49-004	49-609027	1622372.214	1756699.277
49-004	49-609028	1622382.593	1756721.656
49-004	49-609029	1622403.999	1756767.388
49-004	49-609030	1622414.377	1756789.443
49-004	49-609031	1622425.405	1756812.406
49-004	49-609032	1622446.422	1756857.391
49-004	49-609033	1622457.125	1756880.094
49-004	49-609034	1622467.828	1756902.798
49-004	49-609035	1622274.848	1756551.64
49-004	49-609036	1622285.551	1756574.019
49-004	49-609037	1622296.254	1756596.722
49-004	49-609038	1622306.957	1756619.426
49-004	49-609039	1622317.661	1756641.708
49-004	49-609040	1622328.039	1756664.411
49-004	49-609041	1622338.807	1756687.277
49-004	49-609042	1622359.889	1756732.359
49-004	49-609043	1622370.592	1756755.063
49-004	49-609044	1622381.295	1756777.766
49-004	49-609045	1622402.701	1756822.784
49-004	49-609046	1622413.404	1756845.488
49-004	49-609047	1622423.718	1756868.094
49-004	49-609048	1622434.421	1756891.122
49-004	49-609049	1622445.449	1756913.501
49-004	49-609050	1622455.828	1756936.14
49-004	49-609051	1622466.401	1756958.129
49-004	49-609052	1622477.104	1756980.833
49-004	49-609053	1622263.172	1756584.722

Table 7.2-1 (continued)

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
Area 6 West Surface and Shallow Subsurface (continued)			
49-004	49-609054	1622326.807	1756720.359
49-004	49-609055	1622369.295	1756811.173
49-004	49-609056	1622379.998	1756833.812
49-004	49-609057	1622422.421	1756924.528
49-004	49-609058	1622433.124	1756946.518
49-004	49-609059	1622443.697	1756968.508
49-004	49-609060	1622454.4	1756991.212
49-004	49-609061	1622229.441	1756572.722
49-004	49-609062	1622240.144	1756595.425
49-004	49-609063	1622250.847	1756618.129
49-004	49-609064	1622293.4	1756708.683
49-004	49-609065	1622325.185	1756776.469
49-004	49-609066	1622399.717	1756934.583
49-004	49-609067	1622420.994	1756979.536
49-004	49-609068	1622431.697	1757001.915
49-004	49-609069	1622442.4	1757024.618
49-004	49-609070	1622217.765	1756606.128
49-004	49-609071	1622228.144	1756628.507
49-004	49-609072	1622238.847	1756651.113
49-004	49-609073	1622249.55	1756673.817
49-004	49-609074	1622260.253	1756696.52
49-004	49-609075	1622271.021	1756719.062
49-004	49-609076	1622281.4	1756741.765
49-004	49-609077	1622292.103	1756764.144
49-004	49-609078	1622302.806	1756786.848
49-004	49-609079	1622313.509	1756809.876
49-004	49-609080	1622323.888	1756832.255
49-004	49-609081	1622334.915	1756854.893
49-004	49-609082	1622345.294	1756877.597
49-004	49-609083	1622355.932	1756900.203
49-004	49-609084	1622366.635	1756922.907
49-004	49-609085	1622408.993	1757012.618
49-004	49-609086	1622216.468	1756661.817
49-004	49-609087	1622226.847	1756684.52
49-004	49-609088	1622237.55	1756706.899
49-004	49-609089	1622258.696	1756752.144
49-004	49-609090	1622269.399	1756775.172
49-004	49-609091	1622280.103	1756797.875

Table 7.2-1 (continued)

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
Area 6 West Surface and Shallow Subsurface (continued)			
49-004	49-609092	1622301.184	1756842.958
49-004	49-609093	1622311.887	1756865.597
49-004	49-609094	1622322.59	1756888.3
49-004	49-609095	1622343.932	1756933.61
49-004	49-609096	1622354.635	1756955.34
49-004	49-609097	1622386.29	1757023.321
49-004	49-609098	1622396.993	1757046.024
49-004	49-609099	1622321.228	1756944.637
49-004	49-609100	1622331.931	1756966.043
49-004	49-609101	1622342.31	1756988.682
49-004	49-609102	1622363.586	1757034.024
49-004	49-609103	1622373.965	1757056.727
49-004	49-609104	1622298.525	1756954.043
49-004	49-609105	1622330.504	1757022.024
49-004	49-609106	1622319.607	1756999.385
49-004	49-609107	1622341.207	1757044.403
49-004	49-609108	1622286.524	1756987.385
49-004	49-609109	1622297.227	1757010.088
49-004	49-609110	1622318.504	1757055.43
49-004	49-609111	1622329.207	1757078.134
49-004	49-609112	1622332.256	1756496.827
49-004	49-609113	1622374.744	1756587.641
49-004	49-609114	1622417.296	1756677.871
49-004	49-609115	1622459.784	1756768.685
49-004	49-609116	1622502.207	1756859.013
49-004	49-609117	1622523.614	1756904.679
49-004	49-609118	1622298.849	1756484.827
49-004	49-609119	1622320.58	1756530.234
49-004	49-609120	1622341.337	1756575.641
49-004	49-609121	1622362.743	1756621.048
49-004	49-609122	1622383.89	1756665.871
49-004	49-609123	1622405.296	1756711.278
49-004	49-609124	1622426.378	1756756.685
49-004	49-609125	1622447.784	1756801.702
49-004	49-609126	1622468.801	1756847.336
49-004	49-609127	1622490.207	1756892.095
49-004	49-609128	1622511.483	1756937.696
49-004	49-609129	1622532.89	1756982.455

Table 7.2-1 (continued)

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
Area 6 West Surface and Shallow Subsurface (continued)			
49-004	49-609130	1622286.849	1756518.233
49-004	49-609131	1622241.766	1756539.639
49-004	49-609132	1622463.482	1757069.96
49-004	49-609133	1622508.889	1757048.879
49-004	49-609134	1622499.807	1756970.454
49-004	49-609135	1622487.807	1757002.888
49-004	49-609136	1622475.482	1757036.554
49-004	49-609137	1622208.359	1756527.315
49-004	49-609138	1622196.359	1756560.721
49-004	49-609139	1622430.4	1757057.96
49-004	49-609140	1622184.359	1756594.128
49-004	49-609141	1622162.953	1756548.721
49-004	49-609142	1622172.358	1756627.21
49-004	49-609143	1622193.764	1756672.52
49-004	49-609144	1622214.587	1756717.764
49-004	49-609145	1622236.317	1756762.847
49-004	49-609146	1622257.399	1756808.254
49-004	49-609147	1622278.481	1756853.596
49-004	49-609148	1622299.887	1756899.003
49-004	49-609149	1622385.317	1757079.042
49-004	49-609150	1622138.952	1756615.534
49-004	49-609151	1622160.033	1756660.519
49-004	49-609152	1622202.586	1756751.171
49-004	49-609153	1622245.399	1756841.661
49-004	49-609154	1622287.497	1756932.312
49-004	49-609155	1622372.992	1757112.773
49-004	49-609156	1622254.415	1756920.312
49-004	49-609157	1622276.146	1756964.746
49-004	49-609158	1622339.586	1757100.772
49-004	49-609159	1622242.739	1756952.421
49-004	49-609160	1622263.821	1756998.088
49-004	49-609161	1622285.097	1757043.105
49-004	49-609162	1622306.503	1757088.512
49-004	49-609163	1622327.585	1757134.179
49-004	49-609164	1622252.145	1757031.494
49-004	49-609165	1622273.097	1757076.836

Table 7.2-2
Samples Collected and Analyses Requested at Area 6 West, SWMU 49-004

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Gamma Spectroscopy	Tritium	High Explosives	Isotopic Plutonium	Isotopic Uranium	TAL Metals	Perchlorate	Strontium-90	SVOCs	Technetium-99	Uranium	VOCs	Wet Chemistry
0549-95-0315	49-06106	0.0–0.5	Soil	—*	786	—	—	786	—	783	—	—	—	—	786	—	—
0549-95-0316	49-06107	0.0–0.5	Soil	—	786	—	—	786	—	783	—	—	—	—	786	—	—
0549-95-0317	49-06108	0.0–0.5	Soil	—	786	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0318	49-06109	0.0–0.5	Soil	—	786	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0319	49-06110	0.0–0.5	Soil	—	786	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0321	49-06111	0.0–0.5	Soil	—	786	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0322	49-06112	0.0–0.5	Soil	—	786	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0323	49-06113	0.0–0.5	Soil	—	786	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0324	49-06114	0.0–0.5	Soil	—	786	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0325	49-06115	0.0–0.5	Soil	—	786	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0326	49-06116	0.0–0.5	Soil	—	786	—	—	786	—	783	—	—	—	—	786	—	—
0549-95-0327	49-06117	0.0–0.5	Soil	—	786	—	—	786	—	783	—	—	—	—	786	—	—
0549-95-0328	49-06118	0.0–0.5	Soil	—	786	—	—	786	—	783	—	—	—	—	786	—	—
0549-95-0329	49-06137	0.0–0.5	Soil	—	786	—	—	786	—	783	—	—	—	—	786	—	—
0549-95-0330	49-06138	0.0–0.5	Soil	—	786	—	—	786	—	783	—	—	—	—	786	—	—
0549-95-0331	49-06139	0.0–0.5	Soil	—	786	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0332	49-06140	0.0–0.5	Soil	—	786	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0333	49-06141	0.0–0.5	Soil	—	786	—	—	786	—	783	—	—	—	—	786	—	—
0549-95-0334	49-06142	0.0–0.5	Soil	—	786	—	—	786	—	783	—	—	—	—	786	—	—
0549-95-0335	49-06143	0.0–0.5	Soil	—	786	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0336	49-06144	0.0–0.5	Soil	—	786	—	—	786	—	783	—	—	—	—	786	—	—
0549-95-0337	49-06145	0.0–0.5	Soil	—	786	—	—	786	—	783	—	—	—	—	786	—	—
0549-95-0338	49-06146	0.0–0.5	Soil	—	786	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0339	49-06147	0.0–0.5	Soil	—	786	—	—	786	—	783	—	—	—	—	786	—	—
0549-95-0340	49-06148	0.0–0.5	Soil	—	786	—	—	786	—	783	—	—	—	—	786	—	—
0549-95-0341	49-06149	0.0–0.5	Soil	—	786	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0101	49-06213	2.0–5.0	Soil	—	687	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0102	49-06213	5.0–10.0	Soil	—	687	—	—	687	—	683, 687	—	—	682	—	—	—	—
0549-95-0103	49-06213	10.0–12.0	Qbt4	—	687	—	—	687	—	683, 687	—	—	682	—	—	—	—
0549-95-0104	49-06214	2.0–5.0	Fill	—	687	—	—	687	—	683, 687	—	—	682	—	—	—	—
0549-95-0105	49-06214	5.0–9.5	Fill	—	687	—	—	687	—	683, 687	—	—	682	—	—	—	—
0549-95-0106	49-06214	10.0–12.5	Qbt4	—	687	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0107	49-06215	0.0–5.0	Fill	—	687	—	—	687	—	683, 687	—	—	682	—	—	—	—
0549-95-0108	49-06215	6.0–9.5	Fill	—	687	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0110	49-06216	1.5–4.0	Fill	—	687	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0111	49-06216	18.1–20.0	Fill	—	728	—	—	728	—	727, 728	—	—	726	—	—	—	—
0549-95-0112	49-06216	20.0–22.0	Fill	—	728	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0113	49-06217	3.0–5.0	Soil	—	687	—	—	687	—	683, 687	—	—	682	—	—	—	—

Table 7.2-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Gamma Spectroscopy	Tritium	High Explosives	Isotopic Plutonium	Isotopic Uranium	TAL Metals	Perchlorate	Strontium-90	SVOCs	Technetium-99	Uranium	VOCs	Wet Chemistry
0549-95-0114	49-06217	8.0–10.0	Soil	—	687	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0117	49-06218	3.0–5.0	Soil	—	687	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0118	49-06218	8.0–10.0	Qbt4	—	687	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0119	49-06218	12.5–15.0	Qbt4	—	687	—	—	687	—	683, 687	—	—	682	—	—	—	—
0549-95-0120	49-06219	3.0–5.0	Soil	—	687	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0121	49-06219	7.5–10.0	Qbt4	—	687	—	—	687	—	683, 687	—	—	682	—	—	—	—
0549-95-0342	49-06220	0.0–0.5	Soil	—	786	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0343	49-06221	0.0–0.5	Soil	—	786	—	—	786	—	783	—	—	—	—	786	—	—
0549-95-0344	49-06222	0.0–0.5	Soil	—	786	—	—	786	—	783	—	—	—	—	786	—	—
0549-95-0346	49-06223	0.0–0.5	Soil	—	786	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0347	49-06224	0.0–0.5	Soil	—	786	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0348	49-06225	0.0–0.5	Soil	—	786	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0349	49-06226	0.0–0.5	Soil	—	786	—	—	786	—	783	—	—	—	—	786	—	—
0549-95-0350	49-06227	0.0–0.5	Soil	—	786	—	—	786	—	783	—	—	—	—	786	—	—
RE49-10-2203	49-608961	0.0–0.5	Soil	10-258	10-258	—	—	10-258	10-258	10-258	—	—	—	—	—	—	—
RE49-10-2204	49-608961	0.5–1.5	Soil	10-258	10-258	—	—	10-258	10-258	10-258	—	—	—	—	—	—	—
RE49-10-2205	49-608962	0.0–0.5	Soil	10-258	10-258	—	—	10-258	10-258	10-258	—	—	—	—	—	—	—
RE49-10-2206	49-608962	0.5–1.5	Soil	10-258	10-258	—	—	10-258	10-258	10-258	—	—	—	—	—	—	—
RE49-10-2207	49-608963	0.0–0.5	Soil	10-258	10-258	—	—	10-258	10-258	10-258	—	—	—	—	—	—	—
RE49-10-2208	49-608963	0.5–1.5	Soil	10-258	10-258	—	—	10-258	10-258	10-258	—	—	—	—	—	—	—
RE49-10-2209	49-608964	0.0–0.5	Soil	10-258	10-258	—	—	10-258	10-258	10-258	—	—	—	—	—	—	—
RE49-10-2210	49-608964	0.5–1.5	Soil	10-258	10-258	—	—	10-258	10-258	10-258	—	—	—	—	—	—	—
RE49-10-2211	49-608965	0.0–0.5	Soil	10-258	10-258	—	—	10-258	10-258	10-258	—	—	—	—	—	—	—
RE49-10-2212	49-608965	0.5–1.5	Soil	10-258	10-258	—	—	10-258	10-258	10-258	—	—	—	—	—	—	—
RE49-10-2213	49-608966	0.0–0.5	Soil	10-258	10-258	—	—	10-258	10-258	10-258	—	—	—	—	—	—	—
RE49-10-2214	49-608966	0.5–1.5	Soil	10-258	10-258	—	—	10-258	10-258	10-258	—	—	—	—	—	—	—
RE49-10-2215	49-608967	0.0–0.5	Soil	10-258	10-258	—	—	10-258	10-258	10-258	—	—	—	—	—	—	—
RE49-10-2216	49-608967	0.5–1.5	Soil	10-258	10-258	—	—	10-258	10-258	10-258	—	—	—	—	—	—	—
RE49-10-2217	49-608968	0.0–0.5	Soil	10-258	10-258	—	—	10-258	10-258	10-258	—	—	—	—	—	—	—
RE49-10-2218	49-608968	0.5–1.5	Soil	10-258	10-258	—	—	10-258	10-258	10-258	—	—	—	—	—	—	—
RE49-10-2219	49-608969	0.0–0.5	Soil	10-258	10-258	—	—	10-258	10-258	10-258	—	—	—	—	—	—	—
RE49-10-2220	49-608969	0.5–1.5	Soil	10-258	10-258	—	—	10-258	10-258	10-258	—	—	—	—	—	—	—
RE49-10-2221	49-608970	0.0–0.5	Soil	10-258	10-258	—	—	10-258	10-258	10-258	—	—	—	—	—	—	—
RE49-10-2222	49-608970	0.5–1.5	Soil	10-258	10-258	—	—	10-258	10-258	10-258	—	—	—	—	—	—	—
RE49-10-2223	49-608971	0.0–0.5	Soil	10-260	10-259, 10-260	—	—	10-260	10-260	10-260	—	10-259	—	10-259	—	—	—
RE49-10-2224	49-608971	0.5–1.5	Soil	10-260	10-260	—	—	10-260	10-260	10-260	—	—	—	—	—	—	—
RE49-10-2225	49-608972	0.0–0.5	Soil	10-260	10-260	—	—	10-260	10-260	10-260	—	—	—	—	—	—	—
RE49-10-2226	49-608972	0.5–1.5	Soil	10-260	10-259, 10-260	—	—	10-260	10-260	10-260	—	10-259	—	10-259	—	—	—
RE49-10-2227	49-608973	0.0–0.5	Soil	10-260	10-260	—	—	10-260	10-260	10-260	—	—	—	—	—	—	—

Table 7.2-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Gamma Spectroscopy	Tritium	High Explosives	Isotopic Plutonium	Isotopic Uranium	TAL Metals	Perchlorate	Strontium-90	SVOCs	Technetium-99	Uranium	VOCs	Wet Chemistry
RE49-10-2228	49-608973	0.5–1.5	Soil	10-260	10-260	—	—	10-260	10-260	10-260	—	—	—	—	—	—	—
RE49-10-2229	49-608974	0.0–0.5	Soil	10-260	10-260	—	—	10-260	10-260	10-260	—	—	—	—	—	—	—
RE49-10-2230	49-608974	0.5–1.5	Soil	10-260	10-259, 10-260	—	—	10-260	10-260	10-260	—	10-259	—	10-259	—	—	—
RE49-10-2231	49-608975	0.0–0.5	Soil	10-260	10-259, 10-260	—	—	10-260	10-260	10-260	—	10-259	—	10-259	—	—	—
RE49-10-2232	49-608975	0.5–1.5	Soil	10-260	10-260	—	—	10-260	10-260	10-260	—	—	—	—	—	—	—
RE49-10-2233	49-608976	0.0–0.5	Soil	10-260	10-260	—	—	10-260	10-260	10-260	—	—	—	—	—	—	—
RE49-10-2234	49-608976	0.5–1.5	Soil	10-260	10-260	—	—	10-260	10-260	10-260	—	—	—	—	—	—	—
RE49-10-2235	49-608977	0.0–0.5	Soil	10-260	10-260	—	—	10-260	10-260	10-260	—	—	—	—	—	—	—
RE49-10-2236	49-608977	0.5–1.5	Soil	10-260	10-260	—	—	10-260	10-260	10-260	—	—	—	—	—	—	—
RE49-10-2237	49-608978	0.0–0.5	Soil	10-260	10-260	—	—	10-260	10-260	10-260	—	—	—	—	—	—	—
RE49-10-2238	49-608978	0.5–1.5	Soil	10-260	10-260	—	—	10-260	10-260	10-260	—	—	—	—	—	—	—
RE49-10-2239	49-608979	0.0–0.5	Soil	10-260	10-260	—	—	10-260	10-260	10-260	—	—	—	—	—	—	—
RE49-10-2240	49-608979	0.5–1.5	Soil	10-260	10-260	—	—	10-260	10-260	10-260	—	—	—	—	—	—	—
RE49-10-2241	49-608980	0.0–0.5	Soil	10-260	10-260	—	—	10-260	10-260	10-260	—	—	—	—	—	—	—
RE49-10-2242	49-608980	0.5–1.5	Soil	10-260	10-260	—	—	10-260	10-260	10-260	—	—	—	—	—	—	—
RE49-10-2243	49-608981	0.0–0.5	Soil	10-261	10-261	—	—	10-261	10-261	10-261	—	—	—	—	—	—	—
RE49-10-2244	49-608981	0.5–1.5	Soil	10-261	10-259, 10-261	—	—	10-261	10-261	10-261	—	10-259	—	10-259	—	—	—
RE49-10-2245	49-608982	0.0–0.5	Soil	10-261	10-261	—	—	10-261	10-261	10-261	—	—	—	—	—	—	—
RE49-10-2246	49-608982	0.5–1.5	Soil	10-261	10-261	—	—	10-261	10-261	10-261	—	—	—	—	—	—	—
RE49-10-2247	49-608983	0.0–0.5	Soil	10-261	10-261	—	—	10-261	10-261	10-261	—	—	—	—	—	—	—
RE49-10-2248	49-608983	0.5–1.5	Soil	10-261	10-261	—	—	10-261	10-261	10-261	—	—	—	—	—	—	—
RE49-10-2249	49-608984	0.0–0.5	Soil	10-261	10-261	—	—	10-261	10-261	10-261	—	—	—	—	—	—	—
RE49-10-2250	49-608984	0.5–1.5	Soil	10-261	10-261	—	—	10-261	10-261	10-261	—	—	—	—	—	—	—
RE49-10-2251	49-608985	0.0–0.5	Soil	10-261	10-261	—	—	10-261	10-261	10-261	—	—	—	—	—	—	—
RE49-10-2252	49-608985	0.5–1.5	Soil	10-261	10-261	—	—	10-261	10-261	10-261	—	—	—	—	—	—	—
RE49-10-2275	49-608986	0.0–0.5	Soil	10-293	10-293	—	—	10-293	10-293	10-293	—	—	—	—	—	—	—
RE49-10-2276	49-608986	0.5–1.5	Soil	10-293	10-293	—	—	10-293	10-293	10-293	—	—	—	—	—	—	—
RE49-10-2277	49-608987	0.0–0.5	Soil	10-293	10-293	—	—	10-293	10-293	10-293	—	—	—	—	—	—	—
RE49-10-2278	49-608987	0.5–1.5	Soil	10-293	10-293	—	—	10-293	10-293	10-293	—	—	—	—	—	—	—
RE49-10-2279	49-608988	0.0–0.5	Soil	10-293	10-293	—	—	10-293	10-293	10-293	—	—	—	—	—	—	—
RE49-10-2280	49-608988	0.5–1.5	Soil	10-293	10-293	—	—	10-293	10-293	10-293	—	—	—	—	—	—	—
RE49-10-2281	49-608989	0.0–0.5	Soil	10-293	10-293	—	—	10-293	10-293	10-293	—	—	—	—	—	—	—
RE49-10-2282	49-608989	0.5–1.5	Soil	10-293	10-293	—	—	10-293	10-293	10-293	—	—	—	—	—	—	—
RE49-10-2283	49-608990	0.0–0.5	Soil	10-293	10-293	—	—	10-293	10-293	10-293	—	—	—	—	—	—	—
RE49-10-2284	49-608990	0.5–1.5	Soil	10-293	10-293	—	—	10-293	10-293	10-293	—	—	—	—	—	—	—
RE49-10-2285	49-608991	0.0–0.5	Soil	10-293	10-293	—	—	10-293	10-293	10-293	—	—	—	—	—	—	—
RE49-10-2286	49-608991	0.5–1.5	Soil	10-293	10-293	—	—	10-293	10-293	10-293	—	—	—	—	—	—	—
RE49-10-2287	49-608992	0.0–0.5	Soil	10-293	10-293	—	—	10-293	10-293	10-293	—	—	—	—	—	—	—
RE49-10-2288	49-608992	0.5–1.5	Soil	10-293	10-293	—	—	10-293	10-293	10-293	—	—	—	—	—	—	—

Table 7.2-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Gamma Spectroscopy	Tritium	High Explosives	Isotopic Plutonium	Isotopic Uranium	TAL Metals	Perchlorate	Strontium-90	SVOCs	Technetium-99	Uranium	VOCs	Wet Chemistry
RE49-10-2289	49-608993	0.0–0.5	Soil	10-293	10-293	—	—	10-293	10-293	10-293	—	—	—	—	—	—	—
RE49-10-2290	49-608993	0.5–1.5	Soil	10-293	10-293	—	—	10-293	10-293	10-293	—	—	—	—	—	—	—
RE49-10-2291	49-608994	0.0–0.5	Soil	10-293	10-293	—	—	10-293	10-293	10-293	—	—	—	—	—	—	—
RE49-10-2292	49-608994	0.5–1.5	Soil	10-293	10-293	—	—	10-293	10-293	10-293	—	—	—	—	—	—	—
RE49-10-2293	49-608995	0.0–0.5	Soil	10-293	10-293	—	—	10-293	10-293	10-293	—	—	—	—	—	—	—
RE49-10-2294	49-608995	0.5–1.5	Soil	10-293	10-293	—	—	10-293	10-293	10-293	—	—	—	—	—	—	—
RE49-10-2295	49-608996	0.0–0.5	Soil	10-294	10-294	—	—	10-294	10-294	10-294	—	—	—	—	—	—	—
RE49-10-2296	49-608996	0.5–1.5	Soil	10-294	10-294	—	—	10-294	10-294	10-294	—	—	—	—	—	—	—
RE49-10-2297	49-608997	0.0–0.5	Soil	10-402	10-402	—	—	10-402	10-402	10-402	—	—	—	—	—	—	—
RE49-10-2298	49-608997	0.5–1.5	Soil	10-402	10-402	—	—	10-402	10-402	10-402	—	—	—	—	—	—	—
RE49-10-2299	49-608998	0.0–0.5	Soil	10-402	10-402	—	—	10-402	10-402	10-402	—	—	—	—	—	—	—
RE49-10-2300	49-608998	0.5–1.5	Soil	10-402	10-402	—	—	10-402	10-402	10-402	—	—	—	—	—	—	—
RE49-10-2301	49-608999	0.0–0.5	Soil	10-402	10-402	—	—	10-402	10-402	10-402	—	—	—	—	—	—	—
RE49-10-2302	49-608999	0.5–1.5	Soil	10-402	10-402	—	—	10-402	10-402	10-402	—	—	—	—	—	—	—
RE49-10-2303	49-609000	0.0–0.5	Soil	10-402	10-402	—	—	10-402	10-402	10-402	—	—	—	—	—	—	—
RE49-10-2304	49-609000	0.5–1.5	Soil	10-402	10-402	—	—	10-402	10-402	10-402	—	—	—	—	—	—	—
RE49-10-2305	49-609001	0.0–0.5	Soil	10-402	10-402	—	—	10-402	10-402	10-402	—	—	—	—	—	—	—
RE49-10-2306	49-609001	0.5–1.5	Soil	10-402	10-402	—	—	10-402	10-402	10-402	—	—	—	—	—	—	—
RE49-10-2307	49-609002	0.0–0.5	Soil	10-402	10-402	—	—	10-402	10-402	10-402	—	—	—	—	—	—	—
RE49-10-2308	49-609002	0.5–1.5	Soil	10-402	10-402	—	—	10-402	10-402	10-402	—	—	—	—	—	—	—
RE49-10-2309	49-609003	0.0–0.5	Soil	10-401	10-401	—	—	10-401	10-401	10-401	—	—	—	—	—	—	—
RE49-10-2310	49-609003	0.5–1.5	Soil	10-401	10-401	—	—	10-401	10-401	10-401	—	—	—	—	—	—	—
RE49-10-2311	49-609004	0.0–0.5	Soil	10-401	10-401	—	—	10-401	10-401	10-401	—	—	—	—	—	—	—
RE49-10-2312	49-609004	0.5–1.5	Soil	10-401	10-401	—	—	10-401	10-401	10-401	—	—	—	—	—	—	—
RE49-10-2313	49-609005	0.0–0.5	Soil	10-401	10-401	—	—	10-401	10-401	10-401	—	—	—	—	—	—	—
RE49-10-2314	49-609005	0.5–1.5	Soil	10-401	10-401	—	—	10-401	10-401	10-401	—	—	—	—	—	—	—
RE49-10-2315	49-609006	0.0–0.5	Soil	10-401	10-401	—	—	10-401	10-401	10-401	—	—	—	—	—	—	—
RE49-10-2316	49-609006	0.5–1.5	Soil	10-401	10-401	—	—	10-401	10-401	10-401	—	—	—	—	—	—	—
RE49-10-2317	49-609007	0.0–0.5	Soil	10-401	10-401	—	—	10-401	10-401	10-401	—	—	—	—	—	—	—
RE49-10-2318	49-609007	0.5–1.5	Soil	10-401	10-401	—	—	10-401	10-401	10-401	—	—	—	—	—	—	—
RE49-10-2319	49-609008	0.0–0.5	Soil	10-401	10-401	—	—	10-401	10-401	10-401	—	—	—	—	—	—	—
RE49-10-2320	49-609008	0.5–1.5	Soil	10-401	10-401	—	—	10-401	10-401	10-401	—	—	—	—	—	—	—
RE49-10-2329	49-609009	0.0–0.5	Soil	10-400	10-400	—	—	10-400	10-400	10-400	—	—	—	—	—	—	—
RE49-10-2330	49-609009	0.5–1.5	Soil	10-400	10-400	—	—	10-400	10-400	10-400	—	—	—	—	—	—	—
RE49-10-2331	49-609010	0.0–0.5	Soil	10-400	10-400	—	—	10-400	10-400	10-400	—	—	—	—	—	—	—
RE49-10-2332	49-609010	0.5–1.5	Soil	10-400	10-400	—	—	10-400	10-400	10-400	—	—	—	—	—	—	—
RE49-10-2333	49-609011	0.0–0.5	Soil	10-400	10-400	—	—	10-400	10-400	10-400	—	—	—	—	—	—	—
RE49-10-2334	49-609011	0.5–1.5	Soil	10-400	10-400	—	—	10-400	10-400	10-400	—	—	—	—	—	—	—
RE49-10-2335	49-609012	0.0–0.5	Soil	10-400	10-400	—	—	10-400	10-400	10-400	—	—	—	—	—	—	—

Table 7.2-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Gamma Spectroscopy	Tritium	High Explosives	Isotopic Plutonium	Isotopic Uranium	TAL Metals	Perchlorate	Strontium-90	SVOCs	Technetium-99	Uranium	VOCs	Wet Chemistry
RE49-10-2336	49-609012	0.5–1.5	Soil	10-400	10-400	—	—	10-400	10-400	10-400	—	—	—	—	—	—	—
RE49-10-2337	49-609013	0.0–0.5	Soil	10-400	10-400	—	—	10-400	10-400	10-400	—	—	—	—	—	—	—
RE49-10-2338	49-609013	0.5–1.5	Soil	10-400	10-400	—	—	10-400	10-400	10-400	—	—	—	—	—	—	—
RE49-10-2339	49-609014	0.0–0.5	Soil	10-400	10-400	—	—	10-400	10-400	10-400	—	—	—	—	—	—	—
RE49-10-2340	49-609014	0.5–1.5	Soil	10-400	10-400	—	—	10-400	10-400	10-400	—	—	—	—	—	—	—
RE49-10-2341	49-609015	0.0–0.5	Soil	10-400	10-400	—	—	10-400	10-400	10-400	—	—	—	—	—	—	—
RE49-10-2342	49-609015	0.5–1.5	Soil	10-400	10-400	—	—	10-400	10-400	10-400	—	—	—	—	—	—	—
RE49-10-2343	49-609016	0.0–0.5	Soil	10-400	10-400	—	—	10-400	10-400	10-400	—	—	—	—	—	—	—
RE49-10-2344	49-609016	0.5–1.5	Soil	10-400	10-400	—	—	10-400	10-400	10-400	—	—	—	—	—	—	—
RE49-10-2345	49-609017	0.0–0.5	Soil	10-399	10-399	—	—	10-399	10-399	10-399	—	—	—	—	—	—	—
RE49-10-2346	49-609017	0.5–1.5	Soil	10-399	10-399	—	—	10-399	10-399	10-399	—	—	—	—	—	—	—
RE49-10-2347	49-609018	0.0–0.5	Soil	10-399	10-399	—	—	10-399	10-399	10-399	—	—	—	—	—	—	—
RE49-10-2348	49-609018	0.5–1.5	Soil	10-399	10-399	—	—	10-399	10-399	10-399	—	—	—	—	—	—	—
RE49-10-2349	49-609019	0.0–0.5	Soil	10-399	10-399	—	—	10-399	10-399	10-399	—	—	—	—	—	—	—
RE49-10-2350	49-609019	0.5–1.5	Soil	10-399	10-399	—	—	10-399	10-399	10-399	—	—	—	—	—	—	—
RE49-10-2351	49-609020	0.0–0.5	Soil	10-399	10-399	—	—	10-399	10-399	10-399	—	—	—	—	—	—	—
RE49-10-2352	49-609020	0.5–1.5	Soil	10-399	10-399	—	—	10-399	10-399	10-399	—	—	—	—	—	—	—
RE49-10-2353	49-609021	0.0–0.5	Soil	10-399	10-399	—	—	10-399	10-399	10-399	—	—	—	—	—	—	—
RE49-10-2354	49-609021	0.5–1.5	Soil	10-399	10-399	—	—	10-399	10-399	10-399	—	—	—	—	—	—	—
RE49-10-2355	49-609022	0.0–0.5	Soil	10-399	10-399	—	—	10-399	10-399	10-399	—	—	—	—	—	—	—
RE49-10-2356	49-609022	0.5–1.5	Soil	10-399	10-399	—	—	10-399	10-399	10-399	—	—	—	—	—	—	—
RE49-10-2396	49-609039	0.5–1.5	Soil	10-404	10-404	—	—	10-404	10-404	10-404	—	—	—	—	—	—	—
RE49-10-2516	49-609090	0.5–1.5	Soil	10-403	10-403	—	—	10-403	10-403	10-403	—	—	—	—	—	—	—
RE49-10-4930	49-609882	0.0–0.5	Soil	10-438	—	10-438	10-437	10-438	10-438	10-438	10-438	—	10-437	—	—	10-437	10-438
RE49-10-4934	49-609882	9.0–19.0	Qbt4	10-438	—	10-438	10-437	10-438	10-438	10-438	10-438	—	10-437	—	—	10-437	10-438
RE49-10-4941	49-609882	63.0–65.0	Qbt4	10-438	—	10-438	10-437	10-438	10-438	10-438	10-438	—	10-437	—	—	10-437	10-438
RE49-10-4935	49-609883	0.0–0.5	Qbt4	10-438	—	10-438	10-437	10-438	10-438	10-438	10-438	—	10-437	—	—	10-437	10-438
RE49-10-4940	49-609883	9.0–14.0	Qbt4	10-438	—	10-438	10-437	10-438	10-438	10-438	10-438	—	10-437	—	—	10-437	10-438
RE49-10-4937	49-609883	62.0–64.0	Qbt4	10-438	—	10-438	10-437	10-438	10-438	10-438	10-438	—	10-437	—	—	10-437	10-438
RE49-10-4936	49-609884	0.0–1.0	Fill	10-438	—	10-438	10-437	10-438	10-438	10-438	10-438	—	10-437	—	—	10-437	10-438
RE49-10-4932	49-609884	7.5–10.0	Qbt4	10-438	—	10-438	10-437	10-438	10-438	10-438	10-438	—	10-437	—	—	10-437	10-438
RE49-10-4933	49-609884	63.0–65.0	Qbt4	10-438	—	10-438	10-437	10-438	10-438	10-438	10-438	—	10-437	—	—	10-437	10-438
RE49-10-4942	49-609885	0.0–0.5	Soil	10-438	—	10-438	10-437	10-438	10-438	10-438	10-438	—	10-437	—	—	10-437	10-438
RE49-10-4939	49-609885	9.0–14.0	Qbt4	10-438	—	10-438	10-437	10-438	10-438	10-438	10-438	—	10-437	—	—	10-437	10-438
RE49-10-4938	49-609885	63.0–65.0	Qbt4	10-438	—	10-438	10-437	10-438	10-438	10-438	10-438	—	10-437	—	—	10-437	10-438

Note: The numbers in the analytical request columns are analytical request numbers.
*— = Not requested.

Table 7.2-3
Field-Screening Results for Samples Collected at Area 6 West, SWMU 49-004

SWMU or AOC	Location ID	Depth (ft)	Sample ID	PID (ppm)	Alpha (dpm)	Beta/Gamma (dpm)
Area 6 West Drilling Samples						
49-004	49-609882	0.0–0.5	RE49-10-4930	0.0	91	2360
49-004	49-609882	9.0–14.0	RE49-10-4934	0.3	72	2320
49-004	49-609882	63.0–65.0	RE49-10-4941	0.0	59	2430
49-004	49-609883	0.0–6.0	RE49-10-4935	0.0	104	2290
49-004	49-609883	9.0–14.0	RE49-10-4940	1.4	104	2290
49-004	49-609883	62.0–64.0	RE49-10-4937	0.0	65	2340
49-004	49-609885	0.0–6.0	RE49-10-4942	0.0	78	2250
49-004	49-609885	9.0–14.0	RE49-10-4939	0.0	59	2970
49-004	49-609885	63.0–65.0	RE49-10-4938	0.0	59	2970
49-004	49-609884	0.0–1.0	RE49-10-4936	0.0	91	2200
49-004	49-609884	7.0–10.0	RE49-10-4932	0.0	52	1882
49-004	49-609884	63.0–65.0	RE49-10-4933	0.0	72	3030
Area 6 West Surface and Shallow-Subsurface Samples						
49-004	49-608961	0.0–0.5	RE49-10-2203	NA*	91	2950
49-004	49-609861	0.5–1.5	RE49-10-2204	NA	104	2650
49-004	49-608962	0.0–0.5	RE49-10-2205	NA	98	2490
49-004	49-608962	0.5–1.5	RE49-10-2206	NA	107	2760
49-004	49-608963	0.0–0.5	RE49-10-2207	NA	85	2700
49-004	49-608963	0.5–1.5	RE49-10-2208	NA	108	2460
49-004	49-608964	0.0–0.5	RE49-10-2209	NA	104	2500
49-004	49-608964	0.5–1.5	RE49-10-2210	NA	118	2680
49-004	49-608965	0.0–0.5	RE49-10-2211	NA	98	2640
49-004	49-608965	0.5–1.5	RE49-10-2212	NA	78	2850
49-004	49-608966	0.0–0.5	RE49-10-2213	NA	111	2750
49-004	49-608966	0.5–1.5	RE49-10-2214	NA	78	2710
49-004	49-608967	0.0–0.5	RE49-10-2215	NA	98	2660
49-004	49-608967	0.5–1.5	RE49-10-2216	NA	98	2420
49-004	49-608968	0.0–0.5	RE49-10-2217	NA	101	2910
49-004	49-608968	0.5–1.5	RE49-10-2218	NA	85	2480
49-004	49-608969	0.0–0.5	RE49-10-2219	NA	104	2710
49-004	49-608969	0.5–1.5	RE49-10-2220	NA	111	2600
49-004	49-608970	0.0–0.5	RE49-10-2221	NA	98	2890
49-004	49-608970	0.5–1.5	RE49-10-2222	NA	111	2750
49-004	49-608971	0.0–0.5	RE49-10-2223	NA	65	2740
49-004	49-608971	0.5–1.5	RE49-10-2224	NA	72	2860
49-004	49-608972	0.0–0.5	RE49-10-2225	NA	72	2390

Table 7.2-3 (continued)

SWMU or AOC	Location ID	Depth (ft)	Sample ID	PID (ppm)	Alpha (dpm)	Beta/ Gamma (dpm)
Area 6 West Surface and Shallow-Subsurface Samples (continued)						
49-004	49-608972	0.5–1.5	RE49-10-2226	NA	98	2780
49-004	49-608973	0.0–0.5	RE49-10-2227	NA	114	2017
49-004	49-608973	0.5–1.5	RE49-10-2228	NA	59	2800
49-004	49-608974	0.0–0.5	RE49-10-2229	NA	85	2530
49-004	49-608974	0.5–1.5	RE49-10-2230	NA	78	2510
49-004	49-608975	0.0–0.5	RE49-10-2231	NA	91	2630
49-004	49-608975	0.5–1.5	RE49-10-2232	NA	78	2850
49-004	49-608976	0.0–0.5	RE49-10-2233	NA	85	2770
49-004	49-608976	0.5–1.5	RE49-10-2234	NA	111	2610
49-004	49-608977	0.0–0.5	RE49-10-2235	NA	26	776
49-004	49-608977	0.5–1.5	RE49-10-2236	NA	49	937
49-004	49-608978	0.0–0.5	RE49-10-2237	NA	11	845
49-004	49-608978	0.5–1.5	RE49-10-2238	NA	0	1000
49-004	49-608979	0.0–0.5	RE49-10-2239	NA	34	1012
49-004	49-608979	0.5–1.5	RE49-10-2240	NA	18	1093
49-004	49-608980	0.0–0.5	RE49-10-2241	NA	34	954
49-004	49-608980	0.5–1.5	RE49-10-2242	NA	0	1144
49-004	49-608981	0.0–0.5	RE49-10-2243	NA	119	908
49-004	49-608981	0.5–1.5	RE49-10-2244	NA	26	1000
49-004	49-608982	0.0–0.5	RE49-10-2245	NA	49	1058
49-004	49-608982	0.5–1.5	RE49-10-2246	NA	57	925
49-004	49-608983	0.0–0.5	RE49-10-2247	NA	57	1093
49-004	49-608983	0.5–1.5	RE49-10-2248	NA	73	1156
49-004	49-608984	0.0–0.5	RE49-10-2249	NA	42	1121
49-004	49-608984	0.5–1.5	RE49-10-2250	NA	0	874
49-004	49-608985	0.0–0.5	RE49-10-2251	NA	34	966
49-004	49-608985	0.5–1.5	RE49-10-2252	NA	34	1139
49-004	49-608986	0.0–0.5	RE49-10-2275	NA	62	2430
49-004	49-608986	0.5–1.5	RE49-10-2276	NA	62	2500
49-004	49-608987	0.0–0.5	RE49-10-2277	NA	54	2530
49-004	49-608987	0.5–1.5	RE49-10-2278	NA	85	2390
49-004	49-608988	0.0–0.5	RE49-10-2279	NA	139	2730
49-004	49-608988	0.5–1.5	RE49-10-2280	NA	85	2490
49-004	49-608989	0.0–0.5	RE49-10-2281	NA	54	2440
49-004	49-608989	0.5–1.5	RE49-10-2282	NA	46	2580
49-004	49-608990	0.0–0.5	RE49-10-2283	NA	155	2500
49-004	49-608990	0.5–1.5	RE49-10-2284	NA	46	2850

Table 7.2-3 (continued)

SWMU or AOC	Location ID	Depth (ft)	Sample ID	PID (ppm)	Alpha (dpm)	Beta/ Gamma (dpm)
Area 6 West Surface and Shallow-Subsurface Samples (continued)						
49-004	49-608991	0.0–0.5	RE49-10-2285	NA	85	2250
49-004	49-608991	0.5–1.5	RE49-10-2286	NA	116	2730
49-004	49-608992	0.0–0.5	RE49-10-2287	NA	100	2500
49-004	49-608992	0.5–1.5	RE49-10-2288	NA	69	2360
49-004	49-608993	0.0–0.5	RE49-10-2289	NA	46	2290
49-004	49-608993	0.5–1.5	RE49-10-2290	NA	100	2500
49-004	49-608994	0.0–0.5	RE49-10-2291	NA	108	2620
49-004	49-608994	0.5–1.5	RE49-10-2292	NA	85	2540
49-004	49-608995	0.0–0.5	RE49-10-2293	NA	38	2590
49-004	49-608996	0.5–1.5	RE49-10-2294	NA	100	2590
49-004	49-608996	0.0–0.5	RE49-10-2295	NA	131	2570
49-004	49-608996	0.5–1.5	RE49-10-2296	NA	77	2720
49-004	49-608997	0.0–0.5	RE49-10-2297	NA	77	2500
49-004	49-608997	0.5–1.5	RE49-10-2298	NA	77	2380
49-004	49-608998	0.0–0.5	RE49-10-2299	NA	100	2570
49-004	49-608998	0.5–1.5	RE49-10-2300	NA	131	2590
49-004	49-608999	0.0–0.5	RE49-10-2301	NA	108	2690
49-004	49-608999	0.5–1.5	RE49-10-2302	NA	178	2440
49-004	49-609000	0.0–0.5	RE49-10-2303	NA	69	2520
49-004	49-609000	0.5–1.5	RE49-10-2304	NA	108	2350
49-004	49-609001	0.0–0.5	RE49-10-2305	NA	69	2330
49-004	49-609001	0.5–1.5	RE49-10-2306	NA	85	2440
49-004	49-609002	0.0–0.5	RE49-10-2307	NA	116	2530
49-004	49-609002	0.5–1.5	RE49-10-2308	NA	155	2580
49-004	49-609003	0.0–0.5	RE49-10-2309	NA	100	2400
49-004	49-609003	0.5–1.5	RE49-10-2310	NA	131	2550
49-004	49-609004	0.0–0.5	RE49-10-2311	NA	131	2650
49-004	49-609004	0.5–1.5	RE49-10-2312	NA	124	2620
49-004	49-609005	0.0–0.5	RE49-10-2313	NA	116	2810
49-004	49-609005	0.5–1.5	RE49-10-2314	NA	155	3350
49-004	49-609006	0.0–0.5	RE49-10-2315	NA	85	2710
49-004	49-609006	0.5–1.5	RE49-10-2316	NA	131	3130
49-004	49-609007	0.0–0.5	RE49-10-2317	NA	131	2460
49-004	49-609007	0.5–1.5	RE49-10-2318	NA	131	2470
49-004	49-609008	0.0–0.5	RE49-10-2319	NA	93	2700
49-004	49-609008	0.5–1.5	RE49-10-2320	NA	139	2890
49-004	49-609009	0.0–0.5	RE49-10-2329	NA	39	2610

Table 7.2-3 (continued)

SWMU or AOC	Location ID	Depth (ft)	Sample ID	PID (ppm)	Alpha (dpm)	Beta/ Gamma (dpm)
Area 6 West Surface and Shallow-Subsurface Samples (continued)						
49-004	49-609009	0.5–1.5	RE49-10-2330	NA	59	2410
49-004	49-609010	0.0–0.5	RE49-10-2331	NA	47	1996
49-004	49-609010	0.5–1.5	RE49-10-2332	NA	107	2680
49-004	49-609011	0.0–0.5	RE49-10-2333	NA	61	2130
49-004	49-609011	0.5–1.5	RE49-10-2334	NA	61	2270
49-004	49-609012	0.0–0.5	RE49-10-2335	NA	140	2740
49-004	49-609012	0.5–1.5	RE49-10-2336	NA	102	2180
49-004	49-609013	0.0–0.5	RE49-10-2337	NA	118	2420
49-004	49-609013	0.5–1.5	RE49-10-2338	NA	61	2130
49-004	49-609014	0.0–0.5	RE49-10-2339	NA	118	2670
49-004	49-609014	0.5–1.5	RE49-10-2340	NA	72	2530
49-004	49-609015	0.0–0.5	RE49-10-2341	NA	41	2170
49-004	49-609015	0.5–1.5	RE49-10-2342	NA	137	2540
49-004	49-609016	0.0–0.5	RE49-10-2343	NA	118	2600
49-004	49-609016	0.5–1.5	RE49-10-2344	NA	85	2560
49-004	49-609017	0.0–0.5	RE49-10-2345	NA	20	2090
49-004	49-609017	0.5–1.5	RE49-10-2346	NA	137	2370
49-004	49-609018	0.0–0.5	RE49-10-2347	NA	41	2160
49-004	49-609018	0.5–1.5	RE49-10-2348	NA	98	2650
49-004	49-609019	0.0–0.5	RE49-10-2349	NA	91	2410
49-004	49-609019	0.5–1.5	RE49-10-2350	NA	20	2480
49-004	49-609020	0.0–0.5	RE49-10-2351	NA	85	2590
49-004	49-609020	0.5–1.5	RE49-10-2352	NA	47	2300
49-004	49-609021	0.0–0.5	RE49-10-2353	NA	13	2310
49-004	49-609021	0.5–1.5	RE49-10-2354	NA	111	2710
49-004	49-609022	0.0–0.5	RE49-10-2355	NA	118	2510
49-004	49-609022	0.5–1.5	RE49-10-2356	NA	75	2450
49-004	49-609039	0.0–0.5	RE49-10-2396	NA	69	2490
49-004	49-609090	0.5–1.5	RE49-10-2516	NA	100	2630

*NA = Not analyzed.

Table 7.2-4
Summary of Inorganic Chemicals Detected or Detected above BVs at Area 6 West, SWMU 49-004

Sample ID	Location ID	Depth (ft)	Media	Aluminum	Antimony	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Magnesium
Qbt4 Background Value[a]				**7340**	**0.5**	**46**	**1.21**	**1.63**	**2200**	**7.14**	**3.14**	**4.66**	**14500**	**11.2**	**1690**
Soil Background Value[a]				**29200**	**0.83**	**295**	**1.83**	**0.4**	**6120**	**19.3**	**8.64**	**14.7**	**21500**	**22.3**	**4610**
Residential SSL[b]				**7.81E+04**	**3.13E+01**	**1.56E+04**	**1.56E+02**	**7.79E+01**	**na**[c]	**2.19E+02**[d]	**2.30E+01**[e]	**3.13E+03**	**5.48E+04**	**4.00E+02**	**na**
Industrial SSL[b]				**1.13E+06**	**4.54E+02**	**2.24E+05**	**2.26E+03**	**1.12E+03**	**na**	**2.92E+03**[d]	**3.00E+02**[e]	**4.54E+04**	**7.95E+05**	**8.00E+02**	**na**
Construction Worker SSL[b]				**4.07E+04**	**1.24E+02**	**4.35E+03**	**1.44E+02**	**3.09E+02**	**na**	**4.49E+02**[d]	**3.49E+01**[f]	**1.24E+04**	**2.17E+05**	**8.00E+02**	**na**
0549-95-0315	49-06106	0.0–0.5	Soil	—[g]	—	—	—	—	—	—	—	—	—	—	—
0549-95-0316	49-06107	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0326	49-06116	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0327	49-06117	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0328	49-06118	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0329	49-06137	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0330	49-06138	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0333	49-06141	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0334	49-06142	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0336	49-06144	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0337	49-06145	0.0–0.5	Soil	—	—	—	—	—	—	—	—	15.3	—	—	—
0549-95-0339	49-06147	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0340	49-06148	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0102	49-06213	5.0–10.0	Soil	—	6 (UJ)	—	—	0.69 (U)	—	—	9.1 (J)	—	—	—	—
0549-95-0103	49-06213	10.0–12.0	Qbt4	—	5.7 (UJ)	—	—	—	—	—	—	—	—	—	—
0549-95-0104	49-06214	2.0–5.0	Fill	—	5.8 (UJ)	—	—	0.62 (U)	—	—	—	—	—	—	—
0549-95-0105	49-06214	5.0–9.5	Fill	—	6 (UJ)	—	—	0.64 (U)	—	—	13.4	—	—	—	—
0549-95-0107	49-06215	0.0–5.0	Fill	—	6 (UJ)	—	—	0.64 (U)	—	—	—	16.2	—	—	—
0549-95-0111	49-06216	18.1–20.0	Fill	—	—	—	—	—	—	—	—	112	—	—	—
0549-95-0113	49-06217	3.0–5.0	Soil	—	6.4 (UJ)	—	—	0.68 (U)	—	—	—	—	—	—	—
0549-95-0119	49-06218	12.5–15.0	Qbt4	—	6.5 (UJ)	—	—	—	—	—	—	—	—	—	—
0549-95-0121	49-06219	7.5–10.0	Qbt4	12,400	6.2 (UJ)	143 (J-)	—	—	2450	9.7	6.1 (J)	6.4	—	14.6	2760
0549-95-0343	49-06221	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0344	49-06222	0.0–0.5	Soil	—	—	—	—	—	—	—	—	17.9	—	24.1	—
0549-95-0349	49-06226	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	—	—
0549-95-0350	49-06227	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	—	—
RE49-10-2204	49-608961	0.5–1.5	Soil	—	—	303 (J)	—	—	—	—	14.9	—	—	—	—
RE49-10-2205	49-608962	0.0–0.5	Soil	—	—	—	2	—	—	—	—	—	—	—	—
RE49-10-2210	49-608964	0.5–1.5	Soil	—	—	307 (J)	—	—	—	—	—	—	—	—	—
RE49-10-2213	49-608966	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	—	—
RE49-10-2215	49-608967	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	—	—

Table 7.2-4 (continued)

Sample ID	Location ID	Depth (ft)	Media	Aluminum	Antimony	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Magnesium
Qbt4 Background Value[a]				**7340**	**0.5**	**46**	**1.21**	**1.63**	**2200**	**7.14**	**3.14**	**4.66**	**14500**	**11.2**	**1690**
Soil Background Value[a]				**29200**	**0.83**	**295**	**1.83**	**0.4**	**6120**	**19.3**	**8.64**	**14.7**	**21500**	**22.3**	**4610**
Residential SSL[b]				**7.81E+04**	**3.13E+01**	**1.56E+04**	**1.56E+02**	**7.79E+01**	**na**[c]	**2.19E+02**[d]	**2.30E+01**[e]	**3.13E+03**	**5.48E+04**	**4.00E+02**	**na**
Industrial SSL[b]				**1.13E+06**	**4.54E+02**	**2.24E+05**	**2.26E+03**	**1.12E+03**	**na**	**2.92E+03**[d]	**3.00E+02**[e]	**4.54E+04**	**7.95E+05**	**8.00E+02**	**na**
Construction Worker SSL[b]				**4.07E+04**	**1.24E+02**	**4.35E+03**	**1.44E+02**	**3.09E+02**	**na**	**4.49E+02**[d]	**3.49E+01**[f]	**1.24E+04**	**2.17E+05**	**8.00E+02**	**na**
RE49-10-2216	49-608967	0.5–1.5	Soil	35,100	—	403 (J)	2	—	—	—	—	—	—	—	—
RE49-10-2218	49-608968	0.5–1.5	Soil	—	—	—	—	—	—	—	—	—	—	—	—
RE49-10-2223	49-608971	0.0–0.5	Soil	—	—	—	—	—	—	—	10.2 (J)	—	—	—	—
RE49-10-2237	49-608978	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	—	—
RE49-10-2238	49-608978	0.5–1.5	Soil	—	—	—	—	—	—	—	—	—	—	25.9 (J)	—
RE49-10-2239	49-608979	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	31.4 (J)	—
RE49-10-2240	49-608979	0.5–1.5	Soil	—	—	—	—	—	—	—	—	16.8	—	—	—
RE49-10-2241	49-608980	0.0–0.5	Soil	—	—	—	—	—	—	—	—	15.6	—	—	—
RE49-10-2243	49-608981	0.0–0.5	Soil	—	—	—	—	—	—	—	—	14.8	—	—	—
RE49-10-2244	49-608981	0.5–1.5	Soil	—	—	—	—	—	—	—	—	15.4	—	—	—
RE49-10-2245	49-608982	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	—	—
RE49-10-2246	49-608982	0.5–1.5	Soil	—	—	—	—	—	—	—	—	—	—	—	—
RE49-10-2247	49-608983	0.0–0.5	Soil	—	—	—	—	—	—	—	—	29.6	—	23	—
RE49-10-2248	49-608983	0.5–1.5	Soil	—	—	—	—	—	—	—	—	—	—	—	—
RE49-10-2249	49-608984	0.0–0.5	Soil	—	—	—	—	—	—	—	—	19.7	—	—	—
RE49-10-2250	49-608984	0.5–1.5	Soil	—	—	—	—	—	—	—	—	—	—	—	—
RE49-10-2275	49-608986	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	—	—
RE49-10-2282	49-608989	0.5–1.5	Soil	—	—	—	—	—	—	—	8.7	—	—	—	—
RE49-10-2285	49-608991	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	—	—
RE49-10-2293	49-608995	0.0–0.5	Soil	—	—	—	—	—	—	—	—	18.6	—	—	—
RE49-10-2295	49-608996	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	—	—
RE49-10-2296	49-608996	0.5–1.5	Soil	—	—	—	—	—	—	—	—	—	—	—	—
RE49-10-2299	49-608998	0.0–0.5	Soil	—	—	—	—	—	—	—	—	14.8	—	—	—
RE49-10-2300	49-608998	0.5–1.5	Soil	—	—	—	—	—	8190	—	—	120	—	45.5	—
RE49-10-2319	49-609008	0.0–0.5	Soil	—	—	—	—	—	—	—	9.7	—	—	33.8	—
RE49-10-2338	49-609013	0.5–1.5	Soil	—	—	—	—	—	—	—	9.2	—	—	—	—
RE49-10-2343	49-609016	0.0–0.5	Soil	—	—	—	—	—	—	—	8.8	—	—	—	—
RE49-10-2346	49-609017	0.5–1.5	Soil	—	—	—	—	—	—	—	9.3	—	—	—	—
RE49-10-2354	49-609021	0.5–1.5	Soil	—	—	—	—	—	—	—	—	—	—	—	—
RE49-10-4930	49-609882	0.0–0.5	Soil	—	1.15 (U)	—	—	0.576 (U)	—	—	—	—	—	—	—
RE49-10-4934	49-609882	9.0–19.0	Qbt4	—	1.09 (U)	98.9	—	—	10,800 (J-)	—	—	—	—	—	1950
RE49-10-4941	49-609882	63.0–65.0	Qbt4	—	1.01 (U)	—	—	—	—	—	—	—	—	14.3	—
RE49-10-4935	49-609883	0.0–0.5	Qbt4	11,600	1.1 (U)	135	—	—	2490 (J-)	9.45	4.87	22.8	—	16.6	2100
RE49-10-4940	49-609883	9.0–14.0	Qbt4	9070	1.08 (U)	108	—	—	3670 (J-)	10.4	4.39	339	16400	64.5	1760

Table 7.2-4 (continued)

Sample ID	Location ID	Depth (ft)	Media	Aluminum	Antimony	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Magnesium
Qbt4 Background Value[a]				**7340**	**0.5**	**46**	**1.21**	**1.63**	**2200**	**7.14**	**3.14**	**4.66**	**14500**	**11.2**	**1690**
Soil Background Value[a]				**29200**	**0.83**	**295**	**1.83**	**0.4**	**6120**	**19.3**	**8.64**	**14.7**	**21500**	**22.3**	**4610**
Residential SSL[b]				**7.81E+04**	**3.13E+01**	**1.56E+04**	**1.56E+02**	**7.79E+01**	**na**[c]	**2.19E+02**[d]	**2.30E+01**[e]	**3.13E+03**	**5.48E+04**	**4.00E+02**	**na**
Industrial SSL[b]				**1.13E+06**	**4.54E+02**	**2.24E+05**	**2.26E+03**	**1.12E+03**	**na**	**2.92E+03**[d]	**3.00E+02**[e]	**4.54E+04**	**7.95E+05**	**8.00E+02**	**na**
Construction Worker SSL[b]				**4.07E+04**	**1.24E+02**	**4.35E+03**	**1.44E+02**	**3.09E+02**	**na**	**4.49E+02**[d]	**3.49E+01**[f]	**1.24E+04**	**2.17E+05**	**8.00E+02**	**na**
RE49-10-4937	49-609883	62.0–64.0	Qbt4	—	1.01 (U)	—	—	—	—	—	—	—	—	—	—
RE49-10-4936	49-609884	0.0–1.0	Fill	—	1.05 (U)	—	—	0.527 (U)	—	—	—	—	—	—	—
RE49-10-4932	49-609884	7.5–10.0	Qbt4	10,200	1.1 (U)	151	—	—	2800 (J-)	8.49	4.46	25.6	—	43.4	1860
RE49-10-4933	49-609884	63.0–65.0	Qbt4	—	0.992 (U)	—	—	—	—	—	—	—	—	—	—
RE49-10-4942	49-609885	0.0–0.5	Soil	—	1.09 (U)	—	—	0.543 (U)	—	—	—	—	—	—	—
RE49-10-4939	49-609885	9.0–14.0	Qbt4	10,200	1.14 (U)	154	—	—	—	8.84	4.52	7.93	—	13	2290
RE49-10-4938	49-609885	63.0–65.0	Qbt4	—	1.07 (U)	—	—	—	—	—	—	—	—	—	—

Table 7.2-4 (continued)

Sample ID	Location ID	Depth (ft)	Media	Manganese	Mercury	Nickel	Perchlorate	Potassium	Selenium	Silver	Sodium	Thallium	Uranium	Vanadium	Zinc
Qbt4 Background Value[a]				**482**	**0.1**	**6.58**	**na**	**3500**	**0.3**	**1**	**2770**	**1.1**	**2.4**	**17**	**63.5**
Soil Background Value[a]				**671**	**0.1**	**15.4**	**na**	**3460**	**1.52**	**1**	**915**	**0.73**	**1.82**	**39.6**	**48.8**
Residential SSL[b]				**1.07E+04**	**7.71E+00**	**1.56E+03**	**5.48E+01**	**na**	**3.91E+02**	**3.91E+02**	**na**	**5.16E+00**	**2.35E+02**	**3.91E+02**	**2.35E+04**
Industrial SSL[b]				**1.45E+05**	**4.99E+01**	**2.27E+04**	**7.95E+02**	**na**	**5.68E+03**	**5.68E+03**	**na**	**7.49E+01**	**3.41E+03**	**5.68E+03**	**3.41E+05**
Construction Worker SSL[b]				**4.63E+02**	**6.36E+01**	**6.19E+03**	**2.17E+02**	**na**	**1.55E+03**	**1.55E+03**	**na**	**2.04E+01**	**9.29E+02**	**1.55E+03**	**9.29E+04**
0549-95-0315	49-06106	0.0–0.5	Soil	—	—	—	NA[h]	—	—	—	—	1.2 (U)	2.84	—	—
0549-95-0316	49-06107	0.0–0.5	Soil	—	—	—	NA	—	—	—	—	1.2 (U)	1.85	—	—
0549-95-0326	49-06116	0.0–0.5	Soil	—	0.11	—	NA	—	—	—	—	1.2 (U)	2.12	—	142
0549-95-0327	49-06117	0.0–0.5	Soil	—	—	—	NA	—	—	—	—	1.3 (U)	—	—	96.2
0549-95-0328	49-06118	0.0–0.5	Soil	—	—	—	NA	—	—	—	—	1.2 (U)	—	—	64
0549-95-0329	49-06137	0.0–0.5	Soil	—	—	—	NA	—	—	—	—	1.3 (U)	1.99	—	50.9
0549-95-0330	49-06138	0.0–0.5	Soil	707 (J-)	0.11 (U)	—	NA	—	—	—	—	1.3 (U)	1.86	—	159
0549-95-0333	49-06141	0.0–0.5	Soil	—	—	—	NA	3500	—	—	—	1.3 (U)	—	—	64
0549-95-0334	49-06142	0.0–0.5	Soil	—	—	—	NA	—	—	1.4 (U)	—	1.3 (U)	1.92	—	65.1
0549-95-0336	49-06144	0.0–0.5	Soil	—	—	—	NA	4030	—	1.4 (U)	—	1.3 (U)	2.43	—	812
0549-95-0337	49-06145	0.0–0.5	Soil	—	0.11 (U)	—	NA	4240	—	1.5 (U)	—	1.3 (U)	2.29	—	49.8
0549-95-0339	49-06147	0.0–0.5	Soil	—	—	—	NA	4030	—	1.5 (U)	—	1.3 (U)	2.58	—	—
0549-95-0340	49-06148	0.0–0.5	Soil	—	—	—	NA	—	—	1.4 (U)	—	1.3 (U)	2.57	—	—
0549-95-0102	49-06213	5.0–10.0	Soil	—	NA	—	NA	—	—	—	—	—	3.4	—	—
0549-95-0103	49-06213	10.0–12.0	Qbt4	—	—	—	NA	—	—	—	—	—	3.3	—	—
0549-95-0104	49-06214	2.0–5.0	Fill	—	—	—	NA	—	—	—	—	—	3.5	—	—
0549-95-0105	49-06214	5.0–9.5	Fill	878 (J)	—	—	NA	—	—	—	—	—	3.3	—	—
0549-95-0107	49-06215	0.0–5.0	Fill	—	—	—	NA	—	—	1.7 (J)	—	—	4	—	—
0549-95-0111	49-06216	18.1–20.0	Fill	—	0.12 (U)	—	NA	—	—	—	—	1.4 (U)	—	—	—
0549-95-0113	49-06217	3.0–5.0	Soil	—	—	—	NA	—	—	—	—	—	3.6	—	70.6
0549-95-0119	49-06218	12.5–15.0	Qbt4	—	—	—	NA	—	—	—	—	—	3.6	—	—
0549-95-0121	49-06219	7.5–10.0	Qbt4	—	—	8.3 (J)	NA	—	—	—	—	—	3.6	20.1	—
0549-95-0343	49-06221	0.0–0.5	Soil	—	—	—	NA	3870	—	1.5 (U)	—	1.3 (U)	6.88	—	—
0549-95-0344	49-06222	0.0–0.5	Soil	—	0.11 (U)	—	NA	4310	—	1.6 (U)	—	1.4 (U)	8.1	—	—
0549-95-0349	49-06226	0.0–0.5	Soil	—	—	—	NA	—	—	1.4 (U)	—	1.2 (U)	8.4	—	—
0549-95-0350	49-06227	0.0–0.5	Soil	—	—	—	NA	—	—	1.4 (U)	—	1.3 (U)	10.7	—	—
RE49-10-2204	49-608961	0.5–1.5	Soil	1030 (J-)	—	—	NA	—	—	—	—	—	NA	—	—
RE49-10-2205	49-608962	0.0–0.5	Soil	—	—	—	NA	—	—	—	—	—	NA	—	—
RE49-10-2210	49-608964	0.5–1.5	Soil	—	—	—	NA	—	—	—	—	—	NA	—	—
RE49-10-2213	49-608966	0.0–0.5	Soil	—	—	—	NA	—	—	—	—	0.77	NA	—	—
RE49-10-2215	49-608967	0.0–0.5	Soil	—	—	—	NA	—	—	—	—	—	NA	—	67.7
RE49-10-2216	49-608967	0.5–1.5	Soil	—	—	—	NA	—	—	—	—	—	NA	—	—
RE49-10-2218	49-608968	0.5–1.5	Soil	—	—	—	NA	—	—	—	—	—	NA	—	74.8
RE49-10-2223	49-608971	0.0–0.5	Soil	811	—	—	NA	—	—	—	—	—	NA	—	—

Table 7.2-4 (continued)

Sample ID	Location ID	Depth (ft)	Media	Manganese	Mercury	Nickel	Perchlorate	Potassium	Selenium	Silver	Sodium	Thallium	Uranium	Vanadium	Zinc
Qbt4 Background Value[a]				**482**	**0.1**	**6.58**	**na**	**3500**	**0.3**	**1**	**2770**	**1.1**	**2.4**	**17**	**63.5**
Soil Background Value[a]				**671**	**0.1**	**15.4**	**na**	**3460**	**1.52**	**1**	**915**	**0.73**	**1.82**	**39.6**	**48.8**
Residential SSL[b]				**1.07E+04**	**7.71E+00**	**1.56E+03**	**5.48E+01**	**na**	**3.91E+02**	**3.91E+02**	**na**	**5.16E+00**	**2.35E+02**	**3.91E+02**	**2.35E+04**
Industrial SSL[b]				**1.45E+05**	**4.99E+01**	**2.27E+04**	**7.95E+02**	**na**	**5.68E+03**	**5.68E+03**	**na**	**7.49E+01**	**3.41E+03**	**5.68E+03**	**3.41E+05**
Construction Worker SSL[b]				**4.63E+02**	**6.36E+01**	**6.19E+03**	**2.17E+02**	**na**	**1.55E+03**	**1.55E+03**	**na**	**2.04E+01**	**9.29E+02**	**1.55E+03**	**9.29E+04**
RE49-10-2237	49-608978	0.0–0.5	Soil	—	—	—	NA	—	—	11.6	—	—	NA	—	—
RE49-10-2238	49-608978	0.5–1.5	Soil	—	—	—	NA	—	—	—	—	—	NA	—	—
RE49-10-2239	49-608979	0.0–0.5	Soil	—	—	—	NA	—	—	—	—	0.74	NA	—	62.7
RE49-10-2240	49-608979	0.5–1.5	Soil	—	—	19.6	NA	—	—	—	—	—	NA	—	56.5
RE49-10-2241	49-608980	0.0–0.5	Soil	—	—	—	NA	—	—	—	—	—	NA	—	96
RE49-10-2243	49-608981	0.0–0.5	Soil	—	—	—	NA	—	—	—	—	—	NA	—	73
RE49-10-2244	49-608981	0.5–1.5	Soil	—	—	—	NA	—	—	—	—	—	NA	—	73.6
RE49-10-2245	49-608982	0.0–0.5	Soil	—	—	—	NA	—	—	—	—	—	NA	—	87.9
RE49-10-2246	49-608982	0.5–1.5	Soil	—	—	—	NA	—	—	—	—	—	NA	—	77
RE49-10-2247	49-608983	0.0–0.5	Soil	—	—	—	NA	—	—	—	—	—	NA	—	170
RE49-10-2248	49-608983	0.5–1.5	Soil	—	—	—	NA	—	—	—	—	—	NA	—	90.9
RE49-10-2249	49-608984	0.0–0.5	Soil	—	—	—	NA	—	—	—	—	—	NA	—	—
RE49-10-2250	49-608984	0.5–1.5	Soil	—	—	—	NA	—	—	—	—	—	NA	—	70.1
RE49-10-2275	49-608986	0.0–0.5	Soil	—	—	—	NA	—	—	—	—	0.97 (U)	NA	—	—
RE49-10-2282	49-608989	0.5–1.5	Soil	—	—	—	NA	—	—	—	—	—	NA	—	—
RE49-10-2285	49-608991	0.0–0.5	Soil	—	—	—	NA	—	—	—	—	1.2 (U)	NA	—	—
RE49-10-2293	49-608995	0.0–0.5	Soil	—	—	—	NA	—	—	—	—	—	NA	—	75.8
RE49-10-2295	49-608996	0.0–0.5	Soil	—	—	—	NA	—	—	—	1010	—	NA	—	—
RE49-10-2296	49-608996	0.5–1.5	Soil	—	—	—	NA	—	—	—	1390	—	NA	—	—
RE49-10-2299	49-608998	0.0–0.5	Soil	819 (J)	—	—	NA	—	—	—	—	—	NA	—	270
RE49-10-2300	49-608998	0.5–1.5	Soil	—	—	—	NA	—	1.9 (J-)	1.9	1840	—	NA	—	446
RE49-10-2319	49-609008	0.0–0.5	Soil	703 (J-)	—	—	NA	—	—	—	—	—	NA	—	—
RE49-10-2338	49-609013	0.5–1.5	Soil	—	—	—	NA	—	—	—	—	—	NA	—	—
RE49-10-2343	49-609016	0.0–0.5	Soil	—	—	—	NA	—	—	—	—	—	NA	—	—
RE49-10-2346	49-609017	0.5–1.5	Soil	—	—	—	NA	—	—	—	—	—	NA	—	—
RE49-10-2354	49-609021	0.5–1.5	Soil	—	—	—	NA	—	1.9	—	—	—	NA	—	—
RE49-10-4930	49-609882	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	NA	—	—
RE49-10-4934	49-609882	9.0–19.0	Qbt4	—	—	7.01 (J)	0.00263	—	1.09 (UJ)	—	—	—	NA	—	—
RE49-10-4941	49-609882	63.0–65.0	Qbt4	—	—	—	—	—	1.02 (UJ)	—	—	—	NA	—	—
RE49-10-4935	49-609883	0.0–0.5	Qbt4	—	—	8.55	0.0012 (J)	—	1.14 (UJ)	—	—	—	NA	22.1	80.3
RE49-10-4940	49-609883	9.0–14.0	Qbt4	—	—	6.68 (J)	0.00802	—	1.1 (UJ)	—	—	—	NA	19	216
RE49-10-4937	49-609883	62.0–64.0	Qbt4	—	—	—	0.00161 (J)	—	0.998 (UJ)	—	—	—	NA	—	—
RE49-10-4936	49-609884	0.0–1.0	Fill	—	—	—	0.00139 (J)	—	—	—	—	—	NA	—	—
RE49-10-4932	49-609884	7.5–10.0	Qbt4	—	—	7.33 (J)	0.00303	—	1.12 (UJ)	—	—	—	NA	—	—

Table 7.2-4 (continued)

Sample ID	Location ID	Depth (ft)	Media	Manganese	Mercury	Nickel	Perchlorate	Potassium	Selenium	Silver	Sodium	Thallium	Uranium	Vanadium	Zinc
Qbt4 Background Value[a]				**482**	**0.1**	**6.58**	**na**	**3500**	**0.3**	**1**	**2770**	**1.1**	**2.4**	**17**	**63.5**
Soil Background Value[a]				**671**	**0.1**	**15.4**	**na**	**3460**	**1.52**	**1**	**915**	**0.73**	**1.82**	**39.6**	**48.8**
Residential SSL[b]				**1.07E+04**	**7.71E+00**	**1.56E+03**	**5.48E+01**	**na**	**3.91E+02**	**3.91E+02**	**na**	**5.16E+00**	**2.35E+02**	**3.91E+02**	**2.35E+04**
Industrial SSL[b]				**1.45E+05**	**4.99E+01**	**2.27E+04**	**7.95E+02**	**na**	**5.68E+03**	**5.68E+03**	**na**	**7.49E+01**	**3.41E+03**	**5.68E+03**	**3.41E+05**
Construction Worker SSL[b]				**4.63E+02**	**6.36E+01**	**6.19E+03**	**2.17E+02**	**na**	**1.55E+03**	**1.55E+03**	**na**	**2.04E+01**	**9.29E+02**	**1.55E+03**	**9.29E+04**
RE49-10-4933	49-609884	63.0–65.0	Qbt4	—	—	—	—	—	1.02 (UJ)	—	—	—	NA	—	—
RE49-10-4942	49-609885	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	NA	—	—
RE49-10-4939	49-609885	9.0–14.0	Qbt4	—	—	7.19 (J)	—	—	1.14 (UJ)	—	—	—	NA	20	—
RE49-10-4938	49-609885	63.0–65.0	Qbt4	—	—	—	—	—	1.02 (UJ)	—	—	—	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 (2009, 108070) unless otherwise noted.

[c] na = Not available.

[d] SSL for hexavalent chromium.

[e] EPA regional screening level (http://www.epa.gov/region06/6pd/rcra_c/pd-n/screen.htm).

[f] Construction worker SSL calculated using toxicity value from EPA regional screening tables (http://www.epa.gov/region06/6pd/rcra_c/pd-n/screen.htm) and equation and parameters from NMED (2009, 108070).

[g] — = Not detected or not detected above BV.

[h] NA = Not analyzed.

Table 7.2-5
Summary of Organic Chemicals Detected at Area 6 West, SWMU 49-004

Sample ID	Location ID	Depth (ft)	Media	Bis(2-ethylhexyl)phthalate	Chloronaphthalene[2-]	Methylene Chloride	Methylnaphthalene[2-]	Naphthalene	Pyrene
Residential SSL[a]				**3.47E+02**	**6.26E+03**	**1.99E+02**	**3.1E+02**[b]	**4.50E+01**	**1.72E+03**
Industrial SSL[a]				**1.37E+03**	**9.08E+04**	**1.09E+03**	**4.1E+03**[b]	**2.52E+02**	**1.83E+04**
Construction Worker SSL[a]				**4.76E+03**	**2.48E+04**	**1.06E+04**	**1.24E+03**[c]	**7.02E+02**	**6.68E+03**
0549-95-0105	49-06214	5.0–9.5	Fill	—[d]	0.36	NA[e]	—	—	—
RE49-10-4940	49-609883	9.0–14.0	Qbt4	10.1 (J)	—	0.00274 (J)	0.0138 (J)	0.0207 (J)	0.0172 (J)

Notes: All concentrations are in mg/kg. Data qualifiers are defined in Appendix A.

[a] SSLs from NMED (2009, 108070) unless otherwise noted.

[b] EPA regional screening level (http://www.epa.gov/region06/6pd/rcra_c/pd-n/screen.htm).

[c] Construction worker SSL calculated using toxicity value from EPA regional screening tables (http://www.epa.gov/region06/6pd/rcra_c/pd-n/screen.htm) and equation and parameters from NMED (2009, 108070).

[d] —= Not detected.

[e] NA= Not analyzed.

Table 7.2-6
Summary of Radionuclides Detected or Detected above BVs/FVs at Area 6 West, SWMU 49-004

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Cesium-134	Cesium-137	Europium-152	Plutonium-238	Plutonium-239/240	Tritium
Qbt4 Background Value[a]				**na**[b]	**na**	**na**	**na**	**na**	**na**	**na**
Soil Background Value[a]				**0.013**	**na**	**1.65**	**na**	**0.023**	**0.054**	**na**
Residential SAL[c]				**30**	**2.4**	**5.6**	**2.9**	**37**	**33**	**750**
Industrial SAL[c]				**180**	**5.1**	**23**	**11**	**240**	**210**	**440000**
Construction Worker SAL[c]				**34**	**4.1**	**18**	**9.1**	**40**	**36**	**320000**
0549-95-0315	49-06106	0.0–0.5	Soil	0.155	NA[d]	—[e]	—	—	0.134	NA
0549-95-0316	49-06107	0.0–0.5	Soil	—	NA	—	—	—	0.056	NA
0549-95-0317	49-06108	0.0–0.5	Soil	0.263	NA	—	—	NA	NA	NA
0549-95-0323	49-06113	0.0–0.5	Soil	—	NA	—	0.209	NA	NA	NA
0549-95-0328	49-06118	0.0–0.5	Soil	—	NA	—	—	—	0.095	NA
0549-95-0329	49-06137	0.0–0.5	Soil	—	NA	—	—	0.025	—	NA
0549-95-0340	49-06148	0.0–0.5	Soil	—	NA	—	0.259	—	—	NA
0549-95-0102	49-06213	5.0–10.0	Soil	—	—	—	NA	—	0.05	NA
0549-95-0103	49-06213	10.0–12.0	Qbt4	—	—	—	NA	—	0.073	NA
0549-95-0104	49-06214	2.0–5.0	Fill	0.43	—	—	NA	—	0.419	NA
0549-95-0105	49-06214	5.0–9.5	Fill	—	—	—	NA	—	0.029	NA
0549-95-0107	49-06215	0.0–5.0	Fill	—	—	—	NA	—	0.039	NA
0549-95-0111	49-06216	18.1–20.0	Fill	—	NA	—	—	0.007	0.007	NA
0549-95-0113	49-06217	3.0–5.0	Soil	—	—	—	NA	—	0.085	NA
0549-95-0119	49-06218	12.5–15.0	Qbt4	—	—	—	NA	—	0.036	NA
0549-95-0343	49-06221	0.0–0.5	Soil	—	NA	2.02	—	—	0.07	NA
0549-95-0344	49-06222	0.0–0.5	Soil	—	NA	3.28	—	—	0.072	NA

Table 7.2-6 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Cesium-134	Cesium-137	Europium-152	Plutonium-238	Plutonium-239/240	Tritium
Qbt4 Background Value[a]				**na**[b]	**na**	**na**	**na**	**na**	**na**	**na**
Soil Background Value[a]				**0.013**	**na**	**1.65**	**na**	**0.023**	**0.054**	**na**
Residential SAL[c]				**30**	**2.4**	**5.6**	**2.9**	**37**	**33**	**750**
Industrial SAL[c]				**180**	**5.1**	**23**	**11**	**240**	**210**	**440000**
Construction Worker SAL[c]				**34**	**4.1**	**18**	**9.1**	**40**	**36**	**320000**
0549-95-0346	49-06223	0.0–0.5	Soil	0.204	NA	—	—	NA	NA	NA
0549-95-0348	49-06225	0.0–0.5	Soil	—	NA	1.69	—	NA	NA	NA
0549-95-0349	49-06226	0.0–0.5	Soil	—	NA	—	—	—	0.066	NA
0549-95-0350	49-06227	0.0–0.5	Soil	—	NA	2.24	—	—	0.074	NA
RE49-10-2225	49-608972	0.0–0.5	Soil	—	—	—	—	—	0.061	NA
RE49-10-2238	49-608978	0.5–1.5	Soil	—	—	—	—	—	0.0306	NA
RE49-10-2242	49-608980	0.5–1.5	Soil	—	—	—	—	—	0.035	NA
RE49-10-2251	49-608985	0.0–0.5	Soil	0.07 (J)	—	—	—	—	0.18 (J)	NA
RE49-10-2252	49-608985	0.5–1.5	Soil	0.161 (J)	—	—	—	—	0.998	NA
RE49-10-2305	49-609001	0.0–0.5	Soil	—	0.073	—	—	—	—	NA
RE49-10-2319	49-609008	0.0–0.5	Soil	—	—	—	—	—	0.133	NA
RE49-10-2320	49-609008	0.5–1.5	Soil	—	—	0.19	—	—	—	NA
RE49-10-2337	49-609013	0.0–0.5	Soil	—	—	—	—	—	0.083	NA
RE49-10-2339	49-609014	0.0–0.5	Soil	—	—	—	—	—	0.107	NA
RE49-10-2340	49-609014	0.5–1.5	Soil	—	—	—	—	—	0.06	NA
RE49-10-4930	49-609882	0.0–0.5	Soil	—	NA	NA	NA	—	0.0618	—
RE49-10-4940	49-609883	9.0–14.0	Qbt4	0.0995	NA	NA	NA	—	0.435	0.0254444

Table 7.2-6 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Cesium-134	Cesium-137	Europium-152	Plutonium-238	Plutonium-239/240	Tritium
Qbt4 Background Value[a]				**na**[b]	**na**	**na**	**na**	**na**	**na**	**na**
Soil Background Value[a]				**0.013**	**na**	**1.65**	**na**	**0.023**	**0.054**	**na**
Residential SAL[c]				**30**	**2.4**	**5.6**	**2.9**	**37**	**33**	**750**
Industrial SAL[c]				**180**	**5.1**	**23**	**11**	**240**	**210**	**440000**
Construction Worker SAL[c]				**34**	**4.1**	**18**	**9.1**	**40**	**36**	**320000**
RE49-10-4936	49-609884	0.0–1.0	Fill	—	NA	NA	NA	—	—	—
RE49-10-4932	49-609884	7.5–10.0	Qbt4	—	NA	NA	NA	—	—	0.0313933

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] SALs from LANL (2009, 107655).

[d] NA = Not analyzed.

[e] — = Not detected or not detected above BV/FV.

Table 7.2-7
Summary of Pore-Gas Samples Collected
and Analyses Requested at Area 6 West, SWMU 49-004

Sample ID	Location ID	Depth (ft)	Media	Tritium	VOCs
RE49-10-11864	49-609882	9.0–11.0	Pore gas	10-1579	10-1578
RE49-10-11863	49-609882	58.0–60.0	Pore gas	10-1579	10-1578

Table 7.2-8
Summary of Organic Chemicals Detected in Pore-Gas Samples Collected at Area 6 West, SWMU 49-004

Sample ID	Location ID	Depth (ft)	Media	Acetone	Benzene	Butanone[2-]	Chloromethane	Dichlorodifluoromethane	Ethylbenzene	Ethyltoluene[4-]	Styrent	Toluene	Trimethylbenzene[1,2,4-]	Trimethylbenzene[1,3,5-]	Xylene (Total)	Xylene[1,2-]	Xylene[1,3-]+Xylene[1,4-]
RE49-10-11864	49-609882	9.0–11.0	Pore gas	31	20	10	—*	2.9	11	17	3.2	34	18	5.4	46	12	34
RE49-10-11863	49-609882	58.0–60.0	Pore gas	29	9	8.2	1.7	3.1	13	15	2.1	31	12	4.5	50	13	37

Note: All concentrations are in $\mu g/m^3$.

*— = Not detected.

Table 7.2-9
Summary of Tritium in Pore-Gas Samples Collected at Area 6 West, SWMU 49-004

Sample ID	Location ID	Depth (ft)	Media	Tritium
RE49-10-11864	49-609882	9.0–11.0	Pore gas	673.926

Note: All activities are in pCi/L.

Table 8.2-1
Surveyed Coordinates for
2009 Locations at Area 10, AOC 49-002 and SWMU 49-005(a)

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
Area 10 Drilling			
49-005(a)	49-609986	1627042.921	1755376.95
49-005(a)	49-609987	1626971.578	1755377.105
49-005(a)	49-609988	1627007.714	1755398.796
49-005(a)	49-609989	1627007.624	1755354.111
Area 10 Surface and Shallow Subsurface			
49-005(a)/49-002	49-609540	1626996.735	1755377.155
49-005(a)/49-002	49-609541	1627021.891	1755377.205
49-005(a)/49-002	49-609542	1626845.847	1755351.7
49-005(a)/49-002	49-609543	1626896.159	1755351.8
49-005(a)/49-002	49-609544	1626921.316	1755351.849
49-005(a)/49-002	49-609545	1626946.472	1755351.899
49-005(a)/49-002	49-609546	1626871.053	1755326.594
49-005(a)/49-002	49-609547	1626946.522	1755326.743
49-005(a)/49-002	49-609548	1626996.635	1755427.468
49-005(a)/49-002	49-609549	1627072.104	1755427.617
49-005(a)/49-002	49-609550	1626795.435	1755401.913
49-005(a)/49-002	49-609551	1626870.904	1755402.063
49-005(a)/49-002	49-609552	1626946.373	1755402.212
49-005(a)/49-002	49-609553	1626971.628	1755351.949
49-005(a)/49-002	49-609554	1627072.254	1755352.148
49-005(a)/49-002	49-609555	1626795.584	1755326.444
49-005(a)/49-002	49-609556	1626896.209	1755326.643
49-005(a)/49-002	49-609557	1627021.991	1755326.892
49-005(a)/49-002	49-609558	1626820.84	1755276.182
49-005(a)/49-002	49-609559	1626896.309	1755276.331
49-005(a)/49-002	49-609560	1626971.777	1755276.48
49-005(a)/49-002	49-609561	1627021.692	1755477.83
49-005(a)/49-002	49-609562	1626745.023	1755452.127
49-005(a)/49-002	49-609563	1626971.877	1755226.167

Table 8.2-1 (continued)

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
Area 10 Surface and Shallow Subsurface (continued)			
49-005(a)/49-002	49-609564	1626895.96	1755452.425
49-005(a)/49-002	49-609565	1627122.417	1755427.716
49-005(a)/49-002	49-609566	1626745.222	1755351.501
49-005(a)/49-002	49-609567	1627122.616	1755327.091
49-005(a)/49-002	49-609568	1626770.527	1755276.082
49-005(a)/49-002	49-609569	1627047.296	1755251.473
49-005(a)/49-002	49-609570	1626871.252	1755225.968
49-005(a)/49-002	49-609571	1626946.323	1755427.368
49-005(a)/49-002	49-609572	1626971.479	1755427.418
49-005(a)/49-002	49-609573	1627021.792	1755427.517
49-005(a)/49-002	49-609574	1627046.948	1755427.567
49-005(a)/49-002	49-609575	1626820.591	1755401.963
49-005(a)/49-002	49-609576	1626845.747	1755402.013
49-005(a)/49-002	49-609577	1626896.06	1755402.112
49-005(a)/49-002	49-609578	1626921.216	1755402.162
49-005(a)/49-002	49-609579	1626971.529	1755402.262
49-005(a)/49-002	49-609580	1626996.685	1755402.311
49-005(a)/49-002	49-609581	1627021.841	1755402.361
49-005(a)/49-002	49-609582	1627046.998	1755402.411
49-005(a)/49-002	49-609583	1627072.154	1755402.46
49-005(a)/49-002	49-609584	1626795.484	1755376.757
49-005(a)/49-002	49-609585	1626820.641	1755376.807
49-005(a)/49-002	49-609586	1626845.797	1755376.857
49-005(a)/49-002	49-609587	1626870.953	1755376.906
49-005(a)/49-002	49-609588	1626896.11	1755376.956
49-005(a)/49-002	49-609589	1626921.266	1755377.006
49-005(a)/49-002	49-609590	1626946.422	1755377.055
49-005(a)/49-002	49-609591	1626971.579	1755377.105
49-005(a)/49-002	49-609592	1627047.047	1755377.254
49-005(a)/49-002	49-609593	1627072.204	1755377.304
49-005(a)/49-002	49-609594	1626795.534	1755351.601
49-005(a)/49-002	49-609595	1626820.69	1755351.651
49-005(a)/49-002	49-609596	1626871.003	1755351.75
49-005(a)/49-002	49-609597	1626996.785	1755351.999
49-005(a)/49-002	49-609598	1627021.941	1755352.048
49-005(a)/49-002	49-609599	1627047.097	1755352.098
49-005(a)/49-002	49-609600	1626820.74	1755326.494
49-005(a)/49-002	49-609601	1626845.896	1755326.544

Table 8.2-1 (continued)

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
Area 10 Surface and Shallow Subsurface (continued)			
49-005(a)/49-002	49-609602	1626921.365	1755326.693
49-005(a)/49-002	49-609603	1626971.678	1755326.793
49-005(a)/49-002	49-609604	1626996.834	1755326.842
49-005(a)/49-002	49-609605	1627047.147	1755326.942
49-005(a)/49-002	49-609606	1627072.303	1755326.992
49-005(a)/49-002	49-609607	1626795.634	1755301.288
49-005(a)/49-002	49-609608	1626820.79	1755301.338
49-005(a)/49-002	49-609609	1626845.946	1755301.388
49-005(a)/49-002	49-609610	1626871.103	1755301.437
49-005(a)/49-002	49-609611	1626896.259	1755301.487
49-005(a)/49-002	49-609612	1626921.415	1755301.537
49-005(a)/49-002	49-609613	1626946.571	1755301.587
49-005(a)/49-002	49-609614	1626971.728	1755301.636
49-005(a)/49-002	49-609615	1626996.884	1755301.686
49-005(a)/49-002	49-609616	1626845.996	1755276.231
49-005(a)/49-002	49-609617	1626871.152	1755276.281
49-005(a)/49-002	49-609618	1626921.465	1755276.381
49-005(a)/49-002	49-609619	1626946.621	1755276.43
49-005(a)/49-002	49-609620	1626996.934	1755276.53
49-005(a)/49-002	49-609621	1626921.067	1755477.631
49-005(a)/49-002	49-609622	1626971.38	1755477.73
49-005(a)/49-002	49-609623	1627072.005	1755477.929
49-005(a)/49-002	49-609624	1627122.317	1755478.029
49-005(a)/49-002	49-609625	1626845.648	1755452.325
49-005(a)/49-002	49-609626	1626946.273	1755452.524
49-005(a)/49-002	49-609627	1626996.586	1755452.624
49-005(a)/49-002	49-609628	1627046.898	1755452.723
49-005(a)/49-002	49-609629	1627097.211	1755452.823
49-005(a)/49-002	49-609630	1626795.335	1755452.226
49-005(a)/49-002	49-609631	1626770.229	1755427.02
49-005(a)/49-002	49-609632	1626820.541	1755427.119
49-005(a)/49-002	49-609633	1626870.854	1755427.219
49-005(a)/49-002	49-609634	1626921.166	1755427.318
49-005(a)/49-002	49-609635	1626745.122	1755401.814
49-005(a)/49-002	49-609636	1626770.328	1755376.707
49-005(a)/49-002	49-609637	1626770.428	1755326.395
49-005(a)/49-002	49-609638	1626745.321	1755301.189
49-005(a)/49-002	49-609639	1627047.197	1755301.785

Table 8.2-1 (continued)

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
Area 10 Surface and Shallow Subsurface (continued)			
49-005(a)/49-002	49-609640	1627097.509	1755301.885
49-005(a)/49-002	49-609641	1627097.41	1755352.198
49-005(a)/49-002	49-609642	1627122.516	1755377.404
49-005(a)/49-002	49-609643	1627097.31	1755402.51
49-005(a)/49-002	49-609644	1627022.09	1755276.579
49-005(a)/49-002	49-609645	1627072.403	1755276.679
49-005(a)/49-002	49-609646	1627122.715	1755276.778
49-005(a)/49-002	49-609647	1626745.42	1755250.876
49-005(a)/49-002	49-609648	1626795.733	1755250.976
49-005(a)/49-002	49-609649	1626846.046	1755251.075
49-005(a)/49-002	49-609650	1626896.358	1755251.174
49-005(a)/49-002	49-609651	1626946.671	1755251.274
49-005(a)/49-002	49-609652	1626996.984	1755251.373
49-005(a)/49-002	49-609653	1626770.626	1755225.77
49-005(a)/49-002	49-609654	1626820.939	1755225.869
49-005(a)/49-002	49-609655	1626921.564	1755226.068
49-005(a)/49-002	49-609656	1627022.19	1755226.267

Table 8.2-2
Samples Collected and Analyses Requested at Area 10, AOC 49-002

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Gamma Spectroscopy	Isotopic Plutonium	Isotopic Uranium	TAL Metals	Pesticides/PCBs	SVOCs	Uranium
0549-95-0252	49-07536	0.0–0.5	Soil	—*	795	795	—	794, 795	—	—	795
0549-95-0253	49-07537	0.0–0.5	Soil	—	795	795	—	794, 795	—	—	795
0549-95-0254	49-07538	0.0–0.5	Soil	—	795	—	—	—	—	—	—
0549-95-0255	49-07539	0.0–0.5	Soil	—	795	795	—	794, 795	—	—	795
0549-95-0256	49-07542	0.0–0.5	Soil	—	795	795	—	794, 795	—	—	795
0549-95-0257	49-07543	0.0–0.5	Soil	—	795	—	—	—	—	—	—
0549-95-0258	49-07544	0.0–0.5	Soil	—	795	795	—	794, 795	—	—	795
0549-95-0259	49-07545	0.0–0.5	Soil	—	795	—	—	—	—	—	—
0549-95-0260	49-07548	0.0–0.5	Soil	—	795	795	—	794, 795	—	—	795
0549-95-0261	49-07549	0.0–0.5	Soil	—	795	—	—	—	—	—	—
0549-95-0262	49-07550	0.0–0.5	Soil	—	795	—	—	—	—	—	—
0549-95-0263	49-07551	0.0–0.5	Soil	—	795	—	—	—	—	—	—
0549-95-0264	49-07560	0.0–0.5	Soil	—	795	795	—	794, 795	793	793	795
RE49-10-4003	49-609540	0.0–0.5	Soil	10-439	10-439	10-439	10-439	10-439	—	—	—
RE49-10-4004	49-609540	0.5–1.5	Soil	10-439	10-439	10-439	10-439	10-439	—	—	—
RE49-10-4005	49-609541	0.0–0.5	Soil	10-439	10-439	10-439	10-439	10-439	—	—	—
RE49-10-4006	49-609541	0.5–1.5	Soil	10-439	10-439	10-439	10-439	10-439	—	—	—
RE49-10-4007	49-609542	0.0–0.5	Soil	10-439	10-439	10-439	10-439	10-439	—	—	—
RE49-10-4008	49-609542	0.5–1.5	Soil	10-439	10-439	10-439	10-439	10-439	—	—	—
RE49-10-4009	49-609543	0.0–0.5	Soil	10-439	10-439	10-439	10-439	10-439	—	—	—
RE49-10-4010	49-609543	0.5–1.5	Soil	10-439	10-439	10-439	10-439	10-439	—	—	—
RE49-10-4011	49-609544	0.0–0.5	Soil	10-439	10-439	10-439	10-439	10-439	—	—	—
RE49-10-4012	49-609544	0.5–1.5	Soil	10-439	10-439	10-439	10-439	10-439	—	—	—
RE49-10-4013	49-609545	0.0–0.5	Soil	10-439	10-439	10-439	10-439	10-439	—	—	—
RE49-10-4014	49-609545	0.5–1.5	Soil	10-439	10-439	10-439	10-439	10-439	—	—	—
RE49-10-4015	49-609546	0.0–0.5	Soil	10-439	10-439	10-439	10-439	10-439	—	—	—
RE49-10-4016	49-609546	0.5–1.5	Soil	10-439	10-439	10-439	10-439	10-439	—	—	—
RE49-10-4017	49-609547	0.0–0.5	Soil	10-439	10-439	10-439	10-439	10-439	—	—	—
RE49-10-4018	49-609547	0.5–1.5	Soil	10-439	10-439	10-439	10-439	10-439	—	—	—
RE49-10-4023	49-609548	0.0–0.5	Soil	10-433	10-433	10-433	10-433	10-433	—	—	—
RE49-10-4024	49-609548	0.5–1.5	Soil	10-433	10-433	10-433	10-433	10-433	—	—	—
RE49-10-4025	49-609549	0.0–0.5	Soil	10-433	10-433	10-433	10-433	10-433	—	—	—
RE49-10-4026	49-609549	0.5–1.5	Soil	10-433	10-433	10-433	10-433	10-433	—	—	—

Table 8.2-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Gamma Spectroscopy	Isotopic Plutonium	Isotopic Uranium	TAL Metals	Pesticides/PCBs	SVOCs	Uranium
RE49-10-4027	49-609550	0.0–0.5	Soil	10-433	10-433	10-433	10-433	10-433	—	—	—
RE49-10-4028	49-609550	0.5–1.5	Soil	10-433	10-433	10-433	10-433	10-433	—	—	—
RE49-10-4029	49-609551	0.0–0.5	Soil	10-433	10-433	10-433	10-433	10-433	—	—	—
RE49-10-4030	49-609551	0.5–1.5	Soil	10-433	10-433	10-433	10-433	10-433	—	—	—
RE49-10-4031	49-609552	0.0–0.5	Soil	10-433	10-433	10-433	10-433	10-433	—	—	—
RE49-10-4032	49-609552	0.5–1.5	Soil	10-433	10-433	10-433	10-433	10-433	—	—	—
RE49-10-4033	49-609553	0.0–0.5	Soil	10-433	10-433	10-433	10-433	10-433	—	—	—
RE49-10-4034	49-609553	0.5–1.5	Soil	10-433	10-433	10-433	10-433	10-433	—	—	—
RE49-10-4035	49-609554	0.0–0.5	Soil	10-433	10-433	10-433	10-433	10-433	—	—	—
RE49-10-4036	49-609554	0.5–1.5	Soil	10-433	10-433	10-433	10-433	10-433	—	—	—
RE49-10-4037	49-609555	0.0–0.5	Soil	10-433	10-433	10-433	10-433	10-433	—	—	—
RE49-10-4038	49-609555	0.5–1.5	Soil	10-433	10-433	10-433	10-433	10-433	—	—	—
RE49-10-4039	49-609556	0.0–0.5	Soil	10-434	10-434	10-434	10-434	10-434	—	—	—
RE49-10-4040	49-609556	0.5–1.5	Soil	10-434	10-434	10-434	10-434	10-434	—	—	—
RE49-10-4041	49-609557	0.0–0.5	Soil	10-434	10-434	10-434	10-434	10-434	—	—	—
RE49-10-4042	49-609557	0.5–1.5	Soil	10-434	10-434	10-434	10-434	10-434	—	—	—
RE49-10-4043	49-609558	0.0–0.5	Soil	10-434	10-434	10-434	10-434	10-434	—	—	—
RE49-10-4044	49-609558	0.5–1.5	Soil	10-434	10-434	10-434	10-434	10-434	—	—	—
RE49-10-4045	49-609559	0.0–0.5	Soil	10-434	10-434	10-434	10-434	10-434	—	—	—
RE49-10-4046	49-609559	0.5–1.5	Soil	10-434	10-434	10-434	10-434	10-434	—	—	—
RE49-10-4047	49-609560	0.0–0.5	Soil	10-434	10-434	10-434	10-434	10-434	—	—	—
RE49-10-4048	49-609560	0.5–1.5	Qbt4	10-434	10-434	10-434	10-434	10-434	—	—	—
RE49-10-4055	49-609561	0.0–0.5	Soil	10-431	10-431	10-431	10-431	10-431	—	—	—
RE49-10-4056	49-609561	0.5–1.5	Soil	10-431	10-431	10-431	10-431	10-431	—	—	—
RE49-10-4057	49-609562	0.0–0.5	Soil	10-431	10-431	10-431	10-431	10-431	—	—	—
RE49-10-4058	49-609562	0.5–1.5	Soil	10-431	10-431	10-431	10-431	10-431	—	—	—
RE49-10-4059	49-609563	0.0–0.5	Soil	10-431	10-431	10-431	10-431	10-431	—	—	—
RE49-10-4060	49-609563	0.5–1.5	Soil	10-431	10-431	10-431	10-431	10-431	—	—	—
RE49-10-4061	49-609564	0.0–0.5	Fill	10-431	10-431	10-431	10-431	10-431	—	—	—
RE49-10-4062	49-609564	0.5–1.5	Fill	10-431	10-431	10-431	10-431	10-431	—	—	—
RE49-10-4063	49-609565	0.0–0.5	Soil	10-431	10-431	10-431	10-431	10-431	—	—	—
RE49-10-4064	49-609565	0.5–1.5	Soil	10-431	10-431	10-431	10-431	10-431	—	—	—
RE49-10-4065	49-609566	0.0–0.5	Soil	10-431	10-431	10-431	10-431	10-431	—	—	—
RE49-10-4066	49-609566	0.5–1.5	Soil	10-432	10-432	10-432	10-432	10-432	—	—	—

Table 8.2-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Gamma Spectroscopy	Isotopic Plutonium	Isotopic Uranium	TAL Metals	Pesticides/PCBs	SVOCs	Uranium
RE49-10-4067	49-609567	0.0–0.5	Soil	10-432	10-432	10-432	10-432	10-432	—	—	—
RE49-10-4068	49-609567	0.5–1.5	Soil	10-432	10-432	10-432	10-432	10-432	—	—	—
RE49-10-4069	49-609568	0.0–0.5	Soil	10-432	10-432	10-432	10-432	10-432	—	—	—
RE49-10-4070	49-609568	0.5–1.5	Soil	10-432	10-432	10-432	10-432	10-432	—	—	—
RE49-10-4071	49-609569	0.0–0.5	Soil	10-432	10-432	10-432	10-432	10-432	—	—	—
RE49-10-4072	49-609569	0.5–1.5	Soil	10-432	10-432	10-432	10-432	10-432	—	—	—
RE49-10-4073	49-609570	0.0–0.5	Soil	10-432	10-432	10-432	10-432	10-432	—	—	—
RE49-10-4074	49-609570	0.5–1.5	Soil	10-432	10-432	10-432	10-432	10-432	—	—	—
RE49-10-4094	49-609578	0.5–1.5	Soil	10-442	10-442	10-442	10-442	10-442	—	—	—
RE49-10-4138	49-609600	0.5–1.5	Soil	10-442	10-442	10-442	10-442	10-442	—	—	—

Note: The numbers in the analytical request columns are analytical request numbers.
*— = Not requested.

Table 8.2-3
Field-Screening Results for Samples Collected at Area 10

SWMU or AOC	Location ID	Depth (ft)	Sample ID	PID (ppm)	Alpha (dpm)	Beta/Gamma (dpm)
Area 10 Drilling Samples						
49-005(a)	49-609986	0.0–1.0	RE49-10-5403	0.0	65	2150
49-005(a)	49-609988	4.0–5.0	RE49-10-5407	0.0	98	2390
49-005(a)	49-609988	8.0–10.0	RE49-10-5408	0.6	98	2390
49-005(a)	49-609987	0.0–0.5	RE49-10-5404	0.0	91	2170
49-005(a)	49-609986	4.0–5.0	RE49-10-5401	0.0	91	2170
49-005(a)	49-609986	9.0–10.0	RE49-10-5402	0.7	91	2440
49-005(a)	49-609989	0.0–0.6	RE49-10-5414	0.0	78	2290
49-005(a)	49-609989	3.0–4.0	RE49-10-5410	0.0	78	2290
49-005(a)	49-609989	9.0–10.0	RE49-10-5412	0.0	85	1841
49-005(a)	49-609987	0.0–2.0	RE49-10-5409	0.0	65	2160
49-005(a)	49-609987	3.0–5.0	RE49-10-5406	0.0	65	2160
49-005(a)	49-609987	5.0–6.5	RE49-10-5413	0.0	78	2390
49-005(a)	49-609987	6.5–8.0	RE49-10-5411	0.0	78	2390
49-005(a)	49-609987	8.0–10.0	RE49-10-5405	0.0	78	2390

Table 8.2-3 (continued)

SWMU or AOC	Location ID	Depth (ft)	Sample ID	PID (ppm)	Alpha (dpm)	Beta/Gamma (dpm)
Area 10 Surface and Shallow-Subsurface Samples						
49-002/49-005(a)	49-609540	0.0–0.5	RE49-10-4003	NA*	85	2750
49-002/49-005(a)	49-609540	0.5–1.5	RE49-10-4004	NA	78	2610
49-002/49-005(a)	49-609541	0.0–0.5	RE49-10-4005	NA	85	2610
49-002/49-005(a)	49-609541	0.5–1.5	RE49-10-4006	NA	98	2480
49-002/49-005(a)	49-609542	0.0–0.5	RE49-10-4007	NA	98	2200
49-002/49-005(a)	49-609542	0.5–1.5	RE49-10-4008	NA	104	2340
49-002/49-005(a)	49-609543	0.0–0.5	RE49-10-4009	NA	91	2600
49-002/49-005(a)	49-609543	0.5–1.5	RE49-10-4010	NA	65	2470
49-002/49-005(a)	49-609544	0.0–0.5	RE49-10-4011	NA	111	2270
49-002/49-005(a)	49-609544	0.5–1.5	RE49-10-4012	NA	85	2530
49-002/49-005(a)	49-609545	0.0–0.5	RE49-10-4013	NA	78	2160
49-002/49-005(a)	49-609545	0.5–1.5	RE49-10-4014	NA	78	2540
49-002/49-005(a)	49-609546	0.0–0.5	RE49-10-4015	NA	98	2500
49-002/49-005(a)	49-609546	0.5–1.5	RE49-10-4016	NA	111	2110
49-002/49-005(a)	49-609547	0.0–0.5	RE49-10-4017	NA	65	2390
49-002/49-005(a)	49-609547	0.5–1.5	RE49-10-4018	NA	104	2330
49-002/49-005(a)	49-609548	0.0–0.5	RE49-10-4023	NA	111	2130
49-002/49-005(a)	49-609548	0.5–1.5	RE49-10-4024	NA	104	2410
49-002/49-005(a)	49-609549	0.0–0.5	RE49-10-4025	NA	104	2270
49-002/49-005(a)	49-609549	0.5–1.5	RE49-10-4026	NA	111	2360
49-002/49-005(a)	49-609550	0.0–0.5	RE49-10-4027	NA	52	2710
49-002/49-005(a)	49-609550	0.5–1.5	RE49-10-4028	NA	91	2510
49-002/49-005(a)	49-609551	0.0–0.5	RE49-10-4029	NA	98	2350
49-002/49-005(a)	49-609551	0.5–1.5	RE49-10-4030	NA	111	2300
49-002/49-005(a)	49-609552	0.0–0.5	RE49-10-4031	NA	65	2560
49-002/49-005(a)	49-609552	0.5–1.5	RE49-10-4032	NA	111	2330
49-002/49-005(a)	49-609553	0.0–0.5	RE49-10-4033	NA	78	2250
49-002/49-005(a)	49-609553	0.5–1.5	RE49-10-4034	NA	103	2420
49-002/49-005(a)	49-609554	0.0–0.5	RE49-10-4035	NA	29	2300
49-002/49-005(a)	49-609554	0.5–1.5	RE49-10-4036	NA	65	2430
49-002/49-005(a)	49-609555	0.0–0.5	RE49-10-4037	NA	118	2610
49-002/49-005(a)	49-609555	0.5–1.5	RE49-10-4038	NA	85	2300
49-002/49-005(a)	49-609556	0.0–0.5	RE49-10-4039	NA	91	2540
49-002/49-005(a)	49-609556	0.5–1.5	RE49-10-4040	NA	91	2570
49-002/49-005(a)	49-609557	0.0–0.5	RE49-10-4041	NA	118	2580
49-002/49-005(a)	49-609557	0.5–1.5	RE49-10-4042	NA	72	2610
49-002/49-005(a)	49-609558	0.0–0.5	RE49-10-4043	NA	78	2740

Table 8.2-3 (continued)

SWMU or AOC	Location ID	Depth (ft)	Sample ID	PID (ppm)	Alpha (dpm)	Beta/Gamma (dpm)
Area 10 Surface and Shallow-Subsurface Samples (continued)						
49-002/49-005(a)	49-609558	0.5–1.5	RE49-10-4044	NA	81	2200
49-002/49-005(a)	49-609559	0.0–0.5	RE49-10-4045	NA	72	2440
49-002/49-005(a)	49-609559	0.5–1.5	RE49-10-4046	NA	91	2850
49-002/49-005(a)	49-609560	0.0–0.5	RE49-10-4047	NA	91	2510
49-002/49-005(a)	49-609560	0.5–1.5	RE49-10-4048	NA	98	2600
49-002/49-005(a)	49-609561	0.0–0.5	RE49-10-4055	NA	65	2310
49-002/49-005(a)	49-609561	0.5–1.5	RE49-10-4056	NA	104	2270
49-002/49-005(a)	49-609562	0.0–0.5	RE49-10-4057	NA	59	2070
49-002/49-005(a)	49-609562	0.5–1.5	RE49-10-4058	NA	72	2420
49-002/49-005(a)	49-609563	0.0–0.5	RE49-10-4059	NA	98	2410
49-002/49-005(a)	49-609563	0.5–1.5	RE49-10-4060	NA	65	2100
49-002/49-005(a)	49-609564	0.0–0.5	RE49-10-4061	NA	85	2620
49-002/49-005(a)	49-609564	0.5–1.5	RE49-10-4062	NA	85	2330
49-002/49-005(a)	49-609565	0.0–0.5	RE49-10-4063	NA	59	2170
49-002/49-005(a)	49-609565	0.5–1.5	RE49-10-4064	NA	32	2220
49-002/49-005(a)	49-609566	0.0–0.5	RE49-10-4065	NA	91	2110
49-002/49-005(a)	49-609566	0.5–1.5	RE49-10-4066	NA	21	2130
49-002/49-005(a)	49-609567	0.0–0.5	RE49-10-4067	NA	78	2430
49-002/49-005(a)	49-609567	0.5–1.5	RE49-10-4068	NA	32	2270
49-002/49-005(a)	49-609568	0.0–0.5	RE49-10-4069	NA	52	2320
49-002/49-005(a)	49-609568	0.5–1.5	RE49-10-4070	NA	38	1958
49-002/49-005(a)	49-609569	0.0–0.5	RE49-10-4071	NA	78	2460
49-002/49-005(a)	49-609569	0.5–1.5	RE49-10-4072	NA	48	2090
49-002/49-005(a)	49-609570	0.0–0.5	RE49-10-4073	NA	65	1871
49-002/49-005(a)	49-609570	0.5–1.5	RE49-10-4074	NA	78	2610
49-002/49-005(a)	49-609578	0.0–0.5	RE49-10-4094	NA	45	1981
49-002/49-005(a)	49-609600	0.5–1.5	RE49-10-4138	NA	59	2500

*NA = Not analyzed.

Table 8.2-4
Summary of Inorganic Chemicals Detected or Detected above BVs at Area 10, AOC 49-002

Sample ID	Location ID	Depth (ft)	Media	Aluminum	Antimony	Barium	Cadmium	Calcium	Chromium	Cobalt	Copper	Cyanide (Total)	Lead
Qbt4 Background Value[a]				**7340**	**0.5**	**46**	**1.63**	**2200**	**7.14**	**3.14**	**4.66**	**0.5**	**11.2**
Soil Background Value[a]				**29,200**	**0.83**	**295**	**0.4**	**6120**	**19.3**	**8.64**	**14.7**	**0.5**	**22.3**
Residential SSL[b]				**7.81E+04**	**3.13E+01**	**1.56E+04**	**7.79E+01**	**na**[c]	**2.19E+02**[d]	**2.30E+01**[e]	**3.13E+03**	**1.56E+03**	**4.00E+02**
Industrial SSL[b]				**1.13E+06**	**4.54E+02**	**2.24E+05**	**1.12E+03**	**na**	**2.92E+03**[d]	**3.00E+02**[e]	**4.54E+04**	**2.27E+04**	**8.00E+02**
Construction Worker SSL[b]				**4.07E+04**	**1.24E+02**	**4.35E+03**	**3.09E+02**	**na**	**4.49E+02**[d]	**3.49E+01**[f]	**1.24E+04**	**6.19E+03**	**8.00E+02**
0549-95-0252	49-07536	0.0–0.5	Soil	—[g]	5.7 (U)	—	0.73 (J)	—	—	—	—	NA[h]	48 (J-)
0549-95-0253	49-07537	0.0–0.5	Soil	—	5.5 (U)	—	0.59 (U)	—	—	—	—	NA	—
0549-95-0255	49-07539	0.0–0.5	Soil	—	5.6 (U)	—	0.6 (U)	—	—	—	20.5	NA	26.7 (J-)
0549-95-0256	49-07542	0.0–0.5	Soil	—	13.9	—	0.59 (U)	—	—	—	—	NA	—
0549-95-0258	49-07544	0.0–0.5	Soil	—	5.5 (U)	—	0.59 (U)	—	—	—	—	NA	—
0549-95-0260	49-07548	0.0–0.5	Soil	—	5.6 (U)	—	0.59 (U)	—	—	—	98.9	NA	—
0549-95-0264	49-07560	0.0–0.5	Soil	—	5.6 (U)	—	0.6 (U)	—	—	—	—	NA	—
RE49-10-4003	49-609540	0.0–0.5	Soil	—	1.17 (U)	—	0.584 (U)	—	—	—	—	NA	—
RE49-10-4004	49-609540	0.5–1.5	Soil	—	1.11 (U)	—	—	—	—	—	—	NA	—
RE49-10-4005	49-609541	0.0–0.5	Soil	—	1.12 (U)	—	0.559 (U)	—	—	—	—	NA	—
RE49-10-4006	49-609541	0.5–1.5	Soil	—	1.08 (U)	—	—	—	—	—	—	NA	—
RE49-10-4007	49-609542	0.0–0.5	Soil	—	1.23 (U)	—	—	—	—	—	—	NA	—
RE49-10-4008	49-609542	0.5–1.5	Soil	—	1.14 (U)	—	—	—	—	—	—	NA	—
RE49-10-4009	49-609543	0.0–0.5	Soil	—	1.18 (U)	—	—	—	—	—	—	NA	—
RE49-10-4010	49-609543	0.5–1.5	Soil	—	1.13 (U)	—	1.49	—	—	—	—	NA	—
RE49-10-4011	49-609544	0.0–0.5	Soil	—	1.31 (U)	—	0.446 (J)	—	—	—	23.2	NA	27.2
RE49-10-4012	49-609544	0.5–1.5	Soil	—	1.26 (U)	—	—	—	—	—	—	NA	—
RE49-10-4013	49-609545	0.0–0.5	Soil	—	1.25 (U)	—	0.576 (J)	—	—	—	—	NA	40.7
RE49-10-4014	49-609545	0.5–1.5	Soil	—	1.31 (U)	—	0.653 (U)	6730	—	—	—	NA	—
RE49-10-4015	49-609546	0.0–0.5	Soil	—	1.16 (U)	—	—	—	—	—	—	NA	—
RE49-10-4016	49-609546	0.5–1.5	Soil	—	1.22 (U)	—	0.609 (U)	—	—	—	—	NA	—
RE49-10-4017	49-609547	0.0–0.5	Soil	—	1.12 (U)	—	—	—	—	—	—	NA	—
RE49-10-4018	49-609547	0.5–1.5	Soil	—	1.08 (U)	—	0.542 (U)	—	—	—	—	NA	—
RE49-10-4023	49-609548	0.0–0.5	Soil	—	2.02 (U)	—	—	—	—	—	—	NA	—
RE49-10-4024	49-609548	0.5–1.5	Soil	—	1.3 (U)	—	—	—	—	10.3	—	NA	—
RE49-10-4025	49-609549	0.0–0.5	Soil	—	1.28 (U)	—	—	—	—	—	—	NA	—
RE49-10-4026	49-609549	0.5–1.5	Soil	—	1.02 (U)	—	—	—	—	—	—	NA	—
RE49-10-4027	49-609550	0.0–0.5	Soil	—	1.36 (U)	—	—	—	—	—	—	NA	—
RE49-10-4028	49-609550	0.5–1.5	Soil	—	1.21 (U)	—	—	—	—	—	—	NA	—

Table 8.2-4 (continued)

Sample ID	Location ID	Depth (ft)	Media	Aluminum	Antimony	Barium	Cadmium	Calcium	Chromium	Cobalt	Copper	Cyanide (Total)	Lead
Qbt4 Background Value[a]				**7340**	**0.5**	**46**	**1.63**	**2200**	**7.14**	**3.14**	**4.66**	**0.5**	**11.2**
Soil Background Value[a]				**29,200**	**0.83**	**295**	**0.4**	**6120**	**19.3**	**8.64**	**14.7**	**0.5**	**22.3**
Residential SSL[b]				**7.81E+04**	**3.13E+01**	**1.56E+04**	**7.79E+01**	**na**[c]	**2.19E+02**[d]	**2.30E+01**[e]	**3.13E+03**	**1.56E+03**	**4.00E+02**
Industrial SSL[b]				**1.13E+06**	**4.54E+02**	**2.24E+05**	**1.12E+03**	**na**	**2.92E+03**[d]	**3.00E+02**[e]	**4.54E+04**	**2.27E+04**	**8.00E+02**
Construction Worker SSL[b]				**4.07E+04**	**1.24E+02**	**4.35E+03**	**3.09E+02**	**na**	**4.49E+02**[d]	**3.49E+01**[f]	**1.24E+04**	**6.19E+03**	**8.00E+02**
RE49-10-4029	49-609551	0.0–0.5	Soil	—	1.37 (U)	—	—	—	—	—	—	NA	—
RE49-10-4030	49-609551	0.5–1.5	Soil	—	1.52 (U)	—	—	—	—	—	—	NA	—
RE49-10-4031	49-609552	0.0–0.5	Soil	—	1.4 (U)	—	—	—	—	—	—	NA	—
RE49-10-4032	49-609552	0.5–1.5	Soil	—	1.39 (U)	—	—	—	—	—	—	NA	—
RE49-10-4033	49-609553	0.0–0.5	Soil	—	0.934 (U)	—	—	—	—	—	—	NA	—
RE49-10-4034	49-609553	0.5–1.5	Soil	—	1.05 (U)	—	—	6270	—	—	—	NA	—
RE49-10-4035	49-609554	0.0–0.5	Soil	—	1.78 (U)	—	—	—	—	—	—	NA	—
RE49-10-4036	49-609554	0.5–1.5	Soil	—	1.46 (U)	—	—	10,000	—	—	—	NA	—
RE49-10-4037	49-609555	0.0–0.5	Soil	—	1.1 (U)	—	—	—	—	—	—	NA	—
RE49-10-4038	49-609555	0.5–1.5	Soil	—	1.67 (U)	—	—	—	—	—	—	NA	—
RE49-10-4039	49-609556	0.0–0.5	Soil	—	1.12 (UJ)	—	0.558 (U)	—	—	—	—	NA	—
RE49-10-4040	49-609556	0.5–1.5	Soil	—	0.981 (UJ)	—	0.491 (U)	—	—	—	—	NA	—
RE49-10-4041	49-609557	0.0–0.5	Soil	—	1.04 (UJ)	—	0.522 (U)	—	—	—	—	NA	—
RE49-10-4042	49-609557	0.5–1.5	Soil	—	1.03 (UJ)	—	—	—	—	—	—	NA	—
RE49-10-4043	49-609558	0.0–0.5	Soil	—	1.17 (UJ)	—	0.587 (U)	—	—	—	—	NA	24.4
RE49-10-4044	49-609558	0.5–1.5	Soil	—	0.991 (UJ)	—	0.495 (U)	—	—	—	—	NA	—
RE49-10-4045	49-609559	0.0–0.5	Soil	—	1.24 (UJ)	—	0.618 (U)	—	—	—	—	NA	—
RE49-10-4046	49-609559	0.5–1.5	Soil	—	1.1 (UJ)	—	0.55 (U)	—	—	—	—	NA	—
RE49-10-4047	49-609560	0.0–0.5	Soil	—	1.1 (UJ)	—	0.551 (U)	—	—	—	—	NA	—
RE49-10-4048	49-609560	0.5–1.5	Qbt4	10,100	1.04 (UJ)	121	—	—	8.35	3.99	5.18	NA	—
RE49-10-4055	49-609561	0.0–0.5	Soil	—	1.01 (U)	—	—	—	—	—	—	NA	—
RE49-10-4057	49-609562	0.0–0.5	Soil	—	1.24 (U)	—	—	—	—	—	—	NA	—
RE49-10-4059	49-609563	0.0–0.5	Soil	—	1.13 (U)	—	—	—	—	—	—	NA	—
RE49-10-4060	49-609563	0.5–1.5	Soil	—	1.02 (U)	—	—	—	—	—	—	NA	—
RE49-10-4061	49-609564	0.0–0.5	Fill	—	1.04 (U)	—	—	—	—	—	—	NA	—
RE49-10-4062	49-609564	0.5–1.5	Fill	—	1.05 (U)	—	0.523 (U)	—	—	—	—	NA	—
RE49-10-4063	49-609565	0.0–0.5	Soil	—	1.1 (U)	—	—	—	—	—	—	NA	—
RE49-10-4064	49-609565	0.5–1.5	Soil	—	1.09 (U)	—	0.545 (U)	—	—	—	—	NA	—
RE49-10-4065	49-609566	0.0–0.5	Soil	—	1.22 (U)	—	—	—	—	—	—	NA	—
RE49-10-4066	49-609566	0.5–1.5	Soil	—	—	—	0.533 (U)	—	—	—	—	NA	—
RE49-10-4067	49-609567	0.0–0.5	Soil	—	1.07 (U)	—	0.536 (U)	—	—	—	—	NA	—
RE49-10-4068	49-609567	0.5–1.5	Soil	—	1.08 (U)	—	0.541 (U)	—	—	—	—	NA	—
RE49-10-4069	49-609568	0.0–0.5	Soil	—	1.18 (U)	—	0.589 (U)	—	—	—	—	NA	—

Table 8.2-4 (continued)

Sample ID	Location ID	Depth (ft)	Media	Aluminum	Antimony	Barium	Cadmium	Calcium	Chromium	Cobalt	Copper	Cyanide (Total)	Lead
Qbt4 Background Value[a]				**7340**	**0.5**	**46**	**1.63**	**2200**	**7.14**	**3.14**	**4.66**	**0.5**	**11.2**
Soil Background Value[a]				**29,200**	**0.83**	**295**	**0.4**	**6120**	**19.3**	**8.64**	**14.7**	**0.5**	**22.3**
Residential SSL[b]				**7.81E+04**	**3.13E+01**	**1.56E+04**	**7.79E+01**	**na**[c]	**2.19E+02**[d]	**2.30E+01**[e]	**3.13E+03**	**1.56E+03**	**4.00E+02**
Industrial SSL[b]				**1.13E+06**	**4.54E+02**	**2.24E+05**	**1.12E+03**	**na**	**2.92E+03**[d]	**3.00E+02**[e]	**4.54E+04**	**2.27E+04**	**8.00E+02**
Construction Worker SSL[b]				**4.07E+04**	**1.24E+02**	**4.35E+03**	**3.09E+02**	**na**	**4.49E+02**[d]	**3.49E+01**[f]	**1.24E+04**	**6.19E+03**	**8.00E+02**
RE49-10-4070	49-609568	0.5–1.5	Soil	—	1.06 (U)	—	0.531 (U)	—	—	—	—	NA	—
RE49-10-4071	49-609569	0.0–0.5	Soil	—	1.09 (U)	—	0.546 (U)	—	—	—	—	NA	—
RE49-10-4072	49-609569	0.5–1.5	Soil	—	1.09 (U)	—	0.544 (U)	—	—	—	—	NA	—
RE49-10-4073	49-609570	0.0–0.5	Soil	—	1.26 (U)	—	0.628 (U)	—	—	—	—	NA	—
RE49-10-4074	49-609570	0.5–1.5	Soil	—	1.14 (U)	—	0.569 (U)	—	—	—	—	NA	—
RE49-10-4094	49-609578	0.5–1.5	Soil	—	0.977 (U)	—	—	—	—	—	—	NA	—
RE49-10-4138	49-609600	0.5–1.5	Soil	—	1.17 (U)	—	—	—	—	—	—	NA	—

Table 8.2-4 (continued)

Sample ID	Location ID	Depth (ft)	Media	Magnesium	Manganese	Mercury	Nickel	Nitrate	Perchlorate	Selenium	Thallium	Uranium	Vanadium	Zinc
Qbt4 Background Value[a]				**1690**	**482**	**0.1**	**6.58**	**na**	**na**	**0.3**	**1.1**	**2.4**	**17**	**63.5**
Soil Background Value[a]				**4610**	**671**	**0.1**	**15.4**	**na**	**na**	**1.52**	**0.73**	**1.82**	**39.6**	**48.8**
Residential SSL[b]				**na**[c]	**1.07E+04**	**2.30E+01**[e]	**1.56E+03**	**1.25E+05**	**5.48E+01**	**3.91E+02**	**5.16E+00**	**2.35E+02**	**3.91E+02**	**2.35E+04**
Industrial SSL[b]				**na**	**1.45E+05**	**3.10E+02**[e]	**2.27E+04**	**1.82E+06**	**7.95E+02**	**5.68E+03**	**7.49E+01**	**3.41E+03**	**5.68E+03**	**3.41E+05**
Construction Worker SSL[b]				**na**	**4.63E+02**	**9.29E+01**[f]	**6.19E+03**	**4.96E+05**	**2.17E+02**	**1.55E+03**	**2.04E+01**	**9.29E+02**	**1.55E+03**	**9.29E+04**
0549-95-0252	49-07536	0.0–0.5	Soil	—	—	0.72	—	NA	NA	—	—	3.2	—	98.7
0549-95-0253	49-07537	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	3.2	—	—
0549-95-0255	49-07539	0.0–0.5	Soil	—	—	0.11	—	NA	NA	—	—	3.9	—	78.8
0549-95-0256	49-07542	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	3.5	—	—
0549-95-0258	49-07544	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	3.2	—	—
0549-95-0260	49-07548	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	4.2	—	69.9
0549-95-0264	49-07560	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	3.4	—	—
RE49-10-4003	49-609540	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4004	49-609540	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4005	49-609541	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4006	49-609541	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4007	49-609542	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	85.4
RE49-10-4008	49-609542	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4009	49-609543	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4010	49-609543	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	296
RE49-10-4011	49-609544	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	112
RE49-10-4012	49-609544	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	446
RE49-10-4013	49-609545	0.0–0.5	Soil	—	—	0.348	—	NA	NA	—	—	NA	—	94.7
RE49-10-4014	49-609545	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4015	49-609546	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4016	49-609546	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4017	49-609547	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	73.5
RE49-10-4018	49-609547	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4023	49-609548	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4024	49-609548	0.5–1.5	Soil	—	899 (J-)	—	—	NA	NA	—	—	NA	—	—
RE49-10-4025	49-609549	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4026	49-609549	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4027	49-609550	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4028	49-609550	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4029	49-609551	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4030	49-609551	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4031	49-609552	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4032	49-609552	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4033	49-609553	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—

Table 8.2-4 (continued)

Sample ID	Location ID	Depth (ft)	Media	Magnesium	Manganese	Mercury	Nickel	Nitrate	Perchlorate	Selenium	Thallium	Uranium	Vanadium	Zinc
Qbt4 Background Value[a]				**1690**	**482**	**0.1**	**6.58**	**na**	**na**	**0.3**	**1.1**	**2.4**	**17**	**63.5**
Soil Background Value[a]				**4610**	**671**	**0.1**	**15.4**	**na**	**na**	**1.52**	**0.73**	**1.82**	**39.6**	**48.8**
Residential SSL[b]				**na**[c]	**1.07E+04**	**2.30E+01**[e]	**1.56E+03**	**1.25E+05**	**5.48E+01**	**3.91E+02**	**5.16E+00**	**2.35E+02**	**3.91E+02**	**2.35E+04**
Industrial SSL[b]				**na**	**1.45E+05**	**3.10E+02**[e]	**2.27E+04**	**1.82E+06**	**7.95E+02**	**5.68E+03**	**7.49E+01**	**3.41E+03**	**5.68E+03**	**3.41E+05**
Construction Worker SSL[b]				**na**	**4.63E+02**	**9.29E+01**[f]	**6.19E+03**	**4.96E+05**	**2.17E+02**	**1.55E+03**	**2.04E+01**	**9.29E+02**	**1.55E+03**	**9.29E+04**
RE49-10-4034	49-609553	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4035	49-609554	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4036	49-609554	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4037	49-609555	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4038	49-609555	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4039	49-609556	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4040	49-609556	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4041	49-609557	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4042	49-609557	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4043	49-609558	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	61.9
RE49-10-4044	49-609558	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4045	49-609559	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4046	49-609559	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4047	49-609560	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4048	49-609560	0.5–1.5	Qbt4	—	—	—	7.39	NA	NA	1.01 (UJ)	—	NA	18	—
RE49-10-4055	49-609561	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4057	49-609562	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4059	49-609563	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4060	49-609563	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4061	49-609564	0.0–0.5	Fill	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4062	49-609564	0.5–1.5	Fill	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4063	49-609565	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4064	49-609565	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4065	49-609566	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4066	49-609566	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4067	49-609567	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4068	49-609567	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4069	49-609568	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4070	49-609568	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4071	49-609569	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4072	49-609569	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4073	49-609570	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4074	49-609570	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—
RE49-10-4094	49-609578	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	NA	—	—

Table 8.2-4 (continued)

Sample ID	Location ID	Depth (ft)	Media	Magnesium	Manganese	Mercury	Nickel	Nitrate	Perchlorate	Selenium	Thallium	Uranium	Vanadium	Zinc
Qbt4 Background Value[a]				**1690**	**482**	**0.1**	**6.58**	**na**	**na**	**0.3**	**1.1**	**2.4**	**17**	**63.5**
Soil Background Value[a]				**4610**	**671**	**0.1**	**15.4**	**na**	**na**	**1.52**	**0.73**	**1.82**	**39.6**	**48.8**
Residential SSL[b]				**na**[c]	**1.07E+04**	**2.30E+01**[e]	**1.56E+03**	**1.25E+05**	**5.48E+01**	**3.91E+02**	**5.16E+00**	**2.35E+02**	**3.91E+02**	**2.35E+04**
Industrial SSL[b]				**na**	**1.45E+05**	**3.10E+02**[e]	**2.27E+04**	**1.82E+06**	**7.95E+02**	**5.68E+03**	**7.49E+01**	**3.41E+03**	**5.68E+03**	**3.41E+05**
Construction Worker SSL[b]				**na**	**4.63E+02**	**9.29E+01**[f]	**6.19E+03**	**4.96E+05**	**2.17E+02**	**1.55E+03**	**2.04E+01**	**9.29E+02**	**1.55E+03**	**9.29E+04**
RE49-10-4138	49-609600	0.5–1.5	Soil	—	—	—	—	NA	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 (2009, 108070) unless otherwise noted.

[c] na = Not available.

[d] SSL for hexavalent chromium.

[e] EPA regional screening level (http://www.epa.gov/region06/6pd/rcra_c/pd-n/screen.htm).

[f] Construction worker SSL calculated using toxicity value from EPA regional screening tables (http://www.epa.gov/region06/6pd/rcra_c/pd-n/screen.htm) and equation and parameters from NMED (2009, 108070).

[g] — = Not detected or not detected above BV.

[h] NA = Not analyzed.

Table 8.2-5
Summary of Radionuclides Detected or Detected above BVs/FVs at Area 10, AOC 49-002

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Cesium-137	Plutonium-238	Plutonium-239/240
Qbt4 Background Value[a]				**na**[b]	**na**	**na**	**na**
Soil Background Value[a]				**0.013**	**1.65**	**0.023**	**0.054**
Residential SAL[c]				**30**	**5.6**	**37**	**33**
Industrial SAL[c]				**180**	**23**	**240**	**210**
RE49-10-4012	49-609544	0.5–1.5	Soil	—[d]	0.211	—	—
RE49-10-4016	49-609546	0.5–1.5	Soil	—	0.114	—	—
RE49-10-4018	49-609547	0.5–1.5	Soil	—	0.126	—	—
RE49-10-4030	49-609551	0.5–1.5	Soil	—	0.116	—	—
RE49-10-4032	49-609552	0.5–1.5	Soil	0.184	0.122	—	—
RE49-10-4038	49-609555	0.5–1.5	Soil	—	0.23	—	—
RE49-10-4040	49-609556	0.5–1.5	Soil	—	0.0772	—	—
RE49-10-4046	49-609559	0.5–1.5	Soil	—	—	—	0.116
RE49-10-4056	49-609561	0.5–1.5	Soil	—	0.076	—	—
RE49-10-4066	49-609566	0.5–1.5	Soil	—	0.167	—	—
RE49-10-4070	49-609568	0.5–1.5	Soil	—	0.115	—	—
RE49-10-4138	49-609600	0.5–1.5	Soil	—	0.146	—	—

Note: All activities are in pCi/g.

[a] BVs/FVs from LANL (1998, 059730).

[b] na = Not available.

[c] SALs from LANL (2009, 107655).

[d] — = Not detected or not detected above BV/FV.

Table 8.3-1
Samples Collected and Analyses Requested at Area 10, SWMU 49-005(a)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Anions	Gamma Spectroscopy	Tritium	High Explosives	Isotopic Plutonium	Isotopic Uranium	TAL Metals	Perchlorate	SVOCs	Uranium	VOCs	Wet Chemistry
0549-95-0141	49-07512	0.0–0.5	Soil	—*	—	720	—	—	720	—	719	—	718	720	—	—
0549-95-0140	49-07512	4.0–9.0	Qbt4	—	—	728	—	—	728	—	727, 728	—	726	—	—	—
0549-95-0143	49-07527	0.0–0.5	Soil	—	—	720	—	—	720	—	719	—	718	720	—	—
0549-95-0142	49-07527	7.3–10.0	Qbt4	—	—	728	—	—	728	—	727, 728	—	726	—	—	—
RE49-10-4003	49-609540	0.0–0.5	Soil	10-439	—	10-439	—	—	10-439	10-439	10-439	—	—	—	—	—
RE49-10-4004	49-609540	0.5–1.5	Soil	10-439	—	10-439	—	—	10-439	10-439	10-439	—	—	—	—	—
RE49-10-4005	49-609541	0.0–0.5	Soil	10-439	—	10-439	—	—	10-439	10-439	10-439	—	—	—	—	—
RE49-10-4006	49-609541	0.5–1.5	Soil	10-439	—	10-439	—	—	10-439	10-439	10-439	—	—	—	—	—
RE49-10-4007	49-609542	0.0–0.5	Soil	10-439	—	10-439	—	—	10-439	10-439	10-439	—	—	—	—	—
RE49-10-4008	49-609542	0.5–1.5	Soil	10-439	—	10-439	—	—	10-439	10-439	10-439	—	—	—	—	—
RE49-10-4009	49-609543	0.0–0.5	Soil	10-439	—	10-439	—	—	10-439	10-439	10-439	—	—	—	—	—
RE49-10-4010	49-609543	0.5–1.5	Soil	10-439	—	10-439	—	—	10-439	10-439	10-439	—	—	—	—	—
RE49-10-4011	49-609544	0.0–0.5	Soil	10-439	—	10-439	—	—	10-439	10-439	10-439	—	—	—	—	—
RE49-10-4012	49-609544	0.5–1.5	Soil	10-439	—	10-439	—	—	10-439	10-439	10-439	—	—	—	—	—
RE49-10-4013	49-609545	0.0–0.5	Soil	10-439	—	10-439	—	—	10-439	10-439	10-439	—	—	—	—	—
RE49-10-4014	49-609545	0.5–1.5	Soil	10-439	—	10-439	—	—	10-439	10-439	10-439	—	—	—	—	—
RE49-10-4015	49-609546	0.0–0.5	Soil	10-439	—	10-439	—	—	10-439	10-439	10-439	—	—	—	—	—
RE49-10-4016	49-609546	0.5–1.5	Soil	10-439	—	10-439	—	—	10-439	10-439	10-439	—	—	—	—	—
RE49-10-4017	49-609547	0.0–0.5	Soil	10-439	—	10-439	—	—	10-439	10-439	10-439	—	—	—	—	—
RE49-10-4018	49-609547	0.5–1.5	Soil	10-439	—	10-439	—	—	10-439	10-439	10-439	—	—	—	—	—
RE49-10-4023	49-609548	0.0–0.5	Soil	10-433	—	10-433	—	—	10-433	10-433	10-433	—	—	—	—	—
RE49-10-4024	49-609548	0.5–1.5	Soil	10-433	—	10-433	—	—	10-433	10-433	10-433	—	—	—	—	—
RE49-10-4025	49-609549	0.0–0.5	Soil	10-433	—	10-433	—	—	10-433	10-433	10-433	—	—	—	—	—
RE49-10-4026	49-609549	0.5–1.5	Soil	10-433	—	10-433	—	—	10-433	10-433	10-433	—	—	—	—	—
RE49-10-4027	49-609550	0.0–0.5	Soil	10-433	—	10-433	—	—	10-433	10-433	10-433	—	—	—	—	—
RE49-10-4028	49-609550	0.5–1.5	Soil	10-433	—	10-433	—	—	10-433	10-433	10-433	—	—	—	—	—
RE49-10-4029	49-609551	0.0–0.5	Soil	10-433	—	10-433	—	—	10-433	10-433	10-433	—	—	—	—	—
RE49-10-4030	49-609551	0.5–1.5	Soil	10-433	—	10-433	—	—	10-433	10-433	10-433	—	—	—	—	—
RE49-10-4031	49-609552	0.0–0.5	Soil	10-433	—	10-433	—	—	10-433	10-433	10-433	—	—	—	—	—
RE49-10-4032	49-609552	0.5–1.5	Soil	10-433	—	10-433	—	—	10-433	10-433	10-433	—	—	—	—	—
RE49-10-4033	49-609553	0.0–0.5	Soil	10-433	—	10-433	—	—	10-433	10-433	10-433	—	—	—	—	—
RE49-10-4034	49-609553	0.5–1.5	Soil	10-433	—	10-433	—	—	10-433	10-433	10-433	—	—	—	—	—
RE49-10-4035	49-609554	0.0–0.5	Soil	10-433	—	10-433	—	—	10-433	10-433	10-433	—	—	—	—	—
RE49-10-4036	49-609554	0.5–1.5	Soil	10-433	—	10-433	—	—	10-433	10-433	10-433	—	—	—	—	—
RE49-10-4037	49-609555	0.0–0.5	Soil	10-433	—	10-433	—	—	10-433	10-433	10-433	—	—	—	—	—
RE49-10-4038	49-609555	0.5–1.5	Soil	10-433	—	10-433	—	—	10-433	10-433	10-433	—	—	—	—	—

Table 8.3-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Anions	Gamma Spectroscopy	Tritium	High Explosives	Isotopic Plutonium	Isotopic Uranium	TAL Metals	Perchlorate	SVOCs	Uranium	VOCs	Wet Chemistry
RE49-10-4039	49-609556	0.0–0.5	Soil	10-434	—	10-434	—	—	10-434	10-434	10-434	—	—	—	—	—
RE49-10-4040	49-609556	0.5–1.5	Soil	10-434	—	10-434	—	—	10-434	10-434	10-434	—	—	—	—	—
RE49-10-4041	49-609557	0.0–0.5	Soil	10-434	—	10-434	—	—	10-434	10-434	10-434	—	—	—	—	—
RE49-10-4042	49-609557	0.5–1.5	Soil	10-434	—	10-434	—	—	10-434	10-434	10-434	—	—	—	—	—
RE49-10-4043	49-609558	0.0–0.5	Soil	10-434	—	10-434	—	—	10-434	10-434	10-434	—	—	—	—	—
RE49-10-4044	49-609558	0.5–1.5	Soil	10-434	—	10-434	—	—	10-434	10-434	10-434	—	—	—	—	—
RE49-10-4045	49-609559	0.0–0.5	Soil	10-434	—	10-434	—	—	10-434	10-434	10-434	—	—	—	—	—
RE49-10-4046	49-609559	0.5–1.5	Soil	10-434	—	10-434	—	—	10-434	10-434	10-434	—	—	—	—	—
RE49-10-4047	49-609560	0.0–0.5	Soil	10-434	—	10-434	—	—	10-434	10-434	10-434	—	—	—	—	—
RE49-10-4048	49-609560	0.5–1.5	Qbt4	10-434	—	10-434	—	—	10-434	10-434	10-434	—	—	—	—	—
RE49-10-4055	49-609561	0.0–0.5	Soil	10-431	—	10-431	—	—	10-431	10-431	10-431	—	—	—	—	—
RE49-10-4056	49-609561	0.5–1.5	Soil	10-431	—	10-431	—	—	10-431	10-431	10-431	—	—	—	—	—
RE49-10-4057	49-609562	0.0–0.5	Soil	10-431	—	10-431	—	—	10-431	10-431	10-431	—	—	—	—	—
RE49-10-4058	49-609562	0.5–1.5	Soil	10-431	—	10-431	—	—	10-431	10-431	10-431	—	—	—	—	—
RE49-10-4059	49-609563	0.0–0.5	Soil	10-431	—	10-431	—	—	10-431	10-431	10-431	—	—	—	—	—
RE49-10-4060	49-609563	0.5–1.5	Soil	10-431	—	10-431	—	—	10-431	10-431	10-431	—	—	—	—	—
RE49-10-4061	49-609564	0.0–0.5	Fill	10-431	—	10-431	—	—	10-431	10-431	10-431	—	—	—	—	—
RE49-10-4062	49-609564	0.5–1.5	Fill	10-431	—	10-431	—	—	10-431	10-431	10-431	—	—	—	—	—
RE49-10-4063	49-609565	0.0–0.5	Soil	10-431	—	10-431	—	—	10-431	10-431	10-431	—	—	—	—	—
RE49-10-4064	49-609565	0.5–1.5	Soil	10-431	—	10-431	—	—	10-431	10-431	10-431	—	—	—	—	—
RE49-10-4065	49-609566	0.0–0.5	Soil	10-431	—	10-431	—	—	10-431	10-431	10-431	—	—	—	—	—
RE49-10-4066	49-609566	0.5–1.5	Soil	10-432	—	10-432	—	—	10-432	10-432	10-432	—	—	—	—	—
RE49-10-4067	49-609567	0.0–0.5	Soil	10-432	—	10-432	—	—	10-432	10-432	10-432	—	—	—	—	—
RE49-10-4068	49-609567	0.5–1.5	Soil	10-432	—	10-432	—	—	10-432	10-432	10-432	—	—	—	—	—
RE49-10-4069	49-609568	0.0–0.5	Soil	10-432	—	10-432	—	—	10-432	10-432	10-432	—	—	—	—	—
RE49-10-4070	49-609568	0.5–1.5	Soil	10-432	—	10-432	—	—	10-432	10-432	10-432	—	—	—	—	—
RE49-10-4071	49-609569	0.0–0.5	Soil	10-432	—	10-432	—	—	10-432	10-432	10-432	—	—	—	—	—
RE49-10-4072	49-609569	0.5–1.5	Soil	10-432	—	10-432	—	—	10-432	10-432	10-432	—	—	—	—	—
RE49-10-4073	49-609570	0.0–0.5	Soil	10-432	—	10-432	—	—	10-432	10-432	10-432	—	—	—	—	—
RE49-10-4074	49-609570	0.5–1.5	Soil	10-432	—	10-432	—	—	10-432	10-432	10-432	—	—	—	—	—
RE49-10-4094	49-609578	0.5–1.5	Soil	10-442	—	10-442	—	—	10-442	10-442	10-442	—	—	—	—	—
RE49-10-4138	49-609600	0.5–1.5	Soil	10-442	—	10-442	—	—	10-442	10-442	10-442	—	—	—	—	—
RE49-10-5403	49-609986	0.0–1.0	Soil	10-510	10-509	—	10-510	10-508	10-510	10-510	10-509	10-509	10-508	—	10-508	10-509
RE49-10-5401	49-609986	4.0–5.0	Qbt4	10-510	10-509	—	10-510	10-508	10-510	10-510	10-509	10-509	10-508	—	10-508	10-509
RE49-10-5402	49-609986	9.0–10.0	Qbt4	10-510	10-509	—	10-510	10-508	10-510	10-510	10-509	10-509	10-508	—	10-508	10-509
RE49-10-5404	49-609987	0.0–0.5	Soil	10-510	10-509	—	10-510	10-508	10-510	10-510	10-509	10-509	10-508	—	10-508	10-509
RE49-10-5406	49-609987	3.0–5.0	Qbt4	10-510	10-509	—	10-510	10-508	10-510	10-510	10-509	10-509	10-508	—	10-508	10-509
RE49-10-5413	49-609987	5.0–6.5	Qbt4	10-510	10-509	—	10-510	10-508	10-510	10-510	10-509	10-509	10-508	—	10-508	10-509

Table 8.3-1 (continued)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Anions	Gamma Spectroscopy	Tritium	High Explosives	Isotopic Plutonium	Isotopic Uranium	TAL Metals	Perchlorate	SVOCs	Uranium	VOCs	Wet Chemistry
RE49-10-5411	49-609987	6.5–8.0	Qbt4	10-510	10-509	—	10-510	10-508	10-510	10-510	10-509	10-509	10-508	—	10-508	10-509
RE49-10-5405	49-609987	8.0–10.0	Qbt4	10-510	10-509	—	10-510	10-508	10-510	10-510	10-509	10-509	10-508	—	10-508	10-509
RE49-10-5409	49-609988	0.0–2.0	Soil	10-510	10-509	—	10-510	10-508	10-510	10-510	10-509	10-509	10-508	—	10-508	10-509
RE49-10-5407	49-609988	4.0–5.0	Qbt4	10-510	10-509	—	10-510	10-508	10-510	10-510	10-509	10-509	10-508	—	10-508	10-509
RE49-10-5408	49-609988	8.0–10.0	Qbt4	10-510	10-509	—	10-510	10-508	10-510	10-510	10-509	10-509	10-508	—	10-508	10-509
RE49-10-5414	49-609989	0.0–0.5	Soil	10-510	10-509	—	10-510	10-508	10-510	10-510	10-509	10-509	10-508	—	10-508	10-509
RE49-10-5410	49-609989	3.0–4.0	Soil	10-510	10-509	—	10-510	10-508	10-510	10-510	10-509	10-509	10-508	—	10-508	10-509
RE49-10-5412	49-609989	9.0–10.0	Qbt4	10-510	10-509	—	10-510	10-508	10-510	10-510	10-509	10-509	10-508	—	10-508	10-509

Notes: The numbers in the analytical request columns are analytical request numbers. Anions refers to total cyanide and nitrate.
*— = Not requested.

Table 8.3-2
Summary of Inorganic Chemicals Detected or Detected above BVs at Area 10, SWMU 49-005(a)

Sample ID	Location ID	Depth (ft)	Media	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Cyanide (Total)	Lead
Qbt4 Background Value[a]				**7340**	**0.5**	**2.79**	**46**	**1.21**	**1.63**	**2200**	**7.14**	**3.14**	**4.66**	**0.5**	**11.2**
Soil Background Value[a]				**29,200**	**0.83**	**8.17**	**295**	**1.83**	**0.4**	**6120**	**19.3**	**8.64**	**14.7**	**0.5**	**22.3**
Residential SSL[b]				**7.81E+04**	**3.13E+01**	**3.90E+00**	**1.56E+04**	**1.56E+02**	**7.79E+01**	**na**[c]	**2.19E+02**[d]	**2.30E+01**[e]	**3.13E+03**	**1.56E+03**	**4.00E+02**
Industrial SSL[b]				**1.13E+06**	**4.54E+02**	**1.77E+01**	**2.24E+05**	**2.26E+03**	**1.12E+03**	**na**	**2.92E+03**[d]	**3.00E+02**[e]	**4.54E+04**	**2.27E+04**	**8.00E+02**
Construction Worker SSL[b]				**4.07E+04**	**1.24E+02**	**6.54E+01**	**4.35E+03**	**1.44E+02**	**3.09E+02**	**na**	**4.49E+02**[d]	**3.49E+01**[f]	**1.24E+04**	**6.19E+03**	**8.00E+02**
0549-95-0141	49-07512	0.0–0.5	Soil	—[g]	—	—	—	—	—	—	—	—	—	NA[h]	—
0549-95-0140	49-07512	4.0–9.0	Qbt4	12,000	0.75 (UJ)	—	85.6	—	—	2340	8.4	—	6.7	NA	—
0549-95-0143	49-07527	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	NA	—
0549-95-0142	49-07527	7.3–10.0	Qbt4	21,900	0.81 (UJ)	3.4	112	1.9	—	3320	11.4	—	8.2	NA	—
RE49-10-4003	49-609540	0.0–0.5	Soil	—	1.17 (U)	—	—	—	0.584 (U)	—	—	—	—	NA	—
RE49-10-4004	49-609540	0.5–1.5	Soil	—	1.11 (U)	—	—	—	—	—	—	—	—	NA	—
RE49-10-4005	49-609541	0.0–0.5	Soil	—	1.12 (U)	—	—	—	0.559 (U)	—	—	—	—	NA	—
RE49-10-4006	49-609541	0.5–1.5	Soil	—	1.08 (U)	—	—	—	—	—	—	—	—	NA	—
RE49-10-4007	49-609542	0.0–0.5	Soil	—	1.23 (U)	—	—	—	—	—	—	—	—	NA	—
RE49-10-4008	49-609542	0.5–1.5	Soil	—	1.14 (U)	—	—	—	—	—	—	—	—	NA	—
RE49-10-4009	49-609543	0.0–0.5	Soil	—	1.18 (U)	—	—	—	—	—	—	—	—	NA	—
RE49-10-4010	49-609543	0.5–1.5	Soil	—	1.13 (U)	—	—	—	1.49	—	—	—	—	NA	—
RE49-10-4011	49-609544	0.0–0.5	Soil	—	1.31 (U)	—	—	—	0.446 (J)	—	—	—	23.2	NA	27.2
RE49-10-4012	49-609544	0.5–1.5	Soil	—	1.26 (U)	—	—	—	—	—	—	—	—	NA	—
RE49-10-4013	49-609545	0.0–0.5	Soil	—	1.25 (U)	—	—	—	0.576 (J)	—	—	—	—	NA	40.7
RE49-10-4014	49-609545	0.5–1.5	Soil	—	1.31 (U)	—	—	—	0.653 (U)	6730	—	—	—	NA	—
RE49-10-4015	49-609546	0.0–0.5	Soil	—	1.16 (U)	—	—	—	—	—	—	—	—	NA	—
RE49-10-4016	49-609546	0.5–1.5	Soil	—	1.22 (U)	—	—	—	0.609 (U)	—	—	—	—	NA	—
RE49-10-4017	49-609547	0.0–0.5	Soil	—	1.12 (U)	—	—	—	—	—	—	—	—	NA	—
RE49-10-4018	49-609547	0.5–1.5	Soil	—	1.08 (U)	—	—	—	0.542 (U)	—	—	—	—	NA	—
RE49-10-4023	49-609548	0.0–0.5	Soil	—	2.02 (U)	—	—	—	—	—	—	—	—	NA	—
RE49-10-4024	49-609548	0.5–1.5	Soil	—	1.3 (U)	—	—	—	—	—	—	10.3	—	NA	—
RE49-10-4025	49-609549	0.0–0.5	Soil	—	1.28 (U)	—	—	—	—	—	—	—	—	NA	—
RE49-10-4026	49-609549	0.5–1.5	Soil	—	1.02 (U)	—	—	—	—	—	—	—	—	NA	—
RE49-10-4027	49-609550	0.0–0.5	Soil	—	1.36 (U)	—	—	—	—	—	—	—	—	NA	—
RE49-10-4028	49-609550	0.5–1.5	Soil	—	1.21 (U)	—	—	—	—	—	—	—	—	NA	—
RE49-10-4029	49-609551	0.0–0.5	Soil	—	1.37 (U)	—	—	—	—	—	—	—	—	NA	—
RE49-10-4030	49-609551	0.5–1.5	Soil	—	1.52 (U)	—	—	—	—	—	—	—	—	NA	—
RE49-10-4031	49-609552	0.0–0.5	Soil	—	1.4 (U)	—	—	—	—	—	—	—	—	NA	—
RE49-10-4032	49-609552	0.5–1.5	Soil	—	1.39 (U)	—	—	—	—	—	—	—	—	NA	—

Table 8.3-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Cyanide (Total)	Lead
Qbt4 Background Value[a]				**7340**	**0.5**	**2.79**	**46**	**1.21**	**1.63**	**2200**	**7.14**	**3.14**	**4.66**	**0.5**	**11.2**
Soil Background Value[a]				**29,200**	**0.83**	**8.17**	**295**	**1.83**	**0.4**	**6120**	**19.3**	**8.64**	**14.7**	**0.5**	**22.3**
Residential SSL[b]				**7.81E+04**	**3.13E+01**	**3.90E+00**	**1.56E+04**	**1.56E+02**	**7.79E+01**	**na**[c]	**2.19E+02**[d]	**2.30E+01**[e]	**3.13E+03**	**1.56E+03**	**4.00E+02**
Industrial SSL[b]				**1.13E+06**	**4.54E+02**	**1.77E+01**	**2.24E+05**	**2.26E+03**	**1.12E+03**	**na**	**2.92E+03**[d]	**3.00E+02**[e]	**4.54E+04**	**2.27E+04**	**8.00E+02**
Construction Worker SSL[b]				**4.07E+04**	**1.24E+02**	**6.54E+01**	**4.35E+03**	**1.44E+02**	**3.09E+02**	**na**	**4.49E+02**[d]	**3.49E+01**[f]	**1.24E+04**	**6.19E+03**	**8.00E+02**
RE49-10-4033	49-609553	0.0–0.5	Soil	—	0.934 (U)	—	—	—	—	—	—	—	—	NA	—
RE49-10-4034	49-609553	0.5–1.5	Soil	—	1.05 (U)	—	—	—	—	6270	—	—	—	NA	—
RE49-10-4035	49-609554	0.0–0.5	Soil	—	1.78 (U)	—	—	—	—	—	—	—	—	NA	—
RE49-10-4036	49-609554	0.5–1.5	Soil	—	1.46 (U)	—	—	—	—	10,000	—	—	—	NA	—
RE49-10-4037	49-609555	0.0–0.5	Soil	—	1.1 (U)	—	—	—	—	—	—	—	—	NA	—
RE49-10-4038	49-609555	0.5–1.5	Soil	—	1.67 (U)	—	—	—	—	—	—	—	—	NA	—
RE49-10-4039	49-609556	0.0–0.5	Soil	—	1.12 (UJ)	—	—	—	0.558 (U)	—	—	—	—	NA	—
RE49-10-4040	49-609556	0.5–1.5	Soil	—	0.981 (UJ)	—	—	—	0.491 (U)	—	—	—	—	NA	—
RE49-10-4041	49-609557	0.0–0.5	Soil	—	1.04 (UJ)	—	—	—	0.522 (U)	—	—	—	—	NA	—
RE49-10-4042	49-609557	0.5–1.5	Soil	—	1.03 (UJ)	—	—	—	—	—	—	—	—	NA	—
RE49-10-4043	49-609558	0.0–0.5	Soil	—	1.17 (UJ)	—	—	—	0.587 (U)	—	—	—	—	NA	24.4
RE49-10-4044	49-609558	0.5–1.5	Soil	—	0.991 (UJ)	—	—	—	0.495 (U)	—	—	—	—	NA	—
RE49-10-4045	49-609559	0.0–0.5	Soil	—	1.24 (UJ)	—	—	—	0.618 (U)	—	—	—	—	NA	—
RE49-10-4046	49-609559	0.5–1.5	Soil	—	1.1 (UJ)	—	—	—	0.55 (U)	—	—	—	—	NA	—
RE49-10-4047	49-609560	0.0–0.5	Soil	—	1.1 (UJ)	—	—	—	0.551 (U)	—	—	—	—	NA	—
RE49-10-4048	49-609560	0.5–1.5	Qbt4	10,100	1.04 (UJ)	—	121	—	—	—	8.35	3.99	5.18	NA	—
RE49-10-4055	49-609561	0.0–0.5	Soil	—	1.01 (U)	—	—	—	—	—	—	—	—	NA	—
RE49-10-4057	49-609562	0.0–0.5	Soil	—	1.24 (U)	—	—	—	—	—	—	—	—	NA	—
RE49-10-4059	49-609563	0.0–0.5	Soil	—	1.13 (U)	—	—	—	—	—	—	—	—	NA	—
RE49-10-4060	49-609563	0.5–1.5	Soil	—	1.02 (U)	—	—	—	—	—	—	—	—	NA	—
RE49-10-4061	49-609564	0.0–0.5	Fill	—	1.04 (U)	—	—	—	—	—	—	—	—	NA	—
RE49-10-4062	49-609564	0.5–1.5	Fill	—	1.05 (U)	—	—	—	0.523 (U)	—	—	—	—	NA	—
RE49-10-4063	49-609565	0.0–0.5	Soil	—	1.1 (U)	—	—	—	—	—	—	—	—	NA	—
RE49-10-4064	49-609565	0.5–1.5	Soil	—	1.09 (U)	—	—	—	0.545 (U)	—	—	—	—	NA	—
RE49-10-4065	49-609566	0.0–0.5	Soil	—	1.22 (U)	—	—	—	—	—	—	—	—	NA	—
RE49-10-4066	49-609566	0.5–1.5	Soil	—	—	—	—	—	0.533 (U)	—	—	—	—	NA	—
RE49-10-4067	49-609567	0.0–0.5	Soil	—	1.07 (U)	—	—	—	0.536 (U)	—	—	—	—	NA	—
RE49-10-4068	49-609567	0.5–1.5	Soil	—	1.08 (U)	—	—	—	0.541 (U)	—	—	—	—	NA	—
RE49-10-4069	49-609568	0.0–0.5	Soil	—	1.18 (U)	—	—	—	0.589 (U)	—	—	—	—	NA	—
RE49-10-4070	49-609568	0.5–1.5	Soil	—	1.06 (U)	—	—	—	0.531 (U)	—	—	—	—	NA	—
RE49-10-4071	49-609569	0.0–0.5	Soil	—	1.09 (U)	—	—	—	0.546 (U)	—	—	—	—	NA	—
RE49-10-4072	49-609569	0.5–1.5	Soil	—	1.09 (U)	—	—	—	0.544 (U)	—	—	—	—	NA	—
RE49-10-4073	49-609570	0.0–0.5	Soil	—	1.26 (U)	—	—	—	0.628 (U)	—	—	—	—	NA	—

Table 8.3-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Cyanide (Total)	Lead
Qbt4 Background Value[a]				**7340**	**0.5**	**2.79**	**46**	**1.21**	**1.63**	**2200**	**7.14**	**3.14**	**4.66**	**0.5**	**11.2**
Soil Background Value[a]				**29,200**	**0.83**	**8.17**	**295**	**1.83**	**0.4**	**6120**	**19.3**	**8.64**	**14.7**	**0.5**	**22.3**
Residential SSL[b]				**7.81E+04**	**3.13E+01**	**3.90E+00**	**1.56E+04**	**1.56E+02**	**7.79E+01**	**na**[c]	**2.19E+02**[d]	**2.30E+01**[e]	**3.13E+03**	**1.56E+03**	**4.00E+02**
Industrial SSL[b]				**1.13E+06**	**4.54E+02**	**1.77E+01**	**2.24E+05**	**2.26E+03**	**1.12E+03**	**na**	**2.92E+03**[d]	**3.00E+02**[e]	**4.54E+04**	**2.27E+04**	**8.00E+02**
Construction Worker SSL[b]				**4.07E+04**	**1.24E+02**	**6.54E+01**	**4.35E+03**	**1.44E+02**	**3.09E+02**	**na**	**4.49E+02**[d]	**3.49E+01**[f]	**1.24E+04**	**6.19E+03**	**8.00E+02**
RE49-10-4074	49-609570	0.5–1.5	Soil	—	1.14 (U)	—	—	—	0.569 (U)	—	—	—	—	NA	—
RE49-10-4094	49-609578	0.5–1.5	Soil	—	0.977 (U)	—	—	—	—	—	—	—	—	NA	—
RE49-10-4138	49-609600	0.5–1.5	Soil	—	1.17 (U)	—	—	—	—	—	—	—	—	NA	—
RE49-10-5403	49-609986	0.0–1.0	Soil	—	—	—	—	—	—	—	—	—	—	0.59 (UJ)	—
RE49-10-5401	49-609986	4.0–5.0	Qbt4	8590	—	3.1	161 (J+)	—	—	2330	18.4	6.1 (J)	7.9	0.54 (UJ)	12.3
RE49-10-5402	49-609986	9.0–10.0	Qbt4	—	—	—	—	—	—	—	—	—	—	0.52 (UJ)	—
RE49-10-5404	49-609987	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	0.57 (UJ)	—
RE49-10-5406	49-609987	3.0–5.0	Qbt4	10,000	—	3.2	165 (J+)	—	—	2570	8.5	6.4 (J)	6.9	0.55 (UJ)	11.3
RE49-10-5413	49-609987	5.0–6.5	Qbt4	7720	—	—	87.2 (J+)	—	—	—	—	3.2 (J)	6.7	0.54 (UJ)	—
RE49-10-5411	49-609987	6.5–8.0	Qbt4	—	—	—	80.6 (J+)	—	—	—	7.9	—	5.7	0.53 (UJ)	—
RE49-10-5405	49-609987	8.0–10.0	Qbt4	—	—	—	78.9 (J+)	—	—	—	—	—	—	0.53 (UJ)	—
RE49-10-5409	49-609988	0.0–2.0	Soil	—	—	—	—	—	—	—	—	—	—	0.53 (UJ)	—
RE49-10-5407	49-609988	4.0–5.0	Qbt4	8860	—	2.9	118 (J+)	—	—	—	9.6	4.9 (J)	8.5	0.54 (U)	—
RE49-10-5408	49-609988	8.0–10.0	Qbt4	—	—	—	—	—	—	—	—	—	—	0.51 (UJ)	—
RE49-10-5414	49-609989	0.0–0.5	Soil	—	—	—	—	—	—	—	—	—	—	0.56 (UJ)	—
RE49-10-5410	49-609989	3.0–4.0	Soil	—	—	—	—	—	—	—	—	—	—	0.56 (UJ)	—
RE49-10-5412	49-609989	9.0–10.0	Qbt4	—	—	—	—	—	—	—	—	—	—	0.53 (UJ)	—

Table 8.3-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Magnesium	Manganese	Mercury	Nickel	Nitrate	Perchlorate	Potassium	Selenium	Thallium	Uranium	Vanadium	Zinc
Qbt4 Background Value[a]				**1690**	**482**	**0.1**	**6.58**	**na**	**na**	**3500**	**0.3**	**1.1**	**2.4**	**17**	**63.5**
Soil Background Value[a]				**4610**	**671**	**0.1**	**15.4**	**na**	**na**	**3460**	**1.52**	**0.73**	**1.82**	**39.6**	**48.8**
Residential SSL[b]				**na**[c]	**1.07E+04**	**2.30E+01**[e]	**1.56E+03**	**1.25E+05**	**5.48E+01**	**na**	**3.91E+02**	**5.16E+00**	**2.35E+02**	**3.91E+02**	**2.35E+04**
Industrial SSL[b]				**na**	**1.45E+05**	**3.10E+02**[e]	**2.27E+04**	**1.82E+06**	**7.95E+02**	**na**	**5.68E+03**	**7.49E+01**	**3.41E+03**	**5.68E+03**	**3.41E+05**
Construction Worker SSL[b]				**na**	**4.63E+02**	**9.29E+01**[f]	**6.19E+03**	**4.96E+05**	**2.17E+02**	**na**	**1.55E+03**	**2.04E+01**	**9.29E+02**	**1.55E+03**	**9.29E+04**
0549-95-0141	49-07512	0.0–0.5	Soil	—	—	0.11 (U)	—	NA	NA	—	—	1.4 (U)	2.51	—	—
0549-95-0140	49-07512	4.0–9.0	Qbt4	2530	—	—	9	NA	NA	—	0.81 (U)	1.4 (U)	—	—	—
0549-95-0143	49-07527	0.0–0.5	Soil	—	—	0.11 (U)	—	NA	NA	—	—	1.4 (U)	2.3	—	—
0549-95-0142	49-07527	7.3–10.0	Qbt4	3720	—	0.12 (U)	12.1	NA	NA	4090	0.88 (U)	1.5 (U)	4.09	—	—
RE49-10-4003	49-609540	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4004	49-609540	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4005	49-609541	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4006	49-609541	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4007	49-609542	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	85.4
RE49-10-4008	49-609542	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4009	49-609543	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4010	49-609543	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	296
RE49-10-4011	49-609544	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	112
RE49-10-4012	49-609544	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	446
RE49-10-4013	49-609545	0.0–0.5	Soil	—	—	0.348	—	NA	NA	—	—	—	NA	—	94.7
RE49-10-4014	49-609545	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4015	49-609546	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4016	49-609546	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4017	49-609547	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	73.5
RE49-10-4018	49-609547	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4023	49-609548	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4024	49-609548	0.5–1.5	Soil	—	899 (J-)	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4025	49-609549	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4026	49-609549	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4027	49-609550	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4028	49-609550	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4029	49-609551	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4030	49-609551	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4031	49-609552	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4032	49-609552	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4033	49-609553	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4034	49-609553	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4035	49-609554	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4036	49-609554	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—

Table 8.3-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Magnesium	Manganese	Mercury	Nickel	Nitrate	Perchlorate	Potassium	Selenium	Thallium	Uranium	Vanadium	Zinc
Qbt4 Background Value[a]				**1690**	**482**	**0.1**	**6.58**	**na**	**na**	**3500**	**0.3**	**1.1**	**2.4**	**17**	**63.5**
Soil Background Value[a]				**4610**	**671**	**0.1**	**15.4**	**na**	**na**	**3460**	**1.52**	**0.73**	**1.82**	**39.6**	**48.8**
Residential SSL[b]				**na**[c]	**1.07E+04**	**2.30E+01**[e]	**1.56E+03**	**1.25E+05**	**5.48E+01**	**na**	**3.91E+02**	**5.16E+00**	**2.35E+02**	**3.91E+02**	**2.35E+04**
Industrial SSL[b]				**na**	**1.45E+05**	**3.10E+02**[e]	**2.27E+04**	**1.82E+06**	**7.95E+02**	**na**	**5.68E+03**	**7.49E+01**	**3.41E+03**	**5.68E+03**	**3.41E+05**
Construction Worker SSL[b]				**na**	**4.63E+02**	**9.29E+01**[f]	**6.19E+03**	**4.96E+05**	**2.17E+02**	**na**	**1.55E+03**	**2.04E+01**	**9.29E+02**	**1.55E+03**	**9.29E+04**
RE49-10-4037	49-609555	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4038	49-609555	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4039	49-609556	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4040	49-609556	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4041	49-609557	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4042	49-609557	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4043	49-609558	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	61.9
RE49-10-4044	49-609558	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4045	49-609559	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4046	49-609559	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4047	49-609560	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4048	49-609560	0.5–1.5	Qbt4	—	—	—	7.39	NA	NA	—	1.01 (UJ)	—	NA	18	—
RE49-10-4055	49-609561	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4057	49-609562	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4059	49-609563	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4060	49-609563	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4061	49-609564	0.0–0.5	Fill	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4062	49-609564	0.5–1.5	Fill	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4063	49-609565	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4064	49-609565	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4065	49-609566	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4066	49-609566	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4067	49-609567	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4068	49-609567	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4069	49-609568	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4070	49-609568	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4071	49-609569	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4072	49-609569	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4073	49-609570	0.0–0.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4074	49-609570	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4094	49-609578	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-4138	49-609600	0.5–1.5	Soil	—	—	—	—	NA	NA	—	—	—	NA	—	—
RE49-10-5403	49-609986	0.0–1.0	Soil	—	—	—	—	0.9	—	—	—	—	NA	—	—
RE49-10-5401	49-609986	4.0–5.0	Qbt4	2050	—	—	8.5	0.095 (J)	—	—	0.91	—	NA	22	—

Table 8.3-2 (continued)

Sample ID	Location ID	Depth (ft)	Media	Magnesium	Manganese	Mercury	Nickel	Nitrate	Perchlorate	Potassium	Selenium	Thallium	Uranium	Vanadium	Zinc
Qbt4 Background Value[a]				**1690**	**482**	**0.1**	**6.58**	**na**	**na**	**3500**	**0.3**	**1.1**	**2.4**	**17**	**63.5**
Soil Background Value[a]				**4610**	**671**	**0.1**	**15.4**	**na**	**na**	**3460**	**1.52**	**0.73**	**1.82**	**39.6**	**48.8**
Residential SSL[b]				**na**[c]	**1.07E+04**	**2.30E+01**[e]	**1.56E+03**	**1.25E+05**	**5.48E+01**	**na**	**3.91E+02**	**5.16E+00**	**2.35E+02**	**3.91E+02**	**2.35E+04**
Industrial SSL[b]				**na**	**1.45E+05**	**3.10E+02**[e]	**2.27E+04**	**1.82E+06**	**7.95E+02**	**na**	**5.68E+03**	**7.49E+01**	**3.41E+03**	**5.68E+03**	**3.41E+05**
Construction Worker SSL[b]				**na**	**4.63E+02**	**9.29E+01**[f]	**6.19E+03**	**4.96E+05**	**2.17E+02**	**na**	**1.55E+03**	**2.04E+01**	**9.29E+02**	**1.55E+03**	**9.29E+04**
RE49-10-5402	49-609986	9.0–10.0	Qbt4	—	—	—	—	0.16 (J)	—	—	1.1	—	NA	—	—
RE49-10-5404	49-609987	0.0–0.5	Soil	—	—	—	—	0.13 (J)	—	—	—	—	NA	—	—
RE49-10-5406	49-609987	3.0–5.0	Qbt4	1780	—	—	9	0.35	—	—	0.97	—	NA	18.8	—
RE49-10-5413	49-609987	5.0–6.5	Qbt4	1910	—	—	7.6	0.14 (J)	—	—	1.2	—	NA	—	—
RE49-10-5411	49-609987	6.5–8.0	Qbt4	1920	—	—	7.8	0.12 (J)	—	—	1.3	—	NA	—	—
RE49-10-5405	49-609987	8.0–10.0	Qbt4	—	—	—	—	0.19 (J)	0.0037 (J)	—	1.3	—	NA	—	—
RE49-10-5409	49-609988	0.0–2.0	Soil	—	—	—	—	1.7	—	—	—	—	NA	—	—
RE49-10-5407	49-609988	4.0–5.0	Qbt4	2090	—	—	8.2	0.18 (J)	—	—	1	—	NA	22.6	—
RE49-10-5408	49-609988	8.0–10.0	Qbt4	—	—	—	—	0.17 (J)	—	—	1.3	—	NA	—	—
RE49-10-5414	49-609989	0.0–0.5	Soil	—	—	—	—	1.8	—	—	—	—	NA	—	—
RE49-10-5410	49-609989	3.0–4.0	Soil	—	—	—	—	0.9	—	—	—	—	NA	—	—
RE49-10-5412	49-609989	9.0–10.0	Qbt4	—	—	—	—	0.17 (J)	—	—	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 (2009, 108070) unless otherwise noted.

[c] na = Not available.

[d] SSL for hexavalent chromium.

[e] EPA regional screening level (http://www.epa.gov/region06/6pd/rcra_c/pd-n/screen.htm).

[f] Construction worker SSL calculated using toxicity value from EPA regional screening tables (http://www.epa.gov/region06/6pd/rcra_c/pd-n/screen.htm) and equation and parameters from NMED (2009, 108070).

[g] — = Not detected or not detected above BV.

[h] NA = Not analyzed.

Table 8.3-3
Summary of Organic Chemicals Detected at Area 10, SWMU 49-005(a)

Sample ID	Location ID	Depth (ft)	Media	Bis(2-ethylhexyl) phthalate	Butanone[2-]
Residential SSL[a]				**3.47E+02**	**3.96E+04**
Industrial SSL[a]				**1.37E+03**	**3.69E+05**
Construction Worker SSL[a]				**4.76E+03**	**1.48E+05**
RE49-10-5408	49-609988	8.0–10.0	Qbt4	0.046 (J)	—[b]
RE49-10-5414	49-609989	0.0–0.5	Soil	0.16 (J)	0.0018 (J)

Notes: All concentrations are in mg/kg. Data qualifiers are defined in Appendix A.

[a] SSLs from NMED (NMED 2009, 108070).

[b] — = Not detected.

Table 8.3-4
Summary of Radionuclides Detected or Detected above BVs/FVs at Area 10, SWMU 49-005(a)

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Cesium-137	Plutonium-238	Plutonium-239/240
Qbt4 Background Value[a]				**na**[b]	**na**	**na**	**na**
Soil Background Value[a]				**0.013**	**1.65**	**0.023**	**0.054**
Residential SAL[c]				**30**	**5.6**	**37**	**33**
Industrial SAL[c]				**180**	**23**	**240**	**210**
Construction Worker SAL[c]				**34**	**18**	**36**	**36**
0549-95-0141	49-07512	0.0–0.5	Soil	—[d]	—	0.032	0.083
0549-95-0142	49-07527	7.3–10.0	Qbt4	—	—	0.007	—
RE49-10-4012	49-609544	0.5–1.5	Soil	—	0.211	—	—
RE49-10-4016	49-609546	0.5–1.5	Soil	—	0.114	—	—
RE49-10-4018	49-609547	0.5–1.5	Soil	—	0.126	—	—
RE49-10-4030	49-609551	0.5–1.5	Soil	—	0.116	—	—
RE49-10-4032	49-609552	0.5–1.5	Soil	0.184	0.122	—	—
RE49-10-4038	49-609555	0.5–1.5	Soil	—	0.23	—	—
RE49-10-4040	49-609556	0.5–1.5	Soil	—	0.0772	—	—
RE49-10-4046	49-609559	0.5–1.5	Soil	—	—	—	0.116
RE49-10-4056	49-609561	0.5–1.5	Soil	—	0.076	—	—
RE49-10-4066	49-609566	0.5–1.5	Soil	—	0.167	—	—
RE49-10-4070	49-609568	0.5–1.5	Soil	—	0.115	—	—
RE49-10-4138	49-609600	0.5–1.5	Soil	—	0.146	—	—

Note: All activities are in pCi/g.
[a] BVs/FVs from LANL (1998, 059730).
[b] na = Not available.
[c] SALs from LANL (2009, 107655).
[d] — = Not detected or not detected above BV/FV.

Table 8.3-5
Summary of Pore-Gas Samples Collected and
Analyses Requested at Area 10, SWMU 49-005(a)

Sample ID	Location ID	Depth (ft)	Media	Tritium	VOCs
RE49-10-11860	49-609987	4.0–6.5	Pore gas	10-1579	10-1578

Note: The numbers in the analytical request columns are analytical request numbers.

Table 8.3-6
Summary of Organic Chemicals Detected in Pore-Gas Samples Collected at Area 10, SWMU 49-005(a)

Sample ID	Location ID	Depth (ft)	Media	Acetone	Benzene	Butanone[2-]	Chloromethane	Dichlorodifluoromethane	Ethylbenzene	Ethyltoluene[4-]	Styrent	Toluene	Trimethylbenzene[1,2,4-]	Trimethylbenzene[1,3,5-]	Xylene (Total)	Xylene[1,2-]	Xylene[1,3-]+Xylene[1,4-]
RE49-10-11860	49-609987	4.0–6.5	Pore gas	20	12	7.4	1.7	3.2	6.4	9	2.2	18	10	3.1	25	6.5	18

Note: All concentrations are in $\mu g/m^3$.

Table 8.3-7
Summary of Tritium in Pore-Gas Samples Collected at Area 10, SWMU 49-005(a)

Sample ID	Location ID	Depth (ft)	Media	Tritium
RE49-10-11860	49-609987	4.0–6.5	Pore gas	508.993

Note: All activities are in pCi/L.

Appendix A

Acronyms and Abbreviations,
Metric Conversion Table, and Data Qualifier Definitions

A-1.0 ACRONYMS AND ABBREVIATIONS

ALARA	as low as reasonably achievable
AK	acceptable knowledge
amsl	above mean sea level
AOC	area of concern
ATSDR	Agency for Toxic Substances and Disease Registry
AUF	area use factor
BCG	biota concentration guide
bgs	below ground surface
BV	background value
CCV	continuing calibration verification
COC	chain of custody
Consent Order	Compliance Order on Consent
COPC	chemical of potential concern
COPEC	chemical of potential ecological concern
CVAA	cold vapor atomic absorption
DAF	dilution attenuation factor
DL	detection limit
DOE	Department of Energy [U.S.]
DOT	Department of Transportation [U.S.]
dpm	disintegration(s) per minute
EDL	estimated detection limit
EP	Environmental Programs [Directorate]
EPA	Environmental Protection Agency [U.S.]
EPC	exposure point concentration
EQL	estimated quantitation limit
ESL	ecological screening levels
FV	fallout value
GC/MS	gas chromatography-mass spectrometry
GPS	global-positioning system
HDT	hazardous devices team
HE	high explosives
HI	hazard index

HIR	historical investigation report
HAS	hollow stem auger
HQ	hazard quotient
HR	home range
IA	Information Architecture (LANL project)
ICS	interference check sample
ICV	initial calibration verification
IDW	investigation-derived waste
KPA	kinetic phosphorescence
LAL	lower acceptance limit
LANL	Los Alamos National Laboratory
LCS	laboratory control sample
LLW	low-level waste
LOAEL	lowest observed adverse effect levels
MCL	maximum contaminant level [EPA]
MDA	material disposal area
MDC	minimum detectable concentration
MDL	method detection limit
mrem	millirem
MS	matrix spike
MSW	municipal solid waste
NES	nuclear environmental site
NFA	no further action
NMED	New Mexico Environment Department
NMSA	New Mexico Statutes Annotated
NMWQCC	New Mexico Water Quality Control Commission
NOAEL	no observed adverse effect levels
PAUF	population area use factor
PCB	polychlorinated biphenyl
PID	photoionization detector
PPE	personal protective equipment
PQL	practical quantitation limit
PRG	preliminary remediation goal
QA	quality assurance

QC	quality control
QP	quality procedure
RCRA	Resource Conservation and Recovery Act
RCT	radiation control technician
RfD	reference doses
RFI	RCRA facility investigation
RL	reporting limit
RPD	relative percent difference
RPF	Records Processing Facility
RRF	relative retention factor
RT	retention time
SAL	screening action level
SCL	sample collection log
SF	slope factor
SL	screening level
SMO	Sample Management Office
SOP	standard operating procedure
SOW	statement of work
SSL	soil screening level
SV	screening value
SVOC	semivolatile organic compound
SWMU	solid waste management unit
TA	technical area
TAL	target analyte list [EPA]
TD	total depth
T&E	threatened and endangered
TPMC	TerranearPMC, Inc.
TRV	toxicity reference value
UAL	upper acceptance limit
UCL	upper concentration limit
UTL	upper tolerance limit
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 Los Alamos National Laboratory (LANL or the Laboratory) Environmental Programs Directorate standard operating procedures (SOPs) and quality procedures (QPs) (http://www.lanl.gov/environment/all/qa/adep.shtml).

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 health- and safety-based field-screening results are presented in tables throughout the text. Gross-alpha and –beta radiological screening results that guided selection of surface and shallow-subsurface samples for laboratory analysis are presented in Tables D-1 through D-10 in Appendix D.

B-3.1 Field Screening for Radioactivity

Core, surface, and shallow-subsurface samples were screened for gross-alpha and -beta radiation. Screening was conducted by a LANL radiation 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 TPMC 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 on sample collection logs (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-electron-volt (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 in tables presented throughout the investigation report.

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 and percent carbon dioxide 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. Field 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 E600 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 E600 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, the requirements of QP-5.2, 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, tuff, and subsurface pore-gas samples. The samples were collected according to the approved investigation work plan(LANL 2008, 102215).

B-5.1 Surface and Shallow-Subsurface Soil-Sampling Methods

Surface and shallow-subsurface samples were collected 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) and American Radiation Services (ARS).

Samples were labeled, documented, and sealed with custody seals before 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, 11 boreholes were drilled to depths ranging from 10 to 65 ft below ground surface (bgs). A Construction Mine Equipment (CME) 85 hollow-stem auger (HSA) 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 work plan (LANL 2008, 102215) 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.

Samples were submitted for laboratory analysis of the following analytical suites: explosive compounds, perchlorate, nitrate, target analyte list metals, cyanide, americium-241, isotopic plutonium, isotopic uranium, volatile organic compounds (VOCs), semivolatile organic compounds, and gross-alpha, -beta, and -gamma radiation. Samples for VOC analysis were collected immediately to minimize the loss of subsurface VOCs during the sample-collection process.

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. All 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 for analysis of 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 percent oxygen and percent carbon dioxide 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 that 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 soils and tuff were collected in accordance with SOP-5059, Field Quality Control Samples. Field duplicate samples were collected at a frequency of at least one duplicate sample for every ten samples. Field rinsate samples were collected from sampling equipment at a frequency of at least one rinsate sample for every ten samples. Field trip blanks also were collected at a frequency of one per ten samples, if applicable.

B-5.7 Sample Documentation and Handling

Field personnel completed a sample-collection log and chain-of-custody (COC) form for each sample set. Sample containers were sealed with COC seals and placed in coolers at approximately 4°C. Samples were packaged with preservatives, 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

Per the approved work plan, borehole abandonment is currently on hold until approval from the New Mexico Environment Department is obtained. Upon approval, all boreholes will be 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 borehole and 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 SURVEYING

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 (DGPS). 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.

B-7.0 INVESTIGATION-DERIVED-WASTE STORAGE AND DISPOSAL

Management of investigation-derived waste is described in Appendix E. All drill cuttings were stored in less-than-90-day hazardous-waste storage areas and sampled within 10 days. Currently, all drill-cutting waste has been downgraded to nonhazardous and is pending land application. Contact waste from sediment samples is stored in two separate less-than-90-day hazardous-waste storage areas and is pending downgrading based on due diligence. All waste is anticipated to be nonhazardous and either land applied or disposed of at an appropriate off-site facility.

B-8.0 REFERENCES

The following list includes all documents cited in this appendix. Parenthetical information following each reference provides the author(s), publication date, and ER ID. This information is also included in text citations. ER IDs are assigned by the Environmental Programs Directorate's Records Processing Facility (RPF) and are used to locate the document at the RPF and, where applicable, in the master reference set.

Copies of the master reference set are maintained at the NMED Hazardous Waste Bureau and the Directorate. The set was developed to ensure that the administrative authority has all material needed to review this document, and it is updated with every document submitted to the administrative authority. Documents previously submitted to the administrative authority are not included.

LANL (Los Alamos National Laboratory), January 2008. "Investigation Work Plan for Sites at Technical Area 49 Outside the Nuclear Environmental Site Boundary, Revision 1," Los Alamos National Laboratory document LA-UR-08-0449, Los Alamos, New Mexico. (LANL 2008, 102215)

Table B-1.0-1
Brief 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 may in some cases be used for collecting 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. For the 2009–2010 investigation, when the desired depth was reached, the auger was decontaminated before advancing the hole through the sample depth. The sample material was transferred from the auger bucket to a stainless-steel sampling bowl before filling the various required sample containers.
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 and extracts a continuous length of soil and/or rock to be examined as a unit. The split-spoon core barrel is a cylindrical barrel split lengthwise so that 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 VOCs 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 sample collection logs, COC forms, and sample container labels. Collection logs 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 Sample Collection	Field quality-control samples were collected as directed in the Compliance Order on Consent and SOP-5059 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 that include the collection of 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 hr, the backfilled level was checked for settlement and additional concrete/grout 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 being placed in insulated containers with ice to maintain a temperature of 4°C. Other requirements, such as 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 (IA) 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 Plain Coordinate System 1983, NM Central, U.S. ft coordinates. All elevation data were reported relative to the National Geodetic Vertical Datum of 1983.
Management of Environmental Restoration Project Waste, Waste Characterization	Investigation-derived waste (IDW) was managed, characterized, and stored in accordance with an approved waste characterization strategy form that documents site history, field activities, and the characterization approach for each waste stream managed. Waste characterization was adequate to comply with on-site 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

Table C-1
Surveyed Coordinates for 2009 Locations at Area 5, AOC 49-005(b)

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
Area 5 Drilling			
49-005(b)	49-610488	1625152.321	1754724.079

Table C-2
Surveyed Coordinates for 2009 Locations at Area 5, SWMU 49-006

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
Area 5 Drilling			
49-006	49-610486	1625151.305	1754899.823
49-006	49-610487	1625159.566	1754883.073

Table C-3
Surveyed Coordinates for 2009 Locations at Area 5, AOC 49-008(a)

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
Area 5 Surface and Shallow Subsurface			
49-008 (a)	49-609417	1624931.723	1754887.493
49-008 (a)	49-609418	1624920.559	1754905.013
49-008 (a)	49-609419	1624934.3	1754918.582
49-008 (a)	49-609420	1624945.636	1754902.265
49-008 (a)	49-609421	1625235.056	1754962.641
49-008 (a)	49-609422	1625248.212	1754947.812
49-008 (a)	49-609423	1625248.44	1754977.014
49-008 (a)	49-609424	1625260.912	1754962.641

Table C-4
Surveyed Coordinates for 2009 Locations at Area 6, SWMU 49-004

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
Area 6 Drilling			
49-004	49-609882	1622287.472	1756661.486
49-004	49-609883	1622354.581	1756813.742
49-004	49-609884	1622318.736	1756732.418
49-004	49-609885	1622386.778	1756886.791
Area 6 Surface and Shallow Subsurface			
49-004	49-608961	1622273.551	1756607.425
49-004	49-608962	1622283.93	1756630.129
49-004	49-608963	1622294.633	1756652.735
49-004	49-608964	1622305.66	1756675.114
49-004	49-608965	1622316.104	1756697.656
49-004	49-608966	1622337.51	1756743.063
49-004	49-608967	1622358.592	1756788.794
49-004	49-608968	1622390.701	1756856.191
49-004	49-608969	1622401.015	1756879.121
49-004	49-608970	1622411.718	1756901.5
49-004	49-608971	1622410.421	1756956.897
49-004	49-608972	1622388.041	1756967.924
49-004	49-608973	1622365.338	1756977.979
49-004	49-608974	1622398.615	1756990.239
49-004	49-608975	1622375.911	1757000.942
49-004	49-608976	1622353.208	1757011.645
49-004	49-608977	1622389.014	1756912.204
49-004	49-608978	1622378.636	1756889.5
49-004	49-608979	1622357.294	1756844.19
49-004	49-608980	1622346.591	1756821.552
49-004	49-608981	1622336.213	1756799.173
49-004	49-608982	1622314.806	1756754.09
49-004	49-608983	1622304.103	1756731.386
49-004	49-608984	1622282.632	1756685.817
49-004	49-608985	1622271.929	1756663.114
49-004	49-608986	1622297.552	1756540.612
49-004	49-608987	1622318.634	1756586.019
49-004	49-608988	1622350.743	1756654.032
49-004	49-608989	1622393.296	1756744.36
49-004	49-608990	1622436.108	1756835.109
49-004	49-608991	1622478.207	1756925.761
49-004	49-608992	1622349.186	1756709.656

Table C-4 (continued)

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
Area 6 Surface and Shallow Subsurface (continued)			
49-004	49-608993	1622391.998	1756800.47
49-004	49-608994	1622252.145	1756562.018
49-004	49-608995	1622348.213	1756765.766
49-004	49-608996	1622465.104	1757014.24
49-004	49-608997	1622261.551	1756640.41
49-004	49-608998	1622367.997	1756866.894
49-004	49-608999	1622420.021	1757035.321
49-004	49-609000	1622206.738	1756583.425
49-004	49-609001	1622205.44	1756639.437
49-004	49-609002	1622248.318	1756729.765
49-004	49-609003	1622290.806	1756820.579
49-004	49-609004	1622308.904	1756976.746
49-004	49-609005	1622351.91	1757067.106
49-004	49-609006	1622307.801	1757032.727
49-004	49-609007	1622377.014	1756945.286
49-004	49-609008	1622333.229	1756911.231
49-004	49-609009	1622353.337	1756541.91
49-004	49-609010	1622396.15	1756632.724
49-004	49-609011	1622438.703	1756723.278
49-004	49-609012	1622480.542	1756813.703
49-004	49-609013	1622545.539	1756948.724
49-004	49-609014	1622253.766	1756505.908
49-004	49-609015	1622150.952	1756582.03
49-004	49-609016	1622266.48	1756887.003
49-004	49-609017	1622223.668	1756796.254
49-004	49-609018	1622181.44	1756705.926
49-004	49-609019	1622294.179	1757121.854
49-004	49-609020	1622230.739	1756986.152
49-004	49-609021	1622418.399	1757091.367
49-004	49-609022	1622521.214	1757015.472
49-004	49-609023	1622308.255	1756563.316
49-004	49-609024	1622329.661	1756608.398
49-004	49-609025	1622340.04	1756631.426
49-004	49-609026	1622361.186	1756676.574
49-004	49-609027	1622372.214	1756699.277
49-004	49-609028	1622382.593	1756721.656
49-004	49-609029	1622403.999	1756767.388
49-004	49-609030	1622414.377	1756789.443

Table C-4 (continued)

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
Area 6 Surface and Shallow Subsurface (continued)			
49-004	49-609031	1622425.405	1756812.406
49-004	49-609032	1622446.422	1756857.391
49-004	49-609033	1622457.125	1756880.094
49-004	49-609034	1622467.828	1756902.798
49-004	49-609035	1622274.848	1756551.64
49-004	49-609036	1622285.551	1756574.019
49-004	49-609037	1622296.254	1756596.722
49-004	49-609038	1622306.957	1756619.426
49-004	49-609039	1622317.661	1756641.708
49-004	49-609040	1622328.039	1756664.411
49-004	49-609041	1622338.807	1756687.277
49-004	49-609042	1622359.889	1756732.359
49-004	49-609043	1622370.592	1756755.063
49-004	49-609044	1622381.295	1756777.766
49-004	49-609045	1622402.701	1756822.784
49-004	49-609046	1622413.404	1756845.488
49-004	49-609047	1622423.718	1756868.094
49-004	49-609048	1622434.421	1756891.122
49-004	49-609049	1622445.449	1756913.501
49-004	49-609050	1622455.828	1756936.14
49-004	49-609051	1622466.401	1756958.129
49-004	49-609052	1622477.104	1756980.833
49-004	49-609053	1622263.172	1756584.722
49-004	49-609054	1622326.807	1756720.359
49-004	49-609055	1622369.295	1756811.173
49-004	49-609056	1622379.998	1756833.812
49-004	49-609057	1622422.421	1756924.528
49-004	49-609058	1622433.124	1756946.518
49-004	49-609059	1622443.697	1756968.508
49-004	49-609060	1622454.4	1756991.212
49-004	49-609061	1622229.441	1756572.722
49-004	49-609062	1622240.144	1756595.425
49-004	49-609063	1622250.847	1756618.129
49-004	49-609064	1622293.4	1756708.683
49-004	49-609065	1622325.185	1756776.469
49-004	49-609066	1622399.717	1756934.583
49-004	49-609067	1622420.994	1756979.536
49-004	49-609068	1622431.697	1757001.915

Table C-4 (continued)

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
Area 6 Surface and Shallow Subsurface (continued)			
49-004	49-609069	1622442.4	1757024.618
49-004	49-609070	1622217.765	1756606.128
49-004	49-609071	1622228.144	1756628.507
49-004	49-609072	1622238.847	1756651.113
49-004	49-609073	1622249.55	1756673.817
49-004	49-609074	1622260.253	1756696.52
49-004	49-609075	1622271.021	1756719.062
49-004	49-609076	1622281.4	1756741.765
49-004	49-609077	1622292.103	1756764.144
49-004	49-609078	1622302.806	1756786.848
49-004	49-609079	1622313.509	1756809.876
49-004	49-609080	1622323.888	1756832.255
49-004	49-609081	1622334.915	1756854.893
49-004	49-609082	1622345.294	1756877.597
49-004	49-609083	1622355.932	1756900.203
49-004	49-609084	1622366.635	1756922.907
49-004	49-609085	1622408.993	1757012.618
49-004	49-609086	1622216.468	1756661.817
49-004	49-609087	1622226.847	1756684.52
49-004	49-609088	1622237.55	1756706.899
49-004	49-609089	1622258.696	1756752.144
49-004	49-609090	1622269.399	1756775.172
49-004	49-609091	1622280.103	1756797.875
49-004	49-609092	1622301.184	1756842.958
49-004	49-609093	1622311.887	1756865.597
49-004	49-609094	1622322.59	1756888.3
49-004	49-609095	1622343.932	1756933.61
49-004	49-609096	1622354.635	1756955.34
49-004	49-609097	1622386.29	1757023.321
49-004	49-609098	1622396.993	1757046.024
49-004	49-609099	1622321.228	1756944.637
49-004	49-609100	1622331.931	1756966.043
49-004	49-609101	1622342.31	1756988.682
49-004	49-609102	1622363.586	1757034.024
49-004	49-609103	1622373.965	1757056.727
49-004	49-609104	1622298.525	1756954.043
49-004	49-609105	1622330.504	1757022.024
49-004	49-609106	1622319.607	1756999.385

Table C-4 (continued)

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
Area 6 Surface and Shallow Subsurface (continued)			
49-004	49-609107	1622341.207	1757044.403
49-004	49-609108	1622286.524	1756987.385
49-004	49-609109	1622297.227	1757010.088
49-004	49-609110	1622318.504	1757055.43
49-004	49-609111	1622329.207	1757078.134
49-004	49-609112	1622332.256	1756496.827
49-004	49-609113	1622374.744	1756587.641
49-004	49-609114	1622417.296	1756677.871
49-004	49-609115	1622459.784	1756768.685
49-004	49-609116	1622502.207	1756859.013
49-004	49-609117	1622523.614	1756904.679
49-004	49-609118	1622298.849	1756484.827
49-004	49-609119	1622320.58	1756530.234
49-004	49-609120	1622341.337	1756575.641
49-004	49-609121	1622362.743	1756621.048
49-004	49-609122	1622383.89	1756665.871
49-004	49-609123	1622405.296	1756711.278
49-004	49-609124	1622426.378	1756756.685
49-004	49-609125	1622447.784	1756801.702
49-004	49-609126	1622468.801	1756847.336
49-004	49-609127	1622490.207	1756892.095
49-004	49-609128	1622511.483	1756937.696
49-004	49-609129	1622532.89	1756982.455
49-004	49-609130	1622286.849	1756518.233
49-004	49-609131	1622241.766	1756539.639
49-004	49-609132	1622463.482	1757069.96
49-004	49-609133	1622508.889	1757048.879
49-004	49-609134	1622499.807	1756970.454
49-004	49-609135	1622487.807	1757002.888
49-004	49-609136	1622475.482	1757036.554
49-004	49-609137	1622208.359	1756527.315
49-004	49-609138	1622196.359	1756560.721
49-004	49-609139	1622430.4	1757057.96
49-004	49-609140	1622184.359	1756594.128
49-004	49-609141	1622162.953	1756548.721
49-004	49-609142	1622172.358	1756627.21
49-004	49-609143	1622193.764	1756672.52
49-004	49-609144	1622214.587	1756717.764

Table C-4 (continued)

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
Area 6 Surface and Shallow Subsurface (continued)			
49-004	49-609145	1622236.317	1756762.847
49-004	49-609146	1622257.399	1756808.254
49-004	49-609147	1622278.481	1756853.596
49-004	49-609148	1622299.887	1756899.003
49-004	49-609149	1622385.317	1757079.042
49-004	49-609150	1622138.952	1756615.534
49-004	49-609151	1622160.033	1756660.519
49-004	49-609152	1622202.586	1756751.171
49-004	49-609153	1622245.399	1756841.661
49-004	49-609154	1622287.497	1756932.312
49-004	49-609155	1622372.992	1757112.773
49-004	49-609156	1622254.415	1756920.312
49-004	49-609157	1622276.146	1756964.746
49-004	49-609158	1622339.586	1757100.772
49-004	49-609159	1622242.739	1756952.421
49-004	49-609160	1622263.821	1756998.088
49-004	49-609161	1622285.097	1757043.105
49-004	49-609162	1622306.503	1757088.512
49-004	49-609163	1622327.585	1757134.179
49-004	49-609164	1622252.145	1757031.494
49-004	49-609165	1622273.097	1757076.836

Table C-5
Surveyed Coordinates for 2009 Locations
at Area 10, AOC 49-002 and SWMU 49-005(a)

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
Area 10 Drilling			
49-005(a)	49-609986	1627042.921	1755376.95
49-005(a)	49-609987	1626971.578	1755377.105
49-005(a)	49-609988	1627007.714	1755398.796
49-005(a)	49-609989	1627007.624	1755354.111
Area 10 Surface and Shallow Subsurface			
49-005(a)/49-002	49-609540	1626996.735	1755377.155
49-005(a)/49-002	49-609541	1627021.891	1755377.205
49-005(a)/49-002	49-609542	1626845.847	1755351.7
49-005(a)/49-002	49-609543	1626896.159	1755351.8
49-005(a)/49-002	49-609544	1626921.316	1755351.849
49-005(a)/49-002	49-609545	1626946.472	1755351.899
49-005(a)/49-002	49-609546	1626871.053	1755326.594
49-005(a)/49-002	49-609547	1626946.522	1755326.743
49-005(a)/49-002	49-609548	1626996.635	1755427.468
49-005(a)/49-002	49-609549	1627072.104	1755427.617
49-005(a)/49-002	49-609550	1626795.435	1755401.913
49-005(a)/49-002	49-609551	1626870.904	1755402.063
49-005(a)/49-002	49-609552	1626946.373	1755402.212
49-005(a)/49-002	49-609553	1626971.628	1755351.949
49-005(a)/49-002	49-609554	1627072.254	1755352.148
49-005(a)/49-002	49-609555	1626795.584	1755326.444
49-005(a)/49-002	49-609556	1626896.209	1755326.643
49-005(a)/49-002	49-609557	1627021.991	1755326.892
49-005(a)/49-002	49-609558	1626820.84	1755276.182
49-005(a)/49-002	49-609559	1626896.309	1755276.331
49-005(a)/49-002	49-609560	1626971.777	1755276.48
49-005(a)/49-002	49-609561	1627021.692	1755477.83
49-005(a)/49-002	49-609562	1626745.023	1755452.127
49-005(a)/49-002	49-609563	1626971.877	1755226.167
49-005(a)/49-002	49-609564	1626895.96	1755452.425
49-005(a)/49-002	49-609565	1627122.417	1755427.716
49-005(a)/49-002	49-609566	1626745.222	1755351.501
49-005(a)/49-002	49-609567	1627122.616	1755327.091
49-005(a)/49-002	49-609568	1626770.527	1755276.082
49-005(a)/49-002	49-609569	1627047.296	1755251.473
49-005(a)/49-002	49-609570	1626871.252	1755225.968

Table C-5 (continued)

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
Area 10 Surface and Shallow Subsurface (continued)			
49-005(a)/49-002	49-609571	1626946.323	1755427.368
49-005(a)/49-002	49-609572	1626971.479	1755427.418
49-005(a)/49-002	49-609573	1627021.792	1755427.517
49-005(a)/49-002	49-609574	1627046.948	1755427.567
49-005(a)/49-002	49-609575	1626820.591	1755401.963
49-005(a)/49-002	49-609576	1626845.747	1755402.013
49-005(a)/49-002	49-609577	1626896.06	1755402.112
49-005(a)/49-002	49-609578	1626921.216	1755402.162
49-005(a)/49-002	49-609579	1626971.529	1755402.262
49-005(a)/49-002	49-609580	1626996.685	1755402.311
49-005(a)/49-002	49-609581	1627021.841	1755402.361
49-005(a)/49-002	49-609582	1627046.998	1755402.411
49-005(a)/49-002	49-609583	1627072.154	1755402.46
49-005(a)/49-002	49-609584	1626795.484	1755376.757
49-005(a)/49-002	49-609585	1626820.641	1755376.807
49-005(a)/49-002	49-609586	1626845.797	1755376.857
49-005(a)/49-002	49-609587	1626870.953	1755376.906
49-005(a)/49-002	49-609588	1626896.11	1755376.956
49-005(a)/49-002	49-609589	1626921.266	1755377.006
49-005(a)/49-002	49-609590	1626946.422	1755377.055
49-005(a)/49-002	49-609591	1626971.579	1755377.105
49-005(a)/49-002	49-609592	1627047.047	1755377.254
49-005(a)/49-002	49-609593	1627072.204	1755377.304
49-005(a)/49-002	49-609594	1626795.534	1755351.601
49-005(a)/49-002	49-609595	1626820.69	1755351.651
49-005(a)/49-002	49-609596	1626871.003	1755351.75
49-005(a)/49-002	49-609597	1626996.785	1755351.999
49-005(a)/49-002	49-609598	1627021.941	1755352.048
49-005(a)/49-002	49-609599	1627047.097	1755352.098
49-005(a)/49-002	49-609600	1626820.74	1755326.494
49-005(a)/49-002	49-609601	1626845.896	1755326.544
49-005(a)/49-002	49-609602	1626921.365	1755326.693
49-005(a)/49-002	49-609603	1626971.678	1755326.793
49-005(a)/49-002	49-609604	1626996.834	1755326.842
49-005(a)/49-002	49-609605	1627047.147	1755326.942
49-005(a)/49-002	49-609606	1627072.303	1755326.992
49-005(a)/49-002	49-609607	1626795.634	1755301.288
49-005(a)/49-002	49-609608	1626820.79	1755301.338

Table C-5 (continued)

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
Area 10 Surface and Shallow Subsurface (continued)			
49-005(a)/49-002	49-609609	1626845.946	1755301.388
49-005(a)/49-002	49-609610	1626871.103	1755301.437
49-005(a)/49-002	49-609611	1626896.259	1755301.487
49-005(a)/49-002	49-609612	1626921.415	1755301.537
49-005(a)/49-002	49-609613	1626946.571	1755301.587
49-005(a)/49-002	49-609614	1626971.728	1755301.636
49-005(a)/49-002	49-609615	1626996.884	1755301.686
49-005(a)/49-002	49-609616	1626845.996	1755276.231
49-005(a)/49-002	49-609617	1626871.152	1755276.281
49-005(a)/49-002	49-609618	1626921.465	1755276.381
49-005(a)/49-002	49-609619	1626946.621	1755276.43
49-005(a)/49-002	49-609620	1626996.934	1755276.53
49-005(a)/49-002	49-609621	1626921.067	1755477.631
49-005(a)/49-002	49-609622	1626971.38	1755477.73
49-005(a)/49-002	49-609623	1627072.005	1755477.929
49-005(a)/49-002	49-609624	1627122.317	1755478.029
49-005(a)/49-002	49-609625	1626845.648	1755452.325
49-005(a)/49-002	49-609626	1626946.273	1755452.524
49-005(a)/49-002	49-609627	1626996.586	1755452.624
49-005(a)/49-002	49-609628	1627046.898	1755452.723
49-005(a)/49-002	49-609629	1627097.211	1755452.823
49-005(a)/49-002	49-609630	1626795.335	1755452.226
49-005(a)/49-002	49-609631	1626770.229	1755427.02
49-005(a)/49-002	49-609632	1626820.541	1755427.119
49-005(a)/49-002	49-609633	1626870.854	1755427.219
49-005(a)/49-002	49-609634	1626921.166	1755427.318
49-005(a)/49-002	49-609635	1626745.122	1755401.814
49-005(a)/49-002	49-609636	1626770.328	1755376.707
49-005(a)/49-002	49-609637	1626770.428	1755326.395
49-005(a)/49-002	49-609638	1626745.321	1755301.189
49-005(a)/49-002	49-609639	1627047.197	1755301.785
49-005(a)/49-002	49-609640	1627097.509	1755301.885
49-005(a)/49-002	49-609641	1627097.41	1755352.198
49-005(a)/49-002	49-609642	1627122.516	1755377.404
49-005(a)/49-002	49-609643	1627097.31	1755402.51
49-005(a)/49-002	49-609644	1627022.09	1755276.579
49-005(a)/49-002	49-609645	1627072.403	1755276.679
49-005(a)/49-002	49-609646	1627122.715	1755276.778

Table C-5 (continued)

SWMU or AOC	Location ID	Easting (ft)	Northing (ft)
Area 10 Surface and Shallow Subsurface (continued)			
49-005(a)/49-002	49-609647	1626745.42	1755250.876
49-005(a)/49-002	49-609648	1626795.733	1755250.976
49-005(a)/49-002	49-609649	1626846.046	1755251.075
49-005(a)/49-002	49-609650	1626896.358	1755251.174
49-005(a)/49-002	49-609651	1626946.671	1755251.274
49-005(a)/49-002	49-609652	1626996.984	1755251.373
49-005(a)/49-002	49-609653	1626770.626	1755225.77
49-005(a)/49-002	49-609654	1626820.939	1755225.869
49-005(a)/49-002	49-609655	1626921.564	1755226.068
49-005(a)/49-002	49-609656	1627022.19	1755226.267

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 outside 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, 102215) and standard operating procedure (SOP) 5238, Characterization and Management of Environmental Program Waste. SOP-5238 incorporates the requirements of 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 signed WCSF is included in this appendix as Attachment E-1 (on CD). Waste has not yet been dispositioned, so waste profile forms and manifests are not available.

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 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 will be land applied if they meet the criteria of the NMED-approved Notice of Intent decision tree, Land Application of IDW Solids from Construction of Wells and Boreholes, and the LANL radiological decision tree. Cuttings that cannot be land applied are expected to be low-level waste (LLW) or industrial waste that will be disposed of at an authorized off-site disposal facility.
- 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 are expected to be LLW or Green-is-Clean wastes.

- 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 list includes all documents cited in this appendix. Parenthetical information following each reference provides the author(s), publication date, and ER ID. This information is also included in text citations. ER IDs are assigned by the Environmental Programs Directorate's Records Processing Facility (RPF) and are used to locate the document at the RPF and, where applicable, in the master reference set.

Copies of the master reference set are maintained at the NMED Hazardous Waste Bureau and the Directorate. The set was developed to ensure that the administrative authority has all material needed to review this document, and it is updated with every document submitted to the administrative authority. Documents previously submitted to the administrative authority are not included.

LANL (Los Alamos National Laboratory), January 2008. "Investigation Work Plan for Sites at Technical Area 49 Outside the Nuclear Environmental Site Boundary, Revision 1," Los Alamos National Laboratory document LA-UR-08-0449, Los Alamos, New Mexico. (LANL 2008, 102215)

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 or authorized off-site disposal facility
Contact Waste	LLW, Green is Clean	<2 yd^3	AK and analytical results of site investigation samples	30- or 55-gal. drums	Authorized off-site disposal facility
Municipal Solid Waste	MSW	<2 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) 49-006, 49-004, and 49-005(a); and Areas of Concern (AOCs) 49-005(b), 49-008(a), 49-008(b) and 49-002] outside 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, 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, available at http://www.lanl.gov/environment/all/qa/adep.shtml, 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 outside the NES boundary consisted of Areas 5, 6 West, and 10. For purposes of analytical data presentation and review, the TA-49 outside NES boundary analytical data are included in Appendix G (on DVD) as six separate databases corresponding to the three main areas investigated: Area 5: AOC 49-005(b), SWMU 49-006, and AOC 49-008(a); Area 6 West: SWMU 49-004; and Area 10: AOC 49-002 and SWMU 49-005(a).

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 5

At AOC 49-005(b), a total of nine samples (6 soil/fill and 3 tuff), plus two field duplicates, were collected during historical and 2009 investigations. All of the samples were analyzed for target analyte list (TAL) metals; five samples were also analyzed for cyanide, nitrate, and perchlorate. Two samples were analyzed for uranium only.

At SWMU 49-006, a total of 17 samples (3 soil and 14 tuff), plus two field duplicates, were collected during historical and 2009 investigations. All 17 samples were analyzed for TAL metals; 16 samples were analyzed for cyanide, nitrate, and perchlorate. One sample was analyzed for TAL metals only.

At AOC 49-008(a), no samples were collected for analysis of inorganic chemicals.

Area 6 West

At SWMU 49-004, a total of 164 samples (152 soil/fill and 12 tuff), plus 14 field duplicates, were collected during historical and 2009 investigations. All samples were analyzed for TAL metals; 17 samples were analyzed for uranium; and 12 samples were analyzed for cyanide, nitrate, and perchlorate.

Area 10

At AOC 49-002, a total of 71 samples (70 soil/fill and 1 tuff), plus 8 field duplicates, were collected in 1995 and 2009 investigations. All samples were analyzed for TAL metals only.

At SWMU 49-005(a), a total of 82 samples (70 soil/fill and 12 tuff), plus 8 field duplicates, were collected from historical investigations as well as from 2009 investigations. All samples were analyzed for TAL metals; 14 samples were analyzed for cyanide, nitrate, and perchlorate. Two samples were analyzed for uranium only.

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 outside 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 briefly 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 in soil/tuff, 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 datasets are summarized in the following sections.

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 or were not qualified. These data do not have any quality issues associated with the values presented.

F-3.2.1 Chain of Custody

Sample collection log/chain of custody forms (SCL/COCs) were maintained properly for all samples analyzed for inorganic chemicals (Appendix G on DVD).

F-3.2.2 Sample Documentation

All samples analyzed for inorganic chemicals were properly documented on SCL/COCs 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

Holding-time criteria were met for all samples analyzed for inorganic chemicals.

F-3.2.6 Initial and Continuing Calibration Verifications

F-3.2.6.1 Area 5 and Area 10

Initial and continuing calibration verification criteria were met for all samples analyzed for inorganic chemicals.

F-3.2.6.2 Area 6 West

One TAL metal result was qualified as estimated (J) because the ICV and/or CCV were recovered outside the method-specific limits.

F-3.2.7 Interference Check Sample and/or Serial Dilutions

Interference check sample and serial dilution criteria were met for all samples analyzed for inorganic chemicals.

F-3.2.8 Laboratory Duplicate Samples

F-3.2.8.1 Area 5

A total of 20 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 reporting limit (RL), and the duplicate RPD was greater than 35% for soil samples.

F-3.2.8.2 Area 6 West

A total of 129 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 10

A total of 28 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 Blanks

F-3.2.9.1 Area 5

A total of seven TAL metal results were qualified as not detected (U). The sample results were less than or equal to 5 times the concentration of the related analytes in the method blank.

A total of 18 TAL metal results were qualified as not detected (U). The sample results were less than or equal to 5 times the concentration of the related analytes in initial calibration blank and or continuing calibration blank.

F-3.2.9.2 Area 6 West

A total of 55 TAL metals results were qualified as not detected (U). The sample results were less than or equal to 5 times the concentration of the related analytes in the method blank.

A total of 38 TAL metals results were qualified as not detected (U). The sample results were less than or equal to 5 times the concentration of the related analytes in initial calibration blank and or continuing calibration blank.

A total of eight TAL metals results were qualified as not detected (U). The sample results were less than or equal to 5 times the concentration of the related analyte in the equipment or rinsate blank.

A total of 27 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 10

A total of 14 TAL metals results were qualified as not detected (U). The sample results were less than or equal to 5 times the concentration of the related analytes in the method blank.

A total of 68 metals results were qualified as not detected (U). The sample results were less than or equal to 5 times the concentration of the related analytes in initial calibration blank and/or continuing calibration blank.

A total of 14 TAL metals results were qualified as not detected (U).The sample results were less than or equal to 5 times the concentration of the related analytes in the method blank.

A total of 48 TAL metals results were qualified as not detected (U). The sample results were less than or equal to 5 times the concentration of the related analyte in the equipment or rinsate blank.

A total of 28 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-3.2.10 MS Samples

F-3.2.10.1 Area 5

A total of seven TAL metals results were qualified as estimated not detected (UJ) because of low recovery (%R < 75%) for these analytes in the associated spike sample.

A total of five TAL metals results were qualified as estimated and biased low (J-) because of low recovery (%R < 75%) for these analytes in the associated spike sample.

A total of 83 TAL metals results were qualified as estimated and biased high (J+) because of high recovery (%R > 125%) for these analytes in the associated spike sample.

F-3.2.10.2 Area 6 West

A total of 27 TAL metals results were qualified as estimated not detected (UJ) because of low recovery (%R < 75%) for these analytes in the associated spike sample.

A total of 221 TAL metals results were qualified as estimated and biased low (J-) because of low recovery (%R < 75%) for these analytes in the associated spike sample.

A total of 179 TAL metals results were qualified as estimated and biased high (J+) because of high recovery (%R >125%) for these analytes in the associated spike sample.

F-3.2.10.3 Area 10

A total of 129 TAL metals results and 13 total cyanide results were qualified as estimated not detected (UJ) because of low recovery (%R < 75%) for these analytes in the associated spike sample.

A total of 70 TAL metals results were qualified as estimated and biased low (J-) because of low recovery (%R < 75%) for these analytes in the associated spike sample.

A total of 192 TAL metals results were qualified as estimated and biased high (J+) because of high recovery (%R >125%) for these analytes in the associated spike sample.

F-3.2.11 Laboratory Control Sample Recoveries

LCS recovery criteria were met for all samples analyzed for inorganic chemicals.

F-3.2.12 Detection Limits

F-3.2.12.1 Area 5

A total of 28 TAL metals results were qualified as estimated (J) because the sample result was reported as detected between the estimated detection limit (EDL) and the method detection limit (MDL).

A total of four nitrate results, 21 TAL metals results, four cyanide results, and two 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 Area 6 West

A total of 111 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 369 TAL metals results and 3 perchlorate results were qualified as estimated (J) because the sample result was reported as detected between the PQL and the MDL.

F-3.2.12.3 Area 10

A total of 51 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 nine nitrate results, 253 TAL metals results, and one perchlorate result 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 Area 5 and Area 10

No inorganic chemical sample results were qualified as rejected.

F-3.2.13.2 Area 6 West

A total of 16 manganese results and two mercury results were qualified as rejected (R) because of less than 10% recovery in the associated matrix spike analysis.

The rejected data were not used to characterize the nature and extent or the potential human and ecological risks. However, sufficient data of good quality were available to characterize the site(s) and conduct the risk assessments. 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

Complex soil samples, tuff samples, and pore-gas samples collected during historical and 2009 investigations were analyzed for one or more of the following organic chemicals: explosive 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), 8082 (PCBs), and EPA Method TO-15 (VOCs).

F-4.0.1 Area 5

At AOC 49-005(b), a total of seven solid samples (4 soil/fill, and 3 tuff), plus 1 field duplicate, and 1 pore-gas sample, plus 1 field duplicate, were collected during historical and 2009 investigations. A total of seven samples were analyzed for SVOCs, and five samples were also analyzed for explosive compounds and VOCs. The pore-gas sample was analyzed for VOCs only.

At SWMU 49-006, a total of 17 samples (3 soil and 14 tuff), plus 1 field duplicate, were collected during historical and 2009 investigations. All of the samples were analyzed for SVOCs, and 16 samples were also analyzed for explosive compounds and VOCs.

At AOC 49-008(a), a total of 16 surface soil samples, plus 3 field duplicates, were collected during historical and 2009 investigations. All the samples were analyzed for PCBs only.

F-4.0.2 Area 6 West

At SWMU 49-004, a total of 21 solid samples (9 soil/fill, and 12 tuff), plus 1 field duplicate, and 2 pore-gas samples, plus 1 field duplicate, were collected during historical and 2009 investigations. All the solid

samples were analyzed for SVOCs, and 12 solid samples were also analyzed for explosive compounds and VOCs. Pore-gas samples were analyzed for VOCs only.

F-4.0.3 Area 10

At AOC 49-002, one sample was collected during historical investigations and analyzed for SVOCs and PCBs.

At AOC 49-005(a), a total of 18 solid samples (7 soil/fill and 11 tuff) and 1 pore-gas sample were collected from historical investigations as well as from 2009 investigations. Each solid sample was analyzed for SVOCs, and 14 solid samples were also analyzed for explosive compounds and VOCs. The pore-gas sample was 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 (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 internal standards 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 is described briefly in the paragraphs 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).

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.

Internal standards 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. Internal standards are used as the basis for quantitation of target analytes. The %R for internal standards should be within the range of 50%–200%.

Details regarding the quality of the organic chemical analytical data included in the datasets are summarized in the following subsections.

F-4.2 Data Quality Results for Organic 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-4.2.1 Maintenance of Chain of Custody

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 sample collection logs in the field (Appendix G 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-4.2.4 Sample Preservation

Preservation criteria were met for all samples analyzed for organic chemicals.

F-4.2.5 Holding Times

F-4.2.5.1 Area 5, Area 6 West

Holding-time criteria were met for all samples analyzed for organic chemicals.

F-4.2.5.2 Area 10

A total of 56 explosive compounds 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-4.2.6 Initial and Continuing Calibration Verifications

F-4.2.6.1 Area 5

A total of two VOC results were qualified as estimated not detected (UJ) because the affected analytes were analyzed with an initial calibration curve that exceeded the %RSD criteria and/or the associated multipoint calibration correlation coefficient is less than 0.995.

A total of two explosive compound results were qualified as estimated (J). The analyte retention time (RT) shifted by more than 0.05 minutes from the mid-level standard of the initial calibration.

A total of 53 explosive compound results were qualified as estimated not detected (UJ). The affected analytes were analyzed with a relative retention factor (RRF) of <0.05 in the initial calibration and/or CCV.

A total of 20 explosive compound results, 49 SVOC results, and 21 VOC results were qualified as estimated not detected (UJ) because the ICV and/or CCV were recovered outside the method-specific limits.

A total of two explosive compound results were qualified as estimated (J). The ICV and/or CCV were recovered outside the method-specific limits.

F-4.2.6.2 Area 6

A total of four VOC results were qualified as estimated not detected (UJ) because the affected analytes were analyzed with an initial calibration curve that exceeded the percent of risk-specific dose (%RSD) criteria and/or the associated multipoint calibration correlation coefficient is less than 0.995.

A total of 48 VOC results and 45 SVOC results were qualified as estimated not detected (UJ) because the ICV and/or CCV were recovered outside the method-specific limits.

A total of two SVOC results were qualified as estimated (J) because the ICV and/or CCV were recovered outside the method-specific limits.

F-4.2.6.3 Area 10

A total of two VOC results were qualified as estimated not detected (UJ) because the affected analytes were analyzed with an initial calibration curve that exceeded the %RSD criteria and/or the associated multipoint calibration correlation coefficient is less than 0.995.

A total of 28 explosive compound results were qualified as estimated not detected (UJ). The affected analytes were analyzed with an RRF of <0.05 in the initial calibration and/or CCV.

A total of 28 explosive compound results, 28 SVOC results, and 28 VOC results were qualified as estimated not detected (UJ) because the ICV and/or CCV were recovered outside the method-specific limits.

F-4.2.7 Surrogate Recoveries

F-4.2.7.1 Area 5 and Area 6 West

Surrogate recovery criteria were met for all samples analyzed for organic compounds.

F-4.2.7.2 Area 10

A total of 61 VOC results were qualified as estimated not detected (UJ) because the surrogate recovery is less than the LAL but is greater than or equal to 10%.

F-4.2.8 Internal Standard Responses

Internal standard response criteria were met for all samples analyzed for organic compounds.

F-4.2.9 Method Blanks

F-4.2.9.1 Area 5

Three VOC results were qualified as not detected (U) because the sample result is less than or equal to 5 times (10 times for common organic laboratory contaminants) the concentration of the related analyte in the method blank.

Three VOC results were qualified as not detected (U) because the sample result is less than or equal to 5 times the concentration of the related analyte in the trip blank, rinsate blank, or equipment blank.

F-4.2.9.2 Area 6 West and Area 10

Results for samples analyzed for organic chemicals were not qualified because of blank contamination.

F-4.2.10 Laboratory Duplicate Samples

Laboratory duplicates collected for organic chemical analyses indicated acceptable precision for all samples.

F-4.2.11 Laboratory Control Sample Recoveries

LCS recovery criteria were met for all samples analyzed for organic chemicals.

F-4.2.12 Quantitation and Method Detection Limits

F-4.2.12.1 Area 5

One explosive compound result, one VOC result, and two SVOC results were qualified estimated (J) because the results were between the PQL and the MDL.

F-4.2.12.2 Area 6 West

Two SVOC results and one VOC result were qualified estimated (J) because the results were between the PQL and the MDL.

F-4.2.12.3 Area 10

Two SVOC results and one VOC result were qualified estimated (J) because the results were between the PQL and the MDL.

F-4.2.13 Rejected Data

F-4.2.13.1 Area 5

A total of 84 explosive compound results were qualified as rejected (R) because the analytes were not detected in the samples and the analyte RT shifted by more than 0.05 min from the mid-level standard of the initial calibration.

A total of 20 tris(o-cresyl)phosphate results were qualified as rejected (R) because the ICV and/or CCV for this analyte were recovered outside the method-specific limits.

F-4.2.13.2 Area 6 West

Sample results for organic chemical analysis were not qualified as rejected (R).

F-4.2.13.3 Area 10

A total of 14 tris(o-cresyl)phosphate results were qualified as rejected (R) because the ICV and/or CCV for this analyte were recovered outside the method-specific limits.

The rejected data were not used to characterize the nature and extent or the potential human and ecological risks. However, sufficient data of good quality are available to characterize the site(s) and conduct the risk assessments. 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 radionuclides by gamma spectroscopy using EPA Method 901.1; and for americium-241, isotopic plutonium, and isotopic uranium by alpha spectroscopy (HASL-300 Methods) and tritium using EPA Method 906.0. Pore-gas samples were collected and analyzed for tritium using EPA Method 906.0. Tables H-2.2-1 and H-2.2-8 in Appendix H summarizes the samples collected and the analyses requested for each sample. 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.

F-5.0.1 Area 5

At AOC 49-005(b), a total of nine solid samples (6 soil/fill, and 3 tuff), plus four field duplicates, and one pore-gas sample, plus one field duplicate, were collected during historical and 2009 investigations. Solid sample analyses included all nine samples for isotopic plutonium; five samples for americium-241, tritium, and isotopic uranium; and four samples by gamma spectroscopy. The pore-gas sample was analyzed for tritium only.

At SWMU 49-006, a total of 17 samples (3 soil and 14 tuff), plus four field duplicates, were collected during historical and 2009 investigations. All of the samples were analyzed for isotopic plutonium; 16 samples were also analyzed for americium-241, tritium, and isotopic uranium. One sample was analyzed by gamma spectroscopy.

At AOC 49-008(a), no samples were collected for analysis of radionuclides.

F-5.0.2 Area 6 West

At SWMU 49-004, a total of 190 solid samples (176 soil/fill, and 14 tuff) plus 15 field duplicates, and two pore gas samples, plus 1 field duplicate, were collected during historical and 2009 investigations. Solid sample analyses included 138 samples for americium-241 and isotopic uranium; 178 samples by gamma spectroscopy; 12 samples for tritium; 14 samples for isotopic plutonium; and 5 samples for strontium-90 and technetium-99. Pore-gas samples were analyzed for tritium only.

F-5.0.3 Area 10

At AOC 49-002, a total of 77 samples (76 soil/fill and 1 tuff), plus 8 field duplicates, were collected during historical and 2009 investigations. All samples were analyzed by gamma spectroscopy; 71 samples were analyzed for isotopic plutonium; and 64 samples were also analyzed for americium-241 and isotopic uranium.

At AOC 49-005(a) a total of 82 solid samples (70 soil/fill and 12 tuff), plus eight field duplicates, and one pore-gas sample were collected from historical investigations as well as from 2009 investigations. Solid sample analyses included all 82 samples for isotopic plutonium; 78 samples for americium-241 and isotopic uranium; 14 samples for tritium; and 68 samples were analyzed by gamma spectroscopy. The pore-gas sample was analyzed for tritium only.

All radionuclide results are included in Appendix G (on DVD).

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 is 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 briefly below.

The LCS serves as a monitor of the overall performance of each step during the analysis, including sample digestion. For radionuclides in soil/tuff, LCS %Rs 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 dataset 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 sample collection logs 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 Area 5 and Area 10

Results for samples analyzed for radionuclides were not qualified because of blank contamination.

F-5.2.6.2 Area 6

One americium-241 result, one plutonium-239/240 result, and one uranium-234 result 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 americium-241 results and one plutonium-239/240 result 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-5.2.7 Matrix Spike Samples

F-5.2.7.1 Area 5

A total of 14 tritium results were qualified as estimated not detected (UJ) because the associated matrix spike recovery was greater than 125%.

A total of six tritium results were qualified as estimated and biased high (J+) because the associated matrix spike recovery was greater than 125%.

F-5.2.7.2 Area 6

Matrix spike criteria were met for all samples analyzed for radionuclides.

F-5.2.7.3 Area 10

A total of 14 tritium results were qualified as estimated not detected (UJ) because the associated matrix spike recovery was greater than 125%.

F-5.2.8 Tracer Recoveries

F-5.2.8.1 Area 5 and Area 6 West

Tracer recovery criteria were met for all samples analyzed for radionuclides.

F-5.2.8.2 Area 10

A total of six isotopic uranium results were qualified as estimated and potentially biased low (J-) because the associated tracer recovery was less than the LAL but greater than 10%.

F-5.2.9 Laboratory Control Sample 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 Area 5 and Area 6 West

Laboratory duplicate sample recovery criteria were met for all samples analyzed for radionuclides.

F-5.2.10.2 Area 10

A total of three americium-241 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-5.2.11 Rejected Data

F-5.2.11.1 Area 5 and Area 6 West

No radionuclide sample results were qualified as rejected (R).

F-5.2.11.2 Area 10

A total of 66 gamma spectroscopy results (58 cesium-134 and 8 cesium-137) were qualified as rejected (R) because spectral interferences prevent positive identification of the analytes.

The rejected data were not used to characterize the nature and extent or the potential human and ecological risks. However, sufficient data of good quality were available to characterize the sites and conduct the risk assessments. The results of other qualified data were used as reported and do not affect the usability of the sampling results.

F-6.0 REFERENCES

The following list includes all documents cited in this appendix. Parenthetical information following each reference provides the author(s), publication date, and ER ID. This information is also included in text citations. ER IDs are assigned by the Environmental Programs Directorate's Records Processing Facility (RPF) and are used to locate the document at the RPF and, where applicable, in the master reference set.

Copies of the master reference set are maintained at the NMED Hazardous Waste Bureau and the Directorate. The set was developed to ensure that the administrative authority has all material needed to review this document, and it is updated with every document submitted to the administrative authority. Documents previously submitted to the administrative authority are not included.

EPA (U.S. Environmental Protection Agency), February 1994. "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review," EPA-540/R-94/013, Office of Emergency and Remedial Response, Washington, D.C. (EPA 1994, 048639)

EPA (U.S. Environmental Protection Agency), October 1999. "USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review," EPA540/R-99/008, Office of Emergency and Remedial Response, Washington, D.C. (EPA 1999, 066649)

LANL (Los Alamos National Laboratory), July 1995. "Statement of Work (Formerly Called "Requirements Document") - Analytical Support, (RFP number 9-XS1-Q4257), (Revision 2 - July, 1995)," Los Alamos National Laboratory, Los Alamos, New Mexico. (LANL 1995, 049738)

LANL (Los Alamos National Laboratory), March 1996. "Quality Assurance Project Plan Requirements for Sampling and Analysis," Los Alamos National Laboratory document LA-UR-96-441, Los Alamos, New Mexico. (LANL 1996, 054609)

LANL (Los Alamos National Laboratory), December 2000. "University of California, Los Alamos National Laboratory (LANL), I8980SOW0-8S, Statement of Work for Analytical Laboratories," Rev. 1, Los Alamos National Laboratory, Los Alamos, New Mexico. (LANL 2000, 071233)

Table F-3.0-1
Inorganic Chemical, Organic Chemical, and
Radionuclide Analytical Methods for Samples Collected from TA-49

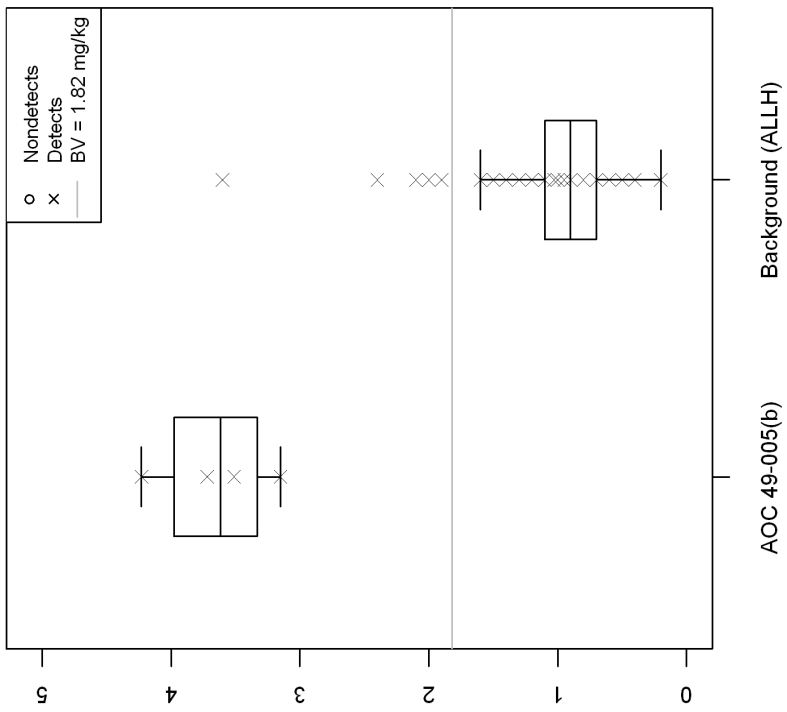
Analytical Method	Analytical Description	Analytical Suite
EPA 300.0	Ion chromatography	Nitrate
EPA 905.0	Precipitation, alpha/beta counting	Strontium-90
EPA 906.0	Distillation and liquid scintillation	Tritium
EPA SW-846: 6010/6010B	Inductively coupled plasma emission spectroscopy—atomic emission spectroscopy	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
EPA SW-846: 8270 and 8270C	GC/MS	SVOCs
EPA SW-846: 8321A	High performance liquid chromatography	Explosive compounds
Generic: gamma spectroscopy	Gamma spectroscopy	Americium-241, cesium-134, cesium-137, cobalt-60, europium-152, ruthenium-106, sodium-22, uranium-235
Generic: kinetic phosphorescence (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



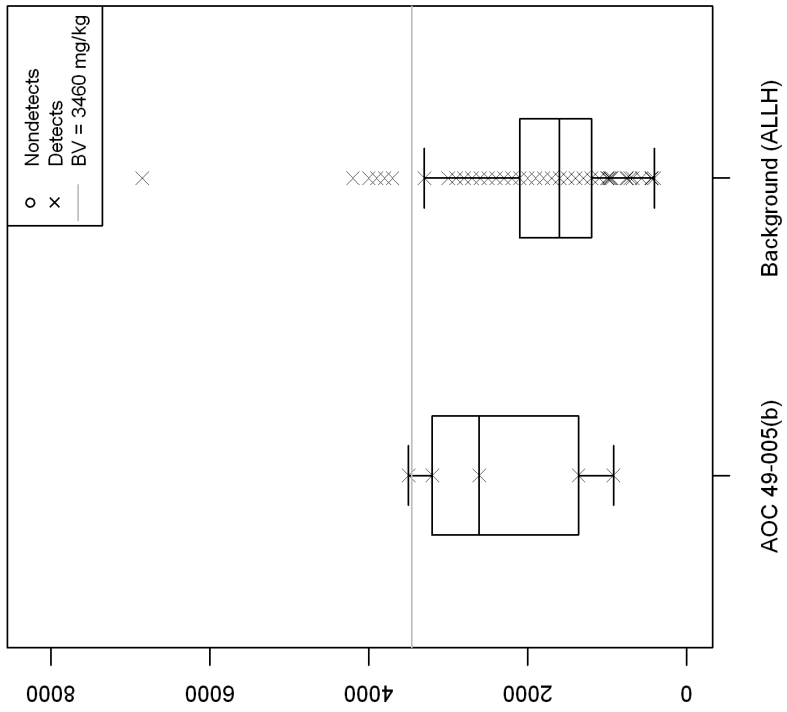
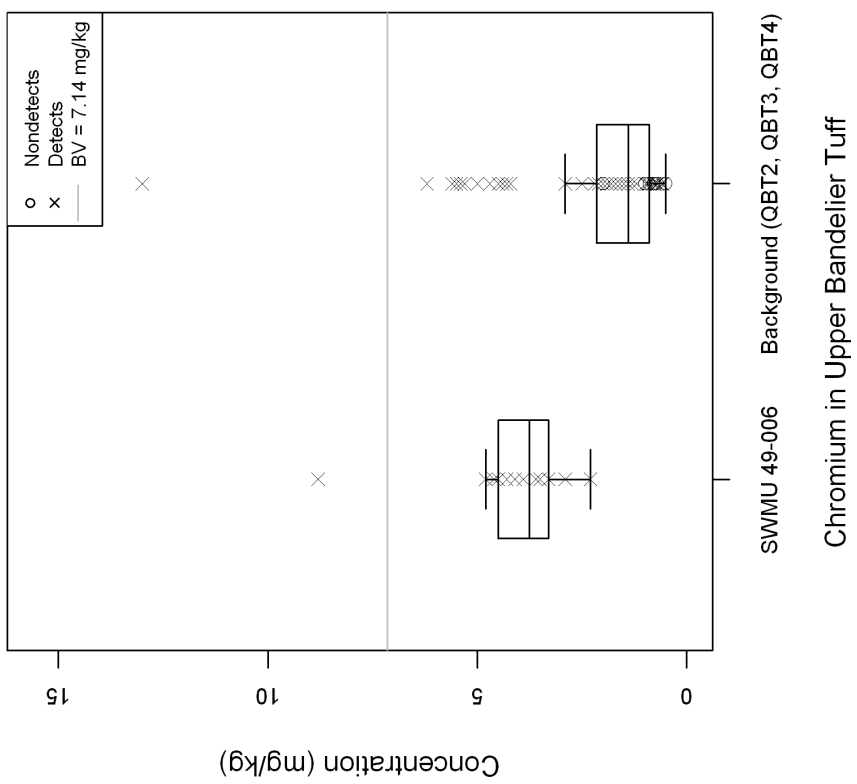


Figure H-1 Box plot for potassium and uranium in soil in Area 5, AOC 49-005(b)



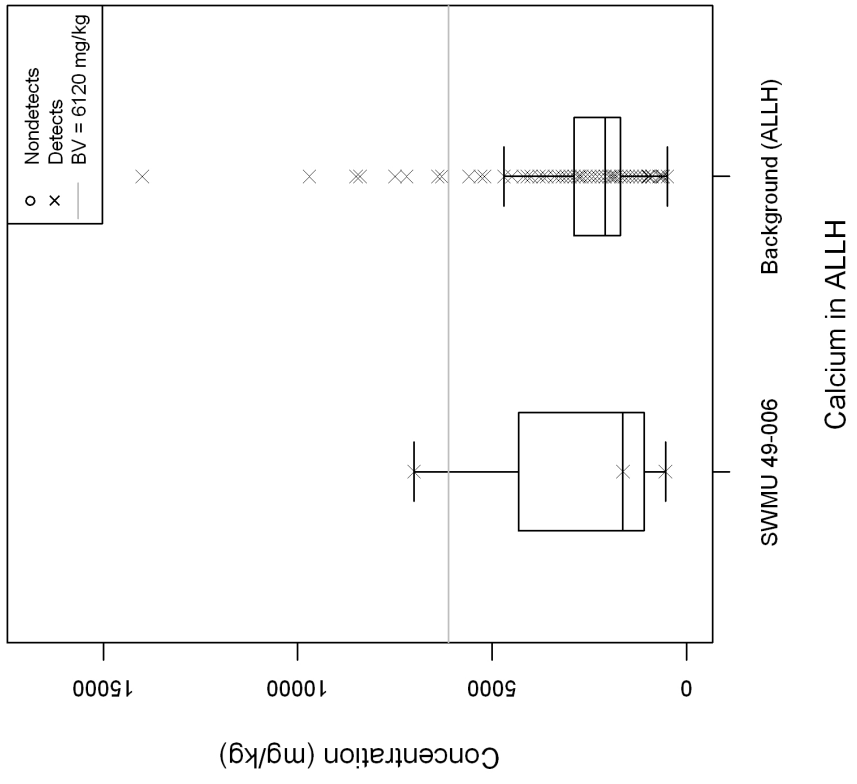
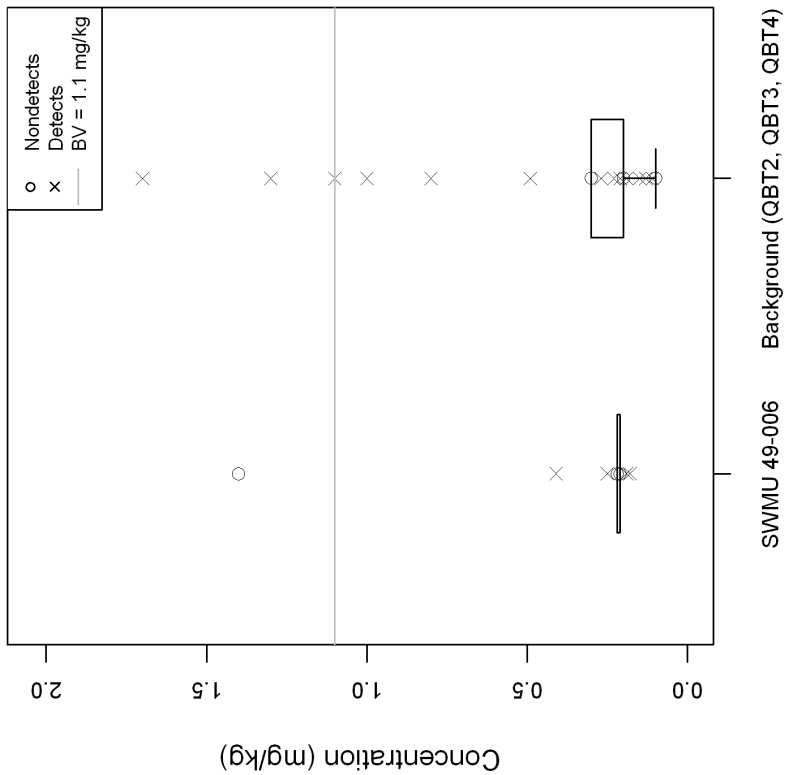


Figure H-2 Box plot for calcium in soil and chromium in tuff in Area 5, SWMU 49-006



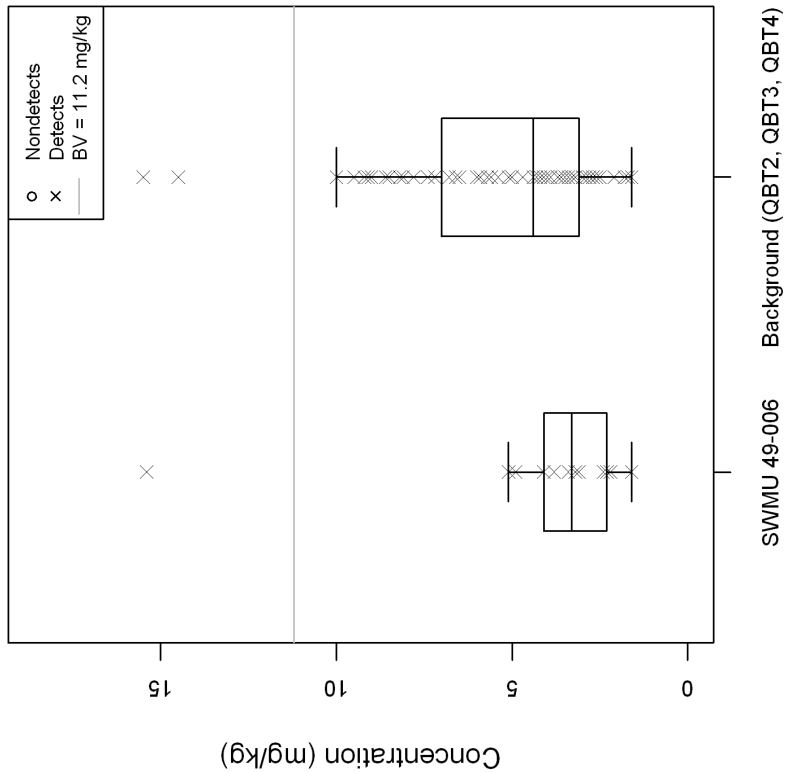
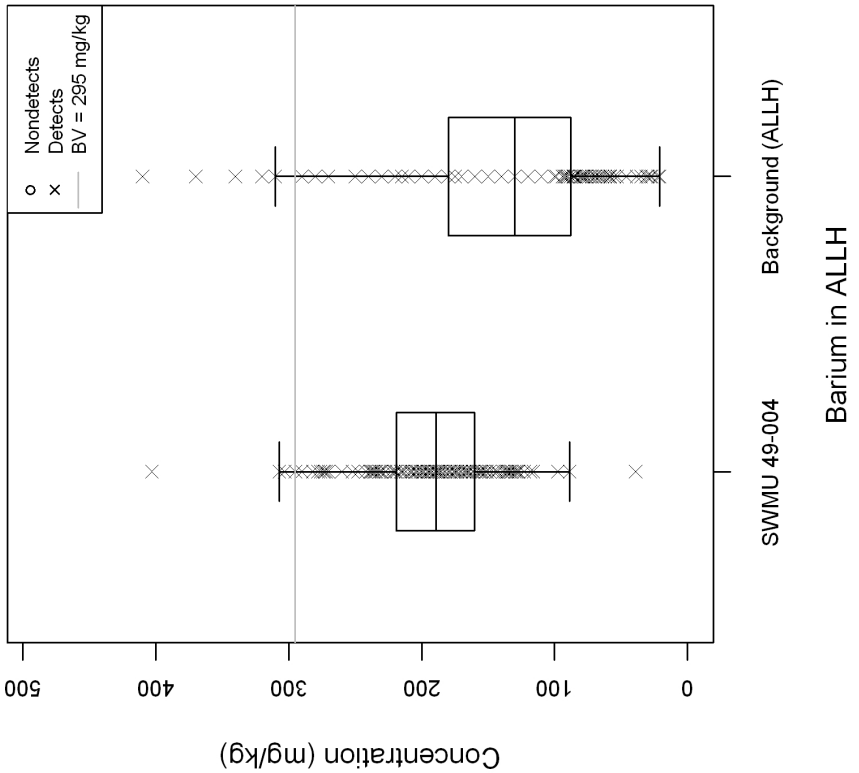


Figure H-3 Box plot for lead and thallium in tuff in Area 5, SWMU 49-006



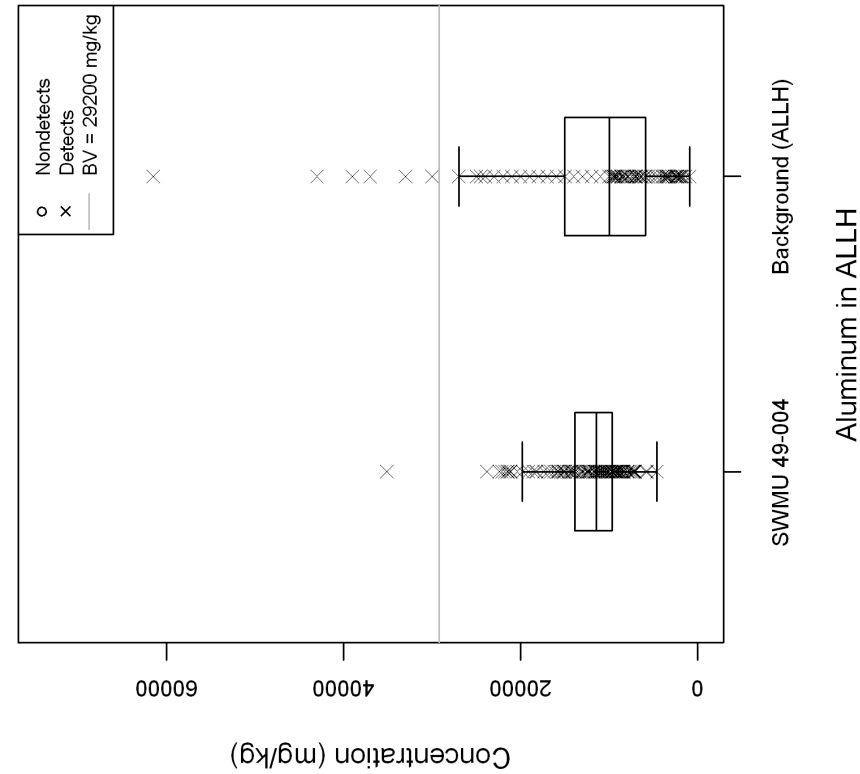
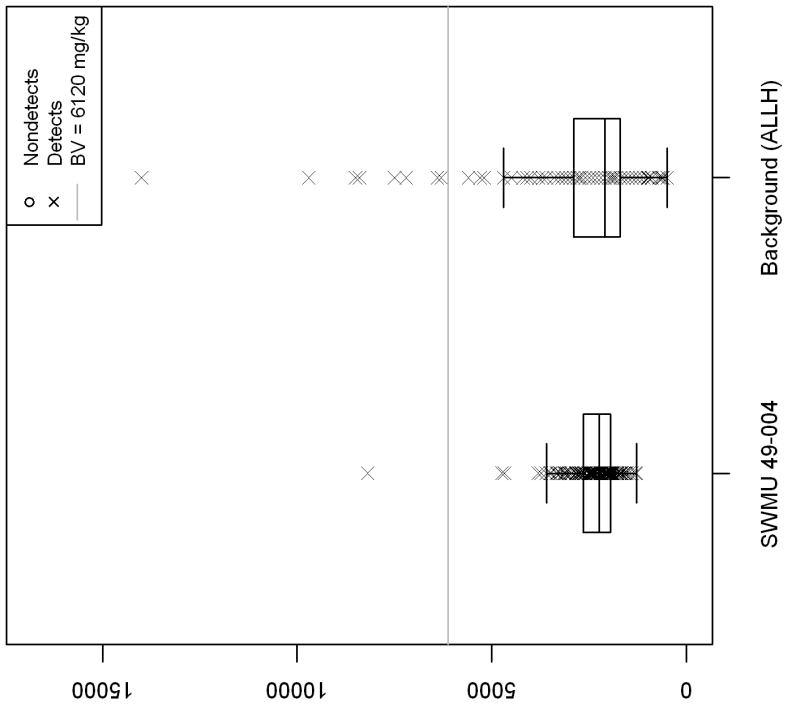


Figure H-4 Box plots for aluminum and barium in soil in Area 6, SWMU 49-004



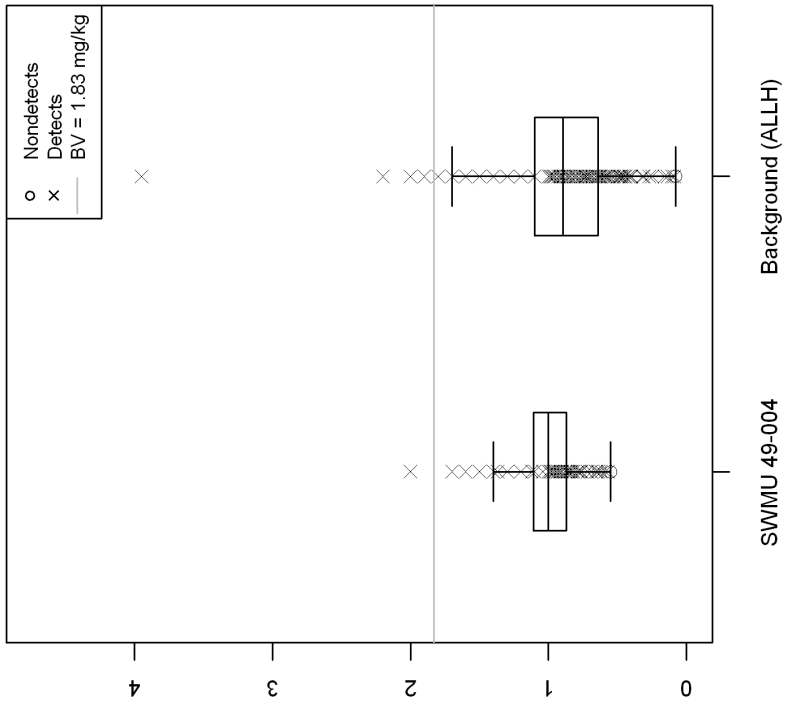
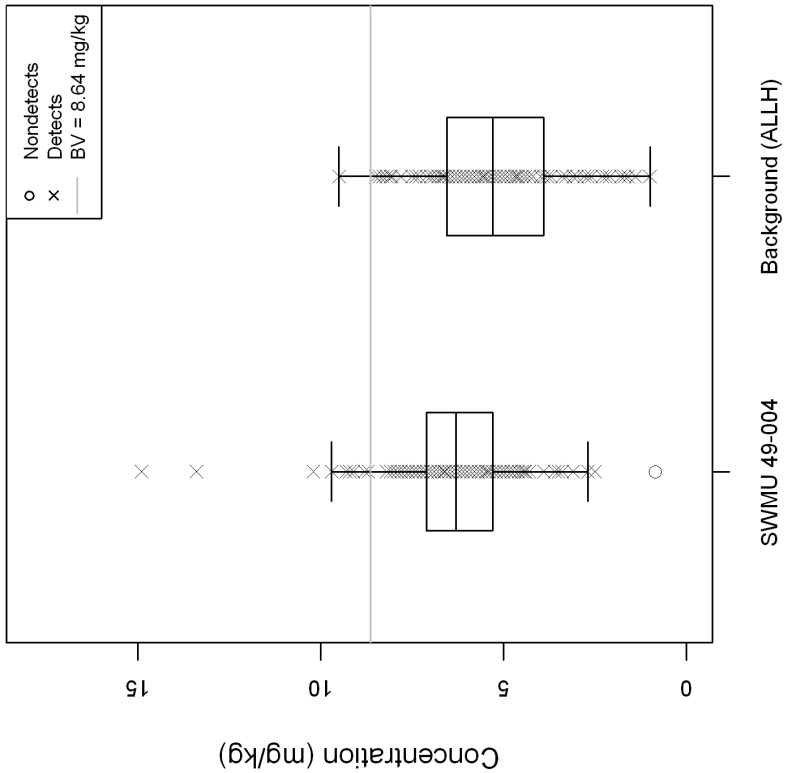


Figure H-5 Box plots for beryllium and calcium in soil in Area 6, SWMU 49-004



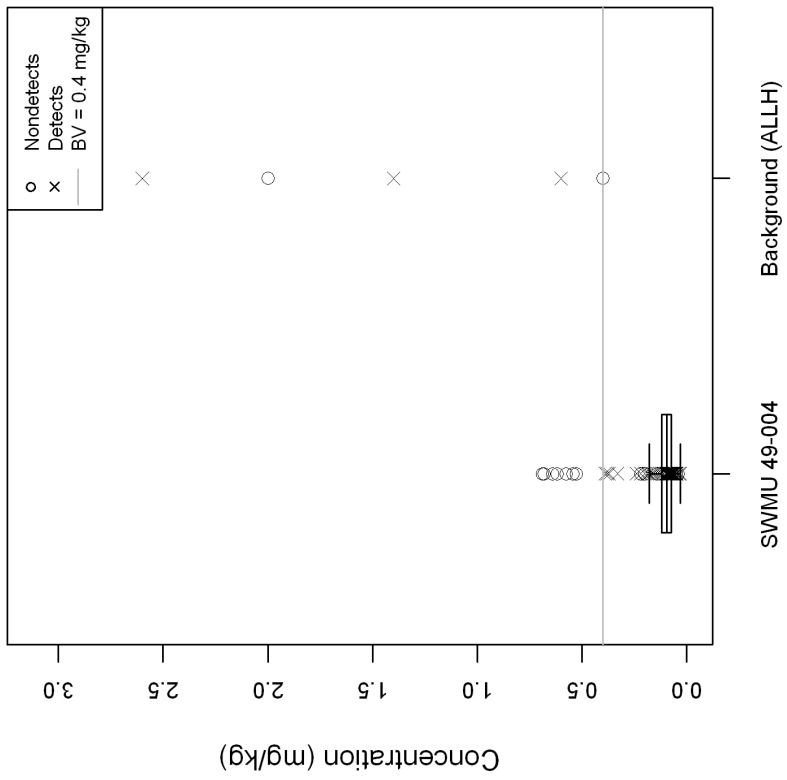
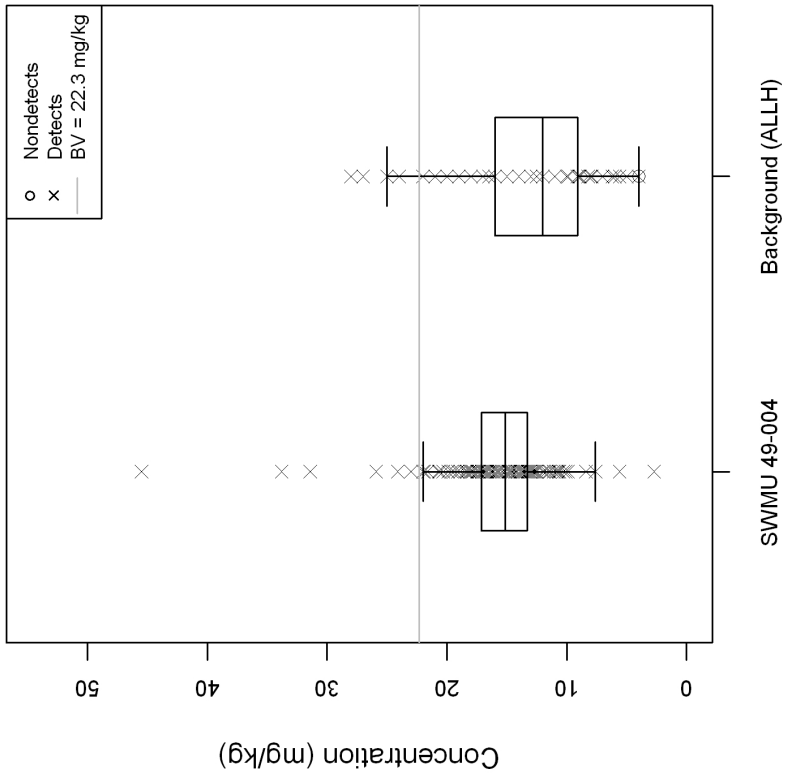


Figure H-6 Box plots for cadmium and cobalt in soil in Area 6, SWMU 49-004



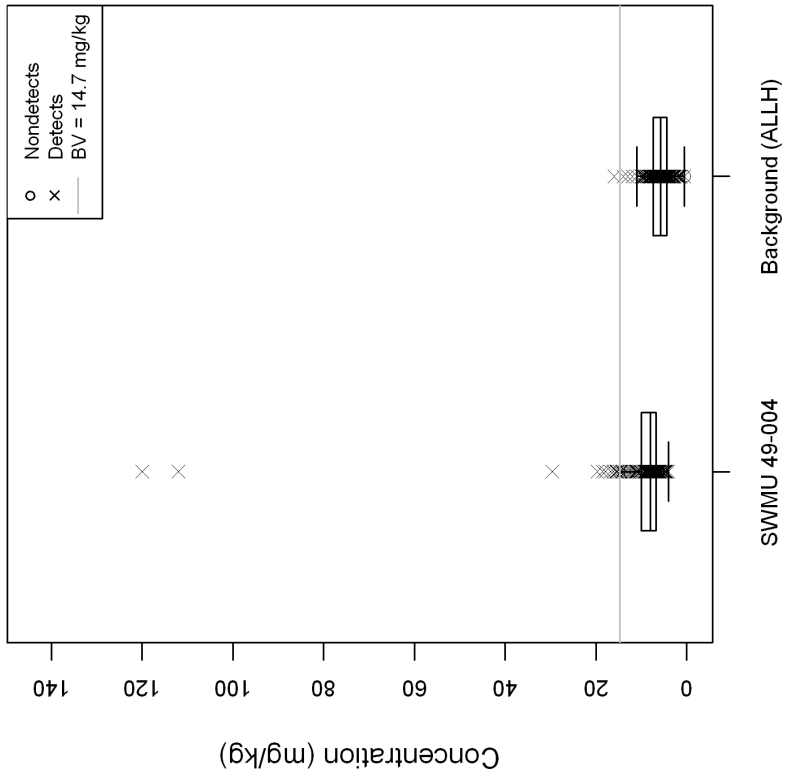
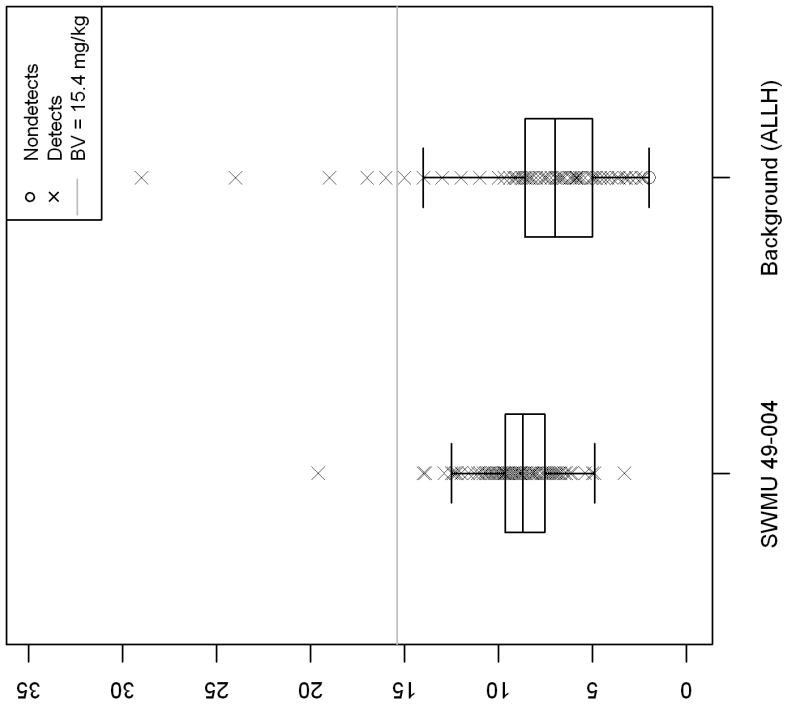


Figure H-7 Box plots for copper and lead in soil in Area 6, SWMU 49-004



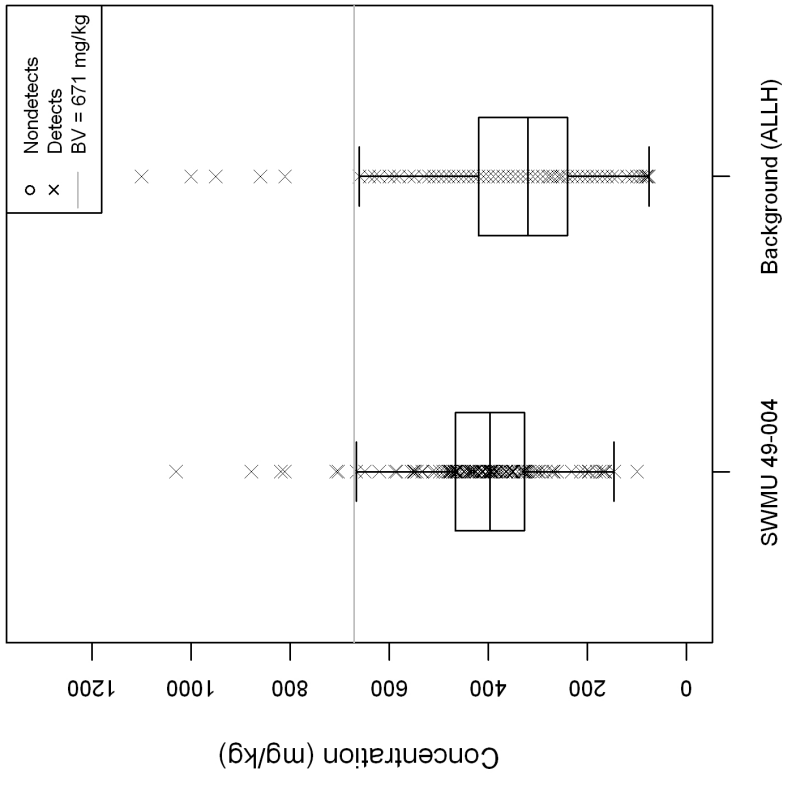
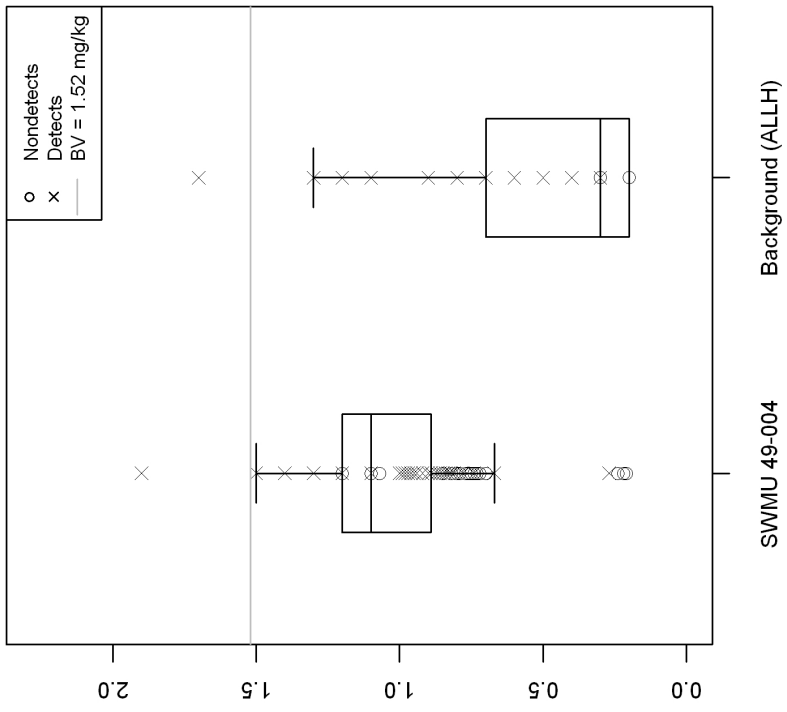


Figure H-8 Box plot for manganese and nickel in soil in Area 6, SWMU 49-004



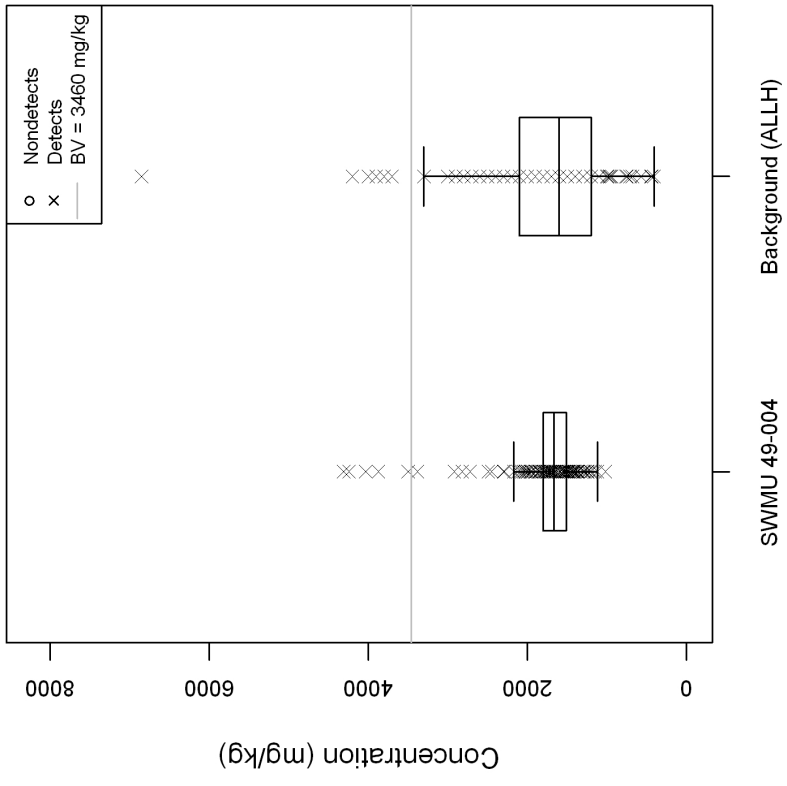
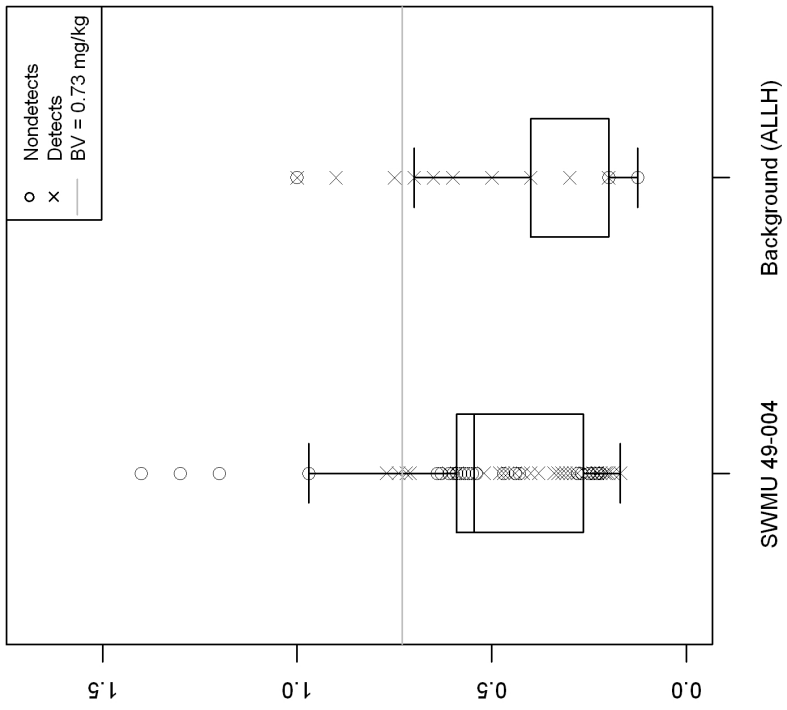


Figure H-9 Box plot for potassium and selenium in soil in Area 6, SWMU 49-004



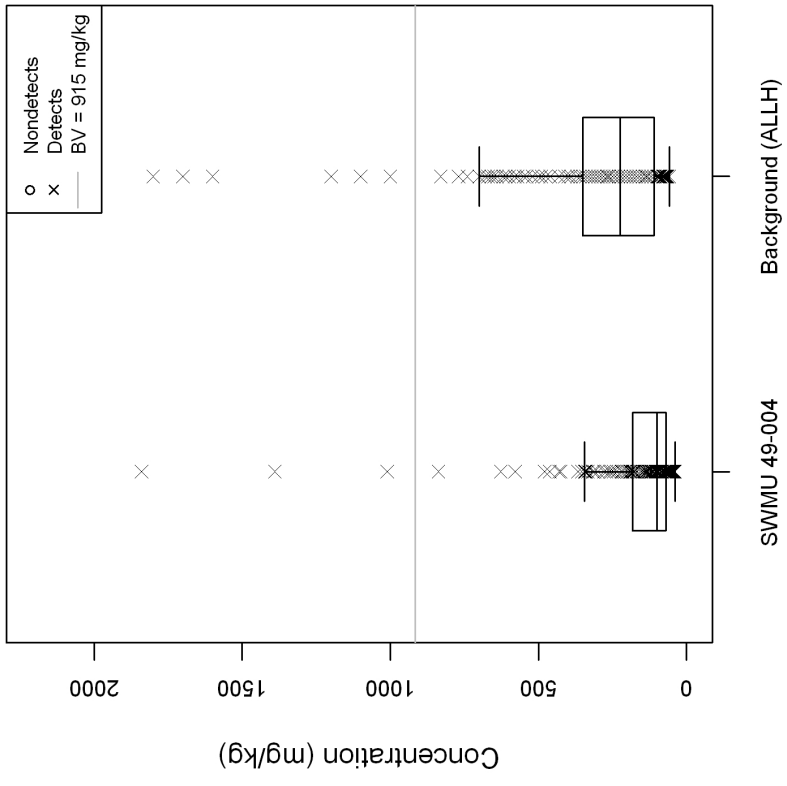


Figure H-10 Box plot for sodium and thallium in soil in Area 6, SWMU 49-004

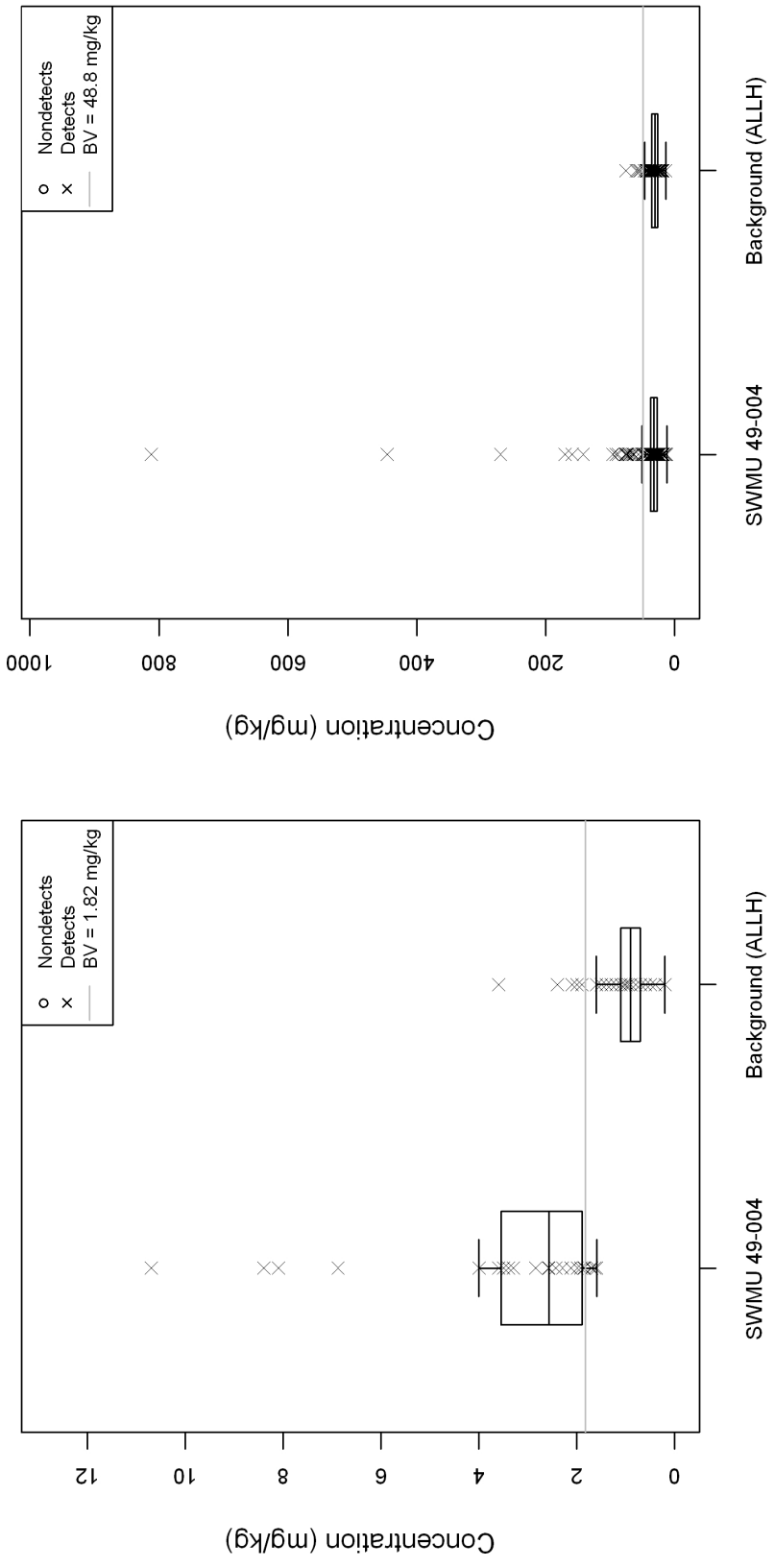
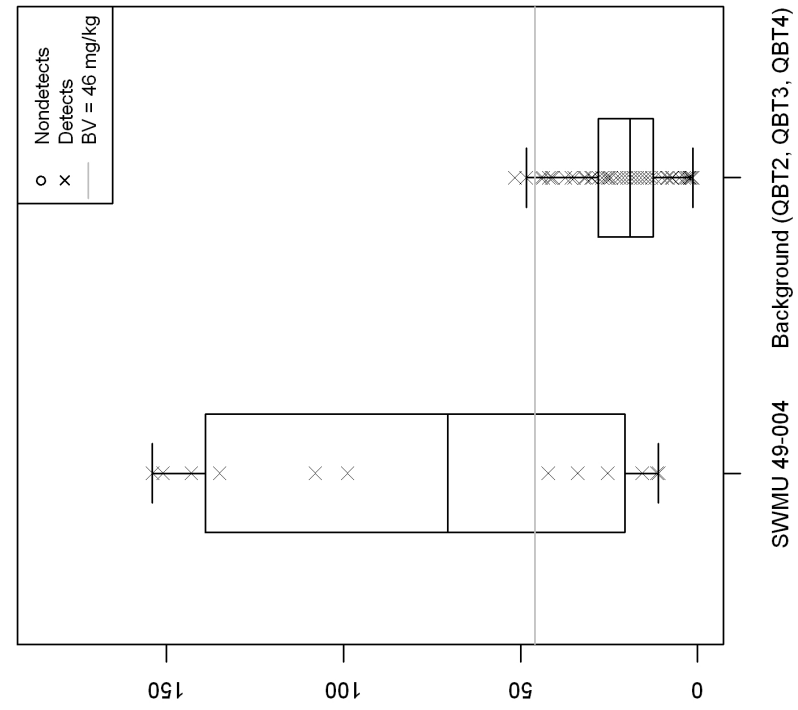


Figure H-11 Box plot for uranium and zinc in soil in Area 6, SWMU 49-004



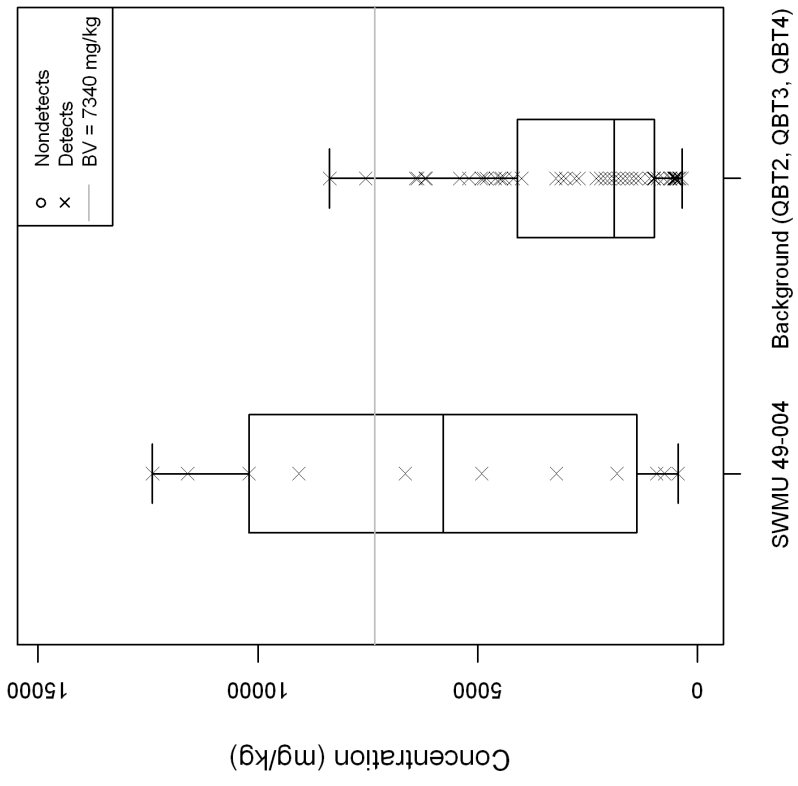
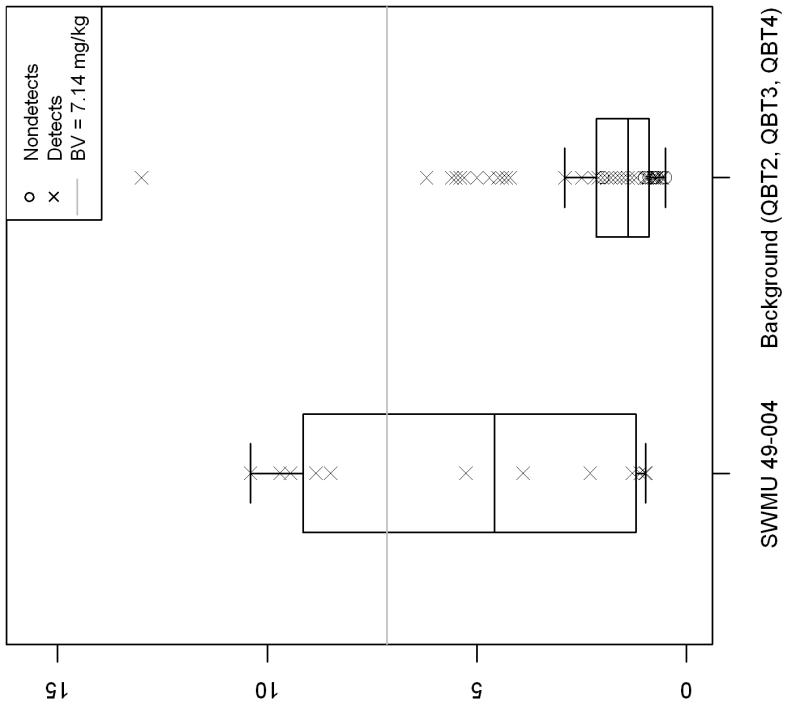


Figure H-12 Box plot for aluminum and barium in tuff in Area 6, SWMU 49-004



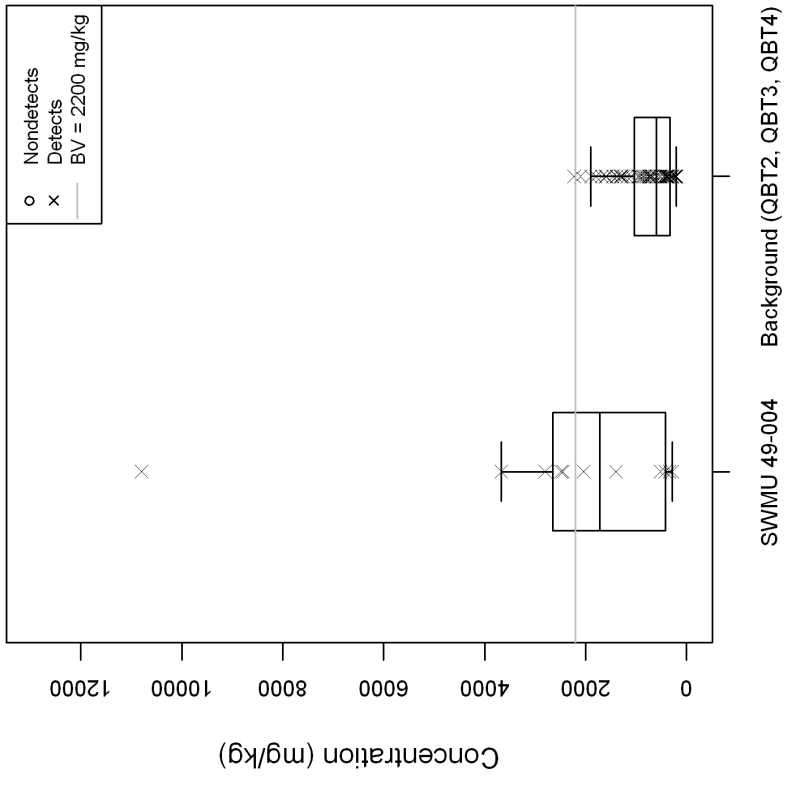
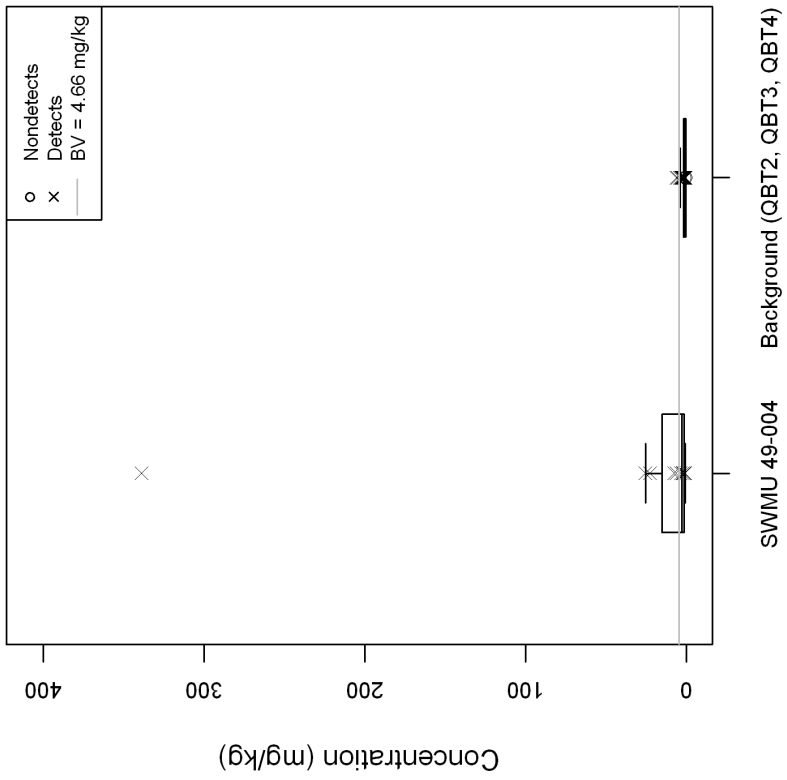


Figure H-13 Box plot for calcium and chromium in tuff in Area 6, SWMU 49-004



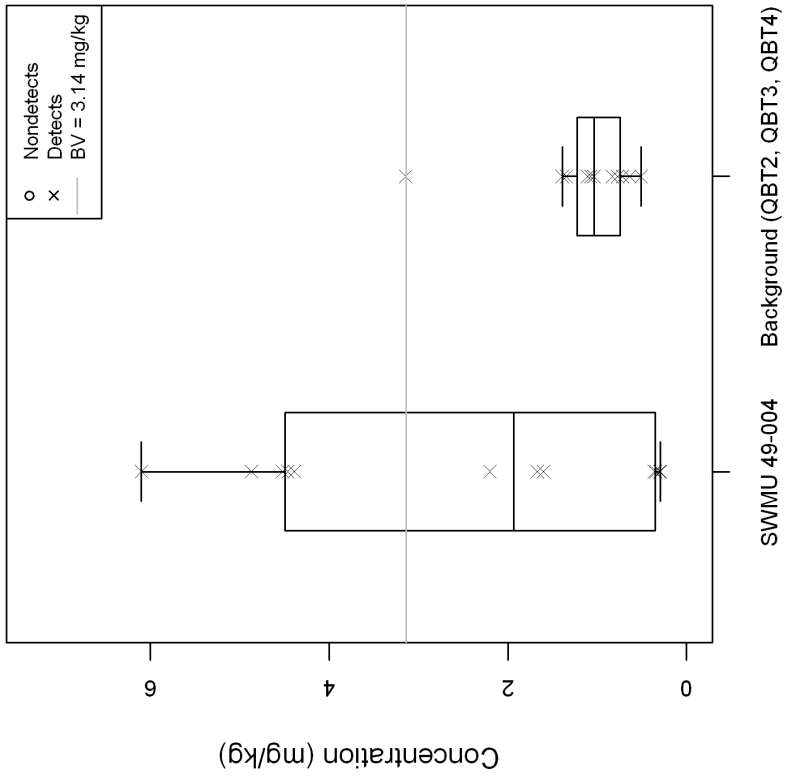
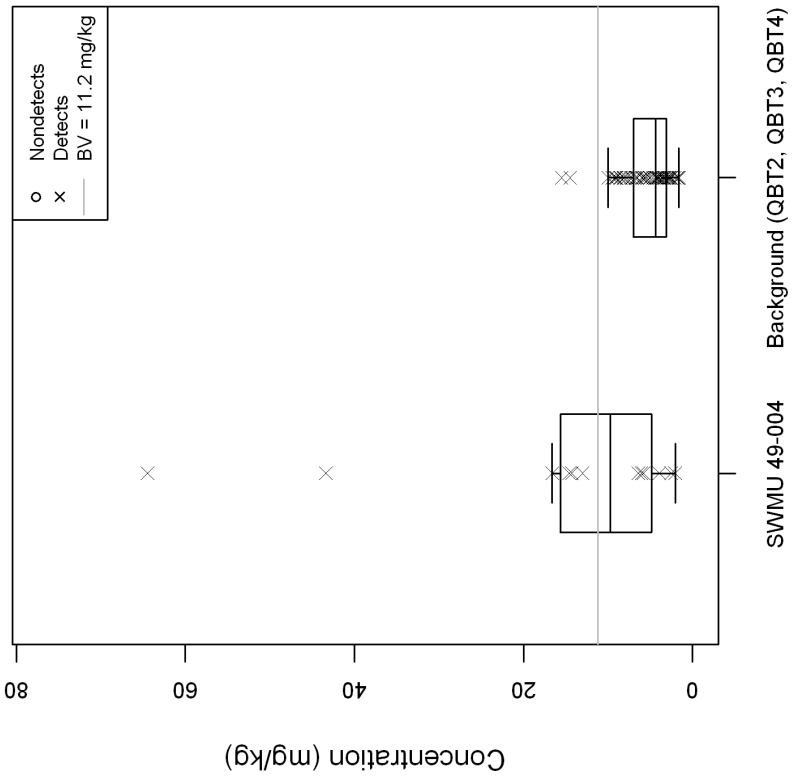


Figure H-14 Box plot for cobalt and copper in tuff in Area 6, SWMU 49-004



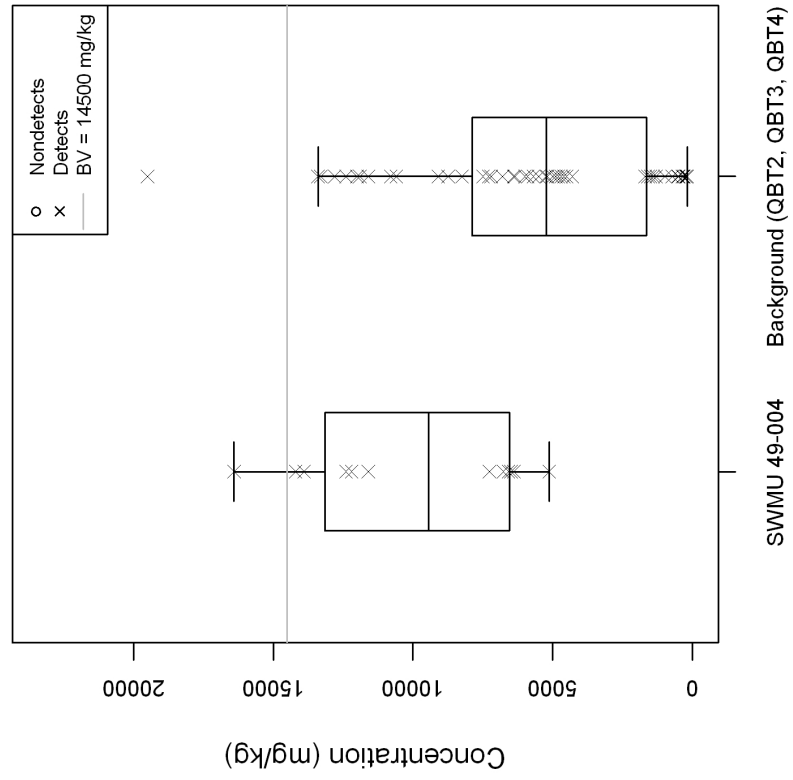
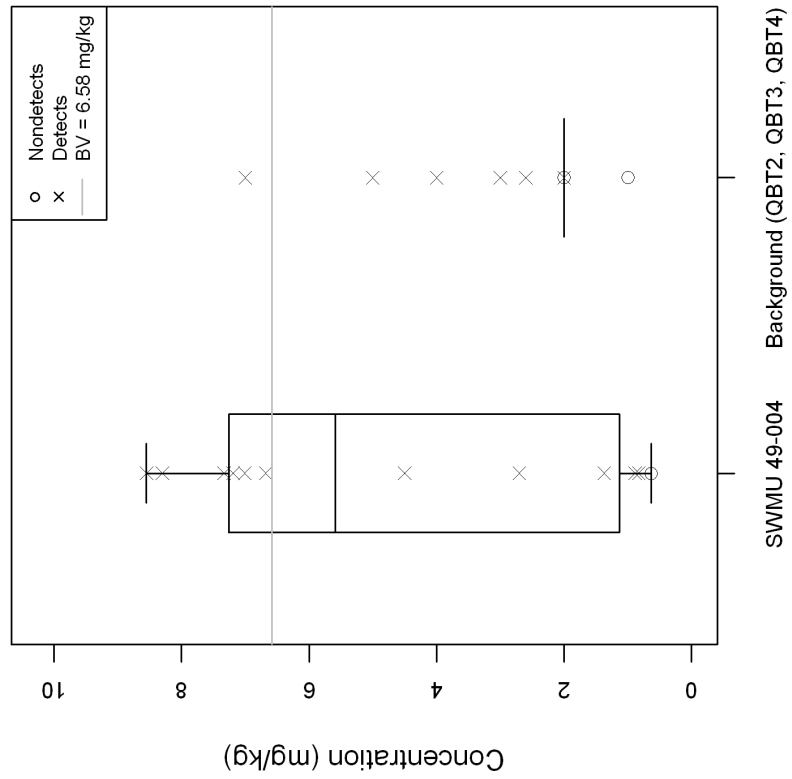


Figure H-15 Box plot for iron and lead in tuff in Area 6, SWMU 49-004



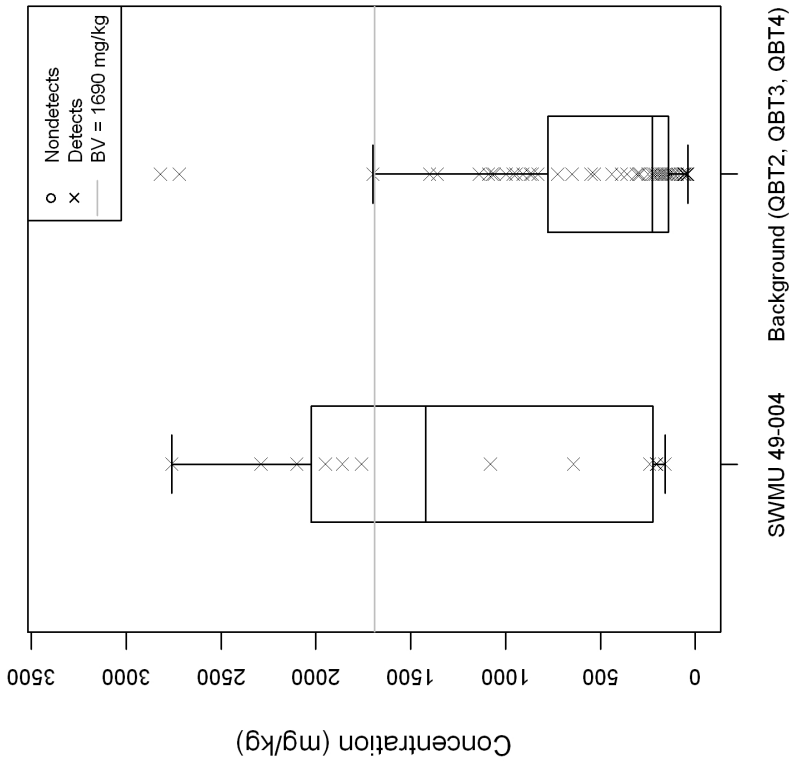
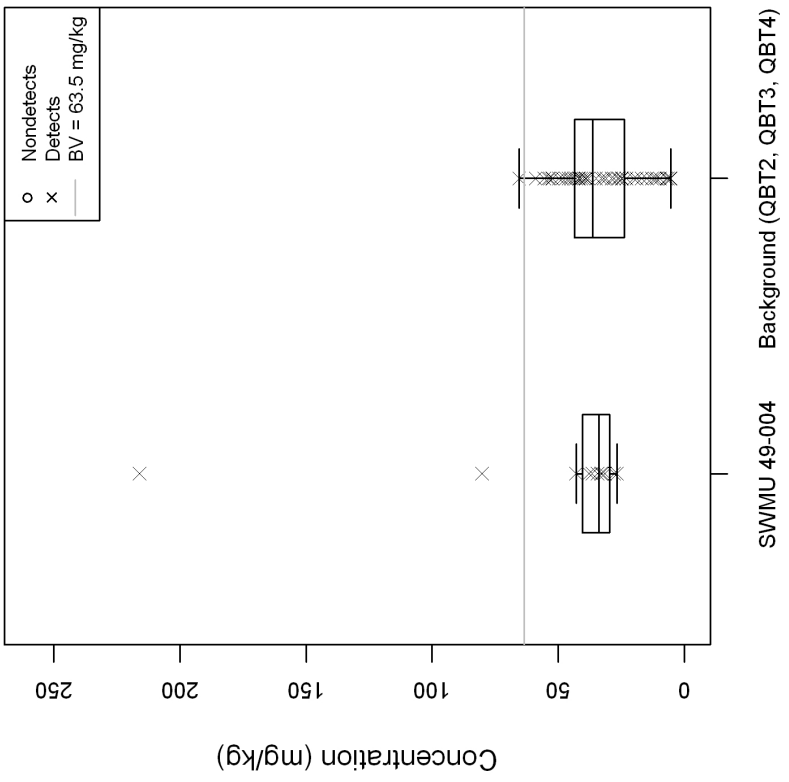


Figure H-16 Box plot for magnesium and nickel in tuff in Area 6, SWMU 49-004



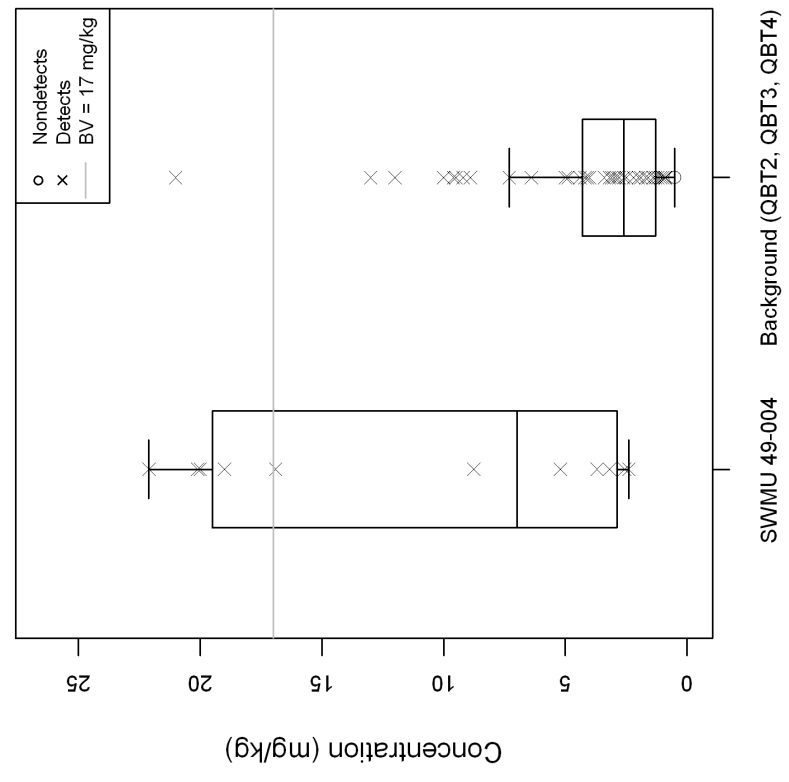


Figure H-17 Box plot for vanadium and zinc in tuff in Area 6, SWMU 49-004

Table H-1
Statistical Analysis of Tuff COPCs for Area 5, SWMU 49-006

Analyte	Gehan Test p-Value	Quantile Test	Retain as COPC?
Chromium	3E-05	0.00088	Yes
Lead	0.98127	0.98563	No
Thallium	0.09525	Not applicable	No

Table H-2
Statistical Analysis of Soil COPCs for Area 6 West, SWMU 49-004

Analyte	Gehan Test p-Value	Quantile Test	Retain as COPC?
Aluminum	0.00203	0.99988	Yes
Barium	0	0.86942	Yes
Beryllium	4.00E-05	0.50368	Yes
Calcium	0.12034	0.99989	No
Cobalt	0	0.05166	Yes
Copper	0	3.00E-04	Yes
Manganese	0	0.32613	Yes
Nickel	0	0.98886	Yes
Potassium	0.13851	0.50368	No
Selenium	0	0.06542	Yes
Sodium	1	0.95404	No

Table H-3
Statistical Analysis of Tuff COPCs for Area 6 West, SWMU 49-004

Analyte	Gehan Test p-Value	Quantile Test	Retain as COPC?
Aluminum	0.01037	0.00263	Yes
Calcium	0.01219	0.00244	Yes
Chromium	0.00219	0.00244	Yes
Cobalt	0.12113	0.0559	No
Iron	9.00E-04	0.0183	Yes
Magnesium	0.00167	0.00244	Yes
Nickel	Could not compute	0.00263	Yes
Vanadium	0.00159	0.0183	Yes
Zinc	0.304	0.60649	No

Appendix I

Risk Assessments

CONTENTS

I-1.0 INTRODUCTION I-1

I-2.0 BACKGROUND I-1
I-2.1 Site Description and Operational History I-1
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Attachments

Attachment I-1 Ecological Scoping Checklist

Attachment I-2 ProUCL Files

I-1.0 INTRODUCTION

This appendix presents the results of the human health and ecological risk screening assessments conducted in support of the investigations of Areas of Concern (AOCs) 49-005(b) and 49-008(a), and Solid Waste Management Units (SWMUs) 49-004 and 49-006 at Technical Area 49 (TA-49) outside the nuclear environmental site (NES) boundary located at Los Alamos National Laboratory (LANL or the Laboratory) (Figure 1.0-1). Summary descriptions of the SWMUs and AOCs comprising TA-49 outside the NES boundary are included in section 2.1 of the investigation report.

I-2.0 BACKGROUND

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 (LANL 2007, 098491). Area 5 served as a central control area for hydronuclear and related experiments. Area 6 consists of two primary areas: Area 6 East, a general support area, and Area 6 West, an inactive landfill and open-burning area historically used for the disposal of solid wastes generated from experimental activities conducted elsewhere at TA-49.

There are currently only a few small-scale on-site uses of TA-49. The Laboratory's high-power microwave group occasionally uses the day room in building 49-115; the Laboratory's hazardous devices team (HDT) uses both the HDT training facility building 49-113 and the associated high-explosives magazine building 49-114 for small-scale explosives training exercises. Additionally, building 49-113 houses the Laboratory's Alternate Emergency Operations Center. The Bandelier Meteorological Station is maintained in the southeast portion of TA-49 as part of its network of meteorological stations.

I-2.1 Site Description and Operational History

TA-49, also known as the Frijoles Mesa site, is centrally located on the Pajarito Plateau and 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 following site descriptions and operational histories are for sites where nature and extent have been defined.

I-2.1.1 AOC 49-005 (b), Small Landfill

AOC 49-005(b) is located within Area 5 and consists of a small debris landfill that contains uncontaminated construction debris from the 1971 and 1984 cleanups. The landfill was created within the concrete-walled basement of the counting room and has dimensions of less than 10-ft-long x 10-ft-wide x 10-ft-deep (LANL 1992, 007670, p. 6.4-9).

I-2.1.2 SWMU 49-006, Sump

SWMU 49-006 is the possible location of a sump in Area 5. In 1959, historical engineering documents discussed the construction of two sumps in this area. There are no other existing records or drawings to confirm the sump's presence, but photographic liquids may have been discharged from a trailer that housed a darkroom or a radiochemistry laboratory (LANL 1992, 007670).

I-2.1.3 AOC 49-008(a), Area of Potential Soil Contamination

AOC 49-008(a) is located within Area 5 and consists of potentially contaminated surface soil from central control area operations conducted from 1959 to 1961. Historical operations included a darkroom, radiochemistry laboratory, and calibration facility. Oil staining has been observed on two concrete pads that contained electrical transformers during historical operations (LANL 1992, 007670, p. 6.4-8).

I-2.1.4 SWMU 49-004, Landfill

SWMU 49-004 is located within Area 6 West and is a landfill used from 1959 to 1961. Prior to burial, wastes were reportedly screened for radioactivity (LANL 1992, 007670, p. 6.3-6). During the 1971 cleanup of TA-49, the landfill [AOC 49-005(b)] was reopened for disposal of uncontaminated materials. Similarly, the site was reopened during a 1984 general cleanup when a disposal trench 30 ft x 100 ft x 15 ft was constructed for uncontaminated solid materials (LANL 1992, 007670, p. 6.3-7).

I-2.2 Investigation Sampling

The final dataset used to identify chemicals of potential concern (COPCs) and evaluate potential risks to human health and the environment for the sites at TA-49 outside the NES boundary consists of all qualified analytical results compiled from both historical sampling activities 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 dataset evaluated in this appendix.

Decision-level analytical data used to determine COPCs for the investigation at TA-49 include results obtained from samples collected during the following investigations/activities:

- 1995 Phase I Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) (LANL 1997, 056594) for SWMUs 49-006, 49-004 and AOC 49-005(b): (LANL 1995, 049974; LANL 1996, 054617) surface soil, sediment, and subsurface samples were collected.
- 2009–2010 investigation: surface and subsurface samples were collected to determine the nature and extent of contamination and obtain general site characterization data for evaluation of remedial alternatives.

I-2.3 Determination of Chemicals of Potential Concern

The analytical data and COPC determination for the TA-49 outside the NES boundary are summarized in the investigation report. Only chemicals detected above background (inorganic chemicals and radionuclides), had detection limits greater than background values (BVs) (inorganic chemicals and radionuclides), or were detected (inorganic chemicals, organic chemicals, and radionuclides) as COPCs. The industrial scenario and the ecological evaluation utilize data for samples collected from 0–1 ft below ground surface (bgs) and 0–5 ft bgs, respectively. The construction worker and the residential scenarios utilize data for samples collected from 0–10 ft bgs. However, all samples with a starting depth less than the lower bound of the interval for each scenario were included in the risk assessments.

Tables I-2.3-1 through I-2.3-11 summarize the COPCs evaluated for risk for each of the TA-49 sites outside the NES boundary [AOC 49-005(b), SWMU 49-006, AOC 49-008(a), and SWMU 49-004]. Some of the COPCs may not be evaluated for potential risk under one or more scenarios because they were only reported below the depth interval associated with a given scenario.

I-3.0 CONCEPTUAL SITE MODEL

The primary mechanisms of contaminant release for the TA-49 sites outside the NES boundary are related to the historical operations and releases discussed in detail in the investigation report. Surface and subsurface soil and tuff are the only media containing residual contamination at the site. Weathering of tuff is the only viable natural process that may result in the exposure of receptors to COPCs in tuff; because of the slow rate of weathering expected for tuff, exposure to COPCs in tuff is negligible, although it is included in the risk-screening assessments.

The lack of saturated conditions in the area restricts the horizontal and vertical migration of contaminants. No alluvial or perched groundwater has been identified in the area. A pathway to groundwater, including the regional aquifer, which is located approximately 1170 ft bgs, is intermittent and incomplete. No permanent surface water exists within the TA-49 sites outside the NES boundary. Occasional surface water runoff occurs as a result of brief, but often intense, seasonal thunderstorms, which can produce significant rainfall in short time periods. Runoff may be generated in the spring as a result of snowmelt. Runoff from the mesa top may contribute minor amounts of flow to surface runoff.

I-3.1 Receptors and Exposure Pathways

The conceptual site model for contaminant exposure to human receptors is shown in Figure I-3.1-1. TA-49 is an industrial area and the industrial scenario is the current and reasonably foreseeable future land use. Therefore, all TA-49 sites outside the NES boundary were evaluated according to the industrial scenario. The construction worker scenario was also evaluated because construction or excavation activity cannot be ruled out. The residential scenario was evaluated for each site as required by the Compliance Order on Consent (the Consent Order).

Primary exposure media for human receptors include surface soil and subsurface soil/tuff. The potential pathways for human exposure to surface soil and tuff are dermal contact, inhalation of vapors or fugitive dust, incidental soil ingestion, and external irradiation. Pathways from subsurface contamination to potential human receptors would be complete only if contaminated soil or tuff were excavated and brought to the surface. The potential pathways would be similar to those from surface soil (i.e., dermal contact, inhalation of vapors or fugitive dust, and incidental soil ingestion). Soil-gas data were evaluated for the potential to migrate to groundwater. Soil-gas data was not evaluated for the vapor intrusion pathway because there are no buildings in the areas and it is not a complete pathway.

The conceptual site model for contaminant exposure for ecological receptors is shown in Figure I-3.1-1 and in the ecological scoping checklist (Attachment I-1). Exposure pathways to surface and subsurface soil and tuff that apply for ecological receptors include root uptake by plants, dermal contact, inhalation of vapors or dust, incidental ingestion of soil, and food web transport. Dietary exposures include soil ingestion and food web transport, and are the primary pathways for wildlife. Surface water is not a complete exposure pathway for ecological receptors due to its transient occurrence. Although soil-gas data were not collected in the 0- to 5-ft interval, it was quantitatively evaluated for potential ecological risk.

For the human health risk evaluation, four unique exposure areas were evaluated: AOCs 49-005(b) and 49-008(a), and SWMUs 49-004 and 49-006. A depth interval of 0–1 ft was used to assess human health risk under the industrial scenario. A depth interval of 0–10 ft was used to assess human health risk under the construction worker scenario and the residential scenario. A depth interval of 0–5 ft was used to assess potential risk to terrestrial ecological receptors. All soil and tuff samples from these depth intervals were included in the assessments.

I-3.2 Environmental Fate and Transport

The evaluation of environmental fate addresses the chemical processes affecting the persistence of a chemical in the environment; the evaluation of transport addresses the physical processes affecting mobility of a contaminant along a migration pathway. Migration through soil and tuff depends on properties such as soil pH, rate of precipitation or snowmelt, soil moisture content, soil/tuff 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 investigation report. Results from the deepest samples collected showed either no detected concentrations of COPCs or low or trace-level concentrations of only a few inorganic, radionuclide, and/or organic COPCs in tuff. The limited migration of contamination is related to the absence of the key factors that facilitate migration, as mentioned above. Given the low concentrations of COPCs and how long the contamination has been present in the subsurface, physical and chemical properties of the COPCs, the lack of saturated conditions, and the depth to groundwater, the potential for contaminant migration to groundwater is very low.

The NMED guidance (NMED 2006, 092513) 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) can 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 areas such as the TA-49 sites outside 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. Therefore, screening of contaminant concentrations in soil against the DAF SSLs was not performed.

The best indication of the potential for future contaminant migration to groundwater is the current vertical distribution of contaminants in the subsurface. Releases at the TA-49 sites outside the NES boundary occurred decades ago. The regional aquifer beneath the aggregate area is approximately 1170 ft bgs. For migration of contaminants to occur from shallow soil to the regional aquifer in a meaningful time frame (e.g., 100 to 1000 yr), significant vertical migration should have already occurred. Sampling has shown that the source is very small and that this migration has not occurred, indicating a very low potential for future contaminant migration to groundwater.

The 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, the potential for ion exchange or sorption, and the potential for natural attenuation and bioremediation. The transport of volatile organic compounds (VOCs) occurs primarily in the vapor phase by diffusion or advection in

subsurface air. The chemical and physical properties of inorganic and organic COPCs at the TA-49 sites outside the NES boundary are presented in Tables I-3.2-1 and I-3.2-2.

The primary release and transport mechanisms that may lead to the potential exposure of receptors in the TA-49 sites outside the NES boundary include:

- dissolution and/or particulate transport of surface contaminants from precipitation and runoff,
- airborne transport of contaminated surface soil or particulates,
- continued dissolution and advective/dispersive transport of chemical and radiological contaminants contained in subsurface soil and bedrock,
- biotic perturbation and/or translocation of contaminants in subsurface contaminated media, and
- uptake of contaminants from soil by biota.

Contaminant distributions at the three sites indicate that after the initial deposition of contaminants from operational activities and historical remediation efforts, elevated levels of contaminants tend to remain concentrated in the vicinity of the original release points.

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. The primary physical and chemical factors that determine and describe the distribution of inorganic COPCs within the soil and tuff are the water solubility of the inorganic chemical and the soil-water partition coefficient (K_d). Other factors besides the K_d values, such as speciation in soil, oxidation/reduction potential (Eh), and pH, also play a role in the likelihood that inorganic chemicals will migrate. 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 K_d values. Inorganic 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 for the inorganic COPCs identified at the TA-49 sites outside the NES boundary. Based on this criterion, aluminum, antimony, barium, beryllium, chromium, cobalt, lead, manganese, mercury, nickel, thallium, uranium, vanadium, and zinc have a low potential to mobilize and migrate through soil and the vadose zone. The K_d values for copper, cyanide, iron, nitrate, perchlorate, selenium, and silver are less than 40 and may indicate that these inorganic chemicals have a greater potential to mobilize and migrate through soil and the vadose zone. These COPCs 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). Information for these inorganic chemicals is also available from the ATSDR website at http://www.atsdr.cdc.gov/toxpro2.html.

The soil and parent material at the TA-49 sites outside the NES boundary is similar to other areas in the vicinity of the Laboratory.

- Copper movement in soil is determined by physical and chemical interactions with the soil components. Most copper deposited in soil is strongly adsorbed and remains in the upper few centimeters. Copper will adsorb to organic matter, carbonate minerals, clay minerals, 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. 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. The average soil pH at the sites is 8.4, so leaching of copper is unlikely.

- Cyanide tends to adsorb onto various natural media, including clay and sediment; however, sorption is insignificant relative to the potential for cyanide to volatilize and/or biodegrade. At soil surfaces, volatilization of hydrogen cyanide is a significant mechanism for cyanide loss. Cyanide occurring at low concentrations in subsurface soil is likely to biodegrade under both aerobic and anaerobic conditions. The extent of cyanide is defined.
- Iron is naturally occurring in soil and tuff and may be relatively mobile under reducing conditions. Iron is sensitive to soil pH conditions and occurs 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-bearing minerals, such as lepidcrocite, hematite, and goethite. The extent of iron is defined.
- Nitrate, and to a lesser degree perchlorate, is highly 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 would inhibit the mobility of nitrate and perchlorate, as well as most other inorganic chemicals. In addition, the concentrations of nitrate detected at the sites are naturally occurring and do not indicate a release.
- 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 greater than 7.5, selenates, which have high solubility and a low tendency to adsorb onto soil particles, are the major selenium species which are very mobile. The average soil pH is 8.4 for the sites, indicating that selenium might migrate, but extent of selenium is defined.
- Silver sorbs onto soil and sediment and tends to form complexes with inorganic chemicals and humic substances in soil. Organic matter complexes with silver and reduces its mobility. The extent of silver is defined at depth.

I-3.2.2 Organic Chemicals

Table I-3.2-2 presents the physical and chemical properties (organic carbon-water partition coefficient [K_{oc}], logarithm to the base 10 octanol/water partition coefficient [log K_{ow}], and solubility) of the organic COPCs identified for the TA-49 sites outside the NES boundary. Physical and chemical properties of organic chemicals are important when evaluating their fate and transport. The following physical/chemical property information illustrates some aspects of the fate and transport tendencies of the TA-49 sites outside the NES boundary COPCs. 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. Butanone[2-] and methylene chloride have water solubilities greater than 1000 mg/L.

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 solubility are more likely to accumulate or bioaccumulate and persist in the environment, to be slightly prone to biodegradation, and to be metabolized in plants and animals. The COPCs identified as having water solubility less than or near

10 mg/L are Aroclor-1260; bis[2-ethylhexyl]phthalate; chloronaphthalene[2-]; pyrene; and tris(o-cresyl)phosphate.

Vapor pressure is a chemical characteristic used to evaluate the tendency of organic chemicals to volatilize. Chemicals with vapor pressure greater than 0.01 millimeters of mercury (mm Hg) are likely to volatilize; therefore, concentrations at the site are reduced over time. Vapors of these chemicals are more likely to travel toward the atmosphere and not migrate toward groundwater. Butanone[2-]; chloronaphthalene[2-]; methylene chloride; methylnaphthalene[2-]; and naphthalene have vapor pressures greater than or near 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. Aroclor-1260; bis(2-ethylhexyl)phthalate; pyrene; trinitrotoluene[2,4,6-]; and tris(o-cresyl)phosphate 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} is above 1000, the greater the affinity the chemical has for bioaccumulation in the food chain, the greater its potential for sorption in the soil, and the lower its mobility (Ney 1995, 058210). The COPCs with a K_{ow} greater than 1000 include Aroclor-1260; bis[2-ethylhexyl]phthalate; chloronaphthalene[2-]; methylnaphthalene[2-]; naphthalene; pyrene; and tris(o-cresyl)phosphate. A K_{ow} of less than 500 indicates high water solubility, high mobility, little to no affinity for bioaccumulation, and degradability by microbes, plants, and animals. Butanone[2-] dinitrotoluene[2,4-]; dinitrotoluene[2,6-]; methylene chloride; and trinitrotoluene[2,4,6-] have a K_{ow} less than 500.

The K_{oc} measures the tendency of a chemical to adsorb to organic carbon in soil. K_{oc} values above 500 L/kg indicate a strong tendency to adsorb to soil, leading to low mobility (NMED 2006, 092513). Aroclor-1260; bis[2-ethylhexyl]phthalate; dinitrotoluene[2,4-]; dinitrotoluene[2,6-]; methylnaphthalene[2-]; naphthalene; pyrene; trinitrotoluene[2,4,6-]; and tris(o-cresyl)phosphate have K_{oc} values above 500 L/kg, indicating a very low potential to migrate toward groundwater. The COPCs with K_{oc} values less than 500 L/kg are amino-4,6-dinitrotoluene[2-]; butanone[2-] and methylene chloride.

The COPCs that are least mobile and most likely to bioaccumulate include: Aroclor-1260; bis[2-ethylhexyl]phthalate; chloronaphthalene[2-]; dinitrotoluene[2,4-]; dinitrotoluene[2,6-]; methylnaphthalene[2-]; naphthalene; pyrene; trinitrotoluene[2,4,6-]; and tris(o-cresyl)phosphate. The more soluble and volatile COPCs, amino-4,6-dinitrotoluene[2-]; butanone[2-]; and methylene chloride, are more likely to travel toward the atmosphere and not migrate toward groundwater. Because the organic COPCs were detected at low concentrations and the extent is defined, they are not likely to migrate to groundwater.

I-3.2.2.1 Evaluation of Pore-Gas Data

The VOC results from pore-gas sampling were screened to evaluate whether concentrations in the subsurface pore gas are a potential source of groundwater contamination. Because no screening levels are available for pore gas that address the potential for groundwater contamination, the screening evaluation was based on groundwater standards or screening levels contained in the Consent Order and Henry's Law constants that describe the equilibrium relationship between vapor and water concentrations. The source of the Henry's Law constants was the New Mexico Environment Department (NMED)

technical background document (NMED 2009, 108070). The following dimensionless form of Henry's Law constant was used:

$$H' = \frac{C_{air}}{C_{water}} \qquad \textbf{Equation I-1}$$

where C_{air} is the volumetric concentration of contaminant in air and C_{water} is the volumetric concentration of contaminant in water. Equation I-1 can be used to calculate the following screening value (SV):

$$SV = \frac{C_{air}}{1{,}000 \times H' \times SL} \qquad \textbf{Equation I-2}$$

where C_{air} is the concentration of VOC in the pore-gas sample (µg/m^3), H' is the dimensionless Henry's Law constant, SL is the screening level (µg/L) and 1000 is a conversion factor from L to m^3, and SV is the screening value. The screening levels (SLs) are groundwater standards and SLs specified in the Consent Order, which include U.S. Environmental Protection Agency (EPA) maximum concentration limits, New Mexico Water Quality Commission standards, and, if standards are not available, NMED tap water SLs (NMED 2009, 108070). The numerator in Equation I-2 is the measured concentration of VOC in pore gas and the denominator represents the concentration in pore gas needed to exceed the SL. Therefore, if the SV is less than 1, the VOC concentration in pore gas is not high enough to cause the water SL to be exceeded, even if the VOCs were in contact with groundwater.

Equation I-2 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 using the maximum detected concentration (Table I-3.2-3). These results show that the SVs are below 1 in all cases. The results of this screening indicate that VOCs in subsurface pore gas are not a potential source of groundwater contamination.

Tritium was also detected in two pore-gas samples at a maximum concentration of 673.9 pCi/L. There is no screening value for tritium.

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-3.2-4 gives physical and chemical properties of the radionuclide COPCs identified at the TA-49 sites outside the NES boundary. Based on K_d values (greater than 40), americium-241, cesium-134, cesium-137, plutonium-238, and plutonium-239 have a very low potential to migrate towards groundwater. No K_d value was found for europium-152 and the K_d value for tritium is less than 40.

- The Human Health Fact Sheet, published by Argonne National Laboratory (http://www.evs.anl.gov/pub/doc/Europium.pdf), states that europium "preferentially adheres fairly tightly to soil, and the concentration associated with soil particles is estimated to be about 240 times higher than in interstitial water." This indicates that europium has a high K_d and,

coupled with the low detection frequency (2 per 160 samples), indicates a very low potential for migration.

- 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 (<1 pCi/g), indicating that there is no significant source of tritium, although this radionuclide is relatively mobile. 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 the upper bound concentrations of COPCs. For comparison to SSLs and screening action levels (SALs), the upper confidence limit (UCL) of the arithmetic mean was calculated when possible and used as the EPC. 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. 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 through I-2.3-11.

Calculation of UCLs of the mean concentrations was done using the EPA ProUCL 4.00.04 software (EPA 2007, 096530), which is based on EPA guidance (EPA 2002, 085640). The ProUCL program calculates a data distribution and a variety of 95%, 97.5%, and 99% UCLs and recommends a distribution and UCL. The UCL for the recommended calculation method was used as the EPC. The ProUCL software performs distributional tests on the dataset for each COPC and recommends the most appropriate UCL based on the distribution of the dataset. Environmental data may have a normal, lognormal, or gamma distribution but are often nonparametric (no definable shape to the distribution). Key aspects of the current version of ProUCL are that it tests data against an expanded range of distribution types, contains a larger suite of statistical tests, and performs analyses on datasets with nondetected values. The ProUCL documentation strongly recommends against using the maximum detection for the EPC. However, it also cautions against using statistical values calculated on less than four to six detected results in a large dataset. Therefore, the maximum detected concentration was used to represent the EPC for COPCs with less than five detected values because the resultant statistical estimate may not be reliable. In these cases, if the observations are highly skewed and result in significant risk due to use of the maximum detected concentration, the COPC is further assessed in the uncertainty section. Input and output data files for ProUCL calculations are provided as Attachment I-2 (on CD).

I-4.0 HUMAN HEALTH RISK-SCREENING ASSESSMENT

Human health risk-screening assessments were conducted for AOC 49-005(b), SWMU 49-004, AOC 49-008(a), and SWMU 49-006 to determine whether COPC concentrations in soil and tuff pose a potential unacceptable risk to human receptors. All sites were screened using the industrial scenario (0–1 ft bgs), the construction worker scenario (0–10 ft bgs), and the residential scenario (0–10 ft bgs). The human health risk-screening assessments compare either the UCL of the mean or the maximum detected concentration of each COPC with SSLs for chemicals and SALs for radionuclides.

I-4.1 Soil-Screening Levels

Human health risk-screening assessments for chemicals were conducted using SSLs for the industrial, construction worker, and residential scenarios obtained from NMED guidance (NMED 2006, 092513). The NMED SSLs are based on a target noncarcinogenic hazard quotient (HQ) of 1.0 and a target cancer risk of 1×10^{-5} (NMED 2006, 092513). If SSLs were not available from NMED guidance, EPA regional screening levels were used (http://www.epa.gov/region06/6pd/rcra_c/pd-n/screen.htm). The EPA SSLs 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}. EPA regional screening levels are not available for construction workers, therefore, when regional screening levels were used for a COPC, the construction worker SSLs were calculated using toxicity values from EPA regional screening tables (http://www.epa.gov/region06/6pd/rcra_c/pd-n/screen.htm) and exposure parameters from NMED (NMED 2009, 108070). Exposure parameters used to calculate the industrial, construction worker, and residential SSLs are presented in Table I-4.1-1.

Radionuclide SALs are used for comparison with radionuclide COPC concentrations and were derived using the residual radioactive model, Version 6.5 (LANL 2005, 088493). The SALs are based on a 15-mrem/yr dose per U.S. Department of Energy (DOE) guidance (DOE 2000, 067489). Exposure parameters used to calculate the industrial, construction worker, and residential SALs are presented in Tables I-4.1-2 and I-4.1-3.

I-4.2 Results of the Human Health Risk-Screening Evaluations

The EPC of each COPC was compared with the SSLs/SALs for the appropriate scenario(s). For carcinogenic chemicals, the EPCs were divided by the NMED or adjusted EPA SSL and then multiplied by 1×10^{-5}. The sum of the cancer 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 NMED or EPA SSL. The HQs were summed to generate a hazard index (HI). The HI was compared with the NMED target HI of 1.0. The dose is determined by dividing the EPC by the SAL, multiplying the ratio by 15 mrem/yr, and summing the individual doses to obtain the total dose for the site. The sum of the doses was compared with the DOE target dose level of 15 mrem/yr (DOE 2000, 067489).

I-4.2.1 AOC 49-005 (b)

The results of the risk-screening assessments for the industrial scenario are presented in Tables I-4.2-1 through I-4.2-4. The COPCs not detected in the 0- to 1-ft depth interval (nitrate, perchlorate, and tritium) were not included in the industrial risk-screening assessment. There are no carcinogenic COPCs for AOC 49-005(b) for the industrial scenario. The HI is approximately 0.004, which is below the NMED target HI of 1.0 (NMED 2009, 108070). The total dose is approximately 0.09 mrem/yr, which is below the DOE target dose limit of 15 mrem/yr (DOE 2000, 067489).

The results of the risk-screening assessments for the construction worker scenario are presented in Tables I-4.2-2 and I-4.2-4. There are no carcinogenic COPCs for AOC 49-005(b) for the construction worker scenario. The HI is approximately 0.03, which is below the NMED target HI of 1.0 (NMED 2009, 108070). The total dose is approximately 0.38 mrem/yr, which is below the DOE target dose limit of 15 mrem/yr (DOE 2000, 067489).

The results of the risk/dose-screening assessments for the residential scenario are presented in Tables I-4.2-3 and I-4.2-4. There are no carcinogenic COPCs for AOC 49-005(b) for the residential scenario. The HI is approximately 0.1, which is below the NMED target HI of 1.0 (NMED 2009, 108070). The total dose is approximately 0.13 mrem/yr, which is below the DOE target dose limit of 15 mrem/yr (DOE 2000, 067489).

I-4.2.2 SWMU 49-006

No COPCs were detected in the 0- to 1-ft depth interval for the industrial scenario.

The results of the risk-screening assessments for the construction worker scenario are presented in Tables I-4.2-5 and I-4.2-8. The COPCs not detected in the 0- to 10-ft depth interval (amino-4,6-dinitrotoluene[2-]; dinitrotoluene[2,4-]; dinitrotoluene[2,6-]; trinitrotoluene[2,4,6-]; and tris[o-cresyl]phosphate) were not included in the construction worker risk-screening assessment. There are no carcinogenic COPCs for SWMU 49-006 for the construction worker scenario. The HI is approximately 0.03, which is below the NMED target HI of 1.0 (NMED 2009, 108070). The total dose is approximately 0.0.002 mrem/yr, which is below the DOE target dose limit of 15 mrem/yr (DOE 2000, 067489).

The results of the risk-screening assessments for the residential scenario are presented in Tables I-4.2-6, I-4.2-7, and I-4.2-8. The COPCs not detected in the 0- to 10-ft depth interval (amino-4,6-dinitrotoluene[2-]; dinitrotoluene[2,4-]; dinitrotoluene[2,6-]; trinitrotoluene[2,4,6-]; and tris[o-cresyl]phosphate) were not included in the residential risk-screening assessment. The total excess cancer risk is approximately 2×10^{-9}, which is below the NMED target risk level of 1×10^{-5} (NMED 2009, 108070). The HI is approximately 0.07, which is below the NMED target HI of 1.0 (NMED 2009, 108070). The total dose is approximately 0.01 mrem/yr, which is below the DOE target dose limit of 15 mrem/yr (DOE 2000, 067489).

I-4.2.3 AOC 49-008(a)

The results of the risk-screening assessments for the industrial scenario are presented in Table I-4.2-9. The total excess cancer risk is approximately 8×10^{-8}, which is below the NMED target risk level of 1×10^{-5} (NMED 2009, 108070). There are no noncarcinogenic or radionuclide COPCs for AOC 49-008(a).

The results of the risk-screening assessments for the construction worker scenario are presented in Table I-4.2-10. The total excess cancer risk is approximately 9×10^{-9}, which is below the NMED target risk level of 1×10^{-5} (NMED 2009, 108070). There are no noncarcinogenic or radionuclide COPCs for AOC 49-008(a).

The results of the risk-screening assessments for the residential scenario are presented in Table I-4.2-11. The total excess cancer risk is approximately 3×10^{-7}, which is below the NMED target risk level of 1×10^{-5} (NMED 2009, 108070). There are no noncarcinogenic or radionuclide COPCs for AOC 49-008(a).

I-4.2.4 SWMU 49-004

Calcium was retained as a COPC because it was detected above background in soil and tuff; however, it does not have a published toxicity value. Calcium is among those elements identified in section 5.9.4 of EPA's Risk Assessment Guidance for Superfund (RAGS) (EPA 1989, 008021) as an essential macronutrient, which can be eliminated as a COPC on the basis of best professional judgment. As an essential nutrient, calcium may be compared to the recommended daily allowance (RDA) for adults and children. The RDA is 1200 mg/d of calcium for an adult and 800 mg/d for a child (National Research Council 1989, 064000). If all the daily incidental ingestion of soil were to occur at the location of the maximum-detected concentration at SWMU 49-004 (10,800 mg/kg), at the EPA default adult soil ingestion rate of 100 mg/d of soil, an adult would ingest approximately 1.54 mg calcium/d. At the intake level of 1.54 mg/d, the adult's ingestion of calcium is far less than the RDA for calcium of 1200 mg/d. If all the daily incidental ingestion of soil were to occur at the location of the maximum detected concentration

at SWMU 49-004 at the EPA default child soil ingestion rate of 200 mg/d of soil, a child would ingest approximately 3.6 mg/d. At the intake level of 3.6 mg/d, the child's ingestion of calcium is far less than the RDA for calcium of 800 mg/d. Therefore, no adverse health effects are expected from calcium at 10,800 mg/kg, and calcium is eliminated as a COPC.

Magnesium was identified as a COPC but does not have a published toxicity value. It is among those elements identified in section 5.9.4 of EPA's Risk Assessment Guidance for Superfund (EPA 1989, 008021) as an essential macronutrient. As an essential nutrient, magnesium may be compared to the RDA for adults and children. The RDA is 420 mg/d of magnesium for an adult male, 320 mg/d for an adult female, and 240 mg/d for a child (National Research Council 1989, 064000). If all the daily incidental ingestion of soil were to occur at the location of the maximum concentration detected at SWMU 49-004 of 2290 mg/kg, at the EPA default adult soil ingestion rate of 100 mg/d of soil, an adult would ingest approximately 0.33 mg/d of magnesium. At the intake level of 0.33 mg/d of magnesium, the adult's ingestion of magnesium is far less than the RDA for magnesium of 320 to 420 mg/d. If all the daily incidental ingestion of soil were to occur at the location of the maximum concentration detected at SWMU 49-004 of 2290 mg/kg, at the EPA default child soil ingestion rate of 200 mg/d of soil, a child would ingest approximately 0.76 mg/d of magnesium. At the intake level of 0.76 mg/d of magnesium, the child's ingestion of magnesium is far less than the RDA for magnesium of 240 mg/d. Therefore, no adverse health effects are expected from magnesium at 2290 mg/kg, and magnesium is eliminated as a COPC.

The results of the risk-screening assessments for the industrial scenario are presented in Tables I-4.2-12 and I-4.2-17. The COPCs not detected in the 0- to 1-ft depth interval (bis[2-ethylhexyl]phthalate; chloronaphthalene[2-]; methylnaphthalene[2-]; naphthalene; pyrene; and tritium) were not included in the industrial risk-screening assessment. There are no carcinogenic COPCs for SWMU 49-004 for the industrial scenario. The HI is approximately 0.09, which is below the NMED target HI of 1.0 (NMED 2009, 108070). The total dose is approximately 0.75 mrem/yr, which is below the DOE target dose limit of 15 mrem/yr (DOE 2000, 067489).

The results of the risk-screening assessments for the construction worker scenario are presented in Tables I-4.2-13, I-4.2-14, and I-4.2-17. The total excess cancer risk is approximately 1×10^{-10}, which is below the NMED target risk level of 1×10^{-5} (NMED 2009, 108070). The HI is approximately 1.6, which is slightly above the NMED target HI of 1.0 (NMED 2009, 108070). The elevated HI is primarily due to manganese. The total dose is approximately 3 mrem/yr, which is below the DOE target dose limit of 15 mrem/yr (DOE 2000, 067489).

The results of the risk/dose-screening assessments 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 is approximately 3×10^{-7}, which is below the NMED target risk level of 1×10^{-5} (NMED 2009, 108070). The HI is approximately 1.0, which is equivalent to NMED target HI of 1.0 (NMED 2009, 108070). The total dose is approximately 1 mrem/yr, which is below the DOE target dose limit of 15 mrem/yr (DOE 2000, 067489).

I-4.3 Evaluation of Vapor Intrusion

The vapor intrusion indoor air pathway was not evaluated because there are no buildings on the sites where soil-gas samples were collected and both soil-gas and soil-sampling results for VOCS were either very low or nondetects.

I-4.4 Uncertainty Analysis

The analyses presented in human health risk-screening assessments are subject to varying degrees and types of uncertainty. Aspects of data evaluation and COPC identification, exposure assessment, toxicity

assessment, and the additive approach all contribute to uncertainties in the risk-assessment process and may affect the evaluation results.

I-4.4.1 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 those chemicals that are either detected or have detection limits above background are retained for further analysis. However, established BVs may not accurately represent certain subunits of the Bandelier Tuff (e.g., fractured, clay-rich material) encountered during sampling because such data are not included in the background dataset. There are no established BVs for organic chemicals and all detected organic chemicals are identified as COPCs and are retained for further analysis. Radionuclides are also identified as COPCs based on background comparisons or detection status.

Other uncertainties associated with the inorganic and organic chemicals may include errors in sampling, laboratory analysis, and data analysis. However, because concentrations used in the risk-screening assessments are less than estimated detection or quantitation limits, data evaluation uncertainties are expected to have little or no effect on the risk-screening results. Many detected concentrations of organic COPCs were qualified J, indicating the values were less than estimated quantitation limits. These results were all included in the assessments.

I-4.4.2 Exposure Assessment

An individual may be subject to exposures in a different manner than the exposure assumptions used to derive the SSLs. For the sites evaluated, individuals might not be on-site now 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 2009, 108070), while the construction worker SSLs are based on exposure of 8 h/d, 250 d/yr, and 1 yr (NMED 2009, 108070). The residential SSLs are based on exposure of 24 h/d, 350 d/yr, and 30 yr (NMED 2009, 108070). As a result, the industrial, construction worker, and residential scenarios evaluated at these sites likely overestimate the exposure and risk/dose.

A number of assumptions are made relative to exposure pathways, including input parameters, whether or not a given pathway is complete, 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 (EPA 2007, 099314; NMED 2009, 108070). When several upper-bound values (as are found in NMED 2009, 108070) are combined to estimate exposure for any one pathway, the resulting risk 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. The use of a UCL is intended to provide a protective, upper-bound estimate of the 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 concentrations or detection limits 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.

One site has potential risk that exceeds the NMED target level. The potential risk may be overestimated because of uncertainties associated with the EPCs and/or the COPCs.

I-4.4.2.1 SWMU 49-004

The HI for the construction worker scenario (1.6) is slightly above the target HI of 1.0 and is primarily due to manganese. The manganese soil concentrations (99.7 mg/kg to 1030 mg/kg) were comparable to the range of soil background concentrations (76 mg/kg to 1100 mg/kg) and the EPC is 424 mg/kg, which is also similar to the soil and tuff BVs (671 mg/kg and 482 mg/kg, respectively (LANL 1998, 059730)]. In addition, the manganese SSL (432 mg/kg) is less than the soil and tuff BVs. Without manganese, the HI is approximately 0.7, which is below the NMED target HI of 1.0.

I-4.4.3 Toxicity Assessment

The primary uncertainty associated with the screening values is related to the derivation of toxicity values used in their calculation. Toxicity values (slope factors [SFs] and reference doses [RfDs]) were used to derive the risk-based screening values used in the screening evaluation (NMED 2009, 108070). Uncertainties were identified in four 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, and (4) the chemical form of the COPC.

I-4.4.3.1 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 between animals and humans in chemical absorption, metabolism, excretion, and toxic responses. 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.

I-4.4.3.2 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 assessment. This factor of 10 is generally considered to result in a conservative estimate of risk to noncarcinogenic COPCs.

I-4.4.3.3 Derivation of RfDs and SFs

The RfDs and SFs are often determined by extrapolation from animal data to humans, which may result in uncertainties in toxicity values because differences exist between other animals and humans in chemical absorption, metabolism, excretion, and toxic response. 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 into each of these steps, resulting in the overestimation of potential risk.

I-4.4.3.4 Chemical Form of the COPC

COPCs may be bound to the environmental matrix and not available for absorption into the human body. However, the exposure scenarios default to the assumption that the COPCs are bioavailable. This assumption can lead to an overestimation of the total risk.

I-4.4.4 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 and on different target organs but are addressed additively.

I-4.5 Interpretation of Human Health Screening Results

I-4.5.1 Industrial Scenario

There were no carcinogenic COPCs for AOC 49-005(b), SWMU 49-006, and SWMU 49-004 for the industrial scenario. No COPCs were detected in the 0- to 1-ft depth interval for the industrial scenario at SWMU 49-006. The total excess cancer risk for AOC 49-008(a) is approximately 8×10^{-8}, which is below the NMED target risk level of 1×10^{-5} (NMED 2009, 108070). The HIs for AOC 49-005(b) and SWMU 49-004 are approximately 0.004 and 0.09, respectively, which are below the NMED target HI of 1.0 (NMED 2009, 108070). The total doses are approximately 0.09 and 0.75 mrem/yr for AOC 49-005(b) and SWMU 49-004, respectively, which are below the DOE target dose limit of 15 mrem/yr (DOE 2000, 067489). The total dose for the industrial scenario is equivalent to a total risk of 1×10^{-6}, based on a comparison with EPA's industrial preliminary remediation goals (PRGs) for radionuclides (http://epa-prgs.ornl.gov/radionuclides/download/rad_master_prg_table_pci.xls).

I-4.5.2 Construction Worker Scenario

There were no carcinogenic COPCs for AOC 49-005(b) and SWMU 49-006 for the construction worker scenario. The total excess cancer risks are approximately 9×10^{-9} and 1×10^{-10} for AOC 49-008(a) and SWMU 49-004, respectively, which are below the NMED target risk level of 1×10^{-5} (NMED 2009, 108070). The HIs are approximately 0.02 and 0.03 for AOC 49-005(b) and SWMU 49-006, respectively, which are below the NMED target HI of 1.0 (NMED 2009, 108070). The construction worker scenario HI for SWMU 49-004 (1.6) is slightly above the target HI of 1.0, primarily due to manganese. However, the range of manganese soil concentrations (99.7 mg/kg to 1030 mg/kg) was comparable to the range of soil background concentrations (76 mg/kg to 1100 mg/kg), the EPC for manganese is similar to BVs, and the manganese SSL is less than BVs. The HI without manganese is 0.7. The total doses are approximately 0.13, 0.002, and 1 mrem/yr for AOC 49-005(b), SWMU 49-006, and SWMU 49-004, respectively, which are below the DOE target dose limit of 15 mrem/yr (DOE 2000, 067489). The total doses for the construction worker scenario are equivalent to total risks of 1×10^{-6}, 3×10^{-7}, and 4×10^{-6} for AOC 49-005(b), SWMU 49-006, and SWMU 49-004, respectively, based on a comparison with EPA's industrial PRGs for radionuclides (http://epa-prgs.ornl.gov/radionuclides/download/rad_master_prg_table_pci.xls).

I-4.5.3 Residential Scenario

There were no carcinogenic COPCs for AOC 49-005(b) and SWMU 49-006 for the residential scenario. The total excess cancer risks are approximately 3×10^{-7} for both AOC 49-008(a) and SWMU 49-004, respectively, which are below the NMED target risk level of 1×10^{-5} (NMED 2009, 108070). The HIs are approximately 0.1, 0.07, and 1 for AOC 49-005(b), SWMU 49-006, and SWMU 49-004, respectively, which are below or equivalent to the NMED target HI of 1.0 (NMED 2009, 108070). The total doses are approximately 0.38, 0.01, and 3 mrem/yr for AOC 49-005(b), SWMU 49-006, and SWMU 49-004, respectively, which are below the DOE target dose limit of 15 mrem/yr (DOE 2000, 067489). The total doses for the construction worker scenario are equivalent to total risks of 2×10^{-6}, 2×10^{-7}, and 7×10^{-6} for AOC 49-005(b), SWMU 49-006, and SWMU 49-004, respectively, based on a comparison with EPA's residential PRGs for radionuclides (http://epa-prgs.ornl.gov/radionuclides/download/rad_master_prg_table_pci.xls).

I-4.5.4 Pore Gas

Screening was performed for each of the VOCs detected in pore gas using the maximum detected concentration. These results show that the SVs are below 1 in all cases, indicating that VOCs in subsurface pore gas are not a potential source of groundwater contamination.

Tritium was also detected in two pore-gas samples at a maximum concentration of 673.9 pCi/L. There is no screening value for tritium.

I-5.0 ECOLOGICAL SCREENING ASSESSMENT

The approach used to evaluate ecological risk is described in "Screening Level Ecological Risk Assessment Methods, Revision 2" (LANL 2004, 087630). The assessment consists of four parts: (1) a scoping evaluation, (2) a screening evaluation, (3) an uncertainty analysis, and (4) 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-1) is a useful tool for organizing existing ecological information. The information in the scoping checklists was used to determine whether ecological receptors might be affected, to identify the types of receptors that might be present, and to develop the ecological conceptual site model (Figure I-3.1-1)

Soil at Areas 5 and 6 has been disturbed. The soil is intermixed with patches of bedrock, which occurs predominantly near the edges of the mesa east of developed areas of TA-49. Removal actions have taken place and there are numerous roadways throughout 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. No threatened and endangered (T&E) species habitat is present at the site. However, the area falls within the Mexican spotted owl foraging area.

Surface water runoff terminates northward into Water Canyon, eastward into a tributary canyon at Ancho Canyon, or southward into Ancho Canyon from Frijoles Mesa (LANL 2007, 098492). Drainage ditches

along the roads provide control of runoff. Area 5 is located on a flat slope in the center of TA-49. Areas 6 and 10 are located on the edge of the mesa near Water Canyon and provide the greatest potential for runoff. Water Canyon experiences ephemeral flow caused by runoff during the intense summer storms and snowmelt events. There is little to no recharge to the regional aquifer.

No potential for exposure to aquatic receptors exists because no persistent aquatic habitat or perennial source of water occurs in the canyon. Additionally, the depth of the regional aquifer (approximately 1170 ft bgs) and the semiarid climate at the Laboratory preclude transport to groundwater. The potential exposure of terrestrial receptors to COPCs in surface soil and unconsolidated tuff is by root uptake, inhalation, soil ingestion, dermal contact, external irradiation, and food web transport (Figure I-3.1-1).

Exposure pathways to receptors from COPCs in consolidated tuff are considered incomplete because COPCs in tuff are generally immobilized and become available to receptors only as a function of the slow rates of weathering of the tuff. Plant exposure to COPCs 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 assumed to be unavailable to the extent necessary to cause adverse population-level effects. Soil-gas samples were collected below the 0- to 5-ft interval but are assessed quantitatively.

Potentially complete pathways for exposure of terrestrial receptors to COPCs exist at the site. The potential risk was evaluated quantitatively in this risk-screening assessment for the following ecological receptors, representing several feeding guilds and trophic levels:

- plants
- soil-dwelling invertebrates (represented by the earthworm)
- mammalian omnivore (represented by deer mouse)
- mammalian insectivore (represented by montane shrew)
- mammalian herbivore (represented by desert cottontail)
- mammalian carnivore (represented by red fox)
- avian insectivore, omnivore, and herbivore (represented by American robin)
- avian insectivore and carnivore (represented by American kestrel); surrogate for avian T&E species

The rationale for these receptors is presented in “Screening Level Ecological Risk Assessment Methods, Revision 2” (LANL 2004, 087630). The Mexican spotted owl is the only T&E species known to frequent the Laboratory area. The owl’s primary habitat is densely forested canyons; the TA-49 sites outside the NES boundary are in its habit buffer zone, and the owl may use the canyons and surrounding areas to forage. Of the terrestrial receptors being evaluated, only the montane shrew is not expected to be present at the TA-49 sites outside the NES boundary because it requires free water for survival; surface water does not exist at the site. However, because the shrew represents the insectivorous feeding guild for mammals, which is not specifically represented by any of the other terrestrial receptors, the shrew was evaluated in this risk-screening assessment.

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) because 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 has 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. It is assumed, for the purposes of ecological screening that nonradionuclides have common toxicological effects and that HQs may be added.

I-5.3 Screening Evaluation

The ecological risk-screening assessments identify chemicals of potential ecological concern (COPECs) and are based on the comparison of EPCs (UCLs or maximum-detected concentrations) (LANL 2004, 087630) to ecological screening levels (ESLs) in accordance with Laboratory guidance (LANL 2004, 087630).

The ESLs were obtained from the ECORISK Database, Version 2.4 (LANL 2009, 107524) 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, is presented in the ECORISK Database, Version 2.4 (LANL 2009, 107524). The HQ calculated for each COPEC and screening receptor is the ratio of the EPC to the ESLs for each ecological receptor. 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. The analysis begins with a comparison of the minimum ESL for each COPC with the EPC. HQs greater than 0.3 are used to identify COPECs (LANL 2004, 087630). Individual HQs for a receptor are summed to derive an HI; an HI greater than 1.0 is an indication that further assessment may be needed. COPCs without ESLs are retained as COPECs and evaluated further in the uncertainty section. 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 AOC 49-005(b)

The results of the minimum ESL comparisons are presented in Table I-5.3-2. Cyanide, mercury, and thallium 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-5.3-3. The HI analysis indicates that all of the receptors, except the kestrel, cottontail, earthworm, and red fox, have HIs greater than 1. The COPECs and receptors are discussed in the uncertainty section.

Nitrate does not have ESLs, is retained as a COPEC, and is discussed in the uncertainty section.

I-5.3.2 SWMU 49-006

The results of the minimum ESL comparisons are presented in Table I-5.3-4. Chromium, cyanide, mercury, and bis(2-ethylhexyl)phthalate 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 all of the receptors, except the deer mouse, cottontail, montane shrew, and red fox, have HIs greater than 1. The COPECs and receptors are discussed in the uncertainty section.

Nitrate does not have ESLs, is retained as a COPEC, and is discussed in the uncertainty section.

I-5.3.3 AOC 49-008(a)

The results of the minimum ESL comparisons are presented in Table I-5.3-6. Aroclor-1260 is retained as COPEC because the HQ was greater than 0.3 (0.49). The HQs and HIs for each COPEC and receptor combination are presented in Table I-5.3-7. The HI analysis indicates that all of the receptors have HIs less than 1 and no COPECs are retained. Therefore, there are no potential risks to ecological receptors and no further assessment of Aroclor-1260 is needed.

I-5.3.4 SWMU 49-004

The results of the minimum ESL comparisons are presented in Table I-5.3-8. Antimony, barium, beryllium, chromium, cobalt, copper; lead, manganese, mercury, nickel, selenium and zinc are retained as COPECs because the HQs are greater than 0.3. The HQs and HIs for each COPEC and receptor combination are presented in Table I-5.3-9. The HI analysis indicates that all of the receptors, except the kestrel (top carnivore), cottontail and red fox, have HIs greater than 1. The COPECs and receptors are discussed in the uncertainty section.

Perchlorate does not have ESLs, is retained as a COPEC, and is discussed in the uncertainty section.

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 average soil pH for the TA-49 sites outside the NES boundary is 8.4.

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. The following is a qualitative uncertainty analysis of the issues relevant to evaluating potential ecological risk at each site.

I-5.4.1 Chemical Form

The assumptions used in the ESL derivations are conservative and not necessarily representative of actual conditions. These assumptions include maximum chemical bioavailability, maximum receptor ingestion rates, minimum body weight, and additive effects of multiple COPECs. These factors tend to result in conservative ESL estimates, which may lead to an overestimation of the potential risk. The assumption of additive effects for multiple COPECs may result in an overestimation or underestimation of the potential risk to receptors.

The chemical form of the individual COPCs was not determined as part of the investigation. Toxicological data are typically based on the most toxic and bioavailable chemical species, which are not typically found in the environment. Inorganic, radionuclide, and organic COPECs are generally not 100% bioavailable to receptors in the natural environment because of interference from other natural processes, such as 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 2004, 087630), and the values are biased toward overestimating the potential risk to receptors.

I-5.4.2 Exposure Assumptions

The EPCs used in the calculations of HQs are the UCLs or the maximum detected concentrations in the soil/fill/tuff to depths of 5 ft bgs and are conservative estimates of exposure to each COPEC. The sampling efforts 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. These exposure assumptions for terrestrial receptors in the TA-49 sites outside the NES boundary are likely to overestimate potential ecological exposure and risk.

Although two sites have pore-gas data from below the 0- to 5-ft depth interval and detected concentrations are low, pore gas was quantitatively evaluated using the pocket gopher as the receptor.

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 underestimation or overestimation of potential risk.

I-5.4.4 Comparison with Background Concentrations

I-5.4.4.1 AOC 49-005(b)

The EPCs for the following inorganic chemicals are similar to background soil or tuff concentrations: cyanide, mercury, and thallium (Table I-5.4-1). These inorganic chemicals are not retained as COPECs

because their EPCs are similar to background concentrations; therefore, exposure of the receptors to these inorganic chemicals is similar to background.

I-5.4.4.2 SWMU 49-006

The EPCs for the following inorganic chemicals are similar to soil or tuff background concentrations: chromium, cyanide, and mercury (Table I-5.4-2). These inorganic chemicals are not retained as COPECs because their EPCs are similar to background concentrations; therefore, exposure of the receptors to these inorganic chemicals is similar to background.

I-5.4.4.3 AOC 49-008(a)

AOC 49-008(a) had no inorganic COPECs.

I-5.4.4.4 SWMU 49-004

The EPCs for the following inorganic chemicals are similar to soil or tuff background concentrations: antimony, barium, beryllium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, selenium thallium, and zinc (Table I-5.4-3). These inorganic chemicals are not retained as COPECs because their EPCs are similar to background concentrations; therefore, exposure of the receptors to these inorganic chemicals is similar to background.

I-5.4.5 Area Use Factors

Area use factors (AUFs) are used to account for the amount of time that a receptor is likely to spend within the contaminated areas, based on the size of the receptor's home range (HR). The AUFs for individual organisms were developed by dividing the size of the site by the receptor's HR. Because T&E species must be assessed on an individual basis (EPA 1999, 070086), the AUF is used for the Mexican spotted owl. The kestrel (top carnivore) is used as the surrogate receptor for the Mexican spotted owl. The unadjusted HI for the kestrel (top carnivore) is above 1.0 only for SWMU 49-006. The site area for SWMU 49-006 is approximately 0.017 hectares (ha), and the HR for the Mexican spotted owl is 366 ha (Table I-5.4-4). Therefore, the AUF for the Mexican spotted owl is 0.0005. Application of this AUF for the Mexican spotted owl to the HQ for the kestrel (top carnivore), minus the inorganic COPECs previously eliminated, results in an adjusted HI of 0.00007. Therefore, there are no potential adverse ecological risks to the Mexican spotted owl at the TA-49 sites outside the NES boundary.

I-5.4.6 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 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). Bowman et al. estimates that the median dispersal distance for mammals is 7 times the linear dimension of the HR, which is equivalent to 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 40 HR.

The population area use factor (PAUF) is calculated by dividing the site area by the population area of the receptor (Table I-5.4-4). The HQs and HIs are recalculated minus the inorganic COPECs eliminated based on similarity to background and adjusted by multiplying by the PAUFs. The HQs for the plant and earthworm are not adjusted by PAUFs because these receptors do not have HRs. SWMU 49-006 is the only site remaining that has a COPEC with an ESL. The adjusted HIs are all 0.01 or less for bis(2-ethylhexyl)phthalate (Table I-5.4-5). Bis(2-ethylhexyl)phthalate is eliminated as a COPEC at SWMU 49-006.

I-5.4.7 COPECs without ESLs

Several COPECs do not have ESLs for any receptor in version 2.4 of the ECORISK Database (LANL 2009, 107524) because literature searches for relevant toxicity data for these chemicals have not been completed. In an effort to address this uncertainty and provide a quantitative assessment of potential ecological risk, several online toxicity databases have been searched in order to determine if any relevant toxicity information are available. The online databases searched were 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, USDA Integrated Pesticide Management Database, American Bird Conservancy Pesticide Toxicity Database, and Oak Ridge National Laboratory Risk Assessment Information System. Toxicity data was obtained for several COPECs and receptors as a result of this online database search and interim ESLs were calculated. The ESLs are termed interim because the information and calculations are still undergoing review, and documentation required for the ECORISK Database has not yet been completed. As a result, the ESLs are not yet in the ECORISK Database. Once the development process is completed the interim ESLs will be finalized and included in the appropriate revision to the ECORISK Database. Although the majority of the COPECs listed did not have any relevant toxicity data in the online databases listed above, a search of the literature continues in an effort to determine if any relevant toxicity information exists.

In the absence of a chemical-specific ESL, COPEC concentrations can be compared to 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 that 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.

I-5.4.7.1 AOC 49-005(b)

No ESLs are available in the ECORISK Database, Version 2.4 (LANL 2009, 107524) for nitrate. Nitrate does not have interim or surrogate ESLs and is assessed qualitatively.

Nitrate was detected in two samples within the 0- to 5-ft depth interval with a maximum detected concentration of 1.7 mg/kg. Nitrate is naturally occurring and the detected concentrations likely reflect natural levels, but no background data are available. The NMED residential SSL for nitrate is 125,000 mg/kg, indicating that the potential toxicity is very low. Because of the potential very low toxicity and the naturally occurring concentrations, nitrate is eliminated as a COPEC.

I-5.4.7.2 SWMU 49-006

Nitrate was detected in two samples within the 0- to 5-ft depth interval with a maximum detected concentration of 0.26 mg/kg. Nitrate is naturally occurring and the detected concentrations likely reflect natural levels, but no background data are available. The NMED residential SSL for nitrate is 125,000 mg/kg, indicating that the potential toxicity is very low. Because of the potential very low toxicity and the naturally occurring concentrations, nitrate is eliminated as a COPEC.

I-5.4.7.3 SWMU 49-004

No ESLs are available in the ECORISK Database, Version 2.4 (LANL 2009, 107524) for perchlorate. Perchlorate does not have interim or surrogate ESLs and is assessed qualitatively.

Perchlorate was detected in two samples within the 0- to 5-ft depth interval with a maximum detected concentration of 0.0014 mg/kg. The NMED residential SSL for perchlorate is 54.8 mg/kg, indicating that the potential toxicity is low. Because of the potential low toxicity and infrequent detection, perchlorate is eliminated as a COPEC.

I-5.5 Interpretation of Ecological 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 at the TA-49 sites outside the NES boundary. Receptors were evaluated using several lines of evidence: minimum ESL comparisons, HI analyses, comparison to background concentrations, and potential effects to populations (individuals for T&E species).

I-5.5.1.1 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.
- HIs were greater than 1.0 for the plant at AOC 49-005(b), SWMU 49-006, and SWMU 49-004.
- Several COPECs were eliminated because their EPCs were similar to background concentrations. No COPECs were retained at any site for the plant.
- The plant communities were evaluated at all sites during site visits. No evidence of adverse impacts of contamination to the plant community based on field observations was found during site visits (Attachment I-1); the plant community is typical of the surrounding area and appears healthy.

These lines of evidence support the conclusion that no potential ecological risk to the plants exists at the TA-49 sites outside of the NES boundary.

I-5.5.1.2 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.
- HIs were less than 1.0 for the earthworm at AOCs 49-005(b) and 49-008(a).
- Several COPECs were eliminated because their EPCs were similar to background concentrations. No COPECs were retained at any site for the earthworm.
- The plant communities were evaluated at all sites during site visits. No evidence of adverse impacts of contamination to the plant community based on field observations was found during site visits (Attachment I-1); the plant community is typical of the surrounding area and appears healthy. Because the plant community does not appear to be affected by the COPECs, the earthworm population is also likely not affected.

These lines of evidence support the conclusion that no potential ecological risk to the earthworm exists at the TA-49 sites outside of the NES boundary.

I-5.5.1.3 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.
- HIs were less than 1.0 for the shrew at AOCs 49-005(b) and 49-008(a) and SWMU 49-006.
- Several COPECs were eliminated because their EPCs were similar to background concentrations. No COPECs were retained at any site for the shrew.

These lines of evidence support the conclusion that no potential ecological risk to the montane shrew exists at the TA-49 sites outside of the NES boundary.

I-5.5.1.4 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.
- HIs were less than 1.0 for the deer mouse at SWMU 49-006 and AOC 49-008(a).
- Several COPECs were eliminated because their EPCs were similar to background concentrations. No COPECs were retained at any site for the deer mouse.
- These lines of evidence support the conclusion that no potential ecological risk to the deer mouse exists at the TA-49 sites outside of the NES boundary.

I-5.5.1.5 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.
- HIs were less than or equivalent to 1.0 for the cottontail at all sites.

These lines of evidence support the conclusion that no potential ecological risk to the cottontail exists at the TA-49 sites outside of the NES boundary.

I-5.5.1.6 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.
- HIs were less than or equivalent to 1.0 for the red fox at all sites.

These lines of evidence support the conclusion that no potential ecological risk to the fox exists at the TA-49 sites outside of the NES boundary.

I-5.5.1.7 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.
- HIs were greater than 1.0 for the robin (all feeding guilds) at all sites, except AOC 49-008(a).
- Several COPECs were eliminated because their EPCs were similar to background concentrations. No COPECs were retained at AOC 49-005(b) and SWMU 49-004 for the robin.
- The HIs for the robin (omnivore and insectivore) were adjusted by the PAUF at SWMU 49-006, which is the ratio of the site area to the robin's population area. The adjusted HIs were less than 1.0 at SWMU 49-006.

These lines of evidence support the conclusion that no potential ecological risk to the robin (all feeding guilds) exists at the TA-49 sites outside of the NES boundary.

I-5.5.1.8 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 less than 1.0 for the kestrel (intermediate carnivore) at AOCs 49-005(b) and 49-008(a).
- Several COPECs were eliminated because their EPCs were similar to background concentrations. No COPECs were retained at SWMU 49-004 for the kestrel (intermediate carnivore).
- The HI was adjusted by the PAUF at SWMU 49-006, which is the ratio of the site area to the kestrel's population area. The adjusted HI was less than 1.0 at SWMU 49-006.

These lines of evidence support the conclusion that no potential ecological risk to the kestrel (intermediate carnivore) exists at the TA-49 sites outside of the NES boundary.

I-5.5.1.9 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 1.0 for the kestrel (top carnivore) at AOC 49-008(a) and SWMU 49-004.

- Several COPECs were eliminated because their EPCs were similar to background concentrations. No COPECs were retained at AOC 49-005(b) for the kestrel (top carnivore).
- The HI was adjusted by the PAUF at SWMU 49-006, which is the ratio of the site area to the kestrel's population area. The adjusted HI was less than 1.0 at SWMU 49-006.
- The kestrel (top carnivore) is a surrogate for the Mexican spotted owl. The HIs were adjusted for the owl's AUF. The adjusted HIs were less than 1.0 for 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 outside of the NES boundary.

I-5.5.2 COPECs with No ESLs

COPECs with no ESLs were not evaluated for each receptor. Because an interim or surrogate ESL was not available, the residential SSL was used to estimate potential toxicity. In addition, the frequency of detection and the concentrations detected were also evaluated. All COPECs without ESLs were eliminated based on these comparisons.

The analysis of COPECs with no ESLs supports the conclusion that there is no potential ecological risk to receptors at the TA-49 sites outside of the NES boundary.

I-5.5.3 DOE Tier I Bioconcentration Guide

The DOE Tier I Biota Concentration Guide (BCG) is a lower value for cesium-137 (21.6 pCi/g) than the ECORISK Database final ESLs (680 pCi/g). Cesium-137 was a COPC at several sites. Using the EPCs for cesium-137 for each site and the DOE Tier I BCG, the HQs for these radionuclides are all less than 1.0. These HQs are too small to impact the HIs for these sites. In addition, the DOE BCG incorporates bioaccumulation factors that are orders of magnitude higher than those in the ECORISK Database. Environmental surveillance and monitoring at the Laboratory indicate that bioaccumulation factors are not as high as those used by DOE (Bennett et al. 1996, 056035). Therefore, the ESL comparison is more representative than the BCG comparison.

I-5.5.4 Pore-Gas Screening Assessment

One round of pore-gas samples were collected at AOC 49-005(b) and SWMU 49-004. The shallowest depth at which pore-gas samples were collected was 9 to 10 ft bgs. Although this depth is below the 0- to 5-ft depth used to evaluate ecological risk, it provides a comparison to evaluate potential risk to the pocket gopher. Several VOCs detected in pore gas have inhalation ESLs in the ECORISK Database, Version 2.4 (LANL 2009, 107524). These VOCs include acetone; benzene; 2-butanone; chloromethane; dichlorofluoromethane; styrene; tetrachloroethene; toluene; and xylene. Surrogates were used for ethylbenzene; 4-ethyltoluene; 1,2,4-trimethylbenzene; 1,3,5-trimethylbenzene; 1,2-xylene; and 1,3-xylene+1,4-xylene. The maximum detected concentration for each VOC was compared to the inhalation ESLs and the HIs were 0.003 and 0.004 for AOC 49-005(b) and SWMU 49-004, respectively (Tables I-5.5-1 and I-5.5-2).

I-6.0 CONCLUSIONS

I-6.1 Human Health

The human health risk-screening assessments found no unacceptable risks or doses under the industrial, construction worker, and residential scenarios for AOCs 49-005(b) and 49-008(a) and SWMUs 49-006.

and 49-004. The total excess cancer risks were below the NMED target risk level of 1×10^{-5} (NMED 2009, 108070). The HIs were below the NMED target HI of 1.0 (NMED 2009, 108070) for AOC 49-005(b) and SWMU 49-006. The HIs for the industrial and residential scenarios at SWMU 49-004 are below 1.0. However, the HI for the construction worker scenario was slightly above 1.0 due to manganese. The range of manganese soil concentrations was comparable to the range of soil background concentrations, the EPC is similar to BVs, and the manganese SSL is less than the BVs. Without manganese the HI is 0.7, which is less than the NMED target HI of 1.0.

However, additional sampling at SWMU 49-004 is necessary to address potential contamination from dioxins and furans, which may affect the potential risk.

The total doses are below the DOE target dose limit of 15 mrem/yr for all sites. The equivalent risks range from 2×10^{-7} to 7×10^{-6} based on a comparison with EPA's PRGs for radionuclides (http://epa-prgs.ornl.gov/radionuclides/download/rad_master_prg_table_pci.xls).

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. 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 Pore Gas

The SVs for all pore-gas COPCs were below 1, indicating that VOCs in subsurface pore gas are not a potential source of groundwater contamination.

Tritium was also detected in two pore-gas samples at a maximum concentration of 673.9 pCi/L. There is no screening value for tritium.

I-6.3 Ecological

No potential ecological risks in soil were found for any receptor based on minimum ESL comparisons, HI analyses, comparisons to background concentrations, and potential effects to populations (individuals for T&E species). These lines of evidence support the conclusion that no potential ecological risks exist at the TA-49 sites outside the NES boundary. However, additional sampling at SWMU 49-004 is necessary to address potential contamination from dioxins and furans. In addition, the VOC concentrations in pore gas do not pose a potential risk to the pocket gopher.

I-7.0 REFERENCES

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Copies of the master reference set are maintained at the NMED Hazardous Waste Bureau and the Directorate. The set was developed to ensure that the administrative authority has all material needed to

review this document, and it is updated with every document submitted to the administrative authority. Documents previously submitted to the administrative authority are not included.

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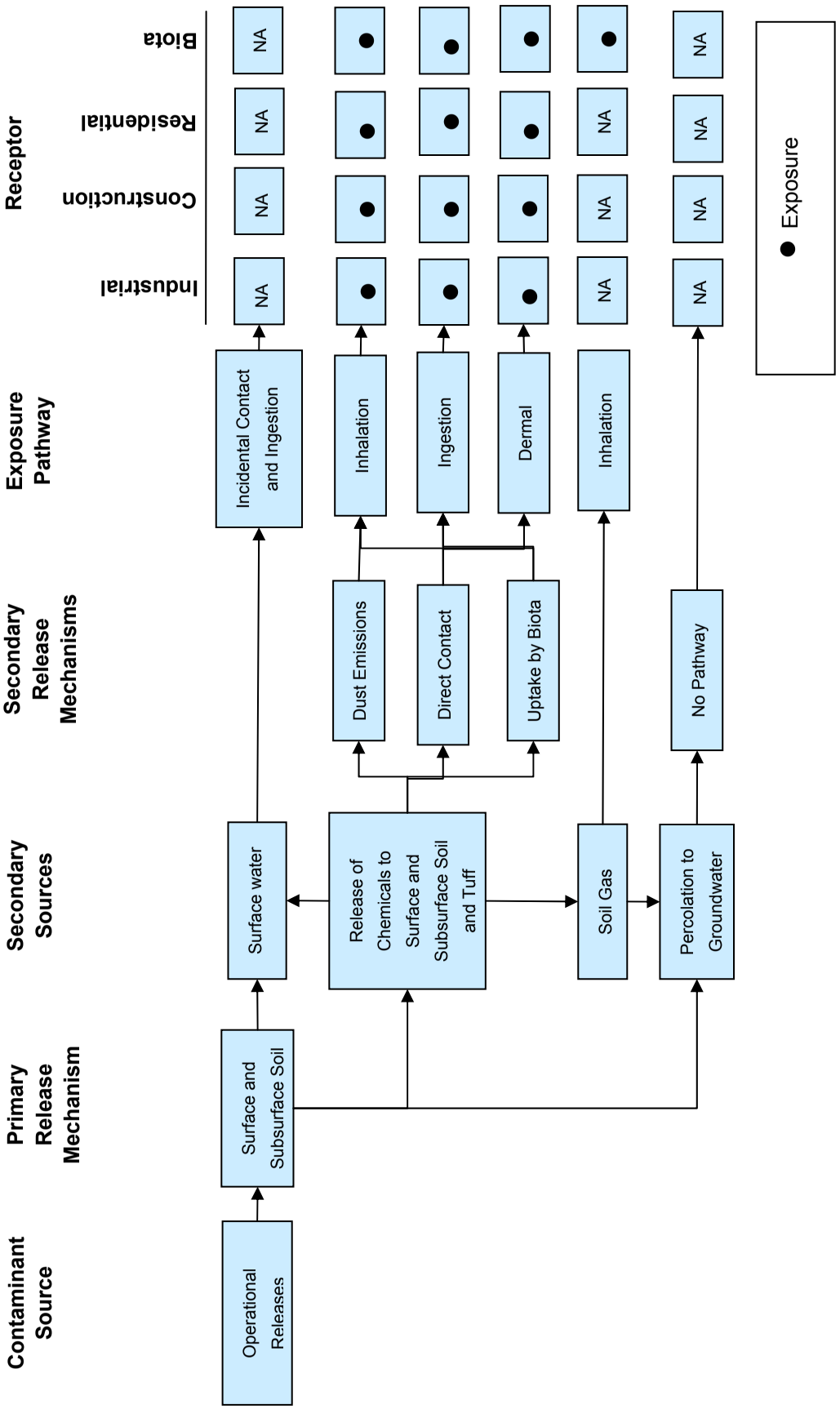


Figure I-3.1-1 Conceptual site model for TA-49 sites outside the NES boundary

Table I-2.3-1
Exposure Point Concentrations for AOC 49-005(b) for the Industrial Scenario (0- to 1-ft bgs depth)

COPC	Number of Analyses/ Number of Detects	Minimum Concentration	Maximum Concentration	Mean Concentration	Standard Deviation	EPC	Distribution Type	EPC Method
Inorganic Chemicals (mg/kg)								
Cyanide (total)	1/1	0.16	0.16	0.16	n/a*	0.16	n/a	Maximum detected concentration
Mercury	3/1	0.0198	0.12 (U)	0.0799	0.053	0.0198	n/a	Maximum detected concentration
Nitrate	1/1	1.7	1.7	1.7	n/a	1.7	n/a	Maximum detected concentration
Thallium	3/1	0.2	1.5 (U)	1.07	0.751	0.2	n/a	Maximum detected concentration
Uranium	2/2	3.51	3.72	3.615	0.148	3.72	n/a	Maximum detected concentration
Radionuclides (pCi/g)								
Cesium-137	2/1	0.059 (U)	0.136	0.0975	0.0544	0.136	n/a	Maximum detected concentration
Plutonium-238	3/2	0.005	0.023 (U)	0.0153	0.00929	0.018	n/a	Maximum detected concentration
Plutonium-239/240	3/1	0.0 (U)	0.014	0.00893	0.00776	0.014	n/a	Maximum detected concentration

Note: Data qualifiers are defined in Appendix A.
*n/a = Not applicable.

Table I-2.3-2
Exposure Point Concentrations for AOC 49-005(b) for the Construction Worker and Residential Scenario (0- to 10-ft bgs depth)

COPC	Number of Analyses/ Number of Detects	Minimum Concentration	Maximum Concentration	Mean Concentration	Standard Deviation	EPC	Distribution Type	EPC Method
Inorganic Chemicals (mg/kg)								
Cyanide (Total)	4/1	0.16	0.57 (U)	0.46	0.2	0.16	n/a*	Maximum detected concentration
Mercury	8/4	0.0198	0.12 (U)	0.0698	0.0464	0.034	n/a	Maximum detected concentration
Nitrate	4/4	0.22	1.7	0.978	0.627	1.7	n/a	Maximum detected concentration
Perchlorate	4/2	0.0025	0.0056 (U)	0.0042	0.00159	0.0032	n/a	Maximum detected concentration
Selenium	8/1	0.29 (U)	1.2	0.711	0.327	1.2	n/a	Maximum detected concentration
Thallium	8/4	0.2	1.5 (U)	0.859	0.635	0.35	n/a	Maximum detected concentration
Uranium	4/4	3.15	4.23	3.653	0.451	4.23	n/a	Maximum detected concentration
Radionuclides (pCi/g)								
Cesium-137	4/2	0.059 (U)	0.136	0.0985	0.0401	0.136	n/a	Maximum detected concentration
Plutonium-238	8/3	-0.012 (U)	0.023 (U)	0.00359	0.0121	0.018	n/a	Maximum detected concentration
Plutonium-239/240	8/3	-0.0012 (U)	0.025	0.00959	0.00831	0.025	n/a	Maximum detected concentration
Tritium	4/1	0.06 (UJ)	0.223	0.138	0.0835	0.223	n/a	Maximum detected concentration

Note: Data qualifiers are defined in Appendix A.
*n/a = Not applicable.

Table I-2.3-3
Ecological COPC Statistics for AOC 49-005(b) (0- to 5-ft bgs depth)

COPC	Number of Analyses/ Number of Detects	Minimum Concentration	Maximum Concentration	Mean Concentration	Standard Deviation	EPC	Distribution Type	Distribution
Inorganic Chemicals (mg/kg)								
Cyanide (total)	2/1	0.16	0.56 (U)	0.36	0.08	0.16	n/a*	Maximum detected concentration
Mercury	6/2	0.0198	0.12 (U)	0.0839	0.00203	0.0338	n/a	Maximum detected concentration
Nitrate	2/2	0.22	1.7	0.96	1.047	1.7	n/a	Maximum detected concentration
Thallium	6/2	0.2	1.5 (U)	1.058	0.61	0.35	n/a	Maximum detected concentration
Uranium	4/4	3.15	4.23	3.653	0.451	4.23	n/a	Maximum detected concentration
Radionuclides (pCi/g)								
Cesium-137	4/2	0.0059 (U)	0.136	0.985	0.0401	0.136	n/a	Maximum detected concentration
Plutonium-238	6/3	-0.005 (U)	0.023 (U)	0.00782	0.0108	0.018	n/a	Maximum detected concentration
Plutonium-239/240	6/3	0.0 (U)	0.025	0.0113	0.00835	0.025	n/a	Maximum detected concentration

Note: Data qualifiers are defined in Appendix A.
*n/a = Not applicable.

Table I-2.3-4
Exposure Point Concentrations for SWMU 49-006 for the Construction Worker and Residential Scenario (0- to 10-ft bgs depth)

COPC	Number of Analyses/ Number of Detects	Minimum Concentration	Maximum Concentration	Mean Concentration	Standard Deviation	EPC	Distribution Type	EPC Method
Inorganic Chemicals (mg/kg)								
Chromium	5/5	2.3	13.9	7.6	5.726	13.9	n/a*	Maximum detected concentration
Cyanide (total)	4/2	0.16	0.55 (U)	0.355	0.219	0.17	n/a	Maximum detected concentration
Mercury	5/4	0.0144	0.12	0.0593	0.0473	0.12	n/a	Maximum detected concentration
Nitrate	4/4	0.12	0.26	0.205	0.0603	0.26	n/a	Maximum detected concentration
Selenium	5/1	0.34 (U)	0.82 (U)	0.49	0.202	0.55	n/a	Maximum detected concentration
Organic Chemicals (mg/kg)								
Bis(2-ethylhexyl)phthalate	5/1	0.066	0.37(U)	0.307	0.135	0.066	n/a	Maximum detected concentration
Radionuclides (pCi/g)								
Plutonium-238	5/1	0.0035 (U)	0.0189 (U)	0.00858	0.00626	0.005	n/a	Maximum detected concentration
Tritium	4/1	0.036 (U)	0.408	0.158	0.169	0.408	n/a	Maximum detected concentration

Note: Data qualifiers are defined in Appendix A.
*n/a = Not applicable.

Table I-2.3-5
Ecological COPC Statistics for SWMU 49-006 (0- to 5-ft bgs depth)

COPC	Number of Analyses/ Number of Detects	Minimum Concentration	Maximum Concentration	Mean Concentration	Standard Deviation	EPC	Distribution Type	EPC Method
Inorganic Chemicals (mg/kg)								
Chromium	2/2	13.6	13.9	13.75	0.212	13.9	n/a*	Maximum detected concentration
Cyanide (total)	2/2	0.16	0.17	0.165	0.00707	0.17	n/a	Maximum detected concentration
Mercury	2/2	0.0279	0.0344	0.0312	0.0046	0.0344	n/a	Maximum detected concentration
Nitrate	2/2	0.23	0.26	0.245	0.0212	0.26	n/a	Maximum detected concentration
Organic Chemicals (mg/kg)								
Bis(2-ethylhexyl)phthalate	2/1	0.066	0.37 (U)	0.218	0.215	0.066	n/a	Maximum detected concentration
Butanone[2-]	2/1	0.0058	0.023 (U)	0.0144	0.0122	0.0058	n/a	Maximum detected concentration
Radionuclides (pCi/g)								
Tritium	2/1	0.081 (U)	0.408	0.245	0.231	0.408	n/a	Maximum detected concentration

Note: Data qualifiers are defined in Appendix A.
*n/a = Not applicable.

Table I-2.3-6
Exposure Point Concentrations for AOC 49-008(a) for the Industrial Scenario (0- to 1-ft bgs depth)

COPC	Number of Analyses/ Number of Detects	Minimum Concentration	Maximum Concentration	Mean Concentration	Standard Deviation	EPC	Distribution Type	EPC Method
Organic Chemicals (mg/kg)								
Aroclor-1260	16/4	0.00355 (U)	0.0681	0.0118	0.02	0.0681	n/a*	Maximum detected concentration

Note: Data qualifiers are defined in Appendix A.
*n/a = Not applicable.

Table I-2.3-7
Exposure Point Concentrations for AOC 49-008(a) for the Construction Worker and Residential Scenario (0- to 10-ft bgs depth)

COPC	Number of Analyses/ Number of Detects	Minimum Concentration	Maximum Concentration	Mean Concentration	Standard Deviation	EPC	Distribution Type	EPC Method
Organic Chemicals (mg/kg)								
Aroclor-1260	16/4	0.00355 (U)	0.0681	0.0118	0.02	0.0681	n/a*	Maximum detected concentration

Note: Data qualifiers are defined in Appendix A.
*n/a = Not applicable.

Table I-2.3-8
Exposure Point Concentrations for AOC 49-008(a) Ecological Receptors (0- to 5-ft bgs depth)

COPC	Number of Analyses/ Number of Detects	Minimum Concentration	Maximum Concentration	Mean Concentration	Standard Deviation	EPC	Distribution Type	EPC Method
Organic Chemicals (mg/kg)								
Aroclor-1260	16/4	0.00355 (U)	0.0681	0.01181	0.02	0.0681	n/a*	Maximum detected concentration

Note: Data qualifiers are defined in Appendix A.
*n/a = Not applicable.

Table I-2.3-9
Exposure Point Concentrations for SWMU 49-004 for the Industrial Scenario (0- to 1-ft bgs depth)

COPC	Number of Analyses/ Number of Detects	Minimum Concentration	Maximum Concentration	Mean Concentration	Standard Deviation	EPC	Distribution Type	EPC Method
Inorganic Chemicals (mg/kg)								
Aluminum	148/148	5740	35,100	12,363	4,264	12,952	Nonparametric	95% Modified-t
Antimony	148/96	0.074	6 (UJ)	0.19	0.0809	0.207	Lognormal	95% KM (BCA)
Barium	148/148	88.7	403	192.6	46.51	198.9	Normal	95% Student's-t
Beryllium	148/148	0.57	2	1.041	0.254	1.076	Nonparametric	95% Modified-t
Chromium	148/148	4.9	14.4	9.614	1.764	9.854	Normal	95% Student's-t
Cobalt	148/148	2.5	14.9	6.255	1.557	6.468	Nonparametric	95% Modified-t
Copper	148/148	4	120	9.685	9.857	11.13	Nonparametric	95% Modified-t
Iron	148/148	5750	19,000	12,365	2319	12,680	Normal	95% Student's-t
Lead	148/148	5.6	45.5	15.74	4.422	16.35	Nonparametric	95% Modified-t
Manganese	132/132	99.7	1030	404.9	135.3	424.6	Nonparametric	95% Modified-t
Mercury	146/69	0.0136	0.11	0.0254	0.0134	0.0275	Nonparametric	95% KM (Percentile Bootstrap)
Nickel	148/148	4.9	19.6	8.767	1.867	9.017	Approximate gamma	95% Approximate gamma
Perchlorate	4/2	0.0012	0.0024 (U)	0.0018	0.00059	0.00139	n/a*	Maximum detected concentration
Selenium	148/127	0.22 (UJ)	1.9	1.073	0.42	1.115	Nonparametric	95% KM (BCA)
Silver	148/94	0.028	11.6	0.208	0.964	0.362	Nonparametric	95% KM (BCA)
Thallium	148/65	0.17	1.4 (U)	0.297	0.126	0.321	Nonparametric	95% KM (Percentile Bootstrap)
Uranium	18/18	1.59	10.7	3.641	2.821	6.539	Nonparametric	95% Chebyshev (Mean, Sd)
Vanadium	148/148	9.7	31.6	22.77	4.387	23.36	Normal	95% Student's-t
Zinc	148/148	12.3	812	47.72	77.74	75.57	Nonparametric	95% Chebyshev (Mean, Sd)

Table I-2.3-9 (continued)

COPC	Number of Analyses/ Number of Detects	Minimum Concentration	Maximum Concentration	Mean Concentration	Standard Deviation	EPC	Distribution Type	EPC Method
Radionuclides (pCi/g)								
Americium-241	165/5	-0.251 (U)	0.263	0.0188	0.0545	0.263	n/a	Maximum detected concentration
Cesium-134	127/1	-0.109 (U)	0.073	-0.0125	0.0305	0.073	n/a	Maximum detected concentration
Cesium-137	161/38	-0.036	3.28	0.193	0.39	0.388	Nonparametric	97.5% KM (Chebyshev)
Europium-152	160/2	-0.29 (U)	0.4 (U)	0.0791	0.12	0.259	n/a	Maximum detected concentration
Plutonium-238	148/8	-0.027 (U)	0.04 (U)	0.00204	0.0115	0.025	n/a	Maximum detected concentration
Plutonium-239/240	148/31	-0.0319 (U)	0.998	0.0268	0.0841	0.0707	Lognormal	97.5% KM (Chebyshev)

Note: Data qualifiers are defined in Appendix A.

*n/a = Not applicable.

Table I-2.3-10
Exposure Point Concentrations for SWMU 49-004 for the Construction Worker and Residential Scenario (0- to 10-ft bgs depth)

COPC	Number of Analyses/ Number of Detects	Minimum Concentration	Maximum Concentration	Mean Concentration	Standard Deviation	EPC	Distribution Type	EPC Method
Inorganic Chemicals (mg/kg)								
Aluminum	157/157	5740	35,100	12,312	4194	12,873	Nonparametric	95% Modified-t
Antimony	157/96	0.074	6.4 (UJ)	0.19	0.079	0.207	Lognormal	95% KM (BCA)
Barium	157/157	88.7	403	190.1	46.98	196.3	Normal	95% Student's-t
Beryllium	157/157	0.57	2	1.032	0.252	1.065	Nonparametric	95% Modified-t
Chromium	157/157	4.9	14.4	9.621	1.791	9.857	Normal	95% Student's-t
Cobalt	157/157	1.67	14.9	6.266	1.696	6.492	Nonparametric	95% Modified-t
Copper	157/157	3.69	339	11.85	28	21.59	Nonparametric	95% Chebyshev (Mean, Sd)
Iron	157/157	5750	19,000	12,462	2334	12,770	Normal	95% Student's-t
Lead	157/157	5.6	64.5	16.16	6.262	17.02	Nonparametric	95% Modified-t
Manganese	141/141	99.7	1030	404.6	138.6	424.2	Nonparametric	95% Modified-t
Mercury	154/71	0.0136	0.11	0.0258	0.0147	0.028	Nonparametric	95% KM (Percentile Bootstrap)
Nickel	157/157	4.9	19.6	8.772	1.903	9.019	Approximate gamma	95% Approximate gamma
Perchlorate	8/5	0.0012	0.00802	0.0029	0.00216	0.00802	n/a*	Maximum detected concentration
Selenium	157/128	0.21 (UJ)	1.9	0.996	0.357	1.08	Nonparametric	95% KM (BCA)
Silver	157/99	0.028	11.6	0.22	0.939	0.367	Nonparametric	95% KM (BCA)
Thallium	157/69	0.114	1.4 (U)	0.29	0.125	0.311	Nonparametric	95% KM (Percentile Bootstrap)
Uranium	23/23	1.59	10.7	3.606	2.481	5.861	Nonparametric	95% Chebyshev (Mean, Sd)
Vanadium	157/157	8.76	31.8	22.69	4.558	23.3	Normal	95% Student's-t
Zinc	157/157	12.3	812	48.34	76.73	75.04	Nonparametric	95% Chebyshev (Mean, Sd)
Organic Chemicals (mg/kg)								
Bis-2-ethylhexylphthalate	14/1	0.35 (U)	10.1	1.07	2.599	10.1	n/a	Maximum detected concentration
Chloronaphthalene[2-]	14/1	0.0368 (U)	0.4 (U)	0.18	0.171	0.36	n/a	Maximum detected concentration

Table I-2.3-10 (continued)

COPC	Number of Analyses/ Number of Detects	Minimum Concentration	Maximum Concentration	Mean Concentration	Standard Deviation	EPC	Distribution Type	EPC Method
Methylnaphthalene[2-]	14/1	0.0138	0.4 (U)	0.179	0.173	0.0138	n/a	Maximum detected concentration
Naphthalene	14/1	0.0207	0.4 (U)	0.179	0.172	0.0207	n/a	Maximum detected concentration
Pyrene	14/1	0.0172	0.4 (U)	0.179	0.172	0.0172	n/a	Maximum detected concentration
Methylene chloride	8/1	0.00274	0.00577 (U)	0.00521	0.00095	0.00274	n/a	Maximum detected concentration
Radionuclides (pCi/g)								
Americium-241	181/7	-0.251 (U)	0.43	0.0334	0.0774	0.43	n/a	Maximum detected concentration
Cesium-134	139/1	-0.109 (U)	0.13 (U)	-0.00293	0.0433	0.073	n/a	Maximum detected concentration
Cesium-137	173/38	-0.036 (U)	3.28	0.186	0.377	0.368	Nonparametric	97.5% KM (Chebyshev)
Europium-152	160/2	-0.29 (U)	0.4 (U)	0.0791	0.12	0.259	n/a	Maximum detected concentration
Plutonium-238	157/8	-0.027 (U)	0.04 (U)	0.00206	0.0111	0.025	n/a	Maximum detected concentration
Plutonium-239/240	157/36	-0.0319 (U)	0.998	0.032	0.0934	0.0792	Lognormal	97.5% KM (Chebyshev)
Tritium	8/2	0.00186 (U)	0.03139	0.014	0.0106	0.0314	n/a	Maximum detected concentration

Note: Data qualifiers are defined in Appendix A.

*n/a = Not applicable.

Table I-2.3-11
Ecological COPC Statistics for SWMU 49-004 (0- to 5-ft bgs depth)

COPC	Number of Analyses/ Number of Detects	Minimum Concentration	Maximum Concentration	Mean Concentration	Standard Deviation	EPC	Distribution Type	Distribution
Inorganic Chemicals (mg/kg)								
Aluminum	150/150	5740	35,100	12,361	4237	12,942	Nonparametric	95% Modified-t
Antimony	150/96	0.074	6.4 (UJ)	0.19	0.0809	0.207	Lognormal	95% KM (BCA)
Barium	150/150	88.7	403	192	46.47	198.3	Normal	95% Student's-t
Beryllium	150/150	0.57	2	1.039	0.253	1.073	Nonparametric	95% Modified-t
Chromium	150/150	4.9	14.4	9.617	1.754	9.854	Normal	95% Student's-t
Cobalt	150/150	2.5	14.9	6.268	1.551	6.479	Nonparametric	95% Modified-t
Copper	150/150	4	120	9.707	9.798	11.14	Nonparametric	95% Modified-t
Iron	150/150	5750	19,000	12,376	2308	12,688	Normal	95% Student's-t
Lead	150/150	5.6	45.5	15.75	4.396	16.36	Nonparametric	95% Modified-t
Manganese	134/134	99.7	1030	404.5	134.3	423.9	Nonparametric	95% Modified-t
Mercury	148/69	0.0136	0.11	0.0253	0.0133	0.0274	Nonparametric	95% KM (Percentile Bootstrap)
Nickel	150/150	4.9	19.6	8.764	1.859	9.011	Approximate gamma	95% Approximate gamma
Perchlorate	4/2	0.0012	0.0024 (U)	0.0018	0.00059	0.00139	n/a*	Maximum detected concentration
Selenium	150/126	0.21 (UJ)	1.9	1.067	0.246	1.114	Nonparametric	95% KM (BCA)
Silver	150/95	0.028	11.6	0.211	0.959	0.375	Nonparametric	95% KM (BCA)
Thallium	150/65	0.17	1.4 (U)	0.297	0.125	0.318	Nonparametric	95% KM (Percentile Bootstrap)
Uranium	20/20	1.59	10.7	3.632	2.668	6.232	Nonparametric	95% Chebyshev (Mean, Sd)
Vanadium	150/150	9.7	31.6	22.77	4.358	23.36	Normal	95% Student's-t
Zinc	150/150	12.3	812	47.78	77.24	75.27	Nonparametric	95% Chebyshev (Mean, Sd)
Radionuclides (pCi/g)								
Americium-241	171/6	-0.251	0.43	0.0265	0.0696	0.43	n/a	Maximum detected concentration
Cesium-134	133/1	-0.109 (U)	0.12 (U)	-0.00794	0.0369	0.073	n/a	Maximum detected concentration

Table I-2.3-11 (continued)

COPC	Number of Analyses/ Number of Detects	Minimum Concentration	Maximum Concentration	Mean Concentration	Standard Deviation	EPC	Distribution Type	Distribution
Cesium-137	167/38	-0.036 (U)	3.28	0.19	0.384	0.378	Nonparametric	97.5% KM (Chebyshev)
Europium-152	160/2	-0.29 (U)	0.4 (U)	0.0791	0.12	0.259	n/a	Maximum detected concentration
Plutonium-238	150/8	-0.027 (U)	0.04 (U)	0.00209	0.0114	0.025	n/a	Maximum detected concentration
Plutonium-239/240	150/33	-0.0319 (U)	0.998	0.0298	0.0896	0.0762	Lognormal	97.5% KM (Chebyshev)

Note: Data qualifiers are defined in Appendix A.

*n/a = Not applicable.

Table I-3.2-1
Physical and Chemical Properties of Inorganic COPCs

COPC	K_d [a] (cm^3/g)	Water Solubility [a,b] (mg/L)
Aluminum	1500	Insoluble
Antimony	45	Insoluble
Barium	41	Insoluble
Beryllium	790	Insoluble
Chromium	850[c]	Insoluble
Cobalt	45	Insoluble
Copper	35	Insoluble
Cyanide (total)	9.9	na[d]
Iron	25	Insoluble
Lead	900	Insoluble
Manganese	65	Insoluble
Mercury	52	Insoluble
Nickel	65	Insoluble
Nitrate	0.0356	na
Perchlorate	na	2.45E+05
Selenium	5	Insoluble
Silver	8.3	Insoluble
Thallium	71	Insoluble
Uranium	450 [c]	Insoluble
Vanadium	1000	Insoluble
Zinc	62	Insoluble

[a] Information from http://rais.ornl.gov/cgi-bin/tools/TOX_search?select=chem.

[b] Denotes reference information from http://www.epa.gov/superfund/sites/npl/hrsres/tools/scdm.htm.

[c] As chromium salts.

[d] na = Not available.

Table I-3.2-2
Physical and Chemical Properties of Organic COPCs

COPC	Organic Carbon Partition Coefficient, K_{oc}[a] (L/kg)	Log Octanol-Water Partition Coefficient, K_{ow}[a]	Water Solubility[a] (mg/L)	Vapor Pressure[a] (mm Hg at 25°C)
Amino-4,6-dinitrotoluene[2-]	2.83E+02	1.84E+00	3.19E+02	1.47E-06
Aroclor-1260	3.05E+05	8.27E+00	1.44E-02	1.30E-07
Bis(2-ethylhexyl)phthalate	1.65E+05	7.60E+00	2.70E-01	1.42E-07
Butanone[2-]	3.83E+00	2.9E-01	2.23E+05	9.06E+01
Chloronaphthalene[2-]	2.98E+03	3.98E+00	11.7E+00	9.03E-03
Dinitrotoluene[2,4-]	5.76E+02	1.98E+00	2.00E+02	1.47E-04
Dinitrotoluene[2,6-]	5.87E+02	2.10E+00	1.51E+02	5.76E-04
Methylene chloride	2.17E+01	1.25E+00	1.30E+04	4.35E+02
Methylnaphthalene[2-]	2.98E+03	3.86E+00	2.46E+01	5.5E-02
Naphthalene	1.84E+03	3.3E+00	3.1E+01	8.5E-02
Pyrene	5.43E+04	4.88E+00	1.35E-01	4.50E-06
Trinitrotoluene[2,4,6-]	2.81E+03	1.60E+00	1.15E+02	8.02E-06
Tris(o-cresyl)phosphate[b]	2.47E+06	9.49E+00	6.00E-01	8.28E-08

[a] Information from http://rais.ornl.gov/cgi-bin/tools/TOX_search?select=chem, unless otherwise noted.

[b] Tri(2-ethylhexyl)phosphate used as surrogate.

Table I-3.2-3
Results of Pore-Gas Screening Based on Maximum Detected Concentrations

Chemical	Maximum Detected Concentration ($\mu g/m^3$)	H' [a] (dimensionless)	Groundwater Screening Level [b] ($\mu g/L$)	Screening Value
Acetone	31	0.0016	21800[c]	0.0009
Benzene	20	0.228	5	0.02
Butanone[2-]	10	0.0011	7060[c]	0.001
Chloromethane	1.7	0.36	17.8[c]	0.0003
Dichlorodifluoromethane	3.2	14	395[c]	0.0000006
Ethylbenzene	13	0.323	700	0.00006
Ethyltoluene[4-]	17	na	na	na
Styrene	3.2	0.11	100	0.0003
Tetrachloroethene	7.3	0.72	5	0.002
Toluene	34	0.272	750[e]	0.0002
Trimethylbenzene[1,2,4-]	18	0.25	15[d]	0.005
Trimethylbenzene[1,3,5-]	5.4	0.36	370[d]	0.00004
Xylene (Total)	50	0.3	620[e]	0.0003
Xylene[1,2-]	13	0.213	620[e]	0.0001
Xylene[1,3-]+Xylene[1,4-]	37	0.3	620[e]	0.0002

[a] Henry's law constant from NMED (NMED 2009 ,108070).

[b] EPA maximum contaminant level (MCL) (40 Code of Federal Regulations 141.61), unless otherwise noted.

[c] NMED tap-water screening level (NMED 2009, 108070).

[d] EPA regional tap-water screening level (http://www.epa.gov/region06/6pd/rcra_c/pd-n/screen.htm).

[e] NMWQCC groundwater standard (20.6.2.3103 New Mexico Administrative Code).

Table I-3.2-4
Physiochemical Properties of Radionuclide COPCs

COPC	Soil-Water Partition Coefficient, K_d [a] (cm^3/g)	Water Solubility [b] (g/L)
Americium-241	680	Insoluble
Cesium-134	1000[c]	Insoluble
Cesium-137	1000	Insoluble
Europium-152	na[d]	na
Plutonium-238	4500	Insoluble
Plutonium-239	4500	Insoluble
Tritium	9.9	Soluble

[a] Information from Superfund Chemical Data Matrix (EPA 1996, 064708).

[b] Information from http://www.epa.gov/superfund/sites/npl/hrsres/tools/scdm.htm.

[c] Cesium-137 used as a surrogate.

[d] na = No information available.

Table I-4.1-1
Parameters Used to Calculate Chemical SSLs

Parameters	Industrial Values	Residential Values	Construction Worker Values
Target HQ	1	1	1
Target cancer risk	10^{-5}	10^{-5}	10^{-5}
Averaging time (carcinogen)	70 yr x 365 d	70 yr x 365 d	70 yr x 365 d
Averaging time (noncarcinogen)	ED x 365 d	ED x 365 d	ED x 365 d
Skin absorption factor	Semivolatile organic compound (SVOC) = 0.1; Chemical-specific	SVOC = 0.1; Chemical-specific	SVOC = 0.1; Chemical-specific
Adherence factor–child	n/a[a]	0.2 mg/cm^2	n/a
Body weight–child	n/a	15 kg (age: 0–6 years)	n/a
Cancer slope factor–oral (chemical-specific)	(mg/kg-d)$^{-1}$	(mg/kg-d)$^{-1}$	(mg/kg-d)$^{-1}$
Cancer slope factor–inhalation (chemical-specific)	(mg/kg-d)$^{-1}$	(mg/kg-d)$^{-1}$	(mg/kg-d)$^{-1}$
Exposure frequency	225 d/yr	350 d/yr	250 d/yr
Exposure duration–child	n/a	6 yr	n/a
Age-adjusted ingestion factor	n/a	114 mg-yr/kg-d	n/a
Age-adjusted inhalation factor	n/a	11 m^3-yr/kg-d	n/a
Inhalation rate–child	n/a	10 m^3/d	n/a
Soil ingestion rate–child	n/a	200 mg/d	n/a
Particulate emission factor	6.61 x 10^9 m^3/kg	6.61 x 10^9 m^3/kg	2.1 x 10^6 m^3/kg
RfD–oral (chemical-specific)	(mg/kg-d)	(mg/kg-d)	(mg/kg-d)
RfD–inhalation (chemical-specific)	(mg/kg-d)	(mg/kg-d)	(mg/kg-d)
Exposed surface area–child	n/a	2800 cm^2/d	n/a
Age-adjusted skin contact factor (carcinogens)	n/a	361 mg-yr/kg-d	n/a
VF for soil (chemical-specific)	(m^3/kg)	(m^3/kg)	(m^3/kg)
Body weight–adult	70 kg	70 kg	70 kg
Exposure duration[b]	25 yr	30 yr	1 yr
Adherence factor–adult	0.2 mg/cm^2	0.07 mg/cm^2	0.3 mg/cm^2
Soil ingestion rate–adult	100 mg/d	100 mg/d	330 mg/d
Exposed surface area–adult	3300 cm^2/d	5700 cm^2/d	3300 cm^2/d
Inhalation rate–adult	20 m^3/d	20 m^3/d	20 m^3/d

Note: Parameter values from NMED (2009, 108070).

[a] n/a = Not applicable.

[b] Exposure duration for lifetime resident is 30 yr. For carcinogens, the exposures are combined for child (6 yr) and adult (24 yr).

Table I-4.1-2
Parameters Used in the SAL Calculations for Radionuclides, Industrial and Construction Worker

Parameter	Industrial, Adult	Construction Worker, Adult
Inhalation rate (m^3/yr)	19,481[a]	19,478[b]
Mass loading (g/m^3)	1.5 x 10^{-7} [c]	0.0004[d]
Outdoor time fraction	0.2053[e]	0.2567[f]
Indoor time fraction	0	0
Soil ingestion (g/yr)	97.4[g]	321[h]

[a] Calculated as [20 m^3/d x 225 d/yr] / [indoor + outdoor time fractions], where 20 m^3/d is the daily inhalation rate of an adult and 225 d/yr is the exposure frequency (NMED 2009, 108070).

[b] Calculated as [20 m^3/d x 250 d/yr] / [indoor + outdoor time fractions], where 20 m^3/d is the daily inhalation rate of an adult and 250 days/yr is the exposure frequency (NMED 2009, 108070).

[c] Calculated as [1/ 6.6 x 10^{+9} m^3/kg] x 1000 g/kg, where 6.6 x 10^{+9} m^3/kg is the particulate emission factor (NMED 2009, 108070).

[d] Calculated as [1/ 2.1 x 10^{+6} m^3/kg] x 1000 g/kg, where 2.1 x 10^{+6} m^3/kg is the particulate emission factor (NMED 2009, 108070).

[e] Calculated as [8 hr/d x 225 d/yr] / 8766 hr/yr, where 8 hr/d is an estimate of the average length of the work day.

[f] Calculated as [9 hr/d x 250 d/yr] / 8766 hr/yr, where 9 hr/d is an estimate of the average length of the work day.

[g] Calculated as [0.1 g/d x 225 d/yr] / [indoor + outdoor time fractions], where 0.1 g/d is the adult soil ingestion rate (NMED 2009, 108070).

[h] Calculated as [0.33 g/d x 250 d/yr] / [indoor + outdoor time fractions], where 0.33 g/d is the adult soil ingestion rate (NMED 2009, 108070).

Table I-4.1-3
Parameters Used in the SAL Calculations for Radionuclides, Residential

Parameters	Residential, Child	Residential, Adult
Inhalation rate (m^3/yr)	3652.5[a]	7305[b]
Mass loading (g/m^3)	1.5 x 10^{-7} [c]	1.5 x 10^{-7} [c]
Outdoor time fraction	0.2236[d]	0.0599[e]
Indoor time fraction	0.7347[f]	0.8984[g]
Soil ingestion (g/yr)	73[h]	36.5[i]

[a] Calculated as [10 m^3/d x 350 d/yr] / [indoor + outdoor time fractions], where 10 m^3/d is the daily inhalation rate of a child (NMED 2009, 108070).

[b] Calculated as [20 m^3/d x 350 d/yr] / [indoor + outdoor time fractions], where 20 m^3/d is the daily inhalation rate of an adult (NMED 2009, 108070).

[c] Calculated as [1/ 6.6 x 10^{+9} m^3/kg) x 1000 g/kg, where 6.6 x 10^{+9} m^3/kg is the particulate emission factor (NMED 2009, 106420).

[d] Calculated as [5.6 hr/d x 350 d/yr] / 8766 hr/yr, where 5.6 hr/d is an estimate of time spent outdoors for a 3- to 11-yr-old child (EPA 1997, 066598, section 15.4-1).

[e] Calculated as [1.5 hr/d x 350 d/yr] / 8766 hr/yr, where 1.5 hr/d is an estimate of time spent outdoors for an adult 12 yr and older (EPA 1997, 066598, section 15.4-1).

[f] Calculated as [(24–5.6 hr/d x 350 d/yr] / 8766 hr/yr.

[g] Calculated as [(24–1.5 hr/d x 350 d/yr] / 8766 hr/yr.

[h] Calculated as [0.2 g/d x 350 d/yr] / [indoor + outdoor time fractions], where 0.2 g/d is the child soil-ingestion rate (NMED 2009, 108070).

[i] Calculated as [0.1 g/d x 350 d/yr] / [indoor + outdoor time fractions], where 0.1 g/d is the adult soil-ingestion rate (NMED 2009, 108070).

Table I-4.2-1
Industrial Noncarcinogenic Screening Evaluation for AOC 49-005(b)

COPC	EPC[a] (mg/kg)	Industrial SSL[b] (mg/kg)	HQ
Cyanide (total)	0.16	2.27E+04	0.00001
Mercury	0.0198	3.10E+02[c]	0.00006
Nitrate	1.7	1.82E+06	0.000001
Thallium	0.2	7.49E+01	0.003
Uranium	3.72	3.41E+03	0.001
		HI	**0.004**

[a] Maximum detected concentration.

[b] SSLs from NMED (2009, 108070).

[c] EPA regional screening level (http://www.epa.gov/region06/6pd/rcra_c/pd-n/screen.htm).

Table I-4.2-2
Construction Worker Noncarcinogenic Screening for AOC 49-005(b)

COPC	EPC[a] (mg/kg)	Construction Worker SSL[b] (mg/kg)	HQ
Cyanide	0.16	6.19E+03	0.00003
Mercury	0.034	9.29E+01[c]	0.0004
Nitrate	1.7	4.96E+05	0.000003
Perchlorate	0.003	2.17E+02	0.00001
Selenium	1.2	1.55E+03	0.0008
Thallium	0.35	2.04E+01	0.02
Uranium	4.23	9.29E+02	0.005
		HI	**0.03**

[a] Maximum detected concentration.

[b] SSLs from NMED (2009, 108070) unless otherwise noted.

[c] Construction worker SSL calculated using toxicity value from EPA regional screening tables (http://www.epa.gov/region06/6pd/rcra_c/pd-n/screen.htm) and equation and parameters from NMED (2009, 108070).

Table I-4.2-3
Residential Noncarcinogenic Screening Evaluation for AOC 49-005(b)

COPC	EPC[a] (mg/kg)	Residential SSL[b] (mg/kg)	HQ
Cyanide	0.16	1.56E+03	0.0001
Mercury	0.034	2.30E+01[c]	0.002
Nitrate	1.7	1.25E+05	0.00001
Perchlorate	0.003	5.48E+01	0.00006
Selenium	1.2	3.91E+02	0.003
Thallium	0.35	5.16E+00	0.07
Uranium	4.23	2.35E+02	0.02
		HI	**0.1**

[a] Maximum detected concentration.

[b] SSLs from NMED (2009, 108070).

[c] EPA regional screening level (http://www.epa.gov/region06/6pd/rcra_c/pd-n/screen.htm).

Table I-4.2-4
Radionuclide Screening Evaluation for AOC 49-005(b)

COPC	Industrial EPC[a] (pCi/g)	Industrial SAL[b] (pCi/g)	Industrial Dose (mrem/yr)	Residential EPC[a] (pCi/g)	Residential SAL[b] (pCi/g)	Residential Dose (mrem/yr)	Construction EPC[a] (pCi/g)	Construction SAL[b] (pCi/g)	Construction Dose (mrem/yr)
Cesium-137	0.136	23	0.089	0.136	5.6	0.36	0.136	18	0.11
Plutonium-238	0.018	240	0.001	0.018	37	0.01	0.018	40	0.01
Plutonium-239/240	0.014	210	0.001	0.025	33	0.01	0.025	36	0.01
Tritium	n/a[c]	n/a	n/a	0.223	750	0.004	0.223	320,000	0.00001
		Total Dose	**0.09**		**Total Dose**	**0.38**		**Total Dose**	**0.13**

[a] Maximum detected concentration used as the EPC.

[b] SALs from LANL (LANL 2009, 107655).

[c] n/a = Not applicable; not a COPC for the exposure scenario.

Table I-4.2-5
Construction Worker Noncarcinogenic Screening for SWMU 49-006

COPC	EPC[a] (mg/kg)	Construction Worker SSL[b] (mg/kg)	HQ
Chromium	13.06	4.49E+02[c]	0.03
Cyanide (total)	0.17	6.19E+03	0.00003
Mercury	0.12	9.29E+01[d]	0.001
Nitrate	0.26	4.96E+05	0.000001
Selenium	0.55	1.55E+03	0.0004
Bis(2-ethylhexyl)phthalate	0.066	4.76E+03	0.00001
		HI	**0.03**

[a] Maximum detected concentration used as the EPC.

[b] SSLs from NMED (2009, 108070).

[c] SSL for hexavalent chromium.

[d] EPA regional screening level (http://www.epa.gov/region06/6pd/rcra_c/pd-n/screen.htm).

Table I-4.2-6
Residential Carcinogenic Screening for SWMU 49-006

COPC	EPC[a] (mg/kg)	Residential SSL[b] (mg/kg)	Cancer Risk
Bis(2-ethylhexyl)phthalate	0.066	3.47E+02	1.90E-09
		Total Excess Cancer Risk	**2E-09**

[a] Maximum detected concentration.

[b] SSLs from NMED (2009, 108070).

Table I-4.2-7
Residential Noncarcinogenic Screening Evaluation for SWMU 49-006

COPC	EPC[a] (mg/kg)	Residential SSL[b] (mg/kg)	HQ
Chromium	13.9	2.19E+02[c]	0.06
Cyanide (total)	0.17	1.56E+03	0.0001
Mercury	0.12	2.30E+01[d]	0.005
Nitrate	0.26	1.25E+05	0.000002
Selenium	0.55	3.91E+02	0.001
		HI	**0.07**

[a] Maximum concentrations used as the EPC.

[b] SSLs from NMED (2009, 108070).

[c] SSL for hexavalent chromium.

[d] EPA regional screening level (http://www.epa.gov/region06/6pd/rcra_c/pd-n/screen.htm).

Table I-4.2-8
Radionuclide Screening Evaluation for SWMU 49-006

COPC [a]	Construction EPC[b] (pCi/g)	Construction SAL[c] (pCi/g)	Construction Dose (mrem/yr)	Residential EPC[b] (pCi/g)	Residential SAL[c] (pCi/g)	Residential Dose (mrem/yr)
Plutonium-238	0.005	40	0.002	0.005	37	0.002
Tritium	0.408	320000	0.00002	0.408	750	0.008
		Total Dose	**0.002**		**Total Dose**	**0.01**

[a] No COPCs identified for the industrial scenario.

[b] Maximum detected concentrations.

[c] SALs from LANL (2009, 107655).

Table I-4.2-9
Industrial Carcinogenic Screening Evaluation for AOC 49-008(a)

COPC	EPC[a] (mg/kg)	Industrial SSL[b] (mg/kg)	Cancer Risk
Aroclor-1260	0.0681	8.26E+00	8.24E-08
		Total Excess Cancer Risk	**8E-08**

[a] Maximum concentration used as the EPC.

[b] SSLs from NMED (2009, 108070).

Table I-4.2-10
Construction Worker Carcinogenic Screening Evaluation for AOC 49-008(a)

COPC	EPC[a] (mg/kg)	Industrial SSL[b] (mg/kg)	Cancer Risk
Aroclor-1260	0.0681	7.58E+01	8.98E-09
		Total Excess Cancer Risk	**9E-09**

[a] Maximum concentration used as the EPC.

[b] SSLs from NMED (2009, 108070).

Table I-4.2-11
Residential Carcinogenic Screening Evaluation for AOC 49-008(a)

COPC	EPC[a] (mg/kg)	Industrial SSL[b] (mg/kg)	Cancer Risk
Aroclor-1260	0.0681	2.22E+00	3.07E-07
		Total Excess Cancer Risk	**3E-07**

[a] Maximum concentration used as the EPC.

[b] SSLs from NMED (2009, 108070).

Table I-4.2-12
Industrial Noncarcinogenic Screening Evaluation for SWMU 49-004

COPC	EPC[a] (mg/kg)	Industrial SSL[b] (mg/kg)	HQ
Aluminum	12,952	1.13E+06	0.01
Antimony	0.207	4.54E+02	0.0005
Barium	198.9	2.24E+05	0.0009
Beryllium	1.076	2.26E+03	0.0005
Chromium	9.854	2.92E+03[c]	0.003
Cobalt	6.468	3.0E+02[d]	0.02
Copper	11.13	4.54E+04	0.0002
Iron	12,680	7.95E+05	0.02
Lead	16.35	8.00E+02	0.02
Manganese	424.6	1.45E+05	0.003
Mercury	0.0275	3.10E+02[d]	0.00009
Nickel	9.017	2.27E+04	0.0004
Perchlorate	0.00139[e]	7.95E+02	0.000002
Selenium	1.115	5.68E+03	0.0002
Silver	0.362	5.68E+03	0.0001
Thallium	0.321	7.49E+01	0.004
Uranium	6.539	3.41E+03	0.002
Vanadium	23.36	5.68E+03	0.004
Zinc	75.57	3.41E+05	0.0002
		HI	**0.09**

[a] EPC is the 95% UCL unless otherwise noted.

[b] SSLs from NMED (2009, 108070) unless otherwise noted.

[c] SSL for hexavalent chromium.

[d] EPA regional screening level (http://www.epa.gov/region06/6pd/rcra_c/pd-n/screen.htm).

[e] Maximum detected concentration.

Table I-4.2-13
Construction Worker Carcinogenic Screening for SWMU 49-004

COPC	EPC[a] (mg/kg)	Residential SSL[b] (mg/kg)	Cancer Risk
Methylene chloride	0.00274	1.99E+02	1.37E-10
		Total Excess Cancer Risk	**1E-10**

[a] Maximum detected concentration.

[b] SSL from NMED (2009, 108070).

Table I-4.2-14
Construction Worker Noncarcinogenic Screening for SWMU 49-004

COPC	EPC[a] (mg/kg)	Construction Worker SSL[b] (mg/kg)	HQ
Aluminum	12,873	4.07E+04	0.32
Antimony	0.207	1.24E+02	0.002
Barium	196.3	4.35E+03	0.045
Beryllium	1.065	1.44E+02	0.007
Chromium	9.857	4.49E+02[c]	0.022
Cobalt	6.492	3.49E+01[d]	0.186
Copper	21.59	1.24E+04	0.002
Iron	12,770	2.17E+05	0.059
Lead	17.02	8.00E+02	0.021
Manganese	424.2	4.63E+02	0.92
Mercury	0.028	9.29E+01[d]	0.0004
Nickel	9.019	6.19E+03	0.001
Perchlorate	0.00802[e]	2.2E+02	0.00004
Selenium	1.08	1.55E+03	0.001
Silver	0.367	1.55E+03	0.0002
Thallium	0.311	2.04E+01	0.015
Uranium	5.861	9.29E+02	0.006
Vanadium	23.3	1.55E+03	0.015
Zinc	75.04	9.29E+04	00.001
Bis(2-ethylhexyl)phthalate	10.1[e]	4.76E+03	0.002
Chloronaphthalene[2-]	0.36[e]	2.48E+04	0.00001
Methylnaphthalene[2-]	0.0138[e]	1.24E+03[d]	0.00002
Naphthalene	0.0207[e]	7.02E+02	0.00003
Pyrene	0.0172[e]	6.68E+03	0.000003
		HI	**1.6**

[a] EPC is the 95% UCL unless otherwise noted.

[b] SSLs from NMED (2009, 108070) unless otherwise noted.

[c] SSL for hexavalent chromium.

[d] Construction worker SSL calculated using toxicity value from EPA regional screening tables (http://www.epa.gov/region06/6pd/rcra_c/pd-n/screen.htm) and equation and parameters from NMED (2009, 108070).

[e] Maximum detected concentration.

Table I-4.2-15
Residential Carcinogenic Screening for SWMU 49-004

COPC	EPC[a] (mg/kg)	Residential SSL[b] (mg/kg)	Cancer Risk
Bis(2-ethylhexyl)phthalate	10.1	3.47E+02	2.91E-07
Methylene chloride	0.00274	1.99E+02	1.37E-10
Naphthalene	0.0207	4.50E+01	4.61E-09
		Total Excess Cancer Risk	**3E-07**

[a] Maximum concentrations used as the EPC.

[b] SSLs from NMED (2009, 108070).

Table I-4.2-16
Residential Noncarcinogenic Screening Evaluation for SWMU 49-004

COPC	EPC[a] (mg/kg)	Residential SSL[b] (mg/kg)	HQ
Aluminum	12,873	7.81E+04	0.2
Antimony	0.207	3.13E+01	0.007
Barium	196.3	1.56E+04	0.01
Beryllium	1.065	1.56E+02	0.007
Chromium	9.857	2.19E+02[c]	0.05
Cobalt	6.492	2.30E+01[d]	0.3
Copper	21.59	3.13E+03	0.007
Iron	12770	5.48E+04	0.2
Lead	17.02	4.00E+02	0.04
Manganese	424.2	1.07E+04	0.04
Mercury	0.028	2.30E+01[d]	0.001
Nickel	9.019	1.56E+03	0.006
Perchlorate	0.00802[e]	5.50E+01	0.0001
Selenium	1.08	3.91E+02	0.003
Silver	0.367	3.91E+02	0.0009
Thallium	0.311	5.16E+00	0.06
Uranium	5.861	2.35E+02	0.03
Vanadium	23.3	3.91E+02	0.06
Zinc	75.04	2.35E+04	0.003
Chloronaphthalene[2-]	0.36[e]	6.26E+03	0.0001
Methylnaphthalene[2-]	0.0138[e]	3.10E+02[d]	0.00004
Pyrene	0.0172[e]	1.72E+03	0.00001
		HI	**1.0**

[a] EPC is the 95% UCL unless otherwise noted.

[b] SSLs from NMED (2009, 108070).

[c] SSL for hexavalent chromium.

[d] EPA regional screening level (http://www.epa.gov/region06/6pd/rcra_c/pd-n/screen.htm).

[e] Maximum detected concentration.

Table I-4.2-17
Radionuclide Screening Evaluation for SWMU 49-004

COPC	Industrial EPC[a] (pCi/g)	Industrial SAL[b] (pCi/g)	Industrial Dose (mrem/yr)	Residential EPC[a] (pCi/g)	Residential SAL[b] (pCi/g)	Residential Dose (mrem/yr)	Construction EPC[a] (pCi/g)	Construction SAL[b] (pCi/g)	Construction Dose (mrem/yr)
Americium-241	0.263[c]	180	0.022	0.43[c]	30	0.22	0.43[c]	34	0.2
Cesium-134	0.073[c]	9.7	0.113	0.073[c]	2.4	0.46	0.073[c]	7.7	0.14
Cesium-137	0.388	23	0.253	0.368	5.6	0.99	0.368	18	0.31
Europium-152	0.259[c]	11	0.353	0.259[c]	2.9	1.34	0.259[c]	9.1	0.43
Plutonium-238	0.025[c]	240	0.002	0.025[c]	37	0.01	0.025[c]	40	0.01
Plutonium-239/240	0.0707	210	0.005	0.0792	33	0.04	0.0792	36	0.03
Tritium	n/a[d]	n/a	n/a	0.03114[c]	750	0.001	0.03114[c]	3.20E+05	0.000001
		Total Dose	**0.75**		**Total Dose**	**3**		**Total Dose**	**1**

[a] EPC is the 95% UCL unless otherwise noted.

[b] SALs from LANL (2009, 107655).

[c] Maximum detected concentration.

[d] n/a = Not applicable; not a COPC for the site.

Table I-5.3-1
Ecological Screening Levels for Terrestrial Receptors

COPCs	American Kestrel (avian intermediate carnivore)	American Kestrel (avian top carnivore)	American Robin (avian herbivore)	American Robin (avian insectivore)	American Robin (avian omnivore)	Deer Mouse (mammalian omnivore)	Desert Cottontail (mammalian herbivore)	Earthworm (soil-dwelling invertebrate)	Plant (terrestrial autotroph - producer)	Montane Shrew (mammalian insectivore)	Red Fox (mammalian top carnivore)
Inorganic Chemicals (mg/kg)											
Aluminum	na*	na	na	na	na	na	na	na	na	na	na
Antimony	na	na	na	na	na	0.48	2.9	78	0.05	0.26	45
Barium	11,000	37,000	820	1000	930	1800	3300	330	110	1300	41,000
Beryllium	na	na	na	na	na	56	170	40	2.5	18	420
Chromium	7700	37000	1900	830	1100	1900	13000	2.3	2.4	750	30000
Cobalt	930	3500	170	96	120	400	1800	na	13	160	5400
Copper	110	1600	38	15	22	64	270	80	70	38	3800
Cyanide (total)	0.47	0.58	0.1	0.1	0.1	340	740	na	na	310	2200
Iron	na	na	na	na	na	na	na	na	na	na	na
Lead	120	810	21	14	16	120	370	1700	120	72	3700
Manganese	35,000	90,000	1400	3100	1900	1400	2000	450	220	1500	41,000
Mercury	0.082	0.28	0.07	0.013	0.022	3	22	0.05	34	1.7	46
Nickel	160	2900	160	21	38	20	500	280	38	9.7	1200
Nitrate	na	na	na	na	na	na	na	na	na	na	na
Perchlorate	na	na	na	na	na	na	na	na	na	na	na
Selenium	5.6	97	1	0.75	0.87	0.83	2.1	4.1	0.52	0.66	84
Silver	19	840	11	2.6	4.3	24	150	na	560	14	4100
Thallium	6.6	75	9.2	0.9	1.6	0.068	2.8	na	0.1	0.032	2.8
Uranium	21,000	39,000	1900	1600	1700	750	2000	na	25	220	4800
Vanadium	84	170	8.9	6.7	7.6	480	1500	na	0.025	140	3300
Zinc	320	2400	350	48	85	170	1800	120	160	98	6000

Table I-5.3-1 (continued)

COPCs	American Kestrel (avian intermediate carnivore)	American Kestrel (avian top carnivore)	American Robin (avian herbivore)	American Robin (avian insectivore)	American Robin (avian omnivore)	Deer Mouse (mammalian omnivore)	Desert Cottontail (mammalian herbivore)	Earthworm (soil-dwelling invertebrate)	Plant (terrestrial autotroph - producer)	Montane Shrew (mammalian insectivore)	Red Fox (mammalian top carnivore)
Organic Chemicals (mg/kg)											
Aroclor-1260	3.7	4.6	46	0.88	1.7	20	3000	na	na	10	0.14
Bis(2-ethylhexyl)phthalate	0.045	0.033	20	0.02	0.04	1.1	2700	na	na	0.59	1.2
Butanone[2-]	na	na	na	na	na	360	420	na	na	2600	420,000
Radionuclides (pCi/g)											
Americium-241	35,000	62,000	13,000	4000	4000	32,000	32,000	44	21,000	31,000	26,000
Cesium-134	1700	1300	1900	1700	1700	1100	1000	770	1100	1100	320
Cesium-137	3700	2900	4200	3800	3700	2400	2300	1700	2300	2400	680
Europium-152	1000	1000	1000	970	970	530	530	380	520	520	500
Plutonium-238	32,000	130,000	8300	2000	2100	110,000	120,000	44	110,000	92,000	30,000
Plutonium-239	34,000	160,000	8600	2100	2100	150,000	170,000	47	160,000	110,000	33,000
Tritium	630,000	580,000	300,000	600,000	440,000	330,000	230,000	48,000	36,000	340,000	190,000

*na = Not available.

Table I-5.3-2
Minimum ESL Comparison for AOC 49-005(b)

COPC	EPC* (mg/kg)	Final ESL (mg/kg)	Final ESL Receptor	Hazard Quotient
Inorganic Chemicals (mg/kg)				
Cyanide (total)	0.16	0.1	American robin (all)	**1.6**
Mercury	0.0338	0.013	American robin (insectivore)	**2.6**
Thallium	0.35	0.032	Montane shrew (insectivore)	**10.9**
Uranium	4.23	25	Plant	0.2
Radionuclides (pCi/g)				
Cesium-137	0.13 6	680	Red fox (top carnivore)	0.0002
Plutonium-238	0.018	44	Earthworm (invertebrate)	0.0004
Plutonium-239	0.025	47	Earthworm (invertebrate)	0.0005

Note: Bold values indicate HQ greater than 0.3.
*Maximum detected concentration.

Table I-5.3-3
Hazard Index Analysis for AOC 49-005(b)

COPEC	EPC[a] (mg/kg)	American Kestrel (avian intermediate carnivore)	American Kestrel (avian top carnivore)	American Robin (avian herbivore)	American Robin (avian insectivore)	American Robin (avian omnivore)	Deer Mouse (mammalian omnivore)	Desert Cottontail (mammalian herbivore)	Earthworm (soil-dwelling invertebrate)	Plant (terrestrial autotroph - producer)	Montane Shrew (mammalian insectivore)	Red Fox (mammalian top carnivore)
Inorganic Chemicals (mg/kg)												
Cyanide (Total)	0.16	**0.34**	0.28	**1.6**	**1.6**	**1.6**	0.0005	0.0002	na[b]	na	0.001	0.00007
Mercury	0.0338	**0.41**	0.12	**0.48**	**2.6**	**1.54**	0.01	0.002	**0.68**	0.001	0.02	0.0007
Thallium	0.35	0.05	0.005	0.04	**0.39**	0.22	**5.1**	0.1	na	**3.5**	**10.9**	0.13
HI		0.8	0.4	**2**	**5**	**3**	**5**	0.1	0.7	**4**	**11**	0.1

Note: Bold values indicate HQ greater than 0.3 or HI greater than 1.0.
[a] Maximum detected concentration.
[b] na = Not available.

Table I-5.3-4
Minimum ESL Comparison for SWMU 49-006

COPC	EPC* (mg/kg)	Final ESL (mg/kg)	Final ESL Receptor	HQ
Inorganic Chemicals (mg/kg)				
Chromium	13.9	2.3	Earthworm (invertebrate)	**6.0**
Cyanide (total)	0.17	0.1	American robin (all)	**1.7**
Mercury	0.0344	0.013	American robin (insectivore)	**2.6**
Organic Chemicals (mg/kg)				
Bis(2-ethylhexyl)phthalate	0.066	0.02	American robin (insectivore)	**3.3**
Butanone[2-]	0.0058	360	Deer mouse (omnivore)	0.00002
Radionuclides (pCi/g)				
Tritium	0.408	36,000	Plant	0.00001

Note: Bold values indicate HQ greater than 0.3.
*Maximum detected concentration.

Table I-5.3-5
Hazard Index Analysis for SWMU 49-006

COPEC	EPC[a] (mg/kg)	American Kestrel (avian intermediate carnivore)	American Kestrel (avian top carnivore)	American Robin (avian herbivore)	American Robin (avian insectivore)	American Robin (avian omnivore)	Deer Mouse (mammalian omnivore)	Desert Cottontail (mammalian herbivore)	Earthworm (soil-dwelling invertebrate)	Plant (terrestrial autotroph - producer)	Montane Shrew (mammalian insectivore)	Red Fox (mammalian top carnivore)
Inorganic Chemicals (mg/kg)												
Chromium	13.9	0.006	0.003	0.05	0.07	0.06	0.02	0.004	**40.9**	**39.7**	0.05	0.002
Cyanide (total)	0.17	**0.36**	0.29	**1.7**	**1.7**	**1.7**	0.001	0.0002	na[b]	na	0.001	0.00008
Mercury	0.0344	**0.42**	0.12	**0.49**	**2.6**	**1.56**	0.01	0.002	**0.69**	0.001	0.02	0.0007
Organic Chemicals (mg/kg)												
Bis(2-ethylhexl)phthalate	0.066	**1.47**	**2.0**	0.003	**3.3**	**1.65**	0.06	0.00002	na	na	0.11	0.06
HI		**2**	**2**	**2**	**8**	**5**	0.08	0.006	**42**	**40**	0.2	0.06

Note: Bold values indicate HQs greater than 0.3 or HI greater than 1.0.
[a] Maximum detected concentration.
[b] na = Not available.

Table I-5.3-6
Minimum ESL Comparison for AOC 49-008(a)

COPC	EPC (mg/kg)	Final ESL (mg/kg)	Final ESL Receptor	HQ
Organic Chemicals (mg/kg)				
Aroclor-1260	0.0681	0.14	Red fox (top carnivore)	**0.49**

Note: Bold values indicate HQ greater than 0.3.

Table I-5.3-7
Hazard Index Analysis for SWMU 49-008(a)

COPEC	EPC (mg/kg)	American Kestrel (avian intermediate carnivore)	American Kestrel (avian top carnivore)	American Robin (avian herbivore)	American Robin (avian insectivore)	American Robin (avian omnivore)	Deer Mouse (mammalian omnivore)	Desert Cottontail (mammalian herbivore)	Earthworm (soil-dwelling invertebrate)	Plant (terrestrial autotroph - producer)	Montane Shrew (mammalian insectivore)	Red Fox (mammalian top carnivore)
Organic Chemicals (mg/kg)												
Aroclor-1260	0.0681	0.02	0.01	0.001	0.1	0.04	0.003	0.0002	na*	na	0.007	**0.49**
HI		0.02	0.01	0.001	0.1	0.04	0.003	0.0002	na	na	0.007	0.5

Note: Bold values indicate HQ greater than 0.3.
*na = Not available.

Table I-5.3-8
Minimum ESL Comparison for SWMU 49-004

COPC	EPC (mg/kg)	Final ESL (mg/kg)	Final ESL Receptor	HQ
Inorganic Chemicals (mg/kg)				
Antimony	0.207	0.05	Plant	**4.1**
Barium	198.3	110	Plant	**1.8**
Beryllium	1.073	2.5	Plant	**0.43**
Chromium	9.854	2.3	Earthworm (invertebrate)	**4.3**
Cobalt	6.479	13	Plant	**0.5**
Copper	11.14	15	American robin (insectivore)	**0.7**
Lead	16.36	14	American robin (insectivore)	**1.2**
Manganese	423.9	220	Plant	**1.9**
Mercury	0.0274	0.013	American robin (insectivore)	**2.1**
Nickel	9.011	9.7	Montane shrew (insectivore)	**0.9**
Selenium	1.114	0.52	Plant	**2.1**
Silver	0.375	2.6	American robin (insectivore)	0.1
Thallium	0.318	0.032	Montane shrew (insectivore)	**9.9**
Uranium	6.232	25	Plant	0.2
Vanadium	23.36	0.025	Plant	**934**
Zinc	75.27	48	American robin (insectivore)	**1.6**
Radionuclides (pCi/g)				
Americium-241	0.214	44	Earthworm (invertebrate)	0.005
Cesium-134	0.073	320	Red fox (top carnivore)	0.0002
Cesium-137	0.378	680	Red fox (top carnivore)	0.001
Europium-152	0.259	380	Earthworm (invertebrate)	0.001
Plutonium-238	0.025	44	Earthworm (invertebrate)	0.001
Plutonium-239	0.0762	47	Earthworm (invertebrate)	0.002

Note: Bold values indicate HQ greater than 0.3.

Table I-5.3-9
Hazard Index Analysis for SWMU 49-004

COPEC	EPC (mg/kg)	American Kestrel (avian intermediate carnivore)	American Kestrel (avian top carnivore)	American Robin (avian herbivore)	American Robin (avian insectivore)	American Robin (avian omnivore)	Deer Mouse (mammalian omnivore)	Desert Cottontail (mammalian herbivore)	Earthworm (soil-dwelling invertebrate)	Plant (terrestrial autotroph - producer)	Montane Shrew (mammalian insectivore)	Red Fox (mammalian top carnivore)
Inorganic Chemicals (mg/kg)												
Antimony	0.207	na*	na	na	na	na	**0.43**	0.07	0.003	**4.1**	**0.8**	0.005
Barium	198.3	0.02	0.005	0.24	0.2	0.21	0.11	0.06	**0.6**	**1.8**	0.15	0.005
Beryllium	1.073	na	na	na	na	na	0.02	0.006	0.03	**0.43**	0.06	0.003
Chromium	9.854	0.001	0.0003	0.005	0.01	0.009	0.005	0.0008	**4.3**	**4.1**	0.01	0.0003
Cobalt	6.479	0.007	0.002	0.04	0.07	0.05	0.02	0.004	na	**0.5**	0.04	0.001
Copper	11.14	0.1	0.007	0.29	**0.74**	**0.51**	0.17	0.04	0.14	0.16	0.29	0.003
Lead	16.36	0.14	0.02	**0.78**	**1.2**	**1.0**	0.14	0.04	0.01	0.14	0.23	0.004
Manganese	423.9	0.01	0.005	0.3	0.14	0.22	0.3	0.21	**0.94**	**1.9**	0.28	0.01
Mercury	0.0274	**0.33**	0.1	**0.39**	**2.1**	**1.2**	0.009	0.001	**0.55**	0.001	0.02	0.001
Nickel	9.011	0.06	0.003	0.06	**0.43**	0.24	**0.45**	0.02	0.03	0.24	**0.93**	0.008
Selenium	1.114	0.2	0.01	**1.1**	**1.5**	**1.3**	**1.3**	**0.53**	0.27	**2.1**	**1.7**	0.01
Thallium	0.318	0.05	0.004	0.03	**0.35**	0.2	**4.7**	0.11	na	**3.2**	**9.9**	0.11
Vanadium	23.36	0.28	0.14	**2.6**	**3.5**	**3.1**	0.05	0.02	na	**934**	0.17	0.007
Zinc	75.27	0.24	0.03	0.22	**1.6**	**0.89**	**0.44**	0.04	**0.63**	**0.47**	**0.77**	0.01
HI		1	0.3	**6**	**12**	**9**	**8**	1	**8**	**953**	**15**	0.2

Note: Bold values indicate HQs greater than 0.3 or HI greater than 1.0.
*na = Not available.

Table I-5.4-1
Comparison of EPCs to Background Concentrations for AOC 49-005(b)

COPEC	EPC (mg/kg)	Soil Background Concentration (mg/kg)	Tuff Background Concentration (mg/kg)
Cyanide (total)	0.16	0.5*	0.5*
Mercury	0.0338	0.05–0.1	0.1*
Thallium	0.35	0.063–1	0.05–1.7

Note: From LANL (1998, 059730).
*No background data set; value is the BV.

Table I-5.4-2
Comparison of EPCs to Background Concentrations for SWMU 49-006

COPEC	EPC (mg/kg)	Soil Background Concentration (mg/kg)	Tuff Background Concentration (mg/kg)
Chromium	13.9	1.9–36.5	0.25–13.0
Cyanide (total)	0.17	0.5*	0.5*
Mercury	0.034	0.05–0.1	0.1*

Note: From LANL (1998, 059730).
*No background data set; value is the BV.

Table I-5.4-3
Comparison of EPCs to Background Concentrations for SWMU 49-004

COPEC	EPC (mg/kg)	Soil Background Concentration (mg/kg)	Tuff Background Concentration (mg/kg)
Antimony	0.207	0.1–1.0	0.05–0.4
Barium	198.3	21.0–410	1.4–51.6
Beryllium	1.073	0.04–3.95	0.04–1.8
Chromium	9.854	1.9–36.5	0.25–13.0
Cobalt	6.479	1.0–9.5	3.14*
Copper	11.14	0.25–16.0	0.25–6.2
Lead	16.36	2.0–28.0	1.6–15.5
Manganese	423.9	76.0–1,100	22.0–752
Mercury	0.0274	0.05–0.1	0.1*
Nickel	9.011	1–29.0	0.5–7.0
Selenium	1.114	0.1–1.7	0.1–0.105
Thallium	0.318	0.063–1.0	0.05–1.7
Vanadium	23.36	4–56.5	0.25–21.0
Zinc	75.27	14–75.5	5.5–65.6

Note: From LANL (1998, 059730).
*No background data set; value is the BV.

Table I-5.4-4
PAUFs for Ecological Receptors

Receptor	Home Range[a] (ha)	Population Area[a] (ha)	PAUF[b] SWMU 49-006
American kestrel	106	4240	0.000004
American robin	0.42	16.8	0.001
Deer mouse	0.077	3.0	0.006
Desert cottontail	3.1	124	0.00014
Montane shrew	0.39	15.6	0.0011
Red fox	1038	41,520	0.0000004
Mexican spotted owl[c]	366	n/a[d]	0.00005

[a] Values from EPA (1993, 059384).

[b] PAUF is calculated as the area of the site (0.017 ha) divided by the population area. No PAUF is calculated for earthworms or plants.

[c] Value for Mexican spotted owl is the AUF based on individual HR.

[d] n/a = Not applicable.

Table I-5.4-5
Adjusted HQs and HIs for SWMU 49-006

COPEC	EPC (mg/kg)	American Kestrel (avian intermediate carnivore)	American Kestrel (avian top carnivore)	American Robin (avian herbivore)	American Robin (avian insectivore)	American Robin (avian omnivore)	Deer Mouse (mammalian omnivore)	Desert Cottontail (mammalian herbivore)	Earthworm (soil-dwelling invertebrate)a	Plant (terrestrial autotroph - producer)a	Montane Shrew (mammalian insectivore)	Red Fox (mammalian top carnivore)
Organic Chemicals (mg/kg)												
Bis(2-ethylhexyl) phthalate	0.066	0.00007	0.000008	0.000003	0.003	0.002	0.0004	0.000000003	na*	na	0.0001	0.0002
Adjusted HI		0.00007	0.000008	0.000003	0.003	0.002	0.0004	0.000000003	na	na	0.0001	0.0002

*na = Not available.

Table I-5.5-1
HI Analysis for Pore-Gas Samples for AOC 49-005(b)

COPCs	Maximum Detected Concentration ($\mu g/m^3$)	Inhalation ESL ($\mu g/m^3$)	HQ
Acetone	18	530,000	0.00003
Benzene	6	25,000	0.0002
Butanone[2-]	5.4	na[a]	na
Chloromethane	1.7	21,000	0.00008
Dichlorodifluoromethane	3	2,600,000	0.000001
Ethylbenzene[b]	7.4	25,000	0.0003
Ethyltoluene[4-][c]	19	60,000	0.0003
Tetrachloroethene	7.3	73,000	0.0001
Toluene	24	60,000	0.0004
Trimethylbenzene[1.2.4-][b]	9.9	25,000	0.0004
Trimethylbenzene[1,3,5][b]	3.4	25,000	0.0001
Xylene(total)	29	87,000	0.0003
Xylene[1,2-][d]	7.3	87,000	0.00008
Xylene[1,3-]+Xylene[1,4-][d]	21	87,000	0.0002
		HI	**0.003**

Note: ESLs obtained from ECORISK Database, Version 2.4 (LANL 2009, 107524).

[a] na = Not available.

[b] Benzene used as a surrogate.

[c] Toluene used as a surrogate.

[d] Total xylene used as a surrogate.

Table I-5.5-2
HI Analysis for Pore-Gas Samples for SWMU 49-004

COPCs	Maximum Detected Concentration ($\mu g/m^3$)	Inhalation ESL ($\mu g/m^3$)	HQ
Acetone	39	530,000	0.00007
Benzene	20	25,000	0.0008
Butanone[2-]	10	na[a]	na
Chloromethane	1.7	21,000	0.00008
Dichlorodifluoromethane	3.1	2,600,000	0.000001
Ethylbenzene[b]	13	25,000	0.0005
Ethyltoluene[4-][c]	17	60,000	0.0003
Styrene	3.2	na	na
Toluene	34	60,000	0.0006
Trimethylbenzene[1.2.4-][b]	18	25,000	0.0007
Trimethylbenzene[1,3,5][b]	5.4	25,000	0.0002
Xylene(total)	50	87,000	0.0006
Xylene[1,2-][d]	13	87,000	0.0001
Xylene[1,3-]+Xylene[1,4-][d]	37	87,000	0.0004
		HI	**0.004**

Note: ESLs obtained from ECORISK Database, Version 2.4 (LANL 2009, 107524).

[a] na = Not available.

[b] Benzene used as a surrogate.

[c] Toluene used as a surrogate.

[d] Total xylene used as a surrogate.

Attachment I-1

Ecological Scoping Checklist

I1-1.0 PART A—SCOPING MEETING DOCUMENTATION

Site ID	TA-49 Sites Outside NES Boundary
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 TA-49 between 1959 and 1961. The experiments deposited plutonium, uranium, lead, and beryllium in underground shafts. *SWMU 49-006* is the possible location of a sump. Photographic liquids have been discharged to the sump. A radiochemistry laboratory is another possible source of discharged liquid. *SWMU 49-004* consists of an inactive open burning area/ landfill used from 1959 to 1961 for open-pit burning of combustible construction materials and burial of uncontaminated residues. The landfill was reopened in 1971 and 1984 for disposal of uncontaminated materials due to a cleanup. *AOC 49-005(b)* consists of a small landfill to dispose of uncontaminated construction debris from a 1984 cleanup. *AOC 49-008(a)* consists of contaminated soil from a darkroom, radiochemistry laboratory, and calibration facility. Two electrical transformer pads are outside the northeast and northwest corners of this area and consisted of possible transformer oil leaking.
List of Primary Impacted Media **(Indicate all that apply.)**	**Surface soil –** yes **Surface water/sediment –** n/a **Subsurface –** yes **Groundwater –** n/a **Other, explain –** none
FIMAD vegetation class based on Arcview vegetation coverage **(Indicate all that apply.)**	**Water** – **Bare Ground/Unvegetated** – The TA-49 complex, 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 there are numerous roadways throughout the area. **Spruce/fir/aspen/mixed conifer** – **Ponderosa pine –** The dominant overstory vegetation type surrounding the area is ponderosa pine, with minor vegetation components of fir (white and Douglas) and piñon **Piñon juniper/juniper savannah** –**Grassland/shrubland** – **X** The understory contains mostly native and nonnative grasses and ruderal species indicative of disturbance, with a few shrubs and forbs. **Developed** – **Burned –** Habitat fragmentation at the site is high. The general habitat quality in undisturbed areas is sufficient to support grazing and foraging by terrestrial receptors.
Is T&E Habitat Present? **If applicable, list species known or suspected to use the site for breeding or foraging.**	No threatened and endangered (T&E) species nesting habitat is present at the site. However, the area falls within the Mexican spotted owl foraging habitat.

Provide list of Neighboring/ Contiguous/ Up-gradient sites, include a brief summary of COPCs and form of releases for relevant sites and reference map as appropriate. **(Use information to evaluate need to aggregate sites for screening.)**	TA-49 is geographically isolated from the Laboratory. However, several groups of SWMUs and AOCs are associated with TA-49 and are located inside the NES boundary. They include SWMUs 49-001(a), 49-001(b), 49-001(c), 49-0019d), 49-001(e), 49-001(f), 49-001(g), 49-003 and AOCs 49-008(c), and 49-008(d).
Surface Water Erosion Potential Information **Summarize information from SOP 2.01, including the run-off subscore (maximum of 46); terminal point of surface water transport; slope; and surface water runon sources.**	The 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 site.

I1-2.0 PART B—SITE VISIT DOCUMENTATION

Site ID	TA-49 Sites Outside NES Boundary
Date of Site Visit	Pattie Baucom/Win Cromec
Site Visit Conducted by	March 15, 2010

Receptor Information:

Estimate cover	**Relative vegetative cover (high, medium, low, none) =** medium **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 FIMAD vegetation class to assist in ground-truthing the Arcview information	Vegetation is as noted above.
Field notes on T&E Habitat, if applicable. Consider the need for a site visit by a T&E subject matter expert to support the use of the site by T&E receptors.	TA-49 is within the Mexican spotted owl foraging habitat. No nests are present in the area.
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 field work at the site: bobcat, elk, mule deer, coyotes, rabbits, mice, and birds. Mountain lion and bear 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 is 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**	**Surface Water:** Ephemeral stream drainage down gradient. **Groundwater:** No **Air:** Surface contamination may be dispersed by wind though vegetation and forest litter inhibits this process substantially.
Interim action needed to limit off-site transport? **(yes/no/uncertain)** **Provide explanation/ recommendation to project lead for IA SMDP.**	No. Runoff and air dispersion are limited or not present.

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**.**
Interim action needed to limit apparent ecological effects? **(yes/no/uncertain)** **Provide explanation and recommendations to mitigate apparent exposure pathways to project lead for IA SMDP.**	No effects observed.

No Exposure/Transport Pathways:

If there are no complete exposure pathways to ecological receptors onsite and no transport pathways to offsite receptors, the remainder of the checklist should not be completed. Stop here and provide additional explanation/justification for proposing an ecological No Further Action recommendation (if needed). At a minimum, the potential for future transport should include likelihood that future construction activities could make contamination more available for exposure or transport. Not applicable.

Adequacy of Site Characterization:

Do existing or proposed data provide information on the nature, rate and extent of contamination? **(yes/no/uncertain)** **Provide explanation** **(Consider if the maximum value was captured by existing sample data.)**	No. Nature and extent has been determined for four sites evaluated for risk. Additional sampling is needed to define extent at the other sites.
Do existing or proposed data for the site address potential transport pathways of site contamination? **(yes/no/uncertain)** **Provide explanation** **(Consider if other sites should aggregated to characterize potential ecological risk.)**	Canyons investigations will include sampling in Water Canyon and Ancho Canyon, which receive runoff from TA-49.

I1-3.0 PART C—ECOLOGICAL PATHWAYS CONCEPTUAL EXPOSURE MODEL

Question A:

Could soil contaminants reach receptors via vapors?

- **Volatility of the hazardous substance (volatile chemicals generally have Henry's Law constant >10^{-5} atm-me/mol and molecular weight <200 g/mol).**

Answer (likely/unlikely/uncertain): Unlikely

Provide explanation: Volatile chemicals are detected at low concentrations**.**

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: No high levels of surface contamination are documented however vegetation in some areas is sparse and contaminated soil could be dispersed by wind.

Question C:

Can contaminated soil be transported to aquatic ecological communities (use SOP 2.01 run-off score and terminal point of surface water runoff to help answer this question)?

- **If the SOP 2.01 run-off score* for each PRS included in the site is equal to zero, this suggests that erosion at the site is not a transport pathway. (* Note that the runoff score is not the entire erosion potential score, rather it is a subtotal of this score with a maximum value of 46 points).**
- **If erosion is a transport pathway, evaluate the terminal point to see if aquatic receptors could be affected by contamination from this site.**

Answer (likely/unlikely/uncertain): Unlikely

Provide explanation: There are no nearby aquatic communities that could be impacted by runoff from the site.

Question D:

Is contaminated groundwater potentially available to biological receptors through seeps or springs or shallow groundwater?

- **Known or suspected presence of contaminants in groundwater.**
- **The potential for contaminants to migrate via groundwater and discharge into habitats and/or surface waters.**
- **Contaminants may be taken up by terrestrial and rooted aquatic plants whose roots are in contact with groundwater present within the root zone (~1 m depth).**

Terrestrial wildlife receptors generally will not contact groundwater unless it is discharged to the surface.

Answer (likely/unlikely/uncertain): Unlikely

Provide explanation: There is no alluvial or perched water beneath site and there are no nearby springs or seeps.

Question E:

Is infiltration/percolation from contaminated subsurface material a viable transport and exposure pathway?

- **Suspected ability of contaminants to migrate to groundwater.**
- **The potential for contaminants to migrate via groundwater and discharge into habitats and/or surface waters.**
- **Contaminants may be taken up by terrestrial and rooted aquatic plants whose roots are in contact with groundwater present within the root zone (~1 m depth).**

- **Terrestrial wildlife receptors generally will not contact groundwater unless it is discharged to the surface.**

Answer (likely/unlikely/uncertain): Unlikely

Provide explanation: There is no alluvial or perched water beneath site and there are no nearby springs or seeps.

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: Mass wasting would not be a release mechanism because areas where there are steeper slopes are composed of consolidated tuff. Erosion is minimal at the site.

Question G:

Could airborne contaminants interact with receptors through respiration of vapors?

- **Contaminants must be present as volatiles in the air.**
- **Consider the importance of inhalation of vapors for burrowing animals.**
- **Foliar uptake of organic vapors is typically not a significant exposure pathway.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 1

Terrestrial Animals: 1

Provide explanation: Volatile organics, if present, are detected at very low concentrations**.**

Question H:

Could airborne contaminants interact with plants through deposition of particulates or with animals through inhalation of fugitive dust?

- **Contaminants must be present as particulates in the air or as dust for this exposure pathway to be complete.**
- **Exposure via inhalation of fugitive dust is particularly applicable to ground-dwelling species that would be exposed to dust disturbed by their foraging or burrowing activities or by wind movement.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 2

Terrestrial Animals: 2

Provide explanation: Deposition of particulates on plants may be an exposure pathway to terrestrial receptors. Inhalation of resuspended dust is also a viable pathway for surface contaminants; however, most contamination is in the subsurface.

Question I:

Could contaminants interact with plants through root uptake or rain splash from surficial soils?

- **Contaminants in bulk soil may partition into soil solution, making them available to roots.**
- **Exposure of terrestrial plants to contaminants present in particulates deposited on leaf and stem surfaces by rain striking contaminated soils (i.e., rain splash).**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 2

Provide explanation: Contamination is mostly in the subsurface and at depths that could be taken up by plant roots.

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: 2

Provide explanation: Some contaminants are known to be bioaccumulators, however, most contamination is present in the subsurface.

Question K:

Could contaminants interact with receptors via incidental ingestion of surficial soils?

- **Incidental ingestion of contaminated soil could occur while animals grub for food resident in the soil, feed on plant matter covered with contaminated soil or while grooming themselves clean of soil.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 2

Provide explanation: Foraging and grooming activities may result in exposure to terrestrial receptors via incidental ingestion. However, most contamination is present in the subsurface.

Question L:

Could contaminants interact with receptors through dermal contact with surficial soils?

- **Significant exposure via dermal contact would generally be limited to organic contaminants that are lipophilic and can cross epidermal barriers.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 1

Provide explanation: Exposure via dermal contact is possible for terrestrial receptors, however, the organic COPCs are not lipophilic.

Question M:

Could contaminants interact with plants or animals through external irradiation?

- **External irradiation effects are most relevant for gamma emitting radionuclides.**
- **Burial of contamination attenuates radiological exposure.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 1

Terrestrial Animals: 1

Provide explanation: There are no gamma-emitting radionuclides detected at the site**.**

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: 1

Provide explanation: There is no persistent surface water on the site.

Question O:

Could contaminants interact with receptors through food web transport from water and sediment?

- **The chemicals may bioconcentrate in food items.**
- **Animals may ingest contaminated food items.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 0

Provide explanation: There is no persistent water on the site.

Question P:

Could contaminants interact with receptors via ingestion of water and suspended sediments?

- **If sediments are present in an area that is only periodically inundated with water, terrestrial receptors may incidentally ingest sediments.**
- **Terrestrial receptors may ingest water-borne contaminants if contaminated surface waters are used as a drinking water source.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Animals: 0

Provide explanation: There is no persistent water on the site.

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: There is no persistent water on the site.

Question R:

Could contaminants interact with plants or animals through external irradiation?

- **External irradiation effects are most relevant for gamma emitting radionuclides.**
- **Burial of contamination attenuates radiological exposure.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Terrestrial Plants: 2

Terrestrial Animals: 1

Provide explanation: There are no gamma-emitting radionuclides detected at the site.

Question S:

Could contaminants bioconcentrate in free floating aquatic, attached aquatic plants, or emergent vegetation?

- **Aquatic plants are in direct contact with water.**
- **Contaminants in sediment may partition into pore water, making them available to submerged roots.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

Aquatic Plants/Emergent Vegetation: 0

Provide explanation: There is no persistent water on the site.

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: There is no persistent water on the site.

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: There is no persistent water on the site.

Question V:

Could contaminants interact with aquatic plants or animals through external irradiation?

- **External irradiation effects are most relevant for gamma emitting radionuclides.**
- **The water column acts to absorb radiation, thus external irradiation is typically more important for sediment dwelling organisms.**

Provide quantification of exposure pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

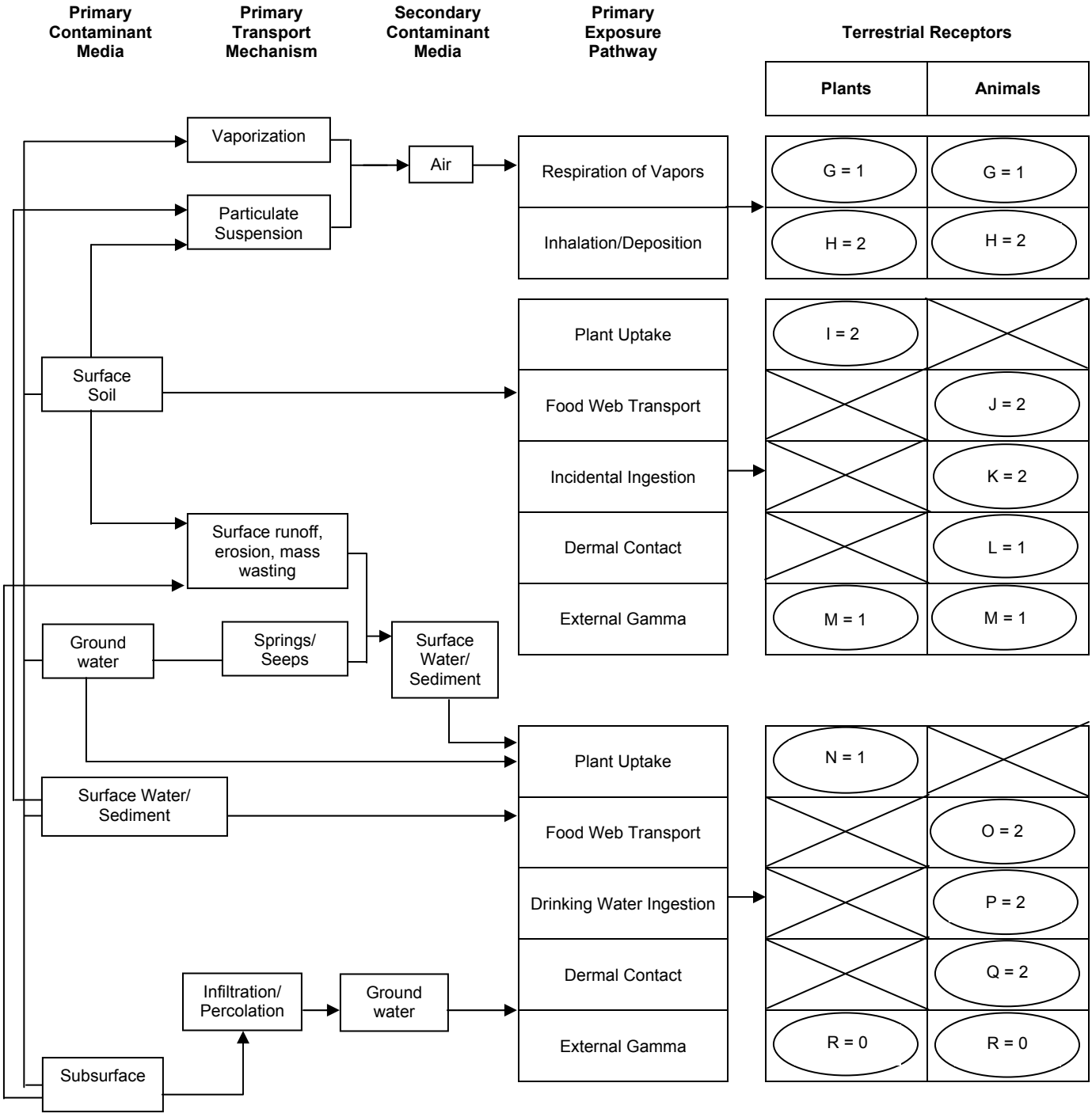
Aquatic Plants: 0

Aquatic Animals: 0

Provide explanation: There is no persistent water on the site.

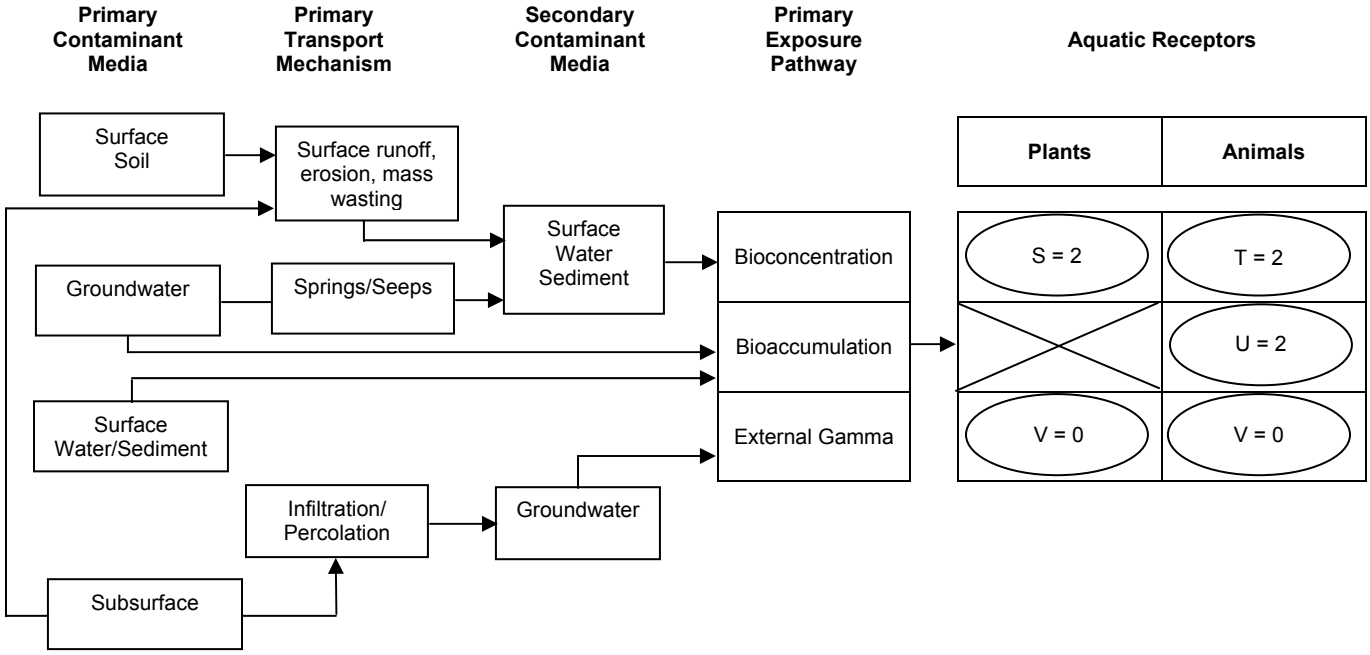
NOTE:
Letters in circles refer to questions on the Scoping Checklist

Ecological Scoping Checklist
Terrestrial Receptors
Ecological Pathways Conceptual Exposure Model



NOTE:
Letters in circles refer to questions on the Scoping Checklist

Ecological Scoping Checklist
Aquatic Receptors
Ecological Pathways Conceptual Exposure Model

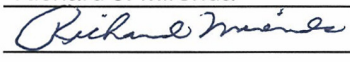


Signatures and certifications:

Checklist completed by (provide name, organization and phone number):

Name (printed): Pattie Baucom/Win Cromec
Name (signature): 
Organization: TPMC/WGI
Phone number: 505-412-3998/720-231-1107
Date Completed: March 15, 2010

Verification by another party (provide name, organization and phone number):

Name (printed): Richard J. Mirenda
Name (signature): 
Organization: Los Alamos National Laboratory
Phone number: 505-665-6953

Attachment I-2

ProUCL Files
(on CD included with this document)

Appendix J

Los Alamos National Laboratory Cultural Resource Team Assessment of Trenches Located in Area 6 West, Solid Waste Management Unit 49-004

Los Alamos
NATIONAL LABORATORY
EST. 1943

memorandum

Environmental Protection Division
Ecology and Air Quality Group

To/MS: Mark Vaneeckhout, CM-STRS, M992
From/MS: Leslie Hansen, ENV-EAQ, J978
Phone/Fax: 5-9873/5-8858
Symbol: ENV-EAQ:10-015
Date: January 19, 2010

ORIGIN OF "OPEN TRENCHES" IN TA-49, AREA 6 WEST

The LANL ENV-EAQ Cultural Resources Team has been requested by the Environmental Programs Directorate to provide an evaluation of the possible origin and nature of four trenches in Technical Area 49 (TA-49) on Frijoles Mesa. Solid Waste Management Unit (SWMU) 49-004 is located along a portion of Fire Break 4, with three of the four trenches being located a few hundred meters to the west. The fourth trench is located west of the other three trenches near the paved mesa top road. These trenches and SWMU-49-004 are described in the Area 6 West discussion in the October 2007 report *Historical Investigation Report for Sites at Technical Area 49 Outside the Nuclear Environmental Site Boundary* (LA-UR-07-6428), and are depicted in Figure 2.3-3 of that report. For ease of discussion in this memo, the four trenches are designated A-D from west to east. We note that the somewhat isolated westernmost Trench A near the paved road could not be relocated by the Cultural Resources Team; however, two of the other three trenches (B and C) have been periodically visited since the late 1990s, including specifically on behalf of the Environmental Programs Directorate in 2009. The Cultural Resources Team observed the presumed location of the easternmost Trench D (the trench closest to SWMU-49-004), and could tell that the area had been disturbed, but the actual physical structure of the trench could not be ascertained.

As noted by the Historical Investigation Report, SWMU-49-004 is the location of a landfill dating to the period of 1959-1961 and associated with the open-pit burning of Laboratory combustible construction wastes and for burial of uncontaminated wastes. The landfill area was reopened in 1971 for disposal of materials as part of a general cleanup of TA-49, and again in 1984 for disposal of uncontaminated solid wastes. The four trenches are absent in aerial photographs taken in 1935, but are present in aerial photographs taken in 1954. Due to the apparent absence of additional aerial photographs between these two dates, a more precise date for the construction of the trenches is not possible. However, it was the opinion of authors of the Historical Investigation Report that because the trenches pre-dated the beginning of intensive Laboratory operations at TA-49 in the period of 1959-1961, they were not used for the disposal of contaminated Laboratory materials. This opinion was supported by negative findings during a radiological survey in and around the four trenches in 1995, which included single auger holes placed in the bottom of the three open trenches.

Trench B and Trench C are directly associated with visible Ancestral Pueblo masonry roomblocks sites (LA 15861 and LA 15866A, respectively). Trench B is placed immediately east of the roomblock for site LA 15861 in an area that would have dissected the major trash deposit associated with the roomblock. Trench C appears to have been placed through a series of masonry rooms associated with the two-row roomblock at site LA 15866A (Figure 1).

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Laboratory archaeologist Charlie Steen excavated the remaining surface rooms at LA 15866A (Figure 2) sometime between the La Mesa Fire in 1977 and 1981 (*Pajarito Plateau Archaeological Surveys and Excavations, II*, LA-8860-NERP, dated April, 1982, pp. 34-35). Steen states (p. 34): "When TA-49 was abandoned [i.e., immediately after the 1959-61 operations], it was planned to bury scrap metal and other 'garbage' in three large trenches. Bulldozers bladed out the trenches and one of them was partially filled with trash when it was determined not to bury the scrap." In Laboratory archaeological site records Steen dated the excavation of the trenches to around 1960. Based on the previously mentioned aerial photographs it is obvious that Steen was in error regarding the date of the excavation of the trenches. It would make sense that because the trenches were already open and visible by 1959, they could have been considered as potential disposal locations for the 1959-1961 activities in TA-49. What is unclear is what Steen meant by the implication that 'garbage' or 'trash' was buried in the partially backfilled trench. Presumably he got this information from other Laboratory employees familiar with the 1959-1961 TA-49 activities. It is possible, although seemingly unlikely, that Steen confused the partially backfilled trench with the SWMU-49-004 landfill trench and the 1971 reopening of the landfill for waste disposal. We speculate based on proximity that Steen's partially backfilled trench containing the Laboratory trash is our present Trench D, although this is by no means certain.

The October 2007 Historical Investigation Report suggests that the four trenches in Area 6 West may have been related to pre-Laboratory mine-claim activities during the period of 1935 to 1943. It is, instead, the present opinion of the LANL Cultural Resources Team that at least the trenches through the two archaeological sites (Trench B in LA 15861 and Trench C in LA 15866A) were likely purposefully placed with the intent to gain information and/or artifacts (such as ceramic pots associated with burials) from the trench excavations. This is suggested by the alignment of the trenches exactly parallel to the long axis of the two associated roomblocks, and the placement of Trench B so as to cut through the middle of the LA 15861 trash midden (and potentially to look for the presence of a semi-subterranean ceremonial kiva structure which typically are located to the east of roomblocks), and the placement of Trench C so as to cut through the entire string of western rooms of the LA 15866A two-row masonry roomblock..

Trenches B and C conceivably may have been the work of a pre-Laboratory (1935-1943) local homesteader, or early Laboratory (1943-1954) employee "pot-hunting" the two sites. However, the LANL Cultural Resources Team presently believes it even more likely that the trenches were placed by Frederick Worman, the Laboratory's first archaeologist who worked at LANL between late 1950 and 1971.

In a May 1977 report (*Pajarito Plateau Archaeological Survey and Excavations*, LASL-77-4, pp. 5-6), Charlie Steen notes that in 1950, while then still employed at Adams State College in Colorado, Worman placed three sizable trenches in the large Ancestral Pueblo Late Coalition period plaza pueblo site (LA 4693) situated between Buildings 49-113 and 49-115. Because LA 4693 is only about 650 meters to the southeast of LA 15866A, it is probable that Worman was aware of the presence of LA 15866A and LA 15861. Assuming this to have been the case, Worman may have elected to place trenches at LA 15866A and LA 15861 during the period of 1950 to 1954 to better understand the range of Ancestral Pueblo habitation roomblock sites in the vicinity of LA 4693. Regrettably, as noted by Steen, Worman prepared no report on his trenches at LA 4693, which may also explain the lack of information regarding the trenches at LA 15866A and LA 15861.

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If Frederick Worman was, in fact, responsible for the excavation of Trenches B and C, this may also explain the other two trenches in Area 6 West. Situated around the many Ancestral Pueblo roomblock habitation sites at TA-49 are numerous Ancestral Pueblo fieldhouse structures consisting of 1-2 masonry rooms with few associated artifacts. It is therefore possible that Trenches A and D were used by Worman to explore fieldhouse structures whose integrity and very presence has since been obliterated by the trenches. However, this does not preclude the possibility that one of these two trenches, perhaps Trench D, was later used for Laboratory 'trash' as noted by Steen.

In conclusion, the LANL Cultural Resources Team is of the opinion that at least the two trenches associated with LA 15861 and LA 15866A (Trenches B and C) are more likely to have been originally excavated by Frederick Worman, or at least knowledgeable pot-hunters, rather than by the Laboratory for waste disposal. The general open nature and physical appearance of these two trenches strongly suggests that they were never used for waste disposal. One practical test of presumed archaeological origin of these two trenches would be to place test trenches in the debris mounds at each end of Trench B and Trench C and to stratigraphically study the depositional character of these mound deposits. A rapidly excavated Laboratory waste disposal trench would likely yield debris mounds with generally homogenous deposits consisting of few well defined stratigraphic lenses, whereas a trench excavated by pot-hunters or an archaeologist should yield evidence of several distinct stratigraphic lenses representing the stripping of archaeological site deposits in somewhat controlled levels each 10-20 cm thick. Trenches A and D are more problematic and the LANL Cultural Resources Team cannot vouch for their origin or later use, although a reasonable inference is that they were initially excavated at around the same time as Trench B and Trench C.

LH:alb

Cy:
Bruce Masse, ENV-EAQ, J978
ENV-EAQ File

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Figure 1. View looking south along the open trench (Trench C) associated with archaeological site LA 15866A, soon after the Cerro Grande Fire (October 2000).

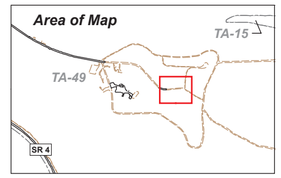


Figure 2. View looking south at masonry rooms adjacent to open trench at LA 15866A (Trench C), excavated by Charlie Steen after the 1977 La Mesa Fire (October 2000).

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1625000 1625200 1625400

1756000 1754800 1754600



This map was created for work processes associated with the *Investigation Report for TA-49 Sites Outside the NES Boundary*. All other uses for this map should be confirmed with the LANL EP-ERSS Division.

0 5 10 20 30 40 50 Feet

contour interval = 10 ft

New Mexico State Plane Coordinates - Central Zone FT, North American Datum 1983, NGVD 1929

49-610486 3-40 ft
RE49-10-7059 3-5 ft ALLH
Calcium 7010 (J+)
Nitrate 0.23
RE49-10-7060 8-10 ft Qbt 4
Nitrate 0.21 (J)
RE49-10-7061 13-15 ft Qbt 4
Nitrate 0.17 (J)
RE49-10-7062 18-20 ft Qbt 4
Nitrate 0.22
RE49-10-7063 23-25 ft Qbt 4
Nitrate 0.33
RE49-10-7064 28-30 ft Qbt 4
Nitrate 0.46
RE49-10-7065 33-35 ft Qbt 4
Nitrate 0.44
RE49-10-7066 38-40 ft Qbt 4
Nitrate 0.36

49-610487 1.5-40 ft
RE49-10-7074 1.5-3 ft ALLH
Nitrate 0.26
RE49-10-7073 6.8-8.8 ft ALLH
Mercury 0.12
Nitrate 0.12 (J)
RE49-10-7069 13-15 ft Qbt 4
Nitrate 0.16 (J)
RE49-10-7068 18-20 ft Qbt 4
Nitrate 0.46
RE49-10-7067 23-25 ft Qbt 4
Nitrate 0.35
RE49-10-7070 28-30 ft Qbt 4
Nitrate 0.22
RE49-10-7071 33-35 ft Qbt 4
Chromium 8.8
Nitrate 0.31
RE49-10-7072 38-40 ft Qbt 4
Nitrate 0.31
Lead 15.4

49-609423 0-1.5 ft
49-609421 0-1.5 ft
49-609424 0-1.5 ft
49-609422 0-1.5 ft

49-609419 0-1.5 ft
49-609420 0-1.5 ft
49-609417 0-1.5 ft
49-609418 0-1.5 ft

SWMU 49-008(a)

SWMU 49-006
49-05095 5-10 ft

49-101

49-05079 0-5 ft
0549-95-0139 0-0.5 ft ALLH
Potassium 3500
Uranium 3.51
0549-95-0137 3.3-5 ft FILL
Uranium 3.15

AOC 49-005(b)

49-05078 0-5 ft
0549-95-0136 0-0.5 ft ALLH
Uranium 3.72
0549-95-0135 3.6-5 ft FILL
Uranium 4.23

49-610488 0-15 ft
RE49-10-7075 0-2.5 ft ALLH
Nitrate 1.7
RE49-10-7076 2.5-4.3 ft ALLH
Nitrate 0.22
RE49-10-7077 5-7.5 ft Qbt 4
Nitrate 0.79
Perchlorate 0.0025 (J)
Selenium 1.2
RE49-10-7078 7.5-10 ft Qbt 4
Nitrate 1.2
Perchlorate 0.0032 (J)
RE49-10-7079 12.5-15 ft Qbt 4
Nitrate 1
Perchlorate 0.0065
Selenium 0.53 (J-)

- Sampling location
- Borehole
- Prior sampling location
- SWMU 49-008(a)
- Landfill
- LANL structure
- Fence
- Paved road/parking
- Dirt road
- 10 ft contour

Location ID (*2010* - red or underlined [in B&W], *historical* - black or not underlined) ***and Overall sampled interval*** (min–max)

Sample description (sample ID, depth (ft), media)

12-34567 2.5–6 ft
RE12-34-5678 0.0–0.50 SOIL
Copper 5.5
Selenium 0.5 (J)
⋮

Analyte data (analyte, result, optional qualifier code)

Result Qualifiers:
J = Estimated value
J+= Estimated value biased high
J- = Estimated value biased low

Note: All analytical results reported in milligrams per kilogram (mg/kg) or in picocuries per gram (pCi/g) except as noted.

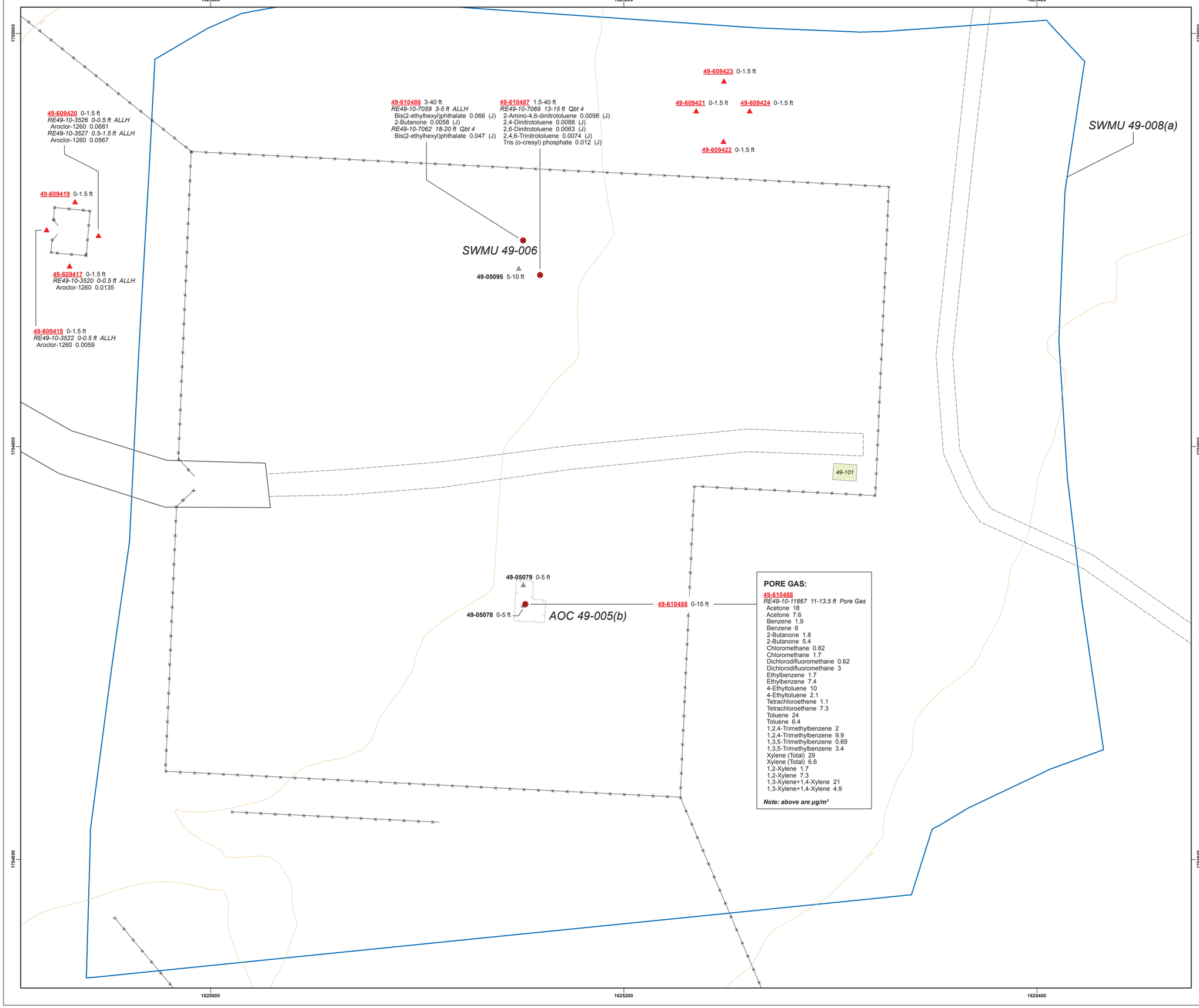
PLATE 1

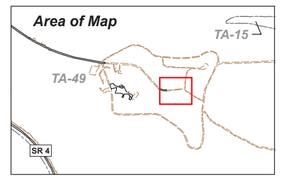
Area 5
[AOC 49-005(b) and SWMU 49-006] inorganic chemical concentrations detected above background values

Map Number: TPMC_030310A
Date: March 3, 2010 Rev: August 25, 2010
DraftedBy: TPMC File Name: TA49_Area5_HITS

1625000 1625200 1625400

1755000 1754800 1754600





This map was created for work processes associated with the *Investigation Report for TA-49 Sites Outside the NES Boundary*. All other uses for this map should be confirmed with the LANL EP-ERSS Division.

0 5 10 20 30 40 50 Feet

contour interval = 10 ft

New Mexico State Plane Coordinates - Central Zone FT, North American Datum 1983, NGVD 1929

- Sampling location
- Borehole
- Prior sampling location
- SWMU 49-008(a)
- Landfill
- LANL structure
- Fence
- Paved road/parking
- Dirt road
- 10 ft contour

Location ID (*2010* - red or underlined [in B&W], *historical* - black or not underlined) ***and Overall sampled interval*** (min–max)

Sample description (sample ID, depth (ft), media)

12-34567 2.5–6 ft
RE12-34-5678 0.0–0.50 SOIL
Copper 5.5
Selenium 0.5 (J)
⋮

Analyte data (analyte, result, optional qualifier code)

Result Qualifiers:
J = Estimated value
J+= Estimated value biased high
J- = Estimated value biased low

Note: All analytical results reported in milligrams per kilogram (mg/kg) or in picocuries per gram (pCi/g) except as noted.

PLATE 2

Area 5
[AOC 49-005(b), SWMU 49-006, and AOC 49-008(a)] organic chemical concentrations detected

Map Number: TPMC_030310A
Date: March 3, 2010 Rev: August 25, 2010
DraftedBy: TPMC File Name: TA49_Area5_HITS

1625000 1625200 1625400

1755000 1754800 1754600

49-609423 0-1.5 ft

49-609421 0-1.5 ft 49-609424 0-1.5 ft

49-609422 0-1.5 ft

SWMU 49-008(a)

49-609419 0-1.5 ft

49-609420 0-1.5 ft

49-609417 0-1.5 ft

49-609418 0-1.5 ft

49-610486 3-40 ft
RE49-10-7059 3-5 ft ALLH
Tritium 0.408 (J+)
RE49-10-7063 23-25 ft Qbt 4
Tritium 0.279 (J+)
RE49-10-7065 33-35 ft Qbt 4
Tritium 0.309 (J+)
RE49-10-7066 38-40 ft Qbt 4
Tritium 0.345 (J+)

SWMU 49-006

49-05095 5-10 ft
0549-95-0133 5-10 ft Qbt 4
Plutonium-238 0.005

49-610487 1.5-40 ft
RE49-10-7067 23-25 ft Qbt 4
Tritium 0.431 (J+)

49-101

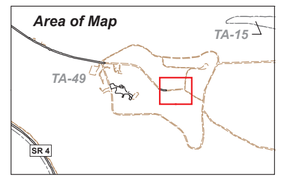
49-05079 0-5 ft
0549-95-0137 3.3-5 ft FILL
Plutonium-238 0.007
Plutonium-239/240 0.009

49-610488 0-15 ft
RE49-10-7078 7.5-10 ft Qbt 4
Tritium 0.223 (J+)

AOC 49-005(b)

49-05078 0-5 ft
0549-95-0135 3.6-5 ft FILL
Cesium-137 0.13
Plutonium-239/240 0.025

7140



This map was created for work processes associated with the *Investigation Report for TA-49 Sites Outside the NES Boundary*. All other uses for this map should be confirmed with the LANL EP-ERSS Division.

0 5 10 20 30 40 50 Feet

contour interval = 10 ft

New Mexico State Plane Coordinates - Central Zone FT, North American Datum 1983, NGVD 1929

- Sampling location
- Borehole
- Prior sampling location
- SWMU 49-008(a)
- Landfill
- LANL structure
- Fence
- Paved road/parking
- Dirt road
- 10 ft contour

Location ID (*2010* - red or underlined [in B&W], *historical* - black or not underlined) ***and Overall sampled interval*** (min–max)

Sample description (sample ID, depth (ft), media)

12-34567 2.5–6 ft
RE12-34-5678 0.0–0.50 SOIL
Copper 5.5
Selenium 0.5 (J)
⋮

Analyte data (analyte, result, optional qualifier code)

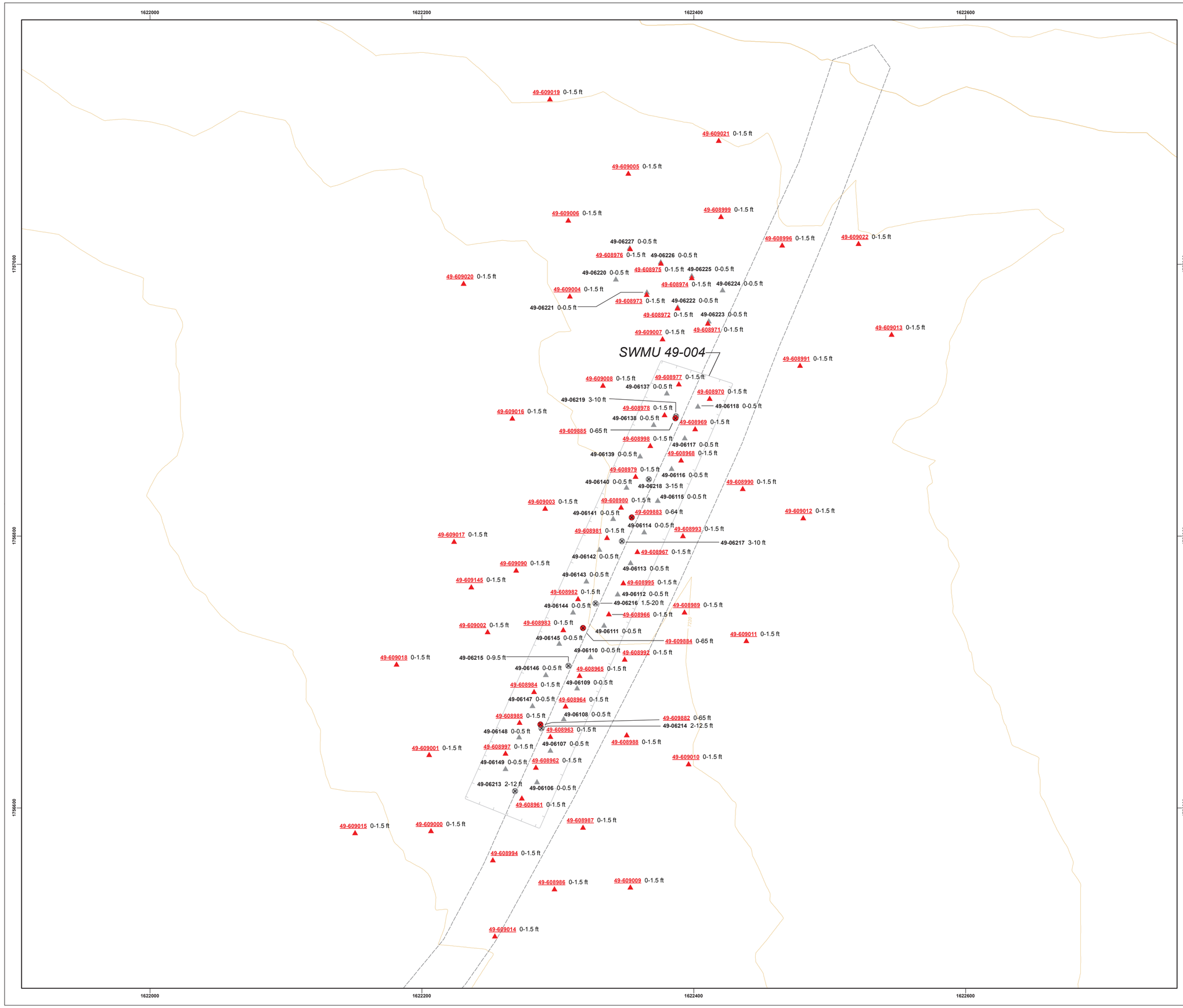
Result Qualifiers:
J = Estimated value
J+= Estimated value biased high
J- = Estimated value biased low

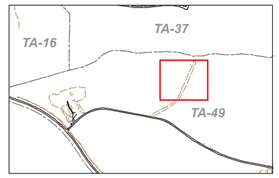
Note: All analytical results reported in milligrams per kilogram (mg/kg) or in picocuries per gram (pCi/g) except as noted.

PLATE 3

Area 5
[AOC 49-005(b) and SWMU 49-006] radionuclides detected above background or fallout values

Map Number: TPMC_030310A
Date: March 3, 2010 Rev: August 25, 2010
DraftedBy: TPMC File Name: TA49_Area5_HITS





This map was created for work processes associated with the *Investigation Report for TA-49 Sites Outside the NES Boundary*. All other uses for this map should be confirmed with the LANL EP-ERSS Division.

0 10 20 40 60 80 100 Feet

contour interval = 10 ft

New Mexico State Plane Coordinates - Central Zone FT, North American Datum 1983, NGVD 1929

- Sample location
- Prior sampling location
- Borehole
- Prior borehole
- Landfill
- LANL structure
- Fence
- Paved road/parking
- Dirt road
- 10 ft contour

Location ID (*2010* - red or underlined [in B&W], *historical* - black or not underlined) *and Overall sampled interval* (min, max)

PLATE 4

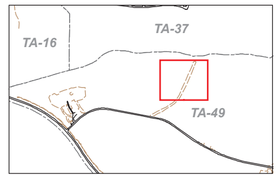
Area 6 West

[SWMU 49-004] locations with 2009/2010 and historical decision-level sample data

Map Number: TPMC_030810A
Date: March 8, 2010 Rev: August 27, 2010
DraftedBy: TPMC File Name: TA49_Area6W_HITS

1622000 1622200 1622400 1622600

1757000 1756800 1756600



This map was created for work processes associated with the *Investigation Report for TA-49 Sites Outside the NES Boundary.* All other uses for this map should be confirmed with the LANL EP-ERSS Division.

N

0 10 20 40 60 80 100 Feet

contour interval = 10 ft

New Mexico State Plane Coordinates - Central Zone FT, North American Datum 1983, NGVD 1929

SWMU 49-004

- Sample location
- Prior sampling location
- Borehole
- Prior borehole
- Landfill
- LANL structure
- Fence
- Paved road/parking
- Dirt road
- 10 ft contour

Location ID (*2010* - red or underlined [in B&W], *historical* - black or not underlined) *and* ***Overall sampled interval*** (min–max)

Sample description (sample ID, depth (ft), media)

Analyte data (analyte, result, optional qualifier code)

Result Qualifiers:
J = Estimated value
J+= Estimated value biased high
J- = Estimated value biased low

Note: All analytical results reported in milligrams per kilogram (mg/kg) or in picocuries per gram (pCi/g) except as noted.

49-609019 0-1.5 ft

49-06227 0-0.5 ft
0549-95-0350 0-0.5 ft ALLH
Uranium 10.7

49-609005 0-1.5 ft

49-06226 0-0.5 ft
0549-95-0349 0-0.5 ft ALLH
Uranium 8.4

49-609006 0-1.5 ft

49-06221 0-0.5 ft
0549-95-0343 0-0.5 ft ALLH
Uranium 6.88

49-608999 0-1.5 ft

49-609021 0-1.5 ft
RE49-10-2354 0.5-1.5 ft ALLH
Selenium 1.9

49-608996 0-1.5 ft

49-609022 0-1.5 ft

49-608976 0-1.5 ft

49-06225 0-0.5 ft

49-06220 0-0.5 ft

49-608975 0-1.5 ft

49-609020 0-1.5 ft

49-608974 0-1.5 ft

49-06224 0-0.5 ft

49-609004 0-1.5 ft

49-06137 0-0.5 ft
0549-95-0329 0-0.5 ft ALLH
Uranium 1.99
Zinc 50.9

49-608973 0-1.5 ft

49-608972 0-1.5 ft

49-06223 0-0.5 ft

49-609007 0-1.5 ft

49-609008 0-1.5 ft
RE49-10-2319 0-0.5 ft ALLH
Cobalt 9.7
Lead 33.8
Manganese 703 (J-)

49-608978 0-1.5 ft
RE49-10-2237 0-0.5 ft ALLH
Silver 11.6
RE49-10-2238 0.5-1.5 ft ALLH
Lead 25.9 (J)

49-609013 0-1.5 ft
RE49-10-2338 0.5-1.5 ft ALLH
Cobalt 9.2

49-608991 0-1.5 ft

49-06222 0-0.5 ft
0549-95-0344 0-0.5 ft ALLH
Copper 17.9
Lead 24.1
Uranium 8.1

49-06138 0-0.5 ft
0549-95-0330 0-0.5 ft ALLH
Manganese 707 (J-)
Uranium 1.86
Zinc 159

49-608977 0-1.5 ft

49-608998 0-1.5 ft
RE49-10-2299 0-0.5 ft ALLH
Copper 14.8
Manganese 819 (J)
Zinc 270
RE49-10-2300 0.5-1.5 ft ALLH
Copper 120
Lead 45.5
Selenium 1.9 (J-)
Silver 1.9
Zinc 446

49-609016 0-1.5 ft
RE49-10-2343 0-0.5 ft ALLH
Cobalt 8.8

49-608979 0-1.5 ft
RE49-10-2239 0-0.5 ft ALLH
Lead 31.4 (J)
Thallium 0.74
Zinc 62.7
RE49-10-2240 0.5-1.5 ft ALLH
Copper 16.8
Nickel 19.6
Zinc 56.5

49-608970 0-1.5 ft

49-608971 0-1.5 ft
RE49-10-2223 0-0.5 ft ALLH
Cobalt 10.2 (J)
Manganese 811

49-608969 0-1.5 ft

49-06118 0-0.5 ft
0549-95-0328 0-0.5 ft ALLH
Zinc 64

49-06141
0549-95-0333 0-0.5 ft ALLH
Zinc 64

49-06139 0-0.5 ft

49-06140 0-0.5 ft

49-608990 0-1.5 ft

49-06219 3-10 ft
0549-95-0121 7.5-10 ft Qbt 4
Aluminum 12400
Barium 143 (J-)
Calcium 2450
Chromium 9.7
Copper 6.4
Lead 14.6
Magnesium 2760
Nickel 8.3 (J)
Uranium 3.6
Vanadium 20.1

49-06115 0-0.5 ft

49-608968 0-1.5 ft
RE49-10-2218 0.5-1.5 ft ALLH
Zinc 74.8

49-609885 0-65 ft
RE49-10-4939 9-14 ft Qbt 4
Aluminum 10200
Barium 154
Chromium 8.84
Copper 7.93
Lead 13
Magnesium 2290
Nickel 7.19 (J)
Vanadium 20

49-609003 0-1.5 ft

49-609012 0-1.5 ft

49-06117 0-0.5 ft
0549-95-0327 0-0.5 ft ALLH
Zinc 96.2

49-06218 3-15 ft
0549-95-0119 12.5-15 ft Qbt 4
Uranium 3.6

49-06116 0-0.5 ft
0549-95-0326 0-0.5 ft ALLH
Mercury 0.11
Uranium 2.12
Zinc 142

49-06142 0-0.5 ft
0549-95-0334 0-0.5 ft ALLH
Uranium 1.92
Zinc 65.1

49-608981 0-1.5 ft
RE49-10-2243 0-0.5 ft ALLH
Copper 14.8
Zinc 73
RE49-10-2244 0.5-1.5 ft ALLH
Copper 15.4
Zinc 73.6

49-06114 0-0.5 ft

49-609017 0-1.5 ft
RE49-10-2346 0.5-1.5 ft ALLH
Cobalt 9.3

49-608982 0-1.5 ft
RE49-10-2245 0-0.5 ft ALLH
Zinc 87.9
RE49-10-2246 0.5-1.5 ft ALLH
Zinc 77

49-06144 0-0.5 ft
0549-95-0336 0-0.5 ft ALLH
Uranium 2.43
Zinc 812

49-609090 0-1.5 ft

49-06113 0-0.5 ft

49-608980 0-1.5 ft
RE49-10-2241 0-0.5 ft ALLH
Copper 15.6
Zinc 96

49-06143 0-0.5 ft

49-609145 0-1.5 ft

49-608983 0-1.5 ft
RE49-10-2247 0-0.5 ft ALLH
Copper 29.6
Lead 23
Zinc 170
RE49-10-2248 0.5-1.5 ft ALLH
Zinc 90.9

49-06112 0-0.5 ft

49-608993 0-1.5 ft

49-609883 0-64 ft
RE49-10-4935 0-0.5 ft Qbt 4
Aluminum 11600
Barium 135
Calcium 2490 (J-)
Chromium 9.45
Copper 22.8
Lead 16.6
Magnesium 2100
Nickel 8.55
Perchlorate 0.0012 (J)
Vanadium 22.1
Zinc 80.3
RE49-10-4940 9-14 ft Qbt 4
Aluminum 9070
Barium 108
Calcium 3670 (J-)
Chromium 10.4
Copper 339
Iron 16400
Lead 64.5
Magnesium 1760
Nickel 6.68 (J)
Perchlorate 0.00802
Vanadium 19
Zinc 216
RE49-10-4937 62-64 ft Qbt 4
Perchlorate 0.00161 (J)

49-06145 0-0.5 ft
0549-95-0337 0-0.5 ft ALLH
Copper 15.3
Uranium 2.29
Zinc 49.8

49-609002 0-1.5 ft

49-06111 0-0.5 ft

49-609011 0-1.5 ft

49-608995 0-1.5 ft
RE49-10-2293 0-0.5 ft ALLH
Copper 18.6
Zinc 75.8

49-608989 0-1.5 ft
RE49-10-2282 0.5-1.5 ft ALLH
Cobalt 8.7

49-06217 3-10 ft
0549-95-0113 3-5 ft ALLH
Uranium 3.6
Zinc 70.6

49-608967 0-1.5 ft
RE49-10-2215 0-0.5 ft ALLH
Zinc 67.7
RE49-10-2216 0.5-1.5 ft ALLH
Aluminum 35100
Barium 403 (J)
Beryllium 2

49-608984 0-1.5 ft
RE49-10-2249 0-0.5 ft ALLH
Copper 19.7
RE49-10-2250 0.5-1.5 ft ALLH
Zinc 70.1

49-06147 0-0.5 ft
0549-95-0339 0-0.5 ft ALLH
Uranium 2.58

49-06110 0-0.5 ft

49-06216 1.5-20 ft
0549-95-0111 18.1-20 ft FILL
Copper 112

49-609018 0-1.5 ft

49-06146 0-0.5 ft

49-608992 0-1.5 ft

49-608966 0-1.5 ft
RE49-10-2213 0-0.5 ft ALLH
Thallium 0.77

49-06148 0-0.5 ft
0549-95-0340 0-0.5 ft ALLH
Uranium 2.57

49-608965 0-1.5 ft

49-06109 0-0.5 ft

49-609884 0-65 ft
RE49-10-4936 0-1 ft FILL
Perchlorate 0.00139 (J)
RE49-10-4932 7.5-10 ft Qbt 4
Aluminum 10200
Barium 151
Calcium 2800 (J-)
Chromium 8.49
Copper 25.6
Lead 43.4
Magnesium 1860
Nickel 7.33 (J)
Perchlorate 0.00303

49-608961 0-1.5 ft
RE49-10-2204 0.5-1.5 ft ALLH
Barium 303 (J)
Cobalt 14.9
Manganese 1030 (J-)

49-608985 0-1.5 ft

49-06108 0-0.5 ft

49-06215 0-9.5 ft
0549-95-0107 0-5 ft FILL
Copper 16.2
Silver 1.7 (J)
Uranium 4

49-608988 0-1.5 ft

49-609001 0-1.5 ft

49-608997 0-1.5 ft

49-608963 0-1.5 ft

49-609010 0-1.5 ft

49-608964 0-1.5 ft
RE49-10-2210 0.5-1.5 ft ALLH
Barium 307 (J)

49-06149 0-0.5 ft

49-06214 2-12.5 ft
0549-95-0104 2-5 ft FILL
Uranium 3.5
0549-95-0105 5-9.5 ft FILL
Cobalt 13.4
Manganese 878 (J)
Uranium 3.3

49-609882 0-65 ft
RE49-10-4934 9-19 ft Qbt 4
Barium 98.9
Calcium 10800 (J-)
Magnesium 1950
Nickel 7.01 (J)
Perchlorate 0.00263
RE49-10-4941 63-65 ft Qbt 4
Lead 14.3

49-609015 0-1.5 ft

49-609000 0-1.5 ft

49-608987 0-1.5 ft

49-06107 0-0.5 ft
0549-95-0316 0-0.5 ft ALLH
Uranium 1.85

49-608962 0-1.5 ft
RE49-10-2205 0-0.5 ft ALLH
Beryllium 2

49-608994 0-1.5 ft

49-608986 0-1.5 ft

49-609009 0-1.5 ft

49-06106 0-0.5 ft
0549-95-0315 0-0.5 ft ALLH
Uranium 2.84

49-06213 2-12 ft
0549-95-0102 5-10 ft ALLH
Cobalt 9.1 (J)
Uranium 3.4
0549-95-0103 10-12 ft Qbt 4
Uranium 3.3

49-609014 0-1.5 ft

PLATE 5

Area 6 West

[SWMU 49-004] inorganic chemical concentrations detected above background values

Map Number: TPMC_030810A
Date: March 8, 2010 Rev: August 27, 2010
DraftedBy: TPMC File Name: TA49_Area6W_HITS

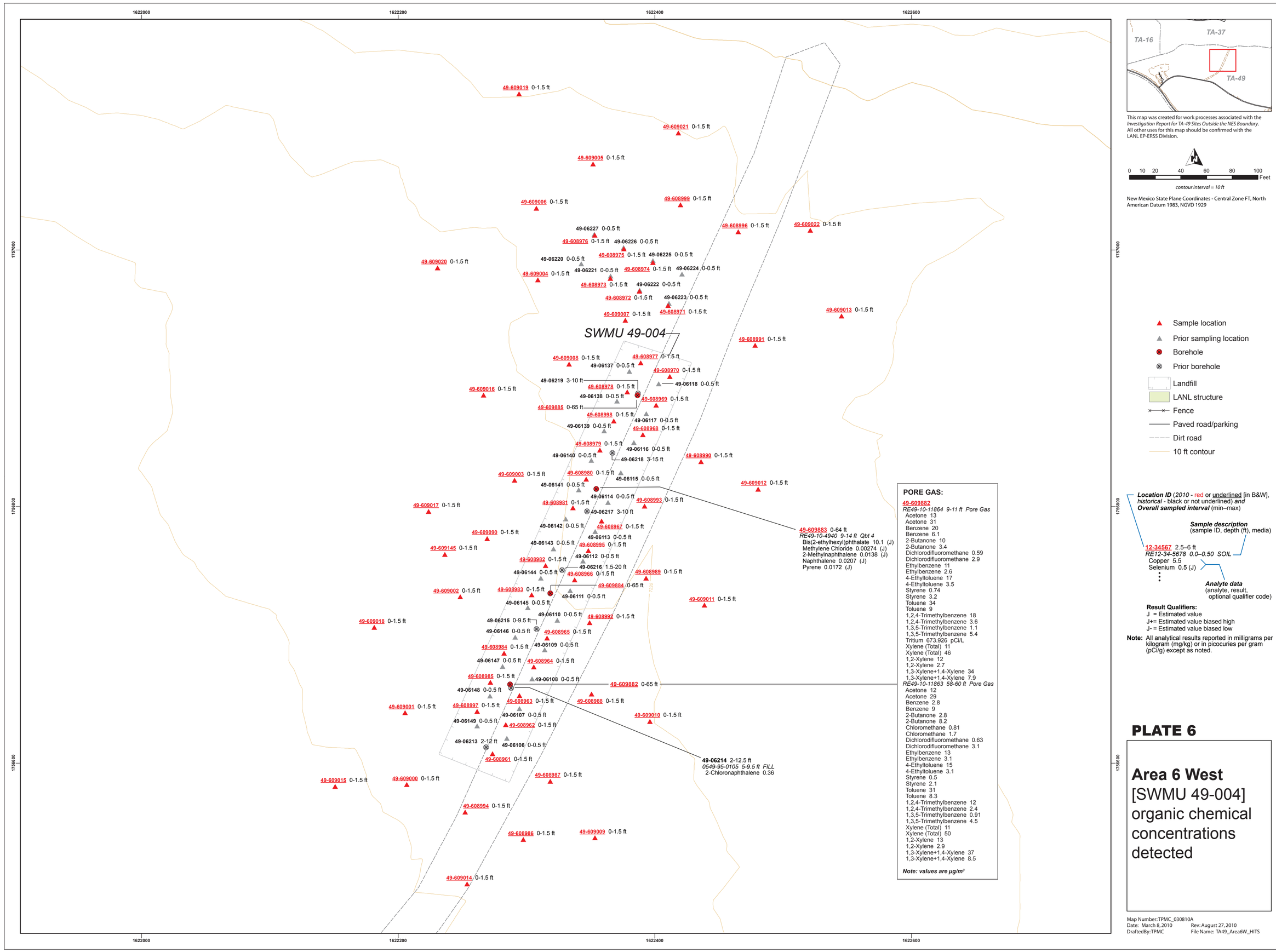


PLATE 6

Area 6 West [SWMU 49-004] organic chemical concentrations detected

Map Number:TPMC_030810A
Date: March 8,2010 Rev: August 27,2010
DraftedBy:TPMC File Name: TA49_Area6W_HITS

1622000 1622200 1622400 1622600

1757000 1756800 1756600

49-609019 0-1.5 ft

49-609021 0-1.5 ft

49-609005 0-1.5 ft

49-608999 0-1.5 ft

49-609006 0-1.5 ft

49-608996 0-1.5 ft

49-609022 0-1.5 ft

49-608976 0-1.5 ft

49-608975 0-1.5 ft

49-609020 0-1.5 ft

49-06220 0-0.5 ft

49-608974 0-1.5 ft

49-609004 0-1.5 ft

49-608973 0-1.5 ft

49-06224 0-0.5 ft

49-608971 0-1.5 ft

49-609007 0-1.5 ft

SWMU 49-004

49-608991 0-1.5 ft

49-608977 0-1.5 ft

49-06219 3-10 ft

49-608970 0-1.5 ft

49-609016 0-1.5 ft

49-06138 0-0.5 ft

49-608969 0-1.5 ft

49-609885 0-65 ft

49-608998 0-1.5 ft

49-06117 0-0.5 ft

49-06139 0-0.5 ft

49-608968 0-1.5 ft

49-608979 0-1.5 ft

49-06116 0-0.5 ft

49-06140 0-0.5 ft

49-608990 0-1.5 ft

49-06115 0-0.5 ft

49-609003 0-1.5 ft

49-06141 0-0.5 ft

49-609012 0-1.5 ft

49-608981 0-1.5 ft

49-06114 0-0.5 ft

49-609017 0-1.5 ft

49-608993 0-1.5 ft

49-06142 0-0.5 ft

49-608967 0-1.5 ft

49-609090 0-1.5 ft

49-06143 0-0.5 ft

49-608995 0-1.5 ft

49-609145 0-1.5 ft

49-608982 0-1.5 ft

49-06112 0-0.5 ft

49-06144 0-0.5 ft

49-608989 0-1.5 ft

49-609002 0-1.5 ft

49-608983 0-1.5 ft

49-608966 0-1.5 ft

49-06111 0-0.5 ft

49-609011 0-1.5 ft

49-06145 0-0.5 ft

49-06110 0-0.5 ft

49-609018 0-1.5 ft

49-06146 0-0.5 ft

49-608992 0-1.5 ft

49-608965 0-1.5 ft

49-608984 0-1.5 ft

49-06109 0-0.5 ft

49-608964 0-1.5 ft

49-06147 0-0.5 ft

49-608988 0-1.5 ft

49-608997 0-1.5 ft

49-608963 0-1.5 ft

49-609010 0-1.5 ft

49-608962 0-1.5 ft

49-06149 0-0.5 ft

49-608961 0-1.5 ft

49-609015 0-1.5 ft

49-609000 0-1.5 ft

49-608987 0-1.5 ft

49-608994 0-1.5 ft

49-608986 0-1.5 ft

49-609009 0-1.5 ft

49-609014 0-1.5 ft
RE49-10-2339 0-0.5 ft ALLH
Plutonium-239/240 0.107
RE49-10-2340 0.5-1.5 ft ALLH
Plutonium-239/240 0.06

49-06227 0-0.5 ft
0549-95-0350 0-0.5 ft ALLH
Cesium-137 2.24
Plutonium-239/240 0.074

49-06221 0-0.5 ft
0549-95-0343 0-0.5 ft ALLH
Cesium-137 2.02
Plutonium-239/240 0.07

49-609008 0-1.5 ft
RE49-10-2319 0-0.5 ft ALLH
Plutonium-239/240 0.133
RE49-10-2320 0.5-1.5 ft ALLH
Cesium-137 0.19

49-608978 0-1.5 ft
RE49-10-2238 0.5-1.5 ft ALLH
Plutonium-239/240 0.0306

49-608980 0-1.5 ft
RE49-10-2242 0.5-1.5 ft ALLH
Plutonium-239/240 0.035

49-608985 0-1.5 ft
RE49-10-2251 0-0.5 ft ALLH
Americium-241 0.07 (J)
Plutonium-239/240 0.18 (J)
RE49-10-2252 0.5-1.5 ft ALLH
Americium-241 0.161 (J)
Plutonium-239/240 0.998

49-06148 0-0.5 ft
0549-95-0340 0-0.5 ft ALLH
Europium-152 0.259

49-609001 0-1.5 ft
RE49-10-2305 0-0.5 ft ALLH
Cesium-134 0.073

49-06226 0-0.5 ft
0549-95-0349 0-0.5 ft ALLH
Plutonium-239/240 0.066

49-06225 0-0.5 ft
0549-95-0348 0-0.5 ft ALLH
Cesium-137 1.69

49-609013 0-1.5 ft
RE49-10-2337 0-0.5 ft ALLH
Plutonium-239/240 0.083

49-608972 0-1.5 ft
RE49-10-2225 0-0.5 ft ALLH
Plutonium-239/240 0.061

49-06222 0-0.5 ft
0549-95-0344 0-0.5 ft ALLH
Cesium-137 3.28
Plutonium-239/240 0.072

49-06223 0-0.5 ft
0549-95-0346 0-0.5 ft ALLH
Americium-241 0.204

49-06137 0-0.5 ft
0549-95-0329 0-0.5 ft ALLH
Plutonium-238 0.025

49-06118 0-0.5 ft
0549-95-0328 0-0.5 ft ALLH
Plutonium-239/240 0.095

49-06218 3-15 ft
0549-95-0119 12.5-15 ft Qbt 4
Plutonium-239/240 0.036

49-609883 0-64 ft
RE49-10-4940 9-14 ft Qbt 4
Americium-241 0.0995
Plutonium-239/240 0.435
Tritium 0.0254444

49-06217 3-10 ft
0549-95-0113 3-5 ft ALLH
Plutonium-239/240 0.085

49-06113 0-0.5 ft
0549-95-0323 0-0.5 ft ALLH
Europium-152 0.209

49-06216 1.5-20 ft
0549-95-0111 18.1-20 ft FILL
Plutonium-238 0.007
Plutonium-239/240 0.007

49-609884 0-65 ft
RE49-10-4932 7.5-10 ft Qbt 4
Tritium 0.0313933

49-06215 0-9.5 ft
0549-95-0107 0-5 ft FILL
Plutonium-239/240 0.039

49-06108 0-0.5 ft
0549-95-0317 0-0.5 ft ALLH
Americium-241 0.263

49-609882 0-65 ft
RE49-10-4930 0-0.5 ft ALLH
Plutonium-239/240 0.0618

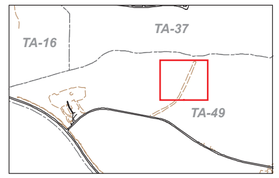
49-06214 2-12.5 ft
0549-95-0104 2-5 ft FILL
Americium-241 0.43
Plutonium-239/240 0.419
0549-95-0105 5-9.5 ft FILL
Plutonium-239/240 0.029

49-06107 0-0.5 ft
0549-95-0316 0-0.5 ft ALLH
Plutonium-239/240 0.056

49-06106 0-0.5 ft
0549-95-0315 0-0.5 ft ALLH
Americium-241 0.155
Plutonium-239/240 0.134

49-06213 2-12 ft
0549-95-0102 5-10 ft ALLH
Plutonium-239/240 0.05
0549-95-0103 10-12 ft Qbt 4
Plutonium-239/240 0.073

PORE GAS:
49-609882
RE49-10-11864 9-11 ft Pore Gas
Tritium 673.93
Note: value is pCi/l



This map was created for work processes associated with the *Investigation Report for TA-49 Sites Outside the NES Boundary.* All other uses for this map should be confirmed with the LANL EP-ERSS Division.

0 10 20 40 60 80 100 Feet

contour interval = 10 ft

New Mexico State Plane Coordinates - Central Zone FT, North American Datum 1983, NGVD 1929

- Sample location
- Prior sampling location
- Borehole
- Prior borehole
- Landfill
- LANL structure
- Fence
- Paved road/parking
- Dirt road
- 10 ft contour

Location ID (*2010* - red or underlined [in B&W], *historical* - black or not underlined) *and* ***Overall sampled interval*** (min–max)

Sample description (sample ID, depth (ft), media)

12-34567 2.5–6 ft
RE12-34-5678 0.0–0.50 SOIL
Copper 5.5
Selenium 0.5 (J)
⋮

Analyte data (analyte, result, optional qualifier code)

Result Qualifiers:
J = Estimated value
J+= Estimated value biased high
J- = Estimated value biased low

Note: All analytical results reported in milligrams per kilogram (mg/kg) or in picocuries per gram (pCi/g) except as noted.

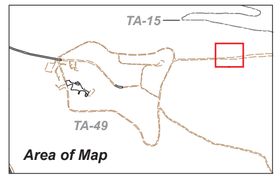
PLATE 7

Area 6 West [SWMU 49-004] radionuclides detected above background or fallout values

Map Number: TPMC_030810A
Date: March 8, 2010 Rev: August 27, 2010
Drafted By: TPMC File Name: TA49_Area6W_HITS

1626800 1627000

1755400 1755200



This map was created for work processes associated with the *Investigation Report for TA-49 Sites Outside the NES Boundary*. All other uses for this map should be confirmed with the LANL EP-ERSS Division.

0 5 10 20 30 40 50 Feet

contour interval = 10 ft

New Mexico State Plane Coordinates - Central Zone FT, North American Datum 1983, NGVD 1929

49-609561 0-1.5 ft
49-609562 0-1.5 ft
49-609564 0-1.5 ft
49-609548 0-1.5 ft
49-609549 0-1.5 ft
49-609565 0-1.5 ft
49-609550 0-1.5 ft
49-609551 0-1.5 ft
49-609578 0-1.5 ft
49-609552 0-1.5 ft
49-609988 0-10 ft
SWMU 49-005(a)
49-609987 0-10 ft
49-609540 0-1.5 ft
49-609541 0-1.5 ft
49-609986 0-10 ft
49-07512 0-9 ft
49-07527 0-10 ft
49-609989 0-10 ft
49-609566 0-1.5 ft
49-609542 0-1.5 ft
49-609543 0-1.5 ft
49-609544 0-1.5 ft
49-609545 0-1.5 ft
49-609553 0-1.5 ft
49-609554 0-1.5 ft
49-07560 0-0.5 ft
49-07545 0-0.5 ft
49-07542 0-0.5 ft
49-07539 0-0.5 ft
49-07536 0-0.5 ft
49-07551 0.-0.5 ft
49-07548 0-0.5 ft
AOC 49-002
49-609555 0-1.5 ft
49-609600 0-1.5 ft
49-609546 0-1.5 ft
49-609556 0-1.5 ft
49-609547 0-1.5 ft
49-609557 0-1.5 ft
49-609567 0-1.5 ft
49-07550 0-0.5 ft
49-07549 0-0.5 ft
49-07544 0-0.5 ft
49-07543 0-0.5 ft
49-07538 0-0.5 ft
49-07537 0-0.5 ft
49-609568 0-1.5 ft
49-609558 0-1.5 ft
49-609559 0-1.5 ft
49-609560 0-1.5 ft
49-609569 0-1.5 ft
49-609570 0-1.5 ft
49-609563 0-1.5 ft

- Sampling location
- Prior sampling location
- Borehole
- Prior borehole
- Landfill
- LANL structure
- Former structure (*concrete slabs and small shafts/borings*)
- Fence
- Paved road/parking
- Dirt road
- 10 ft contour

Location ID (*2010* - red or underlined [in B&W], *historical* - black or not underlined) *and* ***Overall sampled interval*** (min–max)

Detail of former structures at Area 10

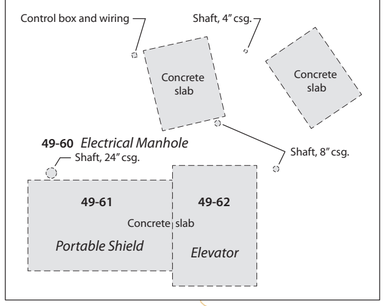


PLATE 8

Area 10
[AOC 49-002 and SWMU 49-005(a)] locations with 2009/2010 and historical decision-level sample data

Map Number:TPMC_030810B
Date: March 8, 2010 Rev: September 1, 2010
DraftedBy:TPMC File Name: TA49_Area10_HITS

1626800 1627000

1755400 1755200

49-609987 0-10 ft
RE49-10-5404 0-0.5 ft ALLH
Nitrate 0.13 (J)
RE49-10-5406 3-5 ft Qbt 4
Aluminum 10000
Arsenic 3.2
Barium 165 (J+)
Calcium 2570
Chromium 8.5
Cobalt 6.4 (J)
Copper 6.9
Lead 11.3
Magnesium 1780
Nickel 9
Nitrate 0.35
Selenium 0.97
Vanadium 18.8
RE49-10-5413 5-6.5 ft Qbt 4
Aluminum 7720
Barium 87.2 (J+)
Cobalt 3.2 (J)
Copper 6.7
Magnesium 1910
Nickel 7.6
Nitrate 0.14 (J)
Selenium 1.2
RE49-10-5411 6.5-8 ft Qbt 4
Barium 80.6 (J+)
Chromium 7.9
Copper 5.7
Magnesium 1920
Nickel 7.8
Nitrate 0.12 (J)
Selenium 1.3
RE49-10-5405 8-10 ft Qbt 4
Barium 78.9 (J+)
Nitrate 0.19 (J)
Perchlorate 0.0037 (J)
Selenium 1.3

49-609988 0-10 ft
RE49-10-5409 0-2 ft ALLH
Nitrate 1.7
RE49-10-5407 4-5 ft Qbt 4
Aluminum 8860
Arsenic 2.9
Barium 118 (J+)
Chromium 9.6
Cobalt 4.9 (J)
Copper 8.5
Magnesium 2090
Nickel 8.2
Nitrate 0.18 (J)
Selenium 1
Vanadium 22.6
RE49-10-5408 8-10 ft Qbt 4
Nitrate 0.17 (J)
Selenium 1.3

49-609561 0-1.5 ft

49-07527 0-0.5 ft
0549-95-0143 0-0.5 ft ALLH
Uranium 2.3
0549-95-0142 7.3-10 ft Qbt 4
Aluminum 21900
Arsenic 3.4
Barium 112
Beryllium 1.9
Calcium 3320
Chromium 11.4
Copper 8.2
Magnesium 3720
Nickel 12.1
Potassium 4090
Uranium 4.09

49-609562 0-1.5 ft
49-609564 0-1.5 ft
49-609548 0-1.5 ft
RE49-10-4024 0.5-1.5 ft ALLH
Cobalt 10.3
Manganese 899 (J-)
49-609549 0-1.5 ft
49-609565 0-1.5 ft
49-609550 0-1.5 ft
49-609551 0-1.5 ft
49-609578 0-1.5 ft
49-609552 0-1.5 ft

SWMU 49-005(a)

49-609541 0-1.5 ft

49-609986 0-10 ft
RE49-10-5403 0-1 ft ALLH
Nitrate 0.9
RE49-10-5401 4-5 ft Qbt 4
Aluminum 8590
Arsenic 3.1
Barium 161 (J+)
Calcium 2330
Chromium 18.4
Cobalt 6.1 (J)
Copper 7.9
Lead 12.3
Magnesium 2050
Nickel 8.5
Nitrate 0.095 (J)
Selenium 0.91
Vanadium 22
RE49-10-5402 9-10 ft Qbt 4
Nitrate 0.16 (J)
Selenium 1.1

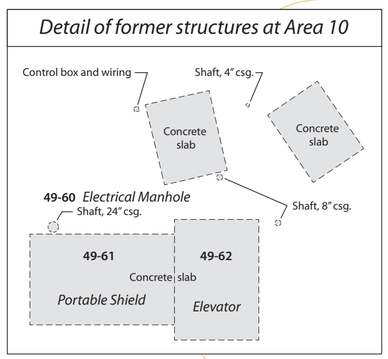
49-07560 0-0.5 ft
0549-95-0264 0-0.5 ft ALLH
Uranium 3.4
49-07542 0-0.5 ft
0549-95-0256 0-0.5 ft ALLH
Antimony 13.9
Uranium 3.5
49-609542 0-1.5 ft
RE49-10-4007 0-0.5 ft ALLH
Zinc 85.4
49-609543 0-1.5 ft
RE49-10-4010 0.5-1.5 ft ALLH
Cadmium 1.49
Zinc 296
49-609566 0-1.5 ft
49-07551 0.-0.5 ft
49-07545 0-0.5 ft
49-609553 0-1.5 ft
RE49-10-4034 0.5-1.5 ft ALLH
Calcium 6270
49-609554 0-1.5 ft
RE49-10-4036 0.5-1.5 ft ALLH
Calcium 10000
49-07548 0-0.5 ft
0549-95-0260 0-0.5 ft ALLH
Copper 98.9
Uranium 4.2
Zinc 69.9

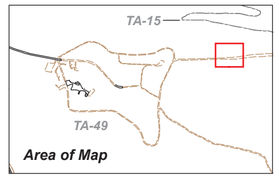
AOC 49-002

49-609547 0-1.5 ft
RE49-10-4017 0-0.5 ft ALLH
Zinc 73.5
49-07537 0-0.5 ft
0549-95-0253 0-0.5 ft ALLH
Uranium 3.2
49-609555 0-1.5 ft
49-609600 0-1.5 ft
49-609546 0-1.5 ft
49-609556 0-1.5 ft
49-609557 0-1.5 ft
49-609567 0-1.5 ft
49-07550 0-0.5 ft
49-07549 0-0.5 ft
49-07544 0-0.5 ft
0549-95-0258 0-0.5 ft ALLH
Uranium 3.2
49-07543 0-0.5 ft
49-07538 0-0.5 ft
49-07512 0-9 ft
0549-95-0141 0-0.5 ft ALLH
Uranium 2.51
0549-95-0140 4-9 ft Qbt 4
Aluminum 12000
Barium 85.6
Calcium 2340
Chromium 8.4
Copper 6.7
Magnesium 2530
Nickel 9
49-609989 0-10 ft
RE49-10-5414 0-0.5 ft ALLH
Nitrate 1.8
RE49-10-5410 3-4 ft ALLH
Nitrate 0.9
RE49-10-5412 9-10 ft Qbt 4
Nitrate 0.17 (J)
Selenium 1.1

49-07539 0-0.5 ft
0549-95-0255 0-0.5 ft ALLH
Copper 20.5
Lead 26.7 (J-)
Mercury 0.11
Uranium 3.9
Zinc 78.8
49-609568 0-1.5 ft
49-609558 0-1.5 ft
RE49-10-4043 0-0.5 ft ALLH
Lead 24.4
Zinc 61.9
49-609559 0-1.5 ft
49-609544 0-1.5 ft
RE49-10-4011 0-0.5 ft ALLH
Cadmium 0.446 (J)
Copper 23.2
Lead 27.2
Zinc 112
RE49-10-4012 0.5-1.5 ft ALLH
Zinc 446
49-609560 0-1.5 ft
RE49-10-4048 0.5-1.5 ft Qbt 4
Aluminum 10100
Barium 121
Chromium 8.35
Cobalt 3.99
Copper 5.18
Nickel 7.39
Vanadium 18
49-609569 0-1.5 ft
49-609570 0-1.5 ft
49-609563 0-1.5 ft
49-07536 0-0.5 ft
0549-95-0252 0-0.5 ft ALLH
Cadmium 0.73 (J)
Lead 48 (J-)
Mercury 0.72
Uranium 3.2
Zinc 98.7
49-609545 0-1.5 ft
RE49-10-4013 0-0.5 ft ALLH
Cadmium 0.576 (J)
Lead 40.7
Mercury 0.348
Zinc 94.7
RE49-10-4014 0.5-1.5 ft ALLH
Calcium 6730

Detail of former structures at Area 10





This map was created for work processes associated with the *Investigation Report for TA-49 Sites Outside the NES Boundary*. All other uses for this map should be confirmed with the LANL EP-ERSS Division.

0 5 10 20 30 40 50 Feet

contour interval = 10 ft

New Mexico State Plane Coordinates - Central Zone FT, North American Datum 1983, NGVD 1929

- Sampling location
- Prior sampling location
- Borehole
- Prior borehole
- Landfill
- LANL structure
- Former structure (*concrete slabs and small shafts/borings*)
- Fence
- Paved road/parking
- Dirt road
- 10 ft contour

Location ID (*2010* - red or underlined [in B&W], *historical* - black or not underlined) *and* ***Overall sampled interval*** (min–max)

Sample description (sample ID, depth (ft), media)

12-34567 2.5–6 ft
RE12-34-5678 0.0–0.50 SOIL
Copper 5.5
Selenium 0.5 (J)
⋮

Analyte data (analyte, result, optional qualifier code)

Result Qualifiers:
J = Estimated value
J+= Estimated value biased high
J- = Estimated value biased low

Note: All analytical results reported in milligrams per kilogram (mg/kg) or in picocuries per gram (pCi/g) except as noted.

PLATE 9

Area 10
[AOC 49-002 and SWMU 49-005(a)] inorganic chemical concentrations detected above background values

Map Number: TPMC_030810B
Date: March 8, 2010 Rev: September 1, 2010
DraftedBy: TPMC File Name: TA49_Area10_HITS

1626800 1627000

1755400 1755200

PORE GAS:

49-609987
RE49-10-11860 4-6.5 ft Pore Gas
Acetone 20
Acetone 8.4
Benzene 12
Benzene 3.9
2-Butanone 2.5
2-Butanone 7.4
Chloromethane 0.8
Chloromethane 1.7
Dichlorodifluoromethane 0.64
Dichlorodifluoromethane 3.2
Ethylbenzene 1.5
Ethylbenzene 6.4
4-Ethyltoluene 1.8
4-Ethyltoluene 9
Styrene 0.52
Styrene 2.2
Toluene 18
Toluene 4.7
1,2,4-Trimethylbenzene 10
1,2,4-Trimethylbenzene 2.1
1,3,5-Trimethylbenzene 0.63
1,3,5-Trimethylbenzene 3.1
Tritium 508.993 pCi/L
Xylene (Total) 25
Xylene (Total) 5.7
1,2-Xylene 1.5
1,2-Xylene 6.5
1,3-Xylene+1,4-Xylene 18
1,3-Xylene+1,4-Xylene 4.2

Note: values are µg/m3

49-609561 0-1.5 ft
49-609562 0-1.5 ft
49-609564 0-1.5 ft
49-609548 0-1.5 ft
49-609549 0-1.5 ft
49-609565 0-1.5 ft
49-609987 0-10 ft
49-609550 0-1.5 ft
49-609551 0-1.5 ft
49-609578 0-1.5 ft
49-609552 0-1.5 ft
49-609988 0-10 ft
RE49-10-5408 8-10 ft Qbt 4
Bis(2-ethylhexyl)phthalate 0.046 (J)

SWMU 49-005(a)

49-609540 0-1.5 ft
49-609541 0-1.5 ft
49-609986 0-10 ft
49-07512 0-9 ft
49-07527 0-10 ft

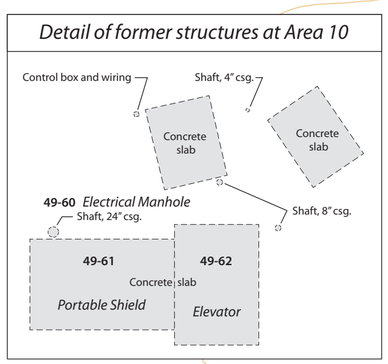
49-07560 0-0.5 ft
49-609544 0-1.5 ft
49-609566 0-1.5 ft
49-609542 0-1.5 ft
49-609543 0-1.5 ft
49-609545 0-1.5 ft
49-609553 0-1.5 ft
49-609554 0-1.5 ft
49-07545 0-0.5 ft
49-07542 0-0.5 ft
49-07539 0-0.5 ft
49-07536 0-0.5 ft
49-07551 0.-0.5 ft
49-07548 0-0.5 ft
49-609989 0-10 ft
RE49-10-5414 0-0.5 ft ALLH
Bis(2-ethylhexyl)phthalate 0.16 (J)
2-Butanone 0.0018 (J)

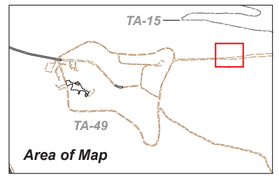
AOC 49-002

49-609555 0-1.5 ft
49-609600 0-1.5 ft
49-609546 0-1.5 ft
49-609556 0-1.5 ft
49-609547 0-1.5 ft
49-609557 0-1.5 ft
49-609567 0-1.5 ft
49-07550 0-0.5 ft
49-07549 0-0.5 ft
49-07544 0-0.5 ft
49-07543 0-0.5 ft
49-07538 0-0.5 ft
49-07537 0-0.5 ft

49-609568 0-1.5 ft
49-609558 0-1.5 ft
49-609559 0-1.5 ft
49-609560 0-1.5 ft
49-609569 0-1.5 ft
49-609570 0-1.5 ft
49-609563 0-1.5 ft

Detail of former structures at Area 10





This map was created for work processes associated with the *Investigation Report for TA-49 Sites Outside the NES Boundary*. All other uses for this map should be confirmed with the LANL EP-ERSS Division.

0 5 10 20 30 40 50 Feet

contour interval = 10 ft

New Mexico State Plane Coordinates - Central Zone FT, North American Datum 1983, NGVD 1929

- Sampling location
- Prior sampling location
- Borehole
- Prior borehole
- Landfill
- LANL structure
- Former structure (*concrete slabs and small shafts/borings*)
- Fence
- Paved road/parking
- Dirt road
- 10 ft contour

Location ID (*2010* - red or underlined [in B&W], *historical* - black or not underlined) *and* ***Overall sampled interval*** (min–max)

Sample description (sample ID, depth (ft), media)

12-34567 2.5–6 ft
RE12-34-5678 0.0–0.50 SOIL
Copper 5.5
Selenium 0.5 (J)
⋮

Analyte data (analyte, result, optional qualifier code)

Result Qualifiers:
J = Estimated value
J+= Estimated value biased high
J- = Estimated value biased low

Note: All analytical results reported in milligrams per kilogram (mg/kg) or in picocuries per gram (pCi/g) except as noted.

PLATE 10

Area 10
[AOC 49-002 and SWMU 49-005(a)] organic chemical concentrations detected

Map Number: TPMC_030810B
Date: March 8, 2010 Rev: September 1, 2010
DraftedBy: TPMC File Name: TA49_Area10_HITS

1626800 1627000

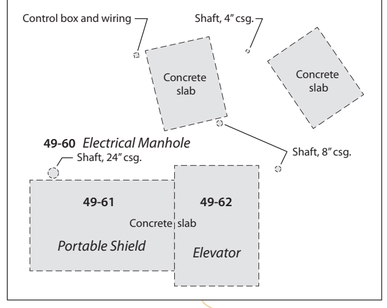
1755400 1755200

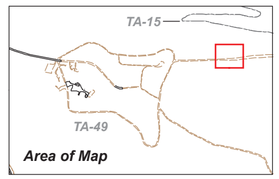
PORE GAS:
49-609987
RE49-10-11860 4-6.5 ft Pore Gas
Tritium 508.99
Note: value is pCi/l

49-609561 0-1.5 ft
RE49-10-4056 0.5-1.5 ft ALLH
Cesium-137 0.076

49-609562 0-1.5 ft
49-609564 0-1.5 ft
49-609548 0-1.5 ft
49-609549 0-1.5 ft
49-609565 0-1.5 ft
49-609550 0-1.5 ft
49-609551 0-1.5 ft
RE49-10-4030 0.5-1.5 ft ALLH
Cesium-137 0.116
49-609578 0-1.5 ft
49-609552 0-1.5 ft
RE49-10-4032 0.5-1.5 ft ALLH
Americium-241 0.184
Cesium-137 0.122
49-609987 0-10 ft
49-609988 0-10 ft
SWMU 49-005(a)
49-609544 0-1.5 ft
RE49-10-4012 0.5-1.5 ft ALLH
Cesium-137 0.211
49-609540 0-1.5 ft
49-609541 0-1.5 ft
49-609986 0-10 ft
49-609600 0-1.5 ft
RE49-10-4138 0.5-1.5 ft ALLH
Cesium-137 0.146
49-609546 0-1.5 ft
RE49-10-4016 0.5-1.5 ft ALLH
Cesium-137 0.114
49-07512 0-9 ft
0549-95-0141 0-0.5 ft ALLH
Plutonium-238 0.032
Plutonium-239/240 0.083
49-609542 0-1.5 ft
49-609566 0-1.5 ft
RE49-10-4066 0.5-1.5 ft ALLH
Cesium-137 0.167
49-07560 0-0.5 ft
49-609543 0-1.5 ft
49-609545 0-1.5 ft
49-609553 0-1.5 ft
49-609989 0-10 ft
49-07527
0549-95-0142 7.3-10 ft Qbt 4
Plutonium-238 0.007
49-609554 0-1.5 ft
49-07551 0.-0.5 ft
49-07548 0-0.5 ft
49-07545 0-0.5 ft
49-07542 0-0.5 ft
49-07539 0-0.5 ft
49-07536 0-0.5 ft
AOC 49-002
49-609547 0-1.5 ft
RE49-10-4018 0.5-1.5 ft ALLH
Cesium-137 0.126
49-609555 0-1.5 ft
RE49-10-4038 0.5-1.5 ft ALLH
Cesium-137 0.23
49-07550 0-0.5 ft
49-07549 0-0.5 ft
49-07544 0-0.5 ft
49-07543 0-0.5 ft
49-07538 0-0.5 ft
49-07537 0-0.5 ft
49-609557 0-1.5 ft
49-609567 0-1.5 ft
49-609556 0-1.5 ft
RE49-10-4040 0.5-1.5 ft ALLH
Cesium-137 0.0772
49-609558 0-1.5 ft
49-609568 0-1.5 ft
RE49-10-4070 0.5-1.5 ft ALLH
Cesium-137 0.115
49-609559 0-1.5 ft
RE49-10-4046 0.5-1.5 ft ALLH
Plutonium-239/240 0.116
49-609560 0-1.5 ft
49-609569 0-1.5 ft
49-609570 0-1.5 ft
49-609563 0-1.5 ft

Detail of former structures at Area 10





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0 5 10 20 30 40 50 Feet

contour interval = 10 ft

New Mexico State Plane Coordinates - Central Zone FT, North American Datum 1983, NGVD 1929

- Sampling location
- Prior sampling location
- Borehole
- Prior borehole
- Landfill
- LANL structure
- Former structure (*concrete slabs and small shafts/borings*)
- Fence
- Paved road/parking
- Dirt road
- 10 ft contour

Location ID (*2010* - red or underlined [in B&W], *historical* - black or not underlined) *and* ***Overall sampled interval*** (min–max)

Sample description (sample ID, depth (ft), media)

12-34567 2.5–6 ft
RE12-34-5678 0.0–0.50 SOIL
Copper 5.5
Selenium 0.5 (J)
⋮

Analyte data (analyte, result, optional qualifier code)

Result Qualifiers:
J = Estimated value
J+= Estimated value biased high
J- = Estimated value biased low

Note: All analytical results reported in milligrams per kilogram (mg/kg) or in picocuries per gram (pCi/g) except as noted.

PLATE 11

Area 10
[AOC 49-002 and SWMU 49-005(a)] radionuclides detected above background or fallout values

Map Number: TPMC_030810B
Date: March 8, 2010 Rev: September 1, 2010
DraftedBy: TPMC File Name: TA49_Area10_HITS