04-001

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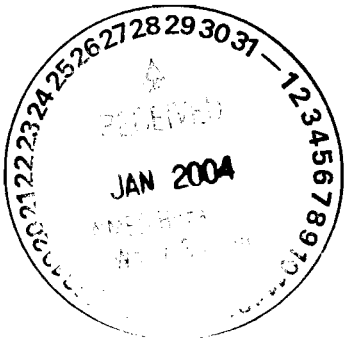
Date: January 30, 2004
Refer to: ER2004-0045



Mr. John Young, Project Leader
Permits Management Program
NMED – Hazardous Waste Bureau
2905 Rodeo Park Drive East
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SUBJECT: SUBMITTAL OF ACCELERATED CORRECTIVE ACTION WORK PLAN FOR THE INVESTIGATION AND REMEDIATION OF CONSOLIDATED SOLID WASTE MANAGEMENT UNIT (SWMU) 19-001-99

Dear Mr. Young:

Enclosed are two copies of the Los Alamos National Laboratory (LANL) Risk Reduction Environmental Stewardship–Remediation Services Accelerated Corrective Action Work Plan for the Investigation and Remediation of Consolidated SWMU 19-001-99.

LANL's July 13, 1998, "Response to Request for Supplemental Information for RFI Report TA-19, 19-001, 19-003, and C-19-001" specified that the work plan would be submitted in the format used at the time of submittal. Based on discussions with Darlene Goering of your staff, this Accelerated Corrective Action Work Plan is being submitted in the format outlined in Section XI.B of the November 26, 2002, Imminent and Substantial Endangerment Order.

If you have any questions, please contact Terry Rust at (505) 665-8843 or Tony Trujillo at (505) 845-5987.

Sincerely,

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

Sincerely,

David Gregory, Federal Project Director
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1593

DM/DG/NR/th

Enclosures: Certification
Corrective Action Work Plan (ER2003-0749)

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CERTIFICATION

CERTIFICATION BY THE RISK REDUCTION AND ENVIRONMENTAL STEWARDSHIP-REMEDIATION SERVICES (RRES-RS) PROJECT TECHNICAL REPRESENTATIVES

Document Title: **SUBMITTAL OF ACCELERATED CORRECTIVE ACTION WORK PLAN FOR THE INVESTIGATION AND REMEDIATION OF CONSOLIDATED SOLID WASTE MANAGEMENT UNIT (SWMU) 19-001-99**

I certify under penalty of law that these documents and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violation.

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David McInroy, Deputy Project Director
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or

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David R Gregory Date: Jan 28, 2004

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LA-UR-04-0199
January 2004
ER2003-0749

Accelerated Corrective Action Work Plan for the Investigation and Remediation of Consolidated Solid Waste Management Unit 19-001-99 (Former TA-19/East Gate Laboratory)

Los Alamos
NATIONAL LABORATORY
Los Alamos NM 87545

CD is included with this document

Disclaimer

This document contains data on radioactive materials, including source, special nuclear, and by-product material. The management of these materials is regulated under the Atomic Energy Act and is specifically excluded from regulation under the Resource Conservation and Recovery Act and the New Mexico Hazardous Waste Act. These data are provided to the New Mexico Environment Department for informational purposes only.

Prepared by
Risk Reduction and Environmental Stewardship–Remediation Services

LA-UR-04-0199
ER2003-0749

Accelerated Corrective Action Work Plan for the Investigation and Remediation of Consolidated Solid Waste Management Unit 19-001-99 (Former TA-19/East Gate Laboratory)

January 2004

Responsible team leader:

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1.0 EXECUTIVE SUMMARY

This accelerated corrective action (ACA) work plan presents an approach for characterizing consolidated Solid Waste Management Unit (SWMU) 19-001-99, Technical Area (TA-) 19, East Gate Laboratory, at Los Alamos National Laboratory (LANL or the Laboratory). SWMU 19-001-99 is part of the TA-72 land parcel located east of the Los Alamos County airport.

The site is situated on Los Alamos Mesa and is bounded by Pueblo Canyon to the north and a side canyon to the southeast. The SWMUs and area of concern (AOC) comprising consolidated SWMU

19-001-99 include the following: SWMU 19-001 (septic system), SWMU 19-002 (surface disposal area), SWMU 19-003 (sewer drainline and outfall), and AOC C-19-001 (potential soil contamination beneath buildings). The East Gate Laboratory was constructed in the summer of 1944 and used between 1944 and 1947 to test electrical equipment. Some site buildings, including the battery building, guard house, and latrine, were removed in 1956, and the property was abandoned in 1974. Currently, SWMU 19-001-99 is undeveloped and includes access to, and a portion of, a public recreational hiking trail.

The objective of this ACA work plan is threefold: (1) to remove a limited amount soil based on historical sampling; (2) to define the nature and extent of contamination at SWMU 19-001-99; and (3) to support a determination of either additional post-risk analysis removal activities or no further action for the site. To meet this objective, the Laboratory's Risk Reduction and Environmental Stewardship–Remediation Services project (formerly the Environmental Restoration Project) will conduct the following activities:

- perform limited soil removal at locations with elevated concentrations of potential contaminants (inorganic, radiological, and organic chemicals);
- establish a sampling protocol for investigating potential contamination at the site based on historical sample analytical results;
- collect soil and tuff surface and subsurface samples to fully characterize the lateral and vertical extent of potential contamination at the site;
- assess potential risk to human and ecological receptors based on the concentrations of chemicals of potential concern identified at the site; and
- determine a remedial approach for the site, if necessary.

After ACA activities are complete, the site will be restored and best management practices will be implemented as needed. The waste generated during the sampling activities will be disposed of in accordance with applicable Laboratory and regulatory requirements.

1.0 INTRODUCTION

1.1 General Site Information

Los Alamos National Laboratory (LANL or the Laboratory) is a multidisciplinary research facility owned by the US Department of Energy (DOE) and managed by the University of California. The Laboratory is located in north-central New Mexico approximately 60 mi (97 km) northeast of Albuquerque and 20 mi (32 km) northwest of Santa Fe. The Laboratory site covers 40 mi^2 (104 km^2) of the Pajarito Plateau, which consists of a series of finger-like mesas separated by deep canyons. These canyons contain ephemeral and intermittent streams that run west-to-east. Mesa tops range in elevation from approximately 6200 to 7800 ft (1890 to 2377 m). The eastern portion of the plateau stands 300 to 900 ft (91 to 274 m) above the Rio Grande River valley.

The Laboratory's Risk Reduction and Environmental Stewardship-Remediation Services (RRES-RS) project (formerly the Environmental Restoration Project) is involved in a national DOE effort to reduce risk to human health and the environment at its facilities. The goal of RRES-RS is to ensure that DOE's past operations do not threaten human or environmental health and safety in and around Los Alamos County. To achieve this goal, RRES-RS is investigating and remediating when necessary sites potentially contaminated by past Laboratory operations.

This accelerated corrective action (ACA) work plan outlines the technical approach proposed for the investigation and remediation activities at the Laboratory's consolidated Solid Waste Management Unit (SWMU) 19-001-99, Technical Area (TA-) 19. TA-19, formerly known as the East Gate laboratory, is now part of TA-72 and is located in Santa Fe County. SWMU 19-001-99 is located on Los Alamos Mesa east of the Los Alamos County airport and the East Gate industrial park. It is bounded by Pueblo Canyon on the north and by a small branch of Pueblo Canyon on the south. Currently, SWMU 19-001-99 is undeveloped and includes a recreational hiking trail. Figure 1 shows the location of SWMU 19-001-99 and the SWMUs and area of concern (AOC) associated with the site. A brief description of each is provided in the following subsections. Historical data collected at the site are discussed in Section 2.7 of this work plan.

1.1.1 SWMU 19-001, Septic System

The septic system consisted of a storage tank, the outfall from the tank, and associated piping. The system was operated from about 1957 until about 1974 and reportedly handled sanitary waste from the retreat building. Because this system handled only sanitary waste, no hazardous or radioactive contamination is suspected. The septic tank and pipelines were removed as a part of a voluntary corrective action (VCA) conducted in 1995 (LANL 1992, 0781).

1.1.2 SWMU 19-002, Surface Disposal Area

The surface disposal area covers an area of approximately 100 ft by 10 ft (30 m by 3 m) in Pueblo Canyon, north of TA-19. Building debris from decommissioned TA-19 structures and numerous old batteries were disposed of on the north-facing slope of Pueblo Canyon immediately north of TA-19. The building debris and batteries were removed as a part of a VCA conducted in 1995 (LANL 1992, 0781).

1.1.3 SWMU 19-003, Sewer Drainline and Outfall

A sewer drainline and outfall handled sanitary waste from the laboratory building and was probably used from 1944 until the building was decommissioned in 1974. Wastes were discharged through the sewer drainline to an outfall into Pueblo Canyon (LANL 1992, 0781).

1.1.4 AOC C-19-001, Potential Soil Contamination Beneath Buildings

AOC C-19-001 contains potentially contaminated soil located beneath the now-demolished laboratory, battery building, guard house (the precise location of the guard house could not be verified by previous reports or historical documents of the site), latrine, retreat building, and shelter buildings (LANL 1992, 0781).

1.2 Investigation Objectives

The investigation and remediation of SWMU 19-001-99 will be conducted in accordance with Resource Conservation and Recovery Act (RCRA) requirements and the New Mexico Hazardous and Solid Waste Act (HSWA). Radionuclide contamination levels are regulated by DOE Order 5400.5, "Radiation Protection of the Public and the Environment." SWMU 19-001-99 has been identified as having a radionuclide component. The approved installation work plan (IWP) for the former Environmental Restoration Project (LANL 1998, 62060) describes the methodologies used in this investigation. An ACA checklist and field work authorization form are provided in Appendix B.

The decisions to remove a limited amount of soil and re-evaluate the nature and extent of contamination at SWMU 19-001-99 were based on a review of the historical sampling results and maps associated with the site. All previous investigations performed, including analytical and field screening data collected during previous RCRA Facility Investigation ([RFI] LANL 1997, 71468) and VCA activities (LANL 1996, 05269) at SWMU 19-001-99, were consolidated for this ACA work plan. Details of the data review are provided in Section 2.7.

This investigation and remediation work plan presents the results of historical investigations, describes the site surface and subsurface conditions, and outlines the scope of activities for investigating and remediating SWMU 19-001-99. Appendix A includes a list of acronyms and abbreviations and defines the terms used in this report. Appendix B contains the ACA and fieldwork authorization form. Appendix C, on a CD attached to the inside back cover of this report, presents the analytical data collected for this SWMU collected during two previous site investigations: the 1995 VCA for SWMU 19-002 and the 1997 RCRA facility investigation for SWMUs 19-001 and 19-003 and AOC C-19-001. Appendix D outlines the historical data evaluation and the methodology used to develop this ACA work plan. Appendix E describes how investigation-derived wastes will be managed.

2.0 BACKGROUND

2.1 Operational History

Consolidated SWMU 19-001-99, the former East Gate laboratory, and the septic system, operated from 1944 to 1974. The former East Gate laboratory was constructed in the summer of 1944 for a scientist who needed an isolated location for experimental work using small radioactive sources. In 1947, the site consisted of a storage hutment and laboratory building used for spontaneous fission experiments and storing radioactive source material. In the early 1950's, more buildings were added until the site consisted of a laboratory, battery, guard, retreat, shelter buildings, and a latrine and septic tank. During this period, documented site operations included irradiation experiments using sealed lanthanum sources and two scintillation studies involving the use of aromatic compounds (Froman 1953, 0643). In 1956, several buildings, including the battery building, guard house, and latrine, were decommissioned and removed. The remaining structures were transferred to the Zia Company in 1957 and 1962. The retreat building operated from 1944 to 1962 when it was transferred to the Zia Company and assigned to DOE-Los Alamos Area Office municipal activities branch and used for civil defense purposes. It later was leased to the Los Alamos radio club, which used the site until 1974. The retreat building's septic system operated from 1957 to 1974. All remaining buildings were removed in 1974 when the property was abandoned.

2.2 Land Use

The historical land use at SWMU 19-001-99 was industrial. However, since the structures were removed in 1956 and all operations abandoned at the East Gate laboratory in 1974, SWMU 19-001-99 has remained undeveloped and has been used only for recreational purposes. It includes access to, and a portion of, a public recreational hiking trail.

2.3 Relationship to Other SWMUs and AOCs

The following SWMUs and AOC are the only nearby SWMUs and/or AOC that could have potentially affected SWMU 19-001-99: (1) Consolidated SWMU 73-001(b)-99, (2) SWMUs associated with TA-26 D-Site activities (see Section 2.3.2 below), and (3) AOC 00-018(b). Figure 2 shows the locations of these SWMUs and AOC with respect to SWMU 19-001-99. Descriptions for these nearby SWMUs and AOC are presented in the following subsections.

2.3.1 Consolidated SWMU 73-001-99, Former Landfill at the Los Alamos Airport

Consolidated SWMU 73-001(b)-99 consists of SWMUs 73-001(b), 73-001(c), and 73-001(d), all former structures at the Los Alamos airport. SWMUs 73-001(b) and 73-001(c) were removed by trench excavation for SWMU 73-001(d) and lie within its boundary.

SWMU 73-001(b) was a pit used to dispose of waste oil. It was located west of the bunker area [SWMU 73-001(c)] and northeast of the end of the airport runway. The pit is estimated to have been about 100 ft by 25 ft (30 m by 8 m), with an unknown depth; its center is estimated to have been located near the center of the south trench in the debris disposal area [SWMU 73-001(d)]. The pit, operated by the Zia Company, was used to dispose of waste oils from the motor pool, craft shops, and a vehicle shop. The pit's operation dates are estimated to be from 1947 to 1974.

SWMU 73-001(c), built in 1947, consisted of four bunkers used to store high explosives (HE). The bunkers were located along the north canyon rim east of the airstrip. The bunkers were built on four concrete pads and covered with soil. The Zia Company acquired three of the bunkers in 1948, and one bunker reportedly continued to be used by the Laboratory's protective force from 1948 to 1964, at which time it was transferred to the Zia Company. Contamination surveys, conducted in 1973, showed that the bunkers were free of radioactive contamination, and no significant chemical contamination had occurred. The bunkers were demolished in 1974.

SWMU 73-001(d) was used as a landfill debris disposal area from 1984 to 1986. The disposal area consisted of two roughly parallel unlined trenches dug to a depth of 35 ft (11 m). To the west, the trenches extend to within about 150 ft (46 m) of the airport runway windsock; to the east, they extend about 800 ft (244 m) beyond the end of the runway. The north and south boundaries extend to within about 50 ft (15 m) of a security fence and asphalt runway, respectively. In 1984, the site was used to bury debris excavated from the western portion of SWMU 73-001(a), now part of consolidated SWMU 73-001(a)-99, and from SWMUs 73-001(b) and 73-001(c). The trenches are estimated to contain 126,000 yd^3 (96,334 m^3) of debris. In 1986, the debris disposal area was covered with soil and reseeded.

2.3.2 TA-26, D-Site

TA-26, situated toward the east end of Los Alamos Mesa, covers about five ac (2.0 ha) within the current boundaries of TA-73. Bisected by State Road 502, TA-26 is bounded by Los Alamos Canyon on the south and Pueblo Canyon to the north. The Los Alamos County airport is located directly northwest of TA-26.

D-Site is the area of TA-26 south of State Road 502 that contained the East Gate vault (TA-26-1). D-Site was a five-room concrete vault established for storing radioactive materials (LASL, 1947, 0664). The Zia Company later used it to store HE. The vault operated from about 1946 to 1966. In addition to the East Gate vault, D-site also consisted of guard towers A and B (TA-26-2,-3), a guard building (TA-26-4), the east room septic system (TA-26-5), and a sump system (TA-26-6).

TA-26 D-site contained four SWMUs: (1) SWMU 26-001, a surface disposal site; (2) SWMU 26-002 (a), an acid sump system; (3) SWMU 26-002(b), a drainage system; and (4) SWMU 26-003, a septic tank. SWMU 26-001, a disposal area on the south-facing slope of Los Alamos Canyon, contains debris from the East Gate Vault. SWMU 26-002 (a) was the acid sump system that served the concrete storage vault at D-Site from 1948 to 1965. The sump system consisted of a 6 in. (152 mm) vitrified clay pipe (VCP) floor drain in the south center room of the vault connected to a collection sump and outfall that discharged to Los Alamos Canyon. The collection sump was located outside the vault. The sump was decommissioned and its contents were disposed of either at TA-50, Material Disposal Area C, or over the edge of the mesa along with the vault debris. SWMU 26-002(b) was the equipment room drainage system for the concrete storage vault. It carried effluent through a 4-in. (102-mm) VCP that discharged directly to Los Alamos Canyon. SWMU 26-003 was the septic system that served sanitary facilities in the east room of the historic concrete storage vault. The septic system connected to a 250-gal. (946-L]) steel septic tank. The effluent discharged to Los Alamos Canyon. The septic tank was thought to have handled only sanitary waste; however, because radioactive contamination was found in the vault, it is possible that contaminants were introduced into the system. Positive documentation of the septic tank's removal has not been located, but it probably was removed at the same time that the sump system [SWMU 26-002(a)] was decommissioned. A radiological survey of the septic tank was not conducted because the tank was not easily accessible.

2.3.3 AOC 00-018(b), Sludge-Bed Wastewater Treatment Plant

AOC 00-018(b) is the active Bayo Canyon wastewater treatment plant, located at the intersection of Pueblo and Bayo Canyons. It began operating in 1963 and was upgraded in 1966. The plant treats the sanitary waste stream that was previously routed to the central wastewater treatment plant (SWMU 00-019) and sanitary waste from residences on Barranca Mesa (the mesa directly to the north of Los Alamos Mesa). Most wastes treated at the plant were from businesses, eastern Los Alamos residences, and Barranca Mesa residences. After the Pueblo Canyon wastewater treatment plant was decommissioned in 1992, the remaining northern and western Los Alamos residential sanitary waste streams were routed to the Bayo Canyon wastewater treatment plant. Since 1992, this plant has been the primary supplier of effluent for irrigation at the Los Alamos golf course and recreational ball fields. The effluent outfall plant is permitted under a National Pollutant Discharge Elimination System permit number NM0020141. Suspect contaminants at AOC 00-018(b) were inorganic chemicals, organic chemicals, polychlorinated biphenyls (PCBs)/pesticides, and radionuclides.

2.4 Contaminant Transport Mechanisms and Potential Receptors

The primary mechanisms of contaminant release at SWMU 19-001-99 are related to the historical laboratory operations at the site, specifically sanitation systems that served the site facilities and surface runoff at the site. Surface and subsurface soil and tuff are the only media containing residual contamination at the site.

The potential pathways for human exposure to surface soil and tuff are dermal contact, inhalation of vapors and particulates, and incidental soil ingestion. 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 then be similar to those of a surface soil release (i.e., dermal contact, inhalation of vapors or fugitive dust, and incidental soil ingestion).

For ecological receptors, pathways from subsurface contamination to potential surface-dwelling animals would be complete only if contaminated soil or tuff were excavated and brought to the surface. The potential pathways would then be similar to those of a surface soil release (i.e., dermal contact, inhalation of vapors or fugitive dust, incidental ingestion of soil, uptake by plants, and food-web transport). Pathways from subsurface releases may be complete for plants and burrowing animals, including the uptake of contaminants by plant roots and the exposure of burrowing animals via dermal contact, inhalation of vapors or dust, incidental ingestion of soil, and food-web transport.

Downward migration of contaminants in the vadose zone is limited by a lack of hydrostatic pressure. The lack of saturated conditions in the area would restrict both horizontal and vertical migration. No perched alluvial aquifers have been identified in the area of SWMU 19-001-99, nor are there springs or seeps nearby that would indicate the presence of perched alluvial aquifers. Therefore, a complete pathway to the groundwater, including the regional aquifer, located approximately 1000 ft (305 m) below ground surface (bgs) from the mesa top, is unlikely.

2.5 Waste Inventory

The site is potentially contaminated by radioactive, hazardous, sanitary, and solid waste. Radioactive materials handled at the site were of three known types: (1) actinides, used for spontaneous fission experiments in microgram quantities; (2) a cobalt-60, 300-Curie source, used for irradiation as late as 1961 (cobalt-60 has a 5.27 year half-life); and (3) a radioactive lanthanum source used in irradiation experiments. The lanthanum source probably used lanthanum-140 derived from barium-140, both of which have very short half-lives (40 hours and 12 days, respectively).

Sanitary waste was likely generated from the guard house and from the septic system and outfall from the laboratory building. A certification dated October 11, 1972, indicated that the septic tank for the guard house was free of HE and radioactive material (LANL 1997, 71468). No radioactive material was found in the outfall areas during previous RFI activities. The solid waste found at, and subsequently removed from, SWMU 19-002, consisted of demolition refuse from decommissioned buildings, which was deposited in a 100-ft by 10-ft (30-m by 3-m) area in Pueblo Canyon.

2.6 Historical Releases

Potential releases related to historical activities at the site include

- releases to surface and subsurface soil and tuff related to the septic systems at the site, including SWMU 19-001 (septic system) and SWMU 19-003 (sewer drainline and outfall);
- releases to surface and subsurface soil and tuff related to the surface disposal of building and battery debris at SWMU 19-002; and
- releases to surface and subsurface soil and tuff beneath the buildings at the site (AOC C-19-001) related to laboratory operations.

In 1974, building and property surveys were conducted at TA-19 to identify any potential contamination. Survey results indicated that the structures were free of HE, radioactive, chemical, and toxic contamination. Soil samples collected in the vicinity of two effluent discharge points in 1974 were analyzed for radionuclides. Soil sample results indicated that no radioactive materials had been released.

2.7 Summary of Historical Investigations

2.7.1 1995 VCA

In August 1995, SWMU 19-002 was sampled as a part of the Phase I RFI Work Plan for Operable Unit (OU) 1071 (LANL 1992, 0781). A VCA for SWMU 19-002 was conducted in September 1995 and the results are documented in a February 1996 VCA completion report (LANL 1996, 05269). As part of the VCA, approximately 2 yd^3 (1.5 m^3) of concrete debris and 1.5 yd^3 (1.1 m^3) of battery and associated debris were removed from SWMU 19-002 on the mesa slope into Pueblo Canyon. The VCA sampling of SWMU 19-002 included the following:

- eighteen soil samples, one battery material sample, and a waste characterization sample analyzed using a mobile chemical analytical laboratory, and
- five soil confirmation samples and one battery material sample submitted to an off-site/fixed laboratory.

The VCA completion report for SWMU 19-002 concluded that "no release of RCRA hazardous material occurred" at the site and recommended that the site "be removed from the HSWA list of [SWMUs]" (LANL 1996, 05269).

2.7.2 1997 RCRA Facility Investigation

In 1997, further investigation was conducted to complete the characterization and remediation of the site, specifically at SWMUs 19-001 and 19-003 and AOC C-19-001. The septic system and sewer drainlines were located and removed in July 1997. The drainlines stopped approximately 20 ft (6 m) short of the mesa edge, apparently terminating in gravel-filled trenches. The septic tank was uncovered, pumped dry of approximately 300 gal. (1136 L) of water, primarily infiltration water, and removed. Confirmation samples were collected at two depths (soil and tuff) beneath the structures that had been removed. These samples were analyzed for volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs), metals, and radionuclides using gamma spectroscopy. The 1997 RFI sampling included the following:

- two soil samples and seven tuff samples from SWMU 19-001,
- two soil samples and six tuff samples from SWMU 19-003, and
- seven soil samples from AOC C-19-001.

Figures 3 and 4 show the locations of the samples collected at the site, except for the following five sample locations: 19-01001, 19-01002, 19-01022, 19-01023, and 19-01024. These five locations are associated with SWMU 19-002 and are located on the north mesa slope, downgradient of sample locations 19-01266, 19-01267, 19-01268, and 19-01269. However, because neither a sample location map was provided in the 1995 VCA completion report (LANL 1996, 05269), nor could one be located for SWMU 19-002, the five sample locations are not plotted.

All three areas were recommended for no further action (NFA) in the RFI report completed in September 1997 (LANL 1997, 71468). However, a subsequent request for supplemental information from the New Mexico Environment Department (NMED) in 1998 indicated the need for further site characterization at SWMU 19-001-99 (NMED 1998, 59642).

2.7.3 Historical Data Evaluation

To address the need for further site remediation or investigation at SWMU 19-001-99, a comprehensive list of chemicals of potential concern (COPCs) for SWMU 19-001-99 was created based on historical field analytical and fixed laboratory data from the 25 fixed laboratory analytical sampling locations collected during the two previous site investigations of SWMU 19-001-99 (see Figures 3 and 4). All historical analytical data collected at SWMU 19-001-99 are provided in Appendix C (on a CD attached to the inside back cover of this report). Historical tuff and soil samples collected are summarized in Table 1. Inorganic and radiological COPCs in soil and tuff were evaluated based on a comparison to Laboratory-specific background values (BVs) or fallout values ([FVs] LANL 1998, 59730). No background datasets are available for organic chemicals. COPCs were defined as inorganic and radiological chemicals that exceeded BVs or FVs and detected organic chemicals.

2.7.3.1 Inorganic Chemical Data

Table 2 summarizes the historical inorganic chemical analytical data, including range of concentrations measured in the investigative samples, and a comparison of the concentrations for each analyte to the Laboratory-specific BVs for soil and tuff (LANL 1998, 59730). The background comparisons are divided into samples collected from soil and those collected from tuff because the background data sets are matrix-specific. Eleven inorganic chemicals (arsenic, barium, cadmium, calcium, copper, lead, magnesium, manganese, mercury, selenium, and zinc) were detected in the investigative samples above their respective BVs for soil and/or tuff. Three inorganic chemicals were not detected but had detection limits above their respective BVs (antimony, silver, and thallium in soil, and antimony in tuff). Calcium and magnesium were excluded as COPCs because they are essential nutrients.

In summary, a total of nine inorganic chemicals were retained as COPCs for SWMU 19-001-99 because they were detected at concentrations above BVs, and three inorganic chemicals were retained as COPCs because their detection limits exceeded BVs. Table 3 presents the historical sample analytical results of inorganic chemicals detected (or with detection limits) above BVs.

2.7.3.2 Radionuclide Chemical Data

Table 4 summarizes the historical radiological data, including range of activities measured in the investigative samples, and comparison of activities for each analyte with FVs for soil and BVs for soil and tuff (LANL 1998, 59730). Detected radionuclides without BVs or FVs are determined to be COPCs. Of the radionuclides, one was detected above soil or tuff BVs or FVs (cesium-137). Additionally, europium-152 (no BV or FV available) was detected in one tuff sample. Both radionuclides were retained as COPCs. Table 5 presents the historical analytical results for all soil and tuff samples with radionuclide activities greater than BVs or FVs and detections for COPCs for which no BV or FV exists.

2.7.3.3 Organic Chemical Data

Table 6 summarizes the historical organic analytical data for organic chemicals, including range of concentrations measured in the investigative samples and estimated quantitation limits for all detected organic chemicals. A total of 26 organic chemicals (20 in soil and 21 in tuff) were detected in the investigative samples, and all were retained as COPCs. Table 7 lists all historical samples with detected organic COPCs.

2.7.3.4 Summary of Chemicals of Potential Concern

The COPCs identified for SWMU 19-001-99 are summarized in Table 8. A total of 12 inorganic chemicals were retained as COPCs. Nine inorganic chemicals were identified as COPCs for soil: antimony,

cadmium, copper, lead, manganese, mercury, silver, thallium, and zinc. Five inorganic chemicals were identified as COPCs for tuff: antimony, arsenic, barium, selenium, and zinc. Two radionuclides were retained as COPCs: cesium-137 (soil and tuff) and europium-152 (soil). A total of 26 organic chemicals were retained as COPCs: 20 in soil and 21 in tuff. The evaluation of these COPCs for determining additional soil removal and/or additional investigation is provided in detail in Appendix D.

3.0 SITE CONDITIONS

SWMU 19-001-99 is situated on a far-east mesa of the Pajarito Plateau at an elevation of 6910 ft (2106 m) above mean sea level. The site is located on Los Alamos Mesa and is bounded by Pueblo Canyon to the north and a small side canyon to Pueblo Canyon to the southeast. The topography on the top of the mesa is relatively flat and dips gently to the east but drops steeply at greater than a 40% slope into the surrounding canyons.

The Pajarito Plateau is drained by several west-to-east oriented canyons, and surface water flows eastward toward the Rio Grande. The average annual rainfall on this portion of the Pajarito Plateau is 18.3 in., of which at least a third is received from the convective thunderstorms that commonly occur during the months of July and August (LANL 2002, 73876). Drainages in both Pueblo Canyon and the side canyon to the southeast are generally dry and exhibit ephemeral flow only after intense rainfall events.

Surface soils at the site are predominantly silty sands formed by the degradation and weathering of the underlying tuff. Subsurface conditions at the site are defined by the Tshirege Member of the Bandelier Tuff (Qbt) which consists of multiple layers of ash-flow tuffs approximately 300 to 600 ft (91 to 183 m), thick. Portions of the Tshirege Member are highly welded and form vertical cliffs as well as the caprock on the plateau.

Because of the substantial relief and limited groundwater recharge, the regional water table is approximately 1000 ft (305 m) bgs from the mesa top on the eastern side of the Pajarito Plateau. The movement of meteoric water and potential migration of contaminants from the surface to the aquifer is very limited because of the considerable thickness of the vadose zone and the minimal amount of precipitation at the site.

3.1 Surface Conditions

Surficial deposits on the Pajarito Plateau consist of coarse-grained colluvium on steep hillslopes and along the base of cliffs (generally fine-grained fluvial and colluvial sediments with a thin cover of eolian fine-grained sediments on the flatter parts of mesa surfaces) and alluvial fan deposits at the mouths of drainages cut into the mountain front or escarpments related to post-Bandelier faulting. Well-developed soils generally occur only on the gently sloping surfaces associated with the mesas. These soils usually consist of several subhorizons of the Bandelier Tuff that contain reddish clay. Soils present on top of the mesas and the soils comprising the steep hill slopes, drainages, and other areas flanking erosionally stable mesa tops are typically thin and weakly developed, possessing only an A horizon and C horizon. Erosion of the mesa top is caused primarily by shallow run-off on the relatively flat part of the mesas, by deeper run-off in channels cut into mesa surfaces, and by rockfall and colluvial transport on the walls of the canyon.

SWMU 19-001-99 is located on the top of Los Alamos Mesa. A thin layer of soil is preserved in flat parts of the mesa surface and supports small outcroppings of vegetation. Tuff outcrops dominate the steep mesa slopes, and little to no vegetation is present on the upper slope reaches. Soil development and vegetative covering increase progressively downslope.

3.2 Subsurface Conditions

The regional stratigraphy of the Pajarito Plateau consists of the Bandelier Tuff, the Cerros del Rio lavas, the Puye Formation, the Totavi Lentil deposits, the Santa Fe Group, and the Santa Fe age basalts. SWMU 19-001-99 is located on a mesa top and, therefore, subsurface conditions defining the site include only the plateau's uppermost stratigraphic unit, the Tshirege Member of the Bandelier Tuff. Descriptions of the Bandelier Tuff members are provided in the following subsections.

3.2.1 Bandelier Tuff

In regard to Bandelier Tuff, the term welding is used to distinguish between tuffs that are uncompacted and porous (nonwelded) from tuffs that are more compacted and dense (welded). In the field, the degree of welding in tuff is quantified by the degree of flattening of pumice fragments (a higher degree of flattening and elongation equals a higher degree of welding). Petrographically, welded tuffs show adhesion (welding) of grains, while nonwelded tuffs do not. The term devitrified is applied to tuffs whose volcanic glass has crystallized.

3.2.1.1 Tshirege Member

The Tshirege Member of the Bandelier Tuff is a compound cooling unit that resulted from several successive ash-flow deposits separated by periods of inactivity, which allowed for partial cooling of each unit. Properties related to water flow and contaminant migration (e.g., density, porosity, degree of welding, fracture content, and mineralogy) vary both vertically and laterally as a result of localized emplacement temperature, thickness, gas content, and composition.

3.2.1.2 Tshirege Member Unit 3 (Qbt 3)

Unit 3 of the Tshirege Member of the Bandelier Tuff is poorly welded and nonindurated to slightly indurated. Forming the cliff caprocks of the Pajarito Plateau, unit 3 defines the tuff at the soil/tuff interface at SWMU 19-001-99.

3.2.1.3 Tshirege Member Unit 2 (Qbt 2)

Unit 2 of the Tshirege Member of the Bandelier Tuff is a competent, resistant unit that forms cliffs where it is exposed on the sides of the mesa. The rock is described as a moderately welded ash-flow tuff composed of crystal-rich, devitrified pumice fragments in a matrix of ash, shards, and phenocrysts (primarily potassium feldspar and quartz).

Unit 2 is extensively fractured as a result of contraction during post-depositional cooling. The cooling-joint fractures are visible on the mesa edges and on the walls of the pits. In general, the fractures dissipate at the bottom of unit 2. On average, fractures in unit 2 are nearly vertical. Mean spacing between fractures ranges between 1.9 ft and 2.6 ft (0.6 m and 0.8 m), and fracture width ranges between less than 0.03 in. and 0.51 in. (1 mm and 13 mm), with a median width of 0.12 in. (3 mm). The fractures are typically filled with clays to a depth of about 9.9 ft (3 m); smectites are the dominant clay minerals present. Smectites are known for their tendency to swell when water is present and for their ability to strongly bind certain elements, both of which have implications for the transport of radionuclides and inorganic chemicals in fractures. Opal and calcite can occur throughout the fractured length, usually in the presence of tree and plant roots (live and decomposed); the presence of both the minerals and the roots indicates some moisture at depth in fractures.

At the base of unit 2 is a series of thin (less than 3.9 in. [100 mm] thick) discontinuous, crystal-rich, fine- to coarse-grained surge deposits. Bedding structures are often observed in these deposits. The surge beds mark the base of unit 2.

3.2.1.4 Tshirege Member Unit 1v (Qbt 1v)

Tshirege Member unit 1v is a vapor-phase-altered cooling unit underlying unit 2. This unit forms sloping outcrops, which contrast with the near-vertical cliffs of unit 2. Unit 1v is further subdivided into units 1vu and 1vc.

Unit 1vu is the uppermost portion of Unit 1v where u signifies upper. It is devitrified and consists of vapor-phase-altered ash-fall and ash-flow tuff. Unit 1vu is unconsolidated at its base and becomes moderately welded nearer the overlying unit 2. Only the more prominent cooling fractures originating in unit 2 continue into the more welded upper section of unit 1vu and are not present in the less-consolidated lower section. More typically, fractures in unit 2 do not extend into Unit 1vu.

Unit 1vc lies beneath unit 1vu, where c stands for colonnade, named for the columnar jointing visible in cliffs formed from this unit. unit 1vc is a poorly welded, devitrified ash-flow tuff at its base and top, becoming more welded in its interior.

3.2.1.5 Tshirege Member Unit 1g (Qbt 1g)

The basal contact of unit 1vc is marked by a rapid change (within 0.7 ft [0.2 m] vertical) from devitrified (crystallized) matrix in unit 1vc to vitric (glassy) matrix in the underlying unit 1g. Vitric pumices in unit 1g stand out in relief on weathered outcrops, while devitrified pumices above this interval are weathered out. In outcrop, this devitrification interval forms a prominent erosional recess termed the vapor-phase notch. No depositional break is associated with the vapor-phase notch; the abrupt transition indicates that this feature is the base of the devitrification that occurred in the hot interior of the cooling ash-flow sheet after emplacement.

Unit 1g is a vitric, pumiceous, nonwelded ash-flow tuff underlying the devitrified unit 1vc. Few fractures are observed in the visible outcrops of this unit, and weathered cliff faces have a distinctive Swiss-cheese appearance because of the softness of the tuff. The uppermost 5 ft to 20 ft (1.5 m to 6.1 m) of unit 1g are iron-stained and slightly welded. This portion of unit 1g is resistant to erosion, helping to preserve the vapor-phase notch in outcrop. A distinctive pumice-poor surge deposit forms the base of unit 1g.

3.2.1.6 Tsankawi Pumice Bed

The Tsankawi Pumice Bed is the basal air-fall deposit of the Tshirege Member of the Bandelier Tuff. It is a thin bed of gravel-sized vitric pumice.

3.2.1.7 Cerro Toledo Interval (Qct)

The Cerro Toledo interval consists of thin beds of tuffaceous sandstones, paleosols, siltstones, ash, and pumice falls; the Cerro Toledo interval separates the Tshirege and Otowi Members of the Bandelier Tuff. The Cerro Toledo interval also includes localized gravel- and cobble-rich fluvial deposits predominantly derived from intermediate composition lavas eroded from the Jemez Mountains west of the Pajarito Plateau. The interval is about 20 ft (6.1 m) thick.

3.2.1.8 Otowi Member (Qbo)

The Otowi Member tuffs are about 100 ft (30 m) thick in the northwestern portion of the plateau and become thinner towards the east. The tuffs are a massive, nonwelded, pumice-rich, and mostly vitric ash

flow. The pumices are fully inflated, supporting tubular structures that have not collapsed as a result of welding. The matrix is an unsorted mix of glass shards, phenocrysts, perlite clasts, and minute broken pumice fragments.

The Guaje Pumice Bed is the basal air-fall deposit of the Otowi Member of the Bandelier Tuff. The pumice bed is nonwelded and brittle. Pumice tubes are partially filled with silica cement.

3.2.2 Hydrology

The proposed hydrogeologic conceptual model for the Pajarito Plateau (LANL 1998, 59599) predicts that surface conditions such as topography, surface water flow, and microclimate greatly influence infiltration of water into the subsurface and the subsequent transport of water, vapor, and solutes through the upper regions of the vadose zone. According to model predictions, movement through deeper layers, including the regional aquifer, is influenced only weakly by surface conditions and is influenced more strongly by hydraulic characteristics of aquifer rocks, regional groundwater flow patterns, and stresses induced by water supply production. The following sections provide an overview of infiltration rates and groundwater occurrence in the vicinity of SWMU 19-001-99.

3.2.2.1 Infiltration

Surface and near-surface conditions (topography, precipitation, surface runoff) control water infiltration into the subsurface and the transport of contaminants in the shallow subsurface. In this respect, the climate behavior of mesas and canyons forming the plateau differ from one another (LANL 1998, 59599). Mesas are generally dry, both on the surface and within the rock that forms the mesa. Canyons range from wet to relatively dry; the wettest canyons contain continuous streams and perennial groundwater in the canyon-bottom alluvium. Dry canyons have only occasional stream flow and may lack alluvial groundwater.

The amount of mesa top recharge along the north eastern portion of the Laboratory where SWMU 19-001-99 is located is minimal. Fractures within mesas do not enhance the movement of dissolved contaminants unless saturated conditions develop. Contaminants in the vapor phase generally migrate in a diffusive manner through mesas (Stauffer et al. 2002, 69794; LANL 1997, 63131).

3.2.2.2 Groundwater

Groundwater beneath the Pajarito Plateau occurs in three distinct horizons: (1) in the regional aquifer, (2) in shallow perched zones beneath canyons that maintain relatively wet surface conditions (surface flow) for most of the year, and (3) in intermediate perched zones in the vadose zone, between the regional aquifer and the shallow perched zones (Nylander et al. 2003, 76059).

The regional aquifer occurs within the Santa Fe Group and Puye Formation and is the only aquifer capable of large-scale municipal water supply (Purtymun 1984, 6513). The regional aquifer extends throughout the Española Basin (an area roughly 2317 mi^2 [6000 km^2]) and reaches its maximum thickness beneath the Pajarito Plateau (over 9800 ft [3000 m] thick [Cordell 1979, 76049]). Depths to the regional aquifer range between about 1200 ft (366 m) bgs along the western edge of the plateau to about 600 ft (183 m) bgs to the east. Beneath SWMU 19-001-99, the water table elevation is approximately 1000 ft (305 m) bgs from the mesa top.

Groundwater in the shallow perched zones occurs within the canyon alluvium (i.e., gravel, sand and finer sediments deposited by surface flow in the canyon bottoms). The alluvial deposits are limited in their geographical extent and very permeable relative to the underlying Bandelier Tuff; hence, surface water readily infiltrates the alluvium and becomes captured, forming narrow, ribbon-like alluvial aquifers that lie

directly beneath the canyon bottoms. These shallow alluvial aquifers generally occur at depths less than 100 ft [30 m]) and are as much as 100 ft (30 m) thick in some locations. With the exception of TA-16, shallow alluvial perched aquifers have been detected only beneath canyons with relatively wet surface conditions (surface flow) for most of the year (i.e., Los Alamos Canyon). Currently, there is no evidence to indicate the presence of a shallow alluvial aquifer beneath SWMU 19-001-99 (Nylander et al. 2003, 76059).

Groundwater also occurs in intermediate perched water zones. In areas where low-permeability beds impede the downward migration of water, water will pool and collect, forming isolated intermediate depth aquifers. Evidence of intermediate depth aquifers has been found beneath Pueblo, Los Alamos, Sandia, Mortandad, Pajarito, and Ancho Canyons and Cañon de Valle (Nylander et al. 2003, 76059). These perched intermediate aquifers are morphologically similar to the shallow alluvial aquifers, occurring as narrow ribbons that follow the canyons; however, the depths at which these intermediate aquifers occur are highly variable, ranging from less than 100 ft [30 m] bgs to as much as 900 ft (274 m) bgs from the canyon bottoms.

3.2.2.3 Vadose Zone

The region beneath the ground surface and above the regional aquifer is called the vadose (unsaturated) zone. The source of moisture in the vadose zone is precipitation, most of which is removed as runoff, evaporation, and transpiration (LANL 1997, 63131). The subsurface movement of the remaining moisture (often referred to as recharge) is predominantly vertical in direction and is influenced by properties and conditions of the vadose zone.

The geologic property of the Bandelier Tuff that most influences fluid flow in the unsaturated zone is the degree of welding. Welded tuffs tend to have less matrix porosity and more fractures than nonwelded tuffs. Fractures in welded tuff may include relatively close-spaced cooling joints as well as tectonic fractures. Although nonwelded tuffs also have fractures, they are generally less abundant than in welded tuffs. At SWMU 19-001-99, the mesa caprock is exposed in several tuff outcroppings. The tuff appears highly welded but shows little to no signs of weathering or fractures.

4.0 SCOPE OF ACTIVITIES

The ACA for SWMU 19-001-99 includes the following activities:

- Removing soils from locations of historical samples with elevated COPC concentrations
- Sampling for further site characterization, including
    - mobilization and site preparation
    - pre-sampling geodetic survey
    - surface and subsurface sampling
    - field screening
    - fixed analytical laboratory analysis
    - site restoration and demobilization
    - post-sampling geodetic survey
- Determining whether potential risk to human health and the environment has been reduced sufficiently for unrestricted site use

- Developing planning and field documents for the implementation of the work plan to ensure potential risk has been adequately reduced
- Preparing a detailed report of the work performed, including presentation and analysis of all data collected

Investigation methods for performing the work described above are provided in Section 5.0. The schedule for the planned activities is provided in Section 7.0.

5.0 INVESTIGATION METHODS

The most current revisions of the following RRES-RS standard operating procedures (SOPs), quality procedures (QPs), and quality management plan are applicable to the investigation proposed in this plan. They are available at http://erproject.lanl.gov/documents/procedures.html.

- SOP-01.01, *General Instruction for Field Investigations*
- SOP-01.02, *Sample Container and Preservation*
- SOP-01.03, *Handling, Packaging and Shipping of Samples*
- SOP-01.04, *Sample Control and Field Documentation*
- SOP-01.05, *Field Quality Control Samples*
- SOP-01.06, *Management of ER Project Wastes*
- SOP-01.08, *Field Decontamination of Drilling and Sampling Equipment*
- SOP-01.10, *Waste Characterization*
- SOP-01.12, *Field Site Closeout Checklist*
- SOP-03.11, *Geodetic Surveys*
- SOP-06.09, *Spade and Scoop Method for Collection of Soil Samples*
- SOP-06.10, *Hand Auger and Thin-Wall Tube Sampler*
- SOP-10.01, *Screening for Polychlorinated Biphenyls in Soil*
- SOP-10.08, *Operation of the Spectrace 9000 Field-Portable X-Ray Fluorescence Instrument*
- SOP-12.01, *Field Logging, Handling, and Documentation of Borehole Materials*
- QP-2.2, *Personnel Orientation and Training*
- QP-3.2, *Lessons Learned*
- QP-3.4, *Managing Nonconformance, Deficiency and Corrective Actions*
- QP-4.4, *Record Transmittal to the Records Processing Facility*
- QP-4.12, *Documenting Oral Communications*
- QP-5.2, *Control of Measuring and Test Equipment*
- QP-5.3, *Readiness Planning and Reviews*
- QP-5.7, *Notebook Documentation for Environmental Restoration Technical*
- QP-7.2, *Supplier Evaluation and the RRES-RS Quality Management Plan*
- QP-10.3, *Stop Work and Restart*

Additional procedures may be added as necessary to guide the work plan activities.

5.1 Soil Removal

Based on the evaluation of historical analytical data presented in Appendix D, the historical sampling locations 19-01266 and 19-01268 were selected for soil removal as part of this ACA. Metal concentrations at 19-01266 and cesium-137 and fluoranthene concentrations at 19-01268 were elevated relative to corresponding concentrations at the other historical sampling locations, based on statistical outlier tests of the data set. To date, the potential risk to human and ecological receptors has not been evaluated for COPCs at SWMU 19-001-99; however, because COPC concentrations at these two historical sampling locations are elevated, RRES-RS has opted to perform soil removal as part of the ACA for SWMU 19-001-99.

Approximately 1.0 yd^3 (0.76 m^3) of soil will be removed at each location identified, yielding a total of approximately 2.0 yd^3 (1.5 m^3) soil to be excavated and removed from the site. Four confirmation soil samples (two samples at each location) will be collected to verify the effectiveness of the soil removal. Chemical and radiochemical analyses for confirmation soil samples will be consistent with the site characterization sampling and analysis as described in Section 5.3.5. In addition, all soil removal confirmation data will be combined with the surface and subsurface soil and tuff data that will be collected for the purpose of further site characterization and evaluated in the context of potential risk to human and ecological receptors.

5.2 Sampling for Site Characterization and Nature and Extent

The lateral and vertical extent of COPCs at SWMU 19-001-99 will be determined by performing surface and subsurface soil and tuff sample collection and analysis. The data will be evaluated to determine whether residual COPC concentrations at the site pose potential human health or ecological risks to the and whether additional soil removal is warranted.

A seven-step data quality objective (DQO) process and the Visual Sample Plan (VSP), version 2.2 were used to develop the optimal sampling design required for further site characterization and risk evaluation at SWMU 19-001-99. The DQOs were developed to optimize the design of the proposed sampling activities. The statistically based sampling design program, VSP, version 2.2, was used to determine the appropriate number of samples needed and the specific locations where the samples should be collected. The sampling design for SWMU 19-001-99 is detailed in Appendix D and summarized below.

AOC C-19-001 Mesa Top: Thirty-one sampling locations based on a systematic sampling grid developed in VSP, version 2.2 (see Appendix D). Sample locations were derived using the Wilcoxon Signed-Rank (One-Sample) Test statistical method (Gilbert 1987, 56179). Proposed sampling locations at AOC C-19-001 mesa top are depicted on Figure 5.

SWMU 19-001-99 Lower Mesa Slopes: Eight sampling locations at the downgradient extent of SWMU 19-001-99 determined from field reconnaissance of drainage features on the mesa slopes. Figure 6 shows the proposed sampling locations for the north and south mesa slopes.

Data acquired during the field investigation will be evaluated based on the five steps for the data quality assessment process outlined in the US EPA document "Guidance for Data Quality Assessment, Practical Methods for Data Analysis EPA QA/G-9" (EPA 2000, 73790). Performance of the sampling design will be statistically tested (by power analysis) as part of the data assessment process.

5.3 Mobilization, Sampling, and Associated Field Activities

Implementation of the ACA site characterization activities include mobilization and site preparation, collection of surface and subsurface characterization or confirmation samples at locations associated with

former AOC C-19-001 structures and in drainages on the lower mesa slopes, field screening of polyaromatic hydrocarbons (PAHs) and metals, and submittal of confirmation samples for fixed laboratory analysis. Per a previous request by the NMED, field screening and confirmation sampling for PCBs will also be conducted (NMED 1998, 59642).

5.3.1 Mobilization and Site Preparation

Mobilization and site preparation activities include the following tasks:

- mobilizing equipment and preparing the sites (including any necessary best management practices [BMPs]) and
- ensuring site control, including waste management and support areas, to prevent unauthorized entry by workers or the public, using fences, signs, and any other appropriate measures.

5.3.2 Pre-Sampling Geodetic Survey

Land surveys will be conducted to properly identify and stake proposed sampling locations.

5.3.3 Surface and Subsurface Sampling

Surface soil and subsurface soil and/or tuff samples will be collected from a total of 31 locations on the mesa top (within the boundaries of AOC C-19-001) and from eight locations on the mesa slopes (see Figures 5 and 6). The eight mesa slope locations will be placed in the main drainage channels present at the lower reaches of the mesa slopes to define a perimeter around the area of residual contamination.

To define lateral extent of the residual contamination detected during previous investigations, the eight additional grid point samples will be collected from grid points forming a perimeter around the area of residual contamination. Hand-auger and slide-hammer sampling will be used to advance the shallow borings at each location, and samples will be collected from two distinct horizons and depths: surface soils (0–0.5 ft [0.1 m]) and the soil/weathered tuff interface (3.5–4.0 ft [1.0 m] or less, depending on auger refusal resulting from the presence of competent tuff). Surface soil samples will be collected using stainless steel scoops and subsurface soil or tuff samples will be collected in 6-in.-long by 2-in.-diameter (152-mm-long by 51-mm-diameter) brass or stainless steel liners. To minimize the loss of VOCs, samples for VOC analysis will be collected immediately upon recovery using disposable En Core® samplers.

Surface soil and subsurface soil or tuff samples will be collected from the specified sample depths at each sample location in accordance with the SOP-6.09, "Spade and Scoop Method for Collection of Soil Samples," and SOP-6.10, "Hand Auger and Thin-Wall Tube Sampler."

5.3.4 Field Analytical Methods

Visual and apparent odor observations in the field will be recorded in boring logs for each sampling location. Strategic Diagnostics, Inc., RaPID Assay® enzyme immunoassay test kits will be used to field screen both soil and tuff samples for total PCBs and PAHs. In addition, a Spectrace 9000 field-portable X-ray fluorescence (XRF) instrument will be the screening tool for detecting metals such as antimony, lead, manganese, and zinc. Immunoassay and XRF field screening results will be recorded on the field boring logs. A field duplicate sample will be screened with every set (typically 10) of characterization samples analyzed.

The field analytical method for total PCBs (as Aroclor-1254) is EPA SW-846 Method 4020. The field analytical method for total PAHs (as benzo[a]pyrene) is EPA SW-846 Method 4035. The test kit detection limit for total PCBs is 0.5 parts per million, and the detection limit for PAHs is 10 parts per billion.

Surface soil and subsurface soil or tuff samples will be field screened for PCBs and metals in accordance with the SOP-10.01, "Screening for Polychlorinated Biphenyls in Soil," and SOP-10.08, "Operation of the Spectrace 9000 Field-Portable X-Ray Fluorescence Instrument," respectively.

5.3.5 Fixed Laboratory Analytical Methods

Approximately 10% of the surface and subsurface soil or tuff samples collected from the 31 grid points inside AOC C-19-001 and all of the samples collected from the mesa slopes will be sent to an off-site contract laboratory for confirmation analysis. The confirmation samples will be selected based on the range of concentrations observed during field screening for specific constituents (total PAHs, PCBs, and metals). Samples at the upper limit of the concentration range (top 10%) will be submitted for confirmation analysis.

Confirmation sample collection and analysis will be coordinated with the Sample Management Office (SMO). Once samples have been collected, samples will be stored and transported to the RRES-RS SMO in accordance with SOP-01.03, "Handling, Packaging and Shipping of Samples." The SMO will ship samples to an analytical laboratory qualified according to QP-07.2, "Supplier Evaluation," and on the RRES-RS-approved list of suppliers.

Surface soil and subsurface soil or tuff confirmation samples will be submitted to the SMO for off-site contract laboratory analysis for the following contaminant suites: VOCs, SVOCs (including PAHs), PCBs, pesticides, herbicides, gamma- and alpha-emitting radionuclides, and target analyte (TAL) list metals, based on recommendations from the NMED (NMED 1998, 59642). In addition, confirmation samples for which PCBs are detected during field screening will also be analyzed for dioxins/furans. In the event that no PCBs are detected during field screening, samples from two of the confirmation locations associated with the outfall/mesa slope soil removals will be sent to a fixed laboratory for analysis of dioxins/furans.

The minimum numbers of site characterization and confirmation samples to be collected at SWMU 19-001-99 are listed in Table 9. The routine turnaround time for the samples submitted for off-site contract laboratory analysis is 30 days. Specific analytical methods for organic and inorganic compounds are described in the EPA document, "Test Methods for Evaluating Solid Waste" (SW-846).

5.3.6 Site Restoration, Decontamination, and Demobilization Activities

Site restoration, decontamination, and demobilization activities include the following tasks.

- Site restoration will include backfilling of all sampling locations to the surrounding grade of the ground surface. Extensive revegetation upon completion of RRES-RS activities will likely not be required since the site is currently sparsely vegetated; however, native seed mix will be by hand dispersed over areas of significant disturbance. In addition, BMPs to control stormwater run-on and run-off will be installed or maintained, as needed.
- Disturbance from intrusive activities such as hand-auger sampling are minimal; however, any excavated subsurface soil and tuff from all sampling locations will be used to backfill the respective borings.
- Stainless steel sampling equipment will be decontaminated between sampling locations using an alconox/water solution decontamination technique in accordance with SOP-01.08, "Field Decontamination of Drilling and Sampling Equipment."
- Decontamination wastewater will be sampled and stored in a 5-gal. (19-L) plastic bucket to decontaminate sampling equipment daily and may be disposed of on-site, based on the exemption for wastewater volumes of less than 6 gal. (23 L) per day.

- All sampling and decontamination equipment, materials, and investigation-derived wastes will be removed from the site.
- A final site inspection will be conducted to assure that site restoration, decontamination, and demobilization activities are completed.

All site preparation, site field work (excavation, sampling, etc.), and site restoration activities will be documented, along with photographs with descriptive annotations taken during this phase of the work plan. The investigation-derived waste management plan for wastes generated during the ACA field activities is presented in Appendix E.

5.3.7 Post-Sampling Geodetic Survey

A post-investigation geodetic survey will be conducted at all hand-auger sampling locations to confirm the exact locations of sample collection and to ensure that any deviations from the proposed sample design are documented. The post-investigation geodetic survey will be performed in accordance with SOP-03.11, "Geodetic Surveys."

6.0 MONITORING AND SAMPLING PLAN

Currently, there are no monitoring activities at SWMU 19-001-99. It is anticipated that the ACA activities for the investigation and remediation of SWMU 19-001-99 will be the final remedy for the site. Therefore, additional post-ACA sampling or monitoring activities are not planned for the site.

7.0 SCHEDULE

Field activities associated with implementation of this ACA work plan are expected to begin in January 2004. A completion report for the ACA will be prepared and submitted to the NMED Hazardous Waste Bureau (HWB) by September 2004. The schedule for specific ACA preparation and field activities is summarized in Table 10.

8.0 REFERENCES

The following list includes all documents cited in this report. Parenthetical information following each reference provides the author, publication date, and ER ID number. This information is also included in text citations. ER ID numbers are assigned by the RRES-RS Records Processing Facility (RPF) and are used to locate the document at the RPF and, where applicable, in the RRES-RS project reference set titled "Reference Set for Operable Unit 1071."

Copies of the reference sets are maintained at the NMED Hazardous Waste Bureau; the DOE Los Alamos Site Office; US Environmental Protection Agency, Region 6; and RRES-RS project. The sets were developed to ensure that the administrative authority has all material needed to review this document, and they are updated periodically as needed.

Cordell, L., 1979. "Gravimetric Expression of Graben Faulting in Santa Fe Country and the Española Basin, New Mexico," New Mexico Geological Society Guidebook, 30th Annual Field Conference, Santa Fe, New Mexico, pp. 59–64. (Cordell 1979, 76049)

EPA (US Environmental Protection Agency), July 2000. "Guidance for Data Quality Assessment, Practical Methods for Data Analysis EPA QA/G-9," EPA/600/R-96/084, Office of Environmental Information, Washington, D.C. (EPA 2000, 73790)

Froman, D., October 25, 1953. "Proposed Housing Air Strip Housing Area," Los Alamos National Laboratory memorandum to Paul Wilson from Darol Froman, Los Alamos, New Mexico. (Froman 1953, 0643)

Gilbert, R. O., 1987. Statistical Methods for Environmental Pollution Monitoring, Van Nostrand Reinhold, New York. (Gilbert 1987, 56179).

LANL (Los Alamos National Laboratory), May 1992. "RFI Work Plan for Operable Unit 1071," Los Alamos National Laboratory document LA-UR-92-810, Los Alamos, New Mexico. (LANL 1992, 0781)

LANL (Los Alamos National Laboratory), February 1996. "Voluntary Corrective Action Completion Report for PRS 19-002, Surface Disposal Area Former TA-19," Los Alamos National Laboratory document LA-UR-96-433, Los Alamos, New Mexico. (LANL 1996, 05269)

LANL (Los Alamos National Laboratory), April 1997. "Performance Assessment and Composite Analysis for Los Alamos National Laboratory Material Disposal Area G," Los Alamos National Laboratory document LA-UR-97-85, Los Alamos, New Mexico. (LANL 1997, 63131)

LANL (Los Alamos National Laboratory), September 1997. "RFI Report for TA-19, PRSs 19-001, 19-003, and C-19-001," Los Alamos National Laboratory document LA-UR-97-3791. (LANL 1997, 71468)

LANL (Los Alamos National Laboratory), May 1998. "Hydrogeologic Workplan Los Alamos National Laboratory," Los Alamos National Laboratory Document, LA-UR-01-6511, Los Alamos, New Mexico. (LANL 1998, 59599)

LANL (Los Alamos National Laboratory), September 1998. "Inorganic and Radionuclide Background Data for Soils, Canyon Sediments, and Bandelier Tuff at Los Alamos National Laboratory," Los Alamos National Laboratory document LA-UR-98-4847, Los Alamos, New Mexico. (LANL 1998, 59730)

LANL (Los Alamos National Laboratory), November 1998. "Installation Work Plan for Environmental Restoration Project, Revision 7," Los Alamos National Laboratory document LA-UR-98-4652, Los Alamos, New Mexico. (LANL 1998, 62060)

LANL (Los Alamos National Laboratory), September 2002. "Environmental Surveillance at Los Alamos during 2001," Los Alamos National Laboratory report LA-13979-ENV, Los Alamos, New Mexico. (LANL 2002, 73876)

LASL (Los Alamos Scientific Laboratory), January 23, 1947. "Nomenclature; Technical Areas Assigned to the Laboratory," Los Alamos, New Mexico. (LASL, 1947, 0664)

NMED (New Mexico Environment Department), June 10, 1998. "Request for Supplemental Information RFI Report for TA-19 Potential Release Sites (PRSs) 19-001, 19-003, and C-19-001," NM0890010515, Letter to T. Taylor, DOE/LAAO, and J. Browne, LANL, from Robert S. Dinwiddie, RCRA Permits Management Program, Hazardous and Radioactive Materials Bureau. (NMED 1998, 59642)

Nylander, C. L., K. A. Bitner, G. Cole, E. H. Keating, S. Kinkead, P. Longmire, B. Robinson, D. B. Rogers, and D. Vaniman, March 2003. "Groundwater Annual Status Report for Fiscal Year 2002," Los Alamos National Laboratory document LA-UR-03-0244, Los Alamos, New Mexico. (Nylander et al. 2003, 76059)

Purtymun, W. D., January 1984. "Hydrologic Characteristics of the Main Aquifer in the Los Alamos Area Development of Ground Water Supplies," Los Alamos National Laboratory report LA-9957-MS, Los Alamos, New Mexico. (Purtymun 1984, 6513)

Stauffer, P. H., K. H. Birdsell, M. Witkowski, T. Cherry, and J. Hopkins, March 2000. "Subsurface Vapor-Phase Transport of TCA at MDA L: Model Predictions," Los Alamos National Laboratory report LA-UR-00-2080, Los Alamos, New Mexico. (Stauffer et al. 2000, 69794)

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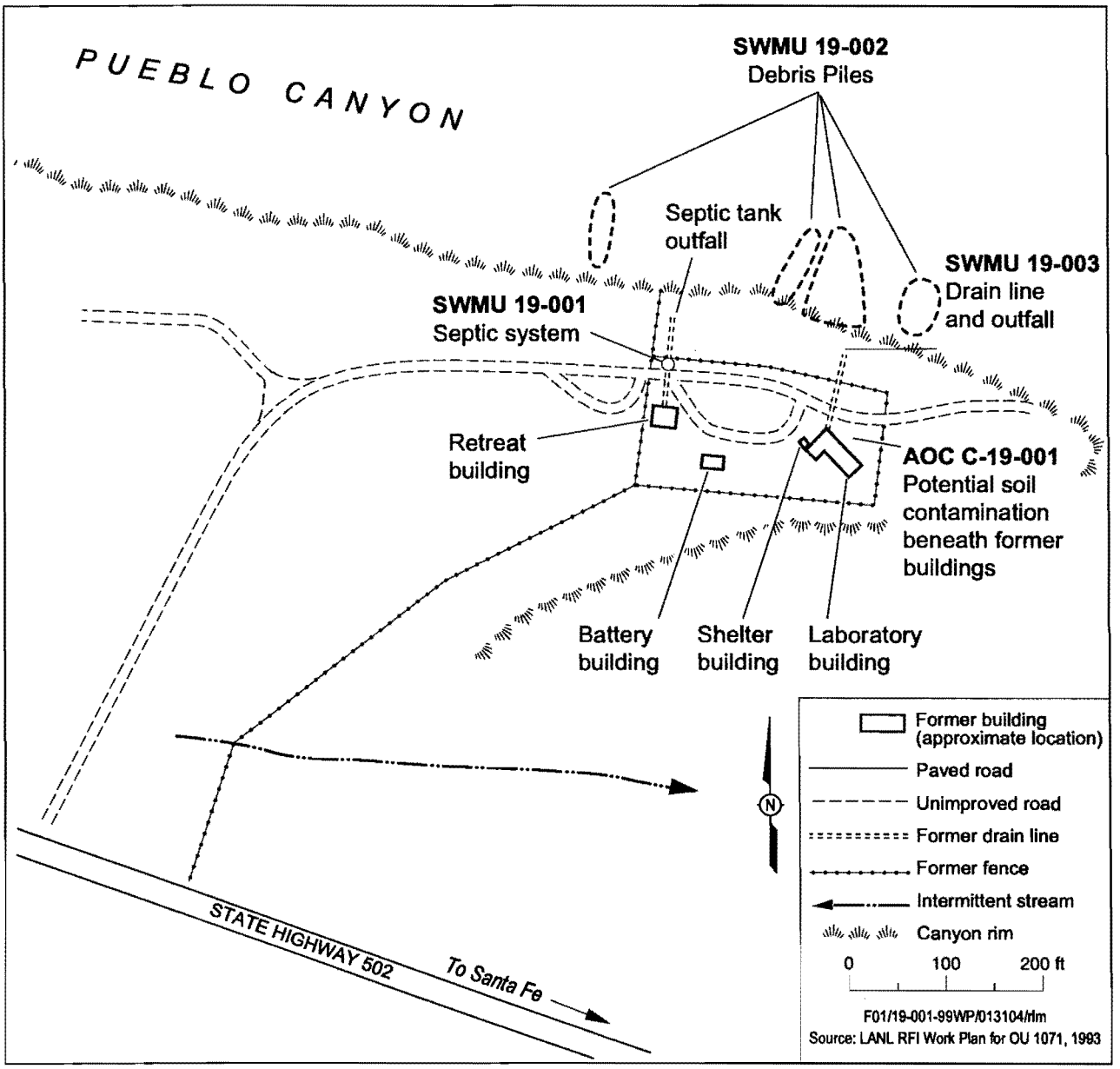

Figure 1. Consolidated SWMU 19-001-99

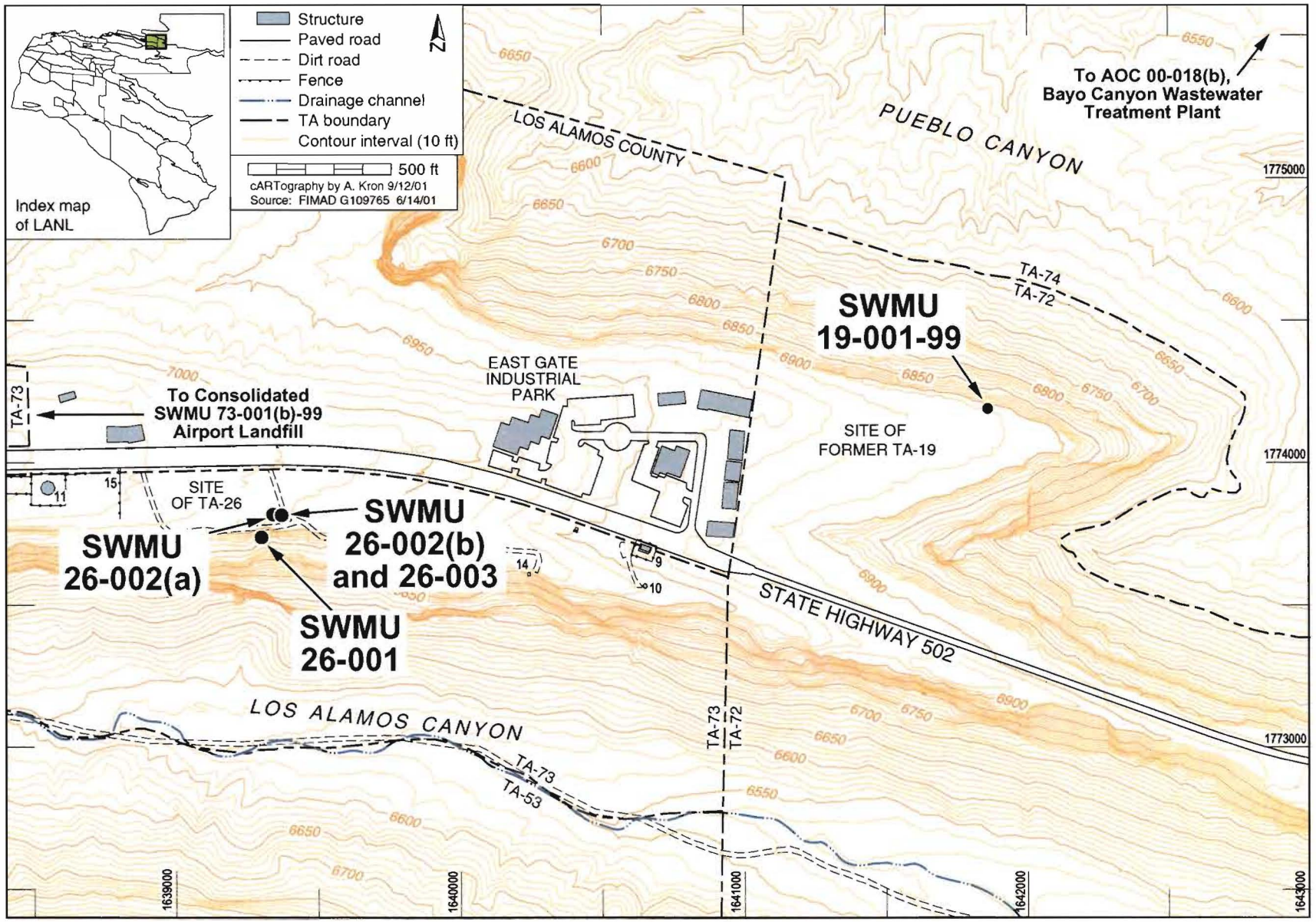

Figure 2. **SWMUs and AOC in the vicinity of SWMU 19-001-99**

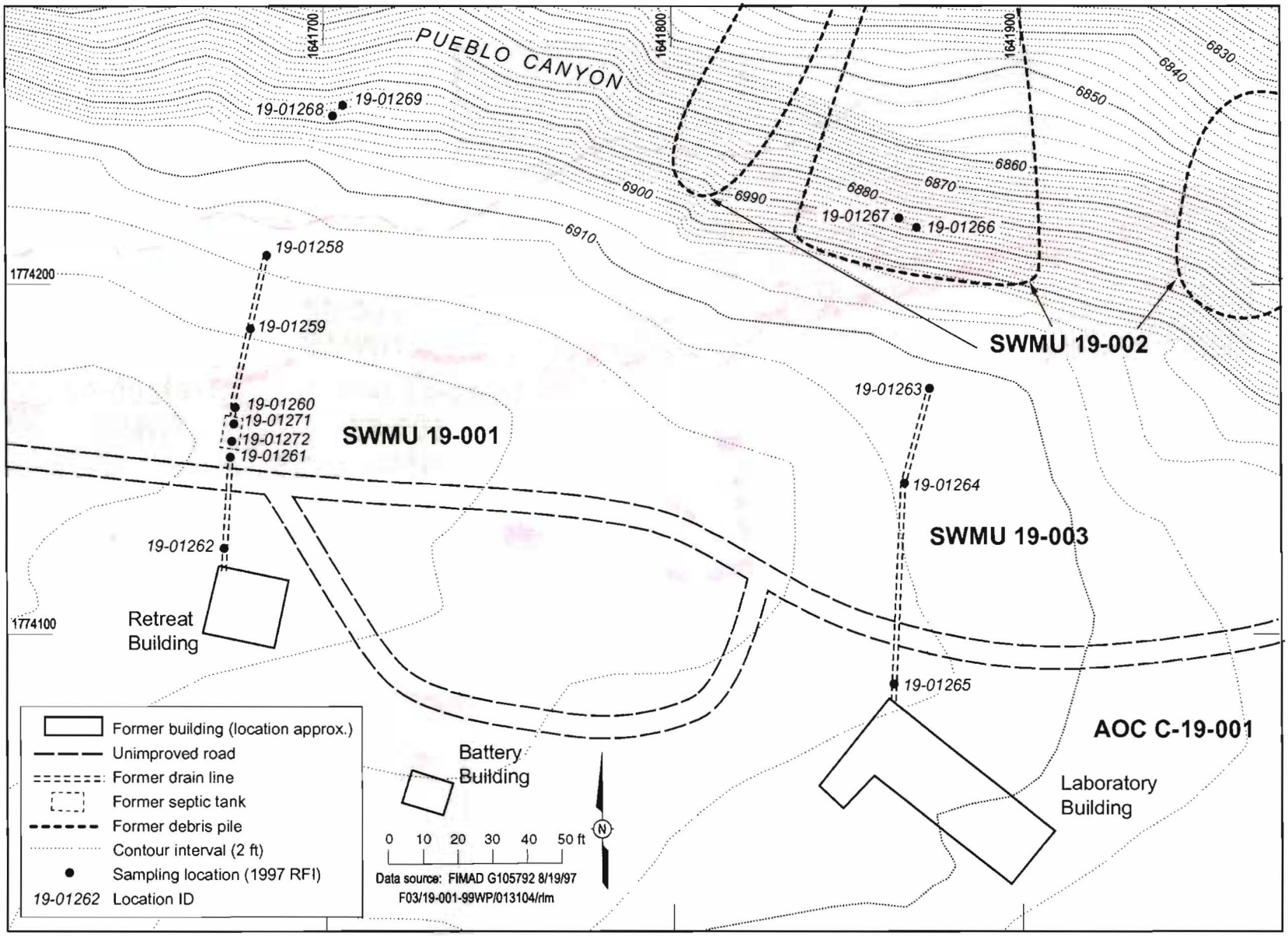

Figure 3. Location of historical soil and tuff samples at consolidated SWMU 19-001-99

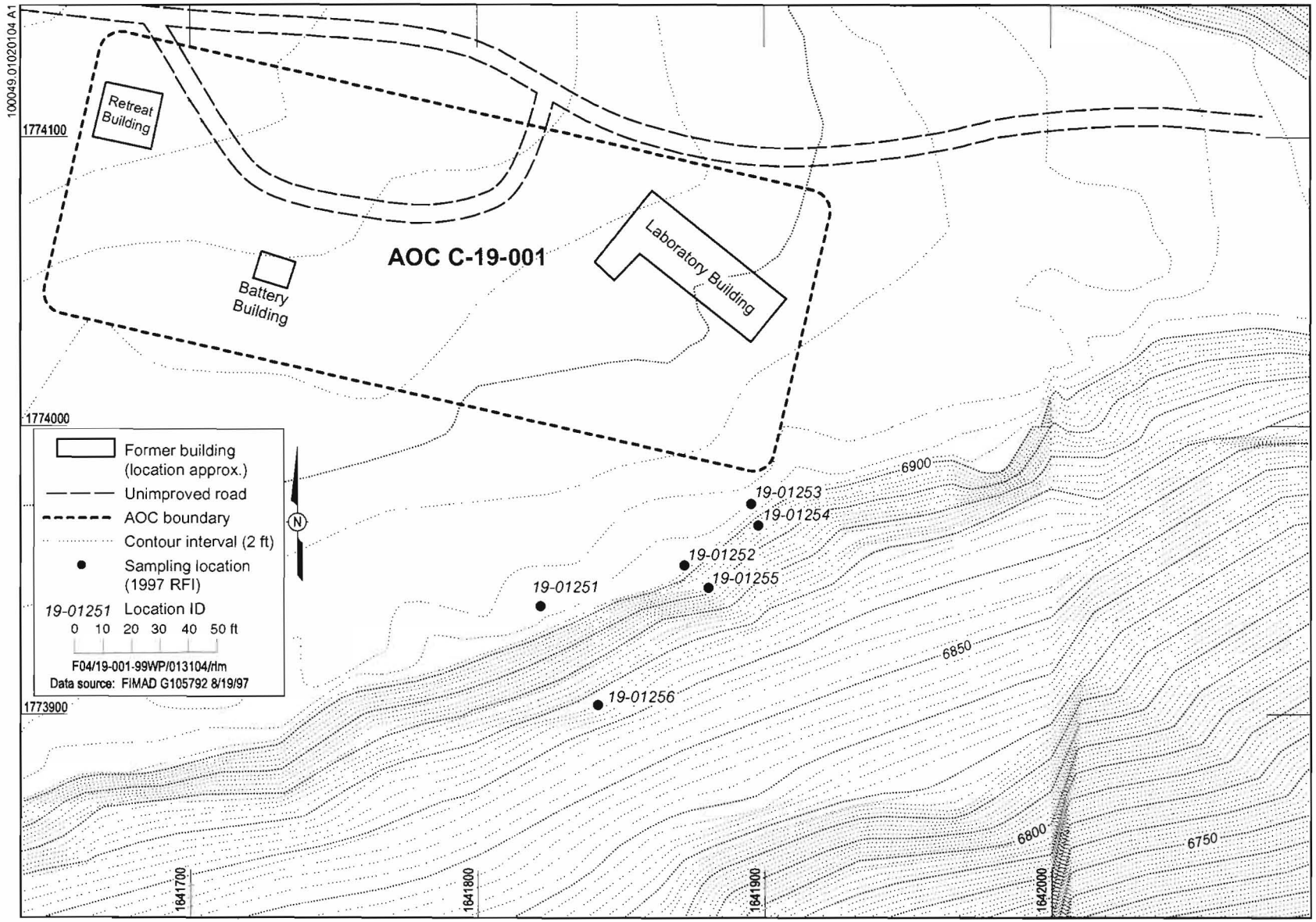

Figure 4. Location of historical soil and tuff samples on the South Mesa slope, SWMU 19-001-99

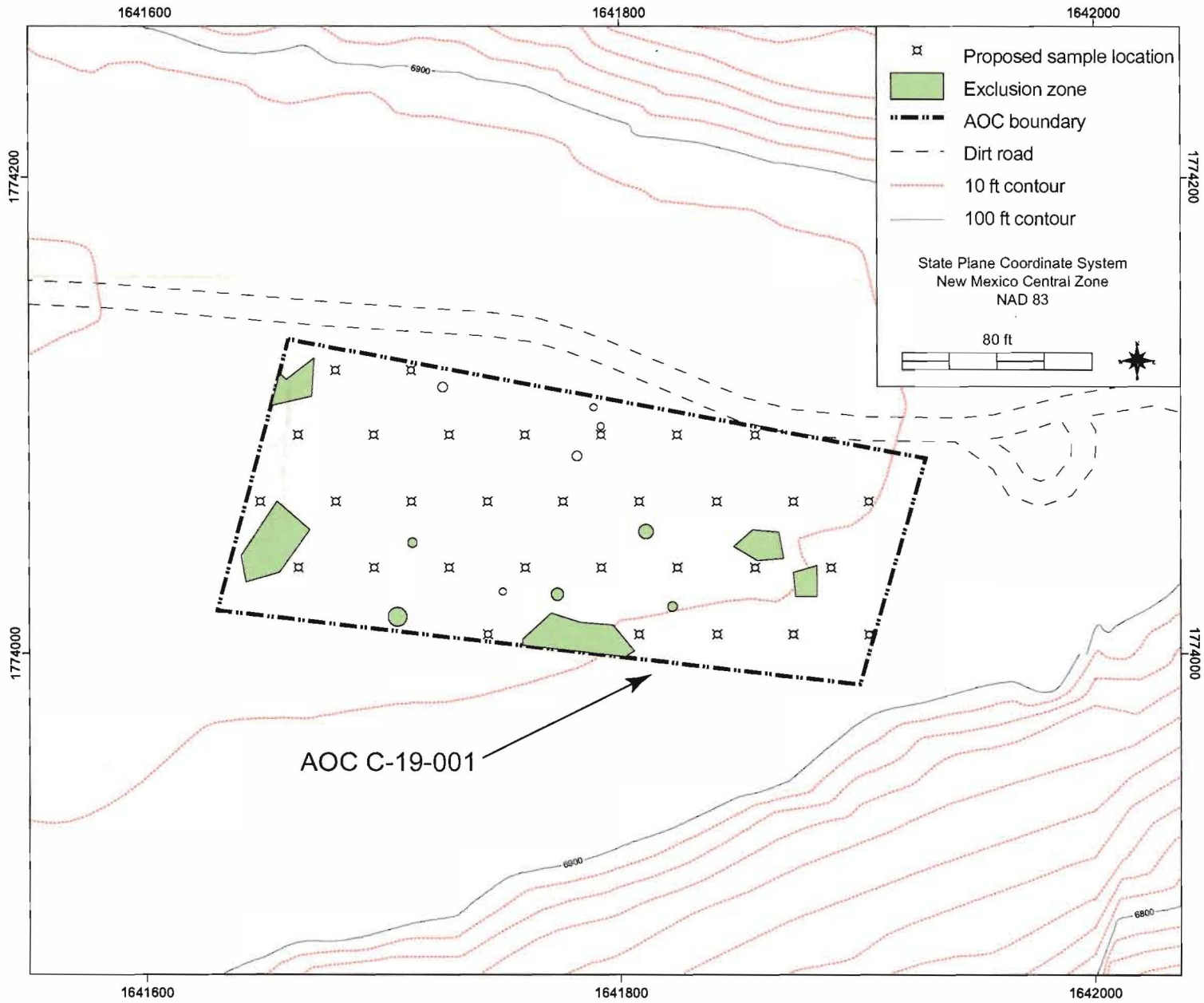

Figure 5. Proposed sampling locations for the mesa top at SWMU 19-001-99

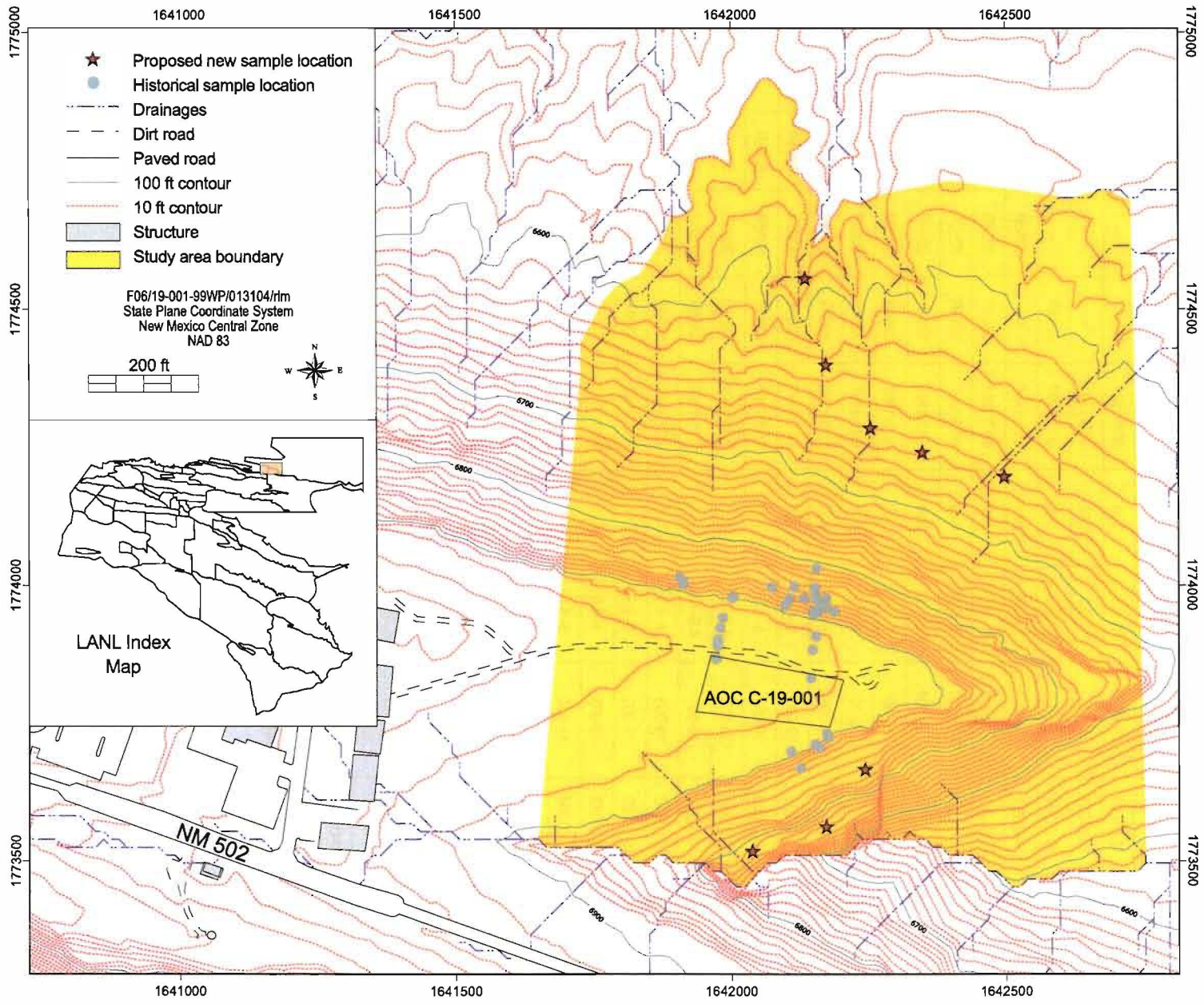

Figure 6. Proposed sampling locations for the mesa slopes at SWMU 19-001-99

Table 1
Historical Soil and Tuff Samples Collected for Fixed Laboratory Analysis, SWMU 19-001-99

Sample ID	Location ID	SWMU	Depth (ft)	Medium	Collection Date	Analytical Methods			
						Metals	SVOCs	VOCs	Gamma Spectroscopy
0119-95-0002	19-01001	19-002	0–0.5	Soil	6/22/1995	—*	548	548	550
0119-95-0003	19-01002	19-002	0–0.5	Soil	6/22/1995	—	548	548	550
0119-95-0024	19-01022	19-002	0–0.5	Soil	8/29/1995	—	—	1019	—
0119-95-0025	19-01023	19-002	0–0.5	Soil	8/29/1995	—	—	1019	—
0119-95-0026	19-01024	19-002	0–0.5	Soil	8/29/1995	—	—	1019	—
0119-97-0051	19-01251	C-19-001	0–0.5	Soil	6/17/1997	3254R	—	3253R	3255R
0119-97-0057	19-01251	C-19-001	0–0.5	Soil	6/20/1997	—	3256R	—	—
0119-97-0052	19-01252	C-19-001	0–0.5	Soil	6/17/1997	3254R	3253R	3253R	3255R
0119-97-0053	19-01253	C-19-001	0–0.5	Soil	6/16/1997	3254R	3253R	3253R	3255R
0119-97-0054	19-01254	C-19-001	0–0.5	Soil	6/17/1997	3254R	3253R	3253R	3255R
0119-97-0056	19-01255	C-19-001	0–0.5	Soil	6/17/1997	3254R	3253R	3253R	3255R
0119-97-0055	19-01256	C-19-001	0–0.5	Soil	6/17/1997	3254R	3253R	3253R	3255R
0119-97-0058	19-01258	19-001	5–5.3	Tuff	7/15/1997	3386R	3385R	3385R	3387R
0119-97-0059	19-01259	19-001	5–5.3	Tuff	7/15/1997	3386R	3385R	3385R	3387R
0119-97-0060	19-01260	19-001	5–5.3	Tuff	7/15/1997	3386R	3385R	3385R	3387R
0119-97-0061	19-01261	19-001	4.5–4.8	Tuff	7/15/1997	3386R	3385R	3385R	3387R
0119-97-0062	19-01262	19-001	4.5–4.8	Tuff	7/15/1997	3386R	3385R	3385R	3387R
0119-97-0063	19-01263	19-003	3–3.3	Tuff	7/15/1997	3386R	3385R	3385R	3387R
0119-97-0077	19-01263	19-003	3–3.3	Tuff	7/15/1997	3386R	3385R	3385R	3387R
0119-97-0073	19-01263	19-003	4–4.3	Tuff	7/17/1997	3424R	3423R	3423R	3425R
0119-97-0064	19-01264	19-003	3–3.3	Tuff	7/15/1997	3386R	3385R	3385R	3387R
0119-97-0065	19-01265	19-003	3–3.3	Tuff	7/15/1997	3386R	3385R	3385R	3387R
0119-97-0066	19-01266	19-002/19-003	0–0.25	Soil	7/15/1997	3386R	3385R	3385R	3387R
0119-97-0067	19-01267	19-002/19-003	0–0.25	Soil	7/15/1997	3386R	3385R	3385R	3387R
0119-97-0068	19-01268	19-001	0–0.25	Soil	7/15/1997	3386R	3385R	3385R	3387R
0119-97-0069	19-01269	19-001	0–0.25	Soil	7/15/1997	3386R	3385R	3385R	3387R
0119-97-0071	19-01271	19-001	10–10.5	Tuff	7/17/1997	3424R	3423R	3423R	3425R
0119-97-0072	19-01272	19-001	10–10.5	Tuff	7/17/1997	3424R	3423R	3423R	3425R
0119-97-0076	19-01272	19-003	10–10.5	Tuff	7/17/1997	3424R	3423R	3423R	3425R

* — = Analytical sampling not performed for this sample.

Table 2
Historical Inorganic Chemical Data Summary,
SWMU 19-001-99

Chemical	Medium	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	BV[a] (mg/kg)[b]
Aluminum	Soil	10	10	2100–8300	29,200
	Tuff	11	11	793–4,990	7340
Antimony	Soil	10	0	[4.53][c]–[11.0]	0.83
	Tuff	11	0	[0.70]–[4.99]	0.50
Arsenic	Soil	10	10	1–6.7	8.17
	Tuff	11	11	0.56–3.26	2.79
Barium	Soil	10	10	35.7–140	295
	Tuff	11	11	27.0–82.0	46.0
Beryllium	Soil	10	9	0.42–0.94	1.83
	Tuff	11	4	[0.34]–0.90	1.21
Cadmium	Soil	10	2	[0.49]–10.3	0.40
	Tuff	11	0	[0.08]–[0.50]	1.63
Calcium	Soil	10	10	1510–10,000	6120
	Tuff	11	11	1830–27,400	2200
Chromium	Soil	10	10	2.00–6.30	19.3
	Tuff	11	10	[0.98]–2.50	7.14
Cobalt	Soil	10	10	1.40–3.40	8.64
	Tuff	11	4	[0.84]–1.70	3.14
Copper	Soil	10	10	2.80–128	14.7
	Tuff	11	11	1.20–2.89	4.66
Iron	Soil	10	10	2340–8800	21,500
	Tuff	11	11	1030–4400	14,500
Lead	Soil	10	10	11.0–173	22.3
	Tuff	11	11	4.49–11.0	11.2
Magnesium	Soil	10	10	500–1900	4610
	Tuff	11	11	549–4,390	1690
Manganese	Soil	10	10	102–6210	671
	Tuff	11	11	47.7–113	482
Mercury	Soil	10	2	[0.05]–3.31	0.10
	Tuff	11	2	[0.02]–0.06	0.10
Nickel	Soil	10	9	[2.10]–7.24	15.4
	Tuff	11	11	1.87–4.00	6.58
Potassium	Soil	10	10	409–1600	3460
	Tuff	11	11	242–905	3500
Selenium	Soil	10	0	[0.23]–[0.33]	1.52
	Tuff	11	1	[0.20]–[0.57]	0.30
Silver	Soil	10	0	[0.45]–[2.20]	1.00
	Tuff	11	0	[0.25]–[0.50]	1.00
Sodium	Soil	10	10	73.0–315	915
	Tuff	11	11	84.9–760	2770

Table 2 (continued)

Chemical	Medium	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	BV[a] (mg/kg)
Thallium	Soil	10	0	[0.18]–[1.10]	0.73
	Tuff	11	0	[0.16]–[0.46]	1.10
Vanadium	Soil	10	10	4.70–13.0	39.6
	Tuff	11	11	3.20–7.30	17.0
Zinc	Soil	10	10	30.0–6380	48.8
	Tuff	11	11	5.73–102	63.5

[a] BV = Background value (LANL 1998, 59730).

[b] mg/kg = Milligram(s) per kilogram.

[c] [ ] = The chemical was undetected; detection limit shown.

Table 3
Historical Analytical Results of Inorganic Chemicals Above BVs,
SWMU 19-001-99

Chemical	Location ID Number	Sample ID Number	Sample Concentration (mg/kg)	BV [a] (mg/kg)	Medium	Depth (ft)
Antimony	19-01251	0119-97-0051	10 (UJ)	0.83	Soil	0–0.5
	19-01255	0119-97-0056	10 (UJ)	0.83	Soil	0–0.5
	19-01252	0119-97-0052	11 (UJ)	0.83	Soil	0–0.5
	19-01253	0119-97-0053	11 (UJ)	0.83	Soil	0–0.5
	19-01254	0119-97-0054	11 (UJ)	0.83	Soil	0–0.5
	19-01256	0119-97-0055	11 (UJ)	0.83	Soil	0–0.5
	19-01266	0119-97-0066	4.53 (U)	0.83	Soil	0–0.25
	19-01267	0119-97-0067	4.59 (U)	0.83	Soil	0–0.25
	19-01268	0119-97-0068	4.9 (U)	0.83	Soil	0–0.25
	19-01269	0119-97-0069	4.9 (U)	0.83	Soil	0–0.25
	19-01271	0119-97-0071	0.7 (U)	0.50	Tuff	10–10.5
	19-01272	0119-97-0072	0.7 (U)	0.50	Tuff	10–10.5
	19-01263	0119-97-0073	0.71 (U)	0.50	Tuff	4–4.3
	19-01263	0119-97-0063	4.19 (U)	0.50	Tuff	3–3.3
	19-01262	0119-97-0062	4.21 (U)	0.50	Tuff	4.5–4.8
	19-01260	0119-97-0060	4.69 (U)	0.50	Tuff	5–5.3
	19-01261	0119-97-0061	4.72 (U)	0.50	Tuff	4.5–4.8
	19-01264	0119-97-0064	4.86 (U)	0.50	Tuff	3–3.3
	19-01259	0119-97-0059	4.89 (U)	0.50	Tuff	5–5.3
	19-01265	0119-97-0065	4.92 (U)	0.50	Tuff	3–3.3
	19-01258	0119-97-0058	4.99 (U)	0.50	Tuff	5–5.3
Arsenic	19-01263	0119-97-0073	3.1	2.79	Tuff	4–4.3
	19-01265	0119-97-0065	3.26 (J-)	2.79	Tuff	3–3.3
Barium	19-01272	0119-97-0072	46.5	46.0	Tuff	10–10.5
	19-01263	0119-97-0063	48.5	46.0	Tuff	3–3.3
	19-01264	0119-97-0064	55	46.0	Tuff	3–3.3
	19-01260	0119-97-0060	59.7	46.0	Tuff	5–5.3
	19-01265	0119-97-0065	70.8	46.0	Tuff	3–3.3
	19-01263	0119-97-0073	82	46.0	Tuff	4–4.3
Cadmium	19-01267	0119-97-0067	1.36	0.40	Soil	0–0.25
	19-01266	0119-97-0066	10.3	0.40	Soil	0–0.25
	19-01268	0119-97-0068	0.49 (U)	0.40	Soil	0–0.25
	19-01269	0119-97-0069	0.49 (U)	0.40	Soil	0–0.25
	19-01251	0119-97-0051	0.52 (U)	0.40	Soil	0–0.5
	19-01255	0119-97-0056	0.52 (U)	0.40	Soil	0–0.5
	19-01252	0119-97-0052	0.53 (U)	0.40	Soil	0–0.5
	19-01253	0119-97-0053	0.53 (U)	0.40	Soil	0–0.5
	19-01254	0119-97-0054	0.54 (U)	0.40	Soil	0–0.5
	19-01256	0119-97-0055	0.56 (U)	0.40	Soil	0–0.5

Table 3 (continued)

Chemical	Location ID Number	Sample ID Number	Sample Concentration (mg/kg)	BV[a] (mg/kg)	Medium	Depth (ft)
Copper	19-01268	0119-97-0068	17.8	14.7	Soil	0–0.25
	19-01267	0119-97-0067	20.5	14.7	Soil	0–0.25
	19-01266	0119-97-0066	128	14.7	Soil	0–0.25
Lead	19-01256	0119-97-0055	27	22.3	Soil	0–0.5
	19-01267	0119-97-0067	68.6	22.3	Soil	0–0.25
	19-01266	0119-97-0066	173 (J+)[b]	22.3	Soil	0–0.25
	19-01268	0119-97-0068	32.9 (J+)	22.3	Soil	0–0.25
Manganese	19-01267	0119-97-0067	1,790 (J-)[c]	671	Soil	0–0.25
	19-01266	0119-97-0066	6,210 (J-)	671	Soil	0–0.25
Mercury	19-01267	0119-97-0067	0.464	0.10	Soil	0–0.25
	19-01266	0119-97-0066	3.31	0.10	Soil	0–0.25
	19-01252	0119-97-0052	0.11 (U)[d]	0.10	Soil	0–0.5
	19-01253	0119-97-0053	0.11 (U)	0.10	Soil	0–0.5
	19-01254	0119-97-0054	0.11 (U)	0.10	Soil	0–0.5
	19-01256	0119-97-0055	0.11 (U)	0.10	Soil	0–0.5
Selenium	19-01265	0119-97-0065	0.387 (J)	0.30	Tuff	3–3.3
	19-01271	0119-97-0071	0.56 (U)	0.30	Tuff	10–10.5
	19-01272	0119-97-0072	0.56 (U)	0.30	Tuff	10–10.5
	19-01263	0119-97-0073	0.57 (U)	0.30	Tuff	4–4.3
Silver	19-01251	0119-97-0051	2.1 (U)	1.00	Soil	0–0.5
	19-01252	0119-97-0052	2.1 (U)	1.00	Soil	0–0.5
	19-01253	0119-97-0053	2.1 (U)	1.00	Soil	0–0.5
	19-01255	0119-97-0056	2.1 (U)	1.00	Soil	0–0.5
	19-01254	0119-97-0054	2.2 (U)	1.00	Soil	0–0.5
	19-01256	0119-97-0055	2.2 (U)	1.00	Soil	0–0.5
Thallium	19-01251	0119-97-0051	1 (UJ)[e]	0.73	Soil	0–0.5
	19-01255	0119-97-0056	1 (UJ)	0.73	Soil	0–0.5
	19-01252	0119-97-0052	1.1 (UJ)	0.73	Soil	0–0.5
	19-01253	0119-97-0053	1.1 (UJ)	0.73	Soil	0–0.5
	19-01254	0119-97-0054	1.1 (UJ)	0.73	Soil	0–0.5
	19-01256	0119-97-0055	1.1 (UJ)	0.73	Soil	0–0.5
Zinc	19-01256	0119-97-0055	51	48.8	Soil	0–0.5
	19-01267	0119-97-0067	2,540	48.8	Soil	0–0.25
	19-01266	0119-97-0066	6,380	48.8	Soil	0–0.25
	19-01271	0119-97-0071	102	63.5	Tuff	10–10.5

[a] BV = Background value (LANL 1998, 59730).

[b] (J+) = The chemical was positively identified and the result is likely biased high.

[c] (J-) = The chemical was positively identified and the result is likely biased low.

[d] (U) = The chemical was undetected; value provided is the detection limit.

[e] (UJ) = The chemical was undetected; value provided is the detection limit.

Table 4
Historical Radionuclide Chemical Data Summary,
SWMU 19-001-99

Chemical	Medium	Number of Analyses	Number of Detects	Activity Range (pCi/g)[b]	BV[a] or Fallout Value (pCi/g)
Americium-241	Soil	12	0	[0.02]–[0.14][c]	0.013
	Tuff	11	0	[-0.22]–[0.20]	0.05
Cesium-134	Soil	4	0	[-0.01]–[0.04]	na[d]
	Tuff	11	0	[-0.03]–[0.04]	na
Cesium-137	Soil	12	12	0.21–5.85	1.65
	Tuff	11	1	[-0.03]–0.14	0.10
Cobalt-60	Soil	12	0	[-0.09]–[0.05]	na
	Tuff	11	0	[-0.05]–[0.04]	na
Europium-152	Soil	12	1	[-0.24]–[0.35]	na
	Tuff	11	0	[-0.11]–[0.70]	na
Ruthenium-106	Soil	12	0	[-0.71]–[0.16]	na
	Tuff	11	0	[-0.31]–[0.25]	na
Sodium-22	Soil	12	0	[-0.06]–[0.03]	na
	Tuff	11	0	[-0.03]–[0.03]	na
Uranium-235	Soil	4	0	[-0.08]–[0.31]	0.20
	Tuff	11	0	[0.01]–[0.88]	0.09

[a] BV = Background value (LANL 1998, 59730).

[b] pCi/g = picoCuries(s) per gram.

[c] [ ] = The chemical was undetected; minimum detectable activity is shown.

[d] na = Not available.

Table 5
Historical Analytical Results of Radionuclides Above BVs/Fallout Values, SWMU 19-001-99

Chemical	Location ID Number	Sample ID Number	Sample Activity (pCi/g)	BV or Fallout Value (pCi/g)	Medium	Depth (ft)
Cesium-137	19-01267	0119-97-0067	2.08	1.65	Soil	0–0.25
Cesium-137	19-01266	0119-97-0066	2.49	1.65	Soil	0–0.25
Cesium-137	19-01268	0119-97-0068	5.85	1.65	Soil	0–0.25
Cesium-137	19-01264	0119-97-0064	0.14	0.10	Tuff	3–3.3
Europium-152	19-01001	0119-95-0002	0.201	na	Soil	0–0.5

Table 6
Historical Organic Chemical Data Summary,
SWMU 19-001-99

Chemical	Medium	Number of Analyses	Number of Detects	Concentration Range (mg/kg)[a]	EQL[b] (mg/kg)
Acenaphthene	Soil	12	1	0.14–[3.40][c]	3.40
	Tuff	11	3	[0.33]–6.60	0.34
Acenaphthylene	Soil	12	1	0.07–[3.40]	3.40
Acetone	Soil	15	1	[0.01]–0.20	0.04
	Tuff	11	3	[0.002]–0.04	0.02
Anthracene	Tuff	11	4	0.04–8.80	0.34
Benzo(a)anthracene	Soil	12	1	0.19–[3.40]	3.40
	Tuff	11	6	0.07–15.0	0.34
Benzo(a)pyrene	Tuff	11	5	0.07–13.0	0.34
Benzo(b)fluoranthene	Soil	12	3	[0.09]–[3.40]	3.40
	Tuff	11	5	0.09–16.0	0.34
Benzo(g,h,i)perylene	Tuff	11	3	[0.33]–4.10	0.34
Benzo(k)fluoranthene	Tuff	11	3	0.18–5.70	0.34
Bis(2-ethylhexyl)phthalate	Soil	12	1	[0.07]–[3.40]	3.40
	Tuff	11	3	0.14–0.36	0.34
Butanone[2-]	Soil	15	2	0.002–[0.02]	0.02
Carbazole	Soil	5	2	0.05–[0.68]	0.68
	Tuff	8	3	[0.33]–3.80	0.34
Chrysene	Soil	12	3	[0.12]–[3.40]	3.40
	Tuff	11	6	0.08–14.0	0.34
Dibenz(a,h)anthracene	Tuff	11	2	[0.33]–1.40	0.34
Dibenzofuran	Soil	12	3	0.04–[3.40]	3.40
	Tuff	11	3	0.16–2.40	0.34
Dichloroethene[1,1-]	Soil	15	1	0.003–[0.006]	0.006
Fluoranthene	Soil	11	4	0.13–2.60	0.36
	Tuff	11	9	0.05–27.0	0.34
Fluorene	Soil	12	1	0.19–[3.40]	3.40
	Tuff	11	3	[0.33]–3.50	0.34
Indeno(1,2,3-cd)pyrene	Tuff	11	3	[0.33]–4.90	0.34
Methylene Chloride	Soil	15	4	[0.003]–0.012	0.006
	Tuff	11	9	0.003–0.009	0.005
Methylnaphthalene[2-]	Soil	12	2	0.33–[3.40]	3.40
	Tuff	11	3	0.04–1.10	0.34
Naphthalene	Soil	14	2	[0.005]–[3.40]	3.40
	Tuff	11	3	0.06–2.00	0.34

Table 6 (continued)

Chemical	Medium	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	EQL (mg/kg)
Phenanthrene	Soil	11	3	[0.19]–3.20	0.68
	Tuff	11	9	0.04–26.0	0.34
Pyrene	Soil	12	4	0.13–[3.40]	3.40
	Tuff	11	10	0.04–25.0	0.34
Toluene	Soil	15	7	0.004–0.21	0.006
Trichloro-1,2,2-trifluoroethane[1,1,2-]	Soil	12	1	[0.003]–[0.006]	0.006

[a] mg/kg = Milligram(s) per kilogram.

[b] EQL = Estimated quantitation limit.

[c] [ ] = The chemical was undetected; detection limit is shown.

Table 7
Historical Analytical Results of Detected Organic Chemicals,
SWMU 19-001-99

Chemical	Location ID Number	Sample ID Number	Sample Concentration (mg/kg)[a]	Medium	Depth (ft)
Acenaphthene	19-01268	0119-97-0068	0.14 (J)[b]	Soil	0 – 0.25
	19-01261	0119-97-0061	0.34	Tuff	4.5 – 4.8
	19-01258	0119-97-0058	5.7	Tuff	5 – 5.3
	19-01264	0119-97-0064	6.6	Tuff	3 – 3.3
	19-01268	0119-97-0068	0.072 (J)	Soil	0 – 0.25
Acetone	19-01255	0119-97-0056	0.2 (J+)[c]	Soil	0 – 0.5
	19-01271	0119-97-0071	0.034	Tuff	10 – 10.5
	19-01272	0119-97-0072	0.041	Tuff	10 – 10.5
	19-01263	0119-97-0073	0.044	Tuff	4 – 4.3
Anthracene	19-01261	0119-97-0061	1	Tuff	4.5 – 4.8
	19-01258	0119-97-0058	7.6	Tuff	5 – 5.3
	19-01264	0119-97-0064	8.8	Tuff	3 – 3.3
	19-01259	0119-97-0059	0.038 (J)	Tuff	5 – 5.3
Benzo(a)anthracene	19-01268	0119-97-0068	0.19 (J)	Soil	0 – 0.25
	19-01263	0119-97-0073	0.2	Tuff	4 – 4.3
	19-01272	0119-97-0072	0.25	Tuff	10 – 10.5
	19-01261	0119-97-0061	1.8	Tuff	4.5 – 4.8
	19-01258	0119-97-0058	13	Tuff	5 – 5.3
	19-01259	0119-97-0059	0.074 (J)	Tuff	5 – 5.3
	19-01264	0119-97-0064	15 (J)	Tuff	3 – 3.3
Benzo(a)pyrene	19-01272	0119-97-0072	0.19	Tuff	10 – 10.5
	19-01261	0119-97-0061	1.5	Tuff	4.5 – 4.8
	19-01258	0119-97-0058	13	Tuff	5 – 5.3
	19-01264	0119-97-0064	13	Tuff	3 – 3.3
	19-01259	0119-97-0059	0.07 (J)	Tuff	5 – 5.3
Benzo(b)fluoranthene	19-01267	0119-97-0067	0.14 (J)	Soil	0 – 0.25
	19-01269	0119-97-0069	0.17 (J)	Soil	0 – 0.25
	19-01268	0119-97-0068	0.77 (J)	Soil	0 – 0.25
	19-01272	0119-97-0072	0.19	Tuff	10 – 10.5
	19-01261	0119-97-0061	2.4	Tuff	4.5 – 4.8
	19-01264	0119-97-0064	14	Tuff	3 – 3.3
	19-01258	0119-97-0058	16	Tuff	5 – 5.3
	19-01259	0119-97-0059	0.089 (J)	Tuff	5 – 5.3
Benzo(g,h,i)perylene	19-01261	0119-97-0061	0.65	Tuff	4.5 – 4.8
	19-01264	0119-97-0064	4	Tuff	3 – 3.3
	19-01258	0119-97-0058	4.1	Tuff	5 – 5.3

Table 7 (continued)

Chemical	Location ID Number	Sample ID Number	Sample Concentration (mg/kg)	Medium	Depth (ft)
Benzo(k)fluoranthene	19-01272	0119-97-0072	0.18	Tuff	10 – 10.5
	19-01258	0119-97-0058	5.1	Tuff	5 – 5.3
	19-01264	0119-97-0064	5.7	Tuff	3 – 3.3
Bis(2-ethylhexyl)phthalate	19-01268	0119-97-0068	0.14 (J)	Soil	0 – 0.25
	19-01264	0119-97-0064	0.14 (J)	Tuff	3 – 3.3
	19-01261	0119-97-0061	0.16 (J)	Tuff	4.5 – 4.8
	19-01258	0119-97-0058	0.36 (J)	Tuff	5 – 5.3
Butanone[2-]	19-01267	0119-97-0067	0.002 (J)	Soil	0–0.25
	19-01266	0119-97-0066	0.003 (J)	Soil	0–0.25
Carbazole	19-01269	0119-97-0069	0.051 (J)	Soil	0–0.25
	19-01268	0119-97-0068	0.21 (J)	Soil	0–0.25
	19-01261	0119-97-0061	0.79	Tuff	4.5–4.8
	19-01258	0119-97-0058	3.2	Tuff	5–5.3
	19-01264	0119-97-0064	3.8	Tuff	3–3.3
Chrysene	19-01252	0119-97-0052	0.56	Soil	0–0.5
	19-01268	0119-97-0068	0.7600001	Soil	0–0.25
	19-01269	0119-97-0069	0.2 (J)	Soil	0–0.25
	19-01263	0119-97-0073	0.21	Tuff	4–4.3
	19-01272	0119-97-0072	0.26	Tuff	10–10.5
	19-01261	0119-97-0061	1.9	Tuff	4.5–4.8
	19-01258	0119-97-0058	13	Tuff	5–5.3
	19-01259	0119-97-0059	0.08 (J)	Tuff	5–5.3
	19-01264	0119-97-0064	14 (J)	Tuff	3–3.3
Dibenz(a,h)anthracene	19-01258	0119-97-0058	1.4	Tuff	5–5.3
	19-01264	0119-97-0064	1.4	Tuff	3–3.3
Dibenzofuran	19-01252	0119-97-0052	0.47	Soil	0–0.25
	19-01269	0119-97-0069	0.037 (J)	Soil	0–0.25
	19-01268	0119-97-0068	0.33 (J)	Soil	0–0.25
	19-01258	0119-97-0058	2	Tuff	5–5.3
	19-01264	0119-97-0064	2.4	Tuff	3–3.3
	19-01261	0119-97-0061	0.16 (J)	Tuff	4.5–4.8
Dichloroethene[1,1-]	19-01024	0119-95-0026	0.003 (J)	Soil	0–0.5
Fluoranthene	19-01269	0119-97-0069	0.6300001	Soil	0–0.25
	19-01252	0119-97-0052	2	Soil	0–0.5
	19-01268	0119-97-0068	2.6	Soil	0–0.25
	19-01267	0119-97-0067	0.13 (J)	Soil	0–0.25
	19-01263	0119-97-0073	0.43	Tuff	4–4.3
	19-01272	0119-97-0072	0.53	Tuff	10–10.5

Table 7 (continued)

Chemical	Location ID Number	Sample ID Number	Sample Concentration (mg/kg)	Medium	Depth (ft)
Fluoranthene	19-01261	0119-97-0061	4	Tuff	4.5–4.8
	19-01258	0119-97-0058	23	Tuff	5–5.3
	19-01264	0119-97-0064	27	Tuff	3–3.3
	19-01263	0119-97-0063	0.048 (J)	Tuff	3–3.3
	19-01260	0119-97-0060	0.06 (J)	Tuff	5–5.3
	19-01262	0119-97-0062	0.065 (J)	Tuff	4.5–4.8
	19-01259	0119-97-0059	0.13 (J)	Tuff	5–5.3
Fluorene	19-01268	0119-97-0068	0.19 (J)	Soil	0–0.25
	19-01261	0119-97-0061	0.35	Tuff	4.5–4.8
	19-01258	0119-97-0058	3.2	Tuff	5–5.3
	19-01264	0119-97-0064	3.5	Tuff	3–3.3
Indeno(1,2,3-cd)pyrene	19-01261	0119-97-0061	0.6300001	Tuff	4.5–4.8
	19-01264	0119-97-0064	4.8	Tuff	3–3.3
	19-01258	0119-97-0058	4.9	Tuff	5–5.3
Methylene Chloride	19-01269	0119-97-0069	0.006	Soil	0–0.25
	19-01266	0119-97-0066	0.009	Soil	0–0.25
	19-01255	0119-97-0056	0.011 (J+)	Soil	0–0.5
	19-01267	0119-97-0067	0.012 (J)	Soil	0–0.25
	19-01271	0119-97-0071	0.0061	Tuff	10–10.5
	19-01263	0119-97-0063	0.007	Tuff	3–3.3
	19-01264	0119-97-0064	0.008	Tuff	3–3.3
	19-01262	0119-97-0062	0.009	Tuff	4.5–4.8
	19-01259	0119-97-0059	0.003 (J)	Tuff	5–5.3
	19-01261	0119-97-0061	0.003 (J)	Tuff	4.5–4.8
	19-01258	0119-97-0058	0.003 (J)	Tuff	5–5.3
	19-01265	0119-97-0065	0.004 (J)	Tuff	3–3.3
	19-01260	0119-97-0060	0.004 (J)	Tuff	5–5.3
Methylnaphthalene[2-]	19-01252	0119-97-0052	0.37	Soil	0–0.25
	19-01268	0119-97-0068	0.33 (J)	Soil	0–0.25
	19-01258	0119-97-0058	1	Tuff	5–5.3
	19-01264	0119-97-0064	1.1	Tuff	3–3.3
	19-01261	0119-97-0061	0.041 (J)	Tuff	4.5–4.8
Naphthalene	19-01268	0119-97-0068	1.4	Soil	0–0.25
	19-01252	0119-97-0052	1.7	Soil	0–0.5
	19-01264	0119-97-0064	1.8	Tuff	3–3.3
	19-01258	0119-97-0058	2	Tuff	5–5.3
	19-01261	0119-97-0061	0.063 (J)	Tuff	4.5–4.8

Table 7 (continued)

Chemical	Location ID Number	Sample ID Number	Sample Concentration (mg/kg)	Medium	Depth (ft)
Phenanthrene	19-01269	0119-97-0069	0.58	Soil	0–0.25
	19-01252	0119-97-0052	3.1	Soil	0–0.5
	19-01268	0119-97-0068	3.2	Soil	0–0.25
	19-01263	0119-97-0073	0.32	Tuff	4–4.3
	19-01272	0119-97-0072	0.39	Tuff	10–10.5
	19-01261	0119-97-0061	3.4	Tuff	4.5–4.8
	19-01258	0119-97-0058	23	Tuff	5–5.3
	19-01264	0119-97-0064	26	Tuff	3–3.3
	19-01263	0119-97-0063	0.038 (J)	Tuff	3–3.3
	19-01260	0119-97-0060	0.047 (J)	Tuff	5–5.3
	19-01262	0119-97-0062	0.056 (J)	Tuff	4.5–4.8
	19-01259	0119-97-0059	0.12 (J)	Tuff	5–5.3
Pyrene	19-01269	0119-97-0069	0.5	Soil	0–0.25
	19-01252	0119-97-0052	1.8	Soil	0–0.5
	19-01268	0119-97-0068	3	Soil	0–0.25
	19-01267	0119-97-0067	0.13 (J)	Soil	0–0.25
	19-01263	0119-97-0073	0.31	Tuff	4–4.3
	19-01272	0119-97-0072	0.39	Tuff	10–10.5
	19-01261	0119-97-0061	3.1	Tuff	4.5–4.8
	19-01258	0119-97-0058	24	Tuff	5–5.3
	19-01263	0119-97-0063	0.042 (J)	Tuff	3–3.3
	19-01262	0119-97-0062	0.058 (J)	Tuff	4.5–4.8
	19-01265	0119-97-0065	0.06 (J)	Tuff	3–3.3
	19-01260	0119-97-0060	0.061 (J)	Tuff	5–5.3
	19-01259	0119-97-0059	0.13 (J)	Tuff	5–5.3
	19-01264	0119-97-0064	25 (J)	Tuff	3–3.3
Toluene	19-01268	0119-97-0068	0.004 (J)	Soil	0–0.25
	19-01266	0119-97-0066	0.004 (J)	Soil	0–0.25
	19-01269	0119-97-0069	0.005 (J)	Soil	0–0.25
	19-01255	0119-97-0056	0.01 (J+)	Soil	0–0.5
	19-01267	0119-97-0067	0.011 (J)	Soil	0–0.25
	19-01001	0119-95-0002	0.028 (J)	Soil	0–0.5
	19-01002	0119-95-0003	0.21 (J)	Soil	0–0.5
Trichloro-1,2,2-trifluoroethane[1,1,2-]	19-01002	0119-95-0003	0.005 (J)	Soil	0–0.5

[a] mg/kg = Milligram(s) per kilogram.

[b] (J) = The chemical was positively identified and the result is estimated.

[c] (J+) = The chemical was positively identified and the result is likely biased high.

Table 8
Summary of Chemicals of Potential Concern, SWMU 19-001-99

Chemical	Soil	Tuff	Rationale
Inorganic Chemicals			
Aluminum	—[a]	—	Eliminated for soil and tuff because detected concentrations did not exceed established background values (BVs)
Antimony	X[b]	X	Retained for soil and tuff because detection limits exceeded established BVs
Arsenic	—	X	Retained for tuff because detected concentrations exceeded established BV
Barium	—	X	Retained for tuff because detected concentrations exceeded established BV
Beryllium	—	—	Eliminated for soil and tuff because detected concentrations did not exceed established BVs
Cadmium	X	—	Retained for soil because detected concentrations exceeded established BV
Cobalt	—	—	Eliminated for soil and tuff because detected concentrations did not exceed established BVs
Copper	X	—	Retained for soil because detected concentrations exceeded established BV
Iron	—	—	Eliminated for soil and tuff because detected concentrations did not exceed established BVs
Lead	X	—	Retained for soil because detected concentrations exceeded established BV
Manganese	X	—	Retained for soil because detected concentrations exceeded established BV
Mercury	X	—	Retained for soil because detected concentrations exceeded established BV
Nickel	—	—	Eliminated for soil and tuff because detected concentrations did not exceed established BVs
Selenium	—	X	Retained for tuff because detected concentrations exceeded established BV
Silver	X	—	Retained for soil because detection limits exceeded established BV
Thallium	X	—	Retained for soil because detection limits exceeded established BV
Vanadium	—	—	Eliminated for soil and tuff because detected concentrations did not exceed established BVs
Zinc	X	X	Retained for soil and tuff because detected concentrations exceeded established BVs
Radionuclides			
Americium-241	—	—	Eliminated for soil and tuff because there were no detected activities
Cesium-134	—	—	Eliminated for soil and tuff because there were no detected activities
Cesium-137	X	X	Retained for soil and tuff because detected activities exceeded established BVs
Cobalt-60	—	—	Eliminated for soil and tuff because there were no detected activities
Europium-152	X	—	Retained for soil because detected activities exceeded established BVs
Ruthenium-106	—	—	Eliminated for soil and tuff because there were no detected activities
Sodium-22	—	—	Eliminated for soil and tuff because there were no detected activities
Uranium-235	—	—	Eliminated for soil and tuff because there were no detected activities

Table 8 (continued)

Chemical	Soil	Tuff	Rationale
Organic Chemicals			
Acenaphthene	X	X	Retained for soil and tuff because concentrations were detected
Acenaphthylene	X	—	Retained for soil because concentrations were detected
Acetone	X	X	Retained for soil and tuff because concentrations were detected
Anthracene	—	X	Retained for tuff because concentrations were detected
Benzo(a)anthracene	X	X	Retained for soil and tuff because concentrations were detected
Benzo(a)pyrene	—	X	Retained for tuff because concentrations were detected
Benzo(b)fluoranthene	X	X	Retained for soil and tuff because concentrations were detected
Benzo(g,h,i)perylene	—	X	Retained for tuff because concentrations were detected
Benzo(k)fluoranthene	—	X	Retained for tuff because concentrations were detected
Bis(2-ethylhexyl)phthalate	X	X	Retained for soil and tuff because concentrations were detected
Butanone[2-]	X	—	Retained for soil because concentrations were detected
Carbazole	X	X	Retained for soil and tuff because concentrations were detected
Chrysene	X	X	Retained for soil and tuff because concentrations were detected
Dibenz(a,h)anthracene	—	X	Retained for tuff because concentrations were detected
Dibenzofuran	X	X	Retained for soil and tuff because concentrations were detected
Dichloroethene[1,1-]	X	—	Retained for soil because concentrations were detected
Fluoranthene	X	X	Retained for soil and tuff because concentrations were detected
Fluorene	X	X	Retained for soil and tuff because concentrations were detected
Indeno(1,2,3-cd)pyrene	—	X	Retained for tuff because concentrations were detected
Methylene Chloride	X	X	Retained for soil and tuff because concentrations were detected
Methylnaphthalene[2-]	X	X	Retained for soil and tuff because concentrations were detected
Naphthalene	X	X	Retained for soil and tuff because concentrations were detected
Phenanthrene	X	X	Retained for soil and tuff because concentrations were detected
Pyrene	X	X	Retained for soil and tuff because concentrations were detected
Toluene	X	—	Retained for soil because concentrations were detected
Trichloro-1,2,2-triflouoroethane[1,1,2-]	X	—	Retained for soil because concentrations were detected

[a] — = Chemical was eliminated as a chemical of potential concern

[b] X = Chemical was retained as a chemical of potential concern

Table 9
Sample Depths and Descriptions Proposed for SWMU 19-001-99

Depth (ft, bgs)	Location Description	Field Screening Analysis	Fixed Laboratory Analysis	Total Number of Samples for Field Screening Analysis	Estimated Number of Samples for Fixed Laboratory Analysis
0–0.5 and 3.5–4.0	Soil/tuff samples collected at 31 locations inside AOC C-19-001	PAHs PCBs XRF metals	VOCs SVOCs PCBs Pesticides Herbicides Dioxins/furans* Radionuclides TAL metals	62	6
0–0.5 and 3.5–4.0	Soil/tuff samples collected from 5 locations on the northern slope of the mesa			10	10
0–0.5 and 3.5–4.0	Soil/tuff samples collected from 3 locations on the southern slope of the mesa			6	6
0-0.5	Soil/tuff samples collected after soil removal			4	4
0–0.5 and 3.5–4.0	Field Duplicate Samples			8	3

* Samples will be analyzed for dioxins/furans only if PCBs are detected during field screening.

Table 10
ACA Field Implementation Schedule, SWMU 19-001-99

Activity	Duration (workdays)	Start	Finish
Readiness review/preparation	6	January 27, 2004	February 3, 2004
Field preparation: • mobilize equipment • implement BMPs • establish work zones and waste management areas	3	February 4, 2004	February 06, 2004
Pre-sampling geodetic survey	2	February 9, 2004	February 10, 2004
Soil removal (based on historical sampling)	15	February 11, 2004	March 2, 2004
Surface and subsurface sampling	15	March 3, 2004	March 23, 2004
Post-Sampling Geodetic survey	2	March 23, 2004	March 25,2004
Laboratory analysis	35	March 11, 2004	April 30, 2004
Site restoration and demobilization	5	March 24, 2004	March 30, 2004
Final site inspection	1	March 30, 2004	
Data validation	30	May 3, 2004	June 11, 2004
Overall	112	January 27, 2004	June 11, 2004

Appendix A

Acronyms, Abbreviations, and Glossary

ACA	accelerated corrective action
AOC	area of concern
bgs	below ground surface
BMP	best management practice
BV	background value
COPC	chemical of potential concern
CWDR	chemical waste disposal request
DOE	US Department of Energy
DQO	data quality objective
EQL	estimated quanititation limit
ESL	ecological screening level
EPA	US Environmental Protection Agency
FV	fallout value
HE	high explosive
HWB	Hazardous Waste Bureau
HSWA	Hazardous and Solid Waste Act
IDW	investigation-derived waste
IWP	installation work plan
LANL	Los Alamos National Laboratory
LIR	Laboratory Implementation Requirements
NFA	no further action
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
OU	operable unit
PAH	polyaromatic hydrocarbon
PCB	polychlorinated biphenyl
PPE	personal protective person
QP	quality procedure
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RRES-RS	Risk Reduction and Environmental Stewardship–Remediation Services
SAL	screening action level
SMO	Sample Management Office
SOP	standard operating orocedure
SVOC	semivolatile organic compound
SWMU	solid waste management unit
TAL	target analyte list
TA	Technical Area
UCL	upper confidence limit
VCA	voluntary corrective action
VOC	volatile organic compound
VCP	vitrified clay pipe
VSP	Visual Sample Plan
WPF	waste profile form
XRF	X-ray fluorescence

alluvial—Said of materials or features deposited by running water.

alluvial fan—A fan-shaped piedmont accumulation of sediment deposited by a stream.

aquifer—A permeable body of geologic material capable of yielding groundwater to wells or springs.

background value (BV)—The upper tolerance limits (UTLs) of background sample results, calculated as the upper 95% confidence limit for the 95th percentile. In cases where a UTL cannot be calculated, either the detection limit or maximum reported value is used as a BV. Background values are used as simple threshold numbers to identify potentially contaminated site sample results as greater than background levels. Background values exist for inorganic chemicals and radionuclides.

baseline risk assessment (also **risk assessment**)—A site-specific analysis of the potential adverse effects caused by hazardous substance releases from a site in the absence of any actions to control or mitigate these releases. There are four steps in baseline risk assessment: data collection and analysis, exposure assessment, toxicity assessment, and risk characterization.

chemical of potential concern (COPC)—A chemical detected at a site that has the potential to adversely affect human and or ecological receptors due to its concentration, distribution and mechanism of toxicity. The chemical remains a concern until exposure pathways and receptors are evaluated in a site-specific risk assessment.

conceptual model (see **site conceptual model**)

contaminant—Any chemical (including radionuclides) present in environmental media or on structural debris at a concentration that may present a risk to human health or the environment.

corrective action—A measure taken to rectify conditions adverse to human health or the environment.

data quality objectives (DQOs)—The qualitative and quantitative goals that are developed before sampling begins that clarify the investigation objectives and identify the type, quantity and quality of data needed to support decisions.

discharge (also **hazardous waste discharge**)—As defined under RCRA, 40 CFR 260.10, the accidental or intentional spilling, leaking, pumping, pouring, emitting, emptying, or dumping of hazardous waste into or on any land or water.

ecological screening level (ESL) —An organism's exposure-response threshold for a given chemical constituent. It is the concentration of a substance in a particular medium that corresponds to a hazard quotient (HQ) of 1.0 for a given organism and below which no risk is indicated.

ephemeral stream –Said of a stream or spring that flows only during and immediately after periods of rainfall or snowmelt.

groundwater—Water in a subsurface saturated zone.

Hazardous and Solid Waste Amendments (HSWA)—Amendments to the Resource Conservation and Recovery Act, 1984. HSWA added land disposal restrictions, minimum technology requirements, and expanded corrective action authorities to the RCRA statue.

hazardous substance—As defined by 40 CFR 302.3, any substance designated pursuant to 40 CFR 302. 40 CFR 302.4 – Designation of Hazardous Substances:

(a) listed hazardous substances. The elements, compounds and hazardous wastes appearing in Table 302.4 are designated as hazardous substances under section 102(a) of the CERCLA.

(b) unlisted hazardous substances. A solid waste, defined in 40 CFR 261.2, which is not excluded from regulation as a hazardous waste under 40 CFR 261.4(b), is a hazardous substance under section 101(14) of the CERCLA if it exhibits any of the characteristics identified in 40 CFR 261.20 through 261.24. See Hazardous Waste. Note: This definition incorporates by reference, substances listed in CWA sections 311 and 307(a); CAA section 112; RCRA section 3001; and TSCA section 7.

hazardous waste—As defined by RCRA 40 CFR 261.3, any solid waste is generally a hazardous waste if it is not excluded from regulation as a hazardous waste, is listed in the regulations as a hazardous waste, exhibits any of the defined characteristics of hazardous waste (ignitability, corrosivity, reactivity, or toxicity), or is a mixture of solid waste and hazardous waste.

HSWA module—A portion of the Laboratory's permit to operate under RCRA that contains requirements specific to Los Alamos National Laboratory. It is this portion of the permit that contains the list of solid waste management units that must be cleaned up in accordance with RCRA procedures.

intermittent stream—Said of a stream that flows only in certain reaches due to losing and gaining characteristics of the channel bed.

medium (environmental)—Any material capable of absorbing or transporting constituents including tuffs, soils and sediments derived from these tuffs, surface water, groundwater, air, structural surfaces, and debris.

meteoric water— Water produced by or derived from the atmosphere. Meteoric waters start as precipitation in the hydrologic cycle, and the source thereof is evaporation from oceanic surfaces.

migration—The movement of inorganic and organic species through unsaturated or saturated materials.

migration (transport) pathway—A route (e.g., a stream or subsurface flow path that controls the potential movement of contaminants to environmental receptors (plants, animals, humans).

outfall—The vent or end of a drain, pipe, sewer, ditch, or other conduit that carries waste water, sewage, storm runoff, or other effluent into a stream.

perched aquifer— a saturated zone with in the zone of aeration that overlies a confining layer; a perched aquifer is above the main water table.

perennial stream—Said of a stream or reach that flows continuously throughout the year.

RCRA facility investigation (RFI)—The second step of a RCRA corrective action, to gather enough data to fully characterize the nature, extent, and rate of migration of contaminants to determine the appropriate response action. The RFI is generally equivalent to the RI portion of the Superfund process.

receptor—A person, plant, animal, or geographical location that is exposed to a chemical or physical agent released to the environment by human activities.

recharge—The process by which water is added to the zone of saturation, either directly from the overlying unsaturated zone or indirectly by way of another material in the saturated zone.

remediation—The process of reducing the concentration of a contaminant (or contaminants) in air, water, or soil media to a level that poses an acceptable risk to human health; the act of restoring a contaminated area to a usable condition based on specified standards.

remedy, or remedial action—Those actions consistent with permanent remedy instead of or in addition to removal actions in the event of a release or threatened release of a hazardous substance into the environment, to prevent or minimize the release of hazardous substances so that they do not migrate to cause substantial danger to present or future public health or welfare or the environment. The term includes, but is not limited to, such actions at the location of the release as storage, confinement, perimeter protection using dikes, trenches, or ditches, clay cover, neutralization, cleanup of released hazardous substances and associated contaminated materials, recycling or reuse, diversion, destruction, segregation of reactive wastes, dredging or excavations, repair or replacement of leaking containers, collection of leachate and run-off, on-site treatment or incineration, provision of alternative water supplies, and any monitoring reasonably required to assure that such actions protect the public health and welfare and the environment. (CERCLA 101[24]) Activities conducted at DOE facilities to reduce potential risks to people and/or harm to the environment from radioactive and/or hazardous substance contamination. (DOE Order 5820.2A)

removal action—An immediate action taken over the short term to address a release or threatened release of **hazardous substances**. (DOE 1991)

residential use scenario—The most stringent of the three current and future use scenarios being considered by the ER Project and the level of cleanup EPA is currently specifying for SWMUs located off the Laboratory site and for those released for non-Laboratory use.

Resource Conservation and Recovery Act (RCRA) —Regulations establishing a comprehensive hazardous waste management system under the authority of RCRA Subtitle C. RCRA regulates hazardous waste from its point of generation through its point of final disposal. RCRA also regulates solid waste under Subtitle D.

risk—A measure of a negative or undesirable impact associated with an event.

risk assessment (see **baseline risk assessment**)

risk characterization—The summarization and integration of the results of toxicity and exposure assessments into quantitative and qualitative expressions of risk. The major assumptions, scientific judgments, and sources of uncertainty related to the assessment are also presented.

sample—A portion of a material (e.g., rock, soil, water, air), which, alone or in combination with other samples, is expected to be representative of the material or area from which it is taken. Samples are typically sent to a laboratory for analysis or inspection or are analyzed in the field. When referring to samples of environmental media, the term **field sample** may be used.

screening action level (SAL) —A medium-specific concentration level for a chemical derived using conservative criteria below which it is generally assumed that there is no potential for unacceptable risk to human health. The derivation of a SAL is based on conservative exposure and land use assumptions. However, if an applicable regulatory standard exists that is less than the value derived by risk-based computations, it will be used for the SAL.

screening assessment—A process designed to determine whether contamination detected in a particular medium at a site may present a potential unacceptable human health and /or ecological risk. The assessment utilizes screening levels that are either human-health or ecologically-based

concentrations derived using chemical specific toxicity information and standardized exposure assumptions below which no additional actions are generally warranted.

site characterization—The program of exploration and research, both in the laboratory and in the field, undertaken to establish the geological, hydrological, and chemical conditions at a site. Site characterization includes borings, surface excavations, excavation of exploratory shafts, limited subsurface lateral excavations and borings and geophysical testing. (10 CFR 60.2)

site conceptual model—A qualitative or quantitative description of sources of contamination, environmental transport pathways for contamination, and biota that may be impacted by contamination (called receptors) and whose relationships describe qualitatively or quantitatively the release of contamination from the sources, the movement of contamination along the pathways to the exposure points, and the uptake of contaminant by the receptors.

solid waste management unit (SWMU)—Any discernible unit at which solid wastes have been placed at any time, irrespective of whether the unit was intended for the management of solid or hazardous waste.

standard operating procedure (SOP)—A written document that details the method for an operation, analysis, or action with thoroughly prescribed techniques and steps, and is officially approved as the method for performing certain routine or repetitive tasks.

technical area (TA)—Administrative units established by the Laboratory for all its operations. There are currently 49 active TAs, spread over 43 square miles.

topography—The physical features of a place or region.

treatment—Any method, technique, or process, including elementary neutralization, designed to change the physical, chemical, or biological character or composition of any hazardous waste so as to neutralize such waste, or so as to recover energy or material resources from the waste, or so as to render such waste non-hazardous, or less hazardous; safer to transport, store, or dispose of; or amenable for recovery, amenable for storage, or reduced in volume.

tuff—A compacted deposit of volcanic ash and dust that contains rock and mineral fragments accumulated during an eruption.

vadose zone—The unsaturated zone. Portion of the subsurface above the regional *water table* in which pores are not fully saturated.

water table—The top of the saturated zone; the water level associated with an unconfined aquifer.

welded tuff—A volcanic deposit hardened by the action of heat, pressures from overlying material, and hot gases.

Appendix B

ACA Checklist and Fieldwork Authorization Form

Accelerated Corrective Action (ACA)
Checklist and Field Work Authorization Form

PRS Number: Consolidated SWMU 19-001-99 ☐ HSWA ☐ Non-HSWA

Yes	No	
X		Fact sheet describing planned activities is complete and attached to checklist.
X		COPC(s) for human health risk (HH), ecological risk (ECO), or other requirements are known or will be determined during accelerated site characterization.
X		Nature and extent of contamination is defined or accelerated site characterization is planned as part of this action to define nature and extent and to guide cleanup.
X		Cleanup levels/preliminary remediation goals (PRGs) are appropriate.
X		Remedy is obvious.
X		Time for removal is less than six months.
X		Remedy is final.
X		Land use assumptions are straightforward.
X		Treatment, Storage, and Disposal (TSD) Facilities are available for waste type and volume.
X		Cleanup cost is reasonable for the planned action and meets accelerated decision logic criterion for decision to proceed with ACA.
X		Briefing for NMED is required.

Explain criteria not checked above:

Los Alamos
Environmental Restoration Project

Accelerated Corrective Action (ACA) Checklist and Field Work Authorization Form

PRS Number: Consolidated SWMU 19-001-99 ☐ HSWA ☐ Non-HSWA

Upon reviewing the Accelerated Corrective Action Fact Sheet and the criteria checklist above, the appropriate Accelerated Corrective Action approach for the PRS(s) is (check one): ☐ VCA ☐ VCM

Signatures of the Representative for UC-Laboratory, DOE-LAAO, and NMED-HRMB:

UC: _____ _____
(Print Name and Title, then Sign) (Date)

DOE: _____ _____
(Print Name and Title, then Sign) (Date)

NMED: _____ _____
(Print Name and Title, then Sign) (Date)

The undersigned have reviewed the final plan and believe that it fully satisfies the appropriate Accelerated Corrective Action Approach.

Signatures of the Representative for UC-LANL and DOE-LAAO

UC: _____ _____
(Print Name and Title, then Sign) (Date)

DOE: _____ _____
(Print Name and Title, then Sign) (Date)

Action	Date	Correspondence ID
VCA or VCM plan submitted to NMED		
NOD or RSI received from NMED		
Laboratory response to NOD or RSI		
NMED approval of VCA or VCM plan		

After reviewing the VCA or VCM plan for the site(s) listed above and believing that the ACA process and VCA or VCM criteria have been met, I authorize the fieldwork to proceed.

DOE ER Program Manager _____ _____
(Signature) (Date)

Los Alamos
Environmental Restoration Project

Appendix C

Historical Analytical Data
for Consolidated SWMU 19-001-99
(CD on inside back cover of this report)

APPENDIX C HISTORICAL ANALYTICAL DATA

This appendix presents all analytical data collected for consolidated Solid Waste Management Unit (SWMU) 19-001-99 during the two previous site investigations: (1) the 1995 Voluntary Corrective Action (VCA) for SWMU 19-002 and (2) the 1997 Resource Conservation and Recovery Act Facility Investigation of SWMUs 19-001 and 19-003 and Area of Concern C-19-001. All analytical data are provided on the accompanying CD labeled "Historical Analytical Data for Consolidated SWMU 19-001-99."

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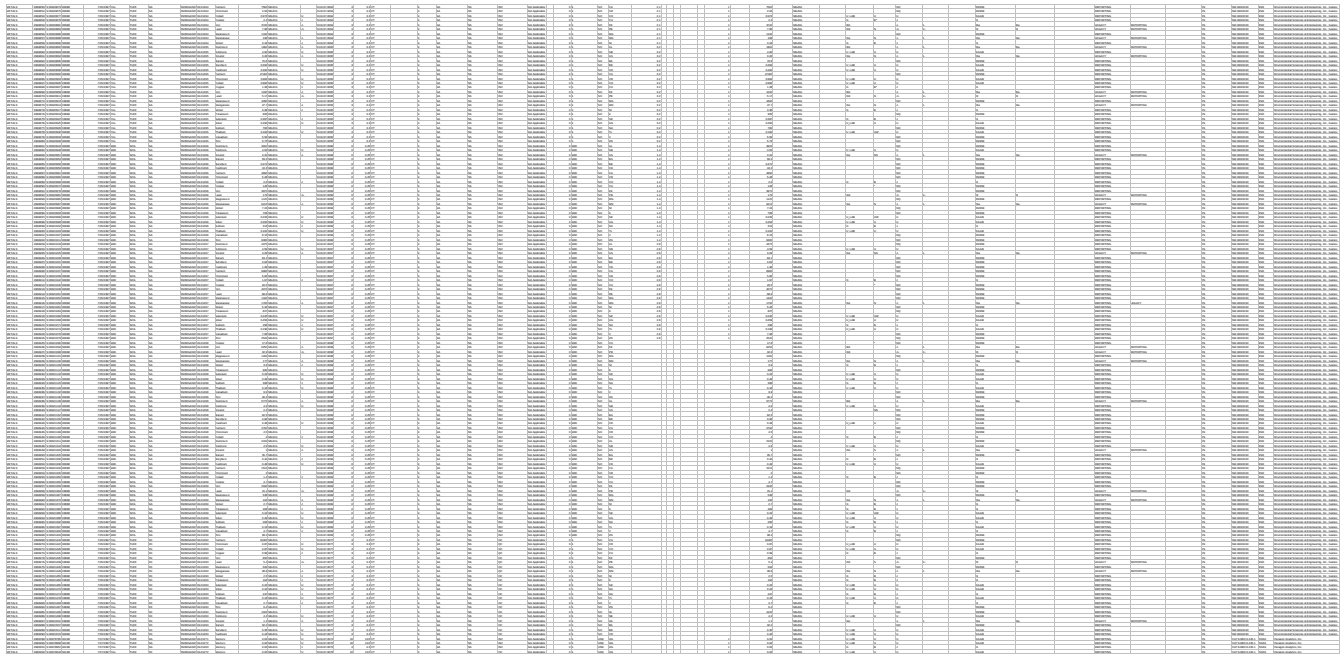

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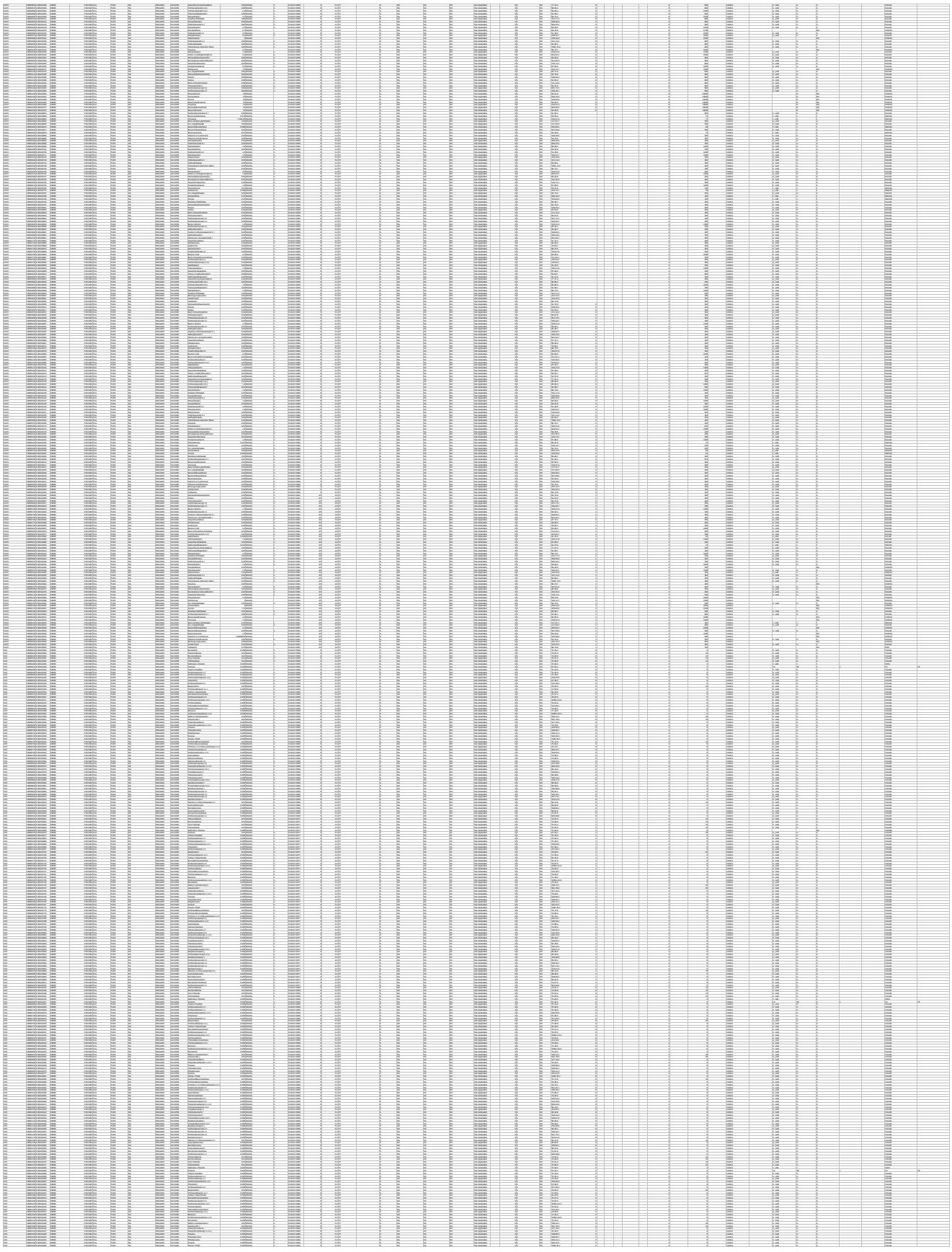

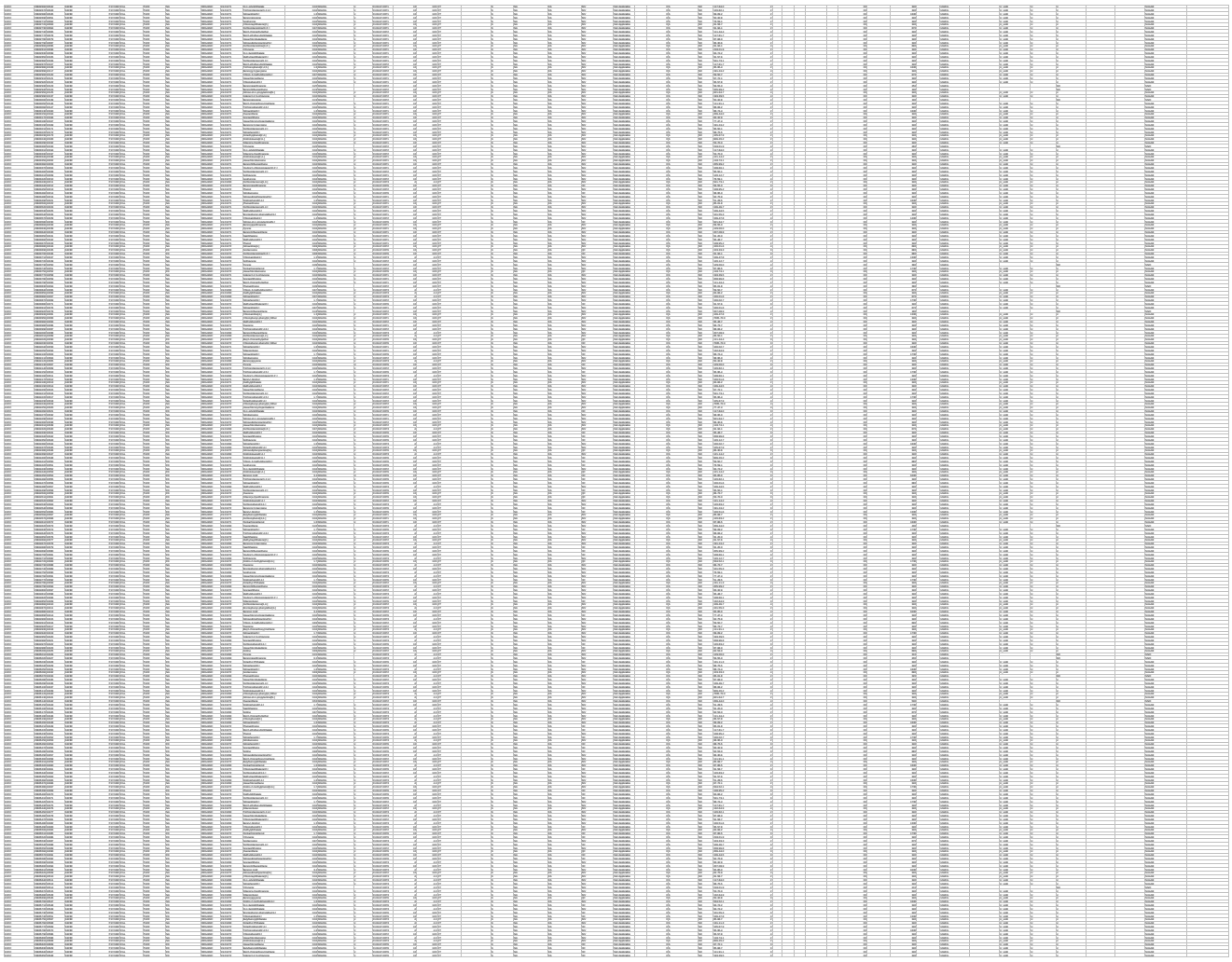

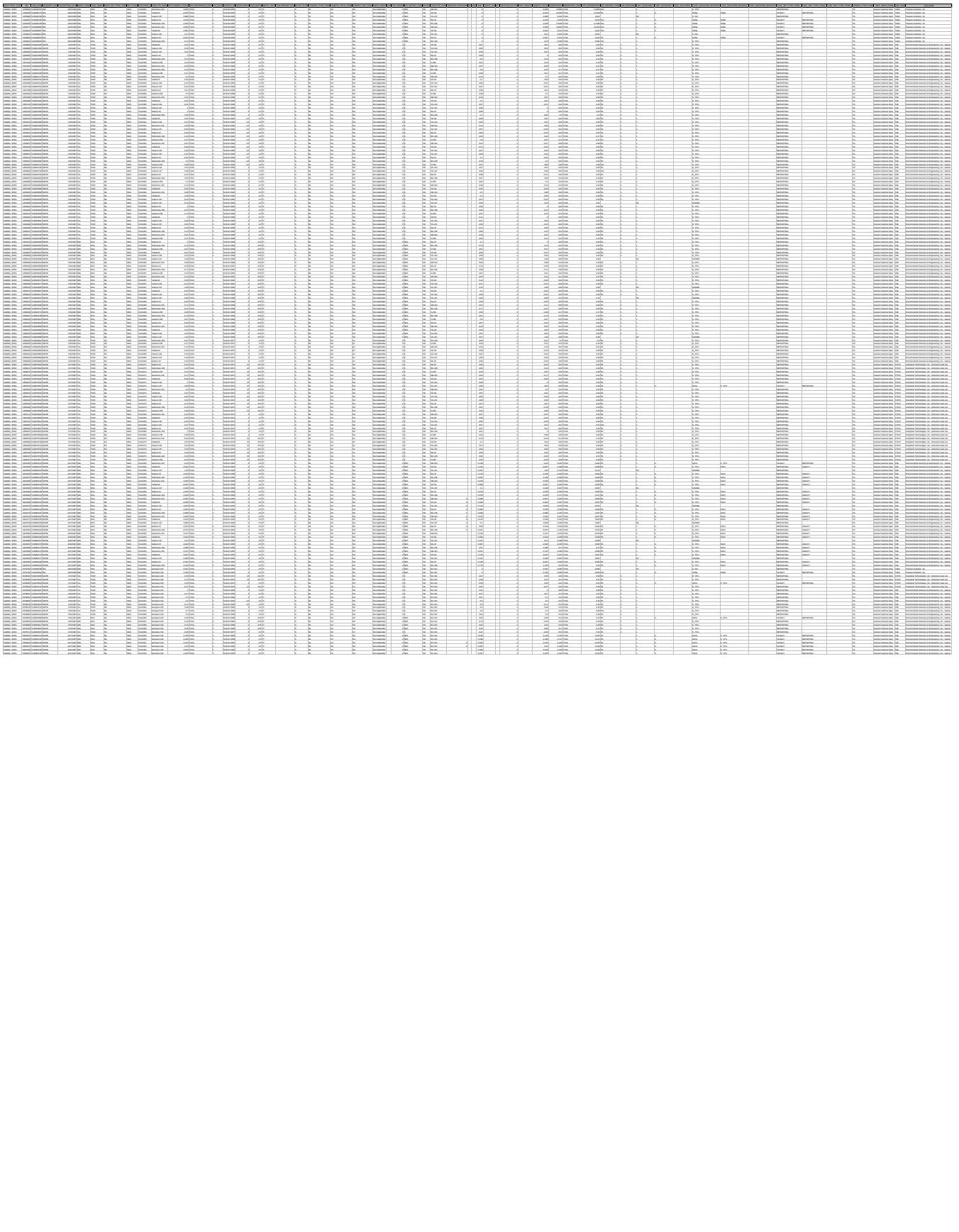

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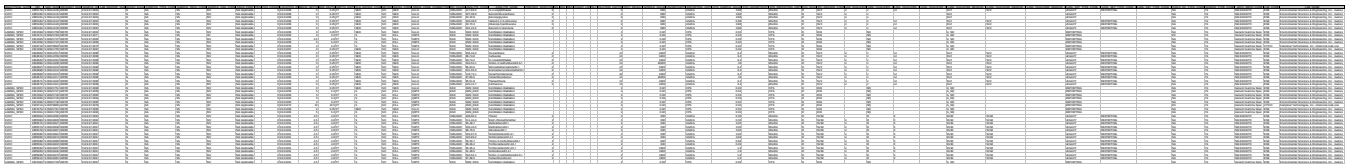

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Appendix D

Historical Data Evaluation and Sampling Design Rationale

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D-1.0 INTRODUCTION

This appendix presents the details of the historical data evaluation and the methodology used to develop the accelerated corrective action (ACA) sampling design for consolidated Solid Waste Management Unit (SWMU) 19-001-99. All historical data (provided in Appendix C on the CD attached to the inside back cover of this report) collected during the 1995 voluntary corrective action (VCA) for SWMU 19-002 (LANL 1996, 05269) and the 1997 Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) of SWMUs 19-001 and 19-003 and Area of Concern (AOC) C-19-001 (LANL 1997, 71468) were evaluated in two phases to address the need for further site remediation or investigation at SWMU 19-001-99. The first phase of the evaluation, presented in Section 2.7.3 of the work plan, identified the chemicals of potential concern (COPCs) at SWMU 19-001 (see Table 8). The second phase of the evaluation, an evaluation of COPCs by location, is presented in Section D-1.1.

Both data quality objectives (DQOs) and Visual Sample Plan (VSP), version 2.2, were used to develop the sampling design for the investigation and remediation of SWMU 19-001-99. To further ascertain the lateral and vertical extent of the COPCs at SWMU 19-001-99, additional sampling activities, including field screening and sample collection and analyses, are required. DQOs for SWMU 19-001-99, described in Section D-2.0, were developed to optimize the design of the proposed sampling activities. The results of VSP, version 2.2, used to optimize the sampling design for characterizing AOC C-19-001, are summarized in Section D-3.0.

D-1.1 Sample Location Evaluation of Chemicals of Potential Concern

The COPCs identified in the historical data collected at SWMU 19-001-99 were evaluated by location to determine where, if any, additional soil removal or further site characterization is warranted. The locations for 20 of the 25 historical fixed laboratory analytical sample locations evaluated are presented in Figures 3 and 4. The five remaining sample locations (19-01001, 19-01002, 19-01022, 19-01023, and 19-01024) are associated with SWMU 19-002 and are located on the north mesa slope, downgradient of sample locations 19-01266, 19-01267, 19-01268, and 19-01269. However, because neither a sample location map was provided in the 1995 VCA completion report (LANL 1996, 05269), nor could one be located for SWMU 19-002, the five sample locations are not plotted.

The decision either to remove soil at a historical sampling location or to defer soil removal until further site characterization has been conducted is based on the location's applicable chemical exposure and transport pathways, as defined by the site conceptual model. Historical sampling locations were subdivided into three groups based on site topography: (1) sample locations occurring on the flat mesa top (within AOC C-19-001); (2) sample locations occurring on the lower moderately graded mesa slopes; and (3) sample locations occurring on the very steeply graded upper mesa slopes. The applicable exposure and transport pathways for each location group are summarized below.

Mesa Top Locations – Direct contact with laboratory buildings, septic systems, and their associated activities. Mesa surface defined by thin (0–2 ft [0–0.6 m]) capping of unconsolidated soil, outcroppings of densely welded tuff, and widely dispersed clusters of trees and bushes. Flat mesa top easily accessible to both human and ecological receptors.

Upper Mesa Slope Locations – Direct contact with debris piles. Upper mesa slopes defined by exposed cliffs of densely-welded tuff. Little to no soil and vegetation present, occurring only in drainages and small ledges formed by slight breaks in slope. The very steep gradient of the cliff faces making upper mesa slopes inaccessible to either human or ecological receptors.

Lower Mesa Slope Locations – Direct contact with debris piles. Lower mesa slopes defined by soil and tuff outcroppings with sparse vegetation. Human and ecological receptor accessibility varying, generally increasing as the slope gradient decreases.

All detected inorganic chemicals, radionuclides, and organic chemicals were evaluated using a standard deviation outlier test (EPA 1989, 72731). At locations where the outlier test indicated an elevated COPC concentration in soil relative to other historical sampling locations, limited soil removal is recommended to further reduce overall risk at the site. Table D-1 summarizes the two historical sampling locations that are recommended for soil removal. Historical sample locations 19-01002 and 19-01255 also failed the outlier test for toluene and acetone, respectively; however, these chemicals are known common laboratory contaminants and were detected only once at each location. Therefore, soil removal at these locations based on potential laboratory contamination of toluene and acetone is not recommended until further site characterization and risk have been evaluated. Table D-2 summarizes the COPCs, the media of concern, the recommended action(s), and the corresponding rationale for each recommended action for all locations.

In summary, based on the historical data evaluation, the following actions are recommended for each location group:

- *Mesa Top Locations* – Conduct additional site characterization sampling to assess potential risk to human and ecological receptors
- *Upper Mesa Slope Locations* – Perform a soil removal at the following historical sampling locations 19-01266 and 19-01268. For all other upper mesa slope locations, collect additional samples downgradient to determine the extent of contamination and assess the potential risk to human and ecological receptors
- *Lower Mesa Slope Locations* – Collect additional samples downgradient to determine extent of contamination and assess potential risk to human and ecological receptors

D-2.0 DATA QUALITY OBJECTIVES

The seven-step DQO planning process is a systematic and efficient way to determine the type, quantity, and quality of data needed to support project decisions. As defined by the US Environmental Protection Agency (EPA) guidance document, "Data Quality Objectives Process for Superfund" (EPA 1993, 82274) and outlined in the "Guidance for the Data Quality Objective Process" (EPA 2000, 80801), the goal of the seven-step DQO process is to collect high quality data for environmental decision making while minimizing data acquisition expenditures. To achieve this goal, the DQO process minimizes developing sampling designs that produce unnecessary duplication or unsuitable data. The process allows decision makers to define the data requirements and acceptable rates of error based on how the data will be utilized during the planning stages of data collection activities. Relevant data quality requirements that impact data use limitations are also specified during the DQO planning stages. Details of the DQO process and DQO literature can be found online at http://www.hanford.gov/dqo/index.html.

Step 1: State the Problem

Based on site history and available historical data, the current dataset for SWMU 19-001-99 is not adequate to determine the lateral and vertical extent of contamination from potential sources on site or to determine the potential risks to human health and ecological receptors on site.

Step 2: Identify Decisions

The decisions to be made concerning data acquisition to support site characterization and risk evaluation are identified below.

- Determine the specific COPCs associated with the site
- Determine whether specific areas of the site can be eliminated from the investigation (e.g., outcrops of impermeable, welded tuff)
- Determine whether (1) the concentrations of radionuclides and inorganic chemicals in soil and tuff are above Los Alamos National Laboratory-specific background or fallout values and (2) organic chemicals are present
- Determine whether COPC concentrations in soil and tuff are above risk thresholds such as human health screening action levels (SALs) and ecological screening levels (ESLs)

Step 3 Identify Inputs

The information needed to support project decisions are identified below.

- Historical information regarding site activities
- Physical, biological, and topographical surveys of the site
- Historical analytical data for soil and tuff at the site

Step 4: Specify Boundaries

Based upon historical data, the environmental media to be sampled are unconsolidated materials such as surface and subsurface soils and weathered tuff (underlying weathered bedrock). Figure D-1 presents the proposed study area boundaries for this ACA based on the historical sample locations. The proposed study area boundaries were based on current local topographic features and historic sampling locations where additional data needs were identified in the historical data evaluation. The lateral and vertical sampling boundaries are defined below.

Lateral Sampling Boundaries:

Sampling at AOC C-19-001 will be limited to an area approximately 300 ft long by 150 ft wide (91 m long by 46 m wide) potentially impacted by past facility operations within boundaries defined by former fence lines that surrounded the former laboratory buildings (see Figure 1). Inaccessible areas within the AOC where sampling cannot be conducted because mature tree trunks and welded tuff outcrops hamper sample collection were designated as "exclusion zones." Exclusion zones were surveyed and removed from the sampling area design. Figure D-2 presents the sampling exclusion zones identified within AOC C-19-001.

Sampling on the mesa slopes below SWMUs 19-001, 19-002, and 19-003 will focus on erosion rills/drainages potentially affected by runoff from the drainline outfalls and debris piles associated with these SWMUs. New sample locations were selected downgradient of the original sample locations to determine the lateral extent of potential contamination into adjacent canyons. Samples will be collected downslope in areas where sediment transport has transitioned from erosional to depositional (typically where the slope transitions to less than 20% grade).

Vertical Sampling Boundaries:

Two depths are proposed for all sample locations: 0–0.5 ft (0–0.15 m) and 3.5–4.0 ft (1.0–1.2 m) or the soil/tuff interface (whichever is encountered first).

Step 5: Define Decision Rules

The decision rules guiding the decision-making process and selection of an appropriate corrective action for SWMU 19-001-99 are defined below.

Decision Rule 1a: Noncarcinogenic COPC Evaluation of Potential Human Health Risk

If the human health screening risk analysis—as based on a comparison of site COPC concentrations (95% upper confidence limit [UCL] of the mean) to screening risk thresholds (one-tenth of the SALs)—indicates that potential unacceptable risk is present at the site, then remedial action will be conducted; otherwise, no further action (NFA) will be required.

Decision Rule 1b: Carcinogenic COPC Evaluation of Potential Human Health Risk

If the human health screening risk analysis—as based on a comparison of site COPC concentrations (95% UCL of the mean) to SALs—indicates that potential unacceptable risk is present at the site, then remedial action will be conducted; otherwise, NFA will be required.

Decision Rule 1c: Radiological COPC Evaluation of Potential Human Health Risk

If the human health screening risk analysis—as based on a comparison of site COPC concentrations (95% UCL of the mean) to SALs—indicates that potential unacceptable risk is present at the site, then remedial action will be conducted; otherwise, NFA will be required.

Decision Rule 2: COPC Evaluation of Potential Ecological Risk

If the ecological screening risk analysis—as based on a comparison of site COPC concentrations (95% UCL of the mean) to ESLs—indicates that potential unacceptable risk is present at the site, then remedial action will be conducted; otherwise, NFA will be required.

Step 6: Specify Error Tolerances

Acceptable limits for decision errors and appropriate performance goals to manage the uncertainty of making decisions for the site are summarized below.

The acceptable limits for false positive (alpha) or false negative (beta) decision errors are based on the potential consequences of these decision errors (such as risks to human health and the environment or unnecessary expenditures for additional sampling) if specific contaminants are detected either above or below the action levels. The tolerance limits have been preliminarily established at 5% for false positives and 20% for false negatives. The consequences of such decision errors are presented in Table D-3.

Step 7: Optimize Sample Design

The optimal sampling design will effectively minimize the number of samples required to verify the presence of contamination and quantify the contaminant concentrations on site.

The optimal sampling scheme developed for SWMU 19-001-99 includes the following key elements:

- Selection of lead as the COPC to develop the sampling design because of its suspected historical use on site, including lead-acid batteries stored at the battery building and possibly lead shielding for scintillation/irradiation experiments at the laboratory building

- Statistical evaluation of the frequency distribution of lead
- Determination of the number of samples needed to make appropriate decisions based on the error tolerance limits

D-2.1 Optimal Sample Design for SWMU 19-001-99

The optimal sampling design for SWMU 19-001-99 is outlined as follows.

AOC C-19-001 Mesa Top: Thirty-one sampling locations based on a systematic sampling grid developed in VSP, version 2.2 (see Section D-3.0). Sample locations were derived using the Wilcoxon Signed-Rank (One-Sample) Test statistical method (Gilbert 1987, 56179). Proposed sampling locations at AOC C-19-001 mesa top are depicted in Figures 5 and D-2.

SWMU 19-001-99 Lower Mesa Slopes: Seven sampling locations at the downgradient extent of SWMU 19-001-99 determined from field reconnaissance of drainage features on the mesa slopes. Figure 6 shows the proposed sampling locations for the north and south mesa slopes.

Data acquired during the field investigation will be evaluated based on the five steps for the data quality assessment process outlined in the EPA's guidance for data quality assessment QA/G-9 (EPA 2000, 73790). Performance of the sampling design will be statistically tested by power analysis as part of the data assessment process.

D-3.0 VISUAL SAMPLE PLAN, VERSION 2.2

VSP, version 2.2 was used to optimize the sampling design for site characterization (see Figures 5 and D-1). The statistically based VSP sampling design determines the appropriate number of samples needed and the specific locations where the samples should be collected. The sample media (i.e., soil and tuff) and analytical methods proposed (field screening and fixed laboratory) are summarized in Section 5.2.

The statistical method and assumptions associated with the sampling design, as well as general guidelines for conducting post-sampling data analysis, are described below.

D-3.1 Objective of the Sampling Design

The primary purpose of sampling at this site is to compare an average site value with a fixed threshold (e.g., a comparison of the arithmetic mean for a given COPC to the SAL for that COPC). The working hypothesis (or null hypothesis) is that the average site concentration for a COPC (arithmetic mean) is equal to or exceeds the threshold (SAL). The alternative hypothesis is that the average site concentration is less than the threshold. VSP calculates the number of samples required to reject the null hypothesis in favor of the alternative one, given a selected sampling approach and input to the associated equation.

D-3.2 Type of Sampling Design

A nonparametric systematic sampling approach with a random start was used to determine the number of samples and to specify sampling locations. Lead was selected for the sampling design based on its suspected historical use on site, including lead-acid batteries stored at the battery building and possibly shielding for scintillation/irradiation experiments at the laboratory building. A nonparametric formula was chosen because the conceptual model and historical information (e.g., historical data from this site) indicate that the lead concentrations at the site follow a non-parametric distribution. Figure D-2 shows the proposed sampling locations at AOC C-19-001 determined by applying VSP using the Wilcoxon Signed-Ranks test (Gilbert 1987, 56179) and a systematic sampling scheme.

Both parametric and nonparametric equations rely on assumptions about the population. Typically, however, nonparametric equations require fewer assumptions and allow for more uncertainty about the

statistical distribution of values at the site. Locating the sample points over a systematic grid with a random start ensures adequate spatial coverage of the site.

D-3.3 Total Number of Samples: Equation and Parameters

The equation used to calculate the number of samples is based on a Wilcoxon Signed-Ranks test (Gilbert 1987, 56179). For SWMU 19-001-99, the null hypothesis is that the average site value (represented by the arithmetic mean of lead concentrations in historical samples) is greater than the threshold (represented by the SAL for lead). The total number of samples to collect is calculated such that if the inputs to the equation are true, then the calculated number of samples will cause the null hypothesis to be rejected.

The formula used to calculate the number of samples is:

$$n = 1.16\left[\frac{\left(S^2_{sample} + \frac{S^2_{analytical}}{r}\right)}{\Delta^2}\left(Z_{1-\alpha} + Z_{1-\beta}\right)^2 + 0.5Z^2_{1-\alpha}\right]$$

where

- n = number of samples
- S = estimated standard deviation for lead in soil including analytical error (50 parts per million [ppm] of lead)
- Δ = width of the gray region (25 ppm of lead)
- α = acceptable probability of incorrectly concluding the site mean is less than the threshold (5%)
- β = acceptable probability of incorrectly concluding the site mean exceeds the threshold (20%)
- $Z_{1-\alpha}$ = value of the standard normal distribution such that the proportion of the distribution less than $Z_{1-\alpha}$ is 1-α (1.64485, automatically calculated by VSP)
- $Z_{1-\beta}$ = value of the standard normal distribution such that the proportion of the distribution less than $Z_{1-\beta}$ is 1-β (0.841621, automatically calculated by VSP)

Figure D-3 presents a "performance goal diagram" showing the probability of concluding the sample area has contamination (i.e., the sampled population's average concentration exceeds the SAL) on the vertical axis versus a range of possible true mean values of potential contaminants for the site on the horizontal axis. This graph includes the parameters to the Wilcoxon Signed-Ranks test equation and graphically depicts the calculation results.

The right vertical line represents the threshold (SAL of 400 ppm for lead) on the horizontal axis. The width of the gray shaded area is equal to Δ; the upper horizontal dashed line is positioned at 1-α on the vertical axis; the lower horizontal dashed line is positioned at β on the vertical axis. The left vertical line is positioned at one standard deviation below the threshold. The shape of the curve through the gray region corresponds to the estimates of variability. The calculated number of samples results in the curve that passes through the lower bound of Δ at β and the upper bound of Δ at 1-α. If any of the inputs change, the number of samples changes respectively.

D-3.4 Summary of Sampling Design

Table D-4 summarizes the sampling design developed using VSP, and Table D-5 lists the coordinates of sampling locations at AOC C-19-001. The corners of AOC C-19-001 were surveyed on October 22, 2003, and imported into VSP to enable VSP to calculate coordinates for the sampling design.

D-3.5 Recommended Data Analysis

The site characterization data will be verified and validated before they are used for making recommendations for additional remediation or investigation, if needed. Graphical and analytical tools will be used to verify the assumptions of any statistical analyses that are performed. The data will be assessed to determine whether they are adequate in both quality and quantity to support the primary objective of sampling.

Because the primary objective for sampling for this site is to generate data of adequate quality and quantity to compare the average site concentration with a threshold value, the data will be assessed in this context. Assuming the data are adequate, at least one statistical test will be performed to compare the data collected with the threshold of interest. Results of the data quality assessments will be included with the SWMU 19-001-99 ACA completion report.

D-4.0 REFERENCES

The following list includes all documents cited in this report. Parenthetical information following each reference provides the author, publication date, and ER ID number. This information is also included in text citations. ER ID numbers are assigned by the RRES-RS Records Processing Facility (RPF) and are used to locate the document at the RPF and, where applicable, in the RRES-RS project reference set titled "Reference Set for Operable Unit 1071."

Copies of the reference sets are maintained at the NMED Hazardous Waste Bureau; the DOE Los Alamos Site Office; US Environmental Protection Agency, Region 6; and RRES-RS project. The sets were developed to ensure that the administrative authority has all material needed to review this document, and they are updated periodically as needed.

EPA (US Environmental Protection Agency), September 1989. "Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities: Interim Final Guidance," EPA/530/SW-89-026, Office of Solid Waste Management Division, Washington, D.C. (EPA 1989, 72731)

EPA (US Environmental Protection Agency), September 1993. "Data Quality Objectives Process for Superfund: Interim Final Guidance," EPA/540/G-93-071, Office of Solid Waste and Emergency Response, Washington, D.C. (EPA 1993, 82274)

EPA (US Environmental Protection Agency), July 2000. "Guidance for Data Quality Assessment, Practical Methods for Data Analysis EPA QA/G-9," EPA/600/R-96/084, Office of Environmental Information, Washington, D.C. (EPA 2000, 73790)

EPA (US Environmental Protection Agency), August 2000. "Guidance for the Data Quality Objectives Process EPA QA/G-4," EPA/600/R-96/055, Office of Research and Development, Washington D. C. (EPA 2000, 80801)

Gilbert, R. O., 1987. *Statistical Methods for Environmental Pollution Monitoring,* Van Nostrand Reinhold, New York. (Gilbert 1987, 56179).

LANL (Los Alamos National Laboratory), February 1996. "Voluntary Corrective Action Completion Report for PRS 19-002, Surface Disposal Area Former TA-19," Los Alamos National Laboratory document LA-UR-96-433, Los Alamos, New Mexico. (LANL 1996, 05269)

LANL (Los Alamos National Laboratory), September 1997. "RFI Report for TA-19, PRSs 19-001, 19-003, and C-19-001," Los Alamos National Laboratory document LA-UR-97-3791, Los Alamos, New Mexico. (LANL 1997, 71468)

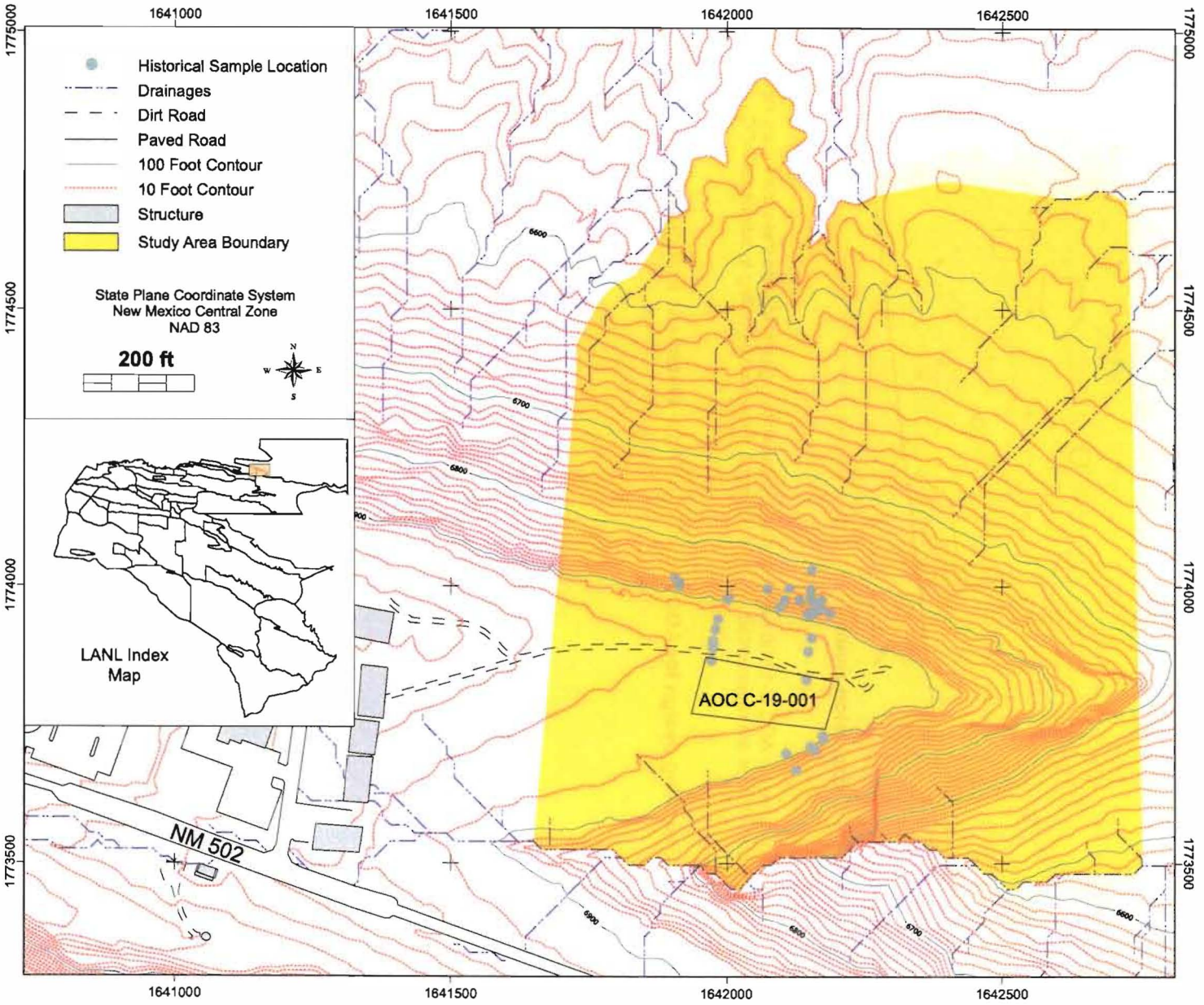
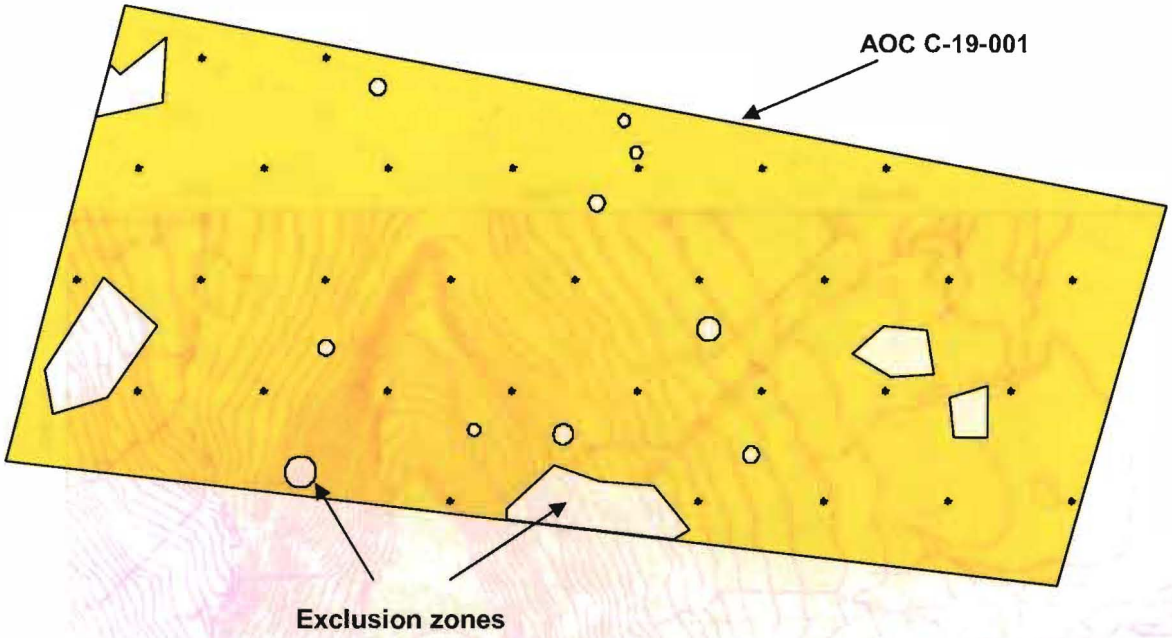
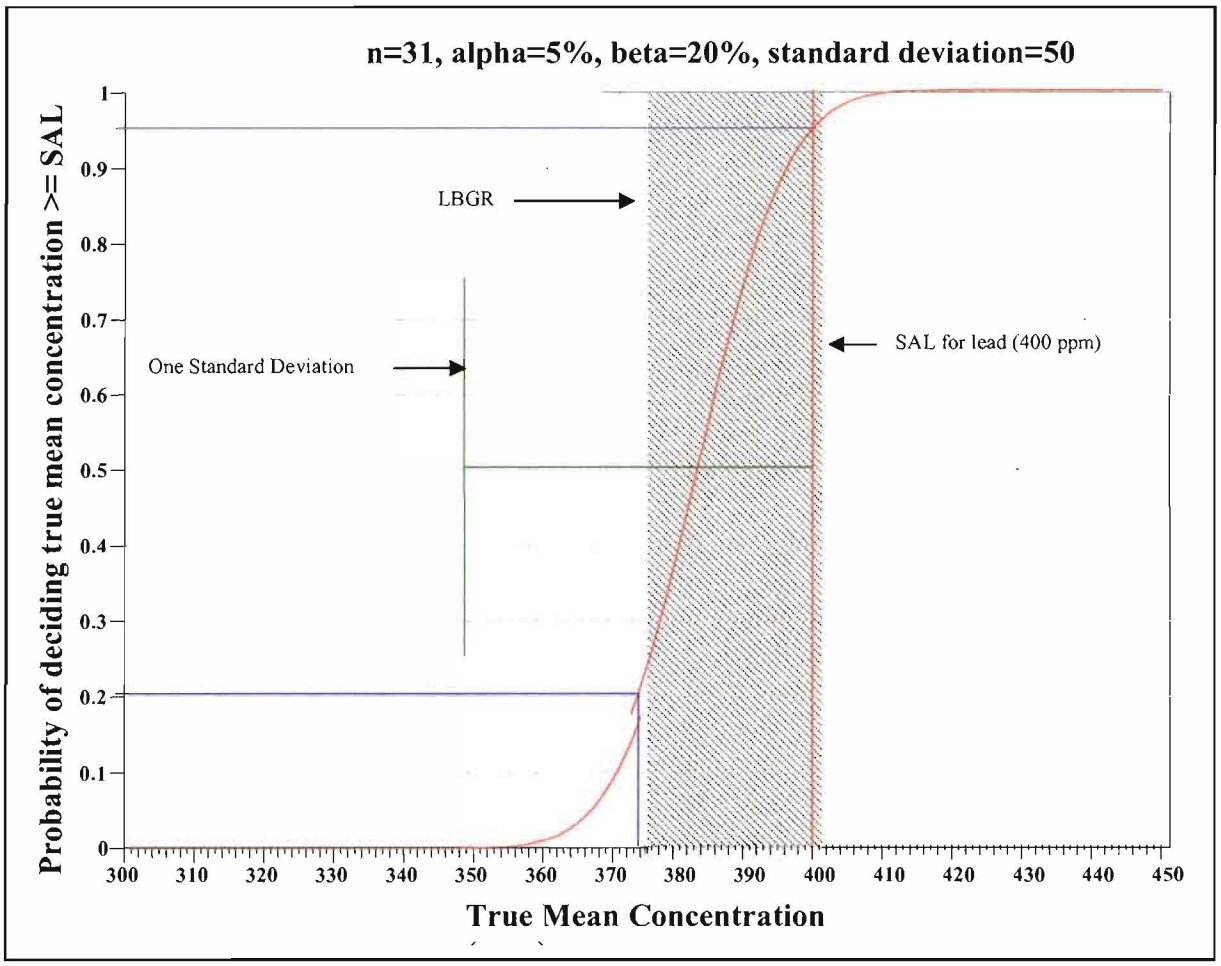


Figure D-1. Proposed study area boundaries for SWMU 19-001-99



Note: The exclusion zones for AOC C-19-001 are denoted by the white regions. Mature trees trunks are represented by white circles. Tuff outcrops are represented by white polygons. Proposed sampling locations for AOC C-19-001 are denoted by asterisks (*).

Figure D-2. Sampling design for AOC C-19-001 using a systematic triangular grid



LBGR = Lower boundary of the gray region
SAL = Screening action level

Figure D-3. Wilcoxon Signed-Ranks (One-Sample) Test (Gilbert 1987, 56179)

Statistical Assumptions

The assumptions associated with the computations of the number of samples are as follows:

1. The data originate from a symmetrical (but not necessarily normal) population
2. The variance estimate, S2, is reasonable and representative of the population being sampled
3. The population values are not spatially or temporally correlated
4. The sampling locations will be selected probabilistically

The variability of the first three assumptions will be assessed using the data set for lead concentrations collected from the additional characterization sampling at the site. The last assumption is valid because the grid sample locations were selected based on a random start.

Table D-1
Summary of Historical Sample Locations Recommended for Soil Removal at SWMU 19-001-99

Associated SWMU	SWMU Description	Location ID	Location Description	Location-Specific COPCs	Recommended Action	Rationale
19-002/ 19-003	Septic outfall area for former laboratory building	19-01266	North mesa slope, head of central debris pile Very steep gradient	Cadmium, copper, lead, manganese, mercury, zinc	Limited soil removal	Sample concentration is significantly elevated with respect to the expected concentration range within the sample population.
19-001	Septic tank outfall area for former retreat building	19-01268	North mesa slope, west of SWMU 19-002 Very steep gradient	Cesium-137, fluoranthene	Limited soil removal	Sample concentration is significantly elevated with respect to the expected concentration range within the sample population.

Table D-2
Data Evaluation for Risk Characterization:
Summary of All SWMU 19-001-99 COPCs, by Location

Associated SWMU	SWMU Description	Location ID	Location Description	Location-Specific COPCs	Media of Concern	Recommended Action	Rationale
19-002	North mesa surface disposal area for debris associated with TA-19 activities.	19-01001	North mesa slope, toe of debris pile.	Toluene, Europium-152	Soil	Collect additional samples downgradient to determine extent of contamination and assess potential risk to human and ecologic receptors.	(1) Sampling downgradient required to determine lateral extent of detected organics and radiological components. (2) To evaluate lateral extent of inorganic chemicals.
19-002	North mesa surface disposal area for debris associated with TA-19 activities.	19-01002	North mesa slope, toe of debris pile.	Toluene, Trichloro-1,2,2-trifluoroethane[1,1,2-]	Soil	Collect additional samples downgradient to determine extent of contamination and assess potential risk to human and ecologic receptors.	(1) Sampling downgradient required to determine lateral extent of detected organics. (2) To evaluate lateral extent of inorganic chemicals.
19-002	North mesa surface disposal area for debris associated with TA-19 activities.	19-01022	North mesa slope, toe of debris pile.	None	Soil	Collect additional samples downgradient to determine extent of contamination and assess potential risk to human and ecologic receptors.	Incomplete list of organic chemicals evaluated, of which all were 100% not detected. Inorganic chemicals and radiological chemicals were not evaluated.
19-002	North mesa surface disposal area for debris associated with TA-19 activities.	19-01023	North mesa slope, toe of debris pile.	None	Tuff	Collect additional samples downgradient to determine extent of contamination and assess potential risk to human and ecologic receptors.	Incomplete list of organic chemicals evaluated, of which all were 100% not detected. Inorganic chemicals and radiological chemicals were not evaluated.
19-002	North mesa surface disposal area for debris associated with TA-19 activities.	19-01024	North mesa slope, toe of debris pile.	Dichloroethene[1,1-]	Soil	Collect additional samples downgradient to determine extent of contamination and assess potential risk to human and ecologic receptors.	(1) Sampling downgradient required to determine lateral extent of detected organics. (2) Incomplete list of organic chemicals evaluated. The organic chemicals detected are listed. Inorganic chemicals and radiological chemicals not evaluated.
C-19-001	South mesa surface disposal area for debris associated with TA-19 activities.	19-01251	Mesa top, south of AOC C-19-001. Westernmost location sampled for C-19-001.	Antimony, Cadmium, Silver, Thallium	Soil	Conduct additional site characterization sampling to assess potential risk to human and ecologic receptors.	Reported detection limit exceeds the BV.[a]
C-19-001	South mesa surface disposal area for debris associated with TA-19 activities.	19-01252	Mesa top, south of AOC C-19-001. At mesa top edge.	Mercury, Silver, Thallium	Soil	Conduct additional site characterization sampling to assess potential risk to human and ecologic receptors.	Reported detection limit exceeds the BV.
				Dibenzofuran, Fluoranthene, Methylnaphthalene[2-], Naphthalene, Phenanthrene, Pyrene	Soil		The organic chemicals listed were detected.
C-19-001	South mesa surface disposal area for debris associated with TA-19 activities.	19-01253	Mesa top, directly south of the SE corner of AOC C-19-001.	Antimony, Cadmium, Mercury, Silver, Thallium	Soil	Conduct additional site characterization sampling to assess potential risk to human and ecologic receptors.	Reported detection limit exceeds the BV.
C-19-001	South mesa surface disposal area for debris associated with TA-19 activities.	19-01254	South mesa slope, 6 ft below sample location 19-01253. Very steep gradient.	Antimony, Cadmium, Mercury, Silver, Thallium	Soil	Collect additional samples downgradient to determine extent of contamination and assess potential risk to human and ecologic receptors.	Reported detection limit exceeds the BV. Sampling downgradient required to determine lateral extent of potential inorganic contamination.
C-19-001	South mesa surface disposal area for debris associated with TA-19 activities.	19-01255	South mesa slope,11 ft below sample location 19-01252. Along outer edge of a break in slope. Steep gradient.	Acetone, Methylene Chloride, Toluene	Soil	Collect additional samples downgradient to determine extent of contamination and assess potential risk to human and ecologic receptors.	Chemical is detected. Sampling downgradient required to determine lateral extent of detected organics.
				Antimony, Cadmium, Silver, Thallium	Soil		Sample downgradient to determine lateral extent of potential inorganic contamination. Reported detection limit exceeds the BV.

Table D-2 (continued)
Data Evaluation for Risk Characterization:
Summary of All SWMU 19-001-99 COPCs, by Location

Associated SWMU	SWMU Description	Location ID	Location Description	Location-Specific COPCs	Media of Concern	Recommended Action	Rationale
C-19-001	South mesa surface disposal area for debris associated with TA-19 activities.	19-01256	South mesa slope, southernmost sample location. Sample location within a break in slope. Steep gradient.	Lead, Zinc	Soil	Collect additional samples downgradient to determine extent of contamination and assess potential risk to human and ecologic receptors.	Reported concentration exceeds the BV. Sampling downgradient required to determine lateral extent of inorganic chemicals.
				Antimony, Cadmium, Mercury, Silver, Thallium	Soil		Sample downgradient to determine lateral extent of potential inorganic contamination. Reported detection limit exceeds the BV.
19-001	Septic system associated with retreat building.	19-01258	Mesa Top. Northernmost sample location along septic outlet drain line for retreat building.	Acenaphthene, Anthracene, Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, BEHP, Carbazole, Chrysene, Dibenz(a,h)anthracene, Dibenzofuran, Fluoranthene, Fluorene, Indeno(1,2,3-cd)pyrene, Methylene Chlor	Tuff	Conduct additional site characterization sampling to assess potential risk to human and ecologic receptors.	The organic chemicals listed were detected.
				Antimony	Tuff		Reported detection limit exceeds the BV.
19-001	Septic system associated with retreat building.	19-01259	Mesa top. Along septic outlet drain line for retreat building. Approximately 20 ft south of sample location 19-01258.	Anthracene, Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Chrysene, Fluoranthene, Methylene Chloride, Phenanthrene, Pyrene	Tuff	Conduct additional site characterization sampling to assess potential risk to human and ecologic receptors.	The organic chemicals listed were detected.
				Antimony	Tuff		Reported detection limit exceeds the BV.
19-001	Septic system associated with retreat building.	19-01260	Mesa top. Along septic outlet drain line for retreat building, few feet north of septic storage tank.	Fluoranthene, Methylene Chloride, Phenanthrene, Pyrene	Tuff	Conduct additional site characterization sampling to assess potential risk to human and ecologic receptors.	The organic chemicals listed were detected.
				Barium	Tuff		Reported concentration exceeds the BV.
				Antimony	Tuff		Reported detection limit exceeds the BV.

Table D-2 (continued)
Data Evaluation for Risk Characterization:
Summary of All SWMU 19-001-99 COPCs, by Location

Associated SWMU	SWMU Description	Location ID	Location Description	Location-Specific COPCs	Media of Concern	Recommended Action	Rationale
19-001	Septic system associated with retreat building.	19-01261	Mesa top. Along septic line from retreat building. Few feet south of septic tank.	Acenaphthene, Anthracene, Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, BEHP, Carbazole, Chrysene, Dibenzofuran, Fluoranthene, Fluorene, Indeno(1,2,3-cd)pyrene, Methylene Chloride, Methylnaphthalene[2], Naphthalene, Phen	Tuff	Conduct additional site characterization sampling to assess potential risk to human and ecologic receptors.	The organic chemicals listed were detected.
				Antimony	Tuff		Reported detection limit exceeds the BV.
19-001	Septic system associated with retreat building.	19-01262	Mesa top. Along septic line from retreat building. Few feet north of retreat building.	Fluoranthene, Methylene Chloride, Phenanthrene, Pyrene	Tuff	Conduct additional site characterization sampling to assess potential risk to human and ecologic receptors.	The organic chemicals listed were detected.
				Antimony	Tuff		Reported detection limit exceeds the BV.
19-003	Septic system associated with laboratory building.	19-01263	Mesa Top. Northernmost sample location along septic outlet drain line for laboratory building .	Acetone, Benzo(a)anthracene, Chrysene, Fluoranthene, Methylene Chloride, Phenanthrene, Pyrene	Tuff	Conduct additional site characterization sampling to assess potential risk to human and ecologic receptors.	The organic chemicals listed were detected.
				Arsenic, Barium	Tuff		Reported concentration exceeds the BV.
				Antimony, Selenium	Tuff		Reported detection limit exceeds the BV.
19-003	Septic system associated with laboratory building.	19-01264	Mesa top. Along septic outlet drain line for laboratory building. Approximately 25 ft south of sample location 19-01263.	Acenaphthene, Anthracene, Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, BEHP, Carbazole, Chrysene, Dibenz(a,h)anthracene, Dibenzofuran, Fluoranthene, Fluorene, Indeno(1,2,3-cd)pyrene, Methylene Chlor	Tuff	Conduct additional site characterization sampling to assess potential risk to human and ecologic receptors.	The organic chemicals listed were detected.
				Barium, Cesium-137	Tuff		Reported concentration exceeds the BV.
				Antimony	Tuff		Reported detection limit exceeds the BV.
19-003	Septic system associated with laboratory building.	19-01265	Mesa top. Along septic outlet line for laboratory building. Several feet north of laboratory building.	Methylene Chloride, Pyrene	Tuff	Conduct additional site characterization sampling to assess potential risk to human and ecologic receptors.	The organic chemicals listed were detected.
				Arsenic, Barium, Selenium	Tuff		Reported concentration exceeds the BV.
				Antimony	Tuff		Reported detection limit exceeds the BV.

Table D-2 (continued)
Data Evaluation for Risk Characterization:
Summary of All SWMU 19-001-99 COPCs, by Location

Associated SWMU	SWMU Description	Location ID	Location Description	Location-Specific COPCs	Media of Concern	Recommended Action	Rationale
19-002 / 19-003	Septic outfall area for laboratory building.	19-01266	North mesa slope, head of central debris pile. Very steep gradient.	Butanone[2-], Methylene Chloride, Toluene	Soil	Collect additional samples downgradient to determine extent of contamination and assess potential risk to human and ecologic receptors.	Chemical is detected. Sampling downgradient required to determine lateral extent of detected organics.
				Cadmium, Cesium-137, Copper, Lead, Manganese, Mercury, Zinc	Soil		Reported concentration exceeds BV. Sampling downgradient required to determine lateral extent of inorganic and radiological chemicals.
				Antimony	Soil		Reported detection limit exceeds BV. Sampling downgradient required to determine lateral extent of potential inorganic contamination.
19-002 / 19-003	Septic outfall area for laboratory building.	19-01267	North mesa slope, head of central debris pile. Very steep gradient.	Benzo(b)fluoranthene, Butanone[2-], Fluoranthene, Methylene Chloride, Pyrene, Toluene	Soil	Collect additional samples downgradient to determine extent of contamination and assess potential risk to human and ecologic receptors.	Chemical is detected. Sampling downgradient required to determine lateral extent of detected organics.
				Cadmium, Cesium-137, Copper, Lead, Manganese, Mercury, Zinc	Soil		Reported concentration exceeds BV. Sampling downgradient required to determine lateral extent of inorganic and radiological chemicals.
				Antimony	Soil		Reported detection limit exceeds BV. Sampling downgradient required to determine lateral extent of potential inorganic contamination.
19-001	Septic tank outfall area for retreat building.	19-01268	North mesa slope, west of SWMU 19-002. Very steep gradient.	Acenaphthene, Acenaphthylene, Benzo(a)anthracene, Benzo(b)fluoranthene, BEHP, Carbazole, Chrysene, Dibenzofuran, Fluoranthene, Fluorene, Methylnaphthalene[2-], Naphthalene, Phenanthrene, Pyrene, Toluene	Soil	Collect additional samples downgradient to determine extent of contamination and assess potential risk to human and ecologic receptors.	Chemical is detected. Sampling downgradient required to determine lateral extent of detected organics.
				Cesium-137, Copper, Lead	Soil		Reported concentration exceeds BV. Sampling downgradient required to determine lateral extent of inorganic and radiological chemicals.
				Antimony, Cadmium	Soil		Reported detection limit exceeds BV. Sampling downgradient required to determine lateral extent of potential inorganic contamination.

Table D-2 (continued)
Data Evaluation for Risk Characterization:
Summary of All SWMU 19-001-99 COPCs, by Location

Associated SWMU	SWMU Description	Location ID	Location Description	Location-Specific COPCs	Media of Concern	Recommended Action	Rationale
19-001	Septic tank outfall area for retreat building.	19-01269	North mesa slope, west of SWMU 19-002. Very steep gradient.	Benzo(b)fluoranthene, Carbazole, Chrysene, Dibenzofuran, Fluoranthene, Methylene Chloride, Phenanthrene, Pyrene, Toluene	Soil	Collect additional samples downgradient to determine extent of contamination and assess potential risk to human and ecologic receptors.	Chemical is detected. Sampling downgradient required to determine lateral extent of detected organics.
				Cadmium	Soil		Reported detection limit exceeds BV. Sampling downgradient required to determine lateral extent of potential inorganic contamination.
19-001	Septic system associated with retreat building.	19-01271	Mesa top. Former septic storage tank.	Acetone, Methylene Chloride	Tuff	Conduct additional site characterization sampling to assess potential risk to human and ecologic receptors.	The organic chemicals listed were detected.
				Zinc	Tuff		Reported concentration exceeds the BV.
				Antimony, Selenium	Tuff		Reported detection limit exceeds the BV.
19-001	Septic system associated with retreat building.	19-01272	Mesa top. Former septic storage tank.	Acetone, Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Chrysene, Fluoranthene, Phenanthrene, Pyrene	Tuff	Conduct additional site characterization sampling to assess potential risk to human and ecologic receptors.	The organic chemicals listed were detected.
				Barium	Tuff		Reported concentration exceeds the BV.
				Antimony, Selenium	Tuff		Reported detection limit exceeds the BV.

[a] BV = Background value (LANL 1998, 59730).

Table D-3
Evaluation of Potential Decision Error Consequences for SWMU 19-001-99

Decision Rule	Alternative Action	Possible Decision Error	Consequences of the Decision Error	Severity of Consequences of Decision Error When True Parameter Is				Decision Error that Has More Severe Consequences Near the Action Level
				Far below the Action Level	Below But Near the Action Level	Above But Near the Action Level	Far Above the Action Level	
1a-c	Remedial Action	Removal of noncontaminated media (soil or tuff)	Unnecessary expense Delay of site closure	Moderate	Low	None	None	Failure to mitigate risks (on-site and off-site) to human receptors from contaminated media (soil or tuff)
	No Further Action	Failure to mitigate risks to human receptors from contaminated media (soil or tuff)	Closure of a site that poses unacceptable risk to human receptors Off-site transport of contaminants	None	Low	Moderate	Severe	
2	Remedial Action	Removal of noncontaminated media (soil or tuff)	Unnecessary expenses Delay of site closure	Moderate	Low	None	None	Failure to mitigate risks (on-site and off-site) to ecological receptors from contaminated media (soil or tuff)
	No Further Action	Failure to mitigate risks to ecological receptors from contaminated media (soil or tuff)	Closure of a site that poses unacceptable risk to ecological receptors Off-site transport of contaminants	None	Low	Moderate	Severe	

Table D-4
Summary of Sampling Design for AOC C-19-001

Primary objective of design	Compare a site mean or median to a fixed threshold
Type of sampling design	Nonparametric
Sample placement (location) in the field	Systematic with a random start location
Working (null) hypothesis	The mean value at the site exceeds the threshold
Formula for calculating number of sampling locations	Wilcoxon Signed-Ranks (One-Sample) Test
Calculated total number of samples	31
Number of selected sample areas	1 (entire area at AOC C-19-001)
Specified sampling area [a]	27690.46 ft^2
Size of grid / Area of grid cell [b]	32.1158 ft / 893.241 ft^2
Grid pattern	Triangular

[a] The sampling area is the total surface area of AOC C-19-001 minus the "exclusion zones."

[b] Size of grid/Area of grid cell gives the linear and square dimensions of the grid used to systematically place samples.

Table D-5
Coordinates of Sampling Locations at AOC C-19-001

X Coordinate	Y Coordinate
1641679.9687	1774119.3635
1641712.0845	1774119.3635
1641663.9108	1774091.5504
1641696.0266	1774091.5504
1641728.1424	1774091.5504
1641760.2582	1774091.5504
1641792.3740	1774091.5504
1641824.4898	1774091.5504
1641856.6057	1774091.5504
1641647.8529	1774063.7373
1641679.9687	1774063.7373
1641712.0845	1774063.7373
1641744.2003	1774063.7373
1641776.3161	1774063.7373
1641808.4319	1774063.7373
1641840.5477	1774063.7373
1641872.6636	1774063.7373
1641904.7794	1774063.7373
1641663.9108	1774035.9242
1641696.0266	1774035.9242
1641728.1424	1774035.9242
1641760.2582	1774035.9242
1641792.3740	1774035.9242
1641824.4898	1774035.9242
1641856.6057	1774035.9242
1641888.7215	1774035.9242
1641744.2003	1774008.1110
1641808.4319	1774008.1110
1641840.5477	1774008.1110
1641872.6636	1774008.1110
1641904.7794	1774008.1110

State Plane Coordinate System, New Mexico Central Zone, NAD 83.

Appendix E

Investigation-Derived Waste Management

APPENDIX E INVESTIGATION-DERIVED WASTE MANAGEMENT

E-1.0 Introduction

This appendix describes how investigation-derived waste (IDW) generated during the Accelerated Corrective Action (ACA) investigation of Consolidated Solid Waste Management Unit (SWMU) 19-001-99 at Los Alamos National Laboratory (LANL or the Laboratory) will be managed. IDW is solid waste generated as a result of field investigation activities and may include, but is not limited to, drill cuttings; purge water; contaminated personal protective equipment (PPE), sampling supplies, and plastic; fluids from the decontamination of PPE and sampling equipment; and all other wastes potentially contacting contaminants. Certain field investigation activities may also displace environmental media, defined as naturally occurring material indigenous to the environment, including groundwater, surface water, surface and subsurface soils, rocks, bedrock, and gravel. Consistent with the US Environmental Protection Agency (EPA) "area of contamination" policy, environmental media are not considered to be waste (and, hence, not IDW) if they are returned to their point of origin. IDW generated during the investigation of SWMU 19-001-99 will be managed to protect human health and the environment, comply with applicable regulatory requirements, and adhere to the Laboratory waste minimization goals.

All IDW generated during field investigation activities will be managed in accordance with applicable Risk Reduction and Environmental Stewardship–Remediation Services (RRES-RS) Project Standard Operating Procedures (SOPs). These SOPs incorporate the requirements of all applicable EPA and New Mexico Environment Department regulations, US Department of Energy (DOE) orders, and Laboratory Implementation Requirements (LIRs). RRES-RS SOPs applicable to the characterization and management of IDW (and specifically addressed in this appendix) are

- SOP-01.06, Management of Environmental Restoration (ER) Project Waste
- SOP-01.08, Field Decontamination of Drilling and Sampling Equipment
- SOP-01.10, Waste Characterization
- SOP-01.12, Field Site Closeout Checklist

These SOPs are among the SOPs applicable to the investigation at SWMU 19-001-99 and are available at the following URL: http://erproject.lanl.gov/documents/procedures.html.

Investigation activities will be conducted in a manner that minimizes the waste generation by implementing the requirements of the RRES-RS Waste Minimization Awareness Plan, which is updated annually as a requirement of Module VIII of the Laboratory's Hazardous Waste Facility Permit.

Prior to the start of field investigation activities, a waste characterization strategy form (WCSF) will be prepared and approved per requirements of SOP-01.10. The WCSF will provide detailed information on IDW characterization, management, containerization, and potential volume generation. IDW characterization will be achieved through existing data and/or documentation, through direct sampling of the IDW, or sampling of the media being investigated (i.e., surface soil, subsurface soil, etc.). If sampling is necessary, it will be described in a sampling and analysis plan developed in conjunction with the WCSF.

The selection of waste containers will be based on the appropriate US Department of Transportation requirements and the type and amount of IDW planned to be generated. Immediately following containerization, each waste container will be individually labeled by waste classification, item identification number, radioactivity (if applicable), and date generated. Waste containers will be managed in clearly marked and appropriately constructed waste accumulation areas. Waste accumulation area

postings, regulated storage duration, and inspection requirements will be based on the type of IDW and its classification. Container and storage requirements will be detailed in the WCSF and approved prior to waste generation.

E-1.1 Waste Management and Disposal

Waste management and disposal activities for SWMU 19-001-99 include the following tasks:

- Manage all environmental media and wastes, including used immunoassay test kits, in accordance with all applicable regulations and DOE/Laboratory/RRES-RS implementing requirements, including, but not limited to, the Resource Conservation and Recovery Act (RCRA)/Hazardous Solid Waste Act; the New Mexico Administrative Code (NMAC), Title 20, Chapter 4, Part 1 (20 NMAC 4.1) 20 NMAC 9.1; the Clean Water Act, 20 NMAC 6.2; the Toxic Substances Control Act; the Clean Air Amendment; the LIR 404 series;-SOP-01.06, "Management of Environmental Restoration Project Waste," and SOP-01.10, "Waste Characterization."
- Establish less than 90-day waste accumulation area(s) for potential hazardous waste (used immunoassay test kits and potential industrial or New Mexico Special Waste). Components of used immunoassay test kits are assumed to be hazardous waste until receipt of waste characterization results confirm otherwise.
- Collect waste characterization samples for laboratory analysis within 24 hours of generating the waste.
- Coordinate the management, transportation, and disposal of all wastes with the RRES Environmental Characterization and Remediation program.
- Ensure that all returned samples, whether for site or waste characterization, are properly managed, characterized, and disposed of.
- Ensure that all waste, including but not limited to, returned samples, used PPE, used immunoassay test kits, contaminated media, debris, equipment, and other investigation-derived waste are properly characterized and disposed. Sites must be verified as "waste free" by RRES-RS waste management personnel prior to completion of the project (SOP-01.12, "Field Site Closeout Checklist").

E-1.2 Estimated Types and Volumes of Waste

Five separate waste streams are anticipated from this field investigation. The waste streams, expected waste types, and volumes are summarized in Table E-1. For wastes solely generated during ACA activities (e.g., PPE, equipment, and removed soil), it is assumed that the waste contaminants will be identical to the contaminants found in the soil. Therefore, characterization of these wastes will be based on results of the fixed laboratory analysis of the characterization and confirmation samples for soil. Waste stream descriptions, including the principal components of the waste and any uncertainties in volume calculations, are described in the following paragraphs.

Potentially contaminated soil: This waste stream will be composed of chemical and low-level radioactive (bulk) unconsolidated soil waste. Characterization of this waste will be determined from the contamination levels found in the soil based on historical sampling analytical results.

Decontamination water: This waste stream will be composed of washing liquids generated from the decontamination of sampling equipment. However, the majority of equipment decontamination will be performed using dry techniques in accordance with SOP-01.08, "Field Decontamination of Drilling and Sampling Equipment."

Plastics, PPE, and sampling wastes: This waste stream will include various types of plastic sheeting (e.g., tarps and contamination control covers), disposable gloves and coveralls, and sampling supplies such as plastic scoops, plastic bags, jars, and dry decontamination waste. Plastics, personnel protective equipment, and sampling-related wastes have the potential to become contaminated through direct contact with contaminated environmental media and debris. Because this waste is generated during only during ACA activities, it is assumed that the waste contaminants will be identical to the contaminants found in the soil. Therefore, characterization of this waste will be based on results of the fixed laboratory analysis of the characterization and confirmation samples for soil.

Spent immunoassay test kits: Sampling containers and materials from used test kits. This waste stream consists of glass ampules, soil, and miscellaneous plastic/Teflon. This solid waste is assumed to be hazardous based on its ignitability, until a flash point test determines it to be non-hazardous. This waste will be stored in a 55-gallon steel drum at a Satellite Accumulation Area on site until a waste profile form (WPF) and chemical waste disposal request (CWDR) are approved, and it is transported offsite for final disposal.

Spent methanol from test kits: This is a RCRA hazardous waste (U154) because of its ignitability; methanol from each individual immunoassay test/sample vial will be transferred to a polyethylene storage bottle with a threaded/sealed top. The material safety data sheet for methanol will be the basis of acceptable knowledge for this waste stream. This waste will be stored in a sealed secondary container at a Satellite Accumulation Area on site until a WPF and CWDR are approved and it is transported offsite for final disposal.

Table E-1
Waste Streams, Types, and Volumes Estimated for SWMU 19-001-99

Waste Stream	Waste Type	Anticipated Volume
Potentially contaminated soil	Solid, chemical, low-level radioactive (bulk)	Two 1-yd^3 bulk sacks
Decontamination water	Liquid, industrial wastewater	Less than 6 gal. per day disposed of on site
PPE, plastic sheeting, and disposable sampling equipment	Solid industrial waste	One 55-gal. drum with polyethylene liner
Spent immunoassay test kits	Solid industrial waste	Approximately five 1-gal. resealable bags stored in a 55-gal. steel drum
Spent methanol from test kits	Chemical, hazardous waste (U154)	Less than 1 L stored in secondary container