LA-UR-06-6918
October 2006
EP2006-0783

Investigation/Remediation Work Plan for Material Disposal Area B, Solid Waste Management Unit 21-015, at Technical Area 21, Revision 1

Los Alamos
NATIONAL LABORATORY
EST.1943

Prepared by
Environmental Programs Directorate

LA-UR-06-6918
EP2006-0783

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EXECUTIVE SUMMARY

This investigation/remediation work plan (IRWP) describes the methodology that will be used to excavate the historical contents of Material Disposal Area (MDA) B, Solid Waste Management Unit 21-015, at Technical Area 21 within Los Alamos National Laboratory (LANL or the Laboratory). This IRWP also introduces the sampling and analysis methodology to be used to characterize the excavation bottom and side walls. Included in this IRWP is the complete removal of potential contaminant sources (in the form of buried waste) from the MDA B disposal trenches. Based on a conservative estimate of potential radiological waste inventory, MDA B has been categorized as a Nuclear Hazard Category 3 nuclear facility, requiring special consideration of radiological and hazardous materials work-related safety issues.

This investigation/remediation is being conducted under the requirements of the March 1, 2005, Compliance Order on Consent (hereafter, the Consent Order), which replaces the corrective action requirements of Module VIII of the Laboratory's Hazardous Waste Facility Permit.

The principal objectives of the IRWP are to

- characterize the types and quantities of waste contained in historical disposal trenches at MDA B;
- remove, and properly dispose of, all waste material buried in disposal trenches at MDA B;
- collect confirmation samples to characterize the radiological, organic chemical, and inorganic chemical concentrations in the soil and rock adjacent to the disposal trench sides and bottoms and in the deeper subsurface beneath the site; and
- obtain (through the third objective) the data needed to prepare a sampling and analysis plan (SAP) to support the evaluation of the potential risk to human health and the environment associated with any residual contamination remaining at MDA B after the waste is removed.

Achieving these objectives requires direct excavating into the MDA B disposal trenches, collecting confirmation samples from the geologic media below and adjacent to the excavation(s) to verify whether residential soil screening levels (SSLs) and screening action levels (SALs), hereafter identified as "residential cleanup levels," have been met, and to prepare a SAP that may include advancing boreholes into the deeper subsurface to define any residual extent of contamination.

This work plan proposes the complete removal of the waste material buried at MDA B in order to

- reduce or eliminate the potential risk to the public and the environment by removing the contaminant source in a single effort;
- reduce the impact on the public, including the businesses on DP Road, by completing the remediation of MDA B earlier than currently scheduled; and
- remediate the site to residential cleanup levels (or, if necessary, a combination of residential and industrial cleanup levels [contingency]) that are protective of human health.

All buried waste will be removed and disposed of at appropriate disposal facilities according to the characteristics of the waste. Surrounding soil and tuff will be excavated until analytical results from associated confirmation samples indicate that inorganic chemical, organic chemical, and radionuclide concentrations are below their respective residential cleanup levels. The goal of excavation will be to remove all contamination to below those levels, but this will be limited by the practical ability to excavate safely.

Excavation activities will be performed inside a temporary mobile structure in order to provide access control, protect the operations from environmental factors, and impede off-site exposure to excavated

material. Designed safety features such as temporary enclosures will help isolate the planned field activities from the public and surrounding environment. Work activities will be planned to minimize the impact on the public, including the businesses on DP Road. To assess possible issues, plan and control the work environment, and prevent damage to the surrounding environment, an implementation plan will be developed. Materials removed from the excavation will be evaluated to ensure proper handling in accordance with all applicable Laboratory health and safety requirements.

Samples taken for waste and in-situ material characterization will be collected based on field-screening data and physical observations. Samples will be analyzed at quality-controlled laboratories for a comprehensive suite of analytes. Analytical and observational data will be used to establish the waste types and volumes within the disposal trenches.

A SAP will be prepared to accomplish the following:

- Further define the extent of contamination within the tuff matrix beneath the disposal area and characterize fractures in the Bandelier Tuff
- Evaluate the permeability of the tuff unit overlying the Cerro Toledo interval
- Determine if perched groundwater is present beneath the site

The SAP will be prepared to coincide with the conclusion of excavation and will address the installation of boreholes and sampling beneath the excavation, if necessary, in accordance with Section IV.C.2.d of the Consent Order.

Analytical data from samples taken at locations immediately below and adjacent to the disposal trenches during or after excavation, as well as the deeper borehole data, will supplement the existing data, providing better definition of the nature and extent of potential residual contamination at the site. The SAP will be prepared after the excavation activities and will be submitted to NMED to address the extent of any residual contamination not removed during the remedial excavation activities. This SAP will be submitted to NMED within 90 days of concluding the excavation activities. The SAP must be approved by NMED ahead of its execution. All data collected will be included in an investigation report to be submitted to NMED following completion of the investigation and source-removal activities. During field operations quarterly status reports will be prepared to keep NMED apprised of field conditions and the progress of activities. The first status report is due 90 days after the start of the field activities. Any deviations from this work plan will be documented in the report.

Appendix B to this work plan, the historical investigation report, describes the results of previous investigations into contaminants that may have been discharged or released at MDA B during historical operations at the site. The investigations include known and suspected sources of potential groundwater contaminants and a review of existing data and other information acquired during previous investigations. Also included are results of the previously undocumented 1998 Resource Conservation and Recovery Act facility investigation.

Because of the proximity of MDA B to the city of Los Alamos and the businesses immediately across the street, public meetings will be held during the planning and execution of field activities. Information regarding emergency warning and response will be provided to those businesses that could be affected.

The activities proposed in this plan will be effective in the long term by removing all contaminant source material, thereby permanently reducing human health and ecological risk and removing the potential for any ongoing releases in the subsurface. The removal of all buried waste at MDA B is technically feasible; excavation of hazardous waste landfills has been performed at numerous national sites and is based on

tested and readily available technology. Because of demonstrated results at similar sites, long-term effectiveness of the proposed activities is expected. These activities also represent a cost-effective solution that reduces the likelihood of multiple iterations of investigation and remediation.

MDA B will remain under the control of the federal government until decisions are made concerning the future commercial development of the DP Road corridor.

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1.0 INTRODUCTION

1.1 General Site Information

Los Alamos National Laboratory (LANL or the Laboratory) is a multidisciplinary research facility owned by the U.S. Department of Energy (DOE) and managed by Los Alamos National Security (LANS), LLC. The Laboratory is located in north-central New Mexico, approximately 60 mi north of Albuquerque and 20 mi northwest of Santa Fe. The Laboratory site covers 40 mi^2 of the Pajarito Plateau, which consists of a series of finger-like mesas separated by deep canyons containing perennial and intermittent streams running from west to east. Mesa tops range in elevation from approximately 6200 to 7800 ft above sea level (asl).

The Laboratory's Environmental Programs (EP) Directorate is participating in a national effort by the DOE to clean up sites and facilities formerly involved in weapons research and production. The EP Directorate's goal is to ensure that DOE's past operations do not threaten human or environmental health and safety in and around Los Alamos County, New Mexico. To achieve this goal, EP investigates sites potentially contaminated by past Laboratory operations. The site discussed in this work plan is a site where solid wastes had been placed at one time (i.e., it is a solid waste management unit [SWMU]).

This investigation/remediation work plan (IRWP) is being conducted under the requirements of the March 1, 2005, Compliance Order on Consent (hereafter, the Consent Order), which replaces the corrective action requirements of Module VIII of the Laboratory's Hazardous Waste Facility Permit (EPA 1990, 01585). The New Mexico Environment Department (NMED) is the administrative authority for activities being performed under the Consent Order. Information on radioactive materials and radionuclides, including the results of sampling and analysis of radioactive constituents, is voluntarily provided to NMED in accordance with DOE policy.

Material Disposal Area (MDA) B is an inactive subsurface disposal site, designated SWMU 21-015, which may contain both hazardous and radiological chemicals. The site is located in Technical Area 21 (TA-21), on Delta Prime (DP) Mesa (a mesa separating Los Alamos Canyon and DP Canyon) (see Appendix B, Figures B-1, B-2). MDA B occupies approximately 6 acres and consists of multiple disposal trenches (Figure 1.1-1). From 1944 until it closed in 1948, MDA B received process wastes from operations within TA-21 at DP East and DP West. The wastes disposed of at MDA B were highly heterogeneous, primarily radioactively contaminated laboratory wastes and debris and limited liquid chemical waste; however, a formal waste inventory was not maintained (LANL 1991, 07529).

1.2 Investigation Objectives

MDA B has been investigated numerous times since disposal operations were discontinued. These investigations focused on surface characterization and subsurface releases outside the actual disposal trenches. The nature and extent of contamination released from MDA B is generally known; however, none of the investigations have specifically targeted the characterization of the contents of the MDA B disposal trenches and the soil or tuff near the interface with the waste disposal trenches. As discussed in the historical investigation report ([HIR] Appendix B) and in section 2, waste-disposal practices during MDA B's operational lifetime are not well documented. The contents of the MDA B disposal trenches are largely uncharacterized but represent an ongoing potential source for release of contamination beyond the boundaries of the disposal trenches.

The principal objectives of the IRWP are to

- characterize the types and quantities of waste contained in the historical disposal trenches at MDA B;
- remove, and properly dispose of, all waste material buried in disposal trenches at MDA B;
- characterize the radionuclide, organic chemical, and inorganic chemical concentrations in the soil and rock adjacent to the disposal trench sides and bottoms and in the deeper subsurface beneath the site;
- obtain (through the third objective) the data needed to prepare a sampling and analysis plan (SAP) to support the evaluation of the nature and extent associated with any residual contamination remaining at MDA B after the waste is removed.

Achieving these objectives requires direct excavating into the MDA B disposal trenches, collecting samples from the geologic media below and adjacent to the excavation(s), and advancing boreholes into the deeper subsurface.

Data about the residual radiological and hazardous chemical concentrations will come from samples to be taken from the fill, soil, or rock in the side walls of the excavation at a later date based on the approved SAP from the native tuff in the bottom of the excavation. These data will be used to assess the nature and extent of potential residual contamination beneath and surrounding the MDA disposal trenches.

This work plan describes the rationale for the proposed scope of work and specifies the excavation and sampling methodologies and protocols that will be used for collecting, analyzing, and evaluating the data required to meet the objectives of this IRWP.

2.0 BACKGROUND

Appendix B of this document is the HIR. The HIR provides the most complete information regarding MDA B's background. A summary of the relevant background information is provided in this section. Complete details, including specific analytical results, are presented in the HIR.

2.1 Operational History

Historical records state that MDA B consisted of several disposal trenches approximately 300 ft long, 15 ft wide, and 12 ft deep, and that MDA B included at least one smaller shallower trench on the eastern end of the site (LANL 1991, 07529). Waste disposal at MDA B ceased in 1948. Geophysical surveys were conducted in 1996, 1997, and 1998, to delineate the location and number of disposal trenches at MDA B (Ferguson et al. 1998, 58212; Bay Geophysical 1998, 64146; Bay Geophysical 1998, 64147; Thavoris 2001, 83862). The results of the surveys were interpreted as several large trenches. One to three of these make up the western portion of the MDA; one large trench makes up the eastern portion (see Appendix B, Figure B-26).

From 1944 until 1948, the Laboratory's primary waste-producing operations at TA-21 were located at DP East and DP West. By the fall of 1944, the Laboratory's Chemistry Division had developed several separation techniques to recover plutonium from residues. Solids from incinerator reduction operations were dissolved in nitric and hydrofluorous acids to recover trace amounts of plutonium (Merrill 1990, 11721). During the early 1940s, plutonium recovery was conducted until the maximum concentration for plutonium in solution was 10^{-4} g/L. Once this concentration was reached, the solution was discarded. These processes are described to provide an overview of the materials that were potentially disposed of at MDA B.

There are several indications that hazardous chemicals may be present at MDA B. In 1948, a portion of the disposal area caught fire. During the fire, several cartons of waste caused minor explosions and, on one occasion, a cloud of pink gas arose from the debris in the dump. The chemicals disposed of included old bottles of organic compounds such as perchlorate, ethers, and solvents. A 1987 DOE document also stated that lecture bottles, mixtures of spent chemicals, old chemicals, and corrosive gases may be in the trenches at the east end of MDA B (DOE 1986, 08657).

The principal radioactive contaminants consist of the types of radioactive materials used at the time: plutonium, polonium, uranium, americium, curium, radioactive lanthanum (RaLa), and actinium. Additionally, there could be waste products possibly contaminated with either uranium-235 or cesium-137 from the water boiler reactor (Meyer 1952, 28154). Short-lived radionuclides, such as RaLa, are no longer present because of radioactive decay. The majority of the radioactively contaminated waste probably consisted of paper, rags, rubber gloves, glassware, and small metal apparatuses placed in cardboard boxes by the waste originator and sealed with masking tape. The remainder of the material consisted of metal, such as air ducts and large metal apparatuses. The latter type of material was placed in wooden boxes or wrapped with paper (Meyer 1952, 28154). At least one truck contaminated with fission products from the Trinity test is believed to be buried in MDA B (DOE 1986, 08657).

The complete operational history relevant to MDA B during the 1944 to 1948 time frame that MDA B was open is presented in LANL's "MDA Historical Context" document (LANL 2006, draft).

2.2 Summary of Historical Investigations

Detailed discussions of data from surface and subsurface investigations are presented in sections B-3 and B-4 of the HIR (Appendix B). The following subsections summarize the relevant results.

2.2.1 Surface Soils

Surface investigations at MDA B have included surface soil sampling and surface flux measurements of volatile organic compounds (VOCs). Sampling events occurred from 1966 to 2001.

It is difficult to directly relate MDA B surface concentrations to specific releases from MDA B. There have been various site-wide releases of chemicals to the surface at TA-21 from facility operations and stack emissions (LANL 1994, 26073; LANL 1995, 52350). Additionally, the surface at MDA B has been paved, reworked, and used as a pilot for a barrier project. The locations and concentrations of organic chemicals, inorganic chemicals, and radionuclides in surface soils are reported in Appendix B (sections B-3 and B-4).

Americium-241, cesium-137, plutonium-238, plutonium-239, and tritium were detected consistently across the surface of MDA B (Appendix B, Figure B-45). Plutonium-239 is the most consistently detected radionuclide and, along with tritium, is a site-wide contaminant based on 1992 mesa-wide survey data (LANL 1994, 26073; LANL 1995, 52350).

Organic chemicals were detected very infrequently at the surface of MDA B (Appendix B, Figure B-47). Lead and zinc were detected above background values consistently across MDA B. Other inorganic chemicals, including cadmium, copper, and mercury, were detected above background values across the site. The spatial distribution of inorganic chemicals in surface soils is shown in Appendix B, Figure B-46.

2.2.2 Subsurface Tuff

Three subsurface investigation campaigns were conducted at MDA B. These occurred in 1966 (Kennedy 1966, 00540), 1983 (LANL 1991, 07529), and 1998 (unpublished data, presented in Appendix B of this report, section B-4.3.1). In 1966 and 1983, vertical boreholes were drilled alongside the disposal area

boundary. The 1983 results indicated potential tritium contamination at depth. In 1998, seven angled boreholes were drilled beneath the disposal trenches in order to assess potential releases from the disposal trenches. Borehole logs from the 1998 drilling activities are included as Appendix E to this report. Lead was detected slightly above background at several depths in one angled borehole at the west end of the disposal site (location ID 21-10557) and in one sample in another angled borehole in the central part of the site (location ID 21-10551). Aluminum, arsenic, cadmium, mercury, and zinc were also detected at concentrations above background (LANL 1998, 59730) in the 1998 boreholes (Appendix B, Figure B-29).

Tritium was detected above background (LANL 1998, 59730) in six of seven boreholes (Appendix B, Figure B-28 and Table B-27). Borehole 21-10556 was the only borehole with no detections of tritium above background. The tritium concentration in borehole 21-10554 increased slightly over the length of the boring, but it showed a decrease in concentration in the deepest sample (Appendix B, Figures B-28 and B-36). Borehole 21-10554 is located beneath what is believed to be the chemical disposal trench. It appears that tritium has been released from the disposal trenches to the subsurface tuff. Americium-241 and strontium-90 were also detected in borehole 21-10554 and showed decreasing concentrations with depth (Appendix B, Figures B-28 and B-36). Uranium-234, -235, and -238 were detected above background in one sample in one borehole, 21-10557 (Appendix B, Figures B-28 and B-40).

The pore-gas sampling results from the angled boreholes identified trace levels of several VOCs, primarily trichloroethene (TCE) and 1,1,1-trichloroethane (TCA), in the subsurface, in the parts per billion by volume (ppbv) range (Appendix B, Figure B-30). Pore-gas samples were collected using a borehole packer system and SUMMA canister collection method. The VOCs detected are generally consistent across the site (Appendix B, Table B-30).

2.2.3 Summary of MDA B Contaminants

Data from the site investigations conducted to date indicate that low concentrations of radionuclides, inorganic chemicals, and organic chemicals have been detected in surface soils and subsurface tuff. Figures B-28, B-29, B-30, B-45, B-46, and B-47 (see Appendix B) are plan view maps showing the locations and concentrations of inorganic chemicals and radionuclides detected above background (LANL 1998, 59730) and detected organic chemicals in the surface and subsurface of MDA B. According to a review of the available data, the sources of surface and subsurface contamination are limited in nature and extent and are mainly related to past disposal practices at the MDA B disposal trenches.

3.0 SITE CONDITIONS

The following sections present the current surface features and the existing subsurface geologic characteristics beneath TA-21, in general, and MDA B, in particular. Some of the known surface and subsurface characteristics and their potential effects on the occurrence and concentration of contaminants are listed below:

- a canyon-mesa terrain, which affects meteorological conditions and ecological habitats at the surface
- a semiarid climate with low precipitation and a high evapotranspiration rate, which limits the extent of subsurface moisture percolation, limiting the amount of moisture available for the leaching of radionuclides or other hazardous waste constituents
- a thick and relatively dry unsaturated (vadose) zone, which greatly restricts or prevents downward migration of contaminants in the liquid phase through the vadose zone to the regional aquifer

This information, and information about other elements of the environmental setting at MDA B, is useful when evaluating the site investigation data with respect to the potential impact of contamination from historical site activities.

3.1 Surface Conditions

The elevation at the top of DP Mesa in the vicinity of MDA B ranges from 7160 ft to 7220 ft asl, with a gentle slope to the south. The canyon slope ranges from 7060 ft asl in the bottom of BV Canyon to 7180 ft asl on the south edge of DP Mesa, immediately south of MDA B. Surface drainage from MDA B (e.g., rainwater, snow melt) flows south into BV Canyon (so named because it is adjacent to MDA B and MDA V), a shallow tributary of Los Alamos Canyon. Topography prevents MDA B surface runoff from flowing north into DP Canyon (Appendix B, Figure B-6).

Occupying approximately 6 acres (2.4 hectares), MDA B consists of three areas:

- a small soil-covered vegetated area at the extreme western end of MDA B (approximately 105 ft by 150 ft)
- a large asphalt-paved area occupying the long western leg and the central portion of the site (approximately 1500 ft long by 120 ft wide)
- a soil-covered vegetated area occupying the eastern leg of MDA B (approximately 600 ft long by 150 ft wide)

None of the three areas contains any surface structures or utilities, and all are enclosed by a galvanized steel chain link fence. Vegetation has penetrated portions of the asphalt pavement through cracks, and trees line a portion of the northern boundary of the site. Air-monitoring stations are located on the northern and northeastern sides of the fence along DP Road.

The area to the west of MDA B is vacant but was the former location of a residential trailer park. To the east of MDA B are Consolidated Units 21-027(d)-99, 21-018(a)-99 (MDA V), and 21-024(e)-99. To the north are Consolidated Unit 21-024(f) and SWMUs 21-013 (d,e). To the northwest is SWMU 21-029 (DP Tank Farm). To the southwest are Consolidated Unit 00-030(b)-00 and SWMU 00-010(a) (Appendix B, Figure B-3). Immediately to the north of MDA B and the south of DP Road is an unpaved area heavily used by commercial businesses along DP Road for parking and staging materials and deliveries. The area to the north of, and alongside, DP Road is paved and occupied by commercial buildings. The businesses include a building supply store, a newspaper office, a caterer, and other office space. Farther to the east along DP Road, the Laboratory has active research facilities and office space at TA-21. DP Road is the only access for the commercial businesses and the Laboratory facilities.

3.1.1 Surface Water

Mesas of the Pajarito Plateau are generally dry, both on the surface and within the bedrock forming the mesa. Canyons range from wet to relatively dry; the wettest canyons contain continuous streams and perennial groundwater in the canyon-bottom alluvium. DP Mesa is bounded on the north by DP Canyon and on the south by Los Alamos Canyon and BV Canyon, which in turn flows into Los Alamos Canyon. DP and Los Alamos Canyons have intermittent flow sufficient to support alluvial groundwater systems, but BV Canyon has only occasional stream flow that is insufficient to support alluvial groundwater.

There are no streams on DP Mesa; stormwater and snowmelt generally run off the mesa as sheet flow or in small drainages off the mesa sides. Runoff from MDA B consists of sheet flow into BV Canyon, which in turn flows into Los Alamos Canyon.

The EP Directorate has developed a standard operating procedure (SOP) for assessing the potential for erosion and sediment transport at individual SWMUs (SOP-2.01). Erosion potential is numerically rated from 1 to 100 using a matrix system. SWMUs that score greater than 60 have a high erosion potential. The erosion potential score for SWMU 21-015 (MDA B) is 17.9, indicating a low erosion potential.

3.1.2 Surface Soils

Natural or undisturbed surface soil cover is limited at TA-21 because of Laboratory operations such as waste disposal and building construction and demolition. The present-day mesa surface in the area of MDA B is predominantly asphalt and landfill cover material. Where they are undisturbed, soils on the mesa surface are typically thin and poorly developed. They tend to be sandy in texture near the surface, with increased clay content in the deeper horizons. A discussion of the soils in the Los Alamos area can be found in section 2.2.1.3 of the ER Project's installation work plan (LANL 1998, 62060, pp. 2–21) and in Nyhan et al. (1978, 05702, pp. 24–25).

3.2 Subsurface Conditions

None of the three MDA B areas has any underground utilities, underground storage tanks, or septic tanks associated with MDA B operations. There is an abandoned radioactive liquid waste line running along the southern boundary of the site, outside the fence, that served other Laboratory facilities (LANL 2003, 91446). This waste line is not part of SWMU 21-015 but will be investigated and removed as part of the excavation and characterization activities. Outside the fence, near the southeast corner of the site, is a Los Alamos County sanitary sewer lift station. Buried water and communications lines are located under the area between the north fence and DP Road. A water hydrant is located inside the northwest corner of the fence.

3.2.1 Stratigraphy

The generalized stratigraphy of DP Mesa in the area of MDA B is shown in Figure 3.2-1. DP Mesa consists of Bandelier Tuff (Qbt) overlain by a thin layer of alluvium and soil. The Bandelier Tuff unit is subdivided into two members in ascending order: the Otowi and the Tshirege. MDA B is situated within the Tshirege Member, which is a compound cooling unit divided into four distinct cooling units (units 4, 3, 2, 1v/1g) (Broxton et al. 1995, 50121, pp. 45–51). The bedrock directly underlying TA-21 is cooling unit 3 (Qbt 3) of the Upper Tshirege, a cliff-forming tuff that is nonwelded to partially welded. Below MDA B, the Otowi and Tshirege Members are separated at about 300 ft below ground surface (bgs) by the Cerro Toledo (Qct) interval, a 10- to 40-ft-thick sequence of volcaniclastic sediments deposited in braided stream systems. The Bandelier Tuff and deposits of the Cerro Toledo interval are derived primarily from explosive volcanic eruptions in the Valles Caldera approximately 1.2 million yr ago (Goff 1995, 49682, p. 7). The basal Guaje Pumice Bed of the Otowi Member separates the Bandelier Tuff from the underlying clastic fanglomerate sediments of the Puye Formation (Tp). This feature may be locally absent in portions of TA-21.

3.2.2 Cliff Retreat and Fractures

According to a report about geomorphic studies at DP Mesa and vicinity (Reneau 1995, 50143, pp. 66–69), tributary stream systems and their canyons (possibly including BV Canyon and the upper reaches of DP Canyon) developed before the incision of Los Alamos Canyon, and minimal cliff retreat has occurred in these canyons since then. A paleochannel that has been identified as extending over portions of the DP Mesa may also be related to the tributary stream system. The report goes on to say that the exposure of most of the MDAs at TA-21 on DP Mesa through cliff retreat is improbable over periods exceeding 10,000 yr. The exception, MDA V, is more difficult to evaluate. According to a fracture study conducted at

TA-21, a relatively high-density fracture zone runs with a northerly strike through MDA V (Wohletz 1995, 54404). This zone may be related to the Pajarito fault system. The fracture characteristics of unit 2 of the Tshirege Member, which was the focus of this study, are very similar to those found in previous fracture studies of unit 3, allowing for extrapolation of results to the rocks directly below TA-21.

3.2.3 Hydrogeology

3.2.3.1 Infiltration

The proposed hydrogeologic conceptual model for the Pajarito Plateau (LANL 1998, 59599, p. 5) predicts the infiltration of water into the subsurface and the subsequent transport of water, vapor, and solutes through the upper regions of the vadose zone. This process is heavily influenced by surface conditions such as topography, surface water flow, and precipitation. The natural source of moisture in the vadose zone is precipitation, most of which is removed as runoff and evapotranspiration (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.

Two geologic properties of the Bandelier Tuff that significantly influence recharge rates are the degree of welding and devitrification. Both result from the prolonged presence of residual gases and high temperatures following deposition. Because different tuff units were deposited at different temperatures, and because individual units were laid out in variable thicknesses over different landscapes, cooling was not uniform. Consequently, welding varies spatially, both between and within separate depositional layers. Welded tuffs tend to be more fractured than nonwelded tuffs.

Under unsaturated conditions, most of the open fractures beneath the site are expected to be completely dry, and vadose zone water will exist in the tuff matrix only. Only in situations where substantial infiltration occurs from the ground surface, as was potentially the case under the active absorption beds, will the fractures become wet and conduct water. However, modeling studies predict that when fractures disappear at contacts between stratigraphic subunits, when fracture fills are encountered, or when fracture coatings are interrupted, fracture moisture is absorbed into the tuff matrix (Soll and Birdsell 1998, 70011, pp. 193–202).

3.2.3.2 Perched Groundwater

Observations of perched intermediate groundwater in Laboratory wells are rare on the Pajarito Plateau. Perched waters are thought to form mainly at horizons where geologic properties change dramatically, such as at paleosol horizons with clay or caliche found in basalt and volcanic sediment sequences. The Cerro Toledo interval, Guaje Pumice Bed, and Puye Formation are local examples. The Cerro Toledo interval was drilled through at well LADP-4, which is located immediately north of TA-21 in DP Canyon, but groundwater was not observed, and the Guaje Pumice Bed was not encountered. Perched intermediate groundwater has been observed in some locations on the plateau, including at well LADP-3 (in the Guaje Pumice at 6430 ft asl) and at well R-7 (in the Puye Formation at 6420 ft asl), both south of TA-21 in Los Alamos Canyon, and at well Otowi-4 on the eastern base of DP Mesa east of TA-21 (in the Puye at 6380 ft asl). Figure 3.2-2 shows the locations of Laboratory groundwater wells with respect to MDA B. Saturated conditions were not encountered in the boring at location 21-02523 near MDA V (Figure B-3). This boring was drilled into the Otowi Member of the Bandelier Tuff to a depth of 660 ft bgs (approximately 6500 ft asl).

3.2.3.3 Regional Aquifer

The main aquifer in the Los Alamos area rises westward from the Rio Grande within the Santa Fe Group and into the Puye Formation beneath the central and western portion of the Pajarito Plateau. The depth of the aquifer decreases from about 1200 ft bgs along the western margin of the plateau to about 600 ft bgs along the eastern margin (see Figure 3.2-2). The regional aquifer was encountered in deep wells near MDA B at 5870 ft asl in well R-7, at 5850 ft asl in well Otowi-4, and at 5835 ft asl in well R-8, (Figure 3.2-2), resulting in an approximate 1260-ft depth to groundwater at MDA B. The groundwater in the main aquifer is separated from any alluvial or perched groundwater by 350–620 ft of tuff and volcanic sediments (Purtymun 1995, 45344, p. 29).

4.0 SCOPE OF ACTIVITIES

Executing the activities included in this work plan will result in the removal of all buried waste at MDA B, and the characterization of the remaining soil and bedrock (tuff) to determine the nature and extent of any residual contamination, any potential human health or ecological risk associated with the site, and the potential need for future corrective action. The sequence of disposal trench excavation will maximize efficiency and safety and optimize the ability to stage material and equipment on the site. The proximity to the city of Los Alamos and the businesses located north of DP Road requires that precautions be taken to minimize the potential for exposure of the public to hazards that may be encountered during excavation. An emergency response plan will be implemented to provide specific steps for notifying and protecting the public in the event of a release of hazardous material. Training of the adjacent business occupants and employees will be conducted and will include contingency planning for worst-case accident scenarios such as spontaneous ignition of pyrophoric materials by exposure to air. Training and work progress will be communicated on an as-needed basis, to accommodate the dynamic nature of the investigation.

The impact on the public will be minimized to the degree practicable by careful planning of the excavation and investigation activities. Activities related to investigation/remediation and materials management will be conducted within the site boundary and inside an enclosure. The enclosure will allow work to be performed during inclement weather (rain, snow, high winds). Also, the enclosure will prevent the direct exposure of material in the open excavation to adverse weather conditions and will provide some measure of site security and control. To mitigate the hazards associated with operating combustion engine equipment within the enclosure, a fresh air circulation system will continuously replace air in the enclosure and eliminate combustion gases at a determined rate. Excavations will be backfilled upon complete removal of all buried waste to prevent ongoing hazards associated with open excavations and to prevent the heavy equipment from tracking any residual contamination outside of the excavation.

4.1 Justification for Proposed Scope of Work

The scope of this work plan; the sampling conducted for the 1998 SAP (LANL 1998, 59506) and addendum (LANL 1998, 70231) approved by NMED; and the previous Resource Conservation and Recovery Act facility investigations (RFIs) and data collected for TA-21, MDA B, and MDA V form a basis for comparison with the Consent Order. The Laboratory's proposed approach is to excavate and remove all historical contents of MDA B and remediate the site to residential cleanup levels (i.e., soil screening levels [SSLs] for chemicals and screening action levels [SALs] for radionuclides). At the conclusion of the excavation, the Laboratory will then prepare a SAP (if necessary) for NMED approval. The objective of the SAP will be to define the nature and extent of any residual contamination at MDA B by using data from previous RFI work and by removing the contaminant source (buried waste) and allowing sampling beneath the waste trenches. The nature and extent of any residual contamination will be characterized by sampling directly beneath the former waste disposal trenches after the waste has been removed and possibly also by drilling subsurface boreholes.

Table 4.1-1 provides a detailed comparison of the investigation requirements identified in the Consent Order with a brief justification for the Laboratory's proposed approach. Should field conditions differ substantially from those that are anticipated (based on conditions encountered during past site activities), additional investigations or other activities may be implemented upon agreement with NMED.

In 1998, geophysical surveys were conducted to define the disposal trench geometries, as specified in Section IV.C.2.d.ii of the Consent Order (section B-2.2.2 and B-4.2).

The Consent Order requirements specify the installation of eight borings at MDA B, including two deep borings to the base of the Cerro Toledo interval. In addition to removing all waste from MDA B, the Laboratory proposes drilling vertical boreholes to the base of the Cerro Toledo interval, if necessary, to define the nature and extent of contamination at the site. This will be accomplished at the conclusion of the excavation activities by implementing a NMED-approved SAP.

Potential contamination in the tuff beneath and in the side walls of the disposal trenches will be characterized by field screening, sampling, and laboratory analyses. Field screening will be used to identify areas of potentially elevated contamination; the screening results will be used to target additional excavation, if necessary, and to identify locations for biased sampling after completion of excavation and backfilling. Sample analyses will include all analytes required by the Consent Order. This means that pH, polychlorinated biphenyls (PCBs), explosive compounds, dioxins, furans, nitrates, perchlorate, and cyanide, which were not part of previous analytical suites, will be included in the analytical suite for MDA B. This is in addition to the VOCs, semivolatile organic compounds (SVOCs), radionuclides, and target analyte list (TAL) metals previously analyzed.

If necessary, fracture characteristics, formation permeability, the presence of groundwater, and the extent of subsurface contamination will be defined through completion of the deep vertical boreholes. The boreholes will be drilled, and samples will be collected and analyzed, in accordance with the Consent Order requirements (Section IV.C.2.d.iv).

The Laboratory's proposed approach will use past sampling results from boreholes drilled according to the 1998 SAP, in conjunction with data collected from the implementation of this work plan, to define the nature and extent of contaminants in the intermediate range bedrock below the disposal trenches. With the exception of tritium, the extent of subsurface contamination has been defined by the angled boreholes completed in 1998 (section B-4.3.1). The deepest sample from each borehole did not contain either contamination above analytical detection limits for organic chemicals or contamination above background values for inorganic chemicals and radionuclides. Tritium was detected at very low levels (0.100 pCi/L to 0.75 pCi/L) in the deepest samples in some boreholes. Samples collected adjacent to the disposal trenches did not contain either contamination above laboratory detection limits for organic chemicals or contamination above background values for inorganic chemicals and radionuclides. Pore-gas samples were collected in the angled boreholes, and the maximum detected concentrations of VOCs were less than 1 part per billion by volume (ppbv).

The Laboratory's proposed approach will also use the existing RFI surface and sediment data to define the nature of surface soil and sediment contamination. The extent of surface soil and sediment contamination has been defined by surface investigations at MDA B and in BV Canyon in conjunction with TA-21 site-wide RFI sampling (LANL 1995, 52350; LANL 1994, 26073).

Perched groundwater was investigated by a 1994 borehole drilled adjacent to MDA V (Location ID 21-02523, Figure B-3), located approximately 370 ft east of MDA B. The 660-ft-deep borehole, located near what was formerly an absorption bed that discharged quantities of water into the tuff, was unsaturated for the entire depth. The highest moisture content measured was 25% in the Bandelier Tuff,

just above the Cerro Toledo interval (300–333 ft bgs), a level well below that required for saturation (38%) in the Bandelier Tuff (LANL 2004, 87358). In 2005, a second deep borehole was drilled at MDA V, 100 ft east of MDA B, which will provide additional permeability data for the tuff overlying the Cerro Toledo interval in proximity to MDA B.

The scope of activities described in this work plan includes complete excavation, characterization, and disposal of all waste buried at the site, as well as characterization of any potential residual contamination in the tuff and soil below and surrounding the waste trenches. Site characterization includes the use of boreholes to the depth of the Cerro Toledo interval, as necessary, as specified by the Consent Order and the NMED-approved SAP.

This proposed approach provides several advantages over the interim process of exploratory trenching and characterization of waste trench contents described in the Consent Order:

- Removal of the potential contaminant source (buried waste) will reduce environmental risk associated with the site.
- Potential risk to the public will be reduced or eliminated by removing the contaminant source in a single effort.
- Complete removal of waste is more technically feasible than previously proposed alternatives such as exploratory trenching and characterization of waste trench contents.
- Remediation of MDA B will be completed earlier than currently scheduled.
- Duration of impacts on the public, and costs to the public, will be reduced by completing remediation earlier than currently scheduled and by eliminating a potential second round of excavations to complete the excavations or other remedy.
- Remediating to residential cleanup levels could allow future commercial development of the DP Road corridor sooner than currently anticipated.

4.2 Regulatory Basis for Technical Approach

The regulatory basis for handling waste materials during the MDA B investigation/remediation is based on the application of the Environmental Protection Agency's (EPA's) area of contamination (AOC) concept. This concept was discussed in detail in the preamble to the National Contingency Plan (55 FR 8758-8760, March 8, 1990) and more recently in an Office of Solid Waste and Emergency Response guidance memorandum entitled, "Use of the Area of Contamination (AOC) Concept During RCRA Cleanups" (EPA 1996, 82288). The AOC concept provides for areas of contiguous contamination to be designated as a RCRA "unit" (for example, a landfill) for the purposes of implementing a remedy. In general, activities such as excavation, movement, consolidation, in-situ treatment, and redeposition of hazardous remediation wastes within the AOC will not trigger RCRA Subtitle C requirements because they are not considered treatment, storage, or disposal. These activities must occur entirely within the AOC boundaries and cannot be associated with any ex-situ treatment or storage units either within or outside the AOC.

A request to obtain an AOC designation for this work will be submitted to NMED for approval no less than 30 days before a notification of site investigation sampling. A notification of site investigation/ sampling activities will be submitted 15 days before the commencement of any field activity pursuant to Section V.E.2 of the Consent Order. The request will specify the boundaries of the proposed AOC, the rationale for how the boundaries were established, and an explanation of how the boundaries will be delineated. The request will also describe the activities to be conducted within the AOC. The AOC concept is

presented in SOP-1.06, Rev. 2 ("Management of Environmental Restoration Project Waste," section 8.10). The procedure requires that the AOC designation be approved by an EP Directorate regulatory compliance representative and NMED.

MDA B is identified as SWMU 21-015 in the Laboratory's Hazardous Waste Facility Permit. MDA B, a land-based SWMU, meets the definition of a landfill in accordance with RCRA regulations (40 CFR 260.10).

This IRWP will be conducted under the requirements of the Consent Order. The removal of contaminant source material will involve the excavation of buried historical waste and surrounding soil and tuff until inorganic chemical and organic chemical levels are below residential cleanup levels, as specified in Section VIII.B.1 of the Consent Order, or below residential cleanup levels for radionuclides, to the extent practicable as determined by NMED. Once initial screening and segregation activities have been completed, the excavated material will be transferred to a staging facility for definitive identification, packaging, and shipping to appropriate off-site disposal facilities. These materials will be handled under RCRA hazardous waste requirements, as appropriate.

Long-Term Effectiveness of the Proposed Activities

Residential cleanup levels are the primary means of assuring long-term effectiveness to remove all waste and contaminated media. The residential cleanup levels were specifically developed to require no restrictions on the use of the property or other controls to prevent exposure to residual levels of contaminants. All waste material buried in the MDA B disposal trenches and all surrounding media that do not meet residential cleanup levels will be removed and disposed of. Starting with the highest priority, the long-term benefits of this action are as follows:

- Removes the primary source term for contaminant releases to the environment
- Eliminates the potential for future contaminant releases to the environment
- Renders the site suitable to use for local businesses and residences
- Is the most expeditious approach to the investigation and remediation of MDA B and reduces the impact to local businesses by completing the remediation of MDA B earlier than previously scheduled

As the excavation proceeds, screening, confirmation, and borehole samples will be taken at the exposed excavation bottom and side slopes. This sampling will directly determine any residual contamination and allow a high confidence in determining potential risk/dose. If the objectives of the project are met, no long-term monitoring will be required and the site can be closed and transferred to the public with no land-use restrictions.

Possible Contingencies If Residential Cleanup Levels Cannot Be Achieved

If the Laboratory cannot achieve residential cleanup levels at MDA B, then the Laboratory will submit a demonstration to NMED that residential cleanup levels are deemed impracticable, pursuant to Section VIII.E of the Consent Order. This demonstration is subject to NMED approval. Specific actions related to this demonstration will be identified and may include the following possible contingencies:

- Residential cleanup levels are deemed impracticable pursuant to Section VIII.E of the Consent Order

- Adjust cleanup goals to meet an industrial scenario instead of a residential one.
- Perform a site-specific human health risk assessment to establish cleanup levels.
- Perform an engineering analysis of cleanup alternatives.
- Establish deed restrictions and/or other institutional controls if ownership of the property is transferred.
- Develop a long-term monitoring plan and/or other institutional controls if DOE retains ownership of the property.
- Select a combination of the above options based on discussions with NMED.

Any contingency action will be designed to meet the cleanup goals contained in the Consent Order (i.e., 10^{-5} cancer risk and hazard index of 1) as well as the DOE dose limit of 15 mrem/yr, based on the reasonably foreseeable future land use of the site.

Costs Associated with Proposed Activities

Costs are presented in Appendix C of this work plan.

4.3 Health and Safety and Environmental Protection

4.3.1 Integrated Safety Management (ISM)

MDA B has been categorized by the Laboratory as a Hazard Category 3 nuclear facility (DOE 2003, 87047), based on a bounding estimated inventory of less than 100 g of plutonium-239 for the entire MDA (Rogers 1977, 05707). Facilities are categorized using DOE-STD-1027-92, “Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports,” and a documented safety analysis (DSA) is required by 10 CFR 830 subpart B. A Hazard Category 3 facility is a relatively low-hazard nuclear facility for which a hazard analysis shows the potential for significant but localized consequences.

DOE nuclear safety requires that a safety basis be prepared and maintained for the range of planned operations at MDA B. The safety basis prepared for the MDA B disposal trenches will include reliance upon hazard controls to provide adequate protection for workers, the public, and the environment. These controls will include engineered features designed to prevent or mitigate the consequences of an operational accident. Controls may also be established to narrow the envelope of permissible operation, such as limiting the amount of hazardous materials exposed or removed from the MDA B disposal trenches at any one time. The safety basis must be kept current and must consider any changes to the facility, the operations, or the hazards as they are analyzed. The DSA will be prepared by the Laboratory for the DOE and is not part of this document. The DSA will contain controls to protect the public, the workers, and the environment from the hazards associated with MDA B's postulated inventory, which includes both hazardous chemicals and radionuclides. Work conducted as part of this phase of the IRWP will be performed in accordance with the controls established by the DSA as well as any resultant technical safety requirements (TSRs). The controls will be incorporated into the site-specific health and safety plan (SSHASP) required by 29 CFR 1910 and 29 CFR 1926, the Laboratory's ISM requirements, and other site-specific procedures.

4.3.2 Environmental Protection Monitoring

Activities within the excavation enclosure will be monitored using real-time continuous air monitoring (CAM) systems or similar devices. The CAMs will survey airborne radioactive particles inside the work zone and outside the enclosure at specific locations around the site. In particular, beta and/or alpha activities will be monitored to ensure that they remain below action levels identified in the DSA and the SSHASP. Levels of VOCs and airborne particulates (dust) will also be monitored. Monitoring stations will be located along the DP Road corridor to detect any off-site radiological releases during excavation activities. The DSA and SSHASP will specify the monitoring requirements to ensure that federal, state, and local environmental protection limits are not exceeded. Details of radiation monitoring equipment and procedures will be included in a radiation protection program to be developed specifically for MDA B activities.

4.3.3 Emergency Response

An emergency response plan will be prepared to establish a program that optimizes a safe and informed response to emergency situations, with the intent of protecting project personnel, the public, the environment, and property, in the event of hazardous substance releases, employee contamination, accidents, injuries, fires, or natural disasters. At a minimum, the emergency response plan will contain the following elements:

- Training
- Drills and exercises
- Site security and control
- Notification procedures (emergency responders and the public)
- Personnel accountability process
- Site evacuation
- Medical support
- Emergency response equipment
- Emergency response equipment maintenance and inspection
- Emergency response actions to
    - ♦ Radiological material releases
    - ♦ Hazardous chemical releases
    - ♦ Accidents resulting in property damage or injury
    - ♦ Fires and explosions
    - ♦ Natural disasters
    - ♦ Emergencies resulting from personal protective equipment (PPE) failure

A critical part of any emergency response will be the ability of onsite project personnel to recognize and mitigate actual or potential emergency situations. To accomplish this, onsite personnel will train to the emergency response plan and will demonstrate their ability to effectively respond to emergency situations through the use of mockups, drills, and exercises. Additionally, the abilities of onsite personnel will be independently confirmed using the Laboratory readiness assessment (LRA) process.

4.4 Excavation of Disposal Trench Contents

Disposal trenches will be completely excavated, and all waste and excavated environmental media (e.g., soil, overburden material, and tuff) will be characterized. All waste from the disposal trenches will be processed for disposal at approved off-site disposal facilities. Environmental media will be evaluated for either disposal as waste or for returning them to the excavated area. The conditions for returning environmental media to the site are described below and will be addressed further as part of the Laboratory's request for an AOC designation to be submitted to NMED upon approval of this work plan. All waste trenches will be excavated to a minimum depth of the buried material, with deeper excavation done as required if buried waste is found deeper. The entire width of all waste trenches will be excavated, with side slopes on each side (north and south) where possible to allow safe access to excavation and to eliminate or minimize the need for shoring up excavation walls. If the proximity of waste trenches to DP Road on the north side precludes the necessary side slope, shoring up or other methods may be used as appropriate to ensure the stability of the excavation.

All disposal trench contents will be handled as waste and processed for disposal. Overburden material and material excavated in order to lay back the side slopes of the excavation will be initially screened to determine if it must be considered waste or if it is potentially suitable for being returned to the excavation site based on a nonhazardous waste determination and meeting residential cleanup levels. Representative samples will be collected from the overburden and lay-back material as it is excavated. Screening analyses will be performed using laboratory procedures and instrumentation and will include TAL metals, SVOCs, VOCs, and gamma-emitting radionuclides. If the screening analyses indicate that there is potential for hazardous waste and/or contaminants to be present above residential cleanup levels, the material will be handled as waste. If the screening results indicate that the material is not hazardous waste and potentially meets residential cleanup levels, representative samples will be collected and submitted through the Laboratory's Sample Management Office (SMO) for analysis of TAL metals, radionuclides (by gamma spectroscopy), isotopic uranium, isotopic plutonium, tritium, strontium-90, VOCs, SVOCs, dioxins/furans, PCBs, explosive compounds, perchlorate/nitrate, and cyanide. The material will be stockpiled within the boundary of the AOC until analytical results are received and reviewed. If the analytical results indicate hazardous waste and/or that contaminants exceed residential cleanup levels, the material will be processed as waste. If results indicate that hazardous waste and cleanup goals are met, the material will be used to backfill the excavation. The placement of the material as backfill will be tracked so that analytical data may be linked to specific areas of the site.

Field screening of the excavation floor and side walls will be used to determine if further excavation is required. Material will be excavated until field screening indicates that residual contaminant levels are at, or below, the residential cleanup levels. Additional excavation may also be warranted by the presence of significant fractures, fracture zones, or stained areas. Field screening will include the analysis of organic chemicals using a portable gas chromatograph/mass spectrometer (GC/MS) and radionuclide screening for alpha, beta, and gamma radiation. If further excavation does not reveal material with contaminant concentrations below residential cleanup levels within a reasonable depth, the decision to cease deeper excavation may be made on the basis of safety and the practical limitations of slope lay-back requirements. As a contingency, if the proposed cleanup levels are not reached in specific locations, the coordinates of those locations will be recorded using a global positioning satellite (GPS) system or other survey methods. The coordinates will allow the locations to be identified for further characterization of nature and extent of contamination based on the SAP to be submitted at the conclusion of the excavation.

All trenches will be backfilled with clean fill material (i.e., appropriate soil and/or rock either from an off-site source or from excavated overburden and side slope material that has been sampled and determined to be nonhazardous and meets cleanup goals) after waste is removed. Backfill will be compacted to an

appropriate density to prevent erosion or settling; backfilled areas will be seeded or covered with appropriate erosion-control material as appropriate. Fill will consist of appropriate soil and/or rock material that can be verified as uncontaminated, either from an off-site source or from excavated overburden and side slope material that has been sampled and determined to be uncontaminated.

Excavation will be performed inside an enclosure, as described in section 4.0, to provide site access control, help control off-site environmental impacts, reduce exposure to the public, and protect the excavation operations from environmental factors that could interfere with the safe and efficient execution of field operations. The enclosure will be designed to enable excavation across the entire width of the waste trenches plus the required slopes or shoring on both sides. The enclosure will provide access for equipment and various waste containers that need to be moved in or out during the progress of the excavation.

4.5 Segregation of Waste by Material Type

Upon excavation, materials will be segregated according to identifiable waste types. Segregation will help with the evaluation of waste streams and the estimation of waste volumes. A variety of segregation methods, such as mechanical screens, hand operations, robotic arms, etc., may be evaluated and used, as appropriate.

Waste inspection and segregation will be performed inside a separate area of the excavation enclosure or an additional enclosure. This will protect the operation from environmental factors and control exposure to the environment and the public. This enclosure will contain facilities for segregating, declassifying, identifying, packaging, and managing excavated material, thereby allowing these activities to be performed independently of the excavation operation and ensuring that proper radiological, health and safety, and environmental controls are maintained.

4.6 Hazard Category Screening of Waste

Using representative samples of the waste materials from MDA B, qualitative and quantitative analytical tests will be performed onsite to rapidly identify primary physical, radiological, and chemical hazards. Based on the historical information available about the MDA B area, the primary hazard characteristics for rapid identification will be radioactivity, flammability, corrosivity, oxidation potential, physical properties, and reactivity with air and water. The methods used for making these determinations will be selected to provide the optimal combination of accuracy, repeatability, and workflow efficiency.

Hazard category (HAZCAT) screening will be performed onsite, either at the dig face within the excavation enclosure or in a mobile field laboratory where instruments can be properly maintained to ensure that an adequate level of data quality is obtained. The HAZCAT screening process will provide the basic information needed for segregating waste materials by physical form (solid, liquid, or gas) and by hazard class (radioactive, reactive, corrosive, or flammable). This screening will also ensure the safe segregation and compatibility of materials in waste staging areas.

4.7 Definitive Identification Screening of Waste

Definitive identification screening of waste trench contents will be implemented as necessary for waste profiling or characterization. Definitive identification screening will be performed at a laboratory that is certified for those analyses that are required to meet the waste acceptance criteria (WAC). The laboratory will be equipped with portable analytical instruments which may include a GC, immunoassay kit, x-ray fluorescence (XRF) spectrometer, or other instruments suitable for the specific analyses needed for the WAC. Definitive identification screening of containers exhibiting special physical or chemical hazards

(e.g., high-pressure gas cylinders) may require the use of both manual and remote sample-handling techniques.

4.8 Inventory Management and Tracking

The inventory of excavated materials will be recorded in an electronic database developed specifically to meet the MDA B data-collection requirements and populated with data from each step in the investigation/remediation. Barcode labels and scanners will be used to link containers and samples to the database and to track movement of containers and samples among the excavation enclosure, staging area(s), and the definitive identification facility. The database will contain fields for capturing the following types of data:

- type, location, and volume of excavated materials;
- physical descriptions and initial hazard classification;
- HAZCAT screening results and hazard categorization;
- definitive identification screening results;
- waste volume, compositing, packaging, storage, and shipping details;
- sample collection, analyses, and tracking records for excavated materials and in-situ soil and tuff samples;
- geodetic survey or GPS data for the locations of key features in the excavations, such as disposal trench geometry, disposal trench contents of specific interest, and sampling locations.

4.9 Waste Management

Wastes will be characterized through laboratory analyses for the purpose of segregating waste materials for treatability and/or disposal. This level of characterization will be required for comparison with the WAC of each identified treatment storage disposal facility (TSDF); for selection of appropriate waste packaging; and for compliance with U.S. Department of Transportation (DOT) requirements.

The regulatory classification for each of the possible waste streams includes solid waste, industrial solid waste, New Mexico special waste (NMSW), RCRA hazardous waste, low-level radioactive waste (LLW), transuranic waste (TRU), mixed low-level waste (MLLW), and transuranic mixed waste (TRU mixed). Anticipated waste streams and potential disposal facilities are listed in Table D-1 (see Appendix D).

An analysis of treatment and disposal pathways will be used to define specific waste streams, their parameters, and their acceptability for treatment or disposal at specific off-site TSDFs.

Waste materials excavated from MDA B will be containerized appropriately for off-site disposal. Waste packaging will be performed within the enclosed materials-handling structure. Expected waste streams, estimated volumes, and likely disposal destinations are presented in Table D-1.

4.10 Characterization Sampling of Excavation Bottoms

Samples of geologic material will be collected from beneath the excavation floor to help define the horizontal and vertical extent of potential contamination. The results will be evaluated to determine if additional excavation is necessary and if residual contamination poses any unacceptable risk to human health or the environment, and to support further contingencies in the event that cleanup levels are not achieved. A systematic-random sampling design will be deployed for the sampling of MDA B. Characterizing the nature and extent of contamination requires a statistically valid number of samples

systematically spaced throughout the trench. Under this data collection strategy, analytical data are compared with residential cleanup levels on a point-by-point basis, maximizing the spatial coverage, locations of elevated screening values, and the determination of the extent of contamination. The systematic-random sampling approach using a number of equal-area grid cells along the trench will be established. The specific node to be sampled within each grid is randomly selected. This randomly selected node is sampled within each grid. The sampling approach is called multiple systematic or systematic-stratified sampling. In addition to the randomly selected locations, biased samples will be collected at areas where elevated field screening, visual staining, fractures, or areas of elevated moisture are observed. Samples will be analyzed for inorganic chemicals, organic chemicals, and radionuclides. Analyses will include TAL metals, radionuclides (by gamma spectroscopy), isotopic uranium, isotopic plutonium, tritium, strontium-90, VOCs, SVOCs, dioxins/furans, PCBs, explosive compounds, perchlorate/nitrate, and cyanide (Table 4.10-1). Site-characterization samples will be processed under chain of custody through the SMO and sent to off-site analytical laboratories for the requested analyses.

4.11 Surveying Locations and Features of Excavations

The geometry and primary features of the excavation(s) will be surveyed using a GPS system or other appropriate method. Survey points will include locations and elevations of sample locations, locations of buried items of interest, locations of potential residual contamination identified by field screening, and any other features deemed important to the investigation/remediation. Survey results will be plotted on a site map delineating the actual waste trench boundaries and excavation boundaries.

4.12 Excavation Backfilling, Compaction, and Clean Cover Replacement

The excavation(s) will be backfilled to original grade with clean fill material. The cover thickness and composition will be suitable for establishing a vegetative cover for stabilization. Backfill material will be compacted during emplacement, to a degree sufficient to prevent significant settling or erosion.

4.13 TA-21 Industrial Waste Line

The TA-21 industrial waste line, located along the southern boundary of MDA B, may be encountered during the excavation of some portions of MDA B, although portions of the line were removed in 2003 (LANL 2003, 91446). The remaining 2,300-ft portion of the TA-21 industrial waste line, located along the southern boundary of MDA B, will be removed. Portions of the line were removed in 2002 as part of land-transfer activities (LANL 2003, 91446). The TA-21 industrial waste line was installed in 1982 to support TA-21 Tritium System Test Assembly operations. The line allowed treated water to be piped directly from TA-21 to the TA-50 Radioactive Liquid Waste Treatment Facility. The 4,800-ft line was a 3-in.-diameter, Schedule 80, carbon-steel pipe wrapped in polypropylene and was cathodically protected. The entire pipeline was periodically hydrostatically pressure-tested by standard operating procedure to a pressure of 450 psi, and no leaks were detected during the service life of the pipeline. The pipeline was flushed three times with demineralized water and removed from service in August 2001. In the summer of 2002, a 1,500-ft section on the southeastern side of MDA B and a 1,000-ft section on the southwestern side of MDA B were removed. A site characterization performed before the line was removed had determined that the soils surrounding the pipe were clean (LANL 2003, 91446).

The waste line was a LLW management unit regulated by DOE and operated in accordance with DOE requirements. These DOE requirements included pressure-testing to ensure that there was no leakage. The effluent that passed through the line was carefully maintained in a pH range of 8 to 9. The waste line was not used for the management of hazardous wastes or hazardous constituents. The waste line is not a SWMU/AOC or part of a SWMU/AOC and is not subject to regulation under the Consent Order. It is necessary to remove the line to implement the cleanup activities at MDA B. Limited sampling is planned

during the removal to verify the pressure-testing results and confirm whether contamination is present. If evidence of leakage is detected based on field screening during the removal, samples will be collected at those locations and, in accordance with DOE policy, LANL will provide the sampling results to NMED.

4.14 Borehole Sampling Activities

Based on the results of confirmation sampling and observations during fieldwork, candidate borehole sampling locations will be evaluated and selected in a SAP (introduced in the Executive Summary) that will be submitted to NMED after completing the excavation. Candidate borehole locations will be determined based on the following criteria:

- Residential cleanup levels were not attained because the depth of the excavation limited the equipment and/or because of safety concerns.
- Areas of heavy staining, severe fracturing, and/or high moisture content exist.
- Areas of the excavation exist that contained levels above residential cleanup levels.
- Waste areas of the excavation exist that contain a significantly high hazard.

Following completion of excavation activities, a SAP will be submitted to NMED describing the proposed plan to determine the extent of residual contamination present in media that was not removed during the remedial excavation. The SAP will be submitted within 90 days after the conclusion of removal activities. The SAP will include the analytical results from confirmatory sampling, a summary of excavation activities and how they pertain to selecting borehole locations, the proposed number of boreholes and their locations, the proposed analytical suite for investigation samples, sampling intervals (soil/tuff and pore gas), and a map showing the proposed locations. The SAP will be approved by NMED ahead of its execution.

These vertical boreholes will be drilled to characterize the deeper subsurface at MDA B. Information from the boreholes will further define the vertical extent of contamination, provide geotechnical data and fracture characterization, and determine if perched groundwater exists beneath the site. The planned depth of the boreholes will be presented in the SAP. Data collected from the boreholes will include field screening, lithology, contaminant characterization, geotechnical testing, fracture characterization, pore gas, perched groundwater, and geophysical logging. Deep boreholes to the base of the Cerro Toledo interval, approximately 380 ft bgs, will be installed only if necessary, and the rationale will be discussed in the SAP.

Borehole drilling and sampling will be conducted to further define the extent of potential residual contamination within the tuff matrix beneath the disposal areas, to characterize fractures in Tshirege units 2 and 3 of the Bandelier Tuff, and to establish the hydraulic conductivity of the tuff unit overlying the Cerro Toledo interval below TA-21. The candidate locations and numbers of the boreholes will be determined based on confirmatory sampling results and observations made during fieldwork and will be biased to areas where liquid wastes were disposed of, either in containers or directly into the unlined waste trenches. The boreholes will be located in areas selected to enhance the definition of the lateral and vertical extent of potential contamination.

Cores will be collected continuously from the surface to the total depth in each borehole. All cores will be visually examined in the field and screened for radiological contamination and VOCs. Core samples will be collected from directly below the base elevation of the disposal trenches and at the total depth of each borehole. At least two other depth intervals (including the sample exhibiting the highest field-screening detection and the sample from the maximum depth in each boring that displays field-screening evidence

of contamination) will be selected for sampling, for a minimum of four samples in each borehole. Additional samples may be collected at depths that show field screening or other evidence of contamination, lithologic contacts, fractures, fracture-fill material, surge beds, or other higher-permeability units. In the absence of elevated field-screening results in the boreholes, sample locations will be selected based on physical features.

Samples collected from boreholes will be submitted to the SMO for analysis of VOCs, SVOCs, explosive compounds, pH, PCBs, dioxins, furans, nitrates, perchlorate, TAL metals, total uranium, cyanide, tritium, isotopic uranium, isotopic plutonium, strontium-90, and gamma-emitting radionuclides (Table 4.14-1).

Whenever a fracture sample is collected, an additional sample will be collected from the rock matrix adjacent to the fracture sample material to allow a direct comparison to be made between the contaminant concentrations in the fracture fill and the surrounding rock matrix.

A minimum of three core samples from the tuff units overlying the Cerro Toledo interval and one from within the Cerro Toledo interval will be collected from each borehole for geotechnical analysis to characterize the vadose zone hydrogeology beneath the site. Samples will be analyzed for saturated and unsaturated hydraulic conductivity, matric potential, porosity, chloride-ion concentration, moisture content, and bulk density. Information about the analytical and geotechnical tests planned for the borehole samples is summarized in Table 4.14-1.

Field documentation of the samples collected from fractures will include a detailed physical description of the fracture-fill material and surrounding rock matrix. The volumes of fracture fill and rock matrix material included in the sample (if both media are included in a sample) will be estimated from field measurements and will be recorded on the corresponding sample collection log.

Subsurface pore-gas samples will be collected from the boreholes. In each borehole, one sample will be collected at a depth equivalent to the base of the targeted disposal unit. A second sample will be collected at the total depth of the borehole. Subsurface pore-gas samples will be submitted for the analysis of VOCs and tritium. If any volatile contaminants are detected, a second round of samples will be collected approximately 30 days later. The decision about installing pore-gas monitoring wells will be based on the results of this sampling. The boreholes will remain open until the decision to install vapor monitoring wells is made. A long-term vapor monitoring program will be developed, as appropriate.

Groundwater samples will be collected from any interval encountered during drilling that produces sufficient water. Based on current understanding of the site, it is expected that any such interval will be a localized phenomenon and is unlikely to be part of an alluvial or regional groundwater system. The samples will be analyzed for VOCs, SVOCs, explosive compounds, pH, PCBs, dioxins, furans, nitrates, perchlorate, TAL metals, total uranium, cyanide, and tritium, isotopic uranium, isotopic plutonium, strontium-90, and gamma-emitting radionuclides. If groundwater is encountered in sufficient quantity to warrant monitoring, a monitoring well design will be prepared and submitted to NMED for approval. A monitoring well would then be installed in accordance with the approved design, and a long-term groundwater monitoring program would be developed, as appropriate.

To provide additional data for vadose zone characterization, geophysical logging will be performed in competent boreholes.

In addition, a borehole will be drilled in the area west of MDA B to allow site characterization and possible vapor monitoring. This boring will be advanced to a depth of at least 20 ft below the base of the waste disposal trench at MDA B, and at least 25 ft below the deepest detected contamination, based on field screening or laboratory analyses. A minimum of two core samples will be collected from the borehole; one

will be collected at the total depth of the borehole, and the other sample interval(s) will be selected based on field screening, presence of fractures, or other observed features. Core samples will be analyzed for VOCs, SVOCs, explosive compounds, pH, PCBs, dioxins, furans, nitrates, perchlorate, TAL metals, total uranium, cyanide, and tritium, isotopic uranium, isotopic plutonium, strontium-90, and gamma-emitting radionuclides. Pore-gas samples will be collected from at least two intervals, including the total depth, and will be analyzed for tritium and VOCs. Depending upon the results of the core and pore-gas sample analyses, the borehole may be developed as a vapor monitoring well. In this case, a vapor monitoring plan and well design will be developed and submitted to NMED for approval prior to implementation.

5.0 INVESTIGATION METHODS

The methods and procedures for conducting the activities identified in the MDA B IRWP are presented below. Specific procedures and standardized methods are available for some activities, such as sample collection and analysis. In the event that there is no approved method for a specific activity, a method will be developed as part of an implementation plan that will be written before beginning field operations. Additional activities and procedures may be added in response to changing conditions, redirection, or discoveries in the field. Applicable methods are summarized in Table 5.0-1.

5.1 Excavation Methods

Excavations will be completed using a standard track-mounted hydraulic excavator (a trackhoe) to carefully expose and remove landfill contents for inspection, identification, and removal. The primary method employed will involve initiating the excavation with a downward-sloping ramp leading to the initial access point within the waste trench area. A sloping dig face will be established on which the buried waste is exposed for inspection and initial characterization. The dig face will be established so that the entire thickness of the landfill, from the surface to the native tuff beneath the buried waste, is exposed. The slope of the dig face may vary depending upon the degree of cohesiveness of the waste trench contents, but it will not be so steep that hazardous conditions are created in which the face could collapse unexpectedly. The dig face will be advanced in lifts, the thickness of which will be determined by the nature of the buried waste and the ease or difficulty of removing material with the excavator. Lift thickness should be the minimum that is practicable in order to minimize the variability of exposed material and the volume of material being processed at any given time. The excavator will have the capability to be operated remotely to minimize risk to the operator from potential releases of hazardous material.

In order to avoid confined space hazards or the danger of excavation wall collapse, each side of the excavation (i.e., perpendicular to the active dig face) will be sloped back at an angle of approximately 45°. This approach will result in significantly greater volumes of excavated material but it will reduce the hazards associated with working in the excavation. The excavated overburden and lay-back material will be staged or stockpiled separately from the contents of the waste trenches and will be screened and sampled to determine if it must be handled as waste. To minimize waste, the overburden and lay-back material will be characterized and, if it is determined that it is uncontaminated, will be used as backfill when the excavation is complete.

The waste excavation consists of the following activities:

- The overburden will be removed from above the waste material from the surface down to the top of the buried waste. This material will consist of topsoil and/or fill material and, in some areas, asphalt, and will require minimal screening and segregation.
- After the overburden is removed, excavation will proceed until all waste is removed and field screening indicates that the exposed soil/tuff meets residential cleanup levels. Excavated waste

material will require careful initial screening and segregation immediately after its removal from the dig face. Some initial screening of material may also be performed on the dig face using instruments attached to the excavator arm or bucket. Excavated material will be placed on the floor of the excavation for initial screening and segregation.

- The excavator equipment operator or field technician will perform an initial survey of newly exposed material for immediately dangerous to life and health (IDLH), high radiation, or other dangerous conditions.
- If initial screening results indicate that conditions are acceptable, the excavator equipment operator will shut down the excavator and screening personnel may enter, using appropriate levels of PPE. If initial screening results indicate that conditions are not safe for entry, the excavator equipment operator may cover the suspect material with clean soil until the appropriate course of action is determined.
- Material may be removed by hand or with the excavator equipment and then segregated into proper transfer containers or overpacks. Hand excavation is permitted if initial IDLH and other screening results indicate safe conditions and the excavation is evaluated and approved for personnel access to the face.
- Excavation will continue until field screening (using laboratory methods) indicates that all undisturbed geologic material has levels below residential cleanup levels for TAL metals, SVOCs, and VOCs, as determined by NMED (NMED 2005, 90802 or current version) or EPA (EPA 2005, 91002 or current version), and levels below residential cleanup levels for radionuclides (LANL 2005, 88493 or current version). Excavation will continue until residential cleanup levels are met or until deemed impracticable, as determined by NMED.

5.2 Initial Screening Methods

The excavator equipment operator will perform an initial survey of newly exposed material (dig face) for high radiation or other hazardous conditions using instruments mounted on the excavator bucket or arm.

Several screening tools will be used for initial health and safety monitoring. Radiological monitoring equipment includes a gamma dose rate meter (ion chamber), sodium iodide detector, a neutron dose rate meter, and a CAM instrument. VOCs will be screened using a photoionization detector (PID) with an 11.7 eV lamp. Gases can be screened for by using Drager tubes for acid gases, basic gases, carbon monoxide, hydrocyanic acid, nitrous gases, and others as appropriate. Combustible gases will be screened for by using a multigas detector if voids within the disposal area are present. The heat of waste trench contents will be regularly monitored using a handheld infrared thermometer. The infrared thermometer will also help monitor for pyrophoric materials (pyrophoric materials can spontaneously ignite when exposed to air). Conditions will be continuously monitored for changes that could affect the safety of workers in the excavation. Health and safety requirements may preclude personnel entry into the excavations, so it may be necessary to equip the end of the boom of the excavator with a camera or continuous monitoring tools. Remote sensing instruments may also be used to monitor conditions and identify materials in the open excavation that could pose an immediate threat to site personnel.

Representative samples of excavated overburden and lay-back material (i.e., material that does not come from the waste trenches but has been excavated only to facilitate the safe removal of the waste trench contents) will be collected to make an initial determination about whether the material must be handled as waste. Existing sample data from previous investigations, where available, may be used to supplement initial screening of the overburden and lay-back material. A plan for representative sampling and analysis of this material will be developed. The samples will be analyzed for TAL metals, SVOCs, VOCs, and

alpha- and gamma-emitting radionuclides. The material will be stockpiled within the AOC boundary until the analytical results are available for review. If the results of this initial screening on overburden and lay-back material indicate organic, inorganic, or radionuclide constituents above residential cleanup levels, the material will be handled as IDW. This material, when excavated, will be stockpiled in discrete lots in a volume that will allow adequate representative sampling. Any lots that are found to be uncontaminated by the initial screening will be further sampled to determine their suitability for use as backfill at MDA B or for other purposes.

Representative samples of the lots that pass the initial screening will be collected and submitted to the SMO for analysis of TAL metals, radionuclides(by gamma spectroscopy), isotopic uranium, isotopic plutonium, tritium, strontium-90, VOCs, SVOCs, dioxins/furans, PCBs, explosive compounds, perchlorate, nitrates, and cyanide. If the results of these sample analyses indicate that any inorganic chemicals or radionuclides are above their respective background values, or if organic chemicals are detected, the material will be considered waste and will be processed for disposal. If the material is found to be uncontaminated, it may be used to backfill the MDA B excavation. This approach allows for the minimization of waste generated during excavation while ensuring that any backfill material that is used is uncontaminated.

5.3 Initial Waste-Segregation Methods

The excavated waste and any other excavated material will be initially sorted within the excavation enclosure. When possible, debris will be sorted using the excavator bucket. If manual sorting is required, appropriate handling devices will be used to minimize the direct handling of material. As determined by the initially identified properties of the material and the monitored conditions within the enclosure, appropriate PPE will be used.

The initial segregation of waste will be based on field observations, physical characteristics, and initial screening results. Waste and chemicals in containers will be moved to a separate onsite support structure where they will be staged, opened, and tested. A positive identification of the material may be accomplished using the definitive identification screening equipment available onsite, or it may be necessary to ship a representative sample to an off-site analytical laboratory for analysis.

Segregated material may be containerized in drums, boxes, roll-off bins, or other appropriate containers. Size reduction of debris (i.e., compaction) may be performed if appropriate, but only after the initial characterization and identification of potential hazards has been completed. Inspection and declassification of materials will be conducted during the initial sorting.

All materials will be managed appropriately to prevent the release of any contamination to the environment within the AOC or off-site.

5.4 Final Waste-Segregation Methods

Materials identified as waste will be segregated into specific waste types for appropriate disposal. Investigation/remediation activities will minimize the waste generated by following the Laboratory's Hazardous Waste Minimization Report (LANL 2005, 91291). Any containers removed from the excavation will be physically inspected for their ability to continue to safely hold the waste materials. If warranted, the contents will be either transferred to a new container or placed in an overpack. The waste material’s hazardous characteristics and compatibility will dictate the manner in which the containers will be further handled. Small containers (<5 gal.) of similar hazard class or compatibility may be placed in larger containers such as a lab pack for subsequent safe storage and/or transportation. Large containers of

similar hazard class or compatibility will be grouped together for subsequent safe storage and/or transportation.

All waste generated as a result of this investigation/remediation will be managed in accordance with the applicable SOPs. These SOPs incorporate the requirements of applicable EPA and NMED regulations, DOE orders, Laboratory Implementation Requirements, and Laboratory Implementation Guidelines. The following SOPs are applicable to the characterization and management of IDW:

- SOP-1.06, Management of Environmental Restoration Project Waste
- SOP-1.10, Waste Characterization

All waste generated, and all materials discovered as a result of the investigation/remediation of MDA B, will be managed in such a way as to protect human health and the environment, comply with applicable regulatory requirements, and adhere to the Laboratory's waste-minimization goals.

Before field-investigation/remediation activities, the subcontractor will develop a waste management plan. The plan will be prepared and approved according to the requirements of SOP-1.10 and will include a completed Waste Characterization Strategy Form (WCSF). The WCSF will provide detailed information about the anticipated waste to be managed, including IDW and other waste materials deemed to be "newly generated." The WCSF information will include characterization, management, containerization, and potential or estimated volume. Upon the discovery of unanticipated material, an addendum to the WCSF will be generated to cover the new waste stream.

Selection of waste containers will be based on the appropriate DOT shipping requirements and the type and amount of waste generated. Containers removed as a result of the investigation/remediation, and new containers used for safe and compliant handling purposes, will be individually labeled by waste classification, item identification number, radioactivity (if applicable), and date generated. Additional details regarding the management of IDW are presented in Appendix D.

5.5 Characterization Sampling Methods for Soil and Tuff

As described in section 4.10, samples will be collected from the tuff beneath the bottom of the excavation(s) after all waste contents have been removed. At each location, a minimum of two samples will be collected, at depths corresponding to approximately 0–0.5 ft and 1.5–2.0 ft below the excavation bottom. The deeper samples should be collected at a depth with little or no evidence of contamination, based on visual observation and field-screening results. The locations of all samples will be identified by use of GPS coordinates obtained at the time the locations are selected or when the samples are collected.

Field duplicate, equipment rinsate, and field trip blank samples will be collected at a frequency of 5% for quality assurance/quality control (QA/QC) purposes and in accordance with the Consent Order.

If saturated conditions or free water are encountered in the excavation bottom in sufficient quantities, water samples will be collected and submitted for off-site analytical laboratory analysis. The extent of saturation or high moisture conditions, if any, will be observed and documented during excavation and sampling.

5.6 Geodetic Survey Methods

To record the location and dimensions of the excavation, and to record the locations of the selected sample collection points, geodetic surveying will be conducted before excavations are backfilled.

Horizontal coordinates and elevations will be determined by differentially corrected GPS. Sample coordinates will be reported to the SMO.

5.7 Excavation Backfilling and Surface Restoration Methods

Once all waste is removed, the waste trenches will be backfilled and compacted and clean soil cover material will be replaced over the affected area. Clean fill material will be shipped in from off-site. All affected surfaces will be restored to their original grade (approximately), reseeded, and a straw mulch or appropriate erosion-control fabric will be applied to help stabilize the surface. To prevent future subsidence, the backfill material will be compacted to the extent practical. Best management practices will be established to monitor and prevent erosion.

5.8 Waste-Management Methods

Representative samples of the waste will be collected from the waste containers in a manner compliant with EP Directorate SOPs, EPA methods, and/or the disposal facility's sampling guidelines. Analytes, sample frequencies, sample sizes, sample type (discrete or composite), and the analytical techniques will be prescribed by the WAC for the chosen disposal facilities. Waste-characterization samples, where required, will be submitted through the SMO for analysis at off-site analytical laboratories.

The investigation/remediation activities described in this work plan will generate a variety of types of IDW that will be managed in accordance with applicable federal, state, DOE, and Laboratory requirements. The IDW management plan is presented in Appendix D of this work plan.

5.9 Borehole Installation, Sampling, and Testing Methods

5.9.1 Drilling Methods

Boreholes will be drilled with a drill rig capable of continuous coring and deep borehole production. All drilling activities will follow appropriate Laboratory guidance documents and protocols to ensure that health and safety issues are reviewed and addressed during field operations.

Boreholes will be drilled initially using a hollow-stem auger. In the event that boreholes cannot be completed by this method, air-rotary drilling with a split barrel sampler will be used. This will ensure that the desired depth can be achieved and that continuous core can be collected.

5.9.2 Borehole Soil and Rock Sampling Methods

All boreholes will be cored continuously and logged following the current versions of SOP-4.01 and SOP-12.01. Following the current version of SOP-6.26, subsurface tuff samples will be collected from core retained in a split-spoon core barrel and placed into sealed sleeves or core-protect bags to preserve core moisture. The analytical suites for the samples from each borehole are listed in Table 4.14-1.

The primary screening methods to be used are (1) visual examination, (2) radiological screening, and (3) headspace vapor screening for VOCs, in accordance with Section IX.B of the Consent Order.

Radiological screening will target gross alpha, beta, and gamma radiation. Field screening for alpha, beta, and gamma radiation will be conducted within 6 in. of the core material. All instrument background checks, background ranges, and calibration procedures will be documented daily in the field logbooks.

Field screening for VOCs will be accomplished using headspace analysis at 10-ft intervals in each borehole, in accordance with Section IX.B of the Consent Order. Headspace vapor screening of subsurface core for VOCs will be conducted using a PID equipped with an 11.7 eV lamp as specified in

SOP-6.33. The maximum sustained reading and the ambient air temperature will be recorded on the field borehole log for each sample. The PID will be calibrated each day to the manufacturer's standard for instrument operation (all daily calibration results will be documented in the field logbooks).

QA/QC samples will include field duplicate samples to evaluate the reproducibility of the sampling technique and rinsate blanks to evaluate decontamination procedures. These samples and other required QA/QC samples will be collected following the current revision of SOP-1.05 and will comply with the collection frequency specified in the Consent Order.

5.9.3 Geotechnical Analysis Methods

Formation lithology, fracture occurrence, orientation, density, and core recovery (compared to interval drilled) will be established in the field. Lithology and fracture data will be defined following methods described in SOP-4.01 and SOP-12.01. During drilling in the Cerro Toledo interval, brass, lexan, or equivalent sleeves will be used to line the core barrel in order to improve recovery and maintain structural integrity of the core and to enhance the accuracy of the geotechnical data.

Analyses for saturated and unsaturated hydraulic conductivity, porosity, bulk density, and moisture content will be performed using analytical methods specified by contract requirements of the SMO (LANL 2000, 71233). One field duplicate for every ten geotechnical samples taken will be collected and submitted for the same analyses.

5.9.4 Geophysical Logging Methods

Geophysical logging will be performed in competent boreholes using methods described in SOP-4.04 and SOP-5.07, which will provide additional data for characterization of the tuff matrix in the vadose zone.

5.9.5 Pore-Gas Sampling Methods

Subsurface pore-gas samples will be collected from all boreholes in accordance with the current version of SOP-6.31, after allowing for the equilibration of pore gases at the completion of drilling activities. In each borehole, one sample will be collected at the depth of the nearest adjacent disposal unit; the second sample will be collected at the total depth. Pore-gas samples will be collected using a straddle packer to isolate discrete depths within the borehole. Each interval will be purged before sampling until measurements of carbon dioxide and oxygen are stable and representative of subsurface conditions. In brief, a purge pump is used to withdraw borehole and formation vapors through the borehole or constructed sampling port. Concentrations of purge indicator gases (carbon dioxide and oxygen) are monitored continuously during this pre-sampling cycle. Once indicator gas concentrations are stable, proper purge is achieved, and formation vapor sampling can proceed. Subsurface pore-gas samples will be collected in SUMMA canisters and submitted for VOC analysis using EPA Method TO-15. Tritium samples will be collected in silica gel samplers and submitted for tritium analysis using EPA Method 906.0.

Pore-gas QA/QC samples will consist of equipment blanks and field duplicates. These samples will be collected at a frequency of one QA/QC sample for every ten regular samples, as specified in Section IX.B.2.e of the Consent Order. The equipment blank will be collected after sampling and purge decontamination by pulling zero gas (99.9% ultrahigh-purity nitrogen) through the packer sampling apparatus and accumulating a sample of zero gas using SUMMA canisters and silica gel samplers.

If the decision is made to install a pore-gas monitoring well, a well design will be developed that outlines target intervals, port types and quantity, and packer configurations. This design will be submitted to NMED for approval prior to implementation.

5.9.6 Perched Groundwater Sampling Methods

If saturation is encountered as a borehole is being advanced, drilling will be stopped to determine if a sufficient volume of water for sample analyses can be produced from the borehole. In general, a minimum of 0.5 to 1 L of water is required to conduct a partial suite of analyses. If a full suite of analyses cannot be conducted, samples will be analyzed for geochemical parameters and for priority contaminants which will be chosen based on site knowledge and new data produced during the implementation of this work plan. The geochemical analyses will be performed at the Laboratory's onsite geochemical laboratory, and verification may be needed to ensure that sampled water was derived from the formation.

Drilling will be continued in a water-producing borehole until the base of saturation or the perching horizon is reached, to determine the thickness of saturation and the characteristics of the perching horizon. If possible, the perching horizon will not be penetrated. A monitoring well as-built design drawing will be developed and submitted to NMED for approval. Following approval, the well will be installed and developed in accordance with SOP-5.01 and SOP-5.02 and Section IV.C.2.d.vii of the Consent Order.

An additional borehole will be drilled adjacent to the well using a double-wall-casing advancement drilling method to isolate the known zone of saturation; the borehole will be advanced to the planned total depth of the borehole or until another zone of saturation is encountered.

If drilling is halted because of the observation of water but sufficient water for a representative sample cannot be recovered from the borehole, drilling will be continued. Small volumes of water from discrete intervals will not be composited to make up the minimum volume of water necessary for a sample.

5.9.7 Borehole Abandonment Methods

Backfilling (abandonment) of investigation boreholes will be conducted according to the requirements of Section X.D of the Consent Order. Backfill materials will be selected and placed specifically to account for observed subsurface conditions such as zones of increased moisture. At the time of abandonment, the abandonment will be thoroughly documented in a field logbook, in accordance with SOP-5.03; documentation will include, at a minimum, the types of backfill material used (such as bentonite and/or cement), the volumes (calculated and actual) of backfill material used, intervals of placement, and any additives used to enhance backfilling. No drill cuttings will be placed back in the boreholes at the time of abandonment.

5.10 Equipment Decontamination Methods

Following excavation and transportation activities, project personnel will decontaminate all the equipment that was involved in excavation, drilling, and material-removal activities. Residual material adhering to equipment will be removed using dry decontamination methods, including the use of wire brushes and scrapers (SOP-1.08). If equipment cannot be free-released following dry decontamination, a high-pressure sprayer, along with long-handled brushes and rods, will be used to more effectively remove contaminated material from equipment. Pressure-washing of equipment will be performed on a temporary wash pad with a high-density polyethylene liner. Cleaning solutions and wash water will be collected and contained for proper disposal. Decontamination fluids will be sampled to determine final disposition. Air filters on equipment operating in the exclusion zone will be considered contaminated and will be removed and processed for disposal; the filters will be replaced with new clean filters before equipment leaves the site. Equipment will be surveyed and tagged for free release by an HSR-1 radiological control technician (RCT) before being demobilized.

6.0 MONITORING AND SAMPLING PROGRAM

The proposed investigation/remediation does not include a monitoring program at MDA B. Based on information collected from past investigation activities, it is not anticipated that monitoring will be required at MDA B following the implementation of this work plan. However, intermediate groundwater monitoring wells or vapor monitoring wells will be installed if proposed investigation/remediation results indicate the presence of shallow perched groundwater or pore-gas contamination. If any monitoring wells are necessary, a monitoring plan will be developed and submitted to NMED. The monitoring plan will detail the parameters to be monitored, the monitoring frequency, and the procedures to be followed.

7.0 SCHEDULE

This revised MDA B IRWP addresses NMED comments provided in the NMED notice of disapproval received by LANL on August 22, 2006 (NMED 2006, 93536). Preparation for investigation/remediation activities is scheduled to start in January, 2007. Fieldwork is expected to start in January 2008. The excavation will take approximately 24 months to complete, with a scheduled finish date of December 2009. Sampling, characterization, and restoration will be completed in early 2010.

The investigation report will be submitted to NMED in or before December 2010.

8.0 REFERENCES

The following list includes all documents cited in this report (with the exception of Appendix B which has its own list). 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 EP Directorate's Records Processing Facility (RPF) and are used to locate the document at the RPF and, where applicable, in the EP Directorate reference set titled "Reference Set for Material Disposal Areas, Technical Area 21."

Copies of the reference sets are maintained at the NMED Hazardous Waste Bureau; the DOE Los Alamos Site Office; the U.S. Environmental Protection Agency, Region 6; and the EP Directorate. The sets were developed to ensure the administrative authority has all material needed to review this document, and they are updated periodically as needed. Documents previously submitted to the administrative authority are not included.

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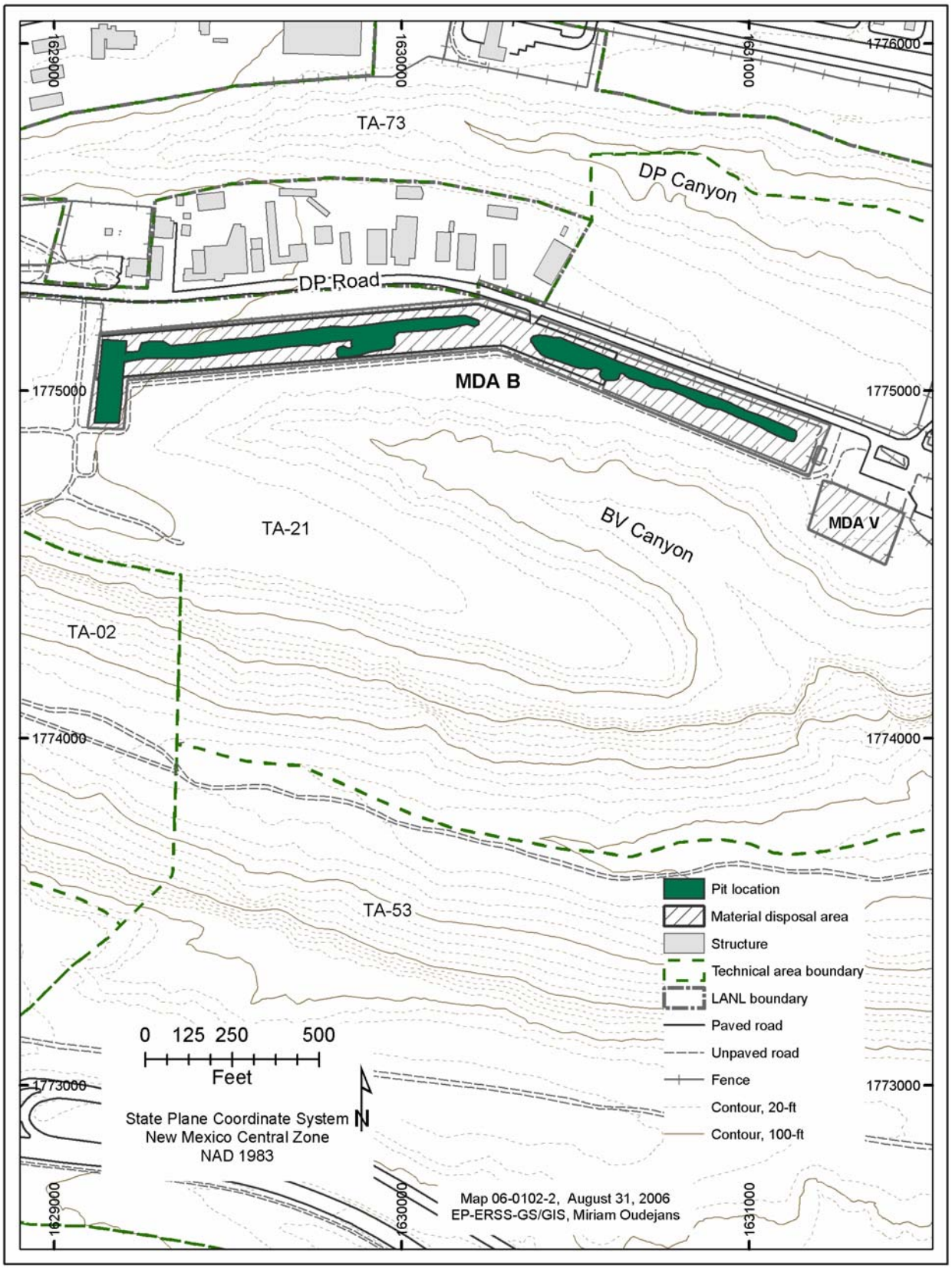

Figure 1.1-1. MDA B site plan

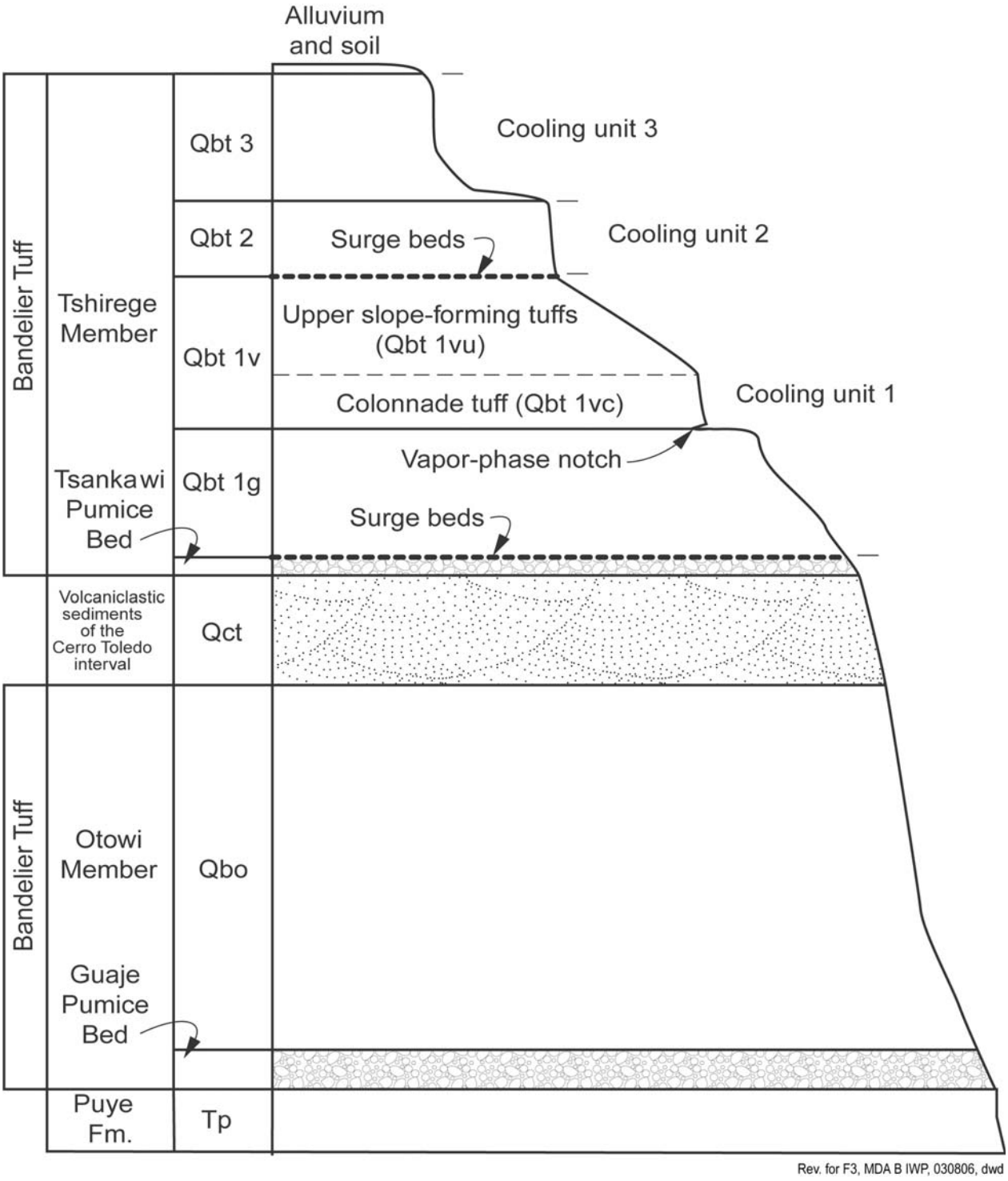

Figure 3.2-1. Generalized stratigraphy of DP Mesa in the area of MDA B

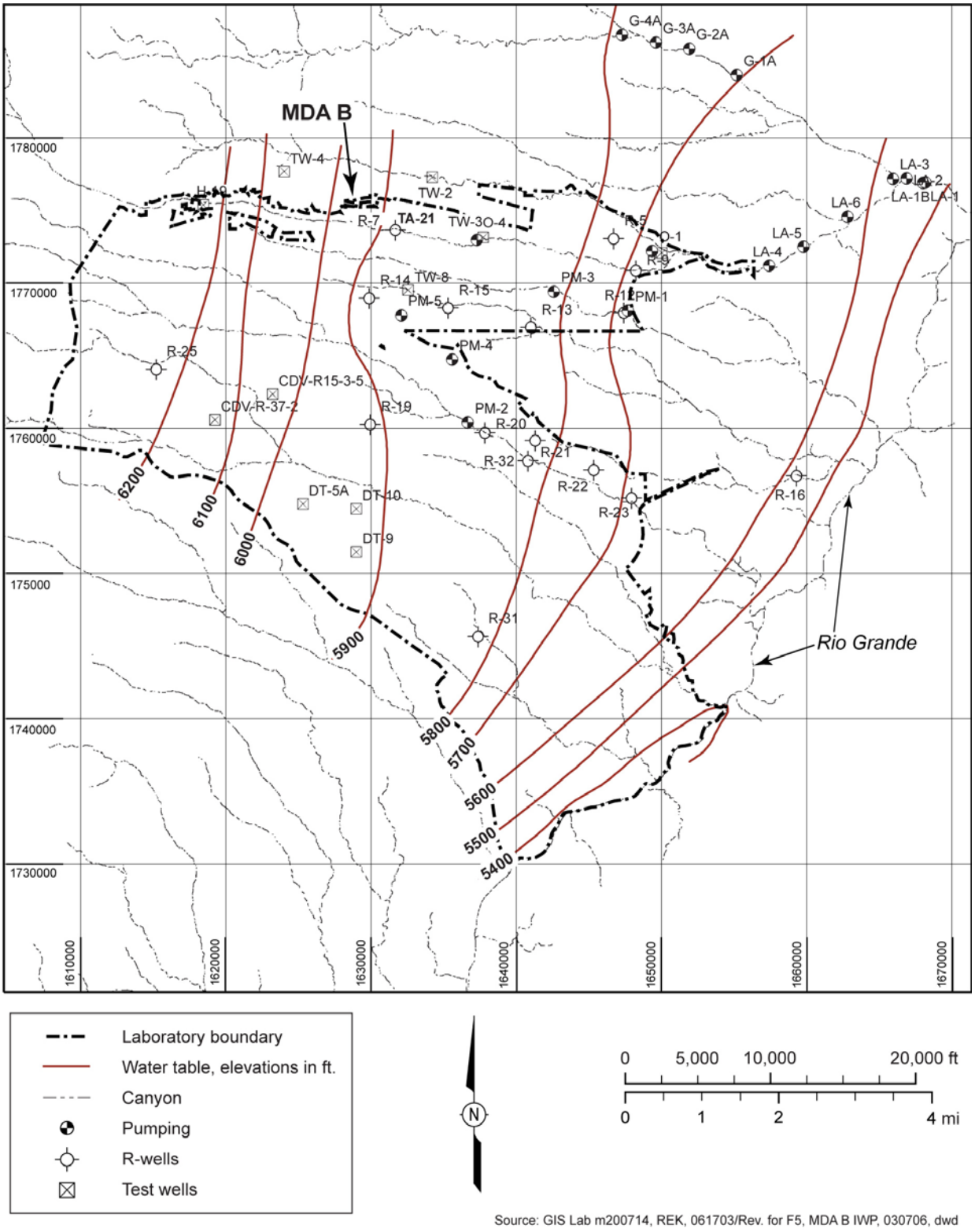

Figure 3.2-2. Locations of Laboratory groundwater wells with respect to MDA B and elevations of the top of the regional aquifer

Table 4.1-1
Consent Order Specifications and LANL-Proposed Alternatives

Item	Consent Order Specification	LANL-Proposed Alternative	Justification for Alternative
1	In accordance with Section IV.C.2.d.i, the Respondents shall conduct a survey of the disposal units comprising MDA B. The Respondents shall determine the dimensions and total depth of each disposal trench, absorption bed, shaft, pit, and other unit at MDA B into which waste was disposed; and the base profile, topography, low elevation point, and down-slope end of the base of each disposal trench, shaft, pit, and absorption bed at MDA B into which waste was disposed. The dimensions and base elevations of each trench, absorption bed, pit, shaft, and other unit at MDA B shall be determined using as-built construction drawings and boring logs. If unavailable, ground penetrating radar, magnetic surveys, or other methods shall be used. The survey shall be completed prior to implementation of the drilling explorations under Section IV.C.2.d.iii. (Order Section IV.C.2.d.ii).	Disposal unit surveys have been performed previously. A geophysical survey to locate disposal units was performed during 1998 (see Appendix B, sections B-2.2.2 and B-4.2). Dimensions of the disposal trenches have been identified by previous geophysical study.	Direct observation and measurements of the limits of the waste-disposal trench boundaries will be used to supplement the geophysical survey previously performed.
2	The Respondents shall conduct subsurface explorations as specified in the approved work plan in order to obtain sufficient data to characterize the extent of contamination, and to characterize fracture density, fracture orientation, and fracture fill material or the absence of fracture fill material at MDA B. The fracture characterization of the rock formations underlying MDA B shall be completed utilizing data acquired from outcrops, cores, and downhole geophysical and video log data. A discussion of the sampling methods and potential locations for collecting rock fracture data shall be included within the required characterization work plan for MDA B. The Department, prior to field investigation and data collection activities, shall approve the methods and locations for the fracture investigation activities. Pursuant to the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval a work plan for subsurface investigation activities at MDA B. Implementation of the approved work plan shall meet the following requirements, subject to the procedures contained in Section III.M of this Consent Order. Respondents shall include information associated with the borings located and advanced in accordance with the EPA-approved work plan and NMED-approved SAP in the work plan to be submitted to the Department. Subject to the procedures in Section III.M, these borings may be used to satisfy the requirements of this Section (IV.C.2.d.iii) (Order Section IV.C.2.d.iii)	The potential contaminant source (buried waste) at MDA B will be completely excavated, exposing bedrock for additional extent and fracture characterization. Fractures have been characterized previously through TA-21-wide geologic investigations conducted as part of the Operable Unit 1106 investigation (see Appendix B, section B-3.14). Previously installed boreholes were also logged for fractures (see Appendix B, section B-4.3.1, and Appendix E). Based on the proposed SAP to be submitted at the conclusion of the excavation activities, candidate boreholes will be advanced at MDA B. Boreholes will be drilled in accordance with Section X.B of the Order, and fracture characterization will be performed. Borehole locations will be based on excavation screening and analytical results; proposed locations will be submitted to NMED for approval.	Because MDA B was used as a chemical and solid waste-disposal area, fractures are less significant to subsurface transport at MDA B than at other MDAs where absorption beds exist and where millions of gal. of liquid radioactive wastes were disposed. The extent of contamination has been identified for the limited set of contaminants analyzed by the seven previous angled holes. Results from the additional sampling and expanded analytical suite beneath the waste trenches and proposed boreholes will be used to evaluate near-trench and deep bedrock characteristics and contamination in conjunction with the borehole data previously collected. The proposed boreholes I at MDA B will provide additional fracture characterization data.

Table 4.1-1 (continued)

Item	Consent Order Specification	LANL-Proposed Alternative	Justification for Alternative
3	Eight (8) borings, or the number defined in the Department-approved MDA B Investigation Work Plan, shall be advanced using hollow-stem auger drilling methods where practical or other drilling methods approved by the Department. Two borings shall be advanced to the base of the Cerro Toledo interval. All borings shall be drilled in accordance with Section X.B of this Order. The Department, prior to drilling, shall approve the location of the borings and the drilling method (Order Section IV.C.2.d.iii, Item 1).	Seven angled boreholes were installed in 1998, in accordance with the SAP approved by NMED (see Appendix B, section B-4.3.1). Upon removal of all buried waste, characterization samples will be collected from beneath the excavation and from the excavation sidewalls. Both unbiased and biased sample locations will be selected. Boreholes will be advanced to the depths approved by NMED in the approved SAP. Borehole locations will be based on excavation screening and analytical results; proposed locations will be submitted to NMED for approval.	The addition of sampling of the subsurface soil and tuff in the excavation boreholes will supplement the seven 1998 angled boreholes in determining the nature and extent of contamination from the MDA B disposal trenches. A deep borehole (Location ID 21-02523) was drilled approximately 660 ft east of MDA B at MDA V and extended 370 ft below the ground surface. Another deep borehole was drilled in the area of MDA V as part of the 2005 MDA V work plan.
4	Selected boreholes, as specified in the Department-approved work plan, shall be characterized using geophysical logging techniques approved by the Department. (Order Section IV.C.2.d.iii, Item 2)	No deviation.	None.
5	A monitoring well shall be installed if groundwater (perched or regional) is encountered during drilling activities or if geophysical results indicate possible zone(s) of saturation. The wells shall be constructed in accordance with Section X of this Order. (Order Section IV.C.2.d.iii, Item 3)	No deviation.	None.
6	Vapor monitoring wells shall be installed in the borings if vapor-phase contamination is detected during drilling activities. (Order Section IV.C.2.d.iii, Item 4)	No deviation.	None.
7	All borings not completed as monitoring wells (vapor or groundwater monitoring wells) shall be properly plugged and abandoned. Documentation of proper well abandonment shall be submitted to the Department as an appendix to the investigation report. (Order Section IV.C.2.d.iii)	No deviation.	None.
8	Soil samples shall be collected continuously for the first 40 ft and at ten-ft intervals thereafter. (Order Section IV.C.2.d.iv, Item 1)	No deviation.	None.
9	Samples shall be collected and screened in accordance with the methods described in Section IX.B of this Order. (Order Section IV.C.2.d.iv, Item 2)	No deviation	None.
10	A minimum of three core samples from the tuff overlying the Cerro Toledo shall be collected and submitted for laboratory permeability testing in accordance with Section IX.B of this Order. (Order Section IV.C.2.d.iv, Item 3)	No deviation.	None.

Table 4.1-1 (continued)

Item	Consent Order Specification	LANL-Proposed Alternative	Justification for Alternative
11	Field-screening and laboratory sample selection shall be biased towards evidence of contamination, lithologic contacts, fractures, fracture fill material, surge beds, and other higher permeability units identified during investigation activities. The samples shall be collected and screened in accordance with the methods described in Section IX.B of this Order. (Order Section IV.C.2.d.iv, Item 4)	No deviation.	None.
12	Sediment, soil and rock samples shall, at a minimum, be obtained from each boring at the intervals described in Paragraph 1 above and from the bedrock directly below the base elevation of each absorption bed or shaft. A sample also shall be obtained at the maximum depth of each boring. (Order Section IV.C.2.d.iv, Item 5)	No deviation.	None.
13	A minimum of four samples shall be selected from each boring for submittal to a laboratory for analysis of VOCs, SVOCs, explosive compounds, pH, PCBs, dioxins, furans, nitrates, perchlorate, TAL [target analyte list] metals, cyanide, and radionuclides. The sample exhibiting the highest field -detection; the sample obtained from the maximum depth in each boring that displays field-screening evidence of contamination; the sample located immediately below the base of any pit, tank, or other structure; and the sample from the total boring depth shall be submitted for laboratory analysis. The Department may require that additional samples, collected from the borings, be submitted for laboratory analyses. (Order Section IV.C.2.d.iv, Item 6)	No deviation.	None.
14	The Respondents shall investigate contaminant transport from MDA B to canyon alluvial sediments through the implementation of the Work Plan for Los Alamos and Pueblo Canyons, dated November 1995, and the addendum to the Work Plan, dated February 2002, as described in Section IV.B.1.b.i of this Consent Order. The work plan and addendum were approved by the Department in June 1997 and May 2002, respectively. Respondents state that, pursuant to the EPA-approved RFI Work Plan for OU 1106, the Respondents investigated sediments in drainage channels leading from MDA B to Los Alamos Canyon. The investigation work plan shall include requirements for sediment sampling and characterization of the drainages at MDA B in accordance with Section IV.A.4 of this Consent Order. If, after completion of the investigation of canyon sediments pursuant to the Work Plan for Los Alamos and Pueblo Canyons and addendum, the nature and extent contaminant releases from MDA B drainages to Los Alamos Canyon have not been established, the Department will require additional sediment investigations of the drainages leading from MDA B. (Order Section IV.C.2.d.v)	No drainage sediment investigation will be conducted. TA-21 outfalls and drainages have been characterized previously in the Phase report and addendum already submitted to NMED (LANL 1995, 52350). The nature and extent of sediment contamination in Los Alamos Canyon was investigated and reported in the Los Alamos/Pueblo Canyons Investigation Report submitted to NMED on April 30, 2004 (LANL 2004, 87390)	Sediment contamination has been investigated in accordance with other approved investigation work plans.

Table 4.1-1 (continued)

Item	Consent Order Specification	LANL-Proposed Alternative	Justification for Alternative
15	Pursuant to Section IV.C.2.d.i and the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval a work plan to collect subsurface vapor samples from discrete zones in each subsurface vapor monitoring well or boring at MDA B, at depths approved by the Department, for field and laboratory analyses. The samples shall be collected and analyzed in accordance with Section IX.B of this Consent Order. Implementation of the approved work plan shall meet the following requirements, subject to the procedures in Section III.M of this Consent Order: Subsurface vapor samples shall be collected from all newly drilled borings during site investigation activities. An investigation vapor monitoring and sampling plan shall be prepared in accordance with the format described in Section XI.B of this Consent Order and submitted by the Respondents to the Department for approval. Subsurface vapor sampling shall be conducted at MDA B in each existing and newly constructed vapor well and boring specified in the approved work plan. Samples of subsurface vapors shall be collected by the Respondents from subsurface vapor monitoring points at discrete zones based on investigation and monitoring results. The monitoring points must be approved by the Department prior to sample collection. Based on the results of the investigation vapor monitoring, a long-term subsurface vapor monitoring and sampling work plan shall be submitted to the Department for review and approval. (Order Section IV.C.2.d.vi)	No deviation.	None.
16	If intermediate zone groundwater is encountered or if geophysical or other evidence suggests the presence of intermediate perched groundwater during the required subsurface investigations for MDA B, the Department will require a work plan for the installation of intermediate groundwater monitoring well(s) The minimum depth of the subsurface investigations for MDA B will be the base of the Cerro Toledo interval. If groundwater is detected, these monitoring wells shall target all potential intermediate perched water bearing intervals identified during subsurface explorations at MDA B. If perched groundwater is encountered in sufficient quantities to allow sampling, the Respondents shall sample and analyze the water in accordance with characterization requirements in the approved work plan and provide recommendations for a long-term groundwater monitoring plan in the Investigation Report described in Section IV.C.2.d.x. (Order Section IV.C.2.d.vii)	No deviation.	None.

Table 4.1-1 (continued)

Item	Consent Order Specification	LANL-Proposed Alternative	Justification for Alternative
17	If the Department determines the need for additional wells intersecting the regional groundwater aquifer associated with TA-21 based on investigation data, the Respondents shall submit to the Department for review and approval a work plan for the installation of such wells. The wells shall be installed according to the requirements in Section X of this Order. (Order Section IV.C.2.d.viii)	No regional groundwater investigations will be performed as part of this work plan. Regional groundwater investigations are being conducted in accordance with the hydrogeologic work plan (LANL 1998, 59599), approved by NMED, and "Los Alamos Canyon and Pueblo Canyon Intermediate and Regional Aquifer Groundwater Work Plan" (LANL 2003, 82612).	Installation of regional groundwater wells would duplicate the work being performed under the hydrogeologic work plan and "Los Alamos Canyon and Pueblo Canyon Intermediate and Regional Aquifer Groundwater Work Plan" (LANL 2003, 82612).
18	Groundwater samples shall be obtained from Los Alamos Canyon monitoring wells LAO-1.2, LAO-1.8, LAO-1.6(g), LAO-2, LAO-3A, LAO-4.5C, LAO-5, LAO-6, LAO-6A, LADP-3, R-9i, R-5, R-7, R-8, R-9, TW-3, and any wells installed in the future determined by the Department to be required and at the frequency described in Section XII of this Order. As described in Section IV.B.1.e.viii, TW-3 shall be plugged and abandoned according to the procedures in Section X.D. Groundwater shall be monitored from TW-3 until the well is properly abandoned. (Order Section IV.C.2.d.ix, Item 1)	No groundwater sampling of existing wells will be performed as part of this work plan. The wells identified in Section IV.C.2.d.ix, Item 1, of the Order will be monitored as specified in the facility-wide groundwater monitoring plan required under Section IV.A.3 of the Order.	Groundwater investigations would duplicate the work required under Section IV.A.3 of the Order.
19	The groundwater sampling shall be conducted in accordance with Section IX.B of this Order. (Order Section IV.C.2.d.ix, Item 2)	No groundwater sampling of existing wells will be performed as part of this work plan (see Item 18 above).	See Item 18 above.
20	Groundwater samples shall be collected from the Los Alamos Canyon monitoring wells for submittal to a laboratory for analysis of general chemistry parameters as described in Section IX.B of this Order, radionuclides, perchlorate, TAL metals, cyanide, VOCs, SVOCs, explosive compounds, and for other analytes specified by the Department. (Order Section IV.C.2.d.ix, Item 3)	No groundwater sampling of existing wells will be performed as part of this work plan (see Item 18 above).	See Item 18 above.
21	Based on the results of the investigations conducted at TA-21, and after completing the installation of all additional monitoring wells in the Los Alamos Canyon watershed, as described in Section IV.B and subject to the procedures in Section III.M of this Consent Order, the Respondents shall submit to the Department for review and written approval a watershed-specific long-term groundwater monitoring plan for Los Alamos Canyon. Upon Department approval of the long-term monitoring plan for the Los Alamos Canyon watershed, the requirements of the long-term monitoring plan shall apply and shall supersede the requirements of the Los Alamos Canyon watershed section of the Interim Plan. (Order Section IV.C.2.d.x)	A long-term groundwater monitoring and sampling work plan will not be prepared as part of the MDA B investigation. Results of the MDA B investigation will be considered during development of the groundwater monitoring plan required under Section IV.A.3.	Development of a long-term groundwater monitoring plan for MDA B would duplicate the work required under Section IV.A.3 of the Consent Order.

Table 4.10-1
Proposed Sampling at Bottom of Excavation

Sample Type	Number of Sample Locations	Number of Samples	Depth Below Bottom of Excavation	Analytical Suite
Soil/tuff	Systematic-random sampling approach as discussed in section 4.10	Minimum of 2 per location	0–0.5 ft and 1.5–2.0 ft or based on field observations	TAL metals Radionuclides by gamma spectroscopy Tritium Isotopic uranium Isotopic plutonium Strontium-90 VOCs SVOCs Dioxins/furans PCBs Perchlorate Cyanide pH Nitrates Explosive compounds
Water (only if saturated conditions are encountered in excavation)	TBD*	TBD	Up to 2 ft	TAL metals Radionuclides by gamma spectroscopy Tritium Isotopic uranium Isotopic plutonium Strontium-90 VOCs SVOCs Dioxins/furans PCBs Perchlorate Cyanide pH Nitrates Explosive compounds

* TBD = to be determined.

Table 4.14-1
Proposed Borehole Sampling

Borehole Number	Sample Type	Number of Samples	Target Intervals/features	Field-Screening Intervals[a]	Core Intervals[b]	Analytical Suite
Boreholes (to be determined [TBD]) Parcel A-8b boreholes (TBD)	Characterization of nature and extent of contamination	TBD TBD	Highest field-screening value Deepest field detection of contamination Immediately below the base of the disposal trenches Total boring depth (base of Cerro Toledo) Fractures and adjacent tuff matrix—paired (as necessary)	Continuous to 40 ft; then every 10 ft to total depth (TD)	Continuous; discrete samples at minimum of 4 depth intervals or 2 depth intervals (A-8b boreholes)	TAL metals Radionuclides by gamma spectroscopy Tritium Isotopic uranium Isotopic plutonium Strontium-90 VOCs SVOCs Dioxins/furans PCBs Perchlorate Cyanide pH Nitrates Explosive compounds
Boreholes (TBD) Parcel A-8b boreholes (TBD)	Geotechnical	Minimum of 4 per borehole	Three from the Tuff units above Cerro Toledo interval One from the Cerro Toledo interval Fractures and adjacent tuff matrix – paired (as necessary)	Continuous to 40 ft; then every 10 ft to TD	Continuous; discrete samples at minimum of 4 depth intervals	Saturated and unsaturated hydraulic conductivity Porosity Bulk density Matric potential Chloride-ion concentration Moisture content
Boreholes (TBD) Parcel A-8b boreholes (TBD)	Groundwater	At each occurrence	Perched groundwater	At each occurrence	N/A[c]	TAL metals Radionuclides by gamma spectroscopy Tritium Isotopic uranium Isotopic plutonium Strontium-90 VOCs SVOCs Dioxins/furans PCBs Perchlorate Cyanide pH Nitrates Explosive compounds General chemistry [d]
Boreholes (TBD) Parcel A-8b boreholes (TBD)	Pore gas	2 per borehole 2 per A-8b borehole	Immediately below base of the disposal trenches, total boring depth, biased depths	N/A	N/A	VOCs Tritium Percent moisture

[a] Screening for radiological contamination will be conducted continuously on recovered cores from 0 to 40 ft bgs. Additional field-screening will be made of recovered cores at 10-ft intervals at depths greater than 40 ft bgs to TD of each borehole. VOC headspace, XRF, and HE screening will be conducted at 10-ft intervals over the entire length of the borehole.

[b] Continuous cores will be collected from each borehole from 0 to 40 ft bgs. Cores will be collected from 10-ft intervals at depths greater than 40 ft.

[c] Not applicable

[d] General groundwater chemistry analysis includes anions, alkalinity, total organic carbon, total inorganic carbon, and total dissolved solids.

Table 5.0-1
Summary of Investigation Methods

Method	Summary
Spade-and-scoop collection of soil samples	This method is typically used for collection of shallow (i.e., approximately 0–12 in.) soil or sediment samples. The "spade-and-scoop" method involves digging a hole to the desired depth, as prescribed in the sampling and analysis plan, and collecting a discrete grab sample. The sample is typically placed in a clean stainless-steel bowl for transfer into various sample containers.
Split-spoon core-barrel sampling	In this method, a stainless-steel core barrel (typically 4-in. i.d., 2.5 ft long) is advanced using a powered drilling rig. The core barrel extracts a continuous length of soil and/or rock which can be examined as a unit. The split-spoon core barrel is a cylindrical barrel split lengthwise so that the two halves can be separated to expose the core sample. Once extracted, the section of core is typically screened for radioactivity and organic vapors, photographed, and described in a geologic log. A portion of the core may then be collected as a discrete sample from the desired depth.
Headspace vapor screening	Individual soil, rock, or sediment samples may be field-screened for volatile organic compounds by placing a portion of the sample in a plastic sample bag or in a glass container with a foil-sealed cover. The container is sealed and gently shaken, and allowed to equilibrate for 5 min. The sample is then screened by inserting a PID probe into the container and measuring and recording any detected vapors. PIDs must use lamps with voltage of 10.6 eV or higher.
Handling, packaging, and shipping of samples	Field team members seal and label samples before packing, and ensure that the sample containers and the containers used for transport are free of external contamination. Field team members package all samples so as to minimize the possibility of breakage during transportation. After all environmental samples are collected, packaged, and preserved, a field team member transports them to either the SMO or an SMO-approved radiation screening laboratory under chain-of-custody. The SMO arranges for shipping of samples to analytical laboratories. The field team member must inform the SMO and/or the radiation screening laboratory coordinator when levels of radioactivity are in the action-level or limited-quantity ranges.
Sample control and field documentation	The collection, screening, and transport of samples are documented on standard forms generated by the SMO. These include sample collection logs, chain-of-custody forms, and sample container labels. Sample collection logs are completed at the time of sample collection, and are signed by the sampler and a reviewer who verifies the logs for completeness and accuracy. Corresponding labels are initialed and applied to each sample container, and custody seals are placed around container lids or openings. Chain-of-custody forms are completed and assigned to verify that the samples are not left unattended. Site attributes (e.g., former and proposed soil sample locations, sediment sample locations) are located by using a GPS. Horizontal locations will be measured to the nearest 0.5 ft. The survey results for this field event will be presented as part of the investigation report. Sample coordinates will be uploaded into the ER Database.

Table 5.0-1 (continued)

Method	Summary
Field quality control samples	Field quality control samples are collected as directed in the Order on Consent as follows: Field Duplicate: At a frequency 10%; collected at the same time as a regular sample and submitted for the same analyses. Equipment Rinsate Blank: At a frequency of 10%; collected by rinsing sampling equipment with deionized water, which is collected in a sample container and submitted for laboratory analysis. Trip Blanks: Required for all field events that include the collection of samples for volatile organic compound (VOC) analysis. Trip blanks containers of certified clean sand that are opened and kept with the other sample containers during the sampling process.
Field decontamination of drilling and sampling equipment	Dry decontamination is the preferred method to minimize the generation of liquid waste. Dry decontamination may include the use of a wire brush or other tool for removal of soil or other material adhering to the sampling equipment, followed by use of a commercial cleaning agent (non-acid, waxless cleaners) and paper wipes. Dry decontamination may be followed by wet decontamination if necessary. Wet decontamination may include washing with a non-phosphate detergent and water, followed by a water rinse and a second rinse with deionized water. Alternatively, steam cleaning may be used.
Containers and preservation of samples	Specific requirements/processes for sample containers, preservation techniques, and holding times are based on EPA guidance for environmental sampling, preservation, and quality assurance. Specific requirements for each sample are printed on the sample collection logs provided by the SMO (size and type of container, i.e., glass, amber glass, polyethylene, preservative, etc.). All samples are preserved by placing in insulated containers with ice to maintain a temperature of 4°C. Other requirements such as nitric acid or other preservatives may apply to different media or analytical requests.
Management, characterization, and storage of investigation-derived waste (IDW)	IDW is managed, characterized, and stored in accordance with an approved waste characterization strategy form (WCSF) that documents site history, field activities, and the characterization approach for each waste stream managed. Waste characterization shall be adequate to comply with onsite or off-site waste acceptance criteria. All stored IDW will be marked with appropriate signage and labels, as appropriate. Drummed IDW will be stored on pallets to prevent deterioration of containers. Generators are required to reduced in volume of waste generated by as much as is technically and economically feasible. Means to store, control, and transport each potential waste type and classification shall be determined prior to the start of field operations that generate waste. A waste storage area shall be established prior to generating waste. Waste storage areas located in controlled areas of the laboratory shall be controlled as needed to prevent inadvertent addition or management of wastes by unauthorized personnel. Each container o f waste generated shall be individually labeled as to waste classification, item identification number, and radioactivity (if applicable), immediately following containerization. All waste shall be segregated by classification and compatibility to prevent cross-contamination. See Appendix B for additional information.

Appendix A

Acronyms and Abbreviations and Glossary

A-1.0 ACRONYMS AND ABBREVIATIONS

AA	administrative authority
AB	authorization basis
AK	acceptable knowledge
AOC	area of contamination
asl	above sea level
bgs	below ground surface
BMP	best management practice
BTEX	benzene, toluene, ethylbenzene, and xylene
BV	background value
CAM	continuous air monitoring
CFR	Code of Federal Regulations
COPC	chemical of potential concern
cpm	counts per minute
DDT	4,4'-Dichlorodiphenyltrichlorethane (a pesticide)
DOE	Department of Energy (U.S.)
DOE-LASO	Department of Energy Los Alamos Site Office
DOT	Department of Transportation (U.S.)
DP	Delta Prime (name of mesa)
DSA	documented safety analysis
EP	Environmental Programs (a LANL directorate)
EPA	Environmental Protection Agency (U.S.)
ER	environmental restoration
eV	electron-volt
FV	fallout value
g/L	grams per liter
GC	gas chromatograph
GC/MS	gas chromatograph/mass spectrometer
GPR	ground-penetrating radar
GPS	global positioning satellite
HAZCAT	hazard characterization
HEPA	high efficiency particulate air

HIR	historical investigation report
HLW	high-level radioactive waste
HSWA	Hazardous and Solid Waste Amendments of 1984
IDLH	immediately dangerous to life and health
IDW	investigation-derived waste
IRWP	investigation/remediation work plan
ISM	integrated safety management
IWD	integrated work document
LANL	Los Alamos National Laboratory
LLW	low-level (radioactive) waste
LRA	Laboratory readiness assessment
MDA	material disposal area
MLLRW	mixed low-level radiological waste
MLLW	mixed low-level (radioactive) waste
MS	mass spectrometer
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NMSW	New Mexico Special Waste
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
pCi/L	picocuries per liter
PID	photoionization detector
ppbv	parts per billion by volume
PPE	personal protective equipment
QA	quality assurance
QC	quality control
QP	quality procedure
RaLa	radioactive lanthanum
RCRA	Resource Conservation and Recovery Act
RCT	radiological control technician
RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine (high explosive)
RFI	RCRA facility investigation

RPF	Records Processing Facility (part of ENV-ERS)
SAL	screening action level
SAP	sampling and analysis plan
SCL	sample collection log
SMO	sample management office
SOP	standard operating procedure
SSHASP	site-specific health and safety plan
SSL	soil screening level
SVOC	semivolatile organic compound
SWMU	solid waste management unit
TA	technical area
TAL	target analyte list
TCA	1,1,1-trichloroethane
TCE	trichloroethene
TCLP	toxicity characteristic leaching procedure
TNT	trinitrotoluene
TSCA	Toxic Substances Control Act
TSDF	treatment storage and disposal facility
TRU	transuranic waste
TSR	technical safety requirements
UC	University of California
UHC	underlying hazardous constituent
USGS	United States Geological Survey
UST	underground storage tank
VOC	volatile organic compound
WAC	waste acceptance criteria
WCSF	Waste Characterization Strategy Form
WP	work plan
WPF	waste profile form
XRF	x-ray fluorescence

A-2.0 GLOSSARY

aboveground storage tank (AST)—An above-ground storage tank.

area of contamination—As defined by the U.S. Environmental Protection Agency, certain areas of generally dispersed contamination that could be equated to a Resource Conservation and Recovery Act (RCRA) landfill. The movement of hazardous wastes within those areas would not be considered land disposal and would not trigger RCRA land-disposal restrictions. An area of contamination may be designated by the Environmental Remediation and Surveillance Program as part of a corrective action for waste management purposes, subject to approval by the administrative authority.

groundwater—Interstitial water that occurs in saturated earth material and is capable of entering a well in sufficient amounts to be used as a water supply.

high sensitive metal detector (EM-61)—EM-61 is a time-domain metal detector that detects both ferrous and nonferrous metals. A powerful transmitter generates a pulsed primary magnetic field in the earth which induces eddy currents in nearby metallic objects. The eddy current decay produces a secondary magnetic field measured by the receiver coil.

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

operable units (OUs)—At Los Alamos National Laboratory, 24 areas originally established for administering the Environmental Remediation and Surveillance Program. Set up as groups of potential release sites, the OUs were aggregated according to geographic proximity for the purposes of planning and conducting Resource Conservation and Recovery Act (RCRA) facility assessments and RCRA facility investigations. As the project matured, it became apparent that there were too many areas to allow efficient communication and to ensure consistency in approach. In 1994, the 24 OUs were reduced to 6 administrative field units.

outfall—A place where effluent is discharged into receiving waters.

photoionization detector (PID)—A real-time monitoring instrument used to detect organic vapors in air. Organic vapor concentrations are read in parts per million.

polychlorinated biphenyls (PCBs)—Any chemical substance limited to the biphenyl molecule that has been chlorinated to varying degrees, or any combination that contains such substances. PCBs are colorless, odorless compounds that are chemically, electrically, and thermally stable and have proven to be toxic to both humans and other animals.

potential release site—A term for a potentially contaminated site at Los Alamos National Laboratory that refers to solid waste management units and areas of concern.

radionuclide—Radioactive particle (human-made or natural) with a distinct atomic weight number.

RCRA facility investigation (RFI)—A Resource Conservation and Recovery Act (RCRA) investigation that determines if a release has occurred and characterizes the nature and extent of contamination at a hazardous waste facility. The RFI is generally equivalent to the remedial investigation portion of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process.

regional aquifer — Geologic material(s) or unit(s) of regional extent whose saturated portion yields significant quantities of water to wells, contains the regional zone of saturation, and is characterized by the regional water table or potentiometric surface.

release—Any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing of hazardous waste or hazardous constituents into the environment.

Resource Conservation and Recovery Act—The Solid Waste Disposal Act as amended by the Resource Conservation and Recovery Act of 1976 (Public Law [PL] 94-580, as amended by PL 95-609 and PL 96-482, United States Code 6901 et seq.).

sample—A portion of a material (e.g., rock, soil, water, or air), which, alone or in combination with other portions, is expected to be representative of the material or area from which it is taken. Samples are typically either 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.

sediment—(1) A mass of fragmented inorganic solid that comes from the weathering of rock and is carried or dropped by air, water, gravity, or ice. (2) A mass that is accumulated by any other natural agent and that forms in layers on the earth's surface (e.g., sand, gravel, silt, mud, fill, or loess). (3) A solid material that is not in solution and is either distributed through the liquid or has settled out of the liquid.

solid waste management unit (SWMU)—(1) Any discernible site at which solid wastes have been placed at any time, whether or not the site use was intended to be the management of solid or hazardous waste. SWMUs include any site at a facility at which solid wastes have been routinely and systematically released. This definition includes regulated sites (i.e., landfills, surface impoundments, waste piles, and land treatment sites), but does not include passive leakage or one-time spills from production areas and sites in which wastes have not been managed (e.g., product storage areas). (2) According to the March 1, 2005, Compliance Order on Consent (Consent Order), any discernible site at which solid waste has been placed at any time, and from which the New Mexico Environment Department determines there may be a risk of a release of hazardous waste or hazardous waste constituents (hazardous constituents), whether or not the site use was intended to be the management of solid or hazardous waste. Such sites include any area in Los Alamos National Laboratory at which solid wastes have been routinely and systematically released; they do not include one-time spills.

technical area (TA)—At Los Alamos National Laboratory, an administrative unit of operational organization (e.g., TA-21).

terrain conductivity (EM31)—An inductive method that maps geological variations, groundwater contaminants, or any subsurface feature associated with changes in the ground conductivity using a patented electromagnetic inductive technique that makes the measurements without electrodes or ground contact. With this inductive method, surveys can be carried out under most geological conditions, including those of high surface resistivity, such as sand, gravel, and asphalt.

tuff—Consolidated volcanic ash, composed largely of fragments produced by volcanic eruptions.

U.S. Environmental Protection Agency (EPA)—The federal agency responsible for enforcing environmental laws. Although state regulatory agencies may be authorized to administer some of this responsibility, EPA retains oversight authority to ensure the protection of human health and the environment.

volcaniclastic sediments—Pertaining to a clastic rock containing volcanic material transported and deposited by wind.

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Appendix B

Historical Investigation Report

CONTENTS

Figures

Tables

B-1.0 INTRODUCTION

The information presented in this appendix encompasses the area designated as Solid Waste Management Unit (SWMU) 21-015, or Material Disposal Area (MDA) B, within Technical Area (TA) -21 at the Los Alamos National Laboratory (LANL, or the Laboratory). The Laboratory is a multidisciplinary research facility owned by the Department of Energy (DOE) and managed by the University of California. The Laboratory is located in north-central New Mexico approximately 60 mi northeast of Albuquerque and 20 mi northwest of Santa Fe. Figure B-1 shows the location of the Laboratory, MDA B, and surrounding landholdings. The Laboratory site covers 40 mi^2 of the Pajarito Plateau, which consists of a series of finger-like mesas separated by deep canyons containing perennial and intermittent streams running from west to east. Mesa tops range in elevation from approximately 7800 ft to 6200 ft.

This historical investigation report (HIR) presents the results of previous investigations, including a summary of the field investigations and associated environmental data collected to date for MDA B. The purpose of the HIR is to provide supporting information for the sampling design and fieldwork necessary to complete the MDA B work plan.

This HIR includes data collected as part of the Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) of MDA B (LANL 1991, 07529). Site recommendations are not presented in this HIR; only factual findings from previous investigations and limited interpretation of results is reported.

B-2.0 SITE HISTORY AND TA-21 BACKGROUND

B-2.1 Facility Location and Background

TA-21 is located in the northeast portion of the Laboratory on Delta Prime (DP) Mesa between Los Alamos (LA) Canyon (to the south) and DP Canyon (to the north). Figure B-2 shows TA-21 and the MDAs located within its boundaries. TA-21 comprised two operational areas, DP West and DP East, which produced liquid and solid radioactive wastes. Operations at DP West included plutonium processing, and operations at DP East included weapons initiator production. MDA B is one of five MDAs at TA-21 (MDAs A, B, T, U, and V) that received wastes from operations at these facilities (Figure B-2). There are several other SWMUs located near MDA B (Figure B-3). The SWMUs closest to MDA B are SWMU 21-029 (DP Tank Farm), SWMU 21-024(f) (septic system), SWMU 21-018(a)-99 (MDA V), SWMU 00-010(a) (surface disposal site), SWMU 00-030(b)-00 (septic system), and SWMU 21-013(d)-99 (surface disposal area) (LANL 1991, 07529).

SWMU 21-029 (DP Tank Farm) is the former location of 15 storage tanks and two fill stations that contained petroleum hydrocarbon product. DP Tank Farm was operational from 1946 to 1985 and is a 3.5-acre site located between the eastern boundary of the Knights of Columbus property line and the western boundary of the Los Alamos County Fire and Training Station. SWMU 21-029 was the primary fueling station for the LANL motor pool until the late 1970s, when some of the fuel storage and distribution operations were moved to TA-3. Equipment at the site consisted of storage tanks, fill ports, valve boxes, and subsurface distribution piping. Individual tank capacities ranged between approximately 2100 and 51,000 gal., with a total site capacity of over 280,000 gal. Thirteen of the tanks were installed below ground and two were installed aboveground.

SWMU 21-024(f) (a septic system) received effluent from Building TA-21-45 from 1947 to 1954. Initially the building was used for safety training. In 1949, Building TA-21-45 was renovated for the Industrial Waste Studies Group, a group that studied various waste streams in an attempt to recover more plutonium and uranium as well as other valuable and scarce materials (Figure B-3). The effluent from the

building was conveyed north through a 4 in. diameter vitrified clay pipe, approximately 84 ft to a 1000-gal. steel septic tank (structure number TA-21-124).

SWMU 00-010 (a) is a former surface disposal area used for stockpiling and storing canisters of roofing asphalt and roofing coal-tar pitch.

SWMU 00-030(b) is the former Sixth Street warehouse septic system and associated outfalls.

SWMU 21-013(d)-99 is a former disposal area referred to as the "cold dump" used by construction contractors for disposal of construction-related debris, and was used from 1947 until 1983.

SWMU 21-018(a) (MDA V) is a 0.88-acre site consisting of three wastewater absorption beds (1, 2, and 3) immediately east of MDA B (Figure B-3). MDA V has been consolidated with several other neighboring SWMUs that are now collectively known as SWMU 21-018(a)-99. In addition to the absorption beds [SWMU 21-018(a)], consolidated SWMU 21-018(a)-99 includes a former laundry facility [SMWU 21-018(b)], a waste treatment laboratory (SWMU 21-009), a septic system and outfall (SWMU 21-023), and a surface disposal area [SWMU 21-013(b)]. MDA V is inactive, and all aboveground structures have been removed. The absorption beds received liquid waste from laundry operations between October 1945 and 1961.

B-2.2 MDA B: Site Description and Operational History

MDA B was a radioactive waste-disposal facility for Laboratory wastes (Rogers 1977, 05707). Currently the site is inactive and consists of trenches located at the west end of DP Mesa in TA-21 (Figure B-4). MDA B is designated as SWMU 21-015 in Module VIII of the Laboratory's Hazardous Waste Facility Permit. Additional information about site description and the operational history of MDA B is provided in the following discussions.

B-2.2.1 MDA B Layout

MDA B is located on DP Mesa (a mesa between LA Canyon and DP Canyon) just west of the fenced area of TA-21 and south of commercial businesses on DP Road as shown on Figure B-4. Occupying approximately 6 acres (24,000 m^2), MDA B consists of three areas, as shown on Figure B-5:

- a small soil-covered, unpaved area at the extreme western end of MDA B (approximately 105 ft by 150 ft);
- a large asphalt-paved area occupying the long western leg and the central portion of the site (approximately 1500 ft long by 120 ft wide); and
- an unpaved area occupying the eastern leg of MDA B (approximately 600 ft long by 150 ft wide).

The three areas have no surface structures, and the entire site is enclosed by galvanized steel chainlink fencing. Vegetation has penetrated through cracks in the asphalt pavement, and trees line a portion of the northern and southern boundary of the site.

The area to the north of MDA B and south of DP Road is an unpaved area heavily used by businesses for parking and staging materials and deliveries. The area north of and along DP Road is paved and occupied by commercial buildings. The area to the south of MDA B slopes gently for 50 to 100 ft to the edge of BV Canyon, a shallow tributary of LA Canyon. The area to the west of MDA B is the former location of a residential trailer park and is presently a vacant lot. To the east of MDA B is consolidated SWMU 21-018(a)-99, which includes MDA V.

B-2.2.2 MDA B Subsurface Features

Sources cited in the RFI work plan describe from one to six trenches of differing dimensions at MDA B. (LANL 1991, 07529.1, p. 16-24). The approximate trench locations from historical information in the RFI work plan are shown in Figure B-5. None of the trenches was lined. There are no extant construction drawings, as-built drawings, or literature describing the sizes, configurations, or construction methods of the trenches. Subsurface dimensions of the trenches were estimated using results from geophysical surveys conducted in 1998 (Bay Geophysical 1998, 64146; Bay Geophysical 1998, 64147). The geophysics-based estimate of the disposal trenches surface area is 9700 m^2, and the volume is 36,630 m^3. Figure B-4 shows the estimated boundary of the MDA B trenches based on the geophysical surveys. A complete summary of the geophysical investigations is provided in section B-4.2 of this report.

None of the three MDA B areas has any underground utilities, underground storage tanks, or septic tanks that were associated with MDA B operations. There is an abandoned underground radioactive liquid waste line running along the southern boundary of the site, outside the fence, that served other LANL facilities. Outside the fence near the southeast corner of the site is a Los Alamos County sanitary sewer lift station. Buried water and communications lines are located under the area between the north fence and DP Road. A water hydrant is located inside the northwest corner of the fence and an air-monitoring station is positioned on the outside of the east fence. This waste line and utilities are not part of MDA B (SWMU 21-015).

B-2.2.3 Hydrologic Setting

MDA B is located on a relatively flat portion of DP Mesa with elevations ranging from 7160 to 7220 ft above sea level. Surface drainage from MDA B (rainwater, snow melt) flows south into BV Canyon and does not drain into DP Canyon to the north (Figure B-6). BV Canyon (so named because of its geographical location between MDAs B and V) is a shallow, hanging valley approximately 50 ft deep adjacent to MDA B, incised within Units 2 and 3 of the Tshirege Member of the Bandelier Tuff. Relatively little sediment is stored in BV Canyon. As flow from the canyon drops over a cliff into LA Canyon, it generally infiltrates into an extensive bouldery, colluvial deposit without reaching the main channel (Goff 1995, 49682).

The regional aquifer beneath TA-21 is at an elevation of approximately 5870 ft (determined in Test Well 2 in Pueblo Canyon and in Otowi 4 in Los Alamos Canyon), chiefly within sediments of the Puye and Tesuque Formations (Purtymun 1995, 45344, p. 29). Thus, for mesa-top sites at TA-21 such as MDA B, more than 1200 ft of tuff and volcaniclastic sediments separate the surface from the regional aquifer. In addition to the regional aquifer, shallow alluvial aquifers exist in the sediments of LA Canyon and DP Canyon. The proximate SWMUs identified around MDA B are located within the same groundwater aggregate. The deep hydrogeologic system (including the regional aquifer), which for the purposes of this report means the deep subsurface beneath MDA B, is being investigated in accordance with the hydrogeologic work plan (LANL 1998, 59599), approved by the New Mexico Environment Department (NMED).

B-2.2.4 Cultural Resources

In compliance with Section 106 of the National Historic Preservation Act of 1966 as implemented by Title 36 Code of Federal Regulations (CFR) Part 800, “Protection of Historic Properties,” the subsurface investigation at MDA B was reviewed for possible impacts to archaeological and other cultural resources. The area of potential impact is in a previously surveyed location. A cultural resource survey report covering this area has been sent to the State Historic Preservation Office, and concurrence has been

received. No known intact archaeological sites remain in the project area. The project can proceed without affecting any known cultural resources.

B-2.2.5 Ecological Habitat

Comprehensive plant and animal inventories are required by the Federal Endangered Species Act of 1973; the New Mexico Wildlife Conservation Act; Executive Order 11990, "Protection of Wetlands"; Executive Order 11988, "Floodplain Management"; Title 10 CFR Part 1022, "Compliance with Floodplain/Wetlands Environmental Review Requirements"; and DOE Order 5400.1, "General Environmental Protection Program." The MDA B area is addressed in a 1992 biological evaluation (Bennett 1996, 58236).

The preurban natural overstory for this portion of the mesa was a ponderosa pine forest and piñon-juniper woodland ecozone. The understory comprised grasses and forbs commonly found in disturbed soils (western wheat grass, Canada bluegrass, bottlebrush squirreltail, cheat grass, sand dropseed, summer cypress, prickly lettuce, and horseweed). There are no threatened or endangered species in the immediate vicinity of this site.

The slopes south of MDA B into BV Canyon comprise primarily piñon-juniper woodland with some ponderosa pines. The vegetation within the former trailer park to the west is highly disturbed with numerous cottonwood trees. To the east and north, the surface is highly disturbed with minimum vegetation.

MDA B is on the border of the core habitat for the Mexican spotted owl. This site is within an area that the owl may be assumed to forage with a moderate to low frequency. MDA B is within an area where the potential for foraging for the peregrine falcon is moderate to low. The presence of an 8-ft-high fence prevents foraging by large mammals in this area.

B-2.2.6 Operational History

The Laboratory's primary waste-producing operations during MDA B's operational lifetime were conducted at areas referred to as DP East and DP West. By fall of 1944, the LANL Chemistry Division had developed several separation techniques to recover plutonium from residues. The DP West plutonium purification facility used a separation process based on double plutonium precipitation using trioxalate and plutonyl acetate. Other processing operations produced solutions (from supernatants) containing iron, potassium, sulfates, nitrates, phosphates, chloride, iodine, bromine, and carbon dioxide; all contained traces of plutonium. During the early 1940s, the acceptable discharge concentration for plutonium was 10^{-4} g/L. Noncombustibles as well as halogenated waste solutions containing organic chemicals were treated and extracted to recover plutonium. These recovery efforts generated the bulk of the solid and liquid waste streams, which were either stored or treated before discharge. In addition, solids from incinerator reduction operations were dissolved in nitric and hydrofluorous acids to recover trace amounts of plutonium. Hydrochloric acid was used almost exclusively during 1945 and 1946 for dissolution of plutonium metal, but in 1947 the dissolution was primarily accomplished with hydrogen iodide (Merrill 1990, 11721).

From 1945 until 1948, MDA B was an active subsurface disposal site for DP East and DP West area operations wastes. Much of the process waste produced at TA-21 was disposed of at MDA B during that time, but no formal waste inventory was ever maintained. The waste was highly heterogeneous, primarily radioactively contaminated laboratory waste and debris. Limited volumes of liquid waste are believed to have been emplaced in at least one chemical disposal trench at the eastern end of MDA B. Rogers (1977, 05707) indicates wastes were emplaced by the truckload in piles filling the entire trench depth and

width rather than in vertical layers. The material was subsequently covered weekly with fill dirt using a bulldozer. In addition, no effort was made to keep waste types or loads separate (Meyer 1952, 28154). Figure B-5 shows the probable locations of the trenches at MDA B based on historical information. Table B-1 provides a list of operations at MDA B, summarized from the following information published in the TA-21 RFI work plan (LANL 1991, 07529, pp. 16- 24 to 16-25).

> In 1945, pits at MDA A were being filled at such a rate that additional waste disposal pits were necessary. MDA B was a favorable location because sufficient space was available. Tyler (1945) suggested that a trench 15 ft wide by 300 ft long be dug at the eastern end of MDA B. Dow (1945) suggested that the excavation of this waste pit was to be continued until a depth of 12 ft was reached or until September 1, 1945, whichever came sooner. It is not known if the completed pit achieved the dimensions of 15 by 300 ft by 12 ft deep or precisely where it was located.
>
> Other memos indicated there were additional pits. Meyer (1952) said that four pits were dug in MDA B by 1945 and that space was exhausted by 1948. The locations of these pits are not precisely known; however, their dimensions and orientations to fence lines are known. Personal testimony and reference to common Laboratory practice at the time suggested that four disposal pits 300 ft long, 15 ft wide, and 12 ft deep were located parallel to the fence line along DP road and that two pits of uncertain length were located in the north-south leg of MDA B at the western end of the site (Rogers 1977).
>
> Several sources indicated that additional trenches were located at the easternmost part of MDA B for chemical disposal. A 1964 memo (Safety Office 1964) stated that a covered shallow trench 2-ft wide by 40-ft long by 3-ft deep was located at the extreme eastern end of MDA B. Another source indicated several small slit trenches, 3 to 4 ft deep, 2 ft wide, and less than 40 ft long were reportedly dug in this area for chemical disposal (DOE 1987).
>
> The exact number of pits cannot be ascertained with available information. However, one can assume that there were a minimum of four disposal pits parallel to the fence along DP road and at least one trench for chemical disposal at the easternmost end of MDA B.
>
> A fire occurred at MDA B in 1948 (Buckland 1948). The fire was estimated to have lasted two hours, had great intensity, and covered a waste area of 2500 ft^2 (McCurdy 1973, 00541). The probable cause was spontaneous combustion of mixed chemicals in waste probably containing plutonium, americium, and fission products. The location of this fire is not well known. Buckland and Enders had different recollections regarding where the fire occurred (Rogers 1978).
>
> Because of the seriousness of the fire at MDA B and its close proximity to living and working areas, another disposal site location was selected near Ten Site (Rogers 1977). After the fire, MDA B was no longer used for contaminated waste disposal. Shortly after MDA B was closed, subsidence occurred. This was remedied by using the area for disposal of uncontaminated concrete and soil from construction sites (Rogers 1977).
>
> MDA B was probably fenced as early as 1944 as indicated by the Meyer's memo (1952, 28154). In 1966, another request was made to replace the then-current fence with an 8-ft chain link fence (The Zia Company 1966).

The western two-thirds of MDA B was fenced and compacted in 1966 per instructions in Hilton (1966) and leased by DOE to Los Alamos County for trailer storage. The former location of the storage area is indicated by the paved area. Los Alamos County has been asked to vacate use of this site as a trailer storage area by September 30, 1990 (Bohannan 1990).

Surface stabilization of the east-end of MDA B began on July 6, 1982 (Emelity 1982) and was completed by October 15, 1982 (Emelity 1982). The fence was moved outward by 10 ft, surfaces were decontaminated, vegetation was removed, and the area was covered with soil, compacted, and re-seeded. Capping studies were initiated on the east end of Area B in 1987 to evaluate alternative cover designs.

B-2.2.7 Disposal, Discharges, and Releases

Waste inventory information for MDA B is basically anecdotal, as waste inventory records were not maintained during the active disposal life of this area (1945 to 1948). The following waste characteristics information for MDA B was published in the TA-21 RFI work plan (LANL 1991, 07529).

B-2.2.7.1 Nonradioactive Waste

There are some indications hazardous chemicals may be present at MDA B. Drager (1948, 00552), commenting on the 1948 fire, reported there was some evidence chemicals had been disposed of in the dump in an unauthorized manner, that is, in cardboard containers used for the regular disposal of common laboratory waste. In the fire, several cartons of waste caused minor explosions, and on one occasion, a cloud of pink gas arose from the debris in the dump. Documented employee interviews (DOE 1986, 08657) stated chemical disposal occurred at the east end of MDA B. Chemicals disposed of included old bottles of organic chemicals, including perchlorate, ethers, and solvents. The 1987 DOE document also stated lecture bottles, mixtures of spent chemicals, old chemicals, and corrosive gases may be in the trench(es) at the east end of MDA B (DOE 1986, 08657).

B-2.2.7.2 Radioactive Waste

The principal radioactive contaminants consist of the types of radioactive materials used at the time: plutonium, polonium, uranium, americium, curium, radioactive lanthanum, actinium, and waste products from the water boiler reactor (Meyer 1952, 28154). However, approximately 90% of the waste consisted of radioactively contaminated paper, rags, rubber gloves, glassware, and small metal apparatuses placed in cardboard boxes by the waste originator and sealed with masking tape. The remainder of the material consisted of metal, including air ducts and large metal apparatuses. The latter type of material was placed in wood boxes or wrapped with paper (Meyer 1952, 28154). At least one truck, contaminated with fission products from the Trinity test, is buried in MDA B (DOE 1986, 08657).

B-2.2.7.3 Releases

Releases from MDA B have not been identified in historical or operational records. The possibility exists that airborne contaminants were released from the site during the MDA B operational period from 1944 to 1948 and in subsequent years before the complete burial of the inactive site. Since 1966, the central portion and western leg of MDA B have been covered with asphalt. Since 1982, the eastern leg of MDA B has been covered with a clean soil cover.

Surface and subsurface releases have been evaluated multiple times since closure of the site and are discussed in Sections 3 and 4.

B-3.0 PRE-RFI AND OTHER FIELD INVESTIGATIONS

Numerous data collection and investigative activities have been conducted at MDA B since the site ceased waste disposal activities in 1948. The activities were conducted to document the condition of the site at a given time, to determine an appropriate cover for the disposal area, and to support the RFI for the site. These activities and their corresponding data, including geologic field investigations, geophysical investigations, and surface and subsurface sampling, are divided into pre-RFI and other field investigations (this section), and RFI investigations (Section 4.0). Tables B-2 and B-3 present summary chronologies of pre-RFI and RFI activities.

Data from investigations conducted at MDA B before commencement of the RFI in 1992 are summarized from information presented in the TA-21 work plan (LANL 1991, 07529). The work plan made frequent comparisons of historical investigation data with radionuclide background concentrations available at the time the work plan was written. The sources for background values used included Purtymun et al. (1987, 06687) and the Environmental Surveillance Group (1980, 05961). The qualitative comparisons of site data to background values made in the work plan are presented again in the following sections.

Subsurface sampling locations have not been substantially impacted by surface stabilization and clean-fill cover placement work, paving activities, and landfill cover studies (Nyhan et al. 1986, 06616; 1998, 71345) conducted at the site in the time since the locations were first sampled. The data are limited to radioactivity, radionuclide concentrations, and moisture content data. These results should generally be comparable to results obtained by more recent investigations and analytical methods.

Investigations preceding the RFI at MDA B did not include analyses for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), perchlorate, dioxins, furans, or inorganic chemicals. For investigations preceding 1990, there is no information on analytical data quality.

B-3.1 Borehole Installation and Surface Investigation (1966)

In 1966, the Laboratory and the United States Geological Survey conducted a joint study at MDA B to evaluate precipitation-driven migration of radioactive contaminants from the trenches into the adjacent subsurface soil and tuff. The investigators drilled thirteen 25- to 50-ft boreholes around the perimeter of MDA B (Figure B-7; Kennedy 1966, 00540; Purtymun and Kennedy 1966, 11833). Samples of drill cuttings were analyzed for gross alpha and beta-gamma radioactivity, isotopic plutonium, and total uranium. Data from these boreholes indicated gross alpha, gross beta-gamma, and total uranium levels were equivalent to local background, and isotopic plutonium levels were not detected. Results are provided in Table B-4.

Following drilling, the open boreholes were logged with a neutron moisture probe to determine moisture contents in the soil and tuff. The borehole moisture data showed generally elevated moisture contents near the surface, with moisture levels decreasing and stabilizing within the top 15 ft of the boreholes (Figures B-8 and B-9). Below 15 ft, the soil moisture contents were less than 10% by weight, except in borehole DPS-6. Soil moisture contents in borehole DPS-6 averaged 12% by weight at depths greater than 15 ft.

B-3.2 1966 and 1971 Surface Radiological Surveys

Radiological surveys of the western, paved area of MDA B were conducted in 1966 and again in 1971 using hand-held instruments. The 1966 beta-gamma radiological survey showed count rates above instrument background at a height of 20 in. above the asphalt (LANL 1991, 07529). In 1971, LANL's H-1

Group conducted an alpha- and beta-gamma survey over the same area. A Ludlum Model 139 alpha counter and a Model E-112-B beta-gamma counter were used. The results showed no alpha contamination and beta counts at instrument background (LANL 1991, 07529).

B-3.3 Soil Study (1970)

In 1970, Kennedy and Purtymun (1970, 01310) investigated plutonium derived from TA-21 stack emissions in DP mesa soils. The objective of this study was to quantify the mass of stack-emission radionuclides deposited on the mesa top. They estimated 0.26 Ci, equivalent to 2% of the total mass of plutonium released through TA-21 operational stack emissions through 1969, had been deposited on DP mesa (Kennedy and Purtymun 1970, 01310). The results also confirmed the presence of plutonium in surface soils near MDA B.

B-3.4 Soil Sampling and Radiological Survey (1976-1977)

Soil samples were collected from the unpaved area on the east side of MDA B from September 1976 through October 1977 (Booth 1978, 07053). Samples were analyzed for radionuclides and measured for gross alpha and beta radiation. In addition to the soil sampling, a Phoswich gamma survey was conducted (at an energy level of 12^{-4} keV) over the eastern portion of MDA B. The gamma survey included additional surface soil sampling on a 10- by 15-m grid and biased surface soil samples based on Phoswich readings. Sampling locations are shown on Figure B-10 and are denoted as 1977 Trocki Gamma Survey Soil Samples and 1977 Trocki Transect Soil Samples. The results of 1976–77 soil sampling are given in Table B-5. In 1978, additional analyses were performed on these soil samples. The analytes and results are presented in Table B-6 (Booth 1978, 07053).

Tritium and plutonium 239/240 results for the soil samples are presented on Figures B-11 and B-12. The tritium concentrations were above background levels of 7.2 nCi/L (Purtymun et al. 1987, 06687) but were generally less than 20 nCi/L (Gunderson 1981, 03526). Eleven samples had levels higher than 20 nCi/L, with a maximum detected concentration level of 3420 nCi/L (Figure B-12). The plutonium-239/240 concentrations were generally above 1 pCi/g, which is considerably higher than the maximum worldwide fallout levels of 0.025 pCi/g given by Purtymun et al. (1987, 06687). Samples from two locations showed concentrations of 25.7 and 47.1 pCi/g. Additionally, elevated levels of americium-241, plutonium-238, and cesium-137 were detected (Table B-5).

The gamma survey identified an “apparent pit surface” with surface uranium-233 contamination along with high levels of surface plutonium-239/240 (1370 pCi/g) (Figure B-12). Waste was exposed at the surface in this area and subsidence was evident. Line transect samples showed elevated tritium levels in the eastern portion of the site tended to coincide with high gross alpha activity. The gamma survey concluded contamination in the middle and southern portion of the area identified during the investigation was most likely because of late 1940s burial practices. Pieces of contaminated equipment were sometimes spread on the surface until a suitable pit location was available. Lack of adequate pit cover probably accounted for the above-background contamination over the “apparent pit surface” (Booth 1978, 07053).

B-3.5 Soil Sampling (1979)

During the late 1970s, a series of studies at MDA B was conducted as part of the environmental surveillance and radioecological programs at the Laboratory (LANL 1991, 07529).

Perimeter soils at five locations plus one location for background were sampled along the southern edge of MDA B in 1979. The samples were analyzed for a suite of radionuclides. Background samples were

collected at two depths approximately 200 ft west of MDA B to document background concentrations near MDA B. Sample locations and analytical results for these samples are shown on Figures B-13 and B-14. Analytical results are also presented in Table B-7. Above-background concentrations of actinium-227, plutonium-238, plutonium-239/240, cesium-137, total uranium, and tritium were identified; plutonium-239/240 concentrations were typically the highest above local background.

B-3.6 Vegetation Samples (1980-1981)

Vegetation was sampled in 1980 and 1981 at the same locations as soils sampled in 1979 (Figures B-13 and B-14). These results, along with plutonium isotope data for control samples collected in Guaje Canyon, are presented in Table B-8. In general, higher levels of radionuclides were found in vegetation collected at locations on the eastern unpaved section of MDA B. However, not all samples at those locations showed elevated levels of radionuclides. In addition, the fruit from a peach tree located on the west end of MDA B was sampled and analyzed for tritium, plutonium-238, plutonium-239/240, and strontium-90. These data are presented in Table B-9. Plutonium-238 and plutonium-239/240 were detected in the peach samples along with tritium and strontium-90.

B-3.7 Prerenovation Vegetation Sampling (1982)

MDA B was scheduled for clean-fill covering and surface stabilization in the fall of 1982. Stabilization of the soil surface required the removal of all plants, including stumps and roots. Before surface and subsurface vegetation removal, a comprehensive sampling plan was implemented to collect and analyze samples from various “layers” adjacent to the site, including surface and subsurface soil, litter, roots, stems, and leaves (Wenzel et al. 1987, 58214). The purpose of the study was to determine whether any peripheral trees or shrubs were rooting into buried waste material, to examine rooting patterns in a shallow land burial site, and to study the distribution patterns and partitioning of different radionuclides in the various parts of individual plants and types of site vegetation. Analyses included cesium-137, plutonium-239/240, uranium, and scandium. Sampling locations for 1982 are given on Figure B-10 and include some subsurface samples. The data are presented in Table B-10 and expressed as a mean with a standard plus/minus deviation and a coefficient of variation. Results indicated activity in vegetation was elevated over background levels (Wenzel et al. 1987, 58214). For all analyzed radionuclides, both root and bark measurements generally showed greater concentrations than the corresponding wood (heart wood and sap wood) measurement. Surface soil samples contained elevated levels of tritium and plutonium-239/240. The ratio of radionuclide concentrations in surface-soil to concentrations in corresponding vegetation samples (wood) ranged from a high of 8:1 for plutonium to a low of 5:1 for cesium-137.

The subsurface soil samples were collected to depths of approximately 5 ft below ground surface (bgs) from beneath vegetation (Wenzel et al 1987, 58214). It is not clear whether these samples were collected within the disposal trenches. Total uranium and isotopic plutonium were present in the subsurface samples at greater than background levels (Environmental Surveillance Group 1980, 05961); cesium-137 was present at less than background levels. Scandium was also detected. The results indicated a decrease in activity with increasing depth for iso-plutonium and cesium-137. Uranium and scandium activities did not appear to decrease with depth, up to the maximum sampled depth.

The following excerpt from the Wenzel study (Wenzel et al. 1987, 58214) is presented here to provide information on the actual contents and contaminant levels directly in the MDA B disposal trenches. This is the only known information on the MDA B trench inventory established after site closure and independent of historical operations records.

Ponderosa pine was found rooting in what may be a trench described by Rogers (1977) as being 90 cm wide and 2 m long. Soils in the area were deep and alpha contaminated debris was exposed at the surface under the tree canopy. The tree was selected for excavation because of the presence of exposed 1.3-cm diameter metal pipe (electrical conduit) having measurable radioactivity (about 2000 alpha counts/minute/60 cm^2). The pipe continued downward beneath the roots. Beneath the roots some copper and electrical wires were uncovered, but had no detectable alpha radioactivity. At about 40 cm deep, a mass of rubber gloves was excavated. Radioactivity on the surface of the gloves varied from 0 to 6000 alpha counts/minute. Other gloves in the area had no measurable alpha radioactivity. At 45 cm a large lateral root had come into contact with a rubber glove. The rubber glove and its contents (the glove contained a 6-cm ball of radioactive waste) provided resistance to root growth. Where the fingers of the glove had not provided resistance, the root had grown between the fingers until the resistance of the rubber had retarded growth. This gave the root the appearance of a hand. Soil and the glove measured 10,000 alpha counts/minute. Excavation was discontinued because of the high radiation levels. In the same layer there were brown Duroglass bottles still filled with liquid, rubber tubing, plaster, and metal tubing that had been painted. Roots and soils were collected and the hole backfilled. No cardboard or wood materials were found in the excavation site. This was probably due to decay of cardboard and wood and consumption by soil arthropods. There was also indication that some waste material was dumped in the trench without previous packaging.

B-3.8 Prerenovation Soil Sampling (1982)

In addition to the vegetation sampling effort, prior to cover placement, soil samples were collected along diagonal transects at depths of 0–1 cm, 1–10 cm, and 10–30 cm (Figure B-10). Sample analysis results are given in Table B-11 and shown on Figures B-16 and B-17.

At the 0–1 cm depth, there were 35 samples analyzed for tritium, all having values above background (Purtymun et al. 1987, 06687). The values ranged from 13,400 pCi/L to 25,600,000 pCi/L (Table B-11; Figure B-16). At sampling depths of 1–10 cm and 10–30 cm, the tritium was also above background (Purtymun et al. 1987, 06687), with high values of 7,050,000 pCi/L and 4,740,000 pCi/L, respectively. Within the top foot, the levels decreased with depth. The 1982 tritium levels were much higher than those observed in 1977. At 0–1 cm, 40 samples were analyzed for plutonium-239/240, 97% of which were above background, with a highest observed concentration of 58 pCi/g (Table B-11; Figure B-17). At 1–10 cm, all results were above background (Purtymun et al. 1987, 06687), while at 10–30 cm, 87% were above background (Purtymun et al. 1987, 06687). The concentration ranges for plutonium-239/240 at both these depths were comparable to the concentration range at the 0–1 cm depth.

B-3.9 Postrenovation Soil Sampling (1982)

After the covering of the eastern side of MDA B was completed, soil samples were taken at four locations on the perimeter of MDA B in October 1982. Three of the locations are shown on Figure B-15. The location of the fourth sample (B-4) is not known. These samples were collected outside the area of cover placement and were analyzed for a suite of radionuclides including tritium, total uranium, and isotopic plutonium. The results are presented in Table B-12.

B-3.10 Baseline Soil Sampling (1983)

In 1983, surface soil samples were collected from the eastern portion and analyzed for a suite of radionuclides. Three sampling depths were again used, 0–1 cm, 1–10 cm, and 10–30 cm. The laboratory

results are presented in Table B-13 and shown on Figures B-18 through B-21 (Mayfield 1985, 01110). The objective of this sampling campaign was to reestablish a radionuclide concentration baseline for monitoring future contamination, because clean fill was brought on-site in 1982 when MDA B was covered (Mayfield 1985, 01110). The locations of the surface baseline sampling points are not fully documented but assumptions were made in order to record the data in the RFI report because of its importance to future monitoring activities at MDA B (LANL 1991, 07529).

Within the fenced area, tritium concentrations were 35,000 pCi/L or less, with most locations being less than 20,000 pCi/L. In a number of cases the concentrations at or outside the fence line were higher than the concentrations inside the fence (LANL 1991, 07529). The predicted concentration contours for tritium showed the highest concentrations at the corners of the area, especially the southwestern corner beyond the fence line (Figure B-22).

Plutonium-239/240 concentrations are generally within background levels (Purtymun et al. 1987, 06687) (< 0.025 pCi/g) inside the fenced area. However, the concentrations on or outside the fence line are above background (Purtymun et al. 1987, 06687) levels. The concentrations outside the fenced area are similar to concentrations observed in previous sampling (LANL 1991, 07529). The predicted concentration contours for plutonium-239/240 also show the highest concentrations at the corners of the area beyond the fence (Figure B-23).

Plutonium-238 was detected at low levels, with a few exceptions (Figure B-20). Uranium concentrations slightly exceeded the maximum background level of 3.4 μg/g (Figure B-21). Those exceptions are either on the fence line or outside the fence line.

Radionuclide concentrations were low inside the fence because MDA B was covered with clean fill in 1982 before sampling. However, clean fill was not put outside the fence. Elevated levels outside the MDA B fence may be representative of local contaminant levels at the TA-21 (LANL 1991, 07529).

B-3.11 Borehole Installation (1983)

In 1983, two boreholes were drilled at the northeast and southeast edges of MDA B outside the disposal trenches to depths up to 58 ft bgs (Figure B-15). Samples were analyzed for tritium, uranium, plutonium-238, plutonium-239/240, and cesium-137 (LANL 1991, 07529, p. 16-32). Results are provided in Table B-14. The analytical results indicated cesium-137, plutonium-238, and most plutonium-239/240 concentrations were all within the background levels (Purtymun et al. 1987, 06687). Uranium was slightly higher than the background range (Purtymun et al. 1987, 06687) used for the study. Two plutonium 239/240 levels (one in the 0- to 3-ft interval of hole B-1 [0.206 pCi/g] and another in the 3- to 8-ft interval for hole B-2 [0.25 pCi/g]) were above the background level of 0.025 pCi/g. Tritium concentrations, on the other hand, increased with depth. Tritium data are available only to a depth of 23 ft bgs. The concentrations ranged from 7500 pCi/L to 36,000 pCi/L.

B-3.12 Soil Sampling (1984)

Soil samples were collected in May 1984 at three locations. These locations were described in a field notebook (Mayfield 1985, 01110) as follows: B-1, southern end of the western-fenced unpaved area; B-2, southern end of MDA B near the western corner of the unpaved area; and B-3, north side near DP Road at the northwestern corner of the eastern unpaved area of MDA B; however, these locations cannot be accurately placed on a site map. The laboratory results are presented in Table B-15. Tritium concentrations are less than background. Plutonium-238 concentrations exceeded background (Purtymun et al. 1987, 06687) only at location B-3. Plutonium-239/240 concentrations exceeded background at all locations and ranged from 0.4 to 7.4 pCi/g (LANL 1991, 07529).

B-3.13 Environmental Surveillance Cover Investigation (1990)

The present clean-fill cover on the eastern portion of MDA B was placed in 1982 (Nyhan et al. 1986, 06616.1; 1998, 71345). Because little was known about properties of the material used for the cover, an investigation was conducted in 1990 to obtain this information. The investigation included radiological surveys to identify surface radionuclide contamination and the collection of soil samples for plutonium-238, plutonium-239/240, cesium-137, strontium-90, americium-241, tritium, and total uranium analysis (LANL 1996, 58213).

MDA B was sampled around its perimeter and on a grid laid out on the eastern covered area of the site (Figure B-24). The results of this investigation show low levels of radioactive contamination in the cover material at MDA B (Table B-16). Except for tritium and uranium, the contamination occurred primarily at the southwestern edge along the boundary with the asphalt pavement and in a cluster near the center of the covered area. Tritium was elevated above background (LANL 1998, 59730) in the samples analyzed, representing an east-to-west strip down the middle of the eastern leg of MDA B. Uranium was slightly elevated throughout the area sampled. The uniformity of the uranium results may indicate the material used for the cover has slightly greater naturally occurring uranium content than the surface soils around TA-21.

B-3.14 1992 and 1993 Geologic Field Investigations

In 1992 and 1993, geologic field investigations were conducted at TA-21. The investigations were not specific to MDA B, but the resulting information is applicable to the characterization of the MDA B subsurface. The investigations included studies of the site geology, fractures, stratigraphy, petrography, mineralogy, and geomorphology. These investigations are summarized in “Earth Science Investigations for Environmental Restoration—Los Alamos National Laboratory Technical Area 21” (Broxton and Eller 1995, 58207).

The results pertaining to fractures and cliff retreat are summarized below.

- A total of 1662 fractures was documented and measured along a 7312-ft section of LA Canyon on a line parallel to MDA B through MDA U. Northeast-striking fractures are approximately 30% more abundant than northwest-striking fractures. Furthermore, the northeast striking fractures (those dipping north into the northwest quadrant) are over three times more abundant than south-dipping ones.
- Available data on the cliff-retreat process at TA-21 indicate exposure of buried waste by the retreat of the slopes more than 50 ft from the cliffs is unlikely within a time frame of 10,000 years or more.

B-3.15 1993 and 1996 Deep Geochemical, Geohydrologic, and Groundwater Investigations

A relatively large quantity of data is available for the deeper geologic units comprising DP Mesa and the deep saturated zones (Broxton and Eller 1995, 58207). Data are summarized from fracture mapping, geomorphic mapping, geologic section measurement, and several boreholes. The boreholes were advanced in the adjacent canyons (DP and LA) to depths from 350 to 2800 ft bgs. Data on mineralogy, geochemistry, hydrology, and physical properties from Broxton and Eller (1995, 58207) provide characterization of the conditions beneath MDA B.

The unit in which MDA B was excavated is identified as the Quaternary age, Unit 3 of the Tshirege Member of the Bandelier Tuff (Qbt3). The data for this unit and deeper geologic units are in Springer et al.

(2001, 70114). The Springer report results could be used to provide parameter values to support modeling required for analyzing remedial alternatives for MDA B.

B-4.0 RCRA FACILITY INVESTIGATIONS

The Risk Reduction Environmental Stewardship – Remediation Services (RRES-RS) project has conducted fieldwork in support of the RFI process at MDA B since 1992 (LANL 1991, 07529; LANL 1998, 59506; LANL 2001, 70231). This section summarizes and provides details of these efforts, including a TA-21 mesa-wide surface soil sampling effort, a geophysical investigation, and surface and subsurface investigations conducted to characterize the nature and extent of contaminants around and beneath the buried waste at MDA B. Surface and subsurface media were sampled between 1994 and 2001. In 1998, seven angled boreholes were advanced beneath the disposal trenches to determine if chemical or radiological contaminants had been released from the trenches to the subsurface. SUMMA pore-gas data were also collected during drilling activities. In 2001, passive soil-vapor sampling was conducted using the EMFLUX passive VOC sampling system to augment SUMMA data on vapor-phase organic chemicals in subsurface pore gas. Table B-17 provides a summary of the media sampled, number of samples collected, and the requested analyses for each phase of the RFI.

B-4.1 1992 DP Mesa-Wide Surface Soil Sampling

Surface soil samples were collected across all of DP Mesa to document local TA-21-wide contaminant levels for comparison with levels found within discrete SWMUs (LANL 1991, 07529). Twenty-eight samples from this TA-21 site-wide effort are located around MDA B's perimeter and have been included in the RFI data set for MDA B. The sample locations are shown on Figure B-25. A summary of samples collected is provided in Table B-18. In addition, Table B-19 provides the frequency of inorganic chemicals above background. Table B-20 provides inorganic chemical analyses of surface soils above the background levels (LANL 1998, 59730). The frequency of detected organic chemicals is provided in Table B-21. Table B-22 provides a summary of detected organic chemicals.

The frequency of detected radionuclides in surface soil samples is provided in Table B-23. The results for plutonium–239 detected above the background levels (LANL 1998, 59730) are of acceptable quality and are presented on Table B-24. Plutonium-239 activities were ubiquitous across the site and generally elevated above background values (LANL 1998, 59730) around the entire perimeter of the site and in BV Canyon, with the highest activities detected along the northern edge of the east leg of MDA B and along the far western boundary of the site.

B-4.2 1998 RFI Geophysical Surveys

Geophysical surveys were conducted in 1998 by Bay Geophysical (1998, 64146; 64147). The purpose of this investigation was to better delineate the locations and dimensions of the historical disposal trenches (LANL 1998, 59506). The investigations included three survey techniques selected to provide complementary information, each potentially supporting the interpretation of the others. The techniques used included high sensitivity metal detector (EM-61), terrain conductivity (EM-31), and ground penetrating radar (GPR). These techniques look for metal objects, changes in material conductivity, and anomalous objects or surfaces. The locations of these features were used to delineate the historical disposal trenches. Figure B-26 shows the interpretation of the EM-61 survey, which best depicts the trench locations.

The 1998 geophysical surveys indicated a single primary trench in the eastern leg of MDA B. This trench appears to be approximately 800 ft long and varies in width from about 25 to 60 ft. Depending on interpretation of the geophysical data, the western leg of MDA B contains either one continuous trench, or

three shorter end-to-end trenches. The trench is about 40 ft wide, with a total length of about 1000 ft. If there are three trench segments present, each is in the range of 300 to 400 ft in length. Interpretation of GPR transects indicated trench depths approximately 11 to 15 ft beneath the present ground surface (Bay Geophysical 1998, 64146; 64147). Numerous metal objects were identified in these trenches, and estimates of the depth to the tops of some trenches were made from the EM-61 data. These estimates ranged from 1.3 to 7.2 ft (with a mean of 4.1 ft) below existing ground level.

No clear delineation of the edges or floor of one or more "chemical pits" (reported to be at the southern portion of the east-end of MDA B) was identified. However, the EM-31 terrain conductivity measurement technique identified a difference (decrease) in conductivity in the appropriate region. The area was larger than the archival descriptions of the slit trenches indicated, which may indicate the presence of several small chemical disposal pits in the same general area.

The depth of the existing cover is best estimated using the results of the EM-61 survey, which looked for the depth to metal objects. As mentioned above, the shallowest objects were identified from 1.3 to 7.2 ft, and therefore, the existing cover depth is estimated to range from 1.3 to 7.2 ft in depth.

Historical information indicates one or two relatively short trenches at the far west-end of MDA B, possibly running north/south. The geophysical surveys were not able to identify such features, but did identify the presence of buried metal objects. During processing of the geophysical data, it was speculated the surveys in the far west end were hampered by interference from the fence and the limited working space in the area. Numerous scattered anomalies were identified. Based on the locations of detected metal objects, the burial area appeared to extend beyond the fence. The survey was continued around the outside of the fence to the south and west, and the results indicated additional buried metal objects. The calculated depth of buried metal objects ranges from 0.1 to 6.8 ft in this area. Partially exposed buried objects were observed on the western side of this area. The geophysical results provide an adequate estimate of the disposal trench locations and dimensions. Further geophysical investigations would first require ground truthing or verification of the initial results.

B-4.3 RFI Subsurface Investigations

In 1998, seven angled boreholes were advanced beneath the waste trenches (LANL 1998, 59506). In 2001, passive soil-vapor sampling was conducted using the EMFLUX passive VOC sampling system to evaluate vapor-phase organic chemicals in the subsurface pore gasses (LANL 2001, 70231). Results of the subsurface investigations are described in the following sections.

B-4.3.1 Angled Boreholes (1998)

A subsurface investigation was conducted at MDA B in 1998 as part of the MDA B RFI (LANL 1991, 07529.1; LANL 1998, 59506). A total of seven angled boreholes (Location IDs 21-10551 through 21-10557) were advanced beneath the MDA B disposal trenches as delineated by geophysical surveys and historical information (Figure B-27). Three of the boreholes were advanced beneath the trenches in the western leg of MDA B (Location IDs 21-10552, 21-10553, 21-10557), two were advanced beneath either end of the trench in the eastern leg of MDA B (Location IDs 21-10551, 21-10555), another was advanced beneath the estimated area of the chemical pit (Location IDs 21-10554), and one was advanced beneath the area at the far west end of MDA B (Location ID 21-10556), where trenches were expected to be found but could not be identified by geophysical surveys. Core samples were collected every 10 ft beneath the trenches. Fifty-five core samples were analyzed by gamma spectroscopy for strontium-90, tritium, americium-241, uranium isotopes, and plutonium isotopes and for SVOCs and inorganic chemicals. Figures showing borehole lengths, depths, inclinations, and analytes detected above background values (LANL 1998, 59730) in the angled boreholes are presented in Figures B-28 through

B-40. A summary of samples collected from the angled boreholes is provided in Table B-25. The complete list of analytical results for all samples is provided in Appendix E. All tuff samples were collected in cooling unit 3 of the Tshirege member of the Bandelier Tuff (Qbt3).

Most notable of the angled boreholes is Location 21-10554, which was placed to investigate the chemical disposal pits (Figure B-27). It is believed this borehole penetrated the subsurface corner of a pit at a point about 11 ft from the top of the angled boring (8 ft vertical bgs). Metal shavings observed in the core were analyzed and determined to be beryllium metal. Field screening of the core in the 15- to 20-ft interval indicated elevated gross alpha activity of 250 counts per minute (cpm) and gross beta/gamma activity of 160 cpm over instrument background. A sample was collected from the 19- to 20-ft interval (14-ft vertical bgs) for laboratory analysis. Field personnel reported a vinegar-like odor from the 22- to 25-ft interval and field screening of core for organic vapors with a photo-ionization detector indicated 5.9 parts per million organic vapor. Small fractures (1–3 mm) were also observed in the 22- to 25-ft interval and sample MD21-98-0168 collected at 24–25 ft (17 ft bgs vertical depth).

Table B-26 presents the frequency of detected radionuclides above background value. Plutonium-239 was detected in Location ID 21-10554 at concentrations above background levels (LANL 1998, 59730), but the concentrations decreased with depth (Figures B-29 and B-36). Two plutonium-239 samples in Location ID 21-10555 (Figures B-28 and B-37) were above background. A minor release of plutonium may be evident based on data from Location ID 21-10554; however, its extent is limited. Table B-27 presents radionuclide results above their background values.

Tritium was detected above background (LANL 1998, 59730) in six of seven boreholes (Figure B-28; Table B-27). Location ID 21-10556 was the only borehole with no detections of tritium above background. The tritium concentration in Location ID 21-10554 increased slightly over the length of the boring but showed a decrease in concentration in the deepest sample (Figures B-28 and B-36). Location ID 21-10554 is located beneath what is believed to be the chemical disposal pit. Tritium has been released from the disposal trenches to the subsurface tuff.

The frequency of detected inorganic chemicals above background value is presented in Table B-28. Inorganic chemical results above background value are presented in Table B-29. Lead was detected above background (LANL 1998, 59730) at several depths in Location ID 21-10557 (Figures B-29 and B-39) and at one depth in Location ID 21-10551; concentrations decreased with depth (Figures B-29 and B-31). Arsenic was detected above background at one depth in Location ID 21-10557 (Figures B-29, B-39) and at two depths in Location ID 21-10556 (Figures B-29, B-38). Cadmium, mercury, and zinc were detected above background at one depth at Location ID 21-10554 (Figures B-29, B-35).

No SVOCs were detected in the samples analyzed from the 1998 boreholes.

Three pore-gas samples were collected for VOC analysis from each of the seven boreholes angled beneath the MDA B trenches. The samples were collected in evacuated SUMMA canisters at discrete intervals by running an extraction tube to the bottom of the borehole and sealing it off with an inflatable borehole packer. A summary of samples collected is presented in Table B-30. The samples were collected at 35 ft, 75 ft, and 100 ft along the length of the angled boreholes (approximately 25 ft, 53 ft, and 70 ft vertically bgs). The angled boreholes pass directly beneath the disposal trenches, where the highest potential for contamination exists. The highest detected concentrations were at trace levels [parts per billion by volume (ppbv)], with the highest being 1,1,1-trichloroethane (1,1,1-TCA) at 190 ppbv and trichloroethene (TCE) at 120 ppbv (Figure B-30, Table B-31).

B-4.3.2 2001 MDA B EMFLUX VOC Sampling

Additional VOC data was collected to further define the lateral extent of the potential VOC contamination and identify any missed subsurface sources of organic vapors (LANL 2001, 70231). Rather than drilling more boreholes for VOC sampling, the EMFLUX passive soil gas collection method was used as a non-intrusive method of collecting this additional data. The EMFLUX method measures the surface flux of VOCs, and allows for large areas to be sampled relatively quickly. A flux of VOCs at the surface can be correlated to subsurface vapor phase VOCs. The sampling locations were selected to provide coverage of the surface of the disposal trenches; the sample locations are depicted on Figure B-41. In September 2001, EMFLUX passive soil gas collectors were installed at 80 surface locations at MDA B. Table B-32 presents a summary of EMFLUX samples collected. Table B-33 presents detected organic chemicals in EMFLUX samples. Table B-31 provides the frequency and the minimum and maximum concentrations of detected organic chemicals in EMFLUX samples. The sample results for tetrachloroethene (PCE) and TCE are shown on Figures B-42 and B-43, respectively. The EMFLUX method did not detect TCA as did pore-gas analysis for the 1998 sampling, but did detect PCE. PCE and TCE were frequently detected and are good indicators for extent of surface emissions for the subsurface VOCs. The data indicate most PCE and TCE detections were within the estimated boundaries of the waste trenches. No elevated concentrations of these VOCs were detected at the west end of the western leg of the site, outside the disposal trench boundaries.

B-4.4 RFI Surface Sampling

Several RFI surface sampling events were completed between 1994 and 2001 to characterize the nature and extent of contamination in surface soils and sediment. Results of the surface investigations are described in the following sections.

B-4.4.1 1994 RFI Surface Soil and Sediment Sampling

A surface investigation of MDA B was conducted in 1994 to identify areas of surface contamination between the southern MDA B fenceline and the edge of BV Canyon, directly south of the disposal area, and to determine if contaminants were migrating from MDA B into the canyon (Figure B-25). The 1994 sampling activities included a radiological survey of MDA B, collection of soil samples from a depth of 0 to 6 in. at MDA B, and collection of sediment samples from depths of 0–3 in., 3–6 in., and 6–12 in. from five locations in BV Canyon. A total of 85 samples was collected and analyzed for TAL metals, SVOCs, and radionuclides (gamma spectroscopy, isotopic plutonium, isotopic uranium, total uranium, strontium-90, and tritium). All samples were sent to a fixed-site laboratory for analysis. Table B-34 provides a summary of surface soil and sediment samples collected. The frequency of detected inorganic chemicals above background value in surface soil and sediment samples is presented in Table B-37. Inorganic chemical results above background value in surface soil and sediment samples are provided in Table B-36. The frequency of detected organic chemicals is presented in Table B-37. Table B-39 provides detected organic chemicals in surface soil and sediment samples. The frequency of detected radionuclides in surface soil and sediment samples is provided in Table B-38. Table B-40 provides radionuclides detected above BVs.

B-4.4.2 1998 RFI Surface Soil Investigation

The 1998 RFI surface soil investigation at MDA B consisted of collection of samples from the north and west sides of the paved area to address data needs following evaluation of the 1994 RFI surface sampling data (LANL 1998, 59506; Figure B-44). A summary of surface soil and sediment samples is presented in Table B-41. The 1998 surface sampling event included collection of asphalt samples from the asphalt cover, soil samples from beneath the asphalt cover, and soil samples from the east end, the

vicinity of the probable chemical trench. In addition, soil samples were collected from the area to the south of MDA B to improve spatial coverage in the area. The asphalt samples were collected for waste disposal assessment and analyzed for radionuclides, toxicity characteristic leaching procedure (TCLP) metals, SVOCs, and PCBs. These waste-characterization samples are not included in the RFI data. The soil samples from directly beneath the asphalt were analyzed for tritium and moisture content only. The remaining soil samples were analyzed for radionuclides, SVOCs, and metals. A total of 29 surface soil samples were collected in 1998. Table B-42 provides frequency of detected inorganic chemicals above background value. Table B-43 provides inorganic chemical results above the background values (LANL 1998, 59730). The frequency of detected organic chemicals in surface soil samples is provided in Table B-44. Table B-45 provides detected organic chemicals in surface soil (sediment contaminants were not detected). The frequency of radionuclides in surface soil and sediment samples is provided in Table B-46. Radionuclides above their background values in surface soil and sediment samples are shown in Table B-47.

Chemicals of potential concern (COPCs) in surface soils identified in and around MDA B included plutonium-239, americium-241, tritium, lead, and silver. Plutonium-238, plutonium-239, lead, and silver are discussed below to illustrate the general and specific spatial distributions of the surface contamination at MDA B. Plutonium-238 and plutonium-239 are surface releases from MDA B (Figure B-45). The maximum activities of plutonium-238 were located on the north-central perimeter of the MDA, within the current fence line (Figure B-48). Activities decrease with distance from MDA B in all directions. The data indicate that the extent of plutonium-238 releases from MDA B was bounded by samples with activities near the background values. Plutonium-239 is present at levels greater than background values on most of the perimeter of MDA B, with the highest activities being on the west and north-central perimeter, within the current fence-line (Figure B-49). Activities of plutonium-239 decreased with distance from the perimeter of MDA B to levels indistinguishable from TA-21 activities as determined from the TA-21 site-wide survey (LANL 1991, 07529). Lead was one of the predominant inorganic COPCs occurring in MDA B surface soils (Figures B-46 and B-50). Silver was not detected in the immediate vicinity of MDA B, yet analytical data show concentrations above background (LANL 1998, 59730) in BV Canyon.

The chemical trench in the southeastern part of MDA B was the target of focused sampling to identify releases of VOCs into the surface soils. Soils were sampled in seven locations (Location IDs 21-01981, 21-01982, 21-01984, 21-01985, 21-01986, 21-01987, and 21-01988) in the vicinity of the chemical trench in 1998 for VOCs only, as shown on Figure B-47. Appendix E, Table E-7, provides the results. No VOCs were detected in these samples.

In addition to surface soil samples, samples of the asphalt cover were collected for waste evaluations. The asphalt sample results showed the presence of typical asphalt components. No metals, PCBs, or nonasphalt SVOCs were reported in these samples.

There are indications from other Laboratory sites (MDA AB at TA-49 in particular) that the presence of asphalt covers may increase subsurface moisture content by restricting the natural loss of moisture from the soil profile through evaporation and transpiration by plants. The average moisture content for the six MDA B soil samples collected beneath the asphalt cover was 10.9% (by weight). By comparison, the average moisture content in the 24 surface soil samples collected during the same 1998 investigation, from surrounding locations without asphalt cover, was 5.1% (by weight). Tritium was not detected in the soil immediately beneath the asphalt.

B-4.4.3 2001 MDA B Surface Soil Plutonium Sampling

In September 2001, 10 surface soil samples were collected at MDA B for isotopic plutonium analysis along the western edge and north-central boundary of MDA B (Figure B-44; Table B-48). The sampling

and analysis plan (SAP) identified a need for greater resolution of lateral extent to support future remediation efforts (LANL 2001, 70231). Five samples from 0–6 in. were collected at the northern and western boundaries of MDA B.

Plutonium-239 activities were detected above background (maximum of 6.66 pCi/g) at two of the four sample locations on the north side of the east leg of MDA B. Plutonium-239 activities were also detected at slightly above background levels at six of the ten sample locations on the north and west perimeters of MDA B (Figure B-45; LANL 1998, 59730). Table B-49 lists the frequency of detects above background value for isotopic plutonium. Table B-50 provides the surface soil samples above the background value for iso-plutonium analyses (LANL 1998, 59730).

B-4.5 Summary of Field Investigations

Numerous surface and subsurface environmental investigations have been conducted at and in the vicinity of MDA B beginning in 1966. Early (non-RFI) investigations focused on collecting data to support site stabilization efforts at the disposal area. RFI investigations have focused on defining the nature and extent of contamination following cessation of waste disposal and subsequent installation of both asphalt and soil covers over the disposal area. The most recent investigation was conducted in 2001.

Review of data from the field investigations of MDA B indicate the data were of sufficient quality and quantity to support the following statements:

- Some radionuclides and metals are present at concentrations greater than background values in surface soils along the perimeter of the site in areas not covered by asphalt or the 1982 cover.
- VOCs were detected in the subsurface soil pore gas in all seven angled boreholes drilled beneath the disposal area in 1998.
- Tritium, plutonium-239, uranium, and lead are present at concentrations above background values in three of the seven boreholes drilled beneath the disposal area in 1998.
- Other inorganic compounds were isolated detections above background values.
- The average moisture content in soils beneath the asphalt (10.6 wt%) is elevated compared with the surrounding surface soils (5.1 wt%) and subsurface materials (5.6 wt%).
- Elevated radionuclides, organic chemicals, and inorganic chemicals were detected in some surface soil samples.

B-5.0 SUMMARY OF SITE CONDITIONS

The RFI dataset includes results from surface and subsurface investigations. Surface investigations include soil and sediment sampling as well as the surface flux and SUMMA investigations for VOCs. The subsurface investigations include subsurface tuff sampling from boreholes.

B-5.1 General Discussion of Surface Data

Surface investigations at MDA B have included surface soil sampling, sediment sampling from BV Canyon, and surface flux measurements of VOCs. A total of 14 surface sampling events occurred from 1966 to 2001.

Based on the concentrations and locations of the surface samples, radionuclides have been released during operations in low levels to the surface soils around MDA B. Americium-241, cesium-137,

plutonium-238, plutonium-239, and tritium were found across MDA B. Figure B-48 shows the distribution of plutonium-238 activities across the site.

Plutonium-239 activities are elevated along the perimeter of MDA B as shown in Figure B-49. Organic chemicals (SVOCs) were detected infrequently at MDA B. These data do not indicate a release of organic chemicals to surface soils.

Lead, uranium (total), and zinc were detected above background (LANL 1998, 59730) consistently across MDA B. Figure B-50 shows the spatial distribution of lead in surface soil. The occurrence of lead could be attributed to DP road traffic or the trailer storage from 1966 to 1994. Elevated zinc is associated with weathering of the galvanized security fence.

B-5.2 General Discussion of Sediment

The sediment data in BV Canyon indicate several radionuclides are elevated above background levels, similar to the surface soil data. Plutonium-239 is found in the channel sediments between 1 and 5 pCi/g, consistent with concentrations on the slopes south of MDA B (Figure B-49). No apparent trend for plutonium-239 (increasing or decreasing) is observed in the sediments or soils.

Because no definitive trends were found in the canyon sediments, and to see if contamination in BV Canyon is contributing contamination downstream into LA Canyon, data from the “Evaluation of Sediment Contamination in Upper Los Alamos Canyon, Reaches LA-1, LA-2, and LA-3” (LANL 1998, 65407) were reviewed. BV Canyon discharges to LA Canyon just upstream of reach LA-1 East. The levels of plutonium-239 in the reach upstream of LA-1 East (and BV Canyon) are very similar to those within LA-1 East. It does not appear BV Canyon is contributing contamination to LA Canyon greater than the contamination already present in the canyon sediment.

The sediment data in BV Canyon indicate several metals are elevated above background levels, similar to the surface soil data. Lead and zinc are elevated, which is consistent with the surface soil data. Zinc levels are consistent with levels detected along the fence line of MDA B. Several metals (antimony, cobalt, and selenium) had analytical results with detection limits greater than the sediment background. No definitive trends were found in the sediment data with depth or with distance downstream. Uranium and silver were also detected above background levels.

No organic chemicals were detected in the sediments.

B-5.3 General Discussion of Subsurface Tuff

Three subsurface campaigns were conducted at MDA B: 1966, 1983, and 1998. In 1966 and 1983, vertical boreholes were drilled outside the disposal area. The 1983 results indicated tritium contamination at depth. The 1998 angled boreholes (45-52 degrees from vertical) were drilled in order to assess potential releases from the disposal trenches. The data from the 1998 subsurface investigation indicate most COPCs are present at background levels (LANL 1998, 59730) beneath the trenches. The COPCs are consistent with the historical information on the types of wastes disposed in the trench areas. Lead was detected above background at several depths in Location ID 21-10557 (at the west end of the disposal site), with concentrations decreasing with depth. Lead was also detected in one sample from Location ID 21-10551, but was not detected in any other borehole, including Location ID 21-10556, which is just to the south of Location ID 21-10557. Tritium was detected in the seven angled boreholes and exhibited a decreasing concentration trend (to near background values) with depth in all boreholes except Location ID 21-10554, where its concentration increased slightly over the length of the boring. Location

ID 21-10554 is located beneath what is believed to be the chemical disposal trench. Tritium has been released from the waste to the subsurface tuffs.

Plutonium-239 was detected in Location ID 21-10554 at concentrations above background levels (LANL 1998, 59730), with concentrations decreasing with depth. It was not detected below 50 ft in the borehole. All but one plutonium-239 sample in Location ID 21-10555, to the east of Location ID 21-10554, were below background. A minor release of plutonium may be evident based on data from Location ID 21-10554.

Americium-241, strontium-90, and isotopic uranium were detected in isolated intervals at concentrations above background (LANL 1998, 59730) in Location IDs 21-10554, 21-10566, and 21-10557.

The pore-gas samples from the boreholes detected VOCs in the subsurface. The analytes are detected at trace levels across the site (in the ppbv range). No elevated VOC levels were detected in the pore-gas samples from Location ID 21-10554 beneath the likely location of the chemical pit. There is an increase in the number of VOCs detected at the far western end of the site, although there are no trends with depth. The pore-gas data do not indicate the presence of a vapor plume beneath MDA B. The 2001 surface-flux data, although not directly comparable to the pore-gas results because of the different units of measurement, also do not indicate the presence of a plume or single VOC source. The detected VOCs were all within the boundaries of MDA B.

B-5.4 Summary of MDA B Contaminants

The data indicate low concentrations of radionuclides, inorganic chemicals, and organic chemicals in the surface soils, sediments, and subsurface tuff.

Surface releases appear to be related to past disposal operations that distributed primarily isotopic plutonium to the surface soils along the perimeter of MDA B. The cessation of disposal operations and the placement of an interim cover of soil and asphalt have prevented additional releases. Current soil contamination is available for additional migration by wind entrainment and surface water runoff.

A subsurface release to tuff of low concentrations of contaminants is limited in extent. The primary subsurface contaminants are tritium and VOCs in the vapor phase. Additionally, some limited aqueous phase releases occurred based on borehole detections of iso-plutonium. However, the vertical extent of these releases is very limited indicating this release mechanism is minor and not active and the distribution of contamination was the result of disposal practices, which may have included liquid disposal. The sources of contamination appear to be limited to past disposal practices at the trenches and diffusion of vapor-phase tritium and VOCs in low concentration from the disposed waste.

B-6.0 REFERENCES

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

Copies of the master reference set are maintained at the NMED Hazardous Waste Bureau; the U.S. Department of Energy–Los Alamos Site Office; the U.S. Environmental Protection Agency, Region 6; and the Directorate. The set was developed to ensure that the administrative authority has all material needed to review this document, and it is updated with every document submitted to the administrative authority. Documents previously submitted to the administrative authority are not included.

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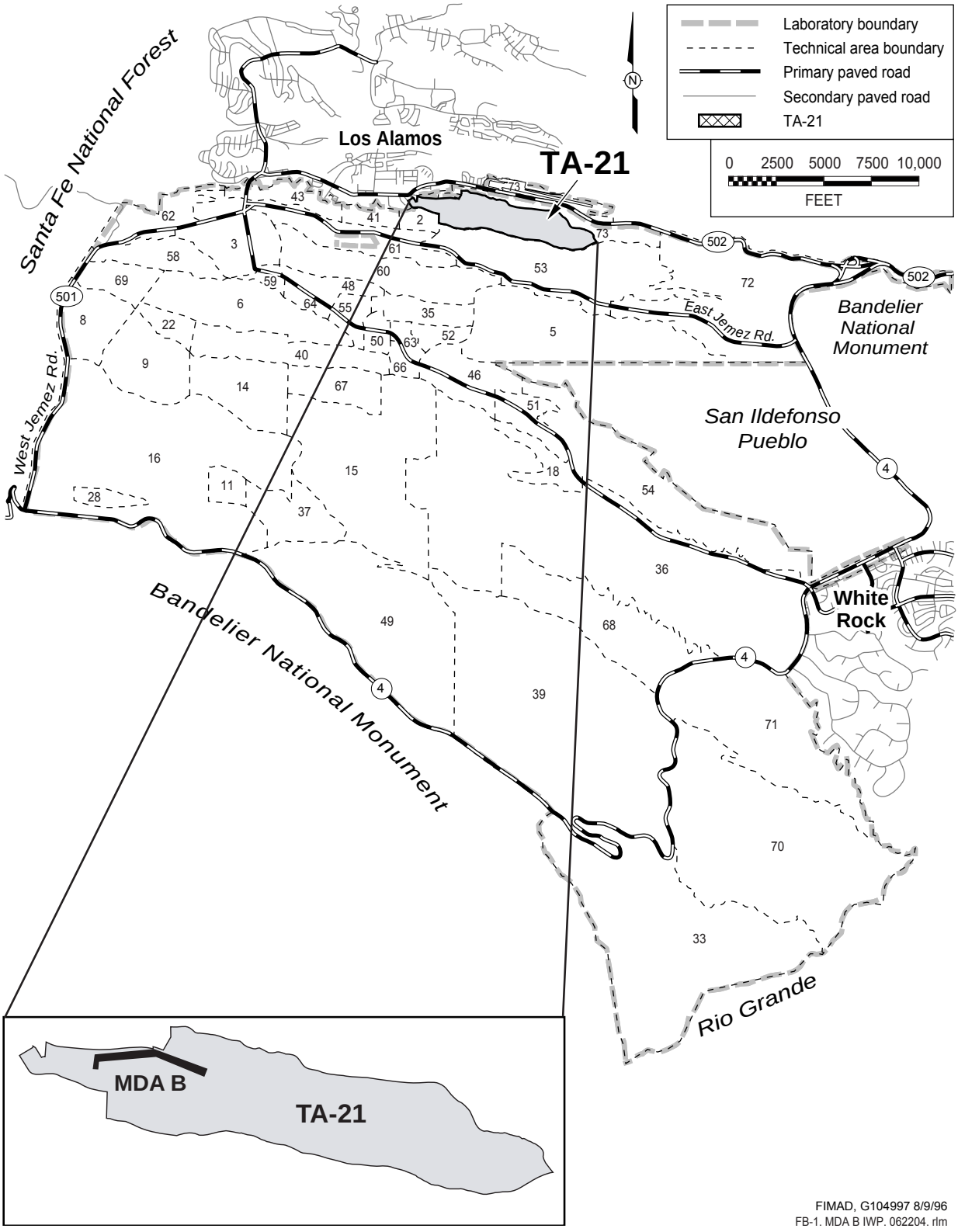


Figure B-1. Location of TA-21 and MDA B with respect to Laboratory technical areas and surrounding landholdings

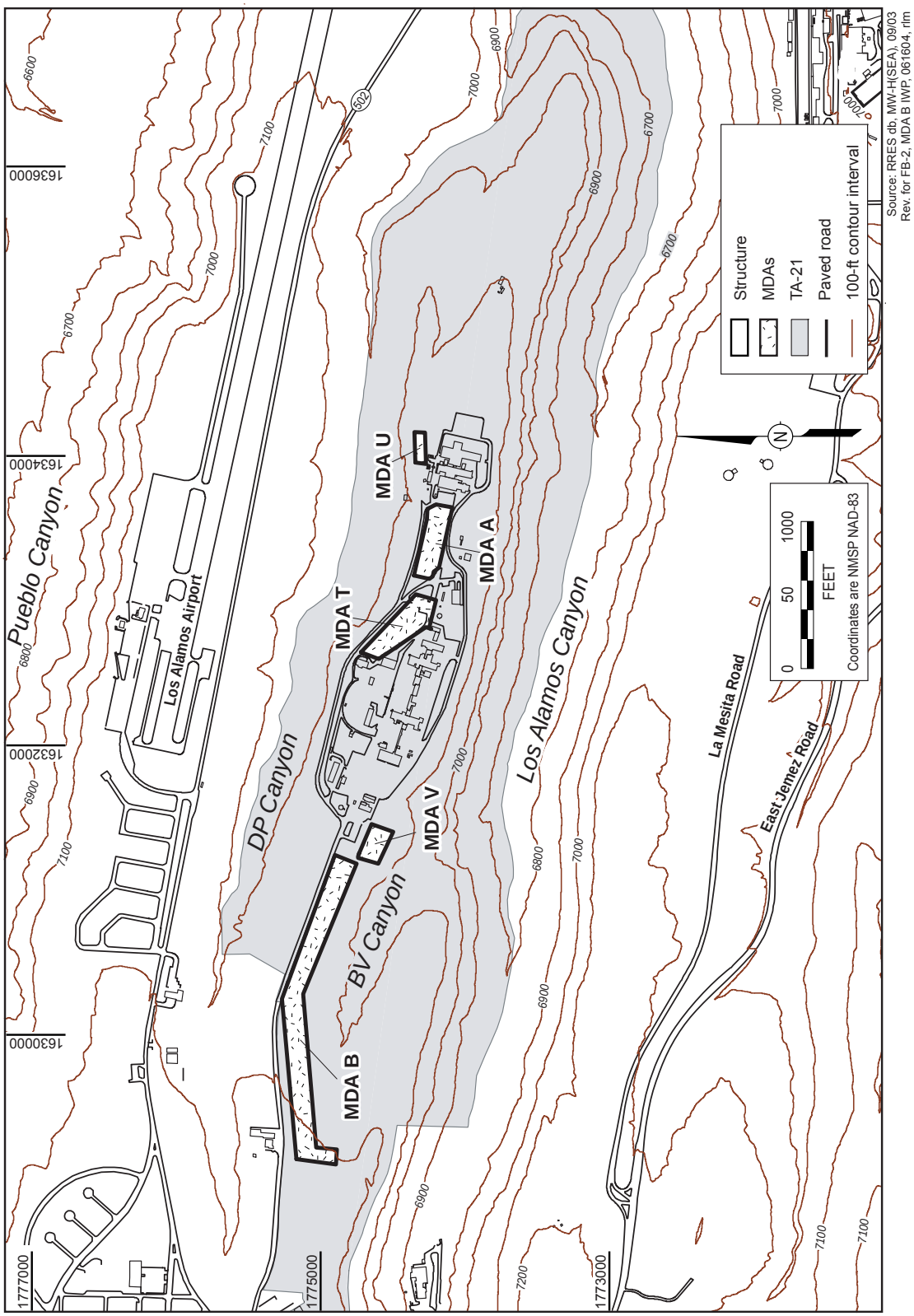


Figure B-2. Material disposal areas in TA-21

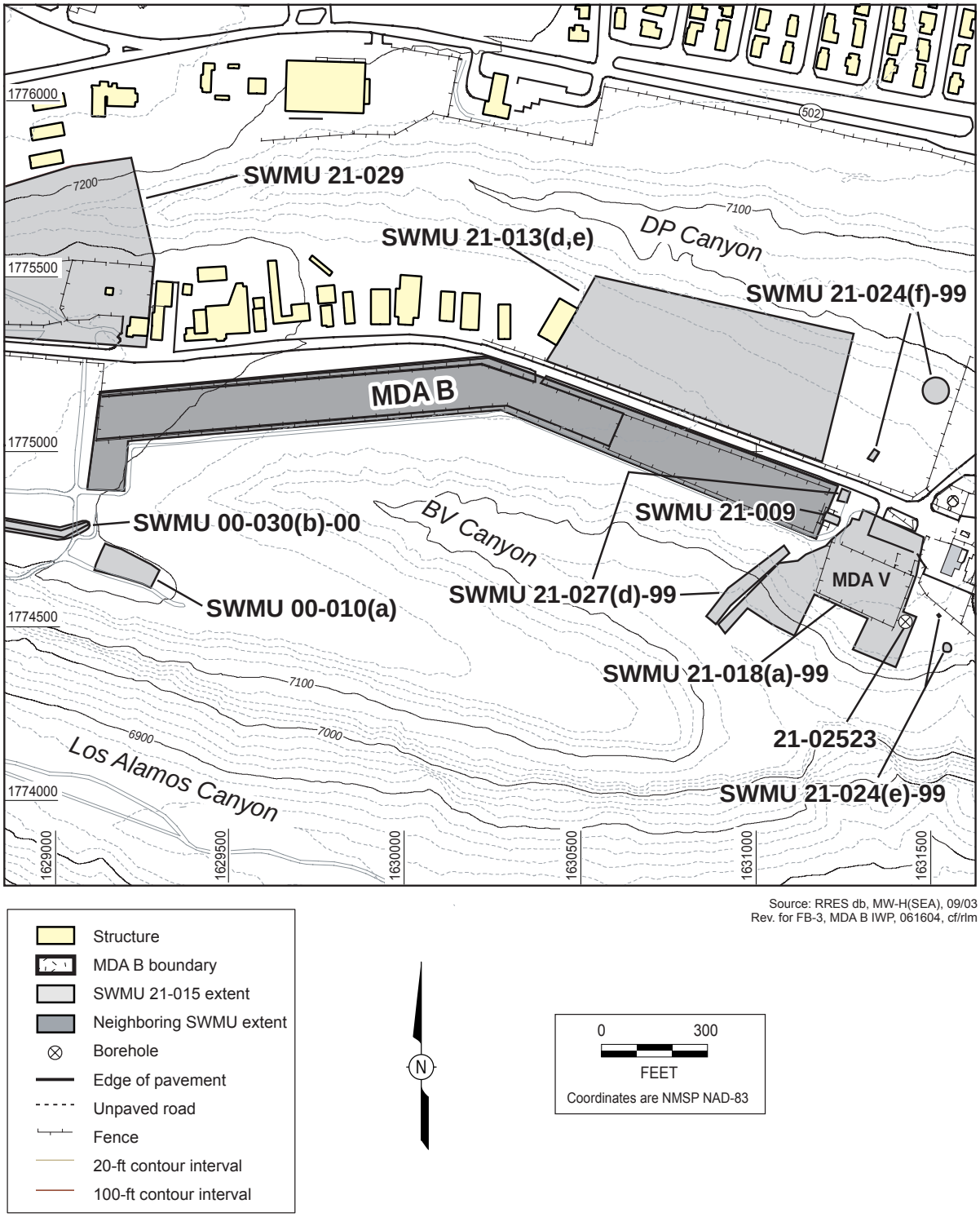


Figure B-3. SWMUs near MDA B

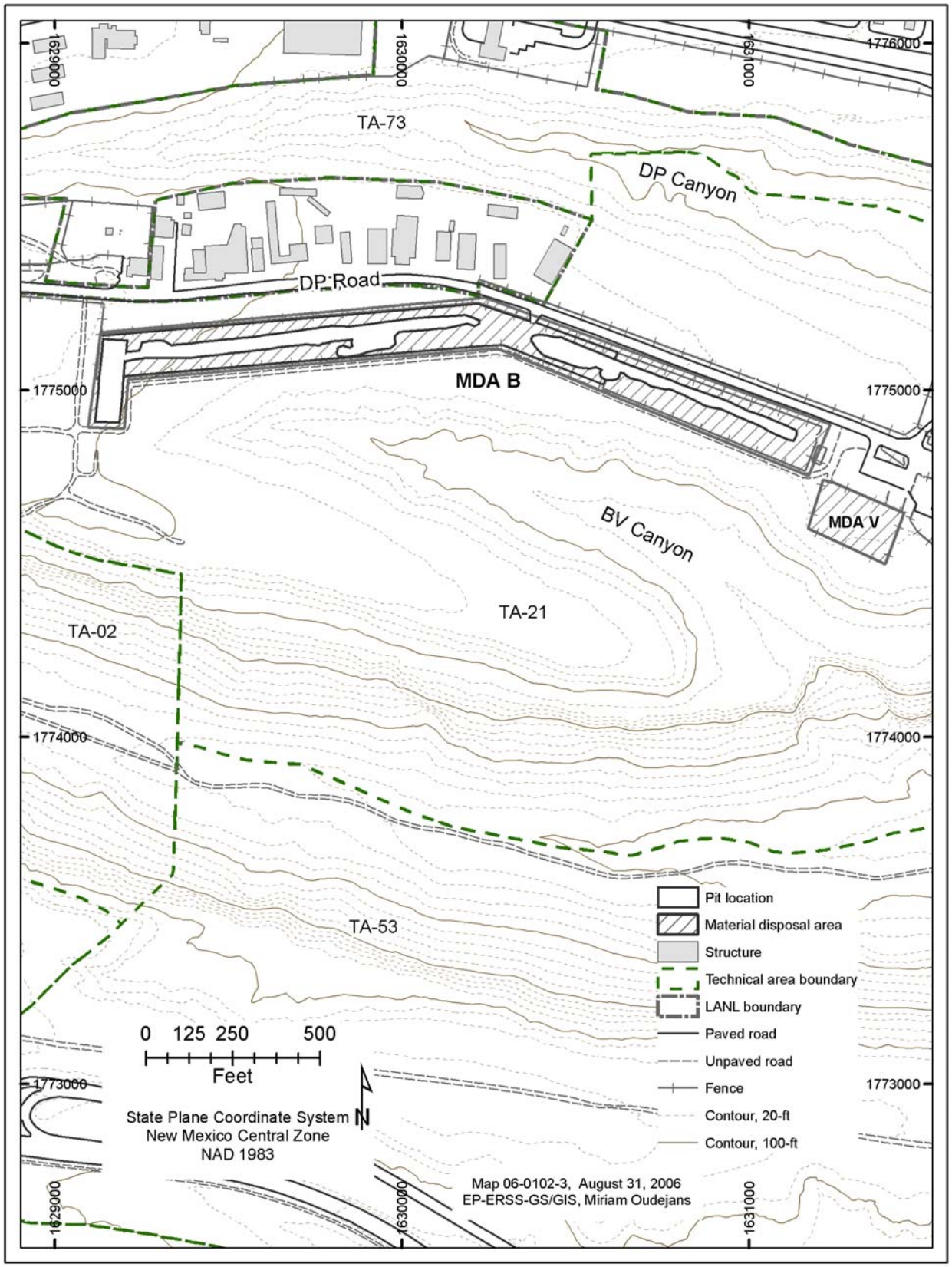
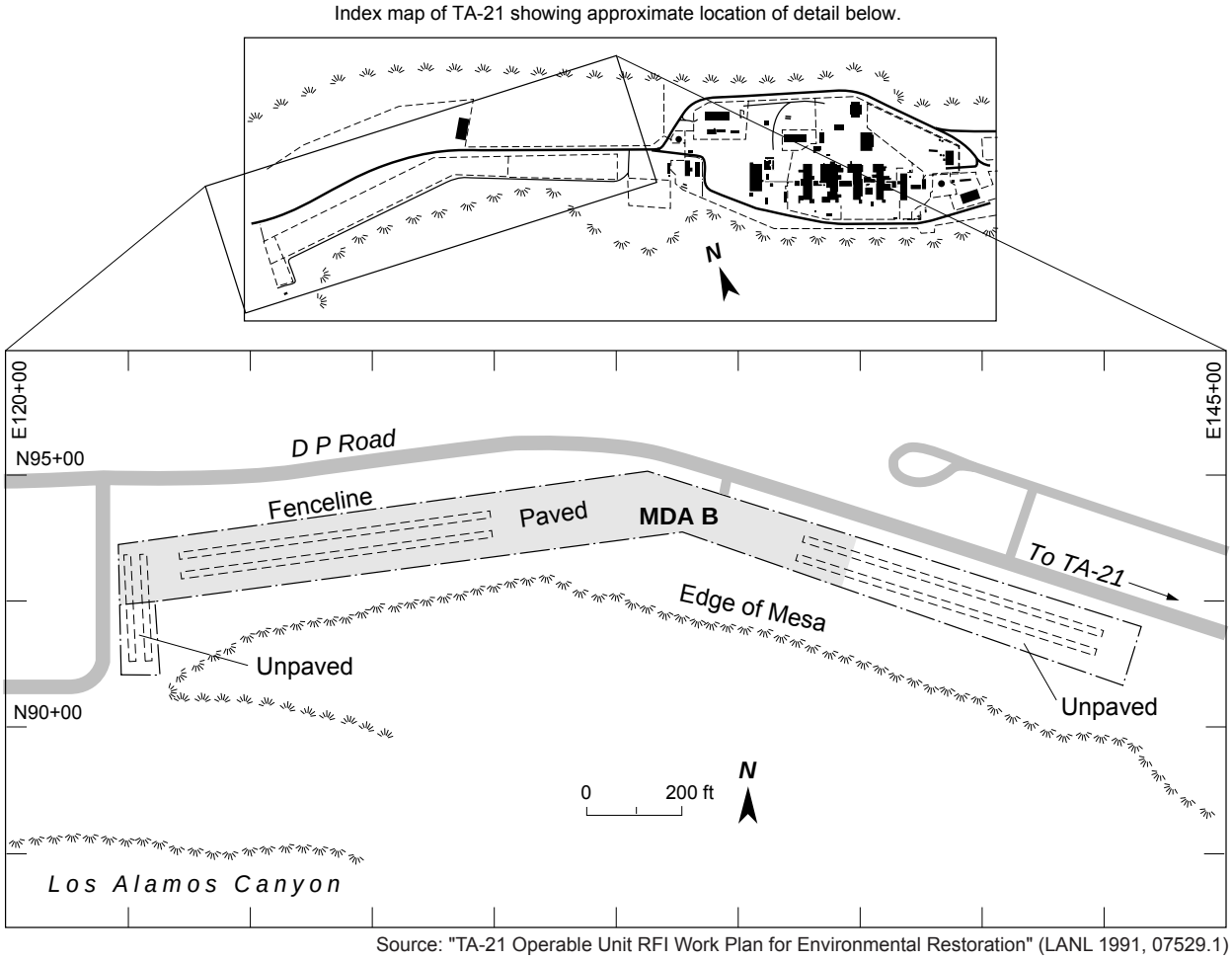


Figure B-4. MDA B detail and approximate disposal trench locations



Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529.1)

Figure B-5. Base map of MDA B showing estimated locations (from Rodgers 1977, 05707) of disposal trenches (as presented in the TA-21 RFI Work Plan)

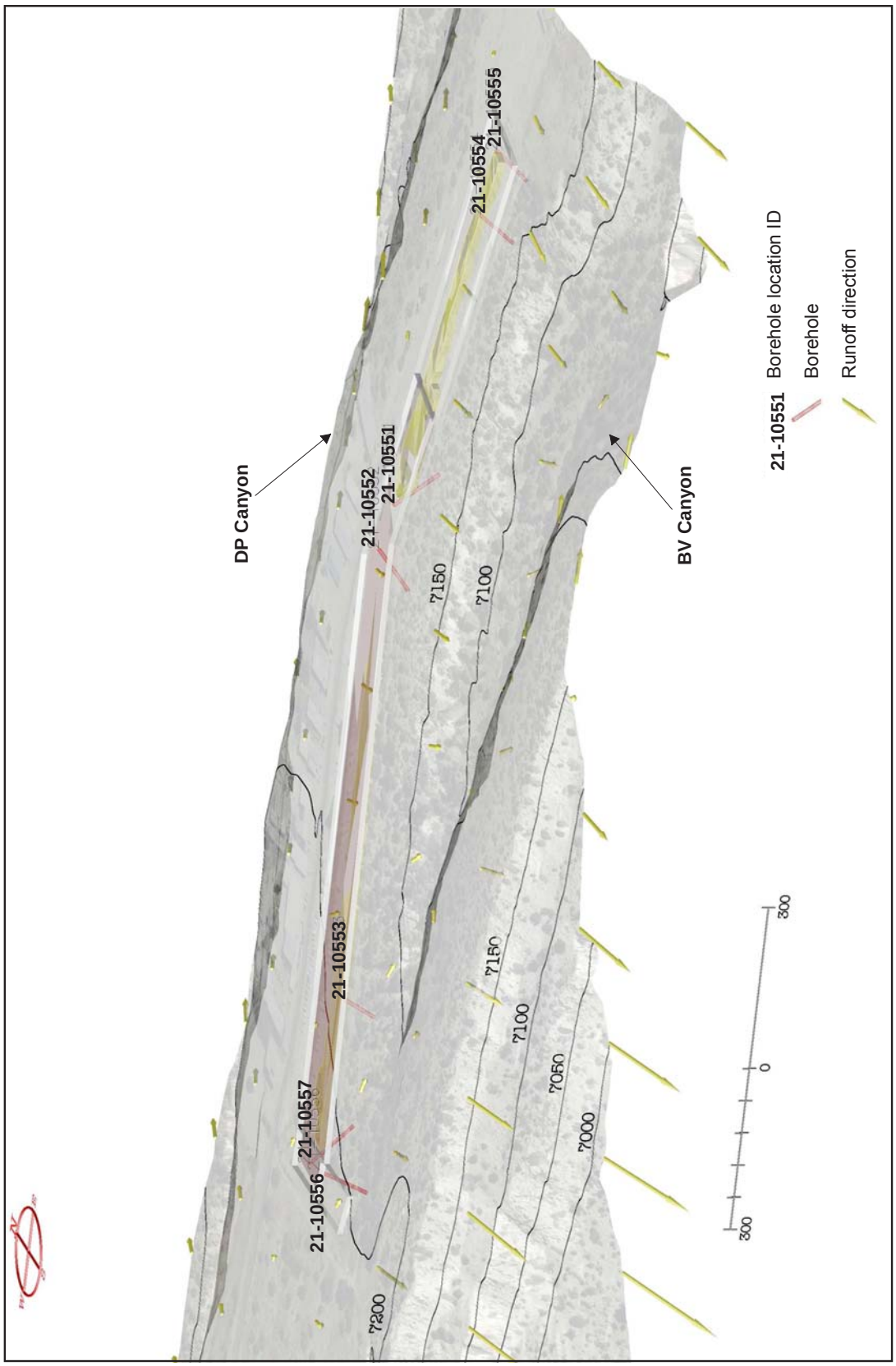


Figure B-6. Surface water runoff at MDA B

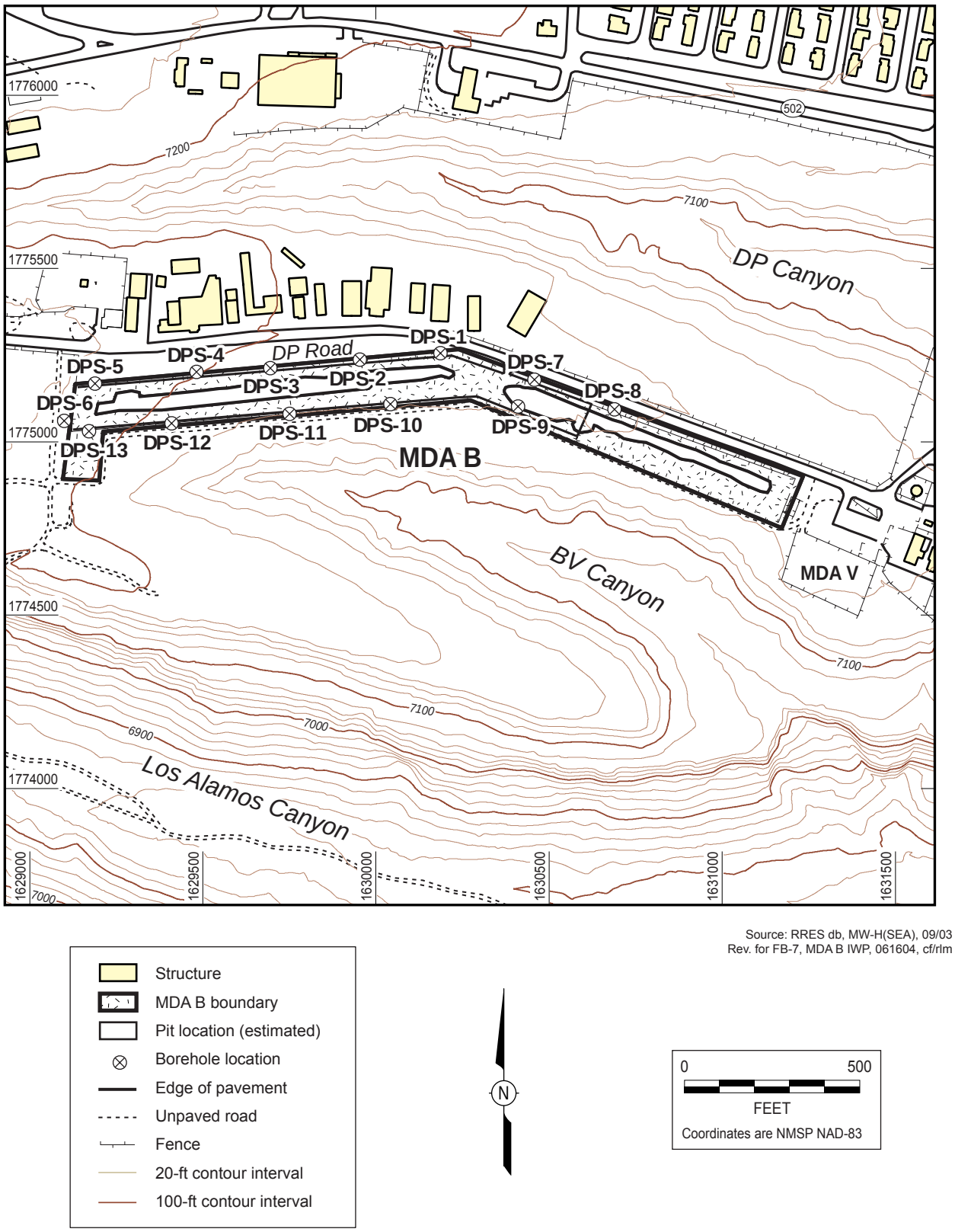
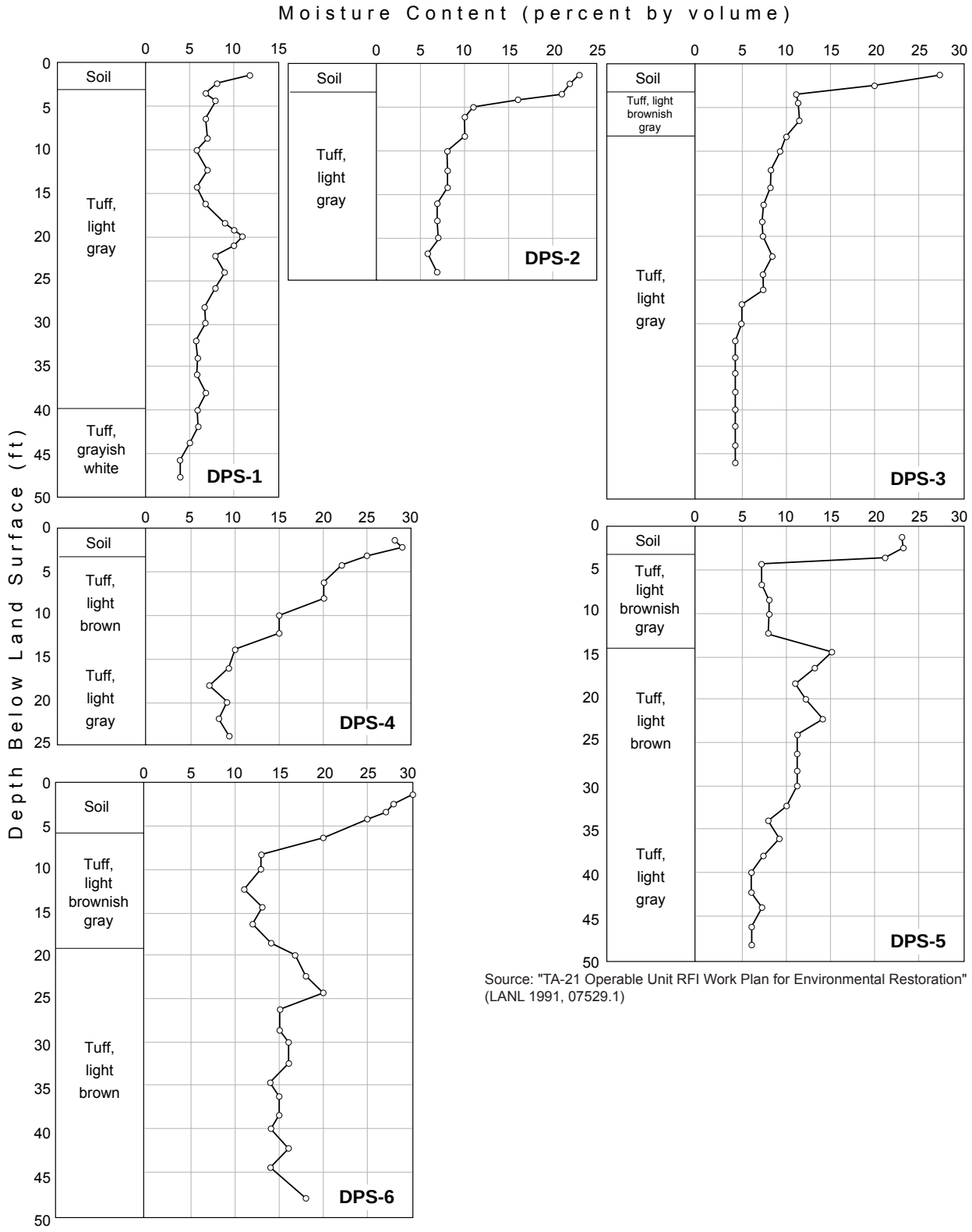
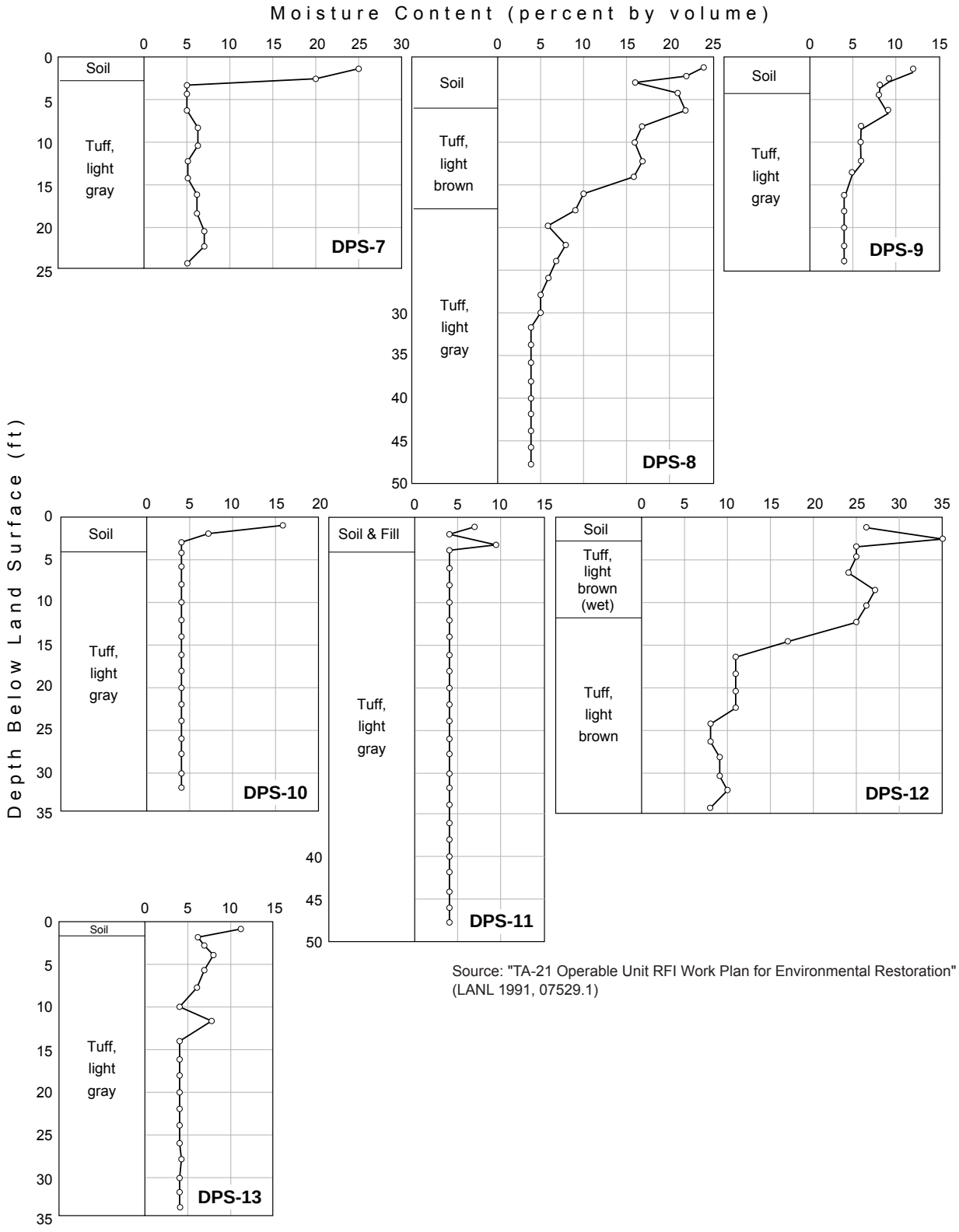


Figure B-7. Locations of boreholes drilled at MDA B in 1966



Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529.1)

Figure B-8. Moisture content in test holes DPS-1 through DPS-6 drilled in 1966 (as presented in the TA-21 RFI Work Plan)



Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529.1)

Figure B-9. Moisture content in test holes DPS-7 through DPS-13 drilled in 1966 (as presented in the TA-21 RFI Work Plan)

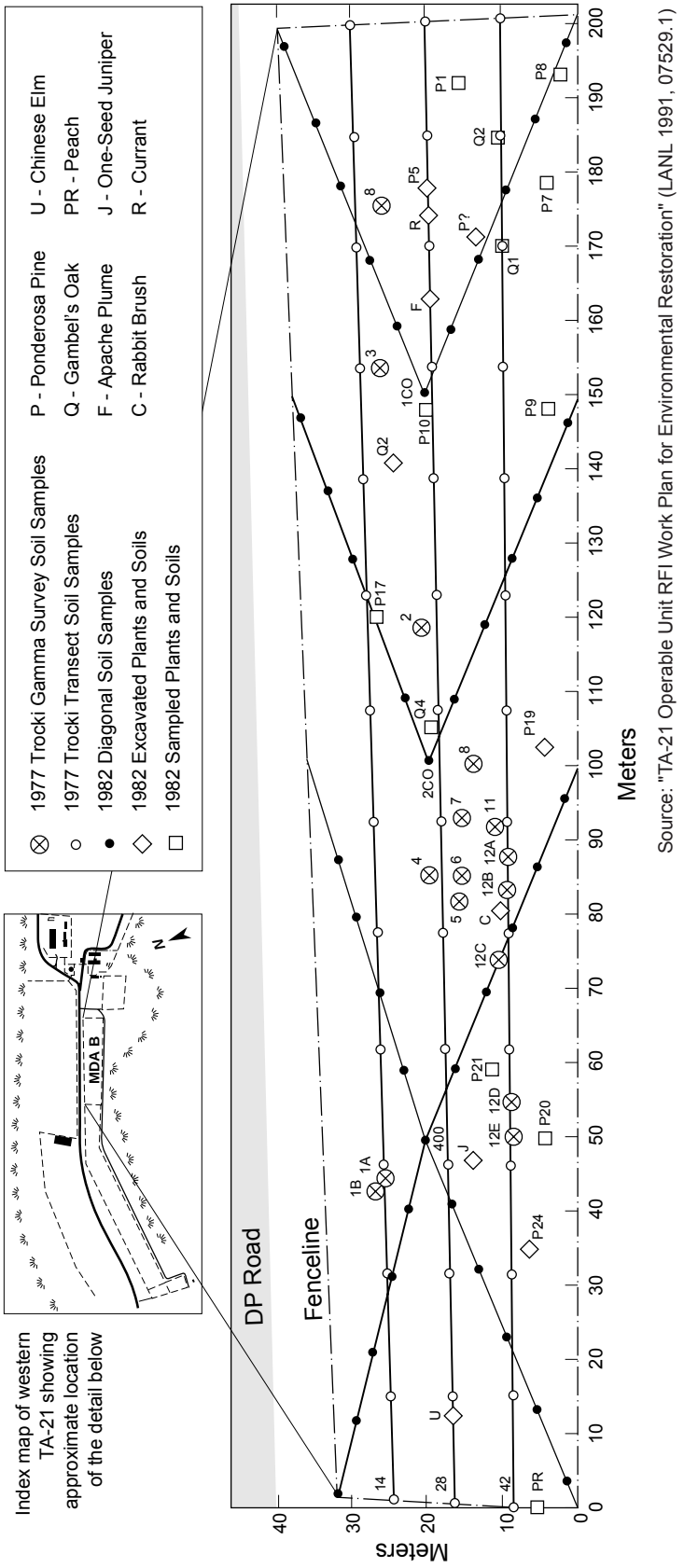


Figure B-10. MDA B 1976-1977 and 1982 soil sampling, and 1982 soil and vegetation sampling sites (as presented in the TA-21 RFI Work Plan)

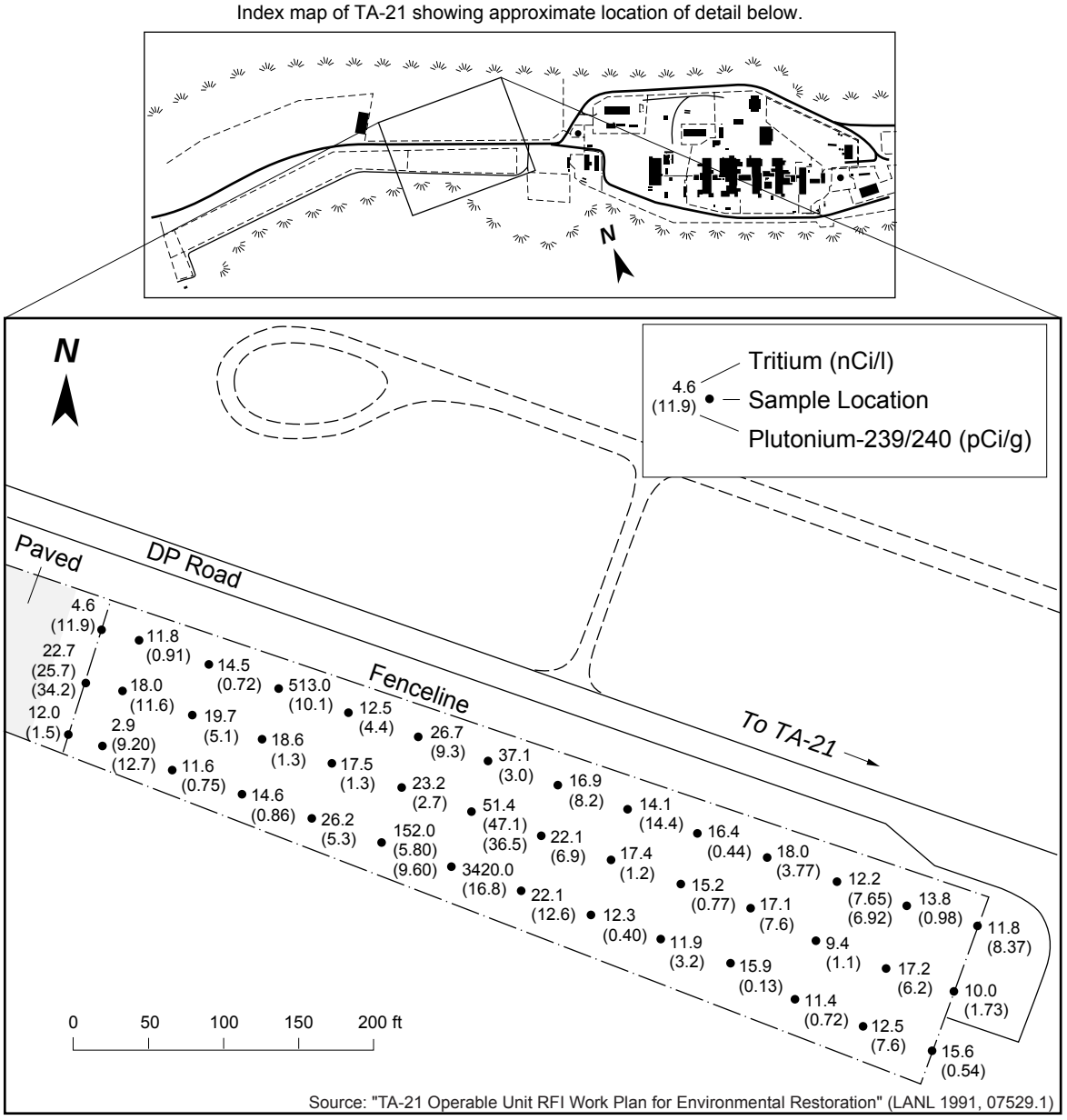


Figure B-11. Surface soil sampling locations for 1977 Trocki transect samples at MDA B (as presented in the TA-21 RFI Work Plan)

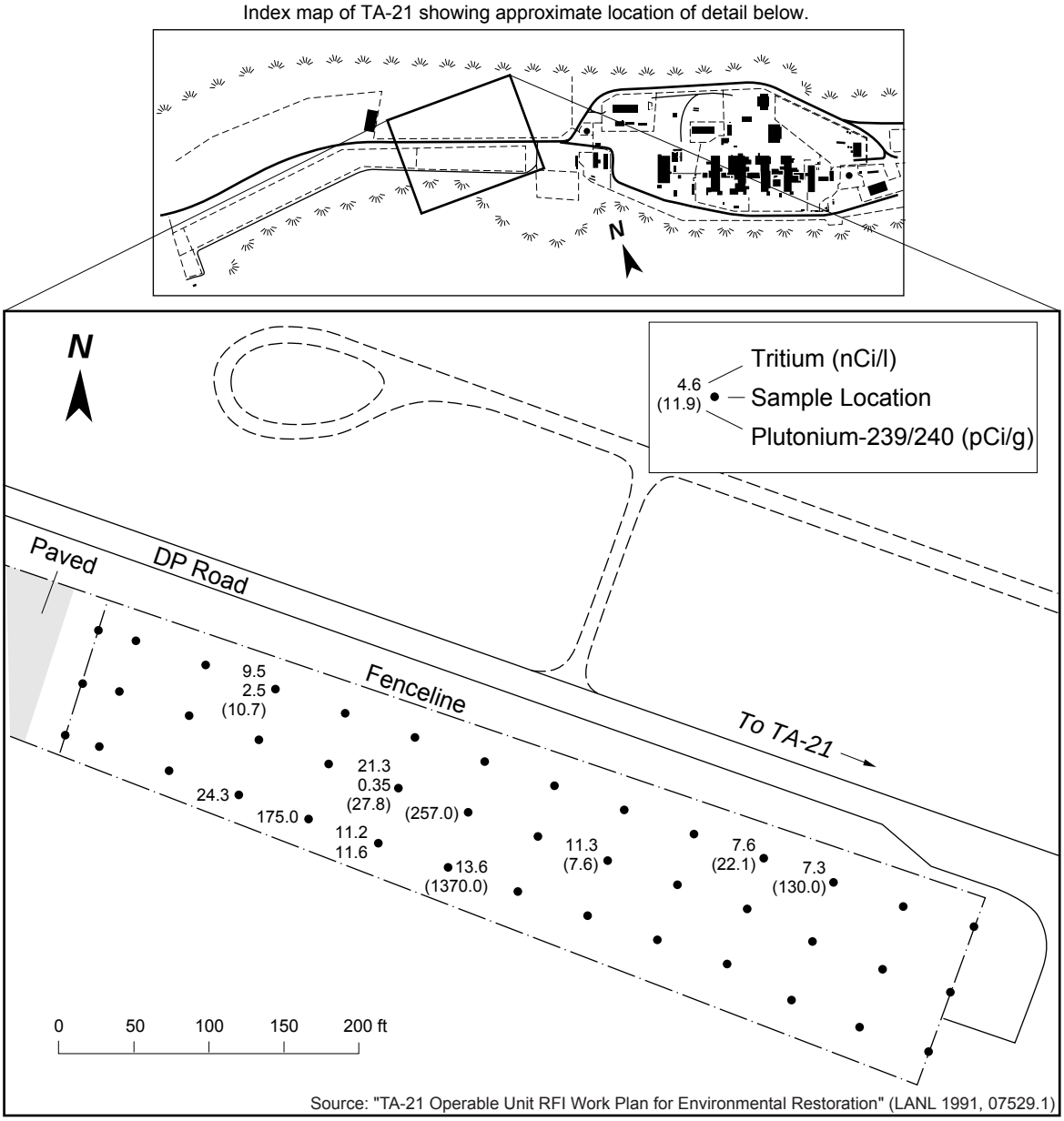
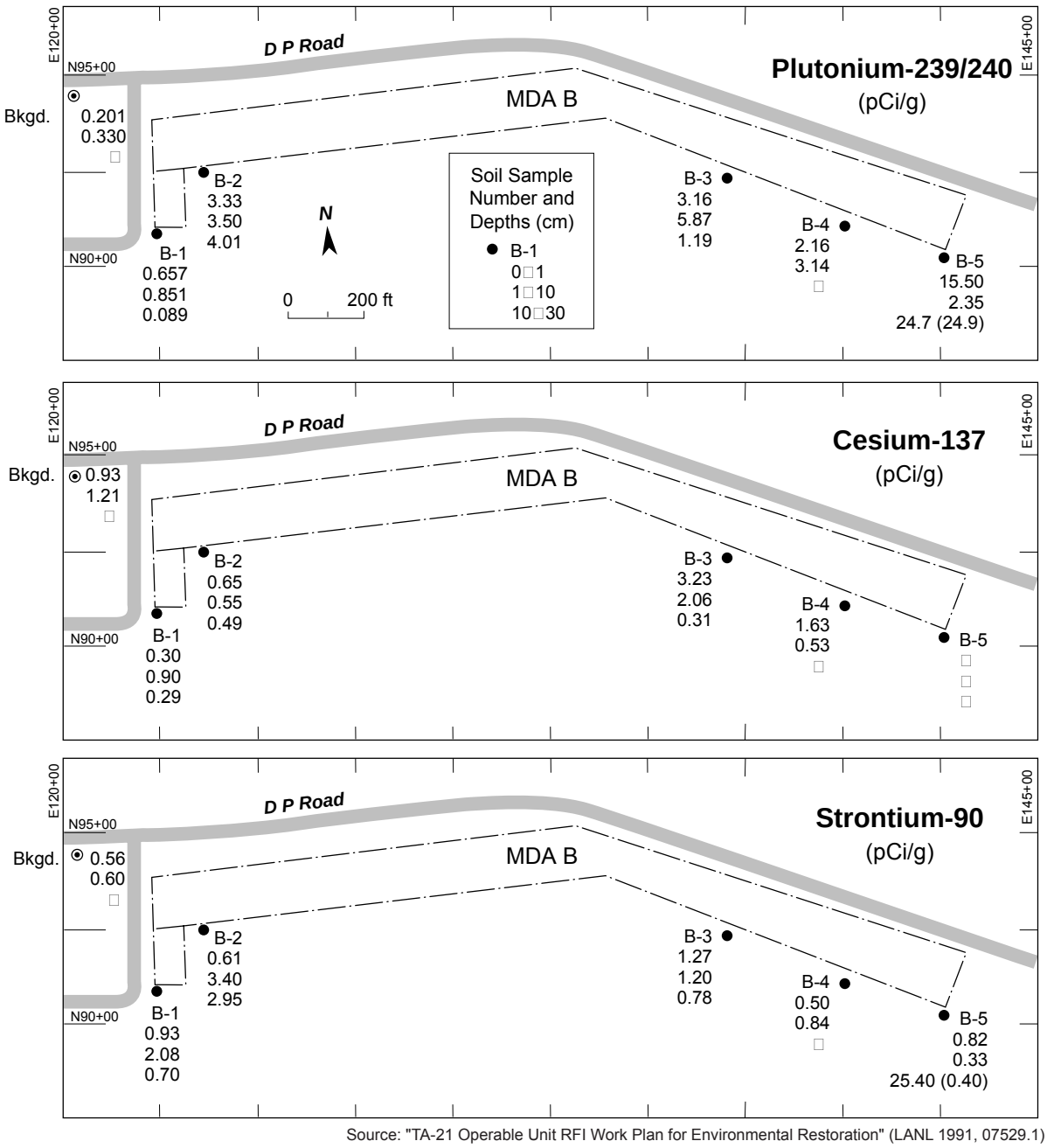
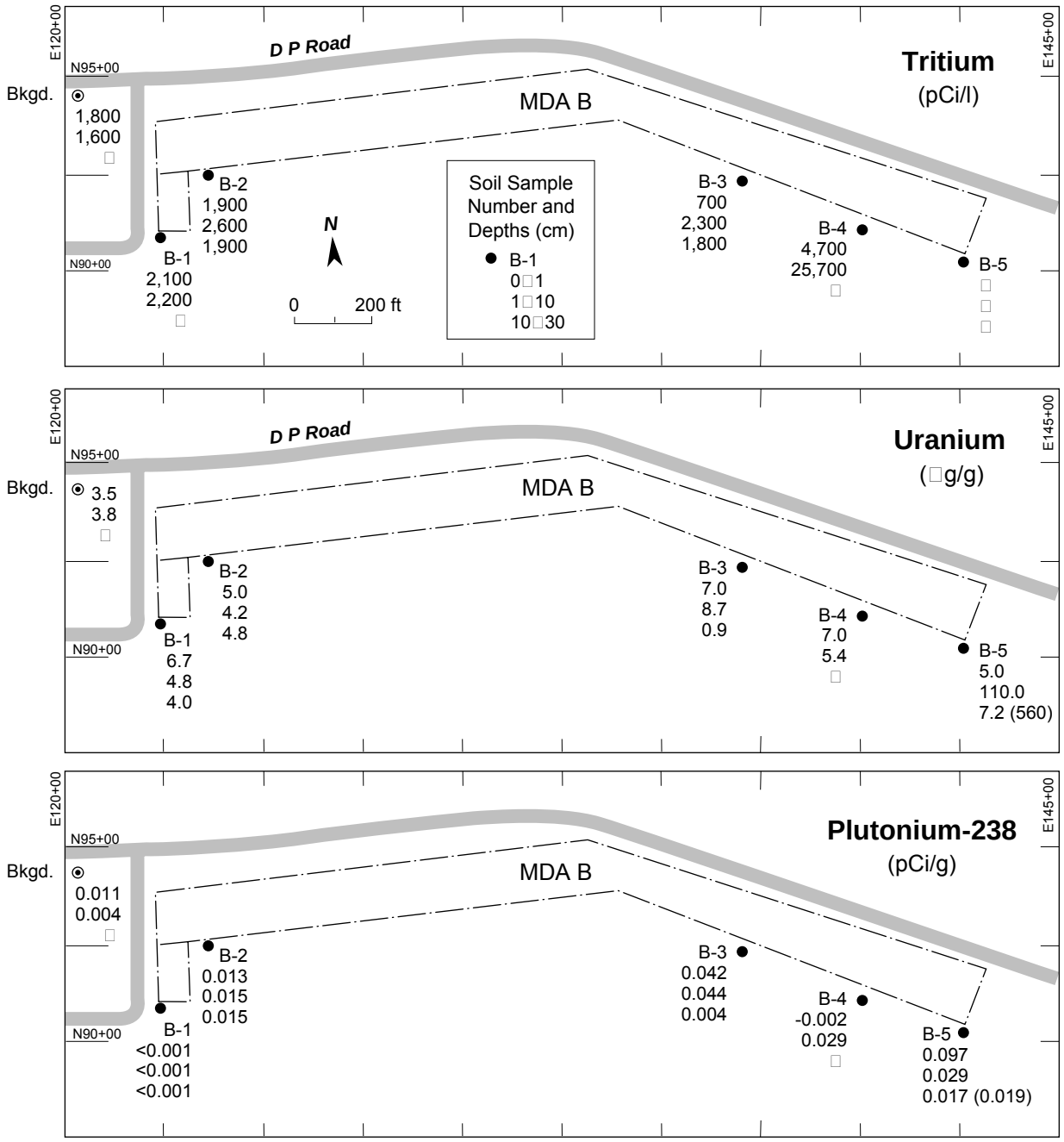


Figure B-12. Surface soil sampling locations from 1977 Trocki gamma survey at MDA B (as presented in the TA-21 RFI Work Plan)



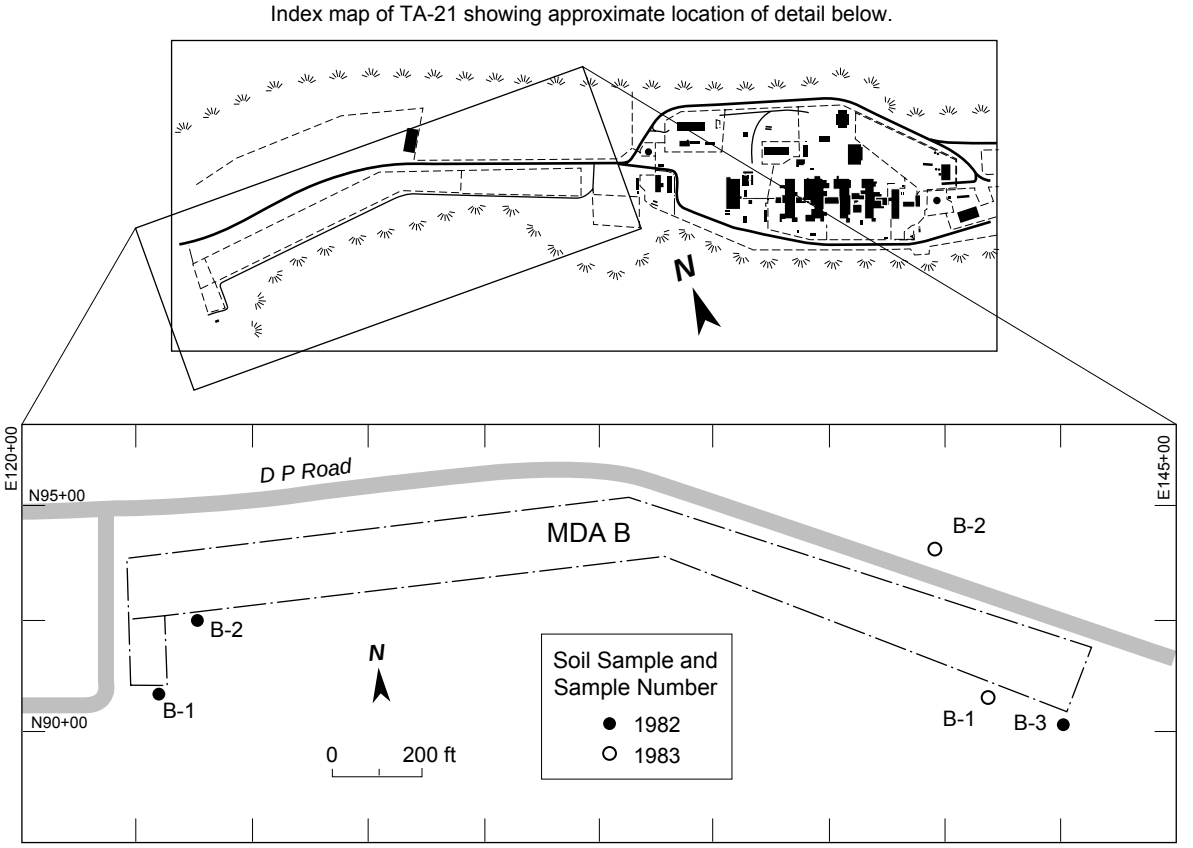
Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529.1)

Figure B-13. Concentrations of plutonium-239/240, cesium-137, and strontium-90 in soils sampled in MDA B in 1979 (as presented in the TA-21 RFI Work Plan)



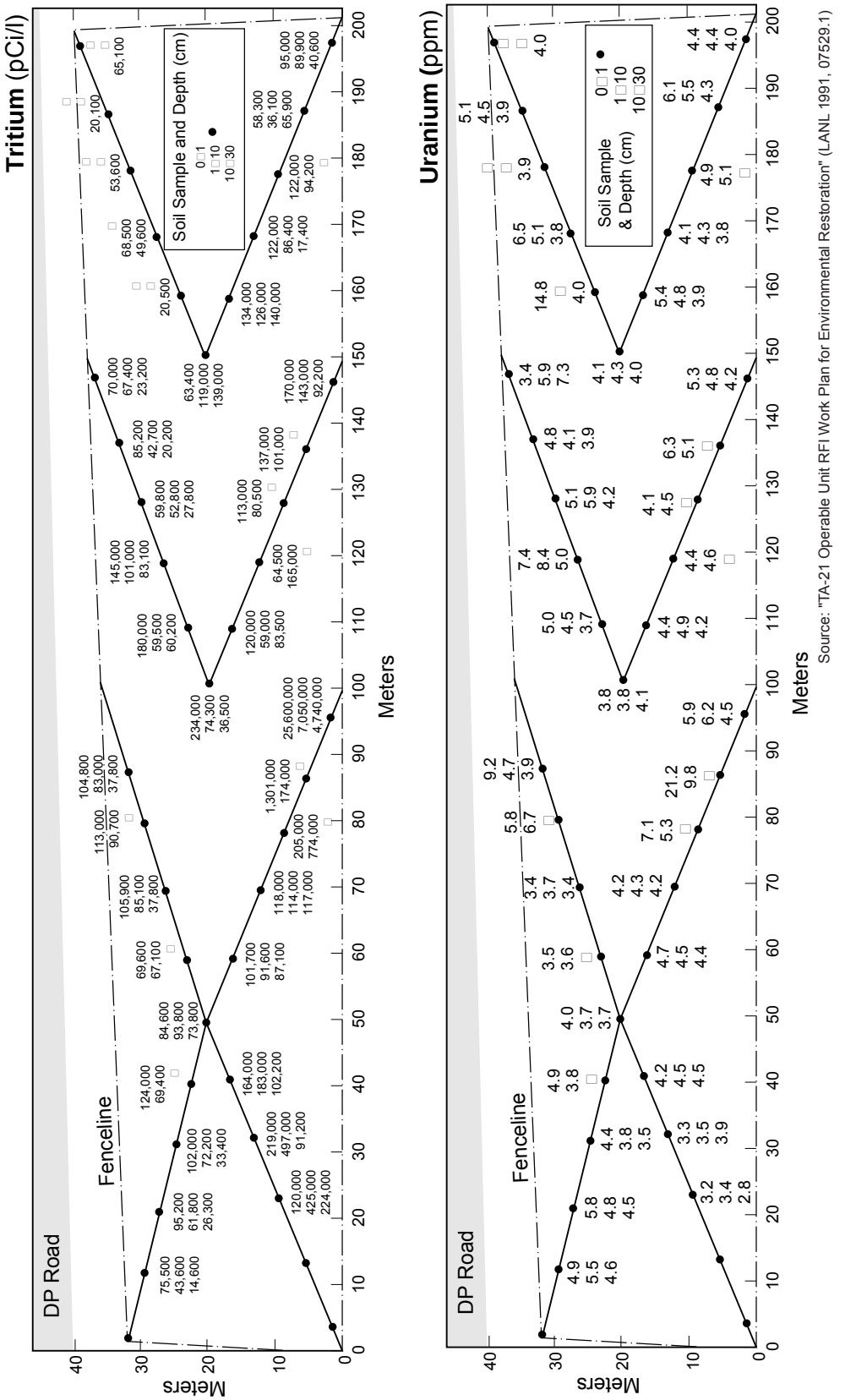
Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529.1)

Figure B-14. Concentrations of tritium, uranium, and plutonium-238 in soils sampled in MDA B in 1979 (as presented in the TA-21 RFI Work Plan)



Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529.1)

Figure B-15. Locations of 1982 perimeter soil samples and 1983 boreholes at MDA B (as presented in the TA-21 RFI Work Plan)



Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529.1)

Figure B-16. Tritium and total uranium concentrations in surface soils sampled in 1982 at MDA B before renovation (as presented in the TA-21 RFI Work Plan)

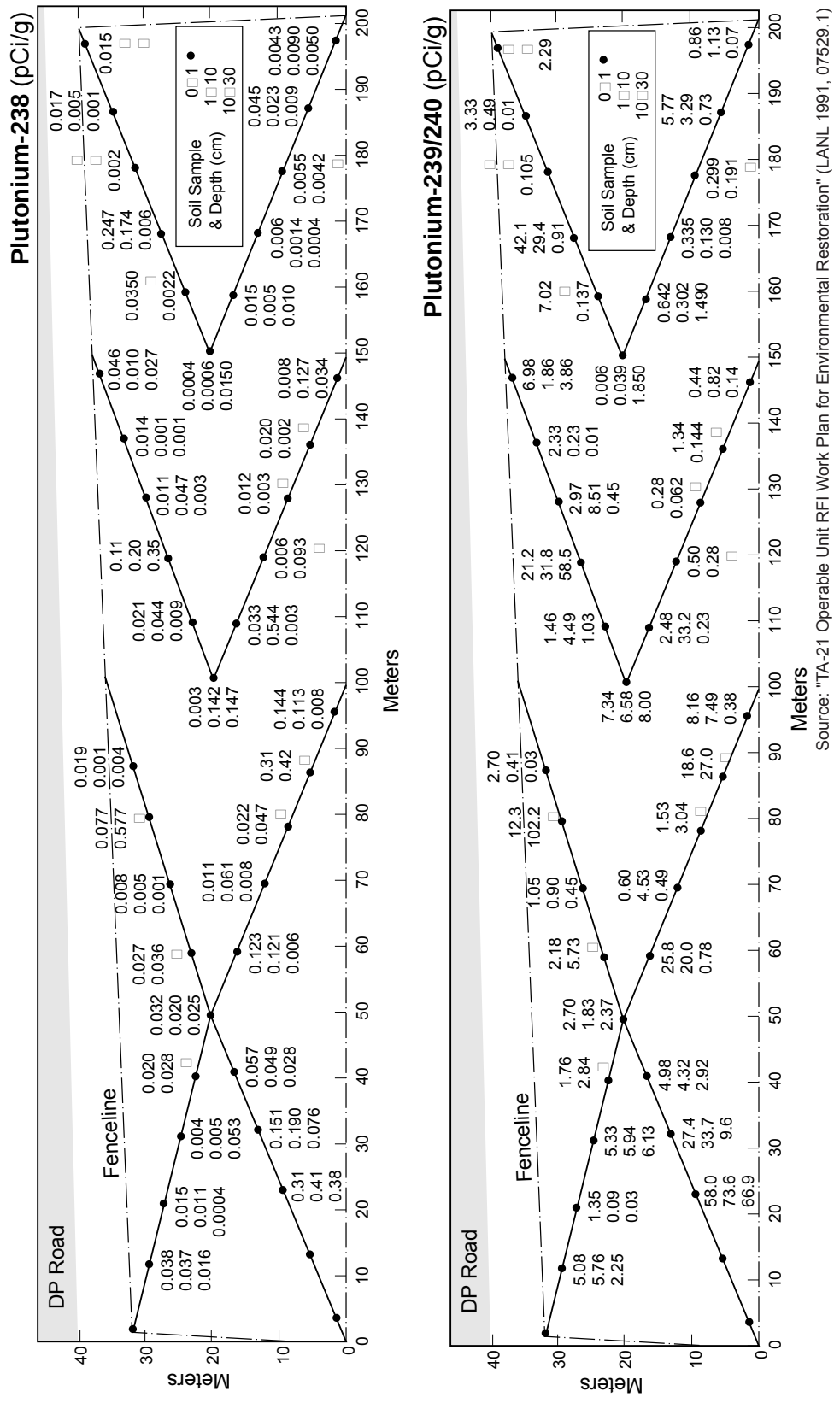
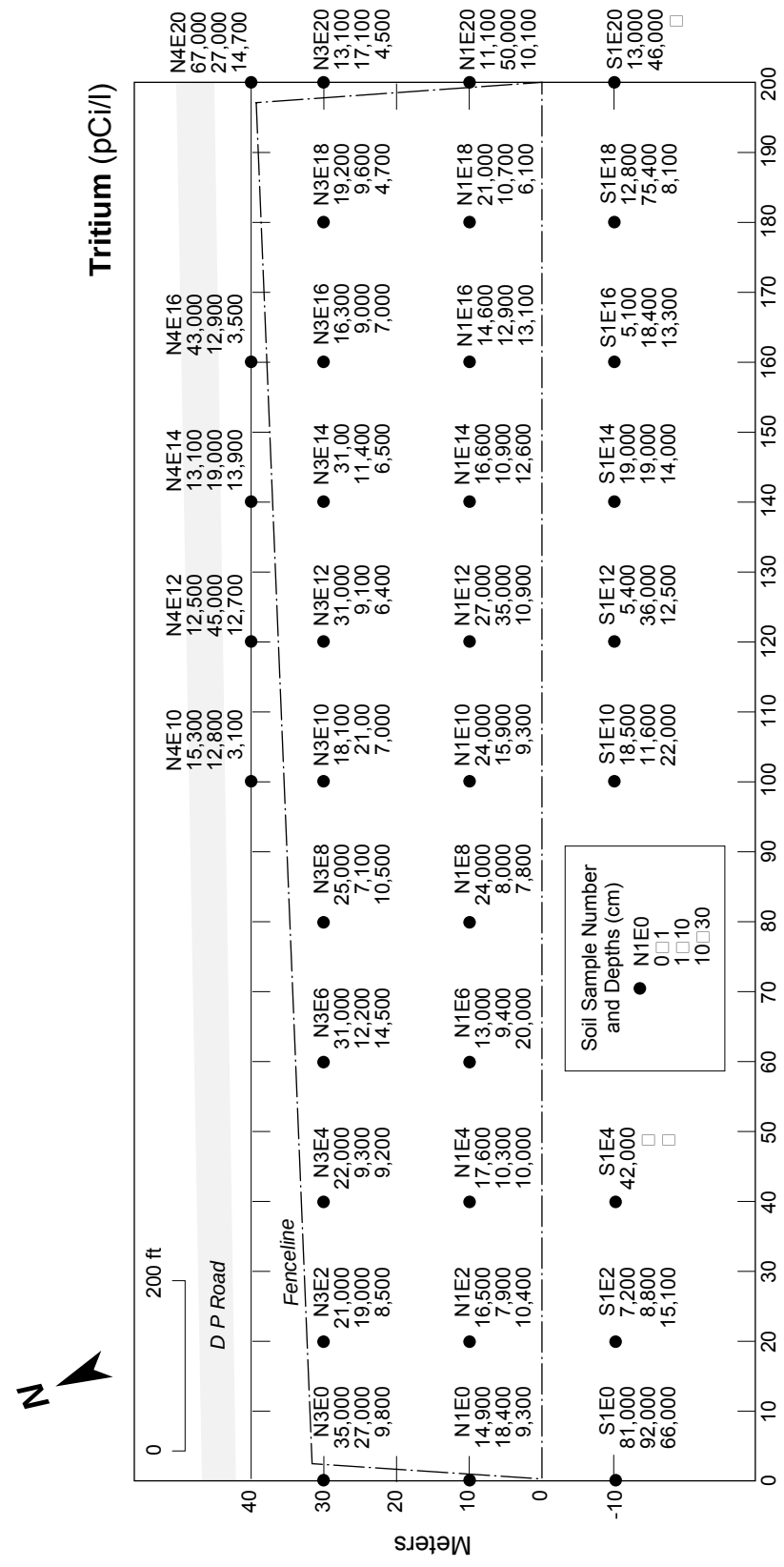
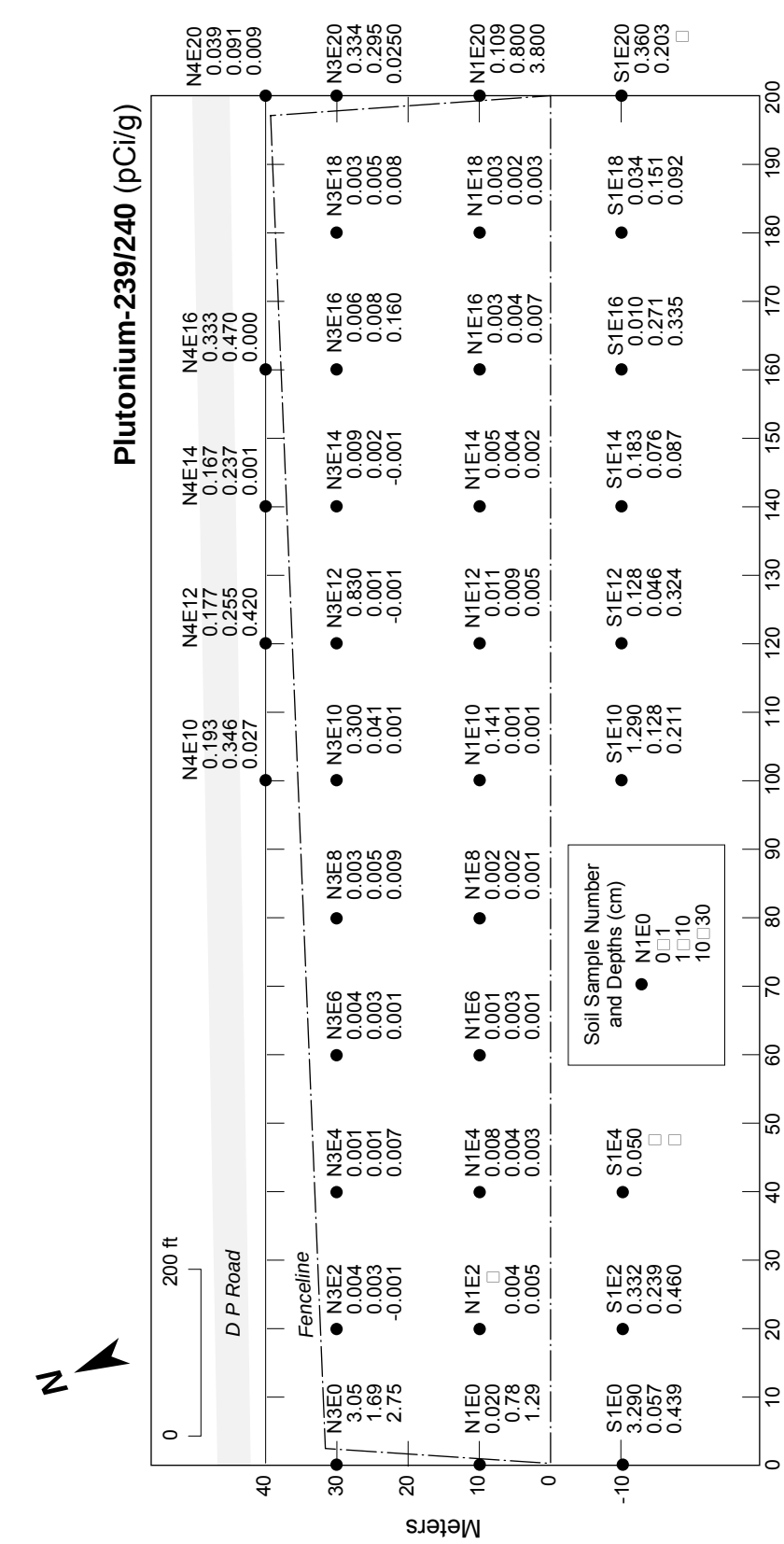


Figure B-17. Plutonium-238 and –239/240 concentrations in surface soils sampled in 1982 at MDA B before renovation (as presented in the TA-21 RFI Work Plan)



Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529.1)

Figure B-18. Tritium concentrations for MDA B surface soil samples (Mayfield 1985b) (as presented in the TA-21 RFI Work Plan)



Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529.1)

Figure B-19. Plutonium-239/240 concentrations for 1983 MDA B surface soil samples (as presented in the TA-21 RFI Work Plan)

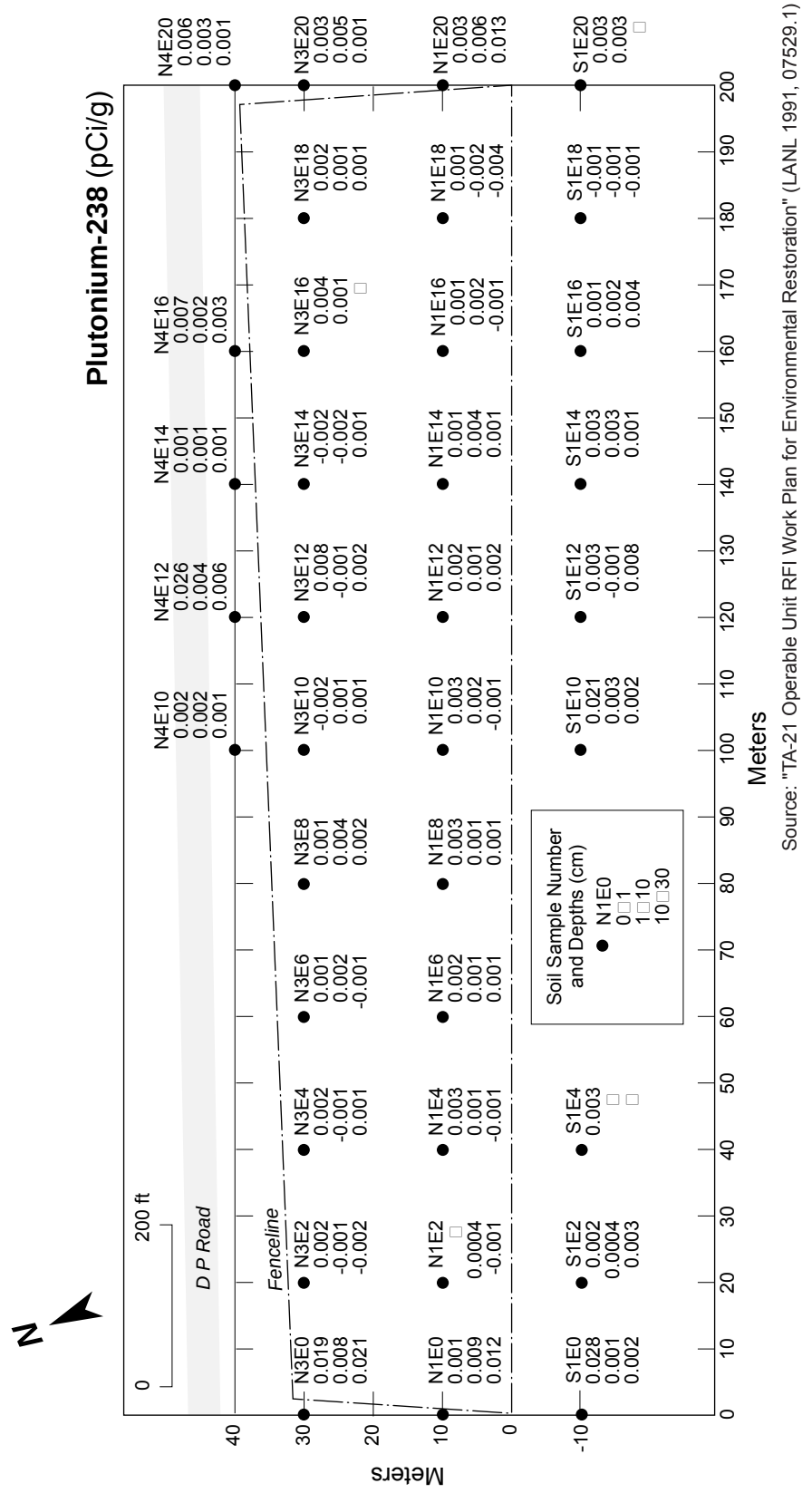


Figure B-20. Plutonium-238 concentrations for 1983 MDA B surface soil samples (as presented in the TA-21 RFI Work Plan)

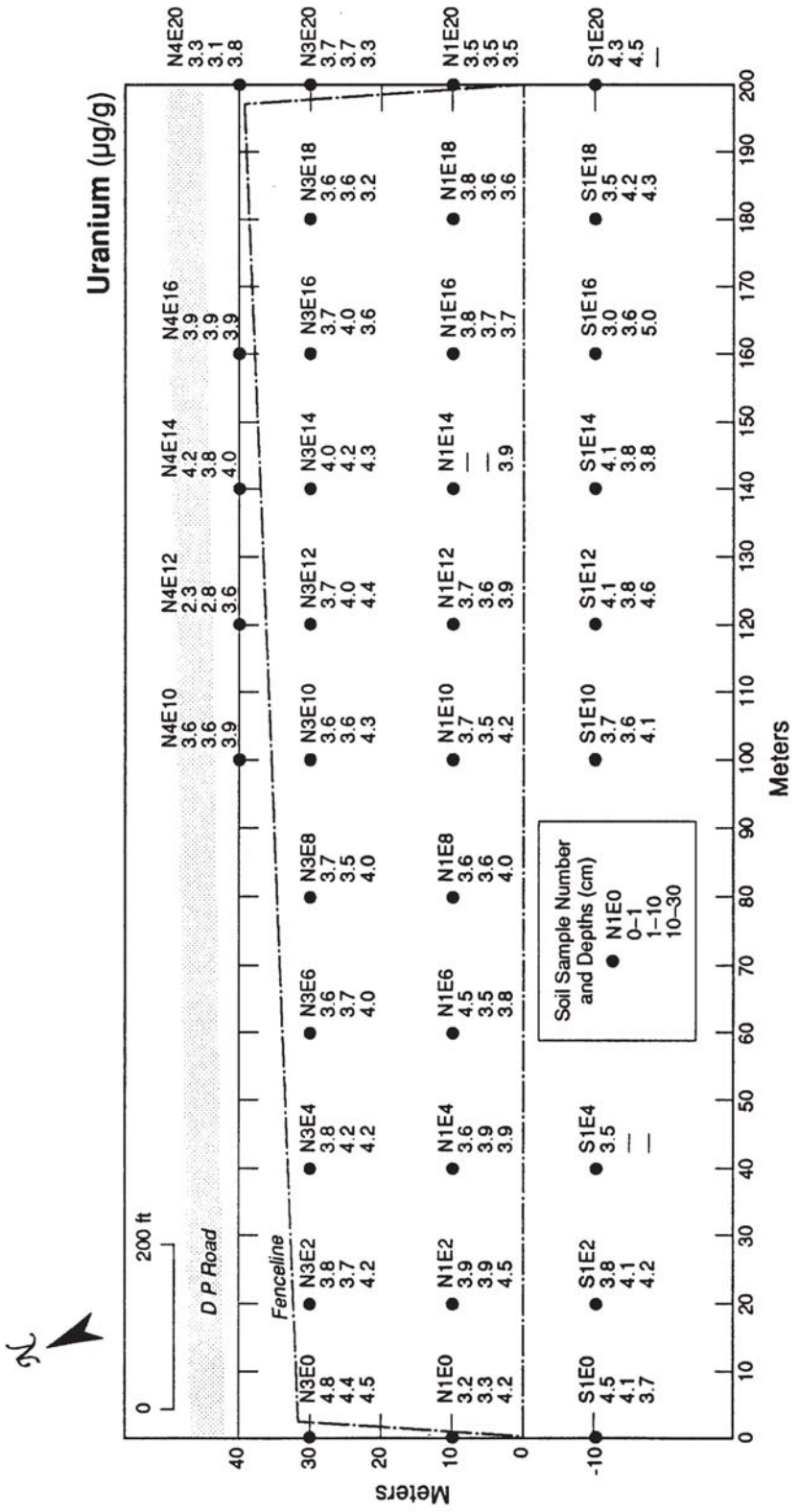


Figure B-21. Uranium concentrations for 1983 MDA B surface soil samples (as presented in the TA-21 RFI Work Plan)

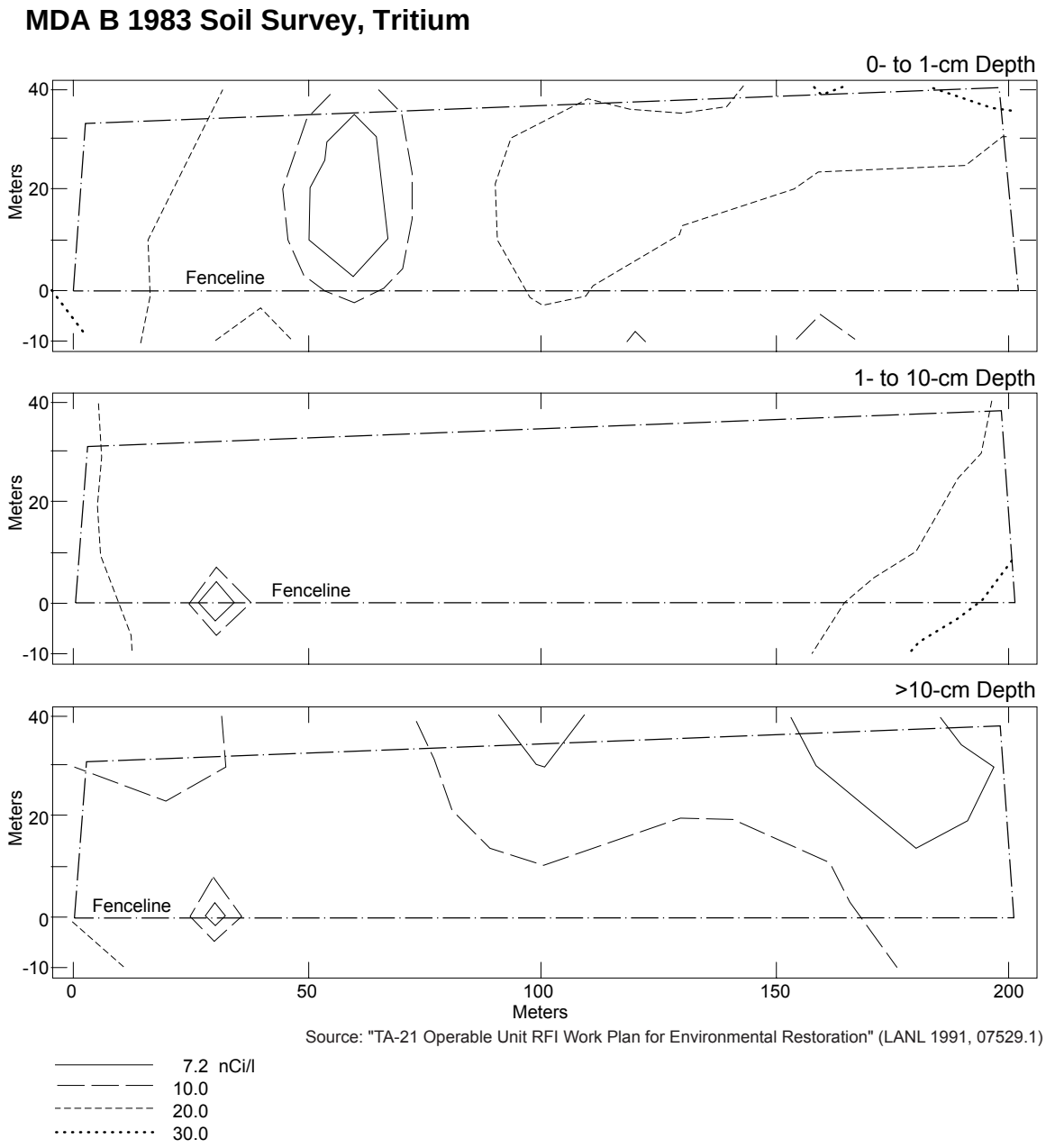


Figure B-22. Concentration contours for tritium from 1983 soil samples at MDA B (as presented in the TA-21 RFI Work Plan)

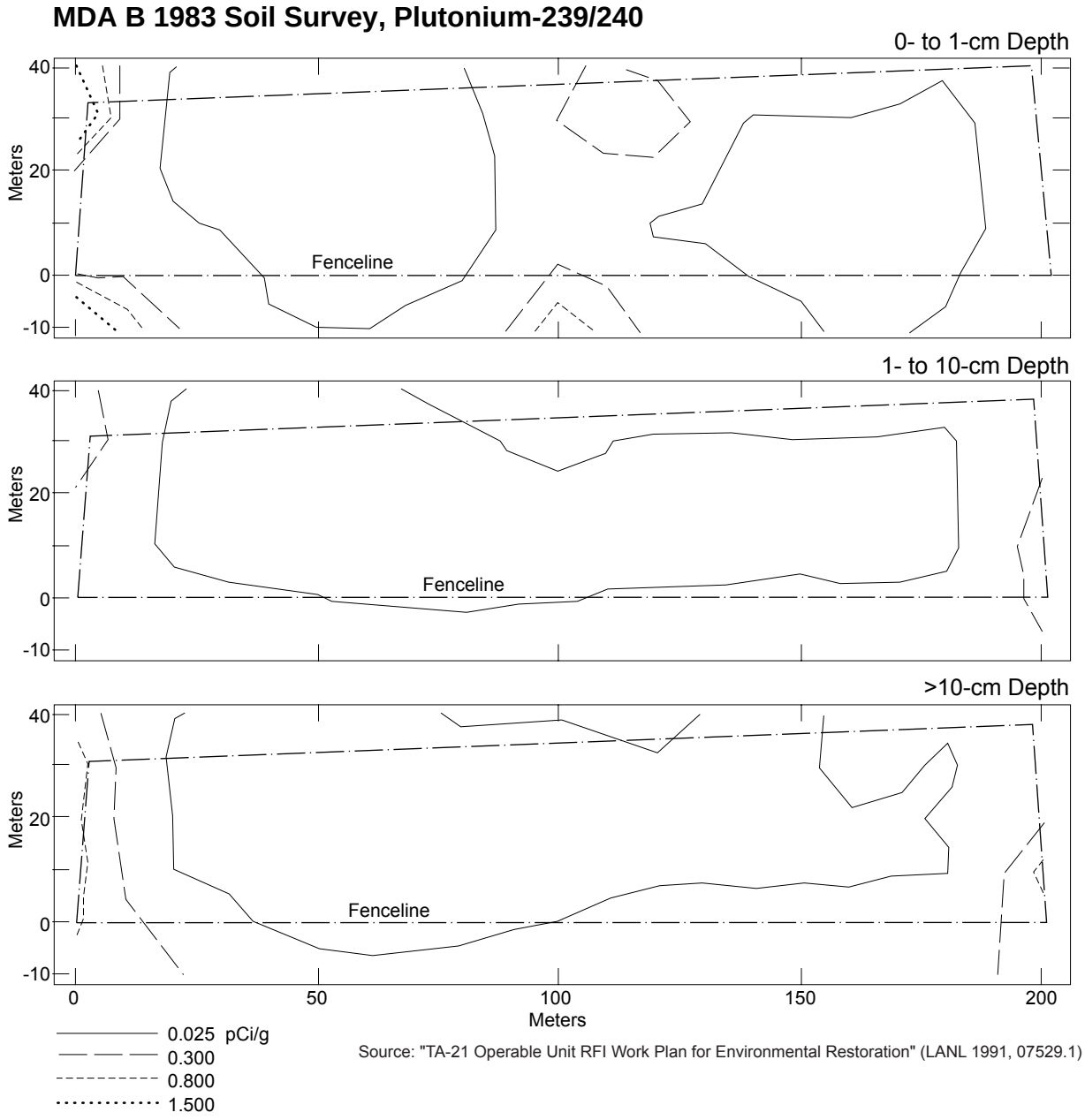


Figure B-23. Concentration contours for plutonium-239/240 from 1983 soil samples at MDA B (as presented in the TA-21 RFI Work Plan)

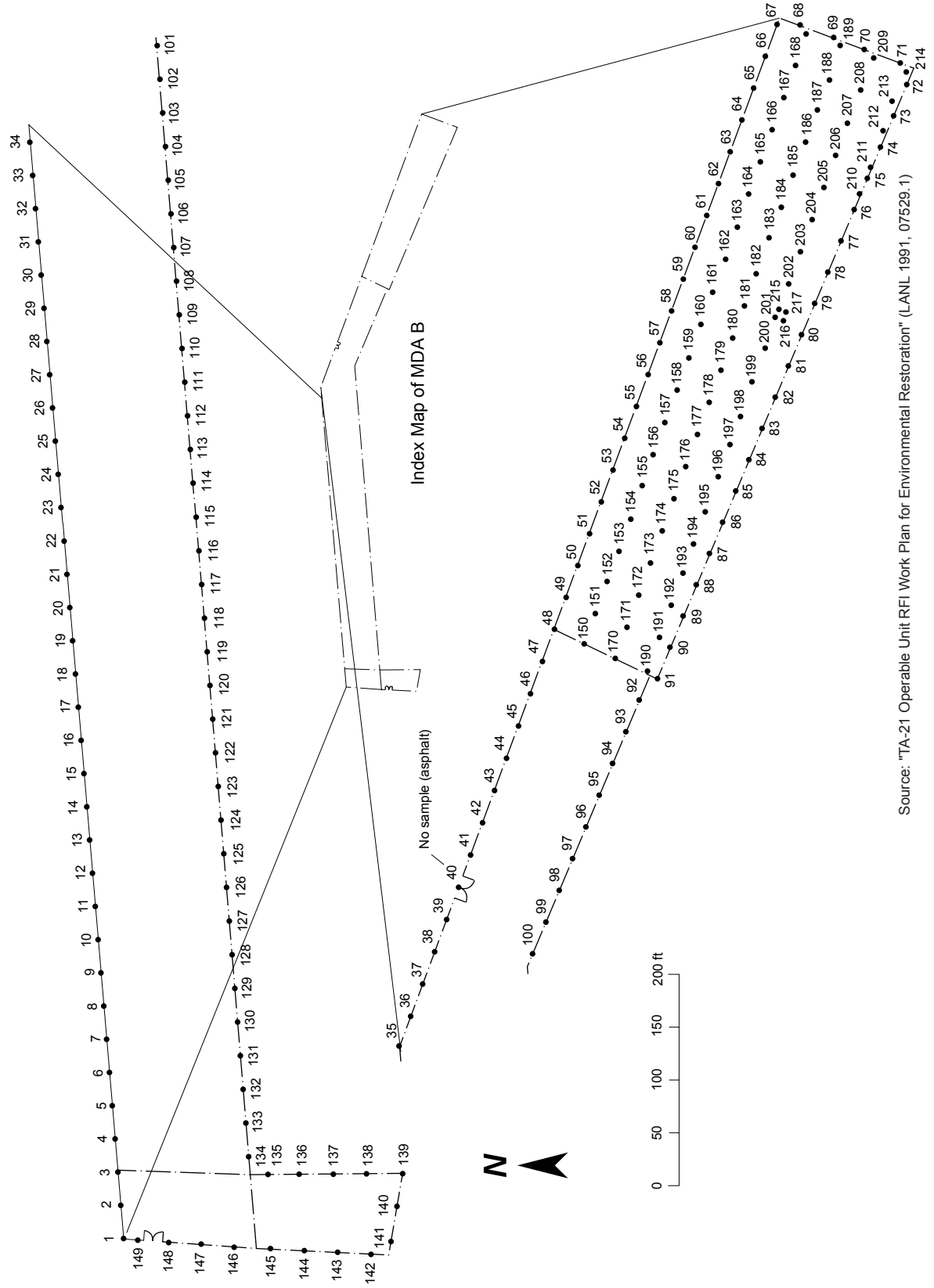


Figure B-24. Fall 1990 surface soils sampling plan at MDA B (as presented in the TA-21 RFI Work Plan)

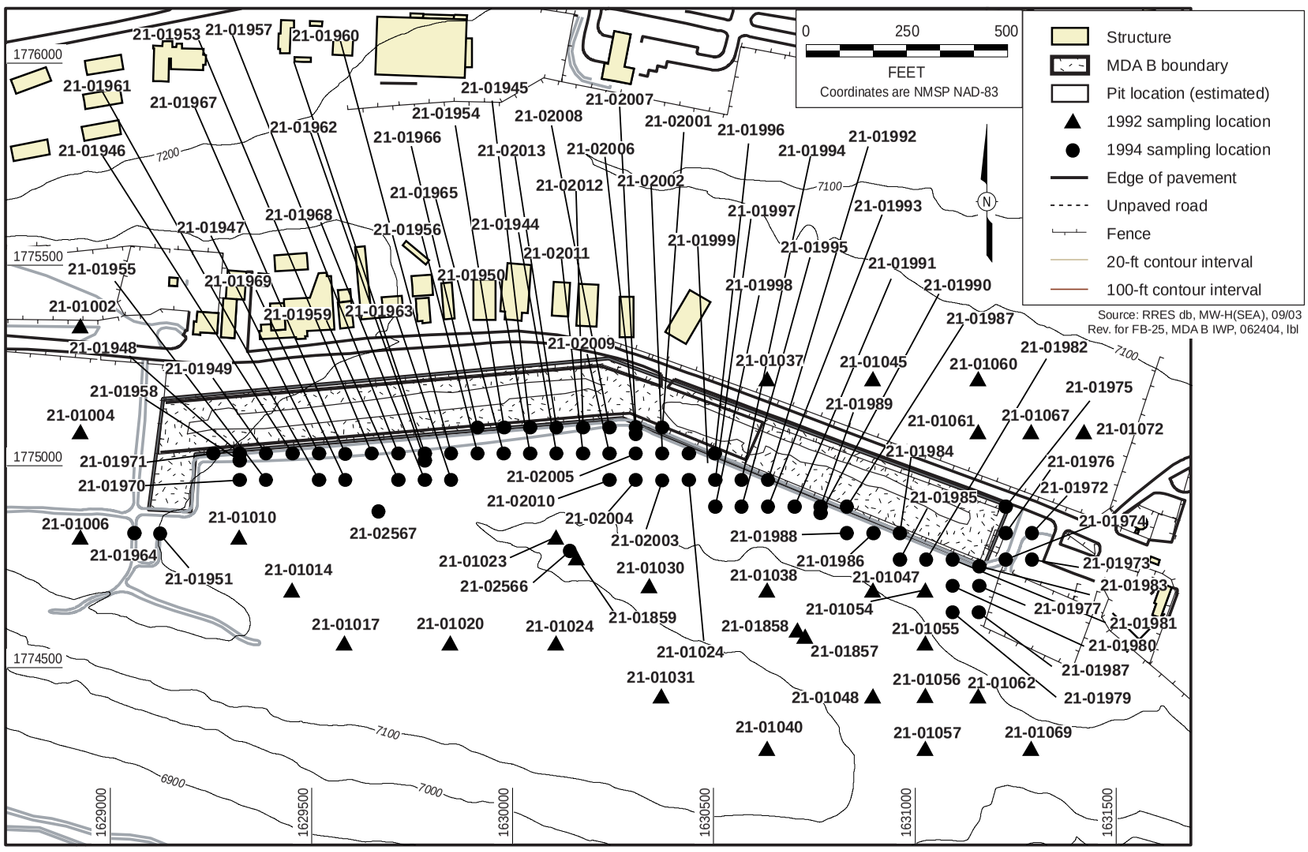


Figure B-25. Locations of 1992 and 1994 surface samples

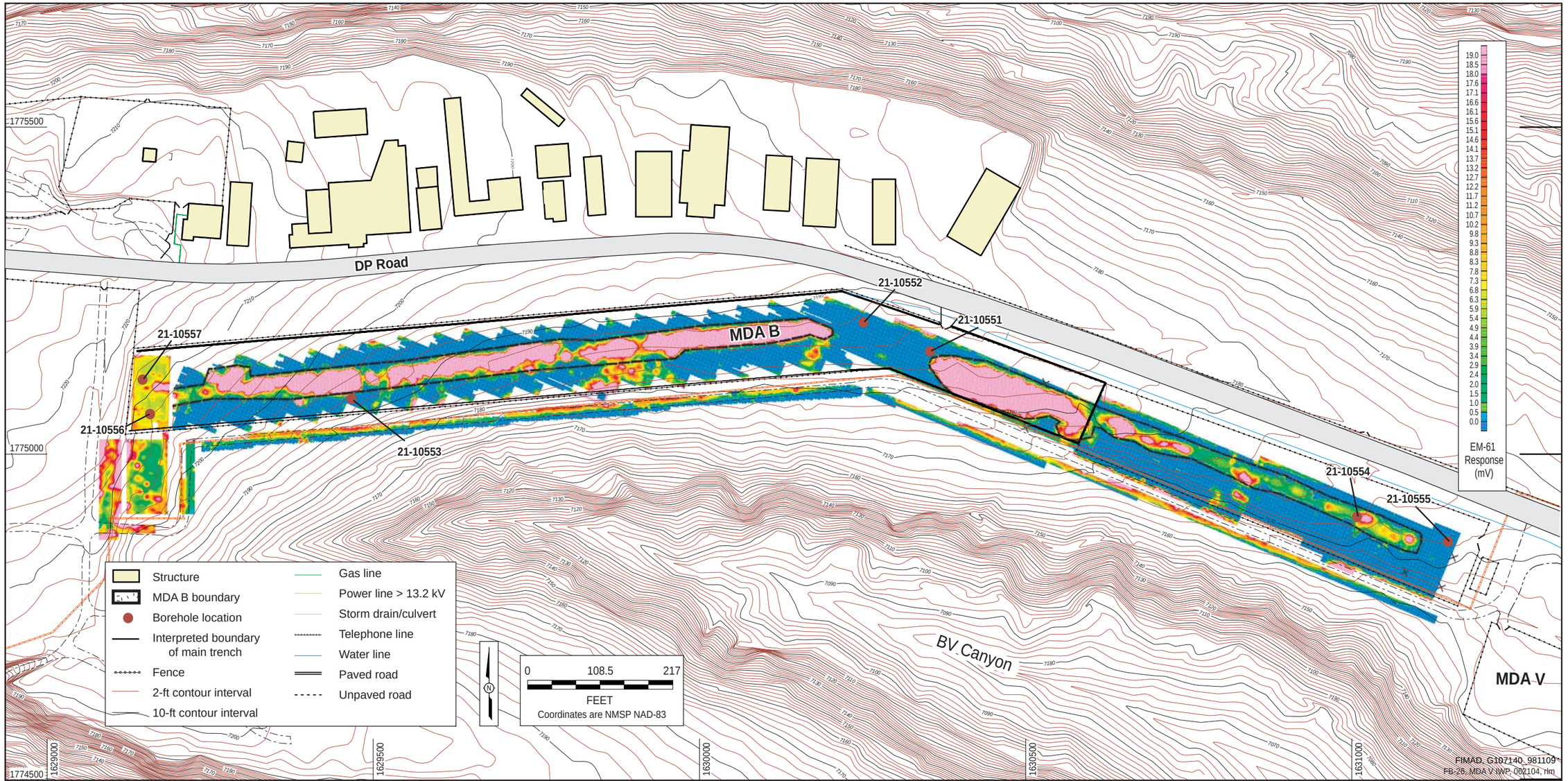


Figure B-26. MDA B disposal trenches delineated using EM-61 geophysical survey data

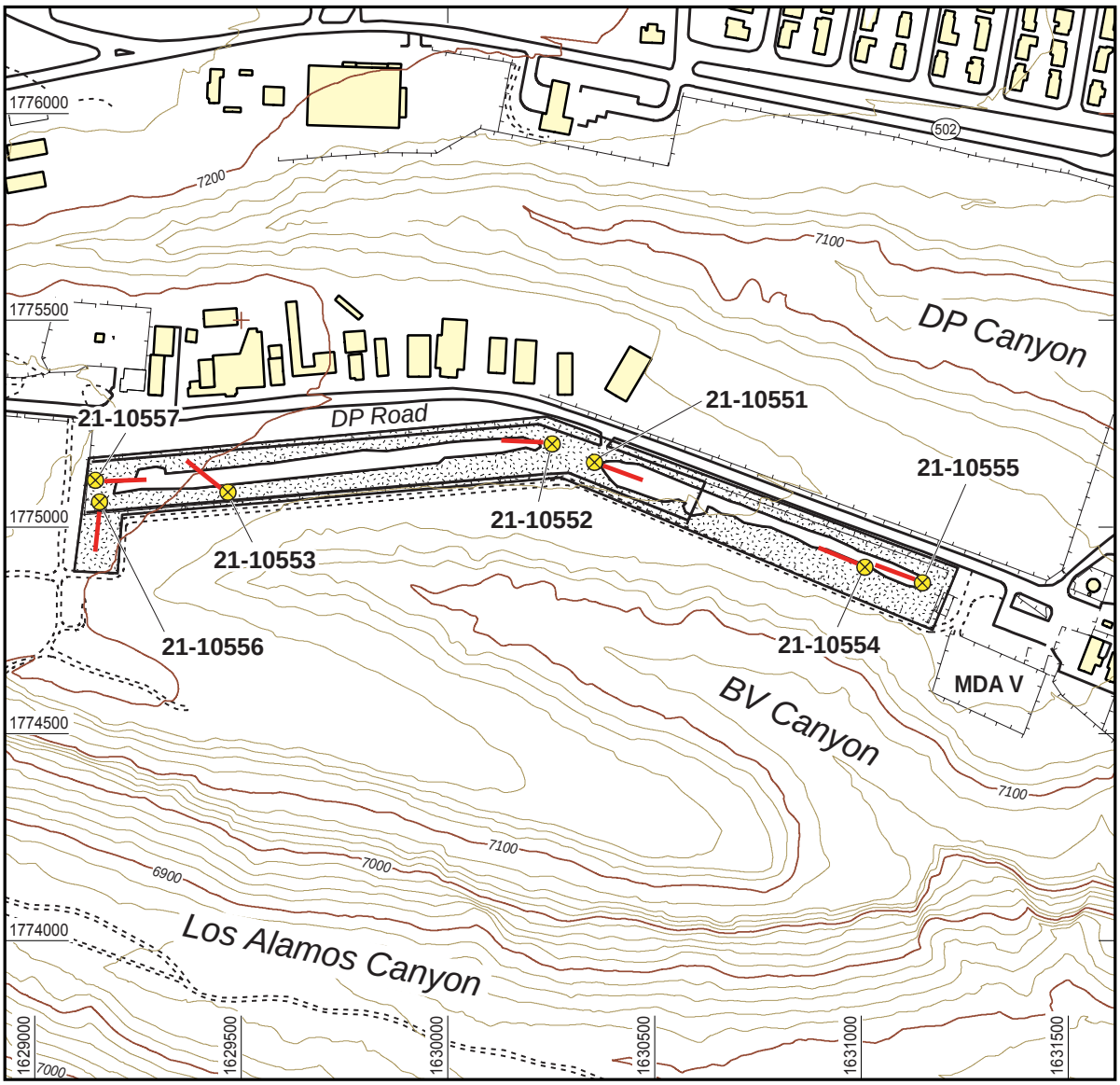


Figure B-27. Locations of angled boreholes drilled in 1998

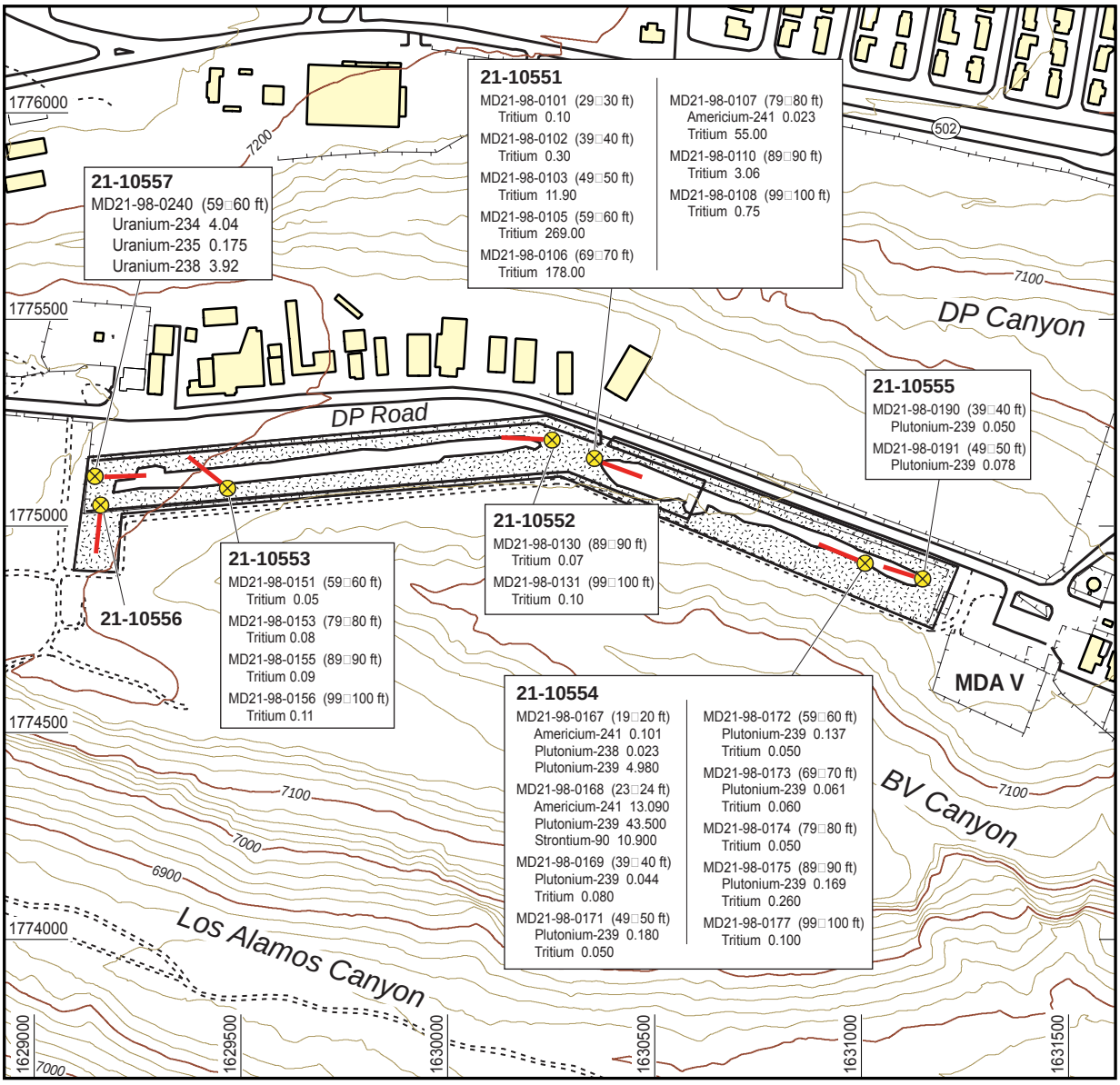


Figure B-28. Radionuclides above background in 1998 angled borehole samples

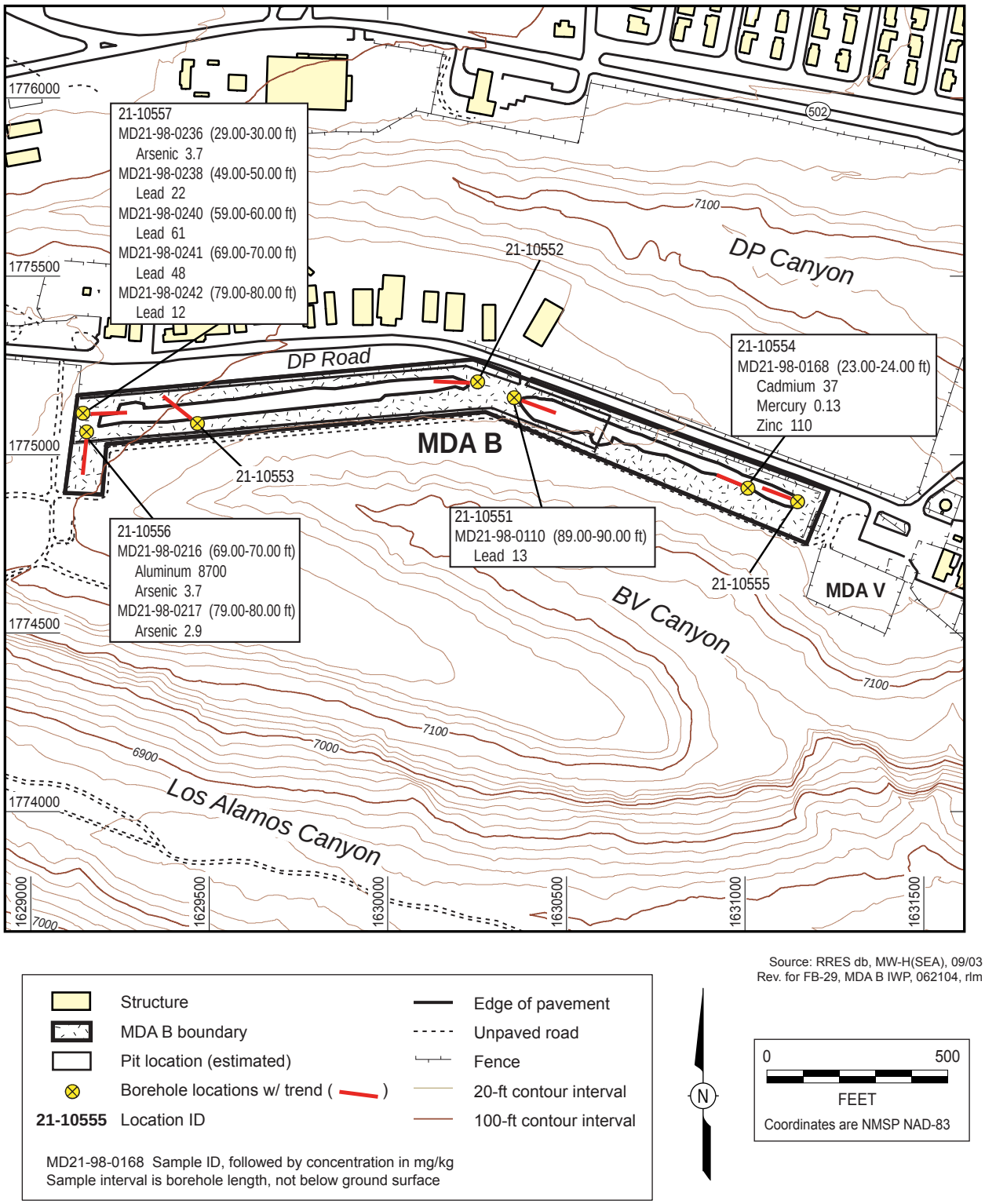


Figure B-29. Inorganic chemicals above background in 1998 angled borehole samples

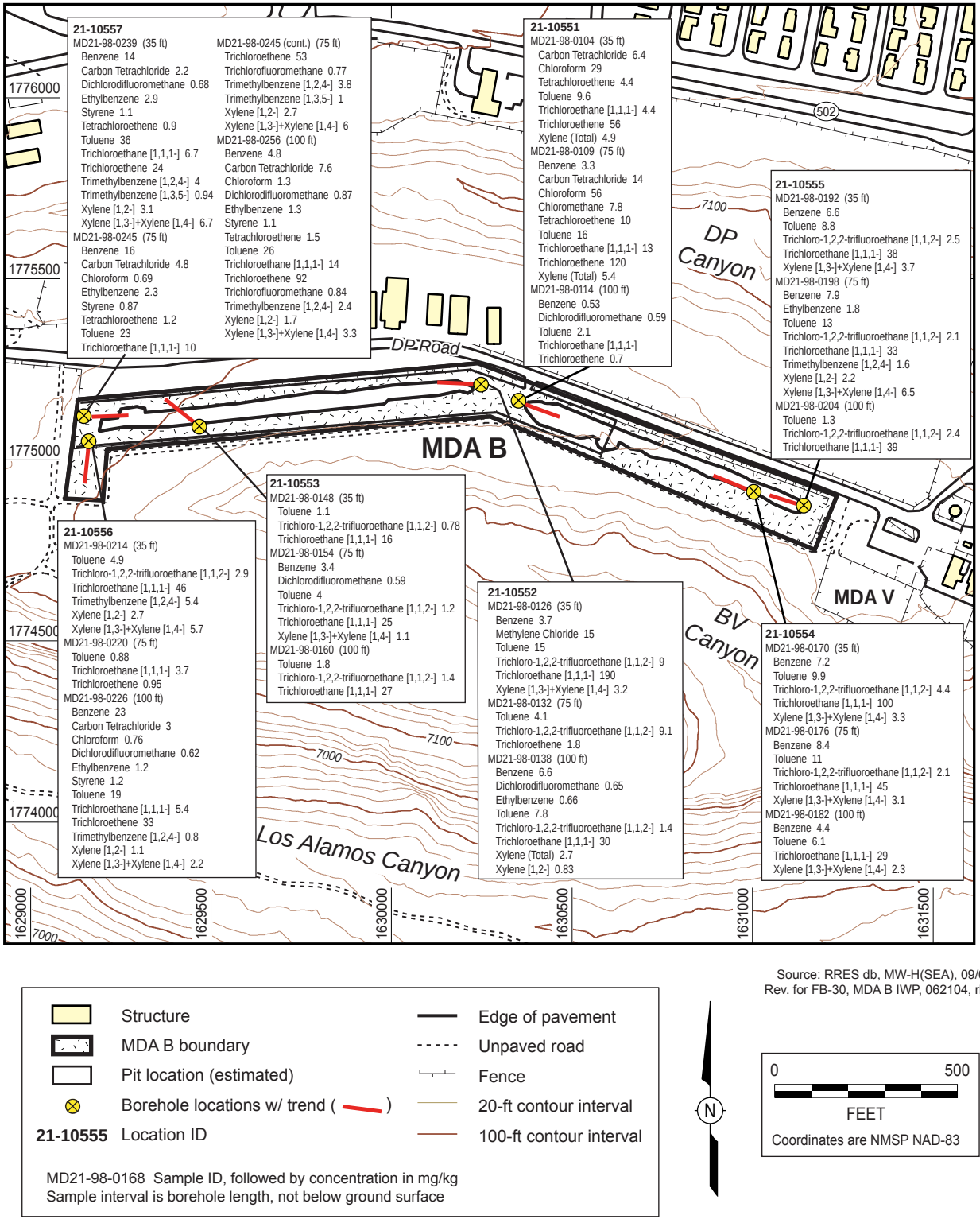


Figure B-30. Volatile organic compounds detected in pore gas samples from 1998 angled boreholes

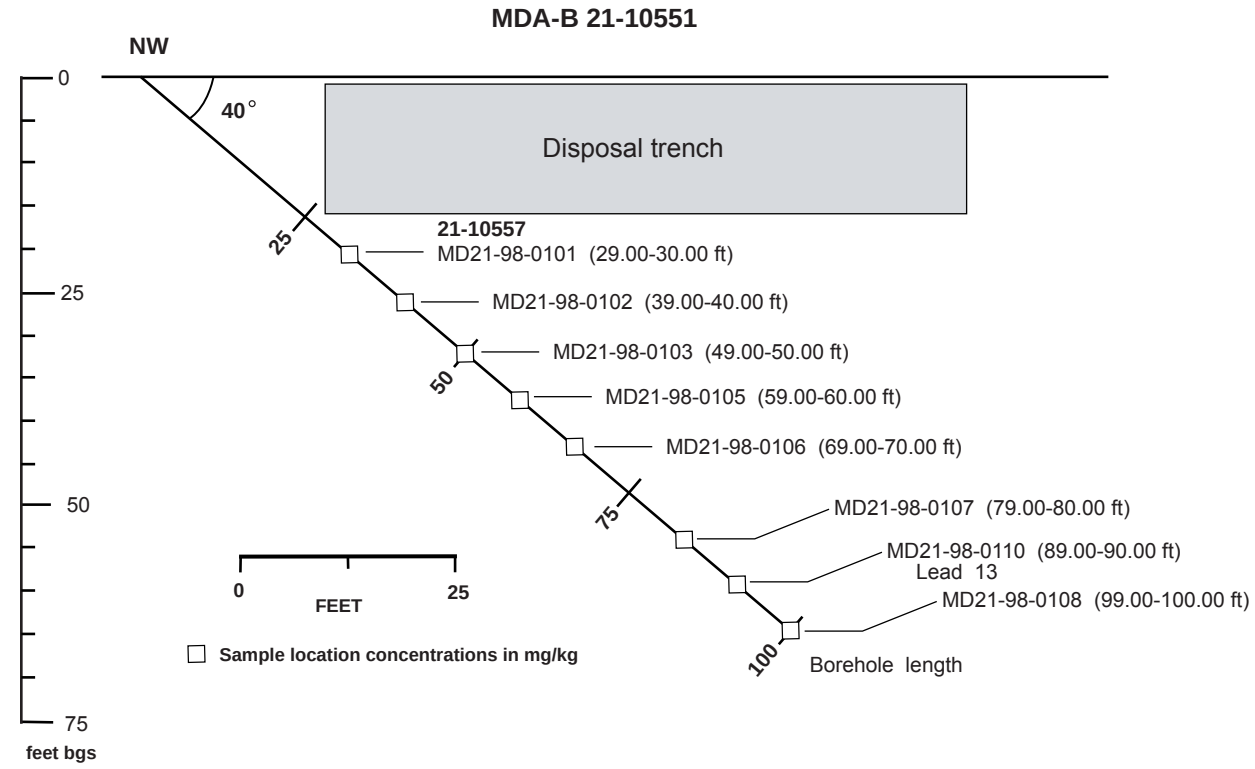


Figure B-31. Schematic profile of MDA B Location ID 21-10551 with inorganic chemicals above background

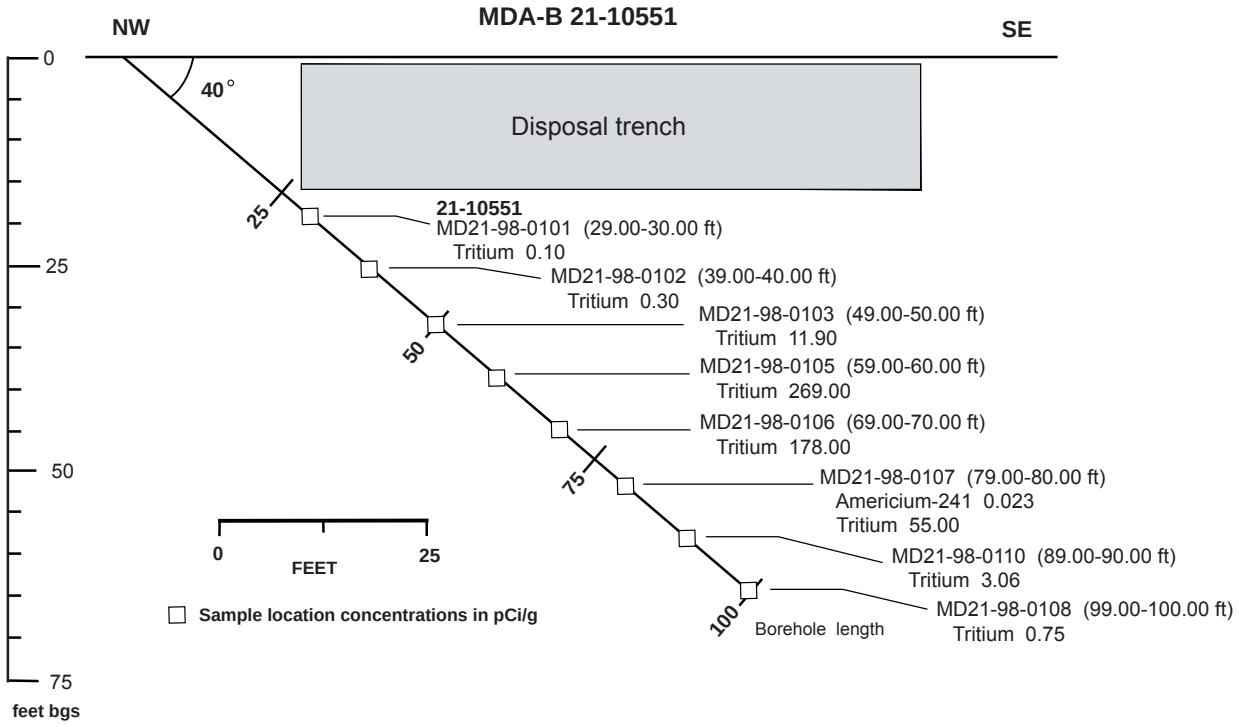


Figure B-32. Schematic profile of MDA B borehole 21-10551 with radionuclides above background

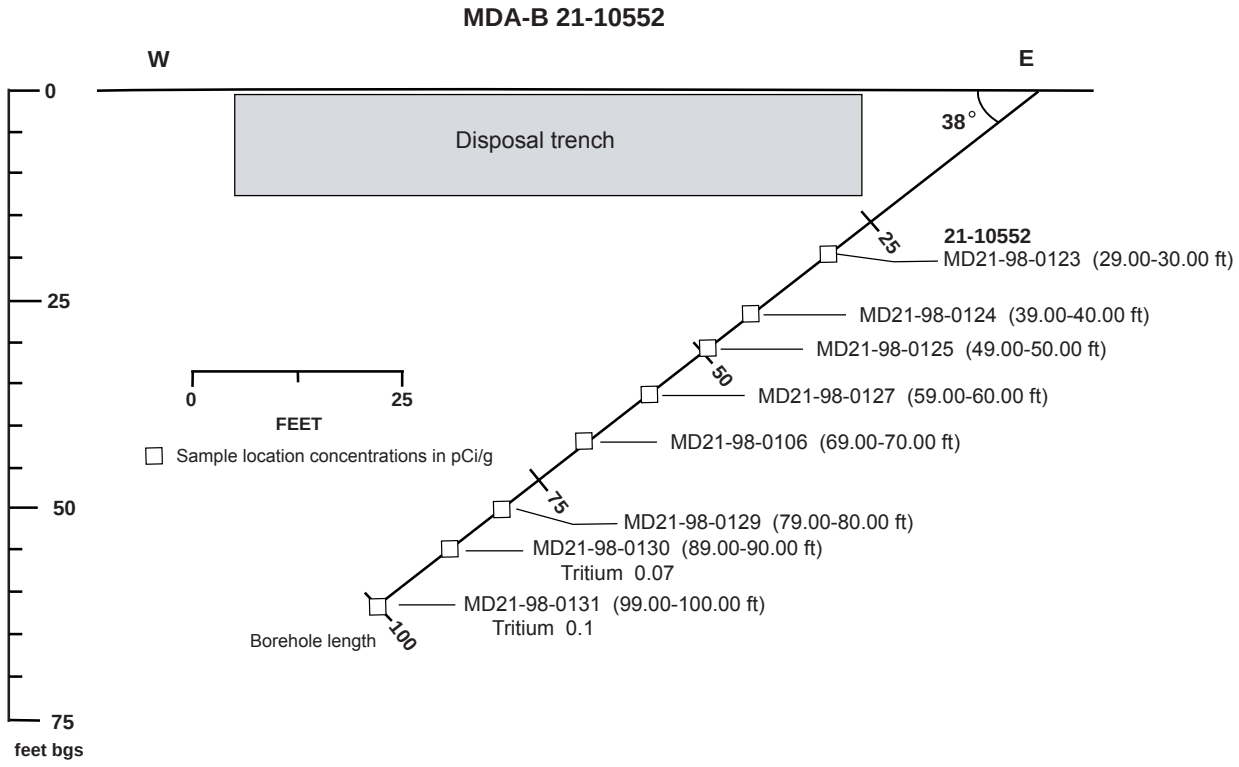


Figure B-33. Schematic profile of MDA B borehole 21-10552 with radionuclides above background

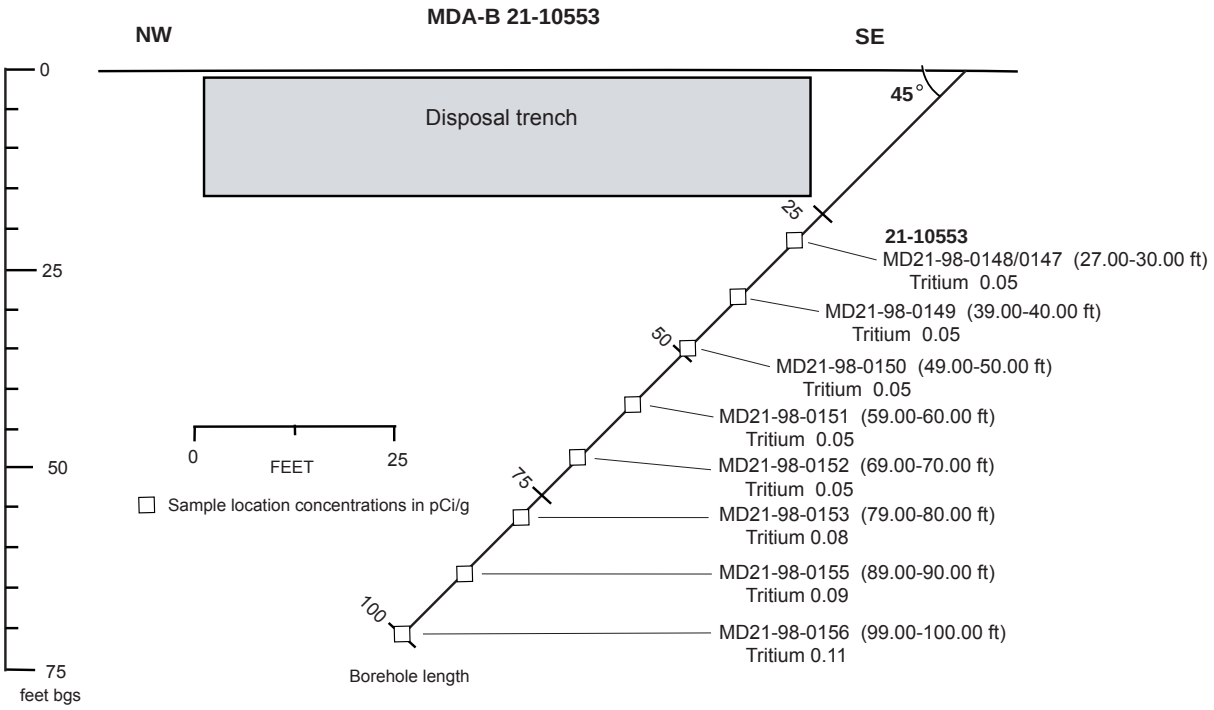


Figure B-34. Schematic profile of MDA B borehole 21-10553 with radionuclides above background

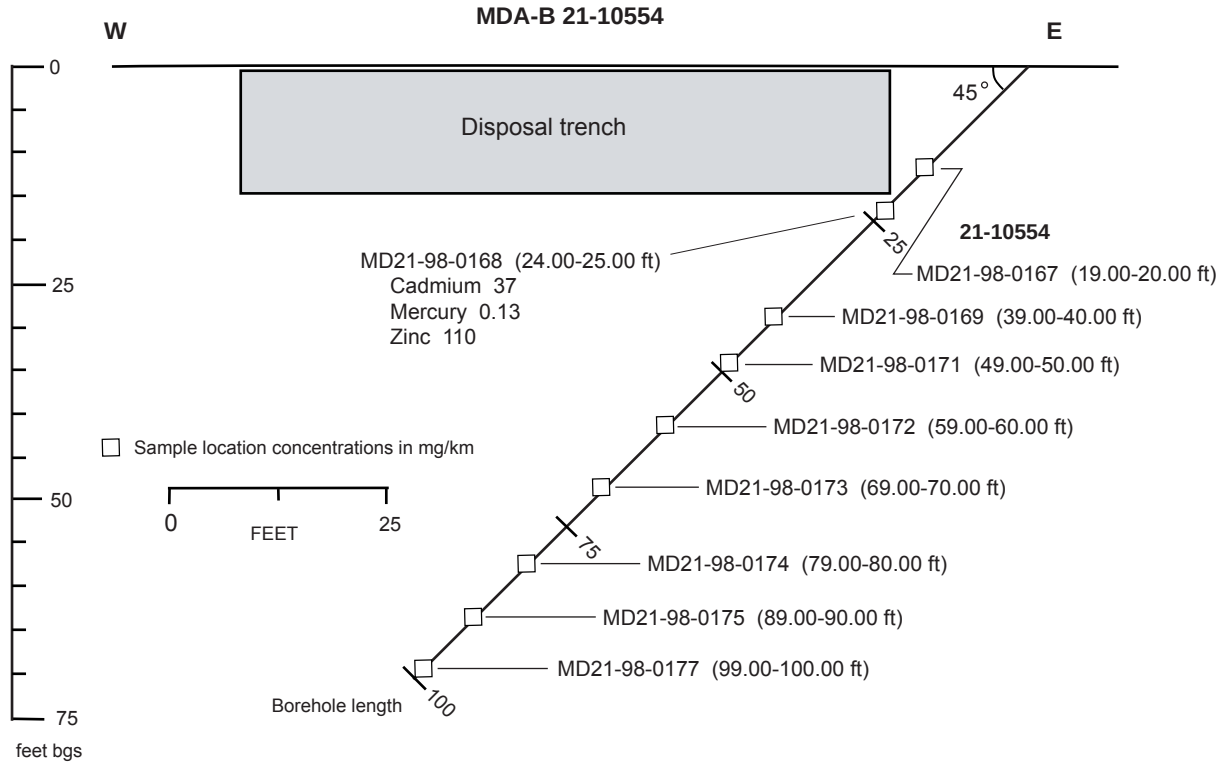


Figure B-35. Schematic profile of MDA B borehole 21-10554 with inorganic chemicals above background

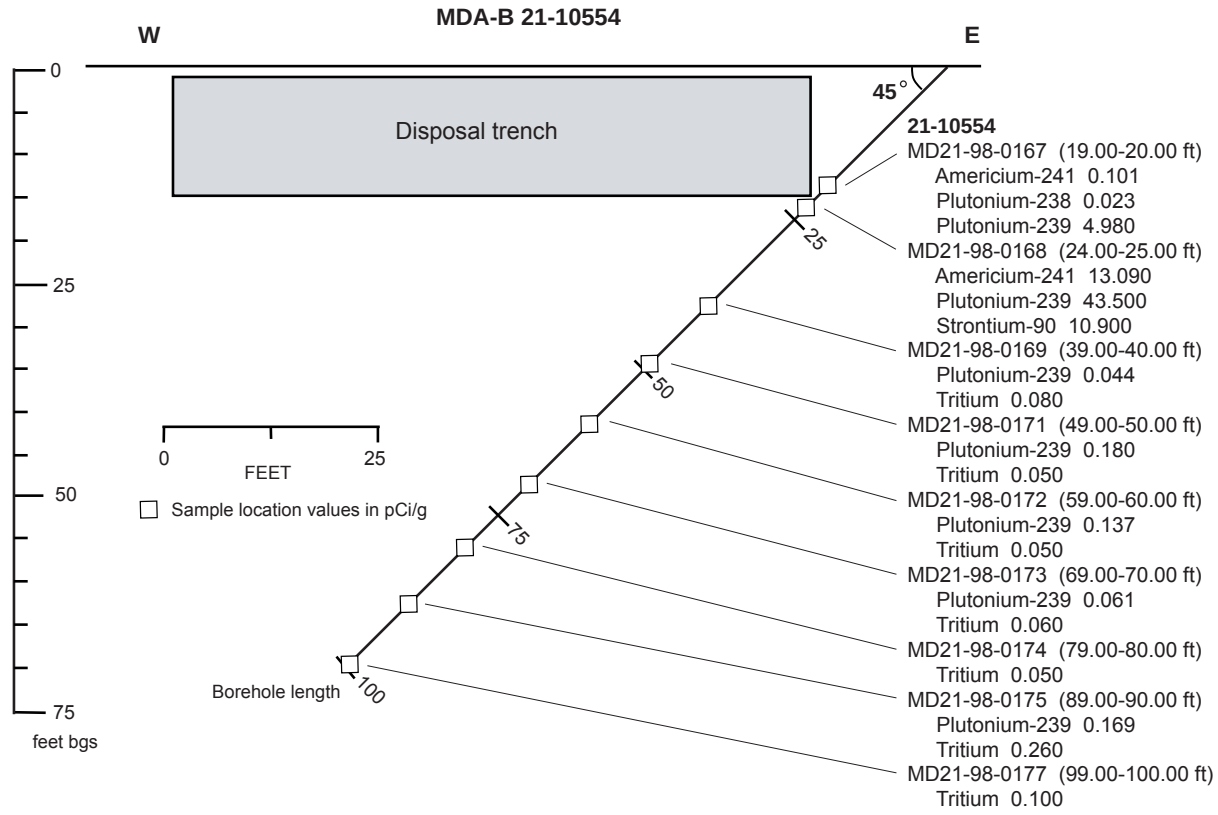


Figure B-36. Schematic profile of MDA B borehole 21-10554 with radionuclides above background

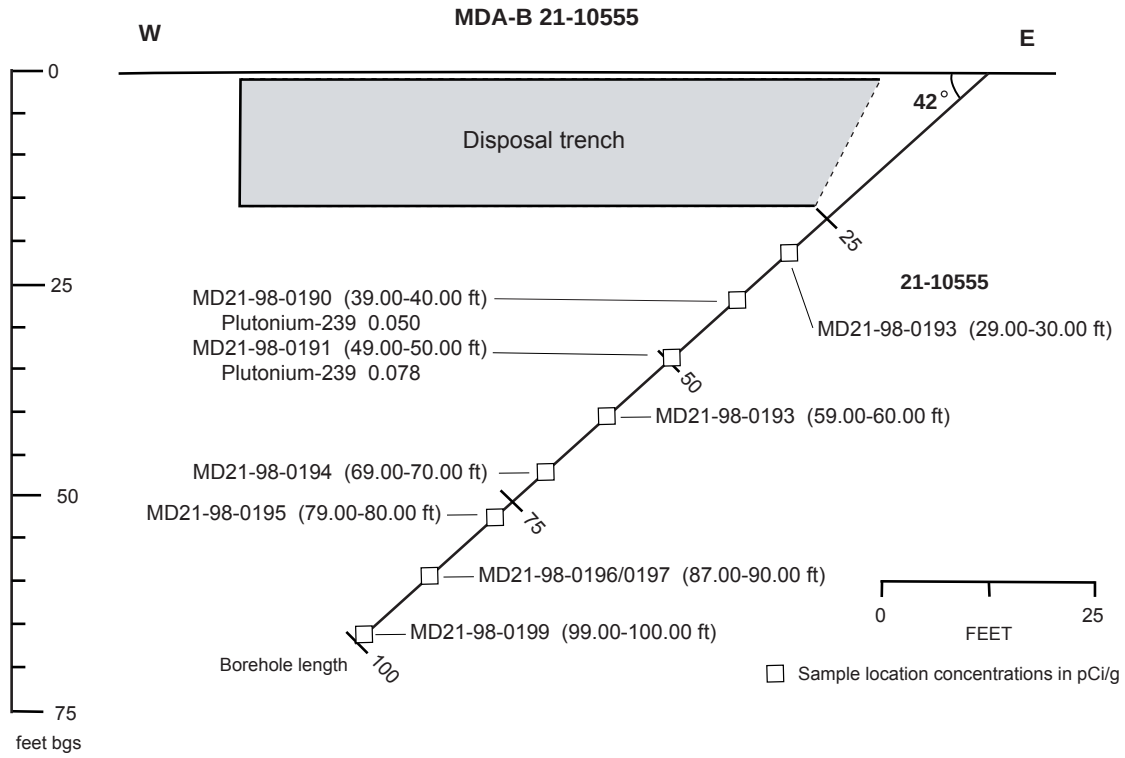


Figure B-37. Schematic profile of MDA B borehole 21-10555 with radionuclides above background

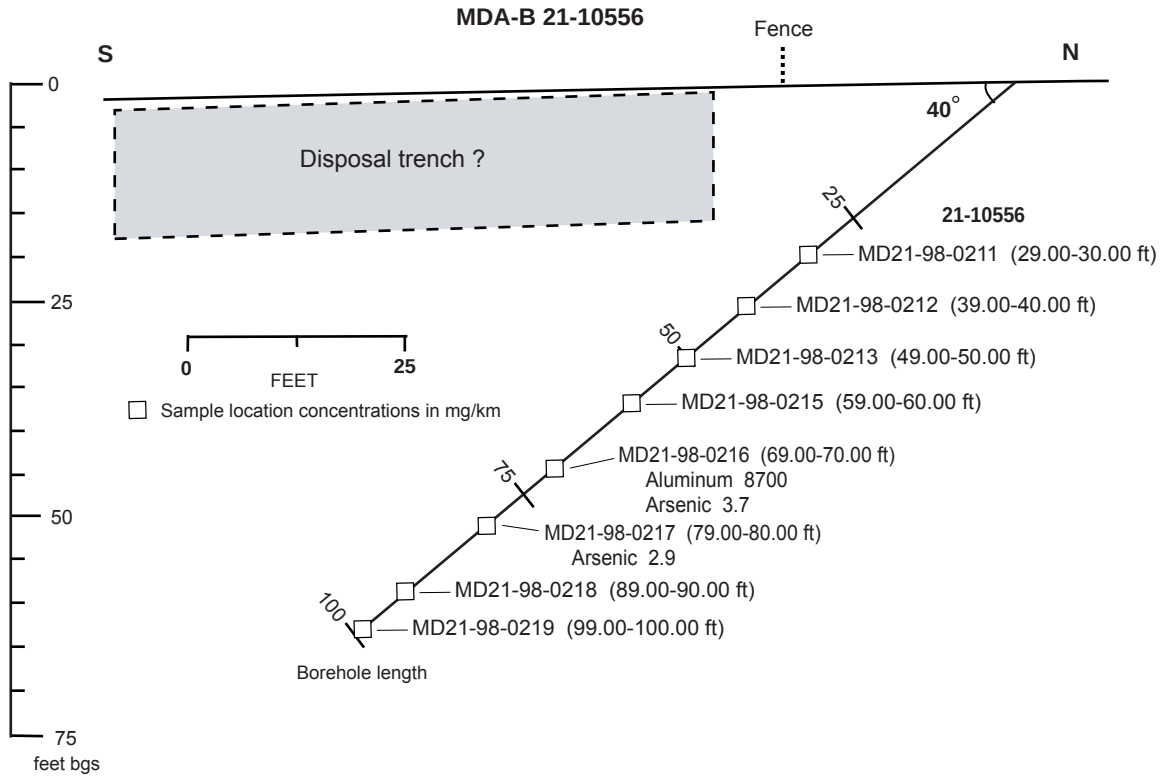


Figure B-38. Schematic profile of MDA B borehole 21-10556 with inorganic chemicals above background

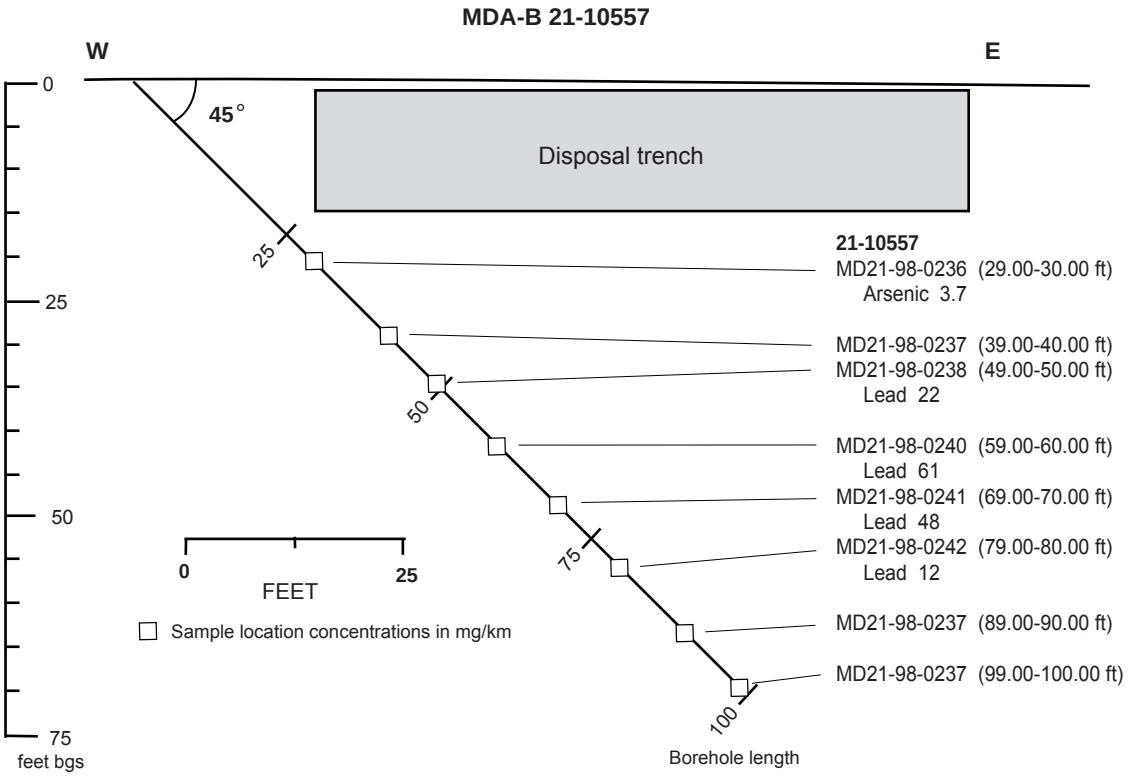


Figure B-39. Schematic profile of MDA B borehole 21-10557 with inorganic chemicals above background

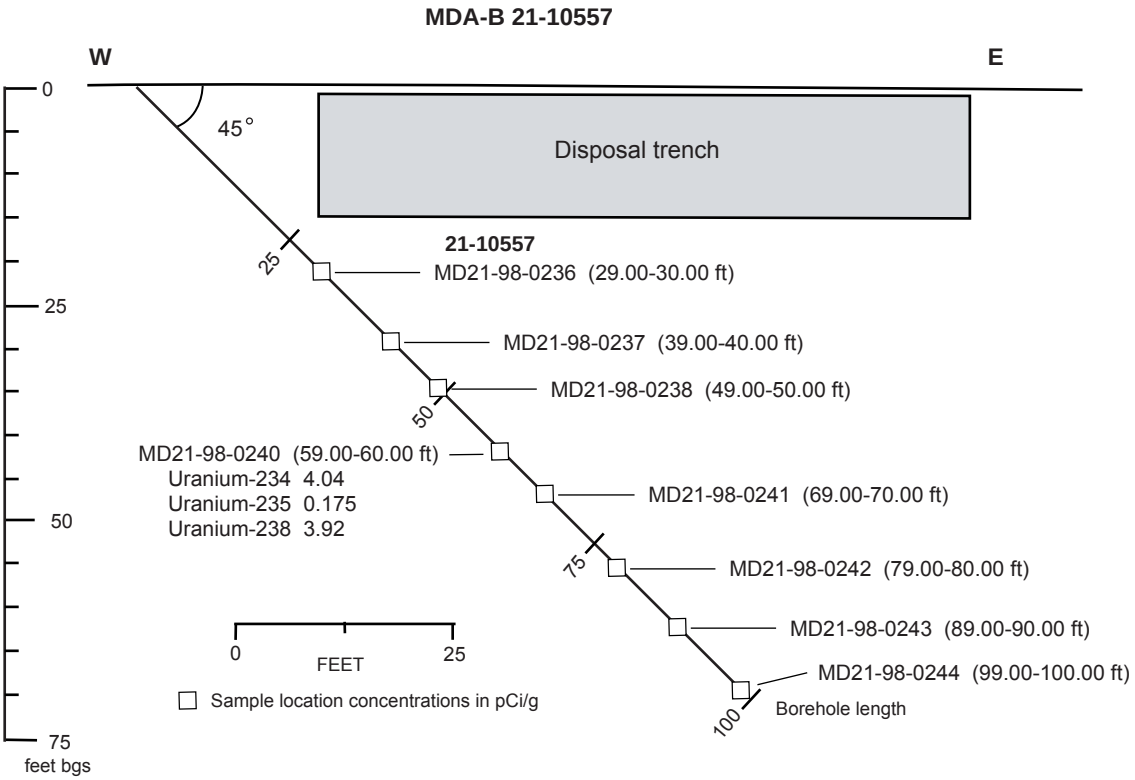


Figure B-40. Schematic profile of MDA B borehole 21-10557 with radionuclides above background

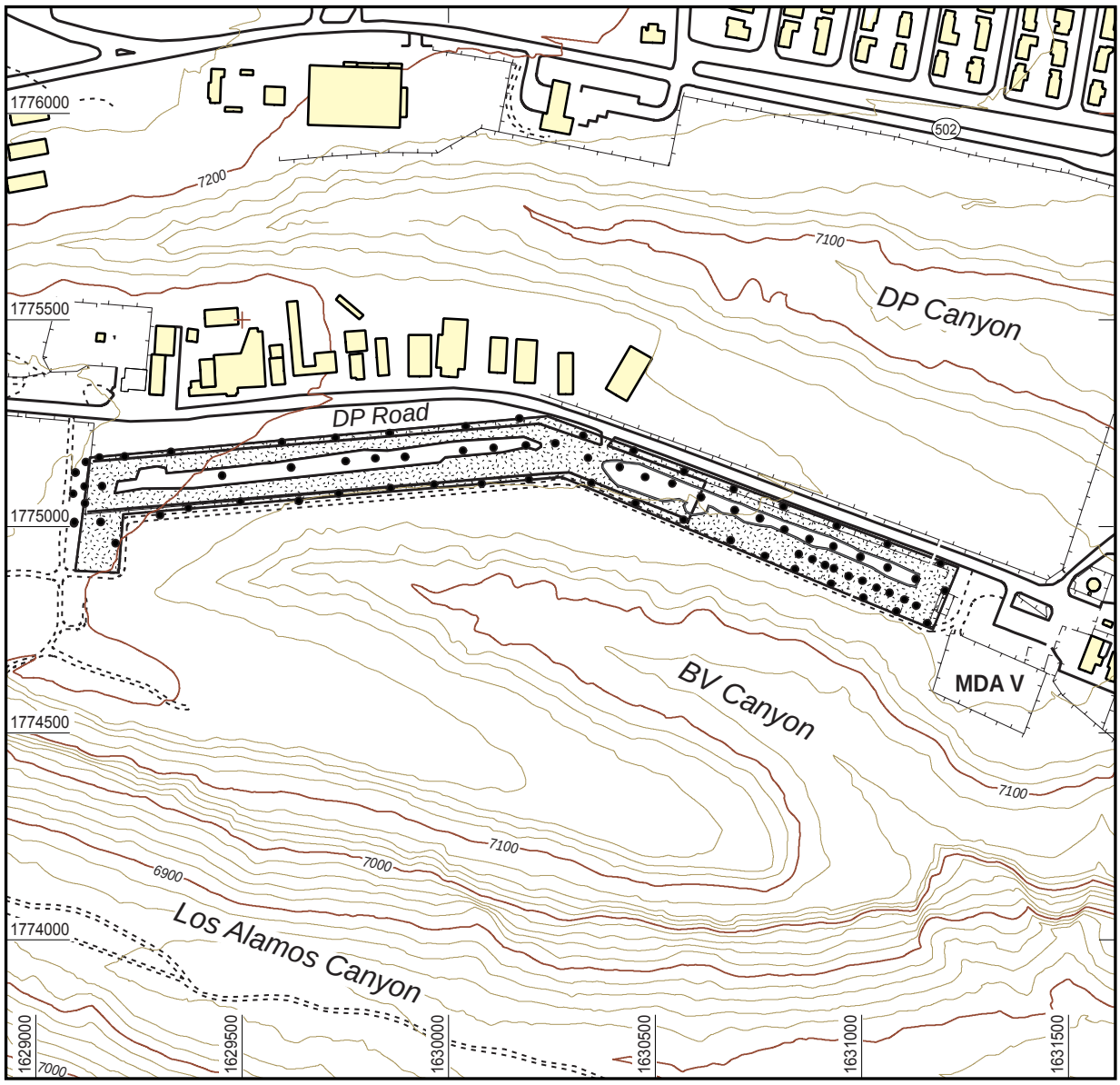


Figure B-41. EMFLUX passive soil gas VOC sample locations

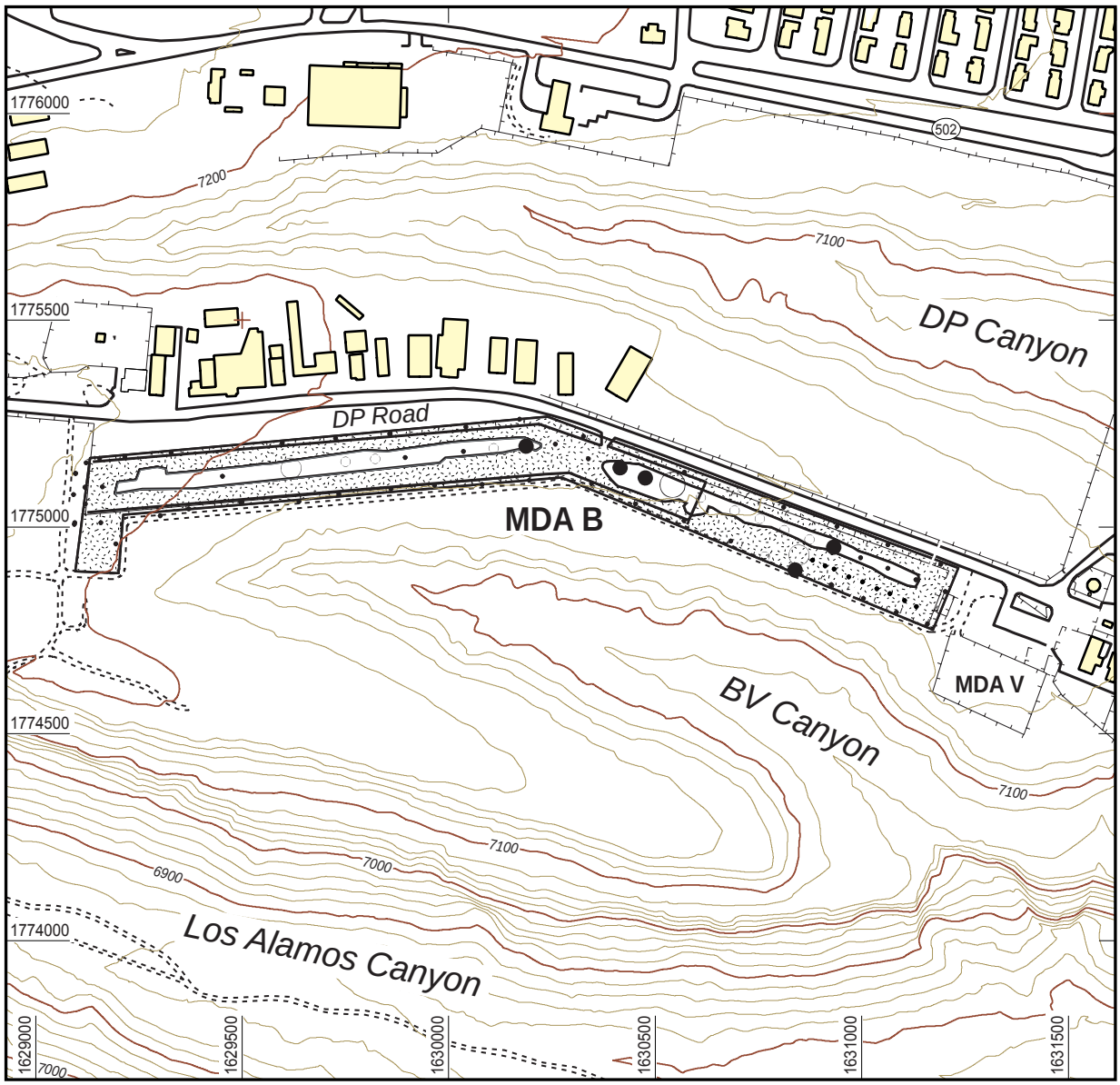


Figure B-42. PCE concentrations in EMFLUX passive soil gas samples

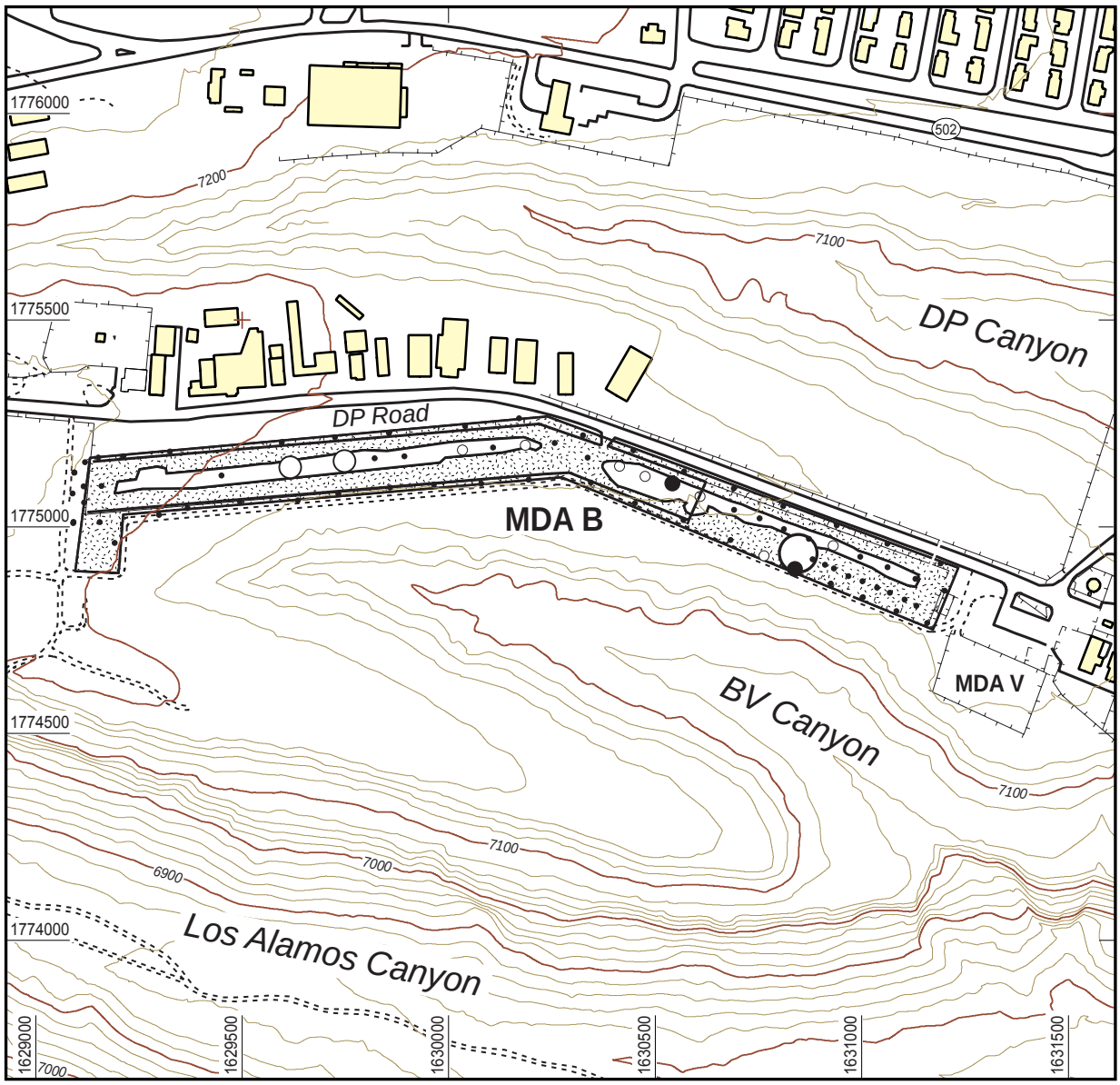
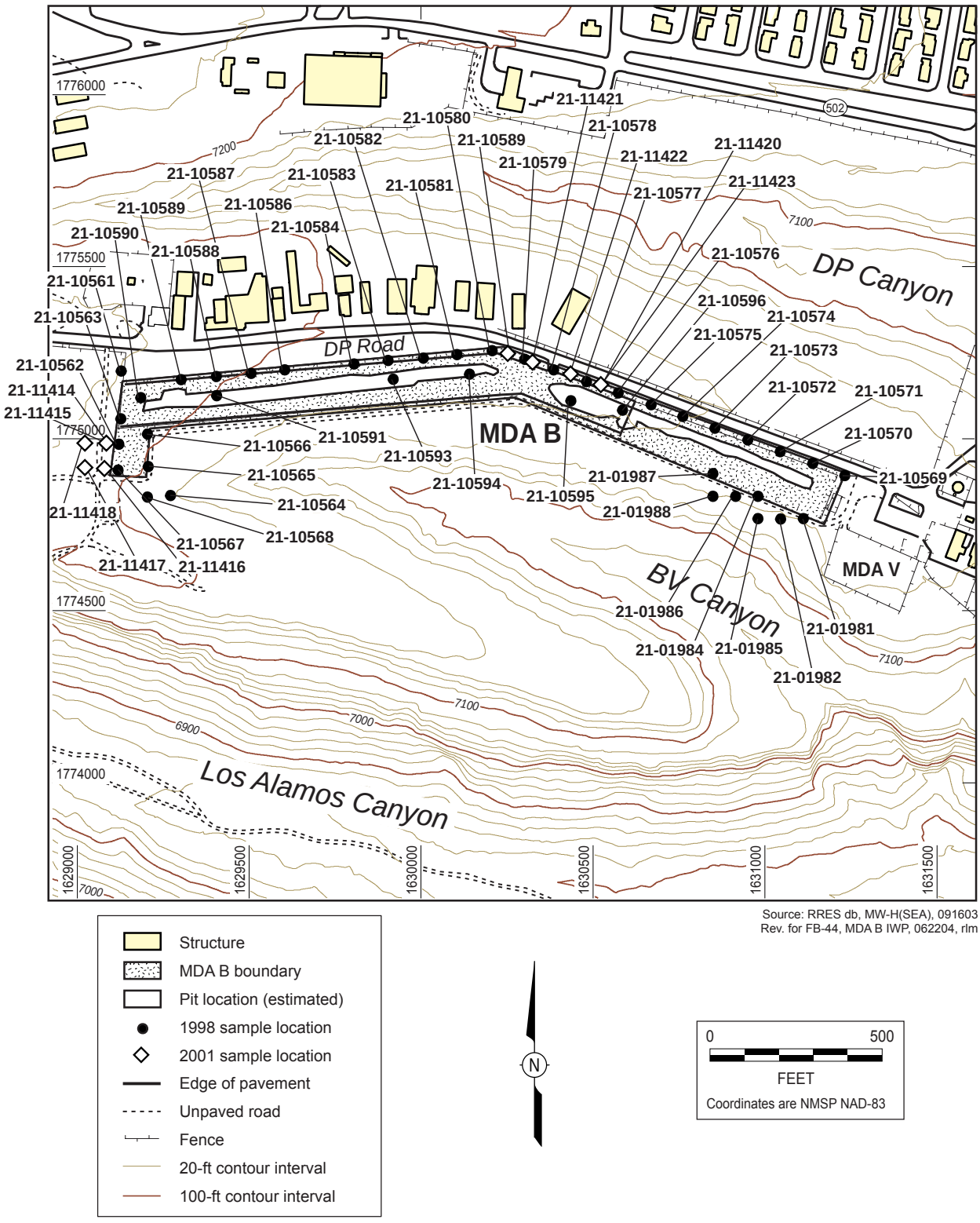
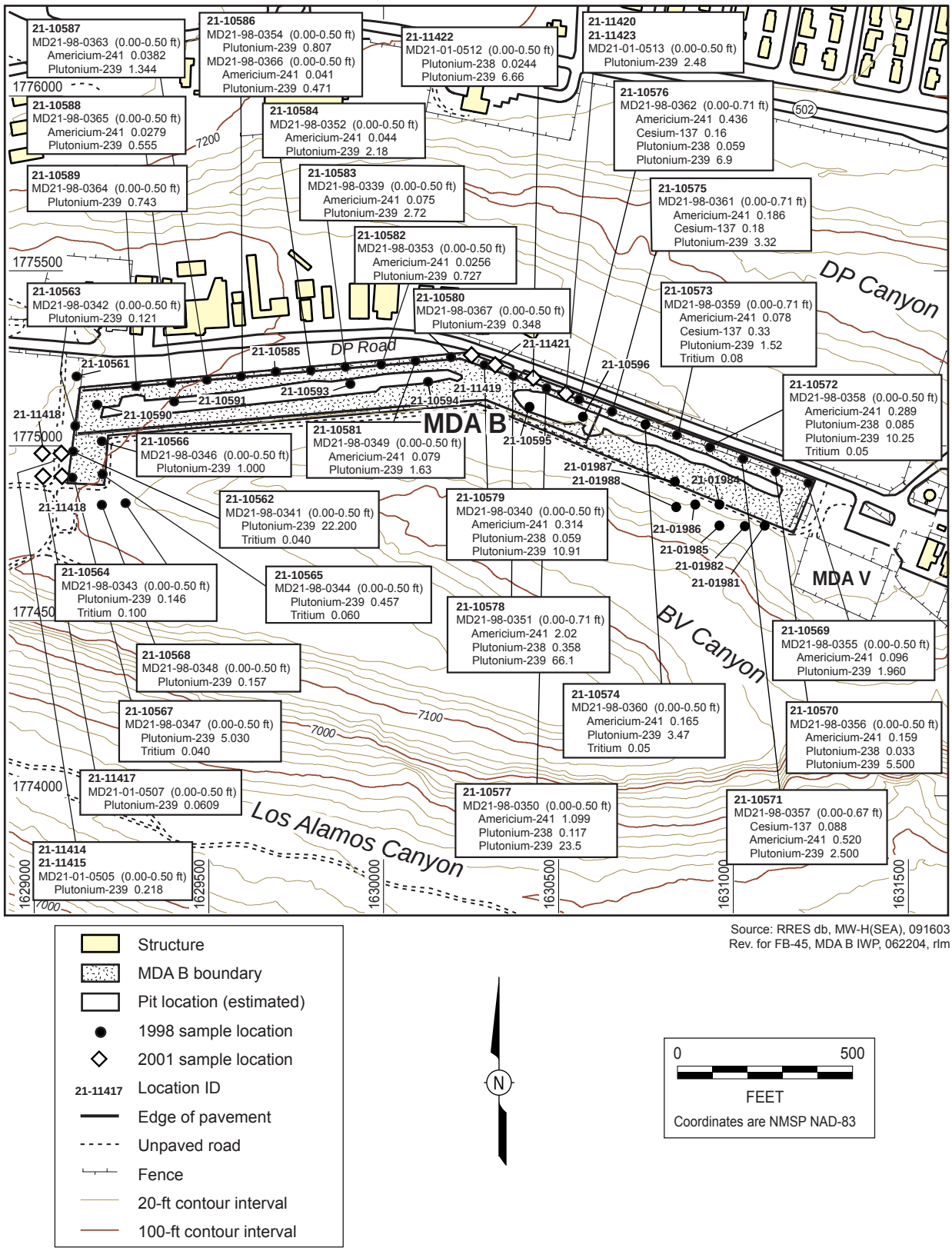


Figure B-43. TCE concentration in EMFLUX passive soil gas samples



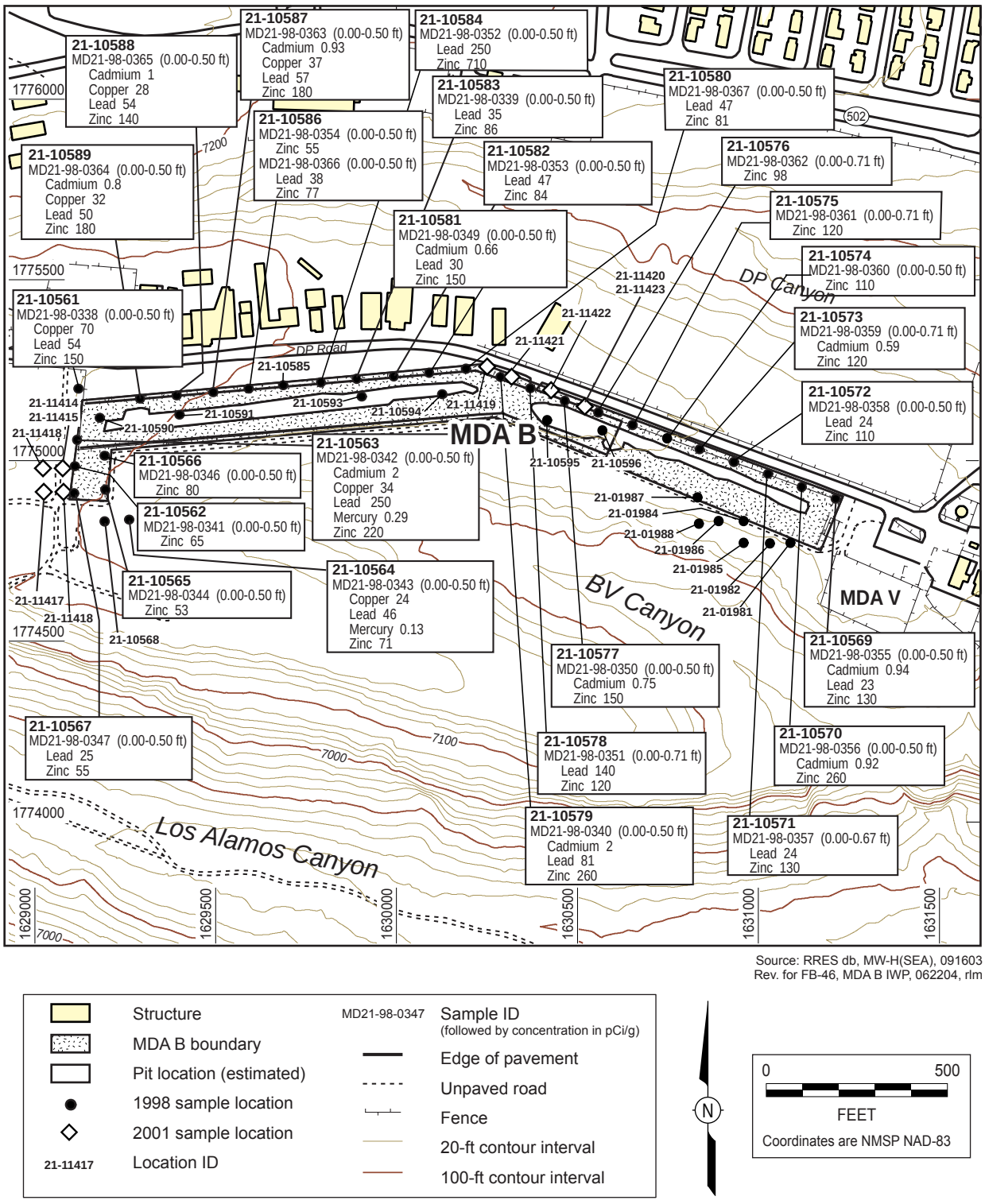
Source: RRES db, MW-H(SEA), 091603
Rev. for FB-44, MDA B IWP, 062204, rlm

Figure B-44. Locations of 1998 and 2001 surface samples



Source: RRES db, MW-H(SEA), 091603
Rev. for FB-45, MDA B IWP, 062204, rlm

Figure B-45. Radionuclides above background in 1998 and 2001 surface samples



Source: RRES db, MW-H(SEA), 091603
Rev. for FB-46, MDA B IWP, 062204, rlm

Figure B-46. Inorganic chemicals above background in 1998 and 2001 surface samples

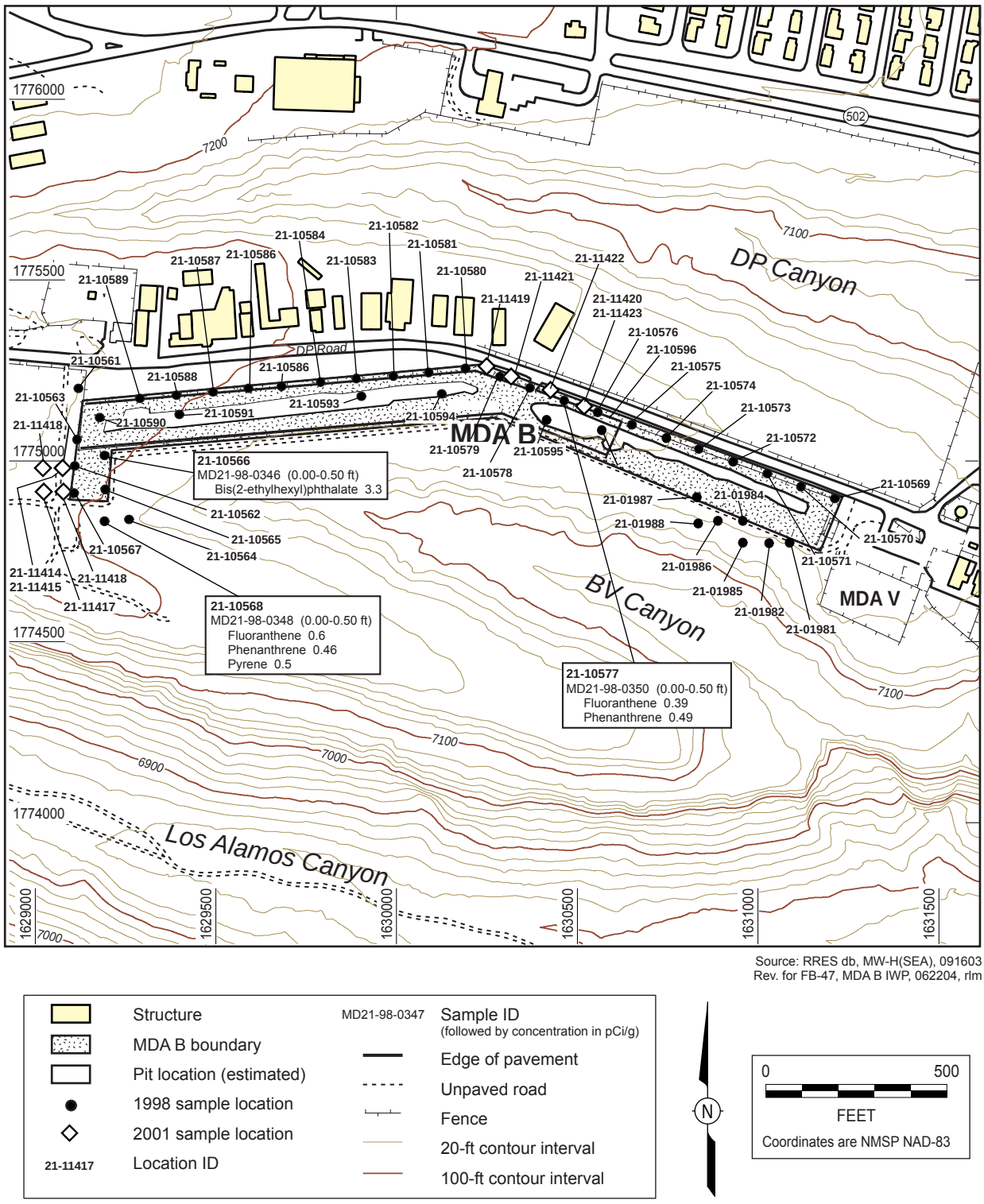


Figure B-47. Organic chemicals above background in 1998 and 2001 surface samples

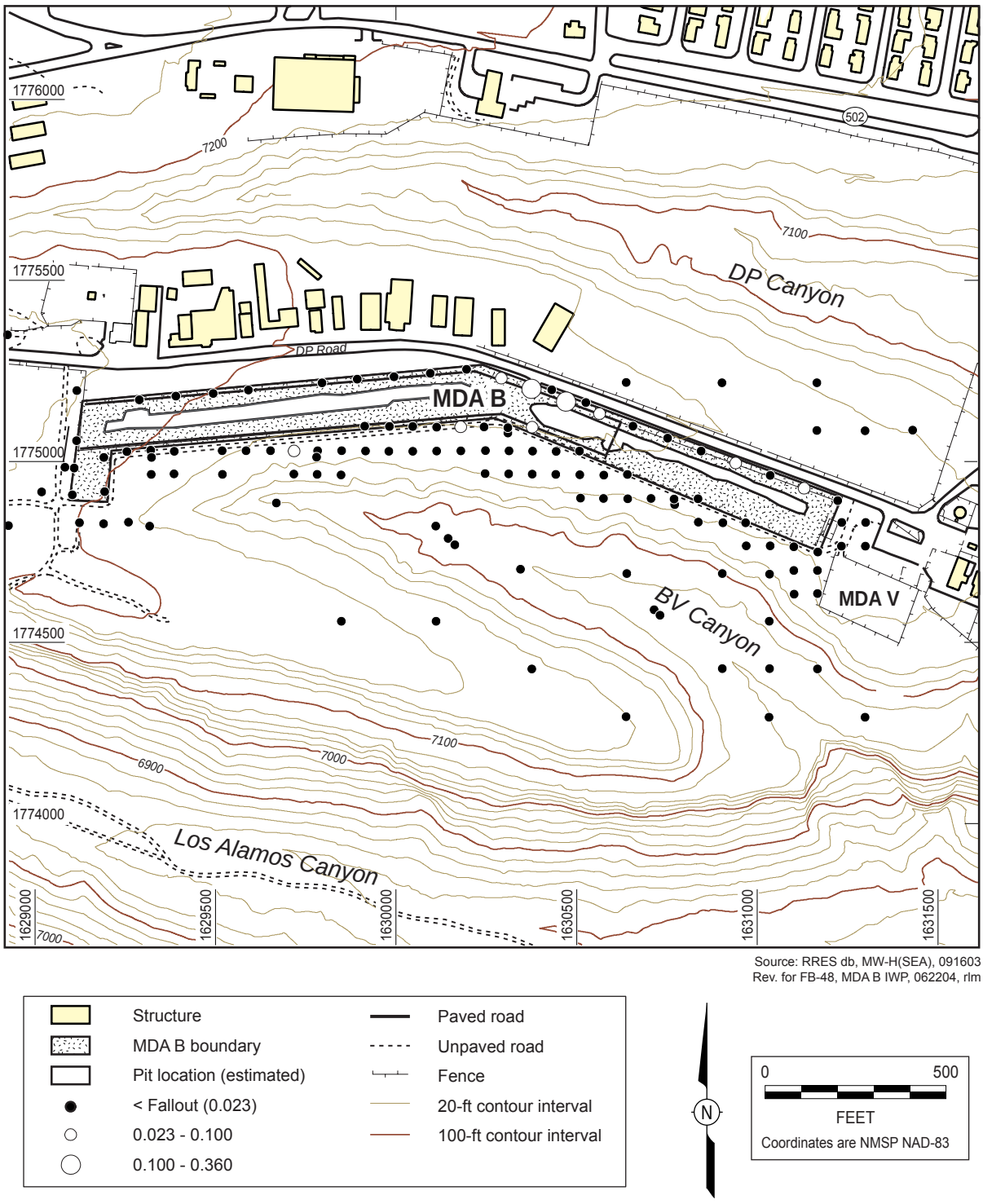


Figure B-48. Distribution of plutonium-238 in surface soils and sediment

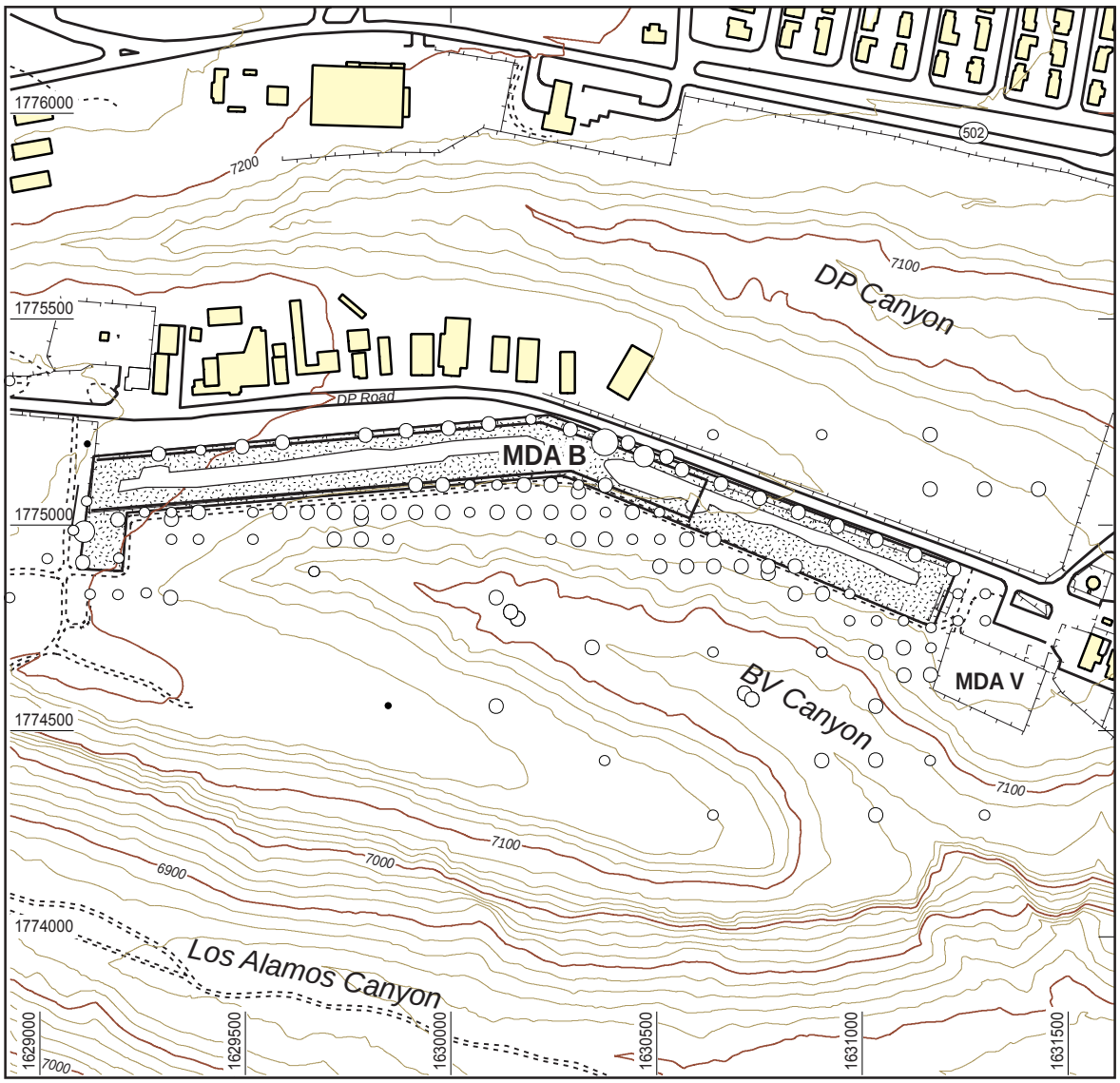


Figure B-49. Distribution of plutonium-239 in surface soils and sediment

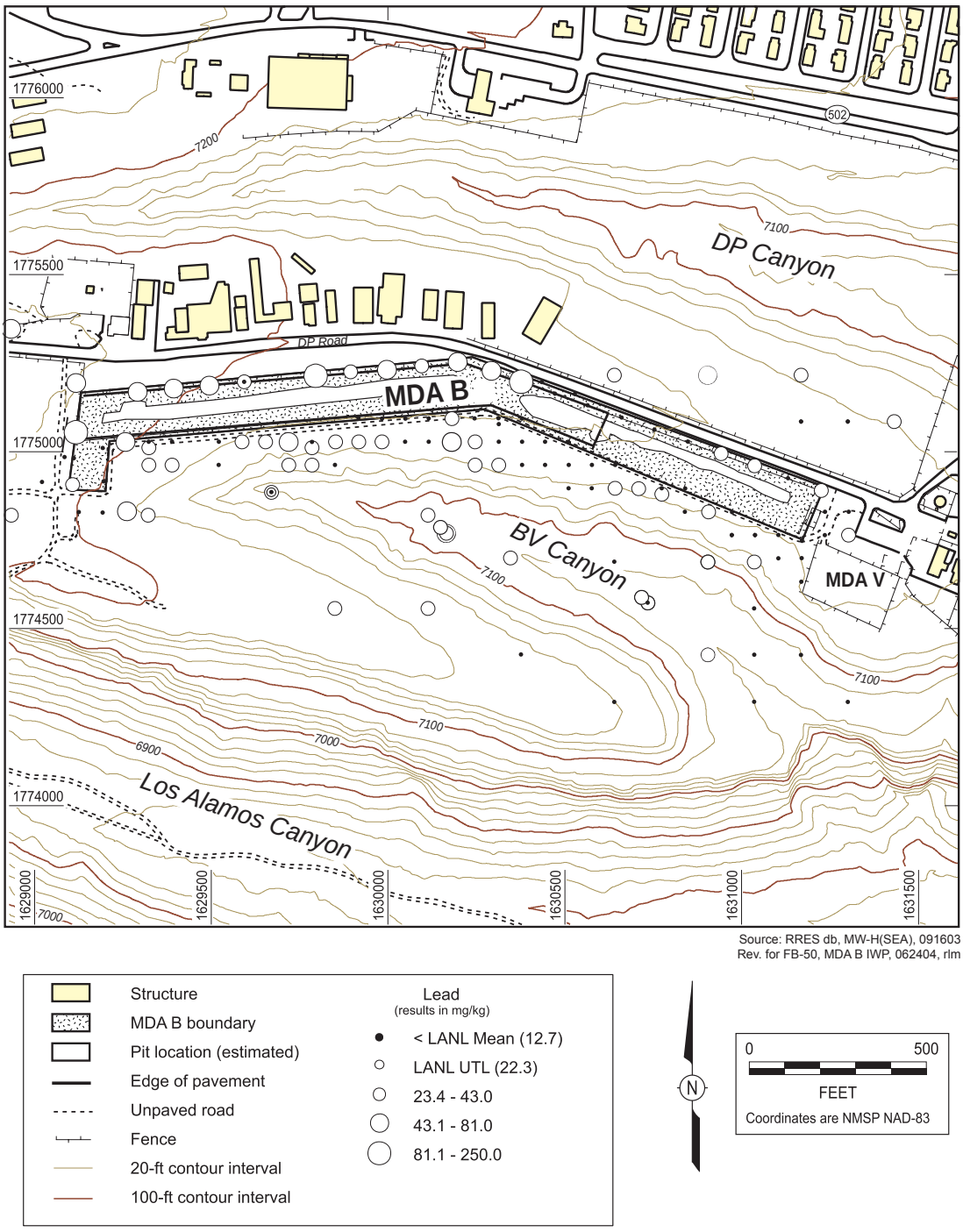


Figure B-50. Distribution of lead in surface soils and sediment

Table B-1
Operational Chronology

Date	Activity	Location	Activity Summary
1944	Area fenced	MDA B	Fence installed around MDA B
1945-1948	Active waste disposal operations	MDA B	Heterogeneous; primarily radioactive contaminated lab wastes and debris (including metals); limited liquids ▪ Chemical pit on east side ▪ Disposal trench on west end ▪ No waste inventory maintained
1948	Fire	MDA B (exact location unknown)	Fire erupted in waste materials
1949	Waste disposal ceased	MDA B	Waste disposal operations at MDA B discontinued
1949	Subsidence occurred	MDA B	Subsidence remedied by filling with clean concrete and construction materials
1966	Fence, installation, and soil compaction	MDA B	▪ Replaced existing fence with 8-ft chain link fence ▪ Prepared for lease to Los Alamos County
1966	Asphalt cover installation	Western ⅔ of MDA B	Asphalt cover installed
1966	Area leased to Los Alamos County	Western ⅔ of MDA B	Paved portion of MDA B becomes Los Alamos County trailer storage facility
1981	Soil removal	Surface soils above possible trench on E end of MDA B	Soil removal operations performed
1982	Surface stabilization	East end of MDA B	Surface stabilization operations performed
1990	Los Alamos County lease termination	Western ⅔ of MDA B	Los Alamos County asked to vacate site by 9-30-1990
5/23/90	Hazardous. Waste Facility permit	LANL facilities and SWMUs	Module VIII of RCRA Permit becomes effective

Table B-2
Pre-RFI Investigation Chronology

Date	Activity	Location	Analyses Requested	Activity Summary
1966	Borehole installation (13)	Perimeter of MDA B	Radioactivity Radionuclides Moisture content	No radionuclides detected above local background Some lateral water movement, below effective porosity of tuff
1977	Radiological survey	Surface soils on East end of MDA B	Radioactivity	Located apparent disposal trenches Exposed waste observed Subsidence observed Surface U-233 contamination Surface Pu-239 contamination Elevated H3 levels
1982	Ecological study	Subsurface soils of MDA B	Radionuclides	Samples collected to 5 ft. bgs U and Pu above local background Cs above local background Pu and Cs decrease w/ depth
1983	Borehole installation (2)	Northeast and southeast edges of MDA B	Radionuclides	Total depth of 58 ft. bgs H3 concentrations increased w/depth to 23 ft. bgs H3 analysis not requested below 23 ft. bgs
1990	Environmental Surveillance cover investigation	East end of MDA B	Radionuclides	Low-level radiological contamination in surficial soils of cover H3 elevated in east-west strip down middle of east side of MDA B U slightly elevated over entire sample area
1990	Environmental Surveillance surface investigations	Surface soils at fenceline	Radionuclides	Am-241, Pu-238, -239, H3, Sr-90, and total U above local background Pu-239, Am-241, and H3 most prevalent

1 bgs = below ground surface.

Table B-3
RFI Investigation Chronology

Date	Activity	Location	Analyses Requested	Activity Summary
1992	RFI surface characterization	Surface soils across DP Mesa	Radionuclides Organics Inorganics	Pu-238, Pu-239 and Pb greater than background along north and south boundaries of MDA B
1992-1993	Geologic investigations	DP Mesa	Site geology Fractures Stratigraphy Petrography Mineralogy Geomorphology	1662 fractures documented parallel to MDA B through MDA U Northeast striking fractures 30% more abundant than northwest striking fractures and north dipping fractures 3X more abundant than south dipping ones Fractures in Cooling Unit 2; waste in Cooling Unit 3
1993	Deep geochemical, geohydrologic & groundwater investigations	DP Mesa	Site geology Fractures Stratigraphy Petrography Mineralogy Geomorphology	Springer report (Springer et al. 2001, 70114)
1994	RFI surface characterization	Surface soils south and southeast of MDA B	Radionuclides Organics Inorganics	Pu-238, Pu-239 and Pb greater than background along north and south boundaries of MDA B
1996	Deep geochemical, geohydrologic and groundwater investigations	DP Mesa		Springer report (Springer et al. 2001, 70114)
1997	SAGE Geophysical investigations	Eastern leg (unpaved area)	Total-field magnetics Seismic refractions Ground-penetrating radar Resistivity	Data was interpreted as indicating only 1 trench in eastern leg
1998	RFI cover investigation	Asphalt cover Soil immediately beneath cover	Radioactivity Radionuclides TCLP metals SVOCs PCBs Tritium Moisture content	Pu-239 concentrations greater than background/fallout at east and west end of MDA B No H3 detected Average moisture content was 10.9%
1998	RFI characterization	Surface soils west, northeast, and north of MDA B Subsurface soils beneath MDA B	Radionuclides Organics Inorganics	Slightly elevated Pu-239, Am-231 and Pb concentrations along edges of asphalt pad

Table B-3 (continued)

Date	Activity	Location	Analyses Requested	Activity Summary
1998	Geophysical surveys	Surface of MDA B	High sensitivity metal detection Terrain conductivity Ground-penetrating radar	Confirmed SAGE geophysical interpretation of single trench in east leg of area Data interpreted a single trench in west leg of area
1998	Angle borehole installation (7)	Beneath MDA B	Radioactivity Radionuclides Moisture content VOCs (pore gas)	H3 greater than background in at least 1 sample in all 7 boreholes H3 greater than background in all but 1 of BH4 samples Beryllium metal shavings in BH4 Almost every VOC detected in soil gas at every depth in BH7 Toluene detected in every borehole at every depth TCA detected in every borehole at every depth except BH2 at 75 ft.
2001	Surface soil sampling	Surface soils north and west of MDA B	Isotopic Pu	Pu-239 greater than background in 2 samples on north side MDA B and 2 samples on west side
2001	EMFLUX® survey	Surface of MDA B	VOCs	Tetrachloroethene and trichloroethene detected from soil gas emissions within boundaries of the identified waste trenches

Table B-4
Radionuclide Results from 1966 Borehole Investigation,
As Presented in the TA-21 RFI Work Plan

TABLE 16.2-XII
RADIOCHEMICAL ANALYSES OF SOIL AND TUFF FROM TEST HOLES DPS-1, 3, & 5
(DRILLED IN 1966)

Depth (feet)	Material	Gross alpha (d/m/g)[a]			Gross beta-gamma (d/m/g)[a]			Plutonium (d/m/g)[a]	Uranium (µg/g)[b]
		DPS-1 DPS-1, 3, 5		DPS-3 DPS-1, 3, 5	DPS-5		DPS-1	DPS-3	DPS-5
0-1	Soil	0.4	1.2	0.5	3.1	12.6	4.5	<0.4	<0.5
1-2	Soil	0.5	0.3	0.9	3.0	4.3	4.8	<0.4	<0.5
2-3	Soil	0.7	0.1	0.3	3.6	1.6	2.7	<0.4	<0.5
3-5	Tuff	0.3	0.1	0.1	2.4	1.5	3.4	<0.4	<0.5
5-10	Tuff	0.3	0.6	0.1	6.0	1.3	1.5	<0.4	<0.5
10-15	Tuff	0.6	0.3	0.4	2.7	0.0	3.6	<0.4	<0.5
15-20	Tuff	0.7	0.1	0.3	3.6	0.0	1.3	<0.4	<0.5
20-25	Tuff	0.4	0.1	0.3	2.2	0.1	1.6	<0.4	<0.5
25-30	Tuff	0.3	0.1	1.0	1.0	0.1	7.6	<0.4	<0.5
30-35	Tuff	0.2	0.5	0.5	1.2	1.6	3.1	<0.4	<0.5
35-40	Tuff	0.3	0.4	0.2	0.6	0.7	0.9	<0.4	<0.5
40-45	Tuff	0.4	0.0	0.2	1.2	0.1	2.5	<0.4	<0.5
45-50	Tuff	0.4	0.1	0.3	0.0	0.7	4.6	<0.4	<0.5

[a] Disintegrations per minute per gram.
[b] Micrograms per gram.

Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529)

Table B-4 (continued)

TABLE 16.2-XIII
RADIOCHEMICAL ANALYSES OF SOIL AND TUFF FROM TEST HOLES DPS-2 & 4
(DRILLED IN 1966)

Depth (feet)	Material	Gross alpha (d/m/g)[a]		Gross beta-gamma (d/m/g)[a]		Plutonium (d/m/g)[a]	Uranium (µg/g)[b]
		DPS-2	DPS-4	DPS-2	DPS-4	DPS-2 & 4	DPS-2 & 4
0-1	Soil	0.9	0.3	9.1	4.3	<0.4	<0.5
1-2	Soil	0.5	1.1	2.8	4.9	<0.4	<0.5
2-3	Soil	0.8	0.0	0.6	0.0	<0.4	<0.5
3-5	Tuff	0.6	0.2	0.3	0.0	<0.4	<0.5
5-10	Tuff	0.3	0.3	1.8	1.9	<0.4	<0.5
10-15	Tuff	0.6	0.1	2.5	1.3	<0.4	<0.5
15-20	Tuff	0.6	0.5	3.3	0.6	<0.4	<0.5
20-25	Tuff	0.5	0.9	2.1	4.6	<0.4	<0.5

[a] Disintegrations per minute per gram.
[b] Micrograms per gram.

Table B-4 (continued)

TABLE 16.2-XIV
RADIOCHEMICAL ANALYSES OF SOIL AND TUFF FROM TEST HOLES DPS-6, 8, & 11
(DRILLED IN 1966)

Depth (feet)	Material	Gross alpha (d/m/g)[a]			Gross beta-gamma (d/m/g)[a]			Plutonium (d/m/g)[a]	Uranium (µg/g)[b]
		DPS-6 DPS-6, 8, 11		DPS-8 DPS-6, 8, 11	DPS-11		DPS-6	DPS-8	DPS-11
0-2	Soil	0.8	0.6	0.3	6.1	3.3	2.1	<0.4	<0.5
2-5	Soil	0.7	0.5	0.6	4.6	4.9	4.0	<0.4	<0.5
5-10	Soil & tuff	0.8	0.4	0.4	4.0	5.8	1.3	<0.4	<0.5
10-15	Tuff	0.6	0.3	0.5	3.3	3.6	1.9	<0.4	<0.5
15-20	Tuff	0.8	0.4	0.5	5.2	2.2	2.8	<0.4	<0.5
20-25	Tuff	1.2	0.4	0.5	5.7	1.3	1.2	<0.4	<0.5
25-30	Tuff	0.8	0.1	0.7	3.4	1.0	3.0	<0.4	<0.5
30-35	Tuff	0.5	0.6		2.7	3.4		<0.4	<0.5
35-40	Tuff	0.3	0.2	0.6	3.6	4.9	1.9	<0.4	<0.5
40-45	Tuff	0.2	0.4	0.9	2.8	4.6	2.7	<0.4	<0.5
45-50	Tuff	0.2	0.4	0.5	3.0	3.0	1.8	<0.4	<0.5

[a]Disintegrations per minute per gram.
[b] Micrograms per gram.

Table B-4 (continued)

TABLE 16.2-XV
RADIOCHEMICAL ANALYSES OF SOIL AND TUFF FROM TEST HOLES DPS-7&9
(DRILLED IN 1966)

Depth (feet)	Material	Gross alpha (d/m/g)[a]		Gross beta-gamma (d/m/g)[a]		Plutonium (d/m/g)[a]	Uranium (µg/g)[b]
		DPS-7	DPS-9	DPS-7	DPS-9	DPS-7 & 9	DPS-7 & 9
0-2	Soil	1.2	0.7	3.9	2.4	<0.4	<0.5
2-5	Soil & Tuff	0.6	0.5	3.9	2.1	<0.4	<0.5
5-10	Tuff	0.2	0.4	1.3	3.7	<0.4	<0.5
10-15	Tuff	0.3	0.5	1.5	1.8	<0.4	<0.5
15-20	Tuff	0.5	0.5	2.4	3.7	<0.4	<0.5
20-25	Tuff	0.4	0.3	2.7	1.0	<0.4	<0.5

[a] Disintegrations per minute per gram.
[b] Micrograms per gram.

TABLE 16.2-XVI
RADIOCHEMICAL ANALYSES OF SOIL AND TUFF FROM TEST HOLES DPS10, 12, & 13
(DRILLED IN 1966)

Depth (feet)	Material	Gross alpha (d/m/g)[a]			Gross beta-gamma (d/m/g)[a]			Plutonium (d/m/g)[a]	Uranium (µg/g)[b]
		DPS-10	DPS-12	DPS-13	DPS-10	DPS-12	DPS-13	DPS-10, 12, 13	DPS-10, 12, 13
0-2	Soil	0.4	0.8	1.0	3.1	1.2	4.3	<0.4	<0.5
2-5	Soil & tuff	0.3	0.4	0.7	3.0	1.6	0.0	<0.4	<0.5
5-10	Tuff	0.8	0.4	0.4	2.5	0.4	2.1	<0.4	<0.5
10-15	Tuff	0.6	0.3	0.7	2.7	1.0	2.8	<0.4	<0.5
15-20	Tuff	0.6	0.4	0.6	4.3	0.0	0.0	<0.4	<0.5
20-25	Tuff	0.5	0.5	0.8	2.7	3.0	0.9	<0.4	<0.5
25-30	Tuff	0.2	0.8	0.9	2.1	0.9	1.9	<0.4	<0.5
30-35	Tuff	1.0	0.4	0.4	0.7	0.6	0.4	<0.4	<0.5

[a] Disintegrations per minute per gram.
[b] Micrograms per gram.

Table B-5
Radionuclide Results from 1977 Soil Sampling,
As Presented in the TA-21 RFI Work Plan

TABLE 16.2-II
MDA B SOIL SURVEY SAMPLES (1977)

Lab. Sample Number	I.D. Number	Gross a pCi/g	Gross c pCi/g	Tritium nCi/l	TOTAL Uranium mg/g	^{241}Am pCi/g	^{238}Pu pCi/g	$^{239/240}Pu$ pCi/g	^{137}Cs pCi/g
	BKGD.[a,b]			7.20[a]	3.4[a]	0.023[b]	0.005[a]	0.025[a]	1.09[a]
77.06540	BS-1	4.40	3.70	11.80[c]					
77.06541	BS-2	4.30	4.30	13.80[c]					
77.06542	BS-3	16.00[c]	5.70	12.20[c]					7.65[c]
77.06543	BS-4	8.60	8.60c	18.00[c]					
77.06544	BS-5	5.10	3.20	16.40[c]					
77.06545	BS-6	8.80	6.40	14.10[c]					
77.06546	BS-7	9.10	5.40	16.90[c]					
77.06547	BS-8	7.30	7.30	37.10[c]					
77.06548	BS-9	11.00[c]	6.50	26.70[c]					
77.06549	BS-10	6.20	4.30	12.50[c]					
77.06550	BS-11	46.00[c]	5.40	513.00[c]			1.40[c]	0.01	10.10[c]
77.06551	BS-12	4.40	5.10	14.50[c]					
77.06552	BS-13	11.00[c]	4.30	11.80[c]					
77.06553	BS-14	5.80	7.00	4.60					
77.06554	BS-15	5.30	4.50	10.00[c]					
77.06555	BS-16	5.10	4.60	17.20[c]					
77.06556	BS-17	6.40	6.60	9.40[c]					
77.06557	BS-18	3.00	4.10	17.10[c]					
77.06558	BS-19	5.80	6.10	15.20[c]					
77.06559	BS-20	6.10	5.70	17.40[c]					
77.06560	BS-21	5.70	6.50	22.10[c]					
77.06561	BS-22	27.00c	6.50	51.40[c]	7.70c		0.63c	47.60[c]	0.07
77.06562	BS-23	6.20	3.80	23.20[c]					
77.06563	BS-24	3.80	3.80	17.50[c]					
77.06564	BS-25	4.50	5.40	18.60[c]					
77.06565	BS-26	6.20	4.20	19.70[c]					

Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529)

Table B-5 (continued)

TABLE 16.2-II
MDA B SOIL SURVEY SAMPLES (1977)

Lab. Sample Number	I.D. Number	Gross a pCi/g	Gross c pCi/g	Tritium nCi/l	TOTAL Uranium mg/g	^{241}Am pCi/g	^{238}Pu pCi/g	$^{239/240}Pu$ pCi/g	^{137}Cs pCi/g
	BKGD.[a,b]			7.20[a]	3.4[a]	0.023[b]	0.005[a]	0.025[a]	1.09[a]
77.06566	BS-27	15.00c	2.70	18.00[c]	2.70	1.12[c]			0.11
77.06567	BS-28	30.00c	3.90	22.70[c]	2.70	0.90[c]	0.06c	25.70[c]	0.53
77.06568	BS-29	3.90	4.40	15.40[c]	5.00[c]				0.87
77.06569	BS-30	8.40	31.00[c]	12.50[c]	5.70[c]	0.45[c]			1.31[c]
77.06570	BS-31	3.80	3.40	11.40[c]					
77.06571	BS-32	1.30	2.80	15.90[c]					
77.06572	BS-33	8.50	9.00[c]	11.90[c]	0.01				2.04[c]
77.06573	BS-34	5.90	5.50	12.30[c]					
77.06574	BS-35	13.00c	8.60[c]	22.10[c]	14.00c	2.10[c]			1.45[c]
77.06575	BS-36	26.00c	7.70	3420.00[c]	0.00	1.76c	0.14c	16.80[c]	1.11[c]
77.06576	BS-37	15.00c	7.40	152.00[c]	4.60[c]	3.70[c]		5.80[c]	1.60[c]
77.06577	BS-38	9.20	7.00	26.20[c]					
77.06578	BS-39	4.00	4.50	14.60[c]					
77.06579	BS-40	2.90	4.30	11.60[c]					
77.06580	BS-41	12.00c	3.30	2.89	3.40	1.40[c]	0.00	9.20[c]	0.42
77.06581	BS-42	3.30	4.60	12.00[c]					
77.08455	BS-43			12.10[c]	5.10[c]				0.60
77.08456	BS-44			13.80[c]	4.30[c]				0.89
77.08457	BS-45			13.40[c]	8.80[c]				1.59[c]
77.08458	BS-46			11.20[c]	7.40[c]				2.50[c]
77.08459	BS-47			.780	4.00[c]				0.56
77.08460	BS-48			.880	5.10[c]				1.65[c]
77.08461	BS-49			18.60[c]	7.90[c]				1.38[c]
77.08462	BS-50			14.50[c]	8.30[c]				0.37
77.08463	BS-51			8.50	6.60[c]				1.49[c]
77.06582	BPS-1A	6.30	4.30	10.70					
77.06583	BPS-1B	240.00[c]	350.00[c]	9.50				-0.04	2.50[c]
77.07684	BPS-2	1600.00[c]	137.00[c]	11.30[c]	79.00[c]		0.02[c]	7.61[c]	0.80

Table B-5 (continued)

TABLE 16.2-II
MDA B SOIL SURVEY SAMPLES (1977)

Lab. Sample Number	I.D. Number	Gross a pCi/g	Gross c pCi/g	Trifium nCi/l	TOTAL Uranium mg/g	^{241}Am pCi/g	^{238}Pu pCi/g	$^{239/240}Pu$ pCi/g	^{137}Cs pCi/g
	BKGD.[a,b]			7.20[a]	3.4[a]	0.023[b]	0.005[a]	0.025[a]	1.09[a]
77.06585	BPS-3	370.00[c]	560.00[c]	7.7	835.00[c]		0.03[c]	22.10[c]	0.89
77.06586	BPS-4	7.10	6.40	983.00[c]					
77.06587	BPS-5	10.00[c]	152.00[c]	21.30[c]	13.00[c]		-0.03	27.80[c]	127.00[c]
77.06588	BPS-6	3.10	99.00[c]	.345			0.79[c]		
77.06589	BPS-7	200.00[c]	5.60	24.80[c]	5.40[c]	71.00[c]	5.00[c]	257.00[c]	0.48
77.06590	BPS-8	6200.00[c]	-15.00	7.30	9.70[c]	233.00[c]		130.00[c]	1.03
77.06591	BPS-9	17.00[c]	8.50[c]	24.80[c]	6.30[c]	52.20[c]	0.78[c]	51.90[c]	0.92
77.06592	BPS-11	2000.00[c]	18.00[c]	31.70[c]	8.10[c]		27.10[c]	1370.00[c]	0.71
	BPS-12A			43.60[c]			20.00[c]	0.00	0.00
	BPS-12B			11.62[c]	100.00[c]	0.00	0.00	0.00	6.00[c]
	BPS-12C			11.20[c]			0.00	0.00	0.00
	BPS-12D			175.00[c]	1.90		0.00	0.00	0.43
	BPS-12E			24.30[c]				0.00	0.00
	BPS-13			58.20[c]					

[a]Upper limit background levels from Purtymun (1987).
[b]Upper limit background levels from The Environmental & Surveillance Group (1980).
[c]Above background activity.

Table B-6
Radionuclide Results from 1978 Reanalysis of 1977 Soil Samples,
As Presented in the TA-21 RFI Work Plan

TABLE 16.2-III
MDA B SOIL SURVEY SAMPLES (1978)

Loc.	$^{239,240}Pu$ pCi/g	^{90}Sr pCi/g	^{226}Ra pCi/g	Th mg/g	Other
BKGD.[a]	.025[a]	.88[a]	.005[b]		
BS-1	8.37±0.03	0.72±0.08	1.2±0.3	10.8±.6	0.53±0.07 ^{137}Cs -0.3±0.4 ^{227}Ac
BS-2	0.975±0.017		0.9±0.5	10.8±6	0.71±0.10 ^{137}Cs -0.9±0.4 ^{227}Ac
BS-3	6.92±0.07	0.53±0.07	0.9±0.3	11.3±.6	1.30±0.13 ^{137}Cs 0.1±0.9 ^{227}Ac
BS-4	3.77±0.05		1.4±0.3	11.7±.6	1.06±0.08 ^{137}Cs 0.0±0.2 ^{227}Ac
BS-5	0.438±0.013	1.66±0.11	1.3±0.2	11.6±.6	0.20±0.05 ^{137}Cs 0.0±0.5 ^{227}Ac
BS-6	14.36±0.12		1.19±0.17	10.2±.6	0.92±0.08 ^{137}Cs -0.5±0.5 ^{227}Ac
BS-7	8.19±0.08	1.27±0.11	0.73±0.13	11.8±.6	0.80±0.08 ^{137}Cs 0.1±0.5 ^{227}Ac
BS-8	3.03±0.04		1.3±0.3	13.0±6	1.39±0.14 ^{137}Cs 0.3±0.9 ^{227}Ac
BS-9	9.34±0.10	0.70±0.09	1.7±0.4	11.3±.6	1.14±0.14 ^{137}Cs -2.0±1.1 ^{227}Ac
BS-10	4.42±0.04		1.7-0.4	10.3±.6	0.49±0.07 ^{137}Cs 0.8±0.5 ^{227}Ac
BS-11			1.6±0.2		1.03±0.07 ^{137}Cs pci/g
					0.80±0.20 ^{241}Am pci/g
BS-12	0.718±0.015	1.54±0.10	1.54±0.18	13.4±.6	1.25±0.14 ^{137}Cs -0.8±1.0 ^{227}Ac
BS-13	0.908±0.018		1.23±0.11	12.4±.6	0.78±0.05 ^{137}Cs 0.2±0.2 ^{227}Ac
BS-14	11.91±0.12	1.73±0.11	1.07±0.10	10.2±.6	1.06±0.08 ^{137}Cs -0.1±0.4 ^{227}Ac
BS-15	1.73±0.03		1.09±0.14	13.2±.6	0.84±0.07 ^{137}Cs 0.0±0.4 ^{227}Ac
BS-16	6.19±0.06	0.55±0.13	1.39±0.12	13.3±.6	1.06±0.06 ^{137}Cs 0.2±0.2 ^{227}Ac
BS-17	1.12±0.03		1.34±0.10	12.0±.6	1.87±0.11 ^{137}Cs -0.5±0.5 ^{227}Ac
BS-18	7.59±0.08	0.78±1.2	1.15±0.14	13.3±.6	0.79±0.06 ^{137}Cs 0.2±0.2 ^{227}Ac
BS-19	0.765±0.018		1.30±0.11	12.5±.6	0.85±0.07 ^{137}Cs -0.7±0.6 ^{227}Ac
BS-20	1.16±0.03		1.0±0.3	11.9±.6	1.00±0.08 ^{137}Cs -0.4±0.5 ^{227}Ac
BS-21	6.9±0.1		1.1±0.3	12.4±.6	1.69±0.10 ^{137}Cs 0.4±0.3 ^{227}Ac
BS-22	36.5±0.8		1.2±0.4	10.8±.6	0.27±0.05 ^{137}Cs -0.5±0.4 ^{227}Ac
BS-23	2.69±0.04		1.25±0.13	11.3±.6	0.49±0.06 ^{137}Cs -0.2±0.5 ^{227}Ac
BS-24	1.27±0.03		1.7±0.4	12.4±.6	0.80±0.08 ^{137}Cs 0.1±0.6 ^{227}Ac
BS-25	1.27±0.02		1.2±0.3	10.9±.6	0.94±0.07 ^{137}Cs 0.3±0.3 ^{227}Ac
BS-26	5.09±0.06		1.3±0.3	12.8±.6	0.53±0.07 ^{137}Cs 0.0±0.5 ^{227}Ac
BS-27	11.64±0.11	0.7±0.1	0.5±0.3	9.8±.6	0.29±0.05 ^{137}Cs 0.0±0.5 ^{227}Ac
BS-28	34.2±0.6		1.0±0.3	8.1±.6	0.49±0.06 ^{137}Cs -0.6±0.6 ^{227}Ac
BS-29	0.536±0.018		0.85±0.11	15.1±.6	1.01±0.10 ^{137}Cs -0.4±0.6 ^{227}Ac
BS-30	7.60±0.07		1.7±0.3	14.2±.6	1.30±0.08 ^{137}Cs 0.1±0.3 ^{227}Ac
BS-31	0.718±0.017	2.24±0.13	1.06±0.10	13.0±.6	1.31±0.09 ^{137}Cs -0.5±0.6 ^{227}Ac
BS-32	0.131±0.008		1.9±0.3	13.1±.6	0.45±0.05 ^{137}Cs 0.7±0.4 ^{227}Ac
BS-33	3.21±0.04	0.74±0.09	1.4±0.3	14.3±.6	2.29±0.13 ^{137}Cs -0.5±0.5 ^{227}Ac
BS-34	0.399±0.013		0.6±0.2	11.3±.6	1.24±0.10 ^{137}Cs 0.2±0.3 ^{227}Ac
BS-35	12.6±0.3		1.8±0.4	10.3±.6	1.82±0.11 ^{137}Cs -0.7±0.6 ^{227}Ac
BS-36	16.9±0.2		1.1±0.4	12.4±.6	1.13±0.07 ^{137}Cs 0.0±0.3 ^{227}Ac
BS-37	9.56±0.19		1.17±0.13	10.9±.6	1.65±0.12 ^{137}Cs -0.4±0.5 ^{227}Ac
BS-38	5.25±0.07		1.13±0.14	12.0±.6	0.72±0.06 ^{137}Cs -0.3±0.5 ^{227}Ac
BS-39	0.86±0.02	1.51±0.12	1.33±1.5	23.0±.6	0.68±0.07 ^{137}Cs 0.0±0.5 ^{227}Ac
BS-40	0.751±0.018		1.6±0.3	14.8±.6	0.43±0.05 ^{137}Cs -0.4±0.5 ^{227}Ac
BS-41	12.67±0.12	1.5±0.1	1.19±0.14	10.1±.6	0.57±0.04 ^{137}Cs 0.1±0.2 ^{227}Ac

Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529)

Table B-6 (continued)

TABLE 16.2-III
MDA B SOIL SURVEY SAMPLES (1978)

Loc.	$^{239,240}Pu$ pCi/g	^{90}Sr pCi/g	^{226}Ra pCi/g	Th mg/g	Other
BKGD.[a]	.025[a]	.88[a]	.005[b]		
BS-42	1.50±0.03		0.8±0.2	11.0±.6	0.83±0.06 ^{137}Cs 0.3±0.4 ^{227}Ac
BS-43	0.751±0.019	0.77±0.1	1.0±0.3	11.7±.6	0.71±0.07 ^{137}Cs 0.1±0.5 ^{227}Ac
BS-44	0.089±0.006		0.46±0.11	8.7±.6	0.91±0.06 ^{137}Cs -0.3±0.4 ^{227}Ac
BS-45	1.051±0.018	1.0±0.1	1.4±0.4	12.1±.6	1.95±0.12 ^{137}Cs -0.2±0.4 ^{227}Ac
BS-46	2.874±0.018		0.2±0.6	10.9±.6	2.80±0.19 ^{137}Cs -0.4±0.7 ^{227}Ac
BS-47	0.189±0.008	0.5±0.1	0.8±0.2	10.8±.6	0.52±0.08 ^{137}Cs -0.2±0.6 ^{227}Ac
BS-48	0.198±0.007		1.4±0.3	12.2±.6	1.67±0.10 ^{137}Cs 0.7±0.5 ^{227}Ac
BS-49	1.65±0.02	1.68±0.14	0.99±0.06	10.0±.6	1.56±0.09 ^{137}Cs -0.2±0.3 ^{227}Ac
BS-50	3.60±0.05		1.30±0.14	12.8±.6	0.42±0.05 ^{137}Cs 0.3±0.3 ^{227}Ac
BS-51	1.64±0.03	2.04±0.17	1.2±0.4	12.7±.6	1.67±0.10 ^{137}Cs -0.5±0.5 ^{227}Ac
BPS 2			12.9±.08		0.60±0.05 ^{137}Cs pci/g 0.00±0.50 ^{241}Am pci/g
BPS 5			17.5±1.3		131 ±9.00 ^{137}Cs pci/g 0.40±0.20 ^{241}Am pci/g
BPS 8			1.4±0.3		0.98±0.08 ^{137}Cs pci/g 240.0±12.0 ^{241}Am pci/g

[a]Upper limit background levels from Purtymun (1987).
[b]The upper limit background level for ^{226}Ra is the same as that for ^{238}U which is from Purtymun (1987).

Table B-7
Radionuclide Results from 1979 Soil Sampling,
As Presented in the TA-21 RFI Work Plan

TABLE 16.2-IV
MDA B PERIMETER SOIL SURVEY SAMPLES (1979)[a]

Sample Number (cm)	Sample Location	Sample Depth	Tritium Value (pCi/l)	+/-	Uranium Value (µg/g)	+/-	^{238}Pu Value (pCi/g)	+/-	$^{239/240}Pu$ Value (pCi/g)	+/-	^{137}Cs Value (pCi/g)	+/-	^{227}Ac Value (pCi/g)	+/-
BKGD.[b,c]			720[b]		3.4[b]		0.0050[b]		0.025[b]		1.09[b]		0.04[c]	
79.04417	BKGD.[d]	0-1	800	300	3.5	0.4	0.0110	0.0020	0.201	0.008	0.93	0.06	-0.3	0.3
79.04418	BKGD.[d]	1-10	1600	400	3.8	0.4	0.0037	0.0014	0.330	0.010	1.21	0.08	0.1	0.3
79.04419	BS-1	0-1	2100	400	6.7	0.7	-0.0007	0.0015	0.657	0.015	0.30	0.07	-1.5	0.7
79.04420	BS-1	1-10	2200	400	4.8	0.5	0.0005	0.0014	0.851	0.019	0.90	0.09	0.1	0.7
79.04421	BS-1	10-30	0	300	4.0	0.4	0.0007	0.0011	0.089	0.005	0.29	0.09	1.4	0.8
79.04422	BS-2	0-1	1900	400	5.0	0.5	0.0130	0.0020	3.330	0.040	0.65	0.05	-0.1	0.4
79.04423	BS-2	1-10	2600	400	4.2	0.4	0.0150	0.0030	3.500	0.040	0.55	0.06	0.1	0.4
79.04424	BS-2	10-30	1900	400	4.8	0.5	0.0150	0.0020	4.010	0.040	0.49	0.06	-0.7	0.8
79.04425	BS-3	0-1	700	300	7.0	0.7	0.0420	0.0040	3.160	0.040	3.23	0.19	-0.3	0.9
79.04426	BS-3	1-10	2300	400	8.7	0.9	0.0440	0.0040	5.870	0.070	2.06	0.13	-0.4	0.6
79.04427	BS-3	10-30	1800	400	3.9	0.4	0.0040	0.0015	1.188	0.019	0.31	0.16	-1.0	1.5
79.04428	BS-4	0-1	4700	400	7.0	0.7	-0.0019	0.0009	2.160	0.030	1.63	0.12	-0.1	0.8
79.04429	BS-4	1-10	25700	600	5.4	0.5	0.0290	0.0030	3.140	0.040	0.53	0.06	0.0	0.5
79.04430	BS-5	0-1			5.0	0.5	0.0970	0.0050	15.500	0.130				
79.04431	BS-5	1-10			110.0	10.0	0.0290	0.0030	2.350	0.030				
79.04432	BS-5	10-30			7.2	0.7	0.0170	0.0030	24.700	0.200				
79.04433	BS-5	10-30			56.0	6.0	0.0190	0.0030	24.900	0.200				

[a]The ± values reported for each radionuclide are analytical laboratory uncertainty.
[b]Upper limit background levels from Purtymun (1987).
[c]The upper limit background level for Actinium 227 is the same as Uranium 235. The upper limit background level for ^{235}U was derived from Purtymun's upper limit background level for total Uranium.
[d]These samples, taken approximately 200 ft west of MDA B, were intended to document background concentrations near MDA B; however, $^{239/240}Pu$ levels in these samples were eight times the background level.

Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529)

Table B-8
Radionuclide Results for 1980 Vegetation Samples,
As Presented in the TA-21 RFI Work Plan

TABLE 16.2-V
1980 MDA B AND GUAJE CANYON VEGETATION SURVEY SAMPLES[a]

Sample Number BKGD.[b,c]	Sample Location	Species	Tritium Value (pCi/l) 800[b]	+/-	^{235}U Value (ppb) 156[c]	+/-	^{238}Pu Value (pCi/g) 0.00015[b]	+/-	$^{239/240}Pu$ Value (pCi/g) 0.00023[b]	+/-
	MDA B									
80.05340	1	Yucca	1400	300	160	50	-0.0040	0.0040	0.0160	0.0060
80.05341	1	Artemesia	-1800	300	1310	130	-0.0040	0.0030	0.1170	0.0150
80.05342	2	Juniper	600	300	930	100	0.0013	0.0005	0.0640	0.0030
80.05343	3	Melilotus	2900	300	390	50	0.0030	0.0030	0.2290	0.0130
80.05344	3	Andropagon	7300	400	390	50	0.0075	0.0018	0.3170	0.0130
80.05345	3	Quercus	809000	13000	1230	130	0.0043	0.0012	0.0490	0.0030
80.05346	4	Cercocarpus	2400	300	790	80	0.0023	0.0007	0.0930	0.0040
80.05347	4	Quercus	3000	300	1020	100	0.0104	0.0014	0.5100	0.0150
80.05348	4	Andropagon	2300	300	590	60	0.0019	0.0012	0.0770	0.0060
80.05349	5	Guttieriezia	543000	9000	930	100	0.0580	0.0030	0.1160	0.0040
80.05350	5	Bouteloua	29900	700	9950	1000	0.0020	0.0030	0.5200	0.0200
80.05351	5	Verbascum	374000	6000	1740	180	0.0044	0.0014	0.2500	0.0100
	Guaje Controls									
80.06867		Hochia Scoparia					-0.0005	0.0013	0.0070	0.0030
80.06868		Mylilotur					-0.0010	0.0020	0.0070	0.0030
80.06869		Quercus Gambelli					0.0021	0.0019	0.0030	0.0040
80.06870		Artemesia					0.0004	0.0013	0.0120	0.0020
80.06871		Bramus tectorium (dead)					0.0004	0.0003	0.0140	0.0010
80.06872		Bouteloua gracilis					0.0012	0.0014	0.0190	0.0030
80.06873		Pinus ponderosa					0.0020	0.0030	0.0680	0.0080
80.06874							0.0102	0.0018	0.2840	0.0100
80.06875		Pinus edulis					0.0034	0.0014	0.0500	0.0050
80.06876		Juniperus monosperma					-0.0003	0.0010	0.0370	0.0030

[a]The ± values reported for each radionuclide are analytical laboratory uncertainty.
[b]Upper limit background levels from The Environmental & Surveillance Group (1987).
[c]Upper limit background level for U-235 calculated from the upper limit background level for total uranium provided by The Environmental & Surveillance Group (1987).

Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529)

Table B-9
Radionuclide Results for Peaches Collected in 1981,
As Presented in the TA-21 RFI Work Plan

TABLE 16.2-VI
MDA B VEGETATION SURVEY SAMPLE: PEACHES[a]

Sample Number	Sample Location	Sample Depth (cm)	Tritium Value (pCi/l)	+/-	^{238}Pu Value (pCi/g)	+/-	$^{239/240}Pu$ Value (pCi/g)	+/-	^{90}Sr Value (pCi/g)	+/-
BKGD.[b]			800[b]		0.00015[b]		.00023[b]			
81.07118	PEELS	LOWER	1400	500	0.0220	0.0080	0.0740	0.0130	-0.0400	0.0800
81.07119	PEELS	MIDDLE	1400	900	0.1200	0.0120	0.0750	0.0100	0.0900	0.1000
81.07120	PEELS	TOP	7800	700	0.0380	0.0080	0.0350	0.0080	0.1000	0.0800
81.07121	PULP	LOWER	4200	400	0.0110	0.0030	0.0210	0.0040	-0.0700	0.0500
81.07122	PULP	MIDDLE	7200	1000	0.0110	0.0020	0.0100	0.0020	0.0400	0.0600
81.07123	PULP	TOP	1700	400	0.0080	0.0030	0.0210	0.0040	-0.0900	0.0800
81.07124	PITS	LOWER	3600	400	0.0230	0.0060	0.0350	0.0080	-0.0100	0.1000
81.07125	PITS	MIDDLE	2900	400	0.0630	0.0150	0.0750	0.0160	0.1000	0.2000
81.07126	PITS	TOP	800	400	0.0600	0.0140	0.0270	0.0100	-0.1700	0.1100

aThe ± values reported for each radionuclide are analytical laboratory uncertainty.
b Upper background levels from The Environmental & Surveillance Group (1987).

Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529)

Table B-10
Radionuclide Results for Vegetation Samples Collected in 1982,
As Presented in the TA-21 RFI Work Plan

TABLE 16.2-VII
ARITHMETIC MEAN, STANDARD DEVIATION, AND COEFFICIENT
OF VARIATION FOR RADIONUCLIDE RESULTS

Sample Type	N	Sc (ppb dry) $\bar{X} \pm 1\sigma$	Sc COV	U (ppb dry) $\bar{X} \pm 1\sigma$	U COV	^{137}CS (fCi/g dry) $\bar{X} \pm 1\sigma$	^{137}CS COV	$^{239/240}$Pu (fCi/g dry) $\bar{X} \pm 1\sigma$	$^{239/240}$Pu COV
BKGD.				.0096		2060		.23	
Ponderosa Pine 5 - growing in waste									
Soil around waste debris (>100 cm)	6	2660±434	0.16	5070±581	0.11	168±267	1.6	578000±323000	0.56
Litter - pine needles	2	111±11.3	0.10	430±20.5	0.048	385±28.3	0.074	3570±764	0.21
Litter - misc.	1	262		585		423		7210	
Unbagged needles	3	10.4±.912	0.088	63.3±8.61	0.14	23.1±13.4	0.58	21.6±5.84	0.27
Bole bark	2	9.94±8.86	0.89	70.1±49.4	0.70	28.2±36.8	1.3	10400±5830	0.56
Bole wood	5	0.631±.0524	0.083	0.385±.195	0.51	8.50±11.21	1.3	5.27±1.59	0.30
Root wood	5	3.78±7.22	1.9	10.1±14.5	1.4	-0.699±1.96	2.8	250±328	1.3
Root bark	4	141±96.0	0.68	314±199	0.63	3.80±6.56	1.7	23900±31000	1.3
Ponderosa Pine - all remaining									
Soil 2 cm	3	2510±382	0.15	5630±793	0.14	1075±389	0.36	5650±7340	1.3
Soil 10 cm	3	2540±366	0.14	5290±497	0.094	289±266	0.92	4720±6180	1.3
Soil 25 cm, 30 cm	4	3070±760	0.25	4430±1030	0.23	110±96.3	0.88	1230±1270	1.0
Soil 45-55, 80 cm	2	2840±368	0.13	4415±827	0.19	186±335	1.8	884±702	0.79
Soil 150-160 cm	1	2450		4180		-46.9		1020	
Litter - pine needles	7	164±72.2	0.44	426±229	0.54	459±161	0.35	217±102	0.47
Litter - misc.	4	454±322	0.71	867±528	0.61	628±356	0.57	816±741	0.91
Unbagged needles	14	20.0±9.48	0.47	76.7±93.2	1.2	77.9±39.6	0.51	13.0±12.1	0.93
Bole bark	11	43.3±35.6	0.82	74.4±60.7	0.82	30.4±35.7	1.2	557±875	1.6
Bole wood	16	0.391±.538	1.4	0.996±1.36	1.4	3.71±6.52	1.8	1.52±2.25	1.5
Root wood	2	14.3±18.1	1.3	36.3±28.7	0.79	-1.62±6.92	4.3	164±211	1.3
Root bark	4	2.80±5.20	1.9	412±445	1.1	15.5±25.4	1.6	997±1940	1.9

Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529)

Table B-10 (continued)

TABLE 16.2-VII (continued)

Sample Type BKGD.[o]	N	Sc (ppb dry) X ± 1σ	COV	U (ppb dry) X± 1σ	COV .0096[o]	^{137}CS (fCi/g dry) X± 1σ	COV 2060[o]	$^{239/240}Pu$ (fCi/g dry) X± 1σ	COV .23[o]
Peach and Elm (Deciduous trees)									
Soil 2 cm	1	4000		3730		476		18100	
Soil 10 cm	1	4300		3240		383		29500	
Soil 25 cm, 30 cm	1	3770		3720		189		7850	
Soil 80 cm	1	3210		3800		72.7		12100	
Unbagged leaves	4	26.5±15.5	0.58	47.9±18.2	0.38	-34.2		2.63	
Bagged leaves	3	5.18±1.56	0.30	14.4±9.65	0.67	148		4.87	
Bole bark	2	22.5±24.3	1.1	40.0±46.7	1.2	96.0±63.6	0.66	15.3±3.25	0.21
Bole wood	2	0.200±0.0290	0.15	7.68±.488	0.064	1.33±5.43	4.1	4.10±0.431	0.11
Root wood	1	4.77		14.3		-4.27		62.1	
Root bark	1	0.530		602		83.8		4160	
Oak, Chamisa, Ribes, Fallugia (Shrubs)									
Soil 2 cm	3	2850±613	0.22	5900±1850	0.31	1200±560	0.47	14600±9330	0.64
Soil 10 cm	3	3390±1500	0.44	5660±1750	0.31	664±110	0.17	5320±1850	0.35
Soils 25, 30 cm	3	3510±1500	0.43	4170±748	0.18	163±64.0	0.39	1670±759	0.45
Soils 45-55, 80 cm	2	2260±651	0.29	4020±141	0.035	-13.3±35.4	2.7	4140±5310	1.30
Soil 150, 160 cm	1	2730		3770		-35.8		729	
Soil no depth, around waste debris area (>100 cm)	2	3630±2690	0.74	15800±11900	0.75	75.5±7.42	0.098	159000±219000	1.4
Litter - pine needles	1	56.5		96.8		6570		255	
Litter - misc.	2	1100±1190	1.1	1720±1800	1.0	572±366	0.64	14300±18100	1.3
Unbagged leaves	6	23.3±3.67	0.16	62.1±33.3	0.54	28.3±20.6	0.73	36.7±8.15	0.22
Bagged leaves	12	4.86±.848	0.17	21.0±12.8	0.61	26.9±31.4	1.2	5.27±3.76	0.71
Bole bark	3	85.4±73.9	0.87	650±746	1.1	252±219	0.87	98.4±12.4	0.13
Bole wood	3	2.05±2.22	1.1	13.8±7.44	0.54	12.0±9.49	0.79	21.6±3.44	0.16
Root wood	1	39.6		210		-10.4		5.21	
Root bark	1	1.90		6250		121		113	

[a]Table from Wenzel et al. (1987).
[o]Upper limit background levels from The Environmental & Surveillance Group (1987).

Table B-11
Radionuclide Results for 1982 Baseline Soil Sampling,
As Presented in the TA-21 RFI Work Plan

TABLE 16.2-VIII
MDA B SOIL SURVEY SAMPLES[a]

Sample Number	Sample Location	Sample Depth (cm)	Tritium Value (pCi/l)	Tritium +/-	Uranium Value (µg/g)	Uranium +/-	^{238}Pu Value (pCi/g)	^{238}Pu +/-	$^{239/240}Pu$ Value (pCi/g)	$^{239/240}Pu$ +/-
BKGD.[b]			7200[b]		3.40[b]		0.0050[b]		0.0250[b]	
83.02900	1L-10m	0-1	(nCi/l) 134	3	5.40	0.50	0.0150	0.0030	0.6420	0.0170
83.02901	1L-10m	1-10	(nCi/l) 126	3	4.80	0.50	0.0050	0.0030	0.3020	0.0120
83.02902	1L-10m	10-30	(nCi/l) 140	3	3.90	0.40	0.0100	0.0020	1.4900	0.0300
83.02903	1L-20m	0-1	(nCi/l) 112	2	4.10	0.40	0.0060	0.0010	0.3350	0.0100
83.02904	1L-20m	1-10	86400	1400	4.30	0.40	0.0014	0.0000	0.1300	0.0060
83.02905	1L-20m	10-30	17400	400	3.80	0.40	0.0004	0.0010	0.0080	0.0020
83.02906	1L-30m	0-1	(nCi/l) 122	2	4.9	0.50	0.0055	0.0010	0.2990	0.0100
83.02907	1L-30m	1-10	94200	1800	5.1	0.50	0.0042	0.0010	0.1910	0.0090
83.02908	1L-30m	10-30								
83.02909	1L-40m	0-1	58300	1100	6.1	0.60	0.0450	0.0040	5.7700	0.0700
83.02910	1L-40m	1-10	36100	700	5.5	0.60	0.0230	0.0030	3.2900	0.0400
83.02911	1L-40m	10-30	65900	1200	4.3	0.40	0.0090	0.0040	0.7300	0.0200
83.02912	1L-50m	0-1	95000	2000	4.4	0.40	0.0043	0.0010	0.8600	0.0200
83.02913	1L-50m	1-10	89900	1700	4.4	0.40	0.0090	0.0020	1.1300	0.0200
83.02914	1L-50m	10-30	40600	700	4.0	0.40	0.0050	0.0010	0.0700	0.0060
83.02915	1U-10m	0-1			14.8	1.50	0.0350	0.0040	7.0200	0.0100
83.02916	1U-10m	1-10								
83.02917	1U-10m	10-30	20500	500	4.0	0.40	0.0022	0.0010	0.1370	0.0090
83.02918	1U-20m	0-1			6.5	0.70	0 2470	0.0120	42.100	0.5000
83.02919	1U-20m	1-10	68500	1400	5.1	0.50	0.1740	0.0100	29.400	0.3000
83.02920	1U-20m	10-30	49600	1000	3.8	0.40	0.0060	0.0020	0.9100	0.0200
83.02921	1U-30m	0-1								
83.02922	1U-30m	1-10								
83.02923	1U-30m	10-30	53600	900	3.9	0.40	0.0021	0.0010	0.1050	0.0080
83.02924	1U-40m	0-1			5.1	0.50	0.0170	0.0030	3.3300	0.0600
83.02925	1U-40m	1-10			4.5	0.40	0.0051	0.0010	0.4890	0.0170
83.02926	1U-40m	10-30	20100	500	3.9	0.40	0.0010	0.0010	0.0100	0.0020
83.02927	1U-50m	10-30	65100	1100	4.0	0.40	0.0150	0.0030	2.2900	0.0400
83.02928	2C-0m	0-1	(nCi/l) 234	4	3.8	0.40	0.0032	0.0010	7.3400	0.1000
83.02929	2C-0m	1-10	74300	1200	3.8	0.40	0.1420	0.0080	6.5800	0.0900
83.02930	2C-0m	10-30	36500	700	4.1	0.40	0.1470	0.0090	8.0000	0.1000
83.02931	2L-10m	0-1	(nCi/l) 120	2	4.4	0.40	0.0330	0.0040	2.4800	0.0400

Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529)

Table B-11 (continued)

TABLE 16.2-VIII
MDA B SOIL SURVEY SAMPLES[a]

Sample Number	Sample Location	Sample Depth (cm)	Tritium Value (pCi/l)	Tritium +/-	Uranium Value (µg/g)	Uranium +/-	^{238}Pu Value (pCi/g)	^{238}Pu +/-	$^{239/240}Pu$ Value (pCi/g)	$^{239/240}Pu$ +/-
BKGD[b]			7200[b]		3.40[b]		0.0050[b]		0.0250[b]	
83.02932	2L-10m	1-10	59000	1000	4.9	0.50	0.5440	0.0180	33.200	0.0400
83.02933	2L-10m	10-30	83500	1300	4.2	0.40	0.0029	0.0010	0.2320	0.0100
83.02934	2L-20m	0-1	64500	1100	4.4	0.40	0.0057	0.0010	0.5000	0.0170
83.02935	2L-20m	1-10	(nCi/l) 165	3	4.6	0.50	0.0930	0.0070	0.2800	0.0120
83.02937	2L-30m	0-1	(nCi/l) 113	1.9	4.1	0.40	0.0120	0.0070	0.2800	0.0300
83.02938	2L-30m	1-10	80500	1300	4.5	0.40	0.0029	0.0010	0.0620	0.0050
83.02940	2L-40m	0-1	(nCi/l) 137	2	6.3	0.60	0.0200	0.0030	1.3400	0.0300
83.02941	2L-40m	1-10	(nCi/l) 101	1.7	5.1	0.50	0.0017	0.0010	0.1440	0.0070
83.02943	2L-50m	0-1	(nCi/l) 170	3	5.3	0.50	0.0084	0.0010	0.4350	0.0130
83.02944	2L-50m	1-10	(nCi/l) 143	4	4.8	0.50	0.1270	0.0070	0.8200	0.0200
83.02945	2L-50m	10-30	92200	1700	4.2	0.40	0.0340	0.0030	0.0140	0.0020
83.02946	2U-10m	0-1	(nCi/l) 180	3	5.0	0.50	0.0210	0.0040	1.4600	0.0300
83.02947	2U-10m	1-10	59500	1000	4.5	0.50	0.0440	0.0050	4.4900	0.0600
83.02948	2U-10m	10-30	60200	1000	3.7	0.40	0.0090	0.0030	1.0300	0.0200
83.02949	2U-20m	0-1	(nCi/l) 145	3	7.4	0.70	0.1100	0.0200	21.200	2.0000
83.02950	2U-20m	1-10	(nCi/l) 101	1.6	8.4	0.80	0.2010	0.0200	31.800	3.0000
83.02951	2U-20m	10-30	83100	1300	5.0	0.50	0.3460	0.0400	58.500	5.0000
83.02952	2U-30m	0-2	59800	1100	5.1	0.50	0.0110	0.0080	2.9700	0.0500
83.02953	2U-30m	2-10	52800	900	5.9	0.60	0.0470	0.0050	8.5100	0.1100
83.02954	2U-30m	10-30	27800	600	4.2	0.40	0.0031	0.0010	0.4520	0.0160
83.02955	2U-40m	0-1	85200	1500	4.80	0.50	0.0140	0.0030	2.3300	0.0400
83.02956	2U-40m	1-10	42700	800	4.10	0.40	0.0006	0.0010	0.2310	0.0120
83.02957	2U-40m	10-30	20200	500	3.90	0.40	0.0005	0.0010	0.0140	0.0030
83.02958	2U-50m	0-1	70000	1300	3.40	0.30	0.0460	0.0050	6.9800	0.0900
83.02959	2U-50m	1-10	67400	1100	5.90	0.60	0.0100	0.0020	1.8600	0.0300
83.02960	2U-50m	10-30	23200	500	7.30	0.70	0.0270	0.0040	3.8600	0.0600
83.02961	3L-10m	0-1	(nCi/l) 101.7	1.9	4.70	0.50	0.1230	0.0070	25.800	0.3000
83.02962	3L-10m	1-10	91600	1600	4.50	0.50	0.1210	0.0070	20.000	0.2000
83.02963	3L-10m	10-30	87100	1500	4.40	0.40	0.0055	0.0010	0.7840	0.0170
83.02964	3L-20m	0-1	(nCi/l) 118	2	4.20	0.40	0.0113	0.0010	0.6010	0.0130
83.02965	3L-20m	1-10	(nCi/l) 114	3	4.30	0.40	0.0610	0.0040	4.5300	0.0500
83.02966	3L-20m	10-30	(nCi/l) 117	2	4.20	0.40	0.0080	0.0020	0.4910	0.0160

Table B-11 (continued)

TABLE 16.2-VIII
MDA B SOIL SURVEY SAMPLES[a]

Sample Number	Sample Location	Sample Depth (cm)	Tritium Value (pCi/l)	Tritium +/-	Uranium Value (µg/g)	Uranium +/-	^{238}Pu Value (pCi/g)	^{238}Pu +/-	$^{239/240}Pu$ Value (pCi/g)	$^{239/240}Pu$ +/-
BKGD.[b]			7200[b]		3.40[b]		0.0050[b]		0.0250[b]	
83.02967	3L-30m	0-1	(nCi/l) 205	4	7.10	0.70	0.0220	0.0030	1.5300	0.0300
83.02968	3L-30m	1-10	(nCi/l) 774	11	5.30	0.50	0.0470	0.0040	3.0400	0.0400
83.02969	3L-30m	10-30								
83.02970	3L-40m	0-1	(nCi/l) 1301	19	21.20	2.10	0.3060	0.0100	18.600	0.1700
83.02971	3L-40m	1-10	(nCi/l) 174	3	9.80	1.00	0.4220	0.0120	27.000	0.2000
83.02972	3L-40m	10-30								
83.02973	3L-50m	0-1	(nCi/l) 25600	400	5.90	0.60	0.1440	0.0070	8.1600	0.0900
83.02974	3L-50m	1-10	(nCi/l) 7050	100	6.20	0.60	0.1130	0.0070	7.4900	0.0900
83.02975	3L-50m	10-30	(nCi/l) 4740	70	4.50	0.50	0.0080	0.0010	0.3830	0.0130
83.02976	3U-10m	0-1	69600	1200	3.50	0.40	0.0270	0.0040	2.1800	0.0400
83.02977	3U-10m	1-10	67100	1100	3.60	0.40	0.0360	0.0040	5.7300	0.0800
83.02978	3U-10m	10-30								
83.02979	3U-20m	0-1	(nCi/l) 105.9	1.7	3.40	0.40	0.0080	0.0080	1.0500	0.0300
83.02980	3U-20m	1-10	85100	1400	3.70	0.40	0.0050	0.0020	0.9000	0.0300
83.02981	3U-20m	10-30	37800	700	3.40	0.40	0.0006	0.0010	0.4510	0.0170
83.02982	3U-30m	0-1	(nCi/l) 113	1.8	5.80	0.60	0.0770	0.0070	12.310	0.1500
83.02983	3U-30m	1-10	90700	1400	6.70	0.70	0.5770	0.0500	102.20	10.000
83.02985	3U-40m	0-1	(nCi/l) 104.8	1.6	9.20	0.90	0.0190	0.0030	2.7000	0.0500
83.02986	3U-40m	1-10	83000	2000	4.70	0.50	0.0011	0.0010	0.4120	0.0160
83.02987	3U-40m	10-30	37800	700	3.90	0.40	0.0042	0.0010	0.0250	0.0030
83.02991	4C-0m	0-1	84600	1400	4.00	0.40	0.0320	0.0040	2.7000	0.0500
83.02992	4C-0m	1-10	93800	1500	3.70	0.40	0.0200	0.0040	1.8300	0.0400
83.02993	4C-0m	10-30	73800	1300	3.70	0.40	0.0250	0.0030	2.3700	0.0400
83.02994	4L-10m	0-1	(nCi/l) 164	3	4.20	0.40	0.0570	0.0050	4.9800	0.0700
83.02995	4L-10m	1-10	(nCi/l) 183	3	4.50	0.40	0.0490	0.0040	4.3200	0.0600
83.02996	4L-10m	10-30	(nCi/l) 102.2	1.6	4.50	0.40	0.0280	0.0030	2.9200	0.0400
83.02997	4L-20m	0-1	(nCi/l) 219	4	3.30	0.30	0.1510	0.0090	27.400	0.3000
83.02998	4L-20m	1-10	(nCi/l) 497	7	3.50	0.40	0.1900	0.0090	33.700	0.3000
83.02999	4L-20m	10-30	91200	1500	3.90	0.40	0.0760	0.0080	9.5900	0.9000
83.03000	4L-30m	0-1	(nCi/l) 120	14	3.20	0.30	0.3100	0.0300	58.000	6.0000
83.03001	4L-30m	1-10	(nCi/l) 425	7	3.40	0.30	0.4120	0.0160	73.600	0.8000
83.03002	4L-30m	10-30	(nCi/l) 224	4	2.80	0.30	0.3830	0.0130	66.900	0.6000

Table B-11 (continued)

TABLE 16.2-VIII
MDA B SOIL SURVEY SAMPLES[a]

Sample Number	Sample Location	Sample Depth (cm)	Tritium Value (pCi/l)	+/-	Uranium Value (µg/g)	+/-	^{238}Pu Value (pCi/g)	+/-	$^{239/240}Pu$ Value (pCi/g)	+/-
BKGD.[b]			7200[b]		3.40[b]		0.0050[b]		0.0250[b]	
83.03009	4U-10m	0-1	(nCi/l) 124	3	4.90	0.50	0.0200	0.0030	1.7600	0.0300
83.03010	4U-10m	1-10	69400	1100	3.80	0.50	0.0280	0.0040	2.8400	0.0400
83.03012	4U-20m	0-1	(nCi/l) 102	1.7	4.40	0.40	0.0035	0.0010	5.3300	0.0700
83.03013	4U-20m	1-10	72200	1200	3.80	0.40	0.0048	0.0050	5.9400	0.0800
83.03014	4U-20m	10-30	33400	700	3.50	0.40	0.0530	0.0050	6.1300	0.0900
83.03015	4U-30m	0-1	95200	1800	5.80	0.60	0.0150	0.0080	1.3500	0.0300
83.03016	4U-30m	1-10	61800	1000	4.80	0.50	0.0110	0.0020	0.9000	0.0200
83.03017	4U-30m	10-30	26300	600	4.50	0.50	0.0004	0.0010	0.0280	0.0040
83.03018	4U-40m	0-1	75500	1500	4.90	0.50	0.0380	0.0040	5.0800	0.0700
83.03019	4U-40m	1-10	43600	800	5.50	0.60	0.0370	0.0050	5.7600	0.0800
83.03020	4U-40m	10-30	14600	400	4.60	0.50	0.0160	0.0030	2.2500	0.0300
83.03024	1C-0m	0-1	63400	1100	4.10	0.40	0.0004	0.0010	0.0060	0.0010
83.03025	1C-0m	1-10	(nC/l) 119	14	4.30	0.40	0.0006	0.0000	0.0390	0.0030
83.03026	1C-0m	10-30	(nCi/l) 139	3	4.00	0.40	0.0150	0.0030	1.8500	0.0300

[a] The ± values reported for each radionuclide are analytical laboratory uncertainty.
[b] Upper limit background levels from Purtymun (1987).

Table B-12
Radionuclide Results for 1982 Surface Soil Sampling,
As Presented in the TA-21 RFI Work Plan

TABLE 16.2-IX
1982 MDA B SOIL SURVEY SAMPLES[a]

Sample Number	Sample Location	Sample Depth (cm)	Tritium Value (pCi/l)	+/-	Uranium Value (ppm)	+/-	^{238}Pu Value (pCi/g)	+/-	$^{239/240}Pu$ Value (pCi/g)	+/-
BKGD.[b]			7200[b]		3.40[b]		0.0050[b]		0.0250[b]	
82.09371	B-1	0-1	18900	500	4.80	0.50	0.0005	0.0000	0.1160	0.0080
82.09372	B-1	1-6	25800	500	4.60	0.50	0.0022	0.0010	0.1170	0.0080
82.09373	B-2	0-1	31200	600	5.10	0.50	0.0100	0.0020	1.1800	0.0300
82.09374	B-2	1-10	33400	600	4.80	0.50	0.0140	0.0020	2.5900	0.0400
82.09375	B-2	10-30	13000	400	3.80	0.40	0.0012	0.0010	0.2840	0.0110
82.09376	B-3	0-1	53100	1000	3.60	0.40	0.0080	0.0020	0.2290	0.0100
82.09377	B-3	1-10	13200	400	3.10	0.30	0.0070	0.0020	0.2400	0.0400
82.09378	B-3	10-30	10100	300	5.20	0.50	0.0110	0.0020	0.6300	0.0160
82.09379	B-4	0-1	45700	900	3.00	0.30	0.0007	0.0000	0.4830	0.0140
82.09380	B-4	1-10	12900	400	4.80	0.50	0.0100	0.0020	0.5750	0.0160

[a]The ± values reported for each radionuclide are analytical laboratory uncertainty.
[b]Upper limit background levels from Purtymun (1987).

Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529)

Table B-13
Radionuclide Results for 1983 Baseline Soil Sampling,
As Presented in the TA-21 RFI Work Plan

TABLE 16.2-X
MDA B SURFACE SOIL SAMPLES[a,b]

Sample Number	Sample Location (cm)	Sample Depth	Tritium Value (pCi/l)	+/-	Uranium Value (µg/g)	+/-	^{238}Pu Value (pCi/g)	+/-	$^{239/240}Pu$ Value (pCi/g)	+/-
BKGD.[c]			7200[c]		3.40[c]		0.0050[c]		0.0250[c]	
83.04582	N1E0	0-1	14900	1600	3.19	0.16	0.0005	0.0014	0.0200	0.0030
83.04583	N1E0	1-10	18400	1900	3.25	0.23	0.0090	0.0030	0.7800	0.0300
83.04584	N1E0	10-30	9300	1000	4.16	0.21	0.0120	0.0030	1.2900	0.0500
83.04585	N1E2	0-1	16500	1700	3.87	0.19				
83.04586	N1E2	1-10	7900	900	3.86	0.19	0.0004	0.0015	0.0035	0.0018
83.04587	N1E2	10-30	10400	1100	4.45	0.22	-0.0011	0.0014	0.0049	0.0017
83.04588	N1E4	0-1	17600	1800	3.63	0.18	0.0029	0.0017	0.0080	0.0020
83.04589	N1E4	1-10	10300	1300	3.90	0.20	0.0005	0.0015	0.0040	0.0020
83.04590	N1E4	10-30	10000	1100	3.90	0.20	-0.0007	0.0014	0.0029	0.0014
83.04591	N1E6	0-1	13000	1400	4.52	0.23	0.0015	0.0009	0.0007	0.0009
83.04592	N1E6	1-10	9400	1000	3.52	0.25	0.0005	0.0015	0.0032	0.0018
83.04593	N1E6	10-30	20000	2000	3.76	0.19	0.0006	0.0016	0.0010	0.0020
83.04594	N1E8	0-1	24000	2000	3.61	0.18	0.0027	0.0018	0.0021	0.0016
83.04595	N1E8	1-10	8000	900	3.64	0.18	0.0010	0.0016	0.0021	0.0014
83.04596	N1E8	10-30	7800	900	3.98	0.20	0.0006	0.0017	0.0011	0.0018
83.04597	N1E10	0-1	24000	2000	3.71	0.19	0.0029	0.0019	0.1410	0.0100
83.04598	N1E10	1-10	15900	1700	3.54	0.18	0.0021	0.0017	0.0011	0.0017
83.04599	N1E10	10-30	9300	1000	4.16	0.21	-0.0005	0.0017	0.0005	0.0014
83.04600	N1E12	0-1	27000	3000	3.70	0.19	0.0016	0.0014	0.0110	0.0030
83.04601	N1E12	1-10	35000	4000	3.63	0.25	0.0010	0.0030	0.0090	0.0030
83.04602	N1E12	10-30	10900	1200	3.87	0.19	0.0023	0.0013	0.0053	0.0017
83.05615	N1E14	0-1	16600	1700			0.0010	0.0020	0.0050	0.0020
83.05616	N1E14	1-10	10900	1200			0.0004	0.0013	0.0042	0.0018
83.05617	N1E14	10-30	12600	1300	3.89	0.20	0.0013	0.0011	0.0020	0.0011
83.05618	N1E16	0-1	14600	1500	3.77	0.19	0.0009	0.0013	0.0027	0.0015
83.05619	N1E16	1-10	12900	1400	3.74	0.19	0.0018	0.0019	0.0040	0.0020
83.05620	N1E16	10-30	13100	1400	3.72	0.19	-0.0006	0.0016	0.0070	0.0020
83.05621	N1E18	0-1	21000	2000	3.82	0.19	0.0011	0.0017	0.0027	0.0019
83.05622	N1E18	1-10	10700	1100	3.58	0.18	-0.0017	0.0016	0.0022	0.0019
83.05623	N1E18	10-30	6100	700	3.64	0.18	-0.0004	0.0006	0.0027	0.0017

Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529)

Table B-13 (continued)

TABLE 16.2-X
MDA B SURFACE SOIL SAMPLES[a,b]

Sample Number	Sample Location (cm)	Sample Depth	Tritium Value (pCi/l)	+/-	Uranium Value (µg/g)	+/-	^{238}Pu Value (pCi/g)	+/-	$^{239/240}Pu$ Value (pCi/g)	+/-
BKGD.[c]			7200[c]		3.40[c]		0.0050[c]		0.0250[c]	
83.05624	N1E20	0-1	11100	1200	3.49	0.18	0.0027	0.0013	0.1090	0.0080
83.05625	N1E20	1-10	50000	5000	3.49	0.18	0.0060	0.0020	0.8000	0.0300
83.05626	N1E20	10-30	10100	1100	3.52	0.18	0.0130	0.0030	3.8000	0.1300
83.05627	N3E0	0-1	3500	4000	4.81	0.24	0.0190	0.0040	3.0500	0.1100
83.05628	N3E0	1-10	27000	3000	4.41	0.22	0.0080	0.0030	1.6900	0.0700
83.05629	N3E0	10-30	9800	1100	4.51	0.23	0.0210	0.0040	2.7500	0.1100
83.05630	N3E2	0-1	21000	2000	3.75	0.19	0.0018	0.0019	0.0040	0.0020
83.05631	N3E2	1-10	19000	2000	3.65	0.18	-0.0010	0.0020	0.0030	0.0030
83.05632	N3E2	10-30	8500	900	4.16	0.21	-0.0015	0.0017	-0.0010	0.0020
83.05633	N3E4	0-1	22000	2000	3.76	0.19	0.0020	0.0020	0.0010	0.0020
83.05634	N3E4	1-10	9300	1000	4.24	0.21	-0.0012	0.0015	0.0006	0.0012
83.05635	N3E4	10-30	9200	1000	4.20	0.21	0.0010	0.0030	0.0070	0.0030
83.05636	N3E6	0-1	31000	3000	3.63	0.18	0.0008	0.0016	0.0040	0.0030
83.05637	N3E6	1-10	12200	1300	3.68	0.18	0.0017	0.0019	0.0030	0.0030
83.05638	N3E6	10-30	14500	1500	4.03	0.20	-0.0005	0.0015	0.0010	0.0015
83.05639	N3E8	0-1	25000	3000	3.73	0.19	0.0008	0.0017	0.0030	0.0030
83.05640	N3E8	1-10	7100	800	3.48	0.17	0.0037	0.0019	0.0053	0.0018
83.05641	N3E8	10-30	10500	1100	4.01	0.20	0.0015	0.0011	0.0090	0.0030
83.05642	N3E10	0-1	18100	1900	3.56	0.25	-0.0020	0.0020	0.3000	0.0300
83.05643	N3E10	1-10	21000	2000	3.61	0.18	0.0009	0.0017	0.0410	0.0070
83.05644	N3E10	10-30	7000	800	4.29	0.22	0.0010	0.0020	0.0010	0.0020
83.05645	N3E12	0-1	31000	3000	3.72	0.26	0.0080	0.0040	0.8300	0.0400
83.05646	N3E12	1-10	9100	1000	3.98	0.20	-0.0010	0.0020	0.0010	0.0020
83.05647	N3E12	10-30	6400	700	4.37	0.22	0.0020	0.0020	-0.0010	0.0030
83.05648	N3E14	0-1	31000	3000	3.98	0.20	-0.0020	0.0020	0.0090	0.0030
83.05649	N3E14	1-10	11400	1200	4.19	0.21	-0.0018	0.0018	0.0020	0.0020
83.05650	N3E14	10-30	6500	800	4.31	0.22	0.0007	0.0016	-0.0010	0.0030
83.05651	N3E16	0-1	16300	1700	3.70	0.26	0.0040	0.0020	0.0060	0.0030
83.05652	N3E16	1-10	9000	1000	4.04	0.20	0.0010	0.0020	0.0080	0.0020
83.05653	N3E16	10-30	7000	800	3.55	0.25			0.1600	0.0200

Table B-13 (continued)

TABLE 16.2-X
MDA B SURFACE SOIL SAMPLES[a,b]

Sample Number	Sample Location (cm)	Sample Depth	Tritium Value (pCi/l)	Tritium +/-	Uranium Value (µg/g)	Uranium +/-	^{238}Pu Value (pCi/g)	^{238}Pu +/-	$^{239/240}Pu$ Value (pCi/g)	$^{239/240}Pu$ +/-
BKGD.[c]			7200[c]		3.40[c]		0.0050[c]		0.0250[c]	
83.05654	N3E18	0-1	19200	2000	3.64	0.26	0.0021	0.0017	0.0026	0.0016
83.05655	N3E18	1-10	9600	1000	3.59	0.18	0.0005	0.0015	0.0050	0.0020
83.05656	N3E18	10-30	4700	600	3.20	0.22	0.0012	0.0017	0.0080	0.0030
83.05657	N3E20	0-1	13100	1400	3.67	0.18	0.0030	0.0020	0.3340	0.0170
83.05658	N3E20	1-10	17100	1800	3.69	0.26	0.0045	0.0019	0.2950	0.0150
83.05659	N3E20	10-30	4500	600	3.29	0.23	0.0005	0.0015	0.0250	0.0040
83.05660	N4E10	0-1	15300	1600	3.61	0.18	0.0017	0.0014	0.1930	0.0130
83.05661	N4E10	1-10	12800	1400	3.58	0.25	0.0015	0.0018	0.3460	0.0170
83.05662	N4E10	10-30	3100	500	3.94	0.28	0.0005	0.0012	0.0270	0.0040
83.05663	N4E12	0-1	12500	1300	2.32	0.16	0.0260	0.0040	0.1770	0.0100
83.05664	N4E12	1-10	45000	5000	2.80	0.20	0.0039	0.0017	0.2550	0.0150
83.05665	N4E12	10-30	12700	1300	3.57	0.25	0.0057	0.0019	0.4200	0.0200
83.05666	N4E14	0-1	13100	1400	4.24	0.21	0.0010	0.0020	0.1670	0.0130
83.05667	N4E14	1-10	19000	2000	3.79	0.19	0.0010	0.0016	0.2370	0.0130
83.05668	N4E14	10-30	13900	1500	3.98	0.20	0.0010	0.0030	0.0009	0.0030
83.05669	N4E16	0-1	43000	4000	3.91	0.20	0.0070	0.0030	0.3330	0.0190
83.05670	N4E16	1-10	12900	1400	3.86	0.27	0.0020	0.0020	0.4700	0.0200
83.05671	N4E16	10-30	3500	500	3.91	0.20	0.0030	0.0020	0.0670	0.0070
83.05672	N4E20	0-1	67000	7000	3.27	0.16	0.0060	0.0020	0.0390	0.0050
83.05673	N4E20	1-10	27000	3000	3.08	0.22	0.0028	0.0017	0.0910	0.0080
83.05674	N4E20	10-30	14700	1500	3.80	0.19	0.0012	0.0017	0.0090	0.0020
83.05675	S1E0	0-1	81000	8000	4.54	0.23	0.0280	0.0050	3.2900	0.1300
83.05676	S1E0	1-10	92000	9000	4.11	0.21	0.0014	0.0016	0.0570	0.0060
83.05677	S1E0	10-30	66000	7000	3.74	0.19	0.0017	0.0014	0.4390	0.0190
83.05678	S1E2	0-1	7200	800	3.83	0.19	0.0018	0.0015	0.3320	0.0160
83.05679	S1E2	1-10	8800	1000	4.09	0.21	0.0004	0.0012	0.2390	0.0120
83.05680	S1E2	10-30	15100	1600	4.19	0.21	0.0031	0.0017	0.4600	0.0200
83.05681	S1E4	0-1	42000	4000	3.51	0.18	0.0030	0.0020	0.0500	0.0060
83.05682	S1E10	0-1	18500	1900	3.73	0.19	0.0210	0.0030	1.2900	0.0500
83.05683	S1E10	1-10	11600	1200	3.59	0.18	0.0026	0.0013	0.1280	0.0080

Table B-13 (continued)

TABLE 16.2-X
MDA B SURFACE SOIL SAMPLES[a,b]

Sample Number	Sample Location (cm)	Sample Depth	Tritium Value (pCi/l)	Tritium +/-	Uranium Value (µg/g)	Uranium +/-	^{238}Pu Value (pCi/g)	^{238}Pu +/-	$^{239/240}Pu$ Value (pCi/g)	$^{239/240}Pu$ +/-
BKGD.[c]			7200[c]		3.40[c]		0.0050[c]		0.0250[c]	
83.05684	S1E10	10-20	22000	2000	4.05	0.20	0.0024	0.0014	0.2110	0.0110
83.05685	S1E12	0-1	5400	700	4.13	0.21	0.0026	0.0014	0.1280	0.0080
83.05686	S1E12	1-10	36000	4000	3.77	0.19	-0.0013	0.0016	0.0460	0.0050
83.05687	S1E12	10-30	12500	1300	4.56	0.23	0.0080	0.0020	0.3240	0.0180
83.05688	S1E14	0-1	19000	2000	4.07	0.20	0.0030	0.0017	0.1830	0.0110
83.05689	S1E14	1-10	19000	2000	3.81	0.19	0.0032	0.0012	0.0760	0.0060
83.05690	S1E14	10-30	14000	1500	3.83	0.19	0.0009	0.0015	0.0870	0.0070
83.05691	S1E16	0-1	5100	600	2.96	0.21	0.0010	0.0020	0.0100	0.0030
83.05692	S1E16	1-10	18400	1900	3.60	0.18	0.0024	0.0018	0.2710	0.0140
83.05693	S1E16	10-30	13300	1400	4.96	0.25	0.0038	0.0019	0.3350	0.0180
83.05694	S1E18	0-1	12800	1400	3.53	0.25	-0.0010	0.0020	0.0340	0.0050
83.05695	S1E18	1-10	15400	1600	4.24	0.21	-0.0011	0.0017	0.1510	0.0110
83.05696	S1E18	10-30	8100	900	4.33	0.22	0.0005	0.0013	0.0920	0.0080
83.05697	S1E20	0-1	13000	1400	4.27	0.21	0.0030	0.0020	0.3600	0.0200
83.05698	S1E20	1-10	46000	5000	4.45	0.22	0.0029	0.0015	0.2030	0.0100

[a]Mayfield (1983).
[b]The ± values reported for each radionuclide are analytical laboratory uncertainty.
[c]Upper limit background levels from Purtymun (1987).

Table B-14
Radionuclide Results from 1983 Borehole Installation,
As Presented in the TA-21 RFI Work Plan

TABLE 16.2-XVII
1983 PERIMETER SUBSURFACE SOIL SAMPLES

Sample Number	Sample Location	Sample Depth (ft)	Tritium Value (pCi/l)	+/-	Uranium Value (ppm)	+/-	^{238}Pu Value (pCi/g)	+/-	$^{239/240}Pu$ Value (pCi/g)	+/-	^{137}Cs Value (pCi/g)	+/-
BKGD.[a]			7200[a]		3.40[a]		0.0050[a]		0.0250[a]		1.0900[a]	
83.04341	B-1	0-3	7500	800	3.62	0.18	0.0018	0.0012	0.2060	0.0100	0.0628	0.0368
83.04342	B-1	3-8	20000	2000	3.56	0.18	-0.0006	0.0009	0.0029	0.0013	0.0162	0.0207
83.04343	B-1	8-13	23000	2000	3.59	0.18	0.0003	0.0006	0.0024	0.0011	0.0525	0.0271
83.04344	B-1	13-18	32000	3000	3.34	0.18	0.0004	0.0000	0.0011	0.0010	-0.0547	0.0357
83.04345	B-1	18-23	22000	2000	3.35	0.18	0.0006	0.0010	0.0050	0.0010	0.0382	0.0667
83.04353	B-2	0-3	8500	900	3.56	0.18	0.0018	0.0009			-0.0580	0.0362
83.04354	B-2	3-8	17700	1800	3.52	0.18	0.0007	0.0010	0.2540	0.0110	-0.7230	0.0770
83.04355	B-2	8-13	28000	3000	3.24	0.18					0.0530	0.0687
83.04356	B-2	13-18	20000	2000	3.50	0.18	0.0005	0.0010	0.0070	0.0020	0.0463	0.0556
83.04357	B-2	18-23	34000	4000	3.68	0.18	0.0026	0.0010	0.0020	0.0010	0.0330	0.0664
83.04358	B-2 (cm)	23-28	36000	4000	3.71	0.18	-0.0014	0.0000	0.0003	0.0000	0.0975	0.0474
83.04346	B-1	23-28			3.34	0.18	0.0010	0.0000	0.0017	0.0010	0.0647	0.0415
83.04347	B-1	28-33			3.68	0.18	0.0003	0.0010	0.0023	0.0010	0.0665	0.0529
83.04348	B-1	33-38			3.61	0.18	0.0004	0.0000	0.0014	0.0000	0.0457	0.0721
83.04349	B-1	38-43			3.80	0.18	0.0007	0.0000	0.0007	0.0000	-0.4170	0.0372
83.04350	B-1	43-48			3.34	0.18	0.0004	0.0010	0.0009	0.0010	-0.2400	0.0345
83.04351	B-1	48-53			3.71	0.18	0.0009	0.0000	0.0003	0.0000	0.0357	0.0261
83.04352	B-1	53-58			3.51	0.18	0.0019	0.0010	0.0110	0.0020	-0.0012	0.0323
83.04359	B-2	28-33			3.63	0.18	0.0007	0.0010	0.0036	0.0010	-0.2060	0.0213
83.04360	B-2	33-38			3.70	0.18	0.0010	0.0010			0.0305	0.0305
83.04361	B-2	38-43			3.49	0.18	-0.0008	0.0010			-0.1590	0.0385
83.04362	B-2	43-48			3.53	0.18	-0.0003	0.0010			-0.0017	0.0332
83.04363	B-2	48-53			3.39	0.18	-0.0004	0.0000			-0.0027	0.0571
83.04364	B-2	53-58			3.53	0.18	-0.0007	0.0000			-0.7170	0.0355

[a]Upper limit background levels from Purtymun (1987).

Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529)

Table B-15
Radionuclide Results for 1984 Soil Sampling,
As Presented in the TA-21 RFI Work Plan

TABLE 16.2-XI
MDA B SURFACE SOIL SAMPLES[a,b]

Sample Number	Sample Location	Sample Depth (cm)	Tritium Value (pCi/l)	+/-	Uranium Value (ppm)	+/-	^{238}Pu Value (pCi/g)	+/-	$^{239/240}$Pu Value (pCi/g)	+/-
BKGD.[c]			7200[c]		3.40[c]		0.0050[c]		0.0250[c]	
84.04056	B-1	0-1	4800	600			0.0009	0.0018	0.5200	0.0200
84.04057	B-1	1-10	2700	400			0.0054	0.0017	0.6000	0.0200
84.04058	B-1	10-14	2400	300			0.0008	0.0017	0.3900	0.0200
84.04059	B-2	0-1	2400	300			0.0043	0.0016	1.4800	0.0500
84.04060	B-2	1-10	1800	300			0.0080	0.0020	1.0700	0.0400
84.04061	B-2	10-18	1800	300			0.0070	0.0020	1.1800	0.0400
84.04062	B-3	0-1	2500	300			0.0220	0.0040	3.0700	0.1100
84.04063	B-3	1-10	2300	300			0.0228	0.0098	7.3900	0.3100
84.04064	B-3	10-25	2400	300			0.0017	0.0014	0.3900	0.0180

[a]Maylield (1984).
[b]The ± values reported for each radionuclide are analytical laboratory uncertainty.
[c]Upper limit background levels from Purtymun (1967).

Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529)

Table B-16
Radionuclides with Concentrations above Background for 1990 Data
As Presented in the RFI Report for Potential Release Site at TA-21

TABLE 5.1.5-4

RADIONUCLIDES WITH CONCENTRATIONS ABOVE BACKGROUND FOR 1990 DATA

ANALYTE	LOCATION ID	SAMPLE ID	UTL[a] (pCi/g)	SAL[b] (pCi/g)	SAMPLE VALUE (pCi/g)
Americium-241	46	TA-21 B #46	0.336	22	0.42
Americium-241	45	TA-21 B #45	0.336	22	0.42
Americium-241	103	B-030891-103	0.336	22	0.44
Americium-241	83	TA-21 B #83	0.336	22	0.57
Americium-241	92	B-030891-92	0.336	22	0.76
Americium-241	44	TA-21 B #44	0.336	22	0.94
Americium-241	50	TA-21 B #50	0.336	22	1.11
Americium-241	43	TA-21 B #43	0.336	22	1.14
Americium-241	115	B-030891-115	0.336	22	2.2
Americium-241	41	TA-21 B #41	0.336	22	3
Cesium-137	15	TA-21 B #15	1.4	5.1	10.1
Cesium-137	16	TA-21 B #16	1.4	5.1	46.4
Cesium-137	36	TA-21 B #36	1.4	5.1	1.54
Plutonium-238	12	TA-21 B #12	0.014	27	0.019
Plutonium-238	13	TA-21 B #13	0.014	27	0.023
Plutonium-238	18	TA-21 B #14	0.014	27	0.025
Plutonium-238	20	TA-21 B #20	0.014	27	0.015
Plutonium-238	21	TA-21 B #21	0.014	27	0.0548
Plutonium-238	22	TA-21 B #22	0.014	27	0.0252
Plutonium-238	23	TA-21 B #23	0.014	27	0.2
Plutonium-238	25	TA-21 B #25	0.014	27	0.0144
Plutonium-238	31	TA-21 B #31	0.014	27	0.0229
Plutonium-238	32	TA-21 B #32	0.014	27	0.065
Plutonium-238	33	TA-21 B #33	0.014	27	0.017
Plutonium-238	34	TA-21 B #34	0.014	27	0.0167
Plutonium-238	36	TA-21 B #36	0.014	27	0.024
Plutonium-238	37	TA-21 B #37	0.014	27	0.0146
Plutonium-238	38	TA-21 B #38	0.014	27	0.0175
Plutonium-238	39	TA-21 B #39	0.014	27	0.0499
Plutonium-238	41	TA-21 B #41	0.014	27	0.48
Plutonium-238	42	TA-21 B #42	0.014	27	0.0656
Plutonium-238	43	TA-21 B #43	0.014	27	0.0892
Plutonium-238	44	TA-21 B #44	0.014	27	0.11
Plutonium-238	45	TA-21 B #45	0.014	27	0.0313
Plutonium-238	46	TA-21 B #46	0.014	27	0.0562

Source: "RFI Report for Potential Release Site at TA-21" (LANL 1996, LA-UR-96-4444)

Table B-16 (continued)

TABLE 5.1.5-4 (CONTINUED)

RADIONUCLIDES WITH CONCENTRATIONS ABOVE BACKGROUND FOR 1990 DATA

ANALYTE	LOCATION ID	SAMPLE ID	UTL[a] (pCi/g)	SAL[b] (pCi/g)	SAMPLE VALUE (pCi/g)
Plutonium-238	47	TA-21 B #47	0.014	27	0.0375
Plutonium-238	48	TA-21 B #48	0.014	27	0.0259
Plutonium-238	49	TA-21 B #49	0.014	27	0.0155
Plutonium-238	50	TA-21 B #50	0.014	27	0.32
Plutonium-238	51	TA-21 B #51	0.014	27	0.0172
Plutonium-238	53	TA-21 B #53	0.014	27	0.0216
Plutonium-238	58	TA-21 B #58	0.014	27	0.023
Plutonium-238	60	TA-21 B #60	0.014	27	0.0165
Plutonium-238	61	TA-21 B #61	0.014	27	0.0168
Plutonium-238	62	TA-21 B #62	0.014	27	0.0166
Plutonium-238	81	TA-21 B #81	0.014	27	0.0371
Plutonium-238	82	TA-21 B #82	0.014	27	0.0209
Plutonium-238	83	TA-21 B #83	0.014	27	0.0206
Plutonium-238	93	B-030891-93	0.014	27	0.11
Plutonium-238	99	B-030891-99	0.014	27	0.138
Plutonium-238	103	B-030891-103	0.014	27	0.144
Plutonium-238	109	B-030891-109	0.014	27	0.112
Plutonium-238	115	B-030891-115	0.014	27	0.229
Plutonium-238	117	B-030891-117	0.014	27	0.066
Plutonium-238	122	B-122	0.014	27	0.033
Plutonium-238	124	B-124	0.014	27	0.021
Plutonium-238	125	B-125	0.014	27	0.029
Plutonium-238	130	B-130	0.014	27	0.022
Plutonium-238	139	#139	0.014	27	0.0215
Plutonium-238	144	B-022591-144	0.014	27	0.102
Plutonium-238	160	B-022591-160	0.014	27	0.093
Plutonium-238	161	B-022591-161	0.014	27	0.144
Plutonium-238	170	170	0.014	27	0.0371
Plutonium-238	195	B-020491-195	0.014	27	0.122
Plutonium-238	197	B-020491-197	0.014	27	0.042
Plutonium-239	1	TA-21 B #1	0.052	24	0.33
Plutonium-239	2	TA-21 B #2	0.052	24	0.485
Plutonium-239	3	TA-21 B #3	0.052	24	0.461
Plutonium-239	4	TA-21 B #4	0.052	24	0.88
Plutonium-239	5	TA-21 B #5	0.052	24	1.88

Table B-16 (continued)

TABLE 5.1.5-4 (CONTINUED)

RADIONUCLIDES WITH CONCENTRATIONS ABOVE BACKGROUND FOR 1990 DATA

ANALYTE	LOCATION ID	SAMPLE ID	UTL[a] (pCi/g)	SAL[b] (pCi/g)	SAMPLE VALUE (pCi/g)
Plutonium-239	6	TA-21 B #6	0.052	24	1.04
Plutonium-239	7	TA-21 B #7	0.052	24	1.8
Plutonium-239	8	TA-21 B #8	0.052	24	5.97
Plutonium-239	9	TA-21 B #9	0.052	24	0.679
Plutonium-239	10	TA-21 B #10	0.052	24	1.24
Plutonium-239	11	TA-21 B #11	0.052	24	1.33
Plutonium-239	12	TA-21 B #12	0.052	24	3.31
Plutonium-239	13	TA-21 B #13	0.052	24	3.18
Plutonium-239	14	TA-21 B #14	0.052	24	0.756
Plutonium-239	15	TA-21 B #15	0.052	24	1.56
Plutonium-239	16	TA-21 B #16	0.052	24	0.702
Plutonium-239	17	TA-21 B #17	0.052	24	0.39
Plutonium-239	18	TA-21 B #18	0.052	24	1.8
Plutonium-239	19	TA-21 B #19	0.052	24	2.34
Plutonium-239	20	TA-21 B #20	0.052	24	2.5
Plutonium-239	21	TA-21 B #21	0.052	24	9.38
Plutonium-239	22	TA-21 B #22	0.052	24	4.57
Plutonium-239	23	TA-21 B #23	0.052	24	8.2
Plutonium-239	24	TA-21 B #24	0.052	24	0.95
Plutonium-239	25	TA-21 B #25	0.052	24	1.23
Plutonium-239	26	TA-21 B #26	0.052	24	0.0303
Plutonium-239	27	TA-21 B #27	0.052	24	0.813
Plutonium-239	28	TA-21 B #28	0.052	24	0.465
Plutonium-239	29	TA-21 B #29	0.052	24	1.16
Plutonium-239	31	TA-21 B #31	0.052	24	1.85
Plutonium-239	32	TA-21 B #32	0.052	24	6.77
Plutonium-239	33	TA-21 B #33	0.052	24	2
Plutonium-239	34	TA-21 B #34	0.052	24	1.64
Plutonium-239	35	TA-21 B #35	0.052	24	0.495
Plutonium-239	36	TA-21 B #36	0.052	24	2.17
Plutonium-239	36	TA-21 B #36	0.052	24	2.34
Plutonium-239	37	TA-21 B #37	0.052	24	2.42
Plutonium-239	38	TA-21 B #38	0.052	24	6.39
Plutonium-239	39	TA-21 B #39	0.052	24	11.9
Plutonium-239	41	TA-21 B #41	0.052	24	87.2

Table B-16 (continued)

TABLE 5.1.5-4 (CONTINUED)

RADIONUCLIDES WITH CONCENTRATIONS ABOVE BACKGROUND FOR 1990 DATA

ANALYTE	LOCATION ID	SAMPLE ID	UTL[a] (pCi/g)	SAL[b] (pCi/g)	SAMPLE VALUE (pCi/g)
Plutonium-239	42	TA-21 B #42	0.052	24	11.9
Plutonium-239	43	TA-21 B #43	0.052	24	14.1
Plutonium-239	44	TA-21 B #44	0.052	24	20
Plutonium-239	45	TA-21 B #45	0.052	24	5.66
Plutonium-239	46	TA-21 B #46	0.052	24	10.7
Plutonium-239	47	TA-21 B #47	0.052	24	5.24
Plutonium-239	48	TA-21 B #48	0.052	24	3.79
Plutonium-239	49	TA-21 B #49	0.052	24	2.84
Plutonium-239	50	TA-21 B #50	0.052	24	58
Plutonium-239	51	TA-21 B #51	0.052	24	2.75
Plutonium-239	52	TA-21 B #52	0.052	24	2.17
Plutonium-239	53	TA-21 B #53	0.052	24	3.43
Plutonium-239	54	TA-21 B #54	0.052	24	0.352
Plutonium-239	55	TA-21 B #55	0.052	24	0.74
Plutonium-239	56	TA-21 B #56	0.052	24	1.12
Plutonium-239	57	TA-21 B #57	0.052	24	0.266
Plutonium-239	58	TA-21 B #58	0.052	24	0.841
Plutonium-239	59	TA-21 B #59	0.052	24	1.13
Plutonium-239	60	TA-21 B #60	0.052	24	2.97
Plutonium-239	61	TA-21 B #61	0.052	24	2.81
Plutonium-239	62	TA-21 B #62	0.052	24	1.77
Plutonium-239	63	TA-21 B #63	0.052	24	0.45
Plutonium-239	64	TA-21 B #64	0.052	24	0.723
Plutonium-239	65	TA-21 B #65	0.052	24	1.76
Plutonium-239	66	TA-21 B #66	0.052	24	1.98
Plutonium-239	67	TA-21 B #67	0.052	24	1.93
Plutonium-239	68	TA-21 B #68	0.052	24	0.43
Plutonium-239	69	TA-21 B #69	0.052	24	0.668
Plutonium-239	70	TA-21 B #70	0.052	24	0.771
Plutonium-239	71	TA-21 B #71	0.052	24	0.518
Plutonium-239	72	TA-21 B #72	0.052	24	0.116
Plutonium-239	74	TA-21 B #74	0.052	24	0.843
Plutonium-239	75	TA-21 B #75	0.052	24	0.0659
Plutonium-239	76	TA-21 B #76	0.052	24	0.21
Plutonium-239	77	TA-21 B #77	0.052	24	0.0762

Table B-16 (continued)

TABLE 5.1.5-4 (CONTINUED)

RADIONUCLIDES WITH CONCENTRATIONS ABOVE BACKGROUND FOR 1990 DATA

ANALYTE	LOCATION ID	SAMPLE ID	UTL[a] (pCi/g)	SAL[b] (pCi/g)	SAMPLE VALUE (pCi/g)
Plutonium-239	114	B-030891-114	0.052	24	0.413
Plutonium-239	115	B-030891-115	0.052	24	12.898
Plutonium-239	116	B-030891-116	0.052	24	0.29
Plutonium-239	117	B-030891-117	0.052	24	1.333
Plutonium-239	118	B-030891-118	0.052	24	0.177
Plutonium-239	119	B-030891-119	0.052	24	1.351
Plutonium-239	120	B-030891-120	0.052	24	0.668
Plutonium-239	121	B-030891-121	0.052	24	3.813
Plutonium-239	122	B-122	0.052	24	1.61
Plutonium-239	123	B-123	0.052	24	1.02
Plutonium-239	124	B-124	0.052	24	3.81
Plutonium-239	125	B-125	0.052	24	2.97
Plutonium-239	126	B-126	0.052	24	0.247
Plutonium-239	127	B-127	0.052	24	1.01
Plutonium-239	128	B-128	0.052	24	0.52
Plutonium-239	129	B-129	0.052	24	1.24
Plutonium-239	130	B-130	0.052	24	0.1
Plutonium-239	131	#131	0.052	24	0.224
Plutonium-239	132	#132	0.052	24	0.0908
Plutonium-239	133	#133	0.052	24	0.138
Plutonium-239	134	#134	0.052	24	0.303
Plutonium-239	135	#135	0.052	24	0.58
Plutonium-239	136	#136	0.052	24	0.136
Plutonium-239	137	#137	0.052	24	0.095
Plutonium-239	138	#138	0.052	24	1.55
Plutonium-239	139	#139	0.052	24	0.172
Plutonium-239	140	#140	0.052	24	0.141
Plutonium-239	141	#141	0.052	24	0.269
Plutonium-239	142	#142	0.052	24	7.59
Plutonium-239	143	#143	0.052	24	5.96
Plutonium-239	144	B-022591-144	0.052	24	0.749
Plutonium-239	145	B-022591-145	0.052	24	0.4
Plutonium-239	146	B-022591-146	0.052	24	0.436
Plutonium-239	147	B-022591-147	0.052	24	0.37
Plutonium-239	148	B-022591-148	0.052	24	0.309

Table B-16 (continued)

TABLE 5.1.5-4 (CONTINUED)

RADIONUCLIDES WITH CONCENTRATIONS ABOVE BACKGROUND FOR 1990 DATA

ANALYTE	LOCATION ID	SAMPLE ID	UTL[a] (pCi/g)	SAL[b] (pCi/g)	SAMPLE VALUE (pCi/g)
Plutonium-239	149	B-022591-149	0.052	24	0.571
Plutonium-239	150	B-022591-150	0.052	24	0.328
Plutonium-239	169	169	0.052	24	0.191
Plutonium-239	170	170	0.052	24	5.3
Plutonium-239	190	190	0.052	24	0.524
Plutonium-239	191	191	0.052	24	0.537
Plutonium-239	192	B-020491-192	0.052	24	0.098
Plutonium-239	194	B-020491-194	0.052	24	0.116
Plutonium-239	196	B-020491-196	0.052	24	0.192
Plutonium-239	197	B-020491-197	0.052	24	0.216
Plutonium-239	218	218	0.052	24	0.209
Uranium	1	TA-21 B #1	5.45	230	6.18
Uranium	2	TA-21 B #2	5.45	230	8.38
Uranium	12	TA-21 B #12	5.45	230	5.94
Uranium	14	TA-21 B #14	5.45	230	6.44
Uranium	16	TA-21 B #16	5.45	230	5.95
Uranium	17	TA-21 B #17	5.45	230	7.25
Uranium	18	TA-21 B #18	5.45	230	5.77
Uranium	32	TA-21 B #32	5.45	230	5.77
Uranium	33	TA-21 B #33	5.45	230	6.57
Uranium	34	TA-21 B #34	5.45	230	6.32
Uranium	51	TA-21 B #51	5.45	230	5.81
Uranium	52	TA-21 B #52	5.45	230	7.6
Uranium	81	TA-21 B #81	5.45	230	11.92
Uranium	85	TA-21 B #85	5.45	230	6.63
Uranium	92	B-030891-92	5.45	230	8.7
Uranium	93	B-030891-93	5.45	230	8.1
Uranium	94	B-030891-94	5.45	230	6.9
Uranium	95	B-030891-95	5.45	230	6.3
Uranium	98	B-030891-98	5.45	230	8
Uranium	101	B-030891-101	5.45	230	6.6
Uranium	102	B-030891-102	5.45	230	7.1
Uranium	103	B-030891-103	5.45	230	8.7
Uranium	105	B-030891-105	5.45	230	7.2
Uranium	108	B-030891-108	5.45	230	6.3

Table B-16 (continued)

TABLE 5.1.5-4 (CONTINUED)

RADIONUCLIDES WITH CONCENTRATIONS ABOVE BACKGROUND FOR 1990 DATA

ANALYTE	LOCATION ID	SAMPLE ID	UTL[a] (pCi/g)	SAL[b] (pCi/g)	SAMPLE VALUE (pCi/g)
Uranium	110	B-030891-110	5.45	230	7.3
Uranium	112	B-030891-112	5.45	230	5.8
Uranium	113	B-030891-113	5.45	230	8.2
Uranium	114	B-030891-114	5.45	230	5.8
Uranium	115	B-030891-115	5.45	230	7.8
Uranium	117	B-030891-117	5.45	230	7.3
Uranium	121	B-030891-121	5.45	230	7.7
Uranium	144	B-030891-144	5.45	230	6.6
Uranium	145	B-030891-145	5.45	230	6.8
Uranium	147	B-030891-147	5.45	230	9.3
Uranium	148	B-030891-148	5.45	230	6.6
Uranium	153	B-022591-153	5.45	230	6.6
Uranium	158	B-022591-158	5.45	230	6.8
Uranium	159	B-022591-159	5.45	230	6
Uranium	162	B-022591-162	5.45	230	5.8
Uranium	166	B-021191-166	5.45	230	6.3
Uranium	198	B-020491-198	5.45	230	6
Uranium	196	B-020491-196	5.45	230	5.5
Uranium	135	#135	5.45	230	5.53
Uranium	155	B-022591-155	5.45	230	5.6

[a] UTL = Upper tolerance limit derived from LANL-wide data.
[b] SAL = Screening action level.

Table B-17
Summary of Work Plan Specifications and Fieldwork Performed

Media	RFI Work Plan Specification*		Actual Fieldwork Performed	
	Number Samples Analyzed	Analytes (Method)	Number Samples Analyzed	Analytes (Method)
Surface soil initial	80	SVOCs, inorganic compounds, radionuclides (by gamma spectroscopy plus H3, total U, Iso Pu, and Sr-90)	70 (98 collected for Iso Pu and lead)	SVOCs, inorganic compounds, radionuclides (by gamma spectroscopy plus H3, total U, Iso Pu, Iso U, and Sr-90)
Surface soil subsequent	30	To be determined from initial investigation (assumed same as initial)	29 (35 collected for H3, and 39 for Iso Pu)	SVOCs, inorganic compounds, radionuclides (by gamma spectroscopy plus H3, total U, Iso Pu, Iso U)
Subsurface initial	246 (3 vertical and 5 angle borings)	VOCs, SVOCs, inorganic chemicals, radionuclides (by gamma spectroscopy plus H3, total U, Iso Pu, and Sr-90)	55 (7 angle borings)	VOCs, SVOCs, inorganic chemicals, radionuclides (by gamma spectroscopy plus H3, total U, Iso Pu, and Sr-90)
Subsurface subsequent	90 (8 vertical borings)	To be determined from initial investigation (assumed same as initial)	0	n/a
Sediment initial	15 (5 locations)	SVOCs, inorganic compounds, radionuclides (by gamma spectroscopy plus H3, total U, Iso Pu, and Sr-90)	15 (5 locations)	SVOCs, inorganic compounds, radionuclides (by gamma spectroscopy plus H3, total U, Iso Pu, and Sr-90)
Subsurface pore gas	0	n/a	21 (3 from each of the 7 borings)	VOCs
Surface Flux	0	n/a	80 EMFLUX	VOCs

* "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529)

Table B-18
Summary of Surface Soil Samples Collected in 1992 at MDA B

Sample ID	Location ID	Depth (ft)	Medium	Target Analyte List Metals	SVOCs	VOCs	Americium-241	Gamma Spectroscopy	Tritium	Isotopic Plutonium	Isotopic Thorium	Isotopic Uranium	Strontium-90	Uranium
AAA0085	21-01037	0-0.5	Soil	12691	12692	—	12693	—	—	12693	—	—	12693	12693
AAA0093	21-01045	0-0.5	Soil	12691	12692	—	—	—	—	12693	12693	12693	12693	12693
AAA0100	21-01061	0-0.5	Soil	12691	12692	—	12693	—	—	12693	—	—	12693	12693
AAA0102	21-01060	0-0.5	Soil	12691	12692	—	—	—	—	12693	—	—	12693	12693
AAA0105	21-01067	0-0.5	Soil	12691	12692	—	12693	—	—	12693	12693	12693	12693	12693
AAA0109	21-01072	0-0.5	Soil	12700	12701	—	—	—	—	12702	—	—	12702	12702
AAA0204	21-01030	0-0.5	Soil	12741	12742	—	12743	—	—	12743	—	—	12743	12743
AAA0207	21-01038	0-0.42	Soil	12741	12742	—	—	—	—	12743	—	—	12743	12743
AAA0212	21-01047	0-0.5	Soil	12741	12742	—	12743	—	—	12743	12743	12743	12743	12743
AAA0213	21-01047	0-0.5	Soil	12741	12742	—	—	—	—	12743	12743	12743	12743	12743
AAA0217	21-01048	0-0.5	Soil	12741	12742	—	—	—	—	12743	—	—	12743	12743
AAA0222	21-01057	0-0.5	Soil	12758	12742	—	—	—	—	12759	—	—	12759	12759
AAA0224	21-01055	0-0.5	Soil	12741	12742	—	—	—	—	12743	—	—	12743	12743
AAA0226	21-01056	0-0.5	Soil	12741	12742	—	12743	—	—	12743	12743	12743	12743	12743
AAA0231	21-01054	0-0.5	Soil	12758	12742	—	—	—	—	12759	—	—	12759	12759
AAA0234	21-01062	0-0.5	Soil	12758	12742	—	12759	—	—	12759	—	—	12759	12759
AAA0237	21-01069	0-0.5	Soil	12758	12742	—	12759	—	—	12759	—	—	12759	12759
AAA0248	21-01031	0-0.5	Soil	12758	12742	—	12759	—	—	12759	—	—	12759	12759
AAA0253	21-01040	0-0.5	Soil	12758	12742	—	12759	—	—	12759	—	—	12759	12759
AAA0453	21-01002	0-0.5	Soil	13053	13046	—	13054	—	—	13054	—	—	13054	13054
AAA0459	21-01004	0-0.5	Soil	13053	13046	—	13054	—	—	13054	—	—	13054	13054
AAA0462	21-01006	0-0.5	Soil	13053	13046	—	13054	—	—	13054	13054	13054	13054	13054
AAA0466	21-01010	0-0.5	Soil	13047	13046	—	13045	—	—	13045	—	—	13045	13045
AAA0476	21-01014	0-0.5	Soil	13047	13046	—	—	—	—	13045	—	—	13045	13045
AAA0480	21-01017	0-0.33	Soil	13047	13046	—	—	—	—	13045	13045	13045	13045	13045
AAA0484	21-01020	0-0.5	Soil	13040	13031	13031	13041	—	—	13041	—	—	13041	13041
AAA0489	21-01024	0-0.25	Soil	13040	13031	13031	13041	—	—	13041	—	—	13041	13041
AAA0495	21-01023	0-0.5	Soil	13053	13046	—	13054	—	—	13054	13054	13054	13054	13054

Table B-19
Frequency of Inorganic Chemicals above Background Value in Surface Soil Samples Collected in 1992 at MDA B

Analyte	Medium	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	Background Value (mg/kg)[a]	Frequency of Detects Above Background Value	Frequency of Nondetects Above Background Value
Aluminum	Soil	28	28	1500 to 69,100	29200	19/28	0/28
Antimony	Soil	28	0	[0.2 to 24.9]	0.83	0/28	28/28
Arsenic	Soil	28	17	0.9 to [62.3]	8.17	1/28	9/28
Barium	Soil	28	28	50 to 618	295	10/28	0/28
Beryllium	Soil	28	20	[1.1] to 5.1	1.83	17/28	0/28
Cadmium	Soil	28	0	[0.6 to 2.0]	0.4	0/28	28/28
Calcium	Soil	28	28	1940 to 11400	6120	4/28	0/28
Chromium	Soil	28	26	[2.0] to 19	19.3	0/28	0/28
Cobalt	Soil	28	26	2.0 to 14	8.64	2/28	0/28
Copper	Soil	28	27	[2.0] to 57.4	14.7	3/28	0/28
Iron	Soil	28	28	4200 to 19100	21500	0/28	0/28
Lead	Soil	28	28	11 to 57	22.3	15/28	0/28
Lithium	Soil	28	19	17 to 32	NA[b]	19/28	n/a
Magnesium	Soil	28	28	430 to 3600	4610	0/28	0/28
Manganese	Soil	28	28	172 to 639	671	0/28	0/28
Molybdenum	Soil	28	6	0.9 to [6.2]	n/a	6/28	n/a
Nickel	Soil	28	20	[3.0] to 13.9	15.4	0/28	0/28
Potassium	Soil	28	28	737 to 41000	3460	19/28	0/28
Selenium	Soil	28	3	[0.2 to 62.3]	1.52	0/28	9/28
Silver	Soil	28	1	[1.0] to 10.8	1	1/28	9/28
Sodium	Soil	28	22	[106] to 31200	915	19/28	0/28
Strontium	Soil	28	28	9.7 to 166	n/a	28/28	n/a
Thallium	Soil	28	3	13 to [62.3]	0.73	3/28	25/28
Uranium	Soil	28	28	2.74 to 14.2	1.82	28/28	0/28
Vanadium	Soil	28	28	3 to 38	39.6	0/28	0/28
Zinc	Soil	28	28	22.1 to 130	48.8	11/28	0/28

[a] Background values from LANL 1998, 59730.

[b] n/a = Not available.

Table B-20
Inorganic Chemical Results above Background Value in Surface Soil Samples Collected in 1992 at MDA B

Sample ID	Location ID	Depth (ft)	Medium	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Cobalt	Copper	Lead	Lithium	Molybdenum	Potassium	Selenium	Silver	Sodium	Strontium	Thallium	Uranium	Zinc
Soil Background Value[a]				29200	0.83	8.17	295	1.83	0.4	6120	8.64	14.7	22.3	n/a	n/a	3460	1.52	1	915	n/a	0.73	1.82	48.8
Residential Soil Screening Levels (mg/kg)[b]				7.78E+04	3.13E+01	3.9E+00	5.45E+03	1.56E+02	7.41E+01	[c]	1.52E+03	3.13E+03	4.0E+02	1.6E+03[d]	3.91E+02		3.91E+02	3.91E+02	[c]	4.69E+04	5.16E+00	1.6E+01[e]	2.35E+04
SWMU 21-015																							
AAA0453	21-01002	0.00-0.50	Soil	—	21.4 (U)f	53.6 (U)	—	—	1.1 (U)	—	—	—	49.9	21.4 (U)	5.4 (U)	—	53.6 (U)	2.1 (U)	—	20.2	53.6 (U)	4.8	55.4
AAA0459	21-01004	0.00-0.50	Soil	—	22.8 (U)	57.1 (U)	—	—	1.1 (U)	—	—	—	—	22.8 (U)	5.7 (U)	—	57.1 (U)	2.3 (U)	—	26.4	57.1 (U)	3.9	-
AAA0462	21-01006	0.00-0.50	Soil	—	22.1 (U)	55.2 (U)	—	—	1.1 (U)	—	—	57.4	35.3	22.1 (U)	5.5 (U)	—	55.2 (U)	2.2 (U)	—	28.8	55.2 (U)	3.9	83
AAA0466	21-01010	0.00-0.50	Soil	—	24.9 (U)	62.3 (U)	—	—	1.2 (U)	—	—	—	26.4	24.9 (U)	6.2 (U)	—	62.3 (U)	2.5 (U)	—	17.6	62.3 (U)	5	-
AAA0476	21-01014	0.00-0.50	Soil	—	21.3 (U)	53.2 (U)	—	—	1.1 (U)	—	—	—	—	21.3 (U)	5.3 (U)	—	53.2 (U)	2.1 (U)	—	9.7	53.2 (U)	5	-
AAA0480	21-01017	0.00-0.33	Soil	—	22.9 (U)	57.2 (U)	—	2.5	1.1 (U)	—	—	—	—	22.9 (U)	5.7 (U)	—	57.2 (U)	2.3 (U)	—	32.7	57.2 (U)	5.1	-
AAA0484	21-01020	0.00-0.50	Soil	—	23.5 (U)	58.9 (U)	—	—	1.2 (U)	—	—	—	25.8	23.5 (U)	5.9 (U)	—	58.9 (U)	2.4 (U)	—	16	58.9 (U)	4.56	-
AAA0495	21-01023	0.00-0.50	Soil	—	22.7 (U)	56.7 (U)	—	—	1.1 (U)	—	—	—	24	22.7 (U)	5.7 (U)	—	56.7 (U)	2.3 (U)	—	14.9	56.7 (U)	4	-
AAA0489	21-01024	0.00-0.25	Soil	—	23.6 (U)	58.9 (U)	—	—	1.2 (U)	—	—	—	25.1	23.6 (U)	5.9 (U)	—	58.9 (U)	2.4 (U)	—	25.2	58.9 (U)	14.2	-
AAA0204	21-01030	0.00-0.50	Soil	64900	6 (U)	—	380	3.1	2 (U)	—	—	25	35	27	4 (U)	29800	—	10.8	19800	98	20 (U)	8.39	130
AAA0248	21-01031	0.00-0.50	Soil	55700	6 (U)	—	-	2.5	2 (U)	—	—	—	—	20	4 (U)	32600	—	—	22000	67	20	6.1	-
AAA0085	21-01037	0.00-0.50	Soil	56600	2 (U)	—	497	2.04	1 (U)	—	—	—	25	22.3	1	23500	—	—	17700	110	20 (U)	4.04	-
AAA0207	21-01038	0.00-0.42	Soil	69100	6 (U)	—	-	4.6	2 (U)	—	—	—	—	23	4 (U)	41000	—	—	31200	27	20 (U)	5.6	62
AAA0253	21-01040	0.00-0.50	Soil	60800	6 (U)	—	305	2.6	2 (U)	—	—	—	—	23	4 (U)	34000	—	—	23300	80	20 (U)	5.1	-
AAA0093	21-01045	0.00-0.50	Soil	55900	3 (U)	—	618	—	1 (U)	6400	—	—	57	21	0.9	25000	—	—	17500	166	20 (U)	2.74	49
AAA0212	21-01047	0.00-0.50	Soil	64300	6 (U)	—	—	3.7	2 (U)	—	—	—	31	23	4 (U)	36300	—	—	27400	37	20 (U)	5.87	52
AAA0213	21-01047	0.00-0.50	Soil	67400	6 (U)	—	—	4.1	2 (U)	—	—	—	33	25	4 (U)	38000	—	—	28600	38	20 (U)	5.14	60
AAA0217	21-01048	0.00-0.50	Soil	45300	6 (U)	—	340	2.5	2 (U)	11400	—	—	26	17	4 (U)	24900	—	—	16700	102	20 (U)	5.75	78
AAA0231	21-01054	0.00-0.50	Soil	55600	6 (U)	—	385	2.7	2 (U)	7800	14	—	29	24	4 (U)	27700	—	—	16800	110	20 (U)	6.5	61
AAA0224	21-01055	0.00-0.50	Soil	58700	6 (U)	9.9	—	3.1	2 (U)	—	—	—	—	22	4 (U)	33200	—	—	25800	41	20 (U)	6.27	-
AAA0226	21-01056	0.00-0.50	Soil	56800	6 (U)	—	—	2.6	2 (U)	—	—	—	—	20	4 (U)	32000	—	—	25200	58	20 (U)	5	66
AAA0222	21-01057	0.00-0.50	Soil	59000	6 (U)	—	—	3.6	2 (U)	—	—	—	—	24	4 (U)	34000	—	—	24000	56	20 (U)	5.8	-
AAA0102	21-01060	0.00-0.50	Soil	59600	3 (U)	—	452	2.28	1 (U)	—	—	—	42	27	1	25400	—	—	16300	107	25	6.39	61
AAA0100	21-01061	0.00-0.50	Soil	55900	3 (U)	—	446	—	1 (U)	—	8.7	—	—	22.5	1	25700	—	—	17800	116	20 (U)	5.19	—

Table B-20 (continued)

Sample ID	Location ID	Depth (ft)	Medium	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Cobalt	Copper	Lead	Lithium	Molybdenum	Potassium	Selenium	Silver	Sodium	Strontium	Thallium	Uranium	Zinc
Soil Background Value				29200	0.83	8.17	295	1.83	0.4	6120	8.64	14.7	22.3	-	-	3460	1.52	1	915	-	0.73	1.82	48.8
Sediment Background Value				-	0.83	3.98	127	-	0.4	-	4.73	11.2	19.7	-	-	-	0.3	1	-	-	-	2.22	60.2
Residential Soil Screening Levels (mg/kg)				7.78E+04	3.13E+01	3.9E+00	5.45E+03	1.56E+02	7.41E+01		1.52E+03	3.13E+03	4.0E+02	1.6E+03	3.91E+02		3.91E+02	3.91E+02		4.69E+04	5.16E+00	1.6E+01	2.35E+04
SWMU 21-015																							
AAA0234	21-01062	0.00-0.50	Soil	55300	6 (U)	—	—	3.7	2 (U)	—	—	—	—	21	4 (U)	36000	—	—	27000	25	20 (U)	5.5	—
AAA0105	21-01067	0.00-0.50	Soil	57200	3 (U)	—	530	—	1 (U)	—	—	—	—	23	1	24000	—	—	16000	133	13	3.64	—
AAA0237	21-01069	0.00-0.50	Soil	66500	6 (U)	—	—	5.1	2 (U)	6200	—	—	—	32	4 (U)	35000	—	—	24000	54	20 (U)	7.2	—
AAA0109	21-01072	0.00-0.50	Soil	60000	3 (U)	—	465	2.19	0.6 (U)	—	—	—	38	26.7	0.9	23800	—	—	16700	129	20 (U)	4.4	—

Note: Units are mg/kg.

a. Background values from LANL 1998, 59730.

b. Soil screening levels from NMED 2004, 85615.

c. Essential nutrient, does not have an SSL.

d. EPA Region 6 human health medium-specific screening levels 2003–2004 (EPA 2003, 81724).

e. EPA Region 9 PRGs table (EPA 2002, 76866).

f. U = The analyte was not detected.

g. n/a = Not available.

h— Not detected or not detected above background unless otherwise marked.

Table B-21
Frequency of Detected Organic Chemicals in Surface Soil Samples Collected in 1992 at MDA B

Analyte	Medium	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	Frequency of Detects
Acenaphthene	Soil	28	1	[0.33] to 1.7	1/28
Chloro-3-methylphenol[4-]	Soil	28	1	[0.33] to 2.9	1/28
Chlorophenol[2-]	Soil	28	1	[0.33] to 2.5	1/28
Dichlorobenzene[1,4-]	Soil	28	1	[0.33 to 1.6]	1/28
Dinitrotoluene[2,4-]	Soil	28	1	[0.33] to 1.7	1/28
Nitrophenol[4-]	Soil	28	1	[0.33] to 3.1	1/28
Nitroso-di-n-propylamine[N-]	Soil	28	1	[0.33 to 1.6]	1/28
Pentachlorophenol	Soil	28	1	[0.33] to 3.9	1/28
Phenol	Soil	28	1	[0.33] to 2.6	1/28
Pyrene	Soil	28	1	[0.33] to 1.6	1/28
Trichlorobenzene[1,2,4-]	Soil	28	1	[0.33 to 1.6]	1/28

Table B-22
Detected Organic Chemical Results in Surface Soil Samples Collected in 1992 at MDA B

Sample ID	Location ID	Depth (ft)*	Medium	Acenaphthene	Chloro-3-methylphenol[4-]	Chlorophenol[2-]	Dichlorobenzene[1,4-]	Dinitrotoluene[2,4-]	Nitrophenol[4-]	Nitroso-di-n-propylamine[N-]	Pentachlorophenol	Phenol	Pyrene	Trichlorobenzene[1,2,4-]
Residential Soil Screening Levels (mg/kg)[a]				4.69E+03	3.1E+02[b,c]	3.91E+02	3.60E+01	1.20E+02	4.9E+02[d]	7.0E-02[d]	2.98E+01	1.80E+04	2.30E+03	6.51E+02
SWMU 21-015														
AAA0226	21-01056	0.00-0.50	Soil	1.7	2.9	2.5	1.4	1.7	3.1	1.5	3.9	2.6	1.6	1.5

Note: Units are mg/kg.

a. Soil screening levels from NMED 2004, 85615.

b. EPA Region 9 PRGs table (EPA 2002, 76866).

c. Soil Screening Level used was for the chemical compound 4-methylphenol.

d. EPA Region 6 human health medium-specific screening levels 2003–2004 (EPA 2003, 81724).

Table B-23
Frequency of Radionuclides Detected above Background Value in Surface Soil Samples Collected in 1992 at MDA B

Analyte	Medium	Number of Analyses	Number of Detects	Concentration Range (pCi/g)	Background Value* (pCi/g)	Frequency of Detects Above Background Value
Americium-241	Soil	16	13	0.009 to 0.73	0.013	11/16
Plutonium-238	Soil	28	5	[0] to 0.018	0.023	0/28
Plutonium-239	Soil	28	28	0.01 to 4.13	0.054	24/28
Strontium-90	Soil	28	0	[-0.3 to 0.9]	1.31	0/28
Thorium-228	Soil	8	8	1.4 to 2.3	2.28	1/8
Thorium-230	Soil	8	8	1.2 to 1.9	2.29	0/8
Thorium-232	Soil	8	8	1.28 to 2.1	2.33	0/8
Uranium-234	Soil	8	8	1.32 to 1.8	2.59	0/8
Uranium-235	Soil	8	0	[0.04 to 0.13]	0.2	0/8
Uranium-238	Soil	8	8	1.4 to 1.9	2.29	0/8

* – Background values from LANL 1998, 59730.

Table B-24
Radionuclide Results Detected above BV in Surface Soil Samples Collected in 1992 at MDA B

Sample ID	Location ID	Depth (ft)	Medium	Americium-241	Plutonium-239	Thorium-228
Soil Background Value[a]				0.013	0.054	2.28
Residential Screening Action Levels (pCi/g)[b]				39	44	2.0
SWMU 21-015						
AAA0453	21-01002	0.00-0.50	Soil	0.014	0.126	—
AAA0462	21-01006	0.00-0.50	Soil	—[c]	0.079	—
AAA0466	21-01010	0.00-0.50	Soil	—	3.245	—
AAA0480	21-01017	0.00-0.33	Soil	—	—	2.3
AAA0495	21-01023	0.00-0.50	Soil	0.073	4.132	—
AAA0489	21-01024	0.00-0.25	Soil	0.049	0.75	—
AAA0204	21-01030	0.00-0.50	Soil	0.031	1.835	—
AAA0248	21-01031	0.00-0.50	Soil	0.024	0.214	—
AAA0085	21-01037	0.00-0.50	Soil	0.046	0.513	—
AAA0207	21-01038	0.00-0.42	Soil	—	0.073	—
AAA0253	21-01040	0.00-0.50	Soil	—	0.094	—
AAA0093	21-01045	0.00-0.50	Soil	—	0.344	—
AAA0212	21-01047	0.00-0.50	Soil	0.014	0.171	—
AAA0213	21-01047	0.00-0.50	Soil	—	0.131	—
AAA0217	21-01048	0.00-0.50	Soil	—	0.775	—
AAA0231	21-01054	0.00-0.50	Soil	—	2.099	—
AAA0224	21-01055	0.00-0.50	Soil	—	0.735	—
AAA0226	21-01056	0.00-0.50	Soil	0.05	0.921	—
AAA0222	21-01057	0.00-0.50	Soil	—	0.9	—
AAA0102	21-01060	0.00-0.50	Soil	—	1.351	—
AAA0100	21-01061	0.00-0.50	Soil	0.071	1.369	—
AAA0234	21-01062	0.00-0.50	Soil	—	0.106	—
AAA0105	21-01067	0.00-0.50	Soil	0.029	0.573	—
AAA0237	21-01069	0.00-0.50	Soil	—	0.115	—
AAA0109	21-01072	0.00-0.50	Soil	—	0.625	—

Note: Units are pCi/g.

a. Background values from LANL 1998, 59730.

b. Soil radionuclide screening action levels from LANL 2002, 73705.

c. Not detected or not detected above background unless otherwise marked.

Table B-25
Summary of Subsurface Samples Collected in 1998 at MDA B (Tuff)

Sample ID	Location ID	Depth (ft)	Medium	Target Analyte List Metals	SVOCs	Americium-241	Gamma Spectroscopy	Tritium	Isotopic Plutonium	Isotopic Uranium	Strontium-90
MD21-98-0101	21-10551	29-30	Tuff	4577R	4576R	4578R	4578R	4578R	4578R	4578R	4578R
MD21-98-0102	21-10551	39-40	Tuff	4577R	4576R	4578R	—*	4578R	4578R	4578R	4578R
MD21-98-0103	21-10551	49-50	Tuff	4577R	4576R	4578R	4578R	4578R	4578R	4578R	4578R
MD21-98-0105	21-10551	59-60	Tuff	4577R	4576R	4578R	4578R	4578R	4578R	4578R	4578R
MD21-98-0106	21-10551	69-70	Tuff	4577R	4576R	4578R	4578R	4578R	4578R	4578R	4578R
MD21-98-0107	21-10551	79-80	Tuff	4583R	4582R	4584R	4584R	4584R	4584R	4584R	4584R
MD21-98-0108	21-10551	99-100	Tuff	4587R	4586R	4588R	4588R	4588R	4588R	4588R	4588R
MD21-98-0110	21-10551	89-90	Tuff	4583R	4582R	4584R	4584R	4584R	4584R	4584R	4584R
MD21-98-0123	21-10552	29-30	Tuff	4592R	4591R	4593R	4593R	4593R	4593R	4593R	4593R
MD21-98-0124	21-10552	39-40	Tuff	4592R	4591R	4593R	4593R	4593R	4593R	4593R	4593R
MD21-98-0125	21-10552	49-50	Tuff	4601R	4600R	4602R	4602R	4602R	4602R	4602R	4602R
MD21-98-0127	21-10552	59-60	Tuff	4601R	4600R	4602R	4602R	4602R	4602R	4602R	4602R
MD21-98-0128	21-10552	69-70	Tuff	4601R	4600R	4602R	4602R	4602R	4602R	4602R	4602R
MD21-98-0129	21-10552	79-80	Tuff	4601R	4600R	4602R	4602R	4602R	4602R	4602R	4602R
MD21-98-0130	21-10552	89-90	Tuff	4657R	4656R	4658R	4658R	4658R	4658R	4658R	4658R
MD21-98-0131	21-10552	99-100	Tuff	4657R	4656R	4658R	4658R	4658R	4658R	4658R	4658R
MD21-98-0146	21-10553	27-30	Tuff	4619R	4618R	4620R	—	4620R	4620R	4620R	4620R
MD21-98-0147	21-10553	29-30	Tuff	4619R	4618R	4620R	—	4620R	4620R	4620R	4620R
MD21-98-0149	21-10553	39-40	Tuff	4619R	4618R	4620R	—	4620R	4620R	4620R	4620R
MD21-98-0150	21-10553	49-50	Tuff	4619R	4618R	4620R	—	4620R	4620R	4620R	4620R
MD21-98-0151	21-10553	59-60	Tuff	4619R	4618R	4620R	—	4620R	4620R	4620R	4620R
MD21-98-0152	21-10553	69-70	Tuff	4622R	4621R	4623R	4623R	4623R	4623R	4623R	4623R
MD21-98-0153	21-10553	79-80	Tuff	4622R	4621R	4623R	4623R	4623R	4623R	4623R	4623R
MD21-98-0155	21-10553	89-90	Tuff	4622R	4621R	4623R	4623R	4623R	4623R	4623R	4623R
MD21-98-0156	21-10553	99-100	Tuff	4622R	4621R	4623R	4623R	4623R	4623R	4623R	4623R
MD21-98-0168	21-10554	23-24	Tuff	4682R	4681R	4683R	4683R	4683R	4683R	4683R	4683R
MD21-98-0169	21-10554	39-40	Tuff	4682R	4681R	4683R	4683R	4683R	4683R	4683R	4683R
MD21-98-0171	21-10554	49-50	Tuff	4682R	4681R	4683R	4683R	4683R	4683R	4683R	4683R
MD21-98-0172	21-10554	59-60	Tuff	4682R	4681R	4683R	4683R	4683R	4683R	4683R	4683R
MD21-98-0173	21-10554	69-70	Tuff	4682R	4681R	4683R	4683R	4683R	4683R	4683R	4683R
MD21-98-0174	21-10554	79-80	Tuff	4682R	4681R	4683R	4683R	4683R	4683R	4683R	4683R

Table B-25 (continued)

Sample ID	Location ID	Depth (ft)	Medium	Target Analyte List Metals	SVOCs	Americium-241	Gamma Spectroscopy	Tritium	Isotopic Plutonium	Isotopic Uranium	Strontium-90
MD21-98-0175	21-10554	89-90	Tuff	4685R	4684R	4686R	4686R	4686R	4686R	4686R	4686R
MD21-98-0177	21-10554	99-100	Tuff	4685R	4684R	4686R	4686R	4686R	4686R	4686R	4686R
MD21-98-0189	21-10555	29-30	Tuff	4707R	4706R	4708R	4708R	4708R	4708R	4708R	4708R
MD21-98-0190	21-10555	39-40	Tuff	4707R	4706R	4708R	4708R	4708R	4708R	4708R	4708R
MD21-98-0191	21-10555	49-50	Tuff	4707R	4706R	4708R	4708R	4708R	4708R	4708R	4708R
MD21-98-0193	21-10555	59-60	Tuff	4734R	4733R	4735R	4735R	4735R	4735R	4735R	4735R
MD21-98-0194	21-10555	69-70	Tuff	4734R	4733R	4735R	4735R	4735R	4735R	4735R	4735R
MD21-98-0195	21-10555	79-80	Tuff	4734R	4733R	4735R	4735R	4735R	4735R	4735R	4735R
MD21-98-0196	21-10555	88-90	Tuff	4731R	4730R	4732R	4732R	4732R	4732R	4732R	4732R
MD21-98-0197	21-10555	88-90	Tuff	4731R	4730R	4732R	4732R	4732R	4732R	4732R	4732R
MD21-98-0199	21-10555	99-100	Tuff	4731R	4730R	4732R	4732R	4732R	4732R	4732R	4732R
MD21-98-0211	21-10556	29-30	Tuff	4768R	4767R	4769R	4769R	4769R	4769R	4769R	4769R
MD21-98-0212	21-10556	39-40	Tuff	4768R	4767R	4769R	4769R	4769R	4769R	4769R	4769R
MD21-98-0213	21-10556	49-50	Tuff	4768R	4767R	4769R	4769R	4769R	4769R	4769R	4769R
MD21-98-0215	21-10556	59-60	Tuff	4768R	4767R	4769R	4769R	4769R	4769R	4769R	4769R
MD21-98-0216	21-10556	69-70	Tuff	4790R	4789R	4791R	4791R	4791R	4791R	4791R	4791R
MD21-98-0217	21-10556	79-80	Tuff	4790R	4789R	4791R	4791R	4791R	4791R	4791R	4791R
MD21-98-0218	21-10556	89-90	Tuff	4790R	4789R	4791R	4791R	4791R	4791R	4791R	4791R
MD21-98-0219	21-10556	99-100	Tuff	4790R	4789R	4791R	4791R	4791R	4791R	4791R	4791R
MD21-98-0236	21-10557	29-30	Tuff	4845R	4844R	4846R	4846R	4846R	4846R	4846R	4846R
MD21-98-0237	21-10557	39-40	Tuff	4845R	4844R	4846R	4846R	4846R	4846R	4846R	4846R
MD21-98-0238	21-10557	49-50	Tuff	4845R	4844R	4846R	4846R	4846R	4846R	4846R	4846R
MD21-98-0240	21-10557	59-60	Tuff	4845R	4844R	4846R	4846R	4846R	4846R	4846R	4846R
MD21-98-0241	21-10557	69-70	Tuff	4849R	4848R	4850R	4850R	4850R	4850R	4850R	4850R
MD21-98-0242	21-10557	79-80	Tuff	4849R	4848R	4850R	4850R	4850R	4850R	4850R	4850R
MD21-98-0243	21-10557	89-90	Tuff	4849R	4848R	4850R	4850R	4850R	4850R	4850R	4850R
MD21-98-0244	21-10557	99-100	Tuff	4849R	4848R	4850R	4850R	4850R	4850R	4850R	4850R

Note: Depths are angled distance from top of borehole, not vertical depth below ground surface.

* — = Not detected or not detected above background unless otherwise marked.

Table B-26
Frequency of Detected Radionuclides above Background in Subsurface Samples Collected in 1998 at MDA B

Analyte	Medium	Number of Analyses	Number of Detects	Concentration Range (pCi/g)	Background Value[a] (pCi/g)	Frequency of Detects Above Background
Americium-241	Tuff	58	2	[-0.0129] to 13.09	n/a	2/58
Cesium-134	Tuff	53	0	[-0.082 to 0.072]	n/a	0/53
Cesium-137	Tuff	53	0	[-0.078 to 0.052]	n/a	0/53
Cobalt-60	Tuff	51	0	[-0.089 to 0.11]	n/a	0/51
Europium-152	Tuff	53	0	[-0.3 to 0.1]	n/a	0/53
Plutonium-238	Tuff	58	0	[-0.026 to 0.196]	n/a	0/58
Plutonium-239	Tuff	58	8	[-0.003] to 43.5	n/a	8/58
Ruthenium-106	Tuff	52	0	[-0.84 to 0.64]	n/a	0/52
Sodium-22	Tuff	53	0	[-0.1 to 0.065]	n/a	0/53
Strontium-90	Tuff	58	1	[-0.56] to 10.9	n/a	1/58
Tritium	Tuff	58	21	[-0.01] to 269	n/a	21/58
Uranium-234	Tuff	58	58	0.576 to 4.04	1.98	1/58
Uranium-235	Tuff	58	51	[0.0244] to 0.175	0.09	1/58
Uranium-238	Tuff	58	1	[0.602] to 3.92	1.93	1/58

a. Background values from LANL 1998, 59730.

b. Not applicable.

Table B-27
Radionuclides Detected above Background Value in Subsurface Samples Collected in 1998 at MDA B

Sample ID	Location ID	Depth (ft)	Medium	Americium-241	Plutonium-239	Strontium-90	Tritium	Uranium-234	Uranium-235	Uranium-238
Qbt 2,3,4 Background Value[b]								1.98	0.09	1.93
Residential Screening Action Levels (pCi/g)[b]				39	44	5.7	890	63	17	86
SWMU 21-015										
MD21-98-0101	21-10551	29.00-30.00	Tuff	—[c]	—	—	0.1	—	—	—
MD21-98-0102	21-10551	39.00-40.00	Tuff	—	—	—	0.3	—	—	—
MD21-98-0103	21-10551	49.00-50.00	Tuff	—	—	—	11.9	—	—	—
MD21-98-0105	21-10551	59.00-60.00	Tuff	—	—	—	269	—	—	—
MD21-98-0106	21-10551	69.00-70.00	Tuff	—	—	—	178	—	—	—
MD21-98-0107	21-10551	79.00-80.00	Tuff	0.0227	—	—	55	—	—	—
MD21-98-0110	21-10551	89.00-90.00	Tuff	—	—	—	3.06	—	—	—
MD21-98-0108	21-10551	99.00-100.00	Tuff	—	—	—	0.75	—	—	—
MD21-98-0130	21-10552	89.00-90.00	Tuff	—	—	—	0.07	—	—	—
MD21-98-0131	21-10552	99.00-100.00	Tuff	—	—	—	0.1	—	—	—
MD21-98-0151	21-10553	59.00-60.00	Tuff	—	—	—	0.05	—	—	—
MD21-98-0153	21-10553	79.00-80.00	Tuff	—	—	—	0.08	—	—	—
MD21-98-0155	21-10553	89.00-90.00	Tuff	—	—	—	0.09	—	—	—
MD21-98-0156	21-10553	99.00-100.00	Tuff	—	—	—	0.11	—	—	—
MD21-98-0168	21-10554	23.00-24.00	Tuff	13.09	43.5	10.9	—	—	—	—
MD21-98-0169	21-10554	39.00-40.00	Tuff	—	0.044	—	0.08	—	—	—
MD21-98-0171	21-10554	49.00-50.00	Tuff	—	0.18	—	0.05	—	—	—
MD21-98-0172	21-10554	59.00-60.00	Tuff	—	0.137	—	0.05	—	—	—
MD21-98-0173	21-10554	69.00-70.00	Tuff	—	0.061	—	0.06	—	—	—

Table B-27 (continued)

Sample ID	Location ID	Depth (ft)	Medium	Americium-241	Plutonium-239	Strontium-90	Tritium	Uranium-234	Uranium-235	Uranium-238
MD21-98-0174	21-10554	79.00-80.00	Tuff	—	—	—	0.05	—	—	—
MD21-98-0175	21-10554	89.00-90.00	Tuff	—	0.169	—	0.26	—	—	—
MD21-98-0177	21-10554	99.00-100.00	Tuff	—	—	—	0.1	—	—	—
MD21-98-0190	21-10555	39.00-40.00	Tuff	—	0.05	—	—	—	—	—
MD21-98-0191	21-10555	49.00-50.00	Tuff	—	0.078	—	—	—	—	—
MD21-98-0240	21-10557	59.00-60.00	Tuff	—	—	—	—	4.04	0.175	3.92

Note: Units are pCi/g.
Depths are angled distance from top of borehole, not vertical depth below ground surface.

a. Background values from LANL 1998, 59730.

b. Soil radionuclide screening action levels from LANL 2002, 73705.

c. Not detected or not detected above background unless otherwise marked.

Table B-28
Frequency of Inorganic Chemicals above Background Value in Subsurface Samples Collected in 1998 at MDA B

Analyte	Medium	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	Background Value* (mg/kg)	Frequency of Detects Above Background Value	Frequency of Nondetects Above Background Value
Aluminum	Tuff	58	58	110 to 8700	7340	1/58	0/58
Antimony	Tuff	35	0	[10 to 11]	0.5	0/35	35/35
Arsenic	Tuff	58	40	[0.53] to 3.7	2.79	3/58	0/58
Barium	Tuff	58	58	2.1 to 39	46	0/58	0/58
Beryllium	Tuff	58	8	[0.51] to 1.2	1.21	0/58	0/58
Cadmium	Tuff	58	1	[0.51] to 37	1.63	1/58	0/58
Calcium	Tuff	58	58	150 to 1500	2200	0/58	0/58
Chromium	Tuff	58	43	[1] to 6.9	7.14	0/58	0/58
Cobalt	Tuff	58	7	[1] to 2.1	3.14	0/58	0/58
Copper	Tuff	55	22	[1] to 4	4.66	0/55	0/55
Iron	Tuff	58	58	1200 to 9300	14500	0/58	0/58
Lead	Tuff	55	54	[0.27] to 61	11.2	5/55	0/55
Magnesium	Tuff	57	57	44 to 1300	1690	0/57	0/57
Manganese	Tuff	53	53	100 to 310	482	0/53	0/53
Mercury	Tuff	58	1	[0.1] to 0.13	0.1	1/58	38/58
Nickel	Tuff	58	12	[2] to 4.2	6.58	0/58	0/58
Potassium	Tuff	58	58	72 to 970	3500	0/58	0/58
Selenium	Tuff	58	0	[0.52 to 1.1]	0.3	0/58	58/58
Silver	Tuff	58	0	[2 to 2.5]	1	0/58	58/58
Sodium	Tuff	58	58	49 to 190	2770	0/58	0/58
Thallium	Tuff	58	0	[0.26 to 2.2]	1.1	0/58	8/58
Vanadium	Tuff	58	46	[0.52] to 8.9	17	0/58	0/58
Zinc	Tuff	58	58	6 to 110	63.5	1/58	0/58

* – Background values from LANL 1998, 59730.

Table B-29
Inorganic Chemical Results above Background Value in Subsurface Samples Collected in 1998 at MDA B

Sample ID	Location ID	Depth (ft)	Medium	Aluminum	Antimony	Arsenic	Cadmium	Lead	Mercury	Selenium	Silver	Thallium	Zinc
Qbt 2,3,4 Background Value[a]				7340	0.5	2.79	1.63	11.2	0.1	0.3	1	1.1	63.5
Residential Soil Screening Levels (mg/kg)[b]				7.78E+04	3.13E+01	3.9E+00	7.41E+01	4.0E+02	1.00E+05	3.91E+02	3.91E+02	5.16E+00	2.35E+04
MD21-98-0101	21-10551	29.00-30.00	Tuff	—[c]	11 (UJ)[d]	—	—	—	0.11 (U)[e]	0.53 (UJ)	2.1 (UJ)	—	—
MD21-98-0102	21-10551	39.00-40.00	Tuff	—	11 (UJ)	—	—	—	0.11 (U)	0.54 (UJ)	2.2 (UJ)	—	—
MD21-98-0103	21-10551	49.00-50.00	Tuff	—	11 (UJ)	—	—	—	0.11 (U)	0.54 (UJ)	2.2 (UJ)	—	—
MD21-98-0105	21-10551	59.00-60.00	Tuff	—	11 (UJ)	—	—	—	0.11 (U)	0.56 (UJ)	2.2 (UJ)	—	—
MD21-98-0106	21-10551	69.00-70.00	Tuff	—	11 (UJ)	—	—	—	0.11 (U)	0.55 (UJ)	2.2 (UJ)	—	—
MD21-98-0107	21-10551	79.00-80.00	Tuff	—	—	—	—	—	0.11 (U)	1.1 (U)	2.2 (U)	—	—
MD21-98-0110	21-10551	89.00-90.00	Tuff	—	—	—	—	13	0.11 (U)	1.1 (U)	2.2 (U)	—	—
MD21-98-0108	21-10551	99.00-100.00	Tuff	—	—	—	—	—	0.11 (U)	1.1 (U)	2.2 (U)	—	—
MD21-98-0123	21-10552	29.00-30.00	Tuff	—	—	—	—	—	0.11 (U)	1.1 (U)	2.2 (U)	—	—
MD21-98-0124	21-10552	39.00-40.00	Tuff	—	—	—	—	—	0.11 (U)	1.1 (U)	2.2 (U)	—	—
MD21-98-0125	21-10552	49.00-50.00	Tuff	—	—	—	—	—	0.11 (U)	0.53 (U)	2.1 (U)	—	—
MD21-98-0127	21-10552	59.00-60.00	Tuff	—	—	—	—	—	0.11 (U)	0.53 (U)	2.1 (U)	—	—
MD21-98-0128	21-10552	69.00-70.00	Tuff	—	—	—	—	—	0.11 (U)	0.54 (U)	2.2 (U)	—	—
MD21-98-0129	21-10552	79.00-80.00	Tuff	—	—	—	—	—	0.11 (U)	0.54 (U)	2.2 (U)	—	—
MD21-98-0130	21-10552	89.00-90.00	Tuff	—	—	—	—	—	0.11 (U)	0.54 (U)	2.2 (U)	—	—
MD21-98-0131	21-10552	99.00-100.00	Tuff	—	—	—	—	—	0.11 (U)	0.54 (U)	2.2 (U)	—	—
MD21-98-0146	21-10553	27.00-30.00	Tuff	—	—	—	—	—	0.11 (U)	0.53 (U)	2.1 (U)	—	—
MD21-98-0147	21-10553	29.00-30.00	Tuff	—	—	—	—	—	0.11 (U)	0.53 (U)	2.1 (U)	—	—
MD21-98-0149	21-10553	39.00-40.00	Tuff	—	—	—	—	—	0.11 (U)	0.54 (U)	2.2 (U)	—	—
MD21-98-0150	21-10553	49.00-50.00	Tuff	—	—	—	—	—	0.11 (U)	0.55 (U)	2.2 (U)	—	—

Table B-29 (continued)

Sample ID	Location ID	Depth (ft)	Medium	Aluminum	Antimony	Arsenic	Cadmium	Lead	Mercury	Selenium	Silver	Thallium	Zinc
Qbt 2,3,4 Background Value				7340	0.5	2.79	1.63	11.2	0.1	0.3	1	1.1	63.5
Residential Soil Screening Levels (mg/kg)				7.78E+04	3.13E+01	3.9E+00	7.41E+01	4.0E+02	1.00E+05	3.91E+02	3.91E+02	5.16E+00	2.35E+04
MD21-98-0151	21-10553	59.00-60.00	Tuff	—	—	—	—	—	0.13 (U)	0.63 (U)	2.5 (U)	—	—
MD21-98-0152	21-10553	69.00-70.00	Tuff	—	—	—	—	—	0.11 (U)	0.54 (U)	2.2 (U)	—	—
MD21-98-0153	21-10553	79.00-80.00	Tuff	—	—	—	—	—	0.11 (U)	0.54 (U)	2.2 (U)	—	—
MD21-98-0155	21-10553	89.00-90.00	Tuff	—	—	—	—	—	0.11 (U)	0.53 (U)	2.1 (U)	—	—
MD21-98-0156	21-10553	99.00-100.00	Tuff	—	—	—	—	—	0.11 (U)	0.54 (U)	2.2 (U)	—	—
MD21-98-0168	21-10554	23.00-24.00	Tuff	—	10 (U)	—	37	—	0.13	1 (U)	2.1 (U)	—	110
MD21-98-0169	21-10554	39.00-40.00	Tuff	—	11 (U)	—	—	—	0.11 (U)	1.1 (U)	2.1 (U)	—	—
MD21-98-0171	21-10554	49.00-50.00	Tuff	—	10 (U)	—	—	—	—	1 (U)	2.1 (U)	—	—
MD21-98-0172	21-10554	59.00-60.00	Tuff	—	10 (U)	—	—	—	—	1 (U)	2.1 (U)	—	—
MD21-98-0173	21-10554	69.00-70.00	Tuff	—	10 (U)	—	—	—	—	1 (U)	2.1 (U)	—	—
MD21-98-0174	21-10554	79.00-80.00	Tuff	—	10 (U)	—	—	—	—	1 (U)	2.1 (U)	—	—
MD21-98-0175	21-10554	89.00-90.00	Tuff	—	10 (U)	—	—	—	—	1 (U)	2.1 (U)	—	—
MD21-98-0177	21-10554	99.00-100.00	Tuff	—	10 (U)	—	—	—	—	1 (U)	2.1 (U)	—	—
MD21-98-0189	21-10555	29.00-30.00	Tuff	—	—	—	—	—	—	1 (U)	2 (U)	—	—
MD21-98-0190	21-10555	39.00-40.00	Tuff	—	—	—	—	—	—	1 (U)	2 (U)	—	—
MD21-98-0191	21-10555	49.00-50.00	Tuff	—	—	—	—	—	0.11 (U)	1.1 (U)	2.1 (U)	—	—
MD21-98-0193	21-10555	59.00-60.00	Tuff	—	10 (U)	—	—	—	—	1 (U)	2.1 (U)	—	—
MD21-98-0194	21-10555	69.00-70.00	Tuff	—	10 (U)	—	—	—	—	1 (U)	2.1 (U)	—	—
MD21-98-0195	21-10555	79.00-80.00	Tuff	—	10 (U)	—	—	—	—	1 (U)	2.1 (U)	—	—
MD21-98-0196	21-10555	88.00-90.00	Tuff	—	10 (U)	—	—	—	—	1 (U)	2.1 (U)	—	—
MD21-98-0197	21-10555	88.00-90.00	Tuff	—	10 (U)	—	—	—	—	1 (U)	2.1 (U)	—	—
MD21-98-0199	21-10555	99.00-100.00	Tuff	—	10 (U)	—	—	—	—	1 (U)	2.1 (U)	—	—

Table B-29 (continued)

Sample ID	Location ID	Depth (ft)	Medium	Aluminum	Antimony	Arsenic	Cadmium	Lead	Mercury	Selenium	Silver	Thallium	Zinc
Qbt 2,3,4 Background Value				7340	0.5	2.79	1.63	11.2	0.1	0.3	1	1.1	63.5
Residential Soil Screening Levels (mg/kg)				7.78E+04	3.13E+01	3.9E+00	7.41E+01	4.0E+02	1.00E+05	3.91E+02	3.91E+02	5.16E+00	2.35E+04
MD21-98-0211	21-10556	29.00-30.00	Tuff	—	10 (U)	—	—	—	—	1 (U)	2.1 (U)	—	—
MD21-98-0212	21-10556	39.00-40.00	Tuff	—	10 (U)	—	—	—	—	1 (U)	2.1 (U)	—	—
MD21-98-0213	21-10556	49.00-50.00	Tuff	—	10 (U)	—	—	—	—	1 (U)	2.1 (U)	—	—
MD21-98-0215	21-10556	59.00-60.00	Tuff	—	10 (U)	—	—	—	—	1 (U)	2.1 (U)	—	—
MD21-98-0216	21-10556	69.00-70.00	Tuff	8700	11 (U)	3.7	—	—	0.11 (U)	0.55 (U)	2.2 (U)	—	—
MD21-98-0217	21-10556	79.00-80.00	Tuff	—	11 (U)	2.9	—	—	0.11 (U)	0.54 (U)	2.2 (U)	—	—
MD21-98-0218	21-10556	89.00-90.00	Tuff	—	11 (U)	—	—	—	0.11 (U)	0.54 (U)	2.2 (U)	—	—
MD21-98-0219	21-10556	99.00-100.00	Tuff	—	10 (U)	—	—	—	—	0.52 (U)	2.1 (U)	—	—
MD21-98-0236	21-10557	29.00-30.00	Tuff	—	11 (U)	3.3	—	—	0.11 (U)	1.1 (U)	2.2 (U)	2.2 (U)	—
MD21-98-0237	21-10557	39.00-40.00	Tuff	—	11 (U)	—	—	—	0.11 (U)	1.1 (U)	2.1 (U)	2.1 (U)	—
MD21-98-0238	21-10557	49.00-50.00	Tuff	—	11 (U)	—	—	22	0.11 (U)	1.1 (U)	2.2 (U)	2.2 (U)	—
MD21-98-0240	21-10557	59.00-60.00	Tuff	—	11 (U)	—	—	61	0.11 (U)	1.1 (U)	2.2 (U)	2.2 (U)	—
MD21-98-0241	21-10557	69.00-70.00	Tuff	—	11 (U)	—	—	48	0.11 (U)	1.1 (U)	2.2 (U)	2.2 (U)	—
MD21-98-0242	21-10557	79.00-80.00	Tuff	—	11 (U)	—	—	12	0.11 (U)	1.1 (U)	2.2 (U)	2.2 (U)	—
MD21-98-0243	21-10557	89.00-90.00	Tuff	—	11 (U)	—	—	—	0.11 (U)	1.1 (U)	2.2 (U)	2.2 (U)	—
MD21-98-0244	21-10557	99.00-100.00	Tuff	—	11 (U)	—	—	—	0.11 (U)	1.1 (U)	2.2 (U)	2.2 (U)	—

Notes Units are mg/kg.
Depths are angled distance from top of borehole, not vertical depth below ground surface.

a. Background values from LANL 1998, 59730.

b. Soil screening levels from NMED 2004, 85615.

c. — = Not detected or not detected above background unless otherwise marked.

d. UJ = The analyte was not detected, with an expectation that the reported result is more uncertain then usual, and is estimated.

e. U = The analyte was not detected.

Table B-30
Summary of Pore Gas Sample Results Collected in 1998 at MDA B

Sample ID	Location ID	Analyte Name	Result (ppbv)	Collection Date
MD21-98-0226	21-10556	Benzene	23	10/2/1998
MD21-98-0245	21-10557	Benzene	16	10/8/1998
MD21-98-0239	21-10557	Benzene	14	10/7/1998
MD21-98-0176	21-10554	Benzene	8.4	9/23/1998
MD21-98-0198	21-10555	Benzene	7.9	9/28/1998
MD21-98-0170	21-10554	Benzene	7.2	9/22/1998
MD21-98-0138	21-10552	Benzene	6.6	9/15/1998
MD21-98-0192	21-10555	Benzene	6.6	9/25/1998
MD21-98-0256	21-10557	Benzene	4.8	10/8/1998
MD21-98-0182	21-10554	Benzene	4.4	9/24/1998
MD21-98-0126	21-10552	Benzene	3.7	9/11/1998
MD21-98-0154	21-10553	Benzene	3.4	9/18/1998
MD21-98-0109	21-10551	Benzene	3.3	9/4/1998
MD21-98-0114	21-10551	Benzene	0.53	9/10/1998
MD21-98-0109	21-10551	Carbon Tetrachloride	14	9/4/1998
MD21-98-0256	21-10557	Carbon Tetrachloride	7.6	10/8/1998
MD21-98-0104	21-10551	Carbon Tetrachloride	6.4	9/3/1998
MD21-98-0245	21-10557	Carbon Tetrachloride	4.8	10/8/1998
MD21-98-0226	21-10556	Carbon Tetrachloride	3	10/2/1998
MD21-98-0239	21-10557	Carbon Tetrachloride	2.2	10/7/1998
MD21-98-0109	21-10551	Chloroform	56	9/4/1998
MD21-98-0104	21-10551	Chloroform	29	9/3/1998
MD21-98-0256	21-10557	Chloroform	1.3	10/8/1998
MD21-98-0226	21-10556	Chloroform	0.76	10/2/1998
MD21-98-0245	21-10557	Chloroform	0.69	10/8/1998
MD21-98-0109	21-10551	Chloromethane	7.8	9/4/1998
MD21-98-0256	21-10557	Dichlorodifluoromethane	0.87	10/8/1998
MD21-98-0239	21-10557	Dichlorodifluoromethane	0.68	10/7/1998
MD21-98-0138	21-10552	Dichlorodifluoromethane	0.65	9/15/1998
MD21-98-0226	21-10556	Dichlorodifluoromethane	0.62	10/2/1998
MD21-98-0114	21-10551	Dichlorodifluoromethane	0.59	9/10/1998
MD21-98-0154	21-10553	Dichlorodifluoromethane	0.59	9/18/1998
MD21-98-0239	21-10557	Ethylbenzene	2.9	10/7/1998
MD21-98-0245	21-10557	Ethylbenzene	2.3	10/8/1998
MD21-98-0198	21-10555	Ethylbenzene	1.8	9/28/1998
MD21-98-0256	21-10557	Ethylbenzene	1.3	10/8/1998

Table B-30 (continued)

Sample ID	Location ID	Analyte Name	Result (ppbv)	Collection Date
MD21-98-0226	21-10556	Ethylbenzene	1.2	10/2/1998
MD21-98-0138	21-10552	Ethylbenzene	0.66	9/15/1998
MD21-98-0126	21-10552	Methylene Chloride	15	9/11/1998
MD21-98-0226	21-10556	Styrene	1.2	10/2/1998
MD21-98-0239	21-10557	Styrene	1.1	10/7/1998
MD21-98-0245	21-10557	Styrene	0.87	10/8/1998
MD21-98-0109	21-10551	Tetrachloroethene	10	9/4/1998
MD21-98-0104	21-10551	Tetrachloroethene	4.4	9/3/1998
MD21-98-0256	21-10557	Tetrachloroethene	1.5	10/8/1998
MD21-98-0245	21-10557	Tetrachloroethene	1.2	10/8/1998
MD21-98-0239	21-10557	Tetrachloroethene	0.9	10/7/1998
MD21-98-0239	21-10557	Toluene	36	10/7/1998
MD21-98-0256	21-10557	Toluene	26	10/8/1998
MD21-98-0245	21-10557	Toluene	23	10/8/1998
MD21-98-0226	21-10556	Toluene	19	10/2/1998
MD21-98-0109	21-10551	Toluene	16	9/4/1998
MD21-98-0126	21-10552	Toluene	15	9/11/1998
MD21-98-0198	21-10555	Toluene	13	9/28/1998
MD21-98-0176	21-10554	Toluene	11	9/23/1998
MD21-98-0170	21-10554	Toluene	9.9	9/22/1998
MD21-98-0104	21-10551	Toluene	9.6	9/3/1998
MD21-98-0192	21-10555	Toluene	8.8	9/25/1998
MD21-98-0138	21-10552	Toluene	7.8	9/15/1998
MD21-98-0182	21-10554	Toluene	6.1	9/24/1998
MD21-98-0214	21-10556	Toluene	4.9	9/30/1998
MD21-98-0132	21-10552	Toluene	4.1	9/14/1998
MD21-98-0154	21-10553	Toluene	4	9/18/1998
MD21-98-0114	21-10551	Toluene	2.1	9/10/1998
MD21-98-0160	21-10553	Toluene	1.8	9/18/1998
MD21-98-0204	21-10555	Toluene	1.3	9/28/1998
MD21-98-0148	21-10553	Toluene	1.1	9/17/1998
MD21-98-0220	21-10556	Toluene	0.88	10/1/1998
MD21-98-0132	21-10552	Trichloro-1,2,2-trifluoroethane[1,1,2-]	9.1	9/14/1998
MD21-98-0126	21-10552	Trichloro-1,2,2-trifluoroethane[1,1,2-]	9	9/11/1998
MD21-98-0170	21-10554	Trichloro-1,2,2-trifluoroethane[1,1,2-]	4.4	9/22/1998
MD21-98-0214	21-10556	Trichloro-1,2,2-trifluoroethane[1,1,2-]	2.9	9/30/1998
MD21-98-0192	21-10555	Trichloro-1,2,2-trifluoroethane[1,1,2-]	2.5	9/25/1998

Table B-30 (continued)

Sample ID	Location ID	Analyte Name	Result (ppbv)	Collection Date
MD21-98-0204	21-10555	Trichloro-1,2,2-trifluoroethane[1,1,2-]	2.4	9/28/1998
MD21-98-0198	21-10555	Trichloro-1,2,2-trifluoroethane[1,1,2-]	2.1	9/28/1998
MD21-98-0176	21-10554	Trichloro-1,2,2-trifluoroethane[1,1,2-]	2.1	9/23/1998
MD21-98-0138	21-10552	Trichloro-1,2,2-trifluoroethane[1,1,2-]	1.4	9/15/1998
MD21-98-0160	21-10553	Trichloro-1,2,2-trifluoroethane[1,1,2-]	1.4	9/18/1998
MD21-98-0154	21-10553	Trichloro-1,2,2-trifluoroethane[1,1,2-]	1.2	9/18/1998
MD21-98-0148	21-10553	Trichloro-1,2,2-trifluoroethane[1,1,2-]	0.78	9/17/1998
MD21-98-0126	21-10552	Trichloroethane[1,1,1-]	190	9/11/1998
MD21-98-0170	21-10554	Trichloroethane[1,1,1-]	100	9/22/1998
MD21-98-0214	21-10556	Trichloroethane[1,1,1-]	46	9/30/1998
MD21-98-0176	21-10554	Trichloroethane[1,1,1-]	45	9/23/1998
MD21-98-0204	21-10555	Trichloroethane[1,1,1-]	39	9/28/1998
MD21-98-0192	21-10555	Trichloroethane[1,1,1-]	38	9/25/1998
MD21-98-0198	21-10555	Trichloroethane[1,1,1-]	33	9/28/1998
MD21-98-0138	21-10552	Trichloroethane[1,1,1-]	30	9/15/1998
MD21-98-0182	21-10554	Trichloroethane[1,1,1-]	29	9/24/1998
MD21-98-0104	21-10551	Trichloroethane[1,1,1-]	28	9/3/1998
MD21-98-0160	21-10553	Trichloroethane[1,1,1-]	27	9/18/1998
MD21-98-0154	21-10553	Trichloroethane[1,1,1-]	25	9/18/1998
MD21-98-0148	21-10553	Trichloroethane[1,1,1-]	16	9/17/1998
MD21-98-0256	21-10557	Trichloroethane[1,1,1-]	14	10/8/1998
MD21-98-0109	21-10551	Trichloroethane[1,1,1-]	13	9/4/1998
MD21-98-0245	21-10557	Trichloroethane[1,1,1-]	10	10/8/1998
MD21-98-0239	21-10557	Trichloroethane[1,1,1-]	6.7	10/7/1998
MD21-98-0226	21-10556	Trichloroethane[1,1,1-]	5.4	10/2/1998
MD21-98-0220	21-10556	Trichloroethane[1,1,1-]	3.7	10/1/1998
MD21-98-0114	21-10551	Trichloroethane[1,1,1-]	2.9	9/10/1998
MD21-98-0109	21-10551	Trichloroethene	120	9/4/1998
MD21-98-0256	21-10557	Trichloroethene	92	10/8/1998
MD21-98-0104	21-10551	Trichloroethene	56	9/3/1998
MD21-98-0245	21-10557	Trichloroethene	53	10/8/1998
MD21-98-0226	21-10556	Trichloroethene	33	10/2/1998
MD21-98-0239	21-10557	Trichloroethene	24	10/7/1998
MD21-98-0132	21-10552	Trichloroethene	1.8	9/14/1998
MD21-98-0220	21-10556	Trichloroethene	0.95	10/1/1998
MD21-98-0114	21-10551	Trichloroethene	0.7	9/10/1998
MD21-98-0256	21-10557	Trichlorofluoromethane	0.84	10/8/1998

Table B-30 (continued)

Sample ID	Location ID	Analyte Name	Result (ppbv)	Collection Date
MD21-98-0245	21-10557	Trichlorofluoromethane	0.77	10/8/1998
MD21-98-0214	21-10556	Trimethylbenzene[1,2,4-]	5.4	9/30/1998
MD21-98-0239	21-10557	Trimethylbenzene[1,2,4-]	4	10/7/1998
MD21-98-0245	21-10557	Trimethylbenzene[1,2,4-]	3.8	10/8/1998
MD21-98-0256	21-10557	Trimethylbenzene[1,2,4-]	2.4	10/8/1998
MD21-98-0198	21-10555	Trimethylbenzene[1,2,4-]	1.6	9/28/1998
MD21-98-0226	21-10556	Trimethylbenzene[1,2,4-]	0.8	10/2/1998
MD21-98-0245	21-10557	Trimethylbenzene[1,3,5-]	1	10/8/1998
MD21-98-0239	21-10557	Trimethylbenzene[1,3,5-]	0.94	10/7/1998
MD21-98-0109	21-10551	Xylene (Total)	5.4	9/4/1998
MD21-98-0104	21-10551	Xylene (Total)	4.9	9/3/1998
MD21-98-0138	21-10552	Xylene (Total)	2.7	9/15/1998
MD21-98-0239	21-10557	Xylene[1,2-]	3.1	10/7/1998
MD21-98-0214	21-10556	Xylene[1,2-]	2.7	9/30/1998
MD21-98-0245	21-10557	Xylene[1,2-]	2.7	10/8/1998
MD21-98-0198	21-10555	Xylene[1,2-]	2.2	9/28/1998
MD21-98-0256	21-10557	Xylene[1,2-]	1.7	10/8/1998
MD21-98-0226	21-10556	Xylene[1,2-]	1.1	10/2/1998
MD21-98-0138	21-10552	Xylene[1,2-]	0.83	9/15/1998
MD21-98-0239	21-10557	Xylene[1,3-]+Xylene[1,4-]	6.7	10/7/1998
MD21-98-0198	21-10555	Xylene[1,3-]+Xylene[1,4-]	6.5	9/28/1998
MD21-98-0245	21-10557	Xylene[1,3-]+Xylene[1,4-]	6	10/8/1998
MD21-98-0214	21-10556	Xylene[1,3-]+Xylene[1,4-]	5.7	9/30/1998
MD21-98-0192	21-10555	Xylene[1,3-]+Xylene[1,4-]	3.7	9/25/1998
MD21-98-0170	21-10554	Xylene[1,3-]+Xylene[1,4-]	3.3	9/22/1998
MD21-98-0256	21-10557	Xylene[1,3-]+Xylene[1,4-]	3.3	10/8/1998
MD21-98-0126	21-10552	Xylene[1,3-]+Xylene[1,4-]	3.2	9/11/1998
MD21-98-0176	21-10554	Xylene[1,3-]+Xylene[1,4-]	3.1	9/23/1998
MD21-98-0182	21-10554	Xylene[1,3-]+Xylene[1,4-]	2.3	9/24/1998
MD21-98-0226	21-10556	Xylene[1,3-]+Xylene[1,4-]	2.2	10/2/1998
MD21-98-0154	21-10553	Xylene[1,3-]+Xylene[1,4-]	1.1	9/18/1998

Table B-31
Frequency of Detected Organic Chemicals in EMFLUX Samples Collected in 2001 at MDA B

Analyte	Number of Samples	Number of Detects	Min Detect ($ng/m^2/min$)	Max Detect ($ng/m^2/min$)
Aliphatic Hydrocarbons	80	47	7.84	2844.31
Benzene	80	4	0.96	1.49
Bromoform	80	1	14.91	14.91
Carbon Tetrachloride	80	5	0.26	1.12
Ethylbenzene	80	3	0.83	1.2
2-Methylnaphthalene	80	2	8.34	31.54
Naphthalene	80	5	1.35	52.2
Tetrachloroethene	80	19	0.18	19.97
Trichloroethene	80	12	0.19	12.81
1,2,4-Trimethylbenzene	80	8	0.84	46.93
1,3,5-Trimethylbenzene	80	9	0.93	16.29
Xylenes	80	12	0.79	5.11

Table B-32
Summary of EMFLUX Surface Soil Samples Collected in 2001 at MDA B

Sample ID	Location ID	Collection Date
MD21-01-0323	21-11317	9/13/01 – 9/17/01
MD21-01-0324	21-11318	9/13/01 – 9/17/01
MD21-01-0325	21-11319	9/13/01 – 9/17/01
MD21-01-0326	21-11320	9/13/01 – 9/17/01
MD21-01-0327	21-11321	9/13/01 – 9/17/01
MD21-01-0328	21-11322	9/13/01 – 9/17/01
MD21-01-0329	21-11323	9/13/01 – 9/17/01
MD21-01-0330	21-11324	9/13/01 – 9/17/01
MD21-01-0331	21-11325	9/13/01 – 9/17/01
MD21-01-0332	21-11326	9/13/01 – 9/17/01
MD21-01-0333	21-11327	9/13/01 – 9/17/01
MD21-01-0334	21-11328	9/13/01 – 9/17/01
MD21-01-0335	21-11329	9/13/01 – 9/17/01
MD21-01-0336	21-11330	9/13/01 – 9/17/01
MD21-01-0337	21-11331	9/13/01 – 9/17/01
MD21-01-0338	21-11332	9/13/01 – 9/17/01
MD21-01-0339	21-11333	9/13/01 – 9/17/01
MD21-01-0340	21-11334	9/13/01 – 9/17/01
MD21-01-0341	21-11335	9/13/01 – 9/17/01
MD21-01-0342	21-11336	9/13/01 – 9/17/01

Table B-32 (continued)

Sample ID	Location ID	Collection Date
MD21-01-0343	21-11337	9/13/01 – 9/17/01
MD21-01-0344	21-11338	9/13/01 – 9/17/01
MD21-01-0345	21-11339	9/13/01 – 9/17/01
MD21-01-0346	21-11340	9/13/01 – 9/17/01
MD21-01-0347	21-11341	9/13/01 – 9/17/01
MD21-01-0348	21-11342	9/13/01 – 9/17/01
MD21-01-0349	21-11343	9/13/01 – 9/17/01
MD21-01-0350	21-11344	9/13/01 – 9/17/01
MD21-01-0351	21-11345	9/13/01 – 9/17/01
MD21-01-0352	21-11346	9/13/01 – 9/17/01
MD21-01-0353	21-11347	9/13/01 – 9/17/01
MD21-01-0354	21-11348	9/13/01 – 9/17/01
MD21-01-0355	21-11349	9/13/01 – 9/17/01
MD21-01-0356	21-11350	9/13/01 – 9/17/01
MD21-01-0357	21-11351	9/13/01 – 9/17/01
MD21-01-0358	21-11352	9/13/01 – 9/17/01
MD21-01-0359	21-11353	9/13/01 – 9/17/01
MD21-01-0360	21-11354	9/13/01 – 9/17/01
MD21-01-0361	21-11355	9/13/01 – 9/17/01
MD21-01-0362	21-11356	9/13/01 – 9/17/01
MD21-01-0363	21-11357	9/13/01 – 9/17/01
MD21-01-0364	21-11358	9/13/01 – 9/17/01
MD21-01-0365	21-11359	9/13/01 – 9/17/01
MD21-01-0366	21-11360	9/13/01 – 9/17/01
MD21-01-0367	21-11361	9/13/01 – 9/17/01
MD21-01-0368	21-11362	9/13/01 – 9/17/01
MD21-01-0369	21-11363	9/13/01 – 9/17/01
MD21-01-0370	21-11364	9/13/01 – 9/17/01
MD21-01-0371	21-11365	9/13/01 – 9/17/01
MD21-01-0372	21-11366	9/13/01 – 9/17/01
MD21-01-0373	21-11367	9/13/01 – 9/17/01
MD21-01-0374	21-11368	9/13/01 – 9/17/01
MD21-01-0375	21-11369	9/13/01 – 9/17/01
MD21-01-0376	21-11370	9/13/01 – 9/17/01
MD21-01-0377	21-11371	9/13/01 – 9/17/01
MD21-01-0378	21-11372	9/13/01 – 9/17/01
MD21-01-0379	21-11372	9/13/01 – 9/17/01
MD21-01-0380	21-11373	9/13/01 – 9/17/01

Table B-32 (continued)

Sample ID	Location ID	Collection Date
MD21-01-0381	21-11374	9/13/01 – 9/17/01
MD21-01-0382	21-11375	9/13/01 – 9/17/01
MD21-01-0383	21-11376	9/13/01 – 9/17/01
MD21-01-0384	21-11376	9/13/01 – 9/17/01
MD21-01-0385	21-11377	9/13/01 – 9/17/01
MD21-01-0386	21-11378	9/13/01 – 9/17/01
MD21-01-0387	21-11379	9/13/01 – 9/17/01
MD21-01-0388	21-11380	9/13/01 – 9/17/01
MD21-01-0389	21-11381	9/13/01 – 9/17/01
MD21-01-0390	21-11382	9/13/01 – 9/17/01
MD21-01-0391	21-11383	9/13/01 – 9/17/01
MD21-01-0392	21-11384	9/13/01 – 9/17/01
MD21-01-0393	21-11385	9/13/01 – 9/17/01
MD21-01-0394	21-11386	9/13/01 – 9/17/01
MD21-01-0395	21-11387	9/13/01 – 9/17/01
MD21-01-0396	21-11388	9/13/01 – 9/17/01
MD21-01-0397	21-11388	9/13/01 – 9/17/01
MD21-01-0398	21-11389	9/13/01 – 9/17/01
MD21-01-0399	21-11390	9/13/01 – 9/17/01
MD21-01-0400	21-11391	9/13/01 – 9/17/01
MD21-01-0401	21-11392	9/13/01 – 9/17/01
MD21-01-0402	21-11393	9/13/01 – 9/17/01

Table B-33
Detected Organic Chemicals in EMFLUX Samples Collected in 2001 at MDA B

Sample ID	Aliphatic Hydrocarbons	Benzene	Bromoform	Carbon Tetrachloride	Ethylbenzene	2-Methyl-naphthalene	Naphthalene	Tetra-chloroethene	Trichloroethene	1,2,4-Trimethyl-benzene	1,3,5-Trimethyl-benzene	Xylenes
MD21-01-0332	—*	—	—	—	—	—	—	7.04	12.81	—	—	—
MD21-01-0336	—	—	—	0.56	—	—	—	1.01	0.4	—	—	—
MD21-01-0337	—	—	—	0.26	—	—	—	0.29	—	—	—	—
MD21-01-0338	—	—	—	—	—	—	—	0.38	—	—	—	—
MD21-01-0339	—	—	—	—	—	—	—	0.2	—	—	—	—
MD21-01-0340	—	—	—	—	—	—	—	0.28	—	—	—	—
MD21-01-0341	—	—	—	1.12	—	—	—	0.5	0.5	—	—	—
MD21-01-0342	11.86	—	—	—	—	—	—	19.97	1.06	—	—	—
MD21-01-0343	257.17	1.03	—	—	—	—	—	0.88	0.53	—	—	—
MD21-01-0344	63.27	1.49	14.91	—	—	—	—	1.07	0.5	—	0.96	2.35
MD21-01-0345	2844.31	—	—	—	—	—	52.2	—	—	46.93	16.29	1.96
MD21-01-0346	124.85	—	—	—	—	31.54	—	—	—	—	—	—
MD21-01-0347	128.14	—	—	—	0.83	—	3.96	0.76	0.33	1.46	2.72	2.9
MD21-01-0348	50.15	—	—	—	0	—	1.35	0.19	0	1.2	—	1.42
MD21-01-0349	19.04	—	—	—	0	—	—	—	0.6	—	1.02	1.48
MD21-01-0350	249.84	—	—	—	0	—	—	—	—	—	—	—
MD21-01-0351	109.99	—	—	—	1.2	8.34	2.11	0.18	0	1.41	2.42	4.44
MD21-01-0352	17.26	—	—	—	0	0	0	0.3	7.08	0.84	1.38	1.45
MD21-01-0353	29.82	—	—	0.44	0	0	1.56	4.69	4.55	0.87	1.38	2.02
MD21-01-0354	20.25	—	—	—	—	—	—	—	—	—	—	0.79
MD21-01-0355	11.91	1	—	—	—	—	—	—	—	0.9	0.93	2.67
MD21-01-0357	27.12	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0359	15.16	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0360	12.02	—	—	0.88	—	—	—	1.7	1.1	—	—	—
MD21-01-0361	21.13	—	—	—	—	—	—	0.35	0.19	—	—	—
MD21-01-0362	8.43	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0363	43.25	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0365	66.28	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0366	38.47	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0367	22.92	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0369	11.56	—	—	—	—	—	—	—	—	—	—	—

Table B-33 (continued)

Sample ID	Aliphatic Hydrocarbons	Benzene	Bromoform	Carbon Tetrachloride	Ethylbenzene	2-Methyl-naphthalene	Naphthalene	Tetra-chloroethene	Trichloroethene	1,2,4-Trimethyl-benzene	1,3,5-Trimethyl-benzene	Xylenes
MD21-01-0370	16.34	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0371	29.77	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0374	10.22	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0375	8.13	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0376	42.36	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0377	37.59	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0378	7.84	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0380	61.83	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0381	26.83	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0382	9.33	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0384	37.58	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0385	65.24	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0386	50.89	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0387	17.9	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0388	21.45	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0389	17.77	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0390	21.48	—	—	—	—	—	—	0.31	—	—	—	—
MD21-01-0392	0	—	—	—	—	—	—	0.34	—	—	—	—
MD21-01-0396	22.18	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0397	13.57	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0398	40.93	—	—	—	—	—	—	—	—	—	—	1.23
MD21-01-0399	58.51	—	—	—	—	—	—	—	—	—	—	—
MD21-01-0400	64.55	1.1	—	—	1.04	—	—	—	—	2.5	3.31	5.11
MD21-01-0401	24.05	0.96	—	—	—	—	—	—	—	—	—	—

Note: Units are ng/m^2/min.

* — = Not detected or not detected above background unless otherwise marked.

Table B-34
Summary of Surface Soil and Sediment Samples Collected in 1994 at MDA B

Sample ID	Location ID	Depth (ft)	Medium	Target Analyte List Metals	SVOCs	Americium-241	Gamma Spectroscopy	Tritium	Isotopic Plutonium	Isotopic Uranium	Uranium
AAA7501	21-01857	0-0.25	Sediment	19210	18483	—*	19356	19356	19356	—	19356
AAA7502	21-01857	0.25-0.5	Sediment	19210	18483	—	19356	19356	19356	—	19356
AAA7503	21-01857	0.5-1.0	Sediment	19210	18483	—	19356	19356	19356	—	19356
AAA7504	21-01858	0-0.25	Sediment	19210	18483	—	19356	19356	19356	—	19356
AAA7505	21-01858	0.25-0.5	Sediment	19210	18483	—	19356	19356	19356	—	19356
AAA7506	21-01858	0.5-1.0	Sediment	19210	18483	—	19356	19356	19356	—	19356
AAA7507	21-01859	0-0.25	Sediment	19210	18483	—	19356	19356	19356	19356	19356
AAA7508	21-01859	0.25-0.5	Sediment	19210	18483	—	19356	19356	19356	—	19356
AAA7509	21-01859	0.5-1.0	Sediment	19336	18814	—	19336	19336	19336	—	19336
AAB6946	21-01944	0-0.5	Soil	18724	18360	—	19351	19351	19351	—	19351
AAB6947	21-01945	0-0.5	Soil	18724	18360	—	19351	19351	19351	—	19351
AAB6948	21-01946	0-0.5	Soil	18748	18374	—	19353	19353	19353	—	19353
AAB6949	21-01947	0-0.5	Soil	18748	18374	—	19353	19353	19353	—	19353
AAB6950	21-01948	0-0.5	Soil	18748	18374	—	19353	19353	19353	—	19353
AAB6951	21-01949	0-0.5	Soil	18748	18374	—	19353	19353	19353	—	19353
AAB6952	21-01950	0-0.5	Soil	18724	18360	—	19351	19351	19351	19351	19351
AAB6953	21-01951	0-0.5	Soil	18748	18374	—	19353	19353	19353	—	19353
AAB6954	21-01952	0-0.5	Soil	18724	18360	—	19351	19351	19351	—	19351
AAB6955	21-01953	0-0.5	Soil	18724	18360	—	19351	19351	19351	—	19351
AAB6956	21-01954	0-0.5	Soil	18724	18360	—	19351	19351	19351	—	19351
AAB6957	21-01955	0-0.5	Soil	18748	18374	—	19353	19353	19353	19353	19353
AAB6958	21-01956	0-0.5	Soil	18724	18360	—	19351	19351	19351	—	19351
AAB6959	21-01957	0-0.5	Soil	18724	18360	—	19351	19351	19351	—	19351
AAB6960	21-01958	0-0.5	Soil	18748	18374	—	19353	19353	19353	—	19353
AAB6961	21-01959	0-0.5	Soil	18724	18360	—	19351	19351	19351	—	19351
AAB6962	21-01960	0-0.5	Soil	18724	18360	—	19351	19351	19351	—	19351
AAB6963	21-01961	0-0.5	Soil	18748	18374	—	19353	19353	19353	—	19353
AAB6964	21-01962	0-0.5	Soil	18724	18360	—	19351	19351	19351	—	19351
AAB6965	21-01963	0-0.5	Soil	18724	18360	—	19351	19351	19351	—	19351
AAB6966	21-01964	0-0.5	Soil	18748	18374	—	19353	19353	19353	—	19353
AAB6967	21-01965	0-0.5	Soil	18724	18360	—	19351	19351	19351	—	19351

Table B-34 (continued)

Sample ID	Location ID	Depth (ft)	Medium	Target Analyte List Metals	SVOCs	Americium-241	Gamma Spectroscopy	Tritium	Isotopic Plutonium	Isotopic Uranium	Uranium
AAB6968	21-01966	0-0.5	Soil	18724	18360	—*	19351	19351	19351	—	19351
AAB6969	21-01967	0-0.5	Soil	18724	18360	—	19351	19351	19351	—	19351
AAB6970	21-01968	0-0.5	Soil	18724	18360	—	19351	19351	19351	—	19351
AAB6971	21-01969	0-0.5	Soil	18748	18374	—	19353	19353	19353	—	19353
AAB6972	21-01970	0-0.5	Soil	18748	18374	—	19353	19353	19353	—	—
AAB6973	21-01971	0-0.5	Soil	18748	18374	—	19353	19353	19353	—	—
AAB6974	21-01972	0-0.5	Soil	18746	18237	—	19346	19346	19346	—	19346
AAB6975	21-01973	0-0.5	Soil	18744	18266	19053	19053	19053	19053	19053	—
AAB6976	21-01974	0-0.5	Soil	20172	18174	19981	19981	19981	19981	19981	—
AAB6977	21-01975	0-0.5	Soil	20172	18174	19981	19981	19981	19981	19981	—
AAB6978	21-01976	0-0.5	Soil	20172	18174	19981	19981	19981	19981	19981	—
AAB6979	21-01977	0-0.5	Soil	18744	18266	19053	19053	19053	19053	19053	—
AAB6980	21-01978	0-0.5	Soil	18744	18266	19053	19053	19053	19053	19053	—
AAB6981	21-01979	0-0.5	Soil	18744	18266	19053	19053	19053	19053	19053	—
AAB6982	21-01980	0-0.5	Soil	18744	18266	19053	19053	19053	19053	19053	—
AAB6983	21-01981	0-0.5	Soil	18744	18266	19053	19053	19053	19053	—	—
AAB6984	21-01982	0-0.5	Soil	18744	18266	19053	19053	19053	19053	19053	—
AAB6985	21-01983	0-0.5	Soil	18744	18266	19053	19053	19053	19053	19053	—
AAB6986	21-01984	0-0.5	Soil	18746	18237	—	19346	19346	19346	19346	19346
AAB6987	21-01985	0-0.5	Soil	18746	18237	—	19346	19346	19346	—	19346
AAB6988	21-01986	0-0.5	Soil	18746	18237	—	19346	19346	19346	—	19346
AAB6989	21-01987	0-0.5	Soil	18746	18237	—	19346	19346	19346	—	19346
AAB6990	21-01988	0-0.5	Soil	18746	18237	—	19346	19346	19346	—	19346
AAB6991	21-01989	0-0.5	Soil	18746	18237	—	19346	19346	19346	—	19346
AAB6992	21-01990	0-0.5	Soil	18746	18237	—	19346	19346	19346	—	19346
AAB6993	21-01991	0-0.5	Soil	18746	18237	—	19346	19346	19346	19346	19346
AAB6994	21-01992	0-0.5	Soil	18746	18237	—	19346	19346	19346	19346	19346
AAB6995	21-01993	0-0.5	Soil	18746	18237	—	19346	19346	19346	—	19346
AAB6996	21-01994	0-0.5	Soil	18723	18236	19041	19041	19041	19041	—	19041
AAB6997	21-01995	0-0.5	Soil	18723	18236	19041	19041	19041	19041	19041	—
AAB6998	21-01996	0-0.5	Soil	18723	18236	19041	19041	19041	19041	19041	—
AAB6999	21-01997	0-0.5	Soil	18723	18236	19041	19041	19041	19041	19041	—

Table B-34 (continued)

Sample ID	Location ID	Depth (ft)	Medium	Target Analyte List Metals	SVOCs	Americium-241	Gamma Spectroscopy	Tritium	Isotopic Plutonium	Isotopic Uranium	Uranium
AAB7000	21-01998	0-0.5	Soil	18496	18312	19149	19149	19149	19149	19149	—
AAB7001	21-01999	0-0.5	Soil	18496	18312	19149	19149	19149	19149	19149	—
AAB7002	21-02000	0-0.5	Soil	18496	18312	19149	19149	19149	19149	19149	—
AAB7003	21-02001	0-0.5	Soil	18496	18312	19149	19149	19149	19149	19149	—
AAB7004	21-02002	0-0.5	Soil	18496	18312	19149	19149	19149	19149	19149	—
AAB7005	21-02003	0-0.5	Soil	18496	18312	19149	19149	19149	19149	19149	—
AAB7006	21-02004	0-0.5	Soil	18496	18312	19149	19149	19149	19149	19149	—
AAB7007	21-02005	0-0.5	Soil	18496	18312	19149	19149	19149	19149	19149	—
AAB7008	21-02005	0-0.5	Soil	18496	18312	19149	19149	19149	19149	19149	—
AAB7009	21-02007	0-0.5	Soil	18496	18312	19149	19149	19149	19149	19149	—
AAB7010	21-02008	0-0.5	Soil	18496	18312	19149	19149	19149	19149	19149	—
AAB7011	21-02009	0-0.5	Soil	18496	18312	19149	19149	19149	19149	19149	—
AAB7012	21-02010	0-0.5	Soil	18496	18312	19149	19149	19149	19149	19149	—
AAB7013	21-02011	0-0.5	Soil	18496	18312	19149	19149	19149	19149	19149	—
AAB7014	21-02012	0-0.5	Soil	18721	18281	19150	19150	19150	19150	19150	—
AAB7015	21-02013	0-0.5	Soil	18274	18360	—	19351	19351	19351	—	19351
AAB7269	21-02566	0-0.25	Sediment	19220	18558	—	19495	19495	19495	—	19495
AAB7270	21-02566	0.25-0.5	Sediment	19220	18558	—	19495	19495	19495	—	19495
AAB7271	21-02566	0.5-1.0	Sediment	19220	18558	—	19495	19495	19495	—	19495
AAB7272	21-02567	0-0.25	Sediment	19220	18558	—	19495	19495	19495	—	19495
AAB7273	21-02567	0.25-0.5	Sediment	19220	18558	—	19495	19495	19495	—	19495
AAB7274	21-02567	0.5-1.0	Sediment	19220	18558	—	19495	19495	19495	—	19495

* — = Indicates no analysis.

Table B-35
Frequency of Inorganic Chemicals above Background Value in Surface Soil and Sediment Samples Collected in 1994 at MDA B

Analyte	Medium	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	Background Value* (mg/kg)	Frequency of Detects Above Background Value	Frequency of Nondetects Above Background Value
Aluminum	Soil	70	70	1990 to 15000	29200	0/70	0/70
	Sediment	15	15	6.27 to 7740	15400	0/15	0/15
Antimony	Soil	70	0	[0.2 to 5.6]	0.83	0/70	14/70
	Sediment	15	0	[0.21 to 1.5]	0.83	0/15	1/15
Arsenic	Soil	70	22	[0.44 to 4.5]	8.17	0/70	0/70
	Sediment	15	10	[1.1] to 4.6	3.98	3/15	0/15
Barium	Soil	70	60	[21] to 192	295	0/70	0/70
	Sediment	15	15	50 to 181	127	5/15	0/15
Beryllium	Soil	70	4	[0.21 to 1.0]	1.83	0/70	0/70
	Sediment	15	1	[0.41] to 1.1	1.31	0/15	0/15
Cadmium	Soil	70	1	[0.05] to 2.5	0.4	1/70	45/70
	Sediment	15	2	[0.21] to 1.2	0.4	2/15	9/15
Calcium	Soil	70	64	783 to 3880	6120	0/70	0/70
	Sediment	15	15	1.2 to 2180	4420	0/15	0/15
Chromium	Soil	70	61	[1.3] to 9	19.3	0/70	0/70
	Sediment	15	15	3.5 to 15.5	10.5	6/15	0/15
Cobalt	Soil	70	0	[0.83 to 6.6]	8.64	0/70	0/70
	Sediment	15	0	[1.6 to 6.7]	4.73	0/15	5/15
Copper	Soil	70	38	[0.94] to 15.6	14.7	1/70	0/70
	Sediment	15	15	7.6 to 24.4	11.2	12/15	0/15
Iron	Soil	70	70	2850 to 15000	21500	0/70	0/70
	Sediment	15	15	1.18 to 8420	13800	0/15	0/15
Lead	Soil	70	70	6.3 to 54.7	22.3	24/70	0/70
	Sediment	15	15	14.9 to 56.6	19.7	13/15	0/15
Magnesium	Soil	70	31	[390] to 2150	4610	0/70	0/70
	Sediment	15	10	1.4 to 1600	2370	0/15	0/15
Manganese	Soil	70	70	75.6 to 448	671	0/70	0/70
	Sediment	15	15	146 to 759	543	1/15	0/15
Mercury	Soil	50	2	[0.02] to 0.07	0.1	0/50	0/50
	Sediment	14	14	0.04 to 0.88	0.1	11/14	0/14
Nickel	Soil	70	8	[1.8] to 11.4	15.4	0/70	0/70
	Sediment	15	0	[0.63 to 6.6]	9.38	0/15	0/15
Potassium	Soil	70	25	[326] to 1680	3460	0/70	0/70
	Sediment	15	9	1.33 to 1970	2690	0/15	0/15

Table B-35 (continued)

Analyte	Medium	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	Background Value* (mg/kg)	Frequency of Detects Above Background Value	Frequency of Nondetects Above Background Value
Selenium	Soil	55	0	[0.62 to 0.75]	1.52	0/55	0/55
	Sediment	15	0	[0.55 to 0.73]	0.3	0/15	15/15
Silver	Soil	70	0	[0.06 to 2.3]	1	0/70	19/70
	Sediment	15	12	[2.1] to 16.5	1	12/15	3/15
Sodium	Soil	56	0	[30.9 to 261]	915	0/56	0/56
	Sediment	15	0	[10.3 to 101]	1470	0/15	0/15
Thallium	Soil	70	0	[0.2 to 0.69]	0.73	0/70	0/70
	Sediment	15	0	[0.21 to 0.7]	0.73	0/15	0/15
Uranium	Soil	38	38	1.27 to 11.1	1.82	30/38	0/38
	Sediment	15	15	1.91 to 6.67	2.22	13/15	0/15
Vanadium	Soil	70	30	3.5 to 20.6	39.6	0/70	0/70
	Sediment	15	11	[7.3] to 22.2	19.7	2/15	0/15
Zinc	Soil	70	70	12.2 to 137	48.8	7/70	0/70
	Sediment	15	15	24.9 to 31	60.2	10/15	0/15

* Background values from LANL 1998, 59730.

Table B-36
Inorganic Chemical Results above Background Value in Surface Soil and Sediment Samples Collected in 1994 at MDA B

Sample ID	Location ID	Depth (ft)	Medium	Antimony	Arsenic	Barium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Mercury	Selenium	Silver	Uranium	Vanadium	Zinc
Soil Background Value[a]				0.83	8.17	295	0.4	19.3	8.64	14.7	22.3	671	-0.1	1.52	1	1.82	39.6	48.8
Sediment Background Value[a]				0.83	3.98	127	0.4	10.5	4.73	11.2	19.7	543	0.1	0.3	1	2.22	19.7	60.2
Residential Soil Screening Levels (mg/kg)[b]				3.13E+01	3.9E+00	5.45E+03	7.41E+01	2.34E+02	1.52E+03	3.13E+03	4.0E+02	1.55E+03	1.00E+05	3.91E+02	3.91E+02	1.6E+01[e]	5.48E+02	2.35E+04
SWMU 21-015																		
AAA7501	21-01857	0.00-0.25	Sediment	—[d]	—	—	—	—	—	11.9	33.9	—	0.45	0.58 (U)[c]	10.5	5.42 (J)[e]	—	80.2
AAA7502	21-01857	0.25-0.50	Sediment	—	—	—	0.52 (U)[f]	11.2	—	13.5	33.6	—	0.46	0.58 (U)	12.5	5.92 (J)	—	87.4
AAA7503	21-01857	0.50-1.00	Sediment	—	—	—	—	—	—	—	—	—	0.57	0.55 (U)	4.7	3.4 (J)	—	—
AAA7504	21-01858	0.00-0.25	Sediment	—	—	—	—	—	—	—	28.5	—	0.35	0.57 (U)	7.3	2.84 (J)	—	61.4
AAA7505	21-01858	0.25-0.50	Sediment	—	4.4 (J)[d]	134	0.57 (U)	—	6.7 (U)	—	38.6	759	0.55	0.58 (U)	12	4.01 (J)	—	78.8
AAA7506	21-01858	0.50-1.00	Sediment	—	—	—	—	11.1	—	12	33.6	—	0.58	0.55 (U)	14.7	5.32 (J)	—	80.8
AAA7507	21-01859	0.00-0.25	Sediment	—	4.5 (J)	171	0.9 (U)	12.6	5 (U)	20.6	52.7	—	0.67	0.65 (U)	11.1	6.3 (J)	21	129
AAA7508	21-01859	0.25-0.50	Sediment	—	4.6 (J)	181	0.94 (U)	15.5	5.1 (U)	24.4	56.6	—	0.88	0.57 (U)	16.5	5.59 (J)	22.2	131
AAA7509	21-01859	0.50-1.00	Sediment	—	—	—	0.42 (U)	—	—	14	27.4	—	—	0.63 (U)	8.3	6.67 (J)	—	—
AAB6946	21-01944	0.00-0.50	Soil	—	—	—	—	—	—	—	—	—	—	—	—	8.64 (J)	—	—
AAB6947	21-01945	0.00-0.50	Soil	—	—	—	—	—	—	—	—	—	—	—	—	9.68 (J)	—	—
AAB6949	21-01947	0.00-0.50	Soil	—	—	—	0.54 (U)	—	—	—	—	—	—	—	—	—	—	—
AAB6950	21-01948	0.00-0.50	Soil	—	—	—	1.1 (U)	—	—	—	—	—	—	—	—	—	—	—
AAB6951	21-01949	0.00-0.50	Soil	—	—	—	0.89 (U)	—	—	—	—	—	—	—	—	3.97 (J)	—	—
AAB6952	21-01950	0.00-0.50	Soil	—	—	—	—	—	—	—	—	—	—	—	—	7.21 (J)	—	—
AAB6953	21-01951	0.00-0.50	Soil	—	—	—	0.97 (U)	—	—	—	—	—	—	—	—	2.51 (J)	—	—
AAB6954	21-01952	0.00-0.50	Soil	—	—	—	0.62 (U)	—	—	—	—	—	—	—	—	2.89	—	—
AAB6955	21-01953	0.00-0.50	Soil	—	—	—	0.5 (U)	—	—	—	31.2	—	—	—	—	2.66	—	54.2
AAB6956	21-01954	0.00-0.50	Soil	—	—	—	—	—	—	—	—	—	—	—	—	1.93	—	—
AAB6957	21-01955	0.00-0.50	Soil	—	—	—	0.54 (U)	—	—	—	40.4	—	—	—	—	3.6 (J)	—	—
AAB6958	21-01956	0.00-0.50	Soil	—	—	—	—	—	—	—	24.6	—	—	—	—	2.46	—	—
AAB6959	21-01957	0.00-0.50	Soil	—	—	—	0.68 (U)	—	—	—	54.7	—	—	—	—	3.65	—	66.3
AAB6960	21-01958	0.00-0.50	Soil	—	—	—	1.1 (U)	—	—	—	23.3	—	—	—	—	3.63 (J)	—	—
AAB6961	21-01959	0.00-0.50	Soil	—	—	—	—	—	—	—	22.9	—	—	—	—	4.88	—	—
AAB6962	21-01960	0.00-0.50	Soil	—	—	—	0.42 (U)	—	—	—	22.5	—	—	—	—	2.57	—	—

Table B-36 (continued)

Sample ID	Location ID	Depth (ft)	Medium	Antimony	Arsenic	Barium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Mercury	Selenium	Silver	Uranium	Vanadium	Zinc
Soil Background Value				0.83	8.17	295	0.4	19.3	8.64	14.7	22.3	671	-0.1	1.52	1	1.82	39.6	48.8
Sediment Background Value				0.83	3.98	127	0.4	10.5	4.73	11.2	19.7	543	0.1	0.3	1	2.22	19.7	60.2
Residential Soil Screening Levels (mg/kg)				3.13E+01	3.9E+00	5.45E+03	7.41E+01	2.34E+02	1.52E+03	3.13E+03	4.0E+02	1.55E+03	1.00E+05	3.91E+02	3.91E+02	1.6E+01	5.48E+02	2.35E+04
SWMU 21-015																		
AAB6963	21-01961	0.00-0.50	Soil	—	—	—	0.59 (U)	—	—	—	—	—	—	—	—	2.82 (J)	—	—
AAB6964	21-01962	0.00-0.50	Soil	—	—	—	—	—	—	—	25.8	—	—	—	—	3.48	—	—
AAB6966	21-01964	0.00-0.50	Soil	—	—	—	0.67 (U)	—	—	—	—	—	—	—	—	4.15 (J)	—	—
AAB6967	21-01965	0.00-0.50	Soil	—	—	—	—	—	—	—	24.7	—	—	—	—	4.21	—	—
AAB6969	21-01967	0.00-0.50	Soil	—	—	—	—	—	—	—	31.4	—	—	—	—	3.6	—	137
AAB6970	21-01968	0.00-0.50	Soil	—	—	—	—	—	—	—	31.5	—	—	—	—	5.24	—	—
AAB6972	21-01970	0.00-0.50	Soil	—	—	—	—	—	—	—	23.6	—	—	—	—	—	—	—
AAB6973	21-01971	0.00-0.50	Soil	—	—	—	1.2 (U)	—	—	15.6	46.2	—	—	—	—	—	—	60.7
AAB6974	21-01972	0.00-0.50	Soil	—	—	—	0.41 (U)	—	—	—	—	—	—	—	2.1 (U)	—	—	—
AAB6975	21-01973	0.00-0.50	Soil	—	—	—	0.59 (U)	—	—	—	23.8	—	—	—	2.1 (U)	—	—	—
AAB6979	21-01977	0.00-0.50	Soil	—	—	—	0.42 (U)	—	—	—	—	—	—	—	2.1 (U)	—	—	—
AAB6980	21-01978	0.00-0.50	Soil	—	—	—	0.49 (U)	—	—	—	—	—	—	—	2.1 (U)	—	—	—
AAB6981	21-01979	0.00-0.50	Soil	—	—	—	0.68 (U)	—	—	—	23.1	—	—	—	2.2 (U)	—	—	—
AAB6982	21-01980	0.00-0.50	Soil	—	—	—	0.45 (U)	—	—	—	—	—	—	—	2.1 (U)	—	—	—
AAB6983	21-01981	0.00-0.50	Soil	—	—	—	0.43 (U)	—	—	—	—	—	—	—	2.2 (U)	—	—	—
AAB6984	21-01982	0.00-0.50	Soil	—	—	—	0.43 (U)	—	—	—	—	—	—	—	2.1 (U)	—	—	—
AAB6985	21-01983	0.00-0.50	Soil	—	—	—	0.41 (U)	—	—	—	—	—	—	—	2.1 (U)	—	—	—
AAB6986	21-01984	0.00-0.50	Soil	—	—	—	0.47 (U)	—	—	—	—	—	—	—	2.1 (U)	—	—	—
AAB6987	21-01985	0.00-0.50	Soil	—	—	—	0.43 (U)	—	—	—	—	—	—	—	2.1 (U)	3.08	—	—
AAB6988	21-01986	0.00-0.50	Soil	—	—	—	2.5	—	—	—	32.1	—	—	—	2.3 (U)	2.95	—	53.1
AAB6989	21-01987	0.00-0.50	Soil	—	—	—	0.94 (U)	—	—	—	—	—	—	—	2.1 (U)	2.35	—	—
AAB6990	21-01988	0.00-0.50	Soil	—	—	—	0.54 (U)	—	—	—	—	—	—	—	2.2 (U)	3.35	—	—
AAB6991	21-01989	0.00-0.50	Soil	—	—	—	0.66 (U)	—	—	—	—	—	—	—	2.3 (U)	3.25	—	—
AAB6992	21-01990	0.00-0.50	Soil	—	—	—	0.45 (U)	—	—	—	24.8	—	—	—	2.3 (U)	4.54	—	—
AAB6993	21-01991	0.00-0.50	Soil	—	—	—	0.62 (U)	—	—	—	26.6	—	—	—	2.2 (U)	11.1	—	—
AAB6994	21-01992	0.00-0.50	Soil	—	—	—	0.53 (U)	—	—	—	—	—	—	—	2.2 (U)	6.01	—	—
AAB6995	21-01993	0.00-0.50	Soil	—	—	—	0.43 (U)	—	—	—	22.9	—	—	—	2.2 (U)	7.82 (J)	—	—

Table B-36 (continued)

Sample ID	Location ID	Depth (ft)	Medium	Antimony	Arsenic	Barium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Mercury	Selenium	Silver	Uranium	Vanadium	Zinc
Soil Background Value				0.83	8.17	295	0.4	19.3	8.64	14.7	22.3	671	-0.1	1.52	1	1.82	39.6	48.8
Sediment Background Value				0.83	3.98	127	0.4	10.5	4.73	11.2	19.7	543	0.1	0.3	1	2.22	19.7	60.2
Residential Soil Screening Levels (mg/kg)				3.13E+01	3.9E+00	5.45E+03	7.41E+01	2.34E+02	1.52E+03	3.13E+03	4.0E+02	1.55E+03	1.00E+05	3.91E+02	3.91E+02	1.6E+01	5.48E+02	2.35E+04
SWMU 21-015																		
AAB7000	21-01998	0.00-0.50	Soil	5.2 (U)	—	—	0.52 (U)	—	—	—	—	—	—	—	—	—	—	—
AAB7001	21-01999	0.00-0.50	Soil	5.1 (U)	—	—	0.51 (U)	—	—	—	—	—	—	—	—	—	—	—
AAB7002	21-02000	0.00-0.50	Soil	5.3 (U)	—	—	0.53 (U)	—	—	—	—	—	—	—	—	—	—	65
AAB7003	21-02001	0.00-0.50	Soil	5.3 (U)	—	—	0.53 (U)	—	—	—	—	—	—	—	—	—	—	61.8
AAB7004	21-02002	0.00-0.50	Soil	5.2 (U)	—	—	0.52 (U)	—	—	—	—	—	—	—	—	—	—	—
AAB7005	21-02003	0.00-0.50	Soil	5.1 (U)	—	—	0.51 (U)	—	—	—	—	—	—	—	—	—	—	—
AAB7006	21-02004	0.00-0.50	Soil	5.4 (U)	—	—	0.54 (U)	—	—	—	27.8	—	—	—	—	—	—	—
AAB7007	21-02005	0.00-0.50	Soil	5.2 (U)	—	—	0.52 (U)	—	—	—	—	—	—	—	—	—	—	—
AAB7008	21-02006	0.00-0.50	Soil	5.3 (U)	—	—	0.53 (U)	—	—	—	—	—	—	—	—	—	—	—
AAB7009	21-02007	0.00-0.50	Soil	5.2 (U)	—	—	0.52 (U)	—	—	—	—	—	—	—	—	—	—	—
AAB7010	21-02008	0.00-0.50	Soil	5.3 (U)	—	—	0.53 (U)	—	—	—	—	—	—	—	—	—	—	—
AAB7011	21-02009	0.00-0.50	Soil	5.1 (U)	—	—	0.51 (U)	—	—	—	29.7	—	—	—	—	—	—	—
AAB7012	21-02010	0.00-0.50	Soil	5.1 (U)	—	—	0.51 (U)	—	—	—	42	—	—	—	—	—	—	—
AAB7013	21-02011	0.00-0.50	Soil	5.6 (U)	—	—	0.56 (U)	—	—	—	51.6	—	—	—	—	—	—	—
AAB7014	21-02012	0.00-0.50	Soil	—	—	—	—	—	—	—	25.1	—	—	—	—	—	—	—
AAB7015	21-02013	0.00-0.50	Soil	—	—	—	—	—	—	—	—	—	—	—	—	3.94 (J)	—	—
AAB7269	21-02566	0.00-0.25	Sediment	1.5 (U)	—	—	1.2	15.4 (J)	4.8 (U)	14.6	38.5	—	0.21 (J)	0.62 (U)	3	5.46 (J)	—	73.8
AAB7270	21-02566	0.25-0.50	Sediment	—	—	140	1.2	—	5 (U)	16	41.8	—	0.26 (J)	0.72 (U)	3.4	4.36 (J)	—	83.2
AAB7271	21-02566	0.50-1.00	Sediment	—	—	134	0.86 (U)	12.1 (J)	—	16	40.9	—	0.45 (J)	0.73 (U)	9.4	3.9 (J)	—	81.8
AAB7272	21-02567	0.00-0.25	Sediment	—	—	—	0.6 (U)	—	—	11.7	—	—	—	0.67 (U)	2.2 (U)	—	—	—
AAB7273	21-02567	0.25-0.50	Sediment	—	—	—	0.41 (U)	—	—	11.4	22.4	—	—	0.62 (U)	2.1 (U)	—	—	—
AAB7274	21-02567	0.50-1.00	Sediment	—	—	—	0.76 (U)	—	—	13.7	27.3	—	—	0.72 (U)	2.4 (U)	6.13 (J)	—	—

Note: Units are mg/kg.

a Background values from LANL 1998, 59730.

b Soil screening levels from NMED 2004, 85615.

c EPA Region 9 PRGs table (EPA 2002, 76866).

d — = Not available or below background value.

e J = The analyte was detected, but the reported concentration value is expected to be more uncertain than usual.

f U = The analyte was not detected.

Table B-37
Frequency of Detected Organic Chemicals in Surface Soil and Sediment* Samples Collected in 1994 at MDA B

Analyte	Medium	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	Frequency of Detects
Benzo(a)anthracene	Soil	70	1	[0.34] to 0.72	1/70
Benzo(a)pyrene	Soil	70	1	[0.34] to 0.65	1/70
Benzo(b)fluoranthene	Soil	70	1	[0.34] to 0.80	1/70
Benzo(k)fluoranthene	Soil	70	1	[0.34 to 0.57]	1/70
Bis(2-ethylhexyl)phthalate	Soil	70	2	[0.34] to 0.92	2/70
Butylbenzylphthalate	Soil	70	1	[0.34 to 0.57]	1/70
Chrysene	Soil	70	1	[0.34] to 0.83	1/70
Diethylphthalate	Soil	70	1	[0.34] to 90.0	1/70
Fluoranthene	Soil	70	1	[0.34] to 2	1/70
Indeno(1,2,3-cd)pyrene	Soil	70	1	[0.34 to 0.57]	1/70
Phenanthrene	Soil	70	1	[0.34] to 1.3	1/70

* No organic chemicals were detected in sediment samples.

Table B-38
Frequency of Detected Radionuclides above Background Value
in Surface Soil and Sediment Samples Collected in 1994 at MDA B

Analyte	Medium	Number of Analyses	Number of Detects	Concentration Range (pCi/g)	Background Value* (pCi/g)	Frequency of Detects Above Background Value
Americium-241	Soil	70	29	[0 to 3.9]	0.013	29/70
	Sediment	15	0	[-0.09 to 0.25]	0.04	0/15
Cesium-134	Soil	19	2	[0.0073] to 0.21	n/a	2/19
	Soil	47	43	[0.025] to 3.1	1.65	43/47
Cesium-137	Sediment	15	15	0.19 to 0.94	0.9	15/15
Cobalt-60	Soil	15	1	[0.0052 to 0.046]	n/a	1/15
Plutonium-238	Soil	85	28	[-0.0013] to 0.06	0.023	28/85
	Sediment	15	3	0.0004 to 0.015	0.006	3/15
Plutonium-239	Soil	70	67	[0.0062] to 6.6	0.054	67/70
	Sediment	15	15	0.0698 to 5.33	0.068	15/15
Ruthenium-106	Soil	15	0	[0.075 to 0.23]	n/a	0/15
Sodium-22	Soil	17	2	[0.0075] to 0.27	n/a	2/17
Strontium-90	Soil	70	20	[-0.02] to 8	1.31	20/70
	Sediment	15	3	[0.01] to 0.48	1.04	3/15
Thorium-228	Soil	5	1	3.24 to 6.97	2.28	1/5
	Sediment	1	0	[4.66 to 4.66]	2.28	0/1
Tritium	Soil	70	31	[-0.128] to 6.19	n/a	31/70
	Sediment	15	12	[1.25E-02] to 7.98E-02	0.093	15/15
Uranium-234	Soil	3	3	0.96 to 1.22	2.59	3/3
Uranium-235	Soil	34	13	[0.06] to 0.54	0.2	13/34
	Sediment	1	1	0.269 to 0.269	0.2	1/1
Uranium-238	Soil	3	3	1.07 to 1.3	2.29	3/3

* Background values from LANL 1998, 59730.

Table B-39
Organic Chemicals Detected in Surface Soil and Sediment[a] Samples Collected in 1994 at MDA B

Sample ID	Location ID	Depth (ft)	Medium	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Bis(2-ethylhexyl)phthalate	Butylbenzylphthalate	Chrysene	Diethylphthalate	Fluoranthene	Indeno(1,2,3-cd)pyrene	Phenanthrene
Residential Soil Screening Levels (mg/kg)[b]				**6.21E+00**	**6.21E-01**	**6.21E+00**	**6.21E+01**	**3.47E+02**	**2.4E+02** [c]	**6.21E+02**	**4.80E+04**	**2.25E+03**	**6.21E+00**	**1.80E+03**
SWMU 21-015														
AAB6953	21-01951	0.00-0.50	Soil	0.72	0.65	0.8	0.4	—[d]	—	0.83	—	2	0.5	1.3
AAB6958	21-01956	0.00-0.50	Soil	—	—	—	—	0.92	0.5	—	—	—	—	—
AAB6960	21-01958	0.00-0.50	Soil	—	—	—	—	0.52	—	—	—	—	—	—
AAB7002	21-02000	0.00-0.50	Soil	—	—	—	—	—	—	—	90.0	—	—	—

Note: Units are mg/kg.

a No organic chemicals were detected in sediment samples.

b Soil screening levels from NMED 2004, 85615.

c EPA Region 6 human health medium-specific screening levels 2003–2004 (EPA 2003, 81724).

d — = Not available or below background value.

Table B-40
Radionuclide Analyses above the BV in Surface Soil and Sediment Samples Collected in 1994 at MDA B

Sample ID	Location ID	Depth (ft)	Medium	Americium-241	Cesium-134	Cesium-137	Cobalt-60	Plutonium-238	Plutonium-239	Sodium-22	Strontium-90	Thorium-228	Tritium	Uranium-235
Soil Background Value[a]				0.013	n/a[b]	1.65	n/a	0.023	0.054	n/a	1.31	2.28	0.766	0.2
Sediment Background Value[a]				0.04	n/a	0.9	n/a	0.006	0.068	n/a	1.04	2.18	0.093	0.2
Residential Screening Action Levels (pCi/g)				39		5.3	1.2	49	44	1.5	5.7	2.0	890	17
SWMU 21-015														
AAA7501	21-01857	0.00-0.25	Sediment	—[c]	—	—	—	—	1.32 (J)[d]	—	—	—	—	—
AAA7502	21-01857	0.25-0.50	Sediment	—	—	—	—	—	1.34 (J)	—	—	—	—	—
AAA7503	21-01857	0.50-1.00	Sediment	—	—	—	—	—	0.972 (J)	—	—	—	—	—
AAA7504	21-01858	0.00-0.25	Sediment	—	—	—	—	—	1.16 (J)	—	—	—	—	—
AAA7505	21-01858	0.25-0.50	Sediment	—	—	0.936	—	—	1.69 (J)	—	—	—	—	—
AAA7506	21-01858	0.50-1.00	Sediment	—	—	—	—	—	1.56 (J)	—	—	—	—	—
AAA7507	21-01859	0.00-0.25	Sediment	—	—	—	—	0.0107	1.88 (J)	—	—	—	—	0.269
AAA7508	21-01859	0.25-0.50	Sediment	—	—	—	—	0.0146	5.33 (J)	—	—	—	—	—
AAA7509	21-01859	0.50-1.00	Sediment	—	—	—	—	—	1.22	—	—	—	—	—
AAB6946	21-01944	0.00-0.50	Soil	—	—	—	—	—	1.76 (J)	—	—	—	—	—
AAB6947	21-01945	0.00-0.50	Soil	—	—	—	—	—	0.154 (J)	—	—	—	—	—
AAB6949	21-01947	0.00-0.50	Soil	—	—	—	—	—	0.137 (J)	—	—	—	—	—
AAB6950	21-01948	0.00-0.50	Soil	—	—	—	—	—	0.081 (J)	—	—	—	—	—
AAB6951	21-01949	0.00-0.50	Soil	—	—	—	—	—	0.595 (J)	—	—	—	—	—
AAB6952	21-01950	0.00-0.50	Soil	—	—	—	—	—	0.538 (J)	—	—	—	6.48E-02	—
AAB6953	21-01951	0.00-0.50	Soil	—	—	—	—	—	0.248 (J)	—	—	—	—	—
AAB6954	21-01952	0.00-0.50	Soil	—	—	—	—	—	0.609 (J)	—	—	—	—	—
AAB6955	21-01953	0.00-0.50	Soil	—	—	—	—	—	1.104 (J)	—	—	—	4.10E-02	—
AAB6956	21-01954	0.00-0.50	Soil	—	—	—	—	—	0.828 (J)	—	—	—	—	—
AAB6957	21-01955	0.00-0.50	Soil	—	—	—	—	—	0.272 (J)	—	1.6 (J)	—	—	—
AAB6958	21-01956	0.00-0.50	Soil	—	—	—	—	—	1.39 (J)	—	—	—	—	—
AAB6959	21-01957	0.00-0.50	Soil	—	—	—	—	0.048 (J)	3.603 (J)	—	—	—	9.17E-02	—
AAB6960	21-01958	0.00-0.50	Soil	—	—	—	—	—	1.71 (J)	—	—	—	2.32E-02 (J	—
AAB6961	21-01959	0.00-0.50	Soil	—	—	—	—	—	0.883 (J)	—	—	—	—	—
AAB6962	21-01960	0.00-0.50	Soil	—	—	—	—	—	3.74 (J)	—	—	—	2.54E-02	—
AAB6963	21-01961	0.00-0.50	Soil	—	—	—	—	—	0.0901 (J	—	—	—	—	—
AAB6964	21-01962	0.00-0.50	Soil	—	—	—	—	—	0.931 (J)	—	—	—	2.81E-02	—
AAB6965	21-01963	0.00-0.50	Soil	—	—	—	—	—	0.262 (J)	—	—	—	—	—
AAB6966	21-01964	0.00-0.50	Soil	—	—	—	—	—	—	—	2.18 (J)	—	—	—
AAB6967	21-01965	0.00-0.50	Soil	—	—	—	—	—	2.13 (J)	—	—	—	3.71E-02	—
AAB6968	21-01966	0.00-0.50	Soil	—	—	—	—	—	1.26 (J)	—	—	—	—	—
AAB6969	21-01967	0.00-0.50	Soil	—	—	—	—	—	1.22 (J)	—	—	—	—	—

Table B-40 (continued)

Sample ID	Location ID	Depth (ft)	Medium	Americium-241	Cesium-134	Cesium-137	Cobalt-60	Plutonium-238	Plutonium-239	Sodium-22	Strontium-90	Thorium-228	Tritium	Uranium-235
Soil Background Value				0.013	NA	1.65	n/a	0.023	0.054	n/a	1.31	2.28	0.766	0.2
Sediment Background Value				0.04	n/a	0.9	n/a	0.006	0.068	n/a	1.04	2.18	0.093	0.2
Residential Screening Action Levels (pCi/g)				39		5.3	1.2	49	44	1.5	5.7	2.0	890	17
SWMU 21-015														
AAB6970	21-01968	0.00-0.50	Soil	—	—	—	—	—	0.773 (J)	—	—	—	3.09E-02	—
AAB6972	21-01970	0.00-0.50	Soil	—	—	—	—	—	0.291 (J)	—	—	—	1.11 (J)	—
AAB6973	21-01971	0.00-0.50	Soil	—	—	—	—	—	0.442 (J)	—	—	—	—	—
AAB6974	21-01972	0.00-0.50	Soil	—	—	—	—	—	0.128	—	—	—	—	—
AAB6975	21-01973	0.00-0.50	Soil	—	—	—	—	—	0.275	0.27	—	—	4.34E-02	—
AAB6976	21-01974	0.00-0.50	Soil	0.02	—	—	—	—	0.414	—	—	—	—	—
AAB6977	21-01975	0.00-0.50	Soil	0.042	—	—	—	—	—	—	—	—	—	—
AAB6978	21-01976	0.00-0.50	Soil	—	—	—	—	—	0.06	—	—	—	6.10E-02	—
AAB6979	21-01977	0.00-0.50	Soil	0.078	—	—	—	—	0.536	—	—	—	3.13E-02	0.38
AAB6980	21-01978	0.00-0.50	Soil	0.067	—	—	—	—	0.913	—	—	—	4.68E-02	—
AAB6981	21-01979	0.00-0.50	Soil	0.041	—	—	—	—	0.729	—	—	—	4.63E-02	0.36
AAB6982	21-01980	0.00-0.50	Soil	0.05	—	—	—	—	0.915	—	—	—	5.13E-02 (J	0.44
AAB6983	21-01981	0.00-0.50	Soil	—	0.21	—	—	—	0.059	—	—	—	8.19E-02	—
AAB6984	21-01982	0.00-0.50	Soil	0.015	—	—	—	—	0.286	—	—	—	5.83E-02 (J	—
AAB6985	21-01983	0.00-0.50	Soil	—	—	—	—	—	0.09	—	—	—	2.22E-02 (J	—
AAB6986	21-01984	0.00-0.50	Soil	—	—	—	—	—	0.404 (J)	—	—	—	2.87E-02 (J	—
AAB6987	21-01985	0.00-0.50	Soil	—	—	—	—	—	0.176	—	—	—	2.517E-02 (J	—
AAB6988	21-01986	0.00-0.50	Soil	—	—	—	—	—	0.678	—	—	—	0.253 (J)	—
AAB6989	21-01987	0.00-0.50	Soil	—	—	—	—	—	0.987	—	—	—	6.19 (J)	—
AAB6990	21-01988	0.00-0.50	Soil	—	—	—	—	—	0.876 (J)	—	—	—	0.807 (J)	—
AAB6991	21-01989	0.00-0.50	Soil	—	—	—	—	—	1.03	—	—	—	0.485 (J)	—
AAB6992	21-01990	0.00-0.50	Soil	0.524 (J)	—	1.879	—	—	1.80	—	—	—	0.318 (J)	—
AAB6993	21-01991	0.00-0.50	Soil	—	—	—	—	—	1.96	—	—	—	1.29 (J)	0.214
AAB6994	21-01992	0.00-0.50	Soil	—	—	—	—	—	1.18	—	—	6.969	—	—
AAB6995	21-01993	0.00-0.50	Soil	—	—	—	—	—	0.742	—	—	—	5.64E-02 (J	—
AAB6996	21-01994	0.00-0.50	Soil	0.084	—	—	—	—	2.00	—	—	—	3.18E-02	0.4
AAB6997	21-01995	0.00-0.50	Soil	0.044	—	—	—	—	0.773	—	—	—	0.039	0.54
AAB6998	21-01996	0.00-0.50	Soil	0.017	—	—	—	—	0.258	0.23	—	—	2.29E-02	0.4
AAB6999	21-01997	0.00-0.50	Soil	0.024	0.17	—	—	—	0.408	—	—	—	2.40E-02	—
AAB7000	21-01998	0.00-0.50	Soil	0.02	—	2.189 (J)	—	—	0.7 (J)	—	8 (J)	—	—	—
AAB7001	21-01999	0.00-0.50	Soil	0.02	—	—	—	—	0.8 (J)	—	2 (J)	—	—	—
AAB7002	21-02000	0.00-0.50	Soil	—	—	—	—	—	0.3 (J)	—	2.4 (J)	—	—	—
AAB7003	21-02001	0.00-0.50	Soil	—	—	—	—	0.06	4.7 (J)	—	2 (J)	—	—	—
AAB7004	21-02002	0.00-0.50	Soil	—	—	—	0.0315	—	0.4 (J)	—	2 (J)	—	—	—

Table B-40 (continued)

Sample ID	Location ID	Depth (ft)	Medium	Americium-241	Cesium-134	Cesium-137	Cobalt-60	Plutonium-238	Plutonium-239	Sodium-22	Strontium-90	Thorium-228	Tritium	Uranium-235
Soil Background Value				0.013	n/a	1.65	n/a	0.023	0.054	n/a	1.31	2.28	0.766	0.2
Sediment Background Value				0.04	n/a	0.9	n/a	0.006	0.068	n/a	1.04	2.18	0.093	0.2
Residential Screening Action Levels (pCi/g)				39		5.3	1.2	49	44	1.5	5.7	2.0	890	17
SWMU 21-015														
AAB7005	21-02003	0.00-0.50	Soil	0.1	—	—	—	—	5.1 (J)	—	2 (J)	—	—	—
AAB7006	21-02004	0.00-0.50	Soil	0.08	—	3.098 (J)	—	—	6.6 (J)	—	3 (J)	—	—	0.346
AAB7007	21-02005	0.00-0.50	Soil	0.06	—	—	—	—	0.9 (J)	—	2.1 (J)	—	—	—
AAB7008	21-02006	0.00-0.50	Soil	0.02	—	—	—	—	0.9 (J)	—	2.6 (J)	—	—	—
AAB7009	21-02007	0.00-0.50	Soil	—	—	—	—	0.05 (J)	0.3 (J)	—	2 (J)	—	—	—
AAB7010	21-02008	0.00-0.50	Soil	—	—	—	—	—	2.2 (J)	—	2 (J)	—	—	—
AAB7011	21-02009	0.00-0.50	Soil	0.02	—	—	—	—	1.4 (J)	—	2 (J)	—	—	—
AAB7012	21-02010	0.00-0.50	Soil	—	—	—	—	—	0.1 (J)	—	2 (J)	—	—	—
AAB7013	21-02011	0.00-0.50	Soil	0.03 (J)	—	—	—	—	2.3 (J)	—	2 (J)	—	—	—
AAB7014	21-02012	0.00-0.50	Soil	0.247 (J)	—	—	—	0.06 (J)	3 (J)	—	2 (J)	—	—	—
AAB7015	21-02013	0.00-0.50	Soil	—	—	—	—	—	0.305 (J)	—	—	—	—	—
AAB7269	21-02566	0.00-0.25	Sediment	—	—	—	—	—	1.28	—	—	—	—	—
AAB7270	21-02566	0.25-0.50	Sediment	—	—	—	—	—	0.796	—	—	—	—	—
AAB7271	21-02566	0.50-1.00	Sediment	—	—	—	—	—	1.08	—	—	—	—	—
AAB7272	21-02567	0.00-0.25	Sediment	—	—	—	—	—	0.089	—	—	—	—	—
AAB7273	21-02567	0.25-0.50	Sediment	—	—	—	—	—	0.0698	—	—	—	—	—
AAB7274	21-02567	0.50-1.00	Sediment	—	—	—	—	—	0.123	—	—	—	—	—

Note: Units are pCi/g.

a. Background values from LANL 1998, 59730.

b. n/a = Not available.

c. — = Not available or below background value.

d. Radionuclide Screening Action Levels from LANL 2002, 73705.

e. J –=The analyte was detected but the reported concentration value is expected to be more uncertain than usual.

Table B-41
Summary of Surface Soil and Sediment Samples Collected in 1998 at MDA B

Sample ID	Location ID	Depth (ft)	Medium	Target Analyte List Metals	SVOCs	VOCs	Americium-241	Gamma Spectroscopy	Tritium	Isotopic Plutonium	Isotopic Uranium	Strotnium-90
MD21-98-0167	21-10554	19-20	Sediment	4682R	4681R	—*	4683R	4683R	4683R	4683R	4683R	4683R
MD21-98-0338	21-10561	0-0.5	Soil	4583R	4582R	—	4584R	4584R	4584R	4584R	4584R	—
MD21-98-0339	21-10583	0-0.5	Soil	4607R	4606R	—	4608R	—	4608R	4608R	4608R	—
MD21-98-0340	21-10579	0-0.5	Soil	4604R	4603R	—	4605R	—	4605R	4605R	4605R	—
MD21-98-0341	21-10562	0-0.5	Soil	4583R	4582R	—	4584R	4584R	4584R	4584R	4584R	—
MD21-98-0342	21-10563	0-0.5	Soil	4583R	4582R	—	4584R	4584R	4584R	4584R	4584R	—
MD21-98-0343	21-10564	0-0.5	Soil	4583R	4582R	—	4584R	4584R	4584R	4584R	4584R	—
MD21-98-0344	21-10565	0-0.5	Soil	4583R	4582R	—	4584R	4584R	4584R	4584R	4584R	—
MD21-98-0346	21-10566	0-0.5	Soil	4583R	4582R	—	4584R	4584R	4584R	4584R	4584R	—
MD21-98-0347	21-10567	0-0.5	Soil	4583R	4582R	—	4584R	4584R	4584R	4584R	4584R	—
MD21-98-0348	21-10568	0-0.5	Soil	4583R	4582R	—	4584R	4584R	4584R	4584R	4584R	—
MD21-98-0349	21-10581	0-0.5	Soil	4604R	4603R	—	4605R	—	4605R	4605R	4605R	—
MD21-98-0350	21-10577	0-0.5	Soil	4604R	4603R	—	4605R	—	4605R	4605R	4605R	—
MD21-98-0351	21-10578	0-0.71	Soil	4604R	4603R	—	4605R	—	4605R	4605R	4605R	—
MD21-98-0352	21-10584	0-0.5	Soil	4607R	4606R	—	4608R	—	4608R	4608R	4608R	—
MD21-98-0353	21-10582	0-0.5	Soil	4607R	4606R	—	4608R	—	4608R	4608R	4608R	—
MD21-98-0354	21-10586	0-0.5	Soil	4607R	4606R	—	4608R	—	4608R	4608R	4608R	—
MD21-98-0355	21-10569	0-0.5	Soil	4610R	—	—	4611R	4611R	4611R	4611R	4611R	—
MD21-98-0356	21-10570	0-0.5	Soil	4610R	—	—	4611R	4611R	4611R	4611R	4611R	—
MD21-98-0357	21-10571	0-0.67	Soil	4610R	—	—	4611R	4611R	4611R	4611R	4611R	—
MD21-98-0358	21-10572	0-0.5	Soil	4610R	—	—	4611R	4611R	4611R	4611R	4611R	—
MD21-98-0359	21-10573	0-0.71	Soil	4610R	—	—	4611R	4611R	4611R	4611R	4611R	—
MD21-98-0360	21-10574	0-0.5	Soil	4610R	—	—	4611R	4611R	4611R	4611R	4611R	—
MD21-98-0361	21-10575	0-0.71	Soil	4610R	—	—	4611R	4611R	4611R	4611R	4611R	—
MD21-98-0362	21-10576	0-0.71	Soil	4610R	—	—	4611R	4611R	4611R	4611R	4611R	—
MD21-98-0363	21-10587	0-0.5	Soil	4607R	4606R	—	4608R	—	4608R	4608R	4608R	—
MD21-98-0364	21-10589	0-0.5	Soil	4607R	4606R	—	4608R	—	4608R	4608R	4608R	—
MD21-98-0365	21-10588	0-0.5	Soil	4607R	4606R	—	4608R	—	4608R	4608R	4608R	—
MD21-98-0366	21-10586	0-0.5	Soil	4607R	4606R	—	4608R	—	4608R	4608R	4608R	—
MD21-98-0367	21-10580	0-0.5	Soil	4604R	4603R	—	4605R	—	4605R	4605R	4605R	—
MD21-98-0385	21-01987	0-0.5	Soil	—	—	4582R	—	—	—	—	—	—
MD21-98-0386	21-01985	0-0.5	Soil	—	—	4582R	—	—	—	—	—	—

Table B-41 (continued)

Sample ID	Location ID	Depth (ft)	Medium	Target Analyte List Metals	SVOCs	VOCs	Americium-241	Gamma Spectroscopy	Tritium	Isotopic Plutonium	Isotopic Uranium	Strotnium-90
MD21-98-0387	21-01982	0-0.5	Soil	—	—	4582R	—	—	—	—	—	—
MD21-98-0388	21-01984	0-0.5	Soil	—	—	4582R	—	—	—	—	—	—
MD21-98-0389	21-01986	0-0.5	Soil	—	—	4582R	—	—	—	—	—	—
MD21-98-0390	21-01988	0-0.5	Soil	—	—	4582R	—	—	—	—	—	—
MD21-98-0391	21-01981	0-0.5	Soil	—	—	4582R	—	—	—	—	—	—
MD21-98-0522	21-10569	0-0.5	Soil	—	4704R	—	—	—	—	—	—	—
MD21-98-0523	21-10570	0-0.5	Soil	—	4704R	—	—	—	—	—	—	—
MD21-98-0524	21-10571	0-0.5	Soil	—	4704R	—	—	—	—	—	—	—
MD21-98-0525	21-10572	0-0.5	Soil	—	4704R	—	—	—	—	—	—	—
MD21-98-0526	21-10573	0-0.5	Soil	—	4704R	—	—	—	—	—	—	—
MD21-98-0527	21-10574	0-0.5	Soil	—	4704R	—	—	—	—	—	—	—
MD21-98-0528	21-10575	0-0.5	Soil	—	4704R	—	—	—	—	—	—	—
MD21-98-0529	21-10576	0-0.5	Soil	—	4704R	—	—	—	—	—	—	—
MD21-98-0550	21-10590	0-0.5	Soil	—	—	—	—	—	4833R	—	—	—
MD21-98-0551	21-10591	0-0.5	Soil	—	—	—	—	—	4833R	—	—	—
MD21-98-0552	21-10593	0-0.5	Soil	—	—	—	—	—	4833R	—	—	—
MD21-98-0553	21-10594	0-0.5	Soil	—	—	—	—	—	4833R	—	—	—
MD21-98-0554	21-10595	0-0.5	Soil	—	—	—	—	—	4833R	—	—	—
MD21-98-0555	21-10596	0-0.5	Soil	—	—	—	—	—	4833R	—	—	—

* — = Not available or below background value.

Table B-42
Frequency of Inorganic Chemicals above Background Value in Surface Soil and Sediment Samples Collected in 1998 at MDA B

Analyte	Medium	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	Background Value* (mg/kg)	Frequency of Detects Above Background Value	Frequency of Nondetects Above Background Value
Aluminum	Soil	29	29	6800 to 17000	29200	0/29	0/29
	Sediment	1	1	3200 to 3200	15400	0/1	0/1
Antimony	Soil	1	0	[11 to 11]	0.83	0/1	1/1
	Sediment	1	0	[11 to 11]	0.83	0/1	1/1
Arsenic	Soil	29	29	2.1 to 4.9	8.17	0/29	0/29
	Sediment	1	1	2 to 2	3.98	0/1	0/1
Barium	Soil	29	29	70 to 150	295	0/29	0/29
	Sediment	1	1	25 to 25	127	0/1	0/1
Beryllium	Soil	29	28	0.51 to 0.96	1.83	0/29	0/29
	Sediment	1	0	[0.53 to 0.53]	1.31	0/1	0/1
Cadmium	Soil	29	10	[0.51] to 2	0.4	10/29	19/29
	Sediment	1	0	[0.53 to 0.53]	0.4	0/1	1/1
Calcium	Soil	29	29	1500 to 5300	6120	0/29	0/29
	Sediment	1	1	500 to 500	4420	0/1	0/1
Chromium	Soil	29	29	7 to 17	19.3	0/29	0/29
	Sediment	1	1	3.2 to 3.2	10.5	0/1	0/1
Cobalt	Soil	29	29	3.1 to 6.6	8.64	0/29	0/29
	Sediment	1	0	[1.1 to 1.1]	4.73	0/1	0/1
Copper	Soil	29	29	5.7 to 70	14.7	6/29	0/29
	Sediment	1	1	2.2 to 2.2	11.2	0/1	0/1
Iron	Soil	29	29	8700 to 14000	21500	0/29	0/29
	Sediment	1	1	4900 to 4900	13800	0/1	0/1
Lead	Soil	29	29	12 to 250	22.3	18/29	0/29
	Sediment	1	1	6.1 to 6.1	19.7	0/1	0/1
Magnesium	Soil	29	29	1300 to 2400	4610	0/29	0/29
	Sediment	1	1	500 to 500	2370	0/1	0/1
Manganese	Soil	29	29	190 to 440	671	0/29	0/29
	Sediment	1	1	180 to 180	543	0/1	0/1
Mercury	Soil	29	2	[0.1] to 0.29	0.1	2/29	19/29
	Sediment	1	0	[0.11 to 0.11]	0.1	0/1	1/1
Nickel	Soil	29	29	5 to 10	15.4	0/29	0/29
	Sediment	1	1	2.3 to 2.3	9.38	0/1	0/1
Potassium	Soil	29	29	1200 to 2600	3460	0/29	0/29
	Sediment	1	1	450 to 450	2690	0/1	0/1

Table B-42 (continued)

Analyte	Medium	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	Background Value* (mg/kg)	Frequency of Detects Above Background Value	Frequency of Nondetects Above Background Value
Selenium	Soil	29	0	[0.52 to 1.1]	1.52	0/29	0/29
	Sediment	1	0	[1.1 to 1.1]	0.3	0/1	1/1
Silver	Soil	29	0	[2 to 2.2]	1	0/29	29/29
	Sediment	1	0	[2.1 to 2.1]	1	0/1	1/1
Sodium	Soil	29	29	67 to 170	915	0/29	0/29
	Sediment	1	1	110 to 110	1470	0/1	0/1
Thallium	Soil	29	0	[0.25 to 0.27]	0.73	0/29	0/29
	Sediment	1	0	[0.26 to 0.26]	0.73	0/1	0/1
Vanadium	Soil	29	29	13 to 26	39.6	0/29	0/29
	Sediment	1	1	3 to 3	19.7	0/1	0/1
Zinc	Soil	29	29	43 to 710	48.8	28/29	0/29
	Sediment	1	1	33 to 33	60.2	0/1	0/1

* - Background values from LANL 1998, 59730.

Table B-43
Inorganic Chemical Results above Background Value in Surface Soil and Sediment Samples Collected in 1998 at MDA B

Sample ID	Location ID	Depth (ft)	Medium	Antimony	Cadmium	Copper	Lead	Mercury	Selenium	Silver	Zinc
Soil Background Value[1]				**0.83**	**0.4**	**14.7**	**22.3**	**0.1**	**1.52**	**1**	**48.8**
Sediment Background Value[a]				**0.83**	**0.4**	**11.2**	**19.7**	**0.1**	**0.3**	**1**	**60.2**
Residential Soil Screening Levels (mg/kg)[b]				**3.13E+01**	**7.41E+01**	**3.13E+03**	**4.0E+02**	**1.00E+05**	**3.91E+02**	**3.91E+02**	**2.35E+04**
SWMU 21-015											
MD21-98-0167	21-10554	19.00-20.00	Sediment	11 (U)[c]	0.53 (U)	—[d]	—	0.11 (U)	1.1 (U)	2.1 (U)	—
MD21-98-0338	21-10561	0.00-0.50	Soil	—	0.51 (U)	70	54	—	—	2.1 (U)	150
MD21-98-0341	21-10562	0.00-0.50	Soil	—	0.52 (U)	—	—	—	—	2.1 (U)	65
MD21-98-0342	21-10563	0.00-0.50	Soil	—	2	34	250	0.29	—	2 (U)	220
MD21-98-0343	21-10564	0.00-0.50	Soil	—	0.53 (U)	24	46	0.13	—	2.1 (U)	71
MD21-98-0344	21-10565	0.00-0.50	Soil	—	0.52 (U)	—	—	—	—	2.1 (U)	53
MD21-98-0346	21-10566	0.00-0.50	Soil	—	0.53 (U)	—	—	0.11 (U)	—	2.1 (U)	80
MD21-98-0347	21-10567	0.00-0.50	Soil	—	0.52 (U)	—	25	—	—	2.1 (U)	55
MD21-98-0348	21-10568	0.00-0.50	Soil	—	0.53 (U)	—	-	0.11 (U)	—	2.1 (U)	-
MD21-98-0355	21-10569	0.00-0.50	Soil	—	0.94	—	23	0.11 (U)	—	2.1 (U)	130
MD21-98-0356	21-10570	0.00-0.50	Soil	—	0.92	—	-	0.11 (U)	—	2.2 (U)	260
MD21-98-0357	21-10571	0.00-0.67	Soil	—	0.54 (U)	—	24	0.11 (U)	—	2.2 (U)	130
MD21-98-0358	21-10572	0.00-0.50	Soil	11 (U)	0.54 (U)	—	24	0.11 (U)	—	2.2 (U)	110
MD21-98-0359	21-10573	0.00-0.71	Soil	—	0.59	—	—	0.11 (U)	—	2.2 (U)	120
MD21-98-0360	21-10574	0.00-0.50	Soil	—	0.53 (U)	—	—	0.11 (U)	—	2.1 (U)	110
MD21-98-0361	21-10575	0.00-0.71	Soil	—	0.52 (U)	—	—	—	—	2.1 (U)	120
MD21-98-0362	21-10576	0.00-0.71	Soil	—	0.53 (U)	—	—	0.11 (U)	—	2.1 (U)	98
MD21-98-0350	21-10577	0.00-0.50	Soil	—	0.75	—	—	0.11 (U)	—	2.1 (U)	150
MD21-98-0351	21-10578	0.00-0.71	Soil	—	0.52 (U)	—	140	—	—	2.1 (U)	120
MD21-98-0340	21-10579	0.00-0.50	Soil	—	2	—	81	0.11 (U)	—	2.1 (U)	260
MD21-98-0367	21-10580	0.00-0.50	Soil	—	0.53 (U)	—	47	0.11 (U)	—	2.1 (U)	81
MD21-98-0349	21-10581	0.00-0.50	Soil	—	0.66	—	30	—	—	2.1 (U)	150
MD21-98-0353	21-10582	0.00-0.50	Soil	—	0.53 (U)	—	47	0.11 (U)	—	2.1 (U)	84
MD21-98-0339	21-10583	0.00-0.50	Soil	—	0.53 (U)	—	35	0.11 (U)	—	2.1 (U)	86
MD21-98-0352	21-10584	0.00-0.50	Soil	—	0.53 (U)	—	250	0.11 (U)	—	2.1 (U)	710
MD21-98-0354	21-10586	0.00-0.50	Soil	—	0.53 (U)	—	—	0.11 (U)	—	2.1 (U)	55
MD21-98-0366	21-10586	0.00-0.50	Soil	—	0.52 (U)	—	38	-	—	2.1 (U)	77
MD21-98-0363	21-10587	0.00-0.50	Soil	—	0.93	37	57	0.11 (U)	—	2.1 (U)	180
MD21-98-0365	21-10588	0.00-0.50	Soil	—	1	28	54	0.11 (U)	—	2.1 (U)	140
MD21-98-0364	21-10589	0.00-0.50	Soil	—	0.8	32	50	0.11 (U)	—	2.2 (U)	180

Note: Units are mg/kg.

a Background values from LANL 1998, 59730.

b Soil screening levels from NMED 2004, 85615.

c U = The analyte was not detected.

d — = Not available or below background value.

Table B-44
Frequency of Detected Organic Chemicals in Surface Soil and Sediment* Samples Collected in 1998 at MDA B

Analyte	Medium	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	Frequency of Detects
Bis(2-ethylhexyl)phthalate	Soil	29	1	[0.33 to 3.5]	1/29
Fluoranthene	Soil	29	2	[0.33 to 3.5]	2/29
Phenanthrene	Soil	29	2	[0.33 to 3.5]	2/29
Pyrene	Soil	29	1	[0.33 to 3.5]	1/29

* No detected organics in sediment samples.

Table B-45
Detected Organic Chemicals in Surface Soil and Sediment[a] Samples Collected in 1998 at MDA B

Sample ID	Location ID	Depth (ft)	Medium	Bis(2-ethylhexyl)phthalate	Fluoranthene	Phenanthrene	Pyrene
Residential Soil Screening Levels (mg/kg)[b]				**3.47E+02**	**2.25E+03**	**1.80E+03**	**2.30E+03**
MD21-98-0346	21-10566	0.00-0.50	Soil	3.3	—[c]	—	—
MD21-98-0348	21-10568	0.00-0.50	Soil	—	0.6	0.46	0.5
MD21-98-0350	21-10577	0.00-0.50	Soil	—	0.39	0.49	—

a. No detected organics in sediment samples.
b. Soil screening levels from NMED 2004, 85615.
c. — = Not available or below background value.

Table B-46
Frequency of Radionuclides Detected above Background Value
in Surface Soil and Sediment Samples Collected in 1998 at MDA B

Analyte	Medium	Number of Analyses	Number of Detects	Concentration Range (pCi/g)	Background Value[a] (pCi/g)	Frequency of Detects Above Background Value
Americium-241	Soil	29	18	[0.0082] to 2.02	0.013	18/29
	Sediment	1	1	0.101 to 0.101	0.04	1/1
Cesium-134	Soil	15	0	[-0.044 to 0.059]	NA[b]	0/15
	Sediment	1	0	[0.005 to 0.005]	n/a	0/1
Cesium-137	Soil	16	11	0.146 to 1.41	1.65	4/16
	Sediment	1	0	[0.001 to 0.001]	0.9	0/1
Cobalt-60	Soil	16	0	[-0.096 to 0.08]	n/a	0/16
	Sediment	1	0	[-0.012 to -0.012]	n/a	0/1
Europium-152	Soil	16	0	[-0.13 to 0.09]	n/a	0/16
	Sediment	1	0	[0.03 to 0.03]	n/a	0/1
Plutonium-238	Soil	29	6	[-0.0118] to 0.358	0.023	6/29
	Sediment	1	1	0.0234 to 0.0234	0.006	1/1
Plutonium-239	Soil	29	29	[0.05] to 66.1	0.054	28/29
	Sediment	1	1	4.98 to 4.98	0.068	1/1
Ruthenium-106	Soil	16	0	[-0.48 to 0.59]	n/a	0/16
	Sediment	1	0	[-0.28 to -0.28]	n/a	0/1
Sodium-22	Soil	16	0	[-0.11 to 0.045]	n/a	0/16
	Sediment	1	0	[-0.023 to -0.023]	n/a	0/1
Strontium-90	Sediment	1	0	[0.07 to 0.07]	1.04	0/1
Tritium	Soil	35	7	[-0.03] to 0.1	n/a	7/35
Uranium-234	Sediment	1	1	0.832 to 0.832	2.59	0/1
Uranium-235	Soil	29	29	0.035 to 0.109	0.2	0/29
	Sediment	1	1	0.0314 to 0.0314	0.2	0/1
Uranium-238	Soil	29	29	0.858 to 1.92	2.29	0/29
	Sediment	1	1	0.858 to 0.858	2.29	0/1

a. Background values from LANL 1998, 59730.
b. n/a = Not applicable.

Table B-47
Radionuclide Analyses Above Background Value in Surface Soil and Sediment Samples Collected in 1998 at MDA B

Sample ID	Location ID	Depth (ft)	Medium	Americium-241	Cesium-137	Plutonium-238	Plutonium-239	Tritium
Soil Background Value[a]				0.013	1.65	0.023	0.054	0.766
Sediment Background Value[a]				0.04	0.9	0.006	0.068	0.093
Residential Screening Action Levels (pCi/g)[b]				39	5.3	49	44	890
SWMU 21-015								
MD21-98-0167	21-10554	19.00-20.00	Sediment	0.101	—[c]	0.0234	4.98	—
MD21-98-0341	21-10562	0.00-0.50	Soil	—	—	—	22.2	0.04
MD21-98-0342	21-10563	0.00-0.50	Soil	—	—	—	0.121	—
MD21-98-0343	21-10564	0.00-0.50	Soil	—	—	—	0.146	0.1
MD21-98-0344	21-10565	0.00-0.50	Soil	—	—	—	0.457	0.06
MD21-98-0346	21-10566	0.00-0.50	Soil	—	—	—	1	-
MD21-98-0347	21-10567	0.00-0.50	Soil	—	—	—	5.03	0.04
MD21-98-0348	21-10568	0.00-0.50	Soil	—	—	—	0.157	—
MD21-98-0355	21-10569	0.00-0.50	Soil	0.096	—	—	1.96	—
MD21-98-0356	21-10570	0.00-0.50	Soil	0.159	—	0.0328	5.5	—
MD21-98-0357	21-10571	0.00-0.67	Soil	0.088	0.52	—	2.5	—
MD21-98-0358	21-10572	0.00-0.50	Soil	0.289	—	0.085	10.25	0.05
MD21-98-0359	21-10573	0.00-0.71	Soil	0.078	0.33	—	1.52	0.08
MD21-98-0360	21-10574	0.00-0.50	Soil	0.165	—	—	3.47	0.05
MD21-98-0361	21-10575	0.00-0.71	Soil	0.186	0.18	—	3.32	—
MD21-98-0362	21-10576	0.00-0.71	Soil	0.436	0.16	0.059	6.9	—
MD21-98-0350	21-10577	0.00-0.50	Soil	1.099	—	0.117	23.5	—
MD21-98-0351	21-10578	0.00-0.71	Soil	2.02	—	0.358	66.1	—
MD21-98-0340	21-10579	0.00-0.50	Soil	0.314	—	0.059	10.91	—
MD21-98-0367	21-10580	0.00-0.50	Soil	—	—	—	0.348	—
MD21-98-0349	21-10581	0.00-0.50	Soil	0.079	—	—	1.63	—
MD21-98-0353	21-10582	0.00-0.50	Soil	0.0256	—	—	0.727	—
MD21-98-0339	21-10583	0.00-0.50	Soil	0.075	—	—	2.72	—
MD21-98-0352	21-10584	0.00-0.50	Soil	0.044	—	—	2.18	—
MD21-98-0354	21-10586	0.00-0.50	Soil	—	—	—	0.807	—
MD21-98-0366	21-10586	0.00-0.50	Soil	0.041	—	—	0.471	—
MD21-98-0363	21-10587	0.00-0.50	Soil	0.0382	—	—	1.344	—
MD21-98-0365	21-10588	0.00-0.50	Soil	0.0279	—	—	0.555	—
MD21-98-0364	21-10589	0.00-0.50	Soil	—	—	—	0.743	—

Note: Units are pCi/g.

a. Background values from LANL 1998, 59730.

b. Radionuclide Screening Action Levels from LANL, 2002, 73705.

c. — = Not available or below background value.

Table B-48
Summary of Surface Soil Samples Collected in 2001 at MDA B

Sample ID	Location ID	Depth (ft)	Medium	Isotopic Plutonium
MD21-01-0504	21-11414	0-0.5	Soil	205S
MD21-01-0505	21-11415	0-0.5	Soil	205S
MD21-01-0506	21-11416	0-0.5	Soil	205S
MD21-01-0507	21-11417	0-0.5	Soil	205S
MD21-01-0508	21-11418	0-0.5	Soil	205S
MD21-01-0509	21-11419	0-0.5	Soil	205S
MD21-01-0510	21-11420	0-0.5	Soil	205S
MD21-01-0511	21-11421	0-0.5	Soil	205S
MD21-01-0512	21-11422	0-0.5	Soil	205S
MD21-01-0513	21-11423	0-0.5	Soil	205S

Table B-49
Frequency of Radionuclides Detected above Background Value in Surface Soil Samples Collected in 2001 at MDA B

Analyte	Medium	Number of Analyses	Number of Detects	Concentration Range (pCi/g)	Background Value* (pCi/g)	Frequency of Detects Above Background Value
Plutonium-238	Soil	10	1	[-0.00191] to 0.0244	0.023	1/10
Plutonium-239	Soil	10	8	[0.0114] to 6.66	0.054	5/10

* Background values from LANL 1998, 59730.

Table B-50
Radionuclides Detected above Background Value
in Surface Soil Samples Collected in 2001 at MDA B

Sample ID	Location ID	Depth (ft)	Medium	Plutonium-238	Plutonium-239
Soil Background Value[a]				**0.023**	**0.054**
Sediment Background Value[a]				**0.006**	**0.068**
Residential Screening Action Levels (pCi/g)[b]				**49**	**44**
SWMU 21-015					
MD21-01-0504	21-11414	0.00-0.50	Soil	—[c]	0.14
MD21-01-0505	21-11415	0.00-0.50	Soil	—	0.218
MD21-01-0507	21-11417	0.00-0.50	Soil	—	0.0609
MD21-01-0510	21-11420	0.00-0.50	Soil	—	4.37
MD21-01-0512	21-11422	0.00-0.50	Soil	0.0244	6.66
MD21-01-0513	21-11423	0.00-0.50	Soil	—	2.48

Note: Units are pCi/g.

a. Background values from LANL 1998, 59730.

b. Radionuclide screening action levels from LANL, 2002, 73705.

c. — = Not available or below background value.

Appendix C

Costs Associated with Proposed Activities

Table C-1
Costs Associated with Proposed Activities

Activities	Cost	Scope Assumptions
Procurement of Equipment and Facilities	$9,000,000	Based on the equipment and materials list cost estimate. Assume main retrieval enclosure, Definitive Identification Facility structure (lighting, utility power, and fire water systems in each enclosure), support trailers, and heavy equipment. Also includes all radiological, health, safety, and site laboratory equipment.
Site Preparation, Mobilization, Construction, Testing	$3,500,000	Includes removal of acid drainline and installation of new roads and power to new trailers and enclosures and new perimeter fence. The enclosures will have a high-volume ventilation system, lighting, utility power, and fire water systems to install and test. The cost of installing a mock-up site is also included.
Readiness and Start-Up: Excavation: Waste Management:	$1,000,000* $14,500,000 $14,500,000	Includes procedures, training, readiness preparation and review, mock-up training, the complete excavation of trenches, and the disposal of all waste. Assumes 10 months leading up to the start of operations and 24 months of full operations. Assumes an estimated 35,000 yd^3 removed and 27,000 yd^3 disposed of as waste.
Site Restoration and Demobilization	$4,500,000	Includes removal of structures and utilities; 32,000 yd^3 of clean backfill placed as a cover and compacted, graded, and seeded; and the final demobilization.
TOTAL	**$47,000,000.00***	

* Based on estimated types of waste to be removed and the disposal costs for that waste type.

Table C-1 summarizes the project costs in four broad categories. The cost estimates given in Table C-1 are based on planning documents and project cost estimating tools completed over the past year. These estimates were not prepared at the level of detail required for a corrective measure evaluation. The following primary factors drive the scale of the operation:

- Complete excavation of all waste in trenches and surrounding contaminated media
    - ♦ Excavation down to the bottom limit of buried waste material
    - ♦ Further removal down to surfaces and media that have no contamination greater than residential cleanup levels
- Excavation of 2:1 side slopes for safety, constructed in such a way that the excavation may be up to 20 ft wide at the bottom and 100 ft wide at the top
- Excavation under an enclosure with sufficient width to operate. All waste is to be disposed of in a sealed-bag-type system using lined inter-modal or roll-on/roll-off containers.

The summary scope assumptions are noted in Table C-1. Additional assumptions and planning factors that are most significant to the cost estimate are as follows:

- Heavy equipment requirements address all operations, including excavation, clean and suspect contaminated soils, and the lay-down area for waste containers.

- Little or no production infrastructure is available on-site to support the project, thus the cost estimate includes the complete construction of a waste processing area, an on-site laboratory for waste characterization, and support trailers to meet operational needs.
- A haul road is needed on the southern side of Material Disposal Area (MDA) B to divert operations traffic from the DP Road business area, and power will need to be run to provide utility power for the enclosure (lighting, high-volume ventilation system, etc.), emergency backup generators, and health-and-safety trailers along that area.

Appendix D

Management Plan for Investigation-Derived Waste

This appendix describes how investigation-derived waste (IDW) generated during the investigation and remediation of Material Disposal Area (MDA) B at Los Alamos National Laboratory (LANL or the Laboratory) will be managed. IDW is waste generated by field-investigation activities and it may include, but is not limited to, drill cuttings, contaminated personal protective equipment (PPE), sampling supplies, fluids from the decontamination of PPE, sampling equipment, and environmental media such as surface and subsurface soil, rock, bedrock, and tuff. Additionally, material removed from within the trenches at MDA B as part of remediation is included in this plan.

The Laboratory will submit an area of contamination (AOC) designation request to the New Mexico Environment Department (NMED) for approval at least 30 days before the site investigation sampling notification. The request will specify the boundaries of the proposed AOC, describe the rationale for how the boundaries were established and how the boundaries will be delineated, and describe the activities to be conducted within the AOC.

All IDW generated during the MDA B investigation and remediation activities will also be managed in accordance with the latest version of applicable Environmental Programs Directorate standard operating procedures (SOPs). These SOPs incorporate the requirements of all applicable U.S. Environmental Protection Agency and NMED regulations, U.S. Department of Energy (DOE) orders, and Laboratory implementation requirements. The SOPs applicable to the characterization and management of IDW are SOP-1.06, Management of Environmental Restoration Project Waste, and SOP-1.10, Waste Characterization. These SOPs are among those applicable to the investigation and remediation at MDA B and are available at http://erproject.lanl.gov/documents/procedures.html.

Investigation activities will be conducted in a manner that minimizes the generation of waste. Waste minimization will be accomplished by implementing the requirements of the Laboratory's 2005 Los Alamos National Laboratory Hazardous Waste Minimization Report (LANL 2005, 91291). The waste streams that will be generated and managed during the field investigation at MDA B are described below.

Drill cuttings. The drill cuttings waste stream will consist of cuttings from all boreholes drilled during field activities. Drill cuttings will be collected and containerized at the point of generation (i.e., at the drill rig). The drill cuttings waste stream will be characterized by analytical results from direct sampling of the containerized waste. The maximum detected concentrations of radionuclides will be compared with background/fallout values. If maximum concentrations are above background/fallout values, the waste cuttings will be designated as low-level radioactive waste (LLW). Total concentrations of toxicity characteristic leaching procedure (TCLP) constituents will be compared with 20 times the TCLP regulatory level. If total concentrations are less than 20 times the TCLP regulatory level, the waste cuttings will be designated nonhazardous by characteristic. If total concentrations exceed 20 times the TCLP regulatory level, the waste cuttings will be sampled and analyzed using the TCLP to determine if they are hazardous by characteristic. If potential listed hazardous waste constituents are detected, the Laboratory will conduct a review of historical records and data to determine if the source of each constituent was a listed hazardous waste at its point of generation. If the source is determined to be a listed hazardous waste, the cuttings will be managed as hazardous or mixed waste (depending on the levels of radioactivity). Otherwise, the cuttings will be managed as nonhazardous solid waste or LLW (depending on the levels of radioactivity). Based on the results of previous investigations at MDA B, the Laboratory expects these wastes to be designated as LLW that will be disposed of at either Technical Area (TA) 54 or an authorized off-site LLW disposal facility.

Spent PPE. The spent PPE waste stream will consist of PPE that may have come into contact with contaminated environmental media and cannot be decontaminated. The bulk of this waste stream will consist of protective clothing such as coveralls, gloves, shoe covers, and (if required) respirator cartridges. Spent PPE will be collected in containers at personnel decontamination stations.

Characterization of this waste stream will be performed through acceptable knowledge (AK) of the waste materials, the methods of generation, and the levels of contamination observed in the environmental media. The Laboratory expects these wastes to be designated as LLW, Resource Conservation and Recovery Act (RCRA) hazardous, mixed low-level waste (MLLW), and/or industrial. Depending on the characterization, the wastes will be transported to and disposed of at either TA-54 (LLW only) or an authorized off-site waste disposal facility.

Disposable sampling supplies. The disposable sampling supplies waste stream will consist of all the equipment and materials needed for collecting samples that come into direct contact with contaminated environmental media and cannot be decontaminated. This waste stream also includes wastes associated with dry decontamination activities. This waste stream will consist primarily of paper and plastic items collected in bags at the sampling location and transferred to accumulation drums. Characterization of this waste stream will be performed through AK of the waste materials, the methods of generation, and the levels of contamination observed in the environmental media. The Laboratory expects these wastes to be designated as LLW, RCRA hazardous, MLLW, and/or industrial. Depending on the characterization, they will be transported to and disposed of at either TA-54 (LLW only) or an authorized off-site waste disposal facility.

Decontamination fluids. The decontamination fluids waste stream will consist of liquid wastes from decontamination activities (e.g., decontamination solutions and rinse waters). Following waste-minimization practices, the Laboratory employs dry decontamination methods to the extent possible. If dry decontamination cannot be performed, the resultant liquid decontamination wastes will be collected in containers at the point of generation and transferred to accumulation drums. The decontamination fluids waste stream will be accumulated in drums and characterized using analytical results from direct sampling of the containerized waste. The Laboratory expects these wastes to be designated as LLW, RCRA hazardous, MLLW, and/or nonhazardous wastewater. Depending on the characterization, they will be transported to and disposed of at TA-50 (LLW only); another on-site wastewater treatment/disposal facility for which the WAC can be met (nonhazardous wastewater only); or an authorized off-site TSDF (hazardous and MLLW).

Material removed from trenches. The material-removed-from-trenches waste stream will consist of all material removed from within the trenches at MDA B. Due to the uncertainty about the types of material that could be encountered within the trenches, a description of each is not possible; however, examples of what may be encountered are soils, pressurized cylinders, glass containers of chemicals, debris, drums, cardboard, paper, and plastic. Because of this variability, the waste stream will be managed on a case-by-case basis using direct sampling to determine characteristics. The waste types that could be managed during the MDA B activities consist of LLW, MLLW, RCRA hazardous, and/or industrial, and the wastes will be transported to and disposed of at TA-54 (LLW only) or an authorized off-site disposal facility.

Trench spoils. The trench spoils waste stream will consist of all soils removed from within the trenches and all soils removed during the transition from the surface of MDA B to the encounter with the material within the trenches. These soils will be segregated into manageable lots and direct sampling will be used to determine waste characteristics.

Because the trench spoils are environmental media, the Laboratory will request that NMED consider criteria for which the return of trench spoils to the excavation site would be appropriate for waste minimization purposes. For example, a hazardous waste determination would be made in the same way as for the drill cuttings. Total concentrations of TCLP constituents will be compared with 20 times the TCLP regulatory level. If total concentrations are less than 20 times the TCLP regulatory level, the waste will be designated nonhazardous by characteristic. If total concentrations exceed 20 times the TCLP

regulatory level, the waste will be sampled and analyzed using the TCLP to determine if it is hazardous by characteristic. If potential listed hazardous waste constituents are detected, the Laboratory will conduct a review of historical records and data to determine if the source of each constituent was a listed hazardous waste at its point of generation. If the trench spoils are determined to be nonhazardous, detected constituent concentrations will then be compared with the soil screening levels (SSLs) and screening action levels (SALs) used as cleanup goals. If constituent concentrations in the trench spoils meet the screening criteria, the Laboratory proposes to return the environmental media to the trenches. This proposal will be discussed in greater detail in the Laboratory's AOC determination request.

If the trench spoils are hazardous waste and/or do not meet the criteria for being returned to the trenches for other reasons (e.g., SSLs/SALs exceeded), they will be managed as waste. The Laboratory expects these wastes to be designated as LLW, RCRA hazardous, MLLW, and/or industrial, and they will be transported to and disposed of at TA-54 (LLW only) or an authorized off-site waste disposal facility.

Before the start of investigation and remediation activities, a waste characterization strategy form (WCSF) will be prepared and approved according to the requirements in the current revision of SOP-01.10. The WCSF will provide additional detailed information to that provided in this appendix about IDW characterization, potential volume, management, containerization, and disposition options. Additionally, a waste management plan will be developed as part of the MDA B engineering implementation plan to provide the subcontractor with detailed guidance on implementation of the waste management requirements in this appendix and the WCSF. All wastes will be managed in accordance with applicable federal, state, DOE, and Laboratory requirements. Waste streams, expected waste types, estimated waste volumes, and other data are listed in Table D-1.

Table D-1
Summary of Estimated IDW Generation and Management

Waste Stream	Expected Waste Type	Estimated Volume	Characterization Method	Onsite Management	Expected Disposition
Drill cuttings	LLW, MLLW, hazardous, or solid/industrial	60 yd^3	Analytical results from core and/or waste samples	55-gal. drums, covered roll-off containers—AOC staging and/or less-than 90-day accumulation area	TA-54, Area G, or off-site radioactive waste disposal facility (LLW) Off-site authorized TSDF (hazardous or MLLW) Off-site authorized industrial waste facility (solid/industrial)
Spent PPE	LLW, MLLW, hazardous, or solid/industrial waste	20 yd^3	AK	55-gal. drums, covered roll-off containers—AOC staging and/or less-than 90-day accumulation area	TA-54, Area G, or off-site radioactive waste disposal facility (LLW) Off-site authorized TSDF (hazardous or MLLW) Off-site authorized industrial waste facility (solid/industrial)
Disposable sampling supplies	LLW, MLLW, hazardous, or solid/industrial waste	20 yd^3	AK	55-gal. drums, covered roll-off containers—AOC staging and/or less-than 90-day accumulation area	TA-54, Area G, or off-site radioactive waste disposal facility (LLW) Off-site authorized TSDF (hazardous or MLLW) Off-site authorized industrial waste facility (solid/industrial)

Table D-1 (continued)

Waste Stream	Expected Waste Type	Estimated Volume	Characterization Method	Onsite Management	Expected Disposition
Decontamination fluids	LLW, MLLW, hazardous waste, or nonhazardous wastewater	500 gal.	AK	55-gal. drums—AOC staging and/or less-than 90-day accumulation area	LANL TA-50 (LLW) Other on-site waste water treatment/disposal facility (nonhazardous waste water), Off-site authorized TSDF (hazardous or MLLW)
Material from trenches	Solid/industrial	2590 yd^3	Analytical results from waste samples	Covered roll-off containers—AOC staging and/or less-than-90-day accumulation area	Authorized off-site solid/industrial waste facility
	RCRA hazardous waste	7189 yd^3	Analytical results from waste samples	Covered roll-off containers—AOC staging and/or less-than-90-day accumulation area	Authorized off-site TSDF
	LLW	10,800 yd^3	Analytical results from waste samples	Covered roll-off containers—AOC staging and/or less-than-90-day accumulation area	LANL TA-54 or off-site radioactive waste disposal facility
	MLLW	4028 yd^3	Analytical results from waste samples	Covered roll-off containers—AOC staging and/or less-than-90-day accumulation area	Authorized off-site TSDF
Trench spoils	Return to excavation site if nonhazardous and meets screening criteria outlined in AOC request, or LLW, MLLW, hazardous, or solid/industrial waste	14,000 yd^3	Analytical results from waste samples	Covered roll-off containers—AOC staging and/or less-than-90-day accumulation area	If not returned to excavation site: TA-54, Area G, or off-site radioactive waste disposal facility (LLW) Off-site authorized TSDF (hazardous or MLLW) Off-site authorized industrial waste facility (solid/industrial)

Appendix E

Borehole Logs for 1998 Angled Boreholes

LOS ALAMOS NATIONAL LABORATORY
MDA B, PRS 21-015 RFI PROJECT
ENVIRONMENTAL RESTORATION, MDA FOCUS AREA
BOREHOLE LOG

BOREHOLE ID MDA B-1, 21-10551 TA/OU: TA-21 Page 1 of 1

TOTAL DEPTH: 64.3' bgs, 100' angled borehole START DATE: September 3, 1998 END DATE: September 10, 1998

DRILLING EQ/METHOD: Hollow Stem Auger SAMPLING EQ/METHOD: Split Spoon

DRILLING COMPANY: Stewart Brothers Drilling Co. BOREHOLE ORIENTATION: South 67 East, 50 deg. from vertical

DRILLER: Stanley Johnson SITE GEOLOGIST: David Wykoff

Angled Depth (ft)	Core Run (amt.-recov./amt. attemp.)	Anaytical Sample Number (Depth interval)	Field Screening Results	Lithology	Graphic Log	Notes
0	2.3/2.5		No Detectable Activity(NDA)	Fill: Brown soil fill mixed with asphalt at top high moisture content.		
5	2.3/2.5		NDA			
	2.3/2.5		NDA			
10	2.3/2.5		NDA			1-3mm wide brown clay filled fractures(7-7.5 ft)
	2.3/2.5		NDA	Fill: Grey unconsolidated tuff fill material. Large pumice fragments at 14 feet.		
15	2.3/2.5		NDA			Large pumice fragments (14-15 ft)
	2.3/2.5		NDA			
20	2.3/2.5		NDA			
	2.4/2.5		NDA	QBT3: Grey poorly to non-welded tuff, fragments of pumice 2-5 mm, phenocrysts of quartz and sanidine 10-20%		
25	2.4/2.5		NDA			2-5 mm wide brown clay filled fracture (24-25 ft)
	2.4/2.5	MD21-98-0101 Core (29-30 ft)	NDA			
30	2.4/2.5		NDA			
	2.4/2.5		NDA			
35	2.4/2.5	MD21-98-0104 Soil Gas (35ft)	NDA			
	2.4/2.5		NDA			
40	2.4/2.5	MD21-98-0102 Core (39-40ft)	NDA			
	2.5/2.5		NDA			
45	2.5/2.5		NDA			
	2.5/2.5		NDA			
50	2.5/2.5	MD21-98-0103 Core (49-50ft)	NDA			
	2.5/2.5		NDA			
55	2.5/2.5		NDA			
	2.5/2.5		NDA			
60	2.5/2.5	MD21-98-0105 Core (59-60ft)	NDA			
	2.5/2.5		NDA			
65	2.5/2.5		NDA			
	2.5/2.5		NDA			2-5 mm wide brown clay filled fracture (63-65 ft)
70	2.5/2.5	MD21-98-0106 Core (69-70ft)	NDA			
	2.5/2.5		NDA			
75	2.5/2.5	MD21-98-0109 Soil Gas (75ft)	NDA			
	2.5/2.5		NDA			
80	2.5/2.5	MD21-98-0107 Core (79-80ft)	NDA			2-5 mm wide brown clay filled fracture (79-80 ft)
	2.5/2.5		NDA			
85	2.5/2.5	MD21-98-0110 Core (89-90ft)	NDA			
	2.5/2.5		NDA			
90	2.5/2.5		NDA			2-5 mm wide brown clay filled fracture (83-84 ft)
	2.5/2.5	MD21-98-0108 Core (99-100 ft)	NDA			
95	2.5/2.5	MD21-98-0114 Soil Gas (100ft)	NDA			
	2.0/2.5		NDA			
100						

LOS ALAMOS NATIONAL LABORATORY
MDA B, PRS 21-015 RFI PROJECT
ENVIRONMENTAL RESTORATION, MDA FOCUS AREA
BOREHOLE LOG

BOREHOLE ID MDA B-2, 21-10552	TA/OU: TA-21	Page 1 of 1
TOTAL DEPTH: 61.5' bgs, 100' angled borehole	START DATE: September 11, 1998	END DATE: September 15, 1998
DRILLING EQ/METHOD: Hollows Stem Auger	SAMPLING EQ/METHOD: Split Spoon	
DRILLING COMPANY: Stewart Brothers Drilling Co.	BOREHOLE ORIENTATION: North 88 West, 52 deg. from vertical	
DRILLER: Stanley Johnson	SITE GEOLOGIST: David Wykoff	

Angled Depth (ft)	Core Run (amt.-recov./amt. attemp.)	Anaytical Sample Number (Depth interval)	Field Screening Results	Lithology	Graphic Log	Notes
0	2.5/2.5		No Detectable Activity (NDA)	Fill: Brown soil fill mixed with asphalt at top high moisture content.		
5	2.5/2.5		NDA			
	2.5/2.5		NDA	Fill: Grey unconsolidated tuff fill material with cobbles of basalt10-20 mm at 24ft.		
10	2.5/2.5		NDA			
	2.5/2.5		NDA			
15	2.5/2.5		NDA			
	2.0/2.5		NDA			
20	.5/2.5		NDA			
	2.5/2.5		NDA	QBT3: Grey poorly to non-welded tuff, fragments of pumice 2-5 mm, phenocrysts of quartz and sanidene 10-20%.		
25	2.5/2.5		NDA			
	2.5/2.5		NDA			
30	2.0/2.5	MD21-98-0123 Core (29-30 ft)	NDA			
	2.0/2.5		NDA			
35	2.0/2.5	MD21-98-0126 Soil Gas (35ft)	NDA			
	2.0/2.5		NDA			
40	2.5/2.5	MD21-98-0124 Core (39-40 ft)	NDA			1-3mm fractures (39-40ft)
	2.3/2.5		NDA			
45	2.2/2.5		NDA			
	2.2/2.5		NDA			
50	2.2/2.5	MD21-98-0125 Core (49-50 ft)	NDA			
	2.1/2.5		NDA			
55	2.1/2.5		NDA			
	2.1/2.5		NDA			
60	2.4/2.5	MD21-98-0127 Core (59-60 ft)	NDA			2-5mm fracture with iron staining (61-62ft)
	2.1/2.5		NDA			
65	2.1/2.5		NDA			
	2.1/2.5		NDA			
70	2.1/2.5	MD21-98-0128Core (69-70 ft)	NDA			
	2.1/2.5		NDA			
75	2.1/2.5	MD21-98-0132 Soil Gas (75ft)	NDA			1-3mm brown clay filled fracture (74-75ft)
	2.1/2.5		NDA			
80	2.1/2.5	MD21-98-0129 Core (79-80 ft)	NDA			
	2.1/2.5		NDA			
85	2.1/2.5	MD21-98-0130 Core (89-90 ft)	NDA			
	2.2/2.5		NDA			
90	2.5/2.5	MD21-98-0131 Core (99-100 ft)	NDA			
	2.5/2.5		NDA			
95	2.5/2.5	MD21-98-0138 Soil Gas (100ft)	NDA			
	2.5/2.5		NDA			
100						

LOS ALAMOS NATIONAL LABORATORY
MDA B, PRS 21-015 RFI PROJECT
ENVIRONMENTAL RESTORATION, MDA FOCUS AREA
BOREHOLE LOG

BOREHOLE ID MDA B-3, 21-10553	TA/OU: TA-21	Page 1 of 1
TOTAL DEPTH: 70.7' bgs, 100' angled borehole	START DATE: September 16, 1998	END DATE: September 21, 1998
DRILLING EQ/METHOD: Hollows Stem Auger	SAMPLING EQ/METHOD: Split Spoon	
DRILLING COMPANY: Stewart Brothers Drilling Co.	BOREHOLE ORIENTATION: South 50 East, 45 deg. from vertical	
DRILLER: Stanley Johnson	SITE GEOLOGIST: David Wykoff	

Angled Depth (ft)	Core Run (amt.-recov./amt. attemp.)	Anaytical Sample Number (Depth interval)	Field Screening Results	Lithology	Graphic Log	Notes
0	2.5/2.5		No Detectable Activity(NDA)	Fill: Brown soil fill mixed with asphalt at top, high moisture content.		
5	2.5/2.5		18ppm VOC			
	1.5/2.5		NDA			
10	1.5/2.5		NDA	Fill: Grey unconsolidated tuff fill material.		
	2.5/2.5		NDA			
15	2.0/2.5		NDA			
	2.2/2.5		NDA			
20	2.5/2.5		NDA			
	2.5/2.5		NDA	QBT3: Grey poorly to non-welded tuff, fragments of pumice 2-5 mm, phenocrysts of quartz and sanidine 10-20%.		
25	2.5/2.5		NDA			
	2.5/2.5	MD21-98-0146/0147 Core(27-30ft)	NDA			
30	2.5/2.5		NDA			
	2.5/2.5		NDA			
35	2.5/2.5	MD21-98-0148Soil Gas (35ft)	NDA			
	2.5/2.5		NDA			
40	2.5/2.5	MD21-98-0149 Core (39-40ft)	NDA			1-3mm brown clay filled fractures (45-47ft)
	2.5/2.5		NDA			
45	2.5/2.5		NDA			
	2.5/2.5		NDA			
50	2.5/2.5	MD21-98-0150 Core (49-50ft)	NDA			1-3mm brown clay filled fractures(49-50 ft)
	2.5/2.5		NDA			
55	2.5/2.5		NDA			
	2.5/2.5		NDA			
60	2.5/2.5	MD21-98-0151Core (59-60ft)	NDA			1-3mm brown clay filled fractures (60-62 ft)
	2.5/2.5		NDA			
65	2.5/2.5		NDA			
	2.5/2.5		NDA			
70	2.5/2.5	MD21-98-0152 Core (69-70ft)	NDA			
	2.5/2.5		NDA			
75	2.5/2.5	MD21-98-0154 Soil Gas (75ft)	NDA			
	2.5/2.5	MD21-98-0153 Core (79-80ft)	NDA			
80	2.5/2.5		NDA			
	2.5/2.5		NDA			
85	2.5/2.5		NDA			
	2.5/2.5		NDA			
90	2.5/2.5	MD21-98-0155 Core (89-90ft)	NDA			
	2.5/2.5		NDA			1-3mm brown clay filled fractures and iron staining (92-95ft)
95	2.5/2.5	MD21-98-0156 Core (99-100 ft)	NDA			
	2.5/2.5	MD21-98-0160 Soil Gas (100ft)	NDA			
100						

Note: The borehole orientation as recorded does not represent conventional practice. The bearing is reversed. The actual bearing and inclination is North 50 West, 45 deg. from vertical.

LOS ALAMOS NATIONAL LABORATORY
MDA B, PRS 21-015 RFI PROJECT
ENVIRONMENTAL RESTORATION, MDA FOCUS AREA
BOREHOLE LOG

BOREHOLE ID MDA B-4, 21-10554	TA/OU: TA-21	Page 1 of 1
TOTAL DEPTH: 70.7' bgs, 100' angled borehole	START DATE: September 21, 1998	END DATE: September 24, 1998
DRILLING EQ/METHOD: Hollow Stem Auger	SAMPLING EQ/METHOD: Split Spoon	
DRILLING COMPANY: Stewart Brothers Drilling Co.	BOREHOLE ORIENTATION: North 65 West, 45 deg. from vertical	
DRILLER: Stanley Johnson	SITE GEOLOGIST: David Wykoff	

Angled Depth (ft)	Core Run (amt.-recov./amt. attemp.)	Anaytical Sample Number (Depth interval)	Field Screening Results	Lithology	Graphic Log	Notes
0				Fill: Brown soil fill.		
5	2.5/5		No Detectable Activity(NDA)	Fill: Grey unconsolidated tuff fill material.		
10	0/5		NDA	: No recovery.		
15	2.0/2.5		NDA	Fill: Grey unconsolidated tuff fill material.		Metal shavings(11-11.5 ft)
	2.0/2.5		NDA			
	2.3/2.5		NDA			
20	2.5/2.5	MD21-98-0167 Core(19-20ft)	alpha 250cpm beta & gamma 160cpm (17.5 ft)			
	2.5/2.5					
25	2.0/2.5	MD21-98-0168 Core(24-25ft)	5.9 ppm PID			1-3 mm wide fractures, vinegar-like odor (22-25ft)
	2.0/2.5		NDA			
30	2.0/2.5		NDA			
	2.0/2.5		NDA			
35	2.0/2.5	MD21-98-0170 Soil Gas (35ft)	NDA	QBT3: Grey poorly to non-welded tuff, fragments of pumice 2-5 mm, phenocrysts of quartz and sanidine 10-20%.		
	2.0/2.5		NDA			
40	2.0/2.5	MD21-98-0169 Core(39-40ft)	NDA			
	2.5/2.5		NDA			
45	2.5/2.5		NDA			
	2.5/2.5		NDA			
50	2.5/2.5	MD21-98-0171 Core(49-50ft)	NDA			
	2.5/2.5		NDA			
55	2.5/2.5		NDA			
	2.5/2.5		NDA			
60	2.5/2.5	MD21-98-0172 Core(59-60ft)	NDA			
	2.5/2.5		NDA			
65	2.5/2.5		NDA			1-3 mm wide brown clay filled fractures (65-67 ft)
	2.5/2.5		NDA			
70	2.5/2.5	MD21-98-0173 Core(69-70ft)	NDA			
	2.5/2.5		NDA			
75	2.5/2.5	MD21-98-0176 Soil Gas (75ft)	NDA			
	2.5/2.5		NDA			1-3 mm wide brown clay filled fractures and iron staining (76-79 ft)
80	2.5/2.5	MD21-98-0174Core(79-80ft)	NDA			
	2.5/2.5		NDA			
85	2.5/2.5		NDA			
	2.5/2.5		NDA			
90	2.5/2.5	MD21-98-0175 Core(89-90ft)	NDA			Iron staining (90-92 ft)
	2.5/2.5	MD21-98-0177 Core(99-100ft)	NDA			
95	2.5/2.5	MD21-98-0182 Soil Gas (100ft)	NDA			
	2.6/2.5		NDA			
100						

LOS ALAMOS NATIONAL LABORATORY
MDA B, PRS 21-015 RFI PROJECT
ENVIRONMENTAL RESTORATION, MDA FOCUS AREA
BOREHOLE LOG

BOREHOLE ID MDA B-5, 21-10555	TA/OU: TA-21	Page 1 of 1
TOTAL DEPTH: 66.9' bgs, 100' angled borehole	START DATE: September 25, 1998	END DATE: September 28, 1998
DRILLING EQ/METHOD: Hollow Stem Auger	SAMPLING EQ/METHOD: Split Spoon	
DRILLING COMPANY: Stewart Brothers Drilling Co.	BOREHOLE ORIENTATION: North 68 West, 48 deg. from vertical	
DRILLER: Stanley Johnson	SITE GEOLOGIST: David Wykoff	

Angled Depth (ft)	Core Run (amt.-recov./amt. attemp.)	Anaytical Sample Number (Depth interval)	Field Screening Results	Lithology	Graphic Log	Notes
0	2.5/2.5		No Detectable Activity(NDA)	Fill: Brown soil fill.		
5	2.5/2.5		NDA			
	1.5/2.5		NDA			
10	1.5/2.5		NDA			
	2.5/2.5		NDA	Fill: Grey unconsolidated tuff fill material.		
15	2.0/2.5		NDA			
	2.2/2.5		NDA	QBT3: Grey poorly to non-welded tuff, fragments of pumice 2-5 mm, phenocrysts of quartz and sanidine 10-20%.		
20	2.5/2.5		NDA			10mm wide brown clay filled fractures (20-22 ft)
	2.5/2.5		NDA			
25	2.5/2.5		NDA			
	2.5/2.5		NDA			
30	2.5/2.5	MD21-98-0189 Core(29-30ft)	NDA			
	2.5/2.5		NDA			
35	2.5/2.5	MD21-98-0192 Soil Gas (35ft)	NDA			Fragments of basalt, 2-5 cm (35 ft)
	2.5/2.5		NDA			
40	2.5/2.5	MD21-98-0190 Core(39-40ft)	NDA			
	2.5/2.5		NDA			
45	2.5/2.5		NDA			
	2.5/2.5		NDA			
50	2.5/2.5	MD21-98-0191 Core(49-50ft)	NDA			
	2.5/2.5		NDA			
55	2.5/2.5		NDA			
	2.5/2.5		NDA			
60	2.5/2.5	MD21-98-0193 Core(59-60ft)	NDA			1mm wide brown clay filled fractures (58-60 ft)
	2.5/2.5		NDA			
65	2.5/2.5		NDA			
	2.5/2.5		NDA			
70	2.5/2.5	MD21-98-0194 Core(69-70ft)	NDA			1mm wide brown clay filled fractures (70-72ft)
	2.5/2.5		NDA			
75	2.5/2.5	MD21-98-0204 Soil Gas (75ft)	NDA			
	2.5/2.5		NDA			
80	2.5/2.5	MD21-98-0195 Core(79-80ft)	NDA			
	2.5/2.5		NDA			
85	2.5/2.5		NDA			
	2.5/2.5	MD21-98-0196/0197 Core(87-90ft)	NDA			
90	2.5/2.5		NDA			
	2.5/2.5	MD21-98-0199 Core(99-100ft)	NDA			
95	2.5/2.5		NDA			
	2.5/2.5	MD21-98-0198 Soil Gas (100ft)	NDA			
100						

LOS ALAMOS NATIONAL LABORATORY
MDA B, PRS 21-015 RFI PROJECT
ENVIRONMENTAL RESTORATION, MDA FOCUS AREA
BOREHOLE LOG

BOREHOLE ID MDA B-6, 21-10556 TA/OU: TA-21 Page 1 of 1

TOTAL DEPTH: 64.3' bgs, 100' angled borehole START DATE: September 30, 1998 END DATE: October 2, 1998

DRILLING EQ/METHOD: Hollow Stem Auger SAMPLING EQ/METHOD: Split Spoon

DRILLING COMPANY: Stewart Brothers Drilling Co. BOREHOLE ORIENTATION: North 5 East, 50 deg. from vertical

DRILLER: Stanley Johnson SITE GEOLOGIST: David Wykoff

Angled Depth (ft)	Core Run (amt.-recov./amt. attemp.)	Anaytical Sample Number (Depth interval)	Field Screening Results	Lithology	Graphic Log	Notes
0	2.0/2.5		No Detectable Activity(NDA)	Fill: Brown soil fill		
5	2.0/2.5		NDA			
10	1.5/2.5		NDA			
	1.5/2.5		NDA	Fill: Grey unconsolidated tuff fill material.		
15	2.0/2.5		NDA			Small white clay filled fractures 1mm wide
	2.0/2.5		NDA	QBT3: Grey poorly to non-welded tuff, fragments of pumice 2-5 mm, phenocrysts of quartz and sanidine 10-20%.		
20	2.2/2.5		NDA			
	2.5/2.5		NDA			
25	2.5/2.5		NDA			Brown clay filled fracture zone 22.5-23ft
	2.5/2.5		NDA			
30	2.5/2.5	MD21-98-0211 Core(29-30ft)	NDA			
	2.5/2.5		NDA			
35	2.5/2.5	MD21-98-0214 Soil Gas (35ft)	NDA			Small brown clay filled fractures 1mm wide(35-37 ft)
	2.5/2.5	MD21-98-0212 Core(39-40ft)	NDA			
40	2.5/2.5		NDA			
	2.5/2.5		NDA			
45	2.5/2.5		NDA			
	2.5/2.5	MD21-98-0213 Core(49-50ft)	NDA			
50	2.5/2.5		NDA			
	2.5/2.5		NDA			
55	2.5/2.5		NDA			
	2.5/2.5	MD21-98-0215 Core(59-60ft)	NDA			Small brown clay filled fractures 1mm wide(55-57 ft)
60	2.5/2.5		NDA			
	2.5/2.5		NDA			
65	2.5/2.5		NDA			
	2.5/2.5	MD21-98-0216 Core(69-70ft)	NDA			
70	2.5/2.5		NDA			
	2.5/2.5		NDA			
75	2.5/2.5	MD21-98-0220 Soil Gas (75ft)	NDA			
	2.5/2.5	MD21-98-0217 Core(79-80ft)	NDA			
80	2.5/2.5		NDA			
	2.5/2.5		NDA			Iron staining at 83-85ft
85	2.5/2.5		NDA			
	2.5/2.5	MD21-98-0218 Core(89-90ft)	NDA			
90	2.5/2.5		NDA			
	2.5/2.5	MD21-98-0219 Core(99-100ft)	NDA			
95	2.5/2.5		NDA			
100	2.5/2.5	MD21-98-0226 Soil Gas (100ft)	NDA			

Note: The borehole orientation as recorded does not represent conventional practice. The bearing is reversed. The actual bearing and inclination is South 5 West, 50 deg. from vertical.

LOS ALAMOS NATIONAL LABORATORY
MDA B, PRS 21-015 RFI PROJECT
ENVIRONMENTAL RESTORATION, MDA FOCUS AREA
BOREHOLE LOG

BOREHOLE ID MDA B-7, 21-10557	TA/OU: TA-21	Page 1 of 1
TOTAL DEPTH: 70.7' bgs, 100' angled borehole	START DATE: October 7, 1998	END DATE: October 8, 1998
DRILLING EQ/METHOD: Hollow Stem Auger	SAMPLING EQ/METHOD: Split Spoon	
DRILLING COMPANY: Stewart Brothers Drilling Co.	BOREHOLE ORIENTATION: East-West, 45 deg. from vertical	
DRILLER: Stanley Johnson	SITE GEOLOGIST: David Wykoff	

Angled Depth (ft)	Core Run (amt.-recov./amt. attemp.)	Anaytical Sample Number (Depth interval)	Field Screening Results	Lithology	Graphic Log	Notes
0	2.0/2.5		No Detectable Activity(NDA)	Fill: Brown soil fill		
5	2.0/2.5		NDA	Fill: Grey unconsolidated tuff fill material.		
10	1.5/2.5		NDA	QBT3: Grey poorly to non-welded tuff, fragments of pumice 2-5 mm, phenocrysts of quartz and sanidine 10-20%.		
	1.5/2.5		NDA			
15	2.0/2.5		NDA			
	2.0/2.5		NDA			
20	2.2/2.5		NDA			
	2.5/2.5		NDA			
25	2.5/2.5		NDA			Brown clay filled fracture zone (21- 22.5ft)
	2.5/2.5		NDA			
30	2.5/2.5	MD21-98-0236 Core(29-30ft)	NDA			
	2.5/2.5		NDA			
35	2.5/2.5	MD21-98-0239 Soil Gas (35ft)	NDA			Small brown clay filled fractures 5-7mm wide (32-35 ft)
	2.5/2.5		NDA			
40	2.5/2.5	MD21-98-0237 Core(39-40ft)	NDA			
	2.5/2.5		NDA			
45	2.5/2.5		NDA			
	2.5/2.5		NDA			Small red clay filled fractures 1mm wide (43ft)
50	2.5/2.5	MD21-98-0238 Core(49-50ft)	NDA			
	2.5/2.5		NDA			
55	2.5/2.5		NDA			
	2.5/2.5		NDA			
60	2.5/2.5	MD21-98-0240 Core(59-60ft)	NDA			
	2.5/2.5		NDA			
65	2.5/2.5		NDA			
	2.5/2.5		NDA			
70	2.5/2.5	MD21-98-0241 Core(69-70ft)	NDA			Iron staining in fractures (66-67ft)
	2.5/2.5		NDA			
75	2.5/2.5	MD21-98-0245 Soil Gas (75ft)	NDA			
	2.5/2.5		NDA			
80	2.5/2.5	MD21-98-0242Core(79-80ft)	NDA			
	2.5/2.5		NDA			
85	2.5/2.5		NDA			Iron staining at 83-85ft
	2.5/2.5	MD21-98-0243 Core(89-90ft)	NDA			
90	2.5/2.5		NDA			
	2.5/2.5	MD21-98-0244 Core(99-100ft)	NDA			
95	2.5/2.5		NDA			
	2.5/2.5	MD21-98-0256 Soil Gas (100ft)	NDA			
100						

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Appendix F

Phase I RFI Data
(see enclosed CD)