CERTIFICATION

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Document Title: **SUBMITTAL OF "INVESTIGATION WORK PLAN FOR MATERIAL DISPOSAL AREA B AT TECHNICAL AREA 21, SOLID WASTE MANAGEMENT UNIT 21-015"**

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

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

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Prepared by
Risk Reduction and Environmental Stewardship–Remediation Services

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

June 2004

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EXECUTIVE SUMMARY

This investigation work plan describes the sampling and analysis requirements and investigatory methodology for characterizing the contents of Material Disposal Area (MDA) B, Solid Waste Management Unit (SWMU) 21-015, at Technical Area 21 within Los Alamos National Laboratory (LANL or the Laboratory). Based on a conservative estimate of potential radiological waste inventory, MDA B has been categorized as a Hazard Category 3 nuclear facility, requiring special consideration of radiological and hazardous materials work-related safety issues.

From 1944 until 1948, MDA B received waste related to LANL processes. There are no official waste inventory records for MDA B. According to historical data, anecdotal information, and process knowledge, the types of waste disposed at the landfill were highly variable. Disposal trenches may contain radioactive and chemically contaminated laboratory wastes, debris, and waste products from a water boiler as well as containers of solvents, chemical mixtures, and corrosive liquids and gasses. At least one truck contaminated with fission products from the Trinity test is buried in MDA B. Some degree of waste segregation practices is suggested by the presence of shallow chemical-disposal trenches as well as other larger trenches that were presumably for debris and other solid waste. Other documents state that there was no attempt to separate materials.

The principal objectives of the investigation prescribed by this work plan are (1) to characterize the types and estimate the quantities of waste in MDA B; (2) to characterize the radiological, organic chemical, and inorganic chemical concentrations in the soil and rock adjacent to the disposal trench sides and bottom; and (3) to generate operational performance data for potential future corrective actions at the MDA B disposal trenches. Achieving these objectives requires direct excavation into the MDA B disposal trenches.

This work plan is part of a phased approach outlining the methodology directing and documenting the decisions made prior to, and during, field operations. During field operations, brief milestone reports will be prepared to keep the New Mexico Environment Department (NMED) apprised of field conditions and the progress of activities. Any deviations from the work plan will be documented. Because of the proximity of MDA B to the city of Los Alamos and businesses immediately across the street, public meetings will be held during the planning and execution of field activities. In addition, appropriate training, including emergency warning and response, will be conducted for those businesses that will be affected. Designed safety features such as temporary enclosures will help isolate the planned field activities from the adjacent businesses and surrounding environment. Work activities will be planned to minimize the impact on adjacent businesses. To assess possible issues, plan and control the work environment, and prevent damage to the surrounding environment, an implementation plan will be developed.

To characterize buried waste, eight or more exploratory trenches will be advanced laterally across the disposal trenches and will penetrate the entire local thickness and depth of the landfill. The locations of the exploratory trenches will be based on historical, anecdotal, and geophysical information and will be chosen to intercept the disposal trenches and to capture—to the extent practical—a representation of the disposal trench contents. Test pits will be excavated to augment exploratory trench observations and data. Excavation activities will be performed inside a temporary mobile structure to provide access control, protect the operations from environmental factors, and impede off-site exposure to excavated material.

Because of the lack of knowledge about the disposal trench contents and the possible hazards associated with excavating into radiologically and chemically contaminated materials, a flexible plan, with appropriate regulator interaction, allows for an increase in the number of exploratory trenches, changes to the configuration of the exploratory trenches, the ability to isolate and bypass high-risk areas when

encountered, and control over the quantity of material excavated. Samples for waste and in-situ material characterization will be collected based on field 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.

Materials removed from the exploratory trenches will be evaluated to ensure proper handling in accordance with health and safety requirements. To address anticipated disposal trench material-handling scenarios that could be encountered during the field investigation, a decision tree and analysis table is presented in this plan. After additional specific planning, any bypassed materials will be removed from the excavation for proper containment and storage, characterization, packaging, and transportation to an approved disposal facility, on a case-by-case basis. Industrial and low-level radioactive waste, as well as uncontaminated material, may be returned to the excavation in a segregated fashion. Records will be kept of the types and locations of any material returned to the excavation in order to facilitate future potential actions.

Analysis of samples taken at locations immediately below and adjacent to the disposal trenches during exploratory trench and test pit installation will supplement the existing data in order to better define the nature and extent of contamination in the underlying soil and rock. These data will be reported as they become available as part of the milestone reports to the NMED to monitor progress and results.

Appendix B, the historical investigation report, describes the results of investigations of contaminants that may have been discharged or released at MDA B during historical operations at the facility. The investigation includes known and suspected sources for potential groundwater contaminants, and a review of existing data and other information acquired during previous investigations. Included are results of the previously undocumented 1998 Resource Conservation and Recovery Act (RCRA) facility investigation.

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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 US Department of Energy (DOE) and managed by the University of California. The Laboratory is located in north-central New Mexico, approximately 60 mi northeast of Albuquerque and 20 mi northwest of Santa Fe. 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 Risk Reduction and Environmental Stewardship Division–Remediation Services (RRES-RS) project, formerly the Environmental Restoration (ER) Project, is participating in a national effort by the DOE to clean up sites and facilities formerly involved in weapons research and production. The goal of the RRES-RS is to ensure that DOE's past operations do not threaten human or environmental health and safety in and around Los Alamos County, New Mexico. To achieve this goal, the project investigates sites potentially contaminated by past Laboratory operations. The site discussed in this 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, including sampling and analysis, is being conducted under the requirements of the Resource Conservation and Recovery Act (RCRA) and in accordance with the Hazardous and Solid Waste Amendments of 1984 (HSWA) and follows the requirements in Module VIII of the Laboratory's Hazardous Waste Facility Permit (EPA 1990, 01585.2). Module VIII was issued to the Laboratory by the US Environmental Protection Agency (EPA) on May 23, 1990, and modified on May 19, 1994 (EPA 1994, 44146.2). Radionuclides are regulated under DOE Order 5400.5, "Radiation Protection of the Public and the Environment" (proposed rule 10 CFR 834.5). As agreed to with the New Mexico Environment Department (NMED), the purposes of the work described in this plan are to characterize the disposal trench contents and further define nature and extent.

In accordance with Module VIII, the nature and extent of releases of hazardous waste or hazardous constituents are determined through the RCRA facility investigation (RFI) process. Under the RRES-RS project, the Laboratory implements the RFI process for those sites under the administrative authority of DOE.

Material Disposal Area (MDA) B is an inactive subsurface disposal site, designated as SWMU 21-015, that might 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) (Appendix B, Figures B-1, B-2). MDA B occupies approximately 6 acres and consists of multiple disposal trenches (Figure 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).

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.

The objectives of the investigation described in this work plan are to

- characterize the types of waste and estimate the quantities of waste in MDA B;
- characterize (using quantitative screening methods and off-site anaytical laboratory data) the radiological, organic chemical, and inorganic chemical concentrations in fill material, soil, and rock near the interface with the waste-disposal trenches; and
- generate operational performance data for potential future corrective actions within the MDA B disposal trenches.

Meeting these objectives requires direct excavation into the MDA B disposal trenches.

Analytical and observational data will be used to identify contaminants, estimate volumes, and map the types and physical forms of the various wastes contained in the disposal trenches. These data will also be used to refine the health and safety protocols required for future activities associated with the disposal trenches. The operational performance data will be used to determine the safest and most efficient methods for excavating within the disposal trenches and for handling, characterizing, segregating, and disposing of excavated materials.

Data about the residual radiological and hazardous chemical concentrations will be collected from fill, soil, or rock in the side walls of the excavations and from native tuff in the bottom of the exploratory trenches. These data will be used to assess the nature and extent of contamination directly beneath the landfill.

Defining the contents of the disposal trenches will help expedite progress to the final remedy. Instead of waiting for the corrective measures study phase, source characterization activities are proposed in this work plan. This will provide flexibility for further expediting corrective action based on the results of the source term investigation. This approach makes it possible to meet the deadlines for completing the investigation report and the final remedy as specified in the Order issued by the NMED. This work plan describes the rationale for the data collection activities, and it specifies the sampling and excavation methodologies and protocols that will be employed for collecting, analyzing, and evaluating the data required to meet the objectives of this investigation.

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 are in the HIR, including specific analytical results, the approach to selecting exploratory trench locations, and the planning for waste characterization and sampling.

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, 07529.1). Waste disposal at MDA B ceased in 1948. A circa 1946 aerial photograph shows the initial excavation activities at MDA B (Figure 2). 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, 58212.1; Bay Geophysical 1998, 64146; Bay Geophysical 1998, 64147; Thavoris 2001, 83862.1). The results of the surveys were interpreted as several large trenches. One to three of

these comprise the western portion of the MDA and one large trench comprises the eastern portion (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 LANL 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, 11721.1). 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 perchlorates, 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 trench(es) at the east end of MDA B (DOE 1986, 08657.1).

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, 28154.2). Short-lived radionuclides, such as RaLa, are no longer present due to radioactive decay. The majority of the radioactively contaminated waste probably consisted of paper, rags, rubber gloves, glassware, and small metal apparatus 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 apparatus. The latter type of material was placed in wooden boxes or wrapped with paper (Meyer 1952, 28154.2). At least one truck contaminated with fission products from the Trinity test is believed to be buried in MDA B (DOE 1986, 08657.1).

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, 26073.1; LANL 1995, 52350.1). 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, 26073.1; LANL 1995, 52350.1).

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, 00540.1), 1983 (LANL 1991, 07529.1), and in 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 D 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-29 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-29 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, Figure 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. Appendix B's Figures B-28, B-29, B-30, B-45, B-46, and B-47 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. Based on the 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. Known surface and subsurface traits and their potential effects on the occurrence and concentration of contaminants include

- a canyon-mesa terrain, which affects meteorological conditions and ecological habitats at the surface;
- a semi-arid climate with low precipitation and a high evapotranspiration rate, which limits the extent of subsurface moisture percolation, limiting the amount of moisture available for leaching radionuclides or other hazardous waste constituents; and
- a thick, 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.

These and other elements of the environmental setting at MDA B are useful when evaluating site investigation data with respect to the potential impacts of contamination from historical site activities.

3.1 Surface Conditions

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 MDAs B and V), a shallow tributary of Los Alamos Canyon (LA 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:

1. a small, soil-covered, vegetated area at the extreme western end of MDA B (approximately 105 ft by 150 ft);
2. 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
3. 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 has any surface structures or utilities, and all are enclosed by a galvanized steel chainlink fence. Vegetation has penetrated portions of the asphalt pavement through cracks, and trees line a portion of the northern boundary of the site. An air monitoring station is located on the outside of the east fence.

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 SWMUs 21-027(d)-99, 21-018(a)-99 (MDA V), and 21-024(e)-99. To the north are SWMUs 21-024(f) and 21-013 (d,e); to the northwest is SWMU 21-029 (DP Tank Farm). To the southwest are SWMUs 00-030(b)-00 and 00-010(a) (Appendix B, Figure B-3). The area immediately to the north of MDA B and 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 along, 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. Further to the east on DP Road, LANL has active

research facilities and office space at TA-21. DP Road is the only access for commercial businesses and LANL 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 whereas BV Canyon has only occasional stream flow which is insufficient to support alluvial groundwater.

There are no streams on DP Mesa; stormwater and snowmelt generally run off the mesa as sheet flow and 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.

RRES-RS has developed a standard operating procedure (SOP) for assessing the potential for erosion and sediment transport at individual SWMUs (LANL-ER-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

At TA-21, natural or undisturbed surface soil cover is limited, due to 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 undisturbed, soils on the mesa surface are thin and poorly developed. They tend to be sandy in texture near the surface and more clay-like beneath the surface. Soil profiles tend to be more poorly developed on the cliff-forming south-facing slopes than on the north-facing slopes, which tend to have higher organic content. 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 LANL facilities. This waste line is not part of SWMU 21-015. 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. 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). 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 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 years 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 on geomorphic studies at DP Mesa and vicinity (Reneau 1995, 50143.1, pp. 66–69), tributary stream systems and their canyons (possibly including BV Canyon and the upper reaches of DP Canyon) developed prior to incision of LA Canyon, and minimal cliff retreat has occurred in these canyons since then. A paleochannnel identified to extend over portions of the DP Mesa may also be related to the tributary stream system. The report goes on to say that exposure of most of the MDAs at TA-21 on DP Mesa through cliff retreat is improbable over periods exceeding 10,000 years. 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, 54404.1). This zone may possibly be related to the Pajarito Fault system. Fracture characteristics of unit 2 of the Tshirege Member, which was the focus of this study, are very similar to previous fracture studies of unit 3, allowing for extrapolation of results to the rocks directly below TA-21. The study indicates that slant (angled) boreholes drilled in the direction S48E and N-S would optimize fracture intersections in the upper vadose zone under the MDAs at TA-21.

3.2.3 Hydrogeology

3.2.3.1 Infiltration

The proposed hydrogeologic conceptual model for the Pajarito Plateau (Figure 4) (LANL 1998, 59599, p. 5) predicts 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 evaporation and transpiration (or "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.

Differences in degree of surface disturbance and the geologic properties of the tuff lead to differences in recharge rates. Mesa-top recharge can be locally significant when vegetation is removed, when soil and near-surface bedrock are disturbed, or when water is artificially added to the local hydrologic system by activities such as effluent disposal.

Two geologic properties of the Bandelier Tuff that significantly influence recharge rates are the degree of welding and devitrification. Both are effects 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. Fractures within the tuff do not enhance the movement of dissolved contaminants unless saturated conditions exist.

Under unsaturated conditions, most of the open fractures beneath the site are expected to be completely dry, and the water will exist in the tuff matrix only. Only in situations when 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 LANL wells are rare on the Pajarito Plateau. Perched waters are thought to form mainly at horizons where medium 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 was drilled through at LADP-4, 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 LADP-3 (in the Guaje at 6430 ft asl) and at R-7 (in the Puye at 6420 ft asl), both south of TA-21 in LA Canyon, and at Otowi-4 on the eastern base of DP Mesa east of TA-21 (in the Puye at 6380 ft asl). Figure 5 shows the locations of LANL 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. 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. The regional aquifer was encountered in deep wells proximal to MDA B at 5870 ft asl (R-7), 5850 ft asl (Otowi-4), and 5835 ft asl (R-8), all three wells downgradient from MDA B (Figure 5), resulting in an approximate 1260-ft depth to groundwater at MDA B. The groundwater in the main aquifer is separated from alluvial and perched groundwater in the volcanics by 350 to 620 ft of tuff and volcanic sediments (Purtymun 1995, 45344, p. 29).

4.0 SCOPE OF ACTIVITIES

The investigation objective and the scope of activities that will provide characterization information about the contents of the disposal trenches at MDA B are described in the following sections.

Due to the anticipated heterogeneity of the disposal trench contents and the potential for changing and unexpected conditions in the field, the sampling approach is flexible and allows for adjusting the location, number, and types of samples, and the quantity of material removed during exploratory trenching. Such adjustments will be based on field observations, field screening, project team professional judgment, safety issues, and regulatory requirements. A decision tree detailing the segregation, screening, and packaging of excavated material is presented in Figure 6.

Figure 7 provides an approximate sequence of activities for each of the proposed exploratory trenches; this sequence may be modified, as appropriate, to skip a step, reiterate a step or sequence of steps, or add a step. More exploratory trenches may be added to meet the investigation objectives. Excavation of test pits will follow the same sequence for immediate danger to life and health (IDLH) screening but, depending upon the objective for creating the test pit, may stop short of additional screening steps. Other activities will include refining safety considerations and controls based on actual conditions encountered. The following sections provide details for each activity.

An implementation plan will be developed prior to beginning the activities described in this work plan. The plan will closely follow the scope of work detailed in this section. The principle topics and elements are

- the documented safety analysis (DSA), site-specific health and safety plan (SSHASP), integrated work document (IWD), radiological work permit, and waste management plan;
- preparatory activities, including notifications, emergency procedures, operational procedures, mobilization, demobilization, site controls, and enclosure structures;
- the operational readiness review;
- the subcontractor layout of field facilities, enclosure structure(s), staging areas, and decontamination facilities, and other site layout features;
- traffic control/mitigation, including a drawing showing traffic flow patterns on the site, streets, and highways;
- the equipment to be used and a description of the equipment application;
- decision trees for the handling, segregation, and disposition of excavated material;
- the strategy and approach for excavating disposal trench contents (exploratory trenches and test pits), including modifications or additions;
- the strategy and approach for removing chemical containers;
- screening for IDLH conditions;
- initial segregating by material type;
- exploratory trench logging, identification of excavated materials, and recording of exposed disposal trench geometry;
- hazard characterization (HazCat) screening;
- waste management, compositing, and packaging;
- definitive identification of unknown chemicals and materials;
- an electronic inventory management and tracking system;
- sample collection, handling, and documentation;
- surveying of sample locations, and trench geometries and features of excavations;
- backfilling of exploratory trenches and test pits; and
- clean cover replacement and compaction.

If there are significant deviations from the scope outlined in section 4, or from the methods outlined in section 5 of this work plan, they will be identified in the subcontractor's implementation plan. If found by RRES-RS to enhance operations or safety, the changes will be communicated to the NMED for its review and approval.

Because of the planned flexibility of the investigation, close communication with the NMED to inform them of the decision-making processes and the progress of field activities will be achieved by issuing milestone reports. The reports will detail activities of interest. At a minimum, milestone reports will be issued at the completion of each exploratory trench when samples have been selected for analysis. Additional situations that warrant milestone reports may be identified .

The proximity to the city of Los Alamos and the businesses located north of DP Road requires that a real-time emergency warning system be designed and implemented. 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 as needed to accommodate the dynamic nature of the investigation.

Impact on the public will be minimized. Investigation and materials management–related activities will be conducted within the SWMU boundary and inside an enclosure. The enclosure shall provide an environment that allows work to be performed during inclement weather (rain, snow, high winds). The enclosure also prevents the direct exposure of excavated material and the open excavation to adverse weather conditions and provides some measure of site security and control. To mitigate the hazards associated with operating combustion engine equipment within the enclosure, scrubbers may be installed on the equipment, the equipment may be vented outdoors, or a ventilation system may be installed. Excavation activities will be planned and managed with an emphasis on public safety and they may take place during night-time hours when nearby businesses are closed to the public. Specifications for the enclosure will be guided by the DSA and performance requirements. Prior to moving the enclosure, spoils piles will be covered or stabilized and exploratory trenches will be backfilled to prevent off-site migration of excavated materials. Access to commercial and Laboratory operations to the north and east will be maintained.

4.1 Justification for Alternative Scope of Work

The scope of this work plan, the sampling conducted for the 1998 sampling and analysis plan (SAP) (LANL 1998, 59506) and addendum (LANL 1998, 70231) approved by the NMED, and the prior RFI studies and data collected for TA-21, MDA B, and MDA V form a basis for comparison with the NMED Order. Table 1 provides a detailed comparison of the investigation requirements identified in the November 26, 2002, Order with a brief justification for the Laboratory's proposed alternative approach. However, should field conditions differ substantially from those that were anticipated based on conditions encountered during past site activities, additional investigations will be implemented upon agreement with the NMED.

In 1998, geophysical surveys were conducted to define the disposal trench geometries as specified in the Order (section B-2.2.2 and B-4.2). Exploratory trenches will intercept the boundaries of the waste-disposal trenches to confirm the disposal trench boundaries defined in the geophysical investigation. The justifications for using exploratory trenches instead of boreholes are that the profile of the waste-disposal trenches (estimated to be 40 ft wide and up to 15 ft deep) will be exposed and that the landfill contents can be examined to a degree not possible using boreholes as an investigation tool.

The Order requirements specify the installation of eight borings at MDA B, including two deep borings to the Cerro Toledo formation. The Laboratory's approach considers the seven borings already drilled at MDA B per the 1998 SAP and proposes eight exploratory trenches into and through the waste-disposal trenches. The Laboratory's justification for proposing exploratory trenches and test pits for further exploration of MDA B is that trenching will better define the nature, physical variability, and chemical variability of the wastes disposed of at MDA B, and the characteristics of the bedrock immediately below the disposal trenches, than will exploratory borings.

The nature of contamination in the tuff directly beneath and in the side walls of the disposal trenches, where encountered, will be investigated by exploratory trenching, sampling, and laboratory analyses. Sample analyses will include all analytes required by the Order. This means that pH, polychlorinated biphenyls (PCBs), high explosives (HE), dioxins, furans, nitrates, perchlorate, and cyanide, which were not part of previous analytical suites, will now be included, in addition to the VOCs, SVOCs, radionuclides, and target analyte list (TAL) metals previously analyzed. Because no record of HE production or HE usage at TA-21 has been found, the Laboratory's approach will use field screening for HE to determine if HE needs to be analyzed for in the MDA B disposal trenches.

The Laboratory's proposed approach will use past sampling results from boreholes drilled according to the 1998 SAP to define 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 contamination above laboratory 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 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 maximum detected concentrations were less than 1 ppbv for VOCs.

The Laboratory's alternative approach uses 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, 52350.1; LANL 1994, 26073.1).

The Laboratory's approach to defining nature and extent of contamination at MDA B differs from that specified in the Order by using data from previous RFI work. Collecting and analyzing samples obtained immediately below the disposal trenches in the tuff bedrock for an expanded analytical suite, and using the existing intermediate borehole data, will be sufficient to define the nature and extent of surface and subsurface bedrock contamination at MDA B.

Perched groundwater was investigated by a 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), well below that required for saturation (38%) in the Bandelier Tuff (LANL 2004, document in process). In addition, an outcrop of the Cerro Toledo interval can be observed on the cliff face of Los Alamos Canyon approximately 250 ft southeast of MDA B (LANL 1994, 26073.1). Perched water is absent from an outcropping of the Cerro Toledo southeast of MDA B. A deep borehole is planned at MDA V, 100 ft east of MDA B, which will provide permeability data for the tuff overlying the Cerro Toledo interval in proximity to MDA B. Given the geologic location of MDA B upon the TA-21 mesa top, combined with the narrow cross-section of the mesa bounded by Los Alamos and Pueblo Canyons, it is unlikely that perched water will exist under MDA B between the locations near MDA B where the Cerro Toledo is encountered.

4.2 Regulatory Basis for Technical Approach

The regulatory basis for handling waste materials during the MDA B investigation is based on application of the 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.

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

Investigation activities at MDA B will include the excavation of landfill contents from eight (or more) exploratory trenches and the supplementary test pits. The landfill contents will be staged on the surface, within the AOC boundary, for inspection, segregation, cataloging, field screening, and sampling. The AOC boundary is coincident with the SWMU boundary. At the conclusion of the investigation, most of the landfill materials will be returned to the exploratory trenches. These operations will not constitute new acts of treatment, storage, or disposal for the purposes of RCRA. Therefore, the RCRA Subtitle C hazardous waste requirements will not apply to the proposed investigation activities. Some materials may be removed from the exploratory trenches and archived for possible use in treatability studies to support waste-management decisions. A portion of the materials removed from the landfill may be containerized and managed as waste for off-site disposal. These materials will be handled under RCRA hazardous waste requirements, as appropriate.

The AOC concept is presented in LANL-ER-SOP-01.06, R2, section 8.10 ("Management of Environmental Restoration Project Waste," December 13, 2001). The procedure requires that the AOC designation be approved by the RRES-RS regulatory compliance representative and the NMED.

4.3 Health & Safety and Environmental Protection

4.3.1 DSA

MDA B has been categorized by the Laboratory as a Nuclear 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, 05707.2). 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 DSA is required by 10 CFR 830 subpart B. A Hazard Category 3 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 of workers, the public, and the environment. These controls may include engineered features, such as a ventilated enclosure or fire suppression system, 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, workers, and 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 investigation will be preformed 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 SSHASP required by 29 CFR 1910 and 29 CFR 1926, the IWDs, and other site-specific procedures.

When performing the investigation, an important consideration is the uncertainty associated with the actual inventory and distribution of contaminated materials within MDA B. The DSA is being prepared using estimated quantities of hazardous chemicals and radionuclides based on available historical documents/information and sampling data. However, as is recognized elsewhere in this investigation work plan, as the activities associated with this phase of the investigation proceed, the procedures, test methods, and decision trees need to be developed to anticipate and respond to unexpected conditions (for example, inventory in greater quantities than anticipated or inventory of a different type than anticipated). If these conditions are encountered, work will stop and the new information will be analyzed to determine if new controls are needed. As part of this process, the new information or site conditions will be assessed to determine if it represents an unreviewed safety question, which would necessitate a revision to the DSA and potentially cascading changes to the TSRs, SSHASP, IWDs, and other procedures.

4.3.2 Pre-fieldwork Activities

Prior to conducting fieldwork, a series of health and safety, as well as regulatory, tasks must be completed. All of these tasks are described in a quality procedure (QP), LANL-ER-QP-5.3, "Readiness Planning and Review." The main topics covered include general preparatory activities, environmental and cultural protection, health and safety, waste management, training, work requests and permits, support and equipment, analysis and assessment/sample management, sample coordination and management, laboratory and site access, and notifications.

4.3.3 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 they remain below action levels identified in the DSA and SSHASP. VOCs and airborne particulates (dust) will also be monitored. Monitoring stations will be located along the DP Road corridor to detect off-site releases during excavation activities. The DSA and SSHASP, when developed, will specify the monitoring requirements to ensure federal, state, and local environmental protection limits are not exceeded.

4.3.4 Emergency Response

An emergency response plan shall be prepared to establish a program that will optimize a safe and informed response to emergency situations, with the intent of protecting project personnel, collocated workers, 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 pubic)
- Personnel accountability process
- Site evacuation
- Medical support
- Emergency response equipment
- Emergency response equipment maintenance and inspection
- Emergency response actions
    - 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 on-site project personnel to recognize and mitigate actual or potential emergency situations in the initial stages. To accomplish this, on-site personnel will train to the emergency response plan and will demonstrate their ability to effectively respond to emergency situations through the use of mock-ups, drills, and exercises. Additionally, the abilities of on-site personnel will be independently confirmed utilizing the LANL readiness review process.

4.4 Excavation of Disposal Trench Contents

The planned excavation includes the completion of eight (or more) exploratory trenches and approximately 40 test pits within an enclosure to help control potential off-site impacts from investigation operations. The exploratory trenches will help define the nature of disposal trench contents and the test pits will provide targeted supplemental characterization data. The proposed locations for the exploratory excavations are shown on Figure 1. The locations of the exploratory excavations were selected based on results of previous site investigations, geophysical surveys, and site knowledge relative to disposal trench locations and disposal practices.

The justifications for locations and the sequential order of the excavations are provided in Table 2. The sequence of excavations is based on health and safety considerations, location with respect to area businesses, and historical and anecdotal information about disposal trench contents. Excavations may be added, moved, enlarged, or omitted based on findings in the field.

Excavation will begin in the western half of the eastern leg of MDA B (Figure 1). The first location to be excavated is not near area businesses and is not the suspected location of chemical bottle disposal as are exploratory trenches T-2 and T-3. This will allow the development and refinement of techniques, methods, and controls to occur before zones of potentially highly hazardous materials and areas closer to the public are excavated. The exploratory excavations will be advanced through the entire landfill thickness and into the underlying tuff to expose a full profile of the buried waste. In general, the excavations will be advanced laterally across the entire width of the disposal trenches, where practicable.

The geometry of each excavation will be dictated primarily by the most effective digging methods for the type of waste encountered and by spatial restrictions related to the physical enclosure of exploratory trenching operations. Excavation methods are discussed further in section 5.0.

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 safe and efficient execution of field operations. The lateral extent of the exploratory trenches and test pits will be limited by the size of the enclosure. The enclosure will be mobile and will be set up at each location prior to excavating. Design requirements for the enclosure will be specified in the MDA B DSA document.

4.4.1 Evaluation of Excavation Methods

Based on the excavation efficiency and conditions encountered in the field, a variety of excavation methods may be applied during exploratory trenching to evaluate the best approach. Information from these investigations can then be used to reduce uncertainty in designing the approach for future corrective action. The best approach will optimize health and safety guidelines and performance goals.

4.4.2 Guidelines for Excavated Materials

Materials removed from the excavations that could pose an immediate threat to either human or environmental safety will be removed for proper storage, packaging, treatment, and disposal. Examples of this type of waste are drums containing flammable liquids; carboys containing corrosive liquids; and laboratory bottles containing miscellaneous hazardous or unknown liquid, gaseous, or solid chemicals. These containers will be managed in clearly marked and appropriately constructed waste accumulation areas. Figure 8 presents a conceptual site layout for excavation staging and operations. Waste accumulation area postings, regulated storage duration, and inspection requirements will be based on the type of waste and its classification. No liquids will be returned to the landfill. Container and storage requirements will be detailed and approved prior to waste generation.

Environmental media from MDA B may be returned to the landfill if it will not interfere with future activities and does not increase the potential impact on human health and the environment. Environmental media include surface soils, bedrock, sand, gravel, cobbles, and boulders. According to the EPA's AOC concept (EPA 1996, 82288), materials managed within the AOC boundary do not constitute newly generated waste. Landfill debris, containers, rubble, and other waste-zone items may be returned to the excavation if they do not obstruct future site operations or inhibit re-entry, by drilling or other methods, during future corrective actions.

Should large objects such as vehicle bodies be encountered in the exploratory trenches, the objects may be exposed for examination and left in place.

4.4.3 Test Pit Excavation

Test pits will be excavated between the planned exploratory trench locations. The test pits will provide additional means of characterizing and estimating quantities of waste without sampling or necessarily digging to the bottom of the waste zone. Test pit investigations will rely primarily on visual observation and IDLH screening rather than sampling because they are intended to be quick, flexible, and less complex than the exploratory trenches. Additional characterization of landfill contents, soil, and tuff encountered in the test pits may be performed as conditions warrant. This may include sampling, HazCat screening, definitive identification of chemicals and materials, and chemical bottle removal. The locations and depths of the test pits will be determined in the field based on the findings in the exploratory trenches

and other test pits. For planning purposes, 40 test pits are proposed: 20 for the western end of the disposal area, 15 for the eastern end, and 5 for the far western area.

4.5 Screening for IDLH Conditions

The principle IDLH constituents are radiation (gross alpha, beta, gamma), VOCs, combustible gases, and pyrophoric materials. Table 3 includes the methods, instruments, and sequence used for the IDLH monitoring.

4.6 Initial Segregation by Material Type

Waste segregation and inspection will be performed inside an enclosed structure, as described in section 4.0, which may be separate from, but similar to, the structure over the excavation to protect the operation from environmental factors and to control exposure to the environment and the public. This enclosure will contain facilities for segregating, declassifying, identifying, packaging, and managing excavated materials. This will allow performance of these activities to be independent of the excavation operation and will ensure that proper radiological, health and safety, and environmental controls are maintained. A decision tree for waste segregation is presented in Figure 6. Three types of material are expected to be excavated:

1. *Waste in Containers*—Examples of this waste include waste or debris disposed of in 55-gal.drums or other similar metal containers. Waste will most likely be solid material. This waste stream has a high probability of being radioactively contaminated, as the contents could include turnings, cuttings, sludge, or filtration media.

2. *Chemicals in Containers*—This waste type could include glass carboys or other glass bottles containing unknown liquids or solids. These are solid, liquid, or gaseous chemicals disposed of in bottles, jars, cylinders, lecture bottles, or other containers. (Plastic containers were not available during the period of waste disposal.)

3. *Non-containerized Waste Zone Materials*—This waste includes soil and fill matrix, scrap metal, wood, plastics, rubber, concrete, construction and demolition debris, asbestos-contaminated ducts or pipes, organic materials, equipment, classified materials, vehicles, and unknown objects. These materials have a high probability of being radioactive and/or hazardous.

Upon excavation, materials will be segregated according to identifiable waste types. Segregation will help in the evaluation of waste streams and the estimation of waste volumes. Different segregating methods, such as mechanical screens, hand operations, robotic arms, etc., and the practicality of segregating for potential full-scale excavation will be evaluated.

4.7 Removal of Chemical Containers

If caches of intact chemical containers are encountered in the exploratory trenches, they will be removed. This would include primarily liquids and compressed gasses. The excavation will be expanded to expose and remove the containers for characterization and disposal beyond the planned extent of the exploratory trenches to remove chemical containers, unless this is precluded by health and safety considerations or the ability to handle and dispose of the chemicals with the equipment and facilities in place at the site. This will allow efficiencies to be gained during field operations. Based on historical information, chemical containers are expected to be located primarily in the chemical disposal trenches at the eastern end of MDA B. The decision to expand the exploratory trenches to remove chemical containers will be made in the field based on the nature and volume of the chemicals. Removal will continue until chemical containers have been removed to the extent that the excavation can be safely backfilled.

4.8 Exploratory Trench Logging and Identification of Excavated Materials

Accurate description and documentation of the excavated materials is essential for mapping the landfill contents. The waste zone materials will be carefully inspected by a team of qualified inspectors with the appropriate knowledge for accurately characterizing and describing the various types of materials encountered. Those people may include subcontractor and Laboratory personnel with knowledge of chemistry, laboratory research practices, radioactive materials, environmental testing, waste management, and materials handling. To ensure accuracy, quality, and consistency, a formal logging procedure will be developed specifically for this activity.

4.9 Hazard Characterization (HazCat) Screening

Using representative samples of the waste materials from MDA B, a battery of qualitative and quantitative analytical tests will be performed to rapidly identify primary physical, radiological, and chemical hazards. Table 3 provides the HazCat instruments to be used, the screening methods, and the sequence. Based on the historic 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. To perform the HazCat, a combination of American Society for Testing and Materials (ASTM) and LANL-ER-SOP methods will be used. These methods will be performed onsite within a mobile field laboratory where instruments can be properly maintained to ensure that an adequate level of data quality is maintained.

The HazCat screening process will provide the basic information needed for segregating waste materials by physical form (solid, liquid, or gas) and hazard class (radioactive, reactive, corrosive, or flammable). This screening will also ensure the safe segregation and compatibility of materials in waste staging areas.

4.10 Waste Management

The wastes will be further characterized through laboratory analyses for the purposes of segregating waste materials for treatability and/or disposal. This level of characterization will be required for comparison with off-site treatment, storage, and disposal facility (TSDF) waste acceptance criteria (WAC); for selection of appropriate waste packaging; and compliance with US Department of Transportation (DOT) requirements.

The regulatory classification for each of the known 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). The identification of High-Level Radioactive Waste (HLW) is highly unlikely, as the processes that contributed waste to MDA B do not include spent nuclear fuel or liquid or solid derivations thereof. Anticipated waste streams and potential disposal areas are listed in Table 4.

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

4.10.1 Waste Compositing

The planned compositing of waste materials found in MDA B provides economic benefits to the project without jeopardizing human or environmental health or safety. The potential economic benefits of compositing waste materials are

- streamlining of safety control and monitoring zones,

- reduction of the number of samples required for full disposal waste characterization,
- reduction of the number of waste containers for disposal, and
- reduction in waste-disposal costs.

A systematic characterization approach will be used to evaluate the acceptability of compositing different materials of similar hazard categories into common containers. HazCat and definitive identification screening will serve as compatibility-screening analyses to ensure that the compositing process is conducted safely and will not produce adverse reactions. Examples of the compositing process are combining carboys of compatible organic solutions or compositing separate items of industrial waste. Decisions to composite waste materials will also take into account the ability to maintain compliance with potential TSDF WAC.

4.10.2 Waste Packaging

Waste materials excavated from MDA B and not returned to the excavation will be containerized appropriately for off-site disposal. Waste packaging will be performed within the enclosed materials handling structure.

4.11 Definitive Identification Screening

Definitive identification screening of exploratory trench contents will be implemented if the results from IDLH and HazCat screening are inconclusive or if further characterization or quantification is necessary for waste profiling or characterization. Table 3 presents the definitive identification screening methods, frequency, and instruments to be used. Advanced screening may also be necessary to ensure the positive identification of chemicals and the substances for handling them in the safest manner possible. The on-site mobile laboratory will be equipped with portable analytical instrumentsm, including a gas chromatograph (GC) immunoassay kit and X-ray fluorescence (XRF) spectrometer. 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. Handling and sampling of these types of containers will likely be performed by a specialty subcontractor.

4.12 Inventory Management and Tracking

The inventory of excavated materials will be recorded in an electronic database developed specifically for the MDA B data collection requirements and populated with data from each step in the investigatory activities (Figure 7). The database will contain fields for capturing the following types of data:

- type, location, and volume of excavated materials;
- physical descriptions, IDLH screening results, 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;
- descriptions, volumes, and sample results of excavated materials redeposited into the exploratory trenches;

- geodetic survey data for locations of key features in the excavations, such as disposal trench geometry, disposal trench contents, and sampling locations; and
- excavation backfill volumes and analytical data for both clean or returned waste.

4.13 Sampling of Exploratory Trench Bottoms and Sidewalls

Samples of native material from the disposal trench bottoms and side walls will be collected to help define the horizontal and vertical limit of contaminant releases. The results will be evaluated to determine if additional removal is necessary and whether residual contamination poses an acceptable risk. Samples will be collected at regular intervals from the bottom and side walls of each exploratory trench. Additional biased samples will be collected from suspected contaminated areas based on field screening or visual inspection. To guide the flexible, field condition–driven sampling plan, a triad approach is proposed that explicitly allows for adjustments in the numbers and types of samples (Crumbling 2001, 83861; EPA 2001, 83860). The three integrated components of the triad approach are (1) systematic planning, (2) a dynamic work plan, and (3) extensive use of on-site screening tools. Samples will be analyzed for chemical and radiological compounds. Analytes will include TAL metals, radionuclides analyzed by gamma spectroscopy, isotopic uranium, isotopic plutonium, tritium, strontium-90, VOCs, SVOCs, dioxins/furans, PCBs, perchlorate/nitrate, and cyanide (Table 5).

4.14 Surveying Locations and Features of Excavations

The geometry and primary features of the exploratory excavations and the test pits will be surveyed. Survey points will include locations and elevations of sample locations, profiles of the exposed exploratory trenches, locations of buried items of interest, locations of highest contamination identified by field screening, and any other features deemed important to the investigation or future actions. Survey results will be plotted on a site map. The map will delineate MDA B disposal trench boundaries and the different types of waste materials in the various parts of the landfill.

4.15 Exploratory Trench Backfilling, Compaction, and Clean Cover Replacement

The exploratory trenches will be backfilled to original grade. All materials will be returned to the disposal trench except liquids and other items or materials which may interfere with future potential corrective actions, either for health and safety or logistical reasons. Exploratory trenches excavated outside the disposal trench boundaries will be backfilled with clean fill material only. If it is deemed necessary to preserve access to trench bottom sample locations for future drilling activities, a steel conductor casing will be installed at each of the sample locations. Removed asphalt will be segregated from other cover material and stockpiled for disposal. It will not be replaced or used as fill. The cover thickness and composition will be consistent with the existing landfill cover material.

5.0 INVESTIGATION METHODS

The methods and procedures for conducting activities identified in the MDA B investigation are presented below. Specific procedures and standardized methods are available for some activities, such as sample collection and analysis. Operations such as excavation, field identification of excavated materials, exploratory trench logging, and backfilling do not have RRES-RS SOPs. Instead, the subcontractor can follow ASTM, EPA, or other industry standard methods. In the event that there is no approved method for a specific activity, a method will be developed as part of an implementation plan prior to commencement of field operations. Additional activities and procedures may be added in response to changing conditions, redirection, or discoveries in the field. All activities affecting the overall quality of the investigation will need to follow standard procedures and are subject to review and approval by the NMED and RRES-RS.

The following RRES SOPs and QPs are applicable to the investigation methods proposed in this plan:

- ER-SOP-1.01 "General Instructions for Field Investigations"
- ER-SOP-1.02 "Sample Containers and Preservation"
- ER-SOP-1.03 "Handling, Packaging, and Transporting Field Samples"
- ER-SOP-1.04 "Sample Control and Field Documentation"
- ER-SOP-1.05 "Field Quality Control Samples"
- ER-SOP-1.06 "Management of Environmental Restoration Project Waste"
- ER-SOP-1.08 "Field Decontamination of Drilling and Sampling Equipment"
- ER-SOP-1.10 "Waste Characterization"
- ER-SOP-1.12 "Field Site Closeout Checklist"
- ER-SOP-3.11 "Geodetic Surveys"
- ER SOP-6.09 "Spade and Scoop Method for Collection of Soil Samples"
- ER SOP-10.1 "Screening for PCBs in Soil"
- ER SOP-10.08 "Operation of the Spectrace 9000 Field-Portable X-ray Fluorescence Instrument"
- ER SOP-10.14 "Performing and Documenting Gross Gamma Radiation Scoping Surveys"
- ER-QP-2.1 "Documenting Personnel Qualification and Selection Process"
- ER-QP-2.2 "Personnel Orientation and Training"
- ER-QP-3.4 "Managing Nonconformances, Deficiencies, and Corrective Actions"
- ER-QP-4.4 "Records Transmitted to the Records Processing Facility"
- ER-QP-5.2 "Control of Measuring and Test Equipment"
- ER-QP-5.3 "Readiness Planning and Reviews"
- ER-QP-5.7 "Notebook Documentation for Environmental Restoration Technical Activities"
- ER-QP-10.3 "Stop Work and Restart"

Electronic versions of these procedures are available for from the LANL RRES-RS web site.

5.1 Excavation Methods

Exploratory excavations will be completed using a standard, track-mounted hydraulic excavator (trackhoe) to carefully expose and remove landfill contents for inspection and identification. Excavation methods will vary between locations to test different approaches and techniques. The primary methods employed include excavations advanced from the top of the landfill to remove material in lifts or excavations initiated from the side of the landfill and advanced laterally through the fill. In areas such as the chemical disposal trenches in the far eastern part of the site, excavations will be installed parallel with the sidewall of the disposal trench to expose the waste with minimal disturbance, allowing careful removal of intact chemical containers such as carboys, if encountered. Vacuum excavation methods may be used in some areas such as the chemical disposal trenches to carefully remove soil and fill from around containers and prevent breakage. Remote excavation methods may also be employed.

In some cases, it may be most effective to excavate in an arc, or series of arcs, as a function of the swing of the excavator arm. Another excavation method may consist of tee-shaped exploratory trenches. Tee-shaped exploratory trenches allow observation on two axes to further explore the extent of waste types

encountered in the disposal trenches. Linear exploratory trenches may be utilized to complete transects across or alongside the disposal trenches. Short transects may be completed with the excavator in a stationary position, while longer exploratory trenches will require movement of the excavator as the trench is advanced laterally. Figure 9 is a schematic illustrating different excavation approaches. Spatial restrictions may limit the length of the excavations in some cases, particularly with respect to the size of the temporary structure in which excavation operations will be enclosed. Site topography, fences, and other barriers may also limit the lateral extent of the excavations in some areas. In general the type of excavation will be largely dependent on the materials encountered. For instance if quantities of glass carboys filled with liquids are encountered, it would be best to excavate alongside the disposal trench boundary in an effort to minimize container breakage and accidental release. If industrial debris or very large objects are encountered, an arch trench may be better in order to provide a greater area for access. A tee-shaped trench will provide information of the inventory across and along the disposal trench. This decision will be largely up to the field team and will require flexibility, professional judgment, consideration of the project goals, and above all safety. The effectiveness of each type of excavation will be determined by the following criteria: safety, ease of removal of waste zone materials, ability to excavate to the bottom of the waste zone and into the underlying tuff for sample collection, access to the side walls of the disposal trench.

The dimensions of the exploratory trenches will extend to the bottom of the waste material and into the tuff (approximately 12–18 ft deep), they will extend from one side wall of the disposal trench to the other (approximately 15 ft long), and the width of the excavator bucket (approximately 3 ft). Natural mixing and cross-contamination of the waste zone materials will occur during the excavation process. Sloughing of material from the side walls of the exploratory trench may result in a greater volume of material to excavate in order to reach the disposal trench bottom. Waste containers may be broken, damaged, or unrecognizable due to degradation or excavation; these conditions may lead to further mixing during excavation. Materials impacted by releases of liquids due to container breakage will be immediately removed for disposal.

5.2 Test Pit Methods

The test pits will be completed using the same protocols and equipment as the exploratory excavations and within a portable structure. Test pit excavation will remain flexible with respect to location, depth, and quantity. Installation of test pits, like the other excavations, will follow the health and safety plan and in all cases be advanced carefully and progressively through the waste zone while monitoring for IDLH conditions. The approximate dimensions of the test pits will be 6 to 10 ft in diameter and up to 18 ft deep, depending upon what is encountered during the excavation. Screening of the test pit materials will be conducted in a manner similar to the material excavated from the exploratory trenches and is outlined in Table 3. Samples may be collected for laboratory analyses from materials excavated from the test pits if conditions warrant a higher level of characterization. Excavated materials will be managed in the same manner as the material excavated from the exploratory trenches.

5.3 Initial IDLH Screening Methods

Several IDLH screening tools will be used for 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 continuous air monitoring (CAM) instrument. VOCs will be screened for using a flame ionization detector (FID)/ photoionization detector (PID). Gases can be screened for using Drager tubes for acid gases, basic gases, carbon monoxide, hydrocyanic acid, nitrous gases, and others as appropriate. Combustible gases will be screened for using a multigas detector if voids within the disposal area are present. The heat of exploratory 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). Table 3 lists the instruments, methods, and sequence for screening. IDLH conditions will be continuously monitored. 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.

5.4 Initial Waste Segregation Methods

The initial segregation will be based on field observations, physical characteristics, and initial IDLH screening results. The waste zone material will be divided into three primary waste types: (1) waste in containers, (2) chemicals in containers, and (3) non-containerized waste (Figure 6). Waste and chemicals in containers will be moved to a separate on-site facility (within the AOC) where they will be staged, opened, and tested. A positive identification of the material may be accomplished using the definitive identification screening equipment available on-site or it may be necessary to ship a representative sample to an off-site analytical lab for analysis.

Potential backfill materials from the exploratory trenches will be staged near the excavation, sampled for waste characteristics, and either returned to the excavation or prepared for off-site disposal. Asphalt will be segregated and stored on-site for future disposal and will not be returned to the excavation. All materials will be managed appropriately to prevent contamination of adjacent ground surface or migration off-site.

The excavated debris and wastes will be sorted within the temporary structure. When possible, debris will be sorted using the excavator bucket. A slotted or sieved bucket on the excavator may be used to help separate the solid landfill items from the soil matrix. A shaker and screen may also be used to separate soils from rubble. If manual partitioning is required, handling devices will be used, including shovels, rakes, and hoes.

Segregated material may be containerized in drums, boxes, roll-off bins, or other appropriate containers. Size reduction of debris (i.e., compaction) may be required, 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.

5.5 Exploratory Trench Logging Methods

Exploratory trench logs will include locations, depths, and descriptions of all materials removed from the trenches, as well as materials visible in the excavation walls. Clearly visible reference markers will be placed along the length of the exploratory trenches to facilitate location identification and tracking activities. Comprehensive photo- and video-logging of the materials removed from the exploratory trench and the exposed excavation walls will be accomplished to obtain high-quality images for observation and interpretation by others, and as a permanent record. The video and still cameras may be lowered into the excavations on booms or mounted to the excavator arm to obtain closeup images of materials in the exploratory trench walls. Alternatively, if health and safety conditions are met, personnel may enter the excavation and take photos or make a video log of the exposed contents.

5.6 HazCat and Definitive Identification Screening Methods

The following list is a subset of selected LANL-ER-SOPs and ASTM methods for hazardous material analyses that are used to identify the safe handling of the unknown materials. The analyses will be conducted on-site in a laboratory run by two people and will follow safety procedures as described in the SSHASP.

1. ASTM D4978-95, "Standard Test Method for Screening of Reactive Sulfides in Waste"

   This test method screens for materials that readily produce hydrogen sulfide gas in the presence of acids.

2. ASTM D4979-95, "Standard Test Method for Physical Description Screening Analysis in Waste"

   This test method is used to identify wastes by describing certain physical properties, including

   - color,
   - turbidity,
   - viscosity,
   - physical state,
   - layering, and
   - incidental odor.

3. ASTM D4980-89, "Standard Test Method for Screening of pH in Waste"

   This test method provides a quick determination of a waste's relative corrosivity.

4. ASTM D4981-95, "Standard Test Method for Screening of Oxidizers in Waste"

   This test method is used to identify a waste containing oxidizing compounds.

5. ASTM D4982-95, "Standard Test Method for Flammability Potential Screening Analysis"

   This test method is used to indicate the fire-producing potential of a waste material.

6. ASTM D5057-90, "Standard Test Method for Screening Apparent Specific Gravity and Bulk Density of Waste"

   This test method provides a quick means to screen waste for apparent specific gravity or bulk density.

7. ASTM D5058-90, "Standard Test Method for Compatibility of Screening Analysis of Waste, Test Method A–Commingled Waste Compatibility Test Method"

   This test method is used to determine the compatibility of a waste with other waste prior to compositing.

8. ASTM D5058-90, "Standard Test Method for Compatibility of Screening Analysis of Waste, Test Method C–Water Compatibility"

   This test method is used to determine a waste's reactivity in the presence of water.

9. LANL-ER-SOP 10.1, "Screening of PCBs in Soil"

   This test method, or a modified version of this method, provides a quick screening approach for determining whether the waste contains PCBs.

10. LANL-ER-SOP-10.14, "Performing and Documenting Gross Gamma Radiation Scoping Surveys"

This test method can be used to determine the apparent radioactivity of the waste.

Additional definitive identification screening methodologies include colorimetric and immunoassay test kits. The definitive identification screening uses test kits or field analytical instruments and will be used if the HazCat screening is inconclusive. The test kits or field analytical instruments can quantify chemical concentrations or identify individual analytes and may be used to determine sampling locations in the exploratory trenches or for waste segregation and categorization purposes. Screening by colorimetric test kits could be an option to measure total petroleum hydrocarbons; benzene, toluene, ethylbenzene, and xylene (BTEX); PCBs; polycyclic aromatic hydrocarbons (PAHs); trihalomethanes; and nitroaromatics (explosives such as trinitrotoluene [TNT]). Screening by immunoassay kits could be used for PCBs, dioxin, PAHs, hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX), TCE, and mercury.

Unknown materials can be analyzed with a portable GC or XRF spectrometer, depending upon initial investigation results. The GC can provide definitive identification of contaminants in n ear real-time for matrices such as water, soil, soil gas, and ambient air. The XRF instrument would be able to screen for arsenic, barium, cadmium, chromium, copper, lead, mercury, selenium, silver, and zinc. Either tool will help guide waste sorting and segregation.

A separate facility will be used to screen for radiological components. This facility should have capabilities for gamma spectroscopy, low background alpha/beta counting, and alpha spectroscopy. These screening capabilities should be flexible to account for other materials recovered from the exploratory trench.

5.7 Final Waste Segregation Methods

Materials identified as waste will be segregated into their specific waste types for appropriate disposal. Investigation activities will minimize the waste generated by following the RRES-RS Waste Minimization Awareness Plan (LANL 2002, 73901.4). The containers removed from the exploratory trench will be physically inspected for the 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 over pack. 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 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 identified and generated as a result of this investigation will be managed in accordance with the applicable RRES-RS SOPs. These SOPs incorporate the requirements of applicable EPA and NMED regulations, DOE Orders, Laboratory Implementation Requirements, and Laboratory Implementation Guidelines. The following RRES-RS SOPs are applicable to the characterization and management of investigation-derived waste (IDW):

- LANL-ER-SOP-1.06, "Management of Environmental Restoration Project Waste," and
- LANL-ER-SOP-1.10, "Waste Characterization."

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

Prior to field investigation activities, the subcontractor will develop a Waste Management Plan. The plan will be prepared and approved per the requirements of LANL-ER-SOP-1.10 and will include a 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 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, and new containers used for safe, compliant handling purposes, will be individually labeled by waste classification, item identification number, radioactivity (if applicable), and date generated.

5.8 Methods for Sampling Soil and Tuff

Samples will be collected from the exploratory trench side walls and the bottom of the exploratory trenches after all waste contents have been removed. The unbiased trench bottom samples will be collected at intervals of approximately 10 ft and at two depths: 0–0.5 ft (the waste zone/tuff interface) and at least 1.5–2.0 ft below the bottom of the waste zone. The deeper samples should be collected at depth with little or no evidence—based on visual observation and field-screening results—of contamination. To provide lateral bounding information, at least one sample will be collected from each side wall for each exploratory trench. Side wall samples will be collected at intervals of 0–0.5 ft measured perpendicular to the sidewall face of the excavation. There will be a minimum of eight unbiased samples per exploratory trench: six samples from the bottom and two from the side walls. Additional biased samples will be collected from the exploratory trench bottoms, side walls, or test pits, if any of the following features are present: evidence of contamination (e.g., staining or elevated screening levels), lithologic contacts, fractures, fracture fill material, surge beds, or a higher permeability unit.

Samples will be obtained from the excavation using the excavator bucket. Once the material is brought to the surface, samples will be collected in accordance with LANL-ER-SOP-6.09, "Spade and Scoop Method for the Collection of Soil Samples." To reduce the potential for cross-contamination, care will be taken to collect material that is not in direct contact with the excavator bucket. Field duplicate, equipment rinsate, and field blank samples will be collected at a frequency of 10% for QA purposes and in accordance with LANL-ER-SOP-1.05.

5.9 Geodetic Surveying Methods

Geodetic surveying will be conducted prior to backfilling excavations and in accordance with LANL-ER-SOP-3.11. Horizontal coordinates and elevations will be determined by a registered New Mexico professional land surveyor using the New Mexico State Plane Coordinate System. Horizontal and vertical positions will be surveyed as accurately as possible given access limitations to the excavated zones. A lower degree of accuracy may be acceptable for noncritical features. The survey results will be presented as part of the investigation report. Sample coordinates will be reported to the Laboratory's Sample Management Office representative.

5.10 Excavation Backfilling and Exploratory Trench Cover Replacement

The exploratory trenches and test pits will be backfilled, compacted, and clean soil cover material will be replaced over the impacted area. Excavations extending beyond the limits of the disposal trenches will be backfilled with clean fill material only. The clean fill material will be shipped from offsite. All impacted surfaces will be restored to original grade, reseeded, and a straw mulch will be applied to help stabilize the surface. If steel casing is installed to preserve access to exploratory trench bottom sample locations for future drilling activities, it will be inspected by a driller to ensure the feasibility of future drilling access.

To prevent future subsidence, the replaced material will be compacted to the extent practical and will be mounded slightly in anticipation of settling.

5.11 Waste Management

Representative samples of the waste will be collected from the waste containers in a manner compliant with RRES-RS SOPs, US EPA methods, and/or the disposal facility's sampling guidelines. Analytes, sample frequencies, sample sizes, sample type (discreet or composite), and the analytical techniques will be prescribed by the waste acceptance criteria for the chosen disposal facility.

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

6.0 MONITORING AND SAMPLING PROGRAM

The proposed investigation does not include a monitoring program at MDA B. Based on information collected form past investigation activities, periodic water and pore-gas sampling is not warranted. However, if the proposed investigation counterindicates groundwater or pore-gas contamination, an appropriate monitoring system will be designed and installed following agreement by the NMED.

7.0 SCHEDULE

This MDA B investigation work plan will be submitted to the NMED by June 30, 2004. Assuming a 120-day period for NMED review and comment resolution, the work plan will be approved by October 31, 2004. Preparation for investigation activities is scheduled to start on November 1, 2004. Fieldwork is scheduled to start in mid-December and will take approximately 8 months to complete, with a scheduled finish date of August 15, 2005.

To document that excavating the MDA B disposal trenches can be conducted in a safe manner in accordance with nuclear safety requirements in 10 CFR 830, authorization basis (AB) documentation is being prepared for DOE review. AB approval is expected by October 27, 2004. Fieldwork will not be allowed to start until AB approval is received from DOE, but permitting and readiness review activities will proceed in parallel with the AB process.

Field activities, including excavation, waste segregation, and collection of waste and subsurface soil and tuff samples, are anticipated to take 8 months plus time for mobilization and demobilization.

The investigation report will be submitted within 16 months of approval of this work plan.

8.0 REFERENCES

The following list includes all documents cited in this report (Appendix B 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 RRES-RS Records Processing Facility (RPF) and are used to locate the document at the RPF and, where applicable, in the RRES-RS Project reference set titled "Reference Set for 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 US Environmental Protection Agency, Region 6; and the RRES-RS project. 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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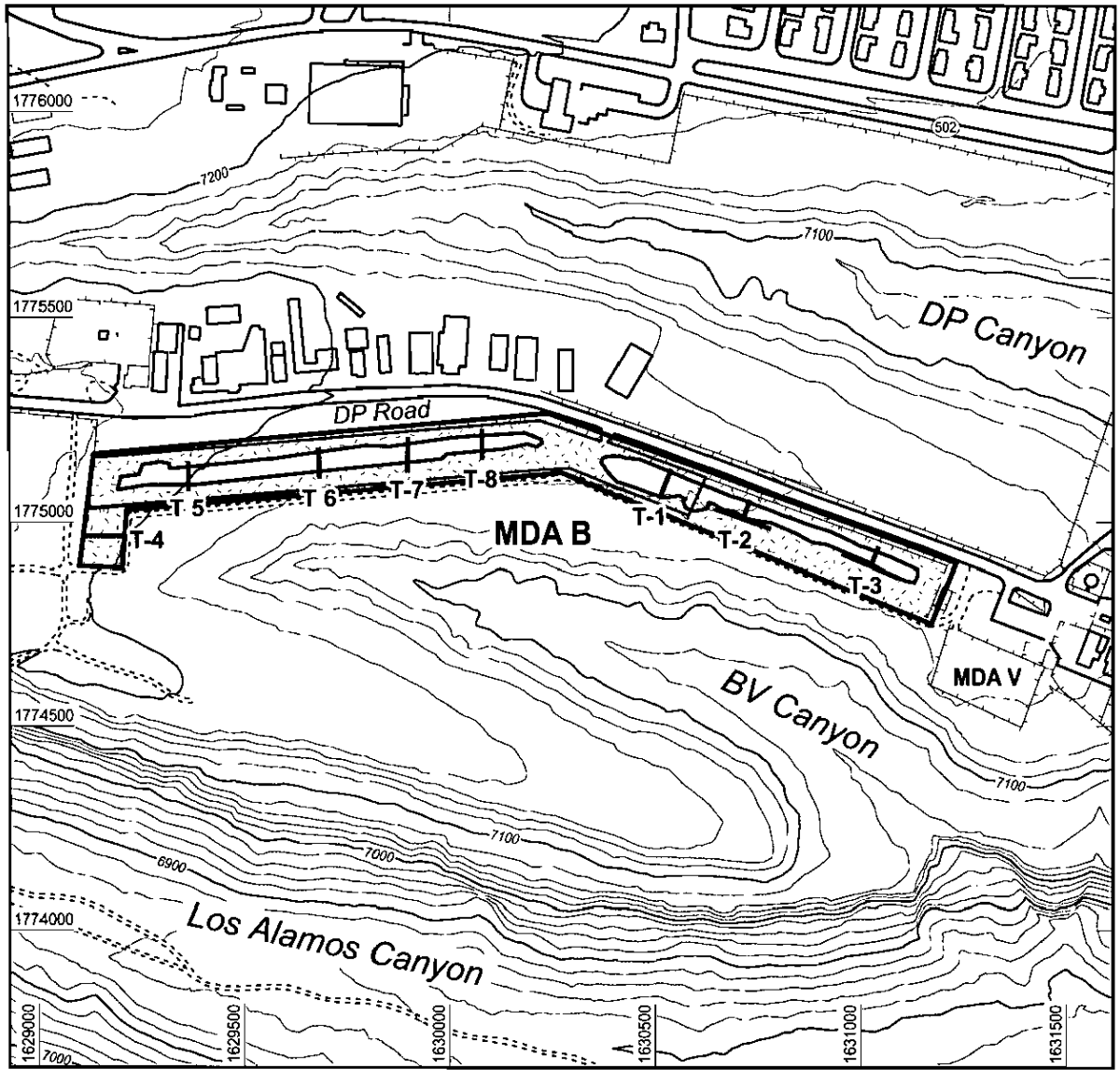


Source: RRES db, MW-H(SEA), 09/03
Rev. for F-1, MDA B IWP, 062304, cf/rlm/lb

Structure
MDA B boundary
Pit location (estimated by geophysical survey)
Trench location
T-9 Trench location ID
Edge of pavement
Unpaved road
Fence
20-ft contour interval
100-ft contour interval

N

0 500
FEET
Coordinates are NMSP NAD-83

Figure 1. MDA B site plan

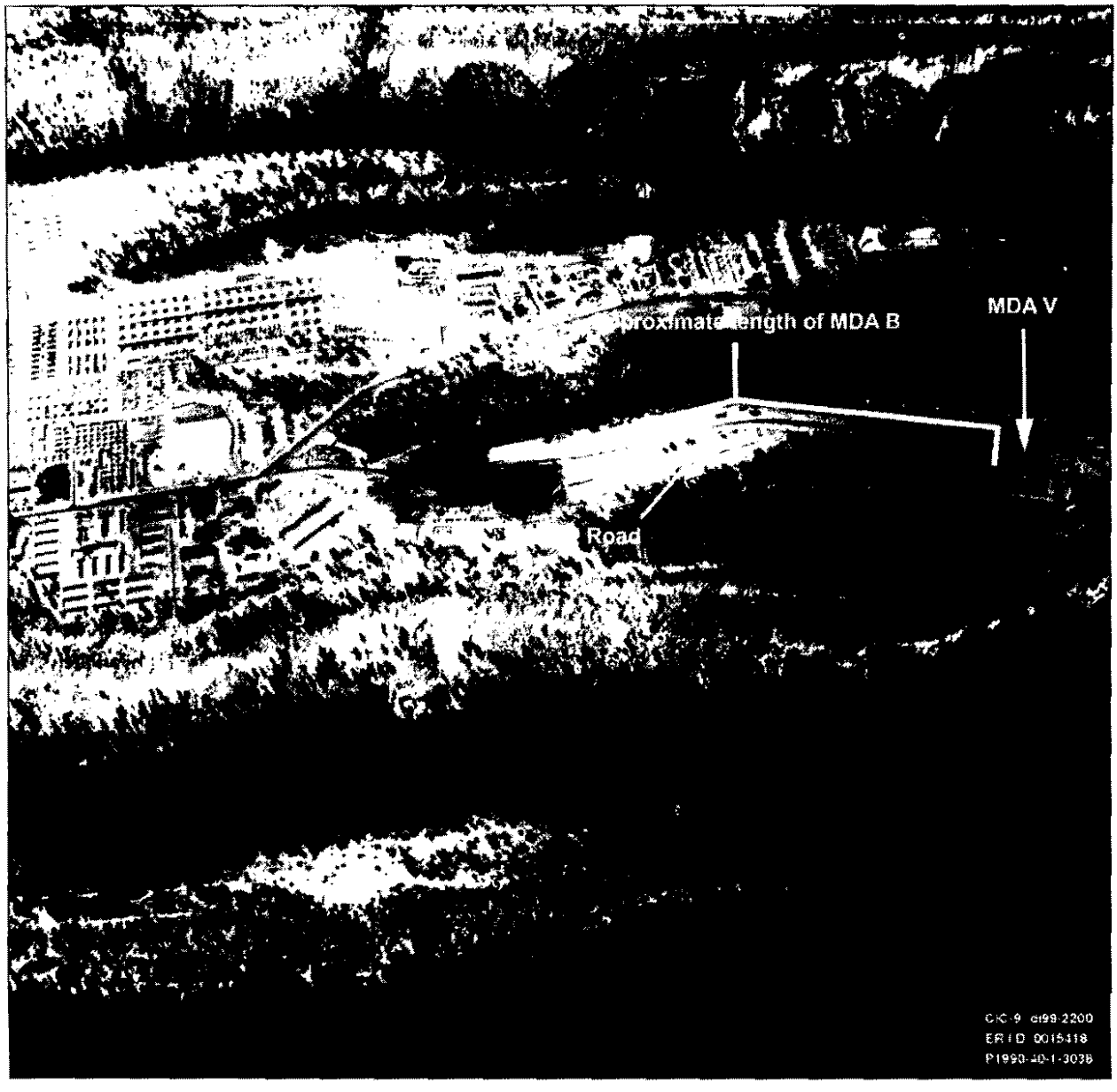


Figure 2. 1946 aerial photograph showing the initial excavation activities at MDA B

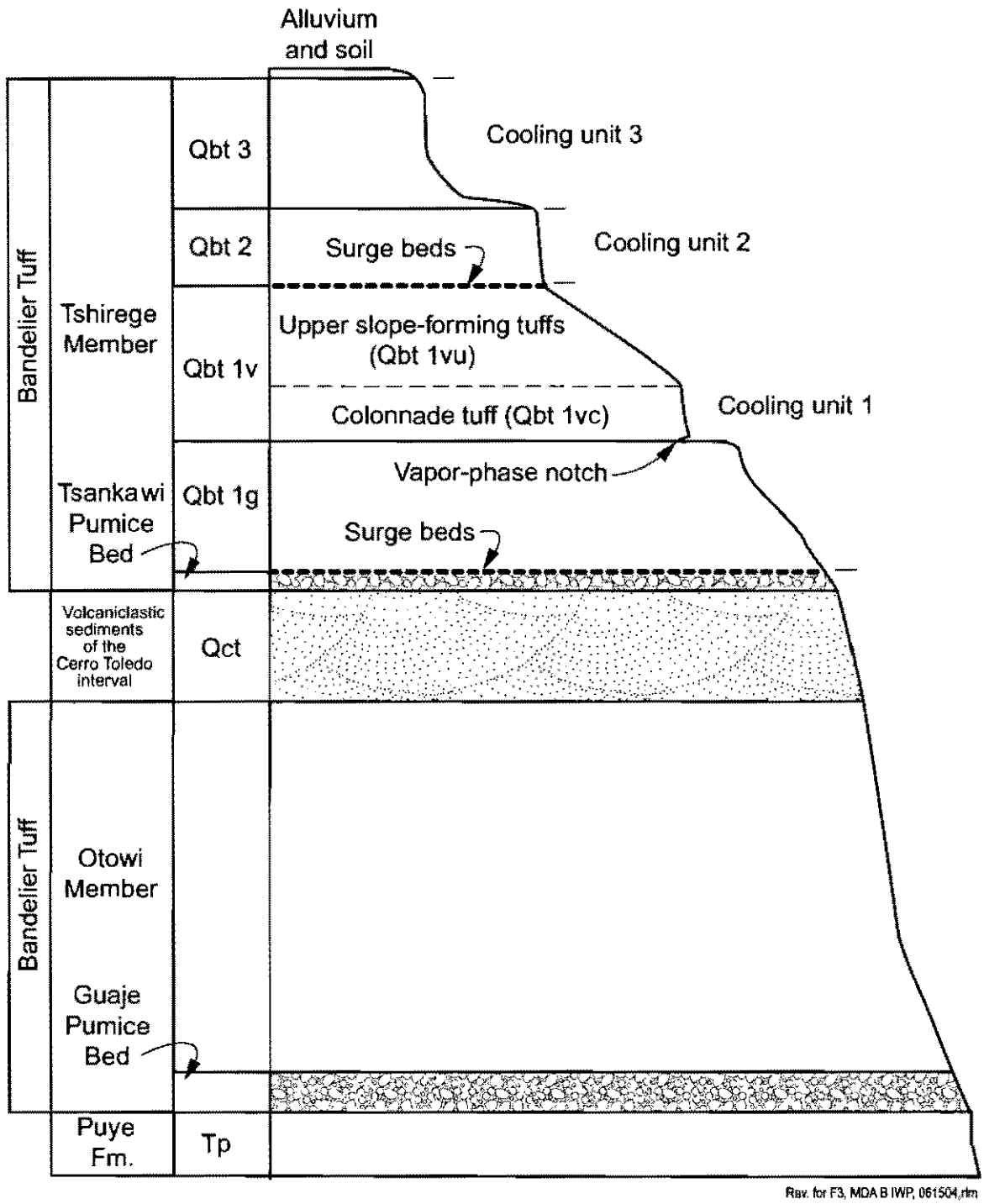


Figure 3. Generalized stratigraphy of DP Mesa in the area of MDA B

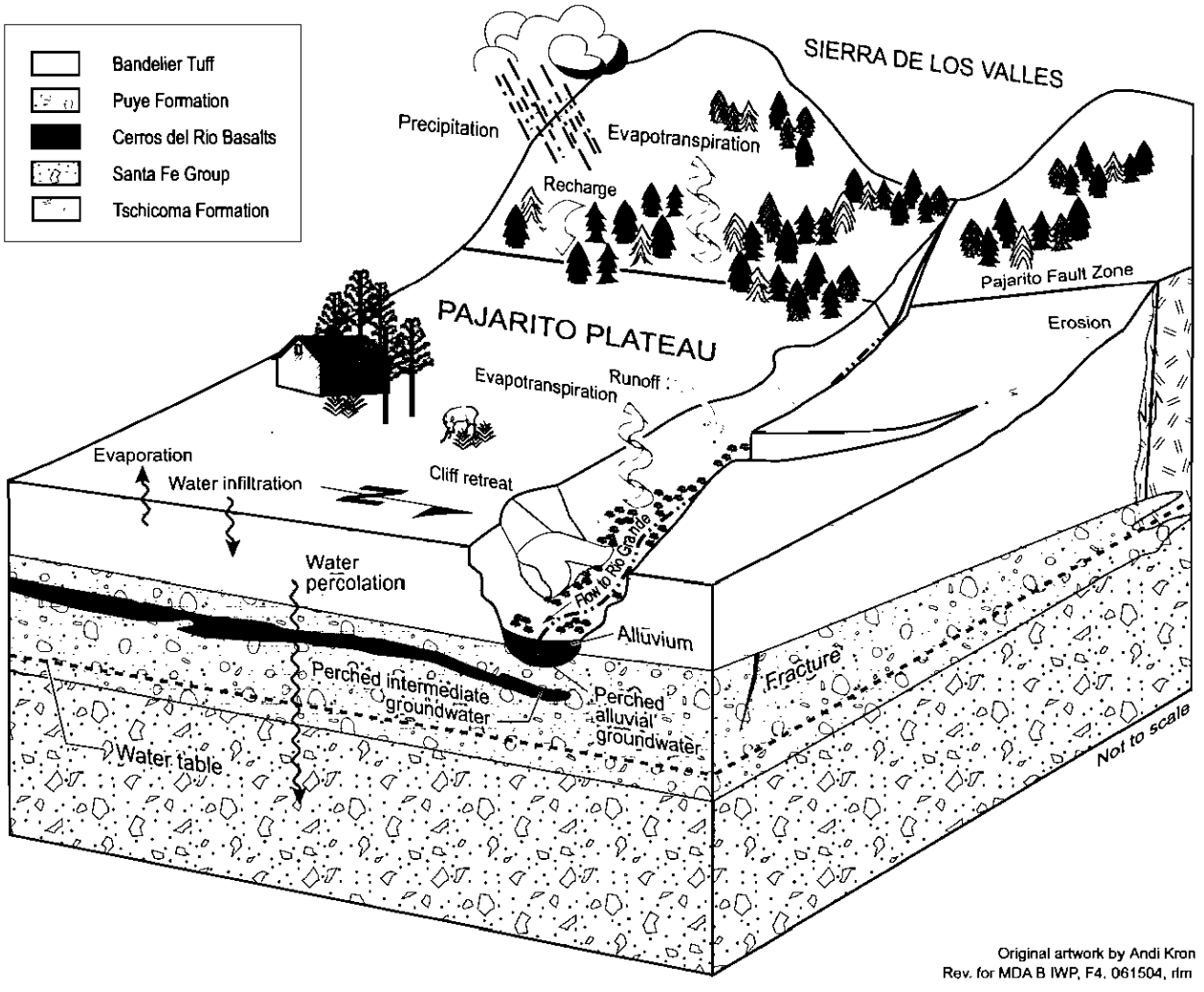
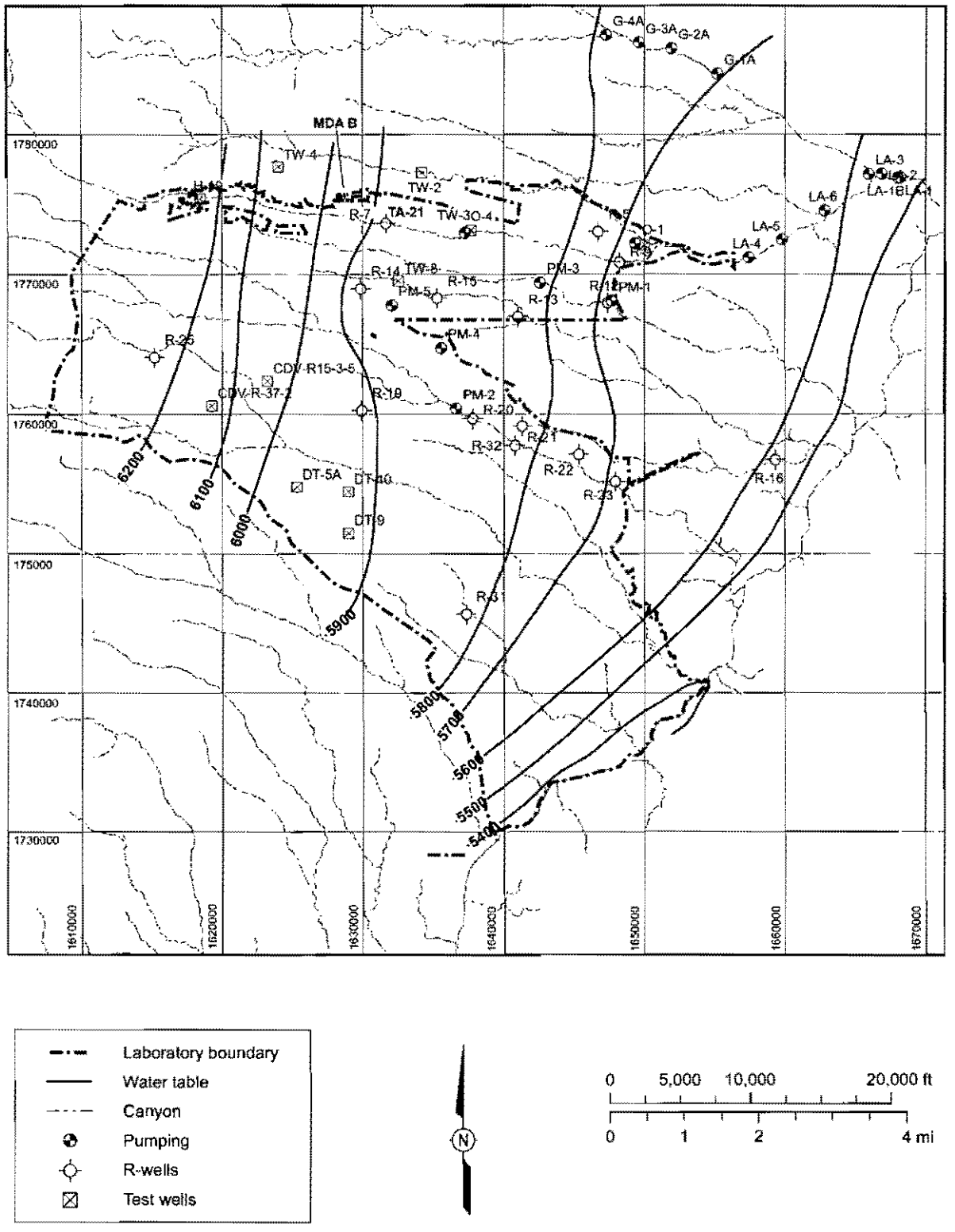


Figure 4. Proposed hydrogeologic conceptual model for the Pajarito Plateau



Source: GIS Lab m200714, REK, 061703/Rev. for F5, MDA B IWP, 061504, rlm

Figure 5. Locations of LANL groundwater wells with respect to MDA B

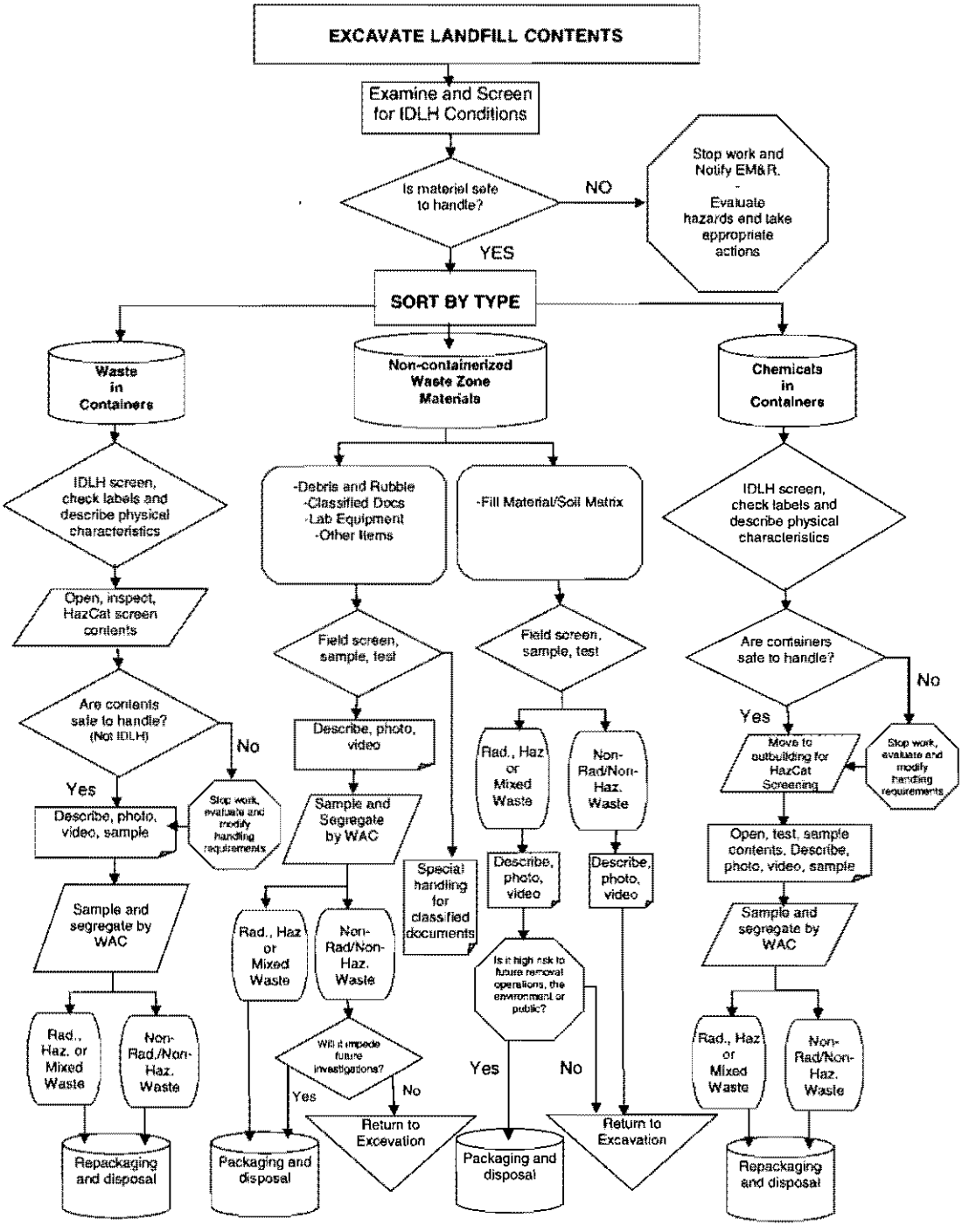


Figure 6. Decision tree detailing sorting, screening, and packaging of excavated material

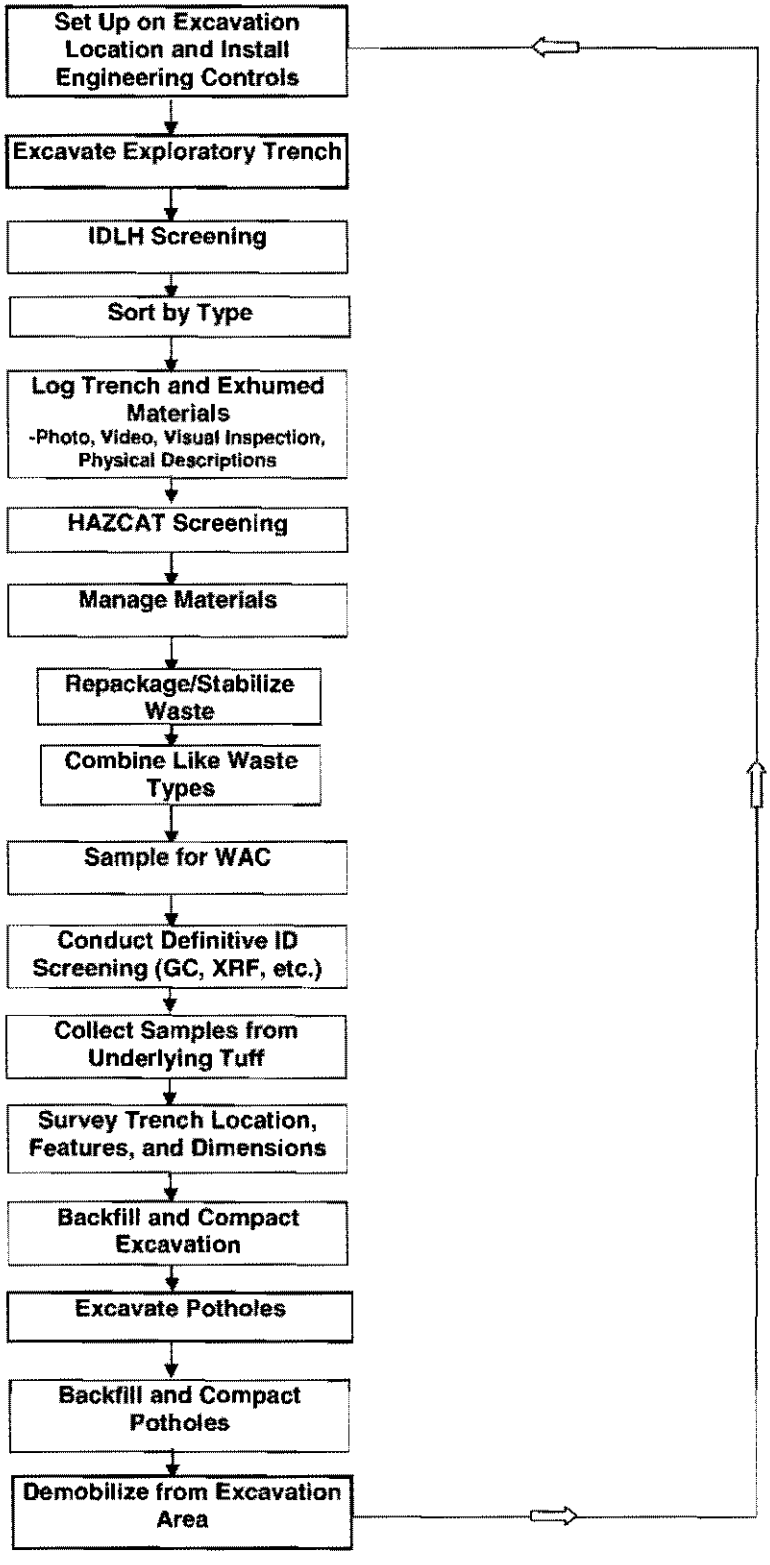


Figure 7. Tentative sequence of activities for each of the eight planned excavations

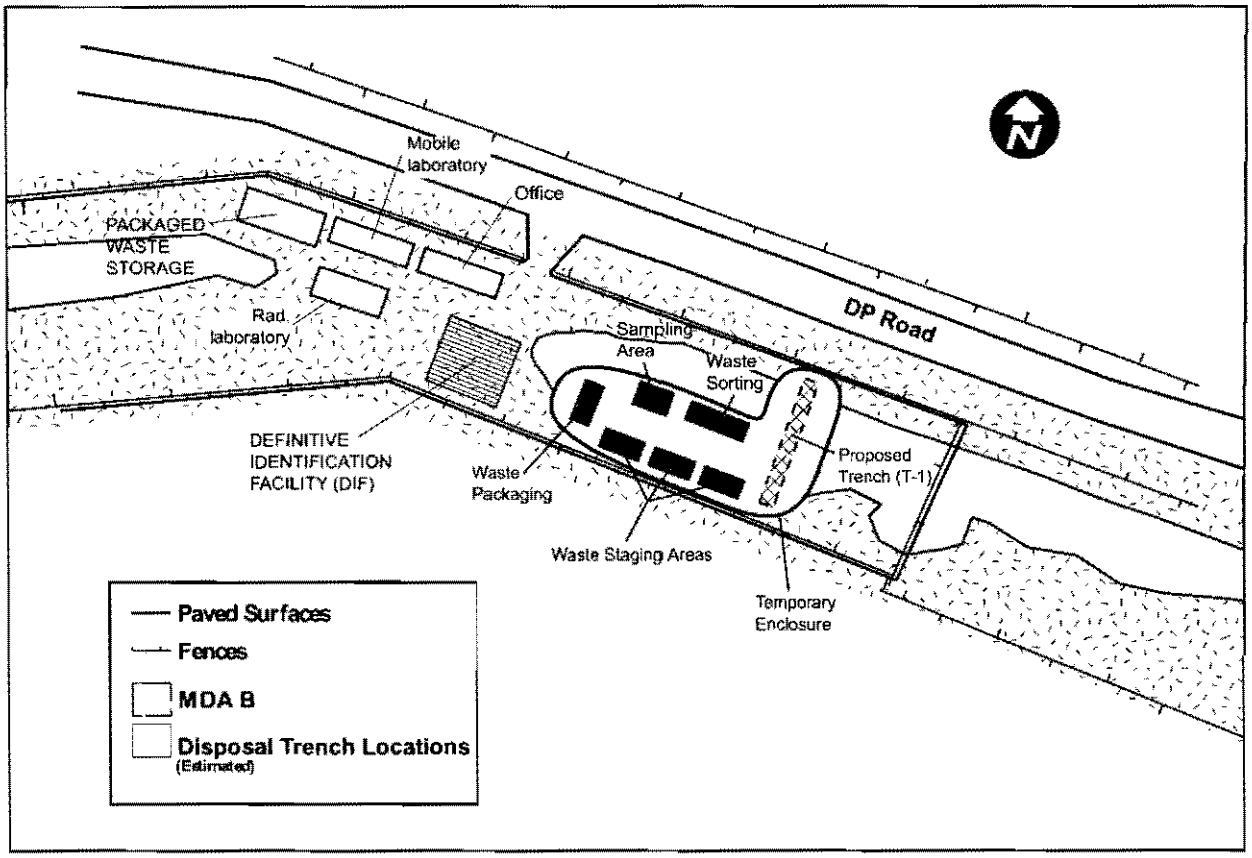


Figure 8. Conceptual site layout for MDA B

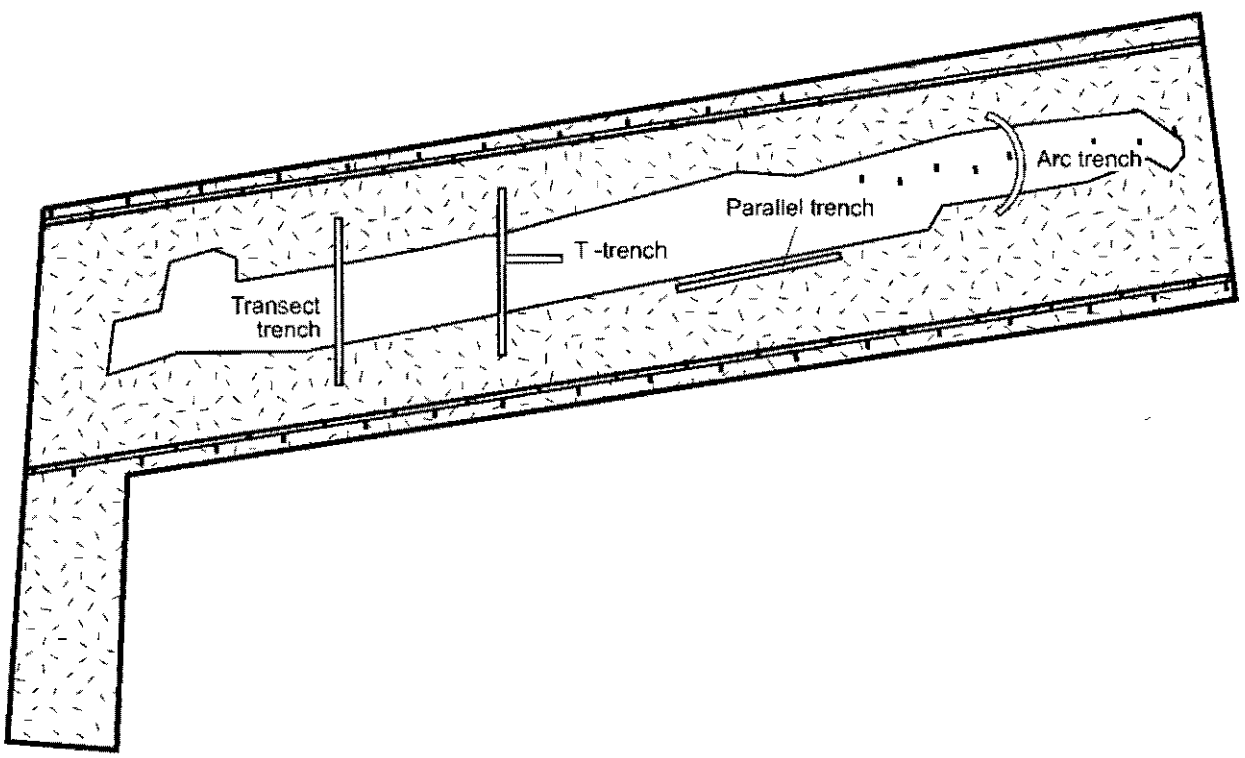


Figure 9. Schematic showing different excavation approaches

Table 1
Summary of Proposed Alternatives to NMED Order Specifications and Justification for Alternatives

Item	NMED Order Specification	LANL-Proposed Alternative and Differences from Order	Justification for LANL Alternative
1	The Respondents shall conduct a survey of the disposal units at MDA B. The Respondents shall determine the dimensions and total depth of each disposal trench, absorption bed, shaft, pit, and other unit, and the base profile, topography, low elevation point, and down-slope end of the base of each disposal trench, shaft, pit, and absorption bed. The dimensions and base elevations of each trench, absorption bed, pit, shaft, and other unit 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 methods used to evaluate the pits and shafts shall be approved by the Department prior to implementation. 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 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. (Order Section IV.C.2.d.iii)	An additional eight exploratory test trenches will extend across the waste-disposal trench, 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 D). No additional fracture characterization is planned.	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 prior angled holes. Results from the additional sampling and expanded analytical suite at the eight exploratory trenches will be used to evaluate near-trench bedrock characteristics and contamination for a comparison with the deeper borehole data previously collected.

Table 1 (continued)

Item	NMED Order Specification	LANL-Proposed Alternative and Differences from Order	Justification for LANL Alternative
3	A minimum of eight borings shall be advanced using hollow-stem auger drilling methods where practical or other drilling methods approved by the Department. Two of the 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 the NMED (see Appendix B, section B-4.3.1). Eight test trenches will be installed through the waste to obtain samples directly below the waste-disposal trenches. A deep borehole (Location ID 21-02523) was drilled approximately 370 ft east of MDA B at MDA V and extended 660 ft below the ground surface. Another deep borehole is planned in the area of MDA V (LANL 2004, document in process). In addition, surface exposures of the Cerro Toledo interval have been observed in Los Alamos Canyon.	The addition of sampling of the subsurface soil and tuff in the eight test trenches will supplement existing angled boreholes in determining the nature and extent of contamination from the MDA B disposal trenches. The deep MDA V borehole and the outcrop of Cerro Toledo interval exposed on the cliff face of Los Alamos Canyon approximately 250 ft southeast of MDA B are sufficiently close to MDA B to confirm the absence of perched water at the Cerro Toledo contact.
4	Each borehole shall be characterized using geophysical logging techniques approved by the Department. (Order Section IV.C.2.d.iii, Item 2)	No new boreholes are planned.	Because no new boreholes are planned, the geophysical logging described in the Order cannot be conducted.
5	A monitoring well(s) 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 monitoring wells are planned.	Zones of saturation were not encountered in previously completed boreholes (see Appendix B, section B-4.3.1, and Appendix D) in or near MDA B. Perched water is not anticipated in the waste-disposal trenches.
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 new pore-gas sampling is proposed for MDA B.	Sufficient pore-gas sampling has occurred under MDA B waste-disposal trenches. Pore-gas sampling was performed on previous boreholes per the SAP approved by the NMED. Maximum detected concentrations were less than 1 ppmv (see Appendix B, section B-4.3.1).

Table 1 (continued)

Item	NMED Order Specification	LANL-Proposed Alternative and Differences from Order	Justification for LANL Alternative
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 within 30 days of abandonment. (Order Section IV.C.2.d.iii)	No borings are planned under this work plan. Exploratory trenches and test pits excavated through the waste will be backfilled with clean soil and/or waste excavated from the trenches, based on field decisions as described in the work plan.	Boreholes installed under the 1998 SAP were properly abandoned in accordance with SOPs. Investigation of the trenches allows contaminated waste to be returned to the exploratory trench and test-pit excavations. Clean soil or tuff will be used where test trenches or test pits extend into tuff or soil outside the waste-disposal trench limits.
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)	Test trenches and test pits allow for continuous sampling of the excavated soil or tuff. No new boreholes are planned.	Core samples collected under the 1998 SAP were taken at 5- and 10-ft intervals in boreholes angled beneath the trenches (see Appendix B, section B-4.3.1). Excavated soil or tuff profiles will be available for logging as material is taken from the excavations. Visual logging and field screening of the soil profile in the excavations serves the same purpose as collecting borehole samples on a continuous basis.
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)	Samples will be collected from the waste and underlying bedrock in a manner appropriate for the excavation of exploratory trenches. Field screening of excavated materials from exploratory trenches and test pits is planned. The screening methods specified in section 5.6 of this plan meet, or exceed, those identified in the Order.	Because exploratory trenches will be made instead of borings, the methods described in Section IX.B for sampling are not applicable.
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 deep borehole is planned for MDA B.	A deep angled borehole is planned for MDA V and will intersect the Cerro Toledo at a horizontal distance of approximately 300 ft from MDA B. Permeability data for the tuff overlying the Cerro Toledo interval will be collected.

Table 1 (continued)

Item	NMED Order Specification	LANL-Proposed Alternative and Differences from Order	Justification for LANL 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)	Samples will be collected as specified (see Table 4 and section 5.8 in this plan). The field-screening methods specified in Table 4 meet or exceed those described in the Order.	Exploratory trenches allow visual screening of subsurface features in a manner that cannot be obtained with boreholes.
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)	Samples will be collected from exploratory trenches and test pits from directly below the waste-disposal trenches and from the maximum excavation depth. Samples will also be collected in disposal trench sidewalls, where encountered.	Collecting samples of the bedrock from the exploratory trenches is comparable to obtaining samples from boreholes.
13	A minimum of four samples shall be selected from each boring for submittal to a laboratory for analysis of VOCs, SVOCs, HE, pH, PCBs, dioxins, furans, nitrates, perchlorate, TAL [target analyte list] metals, total uranium, cyanide, and radionuclides. The sample exhibiting the highest field screening 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)	Previous analytical suites specified in EPA- and NMED-approved work plans did not include HE, pH, PCBs, dioxins, furans, nitrates, perchlorate, and cyanide. Samples from exploratory trenches and test pits will be collected and analyzed for, as specified in the Order, pH, PCBs, HE, dioxins, furans, nitrates, perchlorate, and cyanide. At least six samples will be collected from each exploratory trench for laboratory analysis (see Table 5 in this plan).	Deeper subsurface VOC contamination was characterized using pore-gas sampling data from the 1998 angled boreholes (see section 2.2.2). HE analysis of new samples will confirm the absence of HE. HE compounds were not indicated in previous SVOC analyses (see section 2.2). Dioxins and furans have limited subsurface mobility and are most likely to be detected at, or immediately below, trench bottoms.
14	All TA-21 outfalls shall be investigated in accordance with Section IV.A.4 of this Order. The characterization of the drainages shall be included in the work plan prepared to fulfill the requirements of Section IV.A.4 of this Order. (Order Section IV.C.2.d.v)	No outfall investigation will be conducted. TA-21 outfall drainages have been characterized previously in the Phase report and addendum already submitted to the NMED (LANL 1995, 52350.1).	There are no outfalls associated with MDA B.

Table 1 (continued)

Item	NMED Order Specification	LANL-Proposed Alternative and Differences from Order	Justification for LANL Alternative
15	The Respondents shall determine if vapor-phase contamination is present beneath the site. If vapor-phase contamination is detected, the Respondents shall install vapor monitoring wells in the borings and conduct vapor monitoring and sampling as outlined in Section IX.B of this Order. In addition, the Respondents shall submit a vapor monitoring and sampling work plan for approval by the Department prior to well construction. If vapor-phase contamination is detected, the Respondents shall, at a minimum, collect vapor samples from discrete zones in each vapor monitoring well or boring at depths approved by the Department. These data will be used to evaluate the need for additional monitoring and investigation. (Order Section IV.C.2.d.vi)	No new vapor-phase testing is planned.	Pore-gas sampling was previously conducted using boreholes that were installed in accordance with the 1998 SAP approved by the NMED (see Appendix B, section B-4.3.1).
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, intermediate groundwater monitoring well(s) will be required by the Department. 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 required, the Respondents shall include the well(s) in the TA-21 monitoring and sampling plan. (Order Section IV.C.2.d.vii)	None. The deep borehole which was completed at MDA V, near MDA B, was advanced beyond the base of the Cerro Toledo interval to a depth of 660 ft and did not encounter perched water.	Intermediate perched water was not encountered to the depth of previous investigations at MDA B. The test trenches will not reach the depths previously investigated.
17	The Respondents shall install regional groundwater monitoring wells if the Department determines the need for additional wells intersecting the regional groundwater aquifer associated with TA-21 based on investigation data. 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 the 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).

Table 1 (continued)

Item	NMED Order Specification	LANL-Proposed Alternative and Differences from Order	Justification for LANL Alternative
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, total uranium, cyanide, VOCs, SVOCs, HE, 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	As described in Section IV.B.1.d.vii, Paragraph 7, a long-term groundwater monitoring and sampling work plan shall be submitted to the Department for approval. The work plan shall include the specifics for conducting groundwater sampling at MDA B as part of the Los Alamos/Pueblo Canyon watershed prior to implementation of the groundwater-sampling program. (Order Section IV.C.2.d.ix, Item 4)	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 NMED Order.

Note: The "Order" referred to in this table is dated November 2002 (NMED 2002, 75910).

Table 2
Excavation Location Justifications

Excavation No.	Location	Description	Justification
T-1	Eastern leg of MDA B, west end of disposal trench	Transect primary disposal trench and verify dimensions and identify contents	Investigate large disposal trench identified in geophysics, suspected location of 1946 fire
T-2	Eastern leg of MDA B, east end of chemical disposal trench	Excavate parallel to shallow chemical trenches to remove and examine waste. Extend excavation across trench (T-trench)	Investigate chemicals and radiological contamination detected in angle boring (21-10554) drilled at this location, furthest from area businesses
T-3	Eastern leg of MDA B, center of chemical disposal trench	Excavate parallel to shallow chemical trenches to remove and examine waste. Extend excavation across trench (T-trench)	Investigate western end of shallow chemical disposal trench, reported observation of pallets of glass carboys of liquids at this location
T-4	Western leg of MDA B, west end of disposal trench	Transect chemical disposal trenches to verify locations and inventory contents	Reported trenches not identifiable with geophysics, need to determine location and dimensions
T-5	Western leg of MDA B, west end of primary disposal trench	Transect primary disposal trench and verify dimensions and identify contents	Aerial photos indicate oldest trenches at this location, begin chronological excavation from west (older) to east (newer)
T-6	Western leg of MDA B, west-central portion of primary disposal trench	Transect primary disposal trench and verify dimensions and identify contents	Continue chronological excavation of primary disposal trenches from west (older) to east (newer)
T-7	Western leg of MDA B, east-central portion of primary disposal trench	Transect primary disposal trench and verify dimensions and identify contents	Target geophysics anomaly south of primary trench, continue chronological excavation from west (older) to east (newer)
T-8	Western leg of MDA B, east end of primary disposal trench	Transect primary disposal trench and verify dimensions and identify contents	Continue chronological excavation from west (older) to east (newer)

Notes: The locations of the primary exploratory excavations were selected based on data from anecdotal historical site information, aerial photos, drilling and sampling, and geophysical surveys. The aerial photos indicate MDA B excavation began in the western leg. The table above describes the trench locations and basis for selection of the locations. A discrepancy exists between the historical aerial photographs (Figure 2), older disposal trench location maps (Appendix B, Figure B-6), and geophysical survey results (Appendix B, Figure B-27). The geophysical survey indicates one linear trench in the western leg of MDA B but the historical information, maps, and aerial photographs indicate two parallel trenches. All the exploratory excavations will contribute data for determining the actual trench geometry and contribute to more accurate waste-volume estimates.

Table 3
Screening Methods and Frequency for Excavations

Screening	Analysis	Instrument	Method	Order of Performance
IDLH	Alpha/beta/gamma radiation	Alpha/beta/gamma radiation detector	LANL-ER-SOP-10.14	1
	Pyrophoric materials	Infrared thermometer Newport Model OS521 handheld	Manufacturer's instructions	2
	Gases	Dräger tubes/combustible gas meter: Mine Safety Appliances model: Passport Contractor Multigas Detector	Manufacturer's instructions	3
	VOCs	Flame ionization detector (FID)/photoionization detector (PID), Foxboro model TVA-1000 PID/FID analyzer	EPA SOP #2114[1]: photoionization detector (PID)	4
HazCat: handling and segregation, characterization	Field monitoring for surface and volume radioactivity levels	Rad meter inside a fume hood	LANL-ER-SOP-10.14	1
	Physical description screening analysis in waste: color, turbidity, viscosity, physical state, layering, incidental odor	Physical observations on bench-top lab with fume hood	ASTM D4979-95	2
	Compatibility of screening analysis of waste, Test Method C—Water Compatibility	Bench-top lab with hood	ASTM D5058-90	3
	Screening of pH in waste	Indicator paper and/or a pH meter inside a bench-top lab with fume hood	ASTM D4980-89	4
	Standard test methods for screening of reactive sulfides in waste	Indicator paper inside a fume hood	ASTM D4978-95	5
	Flammability potential screening analysis	Open flame inside a fume hood	ASTM D4982-95	6
	Screening of oxidizers in waste	Indicator paper, bench-top lab with fume hood	ASTM D4981-95	7
	Screening test method for screening apparent specific gravity and bulk density of waste	Physical observation and/or hydrometer and/or a pycnometer inside a fume hood	ASTM D5057-90	8

1 EPA SOPs may be located at USEPA.gov web site.

Table 3 (continued)

Screening	Analysis	Instrument	Method	Order of Performance
HazCat: handling and segregation, characterization *(continued)*	Compatibility of screening analysis of waste, Test Method A—Commingled Waste Compatibility test method	Thermometer and physical observation inside fume hood	ASTM D5058-90	9
	Screening of PCBs in soil (only performed on oily or suspect PCB-contaminated waste materials)	Immunoassay inside a fume hood	LANL-ER-SOP-10.1	10
Definitive identification for disposal characterization*	Chemical composition/ concentration	Gas chromatography	EPA SOP #2107, #2108, #2109	As needed
	Chemical composition/ concentration	Immunoassay	Manufacturer's Instructions	As needed
	Chemical composition/ concentration	X-ray fluorescence	LANL-ER-SOP-10.08, R1	As needed

* Additional or alternate analyses may be required to meet WAC.

Table 4
Regulatory Classifications for Anticipated Waste Streams

Regulatory Classification	Possible Disposal Facility
Solid Waste	Los Alamos County landfill
Industrial or New Mexico special waste	Waste Management of Rio Rancho, NM
RCRA hazardous waste	Envirocare, Utah, or appropriate off-site treatment/disposal facility via LANL, TA-54
Low-level radioactive waste	LANL, TA-54
High-level radioactive waste	Pending identification
Mixed low-level waste	Envirocare, Utah, via LANL, TA-54
Transuranic (TRU), mixed TRU waste	Waste Isolation Pilot Plant via LANL, TA-54

Table 5
Summary of Proposed Sampling at Bottom of Exploratory Trenches

Excavation No.	Number of Sample Locations	Number of Samples	Depth Below Bottom of Excavation	Analytical Suite
T-1, T-2, T-3, T-4, T-5, T-6, T-7, T-8, and additional trenches if necessary	Minimum of 3 per trench	At least 6 per trench	0–0.5 ft and 1.5–2.0 ft	TAL metals Total uranium Radionuclides by gamma spectroscopy Tritium Isotopic uranium Isotopic plutonium Strontium-90 VOCs SVOCs Dioxins/furans PCBs Perchlorate/nitrate Cyanide pH nitrates
Total	**Minimum of 24 locations**	**At least 48 samples**		

Appendix A

Acronyms and Abbreviations and Glossary

A-1.0 ACRONYMS AND ABBREVIATIONS

AA	administrative authority
AOC	area of contamination
asl	above sea level
ASTM	American Society for Testing and Materials
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
CWDR	chemical waste disposal request
DDT	4,4'-Dichlorodiphenyltrichlorethane (a pesticide)
DOE	Department of Energy (US)
DOT	Department of Transportation (US)
DP	Delta Prime (name of mesa)
DQO	data quality objective
DSA	documented safety analysis
EPA	Environmental Protection Agency (US)
ER	environmental restoration
FID	flame ionization detector
FV	fallout value
GC	gas chromatograph
GPR	ground-penetrating radar
HazCat	hazard characterization
HIR	historical investigation report
HLW	high-level radioactive waste
HSWA	Hazardous and Solid Waste Amendments of 1984
IDLH	immediate danger to life and health
IDW	investigation-derived waste
IWD	integrated work document
IR	investigation report
LA	Los Alamos (a canyon)
LANL	Los Alamos National Laboratory
LIG	laboratory implementation guideline (LANL)
LIR	laboratory implementation requirement (LANL)
LLW	log-level radioactive waste
MDA	material disposal area
MLLW	mixed low-level radioactive waste
MS	mass spectrometer
NMED	New Mexico Environment Department
NMSW	New Mexico Special Waste

OSWER	Office of Solid Waste and Emergency Response
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PCS	petroleum contaminated soil
PID	photoionization detector
PPE	personal protective equipment
QA	quality assurance
QC	quality control
RaLa	radioactive lanthanum
RCFA	Regulatory Compliance Focus Area
RCRA	Resource Conservation and Recovery Act
RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine (high explosive)
RFI	RCRA facility investigation
RPF	Records Processing Facility (part of RRES-RS)
RRES-RS	Risk Reduction and Environmental Stewardship–Remediation Services
SAL	screening action level
SAP	sampling and analysis plan
SOP	standard operating procedure
SSHASP	site-specific health and safety plan
SVOC	semivolatile organic compound
SWMU	solid waste management unit
TA	technical area
TAL	target analyte list (EPA)
TCA	1,1,1-trichloroethane
TCE	trichloroethene
TCLP	toxicity characteristic leaching procedure
TSDF	treatment storage and disposal facility
TRU	transuranic waste
TSR	technical safety requirements
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
WPFs	waste profile forms
XRF	x-ray fluorescence

A-2.0 GLOSSARY

aboveground storage tanks (ASTs) — An above-ground storage tank.

area of contamination (AOC) — The AOC concept provides for areas of contiguous contamination to be designated as a Resource Conservation and Recovery Act (RCRA) "unit" (e.g., a landfill) for the purposes of implementing a remedy.

groundwater — Interstitial water which occurs in saturated earth material and which is capable of entering a well in sufficient amount to be utilized as a water supply.

high sensitive metal detector (EM-61) — EM-61 is a time-domain metal detector that detects both ferrous and non-ferrous 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 unit (OU) — At the Laboratory, one of 24 areas originally established for administering the ER Project. Set up as groups of *potential release sites*, the OUs were aggregated based on geographic proximity for the purpose of planning and conducting *RCRA facility assessments* and *RCRA facility investigations*. As the project matured, it became apparent that 24 were too many to allow efficient communication and to ensure consistency in approach. Therefore, in 1994, the 24 OUs were reduced to six administrative "field units."

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

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

polychlorinated biphenyl (PCB) — Any *chemical* substance that is limited to the biphenyl molecule that has been chlorinated to varying degrees or any combination of substances, which 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 animals.

potential release site (PRS) — Refers to potentially contaminated sites at the Laboratory that are identified either as *solid waste management units* (SWMUs) or *areas of concern* (AOCs). PRS refers to *SWMUs* and AOCs collectively.

radionuclide — A nuclide (species of atom) that exhibits radioactivity.

RCRA facility investigation (RFI) — The investigation that determines if a *release* has occurred and the nature and extent of the contamination at a *hazardous waste* facility. The RFI is generally equivalent to the remedial investigation portion of the Comprehensive Environment 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 (including the abandonment or discarding of barrels, containers, and other closed receptacles that contain any *hazardous wastes* or *hazardous constituents*).

Resource Conservation and Recovery Act (RCRA) — The Solid Waste Disposal Act as amended by the Resource Conservation and Recovery Act of 1976. (40 CFR 270.2)

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

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

solid waste management unit (SWMU) — Any identifiable site at which solid wastes have been placed at any time, irrespective of whether the unit was intended for the management of solid or hazardous waste. Such units include any area at or around a facility at which solid wastes have been routinely and systematically stored, such as waste tanks, septic tanks, firing sites, burn pits, sumps, landfills (material disposal areas), wastewater outfall areas, canyons around the Laboratory, and contaminated areas resulting from leaking product storage tanks (including petroleum).

technical area (TA) — The Laboratory established technical areas as administrative units for all its operations. There are currently 49 active TAs spread over 43 square miles.

terrain conductivity (EM31)— EM31 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 — A compacted deposit of volcanic ash and dust that contains rock and mineral fragments accumulated during an eruption.

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

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

Appendix B

Historical Investigation Report

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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, 07529.1). 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, 07529.1).

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 on Figure B-6. 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 pre-urban 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, 11721.1).

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, 07529.1).

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, 07529.1). 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, 06687.1) and the Environmental Surveillance Group (1980, 05961.2). 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, 06616.1; 1998, 71345.1) 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, 11833.1). 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, 07053.3). 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, 07053.3).

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, 06687.1) but were generally less than 20 nCi/L (Gunderson 1981, 03526.2). 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, 06687.1). 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, 07053.3).

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, 07529.1).

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 Pre-Renovation 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, 05961.2); 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 Pre-Renovation 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, 06687.1). 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, 06687.1), 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, 06687.1), while at 10–30 cm, 87% were above background (Purtymun et al. 1987, 06687.1). 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 Post-Renovation 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, 07529.1).

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, 07529.1). 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, 06687.1) (< 0.025 pCi/g) inside the fenced area. However, the concentrations on or outside the fence line are above background (Purtymun et al. 1987, 06687.1) levels. The concentrations outside the fenced area are similar to concentrations observed in previous sampling (LANL 1991, 07529.1). 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, 07529.1).

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, 07529.1, 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, 06687.1). Uranium was slightly higher than the background range (Purtymun et al. 1987, 06687.1) 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, 06687.1) 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, 07529.1).

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, 71345.1). 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, 07529.1; 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, 07529.1). 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-34 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-35 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-36. Inorganic chemical results above background value in surface soil and sediment samples are provided in Table B-37. The frequency of detected organic chemicals is presented in Table B-38. 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-40. Table B-41 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-42. 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 speculated 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-43 provides frequency of detected inorganic chemicals above background value. Table B-44 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-45. Table B-46 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-47. Radionuclides above their background values in surface soil and sediment samples are shown in Table B-48.

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 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, 07529.1). 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-49). 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-50 lists the frequency of detects above background value for isotopic plutonium. Table B-51 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, and the concentrations decrease, in general, with distance away from the site 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, 65407.6) 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, publication date, and ER ID number. This information is also included in text citations. ER ID numbers are assigned by the RRES-RS Records Processing Facility (RPF) and are used to locate the document at the RPF and, where applicable, in the RRES-RS Project reference set titled "Reference Set for 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; US Environmental Protection Agency, Region 6; and RRES-RS Project. 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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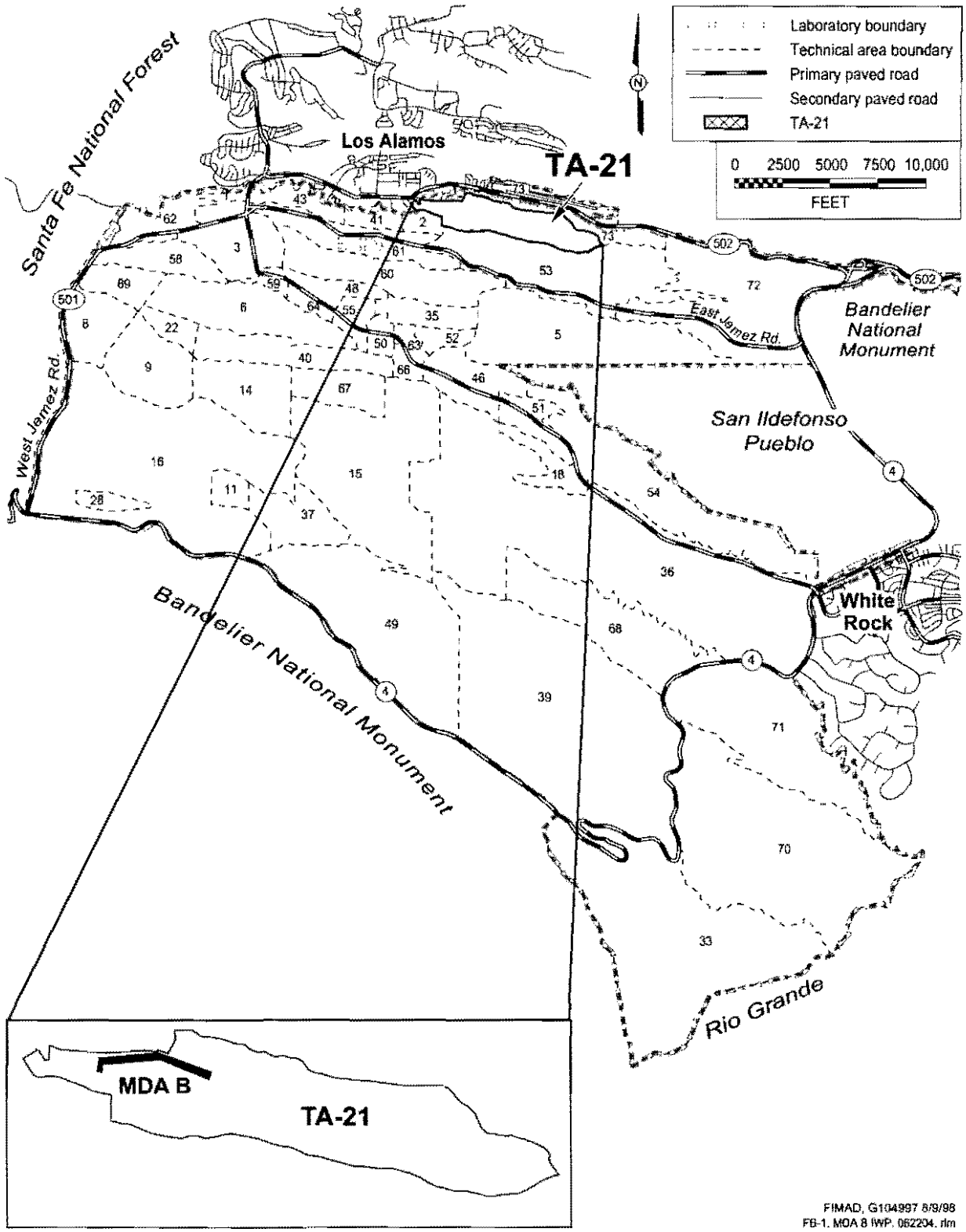


Figure B-1. Location of TA-21 and MDA B with respect to Laboratory technical areas and surrounding landholdings

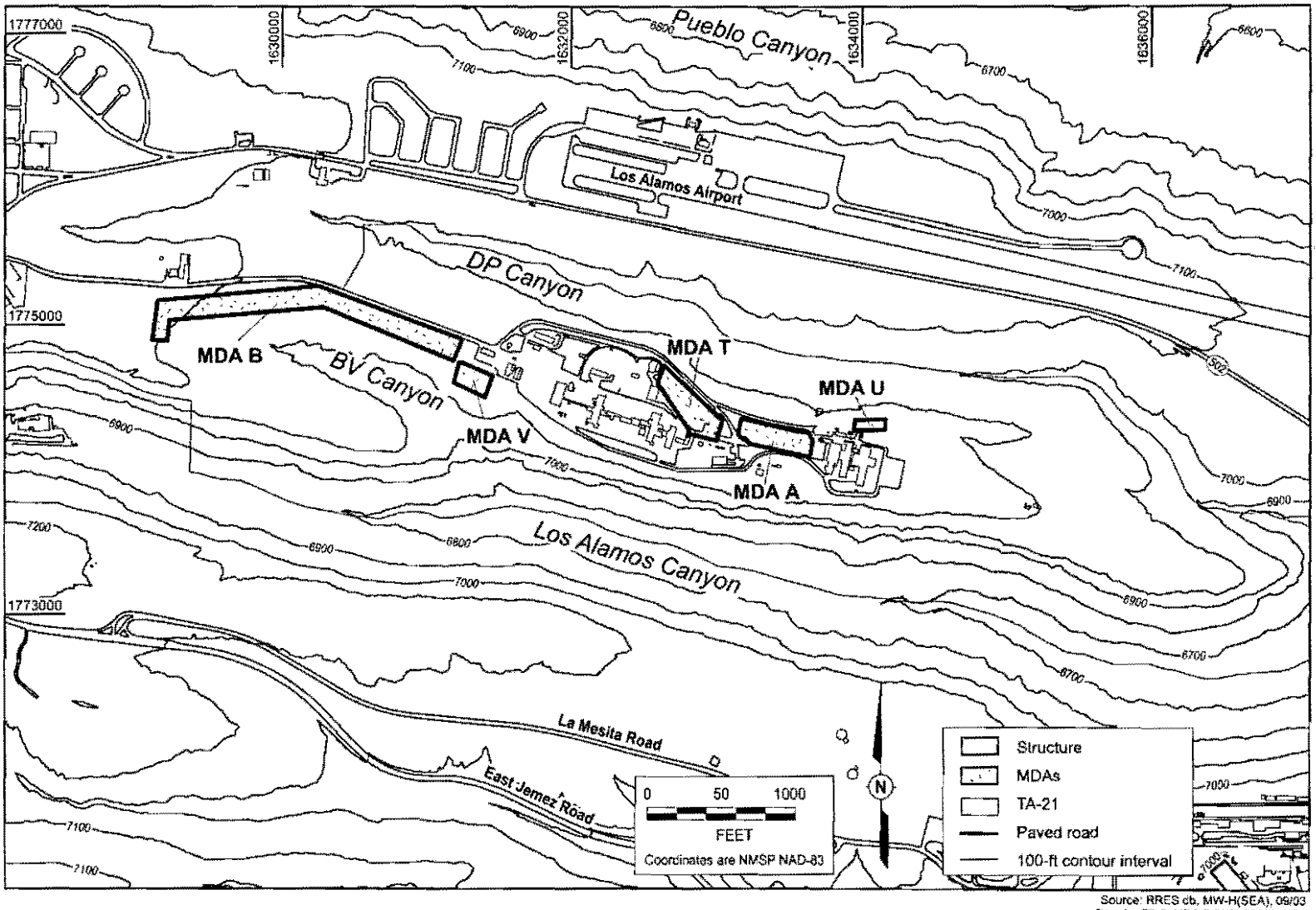


Figure B-2. Material disposal areas in TA-21

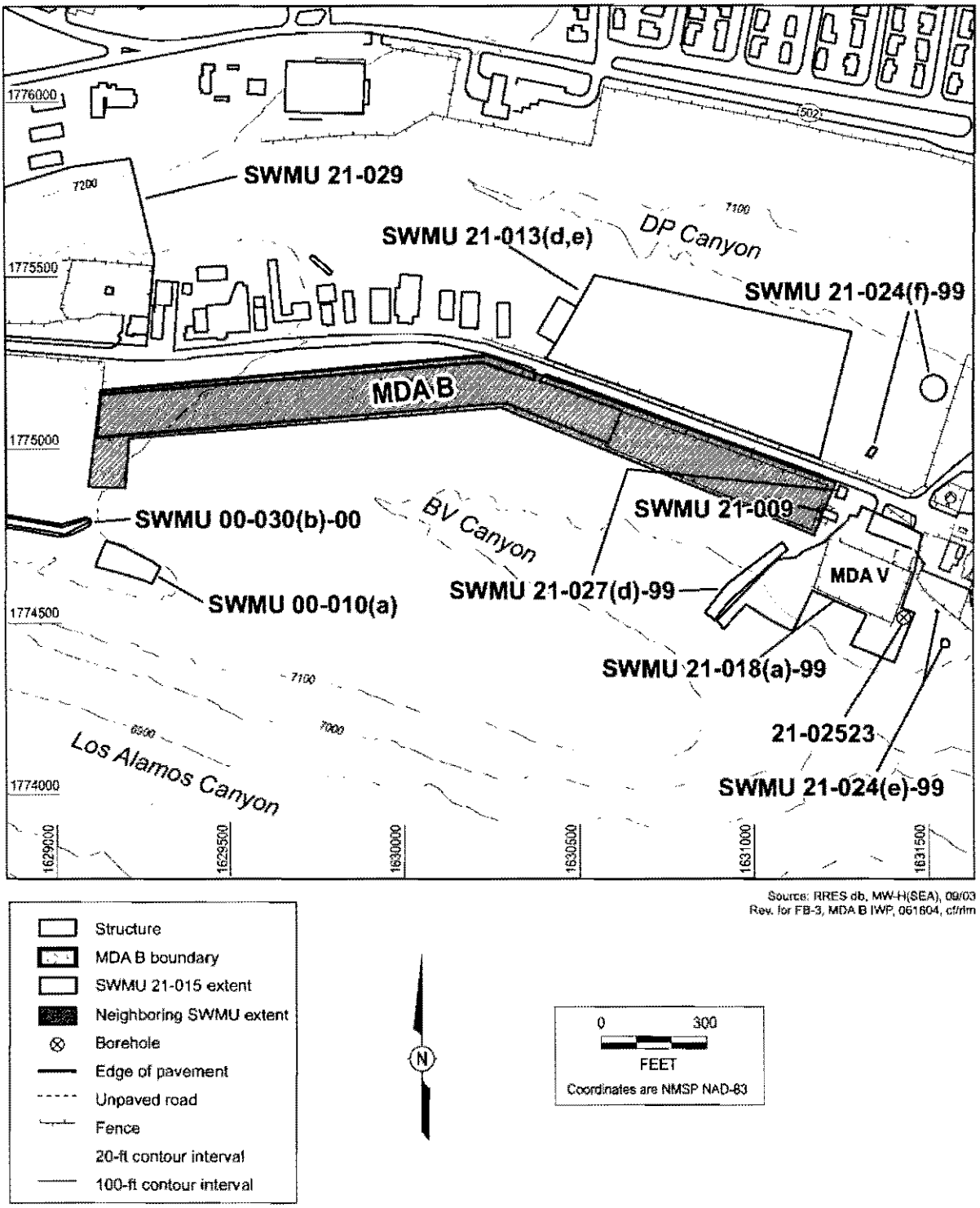


Figure B-3. SWMUs near MDA B

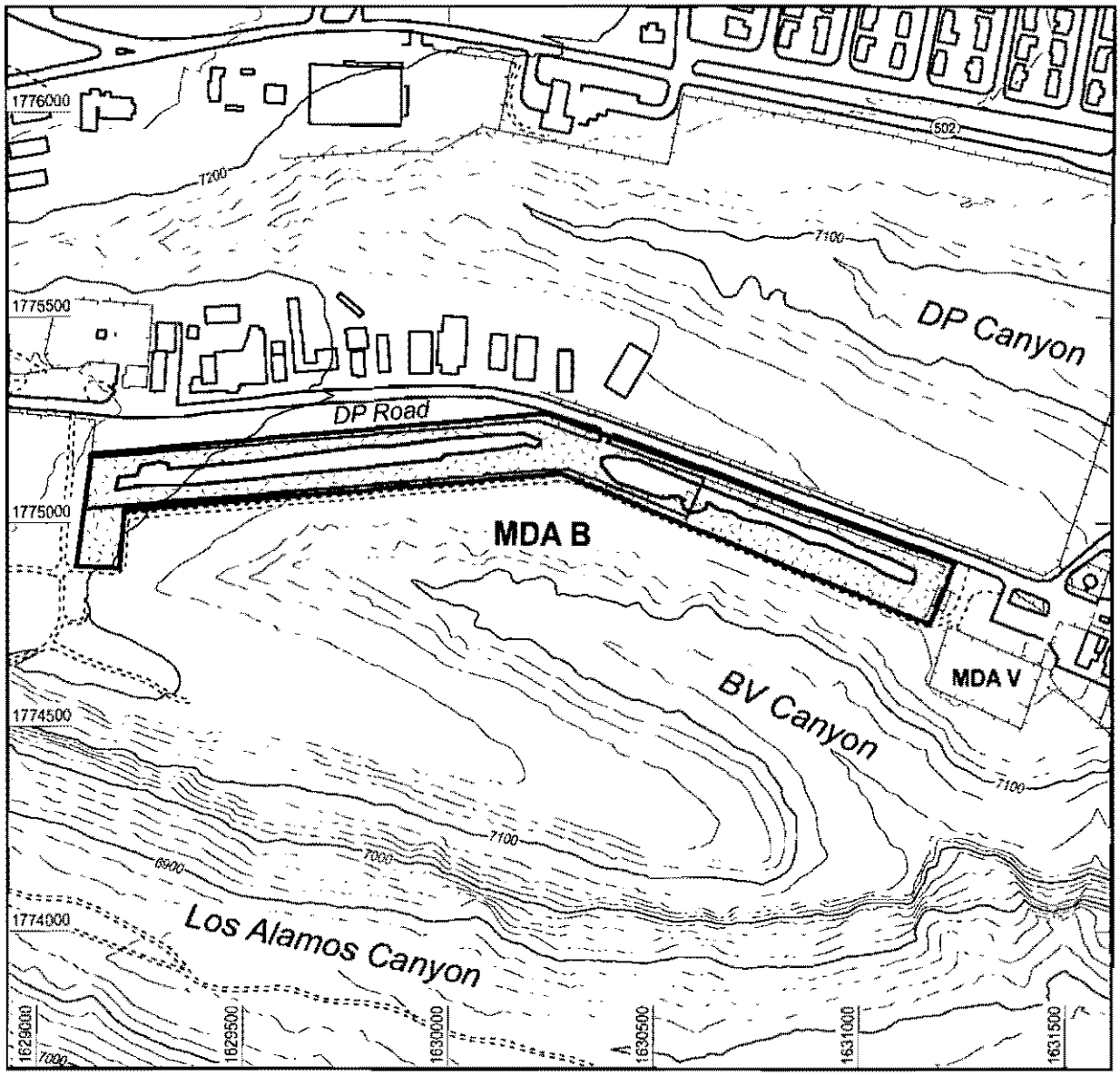
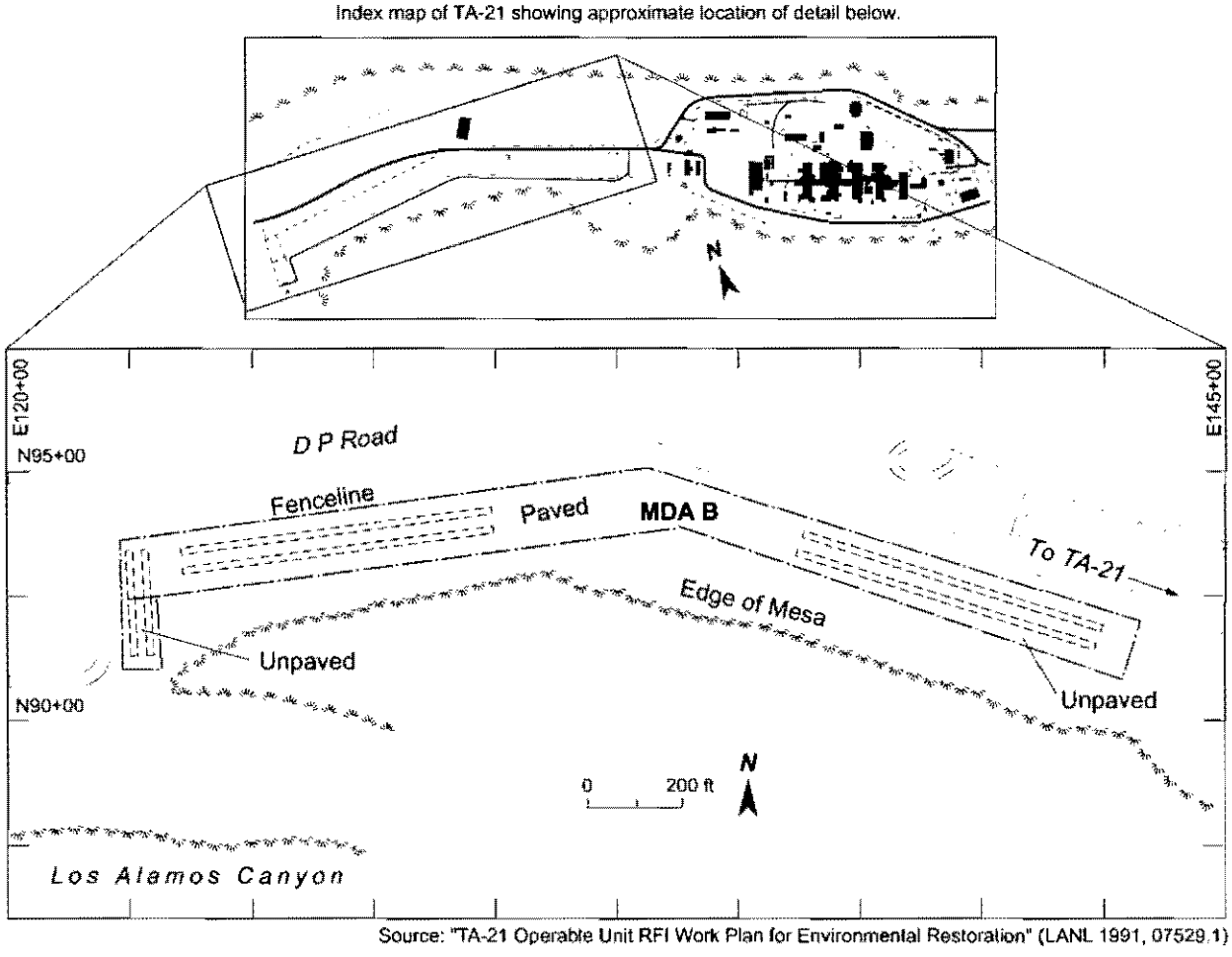


Figure B-4. MDA B detail and approximate disposal trench locations



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)

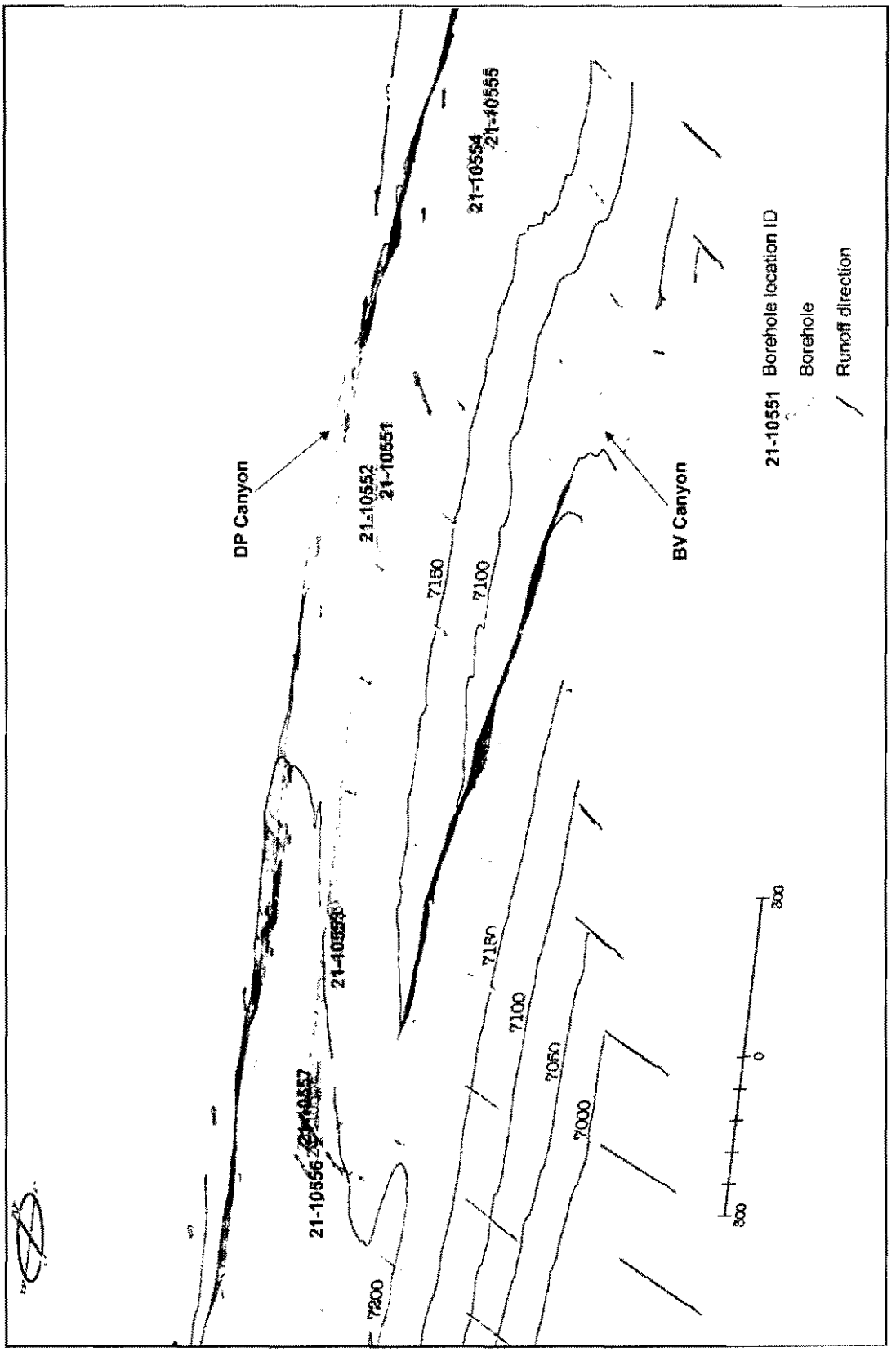
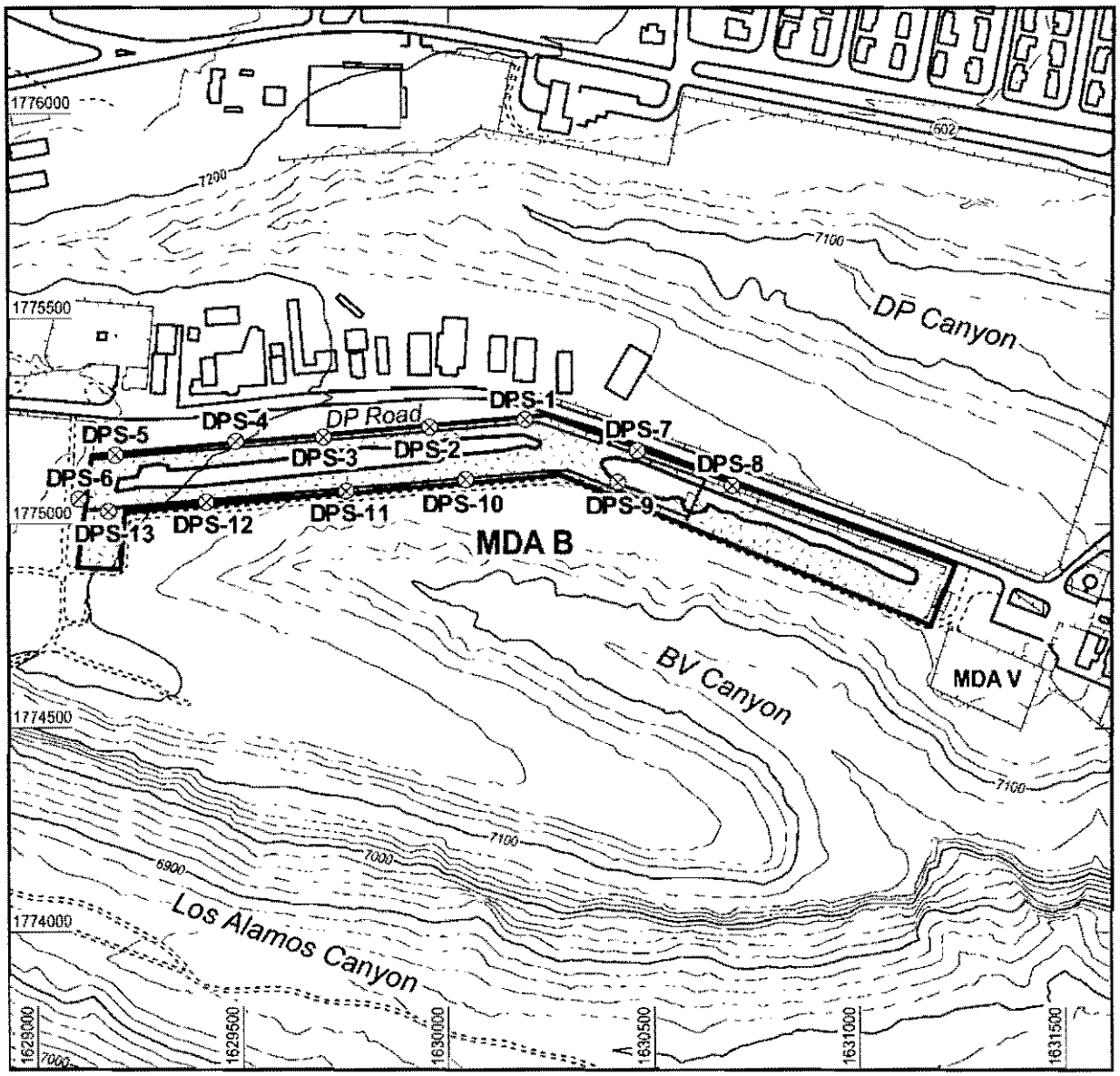


Figure B-6. Surface water runoff at MDA B



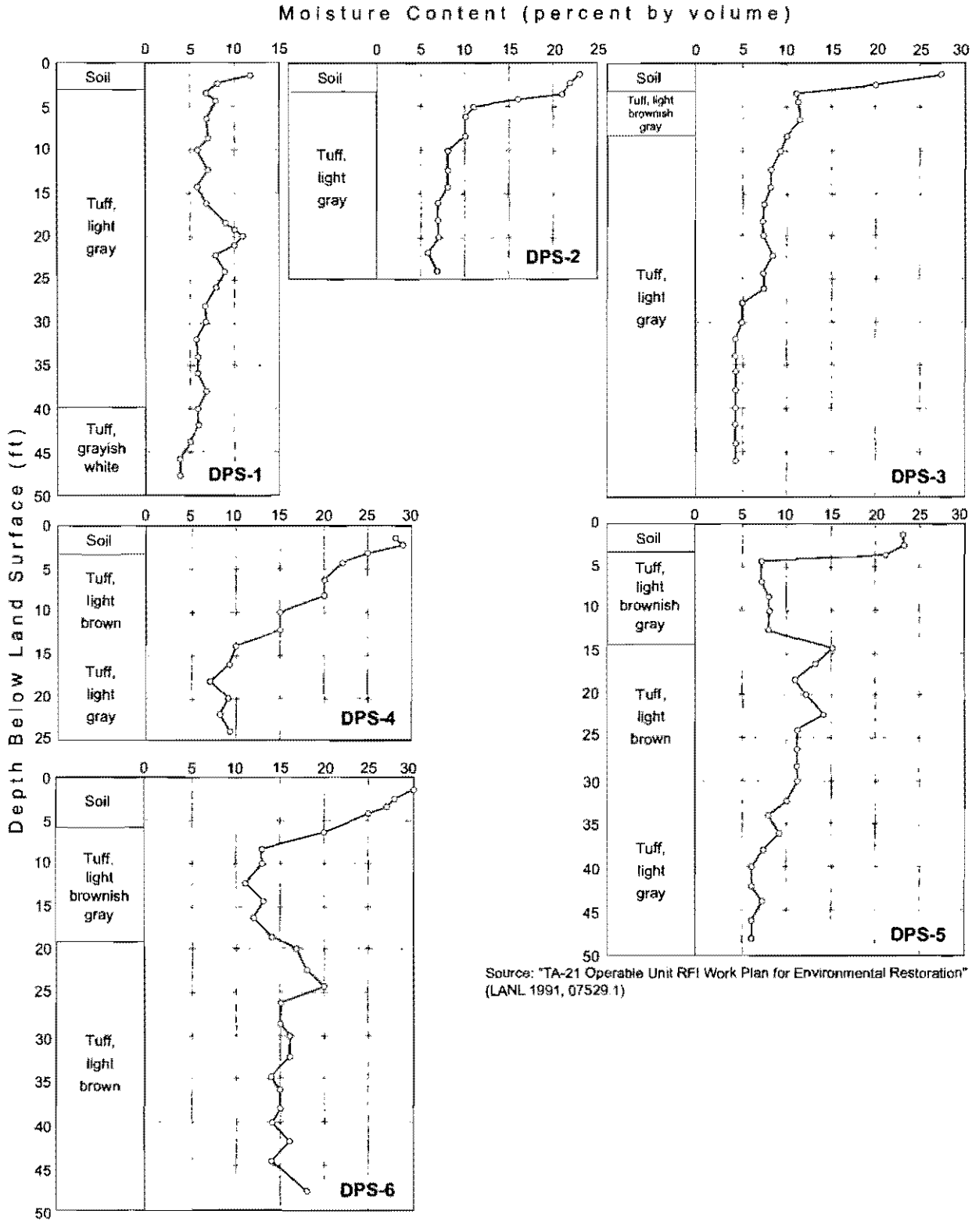
Source: RRES db, MW-H(SEA), 09/03
Rev. for FB-7, MDA B IWP, 061604, cf/rlm

Structure
MDA B boundary
Pit location (estimated)
Borehole location
Edge of pavement
Unpaved road
Fence
20-ft contour interval
100-ft contour interval

N

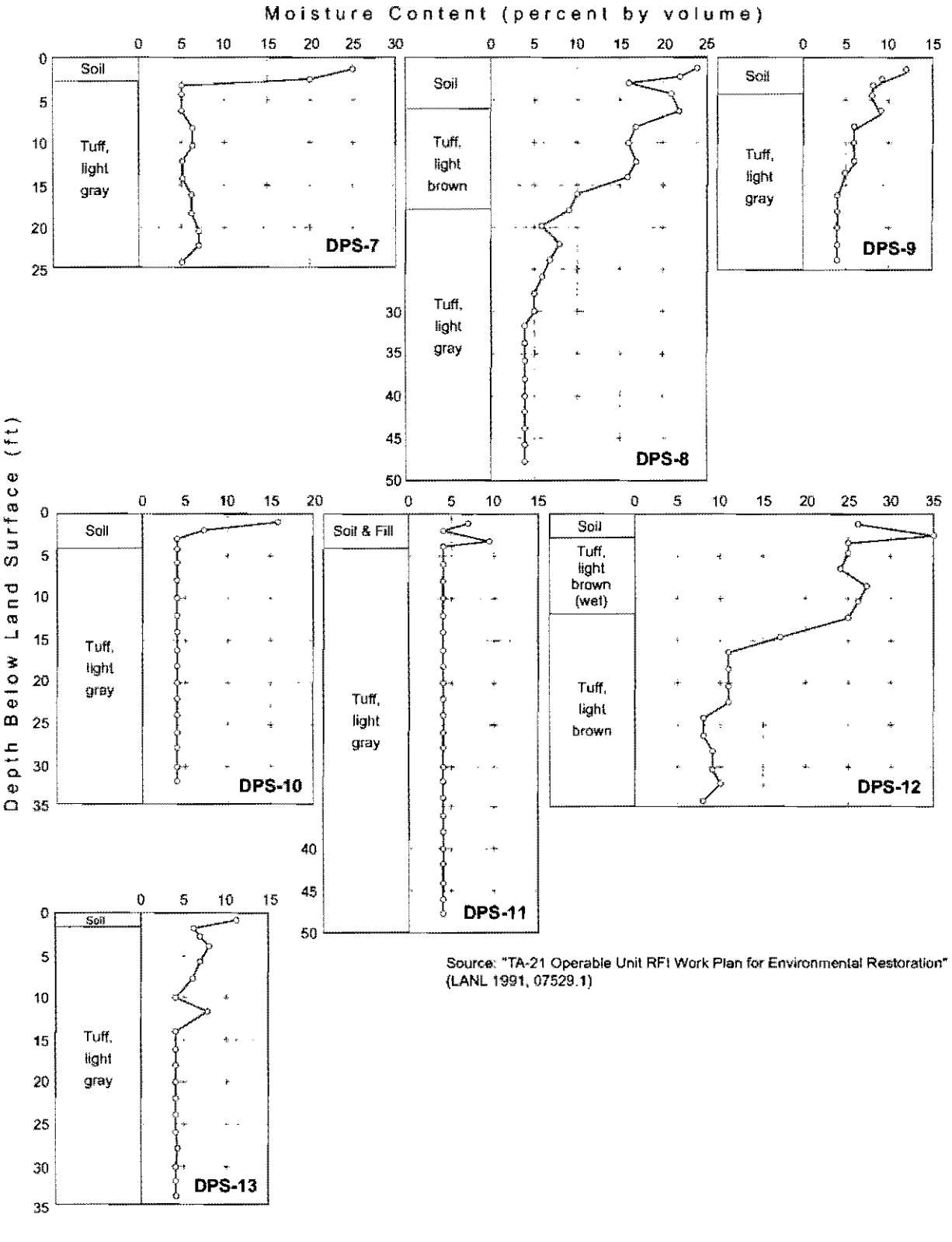
0 500
FEET
Coordinates are NMSP NAD-83

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



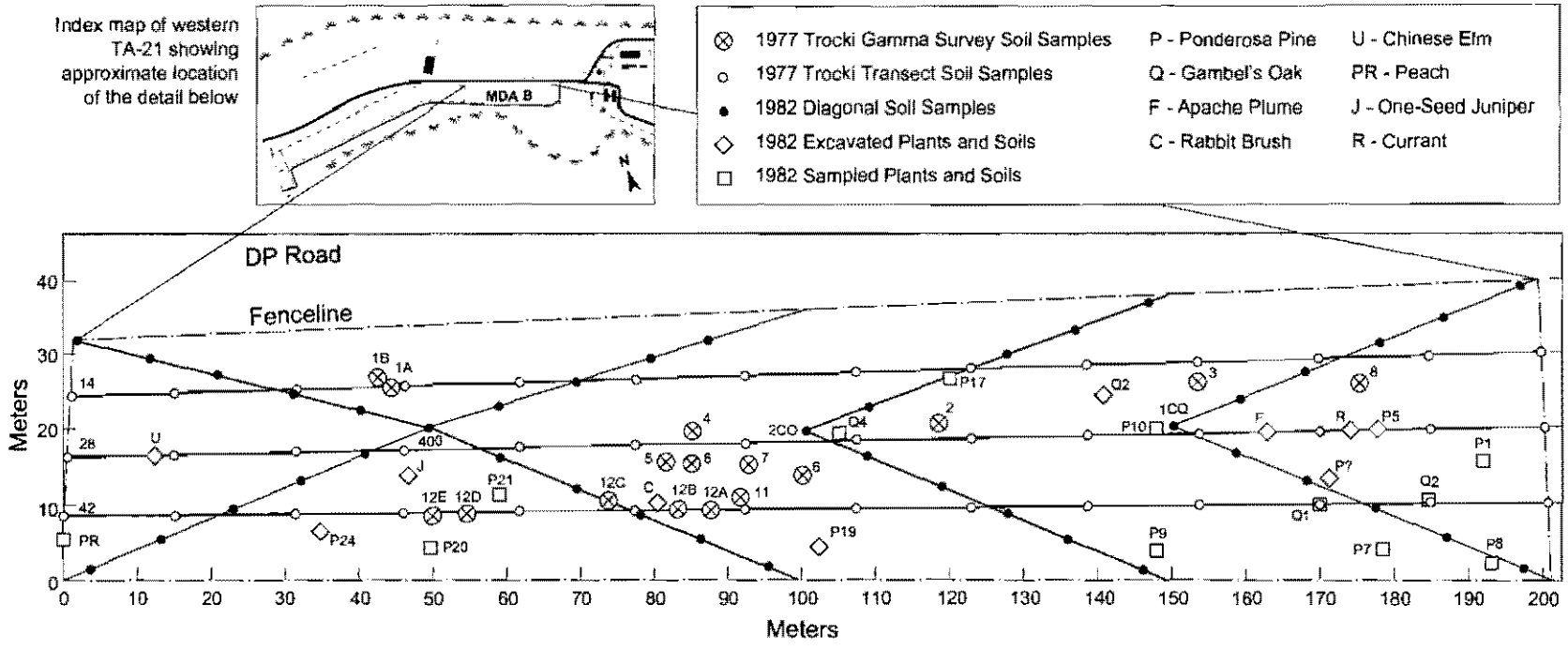
Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529.1)

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)



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

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)

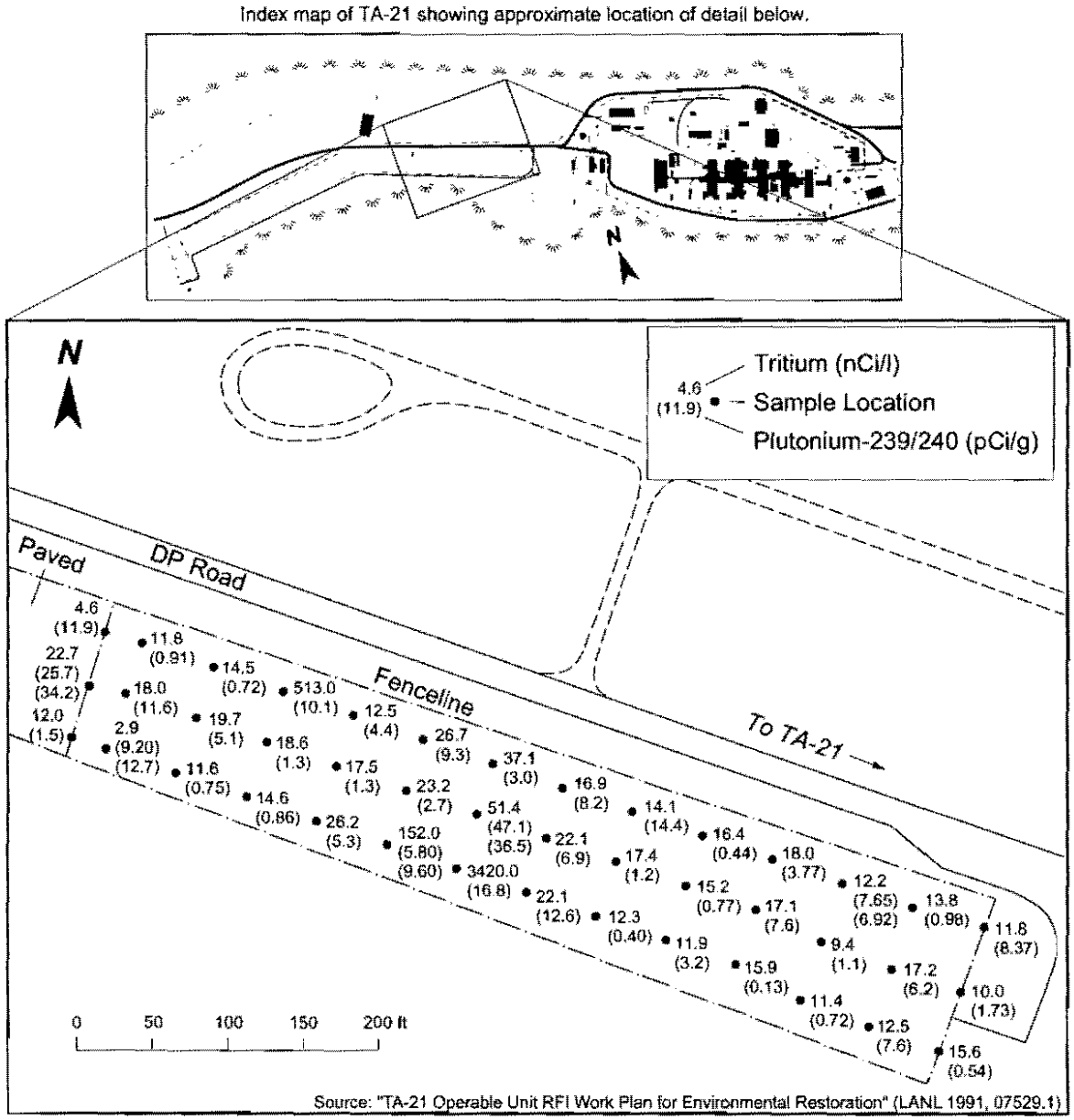


Figure B-11. Surface soil sampling locations for 1977 Trocki transect samples at MDA B (as presented in the TA-21 RFI Work Plan)

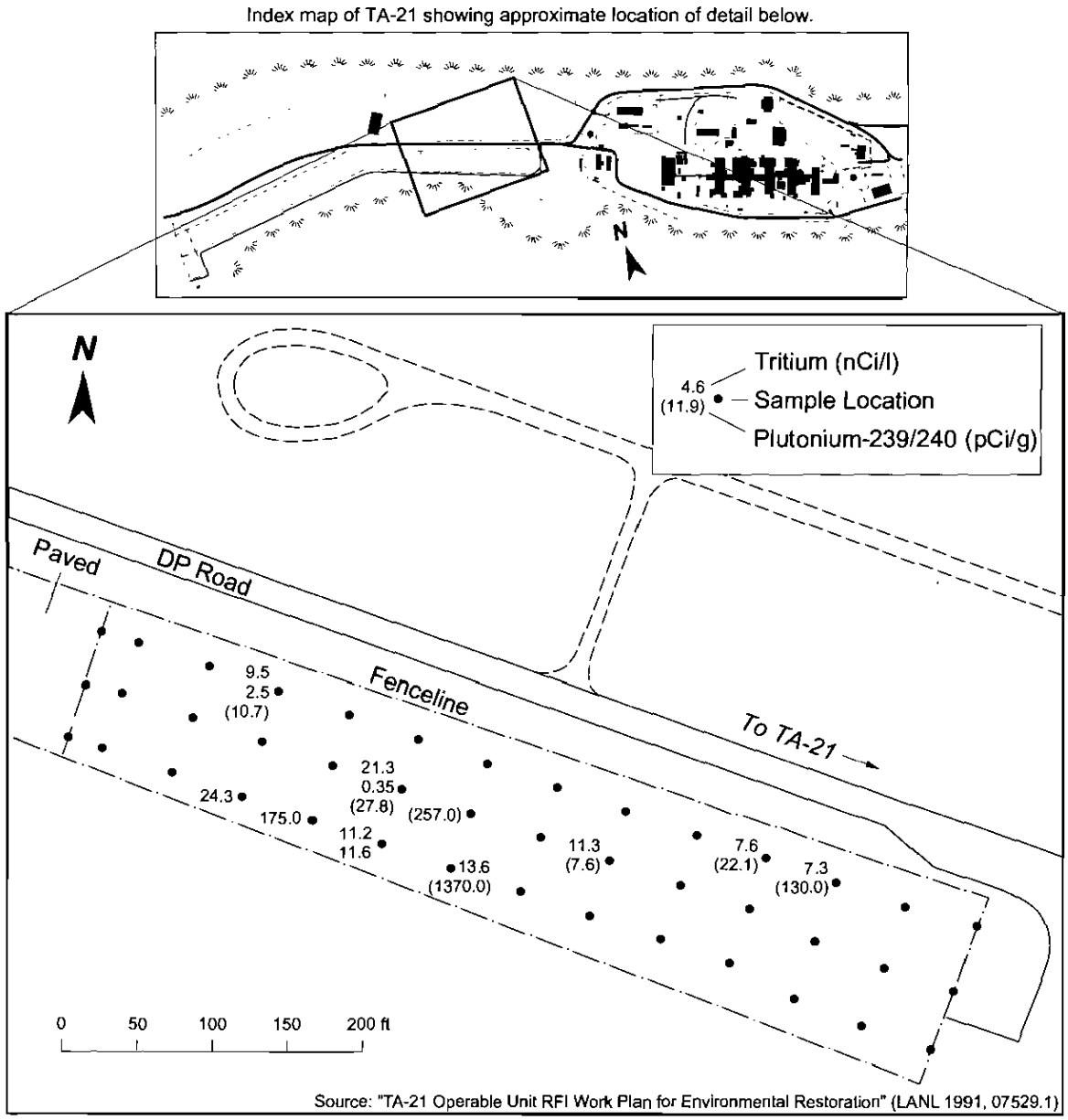
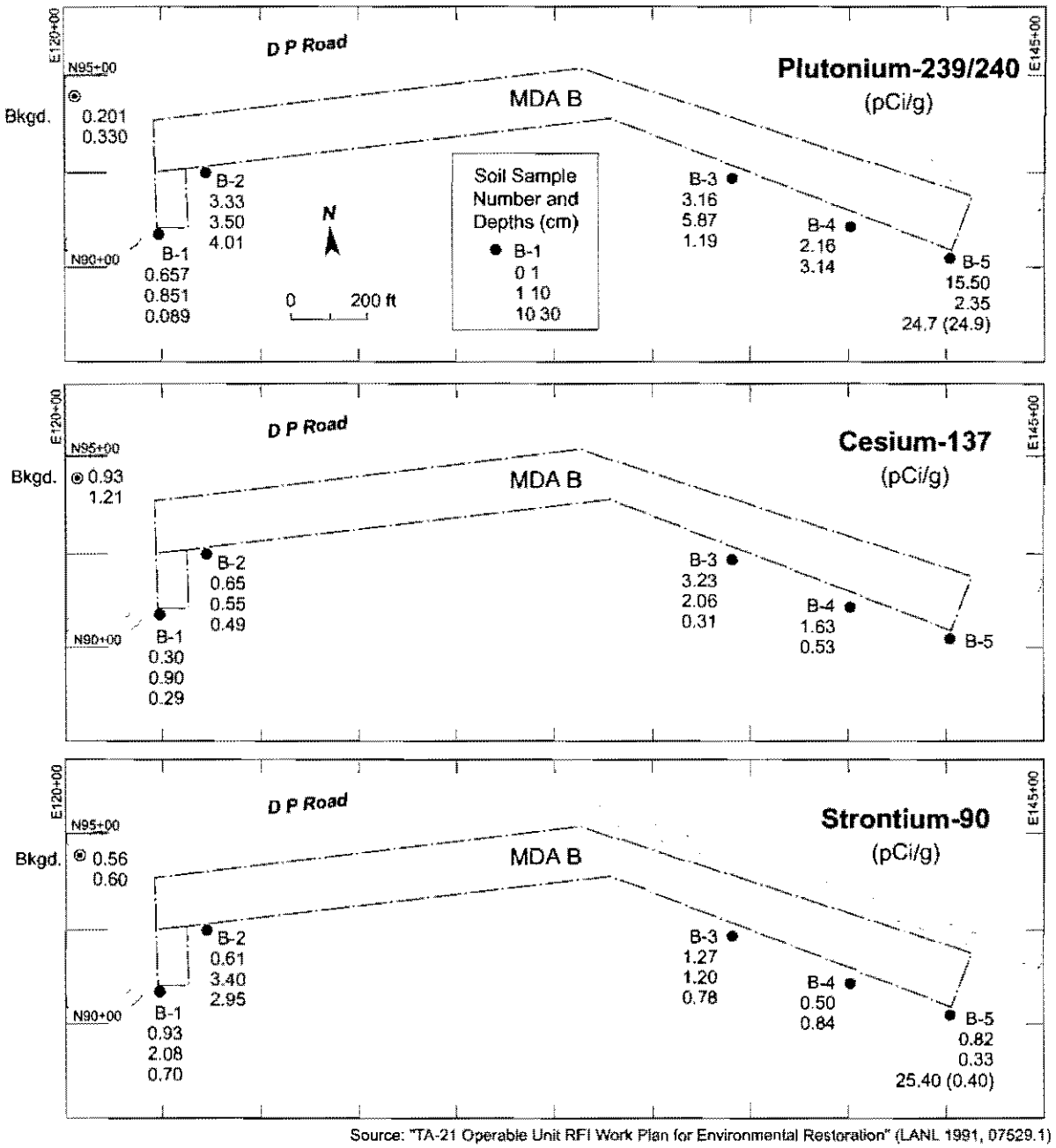
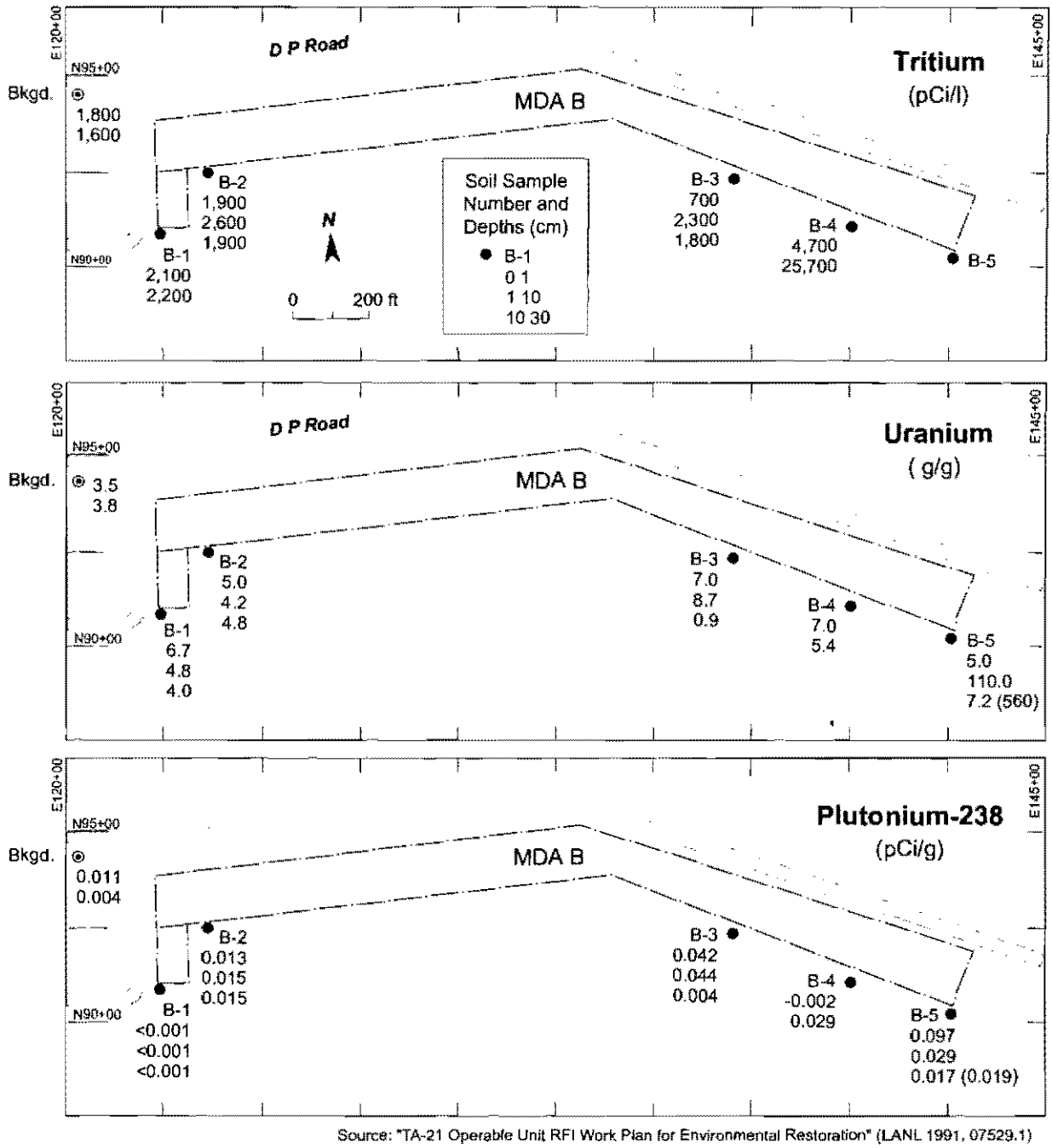


Figure B-12. Surface soil sampling locations from 1977 Trocki gamma survey at MDA B (as presented in the TA-21 RFI Work Plan)



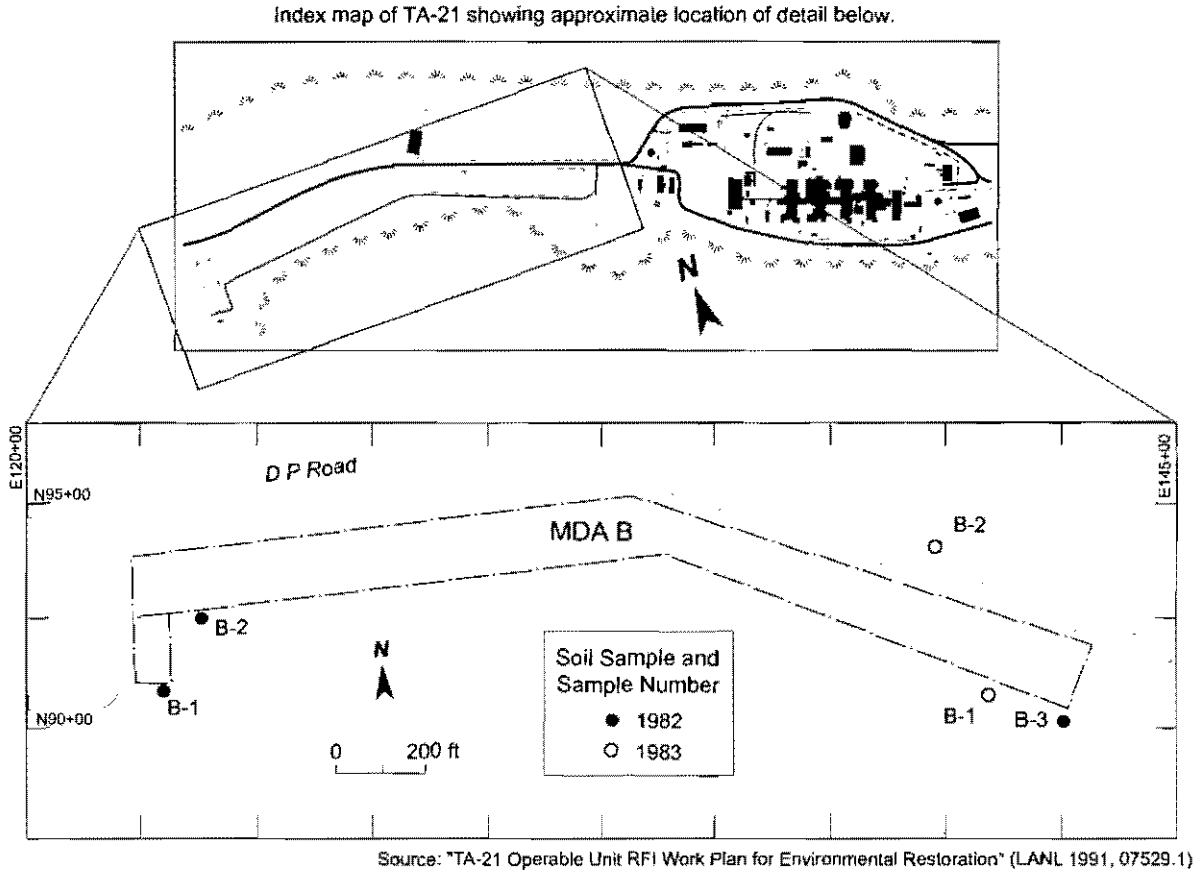
Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529.1)

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)



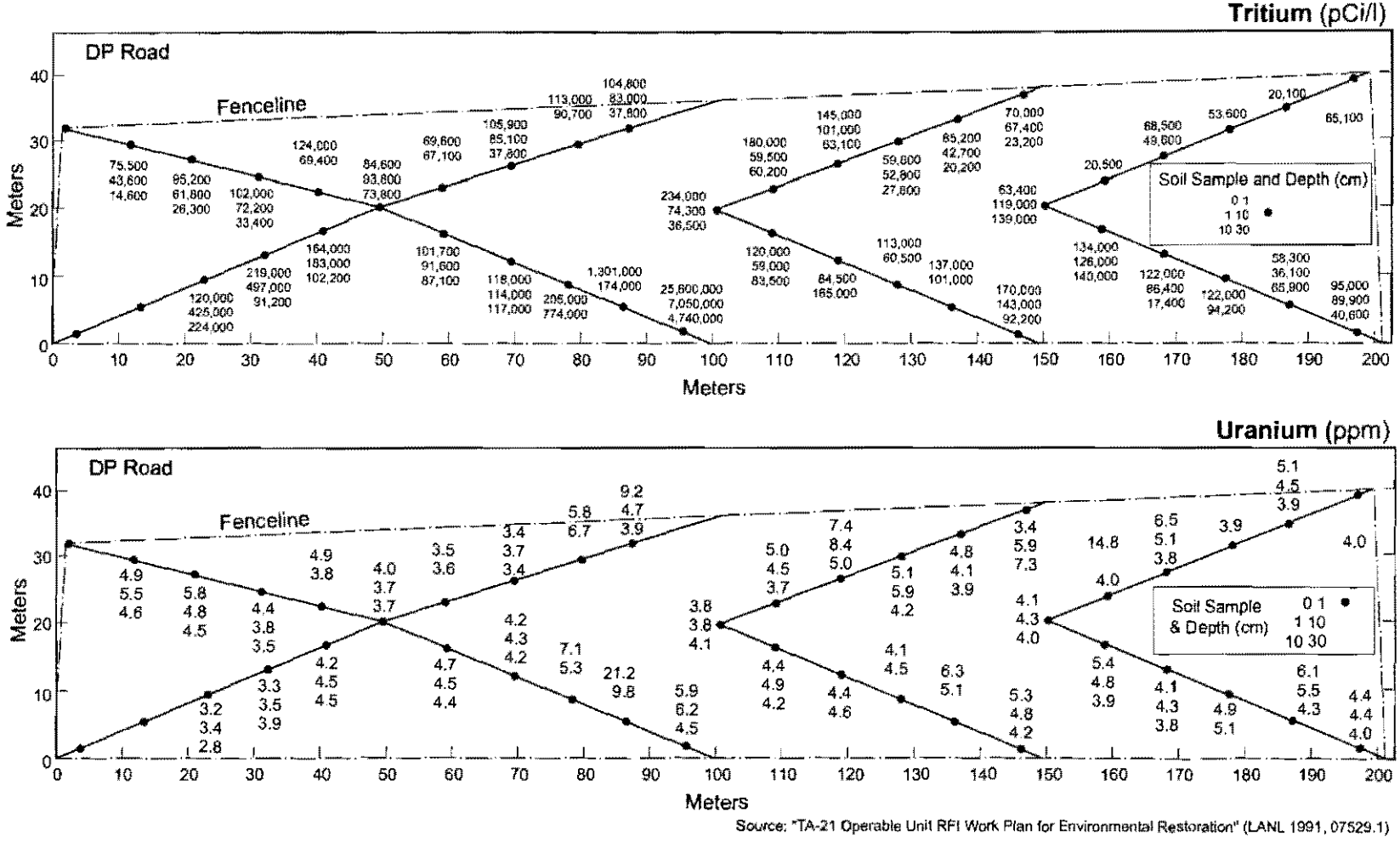
Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529.1)

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)



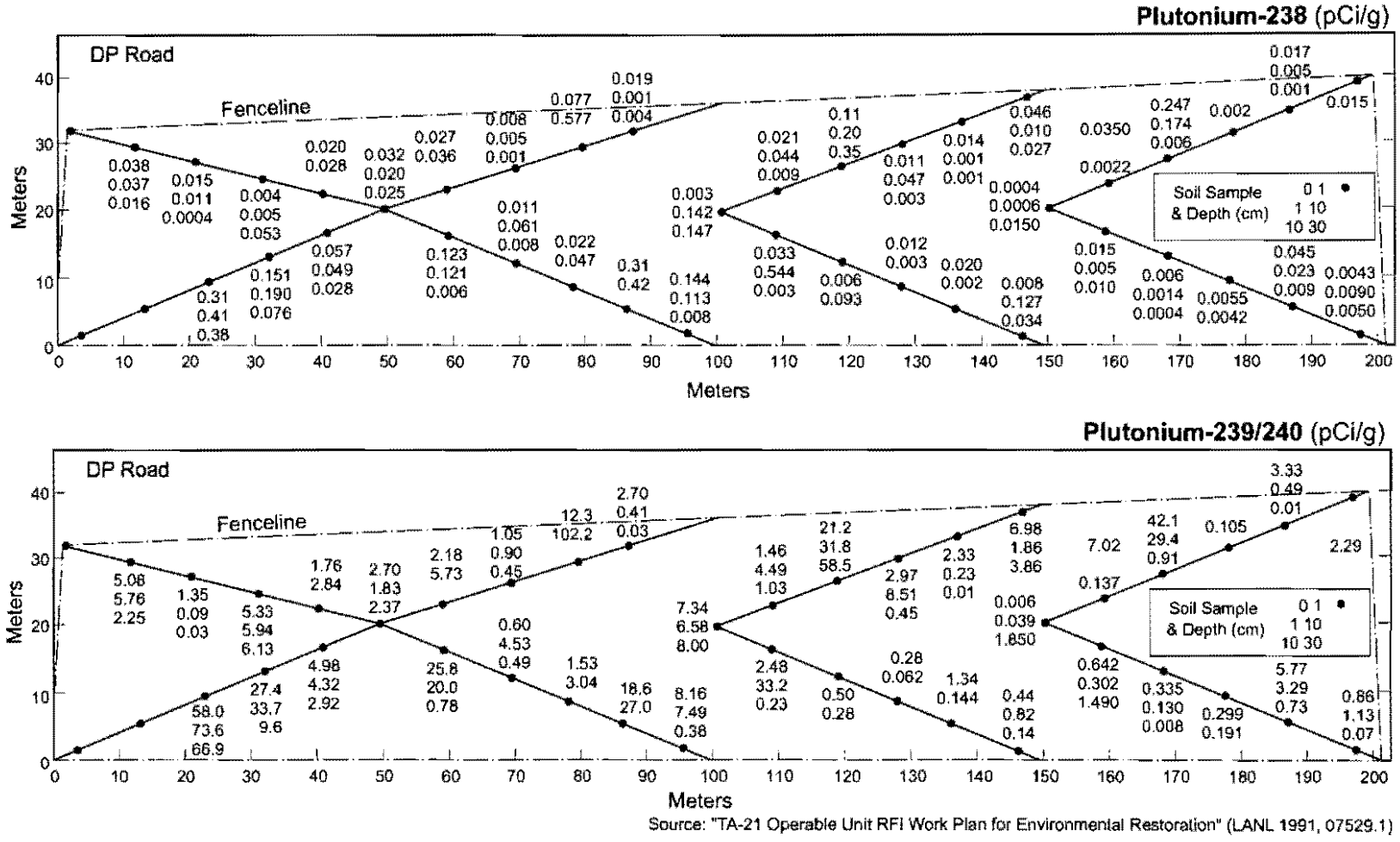
Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529.1)

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



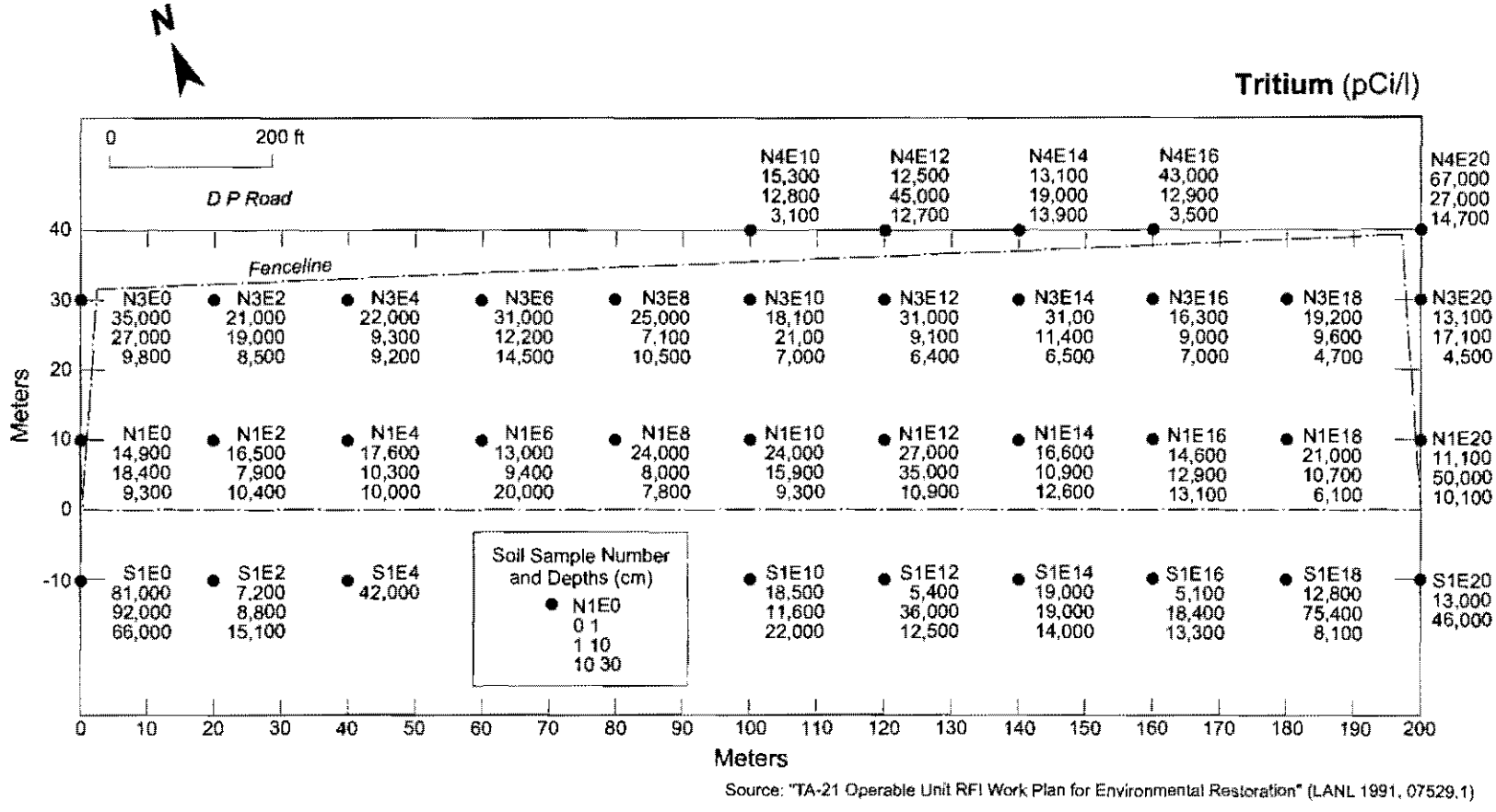
Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529.1)

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)



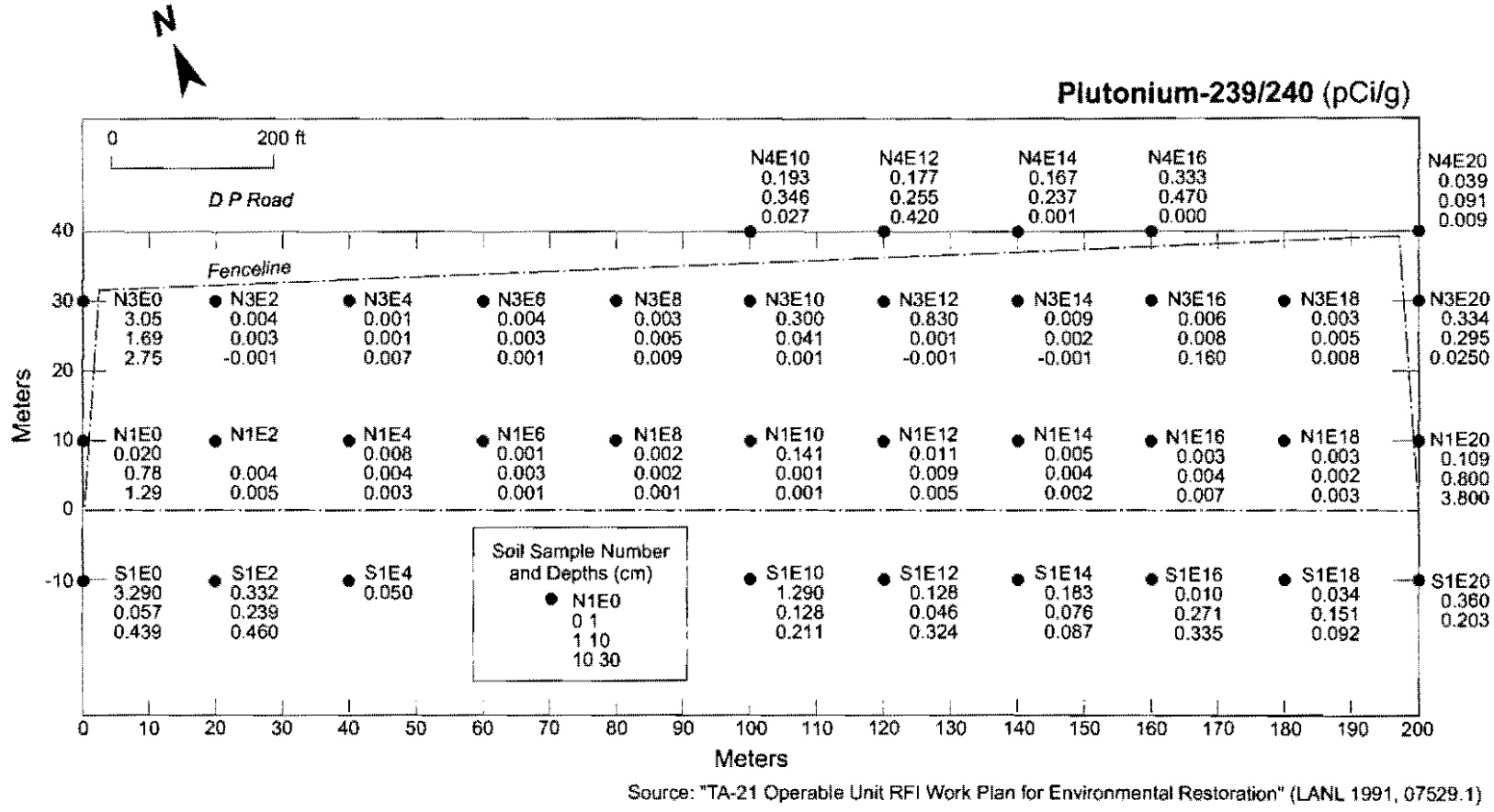
Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529.1)

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)



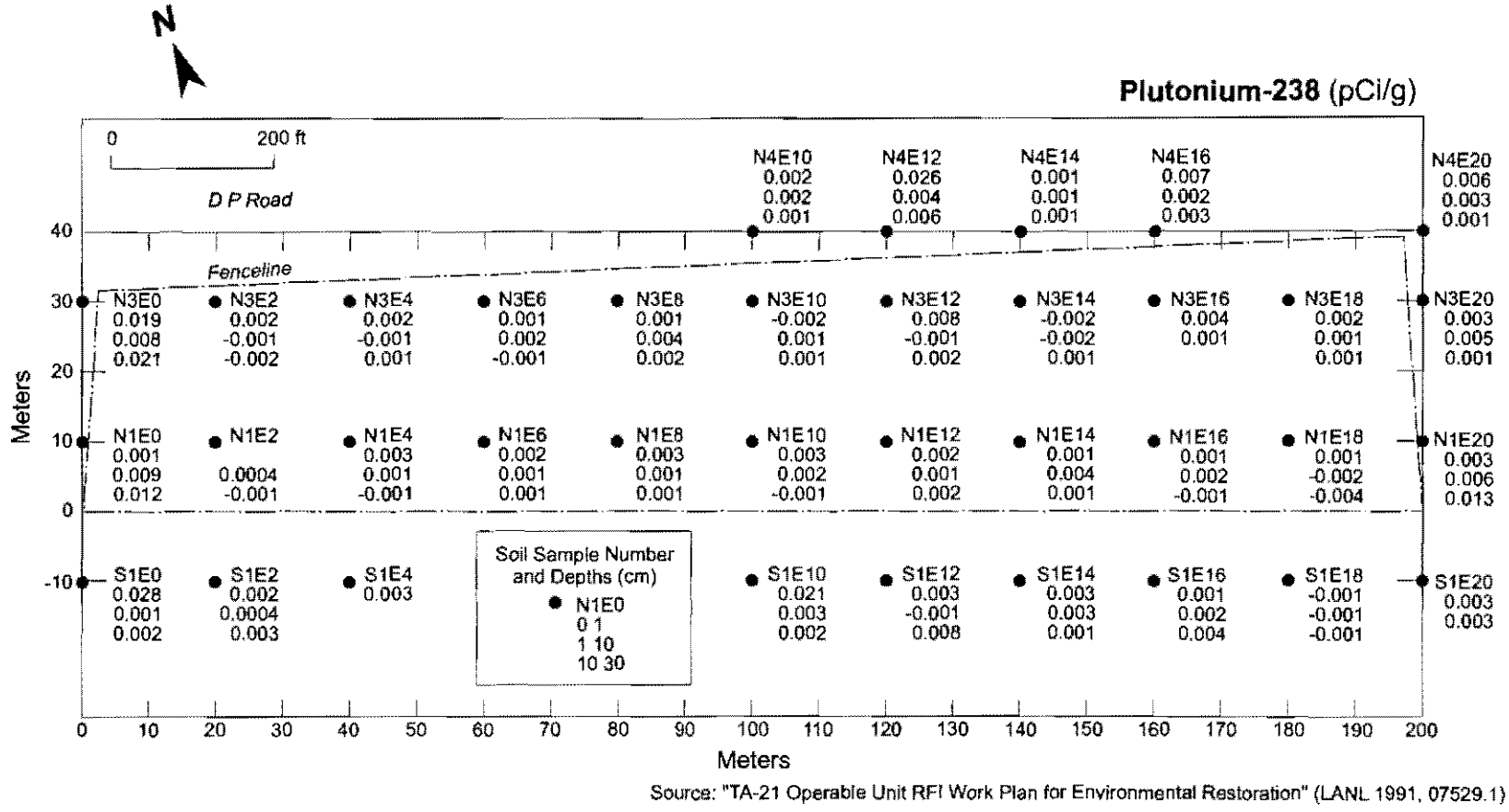
Source: "TA-21 Operable Unit RFI Work Plan for Environmental Restoration" (LANL 1991, 07529.1)

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)



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

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

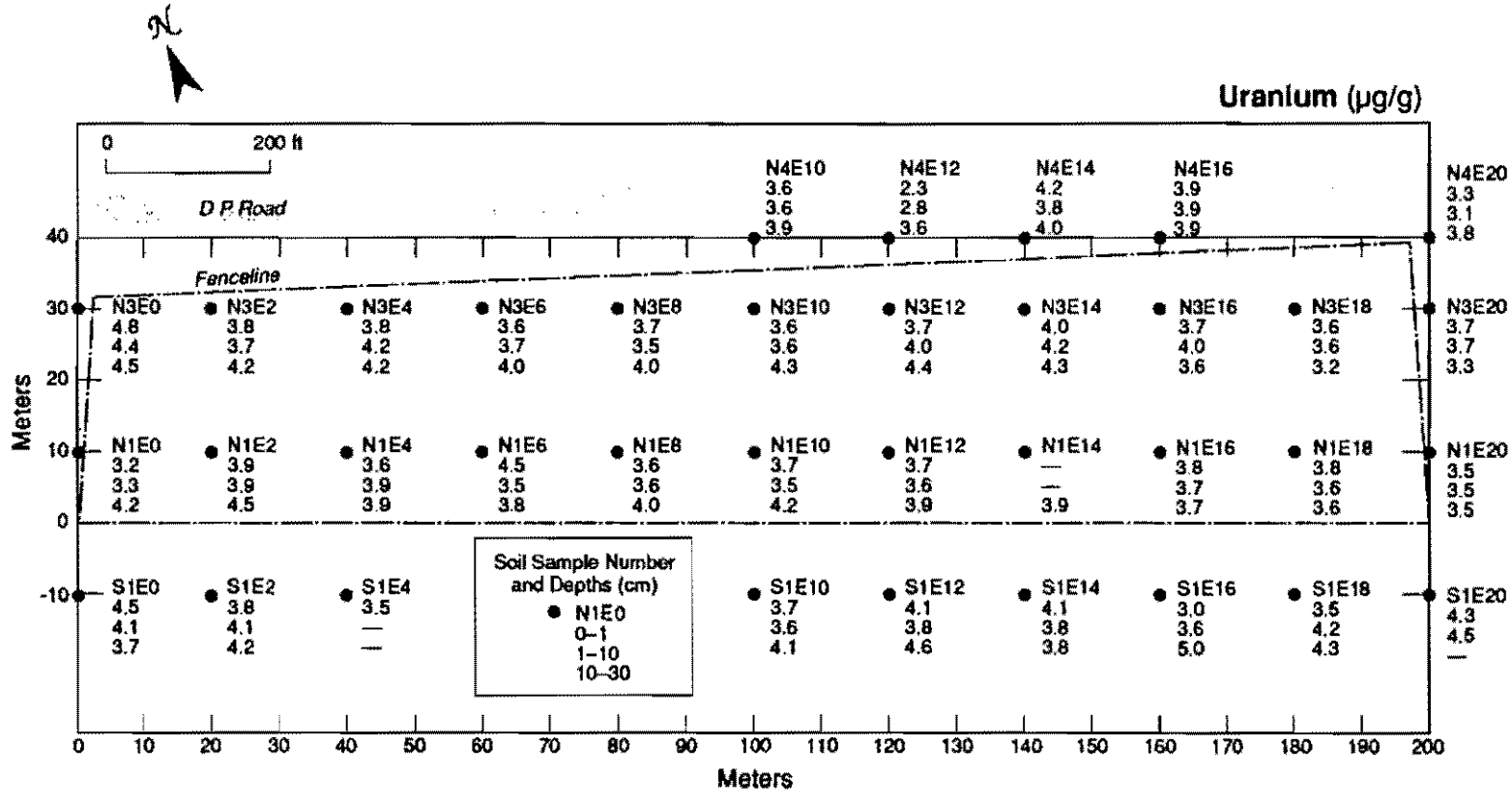


Figure B-21. Uranium concentrations for 1983 MDA B surface soil samples (as presented in the TA-21 RFI Work Plan)

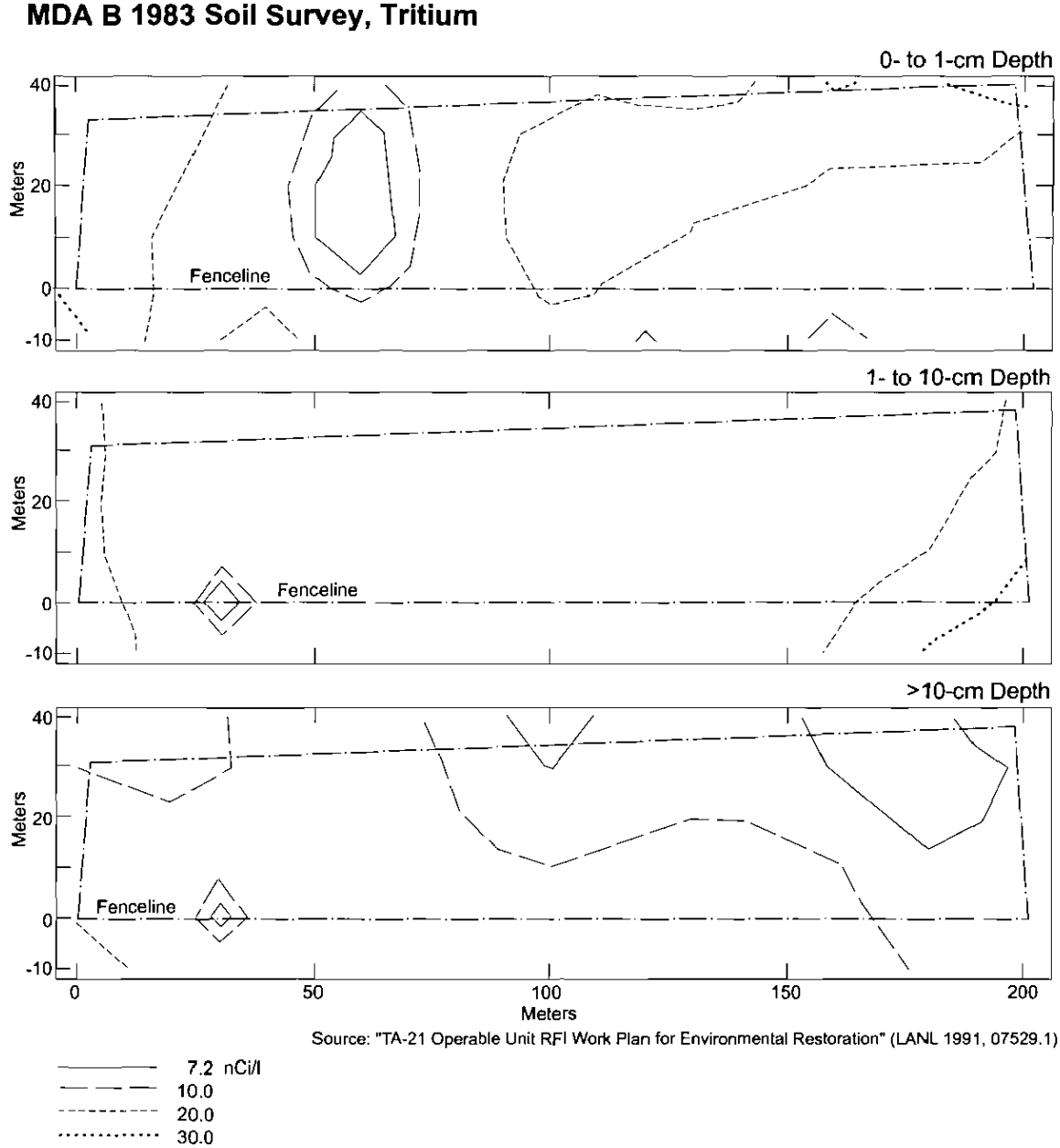


Figure B-22. Concentration contours for tritium from 1983 soil samples at MDA B (as presented in the TA-21 RFI Work Plan)

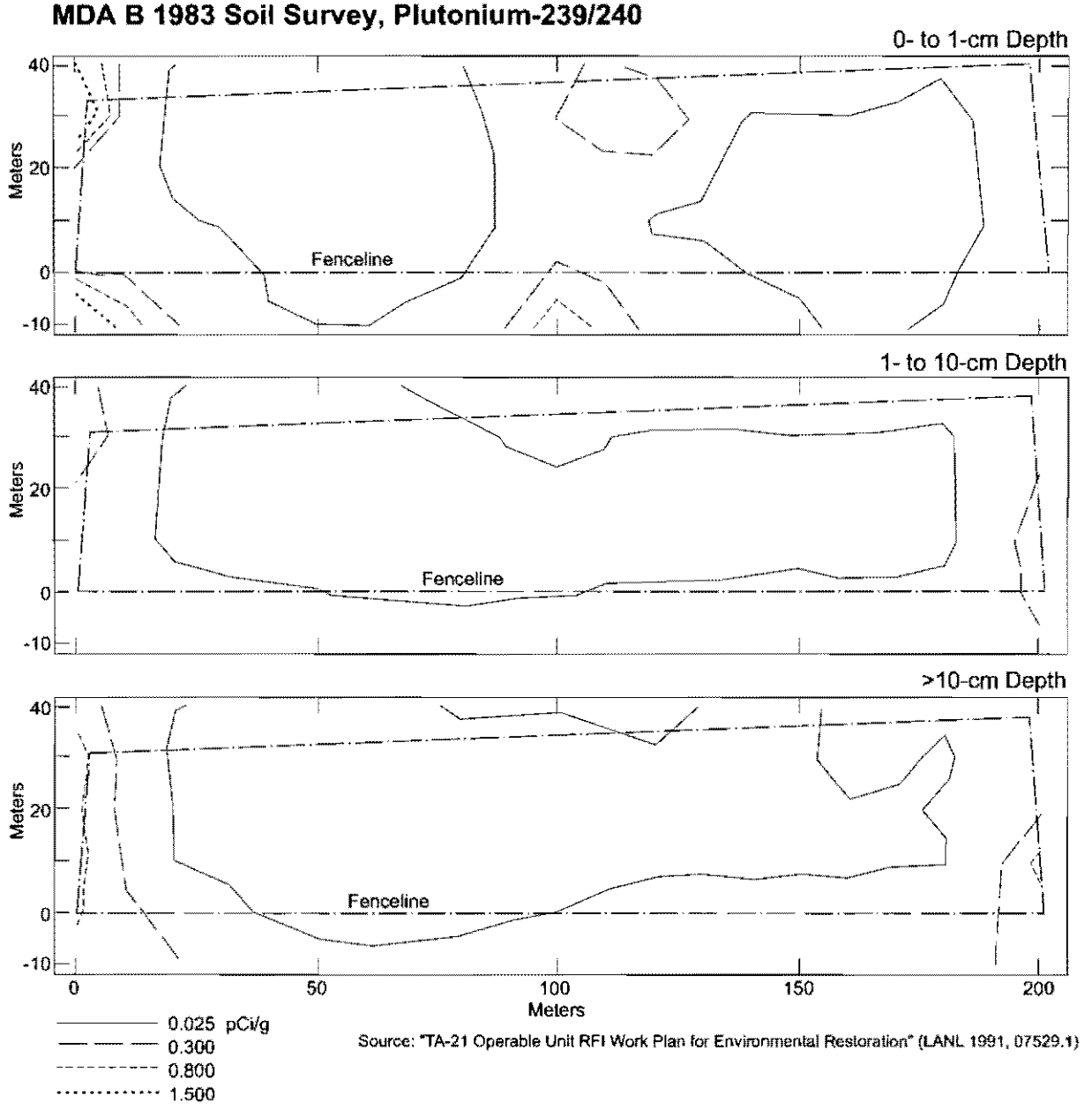
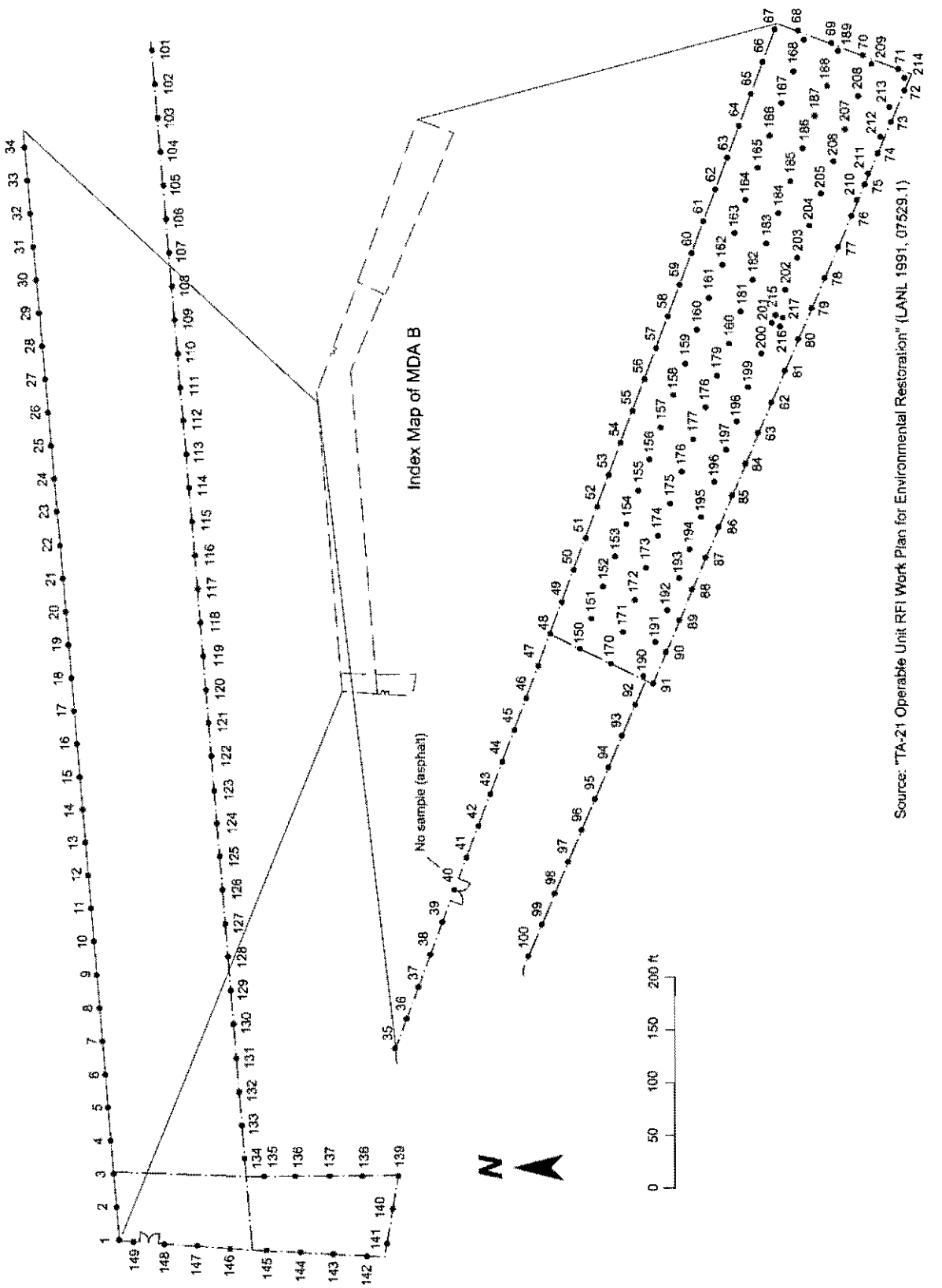


Figure B-23. Concentration contours for plutonium-239/240 from 1983 soil samples at MDA B (as presented in the TA-21 RFI Work Plan)



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

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

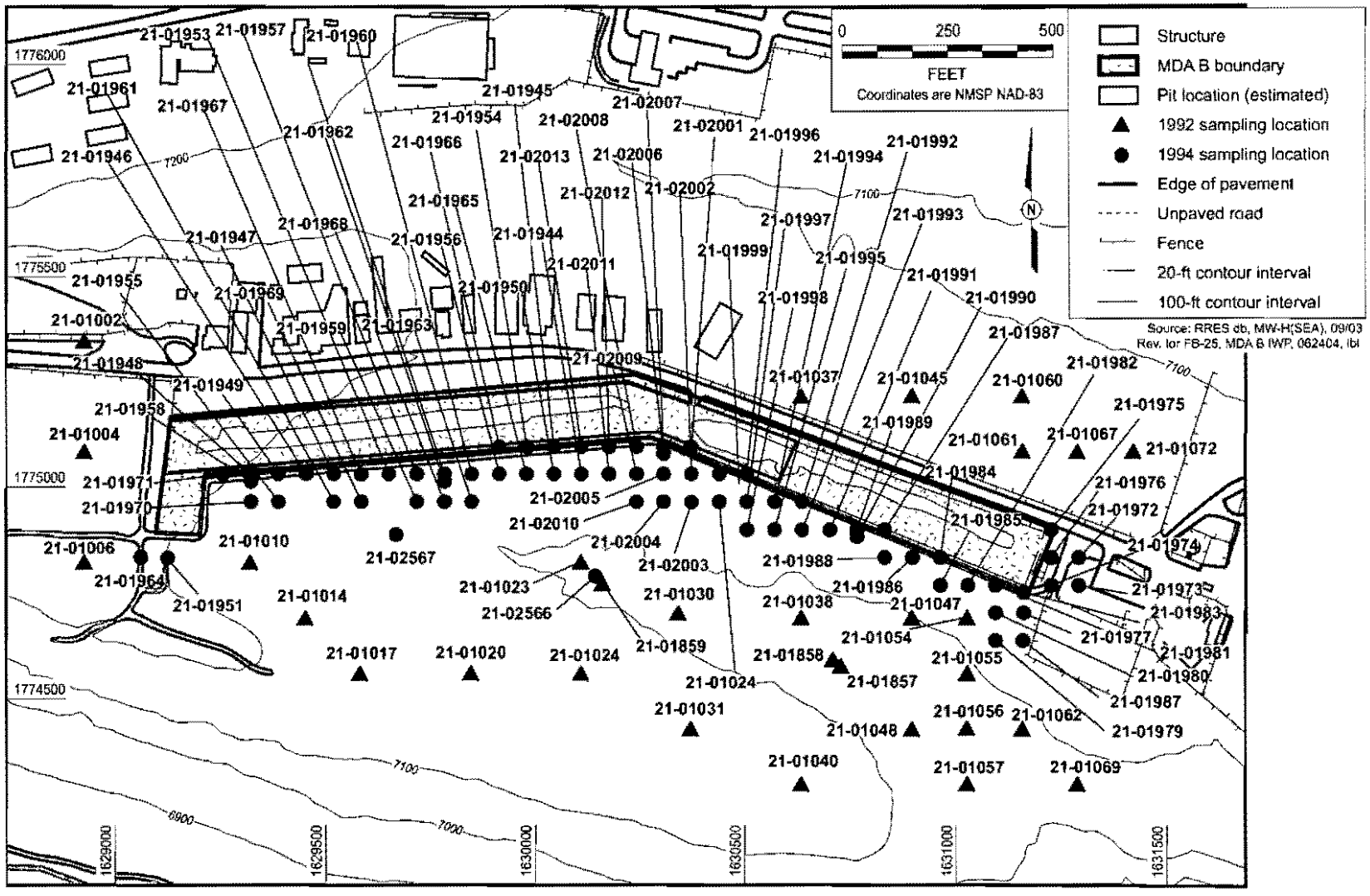


Figure B-25. Locations of 1992 and 1994 surface samples

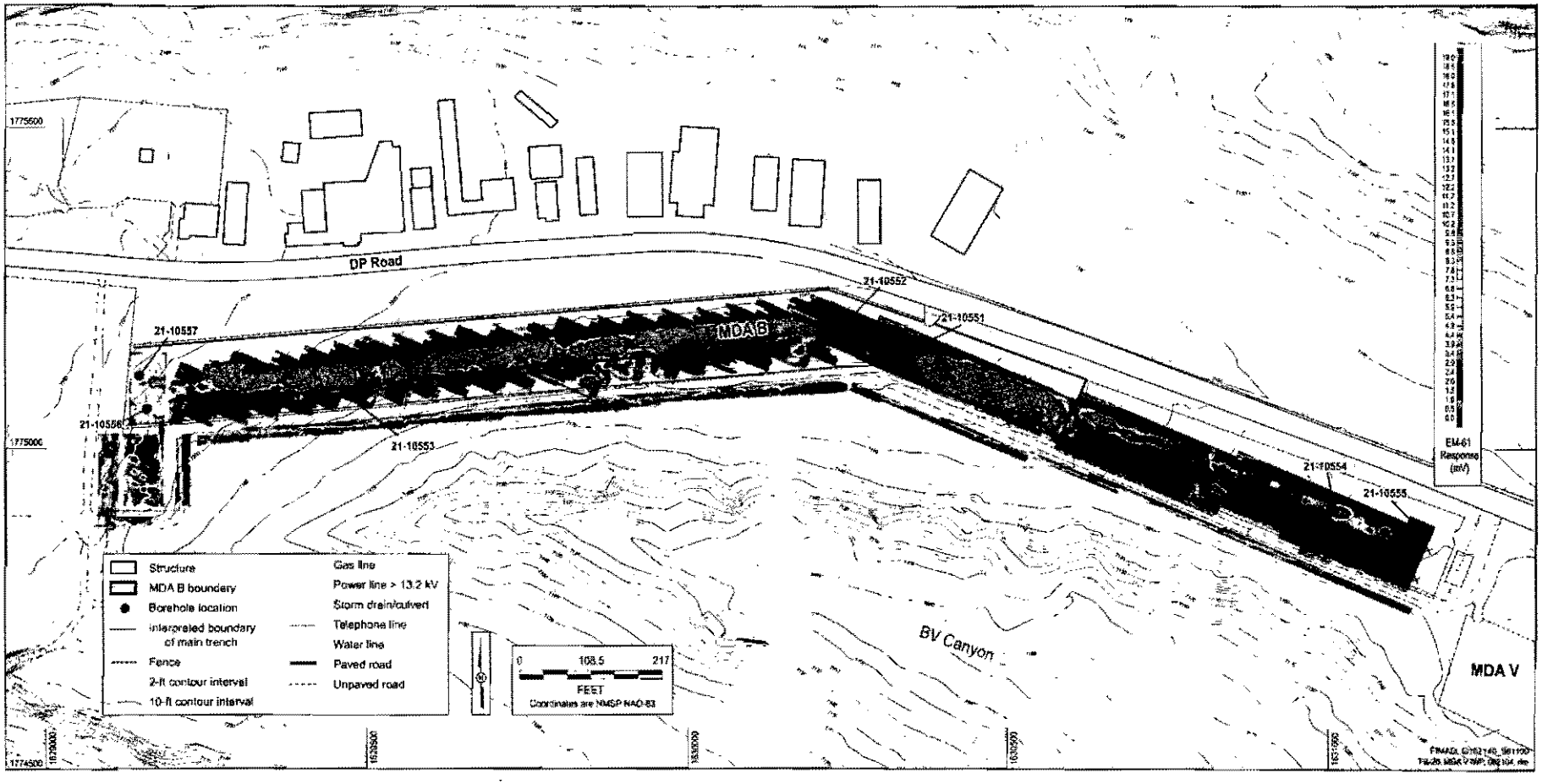


Figure B-26. MDA B disposal trenches delineated using EM-61 geophysical survey data

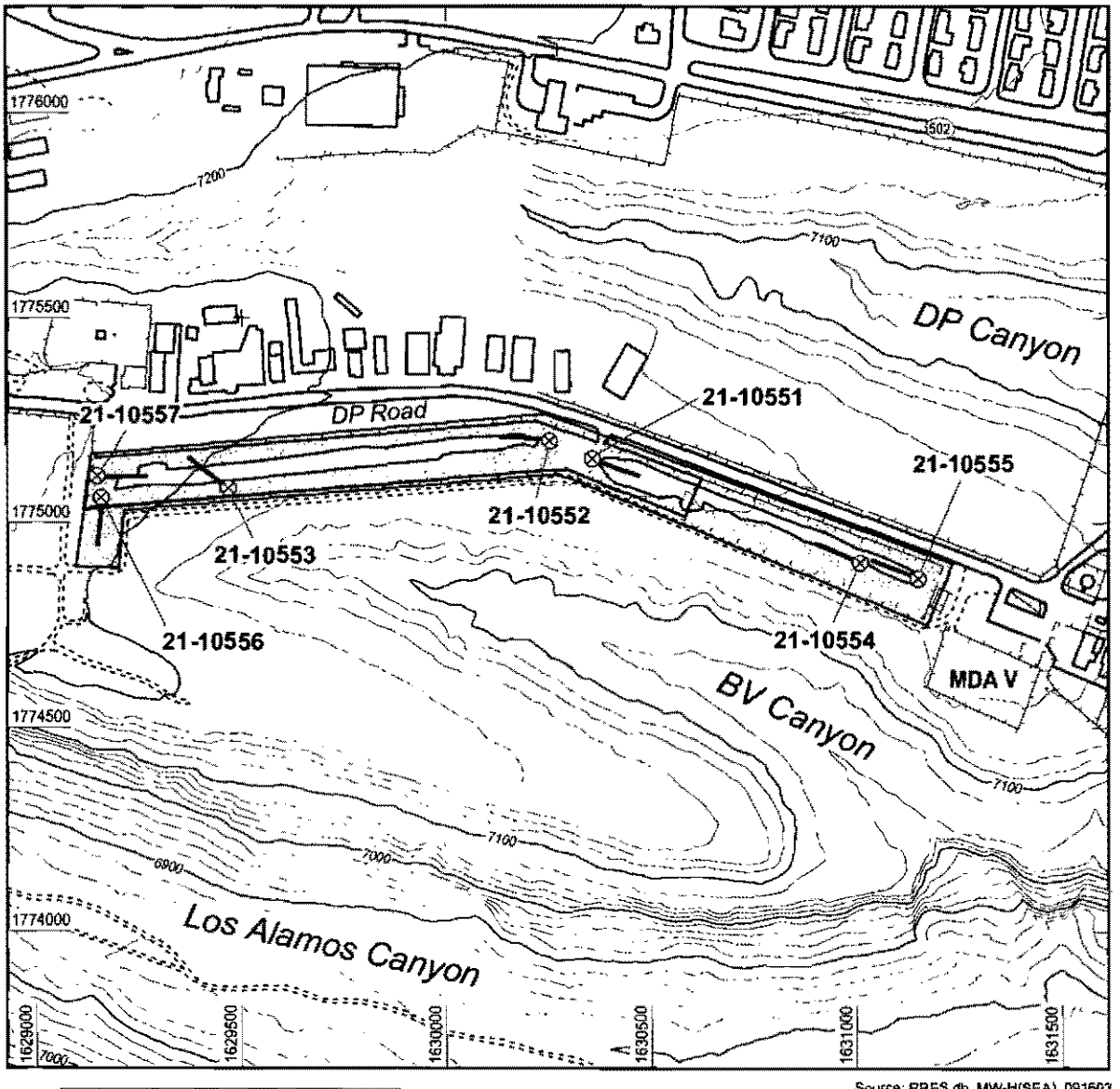
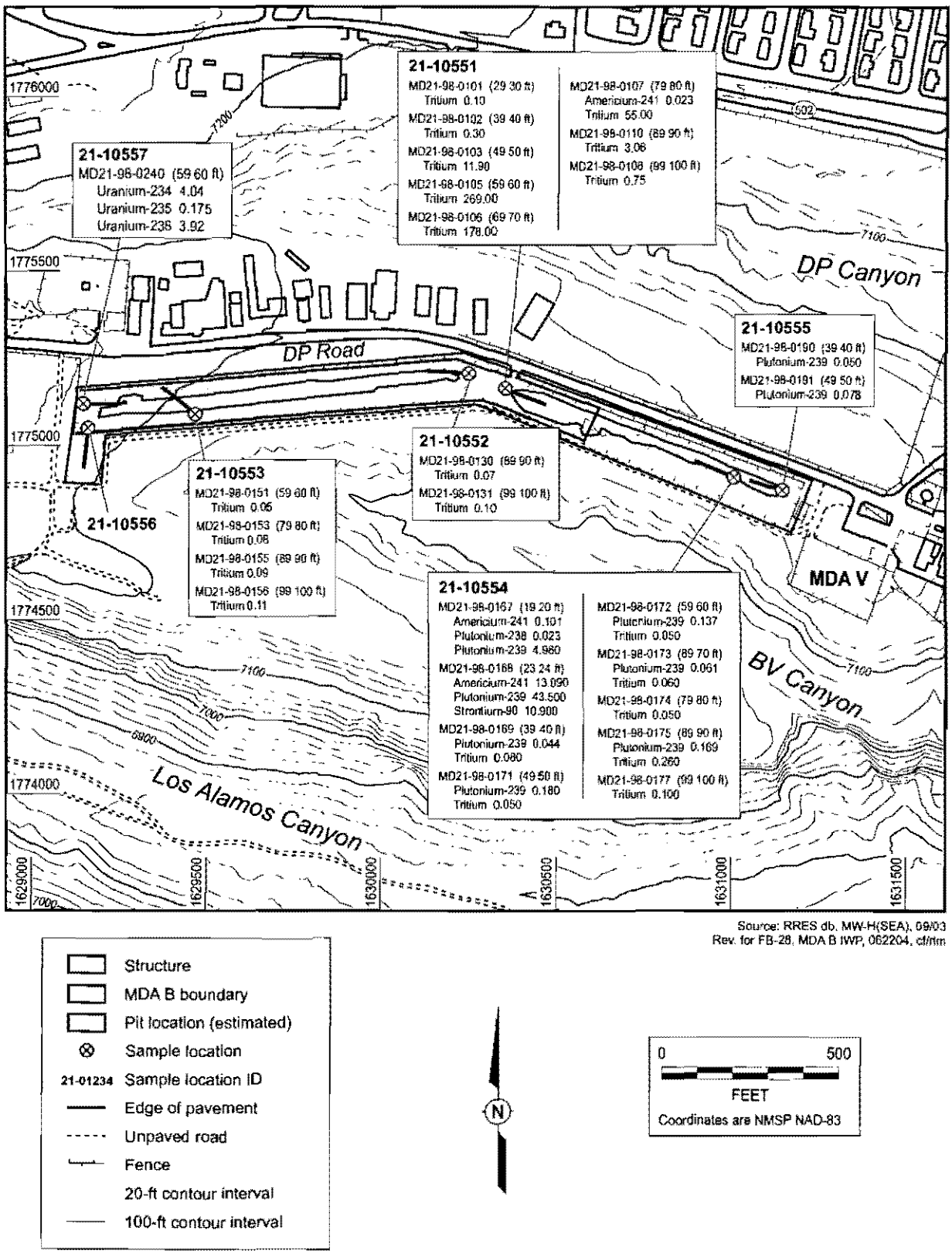


Figure B-27. Locations of angled boreholes drilled in 1998



Source: RRES db, MW-H(SEA), 09/03
Rev. for FB-28, MDA B IWP, 062204, cf/rm

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

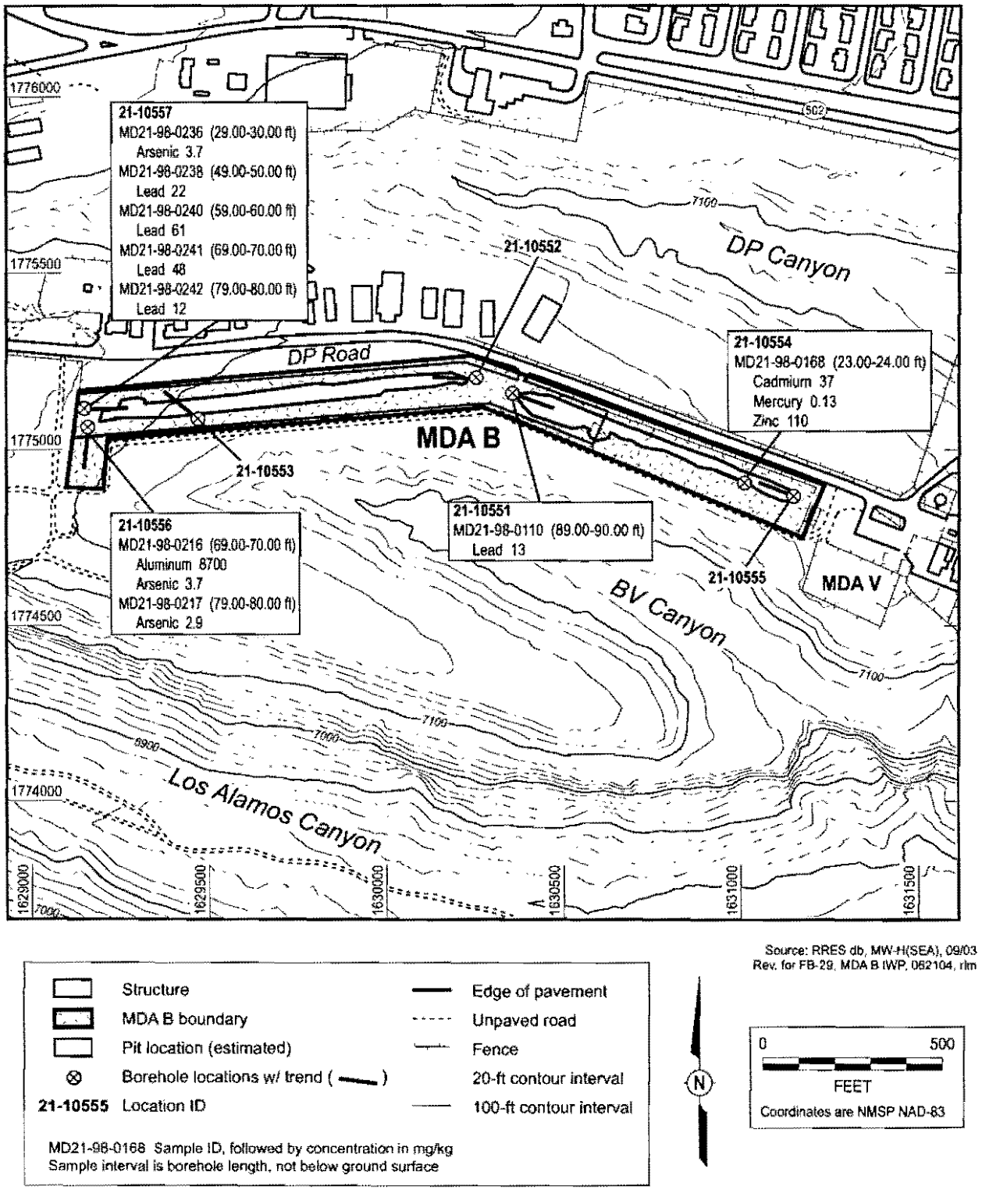


Figure B-29. Inorganic chemicals above background in 1998 angled borehole samples

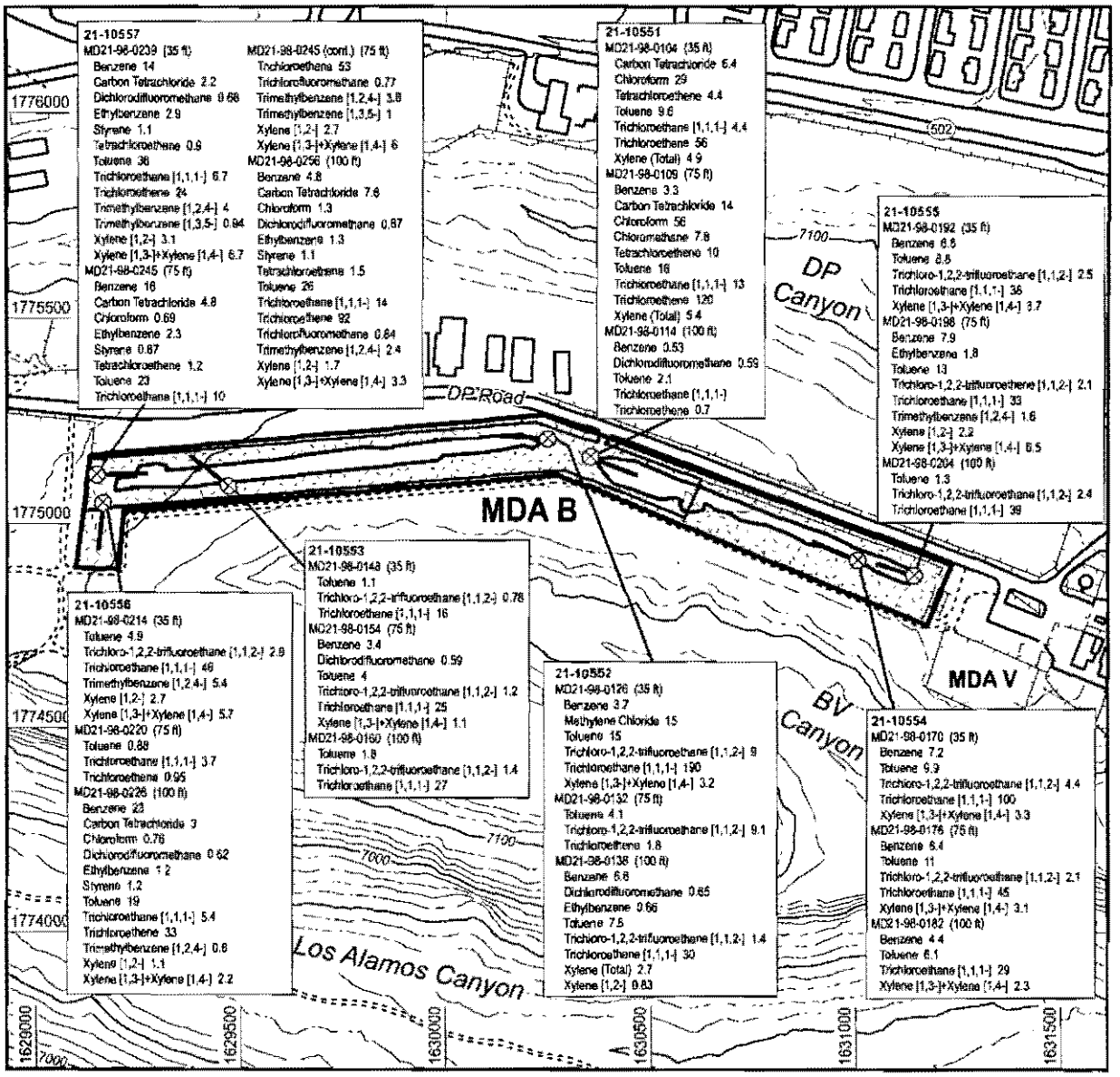


Figure B-30. Volatile organic compounds detected in pore gas samples from 1998 angled boreholes

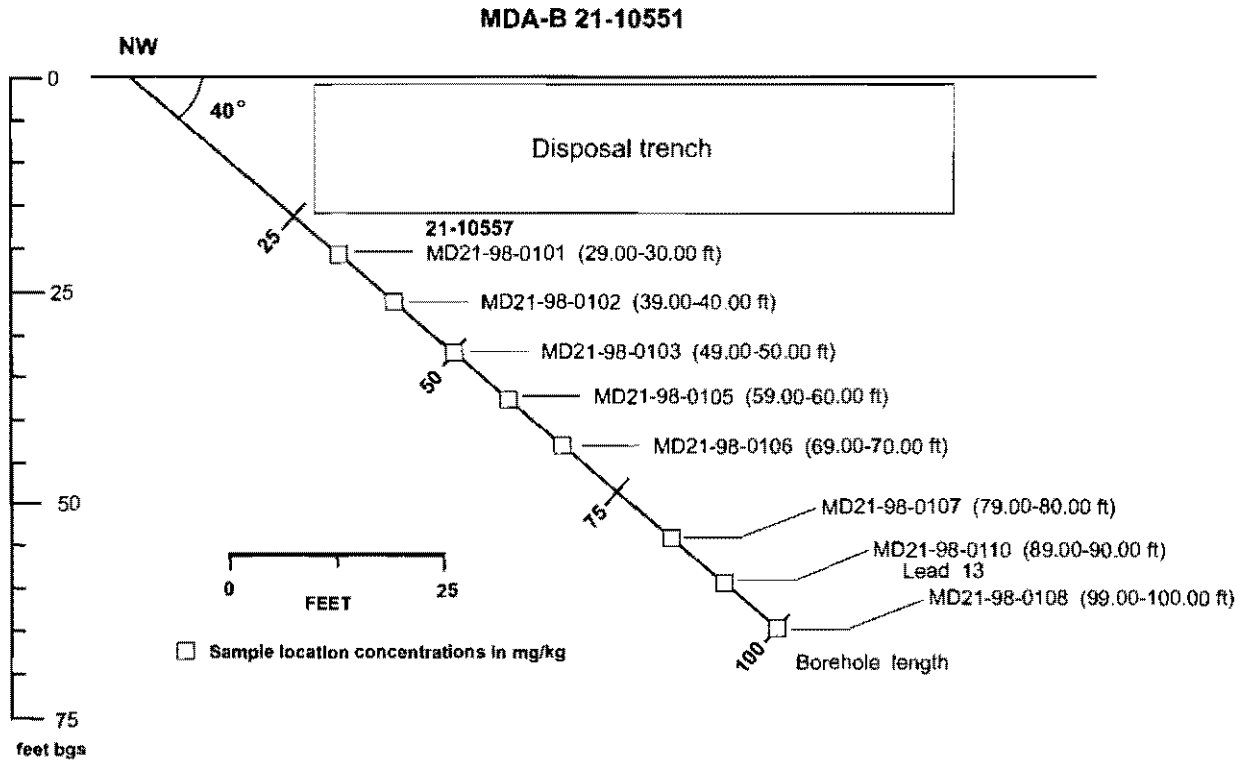


Figure B-31. Schematic profile of MDA B Location ID 21-10551 with inorganic chemicals above background

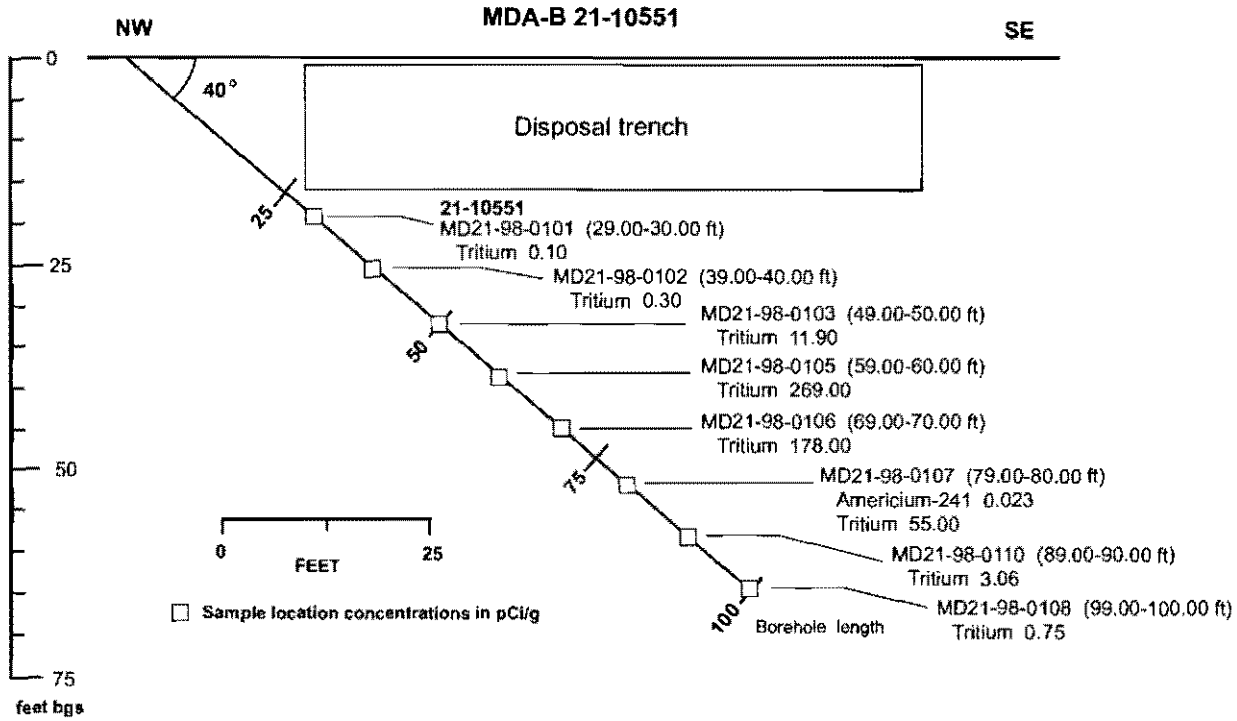


Figure B-32. Schematic profile of MDA B borehole 21-10551 with radionuclides above background

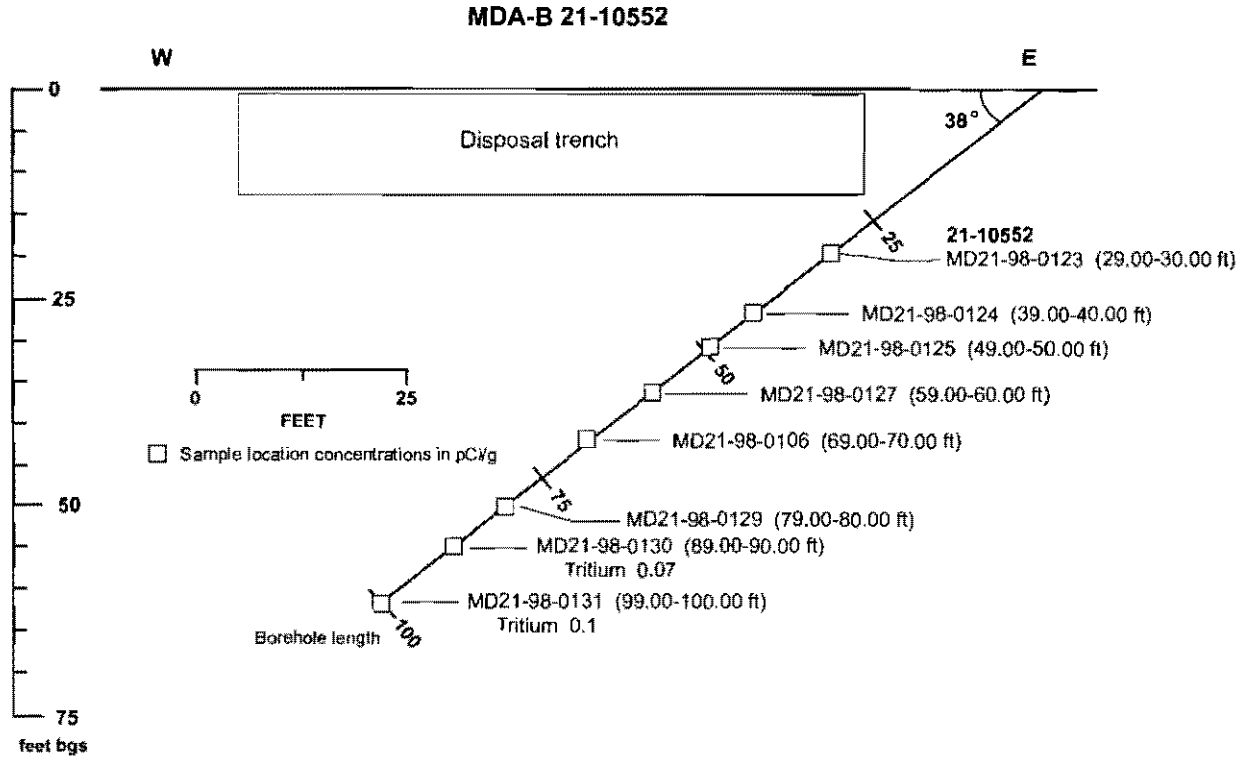


Figure B-33. Schematic profile of MDA B borehole 21-10552 with radionuclides above background

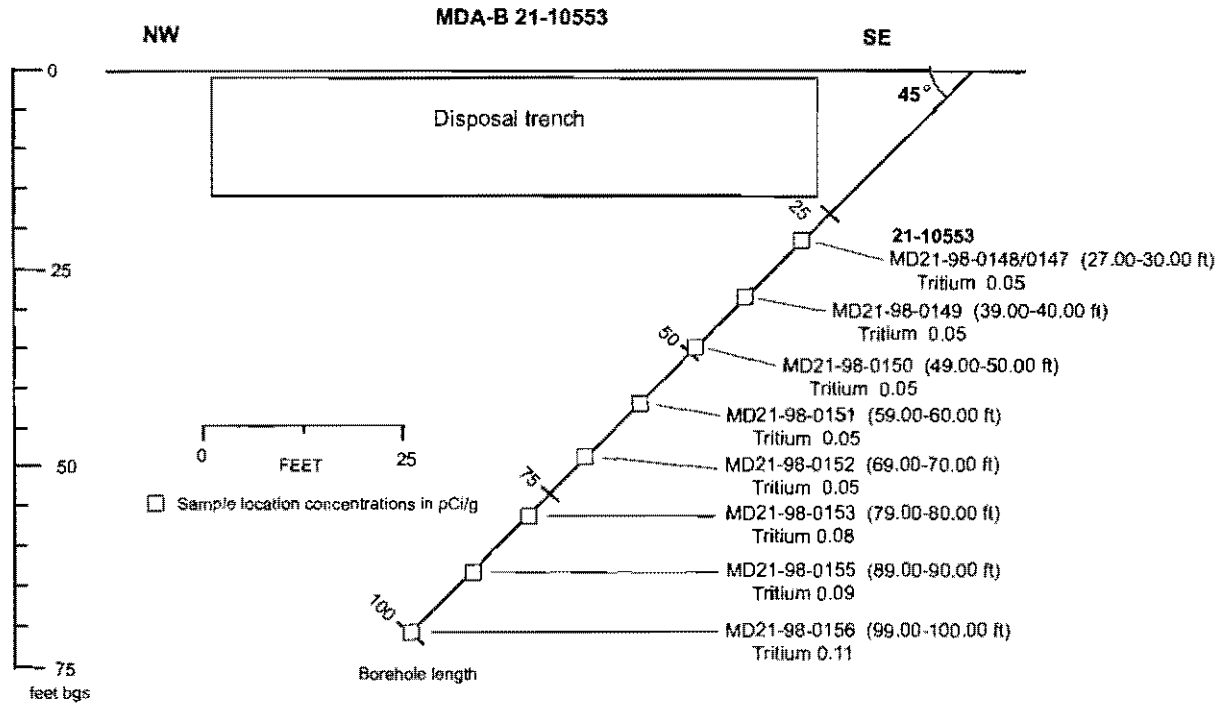


Figure B-34. Schematic profile of MDA B borehole 21-10553 with radionuclides above background

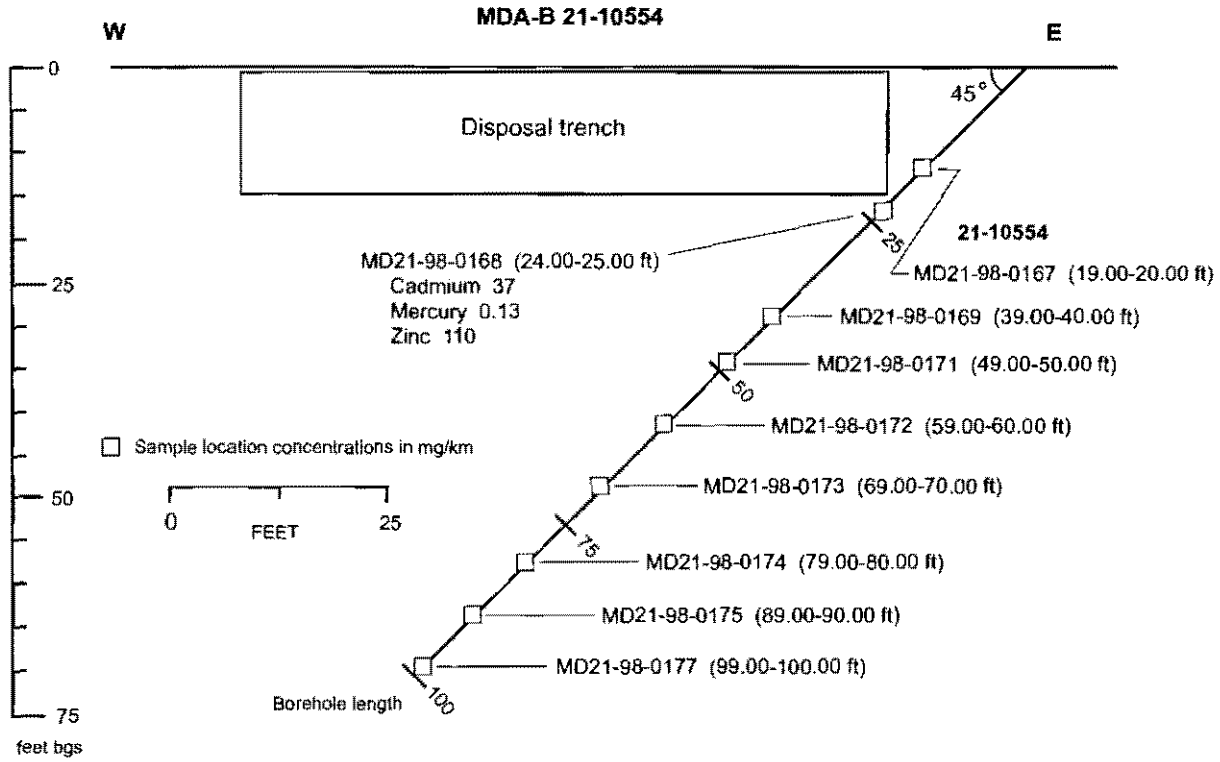


Figure B-35. Schematic profile of MDA B borehole 21-10554 with inorganic chemicals above background

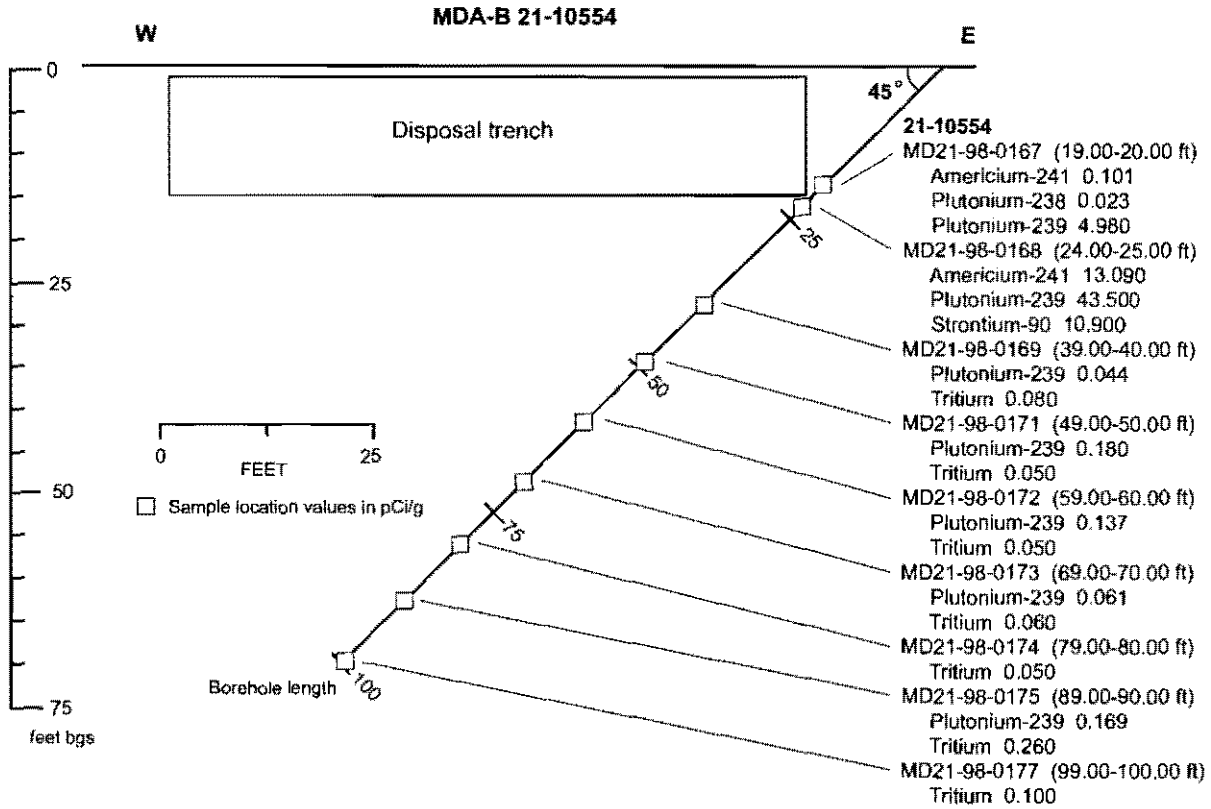


Figure B-36. Schematic profile of MDA B borehole 21-10554 with radionuclides above background

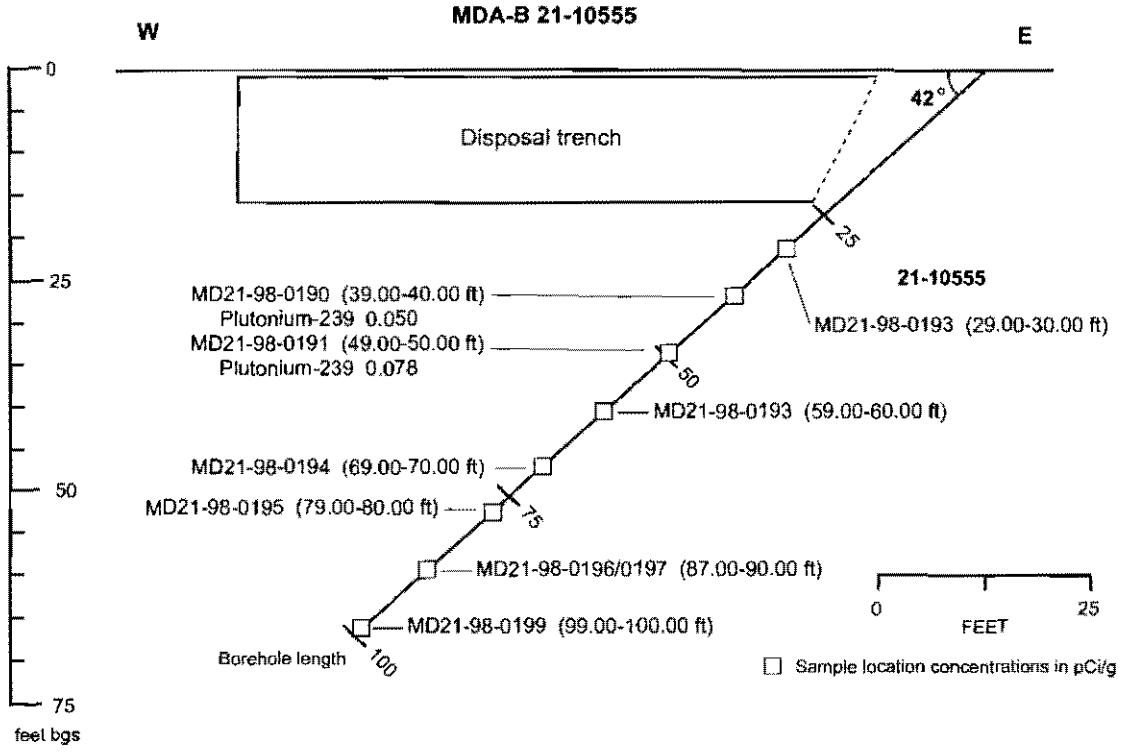


Figure B-37. Schematic profile of MDA B borehole 21-10555 with radionuclides above background

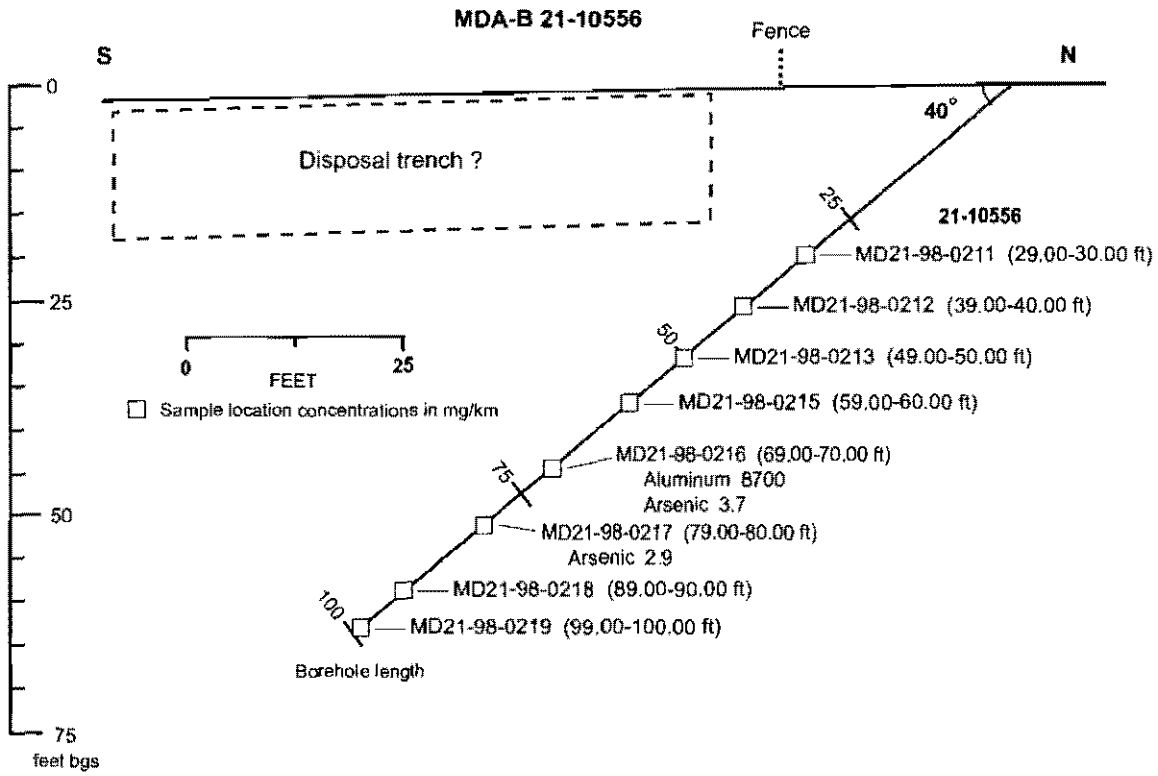


Figure B-38. Schematic profile of MDA B borehole 21-10556 with inorganic chemicals above background

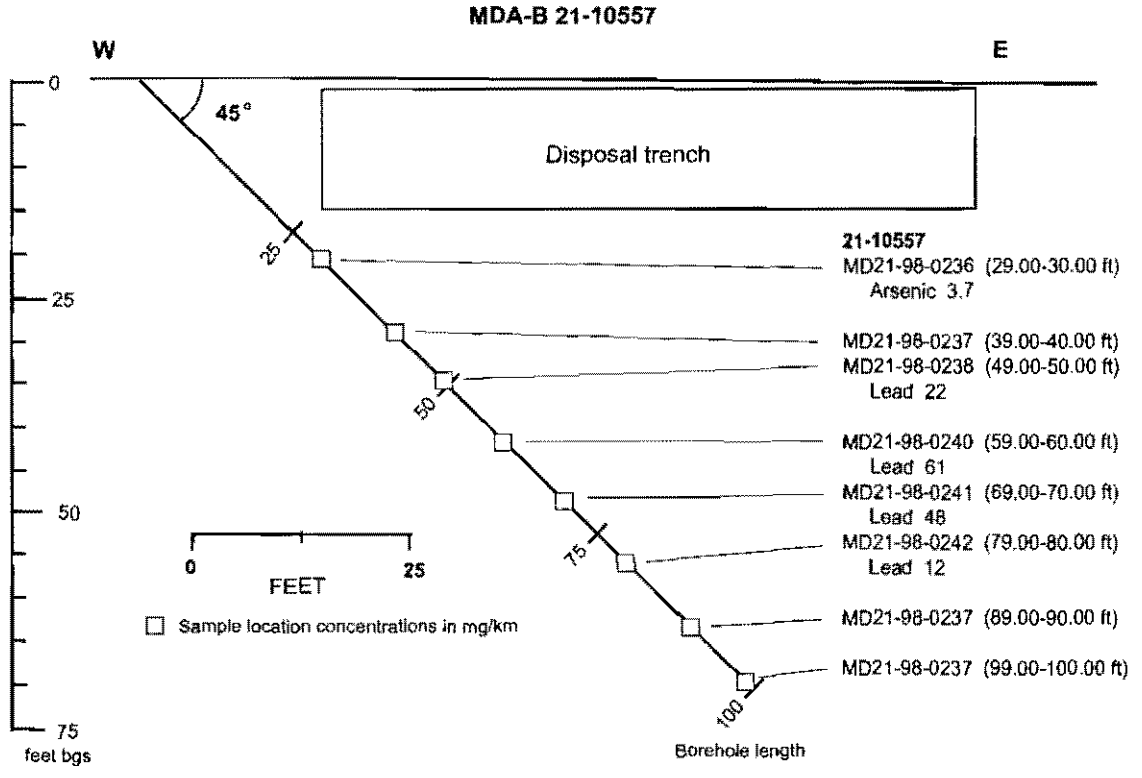


Figure B-39. Schematic profile of MDA B borehole 21-10557 with inorganic chemicals above background

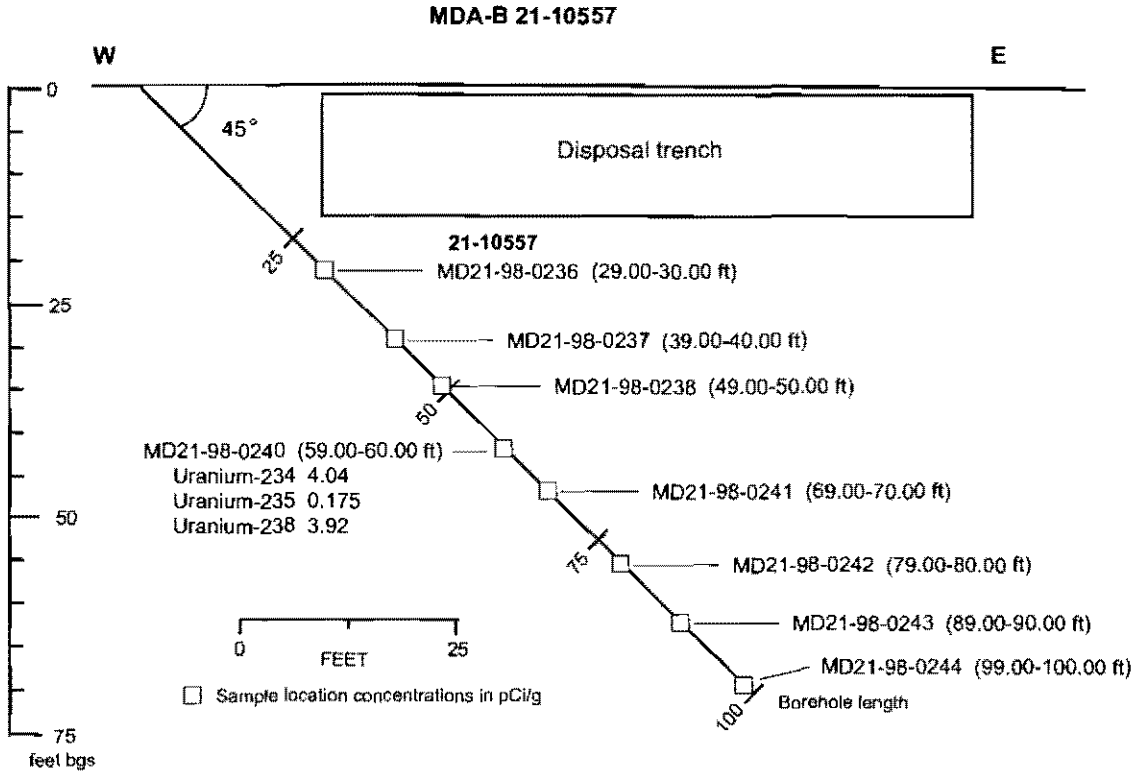


Figure B-40. Schematic profile of MDA B borehole 21-10557 with radionuclides above background

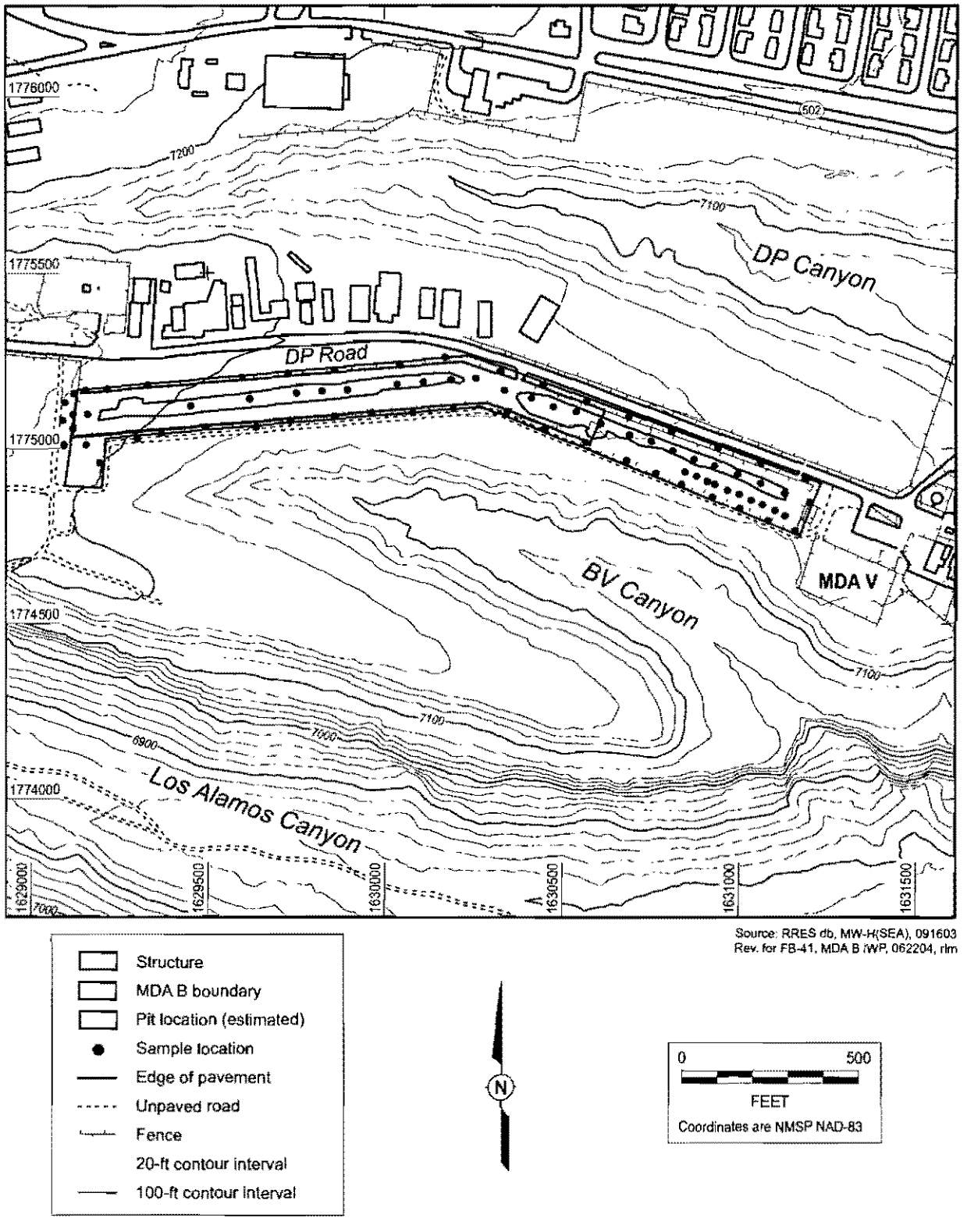


Figure B-41. EMFLUX passive soil gas VOC sample locations

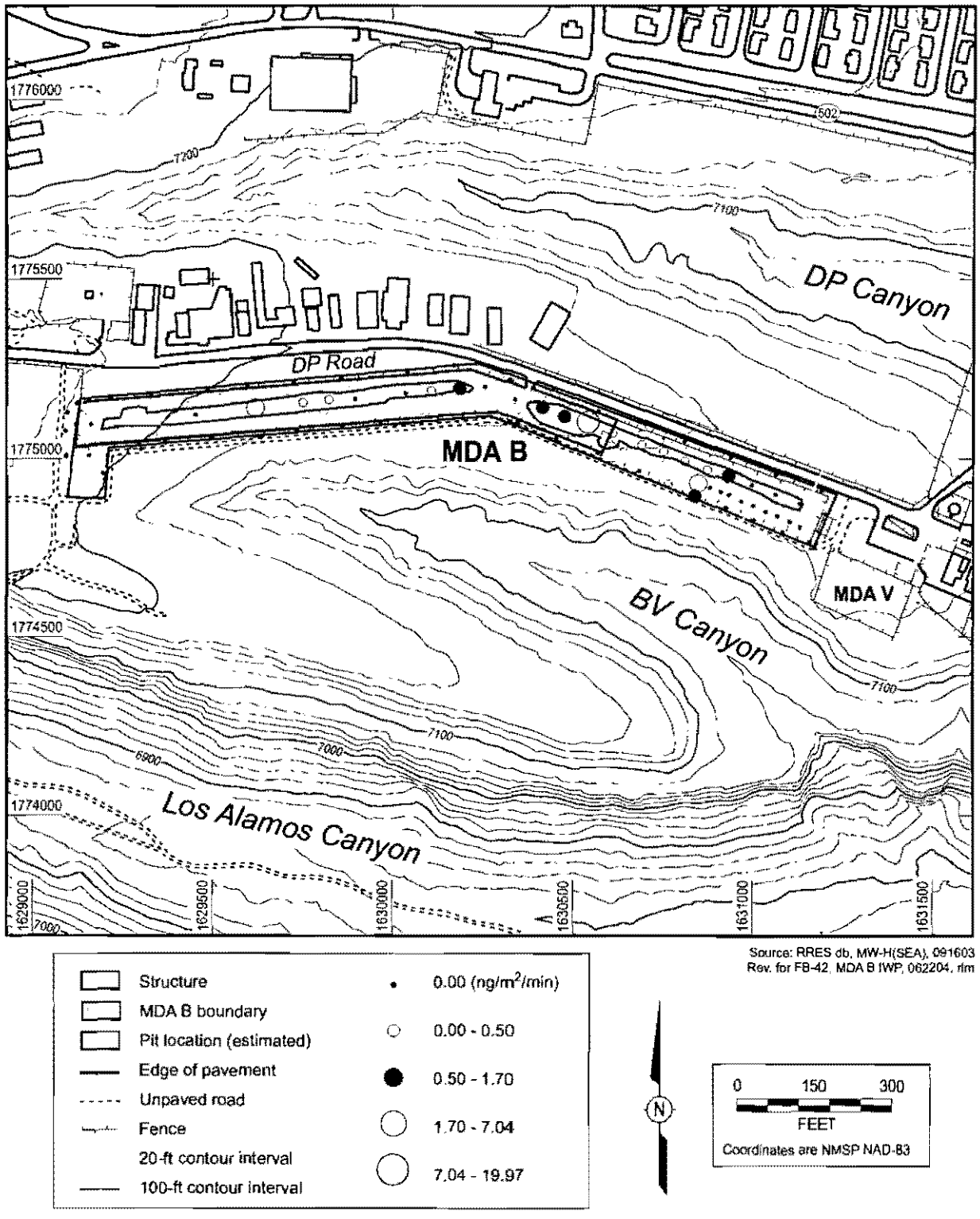


Figure B-42. PCE concentrations in EMFLUX passive soil gas samples

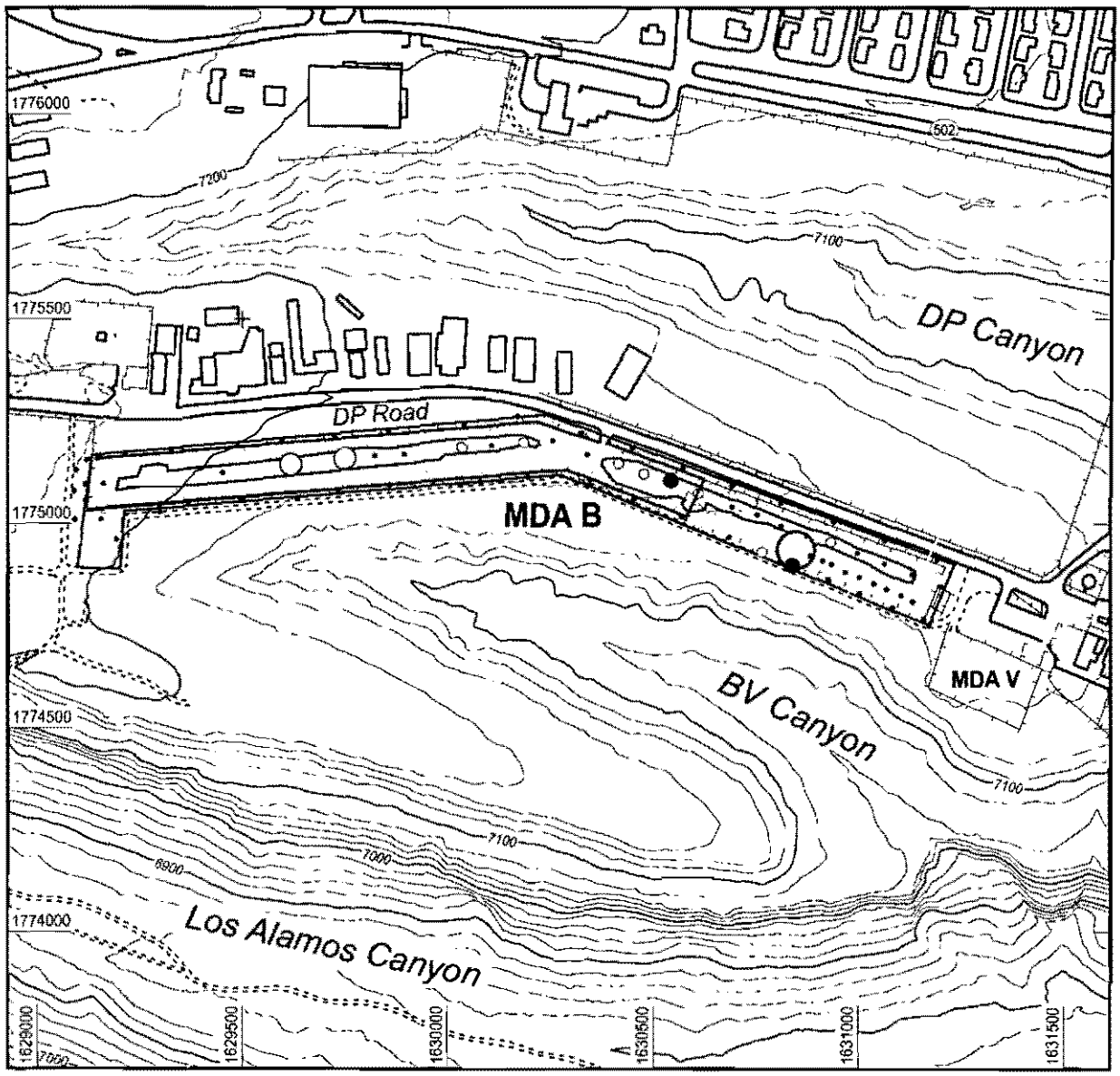


Figure B-43. TCE concentration in EMFLUX passive soil gas samples

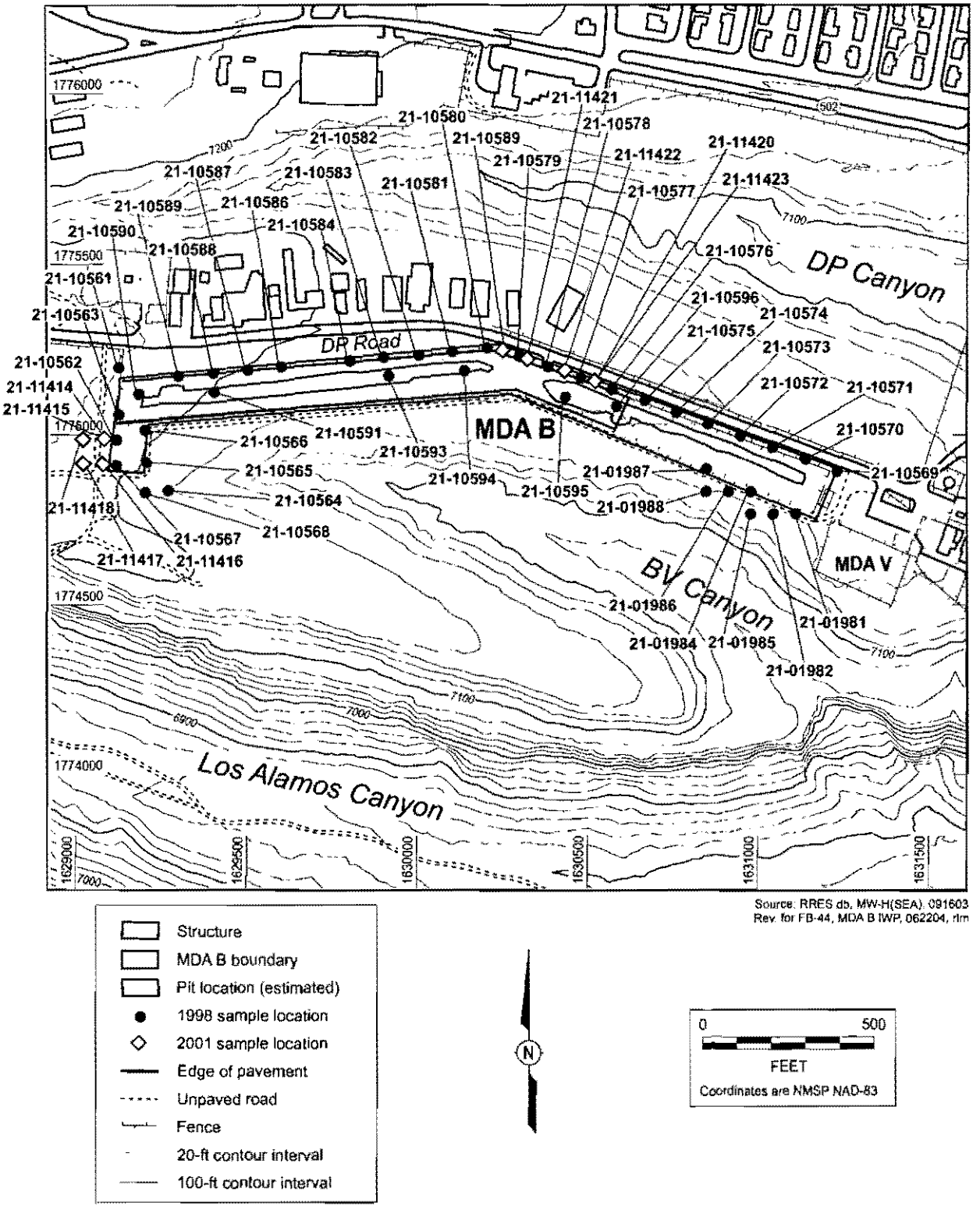


Figure B-44. Locations of 1998 and 2001 surface samples

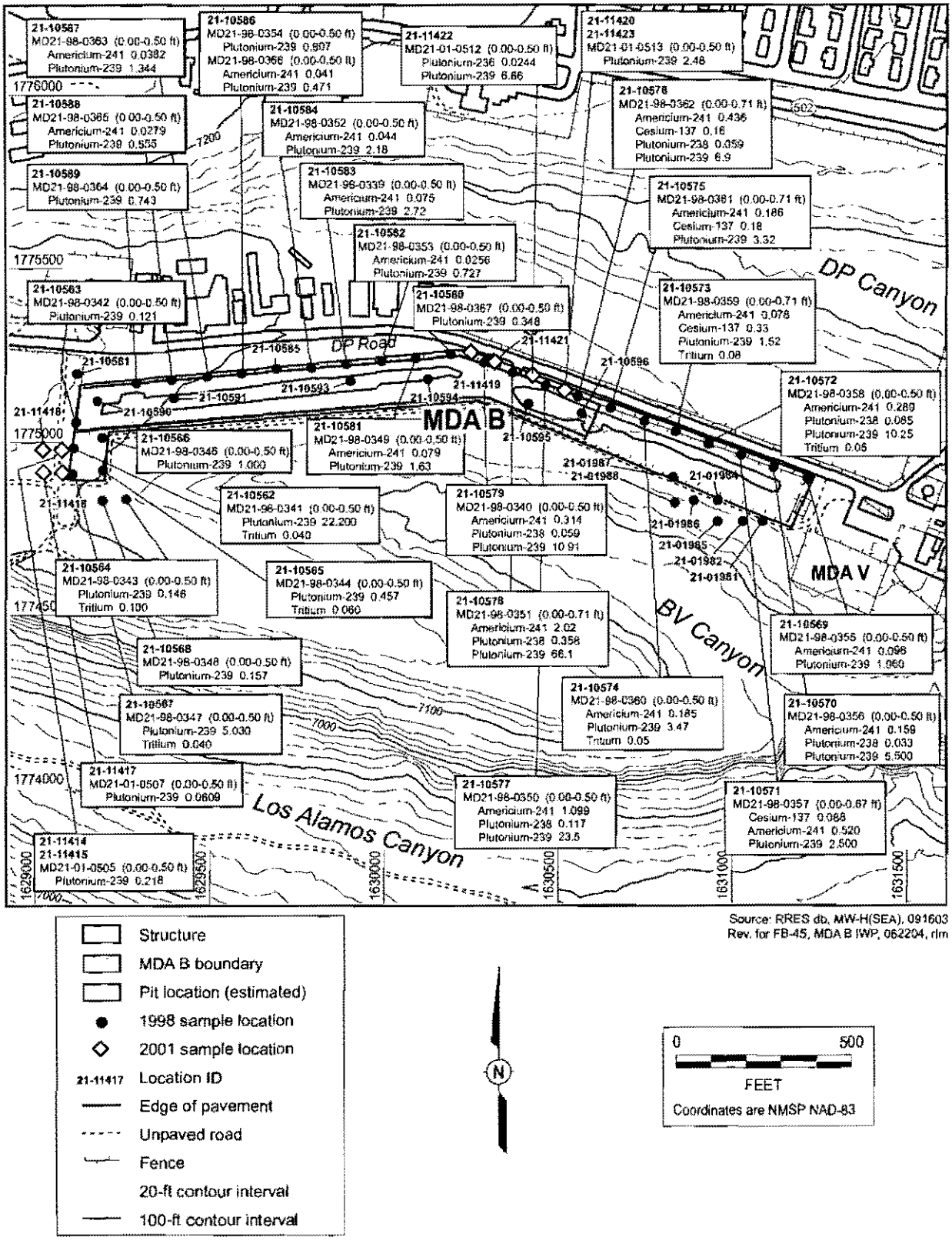
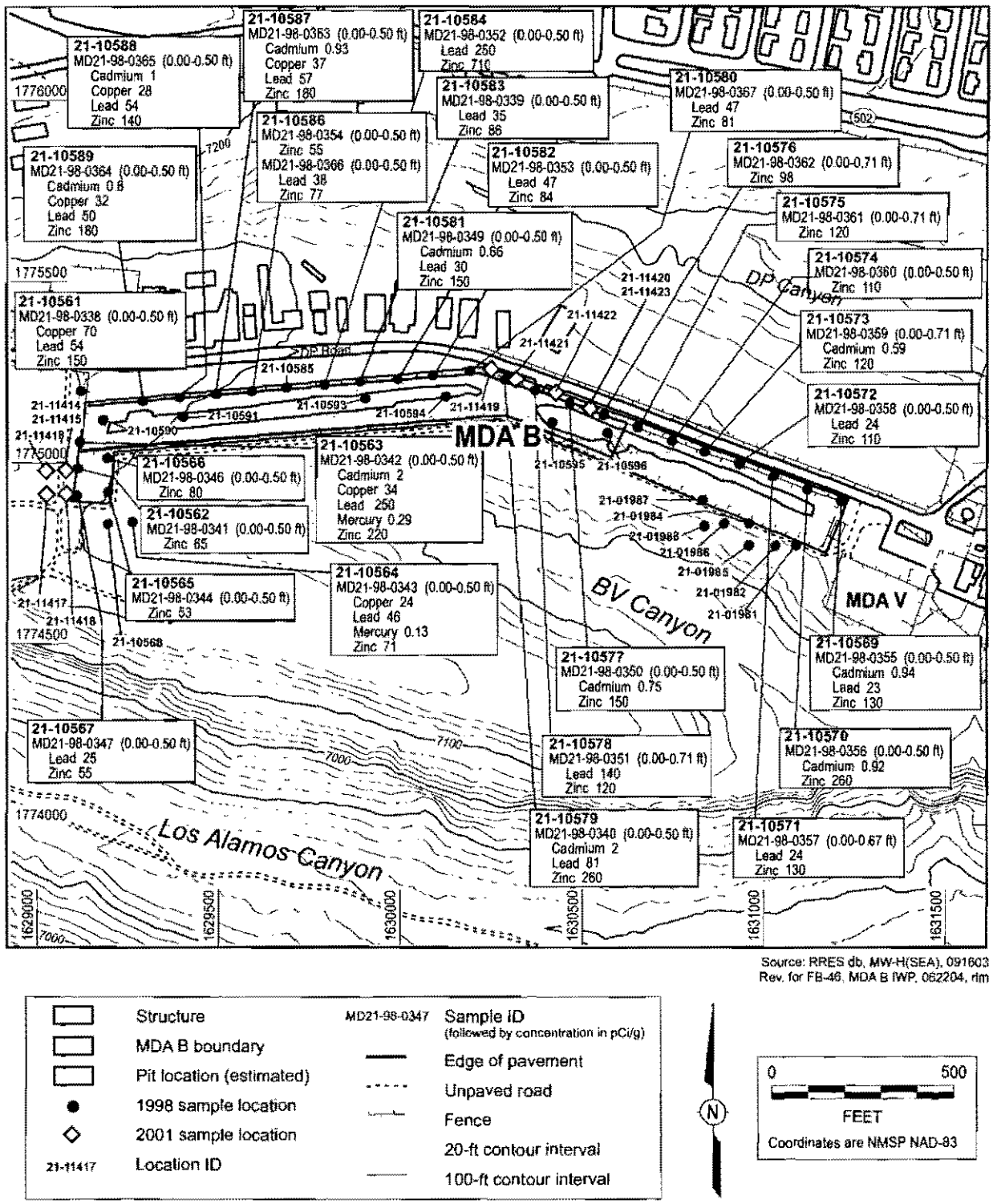


Figure B-45. Radionuclides above background in 1998 and 2001 surface samples



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

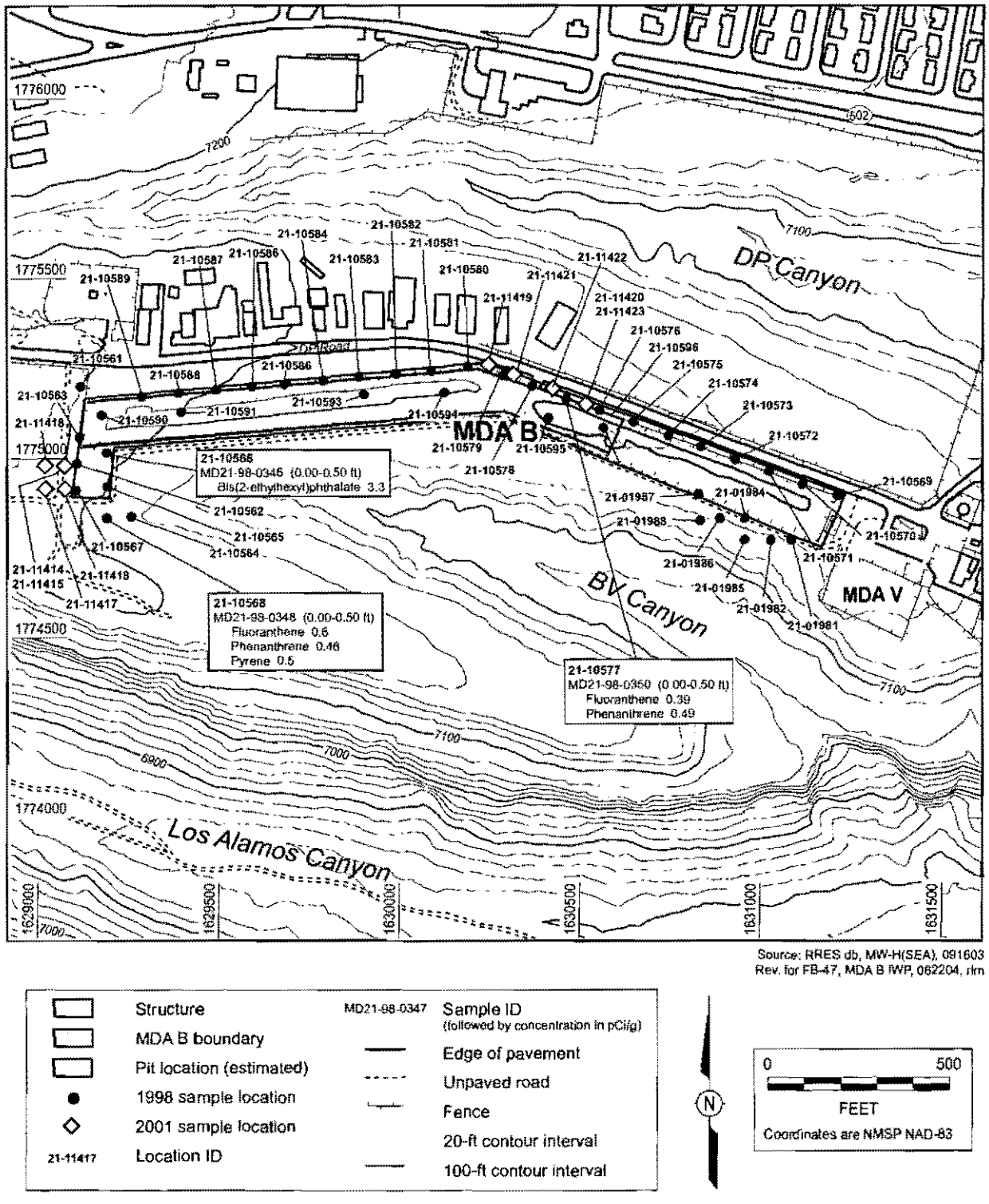


Figure B-47. Organic chemicals above background in 1998 and 2001 surface samples

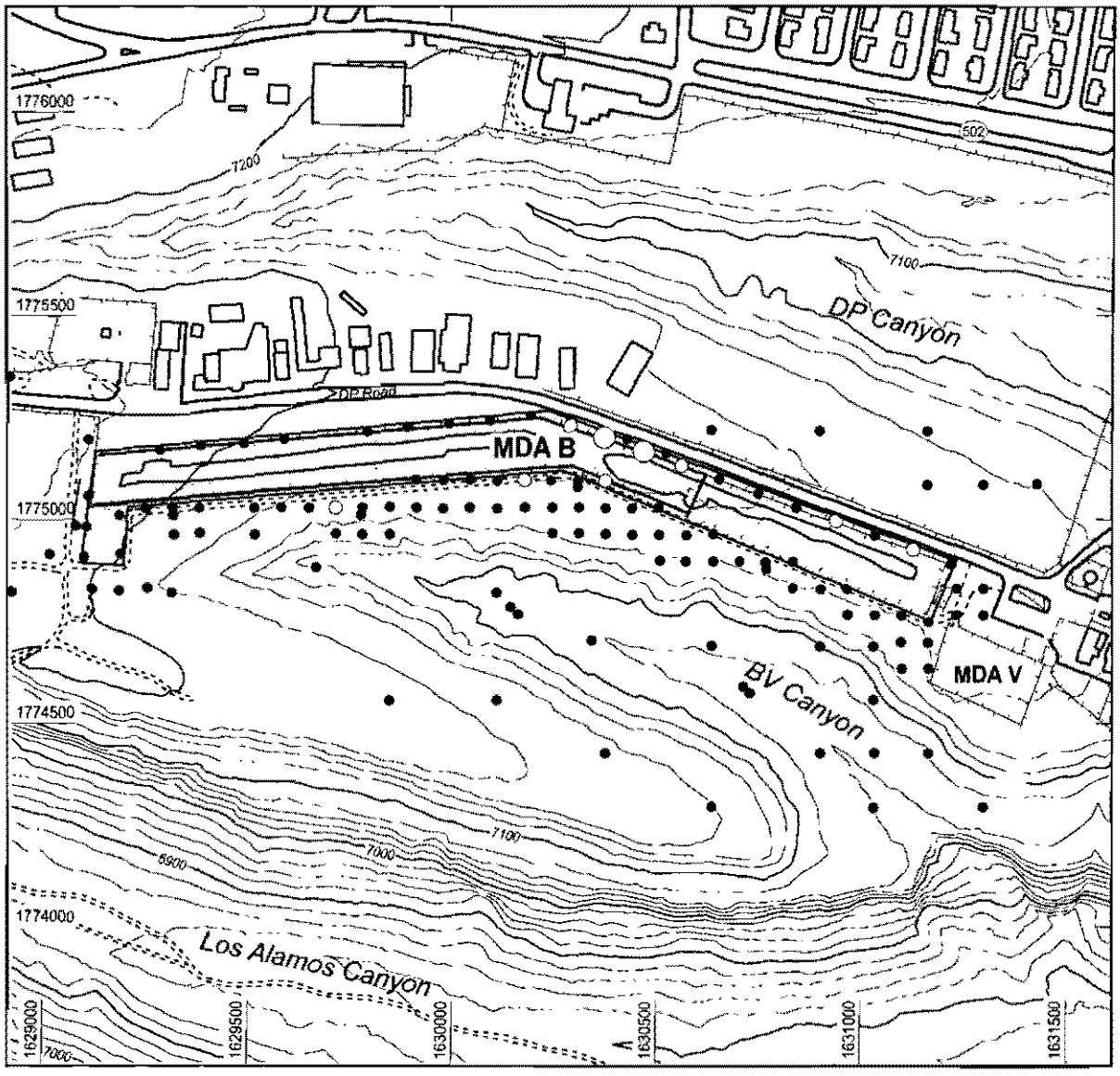


Figure B-48. Distribution of plutonium-238 in surface soils and sediment

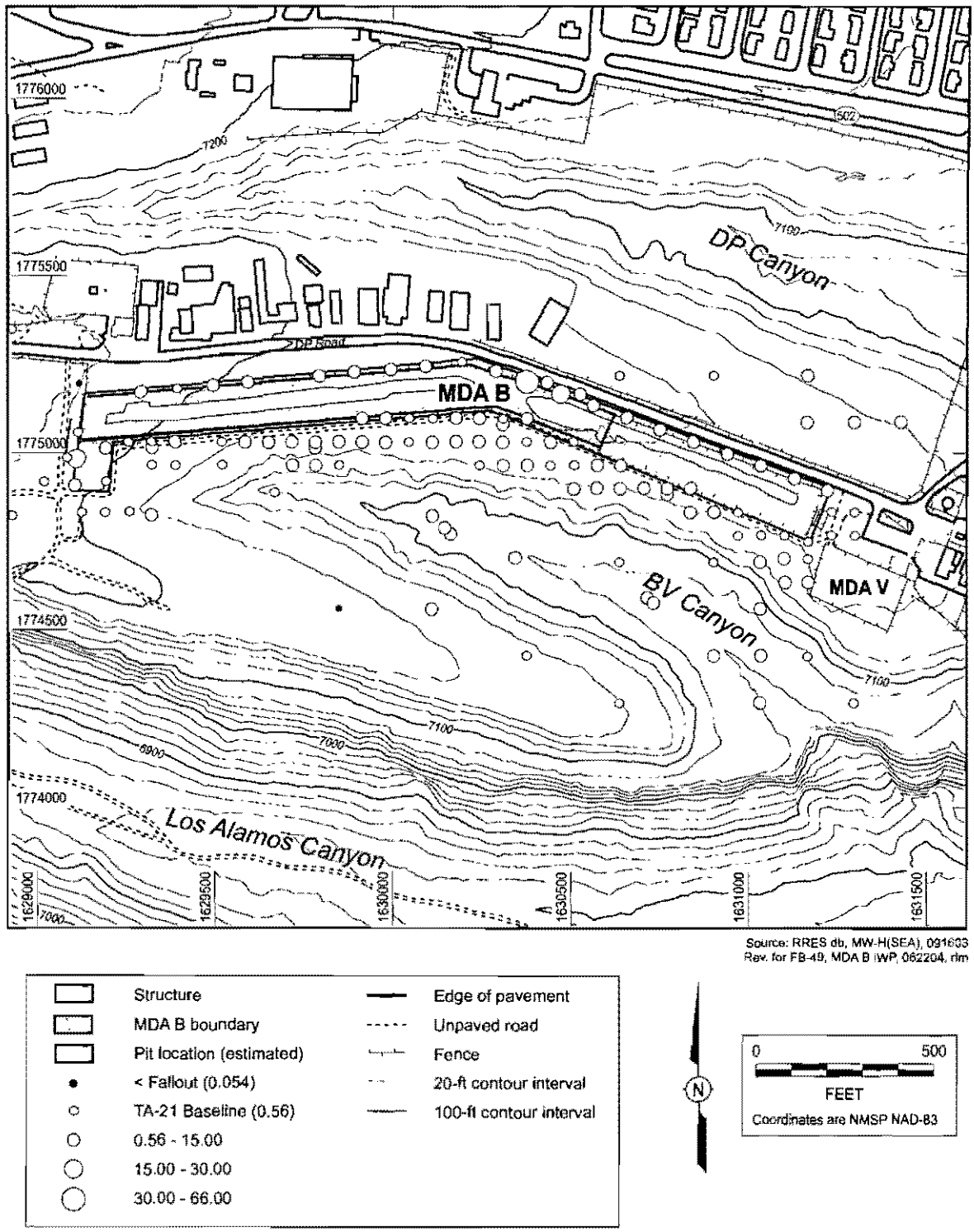


Figure B-49. Distribution of plutonium-239 in surface soils and sediment

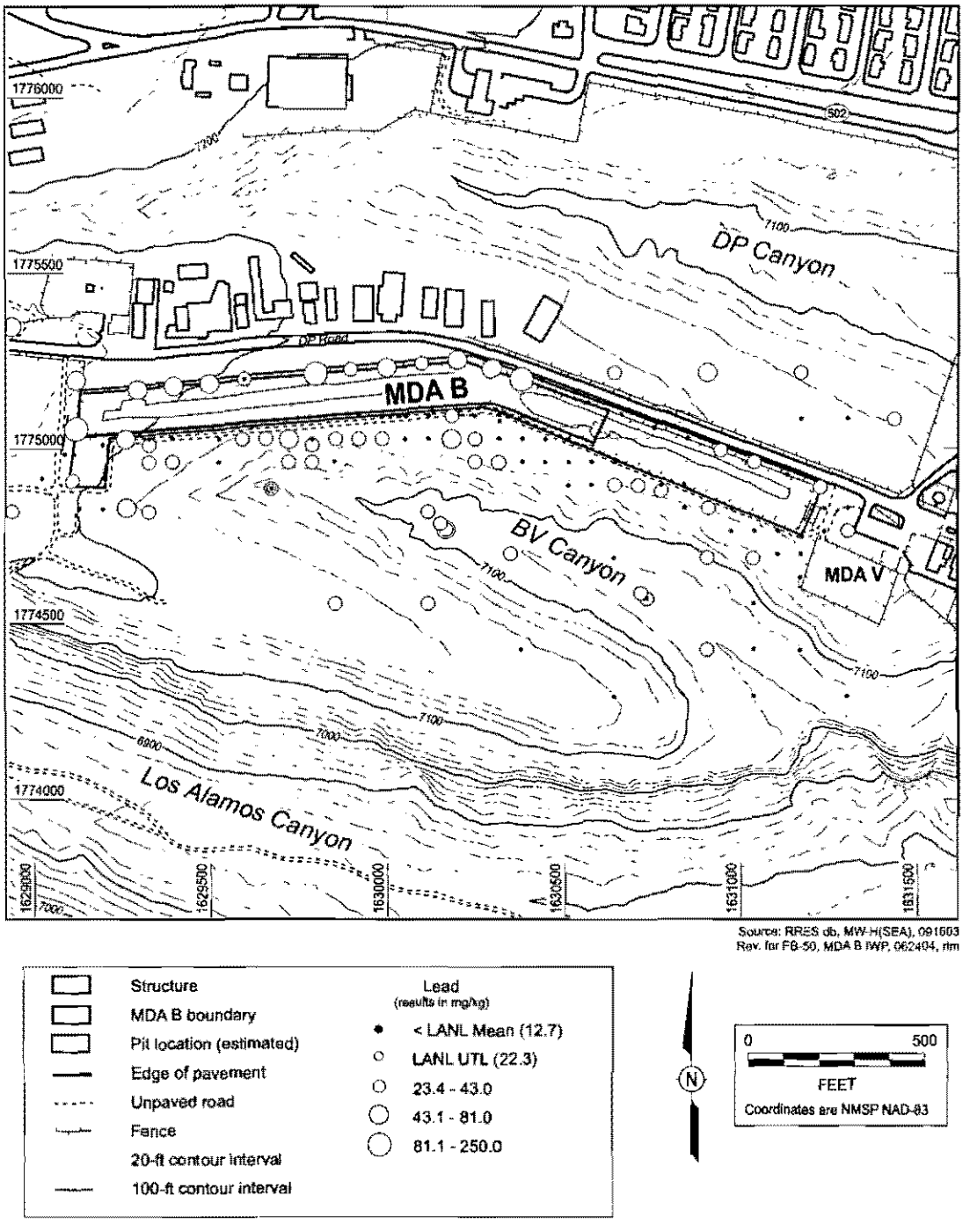


Figure B-50. Distribution of lead in surface soils and sediment

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	4.6	<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, 07529.1)

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	0.8	<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 1968)

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	5.6	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	0.6	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	1.6	<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 1956)

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	1.9	<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 1956)

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	0.6	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	0.8	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	8.40	14.10[c]					
77.06546	BS-7	9.10	5.40	18.90[c]					
77.06547	BS-8	7.30	7.30	37.10[c]					
77.06548	BS-9	11.00[c]	6.50	28.70[c]					
77.06549	BS-10	8.20	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	5.60	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	8.40	8.60	9.40[c]					
77.06557	BS-18	3.00	4.10	17.10[c]					
77.06558	BS-19	5.60	6.10	15.20[c]					
77.06559	BS-20	8.10	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		0.83c	47.60[c]	0.07
77.06562	BS-23	6.20	3.60	23.20[c]					
77.06563	BS-24	3.80	3.80	17.50[c]					
77.06564	BS-25	4.50	5.40	16.60[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, 07529.1)

Table B-5 (continued)

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

Lab. Sample Number	I.D. Number	Gross α 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	0.80[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	6.60[c]	22.10[c]	14.00c	2.10[c]			1.45[c]
77.06575	BS-36	28.00c	7.70	3420.00[c]	0.00	1.75c	0.14c	16.80[c]	1.11[c]
77.06576	BS-37	15.00c	7.40	152.00[c]	4.80[c]	3.70[c]		5.80[c]	1.60[c]
77.06577	BS-38	9.20	7.00	28.20[c]					
77.06578	BS-39	4.00	4.50	14.80[c]					
77.06579	BS-40	2.90	4.30	11.60[c]					
77.06580	BS-41	12.00c	3.30	2.69	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			13.90[c]	4.30[c]				0.89
77.08457	BS-45			13.40[c]	6.80[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			.680	5.10[c]				1.65[c]
77.08461	BS-49			16.60[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]	350.80[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	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]
77.06585	BPS-3	370.00[c]	580.00[c]	7.7	835.00[c]		0.03[c]	22.10[c]	0.89
77.06586	BPS-4	7.10	8.40	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]	0.46
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]	8.30[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. BKGD.[a]	$^{238,240}Pu$ pCi/g .025[a]	^{90}Sr pCi/g .88[a]	^{226}Ra pCi/g .005[b]	Th mg/g	Other
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	0.436±0.013	1.86±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 0.90±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±0.08 ^{137}Cs 0.2±0.2 ^{227}Ac
BS-17	1.12±0.03		1.34±0.10	12.0±.6	1.67±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±0.016		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±0.6 ^{227}Ac
BS-24	1.27±0.03		1.7±0.4	12.4±.6	0.60±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±0.8		1.0±0.3	8.1±.6	0.49±0.06 ^{137}Cs -0.6±0.8 ^{227}Ac
BS-29	0.536±0.018		0.65±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	0.389±0.013		0.6±0.2	11.3±.6	1.24±0.10 ^{137}Cs 0.2±0.3 ^{227}Ac
BS-35	12.8±0.3		1.8±0.4	10.3±.6	1.52±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, 07529.1)

Table B-6 (continued)

TABLE 16.2-IR
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±.8	0.83±0.08 ^{137}Cs 0.3±0.4 ^{227}Ac
BS-43	0.751±0.019	0.77±0.1	1.0±0.3	11.7±.8	0.71±0.07 ^{137}Cs 0.1±0.5 ^{227}Ac
BS-44	0.089±0.006		0.46±0.11	8.7±.8	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±.8	1.95±0.12 ^{137}Cs -0.2±0.4 ^{227}Ac
BS-46	2.874±0.018		0.2±0.6	10.9±.8	2.80±0.19 ^{137}Cs -0.4±0.7 ^{227}Ac
BS-47	0.189±0.009	0.5±0.1	0.8±0.2	10.8±.8	0.52±0.08 ^{137}Cs -0.2±0.6 ^{227}Ac
BS-48	0.198±0.007		1.4±0.3	12.2±.8	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±.8	1.56±0.09 ^{137}Cs -0.2±0.3 ^{227}Ac
BS-50	3.60±0.05		1.30±0.14	12.6±.8	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±.8	1.67±0.10 ^{137}Cs -0.5±0.5 ^{227}Ac
BPS 2			12.9±.09		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		0.96±0.08 ^{137}Cs pci/g 240.0±12.0 ^{241}Am pci/g

[a]Upper limit background levels from Purymun (1987).
[b]The upper limit background level for ^{226}Ra is the same as that for ^{238}U which is from Purymun (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	0.83	0.06	-0.3	0.3
79.04418	BKGD.[d]	1-10	1600	400	3.9	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	0.689	0.005	0.29	0.09	1.4	0.6
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	0.48	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	5.670	0.070	2.06	0.13	-0.4	0.8
79.04427	BS-3	10-30	1800	400	3.9	0.4	0.0040	0.0015	1.168	0.019	0.31	0.16	-1.0	1.5
79.04428	BS-4	0-1	4700	400	7.0	0.7	-0.0019	0.0008	2.160	0.030	1.83	0.12	-0.1	0.8
79.04429	BS-4	1-10	25700	600	5.4	0.5	0.0280	0.0030	3.140	0.040	0.53	0.08	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	0.0180	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, 07529.1)

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	-1900	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	609000	13000	1230	130	0.0043	0.0012	0.0490	0.0030
80.05346	4	Cercocarpus	2400	300	780	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	Gutierrezia	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		Myllotur					-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 tectorum (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	0.2640	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, 07529.1)

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	0.0060	0.0030	0.0210	0.0040	-0.0900	0.0800
81.07124	PITS	LOWER	3500	400	0.0230	0.0080	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	600	400	0.0600	0.0140	0.0270	0.0100	-0.1700	0.1100

a The ± 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, 07529.1)

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

TABLE 18.2-VII
ARITHMETIC MEAN, STANDARD DEVIATION, AND COEFFICIENT OF VARIATION FOR RADIONUCLIDE RESULTS

Sample Type BKGD.[a]	N	Sr (pCi/g dry) X ± 1σ	COV	U (pCi/g dry) X± 1σ	COV .0096[a]	^{137}Cs (fCi/g dry) X± 1σ	COV 2050[a]	$^{239/240}$Pu (fCi/g dry) X± 1σ	COV .23[a]
Ponderosa Pine 5 - growing in waste									
Soil around waste debris (>100 cm)	6	2660±434	0.16	5670±581	0.11	168±287	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±784	0.21
Litter - misc.	1	282		585		423		7210	
Unbagged needles	3	10.4±.812	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	26.2±36.8	1.3	10400±5830	0.56
Bole wood	5	0.631±.0524	0.083	0.385±.195	0.51	6.50±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	2.6	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	5830±793	0.14	1075±389	0.36	5650±7340	1.3
Soil 10 cm	3	2540±386	0.14	5290±497	0.094	289±266	0.92	4720±6160	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	864±702	0.79
Soil 150-180 cm	1	2450		4160		-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	857±526	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±39.8	0.51	13.0±12.1	0.93
Bole bark	11	43.3±35.6	0.82	74.4±80.7	0.62	30.4±35.7	1.2	557±675	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±16.1	1.3	38.3±28.7	0.79	-1.82±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	1.8	997±1940	1.9

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

Table B-10 (continued)

TABLE 16.2-VII (continued)

Sample Type BKGD.[b]	N	Sc (ppb dry) X ± 1σ	COV	U (ppb dry) X± 1σ	COV .0096[b]	^{137}CS (pCi/g dry) X± 1σ	COV 2060[b]	$^{239/240}$Pu (pCi/g dry) X± 1σ	COV .23[b]
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	5.16±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	98.0±63.8	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, Chamise, 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	5680±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	58.5		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	4.66±.646	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±748	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).
[b]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)	+/-	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]	
83.02900	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) 129	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	1.4960	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	88400	1400	4.30	0.40	0.0014	0.0000	0.1300	0.0050
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	1600	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	38100	700	5.5	0.50	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	0.6800	0.0200
83.02913	1L-50m	1-10	89900	1700	4.4	0.40	0.0060	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			8.5	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	800	3.9	0.40	0.0021	0.0010	0.1050	0.0080
83.02924	1U-40m	0-1			6.1	0.50	0.0170	0.0030	3.3300	0.0600
83.02925	1U-40m	1-10			4.6	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	3.6	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	6.5600	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, 07529.1)

Table B-11 (continued)

TABLE 18.2-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]	
83.02932	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	4.8	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	1.5400	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	5.9	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	0.0500
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	1.8	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	500	4.2	0.40	0.0031	0.0010	0.4520	0.0160
83.02955	2U-40m	0-1	85200	1500	4.60	0.50	0.0140	0.0030	2.3300	0.0400
83.02956	2U-40m	1-10	42700	800	4.10	0.40	0.0008	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	57400	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	3.6500	0.0600
83.02961	3L-10m	0-1	(nCi/l) 101.7	1.9	4.70	0.50	0.1230	0.0070	25.500	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	57100	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)	+/-	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]	
83.02967	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	9.60	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	0.3630	0.0130
83.02976	3U-10m	0-1	69600	1200	3.50	0.40	0.0270	0.0040	2.1600	0.0400
83.02977	3U-10m	1-10	87100	1100	3.60	0.40	0.0360	0.0040	5.7300	0.0600
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	1.8	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	84800	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) 184	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	1.8	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	0.0060	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	4.80	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
83.03018	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	43800	800	5.50	0.60	0.0370	0.0050	5.7600	0.0900
83.03020	4U-40m	10-30	14800	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	(nCi/l) 119	14	4.30	0.40	0.0008	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	0.2640	0.0110
82.09376	B-3	0-1	53100	1000	3.60	0.40	0.0060	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	0.0150
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, 07529.1)

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

TABLE 18.2-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	4.18	0.21	0.0120	0.0030	1.2900	0.0500
83.04585	N1E2	0-1	16500	1700	3.67	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	17800	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	3.81	0.18	0.0027	0.0018	0.0021	0.0016
83.04595	N1E8	1-10	8000	900	3.64	0.16	0.0010	0.0018	0.0021	0.0014
83.04596	N1E8	10-30	7800	900	3.98	0.20	0.0008	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	4.18	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	3.67	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	14800	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	0.19	-0.0004	0.0006	0.0027	0.0017

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

Table B-13 (continued)

TABLE 18.2-X
MDA B SURFACE SOIL SAMPLES[a,b]

Sample Number	Sample Location (cm)	Sample Depth	Tritium		Uranium		^{238}Pu		$^{239/240}Pu$	
			Value (pCi/l)	+/-	Value (µg/g)	+/-	Value (pCi/g)	+/-	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	0.0060
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	9600	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	3.85	0.18	-0.0010	0.0020	0.0030	0.0030
83.05632	N3E2	10-30	6500	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	3.88	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	3.58	0.25	-0.0020	0.0020	0.3000	0.0300
83.05643	N3E10	1-10	21000	2000	3.81	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		Uranium		^{238}Pu		$^{239/240}Pu$	
			Value (pCi/l)	+/-	Value (µg/g)	+/-	Value (pCi/g)	+/-	Value (pCi/g)	+/-
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	3.58	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	0.0060	0.0030
83.05657	N3E20	0-1	13100	1400	3.87	0.18	0.0030	0.0020	0.3340	0.0170
83.05658	N3E20	1-10	17100	1800	3.69	0.28	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	1800	3.81	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	0.18	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	0.1870	0.0130
83.05667	N4E14	1-10	19000	2000	3.79	0.19	0.0010	0.0018	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	3.81	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	0.18	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	0.0018	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	0.4800	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	0.1260	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)	+/-	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]	
83.05684	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	4.58	0.23	0.0060	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	3.61	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	16400	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	1800	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	0.3800	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	-0.0008	0.0009	0.0029	0.0013	0.0182	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	0.0567
83.04353	B-2	0-3	8500	900	3.58	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	0.16					0.0530	0.0667
83.04356	B-2	13-18	20000	2000	3.56	0.18	0.0005	0.0010	0.0070	0.0029	0.0463	0.0556
83.04357	B-2	18-23	34000	4000	3.66	0.18	0.0020	0.0010	0.0020	0.0010	0.0330	0.0664
83.04358	B-2	23-28	36000	4000	3.71	0.18	-0.0014	0.0000	0.0003	0.0000	0.0975	0.0474
	(cm)											
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	0.0565	0.0529
83.04348	B-1	33-38			3.81	0.18	0.0004	0.0000	0.0014	0.0000	0.0457	0.0721
83.04349	B-1	38-43			3.60	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	0.0957	0.0281
83.04352	B-1	53-58			3.51	0.18	0.0018	0.0010	0.0110	0.0020	-0.0012	0.0323
83.04359	B-2	28-33			3.63	0.18	0.0007	0.0010	0.0038	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	-0.0005	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, 07529.1)

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]	
84.04058	B-1	0-1	4600	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	1600	300			0.0080	0.0020	1.0700	0.0400
84.04061	B-2	10-18	1600	300			0.0070	0.0020	1.1600	0.0400
84.04062	B-3	0-1	2500	300			0.0220	0.0040	3.6700	0.1100
84.04063	B-3	1-10	2300	300			0.0228	0.0098	7.3900	0.3100
84.04064	B-3	10-25	2100	300			0.0017	0.0014	0.3900	0.0180

[a]Mayfield (1984).
[b]The ± values reported for each radionuclide are analytical laboratory uncertainty.
[c]Upper limit background levels from Purtymun (1987).

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

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	0.0603
Plutonium-239	27	TA-21 B #27	0.052	24	0.813
Plutonium-239	28	TA-21 B #28	0.052	24	0.485
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, 07529.1)

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	[e]	3.91E+02	3.91E+02	[f]	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	8 (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	87400	6 (U)	—	—	4.1	2 (U)	—	—	—	33	25	4 (U)	38000	—	—	28600	38	20 (U)	5.14	80
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	21-01058	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	58	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	6.64	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	[i]	1.52E+03	3.13E+03	4.0E+02	1.6E+03	3.91E+02	[i]	3.91E+02	3.91E+02	[i]	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	23900	—	—	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)[a]	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 Detectedabove 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[c]	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)[e]	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)[g]	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	5.46E+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, B5615.

c EPA Region 9 PRGs table (EPA 2002, 76B66).

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

Investigation-Derived Waste Management

This appendix describes how investigation-derived waste (IDW) generated during the investigation of Material Disposal Area (MDA) B at Los Alamos National Laboratory (the Laboratory or LANL) will be managed. IDW is solid waste generated by field investigation activities and may include, but is not limited to, drill cuttings; purge water; contaminated personal protective equipment (PPE), sampling supplies, and plastic; fluids from the decontamination of PPE and sampling equipment; and all other wastes potentially contacting contaminants. Certain field investigation activities may also displace environmental media, which is defined as naturally occurring material indigenous to the environment and includes groundwater, surface water, surface and subsurface soils, rocks, bedrock, and gravel. According to the US Environmental Protection Agency (EPA) "area of contamination" policy, environmental media are not considered waste (and, hence, not IDW) if they are returned to their points of origin. IDW generated during the investigation of MDA B will be managed in such a manner as to protect human health and the environment, comply with applicable regulatory requirements, and adhere to the Laboratory's waste-minimization goals.

All IDW generated during the field investigation will be managed in accordance with applicable Risk Reduction and Environmental Stewardship–Remediation Services (RRES-RS) standard operating procedures (SOPs). These SOPs incorporate the requirements of all applicable EPA and New Mexico Environment Department regulations, US Department of Energy (DOE) orders, and Laboratory Implementation Requirements. The RRES-RS SOPs that are applicable to the characterization and management of IDW are

- LANL-ER-SOP-1.06, Management of Environmental Restoration Project Waste; and
- LANL-ER-SOP-1.10, Waste Characterization.

These SOPs are among the SOPs applicable to the investigation at MDA B and are available at the following URL: http://erproject.lanl.gov/documents/procedures.html.

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

The waste streams that will be generated and managed during the work at MDA B include

- exploratory trench and pothole spoils;
- PPE, plastic, and other IDW; and
- decontamination fluids.

All wastes will be managed in accordance with applicable federal, state, DOE, and Laboratory requirements. Waste streams, regulatory classification, amounts, and disposal pathways are shown in Table C-1.

Table C-1
Waste Streams from Solid Waste Management Unit (SWMU) 21-015 Investigation Work Plan

Waste Stream	Waste Type	Estimated Volume (yd^3)	Shipped To
Exploratory trench and test pit spoils	Solid waste	400	Los Alamos County landfill, NM
	Industrial or New Mexico special waste	400	Waste Management of Rio Rancho, NM
	Resource Conservation & Recovery Act hazardous waste	100	Envirocare, in Utah, or appropriate treatment/disposal facility via LANL, TA-54
	Low-level radioactive waste	100	LANL, TA-54
	High-level radioactive waste	<1	LANL, TA-54
	Mixed low-level waste	100	Envirocare, in Utah, via LANL, TA-54
	Transuranic waste (TRU), mixed TRU waste	100	Waste Isolation Pilot Plant via LANL, TA-54
PPE, plastic, and other IDW	Solid, low-level waste	6	LANL, TA-54, Area G
Decontamination fluids	Liquid, low-level waste	300	LANL, TA-50, Radioactive Liquid Waste Treatment Facility

The total waste volume from eight exploratory trenches and forty test pits is estimated to be 1200 yd^3. Breakdown of waste types and volumes is entirely speculative. The waste characterization for the work plan–related waste streams will be based on historical documents, process knowledge, and professional judgement.

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

The selection of waste containers will be based on the appropriate Department of Transportation requirements and the type and amount of IDW planned to be generated. Immediately following containerization, each waste container will be individually labeled by waste classification, item identification number, radioactivity (if applicable), and date generated. Waste containers will be managed in clearly marked and appropriately constructed waste accumulation areas. Waste accumulation area postings, regulated storage duration, and inspection requirements will be based on the type of IDW and its classification. Container and storage requirements will be detailed in the WCSF and approved prior to waste generation.

Appendix D

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	2.5/2.5		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 (25-30 ft)	NDA			
30	2.4/2.5		NDA			
	2.4/2.5		NDA			
35	2.4/2.5	MD21-98-0104 Soil Gas (30ft)	NDA			
	2.4/2.5		NDA			
40	2.4/2.5	MD21-98-0102 Core (35-40ft)	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 (45-50ft)	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 (85-90ft)	NDA			
	2.5/2.6		NDA			2-5 mm wide brown clay filled fracture (83-84 ft)
90	2.5/2.5		NDA			
	2.5/2.5	MD21-98-0108 Core (99-100 ft)	NDA			
95	2.5/2.6	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.)	Analytical 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			
10	2.5/2.5		NDA	Fill: Grey unconsolidated tuff fill material with cobbles of basalt10-20 mm at 24ft.		
15	2.5/2.5		NDA			
20	2.5/2.5		NDA			
25	2.0/2.5		NDA			
30	5/2.5		NDA	QBT3: Grey poorly to non-welded tuff, fragments of pumice 2-5 mm, phenocrysts of quartz and sanidene 10-20%.		
35	2.5/2.5		NDA			
40	2.5/2.5		NDA			
45	2.5/2.5		NDA			
50	2.5/2.5		NDA			
55	2.0/2.5	MD21-98-0123 Core (29-39 ft)	NDA			
60	2.0/2.5		NDA			
65	2.0/2.5	MD21-98-0126 Soil Gas (5ft)	NDA			
70	2.0/2.5		NDA			
75	2.5/2.5	MD21-98-0124 Core (39-49 ft)	NDA			1-3mm fractures (39-40ft)
80	2.3/2.5		NDA			
85	2.2/2.5		NDA			
90	2.2/2.5	MD21-98-0125 Core (49-59 ft)	NDA			
95	2.2/2.5		NDA			
100	2.1/2.5		NDA			
	2.1/2.5		NDA			
	2.1/2.5		NDA			
	2.4/2.5	MD21-98-0127 Core (59-69 ft)	NDA			
	2.1/2.5		NDA			
	2.1/2.5		NDA			2-5mm fracture with iron staining (61-62ft)
	2.1/2.5		NDA			
	2.1/2.5	MD21-98-0128Core (69-79 ft)	NDA			
	2.1/2.5		NDA			
	2.1/2.5		NDA			
	2.1/2.5	MD21-98-0132 Soil Gas (74ft)	NDA			1-3mm brown clay filled fracture (74-75ft)
	2.1/2.5		NDA			
	2.1/2.5	MD21-98-0129 Core (79-89 ft)	NDA			
	2.1/2.5		NDA			
	2.1/2.5	MD21-98-0130 Core (89-99 ft)	NDA			
	2.3/2.5		NDA			
	2.5/2.5	MD21-98-0131 Core (99-100 ft)	NDA			
	2.5/2.5		NDA			
	2.5/2.5	MD21-98-0130 Soil Gas (100ft)	NDA			
	2.5/2.5		NDA			

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	MD21-98-0145Soil Gas (35ft)	NDA			
	2.5/2.5		NDA			
40	2.5/2.5	MD21-98-0148 Core (39-40ft)	NDA			
	2.5/2.5		NDA			1-3mm brown clay filled fractures (45-47ft)
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		NDA			
80	2.5/2.5	MD21-98-0153 Core (79-80ft)	NDA			
	2.5/2.5		NDA			
85	2.5/2.5		NDA			
	2.5/2.5		NDA			
90	2.5/2.5	MD21-98-0155 Core (89-90ft)	NDA			1-3mm brown clay filled fractures and iron staining (92-95ft)
	2.5/2.5		NDA			
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.)	Analytical 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		alpha 250cpm beta & gamma 160cpm (17.5 ft)			
20	2.5/2.5	MD21-98-0167 Core(19-20ft)				
	2.5/2.5		5.9 ppm PID			1-3 mm wide fractures, vinegar-like odor (22-25ft)
25	2.0/2.5	MD21-98-0168 Core(24-25ft)				
	2.0/2.5		NDA			
30	2.0/2.5		NDA			
	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%.		
35	2.0/2.5	MD21-98-0170 Soil Gas (33ft)	NDA			
	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	MD21-98-0175 Soil Gas (75ft)	NDA			1-3 mm wide brown clay filled fractures and iron staining (76-79 ft)
	2.5/2.5		NDA			
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	MD21-98-0176 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		NDA			
	2.8/2.5	MD21-98-0182 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-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	MD21-98-0188 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		NDA			
90	2.5/2.5	MD21-98-0196D197 Core(87-90ft)	NDA			
	2.5/2.5		NDA			
95	2.5/2.5	MD21-98-0198 Core(99-100ft)	NDA			
	2.5/2.5		NDA			
100	2.5/2.5	MD21-98-0196 Soil Gas (100ft)	NDA			

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.)	Analytical 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			
	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%.		Small white clay filled fractures 1mm wide
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		NDA			
	2.5/2.5	MD21-98-0214 Soil Gas (35ft)	NDA			Small brown clay filled fractures 1mm wide(35-37 ft)
40	2.5/2.5	MD21-98-0212 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	MD21-98-0213 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	MD21-98-0215 Core(59-60ft)	NDA			Small brown clay filled fractures 1mm wide(55-57 ft)
	2.5/2.5		NDA			
65	2.5/2.5		NDA			
	2.5/2.5		NDA			
70	2.5/2.5	MD21-98-0216 Core(69-70ft)	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			
85	2.5/2.5		NDA			Iron staining at 83-85ft
	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			
	2.5/2.5	MD21-98-0220 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 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%.		
15	1.5/2.5		NDA			
20	2.0/2.5		NDA			
25	2.0/2.5		NDA			
30	2.2/2.5		NDA			
35	2.5/2.5		NDA			Brown clay filled fracture zone (21- 22.5ft)
40	2.5/2.5		NDA			
45	2.5/2.5		NDA			
50	2.5/2.5		NDA			
55	2.5/2.5		NDA			
60	2.5/2.5		NDA			
65	2.5/2.5		NDA			
70	2.5/2.5		NDA			
75	2.5/2.5		NDA			
80	2.5/2.5		NDA			
85	2.5/2.5		NDA			
90	2.5/2.5		NDA			
95	2.5/2.5		NDA			
100	2.5/2.5		NDA			

Appendix E

Phase I RFI Data
(see enclosed CD)