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# Investigation Work Plan for Material Disposal Area T at Technical Area 21, Solid Waste Management Unit 21-016(a)-99

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Prepared by
Risk Reduction and Environmental Stewardship–Remediation Services

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## EXECUTIVE SUMMARY

This work plan (WP) presents investigation activities required to complete the Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) of Material Disposal Area (MDA) T, Solid Waste Management Unit (SWMU) 21-016(a)-99, at Technical Area (TA)-21 at the Los Alamos National Laboratory (LANL or the Laboratory). This work plan also includes a summary description of sampling activities and analytical results for the historical RFI at MDA T. The investigation activities described in this WP are designed to address investigation objectives remaining after past RFI fieldwork was conducted at MDA T.

MDA T is located within TA-21 on Delta Prime (DP) Mesa, south of the North Perimeter Road and DP Canyon. The location is less than a quarter-mile east from the intersection of the North Perimeter Road and DP Road. MDA T consists of 4 absorption beds and 64 shafts, constructed in the Tshirege Member of the Bandelier Tuff, with depths ranging from approximately 4 to 65 ft below the original ground surface. MDA T is fenced to restrict access and covers an area of 2.2 acres. The regional aquifer is approximately 1200 ft below the surface of the MDA.

RFI sampling activities, conducted from 1992 through 1997, include the following:

- *Surface Soil and Fill.* 360 samples were collected for the purpose of field screening and fixed-laboratory analysis for radionuclides (analysis included one or more of the following: gamma-emitting radionuclides by gamma spectroscopy, tritium, uranium isotopes, plutonium isotopes, strontium-90, and americium-241), semivolatile organic compounds (SVOCs), volatile organic compounds (VOCs), and inorganic chemicals.
- *Subsurface Tuff.* 33 vertical and 3 angled boreholes were drilled to collect tuff samples. Core samples were collected every 5 ft and analyzed for SVOCs, and every 10 ft for radionuclides (gamma-emitting radionuclides by gamma spectroscopy, tritium, strontium-90, americium-241, total and isotopic uranium, and isotopic plutonium) and metals.

The objectives of the RFI at MDA T, as defined in the RFI Work Plan for Operable Unit 1106, were to determine if a release of hazardous constituents and/or radionuclides had occurred and, if so, to establish the nature and extent of such releases in the environment. Environmental data generated during historical RFI sampling were analyzed in accordance with these objectives. These analyses consisted of comparisons of site data with background concentrations in environmental media and the following contaminant releases were identified:

- Americium-241, plutonium-238, and plutonium-239 were elevated with respect to background values (BVs) in the surface soil and shallow subsurface extending to DP Canyon.
- Numerous metals were detected above BV in one or more samples in soil and subsurface tuff samples collected from boreholes located in the disposal area. Elevated levels detected above BV for cadmium, copper, and nickel were found near the influent line for Building 035 and in a sample from 5 to 10 ft at location 21-02547.

The Phase I RFI data were evaluated to determine if additional data are required to complete the characterization of the nature and extent of contamination. Additional data requirements include the following:

1. A site-wide radiation mapping survey is needed to document present surface conditions and to help focus sample collection activities. Based on the ubiquitous low levels of radionuclides present in soils within and surrounding TA-21 and the contaminants associated with MDA T, the

DP Canyon slope area to be characterized, the MDA T disposal complex, and the areas 50 ft outside the characterization study area should be surveyed using a Fidler detector coupled with a global positioning system unit and gross gamma NaI detector.

2. Nature and extent data are needed for the DP Canyon slope. Fourteen locations will be sampled. Samples will target the existing drainages where most of the surface flow would have concentrated from MDA T site run-off. Additional samples will characterize the entire area and allow for hazardous constituent and radiological evaluation.
3. Analytical data are needed to complete characterization of releases from the absorption beds and shafts. Samples will be collected from the two angled and three vertical boreholes proposed around and beneath the absorption beds and shafts. To better characterize the fracturing, the angled boreholes will be continuously cored down to and through the top of the Cerro Toledo interval of the Quaternary Bandelier tuff. Porosity, moisture content, permeability tests, and matrix suction will be performed on core samples collected from the angled boreholes and the vertical boreholes. Vapor samples using SUMMA canisters for VOCs and silica absorbents for tritium will be collected from two depths in the deep angled boreholes and one deep vertical borehole in order to document beneath the absorption bed and shafts. The presence of perched water and bedrock fractures will also be evaluated in the deep boreholes.
4. Characterization of the area surrounding Building 257 and associated structures is needed. Three vertical and three angled boreholes will be sampled for chemical and radiological constituents. Tritium vapor will also be sampled to assess if ongoing operations have released tritium to the subsurface.
5. Nature and extent must be defined for Building 035. Seven vertical boreholes are planned to define nature and extent around the former structure. Boreholes need to be drilled and sampled in the areas of elevated americium and plutonium near the southeast and southwest corners of Building 035 to confirm the results of the 1994 sampling and provide the appropriate analytical results. Step-out boreholes from the southeast and southwest corners of the building will also be required.

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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 Department of Energy (DOE) and managed by the University of California. The Laboratory (Figure 1) is located in north-central New Mexico approximately 60 miles northeast of Albuquerque and 20 miles northwest of Santa Fe. The Laboratory site covers 40 square miles 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 between approximately 6200 and 7800 ft. The Technical Area (TA)-21 industrial development is shown on Figure 2.

The Laboratory's Risk Reduction and Environmental Stewardship–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 development. The goal of the RRES-RS Project 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 RRES-RS project investigates sites that were potentially contaminated by past Laboratory operations. The Material Disposal Area (MDA) T site including consolidated Solid Waste Management Unit (SWMU) 21-016(a)-99 (Figure 3) has both hazardous and radiological components and is comprised of SWMUs 21-016(a-c), 21-011(a,b,d,e,f,g,i,j), 21-011(c), and 21-010(a,h) and Areas of Concern (AOCs) C-21-002, 21-028(a), C-21-034, C-21-035, C-21-036, C-21-037, 21-001, 21-011(h), C-21-005, C-21-007, C-21-003, C-21-009, and C-21-012. A summary of the SWMUs and AOCs for MDA T is in Appendix B, Table B-1.

The New Mexico Environment Department (NMED) enforces the Hazardous and Solid Waste Amendments (HSWA) Module of the Laboratory's Hazardous Waste Facility Permit, hereafter referred to as Module VIII. Module VIII specifies conditions and requirements for investigation and cleanup activities performed by RRES-RS at the Laboratory. The Environmental Protection Agency (EPA) issued Module VIII on May 23, 1990, and revised it on May 19, 1994 (EPA 1990, 1585; EPA 1994, 44146). NMED is currently revising the Hazardous Waste Facilities Permit.

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

## 1.2 Investigation Objectives

The purpose of this proposed investigation is to meet investigation objectives identified from assessment of the historical data for MDA T in order to determine the nature and extent of contamination as well as to provide general site characterization data for Corrective Measures Evaluations.

This plan will

- describe the rationale for proposed data collection activities; and
- identify and propose appropriate methods and protocols for collecting, analyzing, and evaluating data to finalize characterization efforts at MDA T.

The work plan (WP) presents information from the 1992, 1993–1994, and 1996–1997 field investigations (Appendix B), used as a basis for developing additional field investigations to define the nature and extent of site contamination and to characterize the site stratigraphy and structural elements.

## 2.0 MDA T BACKGROUND

The following discussions in Sections 2.1 through 2.9 review historical and current characteristics of MDA T. Refer to the attached historical investigation report (HIR) (Appendix B) for a complete review of MDA T's structural and operational history.

### 2.1 Historic Features and Operational History

The operational history of consolidated SWMU 21-016(a)-99 is complex, beginning in 1945 with disposal of industrial wastewater from the plutonium processing facility into absorption beds [SWMU 21-016(a)]. An industrial wastewater treatment plant (Building 035) [SWMU 21-010(a)] was constructed in 1952 to improve the absorption characteristics of the wastewater. Building 035 included a citric acid tank, the contents of which may have included perchlorates.

The absorption beds were in operation from 1945 to 1950. When the amounts of wastewater discharged to the beds reached several thousand gallons per day, the beds became congested and were taken out of service. Treated wastewater was then discharged to an outfall to Delta Prime (DP) Canyon at what is now SWMU 21-011(k).

From 1952 to 1967, it was still possible for the absorption beds to receive wastewater, and small amounts may have been discharged to them during this timeframe.

Two industrial wastewater treatment plants processed waste water in Buildings 035 (removed) and 257 (active). Plutonium-processing acid wastewater was treated and disposed of at MDA T along with process wastewater from the tritium facility. Although Building 035 was decommissioned in 1967, pre-treatment of wastewater from the Tritium Systems Test Assembly (TSTA) continues to be performed at Building 257 prior to disposing the water at TA-50.

In 1967, the new wastewater treatment plant (Building 257) [SWMU 21-011(a)], was completed and replaced Building 035. With operations of Building 257 started, no further discharge of wastewater to the beds occurred.

From 1968 to 1974, approximately 64 disposal shafts [SWMU 21-016(c)] were installed between the disposal beds. Eight-ft diameter disposal shafts were installed and filled with cement-treated americium waste. As these shafts were filled and capped, additional smaller (4-ft and 6-ft) diameter shafts were installed between the larger shafts.

In 1974, a retrievable waste storage area was constructed to provide a method for temporarily storing cement-treated transuranic waste in corrugated metal pipes. The retrievable waste storage area (RWSA) [SWMU 21-016(b)] was 120 ft long, 24 ft wide, and 19 ft deep. The RWSA held a total of 227 corrugated metal pipes (CMPs), which were removed in 1984 (69 pipes) and 1986 (158 pipes).

High-efficiency particulate air filter (HEPA)-equipped incinerators (called salamanders) burned contaminated tricresyl phosphate (TCP) or tributyl phosphate (TBP) mixed with kerosene waste oil from 1964 to 1967 and 1970 to 1972.

The area of the absorption beds, disposal shafts, and RWSA were backfilled and the site was graded to drain towards the north in 1986. No further waste disposal activities took place at SWMU 21-016(a)-99.

## 2.2 Waste Inventory

Disposal shafts contain the only wastes remaining. All other contaminants represent contamination from the various disposal activities, including operation of the absorption beds.

Radionuclides present at MDA T in nonretrievable waste disposal shafts are plutonium-238, plutonium-239, plutonium-240, americium-241, uranium-238, and uranium-235. Each shaft varies in composition and volume of waste. It is not always possible to define the inventory for a specific shaft.

Uncharacterized low-activity waste streams disposed in the shafts include wash-down solids, rinse solids, and wash and rinse water. Values for these low-activity waste streams should be small. It appears that the waste was generated as a result of processing a number of different feed materials, so there may be considerable variability in the composition within a shaft as well as throughout the shaft complex.

Cement-treated waste has highly variable mass ratios of plutonium-239 to americium-241. On an activity basis, more americium-241 is present than plutonium-239 in cement-paste waste. Overall, present day mass ratios and activity ratios are estimated from data presented in Appendix B, Table B-1. Present day inventory totals are estimated in Appendix B (Table B-9).

## 2.3 Relationship to Other SWMUs and AOCs

SWMU 21-011(k), north of MDA T, is the former outfall for Building 257 and underwent voluntary corrective action in 2003. MDA A and the Generals Tanks, located to the west, are material disposal areas for the former TA-21 plutonium processing area and otherwise unrelated to MDA T. Other SWMUs near MDA T are associated with the former plutonium processing plant including SWMU 21-020(a), the former baghouse location west of MDA T. Consolidated SWMU 21-022(b)-99 is southwest of MDA T and comprises former plutonium processing facility waste lines and sumps. SWMU 21-012(b), located west of MDA T, is an inactive dry well constructed in 1980 to receive boiler blowdown from the former TA-21 steam plant.

## 2.4 Historical Releases and Discharges

Accidental releases of contaminated materials into the surrounding environment have occurred during the site's operational history (Rogers 1977, 05707). Releases of contaminated material include accidental spills during site operations, and airborne releases as a result of burning radioactive contaminated oil.

Environmental release sites include contaminated areas in and around the absorption beds and shafts, the bedrock under MDA T, and areas contaminated by spills and releases during treatment and disposal activities.

A 1994 environmental drilling program investigating Building 035 (Stoopes 2003, 76089) detected contamination near the location of former valve boxes adjacent to the building. Tanks and other liquid-holding facilities at Building 035 had no secondary containment and floor sumps and drains were unlined concrete. Leaks may have occurred at joints in buried cast iron and stainless steel pipes. Although the external tanks at Building 257 have secondary containment, some of the containments include floor drains extending to the surrounding site grade. The surrounding area at Building 257, where the americium was unloaded, was not originally covered with asphalt. Unquantified spills that occurred during tanker-truck transfer operations in the americium unloading area were reported (Sagez 2003, 76095, 76090). Sumps inside the building are unlined concrete and may leak. There are four AOCs associated with Building 257 that all involved spills with cement-incorporated waste or other surface releases.

Rogers (1977, 05707) states that it was still possible to release treated wastewater to Absorption Bed 4 as of July 1976. This report indicates that piping and valves were left in place to allow overflow from Tanks 112 [SWMU 21-011(f)] and 113 [SWMU 21-011(g)] to reach the absorption bed and does not indicate that spills occurred in that time frame. No record of a post-1967 release into Absorption Bed 4 is known to exist. The RWSA had unquantified spills and leaks associated with operations. Two AOCs (C-21-009 and C-21-012) are spills associated with the RWSA and the CMP filling operation. Spills, leaks, and releases were reportedly cleaned up at the time, but residual waste contamination and contamination from undetected leaks may exist.

Airborne releases caused by the salamander incinerators were overshadowed by releases from stacks associated with the DP West Plutonium Processing Facility. Building 12 released several curies annually of airborne particulate into the atmosphere, and MDA T is within the projected area of deposition. By comparison, estimates of salamander releases from 1970, 1971, and 1972 total only 6.51 microcuries of plutonium-239/240. Details of the releases from the salamanders are presented in Appendix B, Section B-2.4.3.

## 2.5 Contaminant Transport Mechanisms

Potential transport mechanisms that may lead to exposure of potential receptors include

- vaporization and gaseous diffusion and advection of volatile organic compounds (VOCs) and tritium in air;
- dissolution and/or particulate transport of surface contaminants during rainfall and snow melt runoff events;
- airborne transport of contaminated surface soils;
- continued dissolution and advective/dispersive transport of chemical and radiological contaminants contained in absorption beds and subsurface soil and bedrock as a result of the past wastewater disposal activities;
- biotic perturbation and translocation of contaminants in subsurface waste and contaminated media, including shallow soil and absorption bed material; and
- future migration of contaminants already migrated into the subsurface media.

### 2.5.1 Current Contaminant Potential Receptors

Potential receptors of possible contaminant transport include

- down-gradient groundwater users,
- site workers at MDA T and TA-21,
- trail users in the canyon below MDA T, and
- ecological receptors both on site and immediately surrounding the site.

## 2.6 Current and Proposed Land Use

TA-21 is an industrial use area. The Laboratory does not anticipate that the land use at TA-21 will change in the future.

The disposal complex of the absorption beds and shafts will remain industrial areas under long-term institutional control. Additional areas beyond the fence may also be retained as a buffer zone. Future remediation requirements and options will require review and approval by the administrative authority.

## 2.7 Pre-RFI Investigations

Historic investigations that occurred at MDA T are detailed in Appendix B, pp. B-12–B-34. Field investigations began in 1946 with sampling to characterize the extent and sources of contamination at MDA T and other locations around Los Alamos and included sampling of outfalls, manholes, and wastewater flows. Additional effluent sampling focusing on the DP West plutonium processing facility, including effluent draining from MDA T, took place in 1947 and 1948. These studies included field instrument surveys for both alpha and gamma emitters and radioassay for uranium, plutonium, polonium, and analysis for fluorine.

The first characterization effort for the absorption beds was in 1953 by the US Geological Survey. Five test holes, ranging in depth from 13 to 20 ft, were drilled to collect soil samples. Analyses on the samples included plutonium and ion exchange capacity. The results of the study concluded that no appreciable horizontal migration of contamination had occurred and that plutonium had moved vertically downward to the depth of 20 ft (Rogers 1977, 05707, p. T-19).

From 1959 to 1961, the US Army Corps of Engineers conducted a more detailed study of contaminant migration at the absorption beds. A test pit (caisson) was excavated adjacent to Absorption Bed 1, sidewalls were logged, soil and rock samples obtained, and instrumentation installed to sample matrix saturation. In addition, six angled boreholes were drilled under Absorption Bed 1, ranging in depth from 76 to 99 ft. Plastic pipes were installed and gross alpha assays of the cuttings obtained. Experimental absorption studies were conducted (Rogers 1977, 05707, p. T-19). For a detailed description of the caisson and associated environmental testing, see Appendix B, Section B-2.2.

In 1967, additional borings were conducted at the absorption beds to collect soil and water samples obtained for radioassay. Water samples were also obtained from the caisson installed in 1959 and two DP Canyon test holes. Moisture contents of the tuff were measured. The study compared moisture migration to that found in the previous study. Maximum concentrations of moisture had moved from a depth of 12 ft in 1961 to 40 ft in 1967. Most of the plutonium in the tuff was retained in the upper 20 ft (Purtymun 1967, 01009, p. 5).

Prior to excavation of the RWSA, additional boreholes were drilled in 1974. These boreholes encountered paleochannel deposits at depths of 15 to 25 ft. Radioassay of cores was obtained and the results indicated the presence of tritium, plutonium, americium, and cesium (Rogers 1977, 05707, p. T-28).

In 1978, a study of moisture migration was performed to augment the information from prior studies. The study included two borings. An inventory of plutonium and americium-241 was obtained during volumetric analysis of core from the boreholes. The distribution of plutonium and moisture was compared with values obtained in 1953 and 1960. Plutonium was detected at a maximum depth of 99.5 ft and americium-241 at 101 ft (Nyhan et al. 1984, 06529, p. 6).

Shallow soil sampling and radiological characterizations were conducted in 1984 and 1986. Samples were obtained at three shallow depths under 12 in. Results indicated that low levels of tritium, plutonium-238, plutonium-239, and americium-241 were present across the entire site area and into DP Canyon (Nyhan and Drennon 1993, 23248, p. 3-51).

## 2.8 Phase I RFI Field Investigation Results

Results of the 1992, 1993, and 1994 sampling efforts, as well as the 1996–1997 field investigation of surface soils at MDA T are used to evaluate existing site soil conditions to determine additional data collection requirements. These characterization efforts have been previously reported in the operable unit (OU) 1106 work plan, phase 1b (LANL 1995, 52350; LANL 1996, 70348). Detection results are presented in the following tables and figures in Appendix B:

- Table B-23 presents radionuclide detections above background values (BVs) or fallout values (FVs);
- Table B-24 presents detected results for organic chemicals;
- Table B-25 presents inorganic chemical results above BVs;
- Tables B-26 through B-28 present the frequency of detections for radionuclides, organic chemicals, and inorganic chemicals; and
- Figures 4 through 10 present the organic chemical detections and the detections of radionuclides and inorganic chemicals above background.

A field investigation conducted in 1992 (Appendix B, Figure B-38) represents the first RFI (LANL 1995, 52350, p. 2-1). The investigation included near-surface sampling to determine contamination caused by air-borne contamination from filter buildings and other sources of air-borne releases. Surface and shallow subsurface samples were collected and analyzed for organic chemicals, inorganic chemicals and radionuclides including tritium, plutonium-238, plutonium-239, and americium-241. Results indicate widespread existence of low-level radionuclides. The distribution pattern of contamination indicates that the source of contamination is probably not limited to MDA T. Organic and inorganic chemicals were not generally detected. Figures 4 and 6 and Appendix E, Table E-6, include the locations and contamination encountered during the investigation. Survey locations and elevations are shown in Appendix E, Table E-8. Shallow surface sampling data may not be representative of today's site conditions due to ongoing erosional, depositional and freeze/thaw processes.

Sampling events occurred in 1993 and 1994 (Figures 6 and 7). Additional surface sampling was performed at study areas perceived to need additional definition of contamination, including the small drainage into DP Canyon (LANL 1996, 70348). The results of this event were presented in an RFI report (LANL 1996, 70348). The second event included borings to define contamination around former Building 035 area. Samples were collected and analyzed for radionuclides, and organic and inorganic chemicals as described for the 1992 sampling effort. Sample data are presented in Appendix E and are discussed in Section 2.8 below.

A sampling and analysis plan (SAP) (LANL 1996, 54127.3) was developed and later modified in response to a request for supplemental information from NMED (LANL 1997, 70036). The investigation was conducted in 1996–1997 in order to obtain data in anticipation of preparing an RFI report. A detailed summary of the investigation including a discussion of field activities, borehole logs, analytical results of laboratory testing on samples obtained during field activities, and the results of two surface geophysical investigations conducted to identify buried features including the paleochannel are presented in Appendix B, pp. B-25–B-34. The purpose of the investigation was to define the nature and extent of subsurface contamination resulting from past waste disposal practices at MDA T, including lateral extent of absorption bed contamination and to define the physical limit of the paleochannel through the use of surface geophysical methods. Sample locations and results are shown in Figures 8 through 10.

### 2.8.1 Soils, Quaternary Alluvium (Paleochannel Deposits), and Fill

During disposal operations at MDA T, significant surface soil disturbance occurred. Excavated soil from absorption bed construction was utilized for surface water control berms around the absorption beds (Appendix B, p. B-2). During construction of the disposal shafts (Appendix B, p. B-3), waste soil (spoils) from the augers was piled throughout the site. Excavation and backfilling of the RWSA further disturbed site soils (Appendix B, p. B-3), as did the demolition of Building 035. Regrading the surface of MDA T also resulted in shallow soil disturbance (Appendix B, pp. B-6 and B-23). As a result of grading activities, including backfill of the RWSA, the depth to the bottom of the absorption beds are approximately 9 ft below the current ground surface (see borehole logs of the 1996–1997 investigation, Appendix D).

Radionuclides analyzed include americium-241, plutonium-238, plutonium-239, uranium-234, uranium-238, cesium-137, strontium-90, and tritium (1992, 1993, and 1994 sampling only). Figures 5 and 7 present a summary of samples exceeding maximum fallout/background concentrations for the various radionuclides in surface soils and fill.

Organic analysis was performed to detect the presence of VOCs and semivolatile organic compounds (SVOCs) in soil and fill samples. VOC samples were performed on the samples collected from the area of Building 035. Polychlorinated biphenyls (PCBs) were not analyzed for because MDA T has no history of processes or facilities that stored or used PCB or PCB-contaminated oils (Appendix B, pp. B-1–B-11).

### 2.8.2 Subsurface Tuff

Bandelier Tuff lies directly below the site surface soils under MDA T. Results of the 1994 borehole investigation and the 1996–1997 field investigation are used to assess the knowledge of the nature and extent of contaminants in the subsurface bedrock. Subsurface tuff samples were collected around and below absorption beds, disposal shafts, and the RWSA. The investigation results are presented in Appendix B, pp. B-23–B-34. The 1994 boreholes focused on sampling in and around former Building 035, with boreholes extending only a few feet into bedrock. The 1996–1997 boreholes provide nearly all environmental data collected on tuff samples. Field borehole logs are contained in Appendix D. Although the purpose of the 1996–1997 field program was to collect environmental samples for testing, the boreholes were also logged using geotechnical criteria (Appendix B, p. B-26), including logging of fractures encountered in the samples.

The samples collected during the 1994 and 1996–1997 field-sampling programs were analyzed for target analyte list (TAL) metals and are summarized in Appendix B. Figure 8 shows the results of inorganic concentrations in samples that exceed background values in tuff.

Radionuclides analyzed in soil and tuff include americium-241, plutonium-238, plutonium-239, uranium-234, uranium-238, cesium-137, strontium-90, and tritium. Tritium analyses are limited to samples collected in 1994. Figures 7 and 9 present a summary of samples exceeding maximum fallout/background concentrations for the various radionuclides.

Organic analysis was performed in 1996 and 1997 to detect the presence of VOCs and SVOCs in tuff. Figure 10 presents the location and concentrations detected in samples of MDA T tuff samples. The drilling and sampling around Building 035 resulted in the analysis of two VOC samples in tuff.

### 2.8.3 Laboratory-Wide Site BVs

Background values for inorganic compounds and FVs or BVs for radionuclides are shown on the data tables presented in Appendix E. The Laboratory-wide background determination, "Inorganic and

Radionuclide Background Data for Soil, Canyon Sediment, and Bandelier Tuff at LANL" (LANL 1998, 59730) presents details of BVs and their derivation. The BVs are used to determine contaminant values on figures presented in the following section on data interpretation.

### 2.8.4 Historic Subsurface Flow Regime

During operation of the disposal beds from 1945 through 1967, approximately 18 million gallons of acidic wastewater from the plutonium processing facilities at TA-21 was sent to the four absorption beds, creating a saturated flow regime in the soil and tuff directly below the absorption beds as depicted in Appendix B, Figure B-9. Because the tuff matrix was near or at saturation for a considerable depth (refer to various historic investigations, Appendix B, pp. B-12–B-15 and B-17–B-19), the paleochannel and bedrock fracture flow would potentially form preferential flow paths for both moisture and contaminant migration from the absorption beds.

Early investigations provide evidence of significant alteration of the bedrock, with clay developing immediately below the absorption beds. Early studies indicate saturation at greater depth than the movement of radionuclides, as a result of geochemical attenuation (Appendix B, p. B-14).

## 2.9 Data Evaluation

Data evaluation presents discussions regarding the nature and extent of contamination identified in analytical results collected in the 1992, 1993–1994, and 1996–1997 sampling campaigns. Data are reviewed for four distinct areas:

- The DP Canyon slope area is reviewed separately since it is not a part of the MDA T consolidated SWMU 21-016(a)-99 and also because contaminants that may be present are the result of secondary transport (i.e., runoff and air deposition) rather than planned MDA T operations.
- Buildings 035 and 257 are considered individually because they were/are discrete facilities.
- The RWSA, disposal shafts, and absorption beds are discussed as a single-site element in terms of nature and extent due to the fact that they are immediately adjacent to one another and received similar waste streams. Additional justification for considering the RWSA, disposal shafts, and absorption beds together is provided at the start of Section 2.8.3.

Based on the data review of off-site and on-site laboratory analytical results presented in Appendix B, Section 3.14, Appendix E, Section 2.7 above, data summaries, and evaluation of the status of the physical site conditions, this section identifies the additional data needed to establish the nature and extent of environmental contamination at MDA T. Results for all the samples collected from 1992 through 1997 from off-site fixed laboratory analyses were used for final decision making. The 1992–1994 data, including on-site laboratory data, were used in conjunction with the 1996–1997 data when evaluating the best location and type of additional data collection activities. On-site analyses are not presented in figures.

The following items present conclusions of data needs to assess nature and extent of contamination, including

- surface soil contamination (DP Canyon and MDA T proper);
- depth and extent of radiological and chemical contamination transported by saturated infiltrating water during absorption bed operation (both matrix and fracture flow);
- depth and extent of contamination from shafts; and

- depth and extent of contamination at Buildings 035 and 257 was not developed beyond that previously identified for Building 035 during the 1993–1994 field investigation.

Historic data provide evidence that MDA T was used only for disposal of radiologically contaminated wastewater and americium raffinate sludge (Appendix B, pp. B-1–B-12). No evidence of processing or disposal of high explosives (HE) exists at MDA T.

Furans, PCBs, and dioxins at MDA T are considered to possibly result from the stack emissions from incineration of radiologically contaminated waste oils in the salamander incinerators between 1964 and 1972. Based on historic evidence provided by Laboratory record drawings of the former and present facilities at and near MDA T, there are no other suspected sources for PCB contamination at the MDA T area. There is a potential for a diffuse presence in the large volume of process wastewater placed into the environment from the absorption bed disposal operation.

### 2.9.1 Data Review of DP Canyon Slope

#### 2.9.1.1 Nature and Extent of Contamination in Tuff, Soil, and Sediment – DP Canyon Area

The slope area below MDA T is subject to ongoing erosional and depositional processes. Previous sample collection on the slope was performed in the 1992 and 1993–1994 sampling events. These events did not collect samples deeper than 1.0 ft and so nature and vertical extent cannot be defined using these data. Because of the unstable nature of surface soils, new samples will be collected from the DP Canyon slope area for characterization. The discussion below deals with the nature of contamination identified based on the previous sampling performed in 1992 and 1993–1994. The locations of the 1992 and 1993–1994 surface samples are presented in Appendix B, Figure B-38.

No previous sampling effort sampled outcrops of tuff or subsurface tuff because the airborne and waterborne contaminant pathways present result in shallow contamination not likely to reside in the tuff, unless concentrated absorption occurred such as at SWMU 21-011(k). Contamination may be expected to extend along the drainages where sediment trapped between bedrock outcrops occurs.

##### 2.9.1.1.1 Inorganic Chemicals

Concentrations above BVs for inorganic chemicals were detected in the 1992 and the 1993–1994 field investigations (Figures 4 and 6). Because of the shallow sampling depth (no samples deeper than 1.0 ft), the vertical extent of contamination is not well defined.

Inorganic chemicals including lithium, strontium, cadmium, nickel, total uranium, and zinc were identified in soil samples collected from the DP Canyon slope (Figures 4 and 6). Lithium and strontium have no background to compare to but maintain consistent ranges in the data and are representative of the nature of the soils in the area of the DP Canyon slope. Cadmium was identified uniformly across the area of the slope at concentrations of less than 1.5 mg/kg.

Nickel was identified at location 21-01664 (0–0.5 ft, 19.4 mg/kg). This is the only occurrence on the slope and is not thought to be representative of a release from MDA T. This is supported by the fact that, as discussed below, widespread above-background concentrations of nickel are not observed in the soils within MDA T.

Elevated concentrations of zinc are observed at locations 21-01860 through 21-01862 and 21-02568, which are all located at the northernmost portions of the drainage leading to the DP stream channel.

Concentrations range from 82.4 mg/kg at location 21-02568 (0.5–1.0 ft) down to 56.8 mg/kg at 21-01860 (0.25–0.5 ft).

Total uranium was detected above background at locations 21-01861 (0.5–1.0 ft), 21-01862 (0.5–1.0 ft), and 21-02568 (0–0.25 ft) at 2.48 mg/kg, 1.92 mg/kg, and 2.05 mg/kg, respectively.

#### 2.9.1.1.2 Radionuclides

Past radiological surveys indicate widespread surface contamination at low levels (Appendix B, pp. B-21 and B-22). The current understanding of surface radiological contamination is dated, with the last characterization performed in 1992. Based on the 1992 and 1993–1994 field investigations, radiological near-surface contamination is present throughout the DP Canyon slope area. Contamination extends to the limits of the MDA T disposal area for plutonium-238, plutonium-239, and americium-241 (Figures 5 and 7).

Plutonium-238 is detected throughout the DP Canyon slope area. The highest concentrations of plutonium-238 are found in the northernmost samples within the drainage leading to the DP stream channel (location 21-01862, 4.05 pCi/g at 0–0.25 ft). Plutonium-239 is also present throughout the site. Unlike plutonium-238, plutonium-239 shows a more uniform distribution across the slope area, but has a maximum concentration of 28.51 pCi/g at location 21-01642 from 0–0.5 ft. Americium-241 is present throughout the slope area and the highest concentrations are present in the lower portion of the drainage near the DP stream channel. The maximum americium-241 concentration observed on the DP Canyon slope area is 7.404 pCi/g at location 21-02568 from 0.5–1.0 ft.

The depth to which radiological contamination extends is not defined by the shallow sampling performed.

#### 2.9.1.1.3 Organic Chemicals

Organic chemicals in DP Canyon soils include SVOCs located at shallow depth in the side drainage near DP Canyon drainage. These contaminants are commonly found in industrial areas and associated with paving and traffic. Likely sources include the North perimeter road and paved areas upgradient of the DP site that drain to the subject drainage. Review of the 1993–1994 field investigation (not shown on figures) (locations 21-01860, 21-01861, 21-01862, 21-01868, and 21-01869) identified potential organic contamination at depths of 0–0.25 ft and location 21-02568 at depths of 0.5–1 ft. The expected lateral extent of the contamination is defined by the drainage because of the low probability that overland flow occurs outside the drainage.

### 2.9.1.2 Data Requirements Related to the DP Canyon Slope

Previous sampling of the DP Canyon slope area identified SVOCs, inorganic and radiological constituents above background (Appendix E). Analyses for VOCs were not performed. Results from 1996 and 1997 do not show MDA T to be a viable source for VOC contamination to the DP Canyon slope. Therefore, sampling will not be conducted for VOCs in the slope area. Since the slope area soils are not stable, previously collected samples may not be representative of current site conditions. Surface and shallow subsurface samples need to be collected to define nature and extent for the DP Canyon slope area.

Samples will target the existing drainages where most of the surface flow was concentrated from the MDA T site runoff. Additional samples are needed throughout the area of the slope to characterize for chemical and radiological constituent evaluation. Sample location selection will be biased to areas of elevated radionuclide levels as identified in the walkover radiation survey. Details of DP Canyon slope sampling can be found in Section 4.2.

### 2.9.2 Data Review of Absorption Beds, Shafts, and the RWSA Area

#### 2.9.2.1 Nature and Extent of Contamination for the Absorption Beds, Shafts, and RWSA Area

The disposal shafts were installed between the absorption beds, and installation records (Appendix B, Table B-2) indicate that contamination was already present in the bedrock and soils. The material disposed in the shafts was cement treated or encased in cement-treated raffinate waste. Installation of the disposal shafts followed cessation of absorption bed operations. When the shafts were installed, saturated conditions no longer existed and did not contribute to contaminant transport from the shafts. In this setting, releases from the disposal shafts are expected only a short distance from each shaft (if at all) and are masked by the similar contaminants from the prior absorption bed releases. Furthermore, moisture monitoring adjacent to shafts in 1968 showed that hydration of the cement treated waste as it cured actually drew moisture from the surrounding formation, indicating that releases from the shafts were unlikely during curing (Appendix B, p. B-16).

The RWSA was excavated between Absorption Beds 1 and 3. It was later backfilled with imported fill material following removal of the waste contained in the CMPs. Detections in the backfill would not be related to MDA T processes and would be bounded by the physical excavation limits of the RWSA. Detections at the base of the backfill material or in Qbt would be process-related releases either associated with the waste contained in the CMPs or residual contamination from operation of the absorption beds.

Since both the disposal shafts and the RWSA were constructed between the absorption beds and represent a less mobile solid phase of waste, any release from these sources would be of limited extent and surrounded by contamination released from the absorption beds. The contamination detected below MDA T most likely migrated during active operation of the absorption beds, when saturated flow conditions predominated directly below the absorption beds. The extent of contamination in the bedrock matrix may be different from the extent found in fractures.

##### 2.9.2.1.1 Inorganic Chemicals

Limited zinc and silver surface contamination is indicated by the 1992 and 1993–1994 field investigation results for locations within the run-on control drainage (Figures 4 and 6). Lateral extent is bounded by the drainage but vertical extent is not defined because samples were only collected from 0 to 0.5 ft. Lithium, strontium, cadmium, nickel, beryllium, and thallium were identified in soil and fill throughout the area of the beds, shafts, and the RWSA. Both lithium and strontium lack background data to compare to but maintain consistent concentrations throughout the area and are representative of the natural of the fill and soils at the site. Cadmium was identified in RWSA fill materials at 107 mg/kg and is bounded laterally in all directions by values of less than 10 mg/kg. Beryllium was identified in soil/fill at one location (21-01615) at 124 mg/kg. Thallium was detected at locations 21-05054 and 21-05058 in fill material. Thallium is bounded vertically at both locations. Thallium was not detected above background in any other soil/fill samples collected at the site.

A number of inorganic chemicals were detected above background in the 1996–1997 samples (Figure 8). Lateral extent is not defined. Vertical extent has been defined by less than BVs in deeper samples except for the following:

- Copper exceeds both the background value and range of background concentrations (LANL 1998, 59730) at location 21-05075 (8.9 mg/kg at 69.5–70 ft) and 21-05056 (11.4 mg/kg at 49.5–50 ft).
- Chromium exceeds the background value at location 21-05061 (2.4 mg/kg at 189.5–190 ft), but is within the range of background concentrations (LANL 1998, 59730).
- Lead exceeds both the background value and the range of background concentrations (LANL 1998, 59730) at location 21-05062 (21.5 mg/kg at 70–70.5 ft).

The operational history of the absorption beds indicates these as a potential source of perchlorate inorganic contamination.

#### 2.9.2.1.2 Radionuclides

Radionuclides are present in and around the absorption beds, including plutonium-238, plutonium-239, americium-241, strontium-90; cesium-137, uranium-234, uranium-235, and uranium-238 (Figures 7 and 9). Elevated levels of plutonium and americium are indicated for the absorption beds based on analytical data obtained from samples immediately above and below the absorption cobble layer. However, due to the cobble-sized material, samples of the potentially highest contamination within the absorption beds were not obtained in the 1996–1997 field investigation. Samples of absorption bed materials (in gravel just above the cobble layer) exhibit plutonium-239 as high as 230,600 pCi/g (location 21-05053 at 9.5–10.0 ft) and likely represents values within the cobble layer because both the cobbles and gravel became saturated by process water entering the beds during operations. Volumetrically, the level of contamination in the gravel may exceed that of the cobble bed because of the disparity of the particle sizes between the two materials.

The lateral extent of radiological contamination of the absorption bed area is defined by the decreasing trend in contamination away from the edge of the absorption beds. At a distance of approximately 30 ft, the levels of contamination have dropped to less than 10 pCi/g. The single exception is north of Absorption Bed 4 where location 21-05074 (83.2 pCi/g americium-241 at 0.8-1.3 ft) shows an increase from location 21-05073 at approximately the same depth (2.6 pCi/g americium-241 at 2.5–3 ft). This increasing trend may be related to the spill that took place from Absorption Bed 4 and requires further lateral definition.

In individual 1996–1997 boreholes, vertical decreasing trends are observed. Boreholes 21-05053, -05054, -05059, -05060, -05061, -05063, -05071, and -05074 have no radionuclide detections above background in the deepest samples (Figure 9). The remaining boreholes show decreasing trends to levels of less than 10 pCi/g in the deepest samples. The deepest sample that detected radionuclide contamination was at location 21-05051 below Absorption Bed 1 (1.14 pCi/g strontium-90 at 149.5–150 ft). This sample represents the contamination in the matrix of the bedrock media. Vertical extent for the tuff matrix is defined in all locations either by nondetections of decreasing trends for the area of the absorption beds and shafts.

Where borehole logs provide sufficient information, fractured intervals can sometimes be shown to have increased levels of radionuclides relative to surrounding samples obtained in the tuff rock matrix. The deepest fracture sample that contained radiological contamination was at location 21-05053 (2870 pCi/g plutonium-239 at 60–60.7 ft). Also, location 21-05053 from 48 to 60 ft and location 21-05054 at 35 ft have spikes in the levels of radionuclides to levels in excess of 1000 pCi/g. Although there was a fracture sample taken from a deeper depth that did not contain radiological contamination, the nature of fracture flow is such that this may not be representative of the deepest contamination in fractures at the site. It is concluded that the depth of contamination in the fractures below MDA T is indeterminate at this time.

Within the RWSA, americium-241 was identified at location 21-05057 at a concentration of 210,000 pCi/g and is attributed to a reported spill of americium raffinate waste because the americium is 75 times the concentration of plutonium-239. This rate is higher than seen in the absorption beds. The release is bounded vertically by the samples below and is constrained laterally by the RWSA excavation. This is supported further by the surrounding boreholes where americium-241 concentrations are approximately two orders of magnitude lower.

Examination of the potential for a preferential lateral pathway through coarse-grained deposits of the paleochannel defined by the 2003 geophysical investigation in Appendix B, p. B-33, of this document and the 1996–1997 borehole logs (Appendix D) indicates that radionuclides did not migrate a significant lateral distance along the base of the paleochannel. Samples at locations 21-05052 at 26–27 ft, 21-05071 at 34–34.5 ft, and 21-05059 at 31.5–32 ft, upstream and downstream of the disposal beds respectively, did not detect elevated levels of radiological contaminants above 2.64 pCi/g plutonium-239 (location 21-05059 at 31.5–32 ft). Nor were there elevated levels of radiological contamination detected in the bedrock samples collected directly below the paleochannel at these locations. The elevated americium contamination at location 21-05057 has been related to spills within the RWSA and is not indicative of preferential contaminant transport in the paleochannel. Based on this, no nature and extent issues require further investigation as they relate to the paleochannel at MDA T.

#### 2.9.2.1.3 Organic Chemicals

A map showing organic chemicals detected in field samples obtained from the soils under the site is shown in Figure 10. Shallow sampling of soils over the absorption beds and to the north of the absorption beds indicate low levels of organic contamination. Lateral extent is poorly defined.

Boring 21-05057, located in the RWSA, encountered organic contamination in the backfill used to fill the area after removal of the CMPs. Organic detections continued to a depth of 20 ft in fill material and no further detections were found in native materials to a total depth of 50 ft. The original excavation limits form the lateral extent of the contamination. The lateral limit is further defined by the physical presence of the adjacent absorption beds. Organic contamination was not detected in deeper samples obtained in soils and tuff below the bottom of the RWSA.

### 2.9.2.2 Data Requirements Related to the MDA T Absorption Beds, Disposal Shafts, and RWSA

#### 2.9.2.2.1 Absorption Beds and Disposal Shafts

Analytical results from drilling and sampling conducted in 1996 and 1997 showed decreasing vertical and lateral trends within the Qbt 3 and Qbt 2 matrix below and around the absorption beds. Releases from the disposal shafts are minor in comparison to the releases from the absorption beds (which surround the shafts) for the following reasons.

- The process of cement hydration during the curing process was shown to draw moisture into the shafts (Appendix B, p. B-16).
- Following curing, the solidified state of the waste severely limits potential migration.
- Inadvertent drilling of borehole 21-05062 into one of the disposal shafts during the 1996–1997 sampling showed that within 8 ft of the shaft, no increase in contamination levels were seen in the sample data.
- Releases from the absorption beds were more mobile than from the shafts since large volumes of water under saturated conditions carried contamination.

Because the inventory within the shafts contains the same constituents as were released from the absorption beds, differentiating between sources would be speculative at best. However, an attempt to identify if migration out of the shafts has taken place will be made. Analysis targeting the unique chemistry of the cement in the shafts is needed. Analyses of samples from two planned boreholes (4 and 5) located between beds 1 and 2 and the shaft field (see Section 4.5) for soil pH, bicarbonate ($HCO_3$), and carbonate ($CO_3$) are needed to determine if any chemical signature is present in the subsurface tuff from the cement stabilized waste in the shafts. The complete suite of sample analysis is listed in the tables presented in Section 4. Analytical results will be used to determine if a correlation exists between the chemical signature of the cement and contaminant concentrations. Section 4.5 describes the borings and lists the analytical suites for the two boreholes associated with the absorption beds and shafts.

As discussed previously, nature and extent within the Qbt 2 and Qbt 3 matrixes have been defined for the releases from the absorption beds and shafts. Analyses for pH, perchlorate, tritium, total uranium, isotopic uranium, and americium-241 by alpha spectroscopy (gamma spectroscopy was used in 1996–1997) were not performed on the samples submitted from the 1996–1997 event. Samples will be collected as discussed in Section 4.0, including the above analyses, from the two angled boreholes and one deep vertical borehole proposed beneath the MDA T disposal complex and are discussed further in Sections 2.9.3.2 and 4.5).

#### 2.9.2.2.2 Data Requirements Related to Fracture Characterization

Sampling activities in 1996–1997 identified contamination within fractures at depth and laterally away from the absorption beds. Since it is impractical to define extent of contamination in a fracture, systematic characterization of fracturing is required to assist in evaluation of the role fractures played in transport of contamination at MDA T. To better characterize the fracturing, two angled boreholes will be continuously cored down to and through the top of the Cerro Toledo interval of the Quaternary Bandelier tuff (see Section 4.5). Angle boreholes have the best chance of intersecting the vertical fractures that dominate the Bandelier Tuff. Orientation of angled boreholes in a general east-west direction further enhances this opportunity. Fracture density will be defined by recording the rock quality density (RQD) in recovered cores during borehole logging. Borehole logging methods and RQD are described in detail in Section 4. Logging of borehole fractures using a borehole image processing system (BIPS) tool (or equivalent) will also be performed. Fixed lab analytical samples will be collected as discussed in Section 4.5.

#### 2.9.2.2.3 Data Requirements Related to Hydrogeologic Properties

Documentation of the hydrogeologic properties of the tuff units above the Cerro Toledo interval is needed. Porosity, moisture content, permeability tests, Kd, and matrix suction will be performed on core samples collected from the deep angled boreholes and the deep vertical boreholes beneath the disposal complex (boreholes 1, 2, and 3). Samples will be taken from all geologic units encountered (Qbt 3, Qbt 2, and Qct). Details of the hydrogeologic sampling are discussed in Section 4.6 below.

In order to supplement borehole test results, tuff matrix geophysics will also be performed. Neutron and gamma source logs, natural gamma, caliper, and BIPS logs will provide moisture, porosity, lithology, borehole condition, and fracture information that will augment data interpretation.

#### 2.9.2.2.4 Data Requirements Related to Subsurface Tritium and VOC Vapor

Sampling of subsurface pore gas for vapor phase VOCs and tritium has not been performed beneath MDA T. Vapor samples using SUMMA canisters for VOCs and silica gel absorbents for tritium will be collected from two depths in the deep angled boreholes in order to document whether vapor-phase plumes are present beneath MDA T.

#### 2.9.2.2.5 Data Requirements Related to the Buried MDA T Operational Surface

Regrading of the MDA T disposal area has resulted in disturbance and burial of the original operational surface. Focused sampling of this original surface has not been performed. Focused sampling of the operational surface is needed because overflows from the absorption beds and spills during filling operations at the disposal shafts would have been surface releases. Burning of waste oils in the salamanders is the only process at MDA T that may have resulted in a release of dioxins and furans. Surface accumulation of airborne stack emissions from the adjacent plutonium processing plant area may also be present. The operational surface of MDA T would be the most likely affected horizon from the burning activities. Collection of samples from the buried operational surface would determine if a release of dioxins or furans resulted from the burning of waste oils at MDA T. All boreholes to be drilled within MDA T will sample within the operational surface where it can be identified in recovered cores.

#### 2.9.2.2.6 Data Requirements Related to Perched Water

No boreholes have been advanced to sufficient depths to assess whether perched water zones are present above the Qbt 2-Cerro Toledo interval contact. One vertical and two 45-degree-angled boreholes are planned to depths that will reach the Cerro Toledo interval.

### 2.9.3 Data Review of Building 035 Area

#### 2.9.3.1 Nature and Extent of Contamination for Building 035 Area

#### 2.9.3.1.1 Inorganic Chemicals

Samples collected in 1993–1994 sampling at Building 035 identified aluminum, barium, cadmium, copper, lead, lithium, molybdenum, nickel, selenium, silver, strontium, uranium, and zinc as potential contaminants exceeding background (Figure 6). Of these inorganic chemicals, only cadmium, copper, and zinc exceeded the range of background at locations 21-02547 and 21-02609. Nickel was also detected above background at locations 21-02541. Lithium and strontium have no established background concentrations, but were detected at location 21-01628 at approximately the same concentrations observed across the MDA T site and are representative of the natural soils. Total uranium was detected above background around the east, west, and south sides of the building (locations 21-02535, 21-02536, 21-02543, 21-02546, and 21-02609), as well as in the footprint of the building at location 21-02538. The nature and extent of inorganic chemical contamination has not been defined in any location since multiple depths were not sampled or decreasing trends were not observed.

#### 2.9.3.1.2 Radionuclides

Soil contamination was detected at the location of buried tanks and valve boxes removed with the demolition of Building 035 near the southwest corner of the building (locations 21-02546, 21-02547, 21-02609, and 21-02610) (Figure 7). This was the location of a valve box (Structure 21-093; Appendix B, Figure B-7) on the influent lines from the plutonium processing facility. Other boring samples detected contamination in soils located below the former floor slab of the building (locations 21-02538 and 21-02539) and may be a result of unlined sumps and floor drains shown in the record drawings (LANL 2003, 81175). Americium-241 was detected in soils below and surrounding the floor slab near the southeast end of the building (location 21-02541) where americium raffinate treatment occurred. Nature and extent is not defined for radionuclides since samples at multiple depths were not collected, or decreasing trends were not observed in the results.

#### 2.9.3.1.3 Organic Chemicals

Nature and extent for organic chemicals has not been defined for Building 035. While the 1993–1994 field investigation found no organic chemicals, only data for SVOCs in the soils near Building 035 were generated. A single borehole was advanced in the building footprint during the 1996–1997 drilling, but no samples for organic chemicals were collected.

### 2.9.3.2 Data Requirements Associated with Building 035

Samples from previous investigations were collected and tested for inorganic chemicals, SVOCs, VOCs, and radionuclides. No organic chemicals were detected. Cadmium, calcium, copper, lithium, nickel, uranium, and zinc were detected above background in soil and fill. The 1994 sampling event also detected americium-241, plutonium-239, and plutonium-238 above fallout concentrations near the southwest and southeast corners of the former building. The septic tank and drain field have not been sampled and the manner in which the septic tank was left in place has not been confirmed.

The existing data set identified elevated levels of radionuclides in soil and fill materials within the building footprint, along the south side, at the west end, and the southeast corner of the building site.

Additional focused sampling and analysis at the locations of the tanks and buried pipes associated with the building is needed, combined with step-out sample locations to determine lateral extent to the south of the building site. Boreholes located near the highest levels of contamination detected by 1994 data are required to confirm vertical and lateral extent. The existing data set indicates that sampling will continue below the soil-tuff contact.

A borehole associated with the septic tank and drain field will be located, drilled, and sampled as discussed in Section 4 to confirm that operational releases to the drain field did not occur. The drain field has been targeted because it is the intended discharge point from the tank. The results from the drain field are the most conservative representation of any release from the system, because the drain field received a larger volume of liquids than a release from a leaking tank.

The top of the septic tank must be uncovered and the state of abandonment confirmed. If waste is present, the volumes of the liquid and solid phases will be estimated and a representative set of waste characterization samples will be collected.

Boreholes need to be drilled and sampled in the areas of elevated americium and plutonium near the southeast and southwest corners of Building 035 to confirm the results of the 1994 sampling and provide analytical results. Step out boreholes from the southeast and southwest corners of the building will also be required.

Drilling and sampling at the location of a citric acid tank, a potential source of perchlorates adjacent to the east end of the north wall of Building 035, should also be performed. Details of the proposed drilling and sampling are presented in Section 4.5.

tanks of the treatment circuit were replaced with new tanks in 1970. This facility currently operates to partially treat wastewater from the TSTA. The plant wastewater processing circuit includes a clarifier, a flocculator tank, process tanks, filters, pumps and sumps, and chemical holding tanks. Drawings indicate that all externally located tanks have some form of secondary containment (Appendix B).

A complex of utility lines and corridors course through MDA T, mainly between Buildings 035 and 257 and the TSTA. General utility lines also pass through the site. A corridor of acid waste lines runs underground from the northwest corner of Building 257 over to the southwest of Building 035. Waste drainlines also run from the northwest corner of Building 257 over to effluent tanks 112 and 113 to the north. An acid-waste line runs southeast then northeast from Building 035 over to the effluent tanks. An acid-waste line also runs from the southwest corner of Building 035, under Building 257, and east out of MDA T. A natural gas line runs east-west under Building 257 and along the south side of 035. Main water lines run just south of the MDA T fence line, with feeder lines north to Buildings 035 and 257. Aboveground electrical lines run just north of the MDA T fence line, splitting to the south between Buildings 035 and 257, and to the east over tanks 112 and 113 and along the north side of Building 257. Underground electrical lines run between Buildings 035 and 257. Prior to initiation of field activities, extensive work will be required to locate abandoned and existing utility piping and lines.

### 3.1.1 Soils

In general, soils can be considered thin and poorly developed on the mesa surface; they tend to be sandy in texture near the surface and more clay-like beneath the surface. More highly developed soil profiles exist on the north-facing slopes; they tend to be richer in organic matter. Soil profiles on the south-facing slopes tend to be poorly developed. A discussion of the soils in the Los Alamos area can be found in Section 2.2.1.3 of the ER project installation work plan (LANL 1998, 62060.4, pp. 2–21). The original soils in the vicinity of MDA T were poorly developed, as is typical of soils derived from Bandelier Tuff and formed under semiarid climate conditions (Nyhan et al. 1978, 5702, pp. 24–25). At TA-21, natural or undisturbed surface soil cover is limited because of plant operations, disposal unit installations, and fill cover construction. The present-day surface of MDA T is predominantly fill (crushed tuff) and imported topsoil. The graded fluvial sediments in the shallow subsurface paleochannel under the disposal complex area (Section 3.2.1) consist of fine to coarse-grained sands with varying amounts of pebbles and gravels. These sediments exhibited cross-bedding along an excavation wall exposed during construction of the RWSA. A basal layer of dacite to rhyolite boulders was found in most of the boreholes drilled through the paleochannel during the 1996–1997 field investigation (Appendix B).

A majority of the MDA T fenced area has gone through a series of reworking and regrading events throughout its operational history. The absorption beds were excavated and built with gradational fill; the shafts were drilled, lined, and filled; the RWSA was excavated, packed with temporary storage containers, backfilled, then cleared out and backfilled again. Final regrading of the disposal area took place around 1986 with fill soil (approximately 5 to 6 ft deep) placed over the original surface of the MDA T absorption beds, shafts, and the RWSA to facilitate positive drainage across the site.

A geomorphic study (Broxton et al. 1995, 58207, pp. 65–92) of TA-21 divides DP Canyon into four segments that reflect the lithologic variations of the Bandelier Tuff. The two upper segments are relevant to the scope of this plan. The top segment begins upstream of MDA T and is expressed below the site as steep-sided walls cut into the Tshirege upper unit 3 resistant (moderately welded) zone with colluvial boulder piles along the base of the walls. The second upper segment is characterized by a relatively flat, wide depositional plain on either side of the stream channel, bordered by colluvial boulder piles. This feature resulted from erosional cutting into the less welded, lower part of Tshirege unit 3 and the underlying Tshirege nonwelded unit. It contains extensive deposits of sediments from upper DP Canyon

### 2.9.4 Data Review of Building 257 Area

#### 2.9.4.1 Nature and Extent of Contamination for Building 257 Area

The nature and extent of soil contamination at Building 257 is undefined by past investigations. The processes involved at Building 257 were similar to those performed at Building 035 and isotopes of plutonium and uranium, americium-241, strontium-90, cesium-137, inorganic chemicals, and SVOCs are anticipated. Additionally, ongoing operations at Building 257 pre-treated tritium-contaminated wastewater from the TSTA facility. These ongoing operations could potentially have resulted in a release of tritium to the environment. Because of the operational nature of the facility, reconnaissance-level sampling is called for to confirm the nature of any contamination present associated with Building 257.

#### 2.9.4.2 Data Requirements Associated with Building 257

No subsurface tuff characterization samples have been collected in the area of Building 257. Since Building 257 is an active facility, reconnaissance borings from beneath the building, the associated holding tanks, and around the building will be collected.

Since the operations at the building involved treating wastewater with similar contaminants as were disposed of in the shafts and the absorption beds, analysis for Building 257 will be consistent with the rest of MDA T sampling. Additionally, current operations at Building 257 deal primarily with tritiated water from the TSTA facility. The three vertical boreholes (10, 11, and 12) will be sampled for tritium to assess if ongoing operations have released tritium to the subsurface. Details of the proposed drilling and sampling are summarized in Section 4.3.

## 3.0 EXISTING SITE CONDITIONS

### 3.1 Surface Conditions

MDA T consists of a disposal area with absorption beds and buried shafts, RWSA, two industrial wastewater treatment plants located in Buildings 035 (inactive and removed) and 257 (active), two office trailers, associated buried piping, and the surrounding surface features that may have been impacted by operations at these facilities. The disposal complex of shafts and beds is enclosed by a chain-link fence. MDA T is within the boundary of TA-21 (Figures 2 and 3). The general elevation of MDA T ranges between 7130 ft and 7140 ft above sea level, with a slight downward slope across the site from south to north.

According to the geomorphic studies at DP Mesa and Vicinity report (Broxton et al. 1995, 58207, pp. 68–69), the location of TA-21 was at one time part of a braided drainage system on the western end of Pajarito Plateau originating in the Sierra de los Valles. At present, possible signatures of this geologic setting include shallow paleochannel deposits beneath MDA T that have been defined by previous drilling studies and augmented by recent geophysical studies at the site. The geomorphology report also states that these tributary stream systems and their canyons (including DP Canyon) developed prior to incision of Los Alamos Canyon and that minimal cliff retreat has occurred in these canyons since then. The report goes on to say that exposure of most of the MDAs on DP Mesa through cliff retreat is improbable over periods exceeding 10,000 years.

Completed in 1967, the industrial liquid waste treatment facility in Building 257 replaced the one located in Building 035. The new plant includes a process acid wastewater treatment circuit, an americium raffinate treatment circuit, and a pugmill circuit. The original batch waste treatment tanks and storage and from the adjacent canyon walls. Runoff from three of the five MDAs (including T) at TA-21 flows into this segment.

### 3.1.2 Surface Water

The area overlying the disposal structures at MDA T is relatively flat with a gentle slope toward DP Canyon to the north. There were two diversion ditches, one on the east end, and one on the west end of MDA T to channel surface flow away from the site. Storm water and snowmelt runoff from the site is now primarily by sheet flow across the site to the north, along with water from the west perimeter ditch, which collects along the ditch between the north side of the site and North Perimeter Road. Runoff then passes through culverts under the road and continues down tributaries cut into the south sidewall of DP Canyon into the depositional plain adjacent to the DP stream channel. The Laboratory's RRES-RS project has developed a procedure to assess sediment transport and erosion concerns at individual SWMUs (LANL Standard Operating Procedure [SOP] 2.01). It provides a basis for prioritizing and scheduling action to control erosion of potentially contaminated soils at specific SWMUs. The procedure is a two-part evaluation. Part A is a compilation of existing SWMU analytical data, site maps, and knowledge-of-process information. Part B is an assessment of erosion and sediment transport potential at the SWMU. Erosion potential is numerically rated from 1 to 100 using a matrix system. SWMUs that score greater than 60 have a high erosion potential. MDA T has score of 30.3, indicating a low erosion potential. The surface water assessment was conducted in June of 1998. The calculated erosion matrix score includes for site setting, a runoff score of 46, and a run-on score of 11.

## 3.2 Subsurface Conditions

### 3.2.1 Stratigraphy

DP Mesa consists of Bandelier Tuff overlain by a thin layer of alluvium. The Bandelier Tuff unit is subdivided into three members, in ascending order, the Guaje, the Otowi, and the Tshirege. MDA T is situated in the Tshirege Member, which is a compound cooling unit divided into four distinct cooling units (labeled 1 through 4 in ascending order), approximately 340 ft thick, consisting of Units 3, 2, 1v, and 1g (Broxton et al. 1995, 58207.1, pp. 45–51). Bedrock directly underlying the site is cooling unit 3 of the Upper Tshirege, a cliff forming, and nonwelded to partially welded tuff. Below DP Mesa the Otowi and Tshirege Members are separated at about 340 ft bgs by the Cerro Toledo interval, an approximately 10- to 40-ft-thick sequence of volcaniclastic sediments deposited in braided stream systems. The basal Guaje Pumice Bed occurs under DP Mesa at approximately 535 ft bgs. This feature separates the Bandelier Tuff from the underlying clastic fanglomerate sediments of the Puye Formation. Bandelier Tuff is overlain by 0 to 20 ft of alluvium. Alluvium, which is generally thickest near the center of the mesa and thin to absent at the mesa edge, consists of poorly sorted, clay-rich sand and gravel. Much of the alluvium contains angular to subrounded lithic clasts of the Tschicoma volcanic rocks, and crystals of feldspar, quartz, and biotite and other ferromagnesian minerals derived from the Tschicoma Formation.

Previous investigations at MDA T revolved around sampling of the disposal units at the surface, within the structures (absorption beds and the RWSA), and below the structures into the lower Tshirege Formation. Localized affects of historic absorption bed activities were evident as high moisture contents were noted at and proximally below the beds (Appendix B).

The result of the deeper borehole data from the 1996 and 1997 study indicates the cessation of fracture evidence in core as the borings passed through the lower section of Tshirege unit 3 and into unit 2. According to the Wohletz fracture study at TA-21 (Broxton et al. 1995, 58207, pp. 19–30), fracture characteristics of unit 2, which was the focus of their study, are very similar to previous fracture studies of unit 3, allowing for extrapolation of results to the rocks directly below TA-21. A fracture zone of increased fracture density, possibly related to the Pajarito Fault system, runs with a northerly strike under MDA V, which is roughly 1000 ft west of MDA T. Although previous studies at MDA T have not documented fracture occurrences in unit 2, one would assume that they do exist. The Wohletz report suggests that slant (angled) boreholes drilled in the direction S48E and N-S would optimize fracture intersections in the upper vadose zone under the MDAs of TA-21.

### 3.2.2 Regional Hydrogeologic Conditions

The proposed hydrogeologic conceptual model for the Pajarito Plateau (LANL 1998, 59599, p. 5 of Groundwater Protection Strategy) predicts absorption of water into the subsurface and subsequent transport of water, vapor, and solutes through the upper regions of the vadose zone and is heavily influenced by surface conditions such as topography, surface water flow, and microclimate. According to model predictions, movement through deeper layers, including the regional aquifer, is slightly influenced by surface conditions and influenced more by hydraulic characteristics of aquifer rocks, regional groundwater flow patterns, and stresses induced by water supply production.

The general elevation above sea level (asl) at MDA T is 7140 ft. The regional aquifer was encountered at 5870 ft asl in R-7 upstream from TA-21, at 5850 ft asl in Otowi-4 on the east end base of DP Mesa, and at 5835 ft asl in R-8 downstream from TA-21.

#### 3.2.2.1 Absorption

Surface and near-surface conditions (topography, precipitation, surface runoff) control the absorption of water into the subsurface and the transport of contaminants in the shallow subsurface. In this respect, the climate behavior of mesas and canyons forming the Pajarito Plateau differ from one another (LANL 1998, 59599.1, pp. 2–26). Mesas are generally dry, both on the surface and within the bedrock that forms the mesa. Canyons range from wet to relatively dry; the wettest canyons contain continuous streams and perennial groundwater in the canyon-bottom alluvium. Dry canyons have only occasional stream flow and may lack alluvial groundwater.

Higher rainfall, increased vegetative cover, and increased welding and jointing of the tuff might lead to different recharge rates than those observed in better-studied portions of the Laboratory such as TA-54 (LANL 1997, 63131). Mesa-top recharge can be locally significant under disturbed surface conditions. Such local differences occur when vegetation is removed, soil and near surface bedrock are disturbed, or water is artificially added to the local hydrologic system by features such as blacktop, lagoons, or effluent disposal. Fractures within mesas do not enhance the movement of dissolved contaminants unless saturated conditions develop. Contaminants in the vapor phase generally migrate in a diffusive manner through mesas (Stauffer et al. 2002, 69794; LANL 1997, 63131).

The region beneath the ground surface and above the regional aquifer is called the vadose (unsaturated) zone. The natural source of moisture in the vadose zone is precipitation, most of which is removed as runoff, evaporation, and transpiration (LANL 1997, 63131.1). The subsurface movement of the remaining moisture (often referred to as recharge) is predominantly vertical in direction and is influenced by properties and conditions of the vadose zone.

The geologic property of the Bandelier Tuff that most influences the fluid flow in the unsaturated zone is the degree of welding (i.e., compaction). Compaction occurs in the tuff after empactment when glassy pyroclasts (pumices and shards) deform due to the combined effects of overburden pressures from the tuff column and the presence of residual gases and high temperatures. Compaction and cooling history of the tuffs varied vertically and laterally across the plateau as different subunits were emplaced at different temperatures, and as distance from source and paleotopography controlled the thickness of deposits. In addition, the Tshirege Member is characterized by a number of vertical welding breaks which represent brief periods of cooling between deposition of the subunits. Welded tuffs tend to have less matrix porosity and more fractures than nonwelded tuffs. Fractures in welded tuffs may include relatively close-spaced cooling joints and as well as tectonic fractures. Although nonwelded tuffs also have fractures, they are generally less abundant than in welded tuff.

Several competing effects determine moisture content and fluid flux in welded, devitrified tuff. While water moves slowly through the unsaturated tuff matrix, it can move relatively rapidly through fractures if nearly saturated conditions exist (LANL 1997, 63131). A gravimetric water content of 38% is the value for saturation in Bandelier Tuff. The overall saturation levels measured from boreholes passing through and under the absorption beds at MDA T are relatively low. From 0 to 35 ft bgs the gravimetric water content was measured at values between 5% and 25%. At depths from 35 to 100 ft bgs the values averaged around 10%. Some elevated values with depth (greater than 35 ft) could be attributed to fracture fill that had relatively higher gravimetric values than the surrounding tuff (Nyhan et al. 1984, 06529.1, pp. 10–11). At these saturation levels, most of the 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 absorption occurs from the ground surface, as would be the case under 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 coatings are interrupted, fracture moisture is absorbed into the tuff matrix (Soll and Birdsell 1998, 70011, pp. 193–202).

### 3.2.2.2 Perched Intermediate Waters

Observations of perched intermediate water 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 (~340 ft bgs/6840 ft asl), Guaje Pumice Bed (~630 ft bgs/6510 ft asl), and the Puye Formation (~660 ft bgs/ 6480 ft asl) are local examples. The Cerro Toledo was drilled through at Well LADP-4, located north of MDA T in DP Canyon, but water was not observed. LADP-3 was drilled at an elevation (~6755 ft asl) that is below the elevation of the Cerro Toledo interval. Perched intermediate waters have been observed in some locations on the plateau near MDA T, such as at LADP-3 to the south in Los Alamos (LA) Canyon (in the Guaje at ~6430 ft asl), R-7 (in the Puye at ~6420 ft asl), and Otowi-4 (in the Puye at ~6380 ft asl). Other wells drilled over the years near the site have not encountered intermediate saturation zones. It is not known whether perched water bodies are isolated or connected and to what degree they may influence travel times and pathways for contaminants in the vadose zone. The absence of basalt flows in LADP-4 may have left that area without a "pooling" barrier to promote intermediate aquifer development. Purtymun (1995, 45344, p. 28) discusses the existence of three perched aquifers in the Los Alamos area. They are located in the midreach of Pueblo Canyon, the midreach of Los Alamos Canyon, and in the lower reach of Pueblo Canyon and its junction with Los Alamos Canyon.

No perched water was observed under MDA T during previous drilling events, although the boreholes were less than 200 ft bgs in depth (to an elevation of ~6940 ft asl). The deepest borehole drilled to date near the area was the 2800 ft deep Otowi-4 (~3830 ft asl).

### 3.2.2.3 Regional Aquifer

The main aquifer in the Los Alamos area rises westward from the Rio Grande within the Santa Fe Group 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 main aquifer is separated from the alluvium and perched water in the volcanics by 350 to 620 ft of tuff and volcanic sediments.

## 4.0 SCOPE OF ACTIVITIES

The main purpose of this investigation is to satisfy the objectives defined in Section 1.2 of this work plan. The radiological surveys, drilling, and sampling activities will be tailored to address the specific investigation objectives identified in Section 2.8. Regrading fill placement, erosion control projects, and other structural improvement activities are not required for the investigation. Drilling will be employed during investigations at MDA T for a number of reasons, including the following:

- to establish lateral extent with shallow angled and vertical boreholes,
- to establish vertical extent with relatively deep angled and vertical boreholes,
- to collect subsurface moisture profile data, and
- to collect fracture characteristic data.

### 4.1 MDA T Field Investigations

Field investigations at MDA T will consist of the following activities:

- Two angled boreholes (1 and 2) and one vertical borehole (3) will extend into the Cerro Toledo interval to analyze its potential role in vadose zone contaminant transfer. These boreholes, to be located within the boundaries of the MDA T disposal area, are also intended to provide lateral extent information.
- Shallower angle and vertical boreholes will be used to collect data around and under Building 257 and its associated structures, which have not undergone a comprehensive study. This investigation will not attempt to define the contamination of or in its tanks, pipes, or other structures due to current use.
- Surface and shallow subsurface sampling will also be used to collect data as defined from previous investigations and to focus on locations of interest, such as the absorption beds, disposal shafts, storage tanks, Building 035, and drainage paths into DP Canyon adjacent to the site.
- Sampling intervals will follow set guidelines with respect to structure depth and location and to field observations, including radiological screening and core analysis (Table 1).
- Sample intervals will include one each from the depth of the highest field screening detect, the greatest depth of field screening detect, the depth immediately below any structure of concern (beds, shafts, tanks, under buildings, etc.), and at total depth of borehole (Table 1).
- Characterization of fracturing and geotechnical properties of the subsurface media will be conducted down through the Cerro Toledo/Qbt 2 contact.

The methods used to conduct each of these activities are identified and discussed in Section 5, and Tables 1 and 2 provide summaries of the planned sample locations and investigation activities.

### 4.1.1 Justification for Alternative Scope of Work

The proposed work scope contains differences from that presented in the November 26, 2002, NMED Order. The proposed alternate work scopes are summarized in Table 3, along with a brief justification for the alternate approach. The following subsections provide additional details related to the justifications for alternate approaches referenced in Table 3.

### 4.1.2 Field Screening

Section IV.C.2.e.iv, Paragraph 2, of the NMED Order specifies that core samples collected at MDA T be screened using the methods described in Section IX.B of the Order. Section IX.B.2.d of the Order specifies that all core samples be screened by (1) visual examination, (2) headspace vapor screening for VOCs, and (3) metals screening using x-ray fluorescence (XRF). Additional screening for release-specific characteristics, such as pH and HE, shall be conducted where appropriate. Section IV.C.2.e.iv of the Order indicates that screening results for the samples collected at MDA T shall be used to identify samples to be submitted for laboratory analysis.

Results of field investigations at MDA T from 1992 to 1997 indicate that the screening methods specified in the Order, other than visual examination and radiological screening, would be ineffective and would generate no useful information for the purpose of identifying samples to submit for laboratory analysis. The limitations of field screening methods for various classes of analytes are discussed below.

#### 4.1.2.1 VOCs

The headspace vapor screening procedure given in Section IX.B.2.d of the Order calls for the sample to be sealed in a bag or other container and equilibrated with the ambient air inside the container. The concentration of VOCs in the headspace gas is then measured using a PID. The above procedure is designed to identify samples having elevated concentrations of VOCs in the solid matrix. This procedure is designed to cause VOCs associated with the solid phase to volatilize into the headspace, where they can be detected using a PID.

The results of previous investigations at MDA T indicate that this procedure is not appropriate for the core samples to be collected at MDA T because of the low concentrations observed in fixed laboratory analyses results.

#### 4.1.2.2 XRF

XRF methods are not capable of detecting levels of metal contamination previously found at MDA T (near or below background) and would not be useful as a guide to planned sample collection activities.

#### 4.1.2.3 HE

There are no documented processes, historical or present, that involve HE at MDA T. HE screening would also not be useful for sampling guidance or for health and safety reasons.

### 4.1.3 Sample Analysis

At each borehole, surface samples collected will not be analyzed for VOCs. Analysis of dioxins and furans will be only for samples taken at the operational surface. These chemicals only have an airborne release mechanism from the salamander burners and this horizon is the most likely to be contaminated. (Item 14 in Table 3)

### 4.1.4 Groundwater Monitoring

Installation of regional groundwater monitoring wells and the sampling of groundwater wells in the area of MDA T (Table 3, Items 18 through 22) are duplicative of existing work under the Hydrogeologic Work Plan (HWP) (LANL 1998, 59599). These activities are not included in the scope of the SWMU 21-016(a)-99 work plan.

## 4.2 Sampling and Analysis for Site Surface Contamination

Initial activities concerning the site surface conditions would include surveys to delineate the locations of various structures and possibly configurations of abandoned lines. A gross gamma radiation walkover survey of MDA T and accessible areas outside the fencing would be completed in order to show that surface contamination is generally TA-21 inclusive rather than MDA T site source specific. This walkover survey will be followed by selected spade and scoop sampling on the canyon slope and potentially within the MDA T boundary to characterize areas of elevated activities observed in the walkover surveys. The sampling will target areas with respect to the survey results, locations of interest based on previous investigation results, and locations that could augment nature and extent studies to obtain data defining site surface characteristics representative of present day site conditions. These surface samples would most likely be taken from the 0.0 to 0.5-ft and 1.5-to 2.0-ft interval. Samples of the historical surface will also be collected at the borehole locations if indicated by the walkover survey. Additional samples through surface locations may be collected at deeper depths depending on the field screening results.

Analytic evaluations of the samples are summarized in Table 2. VOCs will not be analyzed for due to their volatility. Surface sample analysis of dioxins and furans will not be done because of the past backfilling and grading activities. Surface vapor sampling will be conducted over the absorption beds and the disposal shaft complex if subsurface VOC contamination is detected.

## 4.3 Sampling and Analysis Activities in the DP Canyon Area and Shallow Soil Areas Immediately Adjacent to MDA T Site

MDA T is to function as a permanent repository of the existing shaft waste and absorption bed contaminants. The original site surface received fill and underwent regrading after all disposal operations ended. This minimizes the need to replace shallow surface data within the fenced area and sampling will be focused per the following discussion. Sampling locations in areas immediately adjacent to the north side of the MDA T site and the canyon slope down to the channel of DP Canyon will be based on a number of criteria. Results of the walkover survey will be used to determine sampling locations and resampling of previous sample locations will be used to define vertical and lateral extent. Sampling will focus on locations where previous studies indicated elevated levels of SVOCs and radionuclides.

Figure 11 presents the sample locations along the southern edge of DP Canyon and downslope towards the stream channel, again to address vertical and lateral extent issues. At the locations within the depositional plain (30 through 32) in the canyon, a minimum of two samples (0.5 and 1.5 ft bgs) will be collected. Additional sampling will be based on radiological field screening and previous sampling results. Hand auger techniques will be used at these locations. Samples will be collected to assess effects from operational spills and overflows that occurred during the operation of Absorption Bed 4. Sampling of tuff bedrock will also occur as appropriate. Analytical suites of the samples are summarized in Table 2.

### 4.4 Sampling and Analysis of Soils and Bedrock at Building 257

To assess the condition of soil and bedrock contamination associated with the industrial wastewater treatment facility, Building 257, vertical and angled boreholes will be drilled around and underneath the building and its associated structures (Figure 12). Three shallow vertical boreholes, 9 through 11, will be located along the south, east, and west sides of Building 257 as part of the comprehensive study of that buildings nature and extent. Additional borings for lateral extent may be installed based on results of initial field screening. Three angled boreholes, 6 through 8 (45 degree/130–160 linear ft), will be situated to avoid buried utilities and to provide sampling access under structures. These are oriented to intersect the predominant trend of fractures at TA-21. Data will be collected with regard to operational effects, as well as to investigate the vertical nature and extent effects of particular structures including the (partially below grade) raw waste storage tanks, tanks 112 and 113, tanks 110 and 111, and the americium unloading area. The buried pipes running to and from the building are not a part of the MDA T investigation. Analytic suites of the samples are summarized in Table 2.

### 4.5 Sampling and Analysis at Building 035

Focused drilling at key locations around Building 035 (the north side and the southwest and southeast corners of the building and step out locations west, east and south of the former building) will be used to verify the 1993–1994 data and provide the overall nature and extent of contamination for this area of the site soils. Boreholes 12 through 18 (Figure 13) will target particular locations around the footprint of Building 035, including the valve box, storage tank, and septic leach field locations, to establish vertical and lateral extent issues of previously detected elements, including radionuclides. Borehole 13 will be located just east of Building 035, targeting the location of the septic tank and leach field for that building. Previous sampling events did not have sample locations in this area. This borehole will also provide lateral extent data along the eastern area of the building site. Boreholes 15, 16, and 18 will be used to establish lateral extent along the area south of the building, and results can be compared to results derived from borehole 21-05064 during the 1996–1997 study. Records indicate that a citric acid tank was located on the north side of Building 035. Borehole 12 will be located to characterize the north side of the building and to provide information that could confirm the tank as a source of perchlorates. Borehole 14 will be placed at the east end of the building footprint to confirm activity levels found in previous investigations. Borehole 17 will be located where acid waste lines, buried storage tank(s), and a valve box associated with the fluid lines were located adjacent to the southwest corner of Building 035. Analytical suites of the samples are summarized in Table 2.

### 4.6 Sampling and Analysis for Absorption Bed Area/Shaft Area/RSWA Area

Investigation activities include drilling vertical and angled boreholes to define extent of contaminants in the tuff matrix and to study comparative moisture profile data (Figure 14). Two angled boreholes and one vertical borehole will be used to characterize fractures in Qbt 2 and Qbt 3, as well as to characterize vertical extent of known contaminants from the absorption beds, disposal shafts, and the RWSA. Boreholes 1 and 2 will be drilled as deep, angled holes (45 degree/~545 linear ft). These boreholes will be situated with a north-northwest by south-southeast strike that will pass under the disposal area complex. Borehole 3 will be situated north of Absorption Bed 4 and drilled as a vertical borehole. All three boreholes are planned to pass through the Cerro Toledo interval. Air-rotary coring with a 5-in. bit and a split barrel sampler will be used to ensure that the desired depth can be achieved and continuous core can be collected for comprehensive subsurface studies, such as fracture analysis. These three boreholes will provide a number of sample points for fixed laboratory analysis, adding to vertical and lateral extent characterization within the vadose zone. Visual and structural analysis of the collected core, combined with existing results, will be used to augment fracture characteristic analysis studies. Analytical suites of the samples are summarized in Table 2. Boreholes 4 and 5 will be auger cored down to about 100 ft bgs and sampled $CO_3$ and $HCO_3$ to identify chemical signatures of shaft-derived contamination and absorption-bed-derived contamination.

These boreholes also provide an opportunity to collect geotechnical data to support transport modeling by characterizing site-specific hydrogeologic properties at MDA T. These properties include saturated and unsaturated hydraulic conductivity, chloride-ion concentration, porosity, bulk density, matrix potential (i.e., suction), and moisture content. A detailed profile of moisture content will ensure an adequate data set to calibrate a neutron probe for moisture logging. Collecting a profile of matrix potential in combination with the moisture content will provide data on the likely direction of moisture movement in the subsurface. Estimates of saturated and unsaturated hydraulic conductivity also support modeling of liquid migration in the vadose zone. Tuff samples for chloride-ion concentration support evaluation of the rates of water infiltration and evaporation. These boreholes will also be used for moisture profile analysis and data collection, using a neutron probe (at 1-ft intervals), to compare with the previous moisture data collection events discussed in Appendix B.

## 4.7 Sampling and Analysis for Perched Water and Vadose Zone Characteristics

Three of the planned boreholes (1 through 3) will extend into the Cerro Toledo interval (~350 ft bgs) in order to verify the assumption that there is no groundwater to that depth below MDA T. The analytical suite in the deep borings will be expanded to include analyses for perchlorate. Following initial data evaluation field logging and confirmation by geophysical procedures, installation of monitoring wells for gas or water will proceed following approval by administrative authority.

Subsurface pore-gas samples will be collected from boreholes 1 through 18 following LANL-ER-SOP-6.31. In each borehole, one sample will be collected at the depth in which the borehole is nearest the targeted disposal unit, and the second sample will be collected at total depth (TD). Pore-gas samples will be collected using a straddle packer to isolate discrete depths within the borehole. Each interval will be purged prior to sampling until measurements of carbon dioxide and oxygen are stable and representative of subsurface conditions. Subsurface pore-gas samples will be collected in SUMMA canisters and submitted for analysis of VOCs using EPA Method TO-14, and tritium samples will be collected in silica gel samplers and submitted for tritium analysis using EPA Method 906.0. Although VOCs have not been identified consistently in previous investigations, VOCs are being evaluated in pore gas to assure a subsurface plume does not exist below MDA T. Pore-gas samples will be collected twice: once following completion of drilling and a second time 30 days later.

Quality assurance/ quality control (QA/QC) samples for VOCs in pore-gas will consist of an equipment blank and field duplicate for each sampling round. After sampling and purge decontamination, the equipment blank will be collected by pulling zero gas (99.9% ultra high purity nitrogen) through the packer sampling apparatus. This sample will be used to evaluate decontamination procedures. The field duplicate sample will be used to evaluate the reproducibility of the sampling technique. A field duplicate sample will also be collected for tritium. QA/QC samples will be collected in accordance with LANL-ER-SOP-1.05.

## 5.0 INVESTIGATION METHODS

The following RRES-RS SOPs are applicable to the investigation methods proposed in this plan:

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| ER-SOP-1.01, Rev. 1 | General Instructions for Field Investigations |

| | |
|---|---|
| ER-SOP-1.02, Rev. 1 | Sample Containers and Preservation |
| ER-SOP-1.03, Rev. 2 | Handling, Packaging, and Transporting Field Samples |
| ER-SOP-1.04, Rev. 4 | Sample Control and Field Documentation |
| ER-SOP-1.05, Rev. 0 | Field Quality Control Samples |
| ER-SOP-1.06, Rev. 2 | Management of ER Project Waste |
| ER-SOP-1.08, Rev. 1 | Field Documentation of Drilling and Sampling Equipment |
| ER-SOP-1.10, Rev. 0 | Waste Characterization |
| ER-SOP-3.11, Rev. 1 | Geodetic Surveys |
| ER-SOP-4.01, Rev. 1 | Drilling Methods and Drill-Site Management |
| ER-SOP-4.04, Rev. 2 | Contract Geophysical Logging |
| ER-SOP-5.01, Rev.3 | Well Construction |
| ER-SOP-5.02, Rev. 2 | Well Development |
| ER-SOP-5.03, Rev. 2 | Monitoring Well and RFI Borehole Abandonment |
| ER-SOP-5.07, Rev. 0 | Operation of LANL Owned Borehole Logging Trailer |
| ER-SOP-6.01, Rev. 3 | Purging of Wells for Representative Sampling of Ground Water |
| ER-SOP-6.03, Rev. 2 | Sampling Volatile Organics |
| ER-SOP-6.09, Rev. 1 | Spade and Scoop Method for Collection of Soil Samples |
| ER-SOP-6.10, Rev. 1 | Hand Auger and Thin Wall Tube Sampler |
| ER-SOP-6.14, Rev. 0 | Sediment Material Collection |
| ER-SOP-6.24, Rev. 1 | Sample Collection from Split-Spoon Samplers and Shelby Tube Sampler |
| ER-SOP-6.26, Rev. 1 | Core Barrel Sampling for Subsurface Earth Materials |
| ER-SOP-6.31, Rev. 1 | Atmospheric and Sub-Atmospheric Air Sampling |
| ER-SOP-7.05, Rev. 1 | Subsurface Moisture Measurements Using a Neutron Probe |
| ER-SOP-12.01, Rev. 4 | Field Logging, Handling, and Documentation of Borehole Materials |

The SOPs listed above are available at the following Internet address: http://erproject.lanl.gov/quality/user/sops.asp. Additional procedures may be added as necessary to describe and document quality-affecting activities.

## 5.1 Drilling Methods

The deeper boreholes (1 through 3) will be drilled with a rotary drill rig capable of coring and deep borehole production. The goal is to obtain data for vertical extent analysis and to carry out geotechnical activities and sampling for fracture characteristic studies. Core will be radiologically screened, visually inspected, and geologically logged. All drilling activities will refer to appropriate Laboratory guidance documents and protocol to ensure health and safety issues are reviewed and addressed during field operations.

Each shallow borehole (4 through 18) will be continuously cored using 9 in. auger flights with a split barrel sampler to TD. Samples will be collected at a minimum of two depths to establish vertical extent. Samples may be collected at additional depths if radiological screening is above background. Shallow boreholes will be drilled down to the 40 to 50 ft bgs range in select areas for lateral extent data and in some cases, such as at Building 257, angled down to 130 to 160 ft bgs in order to collect a comprehensive data set for that area. Shallow boreholes (or hand-auger samples, as appropriate) will also revisit areas of interest based on previous sample event results, such as the Building 035 footprint/area to collect additional analyses not previously performed. Hand-auger boreholes will investigate the top of the DP Canyon slope area along the north side of North Perimeter Road that was affected by Absorption Bed 4 overflows, and along the south side slope of DP Canyon down to the stream channel.

The depth, angle, and sampling plans for each borehole and sampling location are described in Table 1. The exact location of each borehole will be determined by a global positioning system (GPS) field survey of pit and shaft boundaries, utility locates as part of the excavation permitting process, and other access restrictive surface conditions.

Note that the exact location of each borehole will be determined after extensive and careful review of the potential risks and access limitations. Pit and shaft boundaries will be mapped via a differential global positioning system survey (+/-2 cm X, Y, Z) following LANL-ER-SOP-3.11, Rev. 1 to further refine borehole locations. A line locate survey will also be conducted in order to further define potentially hazardous utility lines in the work area. Each site will be thoroughly examined to identify potential hazards for subsurface drilling.

## 5.2 Methods of Collecting Soil and Rock Samples

While surface samples will be collected during initial drilling activities, the most common method for surface and shallow subsurface sampling is the spade and scoop method, covered in LANL-ER-SOP 6.09. Stainless steel shovels, spades, scoops, and bowls are used due to ease of decontamination. Disposable tools made of polystyrene or Teflon can also be used if necessary. In some cases, hand-augering tools can be used to collect shallow subsurface samples if geologic material conditions permit. Tools used and their applicability is covered in LANL-ER-SOP 6.10. If the surface location is at bedrock, an axe or hammer and chisel may be used in order to collect samples.

Surface samples will be field screened for health and safety purposes prior to collection, then placed in ziplock bags and /or sample jars as composite grabs derived from hand augers, scoops, or chiseling devices in accordance with the sampling guidance document and appropriate SOPs (see Section 5.0, LANL-ER-SOP-1.01-1.08 series). Planned intervals would be 0.5 ft down to 1–2 ft or refusal. If field radiological screening indicates activity beyond reach of standard surface methods, drilling may be an option in order to define vertical extent.

Continuous core subsurface tuff samples will be analyzed, per LANL-ER-SOP 6.26, for lithologic and structural features, removed from the split-barrel sampler, and placed into seam-sealed plastic sleeves or protec-core heat sealed bags to preserve the core moisture content. Sample jars and/or ziplock bags will be filled with discrete segments of the core. All samples (surface and subsurface) will then be shipped through the sample management office (SMO) to fixed laboratories for analysis. The analytical suites for each borehole and surface sample location are listed in Table 2.

Tuff samples will be collected at least every 10 ft in the deep boreholes (angled 1, 2, and 6 through 8; and vertical 3) beginning beneath the target disposal units or structures. Boreholes 4 through 6, and 9 through 18, will be sampled at least every 5 ft beginning at the surface. Sample locations 19 through 32 will be sampled from the ground surface continuously downward at 1-ft intervals to a depth of refusal. A minimum of two samples will be used for fixed laboratory analysis. Samples will also be collected from intervals where contamination is suspected because of elevated field screening results and/or if visual inspection identifies fractures or staining. If radiological contamination is detected using field-screening methods at the locations TD, the boring will be advanced until contamination is no longer detected. QA/QC samples will include field duplicate samples that will be collected following the applicable SOPs listed in Section 5.0. To confirm decontamination procedures, rinsate blanks will also be collected.

Field documentation of samples collected from fractures will include a detailed physical description of the fracture fill material and rock matrix sampled. The volumes of fracture fill and rock matrix material included in the sample will be estimated from field measurements. An additional sample will be collected from the rock matrix adjacent to the fracture sample material to allow for comparison. The fractures and matrix samples will be paired and assigned unique identifiers.

### 5.3 Collection of Geotechnical Data

All boreholes will be cored continuously to total depth and geologically logged, including lithology, apparent moisture, structural features (specifically fracture occurrence, orientation, and density), and core recovery compared to interval drilled per LANL-ER-SOP 12.01 and LANL-ER-SOP 4.01. RQD can also be documented in the field. The RQD is basically defined as the collective length of core in excess of two by four inches expressed as a percentage of total core drilled, giving you the percentage of solid core obtained, which is dependant on the strength and number of discontinuities in the rock mass. Low numbers reflect incompetent, heavily fractured, or sandy formations. High numbers indicate competent formations. Brass sleeves will be used at boreholes 1, 2, and 3 in the relatively unconsolidated Cerro Toledo interval to improve recovery and maintain structural integrity for geophysical characterization. Samples for Kd analysis will be collected from a minimum of one open and one filled fracture in each deep borehole.

Moisture content samples will be collected at 2.5-ft intervals and placed in glass sample jars. Samples for saturated and unsaturated hydraulic conductivity, matrix potential, porosity, Kd, chloride analysis, and bulk density will be collected once in soil, once in each tuff unit, and twice from the Cerro Toledo interval. The samples collected from the Cerro Toledo interval will be selected from core to be representative of all the textural intervals encountered. Analyses for saturated and unsaturated hydraulic conductivity, porosity, and bulk density will be performed using analytical methods specified by contract requirements of the Laboratory's SMO. One field duplicate for every 20 geotechnical samples taken will be collected and analyzed.

Competent boreholes will allow for geophysical logging runs performed by Water Quality and Hydrology group (WQH), using the Laboratory borehole logging trailer per LANL-ER-SOP-5.07 and contract geophysical logging per LANL-ER-SOP-4.04, which can provide additional data for tuff matrix (vadose zone) characterization, such as porosity, saturation, and potential. Two boreholes (4 and 5) will be used to perform neutron logs at 1-ft intervals for comparison to previous borehole moisture content studies performed in the same area. The downhole camera can also be used to delineate lithologic contacts and augment fracture characterization studies.

### 5.4 Potential Pore-Gas or Perched Saturation Zone Monitor Well Installation

The decision to install vapor monitoring wells will be based on the results of two rounds of vapor sampling using a FLUTE membrane, one at TD of the borehole (completion of drilling) and the second round 30 days later. The samples will be submitted for laboratory analysis. The boreholes will remain open until the decision to install vapor monitoring wells is made.

If a decision is reached to install a pore-gas monitoring well (Figure 15), a well design would be produced outlining target intervals, port types and quantity, and packer configurations. As most of these boreholes would be drilled using hollow-stem auger flights, installation of a pore-gas monitoring well could proceed without redrilling. The hollow stem acts to temporarily case the borehole, so that the well casing (riser) may be inserted down through the center of the augers once the desired depth is reached, minimizing the risk of possible collapse of the borehole.

During drilling operations there is the potential for encountering zones of elevated moisture content, localized saturation, and groundwater. These zones may not be assignable to either an alluvial or the regional groundwater system and represent a localized phenomenon. The Laboratory's decision process for characterizing these zones is presented in the attached flowchart, shown in Figure 16 and described in the following text.

If saturation is encountered as a borehole advances, drilling would be stopped to determine whether sufficient water volume is available to analyze the water quality. These analyses may include metals, anions, perchlorate, alkalinity, carbon organic carbon, total inorganic carbon, and total dissolved solids. Generally the total volume required is approximately 0.5 to 1.0 L. Of this volume, 100 mL is unfiltered and unpreserved; another 100 mL is filtered and preserved with nitric acid. If this minimum volume of groundwater cannot be collected, the borehole would be continued to the planned TD or until saturation is encountered again and the process is repeated. A porous cup lysimeter or absorbent membrane would be installed at the depth of saturation to monitor the zone if the borehole is completed for pore-gas monitoring. Insufficient water sample volumes from discreet depths would not be composited to make the required volume for screening analysis.

If sufficient volume exists, a groundwater sample would be collected and analyzed for the screening constituents on a rapid turnaround basis at a geochemistry laboratory at Los Alamos. Typically, results of groundwater screening samples are available in the R-well drilling program within 48 hr. During this time, the borehole will be advanced to the base of saturation, or the perching horizon, and halted. If possible, the perching horizon would be identified and not penetrated. This activity will determine the thickness of the zone of saturation and the characteristics of the perching horizon. Borehole drilling will cease, and a monitoring well will be designed, and the design will be submitted to NMED for approval. Following approval of the design, the well will be installed. A borehole will be drilled adjacent to the well and the saturated zone isolated with a double wall casing advancement drilling method to isolate the known saturated zone. The additional borehole will then be completed to the planned depths and the process repeated.

Once these wells are installed, an appropriate sampling program will be implemented for data collection and analysis.

### 5.5 Borehole Abandonment

Backfilling (abandonment) of investigation boreholes will be dependant on borehole depth. Shallow borings (down to 20 ft) can be backfilled with the associated cuttings and tamped down. Deeper borings (from 20 ft on) will be backfilled according to procedures outlined in LANL-ER-SOP-5.03. The procedure takes into account any subsurface characteristics (perched zones, etc.) that would require isolation if the decision to abandon versus well installation had been made. The placement of backfill materials, such as bentonite and cement, would be documented with regard to volume (calculated and actual), intervals of placement, and additives used to enhance backfilling.

## 6.0 ONGOING MONITORING AND SAMPLING PROGRAM

There is no ongoing monitoring at SWMU 21-016(a)-99. Groundwater monitoring of existing wells is included as part of the scope of the HWP.

## 7.0 SCHEDULE

The planned submittal date for the MDA T WP to the NMED is February 29, 2004. Following a 60-day review period of the WP by the NMED, subsequent approval would allow field activity preparation and performance to commence. The start of fieldwork is dependent on the finalization of the authorization basis documentation process. Preparation activities and implementation of the field work is anticipated to require approximately 90 days through demobilization from the site. Sample submittals to the SMO should be completed by that time. Receipt of investigation results, is anticipated 30 days after demobilization. A schedule for submittal of final reports and data to NMED that considers authorization basis issues will be drafted by the administrative authority.

## 8.0 REFERENCES

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

Broxton, D.E., P.G. Eller, June 1995. "Earth Science Investigations for Environmental Restoration, Los Alamos National Laboratory Technical Area 21," LA-12934-MS, Los Alamos, New Mexico. (Broxton et al. 1995, 58207)

EPA (US Environmental Protection Agency), April 10, 1990. Module VIII of RCRA Permit No. NM0890010515, EPA Region VI, issued to Los Alamos National Laboratory, Los Alamos, New Mexico, effective May 23, 1990, EPA Region VI, Hazardous Waste Management Division, Dallas, Texas. (EPA 1990, 1585)

EPA (US Environmental Protection Agency), April 19, 1994. Module VIII of RCRA Permit No. NM0890010515, EPA Region VI, new requirements issued to Los Alamos National Laboratory, Los Alamos, New Mexico, effective May 19, 1994, EPA Region VI, Hazardous Waste Management Division, Dallas, Texas. (EPA 1994, 44146)

LANL (Los Alamos National Laboratory), January 1994. "Phase Report Addendum 1B and 1C, Operable Unit 1106 RCRA Facility Investigation," Los Alamos National Laboratory document LA-UR-94-4360, Los Alamos, New Mexico. (LANL 1994, 52350)

LANL (Los Alamos National Laboratory), November 1996. "RFI Report for Potential Release Sites 21-016(a-c), 21-011(a), 21-028(a), C-21-009, and C-21-012, Material Disposal Area T, Field Unit 1," Los Alamos National Laboratory document LA-UR-96-4508, Los Alamos, New Mexico. (LANL 1996, 70348)

LANL (Los Alamos National Laboratory), April 1997. "Performance Assessment and Composite Analysis for Los Alamos National Laboratory Material Disposal Area G," Los Alamos National Laboratory document LA-UR-97-0085, Los Alamos, New Mexico. (LANL 1997, 63131)

LANL (Los Alamos National Laboratory), May 1998. "Hydrogeologic Workplan for Los Alamos National Laboratory," Los Alamos National Laboratory document, LA-UR-01-6511, Los Alamos, New Mexico. (LANL 1998, 59599.1)

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

LANL (Los Alamos National Laboratory), November 1998. "Installation Work Plan for Environmental Restoration Project, Revision 7," Los Alamos National Laboratory document, LA-UR-98-4652, Los Alamos, New Mexico. (LANL 1998, 62060.4)

LANL (Los Alamos National Laboratory), 2003. "List of Drawings Ued in Historical Investigations Report for Material Disposal Area T," Los Alamos, New Mexico. (LANL 2003, 81175)

Nyhan, J.W., June 1978. "Soil Survey of Los Alamos County, New Mexico," Los Alamos National Laboratory report LA-6779-MS, Los Alamos, New Mexico. (Nyhan et al. 1978, 5702)

Nyhan, J. W., July 1984. "Distribution of Radionuclides and Water in Bandelier Tuff Beneath a Former Los Alamos Liquid Waste Disposal Site after 33 Years," Los Alamos National Laboratory report LA-10159-LLWM, Los Alamos, New Mexico. (Nyhan 1984, 06529)

Nyhan, J. W. et al., July 1, 1984. "Distribution of Radionuclides and Water in Bandelier Tuff Beneath a Former Los Alamos Liquid Waste Disposal Site after 33 years," Los Alamos National Laboratory report LA-10159-LLWM, Los Alamos, New Mexico. (Nyhan et al. 1984, 06529)

Nyhan, J. W., and B. Drennon, September 1993. "Data Analysis of the 1984 and 1986 Soil Sampling Programs at Material Disposal Area T in the Los Alamos National Laboratory," Los Alamos National Laboratory report LA-12650-MS, Los Alamos, New Mexico. (Nyhan and Drennon 1993, 23248)

Purtymun, W. D., January 1, 1995. "Geologic and Hydrologic Records of Observation Wells, Test Holes, Test Wells, Supply Wells, Springs, and Surface Water Stations in the Los Alamos Area," Los Alamos National Laboratory report LA-12883-MS, Los Alamos, New Mexico. (Purtymun 1995, 45344)

Purtymun, W. D., February 20, 1967. "Data Pertaining to the Construction of a Solid Waste Disposal Pit," Los Alamos National Laboratory letter to W. Kennedy (H-6) from W. Purtymun, Los Alamos, New Mexico. (Purtymun 1967, 01009)

Rogers, M. A., June 1977. "History and Environmental Setting of LASL Near-Surface Land Disposal Facilities for Radioactive Wastes (Areas A, B, C, D, E, F, G, and T)," Los Alamos Scientific Laboratory report LA-6848-MS, Vols. I and II, Los Alamos, New Mexico. (Rogers 1977, 05707)

Sagez, K., August 2003. Record of communication to D. Salazar (FWO-WFM) from K. Sagez (WGII), Los Alamos, New Mexico. (Sagez 2003, 76090)

Sagez, K., September 2003. Record of communication to W. Moss (FWO-WFM) from K. Sagez (WGII) regarding summary of waste at TA-21, Los Alamos, New Mexico. (Sagez 2003, 76095)

Soll, W., and K. Birdsell, February 1998. "The Influence of Coatings and Fills on Flow in Fractured, Unsaturated Tuff Porous Media System," *Water Resources Research*, Vol. 34, No. 2, pp. 193–202. (Soll and Birdsell 1998, 70011)

Stauffer, P. H., K. H. Birdsell, M. Witkowski, T. Cherry, and J. Hopkins, March 2000. "Subsurface Vapor-Phase Transport of TCA at MDA L: Model Predictions," Los Alamos National Laboratory document LA-UR-00-2080, Los Alamos, New Mexico. (Stauffer et al. 2002, 69794)

Stoopes, G., August 8, 2003. "Drilling and Radiological Contamination at Former Building 35, TA-21 (former Operating Unit (OU) 1106)," memorandum to Ron Rager (Washington Group) from Gary Stoopes (Aurora Technical Services), Los Alamos, New Mexico. (Stoopes 2003, 76089)

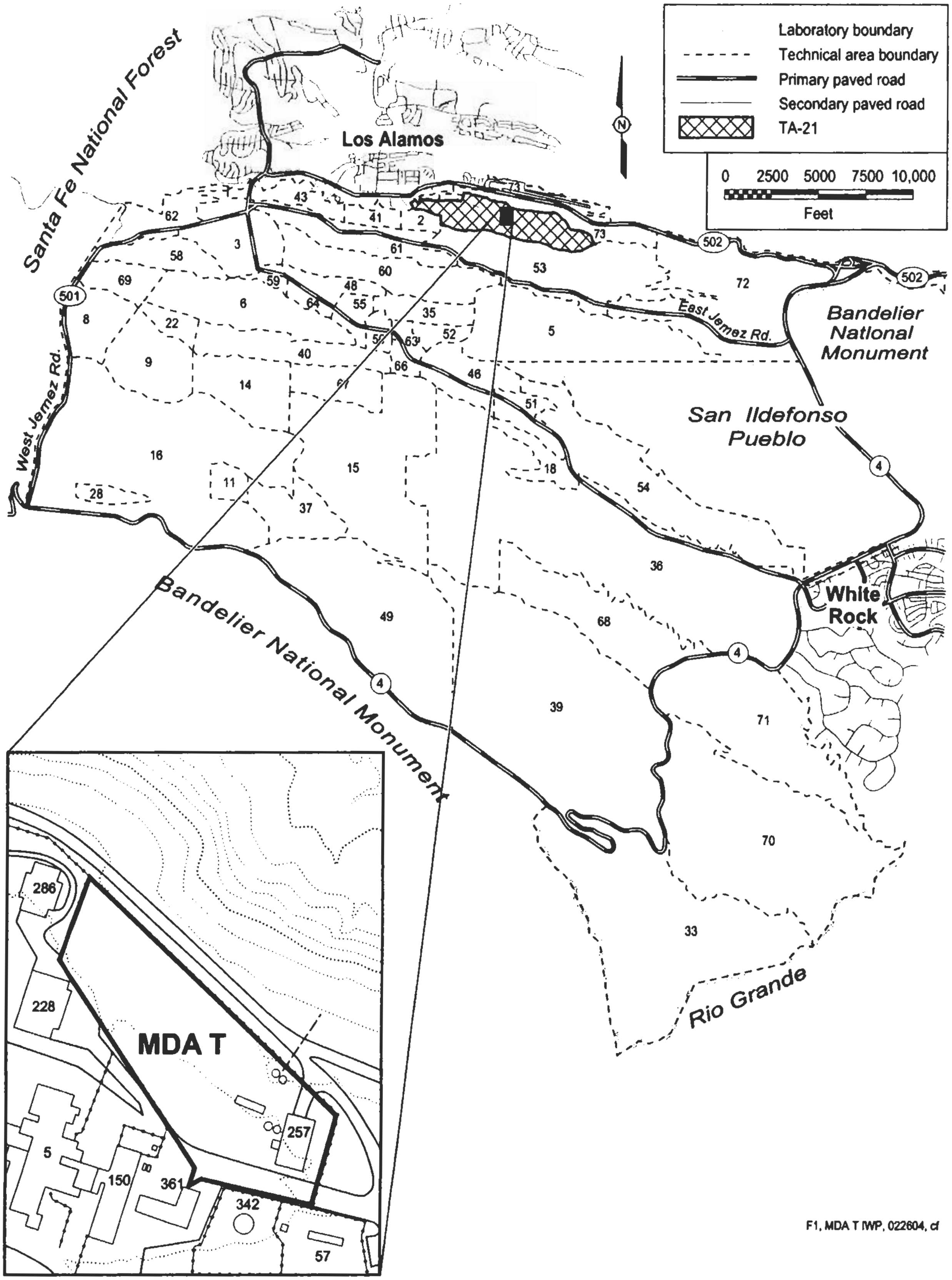
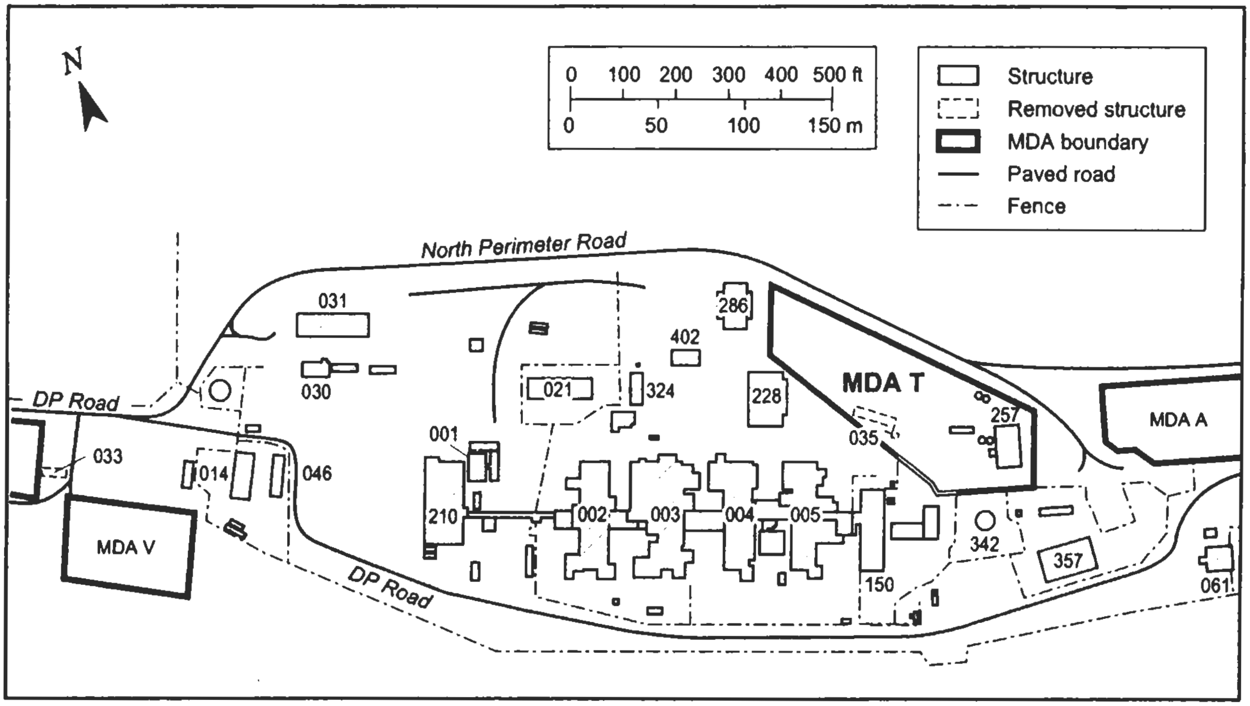
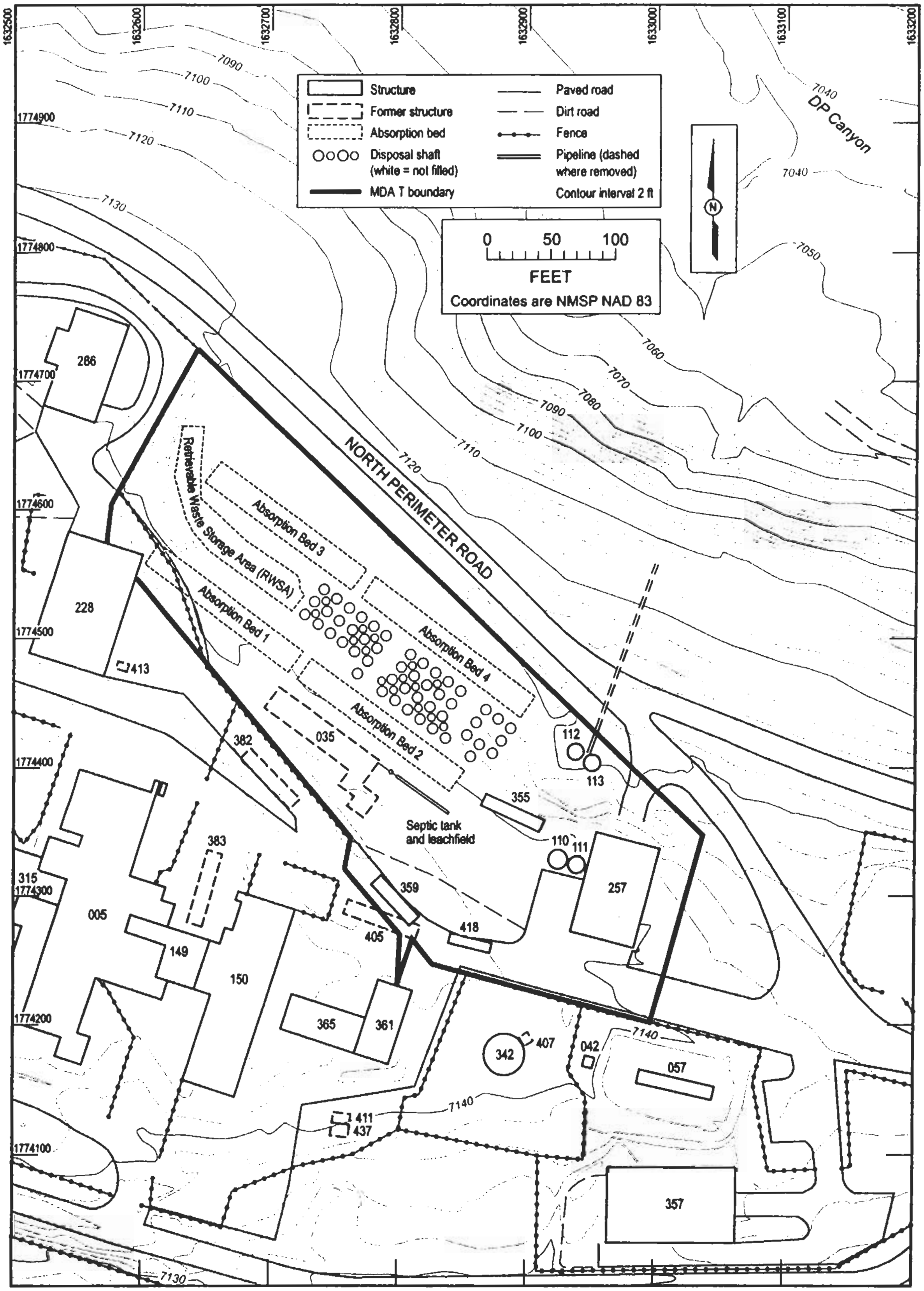


**Figure 1.** **Location of TA-21 with respect to Laboratory TAs and surrounding land holdings**



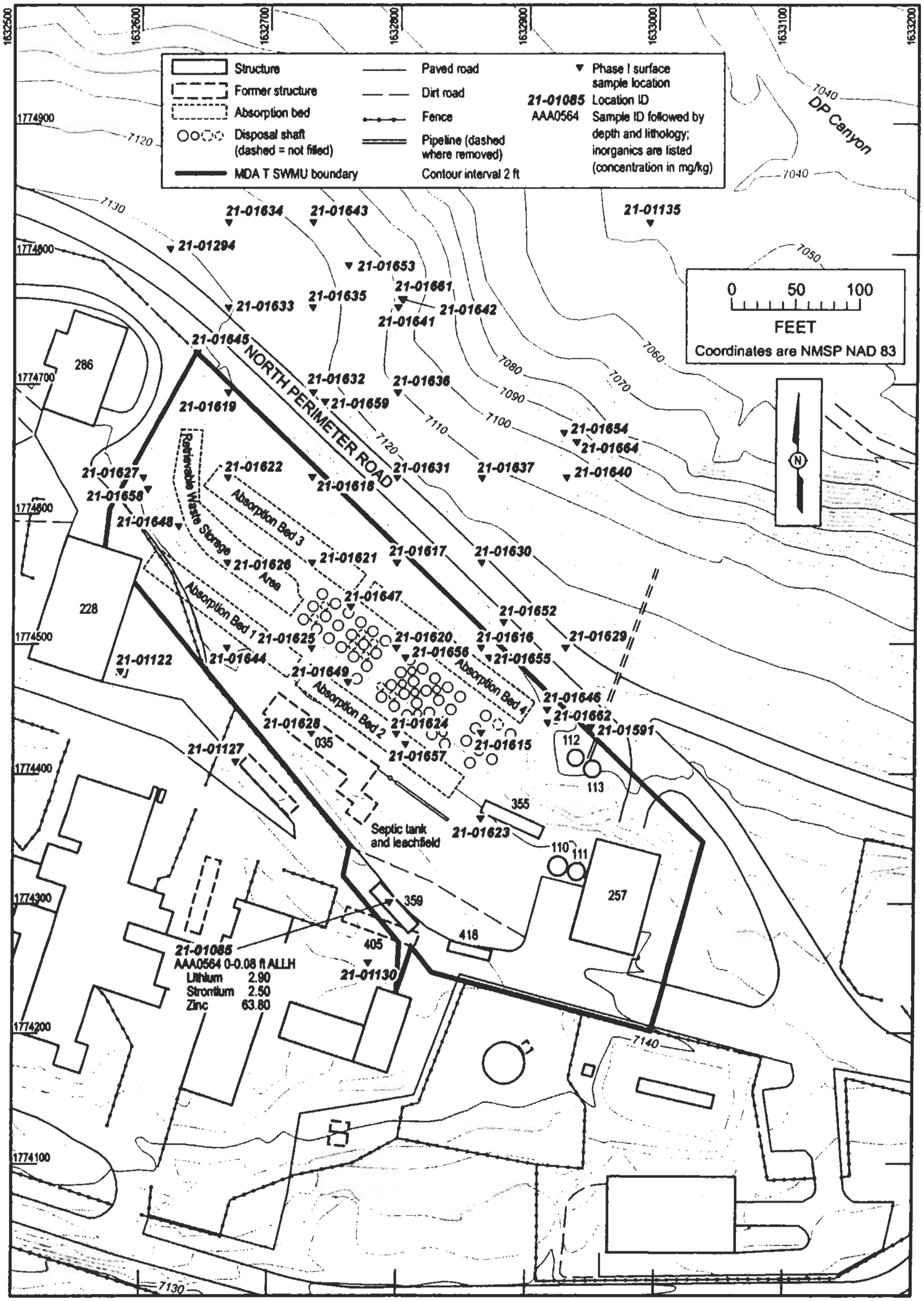
F2, MDA T IWP, 022604
A. Kron 11/17/03
Source: LANL 1991, 07528.1, p. 2–12

**Figure 2.** Location of MDA T in TA-21



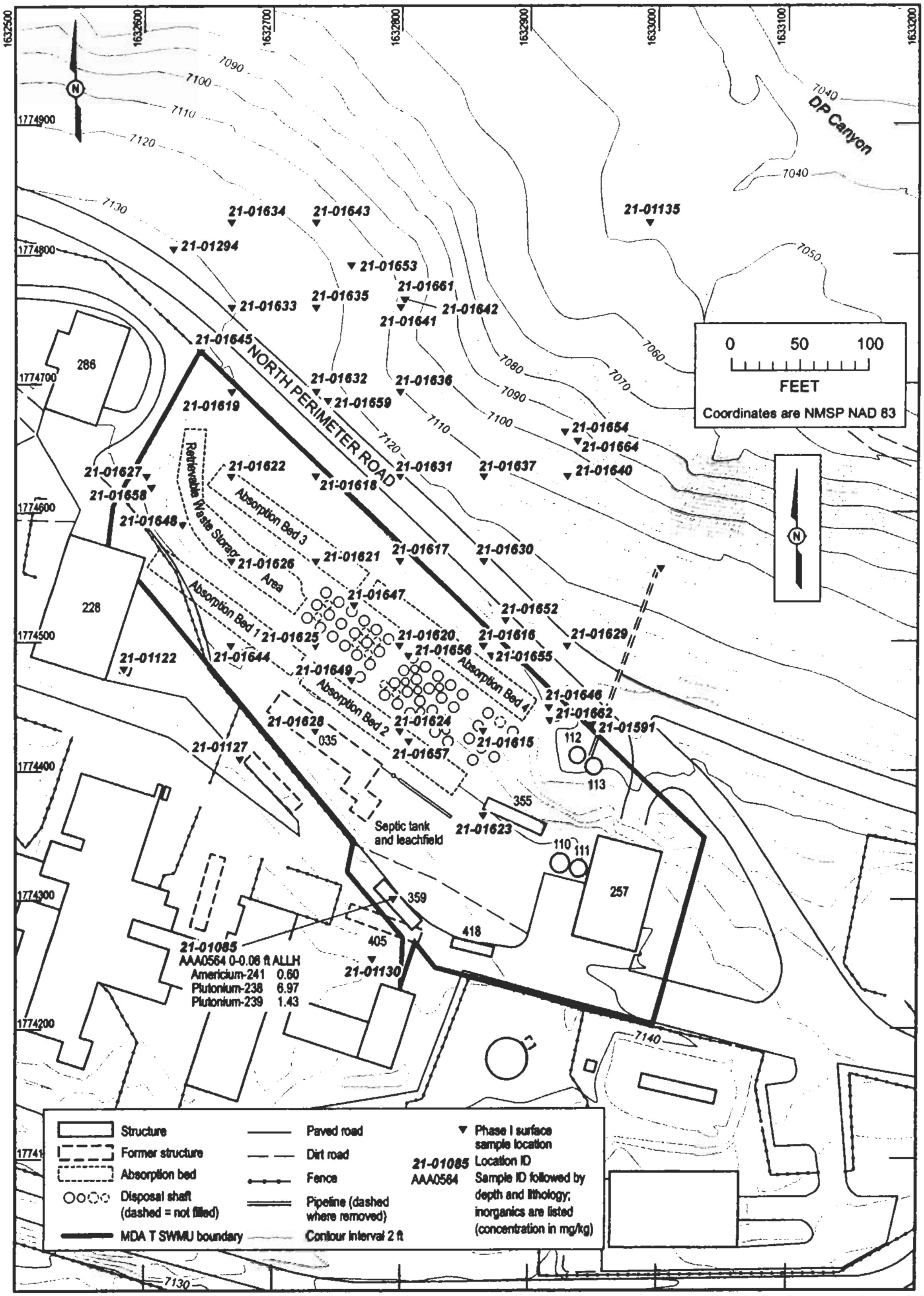
Source: GISLab Plot ID 200299 7/10/02, F3, MDA T IWP, 022604_A. Kron 11/21/03

**Figure 3. Detailed site map of MDA T**



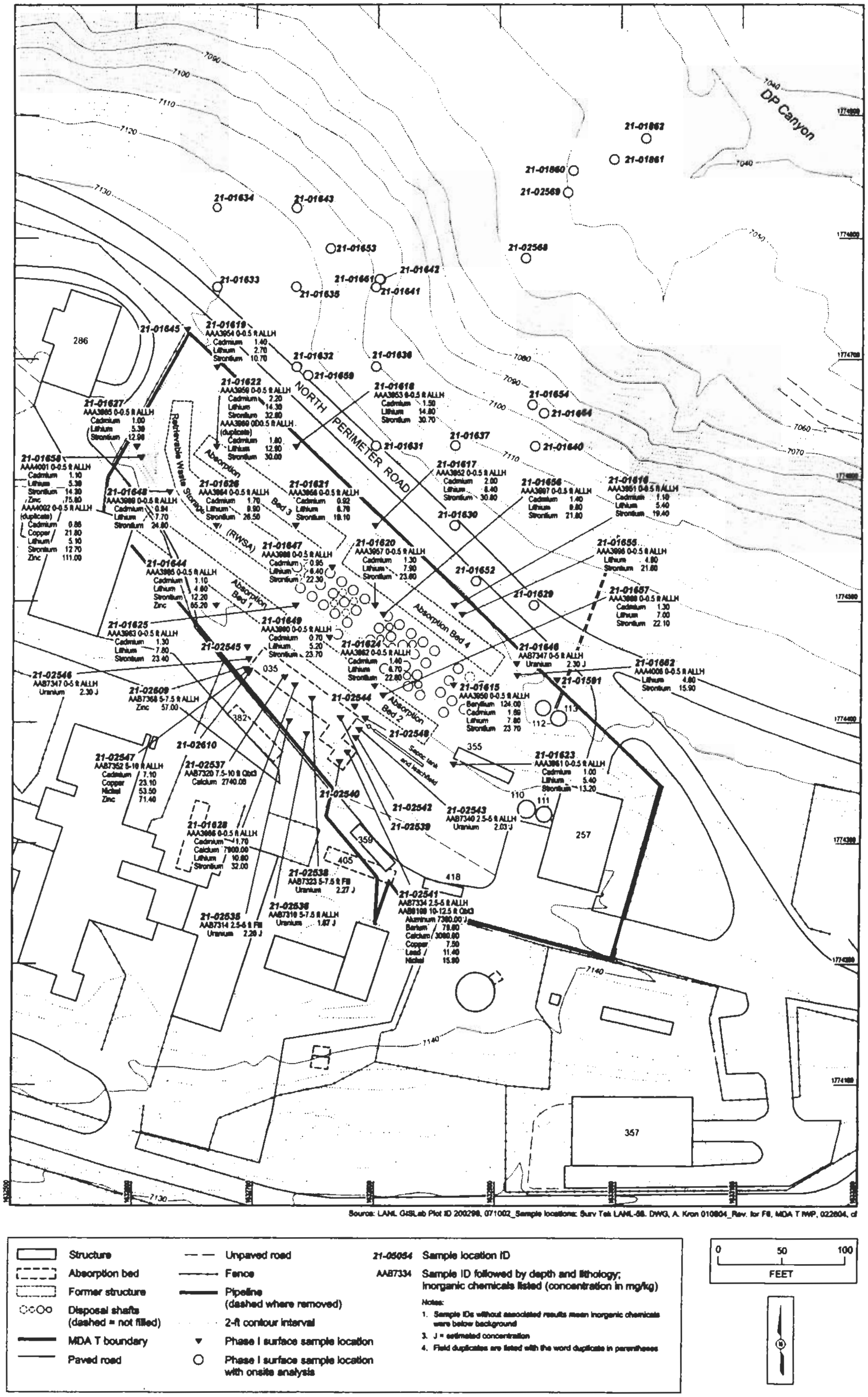
Source: GISLab Plot ID 200299 7/10/02, F4, MDA T IWP, 022604_A. Kron 11/21/03

**Figure 4.** **Inorganic chemicals detected above background values in 1992 Phase I RFI surface samples**



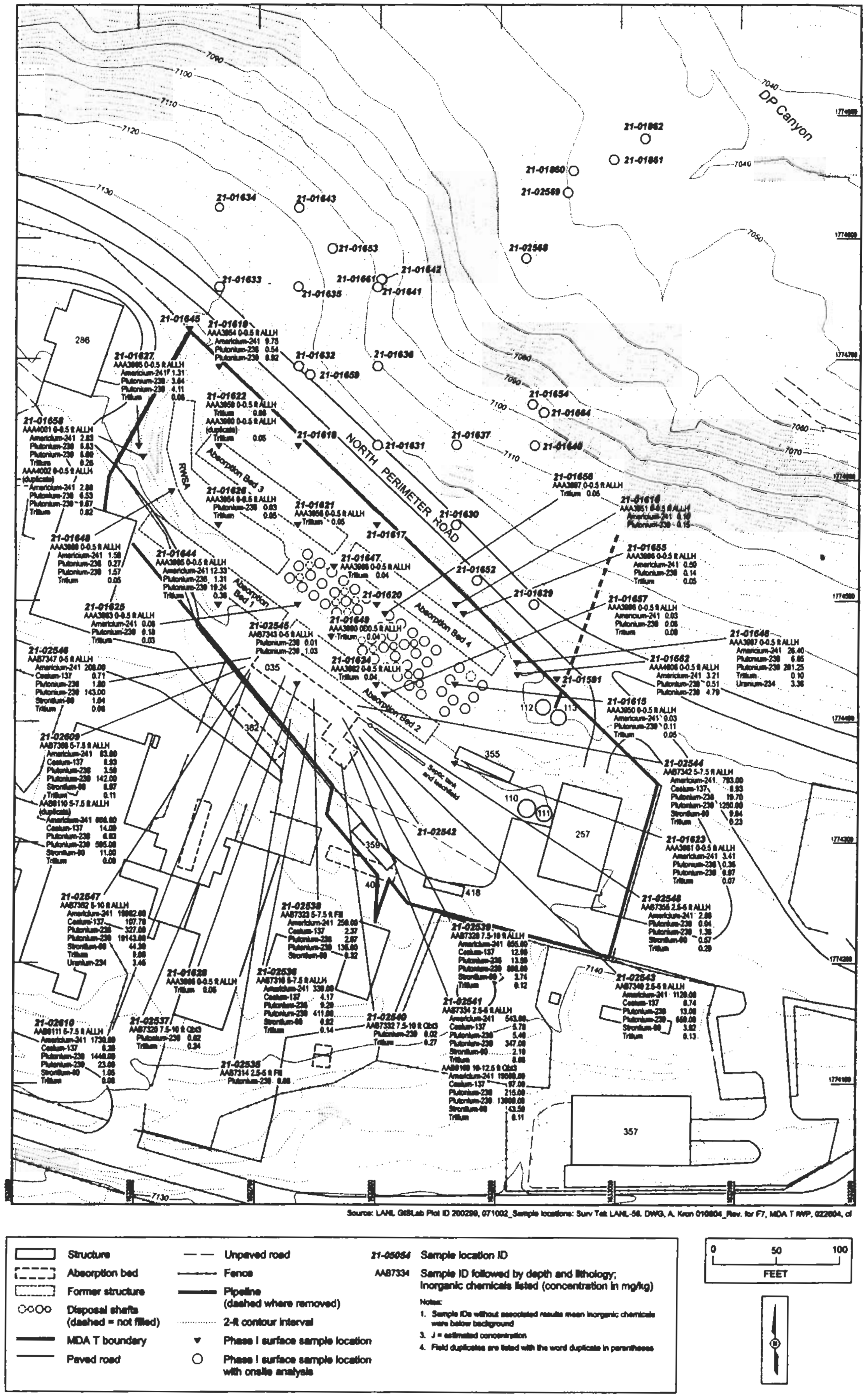
Source: GISLab Plot ID 200299 7/10/02, F5, MDA T IWP, 022604_A. Kron 11/21/03

**Figure 5.** Radionuclides detected above background values/fallout values in 1992 Phase I RFI surface samples



Source: LANL GISLab Plot ID 200298, 071002_Sample locations: Surv Tek LANL-58. DWG, A. Kron 010804_Rev. for F8, MDA T IWP, 022604, cf

Figure 6. Inorganic chemicals detected above background values in 1993–1994 Phase I RFI surface samples

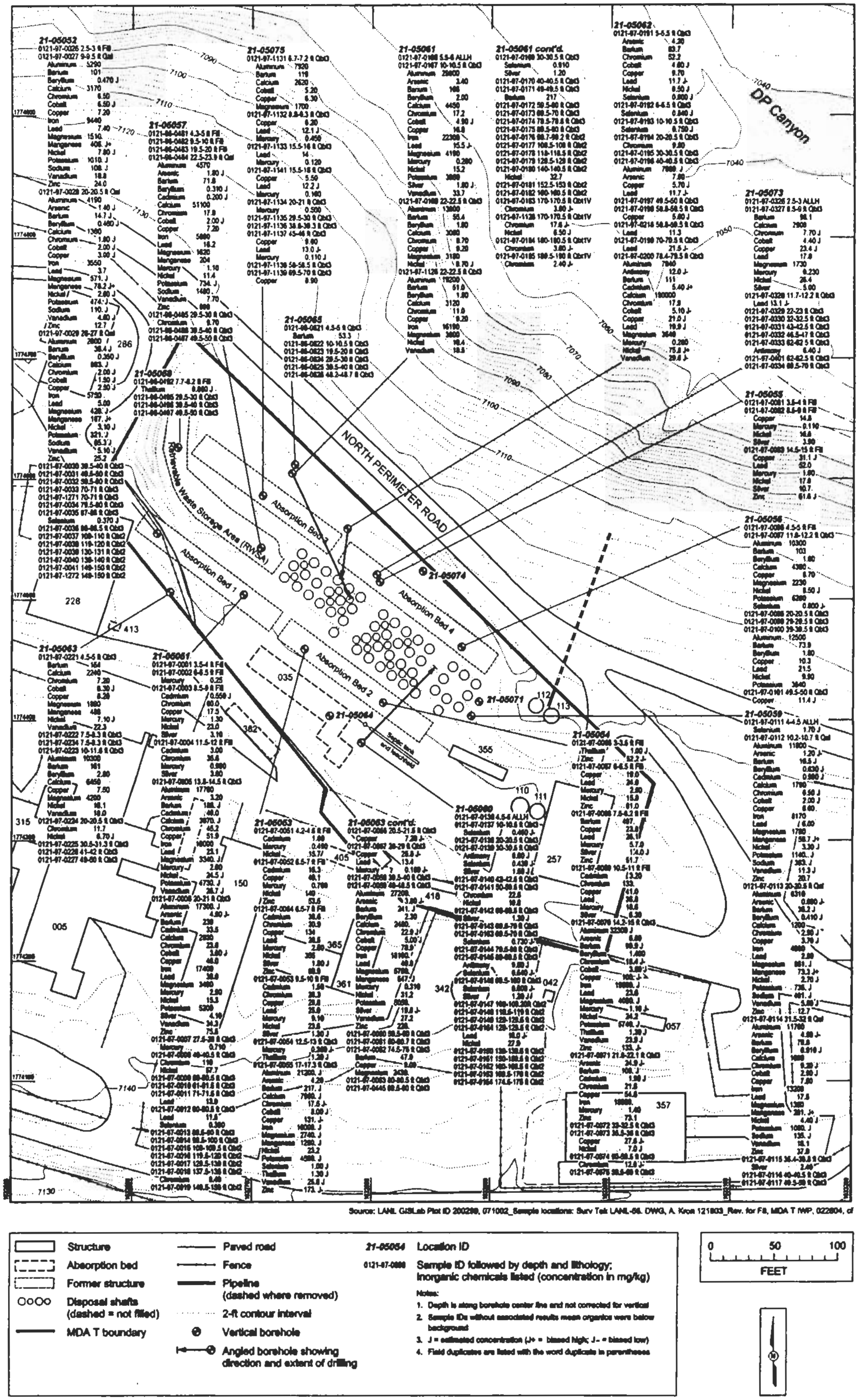


Source: LANL GIS/Lab Plot ID 200299, 071002_Sample locations: Surv Tek LANL-56. DWG, A. Kron 010804_Rev. for F7, MDA T WP, 022604, cf

Notes:

1. Sample IDs without associated results mean inorganic chemicals were below background
3. J = estimated concentration
4. Field duplicates are listed with the word duplicate in parentheses

Figure 7. Radionuclides detected above background values/fallout values in 1993–1994 Phase I RFI surface samples

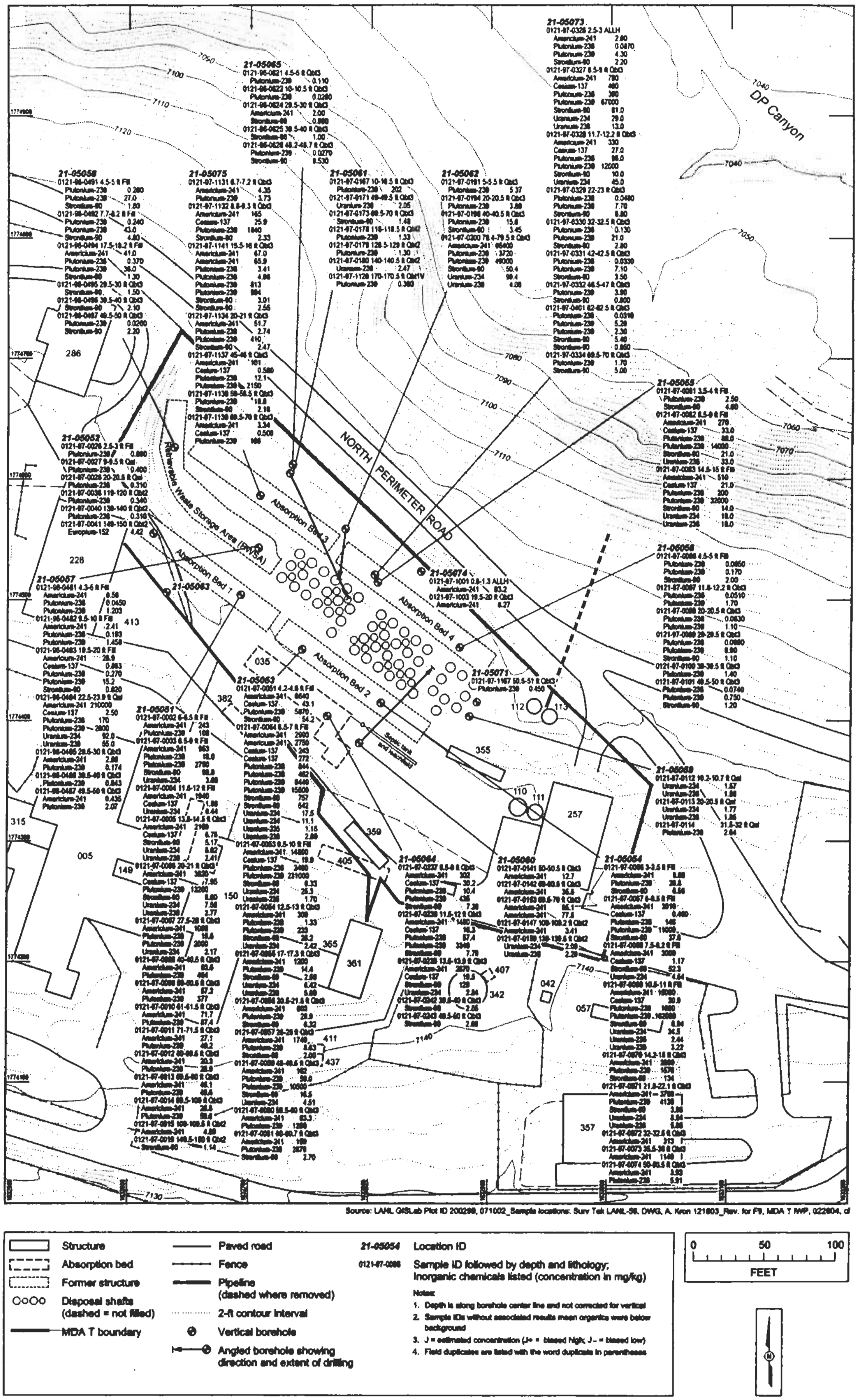


Source: LANL GISLab Plot ID 200289, 071002_Sample locations: Surv Tek LANL-66. DWG, A. Kron 121803_Rev. for F8, MDA T IWP, 022804, cf

Notes:

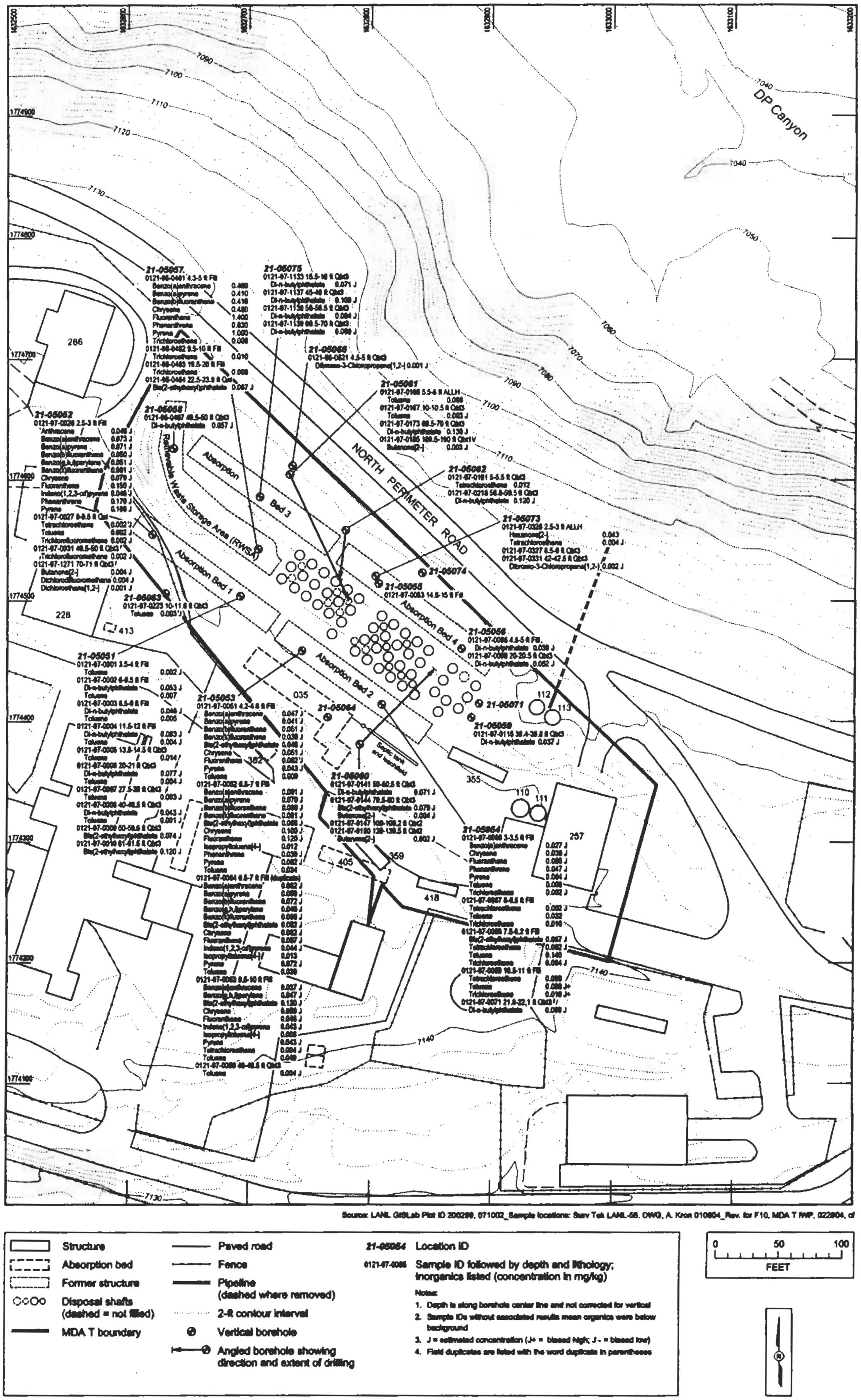
1. Depth is along borehole center line and not corrected for vertical
2. Sample IDs without associated results mean organics were below background
3. J = estimated concentration (J+ = biased high; J– = biased low)
4. Field duplicates are listed with the word duplicate in parentheses

Figure 8. Inorganic chemicals detected above background values in 1996–1997 Phase I RFI boreholes



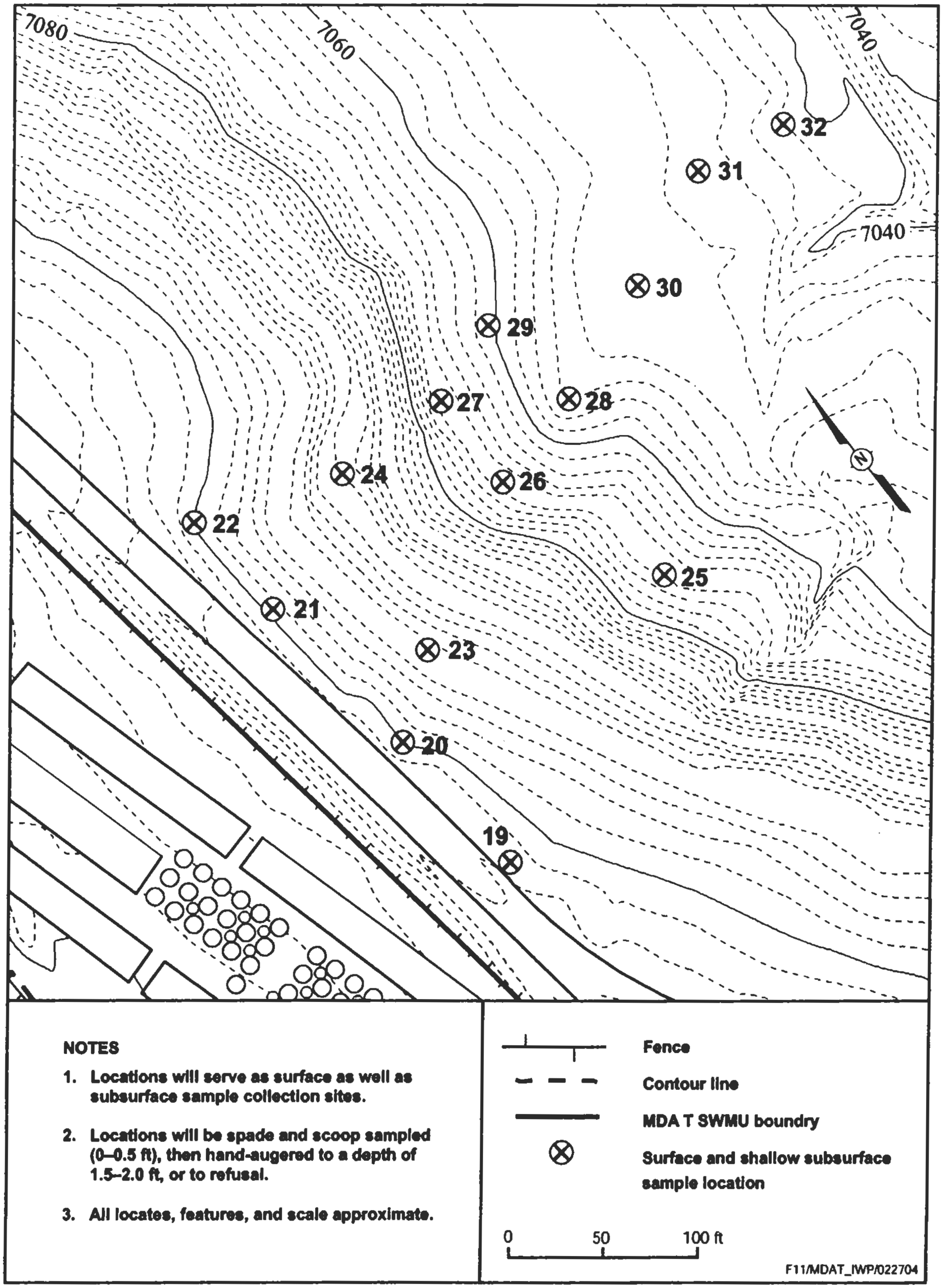
Source: LANL GISLab Plot ID 200299, 071002_Sample locations: Surv Tek LANL-S8. DWG, A. Kron 121603_Rev. for F9, MDA T IWP, 022604, cf

Figure 9. Radionuclides detected above background values/fallout values in 1996–1997 Phase I RFI boreholes



Source: LANL GISLab Plot ID 200289, 071002_Sample locations: Surv Tek LANL-58. DWG, A. Kron 010604_Rev. for F10, MDA T IWP, 022604, cf

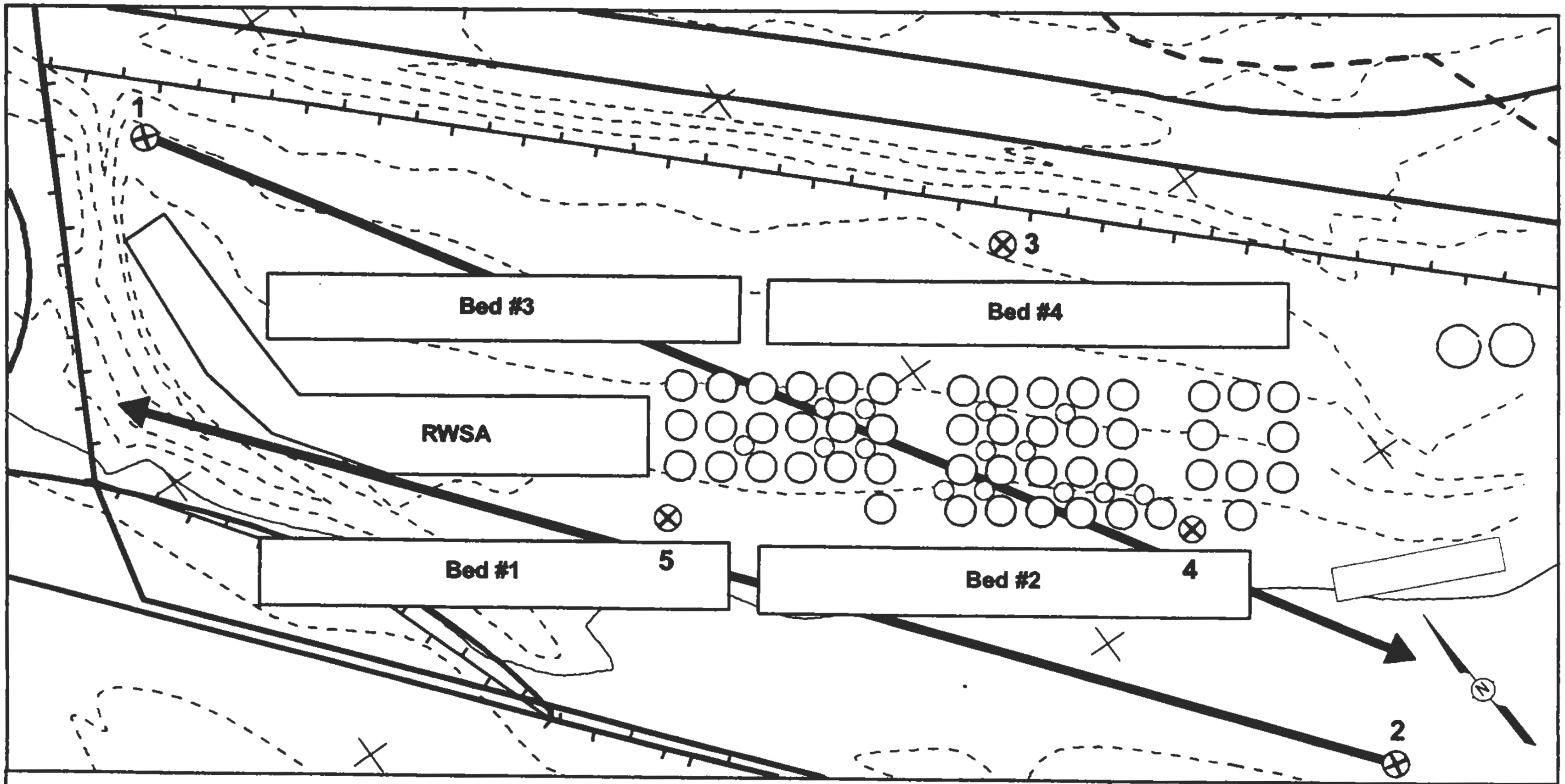
Figure 10. Organic chemicals detected in 1996–1997 Phase I RFI boreholes



**NOTES**

1. Locations will serve as surface as well as subsurface sample collection sites.
2. Locations will be spade and scoop sampled (0–0.5 ft), then hand-augered to a depth of 1.5–2.0 ft, or to refusal.
3. All locates, features, and scale approximate.

**Figure 11.** **Planned surface and near-surface sample locations for the south side of DP Canyon**

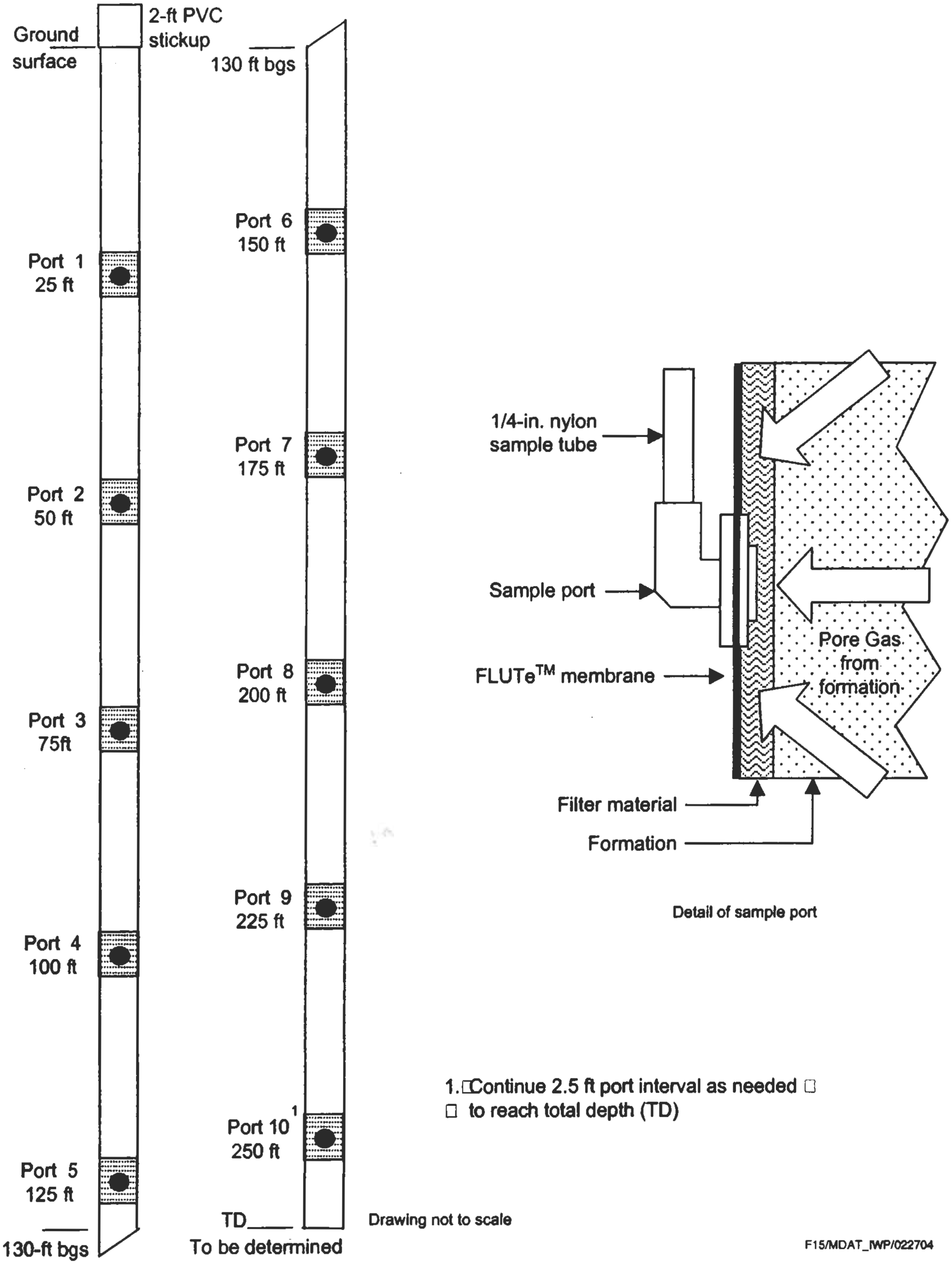


NOTES

1. Boreholes will serve as surface (cuttings) as well as sub-surface (core) sample collection locations.
2. Boreholes will be auger drilled and cored.
3. Boreholes 1 and 2: angled; fracture characterization, vertical extent to the Cerro Toledo Fm. Borehole 3: vertical; lateral and vertical extent to the Cerro Toledo Fm.
4. Boreholes 4 and 5: moisture profiling with core samples and neutron logging
5. All locates, features, and scale approximate

F14/MDAT_IWP/022704

Figure 14. Planned sample locations at the MDA T disposal complex



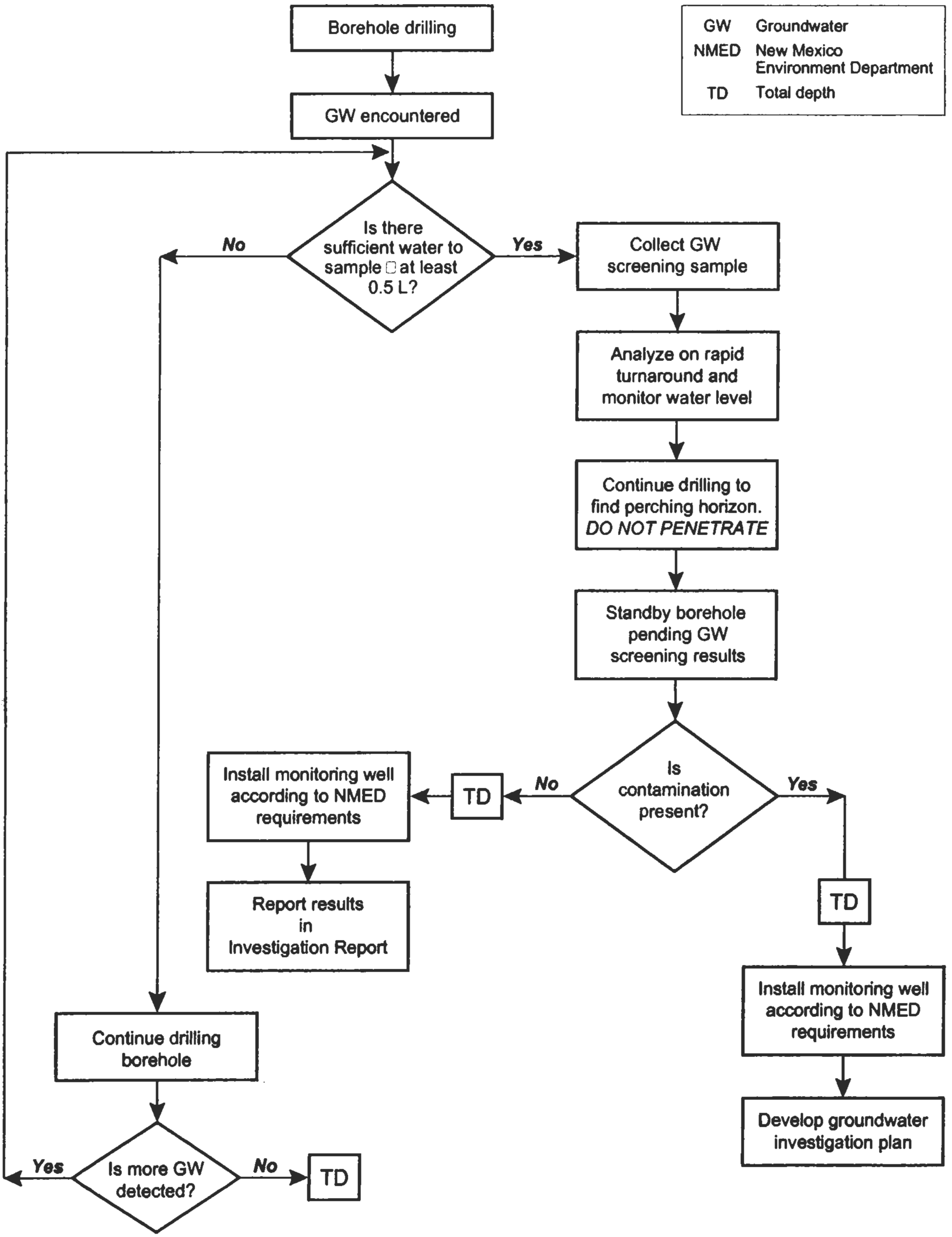
Detail of sample port

[1] Continue 2.5 ft port interval as needed to reach total depth (TD)

Drawing not to scale

F15/MDAT_IWP/022704

**Figure 15. General diagram for construction of a vapor monitoring borehole**



F16/MDAT_IWP/022704

**Figure 16.** MDA T perched groundwater flow chart

## Table 1
## Summary of Proposed Borehole Sample Targets

| Borehole ID | Site/Issue Addressed | Depths of Target Structures (ft); for Angled Holes: Linear Footage of Position Below Target[a] | Estimated Minimum No. of Samples for Fixed-Lab Analysis | Field Screening Intervals[b] | Core Intervals |
|---|---|---|---|---|---|
| 1 at 45° from vertical | Absorption beds and shafts; Vertical extent, fracture analysis, perched water | Absorption bed: TBD<br>Shafts: TBD<br>Top of Cerro Toledo Fm: ~350 ft bgs; ~500 lin. ft<br>TD: ~385 ft bgs | 11 | Every 5 ft | 5 ft |
| 2 at 45° from vertical | Absorption beds and RWSA; Vertical extent, fracture analysis, perched water | Absorption bed: TBD<br>Top of Cerro Toledo Fm: ~350 ft bgs; ~500 lin. ft<br>TD: ~385 ft bgs | 11 | Every 5 ft | 5 ft |
| 3 90° | North side vertical and lateral extent, fracture analysis, perched water | Top of Cerro Toledo Fm: ~350 ft bgs<br>TD: ~385 ft bgs | 10 | Every 5 ft | 5 ft |
| 4 90° | North side of bed #2 comparison borehole for continuous moisture profile; vertical extent | TD: ~100 ft bgs | 4 | Every 5 ft | 2.5 ft |
| 5 90° | North side of bed #1 comparison borehole for continuous moisture profile; vertical extent | TD: ~100 ft bgs | 4 | Every 5 ft | 2.5 ft |
| 6 at 45° from vertical | Bldg. 21-257: Americium loading dock, acid waste tanks and lines, and tanks 21-110 and 111; nature and extent, fracture analysis | Americium dock: TBD<br>Tank base/lines: TBD<br>Tanks 110, 111 base: TBD<br>TD: ~115 ft bgs | 8 | Every 5 ft | 2.5 ft |
| 7 at 45° from vertical | Bldg. 21-257: foundation (w/ raw waste tanks on north side); nature and extent, fracture analysis | East Bldg. Foundation: TBD<br>North Bldg. Foundation: TBD<br>Raw Waste Tank (TD): ~115 ft bgs | 8 | Every 5 ft | 2.5 ft |
| 8 at 45° from vertical | Bldg. 21-257: effluent tanks 21-112 and 113; nature and extent, fracture analysis | Tank 21-112 base: TBD<br>Tank 21-113 base: TBD TD: ~95 ft bgs | 10 | Every 5 ft | 2.5 ft |
| 9 | Bldg. 21-257: west side; nature and extent | TD: ~45 ft bgs | 4 | Every 5 ft | 2.5 ft |
| 10 | Bldg. 21-257: south side; nature and extent | TD: ~45 ft bgs | 4 | Every 5 ft | 2.5 ft |
| 11 | Bldg. 21-257: east side; nature and extent | TD: ~45 ft bgs | 4 | Every 5 ft | 2.5 ft |
| 12 | Bldg. 21-035: north side near citric acid tank locate; lateral and vertical extent | Tank base: TBD<br>TD: ~40 ft bgs | 4 | Every 5 ft | 2.5 ft |
| 13 | Bldg. 21-035: septic tank (removed) and leach field; lateral and vertical extent | Tank base: TBD<br>TD: ~40 ft bgs | 4 | Every 5 ft | 2.5 ft |

## Table 1 (continued)

| Borehole ID | Site/Issue Addressed | Depths of Target Structures (ft); for Angled Holes: Linear Footage of Position Below Target[a] | Estimated No. of Samples for Fixed-Lab Analysis | Field Screening Intervals[b] | Core Intervals |
|---|---|---|---|---|---|
| 14 | Bldg. 21-035: southeast side; lateral and vertical extent | TD: ~40 ft bgs | 4 | Every 5 ft | 2.5 ft |
| 15, 16, and 18 | Bldg. 21-035: Step-out confirmation samples for lateral extent | TD: ~40 ft bgs | 4 | Every 5 ft | 2.5 ft |
| 17 | Bldg. 21-035: west side near influent line valve box and associated structures; lateral and vertical extent | Valve box base: TBD<br>TD: ~40 ft bgs | 4 | Every 5 ft | 2.5 ft |
| **Shallow Soil Sampling by Spade & Scoop or Hand Auger Methods** | | | | | |
| 19–20 | Previous spills from Absorption bed 4 along top of DP Canyon slope; vertical and lateral extent | Fill/soil: 0 to 2 ft; dependent on field screening and previous analytical results | 4 | Surface screening | n/a[c] |
| 21–32 | DP Canyon slope and drainage down to channel; vertical and lateral extent | Fill/soil: 0 to 2 ft; dependent on field screening and previous analytical results | 4 | Surface screening | n/a |

[a] TBD: final target structure depths and total depths drilled to be determined following utility locate results and subsequent finalization of borehole locations.

[b] Field screening consists of alpha, beta/gamma, VOCs, and tritium.

[c] n/a = Not applicable.

## Table 2
## Summary of Proposed Borehole Drilling and Sampling at MDA T

| Site/Issue Addressed | Borehole ID | Location | Borehole Declination from Horizontal (degrees) | Borehole Length (linear ft) | Borehole Depth (ft) | Geologic Units encountered | VOCs | SVOCs | Dioxins/Furans | pH | Total Uranium | Radionuclides | TAL Metals | Nitrates | Perchlorate | $CO_3$ and $HCO_3$ | Gamma Spectroscopy | Americium-241 | Isotopic Plutonium | Isotopic Uranium | Strontium-90 | Tritium |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Borehole Sampling** | | | | | | | | | | | | | | | | | | | | | | |
| Absorption beds, shafts; vertical extent, fracture analysis, perched water | 1 | NNW to SSE, under beds and shafts | 45 | 500 | 385 | Qbt 3, Qbt 2, Qct | X[a] | X | X | X | X | X | X | X | X | —[b] | X | X | X | X | X | X |
| Absorption beds, RWSA; vertical extent, fracture analysis, perched water | 2 | SSE to NNW, under RWSA and shaft field | 45 | 500 | 385 | Qbt 3, Qbt 2, Qct | X[a] | X | X[c] | X | X | X | X | X | X | — | X | X | X | X | X | X |
| North side lateral extent, fracture analysis, perched water | 3 | North side of bed #4 | 90 | 385 | 385 | Qbt 3, Qbt 2, Qct | X[a] | X | X[c] | X | X | X | X | X | X | — | X | X | X | X | X | X |
| North side of bed #2 for continuous moisture profiling; vertical extent and potential shaft release characterization | 4<br>Out moved to South | ~5 ft north of bed #2, ~25 ft west of the eastern end of the bed | 90 | 100 | 100 | Qbt 3 | X[a] | X | X[c] | X | X | X | X | X | X | — | X | X | X | X | X | X |
| North side of bed #1 for continuous moisture profiling; vertical extent and potential shaft release characterization | 5<br>Out moved to South | ~5 ft north of bed #1, ~25 ft west of the eastern end of the bed | 90 | 100 | 100 | Qbt 3 | X[a] | X | X[c] | X | X | X | X | X | X | — | X | X | X | X | X | X |

## Table 2 (continued)

| Site/Issue Addressed | Borehole ID | Location | Borehole Declination from Horizontal (degrees) | Borehole Length (linear ft) | Borehole Depth (ft) | Geologic Units encountered | VOCs | SVOCs | Dioxins/Furans | pH | Total Uranium | Radionuclides | TAL Metals | Nitrates | Perchlorate | $CO_3$ and $HCO_3$ | Gamma Spectroscopy | Americium-241 | Isotopic Plutonium | Isotopic Uranium | Strontium-90 | Tritium |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bldg. 21-257: Americium loading dock, acid waste tanks and lines, and tanks 21-110 and 111; nature and extent, fracture analysis | 6 | ~38 ft SE of Bldg. 257 | 45 | 162 | 115 | Qbt 3/ Qbt 2 ~contact | $X^a$ | X | $X^c$ | X | X | X | X | X | X | — | X | X | X | X | X | X |
| Bldg. 21-257: foundation (w/ raw waste tanks on north side); nature and extent, fracture analysis | 7 | ~ 50 ft east of SW corner of Bldg. 257 | 45 | 162 | 115 | Qbt 3/ Qbt 2 ~contact | $X^a$ | X | $X^c$ | X | X | X | X | X | X | — | X | X | X | X | X | X |
| Bldg. 21-257: effluent tanks 21-112 and 113; nature and extent, fracture analysis | 8 | ~75 ft east of the tanks | 45 | 134 | 95 | Qbt 3 | $X^a$ | X | $X^c$ | X | X | X | X |  | X | — | X | X | X | X | X | X |
| Bldg. 21-257: east, west, & south side; ~~nature and extent~~ | 9–11 | Along east, west, and south sides of Bldg. 257 | 90 | 40 | 40 | Qbt 3 | $X^a$ | X | $X^c$ | X | X | X | X | X | X | — | X | X | X | X | X | X |
| Bldg. 21-035: north side near citric acid tank locate; lateral and vertical extent | 12 | Near citric acid tank location along north side of Bldg. 35 | 90 | 40 | 40 | Qbt 3 | $X^a$ | X | $X^2$ | X | X | X | X | X | X | — | X | X | X | X | X | X |
| Bldg. 21-035: septic tank (removed) and leach field; lateral and vertical extent | 13 | Within leach field east of Bldg. 35 | 90 | 40 | 40 | Qbt 3 | $X^a$ | X | $X^c$ | X | X | X | X | X | X | — | X | X | X | X | X | X |

## Table 2 (continued)

| Site/Issue Addressed | Borehole ID | Location | Borehole Declination from Horizontal (degrees) | Borehole Length (linear ft) | Borehole Depth (ft) | Geologic Units encountered | VOCs | SVOCs | Dioxins/Furans | pH | Total Uranium | Radionuclides | TAL Metals | Nitrates | Perchlorate | $CO_3$ and $HCO_3$ | Gamma Spectroscopy | Americium-241 | Isotopic Plutonium | Isotopic Uranium | Strontium-90 | Tritium |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bldg. 21-035: southeast corner; lateral and vertical extent of a known release site | 14 | Within the southeast section of Bldg. 35 | 90 | 40 | 40 | Qbt 3 | X[a] | X | X[c] | X | X | X | X | X | X | — | X | X | X | X | X | X |
| Bldg. 21-035: south side step outs; lateral and vertical extent | 15, 16, and 18 | South of bldg. 35 | 90 | 40 | 40 | Qbt 3 | X[a] | X | X[c] | X | X | X | X | X | X | — | X | X | X | X | X | X |
| Bldg. 21-035: west side near influent line valve box and associated structures; lateral and vertical extent | 17 | Near influent line valve box and tanks along southwest side of Bldg. 35 | 90 | 40 | 40 | Qbt 3 | X[a] | X | X[c] | X | X | X | X | X | X | - | X | X | X | X | X | X |
| **Shallow Soil Sampling by Spade and Scoop or Hand Auger Methods** | | | | | | | | | | | | | | | | | | | | | | |
| Diversion drainage; vertical and lateral extent | n/a[d] | Western end of MDA T study area | 90 | ~0–2 ft | same | Fill/soil/ Qbt 3 | — | X | — | X | X | X | X | — | X | X | X | X | X | X | X | X[e] |
| Canyon slope (north facing); vertical and lateral extent | Locations targeting drainages and deposition features (19 through 32) | North of DP Road down to the canyon bottom | 90 | ~0–2 ft | same | Fill/soil/ Qbt 3 | — | X | — | X | X | X | X | — | X | X | X | X | X | X | X | X[e] |

*Notes:* 1. For all boreholes, continuous core sampling for curation to 40 ft, every 10 ft subsequently.

2. From each boring, a minimum of four samples for fixed lab analysis, one each of the following:
   - a. highest field screen detect;
   - b. maximum depth of a field screen detect;
   - c. base depth of pits, tanks, shafts, pipes, or other structures; and
   - d. total depth (TD) of borehole.

3. Tuff sample for permeability tests just above Qbt 2/Qct contact in borings that pass into the Cerro Toledo interval.
4. Geotechnical analysis suite will include saturated and unsaturated hydraulic conductivity, matrix potential, porosity, Kd, chloride analysis, and bulk density. Samples will be taken from soil, Qbt, Qbt 2, twice in the Cerro Toledo, and at least once each from an open and filled fracture; for a minimum total of seven samples.
5. All boreholes will also supply a sample from the existing surface, if warranted by walkover radiological survey.
6. Shallow soil sampling will continue to depths greater than 2 ft if indicated by field screening or previous sampling.

[a] VOCs for pore gas by method TO-14.

[b] — = No analytes are planned for this sample.

[c] Dioxin and furan sampling from the buried operational surface only (where identified in recovered cores).

[d] n/a = Not applicable.

[e] Will be analyzed for tritium in soil only.

## Table 3
## NMED Order Specifications and LANL Proposed Alternatives

| Item | NMED Order Specification | LANL Proposed Alternative | Justification for Alternative |
|---|---|---|---|
| 1 | The Respondents shall provide an Investigation Report summarizing the results of past investigation activities conducted at MDA T, in the format described in Section XI of this Order, that includes all data collected for the March 1, 1996 LANL/DOE Sampling and Analysis Plan for Potential Release Site (PRS) 21-016(a,b,c) (EM/ER:96-094). The report shall respond to all comments in the July 29, 1997 Department Request for Supplemental Information, Sampling and Analysis Plan Potential Release Site 21-016(a,b,c) Los Alamos National Laboratory. All additional relevant sediment, groundwater, surface water, and storm water data shall be included in the report. (Order Section IV.C.2.e) | Data collected during implementation of the March 1996 SAP, as well as results of all previous investigations at MDA T are presented in the Historical Investigation Report (HIR) presented as Appendix B of work plan, rather than in separate investigation report. | The HIR is required by Order Section IV.C.2.b, and must include all previous investigations, including the 1996/1997 investigation. Preparation of a separate investigation report for the 1996/1997 investigation would be duplicative of this requirement. |
| 2 | The Respondents shall conduct a survey of the disposal units at MDA T. 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.<br>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. (Order Section IV.C.2.e.ii) | Disposal unit surveys have previously been performed. A geophysical survey to locate disposal units was performed during the 1996–1997 investigation (see Section B-3.13). Engineering drawings of disposal units were reviewed as part of the HIR (see Section B-2.2 and Appendix D). | Survey requirements have been met by previous investigations and are documented in the HIR. Additional surveys would be duplicative of work already performed. |
| 3 | 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 T. The fracture characterization of the rock formations underlying MDA T shall be completed utilizing data acquired from outcrops, cores, and downhole geophysical and video log data. (Order Section IV.C.2.e.iii) | None. Fractures will be characterized through installation of deep angled and vertical boreholes (see Sections 4.5 and 5.2). Boreholes previously installed were also logged for fractures (see Section 2.7.2). | n/a*. |

**Table 3 (continued)**

| Item | NMED Order Specification | LANL Proposed Alternative | Justification for Alternative |
|---|---|---|---|
| 4 | A minimum of eleven borings shall be advanced using hollow-stem auger drilling methods, where practicable, or other drilling methods approved by the Department. Three 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. (Order Section IV.C.2.e.iii, Item 1) | None. The investigation presented in the work plan will include 18 new boreholes, including 3 installed to the base of the Cerro Toledo (see Sections 4.3 through 4.6). Nineteen additional boreholes were installed in 1996–1997 investigation (see Section B-3.13). | n/a. |
| 5 | Each borehole shall be characterized using geophysical logging techniques approved by the Department. (Order Section IV.C.2.e.iii, Item 2) | None. Boreholes will be geophysically logged (see Section 5.3). | n/a. |
| 6 | 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.e.iii, Item 3) | None. Monitoring well(s) will be installed if perched water is encountered in sufficient quantities to allow sampling (see Section 5.4). | n/a. |
| 7 | Vapor monitoring wells shall be installed in the borings if vapor-phase contamination is detected during drilling activities. (Order Section IV.C.2.e.iii, Item 4) | None. Pore-gas samples will be collected from each borehole to determine whether vapor monitoring wells are needed (see Sections 4.6 and 5.4). | n/a. |
| 8 | 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.e.iii) | None (see Section 5.5). | n/a. |
| 9 | Soil samples shall be collected continuously for the first 40 ft and at ten-ft intervals thereafter. (Order Section IV.C.2.e.iv, Item 1) | None. Continuous core samples will be collected from all boreholes (see Sections 5.2 and 5.3). | n/a. |
| 10 | Samples shall be collected and screened in accordance with the methods described in Section IX.B of this Order. (Order Section IV.C.2.e.iv, Item 2) | Samples will be collected as specified. Field screening will be performed for health and safety monitoring, not as described in Section IX.B of the Order. | Field screening methods described in Section IX.B (x-ray fluorescence, headspace VOCs) are not sensitive enough to detect levels of contamination previously found at MDA T (see Section 2.8 and 4.2.1) and would not yield useful information. |

### Table 3 (continued)

| Item | NMED Order Specification | LANL Proposed Alternative | Justification for Alternative |
|---|---|---|---|
| 11 | 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.e.iv, Item 3) | None. Samples for hydraulic conductivity testing will be collected once in each tuff unit and twice from the Cerro Toledo (see Section 5.3). | n/a. |
| 12 | 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.e.iv, Item 4) | Samples will be collected as specified. Field screening will be performed for health and safety monitoring, not as described in Section IX.B of the Order. | See Item 10. |
| 13 | 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.e.iv, Item 5) | None. Samples will be collected as specified. | n/a. |
| 14 | 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 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.e.iv, Item 6) | Analytical suites will not include VOCs, HE, pH, or PCBs. Dioxin, furan, and PCB analysis will be limited to samples collected at the buried operational surface. Samples will be collected as specified, except for use of field screening (see Item 10). At least 4 samples for laboratory analysis will be collected from each borehole (see Table 1). | VOCs are not expected in surface or shallow soils due to age and source of contamination (see Section 2.8). Subsurface VOC contamination will be characterized using pore gas sampling (see Section 4.8). There is no history of HE disposal and these compounds were not indicated by previous SVOC analysis (see Section 2.8). The suspected source of dioxins, furans, and PCBs is atmospheric deposition on the historical operational surface (see Section 4.2.2). |

## Table 3 (continued)

| Item | NMED Order Specification | LANL Proposed Alternative | Justification for Alternative |
|---|---|---|---|
| 15 | 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.e.v) | No outfall investigations will be conducted as part of this work plan. TA-21 outfall drainages were previously characterized in the Phase 1C Report and Addendum submitted to NMED. Contamination in DP and Los Alamos Canyons due to discharges from outfalls is being characterized under the NMED-approved work plan for Los Alamos and Pueblo Canyons and the DP Canyon SAP Addendum. The canyon slope between MDA T and DP Canyon will be investigated (see Section 4.2). | SWMU 21-016(a)-99 does not include any outfalls. Investigation of outfalls would be duplicative of work performed under the approved OU 1106 RFI work plan and documented in the Phase 1C Report and Addendum. Investigation of sediments in DP Canyon would be duplicative of work under Los Alamos and Pueblo Canyons work plan. |
| 16 | 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.e.vi) | None. Pore-gas samples will be collected from each borehole to determine whether vapor monitoring wells are needed (see Sections 4.6 and 5.4). | n/a. |
| 17 | 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 T, intermediate groundwater monitoring well(s) will be required by the Department. The minimum depth of the subsurface investigations for MDA T 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 T. If required, the Respondents shall include the well(s) in the TA-21 monitoring and sampling plan. (Order Section IV.C.2.e.vii) | None. Monitoring well(s) will be installed if perched water is encountered in quantities sufficient for sample collection in deep boreholes installed through the Cerro Toledo (see Section 5.4). | n/a. |

## Table 3 (continued)

| Item | NMED Order Specification | LANL Proposed Alternative | Justification for Alternative |
|---|---|---|---|
| 18 | 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.e.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 (HWP) approved by NMED and the Los Alamos/Pueblo Intermediate and Regional Groundwater Work Plan. | Installation of regional groundwater wells would be duplicative of work being performed under the HWP and the Los Alamos/Pueblo Intermediate and Regional Groundwater Work Plan. |
| 19 | Groundwater samples shall be obtained from Los Alamos Canyon monitoring wells LAO-1.6(g), LAO-2, LAO-3A, LAO-4.5C, LAO-5, LAO-6, LAO-6A, LAUZ-1, LAUZ-2, 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.e.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.e.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 be duplicative of work required under Section IV.A.3 of the Order. |
| 20 | The groundwater sampling shall be conducted in accordance with Section IX.B of this Order. (Order Section IV.C.2.e.ix, Item 2) | No groundwater sampling of existing wells will be performed as part of this work plan (see Item 19). | See Item 19. |
| 21 | 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.e.ix, Item 3) | No groundwater sampling of existing wells will be performed as part of this work plan (see Item 19). | See Item 19. |
| 22 | 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 T as part of the Los Alamos/Pueblo Canyon watershed prior to implementation of the groundwater-sampling program. (Order Section IV.C.2.e.ix, Item 4) | A long-term groundwater monitoring and sampling work plan will not be prepared as part of the MDA T investigation. Results of the MDA T investigation will be considered in development of the groundwater monitoring plan required under Section IV.A.3. | Development of a long-term groundwater monitoring plan for MDA T would be duplicative of work required under Section IV.A.3 of the NMED Order. |

**Table 3 (continued)**

| Item | NMED Order Specification | LANL Proposed Alternative | Justification for Alternative |
|---|---|---|---|
| 23 | The Respondents shall submit to the Department for approval an investigation report that presents the results of the field activities, summarizes the data collected, and presents the recommendations and conclusions for MDA T. The Respondents shall follow the investigation report format outlined in Section XI.C and the compliance schedule in Section XII. (Order Section IV.C.2.e.x) | The MDA T investigation report will be submitted in accordance with a schedule agreed to by NMED and LANL, not the schedule contained in Section XII of the November 26, 2002 NMED Order. | NMED and LANL have negotiated a schedule to supercede that contained in Section XII of the November 26, 2002 Order. |

*n/a = Not applicable.

# Appendix A

## *Acronyms, Glossary, and Metric Conversion Tables*

## A-1.0 ACRONYMS

| | |
|---|---|
| AOC | area of concern |
| ASL | above sea level |
| AST | above-ground storage tank |
| ASTM | American Standard for Testing and Materials |
| bgs | below ground surface |
| BIPS | borehole image processing system |
| BV | background value |
| Ci | curies |
| CME | Central Mine Equipment |
| CMP | corrugated metal pipe |
| $CO_3$ | carbonate |
| COPC | chemical of potential concern |
| CST | Chemical Science and Technology (Laboratory Division) |
| DOE | (US) Department of Energy |
| DP | Delta Prime |
| EM | electromagnetic |
| ER | Environmental Restoration |
| ERDB | Environmental Restoration Data Base |
| EPA | (US) Environmental Protection Agency |
| ERDB | Environmental Restoration Data Base |
| FV | fallout value |
| GPR | ground penetrating radar |
| GPS | global positioning system |
| $HCO_3$ | bicarbonate |
| HE | high explosive |
| HEPA | high-efficiency particulate air (filter) |
| HIR | historical investigation report |
| HSE | Health, Safety, and Environment |
| HSWA | Hazardous and Solid Waste Amendments of 1984 |
| ID | inner diameter |
| IDW | investigation-derived waste |
| IR | investigation report |
| IWP | investigation work plan |
| LA | Los Alamos |

| | |
|---|---|
| LAFPHA/FIDLER | Los Alamos Field Pulse Height Analyzer/Field Instrument for the Detection of Low Energy Radiation |
| LANL | Los Alamos National Laboratory |
| LADP | Los Alamos Delta Prime |
| LIR | Laboratory Implementation Requirement |
| MCE | multiple chemical evaluation |
| MDA | Material Disposal Area |
| MRAL | mobile radiologic analytical laboratory |
| nCi/g | nanocuries per gram |
| NMED | New Mexico Environment Department (NM Environmental Improvement Div. before 1991) |
| NMHWA | New Mexico Hazardous Waste Act |
| OU | operable unit |
| PCB | polychlorinated biphenyl |
| PPE | personal protective equipment |
| PRS | potential release site |
| PVC | polyvinyl chloride |
| QA | quality assurance |
| QC | quality control |
| RCRA | Resource Conservation and Recovery Act |
| RFI | RCRA facility investigation |
| RLWTF | Radioactive Liquid Waste Treatment Facility |
| RQD | rock quality density |
| RRES-RS | Risk Reduction and Environmental Stewardship-Remediation Services |
| RSL | radiological screening laboratory |
| RWSA | retrievable waste storage area |
| SAL | screening action level |
| SAP | sampling and analysis plan |
| SMO | sample management office |
| SOP | standard operating procedure |
| SWMU | solid waste management unit |
| SVOC | semivolatile organic compound |
| SWS | sanitary wastewater systems |
| TA | technical area |
| TAL | target analyte list (EPA) |
| TBP | tributyl phosphate |

| | |
|---|---|
| TCP | tricresyl phosphate |
| TD | total depth |
| TRU | transuranic |
| TSTA | Tritium Systems Test Assembly |
| UTL | upper tolerance limit |
| VOC | volatile organic compound |
| WCSF | Waste Characterization Strategy Form |
| WP | work plan |
| XRF | x-ray fluorescence |

## A-2.0 GLOSSARY

**Alluvium.** Clay, silt, sand, and gravel transported by water and deposited on streambeds, flood plains, and alluvial fans.

**Area of concern (AOC).** An area of potential contamination at the Laboratory that might warrant further investigation or remediation, but which is not a solid waste management unit.

**Background value (BV).** The upper tolerance limits (UTLs) of background sample results, calculated as the upper 95% confidence limit for the 95th percentile. When a UTL cannot be calculated, either the detection limit or the maximum reported value is used as a BV; BVs are used as simple threshold numbers to identify potentially contaminated site sample results that are greater than background levels in that geological sample medium (or group of media). All inorganic chemicals and radionuclides have BVs.

**Fault.** A fracture, or zone of fractures, in rock along which there has been vertical or horizontal movement; adjacent rock surfaces are displaced.

**Field blank (also known as field reagent blank).** A blank sample either prepared in the field or carried to the sampling site, exposed to sampling conditions (e.g., bottle caps removed, preservatives added), and returned to a laboratory for analysis in the same manner in which environmental samples are analyzed. Used to identify the presence of contamination potentially added during the sampling and analysis process.

**Field duplicate.** A second sample collected as near as possible to the original sample.

**Gamma radiation.** A form of electromagnetic, high-energy radiation emitted from a nucleus. Gamma rays are essentially the same as x-rays and require heavy shielding, such as concrete or steel, to be blocked.

**Groundwater.** Water in a subsurface saturated zone; water beneath the regional water table.

**Hazardous and Solid Waste Amendments (HSWA).** The Hazardous and Solid Waste Amendments of 1984 (Public Law No. 98-616, 98 Stat. 3221), which amended the Resource Conservation and Recovery Act of 1976, 42 U.S.C. § 6901 et seq.

**HSWA module.** Module VIII of the Laboratory's Hazardous Waste Facility Permit. This permit allows the Laboratory to operate as a treatment, storage, and disposal facility.

**Hydraulic conductivity.** The rate at which water moves through a medium in a unit of time under a unit hydraulic gradient through a unit area measured perpendicular to the direction of flow.

**Model.** A simplified or idealized conception of a system or process, which can be written as a mathematical formulation (mathematical model)

**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."

**Perched groundwater.** Groundwater that lies above the regional water table and is separated from it by an unsaturated zone.

**Polychlorinated biphenyls (PCBs).** 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.

**Quality assurance.** All those planned and systematic actions necessary to provide adequate confidence that a facility, structure, system, or component will perform satisfactorily in service.

**Quality control (QC).** (1) All those actions necessary to control and verify the features and characteristics of a material, process, product, or service to specified requirements. QC is the process through which actual quality performance is measured and compared with standards. (2) All methods and procedures used to obtain accurate and reliable results from environmental sampling and analysis. Includes rules for when, where, and how samples are taken; sample storage, preservation and transport; and the use of blanks, duplicates, and split samples during the analysis.

**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.

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

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

**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).

**Reporting limit.** The numerical value that an analytical laboratory (in conjunction with its client) selects to determine if a target analyte is detected. Results below the RL are considered not detected, while results greater than the RL are considered detected. The RLs are not necessarily based on instrument sensitivity. RLs can be established at the instrument detection limit, method detection limit, estimated quantitation limit, and contract-required detection limit.

**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)

**Runoff.** The portion of the precipitation on a drainage area that is discharged from the area either by sheet flow or adjacent stream channels.

**Run-on.** Surface water flowing onto an area as a result of runoff occurring higher up the slope.

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

**Screening assessment.** A process designed to determine whether contamination detected in a particular medium at a site may present a potentially unacceptable human-health and /or ecological risk. The assessment utilizes screening levels that are either human-health or ecologically based concentrations derived by using chemical-specific toxicity information and standardized exposure assumptions below which no additional actions are generally warranted.

**Sediment.** (1) A mass of fragmented material 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.

**Site characterization.** Defining the pathways and methods of migration of the hazardous waste or constituents, including the media affected, the extent, direction and speed of the contaminants, complicating factors influencing movement, concentration profiles, etc. (U.S. Environmental Protection Agency, May 1994. "RCRA Corrective Action Plan, Final," Publication EPA-520/R-94/004, Office of Solid Waste and Emergency Response, Washington, DC)

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

**Solid waste management unit (SWMU).** Any discernible unit at which solid wastes have been placed at any time, irrespective of whether the unit was intended for the management of solid or hazardous waste. Such units include any area at a facility at which solid wastes have been routinely and systematically released. This definition includes regulated units (i.e., landfills, surface impoundments, waste piles, and land treatment units) but does not include passive leakage or one-time spills from production areas and units in which wastes have not been managed (e.g., product storage areas).

**Spring.** The site where groundwater discharges to the ground surface.

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

**Stratigraphy.** The science dealing with the succession, age, composition, and history of strata.

**Target analyte.** An element, chemical, or parameter, the concentration, mass, or magnitude of which is designed to be quantified by use of a particular test method.

**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.

**Topography.** The physical configuration of the land surface in an area.

**Tracer.** A substance, usually a radioactive isotope, added to a sample to determine the efficiency (chemical or physical losses) of the chemical extraction, reaction, or analysis. The tracer is assumed to behave in the same manner as that of the target radionuclides. Recovery guidelines for tracer results are 30% to 110% under the current contract laboratory statement of work and will be 40% to 105% under the new statement of work. Correction of the analytical results for the tracer recovery is performed for each sample. The concentration of the tracer added needs to be sufficient to result in a maximum of 10% uncertainty at the 95% confidence level in the measured recovery.

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

**US Department of Energy (DOE).** Federal agency that sponsors energy research and regulates nuclear materials for weapons production.

**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.

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

## A-3.0 METRIC CONVERSION TABLES

### Metric to English Conversions

| Multiply SI (Metric) Unit | by | To Obtain US Customary Unit |
|---|---|---|
| kilometers (km) | 0.62137 | miles (mi) |
| kilometers (km) | 3281 | feet (ft) |
| meters (m) | 3.2808 | feet (ft) |
| meters (m) | 39.3701 | inches (in.) |
| centimeters (cm) | 0.03281 | feet (ft) |
| centimeters (cm) | 0.3937 | inches (in.) |
| millimeters (mm) | 0.0394 | inches (in.) |
| micrometers or microns (μm) | 0.00004 | inches (in.) |
| square kilometers ($km^2$) | 0.3861 | square miles ($mi^2$) |
| hectares (ha) | 2.4710 | acres |
| square meters ($m^2$) | 10.7639 | square feet ($ft^2$) |
| cubic meters ($m^3$) | 35.31 | cubic feet ($ft^3$) |
| kilograms (kg) | 2.2046 | pounds (lb) |
| grams (g) | 0.0353 | ounces (oz) |
| grams per cubic centimeter ($g/cm^3$) | 62.422 | pounds per cubic foot ($lb/ft^3$) |
| milligrams per kilogram (mg/kg) | 1 | parts per million (ppm) |
| micrograms per gram (μg/g) | 1 | parts per million (ppm) |
| liters (L) | 0.26471 | gallons (gal.) |
| milligrams per liter (mg/L) | 1 | parts per million (ppm) |
| degrees Celsius (°C) | 9/5 + 32 | degrees Fahrenheit (°F) |

### Metric Prefixes

| Term | Power of 10 | Symbol |
|---|---|---|
| mega- | $10^6$ | M |
| kilo- | $10^3$ | k |
| deci- | $10^{-1}$ | d |
| centi- | $10^{-2}$ | c |
| milli- | $10^{-3}$ | m |
| micro- | $10^{-6}$ | μ |
| nano- | $10^{-9}$ | n |
| pico- | $10^{-12}$ | p |

# Appendix B

## *Historical Investigation Report*

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## B-1.0 INTRODUCTION

This historical investigation report (HIR), an appendix of the MDA T investigation work plan (WP), presents the results of all previous investigations and includes all activities that were conducted at Material Deposal Area (MDA) T, Technical Area (TA) 21, at the Los Alamos National Laboratory (LANL or the Laboratory). Its organization addresses the 10 requirements of Section IV.C.2.b of the November 26, 2002, New Mexico Environment Department (NMED) Order (NMED 2002, 75910, pp. 120–121). In addition, this HIR presents the 1996–1997 investigations as proposed in the Sampling and Analysis Plan (LANL 1996, 54127.3) as modified by NMED's request for supplemental information (LANL's written response to NMED's request [LANL December 2003, 70036]) in sufficient detail to meet the substantive requirements of the field and laboratory reporting portion of an investigation report (IR) as contained in Section XI.C of the Order. General sections, such as "Background," are in the work plan and are not repeated in this HIR.

## B-2.0 DESCRIPTION AND OPERATIONAL HISTORY

### B-2.1 Current Site Description

The facility of MDA T is defined as the MDA T disposal area, two industrial wastewater treatment plants located in Buildings 035 and 257, associated buried piping, and the surrounding surface features that may have been impacted by operations at these facilities. The MDA T facility is located on DP Mesa, east of Buildings 286 and 228, west of MDA A, north of Buildings 005, 150, and 361, and south of the North Perimeter Road (Figure B-1). The location is less than a quarter-mile from the intersection of the North Perimeter Road and DP Road. The MDA T disposal area is enclosed with a chain link fence, with the exception of the southwest corner of Absorption Bed 1, which lies outside the fence. Figure B-2 shows that the facility limit of MDA T has been expanded southwest to include the corner of Absorption Bed 1, east to include the newer waste treatment plant (Building 257), and north to include an area where surface water run-off and potential overflow from Absorption Bed 4 may have led to surface and/or drainage contamination. This northern area is adjacent to SWMU 21-011(k), an outfall that received industrial wastewater from MDA T. SWMU 21-011(k) and its associated watershed encompass approximately three acres and are presently in the final stages of restoration.

Within the fenced area, approximately 2.2 acres, the surface is heavily vegetated with weeds, grasses, chamisa bushes, and two young ponderosa trees. The surface slopes slightly downward across the site from south to north. Also within the fence are tanks, trailers and offices.

Completed in 1967, a new industrial liquid waste treatment facility (Building 257) replaced the one located in Building 035. Construction details are shown on as-built drawings (Drawings C-36368 through C-36418) (LANL 2003, 81175). The new plant includes a process acid wastewater treatment circuit, an americium raffinate treatment circuit, and a pugmill circuit. The original batch waste treatment tanks and storage tanks of the treatment circuit were replaced with new tanks in 1970 (Drawing C-38166) (LANL 2003, 81175). This facility currently operates to partially treat wastewater from the Tritium Systems Test Assembly (TSTA).

The plant wastewater processing circuit includes a clarifier, a flocculator tank, process tanks, filters, pumps and sumps, and chemical holding tanks (Drawing C-36384) (LANL 2003, 81175). The drawings indicate that all externally located tanks have some form of secondary containment.

MDA T consists of 25 former SWMUs and AOCs now consolidated into SWMU 21-016(a)-99 (Table B-1 and Figure B-2). Additional structures at MDA T include Structures 355, 359, and 418, and offices and lab trailers currently within the MDA T systems area.

### B-2.2 Historic Facility Descriptions

The MDA T disposal area includes absorption beds, sumps, shafts, and the Retrievable Waste Storage Area (RWSA) (Figure B-2). Appendix F (LANL 2003, 81175) lists available engineering drawings maintained on microfilm by the Laboratory as well as record drawings used for this report that, along with written reports, form the basis for the historic facility descriptions.

Four absorption beds [SWMU 21-016(a)] excavated into the Bandelier tuff are shown on Drawing ENG-C 2217. Each bed was designed to be 120 ft long, 20 ft wide, and 4 ft deep and, based on surface surveys of the absorption bed dikes (Drawing ENG-R 4475) and a 1996 geophysical investigation (Geophex 1996, 64694). The absorption beds (Figure B-2) are longer (between 140 and 155 ft) from original top of embankment to top of cut than shown on the construction drawing. The east and west ends of the beds were designed to slope so that the center 100 ft of each absorption bed has a depth of 4 ft and contains the cobble and gravel infiltration media. The geophysical investigation did not distinguish between fill types but did confirm the survey locations of the top of the absorption beds. The sloping ends are likely flatter than shown in the construction drawing due to the access requirements of the construction equipment available and/or taller berms being required due to variances in the original ground surface. The flatter slopes and/or a taller berm would have resulted in longer beds with the end berms being spaced further apart. Borehole location 21-05052 confirms the altered geometry. The borehole did not encounter cobbles even though located approximately 20 ft inside the east berm of Absorption Bed 1. The north and south sides of the beds appear on Drawing ENG-C 2217 as vertical cuts. The distance between the center of Absorption Beds 1 and 3 and the center of Absorption Beds 2 and 4 is 80 ft (Rogers 1977, 05707, p. T-5).

The bottoms of the beds were cut level, trimmed, and cleared of earth and loose material before being filled with stone, gravel, sand, and earth (Figure B-3). The bottom approximately 2 ft of fill was stone, clean and free from dirt, and ranging in size from approximately 3 to 10 in. The stone was graded from large at the bottom to small at the top in order to form a deck for the gravel. The next 6 in. of fill was gravel followed by 6 in. of sand. The top layer of fill was approximately 12 in. of earth. The total thickness of graded fill was 4 ft (Rogers 1977, 05707, pp. T-5, T-11).

The absorption beds received waste through a 3.5 deep 4 high 8 ft wide reinforced concrete distribution box (Structure 121, Figure B-4) [SWMU 21-011(c)] located between Absorption Beds 1 and 2. The waste was transported from the distribution box to each absorption bed through a 6 in. inlet line. Also located near and within these absorption beds were three other sumps (Structures 122, 131, and 132) shown on Drawings R-140 and R-2450. No record of the purpose or fate of these sumps is available; however they may have been removed or buried when the area was regraded in 1986. A 6-in.-diameter buried overflow pipe connected Absorption Bed 1 to Absorption Bed 3 and Absorption Bed 2 to Absorption Bed 4 (Figure B-5, and Drawings C-2217 and C-2338). A floor-drainline from Building 012 extended directly to Absorption Bed 1, discharging at ground surface (Drawing C-2338, Figure B-4, and Rogers 1977, 05707, p. T-11). The term "absorption bed" is defined as being similar to a leach field where wastewater infiltrates into the bedrock.

The original surface of MDA T sloped to the north at a 12 to 1 ratio. Surface water interceptors approximately 2 ft deep and 3 ft wide were cut 10 ft from the south side of the absorption beds and embankment material placed across the west end of Absorption Bed 1, the north side of Absorption Beds

3 and 4, and across the east end of Absorption Bed 4. The embankment had a minimum width of 10 ft and a minimum height of 2 ft (Rogers 1977, 05707, p. T-5).

Associated with the absorption beds, a redwood-lined pit, called a "caisson" was used for monitoring purposes between Absorption Beds 1 and 3 (Figure B-5). Constructed in 1959, the dimensions of the caisson were 6 ft wide by 10 ft long by 30 ft deep. Two horizontal holes at 2-ft depth intervals down to a 28-ft total depth were drilled into Absorption Bed 1 and the tuff beneath the bed. Each pair of horizontal holes was instrumented; one for soil moisture and one for gross alpha measurement (LANL 1991, 07528.1, p. 16-103).

The Shaft Disposal Area [SWMU 21-016(c)] consists of approximately 64 shafts for the disposal of cement-treated radioactive mixtures. These disposal shafts were drilled into the Bandelier tuff located mainly between Absorption Beds 2 and 4 (Figure B-6). Forty-nine shafts were drilled into the tuff using a 4-ft-diameter bucket auger and reaming to an 8-ft-diameter shaft. Fifteen 6-ft- or 4-ft-diameter shafts were located in the shaft field between the 8-ft-diameter shafts (Rogers 1977, 05707, p. T-11). The disposal shafts range in depth from 15 to 65 ft deep (Table B-2). Prior to placement of cement-treated mixtures, the shafts were sprayed with heated roofing asphalt (Drawing R-4475). Although several progress drawings exist, no as-built drawing showing the final configuration of the shafts remains.

Potential shafts, numbered 4, 7, 12, 14–16, 37, 38–40, 45, 61–69, 71, 74, 79, 81, 85, 86, 88, 89, and 96–99 were not drilled. There is conflicting information as to whether or not shaft 90 was drilled. Literature indicates that potential shafts 14–16 were not drilled because of an overhead power line. Potential shafts 37–40 were not drilled because of the presence of an overflow pipe between Absorption Beds 2 and 4. (Rogers 1977, 05707, p. T-11).

The RWSA [SWMU 21-016(b)] (Figure B-6) was an excavation measuring 120 x 24 ft x 19 ft. The ramp leading to the bottom of the pit was 60 ft long. The RWSA was filled with 20-ft x 2.5-ft corrugated metal pipes (CMPs) placed on end in the excavation. Of the 227 CMPs contained in the excavation, 69 pipes were removed in 1984, and 158 CMPs were removed in 1986 (Nyhan 1993, 23248.1, p. 3). However, another reference suggests that only 175 CMPs were originally contained in the RWSA (LANL 1990, 07512.1, p. 21-016). However, all CMPs were removed. The excavation was filled with excavation spoil following removal of the CMPs.

Building 035 [SWMU 21-010(a)] housed the first wastewater treatment facility for treating industrial wastewater from the TA-21 plutonium processing facilities prior to disposal at MDA T (Figure B-7). Construction details are shown on a 1951 as-built drawing (Drawing C-8436) (LANL 2003, 81175). The drawing depicts only minimal pipe and tank detail. The presence of the external tanks indicates that some form of treatment of the process wastewater pre-dates the drawing issue date, although no record of that process is found.

Drawing C-8436 indicates that two 10-ft tall, 2-ft-diameter tanks may have been moved from a nearby outdoor location into the building. The tanks are not identified but may have contained sand filter columns or acid neutralization used as a treatment process pilot test. A valve box (DP-93) and the pipe connection from the absorption bed wastewater line to the building, as well as an under floor discharge pipe extending from the building toward the absorption beds is shown in Drawing C-8436.

Drawings indicate that up to four waste lines ran from the DP West process Buildings (002, 003, 004, 005 and 150) to the industrial waste treatment plant (Building 035) (Nyhan 1990, 12605, p. 37) (Figure B-8 and Drawings C-2563, C-2564, C-8436, C-8439, and C-18227). A complex pipe arrangement fed a buried influent tank (Drawing C-18227). This drawing, showing a tank replacement, may or may not have been implemented as no "as-built" drawing is indicated. Waste from DP East Buildings 152, 155, and 209 was combined and pumped via a buried pipeline to the treatment plant.

Drawings of the 1952 or earlier equipment configurations, in-ground sumps, etc., inside Building 035 are not available, although fabrication drawings of individual pieces of equipment exist. The description of the treatment process contained in Section 2.3.3, Industrial Waste Treatment Processes at Building 035, provides an insight into the general arrangement of the equipment based on usage. This insight leads to the conclusion that the wastewater treatment equipment contained in Building 035 served a similar function to that contained in Building 257.

Based on as-built Drawing C-8439, major modifications of Building 035 took place in 1952. These modifications included a 30-ft extension of the building, addition of exterior above- and below-grade wastewater tanks, and the extension of a batch liquid wastewater treatment circuit for another 10 ft. Tanks included two 13,500-gal. influent holding tanks (Tanks 110 and 111) south of the building structure and the two effluent tanks (Tanks 112 and 113) adjacent to Absorption Bed 4. An emergency overflow from each tank extends to Absorption Bed 4 (Figure B-9).

The 1952 modifications included construction of the DP Canyon outfall [SWMU 21-011(k)] (Drawing C-8439). Drawing C-36385 shows the effluent pipe arrangement for tying into the outfall pipes near the existing effluent holding tanks 112 and 113. The outfall has been remediated in 2003. Drawing C-2082 shows a citric acid storage tank, Tank DPW-120, a 4000-gal. steel aboveground storage tank (AST) located immediately north of Building 035. Historical aerial photos of Building 035 indicated this tank was located at the northeast corner of the building rather than the northwest corner as indicated by Drawing C-2028.

From 1956 to 1964 frequent changes to the building and processes are apparent. In 1956, a vacuum filter room (Drawing C-18169) was added, along with associated equipment which included a filter press to dewater sludge obtained from the underflow of the process wastewater flocculation process. In 1959, an americium waste treatment circuit (Drawing C-21959) was designed and subsequently built to cement-treat americium raffinate waste. In 1960, a chemical storage addition (Drawing C-17858) was designed and subsequently built. This slab-on-grade addition contained no process equipment. In 1964, 50% caustic storage tanks for an expanded americium raffinate treatment circuit (Fowler 1964, 06758) replaced the chemical storage area (Drawing C-17945).

A bathroom in Building 035 drained to a septic tank (Structure DP-185) and leach field (Drawing C-18171) system [SWMU 21-010(e)] at the east end of the building. As shown on Drawing C-36371, the septic tank and leach field were abandoned in place when Building 035 was connected to a sanitary sewer.

Plutonium-contaminated process wastewater processing and americium raffinate treatment at Building 035 ended in 1967 with the demolition of Building 035. The structure and foundations were removed to TA-54 MDA G, a fact confirmed by the 1989 RFI Investigation (LANL 1991, 07528, p. 16-155). The sanitary septic tank and drain field system remained in place after the demolition of Building 035.

Inactive wastewater lines to Building 257 [SWMU 21-011(a)] tie into the existing wastewater lines southwest of Building 035 (Drawings C-36380 and C–36381). The wastewater pipe from DP East, rerouted during treatment plant construction, enters relocated Tanks DP-110 and DP-111 (Figures B-8 and B-9).

The wastewater effluent lines tie into the original effluent line from Building 035 (Drawing C-36380 and C-36385).

The americium raffinate treatment circuit consisted of a raw raffinate storage tank [SWMU 21-011(j)], sodium hydroxide tank [SWMU 21-011(i)], and an unloading area outside the building and south of the DP west tanks. A drum tumbler for mixing cement paste was located inside the building. The cement silo and a wastewater storage tank (Structure 256) associated with pugmill operations were adjacent to the southwest building corner.

Other work areas of Building 257 include a chemical storage area, change room, stock room, maintenance area, laboratory, and an electrical/mechanical room (Figure B-10).

Incinerators, called "salamanders," (Figure B-11) that are conventional oil-burning orchard heaters with a base approximately 2 ft in diameter and a flume 5-ft high, were located on the former absorption beds. The salamanders were modified to burn transuranic and hazardous-constituent-contaminated waste oils. The modifications included a HEPA filter, blower, ducting with sampling ports, and an exhaust stack. The base of the salamander holds approximately 2.9 gal. of fuel. Christenson (1992, 00363, p. 1) and Christenson et al. (1974, 05481, p. 5) also state that the salamanders were an inexpensive commercial burner. The incinerators were removed and no drawings exist showing exact placement of the units. Another reference suggests that the salamanders were three incinerator units described as long trays for open burning of waste (IT Corp. 1990, 01247; Nyhan 1990, 12605, p. 60); however, Laboratory records of such a device are non-existent. Airborne releases from operations of the salamanders comprise SWMU 21-007.

### B-2.3 Operational History

The operational history of the MDA T facility is complex, beginning in 1945 with disposal of industrial wastewater from the plutonium processing facility into absorption beds, construction and operation of an industrial wastewater treatment plant to remove solids and contaminants from the wastewater stream and including alternate disposal of wastewater to a canyon outfall, and replacement of the initial plant with a new facility. In addition, both treatment plants held americium raffinate treatment circuits coupled with cement treatment circuits to handle solids and semisolids generated by the treatment plants and the processing facility. The cement treatment process in turn required disposal of the treated wastes at the RWSA and in drilled shafts (some additional waste solids were added to the shafts during disposal). Additionally, several portable incinerators were used to burn contaminated waste oils.

#### B-2.3.1 Untreated and Treated Wastewater

Figure B-12 depicts a simplified operational history for the treatment and disposal of wastewater at MDA T from 1945 to the present day.

From 1945 to 1952, the four absorption beds received untreated acidic wastewater from uranium and plutonium processing laboratories and floor drain water from Filter Building 012. When the amounts of wastewater discharged to the absorption beds reached several thousand gallons per day, the absorption beds became congested and had to be abandoned in 1967 (Rogers 1977, 05707, p. T-3).

From 1949 until 1967, the majority of acidic wastewater was treated in Building 035 using settling, filtration and neutralization processes (see process description in Section 2.3.3, Industrial Waste Treatment Processes at Building 035). Following completion of the outfall to DP Canyon in 1952 until abandonment of Building 035 in 1967, only small quantities of wastewater went to the absorption beds. Some waste-treated wastewater was used in americium raffinate batch treatment.

Wastewater received from DP East began treatment and discharge to the absorption beds from 1965 to 1967 (LANL 1991, 07528, p. 16-106). In 1967, when the new industrial wastewater treatment facility at

Building 257 came online, most of the wastewater went to the outfall with the exception of that used in raffinate treatment.

Absorption Beds 1 and 2 were designed to fill first and then overflow via connecting pipes into Beds 3 and 4. Reportedly, more liquid waste moved into Beds 1 and 3 than moved into Beds 2 and 4, and at times some of the beds became clogged and overflowed. The overflow moved northward toward DP canyon. However, overflow from the absorption beds never reached the canyon (Rogers 1977, 05707, p. T-11) and was probably contained in the surface containment berms.

Since 1984, wastewater from the Tritium Systems Test Assembly (TSTA) is sent to Building 257 for interim treatment. Although no longer operational, the TSTA continues to send wastewater to Building 257 for interim treatment. Following removal of the wastewater line extending from the effluent tanks at Building 257 to TA-50 in 2002, the treated wastewater is trucked to TA-50 for additional treatment.

### B-2.3.2 Cement-Treated Wastes and Other Solid Waste Disposal

Both industrial waste treatment facilities treated americium raffinate sludge. Batch treatment began in approximately 1952 in Building 035 and continued when Building 257 was operational. (See discussion of the in-plant processes contained in Sections 2.3.3 and 2.3.4, respectively.) Disposal records are unavailable from 1952 to 1968. After 1968, cement-treated waste was disposed of at MDA T.

From 1968 until April 1983, the installation of disposal shafts began for disposal of cement-treated wastes from the pugmill (see Section 2.3.4, Industrial Waste Treatment Processes at Building 257). Spoil from the shaft excavation was stockpiled around the site. Documented detailed methods for the cement treated and solid waste placement are absent. The pugmill circuit and all associated tanks and pipes were removed or abandoned in place after 1983.

A cement paste waste (cement-treated waste) was characterized as "americium strip, alkaline fluoride, and plant sludge mixed with cement in a pug operation" (Rogers 1977, 05707, p. T-5). Additionally, solids reprocessed from washdown, rinse solids, washing, and wash water account for a low activity waste stream.

The larger (8-ft diameter) disposal shafts were installed between Absorption Beds 2 and 4. The shafts were then filled starting on the east side of the disposal field and proceeding west. The smaller disposal shafts were installed as the larger shafts were filled and capped. Shaft number 8 was drilled but no waste placement records exist.

Initially, the cement paste was pumped via a buried 2-in. line from the treatment facility to the Shaft Disposal Area, and placed in the individual shafts using a fire hose connected to the pipe. The pipe was difficult to clean and was later replaced with a fire hose leading directly from the treatment operation. Several shafts were filled in each batch run from the plant. Filling of a shaft stopped several feet below the ground surface and the remainder was filled with clean concrete. Upon completion of a fill run, the treatment circuit was flushed and the washdown water pumped into an empty, lined shaft. The washdown water was then returned to the treatment plant and reprocessed.

Samples were collected and cylinders of the treated waste were cast during the treatment process. Unconfined compression tests show that the cured cement paste obtained 55 to 292 pounds per square inch (psi) strength. The other samples were leached in water for a year and leachate was analyzed. Results of leachate testing indicated initial alpha and beta counts decreased up to one year from initial testing. Additional leachate testing continued after one year but testing was random (Sagez 2003, 76090, p. 4).

In 1974 as the larger diameter shafts were filled and capped, the RWSA was excavated between Absorption Beds 1 and 3 to provide a method of temporarily storing cement-treated transuranic (TRU) waste in CMPs. Spoil from the RWSA excavation was stockpiled around the site. The CMPs were placed on end in the ground and filled similarly to the shafts described previously. An improvement on the initial filling process included placing several feet of clean concrete (i.e., not mixed with waste) prior to filling the CMP with cement-treated waste and then capping the end with several feet of clean concrete following filling. This prevented damage of the cured cement paste during excavation and removal. Filling operations at the RWSA ended in 1982. The pipes were removed in 1984 and 1986 and relocated to MDA G. The RWSA was backfilled in 1986 and the area regraded to facilitate drainage. No further waste storage activities occurred at MDA T.

### B-2.3.3 Industrial Waste Treatment Processes at Building 035

Construction on the industrial liquid waste treatment plant (Building 035) began in 1949 and was completed in 1952. The exact date it was placed into service is unknown.

Treatment included chemical additives such as ferric sulfate and lime for precipitation and neutralization. The ferric sulfate and lime were added to the incoming waste stream, forming a precipitate of ferric hydroxide that settled to the bottom of the settling tanks carrying the plutonium with it (Shipman 1958, 04700, p. 97). Disposition of the precipitate is unknown. Following a process modification, moisture was removed from the sludge to produce a low-moisture filtercake. The sludges (and presumably the filtercake) were buried in MDA C (Abrahams 1962, 08147, p. 25). The liquid derived from dewatering of the sludges that contained plutonium was stored in tanks for several hours or days for control analysis, then discharged to DP Canyon (Abrahams 1962, 08147, p. 25).

Other wastes, such as americium raffinates and hydrofluoric washing solutions, were treated separately by batch methods (Shipman 1958, 04700, p. 97). Hydrofluoric acid was neutralized and discharged to DP Canyon (Abrahams 1962, 08147, p. 25).

The americium raffinates were mixed with cement in 55-gal. drums for transport to Area G. Additional details of the treatment or waste quantities shipped are not available.

In 1957, 99.9% of the plutonium received in all wastes for the year was removed by treatment (Shipman 1958, 04700, p. 96). The Shipman Report also states "All treated waste discharged to the canyon met standards for such discharge. The small volume of plant effluent which did not meet those requirements was recirculated or discharged to the absorption beds."

### B-2.3.4 Industrial Waste Treatment Processes at Building 257

Figure B-13 shows a simplified acid wastewater treatment circuit. In 1967, operations began at Building 257 treating liquid waste from plutonium processing operations associated with DP site and discharging the treated waste through an outfall, SWMU 21-011(k). A process flow diagram (Drawing C-36382) shows the operations contained within the industrial liquid wastewater treatment facility Building 257.

The basis of treatment from 1967 through 1986 at Building 257 was co-precipitation of plutonium with ferric sulfate. The treatment process utilized a "continuous stream" of influent and was temporarily retained in two raw storage tanks constructed of concrete, partially below grade, and located at the north side of the facility (Tanks 110 and 111, Figure B-8). Feed pumps lifted waste in the storage tanks to a flash mixer where lime, ferric sulfate, and coagulant aids were added (Christenson 1970, 08428, p. 1). The wastewater flowed to a flocculator and on to a settling tank. Settled effluent was pumped through a pressure filter and sampled to verify treatment. If the effluent was determined to be adequately treated, it was pumped to two final effluent holding tanks (112 and 113, Figure B-8) and sent to the outfall. If the effluent was not sufficiently treated, it was recirculated through the treatment system (LANL 1991, 07528, p. 16-173). The sludge was drawn off to a sludge storage tank. The sludge from this tank went to the pugmill circuit. Treatment did not fully neutralize the wastewater but raised the pH to the then current acceptable discharge levels (Sagez 2003, 76090, p. 1). Current processes at Building 257 for treating wastewater from TSTA remain similar to previous wastewater treatment operations using a majority of the original equipment.

Figure B-14 shows a simplified americium process flow diagram. From 1967 to 1983, the batch treatment process received americium raffinate waste via the tank truck unloading station located on the west wall of the plant. The pumped raffinate went directly to the neutralization tanks or to the americium storage tank for holding and later neutralization. Neutralization with 50% sodium hydroxide (NaOH) occurred in either of two tanks. A hose from these tanks filled steel drums for further mixing in a drum tumbler. Until 1968, the neutralized drummed americium raffinate went to TA-54 (Fowler 1964, 06758).

In 1968 a pugmill treatment process, shown in Figure B-13, replaced the drum tumblers. In addition to treating americium raffinate, the pugmill treated the sludge from the process water treatment circuit. The combined sludges went to a sludge storage tank (Acid Tank 256). The pugmill received the sludges for mixing with cement from the dry bulk cement storage hopper and feed wastewater from the wastewater treatment circuit. From the pugmill mixer treated waste was pumped through buried pipeline and fire hose to the RWSA and disposal shafts, as shown on Drawing C-36382. The pugmill circuit was removed following completion of shaft and CMP filling.

Wash water from drummed environmental sample collection was delivered to the secondary storage area on the west side of Building 257. The material was evacuated from the drums and put into Storage Tanks 110 and 111 (Figure B-8) for temporary storage until transfer to a vacuum truck for transport and disposal at TA-50.

### B-2.3.5 Incinerator (Salamander) Operations

The salamanders were used to burn contaminated waste oil at MDA T from 1964 to 1967 and between 1970 through 1972. The salamanders were filled with radioactive tricresyl phosphate- (TCP-) or tributyl phosphate- (TBP-) oil mixed with kerosene. Ash from burning was added to the cement-treated waste at an unspecified location in the mixing process. Ductwork and a blower placed over the salamander collected the exhaust and routed it through a HEPA filter that collected particulates before discharging the exhaust to a vertical stack. All the operations were manually controlled (LANL 1990, 07512, p. 13-8).

## B-2.4 Disposal, Discharges, and Releases

Disposal, discharges, and releases at MDA T include cement-treated radioactive sludge and wastewater in the shafts and RWSA CMPs, solid and other liquid wastes co-disposed in the shafts, treated and untreated contaminated wastewater, and incineration of radioactive contaminated waste oils.

### B-2.4.1 Wastewater Treatment and Disposal

The amount of untreated wastewater sent to absorption beds during 1945 to 1952 was on the order of 14 million gal. (Rogers 1977, 05707, p. T-4). The concentration of plutonium in effluent during this time has been estimated at 60 counts per minute per milliliter (c/min/mL) (120 disintegration per minute per milliliter [dis/min/mL]) with an average fluoride concentration of 160 parts per million (ppm). In addition, 10,450 gal. of effluent highly concentrated with ammonium citrate was released into the beds from June

1951 to July 1952. The plutonium concentration of this waste averaged about 7000 c/m/mL (14,000 dis/min/mL) and the fluoride concentrations were about 200 ppm.

From 1953 through 1967, 4.3 million gal. of effluent went into the absorption beds (Rogers 1977, 05707, p. T-5). Of this amount, 2 million gal. came from DP East. Table B-3 presents the volumes of wastewater discharged to absorption beds from 1945 through 1973.

Wastewater contained fluorine, iodine, cadmium, beryllium, lead, mercury, sodium, nitrates, and chlorine in addition to radionuclides (plutonium-238, plutonium-239, plutonium-240, uranium-235, and americium-241). The liquid probably contained solvents and other organic chemicals from the various laboratory operations including solvent extraction.

As of January 1973, the absorption beds received estimated activities of 4 curies (Ci) of tritium and 10 Ci of plutonium-239 (generally consisting of 94 wt% plutonium-239 and 6 wt% plutonium-240) (H Div. 1974, 05469.1; Rogers 1977, 05707, p. T-5).

Building 035 treated liquid radioactive wastes generated at DP West. The waste contained fluorine, iodine, cadmium, beryllium, lead, mercury, sodium, nitrates, and chlorine in addition to radionuclides (plutonium-238, plutonium-239, plutonium-240, uranium-235, and americium-241). The area had spills and leaks associated with it. Radioactivity in the downgradient area below the treatment facility is reported to be above background (LANL 1990, 07512, p. 21-010).

A total of 31,308 gal. of wastewater containing both plutonium and mineral constituents were processed at Building 035 from 1952 through 1961. As seen in Table B-4, the process wastewater included gross alpha emitters and plutonium.

Starting in 1970 and continuing to the present, Building 257 treated 2,866,300 gal. of tritium wastewater that contained a total activity of approximately 51 mCi. Based on available records, the quantities of wastewater treated for TSTA at Building 257 from 1983 to 2002 are shown in Table B-5.

### B-2.4.2 Cement-Treated Waste Treatment and Other Solid Waste Disposal

Batch waste treatment at Building 035 included waste concentrated in "both plutonium and mineral constituents" (Shipman 1958, 04700, p. 96) from DP West. The quantities of batch wastes treated are unknown.

The radioactive wastes included cement-stabilized americium, alkaline fluoride, and plant sludge disposed of in the shafts. Five of the shafts have experimental "bathyspheres" that contain plutonium-239/240 and other mixed fission products buried at various depths and some shafts temporarily held volumes of wastewater. The disposal shafts numbered 3, 17, 18, 19, and 26 contain 3-ft diameter bathyspheres that were placed three to a layer and at various depths (Sagez 2003, 76090, p. 1). Disposal Shaft 17 contains six drums of cyanide salts fixed in asphalt. Shafts 50 and 54 contain demolition debris from Filter Building 012. Shafts 52 and 58 contain four drums of uranium-235. Table B-6 presents the inventory contributions for plutonium-239 contained in the bathyspheres. Besides plutonium-239, plutonium-238, americium-241, uranium-233 and uranium-235, the shafts contain some mixed fission products that are mostly strontium and cesium. Table B-7 provides volumes of plutonium cement-treated waste placed in each shaft. As of July 1976, the disposal shafts contained 7 Ci of uranium-235, 47 Ci of plutonium-238, 191 Ci of plutonium-239, 3761 Ci of americium-241, and 3 Ci of mixed fission products (McGinnis 1976, 00956, p. 3).

Although no documentation records are available, personal protective equipment (PPE) (see 1996–1997 Field Investigation) and other contaminated items are emplaced along with the cement-treated waste.

The RWSA received cement-treated wastes from Building 257 with concentrations greater than 10 nanocuries per gram (nCi/g) of plutonium-239/240 and americium-241. There were 175 filled CMPs stored in the RWSA. Other historical documents refer to 227 CMPs stored in the RWSA. Sixty-nine CMPs contained low-level radioactive wastes with a total inventory of 0.77 Ci plutonium-238, 1.18 Ci plutonium-239, 15.3 Ci americium-241, and 0.16 Ci mixed fission products were relocated to TA-54 MDA G in 1984. An additional 158 CMPs contained TRU wastes with a total inventory of 30.97 Ci plutonium-238, 59.4 Ci plutonium-239, 10,385.4 Ci americium-241, and 0.4 Ci of mixed fission products were relocated to TA-54 MDA G in 1986.

### B-2.4.3 Incinerated Waste

Health, Safety, and Environment (HSE)-7 records on the amount of oils burned in the salamanders and radionuclide assays on ashes are detailed in Nyhan's report in 1990 (LANL 1990, 07512, pp. 144–155) (Table B-8). The report states that approximately 1102 gal. of TCP- and 156 gal. of TBP-contaminated oils were mixed with kerosene and burned in the salamanders between 1964 and 1972. Based on HSE-7 records as reported in the RFI work plan (LANL 1991, 07528, pp. 13-7 and 13-8) the plutonium-239/240 releases for the years 1970, 1971, and 1972 are estimated to be 0.5, 29.4, and 0.8 disintegrations per minute per cubic meter (d/min/$m^3$), respectively. This corresponds to a total release for three years of 30.7 d/min/$m^3$, or 6.51 µCi of plutonium-239/240.

Prior to full-scale use of the salamanders, two trial burns were conducted. The initial test was incineration of a mixture of TCP contaminated with plutonium-239 (with a count of approximately $10^3$ d/m/mL which was diluted with half part kerosene). The maximum plutonium-239 activity in the air was 1.5 d/min/$m^3$. Four air samplers were placed around the burner at a distance of three meters. The experiment was conducted successfully with no contamination of the surrounding ground surface. The surface of the burner became slightly contaminated, but there was little, if any, loose contamination. The activity in the burner ash was approximately $3 \times 10^5$ d/m/gm, and the activity in the soot in the stack was about $3 \times 10^3$ d/m/gm (Christenson and Emelity 1992, 00363, p. 1).

The second test consisted of a mixture of kerosene and $1.0 \times 10^5$ d/min/mL "old fission products" (Christenson and Emelity 1992, 00363, p. 1). The radioactivity travel in the air was measured at 20 d/min/$m^3$ of gross alpha (mostly uranium) and 70 d/min/$m^3$ gross beta. The measure of radioactivity in the burner ash and soot was $6 \times 10^6$ d/m/gm gross beta and $1 \times 10^6$ d/m/gm gross alpha; and $2 \times 10^4$ d/min/gm gross beta and $2 \times 10^3$ d/min/gm gross alpha. HSE-7 calculations are consistent with the testing conducted by C.W. Christenson at the start of the experimental incineration of waste oil at MDA T.

### B-2.4.4 Environmental Releases

Environmental releases include contamination in absorption beds and in the bedrock under MDA T caused by spills and releases during current and former treatment and disposal activities, contaminated equipment, tanks and surfaces of Building 257, and buried process pipes.

A previously unreported environmental drilling program (Stoopes 2003, 76089, p. 2) detected contamination near the location of former valve boxes at Building 035. In addition, tanks and other liquid holding facilities at Building 035 had no secondary containment and floor sumps and drains were unlined concrete. Leaks may have occurred at joints in buried cast iron and stainless steel pipes. Six AOCs are associated with Building 035, mostly tanks or structures involved in the process of disposal of wastewater from DP East and West. AOC 21-028(a), associated with Building 035, cannot be located in historical records.

Although the external tanks at Building 257 have secondary containment, some of the containments include floor drains extending to the surrounding site grade. The surrounding area at the americium unloading area at Building 257 was not originally asphalted, and unquantified spills that occurred during tanker-truck transfer operations are reported. Sumps inside the structure are unlined concrete and may leak. Five AOCs are associated with Building 257; one involving a structure around the building, but the other four all involved spills with cement-incorporated waste.

Rogers states that it was still possible to release treated wastewater to Absorption Bed 4 as of July 1976 (Rogers 1977, 05707). This appears to indicate that piping and valves remained in place to allow overflow from Tanks 112 and 113 to reach the absorption bed and does not indicate that spills occurred in that time frame. No record of a release into Absorption Bed 4 is found.

The RWSA had unquantified spills and leaks associated with operations. Two AOCs (C-21-009 and C-21-012) are spills associated with the RWSA and the CMP filling operation. Spills, leaks, and releases were reportedly cleaned up at the time, but residual waste contamination and contamination from undetected leaks may still exist.

According to LANL personnel, oil spills from the salamanders occurred throughout the salamanders' operation within MDA T (LANL 1990, 07512, p. 21-007). Airborne releases from salamanders (SWMU 21-007) are overshadowed by releases from stacks associated with the DP West Plutonium Processing Facility. Building 012 released several Curies annually of airborne particulate into the atmosphere and MDA T is within the projected area of deposition (LANL 1991, 07528, p. 13-12).

Less than 50 gal. of partially treated TSTA wastewater treated at Building 257 spilled from Tanks 112 and 113 when a gauge stuck and the tanks overflowed (LANL 2001, 72667, p. 1). The wastewater had been used in the cooling towers at the TSTA. Results of an alpha surface survey of the Building 257 interior are shown on Figure B-10.

### B-2.5 Current Waste Inventory

Radionuclides present at MDA T in non-retrievable waste disposal shafts are plutonium-238, plutonium-239, plutonium-240, americium-241, uranium-233, and uranium-235. Each shaft varies in composition and volume of waste. In certain situations there is ambiguity about which shafts received radioactive materials (LASL 1979, 00976, pp. 1–2).

Uncharacterized low activity waste streams disposed in the shafts include solids from wash down. Values for these low activity waste streams should be extremely small (LASL 1979, 00976). In summary, it appears the waste was generated as a result of processing a number of different feed materials so there may be considerable variability in the composition within a shaft as well as between shafts.

Cement-treated waste has high variable mass ratios of plutonium-239 to americium-241, and even greater variability within any given shaft; on an activity basis more americium-241 than plutonium-239 is present in cement-paste waste. "Overall present day mass ratios and activity ratios are estimated from data from Table B-9. LA-6848-MS states that its plutonium -238 and -239 estimates do not include the contributions from 1968 to 1971; it goes on to state these contributions are very small." (LASL 1979, 00976)

A total of 713 g of uranium-233 was disposed in shafts 52 and/or 58 in four 55-gal. drums (LASL 1979, 00976). More detailed records of the shafts receiving uranium or the amount placed in each shaft are unavailable. However, 384 g of "most likely" uranium-235 is inferred to have been placed into shafts 6, 8, 54, 87, 90, 91, 92, and 94 (Complex A) and shafts 52 and 58 (Complex B) based on the dates that shafts were being filled. Note that Complex A includes inventory for shafts 8 and 90.

Other contributions to inventory include the plutonium-239/240 contained in the bathyspheres.

Present day inventory totals by shaft are estimated for plutonium-239, plutonium-238, plutonium-240, and americium-241; in addition to uranium-233 and uranium-235 for shaft complexes A and B (Table B-9).

## B-3.0 HISTORIC INVESTIGATION ACTIVITIES

This section discusses historic investigations that occurred at MDA T beginning with the first field investigation in 1946 through the latest field investigation in 1996/97. The summary results of laboratory and office studies resulting from the initiation of field investigations are also included.

### B-3.1 1946 Field Investigation

The earliest environmental monitoring surveys at MDA T began in July 1946 and continued through November 1946. Samples collected at MDA T were part of a larger sampling effort to characterize the extent and sources of contamination at and around Los Alamos. This investigation reported three separate sampling events collecting effluent and soil samples at an outfall to Absorption Bed 1 and 2, respectively. Two-liter samples were collected for the fluid analysis and 50-g samples were collected for the soil analysis (Rogers 1977, 05707, p. T-11). The surveys checked for radioactive (plutonium) contamination in sewer-water, water, and soil samples collected at MDA T. Sample locations are indicated on Figure B-4.

The analytical methods used to test the samples and the results of sample analyses are described in the report of February 20, 1947 (Kingsley 1947, 04186, p. 3). Four groups of radioassay determinations were conducted. The first group of assays was conducted on water samples from all sanitary and chemical sewer outlets, including Absorption Beds 1 and 2 at MDA T. Samples were collected and assayed in July and September 1946. A second group of assays (October and November 1946) was conducted on soil samples collected from the ground surrounding all sewer outlets found contaminated (including MDA T) when surveyed with a portable alpha survey instrument. A portable "Pee Wee" alpha survey instrument equipped with a 4 x 6 in. flat probe and headphones and the portable "Victoreen" gamma survey meter were used in surveying. The third and fourth groups of assays were conducted on samples collected in and along streambeds of the canyons and are not relevant to this report.

The monitoring of the ground surrounding 25 sewer outlets, including some at MDA T, was completed in December 1946. Soil samples were used in analyses for both polonium and plutonium. The copper disk method was used for the polonium analyses and the lanthanum precipitation method for plutonium analyses. Uranium assays using a fluorimetric procedure of spectroscopic analysis of the water samples resulted in non-detects. Analysis of uranium was therefore discontinued for soil and canyon water samples (Kingsley 1946, 30059, pp. 1, 2).

Results of the sampling and testing related to MDA T are shown in Table B-10. The highest activity for plutonium was found in fluid samples collected in July 1946 from the seepage pits (No. 25 sewer from Building 012) of DP West. The results showed 6,780 d/m/L for July and a drop to only 97 d/m/L in September.

### B-3.2 1947–1948 Field Investigation

In April 1947, collection of effluent samples from the TA-21 chemical sewer outlets began (Rogers 1977, 05707, p. 7-17). The samples were assayed for plutonium, polonium, and uranium. Water samples from MDA T's main drainage (also called "DP West Seepage, Main Drain") were radioassayed and submitted to the analytical group for a fluorine analysis. Samples from the chemical sewer were collected at three different times during the day.

The radioassay results from the monthly report for October 21 to November 20, 1947, were 29,836 c/m/L plutonium and 5.8 c/m/L polonium (LANL 1947, 03587). The result of the fluorine analysis for DP West Seepage, Main Drain at MDA T, was 4.2 mg of fluorine per 100 mc. Samples collected September 26–30, 1947, reported January 2, 1948, indicated the highest activity due to plutonium was found at DP West Seepage Pit Main Drain (B) at 65,639 d/m/L. The January 2, 1948, report also included the analytical procedures for polonium in water samples and soil samples, plutonium in water samples and soil samples, and uranium.

Presumably, the purpose of this sampling was to monitor the quality of the effluent going to the absorption beds. Records on studies and monitoring at MDA T from 1948 to 1953 are not available.

### B-3.3 1953 Field Investigation

In 1953, the US Geological Survey conducted a study to determine "the fate of plutonium contained in liquid wastes discharged onto or just below the surface of the earth" (Herman 1954, 05654).

The investigation included drilling five test holes, DPW-1 through 5, in and around the absorption beds (Figure B-15). The test holes were drilled 13 ft to 20 ft deep, and 68 samples were collected at approximately 1-ft intervals to determine the distribution discharged into the beds. Two of the holes, DPW-1 and DPW-2, were drilled between Absorption Beds 1 and 3 and Absorption Beds 2 and 4, respectively. All samples were analyzed for plutonium, while three were selected for ion-exchange capacity determination (Tables B-11 and B-12) (Rogers 1977, 05707, p. T-19).

Results indicate that

- no appreciable horizontal movement of the plutonium occurred in the first 20 ft of depth,
- plutonium was readily retained by the various earth media (sand, clay, gravel, and rock),
- retention of the plutonium was greater in the finer materials, and
- penetration of the plutonium into the underlying strata was not expected.

### B-3.4 1959–1961 Field Investigation

According to Rogers, (1977, 05707, p. T-19), a study was conducted in October 1959 to determine the distribution of plutonium previously discharged to the absorption beds. A caisson was constructed on the northeast corner of Absorption Bed 1. The walls of the caisson were logged (Figure B-16 and B-17). Horizontal holes, 3 in. in diameter, were drilled at 2-ft depth intervals to a depth of 12 ft, terminating at the center of Absorption Bed 1. At each 2-ft interval, two holes were drilled 2 ft apart horizontally. One hole was used for moisture measurements and the other hole was used for collection of liquid samples using installed suction lysimeters. A 0.58-ft-long core sample for each 2 ft of horizontal depth was collected when the holes were drilled. Part of each core sample was assayed for gross alpha (Table B-13).

The summer of 1960 preliminary infiltration study had DP-West raw waste flow directly into Absorption Bed 1 for one month at an average rate of 8700 gal./day, followed by a month of tap water at 6600 gal./day. Moisture data were collected during and after these discharges.

In late 1960, after the preliminary infiltration study, six deep angled boreholes were drilled at the periphery of Absorption Bed 1 ranging from 76 to 99 ft deep. The boreholes were extended under Absorption Bed 1 (Figure B-5). Air percussion or air rotary drilling techniques ("Wagon Drill") were used; logs of the boreholes are not available. Gross alpha assays of cuttings are shown on Table B-14. The holes were lined with 2.5-in. plastic pipe.

The 1961 infiltration study was similar to the 1960 preliminary study. Twenty-four cubic meters (6400 gal./day) of raw waste went into Absorption Bed 1 from June 30 to August 1961. From August 2 through the 26th, 1961, 7,100 gal./day of tap water was applied. Sampling continued for an additional week after the application of tap water. Samples were continuously collected at each sampling depth, during each day until 0.013 gal. were obtained or eight hours had elapsed. Five daily samples were then composited and used as the weekly sample. Results of analyses on the composite water samples are shown on Table B-15. The objective of this study was to determine if and where water moved beneath a disposal pit and to ascertain if waste products moved with the water.

The USGS report (Rogers 1977, 05707, p. T-22) concludes the following:

"*[1]*...that waste water movement may have changed some of the physical properties of the tuff, such as pore and particles sizes.

*[2]* Some of the wastes discharged in the east end of the disposal pit may have moved laterally through the sand material (Figure B-14) along the sloping top of the tuff and then vertically into the tuff.

*[3]* The lower moisture values...seem to coincide with areas of tuff in which the greatest amount of staining had occurred. The stained areas may indicate a different stage of weathering than that at the clay layer due to alternate wetting and drying cycles...

*[4]* The tuff is extensively jointed (Figure B-14), and the tendency for a liquid to move through the joints is indicated by higher gross alpha count of a 1000 per minute per dry gram at the 20 ft depth...

*[5]* There were several open joints below a depth of 25 ft. Waste water had penetrated the fineline joints to a depth of at least 22 ft and subsequently altered the tuff adjacent to the joint as much as 1/4 in. Clays developed locally and impeded drainage so that the joints retained water to the extent that the moisture content of the tuff was locally as much as 35%...

*[6]* ...Water in the low moisture range apparently moved to depths greater than 90 ft. Water in unknown quantities moves through open joints or joints enlarged by solvents in the waste.

*[7]* ...Below a depth of about 15 to 20 ft the alpha activity was low, except for local areas of high alpha activity where water carried the activity along the joints. Rapid movement of water through joints was substantiated during infiltration studies..."

The references from which this information came use the words "joint" or "vertical fissure" to describe what is now called a "fracture".

### B-3.5 1967 Field Investigation

In January 1967, a reconnaissance study was made of the condition of the absorption beds prior to excavation of the disposal shaft field. Moisture contents were determined adjacent to three existing test holes at 4-ft intervals to 64 ft deep. Water samples collected from DPW-1A, DPW-3, and the caisson installed in the previous investigation and a weathered tuff sample collected from beneath the gravel fill of Absorption Bed 1 near the caisson were subjected to radiochemical analysis. Moisture contents of the tuff were logged in holes DPW-1, DPW-2, and DPW-5 at selected depths. Although not stated by reporting documentation, it is assumed that water content was obtained from core obtained when the boreholes were installed in 1960.

According to a report by Purtymun (1967, 01009, p. 5), effluents from DP-East have at times partially filled the caisson near Absorption Bed 1 creating a more localized point for infiltration of liquids. Test holes DPW-1A and DPW-3 contained some effluent at the time of observation (time not stated in the report, but assumed to be during the January 1967 reconnaissance study). It is supposed that the water in DPW-3 moved down the outside of the casing from water ponding in the caisson. A comparison of the moisture content with previous moisture measurements (March 1961 prior to the addition of 389,000 gal. of tap water and effluents in August 1961 during the study) is shown in Table B-16.

The January 1967 measurements at borehole DPW-1 next to the caisson show the effect of the 1.9 million gal. of effluent from DP East. The maximum concentrations of moisture have moved from the depth of 12 ft (40%, August 1961) to 40 ft (41%, January 1967).

The moisture measurements in DPW-2 and DPW-5 show a general decrease in moisture content of the tuff from August 1961 to January 1967. The indication is that most of the effluents released into Absorption Bed 1 have moved down in the area of the caisson, a focal point for collection and infiltration of effluents in the tuff.

The movement of the effluents in the tuff underlying the absorption beds was mostly downward beneath the absorption beds. The plutonium moved with the effluents and the data indicate that most of the plutonium was retained by Absorption Bed 1 in the upper 20 ft of the tuff. Some plutonium, however, may have moved to greater depths through open joints.

### B-3.6 Data Collected From Disposal Shafts starting in 1968

As discussed in Section 2.1.2, Historic Facility Descriptions presented in Table B-2, the disposal shafts were logged during excavation. A paleochannel extending through a portion of the shaft disposal field was mapped and is shown on Figure B-18. No other details are presented.

A report issued in 1978 (Purtymun et al. 1978, 05730, pp. 1–5) discusses field experiments conducted to determine the movement of fluids and plutonium from the disposal shafts. Although the exact location of the tests is not reported, the findings are relevant to the behavior of contaminant movement from the disposal shafts. Movement of fluids from both raffinate sludge treated with cement paste and sludge without cement treatment were determined by sampling the tuff rock adjacent to disposal shafts. The moisture content of the tuff before disposal of the cement paste was measured and determined to range from 7 to 12% by volume. Following placement of the cement-treated raffinate sludge in a 58-ft-deep shaft in April of 1969, a net decrease in moisture content was measured from borehole cuttings obtained from a test boring. The moisture content in the upper 10 ft of the test boring ranged from 8 to 14% by volume, reflecting infiltration from precipitation. At depths between 10 to 79 ft, the moisture content ranged from 4 to 8% by volume, a decrease of 3 to 6% by volume. Below 79 ft, the moisture in the soil exhibited no significant change from predisposal moisture contents. No change in radiological (gross-beta) activity was noted in the cuttings samples.

The raffinate sludge without the addition of cement (82 and 83% solids) was placed in a 5-ft-diameter, 20-ft-deep shaft. Test borings were located adjacent to the shaft to determine the moisture content of the tuff prior to placement of the waste. Moisture content subsequent to sludge placement was logged by neutron logging equipment. Additional test holes conducted approximately 90 days after sludge placement obtained core for analysis of plutonium movement from the sludge. Sludge was placed in the shaft in two events and the sludge level monitored following each event. Sludge levels in the shaft declined 5 to 7 ft in the first three days and then sharply decreased. Fluids were monitored moving outward and downward from the shaft. After 149 days following placement of the sludge, the fluid had moved over 10 ft into the tuff. The change in moisture content was calculated to account for over 60% of the fluid contained in the sludge. Less than 1% of plutonium contained in the sludge was calculated to have moved into the tuff based on the inventory of plutonium contained in the placed sludge compared to that contained in the tuff bedrock samples (a distance of up to 2 ft from the shaft).

Conclusions from the study include the following:

- The major transport mechanism for radionuclide migration from sludge placed in the shafts drilled into the tuff is by movement of fluids.
- Test holes drilled adjacent to a shaft filled with cement-treated raffinate indicated no loss of fluids into the tuff from the shaft and a net decrease of moisture in the tuff indicated the hydration of the cement was drawing moisture from the tuff into the shaft.
- Open joints in the tuff allowed early movement of the cement-treated raffinate sludge, but upon hydration of the cement in the joint, this movement ceases.
- Untreated raffinate sludge released to a shaft resulted in the movement of moisture and plutonium into the tuff. However, it was calculated that less than 1% of the plutonium inventory had been released into the shaft.

### B-3.7 1974 Field Investigation

As reported by Rogers (Rogers 1977, 05707, p. T-28), in March 1974, a survey was begun to gather surface and subsurface data for the proposed location of the RWSA. This survey included drilling 7 boreholes within the absorption bed boundaries, 40-ft deep in order to obtain composite samples generally over 5-ft intervals. Drilling was completed on March 22, 1974. An additional 6 holes (numbered 1–6) were augered in May 1974. They were located so as to encounter a boulder bed that occurs at a depth of 15 to 25 ft below ground surface (Figure B-19). Logs of these boreholes are not available.

Only general conclusions of the monitor station survey include the following:

- There is no plutonium surface contamination (less than approximately 1.2 $\mu Ci/m^2$) within the boundaries of the fenced site, which did not include the shaft field at that time.
- Americium-241 was detected in Absorption Bed 1, but at a level of only 1.1 $Ci/m^2$ assuming surface contamination.
- No significant levels of external radiation could be attributed to the radioactivity within Absorption Beds 1 and 3 of MDA T.

Seven holes (numbered 7–13) were augered to a depth of 40 ft in April 1974. Samples were collected at 2.5-ft intervals from the 1- to 10-ft depth and at 5-ft intervals from the 10- to 40-ft depth and analyzed for moisture content, gross alpha, gross beta, cesium-137, and tritium.

Six additional holes, augered in May 1974, had samples collected at the same intervals and analyzed for moisture content, gross alpha, gross beta, cesium-137, and tritium, the same as in April. No additional information or results are available.

In 1974, minimum detection limits (LANL 1975, 05488, p. 30, Table IV) for routine analyses of radioactivity in typical solids were 1.0 pCi/g for gross alpha, 2.0 pCi/g for gross beta, 0.2 pCi/g for cesium-137, and 0.6 (±0.5) to 28.0 (±0.9) nCi/L for tritium (Table B-17).

Results of the initial seven augered hole samples included the following:

- One hole was cored to a depth of 14 ft into Absorption Bed 3 (Fried et al. 1977, 00963, p. 124). The americium-241 and plutonium-239/240 distributions are shown in Figure B-20.
- All samples were above worldwide fallout background levels (Nyhan and Dresnnon 1993, 23248, p 27).
- The highest levels of americium-241 were at the surface and between 8.5 and 10 ft; and the highest levels of plutonium were at the surface and between 12.5 and 14 ft.

On October 30, 1974, during excavation of the RWSA, samples were collected from the north and south walls of the excavation. This second investigation included one borehole to 14 ft with radiological logging.

Samples collected from the excavation of the RWSA were analyzed for tritium, plutonium-238, plutonium-239, and gross alpha. Results of RWSA excavation samples are shown on Table B-18.

### B-3.8 1976 Field Investigation

In March 1976, four holes were augered through Absorption Beds 3 and 4 to depths in tuff ranging from 1.5 to 20 ft below the bottom of the bed in order to obtain 56 samples for plutonium analysis. Split-spoon samples were obtained by advancing hollow stem augers through the absorption beds. Approximate locations of the boreholes are shown in Figure B-21. Results of radio-assays of the core samples are shown on Table B-19. The investigation provided field validation of (laboratory) experiments by Argonne National Laboratory workers on the migration of plutonium in tuff. Although the laboratory results for plutonium agreed with the field data, americium was found to migrate farther into the tuff in the field than in the laboratory (Fried et al. 1977, 0963, p. 125).

A laboratory simulation of this site was prepared primarily as a test of the validity of the modeling techniques. A specimen of Los Alamos tuff taken near the site was cut into a cylindrical plug 18 x 77 mm. The curved surface was waxed to restrict lateral flow of liquid. The cylinder of rock was attached to a glass tube that served as a reservoir for liquids, which were to percolate through the rock. Waste solutions were synthesized from americium-241 and plutonium-237 tracer; the latter in place of plutonium-239 to facilitate low-level determination.

Solution volumes and concentrations were proportional (as closely as possible from available Los Alamos records at the time) to permit an arbitrary scale of 2.2 ft/cm. The synthetic waste solutions were then delivered to the test specimen in the same sequence as at the site at a controlled rate of 2 mL/hour using a metering pump. Disposal at the site was not continuous but rather sporadic, and since no record of the cycle is available, no attempt was made to reproduce it. The effluent of the column was collected and prepared for analysis. At the conclusion of the experiment, the specimen was removed from the apparatus, dried, cut into 0.20-in. sections, and analyzed by gamma spectrometry to determine the distribution of actinides in the rock.

According to Fried et al. (1977, 0963, p. 125), examination of the actinide contents in the core collected from the boreholes showed that detectable amounts of these nuclides did migrate to 20 ft below the bottom of the trench under the prevailing conditions. Elevated concentrations of both nuclides (americium and plutonium) are found at less than 1 ft and at 13 ft. The bulk of the americium was centered around the 9-ft depth. There was an abrupt decrease of plutonium and americium below 13 ft—only 0.2% of the detected plutonium was below that level. However, 45% of the plutonium was 1 ft or less from the bottom of the trench.

The distribution of actinides in the simulated model agreed with earlier modeling work using tracers and simulated rain. Characteristic of these data were strong retention of actinides at the near surface with exponential tailing downward. In addition, plutonium exhibits a second concentration band beyond this tail. The percent of plutonium in this band is a function of the prior chemical treatment of the tracer material. An examination of the effluent from the model showed no discernable pattern, it contained no americium and only 5% plutonium. There was a rapid drop in the elution of plutonium once water had rinsed the waste solutions from the rock and was the only eluting agent. This agreed with previous work that showed distribution of plutonium was dependent upon the conditions of loading on the rock such as chemical composition and rate. Once plutonium was adsorbed by the rock, the actual water-induced migration was extremely slow.

The reservations stipulated at the conclusion of this study included the following:

- The model constructed in the laboratory was primarily a chemical model and could not produce geologic conditions at the site.
- Geologic features may outweigh the chemical effects (e.g. a clay-filled fracture at 14 ft which may be restricting downward flow of moisture).
- A singe coring experiment is not sufficient to resolve discrepancies or confirm predictions.

### B-3.9 1978 Field Investigation

Nyhan et al. (1984, 06529, p. 6) conducted a study to determine the vertical distribution of americium-241, plutonium, and water beneath the absorption beds at MDA T.

Two 100-ft-deep holes were drilled through Absorption Beds 1 and 2. Continuous core samples of the tuff were collected beneath the beds by driving a split-spoon sampler, 2 ft long and 3 in. in diameter, through a 9-in.-diameter hollow-stem auger. The sampler was driven with either a 180-lb or a 400-lb drop hammer. At the end of each core run, to minimize cross-contamination, the auger was advanced to the bottom of the core hole before the next core was collected.

No borehole logs are available. However, tables are provided in Nyhan et al. (1984, 06529, pp. 6–16) which reports descriptions of individual samples and resulting moisture contents.

Radionuclide inventories for plutonium and americium-241 contained in each hole were determined based on measured concentrations. The result was expressed as µCi of radioactivity for each hole Figures B-22 and B-23 present the distribution of plutonium and americium-241, respectively, for each borehole with depth.

The inventory of soil water in each hole was calculated from the gravimetric water content and bulk density of all the samples from each hole (Table B-20 and Figure B-24). All depths were reported in meters and centimeters and were used in all laboratory calculations. pH was also determined (Table B-21).

The distribution of plutonium with depth is compared to that obtained in 1953 and 1960 sampling efforts and the results are presented on Figure B-25.

The first high radionuclide concentrations and water content encountered in the tuff beneath the gravel-cobble layer in Absorption Bed 1 were found at sampling depths of 10 to 22 ft. At this depth, a highly weathered, light orange-gray tuff layer with high clay content was found. This layer would be less permeable than the rest of the surrounding tuff because of the severe chemical and hydrologic tuff-weathering processes brought about by the acidic liquid wastes added to this absorption bed.

The next major increase in tuff water content and radionuclide concentrations occurred at a sampling depth of about 26.25 to 29.5 ft in Absorption Bed 1. At this depth, there was a change in tuff units from a light brownish-gray, moderately welded tuff to a light gray, moderately welded tuff. This change was identified on the basis of color changes and the change in total amount of force required to drive the split spoon sampler into the tuff.

Fractures which commonly divided the tuff into irregular blocks, account for some of the variations in tuff water content. Although a few fractures occurring from 9.8 to 39.4 ft at this site could have received saturated flow of liquids directly from the large amounts of effluents discharged to Absorption Bed 1, fractures usually act as barriers for unsaturated liquid flow.

Radionuclides were detected at the bottom of both holes extended through Absorption Bed 1, which received large amounts of tap water and effluents in 1961. The tap water may have provided the additional driving force for radionuclide migration into the underlying bedrock. Plutonium appeared to decrease with depth. In Hole 1, plutonium was detected to a sampling depth of 99.5 ft and americium-241 to a depth of 100 ft. Although Hole 2 samples contained smaller radionuclide concentrations than the samples from Hole 1, americium-241 was detected to a depth of 101 ft and plutonium was found to a sampling depth of 47.5 ft in Hole 2, indicating higher mobility for americium-241 than for plutonium under these environmental conditions.

The plutonium and americium-241 did not penetrate nearly as far into the tuff beneath Absorption Bed 2, most likely because this bed did not receive additional water in 1961.

Fracture filling samples were collected and analyzed for radionuclide concentrations. No significant differences were found in radionuclide concentrations between fracture fill and adjacent tuff samples in eight out of ten cases in the depths ranging from 6.6 to 59 ft, where fractures were encountered in both beds. These results support the idea that fractures in the tuff generally act as barriers to unsaturated flow of migrating waste solutions. However, fractures may play a role in conveying waste solutions through the tuff near the bottom of the absorption beds where saturated flow conditions were more commonly found.

The average pH of tuff samples collected in Absorption Bed 2 ranged from 7.0 to 8.0 below sampling depths of 52.5 ft, which corresponded to sampling depths not receiving detectable levels of plutonium and americium-241 wastes. Samples collected in sampling locations other than these and beneath both beds, which received large volumes of wastes exhibited no significant differences in pH. This indicates the natural buffering capacity of the tuff was still maintaining the pH of this geochemical system in 1978; the acidity of the waste solutions added in the past had not caused a shift in pH.

### B-3.10 1984 and 1986 Field Investigation

Surface sampling investigations for a radiological survey are summarized in a report issued in September 1993 as discussed in Nyhan and Drennon 1993, 23248, p. 3-51.

In June 1984, environmental surveillance data were collected at 29 locations (Figure B-26) at or near MDA T (but not in drainages) on a 65.6- by 65.6-ft grid at depths of 0 to 0.4 in., 0.4 to 3.9 in., and 3.9 to 11.8 in. The usefulness of the data analysis efforts was evaluated and recommendations were made for future studies. Coordinates of the sample locations are provided in the report (Nyhan and Drennon 1993, 23248).

The June through July 1986 investigation was comprised of a survey of the soil radionuclides at MDA T from samples collected at only one depth, 0 to 2 in. (Figure B-27). The 1986 samples were collected 32.8 ft apart, improving on the accuracy of the 1984 survey contour maps. Because of more detailed data, larger land areas were found with higher plutonium concentrations than in the 1984 survey. The 1986 survey identified a northeast-southwest trend in plutonium processing proceeding across the western end of MDA T (encompassing an area of higher concentrations to the south). It was speculated that the entire area had been influenced by water erosion that may have occurred across this end of MDA T for several years. Plutonium-238 and plutonium-239 associated with soil was evidently transported across the western portion of the site, proceeded in a southeastern direction along the fence, crossed the road to the north of the site, and proceeded down a naturally-occurring drainage way. Coordinates of the sample locations are provided in the report (Nyhan and Drennon 1993, 23248, pp. 15, 21).

As discussed in Nyhan and Drennon (1993, 23248), the details of how the samples were actually collected and processed for radiochemical analysis were never fully documented. Most of the information is from interviews of personnel of the Environmental Surveillance Group. Through 1985, approximately 500 to 900 g of soil were sampled from each 0- to 0.4-in., 0.4- to 3.9-in., and 3.9- to 11.8-in. layers of the soil profile at each sampling location. In an effort to collect samples with approximately the same weight from each depth, a steel cylinder with an inner diameter (ID) of 11.8 in. and a height of 0.4 in. was used in collecting sampling from the 0- to 0.4-in. depth. After removal, a steel cylinder with an ID of 3 in. and a height of 3.5 in. was placed in the center of the previous excavations and driven into the profile to collect the 0.4- to 3.9-in. sample. The final 3.9- to 11.8-in. sample was collected in the same hole by driving a metal scoop with an ID of 3 in. to the final 11.8-in. depth. The entire sample from all three depths was analyzed.

In 1986, surface soil samples were collected to a depth of 2 in. using a coring tool with a 3-in. ID. Unlike all the samples collected before 1986, these samples were sieved through a 50-micron mesh screen and only the fine fraction was analyzed for radionuclides. Radiochemical procedures for processing the soil samples through 1985 are summarized in report LA-8810-ENG (LANL 1981, 06055, p. 73). Analogous procedures for the assays on the 1986 samples are described in report LA-10992-ENV, p. 5 (LANL 1987, 06678). In the procedure, plutonium is chemically isolated from a 10-g aliquot of soil, electrodeposited and counted on an alpha spectrometer. The plutonium-239 values mentioned in this report actually represent the sum of plutonium-239 and plutonium-240, because both have identical alpha energies.

The sample surveys performed through 1985 were based on the similar 1980 investigation of MDA A. In 1986, Environmental Surveillance Group personnel laid out a grid of sampling locations across MDA T on 32.8-ft centers based on two survey reference points. Actual sample locations were not surveyed and details of how the grid was laid out are not known.

As reported by Nyhan and Drennon (1993, 23248, p. 27), the Environmental Surveillance Group established "worldwide fallout background information for several radionuclides" as summarized in Table B-22. Environmental Surveillance Group (1980, 05961) and Purtymun et al. (1987, 06687) document the background information in reports.

Tabulated analytical results are not developed in the report. Figures B-28 through B-33 provide graphical representation of 1984 sample values exceeding background at depths of 0.39- to 4 in. and 4 to 11.8 in. for tritium, plutonium-238, and plutonium-239. Graphical representation of 1986 sample values adjusted for background for plutonium-238, plutonium-239, and americium-241 are on Figures B-34 through B-37.

The 1984 survey showed very few elevated tritium levels (i.e., above 7200 pCi/L used as an upper limit for background). The elevated levels occurred in samples from the deeper depth intervals in the area between the northern fence and Absorption Bed 4. Based on these results, most of the soil samples collected in this survey were either below mean background concentration in soil or background concentration plus twice the standard deviation of the mean background concentration. Due to the short half-life of tritium, a time-adjusted tritium concentration for 1993 would be more than one-half of the concentrations determined in 1984.

In contrast, plutonium-239 and plutonium-238 were above the background levels (0.005 pCi/g for plutonium-239 and 0.025 pCi/g for plutonium-240) at all sampling locations. The plutonium concentrations at both sampling depths usually were similar. The highest plutonium-239 concentrations (1.0 to 10 pCi/g) occurred at two locations above the disposal shafts and at one location within the old RWSA runway. Concentrations of soil plutonium-238 ranging from 0.01 to 1 pCi/g dominated the areas to the north and south of the disposal site, as well as within the fence. These are represented by plutonium-239 concentrations in surface soil samples ranging from 10 to 100 pCi/g. Soil samples having plutonium-239 forty- to 100-fold over the upper limit for background concentrations seemed to be more dominant over the disposal site than corresponding elevated values for plutonium-238.

The soil samples discussed above only represent what occurred on the mesa top, i.e., at elevations ranging from 7146 to 7100 ft at MDA T. None of these samples reflect the impact of the treated and untreated liquid wastes discharged to DP Canyon to the north of MDA T.

In addition to the above transport mechanisms, another observation was made in 1986 from survey sample results north of the north MDA T fence (an area of undisturbed juniper woodland). Concentrations of plutonium-238 and plutonium-239 consistently ranged from 0.1 pCi/g to 10 pCi/g and demonstrated ratios of 5 to 25 for plutonium-239 to plutonium-238. This area probably received local airborne fallout from DP site, which influenced this entire area. It is also probable that liquid effluents originally contained in Absorption Beds 3 and 4 overflowed during the early waste history of the site, and plutonium was transported to the low-elevation areas north of the disposal area. Since this same trend was noticed with the soil plutonium results, similar deposition mechanisms could have occurred for amerium-241.

Because the MDA T disposal area received fill and was regraded during and following past disposal activities, the shallow sampling depth may not penetrate former ground surfaces.

### B-3.11 1992 Field Investigation

As reported in the TA-21 Phase Reports, during the fiscal year 1992 (FY92) field investigation, surface samples (0 to 6-in. depth) were collected from the nodes of a 131- by 131-ft sampling grid covering DP Mesa, Los Alamos Canyon, and DP Canyon (LANL 1994, 26073 and LANL 1995, 52350, p. 2-1). The intent of the grid sampling was to establish TA-21 baseline concentrations and identify trends in site-wide contamination resulting from airborne stack emissions. The report "Phase 1A" was issued on June 14, 1993, and summarized TA-21 geologic characterization activities that were performed in 1992. Phase Report 1B was issued on January 28, 1994, and was the "Operable Unit-Wide Surface Soil, Deposition Layer and Filter Building Investigation." This report constituted the second part of the initial phase report and assessed the results from soil sampling activities conducted in 1992. A third phase report segment, Phase Report 1C, addressed the investigations related to outfalls and septic systems. Phase Report 1C discussed only the drainage channel studies at those outfalls that did not require permits under the National Pollution Discharge Elimination System. However, a data requirement in the sampling grid and in characterizing the nature and extent of contamination at the outfalls resulted in the need for additional sampling. Consequently, an addendum to Phase 1B and 1C was issued in January 1995. A figure of the site-wide sample locations is contained in the Phase Reports.

Figure B-38 shows the location of samples collected within and near the MDA T facility for the 1992 field investigation.

Tables B-23 through B-25 present a summary of sample data for radionuclides and inorganic and organic contaminants, from the 1992 field-sampling program. Because the field and laboratory chain-of-custody for the samples is not available for these samples, 1992 data sent to rad van and LANL are used as screening data and data from samples sent to an off-site fixed laboratory were used in this report. Tables B-26 through B-28 present frequency of detections for these same suites.

Four sets of baseline concentrations for TA-21 were defined to differentiate between unique areas of the MDA T facility. The four baseline areas were Process Area, Non-Process Area, Special Impact Area 1, and Special Impact Area 2, which the Process Area and Special Impact Area 1 are associated with MDA T. Sample data were compared to the baseline value appropriate for the area in which the sample was collected. (LANL 1994, 26073, Map 2)

FY92 analytical data for tritium in field samples were reported in pCi/mL of soil moisture. The baseline concentration for tritium (4.95 to 11 pCi/mL of soil moisture) is directly comparable to the analytical data from these field samples. However, the FY92 data cannot be compared to the SAL for tritium (810 pCi/g of dry soil) because soil moisture data were not available for FY92 samples to allow a conversion from pCi/mL soil moisture to pCi/g of dry soil.

### B-3.12 1993–1994 Field Investigations

During July 1993 and August 1994, land and radioactivity surveys were conducted at the site (LANL 1996, 54127.3). Samples were collected from the mesa top and drainage channels. A geodetic survey of MDA T was performed to establish the radiological survey grid and to mark locations of soil samples. Thirty-three locations on a 65.6- by 65.6-ft grid and seventeen locations off the grid were marked. The sample locations are shown on Figure B-38.

Tables B-23 through B-25 present a summary of the sample analyses. Tables B-26 through B-28 present frequency of detection for radionuclides and inorganic and organic contaminants.

In August of 1994, a series of 17 exploratory borings were drilled in and around the footprint of former Building 035 and two associated tanks (Tanks 110 and 111) (Stoopes 2003, 76089). No obvious footprint of the building or tanks remained and as-built drawings and/or surveys probably were used to determine the locations of the exploratory holes. A total of 15 borings (21-2535 through 21-2549) were initially called for in the work plan and completed. Two additional borings, designated as 21-2547A and B on core sample logs, and 21-2609 and 21-2610 on MDA T sample location maps, were completed after radiological contamination was encountered. The sample locations are shown on Figure B-40. The contamination encountered at Boring 21-2547 resulted in a job shutdown (August 19, 1994) for approximately 5 days until a radiological work permit was obtained.

### B-3.12.1 Surface Conditions

Fill soil (approximately 5 to 6 ft deep) emplaced in the late 1980s covered the original surface of the MDA T absorption beds. The investigation was conducted on the fill surface. The area was relatively flat with a gentle slope toward DP Canyon to the north. Storm water run-off was primarily by sheet flow into a tributary of that canyon. There were two diversion ditches, one on the east and one on the west end of MDA T to divert run-on away from the site. MDA T was a fenced area with restricted access.

### B-3.12.2 Survey Methods

According to the RFI Report (LANL 2001, 70348, pp. 8, 9), a radiological survey of MDA T was conducted using the following instruments:

- a FIDLER G-5 sodium iodide scintillation detector that identifies low-energy gamma radiation,
- a Ludlum 33-10 sodium iodide detector that identifies gamma radiation,
- a Ludlum 19 sodium iodide micrometer that also identifies gamma radiation,
- a Ludlum 44-9 pancake GM detector that identifies beta and gamma radiation, and
- a Ludlum 43-1 zinc sulfide detector that identifies alpha radiation. Part of the survey was conducted according to LANL-ER-SOP-06.23, RO, "Measurement of Gamma-Ray Fields Using a Sodium Iodide Detector."

For the July 1993 and August 1994 land and radiological surfeys, the field crew collected 33 samples on the surveyed grid, 17 samples off the grid, and 3 field duplicates from the top 6 in. of soil at MDA T following LANL-ER-SOP-06.09, R0, "Spade and Scoop Method for Collection of Soil Samples." Samples were handled according to LANL-ER-SOP-01.02, R0, "Sample Containers and Preservation," and LANL-ER-SOP-01.03, R0, "Handling, Packaging, and Shipping of Samples." All samples were tracked according to LANL-ER-SOP-01.04, R1, "Sample Control and Field Documentation." The same methods were used to collect 15 samples and 2 field duplicates from the top 12 in. of sediment.

The field crew screened samples for radiation to ensure worker health and safety. The mobile radiological analytical laboratory (MRAL) screened soil samples for gross alpha, beta, and gamma radiation to ensure that radiological criteria for sample transport and for sample acceptance by analytical laboratories were not exceeded. Samples were also analyzed in the MRAL for cesium-137.

### B-3.12.3 Exploratory Boring and Sampling Methods

For the August 1994 sampling at the former Building 035 area, a Central Mine Equipment (CME) 750 wheel-mounted drill rig was used for all borings. This is a highly mobile auger drill rig that used approximately 8-in. augers and employed a split-spoon core barrel sampler to retrieve continuous core. Layne Drilling Company, out of Denver, Colorado was the drilling company.

No boring was deeper than 20 ft below ground surface (bgs) and most encountered tuff ranging from 7.5 to 10 ft bgs. Continuous core was retrieved, screened, and logged for each boring but sampling was only done at locations 21-2545 and 21-2546 (Figure B-41). Four samples each were collected from these two borings at progressive depths from approximately 2 to 20 ft bgs. The core was not archived and was placed in 55-gal. drums and stored at TA-54.

Field screening was done for alpha and beta/gamma (using hand held survey meters), organic vapors, and oxygen/explosive gases. Organic vapors were detected in the additional boring 21-2547B, at approximately the 7.5 to 10 ft interval at 254 ppm (down hole reading). Vapors dissipated after approximately 1.5 hours. The results of radiological field screening are shown in Table B-30.

A portion of the location 21-2547 core with elevated radiological contamination was sampled and sent off-site to a laboratory in Colorado for analysis. The sample contained plutonium-239/240 and americium-241. Knowledge of this sample was conveyed orally from the project leader to the sampler (Stoopes, 2003, 76089) and no formal documentation exists in the form of analytical results.

### B-3.12.4 Summary of Results and Conclusions

All samples from the July and August 1994 land and radioactivity survey were collected from no deeper than 12 in. bgs and some locations had been impacted by the releases from the SWMU 21-011(k) outfall. Tables B-23 through B-25 present a summary of the results for radionuclides, inorganic chemicals, and organic chemicals from the 1994 field-sampling program. Tables B-26 through B-28 present frequency of detections for those same suites.

A summary of the analytical data (combined surface sampling data from 1992, 1993, and 1994) is as follows (LANL 2001, 70348, pp. 29–44):

- concentrations of inorganic chemicals were greater than background values;
- calcium, copper, lead, nickel, and zinc had concentrations greater than soil background values, and therefore were compared to SALs: no inorganic chemicals were greater than SALs;
- radionuclides had concentrations greater than background values;
- americium-241, cesium-137, plutonium-238, plutonium-239, strontium-90 and uranium isotopes had concentrations greater than soil background values, and therefore were compared to SALs; and
- organic compounds were detected.

The organic compounds detected were ten polycyclic aromatic hydrocarbons (PAHs) and one phthalate. The PAHs were all detected downgradient of the roadway and are most likely produced by general anthropogenic activities and are not related to site activities. The phthalate is a common laboratory contaminant. No other organic compounds were detected in these samples; therefore no organic compounds were carried to the SAL comparison.

The preliminary list of chemicals of potential concern (COPCs) based on SAL comparisons and a multiple chemical evaluation (MCE) were americium-241, cesium-137, plutonium-239, and strontium-90.

Due to the potential surface erosion and disturbance that has occurred since the data were collected, these shallow-surface and near-surface sample data (less than one ft) are considered useful for selection of new data work planning but suspect for use as decision-making data. Evaluations against new, recent data is required for proper assessment.

During the 1994 borehole investigation, the highest concentration of radiological contamination was near the southwest corner of former Building 035 (Stoopes 2003, 76089). The contamination was probably associated with a large junction box that was a connection point for numerous pipes and raffinate lines from Building 035 and other buildings at TA-21. Most of the radiological contamination was in a zone between the upper fill and coherent tuff, in a generally moist layer of mixed soil/fill and weathered/altered tuff sandwiched between the present topsoil and tuff. No elevated radiological readings were encountered near or at the surface or in the tuff. After this investigation, radiological contamination associated with Building 035 was thought to be limited both laterally and vertically.

### B-3.13 1996–1997 Field Investigations

A sampling analysis plan (SAP) that addressed SWMUs 21-016(a,b, and c), 21-011(c), 21-028(a), C-21-009, and C-21-012 was submitted to the U.S. Environmental Protection Agency (EPA) Region 6 in March 1996 and then to NMED (LANL 1996, 54127.3). NMED subsequently requested supplemental information regarding the sampling and analysis plan (NMED 1997, 56498). The Laboratory prepared a response to NMED's request for additional information (LANL, 1997, 70036). The SAP, as modified by the comments and response, was implemented in 1996 and 1997 as the Phase I subsurface RFI of MDA T and included a geophysical survey to locate the paleochannel and absorption beds, and the collection and analysis of subsurface samples from eight vertical boreholes. The purpose of the investigation was to sample for the presence of radiological and non-radiological (including RCRA constituents) contaminants in order to evaluate various remedial alternatives. Tables B-23 through B-25 present a summary of the sample data for radionuclides, inorganic, and organic contaminants. Tables B-26 through B-28 present frequency of detections for these same analytical suites.

A geophysical survey was conducted in November 1996, primarily to identify and delineate the position of absorption beds, disposal trenches, a disposal shaft field, and other man-made features at the site prior to the commencement of an exploratory drilling project. A secondary objective was to identify and map the paleochannel.

A total of 19 boreholes with depths ranging from 15 to 200 ft bgs were drilled during this investigation (Table B-31):

- Eight vertical boreholes were drilled directly through the absorption beds to establish the vertical extent of contamination under the beds.
- Two vertical boreholes were drilled through the former RWSA in order to determine if any contamination exists below the RWSA.
- Two vertical boreholes were drilled near the east end of the disposal shafts to evaluate the paleochannel and assess whether the paleochannel has provided a pathway for off-site transport of contamination.
- Four vertical boreholes were drilled outside of the absorption beds to assess the lateral extent of contamination found in the beds.
- Three angled boreholes were drilled under the disposal shafts to evaluate the presence and vertical extent of contamination beneath the shafts.

#### B-3.13.1 Surface Conditions

Fill soil (approximately 5.0 to 6.0 ft deep) emplaced in the late 1980s covered the original surface of the MDA T absorption beds. The area is relatively flat with a gentle slope toward DP Canyon to the north. Runoff is primarily by sheet flow into a tributary of that canyon. There are two diversion ditches, one on the east and one on the west end of MDA T to divert run-on away from the site. MDA T is a fenced area with restricted access.

### B-3.13.2 Drilling and Excavation

Drilling of the subsurface began in December 1996 using a CME 750 drill rig equipped with standard 8.25-in.-outside diameter (OD), 4-in.-ID hollow-stem augers. Continuous subsurface core samples were collected as the augers were advanced, using a 3.125-in.-OD, 5-ft long, stainless steel, split-barrel sampler. (See Appendix D for field logs.) Soil and rock were classified according to American Society for Testing and Materials (ASTM) D2487, Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).

#### Borehole 21-05051: Absorption Bed 1

The borehole was located in Absorption Bed 1 (approximately 35 ft from the eastern edge of the surveyed bed location) and was drilled to a depth of 150 ft bgs. The bed was covered with approximately 6 ft of backfill. The absorption bed was consistent with the description in Rogers (Rogers 1977, 05707.2) and contained radiological contamination. The upper moderately welded Unit 3 tuff was noticeably moist to a depth of 40 ft bgs where it began to dry with depth. The moisture content increased at the contact with the lower unwelded Unit 3 tuff (~60 ft bgs) and remained elevated until the Unit 2 tuff contact (~110 ft bgs) where it quickly decreased with depth. Elevated radioactivity was found in the bed and in the underlying tuff. The higher levels of radioactivity were found in the upper Unit 3 tuff (not in the absorption bed as expected), while lower radiological levels were found in the lower Unit 3 tuff and dropped off dramatically at/near the Unit 2 tuff contact (Figure B-41)

#### Borehole 21-05052: Absorption Bed 1/Paleochannel

The borehole was located southwest of the MDA T fence near the NE corner of Building 228 in Absorption Bed 1 (approximately 18 ft from the western edge of the surveyed bed location) and was drilled to a depth of 150 ft bgs. Backfill material was evident to 6 ft bgs where a layer of decomposed grasses was found. The depth at which the absorption bed would be located contained more silt and clays than sand. The paleochannel was located at a depth of 10–27 ft bgs. The sands in the upper part of the channel were moist and weakly cemented while the lower sands were moist and non-cemented. A dacite/rhyolite cobble zone was encountered at the bottom of the channel. The tuff beneath the paleochannel did not contain the same visible moisture content as encountered in Borehole 21-05051. Radiological contamination was not detected in any fixed lab samples collected from the borehole.

#### Borehole 21-05053: Absorption Bed 2

The borehole was located in Absorption Bed 2 (approximately 35 ft from the western edge of the surveyed bed location) and was drilled to a depth of 90 ft bgs. The bed was covered with approximately 6 ft of backfill. The absorption bed was consistent with the description in the Rogers report (Rogers 1977, 05707, p. T-5) and contained high levels of radiological contamination. Low levels of radiological contamination were observed in the tuff to approximately 30 ft bgs. From this point on, the radiological contamination was found only in fractures, and increased in the fractures from 30 to 67 ft bgs. Below 67 ft bgs, radiological levels dropped to background levels.

**Borehole 21-05054: Absorption Bed 2**

The borehole was located in Absorption Bed 2 (approximately 43 ft from the eastern edge of the surveyed bed location) and was drilled to a depth of 60 ft bgs. The bed was covered with approximately 6 ft of backfill. The absorption bed was consistent with the description in the Rogers report (Rogers 1977, 05707, p. T-5) and contained elevated radiological contamination. Elevated radioactivity was encountered in the tuff (and fractures) to 36 ft bgs (Figure B-41).

**Borehole 21-05055: Absorption Bed 4**

The borehole was located in Absorption Bed 4 (approximately 39 ft from the western edge of the surveyed bed location) and was drilled to a depth of 15 ft bgs. The bed was covered with approximately 6 ft of backfill. The absorption bed was consistent with the description in the Rogers report and contained high levels of radiological contamination. The auger angled off vertical while drilling with the center bit through the cobble zone at the bottom of the bed. The hole was abandoned and a second borehole (21-05073) was drilled approximately 5 ft west of 21-05055 (Figure B-41).

**Borehole 21-05056: Absorption Bed 4**

The borehole was located in Absorption Bed 4 (approximately 39 ft from the eastern edge of the surveyed bed location) and was drilled to a depth of 50 ft bgs. The bed was covered with approximately 5 ft of backfill. The absorption bed was consistent with the description in the Rogers report (Rogers 1977, 05707, p. T-5) and contained background levels of radioactivity (Figure B-41).

**Borehole 21-05057: RWSA/Paleochannel**

The borehole was located in the RWSA (approximately 20 ft from the eastern edge of the surveyed RWSA location) and was drilled to a depth of 50 ft bgs. The cover material over the RWSA surface was indistinguishable from the backfill material in the RWSA. The bottom of the RWSA was believed to be at approximately 20–22 ft bgs. Photographs of the RWSA (before the placement of the CMPs) showed that the eastern end of the RWSA was excavated into the paleochannel (sands, gravels, dacite/rhyolite boulders, and cross bedding was evident in the south wall) and that the floor on the eastern end was not excavated into the tuff. Directly beneath the RWSA floor the drill penetrated into a moist medium-grained sand with black dacite boulders. The backfill material in the RWSA had slightly elevated radioactivity while the dacite layer contained very high levels of radioactivity. The dacite/sand layer analyses indicated extremely high levels of calcium. This is in the area of a reported spill of cement slurry that occurred while filling a CMP. Photographs of the dacite/sand were available for review. The tuff beneath the paleochannel did not contain any elevated radioactivity; however, fractures in the tuff were not encountered in this hole (Figure B-41).

**Borehole 21-05058: RWSA**

The borehole was located in the RWSA (approximately 40 ft from the northwest edge of the surveyed RWSA location) and was drilled to a depth of 50 ft bgs. The cover material over the RWSA was indistinguishable from the backfill material in the RWSA. A sharp backfill/tuff contact is located at 18 ft bgs. It was believed that the borehole was drilled into the access road into the main pit of the RWSA. The underlying tuff is solid and non-fractured. Slightly elevated radioactivity was encountered in the backfill material (Figure B-41).

**Borehole 21-05059: East of Disposal Shafts/Paleochannel**

The borehole was located approximately 10 ft east of the disposal shafts and was drilled to a depth of 50 ft bgs. The upper 8.5 ft consisted of cover and overburden material. Paleochannel sands were encountered from 8.5-36.4 ft bgs. The paleochannel consisted of moist fine to course grain sands with varying amounts of small pebbles and gravel. A large tuff boulder was also encountered at 25 ft bgs. The characteristic dacite/rhyolite boulders at the bottom of the channel were not encountered. Elevated radioactivity was not encountered in the channel or underlying tuff (Figure B-41).

**Borehole 21-05060: Disposal Shafts/Absorption Bed 2**

The borehole was located approximately 30 ft south of Absorption Bed 2 and was drilled at a 30-degree angle from vertical to the northeast to get underneath the disposal shafts. The total length of the borehole was 175 ft, and the vertical depth was approximately 152 ft bgs. Elevated radioactivity (other than tritium) was not encountered. High levels of tritium were found in the nonwelded Unit 3 and Unit 2 (Figure B-41).

**Borehole 21-05061: Disposal Shafts**

The borehole was located approximately 15 ft north of Absorption Bed 3 and was drilled at a 35-degree angle from vertical to the SE to get under the disposal shafts. The total length of the borehole was 190 ft and the vertical depth was approximately 157 ft bgs. Elevated radioactivity (other than tritium) was not encountered. High levels of tritium were found in the nonwelded Unit 3 and Unit 2 (Figure B-41).

**Borehole 21-05062: Disposal Shafts**

The borehole is located approximately 5 ft north of the northeast corner of Absorption Bed 3 and was drilled at a 30-degree angle from vertical to the southeast to get under the disposal shafts. The total length of the borehole was 82.5 ft and the vertical depth was approximately 71 ft bgs. Cement was encountered at 79–79.5 linear ft and drilling was stopped. Drilling continued on a 3-ft run to confirm that a disposal shaft had been encountered. The grout from 79–80 linear ft was dark gray, solid cement. The grout from 80–81.8 linear ft was moist (similar to moist modeling clay) and contained pieces of a plastic bag and gloves. From 81.8–82.5 linear ft there was no recovery. Elevated radioactivity was not encountered in the tuff, but very high radiological levels were present in the cement grout. The grout was still moist and had not set in over 20 years (Figure B-41).

**Borehole 21-05063: South of Absorption Bed 1**

The borehole was located approximately 25 ft south of Absorption Bed 1 and was drilled to a depth of 110.5 ft bgs. The intent of this borehole was to assess lateral extent of contamination from Absorption Bed 1 and tritium to the top of Unit 2. Background levels of radioactivity were detected in the borehole (Figure B-41).

**Borehole 21-05064: South of Absorption Bed 2/Trench Associated with Building 035**

The borehole was located approximately 25 ft south of Absorption Bed 2, inside the footprint of former Building 035, and was drilled to a depth of 50 ft bgs. The intent of this borehole was to assess lateral extent of contamination from Absorption Bed 2. It is believed a trench associated with Building 035 was intersected during drilling. Backfill material was encountered, with high levels of radioactivity, to 15 ft bgs. The underlying tuff was solid, non-fractured, and had no elevated radioactivity (Figure B-41).

### Borehole 21-05065: North of Absorption Bed 3

The borehole was located approximately 20 ft north of Absorption Bed 3 and was drilled to a depth of 50 ft bgs. The intent of this borehole was to assess lateral extent of contamination from Absorption Bed 3. Elevated radioactivity was not encountered in the tuff (Figure 41).

### Borehole 21-05071: East of Disposal Shafts/Paleochannel

The borehole was located approximately 12 ft east of disposal Shaft #2 and 14 ft north of borehole 21-05059. Please see Figure B-6 for the location of Shaft #2. Borehole 21-05071 was drilled to a depth of 200 ft bgs. The upper 8.5 ft consisted of cover and overburden material. Paleochannel sands were encountered from 8.5–34.3 ft bgs. The paleochannel consisted of moist fine to course grain sands with varying amounts of small pebbles and gravel. The characteristic dacite/rhyolite boulders were encountered at 30.5–34.3 ft bgs (the bottom of the channel). Elevated radioactivity, except tritium, was not encountered in the channel or underlying tuff. Elevated tritium was encountered from approximately 20 ft bgs to approximately 150 ft bgs (Figure B-41).

### Borehole 21-05073: Absorption Bed 4

The borehole was located in Absorption Bed 4 (approximately 35 ft from the western edge of the surveyed bed location) and was drilled to a depth of 70 ft bgs. The bed was covered with approximately 5 ft of backfill. The absorption bed was consistent with the description in the Rogers report (Rogers 1977, 05707, p. T-5) and contained elevated radiological contamination. This borehole was drilled 5 ft west of 21-05055, which was terminated at 15 ft bgs after the auger angled off vertical. The TA-21 radiological screening laboratory (RSL) personnel data indicated that elevated radioactivity was present to the bottom of the hole, but fixed lab data did not confirm the RSL data (Figure B-41).

### Borehole 21-05074: North of Absorption Bed 4

The borehole was located approximately 15 ft north of Absorption Bed 4 and was drilled to a depth of 50 ft bgs. The intent of this borehole was to assess lateral extent of contamination from Absorption Bed 4. Elevated radioactivity was detected only in the upper 2.5 ft within the cover material (Figure B-41).

### Borehole 21-05075: Absorption Bed 3

The borehole is located in the middle of Absorption Bed 3 at the overflow pipe location and was drilled to a depth of 70 ft bgs. The bed was covered with approximately 5 ft of cover material. The absorption bed was consistent with the description in the Rogers report (Rogers 1977, 05707, p. T-5) and contained elevated radiological contamination. The tuff underlying the absorption bed contained elevated radioactivity to approximately 22 ft bgs. A large fracture system with elevated radioactivity was encountered from 45–50 ft bgs. Moist silty sand that contained a 1 in. rounded clast of dacite was encountered at 47.5–48.5 ft bgs (Figure B-41).

## B-3.13.3 Exploratory Well Boring Geophysical Logging

No boreholes were logged by geophysics for this investigation.

### B-3.13.4 Subsurface Conditions

MDA T is situated in the Tshirege Member of the Bandelier Tuff, an approximately 700-ft-thick layer consisting of Units 3, 2, 1v, and 1g from top to bottom (Longmire et al. 1995, 52227). Bedrock directly underlying the site surficial soils and fill is cooling unit 3 of the Upper Tshirege, comprised of fallout and ash flow deposits of silicic volcanic rock erupted 1.5–1.2 million years ago. Cooling Unit 3 is a cliff-forming, nonwelded to partially welded unit. Bandelier Tuff is overlain by 0–20 ft of alluvium, which consists of poorly-sorted, clay-rich sand and gravel. Alluvium is generally thickest near the center of the mesa and thin to absent at the mesa edge. Much of the alluvium consists of angular to subrounded lithic clasts of the Tschicoma volcanic rocks, and of crystals of feldspar, quartz, and biotite and other ferromagnesium minerals derived from the Tschicoma Formation.

Bandelier Tuff is underlain by sedimentary rocks of the Puye Formation, which consists of fine- to coarse-grained fanglomerates interbedded locally with axial river gravels and lacustrine siltstone and clay. Material comprising the fanglomerates is derived mainly from the Tschicoma Formation to the west.

A paleochannel is located below the surface of MDA T. The paleochannel is filled by fluvial deposits and believed to extend approximately 30 ft bgs, as identified by the borehole and geophysical investigations. The top of the paleochannel lies beneath surficial soils and fill materials.

### B-3.13.5 Borehole Abandonment

All boreholes, with the exception of angled borehole 21-05062 (which was not sampled) were backfilled with cuttings in the order they were removed. A bentonite seal was then emplaced in the upper 2 to 3 ft. Because of the contamination encountered in the soft, still moist grout in borehole 21-05062, the bottom of the borehole (82.5 ft) was backfilled with concrete to above the depth at which the disposal shaft was encountered. The hole was then backfilled with cuttings. (Steven 2003, 76096). Boreholes were backfilled immediately after sampling was complete.

### B-3.13.6 Groundwater Conditions

Groundwater was not encountered at the depths penetrated by the boreholes of this investigation. See the work plan, Section 3.2.2, for a discussion of the regional and perched groundwater conditions at TA-21.

### B-3.13.7 Surface Water Conditions

The area overlying the disposal structures at MDA T is relatively flat with a gentle slope toward DP Canyon to the north. The original surface of MDA T sloped down to the north at a 12 to 1 ratio, resulting in positive drainage across the site. Surface water interceptors approximately 2 ft deep and 3 ft wide were cut 10 ft from the south side of the absorption beds and embankment material placed across the west end of Absorption Bed 1, the north side of Absorption Beds 3 and 4, and across the east end of Absorption Bed 4. The embankment had a minimum width of 10 ft and a minimum height of 2 ft (Rogers 1977, 05707, p. T-5). There were two ditches, one on the east end and one on the west end of MDA T to divert run-on away from the site. Storm water and snowmelt runoff from the site is now primarily by sheet flow to the north, which collects along the south side ditch of North Perimeter Road. Runoff then passes through culverts under the road and continues down tributaries cut into the south sidewall of DP Canyon into the depositional plain adjacent to the DP stream channel.

#### B-3.13.8 Surface Air and Subsurface Vapor Conditions

No surface air or subsurface vapor monitoring (other than field screening) or sampling was performed for this investigation.

#### B-3.13.9 Pilot Testing

There were no pilot scale tests conducted for this investigation.

#### B-3.13.10 Geophysical Survey Methods and Interpretation

##### B-3.13.10.1 1996 Survey

The following information is from the Geophex, Ltd. Report submitted to the Laboratory on September 1, 1996 (Geophex 1996, 64694). The purpose of the surface geophysical survey was to further delineate the location of the absorption beds and manmade buried features. An electromagnetic (EM) survey was conducted using a hand-held, digital, broadband EM sensor. The sensor exploits the relationship between electric fields, magnetic fields, and electrical current to detect changes in subsurface conductivity. A 175- by 350-ft grid system within the fenced boundaries of MDA T was established. Prior to the investigation, a series of survey markers locating the position of absorption beds, disposal shafts, and waste pits, as indicated on historical records, were installed and surveyed by Survtek, Inc. These surveyed markers were tied into the LANL survey grid system in order to compare the suspected locations of these features with geophysical survey results. The survey was conducted along survey lines spaced 2.5 ft apart, with an in-line sampling interval of approximately 1 ft. This interval provided approximately 19,000 sampling locations. At each sampling location, in-phase and quadrature data at two frequencies, 4,050 and 12,270 hertz (Hz) were obtained. These frequencies were recorded and analyzed for each of the approximately 19,000 surface locations.

A ground-penetrating radar (GPR) survey was conducted along eleven profiles across the site. The GPR employed for this survey was the Sensors and Software pulse EKKO IV digital GPR. This system employed an extremely short electromagnetic pulse that penetrated into the earth. It operated on a number of frequencies depending on the antenna selected, typically 50, 100, or 200 mega hertz (MHz). The return signal was continuously recorded on a strip-chart or in a digital recording device. GPR anomalies resulted when there was a contrast in bulk dielectric property between materials. A computer displayed and stored the profile data and controlled the system.

Each profile was surveyed with reflection data recorded at 1-ft intervals using three different frequencies. Each record was comprised of 64 separate samples stacked together for improved signal-to-noise ratio. Four GPR lines, acquired using 50 MHz antennas, successfully imaged Absorption Bed 4 and other objects at the site (Figure B-42). The surveys confirmed, at least partially, the geodetically surveyed locations of the absorption beds, as well as several location anomalies interpreted to be man-made structures in the area (LANL 1998, 65010, pp. 5 and 6). The geophysical investigation was not successful in defining the paleochannel feature.

##### B-3.13.10.2 2003 Survey

Advanced Geological Services (AGS) performed an integrated geophysical survey at MDA T in 2003 (AGS 2003, 81176) as part of a larger effort to map the paleochannel that underlies the mesa top. The purpose of the survey was to delineate the lateral and vertical extent of the paleochannel logged in borings and shaft excavations. The survey was performed using capacitively coupled electrical resistivity and digital ground penetrating radar (GPR) techniques. The results of the survey identified a low resistivity anomaly that is attributed to the paleochannel material. The test borings and shaft excavations serve to corroborate the interpreted paleochannel at MDA T. The lateral extent of the paleochannel extends across TA 21 from east to west. The depth and vertical configuration were estimated from inverse modeling of the sounding data.

The paleochannel could not be confidently identified in the GPR data using 200 or 100 MHz antennas due to excessive noise and insufficient penetration.

The electrical resistivity data was collected using an Ohm Mapper resistivity system manufactured by Geometrics, Inc. The Ohm Mapper is a capacitively coupled system that is designed to measure subsurface electrical resistivity in areas of high surface resistivity where exploration using traditional direct current resistivity systems is impractical. The system operates by delivering alternating current that is capacitively coupled into the earth at a particular frequency by the alternating voltage applied to the transmitting dipole. The Ohm Mapper is designed to be pulled along the ground surface as a streamer and thereby produce an almost continuous apparent resistivity profile.

Figure B-43 shows the location of the paleochannel at MDA T as interpreted from the geophysical information. Due to a significant amount of buried piping and existing structures near Building 257, a buried gas pipeline extending across TA-21 between MDA T and MDA A, and buried debris disposal at MDA A; the extent of the paleochannel could not be mapped further east until just west of the MDA A area.

### B-3.13.11 Soil and Rock Sampling

The drilling of 19 boreholes, as described in Section 3.13.2, with concurrent sampling were conducted in accordance with LANL-ER-SOP-01.01 "General Instructions for Field Investigation," LANL-ER-SOP-04.01 "Drilling Methods and Drilling Management," and LANL-ER-SOP-01.08 "Field Decontamination of Drilling and Sampling Equipment" (LANL 0875, 1977). Samples were collected at nominal 5-ft intervals for volatile organic compound (VOC) and radioactivity analyses, and at nominal 10-ft intervals and submitted to a MRAL for analyses of gross alpha, beta, and gamma radiation. Ten percent of the samples submitted to the MRAL were collected and submitted to a fixed laboratory for further analysis. Core samples were drilled and retrieved in 2.5-ft intervals to achieve maximum recovery.

Subsurface samples were assigned identification numbers by the Sample Data Management System (SDMS). During a sampling event, the sample identification number, sample depth, date and time collected, and VOC concentration and radioactivity levels (based on field screening) were recorded on a sample collection log. Each location was surveyed after the sampling events were completed. Sample collection logs contain the borehole identification number, samples collected, date and time collected, sample location ID, collection depths, field screening method and results, and core sample log (Appendix D).

All sampling, chain-of-custody and sample collection log documentation were completed in accordance with LANL-ER-SOP-01.02 "Sample Container and Preservation," LANL-ER-SOP-01.03 "Handling, Packaging, and Shipping of Samples," LANL-ER-SOP-01.04 "Sample Control and Field Documentation," and LANL-ER-SOP-06.24 "Sample Collection from Split-Spoon Samplers and Shelby Tube Samplers." All samples and analytical results were tracked by the SDMS.

### B-3.13.12 Soil and Rock Sample Field Screening

Table B-37 shows radiological field screening results above background for the 1996–1997 field investigation. There were no organic chemicals detected by the field screening methods used. Tritium field screening methods gave false positives and upon further review and assessment were terminated. The intervals of samples collected in the fracture zones are located in Table B-38

Samples were collected at nominal 5-ft intervals in accordance with LANL-ER-SOP-01.02, LANL-ER-SOP-01.03, LANL-ER-SOP-01.04 and LANL-ER-SOP-06.24. At each 5-ft interval, retrieved core samples were screened for VOCs using a photoionization detector (PID) in units of parts per million (ppm) and radioactivity using a Ludlum Model 2221 scaler ratemeter with a Ludlum 44-9 Geiger Muelier (GM) probe to detect beta/gamma radiation, and a Ludlum Model 43-44 with an air proportional probe to detect alpha radiation, in units of cpm. All visual and detected contamination encountered during drilling and sampling was recorded in field logbooks and sample collection logs in accordance with LANL-ER-SOP-12.01. At each 10-ft retrieved core interval, samples were collected and submitted to the MRAL for analyses of gross alpha, beta and gamma radiation. The MRAL also analyzed for VOCs, using EPA SW-846 Method 8260, and for total metals by x-ray fluorescence (XRF). Ten percent of the samples analyzed by the MRAL were submitted to a fixed laboratory for analyses by gamma spectroscopy, total uranium, isotopic plutonium, tritium, strontium-90, VOCs, SVOCs, and target analyte list (TAL) metals.

#### B-3.13.12.1 Soil and Rock Analytical Results

The locations of analytical tests were based in part on the results of field screening values as well as at locations where field screening values coincided with fracture sample locations.

Tables B-23 through B-25 present a summary of the sample results for radionuclides, inorganic chemicals, and organic chemicals from samples obtained below absorption beds, the RWSA, disposal shafts, and at the bottom of each borehole.

Soil and rock analytical results are entered in the Environmental Restoration Data Base (ERDB) using LANL SOP 15.17 to control and assure the quality of the data. Entry is electronic from the analytical laboratory in order to eliminate data entry error. For consolidated SWMU 21-016(a)-99, the data represented in the database includes analytical results collected from the 1992, 1993–1994, and 1996–1997 field investigations. The following discussion of the analytical results pertains to the full database of consolidated SWMU 21-016(a)-99. Data specific to the 1996–1997 field investigation are not repeated separately in this HIR due to the large volume of data collected.

Table B-26 summarizes the frequency of radionuclides detected in samples analyzed by the analytical laboratories. Table B-27 summarizes the frequency of organic chemicals detected in samples analyzed by the analytical laboratories. Table B-28 summarizes the frequency of inorganic chemicals detected in samples analyzed by the analytical laboratories.

Appendix E presents the analytical data contained in the Environmental Restoration Data Base (ERDB) for radionuclides, organic chemicals, and inorganic chemicals suitable for decision-making at MDA T. These data are compiled from investigations performed in 1992, 1993, 1994, and 1996–1997 field investigations. Data qualifiers and quality exceptions are included in the tables and discussed in Appendix E. Tables E-1 through E-3 present the analytical data for radionuclides, organic chemicals, and inorganic chemicals for all field investigations. Tables B-23 through B-25 present sample analyses that resulted in detectable values for radionuclides, and inorganic and organic contaminants for each analyte and radionuclide obtained from the field sampling programs. Data qualifiers and quality exceptions are included in the tables and discussed in Appendix E. Tables B-26 through B-28 present frequency of detections for these same suites.

### B-3.14 RFI Analytical Results

RFI analytical results include data collected in the 1992, 1993-1994, and 1996-1997 field investigations. Data resides in the ER database. Some of the analyses were performed when LANL had its own on-site laboratory. The majority of the analyses were performed by off-site EPA approved analytical laboratories.

Data validation results for subsurface samples indicate that some data were qualified.

### B-3.14.1 Inorganic Chemical Results

The data were assessed for TAL metals, cyanide and uranium. Mercury results were rejected for several samples because sample hold times were exceeded. Lead and selenium analysis were rejected for several samples because the matrix spike was less than 30%. Some antimony, arsenic, beryllium, chromium, cyanide (total), lead, mercury, selenium, and thallium results were qualified UJ (indicating that the reported detection limit is estimated) for some samples because of a low recovery in the matrix spike sample. Some results for arsenic, beryllium, chromium, cobalt, copper, lead, manganese, mercury, selenium, silver, thallium, vanadium, and zinc were qualified J- (indicating that the result is estimated and biased low) because of a low recovery in the matrix spike sample. Numerous results for various inorganic chemicals were qualified J (results estimated) because the relative percent difference between the sample and the laboratory duplicate was greater than the advisory limit. Some inorganic chemicals also had results qualified J (result is estimated) because the result was less than the estimated detection limit, but above the method detection limit. Some results for arsenic, cadmium, iron, lead, manganese, and nickel were qualified J+ (results is estimated and biased high) because the interference check sample was high. A sodium result was qualified U (not detected) because the concentration was less than five times the concentration in the method blank.

The estimated detection limits (UJ) as well as the estimated results (J) will be evaluated in the data review the same as all other reported detection limits and detected results based on EPA guidance (EPA 1992, 5497). J- and J+ qualifiers are only an indication of a low bias or high bias on one type of QC sample and the amount of the bias is not known. The data available for decision making are of good quality and can be used for data assessment.

### B-3.14.2 Radionuclide Results

Subsurface soil and tuff were analyzed for americium-241 (by alpha spectroscopy), gamma-emitting radionuclides, isotopic plutonium, isotopic uranium, strontium-90, and tritium. The full-suite analyte list in the analytical services statement of work (LANL 1995, 49738) includes the decay series of the naturally occurring radionuclides, uranium-235, uranium-238, and thorium-232, as well as fission and activation products and their progeny. The primary radionuclides reliably measured by gamma spectroscopy include activation products (americium-241, cobalt-60, and sodium-22); fission products (cesium-134, cesium-137, europium-152, and ruthenium-106); and ureanium-235.

Some data were qualified R (rejected) because the minimum detectable activity is missing.

Some radionuclides qualified U (not detected) because the sample concentrations were less than the minimum detectable activity or because the associated sample concentration was less than the total propogated uncertainty. Overall, the subsurface radionuclide data available for decision making are good quality and suitable for data assessment.

### B-3.14.3 Evaluation of Organic Chemicals

Subsurface soil and tuff samples were analyzed for VOCs and SVOCs. One sample analyzed for SVOCs was rejected because of low sample surrogate recovery. Results for some organic chemicals were qualified U (not detected) because the detected concentrations were less than ten times the amount of the method blank. Several organic chemicals were qualified UJ (nondetect estimated) indicating that the holding time was exceeded, because surrogate recovery was low but greater than 10%, or the internal standard was between 10% and 50%). Some organic chemical results were qualified J (result estimated) because the result was less than the practical quantification limit, but greater than the method detection limit. Results of toluene and trichloroethene for one sample were qualified J+ (estimated and biased high) because the surrogate recovery was high. Overall the subsurface organic data available for decision making are good quality and suitable for data assessment.

### B-3.15 Site Background

Background values for inorganic compounds and fallout or background values for radionuclides are shown in the data tables presented in Appendix E. The Laboratory-wide background determination, "Inorganic and Radionuclide Background Data for Soil, Canyon Sediment, and Bandelier Tuff at LANL" (LANL 1998, 59730) presents details of BVs and their derivation.

### B-3.16 Summary

Radioactive contamination was detected beneath Absorption Beds 1, 2, 3, and 4. Radioactive contamination beneath Absorption Bed 1 was found to extend to a depth of approximately 100 ft, which concurs with Nyhan's 1978 results. Radioactive contamination beneath Absorption Bed 2 extends to approximately 67 ft, but the concentrations were higher than those detected in Bed 1. Differences between Absorption Beds 1 and 2 may be the result of infiltration experiments in Absorption Bed 1. Radioactive contamination was detected beneath Absorption Beds 3 and 4 to depths of 12 and 21 ft, respectively. Elevated radioactivity was detected at a depth of approximately 45 ft beneath Absorption Bed 3 in a fracture. Radioactive contamination also detected at depth in fractures in other boreholes (Appendix F).

Nineteen boreholes were drilled through and under the RWSA, the absorption beds, the shafts and at the location of former Building 035. No borings were drilled at Building 257. Samples were collected at the deepest extent of each borehole, at the location of the highest field screening levels, at bedrock fracture locations, at material contacts, and immediately below each structure targeted in the drilling (see Tables B-23 through B-28). Sample analyses were performed for organic, inorganic, and radionuclide contamination. Vapor sampling was not performed because field screening by a PID device did not indicate the presence of vapor phase contamination. Analysis for PCB, HE, furans, nitrates, perchlorate, or dioxins was not performed.

Results of the radiological survey indicate that although radiation levels were greater than the upper limit of background at several locations, only one location had significantly elevated radiation levels. Sample Location 21-1639 showed gamma radiation at levels approximately ten times background using two instruments, a Ludlum 44-10 gamma radiation detector and Ludlum 19 gamma survey meter. At this location, other instruments showed background radiation levels, suggesting that analytical data for this location should be carefully reviewed.

The EM survey for the geophysical investigation imaged, at least partially, the absorption beds and several localized targets within the survey area, finding them to match the recorded surface survey locations. All the anomaly patterns are interpreted to result from man-made structures, not from a paleochannel.

The GPR successfully imaged Absorption Bed 4 and the high conductivity EM anomaly in the center of the area. Reflections from other targets are also observed on the 50 MHz profiles. Geophex, Ltd. concludes that the 50 MHz operating frequency was most successful, and that additional GPR may provide further guidance to an exploratory drilling program. Both methods utilized confirm that the location of the beds coincide with the survey markers.

Capacitively-coupled electrical resistivity geophysical surveys successfully imaged the paleochannel. Four boreholes encountered the paleochannel both above and below the absorption beds and disposal shafts. Analytical sample results at the contact of the paleochannel material and the tuff bedrock indicate that the paleochannel was not a conduit for lateral migration of contamination to any great extent.

Fractures are present in the tuff and have provided a contaminant pathway during past disposal operations. Under certain conditions, fractures may provide significant migration pathway as indicated by elevated radionuclide levels related to fracture samples obtained from depths as great as 60 ft. Fractures were not found below a depth of approximately 60 ft bgs. Lateral extent of fracture contamination is not defined.

As indicated by a sample obtained from Borehole 21-5062, some of the cement may not have set in the disposal shafts, even though cylinders cast and broken for every batch of cement-treated waste resulted in unconfined compressive strengths greater than 50 psi.

High porosity (K) and fractures present in the tuff bedrock below the disposal area may have provided a significant downward migration pathway.

Based on the results of the analytical testing and borehole locations, lateral transport may not be significant for the bedrock matrix.

## B-4.0 REFERENCES

Abrahams, J.H., J.R., July 1962. "Radioactive Waste Disposal at Los Alamos, New Mexico," Los Alamos, New Mexico. (Abrahams 1962, 08147)

Advanced Geological Services, December 2003. "Geophysical Surveys of the Paleo Channel Beneath MDAs T, A, and V at TA-21," Los Alamos, New Mexico. (AGS 2003, 81176)

Christenson, C.W., and L.A. Emelity, 1992. "Incineration of Contaminated Organic Liquid Wastes, TA-21," Los Alamos National Laboratory report, Los Alamos, New Mexico. (Christenson and Emelity 1992, 00363)

Christenson, C.W., July 1970. "Chemical Treatment and Cement Fixation of Radioactive Wastes," Los Alamos report, Los Alamos, New Mexico. (Christenson 1970, 08428)

Christenson, E.L., R. Garde, and A. M. Valentine, September 9, 1974. "Demolition of Building 12, An Old Plutonium Filter Facility," Los Alamos Scientific Laboratory report LA-5755, Los Alamos, New Mexico. (Christenson et al. 1974, 05481)

Daniel B. Stephens & Associates, Inc., August 7, 1997. "Hydraulic Properties of Los Alamos National Laboratory Technical Area 21, Operable Unit 1106 Soil Samples," Prepared for Los Alamos National Laboratory, Los Alamos, New Mexico. (Daniel B. Stephens & Assoc., Inc. 1997, 76085)

Environmental Surveillance Group, April 1, 1980. "Environmental Surveillance at Los Alamos During 1979," Los Alamos National Laboratory report LA-8200-ENV, Los Alamos, New Mexico. (Environmental Surveillance Group 1980, 05961)

Fowler, E.B., March 24, 1964. "New Treatment Facility at DP West to Replace Building 35," Los Alamos National Laboratory memorandum to T.L. Shipman (Health Div.) from Eric B. Fowler (H-7), Los Alamos, New Mexico. (Fowler 1964, 06758)

Fried, S., et al., June 1,1977. "Distribution of Plutonium and Americium at a Former Los Alamos Waste Disposal Site," Los Alamos National Laboratory, Los Alamos, New Mexico. (Fried 1977, 0963)

Geophex, LTD, September 1, 1996. "Final Report on Geophysical Investigation of Material Disposal Areas A and T (TA-21-016 [a-c] and TA-21-011[c])," prepared by Geophex, LTD. Job #636 for the Los Alamos National Laboratory, Los Alamos, New Mexico (Geophex 1996, 64694)

H-Division Staff, Environmental Studies Group, Waste Management Section, May 1974. "Quarterly Report: Transuranic Solid Waste Management Research Programs October-December 1973," Los Alamos Scientific Laboratory progress report LA-5614-PR, Los Alamos, New Mexico. (H-Division Staff 1974, 05469)

Herman, E.R., August 31, 1954. "Retention of Plutonium in Waste Seepage Beds at Los Alamos," unpublished manuscript in files of U.S. Geological Survey at Santa Fe, New Mexico. (Herman 1954, 05654)

IT Corporation, June 12, 1990. "Draft SWMU Report for TA-21," report performed for the Las Alamos National Laboratory, Las Alamos, New Mexico. (IT Corporation 1990, 01247)

Kingsley, W.H., December 23, 1946. "Monthly Report," memorandum to Las Alamos National Laboratory from W.H. Kingsley, Los Alamos, New Mexico. (Kingsley 1946, 30059)

Kingsley, W.H., February 20, 1947. "Survey of Los Alamos and Pueblo Canyon for Radioactive Contamination and Radio-assay Tests Run on Sewer-Water Samples and Soil Samples Taken from Los Alamos and Pueblo Canyons," Los Alamos National Laboratory report LA-516-MS, Los Alamos, New Mexico. (Kingsley 1947, 04186)

LANL, (Los Alamos National Laboratory), October 20, 1947 "Internal Document Group CMR-12 Monthly Report," J. F. Tribby, (CMR-12) Group Leader, Los Alamos, New Mexico. (LANL 1947, 03587)

LANL, (Los Alamos National Laboratory), May 01, 1975, "Environmental Surveillance at Los Alamos During 1974," Las Alamos National Laboratory report LA-5977-PR, Kenneth E. Apt and V. J. Lee, comp, Los Alamos, New Mexico. (LANL 1975, 05488)

LANL, (Los Alamos National Laboratory), April 1, 1981. "Environmental Surveillance at Los Alamos During 1980 (Environmental and Emergency Response Capabilities of Los Alamos National Laboratory's Radiological air Sampling Program)," Environmental Surveillance Group, Los Alamos National Laboratory report LA-8810-ENV, Los Alamos, New Mexico. (LANL 1981, 06055)

LANL (Los Alamos National Laboratory), April 1, 1987. "Environmental Surveillance at Los Alamos During 1986," Environmental Surveillance Group, Los Alamos National Laboratory report LA-10992-ENV, Los Alamos, New Mexico. (LANL 1987, 06678)

LANL (Los Alamos National Laboratory), November 1990. "Solid Waste Management Units Report," Volumes I through IV, Los Alamos National Laboratory Report No. LA-UR-90-3400, prepared by International Technology Corporation under Contract 9-XS8-0062R-1, Los Alamos, New Mexico. (LANL 1990, 07512)

LANL (Los Alamos National Laboratory), May 1991. "TA-21 Operable Unit RFI Work Plan for Environmental Restoration," Volumes I-III, Los Alamos National Laboratory Report LA-UR-91-962, Los Alamos, New Mexico. (LANL 1991, 07528)

LANL (Los Alamos National Laboratory), May 1991. "Environmental Restoration Standard Operating Procedures," Vol. I–II, Los Alamos, New Mexico. (LANL 1991, 0875)

LANL (Los Alamos National Laboratory), November 1, 1993. "Installation Work Plan for Environmental Restoration Volume II," Los Alamos National Laboratory report LA-UR-92-3987, Los Alamos, New Mexico. (LANL 1993, 26078)

LANL (Los Alamos National Laboratory), January 28, 1994. "Phase Report 1B, TA-21 Operable Unit RCRA Facility Investigation; Operable Unit Wide Surface Soil, Deposition lay and Filter Building Investigation," Los Alamos National Laboratory report LA-UR-93-4390, Los Alamos, New Mexico. (LANL 1994, 26073)

LANL (Los Alamos National Laboratory), January 1995. "The Phase Report Addendum 1B and 1C Operable Unit 1106 RCRA Facility Investigation Volume 1," Los Alamos National Laboratory report LA-UR-94-4360, Los Alamos, New Mexico. (LANL 1995, 52350)

LANL (Los Alamos National Laboratory), February 1, 1996. "Sampling and Analysis Plan for Subsurface Investigation at Solid Waste Management Unit Group 21-016 Material Disposal Area T, Technical Area 21, Field Unit 1, ER Project," Los Alamos National Laboratory, Los Alamos, New Mexico. (LANL 1996, 54127.3)

LANL (Los Alamos National Laboratory), November 14, 1997. "Response to Request for Supplemental Information for SAP for SWMU 21-016 (a,b,c) Former OU 1106" (LANL 1997, 70036)

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

LANL (Los Alamos National Laboratory), February 19, 1998. "Material Disposal Area T SWMU Group 21-016," Los Alamos National Laboratory, Los Alamos, New Mexico. (LANL 1998, 65010)

LANL (Los Alamos National Laboratory), April 26, 2001. "RFI report for Potential Release Sites 21-016(a-c), 21-011(c), 21-028(a), C-21-009, C-21-012, Material Disposal Area T, Field Unit 1," Los Alamos National Laboratory report LA-UR-96-4508, Los Alamos, New Mexico. (LANL 2001, 70348)

LANL (Los Alamos National Laboratory), January 8, 2001. Los Alamos National Laboratory online Daily Bulletin, Los Alamos, New Mexico. (LANL 2001, 72667)

LANL (Los Alamos National Laboratory), 2003. "List of Drawings used in Historical Investigations Report for Material Disposal Area T," Los Alamos, New Mexico. (LANL 2003, 81175)

Los Alamos Scientific Laboratory, February 27, 1979. "Radionuclide Content of Area T Shafts," memorandum from J.L. Warren (H-7) Group Leader to M.A Rogers (H-12) Group Leader, H-7B-79-9, Los Alamos Scientific Laboratory, Los Alamos, New Mexico. (LASL 1979, 00976)

Longmire, P.A., et al., Eds. October 1, 1995. "Natural Background Geochemistry and Statistical Analysis of Selected Soil Profiles, Sediments, and Bandelier tuff, Los Alamos, New Mexico," Los Alamos National Laboratory report LA-UR-95-3468, Los Alamos, New Mexico. (Longmire et al. 1995, 52227)

McGinnis, P.E., March 19, 1976. "Summary of Radionuclides to Disposal Shafts in Area T, TA-21-257 for the Period May 1968-December 31, 1975," memorandum to John Warren (H-7) from Paul McGinnis (H-7), H7-76-PEM-185, Los Alamos, New Mexico. (McGinnis 1976, 00956)

NMED (New Mexico Environment Department), July 29, 1997. "Request for Supplemental Information Sampling and Analysis Plan Potential Release Sites 21-016(a,b,c) Los Alamos National Laboratory 0890010515," New Mexico Environment Department letter from R. Dinwiddie to T. Todd, Santa Fe, New Mexico. (NMED 1998, 56498)

NMED (New Mexico Environment Department), November 26, 2002. "State of New Mexico Environment Department in the Matter of the United States Department of Energy and the University of California, Los Alamos National Laboratory, Los Alamos County, NM Respondents. Order Proceeding Under the New Mexico Hazardous Waste Act 74-4-10.1 and 74-4-13 [also referred to as Corrective Action Order or Imminent and Substantial Endangerment Order] (NMED 2002, 75910)

Nyhan, J.W. et al., July 1, 1984. "Distribution of Radionuclides and Water in Bandelier Tuff Beneath a Former Los Alamos Liquid Waste Disposal Site after 33 years," Los Alamos National Laboratory report LA-10159-LLWM, Los Alamos, New Mexico. (Nyhan et al. 1984, 06529)

Nyhan, J.W. September 1990. "SWMU Descriptions and Identifications of Data Needs: TA-21 Surface Units Aggregate at Los Alamos New Mexico." Los Alamos National Laboratory, Los Alamos, New Mexico, (Nyhan 1990, 12605)

Nyhan, J. W., and B. J. Drennon, September 1993. "Data Analysis of the 1984 and 1986 Soil Sampling Programs at Materials Disposal Area T in the Los Alamos National Laboratory," Los Alamos National Laboratory report LA-12650-MS, Los Alamos, New Mexico. (Nyhan and Drennon 1993, 23248)

Purtymun, W.D., February 20, 1967. "Data Pertaining to the Construction of a Solid Waste Disposal Pit," Letter to William Kennedy (H-6) from W. Purtymun, Los Alamos, New Mexico. (Purtymun 1967, 01009)

Purtymun, William D., June 1, 1978, "Movement of Fluids and Plutonium from Shafts at Los Alamos," New Mexico. (Purtymun, 1978, 05730)

Purtymun, W. D., R. J. Peters, T. E. Buhl, M. N. Maes, and F. H. Brown, November 1987. "Background Concentrations of Radionuclides in Soils and River Sediments in Northern New Mexico, 1974-1986," Los Alamos National Laboratory report LA-11134-MS, Los Alamos, New Mexico. (Purtymun et al. 1987, 6687)

Rogers, M. A., June 1977. "History and Environmental Setting of LASL Near-Surface Land Disposal Facilities for Radioactive Wastes (Areas A, B, C, D, E, F, G, and T)," Los Alamos Scientific Laboratory, Report LA-6848-MS, Vols. I and II, Los Alamos, New Mexico. (Rogers 1977, 05707)

Sagez, K., August 19, 2003. Personal Communication from Kevin Sagez (WGII) to David Salazar, Los Alamos, New Mexico. (Sagez 2003, 76090)

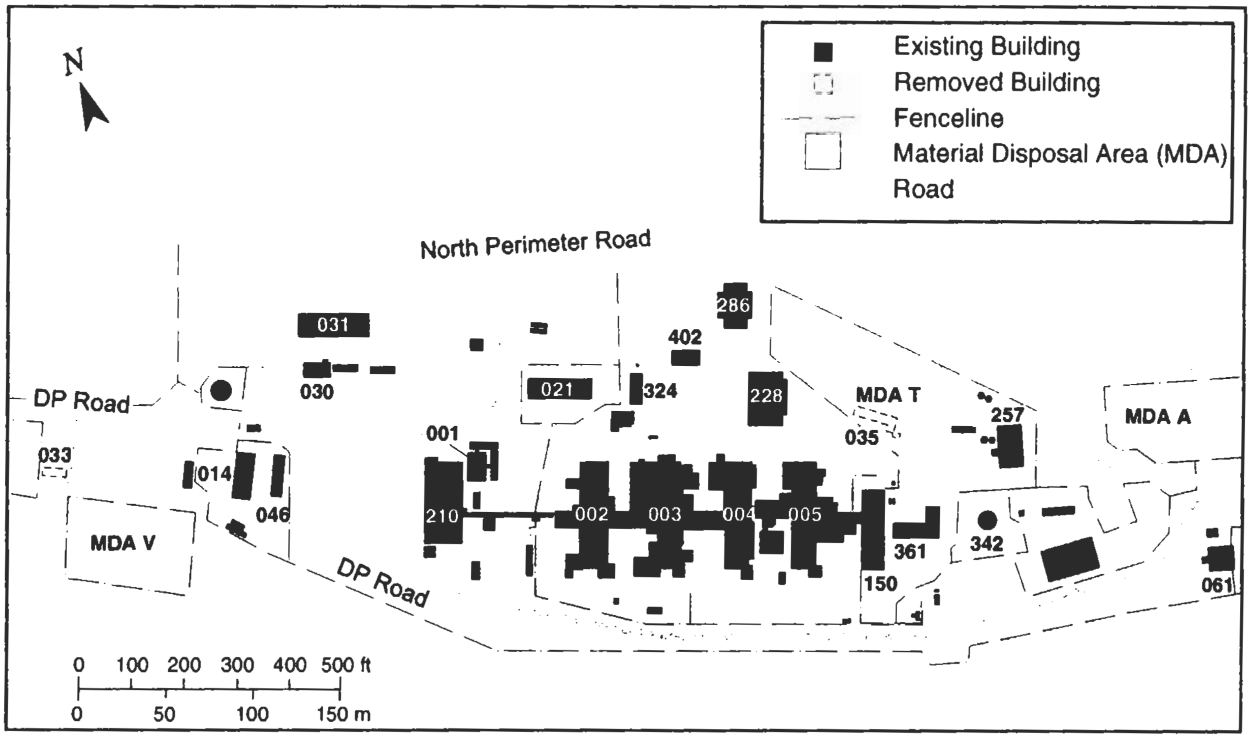
Sagez, K., September 11, 2003. Personnel Communication from K. Sagez (WGII) to W. David (FWO-WFM), Los Alamos, New Mexico. (Sagez 2003, 76095)

Shipman, T.L., May 1, 1958. "Annual Report of the Health Division 1957," Los Alamos Scientific Laboratory report LA-2216, Los Alamos, New Mexico. (Shipman 1958, 04700)

Springer, Everett P., 2000. Hydrogeologic Properties of the Bandelier Tuff and Groundwater Occurrence at DP Mesa, TA-21, Los Alamos National Laboratory, Los Alamos, New Mexico. (Springer 2000, 70114)

Stoopes, G., August 8, 2003. "Drilling and radiological contamination at former Building 35, TA-21 (former OU 1106)," memorandum to Ron Rager (Washington Group) from Gary Stoopes (Aurora Technical Services), Los Alamos, New Mexico. (Stoopes 2003, 76089)

Steven, D., August 2003. Personal Communication from D. Steven (WGII) to J. Walterscheid (RRES-WQH), Los Alamos, New Mexico. (Steven 2003, 76096)



FB.1/MDAT_IWP/022704
A. Kron 11/17/03
Source: LANL 1991, 07528.1, p. 2-12

**Figure B-1.** **Location of MDA T**

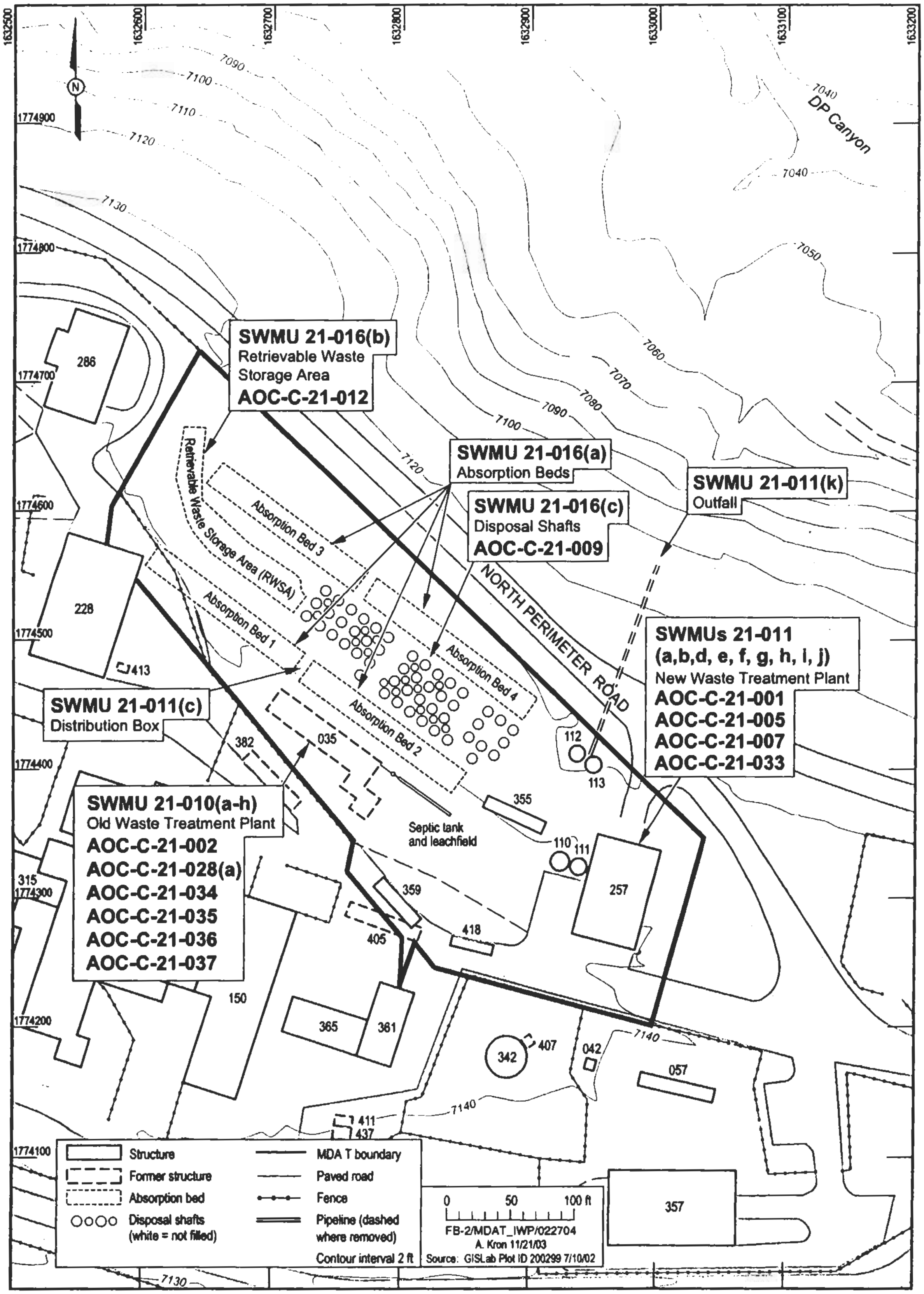
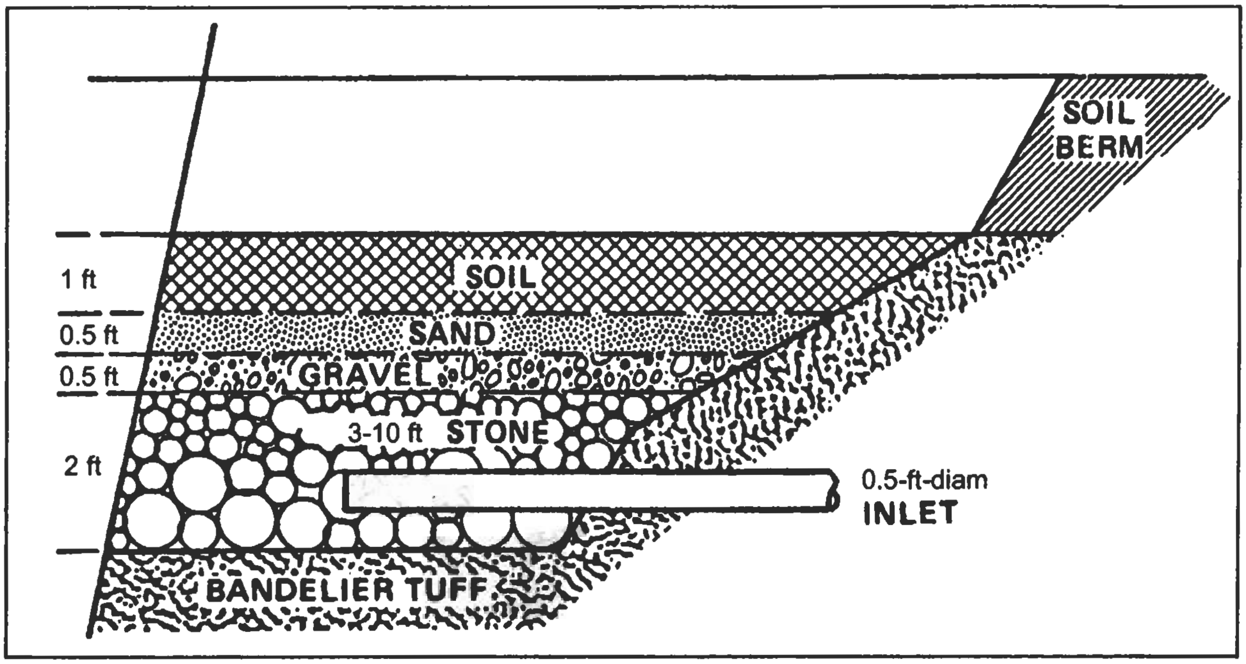
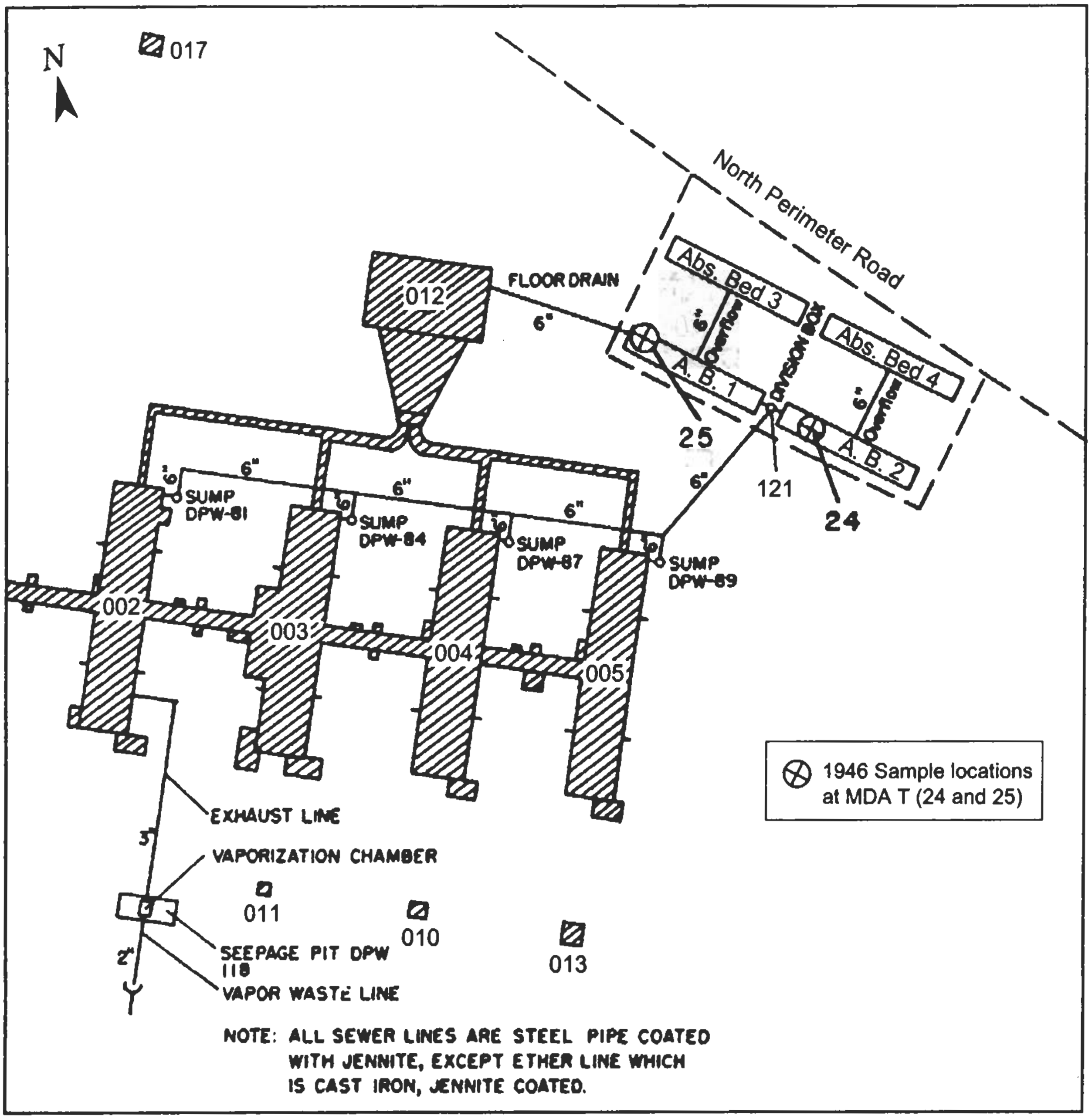


**Figure B-2. SWMUs and AOCs associated with MDA T**



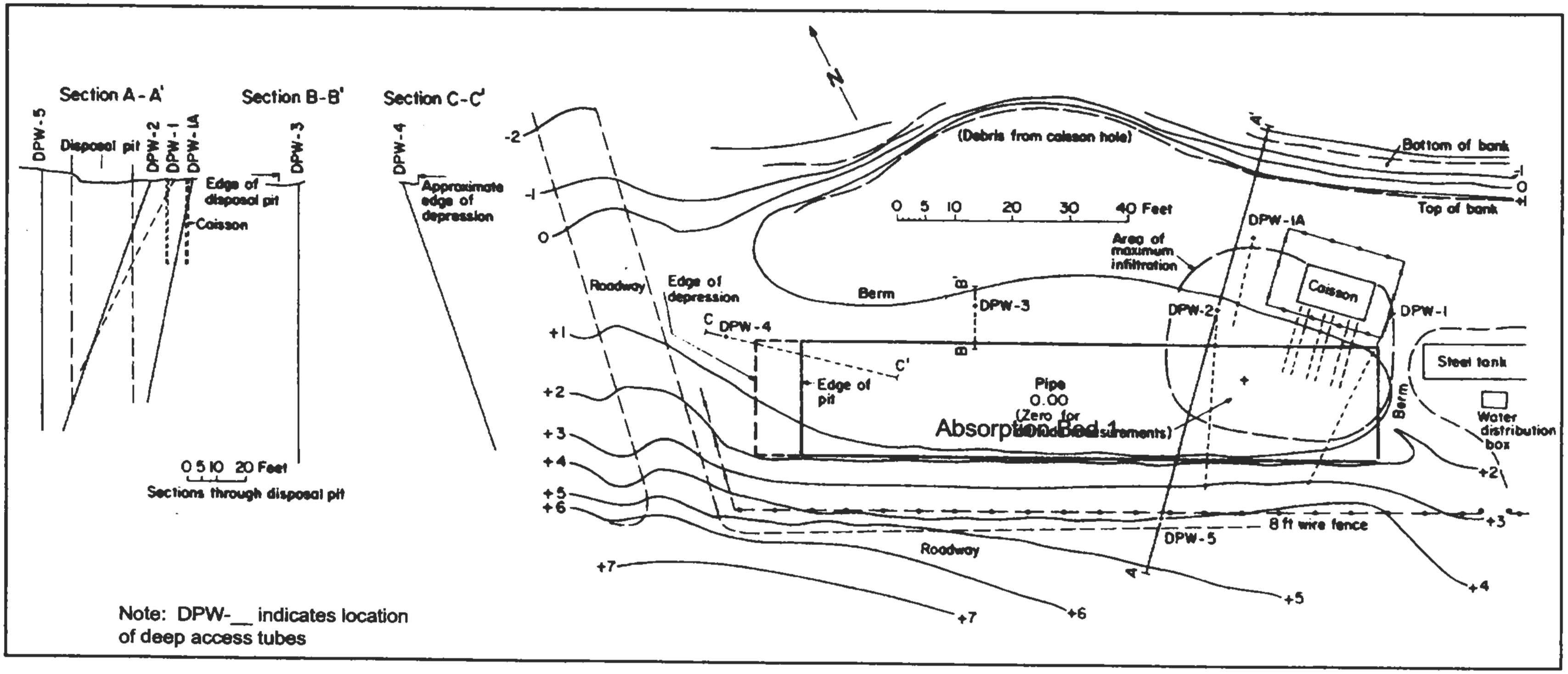
FB-3, MDA T IWP, 022504
A. Kron 11/17/03
Source: Nyhan et al., 1984; 06529.1; p. 5

**Figure B-3.** Cross section of an absorption bed at MDA T



FB.4, MDA T IWP, 022504
A. Kron 12/2/03
Source: Rogers 1977, 05707.2, p. T-18

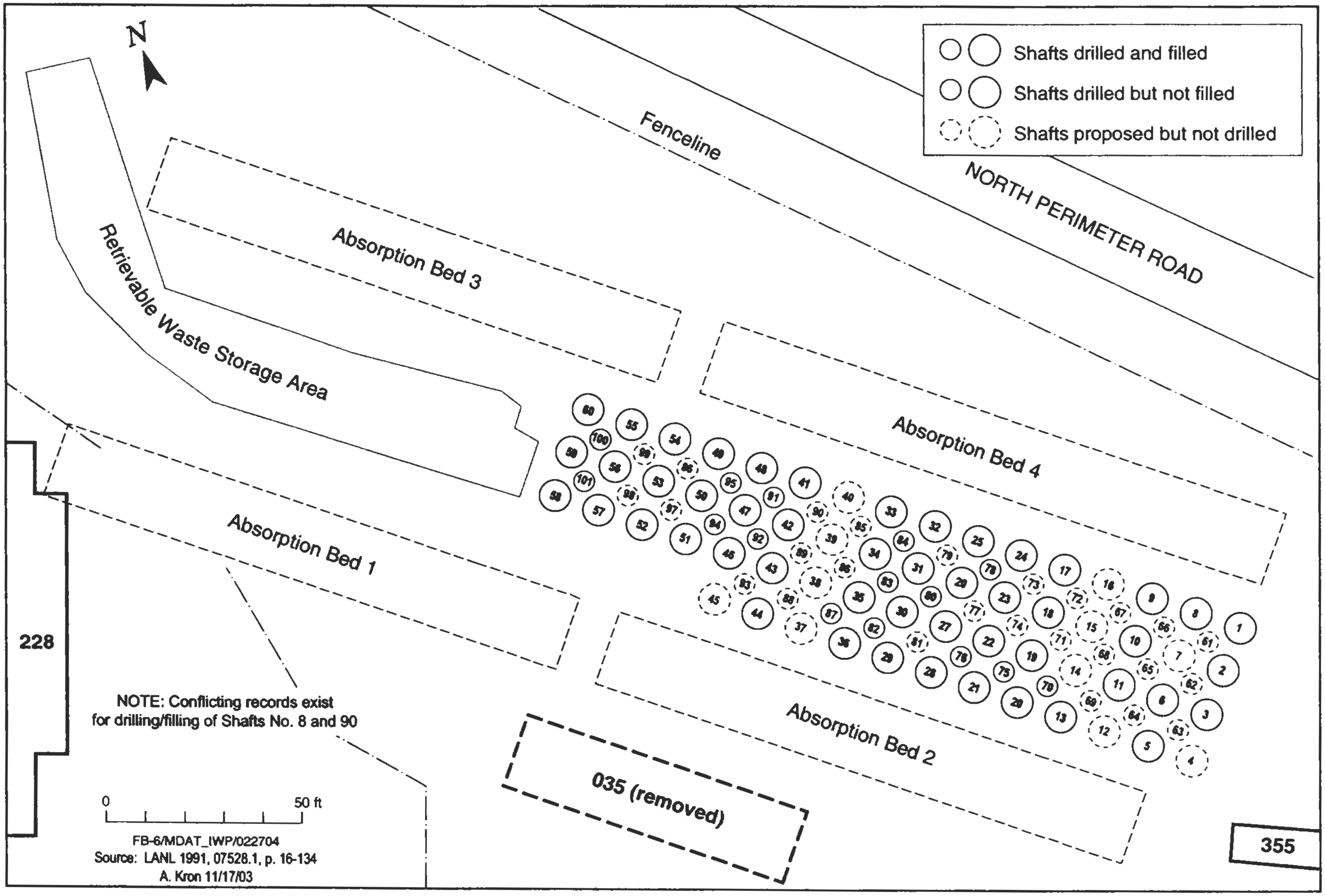
**Figure B-4.** Locations of pipelines to absorption beds



Note: DPW-__ indicates location of deep access tubes

FB.5, MDA T IWP, 022504
Source: Rogers 1977, 05707.2, p. T-27
A. Kron 12/2/03

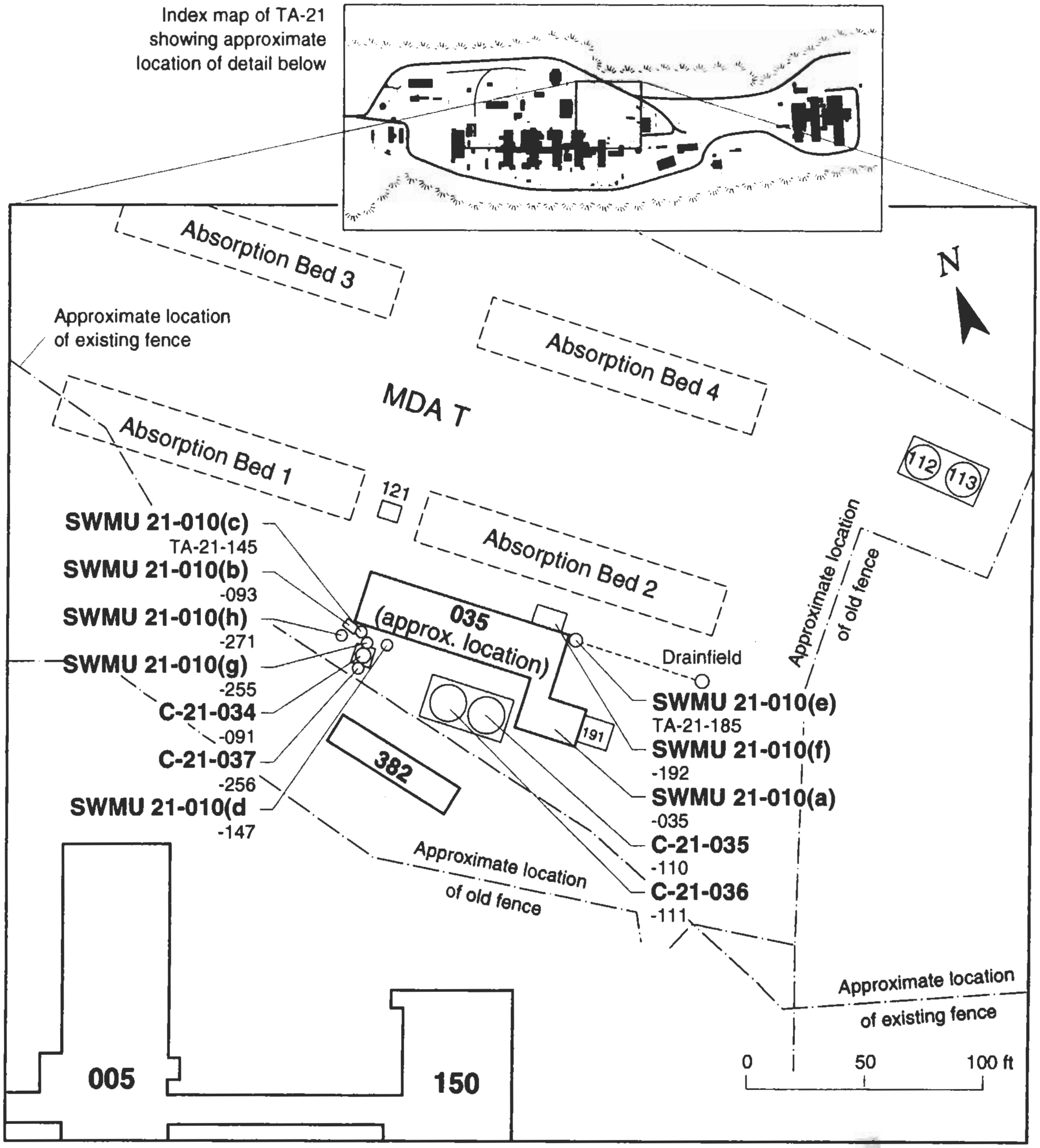
Figure B-5. Locations of caisson and deep access tubes and sections through Absorption Bed 1



NOTE: Conflicting records exist for drilling/filling of Shafts No. 8 and 90

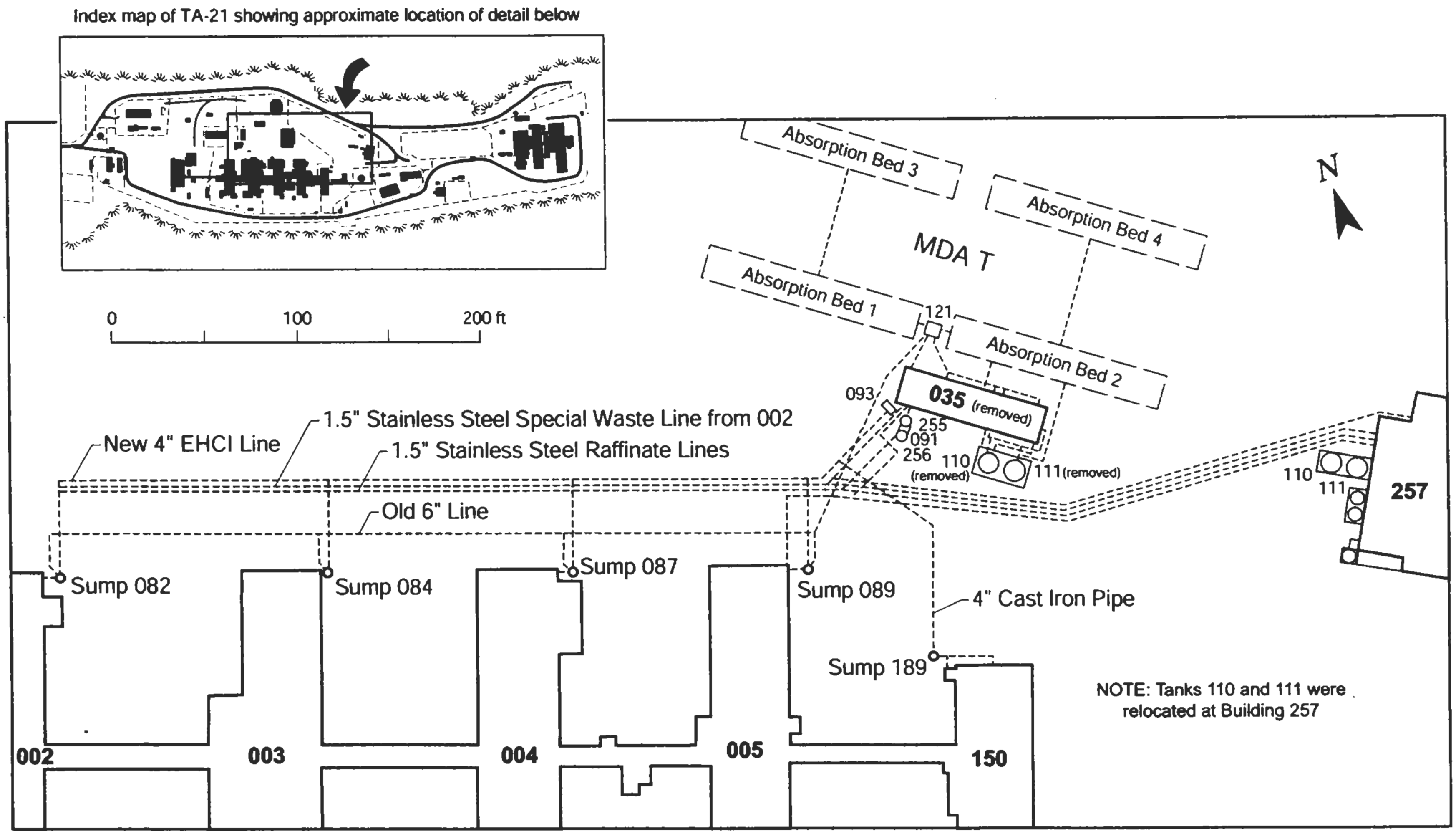
FB-6/MDAT_IWP/022704
Source: LANL 1991, 07528.1, p. 16-134
A. Kron 11/17/03

**Figure B-6. Map showing shafts, absorption beds, and retrievable waste storage area at MDA T**



FB-7, MDA T IWP, 022504
A. Kron 12/2/03
Source: LANL 1991, 07528.1, p. 16-160

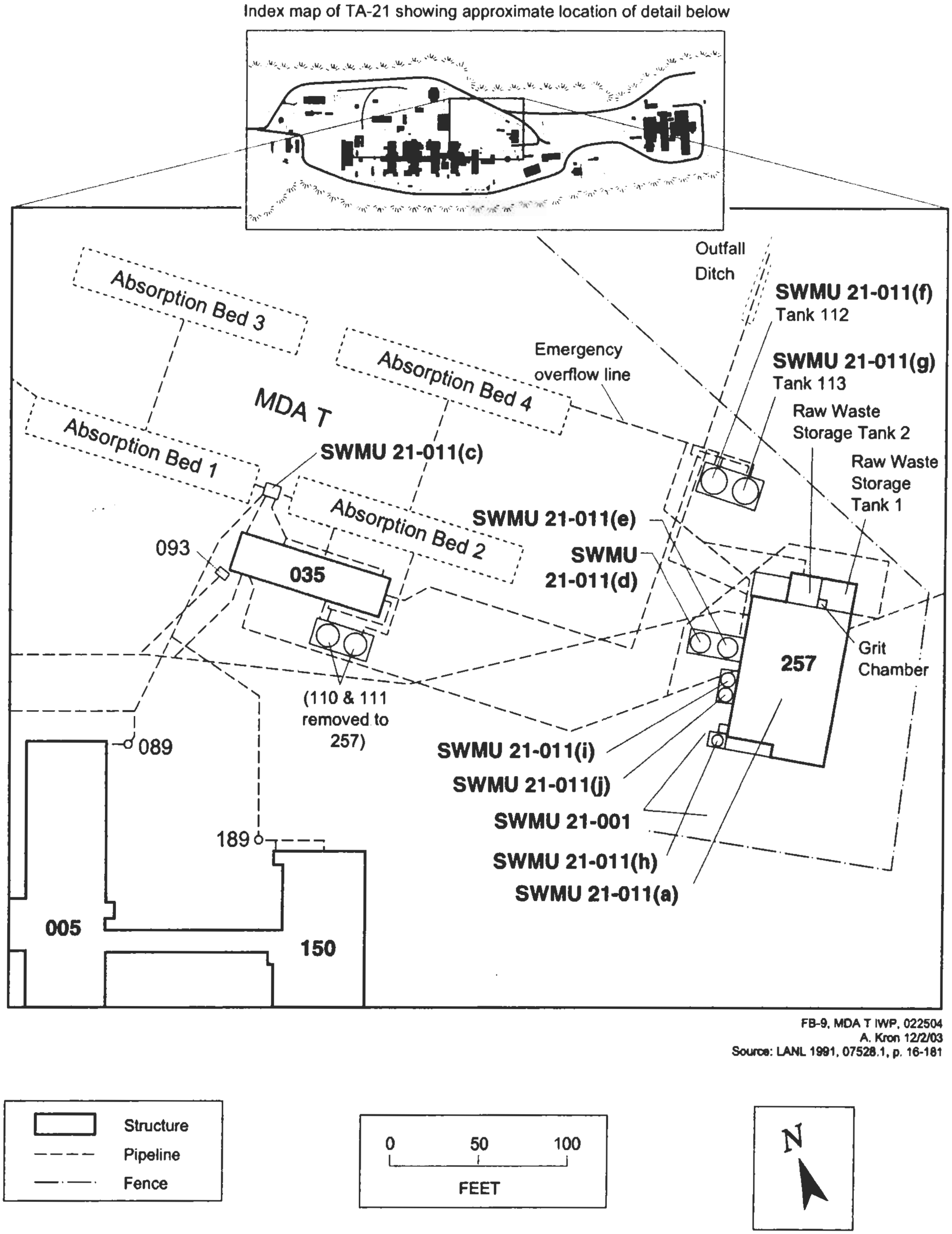
**Figure B-7.** **Locations of the former Industrial Liquid Waste Treatment Facility, Building 035, and associated structures**



NOTE: Tanks 110 and 111 were relocated at Building 257

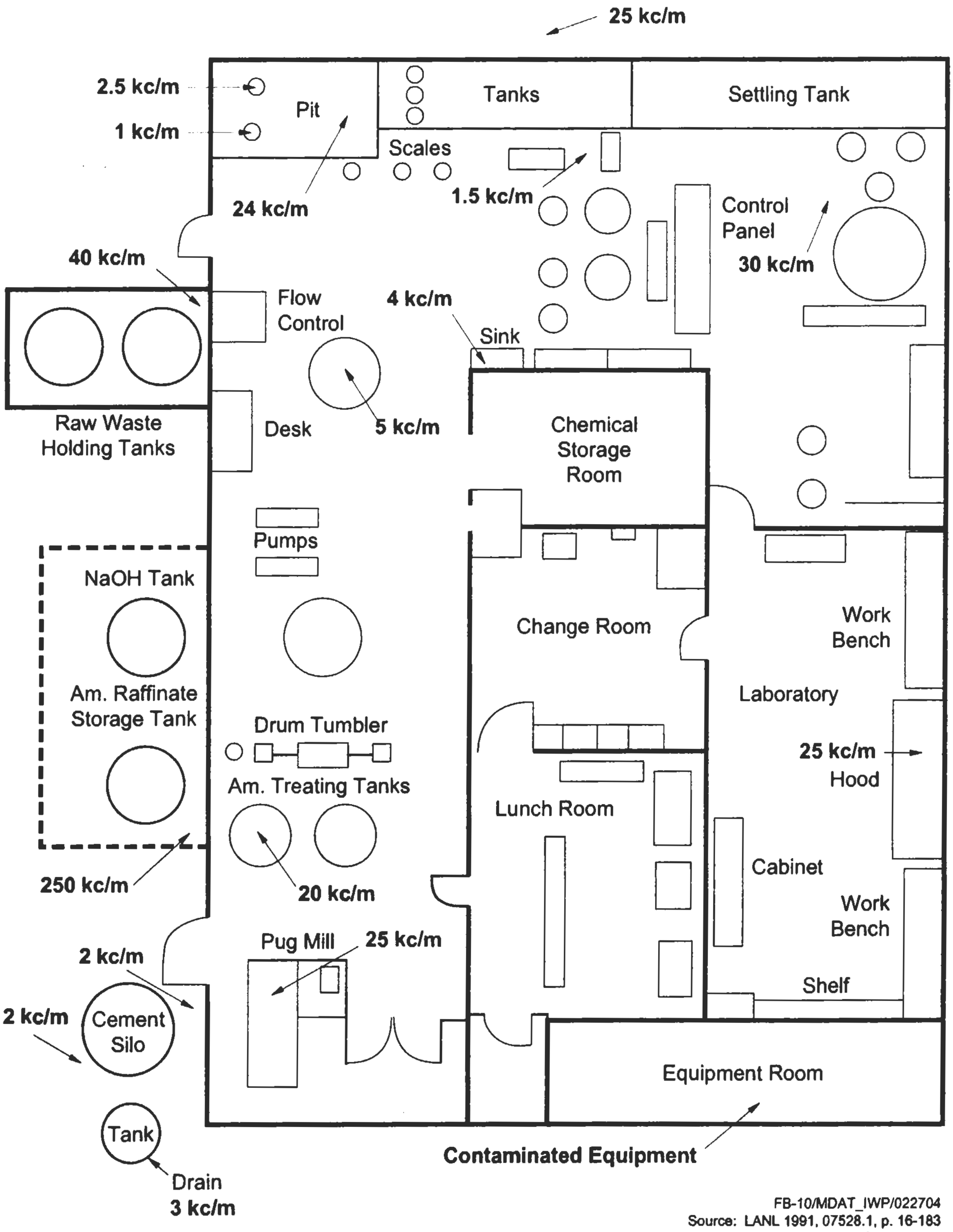
FB-8, MDA T IWP, 022504
A. Kron 12/2/03
Source: LANL 1991, 07528.1, p. 18-27

Figure B-8. Locations of waste lines and sumps as they appeared in 1954 and 1962 on the north end of Buildings 002, 003, 004, 005, and 150.



FB-9, MDA T IWP, 022504
A. Kron 12/2/03
Source: LANL 1991, 07528.1, p. 16-181

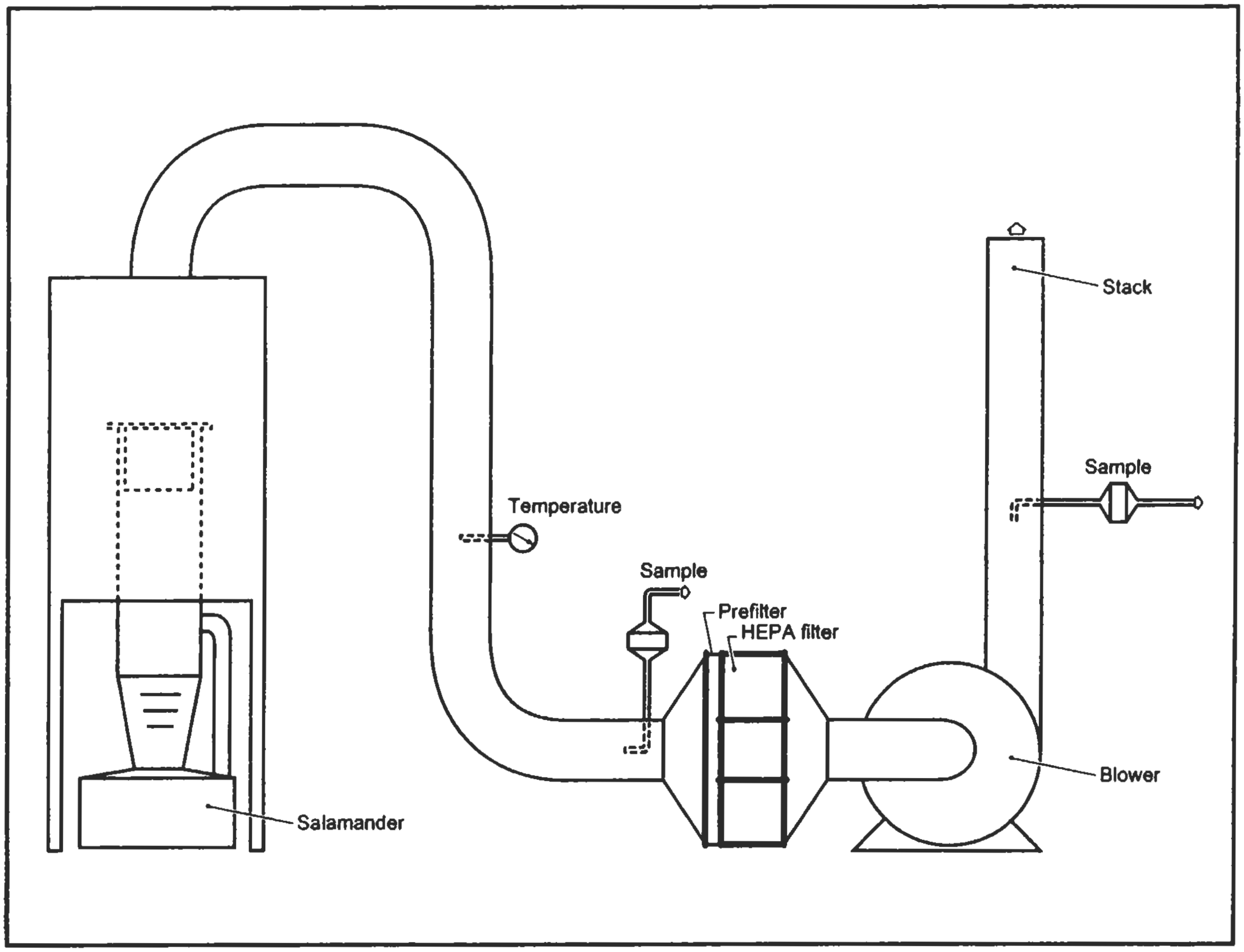
**Figure B-9.** Locations of the new industrial waste treatment facility (Building 257) and emergency overflow lines from tanks 112 and 113



FB-10/MDAT_IWP/022704
Source: LANL 1991, 07528.1, p. 16-183
A. Kron 12/2/03

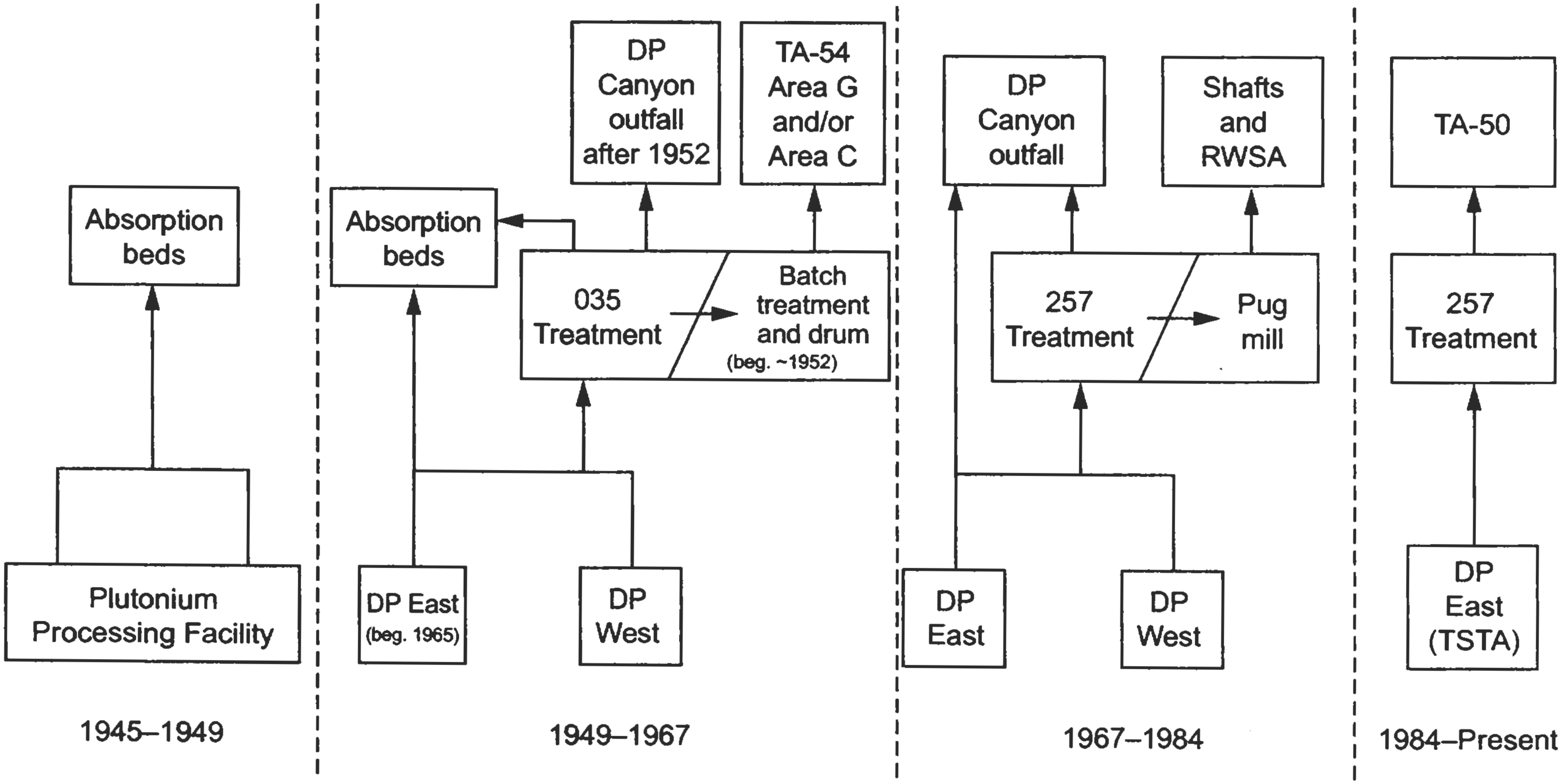
*Note:* Alpha survey (concentrations shown in kilocounts/minute)

**Figure B-10. The new industrial waste treatment plant (Building 257)**



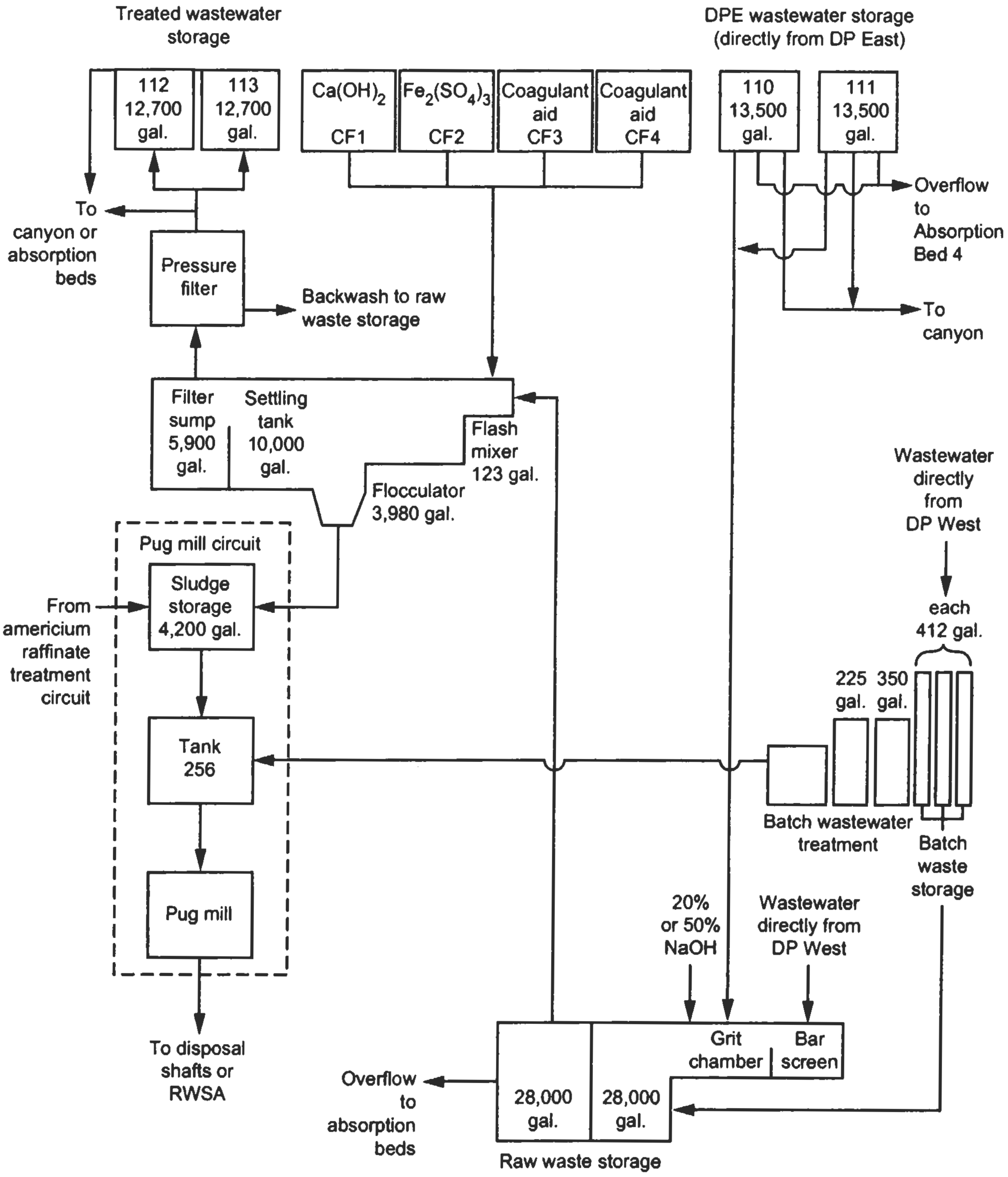
FB-11/MDAT_IWP/022704
Source: Christenson et al. 1974, 05481.1, p. [unnumbered]
A. Kron 11/17/03

**Figure B-11. Schematic diagram of an experimental liquid waste incinerator (salamander)**



FB-12, MDA T IWP, 022504
A. Kron 12/2/03

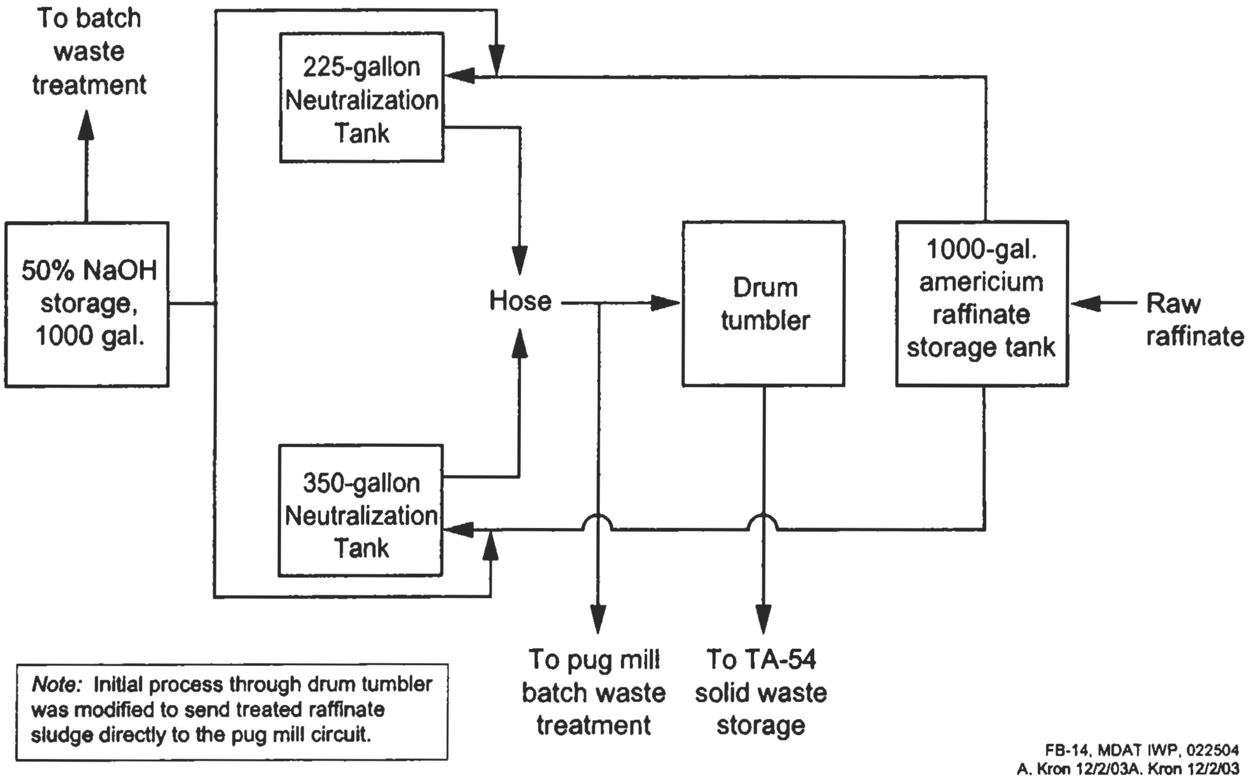
Figure B-12. MDA T simplified wastewater treatment and disposal history



*Notes:*
1. Recirculation lines are not shown.
2. Pumps, valves, motors, and controls are not shown.

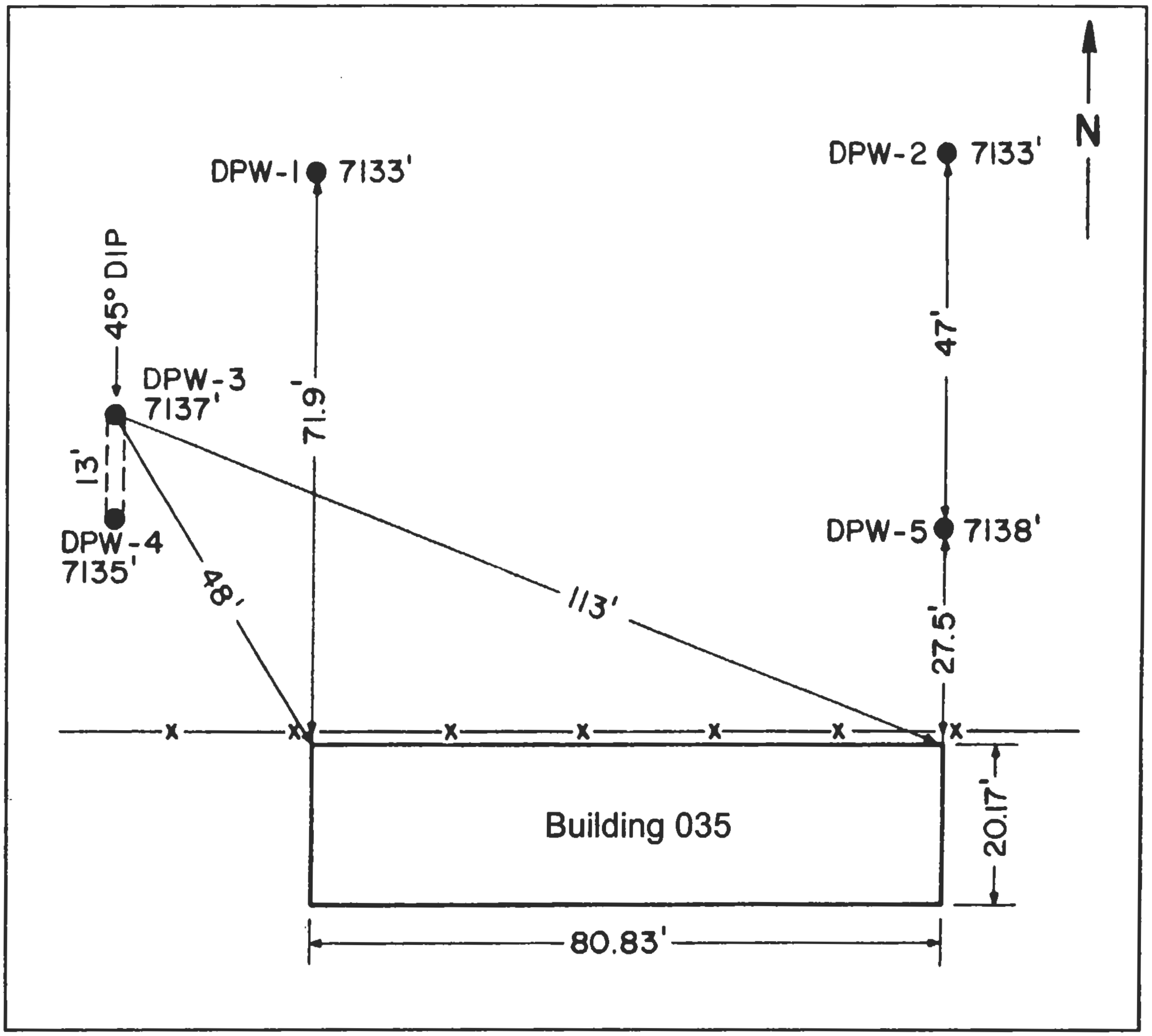
FB-13, MDA T IWP, 022504
A. Kron 12/2/03

**Figure B-13. Building 257 simplified process diagram for acid wastewater treatment circuit and pugmill circuit**



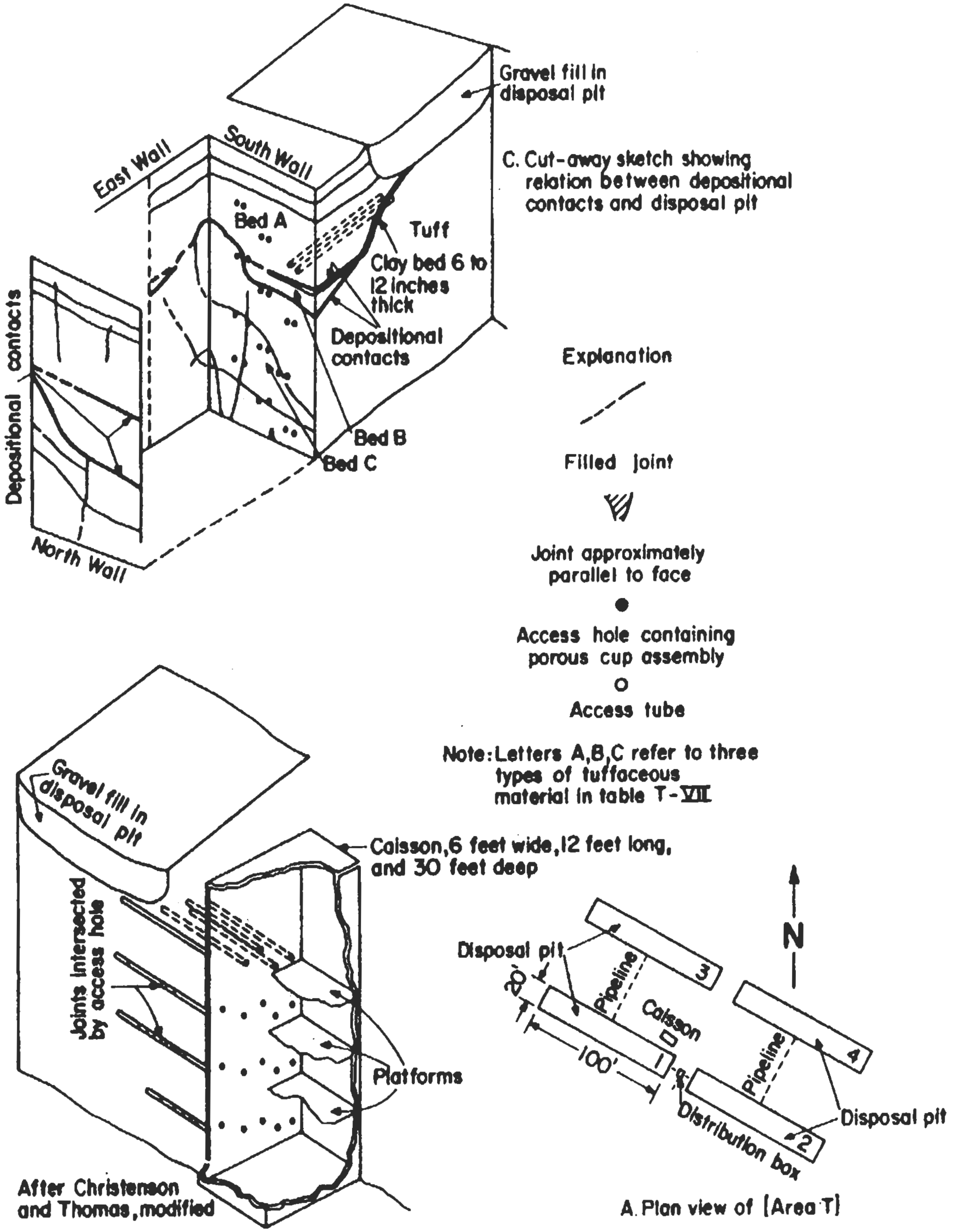
*Note:* Initial process through drum tumbler was modified to send treated raffinate sludge directly to the pug mill circuit.

**Figure B-14. Building 257 simplified process diagram for americium waste neutralization circuit**



FB-15/MDAT_IWP/022704
A. Kron 12/2/03
Source: Rogers 1977, 05707.2, p. T-20.

**Figure B-15. Location of 1953 sampling points at MDA T**



C. Cut-away sketch showing relation between depositional contacts and disposal pit

A. Plan view of [Area T]

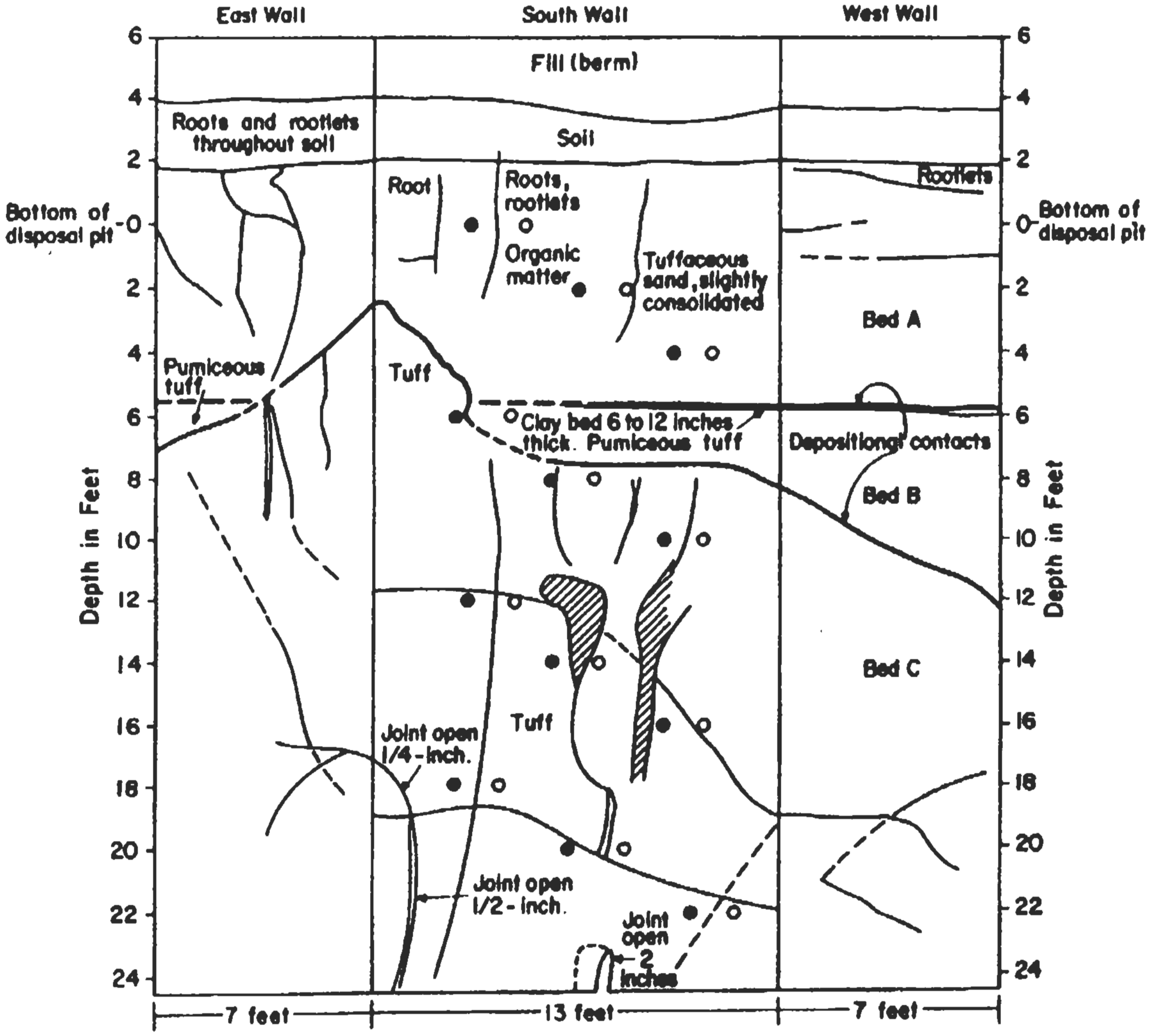
B. Cut-away sketch, showing caisson, east row of horizontal holes, and disposal pit.

FB-16, MDA T IWP, 022504
A. Kron 11/17/03
Source: Rogers 1977, 05707.2, pp. T-25 and T-26

**Figure B-16. Diagrammatic sketches of installation and caisson pit (MDA T) (1959–1961)**

## Description of Material in Caisson Pit at Area T

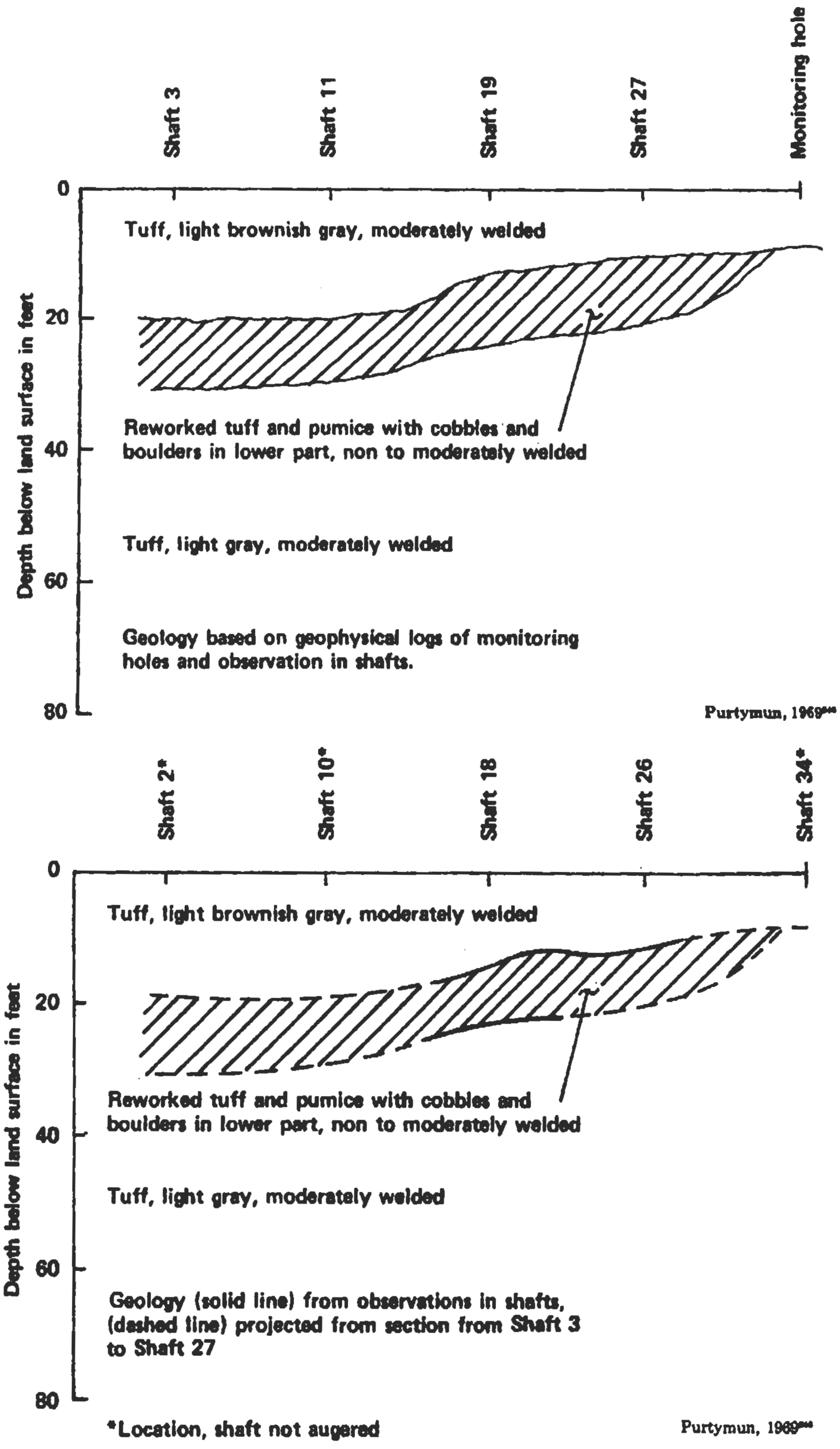
| Position on figure | Description |
|---|---|
| A | Sand, light orange-brown, weathered yellowish, consists of subround to subangular silt to coarse grains of quartz, sanidine, pumice, and minor amounts of mafic minerals, some grains pitted. |
| B | Tuff, light orange-gray, weathered throughout; much clay present. |
| C | Tuff, light gray, weathered yellowish around devitrified pumice fragments and adjacent to joints, locally weathered into clay, weathering more intense in bottom of pit; consists of ash and some mafic minerals. |



D. Sketch of east, south, and west walls of caisson pit showing details of jointing and location of horizontal holes.

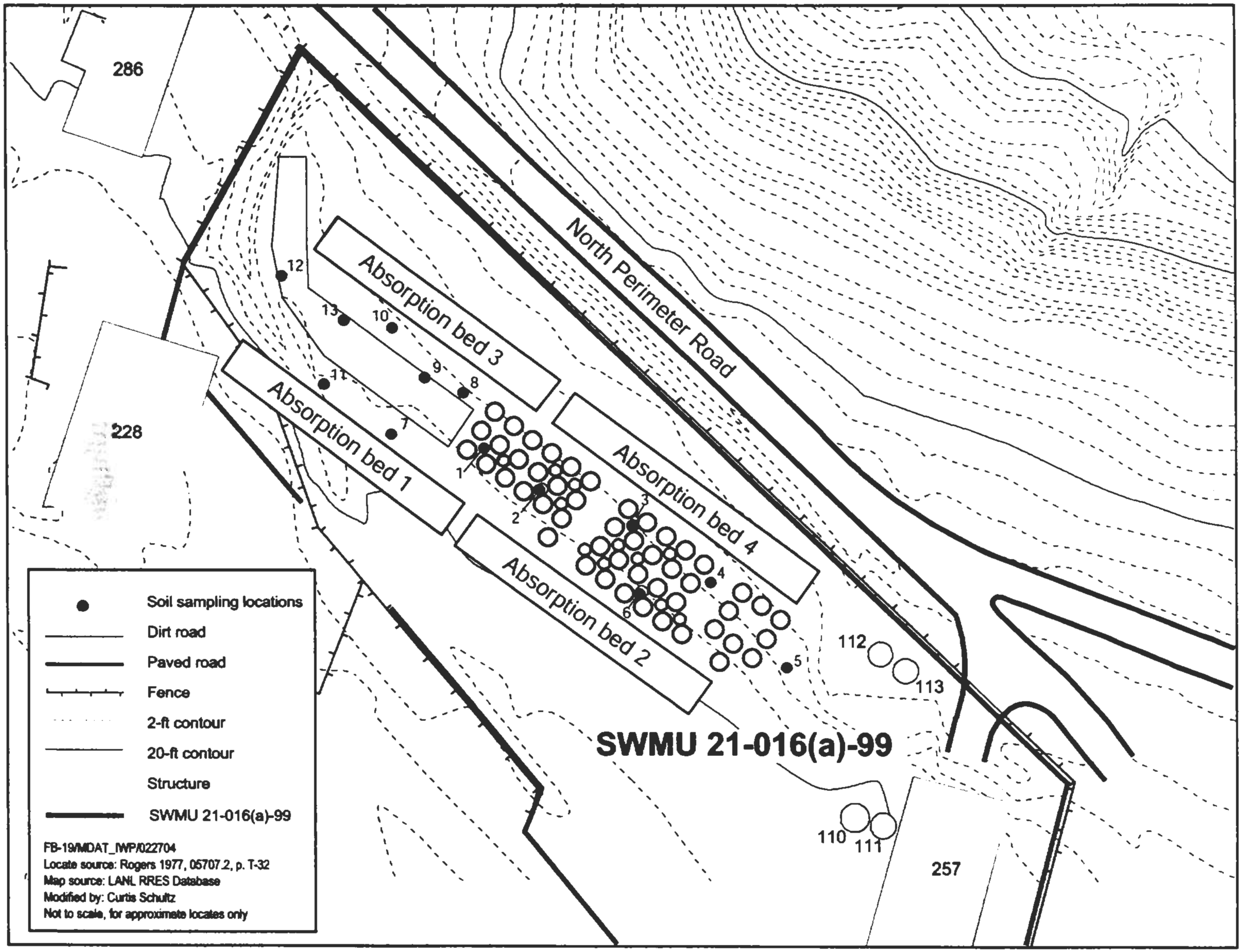
FB.17, MDA T IWP, 022504
Source: Rogers 1977, 05707.2, pp. T-25 and T-26
A. Kron 11/17/03

**Figure B-17. Cross-sectional view of caisson pit (MDA T) (1959–1961)**



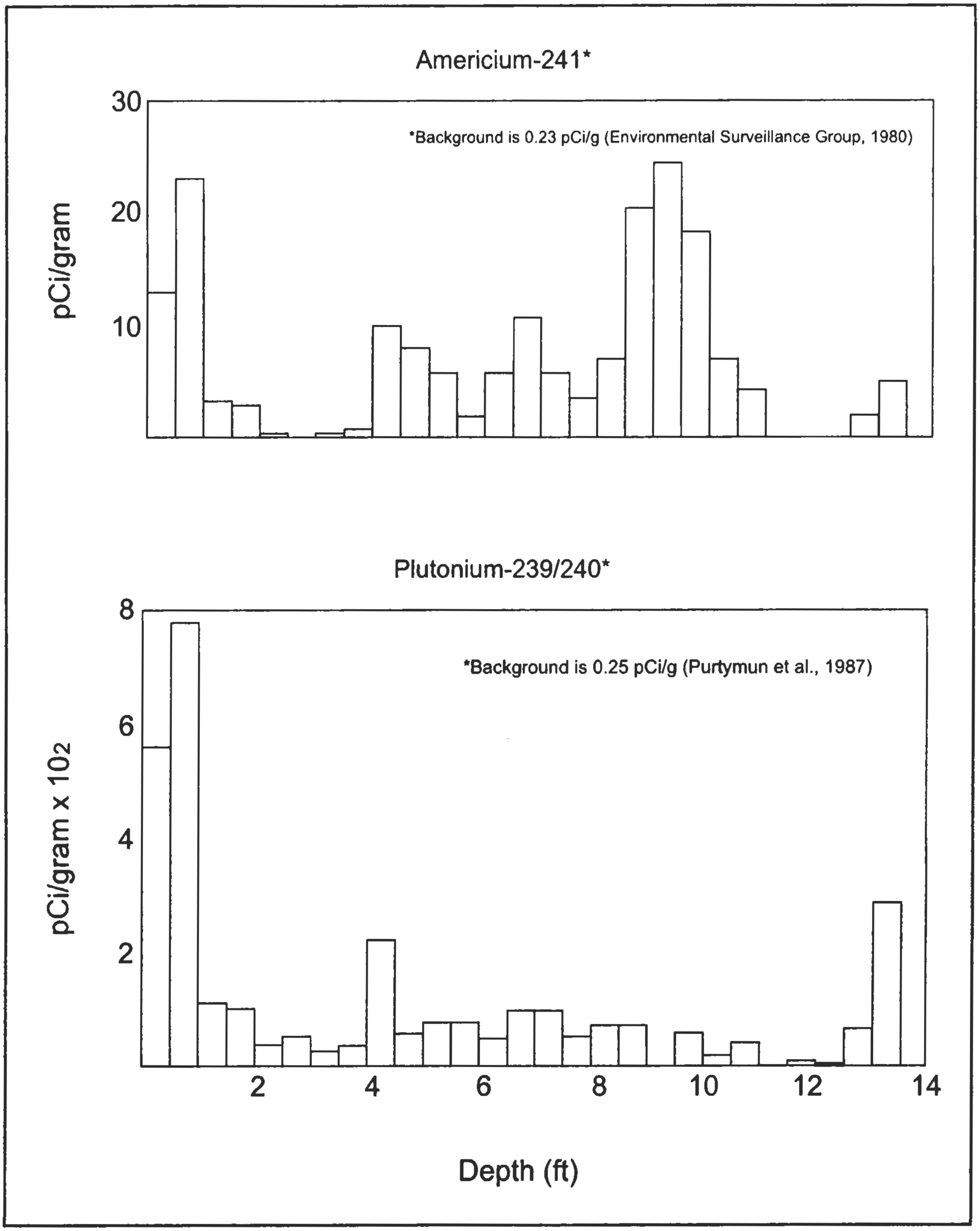
FB-18, MDA T IWP, 022504
A. Kron 9/17/03
Source: Rogers 1977, 05707.2, pp. T-3 and T-4

**Figure B-18. Paleochannel identified in disposal shafts at MDA T**



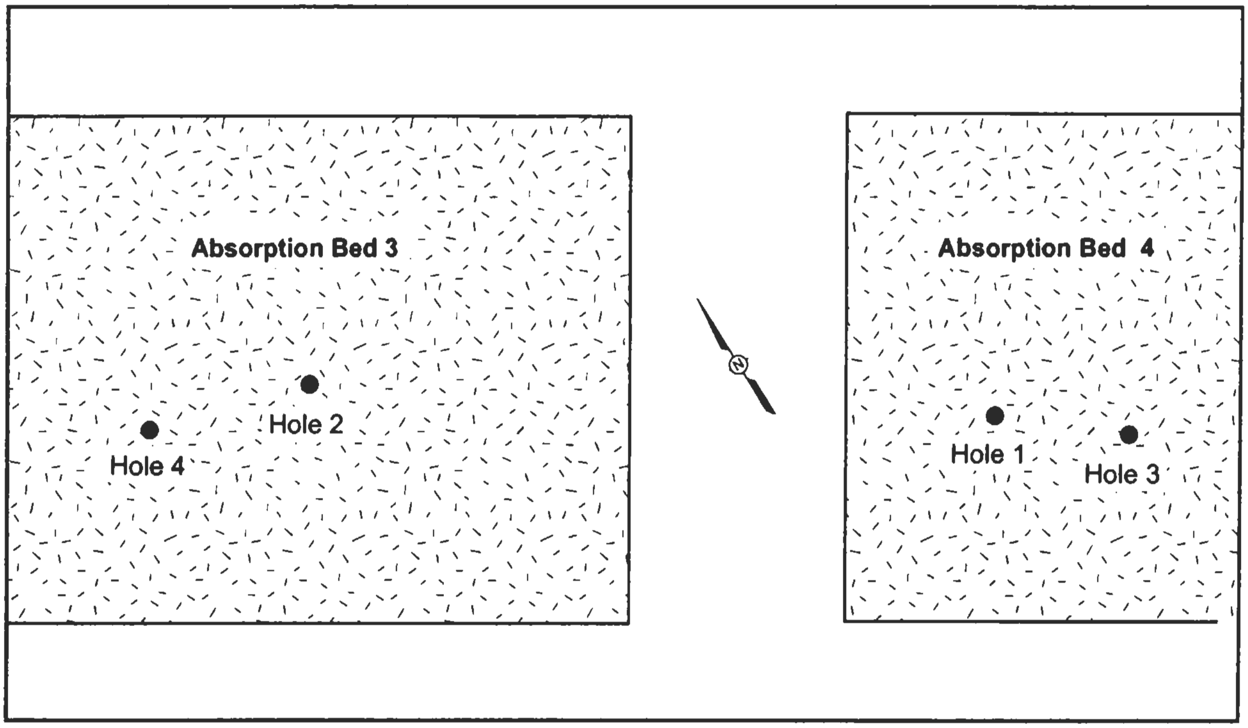
FB-19/MDAT_IWP/022704
Locate source: Rogers 1977, 05707.2, p. T-32
Map source: LANL RRES Database
Modified by: Curtis Schultz
Not to scale, for approximate locates only

**Figure B-19.** Approximate locations of augered holes (1–13) for April–May 1974 studies at MDA T



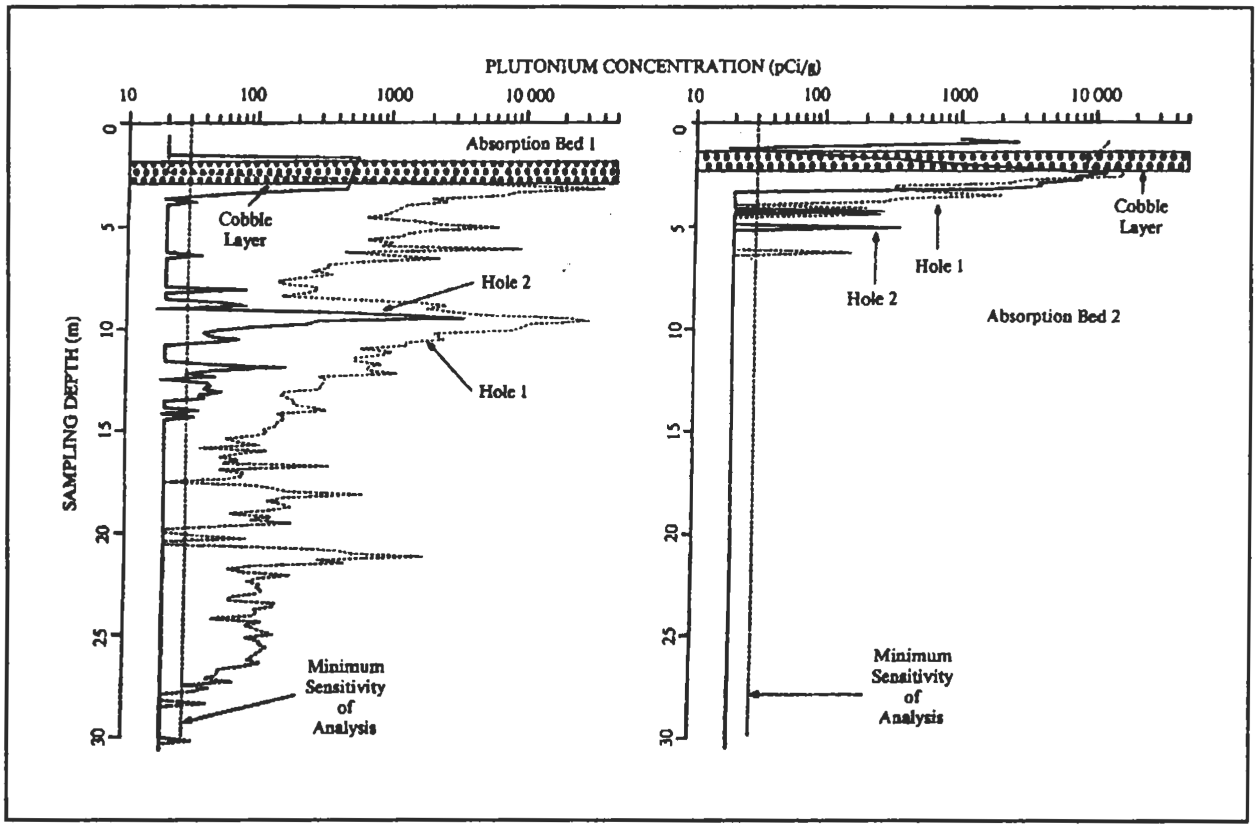
FB-20, MDA T IWP, 022704
A. Kron 11/17/03
Source: LANL 1991, 07528.1, pp. 16-130

**Figure B-20. Distribution of americium and plutonium in Absorption Bed 3 from 1974 sampling**



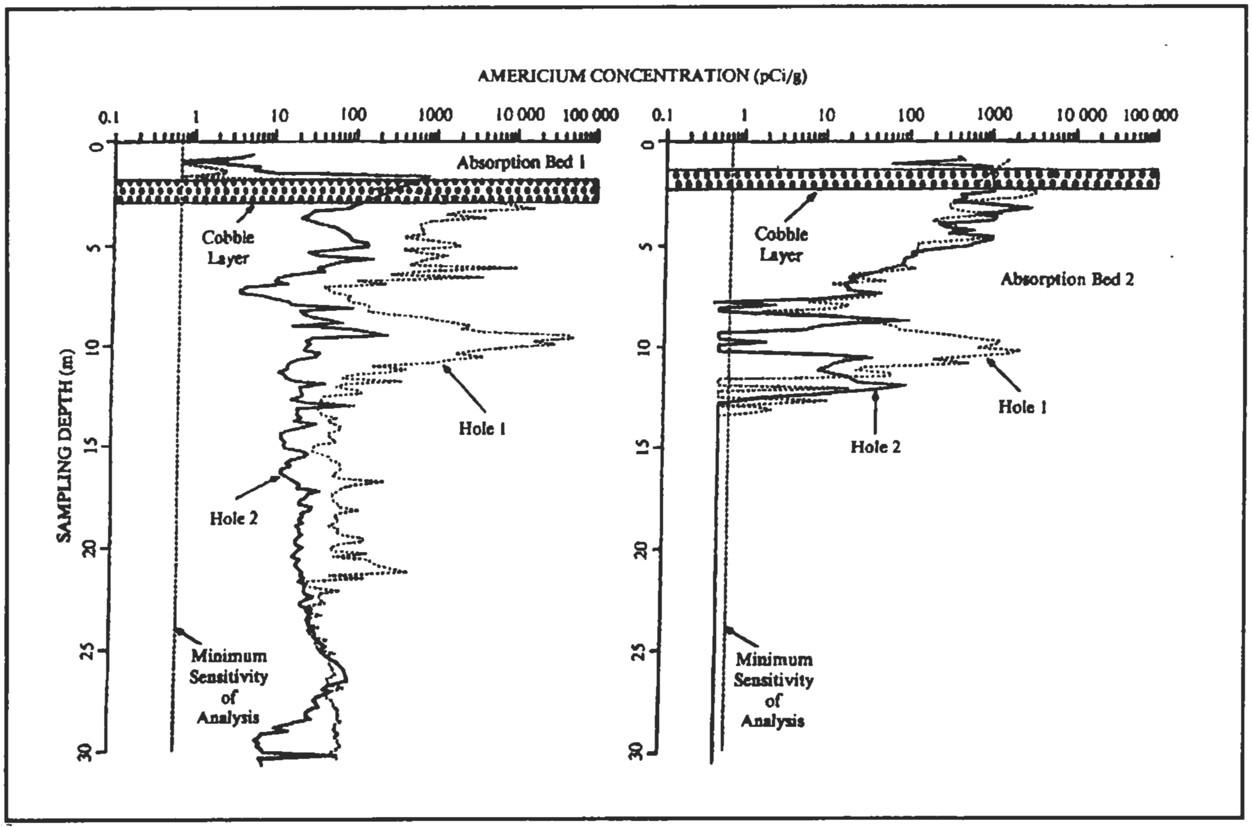
FB-21, MDA T IWP, 022704
A. Kron 11/17/03
Source: Rogers 1977, 05707.2, p. T-39

**Figure B-21. Borehole locations for 1976 field investigation**



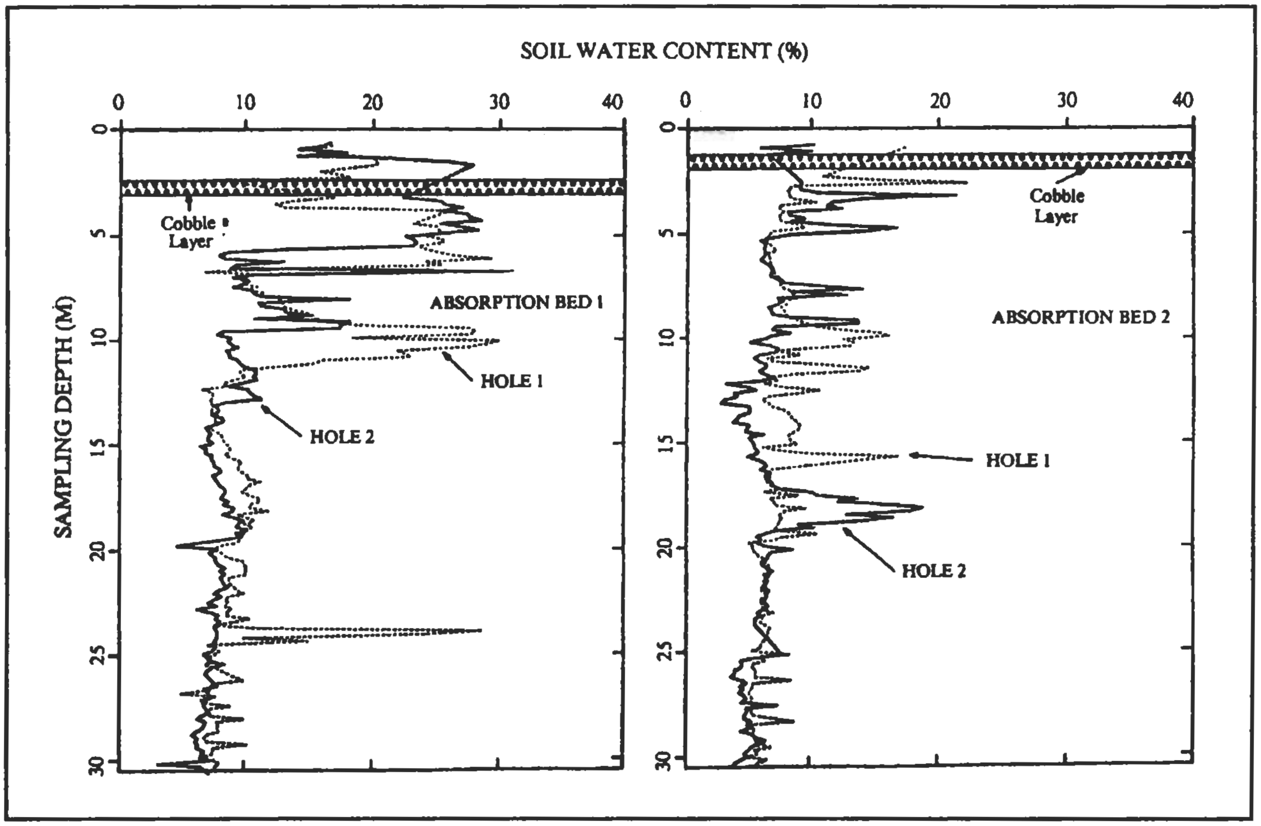
FB-22, MDA T IWP, 022704
Source: Nyhan et al., 1984; 06529.1; p. 8

**Figure B-22.** **Concentration of plutonium as a function of sampling depth for Absorption Beds 1 and 2 in 1978**



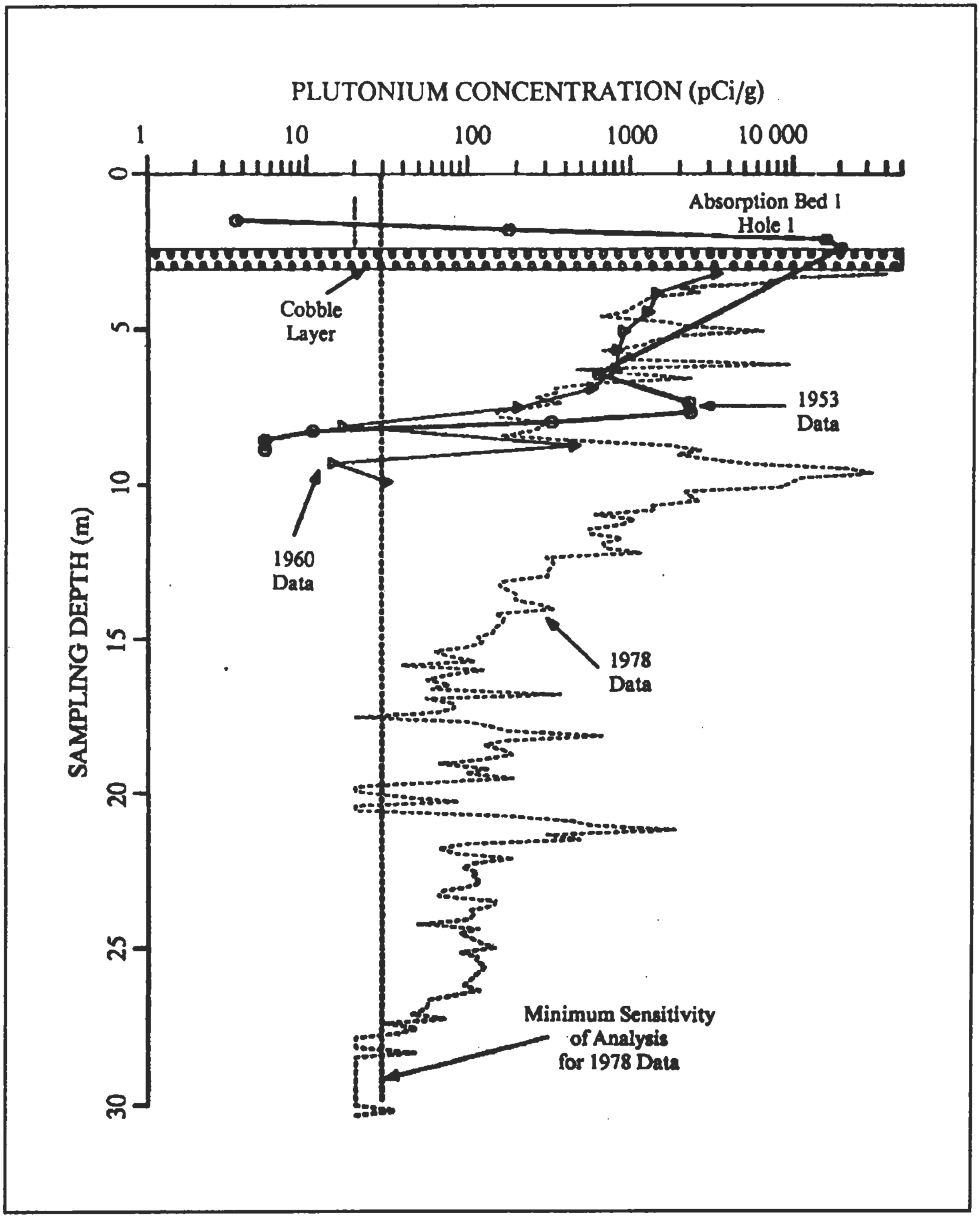
FB-23, MDA T IWP, 022704
Source: Nyhan et al., 1984; 06529.1; p. 9

**Figure B-23.** **Concentration of americium-241 as a function of sampling depth for Absorption Beds 1 and 2 in 1978**



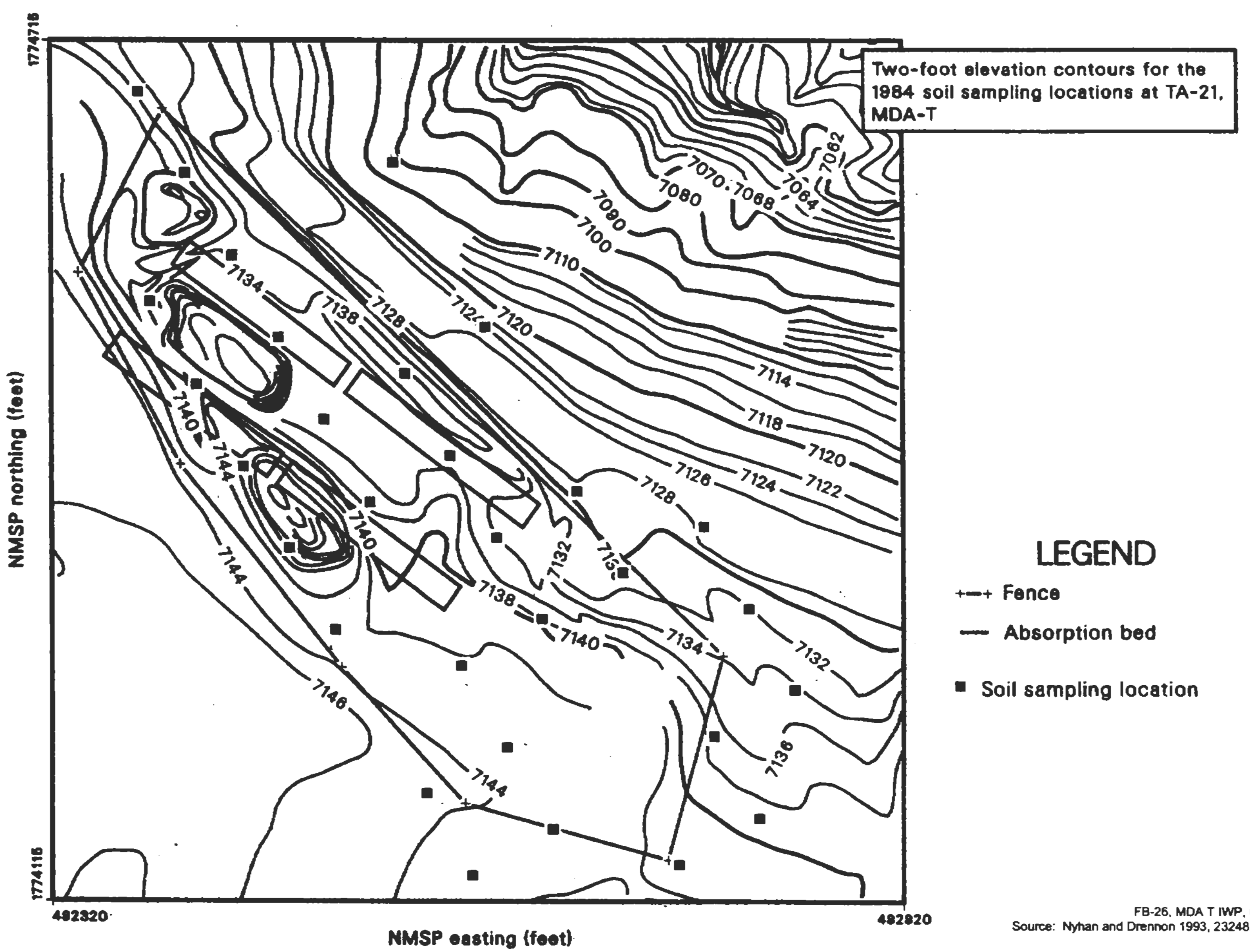
FB-24, MDA T IWP, 022704
Source: Nyhan et al., 1984; 06529.1; p. 11

**Figure B-24.** **Gravimetric soil water content as a function of sampling depth for Absorption Beds 1 and 2 in 1978**



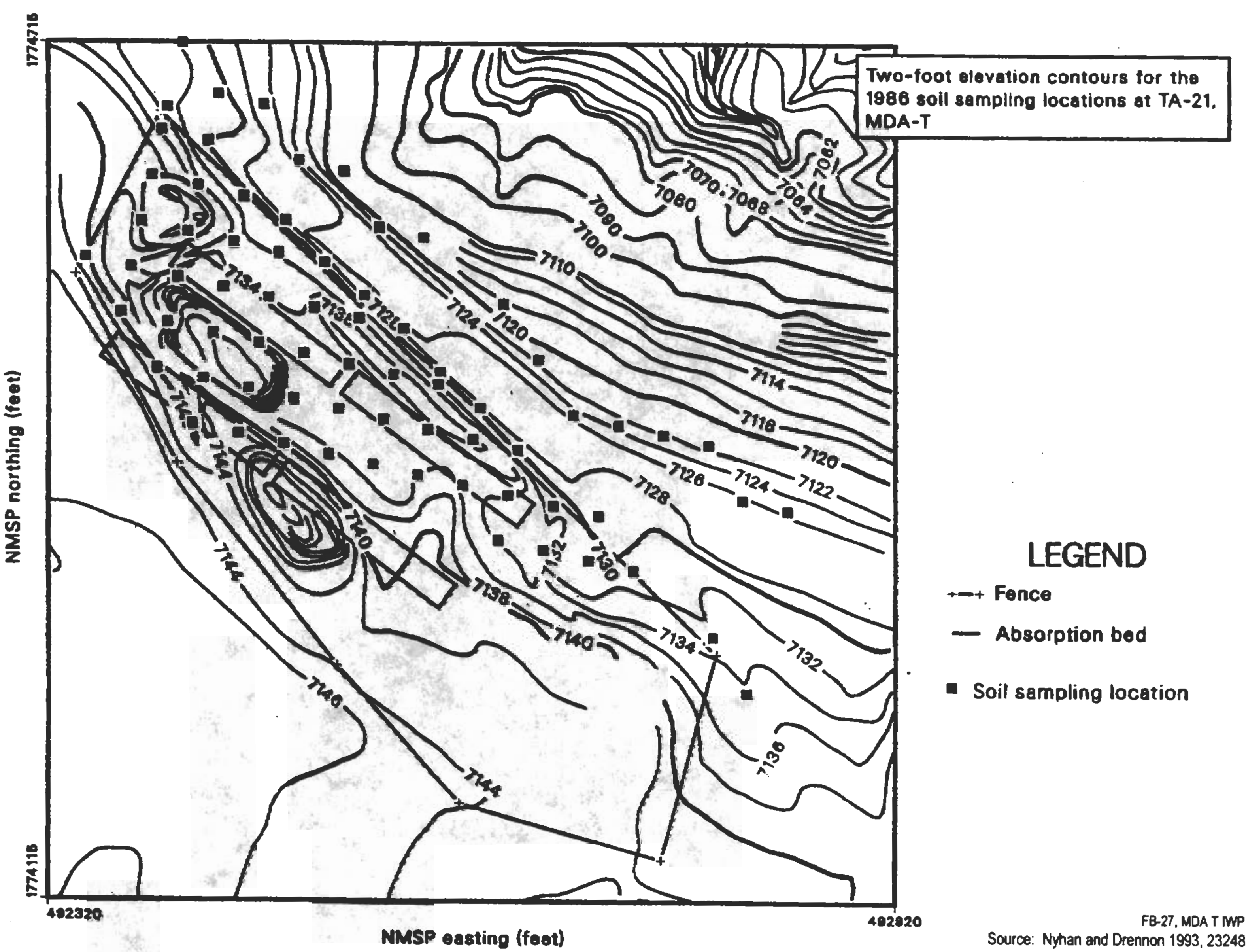
FB-25, MDA T IWP, 022704
Source: Nyhan et al., 1984; 06529.1; p. 15

**Figure B-25.** **Concentration of plutonium as a function of sampling depth for Absorption Beds 1 found in 1953, 1960, and 1978**



FB-26, MDA T IWP, 022704
Source: Nyhan and Drennon 1993, 23248.1, p.23

Figure B-26. Soil sampling locations for 1984 survey of MDA T



FB-27, MDA T IWP, 022704
Source: Nyhan and Drennon 1993, 23248.1, p.25

**Figure B-27.** **Soil sampling locations for 1986 survey of MDA T**

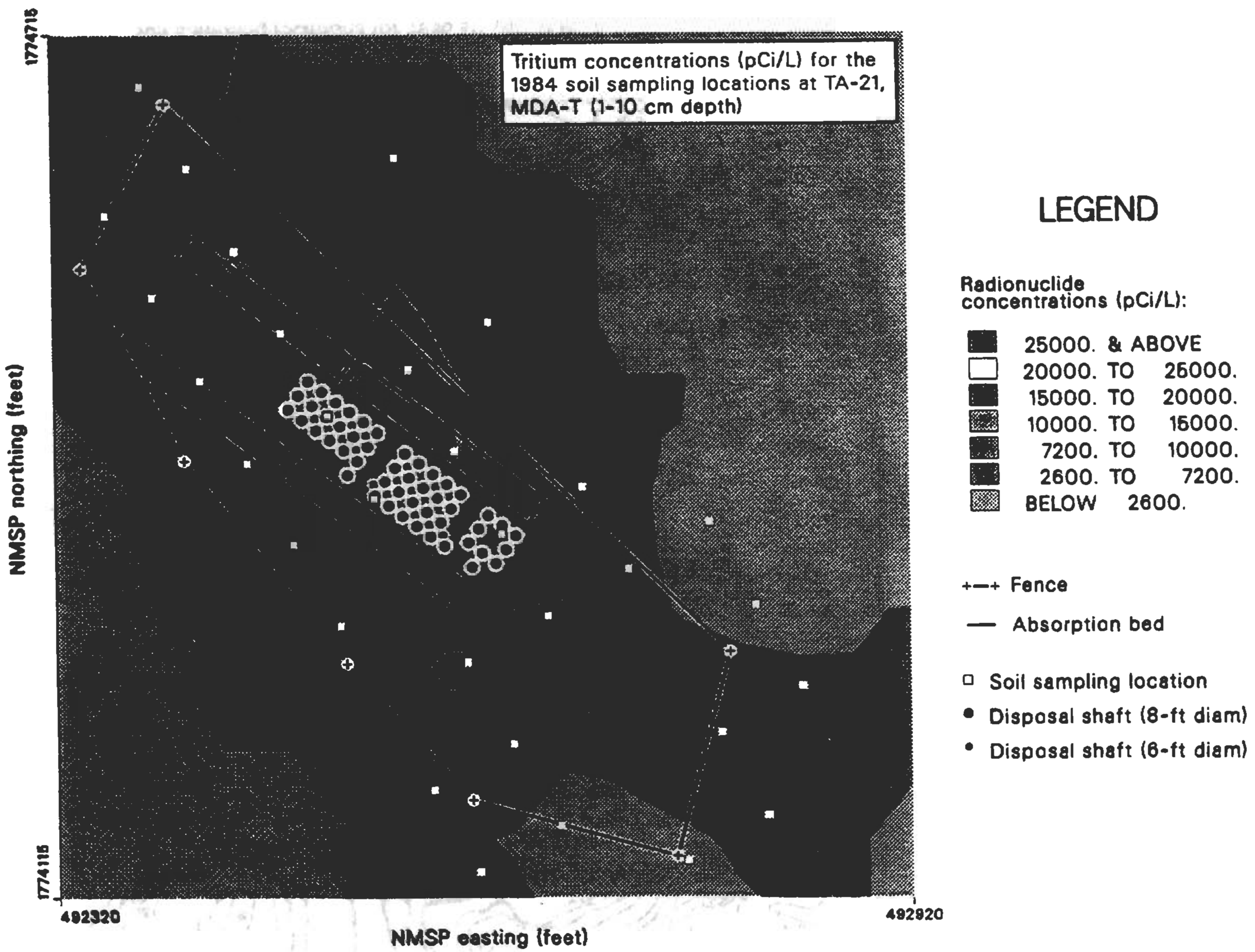


**Figure B-28.** Soil tritium concentration contours for the 1984 sampling grid at MDA T (1–10 cm depth)

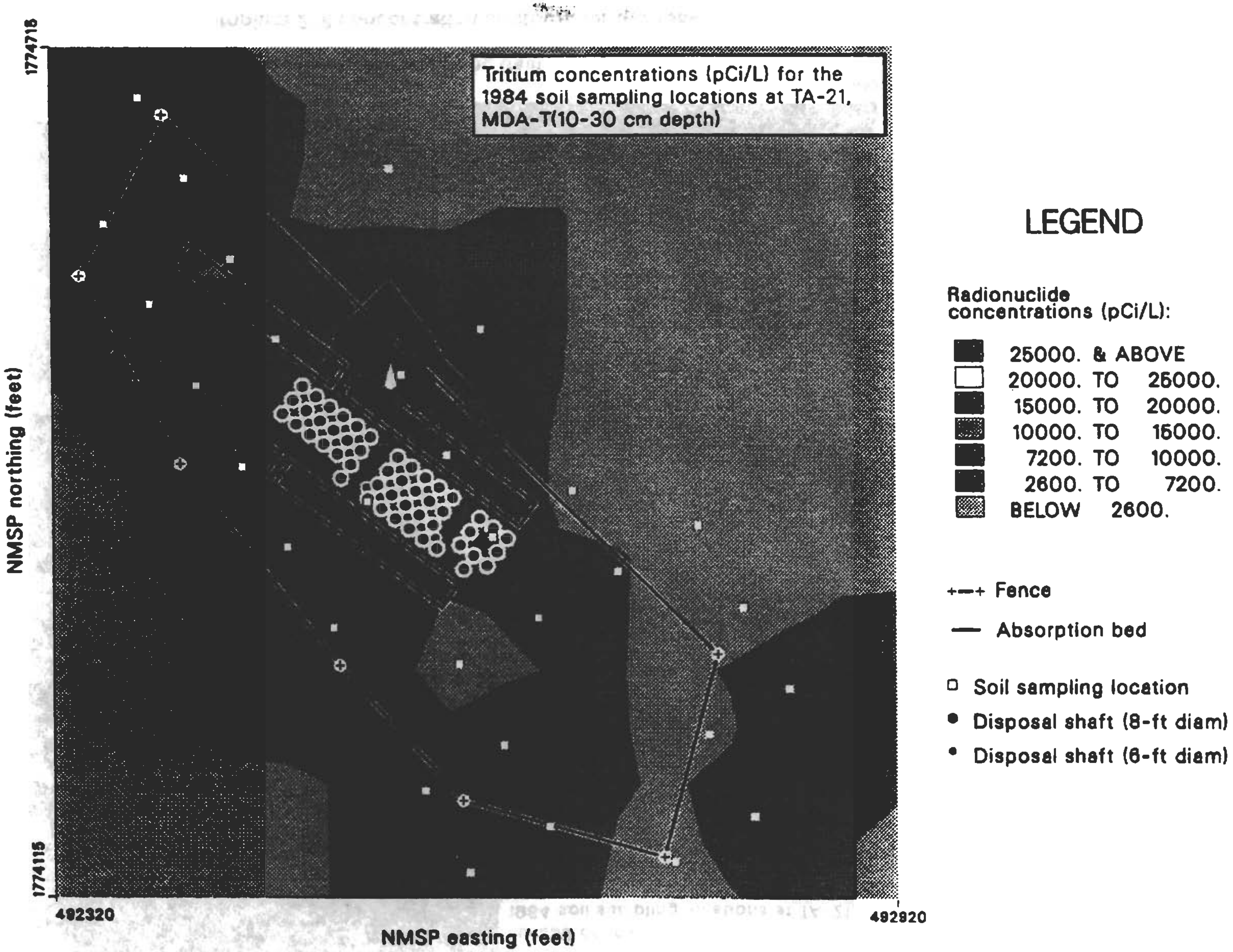


**Figure B-29.** **Soil Tritium concentration contours for the 1984 sampling grid at MDA T (10–30 cm depth)**

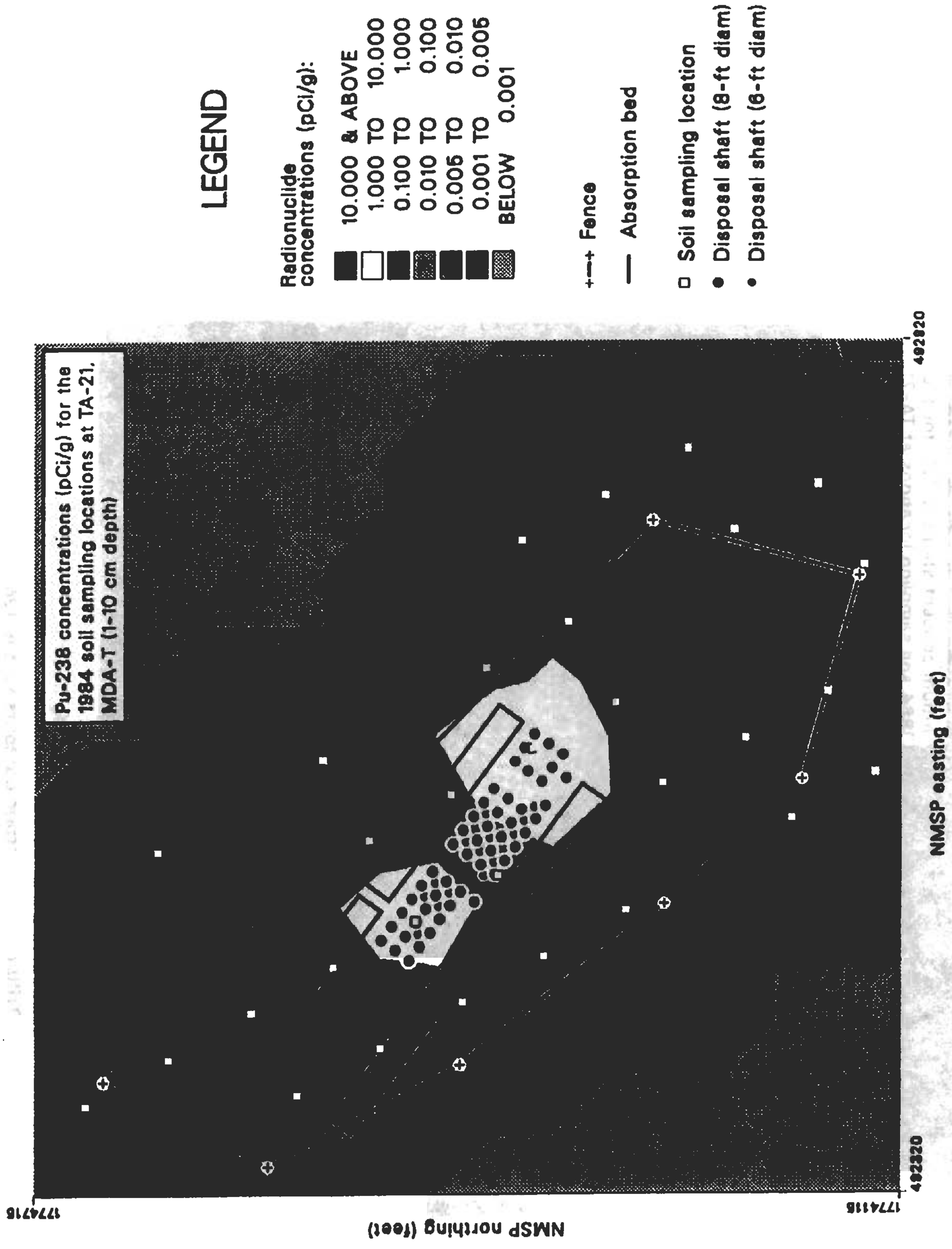


Figure B-30. Soil plutonium-238 concentration contours for the 1984 sampling grid at MDA T (1–10 cm depth)

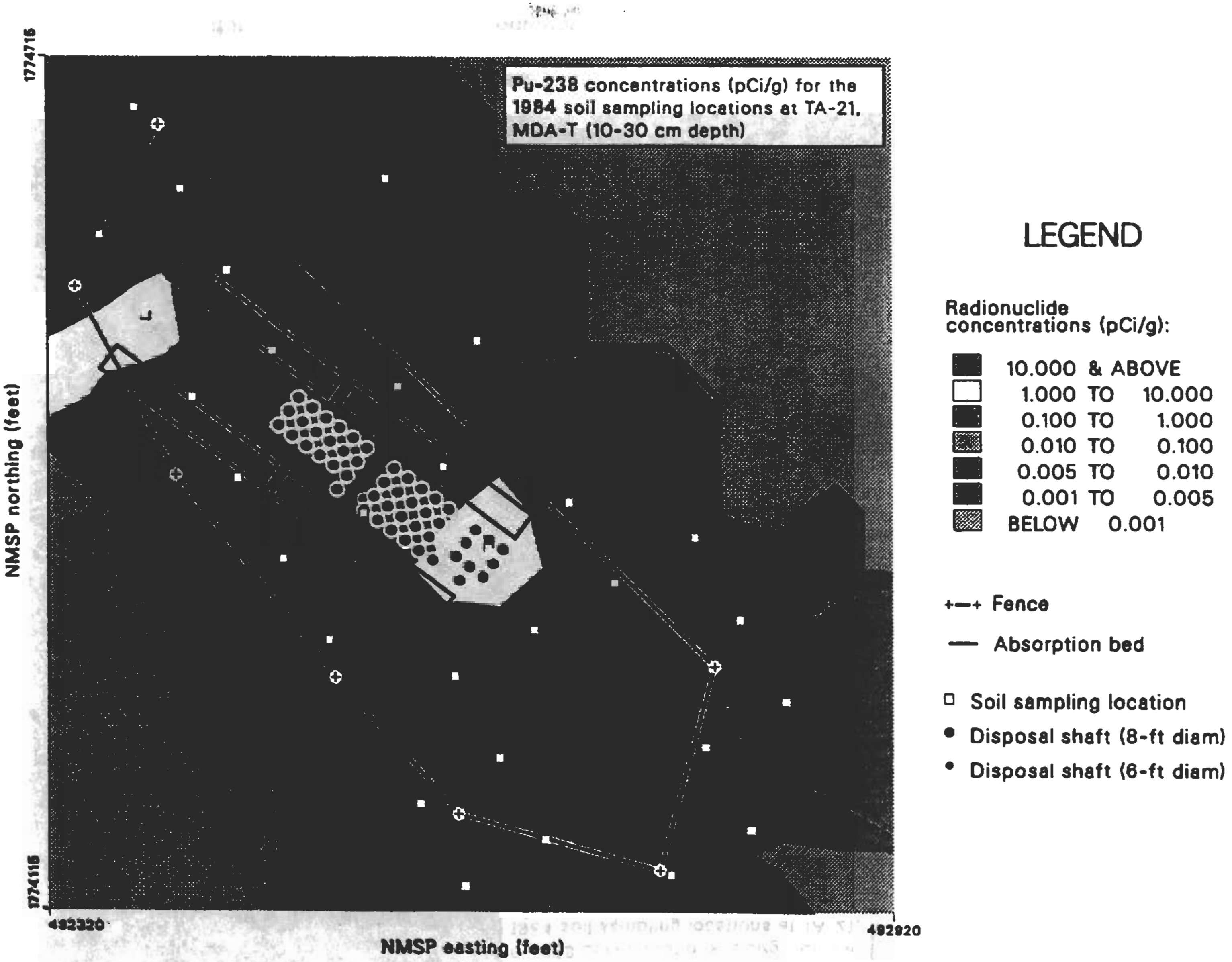


Figure B-31. Soil plutonium-238 concentration contours for the 1984 sampling grid at MDA T (10–30 cm depth)

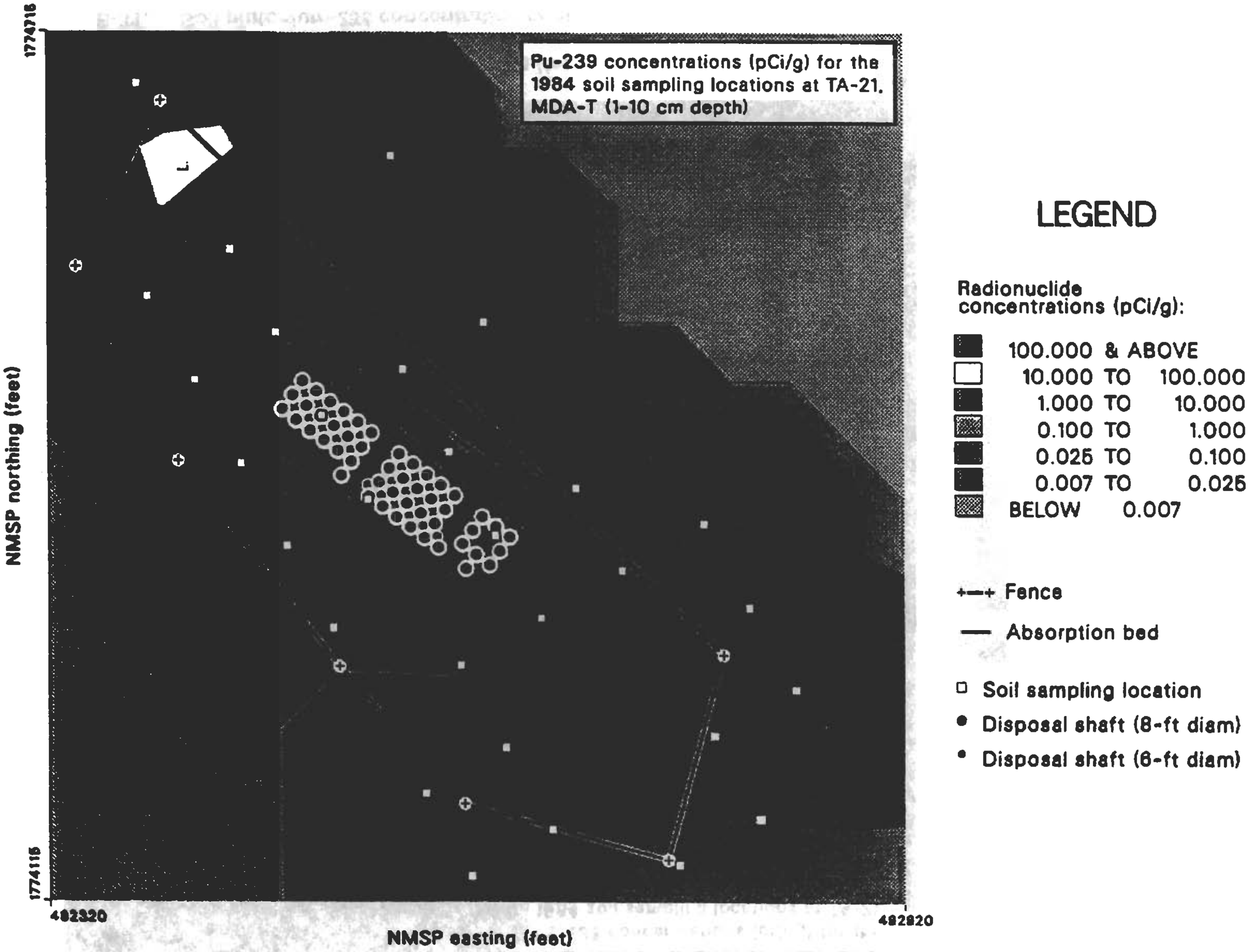


Figure B-32. Soil plutonium-239 concentration contours for the 1984 sampling grid at MDA T (1–10 cm depth)

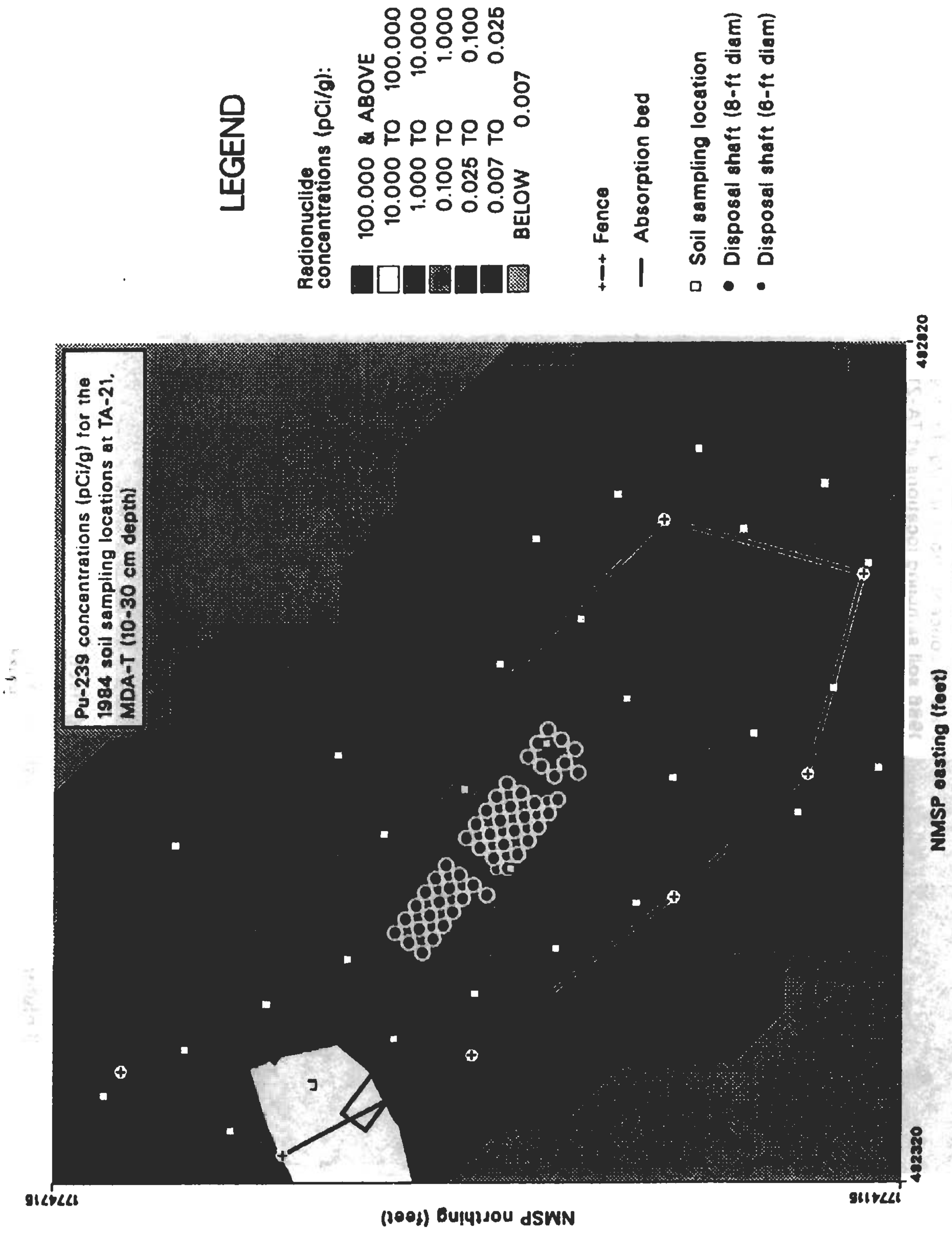


Figure B-33. Soil plutonium-239 concentration contours for the 1984 sampling grid at MDA T (10–30 cm depth)

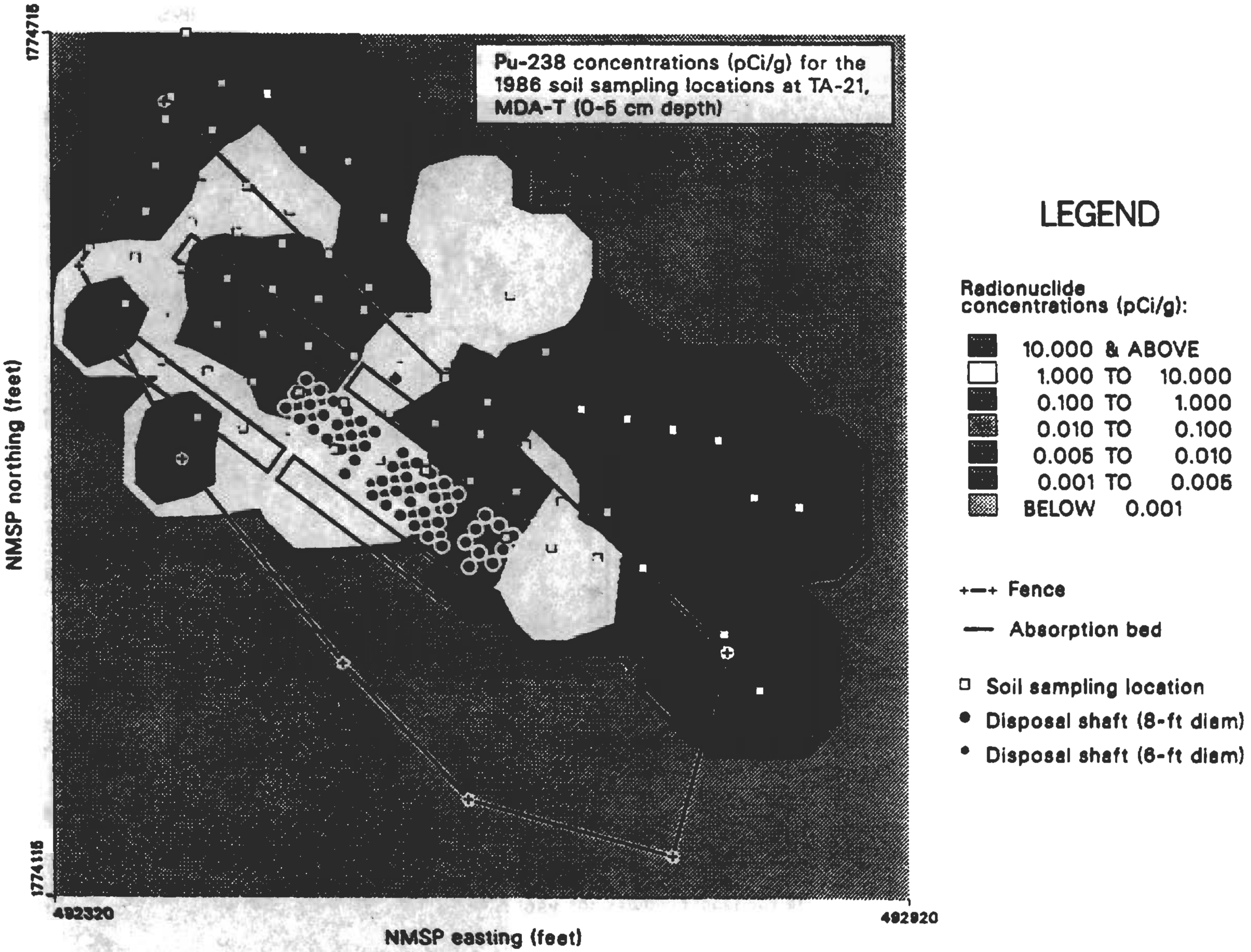


Figure B-34. Soil plutonium-238 concentration contours for the 1986 sampling grid at MDA T (0–5 cm depth)

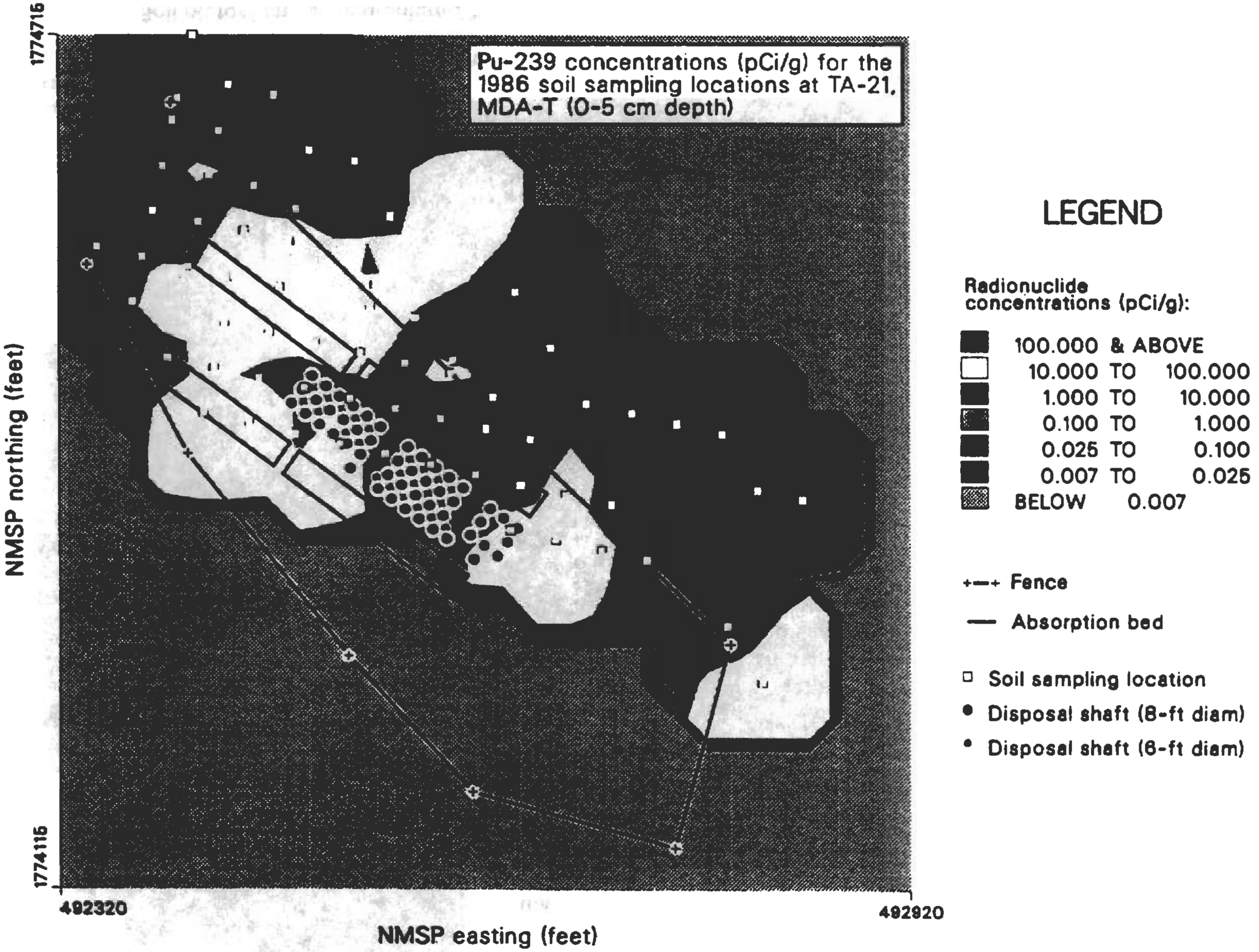


Figure B-35. Soil plutonium-239 concentration contours for the 1986 sampling grid at MDA T (0–5 cm depth)

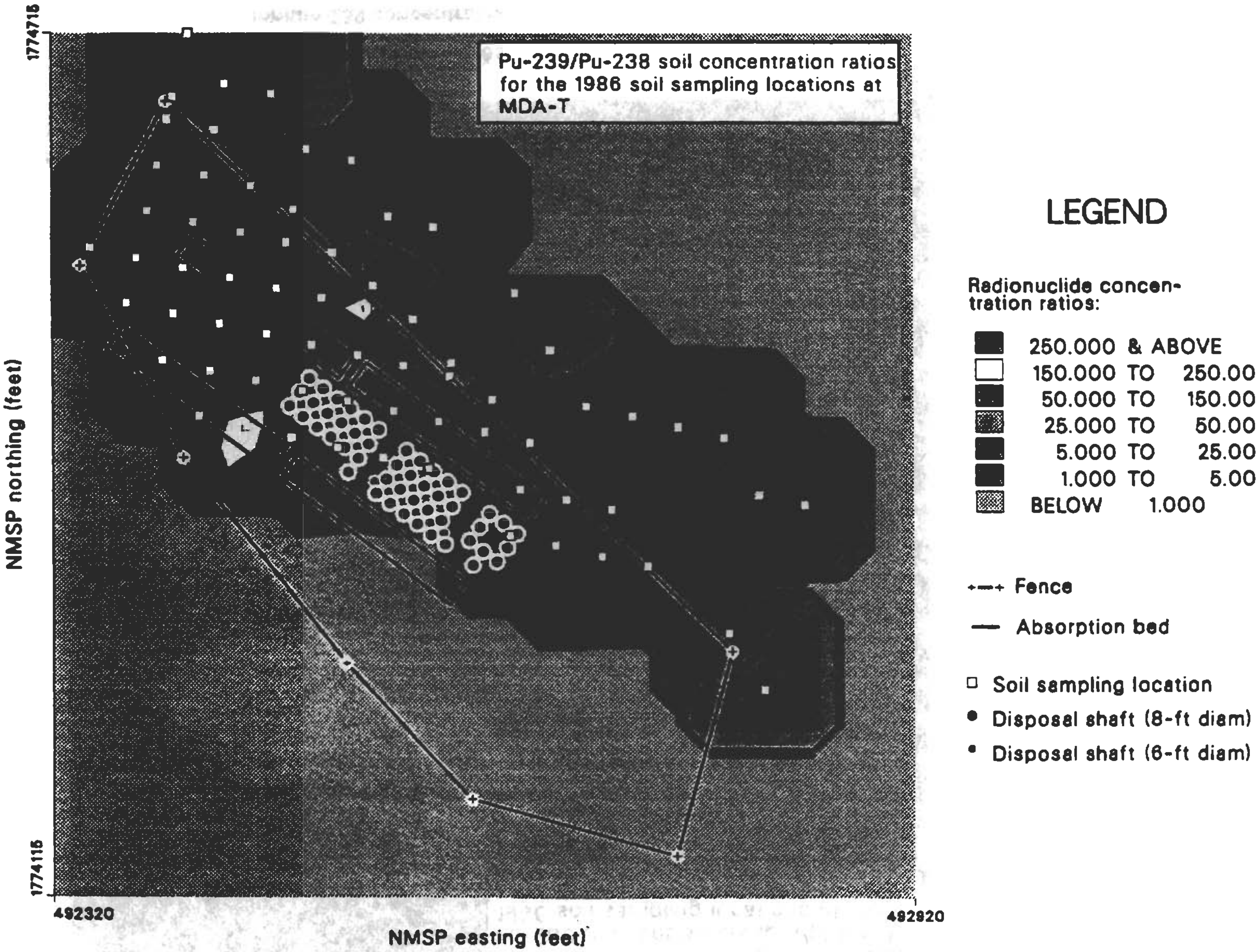


Figure B-36. Soil plutonium-239, plutonium-238 in soil samples collected in the 1986 sampling grid at MDA T (0–5 cm depth)

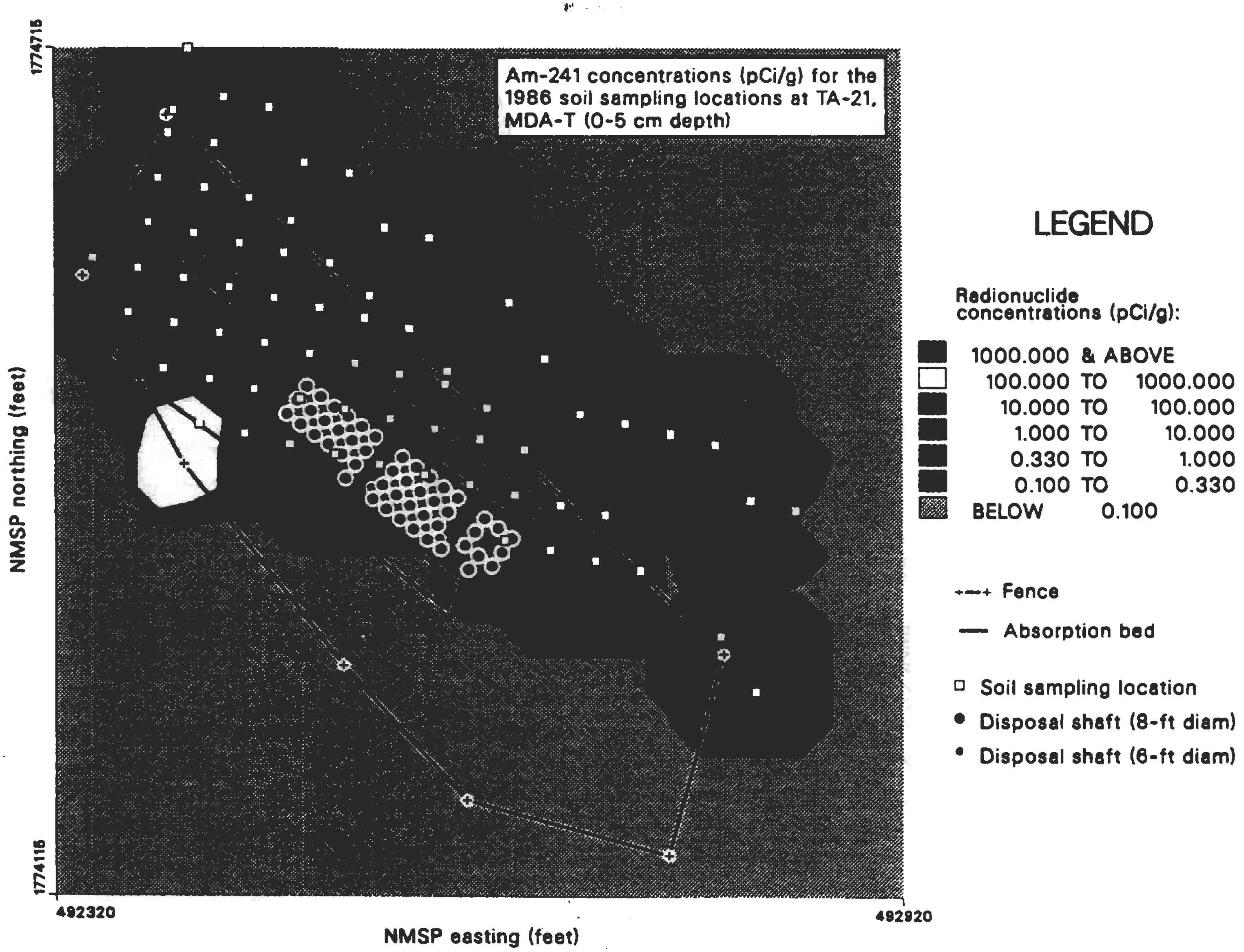


Figure B-37. Soil americium-241 concentration contours for the 1986 sampling grid at MDA T (0–5 cm depth)

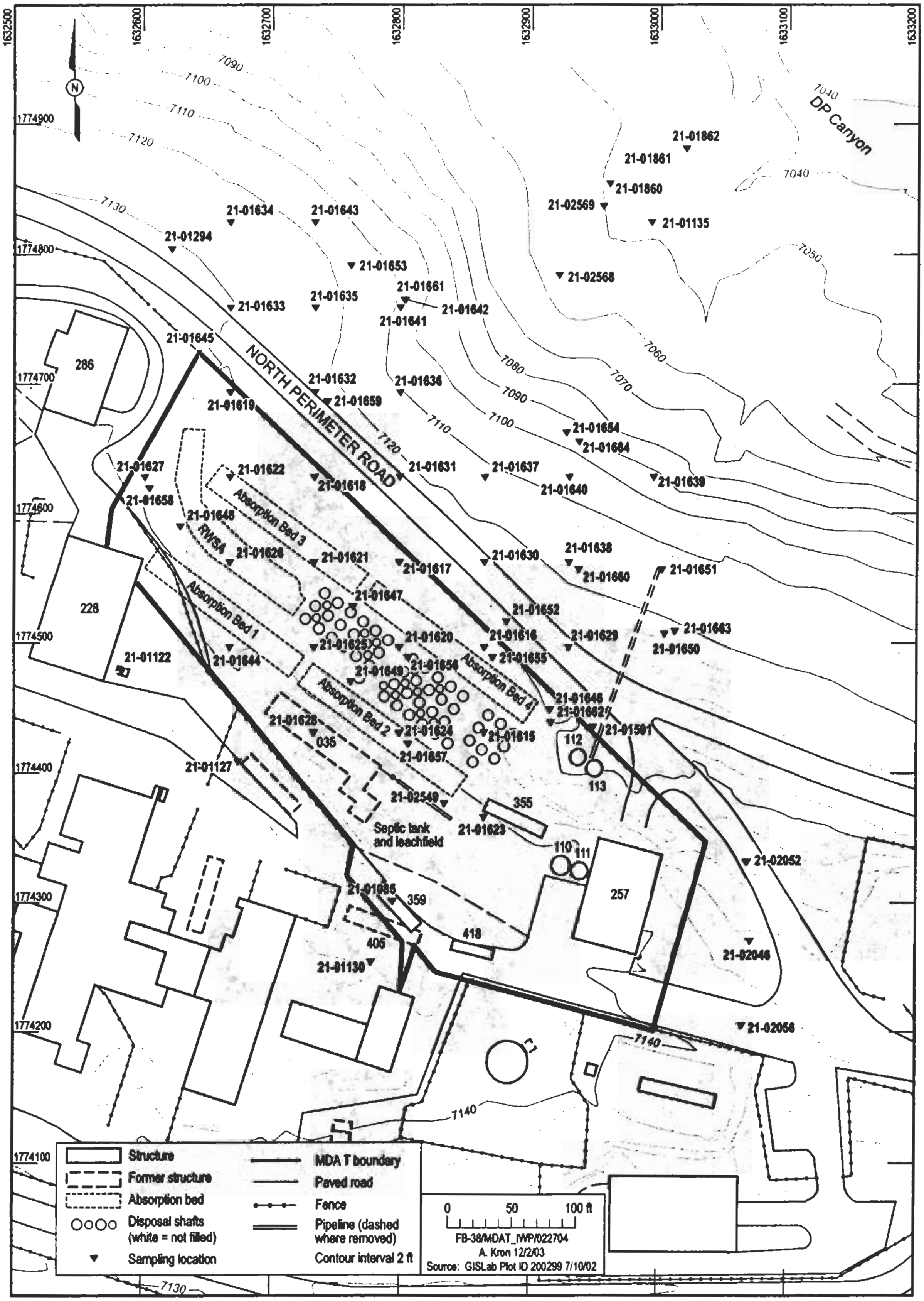
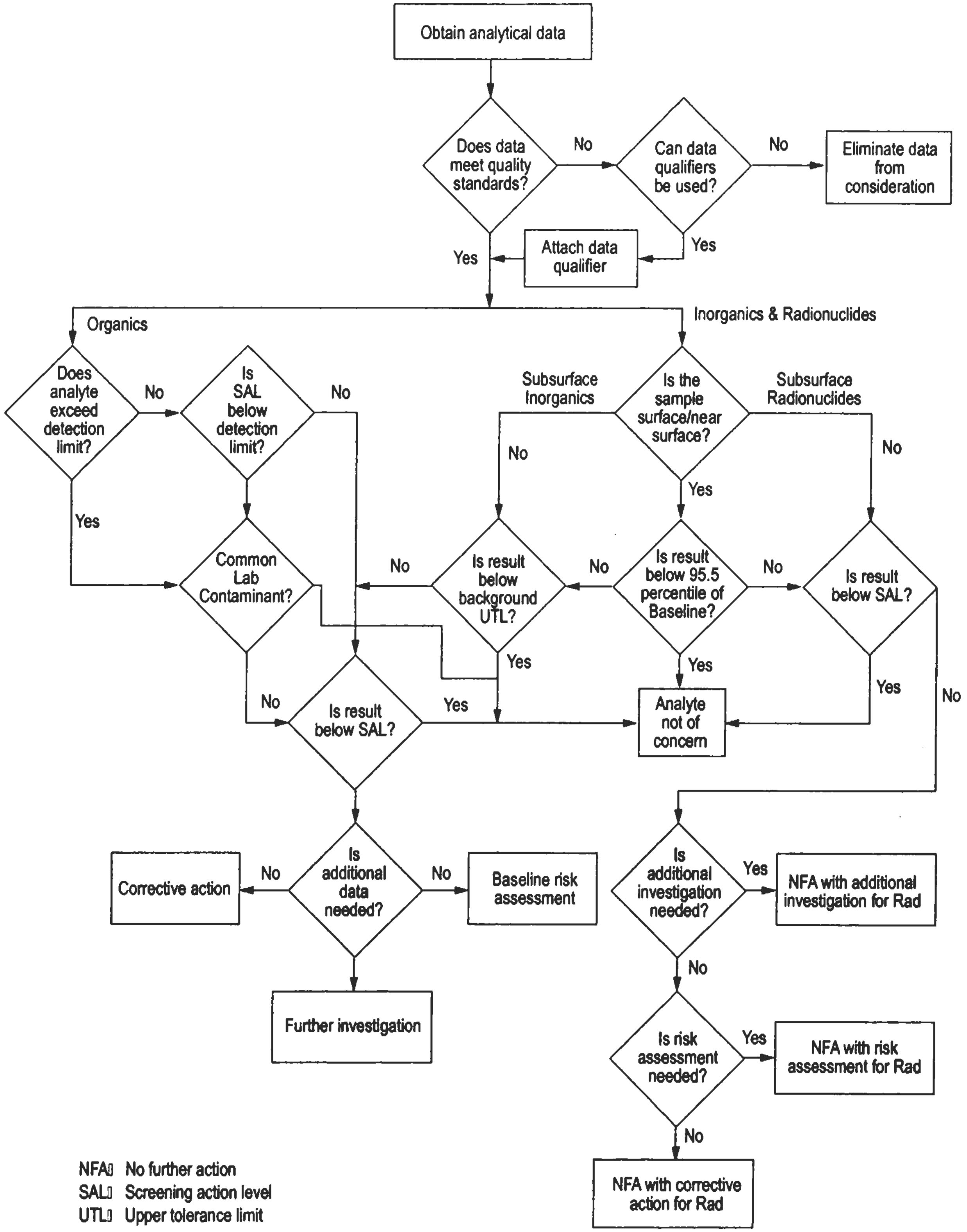
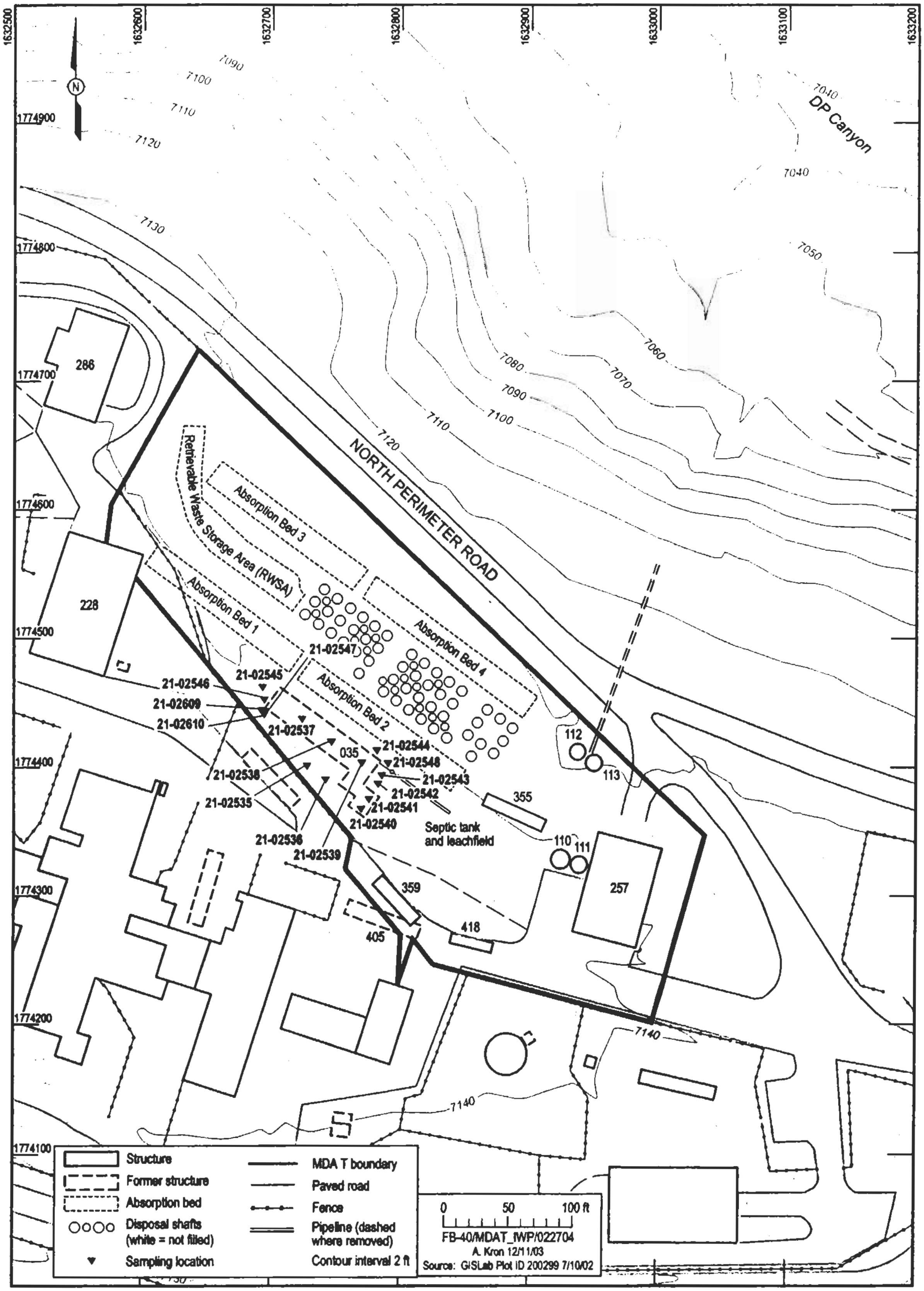


**Figure B-38. Sampling locations for the 1992 and 1993–1994 investigations**



FB-39, MDA T IWP, 022504
A. Kron 9/22/03
Source: LANL 1995, 52350.1, p. 1-23

**Figure B-39. Data interpretation process**



FB-40/MDAT_IWP/022704
A. Kron 12/11/03
Source: GISLab Plot ID 200299 7/10/02

**Figure B-40. Building 035 sampling investigation, 1993–1994**

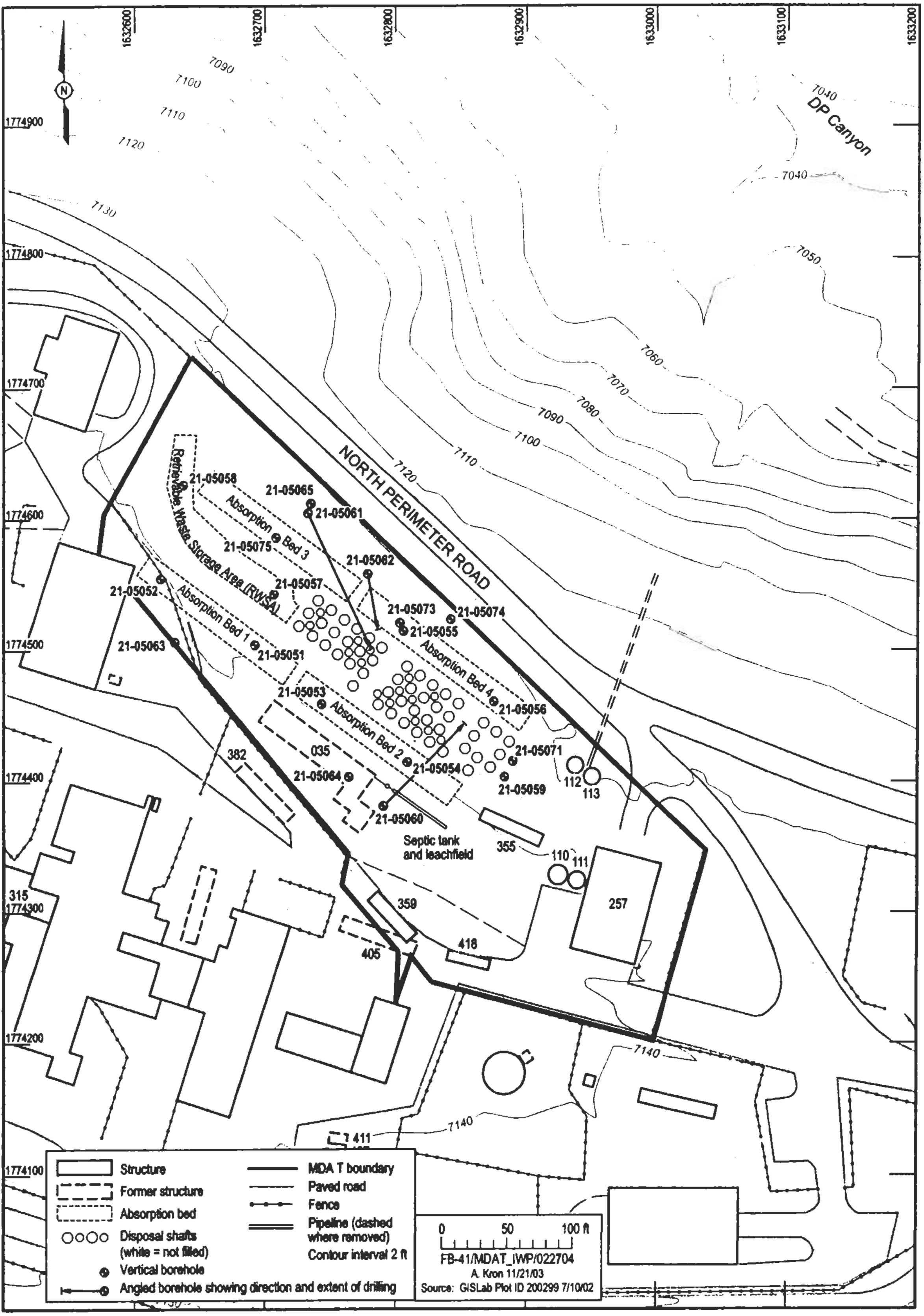
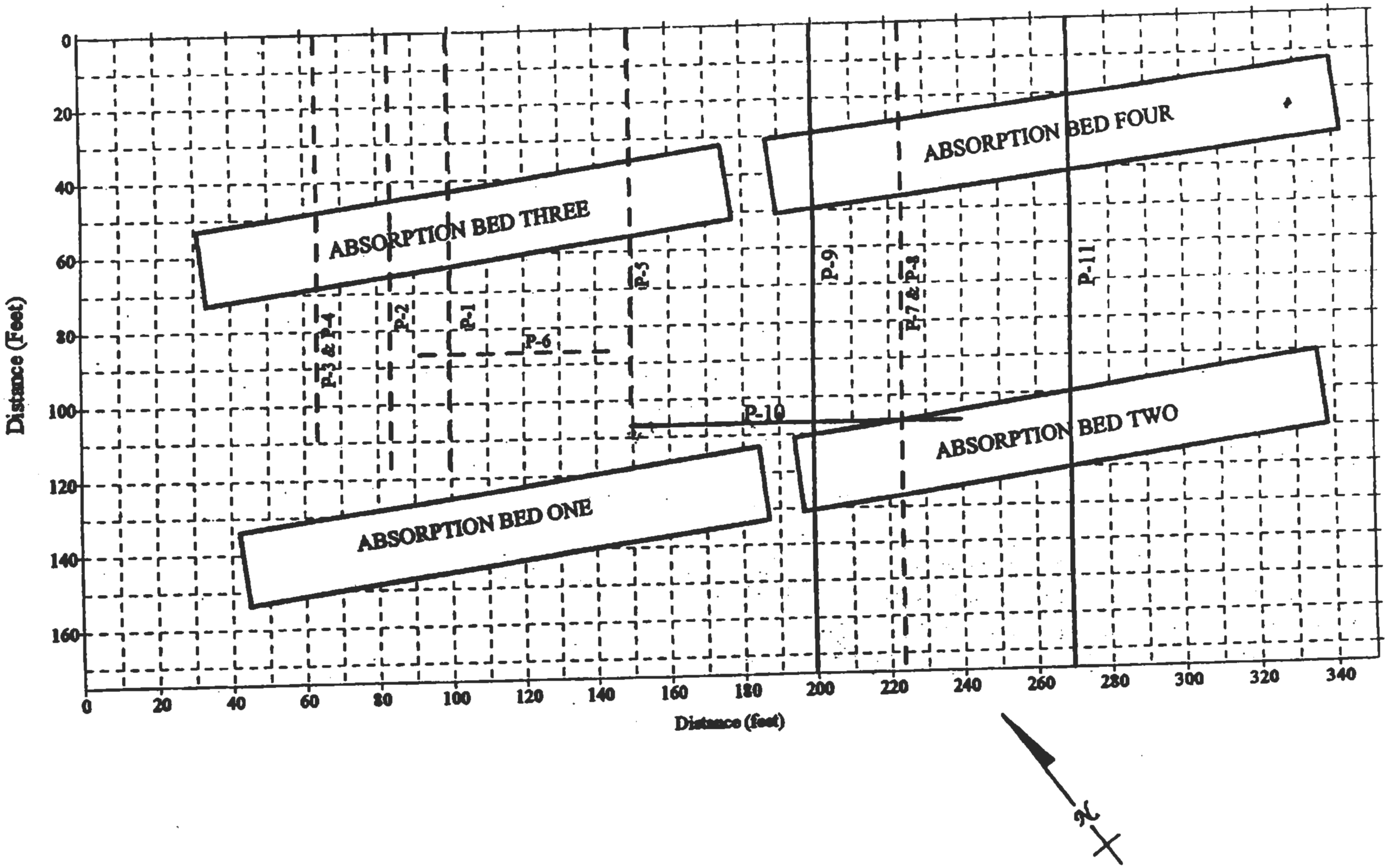
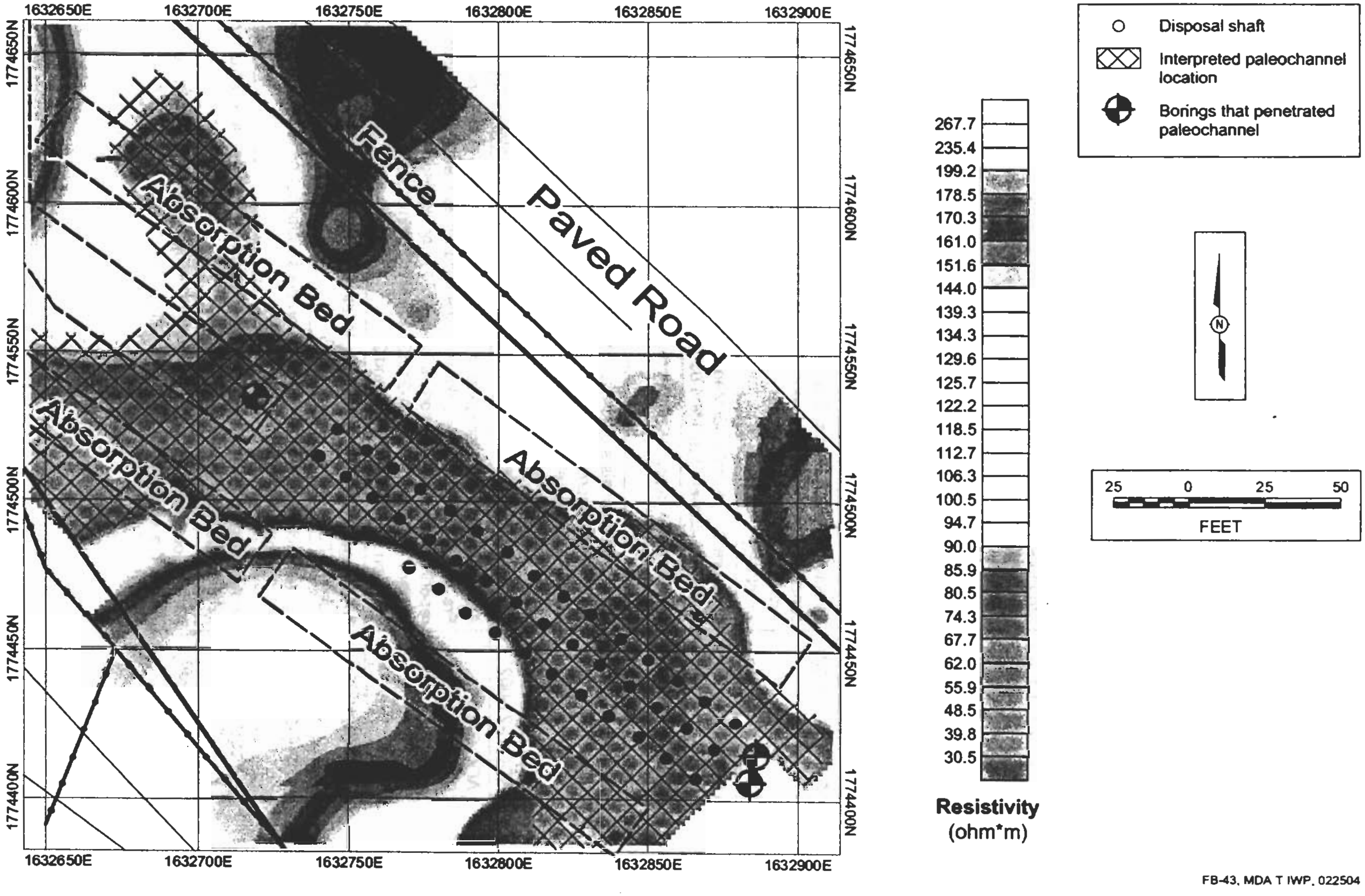


**Figure B-41. Locations of 19 boreholes drilled during the 1996–1997 investigation**



FB-42, MDA T IWP, 022704
Source: Geophex 1996, 64694.1, p. [unnumbered]

Figure B-42. Location of GPR profiles at MDA T



FB-43, MDA T IWP, 022504

Figure B-43. Results of 2003 geophysical survey at MDA T showing interpreted paleochannel location

## Table B-1
## Summary of SWMUs and AOCs within Consolidated SWMU 21-016(a)-99

| General Type | SWMU or AOC | Description |
|---|---|---|
| "Salamander" Releases | SWMU 21-007[1] | Airborne releases from incinerators. |
| Building 035, Former Liquid Waste Treatment Facility | SWMU 21-010(a)[1] | Structure 035, a industrial liquid waste treatment facility used for treating and disposing of contaminated liquid waste from plutonium and uranium-processing laboratories at DP site beginning in 1952. |
| | SWMU 21-010(b)[1] | Structure 93, initially a water manhole that was changed to an acid valve pit manhole. It was located on the southwest corner of Building 035. |
| | SWMU 21-010(c)[1] | Structure 145, a steel 500-gal. underground process tank located near the southwest corner of Building 21-035 and subsequently removed in 1959. |
| | SWMU 21-010(d)[1] | Structure 147, a steel 500-gal. underground process tank located near the southwest corner of Building 21-035 and subsequently removed in 1959. |
| | SWMU 21-010(e)[1] | Structure 185, a 390-gal. sanitary waste septic tank and leach field located on the northeast corner of Building 035. |
| | SWMU 21-010(f)[1] | Structure 192, a grit chamber (8 ft long x 3 ft wide x 7 ft deep), constructed of reinforced concrete with an insulated built-up cover. It was located at the northeast corner of Building 035. (No drawings exist for this structure.) |
| | SWMU 21-010(g)[1] | Structure 255, a 2000-gal. aboveground process tank located at the southwest corner of Building 035. |
| | SWMU 21-010(h)[1] | Structure 271, a process manhole located at the southwest corner of Building 035. |
| | SWMU 21-011(c)[1] | This SWUM consists of two structures: Structure 120, a 4000-gal. holding tank located approximately 35 ft north of Building 035, and Structure 121, a sump located between Absorption Bed 1 and 2 that acted as a distribution box for effluent. |
| | AOC C-21-002[2] | A leak of radionuclides from a waste storage tank to the surrounding soil. |
| | AOC C-21-028(a)[1] | An inactive satellite storage area utilized for the storage of acetone and Freon. Location of site is unknown. The solid waste management units report identifies this location as TA-21-121 near loading docks. The Rogers' report indicates TA-21-121 is the location of the distribution box between Absorption Beds 1 and 2. |
| | AOC C-21-034[2] | A 1000-gal. raffinate holding tank, located at the southwest corner of Building 035. |
| | AOC C-21-035[2] | Former location of an aboveground process water holding tank (Structure 110) on the south side of Building 035. |
| | AOC C-21-036[2] | Former location of an aboveground process water holding tank (Structure 111) on the south side of Building 035. |
| | AOC C-21-037[2] | Former location of a 2,000 gal. Aboveground process tank (Structure 256) at the southwest corner of Building 035. |

### Table B-1 (continued)

| General Type | SWMU or AOC | Description |
|---|---|---|
| Building 21-257 Current Liquid Waste Treatment Facility | SWMU 21-011(a) | Structure 257, the new industrial liquid waste treatment facility, constructed to treat liquid waste from plutonium processing operations associated with DP site. |
| | SWMU 21-011(d and e)[1] | Structures 110 and 111, two 13,500-gal. aboveground process water holding tanks located on the west side of Building 257. |
| | SWMU 21-011(f and g)[1] | Structures 112 and 113, two 12,700-gal. final effluent holding tanks located on the northwest side of Building 257. |
| | AOC 21-011(h)[1] | Former location of a 2000-gal. aboveground process tank at the southwest corner of Building 257. |
| | SWMU 21-011(i)[1] | Structure 288, a 1000-gal. tank storing 50% sodium hydroxide, was located on the west side of Building 257. |
| | SWMU 21-011(j)[1] | Structure 289, a 1600-gal. americium raffinate storage tank located on the west side of Building 257. |
| | AOC C-21-001[1] | A containerized radioactive sludge storage area at southwest corner of Building 257. |
| | AOC C-21-005[2] | A release of americium-241 and plutonium-239 on the west side of Building 257. |
| | AOC C-21-007[2] | A 1982 spill from a tank vent that released americium-241, plutonium-239, and uranium-233 to the surrounding area. |
| | AOC C-21-033[2] | A 1976 cement paste spill that occurred when radioactive cement was being pumped from Building 257 to shafts located between Absorption Beds 1 and 3. |
| Waste disposal at MDA T | SWMU 21-016(a)[1] | The location of four inactive absorption beds. |
| | SWMU 21-016(b)[1] | The retrievable waste storage area (RWSA). |
| | SWMU 21-016(c)[1] | The Shaft Disposal Area. |
| | AOC C-21-009[1] | A 1978 spill of americium-241 cement paste that occurred during the filling of the shafts. |
| | AOC C-21-012[1] | A 1976 spill of cement paste contaminated with americium-241 and plutonium occurred during the filling of corrugated metal pipes (CMPs). |

[1] Included in Consolidated SWMU 21-016(a)-99

[2] Within footprint of Consolidated SWMU 21-016(a)-99

## Table B-2
## Detail at MDA T on 8-ft- and 6-ft-Diameter Shafts

| Shaft Number | Date Completed | Date Filled | Approximate Depth | Substrate and Comments |
|---|---|---|---|---|
| Shaft 1 | 5-17-71 | 10-25-73 | 5.7 m (18.7 ft.) H-7<br>18.9 m (62.0 ft.) Zia | Dirt to 5.5 m (18 ft.)<br>Tuff 5.5-19.8 m (18-65 ft.) |
| Shaft 2 | | 10-14-70 | 6.4 m (21.0 ft.) H-7<br>7.0 m (23.0 ft.) Zia | Boulders at 6.1 m (20 ft.) |
| Shaft 3 | | 4-10-69 | 8.2 m (27.0 ft.) H-7 | |
| Shaft 5 | | 9-9-71 | 18.8 m (61.8 ft.) H-7<br>19.5 m (64.0 ft.) Zia | Tuff |
| Shaft 6 | 3-20-75 | 8-4-75 | 8.2 m (26.8 ft.) H-7<br>6.7 m (22.0 ft.) Zia | 1.0 m (3.0 ft.) pilot hole<br>Boulders in tuff. |
| Shaft 8 | 6-0-74 | | 20.4 m (66.8 ft.) H-7 | |
| Shaft 9 | | 2-16-70 | 19.2 m (63.0 ft.) H-7<br>19.5 m (64.0 ft.) Zia | 0.9-12 m (3-4 ft.)<br>Boulder at 5.5-6.1 m (18-20 ft.) |
| Shaft 10 | | 7-20-71 | 7.1 m (23.2 ft.) H-7<br>7.9 m (26.0 ft.) Zia | Boulders at 7.6 m (25 ft.)<br>Boulders on NE side |
| Shaft 11 | | 11-19-69 | 8.5 m (28.0 ft.) H-7 | |
| Shaft 13 | 9-18-73 | 7-2-74 | 19.8 m (65.0 ft.) Zia | Tuff at 4.6 m (15 ft.)<br>Dirt to 4.6 m (15 ft.) |
| Shaft 17 | | 4-10-69 | 15.2 m (50.0 ft.) H-7 | |
| Shaft 18 | | 11-6-69 | 18.0 m (59.0 ft.) H-7 | |
| Shaft 19 | | 9-5-68 | 19.8 m (65.0 ft.) H-7 | |
| Shaft 20 | 11-25-70 | 2-11-71 | 19.2 m (63.0 ft.) H-7<br>18.9 m (62.0 ft.) Zia | Tuff. Hard from 3.0-6.2 m (10-20 ft.), easy on down. |
| Shaft 21 | | 6-12-72 | 19.0 m (62.3 ft.) H-7<br>19.2 m (63.0 ft.) Zia | Tuff. Hard about 10.7 m (35 ft.) |
| Shaft 22 | 4-9-70 | 8-10-70 | 19.5 m (64.0 ft.) H-7<br>19.2 m (63.0 ft.) Zia | Tuff. Hard for 13.7 m (45 ft.)<br>No boulders. |
| Shaft 23 | 12-1-70 | 5-25-71 | 19.1 m (62.7 ft.) H-7<br>19.2 m (63.0 ft.) Zia | Tuff to 5.5 m (18 ft.) 5.5-8.5 m (18-28 ft.) boulders. Tuff on down. |
| Shaft 24 | 3-13-70 | 5-6-70 | 18.6 m (61.0 ft.) | Boulders at 5.5-8.8 m (18-29 ft.)<br>Boulder layer 0.6 m (2 ft.) thick on N side and 3.4 m (11 ft.) thick on SW side. Hot material 8.8-10 m (29-33 ft.) |
| Shaft 25 | 8-26-70 | 9-15-70 | 4.9 m (16.0 ft.) H-7<br>5.5 m (18.0 ft.) Zia | Boulders at 6.4 m (21 ft.) |
| Shaft 26 | | 3-16-70 | 4.6 m (15.0 ft.) H-7 | |
| Shaft 27 | | 11-22-68 | 17.7 m (58.0 ft.) H-7 | |
| Shaft 28 | 9-5-73 | 3-13-74 | 20.4 m (67.0 ft.) Zia | Tuff. Reamed to 19.5 m (64 ft.) |

Source: Rogers 1977, 05707.2, p. T-13.

## Table B-2 (continued)

| Shaft Number | Completed | Filled | Approximate Depth | Substrate and Comments |
|---|---|---|---|---|
| Shaft 29 | 4-19-71 | 6-12-72 | 18.5 m (60.7 ft.) H-7<br>19.8 m (65.0 ft.) Zia | Tuff. |
| Shaft 30 | 8-7-70 | 11-5-70 | 18.9 m (62.0 ft.) H-7<br>19.1 m (62.5 ft.) Zia | Tuff. Hard from 7.6-9.1 m (25-30 ft.) |
| Shaft 31 | 5-3-71 | 2-18-72 | 5.6 m (18.3 ft.) H-7<br>7.0 m (23.0 ft.) Zia | Boulders from 4.9-7.0 m (16-23 ft.) |
| Shaft 32 | 4-6-70 | 6-3-70 | 4.6 m (15.0 ft.) | Boulders about 1/4 of hole. |
| Shaft 33 | | 8-14-69 | 19.5 m (64.0 ft.) H-7 | |
| Shaft 34 | 5-6-71 | 2-7-72 | 18.4 m (60.3 ft.) H-7<br>18.3 m (60.0 ft.) Zia | Boulders from 4.9-9.8 m (16-32 ft.)<br>Tuff to 18.3 m (60 ft.) |
| Shaft 35 | 6-2-72 | 8-10-72 | 19.0 m (62.3 ft.) H-7<br>18.9 m (62.0 ft.) Zia | Tuff. Easy |
| Shaft 36 | 4-22-71 | 3-2-72 | 18.7 m (61.3 ft.) H-7<br>19.8 m (65.0 ft.) Zia | Tuff hard to 9.1 m (30 ft.) easy on down. |
| Shaft 41 | 5-12-71 | 10-4-72 | 18.9 m (62.0 ft.) | |
| Shaft 42 | 8-28-70 | 12-6-70 | 6.4 m (21.0 ft.) H-7<br>7.0 m (23.0 ft.) Zia | Boulders at 7.0 m (23 ft.) |
| Shaft 43 | 8-22-74 | 4-3-75 | 18.9 m (62.0 ft.) Zia | Pilot hole 19.8 m (65 ft.) deep |
| Shaft 44 | 4-28-71 | 11-12-71 | 19.2 m (62.9 ft.) H-7<br>20.1 m (66.0 ft.) Zia | Hard tuff to 10.7 m (35 ft.)-<br>Soft to 19.8 m (65 ft.) |
| Shaft 46 | 9-11-72 | 2-23-73 | 20.1 m (65.8 ft.) H-7<br>20.1 m (66.0 ft.) Zia | Boulders at 4.9-8.2 m (16-27 ft.)<br>Hard tuff to 14.0 m (46 ft.). Tuff to 20.1 m (66 ft.). |
| Shaft 47 | 8-23-74 | 5-13-75 | 7.6 m (25.0 ft.) Zia | Boulders in bottom |
| Shaft 48 | 10-31-72 | 5-16-74 | 19.2 m (63.0 ft.) | Tuff. Hard from 4.6-10.7 m (15-35 ft.) |
| Shaft 49 | 9-12-74 | 12-5-74 | 18.9 m (62.0 ft.) | Pilot hole 20.1 m (66 ft.) deep tuff. Hard from 4.6-12.2 m (15-40 ft.) |
| Shaft 50 | 9-25-72 | 3-28-73 | 19.9 m (65.3 ft.) H-7<br>14.3 m (47.0 ft.) Zia | 1.2 m (4 ft.) hole to 19.8 m (65 ft.) hot hole. |
| Shaft 51 | 8-20-73 | 4-5-74 | 9.1 m (30.0 ft.) | Tuff to 5.5 m (18 ft.). Boulders 5.5-9.1 m (18-30 ft.) |
| Shaft 52 | 8-31-72 | 2-23-73 | 7.1 m (23.3 ft.) H-7<br>7.0 m (23.0 ft.) Zia | Boulders at 5.2 m (17 ft.) |
| Shaft 53 | 8-24-73 | 12-6-73 | 4.8 m (15.8 ft.) H-7<br>14.8 m (48.5 ft.) Zia | Dirt to 5.2 m (17 ft.). Boulders to 7.6 m (25 ft.). Tuff to 19.8 m (65 ft.). Boulder in pilot hole. |
| Shaft 54 | 10-20-72 | 5-23-73 | 19.1 m (62.8 ft.) H-7<br>19.2 m (63.0 ft.) Zia | Tuff. Hard from 4.6-10.7 m (15-35 ft.) |
| Shaft 55 | 9-12-73 | 8-23-74 | 20.1 m (66.0 ft.) Zia<br>18.9 m (62.0 ft.) H-7 | Dirt to 4.6 m (15 ft.). Tuff to 20.1 m (66 ft.) |

Source: Rogers 1977, 05707.2, p. T-14.

## Table B-2 (continued)

| Shaft Number | Date Completed | Date Filled | Approximate Depth | Substrate and Comments |
|---|---|---|---|---|
| 56 | 10-6-72 | 6-22-73 | 19.2 m (63.0 ft.) Zia | Boulders 5.5-6.7 m (18-22 ft.)<br>Tuff to 19.8 m (65 ft.) |
| 57 | 8-23-74 | 4-22-75 | 7.6 m (25.0 ft.) Zia | Boulders in bottom |
| 58 | 8-28-72 | 1-17-73 | 6.8 m (22.3 ft.) H-7<br>7.3 m (24.0 ft.) Zia | Boulders in 5.5-6.7 m (18-22 ft.) |
| 59 | 9-17-74 | 2-7-75 | 16.5 m (54.0 ft.) Zia | Boulders 4.6-6.1 m (15-20 ft.) |
| 60 | 10-16-72 | 8-3-73 | 5.8 m (19.1 ft.) H-7<br>19.4 m (63.5 ft.) Zia | Tuff. Hard 4.6-10.7 m (15-35 ft.) |
| 70 | 8-20-75 | 12-11-75 | 20.7 m (67.8 ft.) H-7<br>19.4 m (63.5 ft.) Zia | Tuff. Hard 4.6-12.2 m (15-40 ft.) |
| 75 | 3-25-75 | 7-2-75 | 20.3 m (66.5 ft.) H-7<br>19.2 m (63.0 ft.) Zia | Tuff. Hard 4.6-10.7 m (15-35 ft.) |
| 76 | 8-15-75 | 10-9-75 | 20.5 m (67.3 ft.) H-7<br>19.2 m (63.0 ft.) Zia | Tuff. Hard 4.6-10.7 m (15-35 ft.) |
| 78 | 12-1-75 | 5-12-76 | 19.7 m (64.7 ft.) H-7<br>18.3 m (60.0 ft.) Zia | Boulders 6.1-9.1 m (20-30 ft.) |
| 80 | 10-30-75 | 2-20-76 | 20.1 m (66.0 ft.) H-7<br>19.2 m (63.0 ft.) Zia | Tuff. Hard 4.6-12.2 m (15-40 ft.) |
| 82 | 9-30-75 | | 19.5 m (64.0 ft.) H-7<br>18.7 m (61.5 ft.) Zia | Tuff. Hard 4.6-12.2 m (15-40 ft.) |
| 83 | 10-15-75 | 12-16-75 | 7.3 m (24.0 ft.) H-7<br>6.6 m (21.5 ft.) Zia | Tuff. Hard 4.6-12.2 m (15-40 ft.)<br>Hot material SW side |
| 84 | 3-12-76 | 7-28-76 | 15.1 m (49.5 ft.) H-7<br>15.8 m (52.0 ft.) Zia | Boulders from 6.1-8.2 m (20-27 ft.) |
| 87 | 10-10-75 | | 20.0 m (65.5 ft.) H-7<br>19.1 m (62.5 ft.) Zia | Tuff. Hard 4.6-12.2 m (15-40 ft.) |
| 91 | 9-17-76 | | 7.9 m (26.0 ft.) H-7 | |
| 92 | 9-21-76 | | 8.2 m (26.8 ft.) H-7 | |
| 94 | 9-23-76 | | 6.6 m (21.7 ft.) H-7 | |
| 95 | 9-28-76 | | 4.9 m (15.9 ft.) H-7 | |
| 100 | 3-19-76 | | 20.2 m (66.3 ft.) H-7<br>19.4 m (63.5 ft.) Zia | Boulders on SW side at 7.3 m (24 ft.). Tuff on down. |
| 101 | 3-17-76 | | 7.0 m (23.0 ft.) Zia | Boulders at 5.5 m (18 ft.). Hole abandoned at 7.0 m (23 ft.) because encountered hot material. Filled with dirt. |

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This table is composed of data from the Zia Company and Group H-7.

* Shafts 1-60 are 2.4 m (8 ft.) diameter shafts; shafts 70-87 are 1.8 m (6 ft.) diameter shafts.

Source: Rogers 1977, 05707.2, p. T-15.

## Table B-3

## Volume of Wastewater Discharge to Absorption Beds at MDA T in Gallons

| Year | From DPE[b] | From DPW[c] | Year | From DPE | From DPW |
|---|---|---|---|---|---|
| 1945 | 0 | 792,537 (est) | 1966 | 1,150,500 | 0 |
| 1946 | 0 | 1,056,716 (est) | 1967 | 175,943 | 0 |
| 1947 | 0 | 1,320,895 (est) | 1968 | 0 | 0 |
| 1948 | 0 | 1,585,074 (est) | 1969 | 0 | 0 |
| 1949 | 0 | 1,577,413 | 1970 | 0 | 0 |
| 1950 | 0 | 2,649,715 | 1971 | 0 | 0 |
| 1951 | 0 | 3,592,834 | 1972 | 0 | 0 |
| 1952 | 0 | 1,426,567 | 1973 | 0 | 0 |
| 1953 | 0 | 217,155 | | | |
| 1954 | 0 | 54,421 | | | |
| 1955 | 0 | 366,945 | | | |
| 1956 | 0 | 520,433 | | | |
| 1957 | 0 | 419,252 | | | |
| 1958 | 0 | 173,566 | | | |
| 1959 | 0 | 193,115 | | | |
| 1960 | 0 | 198,134 | | | |
| 1961 | 0 | 30,909 | | | |
| 1962 | 0 | 13,473 | | | |
| 1963 | 0 | 60,761 | | | |
| 1964 | 0 | 25,890 | | | |
| 1965 | 658,334 | 36,193 | | | |

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[a] Emelity (1974).

[b] DPW Delta Prime, West□Plutonium Facility.

[c] DPW Delta Prime, East□Plutonium Facility.

Source: LANL 1991, 07528.1, p. 16-144, modified by A. Kron 11/17/03.

## Table B-4

## Volume of Flow into Building 035 Treatment Plant and Influent and Effluent Concentrations of Gross Alpha and Plutonium

| Year | Volume (thousands of gallons) | Gross Alpha | | Plutonium | | |
|---|---|---|---|---|---|---|
| | | Influent (thousands of counts per minute per liter[1]) | Effluent (counts per minute per liter[1]) | Influent (milli-grams liter[1]) | Effluent (counts per minute per plant (mg) | Total equiv. to |
| 1952 | 2,683.0 | 58.2 | 35 | 8,781 | 35.0 | 8,781 |
| 1953 | 4,043.6 | 421.0 | 52 | 92,378 | 79.0 | 92,378 |
| 1954 | 3,226.8 | 187.0 | 73 | 33,560 | 93.0 | 37,836 |
| 1955 | 2,894.5 | 218.0 | 116 | 30,004 | 97.0 | 36,555 |
| 1955 | 3,810.1 | 90.0 | 60 | 18,490 | 59.0 | 23,683 |
| 1957 | 4,712.9 | 58.5 | 65 | 14,883 | 65.0 | 21,030 |
| 1958 | 2,658.8 | 163.0 | 64 | 23,949 | 62.0 | 38,017 |
| 1959 | 2,496.4 | 236.0 | 114 | 32,532 | 98.8 | 56,541 |
| 1960 | 2,294.1 | 626.0 | 310 | 81,159 | 223.0 | 427,829[a] |
| 1961 | 2,488.2 | 661.0 | 695 | 99,154 | 639.0 | 173,938 |

[1] Weighted average

[a] Includes 1.141 gram^ of plutonium 238

Source: Abraham, J. H. (1962, 08147, p. 26)

## Table B-5
## Volume of Wastewater from TSTA to Building 257, 1983 to 2002

| Year | Total Influent Waste (L) |
|---|---|
| 1983 | 4,347,100 |
| 1984 | 3,458,000 |
| 1985 | 3,130,000 |
| 1986 | 5,184,000 |
| 1987 | 3,840,000 |
| 1988 | 3,454,000 |
| 1989 | 2,329,899 |
| 1990 | 2,045,171 |
| 1991 | 2,084,218 |
| 1992 | 1,504,858 |
| 1993 | 895,650 |
| 1994 | 715,007 |
| 1995 | 606,443 |
| 1996 | 980,000 |
| 1997 | 980,000 |
| 1998 | 367,000 |
| 1999 | 45,000 |
| 2000 | 413,000 |
| 2001 | 408,221 |
| 2002 | 30,280 |

Source: Sagez 2003, 76095.

## Table B-6
## Amounts of Plutonium-239 Discarded in Bathyspheres

| Shaft # | Pu-239 in Bathyspheres (Grams) |
|---|---|
| 3 | 290 |
| 17 | 342 |
| 18 | 134 |
| 19 | 245 |
| 26 | 210 |

Source: Haaker 2003, 76097, p. 9/14.

## Table B-7
## Shaft Disposal of Plutonium Radioactive Waste at MDA T

| Shaft Number | Status | Approximate Depth m (ft.) | Cement Paste in Liters | Equivalent $^{239}$Pu in g | Number Spheres and g of $^{239}$Pu |
|---|---|---|---|---|---|
| $1^{a,249}$ | Filled on 10-25-73 | 5.7 m<br>(18.7 ft) | 67,440 | 1204 | |
| $2^{b,250}$ | Filled on 10-14-70 | 6.4 m<br>(21.0 ft) | 23,919 | 111.15 | |
| $3^{248,251}$ | Filled on 4-10-69 | 8.2 m<br>(27.0 ft) | 10,750 | 10 | 3 spheres<br>290 g $^{239}$Pu |
| $5^{252}$ | Filled on 9-9-71 | 18.8 m<br>(61.8 ft) | 87,200 | 905.68 | |
| $6^{187}$ | Filled on 8-4-75 | 8.2 m<br>(26.8 ft) | 35,000 | 700 | |
| 8 | Augered on 6-6-74 | 20.4 m<br>(66.8 ft) | | | |
| $9^{253}$ | Filled on 2-16-70 | 19.2 m<br>(63.0 ft) | 88,775 | 1142.62 | |
| $10^{252}$ | Filled on 7-20-71 | 7.1 m<br>(23.2 ft) | 18,660[c] | 158.52[d] | |
| $11^{251}$ | Filled on 11-19-69 | 8.5 m<br>(28.0 ft) | 18,953[e] | 147[e] | |
| $13^{f,254}$ | Filled on 7-2-74 | 19.8 m<br>(65.0 ft) | 85,500 | 1988 | |
| $17^{248,251}$ | Filled on 4-10-69 | 15.2 m<br>(50.0 ft) | 87,240 | 1237 | 9 spheres<br>342 g $^{239}$Pu |
| $18^{251}$ | Filled on 11-6-69 | 18.0 m<br>(59.0 ft) | 83,442 | 713 | 3 spheres<br>134 g $^{239}$Pu |
| $19^{248,251}$ | Filled on 9-5-68 | 19.8 m<br>(65.0 ft) | 80,280 | 241 | 3 spheres<br>245 g $^{239}$Pu |
| $20^{255}$ | Filled on 2-11-71 | 19.2 m<br>(63.0 ft) | 89,540 | 1182.72 | |
| $21^{256}$ | Filled on 6-12-72 | 19.0 m<br>(62.3 ft) | 87,293 | 841.06 | |
| $22^{250}$ | Filled on 8-10-70 | 19.5 m<br>(64.0 ft) | 88,758 | 908.20 | |
| $23^{255}$ | Filled on 5-25-71 | 19.1 m<br>(62.7 ft) | 80,699 | 1182.64 | |
| $24^{253}$ | Filled on 5-6-70 | 18.6 m<br>(61.0 ft) | 84,103 | 1066.95 | |
| $25^{250}$ | Filled on 9-15-70 | 4.9 m<br>(16.0 ft) | 23,458 | 490.14 | |
| $26^{253}$ | Filled on 3-16-70 | 4.6 m<br>(15.0 ft) | 21,306 | 175.73 | 3 spheres<br>210 g $^{239}$Pu |
| $27^{248,251}$ | Filled on 11-22-68 | 17.7 m<br>(58.0 ft) | 82,770 | 906 | |
| $28^{257}$ | Filled on 3-13-74 | 20.4 m<br>(67.0 ft) | 89,880 | 2063 | |
| $29^{256}$ | Filled on 6-12-72 | 18.5 m<br>(60.7 ft) | 87,847 | 795.22 | |
| $30^{250}$ | Filled on 11-5-70 | 18.9 m<br>(62.0 ft) | 87,086 | 678.98 | |

Source: Rogers 1977, 05707.2, p. T-7.

## Table B-7 (continued)

| Shaft Number | Status | Approximate Depth m (ft.) | Cement Paste in Liters | Equivalent $^{239}$Pu in g | Number Spheres and g of $^{239}$Pu |
|---|---|---|---|---|---|
| 31[256] | Filled on 2-18-72 | 5.6 m<br>(18.3 ft) | 25,900 | 113.78 | |
| 32[250] | Filled on 6-3-70 | 4.6 m<br>(15.0 ft) | 22,509 | 413.11 | |
| 33[248,251] | Filled on 8-14-69 | 19.5 m<br>(64.0 ft) | 90,486 | 1352 | |
| 34[256] | Filled on 7-7-72 | 18.4 m<br>(60.3 ft) | 89,265 | 815.15 | |
| 35[258] | Filled on 8-10-72 | 19.0 m<br>(62.3 ft) | 87,725 | 1058.36 | |
| 36[258] | Filled on 3-2-72 | 18.7 m<br>(61.3 ft) | 89,410 | 956.31 | |
| 41[258] | Filled on 10-4-72 | 18.9 m<br>(62.0 ft) | 68,600 | 913.67 | |
| 42[250] | Filled on 12-8-70 | 6.4 m<br>(21.0 ft) | 32,731 | 101.23 | |
| 43[187] | Filled on 4-3-75 | 18.9 m<br>(62.0 ft) | 89,000 | 2080 | |
| 44[252] | Filled on 11-12-71 | 19.2 m<br>(62.9 ft) | 87,890 | 917.52 | |
| 46[259] | Filled on 2-23-73 | 20.1 m<br>(65.8 ft) | 82,540 | 1510.57 | |
| 47[187] | Filled on 5-13-75 | 7.6 m<br>(25.0 ft) | 35,100 | 880 | |
| 48[g,257] | Filled on 5-16-74 | 19.2 m<br>(63.0 ft) | 65,760 | 1520 | |
| 49 | Filled on 12-5-74 | 18.9 m<br>(62.0 ft) | 92,800 | 2894 | |
| 50[259] | Filled on 3-28-73 | 19.9 m<br>(65.3 ft) | 72,290 | 1052.64 | |
| 51[257] | Filled on 4-5-74 | 9.1 m<br>(30.0 ft) | 38,620 | 672 | |
| 52[259] | Filled on 2-23-73 | 7.1 m<br>(23.3 ft) | 32,740 | 699.61 | |
| 53[249] | Filled on 12-6-73 | 4.8 m<br>(15.8 ft) | 71,610 | 1983 | |
| 54[259] | Filled on 5-23-73 | 19.1 m<br>(62.8 ft) | 90,630 | 1542.28 | |
| 55[h,254] | Filled on 8-23-74 | 18.9 m<br>(62.0 ft) | 90,600 | 1533 | |
| 56[259] | Filled on 6-22-73 | 19.2 m<br>(63.0 ft) | 83,870 | 1332.57 | |
| 57[187] | Filled on 4-22-75 | 7.6 m<br>(25.0 ft) | 37,200 | 700 | |
| 58[259] | Filled on 1-17-73 | 6.8 m<br>(22.3 ft) | 31,950 | 388.98 | |
| 59[187] | Filled on 2-7-75 | 16.5 m<br>(54.0 ft) | 77,400 | 1980 | |
| 60[249] | Filled on 8-3-73 | 5.8 m<br>(19.1 ft) | 90,460 | 1908 | |

Source: Rogers 1977, 05707.2, p. T-8.

## Table B-7 (continued)

| Number | Status | Approximate Depth m (ft.) | Cement Paste in Liters | Equivalent $^{239}$Pu in g | Number Spheres and g of $^{239}$Pu |
|---|---|---|---|---|---|
| 70[187]<br>6-10[i] | Filled on 12-11-75 | 20.7 m<br>(67.8 ft) | 52,400 | 1708 | |
| 75[187]<br>6-15[i] | Filled on 7-2-75 | 20.3 m<br>(66.5 ft) | 52,800 | 1980 | |
| 76[187]<br>6-16[i] | Filled on 10-9-75 | 20.5 m<br>(67.3 ft) | 52,600 | 3010 | |
| 78[187(281)] | Filled on 5-12-76 | 19.7 m<br>(64.7 ft) | 49,800 | 68.73 | |
| 80[187(281)]<br>6-20[i] | Filled on 2-20-76 | 20.1 m<br>(66.0 ft) | 56,300 | 34.04 | |
| 82[187]<br>6-22[i] | Augered on 9-30-75 | 19.5 m<br>(64.0 ft) | | | |
| 83[187]<br>6-23[i] | Filled on 12-16-75 | 7.3 m<br>(24.0 ft) | 18,000 | 430 | |
| 84[j] | Filled on 7-28-76 | 15.1 m<br>(49.5 ft) | 37,700 | 36.97 | |
| 87[187]<br>6-27[i] | Augered on 10-10-75 | 20.0 m<br>(65.5 ft) | | | |
| 91 | Augered on 9-17-76 | 7.9 m<br>(26.0 ft) | | | |
| 92 | Augered on 9-21-76 | 8.2 m<br>(26.8 ft) | | | |
| 94 | Augered on 9-23-76 | 6.6 m<br>(21.7 ft) | | | |
| 95 | Augered on 9-28-76 | 4.9 m<br>(15.9 ft) | | | |
| 100 | Augered on 3-19-76 | 20.2 m<br>(66.3 ft) | | | |

[a] "Shaft was used for wash waters for 21 PMR runs and contains an unknown amount of activity from these washings."[249]

[b] "Shaft 2 received wash water of 33 runs. Wash water contains unaccounted activity."[250]

[c] Plus about 14,200 liters of solids from washdown.[252]

[d] Does not include radioactivity from washdown solids.

[e] "Cement paste only. Remainder of shaft about 21,300 liters, was filled with washdown residue over a period of about 8 months (21 pug mill runs). Equivalent $^{235}$Pu in the residue is probably greater than the $^{239}$Pu in the cement paste added to this shaft."[251]

[f] "This shaft was used for rinse water from 13 Pug Mill Runs and contains an unknown amount of rinse solids'[254]

[g] Contains washings from 62 PMR runs and contains an unknown amount of activity from these runs[254]

[h] "This shaft was used for rinse water from 10 Pug Mill Runs and contains an unknown amount of rinse solids"[254]

[i] Shaft number before 3-12-76[260]

[j] Personal communication P.E. McGinnis, H-7

Source: Rogers 1977, 05707.2, p. T-9.

## Table B-8
## Salamander Waste Management Records from HSE-7

| Date | Salamander Number | ID of Contaminated Organic Liquid incinerator | Volume of Contaminated Liquid Incinerator (gal.) | Gross Alpha Salamander Ash (c/m/g) | Gross Alpha Stovepipe Ash (c/m/g) |
|---|---|---|---|---|---|
| 8/10/64 | 1 | TCP[1] | 1.5 | | |
| 8/11/64 | 1 | TCP | 2 | | |
| | 1 | TCP | 1.5 | | |
| 8/12/64 | 1 | TCP | 1 | | |
| | | | | 2,903,000 | 4790 |
| 8/13/64 | 1 | TCP | 2 | | |
| 8/14/64 | 1 | TCP | 2 | | |
| 8/17/64 | 1 | TCP | 2 | | |
| 8/18/64 | 1 | TCP | 2 | | |
| | 1 | TCP | 1 | | |
| 8/19/64 | 1 | TCP | 2 | | |
| 8/20/64 | 1 | TCP | 2 | | |
| 8/21/64 | 1 | TCP | 2.5 | | |
| | | | | 536,700 | 1790 |
| 8/24/64 | 1 | TCP | 1.5 | | |
| | 1 | TCP | 1.5 | | |
| 8/25/64 | 1 | TCP | 2.5 | | |
| 8/26/64 | 1 | TCP | 1.5 | | |
| | 2 | TCP | 1.5 | | |
| | 3 | TCP | 1.5 | | |
| | 1 | TCP | 1 | | |
| | 2 | TCP | 1 | | |
| | 3 | TCP | 1 | | |
| 8/27/64 | 1 | TCP | 1.5 | | |
| | 2 | TCP | 1.5 | | |
| | 3 | TCP | 1.5 | | |
| | 1 | TCP | 1 | | |
| | 2 | TCP | 1 | | |
| 8/28/64 | 1 | TCP | 1.5 | | |
| | 2 | TCP | 1.5 | | |
| | 3 | TCP | 1.5 | | |
| 8/31/64 | 1 | TCP | 2 | | |
| | 2 | TCP | 2 | | |
| | 3 | TCP | 2 | | |
| 9/1/64 | 1 | TCP | 1.5 | | |
| | 2 | TCP | 1.5 | | |
| | 3 | TCP | 1.5 | | |

## Table B-8 (continued)

| Date | Salamander Number | ID of Contaminated Organic Liquid Incinerator | Volume of Contaminated Liquid Incinerator (gal.) | Gross Alpha Salamander Ash (c/m/g) | Gross Alpha Stovepipe Ash (c/m/g) |
|---|---|---|---|---|---|
| 9/2/64 | 1 | TCP | 2 | | |
| | 2 | TCP | 2 | | |
| | 3 | TCP | 2 | | |
| 9/3/64 | 1 | TCP | 1 | | |
| | 2 | TCP | 2 | | |
| | 3 | TCP | 1.5 | | |
| 9/4/64 | 1 | TCP | 1.5 | | |
| | 2 | TCP | 1.5 | | |
| | 3 | TCP | 1.5 | | |
| 9/8/64 | 1 | TCP | 1.5 | | |
| | 2 | TCP | 1.5 | | |
| | 3 | TCP | 1.5 | | |
| | 1 | TCP | | 138,700 | 1456 |
| | 2 | TCP | | 189,100 | 88 |
| | 3 | | | 111,700 | 55 |
| 9/9/64 | 1 | TCP | 1.5 | | |
| | 2 | TCP | 1.5 | | |
| | 3 | TCP | 1.5 | | |
| 9/10/64 | 1 | TCP | 3 | | |
| 9/11/64 | 1 | TCP | 2.5 | | |
| | 2 | TCP | 2.5 | | |
| | 3 | TCP | 1.5 | | |
| 9/14/64 | 1 | TCP | 2.5 | | |
| | 2 | TCP | 3 | | |
| | 3 | TCP | 3 | | |
| 9/15/64 | 1 | TCP | 1.5 | | |
| | 2 | TCP | 1.5 | | |
| | 3 | TCP | 1.5 | | |
| 9/16/64 | 1 | TCP | 3.25 | | |
| | 2 | TCP | 3.25 | | |
| | 3 | TCP | 3.5 | | |
| 9/17/64 | 1 | TCP | 2.5 | | |
| | 2 | TCP | 2.5 | | |
| | 3 | TCP | 2.5 | | |
| 9/18/64 | 1 | TCP | 2.25 | | |
| | 2 | TCP | 2.25 | | |
| | 3 | TCP | 2.5 | | |
| 9/21/64 | 1 | TCP | 1.5 | | |
| | 2 | TCP | 1.5 | | |
| | 3 | TCP | 1.5 | | |

### Table B-8 (continued)

| Date | Salamander Number | ID of Contaminated Organic Liquid Incinerator | Volume of Contaminated Liquid Incinerator (gal.) | Gross Alpha Salamander Ash (c/m/g) | Gross Alpha Stovepipe Ash (c/m/g) |
|---|---|---|---|---|---|
| 9/22/64 | 1 | TCP | 1.5 | | |
| | 2 | TCP | 1.5 | | |
| | 3 | TCP | 1.5 | | |
| 9/23/64 | 1 | TCP | 3 | | |
| | 2 | TCP | 3 | | |
| | 3 | TCP | 3 | | |
| | 1 | TCP | | 18165 | |
| 9/24/64 | 1 | TCP | 2.5 | | |
| | 2 | TCP | 1.5 | | |
| | 3 | TCP | 3 | | |
| 9/25/64 | 1 | TCP | 1.25 | | |
| | 2 | TCP | 1.5 | | |
| | 3 | TCP | 1.5 | | |
| 9/28/64 | 1 | TCP | 2.5 | | |
| | 2 | TCP | 2.5 | | |
| | 3 | TCP | 2.5 | | |
| 9/29/64 | 1 | TCP | 3 | | |
| | 2 | TCP | 2.5 | | |
| | 3 | TCP | 3 | | |
| | 1 | TCP | | 1,206 | 90 |
| | 2 | TCP | | 45,940 | 122 |
| | 3 | TCP | | 97,750 | 36 |
| 9/30/64 | 1 | TCP | 2.5 | | |
| | 2 | TCP | 2.5 | | |
| | 3 | TCP | 2.5 | | |
| 10/1/64 | 1 | TCP | 2 | | |
| | 2 | TCP | 2 | | |
| | 3 | TCP | 2 | | |
| 10/2/64 | 1 | TCP | 2 | | |
| | 2 | TCP | 2 | | |
| | 3 | TCP | 2 | | |
| 10/5/64 | 1 | TCP | 2.5 | | |
| | 2 | TCP | 2.5 | | |
| | 3 | TCP | 2.5 | | |
| 10/6/64 | 1 | TCP | | 2312 | 148 |
| 10/7/64 | 1 | TCP | 3 | | |
| | 2 | TCP | 3 | | |
| | 3 | TCP | 3 | | |

### Table B-8 (continued)

| Date | Salamander Number | ID of Contaminated Organic Liquid incinerator | Volume of Contaminated Liquid Incinerator (gal.) | Gross Alpha Salamander Ash (c/m/g) | Gross Alpha Stovepipe Ash (c/m/g) |
|---|---|---|---|---|---|
| 10/8/64 | 1 | TCP | 3 | | |
| | 2 | TCP | 3 | | |
| | 3 | TCP | 3 | | |
| 10/9/64 | 1 | TCP | 3 | | |
| | 2 | TCP | 3 | | |
| | 3 | TCP | 3 | | |
| 10/12/64 | 1 | TCP | 2.5 | | |
| | 2 | TCP | 2.5 | | |
| | 3 | TCP | 2.5 | | |
| 10/13/64 | 1 | TCP | 1 | | |
| | 2 | TCP | 1 | | |
| | 3 | TCP | 1.25 | | |
| 10/14/64 | 1 | TCP | 3 | | |
| | 2 | TCP | 3 | | |
| | 3 | TCP | 3 | | |
| 10/15/64 | 1 | TCP | 1.5 | | |
| | 2 | TCP | 1.5 | | |
| | 3 | TCP | 1.5 | | |
| 10/16/64 | 1 | TCP | 1.5 | | |
| | 2 | TCP | 2.5 | | |
| | 3 | TCP | 2.5 | | |
| 10/19/64 | 1 | TCP | 3 | | |
| | 2 | TCP | 3 | | |
| | 3 | TCP | 3 | | |
| 10/20/64 | 1 | TCP | 1.5 | | |
| 10/21/64 | 1 | TCP | 3 | | |
| | 2 | TCP | 3 | | |
| | 3 | TCP | 3 | | |
| 10/22/64 | 1 | TCP | 1.5 | | |
| | 2 | TCP | 1.5 | | |
| | 3 | TCP | 1.5 | | |
| 10/23/64 | 1 | TCP | 1.5 | | |
| | 2 | TCP | 2.5 | | |
| | 3 | TCP | 2.5 | | |
| 10/26/64 | 1 | TCP | 1.5 | | |
| | 2 | TCP | 1.5 | | |
| | 3 | TCP | 1.5 | | |
| 10/28/64 | 1 | TCP | 3 | | |
| | 2 | TCP | 3 | | |
| | 3 | TCP | 3 | | |

**Table B-8 (continued)**

| Date | Salamander Number | ID of Contaminated Organic Liquid incinerator | Volume of Contaminated Liquid Incinerator (gal.) | Gross Alpha Salamander Ash (c/m/g) | Gross Alpha Stovepipe Ash (c/m/g) |
|---|---|---|---|---|---|
| 10/29/64 | 1 | TCP | 3 | | |
| | 2 | TCP | 3 | | |
| | 3 | TCP | 3 | | |
| 10/30/64 | 1 | TCP | 1 | | |
| | 2 | TCP | 1.5 | | |
| | 3 | TCP | 1.5 | | |
| 11/3/64 | 1 | TCP | 3 | | |
| 11/5/64 | 1 | TCP | 1.5 | | |
| 11/9/64 | 1 | TCP | 2.5 | | |
| 11/10/64 | 1 | TCP | 3 | | |
| 11/11/64 | 1 | TCP | 1.5 | | |
| 11/12/64 | 1 | TCP | 3 | | |
| 11/25/64 | 1 | TCP | 3 | | |
| 12/2/64 | 1 | TCP | 1.5 | | |
| 12/3/64 | 2 | TCP | 3 | | |
| 12/4/64 | 2 | TCP | 3 | | |
| 12/7/64 | 2 | TCP | 3 | | |
| 12/10/64 | 2 | TCP | 3 | | |
| 12/11/64 | 2 | TCP | 3 | | |
| 12/14/64 | 3 | TCP | 2 | | |
| 12/15/64 | 3 | TCP | 2.5 | | |
| 12/18/64 | 3 | TCP | 2 | | |
| 12/30/64 | | TCP | | 9830 | 506 |
| | | TCP | | 78,050 | 12,920 |
| | | TCP | | 21,050 | 1,580 |
| 1/19/65 | 1 | TCP | 3 | | |
| | 3 | TCP | 3 | | |
| 1/20/65 | 1 | TCP | 2.5 | | |
| | 3 | TCP | 3.25 | | |
| 1/22/65 | 1 | TCP | 3 | | |
| | 3 | TCP | 3 | | |
| 3/15/65 | 1 | TBP[2] | 4 | | |
| | 2 | TBP | 4 | | |
| | 3 | TBP | 4 | | |
| | 1 | TBP | 6 | | |
| | 2 | TBP | 7 | | |
| | 3 | TBP | 6 | | |
| 3/17/65 | 1 | TBP | 6 | | |
| | 2 | TBP | 6 | | |
| | 3 | TBP | 6 | | |

## Table B-8 (continued)

| Date | Salamander Number | ID of Contaminated Organic Liquid incinerator | Volume of Contaminated Liquid Incinerator (gal.) | Gross Alpha Salamander Ash (c/m/g) | Gross Alpha Stovepipe Ash (c/m/g) |
|---|---|---|---|---|---|
| 3/18/65 | 1 | TBP | 9 | | |
| | 2 | TBP | 9 | | |
| 3/29/65 | 1 | TBP | 5 | | |
| | 2 | TBP | 5 | | |
| | 3 | TBP | 5 | | |
| 3/30/65 | 1 | TBP | 5 | | |
| | 2 | TBP | 5 | | |
| | 3 | TBP | 5 | | |
| 3/31/65 | 1 | TBP | 5 | | |
| | 2 | TBP | 5 | | |
| | 3 | TBP | 5 | | |
| 4/1/65 | 1 | TBP | 5 | | |
| | 2 | TBP | 5 | | |
| | 3 | TBP | 5 | | |
| 4/13/65 | 1 | TBP | 5 | | |
| | 2 | TBP | 5 | | |
| | 3 | TBP | 5 | | |
| 4/14/65 | 1 | TBP | 3 | | |
| | 2 | TBP | 2 | | |
| 4/27/65 | 2 | TCP | 3 | | |
| | 3 | TCP | 3 | | |
| 4/29/65 | 2 | TCP | 4 | | |
| | 3 | TCP | 4.5 | | |
| 6/25/65 | 1 | TCP | 3 | | |
| 6/29/65 | 1 | TCP | 6.5 | | |
| 6/30/65 | 1 | TCP | 3 | | |
| 8/11/66 | 1 | TCP | 3 | | |
| | 2 | TCP | 3 | | |
| 8/12/66 | 1 | TCP | 4 | | |
| | 2 | TCP | 4.5 | | |
| 8/16/66 | 1 | TCP | 4 | | |
| | 2 | TCP | 4 | | |
| 8/17/66 | 1 | TCP | 4 | | |
| 8/17/66 | 2 | TCP | 3 | | |
| 8/18/66 | 1 | TCP | 4.5 | | |
| | 2 | TCP | 5 | | |
| 8/19/66 | 1 | TCP | 3 | | |
| | 2 | TCP | 3 | | |
| 8/22/66 | 1 | TCP | 4 | | |
| | 2 | TCP | 4.5 | | |

## Table B-8 (continued)

| Date | Salamander Number | ID of Contaminated Organic Liquid Incinerator | Volume of Contaminated Liquid Incinerator (gal.) | Gross Alpha Salamander Ash (c/m/g) | Gross Alpha Stovepipe Ash (c/m/g) |
|---|---|---|---|---|---|
| 8/24/66 | 1 | TCP | 3 | | |
| | 2 | TCP | 3 | | |
| 8/25/66 | 1 | TCP | 3.5 | | |
| | 2 | TCP | 4 | | |
| 8/26/66 | 1 | TCP | 2.5 | | |
| | 2 | TCP | 2.5 | | |
| 8/29/66 | 1 | TCP | 3 | | |
| | 2 | TCP | 3 | | |
| 8/31/66 | 1 | TCP | 3 | | |
| | 2 | TCP | 3 | | |
| 6/6/67 | 1 | TCP | 6.5 | | |
| 6/7/67 | 1 | TCP | 8.5 | | |
| 6/9/67 | 1 | TCP | 5 | | |
| 6/12/67 | 1 | TCP | 6 | | |
| 6/13/67 | 1 | TCP | 6 | | |
| 6/15/67 | 1 | TCP | 6 | | |
| 6/21/67 | 1 | TCP | 4 | | |
| 6/22/67 | 1 | TCP | 3 | | |
| 6/23/67 | 1 | TCP | 7 | | |
| **Monthly Totals** | | | | | |
| Jan-70 | | | 7.9 | | |
| February | | | 17.2 | | |
| March | | | none | | |
| April | | | 8.5 | | |
| May | | | 8.8 | | |
| June | | | none | | |
| July | | | none | | |
| August | | | none | | |
| September | | | 10 | | |
| October | | | none | | |
| November | | | 29.1 | | |
| December | | | 21.9 | | |
| Jan-71 | | | 5 | | |
| February | | | 18.5 | | |
| March | | | 7 | | |
| April | | | 3 | | |
| May | | | 4 | | |
| June | | | 2.9 | | |
| July | | | 6.6 | | |
| August | | | 12.9 | | |

## Table B-8 (continued)

| Date | Salamander Number | ID of Contaminated Organic Liquid incinerator | Volume of Contaminated Liquid Incinerator (gal.) | Gross Alpha Salamander Ash (c/m/g) | Gross Alpha Stovepipe Ash (c/m/g) |
|---|---|---|---|---|---|
| September | | | 26.9 | | |
| October | | | 16.9 | | |
| Jan-72 | | | 20.5 | | |
| February | | | none | | |
| March | | | 21.4 | | |
| April | | | 32.5 | | |
| May | | | 35.4 | | |
| June | | | 28 | | |
| July | | | 18.5 | | |
| August | | | 17.4 | | |
| September | | | 21.7 | | |

Source: Nyhan 1990, 12605.

[1] = tricresyl phosphate

[2] = tributyl phosphate

## Table B-9
## Present-Day Estimate of Radionuclide Inventory by Shaft or Complex

| Shaft Number | Estimated Pu-239 (g) | Estimated Pu-238 (g) | Estimated Pu-240 (g) | Estimated Am-241 (g) | U-233 (g) | U-235 (g) |
|---|---|---|---|---|---|---|
| 1 | 20.8 | 0.025 | 1.2 | 21 | | |
| 2 | 3.7 | 0.004 | 0.2 | 2.5 | | |
| 3 | 300.2 | 0.012 | 18 | 5.3 | | |
| 5 | 12 | 0.014 | 0.7 | 24.1 | | |
| 9 | 25 | 0.029 | 1.5 | 23.3 | | |
| 10 | 4 | 0.005 | 0.2 | 4.2 | | |
| 11 | 3.2 | 0.004 | 0.2 | 2.6 | | |
| 13 | 39.6 | 0.047 | 2.4 | 34.6 | | |
| 17 | 373.9 | 0.038 | 22.42 | 16.6 | | |
| 18 | 152.8 | 0.022 | 9.14 | 17.1 | | |
| 19 | 261.3 | 0.019 | 15.7 | 6.2 | | |
| 20 | 11.6 | 0.014 | 0.7 | 26.4 | | |
| 21 | 13.3 | 0.016 | 0.8 | 22.6 | | |
| 22 | 18.8 | 0.022 | 1.1 | 20 | | |
| 23 | 20.4 | 0.024 | 1.2 | 31.4 | | |
| 24 | 17.4 | 0.021 | 1 | 25 | | |
| 25 | 7.2 | 0.009 | 0.4 | 10 | | |
| 26 | 214.5 | 0.005 | 12.9 | 5.6 | | |
| 27 | 32.5 | 0.038 | 2 | 18.1 | | |
| 28 | 40.4 | 0.048 | 2.4 | 33.5 | | |

### Table B-9 (continued)

| Shaft Number | Estimated Pu-239 (g) | Estimated Pu-238 (g) | Estimated Pu-240 (g) | Estimated Am-241 (g) | U-233 (g) | U-235 (g) |
|---|---|---|---|---|---|---|
| 29 | 4.2 | 0.005 | 0.3 | 9.8 | | |
| 30 | 14 | 0.017 | 0.8 | 18.8 | | |
| 31 | 3 | 0.003 | 0.2 | 2.9 | | |
| 32 | 5.4 | 0.006 | 0.3 | 9.4 | | |
| 33 | 24.8 | 0.029 | 1.5 | 20.5 | | |
| 34 | 11.4 | 0.013 | 0.7 | 21.3 | | |
| 35 | 16 | 0.019 | 1 | 25.3 | | |
| 36 | 12.4 | 0.015 | 0.7 | 25.9 | | |
| 41 | 20.5 | 0.024 | 1.2 | 18.1 | | |
| 42 | 4.2 | 0.005 | 0.3 | 2.5 | | |
| 43 | 28.1 | 0.033 | 1.7 | 29.5 | | |
| 44 | 14.5 | 0.017 | 0.9 | 21.2 | | |
| 46 | 33 | 0.039 | 2 | 35.6 | | |
| 47 | 16.6 | 0.02 | 1 | 15.5 | | |
| 48 | 21.7 | 0.026 | 1.3 | 23.4 | | |
| 49 | 62.2 | 0.073 | 3.7 | 49.4 | | |
| 50 | 18.5 | 0.022 | 1.1 | 21.2 | | |
| 51 | 11.4 | 0.013 | 0.7 | 11.7 | | |
| 53 | 28.7 | 0.034 | 1.7 | 33.9 | | |
| 55 | 45.9 | 0.054 | 2.8 | 26.7 | | |
| 56 | 23.9 | 0.028 | 1.4 | 32.6 | | |
| 57 | 19.1 | 0.023 | 1.1 | 11.9 | | |
| 59 | 44.2 | 0.052 | 2.7 | 31.1 | | |
| 60 | 38.2 | 0.045 | 2.3 | 33 | | |
| 70 | 79.9 | 0.094 | 4.8 | 29.8 | | |
| 75 | 32.9 | 0.039 | 2 | 35.4 | | |
| 76 | 56.7 | 0.067 | 3.4 | 53.1 | | |
| 78 | 7.6 | 0.009 | 0.5 | 0.8 | | |
| 80 | 20 | 0.024 | 1.2 | 4 | | |
| 82 | 8.9 | 0.01 | 0.5 | 2.4 | | |
| 83 | 19.6 | 0.023 | 1.2 | 4.8 | | |
| 84 | 9.5 | 0.011 | 0.6 | 0.3 | | |
| 87 | 7.7 | 0.009 | 0.5 | 0.4 | | |
| Complex B: 52, 58 | 34.2 | 0.04 | 2.1 | 20.1 | 713 | |
| Complex A: 6, 8, 54, 90, 91, 92, 94 | 99.8 | 0.118 | 6 | 79.6 | | 713 |
| Totals | 2471 | 1.5 | 148 | 1112 | 713 | 713 |

## Table B-10
## MDA T Results of 1946 Field Investigation

### Absorption Bed 1[23]

| Date | Sample Type | Direct Instru. Reading "Pee Wee" d/m | Po d/m/l | Po d/m/50g | Pu d/m/l | Pu d/m/50g | Pu microg./l |
|---|---|---|---|---|---|---|---|
| July, 1946 | fluid | * | 200 | | 6780 | | $4.8 \times 10^{-2}$ |
| Sept., 1946 | fluid | * | 65 | | 97 | | $69.2 \times 10^{-5}$ |
| Oct.-Nov., 1946 | soil | 800 | | 123 | | 200 | |

### Absorption Bed 2[23]

| Date | Sample Type | Po d/m/50g | Pu d/m/50g | Pu microg./50g |
|---|---|---|---|---|
| July, 1946 | soil | 80 | 80 | $5.7 \times 10^{-4}$ |
| Sept., 1946 | soil | 43 | 122 | $87.1 \times 10^{-5}$ |

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* Not applicable

Source: Rogers 1977, 05707.2, p. T-17.

## Table B-11
## Plutonium Concentrations in Samples from 1953 Test Holes

| Date | Depth Below Surface | Description | Plutonium (pCi/gm) | Notes |
|---|---|---|---|---|
| | | DPW-1 | | |
| August 25-27, 1953 | Surface | Very fine sandy soil | 32 | |
| | 1' | Very fine sandy soil | 4 | |
| | 2' | Very sandy soil | 2 | |
| | 3' | Sandy soil | 4 | |
| | 4' | Coarse sand and clay | 2 | |
| | 5' | Sand | 2 | |
| | 6' | Sand | 2 | |
| | 6' - 10' | Sand | 1 | |
| | 10' - 14' | Sand | 1 | |
| | 15' | Sand | 2 | |
| | | DPW-2 | | |
| August 25-27, 1953 | Surface | Very fine sandy soil | 4 | |
| | 1' | Very fine sandy soil | 2 | |
| | 2' | Sandy soil | 1 | |
| | 3' | Sandy soil | <1 | |
| | 4' | Sand | 1 | |
| | 5' | Sand | 1 | |
| | 6' | Sand | 1 | |
| | 7' | Sand and clay soil | 2 | |
| | 8' | Sand | <1 | |
| | 9' | Sand | 1 | |
| | 10' | Very coarse sand | 2 | |
| | 11' | Fine sand, some gravel | 2 | |
| | 12' | Fine sand | 1 | |
| | 13' | Fine sand | 1 | |
| | 14' | Sand | 1 | |
| | 15' | Sand | 1 | |
| | 16' | Sand | 2 | |
| | 17' | Sand | 1 | |
| | 18' | Sand | 1 | |
| | 19' | Sand | 1 | |
| | 20' | Sand | 1 | |
| | | DPW-3 | | |
| August 28, 1953 | Surface | Very fine sandy soil | 15 | Hole drilled on a 45° slant extending under adjacent absorption bed. Depths given are slant depths. |
| | 1' | Very fine sandy soil | 2 | |
| | 2' | Very fine sandy soil | 4 | |
| | 3' | Very fine sandy soil | 3 | |
| | 4' | Sandy soil | 4 | |
| | 5' | Sand | 3 | |
| | 6' | Very sandy soil | 2 | |
| | 7' | Very sandy soil | 3 | |
| | 8' | Very sandy soil | 1 | |
| | 9' | Sand and clay | 1 | |
| | 10' | Fine sand | 1 | |
| | 11' | Sand | 1 | |
| | 12' | Loose tufaceous sand | 205* | *Point of intersection with absorption bed. |
| | 12.5' | Loose tufaceous sand | 686 | |
| | 13' | Loose tufaceous sand | 605 | |
| | | DPW-4 | | |
| September 21, 24, 25, 30 and October 1, 1953 | Surface | Sandy soil | 4 | |
| | 1' | Sand and gravel, some clay | 180 | |
| | 2' | Sand and gravel, some clay | 16,410 | |
| | 3' | Sand and gravel, some clay | 20,730 | |
| | 12' | Very fine loose tuff | 640 | |
| | 15' | Fine sand | 2,270 | |
| | 16' | Fine sand | 2,320 | |
| | 17' | Loose tuff | 330 | |
| | 18' | Sandy loose tuff | 11 | |
| | 19' | Loose tuff | 5 | |
| | 20' | Broken tuff core | 5 | |
| | | DPW-5 | | |
| September 21, 24, 25, 30 and October 1, 1953 | Surface | Sand and clay soil | 190 | |
| | 1' | Sand and clay soil | 270 | |
| | 2' | Sand and clay soil | 5 | |
| | 3' | Sand and gravel | 36 | |
| | 4' | Sand and gravel | 1,550 | |
| | 5' | Solid tuff core from a boulder | 240 | |
| | 6' | Solid tuff core from a boulder | 36 | |
| | 7' | Friable tuff core | 820 | |
| | 8' | Fine sand and clay | 18 | |
| | 9' | Fine sand and clay | 170 | |
| | 15' | Fine sand | 1090 | |

Source: Rogers 1977, 05707.2, pp. T-21–T-22.

## Table B-12
## Ion Exchange Capacity of Samples from Three of the 1953 Test Holes

| Sample Depth | Megascopic Description | Minerals Present (parts in ten) | | | Ion Exchange Capacity (me/kg) |
|---|---|---|---|---|---|
| DPW-3 at 12 ft. (slant) | Sandy to silty clay and gravel composed of gray pumiceous Bandelier tuff (probably Tshirege member). Due to 45° dip of hole, vertical depth of sample is 8.5 ft. | Clay <2 µ | Feldspar | 4 | 17 |
| | | | Montmorillonite | 3 | |
| | | | Hydrous mica | 2 | |
| | | | Kaolin | | |
| | | | Cristobalite | | |
| | | | Tridymite | | |
| | | | Quartz | | |
| | | Silt 2-62 µ | Feldspar | 4 | |
| | | | Cristobalite | 4 | |
| | | | Tridymite | 1 | |
| | | | Quartz | | |
| DPW-4 at 19 ft. | Gray tuff of Tshirege member of Bandelier tuff. Contains some bit-broken fine particles. | Clay <2 µ | Feldspar | 4 | 7 |
| | | | Cristobalite | 4 | |
| | | | Tridymite | | |
| | | | Quartz | | |
| | | Silt 2-62 µ | Feldspar | 5 | |
| | | | Cristobalite | 4 | |
| | | | Tridymite | 1 | |
| | | | Quartz | | |
| DPW-5 at 5 ft. | Dark gray to white pumiceous tuff. Apparently cored from a boulder. | Clay <2 µ | Feldspar | 5 | 32 |
| | | | Montmorillonite | 2 | |
| | | | Cristobalite | | |
| | | Silt 2-62 µ | Feldspar | | |
| | | | Tridymite | | |
| | | | Cristobalite | | |

Source: Rogers 1977, 05707.2, p. T-23.

## Table B-13
## Gross Alpha Assays for Core Samples, 1959–1961,
## Core Record of Samples from Horizontal Holes Below the Caisson

| Depth (ft) | No. Cores | Average Gross α (c/m/dry gram) | Gross α - All Cores (Max.) | (Min.) |
|---|---|---|---|---|
| 6 | 10 | 3003 | 6613 | 4 |
| 8 | 7 | 1306 | 2850 | 11 |
| 10 | 8 | 1143 | 1872 | 12 |
| 12 | 6 | 821 | 1729 | 414 |
| 14 | 9 | 749 | 2094 | 1 |
| 16 | 9 | 732 | 1305 | 8 |
| 18 | 4 | 517 | 923 | 141 |
| 20 | 7 | 183 | 506 | 45 |
| 22 | 4 | 15 | 20 | 11 |
| 24 | 8 | 402 | 1038 | 175 |
| 26 | 10 | 13 | 88 | 2 |
| 28 | 6 | 28 | 156 | 2 |

Source: Rogers 1977, 05707.2, p. T-26.

## Table B-14
## Gross Alpha Assays for Core Samples, 1959–1961, Deep Hole Core Records

(Samples from "Wagon Drill" - Air Blown to Surface)

| Hole No. | No. Cores | Depth (ft.) | Gross α (c/m/dry gram) | | |
|---|---|---|---|---|---|
| | | | (Avg.) | (Max.) | (Min.) |
| DPW-1 | 10 | 76 | 2 | 3 | 1 |
| DPW-A-1 | 10 | 83 | 24 | 34 | 9 |
| DPW-2 | 11 | 93 | 698 | 3722 | 142 |
| DPW-3 | 11 | 99 | 3 | 7 | 2 |
| DPW-4 | 13 | 99 | 1.5 | 2 | 1 |
| DPW-5 | 7 | 92 | 3 | 6 | 1 |

Source: Rogers 1977, 05707.2, p. T-28.

## Table B-15
## Analysis of 1961 Leachate Samples

| | | Filt. Gross α c/m/ml | Milli-pore Filter Gross α c/m/ml | pH Un-Filt. / Filt | Phen. Alk. | Tot. Alk. | Total Hard-ness | Ca | Mg | Cl$^-$ | NO$_3^-$ | SO$_4^=$ | Filt. Total Solids | Filt. Vol. Solids 400°C | Filt. Vol. Solids 600°C | F$^-$ | Na | K | Surface Tension Dynes/cm | C.O.D. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Avg F | Wkly Raw Comp* | 584 | | 6.0 / 6.9 | 45 | 186 | 170 | 57 | 7 | 70 | 139 | 36 | 17,036 | 316 | 10,596 | 200 | 197 | 1245 | 54.5 | 73 |
| Avg F | Comp. #6 | 48 | | 11.0 | 714 | 1381 | 161 | 32 | 20 | 102 | 146 | 44 | 11,808 | | 2,605 | 230 | 942 | 2927 | 42.3 | 322 |
| Avg W | | 6 | | 8.6 | 22 | 261 | 190 | 52 | 14 | 17 | 9 | 18 | 3,868 | 2,012 | 3,619 | 76 | 138 | 118 | 52.7 | 50 |
| Avg T | | 24 | | 9.7 | 329 | 759 | 177 | 43 | 17 | 66 | 70 | 29 | 7,838 | 2,012 | 3,168 | 144 | 494 | 1366 | 48.1 | 171 |
| Avg F | Comp. #8 | 14 | | 4.3 | 0 | 0 | 359 | 49 | 57 | 61 | 305 | 227 | 4,467 | 1,056 | 2,359 | 33 | 801 | 112 | 52.3 | 353 |
| Avg W | | 14 | | 6.4 | 0 | 175 | 510 | 64 | 84 | 77 | 356 | 272 | 6,286 | 1,912 | 4,048 | 36 | 1127 | 84 | 51.0 | 705 |
| Avg T | | 14 | | 5.5 | 0 | 97 | 443 | 57 | 72 | 70 | 333 | 252 | 5,477 | 1,769 | 3,297 | 34 | 982 | 96 | 51.6 | 548 |
| Avg F | Comp. #10 | 28 | | 4.3 | 0 | 0 | 1820 | 74 | 393 | 73 | 350 | 288 | 8,417 | 752 | 2,351 | 48 | 1870 | 271 | 52.2 | 273 |
| Avg W | | 10 | | 7.0 | 0 | 223 | 420 | 88 | 48 | 63 | 292 | 140 | 5,992 | 2,569 | 6,218 | 52 | 790 | 104 | 51.8 | 392 |
| Avg T | | 18 | | 5.8 | 0 | 124 | 1042 | 82 | 201 | 67 | 318 | 206 | 7,070 | 2,266 | 4,500 | 50 | 1273 | 156 | 52.0 | 339 |
| Avg F | Comp. #12 | 9 | | 9.2 | | | | | | | 290 | | 7,504 | | 2,940 | 220 | | | | |
| Avg W | | 6 | | 8.9 | 440 | 1720 | 325 | 70 | 36 | 180 | 363 | 140 | 9,768 | 1,988 | 2,772 | 280 | | | | |
| Avg T | | 7 | | 9.0 | 440 | 1720 | 325 | 70 | 36 | 180 | 345 | 140 | 8,636 | 1,968 | 2,856 | [illegible] | | | | |
| Avg F | Comp. #14 | 165 | 148 | 3.7 | 0 | 0 | 4161 | 344 | 793 | 1112 | 436 | 355 | 34,622 | 8,548 | 17,175 | 233 | 3620 | 1005 | 53.2 | 67 |
| Avg W | | 126 | 108 | 4.0 | 0 | 0 | 4190 | 256 | 852 | 838 | 406 | 413 | 32,340 | 7,131 | 16,478 | 228 | 3825 | 1203 | 53.2 | 219 |
| Avg T | | 143 | 122 | 3.8 | 0 | 0 | 4177 | 295 | 826 | 960 | 419 | 387 | 33,386 | 7,367 | 16,768 | 230 | 3734 | 1115 | 53.2 | 152 |
| Avg F | Comp. #16 | 11 | | 7.2 | 35 | 390 | 994 | 80 | 191 | 60 | 310 | 47 | 5,156 | 552 | 1,769 | 153 | 1005 | 709 | 51.5 | 136 |
| Avg W | | 6 | | 8.8 | 72 | 855 | 310 | 80 | 33 | 102 | 208 | 73 | 7,822 | 1,491 | 2,916 | 280 | 1099 | 2518 | 46.1 | 461 |
| Avg T | | 8 | | 8.1 | 56 | 648 | 614 | 80 | 99 | 83 | 253 | 61 | 6,637 | 1,115 | 2,406 | 223 | 1057 | 1714 | 48.5 | 271 |
| Avg F | Comp. #18 | 79 | 70 | 3.8 | 0 | 0 | 7375 | 625 | 1335 | 1526 | 446 | 603 | 52,232 | 14,036 | 24,017 | 245 | 5960 | 1631 | 56.0 | 76 |
| Avg W | | 36 | | 5.4 | 0 | 84 | 3290 | 284 | 619 | 610 | 432 | 343 | 34,616 | 12,874 | 24,630 | 220 | 3274 | 1468 | 54.2 | 208 |
| Avg T | | 55 | | 4.7 | 0 | 47 | 5106 | 476 | 964 | 1017 | 438 | 460 | 42,445 | 13,068 | 24,357 | 231 | 4441 | 1551 | 54.8 | 158 |
| Avg F | Comp. #20 | 6 | | 4.7 | 0 | 15 | 2948 | 254 | 555 | 202 | 410 | 96 | 13,999 | 2,808 | 5,789 | 123 | 1610 | 477 | 53.2 | 52 |
| Avg W | | 15 | | 4.6 | 0 | 0 | 3580 | 346 | 653 | 132 | 419 | 167 | 20,013 | 5,213 | 9,647 | 228 | 2216 | 920 | 56.9 | 99 |
| Avg T | | 11 | | 4.5 | 0 | 7 | 3299 | 304 | 609 | 158 | 415 | 141 | 17,340 | 4,812 | 7,932 | 181 | 1989 | 747 | 55.5 | 61 |
| Avg F | Comp. #22 | 8 | | 3.9 | 0 | 0 | 6168 | 431 | 1186 | 370 | 464 | 543 | 40,733 | 11,152 | 18,541 | 245 | 4794 | 896 | 52.1 | 358 |
| Avg W | | 10 | | 3.9 | 0 | 0 | 5510 | 436 | 1061 | 212 | 470 | 341 | 34,127 | 11,097 | 18,770 | 280 | 3682 | 895 | 57.1 | 308 |
| Avg T | | 9 | | 3.9 | 0 | 0 | 5802 | 436 | 1116 | 282 | 467 | 431 | 37,063 | 11,106 | 18,680 | 264 | 4176 | 895 | 54.9 | 327 |
| Avg F | Comp. #24 | 127 | 107 | 4.0 | 0 | 0 | 3103 | 244 | 598 | 160 | 468 | 399 | 20,958 | 3,968 | 8,565 | 173 | 3729 | 675 | 54.3 | 242 |
| Avg W | | 47 | | 4.7 | 0 | 13 | 3300 | 252 | 641 | 159 | 451 | 310 | 20,951 | 5,553 | 9,813 | 188 | 2645 | 898 | 53.3 | 470 |
| Avg T | | 83 | | 4.4 | 0 | 7 | 3212 | 248 | 622 | 160 | 459 | 350 | 20,956 | 5,289 | 9,289 | 181 | 3127 | 799 | 53.7 | 368 |
| Avg F | Comp. #26 | 20 | | 4.5 | 0 | 0 | 4775 | 346 | 939 | 204 | 463 | 342 | 31,430 | 7,120 | 15,268 | 240 | 3472 | 628 | 52.0 | 291 |
| Avg W | | 4 | | 4.5 | 0 | 2 | 4610 | 408 | 362 | 167 | 455 | 219 | 24,748 | 7,691 | 14,086 | 208 | 2642 | 704 | 57.5 | 201 |
| Avg T | | 11 | | 4.5 | 0 | 1 | 4683 | 380 | 896 | 181 | 459 | 266 | 27,718 | 7,596 | 14,612 | 222 | 2953 | 675 | 56.0 | 227 |
| Avg F | Comp. #28 | 19 | | 5.5 | 8 | 150 | 5470 | 239 | 1170 | 169 | 457 | 271 | 22,344 | 7,464 | 10,608 | 175 | 3083 | 371 | 55.1 | 302 |
| Avg W | | 1 | | 7.7 | 2 | 137 | 900 | 112 | 149 | 65 | 330 | 115 | 8,036 | 2,388 | 5,161 | 76 | 1008 | 1260 | 55.7 | 85 |
| Avg T | | 9 | | 6.7 | 4 | 143 | 2931 | 168 | 602 | 111 | 386 | 184 | 14,395 | 3,234 | 7,583 | 120 | 2391 | 851 | 55.3 | 258 |

Code: F = Waste; W = Water; T = Total

*Unfilt. Gross α (c/m/ml) - 565; Unfilt. Tot. Solids - 5454
Unfilt. Vol. Solids (400°C) - 396;
Unfilt. Vol. Solids (600°C) -1368

Source: Rogers 1977, 05707.2, p. T-29

## Table B-16
## Moisture Content of Tuff Adjacent to Test Holes, 1967

| DPW-1 | | | | DPW-2 | | | | DPW-5 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (ft.) | Percent Moisture (by volume) | | | Depth (ft.) | Percent Moisture (by volume) | | | Depth (ft.) | Percent Moisture (by volume) | | |
| | 3-17-61 | 8-23-61 | 1-30-67 | | 3-18-61 | 8-23-61 | 1-30-67 | | 3-19-61 | 8-25-61 | 1-30-67 |
| 1 | 22 | 28 | 34 | 1 | 26 | 34 | 39 | 1 | 20 | 20 | 36 |
| 5 | 24 | 34 | 37 | 4 | 25 | 38 | 40 | 5 | 16 | 16 | 26 |
| 8 | 18 | 38 | 39 | 8 | 30 | 24 | 30 | 10 | 19 | 20 | 26 |
| 12 | 13 | 40 | 22 | 12 | 25 | >50 | 30 | 15 | 20 | 25 | 29 |
| 16 | 14 | 34 | 22 | 16 | 22 | >50 | 28 | 20 | 17 | 22 | 25 |
| 20 | 16 | 35 | 40 | 20 | 16 | >50 | 18 | 25 | 13 | 19 | 18 |
| 24 | 18 | 30 | 34 | 24 | 24 | >50 | 28 | 30 | 12 | 16 | 15 |
| 28 | 16 | 27 | 36 | 28 | 25 | >50 | >50 | 35 | 13 | 18 | 20 |
| 32 | 28 | 36 | 39 | 32 | 22 | >50 | >50 | 40 | 13 | 20 | 18 |
| 36 | 18 | 29 | 41 | 36 | 20 | >50 | 47 | 45 | 11 | 16 | 16 |
| 40 | 14 | 23 | 41 | 40 | 10 | 44 | 16 | 50 | 13 | 21 | 20 |
| 44 | 14 | 27 | 36 | 44 | 10 | 46 | 16 | 55 | 12 | 19 | 20 |
| 48 | 14 | 29 | 30 | 48 | 10 | 42 | 17 | 60 | 12 | 14 | 16 |
| 52 | 16 | 34 | 30 | 52 | 12 | 44 | 22 | 65 | 12 | 15 | 17 |
| 56 | 14 | 28 | 19 | 56 | 14 | 40 | 25 | | | | |
| 60 | 13 | 23 | 16 | 60 | 15 | 28 | 22 | | | | |
| 64 | 13 | 22 | 26 | 64 | 12 | 24 | 17 | | | | |

Note: Water level DPW-1A 1-30-67 24.2 feet
Water level DPW-3 1-30-67 50.3 feet
DPW-4 Destroyed
Depth of DPW-1a, 76 ft; DPW-2, 93 ft; DPW-5, 92 ft.
Logging length of cable - 65 feet in 1967.

Purtymun, 1967[245]

Source: Rogers 1977, 05707.2, p. T-30

## Table B-17
## Soil Sample Analysis Results for 1974 Survey of MDA T, TA-21

| | Depth in feet | % $H_2O$ | Gross alpha (pCi/g) | Gross beta (pCi/g) | Cs (pCi/g) | $^3$H (nCi/ℓ) |
|---|---|---|---|---|---|---|
| HOLE 1 | 0-5 | | | | | |
| | 5-10 | | | | | |
| (5/9/74) | 10-15 | | NO | ANALYSES | | |
| | 15-20 | | | | | |
| | 20-25 | | | | | |
| | 25-30 | | | | | |
| | 30-35 | | | | | |
| HOLE 2 | 0-5 | | | | | |
| | 5-10 | | | | | |
| (5/9/74) | 10-15 | | NO | ANALYSES | | |
| | 15-20 | | | | | |
| | 20-25 | | | | | |
| | 25-30 | | | | | |
| | 30-35 | | | | | |
| | 35-40 | | | | | |
| HOLE 3 | 0-5 | | | | | |
| (5/9/74) | 5-10 | | NO | ANALYSES | | |
| | 10-15 | | | | | |
| | 15-20 | | | | | |
| HOLE 4 | 0-5 | | | | | |
| (5/9/74) | 5-10 | | NO | ANALYSES | | |
| | 10-15 | | | | | |
| | 15-20 | | | | | |
| HOLE 5 | 0-5 | | | | | |
| (5/10/74) | 5-10 | | NO | ANALYSES | | |
| | 10-15 | | | | | |
| | 15-20 | | | | | |
| | 20-25 | | | | | |
| | 25-30 | | | | | |
| | 30-35 | | | | | |
| | 35-40 | | | | | |
| HOLE 6 | 0-5 | | | | | |
| | 5-10 | | | | | |
| (5/15/74) | 10-15 | | | | | |
| | 15-20 | | NO | ANALYSES | | |
| | 20-25 | | | | | |
| | 25-30 | | | | | |
| | 30-35 | | | | | |
| | 35-04 | | | | | |
| HOLE 7 | 0-2-1/2 | 15.7 | 1.8 ± 0.3 | 34.6 ± 1.0 | 0.3 ± 0.1 | No analysis |
| | 2-1/2-5 | 17.9 | 2.7 ± 0.3 | 21.0 ± 0.8 | 0.0 ± 0.1 | 0.6 ± 0.5 |
| (4/18/74) | 5-7-1/2 | 23.0 | 9.4 ± 0.6 | 31.0 ± 1.0 | 0.3 ± 0.1 | 11.4 ± 0.6 |
| | 7-1/2-10 | 17.0 | 2.2 ± 0.3 | 33.5 ± 1.0 | 0.2 ± 0.1 | 3.7 ± 0.5 |
| | 10-15 | 17.8 | 2.7 ± 0.3 | 39.9 ± 1.1 | 0.2 ± 0.1 | No analysis |
| | 15-20 | 14.8 | 2.2 ± 0.3 | 34.1 ± 1.0 | 0.6 ± 0.1 | No analysis |
| | 20-25 | 12.5 | 1.9 ± 0.3 | 39.1 ± 1.0 | 0.3 ± 0.1 | No analysis |
| | 25-30 | 12.7 | 2.7 ± 0.3 | 42.5 ± 1.1 | 0.3 ± 0.1 | No analysis |
| | 30-35 | 12.5 | 3.9 ± 0.4 | 39.2 ± 1.1 | 0.3 ± 0.1 | No analysis |
| | 35-40 | 10.2 | 3.9 ± 0.4 | 39.6 ± 1.1 | 0.2 ± 0.1 | No analysis |
| | 40-47 | 4.4 | 2.9 ± 0.3 | 31.6 ± 1.0 | 0.3 ± 0.1 | No analysis |

Source: Rogers 1977, 05707.2, p. T-33.

## Table B-17 (continued)

| | Depth in feet | % $H_2O$ | Gross alpha (pCi/g) | Gross beta (pCi/g) | Cs (pCi/g) | $^3H$ (nCi/ℓ) |
|---|---|---|---|---|---|---|
| HOLE 8 | 0-2-1/2 | 8.0 | 2.2 ± 0.2 | 36.2 ± 0.6 | 0.8 ± 0.2 | 12.4 ± 0.6 |
| | 2-1/2-5 | 10.0 | 2.3 ± 0.3 | 33.2 ± 1.0 | 0.4 ± 0.1 | 8.6 ± 0.6 |
| (4/17/74) | 5-7-12 | 7.4 | 2.8 ± 0.2 | 48.6 ± 0.7 | 0.2 ± 0.1 | 4.6 ± 0.5 |
| | 7-1/2-10 | 7.6 | 2.4 ± 0.3 | 38.7 ± 1.1 | 0.5 ± 0.1 | 5.2 ± 0.6 |
| | 10-15 | 8.0 | 2.7 ± 0.2 | 46.7 ± 0.7 | 0.1 ± 0.1 | 13.5 ± 0.7 |
| | 15-20 | 8.2 | 3.0 ± 0.2 | 36.7 ± 0.7 | 0.1 ± 0.1 | 19.2 ± 0.8 |
| | 20-25 | 7.5 | 2.6 ± 0.3 | 37.9 ± 1.0 | 0.2 ± 0.1 | 7.5 ± 0.6 |
| | 25-30 | 7.5 | 2.3 ± 0.3 | 35.1 ± 1.0 | 0.2 ± 0.1 | 2.6 ± 0.5 |
| | 30-35 | No analysis | 2.9 ± 0.2 | 38.2 ± 0.7 | 0.3 ± 0.1 | 3.3 ± 0.5 |
| | 35-40 | 8.6 | 3.3 ± 0.2 | 38.1 ± 0.7 | 0.3 ± 0.1 | 1.9 ± 0.5 |
| HOLE 9 | 0-2-1/2 | 14.8 | 2.5 ± 0.3 | 27.8 ± 0.9 | 0.3 ± 0.1 | 7.5 ± 0.6 |
| | 2-1/2-5 | 10.6 | 4.5 ± 0.4 | 39.0 ± 1.1 | 0.3 ± 0.1 | 7.1 ± 0.6 |
| (4/17/74) | 5-7-1/2 | 11.6 | 3.3 ± 0.4 | 36.5 ± 1.0 | 0.3 ± 0.1 | 10.3 ± 0.6 |
| | 7-1/2-10 | 8.2 | 3.3 ± 0.4 | 39.7 ± 1.1 | 0.4 ± 0.1 | 11.7 ± 0.6 |
| | 10-15 | 8.0 | 4.1 ± 0.4 | 45.0 ± 1.1 | 0.1 ± 0.1 | 15.9 ± 0.7 |
| | 15-20 | 9.1 | 3.8 ± 0.4 | 37.1 ± 1.0 | 0.2 ± 0.1 | 25.6 ± 0.9 |
| | 20-25 | 8.7 | 3.4 ± 0.4 | 37.4 ± 1.0 | 0.1 ± 0.1 | 17.5 ± 0.7 |
| | 25-30 | 9.0 | 2.8 ± 0.3 | 38.8 ± 1.1 | 0.4 ± 0.1 | 10.6 ± 0.6 |
| | 30-35 | 9.5 | 20.9 ± 0.8 | 41.2 ± 1.1 | 0.2 ± 0.1 | 11.5 ± 0.6 |
| | 35-40 | 11.4 | 12.7 ± 0.7 | 39.2 ± 1.0 | 0.2 ± 0.1 | 15.2 ± 0.7 |
| HOLE 10 | 0-2-1/2 | 29.6 | 2.5 ± 0.2 | 32.6 ± 0.5 | 0.2 ± 0.1 | 10.9 ± 0.6 |
| | 2-1/2-5 | 17.8 | 5.0 ± 0.3 | 34.5 ± 0.6 | 0.3 ± 0.1 | 8.0 ± 0.6 |
| (4/18/74) | 5-7-1/2 | 22.3 | 3.7 ± 0.2 | 37.9 ± 0.7 | 0.4 ± 0.1 | 7.8 ± 0.6 |
| | 7-1/2-10 | 13.3 | 4.0 ± 0.2 | 31.2 ± 0.6 | 0.4 ± 0.1 | 9.6 ± 0.6 |
| | 10-15 | 14.6 | 4.3 ± 0.4 | 35.4 ± 1.0 | 1.2 ± 0.2 | 7.2 ± 0.6 |
| | 15-20 | 13.8 | 3.7 ± 0.4 | 36.7 ± 1.0 | 0.2 ± 0.1 | 13.2 ± 0.7 |
| | 20-25 | 14.6 | 2.6 ± 0.3 | 39.5 ± 1.1 | No analysis | 10.1 ± 0.6 |
| | 25-30 | 9.4 | 3.7 ± 0.2 | 40.7 ± 0.7 | 0.3 ± 0.1 | 28.0 ± 0.9 |
| | 30-35 | 8.4 | 2.9 ± 0.2 | 40.2 ± 0.7 | 0.4 ± 0.1 | 16.4 ± 0.7 |
| | 35-40 | 8.3 | 4.3 ± 0.3 | 35.0 ± 0.6 | 0.1 ± 0.1 | 19.0 ± 0.8 |
| HOLE 11 | 0-2-1/2 | 16.8 | 1.6 ± 0.3 | 25.2 ± 0.9 | 0.2 ± 0.1 | 12.9 ± 0.7 |
| | 2-1/2-5 | 16.2 | 2.8 ± 0.3 | 25.7 ± 0.9 | 0.0 ± 0.1 | 4.4 ± 0.5 |
| (4/15/74) | 5-7-1/2 | 18.6 | 2.0 ± 0.2 | 28.7 ± 0.6 | 0.1 ± 0.1 | 10.4 ± 0.6 |
| | 7-1/2-10 | 17.6 | 1.6 ± 0.3 | 37.7 ± 1.0 | 0.3 ± 0.1 | 3.5 ± 0.5 |
| | 10-15 | 14.8 | 2.0 ± 0.2 | 35.7 ± 0.6 | No analysis | 4.9 ± 0.6 |
| | 15-20 | 14.0 | 1.7 ± 0.2 | 39.8 ± 0.7 | 0.3 ± 0.1 | 9.8 ± 0.6 |
| | 20-25 | 10.8 | 1.8 ± 0.2 | 36.6 ± 0.7 | 0.1 ± 0.1 | 5.6 ± 0.6 |
| | 25 | 13.0 | 1.8 ± 0.3 | 34.5 ± 1.0 | 0.1 ± 0.1 | 3.5 ± 0.5 |
| | 25-30 | 9.2 | 1.7 ± 0.2 | 32.2 ± 0.6 | 0.2 ± 0.1 | 9.0 ± 0.6 |
| HOLE 12 | 0-2-1/2 | 13.0 | 3.1 ± 0.3 | 32.4 ± 1.0 | 0.2 ± 0.1 | 6.4 ± 0.6 |
| | 2-1/2-5 | 10.7 | 2.9 ± 0.3 | 36.5 ± 1.0 | 0.2 ± 0.1 | 8.3 ± 0.6 |
| (4/18/74) | 5-7-1/2 | 9.3 | 2.9 ± 0.3 | 35.4 ± 1.0 | 1.2 ± 0.2 | 5.4 ± 0.6 |
| | 7-1/2-10 | 6.4 | 2.8 ± 0.3 | 34.1 ± 1.0 | 0.2 ± 0.1 | 7.3 ± 0.6 |
| | 10-15 | 5.6 | 3.7 ± 0.4 | 43.3 ± 1.1 | No analysis | 9.1 ± 0.6 |
| | 15-20 | 5.8 | 3.1 ± 0.3 | 34.5 ± 1.0 | 0.0 ± 0.1 | 2.1 ± 0.5 |
| | 20-25 | 6.8 | 3.5 ± 0.4 | 45.3 ± 1.1 | 0.3 ± 0.1 | 2.0 ± 0.5 |
| | 25-30 | 6.7 | 2.7 ± 0.3 | 29.8 ± 0.9 | 0.3 ± 0.1 | No analysis |
| | 30-35 | 7.2 | 2.4 ± 0.3 | 41.1 ± 1.1 | 0.2 ± 0.1 | No analysis |
| | 35-40 | 7.3 | 3.1 ± 0.3 | 35.0 ± 1.0 | 0.2 ± 0.1 | 1.0 ± 0.5 |
| HOLE 13 | 0-2-1/2 | 10.9 | 2.1 ± 0.3 | 29.2 ± 0.9 | No analysis | No analysis |
| | 2-1/2-5 | 11.3 | 2.5 ± 0.3 | 35.3 ± 1.0 | 0.2 ± 0.1 | 10.6 ± 0.6 |
| | 5-7-1/2 | 9.6 | 3.1 ± 0.3 | 41.0 ± 1.1 | 0.2 ± 0.1 | 11.0 ± 0.6 |
| | 7-1/2-10 | 7.9 | 3.0 ± 0.3 | 35.0 ± 1.0 | 0.3 ± 0.1 | 10.6 ± 0.6 |
| | 10-15 | 10.2 | 3.3 ± 0.4 | 43.0 ± 1.1 | 0.2 ± 0.1 | 9.7 ± 0.6 |
| | 15-20 | 9.3 | 3.8 ± 0.4 | 42.7 ± 1.1 | 0.5 ± 0.1 | 8.6 ± 0.6 |
| | 20-25 | 8.7 | 2.8 ± 0.3 | 35.3 ± 1.0 | 0.2 ± 0.1 | 6.8 ± 0.6 |
| | 20-30 | No analysis | 1.6 ± 0.3 | 36.9 ± 1.0 | No analysis | 8.2 ± 0.6 |
| | 30-35 | 7.6 | 2.0 ± 0.2 | 23.8 ± 0.6 | 0.1 ± 0.1 | 13.3 ± 0.7 |
| | 35-40 | 14.0 | 2.2 ± 0.3 | 39.0 ± 1.1 | 0.3 ± 0.1 | 3.0 ± 0.5 |

Source: Rogers 1977, 05707.2, p. T-34.

## Table B-18
## Soil Samples from Walls of Retrievable Waste Storage Area Pit

| Sample Number | Sample Letter | Sample Description | Date | $^{3}$H (nCi/ℓ) | $^{238}$Pu (pCi/g) | $^{239}$Pu (pCi/g) | Gross Alpha (Ludlum alpha probe)$^{a}$ | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Counts/Min | pCi/g |
| T-SS-1 | | | | | | | | |
| | A | From weathered tuff or soil approximately 0.3 m above non-weathered tuff | 10/30/74 | 29.0 ± 0.9 | 0.000 ± 0.006 | 0.023 ± 0.004 | | |
| | B | 0.6 m below Sample A in fracture zone | 10/30/74 | 20.0 ± 0.7 | 0.000 ± 0.002 | 0.032 ± 0.003 | | |
| | C | 0.6 m below Sample A, adjacent to Sample B, in unaltered tuff | 10/30/74 | 21.0 ± 0.8 | 0.000 ± 0.006 | 0.011 ± 0.003 | | |
| | D | 1.5 m below Sample A in fracture zone | 10/30/74 | 16.4 ± 0.7 | 0.001 ± 0.003 | 0.021 ± 0.003 | | |
| T-SS-2 | | | | | | | | |
| | A | Fracture filling near surface of tuff | 10/30/74 | 11.2 ± 0.6 | 0.005 ± 0.003 | 0.838 ± 0.018 | | |
| | B | Unaltered tuff adjacent to Sample A | 10/30/74 | 8.0 ± 0.5 | 0.000 ± 0.006 | 0.247 ± 0.011 | | |
| T-SS-3 | | From sidewall of ditch holding overflow pipe | 10/30/74 | | | | 41.8 | ≈253 |
| T-SS-4 | | From exposed dirt face approximately 6 m north of Absorption Bed 1 edge and 4.6 m west of present (1974) east fence | 10/30.74 | | | | 9.3 | ≈30 |
| T-SS-5 | | From exposed dirt face approximately 6 m north of Absorption Bed 1 and 12 m west of overflow pipe | 10/30/74 | | | | 9.5 | ≈30 |
| T-SS-6 | | From excavated tuff in northeast corner of area | 10/30/74 | | | | 3.7 | <20 (background) |
| T-SS-7 | | From excavated tuff in northwest | 10/30/74 | | | | 6.4 | <20 (background) |
| T-SS-8 | | From exposed south wall in "weathered tuff" approximately 9 m west of Hole 8 and 24 m from ground level | | 13.4 ± 0.6 | No analysis | 0.41 ± 0.02 | | |
| T-SS-9 | | 9 m west of Sample T-SS-8 and 24 m from ground level | | 22.0 ± 0.8 | 0.001 ± 0.002 | 0.095 ± 0.005 | | |

Source: Rogers 1977, 05707.2, p. T-36

## Table B-18 (continued)

| Sample Number | Sample Letter | Sample Description | Date | $^{3}$H (nCi/l) | $^{238}$Pu (pCi/g) | $^{239}$Pu (pCi/g) | Gross Alpha (Ludlum alpha probe)* Counts/Min | Gross Alpha (Ludlum alpha probe)* pCi/g |
|---|---|---|---|---|---|---|---|---|
| T-SS-10 | | | | | | | | |
| | A | Fracture filling | | 37.4 ± 1.1 | 0.36 ± 0.02 | 52.6 ± 1.0 | | |
| | B | Rock adjacent to fracture, estimated 1 cm thick zone | | 33.9 ± 1.0 | 0.172 ± 0.012 | 23.1 ± 0.4 | | |
| T-SS-11 | | Approximately 9 m west and 1.8 m north of Hole 8 on north wall about 1 m below ground level | | | | | | |
| | A | "Weathered material" in horizontally layered zone | | 18.0 ± 0.7 | >100** | | | |
| | B | Rock beneath Sample A, estimated 5 cm thick zone | | 21.0 ± 0.8 | 0.38 ± 0.02 | 49.2 ± 0.9 | | |
| T-SS-12 | | Fracture zone on north wall approximately 4.6 m west of east end of pit | | | | | | |
| | A | Fracture filling about 1.2 m off floor of pit | - | 18.3 ± 0.7 | 2.50 ± 0.08 | 368 ± 8 | | |
| | B | Rock adjacent to Sample A | | 16.5 ± 0.7 | 0.128 ± 0.019 | 18.1 ± 0.5 | | |
| | C | Scrapings of filling from "hot rock" removed by monitor from Site T-SS-12 | | 11.0 ± 0.6 | >3500** | | | |
| | D | "Hot rock" described in Sample C | | 14.8 ± 0.6 | 0.81 ± 0.03 | 117 ± 2 | | |
| T-SS-13 | | Fracture zone on north wall approximately 12 m west of T-SS-12 | | | | | | |
| | A | Fracture filling | | 19.6 ± 0.7 | 0.014 ± 0.006 | 2.15 ± 0.07 | | |
| | B | Approximately 28 m layer rock adjacent to filling | | 19.0 ± 0.7 | 1.57 ± 0.05 | 0.94 ± 0.04 | | |

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*Rough calibration: $pCi/g = \frac{counts/min - 5}{0.145}$

**No isotope differentiation. Average $^{239}$Pu/$^{238}$Pu ratio for samples T-SS-2A, T-SS-9, T-SS-10A & B, T-SS-11B, T-SS-12A, B & D, and T-SS-13A is 142.

Source: Rogers 1977, 05707.2, p. T-37

## Table B-19
## Results of Radioassay Analysis of Cores Beneath Absorption Beds 3 and 4, 1976

| Hole No. 1 | Bed 4 | Hole No. 2 | Bed 3 | Hole No. 3 | Bed 4 | Hole No. 4 | Bed 3 |
|---|---|---|---|---|---|---|---|
| Depth, in. | pCi/g | Depth, in. | pCi/g | Depth, in. | pCi/g | Depth, in. | pCi/g (Est) |
| 0 - 6 | 950 | 0 - 6 | 2895 | 0 - 6 | 185 | 0 - 6 | 300 |
| 6 - 12 | 195 | 6 - 12 | 1850 | 6 - 12 | 105 | 6 - 12 | 170 |
| 12 - 18 | 1100 | 12 - 30 | 150 | 12 - 18 | 60 | 12 - 18 | 100 |
| NOTE: Hole was abandoned because of caving. | | 30 - 35 | 75 | 18 - 24 | 45 | 18 - 24 | 80 |
| | | 36 - 42 | 15 | 24 - 30 | 5 | 24 - 30 | 60 |
| | | 42 - 48 | 20 | 30 - 36 | 50 | 30 - 36 | 55 |
| | | 48 - 54 | 460 | 36 - 42 | 65 | 36 - 42 | 55 |
| | | 54 - 66 | Background | 42 - 48 | 30 | 42 - 48 | 45 |
| | | 66 - 72 | 40 | 48 - 54 | 15 | 48 - 54 | 30 |
| | | 72 - 84 | Background | 54 - 60 | 30 | 54 - 60 | 10 |
| | | | | 60 - 66 | 570 | 60 - 66 | Background* |
| | | | | 66 - 72 | 25 | 66 - 72 | 230 |
| | | | | 72 - 138 | Background* | 72 - 78 | 60 |
| | | | | | | 78 - 84 | 50 |
| | | | | | | 84 - 90 | 70 |
| | | | | | | 90 - 96 | 70 |
| | | | | | | 95 - 102 | 65 |
| | | | | | | 102 - 108 | 50 |
| | | | | | | 108 - 114 | 55 |
| | | | | | | 114 - 120 | 35 |
| | | | | | | 120 - 126 | 60 |
| | | | | | | 126 - 132 | 55 |
| | | | | | | 132 - 138 | 65 |
| | | | | | | 138 - 144 | 50 |
| | | | | | | 144 - 150 | 50 |
| | | | | | | 150 - 156 | 50 |
| | | | | | | 156 - 162 | 50 |
| | | | | | | 162 - 168 | 50 |
| | | | | | | 168 - 174 | 20 |
| | | | | | | 174 - 240 | Background |

*Less than 10 pCi/g

Source: Rogers 1977, 05707.2, p. T-40.

### Table B-20
### Inventory of Water (CM) in the Tuff Below Absorption Bed 1 at Three Sampling Times

| Depth Below Bottom of Absorption Bed (m) | June 1961 | August 1961 | 1978 |
|---|---|---|---|
| 0-11.28 | 221 | 401 | 241 |
| 11.28-27.13 | 211 | 350 | 194 |
| **Totals** | 432 | 751 | 435 |

Note: Inventory estimates from the neutron moisture gauge data of Christenson and Thomas (1962). The moisture gauge data were collected in June 1961 (before the addition of water to the absorption bed) and in late August 1961 (immediately after the last addition of water to the absorption bed).

Source: Nyhan et al. 1984, 06529.1, p. 16.

### Table B-21
### Average pH of Tuff Samples Collected Beneath Absorption Beds at MDA T in 1978

| Sampling Depth (ft) | Average and Standard Deviation of pH of Tuff from Absorption Bed Number[a] | |
|---|---|---|
| | 1 | 2 |
| Immediately below gravel cobble layer | 7.6 (0.5) | 6.8 (0.50) |
| 33.0 – 33.5 | 7.6 (0.78) | 7.0 (0.25) |
| 52.5 – 53.0 | 8.7 (0.06) | 7.3 (0.47) |
| 64.0 – 64.5 | 7.4 (0.40) | 7.5 (0.91) |
| 84.0 – 84.5 | 7.5 (0.01) | 7.0 (0.11) |
| 98.5 – 99.0 | 7.5 (0.06) | 8.0 (0.73) |
| 99.0 – 99.5 | 8.1 (0.12) | 7.6 (0.91) |

[a] Average pH of one sample collected at each depth from each of two holes.

Source: Nyhan et al. 1984, 06529.1, p. 12.

### Table B-22
### Summary of Background Concentrations of Radionuclides in Soils of Northern New Mexico

| Radionuclide | Units | Mean Concentration | Upper Limit of Background (mean concentration plus 2 standard deviations) |
|---|---|---|---|
| $^{3}H$ | pCi/L | 2600 | 7200 |
| $^{238}Pu$ | pCi/g | 0.001 | 0.005 |
| $^{239}Pu$ | pCi/g | 0.007 | 0.025 |
| $^{241}Am$ | pCi/g | 0.007 | 0.023 |

Source: Nyhan and Drennon 1993, 23248.1

## Table B-23
## Radionuclides Detected Above Background Values, 1992, 1993–1994, and 1996–1997

| Sample ID | Location ID | Depth (ft) | Media | Americium-241 | Cesium-137 | Europium-152 | Plutonium-238 | Plutonium-239 | Strontium-90 | Tritium | Uranium-234 | Uranium-235 | Uranium-238 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Soil Background Value** | | | | 0.013 | 1.65 | —* | 0.023 | 0.054 | 1.31 | 0.766 | 2.59 | — | — |
| **Qbt 2,3,4 Background Value** | | | | 0.05 | 0.1 | — | 0.05 | 0.05 | 1 | 0.3 | 1.98 | — | 1.93 |
| **Qbt 1v Background Value** | | | | — | — | — | — | 0.05 | — | — | — | — | — |
| **Fill Background Value** | | | | 0.013 | 1.65 | — | 0.023 | 0.054 | 1.31 | — | 2.59 | 0.2 | 2.29 |
| **Residential SAL (pCi/g)** | | | | 39 | 5.3 | 2.7 | 49 | 44 | 5.7 | 15140 | 63 | 17 | 86 |
| **Industrial SAL (pCi/g)** | | | | 140 | 19.7 | 9.7 | 176 | 159 | 1615 | 15140 | 1672 | 83.2 | 351 |
| **1992** | | | | | | | | | | | | | |
| AAA0564 | 21-01085 | 0.00–0.08 | Soil | 0.601 | — | — | 6.97 | 1.43 | — | — | — | — | — |
| AAA3950 | 21-01615 | 0.00–0.50 | Soil | 0.033 | — | — | — | 0.11 | — | 5.015713E-02 | — | — | — |
| AAA3951 | 21-01616 | 0.00–0.50 | Soil | 0.1 | — | — | — | 0.149 | — | — | — | — | — |
| AAA3954 | 21-01619 | 0.00–0.50 | Soil | 9.751 | — | — | 0.535 | 8.919 | — | — | — | — | — |
| AAA3958 | 21-01621 | 0.00–0.50 | Soil | — | — | — | — | — | — | 0.0533557 | — | — | — |
| AAA3959 | 21-01622 | 0.00–0.50 | Soil | — | — | — | — | — | — | 5.678161E-02 | — | — | — |
| AAA3960 | 21-01622 | 0.00–0.50 | Soil | — | — | — | — | — | — | 0.0452968 | — | — | — |
| AAA3961 | 21-01623 | 0.00–0.50 | Soil | 3.406 | — | — | 0.354 | 0.969 | — | 6.667447E-02 | — | — | — |
| AAA3962 | 21-01624 | 0.00–0.50 | Soil | — | — | — | — | — | — | 3.782066E-02 | — | — | — |
| AAA3963 | 21-01625 | 0.00–0.50 | Soil | 0.08 | — | — | — | 0.182 | — | 3.370412E-02 | — | — | — |
| AAA3964 | 21-01626 | 0.00–0.50 | Soil | — | — | — | 0.031 | — | — | 4.902605E-02 | — | — | — |
| AAA3965 | 21-01627 | 0.00–0.50 | Soil | 1.31 | — | — | 3.639 | 4.108 | — | 7.801332E-02 | — | — | — |
| AAA3966 | 21-01628 | 0.00–0.50 | Soil | — | — | — | — | — | — | 5.091638E-02 | — | — | — |
| AAA3985 | 21-01644 | 0.00–0.50 | Soil | 12.333 | — | — | 1.307 | 19.237 | — | 0.3575631 | — | — | — |
| AAA3987 | 21-01646 | 0.00–0.50 | Soil | 26.395 | — | — | 6.851 | 201.254 | — | 9.712643E-02 | 3.363 | — | — |
| AAA3988 | 21-01647 | 0.00–0.50 | Soil | — | — | — | — | — | — | 4.237251E-02 | — | — | — |

## Table B-23 (continued)

| Sample ID | Location ID | Depth (ft) | Media | Americium-241 | Cesium-137 | Europium-152 | Plutonium-238 | Plutonium-239 | Strontium-90 | Tritium | Uranium-234 | Uranium-235 | Uranium-238 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Soil Background Value** | | | | **0.013** | **1.65** | — | **0.023** | **0.054** | **1.31** | **0.766** | **2.59** | — | — |
| **Qbt 2,3,4 Background Value** | | | | **0.05** | **0.1** | — | **0.05** | **0.05** | **1** | **0.3** | **1.98** | — | **1.93** |
| **Qbt 1v Background Value** | | | | — | — | — | — | **0.05** | — | — | — | — | — |
| **Fill Background Value** | | | | **0.013** | **1.65** | — | **0.023** | **0.054** | **1.31** | — | **2.59** | **0.2** | **2.29** |
| **Residential SAL (pCi/g)** | | | | **39** | **5.3** | **2.7** | **49** | **44** | **5.7** | **15140** | **63** | **17** | **86** |
| **Industrial SAL (pCi/g)** | | | | **140** | **19.7** | **9.7** | **176** | **159** | **1615** | **15140** | **1672** | **83.2** | **351** |
| AAA3989 | 21-01648 | 0.00–0.50 | Soil | 1.56 | — | — | 0.273 | 1.565 | — | 5.045045E—02 | — | — | — |
| AAA3990 | 21-01649 | 0.00–0.50 | Soil | — | — | — | — | — | — | 4.414966E—02 | — | — | — |
| AAA3996 | 21-01655 | 0.00–0.50 | Soil | 0.504 | — | — | — | 0.136 | — | 4.768559E-02 | — | — | — |
| AAA3997 | 21-01656 | 0.00–0.50 | Soil | — | — | — | — | — | — | 5.432373E-02 | — | — | — |
| AAA3998 | 21-01657 | 0.00–0.50 | Soil | 0.027 | — | — | — | 0.06 | — | 7.567567E-02 | — | — | — |
| AAA4001 | 21-01658 | 0.00–0.50 | Soil | 2.831 | — | — | 6.625 | 8.602 | — | 0.2471635 | — | — | — |
| AAA4002 | 21-01658 | 0.00–0.50 | Soil | 2.881 | — | — | 6.532 | 9.669 | — | 0.8204922 | — | — | — |
| AAA4006 | 21-01662 | 0.00–0.50 | Soil | 3.212 | — | — | 0.511 | 4.791 | — | — | — | — | — |
| **1993–1994** | | | | | | | | | | | | | |
| AAB7314 | 21-02535 | 2.50–5.00 | Fill | — | — | — | — | 0.0847 | — | — | — | — | — |
| AAB7316 | 21-02536 | 5.00–7.50 | Soil | 338 | 4.17 | — | 9.2 | 411 | 0.918 | 0.1410856 | — | — | — |
| AAB7320 | 21-02537 | 7.50–10.00 | Qbt 3 | — | — | — | — | 0.0228 | — | 0.2399339 | — | — | — |
| AAB7323 | 21-02538 | 5.00–7.50 | Fill | 259 | 2.37 | — | 2.07 | 135 | 0.324 | — | — | — | — |
| AAB7328 | 21-02539 | 7.50–10.00 | Soil | 855 | 12.9 | — | 13.5 | 808 | 3.74 | 0.121928 | — | — | — |
| AAB7332 | 21-02540 | 7.50–10.00 | Qbt 3 | — | — | — | — | 0.0229 | — | 0.267933 | — | — | — |
| AAB7334 | 21-02541 | 2.50–5.00 | Soil | 543 | 5.78 | — | 5.4 | 347 | 2.1 | 7.690036E-02 | — | — | — |
| AAB9109 | 21-02541 | 10.00–12.50 | Qbt 3 | 19500 | 97 | — | 215 | 13900 | 43.5 | 0.1136835 | — | — | — |
| AAB7340 | 21-02543 | 2.50–5.00 | Soil | 1120 | 6.74 | — | 13 | 659 | 3.92 | 0.1340795 | — | — | — |

## Table B-23 (continued)

| Sample ID | Location ID | Depth (ft) | Media | Americium-241 | Cesium-137 | Europium-152 | Plutonium-238 | Plutonium-239 | Strontium-90 | Tritium | Uranium-234 | Uranium-235 | Uranium-238 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Soil Background Value** | | | | 0.013 | 1.65 | — | 0.023 | 0.054 | 1.31 | 0.766 | 2.59 | — | — |
| **Qbt 2,3,4 Background Value** | | | | 0.05 | 0.1 | — | 0.05 | 0.05 | 1 | 0.3 | 1.98 | — | 1.93 |
| **Qbt 1v Background Value** | | | | — | — | — | — | 0.05 | — | — | — | — | — |
| **Fill Background Value** | | | | 0.013 | 1.65 | — | 0.023 | 0.054 | 1.31 | — | 2.59 | 0.2 | 2.29 |
| **Residential SAL (pCi/g)** | | | | 39 | 5.3 | 2.7 | 49 | 44 | 5.7 | 15140 | 63 | 17 | 86 |
| **Industrial SAL (pCi/g)** | | | | 140 | 19.7 | 9.7 | 176 | 159 | 1615 | 15140 | 1672 | 83.2 | 351 |
| AAB7342 | 21-02544 | 5.00–7.50 | Soil | 793 | 8.93 | — | 19.7 | 1250 | 9.84 | 0.227282 | — | — | — |
| AAB7343 | 21-02545 | 0.00–5.00 | Soil | — | — | — | 0.0079 | 1.03 | — | — | — | — | — |
| AAB7347 | 21-02546 | 0.00–5.00 | Soil | 208 | 0.712 | — | 1.8 | 143 | 1.04 | 5.962933E-02 | — | — | — |
| AAB7352 | 21-02547 | 5.00–10.00 | Soil | 19982 | 107.78 | — | 327 | 19143 | 44.3 | 5.820486E-02 | 3.45 | — | — |
| AAB7355 | 21-02548 | 2.50–5.00 | Soil | 2.68 | — | — | 0.0427 | 1.36 | 0.574 | 0.290792 | — | — | — |
| AAB7368 | 21-02609 | 5.00–7.50 | Soil | 83.8 | 8.93 | — | 3.5 | 142 | 8.97 | 0.1049749 | — | — | — |
| AAB9110 | 21-02609 | 5.00–7.50 | Soil | 668 | 14 | — | 6.03 | 595 | 11 | 0.091 | — | — | — |
| AAB9111 | 21-02610 | 5.00–7.50 | Soil | 1730 | 8.26 | — | 1440 | 23 | 1.05 | 8.097598E-02 | — | — | — |
| **1996–1997** | | | | | | | | | | | | | |
| 0121-97-0002 | 21-05051 | 6.00–6.50 | Fill | 242.5 | — | — | — | 108.5 | — | — | — | — | — |
| 0121-97-0003 | 21-05051 | 8.50–9.00 | Fill | 952.7 | — | — | 18.02 | 2791 | 98.75 | — | 3.68 | — | — |
| 0121-97-0004 | 21-05051 | 11.50–12.00 | Fill | 1944 | 1.56 | — | — | — | — | — | 6.44 | — | — |
| 0121-97-0005 | 21-05051 | 13.80–14.50 | Qbt 3 | 2155 | 6.78 | — | — | — | 5.17 | — | 8.82 | — | 2.41 |
| 0121-97-0006 | 21-05051 | 20.00–21.00 | Qbt 3 | 3617 | 7.95 | — | — | 13170 | 8.6 | — | 7.56 | — | 2.77 |
| 0121-97-0007 | 21-05051 | 27.50–28.00 | Qbt 3 | 1092 | — | — | 15.56 | 2006 | — | — | 2.17 | — | — |
| 0121-97-0008 | 21-05051 | 40.00–40.50 | Qbt 3 | 93.58 | — | — | — | 463.9 | — | — | — | — | — |
| 0121-97-0009 | 21-05051 | 50.00–50.50 | Qbt 3 | 57.31 | — | — | — | 377.4 | — | — | — | — | — |
| 0121-97-0010 | 21-05051 | 61.00–61.50 | Qbt 3 | 71.67 | — | — | — | 87.42 | — | — | — | — | — |

## Table B-23 (continued)

| Sample ID | Location ID | Depth (ft) | Media | Americium-241 | Cesium-137 | Europium-152 | Plutonium-238 | Plutonium-239 | Strontium-90 | Tritium | Uranium-234 | Uranium-235 | Uranium-238 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Soil Background Value** | | | | **0.013** | **1.65** | **—** | **0.023** | **0.054** | **1.31** | **0.766** | **2.59** | **—** | **—** |
| **Qbt 2,3,4 Background Value** | | | | **0.05** | **0.1** | **—** | **0.05** | **0.05** | **1** | **0.3** | **1.98** | **—** | **1.93** |
| **Qbt 1v Background Value** | | | | **—** | **—** | **—** | **—** | **0.05** | **—** | **—** | **—** | **—** | **—** |
| **Fill Background Value** | | | | **0.013** | **1.65** | **—** | **0.023** | **0.054** | **1.31** | **—** | **2.59** | **0.2** | **2.29** |
| **Residential SAL (pCi/g)** | | | | **39** | **5.3** | **2.7** | **49** | **44** | **5.7** | **15140** | **63** | **17** | **86** |
| **Industrial SAL (pCi/g)** | | | | **140** | **19.7** | **9.7** | **176** | **159** | **1615** | **15140** | **1672** | **83.2** | **351** |
| 0121-97-0011 | 21-05051 | 71.00–71.50 | Qbt 3 | 27.06 | — | — | — | 49.23 | — | — | — | — | — |
| 0121-97-0012 | 21-05051 | 80.00–80.50 | Qbt 3 | 20.32 | — | — | — | 28.86 | — | — | — | — | — |
| 0121-97-0013 | 21-05051 | 89.50–90.00 | Qbt 3 | 46.1 | — | — | — | 49.57 | — | — | — | — | — |
| 0121-97-0014 | 21-05051 | 99.50–100.00 | Qbt 3 | 26.83 | — | — | — | 59.56 | — | — | — | — | — |
| 0121-97-0015 | 21-05051 | 109.00–109.50 | Qbt 2 | 4.89 | — | — | — | — | — | — | — | — | — |
| 0121-97-0019 | 21-05051 | 149.50–150.00 | Qbt 2 | — | — | — | — | — | 1.14 | — | — | — | — |
| 0121-97-0026 | 21-05052 | 2.50–3.00 | Fill | — | — | — | — | 0.86 | — | — | — | — | — |
| 0121-97-0027 | 21-05052 | 9.00–9.50 | Qal | — | — | — | — | 0.4 | — | — | — | — | — |
| 0121-97-0028 | 21-05052 | 20.00–20.50 | Qal | — | — | — | 0.31 | — | — | — | — | — | — |
| 0121-97-0038 | 21-05052 | 119.00–120.00 | Qbt 2 | — | — | — | 0.34 | — | — | — | — | — | — |
| 0121-97-0040 | 21-05052 | 139.00–140.00 | Qbt 2 | — | — | — | 0.31 | — | — | — | — | — | — |
| 0121-97-0041 | 21-05052 | 149.00–150.00 | Qbt 2 | — | — | 4.42 | — | — | — | — | — | — | — |
| 0121-97-0051 | 21-05053 | 4.20–4.60 | Fill | 6638 | 43.05 | — | — | 5872 | 54.22 | — | — | — | — |
| 0121-97-0052 | 21-05053 | 6.50–7.00 | Fill | 2749 | 243.1 | — | 843.8 | 15490 | 756.88 | — | 17.53 | 1.15 | 2.89 |
| 0121-97-0064 | 21-05053 | 6.50–7.00 | Fill | 2987 | 271.9 | — | 462.2 | 8436 | 541.81 | — | 11.1 | — | — |
| 0121-97-0053 | 21-05053 | 9.50–10.00 | Fill | 14760 | 19.89 | — | 2480 | 230600 | 6.33 | — | 25.34 | 1.7 | — |
| 0121-97-0054 | 21-05053 | 12.50–13.00 | Qbt 3 | 308.5 | — | — | 1.33 | 233.3 | 26.23 | — | 2.42 | — | — |
| 0121-97-0055 | 21-05053 | 17.00–17.30 | Qbt 3 | 1198 | — | — | — | 14.39 | 2.56 | — | 6.42 | — | 5.09 |

## Table B-23 (continued)

| Sample ID | Location ID | Depth (ft) | Media | Americium-241 | Cesium-137 | Europium-152 | Plutonium-238 | Plutonium-239 | Strontium-90 | Tritium | Uranium-234 | Uranium-235 | Uranium-238 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Soil Background Value** | | | | **0.013** | **1.65** | — | **0.023** | **0.054** | **1.31** | **0.766** | **2.59** | — | — |
| **Qbt 2,3,4 Background Value** | | | | **0.05** | **0.1** | — | **0.05** | **0.05** | **1** | **0.3** | **1.98** | — | **1.93** |
| **Qbt 1v Background Value** | | | | — | — | — | — | **0.05** | — | — | — | — | — |
| **Fill Background Value** | | | | **0.013** | **1.65** | — | **0.023** | **0.054** | **1.31** | — | **2.59** | **0.2** | **2.29** |
| **Residential SAL (pCi/g)** | | | | **39** | **5.3** | **2.7** | **49** | **44** | **5.7** | **15140** | **63** | **17** | **86** |
| **Industrial SAL (pCi/g)** | | | | **140** | **19.7** | **9.7** | **176** | **159** | **1615** | **15140** | **1672** | **83.2** | **351** |
| 0121-97-0056 | 21-05053 | 20.50–21.50 | Qbt 3 | 602.6 | — | — | — | 29.9 | 6.32 | — | — | — | — |
| 0121-97-0057 | 21-05053 | 28.00–29.00 | Qbt 3 | 1740 | — | — | — | 8.63 | 2 | — | — | — | — |
| 0121-97-0059 | 21-05053 | 48.00–48.50 | Qbt 3 | 1615 | — | — | 56.02 | 10470 | 16.47 | — | 4.51 | — | — |
| 0121-97-0060 | 21-05053 | 59.50–60.00 | Qbt 3 | 83.25 | — | — | — | 1292 | — | — | — | — | — |
| 0121-97-0061 | 21-05053 | 60.00–60.70 | Qbt 3 | 150 | — | — | — | 2871 | 2.7 | — | — | — | — |
| 0121-97-0066 | 21-05054 | 3.00–3.50 | Fill | 8.68 | — | — | — | 26.83 | 6.56 | — | — | — | — |
| 0121-97-0067 | 21-05054 | 6.00–6.50 | Fill | 3011 | 0.46 | — | 146.4 | 11030 | 37.55 | — | — | — | — |
| 0121-97-0068 | 21-05054 | 7.50–8.20 | Fill | 3000 | 1.17 | — | — | — | 52.26 | — | 4.54 | — | — |
| 0121-97-0069 | 21-05054 | 10.50–11.00 | Fill | 14950 | 20.9 | — | 1687 | 161900 | 8.94 | — | 34.51 | 2.44 | 3.22 |
| 0121-97-0070 | 21-05054 | 14.20–15.00 | Qbt 3 | 2893 | — | — | — | 1565 | 133.68 | — | — | — | — |
| 0121-97-0071 | 21-05054 | 21.80–22.10 | Qbt 3 | 3787 | — | — | — | 4134 | 3.96 | — | 8.94 | — | 5.05 |
| 0121-97-0072 | 21-05054 | 32.00–32.50 | Qbt 3 | 313.4 | — | — | — | — | — | — | — | — | — |
| 0121-97-0073 | 21-05054 | 35.50–36.00 | Qbt 3 | 1138 | — | — | — | — | — | — | — | — | — |
| 0121-97-0074 | 21-05054 | 50.00–50.50 | Qbt 3 | 3.93 | — | — | — | 5.91 | — | — | — | — | — |
| 0121-97-0081 | 21-05055 | 3.50–4.00 | Fill | — | — | — | — | 2.5 | 4.6 | — | — | — | — |
| 0121-97-0082 | 21-05055 | 8.50–9.00 | Fill | 270 | 33 | — | 88 | 14000 | 21 | — | — | — | 33 |
| 0121-97-0083 | 21-05055 | 14.50–15.00 | Fill | 510 | 21 | — | 200 | 32000 | 14 | — | 18 | — | 18 |
| 0121-97-0096 | 21-05056 | 4.50–5.00 | Fill | — | — | — | 0.065 | 0.17 | 2 | — | — | — | — |

## Table B-23 (continued)

| Sample ID | Location ID | Depth (ft) | Media | Americium-241 | Cesium-137 | Europium-152 | Plutonium-238 | Plutonium-239 | Strontium-90 | Tritium | Uranium-234 | Uranium-235 | Uranium-238 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Soil Background Value** | | | | **0.013** | **1.65** | — | **0.023** | **0.054** | **1.31** | **0.766** | **2.59** | — | — |
| **Qbt 2,3,4 Background Value** | | | | **0.05** | **0.1** | — | **0.05** | **0.05** | **1** | **0.3** | **1.98** | — | **1.93** |
| **Qbt 1v Background Value** | | | | — | — | — | — | **0.05** | — | — | — | — | — |
| **Fill Background Value** | | | | **0.013** | **1.65** | — | **0.023** | **0.054** | **1.31** | — | **2.59** | **0.2** | **2.29** |
| **Residential SAL (pCi/g)** | | | | **39** | **5.3** | **2.7** | **49** | **44** | **5.7** | **15140** | **63** | **17** | **86** |
| **Industrial SAL (pCi/g)** | | | | **140** | **19.7** | **9.7** | **176** | **159** | **1615** | **15140** | **1672** | **83.2** | **351** |
| 0121-97-0097 | 21-05056 | 11.80–12.20 | Qbt 3 | — | — | — | 0.051 | 1.7 | — | — | — | — | — |
| 0121-97-0098 | 21-05056 | 20.00–20.50 | Qbt 3 | — | — | — | 0.063 | 1.1 | — | — | — | — | — |
| 0121-97-0099 | 21-05056 | 29.00–29.50 | Qbt 3 | — | — | — | 0.096 | 8.9 | 1.1 | — | — | — | — |
| 0121-97-0100 | 21-05056 | 39.00–39.50 | Qbt 3 | — | — | — | — | 1.4 | — | — | — | — | — |
| 0121-97-0101 | 21-05056 | 49.50–50.00 | Qbt 3 | — | — | — | 0.074 | 0.75 | 1.2 | — | — | — | — |
| 0121-96-0481 | 21-05057 | 4.30–5.00 | Fill | 8.56 | — | — | 0.045 | 1.203 | — | — | — | — | — |
| 0121-96-0482 | 21-05057 | 9.50–10.00 | Fill | 2.41 | — | — | 0.193 | 1.458 | — | — | — | — | — |
| 0121-96-0483 | 21-05057 | 19.50–20.00 | Fill | 28.9 | 0.863 | — | 0.27 | 15.23 | 0.82 | — | — | — | — |
| 0121-96-0484 | 21-05057 | 22.50–23.90 | Qal | 210000 | 2.5 | — | 170 | 2800 | — | — | 92 | — | 55 |
| 0121-96-0485 | 21-05057 | 29.50–30.00 | Qbt 3 | 2.56 | — | — | — | 0.174 | — | — | — | — | — |
| 0121-96-0486 | 21-05057 | 39.50–40.00 | Qbt 3 | — | — | — | — | 0.843 | — | — | — | — | — |
| 0121-96-0487 | 21-05057 | 49.50–50.00 | Qbt 3 | 0.435 | — | — | — | 2.067 | — | — | — | — | — |
| 0121-96-0491 | 21-05058 | 4.50–5.00 | Fill | — | — | — | 0.26 | 27 | 1.6 | — | — | — | — |
| 0121-96-0492 | 21-05058 | 7.70–8.20 | Fill | — | — | — | 0.24 | 43 | 4.8 | — | — | — | — |
| 0121-96-0494 | 21-05058 | 17.50–18.20 | Fill | 41 | — | — | 0.37 | 36 | 1.3 | — | — | — | — |
| 0121-96-0495 | 21-05058 | 29.50–30.00 | Qbt 3 | — | — | — | — | — | 1.5 | — | — | — | — |
| 0121-96-0496 | 21-05058 | 39.50–40.00 | Qbt 3 | — | — | — | — | — | 2.1 | — | — | — | — |
| 0121-96-0497 | 21-05058 | 49.50–50.00 | Qbt 3 | — | — | — | — | 0.026 | 2.2 | — | — | — | — |

Table B-23 (continued)

| Sample ID | Location ID | Depth (ft) | Media | Americium-241 | Cesium-137 | Europium-152 | Plutonium-238 | Plutonium-239 | Strontium-90 | Tritium | Uranium-234 | Uranium-235 | Uranium-238 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Soil Background Value** | | | | 0.013 | 1.65 | — | 0.023 | 0.054 | 1.31 | 0.766 | 2.59 | — | — |
| **Qbt 2,3,4 Background Value** | | | | 0.05 | 0.1 | — | 0.05 | 0.05 | 1 | 0.3 | 1.98 | — | 1.93 |
| **Qbt 1v Background Value** | | | | — | — | — | — | 0.05 | — | — | — | — | — |
| **Fill Background Value** | | | | 0.013 | 1.65 | — | 0.023 | 0.054 | 1.31 | — | 2.59 | 0.2 | 2.29 |
| **Residential SAL (pCi/g)** | | | | 39 | 5.3 | 2.7 | 49 | 44 | 5.7 | 15140 | 63 | 17 | 86 |
| **Industrial SAL (pCi/g)** | | | | 140 | 19.7 | 9.7 | 176 | 159 | 1615 | 15140 | 1672 | 83.2 | 351 |
| 0121-97-0112 | 21-05059 | 10.20–10.70 | Qal | — | — | — | — | — | — | — | 1.57 | — | 1.56 |
| 0121-97-0113 | 21-05059 | 20.00–20.50 | Qal | — | — | — | — | — | — | — | 1.77 | — | 1.85 |
| 0121-97-0114 | 21-05059 | 31.50–32.00 | Qal | — | — | — | — | 2.64 | — | — | — | — | — |
| 0121-97-0141 | 21-05060 | 50.00–50.50 | Qbt 3 | 12.73 | — | — | — | — | — | — | — | — | — |
| 0121-97-0142 | 21-05060 | 60.00–60.50 | Qbt 3 | 35.54 | — | — | — | — | — | — | — | — | — |
| 0121-97-0143 | 21-05060 | 69.50–70.00 | Qbt 3 | 77.48 | — | — | — | — | — | — | — | — | — |
| 0121-97-0163 | 21-05060 | 69.50–70.00 | Qbt 3 | 85.08 | — | — | — | — | — | — | — | — | — |
| 0121-97-0147 | 21-05060 | 109.00–109.20 | Qbt 2 | 3.41 | — | — | — | — | — | — | — | — | — |
| 0121-97-0150 | 21-05060 | 139.00–139.50 | Qbt 2 | — | — | — | — | — | — | — | 2.09 | — | 2.29 |
| 0121-97-0167 | 21-05061 | 10.00–10.50 | Qbt 3 | — | — | — | — | 201.7 | — | — | — | — | — |
| 0121-97-0171 | 21-05061 | 49.00–49.50 | Qbt 3 | — | — | — | — | — | — | — | — | — | 2.05 |
| 0121-97-0173 | 21-05061 | 69.50–70.00 | Qbt 3 | — | — | — | — | — | 1.48 | — | — | — | — |
| 0121-97-0178 | 21-05061 | 118.00–118.50 | Qbt 2 | — | — | — | — | 1.33 | — | — | — | — | — |
| 0121-97-0179 | 21-05061 | 128.50–129.00 | Qbt 2 | — | — | — | — | 1.3 | — | — | — | — | — |
| 0121-97-0180 | 21-05061 | 140.00–140.50 | Qbt 2 | — | — | — | — | — | — | — | — | — | 2.47 |
| 0121-97-1128 | 21-05061 | 170.00–170.50 | Qbt 1v | — | — | — | — | 0.38 | — | — | — | — | — |
| 0121-97-0191 | 21-05062 | 5.00–5.50 | Qbt 3 | — | — | — | — | 5.37 | — | — | — | — | — |
| 0121-97-0194 | 21-05062 | 20.00–20.50 | Qbt 3 | — | — | — | — | 3.88 | — | — | — | — | — |

## Table B-23 (continued)

| Sample ID | Location ID | Depth (ft) | Media | Americium-241 | Cesium-137 | Europium-152 | Plutonium-238 | Plutonium-239 | Strontium-90 | Tritium | Uranium-234 | Uranium-235 | Uranium-238 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Soil Background Value** | | | | **0.013** | **1.65** | **—** | **0.023** | **0.054** | **1.31** | **0.766** | **2.59** | **—** | **—** |
| **Qbt 2,3,4 Background Value** | | | | **0.05** | **0.1** | **—** | **0.05** | **0.05** | **1** | **0.3** | **1.98** | **—** | **1.93** |
| **Qbt 1v Background Value** | | | | **—** | **—** | **—** | **—** | **0.05** | **—** | **—** | **—** | **—** | **—** |
| **Fill Background Value** | | | | **0.013** | **1.65** | **—** | **0.023** | **0.054** | **1.31** | **—** | **2.59** | **0.2** | **2.29** |
| **Residential SAL (pCi/g)** | | | | **39** | **5.3** | **2.7** | **49** | **44** | **5.7** | **15140** | **63** | **17** | **86** |
| **Industrial SAL (pCi/g)** | | | | **140** | **19.7** | **9.7** | **176** | **159** | **1615** | **15140** | **1672** | **83.2** | **351** |
| 0121-97-0196 | 21-05062 | 40.00–40.50 | Qbt 3 | — | — | — | — | 15.56 | 3.45 | — | — | — | — |
| 0121-97-0200 | 21-05062 | 78.40–79.50 | Qbt 3 | 66420 | — | — | 3719 | 49020 | 50.38 | — | 99.44 | — | 4.08 |
| 0121-97-0237 | 21-05064 | 8.50–9.00 | Qbt 3 | 302.2 | 30.23 | — | 10.36 | 435.4 | 7.26 | — | — | — | — |
| 0121-97-0238 | 21-05064 | 11.50–12.00 | Qbt 3 | 1480 | 16.33 | — | 57.36 | 3338 | 7.79 | — | — | — | — |
| 0121-97-0239 | 21-05064 | 13.50–13.90 | Qbt 3 | 2668 | 19.45 | — | — | — | 129.13 | — | 2.84 | — | — |
| 0121-97-0242 | 21-05064 | 39.50–40.00 | Qbt 3 | — | — | — | — | — | 2.55 | — | — | — | — |
| 0121-97-0243 | 21-05064 | 49.50–50.00 | Qbt 3 | — | — | — | — | — | 2.68 | — | — | — | — |
| 0121-96-0621 | 21-05065 | 4.50–5.00 | Qbt 3 | — | — | — | — | 0.11 | — | — | — | — | — |
| 0121-96-0622 | 21-05065 | 10.00–10.50 | Qbt 3 | — | — | — | — | 0.028 | — | — | — | — | — |
| 0121-96-0624 | 21-05065 | 29.50–30.00 | Qbt 3 | 2 | — | — | — | — | 0.99 | — | — | — | — |
| 0121-96-0625 | 21-05065 | 39.50–40.00 | Qbt 3 | — | — | — | — | — | 1 | — | — | — | — |
| 0121-96-0626 | 21-05065 | 48.20–48.70 | Qbt 3 | — | — | — | — | 0.027 | 0.53 | — | — | — | — |
| 0121-97-1167 | 21-05071 | 50.50–51.00 | Qbt 3 | — | — | — | — | 0.45 | — | — | — | — | — |
| 0121-97-0326 | 21-05073 | 2.50–3.00 | Soil | 2.6 | — | — | 0.087 | 4.3 | 2.2 | — | — | — | — |
| 0121-97-0327 | 21-05073 | 8.50–9.00 | Qbt 3 | 780 | 460 | — | 390 | 67000 | 81 | — | 29 | — | 13 |
| 0121-97-0328 | 21-05073 | 11.70–12.20 | Qbt 3 | 330 | 27 | — | 96 | 12000 | 10 | — | 45 | — | — |
| 0121-97-0329 | 21-05073 | 22.00–23.00 | Qbt 3 | — | — | — | 0.048 | 7.7 | 8.8 | — | — | — | — |
| 0121-97-0330 | 21-05073 | 32.00–32.50 | Qbt 3 | — | — | — | 0.13 | 21 | 2.8 | — | — | — | — |

## Table B-23 (continued)

| Sample ID | Location ID | Depth (ft) | Media | Americium-241 | Cesium-137 | Europium-152 | Plutonium-238 | Plutonium-239 | Strontium-90 | Tritium | Uranium-234 | Uranium-235 | Uranium-238 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Soil Background Value** | | | | 0.013 | 1.65 | — | 0.023 | 0.054 | 1.31 | 0.766 | 2.59 | — | — |
| **Qbt 2,3,4 Background Value** | | | | 0.05 | 0.1 | — | 0.05 | 0.05 | 1 | 0.3 | 1.98 | — | 1.93 |
| **Qbt 1v Background Value** | | | | — | — | — | — | 0.05 | — | — | — | — | — |
| **Fill Background Value** | | | | 0.013 | 1.65 | — | 0.023 | 0.054 | 1.31 | — | 2.59 | 0.2 | 2.29 |
| **Residential SAL (pCi/g)** | | | | 39 | 5.3 | 2.7 | 49 | 44 | 5.7 | 15140 | 63 | 17 | 86 |
| **Industrial SAL (pCi/g)** | | | | 140 | 19.7 | 9.7 | 176 | 159 | 1615 | 15140 | 1672 | 83.2 | 351 |
| 0121-97-0331 | 21-05073 | 42.00–42.50 | Qbt 3 | — | — | — | 0.033 | 7.1 | 3.5 | — | — | — | — |
| 0121-97-0332 | 21-05073 | 46.50–47.00 | Qbt 3 | — | — | — | — | 3.9 | 0.8 | — | — | — | — |
| 0121-97-0333 | 21-05073 | 62.00–62.50 | Qbt 3 | — | — | — | — | 2.3 | 5.4 | — | — | — | — |
| 0121-97-0401 | 21-05073 | 62.00–62.50 | Qbt 3 | — | — | — | 0.031 | 5.2 | 0.85 | — | — | — | — |
| 0121-97-0334 | 21-05073 | 69.50–70.00 | Qbt 3 | — | — | — | — | 1.7 | 5 | — | — | — | — |
| 0121-97-1001 | 21-05074 | 0.80–1.30 | Soil | 83.21 | — | — | — | — | — | — | — | — | — |
| 0121-97-1003 | 21-05074 | 19.50–20.00 | Qbt 3 | 8.27 | — | — | — | — | — | — | — | — | — |
| 0121-97-1131 | 21-05075 | 6.70–7.20 | Qbt 3 | 4.35 | — | — | — | 3.73 | — | — | — | — | — |
| 0121-97-1132 | 21-05075 | 8.80–9.30 | Qbt 3 | 164.5 | 25.86 | — | — | 1836 | 2.33 | — | — | — | — |
| 0121-97-1133 | 21-05075 | 15.50–16.00 | Qbt 3 | 65.85 | — | — | 3.41 | 613.1 | 2.55 | — | — | — | — |
| 0121-97-1141 | 21-05075 | 15.50–16.00 | Qbt 3 | 66.96 | — | — | 4.86 | 993.6 | 3.01 | — | — | — | — |
| 0121-97-1134 | 21-05075 | 20.00–21.00 | Qbt 3 | 51.71 | — | — | 2.74 | 410.1 | 2.47 | — | — | — | — |
| 0121-97-1137 | 21-05075 | 45.00–46.00 | Qbt 3 | 101.2 | 0.58 | — | 12.1 | 2150 | — | — | — | — | — |
| 0121-97-1138 | 21-05075 | 58.00–58.50 | Qbt 3 | — | — | — | — | 18.8 | 2.18 | — | — | — | — |
| 0121-97-1139 | 21-05075 | 69.50–70.00 | Qbt 3 | 3.34 | 0.5 | — | — | 166 | — | — | — | — | — |

*— = Not detected.

## Table B-24
## Detected Organic Chemicals, 1996–1997

**Part 1**

| Sample ID | Location ID | Depth (ft) | Media | Anthracene | Benz(a)anthra-cene | Benzo(a)pyrene | Benzo(b)fluoran-thene | Benzo(g,h,i) perylene | Benzo(k)fluoran-thene |
|---|---|---|---|---|---|---|---|---|---|
| **Residential SAL (mg/kg)** | | | | $1.6E^{+4}$ | 6.2 | 0.62 | 6.2 | 1800 | 62 |
| **Industrial SAL (mg/kg)** | | | | $3.4E^{+4}$ | 26.0 | 2.6 | 26.0 | 4300 | 260 |
| 0121-97-0001 | 21-05051 | 3.50–4.00 | Fill | —[a] | — | — | — | — | — |
| 0121-97-0002 | 21-05051 | 6.00–6.50 | Fill | — | — | — | — | — | — |
| 0121-97-0003 | 21-05051 | 8.50–9.00 | Fill | — | — | — | — | — | — |
| 0121-97-0004 | 21-05051 | 11.50–12.00 | Fill | — | — | — | — | — | — |
| 0121-97-0005 | 21-05051 | 13.80–14.50 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-0006 | 21-05051 | 20.00–21.00 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-0007 | 21-05051 | 27.50–28.00 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-0008 | 21-05051 | 40.00–40.50 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-0009 | 21-05051 | 50.00–50.50 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-0010 | 21-05051 | 61.00–61.50 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-0026 | 21-05052 | 2.50–3.00 | Fill | 0.048 (J) | 7.300001E-02 (J) | 0.071 (J) | 0.05 (J) | 0.051 (J) | 0.061 (J) |
| 0121-97-0027 | 21-05052 | 9.00–9.50 | Qal | — | — | — | — | — | — |
| 0121-97-0031 | 21-05052 | 49.50–50.00 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-1271 | 21-05052 | 70.00–71.00 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-0051 | 21-05053 | 4.20–4.60 | Fill | — | 0.047 (J) | 0.041 (J) | 0.051 (J) | — | 0.039 (J) |
| 0121-97-0052 | 21-05053 | 6.50–7.00 | Fill | — | 9.100001E-02 (J) | 0.07 (J) | 0.089 (J) | — | 0.081 (J) |
| 0121-97-0064 | 21-05053 | 6.50–7.00 | Fill | — | 0.062 (J) | 0.059 (J) | 0.072 (J) | 0.045 (J) | 0.066 (J) |
| 0121-97-0053 | 21-05053 | 9.50–10.00 | Fill | — | 0.037 (J) | — | — | 0.047 (J) | — |
| 0121-97-0059 | 21-05053 | 48.00–48.50 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-0066 | 21-05054 | 3.00–3.50 | Fill | — | 0.027 (J) | — | — | — | — |
| 0121-97-0067 | 21-05054 | 6.00–6.50 | Fill | — | — | — | — | — | — |
| 0121-97-0068 | 21-05054 | 7.50–8.20 | Fill | — | — | — | — | — | — |
| 0121-97-0069 | 21-05054 | 10.50–11.00 | Fill | — | — | — | — | — | — |
| 0121-97-0071 | 21-05054 | 21.80–22.10 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-0096 | 21-05056 | 4.50–5.00 | Fill | — | — | — | — | — | — |
| 0121-97-0098 | 21-05056 | 20.00–20.50 | Qbt 3 | — | — | — | — | — | — |
| 0121-96-0481 | 21-05057 | 4.30–5.00 | Fill | — | 0.46 | 0.41 | 0.41 | — | — |
| 0121-96-0482 | 21-05057 | 9.50–10.00 | Fill | — | — | — | — | — | — |
| 0121-96-0483 | 21-05057 | 19.50–20.00 | Fill | — | — | — | — | — | — |
| 0121-96-0484 | 21-05057 | 22.50–23.90 | Qal | — | — | — | — | — | — |
| 0121-96-0497 | 21-05058 | 49.50–50.00 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-0115 | 21-05059 | 36.40–36.80 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-0141 | 21-05060 | 50.00–50.50 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-0144 | 21-05060 | 79.50–80.00 | Qbt 3 | — | — | — | — | — | — |

## Table B-24 (continued)

**Part 1 (continued)**

| Sample ID | Location ID | Depth (ft) | Media | Anthracene | Benz(a)anthra-cene | Benzo(a)pyrene | Benzo(b)fluoran-thene | Benzo(g,h,i) perylene | Benzo(k)fluoran-thene |
|---|---|---|---|---|---|---|---|---|---|
| **Residential SAL (mg/kg)** | | | | 1.6E$^{+4}$ | 6.2 | 0.62 | 6.2 | 1800 | 62 |
| **Industrial SAL (mg/kg)** | | | | 3.4E$^{+4}$ | 26.0 | 2.6 | 26.0 | 4300 | 260 |
| 0121-97-0150 | 21-05060 | 139.00–139.50 | Qbt 2 | — | — | — | — | — | — |
| 0121-97-0166 | 21-05061 | 5.50–6.00 | Soil | — | — | — | — | — | — |
| 0121-97-0167 | 21-05061 | 10.00–10.50 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-0173 | 21-05061 | 69.50–70.00 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-0185 | 21-05061 | 189.50–190.00 | Qbt 1v | — | — | — | — | — | — |
| 0121-97-0191 | 21-05062 | 5.00–5.50 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-0218 | 21-05062 | 58.80–59.50 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-0223 | 21-05063 | 10.00–11.60 | Qbt 3 | — | — | — | — | — | — |
| 0121-96-0621 | 21-05065 | 4.50–5.00 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-0326 | 21-05073 | 2.50–3.00 | Soil | — | — | — | — | — | — |
| 0121-97-0331 | 21-05073 | 42.00–42.50 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-1133 | 21-05075 | 15.50–16.00 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-1137 | 21-05075 | 45.00–46.00 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-1138 | 21-05075 | 58.00–58.50 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-1139 | 21-05075 | 69.50–70.00 | Qbt 3 | — | — | — | — | — | — |

## Table B-24 (continued)

**Part 2**

| Sample ID | Location ID | Depth (ft) | Media | Bis(2-ethylhexyl) phthalate | Butanone[2-] | Chrysene | Dibromo-3-Chloropropane [1,2-] | Dichlorodifluoro-methane | Di-n-butylphthalate |
|---|---|---|---|---|---|---|---|---|---|
| **Residential SAL (mg/kg)** | | | | 350 | $3.7E^{+4}$ | 610 | 4.5 | 90 | NA[b] |
| **Industrial SAL (mg/kg)** | | | | 1500 | $8.9E^{+4}$ | 2500 | 40 | 310 | NA |
| 0121-97-0001 | 21-05051 | 3.50–4.00 | Fill | — | — | — | — | — | — |
| 0121-97-0002 | 21-05051 | 6.00–6.50 | Fill | — | — | — | — | — | 0.053 (J) |
| 0121-97-0003 | 21-05051 | 8.50–9.00 | Fill | — | — | — | — | — | 0.046 (J) |
| 0121-97-0004 | 21-05051 | 11.50–12.00 | Fill | — | — | — | — | — | 0.063 (J) |
| 0121-97-0005 | 21-05051 | 13.80–14.50 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-0006 | 21-05051 | 20.00–21.00 | Qbt 3 | — | — | — | — | — | 7.700001E-02 (J) |
| 0121-97-0007 | 21-05051 | 27.50–28.00 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-0008 | 21-05051 | 40.00–40.50 | Qbt 3 | — | — | — | — | — | 0.043 (J) |
| 0121-97-0009 | 21-05051 | 50.00–50.50 | Qbt 3 | 0.074 (J) | — | — | — | — | — |
| 0121-97-0010 | 21-05051 | 61.00–61.50 | Qbt 3 | 0.12 (J) | — | — | — | — | — |
| 0121-97-0026 | 21-05052 | 2.50–3.00 | Fill | — | — | 0.079 (J) | — | — | — |
| 0121-97-0027 | 21-05052 | 9.00–9.50 | Qal | — | — | — | — | — | — |
| 0121-97-0031 | 21-05052 | 49.50–50.00 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-1271 | 21-05052 | 70.00–71.00 | Qbt 3 | — | — | — | — | 0.004 (J) | — |
| 0121-97-0051 | 21-05053 | 4.20–4.60 | Fill | 0.046 (J) | — | 0.051 (J) | — | — | — |
| 0121-97-0052 | 21-05053 | 6.50–7.00 | Fill | 0.058 (J) | — | 0.1 (J) | — | — | — |
| 0121-97-0064 | 21-05053 | 6.50–7.00 | Fill | 0.052 (J) | — | 0.082 (J) | — | — | — |
| 0121-97-0053 | 21-05053 | 9.50–10.00 | Fill | 0.12 (J) | — | 0.059 (J) | — | — | — |
| 0121-97-0059 | 21-05053 | 48.00–48.50 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-0066 | 21-05054 | 3.00–3.50 | Fill | — | — | 0.038 (J) | — | — | — |
| 0121-97-0067 | 21-05054 | 6.00–6.50 | Fill | — | — | — | — | — | — |
| 0121-97-0068 | 21-05054 | 7.50–8.20 | Fill | 0.067 (J) | — | — | — | — | — |
| 0121-97-0069 | 21-05054 | 10.50–11.00 | Fill | — | — | — | — | — | — |
| 0121-97-0071 | 21-05054 | 21.80–22.10 | Qbt 3 | — | — | — | — | — | 0.09 (J) |
| 0121-97-0096 | 21-05056 | 4.50–5.00 | Fill | — | — | — | — | — | 0.039 (J) |
| 0121-97-0098 | 21-05056 | 20.00–20.50 | Qbt 3 | — | — | — | — | — | 0.052 (J) |
| 0121-96-0481 | 21-05057 | 4.30–5.00 | Fill | — | — | 0.48 | — | — | — |
| 0121-96-0482 | 21-05057 | 9.50–10.00 | Fill | — | — | — | — | — | — |
| 0121-96-0483 | 21-05057 | 19.50–20.00 | Fill | — | — | — | — | — | — |
| 0121-96-0484 | 21-05057 | 22.50–23.90 | Qal | 0.087 (J) | — | — | — | — | — |

## Table B-24 (continued)

**Part 2 (continued)**

| Sample ID | Location ID | Depth (ft) | Media | Bis(2-ethylhexyl) phthalate | Butanone[2-] | Chrysene | Dibromo-3-Chloropropane [1,2-] | Dichlorodifluoro-methane | Di-n-butylphthalate |
|---|---|---|---|---|---|---|---|---|---|
| **Residential SAL (mg/kg)** | | | | 350 | 3.7E$^{+4}$ | 610 | 4.5 | 90 | NA |
| **Industrial SAL (mg/kg)** | | | | 1500 | 8.9E$^{+4}$ | 2500 | 40 | 310 | NA |
| 0121-96-0497 | 21-05058 | 49.50–50.00 | Qbt 3 | — | — | — | — | — | 0.057 (J) |
| 0121-97-0115 | 21-05059 | 36.40–36.80 | Qbt 3 | — | — | — | — | — | 0.037 (J) |
| 0121-97-0141 | 21-05060 | 50.00–50.50 | Qbt 3 | — | — | — | — | — | 0.071 (J) |
| 0121-97-0144 | 21-05060 | 79.50–80.00 | Qbt 3 | 0.079 (J) | 0.004 (J) | — | — | — | — |
| 0121-97-0150 | 21-05060 | 139.00–139.50 | Qbt 2 | — | 0.002 (J) | — | — | — | — |
| 0121-97-0166 | 21-05061 | 5.50–6.00 | Soil | — | — | — | — | — | — |
| 0121-97-0167 | 21-05061 | 10.00–10.50 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-0173 | 21-05061 | 69.50–70.00 | Qbt 3 | — | — | — | — | — | 0.13 (J) |
| 0121-97-0185 | 21-05061 | 189.50–190.00 | Qbt 1v | — | 0.003 (J) | — | — | — | — |
| 0121-97-0191 | 21-05062 | 5.00–5.50 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-0218 | 21-05062 | 58.80–59.50 | Qbt 3 | — | — | — | — | — | 0.12 (J) |
| 0121-97-0223 | 21-05063 | 10.00–11.60 | Qbt 3 | — | — | — | — | — | — |
| 0121-96-0621 | 21-05065 | 4.50–5.00 | Qbt 3 | — | — | — | 0.001 (J) | — | — |
| 0121-97-0326 | 21-05073 | 2.50–3.00 | Soil | — | — | — | — | — | — |
| 0121-97-0331 | 21-05073 | 42.00–42.50 | Qbt 3 | — | — | — | 0.002 (J) | — | — |
| 0121-97-1133 | 21-05075 | 15.50–16.00 | Qbt 3 | — | — | — | — | — | 0.071 (J) |
| 0121-97-1137 | 21-05075 | 45.00–46.00 | Qbt 3 | — | — | — | — | — | 0.1 (J) |
| 0121-97-1138 | 21-05075 | 58.00–58.50 | Qbt 3 | — | — | — | — | — | 0.094 (J) |
| 0121-97-1139 | 21-05075 | 69.50–70.00 | Qbt 3 | — | — | — | — | — | 9.900001E-02 (J) |

## Table B-24 (continued)

| Part 3 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | **Location ID** | **Depth (ft)** | **Media** | **Fluoranthene** | **Hexanone[2-]** | **Indeno(1,2,3-cd) pyrene** | **Isopropyltoluene [4-]** | **Phenanthrene** | **Pyrene** |
| **Residential SAL (mg/kg)** | | | | 2300 | NA | 6.2 | 370 | 1.8E$^{+4}$ | 1.8E$^{+4}$ |
| **Industrial SAL (mg/kg)** | | | | 5300 | NA | 2.6 | 580 | 4.4E$^{+4}$ | 4.3E$^{+4}$ |
| 0121-97-0001 | 21-05051 | 3.50–4.00 | Fill | — | — | — | — | — | — |
| 0121-97-0002 | 21-05051 | 6.00–6.50 | Fill | — | — | — | — | — | — |
| 0121-97-0003 | 21-05051 | 8.50–9.00 | Fill | — | — | — | — | — | — |
| 0121-97-0004 | 21-05051 | 11.50–12.00 | Fill | — | — | — | — | — | — |
| 0121-97-0005 | 21-05051 | 13.80–14.50 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-0006 | 21-05051 | 20.00–21.00 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-0007 | 21-05051 | 27.50–28.00 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-0008 | 21-05051 | 40.00–40.50 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-0009 | 21-05051 | 50.00–50.50 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-0010 | 21-05051 | 61.00–61.50 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-0026 | 21-05052 | 2.50–3.00 | Fill | 0.15 (J) | — | 0.048 (J) | — | 0.17 (J) | 0.16 (J) |
| 0121-97-0027 | 21-05052 | 9.00–9.50 | Qal | — | — | — | — | — | — |
| 0121-97-0031 | 21-05052 | 49.50–50.00 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-1271 | 21-05052 | 70.00–71.00 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-0051 | 21-05053 | 4.20–4.60 | Fill | 0.062 (J) | — | — | — | — | 0.043 (J) |
| 0121-97-0052 | 21-05053 | 6.50–7.00 | Fill | 0.12 (J) | — | — | 0.012 | 0.039 (J) | 9.200001E-02 (J) |
| 0121-97-0064 | 21-05053 | 6.50–7.00 | Fill | 0.097 (J) | — | 0.044 (J) | 0.013 | — | 0.072 (J) |
| 0121-97-0053 | 21-05053 | 9.50–10.00 | Fill | 0.046 (J) | — | 0.043 (J) | 0.006 | — | 0.043 (J) |
| 0121-97-0059 | 21-05053 | 48.00–48.50 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-0066 | 21-05054 | 3.00–3.50 | Fill | 0.085 (J) | — | — | — | 0.047 (J) | 0.064 (J) |
| 0121-97-0067 | 21-05054 | 6.00–6.50 | Fill | — | — | — | — | — | — |
| 0121-97-0068 | 21-05054 | 7.50–8.20 | Fill | — | — | — | — | — | — |
| 0121-97-0069 | 21-05054 | 10.50–11.00 | Fill | — | — | — | — | — | — |
| 0121-97-0071 | 21-05054 | 21.80–22.10 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-0096 | 21-05056 | 4.50–5.00 | Fill | — | — | — | — | — | — |
| 0121-97-0098 | 21-05056 | 20.00–20.50 | Qbt 3 | — | — | — | — | — | — |
| 0121-96-0481 | 21-05057 | 4.30–5.00 | Fill | 1.4 | — | — | — | 0.6300001 | 1 |
| 0121-96-0482 | 21-05057 | 9.50–10.00 | Fill | — | — | — | — | — | — |
| 0121-96-0483 | 21-05057 | 19.50–20.00 | Fill | — | — | — | — | — | — |
| 0121-96-0484 | 21-05057 | 22.50–23.90 | Qal | — | — | — | — | — | — |
| 0121-96-0497 | 21-05058 | 49.50–50.00 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-0115 | 21-05059 | 36.40–36.80 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-0141 | 21-05060 | 50.00–50.50 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-0144 | 21-05060 | 79.50–80.00 | Qbt 3 | — | — | — | — | — | — |

## Table B-24 (continued)

| **Part 3 (continued)** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | **Location ID** | **Depth (ft)** | **Media** | **Fluoranthene** | **Hexanone[2-]** | **Indeno(1,2,3-cd) pyrene** | **Isopropyltoluene [4-]** | **Phenanthrene** | **Pyrene** |
| **Residential SAL (mg/kg)** | | | | 2300 | NA | 6.2 | 370 | 1.8E$^{+4}$ | 1.8E$^{+4}$ |
| **Industrial SAL (mg/kg)** | | | | 5300 | NA | 2.6 | 580 | 4.4E$^{+4}$ | 4.3E$^{+4}$ |
| 0121-97-0150 | 21-05060 | 139.00–139.50 | Qbt 2 | — | — | — | — | — | — |
| 0121-97-0166 | 21-05061 | 5.50–6.00 | Soil | — | — | — | — | — | — |
| 0121-97-0167 | 21-05061 | 10.00–10.50 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-0173 | 21-05061 | 69.50–70.00 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-0185 | 21-05061 | 189.50–190.00 | Qbt 1v | — | — | — | — | — | — |
| 0121-97-0191 | 21-05062 | 5.00–5.50 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-0218 | 21-05062 | 58.80–59.50 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-0223 | 21-05063 | 10.00–11.60 | Qbt 3 | — | — | — | — | — | — |
| 0121-96-0621 | 21-05065 | 4.50–5.00 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-0326 | 21-05073 | 2.50–3.00 | Soil | — | 0.043 | — | — | — | — |
| 0121-97-0331 | 21-05073 | 42.00–42.50 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-1133 | 21-05075 | 15.50–16.00 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-1137 | 21-05075 | 45.00–46.00 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-1138 | 21-05075 | 58.00–58.50 | Qbt 3 | — | — | — | — | — | — |
| 0121-97-1139 | 21-05075 | 69.50–70.00 | Qbt 3 | — | — | — | — | — | — |

## Table B-24 (continued)

**Part 4**

| Sample ID | Location ID | Depth (ft) | Media | Tetrachloro-ethene | Toluene | Trichloroethene | Trichlorofluoro-methane |
|---|---|---|---|---|---|---|---|
| **Residential SAL (mg/kg)** | | | | 49 | 180 | 16 | $1.2\text{E}^{+4}$ |
| **Industrial SAL (mg/kg)** | | | | 100 | 180 | 18 | $3.0\text{E}^{+4}$ |
| 0121-97-0001 | 21-05051 | 3.50–4.00 | Fill | — | 0.002 (J) | — | — |
| 0121-97-0002 | 21-05051 | 6.00–6.50 | Fill | — | 0.007 | — | — |
| 0121-97-0003 | 21-05051 | 8.50–9.00 | Fill | — | 0.005 | — | — |
| 0121-97-0004 | 21-05051 | 11.50–12.00 | Fill | — | 0.004 (J) | — | — |
| 0121-97-0005 | 21-05051 | 13.80–14.50 | Qbt 3 | — | 0.014 | — | — |
| 0121-97-0006 | 21-05051 | 20.00–21.00 | Qbt 3 | — | 0.004 (J) | — | — |
| 0121-97-0007 | 21-05051 | 27.50–28.00 | Qbt 3 | — | 0.003 (J) | — | — |
| 0121-97-0008 | 21-05051 | 40.00–40.50 | Qbt 3 | — | 0.001 (J) | — | — |
| 0121-97-0009 | 21-05051 | 50.00–50.50 | Qbt 3 | — | — | — | — |
| 0121-97-0010 | 21-05051 | 61.00–61.50 | Qbt 3 | — | — | — | — |
| 0121-97-0026 | 21-05052 | 2.50–3.00 | Fill | — | — | — | — |
| 0121-97-0027 | 21-05052 | 9.00–9.50 | Qal | 0.002 (J) | 0.002 (J) | — | 0.002 (J) |
| 0121-97-0031 | 21-05052 | 49.50–50.00 | Qbt 3 | — | — | — | 0.002 (J) |
| 0121-97-1271 | 21-05052 | 70.00–71.00 | Qbt 3 | — | — | — | — |
| 0121-97-0051 | 21-05053 | 4.20–4.60 | Fill | — | 9.000001E-03 | — | — |
| 0121-97-0052 | 21-05053 | 6.50–7.00 | Fill | — | 0.034 | — | — |
| 0121-97-0064 | 21-05053 | 6.50–7.00 | Fill | — | 0.03 | — | — |
| 0121-97-0053 | 21-05053 | 9.50–10.00 | Fill | 0.004 (J) | 0.04 | — | — |
| 0121-97-0059 | 21-05053 | 48.00–48.50 | Qbt 3 | — | 0.004 (J) | — | — |
| 0121-97-0066 | 21-05054 | 3.00–3.50 | Fill | — | 0.008 | 0.002 (J) | — |
| 0121-97-0067 | 21-05054 | 6.00–6.50 | Fill | 0.002 (J) | 0.032 | 0.01 | — |
| 0121-97-0068 | 21-05054 | 7.50–8.20 | Fill | 0.002 (J) | 0.14 | 0.004 (J) | — |
| 0121-97-0069 | 21-05054 | 10.50–11.00 | Fill | 0.008 | 8.800001E-02 (J+) | 0.01 (J+) | - |
| 0121-97-0071 | 21-05054 | 21.80–22.10 | Qbt 3 | — | — | — | — |
| 0121-97-0096 | 21-05056 | 4.50–5.00 | Fill | — | — | — | — |
| 0121-97-0098 | 21-05056 | 20.00–20.50 | Qbt 3 | — | — | — | — |
| 0121-96-0481 | 21-05057 | 4.30–5.00 | Fill | — | — | 0.0075 | — |
| 0121-96-0482 | 21-05057 | 9.50–10.00 | Fill | — | — | 0.01 | — |
| 0121-96-0483 | 21-05057 | 19.50–20.00 | Fill | — | — | 7.800001E-03 | — |
| 0121-96-0484 | 21-05057 | 22.50–23.90 | Qal | — | — | — | — |
| 0121-96-0497 | 21-05058 | 49.50–50.00 | Qbt 3 | — | — | — | — |
| 0121-97-0115 | 21-05059 | 36.40–36.80 | Qbt 3 | — | — | — | — |

## Table B-24 (continued)

**Part 4 (continued)**

| Sample ID | Location ID | Depth (ft) | Media | Tetrachloro-ethene | Toluene | Trichloroethene | Trichlorofluoro-methane |
|---|---|---|---|---|---|---|---|
| **Residential SAL (mg/kg)** | | | | 49 | 180 | 16 | 1.2E$^{+4}$ |
| **Industrial SAL (mg/kg)** | | | | 100 | 180 | 18 | 3.0E$^{+4}$ |
| 0121-97-0141 | 21-05060 | 50.00–50.50 | Qbt 3 | — | — | — | — |
| 0121-97-0144 | 21-05060 | 79.50–80.00 | Qbt 3 | — | — | — | — |
| 0121-97-0150 | 21-05060 | 139.00–139.50 | Qbt 2 | — | — | — | — |
| 0121-97-0166 | 21-05061 | 5.50–6.00 | Soil | — | 0.006 | — | — |
| 0121-97-0167 | 21-05061 | 10.00–10.50 | Qbt 3 | — | 0.003 (J) | — | — |
| 0121-97-0173 | 21-05061 | 69.50–70.00 | Qbt 3 | — | — | — | — |
| 0121-97-0185 | 21-05061 | 189.50–190.00 | Qbt 1v | — | — | — | — |
| 0121-97-0191 | 21-05062 | 5.00–5.50 | Qbt 3 | 0.012 | — | — | — |
| 0121-97-0218 | 21-05062 | 58.80–59.50 | Qbt 3 | — | — | — | — |
| 0121-97-0223 | 21-05063 | 10.00–11.60 | Qbt 3 | — | 0.003 (J) | — | — |
| 0121-96-0621 | 21-05065 | 4.50–5.00 | Qbt 3 | — | — | — | — |
| 0121-97-0326 | 21-05073 | 2.50–3.00 | Soil | 0.004 (J) | — | — | — |
| 0121-97-0331 | 21-05073 | 42.00–42.50 | Qbt 3 | — | — | — | — |
| 0121-97-1133 | 21-05075 | 15.50–16.00 | Qbt 3 | — | — | — | — |
| 0121-97-1137 | 21-05075 | 45.00–46.00 | Qbt 3 | — | — | — | — |
| 0121-97-1138 | 21-05075 | 58.00–58.50 | Qbt 3 | — | — | — | — |
| 0121-97-1139 | 21-05075 | 69.50–70.00 | Qbt 3 | — | — | — | — |

[a] — = Not detected.

[b] NA = Not available.

## Table B-25
## Inorganic Chemicals Detected Above Background Values, 1992, 1993–1994, and 1996–1997

| Part 1 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | **Location ID** | **Depth (ft)** | **Media** | **Aluminum** | **Antimony** | **Arsenic** | **Barium** | **Beryllium** | **Cadmium** | **Calcium** |
| **Soil Background Value** | | | | — | 0.83 | — | — | 1.83 | 0.4 | 6120 |
| **Qbt 2,3,4 Background Value** | | | | 7340 | 0.5 | 2.79 | 46 | 1.21 | 1.63 | 2200 |
| **Qbt 1v Background Value** | | | | — | 0.5 | — | — | — | 0.4 | — |
| **Fill Background Value** | | | | — | 0.83 | — | 295 | — | 0.4 | — |
| **Residential SAL (mg/kg)** | | | | 7.4E$^{+4}$ | 30 | 3.9 | 5200 | 150 | 70 | EN |
| **Industrial SAL (mg/kg)** | | | | 1.0E$^{+5}$ | 92 | 17 | 1.5E$^{+4}$ | 440 | 190 | EN |
| **1992** | | | | | | | | | | |
| AAA0564 | 21-01085 | 0.00–0.08 | Soil | — | 5.2 (U) | — | — | — | 0.45 (U) | — |
| AAA3950 | 21-01615 | 0.00–0.50 | Soil | — | — | — | — | 124 | 1.6 | — |
| AAA3951 | 21-01616 | 0.00–0.50 | Soil | — | — | — | — | — | 1.1 | — |
| AAA3952 | 21-01617 | 0.00–0.50 | Soil | — | — | — | — | — | 2 | — |
| AAA3953 | 21-01618 | 0.00–0.50 | Soil | — | — | — | — | — | 1.5 | — |
| AAA3954 | 21-01619 | 0.00–0.50 | Soil | — | — | — | — | — | 1.4 | — |
| AAA3957 | 21-01620 | 0.00–0.50 | Soil | — | — | — | — | — | 1.3 | — |
| AAA3958 | 21-01621 | 0.00–0.50 | Soil | — | — | — | — | — | 0.92 | — |
| AAA3959 | 21-01622 | 0.00–0.50 | Soil | — | — | — | — | — | 2.2 | — |
| AAA3960 | 21-01622 | 0.00–0.50 | Soil | — | — | — | — | — | 1.9 | — |
| AAA3961 | 21-01623 | 0.00–0.50 | Soil | — | — | — | — | — | 1 | — |
| AAA3962 | 21-01624 | 0.00–0.50 | Soil | — | — | — | — | — | 1.4 | — |
| AAA3963 | 21-01625 | 0.00–0.50 | Soil | — | — | — | — | — | 1.3 | — |
| AAA3964 | 21-01626 | 0.00–0.50 | Soil | — | — | — | — | — | 1.7 | — |
| AAA3965 | 21-01627 | 0.00–0.50 | Soil | — | — | — | — | — | 1 | — |
| AAA3966 | 21-01628 | 0.00–0.50 | Soil | — | — | — | — | — | 1.7 | 7900 |
| AAA3985 | 21-01644 | 0.00–0.50 | Soil | — | — | — | — | — | 1.1 | — |
| AAA3987 | 21-01646 | 0.00–0.50 | Soil | — | — | — | — | — | 1.2 | — |
| AAA3988 | 21-01647 | 0.00–0.50 | Soil | — | — | — | — | — | 0.95 | — |
| AAA3989 | 21-01648 | 0.00–0.50 | Soil | — | — | — | — | — | 0.94 | — |
| AAA3990 | 21-01649 | 0.00–0.50 | Soil | — | — | — | — | — | 0.7 | — |
| AAA3996 | 21-01655 | 0.00–0.50 | Soil | — | — | — | — | — | 0.67 (U) | — |
| AAA3997 | 21-01656 | 0.00–0.50 | Soil | — | — | — | — | — | 1.4 | — |
| AAA3998 | 21-01657 | 0.00–0.50 | Soil | — | — | — | — | — | 1.3 | — |
| AAA4001 | 21-01658 | 0.00–0.50 | Soil | — | — | — | — | — | 1.1 | — |
| AAA4002 | 21-01658 | 0.00–0.50 | Soil | — | — | — | — | — | 0.86 | — |
| AAA4006 | 21-01662 | 0.00–0.50 | Soil | — | — | — | — | — | 0.69 (U) | — |
| **1993–1994** | | | | | | | | | | |
| AAB7314 | 21-02535 | 2.50–5.00 | Fill | — | — | — | — | — | 0.57 (U) | — |
| AAB7316 | 21-02536 | 5.00–7.50 | Soil | — | — | — | — | — | 0.5 (U) | — |
| AAB7320 | 21-02537 | 7.50–10.00 | Qbt 3 | — | — | — | — | — | — | 2740 |
| AAB7323 | 21-02538 | 5.00–7.50 | Fill | — | — | — | — | — | 0.7 (U) | — |
| AAB7328 | 21-02539 | 7.50–10.00 | Soil | — | — | — | — | — | 1 (U) | — |
| AAB7332 | 21-02540 | 7.50–10.00 | Qbt 3 | — | — | — | — | — | — | — |

## Table B-25 (continued)

**Part 1 (continued)**

| Sample ID | Location ID | Depth (ft) | Media | Aluminum | Antimony | Arsenic | Barium | Beryllium | Cadmium | Calcium |
|---|---|---|---|---|---|---|---|---|---|---|
| **Soil Background Value** | | | | — | 0.83 | — | — | 1.83 | 0.4 | 6120 |
| **Qbt 2,3,4 Background Value** | | | | 7340 | 0.5 | 2.79 | 46 | 1.21 | 1.63 | 2200 |
| **Qbt 1v Background Value** | | | | — | 0.5 | — | — | — | 0.4 | — |
| **Fill Background Value** | | | | — | 0.83 | — | 295 | — | 0.4 | — |
| **Residential SAL (mg/kg)** | | | | $7.4E^{+4}$ | 30 | 3.9 | 5200 | 150 | 70 | EN |
| **Industrial SAL (mg/kg)** | | | | $1.0E^{+5}$ | 92 | 17 | $1.5E^{+4}$ | 440 | 190 | EN |
| AAB7334 | 21-02541 | 2.50–5.00 | Soil | — | — | — | — | — | 0.76 (U) | — |
| AAB9109 | 21-02541 | 10.00–12.50 | Qbt 3 | 7390 (J) | — | — | 79.6 | — | — | 3060 |
| AAB7340 | 21-02543 | 2.50–5.00 | Soil | — | — | — | — | — | 0.49 (U) | — |
| AAB7342 | 21-02544 | 5.00–7.50 | Soil | — | — | — | — | — | 0.83 (U) | — |
| AAB7343 | 21-02545 | 0.00–5.00 | Soil | — | — | — | — | — | 0.7 (U) | — |
| AAB7347 | 21-02546 | 0.00–5.00 | Soil | — | — | — | — | — | 0.48 (U) | — |
| AAB7352 | 21-02547 | 5.00–10.00 | Soil | — | — | — | — | — | 7.1 | — |
| AAB7355 | 21-02548 | 2.50–5.00 | Soil | — | — | — | — | — | 0.47 (U) | — |
| AAB7368 | 21-02609 | 5.00–7.50 | Soil | — | — | — | — | — | 1.1 (U) | — |
| AAB9110 | 21-02609 | 5.00–7.50 | Soil | — | — | — | — | — | 0.84 (U) | — |
| AAB9111 | 21-02610 | 5.00–7.50 | Soil | — | — | — | — | — | 0.65 (U) | — |
| **1996–1997** | | | | | | | | | | |
| 0121-97-0001 | 21-05051 | 3.50–4.00 | Fill | — | 8.4 (UJ) | — | — | — | 0.47 (U) | — |
| 0121-97-0002 | 21-05051 | 6.00–6.50 | Fill | — | 8.8 (UJ) | — | — | — | 0.49 (U) | — |
| 0121-97-0003 | 21-05051 | 8.50–9.00 | Fill | — | 8.5 (UJ) | — | — | — | 0.55 (J) | — |
| 0121-97-0004 | 21-05051 | 11.50–12.00 | Fill | — | 5.5 (U) | — | — | — | 3 | — |
| 0121-97-0005 | 21-05051 | 13.80–14.50 | Qbt 3 | 17700 | 30.6 (U) | 3.2 | 188 (J) | — | 49 | 3970 (J) |
| 0121-97-0006 | 21-05051 | 20.00–21.00 | Qbt 3 | 17300 (J) | 11.2 (UJ) | 4.5 (J-) | 239 | — | 33.5 | 2930 |
| 0121-97-0007 | 21-05051 | 27.50–28.00 | Qbt 3 | — | 5.7 (U) | — | — | — | — | — |
| 0121-97-0008 | 21-05051 | 40.00–40.50 | Qbt 3 | — | 8.6 (UJ) | — | — | — | — | — |
| 0121-97-0009 | 21-05051 | 50.00–50.50 | Qbt 3 | — | 8.6 (UJ) | — | — | — | — | — |
| 0121-97-0010 | 21-05051 | 61.00–61.50 | Qbt 3 | — | 8.5 (UJ) | — | — | — | — | — |
| 0121-97-0011 | 21-05051 | 71.00–71.50 | Qbt 3 | — | 5.4 (U) | — | — | — | — | — |
| 0121-97-0012 | 21-05051 | 80.00–80.50 | Qbt 3 | — | 5.4 (U) | — | — | — | — | — |
| 0121-97-0013 | 21-05051 | 89.50–90.00 | Qbt 3 | — | 5.3 (U) | — | — | — | — | — |
| 0121-97-0014 | 21-05051 | 99.50–100.00 | Qbt 3 | — | 5.3 (U) | — | — | — | — | — |
| 0121-97-0015 | 21-05051 | 109.00–109.50 | Qbt 2 | — | 5.3 (U) | — | — | — | — | — |
| 0121-97-0016 | 21-05051 | 119.50–120.00 | Qbt 2 | — | 5.3 (U) | — | — | — | — | — |
| 0121-97-0017 | 21-05051 | 129.50–130.00 | Qbt 2 | — | 5.3 (U) | — | — | — | — | — |
| 0121-97-0018 | 21-05051 | 137.50–138.00 | Qbt 2 | — | 5.3 (U) | — | — | — | — | — |
| 0121-97-0019 | 21-05051 | 149.50–150.00 | Qbt 2 | — | 5.4 (U) | — | — | — | — | — |
| 0121-97-0026 | 21-05052 | 2.50–3.00 | Fill | — | 9.2 (U) | — | — | — | 0.93 (U) | — |
| 0121-97-0027 | 21-05052 | 9.00–9.50 | Qal | 5290 | 8.1 (U) | 0.36 (U) | 101 | 0.47 (J) | 0.82 (U) | 3170 |
| 0121-97-0028 | 21-05052 | 20.00–20.50 | Qal | 4190 | 8.9 (U) | 1.4 (J) | 14.7 (J) | 0.46 (J) | 0.9 (U) | 1360 |
| 0121-97-0029 | 21-05052 | 26.00–27.00 | Qal | 2600 | 8.6 (U) | 0.37 (U) | 36.4 (J) | 0.35 (J) | 0.87 (U) | 883 (J) |

## Table B-25 (continued)

**Part 1 (continued)**

| Sample ID | Location ID | Depth (ft) | Media | Aluminum | Antimony | Arsenic | Barium | Beryllium | Cadmium | Calcium |
|---|---|---|---|---|---|---|---|---|---|---|
| **Soil Background Value** | | | | — | 0.83 | — | — | 1.83 | 0.4 | 6120 |
| **Qbt 2,3,4 Background Value** | | | | 7340 | 0.5 | 2.79 | 46 | 1.21 | 1.63 | 2200 |
| **Qbt 1v Background Value** | | | | — | 0.5 | — | — | — | 0.4 | — |
| **Fill Background Value** | | | | — | 0.83 | — | 295 | — | 0.4 | — |
| **Residential SAL (mg/kg)** | | | | 7.4E$^{+4}$ | 30 | 3.9 | 5200 | 150 | 70 | EN |
| **Industrial SAL (mg/kg)** | | | | 1.0E$^{+5}$ | 92 | 17 | 1.5E$^{+4}$ | 440 | 190 | EN |
| 0121-97-0030 | 21-05052 | 39.50–40.00 | Qbt 3 | — | 8.6 (U) | — | — | — | — | — |
| 0121-97-0031 | 21-05052 | 49.50–50.00 | Qbt 3 | — | 8.5 (U) | — | — | — | — | — |
| 0121-97-0032 | 21-05052 | 59.50–60.00 | Qbt 3 | — | 6.1 (U) | — | — | — | — | — |
| 0121-97-0033 | 21-05052 | 70.00–71.00 | Qbt 3 | — | 6.1 (U) | — | — | — | — | — |
| 0121-97-1271 | 21-05052 | 70.00–71.00 | Qbt 3 | — | 7.4 (U) | — | — | — | — | — |
| 0121-97-0034 | 21-05052 | 79.50–80.00 | Qbt 3 | — | 5.8 (U) | — | — | — | — | — |
| 0121-97-0035 | 21-05052 | 87.00–88.00 | Qbt 3 | — | 6.2 (U) | — | — | — | — | — |
| 0121-97-0036 | 21-05052 | 96.00–96.50 | Qbt 3 | — | 5.7 (U) | — | — | — | — | — |
| 0121-97-0037 | 21-05052 | 109.00–110.00 | Qbt 2 | — | 5.6 (U) | — | — | — | — | — |
| 0121-97-0038 | 21-05052 | 119.00–120.00 | Qbt 2 | — | 5.8 (U) | — | — | — | — | — |
| 0121-97-0039 | 21-05052 | 130.00–131.00 | Qbt 2 | — | 5.8 (U) | — | — | — | — | — |
| 0121-97-0040 | 21-05052 | 139.00–140.00 | Qbt 2 | — | 5.8 (U) | — | — | — | — | — |
| 0121-97-0041 | 21-05052 | 149.00–150.00 | Qbt 2 | — | 5.6 (U) | — | — | — | — | — |
| 0121-97-1272 | 21-05052 | 149.00–150.00 | Qbt 2 | — | 5.1 (U) | — | — | — | — | — |
| 0121-97-0051 | 21-05053 | 4.20–4.60 | Fill | — | — | — | — | — | 1.6 | — |
| 0121-97-0052 | 21-05053 | 6.50–7.00 | Fill | — | — | — | — | — | 15.3 | — |
| 0121-97-0064 | 21-05053 | 6.50–7.00 | Fill | — | — | — | — | — | 36.6 | — |
| 0121-97-0053 | 21-05053 | 9.50–10.00 | Fill | — | — | — | — | — | 1.5 | — |
| 0121-97-0054 | 21-05053 | 12.50–13.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0055 | 21-05053 | 17.00–17.30 | Qbt 3 | 21200 (J) | — | 4.2 | 217 (J) | — | — | 7960 (J) |
| 0121-97-0056 | 21-05053 | 20.50–21.50 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0057 | 21-05053 | 28.00–29.00 | Qbt 3 | — | 0.54 (U) | — | — | — | — | — |
| 0121-97-0058 | 21-05053 | 39.50–40.00 | Qbt 3 | — | 8 (UJ) | — | — | — | — | — |
| 0121-97-0059 | 21-05053 | 48.00–48.50 | Qbt 3 | 27200 | 10.4 (U) | 3.8 (J-) | 241 (J) | 2.3 | — | 2480 |
| 0121-97-0060 | 21-05053 | 59.50–60.00 | Qbt 3 | — | 8.6 (UJ) | — | — | — | — | — |
| 0121-97-0061 | 21-05053 | 60.00–60.70 | Qbt 3 | — | 8.6 (UJ) | — | — | — | — | — |
| 0121-97-0062 | 21-05053 | 74.50–75.00 | Qbt 3 | — | 8.5 (UJ) | — | 47.9 | — | — | — |
| 0121-97-0063 | 21-05053 | 80.00–80.50 | Qbt 3 | — | 8.6 (UJ) | — | — | — | — | — |
| 0121-97-0445 | 21-05053 | 89.50–90.00 | Qbt 3 | — | 8.3 (UJ) | — | — | — | — | — |
| 0121-97-0066 | 21-05054 | 3.00–3.50 | Fill | — | — | — | — | — | — | — |
| 0121-97-0067 | 21-05054 | 6.00–6.50 | Fill | — | — | — | — | — | — | — |
| 0121-97-0068 | 21-05054 | 7.50–8.20 | Fill | — | — | — | 497 | — | — | — |
| 0121-97-0069 | 21-05054 | 10.50–11.00 | Fill | — | — | — | — | — | 3.2 | — |
| 0121-97-0070 | 21-05054 | 14.20–15.00 | Qbt 3 | 32300 (J) | 0.62 (U) | 5.8 | 99.9 (J) | 1.4 | — | — |
| 0121-97-0071 | 21-05054 | 21.80–22.10 | Qbt 3 | — | 22.3 (UJ) | 24.9 (J-) | 106 (J) | — | 1.9 (J) | — |
| 0121-97-0072 | 21-05054 | 32.00–32.50 | Qbt 3 | — | — | — | — | — | — | — |

## Table B-25 (continued)

**Part 1 (continued)**

| Sample ID | Location ID | Depth (ft) | Media | Aluminum | Antimony | Arsenic | Barium | Beryllium | Cadmium | Calcium |
|---|---|---|---|---|---|---|---|---|---|---|
| **Soil Background Value** | | | | — | 0.83 | — | — | 1.83 | 0.4 | 6120 |
| **Qbt 2,3,4 Background Value** | | | | 7340 | 0.5 | 2.79 | 46 | 1.21 | 1.63 | 2200 |
| **Qbt 1v Background Value** | | | | — | 0.5 | — | — | — | 0.4 | — |
| **Fill Background Value** | | | | — | 0.83 | — | 295 | — | 0.4 | — |
| **Residential SAL (mg/kg)** | | | | $7.4E^{+4}$ | 30 | 3.9 | 5200 | 150 | 70 | EN |
| **Industrial SAL (mg/kg)** | | | | $1.0E^{+5}$ | 92 | 17 | $1.5E^{+4}$ | 440 | 190 | EN |
| 0121-97-0073 | 21-05054 | 35.50–36.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0074 | 21-05054 | 50.00–50.50 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0075 | 21-05054 | 59.50–60.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0081 | 21-05055 | 3.50–4.00 | Fill | — | 5.5 (U) | — | — | — | 0.89 (U) | — |
| 0121-97-0082 | 21-05055 | 8.50–9.00 | Fill | — | 5.2 (U) | — | — | — | 0.84 (U) | — |
| 0121-97-0083 | 21-05055 | 14.50–15.00 | Fill | — | 8.7 (U) | — | — | — | 0.49 (U) | — |
| 0121-97-0096 | 21-05056 | 4.50–5.00 | Fill | — | 8.9 (U) | — | — | — | 0.5 (U) | — |
| 0121-97-0097 | 21-05056 | 11.80–12.20 | Qbt 3 | 10300 | 10.2 (U) | — | 103 | 1.6 | — | 4390 |
| 0121-97-0098 | 21-05056 | 20.00–20.50 | Qbt 3 | — | 8.4 (U) | — | — | — | — | — |
| 0121-97-0099 | 21-05056 | 29.00–29.50 | Qbt 3 | — | 8.9 (U) | — | — | — | — | — |
| 0121-97-0100 | 21-05056 | 39.00–39.50 | Qbt 3 | 12500 | 9.8 (U) | — | 73.9 | 1.8 | — | — |
| 0121-97-0101 | 21-05056 | 49.50–50.00 | Qbt 3 | — | 19.1 (U) | — | — | — | — | — |
| 0121-96-0481 | 21-05057 | 4.30–5.00 | Fill | — | 11 (UJ) | — | — | — | 0.54 (U) | — |
| 0121-96-0482 | 21-05057 | 9.50–10.00 | Fill | — | 11 (UJ) | — | — | — | 0.57 (U) | — |
| 0121-96-0483 | 21-05057 | 19.50–20.00 | Fill | — | 11 (UJ) | — | — | — | 0.56 (U) | — |
| 0121-96-0484 | 21-05057 | 22.50–23.90 | Qal | 4570 | 0.58 (U) | 1.8 (J) | 71.8 | 0.31 (J) | 0.2 (J) | 51100 |
| 0121-96-0485 | 21-05057 | 29.50–30.00 | Qbt 3 | — | 11 (UJ) | — | — | — | — | — |
| 0121-96-0486 | 21-05057 | 39.50–40.00 | Qbt 3 | — | 11 (UJ) | — | — | — | — | — |
| 0121-96-0487 | 21-05057 | 49.50–50.00 | Qbt 3 | — | 11 (UJ) | — | — | — | — | — |
| 0121-96-0492 | 21-05058 | 7.70–8.20 | Fill | — | — | — | — | — | — | — |
| 0121-96-0495 | 21-05058 | 29.50–30.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-96-0496 | 21-05058 | 39.50–40.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-96-0497 | 21-05058 | 49.50–50.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0111 | 21-05059 | 4.00–4.50 | Soil | — | 5.8 (UJ) | — | — | — | 0.93 (U) | — |
| 0121-97-0112 | 21-05059 | 10.20–10.70 | Qal | 11800 | 5.7 (UJ) | 1.2 (J-) | 16.5 (J) | 0.63 (J) | 0.96 (J) | 1790 |
| 0121-97-0113 | 21-05059 | 20.00–20.50 | Qal | 6310 | 5.9 (UJ) | 0.69 (J-) | 36.2 (J) | 0.41 (J) | 0.95 (U) | 1200 |
| 0121-97-0114 | 21-05059 | 31.50–32.00 | Qal | 11700 | 5.9 (UJ) | 4.5 (J-) | 79.8 | 0.91 (J) | 0.95 (U) | 1690 |
| 0121-97-0115 | 21-05059 | 36.40–36.80 | Qbt 3 | — | 5.4 (UJ) | — | — | — | — | — |
| 0121-97-0116 | 21-05059 | 40.00–40.50 | Qbt 3 | — | 5.3 (UJ) | — | — | — | — | — |
| 0121-97-0117 | 21-05059 | 49.50–50.00 | Qbt 3 | — | 5.5 (UJ) | — | — | — | — | — |
| 0121-97-0136 | 21-05060 | 4.50–5.00 | Soil | — | 9 (U) | — | — | — | 0.5 (U) | — |
| 0121-97-0137 | 21-05060 | 10.00–10.50 | Qbt 3 | — | 8.5 (U) | — | — | — | — | — |
| 0121-97-0138 | 21-05060 | 20.00–20.50 | Qbt 3 | — | 8.5 (U) | — | — | — | — | — |
| 0121-97-0139 | 21-05060 | 30.00–30.50 | Qbt 3 | — | 8.6 (J) | — | — | — | — | — |
| 0121-97-0140 | 21-05060 | 42.00–42.50 | Qbt 3 | — | 8.7 (U) | — | — | — | — | — |
| 0121-97-0141 | 21-05060 | 50.00–50.50 | Qbt 3 | — | 8.1 (U) | — | — | — | — | — |

## Table B-25 (continued)

**Part 1 (continued)**

| Sample ID | Location ID | Depth (ft) | Media | Aluminum | Antimony | Arsenic | Barium | Beryllium | Cadmium | Calcium |
|---|---|---|---|---|---|---|---|---|---|---|
| **Soil Background Value** | | | | — | 0.83 | — | — | 1.83 | 0.4 | 6120 |
| **Qbt 2,3,4 Background Value** | | | | 7340 | 0.5 | 2.79 | 46 | 1.21 | 1.63 | 2200 |
| **Qbt 1v Background Value** | | | | — | 0.5 | — | — | — | 0.4 | — |
| **Fill Background Value** | | | | — | 0.83 | — | 295 | — | 0.4 | — |
| **Residential SAL (mg/kg)** | | | | 7.4E$^{+4}$ | 30 | 3.9 | 5200 | 150 | 70 | EN |
| **Industrial SAL (mg/kg)** | | | | 1.0E$^{+5}$ | 92 | 17 | 1.5E$^{+4}$ | 440 | 190 | EN |
| 0121-97-0142 | 21-05060 | 60.00–60.50 | Qbt 3 | — | 8.2 (U) | — | — | — | — | — |
| 0121-97-0143 | 21-05060 | 69.50–70.00 | Qbt 3 | — | 8.5 (U) | — | — | — | — | — |
| 0121-97-0163 | 21-05060 | 69.50–70.00 | Qbt 3 | — | 8.4 (U) | — | — | — | — | — |
| 0121-97-0144 | 21-05060 | 79.50–80.00 | Qbt 3 | — | 8.7 (U) | — | — | — | — | — |
| 0121-97-0145 | 21-05060 | 89.00–89.50 | Qbt 3 | — | 9.5 (J) | — | — | — | — | — |
| 0121-97-0146 | 21-05060 | 99.50–100.00 | Qbt 3 | — | 8.4 (U) | — | — | — | — | — |
| 0121-97-0147 | 21-05060 | 109.00–109.20 | Qbt 2 | — | 8.3 (U) | — | — | — | — | — |
| 0121-97-0148 | 21-05060 | 118.50–119.00 | Qbt 2 | — | 8.4 (U) | — | — | — | — | — |
| 0121-97-0149 | 21-05060 | 129.00–129.50 | Qbt 2 | — | 8.3 (U) | — | — | — | — | — |
| 0121-97-0164 | 21-05060 | 129.00–129.50 | Qbt 2 | — | 8.3 (U) | — | — | — | — | — |
| 0121-97-0150 | 21-05060 | 139.00–139.50 | Qbt 2 | — | 8.4 (U) | — | — | — | — | — |
| 0121-97-0151 | 21-05060 | 150.00–150.50 | Qbt 2 | — | 8.3 (U) | — | — | — | — | — |
| 0121-97-0152 | 21-05060 | 160.00–160.50 | Qbt 2 | — | 8.4 (U) | — | — | — | — | — |
| 0121-97-0153 | 21-05060 | 169.50–170.00 | Qbt 2 | — | 8.5 (U) | — | — | — | — | — |
| 0121-97-0154 | 21-05060 | 174.50–175.00 | Qbt 2 | — | 8.5 (U) | — | — | — | — | — |
| 0121-97-0166 | 21-05061 | 5.50–6.00 | Soil | — | 8.5 (U) | — | — | — | 0.59 (U) | — |
| 0121-97-0167 | 21-05061 | 10.00–10.50 | Qbt 3 | 29800 | 8.8 (U) | 3.4 | 166 | 2 | — | 4450 |
| 0121-97-0168 | 21-05061 | 22.00–22.50 | Qbt 3 | 13800 | 9.2 (U) | — | 55.4 | 1.6 | — | 3060 |
| 0121-97-1126 | 21-05061 | 22.00–22.50 | Qbt 3 | 19200 | 9.4 (U) | — | 51 | 1.8 | — | 3120 |
| 0121-97-0169 | 21-05061 | 30.00–30.50 | Qbt 3 | — | 8.4 (U) | — | — | — | — | — |
| 0121-97-0170 | 21-05061 | 40.00–40.50 | Qbt 3 | — | 8.4 (U) | — | — | — | — | — |
| 0121-97-0171 | 21-05061 | 49.00–49.50 | Qbt 3 | — | 8.8 (U) | — | 217 | — | — | — |
| 0121-97-0172 | 21-05061 | 59.50–60.00 | Qbt 3 | — | 5.3 (U) | — | — | — | — | — |
| 0121-97-0173 | 21-05061 | 69.50–70.00 | Qbt 3 | — | 5.2 (U) | — | — | — | — | — |
| 0121-97-0174 | 21-05061 | 78.50–78.80 | Qbt 3 | — | 5.3 (U) | — | — | — | — | — |
| 0121-97-0175 | 21-05061 | 89.50–90.00 | Qbt 3 | — | 5.2 (U) | — | — | — | — | — |
| 0121-97-0176 | 21-05061 | 98.70–99.20 | Qbt 2 | — | 5.2 (U) | — | — | — | — | — |
| 0121-97-0177 | 21-05061 | 108.50–109.00 | Qbt 2 | — | 5.2 (U) | — | — | — | — | — |
| 0121-97-0178 | 21-05061 | 118.00–118.50 | Qbt 2 | — | 5.2 (U) | — | — | — | — | — |
| 0121-97-0179 | 21-05061 | 128.50–129.00 | Qbt 2 | — | 5.2 (U) | — | — | — | — | — |
| 0121-97-0180 | 21-05061 | 140.00–140.50 | Qbt 2 | — | 5.2 (U) | — | — | — | — | — |
| 0121-97-0181 | 21-05061 | 152.50–153.00 | Qbt 2 | — | 5.1 (U) | — | — | — | — | — |
| 0121-97-0182 | 21-05061 | 160.00–160.50 | Qbt 2 | — | 5.2 (U) | — | — | — | — | — |
| 0121-97-0183 | 21-05061 | 170.00–170.50 | Qbt 1v | — | 5.1 (U) | — | — | — | 0.83 (U) | — |
| 0121-97-1128 | 21-05061 | 170.00–170.50 | Qbt 1v | — | 5.1 (U) | — | — | — | 0.83 (U) | — |
| 0121-97-0184 | 21-05061 | 180.00–180.50 | Qbt 1v | — | 5.2 (U) | — | — | — | 0.83 (U) | — |

## Table B-25 (continued)

**Part 1 (continued)**

| Sample ID | Location ID | Depth (ft) | Media | Aluminum | Antimony | Arsenic | Barium | Beryllium | Cadmium | Calcium |
|---|---|---|---|---|---|---|---|---|---|---|
| **Soil Background Value** | | | | — | 0.83 | — | — | 1.83 | 0.4 | 6120 |
| **Qbt 2,3,4 Background Value** | | | | 7340 | 0.5 | 2.79 | 46 | 1.21 | 1.63 | 2200 |
| **Qbt 1v Background Value** | | | | — | 0.5 | — | — | — | 0.4 | — |
| **Fill Background Value** | | | | — | 0.83 | — | 295 | — | 0.4 | — |
| **Residential SAL (mg/kg)** | | | | 7.4E$^{+4}$ | 30 | 3.9 | 5200 | 150 | 70 | EN |
| **Industrial SAL (mg/kg)** | | | | 1.0E$^{+5}$ | 92 | 17 | 1.5E$^{+4}$ | 440 | 190 | EN |
| 0121-97-0185 | 21-05061 | 189.50–190.00 | Qbt 1v | — | 5.2 (U) | — | — | — | 0.85 (U) | — |
| 0121-97-0191 | 21-05062 | 5.00–5.50 | Qbt 3 | — | 0.54 (U) | 4.2 | 83.7 | — | — | — |
| 0121-97-0192 | 21-05062 | 6.00–6.50 | Qbt 3 | — | 0.51 (U) | — | — | — | — | — |
| 0121-97-0193 | 21-05062 | 10.00–10.50 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0194 | 21-05062 | 20.00–20.50 | Qbt 3 | — | 0.51 (U) | — | — | — | — | — |
| 0121-97-0195 | 21-05062 | 30.00–30.50 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0196 | 21-05062 | 40.00–40.50 | Qbt 3 | 7660 (J) | 0.54 (U) | 7.8 | — | — | — | — |
| 0121-97-0197 | 21-05062 | 49.50–50.00 | Qbt 3 | — | 1.1 (U) | — | — | — | — | — |
| 0121-97-0198 | 21-05062 | 58.80–59.50 | Qbt 3 | — | 3.3 (U) | 4.1 (U) | — | — | — | — |
| 0121-97-0218 | 21-05062 | 58.80–59.50 | Qbt 3 | — | 5.2 (U) | — | — | — | — | — |
| 0121-97-0199 | 21-05062 | 70.00–70.50 | Qbt 3 | — | 5.2 (U) | — | — | — | — | — |
| 0121-97-0200 | 21-05062 | 78.40–79.50 | Qbt 3 | 7940 | 12 (J—) | — | 111 | — | 5.4 (J+) | 180000 |
| 0121-97-0221 | 21-05063 | 4.50–5.00 | Qbt 3 | — | 6.1 (UJ) | — | 154 | — | — | 2240 |
| 0121-97-0222 | 21-05063 | 7.50–8.30 | Qbt 3 | — | 5.5 (UJ) | — | — | — | — | — |
| 0121-97-0234 | 21-05063 | 7.50–8.30 | Qbt 3 | — | 6 (UJ) | — | — | — | — | — |
| 0121-97-0223 | 21-05063 | 10.00–11.60 | Qbt 3 | 10300 | 7.1 (UJ) | — | 161 | 2.8 | — | 6450 |
| 0121-97-0224 | 21-05063 | 20.00–20.50 | Qbt 3 | — | 6 (UJ) | — | — | — | — | — |
| 0121-97-0225 | 21-05063 | 30.50–31.30 | Qbt 3 | — | 5.8 (UJ) | — | — | — | — | — |
| 0121-97-0226 | 21-05063 | 41.00–42.00 | Qbt 3 | — | 5.5 (UJ) | — | — | — | — | — |
| 0121-97-0227 | 21-05063 | 49.00–50.00 | Qbt 3 | — | 5.8 (UJ) | — | — | — | — | — |
| 0121-96-0621 | 21-05065 | 4.50–5.00 | Qbt 3 | — | — | — | 53.3 | — | — | — |
| 0121-96-0622 | 21-05065 | 10.00–10.50 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-96-0623 | 21-05065 | 19.50–20.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-96-0624 | 21-05065 | 29.50–30.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-96-0625 | 21-05065 | 39.50–40.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-96-0626 | 21-05065 | 48.20–48.70 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0326 | 21-05073 | 2.50–3.00 | Soil | — | 5.3 (U) | — | — | — | 0.86 (U) | — |
| 0121-97-0327 | 21-05073 | 8.50–9.00 | Qbt 3 | — | 8.5 (U) | — | 98.1 | — | — | 2900 |
| 0121-97-0328 | 21-05073 | 11.70–12.20 | Qbt 3 | — | 5.2 (U) | — | — | — | — | — |
| 0121-97-0329 | 21-05073 | 22.00–23.00 | Qbt 3 | — | 5.3 (U) | — | — | — | — | — |
| 0121-97-0330 | 21-05073 | 32.00–32.50 | Qbt 3 | — | 5.4 (U) | — | — | — | — | — |
| 0121-97-0331 | 21-05073 | 42.00–42.50 | Qbt 3 | — | 5.3 (U) | — | — | — | — | — |
| 0121-97-0332 | 21-05073 | 46.50–47.00 | Qbt 3 | — | 5.3 (U) | — | — | — | — | — |
| 0121-97-0333 | 21-05073 | 62.00–62.50 | Qbt 3 | — | 6.4 (J) | — | — | — | — | — |
| 0121-97-0401 | 21-05073 | 62.00–62.50 | Qbt 3 | — | 5.1 (U) | — | — | — | — | — |
| 0121-97-0334 | 21-05073 | 69.50–70.00 | Qbt 3 | — | 5.3 (U) | — | — | — | — | — |

## Table B-25 (continued)

**Part 1 (continued)**

| Sample ID | Location ID | Depth (ft) | Media | Aluminum | Antimony | Arsenic | Barium | Beryllium | Cadmium | Calcium |
|---|---|---|---|---|---|---|---|---|---|---|
| **Soil Background Value** | | | | — | 0.83 | — | — | 1.83 | 0.4 | 6120 |
| **Qbt 2,3,4 Background Value** | | | | 7340 | 0.5 | 2.79 | 46 | 1.21 | 1.63 | 2200 |
| **Qbt 1v Background Value** | | | | — | 0.5 | — | — | — | 0.4 | — |
| **Fill Background Value** | | | | — | 0.83 | — | 295 | — | 0.4 | — |
| **Residential SAL (mg/kg)** | | | | 7.4E$^{+4}$ | 30 | 3.9 | 5200 | 150 | 70 | EN |
| **Industrial SAL (mg/kg)** | | | | 1.0E$^{+5}$ | 92 | 17 | 1.5E$^{+4}$ | 440 | 190 | EN |
| 0121-97-1131 | 21-05075 | 6.70–7.20 | Qbt 3 | 7920 | 5.8 (UJ) | — | 119 | — | — | 2620 |
| 0121-97-1132 | 21-05075 | 8.80–9.30 | Qbt 3 | — | 5.4 (UJ) | — | — | — | — | — |
| 0121-97-1133 | 21-05075 | 15.50–16.00 | Qbt 3 | — | 5.2 (UJ) | — | — | — | — | — |
| 0121-97-1141 | 21-05075 | 15.50–16.00 | Qbt 3 | — | 5.2 (UJ) | — | — | — | — | — |
| 0121-97-1134 | 21-05075 | 20.00–21.00 | Qbt 3 | — | 5.2 (U) | — | — | — | — | — |
| 0121-97-1135 | 21-05075 | 29.50–30.00 | Qbt 3 | — | 5.3 (UJ) | — | — | — | — | — |
| 0121-97-1136 | 21-05075 | 38.80–39.30 | Qbt 3 | — | 8.6 (U) | — | — | — | — | — |
| 0121-97-1137 | 21-05075 | 45.00–46.00 | Qbt 3 | — | 8.9 (U) | — | — | — | — | — |
| 0121-97-1138 | 21-05075 | 58.00–58.50 | Qbt 3 | — | 8.7 (U) | — | — | — | — | — |
| 0121-97-1139 | 21-05075 | 69.50–70.00 | Qbt 3 | — | 8.1 (U) | — | — | — | — | — |

## Table B-25 (continued)

| Part 2 | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | **Location ID** | **Depth (ft)** | **Media** | **Chromium** | **Cobalt** | **Copper** | **Cyanide (Total)** | **Iron** | **Lead** | **Lithium** |
| **Soil Background Value** | | | | — | — | 14.7 | — | — | — | — |
| **Qbt 2,3,4 Background Value** | | | | 7.14 | 3.14 | 4.66 | — | 14500 | 11.2 | — |
| **Qbt 1v Background Value** | | | | 2.24 | — | — | — | — | — | — |
| **Fill Background Value** | | | | 19.3 | — | 14.7 | — | — | 22.3 | — |
| **Residential SAL (mg/kg)** | | | | **230*** | **4500** | **2800** | **1200** | **2.3E+4** | **400** | **1600*** |
| **Industrial SAL (mg/kg)** | | | | **660*** | **1.3E+4** | **8500** | **3000** | **6.9E+4** | **1000** | **23E+4** |
| **1992** | | | | | | | | | | |
| AAA0564 | 21-01085 | 0.00–0.08 | Soil | — | — | — | — | — | — | 2.9 |
| AAA3950 | 21-01615 | 0.00–0.50 | Soil | — | — | — | — | — | — | 7.8 |
| AAA3951 | 21-01616 | 0.00–0.50 | Soil | — | — | — | — | — | — | 5.4 |
| AAA3952 | 21-01617 | 0.00–0.50 | Soil | — | — | — | — | — | — | 8.4 |
| AAA3953 | 21-01618 | 0.00–0.50 | Soil | — | — | — | — | — | — | 14.8 |
| AAA3954 | 21-01619 | 0.00–0.50 | Soil | — | — | — | — | — | — | 2.7 |
| AAA3957 | 21-01620 | 0.00–0.50 | Soil | — | — | — | — | — | — | 7.9 |
| AAA3958 | 21-01621 | 0.00–0.50 | Soil | — | — | — | — | — | — | 8.7 |
| AAA3959 | 21-01622 | 0.00–0.50 | Soil | — | — | — | — | — | — | 14.3 |
| AAA3960 | 21-01622 | 0.00–0.50 | Soil | — | — | — | — | — | — | 12.9 |
| AAA3961 | 21-01623 | 0.00–0.50 | Soil | — | — | — | — | — | — | 5.4 |
| AAA3962 | 21-01624 | 0.00–0.50 | Soil | — | — | — | — | — | — | 6.7 |
| AAA3963 | 21-01625 | 0.00–0.50 | Soil | — | — | — | — | — | — | 7.8 |
| AAA3964 | 21-01626 | 0.00–0.50 | Soil | — | — | — | — | — | — | 9.9 |
| AAA3965 | 21-01627 | 0.00–0.50 | Soil | — | — | — | — | — | — | 5.3 |
| AAA3966 | 21-01628 | 0.00–0.50 | Soil | — | — | — | — | — | — | 10.6 |
| AAA3985 | 21-01644 | 0.00–0.50 | Soil | — | — | — | — | — | — | 4.6 |
| AAA3987 | 21-01646 | 0.00–0.50 | Soil | — | — | — | — | — | — | 4.6 |
| AAA3988 | 21-01647 | 0.00–0.50 | Soil | — | — | — | — | — | — | 6.4 |
| AAA3989 | 21-01648 | 0.00–0.50 | Soil | — | — | — | — | — | — | 7.7 |
| AAA3990 | 21-01649 | 0.00–0.50 | Soil | — | — | — | — | — | — | 5.2 |
| AAA3996 | 21-01655 | 0.00–0.50 | Soil | — | — | — | — | — | — | 4.9 |
| AAA3997 | 21-01656 | 0.00–0.50 | Soil | — | — | — | — | — | — | 9.6 |
| AAA3998 | 21-01657 | 0.00–0.50 | Soil | — | — | — | — | — | — | 7 |
| AAA4001 | 21-01658 | 0.00–0.50 | Soil | — | — | — | — | — | — | 5.3 |
| AAA4002 | 21-01658 | 0.00–0.50 | Soil | — | — | 21.8 | — | — | — | 5.1 |
| AAA4006 | 21-01662 | 0.00–0.50 | Soil | — | — | — | — | — | — | 4.6 |
| **1993–1994** | | | | | | | | | | |
| AAB7314 | 21-02535 | 2.50–5.00 | Fill | — | — | — | — | — | — | — |
| AAB7316 | 21-02536 | 5.00–7.50 | Soil | — | — | — | — | — | — | — |
| AAB7320 | 21-02537 | 7.50–10.00 | Qbt 3 | — | — | — | — | — | — | — |
| AAB7323 | 21-02538 | 5.00–7.50 | Fill | — | — | — | — | — | — | — |
| AAB7328 | 21-02539 | 7.50–10.00 | Soil | — | — | — | — | — | — | — |
| AAB7332 | 21-02540 | 7.50–10.00 | Qbt 3 | — | — | — | — | — | — | — |
| AAB7334 | 21-02541 | 2.50–5.00 | Soil | — | — | — | — | — | — | — |

## Table B-25 (continued)

**Part 2 (continued)**

| Sample ID | Location ID | Depth (ft) | Media | Chromium | Cobalt | Copper | Cyanide (Total) | Iron | Lead | Lithium |
|---|---|---|---|---|---|---|---|---|---|---|
| **Soil Background Value** | | | | — | — | 14.7 | — | — | — | — |
| **Qbt 2,3,4 Background Value** | | | | 7.14 | 3.14 | 4.66 | — | 14500 | 11.2 | — |
| **Qbt 1v Background Value** | | | | 2.24 | — | — | — | — | — | — |
| **Fill Background Value** | | | | 19.3 | — | 14.7 | — | — | 22.3 | — |
| **Residential SAL (mg/kg)** | | | | **230*** | **4500** | **2800** | **1200** | **$2.3E^{+4}$** | **400** | **1600*** |
| **Industrial SAL (mg/kg)** | | | | **660*** | **$1.3E^{+4}$** | **8500** | **3000** | **$6.9E^{+4}$** | **1000** | **$23E^{+4}$** |
| AAB9109 | 21-02541 | 10.00–12.50 | Qbt 3 | — | — | 7.5 | — | — | 11.4 | — |
| AAB7340 | 21-02543 | 2.50–5.00 | Soil | — | — | — | — | — | — | — |
| AAB7342 | 21-02544 | 5.00–7.50 | Soil | — | — | — | — | — | — | — |
| AAB7343 | 21-02545 | 0.00–5.00 | Soil | — | — | — | — | — | — | — |
| AAB7347 | 21-02546 | 0.00–5.00 | Soil | — | — | — | — | — | — | — |
| AAB7352 | 21-02547 | 5.00–10.00 | Soil | — | — | 23.1 | — | — | — | 7.9 (U) |
| AAB7355 | 21-02548 | 2.50–5.00 | Soil | — | — | — | — | — | — | — |
| AAB7368 | 21-02609 | 5.00–7.50 | Soil | — | — | — | — | — | — | — |
| AAB9110 | 21-02609 | 5.00–7.50 | Soil | — | — | — | — | — | — | — |
| AAB9111 | 21-02610 | 5.00–7.50 | Soil | — | — | — | — | — | — | — |
| **1996–1997** | | | | | | | | | | |
| 0121-97-0001 | 21-05051 | 3.50–4.00 | Fill | — | — | — | — | — | — | — |
| 0121-97-0002 | 21-05051 | 6.00–6.50 | Fill | — | — | — | — | — | — | — |
| 0121-97-0003 | 21-05051 | 8.50–9.00 | Fill | 60 | — | 17.5 | — | — | — | — |
| 0121-97-0004 | 21-05051 | 11.50–12.00 | Fill | 35.6 | — | — | — | — | — | — |
| 0121-97-0005 | 21-05051 | 13.80–14.50 | Qbt 3 | 45.2 | 6.7 (U) | 51.9 | 0.32 (U) | 16000 | 23.1 | — |
| 0121-97-0006 | 21-05051 | 20.00–21.00 | Qbt 3 | 23.6 | 3.6 (J) | 48 | — | 17400 | 36.6 | — |
| 0121-97-0007 | 21-05051 | 27.50–28.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0008 | 21-05051 | 40.00–40.50 | Qbt 3 | 119 | — | — | — | — | — | — |
| 0121-97-0009 | 21-05051 | 50.00–50.50 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0010 | 21-05051 | 61.00–61.50 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0011 | 21-05051 | 71.00–71.50 | Qbt 3 | — | — | — | — | — | 13.9 | — |
| 0121-97-0012 | 21-05051 | 80.00–80.50 | Qbt 3 | — | — | — | — | — | 11.5 | — |
| 0121-97-0013 | 21-05051 | 89.50–90.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0014 | 21-05051 | 99.50–100.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0015 | 21-05051 | 109.00–109.50 | Qbt 2 | — | — | — | — | — | — | — |
| 0121-97-0016 | 21-05051 | 119.50–120.00 | Qbt 2 | — | — | — | — | — | — | — |
| 0121-97-0017 | 21-05051 | 129.50–130.00 | Qbt 2 | — | — | — | — | — | — | — |
| 0121-97-0018 | 21-05051 | 137.50–138.00 | Qbt 2 | 8.4 | — | — | — | — | — | — |
| 0121-97-0019 | 21-05051 | 149.50–150.00 | Qbt 2 | — | — | — | — | — | — | — |
| 0121-97-0026 | 21-05052 | 2.50–3.00 | Fill | — | — | — | — | — | — | — |
| 0121-97-0027 | 21-05052 | 9.00–9.50 | Qal | 6.5 | 6.5 (J) | 7.2 | — | 9440 | 7.4 | — |
| 0121-97-0028 | 21-05052 | 20.00–20.50 | Qal | 1.6 (J) | 2 (J) | 3 (J) | — | 3550 | 3.7 | — |
| 0121-97-0029 | 21-05052 | 26.00–27.00 | Qal | 2 (J) | 1.5 (J) | 2.5 (J) | — | 5750 | 5 | — |
| 0121-97-0030 | 21-05052 | 39.50–40.00 | Qbt 3 | — | — | — | — | — | — | — |

## Table B-25 (continued)

**Part 2 (continued)**

| Sample ID | Location ID | Depth (ft) | Media | Chromium | Cobalt | Copper | Cyanide (Total) | Iron | Lead | Lithium |
|---|---|---|---|---|---|---|---|---|---|---|
| **Soil Background Value** | | | | — | — | 14.7 | — | — | — | — |
| **Qbt 2,3,4 Background Value** | | | | 7.14 | 3.14 | 4.66 | — | 14500 | 11.2 | — |
| **Qbt 1v Background Value** | | | | 2.24 | — | — | — | — | — | — |
| **Fill Background Value** | | | | 19.3 | — | 14.7 | — | — | 22.3 | — |
| **Residential SAL (mg/kg)** | | | | **230*** | **4500** | **2800** | **1200** | **2.3E$^{+4}$** | **400** | **1600*** |
| **Industrial SAL (mg/kg)** | | | | **660*** | **1.3E$^{+4}$** | **8500** | **3000** | **6.9E$^{+4}$** | **1000** | **23E$^{+4}$** |
| 0121-97-0031 | 21-05052 | 49.50–50.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0032 | 21-05052 | 59.50–60.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0033 | 21-05052 | 70.00–71.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-1271 | 21-05052 | 70.00–71.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0034 | 21-05052 | 79.50–80.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0035 | 21-05052 | 87.00–88.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0036 | 21-05052 | 96.00–96.50 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0037 | 21-05052 | 109.00–110.00 | Qbt 2 | — | — | — | — | — | — | — |
| 0121-97-0038 | 21-05052 | 119.00–120.00 | Qbt 2 | — | — | — | — | — | — | — |
| 0121-97-0039 | 21-05052 | 130.00–131.00 | Qbt 2 | — | — | — | — | — | — | — |
| 0121-97-0040 | 21-05052 | 139.00–140.00 | Qbt 2 | — | — | — | — | — | — | — |
| 0121-97-0041 | 21-05052 | 149.00–150.00 | Qbt 2 | — | — | — | — | — | — | — |
| 0121-97-1272 | 21-05052 | 149.00–150.00 | Qbt 2 | — | — | — | — | — | — | — |
| 0121-97-0051 | 21-05053 | 4.20–4.60 | Fill | — | — | — | — | — | — | — |
| 0121-97-0052 | 21-05053 | 6.50–7.00 | Fill | — | — | 49.1 | 0.27 (U) | — | — | — |
| 0121-97-0064 | 21-05053 | 6.50–7.00 | Fill | 20.9 | — | 134 | 0.27 (U) | — | 26.5 | — |
| 0121-97-0053 | 21-05053 | 9.50–10.00 | Fill | 28.3 | — | 29.8 | 0.27 (U) | — | 25.9 | — |
| 0121-97-0054 | 21-05053 | 12.50–13.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0055 | 21-05053 | 17.00–17.30 | Qbt 3 | 17.5 (J-) | 8 (J) | 131 (J-) | — | 16000 (J) | — | — |
| 0121-97-0056 | 21-05053 | 20.50–21.50 | Qbt 3 | — | — | 7.2 (J-) | — | — | — | — |
| 0121-97-0057 | 21-05053 | 28.00–29.00 | Qbt 3 | — | — | 25.8 (J-) | — | — | 13.4 | — |
| 0121-97-0058 | 21-05053 | 39.50–40.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0059 | 21-05053 | 48.00–48.50 | Qbt 3 | 22.9 (J) | 5 (J) | 78.9 | — | 18100 | 40.8 | — |
| 0121-97-0060 | 21-05053 | 59.50–60.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0061 | 21-05053 | 60.00–60.70 | Qbt 3 | — | — | — | 0.28 (U) | — | — | — |
| 0121-97-0062 | 21-05053 | 74.50–75.00 | Qbt 3 | — | — | 9 | — | — | — | — |
| 0121-97-0063 | 21-05053 | 80.00–80.50 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0445 | 21-05053 | 89.50–90.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0066 | 21-05054 | 3.00–3.50 | Fill | — | — | — | — | — | — | — |
| 0121-97-0067 | 21-05054 | 6.00–6.50 | Fill | — | — | 19 | — | — | 24 | — |
| 0121-97-0068 | 21-05054 | 7.50–8.20 | Fill | — | — | 23.8 | — | — | 26.1 | — |
| 0121-97-0069 | 21-05054 | 10.50–11.00 | Fill | 133 | — | 41 | 0.3 (U) | — | 36.8 | — |
| 0121-97-0070 | 21-05054 | 14.20–15.00 | Qbt 3 | 18.4 (J-) | 3.5 (J) | 100 (J-) | — | 19600 (J) | 23 | — |
| 0121-97-0071 | 21-05054 | 21.80–22.10 | Qbt 3 | 21.6 | 3.6 (U) | 54.8 | 0.28 (U) | 15900 | — | — |
| 0121-97-0072 | 21-05054 | 32.00–32.50 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0073 | 21-05054 | 35.50–36.00 | Qbt 3 | — | — | 27.6 (J-) | — | — | — | — |

## Table B-25 (continued)

**Part 2 (continued)**

| Sample ID | Location ID | Depth (ft) | Media | Chromium | Cobalt | Copper | Cyanide (Total) | Iron | Lead | Lithium |
|---|---|---|---|---|---|---|---|---|---|---|
| **Soil Background Value** | | | | — | — | 14.7 | — | — | — | — |
| **Qbt 2,3,4 Background Value** | | | | 7.14 | 3.14 | 4.66 | — | 14500 | 11.2 | — |
| **Qbt 1v Background Value** | | | | 2.24 | — | — | — | — | — | — |
| **Fill Background Value** | | | | 19.3 | — | 14.7 | — | — | 22.3 | — |
| **Residential SAL (mg/kg)** | | | | **230*** | **4500** | **2800** | **1200** | **2.3E$^{+4}$** | **400** | **1600*** |
| **Industrial SAL (mg/kg)** | | | | **660*** | **1.3E$^{+4}$** | **8500** | **3000** | **6.9E$^{+4}$** | **1000** | **23E$^{+4}$** |
| 0121-97-0074 | 21-05054 | 50.00–50.50 | Qbt 3 | 12.6 (J-) | — | — | — | — | — | — |
| 0121-97-0075 | 21-05054 | 59.50–60.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0081 | 21-05055 | 3.50–4.00 | Fill | — | — | — | 0.28 (U) | — | — | — |
| 0121-97-0082 | 21-05055 | 8.50–9.00 | Fill | — | — | 14.8 | 0.26 (U) | — | — | — |
| 0121-97-0083 | 21-05055 | 14.50–15.00 | Fill | — | — | 31.1 (J) | 0.28 (U) | — | 52 | — |
| 0121-97-0096 | 21-05056 | 4.50–5.00 | Fill | — | — | — | — | — | — | — |
| 0121-97-0097 | 21-05056 | 11.80–12.20 | Qbt 3 | — | — | 8.7 | 0.32 (U) | — | — | — |
| 0121-97-0098 | 21-05056 | 20.00–20.50 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0099 | 21-05056 | 29.00–29.50 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0100 | 21-05056 | 39.00–39.50 | Qbt 3 | — | — | 10.3 | — | — | 21.5 | — |
| 0121-97-0101 | 21-05056 | 49.50–50.00 | Qbt 3 | — | — | 11.4 (J) | 0.28 (U) | — | — | — |
| 0121-96-0481 | 21-05057 | 4.30–5.00 | Fill | — | — | — | — | — | — | — |
| 0121-96-0482 | 21-05057 | 9.50–10.00 | Fill | — | — | — | — | — | — | — |
| 0121-96-0483 | 21-05057 | 19.50–20.00 | Fill | — | — | — | — | — | — | — |
| 0121-96-0484 | 21-05057 | 22.50–23.90 | Qal | 17.9 | 2 (J) | 7.2 | — | 5860 | 16.2 | — |
| 0121-96-0485 | 21-05057 | 29.50–30.00 | Qbt 3 | 9.7 | — | — | — | — | — | — |
| 0121-96-0486 | 21-05057 | 39.50–40.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-96-0487 | 21-05057 | 49.50–50.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-96-0492 | 21-05058 | 7.70–8.20 | Fill | — | — | — | — | — | — | — |
| 0121-96-0495 | 21-05058 | 29.50–30.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-96-0496 | 21-05058 | 39.50–40.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-96-0497 | 21-05058 | 49.50–50.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0111 | 21-05059 | 4.00–4.50 | Soil | — | — | — | 0.29 (U) | — | — | — |
| 0121-97-0112 | 21-05059 | 10.20–10.70 | Qal | 6.5 (J) | 2 (J) | 6.6 | 0.29 (U) | 8170 | 6 | — |
| 0121-97-0113 | 21-05059 | 20.00–20.50 | Qal | 2.9 (J) | 1.3 (U) | 3.7 (J) | 0.3 (U) | 4800 | 2.8 | — |
| 0121-97-0114 | 21-05059 | 31.50–32.00 | Qal | 9.2 (J) | 2.9 (J) | 7.5 | 0.3 (U) | 13200 | 17.5 | — |
| 0121-97-0115 | 21-05059 | 36.40–36.80 | Qbt 3 | — | — | — | 0.27 (U) | — | — | — |
| 0121-97-0116 | 21-05059 | 40.00–40.50 | Qbt 3 | — | — | — | 0.27 (U) | — | — | — |
| 0121-97-0117 | 21-05059 | 49.50–50.00 | Qbt 3 | — | — | — | 0.28 (U) | — | — | — |
| 0121-97-0136 | 21-05060 | 4.50–5.00 | Soil | — | — | — | — | — | — | — |
| 0121-97-0137 | 21-05060 | 10.00–10.50 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0138 | 21-05060 | 20.00–20.50 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0139 | 21-05060 | 30.00–30.50 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0140 | 21-05060 | 42.00–42.50 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0141 | 21-05060 | 50.00–50.50 | Qbt 3 | 22.5 | — | — | — | — | — | — |
| 0121-97-0142 | 21-05060 | 60.00–60.50 | Qbt 3 | — | — | — | — | — | — | — |

## Table B-25 (continued)

**Part 2 (continued)**

| Sample ID | Location ID | Depth (ft) | Media | Chromium | Cobalt | Copper | Cyanide (Total) | Iron | Lead | Lithium |
|---|---|---|---|---|---|---|---|---|---|---|
| **Soil Background Value** | | | | — | — | 14.7 | — | — | — | — |
| **Qbt 2,3,4 Background Value** | | | | 7.14 | 3.14 | 4.66 | — | 14500 | 11.2 | — |
| **Qbt 1v Background Value** | | | | 2.24 | — | — | — | — | — | — |
| **Fill Background Value** | | | | 19.3 | — | 14.7 | — | — | 22.3 | — |
| **Residential SAL (mg/kg)** | | | | **230*** | **4500** | **2800** | **1200** | **2.3E$^{+4}$** | **400** | **1600*** |
| **Industrial SAL (mg/kg)** | | | | **660*** | **1.3E$^{+4}$** | **8500** | **3000** | **6.9E$^{+4}$** | **1000** | **23E$^{+4}$** |
| 0121-97-0143 | 21-05060 | 69.50–70.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0163 | 21-05060 | 69.50–70.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0144 | 21-05060 | 79.50–80.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0145 | 21-05060 | 89.00–89.50 | Qbt 3 | — | — | — | 0.67 (U) | — | — | — |
| 0121-97-0146 | 21-05060 | 99.50–100.00 | Qbt 3 | — | — | — | 0.67 (U) | — | — | — |
| 0121-97-0147 | 21-05060 | 109.00–109.20 | Qbt 2 | — | — | — | 0.66 (U) | — | — | — |
| 0121-97-0148 | 21-05060 | 118.50–119.00 | Qbt 2 | — | — | — | 0.66 (U) | — | — | — |
| 0121-97-0149 | 21-05060 | 129.00–129.50 | Qbt 2 | — | — | — | 0.66 (U) | — | — | — |
| 0121-97-0164 | 21-05060 | 129.00–129.50 | Qbt 2 | — | — | — | 0.66 (U) | — | 18 (J-) | — |
| 0121-97-0150 | 21-05060 | 139.00–139.50 | Qbt 2 | — | — | — | 0.66 (U) | — | — | — |
| 0121-97-0151 | 21-05060 | 150.00–150.50 | Qbt 2 | — | — | — | 0.66 (U) | — | — | — |
| 0121-97-0152 | 21-05060 | 160.00–160.50 | Qbt 2 | — | — | — | 0.67 (U) | — | — | — |
| 0121-97-0153 | 21-05060 | 169.50–170.00 | Qbt 2 | — | — | — | 0.67 (U) | — | — | — |
| 0121-97-0154 | 21-05060 | 174.50–175.00 | Qbt 2 | — | — | — | 0.67 (U) | — | — | — |
| 0121-97-0166 | 21-05061 | 5.50–6.00 | Soil | — | — | — | — | — | — | — |
| 0121-97-0167 | 21-05061 | 10.00–10.50 | Qbt 3 | 17.2 | 4.9 (J) | 16.8 | — | 22300 | 15.5 (J-) | — |
| 0121-97-0168 | 21-05061 | 22.00–22.50 | Qbt 3 | 8.7 | — | 9.2 | — | — | — | — |
| 0121-97-1126 | 21-05061 | 22.00–22.50 | Qbt 3 | 11.6 | — | 9.2 | — | 16100 | — | — |
| 0121-97-0169 | 21-05061 | 30.00–30.50 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0170 | 21-05061 | 40.00–40.50 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0171 | 21-05061 | 49.00–49.50 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0172 | 21-05061 | 59.50–60.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0173 | 21-05061 | 69.50–70.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0174 | 21-05061 | 78.50–78.80 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0175 | 21-05061 | 89.50–90.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0176 | 21-05061 | 98.70–99.20 | Qbt 2 | — | — | — | — | — | — | — |
| 0121-97-0177 | 21-05061 | 108.50–109.00 | Qbt 2 | — | — | — | 0.65 (U) | — | — | — |
| 0121-97-0178 | 21-05061 | 118.00–118.50 | Qbt 2 | — | — | — | 0.65 (U) | — | — | — |
| 0121-97-0179 | 21-05061 | 128.50–129.00 | Qbt 2 | — | — | — | 0.65 (U) | — | — | — |
| 0121-97-0180 | 21-05061 | 140.00–140.50 | Qbt 2 | 67.2 | — | — | 0.65 (U) | — | — | — |
| 0121-97-0181 | 21-05061 | 152.50–153.00 | Qbt 2 | — | — | — | 0.26 (UJ) | — | — | — |
| 0121-97-0182 | 21-05061 | 160.00–160.50 | Qbt 2 | — | — | — | 0.26 (UJ) | — | — | — |
| 0121-97-0183 | 21-05061 | 170.00–170.50 | Qbt 1v | 3.8 (J-) | — | — | 0.26 (UJ) | — | — | — |
| 0121-97-1128 | 21-05061 | 170.00–170.50 | Qbt 1v | 17.6 (J-) | — | — | 0.26 (UJ) | — | — | — |
| 0121-97-0184 | 21-05061 | 180.00–180.50 | Qbt 1v | 3.6 (J-) | — | — | 0.27 (UJ) | — | — | — |
| 0121-97-0185 | 21-05061 | 189.50–190.00 | Qbt 1v | 2.4 (J-) | — | — | 0.26 (UJ) | — | — | — |

## Table B-25 (continued)

**Part 2 (continued)**

| Sample ID | Location ID | Depth (ft) | Media | Chromium | Cobalt | Copper | Cyanide (Total) | Iron | Lead | Lithium |
|---|---|---|---|---|---|---|---|---|---|---|
| **Soil Background Value** | | | | — | — | 14.7 | — | — | — | — |
| **Qbt 2,3,4 Background Value** | | | | 7.14 | 3.14 | 4.66 | — | 14500 | 11.2 | — |
| **Qbt 1v Background Value** | | | | 2.24 | — | — | — | — | — | — |
| **Fill Background Value** | | | | 19.3 | — | 14.7 | — | — | 22.3 | — |
| **Residential SAL (mg/kg)** | | | | **230*** | **4500** | **2800** | **1200** | **2.3E$^{+4}$** | **400** | **1600*** |
| **Industrial SAL (mg/kg)** | | | | **660*** | **1.3E$^{+4}$** | **8500** | **3000** | **6.9E$^{+4}$** | **1000** | **23E$^{+4}$** |
| 0121-97-0191 | 21-05062 | 5.00–5.50 | Qbt 3 | 52.2 | 4.6 (J) | 9.7 | 0.29 (U) | — | 11.7 (J-) | — |
| 0121-97-0192 | 21-05062 | 6.00–6.50 | Qbt 3 | — | — | — | 0.28 (U) | — | — | — |
| 0121-97-0193 | 21-05062 | 10.00–10.50 | Qbt 3 | — | — | — | 0.27 (U) | — | — | — |
| 0121-97-0194 | 21-05062 | 20.00–20.50 | Qbt 3 | 9.8 | — | — | 0.28 (U) | — | — | — |
| 0121-97-0195 | 21-05062 | 30.00–30.50 | Qbt 3 | — | — | — | 0.27 (U) | — | — | — |
| 0121-97-0196 | 21-05062 | 40.00–40.50 | Qbt 3 | — | — | 5.7 (J) | 0.29 (U) | — | 11.7 (J-) | — |
| 0121-97-0197 | 21-05062 | 49.50–50.00 | Qbt 3 | — | — | — | 0.27 (U) | — | — | — |
| 0121-97-0198 | 21-05062 | 58.80–59.50 | Qbt 3 | — | — | 5.6 (J) | 0.27 (U) | — | — | — |
| 0121-97-0218 | 21-05062 | 58.80–59.50 | Qbt 3 | — | — | — | 0.66 (U) | — | 11.3 | — |
| 0121-97-0199 | 21-05062 | 70.00–70.50 | Qbt 3 | — | — | — | 0.66 (U) | — | 21.5 (J-) | — |
| 0121-97-0200 | 21-05062 | 78.40–79.50 | Qbt 3 | 17.9 | 5.1 (J-) | 21 (J) | 0.83 (U) | — | 19.9 (J) | — |
| 0121-97-0221 | 21-05063 | 4.50–5.00 | Qbt 3 | 7.2 | 8.3 (J) | 8.2 | — | — | — | — |
| 0121-97-0222 | 21-05063 | 7.50–8.30 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0234 | 21-05063 | 7.50–8.30 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0223 | 21-05063 | 10.00–11.60 | Qbt 3 | — | — | 7.5 | — | — | — | — |
| 0121-97-0224 | 21-05063 | 20.00–20.50 | Qbt 3 | 11.7 | — | — | — | — | — | — |
| 0121-97-0225 | 21-05063 | 30.50–31.30 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0226 | 21-05063 | 41.00–42.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0227 | 21-05063 | 49.00–50.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-96-0621 | 21-05065 | 4.50–5.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-96-0622 | 21-05065 | 10.00–10.50 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-96-0623 | 21-05065 | 19.50–20.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-96-0624 | 21-05065 | 29.50–30.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-96-0625 | 21-05065 | 39.50–40.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-96-0626 | 21-05065 | 48.20–48.70 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0326 | 21-05073 | 2.50–3.00 | Soil | — | — | — | 0.28 (U) | — | — | — |
| 0121-97-0327 | 21-05073 | 8.50–9.00 | Qbt 3 | 7.7 (J) | 4.4 (J) | 23.4 (J) | 0.27 (U) | — | 17.8 | — |
| 0121-97-0328 | 21-05073 | 11.70–12.20 | Qbt 3 | — | — | — | 0.26 (U) | — | 13.1 (J-) | — |
| 0121-97-0329 | 21-05073 | 22.00–23.00 | Qbt 3 | — | — | — | 0.27 (U) | — | — | — |
| 0121-97-0330 | 21-05073 | 32.00–32.50 | Qbt 3 | — | — | — | 0.27 (U) | — | — | — |
| 0121-97-0331 | 21-05073 | 42.00–42.50 | Qbt 3 | — | — | — | 0.27 (U) | — | — | — |
| 0121-97-0332 | 21-05073 | 46.50–47.00 | Qbt 3 | — | — | — | 0.27 (U) | — | — | — |
| 0121-97-0333 | 21-05073 | 62.00–62.50 | Qbt 3 | — | — | — | 0.27 (U) | — | — | — |
| 0121-97-0401 | 21-05073 | 62.00–62.50 | Qbt 3 | — | — | — | 0.27 (U) | — | — | — |
| 0121-97-0334 | 21-05073 | 69.50–70.00 | Qbt 3 | — | — | — | 0.27 (U) | — | — | — |
| 0121-97-1131 | 21-05075 | 6.70–7.20 | Qbt 3 | — | 5.2 | 6.3 | — | — | — | — |

## Table B-25 (continued)

**Part 2 (continued)**

| Sample ID | Location ID | Depth (ft) | Media | Chromium | Cobalt | Copper | Cyanide (Total) | Iron | Lead | Lithium |
|---|---|---|---|---|---|---|---|---|---|---|
| **Soil Background Value** | | | | — | — | 14.7 | — | — | — | — |
| **Qbt 2,3,4 Background Value** | | | | 7.14 | 3.14 | 4.66 | — | 14500 | 11.2 | — |
| **Qbt 1v Background Value** | | | | 2.24 | — | — | — | — | — | — |
| **Fill Background Value** | | | | 19.3 | — | 14.7 | — | — | 22.3 | — |
| **Residential SAL (mg/kg)** | | | | **230*** | **4500** | **2800** | **1200** | **2.3E$^{+4}$** | **400** | **1600*** |
| **Industrial SAL (mg/kg)** | | | | **660*** | **1.3E$^{+4}$** | **8500** | **3000** | **6.9E$^{+4}$** | **1000** | **23E$^{+4}$** |
| 0121-97-1132 | 21-05075 | 8.80–9.30 | Qbt 3 | — | — | 6.2 | — | — | 12.1 (J) | — |
| 0121-97-1133 | 21-05075 | 15.50–16.00 | Qbt 3 | — | — | — | — | — | 14 | — |
| 0121-97-1141 | 21-05075 | 15.50–16.00 | Qbt 3 | — | — | 5.5 | — | — | 12.2 (J) | — |
| 0121-97-1134 | 21-05075 | 20.00–21.00 | Qbt 3 | — | — | 4.9 (U) | — | — | — | — |
| 0121-97-1135 | 21-05075 | 29.50–30.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-1136 | 21-05075 | 38.80–39.30 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-1137 | 21-05075 | 45.00–46.00 | Qbt 3 | — | — | 9.6 | — | — | 13 (J-) | — |
| 0121-97-1138 | 21-05075 | 58.00–58.50 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-1139 | 21-05075 | 69.50–70.00 | Qbt 3 | — | — | 8.9 | — | — | — | — |

* = Based on Chromium VI

## Table B-25 (continued)

**Part 3**

| Sample ID | Location ID | Depth (ft) | Media | Magnesium | Manganese | Mercury | Molybdenum | Nickel | Potassium | Selenium |
|---|---|---|---|---|---|---|---|---|---|---|
| **Soil Background Value** | | | | — | — | — | — | 15.4 | — | 1.52 |
| **Qbt 2,3,4 Background Value** | | | | 1690 | 482 | 0.1 | — | 6.58 | 3500 | 0.3 |
| **Qbt 1v Background Value** | | | | — | — | — | — | 2 | — | 0.3 |
| **Fill Background Value** | | | | — | — | 0.1 | — | 15.4 | — | 1.52 |
| **Residential SAL (mg/kg)** | | | | **EN** | **7800** | **23** | **380** | **1500** | **EN** | **380** |
| **Industrial SAL (mg/kg)** | | | | **EN** | **1.4E$^{+4}$** | **69** | **1200** | **4400** | **EN** | **1200** |
| **1992** | | | | | | | | | | |
| AAA0564 | 21-01085 | 0.00–0.08 | Soil | — | — | — | 2.5 (U) | — | — | — |
| AAA3950 | 21-01615 | 0.00–0.50 | Soil | — | — | — | 6.6 (U) | — | — | — |
| AAA3951 | 21-01616 | 0.00–0.50 | Soil | — | — | — | 6.6 (U) | — | — | — |
| AAA3952 | 21-01617 | 0.00–0.50 | Soil | — | — | — | 6.5 (U) | — | — | — |
| AAA3953 | 21-01618 | 0.00–0.50 | Soil | — | — | — | 6.4 (U) | — | — | — |
| AAA3954 | 21-01619 | 0.00–0.50 | Soil | — | — | — | 6.8 (U) | — | — | — |
| AAA3957 | 21-01620 | 0.00–0.50 | Soil | — | — | — | 6.6 (U) | — | — | — |
| AAA3958 | 21-01621 | 0.00–0.50 | Soil | — | — | — | 6.4 (U) | — | — | — |
| AAA3959 | 21-01622 | 0.00–0.50 | Soil | — | — | — | 6.6 (U) | — | — | — |
| AAA3960 | 21-01622 | 0.00–0.50 | Soil | — | — | — | 6.6 (U) | — | — | — |
| AAA3961 | 21-01623 | 0.00–0.50 | Soil | — | — | — | 6.8 (U) | — | — | — |
| AAA3962 | 21-01624 | 0.00–0.50 | Soil | — | — | — | 6.5 (U) | — | — | — |
| AAA3963 | 21-01625 | 0.00–0.50 | Soil | — | — | — | 6.5 (U) | — | — | — |
| AAA3964 | 21-01626 | 0.00–0.50 | Soil | — | — | — | 6.5 (U) | — | — | — |
| AAA3965 | 21-01627 | 0.00–0.50 | Soil | — | — | — | 6.3 (U) | — | — | — |
| AAA3966 | 21-01628 | 0.00–0.50 | Soil | — | — | — | 6.6 (U) | — | — | — |
| AAA3985 | 21-01644 | 0.00–0.50 | Soil | — | — | — | 6.5 (U) | — | — | — |
| AAA3987 | 21-01646 | 0.00–0.50 | Soil | — | — | — | 6.6 (U) | — | — | — |
| AAA3988 | 21-01647 | 0.00–0.50 | Soil | — | — | — | 6.5 (U) | — | — | — |
| AAA3989 | 21-01648 | 0.00–0.50 | Soil | — | — | — | 6.5 (U) | — | — | — |
| AAA3990 | 21-01649 | 0.00–0.50 | Soil | — | — | — | 6.6 (U) | — | — | — |
| AAA3996 | 21-01655 | 0.00–0.50 | Soil | — | — | — | 6.5 (U) | — | — | — |
| AAA3997 | 21-01656 | 0.00–0.50 | Soil | — | — | — | 6.5 (U) | — | — | — |
| AAA3998 | 21-01657 | 0.00–0.50 | Soil | — | — | — | 6.7 (U) | — | — | — |
| AAA4001 | 21-01658 | 0.00–0.50 | Soil | — | — | — | 6.4 (U) | — | — | — |
| AAA4002 | 21-01658 | 0.00–0.50 | Soil | — | — | — | 6.4 (U) | — | — | — |
| AAA4006 | 21-01662 | 0.00–0.50 | Soil | — | — | — | 6.7 (U) | — | — | — |
| **1993–1994** | | | | | | | | | | |
| AAB7314 | 21-02535 | 2.50–5.00 | Fill | — | — | — | — | — | — | — |
| AAB7316 | 21-02536 | 5.00–7.50 | Soil | — | — | — | — | — | — | — |
| AAB7320 | 21-02537 | 7.50–10.00 | Qbt 3 | — | — | — | — | — | — | 1.1 (U) |
| AAB7323 | 21-02538 | 5.00–7.50 | Fill | — | — | — | — | — | — | — |
| AAB7328 | 21-02539 | 7.50–10.00 | Soil | — | — | — | — | — | — | — |
| AAB7332 | 21-02540 | 7.50–10.00 | Qbt 3 | — | — | — | — | — | — | 0.73 (U) |
| AAB7334 | 21-02541 | 2.50–5.00 | Soil | — | — | — | — | — | — | — |

## Table B-25 (continued)

**Part 3 (continued)**

| Sample ID | Location ID | Depth (ft) | Media | Magnesium | Manganese | Mercury | Molybdenum | Nickel | Potassium | Selenium |
|---|---|---|---|---|---|---|---|---|---|---|
| **Soil Background Value** | | | | — | — | — | — | 15.4 | — | 1.52 |
| **Qbt 2,3,4 Background Value** | | | | 1690 | 482 | 0.1 | — | 6.58 | 3500 | 0.3 |
| **Qbt 1v Background Value** | | | | — | — | — | — | 2 | — | 0.3 |
| **Fill Background Value** | | | | — | — | 0.1 | — | 15.4 | — | 1.52 |
| **Residential SAL (mg/kg)** | | | | **EN** | **7800** | **23** | **380** | **1500** | **EN** | **380** |
| **Industrial SAL (mg/kg)** | | | | **EN** | **$1.4E^{+4}$** | **69** | **1200** | **4400** | **EN** | **1200** |
| AAB9109 | 21-02541 | 10.00–12.50 | Qbt 3 | — | — | — | — | 15.9 | — | 0.73 (U) |
| AAB7340 | 21-02543 | 2.50–5.00 | Soil | — | — | — | — | — | — | — |
| AAB7342 | 21-02544 | 5.00–7.50 | Soil | — | — | — | — | — | — | — |
| AAB7343 | 21-02545 | 0.00–5.00 | Soil | — | — | — | — | — | — | — |
| AAB7347 | 21-02546 | 0.00–5.00 | Soil | — | — | — | — | — | — | — |
| AAB7352 | 21-02547 | 5.00–10.00 | Soil | — | — | — | 6.3 (U) | 53.5 | — | — |
| AAB7355 | 21-02548 | 2.50–5.00 | Soil | — | — | — | — | — | — | — |
| AAB7368 | 21-02609 | 5.00–7.50 | Soil | — | — | — | — | — | — | — |
| AAB9110 | 21-02609 | 5.00–7.50 | Soil | — | — | — | — | — | — | — |
| AAB9111 | 21-02610 | 5.00–7.50 | Soil | — | — | — | — | — | — | — |
| **1996–1997** | | | | | | | | | | |
| 0121-97-0001 | 21-05051 | 3.50–4.00 | Fill | — | — | — | — | — | — | 3.4 (U) |
| 0121-97-0002 | 21-05051 | 6.00–6.50 | Fill | — | — | 0.25 | — | — | — | 3.6 (U) |
| 0121-97-0003 | 21-05051 | 8.50–9.00 | Fill | — | — | 1.3 | — | 23 | — | 3.5 (U) |
| 0121-97-0004 | 21-05051 | 11.50–12.00 | Fill | — | — | 0.99 | — | — | — | — |
| 0121-97-0005 | 21-05051 | 13.80–14.50 | Qbt 3 | 3340 (J) | — | 2.6 | — | 24.5 (J) | 4730 (J) | 0.42 (U) |
| 0121-97-0006 | 21-05051 | 20.00–21.00 | Qbt 3 | 3480 | — | 2.9 | — | 15.3 | 5200 | 4.5 (U) |
| 0121-97-0007 | 21-05051 | 27.50–28.00 | Qbt 3 | — | — | 0.71 | — | — | — | 0.37 (U) |
| 0121-97-0008 | 21-05051 | 40.00–40.50 | Qbt 3 | — | — | — | — | 57.7 | — | 0.35 (U) |
| 0121-97-0009 | 21-05051 | 50.00–50.50 | Qbt 3 | — | — | — | — | — | — | 0.35 (U) |
| 0121-97-0010 | 21-05051 | 61.00–61.50 | Qbt 3 | — | — | — | — | — | — | 0.35 (U) |
| 0121-97-0011 | 21-05051 | 71.00–71.50 | Qbt 3 | — | — | — | — | — | — | 0.35 (U) |
| 0121-97-0012 | 21-05051 | 80.00–80.50 | Qbt 3 | — | — | — | — | — | — | 0.35 |
| 0121-97-0013 | 21-05051 | 89.50–90.00 | Qbt 3 | — | — | — | — | — | — | 0.34 (U) |
| 0121-97-0014 | 21-05051 | 99.50–100.00 | Qbt 3 | — | — | — | — | — | — | 0.34 (U) |
| 0121-97-0015 | 21-05051 | 109.00–109.50 | Qbt 2 | — | — | — | — | — | — | 0.34 (U) |
| 0121-97-0016 | 21-05051 | 119.50–120.00 | Qbt 2 | — | — | — | — | — | — | 0.34 (U) |
| 0121-97-0017 | 21-05051 | 129.50–130.00 | Qbt 2 | — | — | — | — | — | — | 0.34 (U) |
| 0121-97-0018 | 21-05051 | 137.50–138.00 | Qbt 2 | — | — | — | — | — | — | 0.34 (U) |
| 0121-97-0019 | 21-05051 | 149.50–150.00 | Qbt 2 | — | — | — | — | — | — | 0.35 (U) |
| 0121-97-0026 | 21-05052 | 2.50–3.00 | Fill | — | — | — | — | — | — | — |
| 0121-97-0027 | 21-05052 | 9.00–9.50 | Qal | 1510 | 406 (J+) | 0.06 (U) | — | 7.8 (J) | 1010 (J) | 0.36 (UJ) |
| 0121-97-0028 | 21-05052 | 20.00–20.50 | Qal | 571 (J) | 78.2 (J+) | 0.06 (U) | — | 2.6 (J) | 474 (J) | 0.42 (UJ) |
| 0121-97-0029 | 21-05052 | 26.00–27.00 | Qal | 428 (J) | 187 (J+) | 0.06 (U) | — | 3.1 (J) | 321 (J) | 0.37 (UJ) |
| 0121-97-0030 | 21-05052 | 39.50–40.00 | Qbt 3 | — | — | — | — | — | — | 0.39 (UJ) |
| 0121-97-0031 | 21-05052 | 49.50–50.00 | Qbt 3 | — | — | — | — | — | — | 0.38 (UJ) |

## Table B-25 (continued)

**Part 3 (continued)**

| Sample ID | Location ID | Depth (ft) | Media | Magnesium | Manganese | Mercury | Molybdenum | Nickel | Potassium | Selenium |
|---|---|---|---|---|---|---|---|---|---|---|
| **Soil Background Value** | | | | — | — | — | — | 15.4 | — | 1.52 |
| **Qbt 2,3,4 Background Value** | | | | 1690 | 482 | 0.1 | — | 6.58 | 3500 | 0.3 |
| **Qbt 1v Background Value** | | | | — | — | — | — | 2 | — | 0.3 |
| **Fill Background Value** | | | | — | — | 0.1 | — | 15.4 | — | 1.52 |
| **Residential SAL (mg/kg)** | | | | **EN** | **7800** | **23** | **380** | **1500** | **EN** | **380** |
| **Industrial SAL (mg/kg)** | | | | **EN** | **$1.4E^{+4}$** | **69** | **1200** | **4400** | **EN** | **1200** |
| 0121-97-0032 | 21-05052 | 59.50–60.00 | Qbt 3 | — | — | — | — | — | — | 0.32 (U) |
| 0121-97-0033 | 21-05052 | 70.00–71.00 | Qbt 3 | — | — | — | — | — | — | 0.32 (U) |
| 0121-97-1271 | 21-05052 | 70.00–71.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0034 | 21-05052 | 79.50–80.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0035 | 21-05052 | 87.00–88.00 | Qbt 3 | — | — | — | — | — | — | 0.37 (J) |
| 0121-97-0036 | 21-05052 | 96.00–96.50 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0037 | 21-05052 | 109.00–110.00 | Qbt 2 | — | — | — | — | — | — | — |
| 0121-97-0038 | 21-05052 | 119.00–120.00 | Qbt 2 | — | — | — | — | — | — | — |
| 0121-97-0039 | 21-05052 | 130.00–131.00 | Qbt 2 | — | — | — | — | — | — | — |
| 0121-97-0040 | 21-05052 | 139.00–140.00 | Qbt 2 | — | — | — | — | — | — | — |
| 0121-97-0041 | 21-05052 | 149.00–150.00 | Qbt 2 | — | — | — | — | — | — | 0.31 (U) |
| 0121-97-1272 | 21-05052 | 149.00–150.00 | Qbt 2 | — | — | — | — | — | — | — |
| 0121-97-0051 | 21-05053 | 4.20–4.60 | Fill | — | — | 0.49 | — | 15.7 | — | — |
| 0121-97-0052 | 21-05053 | 6.50–7.00 | Fill | — | — | 0.76 | — | 140 | — | — |
| 0121-97-0064 | 21-05053 | 6.50–7.00 | Fill | — | — | 2.5 | — | 355 | — | — |
| 0121-97-0053 | 21-05053 | 9.50–10.00 | Fill | — | — | 9.1 | — | 23.8 | — | — |
| 0121-97-0054 | 21-05053 | 12.50–13.00 | Qbt 3 | — | — | 0.36 (J-) | — | — | — | 0.64 (U) |
| 0121-97-0055 | 21-05053 | 17.00–17.30 | Qbt 3 | 2740 (J) | 1290 (J) | — | — | 23.2 | 4590 (J) | 1 (J) |
| 0121-97-0056 | 21-05053 | 20.50–21.50 | Qbt 3 | — | — | — | — | — | — | 0.68 (U) |
| 0121-97-0057 | 21-05053 | 28.00–29.00 | Qbt 3 | — | — | 0.18 (J-) | — | — | — | 0.75 (U) |
| 0121-97-0058 | 21-05053 | 39.50–40.00 | Qbt 3 | — | — | — | — | — | — | 0.32 (U) |
| 0121-97-0059 | 21-05053 | 48.00–48.50 | Qbt 3 | 5750 | 547 (J) | 0.31 | — | 31.2 | 5050 | — |
| 0121-97-0060 | 21-05053 | 59.50–60.00 | Qbt 3 | — | — | — | — | — | — | 0.35 (U) |
| 0121-97-0061 | 21-05053 | 60.00–60.70 | Qbt 3 | — | — | — | — | — | — | 0.35 (U) |
| 0121-97-0062 | 21-05053 | 74.50–75.00 | Qbt 3 | 2430 | — | — | — | — | — | 3.6 (U) |
| 0121-97-0063 | 21-05053 | 80.00–80.50 | Qbt 3 | — | — | — | — | — | — | 3.5 (U) |
| 0121-97-0445 | 21-05053 | 89.50–90.00 | Qbt 3 | — | — | — | — | — | — | 0.34 (U) |
| 0121-97-0066 | 21-05054 | 3.00–3.50 | Fill | — | — | — | — | — | — | — |
| 0121-97-0067 | 21-05054 | 6.00–6.50 | Fill | — | — | 2.5 | — | 15.8 | — | — |
| 0121-97-0068 | 21-05054 | 7.50–8.20 | Fill | — | — | 5.7 | — | — | — | — |
| 0121-97-0069 | 21-05054 | 10.50–11.00 | Fill | — | — | 18.6 | — | — | — | — |
| 0121-97-0070 | 21-05054 | 14.20–15.00 | Qbt 3 | 4000 (J) | — | 1.1 (J-) | — | 24.2 | 5740 (J) | 0.86 (U) |
| 0121-97-0071 | 21-05054 | 21.80–22.10 | Qbt 3 | — | — | 1.4 | — | — | — | 0.69 (U) |
| 0121-97-0072 | 21-05054 | 32.00–32.50 | Qbt 3 | — | — | — | — | — | — | 0.69 (U) |
| 0121-97-0073 | 21-05054 | 35.50–36.00 | Qbt 3 | — | — | — | — | 7 (J) | — | 0.63 (U) |
| 0121-97-0074 | 21-05054 | 50.00–50.50 | Qbt 3 | — | — | — | — | — | — | 0.57 (U) |

## Table B-25 (continued)

Part 3 (continued)

| Sample ID | Location ID | Depth (ft) | Media | Magnesium | Manganese | Mercury | Molybdenum | Nickel | Potassium | Selenium |
|---|---|---|---|---|---|---|---|---|---|---|
| **Soil Background Value** | | | | — | — | — | — | 15.4 | — | 1.52 |
| **Qbt 2,3,4 Background Value** | | | | 1690 | 482 | 0.1 | — | 6.58 | 3500 | 0.3 |
| **Qbt 1v Background Value** | | | | — | — | — | — | 2 | — | 0.3 |
| **Fill Background Value** | | | | — | — | 0.1 | — | 15.4 | — | 1.52 |
| **Residential SAL (mg/kg)** | | | | **EN** | **7800** | **23** | **380** | **1500** | **EN** | **380** |
| **Industrial SAL (mg/kg)** | | | | **EN** | **1.4E$^{+4}$** | **69** | **1200** | **4400** | **EN** | **1200** |
| 0121-97-0075 | 21-05054 | 59.50–60.00 | Qbt 3 | — | — | — | — | — | — | 0.64 (U) |
| 0121-97-0081 | 21-05055 | 3.50–4.00 | Fill | — | — | — | — | — | — | 3.5 (UJ) |
| 0121-97-0082 | 21-05055 | 8.50–9.00 | Fill | — | — | 0.11 | — | 16.6 | — | 3.4 (UJ) |
| 0121-97-0083 | 21-05055 | 14.50–15.00 | Fill | — | — | 1.6 | — | 17.8 | — | — |
| 0121-97-0096 | 21-05056 | 4.50–5.00 | Fill | — | — | — | — | — | — | — |
| 0121-97-0097 | 21-05056 | 11.80–12.20 | Qbt 3 | 2230 | — | — | — | 8.5 (J) | 6260 | 0.8 (J-) |
| 0121-97-0098 | 21-05056 | 20.00–20.50 | Qbt 3 | — | — | — | — | — | — | 0.36 (UJ) |
| 0121-97-0099 | 21-05056 | 29.00–29.50 | Qbt 3 | — | — | — | — | — | — | 0.38 (UJ) |
| 0121-97-0100 | 21-05056 | 39.00–39.50 | Qbt 3 | — | — | — | — | 9.9 | 3640 | 4.2 (UJ) |
| 0121-97-0101 | 21-05056 | 49.50–50.00 | Qbt 3 | — | — | — | — | — | — | 0.39 (UJ) |
| 0121-96-0481 | 21-05057 | 4.30–5.00 | Fill | — | — | 0.11 (U) | — | — | — | — |
| 0121-96-0482 | 21-05057 | 9.50–10.00 | Fill | — | — | 0.11 (U) | — | — | — | — |
| 0121-96-0483 | 21-05057 | 19.50–20.00 | Fill | — | — | 0.11 (UJ) | — | — | — | — |
| 0121-96-0484 | 21-05057 | 22.50–23.90 | Qal | 1620 | 204 | 1.1 | — | 11.4 | 734 (J) | 0.79 (U) |
| 0121-96-0485 | 21-05057 | 29.50–30.00 | Qbt 3 | — | — | 0.11 (U) | — | — | — | — |
| 0121-96-0486 | 21-05057 | 39.50–40.00 | Qbt 3 | — | — | 0.11 (UJ) | — | — | — | — |
| 0121-96-0487 | 21-05057 | 49.50–50.00 | Qbt 3 | — | — | 0.11 (UJ) | — | — | — | — |
| 0121-96-0492 | 21-05058 | 7.70–8.20 | Fill | — | — | — | — | — | — | — |
| 0121-96-0495 | 21-05058 | 29.50–30.00 | Qbt 3 | — | — | — | — | — | — | 0.66 (U) |
| 0121-96-0496 | 21-05058 | 39.50–40.00 | Qbt 3 | — | — | — | — | — | — | 0.64 (U) |
| 0121-96-0497 | 21-05058 | 49.50–50.00 | Qbt 3 | — | — | — | — | — | — | 0.65 (U) |
| 0121-97-0111 | 21-05059 | 4.00–4.50 | Soil | — | — | — | — | — | — | 1.7 (J) |
| 0121-97-0112 | 21-05059 | 10.20–10.70 | Qal | 1780 | 58.7 (J+) | 0.06 (U) | — | 3.3 (J) | 1140 (J) | 0.37 (U) |
| 0121-97-0113 | 21-05059 | 20.00–20.50 | Qal | 861 (J) | 73.3 (J+) | 0.06 (U) | — | 2.7 (J) | 735 (J) | 0.38 (U) |
| 0121-97-0114 | 21-05059 | 31.50–32.00 | Qal | 1360 | 281 (J+) | 0.06 (U) | — | 4.4 (J) | 1060 (J) | 0.38 (U) |
| 0121-97-0115 | 21-05059 | 36.40–36.80 | Qbt 3 | — | — | — | — | — | — | 0.35 (U) |
| 0121-97-0116 | 21-05059 | 40.00–40.50 | Qbt 3 | — | — | — | — | — | — | 0.34 (U) |
| 0121-97-0117 | 21-05059 | 49.50–50.00 | Qbt 3 | — | — | — | — | — | — | 0.35 (U) |
| 0121-97-0136 | 21-05060 | 4.50–5.00 | Soil | — | — | — | — | — | — | — |
| 0121-97-0137 | 21-05060 | 10.00–10.50 | Qbt 3 | — | — | — | — | — | — | 0.45 (J-) |
| 0121-97-0138 | 21-05060 | 20.00–20.50 | Qbt 3 | — | — | — | — | — | — | 0.34 (UJ) |
| 0121-97-0139 | 21-05060 | 30.00–30.50 | Qbt 3 | — | — | — | — | — | — | 0.43 (J-) |
| 0121-97-0140 | 21-05060 | 42.00–42.50 | Qbt 3 | — | — | — | — | — | — | 0.35 (UJ) |
| 0121-97-0141 | 21-05060 | 50.00–50.50 | Qbt 3 | — | — | — | — | 10.8 | — | 0.33 (UJ) |
| 0121-97-0142 | 21-05060 | 60.00–60.50 | Qbt 3 | — | — | — | — | — | — | 0.34 (UJ) |
| 0121-97-0143 | 21-05060 | 69.50–70.00 | Qbt 3 | — | — | — | — | — | — | 0.34 (UJ) |

## Table B-25 (continued)

| Part 3 (continued) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | **Location ID** | **Depth (ft)** | **Media** | **Magnesium** | **Manganese** | **Mercury** | **Molybdenum** | **Nickel** | **Potassium** | **Selenium** |
| **Soil Background Value** | | | | — | — | — | — | 15.4 | — | 1.52 |
| **Qbt 2,3,4 Background Value** | | | | 1690 | 482 | 0.1 | — | 6.58 | 3500 | 0.3 |
| **Qbt 1v Background Value** | | | | — | — | — | — | 2 | — | 0.3 |
| **Fill Background Value** | | | | — | — | 0.1 | — | 15.4 | — | 1.52 |
| **Residential SAL (mg/kg)** | | | | **EN** | **7800** | **23** | **380** | **1500** | **EN** | **380** |
| **Industrial SAL (mg/kg)** | | | | **EN** | **1.4E$^{+4}$** | **69** | **1200** | **4400** | **EN** | **1200** |
| 0121-97-0163 | 21-05060 | 69.50–70.00 | Qbt 3 | — | — | — | — | — | — | 0.73 (J-) |
| 0121-97-0144 | 21-05060 | 79.50–80.00 | Qbt 3 | — | — | — | — | — | — | 0.33 (UJ) |
| 0121-97-0145 | 21-05060 | 89.00–89.50 | Qbt 3 | — | — | — | — | — | — | 0.54 (J-) |
| 0121-97-0146 | 21-05060 | 99.50–100.00 | Qbt 3 | — | — | — | — | — | — | 0.6 (J-) |
| 0121-97-0147 | 21-05060 | 109.00–109.20 | Qbt 2 | — | — | — | — | — | — | 0.34 (U) |
| 0121-97-0148 | 21-05060 | 118.50–119.00 | Qbt 2 | — | — | — | — | — | — | 0.34 (U) |
| 0121-97-0149 | 21-05060 | 129.00–129.50 | Qbt 2 | — | — | — | — | — | — | 0.34 (U) |
| 0121-97-0164 | 21-05060 | 129.00–129.50 | Qbt 2 | — | — | — | — | 27.9 | — | 0.33 (U) |
| 0121-97-0150 | 21-05060 | 139.00–139.50 | Qbt 2 | — | — | — | — | — | — | 0.34 (U) |
| 0121-97-0151 | 21-05060 | 150.00–150.50 | Qbt 2 | — | — | — | — | — | — | 0.34 (U) |
| 0121-97-0152 | 21-05060 | 160.00–160.50 | Qbt 2 | — | — | — | — | — | — | 0.34 (U) |
| 0121-97-0153 | 21-05060 | 169.50–170.00 | Qbt 2 | — | — | — | — | — | — | 0.34 (U) |
| 0121-97-0154 | 21-05060 | 174.50–175.00 | Qbt 2 | — | — | — | — | — | — | 0.34 (U) |
| 0121-97-0166 | 21-05061 | 5.50–6.00 | Soil | — | — | — | — | — | — | — |
| 0121-97-0167 | 21-05061 | 10.00–10.50 | Qbt 3 | 4190 | — | 0.26 | — | 15.2 | 3850 | 3.6 (UJ) |
| 0121-97-0168 | 21-05061 | 22.00–22.50 | Qbt 3 | 3180 | — | — | — | 8.7 (J) | — | 0.37 (UJ) |
| 0121-97-1126 | 21-05061 | 22.00–22.50 | Qbt 3 | 3800 | — | — | — | 10.4 | — | 0.38 (UJ) |
| 0121-97-0169 | 21-05061 | 30.00–30.50 | Qbt 3 | — | — | — | — | — | — | 0.91 |
| 0121-97-0170 | 21-05061 | 40.00–40.50 | Qbt 3 | — | — | — | — | — | — | 0.34 (U) |
| 0121-97-0171 | 21-05061 | 49.00–49.50 | Qbt 3 | — | — | — | — | — | — | 0.89 (U) |
| 0121-97-0172 | 21-05061 | 59.50–60.00 | Qbt 3 | — | — | — | — | — | — | 0.39 (U) |
| 0121-97-0173 | 21-05061 | 69.50–70.00 | Qbt 3 | — | — | — | — | — | — | 0.37 (U) |
| 0121-97-0174 | 21-05061 | 78.50–78.80 | Qbt 3 | — | — | — | — | — | — | 0.38 (U) |
| 0121-97-0175 | 21-05061 | 89.50–90.00 | Qbt 3 | — | — | — | — | — | — | 0.38 (U) |
| 0121-97-0176 | 21-05061 | 98.70–99.20 | Qbt 2 | — | — | — | — | — | — | 0.38 (U) |
| 0121-97-0177 | 21-05061 | 108.50–109.00 | Qbt 2 | — | — | — | — | — | — | 0.38 (U) |
| 0121-97-0178 | 21-05061 | 118.00–118.50 | Qbt 2 | — | — | — | — | — | — | 0.38 (U) |
| 0121-97-0179 | 21-05061 | 128.50–129.00 | Qbt 2 | — | — | — | — | — | — | 0.37 (U) |
| 0121-97-0180 | 21-05061 | 140.00–140.50 | Qbt 2 | — | — | — | — | 32.7 | — | 0.38 (U) |
| 0121-97-0181 | 21-05061 | 152.50–153.00 | Qbt 2 | — | — | — | — | — | — | 0.37 (U) |
| 0121-97-0182 | 21-05061 | 160.00–160.50 | Qbt 2 | — | — | — | — | — | — | 0.38 (U) |
| 0121-97-0183 | 21-05061 | 170.00–170.50 | Qbt 1v | — | — | — | — | — | — | 0.38 (U) |
| 0121-97-1128 | 21-05061 | 170.00–170.50 | Qbt 1v | — | — | — | — | 6.5 (J) | — | 0.37 (U) |
| 0121-97-0184 | 21-05061 | 180.00–180.50 | Qbt 1v | — | — | — | — | 2.1 (U) | — | 0.38 (U) |
| 0121-97-0185 | 21-05061 | 189.50–190.00 | Qbt 1v | — | — | — | — | 2.1 (U) | — | 0.38 (U) |
| 0121-97-0191 | 21-05062 | 5.00–5.50 | Qbt 3 | — | — | — | — | 8.5 (J) | — | 0.8 (J) |

## Table B-25 (continued)

**Part 3 (continued)**

| Sample ID | Location ID | Depth (ft) | Media | Magnesium | Manganese | Mercury | Molybdenum | Nickel | Potassium | Selenium |
|---|---|---|---|---|---|---|---|---|---|---|
| **Soil Background Value** | | | | — | — | — | — | 15.4 | — | 1.52 |
| **Qbt 2,3,4 Background Value** | | | | 1690 | 482 | 0.1 | — | 6.58 | 3500 | 0.3 |
| **Qbt 1v Background Value** | | | | — | — | — | — | 2 | — | 0.3 |
| **Fill Background Value** | | | | — | — | 0.1 | — | 15.4 | — | 1.52 |
| **Residential SAL (mg/kg)** | | | | **EN** | **7800** | **23** | **380** | **1500** | **EN** | **380** |
| **Industrial SAL (mg/kg)** | | | | **EN** | **1.4E$^{+4}$** | **69** | **1200** | **4400** | **EN** | **1200** |
| 0121-97-0192 | 21-05062 | 6.00–6.50 | Qbt 3 | — | — | — | — | — | — | 0.84 (J) |
| 0121-97-0193 | 21-05062 | 10.00–10.50 | Qbt 3 | — | — | — | — | — | — | 0.75 (J) |
| 0121-97-0194 | 21-05062 | 20.00–20.50 | Qbt 3 | — | — | — | — | — | — | 0.71 (U) |
| 0121-97-0195 | 21-05062 | 30.00–30.50 | Qbt 3 | — | — | — | — | — | — | 0.68 (U) |
| 0121-97-0196 | 21-05062 | 40.00–40.50 | Qbt 3 | — | — | — | — | — | — | 0.75 (U) |
| 0121-97-0197 | 21-05062 | 49.50–50.00 | Qbt 3 | — | — | — | — | — | — | 1.5 (U) |
| 0121-97-0198 | 21-05062 | 58.80–59.50 | Qbt 3 | — | — | — | — | — | — | 4.5 (U) |
| 0121-97-0218 | 21-05062 | 58.80–59.50 | Qbt 3 | — | — | — | — | — | — | 0.34 (U) |
| 0121-97-0199 | 21-05062 | 70.00–70.50 | Qbt 3 | — | — | — | — | — | — | 0.34 (U) |
| 0121-97-0200 | 21-05062 | 78.40–79.50 | Qbt 3 | 3640 | — | 0.28 | — | 75.8 (J+) | — | 14.2 (U) |
| 0121-97-0221 | 21-05063 | 4.50–5.00 | Qbt 3 | 1890 | 488 | — | — | 7.1 (J) | — | 0.33 (UJ) |
| 0121-97-0222 | 21-05063 | 7.50–8.30 | Qbt 3 | — | — | — | — | — | — | 0.31 (UJ) |
| 0121-97-0234 | 21-05063 | 7.50–8.30 | Qbt 3 | — | — | — | — | — | — | 0.31 (UJ) |
| 0121-97-0223 | 21-05063 | 10.00–11.60 | Qbt 3 | 4200 | — | — | — | 16.1 | — | 0.37 (UJ) |
| 0121-97-0224 | 21-05063 | 20.00–20.50 | Qbt 3 | — | — | — | — | 6.7 (J) | — | 0.31 (UJ) |
| 0121-97-0225 | 21-05063 | 30.50–31.30 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0226 | 21-05063 | 41.00–42.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0227 | 21-05063 | 49.00–50.00 | Qbt 3 | — | — | — | — | — | — | 0.31 (UJ) |
| 0121-96-0621 | 21-05065 | 4.50–5.00 | Qbt 3 | — | — | — | — | — | — | 0.61 (U) |
| 0121-96-0622 | 21-05065 | 10.00–10.50 | Qbt 3 | — | — | — | — | — | — | 0.62 (U) |
| 0121-96-0623 | 21-05065 | 19.50–20.00 | Qbt 3 | — | — | — | — | — | — | 0.64 (U) |
| 0121-96-0624 | 21-05065 | 29.50–30.00 | Qbt 3 | — | — | — | — | — | — | 0.65 (U) |
| 0121-96-0625 | 21-05065 | 39.50–40.00 | Qbt 3 | — | — | — | — | — | — | 0.65 (U) |
| 0121-96-0626 | 21-05065 | 48.20–48.70 | Qbt 3 | — | — | — | — | — | — | 0.56 (U) |
| 0121-97-0326 | 21-05073 | 2.50–3.00 | Soil | — | — | — | — | — | — | 3.6 (UJ) |
| 0121-97-0327 | 21-05073 | 8.50–9.00 | Qbt 3 | 1730 | — | 0.23 | — | 26.4 | — | 0.36 (U) |
| 0121-97-0328 | 21-05073 | 11.70–12.20 | Qbt 3 | — | — | — | — | — | — | 0.33 (UJ) |
| 0121-97-0329 | 21-05073 | 22.00–23.00 | Qbt 3 | — | — | — | — | — | — | 3.4 (UJ) |
| 0121-97-0330 | 21-05073 | 32.00–32.50 | Qbt 3 | — | — | — | — | — | — | 3.4 (UJ) |
| 0121-97-0331 | 21-05073 | 42.00–42.50 | Qbt 3 | — | — | — | — | — | — | 3.4 (UJ) |
| 0121-97-0332 | 21-05073 | 46.50–47.00 | Qbt 3 | — | — | — | — | — | — | 0.33 (UJ) |
| 0121-97-0333 | 21-05073 | 62.00–62.50 | Qbt 3 | — | — | — | — | — | — | 3.4 (UJ) |
| 0121-97-0401 | 21-05073 | 62.00–62.50 | Qbt 3 | — | — | — | — | — | — | 3.4 (UJ) |
| 0121-97-0334 | 21-05073 | 69.50–70.00 | Qbt 3 | — | — | — | — | — | — | 0.34 (UJ) |
| 0121-97-1131 | 21-05075 | 6.70–7.20 | Qbt 3 | 1700 | — | — | — | — | — | 0.42 (UJ) |
| 0121-97-1132 | 21-05075 | 8.80–9.30 | Qbt 3 | — | — | 0.45 | — | — | — | 0.39 (UJ) |

## Table B-25 (continued)

**Part 3 (continued)**

| **Sample ID** | **Location ID** | **Depth (ft)** | **Media** | **Magnesium** | **Manganese** | **Mercury** | **Molybdenum** | **Nickel** | **Potassium** | **Selenium** |
|---|---|---|---|---|---|---|---|---|---|---|
| **Soil Background Value** | | | | — | — | — | — | 15.4 | — | 1.52 |
| **Qbt 2,3,4 Background Value** | | | | 1690 | 482 | 0.1 | — | 6.58 | 3500 | 0.3 |
| **Qbt 1v Background Value** | | | | — | — | — | — | 2 | — | 0.3 |
| **Fill Background Value** | | | | — | — | 0.1 | — | 15.4 | — | 1.52 |
| **Residential SAL (mg/kg)** | | | | **EN** | **7800** | **23** | **380** | **1500** | **EN** | **380** |
| **Industrial SAL (mg/kg)** | | | | **EN** | **1.4E$^{+4}$** | **69** | **1200** | **4400** | **EN** | **1200** |
| 0121-97-1133 | 21-05075 | 15.50–16.00 | Qbt 3 | — | — | 0.12 | — | — | — | 0.38 (UJ) |
| 0121-97-1141 | 21-05075 | 15.50–16.00 | Qbt 3 | — | — | 0.16 | — | — | — | 0.38 (UJ) |
| 0121-97-1134 | 21-05075 | 20.00–21.00 | Qbt 3 | — | — | 0.5 | — | — | — | 0.38 (UJ) |
| 0121-97-1135 | 21-05075 | 29.50–30.00 | Qbt 3 | — | — | — | — | — | — | 0.38 (UJ) |
| 0121-97-1136 | 21-05075 | 38.80–39.30 | Qbt 3 | — | — | — | — | — | — | 0.39 (U) |
| 0121-97-1137 | 21-05075 | 45.00–46.00 | Qbt 3 | — | — | 0.11 (J) | — | — | — | 0.4 (U) |
| 0121-97-1138 | 21-05075 | 58.00–58.50 | Qbt 3 | — | — | — | — | — | — | 0.39 (U) |
| 0121-97-1139 | 21-05075 | 69.50–70.00 | Qbt 3 | — | — | — | — | — | — | 0.39 (U) |

## Table B-25 (continued)

**Part 4**

| Sample ID | Location ID | Depth (ft) | Media | Silver | Sodium | Strontium | Thallium | Uranium | Vanadium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|
| **Soil Background Value** | | | | 1 | — | — | — | 1.82 | — | 48.8 |
| **Qbt 2,3,4 Background Value** | | | | 1 | — | — | 1.1 | — | 17 | 63.5 |
| **Qbt 1v Background Value** | | | | 1 | — | — | — | — | — | — |
| **Fill Background Value** | | | | 1 | — | — | 0.73 | 1.82 | — | 48.8 |
| **Residential SAL (mg/kg)** | | | | **380** | **EN** | **$3.7E^{+4}$** | **6.1** | **230** | **530** | **$2.3E^{+4}$** |
| **Industrial SAL (mg/kg)** | | | | **1200** | **EN** | **$8.9E^{+4}$** | **18** | **3100** | **1600** | **$6.9E^{+4}$** |
| **1992** | | | | | | | | | | |
| AAA0564 | 21-01085 | 0.00–0.08 | Soil | — | — | 2.5 | — | — | — | 63.8 |
| AAA3950 | 21-01615 | 0.00–0.50 | Soil | 1.1 (U) | — | 23.7 | — | — | — | — |
| AAA3951 | 21-01616 | 0.00–0.50 | Soil | 1.1 (U) | — | 19.4 | — | — | — | — |
| AAA3952 | 21-01617 | 0.00–0.50 | Soil | 1.1 (U) | — | 30.8 | — | — | — | — |
| AAA3953 | 21-01618 | 0.00–0.50 | Soil | 1.1 (U) | — | 30.7 | — | — | — | — |
| AAA3954 | 21-01619 | 0.00–0.50 | Soil | 1.2 (U) | — | 10.7 | — | — | — | — |
| AAA3957 | 21-01620 | 0.00–0.50 | Soil | 1.1 (U) | — | 23.6 | — | — | — | — |
| AAA3958 | 21-01621 | 0.00–0.50 | Soil | 1.1 (U) | — | 19.1 | — | — | — | — |
| AAA3959 | 21-01622 | 0.00–0.50 | Soil | 1.1 (U) | — | 32.6 | — | — | — | — |
| AAA3960 | 21-01622 | 0.00–0.50 | Soil | 1.1 (U) | — | 30 | — | — | — | — |
| AAA3961 | 21-01623 | 0.00–0.50 | Soil | 1.2 (U) | — | 13.2 | — | — | — | — |
| AAA3962 | 21-01624 | 0.00–0.50 | Soil | 1.1 (U) | — | 22.8 | — | — | — | — |
| AAA3963 | 21-01625 | 0.00–0.50 | Soil | 1.1 (U) | — | 23.4 | — | — | — | — |
| AAA3964 | 21-01626 | 0.00–0.50 | Soil | 1.1 (U) | — | 26.5 | — | — | — | — |
| AAA3965 | 21-01627 | 0.00–0.50 | Soil | 1.1 (U) | — | 12.9 | — | — | — | — |
| AAA3966 | 21-01628 | 0.00–0.50 | Soil | 1.1 (U) | — | 32 | — | — | — | — |
| AAA3985 | 21-01644 | 0.00–0.50 | Soil | 1.1 (U) | — | 12.2 | — | — | — | 65.2 |
| AAA3987 | 21-01646 | 0.00–0.50 | Soil | 1.1 (U) | — | 14.4 | — | — | — | — |
| AAA3988 | 21-01647 | 0.00–0.50 | Soil | 1.1 (U) | — | 22.3 | — | — | — | — |
| AAA3989 | 21-01648 | 0.00–0.50 | Soil | 1.3 | — | 24.6 | — | — | — | — |
| AAA3990 | 21-01649 | 0.00–0.50 | Soil | 1.1 (U) | — | 23.7 | — | — | — | — |
| AAA3996 | 21-01655 | 0.00–0.50 | Soil | 1.1 (U) | — | 21.6 | — | — | — | — |
| AAA3997 | 21-01656 | 0.00–0.50 | Soil | 1.1 (U) | — | 21.6 | — | — | — | — |
| AAA3998 | 21-01657 | 0.00–0.50 | Soil | 1.2 (U) | — | 22.1 | — | — | — | — |
| AAA4001 | 21-01658 | 0.00–0.50 | Soil | 1.1 (U) | — | 14.3 | — | — | — | 75.8 |
| AAA4002 | 21-01658 | 0.00–0.50 | Soil | 1.1 (U) | — | 12.7 | — | — | — | 111 |
| AAA4006 | 21-01662 | 0.00–0.50 | Soil | 1.2 (U) | — | 15.9 | — | — | — | — |
| **1993–1994** | | | | | | | | | | |
| AAB7314 | 21-02535 | 2.50–5.00 | Fill | 2.7 (U) | — | — | — | 2.2 (J) | — | — |
| AAB7316 | 21-02536 | 5.00–7.50 | Soil | 2.5 (U) | — | — | — | 1.87 (J) | — | — |
| AAB7320 | 21-02537 | 7.50–10.00 | Qbt 3 | 3.8 (U) | — | — | — | — | — | — |
| AAB7323 | 21-02538 | 5.00–7.50 | Fill | 2.6 (U) | — | — | — | 2.27 (J) | — | — |
| AAB7328 | 21-02539 | 7.50–10.00 | Soil | 2.5 (U) | — | — | — | — | — | — |
| AAB7332 | 21-02540 | 7.50–10.00 | Qbt 3 | 2.4 (U) | — | — | — | — | — | — |
| AAB7334 | 21-02541 | 2.50–5.00 | Soil | 2.2 (U) | — | — | — | — | — | — |

## Table B-25 (continued)

**Part 4 (continued)**

| Sample ID | Location ID | Depth (ft) | Media | Silver | Sodium | Strontium | Thallium | Uranium | Vanadium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|
| **Soil Background Value** | | | | 1 | — | — | — | 1.82 | — | 48.8 |
| **Qbt 2,3,4 Background Value** | | | | 1 | — | — | 1.1 | — | 17 | 63.5 |
| **Qbt 1v Background Value** | | | | 1 | — | — | — | — | — | — |
| **Fill Background Value** | | | | 1 | — | — | 0.73 | 1.82 | — | 48.8 |
| **Residential SAL (mg/kg)** | | | | **380** | **EN** | **3.7E$^{+4}$** | **6.1** | **230** | **530** | **2.3E$^{+4}$** |
| **Industrial SAL (mg/kg)** | | | | **1200** | **EN** | **8.9E$^{+4}$** | **18** | **3100** | **1600** | **6.9E$^{+4}$** |
| AAB9109 | 21-02541 | 10.00–12.50 | Qbt 3 | 2.4 (U) | — | — | — | — | — | — |
| AAB7340 | 21-02543 | 2.50–5.00 | Soil | 2.3 (U) | — | — | — | 2.03 (J) | — | — |
| AAB7342 | 21-02544 | 5.00–7.50 | Soil | 2.4 (U) | — | — | — | — | — | — |
| AAB7343 | 21-02545 | 0.00–5.00 | Soil | 2.1 (U) | — | — | — | — | — | — |
| AAB7347 | 21-02546 | 0.00–5.00 | Soil | 2.4 (U) | — | — | — | 2.3 (J) | — | — |
| AAB7352 | 21-02547 | 5.00–10.00 | Soil | 2.3 (U) | — | 24.5 (U) | — | — | — | 71.4 |
| AAB7355 | 21-02548 | 2.50–5.00 | Soil | 2.3 (U) | — | — | — | — | — | — |
| AAB7368 | 21-02609 | 5.00–7.50 | Soil | 2.3 (U) | — | — | — | — | — | 57 |
| AAB9110 | 21-02609 | 5.00–7.50 | Soil | 2.4 (U) | — | — | — | — | — | — |
| AAB9111 | 21-02610 | 5.00–7.50 | Soil | 2.3 (U) | — | — | — | — | — | — |
| **1996–1997** | | | | | | | | | | |
| 0121-97-0001 | 21-05051 | 3.50–4.00 | Fill | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-0002 | 21-05051 | 6.00–6.50 | Fill | 2 (U) | — | — | — | — | — | — |
| 0121-97-0003 | 21-05051 | 8.50–9.00 | Fill | 3.1 | — | — | — | — | — | — |
| 0121-97-0004 | 21-05051 | 11.50–12.00 | Fill | 3.6 | — | — | — | — | — | — |
| 0121-97-0005 | 21-05051 | 13.80–14.50 | Qbt 3 | 11 (U) | — | — | — | — | 26.7 (J) | — |
| 0121-97-0006 | 21-05051 | 20.00–21.00 | Qbt 3 | 4.1 | — | — | — | — | 34.3 | 75.5 |
| 0121-97-0007 | 21-05051 | 27.50–28.00 | Qbt 3 | 2 (U) | — | — | — | — | — | — |
| 0121-97-0008 | 21-05051 | 40.00–40.50 | Qbt 3 | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-0009 | 21-05051 | 50.00–50.50 | Qbt 3 | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-0010 | 21-05051 | 61.00–61.50 | Qbt 3 | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-0011 | 21-05051 | 71.00–71.50 | Qbt 3 | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-0012 | 21-05051 | 80.00–80.50 | Qbt 3 | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-0013 | 21-05051 | 89.50–90.00 | Qbt 3 | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-0014 | 21-05051 | 99.50–100.00 | Qbt 3 | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-0015 | 21-05051 | 109.00–109.50 | Qbt 2 | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-0016 | 21-05051 | 119.50–120.00 | Qbt 2 | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-0017 | 21-05051 | 129.50–130.00 | Qbt 2 | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-0018 | 21-05051 | 137.50–138.00 | Qbt 2 | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-0019 | 21-05051 | 149.50–150.00 | Qbt 2 | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-0026 | 21-05052 | 2.50–3.00 | Fill | — | — | — | — | — | — | — |
| 0121-97-0027 | 21-05052 | 9.00–9.50 | Qal | 0.82 (U) | 108 (J) | — | 0.24 (U) | — | 18.8 | 24 |
| 0121-97-0028 | 21-05052 | 20.00–20.50 | Qal | 0.9 (U) | 110 (J) | — | 0.28 (U) | — | 4.6 (J) | 12.7 |
| 0121-97-0029 | 21-05052 | 26.00–27.00 | Qal | 0.87 (U) | 65.3 (J) | — | 0.25 (U) | — | 5.1 (J) | 25.2 |
| 0121-97-0030 | 21-05052 | 39.50–40.00 | Qbt 3 | — | — | — | — | — | — | — |

## Table B-25 (continued)

**Part 4 (continued)**

| Sample ID | Location ID | Depth (ft) | Media | Silver | Sodium | Strontium | Thallium | Uranium | Vanadium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|
| **Soil Background Value** | | | | 1 | — | — | — | 1.82 | — | 48.8 |
| **Qbt 2,3,4 Background Value** | | | | 1 | — | — | 1.1 | — | 17 | 63.5 |
| **Qbt 1v Background Value** | | | | 1 | — | — | — | — | — | — |
| **Fill Background Value** | | | | 1 | — | — | 0.73 | 1.82 | — | 48.8 |
| **Residential SAL (mg/kg)** | | | | **380** | **EN** | **$3.7E^{+4}$** | **6.1** | **230** | **530** | **$2.3E^{+4}$** |
| 0121-97-0031 | 21-05052 | 49.50–50.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0032 | 21-05052 | 59.50–60.00 | Qbt 3 | 1.5 (U) | — | — | — | — | — | — |
| 0121-97-0033 | 21-05052 | 70.00–71.00 | Qbt 3 | 1.5 (U) | — | — | — | — | — | — |
| 0121-97-1271 | 21-05052 | 70.00–71.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0034 | 21-05052 | 79.50–80.00 | Qbt 3 | 1.5 (U) | — | — | — | — | — | — |
| 0121-97-0035 | 21-05052 | 87.00–88.00 | Qbt 3 | 1.6 (U) | — | — | — | — | — | — |
| 0121-97-0036 | 21-05052 | 96.00–96.50 | Qbt 3 | 1.5 (U) | — | — | — | — | — | — |
| 0121-97-0037 | 21-05052 | 109.00–110.00 | Qbt 2 | 1.4 (U) | — | — | — | — | — | — |
| 0121-97-0038 | 21-05052 | 119.00–120.00 | Qbt 2 | 1.5 (U) | — | — | — | — | — | — |
| 0121-97-0039 | 21-05052 | 130.00–131.00 | Qbt 2 | 1.5 (U) | — | — | — | — | — | — |
| 0121-97-0040 | 21-05052 | 139.00–140.00 | Qbt 2 | 1.5 (U) | — | — | — | — | — | — |
| 0121-97-0041 | 21-05052 | 149.00–150.00 | Qbt 2 | 1.4 (U) | — | — | — | — | — | — |
| 0121-97-1272 | 21-05052 | 149.00–150.00 | Qbt 2 | 1.3 (U) | — | — | — | — | — | — |
| 0121-97-0051 | 21-05053 | 4.20–4.60 | Fill | — | — | — | — | — | — | — |
| 0121-97-0052 | 21-05053 | 6.50–7.00 | Fill | — | — | — | — | — | — | 53.5 |
| 0121-97-0064 | 21-05053 | 6.50–7.00 | Fill | 1.8 (J) | — | — | — | — | — | 88.9 |
| 0121-97-0053 | 21-05053 | 9.50–10.00 | Fill | 1.3 (J) | — | — | — | — | — | — |
| 0121-97-0054 | 21-05053 | 12.50–13.00 | Qbt 3 | — | — | — | 1.2 (J) | — | — | — |
| 0121-97-0055 | 21-05053 | 17.00–17.30 | Qbt 3 | — | — | — | 1.3 (J) | — | 25.8 (J) | 173 (J-) |
| 0121-97-0056 | 21-05053 | 20.50–21.50 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0057 | 21-05053 | 28.00–29.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0058 | 21-05053 | 39.50–40.00 | Qbt 3 | 1.8 (U) | — | — | — | — | — | — |
| 0121-97-0059 | 21-05053 | 48.00–48.50 | Qbt 3 | 19.8 (J-) | — | — | — | — | 27.2 | 226 |
| 0121-97-0060 | 21-05053 | 59.50–60.00 | Qbt 3 | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-0061 | 21-05053 | 60.00–60.70 | Qbt 3 | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-0062 | 21-05053 | 74.50–75.00 | Qbt 3 | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-0063 | 21-05053 | 80.00–80.50 | Qbt 3 | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-0445 | 21-05053 | 89.50–90.00 | Qbt 3 | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-0066 | 21-05054 | 3.00–3.50 | Fill | — | — | — | 1 (J) | — | — | 52.2 (J-) |
| 0121-97-0067 | 21-05054 | 6.00–6.50 | Fill | — | — | — | — | — | — | 81 |
| 0121-97-0068 | 21-05054 | 7.50–8.20 | Fill | 1.4 (J) | — | — | — | — | — | 51.7 |
| 0121-97-0069 | 21-05054 | 10.50–11.00 | Fill | 8.3 | — | — | 0.76 (U) | — | — | — |
| 0121-97-0070 | 21-05054 | 14.20–15.00 | Qbt 3 | — | — | — | 1.3 (J) | — | 23.9 (J) | 133 (J-) |
| 0121-97-0071 | 21-05054 | 21.80–22.10 | Qbt 3 | 5 (U) | — | — | — | — | — | 73.1 |
| 0121-97-0072 | 21-05054 | 32.00–32.50 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0073 | 21-05054 | 35.50–36.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0074 | 21-05054 | 50.00–50.50 | Qbt 3 | — | — | — | — | — | — | — |

## Table B-25 (continued)

| Part 4 (continued) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sample ID | Location ID | Depth (ft) | Media | Silver | Sodium | Strontium | Thallium | Uranium | Vanadium | Zinc |
| **Soil Background Value** | | | | 1 | — | — | — | 1.82 | — | 48.8 |
| **Qbt 2,3,4 Background Value** | | | | 1 | — | — | 1.1 | — | 17 | 63.5 |
| **Qbt 1v Background Value** | | | | 1 | — | — | — | — | — | — |
| **Fill Background Value** | | | | 1 | — | — | 0.73 | 1.82 | — | 48.8 |
| **Residential SAL (mg/kg)** | | | | **380** | **EN** | **3.7E$^{+4}$** | **6.1** | **230** | **530** | **2.3E$^{+4}$** |
| 0121-97-0075 | 21-05054 | 59.50–60.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0081 | 21-05055 | 3.50–4.00 | Fill | 2 (U) | — | — | — | — | — | — |
| 0121-97-0082 | 21-05055 | 8.50–9.00 | Fill | 3.9 | — | — | — | — | — | — |
| 0121-97-0083 | 21-05055 | 14.50–15.00 | Fill | 10.7 | — | — | — | — | — | 61.6 (J) |
| 0121-97-0096 | 21-05056 | 4.50–5.00 | Fill | — | — | — | — | — | — | — |
| 0121-97-0097 | 21-05056 | 11.80–12.20 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0098 | 21-05056 | 20.00–20.50 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0099 | 21-05056 | 29.00–29.50 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0100 | 21-05056 | 39.00–39.50 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0101 | 21-05056 | 49.50–50.00 | Qbt 3 | 1.9 (U) | — | — | — | — | — | — |
| 0121-96-0481 | 21-05057 | 4.30–5.00 | Fill | 2.2 (U) | — | — | 1.1 (U) | — | — | — |
| 0121-96-0482 | 21-05057 | 9.50–10.00 | Fill | 2.3 (U) | — | — | 1.1 (U) | — | — | — |
| 0121-96-0483 | 21-05057 | 19.50–20.00 | Fill | 2.2 (U) | — | — | 1.1 (U) | — | — | — |
| 0121-96-0484 | 21-05057 | 22.50–23.90 | Qal | 0.32 (U) | 1480 | — | 0.76 (U) | — | 7.7 | 699 |
| 0121-96-0485 | 21-05057 | 29.50–30.00 | Qbt 3 | 2.2 (U) | — | — | — | — | — | — |
| 0121-96-0486 | 21-05057 | 39.50–40.00 | Qbt 3 | 2.2 (U) | — | — | — | — | — | — |
| 0121-96-0487 | 21-05057 | 49.50–50.00 | Qbt 3 | 2.2 (U) | — | — | — | — | — | — |
| 0121-96-0492 | 21-05058 | 7.70–8.20 | Fill | — | — | — | 0.86 (J) | — | — | — |
| 0121-96-0495 | 21-05058 | 29.50–30.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-96-0496 | 21-05058 | 39.50–40.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-96-0497 | 21-05058 | 49.50–50.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0111 | 21-05059 | 4.00–4.50 | Soil | 2.1 (U) | — | — | — | — | — | — |
| 0121-97-0112 | 21-05059 | 10.20–10.70 | Qal | 2 (U) | 393 (J) | — | 0.27 (U) | — | 11.3 (J) | 20.7 |
| 0121-97-0113 | 21-05059 | 20.00–20.50 | Qal | 2.1 (U) | 401 (J) | — | 0.29 (U) | — | 5.8 (J) | 12.7 |
| 0121-97-0114 | 21-05059 | 31.50–32.00 | Qal | 2.1 (U) | 135 (J) | — | 0.28 (U) | — | 18.1 | 37 |
| 0121-97-0115 | 21-05059 | 36.40–36.80 | Qbt 3 | 2.4 | — | — | — | — | — | — |
| 0121-97-0116 | 21-05059 | 40.00–40.50 | Qbt 3 | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-0117 | 21-05059 | 49.50–50.00 | Qbt 3 | 2 (U) | — | — | — | — | — | — |
| 0121-97-0136 | 21-05060 | 4.50–5.00 | Soil | — | — | — | — | — | — | — |
| 0121-97-0137 | 21-05060 | 10.00–10.50 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0138 | 21-05060 | 20.00–20.50 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0139 | 21-05060 | 30.00–30.50 | Qbt 3 | 1.5 (J) | — | — | — | — | — | — |
| 0121-97-0140 | 21-05060 | 42.00–42.50 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0141 | 21-05060 | 50.00–50.50 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0142 | 21-05060 | 60.00–60.50 | Qbt 3 | 1.3 (J) | — | — | — | — | — | — |
| 0121-97-0143 | 21-05060 | 69.50–70.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0163 | 21-05060 | 69.50–70.00 | Qbt 3 | — | — | — | — | — | — | — |

## Table B-25 (continued)

**Part 4 (continued)**

| Sample ID | Location ID | Depth (ft) | Media | Silver | Sodium | Strontium | Thallium | Uranium | Vanadium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|
| **Soil Background Value** | | | | 1 | — | — | — | 1.82 | — | 48.8 |
| **Qbt 2,3,4 Background Value** | | | | 1 | — | — | 1.1 | — | 17 | 63.5 |
| **Qbt 1v Background Value** | | | | 1 | — | — | — | — | — | — |
| **Fill Background Value** | | | | 1 | — | — | 0.73 | 1.82 | — | 48.8 |
| **Residential SAL (mg/kg)** | | | | **380** | **EN** | **3.7E$^{+4}$** | **6.1** | **230** | **530** | **2.3E$^{+4}$** |
| 0121-97-0144 | 21-05060 | 79.50–80.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0145 | 21-05060 | 89.00–89.50 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0146 | 21-05060 | 99.50–100.00 | Qbt 3 | 1.2 (J) | — | — | — | — | — | — |
| 0121-97-0147 | 21-05060 | 109.00–109.20 | Qbt 2 | — | — | — | — | — | — | — |
| 0121-97-0148 | 21-05060 | 118.50–119.00 | Qbt 2 | — | — | — | — | — | — | — |
| 0121-97-0149 | 21-05060 | 129.00–129.50 | Qbt 2 | — | — | — | — | — | — | — |
| 0121-97-0164 | 21-05060 | 129.00–129.50 | Qbt 2 | — | — | — | — | — | — | — |
| 0121-97-0150 | 21-05060 | 139.00–139.50 | Qbt 2 | — | — | — | — | — | — | — |
| 0121-97-0151 | 21-05060 | 150.00–150.50 | Qbt 2 | — | — | — | — | — | — | — |
| 0121-97-0152 | 21-05060 | 160.00–160.50 | Qbt 2 | — | — | — | — | — | — | — |
| 0121-97-0153 | 21-05060 | 169.50–170.00 | Qbt 2 | — | — | — | — | — | — | — |
| 0121-97-0154 | 21-05060 | 174.50–175.00 | Qbt 2 | — | — | — | — | — | — | — |
| 0121-97-0166 | 21-05061 | 5.50–6.00 | Soil | — | — | — | — | — | — | — |
| 0121-97-0167 | 21-05061 | 10.00–10.50 | Qbt 3 | 1.8 (J) | — | — | — | — | 33.7 | — |
| 0121-97-0168 | 21-05061 | 22.00–22.50 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-1126 | 21-05061 | 22.00–22.50 | Qbt 3 | — | — | — | — | — | 18.5 | — |
| 0121-97-0169 | 21-05061 | 30.00–30.50 | Qbt 3 | 1.2 | — | — | — | — | — | — |
| 0121-97-0170 | 21-05061 | 40.00–40.50 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0171 | 21-05061 | 49.00–49.50 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0172 | 21-05061 | 59.50–60.00 | Qbt 3 | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-0173 | 21-05061 | 69.50–70.00 | Qbt 3 | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-0174 | 21-05061 | 78.50–78.80 | Qbt 3 | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-0175 | 21-05061 | 89.50–90.00 | Qbt 3 | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-0176 | 21-05061 | 98.70–99.20 | Qbt 2 | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-0177 | 21-05061 | 108.50–109.00 | Qbt 2 | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-0178 | 21-05061 | 118.00–118.50 | Qbt 2 | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-0179 | 21-05061 | 128.50–129.00 | Qbt 2 | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-0180 | 21-05061 | 140.00–140.50 | Qbt 2 | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-0181 | 21-05061 | 152.50–153.00 | Qbt 2 | 1.8 (U) | — | — | — | — | — | — |
| 0121-97-0182 | 21-05061 | 160.00–160.50 | Qbt 2 | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-0183 | 21-05061 | 170.00–170.50 | Qbt 1v | 1.8 (U) | — | — | — | — | — | — |
| 0121-97-1128 | 21-05061 | 170.00–170.50 | Qbt 1v | 1.8 (U) | — | — | — | — | — | — |
| 0121-97-0184 | 21-05061 | 180.00–180.50 | Qbt 1v | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-0185 | 21-05061 | 189.50–190.00 | Qbt 1v | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-0191 | 21-05062 | 5.00–5.50 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0192 | 21-05062 | 6.00–6.50 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0193 | 21-05062 | 10.00–10.50 | Qbt 3 | — | — | — | — | — | — | — |

## Table B-25 (continued)

**Part 4 (continued)**

| Sample ID | Location ID | Depth (ft) | Media | Silver | Sodium | Strontium | Thallium | Uranium | Vanadium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|
| **Soil Background Value** | | | | 1 | — | — | — | 1.82 | — | 48.8 |
| **Qbt 2,3,4 Background Value** | | | | 1 | — | — | 1.1 | — | 17 | 63.5 |
| **Qbt 1v Background Value** | | | | 1 | — | — | — | — | — | — |
| **Fill Background Value** | | | | 1 | — | — | 0.73 | 1.82 | — | 48.8 |
| **Residential SAL (mg/kg)** | | | | **380** | **EN** | **$3.7E^{+4}$** | **6.1** | **230** | **530** | **$2.3E^{+4}$** |
| 0121-97-0194 | 21-05062 | 20.00–20.50 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0195 | 21-05062 | 30.00–30.50 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0196 | 21-05062 | 40.00–40.50 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0197 | 21-05062 | 49.50–50.00 | Qbt 3 | — | — | — | 1.7 (U) | — | — | — |
| 0121-97-0198 | 21-05062 | 58.80–59.50 | Qbt 3 | 1.3 (U) | — | — | 5 (U) | — | — | — |
| 0121-97-0218 | 21-05062 | 58.80–59.50 | Qbt 3 | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-0199 | 21-05062 | 70.00–70.50 | Qbt 3 | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-0200 | 21-05062 | 78.40–79.50 | Qbt 3 | 1.1 (U) | — | — | — | — | 29.6 (J-) | — |
| 0121-97-0221 | 21-05063 | 4.50–5.00 | Qbt 3 | 1.5 (U) | — | — | — | — | 22.3 | — |
| 0121-97-0222 | 21-05063 | 7.50–8.30 | Qbt 3 | 1.4 (U) | — | — | — | — | — | — |
| 0121-97-0234 | 21-05063 | 7.50–8.30 | Qbt 3 | 1.5 (U) | — | — | — | — | — | — |
| 0121-97-0223 | 21-05063 | 10.00–11.60 | Qbt 3 | 1.8 (U) | — | — | — | — | 18 | — |
| 0121-97-0224 | 21-05063 | 20.00–20.50 | Qbt 3 | 1.5 (U) | — | — | — | — | — | — |
| 0121-97-0225 | 21-05063 | 30.50–31.30 | Qbt 3 | 1.5 (U) | — | — | — | — | — | — |
| 0121-97-0226 | 21-05063 | 41.00–42.00 | Qbt 3 | 1.4 (U) | — | — | — | — | — | — |
| 0121-97-0227 | 21-05063 | 49.00–50.00 | Qbt 3 | 1.5 (U) | — | — | — | — | — | — |
| 0121-96-0621 | 21-05065 | 4.50–5.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-96-0622 | 21-05065 | 10.00–10.50 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-96-0623 | 21-05065 | 19.50–20.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-96-0624 | 21-05065 | 29.50–30.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-96-0625 | 21-05065 | 39.50–40.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-96-0626 | 21-05065 | 48.20–48.70 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-0326 | 21-05073 | 2.50–3.00 | Soil | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-0327 | 21-05073 | 8.50–9.00 | Qbt 3 | 5 | — | — | — | — | — | — |
| 0121-97-0328 | 21-05073 | 11.70–12.20 | Qbt 3 | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-0329 | 21-05073 | 22.00–23.00 | Qbt 3 | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-0330 | 21-05073 | 32.00–32.50 | Qbt 3 | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-0331 | 21-05073 | 42.00–42.50 | Qbt 3 | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-0332 | 21-05073 | 46.50–47.00 | Qbt 3 | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-0333 | 21-05073 | 62.00–62.50 | Qbt 3 | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-0401 | 21-05073 | 62.00–62.50 | Qbt 3 | 1.8 (U) | — | — | — | — | — | — |
| 0121-97-0334 | 21-05073 | 69.50–70.00 | Qbt 3 | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-1131 | 21-05075 | 6.70–7.20 | Qbt 3 | 2.1 (U) | — | — | — | — | — | — |
| 0121-97-1132 | 21-05075 | 8.80–9.30 | Qbt 3 | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-1133 | 21-05075 | 15.50–16.00 | Qbt 3 | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-1141 | 21-05075 | 15.50–16.00 | Qbt 3 | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-1134 | 21-05075 | 20.00–21.00 | Qbt 3 | 1.9 (U) | — | — | — | — | — | — |

## Table B-25 (continued)

| Part 4 (continued) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID** | **Location ID** | **Depth (ft)** | **Media** | **Silver** | **Sodium** | **Strontium** | **Thallium** | **Uranium** | **Vanadium** | **Zinc** |
| **Soil Background Value** | | | | 1 | — | — | — | 1.82 | — | 48.8 |
| **Qbt 2,3,4 Background Value** | | | | 1 | — | — | 1.1 | — | 17 | 63.5 |
| **Qbt 1v Background Value** | | | | 1 | — | — | — | — | — | — |
| **Fill Background Value** | | | | 1 | — | — | 0.73 | 1.82 | — | 48.8 |
| **Residential SAL (mg/kg)** | | | | **380** | **EN** | **$3.7E^{+4}$** | **6.1** | **230** | **530** | **$2.3E^{+4}$** |
| 0121-97-1135 | 21-05075 | 29.50–30.00 | Qbt 3 | 1.9 (U) | — | — | — | — | — | — |
| 0121-97-1136 | 21-05075 | 38.80–39.30 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-1137 | 21-05075 | 45.00–46.00 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-1138 | 21-05075 | 58.00–58.50 | Qbt 3 | — | — | — | — | — | — | — |
| 0121-97-1139 | 21-05075 | 69.50–70.00 | Qbt 3 | — | — | — | — | — | — | — |

*— = not detected

EN = essential nutrient; therefore, SALs not develop.

## Table B-26
## Frequency of Detection for Radionuclides Above Background

| Analyte | Media | Number of Analyses | Number of Detects | Concentration Range (pCi/g) | Background Value (pCi/g) | Frequency of Detects Above Background Value |
|---|---|---|---|---|---|---|
| Americium-241 | Qal | 12 | 1 | [-1.49] to 210000 | NA* | 1/12 |
| | Soil | 44 | 36 | [-0.58] to 19982 | 0.013 | 28/44 |
| | Fill | 25 | 18 | [0.11] to 14950 | 0.013 | 18/25 |
| | Qbt 2 | 36 | 2 | [-1.9] to 4.89 | NA | 2/36 |
| | Qbt 3 | 144 | 44 | [-1.87] to 66420 | NA | 44/144 |
| | Qbt 1v | 7 | 0 | [-0.98 to 0.79] | NA | 0/7 |
| Cesium-134 | Qal | 12 | 0 | [-0.05 to 0.81] | NA | 0/12 |
| | Soil | 5 | 0 | [-0.04 to 0.78] | NA | 0/5 |
| | Fill | 20 | 0 | [-0.28 to 0.8] | NA | 0/20 |
| | Qbt 2 | 36 | 0 | [-0.16 to 0.29] | NA | 0/36 |
| | Qbt 3 | 138 | 0 | [-0.59 to 0.87] | NA | 0/138 |
| | Qbt 1v | 7 | 0 | [-0.1 to 0.07] | NA | 0/7 |
| Cesium-137 | Qal | 12 | 1 | [-0.11] to 2.5 | NA | 1/12 |
| | Soil | 19 | 11 | [-0.07] to 107.78 | 1.65 | 10/19 |
| | Fill | 25 | 12 | [0.01] to 271.9 | 1.65 | 12/25 |
| | Qbt 2 | 36 | 0 | [-0.23 to 0.36] | NA | 0/36 |
| | Qbt 3 | 144 | 11 | [-0.26] to 460 | NA | 11/144 |
| | Qbt 1v | 7 | 0 | [-0.09 to 0.12] | NA | 0/7 |
| Cobalt-60 | Qal | 12 | 0 | [-0.16 to 1.1] | NA | 0/12 |
| | Soil | 5 | 0 | [0.05 to 1.1] | NA | 0/5 |
| | Fill | 23 | 0 | [-0.12 to 0.9] | NA | 0/23 |
| | Qbt 2 | 36 | 0 | [-0.22 to 0.35] | NA | 0/36 |
| | Qbt 3 | 141 | 0 | [-0.39 to 1.1] | NA | 0/141 |
| | Qbt 1v | 7 | 0 | [-0.11 to 0.27] | NA | 0/7 |
| Europium-152 | Qal | 12 | 0 | [-0.46 to 2.3] | NA | 0/12 |
| | Soil | 5 | 0 | [-0.08 to 1.8] | NA | 0/5 |
| | Fill | 23 | 0 | [-0.76 to 2.1] | NA | 0/23 |
| | Qbt 2 | 36 | 1 | [-1.24] to 4.42 | NA | 1/36 |
| | Qbt 3 | 141 | 0 | [-1.89 to 6.08] | NA | 0/141 |
| | Qbt 1v | 7 | 0 | [-0.97 to 0.83] | NA | 0/7 |
| Plutonium-238 | Qal | 12 | 2 | [0.03] to 170 | NA | 2/12 |
| | Soil | 44 | 34 | [0.002] to 1440 | 0.023 | 24/44 |
| | Fill | 25 | 16 | [0.0016] to 2480 | 0.023 | 16/25 |
| | Qbt 2 | 36 | 2 | [0.02] to 0.34 | NA | 2/36 |
| | Qbt 3 | 144 | 21 | [-0.002] to 3719 | NA | 21/144 |
| | Qbt 1v | 7 | 0 | [0.04 to 0.09] | NA | 0/7 |

## Table B-26 (continued)

| Analyte | Media | Number of Analyses | Number of Detects | Concentration Range (pCi/g) | Background Value (pCi/g) | Frequency of Detects Above Background Value |
|---|---|---|---|---|---|---|
| Plutonium-239 | Qal | 12 | 3 | [0.02] to 2800 | NA | 3/12 |
| | Soil | 44 | 38 | [0.005] to 19143 | 0.054 | 28/44 |
| | Fill | 25 | 22 | 0.0847 to 230600 | 0.054 | 22/25 |
| | Qbt 2 | 36 | 2 | [0] to 1.33 | NA | 2/36 |
| | Qbt 3 | 144 | 59 | [0] to 67000 | NA | 59/144 |
| | Qbt 1v | 7 | 1 | [0.02] to 0.38 | NA | 1/7 |
| Ruthenium-106 | Qal | 12 | 0 | [-1.1 to 8] | NA | 0/12 |
| | Soil | 5 | 0 | [-0.57 to 6.9] | NA | 0/5 |
| | Fill | 23 | 0 | [-2.27 to 7.6] | NA | 0/23 |
| | Qbt 2 | 36 | 0 | [-2.98 to 3.3] | NA | 0/36 |
| | Qbt 3 | 141 | 0 | [-3.74 to 8.2] | NA | 0/141 |
| | Qbt 1v | 7 | 0 | [-2.11 to 0.58] | NA | 0/7 |
| Sodium-22 | Qal | 12 | 0 | [-0.19 to 1] | NA | 0/12 |
| | Soil | 5 | 0 | [-0.13 to 0.97] | NA | 0/5 |
| | Fill | 23 | 0 | [-0.08 to 0.93] | NA | 0/23 |
| | Qbt 2 | 36 | 0 | [-0.18 to 0.35] | NA | 0/36 |
| | Qbt 3 | 141 | 0 | [-0.33 to 1] | NA | 0/141 |
| | Qbt 1v | 7 | 0 | [-0.13 to 0.13] | NA | 0/7 |
| Strontium-90 | Qal | 4 | 0 | [0 to 140] | NA | 0/4 |
| | Soil | 44 | 12 | [-0.49] to 44.3 | 1.31 | 12/44 |
| | Fill | 24 | 18 | [0] to 756.88 | 1.31 | 18/24 |
| | Qbt 2 | 21 | 1 | [0] to 1.14 | NA | 1/21 |
| | Qbt 3 | 114 | 41 | [-0.64] to 133.68 | NA | 41/114 |
| | Qbt 1v | 4 | 0 | [0.02 to 0.81] | NA | 0/4 |
| Tritium | Soil | 38 | 31 | [1.237875E-02] to 0.8204922 | NA | 31/38 |
| | Fill | 2 | 0 | [1.233197E-02 to 5.110699E-02] | NA | 0/2 |
| | Qbt 3 | 3 | 3 | 0.1136835 to 0.267933 | NA | 3/3 |
| Uranium-234 | Qal | 4 | 3 | [1.06] to 92 | NA | 3/4 |
| | Soil | 32 | 31 | [0.64] to 3.45 | 2.59 | 2/32 |
| | Fill | 22 | 19 | 0.239 to [35] | 2.59 | 8/22 |
| | Qbt 2 | 21 | 18 | [0.89] to 2.09 | 1.98 | 1/21 |
| | Qbt 3 | 111 | 78 | 0.526 to 99.44 | 1.98 | 11/111 |
| | Qbt 1v | 4 | 4 | 1.35 to 2.43 | 3.12 | 0/4 |
| Uranium-235 | Qal | 12 | 0 | [-0.63 to 9.2] | NA | 0/12 |
| | Soil | 32 | 1 | [0.03 to 0.34] | 0.2 | 0/32 |
| | Fill | 23 | 9 | [0 to 4.4] | 0.2 | 3/23 |
| | Qbt 2 | 36 | 0 | [-0.58 to 1.09] | 0.09 | 0/36 |

## Table B-26 (continued)

| Analyte | Media | Number of Analyses | Number of Detects | Concentration Range (pCi/g) | Background Value (pCi/g) | Frequency of Detects Above Background Value |
|---|---|---|---|---|---|---|
| | Qbt 3 | 141 | 20 | [-11 to 2.77] | 0.09 | 0/141 |
| | Qbt 1v | 7 | 0 | [-0.38 to 0.3] | 0.14 | 0/7 |
| Uranium-238 | Qal | 4 | 3 | [0.87] to 55 | NA | 3/4 |
| | Soil | 32 | 30 | [0.75] to 1.562 | 2.29 | 0/32 |
| | Fill | 22 | 19 | 0.266 to 33 | 2.29 | 4/22 |
| | Qbt 2 | 21 | 17 | 0.97 to 2.47 | 1.93 | 2/21 |
| | Qbt 3 | 111 | 67 | [0.39 to 24] | 1.93 | 7/111 |
| | Qbt 1v | 4 | 4 | 1.34 to 2.02 | 3.05 | 0/4 |

*NA = not applicable

## Table B-27
## Frequency of Detection for Organic Chemicals

| Analyte | Media | Number of Analyses | Number of Detects | Concentration Range (mg/kg) | Frequency of Detects | Quant Limit |
|---|---|---|---|---|---|---|
| Anthracene | Fill | 25 | 1 | 0.048 to [0.45] | 1/25 | 0.47 |
| Benz(a)anthracene | Fill | 25 | 7 | 0.027 to 0.46 | 7/25 | 0.47 |
| Benzo(a)pyrene | Fill | 25 | 5 | 0.041 to [0.45] | 5/25 | 0.47 |
| Benzo(b)fluoranthene | Fill | 25 | 5 | 0.05 to [0.45] | 5/25 | 0.47 |
| Benzo(g,h,i)perylene | Fill | 25 | 3 | 0.045 to [0.45] | 3/25 | 0.47 |
| Benzo(k)fluoranthene | Fill | 25 | 4 | 0.039 to [0.45] | 4/25 | 0.47 |
| Bis(2-ethylhexyl)phthalate | Qal | 7 | 1 | 0.087 to [0.4] | 1/7 | 0.47 |
| Bis(2-ethylhexyl)phthalate | Fill | 25 | 5 | 0.046 to [0.45] | 5/25 | 0.47 |
| Bis(2-ethylhexyl)phthalate | Qbt 3 | 117 | 3 | 0.074 to [0.47] | 3/117 | 0.47 |
| Butanone[2-] | Qbt 2 | 27 | 1 | 0.002 to [0.024] | 1/27 | 0.026 |
| Butanone[2-] | Qbt 3 | 116 | 1 | [0.004] to [0.03] | 1/116 | 0.026 |
| Butanone[2-] | Qbt 1v | 4 | 1 | 0.003 to [0.02] | 1/4 | 0.026 |
| Chrysene | Fill | 25 | 7 | 0.038 to 0.48 | 7/25 | 0.47 |
| Dibromo-3-Chloropropane[1,2-] | Qbt 3 | 116 | 2 | 0.001 to [0.015] | 2/116 | 0.015 |
| Dichlorodifluoromethane | Qbt 3 | 116 | 1 | 0.004 to [0.015] | 1/116 | 0.015 |
| Di-n-butylphthalate | Fill | 25 | 4 | 0.039 to [0.46] | 4/25 | 0.44 |
| Di-n-butylphthalate | Qbt 3 | 117 | 13 | 0.037 to [4] | 13/117 | 0.44 |
| Fluoranthene | Fill | 25 | 7 | 0.046 to 1.4 | 7/25 | 0.47 |
| Hexanone[2-] | Soil | 9 | 1 | [0.022] to 0.043 | 1/9 | 0.03 |
| Indeno(1,2,3-cd)pyrene | Fill | 25 | 3 | 0.043 to [0.45] | 3/25 | 0.47 |
| Isopropyltoluene[4-] | Fill | 25 | 3 | [0.005] to 0.013 | 3/25 | 0.008 |
| Phenanthrene | Fill | 25 | 4 | 0.039 to 0.6300001 | 4/25 | 0.47 |
| Pyrene | Fill | 25 | 7 | 0.043 to 1 | 7/25 | 0.47 |
| Tetrachloroethene | Qal | 7 | 1 | 0.002 to [0.006] | 1/7 | 0.008 |
| Tetrachloroethene | Soil | 9 | 1 | 0.004 to [0.006] | 1/9 | 0.008 |
| Tetrachloroethene | Fill | 25 | 4 | 0.002 to 0.008 | 4/25 | 0.008 |
| Tetrachloroethene | Qbt 3 | 116 | 1 | [0.005] to [0.028] | 1/116 | 0.008 |
| Toluene | Qal | 7 | 1 | 0.002 to [0.006] | 1/7 | 0.007 |
| Toluene | Soil | 9 | 1 | [0.006] to [0.006] | 1/9 | 0.007 |
| Toluene | Fill | 25 | 12 | 0.002 to 0.14 | 12/25 | 0.007 |
| Toluene | Qbt 3 | 116 | 7 | 0.001 to 0.014 | 7/116 | 0.007 |
| Trichloroethene | Fill | 25 | 7 | 0.002 to 0.01 | 7/25 | 0.006 |
| Trichlorofluoromethane | Qal | 7 | 1 | 0.002 to [0.006] | 1/7 | 0.006 |
| Trichlorofluoromethane | Qbt 3 | 116 | 1 | 0.002 to [0.008] | 1/116 | 0.006 |

## Table B-28
## Frequency of Detection for Inorganic Chemicals Above Background

| Analyte | Media | 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 | Qal | 7 | 7 | 2600 to 11800 | NA* | 7/7 | NA |
| | Soil | 43 | 43 | 1190 to 18700 | 29200 | 0/43 | 0/43 |
| | Fill | 25 | 25 | 1910 to 13200 | 29200 | 0/25 | 0/25 |
| | Qbt 2 | 27 | 27 | 221 to 722 | 7340 | 0/27 | 0/27 |
| | Qbt 3 | 117 | 117 | 163 to 32300 | 7340 | 15/117 | 0/117 |
| | Qbt 1v | 4 | 4 | 419 to 506 | 8170 | 0/4 | 0/4 |
| Antimony | Qal | 7 | 0 | [0.58 to 8.9] | NA | 0/7 | NA |
| | Soil | 43 | 1 | [0.21] to [ 9] | 0.83 | 0/43 | 5/43 |
| | Fill | 25 | 0 | [0.26 to 11] | 0.83 | 0/25 | 12/25 |
| | Qbt 2 | 27 | 0 | [5.1 to 8.5] | 0.5 | 0/27 | 27/27 |
| | Qbt 3 | 117 | 4 | [0.24] to [30.6] | 0.5 | 4/117 | 92/117 |
| | Qbt 1v | 4 | 0 | [5.1 to 5.2] | 0.5 | 0/4 | 4/4 |
| Arsenic | Qal | 7 | 5 | [0.36] to 4.5 | NA | 5/7 | NA |
| | Soil | 43 | 31 | [0.7] to 4.5 | 8.17 | 0/43 | 0/43 |
| | Fill | 25 | 20 | 0.55 to 5.7 | 8.17 | 0/25 | 0/25 |
| | Qbt 2 | 27 | 15 | [0.21] to 0.94 | 2.79 | 0/27 | 0/27 |
| | Qbt 3 | 117 | 76 | [0.21] to 24.9 | 2.79 | 9/117 | 1/117 |
| | Qbt 1v | 4 | 3 | [0.38] to 0.76 | 1.81 | 0/4 | 0/4 |
| Barium | Qal | 7 | 7 | 14.7 to 101 | NA | 7/7 | NA |
| | Soil | 43 | 41 | 0.9 to 191 | 295 | 0/43 | 0/43 |
| | Fill | 25 | 23 | 21 to 497 | 295 | 1/25 | 0/25 |
| | Qbt 2 | 27 | 27 | 3.5 to 16.4 | 46 | 0/27 | 0/27 |
| | Qbt 3 | 117 | 111 | 1.1 to 241 | 46 | 21/117 | 0/117 |
| | Qbt 1v | 4 | 4 | 8.5 to 15.6 | 26.5 | 0/4 | 0/4 |
| Beryllium | Qal | 7 | 7 | 0.31 to 0.91 | NA | 7/7 | NA |
| | Soil | 43 | 32 | 0.15 to 124 | 1.83 | 1/43 | 0/43 |
| | Fill | 25 | 18 | 0.18 to 0.84 | 1.83 | 0/25 | 0/25 |
| | Qbt 2 | 27 | 25 | 0.1 to 0.68 | 1.21 | 0/27 | 0/27 |
| | Qbt 3 | 117 | 92 | 0.02 to 2.8 | 1.21 | 8/117 | 0/117 |
| | Qbt 1v | 4 | 4 | 0.43 to 0.51 | 1.7 | 0/4 | 0/4 |
| Cadmium | Qal | 7 | 2 | 0.2 to 0.96 | NA | 2/7 | NA |
| | Soil | 43 | 25 | [0.45] to 7.1 | 0.4 | 25/43 | 18/43 |
| | Fill | 25 | 12 | [0.08] to 36.6 | 0.4 | 7/25 | 12/25 |
| | Qbt 2 | 27 | 4 | [0.46] to 0.89 | 1.63 | 0/27 | 0/27 |
| | Qbt 3 | 117 | 22 | [0.07] to 49 | 1.63 | 4/117 | 0/117 |
| | Qbt 1v | 4 | 0 | [0.83 to 0.85] | 0.4 | 0/4 | 4/4 |

**Table B-28 (continued)**

| Analyte | Media | 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 |
|---|---|---|---|---|---|---|---|
| Calcium | Qal | 7 | 7 | 883 to 51100 | NA | 7/7 | NA |
| | Soil | 43 | 42 | 447 to 7900 | 6120 | 1/43 | 0/43 |
| | Fill | 25 | 25 | 474 to 3930 | 6120 | 0/25 | 0/25 |
| | Qbt 2 | 27 | 27 | 97.3 to 473 | 2200 | 0/27 | 0/27 |
| | Qbt 3 | 117 | 112 | 108 to 180000 | 2200 | 15/117 | 0/117 |
| | Qbt 1v | 4 | 4 | 189 to 465 | 3700 | 0/4 | 0/4 |
| Chromium | Qal | 7 | 7 | 1.6 to 17.9 | NA | 7/7 | NA |
| | Soil | 43 | 41 | [1.7] to 11.6 | 19.3 | 0/43 | 0/43 |
| | Fill | 25 | 24 | [1.9] to 133 | 19.3 | 5/25 | 0/25 |
| | Qbt 2 | 27 | 16 | [0.9] to 67.2 | 7.14 | 2/27 | 0/27 |
| | Qbt 3 | 117 | 85 | [0.13] to 119 | 7.14 | 19/117 | 0/117 |
| | Qbt 1v | 4 | 4 | 2.4 to 17.6 | 2.24 | 4/4 | 0/4 |
| Cobalt | Qal | 7 | 6 | [1.3] to 6.5 | NA | 6/7 | NA |
| | Soil | 43 | 29 | [0.91] to 8.1 | 8.64 | 0/43 | 0/43 |
| | Fill | 25 | 19 | 1.1 to 7.4 | 8.64 | 0/25 | 0/25 |
| | Qbt 2 | 27 | 6 | [1] to 2.1 | 3.14 | 0/27 | 0/27 |
| | Qbt 3 | 117 | 40 | [0.26] to 8.3 | 3.14 | 10/117 | 2/117 |
| | Qbt 1v | 4 | 2 | [1.1] to 1.2 | 1.78 | 0/4 | 0/4 |
| Copper | Qal | 7 | 7 | 2.5 to 7.5 | NA | 7/7 | NA |
| | Soil | 43 | 36 | [1.8] to 23.1 | 14.7 | 2/43 | 0/43 |
| | Fill | 25 | 23 | [1.1] to 134 | 14.7 | 9/25 | 0/25 |
| | Qbt 2 | 27 | 26 | [1.1] to 3.8 | 4.66 | 0/27 | 0/27 |
| | Qbt 3 | 117 | 99 | 0.002 to 131 | 4.66 | 29/117 | 1/117 |
| | Qbt 1v | 4 | 3 | [1.3] to 2.6 | 3.26 | 0/4 | 0/4 |
| Cyanide (total) | Qal | 3 | 0 | [0.29 to 0.3] | NA | 0/3 | NA |
| | Soil | 2 | 0 | [0.28 to 0.29] | NA | 0/2 | NA |
| | Fill | 7 | 0 | [0.26 to 0.3] | NA | 0/7 | NA |
| | Qbt 2 | 15 | 0 | [0.26 to 0.67] | NA | 0/15 | NA |
| | Qbt 3 | 30 | 0 | [0.26 to 0.83] | NA | 0/30 | NA |
| | Qbt 1v | 4 | 0 | [0.26 to 0.27] | NA | 0/4 | NA |
| Iron | Qal | 7 | 7 | 3550 to 13200 | NA | 7/7 | NA |
| | Soil | 43 | 43 | 3310 to 15700 | 21500 | 0/43 | 0/43 |
| | Fill | 25 | 25 | 3120 to 13600 | 21500 | 0/25 | 0/25 |
| | Qbt 2 | 27 | 27 | 869 to 5520 | 14500 | 0/27 | 0/27 |
| | Qbt 3 | 117 | 116 | 1.68 to 22300 | 14500 | 8/117 | 0/117 |
| | Qbt 1v | 4 | 4 | 5450 to 5630 | 9900 | 0/4 | 0/4 |

### Table B-28 (continued)

| Analyte | Media | 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 |
|---|---|---|---|---|---|---|---|
| Lead | Qal | 7 | 7 | 2.8 to 17.5 | NA | 7/7 | NA |
| | Soil | 43 | 43 | 6.1 to 17.4 | 22.3 | 0/43 | 0/43 |
| | Fill | 25 | 25 | 3.9 to 52 | 22.3 | 6/25 | 0/25 |
| | Qbt 2 | 27 | 27 | 1.4 to 18 | 11.2 | 1/27 | 0/27 |
| | Qbt 3 | 109 | 105 | [0.36] to 40.8 | 11.2 | 21/109 | 0/109 |
| | Qbt 1v | 4 | 3 | [1.3] to 7.1 | 18.4 | 0/4 | 0/4 |
| Lithium | Soil | 28 | 27 | 2.7 to 14.8 | NA | 27/28 | NA |
| Magnesium | Qal | 7 | 7 | 428 to 1780 | NA | 7/7 | NA |
| | Soil | 43 | 39 | 324 to 2690 | 4610 | 0/43 | 0/43 |
| | Fill | 25 | 23 | 293 to 2100 | 4610 | 0/25 | 0/25 |
| | Qbt 2 | 27 | 27 | 15.2 to 75.3 | 1690 | 0/27 | 0/27 |
| | Qbt 3 | 117 | 108 | 20.2 to 5750 | 1690 | 15/117 | 0/117 |
| | Qbt 1v | 4 | 4 | 37.8 to 61.9 | 780 | 0/4 | 0/4 |
| Manganese | Qal | 7 | 7 | 58.7 to 406 | NA | 7/7 | NA |
| | Soil | 43 | 43 | 128 to 479 | 671 | 0/43 | 0/43 |
| | Fill | 25 | 25 | 44 to 468 | 671 | 0/25 | 0/25 |
| | Qbt 2 | 27 | 27 | 101 to 336 | 482 | 0/27 | 0/27 |
| | Qbt 3 | 117 | 117 | 7.7 to 1290 | 482 | 3/117 | 0/117 |
| | Qbt 1v | 4 | 4 | 274 to 300 | 408 | 0/4 | 0/4 |
| Mercury | Qal | 7 | 1 | [0.06] to 1.1 | NA | 1/7 | NA |
| | Soil | 4 | 0 | [0.05 to 0.06] | 0.1 | 0/4 | 0/4 |
| | Fill | 23 | 14 | [0.05] to 18.6 | 0.1 | 12/23 | 3/23 |
| | Qbt 2 | 27 | 0 | [0.05 to 0.053] | 0.1 | 0/27 | 0/27 |
| | Qbt 3 | 114 | 26 | [0.05] to 2.9 | 0.1 | 16/114 | 3/114 |
| | Qbt 1v | 4 | 0 | [0.05 to 0.05] | 0.1 | 0/4 | 0/4 |
| Molybdenum | Soil | 28 | 0 | [2.5 to 6.8] | NA | 0/28 | NA |
| Nickel | Qal | 7 | 7 | 2.6 to 11.4 | NA | 7/7 | NA |
| | Soil | 43 | 36 | [1.5] to 53.5 | 15.4 | 1/43 | 0/43 |
| | Fill | 25 | 20 | [1.7] to 355 | 15.4 | 8/25 | 0/25 |
| | Qbt 2 | 27 | 6 | [1.7] to 32.7 | 6.58 | 2/27 | 0/27 |
| | Qbt 3 | 117 | 58 | 0.72 to 75.8 | 6.58 | 20/117 | 0/117 |
| | Qbt 1v | 4 | 1 | [2] to 6.5 | 2 | 1/4 | 2/4 |

### Table B-28 (continued)

| Analyte | Media | 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 |
|---|---|---|---|---|---|---|---|
| Potassium | Qal | 7 | 7 | 321 to 1140 | NA | 7/7 | NA |
| | Soil | 43 | 36 | 256 to 2350 | 3460 | 0/43 | 0/43 |
| | Fill | 25 | 23 | [274] to 2060 | 3460 | 0/25 | 0/25 |
| | Qbt 2 | 27 | 19 | [122] to 502 | 3500 | 0/27 | 0/27 |
| | Qbt 3 | 117 | 84 | [119] to 6260 | 3500 | 8/117 | 0/117 |
| | Qbt 1v | 4 | 3 | 237 to 285 | 6670 | 0/4 | 0/4 |
| Selenium | Qal | 7 | 0 | [0.36 to 0.79] | NA | 0/7 | NA |
| | Soil | 43 | 1 | [0.34] to [3.6] | 1.52 | 1/43 | 1/43 |
| | Fill | 25 | 0 | [0.22 to 3.6] | 1.52 | 0/25 | 5/25 |
| | Qbt 2 | 27 | 0 | [0.3 to 0.38] | 0.3 | 0/27 | 22/27 |
| | Qbt 3 | 116 | 14 | [0.22] to [14.2] | 0.3 | 13/116 | 95/116 |
| | Qbt 1v | 4 | 0 | [0.37 to 0.38] | 0.3 | 0/4 | 4/4 |
| Silver | Qal | 7 | 0 | [0.32 to 2.1] | NA | 0/7 | NA |
| | Soil | 43 | 1 | [0.68] to [2.5] | 1 | 1/43 | 39/43 |
| | Fill | 25 | 11 | [0.17] to 10.7 | 1 | 8/25 | 8/25 |
| | Qbt 2 | 27 | 0 | [0.84 to 1.9] | 1 | 0/27 | 18/27 |
| | Qbt 3 | 117 | 14 | [0.16] to 19.8 | 1 | 9/117 | 60/117 |
| | Qbt 1v | 4 | 0 | [1.8 to 1.9] | 1 | 0/4 | 4/4 |
| Sodium | Qal | 7 | 7 | 65.3 to 1480 | NA | 7/7 | NA |
| | Soil | 16 | 5 | [72.8] to 277 | 915 | 0/16 | 0/16 |
| | Fill | 25 | 23 | 91.5 to 625 | 915 | 0/25 | 0/25 |
| | Qbt 2 | 27 | 27 | 115 to 1020 | 2770 | 0/27 | 0/27 |
| | Qbt 3 | 117 | 107 | 65.1 to 1650 | 2770 | 0/117 | 0/117 |
| | Qbt 1v | 4 | 4 | 206 to 242 | 6330 | 0/4 | 0/4 |
| Strontium | Soil | 28 | 27 | 2.5 to 32.6 | NA | 27/28 | NA |
| Thallium | Qal | 7 | 0 | [0.24 to 0.76] | NA | 0/7 | NA |
| | Soil | 43 | 0 | [0.21 to 0.28] | 0.73 | 0/43 | 0/43 |
| | Fill | 25 | 3 | [0.25] to [1.1] | 0.73 | 2/25 | 4/25 |
| | Qbt 2 | 27 | 1 | [0.25] to [0.26] | 1.1 | 0/27 | 0/27 |
| | Qbt 3 | 117 | 12 | [0.17 to 5] | 1.1 | 3/117 | 2/117 |
| | Qbt 1v | 4 | 0 | [0.24 to 0.25] | 1.24 | 0/4 | 0/4 |
| Uranium | Soil | 11 | 11 | 0.393 to 2.3 | 1.82 | 3/11 | 0/11 |
| | Fill | 2 | 2 | 2.2 to 2.27 | 1.82 | 2/2 | 0/2 |
| | Qbt 3 | 3 | 3 | 1.08 to 1.42 | 2.4 | 0/3 | 0/3 |

## Table B-28 (continued)

| Analyte | Media | 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 |
|---|---|---|---|---|---|---|---|
| Vanadium | Qal | 7 | 7 | 4.6 to 18.8 | NA | 7/7 | NA |
| | Soil | 43 | 37 | 2.6 to 26.8 | 39.6 | 0/43 | 0/43 |
| | Fill | 25 | 23 | 3.2 to 27.9 | 39.6 | 0/25 | 0/25 |
| | Qbt 2 | 27 | 18 | [0.96] to 2.6 | 17 | 0/27 | 0/27 |
| | Qbt 3 | 117 | 77 | [0.23] to 34.3 | 17 | 10/117 | 0/117 |
| | Qbt 1v | 4 | 4 | 1.9 to 2.7 | 4.48 | 0/4 | 0/4 |
| Zinc | Qal | 7 | 7 | 12.7 to 699 | NA | 7/7 | NA |
| | Soil | 43 | 43 | 21.8 to 111 | 48.8 | 6/43 | 0/43 |
| | Fill | 25 | 25 | 10.8 to 88.9 | 48.8 | 6/25 | 0/25 |
| | Qbt 2 | 27 | 27 | 8.6 to 58.8 | 63.5 | 0/27 | 0/27 |
| | Qbt 3 | 117 | 116 | [1.5] to 226 | 63.5 | 5/117 | 0/117 |
| | Qbt 1v | 4 | 4 | 42 to 48.9 | 84.6 | 0/4 | 0/4 |

*NA = not applicable

## Table B-29
## Baseline Concentrations, Background Upper Tolerance Limits, and Screening Action Levels for TA-21, 1992

| Analyte | Non-Process Area Baseline* | Process Area Baseline * | Special Impact Area 1 Baseline * | Background UTLs* | SALs |
|---|---|---|---|---|---|
| Americium-241 | 0.13 | .53 | 0.67 | - | 17.0 |
| Cesium-137 | NA | NA | NA | - | 4.0 |
| Plutonium-238 | 0.24 | 6.21 | 0.16 | - | 20.0 |
| Plutonium-239 | 2.04 | 9.41 | 12.5 | - | 18.0 |
| Strontium-90 | 0.73 | 0.69 | NA | - | 5.4 |
| Thorium-228 | 2.05 | 1.78 | NA | - | NA |
| Thorium-230 | 1.82 | 1.82 | NA | - | 5.0 |
| Thorium-232 | 1.98 | 1.71 | NA | - | 5.0 |
| Tritium | 4.59 | 7.85 | NA | - | 810 |
| Uranium-234 | 2.03 | 1.95 | NA | - | 86.0 |
| Uranium-235 | 0.15 | 0.10 | NA | - | 18.0 |
| Uranium-238 | 2.19 | 1.94 | NA | - | 59.0 |
| Aluminum | 74,900 | 68,700 | NA | 58,900 | NC |
| Antimony | NA | NA | NA | NC | 32 |
| Arsenic | 3.67 | 3.44 | NA | 11.6 | NC |
| Barium | 498 | 513 | NA | 1,140 | 5,600 |
| Beryllium | 4.23 | 4.05 | NA | 3.31 | NC |
| Cadmium | 1.17 | 2.14 | NA | NC | 80 |
| Calcium | 13,880 | 7,500 | NA | 54,400 | NC |
| Chromium[1] | 21 | 18 | NA | 34.2 | 400 |
| Cobalt | 7.99 | 8.50 | NA | 51.1 | NC |
| Copper | 18.9 | 50.8 | NA | 15.7 | 3,000 |
| Iron | 23,200 | 9,210 | NA | 35,600 | NC |
| Lead | 41.1 | 56.5 | NA | 39 | 400 |
| Magnesium | 4,760 | 3,990 | NA | 16,100 | NC |
| Manganese | 485 | 592 | NA | 1,030 | 11,000 |
| Molybdenum | NA | NA | NA | NA | 400 |
| Nickel | 11.9 | 13.6 | NA | 26.7 | 16,000 |
| Potassium | NA | NA | NA | 6,180 | NC |
| Selenium | 0.37 | 0.27 | NA | NC | 400 |
| Silver | 2.33 | 1.55 | NA | NC | 400 |
| Sodium | 29,600 | 27,300 | NA | 1,880 | NC |
| Strontium | 151 | 146 | NA | NA | 48,000 |
| Vanadium | 41 | 43.4 | NA | 66 | 560 |
| Zinc | 69 | 210 | NA | 101 | 24,000 |

^ Maximum detected concentration of constituent is higher than Non-Process Area Baseline, and is carried forward in the screening process.

* Radionuclides are reported in pCi/g, except for tritium which is reported in pCi/ml of soil moisture. Organic and inorganic compounds are reported in mg/kg.

[1] Chromium (VI) SAL.

| | |
|---|---|
| - | Not applicable |
| NA | Not available |
| NC | Not calculated |
| PRS | Potential release site |
| SAL | Screening action level |
| TA | Technical Area |
| UTL | Upper tolerance limit |

Source: LANL 1995, 52350.1, p. 1-20.

## Table B-30
## Field Screening Results Above Background for 1994 Exploratory Borings at TA-21 Building 035

| Location ID | Depth (ft bgs) | Location Description | Alpha (cpm) | Beta/Gamma (cpm) |
|---|---|---|---|---|
| 21-2536 | 5.0–7.5 | Directly beneath former tank #111 | 25–30 | NA[a] |
| 21-2539 | 7.8–10.0 | Directly beneath footprint old footprint of Building 035 | 800 | NA |
| 21-2541 | 2.0–2.5 | Directly beneath footprint old footprint of Building 035 | 450 | NA |
| 21-2543 | ~4.0 | Outside of the former building footprint, along west side | NA | 280 |
| 21-2544 | 5.0–7.0 | Outside former building footprint along the west side | 250 | 1200 |
| 21-2547 | 5.0–7.0 | Outside the former building footprint along the SW corner, near a former junction box/manhole[b] | 25,000 | 2000 |
| 21-2547A | 6.0–7.5 | Southwest of boring 21-2547 | 250 | 350 |
| 21-2547B | 4.8–5.0 | Southeast of boring 21-2547 | 350 | 340 |
|  | 5.0–7.0 |  | 25–50 | NA |

[a] NA = not applicable

[b] Junction box was a nexus of piping from various buildings, including a 6-in. pipe that carried waste to the absorption beds at MDA T.

## Table B-31
## MDA T Borehole Summary, 1996–1997 Investigation

| Borehole ID | Inclination (angle from horizontal) | Azimuth | Total Depth (ft)[a] | Elevation (ft)[b] | Field Screening and Comments |
|---|---|---|---|---|---|
| 21-05051 | 90 | ND[c] | 150 | 7140.58 | 20–2,600 cpm alpha from 5.0–67.5 ft and 140–360 cpm beta/gamma from 5.0–40.0 ft. |
| 21-05052 | 90 | ND | 150 | 7141.99 | No elevated VOCs or radioactivity based on field screening. |
| 21-05053 | 90 | IND | 90 | 7140.70 | 40– 26,000 cpm alpha and 120–3,800 cpm beta/gamma from 2.5–60 ft. |
| 21-05054 | 90 | ND | 60 | 7147.76 | 40–8,000 cpm alpha and 120–1,600 cpm. |
| 21-05055 | 90 | ND | 15 | 7134.35 | 700–1,060 cpm alpha and 220–460 cpm beta/gamma from 8.5–15.0 ft. Refusal at 15 ft. Replaced with 21-05063. |
| 21-05056 | 90 | ND | 50 | 7133.94 | 60 and 67 cpm alpha at 10–12.5 ft and 15.0–17.5 ft, respectively. |
| 21-05057 | 90 | ND | 50 | 7137.79 | 15–52,000 cpm alpha and 320–40,000 cpm beta/gamma from 20.0-30.0 ft based on field screening. |
| 21-05058 | 90 | ND | 50 | 7137.15 | No elevated VOCs or radioactivity based on field screening. |
| 21-05059 | 90 | ND | 50 | 7136.96 | No elevated VOCs or radioactivity based on field screening. |
| 21-05060 | 60 | N44E | 175 | 7141.92 | No elevated VOCs or radioactivity based on field screening. |
| 21-05061 | 55 | S22E | 190 | 7133.93 | No elevated VOCs or radioactivity based on field screening. |
| 21-05062 | 60 | S10E | 82.5 | 7133.36 | No elevated VOCs or radioactivity based on field screening from surface to a depth of 75 ft. 25,000–43,000 cpm alpha and 10,000–20,000 cpm beta/gamma from 75–83 ft where disposal shaft encountered. Drilling terminated after contacting disposal shaft. |
| 21-05063 | 90 | ND | 110.5 | 7142.66 | No elevated VOCs or radioactivity based on field screening. |
| 21-05064 | 90 | ND | 50 | 7141.78 | 25–350 cpm alpha and 200–400 cpm beta/gamma from 7.5–15.0 ft. |
| 21-05065 | 90 | ND | 50 | 7132.36 | No elevated VOCs or radioactivity based on field screening. |
| 21-05071 | 90 | ND | 200 | 7135.81 | No elevated VOCs or radioactivity based on field screening. |
| 21-05073 | 90 | ND | 70 | 7134.25 | 40–2,570 cpm alpha and 200–600 cpm beta/gamma at 5.0–17.5 ft. 60–100 cpm alpha and 120–140 cpm beta/gamma at 35–50 ft. |
| 21-05074 | 90 | ND | 50 | 7132.29 | 1,000 cpm alpha and 165 cpm beta/gamma from 0.0–2.5 ft. 60 cpm alpha and 140 cpm beta/gamma at 25–27.5 ft. |
| 21-05075 | 90 | ND | 70 | 7135.84 | 20–115 cpm alpha and 200–300 cpm beta/gamma from- 7.5–22.5 ft. 55–115 cpm alpha and 120–140 cpm beta/gamma from 45–50 ft. |

[a] Depth indicated is the vertical depth below ground surface except for the angled holes, in which the total depth indicated is the linear drilling footage.

[b] Elevation in feet above mean sea level.

[c] ND = Not detected.

## Table B-32
## Summary of Tests Performed

| Laboratory Sample Number | Initial Soil Properties[1] ($\rho_0$, $\theta$, $\phi$) | Saturated Hydraulic Conductivity[2] | | Moisture Characteristics[3] | | | | Unsaturated Hydraulic Conductivity | Particle Size[4] | | | Effective Porosity | Particle Density | Air Permeability | Atterberg Limits | Proctor Compaction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | CH | FH | HC | PP | TH | RH | | DS | WS | H | | | | | |
| 0121-97-1321 | X | X | | X | X | X | | X | | | | | | | | |
| 0121-97-1322 | X | X | | X | X | X | | X | | | | | | | | |
| 0121-97-1323 | X | X | | X | X | X | | X | | | | | | | | |
| 0121-97-1324 | X | X | | X | X | X | | X | | | | | | | | |
| 0121-97-1325 | X | X | | X | X | X | | X | | | | | | | | |
| 0121-97-1326 | X | X | | X | X | X | | X | | | | | | | | |
| 0121-97-1327 | X | X | | X | X | X | | X | | | | | | | | |

[1] $\rho_0$ = Initial moisture content, $\theta$ = Dry bulk density, $\phi$ = Calculated porosity

[2] CH = Constant head, FH = falling head

[3] HC = Hanging column, PP = Pressure plate, TH = Thermocouple psychrometer, RH = Relative humidity box

[4] DS = Dry sieve, WS = Wet sieve, H = Hydrometer

Source: Daniel B. Stephens and Associates, Inc., 1997, 76085, p. 2

## Table B-33
## Summary of Initial Moisture Content, Dry Bulk Density, Wet Bulk Density, and Calculated Porosity

| Sample Number | Initial Moisture Content Gravimetric (%, g/g) | Initial Moisture Content Volumetric (%, cm$^3$/cm$^3$) | Dry Bulk Density (g/cm$^3$) | Wet Bulk Density (g/cm$^3$) | Calculated Porosity (%) |
|---|---|---|---|---|---|
| 0121-97-1321 | 18.1 | 24.3 | 1.34 | 1.58 | 49.4 |
| 0121-97-1322 | 22.1 | 29.0 | 1.31 | 1.60 | 50.6 |
| 0121-97-1323 | 20.8 | 26.8 | 1.29 | 1.56 | 51.3 |
| 0121-97-1324 | 25.9 | 30.9 | 1.19 | 1.50 | 55.1 |
| 0121-97-1325 | 18.5 | 24.0 | 1.30 | 1.54 | 51.0 |
| 0121-97-1326 | 20.2 | 25.3 | 1.25 | 1.51 | 52.7 |
| 0121-97-1327 | 18.6 | 23.3 | 1.25 | 1.49 | 52.7 |

Source: Daniel B. Stephens and Associates, Inc., 1997, 76085, p. 8

## Table B-34
## Summary of Saturated Hydraulic Conductivity Tests

| Sample Number | $K_{sat}$ (cm/sec) | Method of Analysis Constant Head | Method of Analysis Falling Head |
|---|---|---|---|
| 0121-97-1321 | 7.3E-03 | X | |
| 0121-97-1322 | 5.2E-03 | X | |
| 0121-97-1323 | 9.5E-03 | X | |
| 0121-97-1324 | 9.9E-03 | X | |
| 0121-97-1325 | 1.1E-02 | X | |
| 0121-97-1326 | 9.4E-03 | X | |
| 0121-97-1327 | 6.5E-03 | X | |

Source: Daniel B. Stephens and Associates, Inc., 1997, 76085, p. 4

## Table B-35
## Summary of Moisture Characteristics of the Initial Drainage Curve

| Sample Number | Pressure Head (-cm water) | Moisture Content (%, $cm^3/cm^3$) |
|---|---|---|
| 0121-97-1321 | 0 | 45.6 |
| | 10 | 44.6 |
| | 41 | 28.9 |
| | 82 | 24.8 |
| | 255 | 20.5 |
| | 3263 | 14.9 |
| | 17541 | 9.8 |
| 0121-97-1322 | 0 | 41.1 |
| | 11 | 39.9 |
| | 42 | 30.4 |
| | 82 | 27.3 |
| | 255 | 23.6 |
| | 3161 | 15.3 |
| | 12951 | 11.1 |
| 0121-97-1323 | 0 | 41.0 |
| | 13 | 38.3 |
| | 40 | 27.2 |
| | 82 | 22.0 |
| | 255 | 19.6 |
| | 3467 | 13.2 |
| | 20804 | 8.7 |
| 0121-97-1324 | 0 | 46.0 |
| | 13 | 42.8 |
| | 40 | 32.1 |
| | 82 | 25.5 |
| | 255 | 22.7 |
| | 3059 | 18.1 |
| | 14991 | 12.9 |
| 0121-97-1325 | 0 | 38.6 |
| | 14 | 37.3 |
| | 40 | 25.5 |
| | 82 | 22.5 |
| | 255 | 19.5 |
| | 3263 | 15.9 |
| | 13869 | 11.0 |
| 0121-97-1326 | 0 | 45.7 |
| | 10 | 41.7 |
| | 41 | 30.0 |
| | 82 | 26.6 |
| | 255 | 23.0 |
| | 2957 | 15.4 |
| | 13053 | 9.4 |
| 0121-97-1327 | 0 | 43.4 |
| | 11 | 42.3 |
| | 42 | 28.3 |
| | 82 | 25.3 |
| | 255 | 21.6 |
| | 3263 | 16.5 |
| | 11932 | 11.7 |

Source: Daniel B. Stephens and Associates, Inc., 1997, 76085, pp. 5–6

## Table B-36
## Summary of Calculated Unsaturated Hydraulic Properties

| | $\alpha$ (cm$^{-1}$) | | | N (dimensionless) | | | | |
|---|---|---|---|---|---|---|---|---|
| | Calculated | 95% Confidence Limits | | Calculated | 95% Confidence Limits | | $\theta_r$ | $\theta_s$ |
| Sample Number | Value | Lower | Upper | Value | Lower | Upper | (%) | (%) |
| 0121-97-1321 | 0.0630 | -0.0580 | 0.1839 | 1.5452 | 0.7807 | 2.3097 | 0.1111 | 0.4680 |
| 0121-97-1322 | 0.0696 | -0.0780 | 0.2172 | 1.2635 | 0.8088 | 1.7181 | 0.0587 | 0.4186 |
| 0121-97-1323 | 0.0648 | -0.0559 | 0.1854 | 1.4773 | 0.8198 | 2.1348 | 0.0932 | 0.4179 |
| 0121-97-1324 | 0.0580 | -0.0371 | 0.1530 | 1.5759 | 0.8311 | 2.3207 | 0.1440 | 0.4661 |
| 0121-97-1325 | 0.0537 | -0.0605 | 0.1678 | 1.6415 | 0.5091 | 2.7738 | 0.1300 | 0.3950 |
| 0121-97-1326 | 0.1175 | -0.1464 | 0.3814 | 1.2545 | 0.8356 | 1.6735 | 0.0431 | 0.4622 |
| 0121-97-1327 | 0.0618 | -0.0689 | 0.1925 | 1.5432 | 0.6778 | 2.4087 | 0.1296 | 0.4448 |

Source: Daniel B. Stephens and Associates, Inc., 1997, 76085, p. 7

## Table B-37
## Field Screening Results for Radionuclides Above Background and VOC Screening Results for the 1996–1997 Field Investigation

| Depth (ft) | Field Radiation (Alpha) (cpm) | Field Radiation (Beta/Gamma) (cpm) | Field Radiation ($H_3/H_2O$) (µCi) | PID (VOC) (ppm) | Comments |
|---|---|---|---|---|---|
| **Borehole 16-001, Location 21-05051** | | | | | |
| 3.5–4.0 | NDA* | NDA | NDA | 0.0 | |
| 6.0–6.5 | 220 | 160 | NDA | 0.0 | |
| 8.5–9.0 | 600 | 200 | NDA | 0.0 | |
| 11.5–12.0 | 170 | 160 | NDA | 0.0 | |
| 13.8–14.5 | 2600 | 360 | NDA | 0.0 | |
| 20.0–21.0 | 800 | 200 | NDA | 0.0 | |
| 27.5–28.0 | 650 | 210 | NDA | 0.0 | |
| 40.0–40.5 | 40 | NDA | NDA | 0.0 | |
| 50.0–50.5 | 45 | NDA | NDA | 0.0 | |
| 61.0–61.5 | 30 | NDA | NDA | 0.0 | |
| 71.0–71.5 | NDA | NDA | NDA | 0.0 | |
| 80.0 - 80.5 | NDA | NDA | NDA | 0.0 | |
| 89.5–90.0 | NDA | NDA | NDA | 0.0 | |
| 99.5–100.0 | NDA | NDA | NDA | 0.0 | |
| 109.0–109.5 | NDA | NDA | NDA | 0.0 | |
| 119.5–120.0 | NDA | NDA | NDA | 0.0 | |
| 129.5–130.0 | NDA | NDA | NDA | 0.0 | |
| 137.5–138.0 | NDA | NDA | NDA | 0.0 | |
| 149.5–150.0 | NDA | NDA | NDA | 0.0 | |
| **Borehole 16-002, Location 21-05052** | | | | | |
| 2.5–3.0 | NDA | NDA | NDA | 0.0 | |
| 9.0–9.5 | NDA | NDA | NDA | 0.0 | |
| 20.0–20.5 | NDA | NDA | NDA | 0.0 | |
| 26.0–27.0 | NDA | NDA | NDA | 0.0 | |
| 39.5–40.0 | NDA | NDA | NDA | 0.0 | |
| 49.5–50.0 | NDA | NDA | NDA | 0.0 | |
| 59.5–60.0 | NDA | NDA | NDA | 0.0 | |
| 70.0–71.0 | NDA | NDA | NDA | 0.0 | |
| 79.5–80.5 | NDA | NDA | NDA | 0.0 | |
| 87.0–88.0 | NDA | NDA | NDA | 0.0 | |
| 96.0–96.5 | NDA | NDA | NDA | 0.0 | |
| 109.0–110.0 | NDA | NDA | NDA | 0.0 | |
| 119.0–120.0 | NDA | NDA | NDA | 0.0 | |
| 130.0–131.0 | NDA | NDA | NDA | 0.0 | |

**Table B-37 (continued)**

| Depth (ft) | Field Radiation (Alpha) (cpm) | Field Radiation (Beta/Gamma) (cpm) | Field Radiation ($H_3/H_2O$) (µCi) | PID (VOC) (ppm) | Comments |
|---|---|---|---|---|---|
| 139.0–140.5 | NDA | NDA | NDA | 0.0 | |
| 149.0–150.0 | NDA | NDA | NDA | 0.0 | |
| 129.5–130.0 | NDA | NDA | NDA | 0.0 | |
| 137.5–138.0 | NDA | NDA | NDA | 0.0 | |
| 149.5–150.0 | NDA | NDA | NDA | 0.0 | |
| **Borehole 16-003, Location 21-05053** | | | | | |
| 4.2–4.6 | 950 | 400 | NDA | 0.0 | |
| 6.5–7.0 | 550 | 2400 | NDA | 0.0 | |
| 9.5–10.0 | 26000 | 3800 | NDA | 0.0 | |
| 12.5–13.0 | 160 | 140 | NDA | 0.0 | |
| 17.0–17.3 | 40 | 120 | NDA | 0.0 | |
| 20.5–21.5 | 100 | 140 | NDA | 0.0 | |
| 28.0–29.0 | 220 | 200 | NDA | 0.0 | |
| 39.5–40.0 | NDA | NDA | NDA | 0.0 | |
| 48.0–48.5 | 125 | 140 | NDA | 0.0 | |
| 59.5–60.0 | 175 | 150 | NDA | 0.0 | |
| 60.0–60.7 | 1200 | 300 | NDA | 0.0 | |
| 74.5–75.0 | NDA | NDA | NDA | 0.0 | |
| 80.0–80.5 | NDA | NDA | NDA | 0.0 | |
| 89.5–90.0 | NDA | NDA | NDA | 0.0 | |
| **Borehole 16-004, Location 21-05054** | | | | | |
| 3.0–3.5 | NDA | NDA | NDA | 0.0 | |
| 6.0–6.5 | 1125 | 300 | NDA | 0.0 | |
| 7.5–8.2 | 3800 | 1000 | NDA | 0.0 | |
| 10.5–11.0 | 8000 | 1600 | NDA | 0.0 | |
| 14.2–15.0 | 800 | 260 | NDA | 0.0 | |
| 21.8–22.1 | 2600 | 500 | NDA | 0.0 | |
| 32.0–32.5 | 65 | 160 | NDA | 0.0 | |
| 35.5–36.0 | 450 | 160 | NDA | 0.0 | |
| 50.0–50.5 | NDA | NDA | NDA | 0.0 | |
| 59.5–60.0 | NDA | NDA | NDA | 0.0 | |
| **Borehole 16-005, Location 21-05055** | | | | | |
| 3.5–4.0 | NDA | NDA | NDA | 0.0 | |
| 8.5–9.0 | 700 | 220 | NDA | 0.0 | |
| 14.5–15.0 | 1060 | 460 | NDA | 0.0 | |

**Table B-37 (continued)**

| Depth (ft) | Field Radiation (Alpha) (cpm) | Field Radiation (Beta/Gamma) (cpm) | Field Radiation ($H_3/H_2O$) (µCi) | PID (VOC) (ppm) | Comments |
|---|---|---|---|---|---|
| **Borehole 16-006, Location 21-05056** | | | | | |
| 4.5–5.0 | NDA | NDA | NDA | 0.0 | |
| 11.8–12.2 | 60 | NDA | NDA | 0.0 | |
| 20.0–20.5 | NDA | NDA | NDA | 0.0 | |
| 29.0–29.5 | NDA | NDA | NDA | 0.0 | |
| 39.0–39.5 | NDA | NDA | NDA | 0.0 | |
| 49.5–50.0 | NDA | NDA | NDA | 0.0 | |
| **Borehole 16-007, Location 21-05057** | | | | | |
| 4.3–5.0 | NDA | NDA | NDA | 0.0 | |
| 9.5–10.0 | NDA | NDA | NDA | 0.0 | |
| 19.5–20.0 | NDA | NDA | NDA | 0.0 | |
| 22.5–23.9 | 52000 | 40000 | 90 | 0.0 | per cubic m |
| 29.5–30.0 | 15 | NDA | NDA | 0.0 | |
| 39.5–40.0 | NDA | NDA | NDA | 0.0 | |
| 49.5–50.0 | NDA | NDA | NDA | 0.0 | |
| **Borehole 16-008, Location 21-05058** | | | | | |
| 4.5–5.0 | NDA | NDA | NDA | 0.0 | |
| 7.7–8.2 | NDA | NDA | NDA | 0.0 | |
| 17.5–18.2 | NDA | NDA | NDA | 0.0 | |
| 29.5–30.0 | NDA | NDA | NDA | 0.0 | |
| 39.5–40.0 | NDA | NDA | NDA | 0.0 | |
| 48.5–50.0 | NDA | NDA | NDA | 0.0 | |
| **Borehole 16-009, Location 21-05059** | | | | | |
| 4.0–4.5 | NDA | NDA | NDA | 0.0 | |
| 10.2–10.7 | NDA | NDA | NDA | 0.0 | |
| 20.0–20.5 | NDA | NDA | NDA | 0.0 | |
| 31.5–32.0 | NDA | NDA | NDA | 0.0 | |
| 36.4–36.8 | NDA | NDA | NDA | 0.0 | |
| 40.0–40.5 | NDA | NDA | NDA | 0.0 | |
| 49.5–50.0 | NDA | NDA | NDA | 0.0 | |
| **Borehole 16-010, Location 21-05060** | | | | | |
| 4.5–5.0 | NDA | NDA | NDA | 0.0 | |
| 10.0–10.5 | NDA | NDA | NDA | 0.0 | |
| 20.0–20.5 | NDA | NDA | NDA | 0.0 | |
| 30.0–30.5 | NDA | NDA | NDA | 0.0 | |
| 42.0–42.5 | NDA | NDA | NDA | 0.0 | |
| 50.0–50.5 | NDA | NDA | NDA | 0.0 | |

## Table B-37 (continued)

| Depth (ft) | Field Radiation (Alpha) (cpm) | Field Radiation (Beta/Gamma) (cpm) | Field Radiation ($H_3/H_2O$) (µCi) | PID (VOC) (ppm) | Comments |
|---|---|---|---|---|---|
| 60.0–60.5 | NDA | NDA | NDA | 0.0 | |
| 40.0–40.5 | NDA | NDA | NDA | 0.0 | |
| 50.0–50.5 | NDA | NDA | NDA | 0.0 | |
| 69.5–70.0 | NDA | NDA | NDA | 0.0 | |
| 79.5–80.0 | NDA | NDA | NDA | 0.0 | |
| 89.0–89.5 | NDA | NDA | NDA | 0.0 | |
| 99.5–100.0 | NDA | NDA | NDA | 0.0 | |
| 109.0–109.2 | NDA | NDA | NDA | 0.0 | |
| 118.5–119.0 | NDA | NDA | NDA | 0.0 | |
| 129.0–129.5 | NDA | NDA | NDA | 0.0 | |
| 139.0–139.5 | NDA | NDA | NDA | 0.0 | |
| 150.0–150.0 | NDA | NDA | NDA | 0.0 | |
| 160.0–160.5 | NDA | NDA | NDA | 0.0 | |
| 169.5–170.0 | NDA | NDA | NDA | 0.0 | |
| 174.5–175.0 | NDA | NDA | NDA | 0.0 | |
| **Borehole 16-011, Location 21-05061** | | | | | |
| 5.5–6.0 | NDA | NDA | NDA | 0.0 | |
| 10.0–10.5 | NDA | NDA | NDA | 0.0 | |
| 22.0–22.5 | NDA | NDA | NDA | 0.0 | |
| 30.0–30.5 | NDA | NDA | NDA | 0.0 | |
| 40.0–40.5 | NDA | NDA | NDA | 0.0 | |
| 49.0–49.5 | NDA | NDA | NDA | 0.0 | |
| 59.5–60.0 | NDA | NDA | NDA | 0.0 | |
| 69.5–70.0 | NDA | NDA | NDA | 0.0 | |
| 78.5–78.8 | NDA | NDA | NDA | 0.0 | |
| 89.5–90.0 | NDA | NDA | NDA | 0.0 | |
| 98.7–99.2 | NDA | NDA | NDA | 0.0 | |
| 108.5–109.0 | NDA | NDA | NDA | 0.0 | |
| 118.0–118.5 | NDA | NDA | NDA | 0.0 | |
| 128.5–129.0 | NDA | NDA | NDA | 0.0 | |
| 140.0–140.5 | NDA | NDA | NDA | 0.0 | |
| 152.5–153.0 | NDA | NDA | NDA | 0.0 | |
| 160.0–160.5 | NDA | NDA | NDA | 0.0 | |
| 170.0–170.5 | NDA | NDA | NDA | 0.0 | |
| 180.0–180.5 | NDA | NDA | NDA | 0.0 | |
| 189.5–190.0 | NDA | NDA | NDA | 0.0 | |

**Table B-37 (continued)**

| Depth (ft) | Field Radiation (Alpha) (cpm) | Field Radiation (Beta/Gamma) (cpm) | Field Radiation ($H_3/H_2O$) (µCi) | PID (VOC) (ppm) | Comments |
|---|---|---|---|---|---|
| **Borehole 16-012, Location 21-05062** | | | | | |
| 5.0–5.5 | NDA | NDA | NDA | 0.0 | |
| 6.0–6.5 | NDA | NDA | NDA | 0.0 | |
| 10.0–10.5 | NDA | NDA | NDA | 0.0 | |
| 20.0–20.5 | NDA | NDA | NDA | 0.0 | |
| 30.0–30.5 | NDA | NDA | NDA | 0.0 | |
| 40.0–40.5 | NDA | NDA | NDA | 0.0 | |
| 49.5–50.0 | NDA | NDA | NDA | 0.0 | |
| 58.8–59.5 | NDA | NDA | NDA | 0.0 | |
| 70.0–70.5 | NDA | NDA | NDA | 0.0 | |
| 78.4–79.5 | 25000 | 10000 | NDA | 0.0 | |
| **Borehole 16-013, Location 21-05063** | | | | | |
| 4.5–5.0 | NDA | NDA | NDA | 0.0 | |
| 7.5–8.3 | NDA | NDA | NDA | 0.0 | |
| 10.0–11.6 | NDA | NDA | NDA | 0.0 | |
| 20.0–20.5 | NDA | NDA | NDA | 0.0 | |
| 30.5–31.3 | NDA | NDA | NDA | 0.0 | |
| 41.0–42.0 | NDA | NDA | NDA | 0.0 | |
| 49.0–50.0 | NDA | NDA | NDA | 0.0 | |
| 59.5–60.0 | NDA | NDA | NDA | 0.0 | |
| 69.5–70.0 | NDA | NDA | NDA | 0.0 | |
| 78.0–78.5 | NDA | NDA | NDA | 0.0 | |
| 89.5–90.0 | NDA | NDA | NDA | 0.0 | |
| 99.5–100.0 | NDA | NDA | NDA | 0.0 | |
| 110.0–110.5 | NDA | NDA | NDA | 0.0 | |
| **Borehole 16-014, Location 21-05064** | | | | | |
| 3.5–4.0 | NDA | NDA | NDA | 0.0 | |
| 8.5–9.0 | 25 | NDA | NDA | 0.0 | |
| 11.5–12.0 | 80 | 200 | NDA | 0.0 | |
| 13.5–13.9 | 350 | 400 | NDA | 0.0 | |
| 20.0–20.5 | NDA | NDA | NDA | 0.0 | |
| 29.5–30.0 | NDA | NDA | NDA | 0.0 | |
| 39.5–40.0 | NDA | NDA | NDA | 0.0 | |
| 49.5–50.0 | NDA | NDA | NDA | 0.0 | |

## Table B-37 (continued)

| Depth (ft) | Field Radiation (Alpha) (cpm) | Field Radiation (Beta/Gamma) (cpm) | Field Radiation ($H_3/H_2O$) (µCi) | PID (VOC) (ppm) | Comments |
|---|---|---|---|---|---|
| **Borehole 16-015, Location 21-05065** | | | | | |
| 4.5–5.0 | NDA | NDA | NDA | 0.0 | |
| 10.0–10.5 | NDA | NDA | NDA | 0.0 | |
| 19.5–20.0 | NDA | NDA | NDA | 0.0 | |
| 29.5–30.0 | not recorded | not recorded | not recorded | not recorded | |
| 39.5–40.0 | NDA | NDA | NDA | 0.0 | |
| 48.2–48.7 | NDA | NDA | NDA | 0.0 | |
| **Borehole 16-021, Location 21-05071** | | | | | |
| 5.0–5.5 | NDA | NDA | NDA | 0.0 | |
| 9.5–10.0 | NDA | NDA | NDA | 0.0 | |
| 20.0–20.5 | NDA | NDA | NDA | 0.0 | |
| 28.5–29.0 | NDA | NDA | NDA | 0.0 | |
| 34.0–34.5 | NDA | NDA | NDA | 0.0 | |
| 42.0–42.5 | NDA | NDA | NDA | 0.0 | |
| 50.5–51.0 | NDA | NDA | NDA | 0.0 | |
| 61.0–61.5 | NDA | NDA | NDA | 0.0 | |
| 70.0–70.5 | NDA | NDA | NDA | 0.0 | |
| 80.0–80.5 | NDA | NDA | 14 | 0.0 | per cubic m |
| 90.0–90.5 | NDA | NDA | 22 | 0.0 | per cubic m |
| 97.0–97.5 | NDA | NDA | 26 | 0.0 | per cubic m |
| 100.0–100.5 | NDA | NDA | 10 | 0.0 | per cubic m |
| 104.2–105.0 | NDA | NDA | 120 | 0.0 | per cubic m |
| 109.5–110.0 | NDA | NDA | 10 | 0.0 | per cubic m |
| 118.5–119.5 | NDA | NDA | 30 | 0.0 | per cubic m |
| 129.5–130.0 | NDA | NDA | 12 | 0.0 | per cubic m |
| 140.0–141.0 | NDA | NDA | 10 | 0.0 | per cubic m |
| 149.0–149.5 | NDA | NDA | 32 | 0.0 | per cubic m |
| 159.5–160.0 | NDA | NDA | 30 | 0.0 | per cubic m |
| 170.0–171.0 | NDA | NDA | 40 | 0.0 | per cubic m |
| 180.0–181.0 | NDA | NDA | 40 | 0.0 | per cubic m |
| 190.0–191.0 | NDA | NDA | 40 | 0.0 | per cubic m |
| 197.0–198.0 | NDA | NDA | 60 | 0.0 | per cubic m |
| **Borehole 16-023, Location 21-05073** | | | | | |
| 2.5–3.0 | NDA | NDA | NDA | 0.0 | |
| 8.5–9.0 | 25770 | 600 | NDA | 0.0 | |
| 11.7–12.2 | 682 | 260 | NDA | 0.0 | |
| 22.0–23.0 | NDA | NDA | NDA | 0.0 | |

## Table B-37 (continued)

| Depth (ft) | Field Radiation (Alpha) (cpm) | Field Radiation (Beta/Gamma) (cpm) | Field Radiation ($H_3/H_2O$) (μCi) | PID (VOC) (ppm) | Comments |
|---|---|---|---|---|---|
| 32.0–32.5 | NDA | NDA | NDA | 0.0 | |
| 42.0–42.5 | 85 | 140 | NDA | 0.0 | |
| 46.5–47.0 | 100 | 140 | NDA | 0.0 | |
| 62.0–62.5 | NDA | NDA | NDA | 0.0 | |
| 69.5–70.0 | NDA | NDA | NDA | 0.0 | |
| **Borehole 16-024, Location 21-05074** | | | | | |
| 0.8–1.3 | 1000 | 165 | NDA | 0.0 | |
| 9.0–9.5 | NDA | NDA | NDA | 0.0 | |
| 19.5–20.0 | NDA | NDA | NDA | 0.0 | |
| 26.5–26.9 | 60 | 140 | NDA | 0.0 | |
| 39.5–40.0 | NDA | NDA | NDA | 0.0 | |
| 48.5–49.0 | NDA | NDA | NDA | 0.0 | |
| **Borehole 16-025, Location 21-05075** | | | | | |
| 6.7–7.2 | NDA | NDA | NDA | 0.0 | |
| 8.8–9.3 | 80 | 280 | NDA | 0.0 | |
| 15.5–16.0 | 115 | 300 | NDA | 0.0 | |
| 20.0–21.0 | 20 | 200 | NDA | 0.0 | |
| 29.5–30.0 | NDA | NDA | NDA | 0.0 | |
| 38.8–39.3 | NDA | NDA | NDA | 0.0 | |
| 45.0–46.0 | 115 | 120 | NDA | 0.0 | |
| 58.0–58.5 | NDA | NDA | NDA | 0.0 | |
| 69.5–70.0 | NDA | NDA | NDA | 0.0 | |

*NDA = No detectable activity.

## Table B-38
## Fracture Intervals vs. Sample Interval for 1996–1997 Boreholes

| Location ID | Sample ID | Sample Interval(ft) | Fracture Encountered (ft) |
|---|---|---|---|
| 21-05051 | 0121-97-0005 | 1B.224.5 | 1B.225 |
| | 0121-97-0006 | 20–21 | 21–22 |
| | | none collected | 33.5 hairline fracture |
| 21-05052 | | none collected | 28-29 |
| 21-05053 | 0121-97-0055 | 17–17.3 | 17 |
| | 0121-97-0056 | 20.5–21.5 | 20.5–21.5 thin |
| | 0121-97-0057 | 28–29 | 27–29 |
| | | none collected | 29–32.5 |
| | | none collected | 35.5 |
| | | none collected | 42 |
| | | none collected | 44.5–45 |
| | | none collected | 44.5–48 |
| | | none collected | 51–53 |
| | | none collected | 53–55 |
| | 0121-97-0060 | 59.5–60 | 59.5–59.8 |
| | 0121-97-0061 | 60–60.7 | 60–60.7 |
| | 0121-97-0062 | 74.5–75 | 72.5–75 |
| 21-05054 | | none collected | 13 |
| | 0121-97-0070 | 14.2–15 | 1B.226.2 |
| | 0121-97-0071 | 21.8–22.1 | 21.9 |
| | 0121-97-0072 | 32–32.5 | 32.3 |
| | | none collected | 33 |
| | 0121-97-0073 | 35.5–36 | 35.5–36 |
| | | none collected | 36.8–38 |
| | | | no fractures |
| 21-05056 | 0121-97-0097 | 11.8–12.2 | 11.8–12.2 |
| | | none collected | 23.2 |
| | | none collected | 28 |
| | 0121-97-0099 | 29–29.5 | 29 |
| | 0121-97-0100 | 39–39.5 | 35–40 |
| | | none collected | 40–43 |
| | | none collected | 44.5 |
| | 0121-97-0101 | 49.5–50 | 48–50 |
| 21-05057 | | | no fractures |
| 21-05058 | | none collected | 22 |
| | | none collected | 31.7 |
| 21-05059 | | | no fractures |

### Table B-38 (continued)

| Location ID | Sample ID | Sample Interval | Fracture Encountered |
|---|---|---|---|
| 21-05060<br>Angled borehole: depth is not representative of ft bgs. | | none collected | 37.4 |
| | 0121-97-0140 | 42–42.5 | 41.2–42.5 |
| | | none collected | 76.2 |
| 21-05061<br>Angled borehole: depth is not representative of ft bgs. | | none collected | 14.2 |
| | 0121-97-0168 | 22–22.5 | 22 |
| | | none collected | 46.3 |
| | 0121-97-0171 | 49–49.5 | 49–50 |
| 21-05062<br>Angled borehole: depth is not representative of ft bgs. | 0121-97-0193 | 10–10.5 | 9.2–10 |
| | | none collected | 12.2 |
| | | none collected | 12.5–14 |
| | | none collected | 20.8 |
| | | none collected | 34.5 |
| | 0121-97-0196 | 40–40.5 | 40.5–41.8 |
| | | none collected | 54 |
| | | none collected | 52.5 |
| 21-05063 | 0121-97-0223 | 10–11.6 | 10–11.6 |
| | | none collected | 38 |
| 21-05064 | | none collected | 30.8–31.2 |
| 21-05065 | | none collected | 3.0–5.0 |
| | | none collected | 12–12.5 |
| | | none collected | 15 |
| | | none collected | 21.7 |
| | | none collected | 26.1 |
| | | none collected | 26.8 |
| | | none collected | 27.8 |
| | 0121-96-0624 | 29.5–30 | 29.4 |
| | | none collected | 32.2 |
| | | none collected | 33.7 |
| | | none collected | 41.7 |
| 21-05071 | 0121-97-1167 | 50.5–51 | 50–51 possible fracture |
| 21-05073 | | none collected | 16.5 |
| | 0121-97-0329 | 22–23 | 22–23 |
| | 0121-97-0330 | 32–32.5 | 32 |
| | | none collected | 37.5–38 |
| | | none collected | 40.5 |
| | 0121-97-0331 | 42–42.5 | 42 |
| | 0121-97-0331 | none collected | 43–44 |
| | | none collected | 54.6–55 |

## Table B-38 (continued)

| Location ID | Sample ID | Sample Interval | Fracture Encountered |
|---|---|---|---|
| 21-05074 | 0121-97-1004 | 26.5–26.9 | 26.8 |
| | | none | 36–36.5 |
| 21-05075 | | none | 36 |
| | | | no fractures |
| 21-05056 | 0121-97-0097 | 11.8–12.2 | 11.8–12.2 |
| | | none collected | 23.2 |
| | | none collected | 28 |
| | 0121-97-0099 | 29–29.5 | 29 |
| | 0121-97-0100 | 39–39.5 | 35–40 |
| | | none collected | 40–43 |
| | | none collected | 44.5 |
| | 0121-97-0101 | 49.5–50 | 48–50 |
| 21-05057 | | | no fractures |
| 21-05058 | | none collected | 22 |
| | | none collected | 31.7 |
| 21-05059 | | | no fractures |
| 21-05060<br>Angled borehole: depth is not representative of ft bgs. | | none collected | 37.4 |
| | 0121-97-0140 | 42–42.5 | 41.2–42.5 |
| | | none collected | 76.2 |
| 21-05061<br>Angled borehole: depth is not representative of ft bgs. | | none collected | 14.2 |
| | 0121-97-0168 | 22–22.5 | 22 |
| | | none collected | 46.3 |
| | 0121-97-0171 | 49–49.5 | 49–50 |
| 21-05062<br>Angled borehole: depth is not representative of ft bgs. | 0121-97-0193 | 10–10.5 | 9.2–10 |
| | | none collected | 12.2 |
| | | none collected | 12.5–14 |
| | | none collected | 20.8 |
| | | none collected | 34.5 |
| | 0121-97-0196 | 40–40.5 | 40.5–41.8 |
| | | none collected | 54 |

# Appendix C

## *Management Plan for Investigation-Derived Waste*

## C-1.0 MANAGEMENT OF INVESTIGATION-DERIVED WASTE

This section of the work plan describes how investigation-derived waste (IDW) generated during the investigation of MDA T will be managed. IDW is solid waste generated as a result of field investigation activities and may include, but is not limited to, drill cuttings; purge water; contaminated personal protective equipment (PPE), sampling supplies, and plastic; fluids from 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 including groundwater, surface water, surface and subsurface soils, rocks, bedrock, and gravel. Consistent with the U.S. Environmental Protection Agency (EPA) "area of contamination" policy, environmental media is not considered to be a waste (and, hence, not IDW) if it is returned to its point of origin. IDW generated during the investigation of MDA T will be managed in a way that is protective of human health and the environment, compliant with applicable regulatory requirements, and consistent with Los Alamos National Laboratory (LANL or the Laboratory) waste minimization goals.

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

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

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

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

The waste streams that will be generated and managed during the work plan at MDA T include the following:

- Drill cuttings;
- 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 SWMU 21-016(a)-99 Investigation Work Plan**

| Waste Stream | Waste Type | Volume | Shipped To |
|---|---|---|---|
| Drill cuttings | Solid, Low-level waste (LLW) | 54 yd$^3$ | LANL, TA-54, Area G |
| PPE, plastic, and other IDW | Solid, LLW | 6 yd$^3$ | LANL, TA-54, Area G |
| Decontamination fluids | Liquid, LLW | 300 gal | LANL, TA-50, RLWTF |

The waste characterization for the work plan waste streams will be based on waste characterization samples and RFI samples collected in 1996 and 1997. The existing Waste Characterization Strategy Form (WCSF) will be used and updated with an addendum, as needed. Existing Waste Profile Forms (WPFs) will be used or referenced for new WPFs, as needed.

Drill cuttings and other IDW from the VCM will be managed as LLW in a Radioactive Waste Storage Area, due to the presence of radionuclides (principally uranium isotopes,cesium-137, strontium-90, americium-241 and plutonium-238 and -239) in the waste streams.

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

The selection of waste containers will be based on the appropriate Department of Transportation (DOT) requirements, and the type and amount of IDW planned for generation. Each waste container will be individually labeled as to the waste classification, item identification number, radioactivity (if applicable), and date of generation immediately following containerization. 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 IDW type and classification. Container and storage requirements will be detailed in the WCSF and approved prior to the generation of waste.

Transportation of IDW will comply with appropriate DOT requirements. Depending on waste classification, disposal of solid IDW will take place either onsite at LANL TA-54 Area G, or at an approved offsite disposal facility. Liquid IDW may be processed at the TA-50 Radioactive Liquid Waste Treatment Facility (RLWTF) or the TA-46 Sanitary Wastewater Systems (SWS) Plant. Hazardous and/or mixed waste may be transported and stored at TA-54 Area L prior to offsite disposal. Transportation and disposal requirements will be detailed in the WCSF and approved prior to the generation of waste.

# Appendix D

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## *Borehole Logs*

## LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

**SAMPLE MANAGEMENT FACILITY**

## CORE SAMPLE LOG

Borehole ID 16-001 TA/OU 21 Drill Depth From 0 To 30 Page 1 of 5

Driller Stewart Bro Box #(s) N/A Start Date/Time 1/27/97 1000 End Date/Time 1/30/97 1300

Drilling Equip./Method CME 750 / Auger Sampling Equip./Method Split Spoon / Core

Location ID: 21-05051

Contamination Criteria

| 1/27/97 | 1/28/97 | 1/29/97 | 1/30/97 |
|---|---|---|---|
| α: 12cpm<br>βγ: 138cpm | α: 15cpm<br>βγ: 100cpm | α: 11cpm<br>βγ: 102cpm | α: 12cpm<br>βγ: 81cpm |

Drilling at east end of absorption bed #1 MDA-T TA-21.

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 0 | 1.5/2.5 | N/A | NDA | N/A | 0-1.5' dk-pale brown 5YR 5/2, moist clay/crushed tuff, 6" organics (grasses, roots)<br>1.5-2.5' No Recovery |  | Backfill | 1/27/97 0810 Moving and setting up equipment<br>Run #1 1030 |
|  | 1.5/2.5 | 0127 97 0001, 2.5-4' | NDA |  | 2.5-4 lt. brown 5YR 6/4, damp crushed tuff/silts/sand<br>4-5' No Recovery |  |  | Run #2 1047 |
| 5 | 1.5/2.5 | 0127-97 0002 6-6.5 | α: 222cpm<br>βγ: 160cpm<br>6-6.5 |  | 5-6' lt brown 5YR 6/4 damp crushed tuff with lg tuff fragments, trace gravel at 6'.<br>6-6.5' dk brown moist clay<br>6.5-7.5' No Recovery (clay swelled barrel) |  |  | Run #3 1105 |
|  | 1.5/1.5 | 0127-97 0003 7.5-? | α: 600cpm<br>βγ: 330cpm |  | 7.5-9' dk brown, mix of fine-med grain sand with silt and gravels (50%), moist |  | Absorption Bed | Run #4 1130 |
| 10 | Center Bit |  |  |  | 9-11.5' Center Bit through cobble zone, No Recovery |  |  | Run #5 1145 Center Bit |
|  | 3.5/3.5 | 0127-97 0004 11.5-12<br>0127-97 0005 13.8-14.5 | α: 172cpm<br>βγ: 160cpm<br>11.5'<br>α: 2600cpm<br>βγ: 360cpm<br>13.8-14.5' |  | 11.5-11.8' Pale brown 5YR 5/2 moist fine-med grain sand/crushed tuff sharp flat contact<br>11.8-15' Grayish pink 5YR 7/2, damp mod welded tuff. Fractured at 13.8-15' lt brown 5YR 5/6 clay fill, 0.2-.3" wide at widest point. Clay upto α 2600cpm βγ: 360cpm @ surrounding tuff slight alteration along fracture surface. Surrounding tuff α: 1300cpm |  |  | Run #6 1210 |
| 15 | 5/5 | N/A | α: 260cpm<br>15-15.3'<br>α: 150cpm<br>15.3-18'<br>α: 70cpm<br>18-20'<br>βγ NDA |  | 15-20' Grey mod welded damp-moist tuff above fracture continues to 15.3' α: 260cpm Tuff 15.3'-18' is solid (no fractures) with α: 150cpm. 18-20' (no fractures) α: 70cpm Note that tuff is very damp and βγ is NDA. |  | Bandelier Tuff Unit #3 | lunch break 1345<br>Run #7 1410 |
| 20 | 5/5 | 0127-97 0006 20-21 | α: 800<br>βγ: 200<br>22.5'<br>α: 130cpm<br>βγ: 250cpm<br>24' |  | 20-25' SAA Fracture at 60° 21-22' clay filled α: 800cpm βγ 1200cpm, rootlets. non-fractured tuff at 24' α: 130cpm βγ: 250cpm |  |  | Run #8 1430 |
| 25 | 5/5 | 0127-97 0007 ~~28~~ 27.5-28 | α: 650cpm<br>βγ: 210cpm<br>27.5' |  | 25-30' lt gray mod-strongly welded tuff drying with depth. No visible fractures 27.5-28' weak-mod welded α: 650cpm βγ 210cpm Non fractured tuff at 30' α 300cpm βγ 200cpm |  |  | Run #9 1515 |
| 30 |  |  |  |  |  |  |  |  |

Prepared By J. Wolterscheid Date 1/30/97 Checked By Date 2/3/97

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**LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM**

**SAMPLE MANAGEMENT FACILITY**

**CORE SAMPLE LOG**

Borehole ID 16-001 TA/OU 21 Drill Depth From 30 To 60 Page 2 of 2

Driller Stewart Bros Box #(s) N/A Start Date/Time 1/27/97 1200 End Date/Time 1/30/97 1300

Drilling Equip./Method CME750/ Auger Sampling Equip./Method Split Spoon / Core

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 30 | 5/5 | N/A | α: 380cpm<br>By: 190cpm<br>33.5' | N/A | 30-35 Gray mod welded tuff. Slight increase in moisture. Small hairline fracture with trace alteration (FeOx staining) at 33.5'<br>α 380cpm By 190cpm<br>30-33.5 α: 100cpm<br>34-35' α: 70cpm | | | Run #10<br>Note tuff is moist and damp.<br>End of Day 1610 |
| 35 | 5/5 | N/A | α: 140cpm<br>By: 140cpm<br>36'<br>α: 120cpm<br>35-40' | | 35-40' Gray mod. welded tuff slight increase in pumice. No visible fractures. avg. α: 120cpm over length of core. Faint FeOx staining at 38' α: 140cpm By: 140cpm drying with depth | | Bandelier Tuff Unit #3 | Run #11 0950<br>1/28/97 |
| 40 | 5/5 | 0121-97<br>0008<br>40-42.5 | α: 40cpm<br>By: NDA<br>40-45' | | 40-45' Gray 5YR7/2 mod welded tuff. Dry. No visible fractures. α 40cpm over length of core (40-45') | | | Run #12 1020 |
| 45 | 5/5 | N/A | α: 45cpm<br>By: NDA<br>45-50' | | 45-50' SAA. dry, no fractures. α 45cpm 45-50' | | | Run #13 1040 |
| 50 | 5/5 | 0121<br>97<br>0009<br>50-52.5 | α: 45cpm<br>By: NDA<br>50-55' | | 50-55' SAA, no fractures, trace moisture (no dust when sampling) α 48cpm 50-55'. | | | Run #14 1120 |
| 55<br>60 | 5/5 | N/A | α: 30cpm<br>By: NDA<br>55-60' | | 55-58' SAA No fractures, α 30cpm<br>58-60' Gray. 5YR 7/2 mod welded, FeOx spotting on tuff, dry. α 30cpm No visible fractures. | | | Run #15 1155 |

Prepared By J. Walterscheid Date 1/30/97 Checked By Date 2/3/97

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**LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM**

**SAMPLE MANAGEMENT FACILITY**

**CORE SAMPLE LOG**

**Borehole ID** 16-001 **TA/OU** 21 **Drill Depth From** 60 **To** 90 **Page** 3 **of** 5

**Driller** Stewart Bro. **Box #(s)** NA **Start Date/Time** 1/27/97 1000 **End Date/Time** 1/30/97 1300

**Drilling Equip./Method** CME 750/auger **Sampling Equip./Method** Split Spoon/Core

| Depth (Feet) | Recovery (feet per foot/ %) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 60<br>65 | 1.5/5 | 0121<br>97<br>0010<br>61-61.5 | α:30cpm<br>By:NOA<br>60-61.5 | N/A | 60-61.5' Gray 10YR 6/2, non to partially welded (soft and crumbly) tuff. Tuff is damp. Thin FeOx layering 60.5-61.5'.<br>61.5-65' No Recovery | Loss | | Run# 16 1215<br>Tuff is almost sandy<br>Sample fell out of barrel during retrieval<br>lunch 1230 |
| | 2.5/2.5 | N/A | α:20cpm<br>By:NOA | | 65-67.5' Gray weakly welded, damp tuff No visable fractures. Trace FeOx staining. | | | Run # 17 1350 |
| 70 | 2/2.5 | N/A | α:20cpm<br>By:NOA | | 67.5-69.5' Gray non to weakly welded tuff. Drying out. Note softer (loosely packed) with depth. Slight increase in pumice.<br>69.5-70' No Recovery | Loss | Bandelier Tuff Unit #3 | Run # 18 1410 |
| | 1.5/2.5 | 0121<br>97<br>0011<br>71-71.5 | NOA | | 70-71.5' Gray non-welded (soft) tuff. Still holding some moisture (no dust).<br>71.5-72.5' No Recovery | Loss | | Run # 19 1440<br>Tuff is to soft to push up into catcher. |
| 75 | 1.0/2.5 | N/A | NOA | | 72.5-73.5' Gray non-welded (soft, loose) tuff. damp (increase in moisture)<br>73.5-75' No Recovery | Loss | | Run# 20 1505 |
| | 1.5/2.5 | N/A | NDA | | 75-76.5' Gray non-welded, soft, tuff. damp.<br>76.5-77.5' No Recovery | Loss | | Run# 21 1530 |
| 80 | 1.5/2.5 | N/A | NOA | | 77.5-79' Gray non-welded, soft, damp, tuff.<br>79-80' No Recovery | Loss | | Run# 22 1550<br>End of Day 1600 |
| | 2.5/2.5 | 0121<br>97<br>0012<br>82-82.5 | NDA | | 80-82.5' Gray non to weakly welded, damp. tuff. lg. pumice fragments (white) | | | 1/29/97 0850<br>Run# 23 0940 |
| 85 | 2.5/2.5 | N/A | NOA | | 82.5-85' Gray non welded, damp, tuff. Trace FeOx spotting. | | | Run #24 1005<br>Sandy Tuff<br>(No picture) |
| | 2.5/2.5 | N/A | NDA | | 85-87.5' lt. gray non-welded, damp (drying out with depth) tuff. FeOx spotting. (sandy) | | | Run # 25 1020<br>Sandy Tuff |
| 90 | 2.5/2.5 | 0121 97<br>~~N/A~~<br>0013<br>87.5-90 | NOA | | 87.5-90' lt. gray non-welded soft, tuff. Trace FeOx spotting | | | Run # 26 1045<br>Sandy tuff |

**Prepared By** J. Wattersheid **Date** 1/30/97 **Checked By** **Date** 2/3/97

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## LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

**SAMPLE MANAGEMENT FACILITY**

## CORE SAMPLE LOG

Borehole ID 16-021 TA/OU 21 Drill Depth From 90 To 120 Page 4 of 5

Driller Stewart Bros. Box #(s) NA Start Date/Time 1/27/97 1000 End Date/Time 1/30/97 1300

Drilling Equip./Method CME 750/ Auger Sampling Equip./Method Split Spoon/ Core

| Depth (Feet) | Recovery (feet per foot/ %) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 90 | 2.5/2.5 | N/A | NDA | N/A | 90-92.5' lt gray very weakly welded, damp tuff. Trace FeOx spotting. | | Bandelier Tuff Unit #3 | Run #27 1100<br>Sandy tuff |
| | 2.5/2.5 | N/A | NDA | | 92.5-95 Gray 10YR 6/2 weakly welded / slightly drying out with depth. trace FeOx spotting | | | Run #28 1115 |
| 95 | 2.5/2.5 | N/A | NDA | | 95-97.5' Gray very weakly welded tuff. Drying with depth (no dust almost friable tuff) | | | Run #29 1130 |
| | 2.5/2.5 | 0131 97<br>0014<br>97.5-100 | NDA | | 97.5-100' Grayish-brown very weakly welded tuff, damp Trace FeOx. | | | Run #30 1150<br>Lunch 1225 |
| 100 | 2/2.5 | N/A | NDA | | 100-102' Grayish brown (mottled) non ~~welded~~ to weakly welded SW 1/29/97 damp. tuff. Slight increase in welding with depth.<br>102-102.5' No Recovery | Loss | | Run #31 1430<br>Snow delay until 1430 |
| | 2/2.5 | N/A | NDA | | 102.5-104.5' Mix of mod. welded gray tuff with soft damp lt brown tuff.<br>104.5-105' No Recovery | Loss | | Run #32 1450 |
| 105 | 2/2.5 | N/A | NDA | | 105-107' mix of mod welded gray tuff with soft nonwelded lt brown tuff continues.<br>107-107.5' No Recovery | Loss | | Run #33 1500 |
| | 2/2.5 | 0131-97<br>0015<br>107.5-109.5 | NDA | | 107.5-109.5' mix of tuff continues. welded pieces makeup 30-40% of volume and avg. 1" in size.<br>109.5-110 No recovery | Loss | | Run #34 1520 |
| 110 | 2.5/2.5 | N/A | NDA | | 110-110.5' SAA<br>110.5-112.5' dk gray/brown 5YR 5/2, mod welded tuff drying out with depth, small pumice fragments FeOx spotting (Unit #2) | | Bandelier Tuff Unit #2 | Run #35 1545<br>Hard drilling |
| | 2.5/2.5 | N/A | NDA | | 112.5-115' dk gray mod welded tuff, continues to dry with depth small FeOx spots around pumice(?). No visible fractures | | | Run #36 1605<br>End of Day 1630 |
| 115 | 2.5/2.5 | N/A | NDA | | 115-117.5 SAA | | | 1/31/97 0830<br>Run # 37 0930 |
| 120 | 2.5/2.5 | 0131 97<br>0016<br>117.5-120 | NDA | | 117.5-120 dk gray mod to strong welding dry. tuff. FeOx spots continue No visiable fractures | | | Run #38 0945 |

Prepared By J. Wattenschied Date 1/30/97 Checked By Date 2/3/97

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LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

SAMPLE MANAGEMENT FACILITY

**CORE SAMPLE LOG**

Borehole ID 16-001 TA/OU 21 Drill Depth From 120 To 150 Page 5 of 5
Driller Stewart Bros Box #(s) N/A Start Date/Time 1/27/97 1000 End Date/Time 1/27/97 1300
Drilling Equip./Method CME750 / Auger Sampling Equip./Method Split Spoon / Core

| Depth (Feet) | Recovery (feet per foot/ %) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 120 | 2.5/2.5 | NA | NDA | N/A | 120 - 121.5' dk gray mod to strong welding dry. no fractures<br>121.5 - 122.5' weak to mod welded, dk gray tuff. softer core. No fractures | | Bandelier Tuff Unit #2 | Run #39 1010 |
| | 2.5/2.5 | NA | NDA | | 122.5 - 125' SAA | | | Run #40 1020 |
| 125 | 2.5/2.5 | NA | NDA | | 125 - 127.5' ~~dk gray~~ JW 1/27/97 brownish gray 5YR 4/1 mod. welded (no fractures) tuff | | | Run #41 1030<br>Core is being ground during drilling |
| | 2.5/2.5 | 0121-97-0017<br>129.5-130 | NDA | | 127.5 - 130' Brownish gray mod welded tuff. No visiable fractures. Core is broken up from drilling. | | | Run #42 1045 ~~1100~~ JW 1/27/97 |
| 130 | 2.5/5 | N/A | NDA | | 130 - 132.5' ~~SAA~~ JW 1/27/97 Brownish gray weakly welded tuff mixed with soft gray ash (?)<br>132.5 - 135' No Recovery (soft material pinched barrel) | Loss | | Run #43 1105 |
| 135 | 2/2.5 | N/A | NDA | | 135-137 Mix of mod welded brownish gray tuff fragments (70%) with soft ground up tuff (possibly ash) slight increase in moisture content.<br>137-137.5 No Recovery | Loss | | Run #44 1135 |
| | 2.5/2.5 | 0121-97-0018<br>137.5-140 | NDA | | 137.5 - 140' mix of mod welded tuff fragments with fine med grain ground tuff (soft). Tuff fragments makeup 40% core. | | | Run #45 1150<br>soft drilling<br>sample collected in each |
| 140 | 2.5/2.5 | NA | NDA | | 140 - 142.5' Mix of mod welded and non-welded tuff. No ash. | | | Run #46 1210 |
| | 2.5/2.5 | NA | NDA | | 142.5 - 145' SAA. mod welded fragments makeup 70% of core | | | Run #47 1220 |
| 145 | 2.0/2.5 | NA | NDA | | 145 - ~~147.5~~ 147 JW 1/27/97 SAA. change in color to a grayish brown 5YR 3/2<br>147-147.5 No Recovery | | | Run #48 1230 |
| 150 | 2/2.5 | 0121-97-0019<br>147.5-150 | NDA | | 147.5-148 No Recovery<br>148-150 lt brown, mix of tuff (welded) with nonwelded tuff<br>150 ft Total Depth | Loss | | Run #49 1245<br>lunch 1300 |

Prepared By J. Watterscheid Date 1/30/97 Checked By Date 2/3/97

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## LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

**SAMPLE MANAGEMENT FACILITY**

## CORE SAMPLE LOG

Borehole ID 16-002 TA/OU 21 Drill Depth From 0 To 30 Page 1 of 5

Driller Stewart Bo. Box #(s) NA Start Date/Time 3/24/97 0950 End Date/Time 4/1/97 1205

Drilling Equip./Method CME 750 / Auger Sampling Equip./Method Split Spoon / Core

Location ID: 21-05052

Contamination Criteria

| 3/24/97 | 3/25/97 | 3/31/97 | 4/1/97 |
|---|---|---|---|
| α: 11cpm | α: 7cpm | α: 5cpm | α: 5cpm |
| Bγ: 121cpm | Bγ: 122cpm | Bγ: 133cpm | Bγ: 118 cpm |

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes<br>Drilling at west end of absorption bed #1 MDA-T TA-21. |
|---|---|---|---|---|---|---|---|---|
| 0 | 2.5/2.5 | NA | NDA | NA | 0-0.5' Road: base course, asphalt<br>0.5-2.5' Moderate yellowish brown 10YR5/4 mix of moist clayey silt with crushed tuff. | | Overburden/Backfill | 3/24/97 Drilling 0950<br>Run #1 1000 |
| 5 | 2.5/2.5 | 0121-97<br>0026<br>0050<br>2.5-3' | NDA | | 2.5'-5' SAA with 5% 1" river rock | | | Run #2 1015<br>Field blank 0121-97-0050 collected |
| | 2.5/2.5 | NA | NDA | | 5-7.5' Moderate brown 5YR 4/4 mix of moist clayey silt with crushed tuff, 10% river rock. Note linear layer of decomposed grasses and roots at 6'. | | | Run #3 1040 |
| 10 | 2/2.5 | 0121-97<br>0027<br>9-9.5 | NDA | | 7.5-9' SAA<br>9-9.5' Mix of light brown 5YR6/4 medium to coarse grain sand with small to over 1" gravels. FeOx staining/alteration along rock edges. Moist.<br>9.5-10' no Recovery | | | Run #4 1052 |
| | 2.5/2.5 | NA | NDA | | 10-12.5' Light brown 5YR5/6 medium to coarse grained sand with small pebbles trace clay. Sand is weakly cemented. Moist | | Paleo Channel | Run #5 1106 |
| 15 | 2.5/2.5 | NA | NDA | | 12.5-15' Light reddish brown 5YR 5/6 medium to coarse grain moist sand with small pebbles. Noncemented. | | | Run #6 1130 |
| | 2.5/2.5 | NA | NDA | | 15-17.5' SAA very weakly cemented. | | | Run #7 1155 |
| 20 | 2.5/2.5 | NA | NDA | | 17.5-20' SAA Note ~~[illegible]~~ 18.4-20' [illegible] was collected in stainless steel sleeves for hydrogeological characterization. | | | lunch 1215<br>Run #8 1320<br>~~[illegible]~~ 18.4-20 hydrogeological characterization samples(4) collected. |
| | 2.5/2.5 | 0121-97<br>0028<br>20-22.5 | NDA | | 20-22.5' Light reddish brown 5YR5/6 med. grain moist sand with trace pebbles. Collected in stainless steel sleeves. 21.4-22.8' (3 sleeves) sent for hydro characterization | | | Run #9 1350<br>21.4-22.8 hydrogeological characterization samples(3) collected |
| 25 | 2.5/2.5 | NA | NDA | | 22.5-24' light reddish brown loose non cemented medium grain moist sand<br>24-24.5' light tan med grain moist sand with small dacite and rhyolite pebbles<br>24.5-25' light reddish brown med grain moist sand | | | Run #10 1430 |
| | 2.5/2.5 | 0121-97<br>0029<br>~~NA~~ [illegible]<br>26-27 | NDA | | 25-26.5' SAA<br>26.5-27' Dacite/Rhyolite cobble zone. Rounded 1"+ pebbles in sand, moist<br>27-27.5' Pale brown 10YR6/2 weakly-moderately welded tuff | | | Run #11 1455 |
| 30 | 2.5/2.5 | NA | NDA | | 27.5-30' Pale brown moderately welded trace moisture tuff. 70° clay filled fracture (1-2cm wide) at 28-29' weak alteration along edge of fracture. Core is solid tuff | | Unit #3 | Run #12 1525 |

Prepared By J. Walterscheid Date 4/1/97 Checked By Date 4/2/97

R.1

**LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM**

**SAMPLE MANAGEMENT FACILITY**

**CORE SAMPLE LOG**

Borehole ID 16-002 TA/OU 21 Drill Depth From 30 To 60 Page 2 of 5

Driller Stewart Bro Box #(s) NA Start Date/Time 3/24/97 0950 End Date/Time 4/1/97 1205

Drilling Equip./Method CME 750/ Auger Sampling Equip./Method Split Spoon/Core

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 30 | 2.5/2.5 | NA | NDA | NA | 30-32.5 Pale yellowish brown 10YR 6/2 mod. welded tuff. Trace moisture. 10% pumice 5% qtz. moist. | | Bandelier Tuff Unit #3 | Run #13 1539<br>Solid core |
| 35 | 2.5/2.5 | NA | NDA | | JW 3/24/97 ~~32-32.5~~ 32.5-35 SAA | | | Run #14 1550 |
| 40 | 5/5 | 0121<br>97<br>0030<br>39.5-40 | NDA | | 35-40 Pale yellowish brown 10YR 6/2 moderately welded tuff (solid core) Trace moisture drying with depth. 5-10% flattened pumice, 5% qtz. Solid core. | | | Run #15 1610<br>End of day 1630 |
| 45 | 5/5 | NA | NDA | | 40-45' SAA | | | 3/25/97 Drilling 0830<br>Run #16 0900 |
| 50 | 5/5 | 0121<br>97<br>0031<br>49.5-50 | NDA | | 45-50' SAA. dry. | | | Run #17 0930<br>Will stop at 50' and move to 16-013. Tech team will decide if we need to continue to 150'. End of Day 1000 |
| 55 | 5/5 | NA | NDA | | 50-55' Pale yellowish brown (10YR 6/2) to light brown (5YR 6/4) mottled color ~~with~~ JW 3/31/97 moderately welded (solid core) tuff. increase in moisture content. | | | 3/31/97 Drilling 0820<br>Run #18 0845 |
| 60 | 5/5 | 0121<br>97<br>0032<br>~~0047~~ 1276 JW 4/2/97<br>59.5-60 | NDA | | 55-56.5' SAA<br>56.5-60' Pale yellowish brown (10YR 6/2) to light brown (5YR 6/4) mottled color weakly welded tuff. Slightly moist. Getting softer with depth. | | | Run #19 0900<br>Field Blank 0121-97-~~0047~~ 1276 collected<br>RW 4/2/97 |

Prepared By J. Walterscheid Date 4/1/97 Checked By Date 4/2/97

R.1

LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

SAMPLE MANAGEMENT FACILITY

## CORE SAMPLE LOG

Borehole ID 16-002 TA/OU 21 Drill Depth From 60 To 90 Page 3 of 5

Driller Stewart Bros Box #(s) NA Start Date/Time 4/1/97 0950 End Date/Time 4/1/97 1205

Drilling Equip./Method CME750/Auger Sampling Equip./Method Split Spoon/Core

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 60<br>65 | 4/5 | NA | NDA | NA | 60-61.2 Pale yellowish brown mottled with a light tan color, non-weakly welded tuff slightly moist.<br>61.2-64 Medium light gray (N6) nonwelded, soft (sugary texture) tuff. Slightly moist.<br>64-65 No Recovery | Loss | Bandelier Tuff Unit #3 | Run# 20 0930 |
| 70 | 1.5/5 | NA | NDA | | 65-66.5' SAA<br>66.5-70 No Recovery | Loss | | Run# 21 0943<br>Changing swival to get better recovery |
| 75 | 3.3/5 | 0121-97 0033<br>~~0048~~ 1271 4/4/97<br>70-71 | NDA | | 70-73.3' Medium light gray (N6) non welded (soft) tuff. Sugar texture, slightly moist. Brown mottled alteration(?) zone at ~~70-70.5'~~ 4/4/97 70-71.5'<br>73.3'-75 No Recovery | Loss | | Run# 22 1003<br>Duplicate sample 0121-97-~~0048~~ 1271 collected 4/4/97 |
| | 2.5/2.5 | NA | NDA | | 75-77.5' Medium light gray (N6) non welded (soft) tuff. Sugar texture, slightly moist. | | | Run# 23 1050 |
| 80 | 2.5/2.5 | 0121-97 0034<br>~~77.5-80~~ 4/4/97<br>79.5-80 | NDA | | 77.5-80' SAA | | | Run # 24 1058 |
| | 2.5/2.5 | NA | NDA | | 80-82.5 SAA with some brown mottle alteration at 81-81.4 and 82-82.5'. | | | Run #25 1114 |
| 85 | 2.5/2.5 | NA | NDA | | 82.5-84.3 SAA<br>84.3-85 Light brownish gray (5YR 6/1) soft nonwelded tuff (sugary). Moist (increase in H2O content) | | | Run # 26 1130 |
| 90 | 4/5 | 0121-97 0035<br>87-88 | NDA | | 85-88 SAA<br>88-89 medium light gray (N6) nonwelded (soft) tuff Sugar texture, slightly moist<br>89-90 No Recovery | Loss | | Run # 27 1150 |

Prepared By J. Walterscheid Date 4/1/97 Checked By Date 4/2/97

R1

## LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

**SAMPLE MANAGEMENT FACILITY**

## CORE SAMPLE LOG

Borehole ID 16-002 TA/OU 21 Drill Depth From 90 To 120 Page 4 of 5

Driller Stewart Bro. Box #(s) N A Start Date/Time 3/24/97 0950 End Date/Time 4/1/97 1205

Drilling Equip./Method CME 750/Auger Sampling Equip./Method Split Spoon/Core

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core In Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 90<br>95 | 5/5 | NA | NOA | NA | 90-95' Grayish orange pink (5YR 7/2) with light brown coloring, soft non-welded tuff. FeOx spotting, slightly moist. | | Unit #3 | Run # 28 1205 |
| | 5/5 | 0121-97-0036<br>96-96.5 | NOA | | 95-96.5' SAA<br>96.5-100' Grayish orange pink (5YR 7/2) weak to moderately welded tuff (increase in welding with depth). FeOx spotting trace moisture. | | ? | Run# 29 1215 |
| 100 | 5/5 | NA | NOA | | 100-105' SAA | | | Lunch 1230<br>Run# 30 1400 |
| 105 | 2.5/2.5 | NA | NOA | | 105-107.5' Grayish orange pink (5YR 7/2) to Pale red (10YR 6/2) moderately welded tuff. FeOx spotting, slight increase in moisture. | | Bandelier Tuff Unit #2 | Run# 31 1415<br>Hard drilling. |
| 110 | 2.5/2.5 | 0121-97<br>0037<br>109-110 | NOA | | JW 4/1/97 ~~105-107.5~~<br>107.5-110' Pale reddish gray (10YR 6/2) to grayish red (10YR 4/2) mod. welded tuff. FeOx spotting slightly moist. | | | Run # 32 1430<br>Hard drilling have to ream hole to advance |
| | 2.5/2.5 | NA | NOA | | JW 4/1/97 ~~107.5-110~~<br>110-112.5 SAA | | | Run # 33 1450<br>Hard drilling cont. |
| 115 | 2.5/2.5 | NA | NOA | | 112.5-115' Grayish red (10YR 4/2) moderately welded tuff, slightly moist, increase in qtz. | | | Run # 34 1525<br>Hard drilling, reaming cont. |
| | 2.5/2.5 | NA | NOA | | 115-117.5' SAA | | | Run # 35 1543<br>Hard drilling reaming, |
| 120 | 2.5/2.5 | 0121-97<br>0038<br>117-120 | NOA | ↓ | 117.5-120' SAA, drying out with depth | | | Run # 36 1620<br>Reaming and grinding core |

JW 4/1/97

End of Day 1635

Prepared By J. Watterschied Date 4/1/97 Checked By Date ~~4/~~ 4/2/97

**LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM**

**SAMPLE MANAGEMENT FACILITY**

**CORE SAMPLE LOG**

Borehole ID 16-002 TA/OU 21 Drill Depth From 120 To 150 Page 5 of 5

Driller Stewart Bros Box #(s) NA Start Date/Time 3/24/97 0750 End Date/Time 4/1/97 1205

Drilling Equip./Method CME 750/Auger Sampling Equip./Method Split Spoon/Core

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes 4/1/97 |
|---|---|---|---|---|---|---|---|---|
| 120 | 2.5/2.5 | NA | NDA | NA | 120-122.5' Pale red (10YR 6/2) moderately welded tuff. FeOx spotting, trace to dry moisture content. | | | Run # 37 0920 hard core, having to ream hole |
| | 2.5/2.5 | NA | NDA | | 122.5-125' SAA | | | Run # 38 0930 SAA |
| 125 | 0.7/2.5 | NA | NDA | | 125-125.7 SAA<br>125.7 - ~~130~~ 127.5 No Recovery | Loss | | Run # 39 0944 |
| | 0/2.5 | NA | NDA | | 127.5-130 No Recovery. | Loss | | Run #40 0955 Ground core and went up auger slight (mis latch) |
| 130 | 2.5/2.5 | 0121-97<br>0039<br>130-131<br>1277 | NDA | | 130-132.5' Pale red (10YR 6/2) moderate to strongly welded tuff. Slight decrease in FeOx spotting, dry. | | Bandelier Tuff Unit #2 | Run # 41 1010<br>Field Blank 0121-97-1277 collected |
| | 2.5/2.5 | NA | NDA | | 132.5-135' SAA | | | Run # 42 1031 |
| 135 | 2.5/2.5 | NA | NDA | | 135-137.5' SAA | | | Run # 43 1045 |
| | 2.5/2.5 | 0121-97<br>0040<br>138-140 | NDA | | 137.5-140' Pale Red (10YR 6/2) moderately welded Tuff. FeOx spotting, 10% qtz, dry. | | | Run # 44 1056 |
| 140 | 2.5/2.5 | NA | NDA | | 140-142.5' SAA | | | Run # 45 1119 |
| | 2.5/2.5 | NA | NDA | | 142.5-145' SAA | | | Run # 46 1130 |
| 145 | 2.5/2.5 | NA | NDA | | 145-147.5' Pale Red (10YR 6/2) weak to moderately welded tuff. FeOx spotting, 5-10% qtz, dry | | | Run # 47 1145 |
| 150 | 2.5/2.5 | 0121-97<br>0041<br>1272<br>149-150 | NDA | | 147.5-150' SAA | | | Run # 48 1155<br>Duplicate Sample 0121-97-1272 collected |

150' Total Depth

T.D. 1205'

Prepared By J. Walterscheid Date 4/1/97 Checked By Date 4/2/97

R1

LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

**SAMPLE MANAGEMENT FACILITY**

## CORE SAMPLE LOG

Borehole ID 16-003 TA/OU 21 Drill Depth From 0 To 30 Page 1 of 3

Driller Stewart Bro Box #(s) N/A Start Date/Time 1/21/97 0900 End Date/Time 1/23/97 1040

Drilling Equip./Method CME 750/ Auger Sampling Equip./Method SplitSpoon/ Core

Location ID: 21-05053

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Analytical Sample Number | Field Screening Results Counts Per Minute cpm | Top/Bottom of Core in Box | ~~Background~~ Contamination Criteria<br>1/21/97 α: 10cpm Bγ: 121cpm<br>1/23/97 α: 14cpm Bγ: 100cpm<br>1/23/97 α: 8cpm Bγ: 98cpm<br>Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Drilling at west end of absorption bed #2 MDA-T.<br>Notes |
|---|---|---|---|---|---|---|---|---|
| | 1.5/2.5 | N/A | No Detectable activity<br>NDA | N/A | 0-1' dk brown 5YR 4/4, moist, mix of silty clay with crushed tuff.<br>1-1.5' lt. gray crushed tuff, damp 5YR 7/2<br>1.5-2.5' No Recovery |  | Backfill | 1/21/97 Drilling 0900<br>Run#1 |
| 5 | 2/2.5 | 0121-97<br>0051<br>4.2-4.6 | α: 750cpm<br>Bγ: 400cpm<br>4.5' | | 2.5-3' No Recovery<br>3-4.2' lt. gray crushed tuff, damp (No rad)<br>4.2-5' lt brown 5YR 5/6 silty clay with small pieces of tuff and burnt coal(?) | | | Run #2 0915<br>Top of absorption bed 4.2' |
| | 1.5/2.5 | 0121-97<br>0052<br>0064<br>6.5-7' | α: 550cpm<br>Bγ: 2400cpm<br>6.7' | | 5-6' No Recovery<br>6-7.5' mix of lt brown 5YR 5/6 silty clay (damp) and small (≤1") river gravels (25%)<br>lg. 2" river gravel at 7.5' | | Absorption Bed | Jw 1/21/97<br>Run #3 ~~0930~~ 0950 |
| | 1/2.5 | 0121<br>97<br>0053<br>9.5-10 | α: 26,000<br>Bγ: 3800<br>9.5-10' | | 7.5-9' No Recovery<br>9-10' mix of lt brown silty clay /small river gravel and pieces of clay pipe. Note inside of pipe has α: 45,000 cpm | | | Run#4 1035<br>Driller is not sure on [illegible] dropping pipe or corebox<br>Jw 1/24/97 |
| | Center Bit | | | | 10-12.5' No Recovery. Drilled with center bit through cobbles. | | | Run#5<br>exact footage for Tuff contact unknown |
| 15 | 2.5/2.5 | 0121<br>97<br>0054<br>12.5-13 | α: 160cpm<br>Bγ: 140cpm<br>13' | | 12.5-15' lt gray 5YR 7/2, dry tuff. weak-moderately welded small pumice crystals<br>Rad is dropping with depth. No Fractures. | | Bandelier Tuff unit #3 | Run#6 1200<br>Break for lunch: 1220 |
| | 2.5/2.5 | 0121<br>97<br>0055<br>17-17.5 | α: 40cpm<br>Bγ: 120cpm<br>17' | | 15-17.5 SAA with a horizontal clay filled fracture at 17'. Fracture is 0.6" wide and filled with an dk orange silty clay (damp) rootscars visible in fracture | | | Run#7 1335 |
| 20 | 2.5/2.5 | N/A | α: 150cpm<br>Bγ: 120cpm<br>18' | | 17.5-20' lt gray-tan, moderately welded, dry Tuff. Increase in pumice amount and size (10-15%)<br>(No fractures.) | | | Run#8 1425<br>or possibly carried down from last run. |
| 25 | 5/5 | 0121-97<br>0056<br>20.5-21.5 | α: 100cpm<br>Bγ: 140cpm<br>20.5-21.5' | | 20-25 SAA<br>Set of thin fractures at 20.5-21.5'.<br>lt brown alteration rind in tuff<br>No clay in fractures | | | Run#9 1450 |
| | 4/5 | 0121<br>97<br>0057<br>25-29 | α: 222cpm<br>Bγ: 200cpm<br>27-29'<br>in fracture | | 25-28' lt gray 5YR 7/2, moderately welded, dry tuff<br>27-29' vertical fracture 0.5" wide, clay filled (dk brown to burnt orange) pumices ~~along~~ along edge are altered.<br>29-30' No Recovery (pinched off) | | | Run #10 1520 |

Prepared By J. Walterscheid Date 1/23/97 Checked By Date 2/3/97

R1

## LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

**SAMPLE MANAGEMENT FACILITY**

## CORE SAMPLE LOG

Borehole ID 16-003 TA/OU 21 Drill Depth From 30 To 60 Page 2 of 3

Driller Stewart Bro. Box #(s) N/A Start Date/Time 1/21/97 0900 End Date/Time 1/23/97 1040

Drilling Equip./Method CME750 / Auger Sampling Equip./Method Split Spoon/core

Location ID: 21-05053

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 30–35 | 5/5 | N/A | α: 50cpm<br>By: 100cpm<br>30-32' | N/A | 30-35' lt. gray 5YR 7/2 moderately welded, dry, TUFF. Fracture from last run continues to 32.5'. widest point is 1.2" wide and splits into 2 ~1/4" |  | Bandelier Tuff Unit #3 | Run #11 1550<br>1610 End of Day |
| 35–40 | 5/5 | 0121-97 0058<br>38.5-40' | NDA | | 35-40' lt. gray 5YR 7/2 weak-mod. welded, dry, TUFF. Fracture at 35.5'. Fracture is hairline with lt. brown alteration rind. No detectable activity | | | 1/22/97 0845<br>Run #12 0920 |
| 40–45 | 5/5 | N/A | NDA | | 40-45' SAA Fracture at 42' is very thin with pumices altering to clay on margins. Fracture at 44.5-45' is along the ~~side~~ edge of the core and is clay filled clay is a lt brownish-or 5YR 4/4. | | | Run #13 1000 |
| 45–50 | 5/5 | 0121-97 0059<br>48-49' | α: 125cpm<br>By: 140cpm<br>48'<br>Tuff is NDA | | 45-50' lt. gray 5YR 7/2 weakly welded, dry tuff. Fracture from 44.5' continues to a depth of 48'. lite orange clay filled up to 1" separation. Almost vertical fracture elevated rad in fracture. | | | Run #14 1054 |
| 50–55 | 5/5 | N/A | α: 20cpm<br>By: 140cpm<br>54' in small fracture | | 50-51' SAA<br>51-53 lt brown 5YR 5/6 mod. welded ~~dry~~ damp tuff. Small pumice ~~[illegible]~~ makeup 10% of core. largely fractured clay filled 60° angle No elevated RAD<br>53-55' lt gray mod. welded, dry, TUFF. Clay orange filled fracture on edge of core α: 80cpm By: 140cpm at 54' | | | Run #15 1140<br>lunch Break 1205 |
| 55–60 | 5/5 | 0121-97 0060<br>59.5-60 | α: 175cpm<br>By: 150cpm<br>59.5-60 | | 55-60' lt. gray 5YR 7/2 weak-mod. welded, trace moisture, tuff. very small ~~[illegible]~~ pumices 1-2mm makeup 20% of matrix, lg pumices ≥ 1" < 1%. Friable core. No Rad<br>59.5-59.8 small fracture with brown clay alteration elevated rad | | | Run #16 1430 |

Prepared By J. Wattersheid Date 1/23/97 Checked By Date 2/3/97

R1

LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

SAMPLE MANAGEMENT FACILITY

**CORE SAMPLE LOG**

Borehole ID 16-003 TA/OU 21 Drill Depth From 60 To 90 Page 3 of 3

Driller Stewart Bro Box #(s) N/A Start Date/Time 1/21/97 0900 End Date/Time 1/23/97 1040

Drilling Equip./Method CME750/auger Sampling Equip./Method Split Spoon / Core

Location ID: 21-05053

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core In Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 60–65 | 5/5 | 0121<br>97<br>0061<br>60-60.7 | α 1200cpm<br>βγ 300cpm<br>60-60.7' | N/A | 60-60.7' lt gray mottled brown tuff. trace moisture weakly welded. Fracture. yellowish brown clay fill α 1200 cpm βγ 300cpm<br>60.7-62' Mottled brown weakly welded tuff. trace moisture. strong clay alteration in pumice. No visible fracturing α 100cpm βγ 140cpm<br>62-65' lt grey to mottled brown clay alteration of pumice. α 40cpm βγ 140cpm Increase in moisture. grey tuff is med. welded. | | Bandelier Tuff Unit #3 | Run #17 1505 |
| 65–70 | 5/5 | N/A | NDA | | 65-70' SAA no elevated rad. The softer lt brown tuff [illegible] JW 1/23/97 contains a high H2O concentration then the lt. grey weak-med. welded tuff. No vis. [illegible] fracturing | | | Run #18 1550<br>End of Day |
| 70–75 | 5/5 | 0121<br>97<br>0062<br>72.5-75 | NDA | | 70-72.5 SAA<br>72.5-75 lt brown very soft crumbly moist tuff. non-welded. Clay filled fracture, steeply dipping 0.5" at widest point. dk orange-brown clay | | | 1/23/97 Drilling 0840<br>Run #19 0905 |
| 75–80 | 5/5 | N/A | NDA | | 75-80' dk yellowish orange to light brown 10YR 6/6-5YR 5/6 non-to-weakly welded, damp to moist tuff. Occasional lt. gray med. welded pieces. Pumice is gone or altering to clay 75-76' and 77.5-78' are almost sandy. | | | Run #20 0945 |
| 80–85 | 5/5 | 0121<br>97<br>0063<br>80-82.5 | NDA | | 80-80.5 SAA.<br>80.5- ~~90~~ 85' Surface change in color to lt. gray non-welded damp tuff. Very soft, crumbles when pinched. Pumice intact, trace cly. No visible fractures. | | | Run #21 1000 |
| 85–90 | 5/5 | 0121<br>97<br>0445<br>87.5-90 | NDA | ↓ | ~~90-?~~ JW 1/23/97<br>85-90' SAA<br>90' Total Depth | | | Run #22 1030<br>T.D. 1040 |

Prepared By J. Watterschied Date 1/23/97 Checked By Date 2/3/97

R1

LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

**SAMPLE MANAGEMENT FACILITY**

## CORE SAMPLE LOG

Borehole ID 10-004 TA/OU 21 Drill Depth From 0 To 30 Page 1 of 2

Driller Stewart Bro Box #(s) NA Start Date/Time 1/17/97 0900 End Date/Time 1/20/97 1120

Drilling Equip./Method CME750/ Auger Sampling Equip./Method Split Spoon/ Core

Location ID: 21-05054

Background
1/17/97 α: 7cpm By: 90cpm
1/20/97 α: 13cpm By: 100cpm

Drilling at east end of absorption bed #2

| Depth (Feet) | Recovery (feet per foot/ %) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| | 2/2.5 | N/A | NDA | N/A | 0-1.5ft dk brown 5YR 3/4 crushed tuff/sandy silt<br>1.5-2' Tuff black, mod. welded, grey 10YR 4/2<br>2-2.5' No Recovery | | Backfill | 1/17/97<br>Run#1 0923 |
| 5 | 1.5/2.5 | 0121-97 0066 3.5-4' | NDA | | 2.5-4' Lt. brown 5YR 4/4 mix silt/crushed tuff clay<br>4-5' No Recovery | | | Run #2 0935 |
| | 1.5/2.5 | 0121 97 0067 6.1-6.5 | α: 1125cpm<br>By: 300cpm<br>6.1-6.5 | | 5-6.1 Brown 5YR 4/4 silty clay with some crushed tuff moist sample<br>6.1-6.5' Med Brown 5YR 3/4 silty sand moist<br>6.5-7.5 No Recovery α 1125cpm By 300cpm | | ? ? Absorption Bed | Run#3 0754 |
| | .9/1 | 0121-97 0068 | α 3200<br>By 1200 | | 7.5-8.2' small rich gravel (≤1") with silty clay moist-wet sand at 8.2' | | | Run #4 1015 |
| | Center Bit | | | | 8.5-10' Center Bit through contacts no recovery | | | Run#5 |
| | 2/2.5 | 0121-97 0069 11' | α: 2000cpm<br>By: 1600cpm<br>11' | | 10-10.5' No Recovery<br>10.5-11' med-coarse sand with trace gravel, moist med brown 5YR 4/4. orange alteration at contact α 2000cpm 1600 By: 1600cpm | | | Run#6 1050<br>Tuff contact is flat and has been scraped. |
| 15 | 2.5/2.5 | 0121-97 0070 15' | α: 300cpm<br>By: 260cpm | | 11-12.5' Tuff lt gray 5YR 7/2, mod welded damp. α 1500cpm at 12' By 300cpm<br>12.5-15' lt gray tuff small fracture at 13' α 300cpm By 140cpm. large 1" wide clay filled fracture 13.8-16.2' α drops off to 2450cpm By increases to 260cpm. Sample collected in fracture at 15' | | Bandelier Tuff | Run#7 1130<br>Lunch 1220 Drilling 1320 |
| | 2.5/2.5 | N/A | α: 120<br>By: 220<br>16' | | 15-17.5 Tuff lt gray 5YR 7/2 damp mod. welded, α By drop off quickly with depth and out of the fracture. | | | Run #8 1335 |
| 20 | 2.5/2.5 | N/A | α: 40cpm<br>By: 120cpm | | 17.5-20 Tuff. lt gray mod welded, drying with depth No fractures. | | | Run #9 1350 |
| 25 | 5/5 | 0121 97 0071 21.9' | α 2600<br>By 500cpm<br>21.9'<br>Rest of core is NDA | | 20-25 Tuff lt gray mod. welded, dry very hard<br>21.9' horizontal fracture with dk orange (burnt orange) clay(?) alteration. Does not go into the tuff 2mm-4mm wide α 2600cpm By 500cpm<br>Increase in pumice | | | Run #10 1410 |
| 0 | 5/5 | N/A | NDA | | 25-30' Tuff very hard, lt gray 10YR 6/2, mod. welded, dry No fractures | | | Run #11 1450 |

Prepared By J. Whitehead Date 1/20/97 Checked By Date 1/21/97

R.1

**LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM**

**SAMPLE MANAGEMENT FACILITY**

**CORE SAMPLE LOG**

Borehole ID 16-004 TA/OU 21 Drill Depth From 30 To 60 TD Page 2 of 2

Driller Stewart Bros Box #(s) NA Start Date/Time 1/17/97 0800 End Date/Time 1/20/97 1120

Drilling Equip./Method CME 750 / Auger Sampling Equip./Method Split Spoon / Core

Location ID: 21-05054

| Depth (Feet) | Recovery (feet per foot/ %) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 30 | 5/5 | 0121<br>97<br>0072<br>32-32.5 | α: 65cpm<br>Bγ: 160cpm<br>32.3′ | N/A | 30-35 Tuff lt. tan 5YR 6/4, mod. welded decrease in pumice, increase in qtz Fractures at 32.3′ α 65cpm Bγ 160 cpm very thin trace alteration (orange) Hairline fracture at 33′ No detectable rad. | | | Run # 12 1515<br>End of Day 1600 |
| 35 | 5/5 | 0121<br>97<br>0073<br>35.5-36 | α: 450cpm<br>Bγ: ~~110~~ 160cpm<br>36′ JW 1/20/97<br>α: 300cpm<br>Bγ: ~~300~~ 140 cpm JW 1/20/97<br>37-38 | | 35-40 SAA, turning gray with depth Fractures: 35.5-36′ (clay filled 0.2″ JW wide), α 450 cpm Bγ ~~110~~ 160 cpm, 60° Angle 36.8′→38′: multiple fractures, trace clay, weak tuff alteration, orange-brown alteration along hairline fracture α 300 cpm Bγ: ~~300~~ 140 cpm JW 1/20/97 | | | 1/20/97<br>Drilling 0830<br>Run # 13 0850 |
| 40 | 5/5 | N/A | α: 45cpm<br>Bγ: 120cpm<br>44.5′ | | 40-45 ~~SAA~~ JW 1/20/97 Tuff lt. gray, mod welded, dry. 10YR 6/2, No visible fractures. brown/tan discoloration in core at 44.5′ α 45cpm Bγ: 120 cpm, possible fracture nearby | | | Run #14 0935 |
| 45 | 5/5 | N/A | NDA | | 45-~~50~~′ JW 1/20/97 46.5 Tuff lt gray mod. welded, dry<br>46.5-47′ Tuff non-welded, very soft (loose material) dry<br>47-50′ Tuff lt. gray mod. welded, dry splotchy brown/tan zones throughout no elevated rad. | | Bandelier Tuff | Run #15 1011 |
| 50 | 5/5 | 0121-<br>97<br>0074<br>50-50.5 | NDA | | 50-55′ Tuff lt gray mod welded dry, no fractures | | | Run #16 1040 |
| 55 | 5/5 | 0121<br>97<br>0075<br>59.5-60 | NDA | ↓ | 55-60 Tuff lt. gray-tan 5YR 7/2, mod welded increase in pumice content. No fractures<br>60′ Total Depth | | | Run # 17 1110<br>1120 T.D. |
| 60 | | | | | | | | |

Prepared By J. Walterscheid Date 1/20/97 Checked By Date 1/21/97

R1

**LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM**

**SAMPLE MANAGEMENT FACILITY** | **CORE SAMPLE LOG**

Borehole ID 16-005 TA/OU 21 Drill Depth From 0 To 15 Page 1 of 1

Driller Stewart Bro. Box #(s) N/A Start Date/Time 1/7/97 1330 End Date/Time 1/8/97 1040

Drilling Equip./Method CME 750/Hollow Stem Sampling Equip./Method Split Spoon/Core

Location ID: 21-05055

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| | | | | | Background<br>1/7/97<br>α:3cpm<br>Bγ: 111cpm<br>1/8/97<br>α:21cpm<br>Bγ: 111cpm | | | Drilling into west end of absorption bed #4 MDA-T TA-21 |
| 0 | 2/2.5 | N/A | NDA | N/A | 0-2' dk brown, moist sandy clay, crushed tuff.<br>2-2.5' No recovery | | Backfill | 1/7/97 Drilling 1330<br>Run #1 1342 |
| | 1.5/2.5 | 0121-97<br>0081<br>3.5-4' | NDA | | 2.5-4' dk brown moist sandy clay with crushed tuff<br>4-5' No Recovery | | | Run #2 1353 |
| 5 | 1.5/2.5 | N/A | NDA | | 5-5.5 ~~5.5-6~~ sandy clay with weathered tuff<br>5.5-6' / lt brown med. grain sand, damp, small sub-rounded river gravel (≤1") makeup 50% of core<br>6-6.5' dk brown fine grain moist clayey silt<br>6.5-7.5' No Recovery | | ? | Run #3 1415 |
| | 1.5/2.5 | 0121-97<br>0082<br>8.5-9' | α 700cpm<br>Bγ 320cpm | | 7.5-7.8' dk brown fine grain moist clayey silt<br>7.8-8.5' med grain moist sand with 40% gravels<br>8.5-9' 30% sand 70% gravel<br>9-10' No Recovery | | Absorption Bed | Run # 4 1436<br>1500 Broken bit pulling to replace |
| 10 | Center | Bit | | | 10-12.5' No Recovery center bit through cobble zone. | | | Run #5 1615<br>Center bit through cobbles |
| | 0.5/2.5 | 0121-97<br>0083<br>14.5-15' | α 1060cpm<br>Bγ 460cpm | ↓ | 12.5-14.5 No Recovery (problem with bit)<br>14.5-15' Sand and crushed tuff moist. | | | Run #6 1620<br>Shutdown 1640 |
| | | | | | 15 ft Total Depth<br><br>1/8/97<br><br>Auger flight angled off while drilling through the cobble zone with the center bit. Attempts to ream and straighten the hole were unsuccessful. Abandoned hole 16-005 and moved 5 ft west to drill borehole 16-023.<br><br>JW<br>1/8/97 | | | 1/8/97 0910 |

Prepared By J. Wattersdeil Date 1/8/97 Checked By Date 2/3/97

R1

**LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM**

**SAMPLE MANAGEMENT FACILITY**

**CORE SAMPLE LOG**

Borehole ID 16-056 TA/OU 21 Drill Depth From 0 To 30 Page 1 of 2

Driller Stewart Bros Box #(s) N/A Start Date/Time 1/13/97 1435 End Date/Time 1/15/97 1610

Drilling Equip./Method CME 750 / Auger Sampling Equip./Method Split Spoon / core

Location ID: 21-05056

| Depth (Feet) | Recovery (feet per foot/ %) | Field Borehole Analytical Sample Number | Field Screening Results α, β/γ: | Top/Bottom of Core in Box | Background<br>1/13/97 α: 6cpm βγ: 133cpm<br>1/15/97 α: 8 βγ: 122<br>Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Drilling into MDA-T absorption bed #4. East end.<br>Notes |
|---|---|---|---|---|---|---|---|---|
| 0 | 2.5/2.5 | N/A | NDA | N/A | 0-1' dk brown silty clay, roots<br>1-2.5' crushed tuff with clay | | Backfill | Run #1 1500<br>Cold 5° snowing |
| | 2.5/2.5 | 0121-97 0096 4.5-5 | NDA | | 2.5-4' SAA<br>4-5' fine-med grain silty sand, moist, small pebbles (top of absorption bed) orange color | | | — Run #2 1530 |
| 5 | 2.0/2.5 | N/A | α: 500cpm<br>βγ: 300cpm<br>7' | | 5-6' med-coarse grain sand with lg pebbles dk brown<br>6-7' fine grain moist clay, brown<br>7-7.5 no recovery | | Absorption Bed | — Run #3 1600<br>End of Day 1615 |
| | ~~2~~/1 | N/A | NDA | | 7.5-8', no recovery<br>8-8.5' moist mixed sandy clay with pebbles | | | 1/15/97 0920 Run #4 |
| | Center | Bit | | | 8.5-9.5 cobble zone drilling with center bit | | | Run #5 Center bit |
| 10 | 0.5/0.5 | NA | NDA | | 9.5-10' Ground tuff, ~~moist~~ damp, tan color | | | Run #6 1040 |
| | 2.5/2.5 | 0121-97 0097 11.8-12.2 | α: 60cpm<br>βγ: NDA<br>11.8-12.2 | | 10-12.5 Tuff lite gray, damp weakly welded<br>dk orange clay filled fracture at 11.8-12.2' α 60cpm βγ NDA in fracture | | Bandelier Tuff | Run #7 1050<br>Clay also has a white calcite(?) mineral fill associated with it |
| 15 | 2.5/2.5 | N/A | NDA | | 12.5-15 Tuff continues, weak-mod. welded, lite gray color, damp, no fractures | | | Run #8 1135 |
| | 2.5/2.5 | N/A | α: 67cpm<br>βγ: NDA<br>16' | | 15-17.5 SAA drying with depth, no fractures | | | Run #9 1205 |
| 20 | 2.5/2.5 | N/A | NDA | | 17.5-20 SAA moderately welded | | | Run #10 1225<br>lunch 1230 |
| 25 | 5/5 | 0121-97 0098 20-20.5 | NDA | | 20-35 SAA<br>23.2' ~~22.2~~ thin fracture, trace alteration along surface 90° JW 1/15/97 | | | Drilling 1340<br>Run # 11 1400 |
| 30 | 5/5 | 0121-97 0099 ~~N/A~~ 29'-29.5 | NDA | ↓ | 25-30 SAA<br>Hairline fractures with a tan alteration rind at 28' and 29' alteration is tan in color and extends for appx 1-2" around fracture<br>No elevated rad encountered | | | Run #12 1430 |

Prepared By J. Walterscheid Date 1/15/97 Checked By Date 1/17/~~96~~97

R1

LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

**SAMPLE MANAGEMENT FACILITY**

**CORE SAMPLE LOG**

Borehole ID 16-026 TA/OU 21 Drill Depth From 30 To 50 Page 2 of 2

Driller Stewart Bro Box #(s) N/A Start Date/Time [illegible] 1/15/97 1430 End Date/Time 1/15/97 1610

Drilling Equip./Method CME 750/ Auger Sampling Equip./Method Split Spoon/core

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 30 | 0/5 | ~~0121~~<br>~~97~~<br>~~0099~~<br>JRW<br>1/15/97 | No Recovery | NA | 30-35- No Recovery. Core barrel mislatched | No Recovery | | Run #13 1445 |
| 35 | 5/5 | 0121<br>97<br>0100<br>38-38.5 | NDA | | 35-40' 2-3" wide orange clay filled fracture running length of core. Tuff is weak-mod welded, and altered along core edge of fracture |  | Bandelier Tuff | Run #14 1505 |
| 40 | 2.5/2.5 | N/A | NDA | | 40-42.5 Tuff with 1/4-3/4" fracture running length of core. Tuff is weakly welded and damp. Fracture is orange clay filled | | | Run #15 1540 |
| | 2.5/2.5 | N/A | NDA | | 42.5-45 Tuff, weak-mod. welded, fracture continues to 43'<br>44.5' thin 1/4" clay filled fracture | | | Run #16 1550 |
| 45 | 5/5 | 0121<br>97<br>0101<br>49.5-50 | NDA | | 45-50' Tuff 1/2-1" wide fracture from ~~40~~ JRW 1/17/97 48' to TD at 50'. Fracture is clay filled with a alteration rind 1" from the fracture. | | | Run #17 1600 |
| 50 | | | | | 50 ft Total Depth | | | |

Prepared By J. Walterscheid Date 1/15/97 Checked By Date 1/17/97

R1

LOS ALAMOS NATI' 'AL LABORATORY ENVIRONMENTAL ' 'STORATION PROGRAM

SAMPLE MANAGEMENT FACILITY

## CORE SAMPLE LOG

Borehole ID 16-007 TA/OU 21 Drill Depth From 0 To 30 Page 1 of 2

Driller Stewart Bros. Box #(s) N/A Start Date/Time 1330 [illegible] 96 End Date/Time 19 Dec 96

Drilling Equip./Method CME 750 Auger Sampling Equip./Method 3" Stainless Steel Core Barrel

Location ID: 21-05057

Background: 12/18/96 β/γ = 132 cpm α: 4.6 cpm | 12/19/96 β/γ: 115 cpm α: 4.2 cpm

| Depth (feet) | Recovery (feet per feet / %) | Field Analytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology-Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
|  |  |  |  |  |  |  |  | Drilling into east end of the RWSA at MDA-T TA-21. |
| 0 | 2.2/2.5 | N/A | NDA | N/A | 0-1': Dk brown, moist clayey silts with tuff high organics (grasses)<br>1-2': Dk brown, moist sand with crushed tuff and silts<br>2-2.5' core loss | Loss | Backfill Cover | InZone: 1310<br>Drilling: 1325<br>Run#1: 1335 |
| 5 | 2.5/2.5 | 0121-96-0481<br>4.3-5' |  |  | 2.5-3.5' SAA<br>3.5-4.8' moist tan fine grain sand (10YR 7/4) with small (pebble) clasts (river sand)<br>4.8-5' Gray weathered tuff bands |  | Backfilled RWSA | Run #2: 1355 |
|  | 2/2.5 | N/A |  |  | 5-5.5' core loss<br>5.5-7.5' damp brown (5YR 5/6), clayey sand/tuff with tuff fragments (Backfill) trace cement silt. | Loss |  | Run#3: 1420 |
| 10 | 2.5/2.5 | 0121-96-0482<br>9.5-10' |  |  | 7.5-8' Core loss<br>8-9' fine-med grain lt. brown sand (5YR 6/4) with trace clay and 20% crushed tuff<br>9-10' damp dk brown, clayey med grain sand with 25% crushed tuff fragments (Backfill) (10YR 4/2) | Loss |  | Run#4: 1430 |
|  | 2.5/2.5 | N/A |  |  | 10-12.5' SAA |  |  | Run #5: 1503 |
| 15 | 2.5/2.5 | N/A |  |  | 12.5-15' SAA with slight increase in crushed tuff and clay (Backfill) |  |  | Run #6: 1520 |
|  | 2.5/2.5 | N/A |  |  | 15-17.5' damp backfill material consisting of a tightly packed clayey sand with pieces of crushed tuff (5YR 5/6) sw 12/18/96 |  |  | Run #7: 1535 |
| 20 | 2.5/2.5 | 0121-96-0483<br>17.5-20' |  |  | 17.5-20' becoming fine grained almost silty matrix with crushed tuff.<br>4x4" piece of white synthetic tarp (used to cover spoils pile during placement of waste containers) sw 12/19/96 |  |  | Run #8: 1555<br>1610 shut down |
|  | 2.5/2.5 | N/A | β/γ: 300 cpm<br>α: 20 cpm<br>22.5' |  | 20-22.5' High clay content, moist damp, brown (5YR 4/4) sandy with crushed tuff, grading into a sand |  |  | 19 Dec 96<br>Drilling: 0930<br>Run #9: 0939 |
| 25 | 2.5/2.5 | 0121-96-0484<br>22.5-23.9 | β/γ 40,000<br>α: 52,000<br>H3 90 mCi/m3 |  | 22.5-23.9' Paleo Channel. Black dacite bedded with med. grain sand. β/γ: 40,000 cpm α: 52,000 cpm H3: 90 mCi/m3<br>23.9-25' Tuff, light grey weathered, damp β/γ (25'): 190 CPM, α 180 cpm |  | Paleo Channel | Run #10: 1015 |
|  | 2.5/2.5 | N/A | NDA |  | 25-27.5 Tuff damp. weakly welded, trace clay at 25.5' grey (5YR 7/2) lg. pumice crystals |  | Bandelier Tuff | Run #11: 1120 |
| 30 | 2.5/2.5 | 0121-96-0485<br>27.5-30' | β/γ NDA<br>α 15 CPM<br>30' |  | 27.5-30' Tuff, mod. welded, drying out<br>α 15 CPM at 30' |  |  | Run #12: 1150 |

Prepared by Date 12/19/96 Checked By Date 1/17/97

LOS ALAMOS NATI AL LABORATORY ENVIRONMENTAL :STORATION PROGRAM

**SAMPLE MANAGEMENT FACILITY**

## CORE SAMPLE LOG

Borehole ID 16-007 TA/~~OU~~ 21 Drill Depth From 30 To 50' Page 2 of 2

Driller Stewart Bros. Box #(s) N/A Start Date/Time 18 Dec 96 1330 End Date/Time 19 Dec 96

Drilling Equip./Method CME 750 Auger Sampling Equip./Method 3" Stainless Steel Core Barrel

tion ID: 21-05057

Background 12/19/96
β/γ - 115 CPM
α - 4.2 CPM

| Depth (feet) | Recovery (feet per feet / %) | Field Analytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology-Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 30 | 5.0/5.0 | N/A | NDA ↓ | — | 30-35 Tuff, light gray, changing out with depth (5YR 7/2), mod. welded, trace sanidine crystals, pumice altering to clays small almost horizontal fracture at 33' trace clay infill. 20% qtz. | | ↑ | Run #13: 1215 |
| 35 | 5.0/5.0 | 0121-96-0486<br>39.5-40 | | — | 35-40' SAA | | Bandelier Tuff | Run #14: 1240 |
| 40 | 5.0/5.0 | N/A | | — | 40-45' SAA<br>42-42.7 clay alteration zone tuff changing to a brown color with clay alteration along pumices crystals, trace sanidine crystals (Not a fracture) | | | Run #15: 1300 |
| 45 | 5.0/5.0 | 0121-96-0487<br>49.5-50' | | — | 45-50' SAA<br>clay alteration zone at 45.5-46 | | ↓ | Run #16: 1325 |
| 50 | | | | — | 50' Total Depth | | | |
| 55 | | | | — | | | | |
| 60 | | | | — | | | | |

Prepared by Date 12/19/96 Checked By Date 1/17/97

LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

**SAMPLE MANAGEMENT FACILITY**

## CORE SAMPLE LOG

Borehole ID 16-008 TA/~~OU~~ 21 Drill Depth From 0 To 50' T.D. Page 1 of 2
Driller Stewart Bro. Box #(s) N/A Start Date/Time 10 Dec 96 1000 End Date/Time 11 Dec 96 1255
Drilling Equip./Method CME /Auger Sampling Equip./Method Continuous Core/Split Spoon
Location ID: 21-05058

| Depth (feet) | Recovery (feet per foot / %) | Field Analytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology-Petrology - Soil | Graphic Log | Lithologic Unit | Drilling into western end of the RWSA MDA T TA-21.<br>Notes |
|---|---|---|---|---|---|---|---|---|
| 0.0 | 2/2.5 | N/A | No detectable activity<br>NDA | N/A | 0-2' damp brown clay, sand (20%), tuff (5%), organics (roots, grass) 5YR 3/4 | | | Run #1/ 1050 |
| 5 | 2.5/2.5 | 0121-96-0491<br>4.5-5' | NDA | N/A | 2-2.5' No Recovery<br>2.5-5' damp brown clay/tuff mix (Backfill material) | | | #2/1031 |
| | 1.8/2.5 | N/A | NDA | N/A | 5-5.7' No recovery<br>5.7-8.2' clay/crushed tuff mix Backfill | | | #3/1112 |
| 10 | 0.7/2.5 | 0121-96<br>0492<br>7.7-8.2' | NDA | N/A | 8.2-10.5' No Recovery | Lost | Backfill | #4/1135<br>1200 lunch also, down due to high winds |
| | 2.0/2.5 | N/A | NDA | N/A | 10.5-14.2' Sandy clay with crushed tuff damp, light brown 5YR 6/4<br>14.2-14.7' piece of tuff, weathered | | | #5/1444 |
| 15 | 2.5/2.5 | 0121-96<br>0493<br>14.5-15' | NDA | N/A | 14.7-18.1' Sandy clay with 30% tuff fragments damp light brown 5YR/6/4 (Backfill material) | | P.T. | #6/1521<br>Sample not submitted for analysis JW [illegible] |
| | 2.5/2.5 | N/A | NDA | N/A | | | | #7/1550<br>1604 end of day |
| 20 | 2.5/2.5 | 0121-96-<br>0494<br>17.5-18.2' | NDA | N/A | 18.1-50' Tuff<br>damp moderately welded pale brown/grey 10YR 6/2, 20% qtz, 5-10% pumice. | | | 0830 warming up Rig setting up equipment<br>#8/0900 |
| | 2.5/2.5 | N/A | NDA | N/A | Note sharp flat contact at 18.1'<br>22' small fracture | | | #9/0934 |
| 25 | 2.5/2.5 | N/A | NDA | N/A | SAA (same as above) | | Bandelier Tuff | #10/0952 |
| | 5/5 | 0121-96 | NDA | N/A | SAA, no fracturing | | | #11/1015<br>5 ft runs in tuff |
| 30 | | 0495<br>29.5-30' | NDA | N/A | | | | |

Prepared by Jeff Walterscheid Date Dec 10-11, 96 Checked By Date 1/8/97

LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

SAMPLE MANAGEMENT FACILITY

## CORE SAMPLE LOG

Borehole ID 16-008 TA/~~OU~~ 21 Drill Depth From 30 To 50' Page 2 of 2

Driller Stewart Bro Box #(s) N/A Start Date/Time 10 Dec 96 End Date/Time 11 Dec 96

Drilling Equip./Method CME 750 Hollow Stem Auger Sampling Equip./Method Core / Split Barrel

| Depth (feet) | Recovery (feet per feet / %) | Field Analytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology-Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 30 | 5/5 | N/A | NDA | N/A<br>N/A | 30-50' Tuff cont., drying with depth. 31.7' small fracture 60° trace clay infill. | " | Bandelier Tuff | #12 / 1135 |
| 35 | 5/5 | 0121-96<br>0496<br>39.5-40' | NDA | N/A<br>N/A | SAA no fractures, solid core | " | | #13 / 1215 |
| 90 | 5/5 | N/A | NDA | N/A<br>N/A | SAA no fractures, solid core | " | | #14 / 1245 |
| 45 | 5/5 | 0121-96<br>0497<br>49.5-50' | NDA | N/A<br>N/A | SAA no fractures, solid core, dry | " | | #15 / 1255 |
| 50 | | | | | 50' T.D. (total depth) | " | | |
| | | | | — | | | | |
| | | | | — | | | | |
| | | | | — | | | | |
| | | | | — | | | | |

Prepared by J. Walterscheid Date Dec 11, 96 Checked By Date 1/8/97

## LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

**SAMPLE MANAGEMENT FACILITY**

## CORE SAMPLE LOG

Borehole ID 16-009 TA/OU 21 Drill Depth From 0 To ~~50.0~~ 30 ft [illegible] 2/6/97 Page 1 of 2
Driller Stewart Bro Box #(s) NA Start Date/Time 2/3/97 0930 End Date/Time 2/4/97 1430
Drilling Equip./Method CME750/auger Sampling Equip./Method Split Spoon/core
Location ID: 21-05059

Contamination Criteria
2/3/97 α: 2 cpm Bγ: 92 cpm
2/4/97 α: 13 cpm Bγ: 122 cpm

Notes: Drilling approx 15' east of disposal shafts at MDA-T.

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 0 | 2.5/2.5 | NA | NDA | NA | 0-1.5' Brown 5YR 4/4 moist, mix of crushed tuff, silty clay<br>1.5-2.5' Lt. brown, damp 5YR 6/4 crushed tuff/fine grain silt. |  | Backfill/Overburden | 2/3/97<br>Run# 1 0945 |
|  | 2/2.5 | 0121-97-0111<br>4-4.5 | NDA |  | 2.5-3' SAA<br>3-4.5' Brown 5YR 4/4 moist silty clay<br>4.5-5' No Recovery |  |  | Run# 2 1005 |
| 5 | 2/2.5 | NA | NDA |  | 5-7' Brown 5YR 4/4 moist silty clay, occasional pieces of weathered tuff<br>7-7.5' No Recovery |  |  | Run# 3 1025 |
|  | 2.5/2.5 | NA | NDA |  | 7.5-8.5' Brown 5YR 4/4 moist silty clay<br>8.5-10' Lt. brown 5YR 5/6, fine grain silty sand with white weathered pumice, 5% small gravel (rounded edges) moist. |  | ???<br>Paleo Channel | Run# 4 1050<br>Bank deposit ? |
| 10 | 2.5/2.5 | 0121-97-0112<br>12.2-12.7 | NDA |  | 10-10.3' SAA<br>10.3-12.5' reddish brown 5YR 5/6 damp weakly cemented medium-coarse grained sand. |  |  | Run #5 1105<br>channel sands |
|  | 2.5/2.5 | NA | NDA |  | 12.5'-13.2' SAA less cementing with depth.<br>13.2-14.5' med grain sand with small ~~no~~ gravels<br>14.5-14.8' brown gravelly clay zone<br>14.8-15' medium grain sand, moist (no cementing) |  |  | Run #6 1130 |
| 15 | 2.5/2.5 | NA | NDA |  | 15-17.1' medium grain reddish brown 5YR 5/6 damp to moist sand.<br>17.1-17.5' Coarse grain pebbly sand |  |  | Run# 7 1150 |
|  | 2.5/2.5 | NA | NDA |  | 17.5-17.9' SAA<br>17.9-20' Reddish brown 5YR 5/6 damp/moist med. grain sand with 10-20% small ~~pebbles~~ tuff/gravels |  |  | Run # 8 1210 |
| 20 | 2.5/2.5 | 0121-97-0113<br>22-22.5 | NDA |  | 20-22.5' SAA |  |  | Run# 9 1225 |
|  | 2.5/2.5 | NA | NDA |  | 22.5-24.5 SAA<br>24.5-25.0 Med grained grayish orange 5YR 7/2 sand w/ 10-15% gravels damp |  |  | Lunch 1245<br>Run#10 [illegible]<br>1404 |
| 25 | 2.[illegible]/2.5 | ~~0121-97-0114~~<br>NA | NDA |  | 25.0-27.0' light brownish gray 5YR 6/1 moderately welded tuff w/ pumice infill, altered to pale brown 5YR 5/2. 10-15% pumice.<br>27.0-27.5' moderate brown 5YR 4/4 moderately welded tuff 5% pumice infill (light grey N8) |  |  | Run 11 1430 |
| 30 | 0/2.5 | NA | NA |  | 27.5-30' No Rec. |  |  | cemented [illegible]<br>Run 12 15[illegible]<br>No Recovery [illegible] pumice |

J. Watterscheid
Prepared By J. Crocker Date 2/4/97 Checked By Date 2/7/97

R1

LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

SAMPLE MANAGEMENT FACILITY

## CORE SAMPLE LOG

Borehole ID 16-0029 TA/OU 21 Drill Depth From 30 To 50.0ft Page 2 of 2

Driller Stewart Bros Box #(s) NA Start Date/Time 2/3/97 0930 End Date/Time 2/4/97 1430

Drilling Equip./Method CME/750 w/ augers Sampling Equip./Method Split spoon (core)

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 30 | 1.0/2.5 | 0121-97-0114<br>31.5-33.0 | NDA | NA | 30-31.5' No Recovery<br>31.5-32.5 Poorly Sorted fine sand, silt and subangular Dacitic gravel. Moderate brown 5YR 4/4 | | Paleo Channel | Run #13 1516 |
| | 1.5/2.5 | NA | NDA | NA | 32.5'-33.5 No Recovery<br>33.5-35.0 Moderate brown 5 YR 4/4 Poorly sorted silty sand, gravel and cobbles. | | | Run 14 1600 |
| 35 | 1.4/2.5 | 0121-97-0115<br>36.4-36.9 | NDA | NA | 35.0-36.4 SAA<br>36.4-36.9 Light gray (N7) Poorly welded Tuff. Pumice lapilli are white and ~10%<br>36.9-37.5 Loss | | | Run 15 2/4/97<br>0945 |
| | 2.5/2.5 | NA | NDA | NA | 37.5-40 Light gray (N7) Poorly welded Tuff. Pumice lapilli are white to grayish blue and make up ~10% of Tuff | | Bandelier Tuff Unit #3 | Run 16 1040 |
| 40 | 2.0/2.5 | 0121-97-0116<br>40.0-40.5 | NDA | NA | Grayish orange 5 YR 7/2 (40'-42') Pumice lapilli locally altered Med Gray N5.<br>No Recov 42.0'-42.5' | | | Run 17 1351 |
| | 5/5 | NA | NDA | NA | Grayish orange 5YR 7/2 (42.5-47.5') Pumice Lapilli and Gray (N6) 12-15% | | | Run 18 1415 |
| 45 | — | NA | NDA | NA | / | | | ~~Run 17~~<br>[illegible] 2/4/97 |
| | 2.0/2.5 | 0121-97-0117 | NDA | NA | 47.5-~~50~~ 49.5 Grayish orange 5 YR 7/2 Tuff. Non-Welded. Pumice lapilli to 12% (N6) Med. Gray | | | ~~Run 22~~ 1405<br>Run 19 |
| 50 | | | | | 50ft Total Depth | | | |

Prepared By J Crocker Date 2/4/97 Checked By Date 2/7/97

R1

LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

**SAMPLE MANAGEMENT FACILITY**

**CORE SAMPLE LOG**

Borehole ID 16-010 TA/OU 21 Drill Depth From 0 To 30 Page 1 of 6

Driller Stewart Bro Box #(s) NA Start Date/Time 2/18/97 1010 End Date/Time 2/21/97 1545

Drilling Equip./Method CME 750/ Auger Sampling Equip./Method Split Spoon/Core

Location ID: 21-05060

Contamination Criteria

| 2/18/97 | 2/19/97 | 2/20/97 | 2/21/97 |
|---|---|---|---|
| α: 5cpm<br>Bγ: 98cpm | α: 14cpm<br>Bγ: 110cpm | α: 3cpm<br>Bγ: 93cpm | α: 3cpm<br>Bγ: 93cpm |

| Depth (Feet) | Recovery (feet per foot/ %) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Drilling an angle hole to the NW under the disposal shafts at MDA-T, TA-21. Notes |
|---|---|---|---|---|---|---|---|---|
| 0 | 2.5/2.5 | NA | NDA | NA | 0-1.8' dk brown 5YR 4/4 moist silty clays with trace organics (roots) 10% small pebbles.<br>1.8-2' Concrete | | Overburden/Backfill | Drilling 1010<br>Run #1 1030 |
| 5 | 2.5/2.5 | 0121-97<br>0136<br>4.5-5' | NDA | | 2-2.5' Pale brown 10YR 6/2 moist tuff, weakly welded<br>2.5-3.7 SAA<br>3.7-5' dk brown 5YR 4/4 moist clays with FeOx alteration rings | | | Run #2 1047 |
| | 2.5/2.5 | NA | NDA | | 5-6.9' SAA<br>6.9-7.5' Grayish Pink 5YR 7/2 moist, weakly welded tuff. | | | Run #3 1110 |
| 10 | 2.5/2.5 | NA | NDA | | 7.5-10' Grayish Pink 5YR 7/2 tuff. Mix of soft damp tuff with moderately welded dry pieces of tuff. Tuff fragments make up 30% of core. | | Bandelier Tuff Unit #3 | Run #4 1130 |
| | 2.5/2.5 | 0121-97<br>0137<br>10-10.5 | NDA | | 10-12.5 SAA with fragments making up 50% of the core. | | | Run #5 1142 |
| 15 | 2.5/2.5 | NA | NDA | | 12.5-15' Grayish pink 5YR 7/2 dry moderately welded tuff. 10% pumice. Solid | | | Run #6 1200 |
| 20 | 5/5 | NA | NDA | | 15-20' SAA solid tuff, no fractures | | | Lunch 1215<br>Drilling 1255<br>Run #7 1315 |
| 25 | 5/5 | 0121-97<br>0138<br>20-20.5 | NDA | | 20-25' SAA | | | Run #8 1340 |
| 30 | 5/5 | NA | NDA | | 25-30' Grayish pink 5YR 7/2 dry weak to moderately welded tuff 10% pumice. Trace FeOx staining alteration at 25'.<br>JW 2/21/97<br>No Fractures | | | Run #9 1400 |

Prepared By J. Walterscheid Date 2/21/97 Checked By Date 2/25/97

R.1

LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

SAMPLE MANAGEMENT FACILITY

**CORE SAMPLE LOG**

Borehole ID 16-010 TA/OU 21 Drill Depth From 30 To 60 Page 2 of 6

Driller Stewart Bro Box #(s) NA Start Date/Time 2/18/97 1010 End Date/Time 2/21/97 1545

Drilling Equip./Method CME750 / Auger Sampling Equip./Method Split Spoon / Core

| Depth (Feet) | Recovery (feet per foot/%) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 30 | 5./5 | 0121<br>97<br>0139<br>30-30.5 | NDA | NA | 30-35' Grayish Pink 5YR 7/2 dry, weak to moderately welded tuff. 10% pumice. No Fractures. | | | Run #10 1425 |
| 35 | 5/5 | NA | NDA | | 35-40' SAA small fracture at ~~37.?'~~ 37.4' with trace clay filling. NDA | | | Run #11 1442 |
| 40 | 25/5 | 0121<br>97<br>0140<br>42-42.5 | NDA | | 40-41.2' SAA<br>41.2-42.5' H brown gray weakly welded tuff. trace moisture. clay filled fracture at 60°<br>42.5-45 No Recovery | Loss | Bandelier Tuff Unit #3 | Run #12 1502<br>42' J.C. |
| 45 | 25/25 | NA | NDA | | 45-47.5 Gray 10YR 6/2 soft, non to weakly welded, dry. tuff. | | | Run #13 1520 |
| | 2/2.5 | NA | NDA | | 47.5-49.5' SAA<br>495-50' No Recovery | Loss | | Run #14 1535 |
| 52 | 1.3/2.5 | 0121 97<br>0141<br>50-50.5 | NDA | | 50-51.3' H gray 10YR 6/2 soft non to weakly welded, dry tuff.<br>51.3-52.5 No Recovery. | Loss | | Run #15 1550<br>1600 End of Day |
| 55 | 2.5/2.5 | NA | NDA | | 52.5-54.3' H pinkish gray 5YR 7/2 non welded dry tuff.<br>54.3-55' H pinkish gray 5YR 7/2 mod welded dry tuff. | | | 2/19/97 Drilling 0830<br>Run #16 0908 |
| 60 | 2.5/5 | NA | NDA | | 55-55.5' SAA<br>55.5-57.5' H pinkish gray 5YR 7/2 non-weakly welded (soft) tuff. Slight increase in qtz Dry.<br>57.5-60 No Recovery | Loss | | Run #17 0925<br>57.5-60 No Recovery barrel packed off. |

Prepared By J. Walterscheid Date 2/21/97 Checked By Date 4/5/97

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## LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

**SAMPLE MANAGEMENT FACILITY**

## CORE SAMPLE LOG

Borehole ID 16-010 TA/OU 21 Drill Depth From 60 To 90 Page 3 of 6
Driller Stewart Bo Box #(s) NA Start Date/Time 2/18/97 1010 End Date/Time 2/21/97 1545
Drilling Equip./Method CME 750 / Auger Sampling Equip./Method Split Spoon / Core

| Depth (Feet) | Recovery (feet per foot/ %) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 60 | 2.5/2.5 | 0121-97<br>0142<br>60-62.5 | NDA | NA | 60-62.5' lt pinkish gray 5YR 7/2 non to weakly welded (soft) tuff. 30% Tuff fragments. | | Bandelier Tuff Unit #3 | Run # 18 0945 |
| 65 | 2.5/2.5 | NA | NDA | | 62.5-65' SAA | | | Run #19 1005 |
| | 2.5/2.5 | NA | NDA | | 65-67.5' lt pinkish gray 5YR 7/2 non to weakly welded (soft) tuff. Contains 35% welded tuff fragments. | | | Run #20 1025 |
| 70 | 2.5/25 | 0121-97<br>0143<br>0163<br>67.5-70 | NDA | | 67.5-70 SAA | | | Run # 21 1045<br>Duplicate Sample<br>0121-97-0163 Taken |
| | 2.5/25 | NA | NDA | | 70-72.5 SAA slight increase in pumice | | | Run #22 1106 |
| 75 | 2.0/25 | NA | NDA | | 72.5-74.5 lt pink gray non to weakly welded soft tuff with mottled brown zones.<br>74.5-75 No Recovery | Loss | | Run #23 1125 |
| | 2.5/2.5 | NA | NDA | | 75-77.5 SAA clay filled fracture at 76.2' NDA. Fracture is very thin | | | Lunch 1140<br>Drilling 1230<br>Run # 24 1240 |
| 80 | 2.5/25 | 0121-97<br>0144<br>77.5-80 | NDA | | 77.5-80 lt pinkish gray 5YR 7/2 non welded with 20% welded tuff fragments. Dry | | | Run # 25 1258 |
| | 2.5/2.5 | NA | NDA | | 80-82.5 SAA | | | Run #26 1324 |
| 85 | 2.5/25 | NA | NDA | | 82.5-85 lt gray non to very weakly welded soft dry tuff. 10% welded tuff fragments | | | Run #27 1340 |
| | 25/25 | NA | NDA | | 85-87.5 lt. gray nonwelded, soft, dry tuff. | | | Run # 28 1400 |
| 90 | 2/25 | 0121-97<br>0145<br>89-89.5 | NDA | | 87.5-89.5' lt gray non welded, soft ~~sugary~~ (sugary) dry tuff<br>89.5-90 No Recovery | Loss | | Run #29 1420<br>sugar texture |

Prepared By J. Watterscheid Date 2/21/97 Checked By Date 2/25/97

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**LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM**

**SAMPLE MANAGEMENT FACILITY**

**CORE SAMPLE LOG**

Borehole ID 16-010 TA/OU 21 Drill Depth From 90 To 120 Page 4 of 6

Driller Stewart Bro. Box #(s) NA Start Date/Time 2/18/97 1010 End Date/Time 2/21/97 1545

Drilling Equip./Method CME 750/Auger Sampling Equip./Method Split Spoon/Core

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 90 | 18/2.5 | NA | NDA | NA ↓ | 90-91.8 lt gray soft non-welded dry tuff (sugary).<br>91.8-92.5' No Recovery | Loss | Bandelier Tuff Unit #3 | Run #30 1438 |
| 95 | 2/2.5 | NA | NDA | | 92.5-94.5' SAA<br>94.5-95' No Recovery | Loss | | Run #31 1500 |
| | 1.5/2.5 | NA | NDA | | 95-96.5 lt gray 5YR 6/1, soft non welded dry tuff. Sugar like texture.<br>96.5-97.5' No Recovery | Loss | | Run #32 1520 |
| 100 | 2.5/2.5 | 012197<br>0046<br>97.5-100 | NDA | | 97.5-100' SAA | | | Run #33 ~~1343~~ RW 2/21/97 1543 |
| | 2.5/2.5 | NA | NDA | | 100-102.5' SAA | | | Run #34 1600<br>End of Day 1615 |
| 105 | 2.5/2.5 | NA | NDA | | 102.5-105' lt gray 5YR 6/1, soft non welded dry tuff. 5% pumice | | | 2/20/97 Drilling 0825<br>Run #35 0840 |
| | 2/2.5 | NA | NDA | | 105-107' SAA<br>107-107.5 No Recovery | Loss | | Run #36 0900 |
| 110 | 1.8/2.5 | 0121-97<br>0047<br>108-108.2 | NDA | | 107.5-~~108.8~~ RW 2/21/97 108.2' lt gray 5YR 6/1 soft non welded dry tuff.<br>108.2-110 No Recovery | Loss | | Run #37 0925 |
| | 2/2.5 | NA | NDA | | 110-112 SAA<br>112-112.5 No Recovery | Loss | | Run #38 0948 |
| 115 | 2.5/2.5 | NA | NDA | | 112.5-115' lt gray 5YR 6/1 soft non welded dry tuff. | | | Run #39 1012 |
| | 2.5/2.5 | NA | NDA | | 115-117.5' SAA | | | Run #40 1040 |
| 120 | 1.5/2.5 | 012197<br>0048<br>0165<br>~~118~~ SW 2/21/97 118.5-119 | NDA | | 117.5-119' lt gray 5YR 6/1 soft non-welded dry tuff w/ 15% welded tuff fragments<br>119-120 No Recovery | Loss | | Run #41 1105<br>0121-97-0165 Field Blank QA/QC water sample |

Prepared By J. Walterscheid Date 2/21/97 Checked By Date 2/25/97

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**LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM**

**SAMPLE MANAGEMENT FACILITY**

**CORE SAMPLE LOG**

Borehole ID 16-010 TA/OU 21 Drill Depth From 120 To 150 Page 5 of 6

Driller Stewart Bro. Box #(s) NA Start Date/Time 2/18/97 1010 End Date/Time 2/21/97 1545

Drilling Equip./Method CME 750/Auger Sampling Equip./Method Split Spoon/ Core

| Depth (Feet) | Recovery (feet per foot/ %) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 120 | 2.5/2.5 | NA | NDA | NA | 120-122.5' lt. gray 5YR 6/1 soft nonwelded dry tuff. 20% welded tuff fragments. | | Bandelier Tuff Unit #3 | Run #42 1136 |
| | 2.5/2.5 | NA | NDA | | 122.5-125' SAA | | | Run #43 1203<br>lunch 1215 |
| 125 | 1.3/2.5 | NA | NDA | | 125-126.3' lt brownish gray 5YR 6/1 dry. mix of soft non welded tuff (40%) with moderately welded fragments.<br>126.3-127.5 No Recovery | Loss | | Run #44 1340 |
| | 2/2.5 | 0121-97<br>0149<br>0164<br>127-129.5 | NDA | | 127.5-129.5 grayish pink 5YR 7/2, dry, mix of soft non welded tuff with 65% mod. welded tuff. Increase in qtz to 10% possible FeOx spotting.<br>129.5-130 No Recovery | Loss | | Run #45 1413<br>Duplicate taken |
| 130 | 3'/5 | NA | NDA | | 130-133 Grayish pink 5YR 7/2 dry mix of soft nonwelded tuff with 30% welded tuff.<br>133-135 No Recovery | Loss | | Run #46 1450 |
| 135 | 2/2.5 | NA | NDA | | 135-137' Grayish pink 5YR 7/2 dry, mix of soft non-welded soft tuff with 35% welded tuff<br>137.0-137.5 No Recovery | Loss | | Run #47 1520 |
| | 2/2.5 | 0121-97<br>0150<br>139-139.5 | NDA | | 137.5-139.5 SAA<br>139.5-140 No Recovery | Loss | | Run #48 1550<br>End of Day |
| 140 | 1.5/2.5 | NA | NDA | | 140-141.5' Grayish pink 5YR 7/2 mix of soft non-welded tuff with 35% welded tuff.<br>141.5-142.5 No Recovery | Loss | | 2/21/97 Drilling 0830<br>Run #49 0900 |
| | 2/2.5 | NA | NDA | | 142.5-~~144~~ 144.5 SAA<br>~~144-145 No Recovery~~ JW 2/21/97 144.5-145 No Recovery | Loss | ?. | Run #50 1000 |
| 145 | 2.5/5 | NA | NDA | | ~~142.5~~ 145-147.5 lt grayish pink mix of soft non welded tuff with 35% welded tuff. FeOx spotting in welded tuff fragments.<br>147.5-150 No Recovery | Loss | Unit 2(?) ?. | Run #51 1030 |
| 150 | | | | | | | | |

Prepared By J. Wattersland Date 2/21/97 Checked By Date 2/25/97

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LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

SAMPLE MANAGEMENT FACILITY

**CORE SAMPLE LOG**

Borehole ID 16-010 TA/OU 21 Drill Depth From 150 To 175 TD Page 6 of 6

Driller Stewart Bro Box #(s) NA Start Date/Time 2/18/97 1010 End Date/Time 2/21/97 1545

Drilling Equip./Method CME 750/Auger Sampling Equip./Method Split Spoon/Core

| Depth (Feet) | Recovery (feet per foot/ %) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 150 | 2.5/2.5 | 0121-97<br>0151<br>0162<br>150-152.5 | NDA | NA | 150-152.5 lt gray mix of soft tuff with 35% welded tuff fragments. FeOx spotting on tuff fragments. | | Bandelier Tuff Unit 2 (?) | Run #52 1105<br>0121-97-0162 Field Blank |
| 155 | 3/5 | NA | NDA | | 152.5-155.5' SAA<br>155.5-157.5 No Recovery | Loss | | Run #53 1145<br>Lunch 1215 |
| 160 | 3/5 | 0121-97<br>0152<br>160-160.5 | NDA | | 157.5-160.5 Pale brown 10YR6/2 mix of soft tuff with 40% welded tuff. Tuff fragments are moderately welded with FeOx(?) spotting.<br>160.5-162.5 No Recovery | Loss | | Run #54 1350 |
| 165 | 3/5 | NA | NDA | | 162.5-165' SAA<br>165-165.5' Grayish Pink 5YR 7/2 moderately welded tuff. Dry. 10% qtz. Solid.<br>165.5-167.5 No Recovery | Loss | | Run # 55 1430 |
| 170 | 3.5/5 | 0121<br>97<br>0153<br>169.5-170 | NDA | | 167.5-171' Pale brown 10YR 6/2 mix of soft nonwelded tuff with 40% welded tuff pieces. Tuff fragments are moderately welded.<br>171-172.5' No Recovery | Loss | | Run #56 1505 |
| 175 | 2.5/2.5 | 0121-97<br>0154<br>174.5-175 | NDA | ↓ | 172.5-175' SAA | | | Run #57 1535<br>End of Day 1600 |
| | | | | | 175' Total Depth | | | |

Prepared By J. Walterscheid Date 2/21/97 Checked By Date 4/25/97

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LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

SAMPLE MANAGEMENT FACILITY

**CORE SAMPLE LOG**

Borehole ID 16-011 TA/OU 21 Drill Depth From 0 To 30 Page 1 of 7

Driller Stewart Bro. Box #(s) NA Start Date/Time 2/26/97 1000 End Date/Time 3/6/97 1030

Drilling Equip./Method CME 750/Auger Sampling Equip./Method Split Spoon/Core

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core In Box | Contamination Criteria also see pg. #2<br>2/26/97 α: 9 cpm βγ: 93 cpm<br>2/27/97 α: 6 cpm βγ: 92 cpm<br>3/3/97 α: 3 cpm βγ: [illegible] cpm<br>3/4/97 α: 6 cpm βγ: 97 cpm<br>3/5/97 α: 5 cpm βγ: 93 cpm<br>Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Drilling a 35° angle hole to the SE under absorption bed # 3 and the disposal shafts at MDA-T, TA-21.<br>Notes |
|---|---|---|---|---|---|---|---|---|
| 0<br>5 | 2.5/5 | NA | NDA | NA | 0-2.4' Moderate brown 5YR 4/4 very moist silty hard clay with small pebbles and pieces of asphalt. Roots and grasses to 1.5'.<br>2.4-2.5 Grayish pink 5YR 7/2 weathered tuff<br>2.5-5' No Recovery | Loss | Overburden/Backfill | 2/26/97 Drilling 1010<br>Run #1 1025 |
| | 1/2.5 | 0121-97 0166 5.5-6 | NDA | | 5-6' Light brown 5YR 6/4 silty clay with crushed tuff.<br>6-7.5' No Recovery | Loss | | Run #2 1040<br>putting cuttings in core barrel |
| 10 | 1.5/2.5 | NA | NDA | | 7.5-8' Light brown silty clay with crushed tuff<br>8-9' Light brown 5YR 5/6 silty clay.<br>9-10' No Recovery | Loss | | Run #3 1050 |
| | 1.3/2.5 | 0121-97 0167 10-10.5 | NDA | | 10-11.3' light gray, dry, weak to moderately welded tuff. ~~Clay filled (1" wide) fracture, 75° at [illegible]~~ JEW 2/26/97<br>11.3-12.5' No Recovery | Loss | | Run #4 1102 |
| 15 | 2.5/2.5 | NA | NDA | | 12.5-15' light gray, dry, weak-mod. welded tuff. Clay filled (1" wide) fracture, 75° at 14.3' NDA | | | Run #5 1123 |
| 20 | 2.5/5 | NA | NDA | | 15-17.5' light gray/brown mottled zone. Weak-mod. welded tuff fragments make up 35% of zone. Trace clay, possible fracture zone. NDA.<br>17.5-20 No Recovery | Loss | | Run #6 1140 |
| | 2.5/2.5 | 0121-97 0168 1126 22-22.5 | NDA | | 20-22.5 SAA with clay filled fracture at 22' | | Unit #3 | Run #7 1200<br>Duplicate sample 0121-97-1126<br>Lunch 1230/Snow delay |
| 25 | 1.7/2.5 | NA | NDA | | 22.5-24.2 light brownish gray 5YR 6/1 mix of non welded tuff with 25% welded tuff fragments.<br>24.2-25' No Recovery | Loss | | 2/27/97 0835 Drilling<br>Run #8 0855 |
| | 2.5/2.5 | NA | NDA | | 25-27.5' SAA | | | Run #9 0912 |
| 30 | 2/2.5 | NA | NDA | | 27.5-29.5 light brownish gray mottled 5YR 6/1 mix of non welded (sand) tuff with 30% welded tuff fragments<br>29.5-30' No Recovery | Loss | | Run #10 0925 |

Prepared By J. Wattersdad Date 3/6/97 Checked By Date 3/26/97

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LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

SAMPLE MANAGEMENT FACILITY

**CORE SAMPLE LOG**

Borehole ID 16-011 TA/OU 21 Drill Depth From 30 To 60 Page 2 of 7

Driller Stewart Bro Box #(s) NA Start Date/Time 2/26/97 1000 End Date/Time 3/6/97 1030

Drilling Equip./Method CME 750 / Auger Sampling Equip./Method Split Spoon / Core

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Contamination Criteria<br>3/6/97<br>α: 5cpm<br>βγ: 90cpm<br>Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 30 | 2/2.5 | 0121-97-0167<br>30-32.5 | NDA | NA | 30-32 light brownish gray 5YR 6/1, dry non to weakly welded tuff. Contains 20% welded tuff fragments. Mottled Brown<br>32-32.5' No Recovery | Loss | | Run #11 0940 |
| 35 | 2.5/2.5 | NA | NDA | | 32.5-35' light brownish gray, dry weakly welded tuff with 40% welded tuff fragments. | | | Run #12 0955 |
| | 2.5/2.5 | NA | NDA | | 35-37.5 SAA | | | Run #13 1015 |
| 40 | 2.5/2.5 | NA | NDA | | 37.5-40 light brownish gray (mottled) non to weakly welded tuff. 40% weak to mod. welded tuff fragments. | | | Run #14 1030 |
| | 2.5/2.5 | 0121-97-0170<br>40-42.5 | NDA | | 40-42.5' SAA | | Bandelier Tuff Unit #3 | Run #15 1045 |
| 45 | 1.7/2.5 | NA | NDA | | 42.5-44.3' SAA<br>44.3-45 No Recovery | Loss | | Run #16 1104 |
| | 1.5/2.5 | NA | NDA | | 45-46.5 light brown gray 5YR 6/1 trace moisture non-weakly welded tuff. 20% welded tuff fragments. Brown mottled weathered look. 46.3' clay filled fracture. NDA<br>46.5-47.5 No Recovery | Loss | | Run #17 1121 |
| 50 | 2.5/2.5 | 0121-97-0171<br>1129<br>45-47.5 | NDA | | 47.5-50' Brownish gray 5YR 4/1 ~~damp~~ slightly moist, soft non welded tuff with 10% fragments. 45-50' fracture zone, clay alteration, mottled brown gray. | | | Run # 18 1145<br>Field Blank 0121-97-1127 taken. |
| | 2.5/2.5 | NA | NDA | | 50-52.5' Brownish gray (mottled) moist, soft nonwelded tuff with 20% gray welded tuff fragments. Weathered. | | | Run #19 1205 |
| 55 | 2.5/2.5 | NA | NDA | | 52.5-54.5 Pale brown 5YR 5/2, trace moisture, nonwelded tuff, weathered, 20% welded tuff fragments.<br>54.5-55' Grayish pink 5YR 7/2 dry weakly welded tuff. | | | Run #20 1220<br>Lunch 1230 |
| | 2.5/2.5 | NA | NDA | | 55-57.5' Grayish pink non to weakly welded dry tuff. 20% moderately welded tuff fragments. | | | Run #21 1400 |
| 60 | 2.5/2.5 | 0121-97-0172<br>57.5-60 | NDA | | 57.5-60' SAA | | | Run #22 1415 |

Prepared By J. Walterscheid Date 3/6/97 Checked By Date 3/28/97

R1

LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

SAMPLE MANAGEMENT FACILITY

**CORE SAMPLE LOG**

Borehole ID 16-011 TA/OU 21 Drill Depth From 60 To 90 Page 3 of 7

Driller Stewart Bro Box #(s) NA Start Date/Time 2/26/97 1000 End Date/Time 3/6/97 1030

Drilling Equip./Method CME750/Auger Sampling Equip./Method Split Spoon/Core

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Anaytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 60 | 1.4/2.5 | NA | NDA | NA | 60-61.4' Grayish pink 5YR 7/2 non to weakly welded Tuff. Dry, 20% welded tuff fragments in soft (sugary) tuff<br>61.4-62.5 No Recovery | Loss | Bandelier Tuff Unit #3 | Run #23 1437 |
| 65 | 1.7/2.5 | NA | NDA | | 625-64.3' Grayish pink non welded (soft) dry tuff with 20% welded tuff fragments.<br>64.3-65' No Recovery | Loss | | Run # 24 1455 |
| | 2/2.5 | NA | NDA | | 65-67' Brownish gray (mottled) non welded dry tuff with slight increase (30%) in welded tuff fragments. Possible fracture zone<br>67-67.5 No Recovery. | Loss | | Run # 25 1520 |
| 70 | 2.5/2.5 | 0121-97<br>0173<br>67.5-70 | NDA | | 67.5-69 SAA<br>69-70 Grayish pink non welded dry tuff. Sugary texture. Very soft. 5YR 7/2 | | | Run # 26 1540<br>End of Day 1605 |
| | 2/2.5 | NA | NDA | | 70-72' SAA<br>72-72.5' No Recovery | Loss | | 3/3/97 Drilling 0900<br>Run # 27 0940 |
| 75 | 2/2.5 | NA | NDA | | 72.5-74.5' SAA<br>74.5-75' No Recovery | Loss | | Run # 28 1010 |
| | 2.5/2.5 | NA | NDA | | 75-77.5' Grayish pink 5YR 7/2 soft, non-welded (sugary) dry tuff. | | | Run # 29 1035 |
| 80 | 1.8/2.5 | 0121-97<br>0174<br>78.5-78.8 | NDA | | 77.5-~~78.8~~ 79.3' SAA JW 3/4/97<br>79.3' ~~78.8~~ 80' No Recovery | Loss | | Run # 30 1054 |
| | 2.5/2.5 | NA | NDA | | 80-82.5' Grayish Pink 5YR 7/2 soft, dry non-welded tuff. Sugar like texture | | | Run # 31 1114 |
| 85 | 2/2.5 | NA | NDA | | 82.5-84.5 SAA<br>84.5-85' No Recovery | Loss | | Run # 32 1132 |
| | 2.5/2.5 | NA | NDA | | 85-87.5 SAA | | | Run # 33 1155<br>Lunch 1215 |
| 90 | 2.5/2.5 | 0121-97<br>0175<br>87.5-90 | NDA | ↓ | JW 3/4/97 87.5-90 Light gray soft, dry non-welded tuff. sugar like texture | | | Run # 34 1330 |

Prepared By J. Walterscheid Date 3/6/97 Checked By Date 3/24/97

R1

LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

SAMPLE MANAGEMENT FACILITY

**CORE SAMPLE LOG**

Borehole ID 16-011 TA/OU 21 Drill Depth From 90 To 120 Page 4 of 7

Driller Stewart Bro Box #(s) NA Start Date/Time 2/26/97 1000 End Date/Time 3/6/97 1030

Drilling Equip./Method CME 750/ Auger Sampling Equip./Method Split Spoon / Core

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Anaytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 90 | 1.5/2.5 | NA | NDA | NA | 90-91.5' Light brownish gray 5YR 6/1, soft, dry, fine grain non-welded tuff.<br>91.5-92.5' No Recovery | Loss | Bandelier Tuff Unit #3 | Run # 35 1400 |
| 95 | 2.3/2.5 | NA | NDA | | 92.5-94.7' SAA<br>94.7-95' No Recovery | Loss | | Run#36 1425 |
| | 1.8/2.5 | NA | NDA | | 95-96.8' SAA<br>96.8-97.5' No Recovery | Loss | | Run # 37 1455 |
| 100 | 1.8/2.5 | 0121-97<br>0176<br>98.7-99.2' | NDA | | 97.5-99.3' Light brownish gray 5YR 6/1, soft dry, fine grain non-welded tuff.<br>99.3-100' No Recovery | Loss | | Run # 38 1516 |
| | 1.8/2.5 | NA | NDA | | 100-101.8 SAA<br>101.8-102.5 No Recovery | Loss | | Run# 39 1545<br>End of day 1610 |
| 105 | 2.5/2.5 | NA | NDA | | 102.5-105' Light brownish gray 5YR6/1, soft, dry, fine grain (sugar like texture) non welded tuff. | | | 3/4/97 Drilling 0835<br>Run#40 0900 |
| | 2/2.5 | NA | NDA | | 105-107' SAA<br>107-107.5 No Recovery | Loss | | Run # 41 0927 |
| 110 | 1.5/2.5 | 0121-97<br>0177<br>108.5-109' | NDA | | 107.5-109 SAA<br>109-110 NO Recovery | Loss | | Run #42 0948 |
| | 2.5/2.5 | NA | NDA | | 110-112.5' Light brownish gray 5YR 6/1 soft, dry fine grain non-welded tuff. | | | Run # 43 1015 |
| 115 | 2/2.5 | NA | NDA | | 112.5-114.5 SAA<br>114.5-115 No Recovery | Loss | | Run # 44 1040 |
| | 2/2.5 | NA | NDA | | 115 - 116.7 mix light brownish gray 5YR6/1 with light tan soft, dry non-welded tuff.<br>116.7- 117 Light brownish gray soft dry non-welded tuff. Note 5-10% weakly welded tuff fragments with FeOx spotting<br>117-117.5 No Recovery | Loss | ?<br>? | Run # 45 1105<br>possible fracture<br>Unit 2 ? |
| 120 | 2/2.5 | 0121-97<br>0178<br>118-118.5' | NDA | | 117.5-118.5' Pale yellowish brown 10YR 6/2 mix of 20% soft non-welded tuff with 20% weak to moderately welded tuff fragments with FeOx spotting.<br>118.5-120 No Recovery | Loss | Unit #2 | Run # 46 1130<br>Unit 2 ? |

Prepared By J. Walterscheid Date 3/6/97 Checked By Date 3/25/97

R1

**LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM**

**SAMPLE MANAGEMENT FACILITY** **CORE SAMPLE LOG**

Borehole ID 16-011 TA/OU 21 Drill Depth From 120 To 150 Page 5 of 7

Driller Stewart Bros Box #(s) NA Start Date/Time 2/26/97 1000 End Date/Time 3/6/97 1030

Drilling Equip./Method CME 750/ Auger Sampling Equip./Method Split Spoon / Core

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Anaytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 120 | 1.7/2.5 | NA | NOA | NA | 120 - 121.7' Pale yellowish brown 10YR 6/2 mix of 70% soft dry nonwelded tuff with 30% mod. welded tuff fragments<br>121.7-122.5' No Recovery | Loss | | Run #47 1158<br>Lunch 1215 |
| | 2/2.5 | NA | NOA | | 122.5-124.5 SAA<br>124.5-125' No Recovery | Loss | | Run #48 1330 |
| 125 | 2/2.5 | NA | NOA | | 125-127' SAA with slight increase in percentage of welded fragments.<br>127-127.5' No Recovery | Loss | | Run #49 1355 |
| | 1.5/2.5 | 0121-97<br>0179<br>127.5-129 | NOA | | 127.5 - 129' Pale yellowish brown 10YR 6/2 mix of 65% soft dry, nonwelded tuff with 35% mod. welded tuff pieces. FeOx spotting on welded tuff.<br>129-130' No Recovery | Loss | | Run #50 1420 |
| 130 | 3/5 | NA | NOA | | 130 - 133 SAA<br>133-135 No Recovery | Loss | Bandelier Tuff Unit #2 | Run #51 1455 |
| 135 | 3/5 | NA | NOA | | 135-138 Pale yellow brown (slightly darker) 10YR 6/2. Mix of 65% soft dry non welded tuff with 35% dry moderately welded tuff fragments.<br>138-140 No Recovery | Loss | | Run #52 1538<br>End of day 1600 |
| 140 | 3/5 | 0121<br>97<br>0180<br>140-140.5' | NOA | | 140 - 143' Pale yellow brown 10YR 6/2 mix of 40% soft dry non welded tuff with 60% moderately welded tuff fragments. FeOx spotting on tuff fragments.<br>143-195' No Recovery | Loss | | 3/5/97 Drilling 0840<br>Run #53 0905 |
| 145<br>150 | 3/5 | NA | NOA | | 145- 148' Pale yellow brown 10YR 6/2 mix of 30% soft nonwelded tuff (trace moisture) with 70% moderately welded tuff fragments.<br>148-150 No Recovery | Loss | | Run #54 0942<br>Hardening with depth |

Prepared By J. Waltersheid Date 3/6/97 Checked By Date 3/28/97

R.1

LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

SAMPLE MANAGEMENT FACILITY

**CORE SAMPLE LOG**

Borehole ID 16-011 TA/OU 21 Drill Depth From 150 To 180 Page 6 of 7

Driller Stewart Bros. Box #(s) NA Start Date/Time 2/26/97 1000 End Date/Time 3/6/97 1030

Drilling Equip./Method CME 750/ Auger Sampling Equip./Method Split Spoon / Core

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 150 | 0/2.5 | No Recovery | No Recovery | NA | 150-152.5 No Recovery | Loss | Bandelier Tuff Unit #2 | Run #55 1012<br>No Recovery |
| 155 | 2.5/2.5 | 012197<br>0181<br>152.5-153 | NDA | | 152.5-155' Pale yellowish brown 10YR 6/2 mix of 30% soft non welded tuff with 70% mod. welded tuff. Dry. | | | Run #56 1050 |
| | 2/2.5 | NA | NDA | | 155-157.0' SAA<br>157-157.5 No Recovery | Loss | | Run #57 1138 |
| 160 | 2/2.5 | NA | NDA | | 157.5-159.5' Pale brown mix of 30% soft nonwelded tuff with 70% mod. welded tuff pieces. Dry, FeOx spotting | Loss | | Run #58 1215<br>lunch 1230 |
| | 2.5/2.5 | 012197<br>0182<br>160-160.5 | NDA | | 160-162.5 SAA | | | Run #59 1410 |
| 165 | 3/5 | NA | NDA | | 162.5-165.5 SAA<br>165.5-167.5 No Recovery | Loss | | Run #60 1445 |
| 170 | 3/5 | 0121-97<br>0183<br>0121-97<br>1128<br>170-170.5 | NDA | | JW 4/1/97 ~~177.5~~ 167.5-170.5 Pale brown mix of 45% soft non-welded tuff (trace moisture) with 55% welded tuff fragments. Tuff fragments are dry with FeOx spotting.<br>170.5-172.5 No Recovery | Loss | | Run #61 1525<br>"damp" ~~some~~ JW 4/1/97 musty smell. |
| 175 | 3.5/5 | NA | NDA | | 172.5-176' SAA with a decrease in welded tuff fragments to 30%.<br>176-177.5 No Recovery | Loss | | Run #62 1605<br>End of day 1625 |
| 180 | 3/5 | See next page ~~NA~~ JW 3/6/97 | NDA | ↓ | 177.5-180.5 Pale brown mix of 70% soft non-welded, trace moisture, with 30% mod. welded tuff fragments with FeOx staining | | | 3/6/97 0815 Drilling<br>Run # 63 0900 |

Prepared By J. Walterscheid Date 3/6/97 Checked By Date 3/26/97

R1

LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

SAMPLE MANAGEMENT FACILITY

**CORE SAMPLE LOG**

Borehole ID 16-011 TA/OU 21 Drill Depth From 180 To 190 TD Page 7 of 7

Driller Stewart Bro. Box #(s) NA Start Date/Time 2/26/97 1000 End Date/Time 3/6/97 1045

Drilling Equip./Method CME 750 / Auger Sampling Equip./Method Split Spoon / Core

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 180 | 3/5 Cont. | ~~NA~~ 121-77-0184 180-180.5 | NDA | NA | 180-180.5 SAA<br>180.5-182.5 No Recovery | Loss | | |
| 185 | 4/5 | NA | NDA | | 182.5-186.5 Pale yellow brown 10YR 6/2 mix of 80% soft non-welded tuff (trace moisture) with 20% mod. welded tuff pieces. FeOx spotting on tuff pieces.<br>186.5-187.5' No Recovery | Loss | Unit #2 | Run #64 0950 |
| 190 | 2.5/2.5 | 0121-77-0185 187.5 190 | NDA | | 187.5-190' SAA | | | Run #65 1030 |
| | | | | | 190ft Total Depth | | | |

Prepared By J. Walterscheid Date 3/6/97 Checked By Date 3/25/97

R1

LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

SAMPLE MANAGEMENT FACILITY

## CORE SAMPLE LOG

Borehole ID 16-012 TA/OU 21 Drill Depth From 0.0 To 30.0 Page 1 of 3

Driller Stewart Bros. Box #(s) NA Start Date/Time 2/5/97, 1445 End Date/Time 2/10/97 1000

Drilling Equip./Method CME 750/Auger Sampling Equip./Method Splitspoon / Core

Location ID: 21-05062

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Contamination Criteria<br>2/5/97 ≤ Bkg<br>2/6/97 ≤ Bkg<br>2/7/97 ≤ Bkg<br>2/10/97 ≤ Bkg 95cpm<br>Lithology · Petrology · Soil | Graphic Log | Lithologic Unit | Drilling 30° angle hole towards SE under absorption bed 4 and disposal shafts at MDA-T TA-21.<br>Notes |
|---|---|---|---|---|---|---|---|---|
| 0 | 1.5/1.5 | NA | NDA | NA | 0.0'–0.9' Moderate Brown, 5YR 3/4, Silty Clay.<br>0.9–1.5' light Brown, 5YR 5/6, Silty Fine to Med. grained Sand. | | Soil | Run #1, 1505 0-1.5' |
| | 1.5/3.5 | NA | NDA (3.5-5.5') 0147 | | 1.5–3.5 No Recovery.<br>3.5'–5.0 Clayey Silt, moderate Brown, 5YR 3/4. Weathered Tuff Fragments To 3 cm.<br>5.0 To 5.5 Same as Above (SAA).<br>5.5 To 6.0 SAA | | | Run #2, 1605 1.5'-5.0' |
| 5 | 0.5/0.5 | 0191 | NDA | | | | | Run #3 1605, 5.0'-5.5' |
| | ~~2.0~~ 0.5/2.0 | ~~NA~~ 0192 5.5-7.5 | NDA 0191 | | 6.0 To 7.5 Grayish Orange, 5YR 7/2, moderately welded Tuff. ~5% pumice Lapilli. lapilli altered Moderate Brown, 5YR 4/4. | | | Run #4, 1630, 5.5'-7.5' |
| | 2.0/2.5 | NA | NDA | | 7.5 to 10.0 Grayish Orange, 5YR 7/2, Tuff, moderately Welded and highly Fractured from 9.2 To 10.0'. Fractures are un-filled and closed. | | | Run #5, 1050, 7.5'-10' |
| 10 | 2.5/2.5 | 0121-97-0193 10.0-10.5' | 0193 NDA | ↓ | 10.0 To 12.5 Grayish Orange, 5YR 7/2, Tuff. Moderately Welded. ~8% Pumice lapilli. Fracture with orange clay Fill at 12.2; and un-even welding resulting in core breaking into Disks. | | | Run #6, 10-12.5' 1120 |
| | 2.5/2.5 | NA | NDA | NA | 12.5–15.0 Grayish orange, 5YR 7/2, moderately welded. Highly Fractured from 12.5 To 14'. Fractures have 1-4mm orange clay Fill. | | Bandelier tuff Unit #3 | Run #7 12.5-15'<br>1145 |
| 15 | 5.0/5.0 | NA | NDA | | 15' To 20' SAA. Unfractured. | | | Run #8 15'-20' 1215<br>1225 Lunch |
| 20 | 5.0/5.0 | 0121-97-0194 20-22.5 | NDA | | 20'-25' SAA. Pumice increase to ~10% and are Gray (N7)<br>Fracture at 20.8' with 2-3mm of orange Clay Fill | | | Run #9 20-25' 1350 |
| 25 | 5.0/5.0 | NA | NDA | ↓ | 25' To 29.5 SAA<br>29.5–30.0 Grayish Orange, 5YR 7/2, Tuff. Non-Welded with ~10% Gray (N7) Pumice lapilli. | | | Run #10 25'-30' 1420 |
| 30 | | | | | | | | |

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Prepared By J. Crocker /ERM Date 2/5/97 Checked By Date 2/26/97

R1

LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

SAMPLE MANAGEMENT FACILITY

## CORE SAMPLE LOG

Borehole ID 16-012 TA/OU 21 Drill Depth From 30 To 60 Page 2 of 3

Driller Stewart Bros Box #(s) NA Start Date/Time 2/5/97, 1445 End Date/Time 2/10/97 1000

Drilling Equip./Method CME 750/Auger Sampling Equip./Method Split Spoon/Core

| Depth (Feet) | Recovery (feet per feet/%) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core In Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 30 | 6.0<br>5.0 | 0121-97-0195 (30.0'-30.5') | NDA | NA | 30.0-35.0 Light Brownish Gray, 5YR 6/1 moderately welded Tuff. Pumice Lapilli are gray N6-N7 and 12-15%. Fracture at 34.5 with orange clay fill (2-3mm). | | Bandelier Tuff Unit #3 | Run # 11, 1500 30.0'-35.0' |
| 35 | 2.0<br>5.0 | NA | NDA | | 35.0-37.0 Light Brownish Gray, 5YR 6/1 Tuff. Non-Welded. Core is disaggregated. Gray, N6-N7 Pumice lapilli to ~10%.<br>37.0-40.0 No Recovery. | SSDT | | Run # 12, 1525 35.0'-40.0' (Packed off) Loss 37.0-40.0 |
| 40 | 2.5<br>2.5 | 0121-97-0196 40-40.5' | NDA | | 40.0-40.5 non-welded Tuff, SAA.<br>40.5-42.5 Gray, N7, To Brownish Gray, 5YR 6/1, moderately welded Tuff w/ 12% Gray, N7, Pumice lapilli. A Fracture w/ 1cm moderate Brown-Orange clay fill from 40.5'-41.8'. | | | Run #13, 1540 40.0'-42.5' |
| | 2.5<br>2.5 | NA | NDA | | 42.5-45.0 light gray non-welded to poorly welded Tuff. 12% gray, N6, pumice lapilli. Poorly welded 42.5-44.3, Non-welded 44.3-45. | | | Run # 14, 0915 42.5'-45.0' |
| 45 | 2.1<br>2.5 | NA | NDA | | 45.0-47.1 Non-Welded Tuff, SAA. Orange Alteration @ 46.3.<br>47.1-47.5 No Recovery. | LOSS | | Run # 15, 0940 45.0'-47.5' (Loss, 47.1-47.5). |
| | 2.5<br>2.5 | 0121-97-0197 49.5'-50.0 | NDA | | 47.5-50.0 Gray, N7, To Pinkish Gray 5YR 8/1 Tuff. Moderately welded. 12% Gray, N6, Pumice lapilli. | | | Run # 16, 1000 47.5'-50.0' |
| 50 | 5.0<br>5.0 | NA | NDA | | 50.0-55.0 Pinkish Gray, 5YR 8/1, moderately welded, Tuff. ~~8~~ To 10% Gray, N6, pumice lapilli. Clean, closed fractures at 54.0' and ~~52~~ 52.5' | | | Run # 17, 1040 50.0' To 55.0' |
| 55 | 4.5<br>5.0 | 0121-97-0196 54.5'-59.5<br>0121-97-0218 (Dupl.) 59.0-59.6' | NDA | | 55.0-59.5 Pinkish Gray Tuff, SAA. Becomes Non-Welded 57.5 To 59.5.<br>59.5-60.0 No Recovery | LOSS | | Run # 18, 1110 55.0'-60.0' (Loss, 59.5-60.0). |
| 60 | | | | | | | | |

2/
2/7

Prepared By J. Crocker/ERM Date 2/6/97-2/7/97 Checked By Date 2/20/97

R1

LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

SAMPLE MANAGEMENT FACILITY

## CORE SAMPLE LOG

Borehole ID 16-012 TA/OU 21 Drill Depth From 60 To 82.5 TD Page 3 of 3

Driller Stewart Bros Box #(s) N/A Start Date/Time 2/5/97 1445 End Date/Time 2/10/97 1000

Drilling Equip./Method CME 750/ Auger Sampling Equip./Method Split Spoon/ Core

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 60–65 | 5/5 | NA | NDA | N/A | 60-65' Gray to pinkish gray moderately welded tuff. Pumice lapilli to 12% are gray N6. Unfractured. | | Bandelier Tuff Unit #3 | Run# 19 1150 |
| 65–70 | 2.9/5 | NA | NDA | | 65-65.3 SAA<br>65.3-67.9 Gray N6 non-welded tuff. Pumice lapilli: 6-7% N6 to N5.<br>67.9-70' Loss | Loss | | 1210 Lunch<br>Run# 20 1330 |
| 70–72.5 | 2.5/2.5 | 0127-97<br>0199<br>0220<br>70-70.5 | NDA | | 70-71' Pinkish gray 5YR 8/1 moderately welded tuff with 8% pumice lapilli.<br>71-72.5' Gray N7 mod. welded tuff with 8-10% pumice lapilli. | | | Run# 21 1410 |
| 72.5–75 | 2.3 ~~2.5~~/2.5 | No Sample<br>NA | NDA | | 72.5-74.8 Gray N7 poorly welded tuff. 8% pumice lapilli altered light brown 5YR 6/4.<br>74.8-75 loss | | | Run# 22 1435 |
| 75–80 | 4.5/4.5 | 0121-97<br>0200<br>78.4-79.5 | α: 25,000 cpm<br>βγ 10,000 cpm | | 75-78.9 Non to poorly welded tuff. 8% pumice lapilli altered light brown 5YR 6/4.<br>78.9-79.5' dk grey concrete grout, hard, possible fracture fill. "Hot" α 25000 cpm βγ 10,000 cpm | | | Run# 23 1500<br>End of Day 1515 |
| 80–82.5 | 2.3/3 | NA | α: 43,000 cpm<br>βγ: 20,000 cpm<br>81.5' | | 79.5-80' dk grey hard cement grout dry. Broken.<br>80-81' lt grey moist cement ~~grout~~ grout mixed with plastic bag. Broken up.<br>81-81.5 pieces of tuff mixed with cement grout.<br>81.5-81.8 lt grey moist cement grout. solid.<br>81.8-82.5 No Recovery | Loss<br>TD | Disposal Shaft | 2/10/97 Drilling OE=1<br>J. Walterscheid Geologist<br>Run# 24 0920<br>TD: 1000 |

Total Depth 82.5 ft

Prepared By J. Crocker, J. Walterscheid Date 2/10/97 Checked By Date 2/20/97

R1

**LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM**

**SAMPLE MANAGEMENT FACILITY**

**CORE SAMPLE LOG**

Borehole ID 16-013 TA/OU 21 Drill Depth From 0 To 30 Page 1 of 4

Driller Stewart Bro Box #(s) NA Start Date/Time 3/25/97 1040 End Date/Time 3/27/97 1340

Drilling Equip./Method CME 750/ Auger Sampling Equip./Method Split Spoon/ Core

Location ID: 21-05063

Contamination Criteria

3/25/97 α: 7 cpm Bγ: 122 cpm

3/27/97 α: 14 cpm Bγ: 118 cpm

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Drilling apox. 25' south of absorption bed #1 MDA T, TA-21. |
| 0 | 2.5/2.5 | NA | NDA | NA | 0-0.5" Asphalt and base course.<br>0.5-2.5' Dark yellowish brown 10YR 4/2 moist silty clay with crushed tuff, <5% pebbles. | | Overburden/Backfill | 3/25/97 Drilling 1040<br>Run #1 1045 |
| 5 | 2.5/2.5 | 0121-97<br>0221<br>4.5-5' | NDA | | 2.5-3' SAA<br>3-5' Light brown 5YR 5/6 moist silty clay with tuff fragments. | | | Run #2 1055 |
| | 2.5/2.5 | NA | NDA | | 5'-7.5' Light brown (5YR 5/6) clayey SILT with tuff fragments. Tuff cobble 5.5'-6.0' Moist. | | | Run #3 1109 |
| 10 | 2.5/2.5 | 0121-97<br>-0222<br>-0234<br>7.5-8.3 | NDA | | 7.5'-10.0' Pale brown (5YR 5/2) to Medium gray (N5) TUFF. Poorly welded. Slightly moist. Some Fe-ox staining | | Bandelier Tuff Unit #3 | Run #4 1118 |
| | 2.5/2.5 | 0121-97<br>0223<br>10.0-11.6 MS<br>[illegible] | NDA | | 10.0'-11.6' SAA with clay-filled fracture. Aperture 0.1 ft.<br>11.6'-12.5' Dark gray (N4) TUFF. Poorly welded. Slightly moist. | | | Run #5 1135<br>1145 Lunch break |
| 15 | 2.5/2.5 | NA | NDA | | 12.5-15' SAA | | | Run #6 1310 |
| | 2.5/2.5 | NA | NDA | | 15-17.5 Light brownish gray (5YR 6/1). Poor to weakly welded tuff, slightly moist, Fe-ox spotting. ≤5% qtz. | | | Run #7 1320 |
| 20 | 2.5/2.5 | NA | NDA | | 17.5-20' SAA | | | Run #8 1335 |
| 25 | 5/5 | 0121<br>97<br>0224<br>20-20.5 | NDA | | 20-25' SAA drying with depth | | | Run #9 1355 |
| 30 | 5/5 | NA | NDA | | 25-30' Light brownish gray (5YR 6/1) poorly welded tuff. Trace moisture. Trace Fe-ox spotting. Brown mottled core 26.4-27.2. | | | Run #10 1415 |

Prepared By Jeff Walterscheid / Ron Blegen Date 3/27/97 Checked By Date 3/31/97

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LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

SAMPLE MANAGEMENT FACILITY

## CORE SAMPLE LOG

Borehole ID 16-013 TA/OU 21 Drill Depth From 30 To 60 Page 2 of 4

Driller Stewart Bros Box #(s) NA Start Date/Time 3/25/97 1040 End Date/Time 3/27/97 1340

Drilling Equip./Method CME 750/ Auger Sampling Equip./Method Split Spoon / Core

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Anaylical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 30 | 2/5 | 0121<br>97<br>0225<br>~~30-32.5~~ JW 3/25/97<br>30.5-31.3 | NDA | NA | 30-32.5' Light brown with gray (5YR 6/1) weakly welded tuff. Dry.<br>30.5-32' Light brownish gray mix of 70% non-welded soft tuff with 30% weakly welded tuff fragments. Dry.<br>32-35' No Recovery | Loss | | Run # 11 1430 |
| 35 | 2.5/2.5 | NA | NDA | | 35-37.5' Light brownish gray (5YR 6/1) weakly welded tuff. Dry | | | Run # 12 1442 |
| | 2.5/2.5 | NA | NDA | | 37.5-40 SAA possible small fracture at 38' | | | Run # 13 1455 |
| 40 | 5/5 | 0121<br>97<br>0226<br>41-42 | NDA | | 40-45 Light brownish gray weakly-welded tuff. Dry. Brown/gray mottled zones at 41-42', 43' and 44.5' | | Bandelier Tuff Unit #3 | Run #14 1507 |
| 45 | 5/5 | 0121<br>97<br>0227<br>48-50 | NDA | | JW 3/25/97<br>~~40-45~~' SAA. Brown/gray mottled zones 45-50' at 45-46.5, 48.2-50' | | | Run # 15 1526 |
| 50 | 4.5/5 | NA | NDA | | 50-52' Light brown gray weak to moderately welded tuff. Dry. Mottled zone at 50.5-51.3'<br>52-54.5' Light brown gray (5YR 6/1) non-weakly welded soft tuff.<br>54.5-55' No Recovery | Loss | | Run # 16 1544 |
| 55 | 5/5 | 0121<br>97<br>0228<br>58.5-60 | NDA | ↓ | 55-57.5' Light brown gray non welded, soft tuff trace moisture.<br>57.5-60' Light brown mottled tuff. Non-welded soft, moist. Fe Ox alteration rind around pumice. | | | Run # 17 1556 |
| 60 | | | | | | | | End of Day 1620 |

Prepared By J. Watterscheid Date 3/27/97 Checked By Date 3/31/97

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LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

SAMPLE MANAGEMENT FACILITY

## CORE SAMPLE LOG

Borehole ID 16-013 TA/OU 21 Drill Depth From 60 To 90 Page 3 of 4
Driller Stewart Bo. Box #(s) NA Start Date/Time 3/25/97/1030 End Date/Time 3/27/97/1340
Drilling Equip./Method CME 750/Auger Sampling Equip./Method Split Spoon/Core

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Anaytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 60 | 5/5 | NA | NDA | NA ↓ | 60-65' Light brownish gray (5YR4/1 Xmottled with light brown (5YR6/4)) non-welded tuff. Moist. Some FeOx staining along edges of larger pumice. | | Bandelier Tuff Unit #3 | 3/27/97 Drilling 0845<br>Run #18 0900 |
| 65 | 3/3 | NA | NDA | | 65-68' Light brownish gray (5YR4/1) soft non welded tuff. Slightly moist. Sugary texture. | | | Run # 19 0918 |
| | 2/2 | 0121-97<br>0229<br>0275<br>68.5-70' | NDA | | 68-70' SAA | | | Run # 20 0930<br>Field Blank 0121-97-0235 used. |
| 70 | 4/5 | NA | NDA | | 70-74 Medium light gray (N6) soft non weld tuff. Sugary texture. Slightly moist.<br>74-75. NO Recovery | Loss | | Run # 21 |
| 75 | 3.5/5.0 | 0121-97-0230<br>76.5-78.5' | NDA | | 75-78.5 Medium light gray (N6) non-welded Tuff. Sugary Texture. Slightly moist.<br>78.5-80 No Recovery. | Loss | | Run # 22 0956 |
| 80 | 2.5/2.5 | NA | NDA | | 80.0-82.5 Light gray (N7) non-welded Tuff. Sugary Texture, white Pumice to 2 cm. | | | Run #23 1020 |
| | 2.5/2.5 | NA | NDA | | 82.5-85.0 Light gray (N7) to Med. gray (N6) non-welded Tuff. Pumice are white and as large as 4.0 cm. | | | Run #24 1030 |
| 85 | 2.5/2.5 | NA | NDA | | 85.0-87.5 SAA | | | Run #25 1045 |
| | 2.5/2.5 | 0121-97-0231<br>89.5-90.0 | NDA | | 87.5-90.0 Light gray (N7) to med. gray (N6) non-welded Tuff, white (N9) Pumice to 3.0 cm. Sugary Texture not as prominent as in previous Runs. Slightly moist | | | Run #26 1100 |
| 90 | | | | | | | | |

Prepared By ____ Date 3/27/97 Checked By ____ Date 3/31/97

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**LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM**

**SAMPLE MANAGEMENT FACILITY**

**CORE SAMPLE LOG**

Borehole ID 11-613 TA/OU 21 Drill Depth From 90' To 110.5' Page 4 of 4

Driller Stewart Bros. Box #(s) NA Start Date/Time 3/25/97/1040 End Date/Time 3/27/97/1340

Drilling Equip./Method CME 750/Auger Sampling Equip./Method Split Spoon/Core

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 90 | 3.5/4.0 | NA | NDA | | 90-93.5 Gray (N6-N7) Non-Welded Tuff. Poorly welded 92.0-93.5'. Pumice To 2.0 cm.<br>93.5-94.0 No Recovery. | Loss | Bandelier Tuff Unit #3 | Run #27 1110<br>4 ft. Run Packed-off |
| 95 | 3.5/3.5 | NA | NDA | | 94-97.5 Med. Gray (N6) non-welded To Partly Welded Tuff. White Pumice To 3.0 cm. | | | Run #28 1120<br>3.5 ft run To even Things out |
| | 2.5/2.5 | C121-97-0232-1269<br>99.5'-100' | NDA | | 97.5-100 Med. Gray (N6) Partly to Moderately Welded Tuff. White Pumice To 1.5 cm. Fe Oxide Stains/Spots on Core. | | ? | Run #29 1130 |
| 100 | 5.0/5.0 | NA | NDA | | 100-105 Med. Gray (N6) Partly Welded To Moderately Welded Tuff. White Pumice To 2.0 cm. Minor Fe Stains/Spots. | | ?<br>Bandelier Tuff, Unit #2 | Run #30 1145<br>Harder Drilling. |
| 105 | 2.5/2.5 | NA | NDA | | 105-107.5 SAA. | | | Run # 31 1150 |
| | 1.7/2.5 | NA | NDA | | 107.5- ~~110~~ 109.2 [illegible] 3-27-97 SAA<br>109.2-110 No Recovery. | Loss | | Run # 32 1200<br>(Lunch) |
| 110 | 0.5/0.5 | ?<br>C121-97-0233<br>110-110.5 | NDA | | 110-110.5 Med Gray (N6) Moderately Welded To Strongly Welded Tuff. White Pumice To 2.0 cm. | | | Run # 33 1340<br>TD= 110.5' |

Prepared By P. Walker Date 3/27/97 Checked By Date 3/31/97

R.1

LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

SAMPLE MANAGEMENT FACILITY

**CORE SAMPLE LOG**

Borehole ID 16-014 TA/OU 21 Drill Depth From 0 To 30 ft Page 1 of 2
Driller Stewart Bro. Box #(s) NA Start Date/Time 2/14/97 1120 End Date/Time 2/14/97 1535
Drilling Equip./Method CME750 / Auger Sampling Equip./Method Split Spoon / Core
Location ID: 21-05064

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Contamination Criteria<br>2/14/97<br>α : 2 cpm<br>βγ : 107cpm<br>Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Drilling 20ft south of absorption bed #2 at MDA-T TA-21.<br>Notes |
|---|---|---|---|---|---|---|---|---|
| 0 | 2/2.5 | NA | NDA | NA | 0-0.8' dk brown 5YR silty clay with organics<br>0.8-1.5' Grayish pink weathered tuff, soft, damp.<br>1.5-2' Pale brown 10YR 6/2, mod. welded damp tuff.<br>2-2.5' No Recovery |  | Backfilled Trench | Drilling 1120<br>Run #P 1130 |
| 5 | 1.5/2.5 | 0121-97<br>0236<br>3.5-4 | NDA | | 2.5-4' lt brown mix of crushed tuff with silt, welded tuff fragments. ~~Liner~~ Small amount of asphalt at 3'. Organics (roots at 3.5'.<br>4-5 No Recovery | | | Run #2 1142 |
| | 1.5/2.5 | NA | NDA | | 5-6.5' Broken up tuff (mod welded) with 10% sand/silt, damp.<br>6.5-7.5' No Recovery | | | Run #3 1200<br>will put in catcher for next run. |
| 10 | 1.5/2.5 | [illegible]<br>0121-97<br>0121-97<br>0237<br>8.5-9 | α 25cpm<br>βγ NDA<br>8.5-9 | | 7.5-8' Mix broken tuff with sand<br>8-9' lt brown mix of crushed tuff with silty clays. Trace FeOx, high moisture content<br>9-10' No Recovery | | | Run #4 1212<br>high moisture and clay pinched barrel |
| | 2/2.5 | 0121-97<br>0238<br>10.5-12 | α 80cpm<br>βγ 200cpm<br>10-12' | | 10-12' Brown 5YR 4/4 saturated mix of silty clay with gray tuff fragments<br>12-12.5 No Recovery | | | Run #5 1225<br>Saturated |
| 15 | 2/2.5 | 0121-97<br>0239<br>12.5-13.7 | α 350cpm<br>βγ 400cpm<br>13.7' | | 12.5-13.7 Brown saturated silty clay with tuff fragments. lg frag asphalt 13.6'<br>13.7-14.2 med grain sand, moist<br>14.2-14.5 lt. gray weakly welded moist tuff trace FeOx<br>14.5-15 No Recovery | | | Run #6 1244<br>α 350cpm βγ 400cpm at clay/sand contact |
| | 2.5/2.5 | NA | NDA | | 15-17.5' lt. gray 5YR 7/2 mod welded, moist tuff No fractures. | | Bandelier Tuff Unit #3 | Run #7 1334<br>Hard solid tuff |
| 20 | 2.5/2.5 | NA | NDA | | 17.5-20 SAA | | | Run #8 1346 |
| | 2.5/2.5 | 0121-97<br>0240<br>20-20.5 | NDA | | 20-22.5' lt gray 5YR 7/2 mod welded (hard) tuff. Drying out with depth. No fractures | | | Run #9 1358 |
| 25 | 2.5/2.5 | NA | NDA | | 22.5-25' SAA | | | Run #10 1415 |
| 30 | 5/5 | 0121<br>97<br>0241<br>29.5-30' | NDA | | 25-30' lt gray 5YR 7/2 mod. welded tuff slight increase in pumice. Dry. No fractures. | | | Run #11 1430 |

Prepared By J. Walterscheid Date 2/14/97 Checked By Date 4/20/97

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**LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM**

**SAMPLE MANAGEMENT FACILITY**

**CORE SAMPLE LOG**

Borehole ID 16-014 TA/OU 21 Drill Depth From 30 To 50ft Page 2 of 2

Driller Stewart Bro Box #(s) NA Start Date/Time 2/14/97 1120 End Date/Time 2/14/97 1535

Drilling Equip./Method CME 750/ Auger Sampling Equip./Method Split Spoon/ Core

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Anaytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 30 | 5/5 | NA | NDA | NA | 30-35' lt gray 5YR 7/2 mod welded tuff. Dry. lt brown mottled color 33-34'. small clay filled fracture 30.8-31.2 no detector activity | | Bandelier Tuff Unit #3 | Run #12 1445 |
| 35 | 5/5 | 0121<br>97<br>0242<br>39.5-40 | NDA | | 35-40' lt gray-brown 5YR 7/2 mod welded tuff. Dry. No fractures. | | | Run #13 1500 |
| 40 | 5/5 | NA | NDA | | 40-45 SAA | | | Run #14 1512 |
| 45 | 5/5 | 0121<br>97<br>0243<br>495-50 | NDA | | 45-50' lt brown 5YR 7/2 mod. welded tuff. Dry. No fractures. | | | Run #15 1522 |
| 50 | | | | | 50 ft Total Depth | | | |

Prepared By JWalterscheid Date 2/14/97 Checked By Date 2/20/97

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LOS ALAMOS NATI‘ ‘AL LABORATORY ENVIRONMENTAL ‘ ‘STORATION PROGRAM

SAMPLE MANAGEMENT FACILITY

## CORE SAMPLE LOG

Borehole ID 16-015 TA/~~OU~~ 21 Drill Depth From 0' To 30' Page 1 of 2
Driller Stewart Bro. Box #(s) N/A Start Date/Time 13 Dec 96 1300 End Date/Time 16 Dec 96/1325
Drilling Equip./Method CME750 Auger Sampling Equip./Method Continuous/Auger/Split Spoon

5'
10
20
30
40
50

| Depth (feet) | Recovery (feet per feet / %) | Field Analytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Background: β/γ ~~260~~ 101 cpm [illegible] 13 Dec 96<br>α 9.3 ~~3.2~~ cpm 13 Dec 96<br>16 Dec 96 β/γ - 80 cpm α -<br>Lithology-Petrology - Soil | Graphic Log | Lithologic Unit | Drilling 20ft north of middle of bed #3 MDA-T TA-21 12/13/96<br>Notes |
|---|---|---|---|---|---|---|---|---|
| | 2.5/2.5 | N/A | NDA | N/A | 0-1.5' dark brown, moist clayey silt with 10% sand. (5YR 3/4) | | Overburden/Backfill | 1300 Drilling<br>Run #1: 1310 |
| 5 | 2.5/2.5 | 0121-96<br>0621<br>4.5-5' | | N/A | 1.5-3.0' brownish red (5YR 5/6) iron stained crushed tuff with sand, moist. | | | Run #2: 1330 |
| | 1.5/2.5 | N/A | | N/A | 3.0-5' grey (10YR 6/2) damp weathered tuff with minor iron staining along clay filled fractures.<br>5-6' Core loss | Loss | | Run #3: 1355 |
| 10 | 2.5/2.5 | ~~0121-96~~<br>~~0622~~<br>[illegible] 12/13/96 | | N/A | 6-9' Reddish brown (5YR 4/4) damp to moist silt with fine grain sand.<br>9-50' Tuff: damp light grey moderately welded (10YR 6/2) sharp contact | | | Run #4: 1420 |
| | 2/2.5 | 0121-96<br>0622<br>10-10.5 | | N/A | 12' dk brown moist clay in a fracture<br>12-12.5' core loss at fracture | Loss | | Run #5: 1445 |
| 15 | 2.5/2.5 | N/A | | N/A | SAA<br>12.5' fracture with clay coating white mineral coating (calcite? looking) 45° angle | | | Run #6: 1504<br>End of day 1530 |
| | | | | — | 15.0' 45° fracture with clay coating ( ) | | | 12/16/96<br>1006 · [illegible] Drilling<br>Run #7: 1018 |
| 20 | 5.0/5.0 | 0121-96-0623<br>(19.5-20.5) | | N/A | 15.0' to 25.0' Light gray TUFF. Moderately to strongly welded. Pumice to 10mm common. Trace [illegible] crystals. | | [illegible] | |
| | | | | — | 20.0' to 25.0' SAA<br>21.7' Low angle, fracture (<2") Clay-lined. | | Bandelier | 1050 Run #8 |
| 25 | 5.0/5.0 | N/A | | — | 25.0' to 30.0' | | | |
| | | | | — | Lt. gray TUFF. Moderately to strongly welded. Weathered pumice to 10mm common throughout. Low angle, clay-lined fractures at 26.1', 26.8' | | | 1120 Run #9 |
| 30 | 5.0/5.0 | 0121-96-0624<br>29.5-30 | | — | and 27.8'. High angle clay filled fracture at 29.4 (Aperture 0.04') | | | |

Prepared by Jeff Walterscheid 13 Dec 96
Ron Blegen Date 16 Dec 96 Checked By Date 1/8/97

LOS ALAMOS NATI AL LABORATORY ENVIRONMENTAL :STORATION PROGRAM

SAMPLE MANAGEMENT FACILITY

**CORE SAMPLE LOG**

Borehole ID 16-015 TA/~~OU~~ 21 Drill Depth From 30' To 50' Page 2 of 2

Driller Stewart Bros. Box #(s) N/A Start Date/Time 13 Dec 96/1300 End Date/Time 16 Dec 96/1325

Drilling Equip./Method CME 75 Auger Sampling Equip./Method 3' Stainless Steel Core Barrel

| Depth (feet) | Recovery (feet per feet / %) | Field Analytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology-Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| | | | | | Background: 16 Dec 96<br>.3/8<br>K | | | |
| 30 | 5.0/5.0 | N/A | NDA | — | 30.0 TO 35.0 Light gray (N7) to medium light gray (N6) TUFF. Moderately welded. Large pumice throughout. Low angle fractures with reddish-brown weathered zones at 32.2' and 33.7'. Dry. | | Bandelier Tuff | 1200 - Run # ~~9~~ 10<br>Generator out of fuel<br>1216 - Resume |
| 35 | 5.0/5.0 | 0121-96-0665 (37.5-40.0) | | — | 35.0 TO 40.0 Light gray (N7) to medium light gray (N6) TUFF. Moderately welded. Dry. Reddish-brown weathered zones 35.6' to 36.0 and at 36.5' to 37.0'. | | | 1220 - Run #11 |
| 40 | 5.0/5.0 | N/A | | — | 40.0 TO 45.0 Light gray (N7) TUFF. Moderately welded. Dry. High angle (>45°) fracture at 41.7' is filled with light brown (5YR 5/6) clayey silt. Aperture [illegible]. | | | 1248 Run #12 |
| 45 | 5.0/5.0 | 0121-96-0666 -48.2 TO 48.7 | | — | 45.0 - 50.0 Lt gray (N7) TUFF Moderately welded. Dry. | | | 1303 Run #13 |
| 50 | | | | — | TD @ 50.0 ft BGS. | | | 1325 - TD |

Prepared by Jeff Walterscheid / Ron Blegen Date 13 Dec 96 / 16 Dec 96 Checked By Date 1/8/97

LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

SAMPLE MANAGEMENT FACILITY

CORE SAMPLE LOG

Borehole ID 16-021 TA/OU 21 Drill Depth From 0 To 30 ft Page 1 of 7
Driller Stewart Bro. Box #(s) NA Start Date/Time 3/12/97 1000 End Date/Time 3/17/97 1635
Drilling Equip./Method CME 750 / Auger Sampling Equip./Method Split Spoon / Core
Location ID : 21-05071

Contamination Criteria

| 3/12/97 | 3/13/97 | 3/17/97 |
|---|---|---|
| α: 15cpm | α: | α: 5cpm |
| Bγ: 91cpm | Bγ: | βγ: 127cpm |

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Anaylical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Drilling approx. 9 ft east of disposal shaft #2 into the paleo channel at MDA-T, TA-21. |
| 0 | 1.0/2.5 | NA | NDA | NA | 0-1' Moderate brown 5YR 4/4 mix of clayey silt with crushed tuff, wet due to snow melt, organics to 0.5'.<br>1-2.5' No Recovery (pinched barrel) |  | Overburden/Backfill | 3/12/97 1000 Drilling<br>Run #1 1015 |
| | 0.5/1.5 | NA | NDA | | 2.5-3' dk brown mix of clayey silt/tuff, wet.<br>3'-4' No Recovery | | | Run #2 1030<br>Hitting large rock, will drill with center bit to try and break or move it.<br>Run #3 1105 |
| 5 | 1/1 | NA | NDA | | 4-5' Light brown 5YR 6/4 silts with crushed tuff | | | |
| | 1/2.5 | 0121-97<br>1161<br>5-5.5' | NDA | | 5-6' Light brown 5YR 6/4 silty clay, moist.<br>6-7.5' No recovery (packed off catcher) | | | Run #4 1110 |
| 10 | 2.5/2.5 | 0121-97<br>1162<br>9.5-10 | NDA | | 7.5-8' Light brown silty clay, moist<br>8-8.5 Light brown silty clay with fine grain sand<br>8.5-10' Light brown silty, fine-medium grain sand with small pebbles, moist. | | Paleo-Channel | Run #5 1130 |
| | 2.5/2.5 | NA | NDA | | 10-12.5' Light brown (burnt orange) 5YR 6/4 fine to medium grain sand with 25% pumice fragments, silty. Moist. | | | Run #6 1200 |
| 15 | 2.5/2.5 | NA | NDA | | 12.5-13.5' SAA<br>13.5-15' light brown (burnt orange) fine to medium grain sand with minor silt trace pebbles. | | | Run #7 1210 |
| | 2.5/2.5 | NA | NDA | | 15-17.5' SAA | | | Run #8 1222 |
| 20 | 18/2.5 | NA | NDA | | 17.5-18' SAA<br>18-19' Light tan/brown fine grain sand trace silt<br>19-19.3' Light brown (burnt orange) med grain sand<br>19.3-20' No Recovery | | | Run #9 1236<br>Lunch 1240 |
| | 2.5/2.5 | 0121-97<br>1163<br>20-20.5 | NDA | | 20-21.5' Light tan fine grain sand, moist<br>21.5-22.5' Light brown (burnt) fine-medium grain sand. horizontal bedding is evident. trace silt | | | Run #10 1345 |
| 25 | 2.5/2.5 | NA | NDA | | 22.5-25' altering lt gray/lt brown fine-med. grain sand with minor clay. Bedding is visible. | | | Run #11 1400 |
| | 1/1.5 | NA | NDA | | 25-25.5 SAA<br>25.5-26' Mix of tuff and dacite pebbles (up to 2" in size) with med-coarse grain sand and smaller pebbles.<br>26-26.5 No Recovery | | | Run #12 1415<br>Rotting on center bit to try and break up the dacite cobbles. Dacite cobbles are rounded. |
| | Center | Bit | | | 26.5-27.5 Center Bit no recovery | | | 13 |
| 30 | 2.5/2.5 | 0121-97<br>1164<br>28.5-29 | NDA | | 27.5-28' lt gray med. grain sand moist<br>28-28.8' med ~~grain~~ coarse grain sand with small dacite pebbles<br>28.8-29.3' light brown minor fine grain silt, moist<br>29.3-30 dk gray mod welded tuff with 30% sand | | | Run #14 1445 |

Prepared By J. Walterscheid Date 3/18/97 Checked By Date 3/28/97

R1

LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

SAMPLE MANAGEMENT FACILITY

**CORE SAMPLE LOG**

Borehole ID 16-021 TA/OU 21 Drill Depth From 30 To 60 Page 2 of 7

Driller Stewart Bro Box #(s) NA Start Date/Time 3/12/97 1000 End Date/Time 3/17/97 1635

Drilling Equip./Method CME 750 / Auger Sampling Equip./Method Split Spoon / Core

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 30 | 2.5/2.5 | NA | NDA | NA | 30-30.5' dk orange fine grain silt moist<br>30.5-32.5' mix of gray mod-strongly welded tuff boulders (FeOx staining on tuff) with silt and med grain sand with lg dacite (rounded) boulders, Strong FeOx alteration throughout interval (dry) | | Paleo Channel | Run #15 1500<br>Very hard drilling (drying bit) Rattling on Center Bit |
| | Center Bit | | | | 32.5-33.5 Center Bit No Recovery | | | Run #16 |
| 35 | 1.5/1.5 | 0121-97 1165 34-34.5 | NDA | | 33.5-34.3' brown (brown to orange) fine grain silty sand with large ~~dacite~~ rhyolite cobbles dry<br>34.3-35 grayish orange mod. welded tuff, dry Sharp flat contact | | | Run #17 1550 |
| | 2.5/2.5 | NA | NDA | | 35-37.5' grayish orange 5YR 7/2 weakly welded tuff. Trace moisture, 5-10% pumice. | | | Run #18 1605<br>1630 End of day |
| 40 | 2.5/2.5 | NA | NDA | | 37.5-40' grayish orange 5YR 7/2 weak to moderately welded tuff. (solid core) trace moisture, 5% large elongated pumice. 5% qtz | | | 3/13/97 Drilling 0840<br>Run # 19 0850 |
| 45 | 5/5 | 0121 97 1166 42-42.5 | NDA | | 40-42' SAA<br>42-45' Mottled grayish orange/lt brown non to weakly welded tuff. Dry, 5% pumice, 5% qtz. | | Bandelier Tuff Unit #3 | Run #20 0904 |
| 50 | 4.2/5 | NA | NDA | | 45-49.2' ~~45-44.2~~ JW 3/14/97 SAA<br>49.2-50' ~~44.2-45~~' No Recovery JW 3/14/97 | Loss | | Run #21 0925 |
| 55 | 5/5 | 0121 97 1167 50.5-51' | NDA | | 50-51' Med. yellow brown 10YR5/4, soft non welded tuff with trace moisture. Possible fracture.<br>51-55' Mottled gray/brown weak to mod. welded tuff. Dry, Slight increase in pumice, 5% qtz. Solid core. | | | Run #22 0945 |
| 60 | 5/5 | NA | NDA | | 55-~~60~~' 57' SAA JW 3/14/97<br>57-60' light to med gray non welded dry tuff. Decrease in lg pumice lapilli. | | | Run# 23 1000 |

Prepared By J. Walterscheid Date 3/18/97 Checked By Date 3/28/97

R1

LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

SAMPLE MANAGEMENT FACILITY

**CORE SAMPLE LOG**

Borehole ID 16-021 TA/OU 21 Drill Depth From 60 To 90 Page 3 of 7

Driller Stewart Bro Box #(s) NA Start Date/Time 3/12/97 1020 End Date/Time 3/17/97 1635

Drilling Equip./Method CME 750/ Auger Sampling Equip./Method Split Spoon / Core

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core In Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 60 | 5/5 | 0121<br>97<br>1168<br>61-61.5 | NDA | NA | 60-61' light gray non welded, dry tuff<br>61-62.5' light brown/gray mottled non to weakly welded dry tuff,<br>62.5-65' light gray non-weakly welded dry tuff, 5% small pumice, drop in qtz content. | | Bandelier Tuff Unit #3 | Run #24 1025 |
| 65 | 5/5 | NA | NDA | | 65-70' SAA | | | Run #25 1040 |
| 70 | 3.5/5 | 0121<br>97<br>1169<br>70-70.5 | NDA | | 70-73.5 ' light gray non welded (sugary) tuff. trace moisture, increase in pumice content. Slight color change to darker gray with depth.<br>73.5-75' No Recovery | Loss | | Run #26 1058 |
| 75 | 3/5 | NA | $H^3$<br>16µCi/mg | | 75-78' medium gray non welded (sugary) tuff. Trace moisture.<br>78-80' No Recovery | Loss | | Run #27 1118 |
| 80 | 2.5/2.5 | 0121<br>97<br>1170<br>80-82.5 | $H^3$<br>14 µCi/mg | | 80-82.5 medium gray non-welded (sugary) soft tuff. slight increase in moisture | | | Run # 28 1140 |
| | 2.5/2.5 | NA | H3<br>10 µCi/mg | | 82.5-85' SAA | | | Run # 29 1150 |
| 85 | 2.5/2.5 | NA | H3<br>10 µCi/mg | | 85-87.5' SAA | | | Run # 30<br>Lunch |
| | 2.5/2.5 | NA | H3<br>4 µCi/mg | | 87.5-90' medium gray nonwelded (sugary) soft tuff. trace moisture. | | | Run # 31 1327 |
| 90 | | | | | | | | |

Prepared By J. Walterscheid Date 3/17/97 Checked By Date 3/28/97

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LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

SAMPLE MANAGEMENT FACILITY

**CORE SAMPLE LOG**

Borehole ID 16-021 TA/OU 21 Drill Depth From 90 To 120 Page 4 of 7

Driller Stewart Bro. Box #(s) NA Start Date/Time 3/12/97 1030 End Date/Time 3/17/97 1635

Drilling Equip./Method CME 750/ Auger Sampling Equip./Method Split Spoon/Core

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core In Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 90 | 2.5/2.5 | 0121-97<br>1171<br>90-92.5 | H3<br>22µCi/m3 | NA | 90-92.5 light to medium gray non welded (sugary) dry. tuff. < 5% small soft pumice. | | Bandelier Tuff Unit #3 | Run #32 1340<br>Tuff is slightly more compacted. |
| 95 | 2.5/2.5 | NA | H3<br>10µCi/m3 | | 92.5-94' SAA, increase in large pumice<br>94-95' Pinkish gray 5YR 7/2 (salmon color) weakly welded, up to 1" pumice, dry. | | | Run # 33 1400 |
| | 2.5/2.5 | 0121-97<br>1172<br>97-97.5 | H3<br>26µCi/m3 | | 95-97.5 med. gray mix of 70% non-welded tuff with 30% weakly welded tuff pieces. Dry, trace moisture. soft | | | Run #34 1411 |
| 100 | 2.5/2.5 | NA | H3<br>20µCi/m3 | | 97.5-98' SAA<br>98-100 Grayish pink 5YR 7/2 ~~m~~ weak to med. welded tuff. Dry, solid core. | | | Run #35 1434 |
| | 2.5/2.5 | 0121-97<br>1173<br>100-100.5 | H3<br>10µCi/m3 | | 100-102.5' SAA | | | Run #36 1446 |
| 105 | 2.5/2.5 | 0121-97<br>1174<br>104.2-105 | H3<br>120µCi/m3<br>104.2-105 | | 102.5-104.2' SAA<br>104.2-105' lt. tan soft (powder) dry non-welded tuff. H3: 120µCi/m3 | | ? | Run #37 1502 |
| | 2/2 | NA | H3<br>40µCi/m3 | | 105-106' dk pink moderately welded tuff 8% qtz. FeOx spotting<br>106-106.5 soft gray powdery tuff H3 20µCi/m3<br>106.5-107' d Pinkish gray moderately welded tuff 10% qtz (large crystals) FeOx spotting | | ? | Run # 38 1520<br>very hard drilling, high pull down pressure. |
| | 2/2 | NA | H3<br>12µCi/m3 | | 107-109' SAA | | | Run #39 1550 |
| 110 | 1/1 | 0121-97<br>1175<br>109-110 | H3<br>10µCi/m3 | | 109-110' SAA | | | Run #40 1615 Sample 105<br>Shutdown 1630 |
| | 2.5/2.5 | NA | H3<br>10µCi/m3 | | 110-112.5' Grayish pink 5YR 7/2, moderately welded tuff. FeOx spotting, 10% qtz, ~~covers~~ 5% flattened pumice, dry (dusty). Tuff is a mix of 70% welded fragments with 30% soft (gravelly) tuff.<br>JW 3/11/97 | | Bandelier Tuff Unit #2 | 3/14/97 Drilling 0845<br>Run # 40 0900 |
| 115 | 2.5/2.5 | NA | NDA | | 112.5-115 SAA | | | Run #41 0915 |
| | 2.5/2.5 | NA | H3<br>18µCi/m3 | | 115-117.5' SAA | | | Run #42 0930 |
| 120 | 2/2.5 | 0121-97<br>1176<br>118.5-119.5 | H3<br>30µCi/m3 | ↓ | 117.5-119.5 SAA<br>119.5-120' No Recovery | Loss | | Run #43 0950 |

Prepared By J. Walterscheid Date 3/12/97 Checked By Date 3/28/97

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## LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

**SAMPLE MANAGEMENT FACILITY**

## CORE SAMPLE LOG

Borehole ID 16-021 TA/OU 21 Drill Depth From 120 To ______ Page 5 of 7
Driller Stewart Bo. Box #(s) NA Start Date/Time 3/12/97 1000 End Date/Time 3/17/97 1635
Drilling Equip./Method CME 750/ Auger Sampling Equip./Method Split Spoon/ Core

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Anaylical Sample Number | Field Screening Results | Top/Bottom of Core In Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 120 | 2.5/2.5 | NA | H3<br>14 μCi/m3 | NA | 120-122.5' Grayish pink 5YR 7/2 dry, mix of 40% soft non-welded (ground?) tuff with 60% mod. welded tuff. FeOx spotting on tuff. 5-10% qtz. | | Bandelier Tuff Unit #2 | Run # 44 1010 |
| | 2.5/2.5 | NA. | H3<br>10 μCi/m3 | | 122.5-125' SAA slight increase in moisture content | | | Run # 45 1021 |
| 125 | 2.5/2.5 | NA | H3<br>8 μCi/m3 | | 125-127.5 Pale yellowish brown 10YR 6/2 mix of 40% soft non-welded tuff with 60% mod. welded tuff. Decrease in FeOx spotting, 5% qtz, trace moisture. | | | Run # 46 1035 |
| | 2.5/2.5 | 0121-97<br>1177<br>125-130 | H3<br>12 μCi/m3 | | 127.5-130 SAA | | | Run # 47 1050 |
| 130 | 2.5/5 | NA | H3<br>18 μCi/m3 | | 130-132.5' SAA<br>132.5-135' No Recovery | Loss | | Run # 48 1107 |
| 135 | 3/5 | NA | H3<br>22 μCi/m3 | | 135-138' Light brown 5YR 6/2 mix of 50% soft nonweld tuff (trace moisture) with moderately welded tuff fragments. Increase in FeOx spotting on welded fragments. Increase in qtz. Tuff fragments are dry.<br>138-140' No Recovery | Loss | | Run # 49 1126 |
| 140 | 2.5/5 | 0121-97<br>1178<br>140-141 | H3<br>10 μCi/m3 | | 140-142.5' SAA with increase in moisture<br>142.5-145' No Recovery | Loss | | Run # 50 1144 |
| 145 | 2.5/2.5 | NA | H3<br>40 μCi/m3 | | 145-147.5' Tan to brown mix of 60% soft non-welded weathered tuff with 40% light pink welded tuff fragments. Tuff fragments are spotted with FeOx "dots" 5-10% qtz, 5% pumice, dry. Non welded matrix is moist | | | Run # 51 1159 |
| 150 | 2/2.5 | 0121-97<br>1179<br>145-149.5 | H3<br>32 Ci/m: | | 147.5-149.5' SAA<br>149.5-150 NO Recovery | Loss | | Run # 52 1215<br>Lunch 1230 |

Prepared By J.W. Herscheid Date 3/18/97 Checked By ______ Date 3/28/97

R1

LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

SAMPLE MANAGEMENT FACILITY

**CORE SAMPLE LOG**

Borehole ID 16-021 TA/OU 21 Drill Depth From 150 To 180 Page 6 of 7

Driller Stewart Bro. Box #(s) NA Start Date/Time 3/12/97 1000 End Date/Time 3/12/97 1635

Drilling Equip./Method CME 750/ Auger Sampling Equip./Method Split Spoon / Core

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Anaytical Sample Number | Field Screening Results | Top/Bottom of Core In Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 150 | 2.5/2.5 | NA | H3<br>20 µCi/m3 | NA | 150-152.5' Tan to brown weathered tuff. Matrix is a soft weathered tuff with welded tuff fragments making up 30% of volume. Moisture in the soft matrix material. Pumice in fragments are fine and dk gray | | Bandelier Tuff Unit #2 | Run #53 1350<br>Adding cable to wireline winch |
| 155 | 2.5/2.5 | NA | H3<br>18 µCi/m3 | | 152.5-155 SAA (note: the fine matrix material resembles a fine grain silt) | | | Run #54 1450 |
| | 2.5/2.5 | NA | H3<br>25 µCi/m3 | | 155-157.5 SAA | | | Run #55 1530 |
| 160 | 2.5/2.5 | 0121-97-1180<br>159.5-160 | H3<br>30 µCi/m3 | | 157.5-160' Tan/brown mix of 60% welded tuff fragments with 40% soft (silty) weathered tuff. FeOx spotting on fragments trace moisture (drying with depth) in soft material | | | Run #56 1545 |
| | 2.5/2.5 | NA | H3<br>30 µCi/m3 | | 160-162.5' SAA. Tuff fragments are a light purple color; continuing to dry out. | | | Run # 57 1600<br>End of Day |
| 165 | 2/2.5 | NA | H3<br>40 µCi/m3 | | 162.5-164.5 Mix of moist brown weathered soft tuff (silt?) with 30% weakly welded fragments FeOx spotting on fragments<br>164.5-165' No Recovery | Loss | | 3/18/97 Drilling 1345<br>Run # 58 1355<br>new tritium meter |
| 170 | 2.5/5 | NA | H3<br>40 µCi/m3 | | 165-167.5' Mix of 80% soft moist brown non-welded tuff with 20% pinkish weakly welded tuff fragments. Moisture is caught up in the fine matrix material.<br>167.5-170 No Recovery | Loss | | Run # 59 1414 |
| 175 | 2.5/5 | 0121-97 1181<br>170-171 | H3<br>40 µCi/m3 | | 170-172.5 SAA, drying out with depth<br>172.5 ~~177.5~~ - 175 No Recovery<br>JW 3/17/97 | Loss | | Run #60 1432 |
| 180 | 2.5/5 | NA | H3<br>45 µCi/m3 | | 175-177.5 mix of light brown soft non-welded tuff with 30% weakly welded pinkish gray tuff. Trace moisture.<br>177.5-180 No Recovery | Loss | | Run #61 1503 |

Prepared By J. Walterscheid Date 3/18/97 Checked By Date 3/28/97

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LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

SAMPLE MANAGEMENT FACILITY

**CORE SAMPLE LOG**

Borehole ID 16-021 TA/OU 21 Drill Depth From 180 To 200 Page 7 of 7

Driller Stewart Bros. Box #(s) NA Start Date/Time 3/12/97 1000 End Date/Time 3/17/97 1635

Drilling Equip./Method CME 750/Auger Sampling Equip./Method Split Spoon/Core

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 180 | 2.5/5 | 0121<br>97<br>1182<br>180-181 | H3<br>40µCi/mg | NA | 180-182.5' light brown 5YR 6/4 mix of 70% soft dry nonwelded tuff with 30% weakly welded tuff fragments. FeOx spotting on fragments. Strongly weathered matrix.<br>182.5-185 No Recovery | Loss | Unit #2 | Run #62 1520<br>soft matrix is almost silty |
| 185 | 2.5/5 | NA | H3<br>40µCi/mg | | 185-187.5 SAA<br>187.5-190 No Recovery | Loss | | Run #63 1535 |
| 190 | 2.5/5 | 0121<br>97<br>1183<br>190-191 | H3<br>40µCi/mg | | 190-192.5' light brown 5YR 6/4 soft dry nonwelded to very weakly welded tuff. tuff crumbles when pinched.<br>192.5-195 No Recovery | Loss | | Run #64 1555 |
| 195 | 3/5 | 0121<br>97<br>1184<br>197-198 | H3<br>60µCi/mg | | 195-198 SAA<br>198-200 No Recovery | Loss | | Run #65 1616 |
| 200 | | | | | 200ft Total Depth<br>(TD based on TA-21 RAD Lab screening results) | | | End of day 1635 |

Prepared By J. Watterscheid Date 3/18/97 Checked By Date 3/28/97

R.1

## LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

**SAMPLE MANAGEMENT FACILITY**

## CORE SAMPLE LOG

Borehole ID 16-023 TA/OU 21 Drill Depth From 0 To 30 Page 1 of 3
Driller Stewart Bros Box #(s) N/A Start Date/Time 1/8/97 1335 End Date/Time 1/8/97 1630
Drilling Equip./Method CME750/ Auger Sampling Equip./Method Splitspoon/core
Location ID: 21-05073

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| | | | | | Background<br>1/8/97 α : 21cpm Bγ: 111cpm<br>1/9/97 α:16.4 cpm Bγ: 111cpm | | | Drilling into western end of absorption bed #4 MDA-T TA-21. |
| | 2.2/2.5 | N/A | NDA | N/A | 0-2' Surface soil of moist clayey silty sand with grasses and roots. Tuff fragments at 2'. brown 5YR/4/4<br>2-2.5' No Recovery |  | Backfill ? | Start 1335<br>Run #1 1350 |
| 5 | 1/2.5 | 0121-97<br>0326<br>2.5-3' | NDA | | 2.5-3.5' moist brown silty clay grading into a fine-med gr. sand at 3.5'<br>3.5-5' No recovery | | | Run #2 1405 |
| | 1.5/2.5 | N/A | α 40cpm<br>Bγ H3 NDA | | 5-6.5' light brown (5YR 5/6) silty med gr. sand with river rock pebbles and crushed tuff<br>6.5-7.5 No recovery | | | Run #3 1430 |
| 1/1.5 | ~~.5/1.5~~ sw 1/9/97 | 0121-97<br>0327<br>8.5-9' | α 2570 cpm<br>Bγ 600 cpm<br>H3 NDA | | Note: Run #4 is 7.5-9'. Hit cobbles at 9' and put on center bit<br>7.5-8.5' SAA iron type staining at 8.5'<br>8.5-9' sand with 50% 1" river gravel (this is the hot zone) | | Absorption Bed | Run #4 1440<br>Driller hit cobbles at 9' putting on center bit |
| | Center | Bit | sw 1/9/97 | | 9-11.5' Drilling thru cobble zone with center bit | | | Run #5 center bit to 11.5' |
| 15 | 3.5/3.5 | 0121-97<br>0328<br>11.7-12.2 | α 652 cpm<br>Bγ 260<br>H3 NDA | | 11.5-12' gravel tuff/w.n. ~~sand~~ silty sand<br>12-15' Tuff, moderately welded, gray 10YR 6/2) sw 1/9/97 | | | Run #6 1545<br>Shutdown 1600 |
| | 2.5/2.5 | N/A | α 133 cpm<br>Bγ 233 cpm<br>@ fracture | | 15-17.5' SAA 60° Fracture at 16.5' weak clay alteration of pumice. α 133 cpm Bγ 233 cpm at fracture, Fracture gap, 0.5mm wide, Brown alteration zone around fracture | | | 1/9/97 Start 0815<br>Reaming hole.<br>Run #7 0930 |
| 20 | 2.5/2.5 | N/A | NDA | | 17.5-20' SAA no fracturing, competent core | | | Run #8 0945 |
| 25 | 5/5 | 0121-97<br>0329<br>22-23' | NDA | | 20-25' SAA 22-23' Fracture, dk orange clay (weathering?) thin fracture No detectable rad activity | | Bandelier Tuff | Run #9 1004 |
| 30 | 5/5 | N/A | NDA | ↓ | 25-30' SAA no fracturing, weak to mod. welded. | | | Run #10 1045 |

Prepared By J. Walterscheid Date 1/8/97 Checked By Date 1/17/97

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LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

**SAMPLE MANAGEMENT FACILITY**

## CORE SAMPLE LOG

Borehole ID 16-023 TA/OU 21 Drill Depth From 30 To 60 Page 2 of 3

Driller Stewart Bros Box #(s) N/A Start Date/Time 1/8/97 1335 End Date/Time 1/8/97 1630

Drilling Equip./Method CME750/ Auger Sampling Equip./Method Split Spoon/core

Location ID: 21-05073

| Depth (Feet) | Recovery (feet per foot/ %) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 30 | 5/5 | 0121-97-0330<br>32-32.5' | NDA | N/A | 30-35' Tuff minor fracture at 32' trace clay alteration Competent tuff drying with depth |  | Bandelier Tuff | Run #11 1115 |
| 35 | 5/5 | N/A | α 60<br>β+γ 120 | | 35-40' SAA minor fracture at 37.5-38' tuff altering to a light brown color along fracture NORAD<br>Slight increase in pumice α60; β+γ 120 at a large 3" white pumice crystal (Non-associated fracture) | | | Run #12 1140 |
| 40 | 5/5 | 0121-97-0331<br>42-42.5' | α 35cpm<br>β+γ 140cpm<br>42' | | 40-45' SAA Fractures at: 40.5' 75° ~~(sampled)~~ JW 1/8/97<br>42' 45° (sampled)<br>43-44' iron fracture at 60° large areas weathering to a dk brown color | | | Run #13 1205 |
| 45 | 2.5/5 | 0121-97-0332<br>46.5-47' | α 100<br>β+γ 140 | | 45-~~50'~~ 46' SAA JW 1/8/97<br>46-47.5' Tuff non-welded, lt. gray very soft (powdery)<br>47.5-50' No Recovery | | | Run #14 1240<br>lunch Break 1310 |
| 50 | 2.5/2.5 | N/A | NDA | | 50-52.5' Non-welded soft tuff, 51.8-52.4' brown alteration zone slight increase in moisture content | | | Drilling 1410<br>Run #15 1450 |
| | 2.5/2.5 | N/A | NDA | | 52.5-53 SAA<br>53-55 weakly welded tuff gray competent<br>54.6-55' fracture, dk orange-ish brown clay fill. Fracture along ~~end~~ edge of core JW 1/8/97 | | | Run #16 1506 |
| 55<br>60 | 0/5 | | | | 55-60 No Recovery Mis-latch on core barrel?, ground up and went up outside of augers | | | Run #17 1525 |

Prepared By J. Walterscheid Date 1/8/97 Checked By Date 1/17/96

R1

## LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

**SAMPLE MANAGEMENT FACILITY**

## CORE SAMPLE LOG

Borehole ID 16-023 TA/OU 21 Drill Depth From 60 To 70 T.D. Page 3 of 3

Driller Stewart Bros Box #(s) N/A Start Date/Time 1/8/97 1335 End Date/Time 1/9/97 1630

Drilling Equip./Method CME 750 / auger Sampling Equip./Method Split Spoon / core

Location ID: 21-05073

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Anaytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 60 | 2.5/2.5 | 0121-97 0333 0401 | NDA | | 60-62 Tuff weakly welded, grey No fracturing<br>62-62.5 non-welded tuff lt. brown alteration | " " | Bandelier Tuff | Run 18 1600 |
| 65 | 2.5/2.5 | N/A | NDA | | 62.5-63.5 SAA<br>63.5-65 non-welded grey tuff, soft No visible fracturing | " " | | Run #19 1610 |
| | 2.5/2.5 | N/A | NDA | | 65-67.5 SAA | " " | | Run #20 1620 |
| 70 | 2.5/2.5 | 0121-97 0334 70' | NDA | | 67.5-70 SAA | " " | | Run #21 1630 |
| | | | | | 70 ft T.D. | | | |

Prepared By J. Walterscheid Date 1/9/97 Checked By Date 1/17/97

R1

LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

SAMPLE MANAGEMENT FACILITY

**CORE SAMPLE LOG**

Borehole ID 16-024 TA/OU 21 Drill Depth From 0 To 30ft Page 1 of 2
Driller Stewart Bros Box #(s) NA Start Date/Time 2/12/97 1000 End Date/Time 2/12/97 1550
Drilling Equip./Method CME 750 / Auger Sampling Equip./Method Split Spoon / Core
Location ID: 21-05074

Contamination Criteria
2/12/97
α: 8cpm
β-γ: 126cpm

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Anaylical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes<br>Drilling ≈ 15' ~~east~~ north of absorption bed #4, MDA-T TA-21. |
|---|---|---|---|---|---|---|---|---|
| 0 | 1.9/2.5 | 0121-97-1001<br>0.8-1.3' | α: 1000cpm<br>β-γ: 165cpm<br>0.8-1.3 | NA ↓ | 0-0.8' dk brown 10YR 3/2 clay, organics (grasses, roots) moist.<br>0.8-1.3' Mottled brown/gray mix crushed tuff/sand moist.<br>1.3-1.9' lt. gray 10YR 6/2 crushed tuff<br>1.9-2.5 No Recovery | Loss | Overburden/Backfill | Drilling 1000<br>Run #1 1008 |
| 5 | 1.5/2.5 | NA | NDA | | 2.5-3' lt gray crushed tuff, moist.<br>3-4' lt brown 5YR 5/6 mix of silty clay with crushed tuff, Fe Ox staining.<br>4-5' No Recovery | Loss | | Run #2 1040 |
| | 1.3/2.5 | NA | NDA | | 5-6' lt brown 5YR 5/6 silty clay, moist.<br>6-6.3' lt gray crushed tuff.<br>6.3-7.5' No Recovery | Loss | | Run #3 1050 |
| 10 | 2.0/2.5 | 0121-97-1002<br>9-9.5 | NDA | | 7.5-9.5' lt gray 5YR 7/2 weakly welded tuff, clay.<br>9.5-10' No Recovery | Loss | | Run #4 1105 |
| | 2.5/2.5 | NA | NDA | | 10-12.5' lt gray 5YR 7/2 non to weakly welded tuff. drying with depth. (Friable) | | | Run #5 1118<br>mix of soft tuff with welded tuff fragments |
| 15 | 1.5/2.5 | NA | NDA | | 12.5-14' SAA<br>14-15' No Recovery | Loss | | Run #6 1130 |
| | 2.5/3.5 | NA | NDA | | 15-17.5' lt. gray 5YR 7/2 non-weakly welded tuff. Dry. 7% pumice, (soft with hard pieces of tuff) | | Bandelier Tuff Unit #3 | Run #7 1140 |
| 20 | 2.5/2.5 | 0121-97-1003<br>17.5-20 | NDA | | 17.5-20' SAA | | | Run # 8 1151 |
| | 1.5/2.5 | NA | NDA | | 20-21.5' lt gray 5YR 7/2 non-weakly welded tuff. (mix of soft tuff with welded tuff fragments)<br>21.5-22.5' Dry No Recovery | Loss | | Run #9 1203<br>will put in catcher for better Recovery return from Lunch 1215 |
| 25 | 0.5/2.5 | NA | NDA | | 22.5-23' lt gray non-weakly welded tuff<br>23-25' No Recovery | Loss | | Run #10 1330, No Recovery due to lg piece of tuff caught in catcher |
| | 2.5/2.5 | 0121-97-1004<br>26.5-26.8 | α: 60cpm<br>β-γ: 140cpm<br>26.8' | | 25-27.5' lt gray 5YR 7/2 non-weakly welded tuff. (mix of soft non-welded tuff with welded tuff fragments)<br>small fracture 26.8' lt brown tuff (no clay) | | | Run #11 1350 |
| 30 | 2.5/2.5 | NA | NDA | | 27.5-30' SAA | | | Run #12 1415<br>less welding than previous runs |

Prepared By J. Wattersheid Date 2/12/97 Checked By Date 2/20/97

R1

LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

SAMPLE MANAGEMENT FACILITY

**CORE SAMPLE LOG**

Borehole ID 16-024 TA/OU 21 Drill Depth From 30 To 50 ft TD Page 2 of 2

Driller Stewart Bros Box #(s) NA Start Date/Time 2/12/97 1033 End Date/Time 2/12/97 1550

Drilling Equip./Method CME 750/ Auger Sampling Equip./Method Split Spoon/Core

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Anaylical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 30 | 2.5/2.5 | NA | NDA | NA | 30 - 32.5' lt gray/brown 5YR 7/2 non to weakly welded tuff, Dry. (Soft tuff 60% welded tuff fragments 40%) 7% pumice, slight color change to lt. brown with depth | | Bandelier Tuff Unit #3 | Run # 13 1425 |
| 35 | 2/2.5 | NA | NDA | | 32.5 - 33.3' SAA<br>33.3 - 34.5' lt gray 5YR 7/2 non - weakly welded tuff (soft tuff 65% welded tuff fragments 35%) Dry<br>34.5-35 No Recovery | Loss | | Run # 14 1435 |
| | 2/2.5 | NA | NDA | | 35-36' lt gray brown non to weakly welded tuff.<br>36-36.5 fracture and FeOx staining. soft tuff is light brown welded tuff is gray.<br>36.5-37 lt gray brown tuff. (soft tuff 60% is brown in color and med welded tuff is lt gray 40%)<br>37-37.5 No Recovery | Loss | | Run # 15 1443 |
| 40 | 2.5/2.5 | 0121-97<br>1005<br>37.5-40 | NDA | | 37.5-40' lt gray brown (mottled) non weakly welded tuff, dry, Increase in brown color (alteration?) (soft 70% welded 30%) | | | Run # 16 1455 |
| | 1.8/2.5 | NA | NDA | | 40-41.8' SAA<br>41.8-42.5 No Recovery | Loss | | Run # 17 1510 |
| 45 | 1.7/2.5 | NA | NDA | | 42.5-44.3' lt gray/brown (mottled) 5YR 6/4 non to weakly welded tuff, trace moisture (soft 80% welded 20% mix)<br>44.3-45 No Recovery | Loss | | Run # 18 1520 |
| | 2/2.5 | NA | NDA | | 45-47' lt brown 5YR 6/4 non to weakly welded tuff trace FeOx staining on welded tuff fragments (80% soft tuff 20% welded tuff fragments)<br>47-47.5 No Recovery | Loss | | Run # 19 1530 |
| 50 | 1.5/2.5 | 0121-97<br>1006<br>48.5-47 | NDA | | 47.5-49' SAA<br>49-50' No Recovery | Loss | | Run # 20 1540<br>TD 1550 |
| | | | | | 50' Total Depth | | | |

Prepared By J. Walterscheid Date 2/13/97 Checked By Date 2/20/97

R1

LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

SAMPLE MANAGEMENT FACILITY

## CORE SAMPLE LOG

Borehole ID 16-025 TA/OU 21 Drill Depth From 0 To 30 Page 1 of 3

Driller Stewart Bros Box #(s) NA Start Date/Time 3/10/97 1020 End Date/Time 3/11/97 1430

Drilling Equip./Method CME 750/Auger Sampling Equip./Method Split Spoon/Core

Location ID: 21-05075

Contamination Criteria

| 3/10/97 | 3/11/97 |
|---|---|
| α: 4cpm | α: 20cpm |
| Bγ: 189cpm | Bγ: 110cpm |

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core In Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Drilling in center of absorption bed #3 TA-21, MDA-T. |
| 0 | 2.5/2.5 | NA | NDA | NA | 0-1 Dark moderate brown 5YR 3/4 moist clay, grass, roots.<br>1-2.5' Moderate brown 5YR 4/4 moist clayey silts with crushed tuff. | | ? Backfill ? | 3/10/97 Drilling 1020<br>Run #1 1020 |
| 5 | 2.5/2.5 | NA | NDA | | 2.5-3.8' Light brown 5YR 5/6 medium grain moist sand with silt and small pebbles.<br>3.8-5' silty clay with crushed tuff. | | | Run #2 1035 |
| | 2/2.5 | 0121-97<br>1138<br>6.7-7.2 | NDA | | 5-6.5' medium grain moist silty sand with small pebbles.<br>6.5-7' dk brown moist clay<br>7-7.5' No Recovery | Loss | Absorption Bed #3 | Run #3 1100 |
| 10 | 2/2.5 | 0121-97<br>1132<br>8.8-9.3 | α: 80cpm<br>Bγ: 280cpm<br>8-10 | | 7.5-8' dk brown moist clay<br>8-8.8' Tuff boulder, weathered, soft.<br>8.8-9.2' dk brown moist silty gravel with sand<br>9.2-9.5' dk brown silty clay with 8" river gravels<br>9.5-10' No Recovery | Loss | | Run #4 1115 |
| | 0.5/2.5 | NA | α: 55cpm<br>Bγ: 300cpm<br>10-10.5 | | 10-10.5' 1-2" rock with med grain silty sand<br>10.5-13.5' No Recovery, lg rock plugged core barrel. | Loss | | Run #5 1145 |
| 15 | 0/2.5 | Center Bit | | | 13.5-15' Drilled with center bit through the cobble zone. | Center Bit | | Run #6 1200<br>Drilling with center bit 12.5-13.5'<br>13.5-15' sample fell out of barrel |
| | 1/1 | 1133<br>1141 | α: 115<br>Bγ: 300 | | 15-16' light brownish gray 5YR 6/1 dry (dusty) non-weakly welded tuff. | | Bandelier Tuff Unit #3 | Run #7 1440<br>Duplicate sample 0121-97-1141 collected |
| 20 | 0.5/4 | NA | α: 125cpm<br>Bγ: 300cpm<br>16-16.5 | | 16-16.5' dk brown weakly welded tuff, possible fracture.<br>16.5-20' No Recovery | Loss | | Run #8 1500 |
| | 1.5/2.5 | 0121-97<br>1134<br>20-21 | α: 20cpm<br>Bγ: 300cpm | | 20-21.5' Grayish orange 5YR 7/2 dry (dusty) non-weakly welded tuff with welded chunks of tuff.<br>21.5-22.5' No Recovery | Loss | | Run #9 1515 |
| 25 | 1.5/2.5 | NA | NDA | | 22.5-24' Grayish orange non-weakly welded dry tuff. softer with depth<br>24-25' No Recovery | Loss | | Run #10 1535 |
| | 1.7/2.5 | NA | NDA | | 25-26.7' SAA<br>26.7-27.5 No Recovery | | | Run #11 1552 |
| 30 | 2.5/2.5 | 0121-97<br>1135<br>29.5-30 | NDA | ↓ | 27.5-30' Grayish orange non-weakly welded dry tuff. | | | Run #12 1602<br>End of day 1625 |

Prepared By J. Walterscheid Date 3/11/97 Checked By Date 3/27/97

R1

LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

SAMPLE MANAGEMENT FACILITY

## CORE SAMPLE LOG

Borehole ID 16-025 TA/OU 21 Drill Depth From 30 To 60 Page 2 of 3
Driller Stewart Bro Box #(s) NA Start Date/Time 3/10/97 1320 End Date/Time 3/11/97 1430
Drilling Equip./Method CME 750/Auger Sampling Equip./Method Split Spoon / Core

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core in Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 30 | 2/2 | NA | NDA | NA | 30-32' Grayish orange, dry (dusty) mix of 70% soft non welded tuff with 30% weakly welded tuff fragments. | | | 3/11/97<br>Run #13 0845 |
| 35 | 3/3 | NA | NDA | | 32-35' SAA | | | Run #14 0905 |
| | 1.5/25 | NA | NDA | | 35-36.5' SAA with minor clay filled fracture at 36'. Clay is ~~wetty~~ slightly moist.<br>36.5-37.5 No Recovery | Loss | Bandelier Tuff Unit #3 | Run #15 0920 |
| 40 | 1.7/25 | 0121-97<br>1136<br>37.8-39.3 | NDA | | 37.5-39.3' SAA minor clay filled fracture at 39'. Trace moisture in fracture fill.<br>39.3-40' No Recovery | Loss | | Run #16 0941 |
| | 2/25 | NA | NDA | | 40-42' Grayish orange dry mix of 70% soft non-welded tuff with 30% welded tuff Brown mottled tuff at 41' and 42'.<br>42-42.5' No Recovery | Loss | | Run #17 1000 |
| 45 | 2.5/2.5 | NA | NDA | | 42.5-45' Grayish orange dry, mix of mottled brown gray soft non welded tuff with 20% welded tuff fragments. 1" clay zone at 45'. | | | Run #18 1017 |
| | 2/2.5 | 0121-97<br>1137<br>45-46 | α: 115cpm<br>βγ: 120cpm<br>45-46.5 | | 45-46.5' dk brown moist fracture zone mixed with soft non-welded tuff. 15% clay.<br>46.5-47' dk gray dry soft non welded tuff.<br>47-47.5 No Recovery | Loss | | Run #19 1030<br>high $H_2O$ content in fracture as compared to tuff. |
| 50 | 1.5/2.5 | NA | α: 55cpm<br>βγ: 140cpm<br>47.5-49 | | 47.5-48.5 Fine grain silty sand(?) moist, 1" piece of rounded dacite(?) pebble in sand.<br>48.5-49 FeO stained tuff with clay filled fracture.<br>49-50 No Recovery | Loss | ? | Run #20 1055<br>small paleo channel? |
| | 1.3/2.5 | NA | NDA | | 50-51.3' Brown moist, soft, weathered tuff mixed with 15% white weakly welded pieces of tuff. Fines are silty<br>51.3-52.5 No Recovery | Loss | | Run #21 1125 |
| 55 | 1.5/2.5 | NA | NDA | | 52.5-54 Mottled brown/lt. gray weakly welded weathered tuff. Trace moisture.<br>54-55 No Recovery | Loss | Unit #3 | Run #22 1135 |
| | 1.5/2.5 | NA | NDA | | 55-56.5' lt brownish gray, dry, non welded tuff. Trace pumice.<br>56.5-57.5 No Recovery | Loss | | Run #23 1147 |
| 60 | 1/2.5 | 0121-97<br>1138<br>58-58.5 | NDA | ↓ | 57.5-58.5 SAA<br>58.5-60 No Recovery | Loss | | Run #24 1202<br>Lunch 1220 |

Prepared By J. Wattersweid Date 3/11/97 Checked By Date 3/28/97

R.1

LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

SAMPLE MANAGEMENT FACILITY

**CORE SAMPLE LOG**

Borehole ID 16-025 TA/OU 21 Drill Depth From 60 To 70 Page 3 of 3

Driller Stewart Bo Box #(s) NA Start Date/Time 3/10/97 1030 End Date/Time 3/11/97 1430

Drilling Equip./Method CME 750/ Auger Sampling Equip./Method Split Spoon/Core

| Depth (Feet) | Recovery (feet per feet/ %) | Field Borehole Analytical Sample Number | Field Screening Results | Top/Bottom of Core In Box | Lithology - Petrology - Soil | Graphic Log | Lithologic Unit | Notes |
|---|---|---|---|---|---|---|---|---|
| 60 | 2.5/2.5 | NA | NDA | | 60-62.5' Light brownish gray (5YR 6/1) mix of 60% nonwelded tuff with 40% welded tuff fragments. Trace moisture. | | | Run #25 1345 |
| | 1.5/2.5 | NA | NDA | | 62.5-64' SAA<br>64-65' No Recovery | Loss | Unit #3 | Run #26 1358 |
| 65 | 2/2.5 | NA | NDA | | 65-67' Mottled brown/gray mix of nonwelded tuff with tuff welded tuff fragments.<br>67-67.5' No Recovery | Loss | | Run #27 1410 |
| 70 | 2.5/2.5 | 0121-97<br>1139<br>69.5-70 | NDA | | 67.5-70' SAA | | | Run #28 1420 |
| | | | | | 70 ft Total Depth | | | |

Prepared By J. Watterscheid Date 3/11/97 Checked By Date 3/28/97

R.1

# Appendix E

*Analytical Suites and Results*
*(See enclosed CD)*

# Appendix F

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*List of Drawings*

The list of drawings utilized in the Historical Investigation Report for MDA T appears in the table below and has been submitted to the RRES-RS Records Processing Facility (RPF). Please contact the RPF to request hard copies of these drawings.

**Table F-1**
**List of Record Drawings used in the MDA T HIR Report**

| Drawing Title | Revised | Drawing Number |
|---|---|---|
| **TA-21 Bldg. DP-257** | | |
| Contaminated Waste Disposal Facility Drawing Index | As built 7/12/67<br>2/6-10/68 Rev. 1 was sheet 0 of 50, now sheet 1 of 51 | ENG-C 36368 |
| Contaminated Waste Disposal Facility Vicinity & Site Location Plans | As built 7/12/67<br>2/6-10/68 Rev. 1 was sheet 1 of 50, now sheet 2 of 51 | ENG-C 36369 |
| Contaminated Waste Disposal Facility Site Plan | As built 7/12/67<br>2/6-10/68 Rev. 1 was sheet 2 of 50, now sheet 3 of 51 | ENG-C 36370 |
| Contaminated Waste Disposal Facility Grading Plan & Sections | | ENG-C 36371 |
| Contaminated Waste Disposal Facility Floor Plan | As built 7/12/67<br>2/6-10/68 Rev. 1 was sheet 4 of 50, now sheet 5 of 51 | ENG-C 36372 |
| Contaminated Waste Disposal Facility Building Elevations & Sections | | ENG-C 36373 |
| Contaminated Waste Disposal Facility Wall Sections & Details | | ENG-C 36374 |
| Contaminated Waste Disposal Facility Schedules & Details | | ENG-C 36375 |
| Contaminated Waste Disposal Facility Foundation & Floor Plan | | ENG-C 36376 |
| Contaminated Waste Disposal Facility Sections & Details | | ENG-C 36377 |
| Contaminated Waste Disposal Facility Sections & Details | | ENG-C 36378 |
| Contaminated Waste Disposal Facility Roof Framing Plan & Details | | ENG-C 36379 |
| Contaminated Waste Disposal Facility Mechanical Utilities Plot Plan | As built 7/12/67<br>2/6-10/68 Rev. 1 was sheet 12 of 50, now sheet 13 of 51 | ENG-C 36380 |
| Contaminated Waste Disposal Facility Utilities Plot Plan Profiles | As built 7/12/67<br>2/6-10/68 Rev. 1 was sheet 13 of 50, now sheet 14 of 51 | ENG-C 36381 |
| Contaminated Waste Disposal Facility Process Flow Diagram | As Built 7/12/67<br>2/6-10/68 Rev. 1 was sheet 14 of 50, now sheet 15 of 51 | ENG-C 36382 |
| Contaminated Waste Disposal Facility Process Equipment Plan | As Built 7/12/67<br>2/6-10/68 Rev. 1 was sheet 15 of 50, now sheet 16 of 51 | ENG-C 36383 |

## Table F-1 (continued)

| Drawing Title | Revised | Drawing Number |
|---|---|---|
| Contaminated Waste Disposal Facility Process Piping Plan | As Built 7/12/67<br>2/6-10/68 Rev. 1 was sheet 16 of 50, now sheet 17 of 51 | ENG-C 36384 |
| Contaminated Waste Disposal Facility Treated Waste Storage Area Piping | As built 7/12/67<br>2/6-10/68 Rev. 1 was sheet 17 of 50, now sheet 18 of 51 | ENG-C 36385 |
| Contaminated Waste Disposal Facility Equipment & Piping Sections & Details | | ENG-C 36386 |
| Contaminated Waste Disposal Facility Equipment & Piping Sections & Details | | ENG-C 36387 |
| Contaminated Waste Disposal Facility Equipment & Piping Sections & Details | | ENG-C 36388 |
| Contaminated Waste Disposal Facility Equipment & Piping Sections & Details | | ENG-C 36389 |
| Contaminated Waste Disposal Facility Plumbing & Service Piping Plan | | ENG-C 36390 |
| Contaminated Waste Disposal Facility Plumbing & Service Piping Details | | ENG-C 36391 |
| Contaminated Waste Disposal Facility Heating & Ventilating Plan | | ENG-C 36392 |
| Contaminated Waste Disposal Facility Roof Plan & Misc. Details | | ENG-C 36393 |
| Contaminated Waste Disposal Facility Process Piping & Valve Schedule | | ENG-C 36394 |
| Contaminated Waste Disposal Facility Equipment Schedule | | ENG-C 36395 |
| Contaminated Waste Disposal Facility Electrical Utilities | | ENG-C 36396 |
| Contaminated Waste Disposal Facility Schedule & Legend | | ENG-C 36397 |
| Contaminated Waste Disposal Facility Lighting Plan | | ENG-C 36398 |
| Contaminated Waste Disposal Facility 120/208 Volt Power Plan | | ENG-C 36399 |
| Contaminated Waste Disposal Facility 480 Volt Power Plan | | ENG-C 36400 |
| Contaminated Waste Disposal Facility Communication Plan | | ENG-C 36401 |
| Contaminated Waste Disposal Facility Lightning Protection Plan | | ENG-C 36402 |
| Contaminated Waste Disposal Facility Grounding Plan | | ENG-C 36403 |
| Contaminated Waste Disposal Facility Schedules & Details | | ENG-C 36404 |
| Contaminated Waste Disposal Facility Sections & Details | | ENG-C 36405 |

### Table F-1 (continued)

| Drawing Title | Revised | Drawing Number |
|---|---|---|
| Contaminated Waste Disposal Facility Elevations & Diagrams | | ENG-C 36406 |
| Contaminated Waste Disposal Facility 480 Volt Diagrams | | ENG-C 36407 |
| Contaminated Waste Disposal Facility Communications Diagrams | | ENG-C 36408 |
| Contaminated Waste Disposal Facility Sections & Details | | ENG-C 36409 |
| Contaminated Waste Disposal Facility Pole Line Details | | ENG-C 36410 |
| Contaminated Waste Disposal Facility Elementary Diagrams | | ENG-C 36411 |
| Contaminated Waste Disposal Facility Instrumentation Plan | | ENG-C 36412 |
| Contaminated Waste Disposal Facility Details & Diagrams | | ENG-C 36413 |
| Contaminated Waste Disposal Facility Details & Sections | | ENG-C 36414 |
| Contaminated Waste Disposal Facility Equipment Schedule | | ENG-C 36415 |
| Contaminated Waste Disposal Facility Control Panel Layout | | ENG-C 36416 |
| Contaminated Waste Disposal Facility Panel Details & Diagrams | | ENG-C 36417 |
| Contaminated Waste Disposal Facility Vacuum filter System | | ENG-C 36418 |
| Installation of Batch and Neutralizing Tanks Mech: Partial Plan | 10/31/1969 | ENG-C38166 |
| **TA-21 Bldg. 035** | | |
| D.P.W. Waste Treatment Building Plans and Elevations | As built 6/21/57 | ENG-C 8436 |
| Plot Plan and Influent Holding Tanks | As built 6/21/57 | ENG-C 8439 |
| Tank & Piping Installation | As built 2/27/52 | ENG-2082 |
| Sludge Filtration Installation Mechanical Schematic Flow Diagram | As built 6/21/57 | ENG-C-18169 |
| Sludge Filtration Installation Mechanical Equipment Location Plan | 1/5/61 Changed Location & Capacity of Septic Tank<br>As built 6/27/56 | ENG-C-18171 |
| Special Liquid Waste Mixing Installation | As built 7/9/59 | ENG-C 21959 |
| S.S. Waste Storage Tanks Mech. Plan, Section, & Details | As built 3/9/59<br>Rev. 1 Changed Storage Tanks and Associated Piping | ENG-C18227 |
| New Chemical Storage Addition Floor Plan & Location Plan | As built 7/14/60 | ENG-C-17858 |
| Mechanical Plans & Section | Revised Caustic Storage Tank 8/15/64 | ENG-C17945 |

### Table F-1 (continued)

| Drawing Title | Revised | Drawing Number |
|---|---|---|
| **TA-21 Area** | | |
| DP Waste Disposal Facilities Bldgs 2, 3, 4 and 5 | As built 6/13/45<br>Rev. title 1/27/53 | ENG-C 2217 |
| Structure Location Plan DP Site | As built 9/23/55 | ENG-R 140 |
| Structure Location Plan DP site | As built 8/15/61<br>Rev. 1. 3/13/64 | ENG-R 2450 |
| DP Site Construction | As built 8/22/45 | ENG-C 2338 |
| Materials Disposal Area | As built 6/4/74 | ENG-R 4475 |
| Contaminated Waste Drainage System Plan Profile DP West | As built 4/13/52 | ENG-C 2564 |
| Contaminated Waste Drainage System Plan | As built 4/13/52<br>Rev. 2 10/20/57 | ENG-C 2563 |