TA-21 1996

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

Environmental Restoration Project

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CONTENTS

1.0 INTRODUCTION 1

1.1 General Site History 1

1.2 RFI Overview 6

1.3 Field Activities 8

1.4 Deviations 9

2.0 ENVIRONMENTAL SETTING 10

2.1 Climate 10

2.2 Geology 10

2.2. Geologic Setting 10

2.2.2 Soils 12

2.3 Hydrology 12

2.3.1 Surface water 12

2.3.2 Groundwater 13

2.4 Biological Surveys 13

2.5 Cultural Surveys 14

3.0 APPROACH TO DATA ASSESSMENT AND ANALYSES 14

3.1 Sample Analysis 15

3.1.1 Analytical Methods 15

3.1.2 Data Validation 15

3.2 Background Comparisons 16

3.3 Evaluation of Organic Constituents 17

3.4 Human Health 17

3.4.1 Risk Due to Background 17

3.4.2 Screening Assessment 19

3.4.3 Risk Assessment 20

3.5 Ecological 20

4.0 RESULTS OF QUALITY ASSURANCE/QUALITY CONTROL ACTIVITIES 21

4.1.1 Metals Analyses 22

4.1.2 Organics Analyses 23

4.1.3 Radiochemical Analyses 24

5.0 SPECIFIC RESULTS, CONCLUSIONS, AND RECOMMENDATIONS 24

5.1 MDA T PRSs 24

5.1.1 History 25

5.1.2 Description 26

5.1.3 Previous Investigations 26

5.1.4 Field Investigation 27

5.1.5 Background Comparisons 28

5.1.5.1 Inorganics 29

5.1.5.2 Radionuclides 30

5.1.6 Human Health Assessment 36

5.1.6.1 Screening Assessment 36

5.1.6.2 Risk Assessment 43

5.1.7 Ecological Assessment 43

5.1.8 Extent of Contamination 43

5.1.9 Conclusions and Recommendations 44

6.0 REFERENCES 45

LIST OF TABLES

Table 3.4.1-1 Risk due to background concentrations of soil inorganics assuming a residential scenario[a] 19

Table 5.1.4-2 Field Screening Results for Cesium-137 29

Table 5.1.5-1 Metals with Soil Concentrations Greater than Background UTLs at MDA T and Drainages 30

Table 5.1.5-2 Radionuclides with Soil Concentrations Greater than Background for MDA T and Drainages 31

Table 5.1.5-3 Organic Analytes with Soil Concentrations Greater than Estimated Quantitation Limits for MDA T and Drainages 35

Table 5.1.6-1 COPCs with Soil Concentrations Greater than SALs for MDA T and Drainages 39

Table 5.1.6-2 Results of the Multiple Chemical Evaluation for MDA T and Drainages 40

LIST OF FIGURES

Fig. 1.1. Location map of TA-0 within Los Alamos National Laboratory, Los Alamos County, New Mexico. 3

Fig. 1.1-2. General Location of TA-21 (DP Site). 4

Fig. 1.1-3. Location of MDA T at TA-21. 5

Fig. 2.2-1. Generalized Stratigraphy at TA-21. 11

Fig. 5.1.4-1. Sampling locations at MDA T 28

Fig. 5.1.6-1. Locations of detected organic chemicals and radionuclides that exceed SAL at MDA T. 38

1.0 INTRODUCTION

This report presents the results of a portion of the Phase I Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) at Material Disposal Area T (MDA T) and its drainage area at Technical Area (TA) 21 of Los Alamos National Laboratory (LANL). Included in this report are data from the surface investigation, the approach used to assess and analyze these data, conclusions drawn from these data, and recommendations for further surface investigations at MDA T.

The history of operations at MDA T, data from previous investigations, and the sampling and analysis plan for surface and subsurface investigations are presented in Section 16.3 of the TA-21 Operable Unit RFI Work Plan (LANL 1991, 0689).

The investigations at MDA T address seven potential release sites (PRSs), which were defined in the TA-21 Operable Unit RFI Work Plan (LANL 1991, 0689). Four of these sites (PRSs 21-016[a, b, and c] and PRS 21-011[c]) are Hazardous and Solid Waste Amendments (HSWA) solid waste management units (SWMUs) listed in Module VIII of LANL's RCRA operating permit. Three of these sites, PRS 21-028(a) and areas of concern (AOCs) C-21-009 and C-21-012, are not HSWA SWMUs.

1.1 General Site History

TA-21 is located on Delta Prime (DP) Mesa, immediately east-southeast of the Los Alamos townsite and on the northern boundary of LANL (Fig. 1.1-1 and Fig. 1.1-2). TA-21 was used primarily for plutonium research, metal production, and related activities from 1945 to 1978. Additional background information is presented in Chapter 3 of the TA-21 Operable Unit RFI Work Plan (LANL 1991, 0689).

MDA T is located midway along DP Mesa (Fig. 1.1-3) and measures approximately 2.21 acres. Contributors to surface contamination at MDA T include spills of radioactively contaminated cement paste that were pumped into asphalt-lined disposal shafts and retrievable corrugated metal pipes. At the locations where the radioactively contaminated cement paste was spilled, two AOCs (C-21-009 and C-21-012) have been identified. Spilled material may also have run into the drainages below MDA T. A satellite container storage area, SWMU 21-028(a), may also have contributed to surface contamination at MDA T, but its exact location is unknown. In addition, activities at facilities surrounding MDA T, the old waste facility (Building 35 built in 1952) to the south, and the new waste facility (Building 257 built in 1967) to the east, may have

contributed to surface contamination at MDA T. The drainage from the new waste treatment facility was a national pollutant discharge elimination system (NPDES) permitted outfall (SWMU 21-011[k]) but it may also have contributed to surface contamination in the drainage below MDA T. Recent interviews with LANL staff involved with operating the waste treatment operations at building TA-21-257 indicate that there was at least one instance when the effluent that was intended to be discharged to the outfall at 21-011(k) was directed to bed 4 of MDA T and overflowed across the north perimeter road and into DP Canyon. It is probable that MDA T drainage would affect the outfall at SWMU 21-011(k).

Major contributors to subsurface contamination at MDA T include (1) four absorption beds (SWMU 21-016[a]) used in the disposal of liquid wastes from TA-21 activities, (2) the retrievable waste storage area located between absorption beds 1 and 3 from which all waste had been removed by 1986 (SWMU 21-016[b]), (3) the disposal shafts (SWMU 21-016[c]) located between absorption beds 2 and 4, and (4) a distribution box (SWMU 21-011[c]) located between absorption beds 1 and 2. There is some confusion about the identity of SWMU 21-016(b), which has been assigned to the retrievable waste storage area and to a caisson in the northwest corner of absorption bed 1. According to the 21-016 SWMU report, dated October 31, 1990, "A pit, TA-21-186 (SWMU 21-016[b]), was built in 1959 of redwood and it was about 6 ft by 10 ft by 30 ft deep. The pit was located between two rows of adsorption beds. This pit, referred to as the 'Snake Pit', was used for monitoring purposes and did not contain waste. From 1974 to 1982, transuranic wastes were mixed with cement and pumped into corrugated metal pipes into the pit. There were 175 corrugated metal pipes (2.5 ft in diameter, 20 ft long) in the pit, which was located between adsorption beds 1 and 3. In 1984 to 1986, the pipes were transported to TA-54 with the intention of shipping them to the WIPP site near Carlsbad, NM." The SWMU report also states, "A 30-ft deep caisson (the 'Snake Pit') was dug to obtain horizontal cores in 1961..." (LANL 1990, 0145). It is clear by the descriptions in the SWMU report that, although the physical description of the caisson is given, the retrievable waste storage area is actually the SWMU because "...transuranic wastes were mixed with cement and pumped into corrugated metal pipes into the pit."

In 1987, the surface of MDA T was regraded to slope into DP Canyon and to control run-on and run-off. The regraded surface was capped with 6–12 in. of topsoil and reseeded.

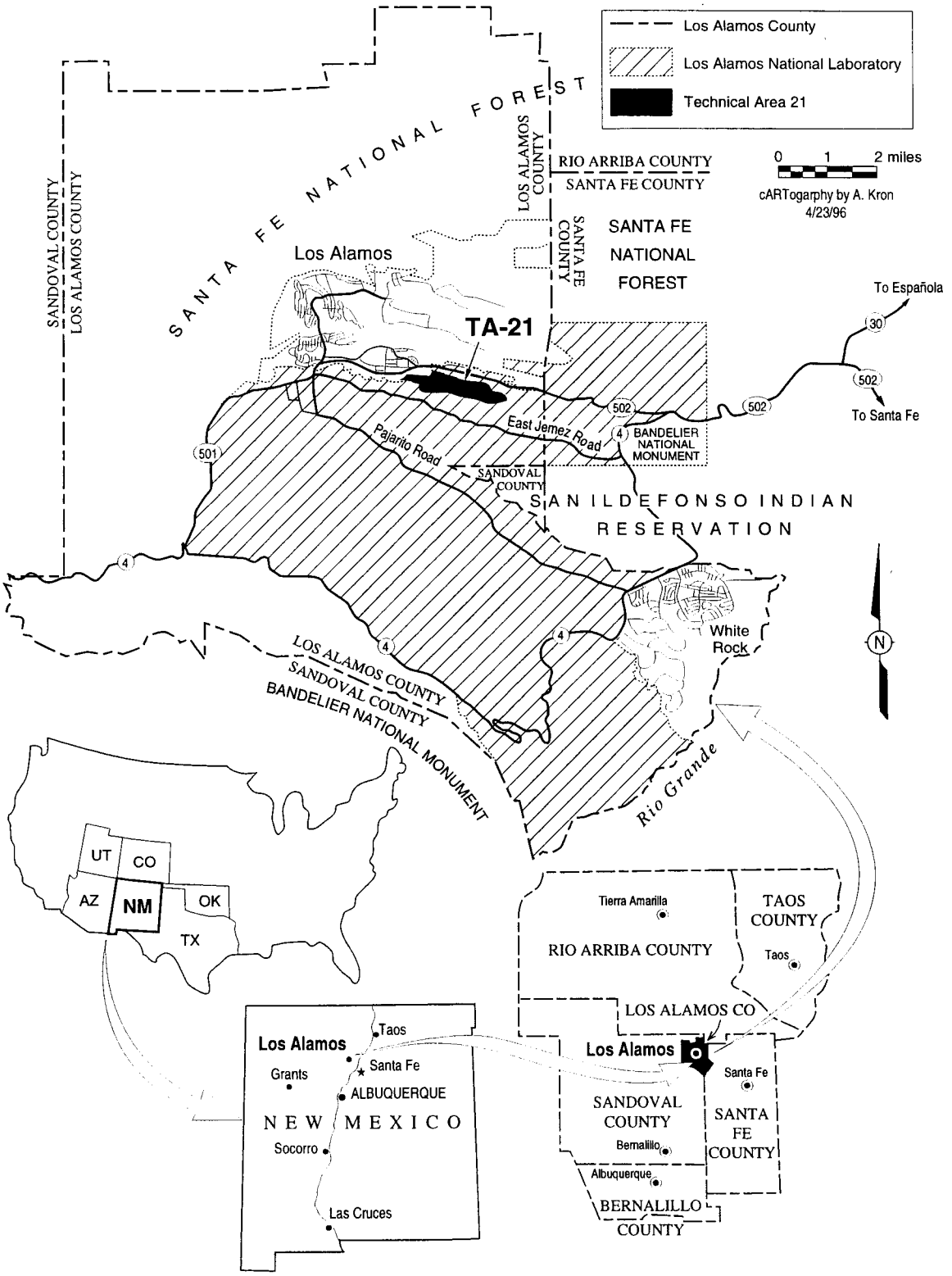

Fig. 1.1. Location map of TA-0 within Los Alamos National Laboratory, Los Alamos County,New Mexico.

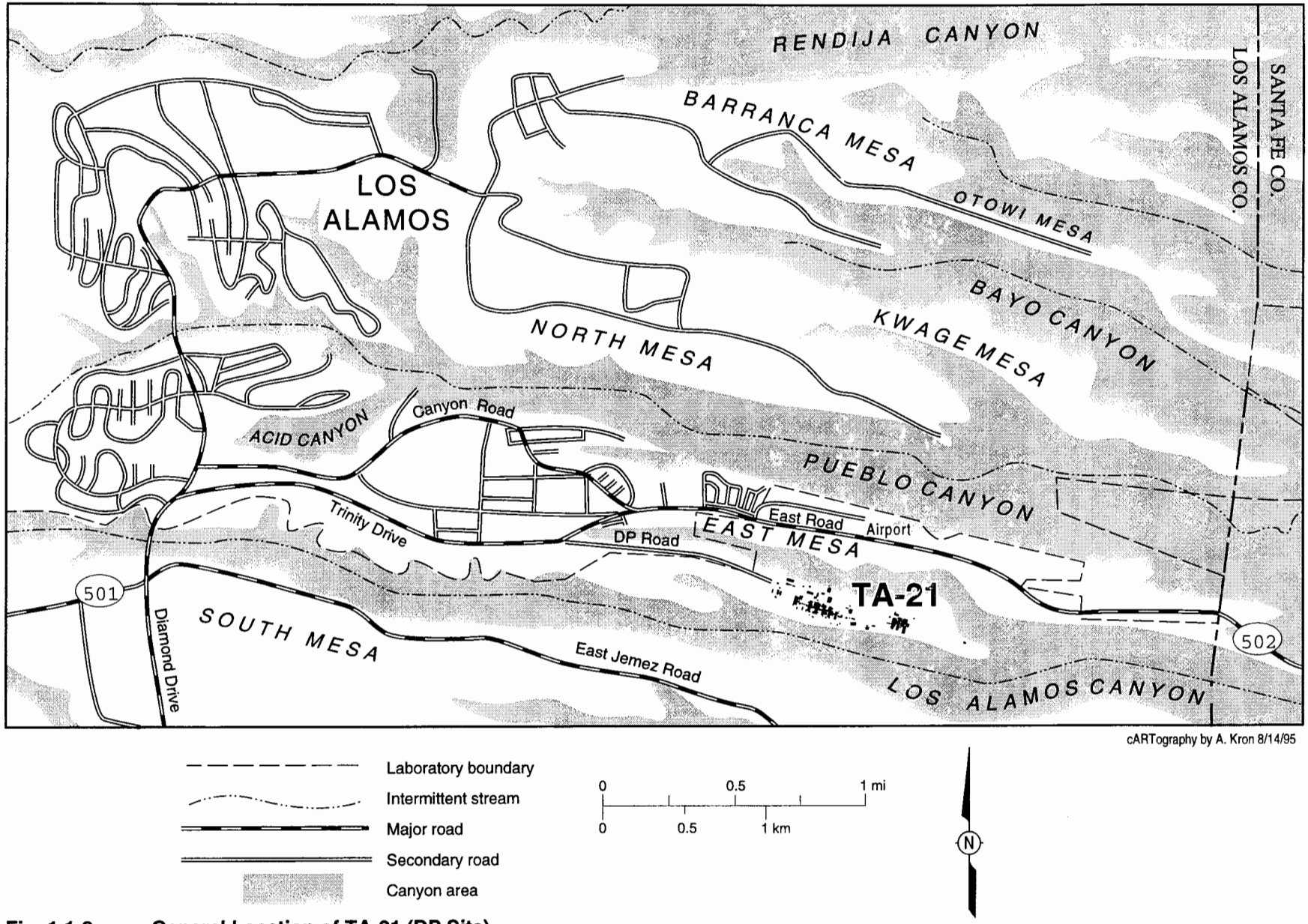

Fig. 1.1-2. General Location of TA-21 (DP Site).

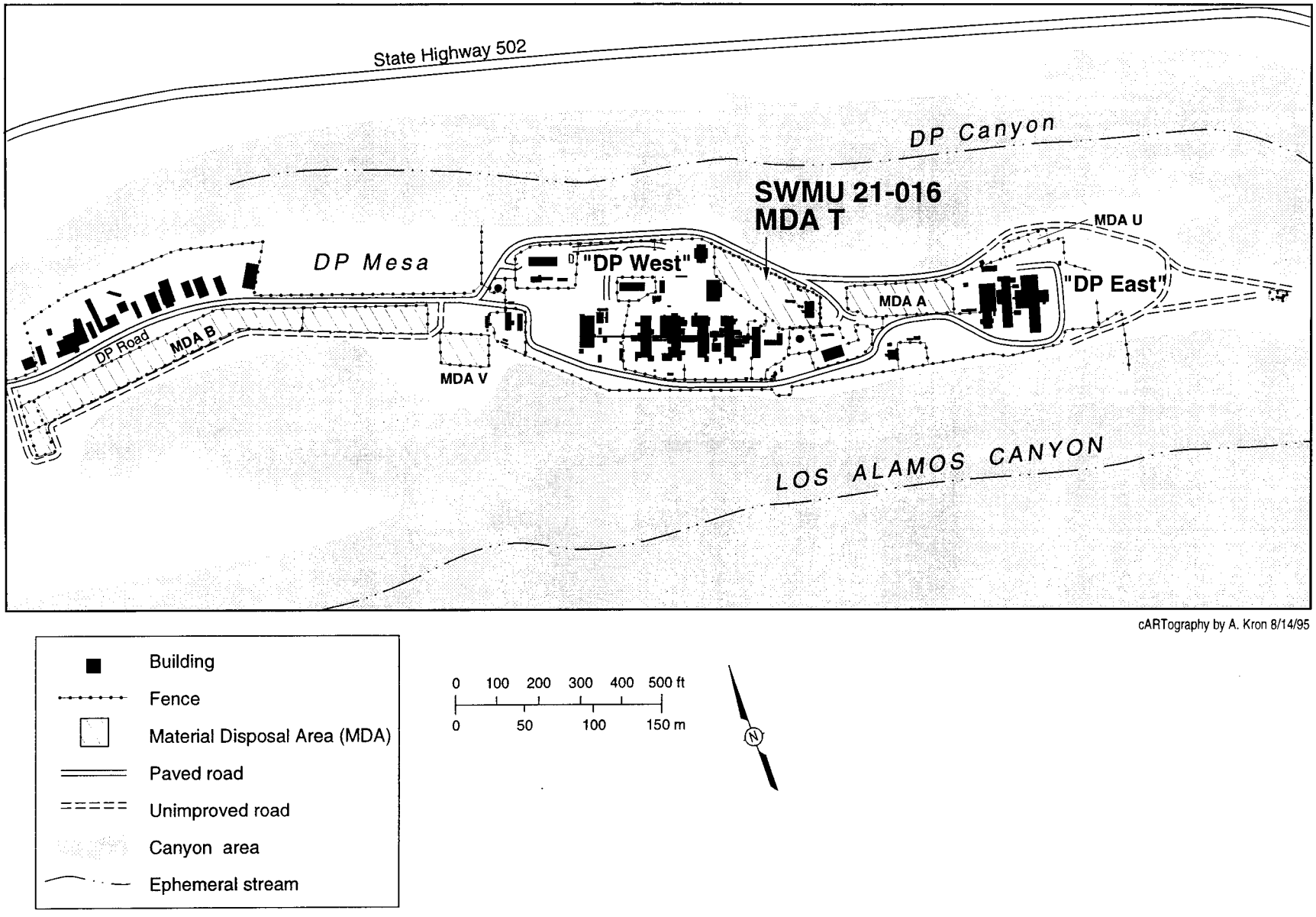

Fig. 1.1-3. Location of MDA T at TA-21.

The absorption beds at MDA T received americium-241, plutonium-238, plutonium-239/240, tritium, natural uranium, and possibly enriched uranium. For additional information, see Section 16.3.1 of the TA-21 Operable Unit RFI Work Plan (LANL 1991, 0689). Other chemicals received by the absorption beds may have included metals, carbonates, citrates, acids, bases, organic compounds, and solvents. The disposal shafts contained americium-241, plutonium-238 and plutonium-239/240 (including plutonium in several bathyspheres buried at various depths), and mixed fission products (including strontium-90 and cesium-137). The corrugated metal pipes stored in the retrievable storage area also contained americium-241, plutonium-238, plutonium-239/240, and other transuranic radionuclides, but they were all removed in 1984 and 1986. The chemicals stored at the satellite container storage area included alcohol, acetone, and Freon™. The two spills of contaminated cement paste that occurred in 1976 and 1978 and caused the respective locations to become AOCs included americium-241.

Additional information is presented in Subsection 16.3 of the TA-21 Operable Unit RFI Work Plan (LANL 1991, 0689).

1.2 RFI Overview

As stated in Sections 16.1.4 and 16.3.2 of the TA-21 Operable Unit RFI Work Plan, the objectives of the Phase I MDA T surface and drainage investigation were (1) to determine the nature and extent of contamination of surface soil both within the fence and beyond the fence to the canyon edge north of MDA T, and (2) to evaluate the possibility that contaminants may have migrated from the surface of MDA T into the drainage channels leading to DP Canyon (LANL 1991, 0689).

Planned soil sampling activities are detailed in Sections 16.1.4 and 16.3.4 of the TA-21 Operable Unit RFI Work Plan (LANL 1991, 0689). At MDA T, sampling was planned for soil depths of 6 in. on the mesa and at depths up to 18 in. in the drainages. Based on historical TA-21 operations and results of previous investigations, analyses of radioactive contaminants were deemed of greatest concern, but other analyses were also planned to provide a complete understanding of surface contamination at MDA T. The following activities were planned for the 1993 field season at MDA T.

1. Conduct a land survey of MDA T on a 65.6 x 65.6-ft grid.

2. Conduct a radioactivity survey of MDA T.

3. Collect

    - 40 samples from the top 6 in. of soil on the surveyed grid,

    - ten samples off the grid (five within the fenced area and five in the area to the north) to determine whether the sampling pattern accurately represents the area, and

    - up to ten contingency samples (from areas where the radiation survey identified elevated radioactivity) to characterize the extent to which contamination may have migrated.

4. Collect field radiological screening samples.

5. Analyze all samples for radionuclides, metals, and semivolatile organic compounds (SVOCs).

6. Analyze contingency samples for volatile organic compounds (VOCs), if needed.

To help investigators assess the effects of operations at and near MDA T in the MDA T drainage area, four activities were planned during the 1994 field season. These activities are listed below.

1. Identify drainage channels and local sediment storage sites based on geomorphic maps completed in 1992 and reported in the Phase Report 1A, RCRA Facility Investigation for OU TA-21 (LANL 1993, 1076).

2. Collect samples from depths of 0 to 6 in., 6 to 12 in., and 12 to 18 in. at each of five locations in the drainage channels.

3. Collect field radiological screening samples.

4. Analyze all samples for radionuclides, metals, and SVOCs.

To define the source term and the lateral and vertical extent of contamination, an initial subsurface investigation at MDA T will include vertical and angled boreholes. Migration of contaminants that has occurred since 1978 beneath absorption bed 1 will be evaluated by drilling a hole close to a previous borehole. This subsurface investigation is detailed in Section 16.3.4.2 of the TA-21 Operable Unit RFI Work Plan (LANL 1991, 0689); results will be assessed in a separate RFI report. In addition, subsequent surface and subsurface investigations are planned to begin after all initial investigations have been completed and reported.

1.3 Field Activities

Field activities were conducted at MDA T in July 1993. 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 x 65.6-ft grid and seventeen locations off the grid were marked.

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 44-10 sodium iodide detector that identifies gamma radiation, a Ludlum 19 sodium iodide microμ meter 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, R0, "Measurement of Gamma-Ray Fields Using a Sodium Iodide Detector."

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 by 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 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.

Field activities at the MDA T drainage took place in August 1994. A field crew collected 15 samples and 2 field duplicates from the top 12 in. of sediment by following the instructions in 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, R1, "Handling, Packaging, and Shipping of Samples"; they were tracked according to LANL-ER-SOP-01.04, R2, "Sample Control and Field Documentation."

At the MDA T drainage, the field crew screened soil samples for radiation to ensure worker health and safety. Part of the screening was conducted according to LANL-ER-SOP-10.07, R0, "Field Monitoring for Surface and Volume Radioactivity Levels." The 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.

1.4 Deviations

Field activities at MDA T and its drainage deviated from the planned approach when the sampling grid was changed. Because the number of samples required in the TA-21 Operable Unit RFI Work Plan was based on an incorrectly scaled map, there were more sampling locations than the expected number (LANL 1991, 0689). The originally planned grid contained fewer sample locations than the actual 65.6 x 65.6-ft grid when it was marked in the field. Although the originally planned total of 50 samples was collected, several planned sample locations at the northwest corner (near Building 21-286) and southeast corner (near Building 21-257) of the planned grid were omitted. In addition, it appears that the actual sampling grid was shifted slightly to the east, and several locations that should have been sampled on the western edge of MDA T were omitted. Because the planned sampling grid was intended to cover MDA T fully and to extend beyond MDA T in three directions, this deviation may prevent a complete assessment of contamination within and beyond MDA T.

Another deviation occurred when drainage samples were collected at finer intervals than the 0- to 6-in., 6- to 12-in., and 12- to 18-in. intervals called for in the work plan. Samples were collected instead at 0- to 3-in., 3- to 6-in., and 6- to 12-in. intervals. This change was made because a geomorphic study at TA-21 indicated that sediments deeper than 12 in. would have been deposited in the drainages before 1940.

2.0 ENVIRONMENTAL SETTING

The environmental setting of the Laboratory is described in Section 2.4 of the Installation Work Plan (IWP) for Environmental Restoration (LANL 1995, 1164). A detailed discussion of the environmental setting for TA-21, including climate, geology, hydrology, and a conceptual hydrogeologic model for the area and its surroundings, is presented in the TA-21 Operable Unit RFI Work Plan (LANL 1991, 0689). A summary is presented in the following sections.

2.1 Climate

The Los Alamos area of northcentral New Mexico is classified as a semiarid, temperate mountain climate. Annual precipitation in the area normally reaches about 18 in., 40% of which occurs as brief, intense thunderstorms during July and August. Winter snowfall averages about 51 in. annually. In summer months, maximum daily temperatures in the Los Alamos area are usually below 90°F, dropping into the 50s at night. Winter temperatures typically range from 30°F to 50°F during the day, and from 15°F to 25°F at night, occasionally dropping to 0°F or below. Winds in Los Alamos often vary greatly with the time of day and location, due in large part to the complex terrain. Wind speeds are less than 2.5 m/s (5.5 mph) about 40% of the time and greater than 5 m/s (11 mph) about 20% of the time. The predominant wind direction is from the south-southwest.

2.2 Geology

2.2. Geologic Setting

A detailed discussion of the geology of the Los Alamos area can be found in Section 2.5.1.3 of the IWP (LANL 1995, 1164). Reports of geological studies at TA-21 are presented in "Earth Science Investigations for Environmental Restoration—Los Alamos National Laboratory Technical Area 21" (Broxton and Eller 1995, 1162). A summary of that material, emphasizing conditions relevant to MDA T is presented below.

TA-21 is located on DP Mesa at an elevation of 7 120–7 150 ft. The area is bounded on the north by DP Canyon and on the south by Los Alamos Canyon. All PRSs are mesa-top sites. Bedrock underlying the site is cooling unit 3 of the Upper (Tshirege) Member of the Bandelier Tuff (Fig. 2.2-1), 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. At this location, the Bandelier Tuff is approximately 710 ft thick.

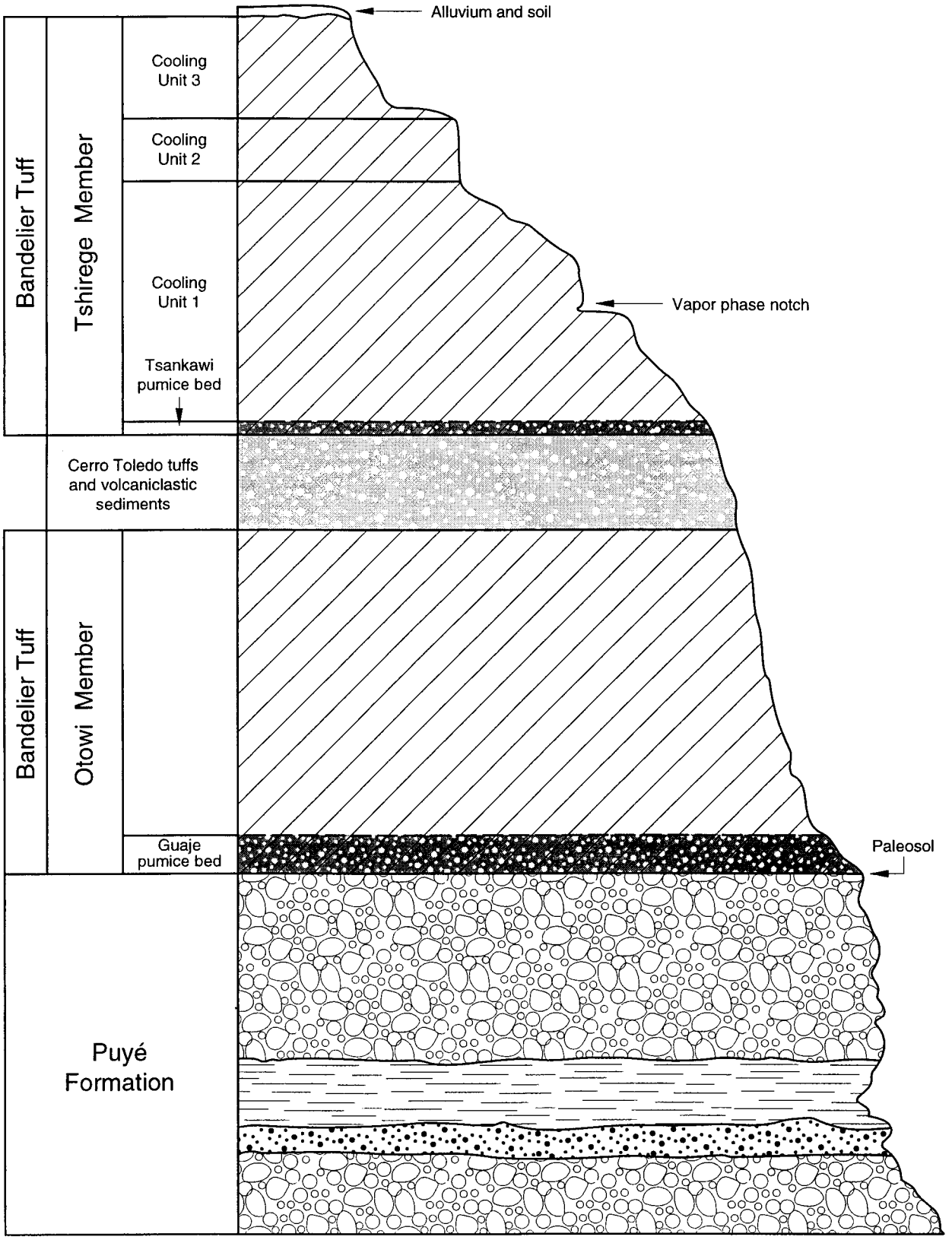

Fig. 2.2-1. Generalized Stratigraphy at TA-21.

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 mesa edges. Much of the alluvium consists of angular to subrounded lithic clasts of Tshicoma volcanic rocks, and of crystals of feldspar, quartz, and biotite and other ferromagnesian minerals derived from the Tshicoma Formation. In addition, the alluvium contains clasts of pumice and tuff probably derived from units of the Bandelier Tuff, the Cerro Toledo tuffs, and possibly from the El Cajete Tuff.

Bandelier Tuff is underlain by sedimentary rocks of the Puyé 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.

2.2.2 Soils

A detailed discussion of the soils in the Los Alamos area can be found in Section 2.5.1.3 of the IWP (LANL 1995, 1164). A summary of that material specific to TA-21 is presented below. At undisturbed areas at TA-21, the soil is composed of moderate to well developed soils on Bandelier Tuff and alluvium. Soils belong to either the Hackroy or Nyjack soil series (Nyhan et al. 1978, 0161). The Hackroy series consists of very shallow to shallow, well-drained soils that have an A-Bt-R profile. Soil textures range from sandy loam to clay. The Nyjack series consists of moderately deep, well-drained soils that have an A-Bt-C-R profile. Texture ranges from gravely, sandy loam to clay loam. In the TA-21 area, the R horizon is highly fractured Bandelier Tuff that shows signs of incipient weathering, and usually has clay-rich soil matrix along bedrock fractures.

Most of TA-21 has been disturbed by construction and operation of the site for the last 40 years, resulting in natural soil profiles that are, in general, not well preserved. In some cases, soil has been removed or buried by fill during construction of pads for buildings, parking lots, and waste pits.

2.3 Hydrology

2.3.1 Surface water

Surface flow occurs as sheetflow during precipitation events, mainly summer thunderstorms. Sheetflow may transport sediments from the mesa surface to adjacent canyons.

2.3.2 Groundwater

The main aquifer beneath the former TA-21 is at an elevation of approximately 5 900 ft (determined in Test Well 2, Pueblo Canyon, and in Otowi 4, Los Alamos Canyon), chiefly within sediments of the Puyé and Tesuque Formations (LANL 1995, 1293; Broxton and Eller 1995, 1162). Thus, for mesa-top sites at TA-21, more than 1 200 ft of tuff and volcaniclastic sediments separate the surface from the main aquifer. In addition to the main aquifer, perched aquifers exist at TA-21. Shallow alluvial aquifers are present in sediments of both Los Alamos Canyon and in DP Canyon, a side canyon that merges with Los Alamos Canyon east of TA-21. These aquifers were intercepted by drill holes LADP 3, LAUZ-1, and LAUZ-2 (Broxton and Eller 1995, 1162). Another perched aquifer, encountered in drill hole LADP-3, is present in the Guaje pumice bed at the base of the Bandelier Tuff, approximately 325 ft below the floor of Los Alamos Canyon (Broxton and Eller 1995, 1162). Unpublished information from drill cores at the former TA-10 show that the top of the Puyé Formation is a weakly to moderately developed paleosol (old soil profile) containing a significant amount of clay. The clay content of the paleosol apparently reduces the permeability enough for water, if available, to perch on top of the Puyé Formation, within the overlying Guaje Pumice Bed (Fig. 2.2-1). That is, the paleosol at the top of the Puyé acts as an aquitard. From borehole LADP-4, the aquifer at the base of the Bandelier tuff is known not to be present in DP Canyon, approximately 1 300 north of LADP-3, and therefore probably does not underlie TA-21. The perched aquifer continues up the canyon at least 3 280 ft, based on well LAOI(A)-1.1, but the lateral continuity of the aquifer in other directions beyond TA-21 is not known at present.

A perennial spring (DP Spring), located on the north side of lower DP Canyon 3 280 ft east-northeast of LADP-4 (Broxton and Eller 1995, 1162), discharges at a rate of 1–4 gal. per minute (LANL 1995, 1293). Possibly the source of water that emerges at DP Spring is from alluvial groundwater in DP Canyon, or, alternatively, from a water body perched within the Bandelier Tuff (between units 1g and 1v) beneath DP Mesa (Broxton and Eller 1995, 1162). However, no perched zone with the Bandelier Tuff was encountered in LADP-4 to support the latter possibility. Study of DP Spring is ongoing.

2.4 Biological Surveys

Comprehensive plant and animal inventories are required by the Federal Endangered Species Act of 1973; the New Mexico Wildlife Conservation Act; Executive Order 11990, Protection of Wetlands; Executive Order 11988, Floodplain Management; 10 CFR 1022; Compliance with

Floodplain/Wetlands Environmental Review Requirements (DOE 1979, 0633); and DOE Order 5400.1, General Environmental Protection Program (DOE 1988, 0075). The required inventories have been performed for the area surrounding this site and the habitat description will be included in the ecological RFI report prepared for the ecological exposure unit in which MDA T is located.

The mesa top where MDA T is located has heavy commercial development and urban disturbance from past TA-21 operations and roadwork. The habitat in this area is described in detail in the biological survey of TA-1 and TA-21 (Bennett 1992, 01-0008).

The preurban natural overstory for the eastern portion of the mesa was a pinion-juniper woodland. The understory currently includes grasses and forbs commonly found in disturbed soils (western wheat grass, Canada bluegrass, bottlebrush squirreltail, cheat grass, sand dropseed, summer cypress, prickly lettuce, and horseweed). There are no threatened or endangered species in the immediate vicinity of this site. Drainages flow north from MDA T and into DP Canyon. DP Canyon receives drainage from many sites along the canyon rim, from its origin in the townsite to its confluence with lower Los Alamos Canyon.

2.5 Cultural Surveys

The National Historic Preservation Act requires a cultural resource survey. However, a survey was not conducted in the area of MDA T because the site is a developed, urban area and a survey would not be relevant.

3.0 APPROACH TO DATA ASSESSMENT AND ANALYSES

The decision approach used for MDA T involves a series of quantitative steps that occur after the field investigation, chemical analysis, and data reporting are complete. These steps begin with routine data validation and continue with more focused data validation, if necessary. Routine validation involves validating each data item against specific targets and adding qualifier flags to the data to signify a potential deficiency. Focused validation consists of analyzing quality assurance/quality control (QA/QC) data for their potential impact on the succeeding data assessment steps (i.e., comparing site data to background concentration data, verifying the identities of detected organic chemicals, comparing site data to screening action levels [SALs] for human health impacts, and performing human health risk assessments

when necessary). The following sections provide overviews of the methods used to complete these quantitative steps. Further details can be found in the guidance document, Technical Approach to RFI Reports (LANL in preparation, 1281).

3.1 Sample Analysis

All samples requiring chemical analysis and documentation are submitted to the sample management office (SMO) and/or the mobile chemistry analytical laboratory (MCAL) for analysis.

3.1.1 Analytical Methods

All samples were analyzed using Environmental Protection Agency (EPA) SW-846 methods or equivalent.

3.1.2 Data Validation

Data verification and validation procedures are used to determine whether data packages have been generated according to specifications and contain the information necessary to determine data sufficient for decision-making.

Data verification is a check of data deliverables against a set of stated requirements to ensure that what has been ordered has been delivered. All analytical data generated in support of the ER Project are verified.

Data validation is the process of determining whether individual results (a datum) can be reliably used to support the decision-making process. During the process, validators determine whether data should be qualified or used with caution because of the potential impact of noted flaws or the failure to achieve analytical precision or bias constraints.

Routine validation is the comparison of quality indicators (such as surrogate recovery, measurements of method blanks, holding times, and differences between replicate measurements) with clearly defined limits to determine whether limitations may need to be placed on the use of the data. Routine validation is most suitable for routine analyses and for those nonroutine analyses for which clearly defined limits have been established.

The focused data validation process addresses those characteristics of the data (e.g., precision and bias) that directly affect the decisions to be based on the data. The same data set may undergo different focused validations for different decisions.

3.2 Background Comparisons

Once the data validation process is complete and the site data are finalized, the next step in the process is to compare site data with available background data. The results of a focused data validation should exclude from consideration for background comparison any contaminant that is identified as an artifact of laboratory or field contamination, analytical interference, or improper analyte identification or quantitation. The purpose of this decision step is to determine if chemicals that have natural or anthropogenic background distributions should be retained as COPCs or eliminated from further consideration. Background data are available from two sources: (1) soil samples collected throughout Los Alamos County for which chemical analyses were performed for certain inorganic (metal) chemicals and naturally occurring radioactive chemicals (Longmire et al. 1995, 1142; Longmire et al. 1995, 1266); and, (2) background concentrations of radioactive chemicals associated with global fallout from atmospheric nuclear testing (e.g., plutonium, cesium, strontium, and tritium) reported in LANL Environmental Surveillance reports (Purtymun et al. 1987, 0211; ESG 1988, 0408; ESG 1989, 0308; Environmental Protection Group 1990, 0497; Environmental Protection Group 1992, 0740).

Comparisons between site data and background data are initially performed by comparing each observed concentration datum with a background screening value estimated from background data. Background screening values are upper tolerance limits (UTLs), maximum reported concentrations, or detection limits of nondetected chemicals. These background screening values are derived from LANL-wide soil background data. Details on the calculation of these background screening values are presented in "Natural Background Geochemistry and Statistical Analysis of Selected Soil Profiles, Sediments, and Bandelier Tuff" (Longmire et al. 1995, 1266). There is one inorganic chemical, silver, for which LANL-wide soil background data do not exist. In this chemical-specific case, PRS sample-specific detection limits for silver are used as nominal background screening values.

Details of statistical methods used to generate UTLs from the background data sets and suggestions for statistical methods for comparing site and background concentration distributions are presented in the guidance document, Statistical Comparisons to Background, Part I (Environmental Restoration Project Assessments Council 1995, 1295). Further statistical comparisons between site and background data might be performed when UTLs are exceeded.

If a chemical has a reported concentration that exceeds its UTL, or fails other statistical background comparison tests (i.e., the site data are statistically greater than background data), then that chemical is carried forward through the screening assessment process. If a chemical

does not have a reported concentration that exceeds the UTL, then that chemical is removed from further consideration.

The ER Project has developed UTLs for the most commonly sampled chemicals and the most commonly analyzed media. For chemicals and media not included in the LANL background data or in the Facility for Information Management, Analysis, and Display (FIMAD), UTLs will be developed by the Decision Support Council as needed.

3.3 Evaluation of Organic Constituents

Background data are not available for organic chemicals. The preliminary evaluation of organic chemicals considers detected chemicals and chemicals that were analyzed for but not detected in any sample. The purpose of this decision step is to determine if organic chemicals should be retained as COPCs or eliminated from further consideration based on detection status. Detection status is determined by the analytical laboratory on a sample-by-sample, analyte-by-analyte basis. Estimated quantitation limits (EQLs) have been established for each analyte as reporting limits when the analyte is not detected. It should be noted that the EQLs reported for individual samples are dependent on a number of factors and may vary from sample to sample and from analysis to analysis. Therefore, the sample-specific EQL for a chemical must be used in this comparison.

If a chemical has a reported concentration that exceeds its reporting limits, then that chemical is generally carried forward through the screening assessment process. If a chemical does not have a reported concentration that exceeds its reporting limits, then that chemical is generally removed from further consideration. Exceptions to these general rules may be made if site-specific process knowledge so indicates. A chemical that is detected may be removed from further consideration if it can be determined that its presence is not due to Laboratory operations, and a chemical that is not detected in any sample may be carried through the decision process if the chemical can be expected to be present at the site based on historical operations.

3.4 Human Health

3.4.1 Risk Due to Background

Background risks can result from inorganics that are naturally occurring at a site. Calculation of background risks using the same methodology as site risk estimates provides a frame of reference for risk levels calculated at a site. This information provides a basis for determining

risk-based remediation goals, which in some circumstances may be set at target risks comparable with background rather than default values (i.e., cancer risk of 1E-6 or hazard index of 1). Background risks can also affect decisions at sites that have constituents for which there are thresholds of toxicity. For some inorganics, background intakes may be near a toxicity threshold such that incremental intakes associated with contamination may be unacceptable.

Background risks calculated here use the same exposure assumptions by which SALs are calculated. SALs are based on health-protective assumptions for a residential scenario (EPA 1995, 1307). For soil exposure, the pathways include incidental soil ingestion, inhalation of resuspended dust, and dermal contact with soil. Background soil data represent several soil horizons from geographically diverse locations. Background risks are estimated for both a median concentration and the UTL from the entire background data set to present the range of potential risk associated with different soil constituent concentrations found in and around Los Alamos (Longmire et al. 1995, 1142). The background risks based on the LANL SAL residential exposure model are provided in Table 3.4.1-1.

Risks due to background are presented for both noncarcinogenic and carcinogenic outcomes. The potential for adverse noncarcinogenic health effects is estimated by a hazard quotient. Intakes leading to a hazard quotient up to 1 are not associated with adverse health effects. None of the median background concentrations result in hazard quotients greater than 1. The hazard quotient of the UTL concentration for manganese exceeds 1 (1.9). However, given the unlikely occurrence of this concentration, the conservative assumptions in the exposure assessment, the margin of safety in the reference dose, and the exceedance of less than a factor of 2, this intake estimate is not expected to be associated with adverse health effects.

Two of the background inorganics are also carcinogens. According to the default exposure assumptions used for SALs, the lifetime cancer risks due to background residential soil exposure are estimated at 1 to 2 in 100 000 each for arsenic and beryllium.

These background risk estimates provide a frame of reference for the screening assessment and site decisions. If a site-specific risk assessment is necessary to further evaluate risks, background risks can also be calculated using the site/scenario-specific assumptions to assist in the remedial action decisions for the site.

TABLE 3.4.1-1

RISK DUE TO BACKGROUND CONCENTRATIONS OF SOIL INORGANICS ASSUMING A RESIDENTIAL SCENARIO[a]

SOIL INORGANIC	BACKGROUND SOIL CONCENTRATION[b] (mg/kg)		HAZARD QUOTIENT		LIFETIME CANCER RISK	
	Median	UTL	Median	UTL	Median	UTL
Aluminum	10 000	38 700	0.13	0.5	nc[c]	nc
Antimony	0.6	1.0	0.019	0.032	nc	nc
Arsenic	4.0	7.82	0.18	0.36	1.1E-5	2.1E-5
Barium	130	315	0.025	0.059	nc	nc
Beryllium	0.895	1.95	0.0027	0.0059	6.4E-6	1.4E-5
Cadmium[d]	0.20	2.76	0.0053	0.071	1.4E-10	1.9E-9
Chromium[e]	7.2	16.1	0.00009	0.0002	nc	nc
Cobalt	6.0	19.2	0.0013	0.0042	nc	nc
Copper	5.75	30.7	0.0021	0.011	nc	nc
Lead[f]	12	23.3	0.03	0.058	nc	nc
Manganese	320	714	0.84	1.9	nc	nc
Mercury	0.05	0.1	0.0022	0.0043	nc	nc
Nickel	7.0	15.2	0.0047	0.01	nc	nc
Selenium	0.3	1.7	0.00078	0.0045	nc	nc
Thallium	0.2	1.0	0.033	0.16	nc	nc
Uranium	0.9	1.87	0.0039	0.0081	nc	nc
Vanadium	21	41.9	0.039	0.078	nc	nc
Zinc	30.7	50.8	0.0013	0.0022	nc	nc

[a] Risk estimates are based on reference doses, slope factors, and EPA Region 9 default exposure assumptions effective in April 1996.
[b] Background soil concentrations taken from Longmire et al. 1995, 1142.
[c] nc = Noncarcinogen
[d] Cancer risks for cadmium are based solely on inhalation of resuspended dust.
[e] Naturally occurring chromium is assumed to exist in a trivalent state.
[f] Hazard quotient based on uptake biokinetic model.

3.4.2 Screening Assessment

The purpose of this decision step is to determine if chemicals should be retained as COPCs or eliminated from further consideration based on comparisons with SALs. This is the last step in the screening assessment process for human health concerns. If COPCs remain after this step, then further action may be proposed. If no COPCs remain after this step, then no further action

(NFA) may be proposed based on human health concerns. SALs are medium-specific concentrations that are calculated using chemical-specific toxicity information and conservative, default exposure assumptions. For those chemicals for which SALs are available, each observed concentration datum is compared with the chemical's SAL. If a chemical has a reported concentration greater than its SAL, then that chemical is retained as a COPC pending further analysis. If a chemical does not have a reported concentration greater than its SAL, then that chemical is generally removed from further consideration. If more than one chemical is present at the site, this decision is deferred pending the results of a multiple chemical evaluation (described below). The decision to identify a chemical as a COPC when a SAL is not available is made on a case-by-case basis, taking into account the availability of process knowledge and toxicological information.

It is possible that COPCs should be retained because of the combined adverse health effects of several chemicals. This possibility is evaluated in a multiple chemical evaluation, in which the reported concentration for each chemical is divided by its respective SAL, and the resulting normalized values are incorporated into a simple additive model. If the sum of the normalized values (i.e., the total normalized value) is less than 1, then the chemicals are removed from further consideration. If the total normalized value is greater than 1, then chemicals having an individual normalized value greater than or equal to 0.1 are retained as COPCs pending further evaluation.

Those chemicals that exceed background concentration thresholds (certain inorganics and radionuclides) or fail other background comparison tests, or exceed reporting limits (organics), and are less than the SAL (all analytes), are divided into three classes: noncarcinogens, chemical carcinogens, and radionuclides. Additive effects are assumed within each class, but each class is evaluated separately. For further information on multiple chemical evaluations, see Technical Approach to RFI Reports (LANL in preparation, 1281).

3.4.3 Risk Assessment

No human health risk assessment was performed for MDA T.

3.5 Ecological

Los Alamos National Laboratory is developing a new approach for ecological risk assessment in cooperation with EPA Region 6 and the NMED. Further discussion of ecological risk assessment methodology will be deferred until the Ecological Exposure Unit methodology that is being developed has been approved by the regulators.

4.0 RESULTS OF QUALITY ASSURANCE/QUALITY CONTROL ACTIVITIES

All samples were submitted with chain-of-custody documentation to the sample coordination facility (SCF) or to the MRAL for analysis. Selected samples were analyzed for target analyte list (TAL) metals by electrothermal atomic absorption performed according to SW-846 method 7041, cold vapor atomic absorption performed according to SW-846 method 7471, inductively coupled plasma mass spectroscopy performed according to SW-846 method 6020, or inductively coupled plasma emission spectroscopy performed according to SW-846 method 6010. TAL metals include aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, lithium, magnesium, manganese, mercury, molybdenum, nickel, potassium, selenium, silver, strontium, thallium, vanadium, and zinc.

For SVOC analyses the method chosen was gas chromatography/mass spectrometry performed according to SW-846 method 8270 (also known as solvent extraction/direct injection).

For radionuclide analyses, several methods were chosen.

- Isotopic plutonium, isotopic uranium, and americium-241 were determined by alpha spectroscopy.
- Total uranium was determined by kinetic phosphorescence analysis.
- Strontium-90 was determined by gas flow proportional counting.
- Tritium was determined by liquid scintillation.
- Remaining radionuclides were determined by gamma spectroscopy.

The following analyses were conducted in the MRAL:

- percent soil moisture analyses for which a Denver Instruments IR100 Moisture Analyzer was used,
- tritium analyses by liquid scintillation counting,
- gross alpha and gross beta analyses by gas flow proportional counting, and
- gross gamma and cesium-137 analyses by scintillation counting with a Bicron 5 x 7-in. sodium iodide well counter.

Data validation was performed on all data from the analytical laboratories. Ten percent of the data were validated at the highest level, level 3. All other data were validated at a level 1 or 2.

(Data validation levels are defined in Health and Environmental Chemistry Quality Assurance Program Plan [Gladney and Gautier 1991, 0410]). When data validated at level 1 or 2 triggered specific questions, a level 3 validation was performed. Validation was performed according to guidelines from the LANL ER Program guidance document, Generic Quality Assurance Project Plan for RCRA Facility Investigations (LANL 1991, 0412).

4.1.1 Metals Analyses

Seventy soil samples were analyzed for TAL metals under four separate requests: 15241, 15245, 15246, and 19223. Only samples included under request 15246 did not present any QC problems.

For request 15245, all lead results from soil samples are qualified as estimated detected quantity, or J, and lead results from water samples are qualified as estimated undetected quantity, or UJ, for a potential low bias indicated by the negative values found for the laboratory blanks analyzed. All zinc results are qualified J for a false positive recovery in the QC blind sample. All other data are acceptable as reported.

For request 19223, all results for antimony in soil samples and selenium in water samples are qualified UJ for low matrix spike recoveries (37% and 63%, respectively). All manganese results are qualified J or UJ for poor agreement between the duplicate samples. Soil samples included under request 19223 were analyzed well beyond the 28-day holding time for mercury. Although all mercury results in FIMAD are qualified by the laboratory as rejected, or R, because the holding time was exceeded, the results for mercury are considered acceptable for the following reasons:

1. The holding time is based on unpreserved water samples; all the samples in question were solid (collected from the top 6 in. of soil).

2. Surface soil samples are less likely to undergo biotransformation from elemental mercury to organomercury compounds than water samples because of the nature of the soil samples.

3. The samples had been kept refrigerated until they were analyzed.

4. The site was decommissioned more than ten years ago; therefore, any mercury biotransformation that occurred in the soil after samples were collected would be insignificant when compared with the mercury biotransformation that occurred in the soil before samples were collected.

It is reasonable to assume that the missed holding times do not have a substantial effect on the data. Because mercury holding times were exceeded, all the mercury data are qualified J or UJ (depending on the individual value) and are used with the understanding that the results are possibly biased low. All other data are acceptable as reported.

4.1.2 Organics Analyses

One trip blank sample was analyzed for VOCs under request 18603. There were no QC problems with the request.

Seventy soil samples were analyzed for SVOCs under requests 15200, 15201, 15218, 15219, 15231, 18600, and 18603. There were minor QC problems with requests 15200, 15201, and 15219 that did not result in data qualification. The data qualified in requests 15218, 15231, 18600, and 18603 are discussed below.

For request 15218, sample AAA4005 had high internal standard recovery (above the +100% criterion). All results for this sample are qualified UJ. All other data are acceptable as reported.

For request 15231, there were recoveries of approximately 10% in the QC blind sample for 2,4-dimethylphenol and benzoic acid. Therefore, these analytes are qualified J or UJ in the samples associated with this request. All other data are acceptable as reported.

For request 18600, all results for the phenol compounds are qualified UJ because the matrix spike, blank, and QC blind sample indicated poor recovery of the phenol compounds. In addition, 2,4-dimethylphenol results are qualified R because of a false negative result in the QC blind sample. All other data are acceptable as reported.

Several samples under request 18603 were re-extracted 7 to 14 days past the 14-day extraction holding time. Because these samples were originally extracted within the appropriate holding time and the original analyses did not indicate the presence of any compounds, the data are not qualified. The polycyclic aromatic hydrocarbon (PAH) compounds are qualified J or UJ because of low recoveries in the QC blind samples. Benzo(b)fluoranthene, hexachloroethane, 2-methylphenol, and o- and p-dichlorobenzene results are qualified R because the QC blind recoveries are less than 10%. All other data are acceptable as reported.

4.1.3 Radiochemical Analyses

Analyses were requested for the following number of soil samples: percent moisture, 73 samples; tritium, 73 samples; strontium-90, 76 samples; actinium-227, 56 samples; cesium-137, 76 samples; americium-241, 76 samples; isotopic plutonium, 76 samples; and isotopic or total uranium, 76 samples. These samples were included under six separate request numbers: 15269, 15271, 15273, 15282, 19149, and 19490. For requests 15273 and 15282, all the QC parameters were within control limits, and all the data are valid without qualification. Detected QC values are considered within control limits when they are within ±20% of the actual QC value. For requests 15269 and 15271, there were false positive recoveries of tritium in the QC blind samples. Therefore, the results are qualified J for a possible high bias. All other data for these two requests are acceptable as reported.

Several QC parameters of samples included under request 19149 were outside control limits. All gamma spectroscopy data are qualified J because the QC blind, laboratory control, and duplicate samples showed results outside control limits. The isotopic plutonium results are qualified J because of low tracer and low QC blind sample results. In addition, all strontium-90 results are qualified J because of low carrier recoveries, low matrix spike results, and high QC blind sample results. All other data are acceptable as reported.

For request 19490, gamma spectroscopy results are the only ones that are not qualified. All the other analytical results for this request are qualified J or UJ for a possible low bias indicated by the QC blind samples. In addition, the matrix spike and laboratory control sample for strontium-90 indicated a possible high bias. Because these results contradict the QC blind sample results and because the QC blind sample results were not precise, the data are qualified.

5.0 SPECIFIC RESULTS, CONCLUSIONS, AND RECOMMENDATIONS

5.1 MDA T PRSs

MDA T is composed of seven PRSs:

- C-21-009 and C-21-012 are the locations of radioactively contaminated cement paste spills.
- SWMU 21-028(a) was a satellite container storage area.
- SWMU 21-016(a) is the former location of four absorption beds used in the disposal of liquid wastes from TA-21 activities.

- SWMU 21-016(b) is the retrievable waste storage area located between absorption beds 1 and 3 from which all waste had been removed by 1986.
- SWMU 21-016(c) is made up of the disposal shafts located between absorption beds 2 and 4.
- SWMU 21-011(c) is a distribution box located between absorption beds 1 and 2.

5.1.1 History

Major contributors to surface contamination at MDA T include spills of radioactively contaminated cement paste that was pumped into (1) asphalt-lined disposal shafts and (2) retrievable corrugated metal pipes. At the locations where the radioactively contaminated cement paste was spilled, two areas of concern (C-21-009 and C-21-012) have been identified. Spilled material may also have run into the drainages below MDA T. A satellite container storage area, SWMU 21-028(a) may also have contributed to surface contamination at MDA T, but its exact location is unknown. In addition, activities at facilities surrounding MDA T, the old waste facility (Building 35 built in 1952) to the south, and the new waste facility (Building 257 built in 1967) to the east, may have contributed to surface contamination at MDA T. The drainage from the new waste treatment facility was into a national pollutant discharge elimination system (NPDES) permitted outfall (SWMU 21-011[k]) but it may also have contributed to surface contamination in the drainage below MDA T. It is probable that MDA T drainage would affect the outfall at SWMU 21-011(k).

Major contributors to subsurface contamination at MDA T include four absorption beds (SWMU 21-016[a]) used in the disposal of liquid wastes from TA-21 activities, the retrievable waste storage area located between absorption beds 1 and 3 from which all waste had been removed by 1986 (SWMU 21-016[b]), the disposal shafts (SWMU 21-016[c]) located between absorption beds 2 and 4, and a distribution box (SWMU 21-011[c]) located between absorption beds 1 and 2. There is some confusion about the identity of SWMU 21-016(b), which has been assigned to the retrievable waste storage area and to a caisson in the northwest corner of absorption bed 1. According to the 21-016 SWMU report, dated October 31, 1990, "A pit, TA-21-186 (SWMU 21-016[b]), was built in 1959 of redwood and it was about 6 ft by 10 ft by 30 ft deep. The pit was located between two rows of adsorption beds. This pit, referred to as the 'Snake Pit', was used for monitoring purposes and did not contain waste. From 1974 to 1982, transuranic wastes were mixed with cement and pumped into corrugated metal pipes into the pit. There were 175 corrugated metal pipes (2.5 ft in diameter, 20 ft long) in the pit, which was located between adsorption beds 1 and 3. In 1984 to 1986, the pipes were transported to

TA-54 with the intention of shipping them to the WIPP site near Carlsbad, NM." The SWMU report also states, "A 30-ft deep caisson (the 'Snake Pit') was dug to obtain horizontal cores in 1961..." (LANL 1990, 0145). It is clear by the descriptions in the SWMU report that, although the physical description of the caisson is given, the retrievable waste storage area is actually the SWMU because "...transuranic wastes were mixed with cement and pumped into corrugated metal pipes into the pit."

The absorption beds at MDA T received americium-241, plutonium-238, plutonium-239/240, tritium, natural uranium, and possibly enriched uranium. For additional information, see Section 16.3.1 of the TA-21 Operable Unit RFI Work Plan (LANL 1991, 0689). Other chemicals received by the absorption beds may have included metals, carbonates, citrates, acids, bases, organic compounds, and solvents. The disposal shafts contained americium-241, plutonium-238 and plutonium-239/240 (including plutonium in several bathyspheres buried at various depths), and mixed fission products (including strontium-90 and cesium-137). The corrugated metal pipes stored in the retrievable storage area also contained americium-241, plutonium-238, plutonium-239/240, or other transuranic radionuclides, but they were all removed in 1984 and 1986. The chemicals stored at the satellite container storage area included alcohol, acetone, and Freon™. The two spills of contaminated cement paste that occurred in 1976 and 1978 causing the respective locations to become AOCs included americium-241.

Additional information is presented in Subsection 16.3 of the TA-21 Operable Unit RFI Work Plan (LANL 1991, 0689).

5.1.2 Description

In 1987, the surface of MDA T was regraded to slope into DP Canyon. The regraded surface was capped with 6–12 in. of topsoil and reseeded.

5.1.3 Previous Investigations

In 1984, environmental surveillance data were collected at 29 locations at or near MDA T (but not in drainages; see Fig. 16.3-4 of the TA-21 Operable Unit RFI Work Plan [LANL 1991, 0689]) on a 65.6 x 65.6-ft grid at depths of 0 to 1, 1 to 10, and 10 to 30 cm. A total of 101 samples were analyzed for tritium, 75 samples for uranium, 63 samples for plutonium-238, and 66 samples for plutonium-239.

In 1986, data were collected on a 65.6 x 65.6-ft grid at 108 sample locations at a depth of 0 to 1 cm. Seventy-five sample locations were inside the fenced area of MDA T, 16 were between the

fence and the North Perimeter Road, and 16 were across the road on the edge of DP Canyon (where MDA T drainages begin). A total of 72 samples were analyzed for americium-241, 73 samples for cesium-137, 69 samples for plutonium-238, and 71 samples for plutonium-239 (Figs. 16.3-7, 16.3-8, 16.3-9, and 16.3-10 of the TA-21 OU RFI Work Plan [LANL 1991, 0689]).

Data were obtained from the 1992 baseline characterization samples collected at nodes of the 131 x 131 ft grid (TA-21 OU RFI, Phase Report 1B) for seven sample locations in DP Canyon, downgradient of MDA T in the MDA T drainages. Samples were collected from 0-to 1-in. and 0-to 6-in. depths.

The data described in this section have not been integrated with the Phase I data pending evaluation of data quality for risk assessment purposes.

5.1.4 Field Investigation

Field Surveys. Results of the radiological survey of MDA T 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 about 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, suggesting that analytical data for this location should be carefully reviewed.

Field Screening at MDA T. Results of soil samples screening in the field and in the MRAL are summarized separately below. Sampling locations are shown in Fig. 5.1.4-1 and summarized in Table 5.1.4-1.

Several samples that were screened in the field slightly exceeded the upper limits of background for alpha and beta/gamma radiation. Of these, only sample AAA3979 from location 21-1639 (which during field surveying showed levels of gamma radiation at about ten times background) showed significantly increased levels of beta/gamma radiation (approximately five times background levels) during field screening.

Results of soil sample screening for alpha and beta radiation by the MRAL were inconclusive. Four samples showed increased gamma radiation: sample AAA3976 had 23.4 $\pm$ 4.4 pCi/g, sample AAA3979 had 343.2 $\pm$ 4.4 pCi/g, sample AAA3991 had 15.60 $\pm$ 4.4 pCi/g, and sample AAA3992 had 19.60 $\pm$ 4.4 pCi/g of gamma radiation. Results of fixed laboratory analyses for these samples are further discussed in Section 5.1.7.

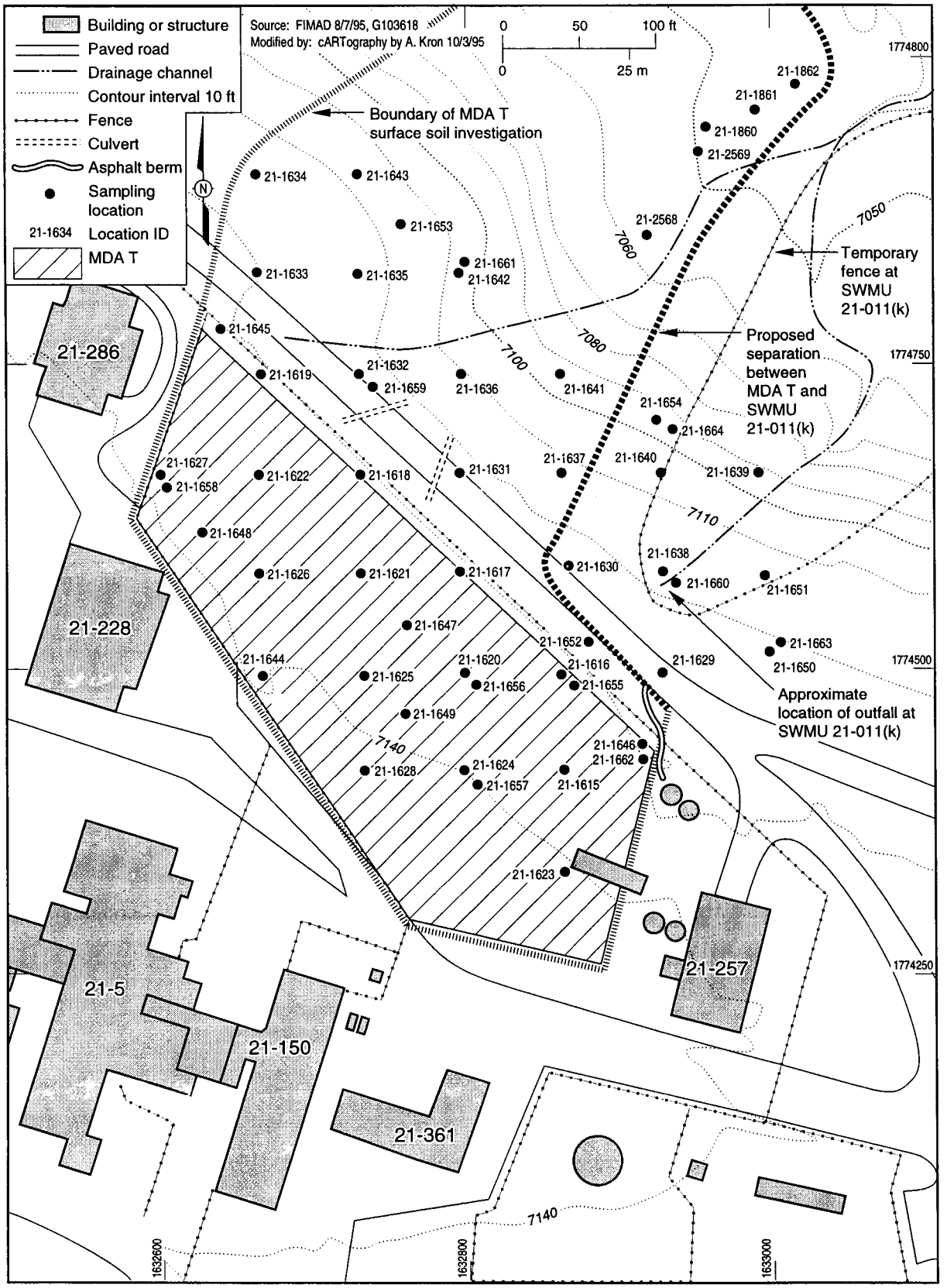

Fig. 5.1.4-1. Sampling locations at MDA T.

Results of soil sample screening for cesium-137 by the MRAL identified ten soil samples with cesium-137 concentrations greater than the screening action level of 5.1 pCi/g (Table 5.1.4-2).

TABLE 5.1.4-2

FIELD SCREENING RESULTS FOR CESIUM-137

SAMPLE ID	CESIUM-137 (pCi/g)
SAL	5.1
AAA3979	331.89 ± 15.62
AAA3980	16.49 ± 3.16
AAA3982 (AAA3981)[a]	5.8 ± 1.66 (3.56 ± 1.32)
AAA3991	19.09 ± 2.14
AAA3992	23.94 ± 2.39
AAA3995	5.48 ± 1.7
AAA4004	5.44 ± 1.51
AAA4005	5.48 ± 1.6
AAA4007	10.29 ± 1.64
AAA4008	5.45 ± 1.64

[a] Sample in parentheses represents a duplicate sample.

Results of fixed laboratory analyses for these samples are further discussed in Section 5.1.6.

Field Screening at the MDA T Drainage. Results from drainage area soil samples screened for alpha and beta/gamma radiation by the field crew showed that radiation levels in many samples exceeded the upper limit of background; however, no samples had significantly elevated radiation levels. Results of soil sample screening for radiation by the MRAL showed no indication of increased alpha, beta, or gamma radiation.

5.1.5 Background Comparisons

5.1.5.1 Inorganics

Four metals were detected above LANL-wide UTLs, as shown in Table 5.1.5-1. One metal, lithium, has no UTL. Other metals were not detected at levels above LANL-wide UTLs and, therefore, are not considered COPCs.

At all locations, analyses for metals included all required contract laboratory analytes except mercury. Mercury was analyzed in 17 samples at only five locations, all in the MDA T drainage area where radionuclide and PAH concentration exceeded their SALs. Mercury was not measured above the EQL of 0.02 mg/kg in any sample. Because mercury was not found at the same place as other chemicals and has not been identified as a process-linked chemical at MDA T, additional mercury sampling at other locations in MDA T is unwarranted.

TABLE 5.1.5-1

METALS WITH SOIL CONCENTRATIONS GREATER THAN BACKGROUND UTLs AT MDA T AND DRAINAGES

ANALYTE	LOCATION ID	SAMPLE ID	DEPTH (in.)	BACKGROUND UTL (mg/kg)	SAL (mg/kg)	SAMPLE VALUE (mg/kg)
Calcium	21-1628	AAA3966	0–6	6120	NA[a]	7 900
Lead	21-1861	AAA7513	0–3	39	400	61.3
Nickel	21-1664	AAA4008	0–6	15.2	1 500	19.4
Zinc	21-1645	AAA3986	0–6	50.8	23 000	132
Zinc	21-1658	AAA4002	0–6	50.8	23 000	111
Zinc	21-2568	AAB7277	6–12	50.8	23 000	82.4
Zinc	21-1658	AAA4001	0–6	50.8	23 000	75.8
Zinc	21-2568	AAB7275	0–3	50.8	23 000	68.1
Zinc	21-2568	AAB7275	0–3	50.8	23 000	66.4
Zinc	21-2568	AAB7276	3–6	50.8	23 000	66
Zinc	21-1644	AAA3985	0–6	50.8	23 000	65.2
Zinc	21-1862	AAA7517	3–6	50.8	23 000	64.9
Zinc	21-1862	AAA7516	0–3	50.8	23 000	62.1
Zinc	21-2568	AAA7549	0–3	50.8	23 000	60.7
Zinc	21-1860	AAA7512	6–12	50.8	23 000	58.7
Zinc	21-1861	AAA7514	3–6	50.8	23 000	56.8
Zinc	21-1861	AAA7514	3–6	50.8	23 000	56.3

[a] NA = Not available.

5.1.5.2 Radionuclides

The primary analytes associated with activities at MDA T are plutonium isotopes and americium-241. The primary analytes associated with activities at the old (Building 35, SWMU 21-010[a-h]) and new (Building 256, SWMU 21-011[a-j]) waste treatment facilities near MDA T are plutonium-238 and -239, uranium-234, -235, and -238, americium-241, strontium-90, cesium-137, and tritium. The same analytes, in addition to thorium-228, -230, and -232, are associated with the new waste treatment facility's drainage area (SWMU 21-011[k]).

Isotopic analyses were performed on samples from MDA T and its drainages, including analyses for the isotopes identified from historical knowledge of waste disposal and process operations listed above. Either TA-21 baseline or LANL-wide background UTLs are available for all of these critical radionuclides, as well as for radium-226 and potassium-40.

Eight radionuclides exceeded their TA-21 UTLs in at least one sample (Table 5.1.5-2). These radionuclides are compared with their SALs in Section 5.1.6.

TABLE 5.1.5-2

RADIONUCLIDES WITH SOIL CONCENTRATIONS GREATER THAN BACKGROUND FOR MDA T AND DRAINAGES

ANALYTE	LOCATION ID	SAMPLE ID	DEPTH (in.)	BACKGROUND UTL (pCi/g)	SAL (pCi/g)	SAMPLE VALUE (pCi/g)
Americium-241	21-1619	AAA3954	0–6	0.818	22	9.751
Americium-241	21-1623	AAA3961	0–6	0.818	22	3.406
Americium-241	21-1627	AAA3965	0–6	0.818	22	1.31
Americium-241	21-1629	AAA3967	0–6	0.818	22	3.077
Americium-241	21-1629	AAA3967	0–6	0.818	22	3.119
Americium-241	21-1630	AAA3968	0–6	0.818	22	1.349
Americium-241	21-1636	AAA3974	0–6	0.818	22	2.962
Americium-241	21-1638	AAA3976	0–6	0.818	22	1.361
Americium-241	21-1639	AAA3979	0–6	0.818	22	1.098
Americium-241	21-1640	AAA3980	0–6	0.818	22	1.444
Americium-241	21-1641	AAA3981	0–6	0.818	22	2.958
Americium-241	21-1641	AAA3982	0–6	0.818	22	1.567
Americium-241	21-1642	AAA3983	0–6	0.818	22	1.321
Americium-241	21-1644	AAA3985	0–6	0.818	22	12.333
Americium-241	21-1645	AAA3986	0–6	0.818	22	0.89
Americium-241	21-1646	AAA3987	0–6	0.818	22	26.395
Americium-241	21-1648	AAA3989	0–6	0.818	22	1.56
Americium-241	21-1650	AAA3991	0–6	0.818	22	3.196
Americium-241	21-1651	AAA3992	0–6	0.818	22	7.464
Americium-241	21-1652	AAA3993	0–6	0.818	22	2.042
Americium-241	21-1658	AAA4001	0–6	0.818	22	2.831
Americium-241	21-1658	AAA4002	0–6	0.818	22	2.881
Americium-241	21-1660	AAA4004	0–6	0.818	22	1.936
Americium-241	21-1661	AAA4005	0–6	0.818	22	1.03
Americium-241	21-1662	AAA4006	0–6	0.818	22	3.212
Americium-241	21-1663	AAA4007	0–6	0.818	22	3.908
Americium-241	21-1860	AAA7510	0–3	0.818	22	5.626
Americium-241	21-1860	AAA7511	3–6	0.818	22	5.641
Americium-241	21-1860	AAA7512	6–12	0.818	22	6.348
Americium-241	21-1861	AAA7513	0–3	0.818	22	2.657
Americium-241	21-1861	AAA7514	3–6	0.818	22	4.246
Americium-241	21-1861	AAA7514	3–6	0.818	22	4.549
Americium-241	21-1861	AAA7515	6–12	0.818	22	1.62
Americium-241	21-1861	AAA7515	6–12	0.818	22	1.85

TABLE 5.1.5-2 (CONTINUED)

RADIONUCLIDES WITH SOIL CONCENTRATIONS GREATER THAN BACKGROUND FOR MDA T AND DRAINAGES

ANALYTE	LOCATION ID	SAMPLE ID	DEPTH (in.)	BACKGROUND UTL (pCi/g)	SAL (pCi/g)	SAMPLE VALUE (pCi/g)
Americium-241	21-1862	AAA7516	0–3	0.818	22	4.87
Americium-241	21-1862	AAA7517	3–6	0.818	22	3.781
Americium-241	21-1862	AAA7518	6–12	0.818	22	1.5
Americium-241	21-1862	AAB7300	6–12	0.818	22	1.508
Americium-241	21-2568	AAA7549	0–3	0.818	22	3.908
Americium-241	21-2568	AAB7275	0–3	0.818	22	5.061
Americium-241	21-2568	AAB7275	0–3	0.818	22	5.129
Americium-241	21-2568	AAB7276	3–6	0.818	22	4.201
Americium-241	21-2568	AAB7276	3–6	0.818	22	4.224
Americium-241	21-2568	AAB7277	6–12	0.818	22	7.404
Americium-241	21-2569	AAB7278	0–3	0.818	22	1.101
Americium-241	21-2569	AAB7279	3–6	0.818	22	2.576
Americium-241	21-2569	AAB7280	6–12	0.818	22	3.459
Cesium-137	21-1629	AAA3967	0–6	1.4[a]	5.1	2.23
Cesium-137	21-1638	AAA3976	0–6	1.4[a]	5.1	31.15
Cesium-137	21-1639	AAA3979	0–6	1.4[a]	5.1	431.42
Cesium-137	21-1640	AAA3980	0–6	1.4[a]	5.1	5.41
Cesium-137	21-1641	AAA3981	0–6	1.4[a]	5.1	1.52
Cesium-137	21-1646	AAA3987	0–6	1.4[a]	5.1	1.51
Cesium-137	21-1650	AAA3991	0–6	1.4[a]	5.1	22.33
Cesium-137	21-1651	AAA3992	0–6	1.4[a]	5.1	31.18
Cesium-137	21-1660	AAA4004	0–6	1.4[a]	5.1	7.87
Cesium-137	21-1663	AAA4007	0–6	1.4[a]	5.1	8.23
Cesium-137	21-1664	AAA4008	0–6	1.4[a]	5.1	1.96
Plutonium-238	21-1619	AAA3954	0–6	0.447	27	0.535
Plutonium-238	21-1627	AAA3965	0–6	0.447	27	3.639
Plutonium-238	21-1636	AAA3974	0–6	0.447	27	1.82
Plutonium-238	21-1641	AAA3981	0–6	0.447	27	0.49
Plutonium-238	21-1641	AAA3982	0–6	0.447	27	0.819
Plutonium-238	21-1644	AAA3985	0–6	0.447	27	1.307
Plutonium-238	21-1646	AAA3987	0–6	0.447	27	6.851
Plutonium-238	21-1658	AAA4001	0–6	0.447	27	6.625
Plutonium-238	21-1658	AAA4002	0–6	0.447	27	6.532
Plutonium-238	21-1662	AAA4006	0–6	0.447	27	0.511

TABLE 5.1.5-2 (CONTINUED)

RADIONUCLIDES WITH SOIL CONCENTRATIONS GREATER THAN BACKGROUND FOR MDA T AND DRAINAGES

ANALYTE	LOCATION ID	SAMPLE ID	DEPTH (in.)	BACKGROUND UTL (pCi/g)	SAL (pCi/g)	SAMPLE VALUE (pCi/g)
Plutonium-238	21-1860	AAA7510	0–3	0.447	27	3.983
Plutonium-238	21-1860	AAA7511	3–6	0.447	27	2.629
Plutonium-238	21-1860	AAA7512	6–12	0.447	27	1.059
Plutonium-238	21-1861	AAA7513	0–3	0.447	27	1.101
Plutonium-238	21-1861	AAA7514	3–6	0.447	27	1.973
Plutonium-238	21-1861	AAA7514	3–6	0.447	27	2.078
Plutonium-238	21-1862	AAA7516	0–3	0.447	27	4.053
Plutonium-238	21-1862	AAA7517	3–6	0.447	27	3.277
Plutonium-238	21-1862	AAA7518	6–12	0.447	27	0.6322
Plutonium-238	21-2568	AAB7275	0–3	0.447	27	2.767
Plutonium-238	21-2568	AAB7275	0–3	0.447	27	3.307
Plutonium-238	21-2568	AAB7276	3–6	0.447	27	3.345
Plutonium-238	21-2568	AAB7277	6–12	0.447	27	2.452
Plutonium-238	21-2569	AAB7278	0–3	0.447	27	1.848
Plutonium-238	21-2569	AAB7279	3–6	0.447	27	1.516
Plutonium-238	21-2569	AAB7280	6–12	0.447	27	2.454
Plutonium-238	21-1862	AAB7300	6–12	0.447	27	0.5082
Plutonium-239	21-1642	AAA3983	0–6	15.5	24	28.512
Plutonium-239	21-1644	AAA3985	0–6	15.5	24	19.237
Plutonium-239	21-1646	AAA3987	0–6	15.5	24	201.254
Plutonium-239	21-1651	AAA3992	0–6	15.5	24	20.549
Plutonium-239	21-1663	AAA4007	0–6	15.5	24	47.935
Potassium-40[a,b]	21-1860	AAA7510	0–3	28.6	12	30.15
Potassium-40[a,b]	21-1860	AAA7512	6–12	28.6	12	29.67
Potassium-40[a,b]	21-2568	AAB7275	0–3	28.6	12	30.36
Potassium-40[a,b]	21-2568	AAB7275	0–3	28.6	12	31.83
Potassium-40[a,b]	21-2568	AAB7276	3–6	28.6	12	32.29
Potassium-40[a,b]	21-2568	AAB7277	6–12	28.6	12	30.02
Potassium-40[a,b]	21-2569	AAB7278	0–3	28.6	12	29.17
Potassium-40[a,b]	21-2569	AAB7279	3–6	28.6	12	32.03
Strontium-90	21-1638	AAA3976	0–6	0.766	4.4	12.34
Strontium-90	21-1639	AAA3979	0–6	0.766	4.4	239.7
Strontium-90	21-1640	AAA3980	0–6	0.766	4.4	2.78
Strontium-90	21-1650	AAA3991	0–6	0.766	4.4	5.57

TABLE 5.1.5-2 (CONTINUED)

RADIONUCLIDES WITH SOIL CONCENTRATIONS GREATER THAN BACKGROUND FOR MDA T AND DRAINAGES

ANALYTE	LOCATION ID	SAMPLE ID	DEPTH (in.)	BACKGROUND UTL (pCi/g)	SAL (pCi/g)	SAMPLE VALUE (pCi/g)
Strontium-90	21-1651	AAA3992	0–6	0.766	4.4	12.4
Strontium-90	21-1660	AAA4004	0–6	0.766	4.4	2.59
Strontium-90	21-1663	AAA4007	0–6	0.766	4.4	1.96
Strontium-90	21-1664	AAA4008	0–6	0.766	4.4	0.78
Thorium-228[b]	21-1860	AAA7510	0–3	1.98	1.7	3.646
Thorium-228[b]	21-1861	AAA7515	6–12	1.98	1.7	3.141
Uranium-235	21-1652	AAA3993	0–6	0.164	10	0.38
Uranium-235	21-1860	AAA7510	0–3	0.164	10	0.1965

[a] These UTLs come from LANL-wide data (Longmire et al. 1995, 1142 and 1266) because background data for these radionuclides was not collected for TA-21 baseline purposes.
[b] For potassium-40 and thorium-228, the SAL is less than the TA-21 UTL; therefore these chemicals are identified as a COPC

Background values for organic compounds are not currently available for LANL. As a preliminary screening, results of analyses for organic compounds were compared with EQLs. Data on organic compounds that were detected above the EQLs in samples collected at MDA T and its drainages are shown in Table 5.1.6-1. In these samples, ten PAHs were detected. In addition, bis(2-ethylhexyl)phthalate was detected at a low concentration in one sample.

TABLE 5.1.5-3

ORGANIC ANALYTES WITH SOIL CONCENTRATIONS GREATER THAN ESTIMATED QUANTITATION LIMITS FOR MDA T AND DRAINAGES

ANALYTE	LOCATION ID	SAMPLE ID	DEPTH (in.)	SAL (mg/kg)	SAMPLE VALUE (mg/kg)
Benzo[a]anthracene	21-1862	AAA7516	0–3	0.61	0.4
Benzo[a]anthracene	21-2568	AAB7277	6–12	0.61	0.61
Benzo[a]pyrene	21-1862	AAA7516	0–3	0.061	0.48
Benzo[a]pyrene	21-2568	AAB7277	6–12	0.061	0.67
Benzo[b]fluoranthene	21-1862	AAA7516	0–3	0.61	0.52
Benzo[b]fluoranthene	21-2568	AAB7277	6–12	0.61	0.61
Benzo[g,h,i]perylene	21-2568	AAB7277	6–12	NA[a]	0.4
Benzo[k]fluoranthene	21-2568	AAB7277	6–12	6.1	0.61
Bis(2-ethylhexyl)phthalate	21-1659	AAA4003	0–6	32	0.44
Chrysene	21-1862	AAA7516	0–3	24	0.48
Chrysene	21-2568	AAB7277	6–12	24	0.83
Fluoranthene	21-2569	AAB7278	0–3	2 600	0.59
Fluoranthene	21-1860	AAA7511	3–6	2 600	0.71
Fluoranthene	21-1862	AAA7516	0–3	2 600	0.95
Fluoranthene	21-2568	AAB7277	6–12	2 600	2.5
Indeno[1,2,3-cd]pyrene	21-2568	AAB7277	6–12	0.61	0.43
Phenanthrene	21-1860	AAA7511	3–6	NA	0.62
Phenanthrene	21-1862	AAA7516	0–3	NA	0.64
Phenanthrene	21-2568	AAB7277	6–12	NA	1.3
Pyrene	21-2569	AAB7278	0–3	2 000	0.44
Pyrene	21-1860	AAA7511	3–6	2 000	0.75
Pyrene	21-1862	AAA7516	0–3	2 000	0.86
Pyrene	21-2568	AAB7277	6–12	2 000	1.8

[a] NA = Not available.

5.1.6 Human Health Assessment

5.1.6.1 Screening Assessment

Radionuclides, metals, and SVOCs that were not eliminated in the background threshold or EQL comparisons are evaluated in this section. In addition, COPCs with no SAL, or with an EQL greater than their SALs, that were not eliminated in the background comparison are evaluated.

Among the radionuclides detected at MDA T and its drainages, actinium-227, lead-210, lead-212, lead-214, radium-224, thallium-208, and thorium-234 have neither a UTL nor a SAL. Of these radionuclides, lead-212, lead-214, radium-224, thallium-208, and thorium-234 have half-lives of less than one month. These radionuclides cannot be associated with historical releases at MDA T because radioactive decay would long ago have reduced their concentrations below measurable levels. Only longer-lived radionuclides (half-lives greater than 0.5 yr) associated with activities at MDA T or nearby waste treatment facilities are evaluated in this report.

Actinium-227 and lead-210 are not associated with activities at MDA-T or nearby waste treatment facilities but are daughter products of uranium isotopes. It is likely that these radionuclides were detected solely because of the presence of their parents. Dose contributions from daughter products, including actinium-227 and lead-210, are incorporated in dose conversion factors for the uranium isotopes. Actinium-227 and lead-210 are therefore not independently evaluated.

SALs are not available for the organic compounds phenanthrene and benzo(g,h,i)perylene, which were detected at MDA T and its drainages. Phenanthrene was identified in three samples at three different locations at a maximum value of 1.3 mg/kg. Because of its similar structure, pyrene is often used as a toxicity surrogate for phenanthrene. The soil SAL for pyrene is 2 400 mg/kg, indicating that the measured concentrations of phenanthrene are unlikely to pose a threat to human health. Benzo(g,h,i)perylene, a noncarcinogenic PAH, was identified in one sample at 0.4 mg/kg. Carcinogenic PAHs have soil SALs approximately equal to the measured concentration of benzo(g,h,i)perylene. Because noncarcinogens typically have higher SALs than carcinogens and because benzo(g,h,i)perylene was found in only one of fifty-five samples, benzo(g,h,i)perylene is unlikely to represent a human health threat at MDA T and its drainages.

Lithium, which has no UTL or soil SAL, was identified at concentrations up to 15 mg/kg in MDA T soil samples. There is no evidence that lithium has ever been associated with processes at MDA T or nearby waste treatment facilities, and the normal daily intake from plant- and animal-based foods (approximately 2 mg/day) greatly exceeds potential intake associated with incidental ingestion of soil from MDA T and its drainages. Therefore, lithium is not recommended for further evaluation.

COPCs with one or more sample values exceeding a SAL are identified in Table 5.1.6-1 and are discussed in detail below. Sample locations corresponding to these data are shown in Fig. 5.1.6-1.

Among the radionuclide COPCs, americium-241, strontium-90, and plutonium-239 were identified at concentrations exceeding SALs based on analyses from a fixed-base laboratory. Cesium-137 was also identified above its SAL based on fixed-base and mobile laboratory analyses; however, only cesium-137 data from fixed-base laboratory analyses are presented in Table 5.1.6-1 because of the lower confidence associated with the mobile laboratory data (mobile laboratory data for cesium-137 are discussed in Section 4.0). Samples identified by field survey or screening as having the greatest increase in radiation levels are included among the samples in which radionuclide COPCs were identified at concentrations exceeding SALs.

Among the organic COPCs, benzo(a)pyrene, benzo(a)anthracene, and benzo(a)fluoranthene were identified at concentrations exceeding their SALs.

The results of the multiple chemical evaluation on chemicals detected at levels greater than their UTLs or EQLs but less than their SALs are provided in Table 5.1.6-2. Radionuclides, carcinogenic chemicals, and noncarcinogenic chemicals are evaluated separately to determine if additive effects of the analytes within these groups could present a health threat. No chemicals or radionuclides were identified as COPCs in the multiple chemical evaluation.

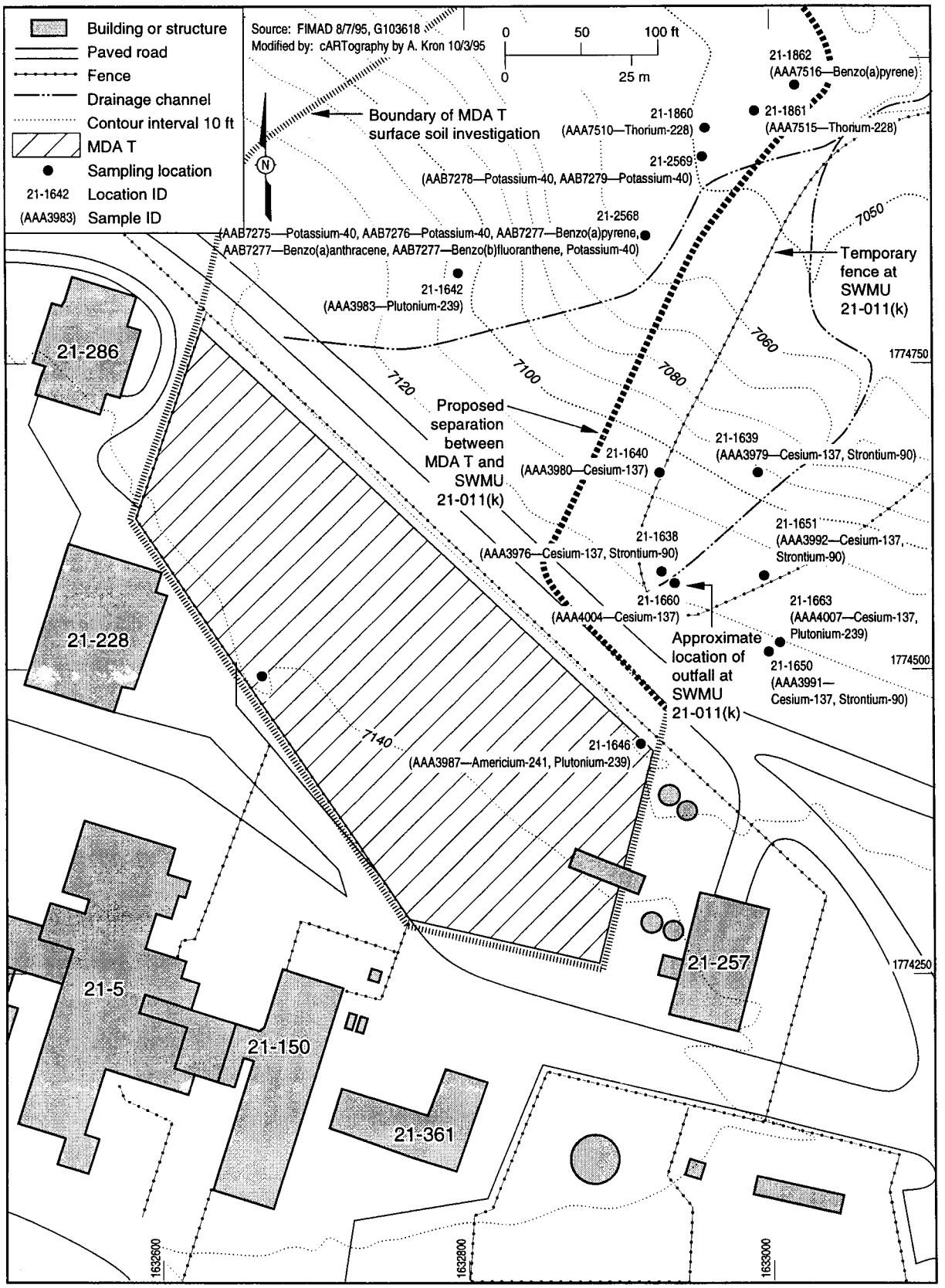

Fig. 5.1.6-1. Locations of detected organic chemicals and radionuclides that exceed SAL at MDA T.

TABLE 5.1.6-1

COPCs WITH SOIL CONCENTRATIONS GREATER THAN SALs FOR MDA T AND DRAINAGES

ANALYTE	LOCATION ID	SAMPLE ID	DEPTH (in.)	SAL (mg/kg or pCi/g)	SAMPLE VALUE (mg/kg or pCi/g)
RADIONUCLIDES					
Americium-241	21-1646	AAA3987	0-6	22	26.395
Cesium-137[a]	21-1640	AAA3980	0-6	5.1	5.41
Cesium-137[a]	21-1660	AAA4004	0-6	5.1	7.87
Cesium-137[a]	21-1663	AAA4007	0-6	5.1	8.23
Cesium-137[a]	21-1650	AAA3991	0-6	5.1	22.33
Cesium-137[a]	21-1638	AAA3976	0-6	5.1	31.15
Cesium-137[a]	21-1651	AAA3992	0-6	5.1	31.18
Cesium-137[a]	21-1639	AAA3979	0-6	5.1	431.42
Plutonium-239	21-1642	AAA3983	0-6	24	28.512
Plutonium-239	21-1663	AAA4007	0-6	24	47.935
Plutonium-239	21-1646	AAA3987	0-6	24	201.254
Strontium-90	21-1650	AAA3991	0-6	4.4	5.57
Strontium-90	21-1638	AAA3976	0-6	4.4	12.34
Strontium-90	21-1651	AAA3992	0-6	4.4	12.4
Strontium-90	21-1639	AAA3979	0-6	4.4	239.7
CARCINOGENS					
Benzo[a]anthracene	21-2568	AAB7277	6-12	0.61	0.61
Benzo[a]pyrene	21-1862	AAA7516	0-3	0.061	0.48
Benzo[a]pyrene	21-2568	AAB7277	6-12	0.061	0.67
Benzo[b]fluoranthene	21-2568	AAB7277	6-12	0.61	0.61

[a] Cesium-137 data are from a fixed-base laboratory; mobile laboratory data are not quantitatively evaluated.

TABLE 5.1.6-2

RESULTS OF THE MULTIPLE CHEMICAL EVALUATION FOR MDA T AND DRAINAGES

ANALYTE	LOCATION ID	SAMPLE ID	MAXIMUM SAMPLE VALUE (mg/kg or pCi/g)	SOIL SAL (mg/kg or pCi/g)	NORMALIZED VALUE
RADIONUCLIDES					
Plutonium-238	21-1646	AAA3987	6.85	27	0.25
Uranium-235	21-1652	AAA3993	0.38	10	0.038
Additive Total					0.29
NONCARCINOGENS					
Fluoranthene	21-2568	AAB7277	2.5	2 600	0.00096
Lead	21-1861	AAA7513	61.3	400	0.15
Nickel	21-1664	AAA4008	19.4	1 500	0.013
Pyrene	21-2568	AAB7277	1.8	2 000	0.0090
Zinc	21-1645	AAA3986	132	23 000	0.0057
Additive Total					0.15
CARCINOGENS					
Benzo(k)-fluoranthene	21-2568	AAB7277	0.61	6.1	0.10
Bis(2-ethylhexyl) phthalate	21-1659	AAA4003	0.44	32	0.014
Indeno [1,2,3-cd] pyrene	21-2568	AAB7277	0.43	0.61	0.70
Additive Total					0.81

Only one sample location associated with MDA T was identified as having COPCs that failed the screening assessment: plutonium-239 and americium-241 at location 21-1646. Sample location 21-1646 is near the northeastern edge of MDA T on the perimeter of the MDA T cap, where an asphalt berm collects and directs surface water toward SWMU 21-011(k), which comprises the drainages associated with the new waste treatment facility (Building 257). The americium-241 and plutonium-239 found at location 21-1646 may be the result of runoff from the area of Building 257 or may be the result of spills of americium-contaminated cement paste (C-21-009 and C-21-012). This sample point was the only location where americium-241 was observed to be greater than the SAL, although it was greater than the TA-21 UTL at almost all

MDA T drainage sample locations. Concentrations of americium-241 decrease with distance from the absorption beds in MDA T. But the farthest downgradient activity levels are not consistent with the TA-21 process area background, therefore, the extent of americium-241 contamination in the MDA T drainage has not been defined. Additional investigation of the extent of americium-241 contamination will be deferred to the DP Canyon investigation scheduled to begin in January 1997. This investigation will address contaminant contributions from all TA-21 PRSs to DP Canyon.

In the MDA T drainage area, strontium-90 and cesium-137 were two of the radionuclides identified as COPCs in the screening assessment. Evaluation of the data from the MDA T drainage is complicated by the probable impact of contamination associated with the new industrial waste treatment plant (Building 257, SWMU 21-011[a-j]) and its drainage area (SWMU 21-011[k]) on the eastern boundary of MDA T and its drainage. Because the MDA T drainages and SWMU 21-011(k) overlap along the canyon adjacent to the eastern portion of the MDA T drainage, and because this area contains most of the COPCs identified in the screening assessment, it is necessary to define the bounds of the investigations for the MDA T drainage and SWMU 21-011(k).

SWMU 21-011(k) has high concentrations of cesium-137 and strontium-90 in soils. A temporary fence surrounds the area of greatest cesium-137 contamination at SWMU 21-011(k) (identified by a field radiation survey described in the TA-21 RFI phase report [LANL 1994, 1260]). The western boundary of the fence approaches the crest separating the main drainage for MDA T (into which two road culverts drain) from the drainage channels affected by discharges into SWMU 21-011(k). All MDA T drainage samples showing cesium-137 and strontium-90 at levels above background are east of the drainage divide (except the sample from location 21-1641). Although it is possible for surface water from the eastern portion of MDA T and its drainage to flow into SWMU 21-011(k), surface water from the new waste treatment facility (Building 257) and its drainage (SWMU 21-011[k]) cannot flow into the main MDA T drainage west of the divide.

Based on the cesium-137 and strontium-90 data, the area east of the divide contains contamination uniquely associated with SWMU 21-011(k). Therefore, samples from this area and from the area east of the MDA T drainage in general should be evaluated as part of SWMU 21-011(k) rather than as part of MDA T and its drainage. The suggested boundary is identified in Fig. 5.1.4-1 and Fig. 5.1.6-1.

Using this boundary, the drainages accepting runoff from the area of sample location 21-1646, where plutonium-239 and americium-241 were found at levels greater than SALs, will be evaluated under the investigation for SWMU 21-011(k). However, there are a number of smaller drainages near the rim of DP Canyon that are associated only with MDA T and that may not have been sampled during the Phase I investigation. Therefore, although extent is defined, additional data may be required to estimate the extent and concentration of americium-241 in surface soil in MDA T drainages. The investigation to assess extent and concentration of americium-241 will be deferred to the DP Canyon investigation scheduled to begin in January 1997.

Plutonium-239 was identified at a concentration slightly above its SAL at location 21-1642 along the upper wall of DP Canyon on the eastern edge of the main MDA T drainage. No other sample in the main MDA T drainages contained plutonium-239 at a concentration exceeding its SAL or TA-21 UTL, although plutonium-239 SALs, as with cesium-137 and strontium-90 SALs, were exceeded in the eastern portion of the drainage and can be attributed to SWMU 21-011(k). Although it is likely that plutonium-239 has migrated into DP Canyon, widespread sediment contamination at levels greater than the SAL is unlikely in the canyon based on the assumption that concentration decreases with distance from MDA T. As for americium-241, additional data may be required to estimate the concentration of plutonium-239 at MDA T and its drainages.

Thorium-228 was greater than the TA-21 UTL (and the SAL) at both locations (21-1860 and 21-1861) where it was analyzed. These locations are in the level area at the base of the main MDA T drainage channel. Thorium-228 is a short-lived decay product of the primordial radionuclide thorium-232, and the two have approximately equal activity in the environment. The thorium-228 data were obtained by gamma spectroscopy, which does not allow accurate quantitation of this radioisotope. In addition, thorium-228 is not known to be associated with process activities specific to MDA T. It is likely, therefore, that these thorium-228 data reflect analytical uncertainty rather than actual site contamination. However, a definitive determination of whether anthropogenic thorium is present a MDA T and drainages cannot be made without additional sampling.

Potassium-40 was analyzed in samples from the MDA T drainages. Eight samples from three sample locations in the level area at the base of the main MDA T drainage channel showed potassium-40 concentrations exceeding the LANL-wide UTL. A statistical comparison of the MDA T drainage potassium-40 data and the LANL background data suggest that the MDA T drainage values are elevated above the LANL-wide UTL. Nevertheless, there are no known activities associated with MDA T that could have contributed potassium-40 to the environment.

In addition, environmental surveillance data (Purtyman et al. 1987, 0211; ESG 1988, 0408; ESG 1989, 0308; Environmental Protection Group 1990, 0497; Environmental Protection Group 1992, 0740) collected at several locations on the Pajarito plateau reveals other examples of locally elevated potassium. In particular, data collected at monitoring points near the EG&G building and Tsankawi have median values of approximately 33 000 parts per million potassium. Given the natural abundance of potassium-40 (0.0118%) and its specific activity (6.99×10^6 pCi/g), these data indicate a median potassium-40 concentration of 27 pCi/g, which is similar to the median value of approximately 30 pCi/g observed in the MDA T drainage data.

Three PAHs, benzo(a)pyrene, benzo(a)anthracene, and benzo(b)fluoranthene, were identified above SALs in the screening assessment at two sampling locations (21-2568 and 21-1862) in the level area at the base of the main MDA T drainage channel. Because PAHs are not associated with process activities at TA-21, the most likely source for these COPCs is surface runoff collected from North Perimeter Road and asphalt areas of TA-21 and discharged into the drainage through the two culverts shown in Fig. 5.1.6-1. Locations 21-2568 and 21-1862 are separated by three sample points where PAHs were also detected but at concentrations below SALs. It is possible that additional PAH sampling in DP Canyon beyond location 21-1862, which is the location furthest from MDA T, will reveal PAHs at detectable concentrations. However, such sampling is not recommended for PAHs because their source in the drainage channel is probably independent of activities at MDA T.

5.1.6.2 Risk Assessment

No human health risk assessment was performed for this PRS because additional data are needed to complete a human health risk assessment.

5.1.7 Ecological Assessment

MDA T is a mesa-top site in a developed, disturbed area. The site provides limited habitat for biota, and it does not contain sensitive habitats and threatened or endangered species. Therefore, there is no immediate ecological risk at MDA T. However, runoff from the site does reach DP Canyon, which is a receptor of runoff from many other sites along its course. Moreover, multiple contaminants can have a cumulative impact on DP Canyon, which contains several sensitive habitats.

5.1.8 Extent of Contamination

Extent of contamination will be assessed when results of the Phase II investigation to be conducted in 1996 are available.

5.1.9 Conclusions and Recommendations

Data from field and laboratory analyses support the following conclusions and recommendations.

- Deviations from the TA-21 work plan, especially the change in sampling grid, may have affected LANL's ability to determine extent and nature of contamination in the southwest and southeast corners of MDA T.

- Three PAHs, benzo(a)pyrene, benzo(a)anthracene, and benzo(b)fluoranthene, were measured at two sample locations in surface soil at concentrations exceeding SALs. These compounds are unlikely to be associated with activities at MDA T or nearby waste treatment facilities.

- Thorium-228 measured above its SAL and is unlikely to reflect site contamination associated with activities at MDA T or nearby waste treatment facilities.

- Cesium-137 and strontium-90, as well as plutonium-239, were measured above their SALs in drainages that may have been affected by SWMU 21-011(k). These measurements should be assessed with other data from SWMU 21-011(k) and the drainages associated solely with SWMU 21-011(k).

- Plutonium-239 was measured above its SAL at only one point in the upper area of the main MDA T drainage and at only one point at MDA T (along the perimeter of the cap where americium-241 was also detected above its SAL). It is likely that these MDA T values are associated either with other SWMUs or represent original MDA T soil at the margin of the cap. Because data indicate the MDA T cap is intact, plutonium-239 and americium-241 migration with surface water runoff or airborne dust from MDA T is not a concern.

- The measured concentrations of COPCs in MDA T drainages are well within a factor of 10 of SAL values, and access to MDA T is currently restricted. Therefore, COPCs in surface soils at MDA T and its drainages do not represent an acute health risk to the occasional visitor to this area.

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LOS ALAMOS NATIONAL LABORATORY
ENVIRONMENTAL RESTORATION PROJECT

COVER SHEET AND CHAIN OF CUSTODY LOG

for

Response to February 12, 2001, NMED Request for Information
Pursuant to the New Mexico Hazardous Waste Act and the
Resource Conservation and Recovery Act
Los Alamos National Laboratory
EPA ID No. 0890010515

ER Records Package No. 722

PRS No: 21-016(a)-99

Question Number: 1-11 ☐ 12-17 ☐ 18 ☑ 19-23 ☐

Category: I ☑ II ☐ III ☐

Date Due to NMED: March 1 ☐ March 16 ☐ April 1 ☐ April 17 ☐ May 1 ☑ June 1 ☐ July 1 ☐
Other _____
Date of Submittal (if different than due date): May 10

Signature of Originator: [signature] Date: 5/7/01

Printed Name of Originator: JOHN HOPKINS

Signature of Quality Representative: [signature] Date: 5-9-01

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Signature of RPF Representative: [signature] Date: 5/9/2001

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Signature of S-7 Representative: [signature] Date: 5/10/01

Printed Name of S-7 Representative: L. BECKSTEAD

Sent to of ESH-19

Signature of ER Representative: _____ Date: _____

Printed Name of ER Representative: _____

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