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RFI Report for Potential Release Site at TA-21

21-015

Material Disposal Area B

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 4

1.3 Field Activities 5

2.0 ENVIRONMENTAL SETTING **5**

2.1 Climate 6

2.2 Geology 6

2.2. Geologic Setting 6

2.2.2 Soils 8

2.3 Hydrology 8

2.3.1 Surface water 8

2.3.2 Groundwater 9

2.4 Biological Surveys 10

2.5 Cultural Surveys 10

3.0 APPROACH TO DATA ASSESSMENT AND ANALYSES **11**

3.1 Sample Analysis 11

3.1.1 Analytical Methods 11

3.1.2 Data Validation 11

3.2 Evaluation of Inorganic Chemical Data 12

3.3 Evaluation of Radiochemical Data 13

3.4 Evaluation of Organic Constituents 14

3.5 Human Health 15

3.5.1 Screening Assessment 15

3.5.3 Risk Assessment 16

3.6 Ecological 16

4.0 RESULTS OF QUALITY ASSURANCE/QUALITY CONTROL ACTIVITIES 16

4.1 RFI Phase I Data Review 18

4.1.1 Inorganic Analyses 18

4.1.2 Organic Analyses ..... [illegible]

4.1.3 Radiochemical Analyses 20

4.2 1990 Environmental Surveillance Data Review 22

5.0 SPECIFIC RESULTS, CONCLUSIONS, AND RECOMMENDATIONS 23

5.1 MDA B (PRS 21-015) 23

5.1.1 History 23

5.1.2 Description 23

5.1.3 Previous Investigations 23

5.1.4 Field Investigation 23

5.1.4.1 Results of Field Surveys 30

5.1.4.2 Results of Field Screening 31

5.1.5 Background Comparisons 32

5.1.5.2 Radionuclides 38

5.1.6 Evaluation of Organic Constituents 52

5.1.7 Human Health Assessment 53

5.1.7.1 Screening Assessment 53

5.1.7.1.1 Analytes with Values Greater Than or Equal to SAL 53

5.1.7.1.2 Analytes Not Evaluated in SAL Comparisons 57

5.1.7.1.3 Multiple Chemical Evaluation 58

5.1.7.2 Risk Assessment 58

5.1.8 Ecological Assessment 58

5.1.9 Extent of Contamination 60

5.1.10 Conclusions and Recommendations 60

6.0 REFERENCES 62

LIST OF TABLES

Table 5.1.4-1 Summary of 1994 Samples Collected at MDA B (PRS 21-015) 27

Table 5.1.5-1 MDA B Soil Concentrations for Inorganics with Values Greater than Los amos Background Concentrrations 35

Table 5.1.5-2 Statistical Tests for Background Comparisons 38

Table 5.1.5-3 Radionuclides with Concentrations Above Background 39

Table 5.1.5-4 Radionuclides with Concentrations Above Background for 1990 Data 44

Table 5.1.6-1 MDA B Soil Concentrations for Detected Organic Analytes .....

Table 5.1.7-1 Radiological Constituents with Concentrations Greater Than SAL 54

Table 5.1.7-2 Organic Constituents with Concentrations Greater Than SALs 55

Table 5.1.7-3 MDA B Multiple Constituent Evaluation for Surface Soil 59

LIST OF FIGURES

Fig. 1.1-1. General location of TA-21 (DP-site). 2

Fig. 1.1-2. Location of MDA B at TA-21. 3

Fig. 2.2-1. Generalized Stratigraphy at TA-21. 7

Fig. 5.1.3-1. Fall 1990 surface soils sampling plan at MDA B. These samples were collected as part of the low-level radioactive waste surveillance program.. 25

Fig. 5.1.4-1. Sampling locations at MDA B. 26

Fig. 5.1.5-1. Locations of detected organics and inorganic chemicals greater than UTLs at MDA B. 33

Fig. 5.1.7-1. Locations of radionuclides and SVOCs above SALs at MDA B. 56

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 Technical Area (TA) 21 at Los Alamos National Laboratory (LANL). Included in this report are the data assessment and analysis approach used in the surface investigation and site-specific results, conclusions, and recommendations for Material Disposal Area (MDA) B (potential release site [PRS] 21-015 and its drainage area).

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). TA-21 was used primarily for plutonium research, metal production, and related activities from 1945 to 1978. Since 1978, administrative and various other activities have been conducted at TA-21. Additional background information is presented in Chapter 3 of the TA-21 Operable Unit RFI Work Plan (LANL 1991, 0689).

MDA B (PRS 21-015) is located on the west end of DP Mesa; its drainage is south into BV Canyon, as shown in Fig. 1.1-2. It is described in detail in Section 16.2 of the TA-21 Operable Unit RFI Work Plan (LANL 1991, 0689). MDA B consists of at least four pits containing buried waste and at least one trench that was used for chemical disposal.

Based on historical records, the waste buried in the pits probably included radioactively contaminated paper, rags, rubber gloves, glassware, small and large metal apparatus, and at least one truck contaminated with fission products from the Trinity test. The radioactive contaminants probably included plutonium, polonium, uranium, americium, curium, actinium, lanthanum, and possibly strontium. The chemicals buried at the east end of the site probably included organic compounds, perchlorates, ethers, solvents, and corrosive gases. Additional information is presented in Section 16.2 of the TA-21 Operable Unit RFI Work Plan (LANL 1991, 0689).

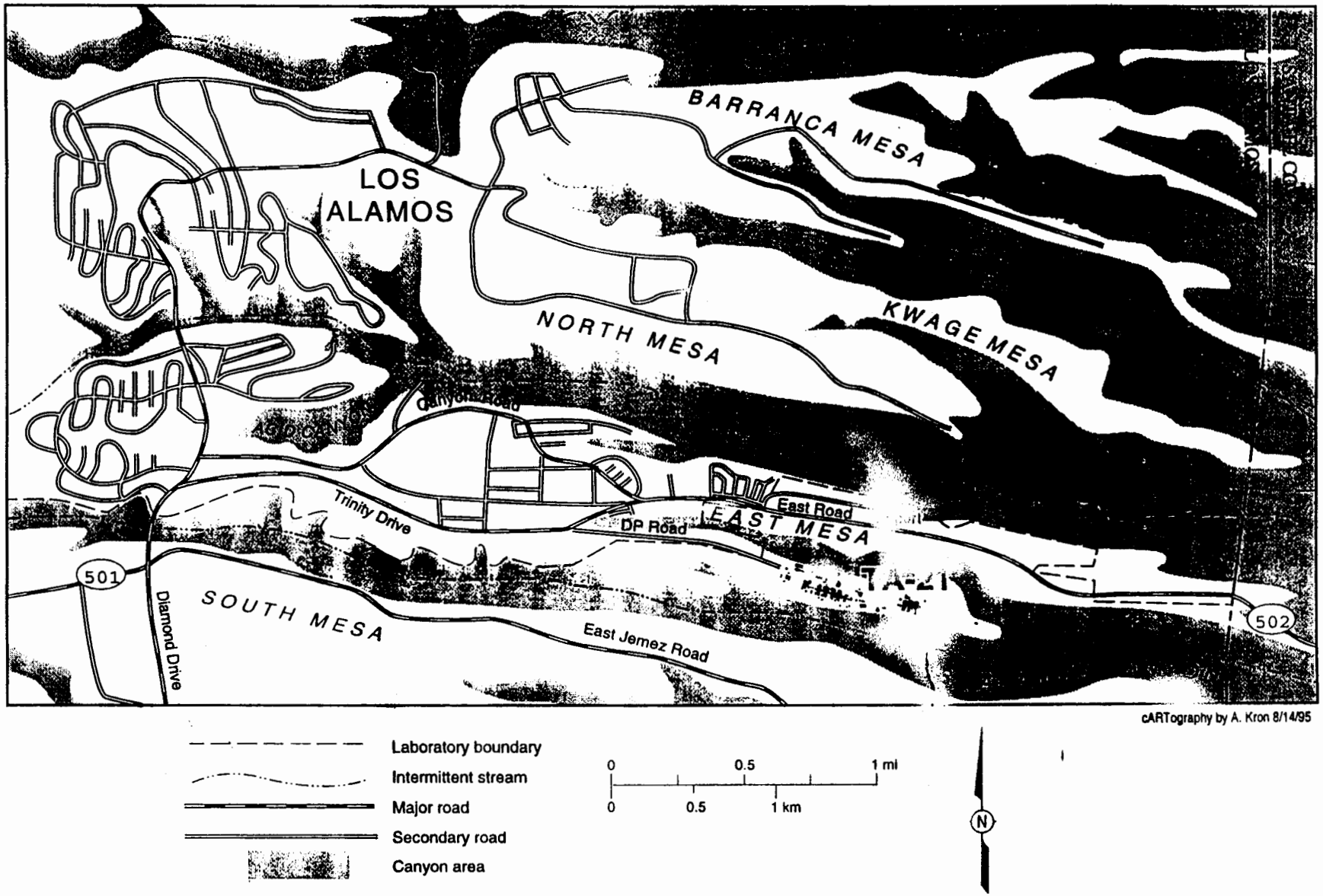


Fig. 1.1-1. General location of TA-21 (DP-site).

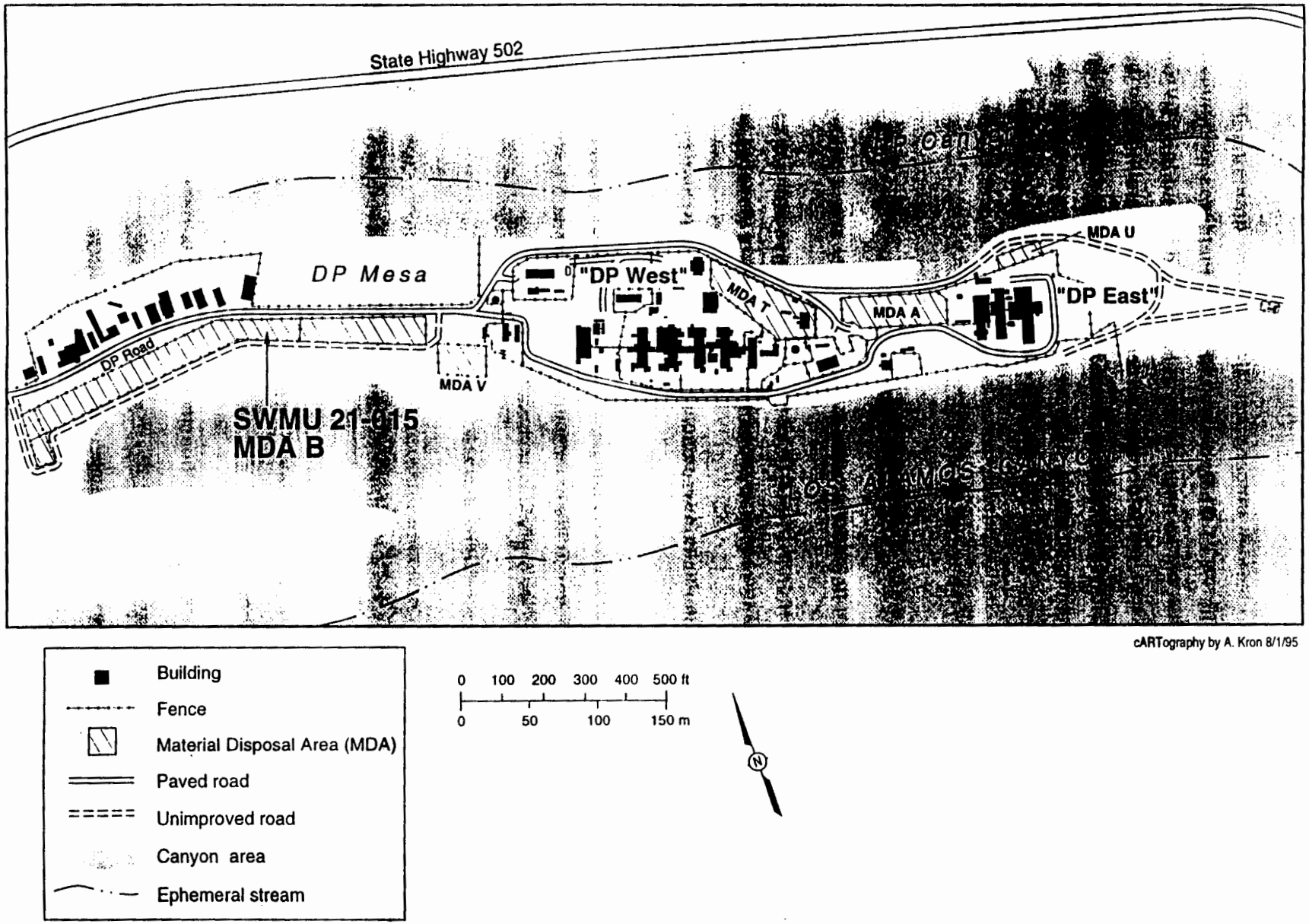


Fig. 1.1-2. Location of MDA B at TA-21.

1.2 RFI Overview

The objective of the Phase I surface investigation at MDA B and its drainage, as stated in Sections 16.1.4 and 16.2.2 of the TA-21 Operable Unit RFI Work Plan, was to identify areas of surface contamination between the southern fence at MDA B and the edge of BV Canyon directly south of the disposal area, and to determine if contaminants are migrating from the area through or into the drainage (LANL 1991, 0689). Section 16.2.4 of the TA-21 Operable Unit RFI Work Plan called for soil sampling to a 6-in. depth at MDA B, and Section 16.1.4 of the same document called for sampling to an 18-in. depth in the drainages (LANL 1991, 0689). Radioactive contaminants were the primary concern, but other analyses were also planned. The following procedures were planned at MDA B:

1. Perform a land survey on a 65.6 x 65.6 ft grid.
2. Survey the area with field instruments for radioactivity above background levels.
3. Collect 64 samples from the top 6 in. of soil on the surveyed grid, six samples off the grid, and up to ten samples to characterize any areas of elevated radioactivity.
4. Screen samples in the field for radioactivity using field instruments and a mobile laboratory.
5. Analyze all samples for radionuclides, metals, and semivolatile organic compounds (SVOCs); analyze seven of the samples (to be collected near the chemical waste disposal pit) for volatile organic compounds (VOCs).

The following procedures were planned at the MDA B drainage.

1. Identify the drainage channel and local sediment storage sites based on geomorphic maps completed in 1992 and reported in the TA-21 Phase Report 1A (LANL 1993, 1076).
2. Collect samples from depths of 0 to 6 in., 6 to 12 in., and 12 to 18 in. at five locations in the drainage channel.
3. Screen samples in the field for radioactivity using field instruments and a mobile laboratory.
4. Analyze all samples for radionuclides, metals, and SVOCs.

Deviations from the planned field activities at MDA B and its drainages are discussed in Section 5.1.4 of this report.

1.3 Field Activities

Field work was conducted at MDA B between July and November 1994 and in the MDA B drainages during August 1994. The investigation area south of MDA B was surveyed in July 1994 to establish the radiological survey grid and to mark locations of soil samples. A 65.6 x 65.6 ft grid and six points off the grid (to determine whether the sampling pattern accurately represented the area) were marked. Survey points were recorded in the New Mexico state planar coordinate system, and LANL Facility for Information Management, Analysis, and Display (FIMAD) identification numbers were assigned.

A radiological survey of MDA B was performed using a FIDLER G-5 sodium iodide scintillation detector to identify low-energy gamma radiation, a Ludlum 44-10 sodium iodide detector to identify high-energy gamma radiation, a Ludlum 19 sodium iodide scintillation survey meter, a Ludlum Model 12 ratemeter with a pancake GM detector to identify beta and gamma radiation, a Ludlum 139 survey meter with an air-proportional detector to identify alpha radiation, and a Ludlum 43-1 zinc sulfide detector to identify alpha radiation. In addition, on August 30, August 31, and September 20, 1994, the paved area of MDA B was surveyed for radiation using a long-range alpha detection (LRAD) system.

Soil samples were collected from the 0 to 6-in. depth at MDA B and from the 0 to 12-in. depth in sediment at the MDA B drainage. Samples were field-screened for radiation using a Ludlum Model 12 ratemeter with a beta/gamma detector and a Ludlum Model 139 survey meter with an alpha detector to ensure that workers were not exposed to excessive radiation levels. Soil samples were also screened in the mobile radiological analytical laboratory (MRAL) to ensure that they did not exceed the radiological criteria for transport to and acceptance by analytical laboratories. Samples were screened for gross alpha, beta, and gamma activity, as well as tritium and moisture.

Samples were delivered to the sample coordination facility (SCF) and subsequently sent to fixed laboratories for further analysis.

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

Los Alamos County has a semiarid, temperate, mountain climate. Summers are generally sunny with moderate, warm days and cool nights. High altitude, light winds, clear skies, and dry atmosphere allow summer temperatures to range from 50°F to 90°F. During the winter, temperatures typically range from 15°F to 50°F. Normal annual precipitation in Los Alamos, including rainfall and water-equivalent snowfall, is 18 in. Of this total, approximately 40% occurs as brief, intense thunderstorms during July and August. Streamflow in canyons can occur as a result of these storms. Spring snowmelt runoff may also induce streamflow in area canyons. Winter snowfall averages 51 in. annually (ESG 1989, 0308). Wind speeds exceed than 5.5 mph about 40% of the time and [illegible] about 20% of the time. Strong winds occur mainly in the spring. 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 B, 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), comprising fallout and ash flow deposits of silicic volcanic rock that 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.

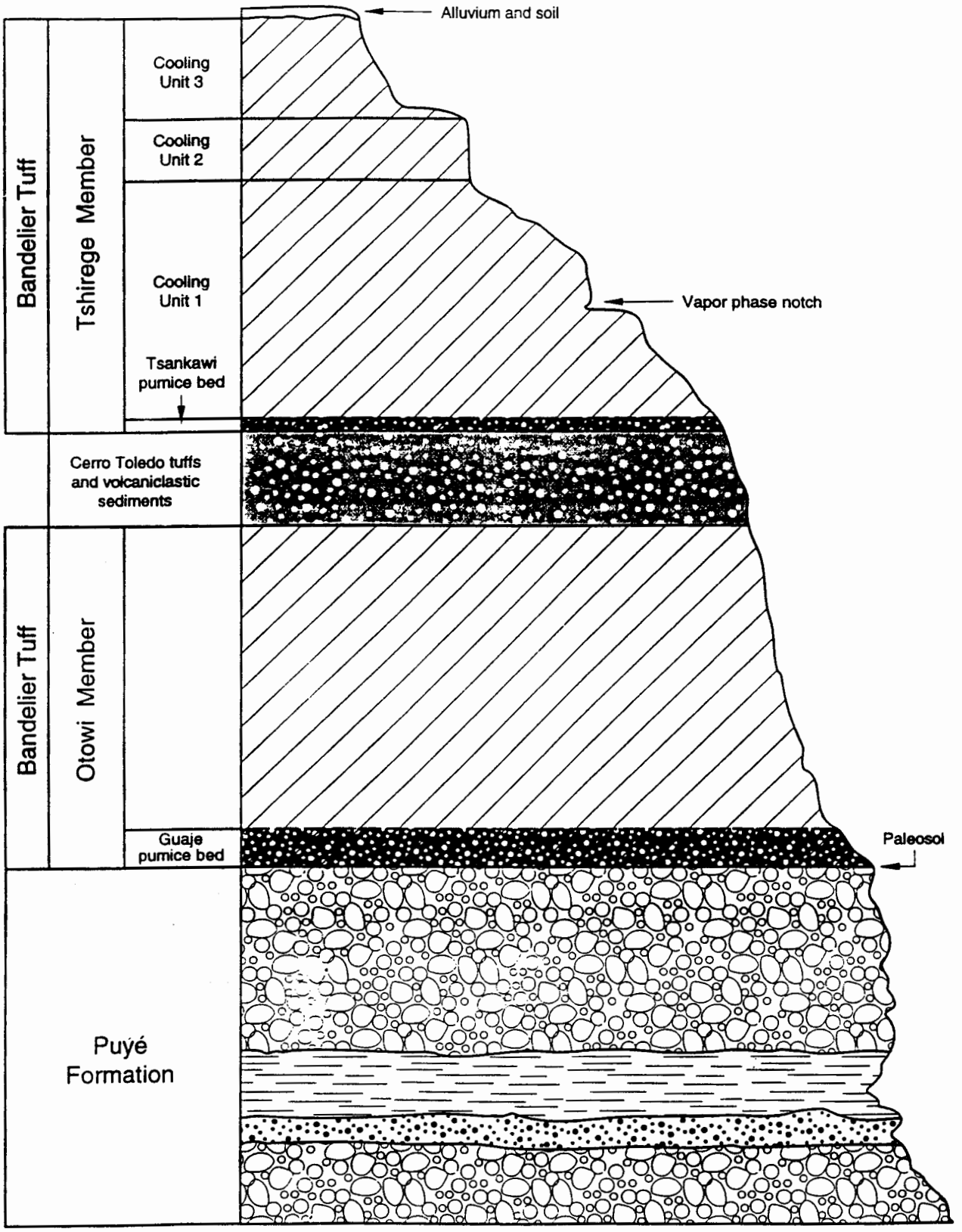


Fig. 2.2-1. Generalized Stratigraphy at TA-21.

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 of TA-21, the soil is composed of moderately 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 gravelly, 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.

Because most of TA-21 has been disturbed by construction and operation of the site for the last 50 years, natural soil profiles are generally 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, two 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). A second 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 shows 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 that water, if available, will 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 1 200 ft north of LADP-3, and therefore probably does not underlie TA-21. The perched aquifer continues upcanyon at least 3 000 ft, based on well LAOI(A)-1.1. The northern extent of the perched aquifer at the base of the Bandelier Tuff is established to be no farther north than MDA-V-DP, because the Guaje Pumice bed was unsaturated in this borehole. Lateral continuity to the south and east is not known, but it is thought that the Guaje Pumice bed dips to the south (Broxton and Eller 1995, 1162).

An intermittent spring (DP Spring), located on the north side of lower DP Canyon 3 000 ft east-northeast of LADP-4 (Broxton and Eller 1995, 1162), discharges at a rate of 0–4 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 within the Bandelier Tuff was encountered in LADP-4 to support the latter possiblity. 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 eastern portion of MDA B is located within the current LANL operating boundary and is a waste management site recovery study area. The western portion has been paved and was once used by Los Alamos County residents as a recreational vehicle storage, but it is now vacant. The mesa top where MDA B is located has heavy commercial development and urban disturbance from past TA-21 waste disposal operations and roadwork. The MDA B area is addressed by a 1992 biological evaluation (Bennett 1992, 01-0008).

The preurban natural overstory for this portion of the mesa was a ponderosa pine forest and pinon-juniper woodland ecozone. The understory currently comprises 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. Sensitive canyon bottom habitats are found in lower Los Alamos Canyon south of the site. Drainages flow south and east from MDA B into Los Alamos Canyon. Los Alamos Canyon is a receptor from many sites along the canyon rim from its origin on Pajarito Mountain through the townsite to its confluence with the Rio Grande.

2.5 Cultural Surveys

As required by the National Historic Preservation Act of 1966 (as amended), a cultural resource survey was conducted at OU 1106 during the summer of 1991 (LANL 1992, 01-0037). The methods and techniques used for this survey conform to those specified in the Secretary of the Interior's standards and guidelines for archeology and historic preservation.

There are no archeological sites in the area of MDA V eligible for inclusion in the National Register of Historic Places under Criterion D.

3.0 APPROACH TO DATA ASSESSMENT AND ANALYSES

The decision approach used for MDA B (PRS 21-015) 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 and radiological analysis and chain-of-custody documentation are submitted to the sample management office (SMO), the MRAL, 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 sufficiency 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, thus indicating that the laboratories can be paid. 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 analysis and for those nonroutine analyses for which clearly defined limits have been established.

The focused data validation process addresses those characteristics of the data (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 Evaluation of Inorganic Chemical Data

The purpose of background comparisons is to determine if chemicals that have natural or anthropogenic background distributions should be retained as chemicals of potential concern (COPCs) or eliminated from further consideration. Background data for decision-making concerning the PRS in this RFI report are from the following source:

- "Natural Background Geochemistry and Statistical Analysis of Selected Soil Profiles, Sediments, and Bandelier Tuff, Los Alamos, New Mexico;" 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, 1266);

Comparisons between site data and background data are initially performed by comparing each observed concentration datum with a chemical-specific background screening value. Chemical-specific 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 and 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, Los Alamos, New Mexico" (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.

If a chemical has a reported concentration that exceeds its background screening value, or fails other statistical background comparison tests (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 background screening value, then that chemical is removed from further consideration. At MDA B, chemicals that lack background data include silver.

Further statistical tests are used for background comparisons when sufficient data are available. When site data contain several nondetects and/or do not appear to satisfy normality assumptions, nonparametric tests are used for further background comparisons. The Gehan modification to the Wilcoxon Rank Sum test and the Quantile test, both of which account for nondetects, are used for these evaluations. The Gehan test is best suited for assessing complete shifts in distribution in a statistically robust manner, whereas the Quantile test is better suited for assessing shifts of a subset of the data. Between the two tests most types of differences between distributions can be captured. Detailed information on selecting statistical tests is presented in the guidance document, "Application of LANL Background Data to ER Project Decision-Making, Part I: Inorganics, EM/ER:96-PCT-010" (Project Consistency Team, 1210; Ryti et al. 1996, 1298). Observed significance levels (p-values) for these tests are presented in Section 5.1.5 of this report. If a p-value is less than a specified probability, typically 0.05 or 5%, then there is some reason to suspect that there is a difference between the background and site distributions; otherwise, no difference is indicated. The results of these statistical tests, when available, are used in addition to the results of the comparison with background screening values to determine if a chemical appears to be greater than background.

3.3 Evaluation of Radiochemical Data

It is important to ensure that the radiochemical data reported are properly evaluated before use in the decision process. Comparing acquired radiochemical results with minimum detectable activities and background data is necessary to determine the presence of radionuclides and to distinguish concentrations of radionuclides associated with Laboratory operations from those attributable to global fallout and/or to naturally occurring radionuclides.

The LANL ER Project requires that radiochemical data be reported by a laboratory on the basis of a detection test. Therefore, as part of the data validation/data assessment, reported results must be evaluated to ensure that only those results that represent detections be used to classify a radionuclide as a COPC. This is typically done by comparing the reported value with the associated minimum detectable activity if one is reported. When the minimum detectable activity is not available or does not meet the data quality needs of the ER Project, the reported value will be tested against an estimated minimum detectable activity. This estimated value is based on instrument counting error. The counting error is typically reported as the analytical uncertainty at a value of 1-sigma (one standard deviation), and the estimated minimum detectable activity is computed as 3-sigma.

Detected radionuclides are retained as COPCs or eliminated from further consideration based on a comparison to natural or anthropogenic background distributions. Radionuclide background data for decision-making concerning the PRS in this RFI report are from the following sources:

- soil, sediment, and tuff samples collected throughout Los Alamos County for which chemical analyses were performed for certain naturally occurring radioactive chemicals (Longmire et al. 1995, 1142; 1995, 1266). MDA B soil samples collected from fill and Units 3 and 2 of the Tshirege Member of the Bandelier Tuff were analyzed for radionuclides.

- background concentrations of radioactive chemicals associated with global fallout from atmospheric nuclear testing (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 radionuclide-specific background screening value which is the UTL or the maximum reported activity. These background screening values are not derived from the TA-21 specific (baseline) data but instead are derived from LANL-wide soil, sediment, and/or tuff background data. Details on the calculation of these values are presented in Longmire et al. (1995, 1266). Certain radionuclides in certain media have no LANL-wide background data. For these exceptions, PRS sample-specific minimum detectable activities are used as nominal background screening values.

3.4 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.

3.5 Human Health

3.5.1 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 to 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 evaluation. 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 one, then the chemicals are removed from further consideration. If the total normalized value is greater than one, then chemicals having an individual normalized value greater than or equal to 0.1 are retained as COPCs pending further evaluation.

Only those chemicals that exceed background concentration thresholds (certain inorganics and radionuclides), fail other background comparison tests, or exceed reporting limits (organics) in at least one sample are included in multiple chemical evaluations. These chemicals 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).

3.5.3 Risk Assessment

The human health risk assessment process consists of the following four steps:

- identification of chemicals of potential concern,
- exposure assessment,
- toxicity assessment, and
- risk characterization.

No human health risk assessment was conducted using only the surface data for MDA B (PRS 21-015). The decision regarding the need to conduct a risk assessment will be deferred until all the Phase I data (including subsurface data) are available.

3.6 Ecological

Los Alamos National Laboratory is developing a new approach for ecological risk assessment in cooperation with EPA Region 6 and the New Mexico Environment Department (NMED). Further discussion of ecological risk assessment methodology will be deferred until the ecological exposure unit methodology that is being developed is approved by the regulators.

4.0 RESULTS OF QUALITY ASSURANCE/QUALITY CONTROL ACTIVITIES

All samples were submitted with chain-of-custody documentation to the SCF or to the MRAL for analysis. Selected samples were analyzed for target analyte list (TAL) metals by graphite furnace atomic absorption (GFAA) (EPA SW-846 Method 7740), cold vapor atomic absorption (CVAA) (EPA SW-846 Method 7470), inductively coupled plasma mass spectroscopy (ICP/MS) (EPA SW-846 Method 6020), and inductively coupled plasma emission spectroscopy (ICPES) (EPA SW-846 Method 6010). The 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. SVOCs analyses were conducted using gas chromatography/mass spectroscopy (GC/MS), EPA SW-846 Method 8270 (Solvent Extraction/Direct Injection). Analyses for radioactive constituents were performed as follows: isotopic plutonium and americium-241 by alpha spectroscopy, total uranium by kinetic phosphorescence analysis (KPA), strontium-90 by gas-flow proportional counting, tritium by liquid scintillation, and actinium-227 and cesium-137 by gamma spectroscopy. For the analyses conducted in the MRAL, percent moisture analyses were conducted using a Denver Instruments IR100 Moisture Analyzer™, tritium analyses were performed using liquid scintillation counting, gross alpha and gross beta analyses were conducted using a gas flow proportional counting technique, and gross gamma, actinium-227, and cesium-137 analyses were conducted using a Bicron 5 x 7 in. sodium iodide well counter.

All data from the analytical laboratories were validated. Ten percent of the data were validated at the highest level (level 3). All other data were validated using a level 1 or level 2 validation. Data validation levels are defined in "Health and Environmental Chemistry: Quality Assurance Program Plan" (Gladney and Gautier 1991, 0410). When there were specific questions concerning data from a level 1 or 2 validation, a level 3 validation was performed. Validation was performed using the guidelines from the LANL ER program, "Generic Quality Assurance Project Plan for RCRA Facility Investigations" (LANL 1991, 0412). All QA/QC results are summarized in Appendix B.

As a result of QA/QC activities, qualifiers are added to the data when necessary as part of routine data validation activities. The following is a list of the qualifiers used in this RFI report and their definitions.

J = Estimated quantity. The analyte was detected in the sample, but there were one or more QC parameters associated with this sample that were outside allowed limits.

UJ =Estimated undetected quantity. The analyte was not detected in the sample, but there were one or more QC parameters associated with this sample that were outside allowed limits.

R = Rejected quantity. The data are deemed not usable because one or more of the QC parameters for the analyte were outside allowed limits to the point that the analyte value is highly questionable.

There can be many reasons for qualifying analytical data. For example, there is a set of sample-specific QC parameters that can cause analytes from individual samples to be qualified, such as surrogate recoveries or duplicate results. There are also batch-specific parameters, such as blind QC samples and method blanks, that affect all of the samples analyzed in a particular group. Often, the quantity of QA/QC data available for site-specific investigations is inadequate for estimating components of measurement error because statistics cannot be defined for sample sizes of one, or estimated well with small sample sizes. Consequently, QA/QC data for site-specific investigations are rarely used to adjust data.

4.1 RFI Phase I Data Review

4.1.1 Inorganic Analyses

Ninety-seven samples were analyzed for TAL metals under eleven separate requests (18496, 18721, 18723, 18724, 18744, 18746, 18748, 19210, 19220, 19336, and 20172). Four requests, 18723, 18744, 18748, and 19210, had no data quality problems. The issues for each of the other requests are discussed below.

For request 18496, all selenium results are qualified as estimated quantities, or J, for a high recovery in the QC blind sample. The results for sodium are qualified either J or estimated undetected quantities, UJ, for low recovery in the QC blind sample. All other data are acceptable as reported.

For request 18721, all arsenic and zinc results are qualified J or UJ for a low recovery in the matrix spike sample. The results for aluminum, chromium, and vanadium are qualified J or UJ for low recovery in the QC blind samples. All other data are acceptable as reported.

For request 18724, all aluminum, chromium, and vanadium results are qualified J or UJ for low recovery in the QC blind samples. The mercury data are also qualified UJ or J for missing the holding time, as discussed below. All other data are acceptable as reported.

For request 18746, all results for aluminum, chromium, iron, and vanadium are qualified J or UJ for low recovery in the QC blind samples. All other data are acceptable as reported.

For request 19336, all antimony results are qualified UJ for low recovery in the matrix spike and QC blind samples. The mercury data are also qualified UJ or J for missing the holding time, as discussed below. All other data are acceptable as reported.

For requests 18724, 19336, 19220, and 20172, the soil samples were analyzed well beyond the 28-day holding time for mercury. The mercury data for these requests are qualified in FIMAD as rejected, or R, for exceeding the holding time. However, the results for mercury are considered acceptable for the following reasons.

1. The holding time is based on unpreserved water samples, and all samples were surface soil samples or water QC samples associated with the soil samples.
2. Surface soil samples are less likely to undergo the biotransformation from elemental mercury to organomercury compounds than water samples because of the nature of the soil samples.
3. The samples were kept refrigerated until analyzed, thereby reducing the rates of chemical reactions.
4. The site stopped receiving waste in 1948 and was capped in 1966. Therefore, any mercury biotransformation that occurred in the soil after samples were collected would be insignificant when compared to 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 mercury data are qualified J or UJ and used with the understanding that the results are possibly biased low. All other data are acceptable as reported for these requests unless specified otherwise above.

4.1.2 Organic Analyses

Four field blank samples were analyzed for VOCs under requests 18174, 18312, 18374, and 18558. There were no QC problems with the request.

Ninety-five samples were analyzed for SVOCs under eleven requests (18174, 18236, 18237, 18266, 18281, 18312, 18360, 18374, 18483, 18558, and 18814). There were minor QC problems with requests 18174, 18236, 18312, 18374, 18483, 18558, and 18814 that did not result in data qualification. The data qualified in requests 18237, 18266, 18281, and 18360 are discussed below.

For request 18237, there were recoveries of less than 10% in the QC blind sample for phenol and 2-methylphenol. Therefore, these analytes are qualified R in the samples associated with this request. All other data are acceptable as reported.

For request 18266, sample AAB6979 missed the holding time by seven days. All results for this sample are qualified UJ. All other data are acceptable as reported.

For request 18281, sample AAA6792 surrogate recoveries for the acid fraction were less than 10%. All acid fraction results for this sample are qualified R. All other data are acceptable as reported.

For report 18360, all results for 2-methylphenol are qualified R because of a false negative result in the QC blind sample. In addition, samples AAB7020 and AAB7024 missed the holding time by five days. All results for these samples are qualified UJ. All other data are acceptable as reported.

4.1.3 Radiochemical Analyses

Ninety-two samples were analyzed for percent moisture, tritium, strontium, actinium-227, cesium-137, americium-241, isotopic plutonium, and total uranium under ten separate requests (19041, 19053. 19091, 19150, 19346, 19351, 19353, 19356, 19495, 19981, and 19857). For four requests (19041, 19053, 19091, and 19981) all QC parameters were within allowed limits and all data are valid without qualification. The data qualified in the remaining requests are discussed below.

For request 19149, there were several QC parameters that were outside acceptable limits. The gamma spectroscopy data are all qualified J because the QC blind, laboratory control, and duplicate samples all showed results outside of acceptable limits. The isotopic plutonium results are all 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 19150, there were several QC parameters that were outside acceptable limits. The gamma spectroscopy data are all qualified J because the QC blind and laboratory control samples all showed results outside acceptable limits. The americium-241 results are all qualified J because of low tracer and low QC blind sample results. In addition, all strontium-90 results are qualified J because of high QC blind sample results. All other data are acceptable as reported.

For request 19346, all results for americium-241, strontium-90, and tritium are qualified J for a possible low bias indicated by the QC blind samples. In addition, the tracer recovery for plutonium, indicated a possible low bias for samples AAB6986, AAB6990, AAB6706, and AAB6708. All other data are acceptable as reported.

For request 19351, all results for plutonium-238, plutonium-239, strontium-90, and total uranium are qualified J because of low QC blind sample results. All other data are acceptable as reported.

For request 19353, all results for plutonium-239, strontium-90, and total uranium are qualified J because of low QC blind sample results. All other data are acceptable as reported.

For request 19356, all results for strontium-90 and total uranium are qualified J because of low QC blind sample results. All other data are acceptable as reported.

For request 19495, all results for plutonium-238, plutonium-239, strontium-90, and total uranium are qualified J because of low QC blind sample results. All tritium results are qualified J because of low matrix spike sample results. All other data are acceptable as reported.

In requests 19346, 19351, and 19353, several samples had reported values for thorium-228 (a daughter of thorium-232) between 3 and 7 pCi/g, well above the SAL (0.77 pCi/g for thorium-232). However, the validity of these values are greatly suspect for the following reasons.

1. Thorium-228 is very difficult to detect using gamma spectroscopy because of its low-energy, infrequent gamma rays (the most frequent gamma ray has an abundance of 1% and an energy of 84.4 keV).

2. The peak used for the identification of thorium-228 (84.4 kev) has many interferences from other naturally occurring radionuclides (thorium 231 and lead isotopes).

3. The other peak used in the identification of thorium-228 (216.0 keV) was not found in any of the samples.

4. Assuming secular equilibrium, the daughters of thorium-232 (lead-212, thallium-208, radium-224, and thorium-228) should have the same activity as the parent. However, all daughter activities (other than thorium-228) are near the expected background of 1 pCi/g for thorium-232 and its daughters.

5. There were large errors (40–50% using 1 sigma) associated with the detection of thorium-228, which adds uncertainty in the identification of the isotope.

Because of the above-mentioned difficulties in the detection of thorium-228, all reported values for thorium-228 will be changed to less than values and qualified UJ for a possible high bias.

4.2 1990 Environmental Surveillance Data Review

Environmental surveillance data were collected at MDA B in 1990. Out of a total of 220 samples collected, 164 were analyzed for a variety of radiological constituents. Radiological constituents and the methods by which they were analyzed included gross gamma radiation using gamma spectroscopy, tritium using liquid scintillation, cesium-137 using gamma spectroscopy, americium-241 using gamma spectroscopy (G) or alpha spectroscopy (RAS), total uranium using delayed neutron activation analysis (DNA) or ICP/MS, plutonium-239 using alpha spectroscopy, strontium-90 using gas-proportional counting, and uranium-235/uranium-238 ratio using ICP/MS.

The first batch of 89 samples (locations 1-39 and 41-90) was submitted under request 10806. There were only two minor QC problems with this entire request. One of nine QC samples for cesium-137 in one report and one of nine QC samples for strontium-90 in one report had low recoveries. Because in both cases eight QC samples were within allowed limits, none of the data are qualified and all data are considered valid.

The second batch of samples (locations 131-143, 167-180, 185-191 and 213-220) was submitted under request 11276. The only QC problem associated with this request was that one of two plutonium-239 QC samples had a high recovery. Because of the high recovery, all plutonium values are qualified J for a possible high bias. All other data are valid and usable without qualification.

The third batch of samples (locations 122-130 and 181-184) was submitted under request 11516. No analyses for tritium and strontium-90 were performed under this request. All QC were within allowed limits and all data are valid and usable without qualification.

The last batch of samples (locations 152-155, 157-164, 166, and 192-198) were submitted under request 13467. No analyses for tritium, strontium-90, cesium-137, or uranium-235/uranium 238 were performed under this request. All QC were within allowed limits and all data are valid and usable without qualification.

5.0 SPECIFIC RESULTS, CONCLUSIONS, AND RECOMMENDATIONS

5.1 MDA B (PRS 21-015)

MDA B (PRS 21-015) is a former MDA that served as a waste repository for TA-21. A Phase I subsurface investigation is planned for the site, and the sampling and analysis plan has been prepared and submitted to NMED for review and approval. This investigation is currently planned to begin in fiscal year 1998.

5.1.1 History

MDA B (PRS 21-015) is described in detail in Section 16.2.1 of the TA-21 Operable Unit RFI Work Plan (LANL 1991, 0689). Based on historical records, the waste buried in the pits at MDA B probably included radioactively contaminated paper, rags, rubber gloves, glassware, small and large metal apparatus, and at least one truck contaminated with fission products from the Trinity test. The radioactive contaminants probably included plutonium, polonium, uranium, americium, curium, actinium, lanthanum, and possibly strontium. The chemicals buried at the east end of the site probably included organic compounds, perchlorates, ethers, solvents, and corrosive gases.

5.1.2 Description

MDA B (PRS 21-015) is located on the west end of DP Mesa and its drainage is south into BV Canyon. MDA B consists of at least four pits containing buried waste and at least one trench for chemical disposal.

5.1.3 Previous Investigations

In October 1990, MDA B was surveyed and sampled intensively for surface radionuclide contamination by LANL's Environmental Surveillance Group (Fig. 5.1.3-1). The area was surveyed using gamma radiation detectors. Samples were collected on a 34 x 34 ft grid (and at two areas in the western section, on a 10 x 10 ft grid) and analyzed for plutonium-238, plutonium 239/240, cesium-137, strontium-90, americium-241, tritium, and total uranium.

5.1.4 Field Investigation

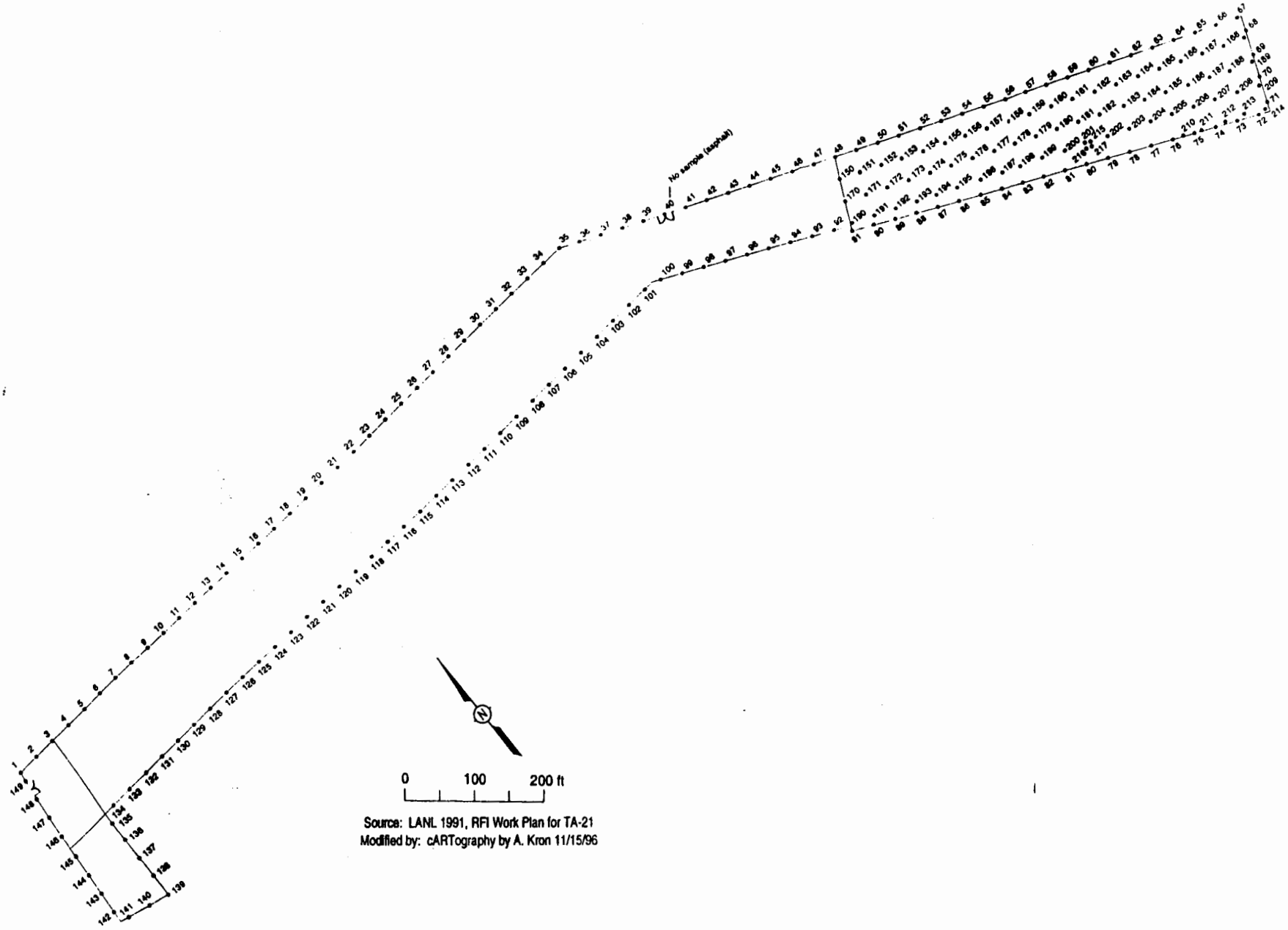
Sampling locations for MDA B are shown in Fig. 5.1.4-1 and summarized in Table 5.1.4-1. The field activities at MDA B and its drainage deviated from the activities planned in the TA-21 Operable Unit RFI Work Plan as follows.

- The sampling grid was changed because the number of samples required in the TA-21 Operable Unit RFI Work Plan (LANL 1991, 0689) was based on an incorrectly drawn map. Toward the end of the sampling period it wa discovered that there were more than the expected number of locations an that too few samples had been planned. To ensure that an adequate number of samples were taken near the western end of MDA B, samples were collected only at grid locations where the radiological survey indicated increased radiation.

- Analyses of VOCs were mistakenly omitted. In the TA-21 Operable Unit RFI Work Plan, seven soil sample [illegible] near the approximate location of the chemical disposal trenc[illegible] [illegible]stern end of [illegible] analyzed for VOCs (LANL [illegible], 068[illegible]). No soil samples were analyzed for VOCs.

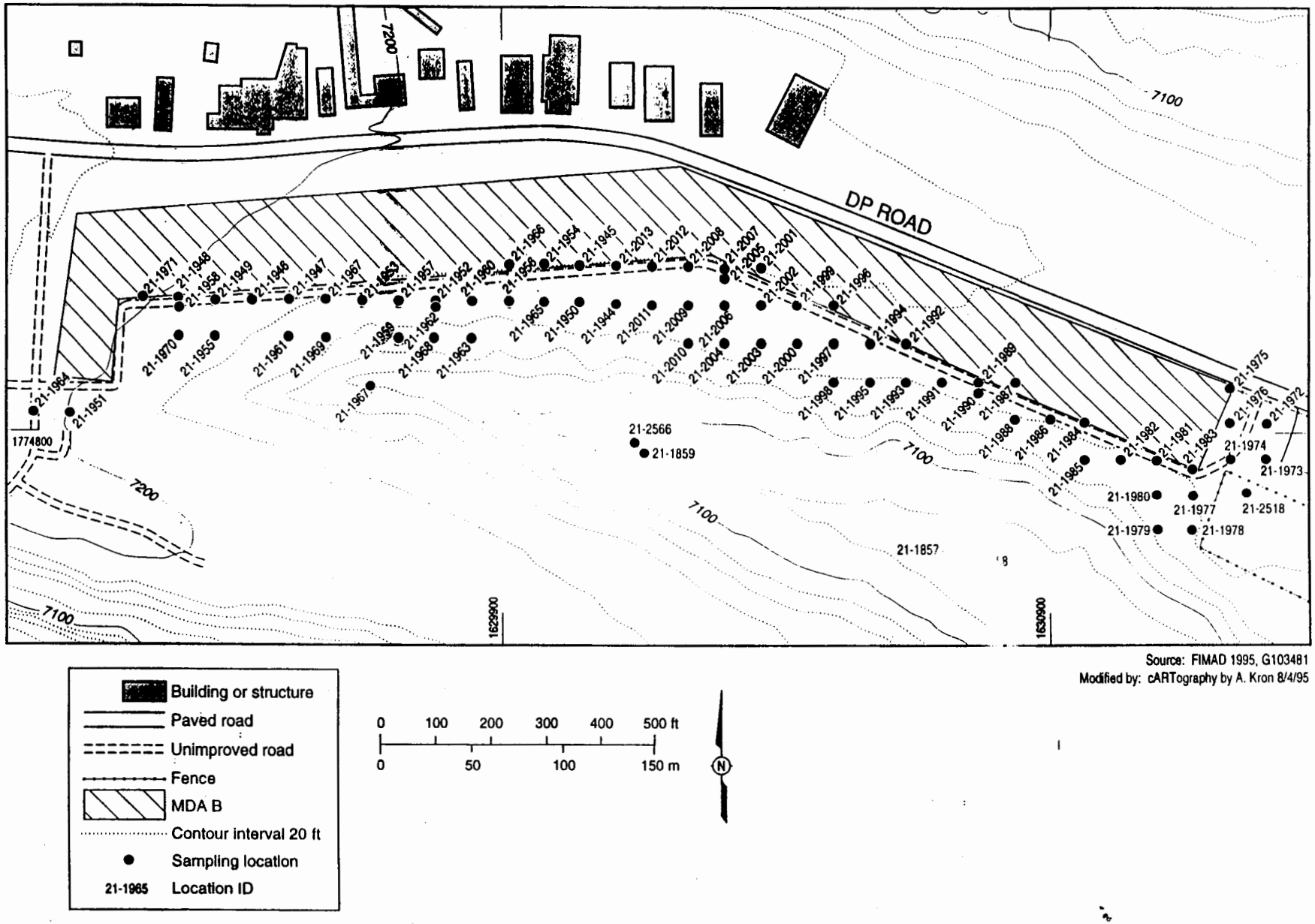
- Analyses for total uranium were not requested for all samples. In the TA-21 Operable Unit RFI Work Plan, all soil samples were to be analyzed for total uranium (LANL 1991, 0689) Total uranium analysis was originally requested on only 11 samples from MDA B. Additional total uranium analyses were subsequently requested, received, and reviewed for this report.

- A radiological survey using a long-range alpha detection (LRAD) system was added to the field surveying that had been planned in the TA-21 Operable Unit RFI Work Plan (LANL 1991, 0689).



Source: LANL 1991, RFI Work Plan for TA-21
Modified by: cARTography by A. Kron 11/15/96

Fig. 5.1.3-1. Fall 1990 surface soils sampling plan at MDA B. These samples were collected as part of the low-level radioactive waste surveillance program..



Source: FIMAD 1995, G103481
Modified by: cARTography by A. Kron 8/4/95

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

TABLE 5.1.4-1

SUMMARY OF 1994 SAMPLES COLLECTED AT MDA B (PRS 21-015)

LOCATION ID	SAMPLE ID	DEPTH (in.)	MATRIX	ANALYTICAL REQUEST NUMBER			
				TAL METALS	RADIO-NUCLIDES	SVOCs	VOCs
21-1857	AAA7501	0–3	Soil	x	x	x	
21-1857	AAA7502	3–6	Soil	x	x	x	
21-1857	AAA7503	6–12	Soil	x	x	x	
21-1858	AAA7504	0–3	Soil	x	x	x	
21-1858	AAA7505	3–6	Soil	x	x	x	
21-1858	AAA7506	6–12	Soil	x	x	x	
21-1859	AAA7507	0–3	Soil	x	x	x	
21-1859	AAA7508	3–6	Soil	x	x	x	
21-1859	AAA7509	6–12	Soil	x	x	x	
21-2566	AAB7269	0–3	Soil	x	x	x	
21-2566	AAB7270	3–6	Soil	x	x	x	
21-2566	AAB7271	6–12	Soil	x	x	x	
21-2567	AAB7272	0–3	Soil	x	x	x	
21-2567	AAB7273	3–6	Soil	x	x	x	
21-2567	AAB7274	6–12	Soil	x	x	x	
NA	AAB7412		Field Blank				x
21-1944	AAB6946	0–6	Soil	x	x	x	
NA	AAB7028		Field Blank				x
21-1945	AAB6947	0–6	Soil	x	x	x	
21-1946	AAB6948	0–6	Soil	x	x	x	
21-1947	AAB6949	0–6	Soil	x	x	x	
21-1948	AAB6950	0–6	Soil	x	x	x	
21-1949	AAB6951	0–6	Soil	x	x	x	
21-1950	AAB6952	0–6	Soil	x	x	x	
21-1951	AAB6953	0–6	Soil	x	x	x	
21-1952	AAB6954	0–6	Soil	x	x	x	
21-1953	AAB6955	0–6	Soil	x	x	x	
21-1954	AAB6956	0–6	Soil	x	x	x	
21-1955	AAB6957	0–6	Soil	x	x	x	
21-1956	AAB6958	0–6	Soil	x	x	x	
21-1957	AAB6959	0–6	Soil	x	x	x	
21-1958	AAB6960	0–6	Soil	x	x	x	
21-1959	AAB6961	0–6	Soil	x	x	x	
	AAB7016	0–6	Field Duplicate	x	x	x	
21-1960	AAB6962	0–6	Soil	x	x	x	

TABLE 5.1.4-1 (CONTINUED)

SUMMARY OF 1994 SAMPLES COLLECTED AT MDA B (PRS 21-015)

LOCATION ID	SAMPLE ID	DEPTH (in.)	MATRIX	ANALYTICAL REQUEST NUMBER			
				TAL METALS	RADIO-NUCLIDES	SVOCs	VOCs
	AAB7024		Field Rinsate	x	x	x	
21-1961	AAB6963	0–6	Soil	x	x	x	
21-1962	AAB6964	0–6	Soil	x	x	x	
21-1963	AAB6965	0–6	Soil	x	x	x	
21-1964	AAB6966	0–6	Soil	x	x	x	
21-1965	AAB6967	0–6	Soil	x		x	
21-1966	AAB6968	0–6	Soil			x	
21-1967	AAB6969	0–6	Soil				
21-1968	AAB6970	0–6	Soil	x	x	x	
21-1969	AAB6971	0–6	Soil	x	x	x	
21-1970	AAB6972	0–6	Soil	x	x	x	
21-1971	AAB6973	0–6	Soil	x	x	x	
21-1972	AAB6974	0–6	Soil	x	x	x	
21-1973	AAB6975	0–6	Soil	x	x	x	
21-1974	AAB6976	0–6	Soil	x	x	x	
21-1975	AAB6977	0–6	Soil	x	x	x	
21-1976	AAB6978	0–6	Soil	x	x	x	
	AAB7017		Field Duplicate	x	x	x	
21-1977	AAB6979	0–6	Soil	x	x	x	
	AAB7021		Equipment Blank	x	x	x	
	AAB7025		Field Rinsate	x	x	x	
21-1978	AAB6980	0–6	Soil	x	x	x	
21-1979	AAB6981	0–6	Soil	x	x	x	
21-1980	AAB6982	0–6	Soil	x	x	x	
21-1981	AAB6983	0–6	Soil	x	x	x	
21-1982	AAB6984	0–6	Soil	x	x	x	
21-1983	AAB6985	0–6	Soil	x	x	x	
21-1984	AAB6986	0–6	Soil	x	x	x	
21-1985	AAB6987	0–6	Soil	x	x	x	
21-1986	AAB6988	0–6	Soil	x	x	x	
21-1987	AAB6989	0–6	Soil	x	x	x	
21-1988	AAB6990	0–6	Soil	x	x	x	
21-1989	AAB6991	0–6	Soil	x	x	x	

TABLE 5.1.4-1 (CONTINUED)

SUMMARY OF 1994 SAMPLES COLLECTED AT MDA B (PRS 21-015)

LOCATION ID	SAMPLE ID	DEPTH (in.)	MATRIX	ANALYTICAL REQUEST NUMBER			
				TAL METALS	RADIO-NUCLIDES	SVOCs	VOCs
21-1990	AAB6992	0–6	Soil	x	x	x	
21-1991	AAB6993	0–6	Soil	x	x	x	
21-1992	AAB6994	0–6	Soil	x	x	x	
21-1993	AAB6995	0–6	Soil	x	x	x	
	AAB7018		Field Duplicate	x	x	x	
21-1994	AAB6996	0–6	Soil	x	x	x	
	AAB7022		Equipment Blank	x	x	x	
	AAB7026		Field Rinsate	x	x	x	
21-1995	AAB6997	0–6	Soil	x	x	x	
21-1996	AAB6998	0–6	Soil	x	x	x	
21-1997	AAB6999	0–6	Soil	x	x	x	
21-1998	AAB7000	0–6	Soil	x	x	x	
21-1999	AAB7001	0–6	Soil	x	x	x	
21-2000	AAB7002	0–6	Soil	x	x	x	
21-2001	AAB7003	0–6	Soil	x	x	x	
21-2002	AAB7004	0–6	Soil	x	x	x	
21-2003	AAB7005	0–6	Soil	x	x	x	
21-2004	AAB7006	0–6	Soil	x	x	x	
21-2005	AAB7007	0–6	Soil	x	x	x	
21-2006	AAB7008	0–6	Soil	x	x	x	
21-2007	AAB7009	0–6	Soil	x	x	x	
21-2008	AAB7010	0–6	Soil	x	x	x	
21-2009	AAB7011	0–6	Soil	x	x	x	
21-2010	AAB7012	0–6	Soil	x	x	x	
	AAB7019	0–6	Field Duplicate	x	x	x	
21-2011	AAB7013	0–6	Soil	x	x	x	
	AAB7023		Equipment Blank	x	x	x	
	AAB7027		Field Rinsate	x	x	x	
21-2012	AAB7014	0–6	Soil	x	x	x	
21-2013	AAB7015	0–6	Soil	x	x	x	
NA	AAB7401		Field Blank				x
NA	AAB7411		Field Blank				x

- The number of QA/QC samples collected at MDA B was revised. The TA-21 Operable Unit RFI Work Plan (LANL 1991, 0689) called for three rinsate blanks, three field blanks, one trip blank, four field duplicates, and six replicates (off-grid samples). The actual number of QA/QC samples submitted for analysis was four rinsate blanks, four field blanks, three trip blanks, four field duplicates, and five off-grid samples.

- Drainages were sampled at finer intervals than the 0- to 6-in. interval, the 6- to 12-in. interval, and the 12- to 18-in. interval called for in the TA-21 Operable Unit RFI Work Plan [illegible] instead at the 0- to 3-in. interval and the 3- to 6-in. interval and the 6- to 12-in. interval to ensure that potentially contaminated soil at the surface was not diluted by deeper uncontaminated soil (12- to 18-in. depth). A geomorphic study at TA-21 indicated that sediments deeper than 12 in. would have been deposited in the drainages before 1040 (Broxton and Eller 1995, 1162).

5.1.4.1 Results of Field Surveys

Results of the radiological survey of MDA B are summarized below.

- Using a FIDLER G-5 sodium iodide scintillation detector, the field crew identified five locations where levels of low-energy gamma radiation were greater than the upper limit of background.

- Using a Ludlum 44-10 sodium iodide detector, the field crew identified 38 locations where levels of high-energy gamma radiation were greater than the upper limit of background.

- Using a Ludlum 12 ratemeter with a pancake GM detector, the field crew identified 38 locations where levels of beta/gamma radiation were greater than the upper limit of background.

- Using a Ludlum 139 survey meter with a proportional detector, the field crew identified five locations where levels of alpha radiation were greater than the upper limit of background.

- Using a Ludlum 19 sodium iodide micro R meter, the field crew identified 15 locations where levels of gamma radiation were greater than the upper limit of background.
- Using a Ludlum 43-1 zinc sulfide detector, the field crew identified four locations where levels of alpha radiation were greater than the upper limit of background.

Although many locations had radiation levels greater than background, these levels were less than twice the upper limit of background and the results of radionuclide analyses at these locations are not expected to be elevated.

Results of the LRAD radiological survey conducted on the paved area of MDA B are described in 1995 documentation (Bounds 1995, 01-0014). All measurements were less than the natural background activity expected in soil on Los Alamos mesa tops. A group of four measurements on the east side of the parking area had values higher than the other measurements (as much as twice the mean background level), however. Investigators suggest this may represent contamination of 100 dpm/100 cm^2 or less above background. There are no soil samples with which analytical results can be correlated.

5.1.4.2 Results of Field Screening

Field screening at MDA B. Results of soil samples field-screened for radiation by the field crew showed that 51 samples had beta/gamma radiation levels greater than the upper limit of background. Only six samples had alpha radiation levels greater than the upper limit of background. In all cases, these levels were less than twice the upper limit of background.

Results of soil samples field-screened for radiation in the MRAL showed no indication of increased radioactivity.

At MDA B, field screening for radiation by the field crew and in the MRAL suggest that radionuclide analytical results should not be greater than background levels.

Field Screening at the MDA B Drainage. Results of soil samples field-screened for radiation by the field crew showed that beta/gamma radiation levels were at or greater than the upper limit of background; however, in all samples radiation levels were less than twice the upper limit of background. In addition, five samples showed alpha radiation at levels ranging from one to five counts per minute (as compared to background levels of zero counts per minute for the instrument).

Results of soil samples field-screened for radiation in the MRAL showed no indication of increased radioactivity.

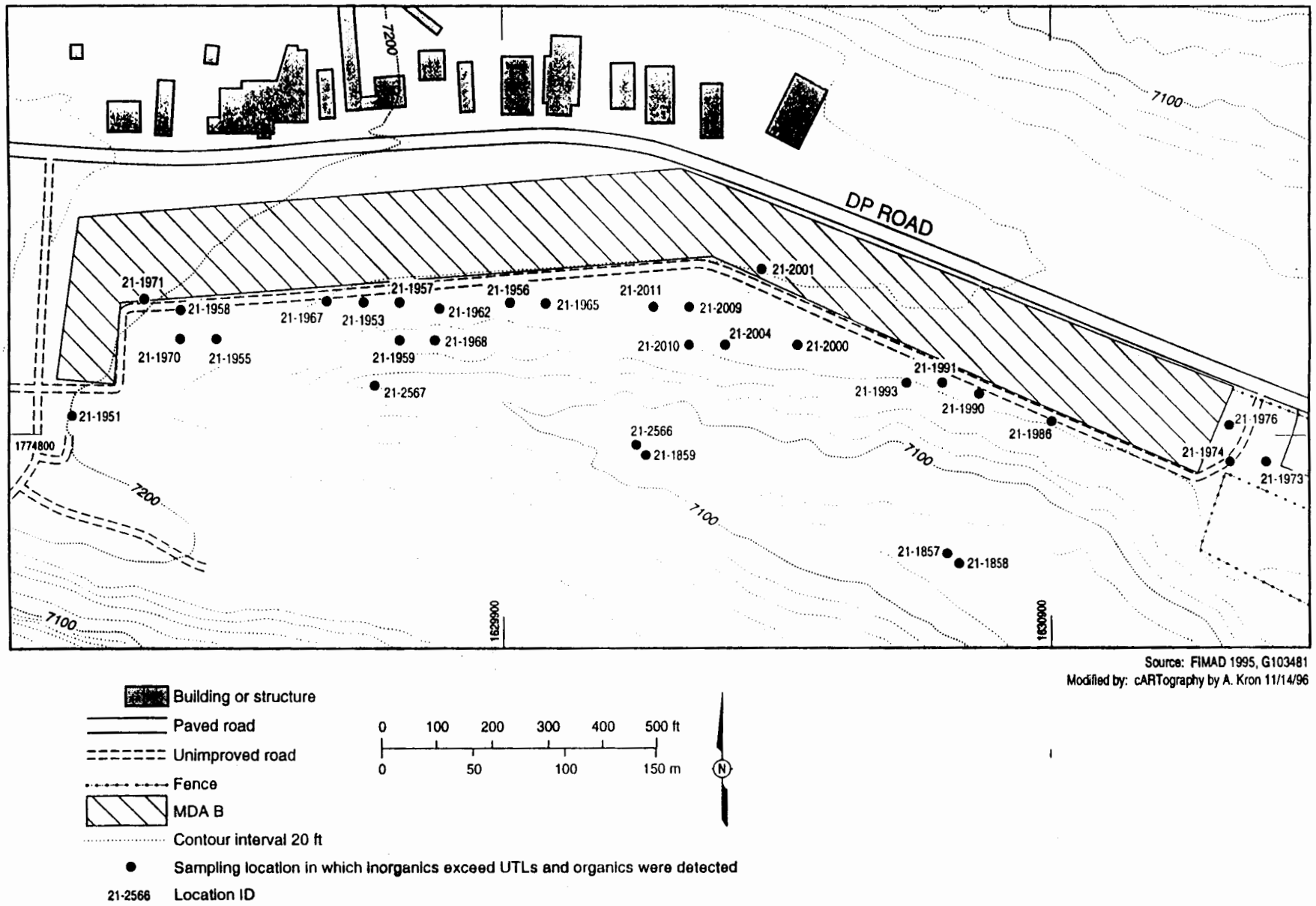
At the MDA B drainage, field screening for radiation by the field crew and in the MRAL suggest that because these results were not markedly elevated, radionuclide analytical results should not be greater than background levels.

5.1.5 Background Comparisons

Background UTLs for LANL surface soils have been calculated for many inorganics and radionuclides. All COPCs with corresponding UTLs were compared to these background thresholds. Background data for the industrialized Laboratory area surface soils specific to DP Mesa have also been collected. However, this data was not used in the screening assessment.

5.1.5.1 Inorganics

Inorganic COPCs with one or more observed value that exceeds the respective background UTL are presented in Table 5.1.5-1 and shown in Fig. 5.1.5-1. Beryllium, lead, manganese, mercury, silver, and zinc are the inorganic COPCs that were observed at values above their respective UTLs. Beryllium and manganese were observed at values greater than their respective UTLs in only one sample. Further comparisons to LANL-wide background data were conducted through the use of the statistical tests recommended in "Statistical Comparisons to Background, Part I" (Environmental Restoration Project Assessments Council 1995, 1218). The Gehan modification to the Wilcoxon Rank Sum test, the Quantile test, and the Slippage test all account reasonably for nondetected data and avoid assumptions of normality in the data. These tests provide measures of shifts between distributions, thus capturing any significant difference between the site data and LANL background data. Observed significance levels (p-values) less than some small probability, typically 0.05, indicate a difference between the distributions being compared. P-values greater than the set threshold (0.05) imply that no difference is observed. The results of these analyses show that the beryllium and manganese observed in the surface soil samples at MDA B are not different from LANL background. Therefore, beryllium and manganese should not be considered COPCs. The p-values for these chemicals are presented in Table 5.1.5-2.



Source: FIMAD 1995, G103481
Modified by: cARTography by A. Kron 11/14/96

Fig. 5.1.5-1. Locations of detected organics and inorganic chemicals greater than UTLs at MDA B.

Lead, mercury, and zinc each were elevated above UTLs in several samples and will be carried forward in the screening assessment to the SAL comparison step because at least two p-values were less than 0.05 from the three statistical tests. Table 5.1.5-2 presents the p-values for these chemicals. Silver, which does not have a UTL, was detected in at least one sample and will be carried forward in the screening assessment process. No other inorganic chemicals were detected at levels above background.

TABLE 5.1.5-1

MDA B SOIL CONCENTRATIONS FOR INORGANICS WITH VALUES GREATER THAN LOS ALAMOS BACKGROUND CONCENTRATIONS

ANALYTE	LOCATION ID	SAMPLE ID	DEPTH (in.)	UTL [a] (mg/kg)	SAL [b] (mg/kg)	SAMPLE VALUE (mg/kg)
Beryllium	21-1857	AAA7501	0 - 3	1.95	NA[c]	5.04
Lead	21-1955	AAB6957	0 - 6	23.3	400	40.4
Lead	21-2566	AAB7271	6 -12	23.3	400	40.9
Lead	21-2566	AAB7270	3 - 6	23.3	400	41.8
Lead	21-2010	AAB7012	0 - 6	23.3	400	42
Lead	21-1971	AAB6973	0 - 6	23.3	400	46.2
Lead	21-2011	AAB7013	0 - 6	23.3	400	51.6
Lead	21-1859	AAA7507	0 - 3	23.3	400	52.7
Lead	21-1957	AAB6959	0 - 6	23.3	400	54.7
Lead	21-1859	AAA7508	3 - 6	23.3	400	56.6
Lead	21-1858	AAA7505	3 - 6	23.3	400	38.6
Lead	21-2566	AAB7269	0 - 3	23.3	400	38.5
Lead	21-1857	AAA7501R[d]	0 - 3	23.3	400	38
Lead	21-1857	AAA7501	0 - 3	23.3	400	33.9
Lead	21-1857	AAA7502	3 - 6	23.3	400	33.6
Lead	21-1858	AAA7506	6 - 12	23.3	400	33.6
Lead	21-1986	AAB6988	0 - 6	23.3	400	32.1
Lead	21-1968	AAB6970	0 - 6	23.3	400	31.5
Lead	21-1859	AAA7509R[d]	6 - 12	23.3	400	31.5
Lead	21-1967	AAB6969	0 - 6	23.3	400	31.4
Lead	21-1953	AAB6955	0 - 6	23.3	400	31.2
Lead	21-2009	AAB7011	0 - 6	23.3	400	29.7
Lead	21-1858	AAA7504	0 - 3	23.3	400	28.5
Lead	21-2004	AAB7006	0 - 6	23.3	400	27.8
Lead	21-1859	AAA7509	6 - 12	23.3	400	27.4
Lead	21-2010	AAB7019	0 - 6	23.3	400	27.4
Lead	21-2567	AAB7274	6 - 12	23.3	400	27.3
Lead	21-1991	AAB6993	0 - 6	23.3	400	26.6
Lead	21-1962	AAB6964	0 - 6	23.3	400	25.8
Lead	21-1990	AAB6992	0 - 6	23.3	400	24.8
Lead	21-1965	AAB6967	0 - 6	23.3	400	24.7
Lead	21-1956	AAB6958	0 - 6	23.3	400	24.6
Lead	21-1973	AAB6975	0 - 6	23.3	400	23.8

TABLE 5.1.5-1 (CONTINUED)

MDA B SOIL CONCENTRATIONS FOR INORGANICS WITH VALUES GREATER THAN LOS ALAMOS BACKGROUND CONCENTRATIONS

ANALYTE	LOCATION ID	SAMPLE ID	DEPTH (in.)	UTL [a] (mg/kg)	SAL [b] (mg/kg)	SAMPLE VALUE (mg/kg)
Lead	21-1970	AAB6972	0 - 6	23.3	400	23.6
Lead	21-1993	AAB7018	0 - 6	23.3	400	23.6
Lead	21-1959	AAB7016	0 - 6	23.3	400	23.4
Manganese	21-1858	AAA7505	3 - 6	714	NA	759
Mercury	21-1976	AAB7017	0 - 6	0.1	23	0.12
Mercury	21-1974	AAB6976	0 - 6	0.1	23	0.19
Mercury	21-2566	AAB7269	0 - 3	0.1	23	0.21
Mercury	21-2566	AAB7270	3 - 6	0.1	23	0.26
Mercury	21-1859	AAA7509	6 - 12	0.1	23	0.27
Mercury	21-1859	AAA7509	6 - 12	0.1	23	0.33
Mercury	21-1858	AAA7504	0 - 3	0.1	23	0.35
Mercury	21-1857	AAA7501	0 - 3	0.1	23	0.45
Mercury	21-2566	AAB7271	6 - 12	0.1	23	0.45
Mercury	21-1857	AAA7502	3 - 6	0.1	23	0.46
Mercury	21-1857	AAA7501	0 - 3	0.1	23	0.53
Mercury	21-1858	AAA7505	3 - 6	0.1	23	0.55
Mercury	21-1857	AAA7503	6 - 12	0.1	23	0.57
Mercury	21-1858	AAA7506	6 - 12	0.1	23	0.58
Mercury	21-1859	AAA7507	0 - 3	0.1	23	0.67
Mercury	21-1859	AAA7508	3 - 6	0.1	23	0.88
Silver	21-1859	AAA7508	3 - 6	NA	380	16.5
Silver	21-2566	AAB7270	3 - 6	NA	380	3.4
Silver	21-2566	AAB7271	6 - 12	NA	380	9.4
Silver	21-2566	AAB7269	0 - 3	NA	380	3
Silver	21-1859	AAA7509R[d]	6 - 12	NA	380	11.8
Silver	21-1859	AAA7509	6 - 12	NA	380	8.3
Zinc	21-1859	AAA7507	0 - 3	50.8	23 000	129
Zinc	21-1859	AAA7508	3 - 6	50.8	23 000	131
Zinc	21-1967	AAB6969	0 - 6	50.8	23 000	137
Zinc	21-1857	AAA7501R[d]	0 - 3	50.8	23 000	99.9
Zinc	21-1857	AAA7502	3 - 6	50.8	23 000	87.4
Zinc	21-2566	AAB7270	3 - 6	50.8	23 000	83.2
Zinc	21-2566	AAB7271	6 - 12	50.8	23 000	81.8
Zinc	21-1858	AAA7506	6 - 12	50.8	23 000	80.8

TABLE 5.1.5-1 (CONTINUED)

MDA B SOIL CONCENTRATIONS FOR INORGANICS WITH VALUES GREATER THAN LOS ALAMOS BACKGROUND CONCENTRATIONS

ANALYTE	LOCATION ID	SAMPLE ID	DEPTH (in.)	UTL [a] (mg/kg)	SAL [b] (mg/kg)	SAMPLE VALUE (mg/kg)
Zinc	21-1857	AAA7501	0 - 3	50.8	23 000	80.2
Zinc	21-1858	AAA7505	3 - 6	50.8	23 000	78.8
Zinc	21-2566	AAB7269	0 - 3	50.8	23 000	73.8
Zinc	21-1957	AAB6959	0 - 6	50.8	23 000	66.3
Zinc	21-2000	AAB7002	0 - 6	50.8	23 000	65
Zinc	21-1859	AAA7509R[d]	6 - 12	50.8	23 000	62.1
Zinc	21-2001	AAB7003	0 - 6	50.8	23 000	61.8
Zinc	21-1858	AAA7504	0 - 3	50.8	23 000	61.4
Zinc	21-1971	AAB6973	0 - 6	50.8	23 000	60.7
Zinc	21-1859	AAA7509	6 - 12	50.8	23 000	60
Zinc	21-1953	AAB6955	0 - 6	50.8	23 000	54.2
Zinc	21-1986	AAB6988	0 - 6	50.8	23 000	53.1

[a] UTL = Upper tolerance limit.
[b] SAL = Screening action level.
[c] NA = Not applicable.
[d] Replicate sample.

TABLE 5.1.5-2

STATISTICAL TESTS FOR BACKGROUND COMPARISONS

CHEMICAL	GEHAN TEST (p-values)	QUANTILE TEST (p-values)	SLIPPAGE TEST (p-values)
Beryllium	1	1	0.3507
Lead	0	0	0
Manganese	1	1	1
Zinc	0.1[illegible]	0.0158	

5.1.5.2 Radionuclides

Background UTLs (derived from LANL-wide data but not from TA-21 specific data) are available for ten of the radionuclides that were analyzed; eight of those (americium-241, cesium-137, plutonium-238, plutonium-239, strontium-90, total uranium, uranium-235, and potassium-40) exceeded their respective LANL-wide UTLs in at least one sample (Table 5.1.5-3). Potassium-40 is a naturally occurring substance and is not known to have been used anywhere on DP Mesa. Because the presence of potassium-40 is not related to current or historical activities at the site, it will not be considered further in this screening assessment. The 17 radionuclides that do not have calculated background levels are compared to their screening action levels in Section 5.1.7.1, along with the seven remaining radionuclides that exceeded LANL-wide UTLs.

The environmental surveillance data collected in 1990 from MDA B includes several observations above background levels for americium-241, cesium-137, plutonium-238, and uranium. These values are reported in Table 5.1.5-4. Plutonium-239 was also observed at concentrations above background in the 1990 data. All samples taken from the perimeter of MDA B had reported plutonium-239 values that were greater than the LANL-wide UTL.

TABLE 5.1.5-3

RADIONUCLIDES WITH CONCENTRATIONS ABOVE BACKGROUND

ANALYTE	LOCATION ID	SAMPLE ID	DEPTH (in.)	UTL[a] (pCi/g)	SAL[b] (pCi/g)	SAMPLE VALUE (pCi/g)
Americium-241	21-1990	AAB6992	0 - 6	0.336	22	0.5239
Cesium-137	21-1991	AAB6993	0 - 6	1.4	5.1	1.556
Cesium-137	21-2009	AAB7011	0 - 6	1.4	5.1	1.5789
Cesium-137	21-1968	AAB6970	0 - 6	1.4	5.1	1.62
Cesium-137	21-1990	AAB6992	0 - 6	1.4	5.1	1.879
Cesium-137	21-1998	AAB7000	0 - 6	1.4	5.1	2.1887
Cesium-137	21-2004	AAB7006	0 - 6	1.4	5.1	3.0977
Plutonium-238	21-1966	AAB6968	0 - 6	0.014	27	0.0141
Plutonium-238	21-1859	AAA7508	3 - 6	0.014	27	0.0146
Plutonium-238	21-1960	AAB6962	0 - 6	0.014	27	0.0177
Plutonium-238	21-1991	AAB6993	0 - 6	0.014	27	0.0203
Plutonium-238	21-1990	AAB6992	0 - 6	0.014	27	0.0223
Plutonium-238	21-1965	AAB6967	0 - 6	0.014	27	0.0253
Plutonium-238	21-1971	AAB6973	0 - 6	0.014	27	0.0349
Plutonium-238	21-1957	AAB6959	0 - 6	0.014	27	0.048
Plutonium-238	21-2007	AAB7009	0 - 6	0.014	27	0.05
Plutonium-238	21-2001	AAB7003	0 - 6	0.014	27	0.06
Plutonium-238	21-2012	AAB7014	0 - 6	0.014	27	0.06
Plutonium-239	21-1981	AAB6983	0 - 6	0.052	24	0.059
Plutonium-239	21-1976	AAB6978	0 - 6	0.052	24	0.06
Plutonium-239	21-2567	AAB7273	3 - 6	0.052	24	0.0698
Plutonium-239	21-1961	AAB6963	0 - 6	0.052	24	0.0733
Plutonium-239	21-1948	AAB6950	0 - 6	0.052	24	0.081
Plutonium-239	21-2567	AAB7272	0 - 3	0.052	24	0.0897
Plutonium-239	21-1983	AAB6985	0 - 6	0.052	24	0.09
Plutonium-239	21-1961	AAB6963	0 - 6	0.052	24	0.0901
Plutonium-239	21-2010	AAB7012	0 - 6	0.052	24	0.1
Plutonium-239	21-2010	AAB7019	0 - 6	0.052	24	0.1
Plutonium-239	21-2567	AAB7274	6 - 12	0.052	24	0.1226
Plutonium-239	21-1972	AAB6974	0 - 6	0.052	24	0.1279
Plutonium-239	21-1947	AAB6949	0 - 6	0.052	24	0.1369
Plutonium-239	21-1945	AAB6947	0 - 6	0.052	24	0.154
Plutonium-239	21-1985	AAB6987	0 - 6	0.052	24	0.1759
Plutonium-239	21-1951	AAB6953	0 - 6	0.052	24	0.2475
Plutonium-239	21-1996	AAB6998	0 - 6	0.052	24	0.258

TABLE 5.1.5-3 (CONTINUED)

RADIONUCLIDES WITH CONCENTRATIONS ABOVE BACKGROUND

ANALYTE	LOCATION ID	SAMPLE ID	DEPTH (in.)	UTL[a] (pCi/g)	SAL[b] (pCi/g)	SAMPLE VALUE (pCi/g)
Plutonium-239	21-1963	AAB6965	0 - 6	0.052	24	0.2618
Plutonium-239	21-1955	AAB6957	0 - 6	0.052	24	0.2724
Plutonium-239	21-1973	AAB6975	0 - 6	0.052	24	0.275
Plutonium-239	21-1982	AAB6984	0 - 6	0.052	24	[illegible]
Plutonium-239	21-1970	AAB6972	0 - 6	[illegible]	[illegible]	[illegible]
Plutonium-239	21-2000	AAB7002	0 - 6	[illegible]	24	0.3
Plutonium-239	21-2007	AAB7009	0 - 6	0.052	24	0.3
Plutonium-239	21-2013	AAB7015	0 - 6	0.052	24	0.3046
Plutonium-239	21-2002	AAB7004	0 - 6	0.052	24	0.4
Plutonium-239	21-1984	AAB6986	0 - 6	0.052	24	0.4025
Plutonium-239	21-1997	AAB6999	0 - 6	0.052	24	0.408
Plutonium-239	21-1974	AAB6976	0 - 6	0.052	24	0.414
Plutonium-239	21-1971	AAB6973	0 - 6	0.052	24	0.4419
Plutonium-239	21-1977	AAB6979	0 - 6	0.052	24	0.536
Plutonium-239	21-1950	AAB6952	0 - 6	0.052	24	0.5375
Plutonium-239	21-1949	AAB6951	0 - 6	0.052	24	0.5946
Plutonium-239	21-1952	AAB6954	0 - 6	0.052	24	0.6094
Plutonium-239	21-1977	AAB6979	0 - 6	0.052	24	0.62
Plutonium-239	21-1993	AAB7018	0 - 6	0.052	24	0.6271
Plutonium-239	21-1986	AAB6988	0 - 6	0.052	24	0.6782
Plutonium-239	21-1998	AAB7000	0 - 6	0.052	24	0.7
Plutonium-239	21-1979	AAB6981	0 - 6	0.052	24	0.729
Plutonium-239	21-1993	AAB6995	0 - 6	0.052	24	0.7418
Plutonium-239	21-1968	AAB6970	0 - 6	0.052	24	0.7726
Plutonium-239	21-1995	AAB6997	0 - 6	0.052	24	0.773
Plutonium-239	21-2566	AAB7270	3 - 6	0.052	24	0.7955
Plutonium-239	21-1999	AAB7001	0 - 6	0.052	24	0.8
Plutonium-239	21-1944	AAB6946	0 - 6	0.052	24	0.8248
Plutonium-239	21-1954	AAB6956	0 - 6	0.052	24	0.8276
Plutonium-239	21-1988	AAB6990	0 - 6	0.052	24	0.8755
Plutonium-239	21-1959	AAB6961	0 - 6	0.052	24	0.8832
Plutonium-239	21-2005	AAB7007	0 - 6	0.052	24	0.9
Plutonium-239	21-2006	AAB7008	0 - 6	0.052	24	0.9
Plutonium-239	21-1978	AAB6980	0 - 6	0.052	24	0.913
Plutonium-239	21-1980	AAB6982	0 - 6	0.052	24	0.915

TABLE 5.1.5-3 (CONTINUED)

RADIONUCLIDES WITH CONCENTRATIONS ABOVE BACKGROUND

ANALYTE	LOCATION ID	SAMPLE ID	DEPTH (in.)	UTL[a] (pCi/g)	SAL[b] (pCi/g)	SAMPLE VALUE (pCi/g)
Plutonium-239	21-1962	AAB6964	0 - 6	0.052	24	0.9311
Plutonium-239	21-1857	AAA7503	6 - 12	0.052	24	0.9715
Plutonium-239	21-1987	AAB6989	0 - 6	0.052	24	0.9865
Plutonium-239	21-1989	AAB6991	0 - 6	0.052	24	1.034
Plutonium-239	21-2566	AAB7271	6 - 12	0.052	24	1.076
Plutonium-239	21-1953	AAB6955	0 - 6	0.052	24	1.104
Plutonium-239	21-1858	AAA7504	0 - 3	0.052	24	1.157
Plutonium-239	21-1859	AAA7509	6 - 12	0.052	24	1.18
Plutonium-239	21-1992	AAB6994	0 - 6	0.052	24	1.184
Plutonium-239	21-1859	AAA7509	6 - 12	0.052	24	1.22
Plutonium-239	21-1967	AAB6969	0 - 6	0.052	24	1.222
Plutonium-239	21-1966	AAB6968	0 - 6	0.052	24	1.263
Plutonium-239	21-2566	AAB7269	0 - 3	0.052	24	1.284
Plutonium-239	21-1857	AAA7501	0 - 3	0.052	24	1.315
Plutonium-239	21-1857	AAA7502	3 - 6	0.052	24	1.336
Plutonium-239	21-1956	AAB6958	0 - 6	0.052	24	1.397
Plutonium-239	21-2009	AAB7011	0 - 6	0.052	24	1.4
Plutonium-239	21-1858	AAA7506	6 - 12	0.052	24	1.561
Plutonium-239	21-1858	AAA7505	3 - 6	0.052	24	1.686
Plutonium-239	21-1958	AAB6960	0 - 6	0.052	24	1.714
Plutonium-239	21-1944	AAB6946	0 - 6	0.052	24	1.755
Plutonium-239	21-1857	AAA7501	0 - 3	0.052	24	1.761
Plutonium-239	21-1990	AAB6992	0 - 6	0.052	24	1.804
Plutonium-239	21-1859	AAA7507	0 - 3	0.052	24	1.876
Plutonium-239	21-1991	AAB6993	0 - 6	0.052	24	1.962
Plutonium-239	21-1994	AAB6996	0 - 6	0.052	24	2.001
Plutonium-239	21-1965	AAB6967	0 - 6	0.052	24	2.132
Plutonium-239	21-1959	AAB7016	0 - 6	0.052	24	2.152
Plutonium-239	21-2008	AAB7010	0 - 6	0.052	24	2.2
Plutonium-239	21-2011	AAB7013	0 - 6	0.052	24	2.3
Plutonium-239	21-2012	AAB7014	0 - 6	0.052	24	3
Plutonium-239	21-1957	AAB6959	0 - 6	0.052	24	3.603
Plutonium-239	21-1960	AAB6962	0 - 6	0.052	24	3.742
Plutonium-239	21-2001	AAB7003	0 - 6	0.052	24	4.7
Plutonium-239	21-2003	AAB7005	0 - 6	0.052	24	5.1

TABLE 5.1.5-3 (CONTINUED)

RADIONUCLIDES WITH CONCENTRATIONS ABOVE BACKGROUND

ANALYTE	LOCATION ID	SAMPLE ID	DEPTH (in.)	UTL[a] (pCi/g)	SAL[b] (pCi/g)	SAMPLE VALUE (pCi/g)
Plutonium-239	21-1859	AAA7508	3 - 6	0.052	24	5.331
Plutonium-239	21-2004	AAB7006	0 - 6	0.052	24	6.6
Strontium-90	21-1955	AAB6957	0 - 6	1	4.4	1.6
Strontium-90	21-1999	AAB7001	0 - 6	1	4.4	[illegible]
Strontium-90	21-200[illegible]	[illegible]	0 - 6	1	4.4	[illegible]
Strontium-90	21-200[illegible]	[illegible]B7004	[illegible] - 6	1	4.4	[illegible]
Strontium-90	21-20[illegible]	AAB7005	0 - 6	1	4.4	2
Strontium-90	21-20[illegible]	AAB7009	0 - 6	1	4.4	2
Strontium-90	21-2008	AAB7010	0 - 6	1	4.4	2
Strontium-90	21-2009	AAB7011	0 - 6	1	4.4	2
Strontium-90	21-2010	AAB7012	0 - 6	1	4.4	2
Strontium-90	21-2011	AAB7013	0 - 6	1	4.4	2
Strontium-90	21-2012	AAB7014	0 - 6	1	4.4	2
Strontium-90	21-2012	AAB7014	0 - 6	1	4.4	2
Strontium-90	21-2010	AAB7019	0 - 6	1	4.4	2
Strontium-90	21-2010	AAB7019	0 - 6	1	4.4	2
Strontium-90	21-2005	AAB7007	0 - 6	1	4.4	2.1
Strontium-90	21-1964	AAB6966	0 - 6	1	4.4	2.18
Strontium-90	21-2000	AAB7002	0 - 6	1	4.4	2.4
Strontium-90	21-2006	AAB7008	0 - 6	1	4.4	2.6
Strontium-90	21-2004	AAB7006	0 - 6	1	4.4	3
Strontium-90	21-1998	AAB7000	0 - 6	1	4.4	8
Uranium	21-2566	AAB7269	0 - 3	5.45	230	5.46
Uranium	21-1857	AAA7501R[c]	0 - 3	5.45	230	5.58
Uranium	21-1859	AAA7508	3 - 6	5.45	230	5.59
Uranium	21-1857	AAA7502	3 - 6	5.45	230	5.92
Uranium	21-1859	AAA7509	6 - 12	5.45	230	6
Uranium	21-1992	AAB6994	0 - 6	5.45	230	6.01
Uranium	21-2567	AAB7274	6 - 12	5.45	230	6.13
Uranium	21-1859	AAA7507	0 - 3	5.45	230	6.3
Uranium	21-1859	AAA7509	6 - 12	5.45	230	6.67
Uranium	21-1950	AAB6952	0 - 6	5.45	230	7.21
Uranium	21-1993	AAB6995	0 - 6	5.45	230	7.82
Uranium	21-1944	AAB6946	0 - 6	5.45	230	8.64
Uranium	21-1944	AAB6946	0 - 6	5.45	230	9.08

TABLE 5.1.5-3 (CONTINUED)

RADIONUCLIDES WITH CONCENTRATIONS ABOVE BACKGROUND

ANALYTE	LOCATION ID	SAMPLE ID	DEPTH (in.)	UTL[a] (pCi/g)	SAL[b] (pCi/g)	SAMPLE VALUE (pCi/g)
Uranium	21-1945	AAB6947	0 - 6	5.45	230	9.68
Uranium	21-1991	AAB6993	0 - 6	5.45	230	11.1
Uranium-235	21-1976	AAB6978	0 - 6	0.084	10	0.11
Uranium-235	21-1984	AAB6986	0 - 6	0.084	10	0.1113
Uranium-235	21-1976	AAB7017	0 - 6	0.084	10	0.14
Uranium-235	21-2001	AAB7003	0 - 6	0.084	10	0.142
Uranium-235	21-1950	AAB6952	0 - 6	0.084	10	0.1492
Uranium-235	21-1955	AAB6957	0 - 6	0.084	10	0.1701
Uranium-235	21-2005	AAB7007	0 - 6	0.084	10	0.1731
Uranium-235	21-1992	AAB6994	0 - 6	0.084	10	0.1892
Uranium-235	21-1975	AAB6977	0 - 6	0.084	10	0.19
Uranium-235	21-1983	AAB6985	0 - 6	0.084	10	0.21
Uranium-235	21-1991	AAB6993	0 - 6	0.084	10	0.2143
Uranium-235	21-2002	AAB7004	0 - 6	0.084	10	0.2666
Uranium-235	21-1859	AAA7507	0 - 3	0.084	10	0.2696
Uranium-235	21-1973	AAB6975	0 - 6	0.084	10	0.27
Uranium-235	21-1982	AAB6984	0 - 6	0.084	10	0.29
Uranium-235	21-2004	AAB7006	0 - 6	0.084	10	0.3458
Uranium-235	21-1979	AAB6981	0 - 6	0.084	10	0.36
Uranium-235	21-1997	AAB6999	0 - 6	0.084	10	0.36
Uranium-235	21-1978	AAB6980	0 - 6	0.084	10	0.37
Uranium-235	21-1977	AAB6979	0 - 6	0.084	10	0.38
Uranium-235	21-1994	AAB6996	0 - 6	0.084	10	0.4
Uranium-235	21-1996	AAB6998	0 - 6	0.084	10	0.4
Uranium-235	21-1980	AAB6982	0 - 6	0.084	10	0.44
Uranium-235	21-1995	AAB6997	0 - 6	0.084	10	0.54

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

TABLE 5.1.5-4

RADIONUCLIDES WITH CONCENTRATIONS ABOVE BACKGROUND FOR 1990 DATA

ANALYTE	LOCATION ID	SAMPLE ID	UTL[a] (pCi/g)	SAL[b] (pCi/g)	SAMPLE VALUE (pCi/g)
Americium-241	46	TA-21 B #46	0.336	22	0.42
Americium-241	45	TA-21 B #45	0.336	22	0.42
Americium-241	103	B-030891-103	0.336	22	0.44
Americium-241	83	TA-21 B #83	0.336	22	0.57
Americium-241	92	B-030891-92	0.336	22	0.76
Americium-241	44	TA-21 B #44	0.336	22	0.94
Americium-241	50	TA-21 B #50	0.336	22	1.11
Americium-241	43	TA-21 B #43	0.3[illegible]	[illegible]2	1.14
Americium-241	115	B-030891-115	0.3[illegible]	[illegible]	2.2
Americium-241	41	TA-21 B #41	0.336	22	3
Cesium-137	15	TA-21 B #15	1.4	5.1	10.1
Cesium-137	16	TA-21 B #16	1.4	5.1	46.4
Cesium-137	36	TA-21 B #36	1.4	5.1	1.54
Plutonium-238	12	TA-21 B #12	0.014	27	0.019
Plutonium-238	13	TA-21 B #13	0.014	27	0.023
Plutonium-238	18	TA-21 B #14	0.014	27	0.025
Plutonium-238	20	TA-21 B #20	0.014	27	0.015
Plutonium-238	21	TA-21 B #21	0.014	27	0.0548
Plutonium-238	22	TA-21 B #22	0.014	27	0.0252
Plutonium-238	23	TA-21 B #23	0.014	27	0.2
Plutonium-238	25	TA-21 B #25	0.014	27	0.0144
Plutonium-238	31	TA-21 B #31	0.014	27	0.0229
Plutonium-238	32	TA-21 B #32	0.014	27	0.065
Plutonium-238	33	TA-21 B #33	0.014	27	0.017
Plutonium-238	34	TA-21 B #34	0.014	27	0.0167
Plutonium-238	36	TA-21 B #36	0.014	27	0.024
Plutonium-238	37	TA-21 B #37	0.014	27	0.0146
Plutonium-238	38	TA-21 B #38	0.014	27	0.0175
Plutonium-238	39	TA-21 B #39	0.014	27	0.0499
Plutonium-238	41	TA-21 B #41	0.014	27	0.48
Plutonium-238	42	TA-21 B #42	0.014	27	0.0656
Plutonium-238	43	TA-21 B #43	0.014	27	0.0892
Plutonium-238	44	TA-21 B #44	0.014	27	0.11
Plutonium-238	45	TA-21 B #45	0.014	27	0.0313
Plutonium-238	46	TA-21 B #46	0.014	27	0.0562

TABLE 5.1.5-4 (CONTINUED)

RADIONUCLIDES WITH CONCENTRATIONS ABOVE BACKGROUND FOR 1990 DATA

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

TABLE 5.1.5-4 (CONTINUED)

RADIONUCLIDES WITH CONCENTRATIONS ABOVE BACKGROUND FOR 1990 DATA

ANALYTE	LOCATION ID	SAMPLE ID	UTL[a] (pCi/g)	SAL[b] (pCi/g)	SAMPLE VALUE (pCi/g)
Plutonium-239	6	TA-21 B #6	0.052	24	1.04
Plutonium-239	7	TA-21 B #7	0.052	24	1.8
Plutonium-239	8	TA-21 B #8	0.052	24	5.97
Plutonium-239	9	TA-21 B #9	0.052	24	0.679
Plutonium-239	1[illegible]	TA-21 B #10	0.052	24	[illegible]
Plutonium-239	11	[illegible] #11	0.052	24	1.33
Plutonium-239	12	TA-21 B #12	0.052	24	3.31
Plutonium-239	13	TA-21 B #13	0.052	24	3.18
Plutonium-239	14	TA-21 B #14	0.052	24	0.756
Plutonium-239	15	TA-21 B #15	0.052	24	1.56
Plutonium-239	16	TA-21 B #16	0.052	24	0.702
Plutonium-239	17	TA-21 B #17	0.052	24	0.39
Plutonium-239	18	TA-21 B #18	0.052	24	1.8
Plutonium-239	19	TA-21 B #19	0.052	24	2.34
Plutonium-239	20	TA-21 B #20	0.052	24	2.5
Plutonium-239	21	TA-21 B #21	0.052	24	9.38
Plutonium-239	22	TA-21 B #22	0.052	24	4.57
Plutonium-239	23	TA-21 B #23	0.052	24	8.2
Plutonium-239	24	TA-21 B #24	0.052	24	0.95
Plutonium-239	25	TA-21 B #25	0.052	24	1.23
Plutonium-239	26	TA-21 B #26	0.052	24	0.0803
Plutonium-239	27	TA-21 B #27	0.052	24	0.813
Plutonium-239	28	TA-21 B #28	0.052	24	0.465
Plutonium-239	29	TA-21 B #29	0.052	24	1.16
Plutonium-239	31	TA-21 B #31	0.052	24	1.85
Plutonium-239	32	TA-21 B #32	0.052	24	6.77
Plutonium-239	33	TA-21 B #33	0.052	24	2
Plutonium-239	34	TA-21 B #34	0.052	24	1.64
Plutonium-239	35	TA-21 B #35	0.052	24	0.495
Plutonium-239	36	TA-21 B #36	0.052	24	2.17
Plutonium-239	36	TA-21 B #36	0.052	24	2.34
Plutonium-239	37	TA-21 B #37	0.052	24	2.42
Plutonium-239	38	TA-21 B #38	0.052	24	6.39
Plutonium-239	39	TA-21 B #39	0.052	24	11.9
Plutonium-239	41	TA-21 B #41	0.052	24	87.2

TABLE 5.1.5-4 (CONTINUED)

RADIONUCLIDES WITH CONCENTRATIONS ABOVE BACKGROUND FOR 1990 DATA

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

TABLE 5.1.5-4 (CONTINUED)

RADIONUCLIDES WITH CONCENTRATIONS ABOVE BACKGROUND FOR 1990 DATA

ANALYTE	LOCATION ID	SAMPLE ID	UTL[a] (pCi/g)	SAL[b] (pCi/g)	SAMPLE VALUE (pCi/g)
Plutonium-239	78	TA-21 B #78	0.052	24	0.479
Plutonium-239	79	TA-21 B #79	0.052	24	0.332
Plutonium-239	80	TA-21 B #80	0.05[illegible]	24	0.45[illegible]
Plutonium-239	81	TA-21 B #81	0.05[illegible]	24	[illegible]
Plutonium-239	82	TA-21 B #82	0.0[illegible]	24	1.53
Plutonium-239	83	TA-21 B #83	0.052	24	1.93
Plutonium-239	84	TA-21 B #84	0.052	24	0.194
Plutonium-239	85	TA-21 B #85	0.052	24	0.181
Plutonium-239	86	TA-21 B #86	0.052	24	0.291
Plutonium-239	87	TA-21 B #87	0.052	24	0.088
Plutonium-239	88	TA-21 B #88	0.052	24	0.0671
Plutonium-239	89	TA-21 B #89	0.052	24	0.681
Plutonium-239	90	TA-21 B #90	0.052	24	1.6
Plutonium-239	91	B-030891-91	0.052	24	2.67
Plutonium-239	92	B-030891-92	0.052	24	4.33
Plutonium-239	93	B-030891-93	0.052	24	10.8
Plutonium-239	94	B-030891-94	0.052	24	0.38
Plutonium-239	95	B-030891-95	0.052	24	0.464
Plutonium-239	96	B-030891-96	0.052	24	0.71
Plutonium-239	97	B-030891-97	0.052	24	0.95
Plutonium-239	98	B-030891-98	0.052	24	1.398
Plutonium-239	99	B-030891-99	0.052	24	27.992
Plutonium-239	100	B-030891-100	0.052	24	2.883
Plutonium-239	101	B-030891-101	0.052	24	0.95
Plutonium-239	102	B-030891-102	0.052	24	2.34
Plutonium-239	103	B-030891-103	0.052	24	5.528
Plutonium-239	104	B-030891-104	0.052	24	2.48
Plutonium-239	105	B-030891-105	0.052	24	2.041
Plutonium-239	107	B-030891-107	0.052	24	0.503
Plutonium-239	108	B-030891-108	0.052	24	0.27
Plutonium-239	109	B-030891-109	0.052	24	8.048
Plutonium-239	110	B-030891-110	0.052	24	0.105
Plutonium-239	111	B-030891-111	0.052	24	0.273
Plutonium-239	112	B-030891-112	0.052	24	4.267
Plutonium-239	113	B-030891-113	0.052	24	3.26

TABLE 5.1.5-4 (CONTINUED)

RADIONUCLIDES WITH CONCENTRATIONS ABOVE BACKGROUND FOR 1990 DATA

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

TABLE 5.1:5-4 (CONTINUED)

RADIONUCLIDES WITH CONCENTRATIONS ABOVE BACKGROUND FOR 1990 DATA

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

TABLE 5.1.5-4 (CONTINUED)

RADIONUCLIDES WITH CONCENTRATIONS ABOVE BACKGROUND FOR 1990 DATA

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

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

5.1.6 Evaluation of Organic Constituents

Background levels for organic chemicals are not currently available for the LANL area. As a preliminary screening, organics are compared to their reporting limits. The data for organic samples that were detected above the reporting limits are shown in Table 5.1.6-1. Nine polycyclic aromatic hydrocarbons (PAHs), including benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, chrysene, fluoranthene, indeno[1,2,3-cd]pyrene, phenanthrene, and pyrene, were detected at MDA B, all in sample AAB6953 at location 21-1951, which is located near a paved surface (Fig. 5.1.5-1). Bis(2-ethylhexyl)phthalate, butyl benzyl phthalate, and diethyl phthalate were also detected at low levels above the analytical method reporting limits in other samples. All twelve of these detected organic chemicals are carried forward in the screening assessment.

TABLE 5.1.6-1

MDA-B SOIL CONCENTRATIONS FOR DETECTED ORGANIC ANALYTES

ANALYTE	LOCATION ID	SAMPLE ID	DEPTH (in.)	SAL[a] (mg/kg)	SAMPLE VALUE (mg/kg)
Benzo[a]anthracene	21-1951	AAB6953	0–6	0.61	0.72
Benzo[a]pyrene	21-1951	AAB6953	0–6	0.061	0.65
Benzo[b]fluoranthene	21-1951	AAB6953	0–6	0.61	0.8
Benzo[k]fluoranthene	21-1951	AAB6953	0–6	6.1	0.4
Bis(2-ethylhexyl)phthalate	21-1958	AAB6960	0–6	32	0.52
Bis(2-ethylhexyl)phthalate	21-1956	AAB6958	0–6	32	0.92
Butyl benzyl phthalate	21-1956	AAB6958	0–6	13 000	0.5
Chrysene	21-1951	AAB6953	0–6	24	0.83
Diethyl phthalate	21-2000	AAB7002	0–6	52 000	90
Fluoranthene	21-1951	AAB6953	0–6	2 600	2
Indeno[1,2,3-cd]pyrene	21-1951	AAB6953	0–6	0.61	0.5
Phenanthrene	21-1951	AAB6953	0–6	NA[b]	1.3
Pyrene	21-1951	AAB6953	0–6	2 000	1.3

[a] SAL = Screening action level.
[b] NA = Not available.

5.1.7 Human Health Assessment

5.1.7.1 Screening Assessment

COPCs that were not eliminated in the background comparison were carried forward to be evaluated by comparison with human health SALs. The same data sets that were used for the UTL comparison (except COPCs eliminated in the UTL comparison) were used for the SALs comparison.

5.1.7.1.1 Analytes with Values Greater Than or Equal to SAL

The radionuclides cesium-137 and plutonium-239 were detected at concentrations above SALs in some samples from the 1990 environmental surveillance data. The radionuclides strontium-90 and radium-226 (which does not have a UTL), and the SVOCs benzo(a)pyrene, benzo[b]fluoranthene, and benzo[a]anthracene exceeded their respective SALs in some samples from the 1994 data (Tables 5.1.7-1 and 5.1.7-2). Sample locations corresponding to these data are shown in Fig. 5.1.7-1.

TABLE 5.1.7-1

RADIOLOGICAL CONSTITUENTS WITH CONCENTRATIONS GREATER THAN SAL

ANALYTE	LOCATION ID	SAMPLE ID	DEPTH (in.)	UTL[a] (pCi/g)	SAL[b] (pCi/g)	SAMPLE VALUE (pCi/g)
Radium-226	21-1973	AAB6975	0–6	NA[c]	0.1	0.83
Radium-226	21-1980	AAB6982	0–6	NA	0.1	1.17
Radium-226	21-1983	AAB6985	0–6	NA	0.1	1.3
Radium-226	21-1981	AAB6983	0–6	NA	0.1	[illegible]
Radium-226	21-1982	AAB6984	0–6	NA	[illegible]	[illegible]
Radium-226	21-1974	[illegible]	0–6	NA	0.1	36
Radium-226	21-1996	AAB6998	0–6	NA	0.1	1.4
Radium-226	21-1995	AAB6997	0–6	NA	0.1	1.42
Radium-226	21-1978	AAB6980	0–6	NA	0.1	1.43
Radium-226	21-1997	AAB6999	0–6	NA	0.1	1.52
Radium-226	21-1979	AAB6981	0–6	NA	0.1	1.59
Radium-226	21-1994	AAB6996R	0–6	NA	0.1	1.7
Radium-226	21-2000	AAB7002	0–6	NA	0.1	1.9239
Radium-226	21-1999	AAB7001	0–6	NA	0.1	2.3805
Radium-226	21-2003	AAB7005	0–6	NA	0.1	2.5093
Radium-226	21-2007	AAB7009	0–6	NA	0.1	2.7835
Radium-226	21-2006	AAB7008	0–6	NA	0.1	2.9747
Radium-226	21-2005	AAB7007	0–6	NA	0.1	3.0368
Radium-226	21-2008	AAB7010	0–6	NA	0.1	3.2984
Radium-226	21-2012	AAB7014	0–6	NA	0.1	3.3547
Radium-226	21-2002	AAB7004	0–6	NA	0.1	3.9527
Radium-226	21-2009	AAB7011	0–6	NA	0.1	4.8837
Radium-226	21-1998	AAB7000	0–6	NA	0.1	5.4805
Radium-226	21-2004	AAB7006	0–6	NA	0.1	5.9604
Radium-226	21-2001	AAB7003	0–6	NA	0.1	6.4437
Strontium-90	21-1998	AAB7000	0–6	1	4.4	8
Cesium-137	15	TA-21 B #15	0–1	1.4	5.1	10.1
Cesium-137	16	TA-21 B #16	0–1	1.4	5.1	46.4
Plutonium-239	99	B-030891-99	0–1	0.052	24	27.992
Plutonium-239	50	TA-21 B #50	0–1	0.052	24	58
Plutonium-239	41	TA-21 B #41	0–1	0.052	24	87.2

[a] UTL = Upper tolerance limit derived from LANL-wide data.
[b] SAL = Screening action level.
[c] NA = Not available.

TABLE 5.1.7-2

ORGANIC CONSTITUENTS WITH CONCENTRATIONS GREATER THAN SALs

ANALYTE	LOCATION ID	SAMPLE ID	DEPTH (in.)	SAL[a] (mg/kg)	SAMPLE VALUE (mg/kg)
Benzo[a]anthracene	21-1951	AAB6953	0–6	0.61	0.72
Benzo[a]pyrene	21-1951	AAB6953	0–6	0.061	0.65
Benzo[b]fluoranthene	21-1951	AAB6953	0–6	0.61	0.8

[a] SAL = Screening action level.

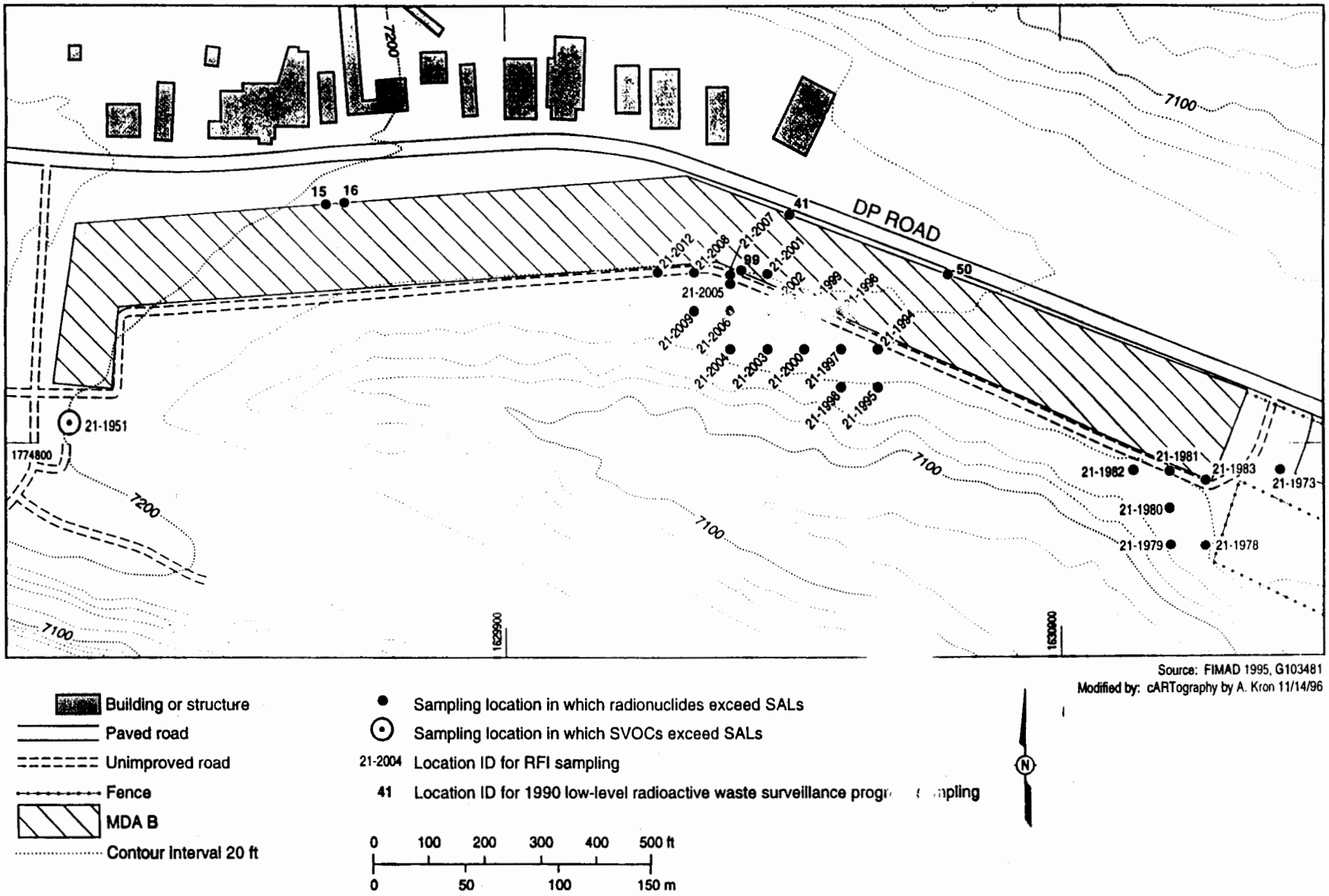


Fig. 5.1.7-1. Locations of radionuclides and SVOCs above SALs at MDA B.

5.1.7.1.2 Analytes Not Evaluated in SAL Comparisons

Five organic constituents, bis(2-chloroethyl)ether, dibenzo(a,h)anthracene, hexachlorobenzene, nitrosodi-n-propylamine [N-], and nitrosodimethylamine [N-], had reporting limits equal to or greater than SALs. These analytes were not detected, and based on available knowledge of historical operations, there is no reason to believe that any of these organic constituents were used on DP Mesa or that they would be present in surface soil as a result of disposal at MDA B. Therefore, none of these consitutents are considered further in this screening assessment.

One organic compound and sixteen radionuclides detected in MDA B surface soil had neither a UTL nor SAL value available for comparison.

Fifteen radionuclides (actinium-227, actinium-228, bismuth-211, bismuth-212, bismuth-214, lead-210, lead-211, lead-212, lead-214, protactinium-231, protactinium-234, protactinium-234m, radon-219, radium-224, and thallium-208) detected in MDA B soils had no UTL or SAL available for comparison. All of these radionuclides are formed during radioactive decay of other radionuclides (parent radionuclides). SALs are available for these parent radionuclides, and calculation of these SALs takes into consideration the dose that is contributed by the daughter radionuclides (for which neither SALs nor UTLs are available). Because the potential dose caused by these daughter radionuclides is accounted for in the SAL of the parent radionuclide, they are not considered COPCs themselves and are eliminated from further evaluation.

The sixteenth radionuclide detected in MDA B soil that had no UTL or SAL available for comparison is cobalt-57. This is a relatively short-lived chemical (with a half-life of approximately one year) that is not associated with activities at MDA B. Because MDA B stopped receiving waste in 1948 and was capped in 1966, this radionuclide cannot be associated with historical releases at MDA B. Given the relatively short half-life of cobalt-57, radioactive decay would long ago have reduced its concentration below measurable levels. In addition, this radionuclide is difficult to detect by gamma spectroscopy because the peak used for identification of cobalt-57 has interferences from naturally occurring radioncludes (europium-152, europium-152m, and radium-223). Therefore, cobalt-57 is eliminated from further evaluation.

Phenanthrene was the only detected organic constituent for which neither a background UTL nor a SAL value is available. Phenanthrene was identified in a single sample, AAB6953, at a concentration 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 2 000 mg/kg, indicating that the

measured concentrations of phenanthrene are unlikely to represent a human health threat if the toxicity of phenanthrene is assumed to be no greater than that of pyrene. Therefore phenanthrene is not considered a COPC and is eliminated from further evaluation.

5.1.7.1.3 Multiple Chemical Evaluation

A multiple chemical evaluation is performed separately for three classes of analytes: noncarcinogens, carcinogens (nonradioactive), and radionuclides. Table 5.1.7-3 presents the results of the preliminary multiple chemical evaluation for [illegible] detected concentrations of constituents detected in all surface soil samples were used in conducting this evaluation. The SAL for chrysene, however, is based on the level of saturation for these chemicals; this number is not risk-based. In order to include chrysene in the risk-based chemical evaluation, the EPA Region 3 risk-based concentration for this chemical is utilized.

For noncarcinogens, carcinogens, and radionuclides, the total normalized values were 0.232, 0.9234, and 0.2541, respectively, using the approach discussed in Section 3.5.2 of this report. Therefore, the noncarcinogens, carcinogens, and radionuclides included in this multiple chemical evaluation are not identified as COPCs.

5.1.7.2 Risk Assessment

No risk assessment was performed on the Phase I surface data for MDA B (PRS 21-015).

5.1.8 Ecological Assessment

MDA B is a mesa top site in a developed, disturbed area. The site provides limited habitat for biota, does not contain sensitive habitats, and threatened or endangered species are not present. Therefore, there is no immediate ecological risk at this site. Runoff from MDA B, PRS 21-015, does reach Los Alamos Canyon, however, and the cumulative effect of drainage from many PRSs along the canyon edge will be assessed in a future investigation.

LANL is developing a new approach for ecological risk assessment in cooperation with EPA Region 6 and NMED. Further ecological risk assessment at this site will be deferred until the site can be assessed as part of the new ecological exposure unit methodology that is being developed.

TABLE 5.1.7-3

MDA B MULTIPLE CONSTITUENT EVALUATION FOR SURFACE SOIL

ANALYTE	SAMPLE ID	SAMPLE VALUE (mg/kg or pCi/g)	SOIL SAL[a] (mg/kg or pCi/g)	NORMALIZED VALUE
NONCARCINOGENIC EFFECTS				
lead	AAB7508	56.6	400	0.142
mercury	AAA7508	0.88	23	0.0383
silver	AAA7508	16.5	380	0.0434
zinc	AAB6969	137	23 000	0.00596
butyl benzyl phthalate	AAB6958	0.5	13 000	0.0000385
diethyl phthlate	AAB7002	90	52 000	0.00173
fluoranthene	AAB6953	2.0	2 600	0.00077
pyrene	AAB6953	1.3	2 000	0.00065
			Total:	0.232
CARCINOGENIC EFFECTS				
benzo(k)fluoranthene	AAB6953	0.40	6.1	0.0656
bis(2-ethylhexyl)phthalate	AAB6958	0.92	32	0.0288
chrysene	AAB6953	0.83	88[b]	0.0094
indeno(123-cd)pyrene	AAB6953	0.5	0.61	0.82
			Total:	0.9234
RADIONUCLIDE EFFECTS				
plutonium-238	TA-21 B#50	0.32	27	0.0119
uranium	TA-21 B#81	11.92	230	0.0518
uranium-235	AAB6997	0.54	10	0.054
			Total:	0.1177

[a] SAL = Screening Action Level
[b] This SAL is from EPA Region III.

5.1.9 Extent of Contamination

nt of contamination will be assessed when results of the Phase I subsurface investigation available.

5.1.10 Conclusions and Recommendations

The purpose of this section is to integrate the Phase I surface soil data with the results of previous investigations and knowledge of site history to determine whether characterization of surface soil at MDA B is sufficient to support a risk assessment if necessary after analysis of the subsurface data is complete.

Deviations from the TA-21 work plan probably did not compromise the intent of the field survey, field screening, or analytical results.

- Although fewer samples were collected at the west end of MDA B than elsewhere because of the change in the sampling grid, contaminants at these locations would migrate into the MDA B drainage, where they would be identified in samples taken at drainage locations. Further sampling on the west end of MDA B is being proposed.

- Even though no surface soils were analyzed for VOCs, analysis for these constituents may be more appropriate in subsurface samples that will be collected in the next investigation phase than in surface samples, from which these compounds tend to volatilize rapidly.

- Samples analyzed for total uranium were distributed throughout the MDA B investigation area even though fewer samples were analyzed than originally planned.

- The LRAD survey supported results from the field survey.

The radionuclide background comparison performed for this report was based on LANL-wide UTLs, not on TA-21 specific UTLs. It is recommended that future background comparisons use the baseline radionuclide data for TA-21 process areas (Ryti 1996, 01-0023).

Based on the results of the human health screening assessment, the only nonradioactive contamination present in surface soil above SALs is a small area of surface soil contaminated with PAHs, which are probably present as a result of runoff from a nearby asphalt-paved area. No additional sampling is recommended for nonradioactive constituents in surface soils. At this time, a risk assessment for nonradioactive contamination of surface soil does not appear to be necessary. However, the need for a risk assessment for MDA B will be reconsidered when subsurface soil data is available at a later date. The subsurface investigation will be conducted according to the sampling plan included in Section 16.2 of the TA-21 Operable Unit RFI Work Plan (LANL 1991, 0689).

Field survey and field screening results suggest that radioactive contamination is not concentrated at any particular surface location at MDA B and has not migrated into the surface of the MDA B drainage. Environmental surveillance data collected in 1990 and data from the 1994 RFI indicate the presence of four radionuclides (cesium-137, plutonium-239, radium-226, and strontium-90) at concentrations above their respective SALs. The 1990 data also indicates higher concentrations of some radionuclides on the north side of the MDA B paved area than those present on the south side of the paved area, where the 1994 surface soil samples were collected. To further investigate the potential for contact with radionuclide contamination on the north side of MDA B where potential for exposure is greater, a radiological survey of the north side of MDA B was conducted in September 1995. No activity above background was detected during this survey. Although these locations present no immediate threat to health and safety based on the results of this survey, it is recommended that additional sampling of surface soil on the north side of the paved area be done in conjunction with the Phase I subsurface sampling activities, and that soil samples be analyzed for radionuclides and inorganic chemicals to complete the evaluation of potential surface soil contamination.

6.0 REFERENCES

Bennett, K., November 1992. "Biological Evaluation for Environmental Restoration Program Operable Units 1106 and 1078, TA-1 and TA-21, Los Alamos Canyon and DP Canyon" (draft), Biological Resource Evaluations Team, Environmental Assessments and Resource Evaluations, Environmental Protection Group Report LA-UR-93-107, Los Alamos National Laboratory, Los Alamos, New Mexico. **(Bennett 1992, 01-0008)**

Bounds, J., 1995. "LRAD Surface Monitoring Resul[illegible] t TA-21," [illegible] ational Laboratory Report, Los Alamos, New Mexico. **(Bounds 1995, 01-0014)**

Broxton, D.E. and P.G. Eller (eds.), June 1995. "Earth Science Investigations for Environmental Restoration—Los Alamos National Laboratory Technical Area 21," Los Alamos National Laboratory report LA-12934-MS, Los Alamos, New Mexico. **(Broxton and Eller 1995, 1162)**

Ebinger, M. H., R. W., Ferenbaugh, A. F. Gallegos, W. R. Hansen, O. B. Myers, and W. J. Wenzel, October 1994. "Preliminary Ecological Screening Assessment for Operable Unit 1106," Los Alamos National Laboratory Report LA-UR-94-3885, Los Alamos, New Mexico. **(Ebinger et al. 1994, 1216)**

Environmental Protection Group, December 1990. "Environmental Surveillance at Los Alamos During 1989," Los Alamos National Laboratory Report LA-12000-ENV, Los Alamos, New Mexico. **(Environmental Protection Group 1990, 0497)**

Environmental Protection Group, March 1992. "Environmental Surveillance at Los Alamos During 1990," Los Alamos National Laboratory Report LA-12271-MS, Los Alamos, New Mexico. **(Environmental Protection Group 1992, 0740)**

Environmental Restoration Project Assessments Council, March 28, 1995. "Statistical Comparisons to Background, Part I," Los Alamos National Laboratory Report LA-UR-95-1217, Los Alamos, New Mexico. **(Environmental Restoration Project Assessments Council 1995, 1218)**

ESG, May 1988. Environmental Surveillance at Los Alamos During 1987, Los Alamos National Laboratory Report LA-11306-ENV, Los Alamos, New Mexico. **(ESG 1988, 0408)**

ESG, June 1989. Environmental Surveillance at Los Alamos During 1988, Los Alamos National Laboratory Report LA-11628-ENV, Los Alamos, New Mexico. **(ESG 1989, 0308)**

Gladney, E. S., and M. A. Gautier, January 1991. "Health and Environmental Chemistry Quality Assurance Program Plan," Los Alamos National Laboratory, Los Alamos, New Mexico. **(Gladney and Gautier 1991, 0410)**

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, 0689)**

LANL (Los Alamos National Laboratory), May 1991. "Generic Quality Assurance Project Plan for RCRA Facility Investigations for the Los Alamos National Laboratory Environmental Restoration Program," Rev. 0, Los Alamos National Laboratory Report ____, Los Alamos, New Mexico. **(LANL 1991, 0412)**

LANL (Los Alamos National Laboratory), June 14, 1993. "Phase Report 1A, TA-21 Operable Unit RCRA Facility Investigation," Los Alamos National Laboratory Report LA-UR-93-2028, Los Alamos, New Mexico. **(LANL 1993, 1076)**

LANL (Los Alamos National Laboratory), November 1993. "Installation Work Plan for Environmental Restoration," Revision 3, Los Alamos National Laboratory Report LA-UR-93-3987, Los Alamos, New Mexico. **(LANL 1993, 1017)**

LANL (Los Alamos National Laboratory), February 1995. "Installation Work Plan for Environmental Restoration," Revision 4, Los Alamos National Laboratory Report LA-UR-95-740, Los Alamos, New Mexico. **(LANL 1995, 1164)**

LANL/SNL (Los Alamos National Laboratory and Sandia National Laboratories), January 2, 1996. "Risk-Based Corrective Action Process," A. M. Dorries (Ed.), Los Alamos National Laboratory Report LA-UR-96-111, Los Alamos, New Mexico. **(LANL/SNL 1996, 1277)**

LANL (Los Alamos National Laboratory), **in preparation.** "Technical Approach to RFI Reports," A. M. Dorries (Ed.), Los Alamos National Laboratory Report **LA-UR-___**, Los Alamos, New Mexico. **(LANL in preparation, 1281)**

Longmire, P., S. Reneau, P. Watt, L. McFadden, J. Gardner, C. Duffy, and R. Ryti, January 1995. "Natural Background Geochemistry, Geomorphology, and Pedogenesis of Selected Soil Profiles and Bandelier Tuff, Los Alamos, New Mexico," (draft) Los Alamos National Laboratory Report LA -12913-MS, Los Alamos, New Mexico. **(Longmire et al. 1995, 1142)**

Longmire, P. A., D. E. Broxton, and S. L Reneau (Eds.), October 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-95-3486, Los Alamos, New Mexico. **(Longmire et al. 1995, 1266)**

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 [illegible] Mexico. **(Purtymun et al. 1987, 0211)**