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Date: November 15, 2007
Refer To: EP2007-0700

James P. Bearzi, Bureau Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6303

Subject: Submittal of Material Disposal Area T Phase II Investigation Report

Dear Mr. Bearzi:

Enclosed please find two hard copies with electronic files of the "Phase II Investigation Report for Consolidated Unit 21-016(a)-99, Material Disposal Area T, at Technical Area 21."

If you have any questions, please contact Bruce Wedgeworth at (505) 231-0108 (brucew@lanl.gov) or Woody Woodworth at (505) 665-5820 (lwoodworth@doeal.gov).

Sincerely,

Susan G. Stiger, Associate Director
Environmental Programs
Los Alamos National Laboratory

Sincerely,

for David R. Gregory, Project Director
Environmental Operations
Los Alamos Site Office

SS/DG/AC/BW:sm

Enclosures: 1) Two hard copies with electronic files - MDA T Phase II Investigation Report (EP2007-0700)

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LA-UR-07-7692
November 2007
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Phase II Investigation Report for Material Disposal Area T at Technical Area 21

Los Alamos
NATIONAL LABORATORY
EST.1943

Prepared by the Environmental Programs Directorate

LA-UR-07-7692
EP2007-0700

Phase II Investigation Report for Material Disposal Area T at Technical Area 21

November 2007

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EXECUTIVE SUMMARY

This Phase II investigation report presents results from the 2007 environmental investigation of Consolidated Unit 21-016(a)-99, also known as Material Disposal Area (MDA) T, within Technical Area (TA) 21 at Los Alamos National Laboratory (LANL or the Laboratory). The 2007 investigation of MDA T was conducted as a follow-on to the 2005–2006 implementation of the approved investigation work plan. Specific requirements for the investigation were defined in the approved Phase II investigation work plan and subsequent modifications.

The four objectives of the 2007 investigation were to: (1) continue characterization of tritium and volatile organic compound (VOC) vapors beneath MDA T; (2) define the vertical extent of americium-241, plutonium-238, and plutonium-239 at locations on the Delta Prime (DP) Canyon slope; (3) assess if americium-241, plutonium-238, and plutonium-239 activities in surface soils have been impacted by recent storm runoff and the December 2006 water main leaks at TA-21; and (4) acquire nitrate and supplemental perchlorate data on the DP Canyon slope.

The 2007 field activities included borehole abandonment, installation and sampling of three permanent vapor-monitoring wells, and collection of soil samples from 11 locations on the DP Canyon slope. Results from the DP Canyon slope were used to update the calculated radiological dose for the DP Canyon slope under the recreational user scenario.

Pore-gas results from the first round of quarterly sampling confirm low concentrations of VOCs and low activities of tritium. Three additional quarters of pore-gas monitoring data will be collected in accordance with the approved vapor-monitoring plan. Nature and extent of pore gas will be comprehensively evaluated and presented in a report following completion of planned vapor-monitoring activities.

The DP Canyon slope data indicate the nature and extent of americium-241, plutonium-238, and plutonium-239 have been defined. The 2007 surface-soil activities are less than the surface-soil samples collected from 1992 to 2006, which indicates there has been some redistribution of americium-241, plutonium-238, and plutonium-239 on the DP Canyon slope. Because of the lower activities detected during the 2007 investigation, the exposure point concentrations and associated dose for each radionuclide under the recreational scenario are lower than previously presented in the 2006 investigation report for MDA T. The nature and extent of nitrate and perchlorate have been fully investigated and defined.

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Acronyms and Abbreviations

AOC	Area of concern
COPC	contaminants of potential concern
DOE	Department of Energy [U.S.]
DP	Delta Prime
EPC	exposure point concentration
IDW	investigation-derived waste
LANL	Los Alamos National Laboratory
MDA	Material disposal area
NES	Nuclear Environmental Site
NMED	New Mexico Environment Department
QC	quality assurance
RCRA	Resource Conservation and Recovery Act
RFI	RCRA facility investigation
RPF	records process facility
RWSA	Retrievable waste storage area
SWMU	solid waste management unit
TA	technical area
UCL	upper confidence limit
VOC	volatile organic compound
WCSF	waste characterization strategy form
WPF	waste profile form

1.0 INTRODUCTION

This Phase II investigation report presents results from the 2007 environmental investigation of Consolidated Unit 21-016(a)-99, also known as Material Disposal Area (MDA) T, within Technical Area (TA) 21 at Los Alamos National Laboratory (LANL or the Laboratory).

As a result of its operational history, Consolidated Unit 21-016(a)-99 contains both radioactive and hazardous components. The site includes four absorption beds that received treated radioactive liquid waste, 64 buried shafts used for the disposal of cement-treated radioactive mixtures, and the Retrievable Waste Storage Area (RWSA) used for the storage of cement-treated radioactive mixtures. The site also includes two industrial wastewater treatment plants and associated subsurface piping and structures. Information on radioactive materials and radionuclides, including the results of sampling and analysis of radioactive constituents, is voluntarily provided to the New Mexico Environment Department (NMED) in accordance with U. S. Department of Energy (DOE) policy.

The 2007 investigation of Consolidated Unit 21-016(a)-99 was conducted as a follow-on to the 2005–2006 implementation of the approved investigation work plan (LANL 2004, 085641; LANL 2004, 088721), in accordance with the specific requirements for the investigation defined in the approved Phase II investigation work plan (LANL 2007, 095131; NMED 2007, 095725) and subsequent modifications (LANL 2007, 098944; NMED 2007, 098946).

The four objectives of the 2007 investigation were to: (1) continue characterization of tritium and volatile organic compound (VOC) vapors beneath MDA T; (2) define the vertical extent of americium-241, plutonium-238, and plutonium-239 at locations on the Delta Prime (DP) Canyon slope where activities increased with depth as identified during previous investigation; (3) assess whether americium-241, plutonium-238, and plutonium-239 activities in surface soil have been impacted by recent storm runoff and the December 2006 water main leaks at TA-21; and (4) acquire nitrate and supplemental perchlorate data on the DP Canyon slope. The 2007 field activities included borehole abandonment, installation and sampling of three permanent vapor-monitoring wells, and collection of soil and tuff samples on the DP Canyon slope.

This report is presented in five sections with three supporting appendices. Section 1 is the introduction. Section 2 summarizes MDA T operational history. Section 3 describes in detail the field activities conducted during the 2007 investigation; provides an overview of the latest round of vapor data for MDA T; presents a review of the 2007 DP Canyon slope data and an updated evaluation of the nature and extent of radionuclides on the DP Canyon slope; and updates the calculated radiological dose for the DP Canyon slope. Conclusions based on previous and new data are presented in section 4. Section 5 cites all references supporting this report. Appendix A includes field documentation, Appendix B analytical results, and Appendix C waste management.

2.0 SITE HISTORY

Consolidated Unit 21-016(a)-99 is a fenced area located within TA-21 on DP Mesa, east of buildings 21-286 and 21-228; west of MDA A; north of buildings 21-005, 21-150, and 21-361; and south of North Perimeter Road (Figure 2.0-1). The site is slightly larger than 2 acres and is vegetated with grasses, chamisa bushes, and two young ponderosa pines. The following subsections provide a condensed review of Consolidated Unit 21-016(a)-99, its historical operations, and investigation activities conducted at the site. A comprehensive review of the site history and facility investigations are presented in the MDA T investigation report (LANL 2006, 094151).

2.1 Operational History

Consolidated Unit 21-016(a)-99 includes the following 25 solid waste management units (SWMUs) and areas of concern (AOCs): SWMUs 21-007; 21-010(a-h); 21-011(a, c, d, e, f, g, i, j); 21-016(a, b, c); and AOCs 21-001, 21-011(h), 21-028(a), C-21-009, and C-21-012. All of the sites were associated with decommissioned radioactive liquid waste treatment facilities and various storage areas. Detailed descriptions of the SWMUs and AOCs that comprise 21-016(a)-99 are presented in the MDA T investigation report (LANL 2006, 094151).

The operational history of Consolidated Unit 21-016(a)-99 is complex, beginning with waste disposal in 1945 and continuing through the backfilling and grading of the site in 1986. Operational discharges of industrial wastewater from the plutonium processing facility to the absorption beds [SWMU 21-016(a)] began in 1945 and stopped in 1950. An industrial wastewater treatment plant (building 21-035) was constructed in 1952 to remove plutonium and other radionuclides from the liquid waste and to improve the absorption characteristics of the wastewater. The industrial liquid waste treatment facility operated from 1952 to 1967, when it was decontaminated and decommissioned. From 1964 to 1967 and again from 1970 to 1972, high-efficiency particulate air filter -equipped mobile incinerators (the salamanders) were in operation. The incinerators burned contaminated tricresyl phosphate or tributyl phosphate mixed with kerosene waste oil. In 1967, the new wastewater treatment plant (building 21-257) [SWMU 21-011(a)] was completed, replacing building 21-035.

The disposal shafts [SWMU 21-016(c)] were installed between 1968 and 1974. The shafts received treated liquid wastes, some contaminated with americium-241, mixed with cement. Five of the shafts have bathyspheres that contain plutonium-239/240 and other mixed fission products. In addition, some shafts received unspecified volumes of wash water. Once the shafts were filled with the waste cement mixture, they were capped.

In 1974, the RWSA was constructed to store cement-treated transuranic waste temporarily in corrugated metal pipes. Treated wastes from building 21-257 containing plutonium-239/240 and americium-241 were mixed with cement and pumped into the pipes. The pipes were stored on end in the RWSA and were subsequently removed and taken to TA-54 from 1984 to 1986.

The area of the absorption beds, disposal shafts, and RWSA was backfilled with clean fill and the site was graded to drain towards the north. No waste disposal activities took place at Consolidated Unit 21-016(a)-99 after 1986.

2.2 Historical Releases and Discharges

Approximately 18.3 million gallons of wastewater were discharged to the Consolidated Unit 21-016(a)-99 absorption beds between 1945 and 1967.

The tanks and other liquid-holding facilities at building 21-035 had no secondary containment, and the floor sumps and drains were unlined concrete. Leaks may have occurred at joints in buried cast iron and stainless-steel pipes. Although the external tanks at building 21-257 have secondary containment, some of the containment structures include floor drains that extend to the surrounding site grade. No data is available to indicate whether the sludge produced by these two treatment facilities was radioactive. Spills of unknown quantity were reported to have occurred during tanker-truck transfer operations in the americium unloading area (Sagez 2003, 076090).

The RWSA also had operational spills and leaks of unknown quantity. Spills, leaks, and releases were reportedly cleaned up at the time(LANL 1996, 070348, p. 1). Undetected leaks may also have occurred.

Airborne releases from the mobile incinerators were less than releases from stacks at the DP West plutonium processing facility. Building 21-012 released several curies annually of airborne particulate into the atmosphere, and Consolidated Unit 21-016(a)-99 is within the projected deposition area.

2.3 Historical Investigations

The MDA T investigation report provides a comprehensive review of the previous investigations conducted at MDA T (LANL 2006, 094151).

2.3.1 Pre–Resource Conservation and Recovery Act (RCRA) Facility Investigations (RFIs)

Field sampling investigations to characterize the extent and sources of contamination at Consolidated Unit 21-016(a)-99 began in 1946. These investigations included field instrument surveys for alpha and gamma emitters; radioassay for uranium, plutonium, and polonium; and analysis for fluorine.

The first characterization effort for the absorption beds was conducted in 1953 by the U.S. Geological Survey. The results of the study indicated that no appreciable horizontal migration of contamination had occurred and that plutonium had moved vertically to a depth of 20 ft (Rogers 1977, 005707, p. T-19).

From 1959 to 1961, the U.S. Army Corps of Engineers conducted a detailed study of contaminant migration at the absorption beds. A test pit (caisson) was excavated adjacent to absorption bed 1, sidewalls were logged, soil and rock samples were obtained, and instrumentation was installed to sample matrix saturation. Six angled boreholes were drilled under absorption bed 1 (Rogers 1977, 005707, p. T-19).

In 1967, additional borings were drilled at the absorption beds to collect samples for radioassay. Water samples were obtained from the caisson installed in 1959 and from two DP Canyon test holes. The study compared moisture migration with that reported in the previous study. Maximum concentrations of moisture had moved from a depth of 12 ft in 1961 to 40 ft in 1967. Most of the plutonium in the tuff was retained in the upper 20 ft (Purtymun 1967, 001009).

In 1974, additional boreholes were drilled before the excavation of the RWSA. These boreholes encountered paleochannel deposits at depths of 15 ft to 25 ft. Radioassay results from core samples indicated the presence of tritium, plutonium, americium, and cesium (Rogers 1977, 005707, p. T-28).

In 1978, moisture migration was studied in two borings. An inventory of plutonium and americium-241 was obtained during volumetric analysis of core from the boreholes. The distribution of plutonium and moisture was compared with values obtained in 1953 and 1960. Plutonium was detected at a maximum depth of 99.5 ft and americium-241 was detected at 101 ft (Nyhan et al. 1984, 058906).

Shallow soil was sampled and analyzed for radionuclides in 1984 and 1986. The results indicated that low levels of tritium, plutonium-238, plutonium-239, and americium-241 were present across the entire site area and into DP Canyon (Nyhan and Drennon 1993, 023248, p. 3-51).

2.3.2 RFI Investigations

1992 to 1994

The first RFI activity at Consolidated Unit 21-016(a)-99 was a field investigation conducted in 1992 (LANL 1995, 052350, p. 2-1). The investigation included near-surface sampling to evaluate site wide airborne stack emissions. Surface and shallow-subsurface samples were collected and analyzed for organic

chemicals, inorganic chemicals, and radionuclides, including tritium, plutonium-238, plutonium-239, and americium-241. The results indicated widespread presence of radionuclides at low specific activities.

Surface sampling was performed in 1993 and 1994 at areas requiring additional contaminant characterization, including the small drainage into DP Canyon (LANL 1996, 070348). The results of this campaign were presented in an RFI report (LANL 1996, 070348).

1996 to 1997

An investigation was conducted in 1996–1997 to further define the nature and extent of subsurface contamination resulting from past waste disposal practices at Consolidated Unit 21-016(a)-99. The investigation sought to define both the lateral extent of absorption bed contamination and the physical limit of the paleochannel. The 1996–1997 borehole samples were analyzed for target analyte list metals and radionuclides. Organic chemical analyses were also performed to detect the presence of VOCs and semivolatile organic compounds (SVOCs) in tuff. Inorganic chemicals were detected above background. Radionuclides including plutonium-238, plutonium-239, americium-241, strontium-90, cesium-137, uranium-234, uranium-235, and uranium-238 were detected or detected above background in and around the absorption beds (LANL 2004, 085641, p. 12).

2005 to 2006

An investigation was conducted in 2005 and 2006 to complete the characterization of the nature and extent of contamination from Consolidated Unit 21-016(a)-99 (MDA T) and to support the future corrective measures evaluations for the site. The investigation was conducted in accordance with the approved investigation work plan (LANL 2004, 085641; LANL 2004, 088721). The results of the 2005–2006 investigation were presented in the investigation report (LANL 2006, 094151).

3.0 CURRENT ACTIVITIES AT MDA T

This section describes the field activities conducted during the 2007 investigation including borehole abandonment, the installation and sampling of permanent vapor-monitoring wells surrounding MDA T, and drilling and sample collection on the DP Canyon slope. These activities are prescribed in the MDA T Phase II Work Plan (LANL 2007, 095131; NMED 2007, 095725) and subsequent modifications (LANL 2007, 098944; NMED 2007, 098946).

This section presents the 2007 investigation solid media and pore gas data, and discusses updated site dose and associated calculations for radionuclides on the DP Canyon slope. Deviations from planned implementation requirements are also presented in this section.

3.1 Borehole Abandonment

Four boreholes [locations 21-25372 (279 ft), 21-25373 (279 ft), 21-25375 (280 ft), and 21-25376 (283 ft)] from the 2005–2006 investigation were to be abandoned. Location 21-25373 was abandoned. The borehole was re-drilled to the original total depth to clear all slough from the borehole and a portland-bentonite grout was tremmied from the total depth to the top of the borehole in accordance with the approved work plan (LANL 2007, 095131; NMED 2007, 095725). The other three boreholes have not been abandoned as of November 15th, 2007. Site access issues and operational protocols associated with Consolidated Unit 21-016(a)-99's designation as a nuclear environmental site (NES) regulated under 10 CFR 830 prevented the abandonment. These boreholes will be abandoned as soon as operational protocols permit access to the borehole locations.

3.2 Installation and Sampling of Permanent Vapor-monitoring Wells

Permanent vapor-monitoring wells were installed at locations 21-603058 (in place of location 21-25263), 21-603059 (in place of location 21-25262), and 21-25264 (Figure 3.2-1)(Goering 2007, 098861). Because access issues associated with the site's designation as an NES, two previously drilled boreholes (locations 21-25262 and 21-25263) could not be reoccupied for completion as vapor wells. Two new locations were selected as replacements and have been assigned new location ID numbers. These boreholes were drilled to the planned total depth without sampling. The third location was re-completed to the original total depth to remove slough from the borehole. A multi-port sample system was installed and sampled from October 15 to November 5, 2007. As-built diagrams for each vapor-monitoring well are shown in Figures 3.2-2, 3.2-3, and 3.2-4.

One round of pore-gas sampling was collected from all ports in each well, except port 2 at location 21-603059. Port 2 did not produce pore-gas vapor, possibly because the welded formation does not allow the extraction of subsurface vapor. Before sampling, pore gas was purged from each sampling port by pumping; once proper purge of the sampling system was verified, vapor sampling proceeded in accordance with standard operating procedure EP-ERSS-SOP-5074, Sampling for Sub-atmospheric Air. Subsurface pore-gas samples were collected in SUMMA canisters for VOC analysis and in silica gel samplers for tritium analysis. Sample locations and depths are tabulated in Table 3.2-1.

3.3 DP Canyon Slope Sampling Activities

A total of 11 locations on DP Canyon slope were sampled on October 13 and 14, 2007. Four locations were sampled using a hand auger and seven locations were sampled using a hollow-stem auger-drilling rig (Figure 3.3-1). All samples were analyzed for americium-241, plutonium-238, plutonium-239/240, nitrate, and perchlorate.

Six locations (21 -25266, 21-02568, 21-01861, 21-01860, 21-01862, and 21-02569) where americium or plutonium activities increased with sampling depth during previous investigations were re-sampled during the 2007 investigation. The three locations (21-25274, 21-25272, 21-01642) previously exhibiting the highest surface concentrations of plutonium-239 were also re-sampled. Finally, two new locations (21-603000 and 21-603001) were selected based on field geomorphic evidence of recent sediment deposition and sampled.

At a minimum, two depths were sampled at each location, one at the surface (generally 0.0 to 0.5 ft) and the second at a minimum of 1 ft into bedrock. In addition, samples were collected from the soil/tuff interface at most locations; however, tuff was exposed at the ground surface at some locations and only surface and 1-ft-into-bedrock samples were collected. Where the soil horizon was much thicker (typically near the toe of the DP Canyon slope) samples were collected at 5-ft intervals through the soil horizon until bedrock was encountered. Sample locations and depths are tabulated in Table 3.2-1.

Locations on the lower section of the DP Canyon slope were sampled using a hollow-stem auger drilling rig. Locations 21-02568 (0.0 to 15.0 ft), 21-02569 (0.0 to 13.0 ft), 21-01860 (0.0 to15.0ft), and 21-01861 (0.0 to 15 ft) were drilled and sampled as planned on October 13, 2007. Locations 21-25266 (0.0 to 14.0 ft), 21-01862 (0.0 to 8.5 ft), and 21-603000 (0.0 to10.0) were drilled and sampled as planned on October 14, 2007.

Continuous core was recovered at each borehole location to collect subsurface environmental screening samples and for off-site analyses. The recovered cores were inspected visually for fractures, staining/discoloration, moisture content, and lithologically logged; borehole logs are presented in

Appendix A. Where fracturing was encountered in the recovered core, a detailed physical description of the fracture-fill material and rock matrix was included in the lithologic logs.

Hand auger sampling was completed on October 14, 2007 on the upper portion of the DP Canyon slope at locations 21-6030001 (0.0 to 3.0 ft), 21-25274 (0.0 to 3.0 ft), 21-01642 (0.0 to 2.0 ft), and 21-25272 (0.0 to 4.0 ft). Sampling material was recovered at each hand auger location for subsurface environmental screening samples and off-site analyses.

Rinsate blanks on all drilling and hand auger sampling equipment and field duplicates were collected at a frequency of 10%.

All samples collected were field screened for VOCs and radioactivity for health and safety purposes before collection. VOC screening was performed using a photoionization detector (PID) equipped with an 11.7-eV bulb. Radiological field screening was conducted using an Eberline E600 with a 380AB probe by LANL Radiation Protection personnel. VOCs were not detected in any of the head-space field-screening samples; all radiological measurements were less than background. The field-screening results were recorded on the borehole logs and sample collection logs; sample collection logs are also presented in Appendix A.

3.4 Data Review for Solid Media and Vapor

The following sections present the 2007 investigation data for the DP Canyon slope and Consolidated Unit 21-016(a)-99. The sections include updated discussions of the nature and extent of inorganic chemicals and radionuclides in solid media on the DP Canyon slope and a general comparison of the 2007 tritium and VOC vapor data with previous data for the subsurface beneath MDA T. Data are presented in Appendix B, which is on the CD included with this report.

3.4.1 DP Canyon Slope Solid Media Data

Inorganic Chemicals

Table 3.4-1 summarizes the perchlorate and nitrate analytical results for all samples collected during the 2007 investigation. Figure 3.4-1 depicts the spatial distribution of detected inorganic chemicals on the DP Canyon slope.

Perchlorate was not detected in any of the DP Canyon slope samples. The nature and extent of perchlorate is defined.

The highest concentration of nitrate (1.2 mg/kg) occurred in a surface soil sample (collected from a depth of 0.0 to 0.8 ft) at location 21-01861. Nitrate was not detected in deeper samples at this location. Nitrate was detected at lower concentrations in two other samples and was not detected in any of the other DP Canyon slope samples. The nature and extent of nitrate is defined.

Radionuclides

Samples were collected from multiple depths at all locations to define the vertical extent of americium-241, plutonium-238 and plutonium-239/240. Table 3.4-1 summarizes the solid media analytical results in samples collected during the 2007 investigation. Figure 3.4-1 depicts the spatial distribution of americium-241, plutonium-238 and plutonium-239/240 on the DP Canyon slope. In addition, Figures 3.4-2, 3.4-3, 3.4-4, and 3.4-5 depict radionuclide activity-with-depth profiles and comparisons between previous and 2007 data for all 2007 sampling locations.

The data show decreasing activities with depth for all three radionuclides at all locations, with a single exception. At location 21-25272 the 2007 plutonium-238 and plutonium-239 activities increase with depth. Plutonium-239 activities increase from 0.06 pCi/g in the surface to 8.9 pCi/g in the 3.5 to 4.0 ft interval; plutonium-238 activities increase from 0.26 pCi/g to 1.27 pCi/g. This sample location is located at the base of the DP Canyon slope and could not be accessed with the drill rig. The samples were collected using a hand auger. The hand auger could only advance ~4 ft into unweathered tuff. The surface soil data collected at this location (16-25272) during earlier investigations are greater than the 2007 results. The plutonium-239 activity was 17.6 pCi/g in the surface soil and 13.1 pCi/g in the 0.5- to 1.0-ft interval; the plutonium-238 activity was 9.1 pCi/g in the surface soil and 3.8 pCi/g in the 0.5- to 1.0-ft interval (LANL 2006, 094151). Considering the earlier data and the 2007 data collectively, plutonium-238 and plutonium-239 activities decrease with depth. Adjacent locations 21-02568 and 21-603000 were sampled to 10 ft and 13.5 ft below ground surface (bgs) and reported decreasing trends approaching zero at the total depth. The nature and extent of americium-241, plutonium-238, and plutonium-239 on the DP Canyon slope is defined.

Locations 21-01642, 21-25274, and 21-25272 (previous investigation locations with the three highest plutonium-239 activities in surface soil) were re-sampled during the 2007 investigation to assess the impact of storm runoff and the water main leak on the distribution of americium-241, plutonium-238, and plutonium-239 on the DP Canyon slope. Two new locations (21-603000 and 21-603001) were also sampled to support the assessment.

Activities at nearly all locations are lower in the 2007 data than in the earlier data (see Figures 3.4-2, 3.4-3, 3.4-4, and 3.4-5). For example, at location 21-25272 the 2005–2006 plutonium-239 activity was 17.6 pCi/g compared to 0.60 pCi/g in 2007; americium-241 and plutonium-238 activities are similarly lower in the 2007 data. At location 21-01642 the plutonium-239 activity was 28.5 pCi/g; the 2007 plutonium-239 activity is 5.39 pCi/g.

At two locations (21-02569 and 21-603001), 2007 investigation results for all three radionuclides did not vary significantly from the earlier results. Location 21-01636 (sampled only in an earlier investigation) is very close to new location 21-603001. The plutonium-239 activity at this location was 4.45 pCi/g and the plutonium-239 activity at 21-603001 in the 2007 data is 4.79 pCi/g; activities for the other two radionuclides in the earlier data are similarly close to the 2007 results (LANL 2006, 094151).

Plutonium-239 activities were higher in the 2007 data than in the earlier data for samples collected from two locations. At new sampling location 21-603000, the 2007 plutonium-239 activity is 10.83 pCi/g. Three locations (21-02568, 21-25271, and 21- 25270) sampled previously are located near 21-603000 in the middle section of the DP Canyon slope. The plutonium-239 activities at these locations were all approximately 5 pCi/g. Finally, at the toe of the DP Canyon slope, the plutonium-239 activity increased from 6.26 pCi/g at location 21-25266 to 14.38 pCi/g in 2007.

The data indicates there has been some redistribution of americium-241, plutonium-238, and plutonium-239 on the DP Canyon slope, with the possibility that plutonium-239 in particular is being translocated to the toe of the slope. Most of the 2007 sample locations were collected from the incised drainage channel running down the middle of the slope originating directly below the storm water culverts that discharge onto the slope. This area receives the majority of runoff on the site and soil and sediment in the drainage channel would be expected to migrate during runoff events. In addition, sediment would be expected to accumulate at the toe of the slope because of the change in topographic gradient. This is also indicated by the thicker soil profile observed in the field at the toe of the slope. Locations on the DP Canyon slope outside the drainage channel are more stable; however, activities of americium-241, plutonium-238, and plutonium-239 in these areas are also lower in the 2007 data than in the earlier data. The data further indicate that MDA T is not acting as an ongoing source of americium-241,

plutonium-238, and plutonium-239; the 2007 activities at most locations are lower than previously observed including those locations (21-603000 and 21-603001) specifically targeting recent deposition of sediment on the slope. This is expected based on the results of the radiation walkover surveys and surface soil sampling previously conducted at MDA T, and because clean fill was used to backfill the site after operations ended (LANL 2006, 094151).

3.4.2 MDA T Subsurface Vapor Data

One of the planned four quarterly rounds of subsurface vapor sampling has been completed for the Phase II investigation. A summary of general observations for the first quarter VOC and tritium results is presented in the following sections.

VOCs

The analytical results for select VOCs in pore gas for the 2007 investigation of MDA T are presented in Table 3.4-2. The spatial distribution of VOCs in subsurface vapor at MDA T is depicted in Figure 3.4-6 and vertical profiles for each borehole are presented in Figures 3.4-7, 3.4-8, and 3.4-9. More than 20 VOCs have been detected in the 2007 MDA T pore-gas samples. Most results were less than 200 µg/m3, the higher results are discussed in detail.

Vapor concentrations of methylene chloride, tetrachloroethene, and trichloroethene exceeded 1000 µg/m3; none of the other detected VOCs were at concentrations exceeding this value. The highest concentrations of methylene chloride (1300 µg/m3 and 1000 µg/m3) occurred in samples collected from the deepest intervals in borehole locations 21-25264 and 21-603059. The concentrations of methylene chloride detected in the deepest intervals at 21-25264 and 21-603059 exceed the screening level based on groundwater cleanup standards (450 ug/m3). Methylene chloride was not detected at equivalent concentrations in samples from these boreholes (location 21-25262 is equivalent to location 21-603059) during previous vapor sampling rounds; however, the maximum concentration of methylene chloride (>2000 µg/m3) detected previously also occurred at the bottom of a borehole (location 21-25263) (LANL 2006, 094151). The three additional rounds of quarterly monitoring will be used to determine whether these results reflect a one-time occurrence or will continue over time.

The highest concentrations of tetrachloroethene (1500 µg/m^3 and 1300 µg/m^3) occurred in samples collected from shallow intervals in borehole locations 21-25264 and 21-603059. Equivalent concentrations (approximately 800 µg/m^3 and 1500 µg/m^3) were also detected in shallow intervals in these same boreholes during previous rounds of vapor sampling at MDA T (LANL 2006, 094151).

The highest concentrations of trichlorethene (1100 µg/m3 and 1200 µg/m3) occurred in samples collected from the deepest two intervals in borehole location 21-603059. Concentrations of trichloroethene were lower (slightly more than 500 µg/m3) at the equivalent borehole (location 21-25262) during previous rounds; however, the maximum concentration of trichloroethene detected previously was approximately 2000 µg/m3, which was in a sample from the deepest interval in borehole location 21-25263 (LANL 2006, 094151).

Toluene was detected at a concentration greater than 1900 µg/m3 in a single previous sample; toluene concentrations did not exceed 25 µg/m3 in the 2007 samples.

Tritium

Tritium activities are substantially lower in the first round of samples collected during the 2007 investigation than in samples collected during 2005–2006 sampling rounds. The maximum tritium activity (9385.24 pCi/l) in the 2007 vapor samples was detected in a sample collected from borehole location

21-25264 at a depth of 150.5 ft (Figure 3.4-10; Table 3.4-3). The highest tritium activity detected in 2005–2006 was 73,400 pCi/L at a depth of approximately 150 ft in borehole location 21-25264 (LANL 2006, 094151). Three additional rounds of tritium data will be collected to evaluate trends in results over time.

3.5 Revised Potential Dose for the DP Canyon Slope

In the investigation report for MDA T (LANL 2006, 094151) human health risk screening assessments were conducted to determine if chemicals of potential concern (COPC) in soil and tuff on the DP Canyon slope pose a potential unacceptable risk or dose to human receptors. Based on the reasonably foreseeable land use, the recreational scenario was designated as the decision scenario for the DP Canyon slope. Site risk and dose were also assessed under a residential scenario as required by the Consent Order for comparison purposes. Because further characterization of radionuclides on the DP Canyon slope was required, revised calculations of the radiological dose have been made; inorganic and organic COPCs in solid media on the DP Canyon slope were not part of the 2007 investigation and are not considered further.

The 2007 data were used to calculate 95% upper confidence limits (UCLs) for americium-241, plutonium-238, and plutonium-239. The 95% UCLs are used as the exposure point concentration (EPC) for all scenarios. The radiological dose from americium-241, plutonium-238, and plutonium-239 was calculated using the EPCs following methodologies used in the investigation report (LANL 2006, 094151). In addition, these calculations were performed using the previous data combined with the 2007 data for the DP Canyon slope. Table 3.5-1 presents the results of these calculations for the previous data as presented in the investigation report for MDA T, the new data, and for the combined data set. The table also presents the radionuclide-specific screening action level for each exposure scenario.

For the recreational scenario, the calculated EPCs for american-241, plutonium-238 and plutonium 239/240 for the combined data set are lower than the EPCs calculated using the previous data alone. As a result, the dose for each radionuclide calculated using the combined data set is lower. This result is expected based on the generally lower overall and average activities for all three radionuclides detected in the 2007 DP Canyon slope samples. The plutonium-239 EPCs and dose calculated using only the 2007 data are slightly higher than the EPCs and dose presented in the investigation report; this is a result of the low number of samples used to calculate the 95% UCL, even though the mean activity for plutonium-239 is lower. Because of the lower activities detected during the 2007 investigation, the EPCs and associated dose for each radionuclide under the residential scenario are also lower than presented in the investigation report (LANL 2006, 094151). In addition, the equivalent risk for the recreational and residential scenarios does not change from that presented in the investigation report (LANL 2006, 094151).

3.6 Deviations

Three deviations from the planned activities specified in the MDA T Phase II investigation work plan (LANL 2007, 095131) are noted in this section. First, three of the four open boreholes could not be abandoned during this field effort; they will be abandoned during a future field effort. Second, two of the vapor-monitoring wells were moved outside of the NES boundary. The location 21-603058 (formerly 21-25263) was moved 40 ft to the northeast and location 21-603059 (formerly 21-25262) was moved 35 ft to the southwest. The relocation of the wells was approved by the NMED (Goering 2007, 098861). Third, the tubing for sampling port 4 in borehole location 21-603058 became entangled in the augers during emplacement and could not be installed at the planned depth of 302 ft bgs. However, a replacement port was installed within the same geologic unit at a depth of 245 ft bgs.

4.0 CONCLUSIONS

The 2007 data indicate that the vertical extent of americium-241, plutonium-238, and plutonium-239 on the DP Canyon slope is defined. In addition, the nature and extent of nitrate and perchlorate are fully investigated and the nature and extent of these inorganic chemicals is defined.

The data also indicate that there has been some redistribution of americium-241, plutonium-238, and plutonium-239 on the DP Canyon slope. There is some potential for the radionuclides to migrate further into DP Canyon. However, as presented in the investigation report for MDA T, the extent of contamination beyond the toe of the slope into DP Canyon has been defined and presented in the Los Alamos and Pueblo Canyons investigation report (LANL 2004, 087390). Any migration of radionuclides into DP Canyon is being monitored as part of LANL's site wide storm water and sediment monitoring programs.

Dose for americium-241, plutonium-238, and plutonium-239/240 under the recreational and residential scenarios are slightly lower or equivalent to the doses presented in the investigation report. In addition, the total equivalent risks for each scenario also do not change substantially from what were presented in the investigation report.

First round quarterly pore-gas sampling confirms low concentrations of VOCs (i.e., less than 2000 µg/m3) and low activities of tritium (i.e., less than 10,000 pCi/L). Three additional quarters of pore-gas monitoring data will be collected in accordance with the current vapor-monitoring plan (LANL 2007, 098944; NMED 2007, 098946). Nature and extent of pore gas will be comprehensively evaluated and presented in a report following completion of planned vapor-monitoring activities.

5.0 REFERENCES

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

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

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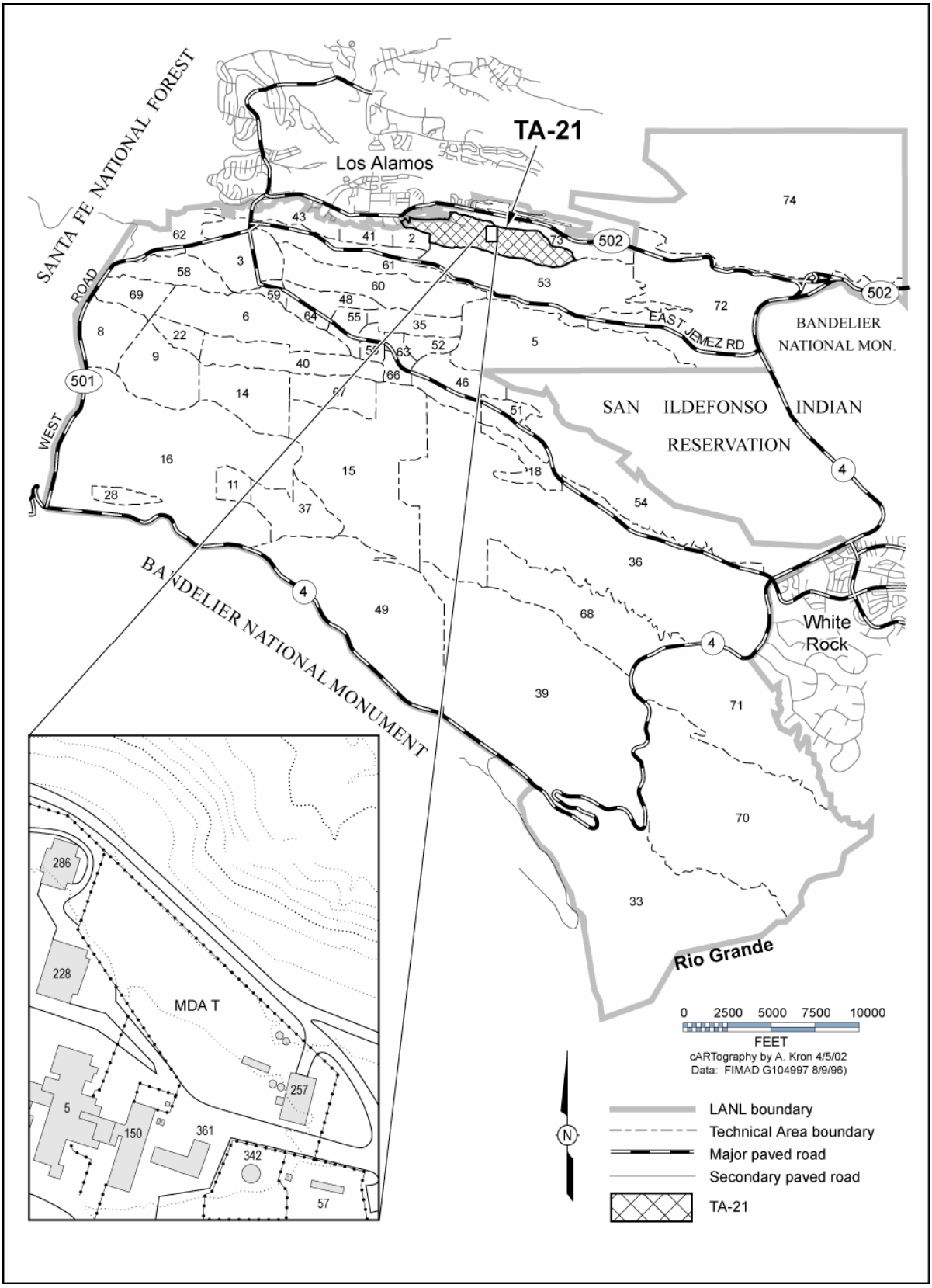

Figure 2.0-1 Location of MDA T at TA-21

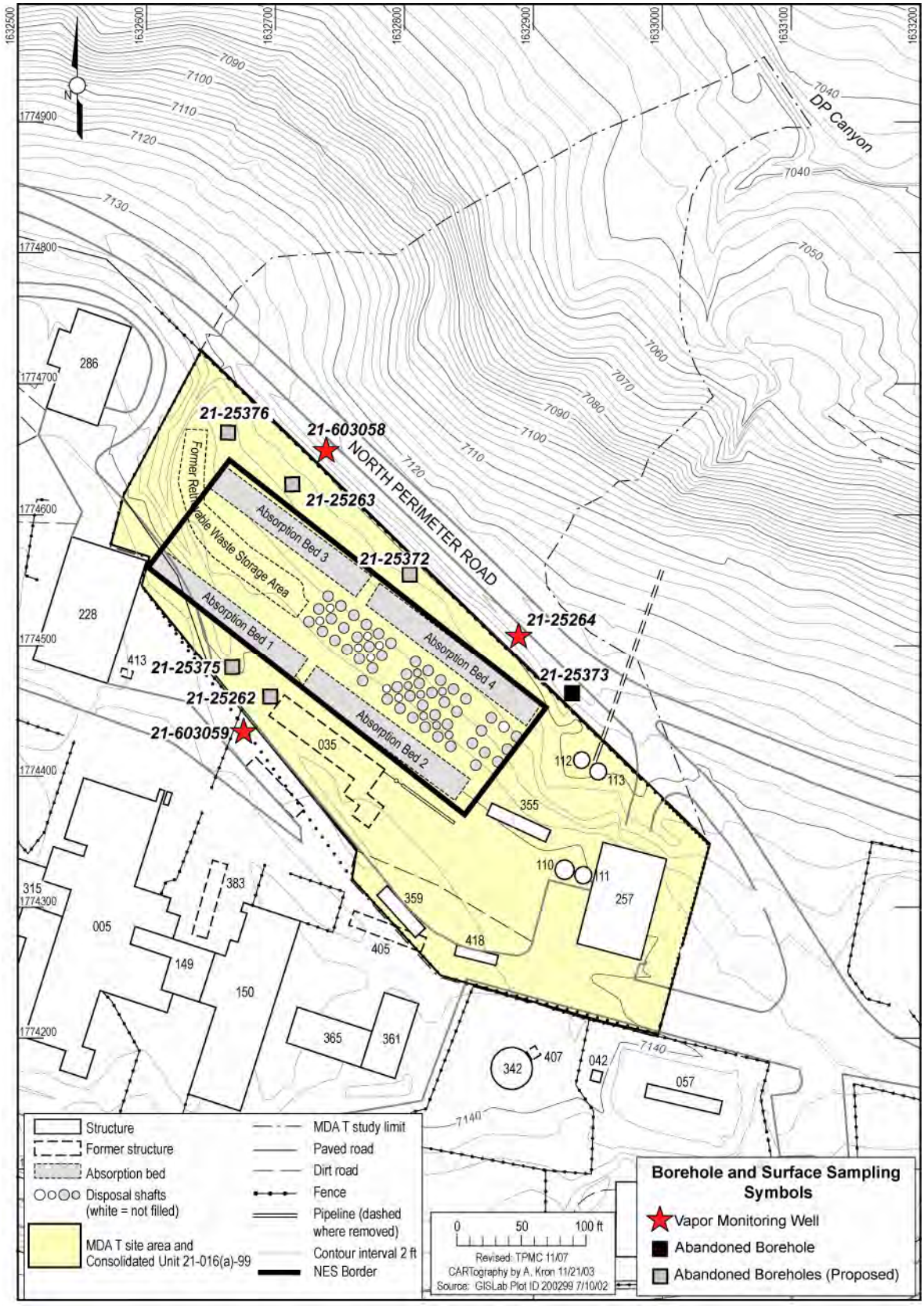

Figure 3.2-1 Location of Vapor-monitoring Wells and Abandoned Boreholes at MDA T

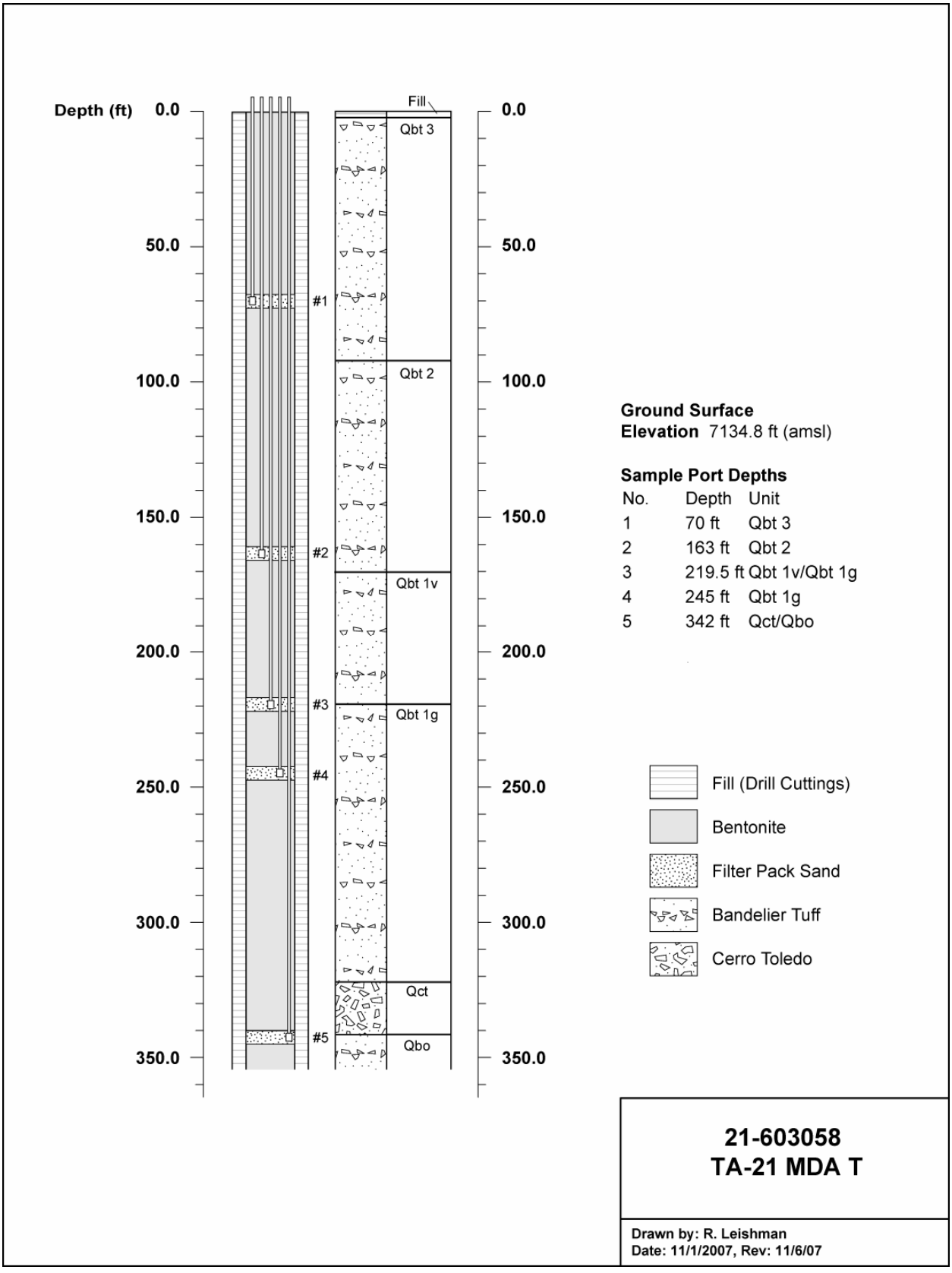

Figure 3.2-2 As-built diagram for vapor-monitoring well location 21-603058

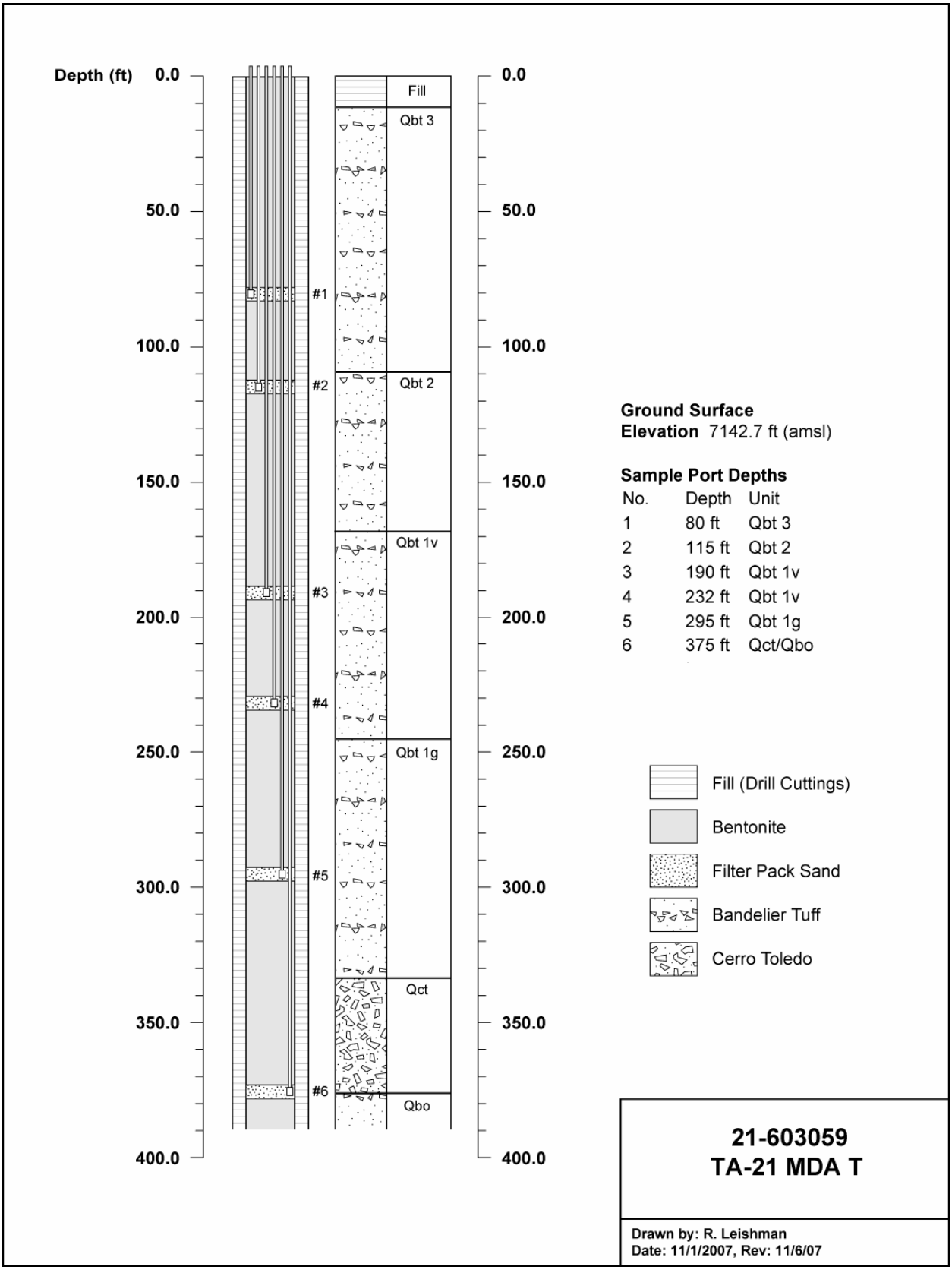

Figure 3.2-3 As-built diagram for vapor-monitoring well location 21-603059

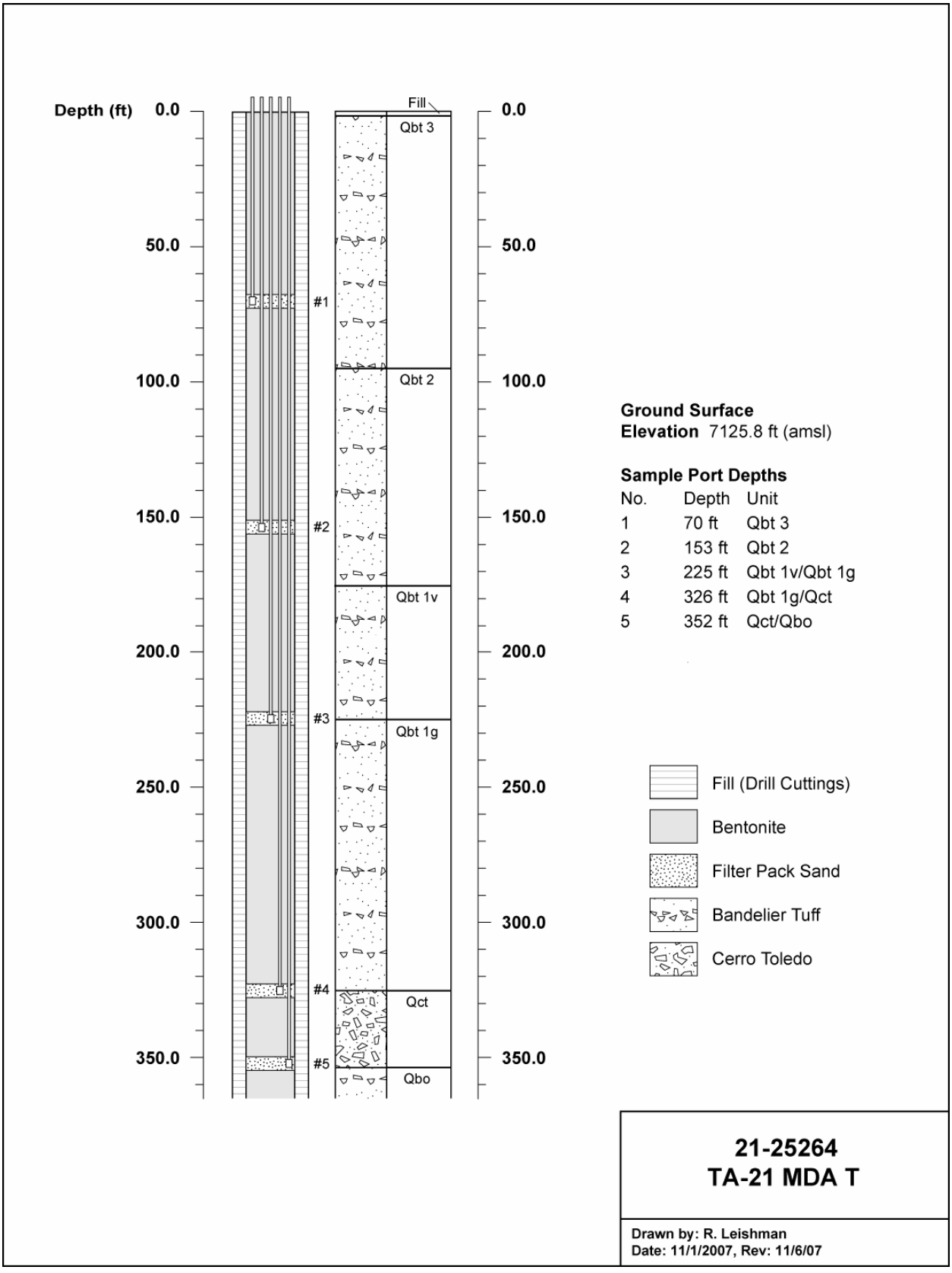

Figure 3.2-4 As-built diagram for vapor-monitoring well location 21-25264

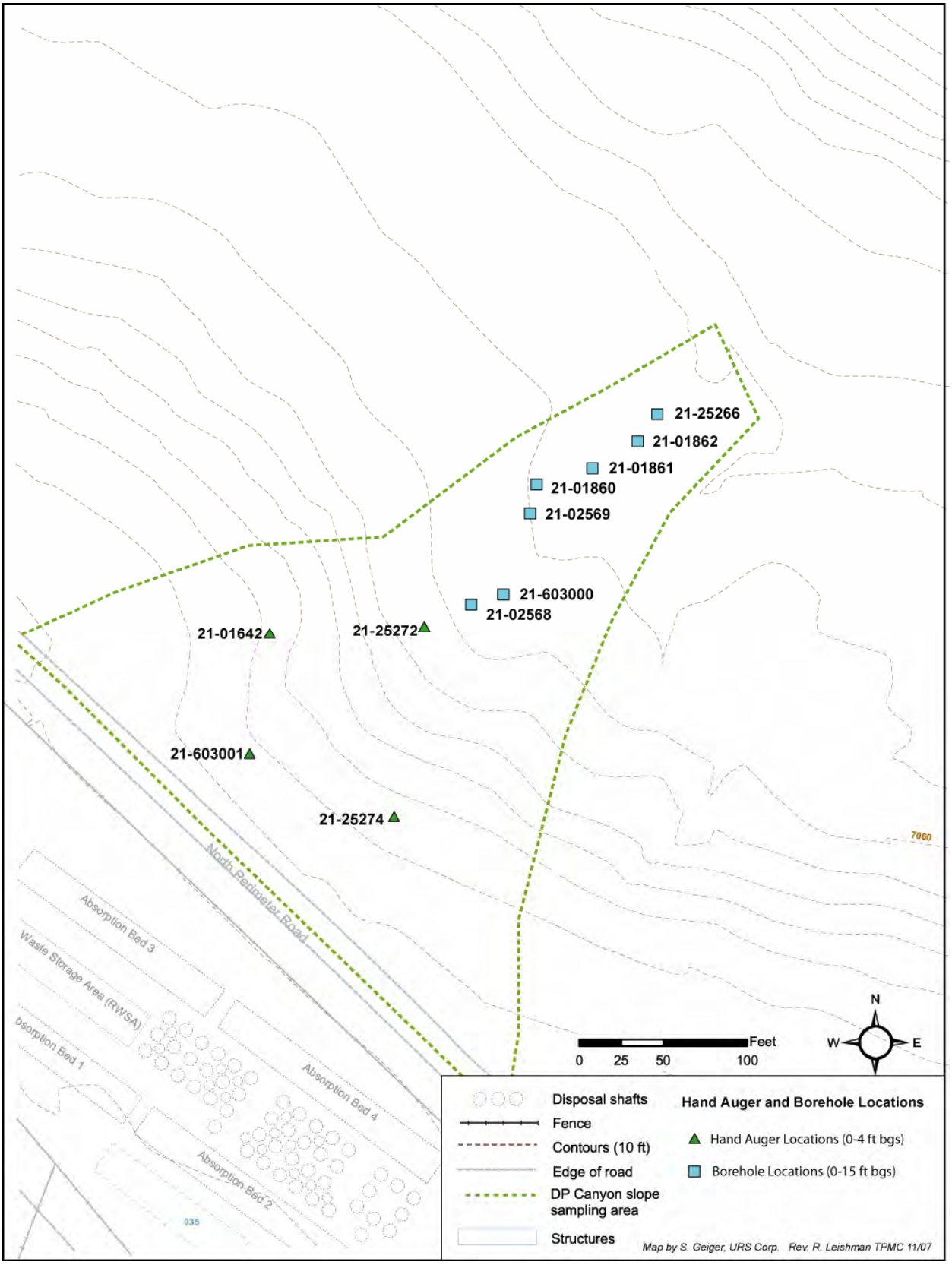

Figure 3.3-1 DP Canyon slope sample locations

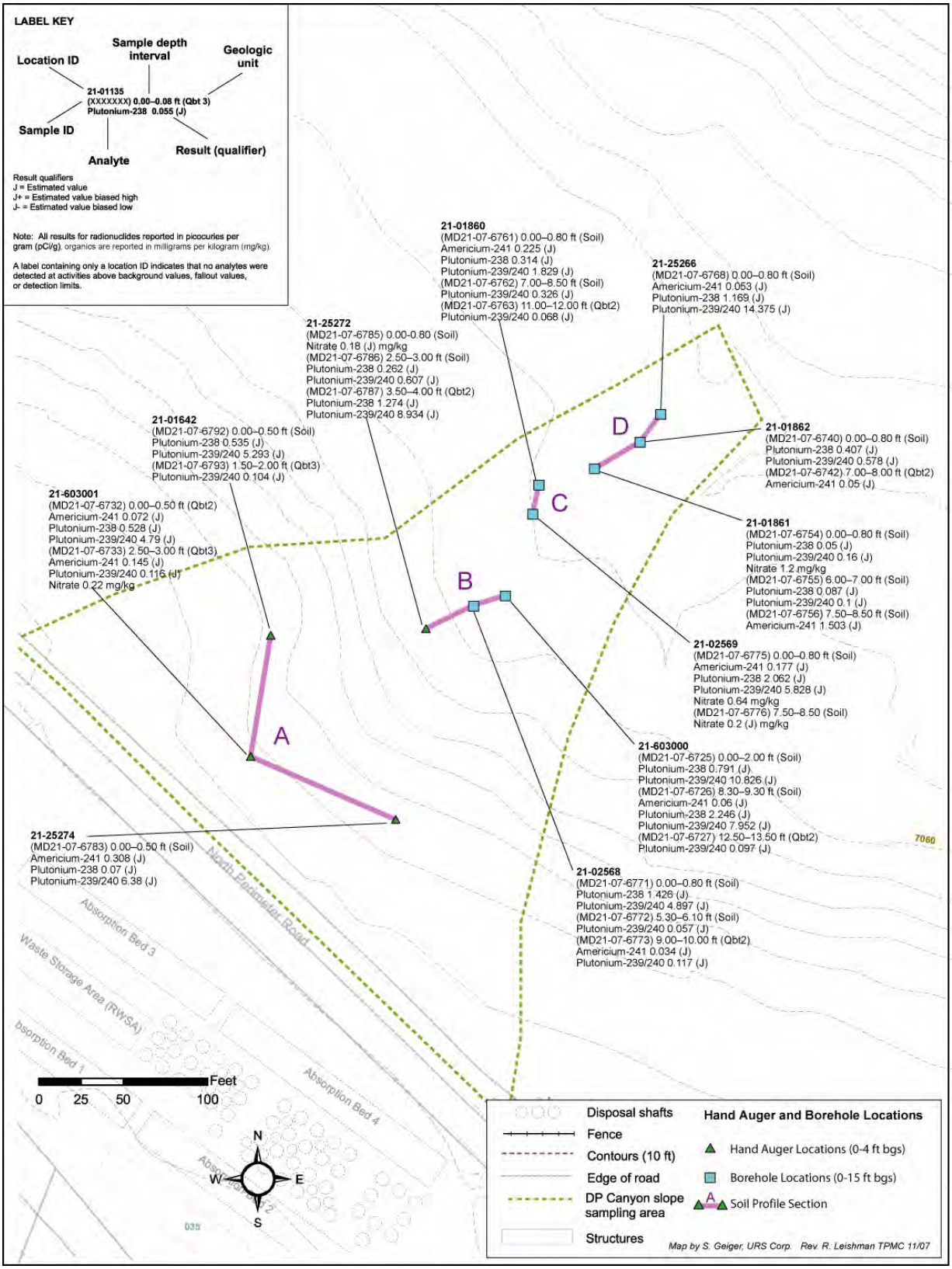

Figure 3.4-1 DP Canyon slope soil and tuff sample results detected or detected above background values and fallout values

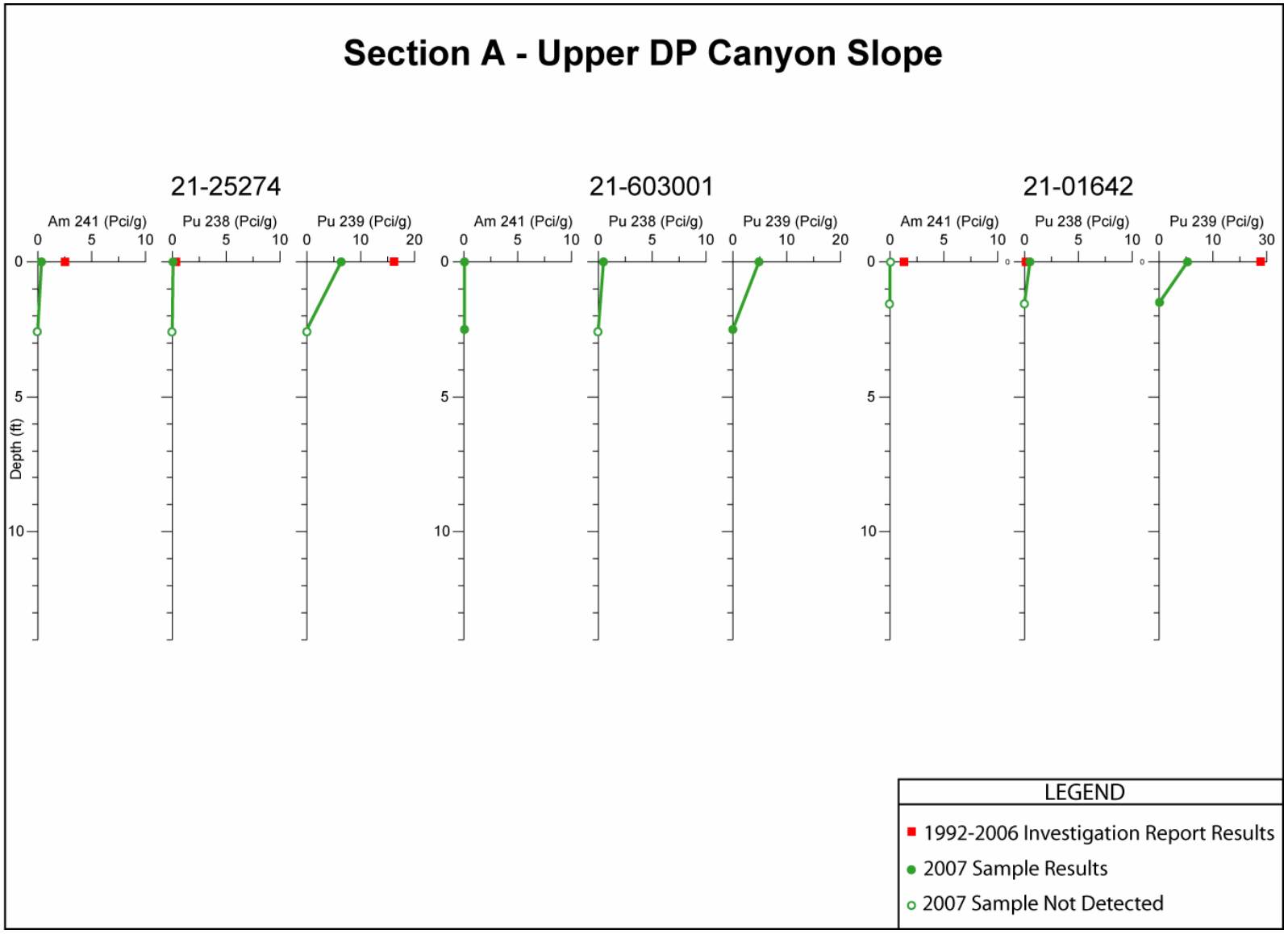

Figure 3.4-2 Upper DP Canyon Slope Data Profile

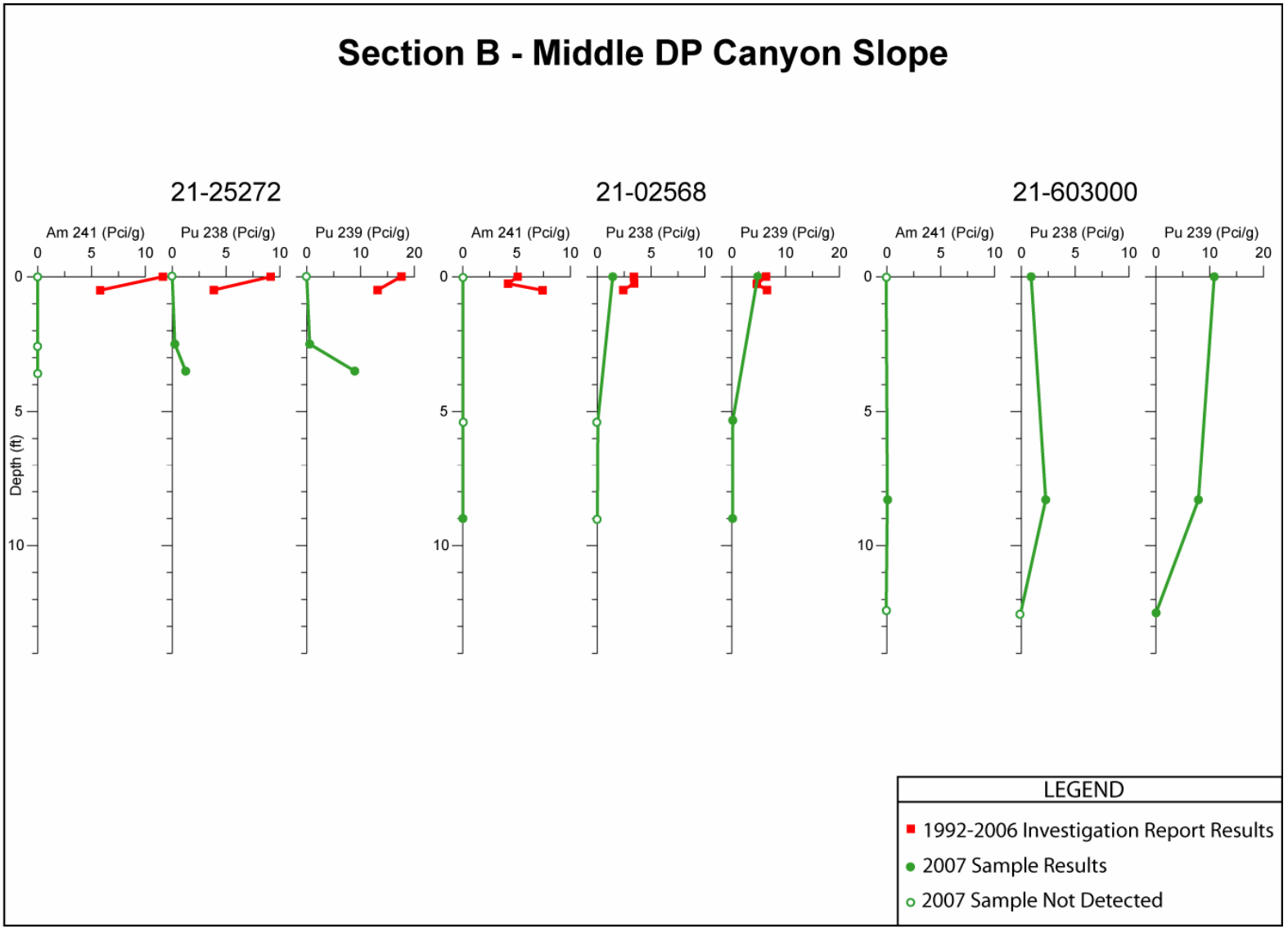

Figure 3.4-3 Middle DP Canyon Slope Data Profile

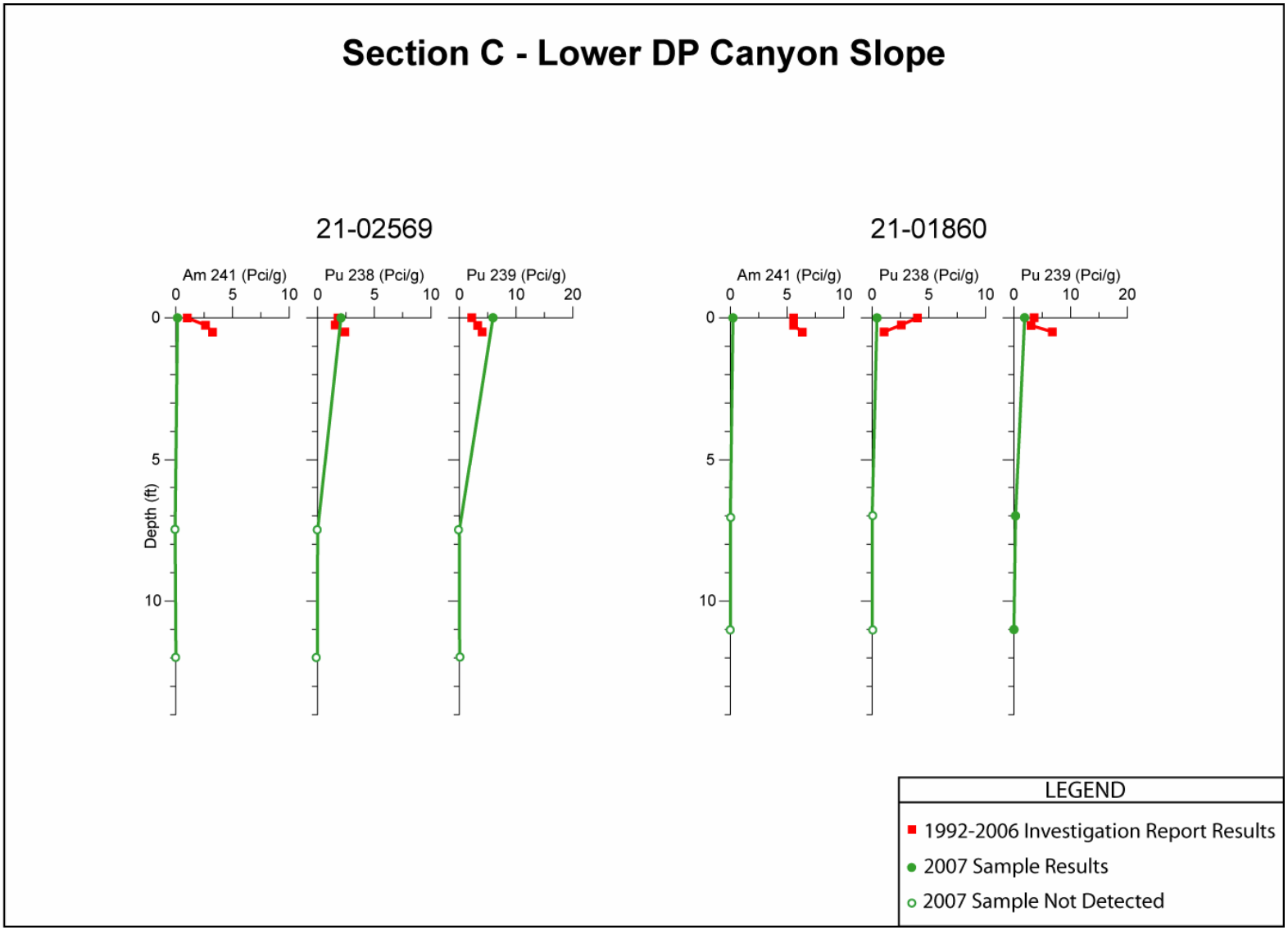

Figure 3.4-4 Lower DP Canyon Slope Data Profile

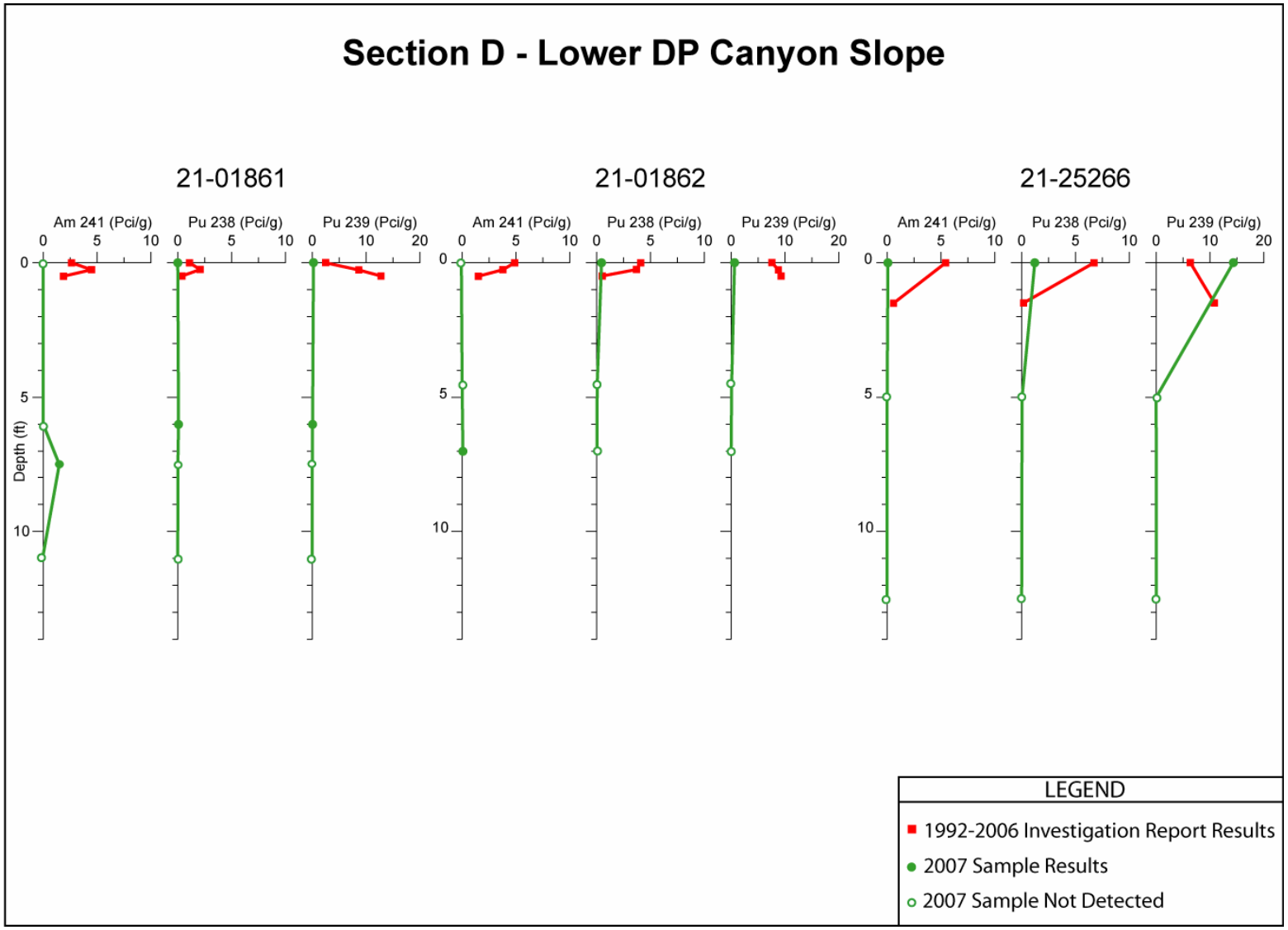

Figure 3.4-5 Bottom DP Canyon Slope Data Profile

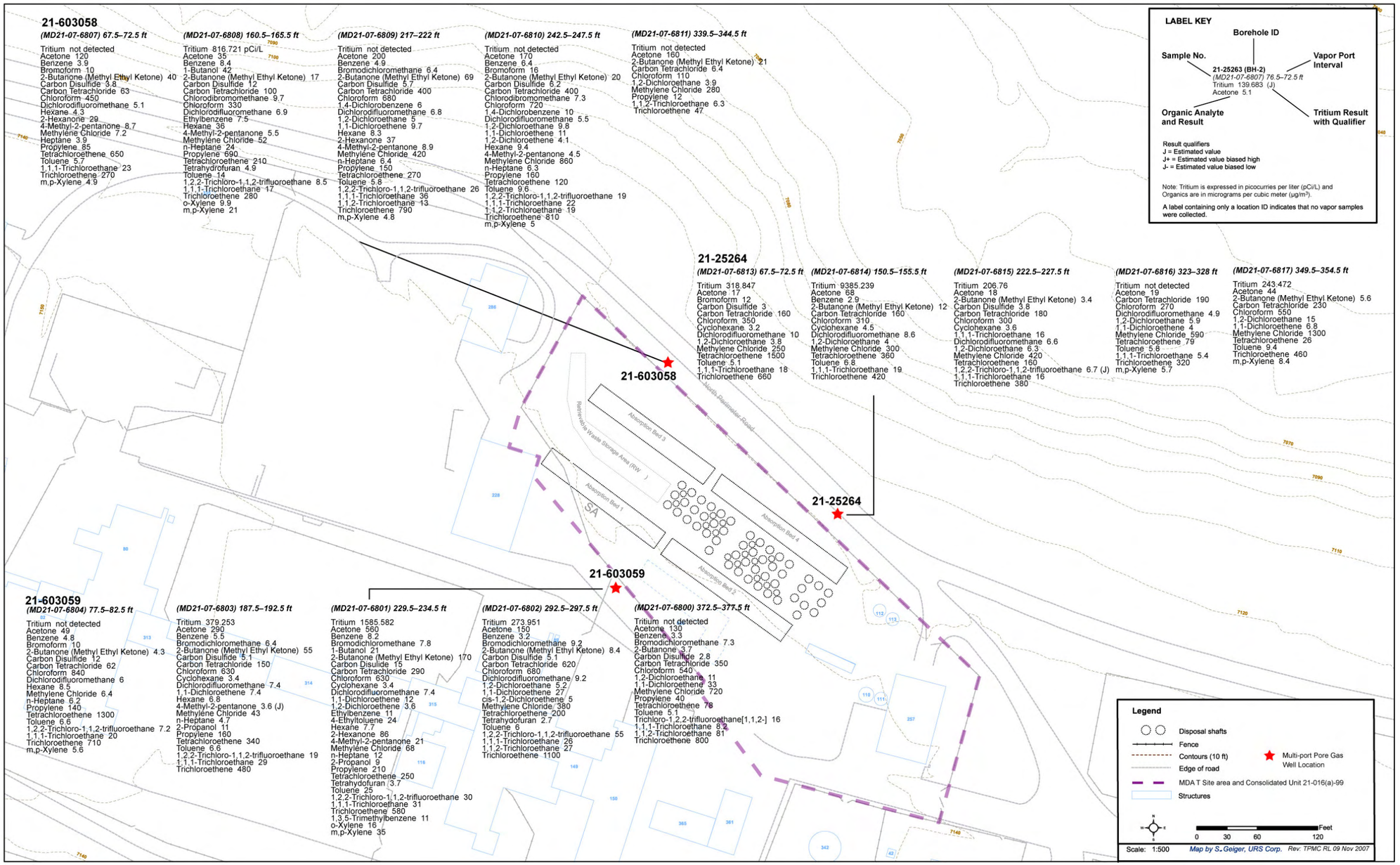

Figure 3.4-6 Tritium and VOCs detected in pore gas

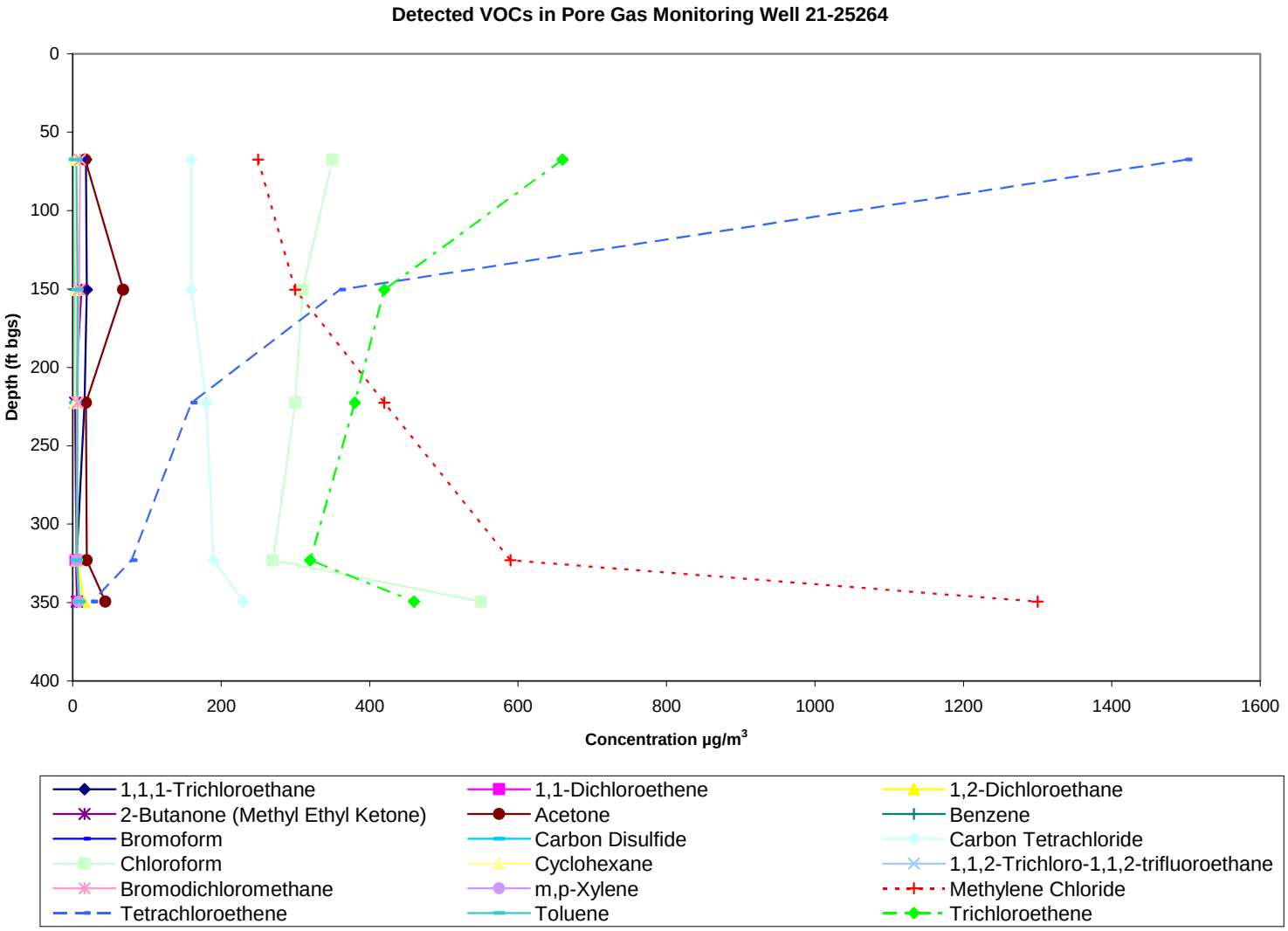

Figure 3.4-7 Vertical profile of detected VOCs in pore gas at well location 21-25264

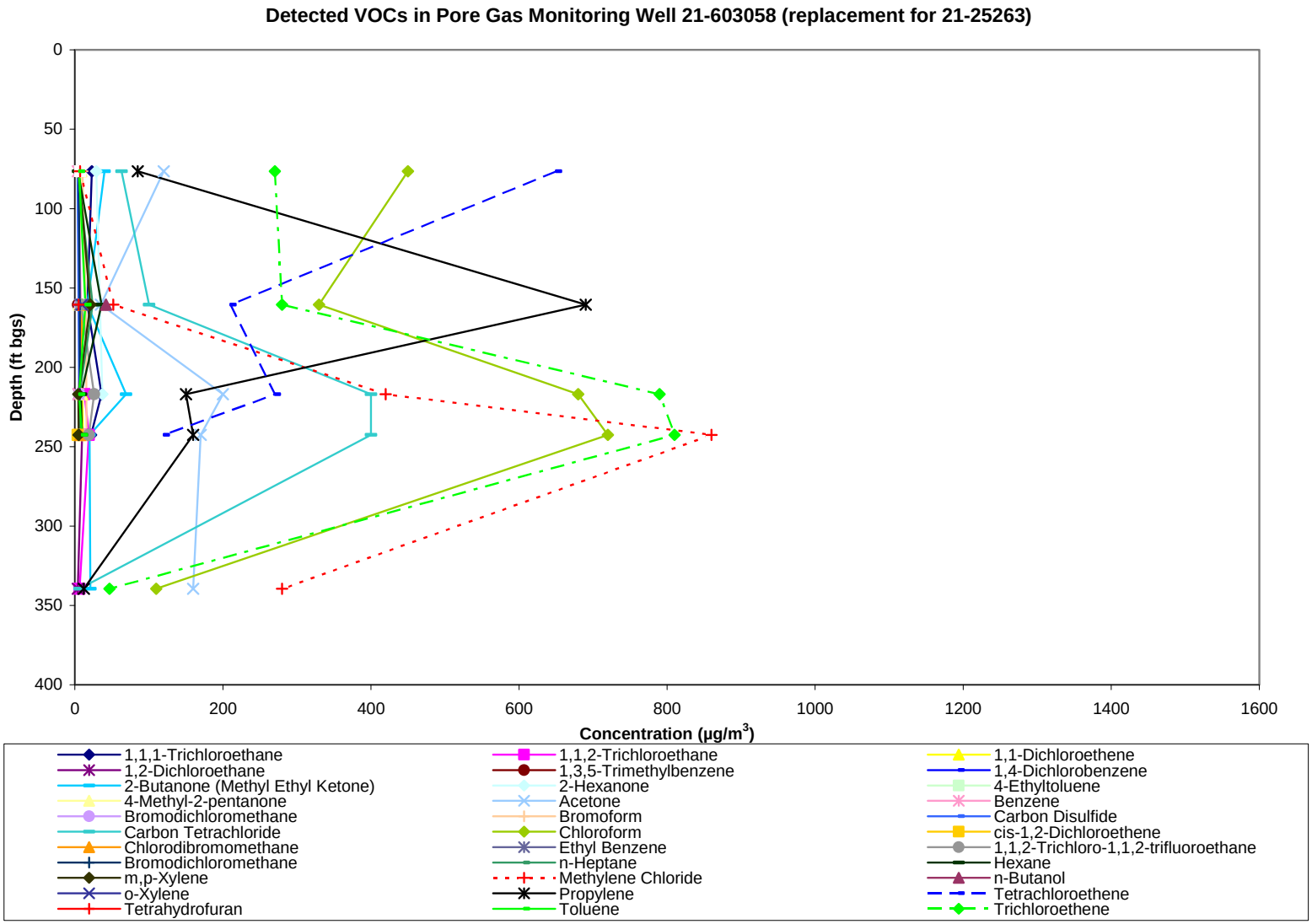

Figure 3.4-8 Vertical profile of detected VOCs in pore gas at well location 21-603058

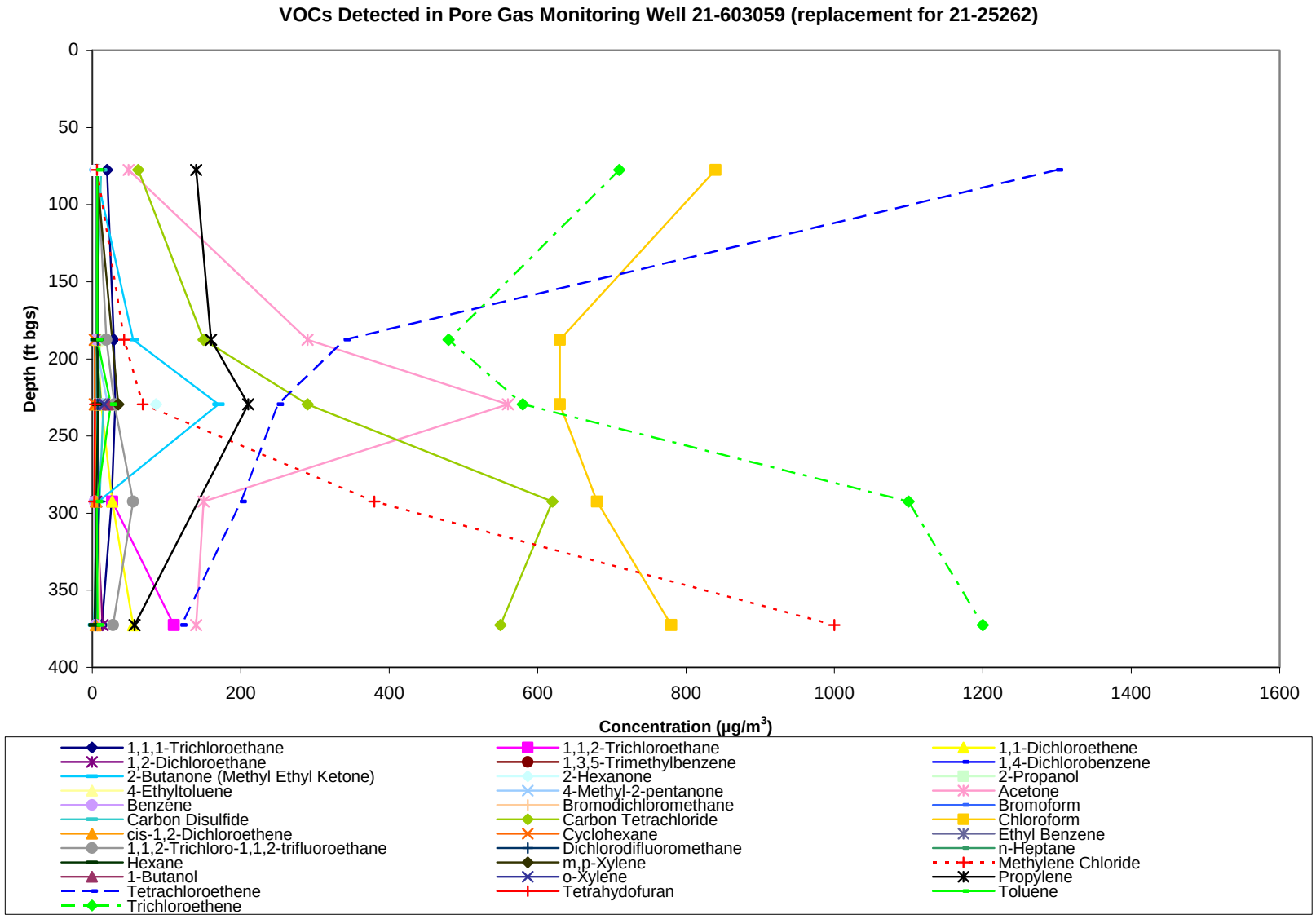

Figure 3.4-9 Vertical profile of detected VOCs in pore gas at well location 21-603059

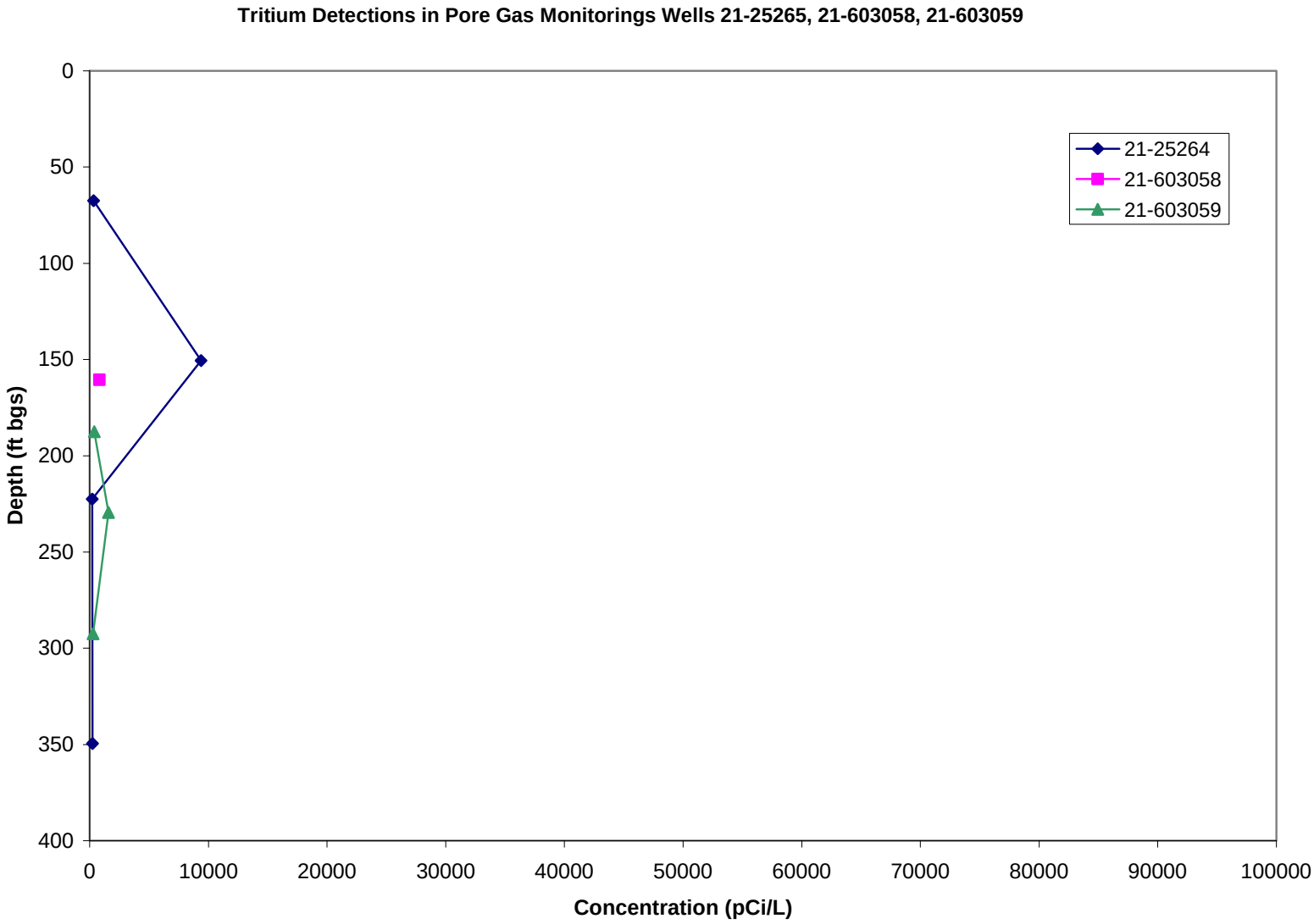

Figure 3.4-10 Vertical profile of tritium in pore gas at well locations 21-25264, 21-603058, and 21-603059

Table 3.2-1
Summary of Samples Collected and Analyses Requested of
Soil and Tuff at Consolidated Unit 21-016(a)-99, MDA T

Sample Id	Location Id	Depth (ft)	Media	Collection Date	Field QC Type	Americium 241	Isotopic Plutonium	Perchlorate	Nitrate	NO3NO2	Tritium	VOC
Soil Samples												
MD21-07-6725	21-603000	0.0-2.0	ALLH	10/14/ 07	na	Y	Y	Y	Y	N	N	N
MD21-07-7022	21-603000	0.0-2.0	ALLH	10/14/ 07	FD	Y	Y	Y	Y	N	N	N
MD21-07-6726	21-603000	8.3-9.3	ALLH	10/14/ 07	na	Y	Y	Y	Y	N	N	N
MD21-07-6727	21-603000	12.5-13.5	QBT	10/14/ 07	na	Y	Y	Y	Y	N	N	N
MD21-07-6732	21-603001	0.0-0.5	ALLH	10/14/ 07	na	Y	Y	Y	Y	N	N	N
MD21-07-6733	21-603001	2.5-3.0	QBT	10/14/ 07	na	Y	Y	Y	Y	N	N	N
MD21-07-6740	21-01862	0.0-0.8	ALLH	10/14/ 07	na	Y	Y	Y	Y	N	N	N
MD21-07-6741	21-01862	4.5-6.5	ALLH	10/14/ 07	na	Y	Y	Y	Y	N	N	N
MD21-07-6742	21-01862	7.0-8.0	QBT	10/14/ 07	na	Y	Y	Y	Y	N	N	N
MD21-07-6754	21-01861	0.0-0.8	ALLH	10/13/ 07	na	Y	Y	Y	Y	N	N	N
MD21-07-6755	21-01861	6.0-7.0	ALLH	10/13/ 07	na	Y	Y	Y	Y	N	N	N
MD21-07-6756	21-01861	7.5-8.5	ALLH	10/13/ 07	na	Y	Y	Y	Y	N	N	N
MD21-07-6757	21-01861	11.0-12.0	QBT	10/13/ 07	na	Y	Y	Y	Y	N	N	N
MD21-07-6761	21-01860	0.0-0.8	ALLH	10/13/ 07	na	Y	Y	Y	Y	N	N	N
MD21-07-6762	21-01860	7.0-8.5	ALLH	10/13/ 07	na	Y	Y	Y	Y	N	N	N
MD21-07-6763	21-01860	11.0-12.0	QBT	10/13/ 07	na	Y	Y	Y	Y	N	N	N
MD21-07-6768	21-25266	0.0-0.8	ALLH	10/14/ 07	na	Y	Y	Y	Y	N	N	N
MD21-07-6769	21-25266	5.0-5.7	ALLH	10/14/ 07	na	Y	Y	Y	Y	N	N	N
MD21-07-6770	21-25266	12.5-13.3	QBT	10/14/ 07	na	Y	Y	Y	Y	N	N	N
MD21-07-6771	21-02568	0.0-0.8	ALLH	10/14/ 07	na	Y	Y	Y	Y	N	N	N
MD21-07-6772	21-02568	5.3-6.1	ALLH	10/14/ 07	na	Y	Y	Y	Y	N	N	N

Table 3.2-1 (continued)

Sample Id	Location Id	Depth (ft)	Media	Collection Date	Field QC Type	Americium 241	I Isotopic Plutonium	Perchlorate	Nitrate	NO3NO2	Tritium	VOC
MD21-07-6773	21-02568	9.0-10.0	QBT	10/14/07	na	Y	Y	Y	Y	N	N	N
MD21-07-6775	21-02569	0.0-0.8	ALLH	10/13/07	na	Y	Y	Y	Y	N	N	N
MD21-07-6776	21-02569	7.5-8.5	ALLH	10/13/07	na	Y	Y	Y	Y	N	N	N
MD21-07-6777	21-02569	12.0-13.0	QBT	10/13/07	na	Y	Y	Y	Y	N	N	N
MD21-07-6783	21-25274	0.0-0.5	ALLH	10/14/07	na	Y	Y	Y	Y	N	N	N
MD21-07-6784	21-25274	2.5-3.0	QBT	10/14/07	na	Y	Y	Y	Y	N	N	N
MD21-07-6785	21-25272	0.0-0.8	ALLH	10/14/07	na	Y	Y	Y	Y	N	N	N
MD21-07-6786	21-25272	2.5-3.0	ALLH	10/14/07	na	Y	Y	Y	Y	N	N	N
MD21-07-6787	21-25272	3.5-4.5	QBT	10/14/07	na	Y	Y	Y	Y	N	N	N
MD21-07-6792	21-01642	0.0-0.5	ALLH	10/14/07	na	Y	Y	Y	Y	N	N	N
MD21-07-6797	21-01642	0.0-0.5	ALLH	10/14/07	FD	Y	Y	Y	Y	N	N	N
MD21-07-6793	21-01642	1.5-2.0	QBT	10/14/07	na	Y	Y	Y	Y	N	N	N
MD21-07-6795	21-01862	4.5-6.5	ALLH	10/14/07	FD	Y	Y	Y	Y	N	N	N
MD21-07-6796	21-01642	na	na	10/14/27	FR	N	N	Y	N	Y	N	N
MD21-07-6798	21-01860	7.0-8.5	ALLH	10/13/27	FD	Y	Y	Y	Y	N	N	N
MD21-07-6799	21-603000	na	na	10/14/07	FR	N	N	Y	N	Y	N	N
MD21-07-7053	21-01642	na	na	10/14/07	FR	N	N	Y	N	Y	N	N
Pore-Gas Vapor Samples												
MD21-07-6800	21-603059	372.5-377.5	na	11/3/2007	na	N	N	N	N	N	Y	Y
MD21-07-6801	21-603059	229.5-234.5	na	11/3/2007	na	N	N	N	N	N	Y	Y
MD21-07-6802	21-603059	292.5-297.5	na	11/3/2007	na	N	N	N	N	N	Y	Y
MD21-07-6803	21-603059	187.5-192.5	na	11/3/2007	na	N	N	N	N	N	Y	Y
MD21-07-6804	21-603059	77.5-82.5	na	11/4/2007	na	N	N	N	N	N	Y	Y
MD21-07-6806	21-603059	372.5-377.5	na	11/3/2007	FD	N	N	N	N	N	Y	Y

Table 3.2-1 (Continued)

Sample Id	Location Id	Depth (ft)	Media	Collection Date	Field QC Type	Americium 241	Isotopic Uranium	Perchlorate	Nitrate	NO3NO2	Tritium	VOC
MD21-07-6807	21-603058	67.5-72.5	na	10/30/07	na	N	N	N	N	N	Y	Y
MD21-07-6808	21-603058	160.5-165.5	na	10/30/07	na	N	N	N	N	N	Y	Y
MD21-07-6809	21-603058	217-222	na	10/30/07	na	N	N	N	N	N	Y	Y
MD21-07-6810	21-603058	242.5-247.5	na	10/30/07	na	N	N	N	N	N	Y	Y
MD21-07-6811	21-603058	339.5-344.5	na	10/30/07	na	N	N	N	N	N	Y	Y
MD21-07-6812	21-603058	339.5-344.5	na	10/30/07	FD	N	N	N	N	N	Y	Y
MD21-07-6813	21-25264	67.5-72.5	na	10/19/07	na	N	N	N	N	N	Y	Y
MD21-07-6814	21-25264	150.5-155.5	na	10/19/07	na	N	N	N	N	N	Y	Y
MD21-07-6815	21-25264	222.5-227.5	na	10/19/07	na	N	N	N	N	N	Y	Y
MD21-07-6816	21-25264	323-328	na	10/19/07	na	N	N	N	N	N	Y	Y
MD21-07-6817	21-25264	349.5-354.5	na	10/19/07	na	N	N	N	N	N	Y	Y
MD21-07-6818	21-603058	na	na	10/30/07	FB	N	N	N	N	N	Y	Y
MD21-08-8445	21-603059	na	na	11/3/07	FB	N	N	N	N	N	Y	Y

Notes:
ALLH = Soil all horizons
FD = Field Duplicate
FR = Field Rinsate
na = not applicable
Nitrate= EPA 300.0
NO3NO2 = EPA:353.1 (for rinsate)
Perchlorate = SW-846:6850
QBT = tuff

Table 3.4-1
Summary of Radionuclides and Inorganic Chemicals Dectected or Detected above Background Values/Fallout Values in Soil and Tuff at Consolidated Unit 21-016(a)-99, MDA T

Sample Id	Location Id	Depth (ft)	Media	Americium-241 (pCi/g)	Plutonium-238 (pCi/g)	Plutonium-239/240 (pCi/g)	Nitrate (mg/kg)	Perchlorate (mg/kg)
QBT2, QBT3 Background Value				na	na	na	na	na
Soil Background Value				0.013	0.023	0.054	na	na
MD21-07-6725	21-603000	0.0-2.0	SOIL	-	0.791 (J)	10.826 (J)	-	-
MD21-07-6726	21-603000	8.3-9.3	SOIL	0.06 (J)	2.246 (J)	7.952 (J)	-	-
MD21-07-6727	21-603000	12.5-13.5	QBT2	-	-	0.097 (J)	-	-
MD21-07-6732	21-603001	0.0-0.5	QBT2	0.072 (J)	0.528 (J)	4.79 (J)	-	-
MD21-07-6733	21-603001	2.5-3.0	QBT3	0.145 (J)	-	0.116 (J)	0.22	-
MD21-07-6740	21-01862	0.0-0.8	SOIL	-	0.407 (J)	0.578 (J)	-	-
MD21-07-6742	21-01862	7.0-8.0	QBT2	0.05 (J)	-	-	-	-
MD21-07-6754	21-01861	0.0-0.8	SOIL	-	0.05 (J)	0.16 (J)	1.2	-
MD21-07-6755	21-01861	6.0-7.0	SOIL	-	0.087 (J)	0.1 (J)	-	-
MD21-07-6756	21-01861	7.5-8.5	SOIL	1.503 (J)	-	-	-	-
MD21-07-6761	21-01860	0.0-0.8	SOIL	0.225 (J)	0.314 (J)	1.829 (J)	-	-
MD21-07-6762	21-01860	7.0-8.5	SOIL	-	-	0.326 (J)	-	-
MD21-07-6763	21-01860	11.0-12.0	QBT2	-	-	0.068 (J)	-	-
MD21-07-6768	21-25266	0.0-0.8	SOIL	0.053 (J)	1.169 (J)	14.375 (J)	-	-
MD21-07-6771	21-02568	0.0-0.8	SOIL	-	1.426 (J)	4.897 (J)	-	-
MD21-07-6772	21-02568	5.3-6.1	SOIL	-	-	0.057 (J)	-	-
MD21-07-6773	21-02568	9.0-10.0	QBT2	0.034 (J)	-	0.117 (J)	-	-

Table 3.4-1 (continued)

Sample Id	Location Id	Depth (ft)	Media	Americium-241 (pCi/g)	Plutonium-238 (pCi/g)	Plutonium-239/240 (pCi/g)	Nitrate (mg/kg)	Perchlorate (mg/kg)
MD21-07-6775	21-02569	0.0-0.8	SOIL	0.177 (J)	2.062 (J)	5.828 (J)	0.64	-
MD21-07-6776	21-02569	7.5-8.5	SOIL	-	-	-	0.2 (J)	-
MD21-07-6783	21-25274	0.0-0.5	SOIL	0.308 (J)	0.07 (J)	6.38 (J)	-	-
MD21-07-6785	21-25272	0.0-0.8	SOIL	-	-	-	0.18 (J)	-
MD21-07-6786	21-25272	2.5-3.0	SOIL	-	0.262 (J)	0.607 (J)	-	-
MD21-07-6787	21-25272	3.5-4.0	QBT2	-	1.274 (J)	8.934 (J)	-	-
MD21-07-6792	21-01642	0.0-0.5	SOIL	-	0.535 (J)	5.293 (J)	-	-
MD21-07-6793	21-01642	1.5-2.0	QBT3	-	-	0.104 (J)	-	-

Notes:
Background values are from LANL 1998, 059730.
na = Not available.
"-" = Not detected or not detected above BV or FV.
pCi/g = picocurries per gram
mg/kg = milligrams per kilogram
QBT 2 = Quaternary Bandelier Tuff Unit 2
QBT 3 = Quaternary Bandelier Tuff Unit 3

Table 3.4-2
Summary of VOCs Detected in Pore Gas at Consolidated Unit 21-016(a)-99

Sample Id	Location Id	Depth (ft)	Acetone	Benzene	Bromodichloromethane	Bromoform	Butanol[1-]	Butanone[2-]	Carbon Disulfide	Carbon Tetrachloride	Chlorodibromomethane	Chloroform	Cyclohexane	Dichlorobenzene[1,4-]	Dichlorodifluoromethane	Dichloroethane[1,2-]	Dichloroethene[1,1-]	Dichloroethene[cis-1,2-]	Ethylbenzene	Ethyltoluene[4-]	Hexane	Hexanone[2-]	Methyl-2-pentanone[4-]	Methylene Chloride	n-Heptane	Propanol[2-]	Propylene	Tetrachloroethene	Tetrahydrofuran	Toluene	Trichloro-1,2,2-trifluoroethane[1,1,2-]	Trichloroethane[1,1,1-]	Trichloroethane[1,1,2-]	Trichloroethene	Trimethylbenzene[1,3,5-]	Xylene[1,2-]	Xylene[1,3-]+Xylene[1,4-]
MD21-07-6804	21-603059	77.5–82.5	49	4.8	—	10	—	4.3	12	62	—	840	—	—	6	—	—	—	—	—	8.5	—	—	6.4	6.2	—	140	1300	—	6.6	7.2	20	—	710	—	—	5.6
MD21-07-6803	21-603059	187.5–192.5	290	5.5	6.4	—	—	55	5.1	150	—	630	3.4	—	7.4	—	7.4	—	—	—	6.8	—	3.6 (J)	43	4.7	11	160	340	—	6.6	19	29	—	480	—	—	—
MD21-07-6802	21-603059	292.5–297.5	150	3.2	9.2	—	—	8.4	5.1	620	—	680	—	—	9.2	5.2	27	5	—	—	—	—	—	380	—	—	—	200	2.7	6	55	26	27	1100	—	—	—
MD21-07-6801	21-603059	229.5–234.5	560	8.2	7.8	—	21	170	15	290	—	630	3.4	—	7.4	—	12	3.6	11	24	7.7	86	21	68	12	9	210	250	3.7	25	30	31	—	580	11	16	35
MD21-07-6800	21-603059	372.5–377.5	130	3.3	7.3	—	—	3.7	2.8	350	—	540	—	—	—	11	33	—	—	—	—	—	—	720	—	—	40	78	—	5.1	16	8.2	81	800	—	—	—
MD21-07-6807	21-603058	67.5–72.5	120	3.9	—	10	—	40	3.8	63	—	450	—	—	5.1	—	—	—	—	—	4.3	29	8.7	7.2	3.9	—	85	650	—	5.7	—	23	—	270	—	—	4.9
MD21-07-6808	21-603058	160.5–165.5	35	8.4	—	—	42	17	12	100	9.7	330	—	—	6.9	—	—	—	7.5	—	36	—	5.5	52	24	—	690	210	4.9	14	8.5	17	—	280	—	9.9	21
MD21-07-6809	21-603058	217.0–222.0	200	4.9	6.4	—	—	69	5.7	400	—	680	—	6	6.8	5	9.7	—	—	—	8.3	37	8.9	420	6.4	—	150	270	—	5.8	26	36	13	790	—	—	4.8
MD21-07-6810	21-603058	242.5–247.5	170	6.4	—	16	—	20	6.2	400	7.3	720	—	10	5.5	9.8	11	4.1	—	—	9.4	—	4.5	860	6.3	—	160	120	—	9.6	19	22	19	810	—	—	5
MD21-07-6811	21-603058	339.5–344.5	160	—	—	—	—	21	—	6.4	—	110	—	—	—	3.9	—	—	—	—	—	—	—	280	—	—	12	—	—	—	—	—	6.3	47	—	—	—
MD21-07-6813	21-25264	67.5–72.5	17	—	—	12	—	—	3	160	—	350	3.2	—	10	3.8	—	—	—	—	—	—	—	250	—	—	—	1500	—	5.1	—	18	—	660	—	—	—
MD21-07-6814	21-25264	150.5–155.5	68	2.9	—	—	—	12	—	160	—	310	4.5	—	8.6	4	—	—	—	—	—	—	—	300	—	—	—	360	—	6.8	—	19	—	420	—	—	—
MD21-07-6815	21-25264	222.5–227.5	18	—	—	—	—	3.4	3.8	180	—	300	3.6	—	6.6	6.3	—	—	—	—	—	—	—	420	—	—	—	160	—	—	6.7 (J)	16	—	380	—	—	—
MD21-07-6816	21-25264	323.0–328.0	19	—	—	—	—	—	—	190	—	270	—	—	4.9	5.9	4	—	—	—	—	—	—	590	—	—	—	79	—	5.8	—	5.4	—	320	—	—	5.7
MD21-07-6817	21-25264	349.5–354.5	44	—	—	—	—	5.6	—	230	—	550	—	—	—	15	6.8	—	—	—	—	—	—	1300	—	—	—	26	—	9.4	—	—	—	460	—	—	8.4

Note: Results are in µg/m3.

Table 3.4-3
Summary of Tritium Detected in Pore Gas
at Consolidated Unit 21-016(a)-99, MDA T

Sample Id	Location Id	Depth (ft)	Tritium
MD21-07-6808	21-603058	160.5-165.5	816.721
MD21-07-6813	21-25264	67.5-72.5	318.847
MD21-07-6814	21-25264	150.5-155.5	9385.24
MD21-07-6815	21-25264	222.5-227.5	206.76
MD21-07-6817	21-25264	349.5-354.5	243.472
MD21-07-6803	21-603059	187.5-192.5	379.253
MD21-07-6801	21-603059	229.5-234.5	1585.58
MD21-07-6802	21-603059	292.5-297.5	273.951
MD21-07-6800	21-603059	372.5-377.5	197.9

Note: Results are in pCi/L.

Table 3.5-1
Summary Statistics, Exposure Point Concentrations, and Calculated Doses for Residential and Recreational Scenarios for the DP Canyon Slope, at Consolidated Unit 21-016(a)-99, MDA T

COPC (pCi/g)	Sampling Event	Number of Analyses	Distribution Type	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	Mean Concentration	Standard Deviation (mg/kg)	95% UCL[a] (mg/kg)	95% UCL Method	Screening Level	Calculated Dose (mrem/yr)
Residential Statistics											
Americium-241	IR report	58	Gamma	0.00494	11.7	2.315	2.317	3.015	Approx. Gamma	30	1.51
Americium-241	New	10	Gamma	0.034	1.503	0.263	0.445	0.587	Approx. Gamma	30	0.29
Americium-241	Combined	68	Gamma	0.00494	11.7	2.013	2.265	2.631	Approx. Gamma	30	1.32
Plutonium-238	IR Report	58	Nonparametric	0.0	9.13	1.433	2.13	2.652	Chebyshev	37	1.04
Plutonium-238	New	14	Normal	0.05	2.246	0.802	0.727	1.145	Student's-t	37	0.46
Plutonium-238	Combined	72	Nonparametric	0.0	9.13	1.311	1.95	2.312	Chebyshev	37	0.94
Plutonium-239/240	IR Report	56	Gamma	0.0127	28.51	5.784	5.097	7.253	Approx. Gamma	33	3.3
Plutonium-239/240	New	20	Nonparametric	0.057	14.38	3.37	4.201	7.465	Chebyshev	33	3.4
Plutonium-239/240	Combined	76	Nonparametric	0.0127	28.51	5.149	4.967	7.632	Chebyshev	33	3.5

Table 3.5-1 (Continued)

Recreational Statistics											
Americium-241	IR Report	51	Gamma	0.035	11.7	2.601	2.328	3.332	Approx. Gamma	280	0.18
Americium-241	New	5	Normal	0.053	0.308	0.167	0.106	0.269	Student's-t	282	0.01
Americium-241	Combined	56	Gamma	0.035	11.7	2.384	2.328	3.089	Approx. Gamma	283	0.16
Plutonium-238	IR Report	51	Nonparametric	0.009	9.13	1.614	2.212	2.964	Chebyshev	330	0.13
Plutonium-238	New	10	Normal	0.05	2.062	0.735	0.642	1.107	Student's-t	332	0.05
Plutonium-238	Combined	61	Gamma	0.009	9.13	1.47	2.061	2.037	Approx. Gamma	333	0.09
Plutonium-239/240	IR Report	49	Gamma	0.324	28.51	6.317	5.058	7.667	Approx. Gamma	300	0.38
Plutonium-239/240	New	10	Normal	0.16	14.38	5.496	4.411	8.053	Student's-t	302	0.40
Plutonium-239/240	Combined	59	Gamma	0.16	28.51	6.178	4.928	7.431	Approx. Gamma	303	0.37

[a] 95 % UCL from PROUCL 4.0 (EPA 2007, 096530) or max detection if one detection or ½ the maximum reporting limit, if no detections.

Appendix A

Field Information

BOREHOLE LOG
Material Disposal Area T Phase II Investigation

BH ID: 21-01860	TA-21	Drill Depth: 0-14 ft bgs	Total Pages: 1
Driller: Dave Starnes/Spectrum		Start Date: 10/13/2007	End Date: 10/13/2007
Drilling Equipment/Method: CME 85 Hollow-Stem Auger		Logged By: M.Sandoval, K.Reid	
Sampling Equipment/Method: 3" ID 5' Length Split-Barrel Sampler			

DEPTH (ft bgs)	RECOVERY (ft/ft)	FIELD SCREENING RESULTS: PID (ppm)/RAD	SAMPLE ID	LITHOLOGICAL DESCRIPTION	LITHOLOGY	NOTES
0 1 2 3 4	4/4	PID=0.0 RAD=<MDA	0-0.8 ft bgs MD21-07-6761	0-4' Soil: well developed, dark brown-black 7.5yr4/2; clayey; very moist fades to pale tan at base (3.5-4ft) 7.5yr5/4. Large pumice and tuff clasts in soil	SOIL	1520 1 ft stick-up
5 6 7 8 9	5/5	PID=0.0 RAD=<MDA	7-8.5 ft bgs MD21-07-6762 MD21-07-6798 (FD)	4-8' Soil: well sorted, clay-silt, 7.5yr5.4, some quartz crystals (1-2mm), intermixed with weathered tuff. 8-9' Tuff, weathered, large quartz, sanidine (2-4mm), gray matrix 7.5yr6/1; soil/clay veins	SOIL QBT 2	1525 **Tuff at 8.0 ft bgs**
10 11 12 13 14	5/5	PID=0.0 RAD=<MDA	11-12 ft bgs MD21-07-6763	9-14' Tuff; sugary texture; pinkish gray matrix 5yr7/2; quartz 15-20%; rare sanidine; plagioclase 15%, oxidation on small minerals; some clayey veins (roots?) into tuff.	QBT 2	1530 TD = 14 ft bgs

BOREHOLE LOG
Material Disposal Area T Phase II Investigation

BH ID: 21-01861	TA-21	Drill Depth: 0-14 ft bgs	Total Pages: 1
Driller: Dave Starnes/Spectrum		Start Date: 10/13/2007	End Date: 10/13/2007
Drilling Equipment/Method: CME 85 Hollow-Stem Auger		Logged By: M.Sandoval, K.Reid	
Sampling Equipment/Method: 3" ID 5' Length Split-Barrel Sampler			

DEPTH (ft bgs)	RECOVERY (ft/ft)	FIELD SCREENING RESULTS: PID (ppm)/RAD	SAMPLE ID	LITHOLOGICAL DESCRIPTION	LITHOLOGY	NOTES
0 1 2 3 4	3/4	PID=0.0 RAD=<MDA	0-0.8 ft bgs MD21-07-6754	0-3' Soil: well-developed silty clay, tuff lithics (2-3cm), reddish soil 7.5yr2.5/2, damp. Lower section 7.5yr6/3, drier, well sorted, silty mud, damp 3-4' No Recovery	SOIL	1600 1 ft stick-up
5 6 7 8 9	5/5	PID=0.0 RAD=<MDA	6-7 ft bgs MD21-07-6755 7.5-8.5 ft bgs MD21-07-6756	4-8' very clayey soil, moist, well-sorted, a few roots, no lithics, reddish 5yr4/6. small vertical fracture <2mm aperture, slight (0-1mm) clay in fracture 8-9' Tuff, striped horizontally, gray and red	SOIL QBT 2	1605 **Tuff at 8.0 ft bgs**
10 11 12 13 14	5/5	PID=0.0 RAD=<MDA	11-12 ft bgs MD21-07-6757	9-14' Tuff, 25% quartz; 3% iron-stained plagioclase; rare sanidine; rare semi-flattened, fibrous pumice; grayish 7.5yr7/1	QBT 2	1615 TD = 14 ft bgs

BOREHOLE LOG
Material Disposal Area T Phase II Investigation

BH ID: 21-01862	TA-21	Drill Depth: 0-8.5 ft bgs	Total Pages: 1
Driller: Dave Starnes/Spectrum		Start Date: 10/14/2007	End Date: 10/14/2007
Drilling Equipment/Method: CME 85 Hollow-Stem Auger		Logged By: M.Sandoval, K.Reid	
Sampling Equipment/Method: 3" ID 5' Length Split-Barrel Sampler			

DEPTH (ft bgs)	RECOVERY (ft/ft)	FIELD SCREENING RESULTS: PID (ppm)/RAD	SAMPLE ID	LITHOLOGICAL DESCRIPTION	LITHOLOGY	NOTES
0 1 2 3 4	3.5/3.5	PID=0.0 RAD=<MDA	0-0.8 ft bgs MD21-07-6740	0-1.5' silty loam, 7.5yr5/4 1.5-3.5' silty clay loam, 5yr5/4	SOIL	1010 1 ft stick-up
5 6 7 8 9	5/5	PID=0.0 RAD=<MDA	4.5-6.5 ft bgs MD21-07-6741 MD21-07-6795 (FD) 7-8 ft bgs MD21-07-6742	3.5-4.5' Same as above 4.5-6.5' Tuff, weathered 6.5-8.5' Tuff, unweathered	QBT 2	**Tuff at 4.5 ft bgs** 1015 TD = 8.5 ft bgs

BOREHOLE LOG
Material Disposal Area T Phase II Investigation

BH ID: 21-02568	TA-21	Drill Depth: 0-10ft bgs	Total Pages: 1
Driller: Dave Starnes/Spectrum		Start Date: 10/14/2007	End Date: 10/14/2007
Drilling Equipment/Method: CME 85 Hollow-Stem Auger		Logged By: M.Sandoval, K.Reid	
Sampling Equipment/Method: 3" ID 5' Length Split-Barrel Sampler			

DEPTH (ft bgs)	RECOVERY (ft/ft)	FIELD SCREENING RESULTS: PID (ppm)/RAD	SAMPLE ID	LITHOLOGICAL DESCRIPTION	LITHOLOGY	NOTES
0 1 2 3 4 5	3/5	PID=0.0 RAD=<MDA	0-0.8 ft bgs MD21-07-6771	0-3' sandy clay loam 3-5' No Recovery	SOIL	1110 1 ft stick-up **Tuff at 5.7 ft bgs**
6 7 8 9 10	5/5	PID=0.0 RAD=<MDA	5.3-6.1 ft bgs MD21-07-6772 9-10 ft bgs MD21-07-6773	5-7.5' Tuff, weathered 7.5-10' Tuff, unweathered	QBT 2	1120 TD = 10 ft bgs

BOREHOLE LOG

Material Disposal Area T Phase II Investigation

BH ID: 21-02569	TA-21	Drill Depth: 0-14 ft bgs	Total Pages: 1
Driller: Dave Starnes/Spectrum		Start Date: 10/13/2007	End Date: 10/13/2007
Drilling Equipment/Method: CME 85 Hollow-Stem Auger		Logged By: M.Sandoval, K.Reid	
Sampling Equipment/Method: 3" ID 5' Length Split-Barrel Sampler			

DEPTH (ft bgs)	RECOVERY (ft/ft)	FIELD SCREENING RESULTS: PID (ppm)/RAD	SAMPLE ID	LITHOLOGICAL DESCRIPTION	LITHOLOGY	NOTES
0 1 2 3 4	4/4	PID=0.0 RAD=<MDA	0-0.8 ft bgs MD21-07-6775	0-4' Soil: well-developed , dark 7.5yr3/2; a few rounded quartz/pumice/tuff/pebbles at very base; pebbly horizon at 2.5ft; blackish clay layer just below pebbles. Very damp.	SOIL	1450 1 ft stick-up
5 6 7 8 9	4.5/5	PID=0.0 RAD=<MDA	7.5-8.5 ft bgs MD21-07-6776	4-8' Same as above with organic rooty layer at 4.5-5 ft bgs 8-9' Tuff, weathered, mixed with soil, damp 7.5YR 4/4	SOIL QBT 2	1453 **Tuff at 8.0 ft bgs**
10 11 12 13 14	3/5	PID=0.0 RAD=<MDA	12-13 ft bgs MD21-07-6777	9-12' Tuff; grayish matrix, 7.5yr7/2, disced; 20% quartz, 5% iron oxidized mafics or pyroxene; 5-10% plagioclase; rare sanidine; poorly welded 12-14' No Recovery	QBT 2	1500 TD = 14 ft bgs

BOREHOLE LOG

Material Disposal Area T Phase II Investigation

BH ID: 21-25266	TA-21	Drill Depth: 0-14 ft bgs	Total Pages: 1
Driller: Dave Starnes/Spectrum		Start Date: 10/19/2007	End Date: 10/19/2007
Drilling Equipment/Method: CME 85 Hollow-Stem Auger		Logged By: M.Sandoval, K.Reid	
Sampling Equipment/Method: 3" ID 5' Length Split-Barrel Sampler			

DEPTH (ft bgs)	RECOVERY (ft/ft)	FIELD SCREENING RESULTS: PID (ppm)/RAD	SAMPLE ID	LITHOLOGICAL DESCRIPTION	LITHOLOGY	NOTES
0 1 2 3 4	4/4	PID=0.0 RAD=<MDA	0-0.8 ft bgs MD21-07-6768	0-2' silty loam 5yr4/4, dry 2-4' silty clay 7.5yr4/4, dry	SOIL	915 1 ft stick-up
5 6 7 8 9	4/5	PID=0.0 RAD=<MDA	5-5.7 ft bgs MD21-07-6769	4-5.3' Same as above 5.3-9' Tuff, weathered, 7.5yr6.2, dry. Quartz 15%, sanidine 10%.	SOIL QBT 2	**Tuff at 5.3 ft bgs** 920
10 11 12 13 14	5/5	PID=0.0 RAD=<MDA	12.5-13.3 ft bgs MD21-07-6770	9-11' Same as above 11-14' Unweathered tuff, 10yr8/1,dry, quartz 10%, sanidine 10%, mafic 1%, Iron staining at grain boundaries.	QBT 2	930 TD = 14 ft bgs

BOREHOLE LOG

Material Disposal Area T Phase II Investigation

BH ID: 21-60300	TA-21	Drill Depth: 0-15 ft bgs	Total Pages: 1
Driller: Dave Starnes/Spectrum		Start Date: 10/19/2007	End Date: 10/19/2007
Drilling Equipment/Method: CME 85 Hollow-Stem Auger		Logged By: M.Sandoval, K.Reid	
Sampling Equipment/Method: 3" ID 5' Length Split-Barrel Sampler			

DEPTH (ft bgs)	RECOVERY (ft/ft)	FIELD SCREENING RESULTS: PID (ppm)/RAD	SAMPLE ID	LITHOLOGICAL DESCRIPTION	LITHOLOGY	NOTES
0 1 2 3 4 5	3/5	PID=0.0 RAD=<MDA	0-2 ft bgs MD21-07-6725 MD21-07-7022(FD) 8.3-9.3 ft bgs	0-3' sandy clay loam, angular pebbles 3%, 10yr3/4, slightly moist. 3-5' No Recovery	SOIL	1130 1 ft stick-up
6 7 8 9 10	5/5	PID=0.0 RAD=<MDA	MD21-07-6726	5-8' silty clay, slightly moist 8-10' Tuff, weathered	SOIL QBT 2	1135 **Tuff at 8.7 ft bgs**
11 12 13 14 15	5/5	PID=0.0 RAD=<MDA	12.5-13.5 ft bgs MD21-07-6727	10-11.5' Tuff, weathered 11.5-15' unweathered tuff 7.5yr8/1, poorly welded, quartz 10%, sanidine 10%, mafics 1%, pumice 3%, vitrified, iron staining at grain boundaries, dry	QBT 2	1140 TD = 15 ft bgs

Appendix B

Analytical Data Results
(Enclosed on CD with this document)

Appendix C

Waste Management

C-1.0 INDRODUCTION

This appendix contains the waste management and disposal records for waste streams generated during the 2007 Phase II investigation of Material Disposal Area T, also known as Consolidated Unit 21-016(a)-99, at Technical Area 21. The Waste Characterization Strategy Form (WCSF) and amendment was prepared to address characterization approaches, on-site waste management, and final disposition options. The Waste Profile Forms (WPFs) and Chemical Waste Disposal Request forms are still in process as of the date of this submittal and are not included in this appendix.

C-2.0 SUMMARY

The waste stream generated at the Consolidated Unit 21-016(a)-99 during the 27 investigation activities is outlined below.

Barcode Identification Number	Waste Storage Container	Waste Type	Approximate Volumes (yd^3)	Waste Deposal Status
10012820	1 yd^3 King Bag	Drill cuttings	1	pending
10012821	1 yd^3 King Bag		1	pending
10012822	1 yd^3 King Bag		1	pending
10012823	1 yd^3 King Bag		1	pending
10012824	1 yd^3 King Bag		1	pending
10012825	1 yd^3 King Bag		1	pending
10012826	1 yd^3 King Bag		1	pending
10012827	1 yd^3 King Bag		1	pending
10012828	1 yd^3 King Bag		1	pending
10012829	1 yd^3 King Bag		1	pending
10012830	1 yd^3 King Bag		1	pending
10012831	1 yd^3 King Bag		1	pending
10012832	15 gal Plastic Drum	Contact waste (plastic sheeting, personal protective equipment, and sample equipment waste)	0.5	pending
		Total volume of waste produced	12.5	

The drill cuttings are stored in 1-yd^3 king bags and staged on site along with the 15-gal. drum of contact waste. This waste is being handled as non-hazardous low-level radioactive waste and is staged pending disposal.

The designated waste management coordinator prepared the investigation-derived waste (IWD) documents, including the WCSF, WPFs, and all waste disposal requests.

C-3.0 WASTE CHARACTERIZATION STRATEGY FORM (WCSF)

The WCSF and the 10/5/07 Amendment were prepared before IDW generation. Both are included in the appendix.

Amendment to the
Waste Characterization Strategy Form (WCSF) for

MDA T Characterization

Date:10/5/07

Introduction

This amendment covers Phase II Characterization work at MDA T. The field work at MDA T will resume in response to NMED Compliance Order requirements. All generated waste streams are expected to be the same as stated in the original WCSF, with the following three additions:

(1) Waste # 4: Petroleum-Contaminated Soil (PCS) (Potential);

(2) Waste # 5: Absorbent Padding Material (Potential) and PPE;

(3) Waste # 6: Municipal Solid Waste (MSW).

BACKGROUND

NMED required the following Phase II activities at MDA T: 1) collection of soil and shallow tuff samples from the DP Canyon hillslope; 2) installation of three permanent vapor monitoring wells; 3) quarterly collection of subsurface vapor samples; and 4) abandonment of boreholes. These activities will be completed from September 2007 to September 2008.

WASTE DESCRIPTION

Waste # 4: Petroleum-Contaminated Soil (PCS) (Potential)

Waste Type: PCS from the release of commercial products such as hydraulic fluid, motor oil, unleaded gasoline, or diesel fuel. This waste stream would only be generated in the event of an accidental release, such as the rupture of a hydraulic or fuel hose.

Anticipated Regulatory Status: New Mexico Special Waste (NMSW) based on the Material Safety Data Sheet (MSDS) for the released product.

Waste # 5: Absorbent Padding Material (Potential) and PPE

Waste Type: Absorbent padding material includes pads, paper towels, or other material used to contain released commercial products considered to be New Mexico Special Waste (NMSW). This waste stream would only be generated in the event of an accidental release, such as the rupture of a hydraulic hose or spill of drilling additives. A spill kit with absorbent materials will be on site at all times. It is assumed that the absorbent padding material has not come in contact with contaminated soil.

Anticipated Regulatory Status: NMSW based on the MSDS for the released product.

Waste # 6: Municipal Solid Waste (MSW)

Waste type: MSW will consist of non-contact trash and debris.
Anticipated Regulatory Status: Municipal solid waste

CHARACTERIZATION, MANAGEMENT, AND DISPOSAL

Waste # 4: Petroleum-Contaminated Soil (PCS) (Potential)

Characterization Approach: The PCS will be characterized based on the MSDS for the product and direct waste characterization sampling (including existing analytical data for the soil). LANL RCTs will conduct radiological surveys on all PCS. If a spill occurs on contaminated soil, the analytical data for the soil should be used. If no data exists for the soil on which it was spilled, analysis of the waste may be required.

Storage and Disposal Method: This waste stream will be stored in containers approved for Petroleum waste, staged in a designated NMSW storage area, and disposed of offsite at an NMSW-permitted facility. If hazardous or mixed waste, it would be accumulated in a hazardous waste accumulation area. If LLW only (non hazardous) it must be accumulated in a rad accumulation area. If the waste is mixed waste, due to rad soil, it would need to be sent off-site for treatment/disposal. If LLW only and no free liquids, it will be disposed in TA-54 or another approved disposal facility.

Waste # 5: Absorbent Padding Material (Potential) and PPE

Characterization Approach: The absorbent material will be characterized based on the MSDS for the released product and direct waste characterization sampling. LANL RCTs will conduct radiological surveys on all absorbent material.

Storage and Disposal Method: This waste stream will be stored in drums in a designated NMSW storage area, and disposed of offsite at a NMSW-permitted.

Waste # 6: Municipal Solid Waste (MSW)

Characterization Approach:
MSW will be characterized based on acceptable knowledge. MSW will be segregated from all other waste streams.

Storage and Disposal Method:
This waste stream will be stored in a plastic bags and placed in LANL sanitary waste dumpsters.

SIGNATURES (Print name and then sign.)		DATE
Project Leader: Bruce Wedgeworth	Bruce Wedgeworth / Brad. Wedgeworth	10/11/07
ERS-ECR Waste Management Coordinator: Gordon Jio	for Gordon Jio	10-11-07
SWRC Representative: Ann Sherrard or Kelly VanDerpoel		10/11/07
NWIS-SWO Representative: Andy Elicio		10/11/07

Table 1.0 Waste Characterization Table

Waste Description	Waste #4 **PCS**	Waste # 5 **Absorbent material**	Waste # 6 **MSW**
Volume	10 cubic yards	10 gallons	10 cubic yards
Packaging	Drums	Drums	Plastic-lined Garbage Can
Regulatory Classification			
Radioactive	x	x	
Solid			X
Hazardous	x	x	
Mixed (hazardous and radioactive)	x	x	
Toxic Substances Control Act (TSCA)			
New Mexico Special Waste	X	X	
Characterization Method			
AK: existing data/documentation	X	X[2]	X
AK: from site characterization (S)			
Direct sampling of containerized waste (W)	X		X

Analytical Testing			
Volatile organic constituents (EPA 8260-B)	X (if needed)	X (if needed)	
Semivolatile Organic Compounds (EPA 8270-C)	X (if needed)	X (if needed)	
Organic Pesticides (EPA 8081-A)			
Organic Herbicides (EPA 8151-A)			
PCBs (EPA 8082)			
Total metals (EPA 6010-B/7471-A)	X	X (if needed)	
Total cyanide (EPA 9012-A)			
High explosives constituents (EPA 8330)			
Asbestos			
Anions including Perchlorate and Nitrates	X	X (if needed)	
TPH (EPA 8015)	X	X (if needed)	
TCLP metals (EPA 1311/6010-B)			
TCLP organics (EPA 1311/8260 & 1311/8270)			
TCLP pest. & herb. (EPA 1311/8081/1311/8151-A)			
Gross alpha (alphacounting)			
Gross beta (beta counting)			
Gross gamma (gamma counting)			
Tritium (liquid scintillation)			
Gamma spectroscopy			
Isotopic plutonium (chem. separation/alpha spec.)			
Isotopic uranium (chem. separation/alpha spec.)			
Strontium-90 (beta proportional counting)			
Americium-241 (chem. separation/alpha spec.)			
Waste Profile Form #	TBD	TBD	TBD

[1]Could be either industrial or used oil

[2]AK from MSDS

Waste Characterization Strategy Form

Project Title	**MDA T Characterization**
Solid Waste Management Unit or Area of Concern #	**Consolidated Unit 21-016(a)-99**
Activity Type	**Surface and Subsurface Characterizations**
Field Team Leader	**Mark Thacker**
Field Waste Management Coordinator	**Mark Shepard**
Completed by	**Mark Shepard/Rob Lundberg**
Date	**September 22, 2005**

Description of Activity:

This Waste Characterization Strategy Form is prepared for upcoming surface and subsurface investigation activities planned at Material Disposal Area (MDA) T. The goal of the current investigation is to characterize the nature and extent of contamination associated with MDA T. The scope of work will be divided into the following activities:

1. Conducting a site-wide gross gamma radiation survey to document present surface conditions and help focus sample collection activities. The areas of investigation are: the southern Delta Prime (DP) Canyon slope area, the MDA T disposal complex, and an approximate 50 ft perimeter outside the MDA T fence boundary.
2. Collecting surface and shallow subsurface samples from approximately 18 locations on the southern slope of DP Canyon. Samples will target the existing drainages where most of the surface flow would have concentrated from MDA T site run-off.
3. Drilling 39 boreholes to characterize subsurface contamination associated with releases from: absorption beds, disposal shafts, Building 257, and former Building 035. The boreholes will be continuously cored. Porosity, moisture content, permeability tests, and matrix suction will be performed on selected core samples collected. The presence of perched water and bedrock fractures will also be evaluated in the deep boreholes. Analytical samples will be collected based on screening results and the depth of nearby absorption beds or disposal shafts.
4. Collecting water samples if perched water is encountered during drilling.
5. Collecting vapor samples from boreholes using SUMMA canisters for VOCs and silica absorbents.
6. Drilling one additional borehole within the Nuclear Environmental Site (NES) boundary. The sampling strategy for this borehole will be identical to the other 38 boreholes.
7. Decontamination of equipment.
8. Maintenance or repair of equipment.
9. Managing investigation-derived waste (IDW).

The guidance document for this work is: Investigation Work Plan for Material Disposal Area T at Technical Area 21, Solid Waste Management Unit 21-016(a)-99, LA-UR-04-0559.

Site History and Description:

The MDA T site, designated as Consolidated Unit 21-016(a)-99, is located on DP Mesa within Technical Area (TA) 21. This area is situated along the northern boundary of the Los Alamos National Laboratory (LANL), and just east-southeast of the Los Alamos town site (see Fig. 1). MDA T comprises Solid Waste Management Units (SWMUs) 21-007; 21-010 (a-h); 21-011 (a, c, d, e, f, g, i, j); 21-016 (a, b, c); and Areas of Concern (AOCs) C-21-001; 21-011(h); C-21-028 (a); C-21-009; and C-21-012. These SWMUs and AOCs address a variety of structures including absorption beds, waste disposal shafts, liquid waste treatment facilities, process tanks and connected piping, and various storage areas adjacent to or within the consolidated SWMU boundary of MDA T.

MDA T occupies an area of about 2.2 acres located in the north-central part of TA-21. The primary features at MDA T are four (4) inactive absorption beds; sixty-four (64) disposal shafts; the subsurface retrievable waste storage area (RWSA) which no longer contains waste; the site of former liquid waste treatment facility Building 035; and the current liquid waste treatment facility at Building 257 (see Fig. 2). The absorption beds and shafts are constructed in the Tshirege Member of the Bandelier Tuff, with depths ranging from approximately 4 to 65 ft below the original ground surface. Fill soil (approximately 5.0 to 6.0 ft deep) emplaced in the late 1980s now covers the original surface of the MDA T absorption beds.

MDA T has a complex process history and was one of the first disposal areas to be used at the Laboratory. A simplified diagram showing the timeline of liquid waste processing and disposal at MDA T is shown in Figure 3.

Absorption Beds

Construction of the four absorption beds for disposal of DP West liquid wastes was completed in 1945. Each bed measures approximately 120 ft long by 20 ft wide by 4 ft deep. Untreated liquid radioactive waste from uranium and plutonium processing laboratories was released to the absorption beds from 1945 to 1952. These beds were also connected to a floor drain in the filter building, TA-21-12. The absorption beds were designed so that beds 1 and 2 received most of the liquid wastes. The overflow from beds 1 and 2 was then discharged to absorption beds 3 and 4, respectively. When the volume of discharges began to exceed the holding capacity of the absorption beds a liquid was treatment plant was constructed.

Building 035 Liquid Waste Treatment

Building 035 housed the first industrial liquid waste treatment facility that began operating in 1952. Building 035 was a chemical precipitation waste treatment plant designed to treat about 50 gallons per minute (gpm). The method of treatment was similar to that employed at the TA-45 plant (Acid Canyon) and involved adding ferric sulfate and lime to the incoming waste stream, forming a precipitate of ferric hydroxide that settled to the bottom carrying the plutonium with it (Shipman 1958, 04700). The liquid derived from de-watering the plutonium-bearing sludges was stored in tanks for several hours or days for control analysis then discharged to a nearby canyon (Abrahams 1962, 08147). This outfall was located in DP Canyon at SWMU 21-011(k). Abrahams also reports that the sludges from Building 035 were buried at MDA C.

Building 035 received a number of additions and modifications over its operating history. In 1956, a vacuum filter system was installed which eliminated the necessity for hauling sludge to the TA-45 plant for filtration (Shipman, 1958, 04700). In 1959, americium waste treatment was constructed to stabilize americium waste in cement for transport to Area G. By 1964, the condition of Building 035 had deteriorated and it was having difficulty keeping up with increasing flow rates (Fowler, 1964, 06758). Building 035 was decommissioned and removed after the new treatment facility for DP Site liquid wastes was constructed at Building 257.

Building 257 Liquid Waste Treatment

Operations at Building 257 began in 1967. The basis of liquid waste treatment at Building 257 was co-precipitation of plutonium with ferric sulfate. The treatment process handled a continuous stream of ~~influent~~ that was temporarily retained in two raw storage tanks at the north end of the building. Raw feed pumps lifted the waste in the storage tanks to a flash mixer where lime, ferric sulfate, and coagulant aids were added (Christenson and Emility 1970, 08428). The wastewater flowed to a flocculator then on to a settling tank; settled effluent was pumped through a pressure filter and then sampled to verify treatment. From there, the effluent was received into two final holding tanks before being released to the DP Canyon outfall.

In addition to the continuous waste water stream, Building 257 also treated a variety of other wastes by "batch" process. The most demanding of these was a high solids-content, highly acidic solution that averaged approximately 1 mg/l of americium-241 and 1 mg/l of plutonium-239 (Christenson and Emility 1970, 08428). This waste stream was received via tanker trailer at an unloading station on the west wall of the facility. The waste was neutralized with a 50% sodium hydroxide (NaOH) solution. Post neutralization, the solids concentration was about 30%, most of which was sodium nitrate. Initially, this waste was pumped into steel drums, mixed with cement and other additives in a drum tumbler, and then shipped to TA-54. The drum tumbler was replaced by a pugmill continuous cement fixation process in 1968.

The pugmill circuit was used to solidify sludge from the process wastewater treatment system as well as the neutralized americium waste and other small-volume streams. The combined sludges were staged in a sludge storage tank prior to being mixed with cement in the pugmill. From the pugmill mixer, the treated product was pumped through a buried pipeline to the disposal shafts. Later on this waste stream was put into corrugated metal pipes (CMPs) for placement in the RWSA.

Disposal Shafts

The Shaft Disposal Area at MDA T consists of approximately 64 shafts for the disposal of radioactive, cement-treated mixtures. These disposal shafts were drilled into the Bandelier Tuff located mainly between Absorption Beds 2 and 4. The shafts are approximately 8 ft in diameter and range in depth from 15 to 65 ft. The shafts were lined with heated roofing asphalt prior to filling with the cement wastes.

Retrievable Waste Storage Area (RWSA)

The RWSA was excavated in 1974 to provide a method for temporarily storing cement-treated transuranic wastes in CMPs. This area was approximately 120 ft long, 24 ft wide, and 19 ft deep. The ramp leading to the bottom of the pit was 60 ft long. Each pipe measured 20 ft long by 2.5 ft in diameter; pipes were placed on end in the excavation. The RWSA held a total of 227 CMPs, which were subsequently removed during 1984 and 1986. The RWSA was backfilled with excavation spoils following removal of the CMPs.

Previous Investigations of MDA T:

A variety of field investigations and studies have been conducted at MDA T ranging from early environmental monitoring surveys in 1946 to the most recent geophysical surveys in 2003. The scope, objectives, and results of pre-RFI studies are presented in detail in the Historical Investigation Report (HIR) for MDA T and are not discussed any further here. Note the HIR appears as Appendix B of the Investigation Work Plan for MDA T (LANL 2004).

This section discusses the results of Phase I RFI field investigations, beginning in about 1992, which provide the most applicable characterization data for the upcoming fieldwork at MDA T. The most recent subsurface characterization data was collected from the drilling program during 1996 and 1997.

1992 Field Investigation

The field investigation conducted in 1992 represents the first RFI fieldwork at MDA T. Surface samples (0 to 6-in. depth) were collected from the nodes of a 131- by 131-ft sampling grid covering DP Mesa, Los Alamos Canyon, and DP Canyon. The intent of the grid sampling was to establish TA-21 baseline concentrations and identify trends in site-wide contamination resulting from airborne stack emissions.

Surface and shallow subsurface samples were collected and analyzed for organic chemicals, inorganic chemicals and radionuclides, including tritium, plutonium-238, plutonium-239, and americium-241. Results of this investigation indicate widespread existence of low-level radionuclides in this area of the Laboratory. The distribution pattern of contamination indicates the source of contamination is probably not limited to MDA T. Organic and inorganic contaminants were not generally detected in this investigation (LANL 2004).

1993-1994 Field Investigations

During July 1993 a geodetic survey of MDA T was performed to establish a radiological survey grid and to mark locations of soil samples. Samples were collected from the top 6 in of soil at 33 locations on a 65.6-by 65.6-ft grid and at 17 locations off the grid. Samples were screened for gross alpha, beta, and gamma radiation at a mobile radiological lab before being sent offsite for fixed laboratory analyses. Field activities in the MDA T drainage occurred in August 1994. A total of 15 samples were collected from the top 12 in. of sediment (LANL 1996, 70348).

Also in August of 1994, a series of 17 exploratory borings were drilled in and around the footprint of former Building 035 and two associated tanks. These borings did not exceed 20 ft below ground surface (bgs) with most encountering tuff between 7.5 and 10 ft bgs. The drill cuttings and core were screened for alpha and beta/gamma radiation, organic vapors and oxygen/explosive gasses. One borehole reportedly encountered radiological contamination that was later determined by laboratory analyses to be americium-241 and plutonium 239/240. This contamination was probably associated with a large junction box that served as a connection point for numerous lines from Building 035 and other buildings in TA-21.

The combined surface sampling results from the 1992, 1993, and 1994 RFI fieldwork at MDA T is summarized as follows:

- Concentrations of inorganic chemicals are present at greater than background values, specifically for calcium, copper, lead, nickel and zinc
- Radionuclides, including americium-241, cesium-137, plutonium-238, plutonium-239, strontium-90 and uranium isotopes are present in concentrations above background values/fallout values.

- Organic compounds were detected, specifically 10 polycyclic aromatic hydrocarbons (PAHs) and one phthalate. These were attributed to proximity to a local roadway and other anthropogenic sources and not site related.

1996-1997 Field Investigations

These are the most recent subsurface investigations performed at MDA T. A geophysical survey was conducted in November 1996, primarily to identify and delineate the position of absorption beds, disposal trenches, the disposal shaft field, and other man-made features at the site prior to the commencement of an exploratory drilling project. A secondary objective of this survey was to identify and map the paleochannel.

A total of 19 boreholes with depths ranging from 15 to 200 ft bgs were drilled during this investigation. The locations of these boreholes are shown in Figure 4 and further described in the HIR for MDA T. General borehole descriptions are as follows:

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

Samples were collected at nominal 5-ft intervals. At each 5-ft interval the core samples were screened for VOCs (using a photoionization detector) and radioactivity (with hand-held alpha and beta/gamma probes). At each 10-ft interval, samples were collected and submitted to the mobile radiological lab for gross alpha, beta, and gamma radiation. Ten percent of the samples submitted to the mobile lab were submitted to fixed laboratory analyses by gamma spectroscopy, total uranium, isotopic plutonium, tritium, strontium-90, VOCs, SVOCs, and target analyte list metals.

Results of the 1996-1997 subsurface investigations at MDA T are summarized as follows:

- Radioactive contamination was detected beneath all absorption beds at depths down to about 100 ft. Some of the contamination appears to be fracture controlled. The greatest concentrations occur in and beneath absorption beds 1 and 2. The principal radionuclides are americium-241; plutonium-239 and –238; cesium-137; strontium-90; and uranium-234, -235, and -238.
- A variety of inorganic metals were detected above background values in soil/tuff. Of the hazardous characteristic metals, only cadmium, chromium, and mercury locally exceeded 20 times their applicable TCLP regulatory level in boreholes drilled in absorption beds 1 and 2.
- Low concentrations of a variety of organic compounds were also detected in the subsurface samples. Potential listed hazardous waste constituents include toluene, trichloroethene,

tetrachloroethene, and Trichlorofluoromethane. There is no record of these chemicals having been used in the plutonium recovery and purification processes at TA-21. Christensen and Maraman report that organics contaminated with plutonium often required special recovery procedures because of the incompatibility of the organics with the routine acid-aqueous separation processes. Plutonium in volatile organic compounds, such as alcohols and acetone was often recovered through distillation or evaporation if small quantities were involved. Larger volumes of such residues would be recovered through $Fe(OH)_3$ carrier precipitation (Christensen and Maraman 1969).

The frequency of detections above background for all samples analyzed by fixed analytical laboratories during the 1992, 1993, 1994, and 1996-1997 field campaigns are summarized in Tables B-26 through B-28. Tables B-26 through B-28 show the frequency of detections for radionuclides, organic chemicals, and inorganic elements and compounds, respectively.

References:

Abrahams, J.H., Jr., 1962, Radioactive Waste Disposal at Los Alamos, New Mexico, Internal Report to the Atomic Energy Commission, Los Alamos, New Mexico. (Abrahams, 1962, 08147)

Christensen, E.L., and Maraman, W.J., April 1969, Plutonium Processing at the Los Alamos Scientific Laboratory, Los Alamos Scientific Laboratory Report LA-3542, Los Alamos, New Mexico. (Christensen and Maraman 1969)

Christenson, C.W. and Emility, L.A., 1970, Chemical Treatment and Cement Fixation of Radioactive Wastes, *in Journal of the Water Pollution Control Federation*, Vol. 42, No.7, p.1343-1350. (Christenson and Emility 1970, 08428).

Fowler, E.B., 1964, New Treatment Facility at DP West to Replace Building 35, Los Alamos Scientific Laboratory Internal Memorandum to T.L. Shipman, Los Alamos, New Mexico. (Fowler 1964, 06758)

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

LANL (Los Alamos National Laboratory) February 2004, Investigation Work Plan for Material Disposal Area T at Technical Area 21, Solid Waste Management Unit 21-016(a)-99, Los Alamos National Laboratory document LA-UR-04-0559, Los Alamos, New Mexico. (LANL 2004)

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

Characterization Strategy:

Three (3) separate waste streams are anticipated from the proposed investigation activities: Borehole Cuttings; "Contact" Wastes, including personal protective equipment (PPE), plastic, disposable sampling equipment and decontamination wipes; and decontamination solutions. Management of Investigation-Derived Wastes (IDW) will follow the "Management Plan for Investigation-Derived Waste", Appendix C in the Investigation Work Plan for Material Disposal Area T at Technical Area 21, Solid Waste Management Unit 21-016(a)-99, LA-UR-04-0559.

Waste # 1: Borehole Cuttings

Waste Type: This waste stream comprises drill cuttings, excess core, and returned samples (from the radiological screening laboratory) generated from the 39 boreholes proposed in this investigation.

Anticipated Regulatory Status: Solid, Nonhazardous, Low-level radioactive waste.

Characterization Approach: Borehole cuttings will be characterized with analytical results from the core samples, augmented by direct sampling of the containerized waste, if needed. The proposed borehole drilling, sampling, and analytical testing scheme for MDA T is provided in Table 1 (see attachments to this WCSF).

To determine if the cuttings are radioactively contaminated, the maximum detected concentrations of radionuclides will be compared with regional background/fallout values. If maximum concentrations exceed background/fallout values, the cuttings will be designated low-level radioactive waste (LLW).

Total concentrations of RCRA toxicity characteristic constituents (see 40 CFR 261.24, Table 1) will be compared with 20 times the applicable regulatory level listed in the table. If any constituent exceeds 20 times its regulatory level, samples of borehole cuttings will be submitted for Toxicity Characteristic Leaching Procedure (TCLP) analysis to determine if the cuttings are hazardous by characteristic.

If potential listed hazardous waste constituents are detected, a thorough review of historical records will be conducted to determine whether the source of each constituent was a listed hazardous waste at its point of generation. If a positive source is identified and confirmed to be a point of generation for listed hazardous waste, then the cuttings will be managed as either hazardous or mixed low-level waste depending on radionuclide concentrations. Otherwise, the cuttings will be managed as nonhazardous solid waste or LLW (depending on radionuclide concentrations).

Storage and Disposal Method: The waste will be containerized in "King" bags or roll-off containers, as appropriate, at or near the point of generation (i.e., the drill rig). The waste will be stored in a radioactive waste staging area within the MDA T perimeter fence. Based on results of previous investigations, this waste stream is anticipated to be classified as LLW that will be disposed at TA-54, Area G or at a LANL approved off-site LLW disposal facility.

Waste # 2: "Contact" IDW

Waste Type: This waste stream includes PPE (gloves, ear plugs); plastic bags and sheeting; disposable sampling supplies; decontamination towels; and other solid waste that come into contact with potentially contaminated environmental media.

Anticipated Regulatory Status: Solid, Non-radioactive and Low-level radioactive waste.

Characterization Approach: Contact IDW will be characterized using knowledge of the waste generating process and the levels of radioactive contamination encountered. Environmental media (soils, drill cuttings, and core) will be screened continuously in the field for radioactivity. Results of the field screening will be used to determine if contact waste has the potential to be radioactively contaminated. This will form the basis for segregating the waste articles for processing through the TA-54 "Green is Clean" (GIC) Operations, or declaring them to be LLW.

Storage and Disposal Method: The non-radioactive contact wastes will be placed in plastic GIC green-striped bags and staged until enough bags have accumulated to warrant shipment. These bags will be transported to TA-54 for GIC verification measurement. Radioactively contaminated articles will be containerized in 55-gallon drums and stored in the radioactive waste staging area. LLW will be disposed at TA-54, Area G or at a LANL approved off-site disposal facility.

Waste # 3: Decontamination Solutions

Waste Type: Aqueous solutions generated from wet decontamination activities.

Anticipated Regulatory Status: Liquid, low-level radioactive waste.

Characterization Approach: This waste stream will be characterized by direct sampling of the containerized waste. Refer to the characterization table below for analytical parameters.

Storage and Disposal Method: This waste will be containerized in 55-gallon drums and stored onsite in the radioactive waste staging area. This waste stream will be disposed at the TA-50 Radioactive Liquid Waste Treatment Facility (RLWTF).

Waste Characterization Strategy Form (continued)
CHARACTERIZATION TABLE

Waste Description	Waste # 1 Borehole Cuttings	Waste # 2 Contact IDW	Waste # 3 Decon Solutions	Waste # ___
Volume	<110 yd^3	<10 yd^3	<100 gal	
Packaging	"King" bags or roll-off containers	GIC plastic bags, 55-gallon drums	Poly or metal drums, 30 or 55-gallon	
Regulatory classification:				
Radioactive	X	X	X	
Solid	X	X	X	
Hazardous				
Mixed (hazardous and radioactive)				
Toxic Substances Control Act (TSCA)				
New Mexico Special Waste				
Industrial				
Characterization Method				
Acceptable knowledge (AK): Existing Data/Documentation	X	X		
AK: Site Characterization (a)	X	X		
Direct Sampling of Containerized Waste			X (c)	
Analytical Testing				
Volatile Organic Compounds (EPA 8260-B)	X	X	X	
Semivolatile Organic Compounds (EPA 8270-C)	X	X	X	
Organic Pesticides (EPA 8081-A)				
Organic Herbicides (EPA 8151-A)				
PCBs (EPA 8082)				
Total Metals (EPA 6010-B/7471-A)	X	X	X (d)	
Total Cyanide (EPA 9012-A)				
High Explosives Constituents (EPA 8330/8321-A)				
Asbestos				
Total petroleum hydrocarbon (TPH)-GRO (EPA 8015-M)				
TPH-DRO (EPA 8015-M)				
Toxicity characteristic leaching procedure (TCLP) Metals (EPA 1311/6010-B)	(b)			
TCLP Organics (EPA 1311/8260-B & 1311/8270-C)				
TCLP Pest. & Herb. (EPA 1311/8081-A/1311/8151-A)				
Gross Alpha (alpha counting) (EPA 900)	X	X	X	
Gross Beta (beta counting) (EPA 900)	X	X	X	
Tritium (liquid scintillation) (EPA 906.0)	X	X	X	
Gamma spectroscopy (EPA 901.1)	X	X	X	
Isotopic plutonium (chem. separation/alpha spec.) (HASL-300)	X	X	X	
Isotopic uranium (chem. separation/alpha spec.) (HASL-300)	X	X	X	
Total uranium (6020 inductively coupled plasma mass spectroscopy [ICPMS])	X	X		
Strontium-90 (EPA 905)	X	X	X	

Waste Description	Waste # 1 Borehole Cuttings	Waste # 2 Contact IDW	Waste # 3 Decon Solutions	Waste # ___
Americium-241 (chem. separation/alpha spec.) (HASL-300)	X	X		
Waste Profile Form #	TBD	TBD	TBD	

Notes:
TBD – to be determined.
(a) the analytical tests indicated below, performed on site characterization samples, will be used to characterize waste streams #1 and #2
(b) contingent on results of total metals analysis; the TCLP samples will be collected directly from containerized waste.
(c) also analyze for COD and TSS.
(d) request METTAL+B analysis.

SIGNATURES	DATE
Project Leader (Print name and then sign below.) Mark Thacker Mark Thacker	10/11/05
ERS-ECR Waste Management Coordinator (Print name and then sign below.) Leonard Trujillo Leonard Trujillo	10/11/05
SWRC Representative (Print name and then sign below.) Kelly VanDerpoel Kelly VanDerpoel	10/7/05
NWIS-SWO Representative (Print name and then sign below.) Michelle Coriz Michelle L. Coriz	10/13/05

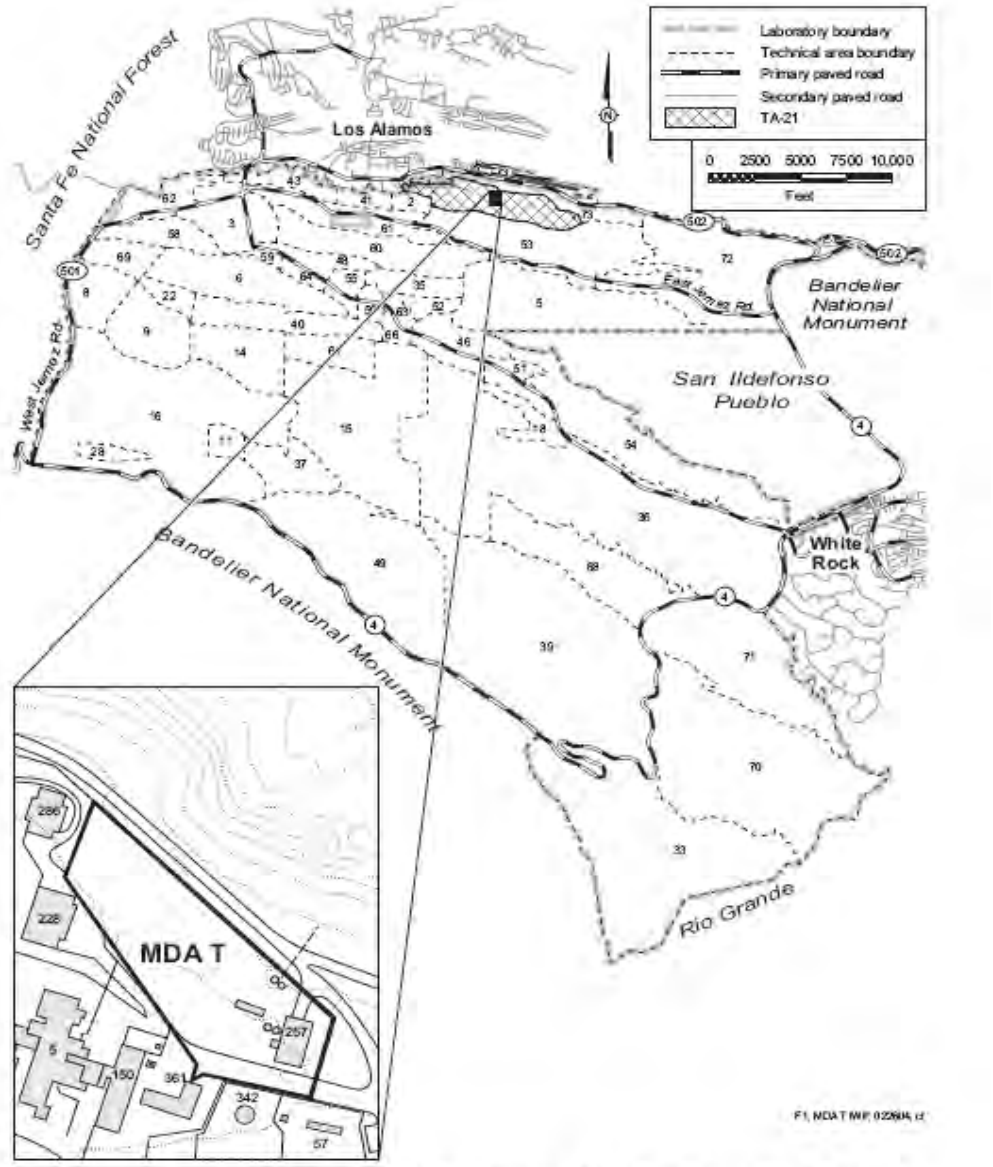

Figure 1. Location of TA-21 with respect to Laboratory TAs and surrounding land holdings

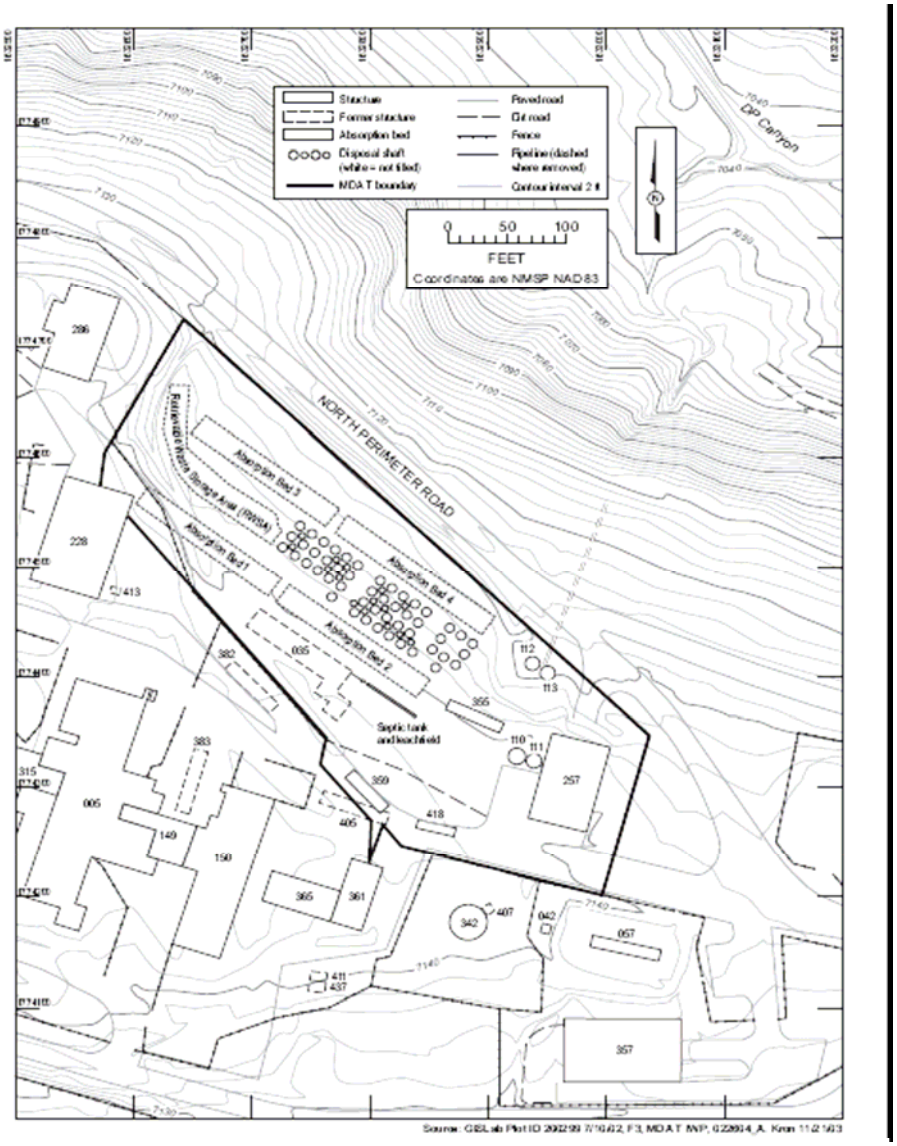

Figure 2. MDA T detailed site map

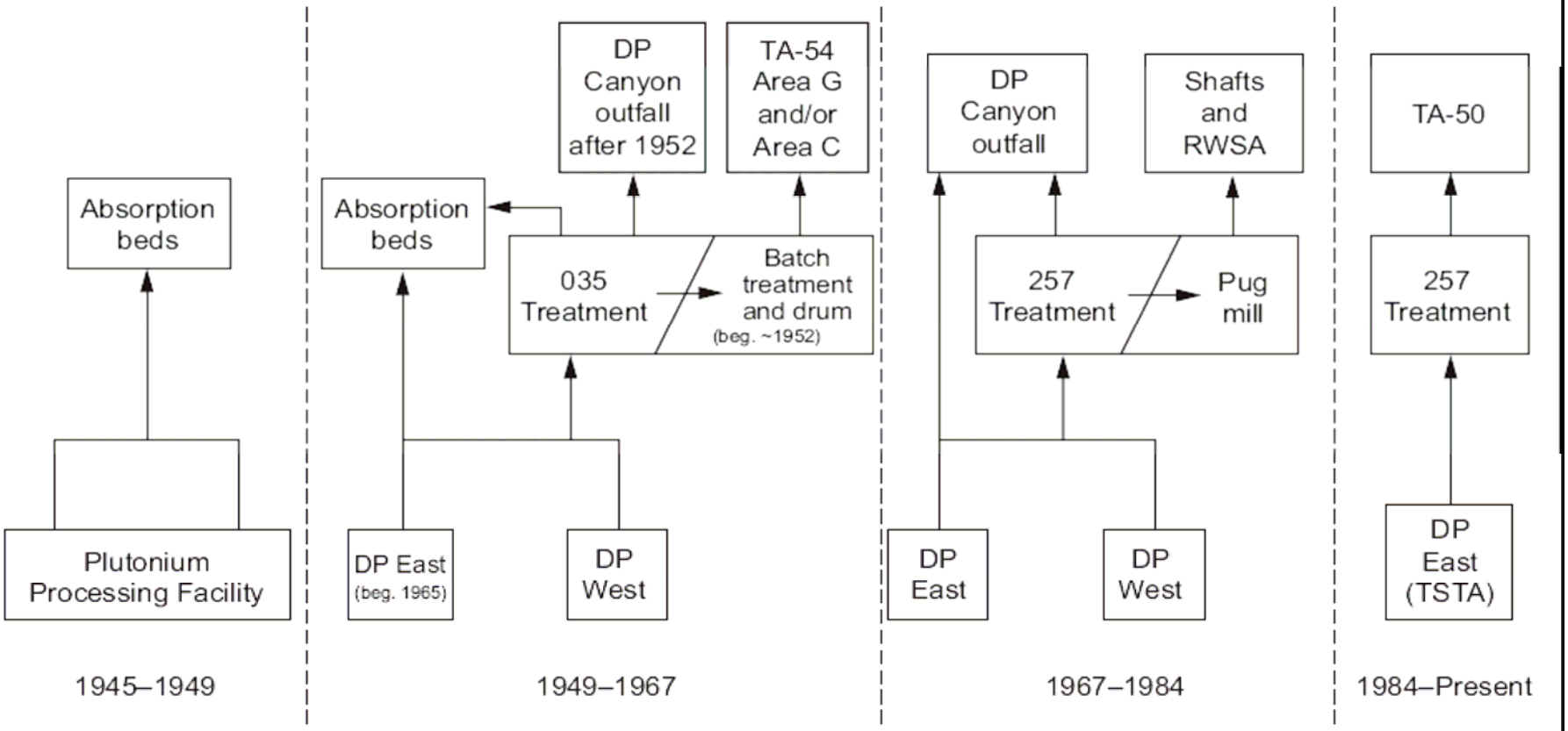

Figure 3. Simplified waste processing and disposal history at MDA T

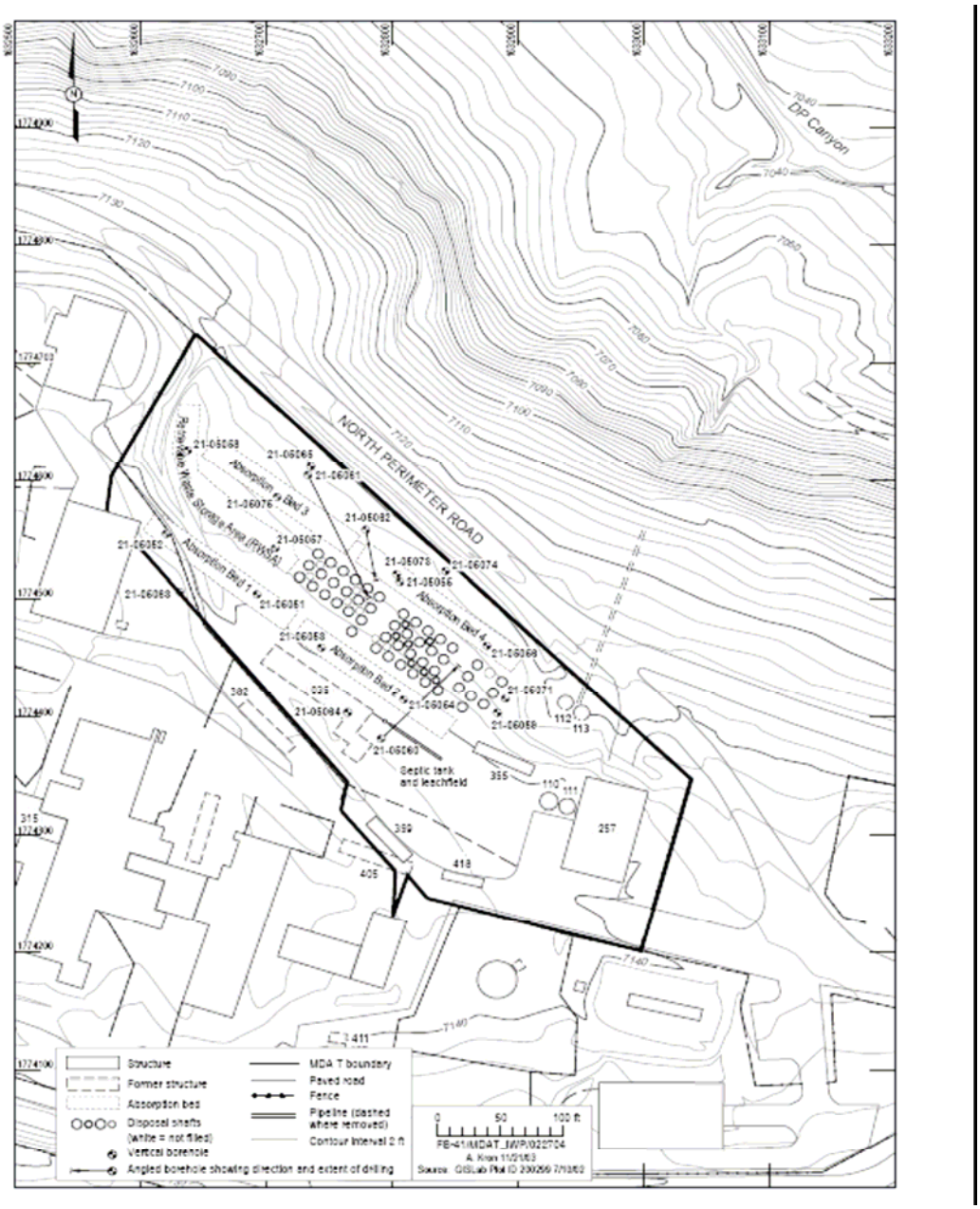

Figure 4. Location of boreholes drilled during 1996-1997 investigations.

Table 1
Summary of Proposed Borehole Drilling and Sampling at MDA T

Site/ Data Need Addressed	Borehole or Location ID	Location	Borehole Depth (ft)	Geologic Units encountered	VOCs[a]	SVOCs	Dioxins/Furans[b]	pH	Total Uranium	Radionuclides	TAL Metals	Nitrates	Perchlorate	CO_3 and HCO_3	Gamma Spectroscopy	Americium-241	Isotopic Plutonium	Isotopic Uranium	Strontium-90	Tritium
Borehole Drilling					**Borehole Sampling: X = planned — = not planned**															
Absorption beds, shafts and RWSA / vertical extent, fractures, perched water	1, 2, and 3	North of absorption bed 3 and 4, south of absorption bed 1	385	Qbt 3, Qbt 2, and Qct	X	X	X	X	X	X	X	X	X	—	X	X	X	X	X	X
Absorption beds, shafts / nature and extent	4	North of MDA T	280	Qbt 3, Qbt 2	X	X	X	X	X	X	X	X	X	—	X	X	X	X	X	X
Absorption beds, shafts; Tank 112 / nature and extent	5	North of MDA T	280	Qbt 3, Qbt 2	X	X	X	X	X	X	X	X	X	—	X	X	X	X	X	X
RWSA, beds and shafts / nature and extent and paleochannel characterization.	6	RWSA	280	Qbt 3, Qbt 2	X	X	X	X	X	X	X	X	X	—	X	X	X	X	X	X
South side of bed #1 / for continuous moisture profiling; vertical extent and potential shaft release characterization	7	~10 ft south of bed #2, ~25 ft west of the eastern end of the bed	280	Qbt 3, Qbt 2	X	X	X	X	X	X	X	X	X	—	X	X	X	X	X	X
Absorption bed 3 nature and extent	8	Northwest of Absorption bed 3	280	Qbt 3, Qbt 2	X	X	X	X	X	X	X	X	X	—	X	X	X	X	X	X
Contingent boreholes / for lateral extent (located as needed in the field)	9, 10, and 11	TBD	280	Qbt 3, Qbt 2	X	X	X	X	X	X	X	X	X	—	X	X	X	X	X	X

Site/issue Addressed	Borehole or Location ID	Location	Borehole Depth (ft)	Geologic Units encountered	VOCs[a]	SVOCs	Dioxins/Furans[b]	pH	Total Uranium	Radionuclides	TAL Metals	Nitrates	Perchlorate	CO_3 and HCO_3	Gamma Spectroscopy	Americium-241	Isotopic Plutonium	Isotopic Uranium	Strontium-90	Tritium
Bldg. 21-257: Americium loading dock, and tanks 21-110 and 111 / nature and extent, fractures	12 and 13	~20 ft west of Bldg. 257	100	Qbt 3, Qbt 2	X	X	X	X	X	X	X	X	X	—	X	X	X	X	X	X
Bldg. 21-257: foundation (w/ raw waste tanks on north side) / nature and extent, fractures	14, 15, and 16	North, south, and east sides of Bldg. 257	100	Qbt 3/ Qbt 2	X	X	X	X	X	X	X	X	X	—	X	X	X	X	X	X
Bldg. 21-257: Contingent boreholes / for nature and extent (located as needed in the field)	17, 18, and 19	TBD	100	Qbt 3, Qbt 2	X	X	X	X	X	X	X	X	X	—	X	X	X	X	X	X
Tank 113 / nature and extent	20 and 21	North and south of tank 113	100	Qbt3, Qbt 2	X	X	X	X	X	X	X	X	X	—	X	X	X	X	X	X
Bldg. 21-035: septic system	22	20 ft south of absorption bed 2	40	Qbt 3	X	X	X	X	X	X	X	X	X	—	X	X	X	X	X	X
Bldg. 21-035: septic system / nature and extent within drain field	23 and 24	Southeast of absorption bed 2	40	Qbt 3	X	X	X	X	X	X	X	X	X	—	X	X	X	X	X	X
Bldg. 21-035: septic tank (removed) and leach field / lateral and vertical extent	25	southeast side of Bldg. 35	100	Qbt 3	X	X	X	X	X	X	X	X	X	—	X	X	X	X	X	X
Paleochannel borings	26-33	Two sets of four borings on east and west side of MDA T to characterize the paleochannel	30	Qbt 3	X	X	X	X	X	X	X	X	X	-	X	X	X	X	X	X
Bldg. 21-035 / investigate possible releases	34,35 and 36	Bldg. 21-035 footprint	40	Qbt 3																

Site/issue Addressed	Borehole or Location ID	Location	Borehole Depth (ft)	Geologic Units encountered	VOCs[a]	SVOCs	Dioxins/Furans[b]	pH	Total Uranium	Radionuclides	TAL Metals	Nitrates	Perchlorate	CO_3 and HCO_3	Gamma Spectroscopy	Americium-241	Isotopic Plutonium	Isotopic Uranium	Strontium-90	Tritium
Investigate drainage, potential water infiltration	37,38, and 39	Surface drainage west of RWSA	40	Qbt 3																
Diversion drainage; vertical and lateral extent	n/a[c]	Western end of MDA T study area	0 – 2 ft	Fill/soil/ Qbt 3	—	X	—	X	X	X	X	—	X	X	X	X	X	X	X	X[d]
Canyon slope (north facing) / vertical and lateral extent	Drainages and deposition features (40 through 53)	North of DP Road down to the canyon bottom	0 –2 ft	Fill/soil/ Qbt 3	—	X	—	X	X	X	X	—	X	X	X	X	X	X	X	X[d]
Dioxin / Furan sampling of buried operation surface	54-62	Distributed throughout MDA T	TBD	Fill	—	—	X	—	—	—	—	—	—	—	—	—	—	—	—	—

Notes: 1. All boreholes will be continuously cored for collection of curation materials to a depth of 40 ft; material for curation will be collected every 10 ft thereafter.

2. From all boreholes, a minimum of four samples will be collected for fixed lab analysis including:
   a. shallowest field screening detection;;
   b. deepest field screening detection;
   c. highest field screening result;
   d. total depth (TD) of borehole.
3. From all boreholes greater than 100 ft in depth, a minimum of four additional samples from preferential flow pathways will be collected for lab analysis.
4. Tuff sample for permeability tests just above Qbt 2/Qct contact in borings that pass into the Cerro Toledo interval.
5. Geotechnical analysis suite will include saturated and unsaturated hydraulic conductivity, matrix potential, porosity, Kd, chloride analysis, and bulk density. Samples will be taken from soil, Qbt3, Qbt2, twice in the Cerro Toledo, and at least once each from an open and filled fracture for a minimum total of seven samples.
6. All borehole locations will also be sampled at the existing surface, if warranted by the results from walkover radiological surveys.
7. Shallow soil sampling will continue to depths greater than 2 ft if appropriate as indicated by field screening or previous sampling.

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

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

[c] n/a = Not applicable.

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

Table B-26
Frequency of Detection for Radionuclides Above Background

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range (pCi/g)	Background Value (pCi/g)	Frequency of Detects Above Background Value
Americium-241	Qal	12	1	[-1.49] to 210000	NA*	1/12
	Soil	44	36	[-0.58] to 19982	0.013	28/44
	Fill	25	18	[0.11] to 14950	0.013	18/25
	Qbt 2	36	2	[-1.9] to 4.89	NA	2/36
	Qbt 3	144	44	[-1.87] to 66420	NA	44/144
	Qbt 1v	7	0	[-0.98 to 0.79]	NA	0/7
Cesium-134	Qal	12	0	[-0.05 to 0.81]	NA	0/12
	Soil	5	0	[-0.04 to 0.78]	NA	0/5
	Fill	20	0	[-0.28 to 0.8]	NA	0/20
	Qbt 2	36	0	[-0.16 to 0.29]	NA	0/36
	Qbt 3	138	0	[-0.59 to 0.87]	NA	0/138
	Qbt 1v	7	0	[-0.1 to 0.07]	NA	0/7
Cesium-137	Qal	12	1	[-0.11] to 2.5	NA	1/12
	Soil	19	11	[-0.07] to 107.78	1.65	10/19
	Fill	25	12	[0.01] to 271.9	1.65	12/25
	Qbt 2	36	0	[-0.23 to 0.36]	NA	0/36
	Qbt 3	144	11	[-0.26] to 460	NA	11/144
	Qbt 1v	7	0	[-0.09 to 0.12]	NA	0/7
Cobalt-60	Qal	12	0	[-0.16 to 1.1]	NA	0/12
	Soil	5	0	[0.05 to 1.1]	NA	0/5
	Fill	23	0	[-0.12 to 0.9]	NA	0/23
	Qbt 2	36	0	[-0.22 to 0.35]	NA	0/36
	Qbt 3	141	0	[-0.39 to 1.1]	NA	0/141
	Qbt 1v	7	0	[-0.11 to 0.27]	NA	0/7
Europium-152	Qal	12	0	[-0.46 to 2.3]	NA	0/12
	Soil	5	0	[-0.08 to 1.8]	NA	0/5
	Fill	23	0	[-0.76 to 2.1]	NA	0/23
	Qbt 2	36	1	[-1.24] to 4.42	NA	1/36
	Qbt 3	141	0	[-1.89 to 6.08]	NA	0/141
	Qbt 1v	7	0	[-0.97 to 0.83]	NA	0/7
Plutonium-238	Qal	12	2	[0.03] to 170	NA	2/12
	Soil	44	34	[0.002] to 1440	0.023	24/44
	Fill	25	16	[0.0016] to 2480	0.023	16/25
	Qbt 2	36	2	[0.02] to 0.34	NA	2/36
	Qbt 3	144	21	[-0.002] to 3719	NA	21/144
	Qbt 1v	7	0	[0.04 to 0.09]	NA	0/7

Table B-26 (continued)

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range (pCi/g)	Background Value (pCi/g)	Frequency of Detects Above Background Value
Plutonium-239	Qal	12	3	[0.02] to 2800	NA	3/12
	Soil	44	38	[0.005] to 19143	0.054	28/44
	Fill	25	22	0.0847 to 230600	0.054	22/25
	Qbt 2	36	2	[0] to 1.33	NA	2/36
	Qbt 3	144	59	[0] to 67000	NA	59/144
	Qbt 1v	7	1	[0.02] to 0.38	NA	1/7
Ruthenium-106	Qal	12	0	[-1.1 to 8]	NA	0/12
	Soil	5	0	[-0.57 to 6.9]	NA	0/5
	Fill	23	0	[-2.27 to 7.6]	NA	0/23
	Qbt 2	36	0	[-2.98 to 3.3]	NA	0/36
	Qbt 3	141	0	[-3.74 to 8.2]	NA	0/141
	Qbt 1v	7	0	[-2.11 to 0.58]	NA	0/7
Sodium-22	Qal	12	0	[-0.19 to 1]	NA	0/12
	Soil	5	0	[-0.13 to 0.97]	NA	0/5
	Fill	23	0	[-0.08 to 0.93]	NA	0/23
	Qbt 2	36	0	[-0.18 to 0.35]	NA	0/36
	Qbt 3	141	0	[-0.33 to 1]	NA	0/141
	Qbt 1v	7	0	[-0.13 to 0.13]	NA	0/7
Strontium-90	Qal	4	0	[0 to 140]	NA	0/4
	Soil	44	12	[-0.49] to 44.3	1.31	12/44
	Fill	24	18	[0] to 756.88	1.31	18/24
	Qbt 2	21	1	[0] to 1.14	NA	1/21
	Qbt 3	114	41	[-0.64] to 133.68	NA	41/114
	Qbt 1v	4	0	[0.02 to 0.81]	NA	0/4
Tritium	Soil	38	31	[1.237875E-02] to 0.8204922	NA	31/38
	Fill	2	0	[1.233197E-02 to 5.110699E-02]	NA	0/2
	Qbt 3	3	3	0.1136835 to 0.267933	NA	3/3
Uranium-234	Qal	4	3	[1.06] to 92	NA	3/4
	Soil	32	31	[0.64] to 3.45	2.59	2/32
	Fill	22	19	0.239 to [35]	2.59	8/22
	Qbt 2	21	18	[0.89] to 2.09	1.98	1/21
	Qbt 3	111	78	0.626 to 99.44	1.98	11/111
	Qbt 1v	4	4	1.35 to 2.43	3.12	0/4
Uranium-235	Qal	12	0	[-0.63 to 9.2]	NA	0/12
	Soil	32	1	[0.03 to 0.34]	0.2	0/32
	Fill	23	9	[0 to 4.4]	0.2	3/23
	Qbt 2	36	0	[-0.58 to 1.09]	0.09	0/36

Table B-26 (continued)

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range (pCi/g)	Background Value (pCi/g)	Frequency of Detects Above Background Value
	Qbt 3	141	20	[-11 to 2.77]	0.09	0/141
	Qbt 1v	7	0	[-0.38 to 0.3]	0.14	0/7
Uranium-238	Qal	4	3	[0.87] to 55	NA	3/4
	Soil	32	30	[0.75] to 1.562	2.29	0/32
	Fill	22	19	0.266 to 33	2.29	4/22
	Qbt 2	21	17	0.97 to 2.47	1.93	2/21
	Qbt 3	111	67	[0.39 to 24]	1.93	7/111
	Qbt 1v	4	4	1.34 to 2.02	3.05	0/4

*NA = not applicable

Table B-27
Frequency of Detection for Organic Chemicals

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	Frequency of Detects	Quant Limit
Anthracene	Fill	25	1	0.048 to [0.45]	1/25	0.47
Benz(a)anthracene	Fill	25	7	0.027 to 0.46	7/25	0.47
Benzo(a)pyrene	Fill	25	5	0.041 to [0.45]	5/25	0.47
Benzo(b)fluoranthene	Fill	25	5	0.05 to [0.45]	5/25	0.47
Benzo(g,h,i)perylene	Fill	25	3	0.046 to [0.45]	3/25	0.47
Benzo(k)fluoranthene	Fill	25	4	0.039 to [0.45]	4/25	0.47
Bis(2-ethylhexyl)phthalate	Qal	7	1	0.087 to [0.4]	1/7	0.47
Bis(2-ethylhexyl)phthalate	Fill	25	5	0.046 to [0.45]	5/25	0.47
Bis(2-ethylhexyl)phthalate	Qbt 3	117	3	0.074 to [0.47]	3/117	0.47
Butanone[2-]	Qbt 2	27	1	0.002 to [0.024]	1/27	0.026
Butanone[2-]	Qbt 3	116	1	[0.004] to [0.03]	1/116	0.026
Butanone[2-]	Qbt 1v	4	1	0.003 to [0.02]	1/4	0.026
Chrysene	Fill	25	7	0.038 to 0.48	7/25	0.47
Dibromo-3-Chloropropane[1,2-]	Qbt 3	116	2	0.001 to [0.015]	2/116	0.015
Dichlorodifluoromethane	Qbt 3	116	1	0.004 to [0.015]	1/116	0.015
Di-n-butylphthalate	Fill	25	4	0.039 to [0.46]	4/25	0.44
Di-n-butylphthalate	Qbt 3	117	13	0.037 to [4]	13/117	0.44
Fluoranthene	Fill	25	7	0.046 to 1.4	7/25	0.47
Hexanone[2-]	Soil	9	1	[0.022] to 0.043	1/9	0.03
Indeno(1,2,3-cd)pyrene	Fill	25	3	0.043 to [0.45]	3/25	0.47
Isopropyltoluene[4-]	Fill	25	3	[0.005] to 0.013	3/25	0.008
Phenanthrene	Fill	25	4	0.039 to 0.6300001	4/25	0.47
Pyrene	Fill	25	7	0.043 to 1	7/25	0.47
Tetrachloroethene	Qal	7	1	0.002 to [0.006]	1/7	0.008
Tetrachloroethene	Soil	9	1	0.004 to [0.006]	1/9	0.008
Tetrachloroethene	Fill	25	4	0.002 to 0.008	4/25	0.008
Tetrachloroethene	Qbt 3	116	1	[0.005] to [0.028]	1/116	0.008
Toluene	Qal	7	1	0.002 to [0.006]	1/7	0.007
Toluene	Soil	9	1	[0.006] to [0.006]	1/9	0.007
Toluene	Fill	25	12	0.002 to 0.14	12/25	0.007
Toluene	Qbt 3	116	7	0.001 to 0.014	7/116	0.007
Trichloroethene	Fill	25	7	0.002 to 0.01	7/25	0.006
Trichlorofluoromethane	Qal	7	1	0.002 to [0.006]	1/7	0.006
Trichlorofluoromethane	Qbt 3	116	1	0.002 to [0.008]	1/116	0.006

Table B-28
Frequency of Detection for Inorganic Chemicals Above Background

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	Background Value (mg/kg)	Frequency of Detects Above Background Value	Frequency of Nondetects Above Background Value
Aluminum	Qal	7	7	2600 to 11800	NA*	7/7	NA
	Soil	43	43	1190 to 18700	29200	0/43	0/43
	Fill	25	25	1910 to 13200	29200	0/25	0/25
	Qbt 2	27	27	221 to 722	7340	0/27	0/27
	Qbt 3	117	117	163 to 32300	7340	15/117	0/117
	Qbt 1v	4	4	419 to 506	8170	0/4	0/4
Antimony	Qal	7	0	[0.58 to 8.9]	NA	0/7	NA
	Soil	43	1	[0.21] to [9]	0.83	0/43	5/43
	Fill	25	0	[0.26 to 11]	0.83	0/25	12/25
	Qbt 2	27	0	[5.1 to 8.5]	0.5	0/27	27/27
	Qbt 3	117	4	[0.24] to [30.6]	0.5	4/117	92/117
	Qbt 1v	4	0	[5.1 to 5.2]	0.5	0/4	4/4
Arsenic	Qal	7	5	[0.36] to 4.5	NA	5/7	NA
	Soil	43	31	[0.7] to 4.5	8.17	0/43	0/43
	Fill	25	20	0.55 to 5.7	8.17	0/25	0/25
	Qbt 2	27	15	[0.21] to 0.94	2.79	0/27	0/27
	Qbt 3	117	76	[0.21] to 24.9	2.79	9/117	1/117
	Qbt 1v	4	3	[0.38] to 0.76	1.81	0/4	0/4
Barium	Qal	7	7	14.7 to 101	NA	7/7	NA
	Soil	43	41	0.9 to 191	295	0/43	0/43
	Fill	25	23	21 to 497	295	1/25	0/25
	Qbt 2	27	27	3.5 to 16.4	46	0/27	0/27
	Qbt 3	117	111	1.1 to 241	46	21/117	0/117
	Qbt 1v	4	4	8.5 to 15.6	26.5	0/4	0/4
Beryllium	Qal	7	7	0.31 to 0.91	NA	7/7	NA
	Soil	43	32	0.15 to 124	1.83	1/43	0/43
	Fill	25	18	0.18 to 0.84	1.83	0/25	0/25
	Qbt 2	27	25	0.1 to 0.68	1.21	0/27	0/27
	Qbt 3	117	92	0.02 to 2.8	1.21	8/117	0/117
	Qbt 1v	4	4	0.43 to 0.51	1.7	0/4	0/4
Cadmium	Qal	7	2	0.2 to 0.96	NA	2/7	NA
	Soil	43	25	[0.45] to 7.1	0.4	25/43	18/43
	Fill	25	12	[0.06] to 36.6	0.4	7/25	12/25
	Qbt 2	27	4	[0.46] to 0.89	1.63	0/27	0/27
	Qbt 3	117	22	[0.07] to 49	1.63	4/117	0/117
	Qbt 1v	4	0	[0.83 to 0.85]	0.4	0/4	4/4

Table B-28 (continued)

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	Background Value (mg/kg)	Frequency of Detects Above Background Value	Frequency of Nondetects Above Background Value
Calcium	Qal	7	7	883 to 51100	NA	7/7	NA
	Soil	43	42	447 to 7900	6120	1/43	0/43
	Fill	25	25	474 to 3930	6120	0/25	0/25
	Qbt 2	27	27	97.3 to 473	2200	0/27	0/27
	Qbt 3	117	112	108 to 180000	2200	15/117	0/117
	Qbt 1v	4	4	189 to 465	3700	0/4	0/4
Chromium	Qal	7	7	1.8 to 17.9	NA	7/7	NA
	Soil	43	41	[1.7] to 11.6	19.3	0/43	0/43
	Fill	25	24	[1.9] to 133	19.3	5/25	0/25
	Qbt 2	27	16	[0.9] to 67.2	7.14	2/27	0/27
	Qbt 3	117	85	[0.13] to 119	7.14	19/117	0/117
	Qbt 1v	4	4	2.4 to 17.6	2.24	4/4	0/4
Cobalt	Qal	7	6	[1.3] to 6.5	NA	6/7	NA
	Soil	43	29	[0.91] to 8.1	8.64	0/43	0/43
	Fill	25	19	1.1 to 7.4	8.64	0/25	0/25
	Qbt 2	27	8	[1] to 2.1	3.14	0/27	0/27
	Qbt 3	117	40	[0.26] to 8.3	3.14	10/117	2/117
	Qbt 1v	4	2	[1.1] to 1.2	1.78	0/4	0/4
Copper	Qal	7	7	2.5 to 7.5	NA	7/7	NA
	Soil	43	36	[1.8] to 23.1	14.7	2/43	0/43
	Fill	25	23	[1.1] to 134	14.7	9/25	0/25
	Qbt 2	27	26	[1.1] to 3.8	4.66	0/27	0/27
	Qbt 3	117	99	0.002 to 131	4.66	29/117	1/117
	Qbt 1v	4	3	[1.3] to 2.6	3.26	0/4	0/4
Cyanide (total)	Qal	3	0	[0.29 to 0.3]	NA	0/3	NA
	Soil	2	0	[0.28 to 0.29]	NA	0/2	NA
	Fill	7	0	[0.26 to 0.3]	NA	0/7	NA
	Qbt 2	15	0	[0.26 to 0.67]	NA	0/15	NA
	Qbt 3	30	0	[0.26 to 0.83]	NA	0/30	NA
	Qbt 1v	4	0	[0.26 to 0.27]	NA	0/4	NA
Iron	Qal	7	7	3550 to 13200	NA	7/7	NA
	Soil	43	43	3310 to 15700	21600	0/43	0/43
	Fill	25	25	3120 to 13600	21600	0/25	0/25
	Qbt 2	27	27	869 to 5520	14600	0/27	0/27
	Qbt 3	117	116	1.88 to 22300	14600	8/117	0/117
	Qbt 1v	4	4	5450 to 5630	9900	0/4	0/4

Table B-28 (continued)

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	Background Value (mg/kg)	Frequency of Detects Above Background Value	Frequency of Nondetects Above Background Value
Lead	Qal	7	7	2.8 to 17.5	NA	7/7	NA
	Soil	43	43	6.1 to 17.4	22.3	0/43	0/43
	Fill	25	25	3.9 to 52	22.3	6/25	0/25
	Qbt 2	27	27	1.4 to 18	11.2	1/27	0/27
	Qbt 3	109	105	[0.36] to 40.8	11.2	21/109	0/109
	Qbt 1v	4	3	[1.3] to 7.1	18.4	0/4	0/4
Lithium	Soil	28	27	2.7 to 14.8	NA	27/28	NA
Magnesium	Qal	7	7	428 to 1780	NA	7/7	NA
	Soil	43	39	324 to 2690	4610	0/43	0/43
	Fill	25	23	293 to 2100	4610	0/25	0/25
	Qbt 2	27	27	15.2 to 75.3	1690	0/27	0/27
	Qbt 3	117	109	20.2 to 5760	1690	16/117	0/117
	Qbt 1v	4	4	37.8 to 61.9	780	0/4	0/4
Manganese	Qal	7	7	58.7 to 406	NA	7/7	NA
	Soil	43	43	128 to 479	671	0/43	0/43
	Fill	25	25	44 to 468	671	0/25	0/25
	Qbt 2	27	27	101 to 336	482	0/27	0/27
	Qbt 3	117	117	7.7 to 1290	482	3/117	0/117
	Qbt 1v	4	4	274 to 300	408	0/4	0/4
Mercury	Qal	7	1	[0.06] to 1.1	NA	1/7	NA
	Soil	4	0	[0.05 to 0.06]	0.1	0/4	0/4
	Fill	23	14	[0.05] to 18.6	0.1	12/23	3/23
	Qbt 2	27	0	[0.05 to 0.053]	0.1	0/27	0/27
	Qbt 3	114	26	[0.05] to 2.9	0.1	16/114	3/114
	Qbt 1v	4	0	[0.05 to 0.05]	0.1	0/4	0/4
Molybdenum	Soil	28	0	[2.5 to 6.8]	NA	0/28	NA
Nickel	Qal	7	7	2.6 to 11.4	NA	7/7	NA
	Soil	43	30	[1.5] to 63.6	15.4	1/43	0/43
	Fill	25	20	[1.7] to 355	15.4	8/25	0/25
	Qbt 2	27	6	[1.7] to 32.7	6.59	2/27	0/27
	Qbt 3	117	58	0.72 to 75.8	6.59	20/117	0/117
	Qbt 1v	4	1	[2] to 6.5	2	1/4	2/4

Table B-28 (continued)

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	Background Value (mg/kg)	Frequency of Detects Above Background Value	Frequency of Nondetects Above Background Value
Potassium	Qal	7	7	321 to 1140	NA	7/7	NA
	Soil	43	36	256 to 2350	3460	0/43	0/43
	Fill	25	23	[274] to 2060	3460	0/25	0/25
	Qbt 2	27	19	[122] to 502	3500	0/27	0/27
	Qbt 3	117	84	[119] to 6260	3500	8/117	0/117
	Qbt 1v	4	3	237 to 285	6670	0/4	0/4
Selenium	Qal	7	0	[0.36 to 0.79]	NA	0/7	NA
	Soil	43	1	[0.34] to [3.6]	1.52	1/43	1/43
	Fill	25	0	[0.22 to 3.6]	1.52	0/25	5/25
	Qbt 2	27	0	[0.3 to 0.38]	0.3	0/27	22/27
	Qbt 3	116	14	[0.22] to [14.2]	0.3	13/116	95/116
	Qbt 1v	4	0	[0.37 to 0.38]	0.3	0/4	4/4
Silver	Qal	7	0	[0.32 to 2.1]	NA	0/7	NA
	Soil	43	1	[0.68] to [2.5]	1	1/43	39/43
	Fill	25	11	[0.17] to 10.7	1	8/25	8/25
	Qbt 2	27	0	[0.84 to 1.9]	1	0/27	18/27
	Qbt 3	117	14	[0.16] to 19.8	1	9/117	60/117
	Qbt 1v	4	0	[1.8 to 1.9]	1	0/4	4/4
Sodium	Qal	7	7	65.3 to 1480	NA	7/7	NA
	Soil	16	5	[72.8] to 277	915	0/16	0/16
	Fill	25	23	91.5 to 625	915	0/25	0/25
	Qbt 2	27	27	115 to 1020	2770	0/27	0/27
	Qbt 3	117	107	65.1 to 1650	2770	0/117	0/117
	Qbt 1v	4	4	206 to 242	6330	0/4	0/4
Strontium	Soil	28	27	2.5 to 32.6	NA	27/28	NA
Thallium	Qal	7	0	[0.24 to 0.76]	NA	0/7	NA
	Soil	43	0	[0.21 to 0.28]	0.73	0/43	0/43
	Fill	25	3	[0.25] to [1.1]	0.73	2/25	4/25
	Qbt 2	27	1	[0.25] to [0.26]	1.1	0/27	0/27
	Qbt 3	117	12	[0.17 to 5]	1.1	3/117	2/117
	Qbt 1v	4	0	[0.24 to 0.25]	1.24	0/4	0/4
Uranium	Soil	11	11	0.393 to 2.3	1.82	3/11	0/11
	Fill	2	2	2.2 to 2.27	1.82	2/2	0/2
	Qbt 3	3	3	1.08 to 1.42	2.4	0/3	0/3

Table B-28 (continued)

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	Background Value (mg/kg)	Frequency of Detects Above Background Value	Frequency of Nondetects Above Background Value
Vanadium	Qal	7	7	4.6 to 18.8	NA	7/7	NA
	Soil	43	37	2.6 to 26.8	39.6	0/43	0/43
	Fill	25	23	3.2 to 27.9	39.6	0/25	0/25
	Qbt 2	27	18	[0.96] to 2.6	17	0/27	0/27
	Qbt 3	117	77	[0.23] to 34.3	17	10/117	0/117
	Qbt 1v	4	4	1.9 to 2.7	4.48	0/4	0/4
Zinc	Qal	7	7	12.7 to 699	NA	7/7	NA
	Soil	43	43	21.8 to 111	48.9	6/43	0/43
	Fill	25	25	10.8 to 88.9	48.9	6/25	0/25
	Qbt 2	27	27	8.6 to 58.8	63.5	0/27	0/27
	Qbt 3	117	116	[1.5] to 226	63.5	5/117	0/117
	Qbt 1v	4	4	42 to 48.9	84.6	0/4	0/4

*NA = not applicable