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MAR 1996
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Date: March 1, 1996
Refer to: EM/ER:96-094

Mr. David Neleigh
NM Federal Facilities Section
EPA, Region 6, 6PD-N
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

SUBJECT: SAMPLING AND ANALYSIS PLAN FOR POTENTIAL RELEASE SITE (PRS) 21-016(a,b,c)

Dear Mr. Neleigh:

The subject sampling plan is enclosed and is submitted as an addition to the Resource Conservation and Recovery Act Facility Work Plan for Operable Unit 1106. This sampling plan supersedes the work plan for Material Disposal Area T subsurface. Los Alamos National Laboratory agreed to submit this Phase I Sampling and Analysis Plan by March 1, 1996. The plan has undergone Laboratory and Department of Energy review.

If you have any questions, please call Garry Allen at (505) 667-3394 or Bonnie Koch at (505) 665-7202.

Sincerely,

Jorg Jansen, Program Manager
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Sincerely,

Theodore J. Taylor, Program Manager
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JJ/TT/bp

Enclosure: Sampling And Analysis Plan For Potential Release Site 21-016(a,b,c)

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Sampling and Analysis Plan for

Subsurface Investigation at
Solid Waste Management Unit
Group 21-016
Material Disposal Area T
Technical Area 21

Field Unit 1

Environmental
Restoration
Project

February 1996

A Department of Energy
Environmental Cleanup Program

Los Alamos
NATIONAL LABORATORY

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1.0 PROBLEM DEFINITION

1.1 Questions to be Answered

This sampling and analysis plan (SAP) supersedes the Material Disposal Area (MDA) T SAP described in Subsection 16.3 of the Technical Area (TA) 21 Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Work Plan (LANL 1991, 0689). However, this SAP will address the same objectives and data needs identified in the TA-21 work plan, which are to define the source term, assess whether contaminants are migrating from MDA T, assess the long-term risk posed by contaminants at MDA T to groundwater, determine the lateral and vertical extent of contamination, assess migration and exposure pathways, and provide initial cost/risk reduction estimates for various remedial alternatives. The investigation will also focus on hydrogeologic and transport parameters to evaluate contaminant fate and transport, and on a paleochannel to evaluate its potential as a migration pathway.

1.2 Purpose

The purpose of the MDA T subsurface investigation is to assess the presence and concentrations of both radiological and nonradiological constituents, including chemicals regulated by RCRA, in order to evaluate various remedial alternatives for the site. Data currently exist for radioactive constituents at MDA T, which are not regulated by RCRA, but not for RCRA-regulated constituents. These radioactive constituents include uranium, plutonium-238, plutonium-239/240, cesium-137, americium-241, tritium, and strontium-90.

Based on known chemical properties of metals, it is expected that the remedial action for inorganic RCRA constituents, if found to be present, will be identical to the types of remedial action needed to address the known radionuclide contamination. Currently, stabilization in place and capping is the preferred alternative.

It is the intent of Los Alamos National Laboratory (LANL) to mobilize personnel and equipment to this site one time to meet the sampling and analytical objectives of this investigation. Therefore, this investigation will serve as a combined Phase I and Phase II RFI.

1.3 Site Description

1.3.1 MDA T Units

MDA T is located at DP West within TA-21 and was one of the first disposal areas used at the laboratory (Figs. 1-1 and 1-2). Construction of four absorption beds, which are approximately 120 ft long by 20 ft wide by 6 ft deep, for disposal of DP West liquid waste was completed in 1945. Untreated waste from uranium and plutonium processing laboratories and the filter building, structure TA-21-12, was released to the absorption beds from 1945 to 1952. In 1952, a waste treatment facility, building TA-21-35, was constructed to remove the plutonium and other radionuclides from the liquid waste because the tuff under the absorption beds had become clogged with suspended solids. When the amount of wastes discharged to the absorption beds had reached several thousand gallons per day, the absorption beds had to be abandoned (Rogers 1977, 0216). After 1952, effluent from building TA-21-35 was discharged to an outfall, now designated as solid waste management unit (SWMU) 21-011(k), in DP Canyon north of MDA T. However, a few hundred gallons of treated wastes from building TA-21-35 were still released to the absorption beds at infrequent intervals until 1967. In addition, wastes from DP East were discharged to the absorption beds from 1965 to 1967. The composition of the DP East wastes is unknown.

The absorption beds were constructed by clearing and grading the ground surface so that the bottoms of the beds were level. Then, the absorption beds were filled from bottom to top with layers of cobbles, gravel, sand, and earth. The absorption beds were designed so that absorption beds 1 and 2 received most of the liquid wastes. Overflow from absorption beds 1 and 2 was then discharged to absorption beds 3 and 4, respectively. In addition to receiving liquid wastes as described in the previous paragraph, absorption bed 1 could have also received liquid waste directly from a floor drain in structure TA-21-12, and absorption bed 2 could have received liquid waste directly from building TA-21-35 and adjacent influent holding tanks TA-21-110 and TA-21-111. In addition, effluent from building TA-21-35 was pumped to two other holding tanks, TA-21-112 and TA-21-113, also installed in 1952. Tanks TA-21-112 and TA-21-113 discharged effluent to the outfall in DP Canyon (SWMU 21-011[k]) as well as to absorption bed 4. The locations of buildings, holding tanks, and pipelines associated with MDA T are shown in Fig. 1-3.

MDA T also contains 62 disposal shafts, a retrievable waste storage area, and a distribution box. The disposal shafts, which are 6 to 8 ft in diameter and 15.2 to 69.3 ft in depth, were augered starting on May 1, 1968. The shafts received treated wastes from building TA-21-257, a waste treatment facility constructed in 1967 to replace building TA-21-35. The liquid americium-contaminated wastes were mixed with cement and pumped down the shafts (Rogers 1977, 0216). In addition, five shafts have bathyspheres containing plutonium-239/240 and other mixed fission products buried at various depths.

The retrievable waste storage area was a pit measuring 60 ft long by 30 ft wide by 20 ft deep. Beginning in 1975, treated wastes from building TA-21-257 containing concentrations greater than 10 nCi/g of plutonium-239/240 and americium-241 were mixed with cement and pumped into corrugated metal pipes, which were then stored on end in the retrievable waste storage area (Rogers 1977, 0216). The pipes were removed in 1984 and 1986, and the retrievable waste storage area backfilled.

The distribution box, located between absorption beds 1 and 2, received liquid wastes through subsurface pipelines and discharged the effluent first to bed 1 and then to bed 2.

All MDA T units are listed in the Hazardous and Solid Waste Amendments (HSWA) Module of LANL's RCRA Permit. The absorption beds and disposal shafts of MDA T are designated as SWMUs 21-016 (a and c), respectively, while the distribution box is designated SWMU 21-011(c). The retrievable waste storage area should be designated SWMU 21-016(b). However, some confusion exists regarding the SWMU designations of the retrievable waste storage area and a caisson near the northeast corner of absorption bed 1 that was excavated in 1959 to study plutonium distribution beneath the absorption beds. The 21-016 SWMU Report, dated October 31, 1990, states,

> A pit, TA-21-186 (SWMU 21-016[b]), was built in 1959 of redwood and it was about 6 ft by 10 ft by 30 ft deep. The pit was located between two rows of absorption beds. This pit, referred to as the 'Snake Pit', was used for monitoring purposes and did not contain waste. From 1974 to 1982, transuranic wastes were mixed with cement and pumped into corrugated metal pipes into the pit. There were 175 corrugated metal pipes (2.5 ft in diameter, 20 ft long) in the pit, which was located between absorption beds 1 and 3. In 1984 to 1986, the pipes were transported to TA-54 with the intention of shipping them to the WIPP site near Carlsbad, NM (LANL 1990, 0145).

The SWMU Report also states, "A 30-foot deep caisson (the 'Snake Pit') was dug to obtain horizontal cores in 1961..." (LANL 1990, 0145).

The description in the SWMU Report contains several inconsistencies. For instance, the SWMU Report states that the "Snake Pit" was used for monitoring (which was the purpose of the caisson), and then states that transuranic wastes were pumped into corrugated metal pipes in the pit (which was the purpose of the retrievable waste storage area). In addition, the term "pit" was used interchangeably for both the caisson and the retrievable waste storage area. It is clear by the descriptions in the SWMU Report that, although the physical description of the caisson ("Snake Pit") is given, the retrievable waste storage area is actually the SWMU because "...transuranic wastes were mixed with cement and pumped into corrugated metal pipes into the pit" (LANL 1990, 0145). Therefore, the investigation described in this SAP will address the retrievable waste storage area, as well as the absorption beds, disposal shafts, and distribution box.

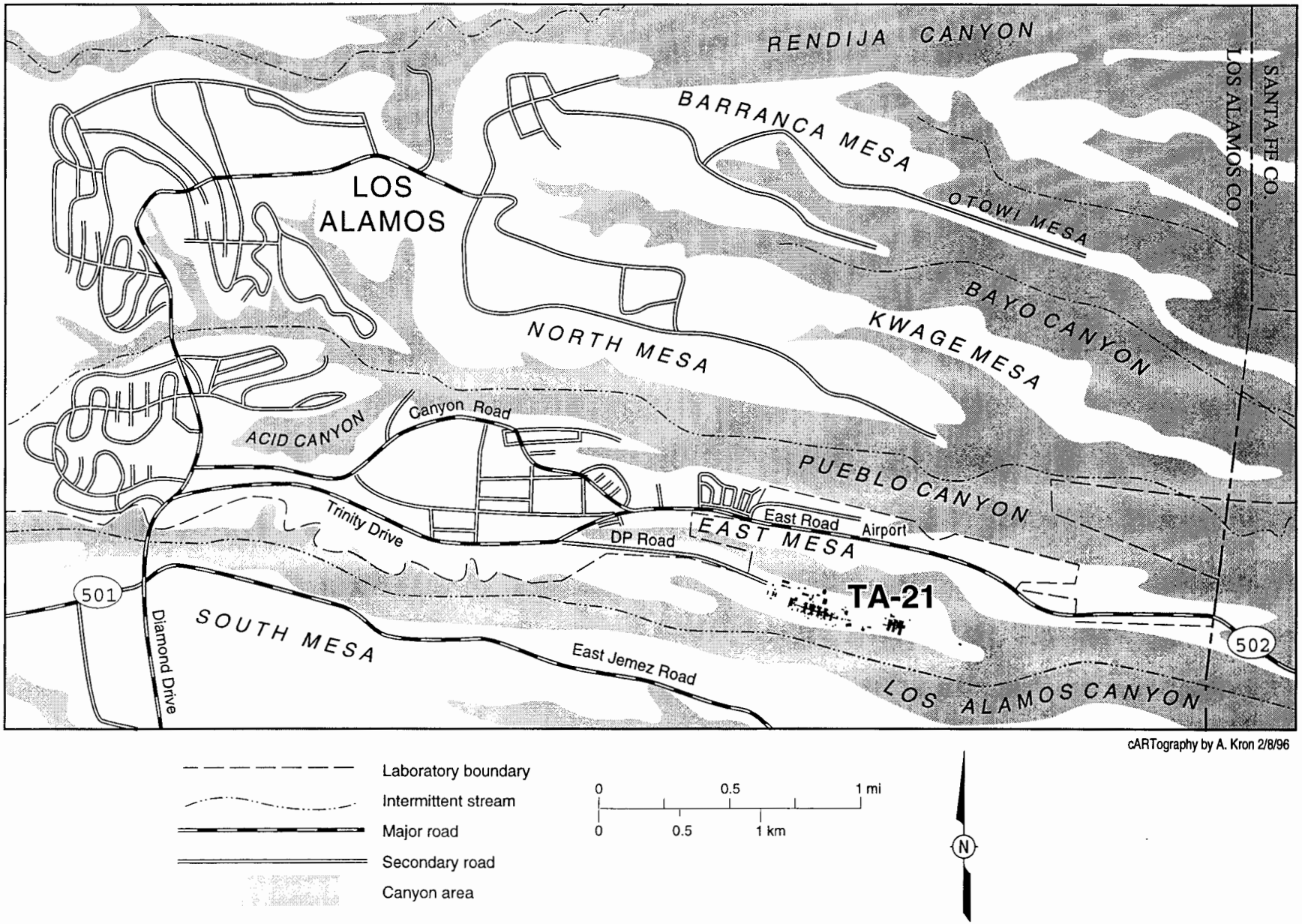

Fig. 1-1. General location of TA-21.

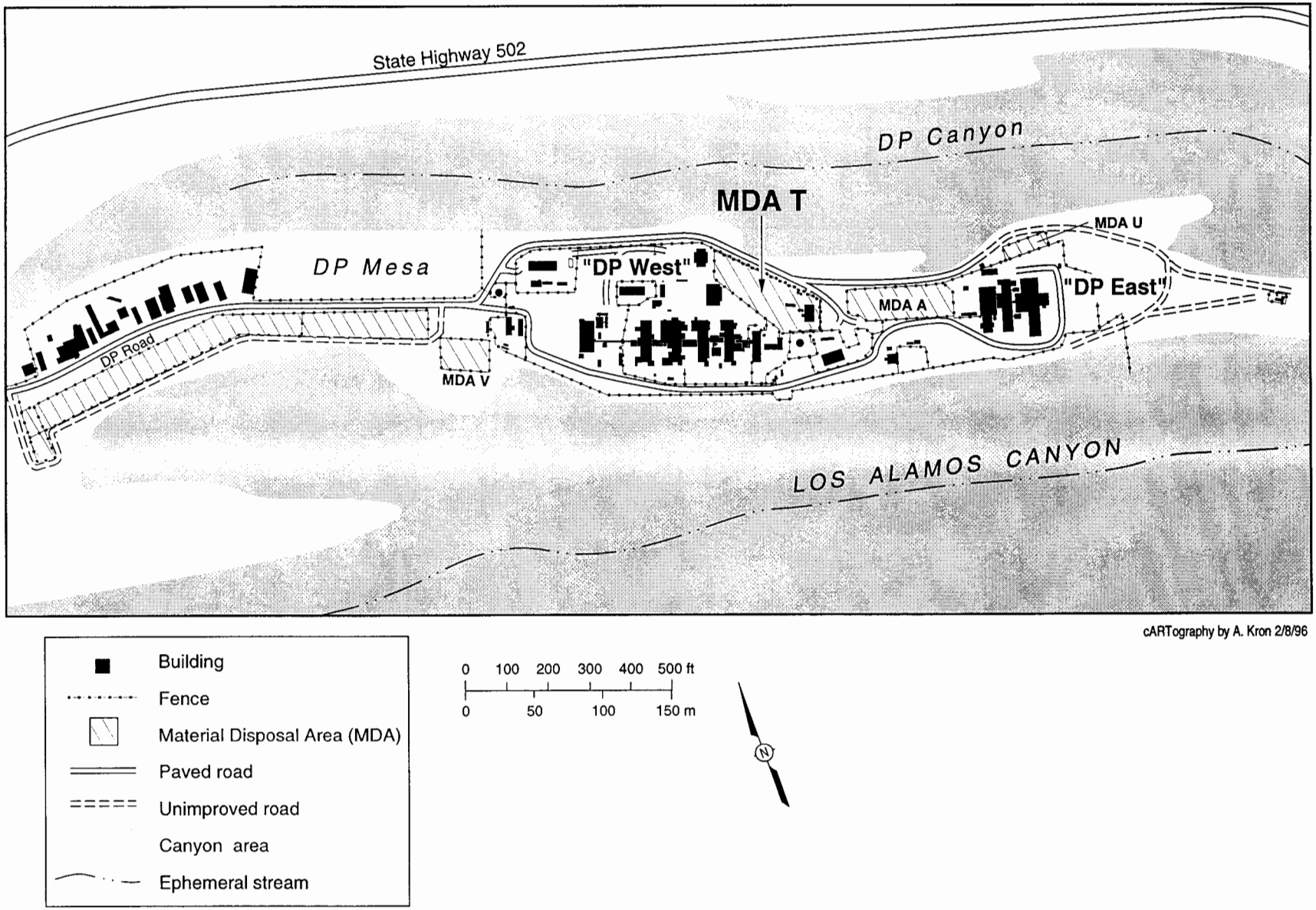

Fig. 1-2. Location of MDA T at TA-21.

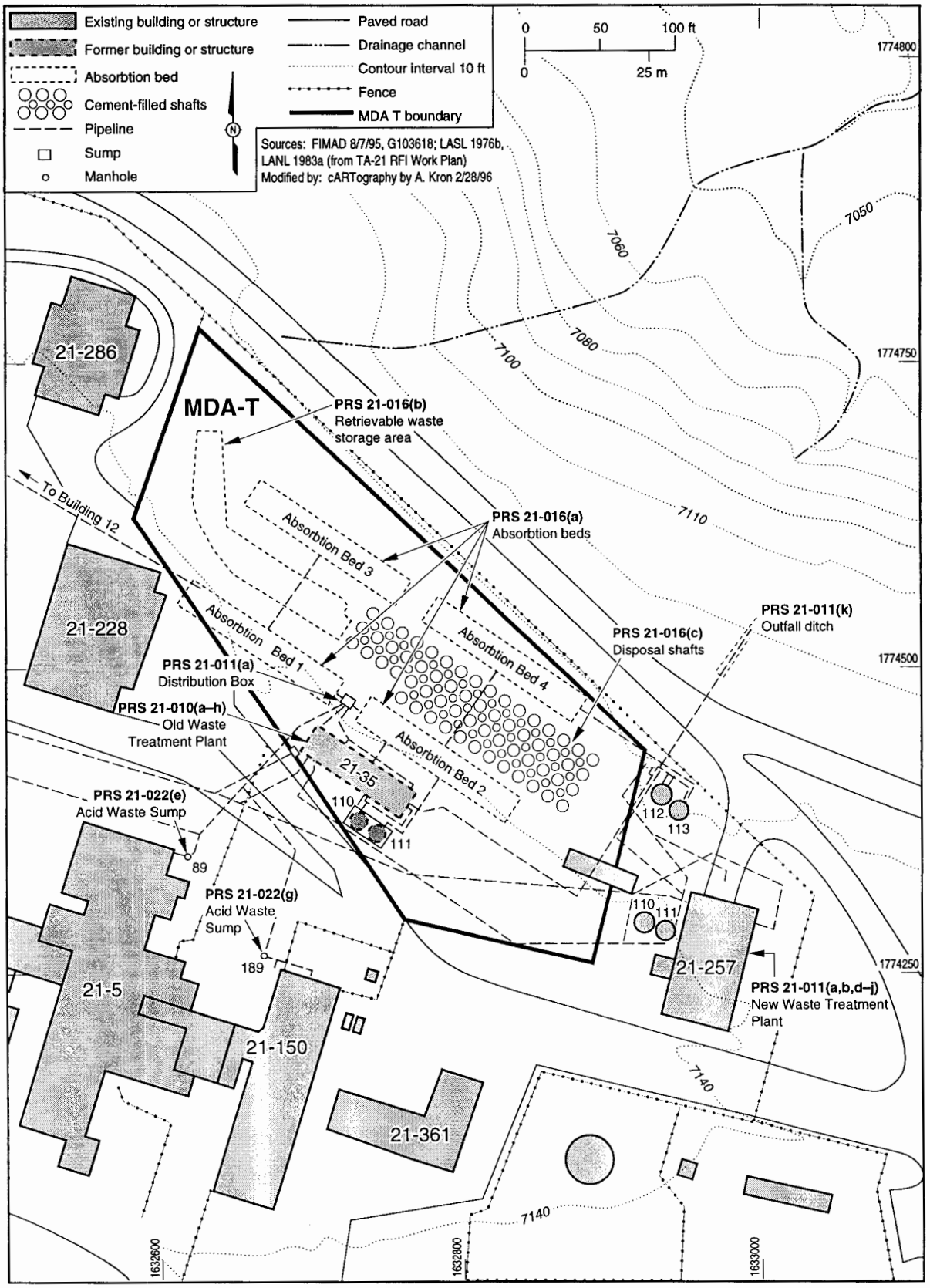

Fig. 1-3. Potential release sites in the vicinity of MDA T.

1.3.2 PRSs in the Vicinity of MDA T

There are numerous other Potential Release Sites (PRSs) in the vicinity of MDA T (Fig. 1-3). The PRSs with the most closely related waste streams are associated with buildings TA-21-35 and TA-21-257 and SWMU 21-011(k). All are described in the TA-21 RFI Work Plan (LANL 1991, 0689).

1.3.3 Geology

The geologic setting for TA-21 is described in Subsection 4.1.7 of the TA-21 RFI Work Plan (LANL 1991, 0689). MDA T is situated in the Tshirege Member of the Bandelier Tuff. Within the Tshirege Member, from top to bottom, are Unit 3, Unit 2, Unit 1v, and Unit 1g. A transition zone, known as the vapor phase notch, is present between Units 1v and 1g. The vapor phase notch typically has a higher moisture content than the surrounding tuff.

A paleochannel is located below the surface of MDA T. Recent studies indicate that the paleochannel was filled by fluvial (related to stream action) deposition. The top of the paleochannel is observable at the original ground surface in historic photographs taken from within the retrievable waste storage area at the time the retrievable waste storage area was excavated. The bottom of the paleochannel is believed to be approximately 30 ft below ground surface (bgs) (Broxton and Eller 1995, 1162). However, not enough data are available at this time to indicate length, width, or trend (direction). The top of the paleochannel is now beneath the fill material emplaced in 1987.

1.4 Historical Data

Previous investigations have revealed that elevated levels of radioactivity are present beneath the absorption beds. Specifically, radioactive contamination is known to be present to a depth of 100 ft bgs beneath absorption bed 1 (LANL 1991, 0689). The presence of RCRA contaminants, primarily metals, associated with the MDA T subunits is suspected based on knowledge of the processes used at TA-21; however, this has never been assessed.

There is an abundance of historical radionuclide data for MDA T from subsurface characterizations in 1953, 1974, and 1978, and surface characterizations in 1984 and 1986. The radionuclides detected (tritium, strontium-90, americium-241, cesium-137, plutonium-238, and plutonium-239/240) are consistent with the suspected effluent constituents from the uranium and plutonium processing laboratories, the floor drain in the filter building

(TA-21-12), and structures TA-21-35 and TA-21-257. Each radionuclide was detected at a concentration greater than its respective screening action level (SAL). These historical data are discussed in Subsection 16.3.1.2 of the TA-21 RFI Work Plan (LANL 1991, 0689).

Three recent RCRA investigations provide data pertinent to this MDA T subsurface characterization. The results of the 1994 RFI of SWMUs 21-010 (a-h) associated with building TA-21-35 suggest the presence of contaminants expected to be associated with the absorption beds. The RFI performed at SWMU 21-011(k), which is an outfall approximately 50 yards north of the MDA T boundary, is described in Phase Report 1C for TA-21, Outfalls Investigation (LANL 1994, 1260). A third RFI of the MDA T surface was conducted in 1994. The results of the Phase I RFIs at building TA-21-35 and the surface of MDA T are summarized in Attachment A.

The radionuclides identified as chemicals of potential concern (COPCs) based on the MDA T surface characterization data include americium-241, cesium-137, plutonium-239/240, and strontium-90. The RFI for PRSs associated with building TA-21-35 identified americium-241, cesium-137, plutonium-238, plutonium-239/240, and strontium-90 as COPCs. The SWMU 21-011(k) RFI identified americium-241, total uranium, plutonium-238, plutonium-239/240, and strontium-90 as COPCs. Thus, the radionuclide COPCs for neighboring PRSs are similar to the MDA T radionuclide COPCs.

Although there is no existing data for RCRA constituents from any previous MDA T subsurface characterizations, Section 3.0 of the TA-21 RFI Work Plan provides more information regarding the origins of RCRA constituents suspected to be present at MDA T (LANL 1991, 0689). The screening assessment performed on the MDA T Phase I surface RFI data did not retain any constituents as COPCs. The screening assessment for SWMU 21-011(k) identified several inorganic chemicals at concentrations above background levels, but no inorganic or organic constituents were retained as COPCs (LANL 1994, 1260).

Subsurface hydrogeologic data collected during the drilling and completion of LADP-3, a monitoring well in LA Canyon, and LAUZ-1, LAUZ-2, and LADP-4, groundwater monitoring wells in DP Canyon, are available for use in subsurface transport modeling at MDA T. Additional data may be gathered from archived core collected during the drilling of a deep borehole, MDA V-DP, which was located adjacent to MDA V in TA-21. These data include, but may not be limited to, porosity, bulk density, mineralogy, saturated hydraulic conductivity, and moisture characteristic.

1.5 Regulatory Context

The current regulatory context for the MDA T subsurface investigation is RCRA. If there are no RCRA COPCs in the subsurface identified by the screening assessment or risk assessment, corrective action will be pursued under Department of Energy (DOE) Order 5820.2A, "Radioactive Waste Management", Chapter III, paragraph 3.j.(4) and/or Chapter II, paragraph 3.I.(1) - (4) (DOE 1988, 0074). If RCRA COPCs are present, corrective action may be pursued under both regulatory drivers, RCRA and DOE Order 5820.2A.

2.0 SAP DESIGN

2.1 Project Overview

The data needs of this investigation are those presented in the TA-21 RFI Work Plan (LANL 1991, 0689) and listed in Subsection 1.1 of this SAP. The overall decision logic for this SAP is presented in Fig. 2-1.

Changes from the SAP presented in the TA-21 RFI Work Plan include the number of boreholes to be drilled and sampled, sampling intervals, number of samples to be collected, and number of analyses performed. The number of boreholes is reduced from a total of 23 in two phases of the original investigation to 22 in this investigation, which includes 15 boreholes at or near MDA T, 5 contingency boreholes to define the lateral extent of contamination, and 2 boreholes under building TA-21-257. Proposed borehole locations are shown in Fig. 2-2 and discussed in detail in Subsection 2.2.

The analytical strategy for the investigation is to maximize the use of quick-turnaround fixed laboratory analyses, mobile laboratory analyses, and field screening. Near real-time review of mobile laboratory results will indicate whether there is a need to drill and sample at greater depths and whether additional boreholes are needed to define the lateral extent of contamination.

2.2 Borehole Locations

The location and spacing of the initial boreholes are based on the known extent of radiological contamination, the size of the absorption beds, and current knowledge of the location and trend of the paleochannel. The boreholes will be drilled in the order presented in the following paragraphs. Proposed borehole locations are shown in Fig. 2-2. Table 2-1 summarizes the number of boreholes, their locations and depths, and the rationale for placement.

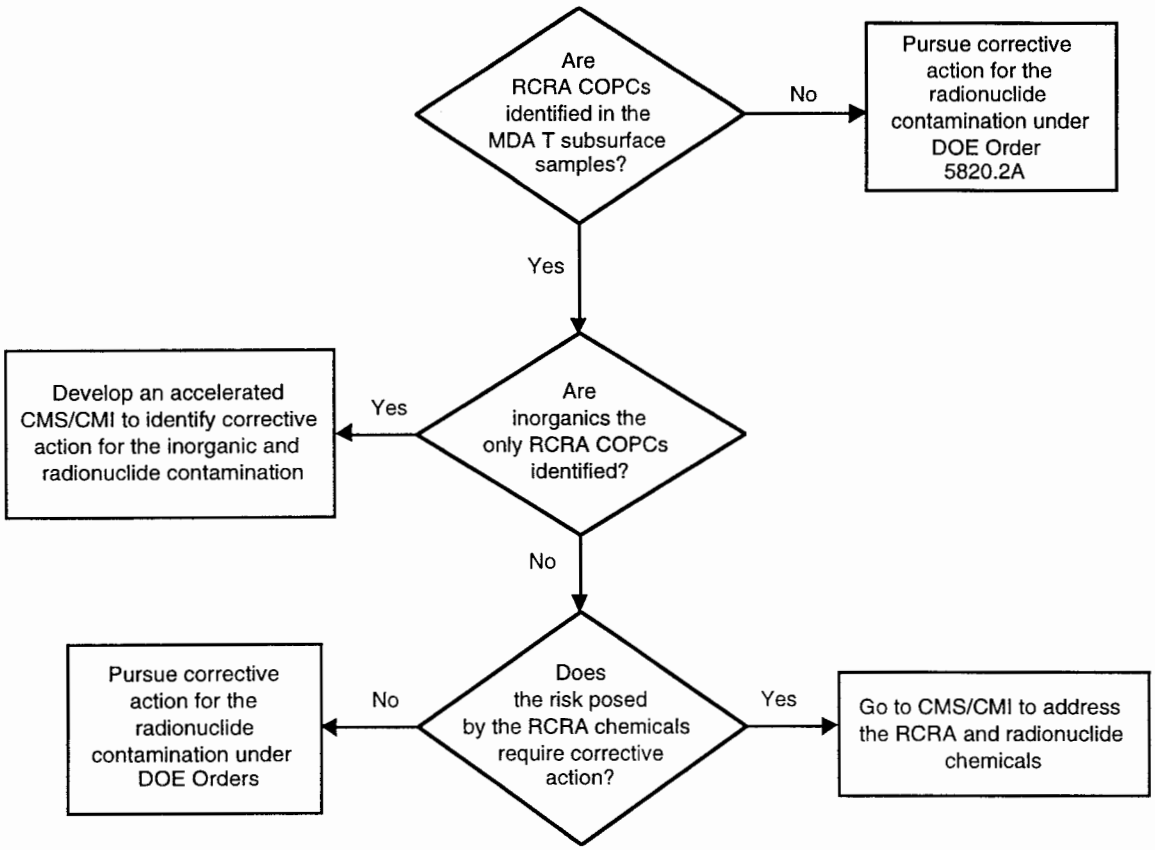

Fig. 2-1. Decision logic for MDA T characterization.

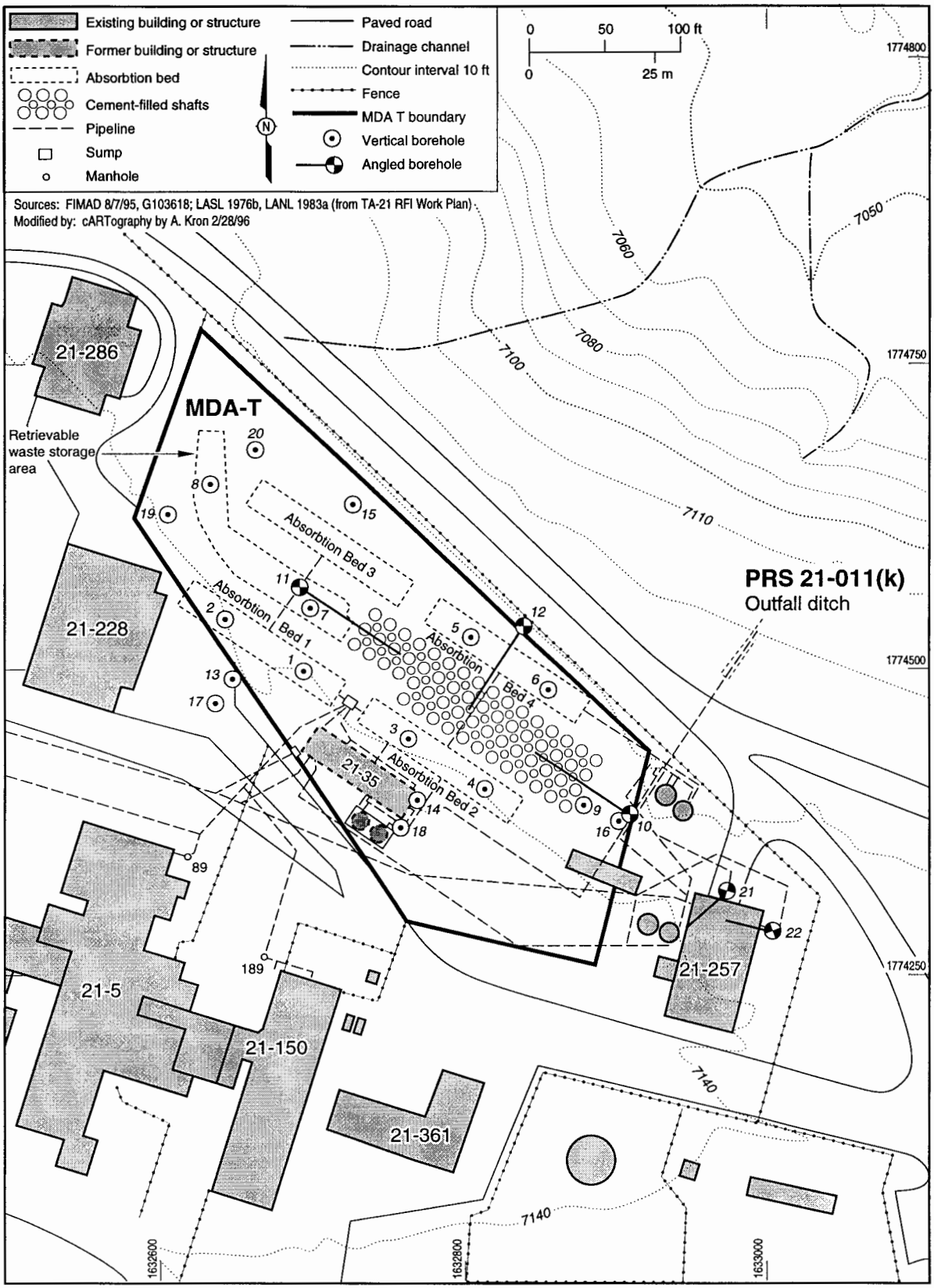

Fig. 2-2. Proposed borehole locations at MDA T.

TABLE 2-1

PROPOSED BOREHOLES AT MDA T

BOREHOLE NUMBER	LOCATION	BOREHOLE TYPE	NOMINAL DEPTH (ft)	NOMINAL LENGTH (ft)	ANGLE IN DEGREES FROM THE HORIZONTAL	PURPOSE
1	Eastern portion of bed 1	Vertical	150 ft	150 ft	90	To assess contaminant types and concentrations in bed 1 with a specific focus on the interval greater than 100 ft.
2	Western portion of bed 1	Vertical	150 ft	150 ft	90	To assess contaminant types and concentrations in bed 1 with a specific focus on the interval greater than 100 ft.
3	Western portion of bed 2	Vertical	50 ft	50 ft	90	To assess contaminant types, concentrations, and vertical extent in bed 2.
4	Eastern portion of bed 2	Vertical	50 ft	50 ft	90	To assess contaminant types, concentrations, and vertical extent in bed 2.
5	Western portion of bed 4	Vertical	50 ft	50 ft	90	To assess contaminant types, concentrations, and vertical extent in bed 4.
6	Eastern portion of bed 4	Vertical	50 ft	50 ft	90	To assess contaminant types, concentrations, and vertical extent in bed 4.
7	Eastern portion of retrievable waste storage area	Vertical	50 ft	50 ft	90	To assess contaminant types, concentrations, and vertical extent in the retrievable waste storage area.
8	Western portion of retrievable waste storage area	Vertical	50 ft	50 ft	90	To assess contaminant types, concentrations, and vertical extent in the retrievable waste storage area and establish a western boundary for lateral extent.
9	East of disposal shaft field	Vertical	150 ft	150 ft	90	To assess types, concentrations, and lateral (eastern) extent of contaminants. Also sample for hydrogeologic parameters.
10	35 ft east of disposal shaft field	Angled	161 ft	178 ft	65	To assess types, concentrations, and vertical extent of contaminants.
11	76 ft west of disposal shaft field	Angled	104 ft	129 ft	45	To assess types, concentrations, and vertical extent of contaminants beneath the disposal shaft field.
12	15 ft north of bed 4, extending under bed 4 and the disposal shaft field	Angled	139 ft	171 ft	65	To assess types, concentrations, and vertical extent of contaminants beneath the disposal shaft field and lateral extent of contamination north of absorption beds.
13	20 ft south of the center portion of bed 1	Vertical	50 ft	50 ft	90	To assess lateral migration of contaminants south of MDA T.
14	20 ft south of the center portion of bed 2	Vertical	50 ft	50 ft	90	To assess lateral migration of contaminants south of MDA T.
15	20 ft north of bed 3	Vertical	50 ft	50 ft	90	To assess lateral migration of contaminants north of MDA T.
16	20 ft east of borehole 16-009	Vertical	50 ft	50 ft	90	To provide contingency for the possibility that borehole 16-009 may be contaminated.
17	20 ft south of borehole 16-013	Vertical	50 ft	50 ft	90	To provide contingency for the possibility that borehole 21-013 may be contaminated.
18	20 ft south of borehole 16-014	Vertical	50 ft	50 ft	90	To provide contingency for the possibility that borehole 21-014 may be contaminated.
19	20 ft southwest of borehole 16-008	Vertical	50 ft	50 ft	90	To provide contingency for the possibility that borehole 21-008 may be contaminated.
20	20 ft northwest of borehole 16-008	Vertical	50 ft	50 ft	90	To provide contingency for the possibility that borehole 21-008 may be contaminated.
21	North side of building TA-21-257	Angled	To be determined	To be determined	To be determined	Assess contaminant types and concentrations with focus on effect on MDA T analytical suites.
22	East side of building TA-21-257	Angled	To be determined	To be determined	To be determined	Assess contaminant types and concentrations with focus on effect on MDA T analytical suites.

2.2.1 Design Assumptions

Waste water from building TA-21-257 was discharged to the absorption beds, mixed with a cement slurry and pumped into the disposal shafts, or mixed with a cement slurry and pumped into metal pipes for storage in the retrievable waste storage area. Therefore, contaminants detected under building TA-21-257 may be indicative of contaminants at MDA T.

Data from boreholes drilled under building TA-21-257 will be assessed and used to refine the analytical requirements for the rest of the MDA T investigation. If no RCRA chemicals are detected in these boreholes, this information will be used as a basis to further limit analysis of inorganic, semivolatile organic compounds (SVOCs) and volatile organic compounds (VOCs) in the remaining MDA T boreholes. Data collected from these boreholes may also be used when the building TA-21-257 RFI is performed. The SAP for building TA-21-257, which is described in the TA-21 RFI Work Plan (LANL 1991, 0689), calls for one angled borehole on the north side of the building and one angled borehole on the east side. Therefore, data collected from boreholes 21 and 22, which will be drilled as part of the MDA T investigation, may be used in place of data from the two boreholes planned as part of the building TA-21-257 RFI.

Based on the flow pattern of effluent into the absorption beds, it is assumed that the highest levels of contamination may be found beneath absorption beds 1 and 2. Proportionally less contamination may be associated with absorption bed 3 because it received only overflow from absorption bed 1. A conservative assumption may be made that contamination associated with absorption bed 4 will be similar to that associated with absorption beds 1 and 2 because it received both overflow from absorption bed 2 and effluent from holding tanks TA-21-112 and TA-21-113. However, the composition and concentration of wastes from the holding tanks is unknown, and contamination associated with absorption bed 4 may be less than that associated with absorption beds 1 and 2.

Migration beneath MDA T may be affected by the presence of a paleochannel, which may have a greater porosity and permeability than the surrounding subsurface matrix. Therefore, the trend and hydrogeologic parameters of the paleochannel must be assessed to determine the impact of the paleochannel on the contaminant migration pathways. The paleochannel will initially be investigated by seismic reflection and/or other geophysical surveys. Geophysical techniques may be able to define the channel based on lithologic contrasts between the paleochannel matrix and the surrounding tuff. If geophysical surveys are not able to define the channel, it will be assessed by geologic logging and sampling from the boreholes to be drilled east of MDA T adjacent to the disposal shafts and in the northeast corner of the retrievable

waste storage area (Fig. 2-2). Previous data indicate that these boreholes will intercept the paleochannel, and sampling results will be assessed to determine whether additional boreholes are needed to trace the trend of the channel.

2.2.2 Boreholes Beneath Building TA-21-257

Two angled boreholes (boreholes 21 and 22) will be drilled beneath building TA-21-257. One of the angled boreholes (borehole 21) will be drilled on the north side of building TA-21-257 near the center of the north wall to avoid underground pipelines near the northwest corner of the building. The borehole will be drilled in a southwesterly direction so as to pass beneath an influent tank and pit located in the building's northwest corner.

The second angled borehole (borehole 22) will be drilled on the east side of building TA-21-257 near the northeast corner of the building so as to drill under an influent settling tank. The borehole will be drilled from east to west.

Details on these boreholes (depths, angles, linear lengths, and true vertical depths) will be determined before mobilizing to the drill site. They will be based on information about utility line locations and will depend on excavation permit conditions.

2.2.3 Central Area Boreholes

Vertical boreholes will be drilled in the Central Area in order to define the source term and the vertical extent of contamination. Two vertical boreholes will be drilled in each of absorption beds 1, 2, and 4 (boreholes 1, 2, 3, 4, 5, and 6) and two vertical boreholes will be drilled in the retrievable waste storage area (boreholes 7 and 8). The exact locations of the boreholes drilled in the absorption beds will be determined after assessing the locations of influent lines. As described in the TA-21 RFI Work Plan (LANL 1991, 0689), boreholes in absorption bed 1 (boreholes 1 and 2) will be drilled to an initial depth of 150 ft bgs to assess the presence of contamination below 100 ft bgs, where radioactive contamination was detected by Nyhan et al. (Nyhan and Drennon 1993, 0363). Boreholes in absorption beds 2 and 4 (boreholes 3, 4, 5, and 6) and the retrievable waste storage area (boreholes 7 and 8) will be drilled to an initial depth of 50 ft bgs to assess the presence and vertical extent of contamination. If contamination is found at the bottom of any of the boreholes described above, the borehole will be extended an additional 20 ft to bound the extent of contamination.

No borehole will be drilled in absorption bed 3 because it received only overflow from absorption bed 1. Two boreholes are required in each of the other absorption beds and the retrievable waste storage area to adequately define the source term and assess the variability of contamination both vertically and laterally.

To assess the lateral extent of contamination east of MDA T, one vertical borehole (borehole 9) will be placed adjacent to the disposal shafts and drilled to an initial depth of 50 ft bgs.

To obtain an accurate geologic description of the paleochannel matrix, a clean borehole through the paleochannel is needed; thus, boreholes 7 and 9 will be drilled where there is a high certainty of intercepting the paleochannel. If no contamination is detected in the initial 50 ft of core from borehole 9, it will be extended to a depth of 150 ft bgs and used to collect samples from the paleochannel and the Unit 3 tuff for hydrogeologic and transport parameters (Table 2-2). If contamination is detected in borehole 9, contingency borehole 16 (described below) will provide samples for hydrogeologic parameters.

TABLE 2-2

HYDROGEOLOGIC AND TRANSPORT PARAMETERS AT MDA T

PARAMETER	METHOD
Mineralogy by x-ray diffraction	Canadian Society of Soil Analysis Soil Sampling & Methods of Analysis Methods 67.2.2, 67.4.1 (67.4.2 if chlorites are present)
Saturated hydraulic conductivity	ASTM D 2434-68 (94)
In situ moisture content	ASTM D 2216-90
Moisture characteristic curve wet range (to 1 bar)	ASTM D 2325-68 (81)
Moisture characteristic curve wet range (to 15 bars)	MOSA CHP.26
Moisture characteristic curve dry range	MOSA CHP.24
Moisture characteristic curve very dry range	Vapor Equilibrium Method DBS&A VEQ (Internal procedure)
Bulk density	MOSA CHP.13
Porosity	MOSA CHP.18
Particle density (specific gravity)	ASTM D 854-92
Unsaturated hydraulic conductivity (calculation)	SSSAJ, 1980

2.2.4 Angled Boreholes Beneath Disposal Shafts

One angled borehole (borehole 10) will be drilled from the east side of the disposal shafts to extend beneath the shafts. This borehole will be drilled at a 65-degree angle from the horizontal in an east-to-west direction. It will begin 35 ft east of the first row of disposal shafts (shafts 1, 2, and 3). Starting the borehole at this location and directing it at this angle will allow the augers to be at a true vertical depth of 75 ft bgs when they pass beneath the first row of disposal shafts. This depth is 8 ft below the bottom of the deepest shaft in the first row. The borehole will be extended for 178 linear feet and terminated beneath the third row of shafts at a true vertical depth of 161 ft bgs.

A second angled borehole (borehole 11) will be drilled from the west side of the disposal shafts to extend beneath the disposal shafts. This borehole will be drilled at a 45-degree angle from the horizontal in a west-to-east direction. It will begin 76 ft west of the last row of disposal shafts (shafts 58, 59, and 60). Starting the borehole at this location and directing it at this angle will allow the augers to be at a true vertical depth of 76 ft bgs when they pass beneath the last row of shafts. This depth is 7 ft below the last row of shafts. The borehole will be extended for 129 linear feet and terminated beneath the third row of shafts at a true vertical depth of 104 ft bgs.

A third angled borehole (borehole 12) will be drilled from the north side of absorption bed 4 to extend beneath the bed and the disposal shafts. This borehole will be drilled at a 65-degree angle from the horizontal in a north-to-south direction. It will begin 15 ft north of the absorption bed and will be drilled beneath shafts 33, 34, and 35. The borehole will begin close to the absorption bed because of the proximity of the northern fence line bordering the property. Starting the borehole at this location and directing it at this angle will allow the augers to be at a true vertical depth of 88 ft bgs when they pass beneath shaft 33. This depth is 17 ft below shaft 33, which is the northern-most shaft of shafts 33, 34, and 35. The borehole will be extended for 171 linear feet and terminated beneath shaft 35 at a true vertical depth of 139 ft bgs. Data collected from borehole 12, from the ground surface to the bottom of the first disposal shaft (shaft 33), will be used to assess the presence of contamination north of the absorption beds.

2.2.5 Boreholes North and South of Absorption Beds

One vertical borehole (borehole 15) will be placed 20 ft north of absorption bed 3 and drilled to an initial depth of 50 ft bgs to assess the potential for lateral migration in a northerly direction.

Two vertical boreholes (boreholes 13 and 14) will be drilled to an initial depth of 50 ft bgs, one each at locations 20 ft south of absorption beds 1 and 2, to assess the lateral extent of contamination south of MDA T.

2.2.6 Contingency Boreholes

If radionuclide or chemical contamination is detected above background concentrations based on field screening or mobile laboratory results in one or both of boreholes 13 and 14, additional borehole(s) (boreholes 17 and 18) will be placed 20 ft south of the respective borehole in which contamination was detected and drilled to an initial depth of 50 ft bgs.

If radiological or chemical contamination is detected above background levels in borehole 8 based on field screening or mobile laboratory results, additional borehole(s) (boreholes 19 and 20) will be placed 20 ft north and 20 ft south, respectively, of the retrievable waste storage area and drilled to an initial depth of 50 ft bgs.

If radioactive or chemical contamination is detected in borehole 9 based on field screening or mobile laboratory results, an additional borehole (borehole 16) will be placed 20 ft east of borehole 9 and drilled to an initial depth of 50 ft bgs to assess the lateral extent of contamination in that direction.

No contingency borehole is planned to complement borehole 7, located in the east end of the retrievable waste storage area between absorption beds 1 and 3. If contamination is detected in borehole 16, results from boreholes 1, 2, and 15 will be used to assess contamination in the area around borehole 7.

2.3 Sampling and Analysis Frequency

The sampling intervals, field screening, and analytical suites that will be requested for each borehole are summarized in Table B-1, Attachment B. Analytical methods to be used are described in Subsection 3.6.

Core samples will be collected from each borehole at 5-ft intervals and screened in the field using hand-held instruments for gross alpha, beta, and gamma radiation and VOCs.

Core samples will be collected at 10-ft intervals and analyzed by a mobile chemical analytical laboratory (MCAL) for VOCs and total metals. Ten percent of the samples collected for MCAL analyses of VOCs and metals will be submitted to a fixed laboratory to evaluate the performance of the field laboratory analysis.

Core samples will be collected at these same 10-ft intervals and submitted to a mobile radiochemical analytical laboratory (MRAL) for analyses of gross alpha, beta, and gamma radiation. Ten percent of these samples will be submitted to a fixed laboratory for analyses by gamma spectroscopy, and for analyses of total uranium, isotopic plutonium, tritium, and strontium-90.

Core samples will be collected from the upper 50 ft of borehole 1 (beneath absorption bed 1) and from the entire length of boreholes 21 and 22 (beneath building TA-21-257) at 10-ft intervals and analyzed by a fixed laboratory for SVOCs. These samples were chosen for SVOC analyses based on historical knowledge of MDA T and the COPCs identified by RFIs conducted at the outfall from building TA-21-257, SWMU 21-011(k), and at building TA-21-35, SWMU 21-010 (a-h). If SVOCs are detected in the upper 50 ft of borehole 1, the remainder of the borehole will also be sampled and analyzed for SVOCs at 10-ft intervals. See Subsection 1.4 and the memoranda in Attachment A for further discussion of SVOC analyses.

If RCRA constituents are detected at concentrations less than SALs in boreholes drilled in absorption beds 1, 2, or 4, samples will not be collected for these analyses from contingency boreholes. If RCRA constituents are detected at concentrations greater than SALs in boreholes drilled in the most contaminated areas, such as absorption bed 1, samples will be collected for RCRA analyses from additional boreholes, which will be drilled to assess the lateral extent of contamination.

If the presence of cobbles prevents sample collection within the absorption beds, the first sample from these boreholes will be collected in the tuff immediately below the absorption beds. If core is recovered within the absorption beds, at least one sample will be collected from that matrix.

To determine hydrogeologic parameters, three samples will be collected from borehole 9 and the results will be used to support a fate and transport model for the disposal area. Sampling depths will be selected to provide data representative of the Unit 3 tuff. To determine the hydrogeologic parameters of the paleochannel, four samples of the paleochannel matrix will be collected (two from borehole 9 and two from borehole 7).

2.4 Planned Data Uses

The primary data need addressed by this SAP is to identify RCRA COPCs; that is, to determine if any RCRA constituents are present at concentrations greater than SALs or would pose an unacceptable risk in the subsurface associated with MDA T. This question will be addressed at areas in and around the absorption beds, the retrievable waste storage area, and the disposal shafts. The analytical data will be evaluated through a screening assessment, in which the maximum values of inorganic analytes that exceed background and organic analytes that exceed detection limits are compared to SALs. In addition, a multiple chemical evaluation will be performed to determine if there are any potential cumulative impacts from analytes that are detected at values less than SALs. Analytes that exceed SALs or contribute substantially to cumulative impact will be retained as COPCs and will be included in a preliminary risk assessment, conducted in accordance with the method described in Appendix K of the Installation Work Plan (LANL 1993, 1017). If no RCRA COPCs are retained, LANL will propose to remove individual SWMUs associated with MDA T from the HSWA permit and will pursue corrective action options under DOE Order 5820.2A.

Another data need addressed by this SAP is related to evaluating migration pathways, especially through the subsurface and the paleochannel, and estimating the long-term risk posed by MDA T contaminants being transported to groundwater. Hydrogeologic data by geologic unit will be required for this evaluation, including saturated conductivity, porosity, bulk density, and mineralogy, as well as information on the waste form composition and degradation behavior.

2.5 Data Quality Requirements

As previously stated, data will be obtained using field screening methods, mobile laboratories, and fixed laboratories.

Field screening methods will be used to determine the presence or absence of contaminants in particular areas or samples. These methods are qualitative, not quantitative. The validity of the data will be confirmed by daily checks of instrument calibrations and comparison of field screening results to laboratory analytical results.

Laboratory data will be evaluated in a screening assessment; therefore, the data must be of sufficient quality to determine whether or not the concentrations exceed or are close to SALs.

The quality of data will be different for the fixed and mobile laboratories. Data from the mobile laboratories in many cases will be as accurate as data from the fixed laboratories; however,

data quality can be affected by conditions in the field. Also, less quality assurance/quality control information is available from the mobile laboratories, leading to greater uncertainties in the data.

All fixed laboratory data should have an accuracy of ± 30 percent or better. This is true for metal, VOC, SVOC, and radiological analyses. In cases where detected concentrations are greatly above or below SALs, larger uncertainties are acceptable. The validity of these analyses will be determined using quality assurance/quality control data supplied according to the EPA SW-846 methods.

The MCAL data (for VOCs and metals) should have an accuracy of ± 50 percent or better. The MRAL data will be of varying quality depending on the analytes. For gamma spectroscopy or gross gamma results when counts greater than 30 minutes are used, an accuracy of ± 50 percent or better is expected. For gross alpha and beta results with counts greater than 30 minutes, a factor of 2 is the expected accuracy. When the MRAL is used with short count times (less than 10 minutes), the data are strictly qualitative. In cases where detected concentrations are greatly above or below the SALs, larger uncertainties than those listed above are acceptable. The validity of these analyses will be determined from daily standards and other quality control checks run with the analyses, such as surrogates, duplicates, and matrix spikes. These data will also be confirmed by fixed laboratory analysis of 10 percent of the samples.

3.0 SAP IMPLEMENTATION

3.1 Surveys

3.1.1 Geophysical Survey

Geophysical surveys will be conducted in an attempt to assess the location, orientation, depth, and width of the paleochannel, and to identify the boundaries of the four absorption beds and the retrievable waste storage area.

Initial tests of geophysical techniques will be used to verify that techniques such as seismic refraction, seismic reflection, magnetic techniques, electromagnetic techniques, dc-resistivity, and ground-penetrating radar are feasible. Several survey lines will be designed to cross over the absorption beds and the paleochannel in locations that will optimize the information required. Where possible, surveys using different geophysical techniques will be collocated to optimize resolution and to reduce technique-dependent uncertainties.

If the geophysical survey does not provide good definition of the paleochannel, its trend, width, and depth may be assessed using cone penetrometer testing (CPT).

3.1.2 Geodetic Survey

Geodetic coordinates of the absorption bed corners and the disposal shafts are provided in the 1984 study by Nyhan et al. (Nyhan and Drennon 1993, 0363). The coordinates are provided in both the Los Alamos Scientific Laboratory (LASL) Grid System and the New Mexico State Plane System. These coordinates will be used by licensed surveyors, under contract to LANL, to identify the absorption bed corners and locations of the disposal shafts under which angled boreholes will be drilled.

3.2 Drilling

Subsurface drilling and sampling at MDA T will be completed in accordance with LANL-ER-SOP-01.01, R0, ICN11, "General Instructions for Field Investigations," LANL-ER-SOP-04.01, R0, "Drilling Methods and Drill Site Management," and LANL-ER-SOP-01.08, R0, "Field Decontamination of Drilling and Sampling Equipment" (LANL, 0875). Drilling will be conducted with a Failing F-10 (or equivalent) drill rig equipped with standard 8.25-in. outside diameter (OD), 4-in. inside diameter (ID), 5-ft long, hollow-stem auger flights. To record lithologic descriptions for the soil boreholes, all hollow-stem auger drilling will be performed in conjunction with continuous core sampling using 3.125-in. OD, stainless-steel split barrels in 5-ft lengths.

Core from the vertical boreholes will be retrieved on a wireline system, while core from the angled boreholes will be retrieved with drill rods. Although core barrels are 5-ft long, core may be recovered in 2.5-ft lengths because better core recovery is achieved with the shorter intervals. The core will be field screened for VOCs using a hand-held photoionization detector (PID) and radioactivity using a Ludlum Model 2221 scaler ratemeter with a Ludlum 44-9 Geiger Mueller (GM) probe to detect beta/gamma radiation and a Ludlum Model 2221 with a Ludlum 43-44 air proportional probe to detect alpha radiation (see Subsection 3.5). The core will then be inspected for visual signs of contamination and geologically described in accordance with LANL-ER-SOP-12.01, R0, "Field Logging, Handling, and Documentation of Borehole Materials" (LANL, 0875). The field team leader (FTL) will document all daily activities in a bound logbook in accordance with LANL-ER-SOP-01.04, R3, "Sample Control and Field Documentation" (LANL, 0875).

3.3 Core Logging

The field geologist will inspect the core for lithology and fractures. In accordance with LANL-ER-SOP-12.01, R1 (LANL, 0875), the field geologist will measure the core run for recovery to the nearest 0.1 ft, and enter the information on the core sample log (LANL, 0875). The top of the run will be the starting point for measurement. If the top is angled across a fracture and does not match the previous run, the starting point will be the mid-point of the fracture. Core loss will also be determined by the field geologist and recorded on the core sample log along with a geologic description (log) of the core.

The field geologist will video tape and/or photograph the core interval. Each video entry will begin with a view of the 3 in. by 5 in. drill run card showing the location identification number, run number, depth interval, and field screening results. The geologist will briefly describe the significant features of the core on the video tape, and enter the video tape interval, with pertinent information, in the field video log. Photographic information will be recorded in the field photographic log, in accordance with LANL-ER-SOP-12.01 (LANL, 0875).

The core will be curated by the field geologist for archiving according to LANL-ER-SOP-12.01 (LANL, 0875).

3.4 Field Decisions

If contamination is detected in any borehole at the initial depth, drilling will continue to a depth of 20 ft beyond the lowermost extent of contamination, defined for purposes of this investigation as 20 pCi/g gross alpha, which is approximately the surface background activity level at uncontaminated areas of TA-21. Core samples will be screened with a Ludlum Model 2221 scaler ratemeter with a 43-1 ZnS scintillation probe, which will be able to detect low-level alpha radiation to determine if the stopping criterion has been achieved.

At the sampling intervals identified in Subsection 2.3, the MRAL samples will be collected from those areas of the core exhibiting the highest level of radioactivity as detected by hand-held screening instruments. If VOCs are detected by hand-held screening instruments at concentrations greater than local background, samples for MCAL analyses of VOCs will be collected. If no areas of a core interval exhibit elevated levels of radioactivity or VOCs, samples will be collected from zones chosen by the geologist or FTL using geologically based criteria.

3.5 Subsurface Soil Sampling

Subsurface samples will be collected in accordance with LANL-ER-SOP-01.02, R0, "Sample Container and Preservation," LANL-ER-SOP-01.03, R1, "Handling, Packaging, and Shipping of Samples," LANL-ER-SOP-01.04, R3, "Sample Control and Field Documentation," and LANL-ER-SOP-06.24, "Sample Collection from Split-Spoon Samplers and Shelby Tube Samplers" (LANL, 0875). Samples will be collected at intervals and for analyses as described in Subsection 2.3.

Subsurface samples will have a pre-assigned identification number from the Sample Data Management System (SDMS). The sample location identification number, sample depth, date and time of sample collection, and VOC concentration and radioactivity level (based on field screening), will be recorded on the sample collection log. Once filled with sample material, sample bottles will be capped, labeled, placed into a plastic Ziploc® bag, and stored in a sample cooler with blue ice.

Sampling personnel will complete chain-of-custody documentation and sample collection logs. The subsurface sampler or FTL will maintain custody of the samples until they are delivered to the MRAL, MCAL, or Sample Management Office (SMO). All samples and results will be tracked in the SDMS.

Rapid turnaround of 24 hours for samples submitted to a MCAL for VOC and metals analyses by x-ray fluorescence (XRF) will be requested. Rapid 3-day turnaround for samples submitted to the fixed laboratory for VOC, SVOC, and Target Analyte List metals (TAL) metals analyses will be requested. Samples will be submitted to an off-site fixed laboratory for radiological analyses on a routine turnaround basis.

Field quality control (QC) samples, such as duplicates, rinsate blanks, and trip blanks, will be collected in accordance with the LANL Environmental Restoration (ER) Quality Assurance Project Plan for Sampling and Analysis (QAPP), which has not yet been finalized and approved. The QAPP should be approved prior to initiation of this investigation, and the specific number and types of QC samples will be determined at that time based on requirements identified in the QAPP.

Samples for moisture-related analyses will be collected in 2.5-ft-long plastic sleeves lining the core barrel. After removing the core from the core barrel, a 6-in to 12-in section of core may be cut from the plastic sleeve for testing. The ends of the section to be tested will be immediately sealed with plastic caps and duct tape and inserted into a multi-layered, aluminized Mylar® sleeve. The Mylar® sleeve will then be sealed in the field with duct tape and transported daily

to an area where it will be heat-sealed. These samples will be stored to protect them from high and low temperature extremes while awaiting delivery to a fixed laboratory. Such core may be stored in an insulated cooler, without ice and out of direct sunlight, or in a temperature-controlled room. The samples collected for mineralogical analyses require no special protection and may be selected from the archived core.

3.6 Analytical Methods

Core samples will be collected from each borehole for MRAL analyses of gross alpha, beta, and gamma radiation. Fixed laboratory radiological analyses include gamma spectroscopy and analysis for total uranium, isotopic plutonium, tritium, and strontium-90. Core samples will be collected for analysis by a MCAL for VOCs using EPA SW-846 Method 8260 and total metals using XRF. Samples will also be analyzed by a fixed laboratory for SVOCs by EPA SW-846 Method 8270. Ten percent of the samples collected for MCAL analyses of VOCs and metals will be submitted to a fixed laboratory to evaluate the performance of the MCAL analyses. Fixed laboratory analyses of VOCs will be performed by EPA SW-846 Method 8260, and fixed laboratory analyses of TAL metals will be performed by EPA SW-846 Methods 6010, 6020, and 7471. Analytical suites to be requested per borehole are summarized in Table B-1, Attachment B.

3.7 Field Screening Methods

Drill rig personnel will remove the split barrel sampler from the borehole and place the unopened split barrel on a work bench in the exclusion zone. The split barrel sampler will be opened and the core screened for radioactivity using a Ludlum Model 2221 scaler ratemeter with a Ludlum 44-9 GM probe to detect beta/gamma radiation and a Ludlum Model 2221 with a Ludlum 43-44 air proportional probe to detect alpha radiation. A PID will be used to screen the core for VOCs. Field screening results will be recorded on the core sample log and in the SDMS by the field geologist.

Hand-held instruments will have had a recent (within one year) factory-approved calibration. Each instrument will also be calibrated daily in the field. The PID will be calibrated daily with isobutylene at a concentration of 100 parts per million. Daily operational checks will be performed on the beta/gamma radiation detector using a beta/gamma-emitting check source in accordance with ESH-1 Procedure ESH-1-07-85. Daily operational checks will be performed on the alpha radiation detector using an alpha-emitting check source in accordance with ESH-1 Procedure ESH-1-07-86.

Small core samples will also be analyzed with a Ludlum Model 2221 scaler ratemeter with a 43-1 probe to detect low-level alpha radiation for measuring the stopping criterion of 20 pCi/g gross alpha. This technique requires the collection of a sample in a petri dish, drying it, placing it in a fixed measurement geometry, and counting it for 10 to 20 minutes.

3.8 Borehole Completion and Abandonment

Vertical boreholes will be backfilled with either a cement/bentonite slurry or drill cuttings based on field screening data, mobile laboratory results, or fixed laboratory results in accordance with LANL-ER-AP-05.3, R0, "Management of Environmental Restoration Program Waste" (LANL, 0875). Vertical boreholes less than 200 ft deep will be backfilled with drill cuttings if fixed laboratory results indicate that radionuclides, VOCs, metals, and SVOCs are within background levels. Upon returning drill cuttings to their respective boreholes, each boring will be completed with a 2-ft thick concrete cap.

All angled boreholes and vertical boreholes with radioactivity or chemical contamination above background or SALs, respectively, based on field screening, mobile laboratory results, or fixed laboratory results, will be backfilled with a concrete/bentonite slurry. A grout pump will be used to inject the slurry into the borehole through a tremie pipe. The tremie pipe will be extended to the bottom of the borehole so that each boring is backfilled from the bottom up to the surface. Each backfilled borehole will be identified with a wooden stake, on which the borehole identification number will be written, set in the boring's concrete cap so that the location may be later surveyed.

3.9 Data Tracking

Field data from sampling activities will be managed with the SDMS. The SDMS will be used to implement all of the record keeping requirements found in LANL-ER-SOP-1.04 as well as to record all required data fields found in the Facility for Information Management, Analysis, and Display (FIMAD) database.

Paper reports from mobile laboratory results will be obtained by the field team for their use in field decisions. The electronic data will be transferred by the mobile laboratory to the SMO via the Electronic Data Deliverable (EDD) and then the SMO will transmit the data to FIMAD.

The SMO will ship samples to contract laboratories for analysis. The SMO has contracts in place that define the laboratory deliverable (both paper and electronic form EDD).

3.10 Schedule

The subsurface investigation is scheduled to start in September 1996. The drilling and sampling operation, including time to mobilize and demobilize, is anticipated to take two to three months. Preparation of the RFI report will begin when all sampling results have been received from the analytical laboratories, are validated, and are available electronically.

4.0 DATA ASSESSMENT

4.1 Verification and Routine Data Validation

All data to be used for site decision-making will be recorded in the ER Project electronic data system. These data will include field sample information, field measurements, and laboratory analyses. The analytical data produced by the contract laboratories will be verified and validated using the standard data verification and baseline validation checklists in accordance with the LANL ER Checklist and Criteria for Verification and Baseline Validation (LANL 1995, 01-0022). The analytical results from a MCAL will have data verification and baseline validation procedures similar to those performed on data from contract laboratories. The analytical results from a MRAL will be used for field screening and decision-making. When data from a MRAL or MCAL are used for decision-making, baseline data validation will be applied.

4.2 Data Quality Assessment

Data quality assessment (DQA) for the results from this investigation will use the general framework outlined in the draft LANL ER QAPP, which has not yet been approved, but will be prior to mobilization to the site for this investigation.

If RCRA chemicals are identified as COPCs, the DQA will include a correlation of RCRA and radiological results early in the investigation to assess whether the presence of one constituent can serve as a predictor of the presence of another constituent. If a correlation is found, these results will be used during the remainder of the investigation. A comparison of results from quick turnaround methods to standard EPA methods will also be made, as will a correlation of gross radioactivity measurements to isotopic data in an attempt to better estimate the source term.

5.0 ADMINISTRATION

5.1 Project Organization

Table 5-1 identifies the key individuals for this project. Figure 5-1 identifies the organizational structure of some of the key personnel identified in Table 5-1. Personnel with defined responsibilities in this project are identified in the following subsections.

5.1.1 Field Project Leader

The field project leader (FPL) is responsible for ensuring that this plan is in conformance with applicable LANL, DOE, RCRA, and State of New Mexico Environment Department requirements and any additional objectives of the project. The FPL will review and approve this plan and any associated procedures and will ensure that the final, on-site investigation report is forwarded to the LANL Records Processing Facility (RPF). The FPL will provide a copy of the final report to DOE. The FPL is also responsible for all field investigation activities, including health and safety. The FPL may delegate any or all of these responsibilities to a field operations manager (FOM).

TABLE 5-1

ORGANIZATIONAL STRUCTURE

INDIVIDUALS RESPONSIBLE FOR PERFORMING THIS PROJECT WORK			
TITLE	**NAME**	**ORGANIZATION**	**PHONE/CELLULAR/PAGER/e-mail**
Field Project Leader (FPL)	Garry Allen	CST-18	phone: 667-3394 e-mail: garry@lanl.gov
Field Operations Manager	Beverly Martin	CIC-12	phone: 665-7430 e-mail: beverly@lanl.gov
Field Team Manager (FTM)	Derek Faulk	ERM/Golder	phone: 662-1320 cellular: 470-4969 e-mail: faulk@alice.lanl.gov
Field Team Leader (FTL) Alternate FTM	Ron Blegen	ERM/Golder	phone: 662-1306 cellular: 470-0882 pager: 820-4440 e-mail: rblegen@alice.lanl.gov
Geologist/Sampler/ Alternate FTL	TBD[a]	ERM/Golder	662-3700
SSO/HPT	TBD	ERM/Golder	662-3700
Alternate SSO/HPT	Kevin Hyde	ERM/Golder	phone: 662-1349 pager: 820-4542
DRILLING TEAM			
TITLE	**NAME**	**ORGANIZATION**	**PHONE/CELLULAR/PAGER/e-mail**
Drilling Supervisor	Paul Garcia	Stewart Brothers	phone: (505) 287-2986 cellular: 470-1131
Lead Driller	TBD	Stewart Brothers	(505) 287-2986
Driller's Assistants	TBD	Stewart Brothers	(505) 287-2986
SUPPORT PERSONNEL			
TITLE	**NAME**	**ORGANIZATION**	**PHONE/CELLULAR/PAGER/e-mail**
ERM/Golder Principal	Al Funk	ERM/Golder	phone:662-1323 e-mail: funk@alice.lanl.gov
ERM/Golder Principal	John Williams	ERM/Golder	phone: 6621332 e-mail: jwilliams@alice.lanl.gov
ERM/Golder HS Staff	Kevin Hyde	ERM/Golder	phone: 662-1349 pager: 820-4542
ESH-1 Representative	Marty Peifer	ESH-1	phone: 667-0083 pager: 104-6649[b]
ESH-1 Representative	Pat LaFrate	ESH-1	phone: 667-7137 e-mail: lafrate@lanl.gov
ESH-5 Representative	Joe Louck	ESH-5	phone: 665-5669 pager: 104-6959[b] e-mail: louckj@eshmail.lanl.gov

[a] TBD = To be determined.
[b] To access pager number, first dial 665-0062.

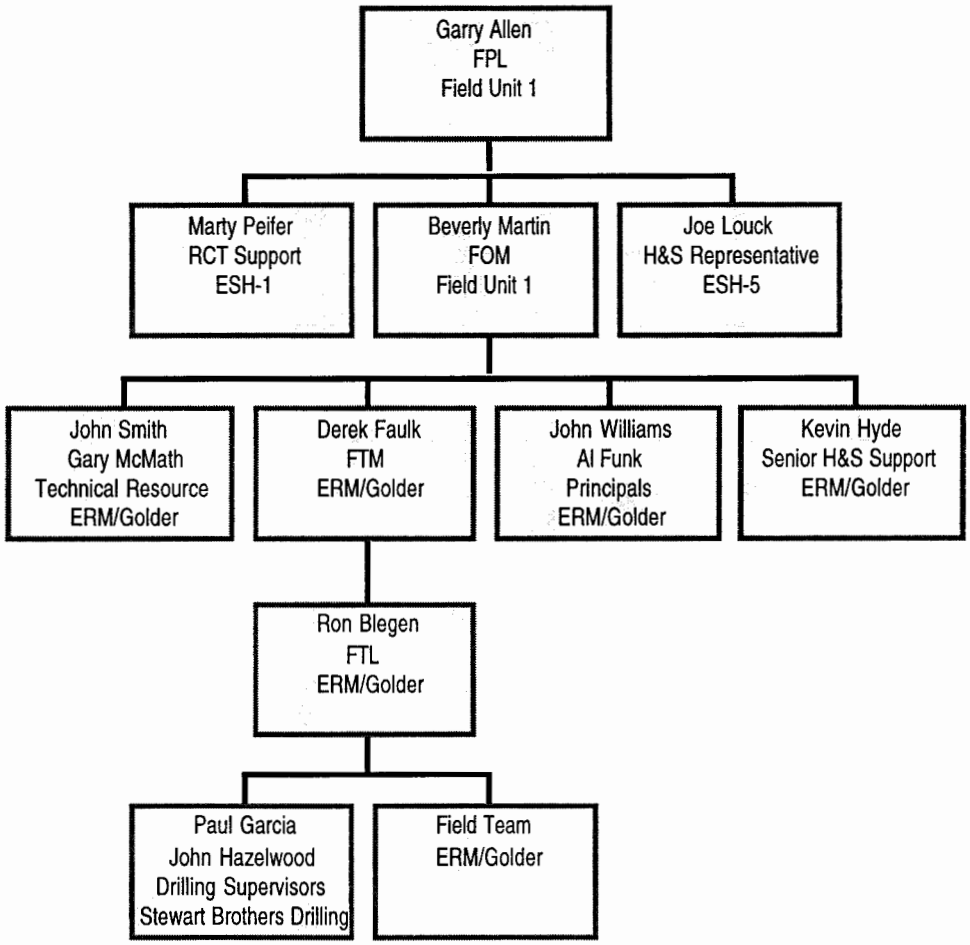

Fig. 5-1. Organizational chart for MDA T field work.

5.1.2 Field Operations Manager

The FOM reports directly to the FPL and is responsible for overseeing field operations. The FOM will function as the primary interface between LANL and other organizations. The FOM is also responsible for developing the sampling and analysis plans and all associated documentation for field sampling. Any deviations from the approved sampling and analysis plan must be reviewed and approved by the FOM. Once the field work is complete, the FOM is responsible for coordinating the technical team to develop and write the RFI report.

5.1.3 Field Team Manager

The field team manager (FTM) reports directly to the FOM and is responsible for ensuring that the provisions of this SAP are followed and correctly implemented in the field. The FTM will provide day-to-day oversight of the project, evaluate any project changes and nonconformances, review project data, and prepare the final reports for transmittal to the FOM. The FTM will be responsible for arranging utility clearances, excavation permits, and personnel access to the area as required. The FTM will interface with appropriate LANL waste management groups to ensure proper disposal of project-generated waste. The FTM may delegate any or all of these responsibilities.

5.1.4 Field Team Leader

The FTL is responsible for field operations and for directing and documenting field activities according to approved plans and procedures. The FTL reports directly to the FTM and will manage subcontractors, field team members, and the Site Safety Officer (SSO). The FTL will implement all provisions of this SAP and is responsible for coordinating and overseeing sample collection activities for this investigation. The FTL is responsible for identifying sample locations, collecting and labeling samples, logging cores, completing chain-of-custody records, verifying the accuracy of data entered in the SDMS, coordinating delivery of samples to the SMO or mobile laboratories, and maintaining a daily field logbook. The FTL will ensure that all activities are conducted in strict accordance with this plan and will provide other assistance to the FTM as requested.

5.1.5 Site Safety Officer/Health Protection Technician (SSO/HPT)

The SSO/HPT reports directly to the FTL and subsequently to the FTM. The SSO/HPT has the authority to implement the Site-Specific Health and Safety Plan (SSHASP) and serves as the primary contact for health and safety issues associated with the implementation of this SAP. For the purposes of this field investigation, the SSO/HPT is responsible for field screening samples for radioactivity prior to shipment to the SMO or mobile laboratories.

5.1.6 Geologist/Sampler

The geologist/sampler will note and record field events related primarily to hydrogeologic and contaminant sample collection. In this role, the geologist/sampler will ensure that all samples are collected at the depths indicated in this plan and that these samples are preserved and documented properly in the field.

5.2 Training

All field project members will have, at a minimum, documentation of 40-hour Occupational Safety and Health Act (OSHA) Hazardous Waste Operations (HAZWOPER) training, a current 8-hour annual HAZWOPER refresher (if applicable), LANL Radiological Worker II, LANL General Employee Training, a current medical fit-for-work statement, and employer hazard communication. In addition, the SSO/HPT will have documentation of training in the ERM/Golder hearing conservation program and LANL's blood-borne pathogens program. Both the FTL and SSO will have current training in first aid and CPR. Additional training for various field team members may be required in accordance with the SSHASP.

5.3 Records

The documentation presented in Table 5-2 shall be completed by the individual (or an approved designee) at the frequency indicated below. The records will be reviewed by the FTL for accuracy and completeness, and then provided to the FTM each night or week, as appropriate.

5.4 Oversight

A readiness review will be conducted prior to the initiation of field work in accordance with LANL-ER-AP-05.01, R1, "Readiness Review for Environmental Restoration Project Field Activities" (LANL, 0875). Peer reviews of this SAP, readiness review documentation, field documentation, and other documentation will be conducted by the TA-21 technical team, the ER Project Office, and/or DOE. Field surveillance inspections will be performed by ESH-5 and

ESH-1 to ensure compliance with the LANL ER Project Health and Safety Plan, the SSHASP, and the LANL Radiological Control (Radcon) Manual. Additional surveillance inspections may be conducted by LANL contractors, the ER Project Office, and DOE to ensure compliance with the draft LANL ER QAPP, standard operating procedures (SOPs), administrative procedures, etc., as well as the SSHASP and LANL Radcon Manual.

TABLE 5-2

DOCUMENT COMPLETION REQUIREMENTS FOR THE INVESTIGATION AT MDA T

ITEM	PERSONNEL	FREQUENCY
COC/Sample Collection Log	Sampler	Daily (if applicable)
Field Team Leader (FTL) Logbook	FTL	Daily
Daily Drilling Summary	Geologist/FTL	Daily
Field Borehole Logs	Geologist	Daily
Final Borehole Logs	Geologist	1 week after demobilization
Waste Management Logbook	On-site Waste Mgr.	Daily
Waste Mgmt. Forms (WPF, etc.)	On-site Waste Mgr.	As generated
Waste Drum Status	On-site Waste Mgr.	Weekly
Waste Drum Summary	On-site Waste Mgr.	1 week after demobilization
Drill Rig Inspection Form	SSO/Competent Person (CP)	Daily
Safety Inspection Form	SSO or CP	Daily
SSO Logbook	SSO	Daily
Air Monitoring/Calibration Records	SSO	Daily
Rad Monitoring/Performance Check	SSO/HPT	Daily
Exclusion Zone Logbook	SSO/HPT	Daily
SSHASP Acknowledgment	SSO	Prior to fieldwork
Tailgate Safety Meeting	SSO	Daily
Visitors Logbook	SSO	Daily
Field Analytical Sample Removal Checklist	Geologist	As generated
Field Video Log	Geologist/FTL	As generated
Field Photographic Log	Geologist/FTL	As generated
Core run markers, Core loss markers, and Sample markers	Geologist	As generated

5.5 Inspection/Acceptance Policies

Drilling and steam cleaning equipment, personal protective equipment, and health and safety items, such as eye washes and fire extinguishers, will be visually inspected by qualified personnel prior to the initiation of field work and at specified intervals during the field operation. Drum/waste storage area(s) will be inspected in accordance with the Site-Specific Waste Characterization Strategy. Storm water runon/runoff controls will be inspected in accordance with the Site-Specific Storm Water Pollution Prevention Plan. All inspections will be documented in field logbooks and/or on specified inspection forms by the personnel conducting the inspection in accordance with the draft LANL ER QAPP.

5.6 Reports to Management

Regular progress and status reports will be prepared and submitted to the FPL, FOM, LANL contractors, and others as designated by the FPL. The status reports will include the following:

- **Daily Field Report.** This report will be prepared daily by the FTL during active field operations. Each report will describe the specific field activities conducted during the day, any surveys performed (such as radioactive, geophysical, or geodetic), sampling activities including number and types of samples collected, field monitoring or screening results, and unexpected events.

- **Weekly Field Status Update.** This report will be prepared by the FTM and submitted each Tuesday. The report will include the following headings: 1) accomplishments in the preceding week, 2) plans for the following week, and 3) issues and problems.

- **Monthly Status Report.** This report will be prepared by the FTM and submitted within 10 working days after the end of the reporting month. The report will include the following headings: 1) accomplishments in the preceding month, 2) plans for the upcoming (current) month, and 3) issues and problems. In addition to discussing field operations, the Monthly Status Report will also address operational concerns.

6.0 REFERENCES

DOE (US Department of Energy) September 26, 1988. "Radioactive Waste Management," DOE Order 5820.2A, Washington, DC. **(DOE 1988, 0074)**

LANL (Los Alamos National Laboratory), November 1990. "Solid Waste Management Units Report," Volumes I through IV, Los Alamos National Laboratory Report No. LA-UR-90-3400, prepared by International Technology Corporation under Contract 9-XS8-0062R-1, Los Alamos, New Mexico. **(LANL 1990, 0145)**

LANL (Los Alamos National Laboratory), May 1991. "TA-21 Operable Unit RFI Work Plan for Environmental Restoration," Volumes I-III, Los Alamos National Laboratory Report LA-UR-91-962, Los Alamos, New Mexico. **(LANL 1991, 0689)**

Rogers, M. A., June 1977. "History and Environmental Setting of LASL Near-Surface Land Disposal Facilities for Radioactive Wastes (Areas A, B, C, D, E, F, G, and T)," Los Alamos Scientific Laboratory Report LA-6848-MS, Vols. I and II, Los Alamos, New Mexico. **(Rogers 1977, 0216)**

LANL (Los Alamos National Laboratory). "Los Alamos National Laboratory Environmental Restoration Program Standard Operating Procedures," Los Alamos National Laboratory report, Los Alamos, New Mexico. **(LANL, 0875)**

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

LANL (Los Alamos National Laboratory), February 28, 1994. "Phase Report 1C, TA-21 Operable Unit RCRA Facility Investigation, Outfalls Investigation," Los Alamos National Laboratory Report LA-UR-94-228, Los Alamos, New Mexico. **(LANL 1994, 1260)**

LANL (Los Alamos National Laboratory), 1995. "LANL Environmental Restoration Checklist and Criteria for Verification and Baseline Validation," Los Alamos National Laboratory Report, Los Alamos, New Mexico. **(LANL 1995, 01-0022)**

Nyhan, J. W., and B. J. Drennon, September 1993. "Data Analysis of the 1984 and 1986 Soil Sampling Programs at Materials Disposal Area T in the Los Alamos National Laboratory," Los Alamos National Laboratory Report, Los Alamos, New Mexico. **(Nyhan and Drennon 1993, 0363)**

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ATTACHMENT A PRELIMINARY SCREENING ASSESSMENTS FOR PRS 21-018(b), AND PRSs 21-010(a-h)

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MEMORANDUM

To: Beverly Martin, LANL, CIC-12, MS-525, 665-7430
From: Randall Ryti, Neptune and Company RTR
Subject: Preliminary screening assessment for MDA T surface samples
Date: February 27, 1996

We have completed the preliminary screening assessment for the MDA T surface sample data (PRS 21-018). All samples were collected from no deeper than 12 inches below ground surface. Some sample locations are in an area that has been impacted by the releases from the PRS 21-011(k) outfall, however all data are evaluated in this memo report. A summary of the analytical data is attached.

Inorganics greater than UTLs:

Calcium, copper, lead, nickel, and zinc had concentrations greater than soil background UTLs, and therefore were compared to SALs.

Radionuclides greater than UTLs:

Am-241, Cs-137, Pu-238, Pu-239, Sr-90, and uranium isotopes had concentrations greater than soil background UTLs, and will be compared to SALs.

Detected Organics:

Ten PAHs and one phthalate were detected. The PAHs were all detected downgradient of the roadway, and are most likely produced by general anthropogenic activities and are not related to site activities. The phthalate is a common laboratory contaminant. No other organics were detected in these samples. Thus no organic chemicals are carried to the SAL comparison.

Preliminary list of COPCs based on SALs comparisons and MCE:

Am-241, Cs-137, Pu-238, Pu-239, and Sr-90 are the COPCs.

Summary:

Only minor concentrations of inorganic chemicals and organics chemicals associated with industrial sites (PAHs) or sampling activities (phthalate) were measured. Some additional analysis of RCRA constituents for the MDA T subsurface investigation is needed. However, none of the existing data suggest that there is a RCRA source term in MDA T.

MDA T Surface Sampling Summary

Analyte (units are mg/kg unless noted)	Non-detects Count	Non-detects Min	Non-detects Max	Detects Count	Detects Min	Detects Max
Aluminium	0			76	1350	18700
Antimony	68	0.21	22	8	0.22	0.27
Arsenic	15	0.8	2.2	61	1	4.5
Barium	2	41.8	42.9	74	29.7	261
Beryllium	20	0.21	0.9	56	0.25	1.1
Cadmium	37	0.44	0.82	39	0.69	2.2
Calcium	3	871	1130	73	1055.2	7900
Chromium	1	2.2	2.2	75	1.8	15.2
Cobalt	23	1.6	6.7	53	2.1	8
Copper	12	1.8	5.8	64	2.2	21.8
Iron	0			76	3430	15700
Lead	0			76	6.1	61.3
Lithium	0			57	2	14.8
Magnesium	13	570	1050	63	665	2690
Manganese	0			76	118	493
Mercury	19	0.02	0.04	0		
Nickel	21	1.8	5.7	55	2.6	19.4
Potassium	16	288	978	60	494	2350
Selenium	72	0.41	0.72	4	0.55	0.7
Silver	73	1	2.4	3	1.1	1.3
Sodium	17	36.6	114	2	39.6	54.9
Strontium	0			57	5.3	36.7
Thallium	73	0.21	0.4	3	0.22	0.24
Uranium	0			19	0	2.48
Vanadium	10	5.8	10.2	66	5.4	26
Zinc	0			76	17.9	132
Actinium-227 (pCi/g)	57	1.82	5.39	0		
Americium-241 (pCi/g)	0			77	0.005	26.395
Cesium-137 (pCi/g)	39	0.29	1.12	28	0.2829	431.42
Iodine-129 (pCi/g)	0			1	0.1698	0.1698
Lead-210 (pCi/g)	0			10	0.615	1.504
Lead-212 (pCi/g)	0			21	1.102	1.764
Lead-214 (pCi/g)	0			21	0.7888	1.468
Plutonium-238 (pCi/g)	0			75	0.002	6.851
Plutonium-239 (pCi/g)	0			75	0.005	201.254
Potassium-40 (pCi/g)	0			21	21.88	32.29
Radium-224 (pCi/g)	0			3	3.843	4.711
Strontium-90 (pCi/g)	0			76	-0.49	239.7
Thallium-208 (pCi/g)	0			2	0.3882	0.3904
Thorium-228 (pCi/g)	0			2	3.141	3.646
Thorium-234 (pCi/g)	0			11	0.5814	1.946
Tritium (pCi/g)	0			75	-0.01037	1.03501
Uranium-234 (pCi/g)	0			55	0.868	3.363
Uranium-235 (pCi/g)	0			57	0.041	0.38
Uranium-238 (pCi/g)	0			55	0.872	2.03
Water (Unbound) (% moisture)	1	9.7	9.7	71	3.9	18.2
Radvan Cesium-137 (pCi/g)	0			52	0	331.89
Radvan Gross Alpha Screening (pCi/g)	0			70	-34.44	48.21
Radvan Gross Beta Screening (pCi/g)	0			70	-33.4	56.1
Radvan Gross Gamma Screening (pCi/g)	0			70	-11.72	343.2
Acenaphthene	70	0.34	0.72	0		

Analyte (units are mg/kg unless noted)	Non-detects Count	Non-detects Min	Non-detects Max	Detects Count	Detects Min	Detects Max
Acenaphthylene	70	0.34	0.72	0		
Aniline	17	0.35	0.52	0		
Anthracene	70	0.34	0.72	0		
Azobenzene	17	0.35	0.52	0		
Benzoic acid	70	1.7	3.6	0		
Benzo[a]anthracene	68	0.34	0.72	2	0.4	0.61
Benzo[a]pyrene	68	0.34	0.72	2	0.48	0.67
Benzo[b]fluoranthene	68	0.34	0.72	2	0.52	0.61
Benzo[g,h,i]perylene	69	0.34	0.72	1	0.4	0.4
Benzo[k]fluoranthene	69	0.34	0.72	1	0.61	0.61
Benzyl alcohol	70	0.34	0.72	0		
Bis(2-chloroethoxy)methane	70	0.34	0.72	0		
Bis(2-chloroethyl)ether	70	0.34	0.72	0		
Bis(2-chloroisopropyl)ether	70	0.34	0.72	0		
Bis(2-ethylhexyl)phthalate	69	0.34	0.72	1	0.44	0.44
Bromophenylphenyl ether [4-]	70	0.34	0.72	0		
Butyl benzyl phthalate	70	0.34	0.72	0		
Chloro-3-methylphenol [4-]	70	0.34	0.72	0		
Chloroaniline [4-]	70	0.34	0.72	0		
Chloronaphthalene [2-]	70	0.34	0.72	0		
Chlorophenol [o-]	70	0.34	0.72	0		
Chlorophenylphenyl ether [4-]	70	0.34	0.72	0		
Chrysene	68	0.34	0.72	2	0.48	0.83
Di-n-butyl phthalate	70	0.34	0.72	0		
Di-n-octyl phthalate	70	0.34	0.72	0		
Dibenzofuran	70	0.34	0.72	0		
Dibenzo[a,h]anthracene	70	0.34	0.72	0		
Dichlorobenzene (1,2) [o-]	70	0.34	0.72	0		
Dichlorobenzene (1,3) [m-]	70	0.34	0.72	0		
Dichlorobenzene (1,4) [p-]	70	0.34	0.72	0		
Dichlorobenzidine [3,3'-]	70	0.35	1.4	0		
Dichlorophenol [2,4-]	70	0.34	0.72	0		
Diethyl phthalate	70	0.34	0.72	0		
Dimethyl phthalate	70	0.34	0.72	0		
Dimethylphenol [2,4-]	70	0.34	0.72	0		
Dinitrophenol [2,4-]	70	0.86	3.6	0		
Dinitrotoluene [2,4-]	70	0.34	0.72	0		
Dinitrotoluene [2,6-]	70	0.34	0.72	0		
Fluoranthene	66	0.34	0.72	4	0.59	2.5
Fluorene	70	0.34	0.72	0		
Hexachlorobenzene	70	0.34	0.72	0		
Hexachlorobutadiene	70	0.34	0.72	0		
Hexachlorocyclopentadiene	70	0.34	0.72	0		
Hexachloroethane	70	0.34	0.72	0		
Indeno[1,2,3-cd]pyrene	69	0.34	0.72	1	0.43	0.43
Isophorone	70	0.34	0.72	0		
Methyl-4,6-dinitrophenol [2-]	70	0.86	3.6	0		
Methylnaphthalene [2-]	70	0.34	0.72	0		
Methylphenol [2-]	70	0.34	0.72	0		
Methylphenol [4-]	70	0.34	0.72	0		
Molybdenum	57	6	7.4	0		

Analyte (units are mg/kg unless noted)	Non-detects Count	Non-detects Min	Non-detects Max	Detects Count	Detects Min	Detects Max
Naphthalene	70	0.34	0.72	0		
Nitroaniline [2-]	70	0.86	3.6	0		
Nitroaniline [3-]	70	0.86	3.6	0		
Nitroaniline [4-]	70	0.86	3.6	0		
Nitrobenzene	70	0.34	0.72	0		
Nitrophenol [2-]	70	0.34	0.72	0		
Nitrophenol [4-]	70	0.86	3.6	0		
Nitrosodi-n-propylamine [N-]	70	0.34	0.72	0		
Nitrosodimethylamine [N-]	17	0.35	0.52	0		
Nitrosodiphenylamine [N-]	70	0.34	0.72	0		
Pentachlorophenol	70	0.86	3.6	0		
Phenanthrene	67	0.34	0.72	3	0.62	1.3
Phenol	70	0.34	0.72	0		
Pyrene	66	0.34	0.72	4	0.44	1.8
Trichlorobenzene [1,2,4-]	70	0.34	0.72	0		
Trichlorophenol [2,4,5-]	70	0.86	3.6	0		
Trichlorophenol [2,4,6-]	70	0.34	0.72	0		
Adipic ester TIC	0			19	0.4	200
Aromatic hydrocarbons TIC	0			1	0.6	0.6
Saturated Hydrocarbons TIC	0			19	0.36	1.2
Unknown alkanes TIC	0			38	0.4	80
Unknown organic acid TIC	0			4	0.4	0.6
Unknown organic compound TIC	0			140	0.38	3
Unknown Polynuclear Aromatic Hydrocarbon TIC	0			4	0.4	0.9
	5227			2293		

TIC Tentatively Identified Compound.

Building 21-35

MEMORANDUM

To: Beverly Martin, LANL, CIC-12, MS-E525, 665-7430
From: Randall Ryti, Neptune and Company, 662-0707, ext 12 RTK
Subject: Preliminary screening assessment of PRS 21-010
Date: February 27, 1996

The preliminary screening assessment for PRSs 21-010(a-h) has been completed. This screening assessment will be fully documented in a RFI report for this PRS. PRSs 21-010(a-h) are possible environmental releases associated with Building 21-35. Most of the data is from subsurface locations collected at intervals between 2.5 and 10 ft in depth. A summary of the analytical data is attached to this memo report.

Inorganics greater than UTLs:

Cadmium, copper, mercury, nickel, and zinc had concentrations greater than the soil background UTLs, and therefore need to be compared to SALs.

Radionuclides greater than UTLs:

Am-241, Cs-137, Pu-238, Pu-239, Sr-90, and uranium isotopes are greater than soil background UTLs. These radionuclides were compared to SALs.

Detected Organics:

No organics, other than TICs, were reported as detected values.

Preliminary list of COPCs based on SAL comparisons and MCE:

Am-241, Cs-137, Pu-238, Pu-239, and Sr-90 are the COPCs.

Summary:

Only minor concentrations of inorganic chemicals were detected in these data, and these modestly elevated concentrations were collocated with the substantially elevated radionuclide concentrations.

	Non-detects			Detects		
Analyte (units are mg/kg unless noted)	Count	Min	Max	Count	Min	Max
Aluminium	0			20	229	10900
Antimony	20	0.21	0.38	0		
Arsenic	17	0.66	2.1	3	1.42	1.7
Barium	7	4	48.5	13	47.6	147
Beryllium	17	0.22	0.77	3	0.37	0.56
Cadmium	17	0.44	1.1	3	1.5	7.1
Calcium	3	235	1150	17	1410	5380
Chromium	5	0.95	2.8	15	2.6	10.9
Cobalt	19	1.5	4.7	1	2.4	2.4
Copper	12	0.87	5.2	8	1.7	23.1
Iron	0			20	870	9770
Lead	0			20	1	17.1
Lithium	1	7.9	7.9	1	7.9	7.9
Magnesium	9	94.7	1230	11	981.5	1860
Manganese	0			20	7.7	336
Mercury	8	0.02	0.06	10	0.06	0.3
Molybdenum	2	6.3	6.3	0		
Nickel	11	1.7	8.3	9	5.3	53.5
Potassium	13	147	904	7	403	1380
Selenium	20	0.64	10.68	0		
Silver	20	2.1	3.8	0		
Sodium	17	72.8	229	1	246	246
Strontium	1	24.5	24.5	1	17.3	17.3
Thallium	20	0.21	0.38	0		
Uranium	0			17	0.393	2.3
Vanadium	12	1.3	11.1	8	7.7	16.5
Zinc	1	1.5	1.5	19	13	71.4
Actinium-227 (pCi/g)	2	0.85	1.37	0		
Americium-241 (pCi/g)	0			20	-0.372	19982
Cesium-137 (pCi/g)	0			20	0.0174	107.78
Plutonium-238 (pCi/g)	0			20	0	1440
Plutonium-239 (pCi/g)	0			20	0.0151	21525
Strontium-90 (pCi/g)	0			21	0.006	45.6
Tritium (pCi/g)	0			20	0.01233	0.29079
Uranium-234 (pCi/g)	0			2	3.45	3.65
Uranium-235 (pCi/g)	0			2	0.14	0.23
Uranium-238 (pCi/g)	0			2	1.5	1.63
Water (% soil moisture)	0			18	5.3	28.91
Acenaphthene	18	0.37	0.45	0		
Acenaphthylene	18	0.37	0.45	0		
Acetone	10	0.022	0.026	0		
Aniline	18	0.37	0.45	0		
Anthracene	18	0.37	0.45	0		
Azobenzene	18	0.37	0.45	0		
Benzene	10	0.006	0.006	0		
Benzoic acid	18	0.89	2.2	0		
Benzo[a]anthracene	18	0.37	0.45	0		
Benzo[a]pyrene	18	0.37	0.45	0		
Benzo[b]fluoranthene	18	0.37	0.45	0		
Benzo[g,h,i]perylene	18	0.37	0.45	0		
Benzo[k]fluoranthene	18	0.37	0.45	0		
Benzyl alcohol	18	0.37	0.9	0		
Bis(2-chloroethoxy)methane	18	0.37	0.45	0		
Bis(2-chloroethyl)ether	18	0.37	0.45	0		
Bis(2-chloroisopropyl)ether	18	0.37	0.45	0		
Bis(2-ethylhexyl)phthalate	18	0.37	0.45	0		
Bromobenzene	10	0.006	0.006	0		

Analyte (units are mg/kg unless noted)	Non-detects Count	Non-detects Min	Non-detects Max	Detects Count	Detects Min	Detects Max
Bromochloromethane	10	0.006	0.006	0		
Bromodichloromethane	10	0.006	0.006	0		
Bromoform	10	0.006	0.006	0		
Bromomethane	10	0.011	0.013	0		
Bromophenylphenyl ether [4-]	18	0.37	0.45	0		
Butanone [2-]	10	0.022	0.026	0		
Butyl benzyl phthalate	18	0.37	0.45	0		
Butylbenzene [n-]	10	0.006	0.006	0		
Butylbenzene [sec-]	10	0.006	0.006	0		
Butylbenzene [tert-]	10	0.006	0.006	0		
Carbon disulfide	10	0.006	0.006	0		
Carbon tetrachloride	10	0.006	0.006	0		
Chloro-3-methylphenol [4-]	18	0.37	0.9	0		
Chloroaniline [4-]	18	0.37	0.9	0		
Chlorobenzene	10	0.006	0.006	0		
Chlorodibromomethane	10	0.006	0.006	0		
Chloroethane	10	0.011	0.013	0		
Chloroform	10	0.006	0.006	0		
Chloromethane	10	0.011	0.013	0		
Chloronaphthalene [2-]	18	0.37	0.45	0		
Chlorophenol [o-]	19	0.37	0.45	0		
Chlorophenylphenyl ether [4-]	18	0.37	0.45	0		
Chlorotoluene [o-]	10	0.006	0.006	0		
Chlorotoluene [p-]	10	0.006	0.006	0		
Chrysene	18	0.37	0.45	0		
Di-n-butyl phthalate	18	0.37	0.88	0		
Di-n-octyl phthalate	18	0.37	0.45	0		
Dibenzofuran	18	0.37	0.45	0		
Dibenzo[a,h]anthracene	18	0.37	0.45	0		
Dibromo-3-chloropropane [1,2-]	10	0.011	0.013	0		
Dibromoethane [1,2-]	10	0.006	0.006	0		
Dibromomethane	10	0.006	0.006	0		
Dichlorobenzene (1,2) [o-]	28	0.006	0.45	0		
Dichlorobenzene (1,3) [m-]	28	0.006	0.45	0		
Dichlorobenzene (1,4) [p-]	28	0.006	0.45	0		
Dichlorobenzidine [3,3'-]	18	0.37	0.9	0		
Dichlorodifluoromethane	10	0.011	0.013	0		
Dichloroethane [1,1-]	10	0.006	0.006	0		
Dichloroethane [1,2-]	10	0.006	0.006	0		
Dichloroethene [1,1-]	10	0.006	0.006	0		
Dichloroethene [trans-1,2-]	10	0.006	0.006	0		
Dichloroethylene [cis-1,2-]	10	0.006	0.006	0		
Dichlorophenol [2,4-]	18	0.37	0.45	0		
Dichloropropane [1,2-]	10	0.006	0.006	0		
Dichloropropane [1,3-]	10	0.006	0.006	0		
Dichloropropane [2,2-]	10	0.006	0.006	0		
Dichloropropene [1,1-]	10	0.006	0.006	0		
Dichloropropene [cis-1,3-]	10	0.006	0.006	0		
Dichloropropene [trans-1,3-]	10	0.006	0.006	0		
Diethyl phthalate	18	0.37	0.45	0		
Dimethyl phthalate	18	0.37	0.45	0		
Dimethylphenol [2,4-]	18	0.37	0.45	0		
Dinitrophenol [2,4-]	18	0.89	2.2	0		
Dinitrotoluene [2,4-]	18	0.37	0.45	0		
Dinitrotoluene [2,6-]	18	0.37	0.45	0		
Ethylbenzene	10	0.006	0.006	0		
Fluoranthene	18	0.37	0.45	0		

Analyte (units are mg/kg unless noted)	Non-detects Count	Min	Max	Detects Count	Min	Max
Fluorene	18	0.37	0.45	0		
Hexachlorobenzene	18	0.37	0.45	0		
Hexachlorobutadiene	18	0.37	0.45	0		
Hexachlorocyclopentadiene	18	0.37	0.45	0		
Hexachloroethane	18	0.37	0.45	0		
Hexanone [2-]	10	0.022	0.026	0		
Indeno[1,2,3-cd]pyrene	18	0.37	0.45	0		
Isophorone	18	0.37	0.45	0		
Isopropylbenzene	10	0.006	0.006	0		
Isopropyltoluene [4-]	10	0.006	0.006	0		
Methyl iodide	10	0.006	0.006	0		
Methyl-2-pentanone [4-]	10	0.022	0.026	0		
Methyl-4,6-dinitrophenol [2-]	18	0.89	2.2	0		
Methylene chloride	10	0.006	0.036	0		
Methylnaphthalene [2-]	18	0.37	0.45	0		
Methylphenol [2-]	18	0.37	0.45	0		
Methylphenol [4-]	18	0.37	0.45	0		
Naphthalene	18	0.37	0.45	0		
Nitroaniline [2-]	18	0.89	2.2	0		
Nitroaniline [3-]	18	0.89	2.2	0		
Nitroaniline [4-]	18	0.73	0.9	0		
Nitrobenzene	18	0.37	0.45	0		
Nitrophenol [2-]	18	0.37	0.45	0		
Nitrophenol [4-]	18	0.89	2.2	0		
Nitrosodi-n-propylamine [N-]	18	0.37	0.45	0		
Nitrosodimethylamine [N-]	18	0.37	0.45	0		
Nitrosodiphenylamine [N-]	18	0.37	0.45	0		
Pentachlorophenol	18	0.89	2.2	0		
Phenanthrene	18	0.37	0.45	0		
Phenol	18	0.37	0.45	0		
Propylbenzene	10	0.006	0.006	0		
Pyrene	18	0.37	0.45	0		
Styrene	10	0.006	0.006	0		
Tetrachloroethane [1,1,1,2-]	10	0.006	0.006	0		
Tetrachloroethane [1,1,2,2-]	10	0.006	0.006	0		
Tetrachloroethylene	10	0.006	0.006	0		
Toluene	10	0.006	0.006	0		
Trichloro-1,2,2-trifluoroethane [1,1,2-]	10	0.006	0.006	0		
Trichlorobenzene [1,2,4-]	18	0.37	0.45	0		
Trichloroethane [1,1,1-]	10	0.006	0.006	0		
Trichloroethane [1,1,2-]	10	0.006	0.006	0		
Trichloroethene	10	0.006	0.006	0		
Trichlorofluoromethane	10	0.006	0.006	0		
Trichlorophenol [2,4,5-]	18	0.89	2.2	0		
Trichlorophenol [2,4,6-]	18	0.37	0.45	0		
Trichloropropane [1,2,3-]	10	0.006	0.006	0		
Trimethylbenzene [1,2,4-]	10	0.006	0.006	0		
Trimethylbenzene [1,3,5-]	10	0.006	0.006	0		
Vinyl chloride	10	0.011	0.013	0		
Xylenes (o + m + p) [Mixed-]	10	0.006	0.006	0		
Phthalate ester (TIC)	0			1	0.92	0.92
Trimethylbenzene [1,2,3-] (TIC)	0			1	1.4	1.4
Unknown organic compound (TIC)	0			19	0.45	3.6
Unsaturated Hydrocarbons (TIC)	0			3	0.67	1.3
Grand Total	2089			396		

ATTACHMENT B SAMPLE ANALYSIS MATRIX FOR PRSs 21-016 (a-c), AND PRS 21-011(c)

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Ta B-1
Sample Analysis Matrix
SWMU 21-016(a-c), 21-011(c)

		Field Survey			Field Screening			Field Laboratory Analysis					Fixed Laboratory Analysis								
		Visual Survey	Land Survey	Radiological	VOCs (PID)	Alpha	Beta/Gamma	Gross Gamma	Gross Alpha	Gross Beta	XRF	VOA 8260	Gamma Spec.	Tritium	Isotopic Pu	Total U	Sr-90	Hydrogeologic Parameters	VOA 8260	SVOC	TAL Metals
1	**Borehole 16-001**																				
	0-5 ft	X	X	X	X	X	X														
	5-10 ft				X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X
	10-15 ft				X	X	X														
	15-20 ft				X	X	X	X	X	X	X	X								X	
	20-25 ft				X	X	X														
	25-30 ft				X	X	X	X	X	X	X	X								X	
	30-35 ft				X	X	X														
	35-40 ft				X	X	X	X	X	X	X	X								X	
	40-45 ft				X	X	X														
	45-50 ft				X	X	X	X	X	X	X	X								X	
	50-55 ft				X	X	X														
	55-60 ft				X	X	X	X	X	X	X	X								P	
	60-65 ft				X	X	X														
	65-70 ft				X	X	X	X	X	X	X	X								P	
	70-75 ft				X	X	X														
	75-80 ft				X	X	X	X	X	X	X	X								P	
	80-85 ft				X	X	X														
	85-90 ft				X	X	X	X	X	X	X	X								P	
	90-95 ft				X	X	X														
	95-100 ft				X	X	X	X	X	X	X	X	X	X	X	X	X		X	P	X
	100-105 ft				X	X	X														
	105-110 ft				X	X	X	X	X	X	X	X								P	
	110-115 ft				X	X	X														
	115-120 ft				X	X	X	X	X	X	X	X								P	
	120-125 ft				X	X	X														
	125-130 ft				X	X	X	X	X	X	X	X								P	
	130-135 ft				X	X	X														
	135-140 ft				X	X	X	X	X	X	X	X								P	
	140-145 ft				X	X	X														
	145-150 ft				X	X	X	X	X	X	X	X								P	
2	**Borehole 16-002**																				
	0-5 ft	X	X	X	X	X	X														

Table B-1
Sample Analysis Matrix
SWMU 21-016(a-c), 21-011(c)

		Field Survey			Field Screening			Field Laboratory Analysis					Fixed Laboratory Analysis								
		Visual Survey	Land Survey	Radiological	VOCs (PID)	Alpha	Beta/Gamma	Gross Gamma	Gross Alpha	Gross Beta	XRF	VOA 8260	Gamma Spec.	Tritium	Isotopic Pu	Total U	Sr-90	Hydrogeologic Parameters	VOA 8260	SVOC	TAL Metals
2	5-10 ft				X	X	X	X	X	X	X	X	X	X	X	X	X		X		X
	10-15 ft				X	X	X														
	15-20 ft				X	X	X	X	X	X	X	X									
	20-25 ft				X	X	X														
	25-30 ft				X	X	X	X	X	X	X	X									
	30-35 ft				X	X	X														
	35-40 ft				X	X	X	X	X	X	X	X									
	40-45 ft				X	X	X														
	45-50 ft				X	X	X	X	X	X	X	X									
	50-55 ft				X	X	X														
	55-60 ft				X	X	X	X	X	X	X	X									
	60-65 ft				X	X	X														
	65-70 ft				X	X	X	X	X	X	X	X									
	70-75 ft				X	X	X														
	75-80 ft				X	X	X	X	X	X	X	X									
	80-85 ft				X	X	X														
	85-90 ft				X	X	X	X	X	X	X	X									
	90-95 ft				X	X	X														
	95-100 ft				X	X	X	X	X	X	X	X	X	X	X	X	X		X		X
	100-105 ft				X	X	X														
	105-110 ft				X	X	X	X	X	X	X	X									
	110-115 ft				X	X	X														
	115-120 ft				X	X	X	X	X	X	X	X									
	120-125 ft				X	X	X														
	125-130 ft				X	X	X	X	X	X	X	X									
	130-135 ft				X	X	X														
	135-140 ft				X	X	X	X	X	X	X	X									
	140-145 ft				X	X	X														
	145-150 ft				X	X	X	X	X	X	X	X									
3	**Borehole 16-003**																				
	0-5 ft	X	X	X	X	X	X														
	5-10 ft				X	X	X	X	X	X	X	X	X	X	X	X	X		X		X
	10-15 ft				X	X	X														

Ta B-1
Sample Analysis Matrix
SWMU 21-016(a-c), 21-011(c)

		Field Survey			Field Screening			Field Laboratory Analysis					Fixed Laboratory Analysis								
		Visual Survey	Land Survey	Radiological	VOCs (PID)	Alpha	Beta/Gamma	Gross Gamma	Gross Alpha	Gross Beta	XRF	VOA 8260	Gamma Spec.	Tritium	Isotopic Pu	Total U	Sr-90	Hydrogeologic Parameters	VOA 8260	SVOC	TAL Metals
3	15-20 ft				X	X	X	X	X	X	X	X									
	20-25 ft				X	X	X														
	25-30 ft				X	X	X	X	X	X	X	X									
	30-35 ft				X	X	X														
	35-40 ft				X	X	X	X	X	X	X	X									
	40-45 ft				X	X	X														
	45-50 ft				X	X	X	X	X	X	X	X									
4	**Borehole 16-004**																				
	0-5 ft	X	X	X	X	X	X														
	5-10 ft				X	X	X	X	X	X	X	X									
	10-15 ft				X	X	X														
	15-20 ft				X	X	X	X	X	X	X	X									
	20-25 ft				X	X	X														
	25-30 ft				X	X	X	X	X	X	X	X									
	30-35 ft				X	X	X														
	35-40 ft				X	X	X	X	X	X	X	X									
	40-45 ft				X	X	X														
	45-50 ft				X	X	X	X	X	X	X	X									
5	**Borehole 16-005**																				
	0-5 ft	X	X	X	X	X	X														
	5-10 ft				X	X	X	X	X	X	X	X	X	X	X	X	X		X		X
	10-15 ft				X	X	X														
	15-20 ft				X	X	X	X	X	X	X	X									
	20-25 ft				X	X	X														
	25-30 ft				X	X	X	X	X	X	X	X									
	30-35 ft				X	X	X														
	35-40 ft				X	X	X	X	X	X	X	X									
	40-45 ft				X	X	X														
	45-50 ft				X	X	X	X	X	X	X	X									
6	**Borehole 16-006**																				
	0-5 ft	X	X	X	X	X	X														
	5-10 ft				X	X	X	X	X	X	X	X									
	10-15 ft				X	X	X														

Table B-1
Sample Analysis Matrix
SWMU 21-016(a-c), 21-011(c)

		Field Survey			Field Screening			Field Laboratory Analysis					Fixed Laboratory Analysis								
		Visual Survey	Land Survey	Radiological	VOCs (PID)	Alpha	Beta/Gamma	Gross Gamma	Gross Alpha	Gross Beta	XRF	VOA 8260	Gamma Spec.	Tritium	Isotopic Pu	Total U	Sr-90	Hydrogeologic Parameters	VOA 8260	SVOC	TAL Metals
6	15-20 ft				X	X	X	X	X	X	X	X									
	20-25 ft				X	X	X														
	25-30 ft				X	X	X	X	X	X	X	X									
	30-35 ft				X	X	X														
	35-40 ft				X	X	X	X	X	X	X	X									
	40-45 ft				X	X	X														
	45-50 ft				X	X	X	X	X	X	X	X									
7	**Borehole 16-007**																				
	0-5 ft	X	X	X	X	X	X														
	5-10 ft				X	X	X	X	X	X	X	X	X	X	X	X	X		X		X
	10-15 ft				X	X	X														
	15-20 ft				X	X	X	X	X	X	X	X									
	20-25 ft				X	X	X														
	25-30 ft				X	X	X	X	X	X	X	X									
	30-35 ft				X	X	X														
	35-40 ft				X	X	X	X	X	X	X	X									
	40-45 ft				X	X	X														
	45-50 ft				X	X	X	X	X	X	X	X									
8	**Borehole 16-008**																				
	0-5 ft	X	X	X	X	X	X														
	5-10 ft				X	X	X	X	X	X	X	X									
	10-15 ft				X	X	X														
	15-20 ft				X	X	X	X	X	X	X	X									
	20-25 ft				X	X	X														
	25-30 ft				X	X	X	X	X	X	X	X									
	30-35 ft				X	X	X														
	35-40 ft				X	X	X	X	X	X	X	X									
	40-45 ft				X	X	X														
	45-50 ft				X	X	X	X	X	X	X	X									
9	**Borehole 16-009**																				
	0-5 ft	X	X	X	X	X	X														
	5-10 ft				X	X	X	X	X	X	X	X	X	X	X	X	X		X		X
	10-15 ft				X	X	X														

Ta B-1
Sample Analysis Matrix
SWMU 21-016(a-c), 21-011(c)

		Field Survey			Field Screening			Field Laboratory Analysis					Fixed Laboratory Analysis								
		Visual Survey	Land Survey	Radiological	VOCs (PID)	Alpha	Beta/Gamma	Gross Gamma	Gross Alpha	Gross Beta	XRF	VOA 8260	Gamma Spec.	Tritium	Isotopic Pu	Total U	Sr-90	Hydrogeologic Parameters	VOA 8260	SVOC	TAL Metals
9	15-20 ft				X	X	X	X	X	X	X	X									
	20-25 ft				X	X	X														
	25-30 ft				X	X	X	X	X	X	X	X						P			
	30-35 ft				X	X	X														
	35-40 ft				X	X	X	X	X	X	X	X									
	40-45 ft				X	X	X														
	45-50 ft				X	X	X	X	X	X	X	X									
	50-55 ft				P	P	P														
	55-60 ft				P	P	P														
	60-65 ft				P	P	P														
	65-70 ft				P	P	P														
	70-75 ft				P	P	P														
	75-80 ft				P	P	P														
	80-85 ft				P	P	P														
	85-90 ft				P	P	P														
	90-95 ft				P	P	P														
	95-100 ft				P	P	P											P			
	100-105 ft				P	P	P														
	105-110 ft				P	P	P														
	110-115 ft				P	P	P														
	115-120 ft				P	P	P														
	120-125 ft				P	P	P														
	125-130 ft				P	P	P														
	130-135 ft				P	P	P														
	135-140 ft				P	P	P														
	140-145 ft				P	P	P														
	145-150 ft				P	P	P											P			
10	**Borehole 16-010**																				
	0-5 ft	X	X	X	X	X	X														
	5-10 ft				X	X	X	X	X	X	X	X	X	X	X	X	X		X		X
	10-15 ft				X	X	X														
	15-20 ft				X	X	X	X	X	X	X	X									
	20-25 ft				X	X	X														

Table B-1
Sample Analysis Matrix
SWMU 21-016(a-c), 21-011(c)

		Field Survey			Field Screening			Field Laboratory Analysis					Fixed Laboratory Analysis								
		Visual Survey	Land Survey	Radiological	VOCs (PID)	Alpha	Beta/Gamma	Gross Gamma	Gross Alpha	Gross Beta	XRF	VOA 8260	Gamma Spec.	Tritium	Isotopic Pu	Total U	Sr-90	Hydrogeologic Parameters	VOA 8260	SVOC	TAL Metals
10	25-30 ft				X	X	X	X	X	X	X	X									
	30-35 ft				X	X	X														
	35-40 ft				X	X	X	X	X	X	X	X									
	40-45 ft				X	X	X														
	45-50 ft				X	X	X	X	X	X	X	X									
	50-55 ft				X	X	X														
	55-60 ft				X	X	X	X	X	X	X	X									
	60-65 ft				X	X	X														
	65-70 ft				X	X	X	X	X	X	X	X									
	70-75 ft				X	X	X														
	75-80 ft				X	X	X	X	X	X	X	X									
	80-85 ft				X	X	X														
	85-90 ft				X	X	X	X	X	X	X	X									
	90-95 ft				X	X	X														
	95-100 ft				X	X	X	X	X	X	X	X									
	100-105 ft				X	X	X														
	105-110 ft				X	X	X	X	X	X	X	X	X	X	X	X	X		X		X
	110-115 ft				X	X	X														
	115-120 ft				X	X	X	X	X	X	X	X									
	120-125 ft				X	X	X														
	125-130 ft				X	X	X	X	X	X	X	X									
	130-135 ft				X	X	X														
	135-140 ft				X	X	X	X	X	X	X	X									
	140-145 ft				X	X	X														
	145-150 ft				X	X	X	X	X	X	X	X									
	150-155 ft				X	X	X														
	155-160 ft				X	X	X	X	X	X	X	X									
	160-165 ft				X	X	X														
	165-170 ft				X	X	X	X	X	X	X	X									
	170-178 ft				X	X	X														
11	**Borehole 16-011**																				
	0-5 ft	X	X	X	X	X	X														
	5-10 ft				X	X	X	X	X	X	X	X	X	X	X	X	X		X		X

Ta B-1
Sample Analysis Matrix
SWMU 21-016(a-c), 21-011(c)

		Field Survey			Field Screening			Field Laboratory Analysis					Fixed Laboratory Analysis								
		Visual Survey	Land Survey	Radiological	VOCs (PID)	Alpha	Beta/Gamma	Gross Gamma	Gross Alpha	Gross Beta	XRF	VOA 8260	Gamma Spec.	Tritium	Isotopic Pu	Total U	Sr-90	Hydrogeologic Parameters	VOA 8260	SVOC	TAL Metals
11	10-15 ft				X	X	X														
	15-20 ft				X	X	X	X	X	X	X	X									
	20-25 ft				X	X	X														
	25-30 ft				X	X	X	X	X	X	X	X									
	30-35 ft				X	X	X														
	35-40 ft				X	X	X	X	X	X	X	X									
	40-45 ft				X	X	X														
	45-50 ft				X	X	X	X	X	X	X	X									
	50-55 ft				X	X	X														
	55-60 ft				X	X	X	X	X	X	X	X									
	60-65 ft				X	X	X														
	65-70 ft				X	X	X	X	X	X	X	X									
	70-75 ft				X	X	X														
	75-80 ft				X	X	X	X	X	X	X	X	X	X	X	X	X		X		X
	80-85 ft				X	X	X														
	85-90 ft				X	X	X	X	X	X	X	X									
	90-95 ft				X	X	X														
	95-100 ft				X	X	X	X	X	X	X	X									
	100-105 ft				X	X	X														
	105-110 ft				X	X	X	X	X	X	X	X									
	110-115 ft				X	X	X														
	115-120 ft				X	X	X	X	X	X	X	X									
	120-125 ft				X	X	X														
	125-129 ft				X	X	X	X	X	X	X	X									
12	**Borehole 16-012**																				
	0-5 ft	X	X	X	X	X	X														
	5-10 ft				X	X	X	X	X	X	X	X	X	X	X	X	X		X		X
	10-15 ft				X	X	X														
	15-20 ft				X	X	X	X	X	X	X	X									
	20-25 ft				X	X	X														
	25-30 ft				X	X	X	X	X	X	X	X									
	30-35 ft				X	X	X														
	35-40 ft				X	X	X	X	X	X	X	X									

Table B-1
Sample Analysis Matrix
SWMU 21-016(a-c), 21-011(c)

		Field Survey			Field Screening			Field Laboratory Analysis					Fixed Laboratory Analysis								
		Visual Survey	Land Survey	Radiological	VOCs (PID)	Alpha	Beta/Gamma	Gross Gamma	Gross Alpha	Gross Beta	XRF	VOA 8260	Gamma Spec.	Tritium	Isotopic Pu	Total U	Sr-90	Hydrogeologic Parameters	VOA 8260	SVOC	TAL Metals
12	40-45 ft				X	X	X														
	45-50 ft				X	X	X	X	X	X	X	X									
	50-55 ft				X	X	X														
	55-60 ft				X	X	X	X	X	X	X	X									
	60-65 ft				X	X	X														
	65-70 ft				X	X	X	X	X	X	X	X									
	70-75 ft				X	X	X														
	75-80 ft				X	X	X	X	X	X	X	X									
	80-85 ft				X	X	X														
	85-90 ft				X	X	X	X	X	X	X	X									
	90-95 ft				X	X	X														
	95-100 ft				X	X	X	X	X	X	X	X	X	X	X	X	X		X		X
	100-105 ft				X	X	X														
	105-110 ft				X	X	X	X	X	X	X	X									
	110-115 ft				X	X	X														
	115-120 ft				X	X	X	X	X	X	X	X									
	120-125 ft				X	X	X														
	125-130 ft				X	X	X	X	X	X	X	X									
	130-135 ft				X	X	X														
	135-140 ft				X	X	X	X	X	X	X	X									
	140-145 ft				X	X	X														
	145-150 ft				X	X	X	X	X	X	X	X									
	150-155 ft				X	X	X														
	155-160 ft				X	X	X	X	X	X	X	X									
	160-165 ft				X	X	X														
	165-171 ft				X	X	X	X	X	X	X	X	X	X	X	X	X		X		X
13	**Borehole 16-013**																				
	0-5 ft	X	X	X	X	X	X														
	5-10 ft				X	X	X	X	X	X	X	X									
	10-15 ft				X	X	X														
	15-20 ft				X	X	X	X	X	X	X	X									
	20-25 ft				X	X	X														
	25-30 ft				X	X	X	X	X	X	X	X									

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Sample Analysis Matrix
SWMU 21-016(a-c), 21-011(c)

		Field Survey			Field Screening			Field Laboratory Analysis					Fixed Laboratory Analysis								
		Visual Survey	Land Survey	Radiological	VOCs (PID)	Alpha	Beta/Gamma	Gross Gamma	Gross Alpha	Gross Beta	XRF	VOA 8260	Gamma Spec.	Tritium	Isotopic Pu	Total U	Sr-90	Hydrogeologic Parameters	VOA 8260	SVOC	TAL Metals
13	30-35 ft				X	X	X														
	35-40 ft				X	X	X	X	X	X	X	X									
	40-45 ft				X	X	X														
	45-50 ft				X	X	X	X	X	X	X	X									
14	**Borehole 16-014**																				
	0-5 ft	X	X	X	X	X	X														
	5-10 ft				X	X	X	X	X	X	X	X	X	X	X	X	X		X		X
	10-15 ft				X	X	X														
	15-20 ft				X	X	X	X	X	X	X	X									
	20-25 ft				X	X	X														
	25-30 ft				X	X	X	X	X	X	X	X									
	30-35 ft				X	X	X														
	35-40 ft				X	X	X	X	X	X	X	X									
	40-45 ft				X	X	X														
	45-50 ft				X	X	X	X	X	X	X	X									
15	**Borehole 16-015**																				
	0-5 ft	X	X	X	X	X	X														
	5-10 ft				X	X	X	X	X	X	X	X									
	10-15 ft				X	X	X														
	15-20 ft				X	X	X	X	X	X	X	X									
	20-25 ft				X	X	X														
	25-30 ft				X	X	X	X	X	X	X	X									
	30-35 ft				X	X	X														
	35-40 ft				X	X	X	X	X	X	X	X									
	40-45 ft				X	X	X														
	45-50 ft				X	X	X	X	X	X	X	X									
16	**Borehole 16-016**																				
	0-5 ft	P	P	P	P	P	P														
	5-10 ft				P	P	P	P	P	P	P	P	P	P	P	P	P		P		P
	10-15 ft				P	P	P														
	15-20 ft				P	P	P	P	P	P	P	P									
	20-25 ft				P	P	P														

Table B-1
Sample Analysis Matrix
SWMU 21-016(a-c), 21-011(c)

		Field Survey			Field Screening			Field Laboratory Analysis					Fixed Laboratory Analysis								
		Visual Survey	Land Survey	Radiological	VOCs (PID)	Alpha	Beta/Gamma	Gross Gamma	Gross Alpha	Gross Beta	XRF	VOA 8260	Gamma Spec.	Tritium	Isotopic Pu	Total U	Sr-90	Hydrogeologic Parameters	VOA 8260	SVOC	TAL Metals
16	25-30 ft				P	P	P	P	P	P	P	P						p			
	30-35 ft				P	P	P														
	35-40 ft				P	P	P	P	P	P	P	P									
	40-45 ft				P	P	P														
	45-50 ft				P	P	P	P	P	P	P	P									
	50-55 ft				P	P	P														
	55-60 ft				P	P	P														
	60-65 ft				P	P	P														
	65-70 ft				P	P	P														
	70-75 ft				P	P	P														
	75-80 ft				P	P	P														
	80-85 ft				P	P	P														
	85-90 ft				P	P	P														
	90-95 ft				P	P	P														
	95-100 ft				P	P	P											P			
	100-105 ft				P	P	P														
	105-110 ft				P	P	P														
	110-115 ft				P	P	P														
	115-120 ft				P	P	P														
	120-125 ft				P	P	P														
	125-130 ftt				P	P	P														
	130-135 ft				P	P	P														
	135-140 ft				P	P	P														
	140-145 ft				P	P	P														
	145-150ft				P	P	P														
17	**Borehole 16-017**																				
	0-5 ft	P	P	P	P	P	P														
	5-10 ft				P	P	P	P	P	P	P	P									
	10-15 ft				P	P	P														
	15-20 ft				P	P	P	P	P	P	P	P									
	20-25 ft				P	P	P														
	25-30 ft				P	P	P	P	P	P	P	P									

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Sample Analysis Matrix
SWMU 21-016(a-c), 21-011(c)

		Field Survey			Field Screening			Field Laboratory Analysis					Fixed Laboratory Analysis								
		Visual Survey	Land Survey	Radiological	VOCs (PID)	Alpha	Beta/Gamma	Gross Gamma	Gross Alpha	Gross Beta	XRF	VOA 8260	Gamma Spec.	Tritium	Isotopic Pu	Total U	Sr-90	Hydrogeologic Parameters	VOA 8260	SVOC	TAL Metals
17	30-35 ft				P	P	P														
	35-40 ft				P	P	P	P	P	P	P	P									
	40-45 ft				P	P	P														
	45-50 ft				P	P	P	P	P	P	P	P									
18	**Borehole 16-018**																				
	0-5 ft	P	P	P	P	P	P														
	5-10 ft				P	P	P	P	P	P	P	P	P	P	P	P	P		P		P
	10-15 ft				P	P	P														
	15-20 ft				P	P	P	P	P	P	P	P									
	20-25 ft				P	P	P														
	25-30 ft				P	P	P	P	P	P	P	P									
	30-35 ft				P	P	P														
	35-40 ft				P	P	P	P	P	P	P	P									
	40-45 ft				P	P	P														
	45-50 ft				P	P	P	P	P	P	P	P									
19	**Borehole 16-019**																				
	0-5 ft	P	P	P	P	P	P														
	5-10 ft				P	P	P	P	P	P	P	P									
	10-15 ft				P	P	P														
	15-20 ft				P	P	P	P	P	P	P	P									
	20-25 ft				P	P	P														
	25-30 ft				P	P	P	P	P	P	P	P									
	30-35 ft				P	P	P														
	35-40 ft				P	P	P	P	P	P	P	P									
	40-45 ft				P	P	P														
	45-50 ft				P	P	P	P	P	P	P	P									
20	**Borehole 16-020**																				
	0-5 ft	P	P	P	P	P	P														
	5-10 ft				P	P	P	P	P	P	P	P	P	P	P	P	P		P		P
	10-15 ft				P	P	P														
	15-20 ft				P	P	P	P	P	P	P	P									
	20-25 ft				P	P	P														
	25-30 ft				P	P	P	P	P	P	P	P									

Table B-1
Sample Analysis Matrix
SWMU 21-016(a-c), 21-011(c)

		Field Survey			Field Screening			Field Laboratory Analysis					Fixed Laboratory Analysis								
		Visual Survey	Land Survey	Radiological	VOCs (PID)	Alpha	Beta/Gamma	Gross Gamma	Gross Alpha	Gross Beta	XRF	VOA 8260	Gamma Spec.	Tritium	Isotopic Pu	Total U	Sr-90	Hydrogeologic Parameters	VOA 8260	SVOC	TAL Metals
20	30-35 ft				P	P	P														
	35-40 ft				P	P	P	P	P	P	P	P									
	40-45 ft				P	P	P														
	45-50 ft				P	P	P	P	P	P	P	P									
Total Samples per Method or Suite					345	345	345	152	152	152	152	152	19	19	19	19	19		19	15	19

X = Planned

P = Possible

Gamma spectroscopy analysis will identify cesium-137, americium-241, and other gamma emitters.

Boreholes #21 and 22 are not identified in this table because details on these boreholes (length, angle, and depth) are not known at this time. Samples will be collected for field screening, field laboratory analysis, and fixed laboratory analysis at the same frequency as shown for borehole #1. Samples will be collected for SVOC analysis at 10-ft intervals from the surface to the bottom of each borehole.