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Date: February 15, 2005
Refer To: ER2005-0063

Kathryn Chamberlain
NMED – Hazardous Waste Bureau
2905 Rodeo Park Drive East
Building 1
Santa Fe, NM 87505-6303

SUBJECT: WRITTEN REQUEST FOR DOCUMENTS REGARDING "GEOTECHNICAL INVESTIGATION, TECHNICAL AREA 50: PUMP HOUSE AND INFLUENT STORAGE TANK VAULT PROJECT", "TA-50 SOIL CHARACTERIZATION ANALYTICAL SUMMARY REPORT", AND ANALYTICAL RESULTS FOR 2003/2004 SAMPLING ACTIVITIES AT SWMUS 50-004(c) and 50-011(a)

Dear Ms. Chamberlain:

Per your letter request dated January 28, 2005 which was received by Los Alamos National Laboratory on February 2, 2005, the following documents are attached:

1. Geotechnical Investigation, Technical Area 50: Pump House and Influent Storage Tank Vault Project, 2002, LA-UR-05-
2. TA-50 Soil Characterization Analytical Summary Report, 2002, LA-UR-05-0841, and
3. Analytical Results for 2003/2004 Sampling Activities at SWMUs 50-004(c) and 50-011(a), LA-UR-05-0966

If you have any questions please do not hesitate to contact John Hopkins at (505) 667-9551.

Sincerely,

Gabriela Lopez Escobedo,
Program Manager, Complex Remedies
Remediation Services
Los Alamos National Laboratory

GLE/JH/ds

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FEB [illegible] 2005
By

Enclosures: as stated

Cy:(w/out enclosures)

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C. Voorhees, NMED-DOE OB
S. Yanicak, NMED-DOE OB, MS J993
ENV-RS File, MS M992
IM-9, MS A150
RPF, MS M707

LA-UR-05-0840

January 15, ~~2001~~ 2002

GEOTECHNICAL INVESTIGATION TECHNICAL AREA 50: PUMP HOUSE AND INFLUENT STORAGE TANK VAULT PROJECT

PROJECT NO. 59-010145.001

Prepared for:
Facility and Waste Operation
FWO – WFM
Los Alamos National Laboratory
Los Alamos, New Mexico

Submitted to:
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SUMMARY OF CONCLUSIONS

The proposed project involves the construction of a new pump house and influent storage tank vault building and a new manhole at Los Alamos National Laboratory (LANL). The project will be located within Technical Area (TA)-50.

According to the present conceptual design, the building will have an approximate overall floor area of 8,250 square feet. The proposed structure will be one to two stories in height; and will be relatively lightly loaded. The building's lowest structural elements will range from about 10 to 20 feet below existing site grades. Open temporary excavations for the building will range from 10 to 20 feet in depth. The proposed manhole will be located approximately 100 feet west of the new building.

The subject project was originally planned as an environmental assessment to be performed by others. The environmental assessment included the drilling of eight borings with continuous sampling at predetermined intervals. The subject geotechnical investigation component to the project was added at a later time. The geotechnical investigation was to utilize the field investigation element of the environmental assessment to generate field data for the subject report.

Eight (8) borings were drilled for the project using a CME 75-drill rig. The majority of the borings were drilled to depths ranging from 23 to 26.5 feet below the ground surface. Boring B-2 was advanced for the purpose of environmental soil characterization and was completed to a total depth of about 90 feet. However, for the purpose of this geotechnical investigation, Boring B-2 was logged to a depth of 25 feet. All borings were continuously logged by a field engineer and samples were taken at 5-foot intervals or closer where appropriate. Field resistivity measurements were performed near the proposed building site. The field resistivity test results are presented in Appendix F.

Fill material was encountered in all the borings to depths of between 1 to 9 feet below the existing ground surface. In two of the borings, B-1 and B-2, native sandy lean clay soils were encountered beneath the fill and extended to depths of 4 to 5 feet. Beneath the fill material and native soils, we encountered volcanic tuff in all of the borings drilled for the project at depths of between 2 to 9 feet below existing grade. No groundwater was encountered in any of the borings at the time of the investigation. Laboratory testing of selected soil samples indicated that in-situ water contents generally ranged from about 6 to 20 percent.

Based upon the results of this investigation, the bearing elevation of the proposed building will be within the zone of volcanic tuff. Major cuts will be required in order to prepare the site for construction. To provide a uniform bearing surface, it is our opinion that the proposed structure can be safely supported on a monolithic mat or raft, or a spread type footing, bearing directly on volcanic tuff. This would involve overexcavating into the volcanic tuff beneath the entire building area.

Suitable ultimate bearing capacity for the volcanic tuff is 18,000 pounds per square foot for conventional shallow foundations. Applying a factor of safety (FS) of 3, an allowable bearing pressure of 6000 pounds per square foot is recommended for design. Perimeter or exterior foundation support should bear at a minimum depth of 30 inches below finished grade and any interior footing support should bear at a depth of 12 inches below finished floor slab.

Total settlement for the foundation system designed and constructed as recommended is considered to be negligible.

Horizontal loads acting on foundations, below grade walls and temporary shoring will be resisted by friction acting along the base of the footing and by passive earth pressures against the side of the footings, walls and shoring. The frictional resistance acting along the base of footings founded on suitable foundation soils may be computed using a coefficient of friction equal to 0.50 with the normal dead load. Passive earth pressures acting against the side of footings, walls and temporary shoring may be assumed to be equivalent to 340 pounds per cubic foot for undisturbed native soil and fill material and 420 pounds per cubic foot for volcanic tuff.

Passive pressure within the upper 1.0 foot of the ground surface should be neglected unless confined by concrete slabs-on-grade or pavement. The values given above may be increased by one-third for transient wind or seismic loads.

Lateral pressure exerted against below grade walls and the manhole structure will depend upon their degree of restraint. Below grade walls braced or restrained at the top to limit movement to less than 0.1 percent of the height of the walls will be subjected to "at-rest" earth pressures. Below grade walls which are not braced or restrained at the top will be subjected to "active" earth pressures. Recommended equivalent fuild pressures for design are:

	Active Pressure (psf/ft)	"At-Rest" Pressure (psf/ft)
Undisturbed native soils and fill material	34	55
Compacted granular backfill	40	60
Volcanic tuff	26	42

The lateral pressures presented above are based upon a condition of horizontal backfill with no surcharge loads.

For this site, the overburden soils consisting of clays can be considered as Type B soils, and all other overburden soils can be considered as Type C when applying the OSHA regulations for excavations. OSHA recommends a maximum slope inclination of 1:1 (horizontal:vertical) for Type B soils, and 1.5:1 for Type C soils. Where an excavation extends through Type B soil into Type C soil conditions, the entire excavation should be sloped no less than 1.5:1. However, slopes may be flattened depending on conditions exposed during construction. If there is not adequate space for sloped excavations, shoring should be used.

Two perpendicular resistivity lines were performed at the building site. Based on the results of the resistivity measurements, the soil and rock underlying the site exhibited resistivities of 56 to 299 ohm-meter (5600 to 299,000 ohm-cm) which falls within the expected range of soil resistivity at LANL, per Section 245 on the LANL Facility Engineering Manual.

This executive summary only provides a brief overview of the work performed and presented in the body of this report. It is highly recommended that the reader of this executive summary also read the report in its entirety as there are specific details presented therein that are otherwise not discussed in this executive summary.

1. INTRODUCTION

1.1 GENERAL

This report presents the results of a Geotechnical Investigation performed for the proposed new pump house and influent storage tank vault building and new manhole to be located within the Technical Area (TA)-50, located at the Los Alamos National Laboratory (LANL) in Los Alamos, New Mexico. The purpose of the Geotechnical Investigation was to evaluate the physical properties of the soil and rock underlying the site vicinity, and to provide recommendations for foundation types and depths, site grading and structural fill, excavation support, below grade walls, moisture protection, and construction considerations.

The investigation included a general site reconnaissance, subsurface exploration, sampling of selected underlying soil and rock, field and laboratory testing, engineering analyses, and preparation of this report. The recommendations contained in this report are subject to the limitations presented herein.

1.2 PROJECT DESCRIPTION

A proposed new pump house and influent storage tank vault building is to be constructed near the southeast corner of the TA-50 facility. The design of this building will be performed according to LANL Engineering Standards, PC2. A new manhole will be located approximately 100 feet to the west. Also included in the project is the installation of a new, buried radioactive-waste pipeline that receives flow from an upgradient, existing manhole structure. The Site Plan, Figure 1, illustrating the conceptual project layout is presented in Appendix A.

The proposed building will consist of a one to two-story structure with a below grade tank basin. The tank basin will include the tank vault and pump house which covers the entire building footprint. The current conceptual design, based on the Conceptual Design Report (CDR) and drawings provided by Facility and Waste Operation - LANL, includes seven 43,000-gallon horizontal influent tanks within the below graded tank vault. The proposed building will be rectangular in shape with an extension on the West side and will be about 8,250 square feet in plan area as shown on Figure 1. The type of construction that will be employed is unknown at this time; however, the building is expected to be relatively lightly loaded, with wall and column loads which are not expected to exceed about 3 kips per lineal foot and 50 kips, respectively. However, heavy floor loads are expected due to the seven influent tanks. An individual tank when filled will weigh on the order of 360,000 pounds. The type of foundation construction that will be employed to distribute the wall, roof, and tank loads is unknown at this time. The building will be constructed with its lowest structural element approximately 10 to 20 feet below existing grades. Open excavations for the construction of the building will be required and will range from 10 to 20 feet in depth depending on the existing site grades around the proposed structure.

An existing building (TA-50-83) along with existing paved parking, access road, and grass area currently occupy the project site. The existing structure will be removed prior to the excavation for the new building. Excavation for the new building may extend into TA–35, which is located to the east. Temporary relocation of a portion of a fence along this boundary may be required. A portion of another existing fence located along the south boundary of the site may need to be permanently relocated.

Buried electrical lines provide service to the existing building from the south. Buried electrical and other possible unknown lines within the limits of the proposed excavation area will be placed out of service and removed. Known buried utility and service lines include a 2-inch water line, underground electrical, and 3-inch and 6-inch tritium lines; these lines may be affected by the excavation for the new building. It is our understanding that these buried lines are located to the north and east, aligned 45 degrees to the plan of the proposed excavation and are buried approximately 3 to 5 feet below existing grade. At their closest point, these lines will be approximately 7 feet from the northwest corner of the proposed excavation.

2. SITE DESCRIPTION

2.1 SURFACE CONDITIONS

The site of the proposed building is located at the southeast corner of TA-50 as shown on Figure 1. The area is currently occupied by an existing building (TA-50-83), paved parking areas and an access road, and landscaping. Building TA-50-83 is a single story structure, approximately 1500 square feet in plan area, and located near the northwest corner of the proposed building excavation. Exterior walls were observed to consist of metal siding. Paved parking and access roads are located to the south and north of TA-50-83. The majority of the site is relatively flat and slopes very gently downward toward the south and east. An existing embankment slope is located to the east of the present building and to the south of the pavement area. The slope is approximately 4 to 6 feet in height with an inclination of 1.5 – 2 to 1 (horizontal to vertical). At the toe of the slope, the grade becomes relatively flat with only 1 to 2 feet change in elevation and extends 7 to 10 feet to an existing fence line. Vegetation around the site consisted of weeds and grasses covering the slope and low-lying areas.

The location of the proposed manhole is approximately 120 feet west of the southwest corner of the existing TA-50-83 building as shown on Figure 1. An existing asphalt paved access road crosses the southeast half of the proposed construction limits of the manhole. The northwest half of the proposed construction area consists of exposed fill soils.

2.2 SUBSURFACE CONDITIONS

The following presents the soil and rock conditions encountered in the eight exploratory borings drilled for this geotechnical investigation. The descriptions that follow are general in nature and represent the conditions encountered in the borings at the time they were drilled. For a more detailed description of the subsurface conditions encountered, refer to the logs of the exploratory borings presented in Appendix B.

The surface soils encountered in the exploratory borings drilled at the site consisted of man-made fill material extending to depths ranging from 1 to 9 feet beneath existing grade. The fill generally consists of clayey sand, silty sand, and sandy lean clay soils of loose to medium dense or firm to hard consistency, and non-plastic to medium plasticity. Native soils were encountered beneath the fill soils in Borings B-1 and B-2 at depths of about 1 to 1.5 feet below existing grade and extended to depths of about 4 to 5' feet below existing grade. The native soils were generally firm to very firm sandy lean clay of low to medium plasticity.

Underlying the native soil and fill material the borings encountered volcanic tuff. The volcanic tuff is a member of the Bandelier tuff, an ash flow deposit which has been consolidated and welded to varying degrees. It is composed of mineral crystals, pumice, latite, and rhyolite fragments and is siliceous in composition. The volcanic tuff is porous, of low unit weight, and is generally soft and friable in comparison with other rock formations. Although soft from a geologic point of view, the volcanic tuff is considered hard from an engineering standpoint. Based on observations of rock cores retrieved by the continuous sampler from the eight exploratory borings, the tuff is fractured along primarily high-angle (>70 degree from horizontal) surfaces. The volcanic tuff extended to the maximum depth explored in the borings.

A summary of the subsurface conditions, general lithology, and depth observed during the field exploration are presented in Table 1 below:

Table 1
Subsurface Condition Summary

Exploratory Boring	Depth Interval (ft)	Lithology
B-1	0 – 4	Soil and Fill
	4	Volcanic Tuff Interface
	4 – 25	Volcanic Tuff
B-2	0 – 5	Soil and Fill
	5	Volcanic Tuff Interface
	5 – 25(90 +/-)	Volcanic Tuff
B-3	0 – 6	Fill
	6	Volcanic Tuff Interface
	6 – 26.5	Volcanic Tuff
B-4	0 – 9	Fill
	9	Volcanic Tuff Interface
	9 – 23	Volcanic Tuff
B-5	0 – 5.5	Fill
B-5	5.5	Volcanic Tuff Interface
	5.5 – 25.5	Volcanic Tuff
B-6	0 – 6.5	Fill
	6.5	Volcanic Tuff Interface
	6.5 – 25	Volcanic Tuff
B-7	0 – 8	Fill
	8	Volcanic Tuff Interface
	8 – 25.3	Volcanic Tuff
B-8	0 – 2	Fill
	2	Volcanic Tuff Interface
	2 – 25.3	Volcanic Tuff

Kleinfelder performed the geotechnical investigation in conjunction with an environmental soil characterization performed by personnel associated with the WGII/PMC/SEA Team. Variances in the depth of fill-soil-tuff interface, and classification of lithology, may exist between the two field observations since geotechnical interpretation must follow the Unified Soil Classification System.

No free groundwater was encountered in our borings at this site to the depth explored. It is possible however, that perched water condition could occur due to seasonal changes, run-off, precipitation, construction activities, and so forth. Soil moisture contents, at the time of the investigation, were generally between about 6 and 20 percent.

Approximate representations of the subsurface stratigraphy have been prepared based on the data collected from borings drilled at the site. The stratigraphy is presented in cross section format as Figure 2, 3, and 4 titled "Cross Section A-A′", "Cross Section B-B′", and "Cross Section C-C′" and may be found in Appendix A. The locations of the cross sections are shown on the Site Plan, Figure 1. It should be noted that these cross sections are approximate and represent an idealized view of the subsurface conditions based on the eight borings drilled at the site. Variations in the subsurface condition may exist which should be considered by the designer and construction contractor.

3. CONCLUSIONS AND RECOMMENDATIONS

3.1 GENERAL

Based upon the results of this investigation, and from our engineering analysis, the bearing elevation of the proposed building, pipeline, and manhole base will be beneath the contact between soil-fill and volcanic tuff. To provide a uniform bearing surface, it is our opinion that these structural elements can be safely supported on a shallow foundation system consisting of a monolithic mat or raft, or a conventional spread type footing bearing directly on volcanic tuff. This would involve overexcavating into the volcanic tuff beneath the entire building area.

Detailed recommendations concerning the necessary site preparation and foundation design are presented in the following sections of this report.

3.2 FOUNDATIONS

3.2.1 FOUNDATION SYSTEM

Based on our understanding of the project requirements and on the subsurface conditions encountered in the borings drilled for the building, we recommend that structural loads of the building be supported on a shallow foundation bearing on properly prepared volcanic tuff. We recommend that the proposed building be supported on either a mat or raft foundation, or on a system of continues and isolated spread footings. Suitable ultimate bearing capacity for the volcanic tuff is 18,000 pounds per square foot. Applying a factor of safety (FS) of 3, an allowable bearing pressure of 6000 pounds per square foot is recommended for design of isolated and spread footings. For design of a mat or raft type foundation system, we recommend a reduced allowable bearing pressure of 2500 pounds per square foot. The allowable bearing pressures presented herein are for dead plus live loads. These allowable bearing pressures may be increased by one-third for transient loads such as wind or seismic. We further recommend that perimeter or exterior foundation support bear at a minimum depth of 30 inches below finished grade. Any interior footing support should bear at a depth of 12 inches below finished floor slab. Isolated spread footings or continuous wall footings should be designed with a minimum width of 24 inches and 18 inches, respectively.

3.2.2 SURFACE PREPARATION

After excavation is completed, loose deleterious material and humps should be removed from throughout the entire building area. When prepared for foundation support systems, final subgrade of the exposed tuff should be within a tolerance of 0.05 feet vertical change of grade over 10 feet horizontal.

3.2.3 ESTIMATED SETTLEMENTS

As a necessary component of preparing foundation recommendations, an evaluation of settlement was completed. However, a comprehensive settlement analysis was not performed and was not deemed warranted in light of the known subsurface conditions and planned construction. All structures proposed at the subject site will be supported in the underlying bedrock tuff. The ultimate bearing capacity of this material, as demonstrated by the compressive strength tests, is an order of magnitude greater than the anticipated loading. Therefore, the recommended allowable bearing capacity is considered conservative and affords a factor of safety of 3 against the loads anticipated.

The standard for tolerable settlement in normal structures is usually taken to be about one 1 inch of total settlement and ¾ inch of differential settlement. For this project, actual settlements of properly constructed foundations are expected to be negligible. This is attributed to the fact that the weight of the permanently removed overburden will equal, or likely exceed, the weight of the replacing structure and the high bearing capacity of the volcanic tuff.

3.2.4 LATERAL LOAD RESISTANCE

Horizontal loads acting on foundations and below grade walls cast in open excavations and properly backfilled with compacted fill will be resisted by friction acting along the base of foundations and by passive earth pressures against the side of foundations. The frictional resistance acting along the base of footings designed and constructed in accordance with the recommendations presented in this report may be computed using a coefficient of friction equal to 0.50 with the normal dead load. Additional lateral load resistance may be provided by passive resistance developed by footings and slabs acting against undisturbed volcanic tuff bedrock or properly prepared backfill. We recommend that an equivalent fluid pressure of 420 and 360 pounds per cubic foot be used in design for undisturbed volcanic tuff bedrock and backfill, respectively. The lateral load resistance values given herein are ultimate values and appropriate factors of safety should be applied by the structural engineer in the lateral equilibrium stability calculations.

3.3 BELOW GRADE WALLS

Below grade walls may be supported on conventional spread footings or cast integrally with a mat or raft slab foundation bearing directly on properly prepared volcanic tuff bedrock as discussed previously. Unrestrained below grade walls backfilled with compacted granular soils and free to rotate more then 0.1 percent of the wall height at the top of the backfill should be designed for active lateral earth pressures equivalent to those exerted by a fluid weighing 40 pounds per cubic foot. Below grade walls backfill restrained at the top to limit movement to less than 0.1 percent of height of the walls including the proposed manhole structure will be subject to "at-rest" earth pressures equivalent to those exerted by a fluid weighing 60 pounds per cubic foot. These lateral earth pressures apply to level backslope and no surcharge loads. Where finished grade behind the wall slopes upward, we recommend that the equivalent fluid pressures given be increased by one pound per cubic foot for every two degrees of slope inclination.

In addition to lateral earth pressures, below grade walls must be designed to resist horizontal pressures that may be generated by surcharge loads applied at the ground surface. Where structures or other loading is placed inside of an imaginary 1½:1 (horizontal: to vertical) plane projected upward from the base of the below grade wall, an additional horizontal thrust equal to one half of the applied load should be considered in wall design.

The lateral earth pressure recommendations given are based on unsaturated backfill and do not consider hydrostatic loading. Special care should be taken to prevent the infiltration of surface water behind the below grade walls. We recommend that the ground surface around the entire facility be hardscaped with either concrete or asphalt paving and that this hardscape surface be sloped to drain away from the facility. Specific recommendations for site drainage and moisture protection are given in later sections of the report.

Wall backfill should be placed and compacted in accordance with the requirements presented in Appendix E.

3.4 CONCRETE SLABS-ON-GRADE

All concrete slabs should be designed to minimize cracking as a result of shrinkage. Reinforcement should be installed as required by the structural design.

Special precautions must be taken during the placement and curing of all concrete slabs. Excessive slump (high water-cement ratio) of the concrete and/or improper curing procedures used during either hot, cold or excessively windy weather conditions could lead to excessive shrinkage, cracking, or curling in the slabs. We recommend that all concrete placement and curing operations be performed in accordance with the standards of the American Concrete Institute (ACI) Manual.

3.5 SITE DRAINAGE & MOISTURE PROTECTION

Positive drainage should be established away from all foundations and concrete slabs-on-grade for a distance of at least 5 feet away from their perimeters. Positive drainage is defined herein as a minimum slope of 4 percent. All utility trenches should be backfilled with compacted structural fill. Special care should be taken during installation of sub-floor lines to reduce the possibility of leaks. All pavement surfaces should be graded to drain all surface water away from the structure.

Recommendations presented previously assume that the below grade walls will not be subjected to hydrostatic pressures. Specifically, we recommend that suitable hardscape be provided to prevent water infiltration. As an alternative, the below grade walls could be constructed with a subdrain to prevent the buildup of hydrostatic pressure. If selected, the subdrain system should be constructed with a free-draining soil layer or manufactured geosynthetic material constructed adjacent to the back of any below grade walls. The free-draining material should be nonplastic and contain a maximum of 10 percent fines (minus No. 200 sieve). A filter may be required between the soil backfill and drainage layer. The vertical drainage zone should be tied into a gravity drainage system at the base of the wall directing intercepted flow to a storm drain or other suitable off-site discharge.

3.6 TEMPORARY EXCAVATION SUPPORT AND SLOPES

For this site, the overburden fill material and native soils consisting of clays can be considered as Type B soils, and all other overburden soils can be considered as Type C when applying the OSHA regulations for excavations. OSHA recommends a maximum slope inclination of 1:1 (horizontal:vertical) for Type B soils, and 1.5:1 for Type C soils. Where an excavation extends through Type B soil into Type C soil conditions, the entire excavation should be sloped no less than 1.5:1. However, slopes may be flattened depending on conditions exposed during construction. If there is not adequate space for sloped excavations, shoring should be used. If any excavation, including a utility trench, is extended to a depth of more than 20 feet, it will be necessary to have the side slopes designed by a professional engineer.

3.6.1 MANHOLE STRUCTURE

Excavation for construction of the manhole will include approximately 2.0 feet of soil and 12.5 feet of volcanic tuff based on the data collected for boring B-8. High-angle rock fractures (>70 degrees from horizontal) and low intact strength of the tuff can result in wall instability in steep-sided excavations. Therefore, unless the manhole is constructed in an open-cut excavation, some type of shoring should be used to support the excavation walls during construction. The shoring can be of any type that protects workers against hazards from falling earth of rock and from lateral earth or rock movements. Consideration should also be given to any surrounding facilities which may be affected should ground movement occur. These include nearby underground utilities and foundations within the zone of influence.

The temporary shoring for the manhole structure should be capable of resisting a uniform lateral earth pressure of 18H pounds per square foot where "H" is defined as the total height of the excavation being supported.

3.6.2 TANK BASIN

The tank basin, including the tank vault and the pump house, will be constructed in an excavation up to 20 feet in depth. Based on the borings, the upper portion of the excavation will be in soil overburden; the reminder in volcanic tuff. Based on observations of rock cores from the eight exploratory borings, the tuff is fractured along primarily high-angle (>70 degree from horizontal) surfaces.

If the tank basin is constructed entirely in an open cut with sides sloped per OSHA regulations or flatter, no temporary support will be needed. However, due to space limitations, some or all of the excavation may include vertical walls or slopes steeper than OSHA regulations. If vertical excavation surfaces in soil or tuff are needed, they should be shored to support maximum external lateral loading.

Permanent below grade walls can be constructed using formwork completely separate from the rock excavation wall or by using the rock excavation surface as the backside form of the permanent below grade wall. If the rock excavation surface is used as the backside form for the wall, external wall loading may be reduced or eliminated by reinforcing the rock walls with rock bolts or dowels, wire mesh, and shotcrete as needed to make the rock walls self supporting. The scope of investigations performed for this report was not sufficient to provide data needed to support the design of self-supporting rock walls; therefore, additional data collection and analyses would be needed if this design approach is to be considered. In lieu of additional data, it is recommended that temporary excavation support for the tank basin be designed for a uniform lateral earth pressure of 22H pounds per square foot where "H" is defined as the total height of the excavation being supported. The recommended pressure given herein is higher than that given for the manhole to account for the soil overburden. The lateral earth pressure loading indicated should be increased as required to satisfy LANL construction safety standards for the type of sharing selected by the contractor.

Due to the limited information pertaining to the pattern, spacing, and angle of the joints and fractures within the volcanic tuff, definitive analysis regarding the stability of the volcanic tuff is not available. We recommend that the contractor retain a geotechnical engineer to observe the soils and rock exposed in all excavations and provide engineering design for the slopes. This will provide an opportunity to classify the soil types encountered, analyze the stability of the volcanic tuff, and to modify the excavation slopes as needed during construction. As a safety measure, it is recommended that all vehicles and soil piles be kept a minimum lateral distance back from the crest of the slope at least equal to the slope height. The exposed slope face should be protected against the elements.

3.7 SITE SEISMICITY

The project site is located within seismic zone 2B (Figure 16-2 of the Uniform Building Code). In keeping with the site categorization procedures outlined in the 1997 edition of the UBC, the project site has an Sc soil profile type. The design of this building will be performed according to the LANL Engineering Standard, PC-2. In accordance with the LANL Engineering Manual, Chapter 5-Structural, Table 202.1B, the seismic parameters I, I_p, C_v and C_a are 1.25, 1.50, 0.40, and 0.28, respectively.

3.8 RESISTIVITY

Two perpendicular resistivity lines were performed at the building site and are shown at the approximate location shown on Figure 1 in Appendix B. The results of the resistivity line are presented in Appendix F. Based on the results of the resistivity measurements, the soil and rock underlying the site exhibited resistivities of 56 to 299 ohm-meter (5600 to 299,000 ohm-cm) which falls within the expected range of soil resistivity at LANL, per Section 245 on the LANL Facility Engineering Manual. This information may be used to determine grounding conditions and/or soil curative properties when combined with additional information.

3.9 CONSTRUCTION CONSIDERATIONS

Based upon the information collected from the eight exploratory boring drilled for the project, the soils to be encountered during earthwork operations are only slightly cemented and the volcanic tuff is considered to be soft and can be excavated with normal earthmoving equipment. There will be material loss due to clearing removal of existing structures, and grubbing operations. Also, there will be shrinkage losses when excavating and compacting the on-site soils and crushed tuff.

4. CLOSURE

4.1 LIMITATIONS

The recommendations contained in this report are based upon the Conceptual Design Report document prepared by ADES Corporation, the field explorations, laboratory tests, and our understanding of the proposed construction. The subsurface data used in the preparation of this report was obtained from the (8) borings advanced during the field investigation. It is anticipated that variations in the subsurface soil and rock conditions will exist between the boring locations. The nature and extent of variations may not be evident until construction occurs. This report was prepared in accordance with generally accepted standards of practice at the time the report was written. No warranty, express or implied, is made. It is the clients responsibility to see that all parties to the project, including Designer, Contractor, Subcontractors, etc., are made aware of this report in its entirety. The use of information contained in this report for giddying and construction purposes should be done at the contractors option and risk.

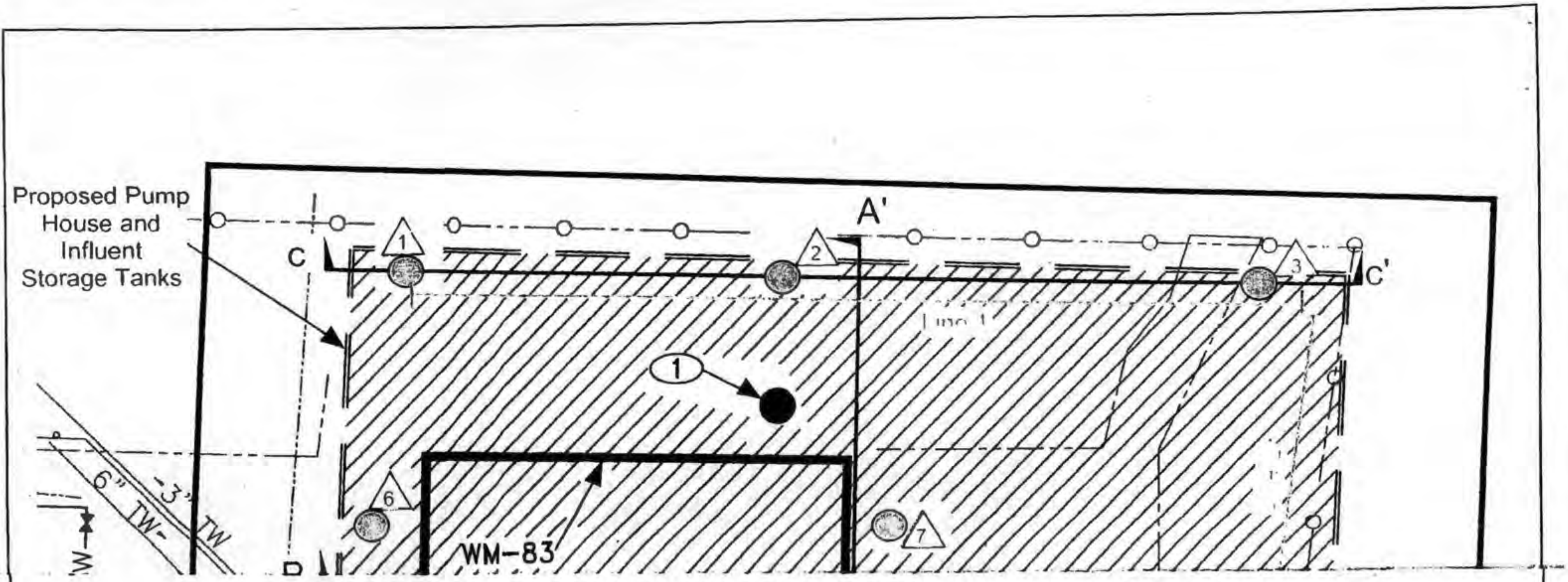
Other standards or documents referenced in any given standard cited in this report, or otherwise relied upon by the authors of this report, are only mentioned in the given standard; they are not incorporated into it or "included by reference" as that latter term is used relative to contracts or other matters of law.

This report may be used only by the Client and only for the purposes stated, within a reasonable time from its issuance. Land use, site conditions (both on- and off-site) or other factors may change over time, and additional work may be required with the passage of time. Any party other than the client who wishes to use this report shall notify Kleinfelder of such intended use. Based on the intended use of the report, Kleinfelder may require that additional work be performed and that an updated report be issued. Non-compliance with any of these requirements by the client or anyone else will release Kleinfelder from any liability resulting from the use of this report by any unauthorized party.

APPENDIX A
Area of Investigation

The field investigation consisted of a surface reconnaissance, surface resistivity testing, and subsurface exploration including drilling exploratory borings. Eight (8) exploratory borings were drilled and logged to depths ranging from about 23 and 26.5 feet below existing grade. Boring B-2 was extended to an overall depth of about 90 feet for environmental purposes. The logs of the test borings are presented in Appendix B. A site plan showing the boring locations is presented as Figure 1. The locations of the borings presented on Figure 1 were provided to us by LANL. Exploration boring coordinates and elevations were provided by the WGII/PMC/SEA Team at LANL.

Exploratory Boring	Northing (ft)	Easting (ft)	Elevation (ft)
B-1	1768973.53	1626334.02	7172.13
B-2	1768920.40	1626331.79	7171.28
B-3	1768856.13	1626329.29	7168.78
B-4	1768873.98	1626279.36	7174.61
B-5	1768924.28	1626270.39	7175.50
B-6	1768978.79	1626297.40	7175.50
B-7	1768905.68	1626297.12	7175.54
B-8	1768896.66	1626147.02	7177.05



Base Drawing: Electronic Site Plan Provided by Los Alamos National Laboratory.

Explanation:

○ △4	Approximate Location of Exploratory Boring and Identification Number
Line 1	Approximate Location of Resistivity Line
B B'	Approximate Location of Cross Section

0 10 ft 20 ft

Scale 1"=20'

N

SITE PLAN

Pump House and Influent Storage Tank Vault
TA-50
Los Alamos, New Mexico

KLEINFELDER
4905 Hawkins NE
Albuquerque, New Mexico 87109
(505) 344-7373 Ph (505) 344-1711 Fax

Drawn by:	SPW	1/02	Client: Los Alamos
Drafted by:	ABL	1/02	
Approved by:	PF	1/02	Figure 1

lanation:

LITHOLOGY

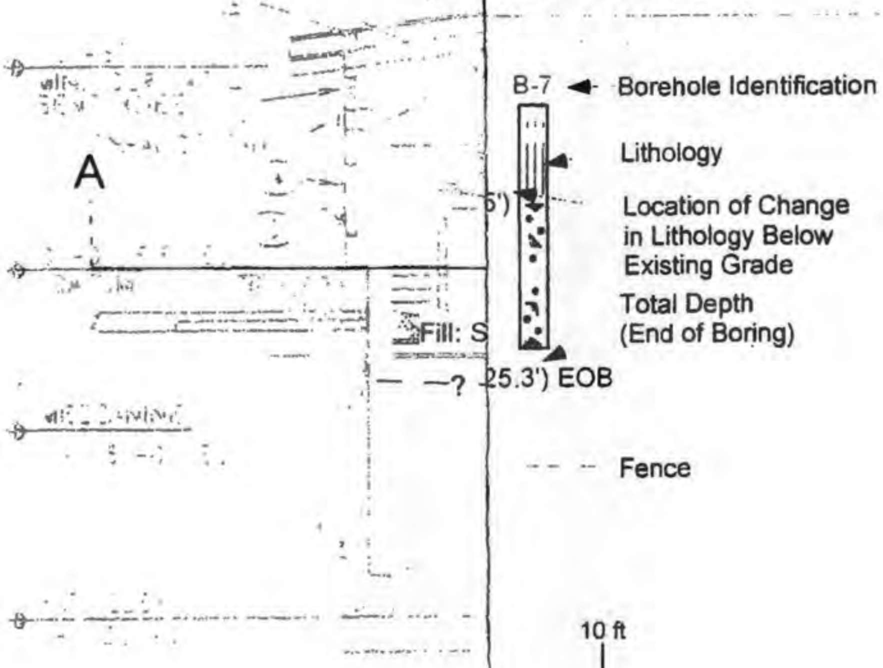
▨ AC= Asphalt/Concrete

Silty Sand

Clayey Sand

Sandy, Lean Clay

Volcanic Tuff



10 ft

Scale
1"=10' Horizontal
1"=10' Vertical

0
10 ft

Note:

1. Boring locations and elevations were deter
2. Stratifications shown are necessary interpo subsurface conditions.
3. Base plans for subsurface profiles taken fr
4. Existing utilities are not shown on subsurfa
5. For boring locations and other notes, see S
6. For logs of project borings, see Appendix B

CROSS SECTION A-A'

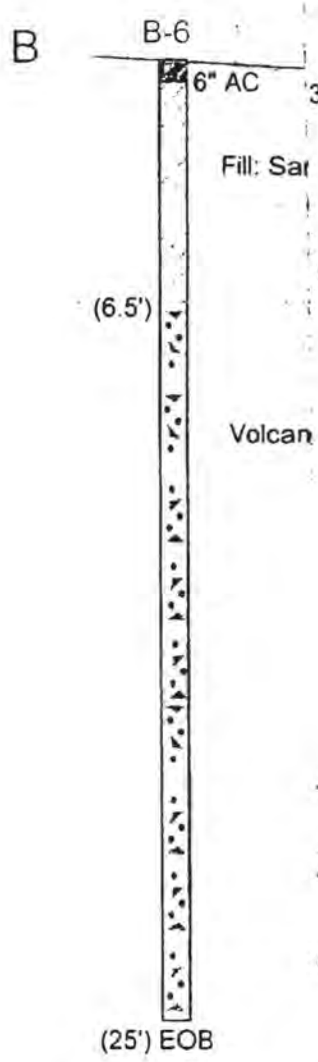
ump House and Influent Storage Tank Vault
TA-50
Los Alamos, New Mexico

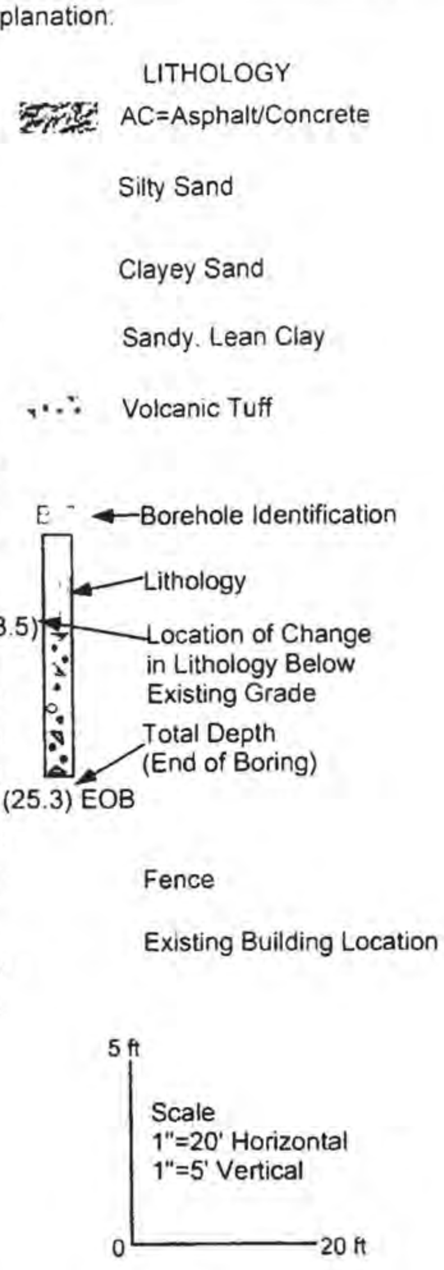
KLEINFELDER
4905 Hawkins NE
Albuquerque, New Mexico 87109
(505) 344-7373 Ph (505) 344-1711 Fax

wn by: SPW 1/02
ked by: ABL 1/02
roved by: PF 1/02

Client: Los Alamos

Figure 2





CROSS SECTION B-B'

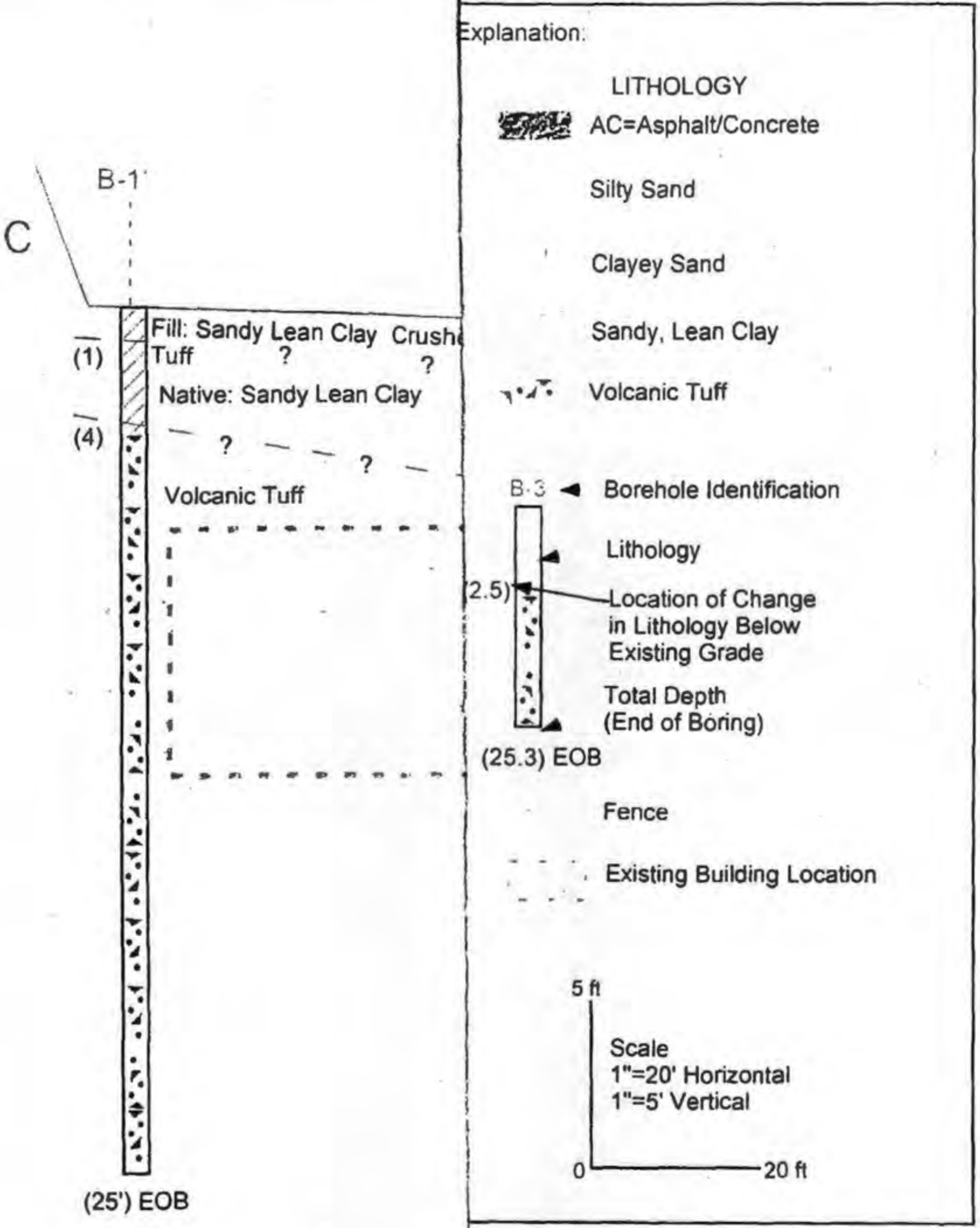
Pump House and Influent Storage Tank Vault
TA-50
Los Alamos, New Mexico

KLEINFELDER
4905 Hawkins NE
Albuquerque, New Mexico 87109
(505) 344-7373 Ph (505) 344 1711 Fax

awn by: SPW 1/02
afted by: ABL 1/02
proved by: PF 1/02

Client: Los Alamos

Figure 3



CROSS SECTION C-C'

Pump House and Influent Storage Tank Vault
TA-50
Los Alamos, New Mexico

KLEINFELDER
4905 Hawkins NE
Albuquerque, New Mexico 87109
(505) 344-7373 Ph (505) 344-1711 Fax

awn by:	SPW	1/02	Client: Los Alamos
afted by:	ABL	1/02	
proved by:	PF	1/02	Figure 4

APPENDIX B
Test Boring Logs and Laboratory Test Results

1 TEST BORINGS

Exploratory drilling was accomplished using a truck-mounted CME-75 drilling rig equipped with 3-¼-inch I.D. hollow-stem auger. Selected soil and rock samples were obtained by a standard penetration test sampler, and a 3.0-inch O.D., 2.42-inch I.D. ring lined sampler. The samplers were driven with a 140-pound CME automatic hammer free-falling through a distance of 30 inches. The sampler driving resistance was recorded as the number of blows per foot of penetration, and are presented on the boring logs. In addition, a 3.5-inch I.D. continuous sampler was utilized. Selected soil and rock samples from the borings were classified in the field by the field engineer and each sample was packaged and transported to our laboratory.

2 LABORATORY TESTING

Moisture content and dry density determinations were made on selected samples recovered. The results of which are presented on the boring logs. Atterberg limits tests and sieve analysis were performed on selected samples. In addition, direct shear and unconfined compressive tests were performed on a selected relatively undisturbed sample.

Field exploration and laboratory testing was performed in general accordance with ASTM standards. The test procedures and methods utilized for this investigation are listed below.

Penetration Test and Split-Barrel Sampling of Soils	D 1586
Ring-Lined Barrel Sampling of Soils	D 3550
Classification of Soils for Engineering Purposes	D 2487
Description and Identification of Soils	D 2488
Preserving and Transporting Soil Samples	D 4220
Field Measurements of Soil Resistivity Using the Wenner Four-Electrod Method	G 57
Sieve Analysis of Fine and Coarse Aggregates	C 136
Laboratory Determination of Water Content of Soil and Rock	D 2216
Liquid Limit, Plastic Limit, and Plasticity Index of Soils	D 4318
Direct Shear Test	D 3080
Unconfined Compressive Strength of Intake Rock	D 2938

THE UNIFIED SOIL CLASSIFICATION SYSTEM

	MAJOR DIVISIONS			Group Symbols		TYPICAL NAMES
COARSE GRAINED SOIL. More than 50% of the material is LARGER than the No. 200 Sieve	**GRAVELS** More than 50% of coarse part is LARGER than the No. 4 Sieve.	**CLEAN GRAVELS** Less than 5% finer than No. 200 Sieve		GW	○	Well graded gravels, gravel - sand mixtures, little or no fines. Cu>4 & 1<Cc>3
				GP	●	Poorly graded gravels or gravel - sand mixtures, little or no fines Cu<4 of 1>Cc<3
		GRAVELS with fines More than 12% finer than No. 200 Sieve	PI < 4	GM	●	Silty gravels, gravel - sand - silt mixtures
			PI >7	GC	▨	Clayey gravels, gravel - sand - clay mixtures
	SANDS More than 50% of coarse part is SMALLER than the No. 4 Sieve.	**CLEAN SANDS** Less than 5% finer than No. 200 Sieve		SW	⁘	Well graded sands, gravelly sands, little or no fines, Cu>6 &1<Cc>3
				SP	⁘	Poorly graded sands or gravelly sands, little or no fines, Cu<6 or 1>Cc<3
		SAND with fines More than 12% finer than No. 200 Sieve	PI <5	SM	⁞	Silty sand, sand - silt mixtures
			PI <7	SC	▨	Clayey sands, sand - clay mixtures
FINE GRAINED SOIL. 50% or more of the material is SMALLER than the No. 200 Sieve	**SILTS & CLAYS** Liquid Limit LESS than 50	PI - Below A - Line		ML	‖	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silt with low plasticity
		PI - Above A - Line		CL	▨	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
				OL	☰	Organic silts and organic clays of low plasticity
	SILTS & CLAYS Liquid Limit GREATER than 50	PI - Below A - Line		MH	‖	Inorganic silts, Micaceous or diatomaceous fine sand or silty soils, elastic silts
		PI - Above A - Line		CH	▨	Inorganic clays of high plasticity, fat clays
				OH	▨	Organic clays of medium to high plasticity, organic silts
		HIGHLY ORGANIC SOILS		Pt	≋	Peat and other highly organic soils

BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

PARTICLE SIZE LIMITS

CLAY	SILT	SAND			GRAVEL		COBBLES	BOULDERS
		Fine	Medium	Coarse	Fine	Coarse		

0.002 mm #200 #40 #10 #4 19mm 76mm 305mm

U.S. Standard Sieve Size

Terminology Used to Describe Soils Relative to their Standard Penetration Resistance (N) in blows per foot (ASTM D1586)

Relative Firmness		Relative Consistency		Relative Density	
SILTS, CLAYS & COHESIVE GRANULAR SOILS (partially saturated)	N	SILTS & CLAYS (saturated or near saturated)	N	SANDS & GRAVELS (uncemented/cohesionless)	N
Hard	50+	Hard	30+	Very Dense	50+
Very Firm	31-50	Very Stiff	16-30	Dense	31-50
Firm	16-30	Stiff	9-15	Medium Dense	11-30
Moderately Firm	9-15	Medium Stiff	5-8	Loose	5-10
Soft	5-8	Soft	3-4	Very Loose	0-4
Very Soft	0-4	Very soft	0-2		

KLEINFELDER

Boring Log

Sheet 1 of 1

Date			
Started: 12/15/2001	Project Number 59-010145	Project TA-50 Pump House	Boring Number B-1
Completed: 12/15/2001			
Backfilled: 12/15/2001	Rig Type: CME 75	Surface Elevation: 7172.13	Logged By: Stephen Woodall

Location: See Site Plan (N1768973.53, E1626334.02)

Sample Type
- A - Auger Cuttings
- CS - 3.5" I.D. Continues sampler
- S - SPT 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- ST - 3" O.D. thin-walled Shelby tube
- NR - No Recovery

Groundwater

Depth (ft)	Hour	Date
	None	

Groundwater Depth	Depth in Feet	Graphical Log	Sample Taken	Sample Type	Penetration Resistance (Blows per Foot)	Moisture content	Dry Density (pcf)	Liquid Limit	Plasticity Index	Percent Passing No. 200 Sieve	Visual Classification
	0	▨		U	24	9.3	86				**FILL: SANDY LEAN CLAY (CL)** - firm, moist, brown
		▨									**SANDY LEAN CLAY (CL)** - firm, damp, brown
		△									**VOLCANIC TUFF** - soft, damp, brown (very weathered, very fractured, poorly welded)
	5	△		U	56/6"						
	10	△		S	50/6"						purple, slightly to moderately weathered, slightly to moderately fractured
		△		CS		8.3	99				
	15	△		S	96/11.5"						
	20	△		S	50/5"						
		△		CS							
	25										**Boring completed @ 25'**

KLEINFELDER

Boring Log

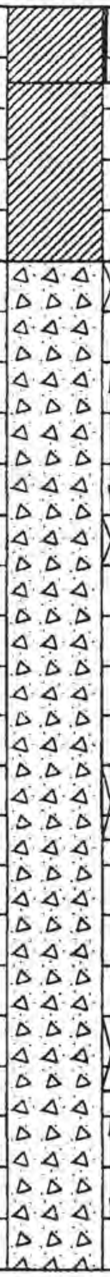
Sheet 1 of 1

Date		Project Number	Project	Boring Number
	Started: 12/15/2001	59-010145	TA-50 Pump House	B-2
	Completed: 12/15/2001			
	Backfilled: 12/15/2001	Rig Type: CME 75	Surface Elevation: 7171.28	Logged By: Stephen Woodall

Location: See Site Plan (N1768920.40, E1626331.79)

Sample Type - A - Auger Cuttings
CS - 3.5" I.D. Continues sampler
S - SPT 2" O.D. 1.38" I.D. tube sample
U - 3 " O.D. 2.42" I.D. tube sample
ST - 3" O.D. thin-walled Shelby tube
NR - No Recovery

Groundwater		
Depth (ft)	Hour	Date
	None	



Groundwater Depth	Depth in Feet	Sample Taken	Sample Type	Penetration Resistance (Blows per Foot)	Moisture content	Dry Density (pcf)	Liquid Limit	Plasticity Index	Percent Passing No. 200 Sieve	Visual Classification
	0		U	38	7.8	100				**FILL: SANDY LEAN CLAY (CL) -** very firm, damp, tan (low plasticity)
										SANDY LEAN CLAY (CL) - very firm, damp, tan
	5		S	50/5"						**VOLCANIC TUFF -** soft, damp brown to purple (very weathered, very fractured, poorly welded)
			CS							
										slightly to moderately weathered, slightly to moderately fractured
	10		S	50/5"						
	15		S	90						
	20		S	84						
			CS							
	25									**Boring logged to a depth of 25', Boring drilled to a depth of 90' for environmental purposes**

KLEINFELDER

Boring Log

Sheet 1 of 1

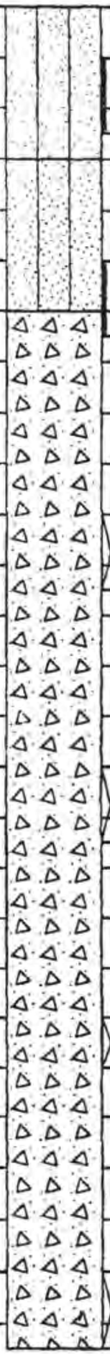
Date			
Started: 12/14/2001	Project Number 59-010145	Project TA-50 Pump House	Boring Number B-3
Completed: 12/14/2001			
Backfilled: 12/14/2001	Rig Type: CME 75	Surface Elevation: 7168.78	Logged By: Stephen Woodall

Location: See Site Plan (N1768856.13, E1626329.29)

Sample Type
- A - Auger Cuttings
- CS - 3.5" I.D. Continues sampler
- S - SPT 2" O.D. 1.38" I.D. tube sample
- U - 3 " O.D. 2.42" I.D. tube sample
- ST - 3" O.D. thin-walled Shelby tube
- NR - No Recovery

Groundwater

Depth (ft)	Hour	Date
	None	



Groundwater Depth	Depth in Feet	Sample Type	Penetration Resistance (Blows per Foot)	Moisture content	Dry Density (pcf)	Liquid Limit	Plasticity Index	Percent Passing No. 200 Sieve	Visual Classification
	0								
		U	22	6.2	100	NV	NP	20	**FILL: SILTY SAND (SM)** - medium dense, moist, brown (some clay, fine to coarse grain)
									with cobbles and gravels
									SILTY SAND (SM) - medium dense, damp, brown (fine to coarse grain)
	5	U	30						
									VOLCANIC TUFF - soft, damp, brown to purple (very weathered, very to moderately feactured, poorly welded)
	10	S	50/6"						
									purple (moderately fractured, moderately weathered)
	15	S	67						purple to brown, gray nodules (quartz)
	20	S	50/5"						
									clay-filled joints 1/16"-1/4"
	25	S	31						
									Boring completed @ 26.5'

KLEINFELDER

Boring Log

Sheet 1 of 1

Date			
Started: 12/13/2001	Project Number 59-010145	Project TA-50 Pump House	Boring Number B-4
Completed: 12/13/2001		Surface Elevation: 7174.61	Logged By: Stephen Woodall
Backfilled: 12/13/2001	Rig Type: CME 75	Location: See Site Plan (N1768873.98, E1626279.36)	

Sample Type
- A - Auger Cuttings
- CS - 3.5" I.D. Continues sampler
- S - SPT 2" O.D. 1.38" I.D. tube sample
- U - 3 " O.D. 2.42" I.D. tube sample
- ST - 3" O.D. thin-walled Shelby tube
- NR - No Recovery

Groundwater

Depth (ft)	Hour	Date
	None	

Groundwater Depth	Depth in Feet	Graphical Log	Sample Taken	Sample Type	Penetration Resistance (Blows per Foot)	Moisture content	Dry Density (pcf)	Liquid Limit	Plasticity Index	Percent Passing No. 200 Sieve	Visual Classification
	0										6" ASPHALT PAVEMENT
				U	20	19.6	105				FILL: SILTY SAND (SM) - medium dense, moist, brown to purple (fine to coarse grain, trace gravels, crushed weathered tuff)
	5			U	29	16.7	107				
	10			S	50/5"						VOLCANIC TUFF - soft, damp, purple brown (moderately weathered, very fractured, poorly welded)
	15			S	93/10.5"						
	20			S	50/4.5"						brown
				A							

Boring completed @ 23'

KLEINFELDER

Boring Log

Sheet 1 of 1

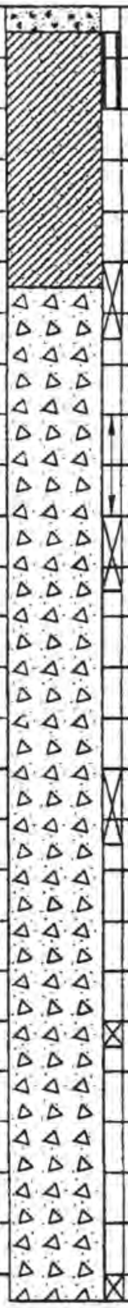
Date			
Started: 12/16/2001	Project Number 59-010145	Project TA-50 Pump House	Boring Number B-5
Completed: 12/16/2001			
Backfilled: 12/16/2001	Rig Type: CME 75	Surface Elevation: 7175.50	Logged By: Stephen Woodall

Location: See Site Plan (N1768924.28, E1626270.39)

Sample Type
- A - Auger Cuttings
- CS - 3.5" I.D. Continues sampler
- S - SPT 2" O.D. 1.38" I.D. tube sample
- U - 3 " O.D. 2.42" I.D. tube sample
- ST - 3" O.D. thin-walled Shelby tube
- NR - No Recovery

Groundwater

Depth (ft)	Hour	Date
	None	



Groundwater Depth	Depth in Feet	Graphical Log	Sample Taken	Sample Type	Penetration Resistance (Blows per Foot)	Moisture content	Dry Density (pcf)	Liquid Limit	Plasticity Index	Percent Passing No. 200 Sieve	Visual Classification
	0										6.5" ASPHALT PAVEMENT
				U	41	17.5	106				FILL: SANDY LEAN CLAY (CL) - very firm, moist, brown (trace gravels to 1/2")
	5			S	68						hard
											VOLCANIC TUFF - soft, damp, brown (completely weathered, poorly welded)
				CS		13.1	101				very weathered
	10			S	77						
											brown to purple (moderately weathered)
	15			S	84						slightly to moderately weathered, slightly to moderately fractured
	20			S	50/6"						
	25			S	50/5"						

Boring completed @ 25.5'

KLEINFELDER

Boring Log

Sheet 1 of 1

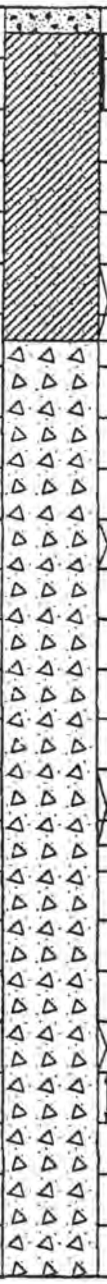
Date Started: 12/16/2001 Completed: 12/16/2001	**Project Number** 59-010145	**Project** TA-50 Pump House	**Boring Number** B-6
Backfilled: 12/16/2001	Rig Type: CME 75	Surface Elevation: 7175.50	Logged By: Stephen Woodall

Location: See Site Plan (N1768978.79, E1626297.12)

Sample Type
- A - Auger Cuttings
- CS - 3.5" I.D. Continues sampler
- S - SPT 2" O.D. 1.38" I.D. tube sample
- U - 3 " O.D. 2.42" I.D. tube sample
- ST - 3" O.D. thin-walled Shelby tube
- NR - No Recovery

Groundwater

Depth (ft)	Hour	Date
	None	



Groundwater Depth	Depth in Feet	Sample Taken	Sample Type	Penetration Resistance (Blows per Foot)	Moisture content	Dry Density (pcf)	Liquid Limit	Plasticity Index	Percent Passing No. 200 Sieve	Visual Classification
	0		U	16	6.8	105				6" ASPHALT PAVEMENT FILL: SANDY LEAN CLAY (CL) - firm, damp, brown
	5		S	53	12.6					hard
										VOLCANIC TUFF - soft, damp, brown (very weathered, poorly welded)
	10		S	50/6"						
										purple (moderately weathered)
	15		S	85						
	20		S	50/5"						
			CS		7.9	98				
	25									Boring completed @ 25'

KLEINFELDER

Boring Log

Sheet 1 of 1

Date Started: 12/14/2001 Completed: 12/14/2001	**Project Number** 59-010145	**Project** TA-50 Pump House	**Boring Number** B-7
Backfilled: 12/14/2001	Rig Type: CME 75	Surface Elevation: 7175.54	Logged By: Stephen Woodall

Location: See Site Plan (N1768905.68, E1626297.12)

Sample Type
- A - Auger Cuttings
- CS - 3.5" I.D. Continues sampler
- S - SPT 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- ST - 3" O.D. thin-walled Shelby tube
- NR - No Recovery

Groundwater

Depth (ft)	Hour	Date
	None	

Groundwater Depth	Depth in Feet	Sample Taken	Sample Type	Penetration Resistance (Blows per Foot)	Moisture content	Dry Density (pcf)	Liquid Limit	Plasticity Index	Percent Passing No. 200 Sieve	Visual Classification
	0									
			U	17	15.9					**6" ASPHALT PAVEMENT** **FILL: SILTY SAND (SM)** - medium dense, damp to moist, brown to purple (fine to coarse grain, crushed tuff, red brick debris)
										FILL: CLAYEY SAND (SC) - loose, moist, brown (fine to medium grained)
	5		U	8	15.7	106	21	8	48	
										VOLCANIC TUFF - soft, damp, brown to purple (moderately weathered, moderately fractured, poorly welded)
	10		U	50/6"						
			CS							
	15		S	63						
	20		S	77						
	25		S	50/4"						
										Boring completed @ 25.3'

KLEINFELDER Boring Log

Sheet 1 of 1

Date			
Started: 12/16/2001	Project Number 59-010145	Project TA-50 Pump House	Boring Number B-8
Completed: 12/16/2001			
Backfilled: 12/16/2001	Rig Type: CME 75	Surface Elevation: 7177.05	Logged By: Stephen Woodall

Location: See Site Plan (N1768896.66, E1626147.02)

Sample Type
- A - Auger Cuttings
- CS - 3.5" I.D. Continues sampler
- S - SPT 2" O.D. 1.38" I.D. tube sample
- U - 3" O.D. 2.42" I.D. tube sample
- ST - 3" O.D. thin-walled Shelby tube
- NR - No Recovery

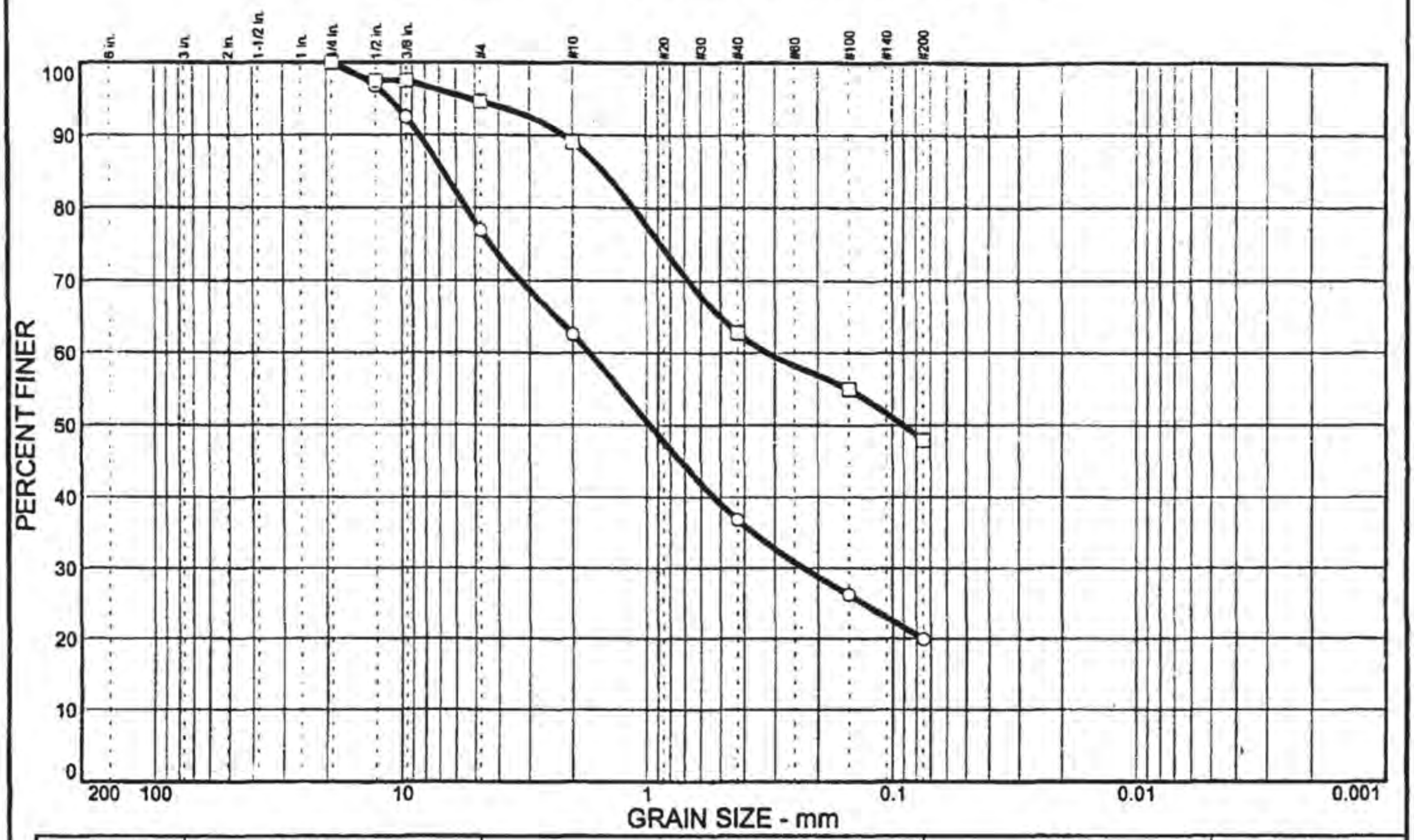
Groundwater

Depth (ft)	Hour	Date
	None	

Groundwater Depth	Depth in Feet	Sample Taken	Sample Type	Penetration Resistance (Blows per Foot)	Moisture content	Dry Density (pcf)	Liquid Limit	Plasticity Index	Percent Passing No. 200 Sieve	Visual Classification
	0	☒	S	25	12.7					**FILL: SILTY SAND (SM)** - medium dense, moist, brown (fine to medium grain, crushed tuff)
										VOLCANIC TUFF - soft, damp, brown (completely to very weathered, poorly welded)
		↕	CS		7.3	98				
	5	☒	S	50/6"						moderately weathered
	10	☒	S	50/5"						
	15	☒	S	50/6"						
	20	☒	S	50/5"						
	25	☒	S	50/3"						

Boring completed @ 25.25'

Particle Size Distribution Report



	% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
○	0.0	23.1	57.0	19.9	
□	0.0	5.4	46.7	47.9	

☒	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	6.77	1.72	0.967	0.229				
□	29	21	1.50	0.321	0.0902					

MATERIAL DESCRIPTION	USCS	AASHTO
○ Silty Sand with Gravel	SM	A-1-b
□ Clayey Sand	SC	A-4(1)

Project No. 59-010145 **Client:** Holmes & Narver/Raytheon

Project: Pump House And Influent Storage Tank Vault

○ **Location:** Boring B3 @ 1 to 2.5 Feet

□ **Location:** Boring B7 @ 4.5 to 6 Feet

Remarks:

○

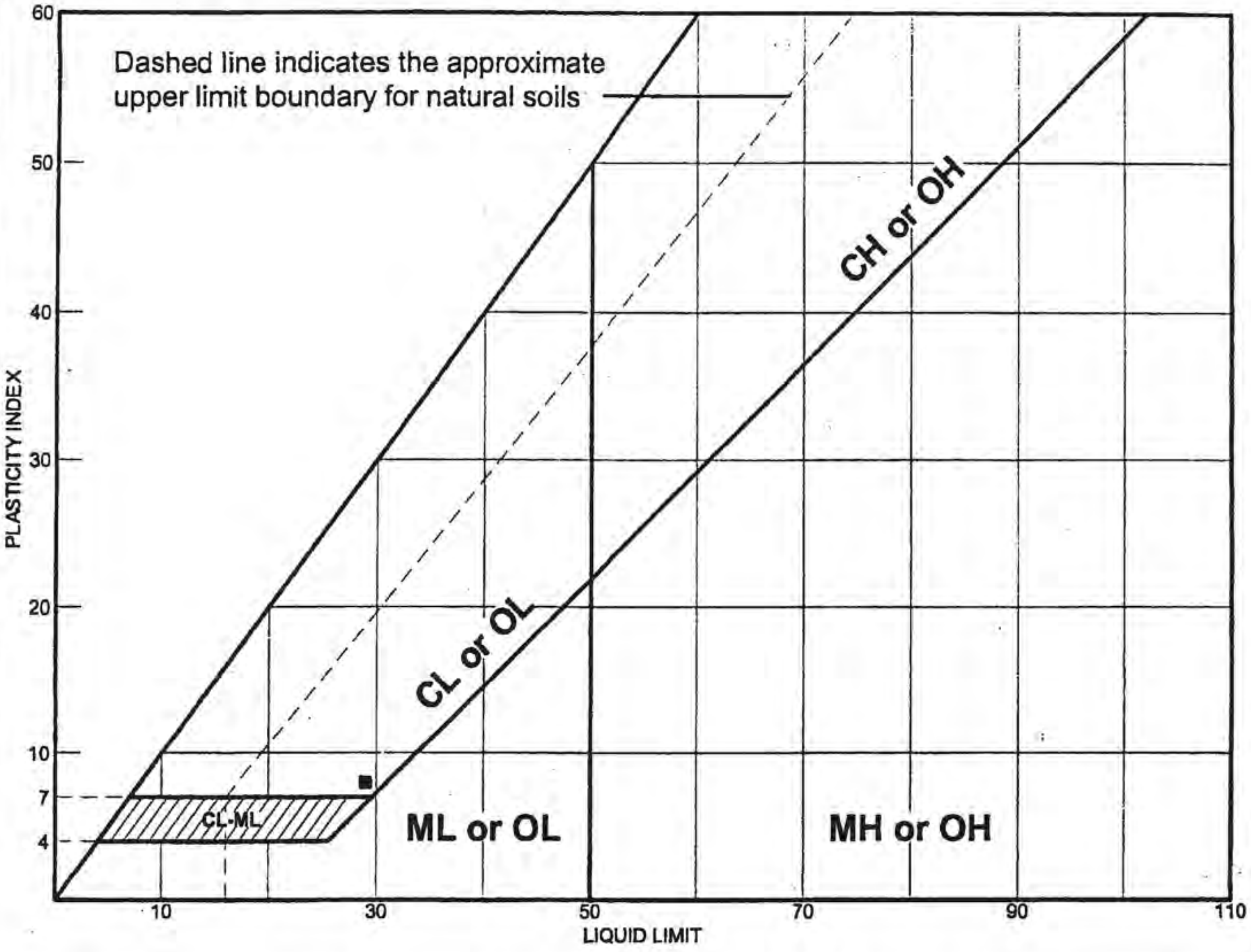
□

Particle Size Distribution Report

KLEINFELDER, INC.

Plate Number: 1

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Silty Sand with Gravel	NV	NP	NP	36.8	19.9	SM
■	Clayey Sand	29	21	8	62.8	47.9	SC

Project No. 59-010145 **Client:** Holmes & Narver/Raytheon

Project: Pump House And Influent Storage Tank Vault
Technical Area (TA)-50

● **Location:** Boring B3 @ 1 to 2.5 Feet

■ **Location:** Boring B7 @ 4.5 to 6 Feet

Remarks:
●
■

LIQUID AND PLASTIC LIMITS TEST REPORT

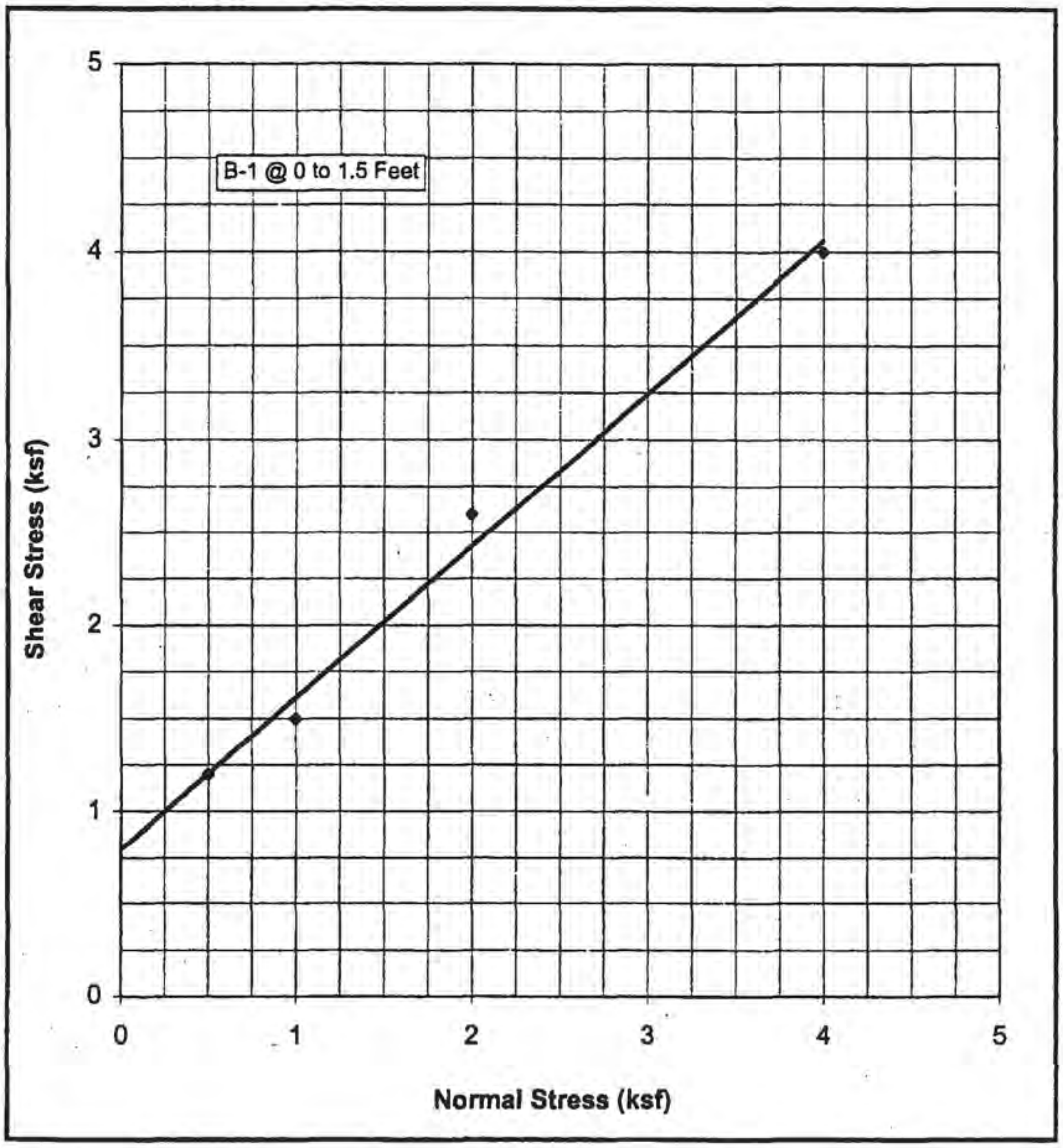
KLEINFELDER, INC.

Plate Number: 2

DIRECT SHEAR TEST RESULTS
ASTM: D 3080

Sample No: B-1 @ 0 to 1.5 Feet

normal stress ksf	shear stress ksf	dry density pcf	moisture content (%)
0.5	1.200	84.6	9.8
1	1.500	88.6	9.7
2	2.600	83.8	8.4
4	4.000	86.2	9.4

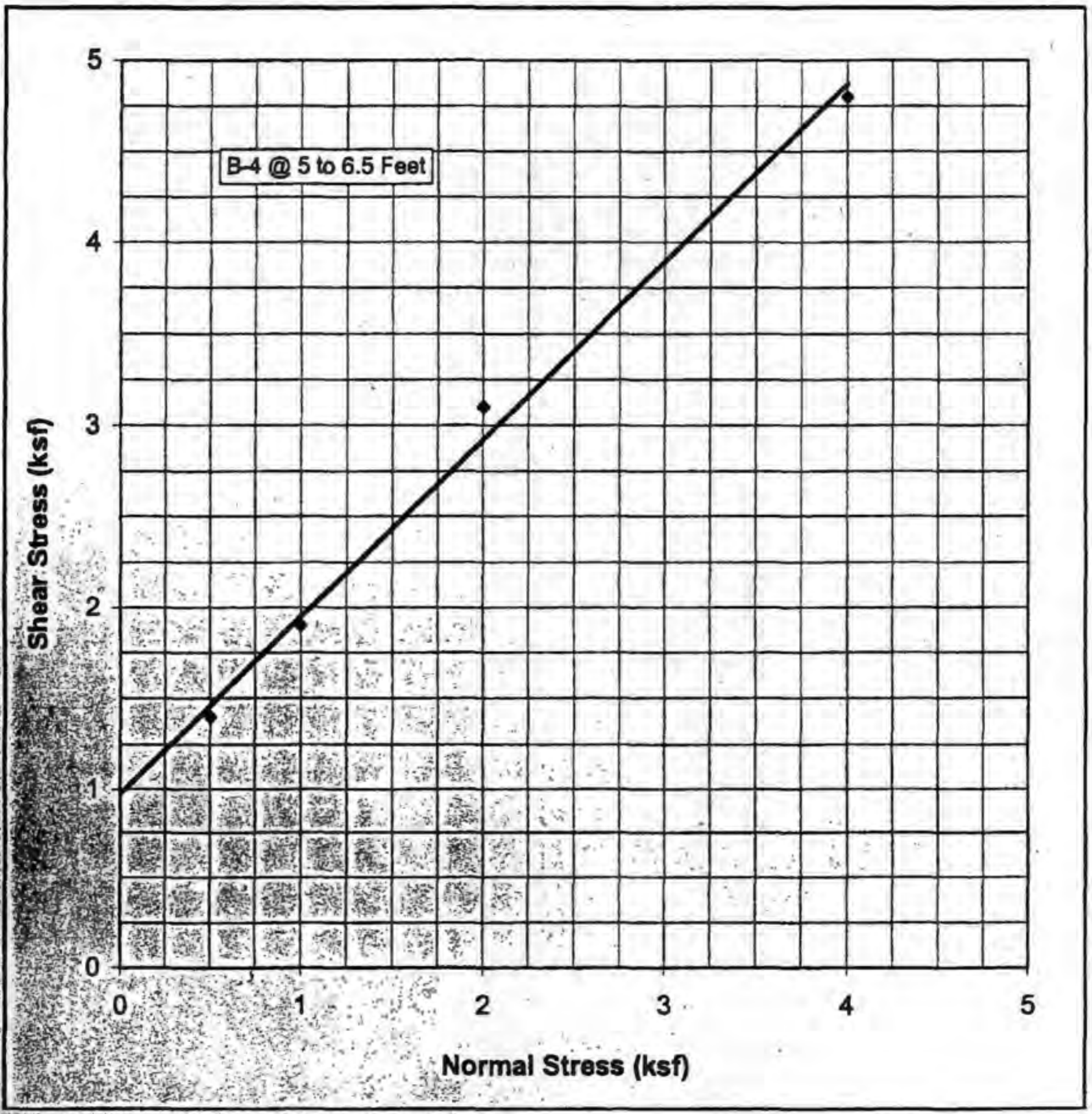


Mohr-Coulomb Failure Envelope
$\phi = 39^{\circ}$
c = 0.8 ksf

DIRECT SHEAR TEST RESULTS
ASTM: D 3080

Sample No: B-4 @ 5 to 6.5 Feet

normal stress ksf	shear stress ksf	dry density pcf	moisture content (%)
0.5	1.400	104.8	16.9
1	1.900	110.0	16.2
2	3.100	105.9	16.9
4	4.800	107.7	16.9

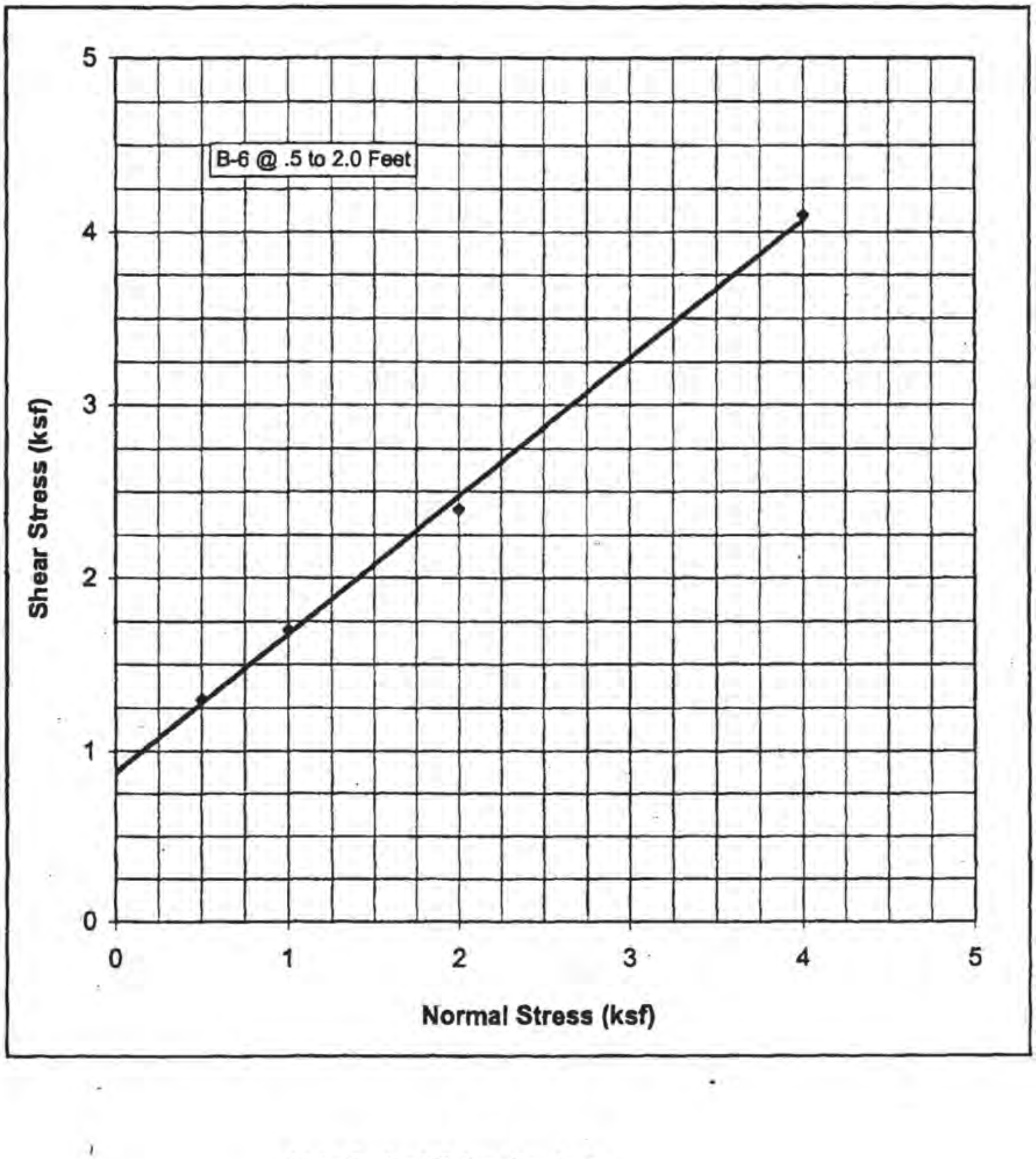


Mohr-Coulomb Failure Envelope
$\phi = 44°$
c = 1.0 ksf

DIRECT SHEAR TEST RESULTS
ASTM: D 3080

Sample No: B-6 @ .5 to 2.0 Feet

normal stress ksf	shear stress ksf	dry density pcf	moisture content (%)
0.5	1.300	106.6	15.9
1	1.700	107.0	16.9
2	2.400	101.8	17.3
4	4.100	106.3	17.1

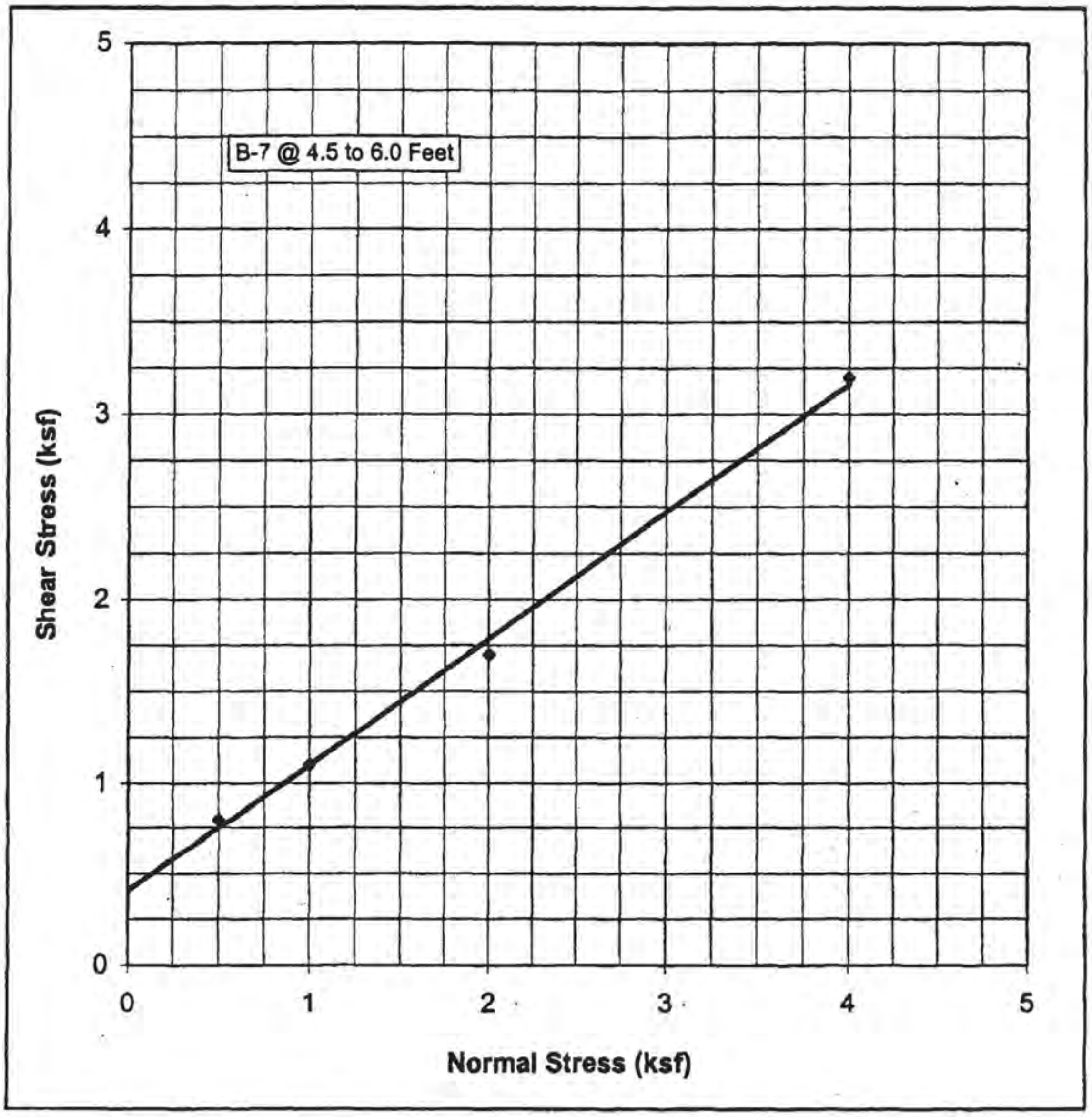


Mohr-Coulomb Failure Envelope
$\phi = 39°$
c = 0.9 ksf

DIRECT SHEAR TEST RESULTS
ASTM: D 3080

Sample No: B-7 @ 4.5 to 6.0 Feet

normal stress ksf	shear stress ksf	dry density pcf	moisture content (%)
0.5	0.800	105.5	15.4
1	1.100	107.4	16.1
2	1.700	108.2	15.9
4	3.200	102.8	15.4



Mohr-Coulomb Failure Envelope
$\phi = 35^\circ$
c = 0.4 ksf

TA-50 PUMP HOUSE AND INFLUENT STORAGE TANK VAULT
UNCONFINED COMPRESSIVE STRENGTH TEST
ASTM D 2938

Boring No.	Depth (ft)	Soil/Rock	Dry Density (PCF)	Moisture Content (%)	Compressive Strength (KSF)	Strain at Failure (%)
B-1	12	Volcanic Tuff	99.2	8.3	58.2	1.6
B-5	8	Volcanic Tuff	100.9	13.1	36.2	1.5
B-6	22	Volcanic Tuff	98.0	7.9	59.8	1.6
B-8	3	Volcanic Tuff	97.7	7.3	44.1	1.2

APPENDIX C
In-situ Test Results

NOT APPLICABLE

APPENDIX D
Calculations

Lateral Earth Pressures

Native Soils and Fills

Ø range {39,44,39,35}°	From (4) Lab Direct Shear Tests
C range {0.8,1.0,0.9,0.4}ksf	From (4) Lab Direct Shear Tests
γ_{wet} range 94.0 to 125.6 pcf	From Lab Data

Equations Ref: **Soil Mechanics in Engineering Practice**
By Karl Terzaghi and Ralph B. Peck, 1967, 2nd Edition (pages 188-189)

Active Earth Pressure (Pa)

Neglect C   C=0 pcf
Lowest Ø   Ø =35°
Highest γ_{wet} γ_{wet} 125.6 pcf
$Pa = \gamma_{wet} \tan^2 (45 - Ø/2)$
Pa= 33.9 pcf
$\boxed{\text{Pa= 34 pcf.}}$

Passive Earth Pressure (Pp)

Neglect C   C=0 pcf
Lowest Ø   Ø =35°
γ_{wet} (lowest) $\gamma_{wet} = 94.0$ pcf
$Pp = \gamma_{wet} \tan^2 (45 + Ø/2)$
Pp= 346.9 pcf
$\boxed{\text{Pp= 340 pcf.}}$

Earth Pressure at Rest (Po)

Lowest Ø   Ø =35°
Highest γ_{wet}=125.6 pcf
$Po = \gamma_{wet} (l\text{-}\sin Ø)$
Po= 53.6 pcf
$\boxed{\text{Po= 55 pcf.}}$

Calculated By:
Stephen Woodall Stephen Woodall

Review By:
John North

On-site Material:

Granular Compacted Backfill:

Backfill material is a mixture of on-site soil and crushed tuff trending to a silty sand

Ø = 30°	Assumed, no data available
C = 0 pcf	Assumed, no data available
γ_{wet} = 120 pcf	Assumed, no data available

Active Earth Pressure (Pa)

$Pa = \gamma_{wet} \tan^2 (45 - Ø/2)$

$\boxed{Pa = 40 \text{ pcf.}}$

Passive Earth Pressure (Pp)

$Pp = \gamma_{wet} \tan^2 (45 + Ø/2)$

$\boxed{Pp = 360 \text{ pcf.}}$

Earth Pressures t Rest (Po)

$Po = \gamma_{wet} (1 - \sin Ø)$

$\boxed{Po = 60 \text{ pcf.}}$

Volcanic Tuff:

Slight to Moderately Fractured
Slight to Highly Weathered
Thickly Bedded
Fracture angles 70° and greater (approximate), based on observations made during field exploration on limited sampling and recovery
Unconfined Compressive Strength (Snc) Ranged from 36.2 to 59.8 ksf
Wet unit weight Ywet pcf ranged from 105.2 to 107.0 pcf

Due to insufficient amount of core, the volcanic tuff's fracture and joint patterns, spacing and angles cannot be quantified; neglect cohesion properties.

Use: Ø = 37°
Assumed: empirical analysis based on the tuff behaving like an angular, well graded sand with Ø ranging from 35° to 45°.
Ref: **Soil Mechanics in Engineering Practice**
By Karl Terzaghi and Ralph B. Peck, 1967, 2nd Edition
table 17.1 (page 107)

Calculated By:
Stephen Woodall Stephen Woodall

Review By:
John North

Passive Earth Pressure (Pp)

Lowest γwet = 105.2 pcf

$Pp= \gamma_{wet} \tan^2 (45 + Ø/2)$

Pp = 423.2 pcf

$\boxed{\text{Pp= 420 pcf.}}$

Active Earth Pressure (Pa)

Highest γ_{wet} γ_{wet} 107.0 pcf

$Pa= \gamma_{wet} \tan^2 (45 - Ø/2)$

Pa= 26.6 pcf

$\boxed{\text{Pa= 27 pcf.}}$

Pressure Distribution Analysis for Brace Loads in Internally Braced Flexible Temporary Walls

Equations Ref: **NAVFAC DM-7, Foundations and Earth Strucures, Design Manual 7.2**
May 1982 (page 7.2-100)

Coarse grain , sand, conditions

$\sigma h= 0.65* Pa*H$ H = height earth material

Native Soils and Fill Material

Pa = 34 pcf

$\sigma h = 22*H$

Volcanic Tuff

Pa = 27 pcf

$\sigma h = 18*H$

Coefficient of Fiction (μ)

Ref: **NAVFAC DM-7, Foundations and Earth Strucures, Design Manual 7.2**
May 1982 (page 7.2-194)

δ for a concrete Interface = ¾ Ø

$\mu = \tan \delta$

For Volcanic Tuff use Ø =37°

μ= **0.53**

$\boxed{\mu = 0.50 .}$

Calculated By:
Stephen Woodall Stephen Woodall

Review By:
John North

Bearing Capacity for Volcanic Tuff

Lowest unconfined compressive strength obtained from (4) Lab tests
Snc = 36.2 ksf

Due to insufficient amount of core, the volcanic tuff's fracture and joint patterns, spacing and angles cannot be quantified; reduce effective Snc by half for use as ultimate.

Ultimate Bearing Capacity (q_U)
$\underline{PU = 18 \text{ ksf}}$

Factor of Safety F.S.
$\underline{F.S. = 3}$

Allowable Bearing Capacity (q_A)
$q_A = q_U / F.S.$
$\boxed{q_A = 6 \text{ ksf, or } 6000 \text{ psf.}}$

Calculated By:
Stephen Woodall Stephen Woodall

Review By:
John North

APPENDIX E
Recommended Specifications and Field Control Requirements

1.1.1. Material for Fill

Structural fill should be placed in accordance with the recommendations presented in Compaction Requirements (see below). Structural fill required to bring the site to finished subgrade elevation should be free of vegetation and debris, and meet the following gradation requirements:

Sieve Size (Square Openings)	Percent Passing by Weight
3 inch	100
No. 4	50-100
No. 200	10-40

The plasticity index of the structural fill should not exceed 12. Based upon the results of our investigation, most of the native tuff at the site will meet these requirements. It is believed that volcanic tuff will break down sufficiently during earthmoving operations to meet the specifications for structural fill.

1.1.2. Compaction Requirements

We recommend that all structural fill be spread in layers not exceeding 6 inches in thickness, moisture conditioned as necessary and compacted. The moisture content of the fill during compaction should be within 2 percent of optimum moisture content. A density of not less than 95 percent of maximum dry density under the building pad, floor slab, sidewalks, paved areas and basecourse should be obtained for the native soils and structural fill. Structural fill, as well as the native soils, outside the building area considered as general site grading should be compacted to 90 percent of maximum dry density. Sand bedding for underground piping system should be compacted to 85 percent except where located in paved areas.

Determine density of in-place material in accordance with specifications listed in the LANL Facility Engineering Manual, Chapter III – Civil, Section 202.6 compaction.

The optimum moisture content and maximum dry density for each soil type used should be determined in accordance with ASTM D1557, modified proctor method.

1.1.3. Weather Limitations

Engineered fill should not be placed when the atmospheric temperature is below 35 degrees Fahrenheit. When the temperature falls below 35 degrees, all areas of completed work should be protected against detrimental effects of ground freezing and any areas affected by freezing should be reconditioned and compacted in conformance with the above requirements. Any soils disturbed due to wetting, drying, or other causes should also be reconditioned prior to placement of additional fill or construction of foundations, floor slabs, pavement or other structural elements. Reconditioning should include scarificative, moisture-conditioning, and recompaction in accordance with requirements presented in previous sections of this report.

1.1.4. Construction Observation & Testing

We recommend that a representative of the geotechnical engineer provide continuous on-site observation and testing during overexcavation and placement of engineered fill to document compliance with the recommendations contained herein. We recommend that tests be made at the following minimum rates:

- One field density test for each 4,500 square feet of original ground surface prior to placing fill.
- One field density test for each 10,000 square feet of fill placed or each layer of fill for each work area, whichever is the greater number of tests.
- One moisture density relationship test (proctor) for each type of material used as determined by sieve analysis and plasticity index.

1 EXCERPTS FROM SECTION I: ORGANIZATION AND ORGANIZATIONAL POLICY

F. Quality System Policy

1. Statement of General Policy: The foundation of the Kleinfelder Materials Services Quality System is to provide services with staff that is properly trained, experienced, and educated, using equipment that meets the requirements of applicable standards and is calibrated in a manner that is traceable to the U.S. Department of Commerce, National Institute of Standards and Technology, and performing services in accordance with recognized standards or materials engineering principles.
    a) Personnel training, experience, and education minimums required by Kleinfelder to qualify for specific positions and job responsibilities are presented in detail in this manual and Appendix C, as well as methods for verifying training and competency.
    b) Methods for assuring the use of proper and calibrated equipment are described in detail in this manual.
    c) Recognized standards and the Kleinfelder policy for establishing procedures when a recognized standard is not available are presented in detail in this manual.
    d) Internal and external methods used to monitor compliance with this manual are also presented in this manual.
2. Resource Assurance: It is Kleinfelder's policy to assure that we have the proper staffing and equipment resources to perform a task before accepting the work and to assure during the performance of the work that the proper resources have been assigned. The Technical Manager (defined herein and denoted in the Organizational Chart in Appendix A) has primary responsibility of making the overall determination in this regard, but, as described herein, each individual is additionally responsible to verify they meet QSM competency requirements and that the equipment used is calibrated and conforms to the requirements of the appropriate standard.
3. Quality System Manual Control: Each Regional Office shall receive a numbered copy of the company Quality System Manual. This number shall be a four digit number corresponding to the Regional Office Number. The Regional Office shall distribute manuals to other local offices within their region, which shall have the same number followed by a lower case letter beginning with a, then b and so on in alphabetical order.
4. Quality System Training: Each individual working for Kleinfelder providing Materials Services receives training regarding our Quality System. This training is provided by a supervisor, who discusses this manual and the systems presented herein section by section with each employee within one month of initial employment. A record of this training is placed in the employee's personnel file (discussed later).
5. Quality System Review: Each time an internal or external audit or on-site inspection is performed, local management staff will review our Quality System to assure it is current and functioning. If revision of a system or procedure is considered necessary by local management staff, a written request for revision shall be submitted to the Senior Materials Consultant. The Senior Materials Consultant is authorized by the Board of

Directors to implement changes deemed appropriate and necessary. At the discretion of the Senior Materials Consultant, revisions that affect company policy may be referred to the Board of Directors for approval.

6. Quality System Manual Revision: If the Senior Materials Consultant determines a requested revision is appropriate, the revision shall be made. The Senior Materials Consultant shall log the revision and distribute the notification of the revision and the log to the Regional Offices. The Regional Offices shall incorporate the changes and the log into their manual and distribute copies to the local offices within their region. Note that changes that are specific only to the requirements of a particular office are made in the Appendix. In these cases, the changes must be approved by the Senior Materials Consultant, but are maintained only at the Regional Office level. The Regional Office is also responsible for maintaining the log related to these changes.
7. Deviations from Quality System Manual: Deviations from the policies, procedures, and systems presented in this manual must be approved by the Technical Manager and noted on related reports, which in turn are signed by authorized individuals.

Excerpts from Section III: Facilities and Equipment

B. Calibration and Verification (6.3.2)

1. Inventory List (6.3.2.1): The *Equipment Inventory List* and copies of manufacturer's instructions are maintained by the Laboratory Manager and are located in the Laboratory Manager's office.
2. Time Interval (R 18 Tables): Kleinfelder has adopted the calibration verification frequency intervals presented in AASHTO Standard R 18 or ASTM Standards C 1077, C 3666 and D 3740, whichever are most frequent. If equipment is not listed in these standards, it will be verified for calibration at least annually. For equipment that is not used as frequently as the required calibration verification frequency, the specified frequency can be extended. However, whenever that piece of equipment is used, it must have had its calibration verified within a time period equal to or less than the specified frequency. If we have reason to suspect equipment is not providing accurate test results, calibration will be performed immediately.
3. Procedures: All tests are performed using calibrated equipment complying with the requirements of the standard of the test being performed. We have prepared equipment maintenance and calibration forms referencing the appropriate standard to be followed for maintenance and calibration for each piece of test equipment. Each piece of equipment to be calibrated has a summary sheet identifying the piece of equipment, the documented procedure or referenced procedure for calibration, the standards used for the calibration and the results of the calibration. Reference standards for calibrations are traceable to NIST (National Institute of Standards and Technology). The NIST reference number is included on the calibration data sheet. If equipment is calibrated externally, the NIST reference number must be provided by the calibrating agency

4. Records and Location of Records:

   a) The completed calibration verification records generated by Kleinfelder and by calibration consultants are located in the Laboratory Manager's office. The calibration records and certification information regarding the traceability to NIST for calibration equipment used are also located in the Laboratory Manager's office.

   b) After three years, at the local office's option, these records may be moved to a permanent storage location.

5. Program Procedures (6.3.2.2)

   a) Method for assuring verifications are current:

      1.) A calibration log located in the Laboratory Manager's office is maintained by the Laboratory Manager. This log lists each piece of equipment, the verification frequency, and a log of the dates when calibrations were performed and the next date due. On the first of each month, the *Calibration Log* is reviewed by the Laboratory Manager and a list of equipment requiring calibration that month is generated.

      2) *Calibration Stickers:* When calibration or calibration verification is performed a sticker is applied to the piece of equipment showing the date the calibration was performed, the date the next verification is due, and the initials of the individual who performed the calibration. These stickers allow individuals using the equipment to verify calibration is current prior to using the equipment.

   b) Responsible Individual:

      1) The Laboratory Manager is responsible for the equipment calibration verification program and is responsible to assure that all equipment in use is currently verified as calibrated.

      2) Each individual using a piece of equipment has responsibility for ensuring the equipment is calibrated prior to use

   c) New Equipment Procedures:

      1) When equipment is received, it is inspected, calibration verified by manufacturer certification or Kleinfelder calibration verification, and added to the *Equipment Inventory List* and the *Calibration Log* by the Laboratory Manager.

      Removal From Service and Out of Calibration/Defective Equipment:

      1) Red tag labels will be affixed to any equipment which needs repair or does not meet calibration criteria. Equipment that has not been calibrated can be identified by the absence of a calibration sticker or the date on the calibration sticker indicating when recalibration is due. This equipment will not be used until repair and/or calibration is performed and the red tag has been removed by the Laboratory Manager. Equipment removed from service and discarded shall be

removed from the *Equipment Inventory List* by the Laboratory Manager.

6. Calibration and Verification Procedures (6.3.2.3):
    a) Kleinfelder performs routine verifications in accordance with the procedures contained in our *Materials Equipment Calibration Guidelines Manual*. For certain calibration and calibration verification requiring specialized equipment not possessed by Kleinfelder, we use outside calibration consultants. A list of these consultants is presented in the Appendix B, Table 5. Equipment manufacturers are also utilized, when necessary, for maintenance, repair, and calibration. Whether calibration and verification is performed by Kleinfelder or others, the procedure shall include measurements that verify that the equipment complies with the requirements of the associated test standard, and the records shall document the measurement results and show comparison to the test standard requirement used to verify conformity or nonconformity.
    b) Location of Procedures Manual:
        1) The Kleinfelder *Materials Equipment Calibration Guidelines Manual* is located in the Laboratory Manager's office. In addition, this manual also contains the calibration forms used for each piece of equipment.
    c) Procedures referenced in applicable standards:
        1) Calibration verification of laboratory equipment procedures are designed to utilize the most current issue of the applicable ASTM, AASHTO, or other applicable standard.
    d) Procedures not referenced in applicable standards:
        1) Where the applicable standard does not specify calibration procedures, they have been developed by Kleinfelder in accordance with standard materials engineering and testing principles. These are contained in the *Materials Equipment Calibration Guidelines Manual.*
7. In-house Calibration Equipment and Reference Standards (6.3.2.4)
    a) Files for Equipment Certifications, Traceability, etc.
        1.) Files are maintained by the Laboratory Manager which contain equipment calibration certifications by outside agencies, in-house equipment calibration verification, concrete curing room temperature and humidity, laboratory accreditations, and NIST traceability standards in the Laboratory Manager's office.
    b) Use and Storage: Equipment and Reference Standards used for In-house calibration verification should not be used for any other purpose and should be stored in a location that limits the potential for use or accidental contact that might invalidate NIST traceability.

Test Data and Field Records and Reports (6.4)

A. Methods (6.4.1)

1. Produce, Prepare, Check, Issue:

a) While the field or laboratory technician or inspector is performing the test or observation, all pertinent information and results will be recorded on the appropriate test data or field report form. Once the test or observation is completed, the technician or inspector will sign the data or field report form and submit it to the laboratory or field supervisor or manager, who will review the results, checking for completeness, accuracy, and reasonableness of information and data on the form. The supervisor will initial the form when satisfied with the results, prepare a draft report, and forward it to word processing. Word processing will prepare the test report and return it to the supervisor. The supervisor will then review the typed version with the original form for accuracy and completeness. If satisfied, the supervisor forwards the report to the individual responsible for signature.

b) After review, editing, if necessary, and approval by the individual who will sign the report, the typed report is returned to administrative staff to prepare it for final typing, copying, and mailing to the client. The original of the typed report will be signed by the authorized individual and mailed to the client with copies distributed to client approved parties and one copy placed in the project files.

c) Kleinfelder requires all engineering work to be performed under the supervision of a properly registered engineer. Engineering work is defined as services where engineering analysis is performed or where an engineering opinion is expressed. The presentation of test results performed in accordance with a standard procedure together with project or standard specifications and the comparison of the test results to those specifications is not considered to be the expression of an engineering opinion.

d) Engineering reports are to be signed by the registered engineer. Reports that contain only the results of tests performed in accordance with a standard test procedure, may be signed by a Laboratory Supervisor or by a Laboratory, Project, Operations, Materials Department, Office, or Regional Manager. Summary reports of observations performed by certified or governing authority approved inspectors must be signed by the Project Manager and an Operations, Department, Office, or Regional Manager. These reports may also include field and laboratory tests. If an opinion is expressed regarding the overall compliance of a structure (roadway, bridge, building) or part of a structure (pad or fill certification), the report must be cosigned by a registered engineer. Whenever Kleinfelder uses the word certify in a report, it is only to certify the observation and testing work performed by Kleinfelder was performed in accordance with our industry standards for the locality where the work was performed and does not relate to work performed by the contractor, other engineers or surveyors, or others.

e) Documentation of checking and review performance is maintained on the word processing work order form and filed in the project file.

B. Typical Report Forms (6.4.2)

1. Typical Format Discussion:

    a) The appropriate standard will be followed in preparing the written results (i.e., required information to be included on the test form). Standard test procedures that were performed will be specifically denoted on test reports. Any deviations from the designated standard procedure shall be noted. If special procedures designed by a properly registered engineer were used, they should be described in detail together with the materials engineering principles used.

    b) Each sample for which test results are presented shall be identified in the report by sample number together with other appropriate identification information, such as materials supplier, materials source, material type, sample location, date sampled, name of party who obtained sample, date received, date tested, tests performed, etc.. Tests results are presented for each sample, and, where applicable, project or other material specifications may be presented and compared to the test results with a pass or fail disposition. Field reports of observations shall include similar project information and identify the nature of the observation, the item being observed, and a precise description of the location of the observation.

    c) Engineering reports typically include the following sections, as appropriate to the scope and complexity of work: Introduction, Scope of Work, Project Approach, Field and Laboratory Investigations, Findings, Engineering Analysis, Conclusions, and Recommendations. Depending upon the complexity of the project, some sections are often combined.

2. Date:

    a) The date of a report denoting the date the report was sent to the client shall be noted on the each page.

3. Amending Reports:

    a) If it becomes necessary to revise or amend a report, the original report date and the date(s) of revision will be shown on the report.

    b) Supplemental reports shall clearly by so identified, with the original report being identified in the report introduction.

4. Location of Standard Forms:

    a) Standard report and test data forms are located in the Laboratory Manager's office.

5. Typical Forms:

    a) Several typical forms are included in the Appendix D.

C. Files and Report Retention:

1. All correspondence, reports, test data and other written communications relative to a project will be stored in our project files. Our office currently uses a two-file system for each project. The first file is the invoice file and contains all financial and contractual data. The second file is the working file and contains all pertinent information to the

project, including test reports. These two files are maintained in separate file rooms within the local office.

2. Our test record system is set-up to retain test data records and reports for a minimum of three years from the date of the report, including original observations, calculations, and derived data with final test reports.. Responsibility for carrying out the policy described herein is assigned to the Technical Manager.

D. Confidentiality:

1. Confidentiality of test reports, both oral and written, is a major professional and ethical concern. Test reports are the property of the client, however, they are copyrighted by Kleinfelder, Inc. to attempt to limit the misuse of the data. Reporting is restricted to the client or client-authorized personnel only. Absolutely no results are distributed to non-client or non Kleinfelder parties, unless authorized by the client.

2. Only management and designated administrative staff are authorized to access or copy information from project files. Files removed from the file cabinets must be *signed out*. Work in progress is often maintained in laboratory or field files before being permanently filed and field and preliminary lab data reports are often reported prior to publication of final reports. Staff involved with these activities are instructed in the confidentiality requirements.

3. Each materials department employee must sign an affidavit documenting their understanding of this requirement. This affidavit is on file in the employee's personnel file.

4. Special Confidential Materials: If the client requests special security of reports and other materials they deem particularly sensitive and confidential, Kleinfelder will comply with these requests, including maintaining these materials in a locked vault.

VII. Internal Quality System Review (6.7)

A. Scope:

1. The Technical Manager or their designee working under their direct supervision shall perform internal quality system reviews to ensure that the established quality system procedures are being followed and consisting of the following:

   a) Proficiency sample reports and responses.

   b) Third party on-site inspection reports and responses.

   c) *Equipment Inventory List*

   d) Equipment calibration verification records.

   e) Technician training and competency verification records.

   f) Records of calibration verification of equipment and materials received during the review period, including new equipment, capping compound, concrete cylinder molds, etc.

B. Frequency:

1. Internal quality system reviews are conducted semi-annually.

C. Individuals Responsible:

1. The Technical Manager is responsible to assure the reviews are performed, that corrective action plans are developed and implemented, and that reports are prepared and distributed.

2. The Laboratory Manager responsible for compliance with the requirements of the quality system, preparation and performance of the corrective action plan, reporting of corrective actions, and recording keeping.

D. Report Preparation and Distribution:

1. The individual performing the inspection shall prepare a report of their findings which shall be distributed to the Laboratory Manager, the Technical Manager, and the Regional Manager.

E. Corrective Action:

1. A plan for corrective action shall be developed and implemented by the Laboratory Manager and approved by the Technical Manager. Upon completion of the corrective action plan, a report shall be prepared by the Laboratory Manager and submitted to the Technical Manager and the Regional Manager.

F. Location of Records:

1. The results of all internal reviews and reports of corrective actions are maintained in the Laboratory Managers office.

TABLE NO. 6

EQUIPMENT CALIBRATION/VERIFICATION INFORMATION

SOILS AND AGGREGATES TEST EQUIPMENT

Kal-Co., Inc. Calibration Procedure Number	Equipment-Test Method	Requirement	Performed By	Interval Months
S100	Mechanical Compactor-T99, T180, D698, D1557	Calibrate	Kal-Co	12
H102	CA Kneading Compactor-T190, D2844	Calibrate	Kal-Co	24
S101	Molds-T99, T134, T135, T136, T180, T190, T193, D698, D558, D559, D560, D1557, D1883, D2844	Ck. Critical Dimensions	Kal-Co	12
S102	Manual Hammer-T99, T180, D698, D1557	Ck. Weight and Critical Dimensions	Kal-Co	12
S103	Liquid Limit Device-T89, D4318	Ck. Wear & Critical Dimensions	Kal-Co	12
S104	Grooving Tool-T89, D4318	Ck Critical Dimensions	Kal-Co	12
S105	Straightedge-T99, T134, T135, T136, T180, D698, D558, D559, D560, D1557	Ck. Critical Dimensions	Kal-Co	12
S106	Hydrometers-T88, D422	Ck. Critical Dimensions	Kal-Co	24
S107	Weighted Foot Assembly-T176, D2419	Ck. Weight	Kal-Co	12
S108	Mechanical SE Shakers-T176, D2419	Calibrate	Kal-Co	12
S109	Annular & Slotted Weights-T193, D1883	Ck. Weight	Kal-Co	12
S110	Penetration Piston-T193, D1883	Ck. Diameter	Kal-Co	12
S111	Standard Metal Specimen-T190, D2884	Ck. Outside Diameter	Kal-Co	12
S112	Metal Follower-T190, D2884	Ck. Diameter	Kal-Co	12
S113	Unit Weight Measures-T19, C29	Calibrate	Kal-Co	12
S114	Sulfate Oven-T104, C88	Ck. Rate of Evaporation	Kal-Co	12
S115	LA Machine-T96, C131	Ck. RPM & Critical Dimensions	Kal-Co	24
S116	Conical Mold and Tamper-T84, C128	Ck. Critical Dimensions	Kal-Co	24
S115	Steel Balls-T96, C131	Ck. Individual & Charge Weight	Kal-Co	24
S116	Sodium Sulfate Containers-T104, C88	Ck. Physical Condition	Kal-Co	12
S117	Sand Cone and Plate-T191, D1556	Calibrate	Kal-Co	12
S118	Speedy Moisture Meter-T217	Calibrate	Kal-Co	12
S119	FA Angularity measure and spatula-T304	Ck. Critical Dimensions	Kal-Co	12
S120	Flat and Elongate Devise-D4791	Ck. Critical Dimensions	Kal-Co	12
S121	Pycnometer-T100, D854	Calibrate	Kal-Co	12
S122	Consol Apparatus/Wts.-T216, D2435	Calibrate	Kal-Co	12
S123	Direct Shear Machine-T236, D3080	Verify Motor Speeds	Kal-Co	12
S124	Mechanical Sieve Shakers-C117, C136	Calibrate	Kal-Co	12
S125	Organic Impurities	Calibrate	Kal-Co	12
S126	Durability Apparatus	Calibrate	Kal-Co	12
S127	California Bearing Ratio	Calibrate	Kal-Co	12
S128	Specific Gravity of Soils-D854	Calibrate	Kal-Co	12

LA-UR-05-0841)

TA-50 SOIL CHARACTERIZATION ANALYTICAL SUMMARY REPORT

For Geotechnical Investigation & Soil Characterization, Cerro Grande Rehabilitation Project, Waste Management Mitigation Task, PI 100145

February 11, 2002

Prepared for:
Los Alamos National Laboratory
FWO-WFM

Prepared by:
Dennis Newell (SEA)
Ken Gillespie (WGII)
Keith Tucker (SEA)

WGII/SEA/PMC
2237 Trinity Drive, Bldg 2, 1st Floor
Los Alamos, NM 87544
505-662-7300

Holmes & Narver/Ratheon
800 Trinity Drive, Suite K
Los Alamos, NM 87544

SEASF-TR-02-270

TABLE NO. 6

EQUIPMENT CALIBRATION/VERIFICATION INFORMATION

GENERAL PURPOSE TEST EQUIPMENT

Kal-Co., Inc. Calibration Procedure Number	Equipment-Test Method	Requirement	Performed By	Interval Months
G100	Mechanical Shakers	Ck. Sieving Thoroughness	Kal-Co	12
G101	Balances, Scales, and Weights	Verify	Kal-Co	12
G102	Thermometers	Calibrate	Kal-Co/Lab	6
G103	Compression Test Machine	Verify	Kal-Co	12
G104	Timers	Ck. Accuracy	Kal-Co/Lab	6
G105	Ovens	Verify Temp. Settings	Kal-Co/Lab	4
G106	Vacuum System	Ck. Pressure	Kal-Co	12
G107	Sieves	Fine (<4.75mm): Ck. Openings and Physical Conditions	Kal-Co	12
G108	Sieves	Coarse (>4.75mm): Ck. Openings & Physical Condition. Fine (<4.75mm): Ck. Physical Condition	Kal-Co/Lab	6
G109	Length Measurement, Calipers, Micrometers, Rulers, Feeler Gauges	Verify	Kal-Co	12
G110	Proving Rings, Dynamometers	Calibrate	Kal-Co	12
G111	Water Baths	Verify Temperature Settings	Kal-Co	12
G112	Dial Gauges	Verify	Kal-Co	12
G113	Testing Machine Platens	Ck. Critical Dimensions & Condition	Kal-Co	12
G114	Speedy Moisture Testers	Ck. Pressure, Scale	Kal-Co	12

Washington

WGINT/PMC LOS ALAMOS TEAM

February 11, 2002

Mr. Ben Evans
Holmes & Narver/Raytheon
800 Trinity Drive, Suite K
Los Alamos, NM 87544

RE: Final TA-50 Soil Characterization Analytical Summary Report

Please find attached the Final TA-50 Soil Characterization Analytical Summary Report. The document is provided in both hard copy and on disk (CD). Three CDs are included, one for your records, and two for distribution to LANL.

The document has gone through LANL review and comment resolution. The author's and WGII Quality Assurance Officer's signatures are on the document. The document requires HNR signatures prior to delivery to LANL. LANL will handle the Derivative Classification.

LANL requires two electronic and 10 hard copies of the report.

Additionally, Dennis Newell has hand-delivered the following in hard copy to LANL.

1. ASSAIGAI Analytical Level IV QA Package Report, Volume I, II, and III.
2. Three file boxes containing the Analytical Results and associated Quantitation Reports for all samples

Feel free to contact Dennis Newell at 662-1325 or newell@lanl.gov with questions.

Sincerely,

John DeJoia
Program Manager

File No.: 020211.01

Washington

January, 23 2002

Ben Evans
Holmes & Narver/Raytheon
800 Trinity Drive, Suite K
Los Alamos, NM 87544

RE: Draft TA-50 Soil Characterization Analytical Summary Report, Rev 0

Dear Mr. Evans:

Please find attached the draft TA-50 Soil Characterization Analytical Summary Report and a LANL comment resolution form. The document is provided in both hard copy and on disk.

This document has been reviewed internally by WGII/SEA and the signature page contains the authors and QA Officer's signature. The document requires HNR review and signature prior to delivery to LANL for their review, per the SOW. The document is due to LANL on Friday, January 25, 2002.

The LANL reviewer list follows:

Rick Alexander, MS E518
Dennis McLain, J593
Darren Meadows, E518
Paula Diepolder, E518
Sean French, J595
Steve Torrez, E518
Dave McInroy, M992
Cheryl Olson, K487
Paula Bertino M992
Jack Ellvinger, K490
Lisa Robinson (project file), E518

Feel free to contact Dennis Newell at 662-1325 or email newell@lanl.gov with questions.

Sincerely,

Mark D. Shepard

for John DeJoia
Program Manager

File No. 020123.02

Washington Group International, Inc. • Federal Projects • 2237 Trinity Drive • Building #2, 1st Floor • Los Alamos, NM USA 87544
(505) 662-7300 • Fax: (505) 662-7800

TA-50 SOIL CHARACTERIZATION ANALYTICAL SUMMARY REPORT

For Geotechnical Investigation & Soil Characterization, Cerro Grande Rehabilitation Project, Waste Management Mitigation Task, PI 100145

February 11, 2002

Prepared for:
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SEASF-TR-02-270

SIGNATURE PAGE

Approved for Release

University Technical Representative

Rick Alexander LANL
Signature Date

Project Team Leader/Facility Manager

Dennis McLain LANL
Signature Date

Concurrence

Derivative Classifier Classification Level____________

Mike Ragsdale LANL
Signature Date

HNR Project Manager

Cody Milligan HNR
Signature Date

WGII Team Quality Assurance Officer

Charles Smiroldo SEA
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HNR Quality Assurance Manager

Denise Clements HNR
Signature Date

WGII Task Manager

Dennis Newell SEA
Signature Date

CONTENTS

EXECUTIVE SUMMARY

The drilling and sampling of eight boreholes was conducted to characterize subsurface materials at the location of the proposed TA-50 Pump House and Influent Storage Tanks and an associated manhole. Solid Waste Management Units (SWMU) 50-011(a), 50-004(b) and 50-004(c) are located within the proposed construction area. Residual contamination from these SWMUs may be present in soils, fill and tuff at the site. The borings were advanced using hollow stem auger drilling and samples were collected continuously using a split spoon core barrel. Six borings (50-BH1, 3, 5, 6, 7, and 8) were advanced and sampled to a depth of 25 ft. One boring (50-BH4) was advanced and sampled to a depth of 23 ft. In addition, one boring (50-BH2) was advanced and sampled to 90 ft. The sampling plan targeted the depths of 3, 10, and 25-ft bgs, with modifications based on the tuff interface location. The sampling plan specified two additional samples at 70 and 90 ft from 50-BH2. Samples were submitted for full suite analytical chemistry including Volatile Organic Compounds (VOC), Semi-volatile Organic Compounds (SVOC), Resource Conservation and Recovery Act (RCRA) TCLP and TAL Metals, Polychlorinated Biphenyls (PCB), Pesticides, Total Petroleum Hydrocarbon – Diesel Range Organics (TPH-DRO), and radionuclides. Samples from 0 to 25-ft were used to characterize excavated soils/tuff generated during excavation and construction activities. Samples from the deeper borehole were collected to investigate potential releases from SWMU 50-011a. In total 33 samples were submitted for analysis. This included 26 soil/fill and tuff samples, 2 duplicates, 2 rinsates, 2 volatile organic analysis (VOA) trip blanks, and one soil trip blank. Geologically, soil/fill was found to be between 1 and 10 ft thick. Underlying the soil/fill was poorly to moderately welded volcanic tuffs. At the soil/fill – tuff interface, the tuffs ranged from highly weathered to fresh. The analytical results show the presence of some contaminants at extremely low concentrations within the projected construction area and depth (25-ft bgs). A few metals were detected in tuffs above background levels, but well below the regulatory limit for hazardous waste. Low concentrations of SVOCs in the form of polycyclic aromatic hydrocarbons (PAH) were found in one shallow sample adjacent to an asphalt road, and are likely associated with the asphalt and/or auto exhaust. Sporadic, low concentration detections of one PCB were found, but the levels do not indicate a spill or release, and are not at regulated levels. The most pervasive contamination was found to be low concentrations of radionuclides above background levels in both the soil/fill and tuff. Based on the analytical results, the excavation of soil/fill and tuff during construction would result in the generation of solid, low-level radioactive waste (LLW). The deep samples (70 and 90 ft bgs) show the presence of a couple metals above background and the presence of some mixed fission and activation products slightly above detection limits. Chromium and lead were detected above background at 70 ft and below background at 90 ft, providing a decreasing trend. No patterns were identified in the radiological data. If these results are interpreted to indicate a release from 50-011a, its extent appears bounded by the sampling.

The field activities and the analytical chemistry have produced defensible data meeting all applicable QA/QC requirements. These results are sufficient to meet the objectives of the project (waste volume and type estimation and worker risk).

1. INTRODUCTION

1.1 Purpose

One of the subprojects of the Cerro Grande Rehabilitation Project, Waste Management Risk Mitigation Task is to construct a Pump House and Influent Storage Tanks Facility at LANL TA-50. Residual contamination may be present in soils from SWMUs 50-011(a), 50-004(b), and 50-004(c), which are located within the footprint of the proposed construction site (IT Corporation 2001, LANL 1992). The soils require characterization with respect to these potential contaminants to 1) estimate the volume and type of waste that may be generated during excavation operations, and 2) assess any risks posed by the subsurface media (soils/fill and tuff) with respect to worker safety during the project. The purpose of this project is to provide the soil characterization required to meet these two objectives for the definitive design of the TA-50 Pump House and Influent Storage Tanks Project. This report documents the field investigation and the results and conclusions of the soil characterization.

Also required for the definitive design is a geotechnical investigation. This investigation was conducted in tandem with the soil characterization by Kleinfelder, Inc., and the results of this investigation are provided in a separate report. The "Geotechnical Investigation, Technical Area 50: Pump House and Influent Storage Tank Vault Project, Project NO. 59-010145.001" (Kleinfelder 2001) serves as the report of record for the Title I and Title II engineering design.

1.2 Scope

To meet the objectives outlined in the purpose, a Sampling and Analysis Plan (SAP) was prepared by LANL. The SAP required eight boreholes to be drilled and sampled. Seven of the boreholes were located within the projected construction zone for the Pump House, and one borehole was located at the location of a proposed manhole. Seven of the boreholes were to be advanced to 25 ft. below ground surface, and one borehole was to be advanced to 90 ft. below ground surface. Figure 3.2-1 depicts the borehole location and associated facility structures. The 25-ft. boreholes were designed to characterize the soils/fill and tuff to the projected maximum depth of excavation related to the construction project. The 90-ft. borehole was designed to 1) characterize the first 25 ft of soil/fill and tuff within the proposed construction area, and 2) to investigate the tuff adjacent and below SWMU 50-011a. The SAP specified 3 samples from 7 boreholes advanced to 25 ft, and 5 samples from one borehole advanced to 90 ft, for a total of 26 samples, not including QA/QC samples. The specified analytical suite included volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), RCRA metals (TAL and TCLP), pesticides, polychlorinated biphenyls (PCBs), total petroleum hydrocarbons and diesel range organics (TPH-DRO), and radiological constituents.

1.3 Quality Program

The soil characterization project was conducted under the WGII quality program as presented in the WGII/LANL Project Contractor's Quality Management Program (CQMP). The quality program includes both the Quality Management Plan and Quality Assurance Procedures (QAPs). This program was initially prepared specifically for work under the LANL ER Deep Drilling Project, but has been expanded to cover all WGII projects at LANL (ER, D&D, and other LANL support). All technical work was performed in accordance with Standard Operating Procedures (SOP). Field personnel are required to read and follow all applicable procedures.

In addition to the WGII quality program, this report was subject to review under the Holmes & Narver/Ratheon (HNR) quality program.

1.4 Sampling Event

Drilling and sampling were conducted from December 13 through December 16, 2001. The drilling and sampling shifts utilized the available hours of daylight and were from approximately 7:00 a.m. through 5:00 p.m. The WGII field team was comprised of Dennis Newell (Field Team Leader), Keith Tucker (Sampler and Waste Management Coordinator), Ken Gillespie (Site Safety Officer), Robert Helton (Driller), Davey Heath (Driller Helper), and Steve Woodall (Geotechnical Engineer). FWO-WFM provided a full-time Radiation Control Technician (RCT) from the ESH-1 pool, who was on-site during all drilling and sampling activities. Darren Meadows provided FWO-WFM project oversight, and Robert Baran conducted ESH-5 health and safety oversight.

2. METHODOLOGY

2.1 Drilling

Drilling was conducted using a CME 75 truck-mounted drill rig using hollow-stem auger methods. Kleinfelder Inc., based in Albuquerque, NM, was subcontracted to WGII to conduct the drilling operations. This method of drilling has proved to be economical and efficient in the soils, fill, and Bandelier Tuff that comprises the Pajarito Plateau. Based on previous site investigations at and adjacent to TA-50, Unit 3 of the Tshirege Member of the Bandelier Tuff was anticipated to be encountered within the first 10 ft. of drilling, for which hollow-stem auger methods would be adequate.

Figure 2.1-1. CME 75 drill rig.

2.2 Sampling

Sampling using the CME 75 drill rig was conducted continuously using 5 ft. core barrels. Both stainless steel and cold steel core barrels were used. When cold steel barrels were used, lexan liners were utilized to prevent cross-contamination of the samples with the metals in the core barrel. A LANL ESH-1 Radiological Control Technician (RCT) screened recovered core, cuttings, and samples for radiological contamination.

The sampling plan specified the collection of three samples each from the eight borings. The target depth for samples was 3, 10, and 25 ft. below ground surface. In each borehole one of the three samples was collected from the tuff interface. If the soil/fill - tuff interface occurred in the first 6 ft, then the interface depth replaced the 3 ft. sample; if the interface occurred between 6 and 17 ft, then the interface depth replaced the 10 ft. sample; and if the interface existed between 17 and 25 ft, then the interface depth replaced the 25 ft. sample. In the 90-ft boring, two additional samples at 70 and 90 ft. below ground surface were collected in accordance to the SAP (LANL 2001c).

The sampling nomenclature used was 50-BH#-XX, where # indicates the borehole number (e.g., 2) and XX is the sample depth (e.g., 10). Specific information on each sample is provided in the sample collection logs (Appendix A).

Figure 2.2-1. Sampling subsurface media.

QA samples required included include two duplicates, two rinsate samples, and a soil trip blank. In addition, the analytical laboratory sent two sealed VOA trip blanks with the sample containers for return and analysis along with the site samples.

Samples were collected following WGII Standard Operating Procedures as outlined in Table 2.2-1.

Table 2.2-1. Standard Operating Procedures

SOP Number and Revision	SOP Title
SOP-1.02, Rev 2	Sample Containers and Preservation
SOP-1.04, Rev 4	Sample Control and Field Documentation
SOP-1.05, Rev 1	Field Quality Control Samples
SOP-1.08, Rev 1	Field Decontamination of Drilling and Sampling Equipment
SOP-6.26, Rev 1	Core Barrel Sampling for Subsurface Earth Materials
SOP-12.01, Rev 4	Field Logging, Handling, and Documentation of Borehole Materials

2.3 Health and Safety

The drilling and sampling activities were conducted under a Site Specific Health and Safety Plan (SSHASP) titled "TA-50 Pump House Geotechnical Investigation and Soil Characterization" (WGII/PMC/SEA 2001). Based on the scope of the project, the field site was managed as a HAZWOPER site. The SSHASP evaluated the hazards based on the specific tasks conducted during the field job and the hazards from potential site contamination related to SWMUs in the vicinity. Based on the analysis of these hazards, controls were specified including Personal Protective Equipment (PPE), engineering controls, and monitoring. Additionally, the SSHASP specified personnel training requirements based on the specific job tasks and potential site hazards.

The level of PPE specified in the SSHASP was modified level D. This included steel-toe boots, safety glasses with side-shields, hard hats, and coveralls. Additional PPE requirements were specified in the Radiological Work Permit (RWP).

Site monitoring called out in the SSHASP included noise monitoring around the drill rig and air monitoring at 50-BH2. At 50-BH2, air monitoring for hydrogen sulfide and explosive atmospheres during the drilling/sampling was required based on potential contaminants from SWMU 50-011a, and an abandoned septic field. Monitoring was required due to the potential presence of decaying raw sewage and subsequent hydrogen sulfide generation in the septic shaft located 19 ft. west of 50-BH2. Based on the age of the septic system, the presence of hydrogen sulfide was unlikely, but monitoring was necessary due to the high toxicity and potential explosive nature of hydrogen sulfide.

2.4 Radiological Safety

All drilling activities were conducted under a Radiological Work Permit (RWP) prepared by ESH-1 radiological support. The permit specified:

- Pre-job screening of all drilling and sampling equipment
- Radiological Worker II Training for field personnel
- Continuous RCT coverage (provided by ESH-1)
- Additional PPE including LANL issued leather gloves, Tyvek coveralls and booties
- Nasal swipes (at lunch and end of shift)
- Screening and release of all samples
- Post-job screening and release of all drilling and sampling equipment

2.5 Waste Management

The Waste Management Coordinator (WMC) for the project was Keith Tucker (SEA). Waste management operations at the site were coordinated with the FWO-WFM WMC. As applicable, the SAP and WGII-SOP-1.06, Rev 2 *Management of Environmental Restoration Project Waste* was followed for the generation, segregation, storage, and labeling of wastes generated during field activities.

The SAP (LANL 2001c) for the project served as the waste management plan. The potential waste forms and potential waste types generated during the investigation include cuttings (LLW, MLLW), decontamination liquids (LLW), and PPE (LLW, Non-hazardous – Non-radioactive). Final waste characterization and profiling was based on the analytical results from the soil and tuff samples. No waste characterization samples were specified in the SAP (LANL 2001c). Borehole cuttings samples were profiled directly from analytical samples from the associated boring. Liquids generated during decontamination were profiled based on the overall analytical results. PPE was profiled by dividing the maximum analytical result per analyte detected by 100. Waste characterization followed WGII-SOP-1.10, Rev 1 *Waste Characterization*, as applicable.

2.6 Analytical Chemistry

ASSAIGAI Analytical Laboratories, Inc. was contracted to conduct the analytical chemistry of all samples; ASSAIGAI Analytical Laboratories, Inc. is an approved DOE analytical laboratory, with detection limits that meet the requirements of the SAP (LANL 2001c). Full-suite analytical chemistry was requested for the samples per the methods outlined in the SAP (LANL 2001c). Included with the analytical chemistry, a Level IV QA/QC package was requested with the data package. The analytical suite included:

- VOCs
- SVOCs
- PCBs
- Pesticides
- TPH-DRO
- RCRA Metals TCLP
- RCRA Metals Total
- Gross Alpha, Gross Beta, and Gamma Spec
- Isotopic Plutonium, Uranium, and Strontium (Sr-90)

Upon receipt of the data, all detects were tabulated including laboratory flags that may disqualify detects. Field QA sample results were compared to results to identify detects that may be related to decontamination, cross-contamination, or sample contamination due to field conditions. Since some inorganic chemicals (metals) and radionuclides are naturally occurring and/or anthropogenically added through atmospheric nuclear testing, these data were compared to "LANL background and fallout values" using the procedures in table 2.6-1.

Table 2.6-1. SOPs followed for background comparisons.

SOP Number and Revision	SOP Title
SOP-15.12, Rev 0	Performing Background Value Comparisons for Inorganic Chemicals
SOP-15.13, Rev 0	Performing Background Value Comparisons for Radionuclides

2.7 Surveying

The locations of the borings were located with a Real-Time Kinematic survey using a Trimble 5700 series GPS system. This type of survey involves the use of two GPS receivers, which communicate via a radio link. The base receiver is stationed at a known point and sends its measured location to the rover receiver. With this information, the roving GPS unit differentially corrects its measured location. Resulting measurements can be accurate to within 2 cm. The base station for the survey was set up at LANL control point 50001, which is located just south of Pajarito Road where it intersects Pecos Drive. This was the best possible control point for the surveyed area, as it provided close to line-of-site signal with most of the drilling locations. The locations of the boreholes in the vicinity of TA-50-WM-83 and TA-50-248 were measured.

The coordinate system used is the US State Plane 1983: New Mexico Central 3002. The project datum is NAD 1983; the Geoid model used is GEOID99 (Conus); the units used are US Survey Feet.

The survey, data compilation, and figures were completed by Mark Wald-Hopkins of Science and Engineering Associates, Inc. in accordance with WGII-SOP-3.11, Rev 1 *Geodetic Surveys*.

3. RESULTS

3.1 Sample Locations

A total of 33 samples were submitted to ASSAIGAI Analytical Laboratories for analysis. The sample collection information (location, ID, media, etc.) is provided in table 3.1-1. Copies of the sample collection logs and chain of custody forms are provided in appendices A and B respectively.

Borehole 4 was completed at 23 ft bgs, short of the 25 ft target depth. Drilling problems resulted in a twisted core-barrel at 23 ft bgs, and the borehole could not be advanced further. However, the core barrel was recovered with its sample intact, and the 25 ft target sample was collected from 22 – 23 ft.

Table 3.1-1. Borehole sample ID and location.

Borehole ID	Sample ID	Sample Interval (ft)	Media	QA Type	Date	Time
50-BH1	50-BH1-3	3 – 5	FILL		12/15/01	0830
	50-BH1-3D	3 – 5	FILL	DUPLICATE	12/15/01	0830
	50-BH1-7	7 – 8	TUFF INTERFACE		12/15/01	0900
	50-BH1-25	24 – 25	TUFF		12/15/01	0940
50-BH2	50-BH2-3	3 – 4	FILL		12/15/01	1045
	50-BH2-7	6.5 – 7.5	TUFF INTERFACE		12/15/01	1100
	50-BH2-25	24 – 25	TUFF		12/15/01	1200
	50-BH2-70	70 - 71	TUFF		12/15/01	1420
	50-BH2-90	90-91.5	TUFF		12/15/01	1530
50-BH3	50-BH3-7	7 – 8	TUFF INTERFACE		12/14/01	1415
	50-BH3-11	11 – 12	TUFF		12/14/01	1440
	50-BH3-25	24 – 25	TUFF		12/14/01	1520
50-BH4	50-BH4-3	3 – 4	FILL		12/13/01	1210
	50-BH4-12	12.5 – 13.5	TUFF INTERFACE		12/13/01	1255
	50-BH4-23	22 – 23	TUFF		12/13/01	1700
	50-BH4-R	N/A	WATER	RINSATE	12/13/01	1550
50-BH5	50-BH5-RB	N/A	WATER	RINSATE	12/16/01	1130
	50-BH5-6	5.5 – 6.5	TUFF INTERFACE		12/16/01	1030
	50-BH5-10	9 – 10	TUFF		12/16/01	1040
	50-BH5-25	24 – 25	TUFF		12/16/01	1110
50-BH6	50-BH6-3	3 – 4	FILL		12/16/01	0815
	50-BH6-7	6.5 – 7.5	TUFF INTERFACE		12/16/01	0845
	50-BH6-25	24 – 25	TUFF		12/16/01	0925
50-BH7	50-BH7-4	4 – 5	FILL		12/14/01	0900
	50-BH7-10	8 – 10	TUFF INTERFACE		12/14/01	0930
	50-BH7-10D	8 – 10	TUFF INTERFACE	DUPLICATE	12/14/01	0930
	50-BH7-25	24 – 25	TUFF		12/14/01	1100
50-BH8	50-BH8-2	1 – 2	TUFF INTERFACE		12/16/01	1245
	50-BH8-9	9 – 10	TUFF		12/16/01	1300
	50-BH8-25	24 – 25	TUFF		12/16/01	1340
N/A	50-SB	N/A	SAND	SOIL TRIP BLANK	12/16/01	1000
N/A	0112289-32A[1]	N/A	WATER	VOA TRIP BLANK	N/A	N/A
N/A	0112289-33A[1]	N/A	WATER	VOA TRIP BLANK	N/A	N/A

[1] VOA Trip Blank prepared and sent by analytical laboratory

3.2 Borehole Locations

The GPS survey of the borehole locations was conducted on December 20, 2001. Table 3.2-1 provides the survey coordinates (northing, easting, and elevation) of ten locations. The units are in feet. Eight of the ten locations surveyed are the borehole location (50-BH1 through 50-BH8); the ninth location is the original BH8 location that was abandoned due to the presence of concrete at 2 ft. below ground surface. The concrete is believed to be encasing abandoned oil-lines for the former solar array at MDA C. The tenth location (CP 50001) is the control point used in the survey.

The coordinate system used is the US State Plane 1983: New Mexico Central 3002. The project datum is NAD 1983; the Geoid model is GEOID99 (Conus); and the units are in US Survey Feet. Figure 3.2-1 shows the borehole locations in map view.

Table 3.2-1. Borehole survey coordinates.

Borehole ID	Northing (Ft)	Easting (Ft)	Elevation (Ft)
50-BH1	1768973.53	1626334.02	7172.13
50-BH2	1768920.40	1626331.79	7171.28
50-BH3	1768856.13	1626329.29	7168.78
50-BH4	1768873.98	1626279.36	7174.61
50-BH5	1768924.28	1626270.39	7175.50
50-BH6	1768978.79	1626297.40	7175.50
50-BH7	1768905.68	1626297.12	7175.54
50-BH8	1768896.66	1626147.02	7177.05
Station 9[a]	1768905.39	1626146.98	7177.45
CP 50001	1768420.43	1625421.60	7214.49

[a] Station 9 is the location of the abandoned BH8 location due to subsurface concrete cased lines

The roving receiver maintained radio link with the base station, and adequate satellite coverage during most of the survey. The exceptions to this occurred at stations 5 (50-BH5) and 6 (50-BH6). At 50-BH5, radio link with the base station was not a problem, however, obstruction from building 50-WM-83 prevented coverage from several satellites. This results in position resolution that is less precise than that possible with full satellite coverage. The two measurements taken at this station were within 14 inches of one another, indicating reasonable accuracy. Additional measurements using a tape measure and the corners and walls of 50-WM-83 support the validity of this statement.

Radio link with the base station at 50-BH6 was lost due to signal obstruction from 50-WM-83. Measurements independent of the base station were taken to determine the approximate location of this borehole. Additional measurements using a tape measure, the corners and walls of WM-83, and the location of station 1 (50-BH1) was used to determine more reliable coordinates for 50-BH6.

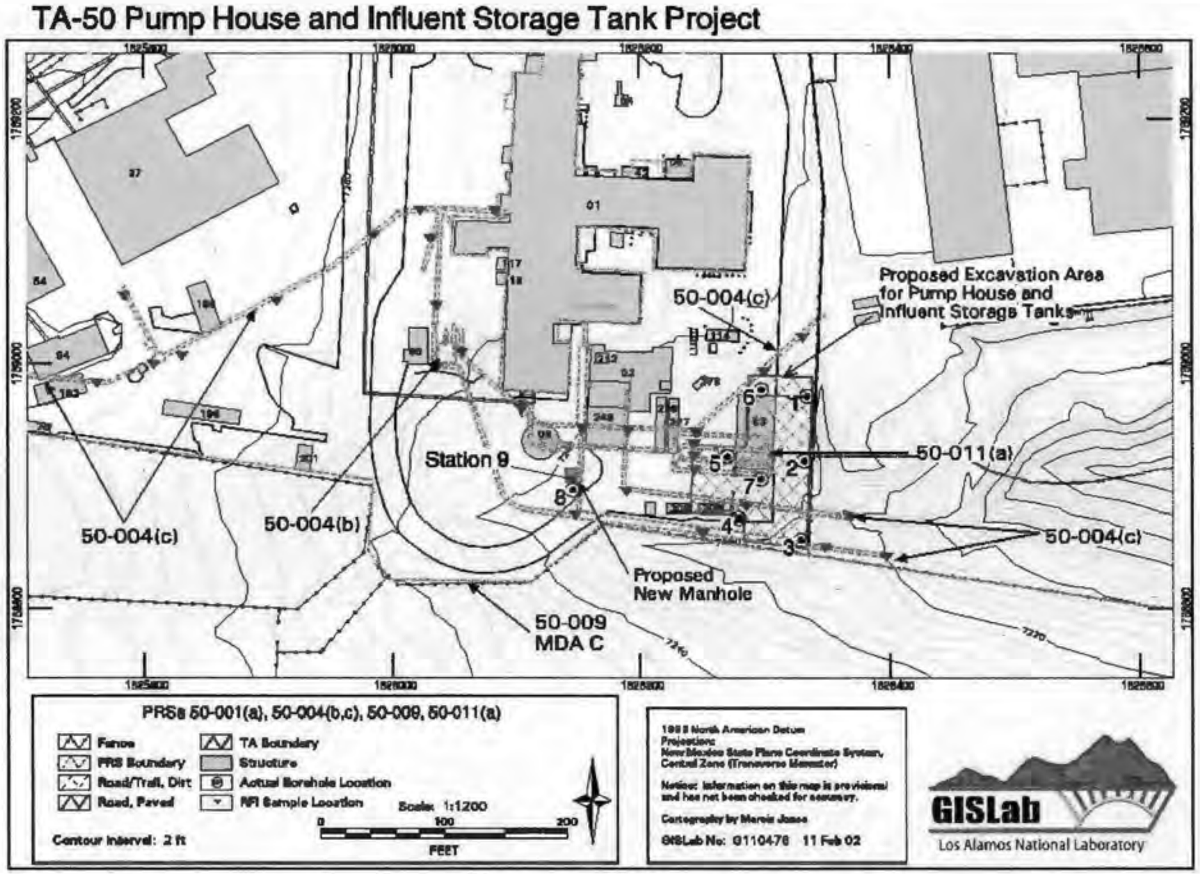

Figure 3.2-1. Borehole locations.

3.3 Health and Safety Monitoring

All drilling and sampling activities were completed with zero injuries and illnesses and zero security or environmental incidents. This can be attributed to the strong working relationship between TA-50 Facility personnel and the HNR - WGII/PMC/SEA Team.

Noise monitoring conducted at and around the drill rig indicated that levels were below action levels requiring worker participation in a hearing conservation program. All field personnel wore hearing protection in the form of earplugs during rig operation.

Air monitoring was conducted every five feet at 50-BH2 with a MSA Model 361 Hydrogen Sulfide, Combustible Gas and Oxygen meter, with the sample probe placed approximately 1-2 ft. down the open augers and near the surface of the cuttings. Monitoring results from 0-91.5 ft. BGS were 0 parts-per-million (ppm) H_2S and 0% of the lower explosive limit (LEL) during 17 separate monitoring events.

ESH-5 inspections of the field site and drilling equipment resulted in no findings.

3.4 Radiological Monitoring

Radiological monitoring included field screening of equipment, personnel, cuttings, core and samples, large area swipes of equipment and sample containers, and daily nasal swipes from workers inside the exclusion zone. All equipment was screened for contamination prior to, during, and after field activities. No detectable activity was found during any of the monitoring. All equipment was released from the facility free of contamination.

The Radiological Work Permit (RWP) required booties to be worn in the exclusion zone. The RWP was revised to remove this requirement, as site field screening data indicated no radiological contamination. This revision was implemented due to the slip hazard of wearing booties on the uneven and snow covered ground found at some of the borehole locations.

3.5 Waste Management

Waste generated during field activities included cuttings, decontamination fluids, PPE, and miscellaneous disposable sampling equipment. Waste cuttings were generated when excess cuttings existed after backfilling the boring. These cuttings were bagged and segregated per borehole. Individually labeled bags of cuttings were placed into 55-gallon open top steel drums for storage and disposal. Decontamination fluids were generated during the decontamination of sample barrels, sample scoops, and sample bowls. Alconox, Fantastik, and deionized water were used. These fluids were placed in a closed-top, steel 55-gallon drum for storage and disposal. PPE, and miscellaneous sampling debris were bagged. Wastes were labeled and stored in an existing waste storage area just north of the field site (figure 3.5-1). Two 55-gallon drums of cuttings, 1 55-gallon drum of decontamination fluid, and 1 55-gallon drum of PPE and associated sampling debris were generated. The drum of decontamination fluid was less than half full.

Figure 3.5-1. Waste storage area, north of WM-83.

Waste characterization is based on the analytical data. Analytical data shows radiological constituents at low levels above background values. All other analytes were either not detected or found at very low values below regulatory limits. The waste is characterized as solid (PPE and cuttings) and liquid (decontamination fluid) low-level radioactive waste (LLW). The solid LLW meets TA-54 Area G WAC, and is acceptable for disposal at that location. The liquid LLW meets TA-50 RLWTF WAC, and is acceptable for disposal at that facility.

3.6 Geology

The subsurface geology was logged at each borehole from recovered core, geotechnical drive samples, and from cuttings when core samples were not recovered. Table 3.6-1 summarizes the geology encountered at each borehole. Appendix C provides the geologic log for each borehole.

Soil and/or fill material was encountered at all boreholes that ranged in thickness from one to 10 feet. Soils encountered were very thin rooted zones (A-horizons) developing on fill material. Native soils developing on tuff were not encountered. Fill materials were comprised of dacite gravels, clay, sand, and crushed tuff, and ranged from dry to moist. The fill encountered beneath the asphalt surface around WM-83 was comprised of clay rich crushed tuff. Reddish-brown devitrified clay pipe or tile fragments were encountered (figure 3.6-1). Fill at 50-BH8 was dacite gravel. Fill at the off-asphalt locations was primarily crushed tuff.

Figure 3.6-1. Vitrified clay pipe or tile found in fill.

The soil/fill - tuff interface was encountered between 1 and 10 feet. At borehole 50-BH8, the tuff interface was encountered at 1 ft. bgs. Around WM-83 the tuff interface ranged from 5.5 to 10 ft. below ground surface (figure 3.6-2). Tuff at the interface ranged from fresh to very weathered (figure 3.6-3). Weathering was characterized by disruption due to soil development, clay alteration of tuff and pumice, clay and fill infillings in fractures, root traces, and oxidation (reddening). The depth of visual identification of weathering ranged from less than a foot to nearly 4 ft.

Figure 3.6-2. Tuff interface – note contact of fill with tuff above rock hammer handle.

Figure 3.6-3. Clay-rich weathered tuff transitioning to fresh tuff.

Tuff below the weathered zone to a depth of 70.5 ft. was identified as Unit 3 of the Tshirege Member of the Bandelier Tuff. In general the tuff is poorly to moderately welded, pink-purple to brown, with ~5% devitrified pumice, and 10 – 15% sanidine phenocrysts. The pumice appear round to slightly flattened, are up to 3 cm, have a sugary texture, and are yellow-white in color. Fractures were uncommon, and when encountered were near vertical and clay filled. Fracture density could not be determined at the scale of the investigation; it exceeds the diameter of the borehole. Borehole 50-BH2 was advanced to 91.5 ft. below ground surface. At 70.5 ft., a prominent color change was identified. Above 70.5 ft., the tuff is pink-purple to brown and below, the tuff is a mottled gray with reddish brown. Also, below 70.5 ft., the tuff is predominantly poorly welded, and the tuff above is more moderately welded. This depth coincides with the contact with Unit 2 of the Tshirege Member, as identified at adjacent borings at MDA C. Unit 2, poorly welded tuff was encountered to a depth of 91.5 ft.

Table 3.6-1. Borehole Geology Summary

Borehole ID	Depth Interval (ft)	Media	Geologic Unit
50-BH1	0 – 7	Soil and Fill	
	7	Tuff Interface	Qbt3[a]
	7 – 25	Tuff	Qbt3
50-BH2	0 – 6.5	Soil and Fill	
	6.5	Tuff Interface	Qbt3
	6.5 - 10	Weathered Tuff	Qbt3
	10 – 70.5	Tuff	Qbt3
	70.5 – 91.5	Tuff	Qbt2[b]
50-BH3	0 – 5.5	Fill	
	5.5	Tuff Interface	Qbt3
	5.5 – 8.5	Weathered Tuff	Qbt3
	8.5 – 25	Tuff	Qbt3
50-BH4	0 – 10	Fill	
	10	Tuff Interface	Qbt3
	10 – 23	Tuff	Qbt3
50-BH5	0 – 5.5	Fill	
	5.5	Tuff Interface	Qbt3
	5.5 – 7	Weathered Tuff	Qbt3
	7 – 25	Tuff	Qbt3
50-BH6	0 – 6.5	Fill	
	6.5	Tuff Interface	Qbt3
	6.5 – 25	Tuff	Qbt3
50-BH7	0 – 8	Fill	
	8	Tuff Interface	Qbt3
	8 – 25	Tuff	Qbt3
50-BH8	0 – 1	Fill	
	1	Tuff Interface	Qbt3
	1 – 25	Tuff	Qbt3

[a] Qbt3 = Unit 3 of the Tshirege Member of the Bandelier Tuff
[b] Qbt2 = Unit 2 of the Tshirege Member of the Bandelier Tuff

3.7 Analytical Chemistry

3.7.1 Analytical Results

The tables provided in the following sections show only the detected analytes within each suite specified by the SAP. The results for the entire analytical suite including the Level IV QA/QC package are provided in appendix D.

3.7.1.1 Total Petroleum Hydrocarbons - Diesel Range Organics

Diesel Range Organics were not detected.

3.7.1.2 Pesticides

Table 3.7.1.2-1. Pesticides Analysis Results

Borehole	Depth (ft)	Sample ID	Analyte	Result (mg/kg)	Detection Limit (mg/kg)
50-BH6	6.5 – 7.5	50-BH6-7	p,p-DDT	0.03	0.01

3.7.1.3 RCRA Metals TCLP

Table 3.7.1.3-1. RCRA Metals TCLP Analysis Results

Borehole	Depth (ft)	Sample ID	Analyte	Result (mg/L)	Detection Limit (mg/L)	Flag[a]
50-BH1	3 - 5	50-BH1-3	Barium	0.4	0.1	
50-BH1	3 - 5	50-BH1-3	Lead	0.08	0.05	B
50-BH1	3 - 5	50-BH1-3D	Barium	0.5	0.1	
50-BH1	3 - 5	50-BH1-3D	Lead	0.07	0.05	B
50-BH1	7 - 8	50-BH1-7	Barium	0.2	0.1	
50-BH1	7 - 8	50-BH1-7	Lead	0.10	0.05	B
50-BH1	24 - 25	50-BH1-25	Barium	0.1	0.1	
50-BH1	24 - 25	50-BH1-25	Lead	0.09	0.05	B
50-BH2	3 - 4	50-BH2-3	Barium	0.6	0.1	
50-BH2	3 - 4	50-BH2-3	Lead	0.12	0.05	B
50-BH2	6.5 – 7.5	50-BH2-7	Barium	0.3	0.1	
50-BH2	24 - 25	50-BH2-25	Lead	0.13	0.05	B
50-BH2	70 – 71	50-BH2-70	Barium	0.2	0.1	
50-BH2	70 – 71	50-BH2-70	Lead	0.08	0.05	B
50-BH2	90 – 91.5	50-BH2-90	Barium	0.2	0.1	
50-BH2	90 – 91.5	50-BH2-90	Lead	0.06	0.05	B
50-BH3	7 - 8	50-BH3-7	Barium	0.4	0.1	
50-BH3	7 - 8	50-BH3-7	Lead	0.09	0.05	B
50-BH3	11 - 12	50-BH3-11	Barium	0.1	0.1	
50-BH3	11 - 12	50-BH3-11	Lead	0.09	0.05	B
50-BH3	24 - 25	50-BH3-25	Barium	0.1	0.1	
50-BH4	3 - 4	50-BH4-3	Barium	1.2	0.1	
50-BH4	3 - 4	50-BH4-3	Lead	0.13	0.05	B
50-BH4	12.5 – 13.5	50-BH4-12	Barium	0.2	0.1	
50-BH4	12.5 – 13.5	50-BH4-12	Lead	0.10	0.05	B
50-BH4	22 - 23	50-BH4-23	Barium	0.2	0.1	
50-BH5	5.5-6.5	50-BH5-6	Barium	0.6	0.1	
50-BH5	5.5-6.5	50-BH5-6	Chromium	0.02	0.02	
50-BH5	5.5-6.5	50-BH5-6	Lead	0.10	0.05	B
50-BH5	9 - 10	50-BH5-10	Barium	0.3	0.1	

Table 3.7.1.3-1. RCRA Metals TCLP Analysis Results (continued)

Borehole	Depth (ft)	Sample ID	Analyte	Result (mg/L)	Detection Limit (mg/L)	Flag[a]
50-BH5	9 – 10	50-BH5-10	Lead	0.08	0.05	B
50-BH5	24 – 25	50-BH5-25	Barium	0.4	0.1	
50-BH5	24 - 25	50-BH5-25	Lead	0.10	0.05	B
50-BH6	3 – 4	50-BH6-3	Barium	0.5	0.1	
50-BH6	3 - 4	50-BH6-3	Lead	0.06	0.05	B
50-BH6	6.5 – 7.5	50-BH6-7	Barium	0.2	0.1	
50-BH6	6.5 – 7.5	50-BH6-7	Chromium	0.02	0.02	B
50-BH6	6.5 – 7.5	50-BH6-7	Lead	0.14	0.05	B
50-BH6	24 - 25	50-BH6-25	Barium	0.1	0.1	
50-BH6	24 - 25	50-BH6-25	Lead	0.08	0.05	B
50-BH7	4 - 5	50-BH7-4	Barium	1.0	0.1	
50-BH7	4 - 5	50-BH7-4	Lead	0.12	0.05	B
50-BH7	8 - 10	50-BH7-10	Barium	0.2	0.1	
50-BH7	8 - 10	50-BH7-10	Lead	0.10	0.05	B
50-BH7	8 - 10	50-BH7-10D	Barium	0.2	0.1	
50-BH7	8 - 10	50-BH7-10D	Lead	0.10	0.05	B
50-BH7	24 - 25	50-BH7-25	Barium	0.2	0.1	
50-BH7	24 - 25	50-BH7-25	Lead	0.06	0.05	B
50-BH8	1 - 2	50-BH8-2	Barium	0.5	0.1	
50-BH8	1 - 2	50-BH8-2	Lead	0.10	0.05	B
50-BH8	9 – 10	50-BH8-9	Barium	0.2	0.1	
50-BH8	9 - 10	50-BH8-9	Lead	0.14	0.05	B
50-BH8	24 – 25	50-BH8-25	Barium	0.1	0.1	
50-BH8	24 - 25	50-BH8-25	Lead	0.07	0.05	B

[a] B = detected in method blank

3.7.1.4 RCRA Metals Total

Table 3.7.1.4-1. RCRA Metals Total Analysis Results

Borehole	Depth (ft)	Sample ID	Analyte	Result (mg/kg)	Detection Limit (mg/kg)	Flag[a]
50-BH1	3 - 5	50-BH1-3	Barium	90.1	0.5	
50-BH1	3 - 5	50-BH1-3	Chromium	6.5	1	
50-BH1	3 - 5	50-BH1-3	Lead	6.6	2	
50-BH1	3 - 5	50-BH1-3D	Barium	102	0.5	
50-BH1	3 - 5	50-BH1-3D	Chromium	4.9	1	
50-BH1	7 - 8	50-BH1-7	Barium	20.7	0.5	
50-BH1	7 - 8	50-BH1-7	Lead	3.7	2	
50-BH1	24 - 25	50-BH1-25	Barium	12.7	0.5	
50-BH1	24 - 25	50-BH1-25	Lead	12.7	2	
50-BH2	3 - 4	50-BH2-3	Barium	102	0.5	
50-BH2	3 - 4	50-BH2-3	Chromium	4.7	1	
50-BH2	3 - 4	50-BH2-3	Lead	9.8	2	
50-BH2	6.5 – 7.5	50-BH2-7	Barium	29.1	0.5	
50-BH2	6.5 – 7.5	50-BH2-7	Chromium	4.6	1	
50-BH2	6.5 – 7.5	50-BH2-7	Lead	13.2	2	
50-BH2	24 - 25	50-BH2-25	Barium	7.6	0.5	
50-BH2	24 - 25	50-BH2-25	Lead	14.3	2	
50-BH2	70 – 71	50-BH2-70	Barium	11.0	0.5	
50-BH2	70 – 71	50-BH2-70	Chromium	8.2	1	
50-BH2	70 – 71	50-BH2-70	Lead	20.7	2	
50-BH2	90 – 91.5	50-BH2-90	Barium	11.6	0.5	
50-BH2	90 – 91.5	50-BH2-90	Chromium	5.3	1	
50-BH2	90 – 91.5	50-BH2-90	Lead	5.0	2	
50-BH3	7 - 8	50-BH3-7	Barium	32.9	0.5	
50-BH3	7 - 8	50-BH3-7	Chromium	7.1	1	
50-BH3	7 - 8	50-BH3-7	Lead	9.6	2	
50-BH3	11 - 12	50-BH3-11	Barium	7.6	0.5	
50-BH3	11 - 12	50-BH3-11	Chromium	2.9	1	
50-BH3	11 - 12	50-BH3-11	Lead	4.6	2	
50-BH3	24 - 25	50-BH3-25	Barium	14.0	0.5	
50-BH3	24 - 25	50-BH3-25	Lead	6.4	2	
50-BH4	3 - 4	50-BH4-3	Barium	91.0	0.5	
50-BH4	3 - 4	50-BH4-3	Chromium	8.7	1	
50-BH4	3 - 4	50-BH4-3	Lead	10.6	2	
50-BH4	3 - 4	50-BH4-3	Mercury	0.09	0.05	
50-BH4	12.5 – 13.5	50-BH4-12	Barium	19.4	0.5	
50-BH4	12.5 – 13.5	50-BH4-12	Chromium	9.0	1	

Table 3.7.1.4-1. RCRA Metals Total Analysis Results (continued)

Borehole	Depth (ft)	Sample ID	Analyte	Result (mg/kg)	Detection Limit (mg/kg)	Flag[a]
50-BH4	12.5 – 13.5	50-BH4-12	Lead	4.4	2	
50-BH4	22 - 23	50-BH4-23	Barium	15.1	0.5	
50-BH4	22 - 23	50-BH4-23	Chromium	1.5	1	
50-BH4	22 - 23	50-BH4-23	Lead	8.3	2	
50-BH5	5.5 - 6.5	50-BH5-6	Barium	43.5	0.5	
50-BH5	5.5 - 6.5	50-BH5-6	Chromium	4.4	1	
50-BH5	5.5 - 6.5	50-BH5-6	Lead	9.3	2	
50-BH5	9 - 10	50-BH5-10	Arsenic	2.8	3	
50-BH5	9 - 10	50-BH5-10	Barium	12.8	0.5	
50-BH5	9 - 10	50-BH5-10	Cadmium	0.21	0.2	
50-BH5	9 – 10	50-BH5-10	Lead	5.8	2	
50-BH5	24 – 25	50-BH5-25	Barium	89.7	0.5	
50-BH5	24 - 25	50-BH5-25	Lead	7.5	2	
50-BH6	3 – 4	50-BH6-3	Arsenic	2.9	3	
50-BH6	3 – 4	50-BH6-3	Barium	41.9	0.5	
50-BH6	3 – 4	50-BH6-3	Chromium	1.8	1	
50-BH6	3 - 4	50-BH6-3	Lead	8.7	2	B
50-BH6	6.5 – 7.5	50-BH6-7	Barium	19.3	0.5	
50-BH6	6.5 – 7.5	50-BH6-7	Chromium	141	1	
50-BH6	6.5 – 7.5	50-BH6-7	Lead	7.2	2	
50-BH6	24 - 25	50-BH6-25	Barium	14.1	0.5	
50-BH6	24 - 25	50-BH6-25	Lead	3.6	2	
50-BH7	4 - 5	50-BH7-4	Arsenic	5	3	
50-BH7	4 - 5	50-BH7-4	Barium	92.1	0.5	
50-BH7	4 - 5	50-BH7-4	Chromium	3.1	1	
50-BH7	4 - 5	50-BH7-4	Lead	7.2	2	
50-BH7	8 - 10	50-BH7-10	Barium	12.5	0.5	
50-BH7	8 - 10	50-BH7-10	Lead	10.7	2	
50-BH7	8 - 10	50-BH7-10D	Barium	14.8	0.5	
50-BH7	8 - 10	50-BH7-10D	Lead	7.6	2	
50-BH7	24 - 25	50-BH7-25	Barium	12.6	0.5	
50-BH7	24 - 25	50-BH7-25	Lead	8.3	2	
50-BH8	1 - 2	50-BH8-2	Barium	57.6	0.5	
50-BH8	1 - 2	50-BH8-2	Chromium	2.4	1	
50-BH8	1 - 2	50-BH8-2	Lead	9.7	2	
50-BH8	9 – 10	50-BH8-9	Barium	18.6	0.5	
50-BH8	9 – 10	50-BH8-9	Chromium	1.0	1	
50-BH8	9 - 10	50-BH8-9	Lead	9.3	2	B
50-BH8	24 – 25	50-BH8-25	Barium	12.5	0.5	

Table 3.7.1.4-1. RCRA Metals Total Analysis Results (continued)

Borehole	**Depth (ft)**	**Sample ID**	**Analyte**	**Result (mg/kg)**	**Detection Limit (mg/kg)**	**Flag**[a]
50-BH8	24 – 25	50-BH8-25	Chromium	4.6	1	
50-BH8	24 - 25	50-BH8-25	Lead	10.4	2	B

[a] B = detected in method blank

3.7.1.5 PCB

Table 3.7.1.5-1. PCB Analysis Results

Borehole	**Depth (ft)**	**Sample ID**	**Analyte**	**Result (mg/kg)**	**Detection Limit (mg/kg)**	**Flag**[a]
50-BH4	3 - 4	50-BH4-3	Aroclor 1260	0.25	0.05	2
50-BH6	3 - 4	50-BH6-3	Aroclor 1260	0.35	0.05	
50-BH6	6.5 – 7.5	50-BH6-7	Aroclor 1260	0.18	0.05	
50-BH7	4 – 5	50-BH7-4	Aroclor 1260	0.09	0.05	
50-BH8	1 – 2	50-BH8-2	Aroclor 1260	0.082	0.05	2

[a] 2 = Matrix spike and matrix duplicate did not meet QA/QC criteria due to matrix interference.

3.7.1.6 VOC

Table 3.7.1.6-1. VOC Analysis Results

Borehole	**Depth (ft)**	**Sample ID**	**Analyte**	**Result (mg/L)**	**Detection Limit (mg/L)**
50-BH4	N/A	50-BH4-R	Chloroform	0.003	.001

3.7.1.7 SVOC

Table 3.7.1.7-1. SVOC Analysis Results

Borehole	Depth (ft)	Sample ID	Analyte	Result (mg/kg)	Detection Limit (mg/kg)	Flag[a]
50-BH8	1 – 2	50-BH8-2	1-Methylnaphthalene	0.049	0.03	
50-BH8	1 – 2	50-BH8-2	2-Methylnaphthalene	0.051	0.03	
50-BH8	1 – 2	50-BH8-2	Acenaphthene	0.48	0.03	
50-BH8	1 – 2	50-BH8-2	Acenaphthylene	0.053	0.03	
50-BH8	1 – 2	50-BH8-2	Anthracene	1.3	0.03	
50-BH8	1 – 2	50-BH8-2	Benzo(a)anthrcene	3.2	0.03	
50-BH8	1 – 2	50-BH8-2	Benzo(a)pyrene	2.7	0.03	
50-BH8	1 – 2	50-BH8-2	Benzo(b&k)fluoranthene	4.3	0.03	
50-BH8	1 – 2	50-BH8-2	Benzo(g,h,i)peylene	2.0	0.3	
50-BH8	1 – 2	50-BH8-2	Chrysene	2.7	0.03	
50-BH8	1 – 2	50-BH8-2	Dibenzofuran	0.20	0.03	
50-BH8	1 – 2	50-BH8-2	Fluoranthene	7.4	0.03	
50-BH8	1 – 2	50-BH8-2	Fluorene	0.40	0.03	
50-BH8	1 – 2	50-BH8-2	Indeno(1,2,3-cd)pyrene	1.7	0.3	
50-BH8	1 – 2	50-BH8-2	Naphthalene	0.13	0.03	
50-BH8	1 – 2	50-BH8-2	Phenathrene	5.0	0.03	
50-BH8	1 – 2	50-BH8-2	Pyrene	6.7	0.03	

3.7.1.8 Radiological Constituents

Table 3.7.1.8-1 presents the detections from the gross alpha, gross beta, and gamma spectroscopy analysis. Table 3.7.1.8-2 provides the detections from the isotopic radiological analyses.

Table 3.7.1.8-1. Gross Alpha, Gross Beta, and Gamma Spectroscopy Detections

Sample ID	Analysis[a]	Activity	Error	MDA	Units	Media
50-BH1-3	G.Alpha	11.47	1.41	2.44	pCi/gm	Soil
50-BH1-3	G.Beta	37.11	1.76	3.07	pCi/gm	Soil
50-BH1-3	Ra-228	1.22	0.04	0.01	pCi/gm	Soil
50-BH1-3	Pb-210	1.82	0.24	0.13	pCi/gm	Soil
50-BH1-3	Cs-137	0.04	0.01	0.004	pCi/gm	Soil
50-BH1-3	Am-241	**0.1**	0.02	0.01	pCi/gm	Soil
50-BH1-3	Mn-54	0.02	0.007	0.004	pCi/gm	Soil
50-BH1-3	Cd-109	0.31	0.2	0.12	pCi/gm	Soil
50-BH1-3D	G.Alpha	18.2	1.76	2.69	pCi/gm	Soil
50-BH1-3D	G.Beta	55.06	2.16	3.38	pCi/gm	Soil
50-BH1-3D	Ra-228	1.33	0.03	0.02	pCi/gm	Soil
50-BH1-3D	Pb-210	1.76	0.12	0.13	pCi/gm	Soil
50-BH1-3D	Cs-137	0.04	0.004	0.004	pCi/gm	Soil
50-BH1-3D	Am-241	0.02	0.02	0.02	pCi/gm	Soil
50-BH1-3D	Cs-134	0.06	0.005	0.06	pCi/gm	Soil
50-BH1-3D	Mn-54	0.02	0.005	0.006	pCi/gm	Soil
50-BH1-7	G.Alpha	10.11	1.5	2.78	pCi/gm	Tuff
50-BH1-7	G.Beta	60.68	2.14	3.17	pCi/gm	Tuff
50-BH1-7	Ra-228	1.12	0.03	0.02	pCi/gm	Tuff
50-BH1-7	Pb-210	1.32	0.11	0.12	pCi/gm	Tuff
50-BH1-7	Cd-109	0.25	0.1	0.1	pCi/gm	Tuff
50-BH1-25	G.Alpha	10.03	1.44	0.263	pCi/gm	Tuff
50-BH1-25	G.Beta	51.77	2.03	3.22	pCi/gm	Tuff
50-BH1-25	Ra-228	1.16	0.06	0.02	pCi/gm	Tuff
50-BH1-25	Pb-210	1.56	0.2	0.11	pCi/gm	Tuff
50-BH1-25	Mn-54	0.01	0.007	0.004	pCi/gm	Tuff
50-BH1-25	Ce-141	0.006	0.009	0.005	pCi/gm	Tuff
50-BH2-3	G.Alpha	16.93	1.75	2.83	pCi/gm	Soil
50-BH2-3	G.Beta	46.29	1.98	3.15	pCi/gm	Soil
50-BH2-3	Ra-228	1.3	0.02	0.02	pCi/gm	Soil
50-BH2-3	Pb-210	1.42	0.11	0.12	pCi/gm	Soil
50-BH2-3	Cs-137	0.02	0.06	0.007	pCi/gm	Soil
50-BH2-3	Cd-109	0.16	0.09	0.11	pCi/gm	Soil
50-BH2-7	G.Alpha	20.64	1.9	2.8	pCi/gm	Tuff
50-BH2-7	G.Beta	68.64	2.36	3.5	pCi/gm	Tuff
50-BH2-7	Ra-228	1.29	0.03	0.02	pCi/gm	Tuff
50-BH2-7	Pb-210	1.85	0.13	0.14	pCi/gm	Tuff
50-BH2-7	Cs-137	0.04	0.007	0.005	pCi/gm	Tuff
50-BH2-7	Am-241	**0.05**	0.01	0.01	pCi/gm	Tuff

Table 3.7.1.8-1. Gross Alpha, Gross Beta, and Gamma Spectroscopy Detections (continued)

Sample ID	Analysis	Activity	Error	MDA	Units	Media
50-BH2-7	Cs-134	0.06	0.006	0.06	pCi/gm	Tuff
50-BH2-7	Mn-54	0.02	0.005	0.006	pCi/gm	Tuff
50-BH2-25	G.Alpha	14.39	1.62	2.63	pCi/gm	Tuff
50-BH2-25	G.Beta	61.35	2.22	3.35	pCi/gm	Tuff
50-BH2-25	Ra-228	1.22	0.01	0.009	pCi/gm	Tuff
50-BH2-25	Pb-210	1.51	0.07	0.07	pCi/gm	Tuff
50-BH2-25	Be-7	0.02	0.02	0.02	pCi/gm	Tuff
50-BH2-25	Mn-54	0.008	0.002	0.002	pCi/gm	Tuff
50-BH2-25	Cd-109	0.25	0.05	0.06	pCi/gm	Tuff
50-BH2-70	G.Alpha	14.7	1.81	3.17	pCi/gm	Tuff
50-BH2-70	G.Beta	64.78	2.26	3.2	pCi/gm	Tuff
50-BH2-70	Ra-228	1.18	0.02	0.02	pCi/gm	Tuff
50-BH2-70	Pb-210	1.35	0.11	0.12	pCi/gm	Tuff
50-BH2-70	Mn-54	0.02	0.005	0.005	pCi/gm	Tuff
50-BH2-90	G.Alpha	23.54	1.97	2.53	pCi/gm	Tuff
50-BH2-90	G.Beta	63.88	2.15	2.91	pCi/gm	Tuff
50-BH2-90	Ra-228	1.39	0.03	0.02	pCi/gm	Tuff
50-BH2-90	Pb-210	1.98	0.13	0.14	pCi/gm	Tuff
50-BH2-90	Cs-134	0.06	0.005	0.06	pCi/gm	Tuff
50-BH2-90	Mn-54	0.03	0.005	0.004	pCi/gm	Tuff
50-BH3-7	G.Alpha	9.32	1.38	2.61	pCi/gm	Tuff
50-BH3-7	G.Beta	38.87	1.79	2.92	pCi/gm	Tuff
50-BH3-7	Ra-228	1.05	0.01	0.009	pCi/gm	Tuff
50-BH3-7	Pb-210	1.34	0.06	0.06	pCi/gm	Tuff
50-BH3-7	Cs-137	**0.21**	0.004	0.002	pCi/gm	Tuff
50-BH3-7	Cs-134	0.05	0.003	0.03	pCi/gm	Tuff
50-BH3-7	Zr-95	0.01	0.002	0.003	pCi/gm	Tuff
50-BH3-7	Cd-109	0.2	0.05	0.05	pCi/gm	Tuff
50-BH3-11	G.Alpha	13.74	1.74	3.19	pCi/gm	Tuff
50-BH3-11	G.Beta	64.81	2.14	2.85	pCi/gm	Tuff
50-BH3-11	Ra-228	1.15	0.02	0.02	pCi/gm	Tuff
50-BH3-11	Pb-210	1.53	0.12	0.12	pCi/gm	Tuff
50-BH3-11	Mn-54	0.01	0.006	0.006	pCi/gm	Tuff
50-BH3-11	Cd-109	0.17	0.09	0.11	pCi/gm	Tuff
50-BH3-25	G.Alpha	11.51	1.54	2.82	pCi/gm	Tuff
50-BH3-25	G.Beta	56.64	2.05	2.95	pCi/gm	Tuff
50-BH3-25	Ra-228	1.15	0.02	0.02	pCi/gm	Tuff
50-BH3-25	Pb-210	1.47	0.11	0.12	pCi/gm	Tuff
50-BH3-25	Mn-54	0.02	0.005	0.006	pCi/gm	Tuff

Table 3.7.1.8-1. Gross Alpha, Gross Beta, and Gamma Spectroscopy Detections (continued)

Sample ID	Analysis	Activity	Error	MDA	Units	Media
50-BH3-25	Cd-109	0.25	0.09	0.1	pCi/gm	Tuff
50-BH4-3	G.Alpha	10.93	1.47	2.69	pCi/gm	Soil
50-BH4-3	G.Beta	44.78	1.95	3.12	pCi/gm	Soil
50-BH4-3	Ra-228	1.06	0.01	0.008	pCi/gm	Soil
50-BH4-3	Pb-210	1.32	0.06	0.07	pCi/gm	Soil
50-BH4-3	Cs-137	0.05	0.004	0.002	pCi/gm	Soil
50-BH4-3	Cs-134	0.03	0.006	0.03	pCi/gm	Soil
50-BH4-3	Mn-54	0.01	0.002	0.002	pCi/gm	Soil
50-BH4-3	Cd-109	0.2	0.05	0.06	pCi/gm	Soil
50-BH4-12	G.Alpha	13.88	1.64	2.83	pCi/gm	Tuff
50-BH4-12	G.Beta	56.94	2.19	3.28	pCi/gm	Tuff
50-BH4-12	Ra-228	1.28	0.04	0.02	pCi/gm	Tuff
50-BH4-12	Pb-210	1.64	0.12	0.13	pCi/gm	Tuff
50-BH4-12	Zr-95	0.03	0.009	0.02	pCi/gm	Tuff
50-BH4-12	Cd-109	0.13	0.1	0.12	pCi/gm	Tuff
50-BH4-23	G.Alpha	14.6	1.68	2.85	pCi/gm	Tuff
50-BH4-23	G.Beta	54.37	2.1	3.16	pCi/gm	Tuff
50-BH4-23	Ra-228	1.14	0.01	0.009	pCi/gm	Tuff
50-BH4-23	Pb-210	1.38	0.06	0.07	pCi/gm	Tuff
50-BH4-23	Am-241	0.009	0.008	0.009	pCi/gm	Tuff
50-BH4-23	Cs-134	0.05	0.03	0.03	pCi/gm	Tuff
50-BH4-23	Mn-54	0.02	0.002	0.002	pCi/gm	Tuff
50-BH4-23	Cd-109	0.3	0.05	0.06	pCi/gm	Tuff
50-BH5-6	G.Alpha	13.43	1.57	2.69	pCi/gm	Tuff
50-BH5-6	G.Beta	54.83	2.03	2.98	pCi/gm	Tuff
50-BH5-6	Ra-228	1.2	0.03	0.01	pCi/gm	Tuff
50-BH5-6	Pb-210	1.23	0.11	0.12	pCi/gm	Tuff
50-BH5-6	Mn-54	0.02	0.05	0.006	pCi/gm	Tuff
50-BH5-6	Cd-109	0.31	0.09	0.1	pCi/gm	Tuff
50-BH5-10	G.Alpha	16.93	1.67	2.39	pCi/gm	Tuff
50-BH5-10	G.Beta	61.55	2.04	2.74	pCi/gm	Tuff
50-BH5-10	Ra-228	1.18	0.06	0.02	pCi/gm	Tuff
50-BH5-10	Pb-210	1.46	0.23	0.12	pCi/gm	Tuff
50-BH5-10	Co-60	0.02	0.008	0.006	pCi/gm	Tuff
50-BH5-10	Am-241	0.02	0.02	0.01	pCi/gm	Tuff
50-BH5-10	Be-7	0.06	0.07	0.03	pCi/gm	Tuff
50-BH5-10	Mn-54	0.01	0.008	0.005	pCi/gm	Tuff

Table 3.7.1.8-1. Gross Alpha, Gross Beta, and Gamma Spectroscopy Detections (continued)

Sample ID	Analysis	Activity	Error	MDA	Units	Media
50-BH5-10	Cd-109	0.66	0.18	0.1	pCi/gm	Tuff
50-BH5-25	G.Alpha	13.7	1.58	2.66	pCi/gm	Tuff
50-BH5-25	G.Beta	58.79	2.1	2.98	pCi/gm	Tuff
50-BH5-25	Ra-228	1.1	0.01	0.01	pCi/gm	Tuff
50-BH5-25	Pb-210	1.37	0.06	0.06	pCi/gm	Tuff
50-BH5-25	Zr-95	0.08	0.003	0.003	pCi/gm	Tuff
50-BH5-25	Ce-141	0.003	0.003	0.003	pCi/gm	Tuff
50-BH5-25	Cd-109	0.31	0.05	0.06	pCi/gm	Tuff
50-BH6-3	G.Alpha	9.98	1.46	2.85	pCi/gm	Soil
50-BH6-3	G.Beta	52.75	2.01	2.95	pCi/gm	Soil
50-BH6-3	Ra-228	1.21	0.02	0.01	pCi/gm	Soil
50-BH6-3	Pb-210	1.35	0.1	0.11	pCi/gm	Soil
50-BH6-3	Cs-137	0.02	0.005	0.006	pCi/gm	Soil
50-BH6-3	Cs-134	0.06	0.006	0.06	pCi/gm	Soil
50-BH6-3	Zr-95	0.3	0.008	0.009	pCi/gm	Soil
50-BH6-3	Cd-109	0.17	0.09	0.1	pCi/gm	Soil
50-BH6-7	G.Alpha	16.75	1.78	2.9	pCi/gm	Tuff
50-BH6-7	G.Beta	57.73	2.04	2.91	pCi/gm	Tuff
50-BH6-7	Ra-228	1.16	0.02	0.02	pCi/gm	Tuff
50-BH6-7	Pb-210	1.36	0.11	0.12	pCi/gm	Tuff
50-BH6-7	Cs-137	0.02	0.004	0.004	pCi/gm	Tuff
50-BH6-7	Zr-95	0.02	0.009	0.01	pCi/gm	Tuff
50-BH6-7	Cd-109	0.33	0.1	0.11	pCi/gm	Tuff
50-BH6-25	G.Alpha	9.82	1.48	2.93	pCi/gm	Tuff
50-BH6-25	G.Beta	51.64	2.04	3.03	pCi/gm	Tuff
50-BH6-25	Ra-228	1.19	0.01	0.01	pCi/gm	Tuff
50-BH6-25	Cs-134	0.06	0.003	0.02	pCi/gm	Tuff
50-BH6-25	Mn-54	0.006	0.002	0.002	pCi/gm	Tuff
50-BH6-25	Cd-109	0.34	0.05	0.06	pCi/gm	Tuff
50-BH7-4	G.Alpha	14.8	1.53	2.25	pCi/gm	Soil
50-BH7-4	G.Beta	41.34	1.81	2.85	pCi/gm	Soil
50-BH7-4	Ra-228	**5.18**	0.05	0.03	pCi/gm	Soil
50-BH7-4	Pb-210	3.59	0.18	0.19	pCi/gm	Soil
50-BH7-4	Cs-137	0.04	0.01	0.008	pCi/gm	Soil
50-BH7-4	Am-241	0.03	0.03	0.03	pCi/gm	Soil
50-BH7-4	Cs-134	0.23	0.01	0.01	pCi/gm	Soil
50-BH7-4	Mn-54	0.01	0.01	0.01	pCi/gm	Soil
50-BH7-4	Ce-141	0.02	0.01	0.01	pCi/gm	Soil
50-BH7-4	Cd-109	1.9	0.22	0.25	pCi/gm	Soil

Table 3.7.1.8-1. Gross Alpha, Gross Beta, and Gamma Spectroscopy Detections (continued)

Sample ID	Analysis	Activity	Error	MDA	Units	Media
50-BH7-10	G.Alpha	11.78	1.51	2.66	pCi/gm	Tuff
50-BH7-10	G.Beta	49.84	1.98	2.98	pCi/gm	Tuff
50-BH7-10	Ra-228	1.15	0.02	0.02	pCi/gm	Tuff
50-BH7-10	Pb-210	1.2	0.1	0.11	pCi/gm	Tuff
50-BH7-10	Zr-95	0.008	0.005	0.007	pCi/gm	Tuff
50-BH7-10	Mn-54	0.02	0.005	0.006	pCi/gm	Tuff
50-BH7-10	Cd-109	0.31	0.09	0.1	pCi/gm	Tuff
50-BH7-10D	G.Alpha	17.95	2.07	3.52	pCi/gm	Tuff
50-BH7-10D	G.Beta	61.79	2.24	3.23	pCi/gm	Tuff
50-BH7-10D	Ra-228	1.06	0.01	0.01	pCi/gm	Tuff
50-BH7-10D	Pb-210	1.28	0.06	0.07	pCi/gm	Tuff
50-BH7-10D	Cs-134	0.05	0.003	0.04	pCi/gm	Tuff
50-BH7-10D	Mn-54	0.01	0.003	0.004	pCi/gm	Tuff
50-BH7-10D	Cd-109	0.1	0.05	0.06	pCi/gm	Tuff
50-BH7-25	G.Alpha	5.24	1.01	2.11	pCi/gm	Tuff
50-BH7-25	G.Beta	47.37	1.85	2.88	pCi/gm	Tuff
50-BH7-25	Ra-228	1.23	0.02	0.01	pCi/gm	Tuff
50-BH7-25	Pb-210	1.52	0.12	0.13	pCi/gm	Tuff
50-BH7-25	Cs-134	0.06	0.005	0.06	pCi/gm	Tuff
50-BH7-25	Be-7	0.04	0.03	0.04	pCi/gm	Tuff
50-BH7-25	Mn-54	0.02	0.005	0.005	pCi/gm	Tuff
50-BH7-25	Cd-109	0.49	0.1	0.11	pCi/gm	Tuff
50-BH8-2	G.Alpha	11.08	1.47	2.61	pCi/gm	Tuff
50-BH8-2	G.Beta	49.54	2.03	3.26	pCi/gm	Tuff
50-BH8-2	Ra-228	1.15	0.01	0.009	pCi/gm	Tuff
50-BH8-2	Cs-137	0.02	0.002	0.002	pCi/gm	Tuff
50-BH8-2	Co-57	0.002	0.002	0.002	pCi/gm	Tuff
50-BH8-2	Cs-134	0.05	0.003	0.03	pCi/gm	Tuff
50-BH8-2	Cd-109	0.25	0.05	0.05	pCi/gm	Tuff
50-BH8-9	G.Alpha	12.95	1.59	2.74	pCi/gm	Tuff
50-BH8-9	G.Beta	55.9	2.17	3.42	pCi/gm	Tuff
50-BH8-9	Ra-228	1.18	0.02	0.02	pCi/gm	Tuff
50-BH8-9	Pb-210	1.47	0.12	0.13	pCi/gm	Tuff
50-BH8-9	Zn-65	0.04	0.01	0.02	pCi/gm	Tuff
50-BH8-9	Mn-54	0.02	0.005	0.005	pCi/gm	Tuff
50-BH8-25	G.Alpha	13.43	1.54	2.53	pCi/gm	Tuff
50-BH8-25	G.Beta	53.57	2.06	3.22	pCi/gm	Tuff
50-BH8-25	Ra-228	1.23	0.01	0.009	pCi/gm	Tuff

Table 3.7.1.8-1. Gross Alpha, Gross Beta, and Gamma Spectroscopy Detections (continued)

Sample ID	Analysis	Activity	Error	MDA	Units	Media
50-BH8-25	Pb-210	1.52	0.06	0.07	pCi/gm	Tuff
50-BH8-25	Cs-137	0.006	0.002	0.003	pCi/gm	Tuff
50-BH8-25	Cs-134	0.06	0.003	0.03	pCi/gm	Tuff
50-BH8-25	Mn-54	0.02	0.002	0.003	pCi/gm	Tuff
50-BH8-25	Cd-109	0.28	0.05	0.06	pCi/gm	Tuff

[a] Values above soil and tuff background presented in Ryti et al (1998) in bold.

Table 3.7.1.8-2. Isotopic Analyses Results (uranium, plutonium, and strontium)

Sample ID	Analysis	Activity	Error	MDA	Units	Media
50-BH1-3	U-238	0.52	0.1	0.04	pCi/gm	Soil
50-BH1-3	U-234	0.51	0.1	0.07	pCi/gm	Soil
50-BH1-3	Pu-239/240	**0.38**	0.08	0.05	pCi/gm	Soil
50-BH1-3	Pu-238	0.04	0.03	0.01	pCi/gm	Soil
50-BH1-3D	U-238	1.1	0.15	0.11	pCi/gm	Soil
50-BH1-3D	U-235	**0.2**	0.08	0.08	pCi/gm	Soil
50-BH1-3D	U-234	1.17	0.16	0.05	pCi/gm	Soil
50-BH1-3D	Pu-239/240	**0.17**	0.06	0.07	pCi/gm	Soil
50-BH1-3D	Pu-238	**0.09**	0.04	0.05	pCi/gm	Soil
50-BH1-7	U-238	0.60	0.11	0.08	pCi/gm	Tuff
50-BH1-7	U-234	0.75	0.13	0.05	pCi/gm	Tuff
50-BH1-7	Pu-239/240	**0.06**	0.03	0.01	pCi/gm	Tuff
50-BH1-7	Pu-238	**0.08**	0.04	0.04	pCi/gm	Tuff
50-BH1-25	U-238	0.81	0.13	0.06	pCi/gm	Tuff
50-BH1-25	U-234	0.69	0.12	0.05	pCi/gm	Tuff
50-BH1-25	Pu-239/240	**0.05**	0.03	0.05	pCi/gm	Tuff
50-BH1-25	Pu-238	0.04	0.03	0.04	pCi/gm	Tuff
50-BH1-25	Sr-90	**1.67**	0.6	1.44	pCi/gm	Tuff
50-BH2-3	U-238	1.00	0.14	0.06	pCi/gm	Soil
50-BH2-3	U-235	0.13	0.06	0.01	pCi/gm	Soil
50-BH2-3	U-234	1.12	0.15	0.05	pCi/gm	Soil
50-BH2-3	Pu-239/240	**0.13**	0.05	0.01	pCi/gm	Soil
50-BH2-3	Pu-238	**0.18**	0.06	0.01	pCi/gm	Soil
50-BH2-7	U-238	0.84	0.13	0.05	pCi/gm	Soil
50-BH2-7	U-235	0.09	0.05	0.04	pCi/gm	Soil
50-BH2-7	U-234	0.86	0.13	0.08	pCi/gm	Soil
50-BH2-7	Pu-239/240	**0.33**	0.08	0.06	pCi/gm	Soil
50-BH2-7	Sr-90	**1.79**	0.58	1.34	pCi/gm	Soil
50-BH2-25	U-238	0.53	0.1	0.05	pCi/gm	Tuff
50-BH2-25	U-234	0.7	0.13	0.05	pCi/gm	Tuff
50-BH2-25	Pu-239/240	0.02	0.02	0.01	pCi/gm	Tuff

Table 3.7.1.8-2. Isotopic Analyses Results (uranium, plutonium, and strontium) (continued)

Sample ID	Analysis	Activity	Error	MDA	Units	Media
50-BH2-90	U-238	0.65	0.11	0.04	pCi/gm	Tuff
50-BH2-90	U-234	0.62	0.12	0.05	pCi/gm	Tuff
50-BH3-7	U-238	0.52	0.1	0.08	pCi/gm	Tuff
50-BH3-7	U-234	0.52	0.11	0.09	pCi/gm	Tuff
50-BH3-7	Pu-239/240	**0.47**	0.09	0.03	pCi/gm	Tuff
50-BH3-7	Pu-238	**0.8**	0.12	0.03	pCi/gm	Tuff
50-BH3-7	Sr-90	**2.55**	0.62	1.34	pCi/gm	Tuff
50-BH3-11	U-238	0.38	0.09	0.04	pCi/gm	Tuff
50-BH3-11	U-235	**0.15**	0.07	0.05	pCi/gm	Tuff
50-BH3-11	U-234	0.58	0.11	0.07	pCi/gm	Tuff
50-BH3-25	U-238	0.41	0.09	0.06	pCi/gm	Tuff
50-BH3-25	U-234	0.44	0.1	0.05	pCi/gm	Tuff
50-BH3-25	Pu-238	0.02	0.02	0.01	pCi/gm	Tuff
50-BH4-3	U-238	0.79	0.12	0.06	pCi/gm	Soil
50-BH4-3	U-235	0.11	0.05	0.01	pCi/gm	Soil
50-BH4-3	U-234	0.74	0.12	0.05	pCi/gm	Soil
50-BH4-3	Pu-239/240	**0.06**	0.03	0.01	pCi/gm	Soil
50-BH4-12	U-238	0.94	0.14	0.04	pCi/gm	Tuff
50-BH4-12	U-234	0.84	0.13	0.05	pCi/gm	Tuff
50-BH4-12	Pu-238	**0.05**	0.03	0.05	pCi/gm	Tuff
50-BH4-23	U-238	0.56	0.11	0.08	pCi/gm	Tuff
50-BH4-23	U-235	0.08	0.05	0.06	pCi/gm	Tuff
50-BH4-23	U-234	0.59	0.11	0.08	pCi/gm	Tuff
50-BH4-23	Sr-90	**2.19**	0.63	1.42	pCi/gm	Tuff
50-BH4-R	Sr-90	3.72	0.72	1.53	pCi/L	Water
50-BH5-6	U-238	0.45	0.1	0.11	pCi/gm	Tuff
50-BH5-6	U-234	0.38	0.1	0.12	pCi/gm	Tuff
50-BH5-10	U-238	0.52	0.11	0.12	pCi/gm	Tuff
50-BH5-10	U-234	0.63	0.12	0.05	pCi/gm	Tuff
50-BH5-10	Pu-239/240	0.02	0.02	0.01	pCi/gm	Tuff
50-BH6-3	U-238	0.41	0.1	0.11	pCi/gm	Soil
50-BH6-3	U-235	0.04	0.03	0.04	pCi/gm	Soil
50-BH6-3	U-234	0.61	0.11	0.02	pCi/gm	Soil
50-BH6-3	Pu-239/240	**0.08**	0.04	0.01	pCi/gm	Soil
50-BH6-3	Sr-90	**2.3**	0.59	1.28	pCi/gm	Soil
50-BH6-25	U-238	0.64	0.12	0.09	pCi/gm	Tuff
50-BH6-25	U-234	0.53	0.11	0.05	pCi/gm	Tuff
50-BH6-25	Pu-239/240	**0.19**	0.12	0.13	pCi/gm	Tuff
50-BH7-4	U-238	0.71	0.12	0.07	pCi/gm	Soil
50-BH7-4	U-235	0.14	0.06	0.07	pCi/gm	Soil
50-BH7-4	U-234	**67**	0.12	0.02	pCi/gm	Soil

Table 3.7.1.8-2. Isotopic Analyses Results (uranium, plutonium, and strontium) (continued)

Sample ID	Analysis	Activity[a]	Error	MDA	Units	Media
50-BH7-4	Pu-239/240	**0.33**	0.09	0.02	pCi/gm	Soil
50-BH7-10	U-238	0.58	0.11	0.1	pCi/gm	Tuff
50-BH7-10	U-235	**0.11**	0.06	0.05	pCi/gm	Tuff
50-BH7-10	U-234	0.53	0.11	0.05	pCi/gm	Tuff
50-BH7-10	Pu-239/240	**0.1**	0.04	0.06	pCi/gm	Tuff
50-BH7-10D	U-238	0.38	0.09	0.06	pCi/gm	Tuff
50-BH7-10D	U-235	0.05	0.04	0.01	pCi/gm	Tuff
50-BH7-10D	U-234	0.49	0.1	0.05	pCi/gm	Tuff
50-BH7-25	U-238	0.47	0.1	0.05	pCi/gm	Tuff
50-BH7-25	U-234	0.46	0.1	0.02	pCi/gm	Tuff
50-BH7-25	Pu-238	0.01	0.01	0.01	pCi/gm	Tuff
50-BH7-25	Sr-90	**2.24**	0.6	1.33	pCi/gm	Tuff
50-BH8-2	U-238	0.69	0.12	0.04	pCi/gm	Tuff
50-BH8-2	U-234	0.79	0.13	0.12	pCi/gm	Tuff
50-BH8-2	Pu-239/240	**0.1**	0.06	0.02	pCi/gm	Tuff
50-BH8-9	U-238	0.58	0.11	0.05	pCi/gm	Tuff
50-BH8-9	U-235	**0.09**	0.05	0.06	pCi/gm	Tuff
50-BH8-9	U-234	0.6	0.11	0.05	pCi/gm	Tuff
50-BH8-9	Pu-238	**0.05**	0.03	0.01	pCi/gm	Tuff
50-BH8-9	Sr-90	**1.4**	0.54	1.3	pCi/gm	Tuff
50-BH8-25	U-238	0.78	0.12	0.06	pCi/gm	Tuff
50-BH8-25	U-235	**0.12**	0.06	0.08	pCi/gm	Tuff
50-BH8-25	U-234	0.9	0.14	0.05	pCi/gm	Tuff

[a] Values above soil and tuff background Ryti et al (1998) in bold.

3.7.2 QA/QC

Rigorous QA/QC was required to ensure that acceptable and defensible results were produced to meet the project objectives. QA/QC for this project encompassed everything from the field sampling to the laboratory analyses. A Level IV QA/QC package was required of the analytical laboratory, which is the most rigorous available. The resulting data set is of high quality, acceptable to meet the objectives of the project, and ultimately, defensible.

Field QA included duplicate samples, rinsate samples, and trip blanks. The field duplicate results are comparable, providing acceptable precision in the analyses. The rinsate sample analytical results confirm that decontamination procedures did not cause cross contamination of samples. Sr-90 was detected in one rinsate blank (50-BH4-R), but it did not impact any subsequent samples. Only chloroform was detected in one rinsate sample, just above detection, which is likely associated with the decontamination agents (Alconox and Fantastik). Trip blanks included two VOA trip blanks prepared and provided by the analytical laboratory, and a soil trip blank. The media for the soil trip blank was provided by the analytical laboratory and the sample was collected in the field. No VOCs were detected in the trip blanks.

The laboratory conducts numerous internal QA/QC analyses to test the methods and analytical equipment. The details of these analyses and corresponding analytical results are provided in the Level IV QA/QC package provided in appendix D.

Lead was detected in the laboratory method blank for the TCLP analysis just above the detection limit. This does not impact the results of the analysis. Chromium was also detected just at detection limit in a method blank for the TCLP analysis; this does not impact the results of the analysis. The data impacted are flagged in Table 3.7.1.3-1.

3.7.3 Comparison of Detections to Regulatory Limits

The primary objective of the investigation is to define the potential waste classification of excavated soils. Detected constituents included radiological, SVOC, pesticides, PCBs, and metals.

The SVOCs and pesticide detected are not regulated under RCRA. The PCB concentrations were all less than 1 ppm, and the regulatory limit for PCB waste is 50 ppm.

The metals detected by TCLP (Toxicity Characteristic Leaching Procedure) were compared to regulatory limits. Barium, chromium, and lead were detected by TCLP. Barium was detected from 0.1 – 1.2 mg/L with an associated regulatory limit of 100 ppm; chromium was detected at 0.2 mg/L with an associated regulatory limit of 5 ppm; and lead was detected from 0.06 – 0.14 mg/l, with an associated regulatory limit of 5 ppm. At the above concentrations, mg/L is equivalent to ppm. All results are well below regulatory limits for hazardous waste. In addition to being below the regulatory limit, lead and chromium were detected in the TCLP method blanks within the range of the concentrations detected.

In summary, the concentrations of detected chemicals (organic, inorganic, PCB, and pesticides) are all below RCRA limits for a hazardous waste. Radionuclides above background concentrations were detected at low levels in all borings; however, in the absence of a hazardous component, the radiological component is not regulated under RCRA.

The radiological component in the soil, fill and tuff classifies any excavated materials as LLW. These materials are subject to the waste acceptance criteria (WAC) of the disposal facility. The radionuclides were detected in very low concentrations, meeting the WAC for TA-54, Area G.

3.7.4 Comparison of Inorganics and Radionuclides to Background and Fallout Values

Background (and fallout value) comparisons for inorganics and radionuclides were conducted using values presented in Ryti et al. (1998) per the applicable SOPs. The background values are typically used to screen data for assessment of extent of contamination, and the presence of contamination for waste characterization.

3.7.4.1 Inorganics

Sample results from soil or fill were compared to the UTL (upper tolerance limit) calculated for soils in the Los Alamos area. Sample results from Unit 3 and Unit 2 tuff were compared to UTLs calculated for Units 2, 3, and 4 tuff.

Detected inorganics (metals) include arsenic, barium, chromium, cadmium, lead, and mercury. The total analysis, not the TCLP, is used for background comparison. Table 3.7.4.1-1 summarizes the comparison to background.

Table 3.7.4.1-1. RCRA Metals (total) compared to background.

Analyte	Max Soil[a]	UTL Soil	Max Tuff	UTL Tuff
Arsenic	5	8.17	2.8	2.79
Barium	102	295	**89.7**	46
Chromium	8.7	19.3	**141**	7.14
Cadmium	ND[b]	0.4	0.21	1.63
Lead	10.6	22.3	**20.7**	11.2
Mercury	0.09	0.1	ND	Not calculated

[a] All units in mg/kg

[b] ND = Non-detected

In summary, no metals were detected in soil/fill above background concentration. In the tuff barium, chromium, and lead were detected above background values.

3.7.4.2 Radionuclides

Some radionuclides are naturally occurring in the soils and tuffs found on the Pajarito Plateau, and some are introduced from radioactive fallout. These are referred to as background values (BV) and fallout values (FV). SOP-15.13, Rev 0 describes the methodology for comparing radiological analyses results to BV and FV. The BV and FV for the Pajarito Plateau and LANL are provided in Ryti et al. (1998).

The Laboratory's list for naturally occurring radionuclides to be compared to BV includes uranium-234, 235, and 238, thorium-228, 230, and 232, radium-226 and 228, and potassium-40. The Laboratory's list for fallout radionuclides to be compared to FV includes tritium, cesium-137, americium-241, plutonium-238, plutonium-239/240, and strontium-90. Surface soils/fill (0 – 6 inches) are compared to fallout values (FV). Samples deeper than 6 inches are compared to background values. For radionuclides included on the fallout list, the detection limit is applied as the background value for subsurface soils and tuffs. Radionuclides detected that are not on the fallout list or background list, and that are not related to laboratory QA/QC, are considered above background.

All samples collected were deeper than 6 inches and fallout values do not apply. For background comparison, values provided in Ryti et al. (1998) are compared to analytical results. Table 3.7.3.2-1 provides the background values used in the comparisons.

Table 3.7.4.2-1. LANL Background for Radionuclides (Ryti, et al 1998)

Analyte	Soil (pCi/g)	Tuff (Unit 3 and 2) (pCi/g)
Am-241	0.013[a]	0.05[b]
Cs-137	1.65[a]	0.1[b]
Pu-238	0.023[a]	0.05[b]
Pu-239/240	0.054[a]	0.05[b]
Sr-90	1.31[a]	1[b]
K-40	36.8	35.7
Ra-226	2.59	1.98
Ra-228	2.33	2.52
Th-228	2.28	2.52
Th-230	2.29	1.98
Th-232	2.33	2.52
U-234	2.59	1.98
U-235	0.20	0.09
U-238	2.29	1.93

[a] Fallout value – applies only to 0-6 inches, for soils/fill deeper than 6 inches, the tuff values apply

[b] Detection limit applied as background for fallout list radionuclides

The results show low concentrations of radionuclides above LANL background values. Specifically, Cs-137, Ra-226, Am-241, Pu-239/240, Pu-238, U-235, U-234 and Sr-90 were detected above LANL background; the values exceeding background are indicated in bold in Tables 3.7.1.8-1 and 2. Additionally, several fission products (e.g., Cs-134) and activation products (e.g., Mn-54), not included in the LANL background data set, were detected at low levels. Radionuclides not included in the LANL background data set are considered anthropogenically added. Gross alpha and beta measurements ranged from 5.24 – 23.54 and 27.11 – 68.64 pCi/g, respectively. The alpha results are generally within those typically seen for materials comprised of or derived from tuff. Most of the beta results are also within the typical values; however, several samples may be slightly elevated. No definitive patterns in contamination were observed. Results for one sample (BH7-4) had high concentrations U-234 and Ra-228 as compared to the rest of the samples.

3.7.5 Comparison to Human Health Screening Action Limits (SALs) and Ecological Screening Limits (ESLs)

Human Health Screening Action Limits (SALs) are applied only to those detections above background within the first 12 ft. Ecological Screening Limits (ESLs) are applied to detections above background in the first 5 ft. The metals, SVOCs, PCBs, and radiological results were compared to SALs and ESLs. SALs and ESLs used for comparison were found in LANL (2001) "Derivation and Use of Radionuclide Screening Action Levels," LANL (2001b) "September 2001 ECORISK database," NMED (2000) "Technical Background Document for Development of Soil Screening Levels," and EPA (2000) "Human Health Medium-Specific Screening Levels."

3.7.5.1 Inorganics (Metals)

All detects above background within the first 12 ft. are less than Human Health SALs. No detections above background were found in the first five feet; therefore, no metals exceed ESLs.

3.7.5.2 SVOC

SVOCs were detected in sample 50-BH8-2. Four compounds were detected at concentrations greater than SALs. Three compounds were detected that exceed ESLs. Table 3.7.5.2-1 summarizes these detections and associated screening level. However, these compounds are PAHs typically associated with the incomplete combustion of fuels commonly associated with roads and asphalt. Sample BH8-2 is shallow and adjacent to an asphalt road; therefore these PAHs are likely associated with the road.

Table 3.7.5.2-1. SVOCs in 50-BH8-2 Exceeding SALs and/or ESLs

SVOC	Result (mg/kg)	SAL (mg/kg)	ESL (mg/kg)
Acenaphthene	0.48	2800	0.25
Benzo(a)anthrcene	3.2	0.62	3
Benzo(a)pyrene	2.7	0.062	9.7
Benzo(b&k)fluoranthene	4.3	0.62	18
Chrysene	2.7	61	2.5

3.7.5.3 PCB

At 50-BH6, Aroclor 1260 was detected greater than its SAL in the 3 – 4 ft. sample. Aroclor 1260 was detected at 0.35 mg/kg, compared to the 0.22 mg/kg SAL.

3.7.5.4 Radionuclides

Only two radionuclides detected above background within the first 12 ft. exceed SALs. At 50-BH7-4, Ra-228 was detected at 5.18 pCi/g with an associated SAL of 5 pCi/g, and U-234 was detected at 67 pCi/g with an associated SAL of 63 pCi/g.

At 50-BH7-4, U-234 was detected at 67 pCi/g, which is above its associated ESL of 51 pCi/g. All other detected radionuclides that have assigned ESLs were found in concentrations less than the ESL. Several of the fission products do not have ESLs at this time.

4. DISCUSSION

4.1 Soil Characterization

VOCs were not detected in any of the soil/fill/tuff samples. Chloroform was detected at very low concentrations (0.003 mg/L [ppm]) and below RCRA regulatory levels (6.0 ppm) in one rinsate blank. This is either a laboratory contaminant, or a compound associated with the decontamination methods (Alconox and/or Fantastik).

SVOCs were detected in only one sample. The shallow tuff interface sample (1 – 2 ft) from BH8 contained very low concentrations of polycyclic aromatic hydrocarbons (PAHs). These are known to be associated with the incomplete combustion of fuels (exhaust) and asphalt. BH8 is adjacent to an asphalt road, and the sample is shallow. It is likely that these detected PAHs are associated with the road. These compounds are not regulated under RCRA with respect to waste characterization.

One pesticide was detected at a concentration near its detection limit in one sample. This chemical is not regulated under RCRA with respect to waste characterization.

One PCB (Aroclor 1260) was detected at ppb levels in several samples. There is no known source or documented release of PCBs in the area and the levels are far below those requiring management as a PCB waste (50 ppm).

Metals (both total and TCLP) were detected in almost all samples. These metals included arsenic, barium, chromium, cadmium, lead and mercury. All TCLP results were below RCRA regulatory limits for hazardous waste. Barium, chromium, and lead (totals) were detected above tuff background levels a several locations. All detected total metals in soil/fill were less than background values.

Radionuclides were detected above background, but at low concentrations throughout the investigated area. The concentrations are at "environmental," levels not detectable by traditional field screening instruments.

Based on these soil characterization results, materials (soil/fill and tuff) excavated during the proposed construction activities may be characterized as solid, low-level radioactive waste (LLW). Radioisotopes detected and their concentrations are well within the TA-54, Area G WAC, providing a disposal path for the waste-stream.

Based on these results and potential waste characterization a second phase of soil characterization is not recommended.

4.2 SWMU 50-011a

Borehole 50-BH2 was drilled to a depth of 90 ft to investigate for possible releases from SWMU 50-011(a), which was a former shaft associated with a septic drain field. The shaft was approximately 50 ft deep, and 50-BH2 was located 19-ft down-gradient from its location. The location of the shaft was determined by FWO-WFM through the review of the TA-50 RFI Work Plan (LANL 1992) and facility engineering drawings. Samples were collected at 70 ft and 90 ft, and submitted for full suite analysis. In the 70-ft sample, chromium and lead were detected above background. Chromium was detected just above background and lead was detected in concentrations approximately twice background. In the 90-ft sample, these analytes were detected below background concentrations. Radionuclides were detected in both the 70 and 90 ft samples. In both, several activation and fission products were detected at very low concentrations. Uranium isotopes were detected in the 90-ft sample below background concentrations for the tuff. The results from the 70 and 90-ft samples do not indicate a definitive release from SWMU 50-011a. However, it could be argued that the greater than background metals in the 70-ft sample is evidence of a release. In any case, there appears to be a decreasing trend in metals concentration from the 70 to 90 ft samples, bounding the vertical extent of any potential release.

5. SUMMARY AND CONCLUSIONS

For the purposes of soil characterization associated with the TA-50 Pump House and Influent Storage Tanks Project, eight boreholes were drilled and sampled. Six were advanced and sampled to a depth of 25 ft, one was advanced and sampled to 23 ft, and one was advanced and sampled to a depth of 90 ft.

Geological observations indicate that the soil/fill – tuff interface ranges from 5.5 to 10 ft. below ground surface (bgs) in the vicinity of the proposed pump house structure. At the location of the manhole, tuff was encountered at 1 ft. bgs. Above the tuff interface, fill was encountered and in a few cases some soil development on the fill was observed. Fill was generally comprised on crushed tuff and clay. The tuff encountered was highly weathered to fresh, poorly to moderately welded, unfractured to fractured, friable to indurated, and moist to dry. The weathered zone ranged from several feet to absent.

Analytical results from the soil/fill and tuff samples show low concentration of radionuclides above background values. VOCs, SVOCs, TPH-DRO, Metals, Pesticides, and PCBs were either not detected or detected at low concentrations below all regulatory limits for waste. In conclusion, materials generated during excavation activities should be characterized as solid LLW based on this investigation.

For comparison purposes, the results were compared to human health screening action levels (SALs) and ecological screening levels (ESLs). Samples exceeding background (as applicable) for the first 12 ft. were compared to SALs, and those from the first 5 ft. were compared to ESLs. SVOCs in one sample exceeded SALs and ESLs; however, these results appear associated with a nearby asphalt road. One PCB detection exceeds its SAL. Two radionuclides exceed SALs, and one radionuclide exceeds its ESL. This comparison does not serve as a human health risk screening assessment or an ecological screening assessment.

Based on the results from the 70 and 90-ft samples collected from 50-BH2, a significant release from SWMU 50-011 is not evident. Radionuclides comprised of exotic fission and activation products were detected at very low concentrations in both samples. Lead and chromium were detected above background at 70 ft and below background a 90 ft. If the metals results are interpreted as evidence of a release, then the data appear to bound the extent of contamination.

6. REFERENCES

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APPENDICES

Appendix A. Sample Collection Logs

Appendix B. Chain of Custody Forms

Appendix C. Borehole Geological Logs

Appendix D. Laboratory Analytical Data Package

TA50 Characterization Drilling
Sample Collection Log

Sample ID: 50-BH1 - 3

Date: 12/15/01 Time: 0830 Sample Type: CORE - FULL SUITE

TA: 50 Sample Location: BOREHOLE 1

QA/QC Type: NA

Grab: Yes____ No____

Composite: Yes ✓ No____

Composite Type: ____

Sampler: Keith Tucker

Signature:

Start Depth: 3.0 End Depth: 5.0 KT 12/15/01 Units: Feet

Samples were collected using WGI-SOPs including: 1.02 rev2, 1.03 rev2, 1.04 rev2, 1.05 rev1 1.08 rev1, 6.24 rev1, and 6.26 rev1

KT 12/15/01

ID	Analysis	Container	Preservative	~~[illegible]~~
1	TPH-DRO	8oz clear glass	None	
2	Pesticide	8oz clear glass	None	
3	TCLP Metal	8oz clear glass	None	
4	TTL Metal, RCRA	8oz clear glass	None	
5	PCB	8oz clear glass	None	
6	Gamma Spec	8oz clear glass	None	
7	Iso U, Pu, Am, Sr90	8oz clear glass	None	
8	SVOA, 8270	8oz clear glass	None	
9	TCLP VOA	8oz amber glass	None	
10	GROSS ALPHA BETA	1 LTR. POLY	"	
11				
12				

Weather: CLEAR, COLD, 28°F

Sampling Methodology/Description: SPLIT SPOON

Field Screening: NDA

Transportation/Destination: By Highway to Assaigai Laboratories, Albuquerque, NM

Sampling Purpose and Observations: Site Characterization

TA50 Characterization Drilling
Sample Collection Log

Sample ID: 50-BH 1- 3D

Date: 12/15/01 Time: 0830 Sample Type: CORE - FULL SUITE DUPLICATE

TA: 50 Sample Location: BOREHOLE 1

QA/QC Type: DUPLICATE

Grab: Yes____ No____

Composite: Yes ✓ No____

Composite Type: ____

Sampler: Keith Tucker

Signature: Keith

Start Depth: 3.0 End Depth: 5.0 Units: Feet

Samples were collected using WGI-SOPs including: 1.02 rev2, 1.03 rev2, 1.04 rev2, 1.05 rev1 1.08 rev1, 6.24 rev1, and 6.26 rev1

KT 12/15/01

ID	Analysis	Container	Preservative	~~COC#~~
1	TPH-DRO	8oz clear glass	None	
2	Pesticide	8oz clear glass	None	
3	TCLP Metal	8oz clear glass	None	
4	TTL Metal, RCRA	8oz clear glass	None	
5	PCB	8oz clear glass	None	
6	Gamma Spec	8oz clear glass	None	
7	Iso U, Pu, Am, Sr90	8oz clear glass	None	
8	SVOA, 8270	8oz clear glass	None	
9	TCLP VOA	8oz amber glass	None	
10	GROSS ALPHA BETA	1LTR POLY	''	
11				
12				

Weather: CLEAR, COLD, 28°F

Sampling Methodology/Description: SPLIT SPOON

Field Screening: NDA

Transportation/Destination: By Highway to Assaigai Laboratories, Albuquerque, NM

Sampling Purpose and Observations: Site Characterization

TA50 Characterization Drilling
Sample Collection Log

Sample ID: 50-BH1-7

Date: 12/15/01 **Time:** 0900 **Sample Type:** CORE - FULL SUITE

TA: 50 **Sample Location:** BOREHOLE 1

QA/QC Type: NA

Grab: Yes____ No____ **Sampler:** Keith Tucker

Composite: Yes ✓ No____

Composite Type: ________ **Signature:**

Start Depth: 7.0 **End Depth:** 8.0 **Units:** Feet

Samples were collected using WGI-SOPs including: 1.02 rev2, 1.03 rev2, 1.04 rev2, 1.05 rev1, 1.08 rev1, 6.24 rev1, and 6.26 rev1

12/15/01

ID	Analysis	Container	Preservative	~~COC#~~
1	TPH-DRO	8oz clear glass	None	
2	Pesticide	8oz clear glass	None	
3	TCLP Metal	8oz clear glass	None	
4	TTL Metal, RCRA	8oz clear glass	None	
5	PCB	8oz clear glass	None	
6	Gamma Spec	8oz clear glass	None	
7	Iso U, Pu, Am, Sr90	8oz clear glass	None	
8	SVOA, 8270	8oz clear glass	None	
9	TCLP VOA	8oz amber glass	None	
10	GROSS ALPHA BETA	1 LTR POLY	"	
11				
12				

Weather: CLOUDY, COLD, 28°F

Sampling Methodology/Description: SPLIT SPOON

Field Screening: NDA

Transportation/Destination: By Highway to Assaigai Laboratories, Albuquerque, NM

Sampling Purpose and Observations: Site Characterization

TA50 Characterization Drilling
Sample Collection Log

Sample ID: 50-BH1 - 25

Date: 12/15/01 **Time:** 0940 **Sample Type:** CORE - FULL SUITE

TA: 50 **Sample Location:** BOREHOLE 1

QA/QC Type: NA

Grab: Yes____ No____

Composite: Yes ✓ No____

Composite Type: ____________

Sampler: Keith Tucker

Signature:

Start Depth: 24.0 **End Depth:** 25.0 **Units:** Feet

Samples were collected using WGI-SOPs including: 1.02 rev2, 1.03 rev2, 1.04 rev2, 1.05 rev1 1.08 rev1, 6.24 rev1, and 6.26 rev1

				12/15/01
ID	Analysis	Container	Preservative	~~COC #~~
1	TPH-DRO	8oz clear glass	None	
2	Pesticide	8oz clear glass	None	
3	TCLP Metal	8oz clear glass	None	
4	TTL Metal, RCRA	8oz clear glass	None	
5	PCB	8oz clear glass	None	
6	Gamma Spec	8oz clear glass	None	
7	Iso U, Pu, Am, Sr90	8oz clear glass	None	
8	SVOA, 8270	8oz clear glass	None	
9	TCLP VOA	8oz amber glass	None	
10	GROSS ALPHA BETA	1 LTR POLY	''	
11				
12				

Weather: CLOUDY, COLD, 20°F

Sampling Methodology/Description: SPLIT SPOON

Field Screening: NDA

Transportation/Destination: By Highway to Assaigai Laboratories, Albuquerque, NM

Sampling Purpose and Observations: Site Characterization

TA50 Characterization Drilling
Sample Collection Log

Sample ID: 50-BH2-3

Date: 12/15/01 **Time:** 1045 **Sample Type:** CORE - FULL SUITE

TA: 50 **Sample Location:** BOREHOLE 2

QA/QC Type: NA

Grab: Yes____ No____

Composite: [✓ Yes] No____

Composite Type: ____________

Sampler: Keith Tucker

Signature:

Start Depth: 3.0 **End Depth:** 4.0 **Units:** Feet

Samples were collected using WGI-SOPs including: 1.02 rev2, 1.03 rev2, 1.04 rev2, 1.05 rev1, 1.08 rev1, 6.24 rev1, and 6.26 rev1

KT 12/15/01

ID	Analysis	Container	Preservative	~~COC#~~
1	TPH-DRO	8oz clear glass	None	
2	Pesticide	8oz clear glass	None	
3	TCLP Metal	8oz clear glass	None	
4	TTL Metal, RCRA	8oz clear glass	None	
5	PCB	8oz clear glass	None	
6	Gamma Spec	8oz clear glass	None	
7	Iso U, Pu, Am, Sr90	8oz clear glass	None	
8	SVOA, 8270	8oz clear glass	None	
9	TCLP VOA	8oz amber glass	None	
10	GROSS ALPHA BETA	1 LTR POLY	1.	
11				
12				

Weather: CLOUDY, COLD, LIGHT SNOW, 30°F

Sampling Methodology/Description: SPLIT SPOON

Field Screening: NDA

Transportation/Destination: By Highway to Assaigai Laboratories, Albuquerque, NM

Sampling Purpose and Observations: Site Characterization

TA50 Characterization Drilling
Sample Collection Log

Sample ID: 50-BH2-7

Date: 12/15/01 Time: 1100 Sample Type: CORE - FULL SUITE

TA: 50 Sample Location: BOREHOLE 2

QA/QC Type: NA

Grab: Yes____ No____

Composite: Yes ✓ No____

Composite Type:

Sampler: Keith Tucker

Signature:

Start Depth: 6.5 End Depth: 7.5 Units: Feet

Samples were collected using WGI-SOPs including: 1.02 rev2, 1.03 rev2, 1.04 rev2, 1.05 rev1
1.08 rev1, 6.24 rev1, and 6.26 rev1

ID	Analysis	Container	Preservative	KT 12/15/01 ~~COC #~~
1	TPH-DRO	8oz clear glass	None	
2	Pesticide	8oz clear glass	None	
3	TCLP Metal	8oz clear glass	None	
4	TTL Metal, RCRA	8oz clear glass	None	
5	PCB	8oz clear glass	None	
6	Gamma Spec	8oz clear glass	None	
7	Iso U, Pu, Am, Sr90	8oz clear glass	None	
8	SVOA, 8270	8oz clear glass	None	
9	TCLP VOA	8oz amber glass	None	
10	GROSS ALPHA BETA	1 LTR POLY	"	
11				
12				

Weather: CLOUDY, COLD, LIGHT SNOW, 30°F

Sampling Methodology/Description: SPLIT SPOON

Field Screening: NDA

Transportation/Destination: By Highway to Assaigai Laboratories, Albuquerque, NM

Sampling Purpose and Observations: Site Characterization

TA50 Characterization Drilling
Sample Collection Log

Sample ID: 50-BH2-25

Date: 12/15/01 Time: 1200 Sample Type: CORE- FULL SUITE

TA: 50 Sample Location: BOREHOLE 2

QA/QC Type: NA

Grab: Yes____ No____

Composite: Yes ✓ No____

Composite Type: ____

Sampler: Keith Tucker

Signature:

Start Depth: 24.0 End Depth: 25.0 Units: Feet

Samples were collected using WGI-SOPs including: 1.02 rev2, 1.03 rev2, 1.04 rev2, 1.05 rev1 1.08 rev1, 6.24 rev1, and 6.26 rev1

				12/15/01
ID	Analysis	Container	Preservative	~~COC#~~
1	TPH-DRO	8oz clear glass	None	
2	Pesticide	8oz clear glass	None	
3	TCLP Metal	8oz clear glass	None	
4	TTL Metal, RCRA	8oz clear glass	None	
5	PCB	8oz clear glass	None	
6	Gamma Spec	8oz clear glass	None	
7	Iso U, Pu, Am, Sr90	8oz clear glass	None	
8	SVOA, 8270	8oz clear glass	None	
9	TCLP VOA	8oz amber glass	None	
10	GROSS ALPHA BETA	1 LTR POLY	"	
11				
12				

Weather: CLOUDY, COLD, LIGHT SNOW, 30°F

Sampling Methodology/Description: SPLIT SPOON

Field Screening: NDA

Transportation/Destination: By Highway to Assaigai Laboratories, Albuquerque, NM

Sampling Purpose and Observations: Site Characterization

TA50 Characterization Drilling
Sample Collection Log

Sample ID: 50-BH2-70

Date: 12/15/01 Time: 1420 Sample Type: CORE - FULL SUITE

TA: 50 Sample Location: BOREHOLE 2

QA/QC Type: NA

Grab: Yes___ No___

Composite: Yes ✓ No___

Composite Type: ___

Sampler: Keith Tucker

Signature:

Start Depth: 70.0 End Depth: 71.0 KT Units: Feet

Samples were collected using WGI-SOPs including: 1.02 rev2, 1.03 rev2, 1.04 rev2, 1.05 rev1 1.08 rev1, 6.24 rev1, and 6.26 rev1

				KT 12/15/01
ID	Analysis	Container	Preservative	~~COC#~~
1	TPH-DRO	8oz clear glass	None	
2	Pesticide	8oz clear glass	None	
3	TCLP Metal	8oz clear glass	None	
4	TTL Metal, RCRA	8oz clear glass	None	
5	PCB	8oz clear glass	None	
6	Gamma Spec	8oz clear glass	None	
7	Iso U, Pu, Am, Sr90	8oz clear glass	None	
8	SVOA, 8270	8oz clear glass	None	
9	TCLP VOA	8oz amber glass	None	
10	GROSS ALPHA BETA	1 LTR POLY	"	
11				
12				

Weather: CLOUDY, COLD, 30°F

Sampling Methodology/Description: SPLIT SPOON

Field Screening: NDA

Transportation/Destination: By Highway to Assaigai Laboratories, Albuquerque, NM

Sampling Purpose and Observations: Site Characterization

TA50 Characterization Drilling
Sample Collection Log

Sample ID: 50-BH2-90

Date: 12/15/01 **Time:** 1530 **Sample Type:** CORE - FULL SUITE

TA: 50 **Sample Location:** BOREHOLE 2

QA/QC Type: NA

Grab: Yes ✓ No____
Composite: Yes ✓ No____
Composite Type: ____________

Sampler: Keith Tucker
Signature:

Start Depth: 90.0 **End Depth:** 91.5 **Units:** Feet

Samples were collected using WGI-SOPs including: 1.02 rev2, 1.03 rev2, 1.04 rev2, 1.05 rev1
1.08 rev1, 6.24 rev1, and 6.26 rev1

ID	Analysis	Container	Preservative	12/15/01 [illegible]#
1	TPH-DRO	8oz clear glass	None	
2	Pesticide	8oz clear glass	None	
3	TCLP Metal	8oz clear glass	None	
4	TTL Metal, RCRA	8oz clear glass	None	
5	PCB	8oz clear glass	None	
6	Gamma Spec	8oz clear glass	None	
7	Iso U, Pu, Am, Sr90	8oz clear glass	None	
8	SVOA, 8270	8oz clear glass	None	
9	TCLP VOA	8oz amber glass	None	
10	GROSS ALPHA BETA	1 LTR POLY	"	
11				
12				

Weather: CLOUDY, COLD, LIGHT SNOW, 30°F

Sampling Methodology/Description: Drive sample - split spoon

Field Screening: NA

Transportation/Destination: By Highway to Assaigai Laboratories, Albuquerque, NM

Sampling Purpose and Observations: Site Characterization

TA50 Characterization Drilling
Sample Collection Log

Sample ID: 50-BH3-7

Date: 12/14/01 Time: 1415 Sample Type: CORE - FULL SUITE

TA: 50 Sample Location: BOREHOLE 3

QA/QC Type: NA

Grab: Yes____ No____

Composite: Yes ✓ No____

Composite Type: ____________

Sampler: Keith Tucker

Signature:

Start Depth: 7.0 End Depth: 8.0 Units: Feet

Samples were collected using WGI-SOPs including: 1.02 rev2, 1.03 rev2, 1.04 rev2, 1.05 rev1 1.08 rev1, 6.24 rev1, and 6.26 rev1

				12/14/01
ID	Analysis	Container	Preservative	~~COC#~~
1	TPH-DRO	8oz clear glass	None	
2	Pesticide	8oz clear glass	None	
3	TCLP Metal	8oz clear glass	None	
4	TTL Metal, RCRA	8oz clear glass	None	
5	PCB	8oz clear glass	None	
6	Gamma Spec	8oz clear glass	None	
7	Iso U, Pu, Am, Sr90	8oz clear glass	None	
8	SVOA, 8270	8oz clear glass	None	
9	TCLP VOA	8oz amber glass	None	
10	GROSS ALPHA BETA	1 LTR. POLY	''	
11				
12				

Weather: CLEAR, COLD, 34°F

Sampling Methodology/Description: SPLIT SPOON

Field Screening: NDA

Transportation/Destination: By Highway to Assaigai Laboratories, Albuquerque, NM

Sampling Purpose and Observations: Site Characterization

TA50 Characterization Drilling
Sample Collection Log

KT 12/14/01

Sample ID: 50-BH3-11

Date: 12/14/01 **Time:** 1440 **Sample Type:** CORE - FULL SUITE

TA: 50 **Sample Location:** BOREHOLE 3

QA/QC Type: NA

Grab: Yes___ No___

Composite: Yes ✓ No___

Composite Type: ______

Sampler: Keith Tucker

Signature:

Start Depth: 10.0 **End Depth:** 12.0 **Units:** Feet

KT 12/14/01

Samples were collected using WGI-SOPs including: 1.02 rev2, 1.03 rev2, 1.04 rev2, 1.05 rev1, 1.08 rev1, 6.24 rev1, and 6.26 rev1

ID	Analysis	Container	Preservative	KT 12/14/01 ~~COC#~~
1	TPH-DRO	8oz clear glass	None	
2	Pesticide	8oz clear glass	None	
3	TCLP Metal	8oz clear glass	None	
4	TTL Metal, RCRA	8oz clear glass	None	
5	PCB	8oz clear glass	None	
6	Gamma Spec	8oz clear glass	None	
7	Iso U, Pu, Am, Sr90	8oz clear glass	None	
8	SVOA, 8270	8oz clear glass	None	
9	TCLP VOA	8oz amber glass	None	
10	GROSS ALPHA BETA	1LTR POLY	NONE	
11				
12				

Weather: CLEAR, COLD 32°F

Sampling Methodology/Description: SPLIT SPOON

Field Screening: NDA

Transportation/Destination: By Highway to Assaigai Laboratories, Albuquerque, NM

Sampling Purpose and Observations: Site Characterization

TA50 Characterization Drilling
Sample Collection Log

Sample ID: 50-BH3-25

Date: 12/14/01 Time: 1520 Sample Type: CORE - FULL SUITE

TA: 50 Sample Location: BOREHOLE 3

QA/QC Type: NA

Grab: Yes___ No___

Composite: Yes [✓] No___

Composite Type:

Sampler: Keith Tucker

Signature:

Start Depth: 24.0 End Depth: 25.0 Units: Feet

Samples were collected using WGI-SOPs including: 1.02 rev2, 1.03 rev2, 1.04 rev2, 1.05 rev1 1.08 rev1, 6.24 rev1, and 6.26 rev1

ID	Analysis	Container	Preservative	KT 12/14/01 ~~COS#~~
1	TPH-DRO	8oz clear glass	None	
2	Pesticide	8oz clear glass	None	
3	TCLP Metal	8oz clear glass	None	
4	TTL Metal, RCRA	8oz clear glass	None	
5	PCB	8oz clear glass	None	
6	Gamma Spec	8oz clear glass	None	
7	Iso U, Pu, Am, Sr90	8oz clear glass	None	
8	SVOA, 8270	8oz clear glass	None	
9	TCLP VOA	8oz amber glass	None	
10	GROSS ALPHA BETA	1 LTR POLY	NONE	
11				
12				

Weather: CLEAR, COLD, 32°F

Sampling Methodology/Description: SPLIT SPOON

Field Screening: NDA

Transportation/Destination: By Highway to Assaigai Laboratories, Albuquerque, NM

Sampling Purpose and Observations: Site Characterization

TA50 Characterization Drilling
Sample Collection Log

Sample ID: 50-BH4-5

Date: 12/13/01 **Time:** 1210 **Sample Type:** CORE - FULL SUITE

TA: 50 **Sample Location:** BOREHOLE 4

QA/QC Type: NA

Grab: Yes____ No____
Composite: Yes ✓ No____
Composite Type: ____

Sampler: Keith Tucker

Signature:

Start Depth: 3.0 **End Depth:** 5.0 12/13/01 **Units:** Feet

Samples were collected using WGI-SOPs including: 1.02 rev2, 1.03 rev2, 1.04 rev2, 1.05 rev1
1.08 rev1, 6.24 rev1, and 6.26 rev1

				12/13/01
ID	Analysis	Container	Preservative	~~COC#~~
1	TPH-DRO	8oz clear glass	None	
2	Pesticide	8oz clear glass	None	
3	TCLP Metal	8oz clear glass	None	
4	TTL Metal, RCRA	8oz clear glass	None	
5	PCB	8oz clear glass	None	
6	Gamma Spec	8oz clear glass	None	
7	Iso U, Pu, Am, Sr90	8oz clear glass	None	
8	SVOA, 8270	8oz clear glass	None	
9	TCLP VOA	8oz amber glass	None	
10	GROSS ALPHA, BETA	1 LTR. POLY	NONE	
11				
12				

Weather: CLEAR, COLD, 32° F, ~~[illegible]~~ 12/13/01

Sampling Methodology/Description: SPLIT SPOON

Field Screening: NDA

Transportation/Destination: By Highway to Assaigai Laboratories, Albuquerque, NM

Sampling Purpose and Observations: Site Characterization

TA50 Characterization Drilling
Sample Collection Log

Sample ID: 50-BH4-12

Date: 12/13/01 Time: 1255 Sample Type: CORE-FULL SUITE

TA: 50 Sample Location: BOREHOLE 4

QA/QC Type: NA

Grab: Yes___ No___

Composite: Yes ✓ No___

Composite Type: ___

Sampler: Keith Tucker

Signature:

Start Depth: 12.5 End Depth: 13.5 Units: Feet

Samples were collected using WGI-SOPs including: 1.02 rev2, 1.03 rev2, 1.04 rev2, 1.05 rev1
1.08 rev1, 6.24 rev1, and 6.26 rev1

ID	Analysis	Container	Preservative	KT 12/13/01 ~~COC#~~
1	TPH-DRO	8oz clear glass	None	
2	Pesticide	8oz clear glass	None	
3	TCLP Metal	8oz clear glass	None	
4	TTL Metal, RCRA	8oz clear glass	None	
5	PCB	8oz clear glass	None	
6	Gamma Spec	8oz clear glass	None	
7	Iso U, Pu, Am, Sr90	8oz clear glass	None	
8	SVOA, 8270	8oz clear glass	None	
9	TCLP VOA	8oz amber glass	None	
10	GROSS ALPHA BETA	1 LTR POLY	NONE	
11				
12				

Weather: CLEAR, COLD, 32°F

Sampling Methodology/Description: SPLIT SPOON

Field Screening: NDA

Transportation/Destination: By Highway to Assaigai Laboratories, Albuquerque, NM

Sampling Purpose and Observations: Site Characterization

TA50 Characterization Drilling
Sample Collection Log

Sample ID: 50-BH4-23

Date: 12/13/01 **Time:** 1700 **Sample Type:** CORE - CHARACTERIZATION (FULL SUITE)

TA: 50 **Sample Location:** BOREHOLE 4

QA/QC Type: NA

Grab: Yes____ KT 12/13/01 No____ **Sampler:** Keith Tucker

Composite: Yes ✓ No____

Composite Type: ____ **Signature:** Keith

Start Depth: 22.0 **End Depth:** 23.0 **Units:** Feet

Samples were collected using WGI-SOPs including: 1.02 rev2, 1.03 rev2, 1.04 rev2, 1.05 rev1
1.08 rev1, 6.24 rev1, and 6.26 rev1

ID	Analysis	Container	Preservative	KT 12/13/01 ~~COC#~~
1	TPH-DRO	8oz clear glass	None	
2	Pesticide	8oz clear glass	None	
3	TCLP Metal	8oz clear glass	None	
4	TTL Metal, RCRA	8oz clear glass	None	
5	PCB	8oz clear glass	None	
6	Gamma Spec	8oz clear glass	None	
7	Iso U, Pu, Am, Sr90	8oz clear glass	None	
8	SVOA, 8270	8oz clear glass	None	
9	TCLP VOA	8oz amber glass	None	
10	GROSS ALPHA, BETA	1LTR POLY	NONE	
11				
12				

Weather: CLEAR, COLD, 30°F

Sampling Methodology/Description: SPLIT SPOON

Field Screening: NDA

Transportation/Destination: By Highway to Assaigai Laboratories, Albuquerque, NM

Sampling Purpose and Observations: Site Characterization

TA50 Characterization Drilling
Sample Collection Log

Sample ID: 50-BH4-R

Date: 12/13/01 **Time:** 1550 **Sample Type:** LIQUID-RINSATE

TA: 50 **Sample Location:** BOREHOLE 4

QA/QC Type: RINSATE (DECON.)

Grab: Yes___ No___ **Sampler:** Keith Tucker

Composite: Yes ✓ No___

Composite Type: ___ **Signature:**

Start Depth: NA **End Depth:** NA **Units:** Feet

Samples were collected using WGI-SOPs including: 1.02 rev2, 1.03 rev2, 1.04 rev2, 1.05 rev1 1.08 rev1, 6.24 rev1, and 6.26 rev1

KT 12/13/01

ID	Analysis	Container	Preservative	~~COC #~~
1	TPH-DRO	1oz clear glass	HCl	
2	Pesticide	2 ltr amber glass	None	
3	TTL Metal, RCRA	2 ltr poly	Nitric	
4	SVOA, 8270	2 ltr amber glass	None	
5	PCB	8oz clear glass	None	
6	TCLP VOA	8oz amber glass	None	
7	Gross alpha, beta,	4 ltr Plastic	None	
8	gamma			
9				
10				
11				
12				

Weather: CLEAR, COLD, 30°F

12/13/01
KT

Sampling Methodology/Description: ~~[illegible]~~ RINSATE/DECON CONFIRMATION. POURED DI WATER OVER DECON'D. CORE BARREL

Field Screening: NDA

Transportation/Destination: By Highway to Assaigai Laboratories, Albuquerque, NM

Sampling Purpose and Observations: Site Characterization / QA QC

TA50 Characterization Drilling
Sample Collection Log

Sample ID: 50-BH5-RB

Date: 12/16/01 Time: 1130 Sample Type: LIQUID - RINSATE

TA: 50 Sample Location: BOREHOLE 5

QA/QC Type: RINSATE, DECON.

Grab: Yes____ No____

Composite: Yes ✓ No____

Composite Type: ________

Sampler: Keith Tucker

Signature:

Start Depth: NA End Depth: NA Units: Feet

Samples were collected using WGI-SOPs including: 1.02 rev2, 1.03 rev2, 1.04 rev2, 1.05 rev1 1.08 rev1, 6.24 rev1, and 6.26 rev1

KT 12/18/01

ID	Analysis	Container	Preservative	~~COC#~~
1	TPH-DRO	1oz clear glass	HCl	
2	Pesticide	2 ltr amber glass	None	
3	TTL Metal, RCRA	2 ltr poly	Nitric	
4	SVOA, 8270	2 ltr amber glass	None	
5	~~PCB~~	~~8oz clear glass~~	~~None~~ KT 12/16/01	
6	~~TCLP VOA~~	~~8oz amber glass~~	~~None~~	
7	Gross alpha, beta,	4 ltr Plastic	None	
8	gamma			
9				
10				
11				
12				

Weather: CLEAR, COLD, 30°F

Sampling Methodology/Description: RINSATE/DECON. CONFIRMATION. POURED DI WATER OVER DECON'D SAMPLING BOWL.

Field Screening: NDA

Transportation/Destination: By Highway to Assaigai Laboratories, Albuquerque, NM

Sampling Purpose and Observations: Site Characterization / QA QC

TA50 Characterization Drilling
Sample Collection Log

Sample ID: 50-BH5-6

Date: 12/16/01 **Time:** 1030 **Sample Type:** CORE - FULL SUITE

TA: 50 **Sample Location:** BOREHOLE 5

QA/QC Type: NA

Grab: Yes____ No____ **Sampler:** Keith Tucker
Composite: Yes ✓ No____
Composite Type: ____ **Signature:**

Start Depth: ~~[illegible]~~ 5.5 KT 12/16/01 **End Depth:** ~~[illegible]~~ 6.5 KT 12/16/01 **Units:** Feet

Samples were collected using WGI-SOPs including: 1.02 rev2, 1.03 rev2, 1.04 rev2, 1.05 rev1
1.08 rev1, 6.24 rev1, and 6.26 rev1

ID	Analysis	Container	Preservative	KT 12/16/01 ~~COC #~~
1	TPH-DRO	8oz clear glass	None	
2	Pesticide	8oz clear glass	None	
3	TCLP Metal	8oz clear glass	None	
4	TTL Metal, RCRA	8oz clear glass	None	
5	PCB	8oz clear glass	None	
6	Gamma Spec	8oz clear glass	None	
7	Iso U, Pu, Am, Sr90	8oz clear glass	None	
8	SVOA, 8270	8oz clear glass	None	
9	TCLP VOA	8oz amber glass	None	
10	GROSS ALPHA BETA	1 LTR POLY	"	
11				
12				

Weather: CLEAR, COLD, 25°F

Sampling Methodology/Description: SPLIT SPOON

Field Screening: NDA

Transportation/Destination: By Highway to Assaigai Laboratories, Albuquerque, NM

Sampling Purpose and Observations: Site Characterization

TA50 Characterization Drilling
Sample Collection Log

Sample ID: 50-BH5-10

Date: 12/16/01 **Time:** 1040 **Sample Type:** CORE - FULL SUITE

TA: 50 **Sample Location:** BOREHOLE 5

QA/QC Type: NA

Grab: Yes / No ___ **Sampler:** Keith Tucker
Composite: Yes / No ___
Composite Type: ___ **Signature:**

Start Depth: 9.0 **End Depth:** 10.0 **Units:** Feet

Samples were collected using WGI-SOPs including: 1.02 rev2, 1.03 rev2, 1.04 rev2, 1.05 rev1
1.08 rev1, 6.24 rev1, and 6.26 rev1

KT 12/16/01

ID	Analysis	Container	Preservative	~~SOC#~~
1	TPH-DRO	8oz clear glass	None	
2	Pesticide	8oz clear glass	None	
3	TCLP Metal	8oz clear glass	None	
4	TTL Metal, RCRA	8oz clear glass	None	
5	PCB	8oz clear glass	None	
6	Gamma Spec	8oz clear glass	None	
7	Iso U, Pu, Am, Sr90	8oz clear glass	None	
8	SVOA, 8270	8oz clear glass	None	
9	TCLP VOA	8oz amber glass	None	
10	GROSS ALPHABETA	1 LTR POLY	"	
11				
12				

Weather: CLEAR, COLD, 25°F

Sampling Methodology/Description: SPLIT SPOON

Field Screening: NDA

Transportation/Destination: By Highway to Assaigai Laboratories, Albuquerque, NM

Sampling Purpose and Observations: Site Characterization

TA50 Characterization Drilling
Sample Collection Log

Sample ID: 50-BH5-25

Date: 12/16/01 **Time:** 1110 **Sample Type:** CORE-FULL SUITE

TA: 50 **Sample Location:** BOREHOLE 5

QA/QC Type: NA

Grab: Yes____ No____
Composite: Yes ✓ No____
Composite Type: ____

Sampler: Keith Tucker
Signature:

Start Depth: 24.0 **End Depth:** 25.0 **Units:** Feet

Samples were collected using WGI-SOPs including: 1.02 rev2, 1.03 rev2, 1.04 rev2, 1.05 rev1 1.08 rev1, 6.24 rev1, and 6.26 rev1

KT 12/16/01

ID	Analysis	Container	Preservative	~~COC#~~
1	TPH-DRO	8oz clear glass	None	
2	Pesticide	8oz clear glass	None	
3	TCLP Metal	8oz clear glass	None	
4	TTL Metal, RCRA	8oz clear glass	None	
5	PCB	8oz clear glass	None	
6	Gamma Spec	8oz clear glass	None	
7	Iso U, Pu, Am, Sr90	8oz clear glass	None	
8	SVOA, 8270	8oz clear glass	None	
9	TCLP VOA	8oz amber glass	None	
10	GROSS ALPHA BETA	1 LTR POLY	"	
11				
12				

Weather: CLEAR, COLD, 30°F

Sampling Methodology/Description: SPLIT SPOON

Field Screening: NDA

Transportation/Destination: By Highway to Assaigai Laboratories, Albuquerque, NM

Sampling Purpose and Observations: Site Characterization

TA50 Characterization Drilling
Sample Collection Log

Sample ID: 50-BH 6-3

Date: 12/16/09 Time: 0815 Sample Type: CORE - FULL SUITE

TA: 50 Sample Location: BOREHOLE 6

QA/QC Type: NA

Grab: Yes___ No___

Composite: Yes ✓ No___

Composite Type: ___

Sampler: Keith Tucker

Signature:

Start Depth: 3.0 End Depth: 4.0 Units: Feet

Samples were collected using WGI-SOPs including: 1.02 rev2, 1.03 rev2, 1.04 rev2, 1.05 rev1 1.08 rev1, 6.24 rev1, and 6.26 rev1

KT 12/16/09

ID	Analysis	Container	Preservative	~~COC#~~
1	TPH-DRO	8oz clear glass	None	
2	Pesticide	8oz clear glass	None	
3	TCLP Metal	8oz clear glass	None	
4	TTL Metal, RCRA	8oz clear glass	None	
5	PCB	8oz clear glass	None	
6	Gamma Spec	8oz clear glass	None	
7	Iso U, Pu, Am, Sr90	8oz clear glass	None	
8	SVOA, 8270	8oz clear glass	None	
9	TCLP VOA	8oz amber glass	None	
10	GROSS ALPHA BETA	1 LTR POLY	"	
11				
12				

Weather: CLEAR, COLD, 15°F

Sampling Methodology/Description: SPLIT SPOON

Field Screening: NDA

Transportation/Destination: By Highway to Assaigai Laboratories, Albuquerque, NM

Sampling Purpose and Observations: Site Characterization

TA50 Characterization Drilling
Sample Collection Log

Sample ID: 50-BH6-7

Date: 12/16/01 Time: 0845 Sample Type: CORE- FULL SUITE

TA: 50 Sample Location: BOREHOLE 6

QA/QC Type: NA

Grab: Yes___ No___

Composite: Yes ✓ No___

Composite Type: ___

Sampler: Keith Tucker

Signature:

Start Depth: 6.5 End Depth: 7.5 Units: Feet

Samples were collected using WGI-SOPs including: 1.02 rev2, 1.03 rev2, 1.04 rev2, 1.05 rev1 1.08 rev1, 6.24 rev1, and 6.26 rev1

				12/16/01
ID	Analysis	Container	Preservative	~~COC#~~
1	TPH-DRO	8oz clear glass	None	
2	Pesticide	8oz clear glass	None	
3	TCLP Metal	8oz clear glass	None	
4	TTL Metal, RCRA	8oz clear glass	None	
5	PCB	8oz clear glass	None	
6	Gamma Spec	8oz clear glass	None	
7	Iso U, Pu, Am, Sr90	8oz clear glass	None	
8	SVOA, 8270	8oz clear glass	None	
9	TCLP VOA	8oz amber glass	None	
10	GROSS ALPHA BETA	1 LTR POLY	"	
11				
12				

Weather: CLEAR, COLD, 15°F

Sampling Methodology/Description: SPLIT SPOON

Field Screening: NDA

Transportation/Destination: By Highway to Assaigai Laboratories, Albuquerque, NM

Sampling Purpose and Observations: Site Characterization

TA50 Characterization Drilling
Sample Collection Log

Sample ID: 50-BH6-25

Date: 12/16/01 **Time:** 0925 **Sample Type:** CORE - FULL SUITE

TA: 50 **Sample Location:** BOREHOLE 6

QA/QC Type: NA

Grab: Yes____ No____ **Sampler:** Keith Tucker

Composite: Yes ✓ No____

Composite Type: ________ **Signature:**

Start Depth: ________ **End Depth:** ________ **Units:** Feet

Samples were collected using WGI-SOPs including: 1.02 rev2, 1.03 rev2, 1.04 rev2, 1.05 rev1 1.08 rev1, 6.24 rev1, and 6.26 rev1

KT 12/16/01

ID	Analysis	Container	Preservative	~~COC #~~
1	TPH-DRO	8oz clear glass	None	
2	Pesticide	8oz clear glass	None	
3	TCLP Metal	8oz clear glass	None	
4	TTL Metal, RCRA	8oz clear glass	None	
5	PCB	8oz clear glass	None	
6	Gamma Spec	8oz clear glass	None	
7	Iso U, Pu, Am, Sr90	8oz clear glass	None	
8	SVOA, 8270	8oz clear glass	None	
9	TCLP VOA	8oz amber glass	None	
10	GROSS ALPHA BETA	1 LTR POLY	"	
11				
12				

Weather: CLEAR, COLD, 15°F

Sampling Methodology/Description: SPLIT SPOON

Field Screening: NDA

Transportation/Destination: By Highway to Assaigai Laboratories, Albuquerque, NM

Sampling Purpose and Observations: Site Characterization

TA50 Characterization Drilling
Sample Collection Log

Sample ID: 50-BH7-4

Date: 12/14/01 **Time:** 0900 **Sample Type:** CORE - FULL SUITE

TA: 50 **Sample Location:** BOREHOLE 7

QA/QC Type: NA

Grab: Yes____ No____

Composite: Yes ✓ No____

Composite Type: ____

Sampler: Keith Tucker

Signature:

Start Depth: 4.0 **End Depth:** 5.0 **Units:** Feet

Samples were collected using WGI-SOPs including: 1.02 rev2, 1.03 rev2, 1.04 rev2, 1.05 rev1 1.08 rev1, 6.24 rev1, and 6.26 rev1

				KT 12/14/01
ID	Analysis	Container	Preservative	~~COC#~~
1	TPH-DRO	8oz clear glass	None	
2	Pesticide	8oz clear glass	None	
3	TCLP Metal	8oz clear glass	None	
4	TTL Metal, RCRA	8oz clear glass	None	
5	PCB	8oz clear glass	None	
6	Gamma Spec	8oz clear glass	None	
7	Iso U, Pu, Am, Sr90	8oz clear glass	None	
8	SVOA, 8270	8oz clear glass	None	
9	TCLP VOA	8oz amber glass	None	
10	GROSS ALPHA BETA	1 LTR POLY	NONE	
11				
12				

Weather: CLEAR, COLD, 30°F

Sampling Methodology/Description: SPLIT SPOON

Field Screening: NDA

Transportation/Destination: By Highway to Assaigai Laboratories, Albuquerque, NM

Sampling Purpose and Observations: Site Characterization

TA50 Characterization Drilling
Sample Collection Log

Sample ID: 50-BH 7- 10

Date: 12/14/01 **Time:** 0930 **Sample Type:** CORE - FULL SUITE

TA: 50 **Sample Location:** BOREHOLE 7

QA/QC Type: NA

Grab: Yes___ No___

Composite: Yes ✓ No___

Composite Type:

Sampler: Keith Tucker

Signature:

Start Depth: 8.0 **End Depth:** 10.0 **Units:** Feet

Samples were collected using WGI-SOPs including: 1.02 rev2, 1.03 rev2, 1.04 rev2, 1.05 rev1
1.08 rev1, 6.24 rev1, and 6.26 rev1

KT 12/14/01

ID	Analysis	Container	Preservative	~~COC #~~
1	TPH-DRO	8oz clear glass	None	
2	Pesticide	8oz clear glass	None	
3	TCLP Metal	8oz clear glass	None	
4	TTL Metal, RCRA	8oz clear glass	None	
5	PCB	8oz clear glass	None	
6	Gamma Spec	8oz clear glass	None	
7	Iso U, Pu, Am, Sr90	8oz clear glass	None	
8	SVOA, 8270	8oz clear glass	None	
9	TCLP VOA	8oz amber glass	None	
10	GROSS ALPHA BETA	1 LTR POLY	NONE	
11				
12				

Weather: CLEAR, COLD, 34°F

Sampling Methodology/Description: SPLIT SPOON

Field Screening: NDA

Transportation/Destination: By Highway to Assaigai Laboratories, Albuquerque, NM

Sampling Purpose and Observations: Site Characterization

TA50 Characterization Drilling
Sample Collection Log

Sample ID: 50-BH7-10D

Date: 12/14/01 **Time:** 0930 **Sample Type:** CORE - FULL SUITE DUPLICATE

TA: 50 **Sample Location:** BOREHOLE 7

QA/QC Type: DUPLICATE

Grab: Yes____ No____

Composite: Yes ✓ No____

Composite Type:

Sampler: Keith Tucker

Signature:

Start Depth: 8.0 **End Depth:** 10.0 **Units:** Feet

Samples were collected using WGI-SOPs including: 1.02 rev2, 1.03 rev2, 1.04 rev2, 1.05 rev1 1.08 rev1, 6.24 rev1, and 6.26 rev1

ID	Analysis	Container	Preservative	KT 12/14/01 ~~COC #~~
1	TPH-DRO	8oz clear glass	None	
2	Pesticide	8oz clear glass	None	
3	TCLP Metal	8oz clear glass	None	
4	TTL Metal, RCRA	8oz clear glass	None	
5	PCB	8oz clear glass	None	
6	Gamma Spec	8oz clear glass	None	
7	Iso U, Pu, Am, Sr90	8oz clear glass	None	
8	SVOA, 8270	8oz clear glass	None	
9	TCLP VOA	8oz amber glass	None	
10	GROSS ALPHA BETA	1 LTR POLY	"	
11				
12				

Weather: CLEAR, COLD, 34°F

Sampling Methodology/Description: SPLIT SPOON

Field Screening: NDA

Transportation/Destination: By Highway to Assaigai Laboratories, Albuquerque, NM

Sampling Purpose and Observations: Site Characterization

TA50 Characterization Drilling
Sample Collection Log

Sample ID: 50-BH7-25

Date: 12/14/01 Time: 1100 Sample Type: CORE-FULL SUITE

TA: 50 Sample Location: BOREHOLE 7

QA/QC Type: NA

Grab: Yes No

Composite: [✓ Yes] No

Composite Type:

Sampler: Keith Tucker

Signature:

Start Depth: 24.0 End Depth: 25.0 Units: Feet

Samples were collected using WGI-SOPs including: 1.02 rev2, 1.03 rev2, 1.04 rev2, 1.05 rev1 1.08 rev1, 6.24 rev1, and 6.26 rev1

				12/14/01
ID	Analysis	Container	Preservative	~~COC #~~
1	TPH-DRO	8oz clear glass	None	
2	Pesticide	8oz clear glass	None	
3	TCLP Metal	8oz clear glass	None	
4	TTL Metal, RCRA	8oz clear glass	None	
5	PCB	8oz clear glass	None	
6	Gamma Spec	8oz clear glass	None	
7	Iso U, Pu, Am, Sr90	8oz clear glass	None	
8	SVOA, 8270	8oz clear glass	None	
9	TCLP VOA	8oz amber glass	None	
10	GROSS ALPHA BETA	1LTR POLY	NONE	
11				
12				

Weather: CLEAR, COLD, 34°F

Sampling Methodology/Description: SPLIT SPOON

Field Screening: NDA

Transportation/Destination: By Highway to Assaigai Laboratories, Albuquerque, NM

Sampling Purpose and Observations: Site Characterization

TA50 Characterization Drilling
Sample Collection Log

Sample ID: 50-BH8-25

Date: 12/16/01 Time: 1340 Sample Type: CORE - FULL SUITE

TA: 50 Sample Location: BOREHOLE 8

QA/QC Type: NA

Grab: Yes____ No____

Composite: Yes ✓ No____

Composite Type: ________

Sampler: Keith Tucker

Signature:

Start Depth: 24.0 End Depth: 25.0 Units: Feet

Samples were collected using WGI-SOPs including: 1.02 rev2, 1.03 rev2, 1.04 rev2, 1.05 rev1 1.08 rev1, 6.24 rev1, and 6.26 rev1

				KT 12/16/01
ID	Analysis	Container	Preservative	~~COC~~ #
1	TPH-DRO	8oz clear glass	None	
2	Pesticide	8oz clear glass	None	
3	TCLP Metal	8oz clear glass	None	
4	TTL Metal, RCRA	8oz clear glass	None	
5	PCB	8oz clear glass	None	
6	Gamma Spec	8oz clear glass	None	
7	Iso U, Pu, Am, Sr90	8oz clear glass	None	
8	SVOA, 8270	8oz clear glass	None	
9	TCLP VOA	8oz amber glass	None	
10	GROSS ALPHA BETA	1 LTR POLY	"	
11				
12				

Weather: CLEAR, COLD, 36°F

Sampling Methodology/Description: SPLIT SPOON

Field Screening: NDA

Transportation/Destination: By Highway to Assaigai Laboratories, Albuquerque, NM

Sampling Purpose and Observations: Site Characterization

TA50 Characterization Drilling
Sample Collection Log

Sample ID: KT 12/16/01 ~~[illegible]~~ · 50-SB

Date: 12/16/01 Time: 1000 Sample Type: SOIL BLANK - FULL SUITE

TA: 50 Sample Location: BOREHOLE 7

QA/QC Type: TRIP BLANK (SOIL)

Grab: Yes____ No____

Composite: Yes ✓ No____

Composite Type:

Sampler: Keith Tucker

Signature:

Start Depth: NA End Depth: NA Units: Feet

Samples were collected using WGI-SOPs including: 1.02 rev2, 1.03 rev2, 1.04 rev2, 1.05 rev1 1.08 rev1, 6.24 rev1, and 6.26 rev1

KT 12/16/01

ID	Analysis	Container	Preservative	~~COC#~~
1	TPH-DRO	8oz clear glass	None	
2	Pesticide	8oz clear glass	None	
3	TCLP Metal	8oz clear glass	None	
4	TTL Metal, RCRA	8oz clear glass	None	
5	PCB	8oz clear glass	None	
6	Gamma Spec	8oz clear glass	None	
7	Iso U, Pu, Am, Sr90	8oz clear glass	None	
8	SVOA, 8270	8oz clear glass	None	
9	TCLP VOA	8oz amber glass	None	
10	GROSS ALPHA BETA	1LTR POLY	"	
11				
12				

Weather: CLEAR, COLD, 32°F

Sampling Methodology/Description: CLEAN SAND POURED INTO BOTTLES IN THE FIELD.

Field Screening: NDA

Transportation/Destination: By Highway to Assaigai Laboratories, Albuquerque, NM

Sampling Purpose and Observations: Site Characterization

TA50 Characterization Drilling
Sample Collection Log

KT 12/16/01

Sample ID: 50-BH8-[illegible] 2

Date: 12/16/01 Time: 1245 Sample Type: CORE - FULL SUITE

TA: 50 Sample Location: BOREHOLE 8

QA/QC Type: NA

Grab: Yes____ No____

Composite: Yes ✓ No____

Composite Type: ____

Sampler: Keith Tucker

Signature:

KT 12/16/01 KT 12/16/01

Start Depth: [illegible] 1.0 End Depth: [illegible] 2.0 Units: Feet

Samples were collected using WGI-SOPs including: 1.02 rev2, 1.03 rev2, 1.04 rev2, 1.05 rev1 1.08 rev1, 6.24 rev1, and 6.26 rev1

ID	Analysis	Container	Preservative	KT 12/16/01 ~~COC #~~
1	TPH-DRO	8oz clear glass	None	
2	Pesticide	8oz clear glass	None	
3	TCLP Metal	8oz clear glass	None	
4	TTL Metal, RCRA	8oz clear glass	None	
5	PCB	8oz clear glass	None	
6	Gamma Spec	8oz clear glass	None	
7	Iso U, Pu, Am, Sr90	8oz clear glass	None	
8	SVOA, 8270	8oz clear glass	None	
9	TCLP VOA	8oz amber glass	None	
10	GROSS ALPHA BETA	1 LTR POLY	"	
11				
12				

Weather: CLEAR, COLD, 34°F

Sampling Methodology/Description: SPLIT SPOON

Field Screening: NDA

Transportation/Destination: By Highway to Assaigai Laboratories, Albuquerque, NM

Sampling Purpose and Observations: Site Characterization

TA50 Characterization Drilling
Sample Collection Log

Sample ID: 50-BH8.9

Date: 12/16/01 **Time:** 1300 **Sample Type:** CORE - FULL SUITE

TA: 50 **Sample Location:** BOREHOLE 8

QA/QC Type: NA

Grab: Yes____ No____

Composite: Yes [✓] No____

Composite Type: ________

Sampler: Keith Tucker

Signature:

Start Depth: 9.0 **End Depth:** 10.0 **Units:** Feet

Samples were collected using WGI-SOPs including: 1.02 rev2, 1.03 rev2, 1.04 rev2, 1.05 rev1 1.08 rev1, 6.24 rev1, and 6.26 rev1

KT 12/16/01

ID	Analysis	Container	Preservative	~~COC~~ #
1	TPH-DRO	8oz clear glass	None	
2	Pesticide	8oz clear glass	None	
3	TCLP Metal	8oz clear glass	None	
4	TTL Metal, RCRA	8oz clear glass	None	
5	PCB	8oz clear glass	None	
6	Gamma Spec	8oz clear glass	None	
7	Iso U, Pu, Am, Sr90	8oz clear glass	None	
8	SVOA, 8270	8oz clear glass	None	
9	TCLP VOA	8oz amber glass	None	
10	GROSS ALPHA BETA	1 LTR POLY	"	
11				
12				

Weather: CLEAR, COLD, 34°F

Sampling Methodology/Description: SPLIT SPOON

Field Screening: NDA

Transportation/Destination: By Highway to Assaigai Laboratories, Albuquerque, NM

Sampling Purpose and Observations: Site Characterization

Appendix B. Chain of Custody Forms

ASSAIGAI ANALYTICAL LABORATORIES, INC.

Chain of Custody Record

7300 JEFFERSON N.E.
ALBUQUERQUE, NEW MEXICO 87109
(505) 345-8964

3332 WEDGEWOOD
EL PASO, TEXAS 79925
(915) 593-6000

127 EASTGATE DRIVE, 212-C
LOS ALAMOS, NEW MEXICO 87544
(505) 662-2558

Lab job No.: 0112289 Date 12/17/01

Page 1 of 3

Client SCIENCE & ENGRG. ASSOC. INC.

Address 2237 TRINITY DR, BLDG 2, 1ST FLR

City / State / Zip LOS ALAMOS, NM 87544

Project Name / Number TASO CHAR. DRILLING

Contract / Purchase Order / Quote

Project Manager / Contact KEITH TUCKER

Telephone No. 505-662-1329

Fax No. 505-662-1398

Samplers : (signature)

AAL Fraction Number	Field Sample Number / Location	Date	Time	Sample Type	Type / Size of Container	Preservation Temp.	Preservation Chemical	No. of Containers	TPH-DRO	PESTICIDES	TCLP METAL	RCRA METAL	PCB's	TCLP VOA	SVOA 8270	ISO U, Pu, Am, Sr90	GROSS ALPHA BETA GAMMA	Remarks
01A →	50-BH1-3 / TASO	12/15/01	0830	S				10	✓	✓	✓	✓	✓	✓	✓	✓	✓	
02A	50-BH1-3D / TASO	12/15/01	0830	S				10	✓	✓	✓	✓	✓	✓	✓	✓	✓	
03A	50-BH1-7 / TASO	12/15/01	0900	S				10	✓	✓	✓	✓	✓	✓	✓	✓	✓	
04A	50-BH1-25 / TASO	12/15/01	0940	S				10	✓	✓	✓	✓	✓	✓	✓	✓	✓	
05A	50-BH2-3 / TASO	12/15/01	1045	S				10	✓	✓	✓	✓	✓	✓	✓	✓	✓	
06A	50-BH2-7 / TASO	12/15/01	1100	S				10	✓	✓	✓	✓	✓	✓	✓	✓	✓	
07A	50-BH2-25 / TASO	12/15/01	1200	S				10	✓	✓	✓	✓	✓	✓	✓	✓	✓	
08A	50-BH2-70 / TASO	12/15/01	1420	S				10	✓	✓	✓	✓	✓	✓	✓	✓	✓	
09A	50-BH2-90 / TASO	12/15/01	1530	S				10	✓	✓	✓	✓	✓	✓	✓	✓	✓	
10A	50-BH3-7 / TASO	12/14/01	1415	S				10	✓	✓	✓	✓	✓	✓	✓	✓	✓	
11A	50-BH3-11 / TASO	12/14/01	1440	S				10	✓	✓	✓	✓	✓	✓	✓	✓	✓	
12A	50-BH3-25 / TASO	12/14/01	1520	S				10	✓	✓	✓	✓	✓	✓	✓	✓	✓	

Relinquished by:
Signature
Printed KEITH TUCKER
Company SEA
Reason ANALYSIS

Date 12/17/01
Time 1305

Received by:
Signature Bina
Printed J. Bianza
Company TA
Reason TA

Relinquished by:
Signature Bina
Printed [illegible]
Company TA
Reason TA

Date 12/17/01
Time 14:31

Received by:
Signature [illegible]
Printed [illegible]
Company AAL
Reason Analysis

Method of Shipment:

Shipment No.

Special Instructions:

Comments:

After analysis, samples are to be:

☐ Disposed of (additional fee)
☐ Stored (30 days max)
☐ Stored over 30 days (additional fee)
☐ Returned to customer

ASSAIGAI ANALYTICAL LABORATORIES, INC.

Chain of Custody Record

7300 JEFFERSON N.E.
ALBUQUERQUE, NEW MEXICO 87109
(505) 345-8964

3332 WEDGEWOOD
EL PASO, TEXAS 79925
(915) 593-6000

127 EASTGATE DRIVE, 212-C
LOS ALAMOS, NEW MÉXICO 87544
(505) 662-2558

Lab job No.: 0112289 Date 12/17/01

Page 2 of 3

Client SCIENCE & ENGRG ASSOC. INC

Address 2237 TRINITY DR, BLDG 2, 1ST FLR

City / State / Zip LOS ALAMOS, NM 87544

Project Name / Number TASO CHAR. DRILLING

Contract / Purchase Order / Quote

Project Manager / Contact KEITH TUCKER

Telephone No. 505-662-1329

Fax No. 505-662-1398

Samplers: (signature)

AAL Fraction Number	Field Sample Number / Location	Date	Time	Sample Type	Type / Size of Container	Preservation Temp.	Preservation Chemical	No. of Containers	TPH-DRO	PESTICIDES	TCLP METAL	RCRA METAL	PCB's	TCLP VOA	SVOA 8270	150 U/Pu Am Sr90	GROSS ALPHA/GAMMA BETA SPEC	Remarks
13A —LK	50.BH4.3/TASO	12/13/01	1210	S				10	✓	✓	✓	✓	✓	✓	✓	✓	✓	
14A —LK	50.BH4.12/TASO	12/13/01	1255	S				10	✓	✓	✓	✓	✓	✓	✓	✓	✓	
15A —LK	50.BH4.23/TASO	12/13/01	1700	S				10	✓	✓	✓	✓	✓	✓	✓	✓	✓	
16A	50.BH4.R/TASO	12/13/01	1550	~~S~~ L			7	[illegible]	✓	✓	[illegible] KT	✓	✓	✓	✓	[illegible] KT	✓	
17A	50.BH5.RB/TASO	12/16/01	1130	L				5	✓	✓		✓			✓		✓	
18A —KZ	50.BH5.6/TASO	12/16/01	1030	S				10	✓	✓	✓	✓	✓	✓	✓	✓	✓	
19A	50.BH5.10/TASO	12/16/01	1040	S				10	✓	✓	✓	✓	✓	✓	✓	✓	✓	
20A	50.BH5.25/TASO	12/16/01	1110	S				10	✓	✓	✓	✓	✓	✓	✓	✓	✓	
21A	50.BH6.3/TASO	12/16/01	0815	S				10	✓	✓	✓	✓	✓	✓	✓	✓	✓	
22A	50.BH6.7/TASO	12/16/01	0845	S				10	✓	✓	✓	✓	✓	✓	✓	✓	✓	
23A	50.BH6.25/TASO	12/16/01	0925	S				10	✓	✓	✓	✓	✓	✓	✓	✓	✓	
24A	50.BH7.4/TASO	12/14/01	0900	S				10	✓	✓	✓	✓	✓	✓	✓	✓	✓	

Relinquished by:
Signature
Printed KEITH TUCKER
Company SEA
Reason ANALYSIS

Date 12/17/01
Time 1305

Received by:
Signature
Printed JA Biava
Company AAL
Reason To A

Relinquished by:
Signature
Printed JA Biava
Company AAL
Reason To A

Date 12/17/01
Time 1431

Received by:
Signature
Printed JESSICA BIAVA
Company AAL
Reason Analysis

Method of Shipment:
Shipment No.
Special Instructions:

Comments:

After analysis, samples are to be:
☐ Disposed of (additional fee)
☐ Stored (30 days max)
☐ Stored over 30 days (additional fee)
☐ Returned to customer

COURIER

ASSAIGAI ANALYTICAL LABORATORIES, INC.

Chain of Custody Record

Lab job No. 0112289 Date 12/17/01

Page 3 of 3

7300 JEFFERSON N.E.
ALBUQUERQUE, NEW MEXICO 87109
(505) 345-8964

3332 WEDGEWOOD
EL PASO, TEXAS 79925
(915) 593-6000

127 EASTGATE DRIVE, 212-C
LOS ALAMOS, NEW MEXICO 87544
(505) 662-2558

Client SCIENCE & ENGRG ASSOC INC.

Address 2237 TRINITY DR, BLDG 2, 1ST FLR

City / State / Zip LOS ALAMOS, NM 87544

Project Name / Number TASO CHAR. DRILLING

Contract / Purchase Order / Quote

Project Manager / Contact KEITH TUCKER

Telephone No. 505-662-1329

Fax No. 505-662-1398

Samplers : (signature)

AAL Fraction Number	Field Sample Number / Location	Date	Time	Sample Type	Type / Size of Container	Preservation		No. of Containers	TPH-DRO	PESTICIDES	TCLP METAL	RCRA METAL	PCBs	TCLP VOA	SVOA 8270	Iso U Pu Am Sr90	GROSS ALPHA BETA / GAMMA SPEC	Remarks
						Temp.	Chemical											
25A	50.BH7.10 / TASO	12/14/01	0930	S				10	✓	✓	✓	✓	✓	✓	✓	✓	✓	
26A	50.BH7.10D / TASO	12/14/01	0930	S				10	✓	✓	✓	✓	✓	✓	✓	✓	✓	
27A	50.BH7.25 / TASO	12/14/01	1100	S				10	✓	✓	✓	✓	✓	✓	✓	✓	✓	
28A	50.BH8.2 / TASO	12/16/01	1245	S				10	✓	✓	✓	✓	✓	✓	✓	✓	✓	
29A	50.BH8.9 / TASO	12/16/01	1300	S				10	✓	✓	✓	✓	✓	✓	✓	✓	✓	
30A	50.BH8.25 / TASO	12/16/01	1340	S				10	✓	✓	✓	✓	✓	✓	✓	✓	✓	
31A	50.SB / TASO	12/16/01	1000	S				2						✓				

2 trip blanks received w/ this c.o.c.
12/18/01

Relinquished by:
Signature
Printed KEITH TUCKER
Company SEA
Reason ANALYSIS
Date 12/17/01
Time 1305

Received by:
Signature
Printed JA Baca
Company AAL
Reason log-in

Relinquished by:
Signature
Printed JA Baca
Company AAL
Reason [illegible]
Date 12/17/01
Time 14:51

Received by:
Signature
Printed [illegible]
Company AAL
Reason Analysis

Method of Shipment:
Shipment No.
Special Instructions:

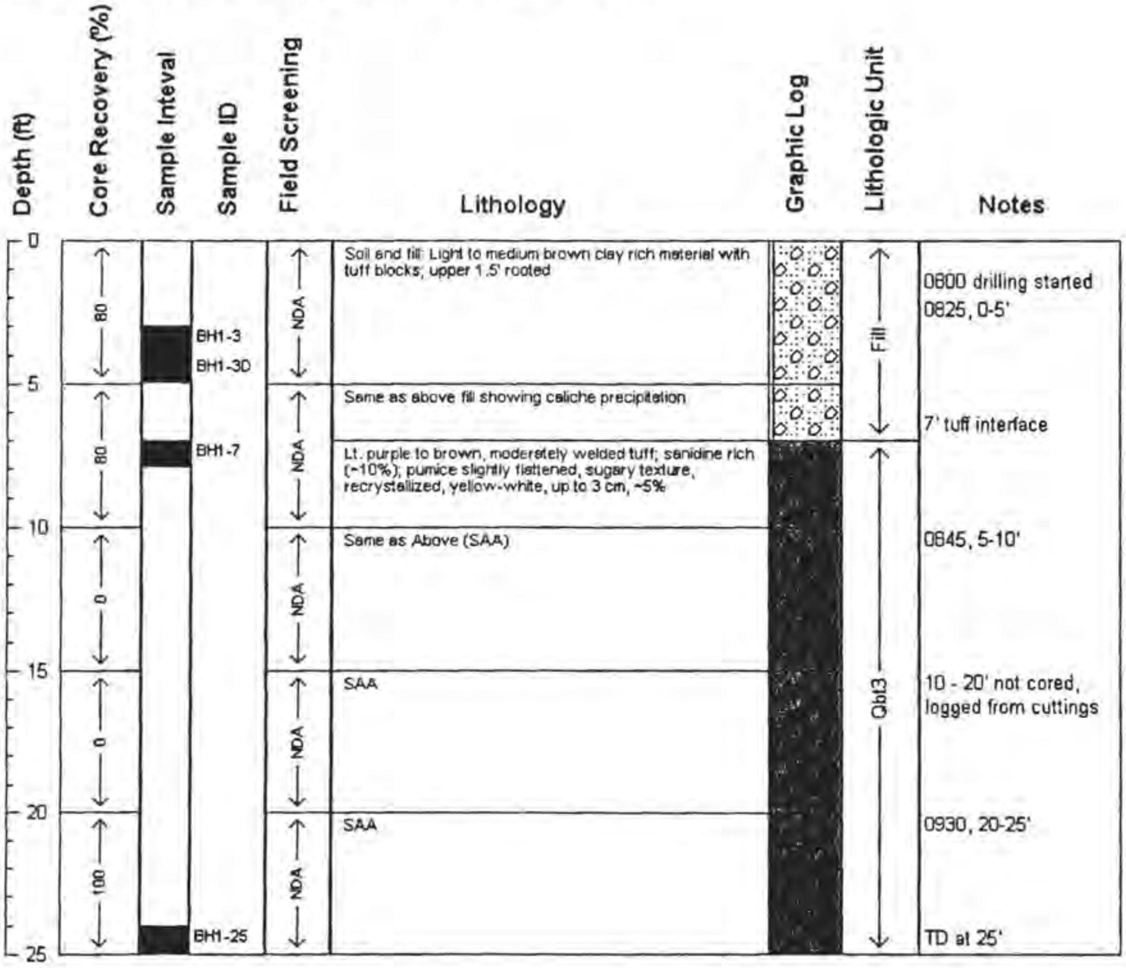
Comments:

After analysis, samples are to be:
☐ Disposed of (additional fee)
☐ Stored (30 days max)
☐ Stored over 30 days (additional fee)
☐ Returned to customer

Appendix C. Borehole Geological Logs

LANL TA-50 Pump House Soil Characterization

Borehole ID: 50-BH1
Location: TA-50, WM 83
Drilling Company: Kleinfelder
Start Date/Time: 12/15/01 / 0800
Driller: Robert Helton
End Date/Time: 12/15/01 / 0930
Drilling Equipment/Method: CME 75/ Hollow Stem Augering
Sampling Equipment/Method: Split Spoon/ continuous sampling
Geologist: Dennis Newell, SEA
Bearing/Inclination: Vertical
Northing: 1768973.53 **Easting:** 1626334.02 **Elevation:** 7172.13

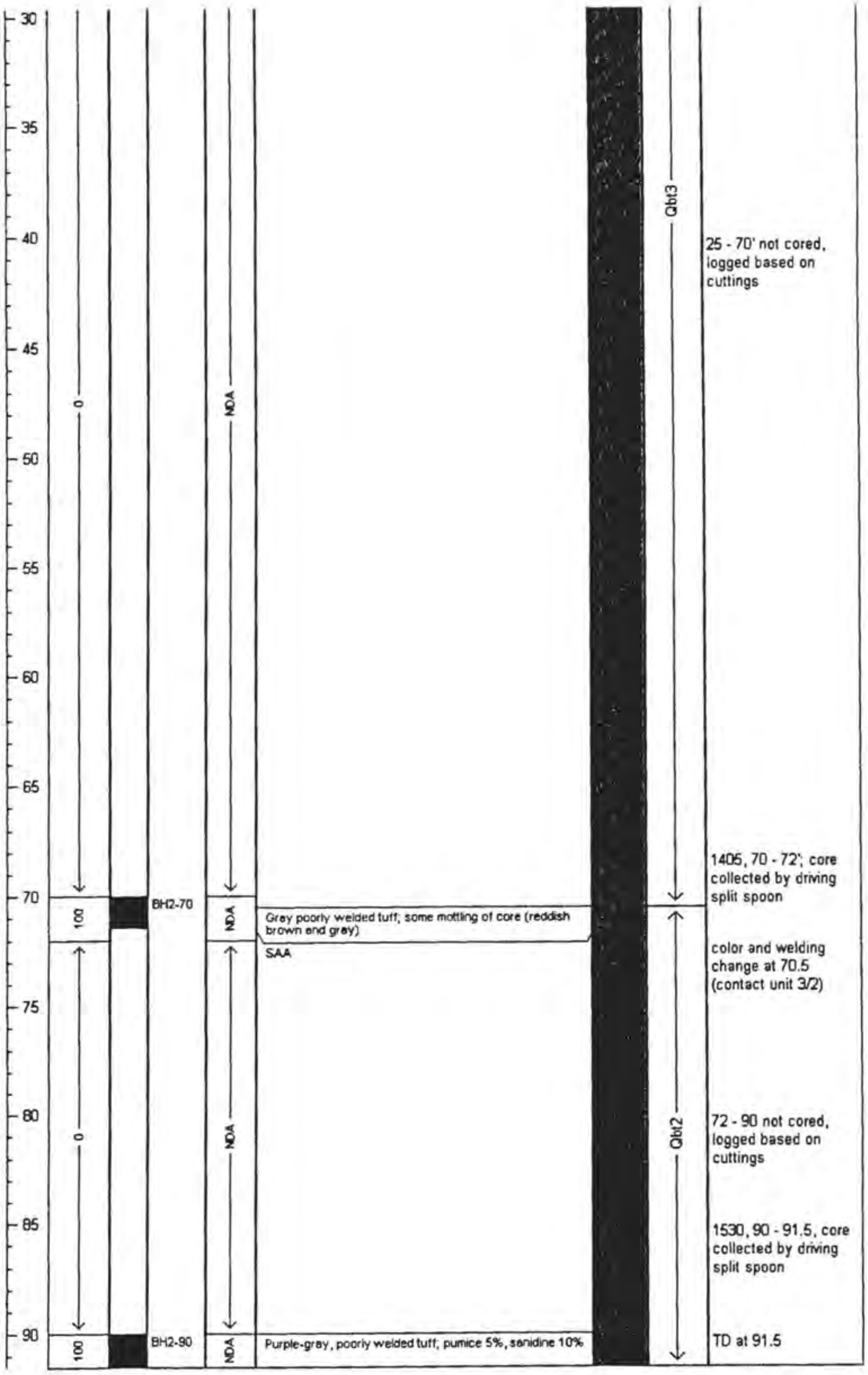


Depth (ft)	Core Recovery (%)	Sample Inteval	Sample ID	Field Screening	Lithology	Graphic Log	Lithologic Unit	Notes
0	80	■	BH1-3 BH1-3D	NDA	Soil and fill: Light to medium brown clay rich material with tuff blocks; upper 1.5' rooted		Fill	0800 drilling started 0825, 0-5'
5	80	■	BH1-7	NDA	Same as above fill showing caliche precipitation Lt. purple to brown, moderately welded tuff; sanidine rich (~10%); pumice slightly flattened, sugary texture, recrystallized, yellow-white, up to 3 cm, ~5%		Fill Qbt3	7' tuff interface
10	0			NDA	Same as Above (SAA)		Qbt3	0845, 5-10'
15	0			NDA	SAA		Qbt3	10 - 20' not cored, logged from cuttings
20	100	■	BH1-25	NDA	SAA		Qbt3	0930, 20-25' TD at 25'
25								

LANL TA-50 Pump House Soil Characterization

Borehole ID: 50-BH2
Location: TA-50, WM 83
Drilling Company: Kleinfelder
Start Date/Time: 12/15/01 / 1030
Driller: Robert Helton
End Date/Time: 12/15/01 / 1530
Drilling Equipment/Method: CME 75/ Hollow Stem Augering
Sampling Equipment/Method: Split Spoon/ continuous sampling
Geologist: Dennis Newell, SEA
Bearing/Inclination: Vertical
Northing: 1768905.68 **Easting:** 1626331.79 **Elevation:** 7175.54

Depth (ft)	Core Recovery (%)	Sample Inteval	Sample ID	Field Screening	Lithology	Graphic Log	Lithologic Unit	Notes
0	80		BH2-3	NDA	Soil/Fill; upper 1.5' rooted soil; 1.5 - 6.5' comprised of mix of silty soil and crushed tuff		Fill	1030 drilling started 1040, 0-5'
5	80		BH2-7	NDA	Poorly welded, moderately weathered tuff; lt - med brown; pumice <5%, up to 1 cm, sugery-yellow white; crystal poor			6.5' Tuff interface
10	0			NDA	SAA except slightly weathered and slightly more welded; pumice up to 2 cm			1050, 5-10'
15	0			NDA	Mod-brown, poorly to moderately welded tuff; 10% sanidine, 5% pumice			1105, 10 - 15'
20	60		BH2-25	NDA	Reddish -brown, poorly to moderately welded tuff; pumice increased to 10% (lt grey to sugary white); sanidine 10-15%; core is damp			1120, 15-20; not cored, logged from geotech sample and cuttings
25					SAA			1150, 20 - 25'



Gray poorly welded tuff; some mottling of core (reddish brown and gray)

SAA

Purple-gray, poorly welded tuff; pumice 5%, sanidine 10%

25 - 70' not cored, logged based on cuttings

1405, 70 - 72'; core collected by driving split spoon

color and welding change at 70.5 (contact unit 3/2)

72 - 90 not cored, logged based on cuttings

1530, 90 - 91.5, core collected by driving split spoon

TD at 91.5

LANL TA-50 Pump House Soil Characterization

Borehole ID: 50-BH3

Location: TA-50, WM 83

Drilling Company: Kleinfelder

Start Date/Time: 12/14/01 / 1320

Driller: Robert Helton

End Date/Time: 12/14/01 / 1530

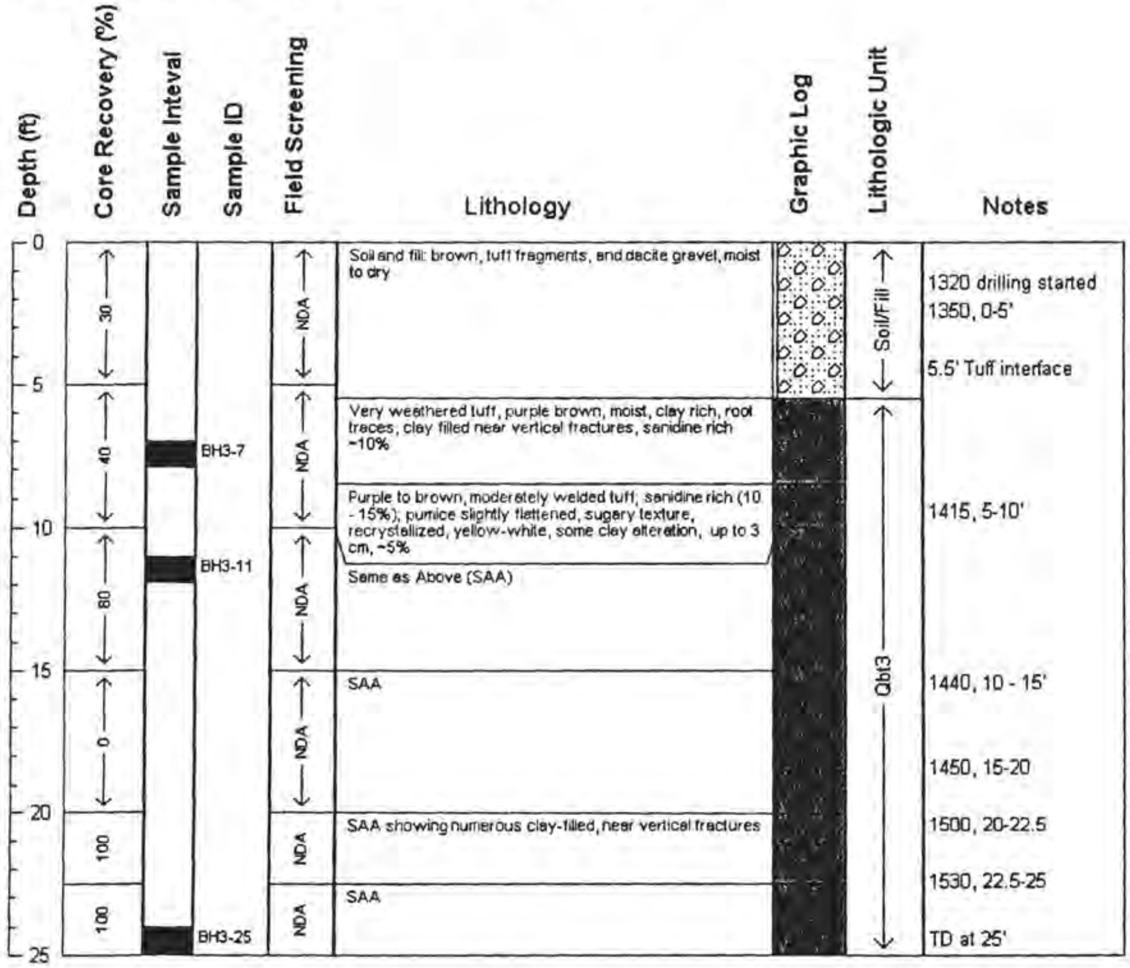
Drilling Equipment/Method: CME 75/ Hollow Stem Augering

Sampling Equipment/Method: Split Spoon/ continuous sampling

Geologist: Dennis Newell, SEA

Bearing/Inclination: Vertical

Northing: 1768856.13 **Easting:** 1626329.29 **Elevation:** 7168.78



Depth (ft)	Core Recovery (%)	Sample Inteval	Sample ID	Field Screening	Lithology	Graphic Log	Lithologic Unit	Notes
0	30			NDA	Soil and fill: brown, tuff fragments, and dacite gravel, moist to dry		Soil/Fill	1320 drilling started 1350, 0-5' 5.5' Tuff interface
5	40		BH3-7	NDA	Very weathered tuff, purple brown, moist, clay rich, root traces, clay filled near vertical fractures, sanidine rich ~10% Purple to brown, moderately welded tuff; sanidine rich (10 - 15%); pumice slightly flattened, sugary texture, recrystallized, yellow-white, some clay alteration, up to 3 cm, ~5%		Qbt3	1415, 5-10'
10	80		BH3-11	NDA	Same as Above (SAA)			1440, 10 - 15'
15	0			NDA	SAA			1450, 15-20
20	100			NDA	SAA showing numerous clay-filled, near vertical fractures			1500, 20-22.5
	100		BH3-25	NDA	SAA			1530, 22.5-25 TD at 25'
25								

LANL TA-50 Pump House Soil Characterization

Borehole ID: 50-BH4

Location: TA-50, WM 83

Drilling Company: Kleinfelder

Start Date/Time: 12/13/01 / 1145

Driller: Robert Helton

End Date/Time: 12/13/01 / 1705

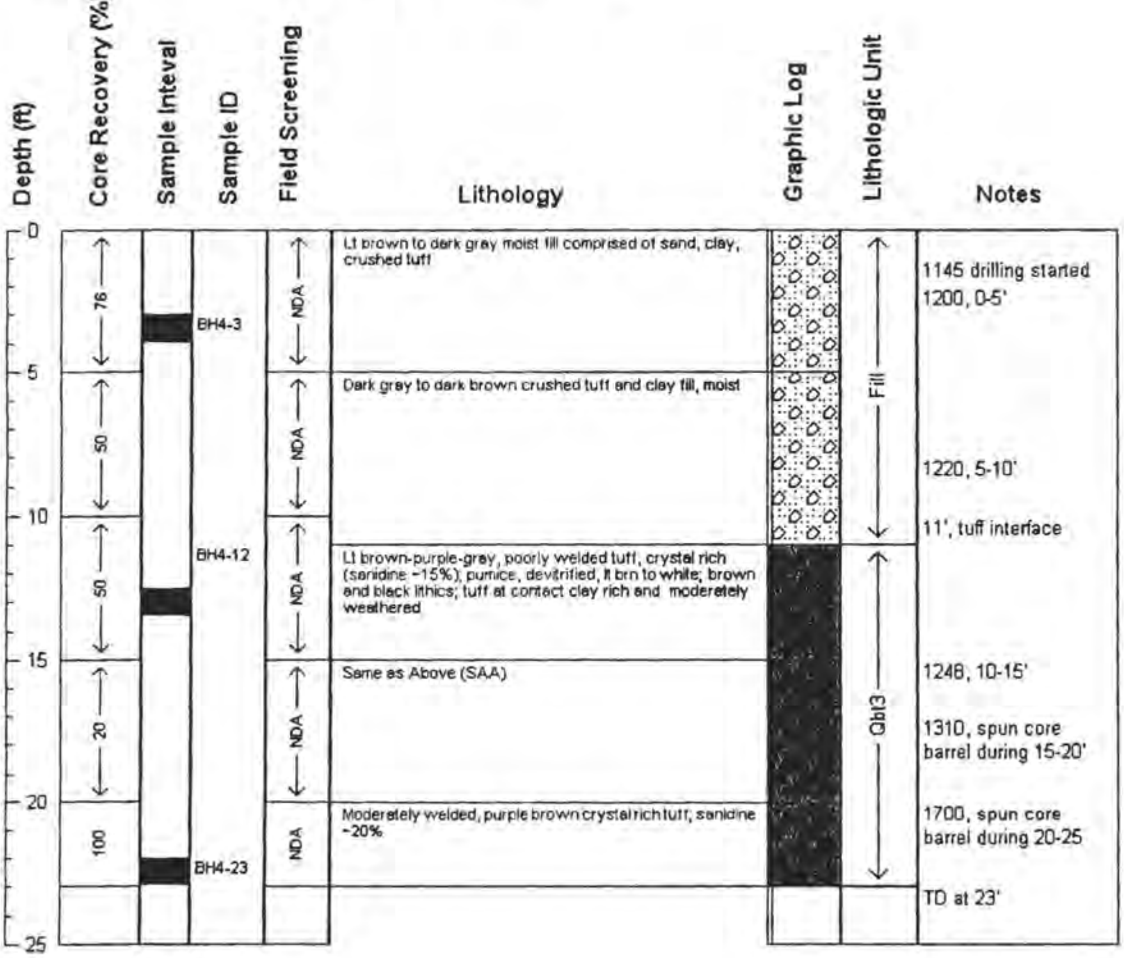
Drilling Equipment/Method: CME 75/ Hollow Stem Augering

Sampling Equipment/Method: Split Spoon/ continuous sampling

Geologist: Dennis Newell, SEA

Bearing/Inclination: Vertical

Northing: 1768873.98 **Easting:** 1626279.36 **Elevation:** 7174.61



Depth (ft)	Core Recovery (%)	Sample Inteval	Sample ID	Field Screening	Lithology	Graphic Log	Lithologic Unit	Notes
0	76	■	BH4-3	NDA	Lt brown to dark gray moist fill comprised of sand, clay, crushed tuff		Fill	1145 drilling started 1200, 0-5'
5	50			NDA	Dark grey to dark brown crushed tuff and clay fill, moist			1220, 5-10' 11', tuff interface
10	50	■	BH4-12	NDA	Lt brown-purple-grey, poorly welded tuff, crystal rich (sanidine ~15%); pumice, devitrified, lt brn to white; brown and black lithics; tuff at contact clay rich and moderately weathered		Qbt3	
15	20			NDA	Same as Above (SAA)			1248, 10-15' 1310, spun core barrel during 15-20'
20	100	■	BH4-23	NDA	Moderately welded, purple brown crystal rich tuff; sanidine ~20%			1700, spun core barrel during 20-25
25								TD at 23'

LANL TA-50 Pump House Soil Characterization

Borehole ID: 50-BH5

Location: TA-50, WM 83

Drilling Company: Kleinfelder

Start Date/Time: 12/16/01 / 0940

Driller: Robert Helton

End Date/Time: 12/16/01 / 1115

Drilling Equipment/Method: CME 75/ Hollow Stem Augering

Sampling Equipment/Method: Split Spoon/ continuous sampling

Geologist: Dennis Newell, SEA

Bearing/Inclination: Vertical

Northing: 1768924.28 **Easting:** 1626270.39 **Elevation:** 7175.50

Depth (ft)	Core Recovery (%)	Sample Inteval	Sample ID	Field Screening	Lithology	Graphic Log	Lithologic Unit	Notes
0	84			NDA	Fill comprised: Dark-brown to reddish brown clay; rich, moist, ruff chunks common		Fill	0940 drilling started 1000, 0-5'
5	70	■	BH5-6	NDA	Very weathered tuff		Qbt3	5.5' tuff interface 1015, 5-10'
					Moderately welded pink-purple tuff; pumice, sugary texture, white-yellow, <3cm, ~5%; senidine phenocrysts 10-15%			
		■	BH5-10					
10	0			NDA	Same as Above (SAA)			
15	0			NDA	SAA			10 - 20' not cored, logged from cuttings
20	70			NDA	Poorly welded reddish brown tuff; pumice 5%, 1-3 cm; senidine 10%; damp to dry			1100, 20-25'
		■	BH5-25					TD at 25'
25								

LANL TA-50 Pump House Soil Characterization

Borehole ID: 50-BH6

Location: TA-50, WM 83

Drilling Company: Kleinfelder

Start Date/Time: 12/16/01 / 0800

Driller: Robert Helton

End Date/Time: 12/16/01 / 0920

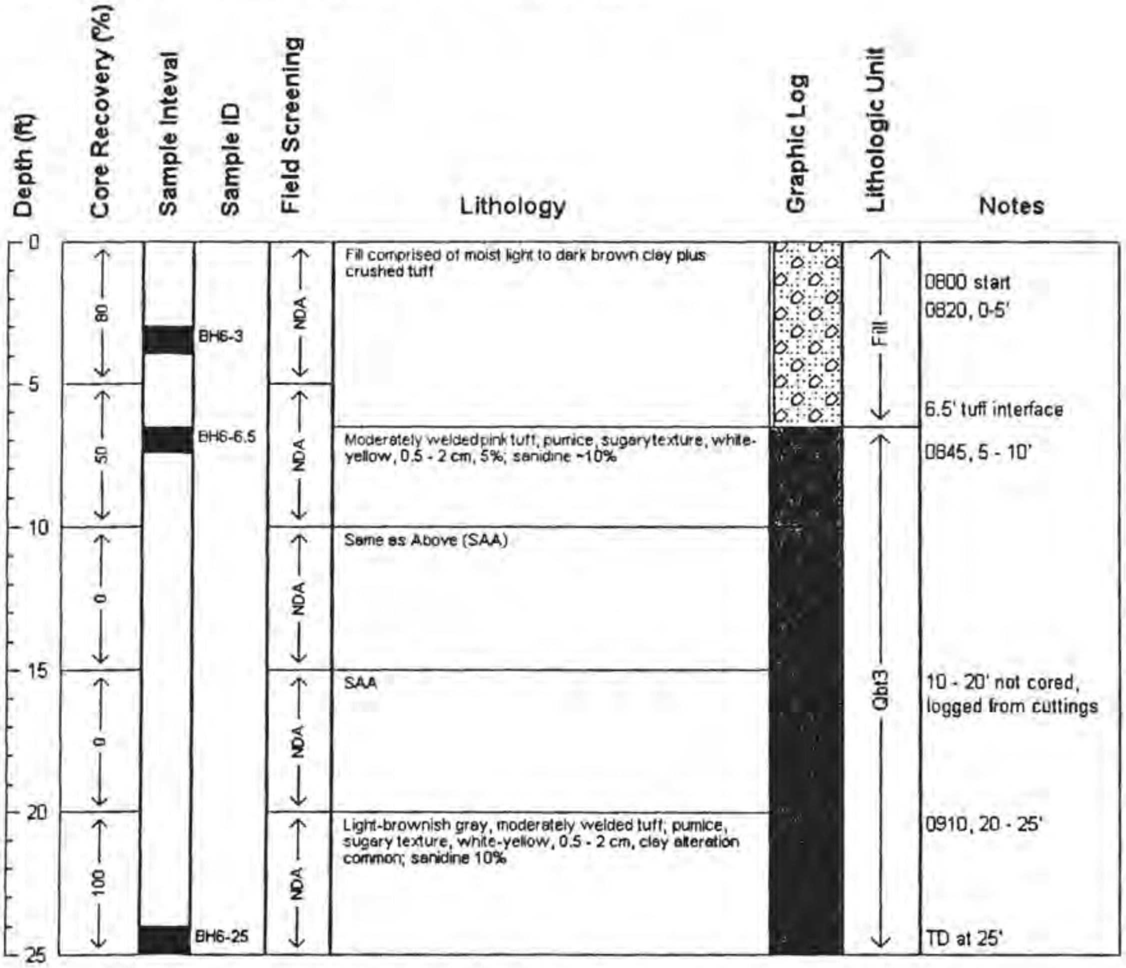
Drilling Equipment/Method: CME 75/ Hollow Stem Augering

Sampling Equipment/Method: Split Spoon/ continuous sampling

Geologist: Dennis Newell, SEA

Bearing/Inclination: Vertical

Northing: 1768978.79 **Easting:** 1626297.40 **Elevation:** 7175.50



Depth (ft)	Core Recovery (%)	Sample Inteval	Sample ID	Field Screening	Lithology	Graphic Log	Lithologic Unit	Notes
0	80		BH6-3	NDA	Fill comprised of moist light to dark brown clay plus crushed tuff		Fill	0800 start 0820, 0-5' 6.5' tuff interface
5	50		BH6-6.5	NDA	Moderately weldedpink tuff, pumice, sugarytexture, white-yellow, 0.5 - 2 cm, 5%; sanidine ~10%		Qbt3	0845, 5 - 10'
10	0			NDA	Same as Above (SAA)			
15	0			NDA	SAA			10 - 20' not cored, logged from cuttings
20	100		BH6-25	NDA	Light-brownish gray, moderately welded tuff; pumice, sugary texture, white-yellow, 0.5 - 2 cm, clay alteration common; sanidine 10%			0910, 20 - 25' TD at 25'
25								

LANL TA-50 Pump House Soil Characterization

Borehole ID: 50-BH7

Location: TA-50, WM 83

Drilling Company: Kleinfelder

Start Date/Time: 12/14/01 / 0830

Driller: Robert Helton

End Date/Time: 12/14/01 / 1045

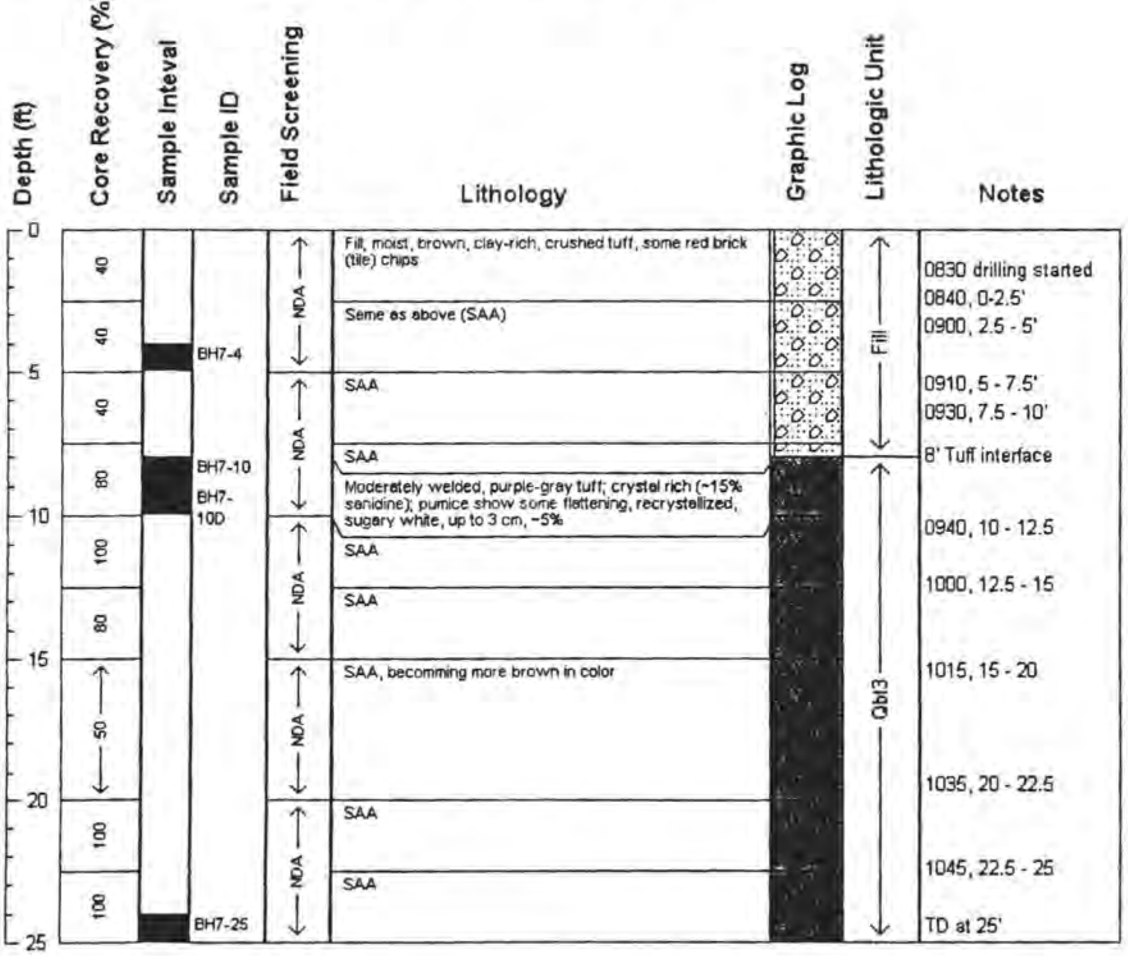
Drilling Equipment/Method: CME 75/ Hollow Stem Augering

Sampling Equipment/Method: Split Spoon/ continuous sampling

Geologist: Dennis Newell, SEA

Bearing/Inclination: Vertical

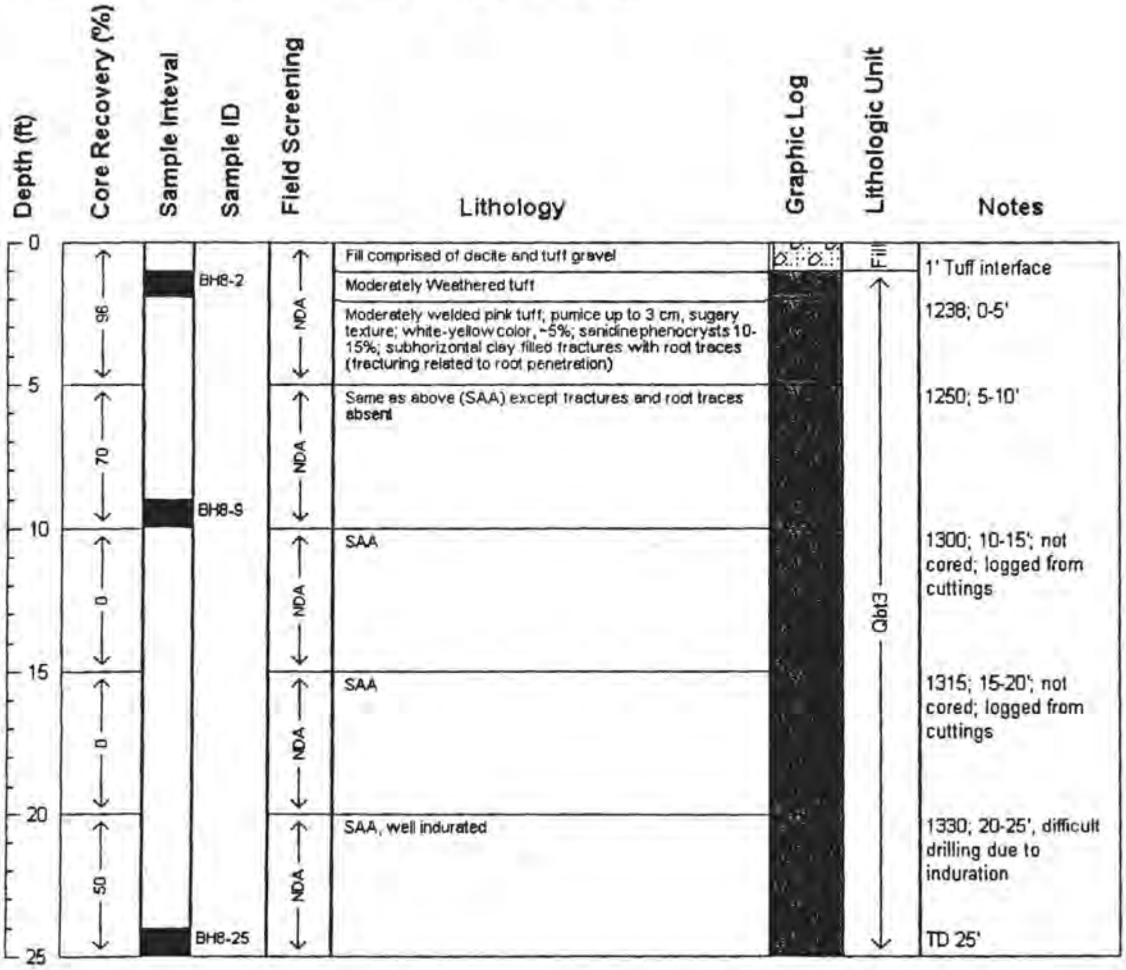
Northing: 1768905.68 **Easting:** 1626297.12 **Elevation:** 7175.54



Depth (ft)	Core Recovery (%)	Sample ID	Field Screening	Lithology	Lithologic Unit	Notes
0	40		NDA	Fill, moist, brown, clay-rich, crushed tuff, some red brick (tile) chips	Fill	0830 drilling started 0840, 0-2.5'
	40	BH7-4		Seme as above (SAA)		0900, 2.5 - 5'
5	40		NDA	SAA		0910, 5 - 7.5' 0930, 7.5 - 10'
	80	BH7-10 BH7-10D		SAA Moderately welded, purple-gray tuff; crystal rich (~15% sanidine); pumice show some flattening, recrystallized, sugary white, up to 3 cm, ~5%	Qbt3	8' Tuff interface
10	100		NDA	SAA		0940, 10 - 12.5
	80			SAA		1000, 12.5 - 15
15	50		NDA	SAA, becomming more brown in color		1015, 15 - 20
20	100		NDA	SAA		1035, 20 - 22.5
	100	BH7-25		SAA		1045, 22.5 - 25 TD at 25'
25						

LANL TA-50 Pump House Soil Characterization

Borehole ID: 50-BH8
Location: TA-50, WM 83
Drilling Company: Kleinfelder
Start Date/Time: 12/16/01 / 12:38
Driller: Robert Helton
End Date/Time: 12/16/01 / 13:45
Drilling Equipment/Method: CME 75/ Hollow Stem Augering
Sampling Equipment/Method: Split Spoon/ continuous sampling
Geologist: Dennis Newell, SEA
Bearing/Inclination: Vertical
Northing: 1768896.66 **Easting:** 1626147.02 **Elevation:** 7177.05



Depth (ft)	Core Recovery (%)	Sample Inteval	Sample ID	Field Screening	Lithology	Graphic Log	Lithologic Unit	Notes
0	96		BH8-2	NDA	Fill comprised of dacite and tuff gravel Moderately Weathered tuff Moderately welded pink tuff; pumice up to 3 cm, sugary texture; white-yellow color, ~5%; sanidinephenocrysts 10-15%; subhorizontal clay filled fractures with root traces (fracturing related to root penetration)		Fill Qbt3	1' Tuff interface 1238; 0-5'
5	70		BH8-9	NDA	Same as above (SAA) except fractures and root traces absent			1250; 5-10'
10	0			NDA	SAA			1300; 10-15'; not cored; logged from cuttings
15	0			NDA	SAA			1315; 15-20'; not cored; logged from cuttings
20	50		BH8-25	NDA	SAA, well indurated			1330; 20-25', difficult drilling due to induration TD 25'
25								

Appendix D. Laboratory Analytical Data Package

SWMU 50-004(c) Samples Taken

Sample ID	Location ID	Depth (ft)	Media	Anions	Metals	Gamma Spectroscopy	Tritium	Isotopic Plutonium	Isotopic Uranium
MD50-04-52698	50-03001	5–9	Qbt 3	1941S*	1941S	1942S	1942S	1942S	1942S
MD50-04-52699	50-03001	5–9	Qbt 3	1941S	1941S	1942S	1942S	1942S	1942S
MD50-03-52047	50-03002	15–20	Qbt 2	1901S	1901S	1902S	1902S	1902S	1902S
MD50-03-52048	50-03003	10–15	Qbt 2	1901S	1901S	1902S	1902S	1902S	1902S
MD50-03-52050	50-03008	10–15	Qbt 2	1901S	1901S	1902S	1902S	1902S	1902S
MD50-03-52052	50-03009	18–22	Fill	1792S	1792S	1793S	1793S	1793S	1793S
MD50-03-52051	50-03009	26–28	Qbt 2	1792S	1792S	1793S	1793S	1793S	1793S
MD50-03-52056	50-22441	10–15	Qbt 2	1901S	1901S	1902S	1902S	1902S	1902S
MD50-03-52057	50-22441	15–20	Qbt 2	1901S	1901S	1902S	1902S	1902S	1902S
MD50-03-52058	50-22442	10–15	Qbt 2	1901S	1901S	1902S	1902S	1902S	1902S
MD50-03-52059	50-22442	15–20	Qbt 2	1901S	1901S	1902S	1902S	1902S	1902S
MD50-03-52060	50-22443	10–15	Qbt 2	1901S	1901S	1902S	1902S	1902S	1902S
MD50-03-52055	50-22443	15–20	Qbt 2	1901S	1901S	1902S	1902S	1902S	1902S
MD50-03-52061	50-22443	15–20	Qbt 2	1901S	1901S	1902S	1902S	1902S	1902S
MD50-03-52062	50-22444	10–15	Qbt 2	1901S	1901S	1902S	1902S	1902S	1902S
MD50-03-52063	50-22444	15–20	Qbt 2	1901S	1901S	1902S	1902S	1902S	1902S

*Sample request number.

Frequency of Detected Inorganic Chemicals at SWMU 50-004(c)

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range[a] (mg/kg)	Background Value[b] (mg/kg)	Frequency of Detects Above Background Value	Frequency of Nondetects Above Background Value
Aluminum	Fill	1	1	3380 to 3380	29200	0/1	0/1
Aluminum	Qbt 2	13	13	963 to 7540	7340	1/13	0/13
Aluminum	Qbt 3	2	2	3380 to 4840	7340	0/2	0/2
Antimony	Qbt 2	12	1	0.0779 to [0.439]	0.5	0/12	0/12
Antimony	Qbt 3	2	0	[1.03 to 1.04]	0.5	0/2	2/2
Arsenic	Fill	1	1	1.86 to 1.86	8.17	0/1	0/1
Arsenic	Qbt 2	13	13	1.65 to 3.31	2.79	4/13	0/13
Arsenic	Qbt 3	2	2	1.67 to 1.71	2.79	0/2	0/2
Barium	Fill	1	1	28.6 to 28.6	295	0/1	0/1
Barium	Qbt 2	13	13	17.3 to 77.6	46	1/13	0/13
Barium	Qbt 3	2	2	22.5 to 51.2	46	1/2	0/2
Beryllium	Fill	1	1	0.642 to 0.642	1.83	0/1	0/1
Beryllium	Qbt 2	13	13	0.37 to 0.76	1.21	0/13	0/13
Beryllium	Qbt 3	2	2	0.58 to 0.602	1.21	0/2	0/2
Cadmium	Fill	1	0	[0.552 to 0.552]	0.4	0/1	1/1
Cadmium	Qbt 2	13	7	0.0483 to [0.554]	1.63	0/13	0/13
Cadmium	Qbt 3	2	1	0.0839 to [0.518]	1.63	0/2	0/2
Calcium	Fill	1	1	1470 to 1470	6120	0/1	0/1
Calcium	Qbt 2	13	13	242 to 1230	2200	0/13	0/13
Calcium	Qbt 3	2	2	966 to 1510	2200	0/2	0/2
Chromium	Fill	1	1	6.33 to 6.33	19.3	0/1	0/1
Chromium	Qbt 2	13	13	0.952 to 4.97	7.14	0/13	0/13
Chromium	Qbt 3	2	2	2.64 to 3.15	7.14	0/2	0/2
Cobalt	Fill	1	1	0.91 to 0.91	8.64	0/1	0/1
Cobalt	Qbt 2	13	13	0.21 to 2.44	3.14	0/13	0/13
Cobalt	Qbt 3	2	2	0.989 to 1.09	3.14	0/2	0/2
Copper	Fill	1	1	2.46 to 2.46	14.7	0/1	0/1
Copper	Qbt 2	13	13	1.03 to 4.53	4.66	0/13	0/13
Copper	Qbt 3	2	2	1.88 to 2.26	4.66	0/2	0/2
Iron	Fill	1	1	8330 to 8330	21500	0/1	0/1
Iron	Qbt 2	13	13	6340 to 9790	14500	0/13	0/13
Iron	Qbt 3	2	2	5370 to 6330	14500	0/2	0/2
Lead	Fill	1	1	2.77 to 2.77	22.3	0/1	0/1
Lead	Qbt 2	13	13	1.91 to 14	11.2	1/13	0/13
Lead	Qbt 3	2	2	2.85 to 3.34	11.2	0/2	0/2
Magnesium	Fill	1	1	631 to 631	4610	0/1	0/1

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range[a] (mg/kg)	Background Value[b] (mg/kg)	Frequency of Detects Above Background Value	Frequency of Nondetects Above Background Value
Magnesium	Qbt 2	13	13	177 to 1050	1690	0/13	0/13
Magnesium	Qbt 3	2	2	479 to 683	1690	0/2	0/2
Manganese	Fill	1	1	253 to 253	671	0/1	0/1
Manganese	Qbt 2	13	13	226 to 308	482	0/13	0/13
Manganese	Qbt 3	2	2	202 to 261	482	0/2	0/2
Mercury	Fill	1	1	0.146 to 0.146	0.1	1/1	0/1
Mercury	Qbt 2	13	11	0.00243 to 0.0226	0.1	0/13	0/13
Mercury	Qbt 3	2	2	0.00629 to 0.00725	0.1	0/2	0/2
Nickel	Fill	1	1	2.08 to 2.08	15.4	0/1	0/1
Nickel	Qbt 2	13	13	0.561 to 6.03	6.58	0/13	0/13
Nickel	Qbt 3	2	2	1.65 to 2.12	6.58	0/2	0/2
Perchlorate	Fill	1	0	[0.044 to 0.044]	na[c]	0/1	na
Perchlorate	Qbt 2	13	0	[0.0421 to 0.0438]	na	0/13	na
Perchlorate	Qbt 3	2	0	[0.0414 to 0.0421]	na	0/2	na
Potassium	Fill	1	1	443 to 443	3460	0/1	0/1
Potassium	Qbt 2	13	13	185 to 919	3500	0/13	0/13
Potassium	Qbt 3	2	2	299 to 395	3500	0/2	0/2
Selenium	Fill	1	0	[0.552 to 0.552]	1.52	0/1	0/1
Selenium	Qbt 2	13	1	0.192 to [1.25]	0.3	0/13	12/13
Selenium	Qbt 3	2	0	[0.518 to 0.527]	0.3	0/2	2/2
Silver	Fill	1	1	0.0515 to 0.0515	1	0/1	0/1
Silver	Qbt 2	13	13	0.0301 to 0.0666	1	0/13	0/13
Silver	Qbt 3	2	2	0.141 to 0.914	1	0/2	0/2
Sodium	Fill	1	1	105 to 105	915	0/1	0/1
Sodium	Qbt 2	13	13	92.9 to 160	2770	0/13	0/13
Sodium	Qbt 3	2	2	85.5 to 88.4	2770	0/2	0/2
Thallium	Fill	1	1	0.0322 to 0.0322	0.73	0/1	0/1
Thallium	Qbt 2	13	7	0.0244 to 0.205	1.1	0/13	0/13
Thallium	Qbt 3	2	2	0.0636 to 0.105	1.1	0/2	0/2
Vanadium	Fill	1	1	5.61 to 5.61	39.6	0/1	0/1
Vanadium	Qbt 2	13	13	2.48 to 12.1	17	0/13	0/13
Vanadium	Qbt 3	2	2	3.83 to 4.55	17	0/2	0/2
Zinc	Fill	1	1	38.8 to 38.8	48.8	0/1	0/1
Zinc	Qbt 2	13	13	28.5 to 42	63.5	0/13	0/13
Zinc	Qbt 3	2	2	26.9 to 28.3	63.5	0/2	0/2

[a] Values in square brackets indicate nondetects.

[b] BVs obtained from LANL 1998, 59730.

[c] na = Not available.

Frequency of Detected Radionuclides at SWMU 50-004(c)

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range[a] (pCi/g)	Background Value[b] (pCi/g)	Frequency of Detects Above Background Value
Americium-241	Fill	1	0	[0.0876 to 0.0876]	0.013	0/1
Americium-241	Qbt 2	13	0	[-0.11 to 0.294]	na[c]	0/13
Americium-241	Qbt 3	2	0	[-0.128 to -0.0988]	na	0/2
Cesium-134	Fill	1	0	[0.00165 to 0.00165]	na	0/1
Cesium-134	Qbt 2	3	0	[-0.00532 to 0.0674]	na	0/3
Cesium-137	Fill	1	0	[0.0167 to 0.0167]	1.65	0/1
Cesium-137	Qbt 2	12	1	[-0.0337] to 0.318	na	1/12
Cesium-137	Qbt 3	2	0	[-0.0141 to 0.000573]	na	0/2
Cobalt-60	Fill	1	0	[0.00173 to 0.00173]	na	0/1
Cobalt-60	Qbt 2	13	0	[-0.0168 to 0.013]	na	0/13
Cobalt-60	Qbt 3	2	0	[0.000543 to 0.0107]	na	0/2
Europium-152	Fill	1	0	[-0.0176 to -0.0176]	na	0/1
Europium-152	Qbt 2	13	0	[-0.0676 to 0.12]	na	0/13
Europium-152	Qbt 3	2	0	[0.0472 to 0.0497]	na	0/2
Plutonium-238	Fill	1	0	[0 to 0]	0.023	0/1
Plutonium-238	Qbt 2	13	1	[-0.00337] to 0.0384	na	1/13
Plutonium-238	Qbt 3	2	0	[-0.00256 to 0.00481]	na	0/2
Plutonium-239	Fill	1	0	[0.00353 to 0.00353]	0.054	0/1
Plutonium-239	Qbt 2	13	3	[-0.00668] to 0.294	na	3/13
Plutonium-239	Qbt 3	2	2	0.0869 to 0.141	na	2/2
Ruthenium-106	Fill	1	0	[0.0292 to 0.0292]	na	0/1
Ruthenium-106	Qbt 2	13	0	[-0.205 to 0.247]	na	0/13
Ruthenium-106	Qbt 3	2	0	[-0.0127 to 0.0629]	na	0/2
Sodium-22	Fill	1	0	[-0.0246 to -0.0246]	na	0/1
Sodium-22	Qbt 2	13	0	[-0.0403 to 0.0375]	na	0/13
Sodium-22	Qbt 3	2	0	[-0.0252 to -0.0149]	na	0/2
Tritium	Fill	1	0	[0.011 to 0.011]	na	0/1
Tritium	Qbt 2	13	10	[0.0155] to 1.43	na	10/13
Tritium	Qbt 3	2	1	[0.0072] to 0.0215	na	1/2
Uranium-234	Fill	1	1	0.535 to 0.535	2.59	0/1
Uranium-234	Qbt 2	13	13	0.462 to 0.724	1.98	0/13
Uranium-234	Qbt 3	2	2	0.686 to 0.847	1.98	0/2
Uranium-235	Fill	1	1	0.0504 to 0.0504	0.2	0/1
Uranium-235	Qbt 2	13	10	[0.0174] to 0.0902	0.09	1/13
Uranium-235	Qbt 3	2	2	0.0768 to 0.132	0.09	1/2
Uranium-238	Fill	1	1	0.53 to 0.53	2.29	0/1

Analyte	**Media**	**Number of Analyses**	**Number of Detects**	**Concentration Range[a] (pCi/g)**	**Background Value[b] (pCi/g)**	**Frequency of Detects Above Background Value**
Uranium-238	Qbt 2	13	13	0.494 to 0.745	1.93	0/13
Uranium-238	Qbt 3	2	2	0.787 to 0.864	1.93	0/2

[a] Values in square brackets indicate nondetects.

[b] BVs obtained from LANL 1998, 59730.

[c] na = Not available.

SWMU 50-004(c) Inorganic Chemicals Detected Above Background Values

Sample ID	Location ID	Depth (ft)	Media	Aluminum	Antimony	Arsenic	Barium	Cadmium	Lead	Mercury	Selenium
Qbt 2,3,4 Background Value[a]				**7340**	**0.5**	**2.79**	**46**	**1.63**	**11.2**	**0.1**	**0.3**
Fill Background Value[a]				**29,200**	**0.83**	**8.17**	**295**	**0.4**	**22.3**	**0.1**	**1.52**
MD50-04-52698	50-03001	5–9	Qbt 3	—[b]	1.03 (UJ)	—	—	—	—	—	0.518 (U)
MD50-04-52699	50-03001	5–9	Qbt 3	—	1.04 (UJ)	—	51.2	—	—	—	0.527 (U)
MD50-03-52047	50-03002	15–20	Qbt 2	—	—	2.83	—	—	—	—	0.528 (U)
MD50-03-52048	50-03003	10–15	Qbt 2	—	—	—	—	—	—	—	0.545 (U)
MD50-03-52050	50-03008	10–15	Qbt 2	7540	—	—	77.6	—	—	—	0.554 (U)
MD50-03-52052	50-03009	18–22	Fill	—	—	—	—	0.552 (U)	—	0.146	—
MD50-03-52051	50-03009	26–28	Qbt 2	—	—	—	—	—	—	—	—
MD50-03-52056	50-22441	10–15	Qbt 2	—	—	—	—	—	—	—	0.503 (U)
MD50-03-52057	50-22441	15–20	Qbt 2	—	—	2.8	—	—	—	—	0.529 (U)
MD50-03-52058	50-22442	10–15	Qbt 2	—	—	—	—	—	—	—	1.25 (U)
MD50-03-52059	50-22442	15–20	Qbt 2	—	—	—	—	—	14	—	0.501 (U)
MD50-03-52060	50-22443	10–15	Qbt 2	—	—	—	—	—	—	—	0.528 (U)
MD50-03-52055	50-22443	15–20	Qbt 2	—	—	3.31	—	—	—	—	0.528 (U)
MD50-03-52061	50-22443	15–20	Qbt 2	—	—	—	—	—	—	—	0.537 (U)
MD50-03-52062	50-22444	10–15	Qbt 2	—	—	—	—	—	—	—	0.519 (U)
MD50-03-52063	50-22444	15–20	Qbt 2	—	—	2.98	—	—	—	—	0.503 (U)

Note: Units are mg/kg.

[a] BVs obtained from LANL 1998, 59730.

[b] — = The concentration was not above the BV.

SWMU 50-004(c) Radionuclides Detected Above Background Values

Sample ID	Location ID	Depth (ft)	Media	Cesium-137	Plutonium-238	Plutonium-239	Tritium	Uranium-235
Qbt 2,3,4 Background Value[a]				**na**[b]	**na**	**na**	**na**	**0.09**
Fill Background Value[a]				**na**	**na**	**na**	**na**	**0.2**
MD50-04-52698	50-03001	5–9	Qbt 3	—[c]	—	0.0869	0.0215	0.132
MD50-04-52699	50-03001	5–9	Qbt 3	—	—	0.141	—	—
MD50-03-52047	50-03002	15–20	Qbt 2	—	—	0.0618	0.327	—
MD50-03-52048	50-03003	10–15	Qbt 2	—	—	0.0648	—	—
MD50-03-52050	50-03008	10–15	Qbt 2	0.318	0.0384	0.294	0.523	0.0902
MD50-03-52052	50-03009	18–22	Fill	—	—	—	—	—
MD50-03-52056	50-22441	10–15	Qbt 2	—	—	—	1.03	—
MD50-03-52057	50-22441	15–20	Qbt 2	—	—	—	0.401	—
MD50-03-52058	50-22442	10–15	Qbt 2	—	—	—	0.618	—
MD50-03-52060	50-22443	10–15	Qbt 2	—	—	—	0.406	—
MD50-03-52055	50-22443	15–20	Qbt 2	—	—	—	1.43	—
MD50-03-52061	50-22443	15–20	Qbt 2	—	—	—	0.558	—
MD50-03-52062	50-22444	10–15	Qbt 2	—	—	—	0.778	—
MD50-03-52063	50-22444	15–20	Qbt 2	—	—	—	0.764	—

Note: Units are pCi/g.

[a] BVs obtained from LANL 1998, 59730.

[b] na = Not available.

[c] — = The concentration was not above the BV.

SWMU 50-011(a) Samples Taken

Sample ID	Location ID	Depth (ft)	Media	Anions	Metals	VOCs	Americium-241	Gamma Spectroscopy	Tritium	Isotopic Plutonium	Isotopic Uranium
MD50-04-55783	50-23548	52.5–55	Qbt 2	2406S*	2406S	2405S	2407S	2407S	2407S	2407S	2407S
MD50-04-55784	50-23548	57.5–60	Qbt 2	2406S	2406S	2405S	2407S	2407S	2407S	2407S	2407S
MD50-04-55785	50-23549	50–52.5	Qbt 2	2406S	2406S	2405S	2407S	2407S	2407S	2407S	2407S
MD50-04-55786	50-23549	57.5–60	Qbt 2	2406S	2406S	2405S	2407S	2407S	2407S	2407S	2407S
MD50-04-55787	50-23549	57.5–60	Qbt 2	2406S	2406S	2405S	2407S	2407S	2407S	2407S	2407S
MD50-05-57554	50-24251	32–32	Fill	2641S	2641S	2640S	2642S	2642S	2642S	2642S	2642S
MD50-05-57555	50-24251	32–32	Fill	2641S	2641S	2640S	2642S	2642S	2642S	2642S	2642S
MD50-05-57556	50-24252	32–32.5	Qbt 3	2636S	2636S	2635S	2637S	2637S	2637S	2637S	2637S
MD50-05-57557	50-24252	32–32.5	Qbt 3	2636S	2636S	2635S	2637S	2637S	2637S	2637S	2637S
MD50-05-57558	50-24253	32–32.5	Fill	2636S	2636S	2635S	2637S	2637S	2637S	2637S	2637S
MD50-05-57559	50-24253	32–32.5	Fill	2636S	2636S	2635S	2637S	2637S	2637S	2637S	2637S

*Sample request number.

Frequency of Detected Inorganic Chemicals at SWMU 50-011(a)

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range[a] (mg/kg)	Background Value[b] (mg/kg)	Frequency of Detects Above Background Value	Frequency of Nondetects Above Background Value
Aluminum	Fill	2	2	369 to 524	29200	0/2	0/2
Aluminum	Qbt 2	4	4	372 to 497	7340	0/4	0/4
Aluminum	Qbt 3	1	1	1570 to 1570	7340	0/1	0/1
Antimony	Fill	2	1	0.106 to [0.4]	0.83	0/2	0/2
Antimony	Qbt 2	4	0	[0.431 to 0.443]	0.5	0/4	0/4
Antimony	Qbt 3	1	0	[0.425 to 0.425]	0.5	0/1	0/1
Arsenic	Fill	2	2	3.42 to 6.4	8.17	0/2	0/2
Arsenic	Qbt 2	4	4	0.909 to 1.33	2.79	0/4	0/4
Arsenic	Qbt 3	1	1	2.38 to 2.38	2.79	0/1	0/1
Barium	Fill	2	2	17.7 to 25.2	295	0/2	0/2
Barium	Qbt 2	4	4	9.92 to 13.1	46	0/4	0/4
Barium	Qbt 3	1	1	20.9 to 20.9	46	0/1	0/1
Beryllium	Fill	2	2	0.0775 to 0.131	1.83	0/2	0/2
Beryllium	Qbt 2	4	4	0.271 to 0.318	1.21	0/4	0/4
Beryllium	Qbt 3	1	1	0.514 to 0.514	1.21	0/1	0/1
Cadmium	Fill	2	2	0.143 to 0.212	0.4	0/2	0/2
Cadmium	Qbt 2	4	0	[0.0637 to 0.551]	1.63	0/4	0/4
Cadmium	Qbt 3	1	0	[0.528 to 0.528]	1.63	0/1	0/1
Calcium	Fill	2	2	1070 to 1780	6120	0/2	0/2
Calcium	Qbt 2	4	4	208 to 241	2200	0/4	0/4
Calcium	Qbt 3	1	1	298 to 298	2200	0/1	0/1
Chromium	Fill	2	2	2.09 to 2.51	19.3	0/2	0/2
Chromium	Qbt 2	4	0	[0.333 to 0.897]	7.14	0/4	0/4
Chromium	Qbt 3	1	1	1.93 to 1.93	7.14	0/1	0/1
Cobalt	Fill	2	2	0.365 to 0.766	8.64	0/2	0/2
Cobalt	Qbt 2	4	4	0.163 to 0.243	3.14	0/4	0/4
Cobalt	Qbt 3	1	1	0.546 to 0.546	3.14	0/1	0/1
Copper	Fill	2	2	6.5 to 10.5	14.7	0/2	0/2
Copper	Qbt 2	4	4	0.95 to 1.2	4.66	0/4	0/4
Copper	Qbt 3	1	1	4.19 to 4.19	4.66	0/1	0/1
Iron	Fill	2	2	1970 to 2300	21500	0/2	0/2
Iron	Qbt 2	4	4	5800 to 7110	14500	0/4	0/4
Iron	Qbt 3	1	1	6560 to 6560	14500	0/1	0/1
Lead	Fill	2	2	2.56 to 2.99	22.3	0/2	0/2
Lead	Qbt 2	4	4	3.44 to 6.54	11.2	0/4	0/4
Lead	Qbt 3	1	1	3.98 to 3.98	11.2	0/1	0/1

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range[a] (mg/kg)	Background Value[b] (mg/kg)	Frequency of Detects Above Background Value	Frequency of Nondetects Above Background Value
Magnesium	Fill	2	2	111 to 154	4610	0/2	0/2
Magnesium	Qbt 2	4	4	153 to 255	1690	0/4	0/4
Magnesium	Qbt 3	1	1	272 to 272	1690	0/1	0/1
Manganese	Fill	2	2	24.3 to 34.2	671	0/2	0/2
Manganese	Qbt 2	4	4	198 to 258	482	0/4	0/4
Manganese	Qbt 3	1	1	97.5 to 97.5	482	0/1	0/1
Mercury	Fill	2	2	0.0259 to 0.166	0.1	1/2	0/2
Mercury	Qbt 2	4	0	[0.0104 to 0.0109]	0.1	0/4	0/4
Mercury	Qbt 3	1	1	0.0257 to 0.0257	0.1	0/1	0/1
Nickel	Fill	2	2	1.34 to 2.01	15.4	0/2	0/2
Nickel	Qbt 2	4	4	0.461 to 0.496	6.58	0/4	0/4
Nickel	Qbt 3	1	1	0.751 to 0.751	6.58	0/1	0/1
Nitrate	Fill	2	2	55.1 to 117	na[c]	2/2	na
Nitrate	Qbt 3	1	1	33.6 to 33.6	na	1/1	na
Perchlorate	Fill	2	0	[0.0403 to 0.0404]	na	0/2	na
Perchlorate	Qbt 2	4	0	[0.0431 to 0.044]	na	0/4	na
Perchlorate	Qbt 3	1	0	[0.0431 to 0.0431]	na	0/1	na
Potassium	Fill	2	2	85.8 to 103	3460	0/2	0/2
Potassium	Qbt 2	4	4	154 to 235	3500	0/4	0/4
Potassium	Qbt 3	1	1	315 to 315	3500	0/1	0/1
Selenium	Fill	2	0	[0.259 to 0.49]	1.52	0/2	0/2
Selenium	Qbt 2	4	2	0.285 to [0.551]	0.3	1/4	2/2
Selenium	Qbt 3	1	0	[0.494 to 0.494]	0.3	0/1	1/1
Silver	Fill	2	2	0.0336 to 0.0338	1	0/2	0/2
Silver	Qbt 2	4	4	0.0245 to 0.029	1	0/4	0/4
Silver	Qbt 3	1	1	0.0435 to 0.0435	1	0/1	0/1
Sodium	Fill	2	2	18.6 to 26.3	915	0/2	0/2
Sodium	Qbt 2	4	4	112 to 158	2770	0/4	0/4
Sodium	Qbt 3	1	1	80.1 to 80.1	2770	0/1	0/1
Thallium	Fill	2	0	[0.0983 to 0.1]	0.73	0/2	0/2
Thallium	Qbt 2	4	4	0.0375 to 0.0684	1.1	0/4	0/4
Thallium	Qbt 3	1	1	0.0263 to 0.0263	1.1	0/1	0/1
Vanadium	Fill	2	2	4.47 to 8.46	39.6	0/2	0/2
Vanadium	Qbt 2	4	4	1.65 to 1.94	17	0/4	0/4
Vanadium	Qbt 3	1	1	3.64 to 3.64	17	0/1	0/1
Zinc	Fill	2	2	12.5 to 22.2	48.8	0/2	0/2

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range[a] (mg/kg)	Background Value[b] (mg/kg)	Frequency of Detects Above Background Value	Frequency of Nondetects Above Background Value
Zinc	Qbt 2	4	4	39.8 to 47.1	63.5	0/4	0/4
Zinc	Qbt 3	1	1	48.1 to 48.1	63.5	0/1	0/1

[a] Values in square brackets indicate nondetects.

[b] BVs obtained from LANL 1998, 59730.

[c] na = Not available.

Frequency of Detected Organic Chemicals at SWMU 50-011(a)

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range (mg/kg)	Frequency of Detects
Acetone	Qbt 2	4	4	0.0143 to 0.0332	4/4

Frequency of Detected Radionuclides at SWMU 50-011(a)

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range[a] (pCi/g)	Background Value[b] (pCi/g)	Frequency of Detects Above Background Value
Americium-241	Fill	2	1	[0.093] to 0.279	0.013	1/2
Americium-241	Qbt 2	4	0	[-0.0327 to 0.00764]	na[c]	0/4
Americium-241	Qbt 3	1	0	[0.169 to 0.169]	na	0/1
Cesium-134	Fill	2	0	[0.021 to 0.027]	na	0/2
Cesium-134	Qbt 2	2	0	[0.0367 to 0.0507]	na	0/2
Cesium-137	Fill	2	0	[0.008 to 0.011]	1.65	0/2
Cesium-137	Qbt 2	4	0	[0.00225 to 0.00733]	na	0/4
Cesium-137	Qbt 3	1	0	[-0.006 to -0.006]	na	0/1
Cobalt-60	Fill	2	0	[-0.002 to 0.004]	na	0/2
Cobalt-60	Qbt 2	4	0	[-0.0121 to 0.00433]	na	0/4
Cobalt-60	Qbt 3	1	0	[0.01 to 0.01]	na	0/1
Europium-152	Fill	1	0	[0.125 to 0.125]	na	0/1
Europium-152	Qbt 2	4	0	[-0.00697 to 0.016]	na	0/4
Plutonium-238	Fill	2	1	[0.002] to 0.056	0.023	1/2
Plutonium-238	Qbt 2	4	1	[-0.00864] to 0.0326	na	1/4
Plutonium-238	Qbt 3	1	1	0.034 to 0.034	na	1/1
Plutonium-239	Fill	2	1	[0.029] to 0.046	0.054	0/2
Plutonium-239	Qbt 2	4	1	[0.00156] to 0.0506	na	1/4
Plutonium-239	Qbt 3	1	1	0.031 to 0.031	na	1/1
Ruthenium-106	Fill	2	0	[-0.013 to 0]	na	0/2
Ruthenium-106	Qbt 2	4	0	[-0.047 to -0.0201]	na	0/4
Ruthenium-106	Qbt 3	1	0	[0.038 to 0.038]	na	0/1

Analyte	Media	Number of Analyses	Number of Detects	Concentration Range[a] (pCi/g)	Background Value[b] (pCi/g)	Frequency of Detects Above Background Value
Sodium-22	Fill	2	0	[-0.009 to 0.001]	na	0/2
Sodium-22	Qbt 2	4	0	[-0.0124 to 0.0424]	na	0/4
Sodium-22	Qbt 3	1	0	[0 to 0]	na	0/1
Tritium	Fill	2	2	4.762 to 6.478	na	2/2
Tritium	Qbt 2	4	3	[0.0268] to 0.0821	na	3/4
Tritium	Qbt 3	1	0	[0.574 to 0.574]	na	0/1
Uranium-234	Fill	2	2	0.465 to 0.47	2.59	0/2
Uranium-234	Qbt 2	4	4	1.11 to 1.27	1.98	0/4
Uranium-234	Qbt 3	1	1	0.523 to 0.523	1.98	0/1
Uranium-235	Fill	2	0	[0.016 to 0.026]	0.2	0/2
Uranium-235	Qbt 2	4	4	0.063 to 0.0818	0.09	0/4
Uranium-235	Qbt 3	1	1	0.02 to 0.02	0.09	0/1
Uranium-238	Fill	2	2	0.388 to 0.56	2.29	0/2
Uranium-238	Qbt 2	4	4	1.11 to 1.3	1.93	0/4
Uranium-238	Qbt 3	1	1	0.456 to 0.456	1.93	0/1

[a] Values in square brackets indicate nondetects.

[b] BVs obtained from LANL 1998, 59730.

[c] na = Not available.

SWMU 50-011(a) Inorganic Chemicals Detected Above Background Values

Sample ID	Location ID	Depth (ft)	Media	Mercury	Nitrate	Selenium
Qbt 2,3,4 Background Value[a]				**0.1**	**na[b]**	**0.3**
Fill Background Value[a]				**0.1**	**na**	**1.52**
MD50-04-55783	50-23548	52.5–55	Qbt 2	—[c]	—	0.551 (U)
MD50-04-55784	50-23548	57.5–60	Qbt 2	—	—	0.332 (J)
MD50-04-55786	50-23549	57.5–60	Qbt 2	—	—	0.533 (U)
MD50-05-57555	50-24251	32–32	Fill	—	55.1	—
MD50-05-57556	50-24252	32–32.5	Qbt 3	—	33.6	0.494 (U)
MD50-05-57558	50-24253	32–32.5	Fill	0.166	117	—

Note: Units are mg/kg.

[a] BVs obtained from LANL 1998, 59730.

[b] na = Not available.

[c] — = The concentration was not above the BV.

SWMU 50-011(a) Detected Organic Chemicals

Sample ID	Location ID	Depth (ft)	Media	Acetone
MD50-04-55783	50-23548	52.5–55	Qbt 2	0.0191
MD50-04-55784	50-23548	57.5–60	Qbt 2	0.0143
MD50-04-55785	50-23549	50–52.5	Qbt 2	0.0252
MD50-04-55786	50-23549	57.5–60	Qbt 2	0.0332

Note: Units are mg/kg.

SWMU 50-011(a) Radionuclides Detected Above Background Values

Sample ID	Location ID	Depth (ft)	Media	Americium-241	Plutonium-238	Plutonium-239	Tritium
Qbt 2,3,4 Background Value[a]				**na**[b]	**na**	**na**	**na**
Fill Background Value[a]				**na**	**na**	**na**	**na**
MD50-04-55783	50-23548	52.5–55	Qbt 2	—[c]	—	—	0.0821
MD50-04-55784	50-23548	57.5–60	Qbt 2	—	—	—	0.048
MD50-04-55785	50-23549	50–52.5	Qbt 2	—	0.0326	0.0506	—
MD50-04-55786	50-23549	57.5–60	Qbt 2	—	—	—	0.0351
MD50-05-57555	50-24251	32–32	Fill	—	0.056	—	4.762
MD50-05-57556	50-24252	32–32.5	Qbt 3	—	0.034	0.031	—
MD50-05-57558	50-24253	32–32.5	Fill	0.279	—	—	6.478

Note: Units are pCi/g.

[a] BVs obtained from LANL 1998, 59730.

[b] na = Not available.

[c] — = The concentration was not above the BV.

Risk, Reduction, and Environmental Stewardship

Remediation Services

ACTION ITEM DELIVERABLE TRACKER FORM

Date Received: 2-2-05 **CT#** 05-006

Requester:
Kathryn Chamberlain

Requester's Organization:
NMED HWB

Subject: Written request for "GeoTechnical Investigation, Technical Area 50: Pump House and influent storage tank vault project", TA-50 soil characterization analytical summary report", and analytical results for 2003/2004" Sampling activities at SWMU's 50-004(c) AND 50-011(a)

Action Assigned To:
John Hopkins

Send Copies To:
Evelyn Rainey
CT File
RPF

2/3/05

Additional Copies To:
Gabriela Lopez Escobedo
Bill Criswell
Alison Dorries

Please complete the following action:
Compile information for delivery or ask for extention if not achievable!

Project Office Due Date: 2/16/05 **Requester's Due Date:** 2/17/05

Call the Project Office at 7-0808 at least three days prior to the Project Office due date if action cannot be met. The Deputy Project Director will work with you to obtain an extension.

Notes: Gone to State

Date Logged In: ____________ **Logged in By:** ____________

PLEASE NOTE: IF AN ACTION WAS ASSIGNED TO YOU PLEASE REMEMBER TO INCLUDE THIS FORM WITH YOUR RESPONSE. IT HELPS TO KEEP TRACK OF THE ACTION/RESPONSE. THANK YOU

State of New Mexico
ENVIRONMENT DEPARTMENT
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
Telephone (505) 428-2500
Fax (505) 428-2567
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BILL RICHARDSON
GOVERNOR

RON CURRY
SECRETARY

DERRITH WATCHMAN-MOORE
DEPUTY SECRETARY

05 FEB -2 PM 1:35

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

January 28, 2005

David Gregory, Federal Project Director
Los Alamos Site Office
Department of Energy
528 35th Street, Mail Stop A316
Los Alamos, NM 87544

G. Pete Nanos, Director
Los Alamos National Laboratory
P.O. Box 1663, Mail Stop A100
Los Alamos, NM 87545

RE: WRITTEN REQUEST FOR "GEOTECHNICAL INVESTIGATION, TECHNICAL AREA 50: PUMP HOUSE AND INFLUENT STORAGE TANK VAULT PROJECT", "TA-50 SOIL CHARACTERIZATION ANALYTICAL SUMMARY REPORT", AND ANALYTICAL RESULTS FOR 2003/2004 SAMPLING ACTIVITIES AT SWMUs 50-004(c) AND 50-011(a)

Messrs. Gregory and Nanos:

In accordance with our telephone conversation on January 27, 2005, the New Mexico Environment Department (NMED) formally requests copies of the *Geotechnical Investigation, Technical Area 50: Pump House and Influent Storage Tank Vault Project* report, dated January 15, 2002, and prepared by Kleinfelder, Inc., the *TA-50 Soil Characterization Analytical Summary Report*, dated February 11, 2002, and referenced by SEASF-TR-02-270, and the analytical results for 2003/2004 sampling activities at SWMUs 50-004(c) and 50-011(a). The Permittees must submit the final laboratory reports/results, in accordance with Section IX.C of the proposed Consent Order. The Permittees must submit the aforementioned reports within fifteen (15) days of receipt of this letter.

Please contact me at (505) 428-2546 should you have any questions.

Sincerely,

Kathryn Chamberlain

Kathryn Chamberlain
Environmental Specialist
Hazardous Waste Bureau

KC

cc: D. Cobrain, NMED HWB
C. Voorhees, NMED DOE OB
S. Yanicak, NMED DOE OB, MS J993
L. King, EPA 6PD-N
J. Vozella, DOE LASO, MS A316
K. Hargis, LANL RRES/DO, MS M591
N. Quintana, LANL E/ER, MS M992
D. McInroy, LANL E/ER, MS M992
J. Hopkins, LANL, RR-ESR
Reading and File LANL TA-50 [50-004(c) & 50-011(a)]